

9 Electrics and electronics

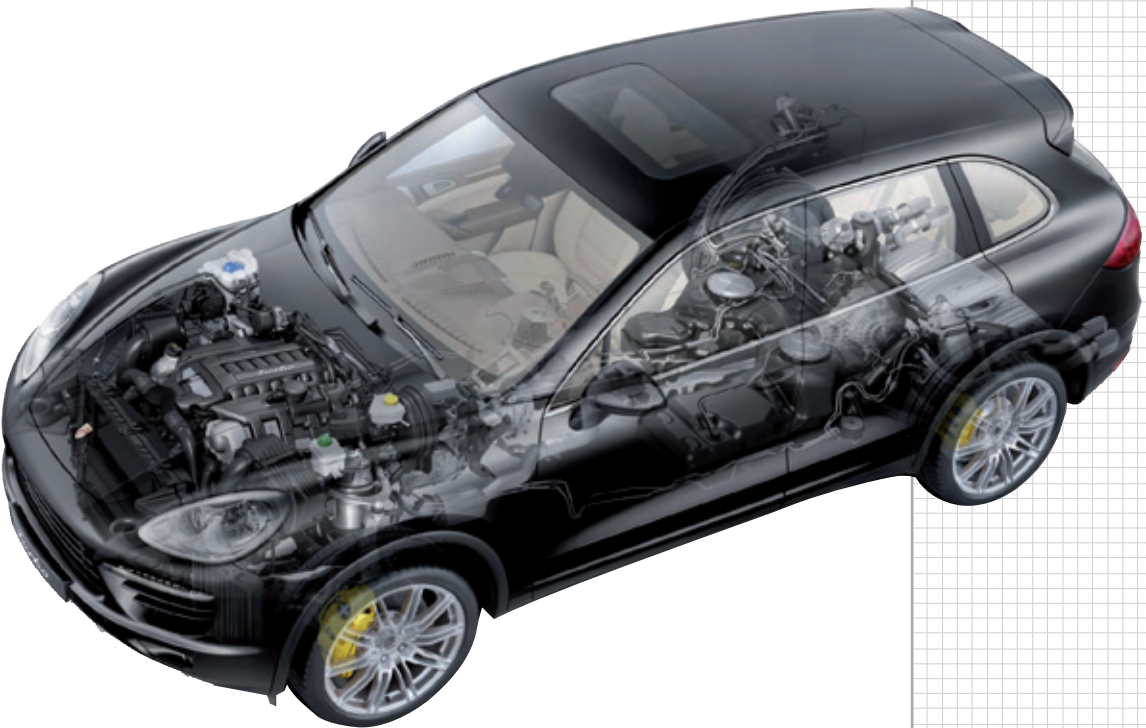
Cayenne
Cayenne S
Cayenne Turbo

General

The electrical systems used in the new 2nd generation Cayenne model series are essentially based on the first generation Cayenne. Relevant basic information can be found in Service Information Technik (SIT 2003, SIT 2004, SIT 2005 and SIT 2008). New technological features in the area of vehicle networking, comfort electronics and driver assistance systems are based on the vehicle systems used in the Panamera. The following sections describe the specific features of the new 2nd generation Cayenne model series.

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Lighting system

Halogen headlights

All Cayenne models apart from the Cayenne Turbo are equipped with H7 projector-type headlights with automatic static headlight levelling as standard and also feature automatic headlight activation and automatic switch-off with Welcome Home function. With the projector-type technology, the light emanating from the light source is projected onto the road via a reflector and a lens, therefore enabling homogeneous illumination with less glare directed at the oncoming traffic.



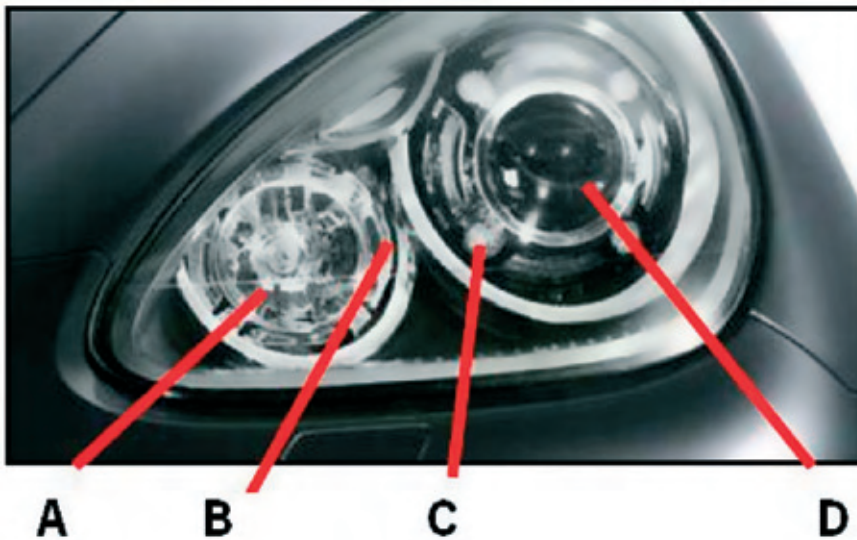
- A H7 auxiliary high beam
- B Dipped beam/high beam

Halogen headlight

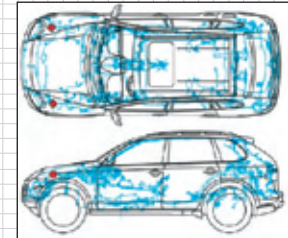
Bi-Xenon headlights

The Xenon headlights (standard in the Cayenne Turbo) have a new Bi-Xenon headlight design (dipped/high beam) with halogen auxiliary high beam. They feature automatic dynamic headlight levelling as well as a headlight cleaning system and are equipped with the adaptive light system Porsche Dynamic Light System (PDLS).

The PDLS offers the functions of dynamic and static cornering light, speed-dependent headlight range control, country road light and fog light function.



Bi-Xenon headlight including PDLS



Headlight control units

- A Auxiliary high beam
- B Static cornering light
- C Turbo daytime running light
- D Dipped/high beam, dynamic cornering light

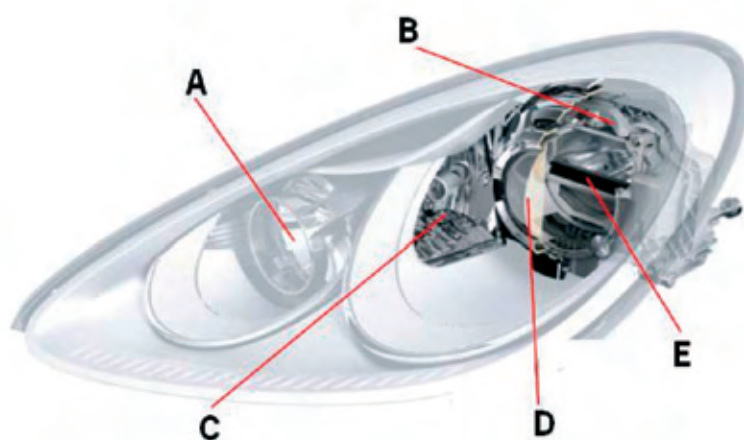
PDLS (Porsche Dynamic Light System)

The PDLS (Porsche Dynamic Light System) consists of a swivelling PDLS module for the dynamic cornering light and headlight levelling and works like the halogen headlights with a projection system. The projection system includes a rotating drum with various contours for modifying the light/dark border of the light, as well as a lens. The Bi-Xenon headlight can be set to different light modes, e.g. country road light and highway light, by way of the drum and changes in the light intensity. The PDLS is supplemented by the light from the static cornering light. Together with the normal Xenon high beam light, which already illuminates the area in front of the vehicle particularly effectively due to the drum position with the cover open fully and higher light intensity, a halogen auxiliary high beam light is also installed in the PDLS.



The PDLS (Porsche Dynamic Light System) is active when the light switch is in the "Auto" position.

- A H7 auxiliary high beam
- B PDLS module
- C Static cornering light (H11)
- D Lens of the PDLS module
- E Drum of the PDLS module



Bi-Xenon headlight including PDLS module

Dynamic cornering light

The dynamic cornering light is activated from a speed of > 1.2 mph (2 km/h). The light control swivels the headlights to the side by up to 15° (15° for outside light unit, 7.5° for inside light unit), depending on the steering angle and vehicle speed in the bend. The light beam is projected onto the road to a maximum range without dazzling oncoming traffic. Consequently, when driving in the dark on twisting roads, the driver can see which way the road is going and can detect any obstacles much earlier and adapt his driving style accordingly. This feature also provides a significant increase in safety when driving on country roads and in protracted highway curves by optimally illuminating those curves. The dipped beam in the Bi-Xenon headlights follows the driver's steering movements and continuously adjusts to the current driving speed. Sensors continuously record the driving speed, lateral acceleration and steering angle, and use this information to 'calculate' the corner. A control unit uses the data it receives to determine the best angle for controlling the dynamic cornering light. The cornering light also remains active when the high beam is switched on, improving the driver's visibility.

Static cornering light

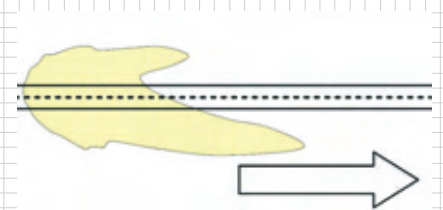
The static cornering light activates an additional halogen light source (H11) with a beam angle of approx. 30° with respect to the direction of travel. The static cornering light is activated by turning the steering wheel when the vehicle is stationary and while driving at speeds of up to 80 mph (130 km/h). As a result, the edge of the roadway is illuminated over a greater distance, e.g. when turning into a side street.

Country road light

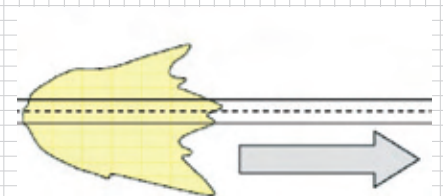
Compared with the dipped beam of a conventional Bi-Xenon headlight, the country road light of the PDLS provides improved illumination of the surrounding area and a better range. The light beam is adapted by way of a special cover contour so that glare is minimized for oncoming traffic.

Fog light function

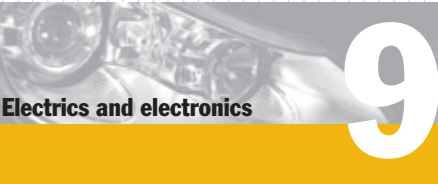
The fog light function improves visibility for the driver while at the same time reducing glare for oncoming traffic on wet roads or in low-visibility conditions, e.g. in fog or when driving on snow. It is linked to activation of the fog lights. The dipped beam spreads out wider and the left headlight adapts the light/dark border horizontally, thereby reducing the range of the light beam. The left headlight also swivels to the left, causing the focal point of the light to move outwards accordingly. This reduces glare for the driver. The fog light function is available at speeds of up to 45 mph (70 km/h). The lighting system switches back to country road light at higher speeds.



Country road light



Fog light function



Electrics and electronics

Bi-Xenon light mode including PDLs	Activation	Speed range
Static cornering light	Automatically via steering angle	0 - 80 mph
Dynamic cornering light	Automatically via steering angle	> 1.2mph
Country road light (dipped beam)	Basic setting - dipped beam with lights on	0 - 80 mph
Fog light function	Manually by activating the fog lights	0 - 45 mph
Fog lights	Manually via light switch	From 0 mph

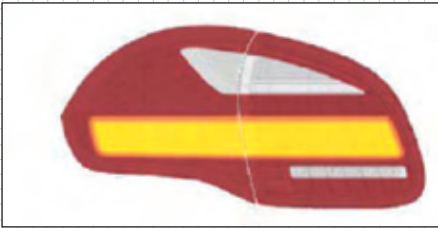
Front light modules

All models also feature front light modules with LED direction indicator lights and LED position light (LED light guides).

With the exception of the Cayenne Turbo, the front light modules also house the LED daytime running lights. On the Cayenne Turbo, the daytime running lights - with four LED spotlights each - are located in the headlights. The position light (LED light guide) is designed to surround the direction indicator lights. Daytime running lights increase driving safety during the day by making the vehicle more visible for other road users.

LED tail lights

The LED tail light modules comprise adaptive brake lights, a rear fog light and a back-up light as well as the tail light, direction indicator light and position light. The third LED brake light is integrated in the roof spoiler. In addition to the visual impact and the long service life, the main advantage of LED technology is its short response time. Compared to around 100 ms for conventional incandescent lamps, the response time for LEDs is only around 0.1 ms. This difference corresponds to a distance of almost 3 m at a speed of 62 mph (100 km/h) due to the faster perception time, which means that the vehicle travelling behind can stop much faster in an emergency. Earlier signalling of braking therefore means that traffic driving behind the vehicle is warned more quickly and therefore also contributes to active safety.



Direction indicator light (26 LEDs)



Tail light (26 LEDs)

Adaptive brake lights

The adaptive brake lights of the Cayenne models produce a pulsating luminous intensity during emergency ABS braking or in the event of extreme deceleration from a speed of more than 45 mph (70 km/h) in order to more effectively alert vehicles travelling behind. If this extreme deceleration brings the vehicle to a standstill, the hazard warning lights come on automatically.

Fog lights/rear fog light

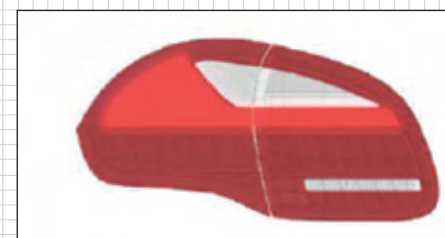
The fog lights and rear fog light are activated using the light switch.

Fog lights: In the dipped beam or parking light switch position, pull the switch until it engages in the first position. The indicator light lights up.

Rear fog light: In the dipped beam or parking light switch position, pull the switch until it engages in the second position. The indicator light lights up.

Sensors

A level sensor at the front and rear of the vehicle respectively determine the tilt of the vehicle. The sensor information is required for the headlight levelling function. The headlight control unit communicates with the stepper motors in the headlights via the LIN interface. The headlight control units communicate with the other control units via CAN crash risks.



Brake light (26 LEDs)



Rear fog light (6 LEDs)



ACC radar sensor

Assistance systems

Cruise control

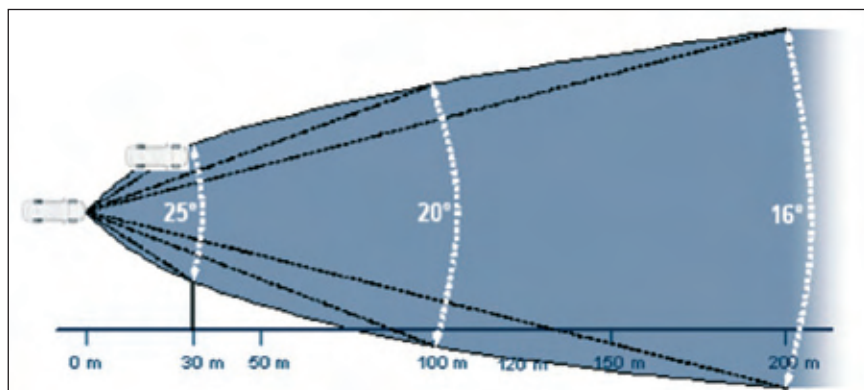
The Cayenne models are equipped with automatic speed control (cruise control) as standard. On long trips, this increases driver comfort, as the selected cruising speed is maintained through automatic braking and acceleration. The programmable speed range extends from 20 – 150 mph (30 – 240 km/h).

Adaptive Cruise Control (ACC)

Adaptive cruise control is optionally available. It uses radar sensors to monitor the distance from the vehicle in front, automatically maintains the distance and brakes if the distance to the vehicle in front is reduced – if necessary bringing the vehicle to a complete stop. The programmable speed range extends from 20 – 130 mph (30 – 210 km/h).



In automatic acceleration mode, the adaptive cruise control (ACC) behaves like the conventional cruise control function and maintains the selected target speed. However, ACC can also maintain a constant speed when driving up or down hill through activation of the braking system or downshifts. Adaptive cruise control relieves the driver of the task of adjusting the target speed to the dynamic traffic conditions. It has been enhanced from a pure cruise control function to a distance control system. If no vehicle is detected in front, the desired speed is reset. If a vehicle is detected in front, the system attempts to keep the time interval (speed-dependent distance) with this vehicle as constant as possible.

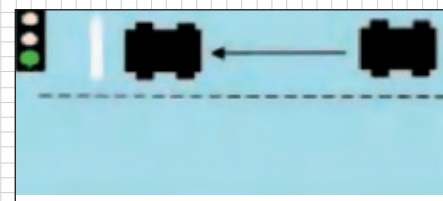


The distance is measured with a radar sensor (long range radar with 76 - 77 GHz), which is installed in the center of the front apron.

Similar to the Porsche Panamera, the adaptive cruise control of the new Cayenne offers the customer the special functions of overtaking aid, boost function and cornering speed control.

Boost function

If the actual speed is less than the selected target speed, e.g. when driving off from a standstill, the driver can activate a "boost" function at any time when the system is active. This is done by holding the cruise control operating lever upwards (resume direction).



Boost function



Activating and deactivating Porsche “Active Safe”.

The Porsche “Active Safe” functions can be switched off completely or partially in the multi-function display. The settings are saved when the ignition is switched on or off.



Visual passive warning

Cornering speed control

When driving around a bend in free driving mode, the cornering speed control function intervenes if a specific lateral acceleration is exceeded. At low speeds, system intervention is triggered by the steering angle, e.g. when driving on a roundabout.

As a result, acceleration is reduced or interrupted or the actual speed is reduced so that the lateral acceleration is also reduced. When the vehicle comes out of the bend, controlled acceleration is resumed or the speed is adapted to the target speed in a controlled manner (if the control function was not interrupted).

The “Follow to Stop” and Porsche “Active Safe” functions have been enhanced in the context of active safety.

Follow to Stop

As in the Panamera, the system readies the brakes whenever a decreasing distance to the vehicle in front is detected in order to reduce the stopping distance if required. Adaptive cruise control and PSM also interact to prefill the brake system. In following mode, the vehicle decelerates smoothly to a stop if the vehicle in front stops (adaptive cruise control “Follow to Stop” mode). The required vehicle deceleration calculated by the adaptive cruise control is regulated via the PSM by actively changing the braking pressure at the wheel brakes (at a maximum of 3.5 m/s^2), so that the distance to the vehicle in front selected by the driver can be maintained. To increase driver comfort, the system activates a crawl phase before finally coming to a stop so that if the vehicle in front only stops briefly, the driver's own vehicle does not actually stop at all and a fluid, slow movement is possible. The driver can drive off after a stop or confirm this by pressing the operating lever or the accelerator pedal.

Porsche “Active Safe”

The system also warns the driver in dangerous situations visually and acoustically as well as for the first time with an additional short braking jolt. This alerts the driver to critical situations. The active safety functions operate independently of activated distance and cruise control. However, there is no response to stationary obstacles.

If there is no braking response from the driver to the advance warning, this is followed shortly afterwards by the acute warning, which consists of a braking jolt and simultaneous acoustic and visual warning. A braking jolt is applied to the vehicle through a very short build-up of brake pressure. This also ensures that the driver's attention is drawn to the traffic. The driver can still prevent a collision by responding appropriately in this dangerous situation.

In combination with adaptive cruise control, an adaptive cruise control display can be shown on the color display of the instrument cluster, with comprehensive information such as target and actual distance, desired speed or speed of the vehicle travelling in front.

In this mode, a speed bar in the colour display shows how much of the available target speed range (19 to 130 mph/30 to 210 km/h) is currently being utilized. Time interval bars, speed bars, desired speed and the speedometer symbol are shown in orange when control operation is active. If the system is only switched on ("standby") but is not active, the display elements named are grey.

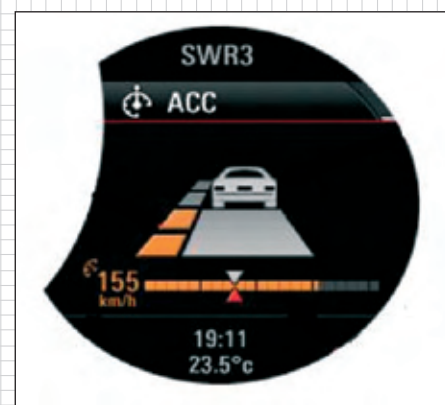
The operating states are displayed via the color display in the instrument cluster in the ACC menu. Warnings are also accompanied by an acoustic signal.

Lane Change Assist (LCA)

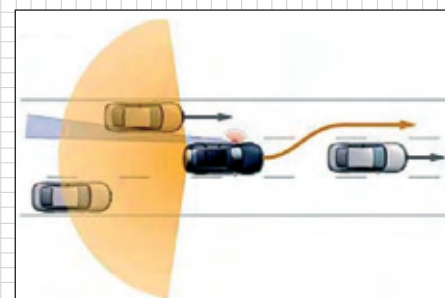
The optional Lane Change Assist (LCA) is used for the first time on the new Cayenne. Lane Change Assist is a vehicle assistance and comfort system that monitors the lanes on the left and right up to 230 ft (70 meters) behind the vehicle, including the blind spot, by way of two radar sensors mounted in the left and right of the bumper. This enhances driving comfort and safety, particularly when driving on the motorway.

LCA is available in the speed range between 19 mph (30 km/h) and max. 160 mph (250 km/h). If a vehicle is in the blind spot or is approaching quickly from behind, an LED information display on the inside of the corresponding door mirror lights up from a distance of 180 ft (55 meters) mirrors for this purpose.

If the driver activates the direction indicator in this situation, the information display flashes brightly to give the driver a clear warning (warning stage) of the approaching vehicle. This information is given in two stages: As long as the driver does not indicate, the light indicates vehicles detected in neighboring lanes discretely and inconspicuously. Lane Change Assist decides whether to display the vehicle based on relative speed and distance. However, if the driver sets the direction indicator, the light flashes brightly to warn him of the detected vehicle.



ACC display (multi-function display)



Lane Change Assist



LED display for LCA (4 LEDs)



LCA button with LED



LCA is deactivated when towing a trailer.

The system saves the last system mode (activated or deactivated) as well as the selected LED brightness for a specific key.

LCA does not actively intervene in the controlling of the vehicle and can be deactivated at any time by the driver by way of a button in the door switch module. When LCA is activated via the LCA button, the system provides visual feedback through the brief lighting up of both LED modules in the door mirrors. There is no feedback from the system when LCA is deactivated. The LCA activation state can be read off using the function light in the button panel (door switch module).

The basic brightness of the LED modules (information display) can be adapted to driver requirements via a menu in the instrument cluster with three brightness levels. The effective brightness of the information display depends on this basic setting and is adjusted in parallel with the current outside brightness.

The range of the radar sensor depends to a large extent on the weather conditions. Temporary non-availability due to dirt on the bumper and/or poor weather conditions (fog, spray behind the vehicle etc.) or a potential system fault is indicated by way of text messages in the instrument cluster and leads to automatic deactivation of the system. It is reactivated by switching it on again manually.

ParkAssist

ParkAssist front and rear with a total of eight sensors and acoustic and visual warning is standard on the Cayenne Turbo and optional for the other models.

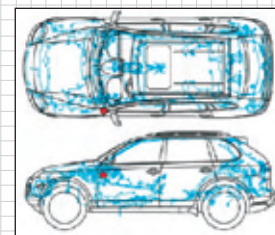
The operating range extends from 0 mph up to a speed of approx. 9 mph (15 km/h).

The sound of the acoustic warning is deeper in the rear than in the front. The intervals decrease until a continuous tone is emitted as the vehicle comes closer to an obstacle.

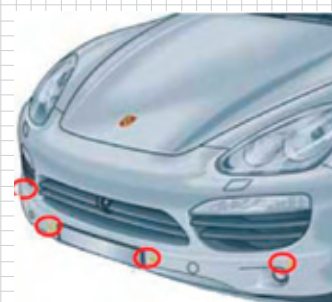
The acoustic warning at the front starts from 3 ft and at the rear from 4 ft. A single initial warning tone is displayed when an obstacle is at a distance of 6 ft. If the distance to an obstacle does not change, the tone is suppressed after approx. 8 seconds. The acoustic warning is played again if the vehicle approaches the obstacle.

In addition, the distances to obstacles are displayed in the form of a schematic representation of the top view of the vehicle in the central display.

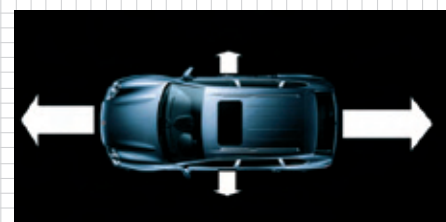
The visual representation of detected obstacles takes place within a detection area in front of and behind the vehicle. In theory, obstacles at a distance of up to 4 ft at the front of the vehicle, up to 4 ft at the side and up to 6 ft at the rear can be displayed in the detection area. Based on the sensor range, obstacles at the side of the vehicle are displayed from approx. 2 ft at the front and from approx. 2.3 ft at the rear. The distance values determined by the system are filtered in order to produce a smooth, stable obstacle display. As a result, obstacles are not displayed until after approx. 2 seconds while stationary (compared with driving). ParkAssist is activated when the ignition is switched on. ParkAssist can be switched off using the ParkAssist OFF switch in the roof console (LED of the button lights up in this case). ParkAssist remains deactivated until it is switched on again via the button or the ignition is switched off and on again.



Installation position of the ParkAssist control unit



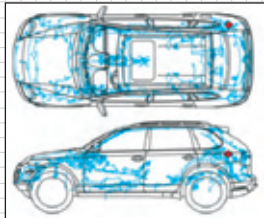
Ultrasonic sensors at front



ParkAssist detection areas



Reversing camera



Installation position of the reversing camera control unit



Dynamic guide lines



Dynamic guide lines

Reversing camera

The optionally available reversing camera (only in combination with PCM as well as ParkAssist front and rear) makes it easier to perform precise reverse parking and reverse manoeuvring as well as to attach a trailer. The reversing camera visually detects the area behind the vehicle.

Opening angle of lens, detection area:

horizontal opening angle 131°, vertical opening angle 100°,

power supply 6.5 V, current consumption max. 100 mA.

The system determines the conditions for switching on and off independently and then switches the camera on. The display output is activated when reverse gear is engaged or if the system detects that the vehicle is rolling backwards. Manual activation via the PCM is also possible. The system is deactivated once a speed of 9 mph (15 km/h) is exceeded after the driver shifts out of reverse gear or when transmission range P is engaged and/or the parking brake is engaged. The reversing camera is integrated in the handle button of the rear lid and transmits the video image to the camera control unit, which is located under the bottom right trim panel in the luggage compartment.

There the picture is equalized and the guide lines incorporated. The image is then transmitted to the PCM. The image is displayed only when the electric parking brake is not engaged. If a trailer was detected or the rear hatch is open, the video image is displayed but the guide lines are not incorporated.

The dynamic guide lines can be displayed in the reversing camera image if desired. They change corresponding to the position of the front wheels. The lines illustrate the driving path with the current steering wheel position and thus show the driver where he would travel with the steering wheel in its current setting.

In addition, the rectangular colored area on the screen, which begins at a distance of 16" (40 cm) from the vehicle and extends to approximately 16 ft (5 m), symbolizes the vehicle length. In addition, ParkAssist's top view display can be overlaid on the image output from the reversing camera. In this case, the ParkAssist display can be shown and hidden again by touching the vehicle on the screen. Depending on the steering angle, ParkAssist is displayed on the left or the right edge of the screen.

Audio and communication

The state-of-the-art audio and communication systems familiar from the Panamera are also available for the Cayenne. These systems meet the highest technical standards and have been optimised to provide enhanced user friendliness.

The now 7-inch large color screen of the CDR-31 audio system (standard for Cayenne and Cayenne S and of Porsche Communication Management (PCM) (standard for Cayenne Turbo, optional for all other Cayenne models) is positioned higher up on the dashboard for better ergonomics and designed as a touchscreen for quick and easy operation. Attention was paid to ensuring that the systems feature only the highest quality materials. The personalized options of the new Cayenne in the area of audio and communication have been further enhanced compared with the predecessor.

It is now available with the Burmester® High-End Surround Sound System from the Panamera. The universal audio interface has also been modified and now supports the connection of various iPod® and iPhone® models to the audio system via the USB connection. The telephone module is now compatible with an increased number of mobile phones.

CDR-31 audio system

The new CDR-31 audio system (standard for Cayenne and Cayenne S has an extremely high-quality user interface. The look, feel and central functions correspond to the latest PCM generation. The main feature of the new audio system generation is a 7-inch TFT display with touchscreen. All the functions (except for volume) of the CDR-31 system can be selected by touching the color screen. This allows fast and simple navigation through the various menus. In addition, the new display guarantees excellent legibility and clarity.

The user interface is adapted to suit the new color screen - both the operating structure and the screen design are the same as for PCM. The screen display is very clear thanks to the fact that many functions that are rarely used have been moved to the second menu level ("OPTION"). A maximum of 5 easy-to-read list entries are displayed on each page. Activating functions via the touchscreen will be the preferred mode of operation for the majority of customers. Nevertheless, virtually all functions can still be operated in the conventional way using the right rotary/pushbutton switch, depending on individual user preference.

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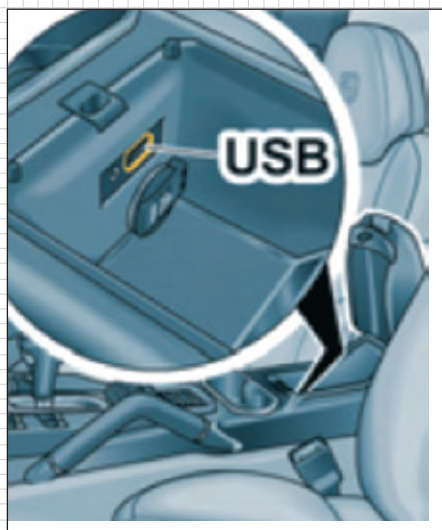
Porsche Communication Management 3.1



CDR-31



Option: A mobile phone can be connected via Bluetooth using the HFP (Hands-Free Profile). In this case, the CDR-31 provides the hands-free functionality.



Audio interface

The standard CDR-31 already has a sound system with 10 speakers divided into 4 channels with a total power output of 100 W and can be used to play audio CDs and music in MP3 format (formats: mp3, aac, wma). For radio listeners, there are up to 36 memory locations available. 30 locations can be freely assigned, while 6 presets are automatically assigned at regular intervals by the Best FM function of the CDR-31 system to the stations with the best reception.

For customers with a GSM (Global System for Mobile Communication) or CDMA (Code Division Multiple Access) mobile phone that supports the Hands-Free Profile (HFP), the mobile phone preparation is optionally available as a convenient Bluetooth® telephone solution with the Phone Book Access function, which can access the phonebook entries.

A 6-disc CD autochanger integrated in the CDR-31 system is also available instead of the standard single CD drive. It is located directly within reach of the driver and, like the single CD drive, also supports the music formats aac, mp3 and wma.

The optional universal audio interface makes it possible to connect an external audio source via the AUX interface. Operation takes place directly at the connected device. The AUX interface is located in the storage bin of the front center console. There is a 12-volt plug socket in the storage bin for supplying power to the external audio source.

The optional digital satellite radio SDARS (Satellite Digital Audio Radio Services) from the provider XM is also available for the first time in combination with the CDR-31 audio system for the new Cayenne in the USA and Canada. This opens up an extensive range of music, sport, entertainment and information stations for customers, with approx. 170 channels in the USA and approx. 130 channels in Canada at present. After a free, three-month trial period, customers can opt to continue using the XM service by paying a subscription. New functions such as searches for tracks and artists as well as auto-search for previously stored favourites allow excellent operating comfort.

Porsche Communication Management 3.1 (PCM) with navigation module

The new Cayenne is optionally available with the latest generation of Porsche Communication Management (PCM 3.1) including navigation module (standard in the Cayenne Turbo). The main features of the latest generation of PCM compared with the predecessor are:

- High-resolution 7-inch WVGA (Wide Video Graphics Array) screen 800 x 480 pixels
- 3D navigation map including Terrain and City models
- Speed limit display in PCM based on navigation data
- Map display in the instrument cluster

Navigation

With the navigation function, users have the option of switching the map view between the new 3D representation (Terrain and City models) or the familiar perspective or two-dimensional representations. A speed limit display shows any speed limits that apply on the roads included in the map material either in PCM (Car display) or in the TFT display on the instrument cluster (the availability of the speed limit display depends on the relevant database status of the map material). The navigation module has an integrated hard disk for fast route calculation. Three alternative route suggestions can be displayed.

The PCM system includes 11 speakers divided into 7 channels, an external amplifier and a total output of 235 W. The integrated CD/DVD player supports audio playback of audio and video DVDs and music in MP3 format (formats: mp3, aac, wma, wav).

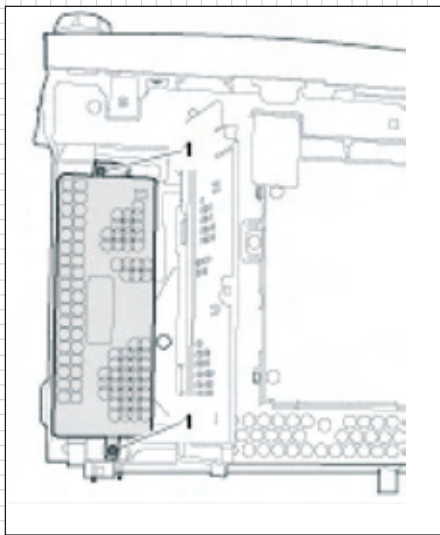
For radio listeners, the audio system includes up to 48 memory locations (42 locations can be freely assigned, 6 presets for Best FM). The integrated CD/DVD player supports audio playback of audio and video DVDs and plays music in MP3 format. Also in 5.1 Discrete Surround Format with the BOSE® Surround Sound System or the Burmester® High-End Surround Sound System, otherwise in stereo. With the new PCM generation, a function for audio transmission via Bluetooth® is available for the first time in the Cayenne. This allows audio data to be transferred from external devices such as music players or mobile phones via the Bluetooth® interface of PCM if this function is supported by the device.



City model



Terrain model



Telephone module cover (underside of device)

Telephone module (option)

The optional telephone module offers superior operating comfort and optimized voice quality. As a quad-band telephone module (for GSM networks 850, 900, 1,800 and 1,900 networks), it now covers all GSM frequency ranges currently used worldwide. Depending on the relevant mobile telephone, the three operating modes familiar from the Panamera are available: In addition to operation with SIM card inserted, the telephone module can automatically detect and switch between the Bluetooth® mobile phone profiles, SIM Access Profile (SAP) and Hands-Free Profile (HFP).

The Cayenne telephone module can also be ordered with a cordless Bluetooth® handset. A charging cradle for the cordless handset is located in the center console storage bin. With the CDR-31 audio system, customers who have mobile phones with the Hands-Free Profile (HFP) and only wish to use the basic mobile telephone functions can also choose the mobile phone preparation as an alternative to the telephone module for PCM. A 6-disc CD/DVD autochanger, which is integrated into the PCM system, is also available optionally instead of the standard single CD/DVD drive.

Audio interface (optional)

The optional universal audio interface makes it possible for the first time to connect an external audio source, e.g. an iPod® or a USB stick, and use it conveniently via the PCM system. Two connection points are provided for this purpose in the storage bin in the front center console:

1. The USB connection can be used to connect not only USB memory sticks with MP3 music and MP3 players, but also various iPod® and iPhone® models, which are operated via PCM, the optional multi-function steering wheel or the optional voice control. Digital audio transmission produces significantly enhanced sound quality with the iPod. Compared with the predecessor, transmission of the audio data to PCM is now digital instead of analog. Another advantage is the noticeably faster list operation in PCM. Access to all track and play lists has also been significantly improved, enabling much faster music searches. The normal Apple iPod® USB cable (supplied by Apple) is used as the connecting cable. The iPod® is also charged via this USB connection.

2. An AUX interface supports the connection of other external audio sources, e.g. a portable CD player. Operation takes place directly at the connected device. As with the CDR-31 audio system, the optional digital satellite radio SDARS available in the USA and Canada from the provider XM is also available in combination with PCM. In combination with PCM, the traffic information sent by XM can now additionally be taken into consideration during dynamic route guidance. Furthermore, extended data services for weather, sport and stock market information are also available.

Electronic logbook (optional)

The electronic logbook is also offered in the Cayenne as an option in combination with PCM. It is used to automatically record the mileage, distance travelled, date and time as well as the start and destination address for each trip.

Voice control (optional)

A latest-generation voice control system is available in combination with the new hard-drive navigation system. Input of the city and the street is evaluated jointly to ensure greater unambiguity. This two-list matching offers simplified operation compared with the former successive evaluation while at the same time increasing the likelihood of finding the desired address immediately. This ensures relaxing and controlled driving comfort. Your hands can stay on the steering wheel and your eyes on the road.



Voice control cannot be activated during a telephone call.



Activation of voice control

BOSE® Surround Sound System

The optional BOSE® Surround Sound System (standard in the Cayenne Turbo) comprises a total of 14 speakers, a 200 W active subwoofer with Class D driver and 200 mm diaphragm diameter as well as 9 amplifier channels to provide an impressive sound experience. A total output of 585 W is therefore available.

A frequency range from 40 Hz to 20 kHz is available at every seat; the maximum undistorted continuous sound pressure level for music signals is greater than 115 dB.

In combination with PCM, the system now opens up the impressive audio spectrum of digital 5.1 recordings when playing music from audio or video DVDs. The audio experience is the next best thing to a live performance with quality sound similar to what you get from a sophisticated home cinema system. In combination with the CDR-31 system, sound reproduction is generally in stereo. The system is immediately recognisable by the BOSE® logo on selected speakers.



BOSE® Surround Sound System

Burmester® High-End Surround Sound System

The Burmester® High-End Surround Sound System was adapted specifically for the new Cayenne and offers superior total output and sound quality. The performance data figures provide impressive proof of this: 16 individually controlled speakers including a 300 W active subwoofer with Class D driver and 250 mm diaphragm diameter, 16 amplifier channels and a total output of more than 1,000 W.

The acoustically effective diaphragm area is over 2,400 cm². A frequency range from 30 Hz to 20 kHz is available at every seat; the maximum undistorted continuous sound pressure level for music signals is greater than 120 dB. In combination with PCM, the Burmester® High-End Surround Sound System naturally also reproduces digital 5.1 recordings when playing back music from audio or video DVDs. In combination with the CDR-31 system, sound reproduction is generally in stereo. The consistent use of the highest quality materials and proven technologies from the Burmester® home hi-fi area ensures “best in class” sound quality in the entire signal chain. Three central goals can be achieved through the consistent use of glass fiber diaphragms in the mid-tone range: glass fiber is lighter than conventional paper diaphragms, enables more stable oscillations through its greater rigidity and leads to an undistorted sound through its higher internal damping.

Sound and technology are not the only areas of excellence offered by the Burmester® High-End Surround Sound System: its design also meets the highest standards. Externally, the system is recognizable by its discreet, silver colored trims with metal surface and Burmester® logos on selected loudspeaker covers. The unique sound and high-quality design of the Burmester® High-End Surround Sound System are therefore the perfect match for the new Cayenne.



Burmester® High-End Surround Sound System

Porsche Rear Seat Entertainment (optional)

As with the CDR-31 audio system, Porsche Rear Seat Entertainment is also available in combination with PCM.

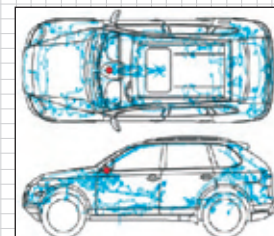


Porsche Rear Seat Entertainment

Compass display (optional)

In addition to the display of the four cardinal and intercardinal points of the compass in the instrument cluster with PCM, a compass display on the dashboard is available in combination with PCM.

The compass consists of the fixed LCD display in the center and the outer movable ring. The red marking on the ring indicates the cardinal point of the compass. The central display shows the current degree heading of the driving direction and the altitude of the vehicle position. The device also has a display in which the altitude above sea level and the compass direction are displayed. The compass direction is displayed rounded off to the nearest degree. The altitude above sea level can be displayed in meters or feet. The value range extends from - 999 m/ft to 19,999 m/ft. The display values are determined by PCM from the GPS data and transmitted to the compass via CAN.



Installation position of the compass

Vehicle electrical system / Energy management

AGM (Absorbed Glass Mat) technology

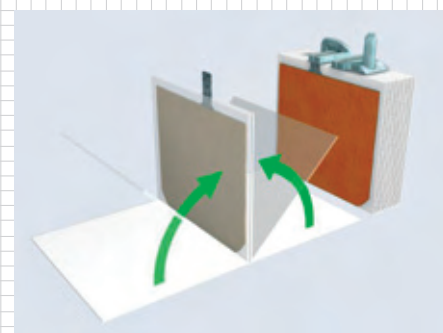
A 12 V 92 Ah 520 A AGM battery is used in the Cayenne; a 12 V 105 Ah 580 A AGM battery is optionally available for colder regions. The battery is located under the left seat in the direction of travel.

The battery is based on AGM (Absorbed Glass Mat) technology. Special micro glass fiber mats lie between the lead plates of the battery and contain all of the battery acid. The absorbing capacity of the glass fiber mats is designed so that although the acid is completely absorbed by the matting, the degree of saturation of the matting is not reached. The sealed system is equipped with a pressure relief valve for the safe discharge of any gases.

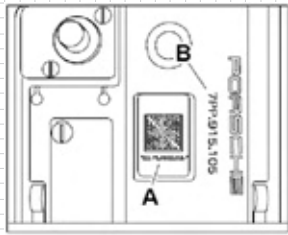
The battery remains leak-proof and dry. Expanding liquid due to frost cannot cause any damage. Furthermore, by packaging the plates in micro glass fiber mats there is virtually no further movement of the plates, which means that vibration has no effect on the battery.



Compass display

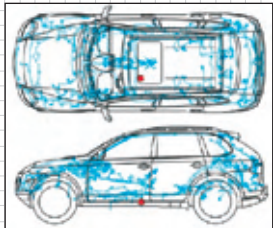


AGM (Absorbed Glass Material)



Caution when jump-lead starting:

Always connect the charging cable/jump leads directly in the engine compartment as otherwise the battery sensor could be damaged.



Installation position of battery sensor

The entire electrolyte is bound by the acid in the matting, which means that there is no need for the maintenance tasks of filling with water and inspecting the electrolyte. AGM batteries are designed with an extremely low internal resistance, resulting in a faster reaction between the acid and the plate material. Higher energy quantities can therefore be produced even in demanding situations such as charging in extreme cold.

Battery replacement must be communicated to the gateway using PIWIS Diagnosis Tester II, specifying the (A) serial number/(B) part number/manufacturer and the battery size under Maintenance/Battery replacement. For charging, a charger with at least 40 A should be connected.

For jump-lead starting, a jump lead should only be connected directly to the external power supply connections in the engine compartment, as otherwise the battery sensor could be damaged and incorrect information (battery charging directly at the battery sensor) forwarded to the gateway.

Battery sensor

The battery sensor is located on the negative terminal of the battery, it is part of the energy management system (battery management). The battery sensor is connected between the negative terminal of the battery and the ground cable.

The purpose of measuring the battery size is to determine the battery condition with sufficient accuracy and to identify closed-circuit current faults in vehicle electrical system diagnosis in production and service.

The following measured variables are measured directly by the sensor

- Battery current
- Battery voltage
- Measurement of the temperature at the negative terminal

The battery current and battery voltage are measured simultaneously.

Relays and fuses

Installation position of fuses/relays:



Fuse box in engine compartment

The main power distributor is installed under the seat on the left in the direction of travel. The function scope corresponds to that of the main power distributor of the Panamera.



Main power distributor

Switch panel on the right/left of dashboard

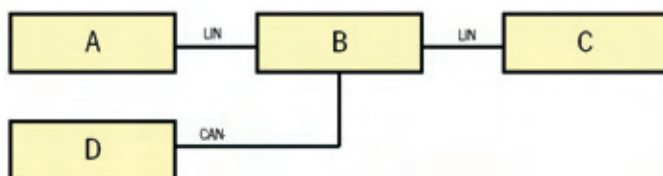


The footwell (steering column/pedals area) contains another relay box (cockpit).

Generator

The generator is liquid-cooled and has a rated current/output of 190 A/2,660 W or 220 A/3,080 W.

For the purposes of generator regulation, the battery sensor information is transferred to the gateway via a LIN (Local Interconnect Network) and the energy requirements are then calculated in the gateway (using an algorithm). The gateway sends this requirements request to the generator regulator, which is designed as a bit-synchronous interface regulator, and the generator regulator then regulates the energy requirements according to the requirements request. The gateway receives the utilization status via the DFM signal (Dynamo Field Monitor) and uses these values to recalculate the energy requirements in the vehicle electrical system.



A Battery sensor

B Gateway

C Generator

D DME

LIN Local Interconnect Network

CAN CAN drive

Vehicle electrical system recuperation

The Cayenne, Cayenne S and Cayenne Turbo feature the new function of vehicle electrical system recuperation as a further fuel-saving measure. The control operation includes the engine control, brake pedal sensor, battery/battery sensor, generator and the vehicle electrical system. The number of cycles (charging and discharge) of the powerful AGM battery could be increased in order to continue to meet requirements with respect to battery life. A software control evaluates the input variables of the components involved, thereby allowing active coordination of the recuperation operation based on the battery charging condition and driver request.

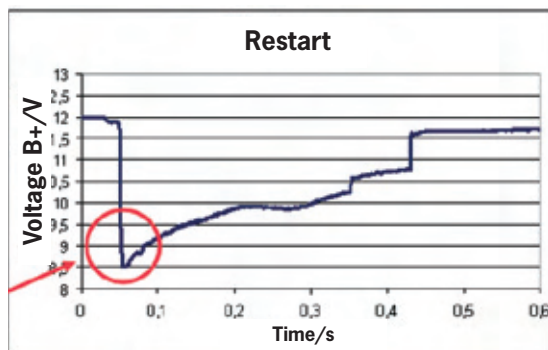
During normal driving and particularly during acceleration, the charging current of the generator is restricted and the vehicle electrical system uses the battery supply. As a result, the engine has to supply less power to charge the battery, which directly results in lower fuel consumption. The battery is mainly charged by the usually otherwise lost braking energy during the braking operation. During braking, the generator power is increased in a targeted manner in order to feed the recuperated energy into the battery. The increased generator power acts with a braking torque on the crankshaft via a drive belt. This leads to vehicle deceleration and therefore supports the conventional brake system.

DC/DC converter (Start Stop)

In the Cayenne the DC/DC converter is installed on the right in the direction of travel, behind the instrument panel.

Situation: (Graphic Restart)

When the engine is started, the vehicle voltage collapses and various components are no longer supplied with the usual 12 V voltage. This can result in a system failure/fault entry.



Restart

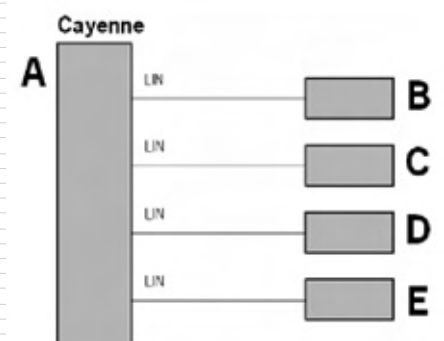
Solution:

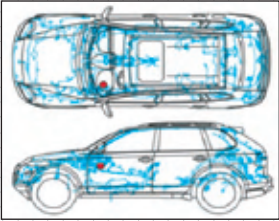
The DC/DC converter is activated when the engine starts (only in the case of a restart) and delivers this missing voltage to the vehicle electrical system.

During Start Stop operation, the Start Stop coordinator (DME) decides to switch off the engine. When the engine is off, the electrical loads will be supplied with energy by the vehicle battery's reserves. The battery voltage falls many times below the cell open-circuit voltage ($2.1 \text{ V/cell} = 12.6 \text{ V}$). When the engine is started, voltage drops occur (when the starter engages and a second voltage drop when the main contacts of the starter are closed and the engine breaks away). Afterwards, the voltage recovers up to the charging voltage as a function of the starter speed, when the starter is switched off and disengaged and after the start of generator charging. The size of the voltage drop depends on the temperature of all the relevant components in the current path, internal resistance and the age of the battery as well as the engine resisting moment when it is turned. During the engine start (boost), the power supply remains uninterrupted and is converted in the range from $12 \pm 0.5 \text{ V}$.

This means that all active loads such as lighting, infotainment system or other comfort/safety features remain unimpaired thanks to stabilization of the vehicle electrical system, as the capacitors compensate for energy bottlenecks. No voltage drop is therefore measured on the generator even under load. The DC/DC control unit © is connected to the gateway (A) via the LIN bus; diagnosis is also performed via the LIN bus.

- A Gateway
- B Generator
- C DC/DC converter
- D Main fuse box
- E Battery sensor
- LIN Local Interconnect Network





Installation position of gateway control unit

Gateway

Databus systems

The gateway manages and routes all messages across bus segments for the following bus interfaces

The LIN interfaces are designed as LIN master interfaces. These LIN interfaces are intended for the connection of a battery sensor, the 12 V DC/DC converter, the generator and a main power distributor. Energy management on the gateway can use the battery sensor to call up various battery characteristics, e.g. voltage, battery charging condition etc., and if required switch off the control units in the vehicle electrical system. For this purpose, the gateway sends the relevant switch-off messages, e.g. via the same LIN bus, to the main power distributor.

Wake-up functions

CAN drive	wakeable	500 kbit/s
CAN crash risks		500 kbit/s
CAN diagnosis	wakeable	500 kbit/s
CAN chassis	wakeable	500 kbit/s
CAN comfort	wakeable	500 kbit/s
CAN MMI	wakeable	500 kbit/s
LIN	wakeable	20 kbit/s

The “Vehicle Network State Manager” of the gateway is a sub-function of network power management and controls the entire vehicle bus communication centrally with respect to wake-up and power-down for Terminal 15 “off”.

After Terminal 15 “off”, all control units send out their sleep readiness. To ensure that the individual bus systems are then switched to sleep mode sequentially rather than in an uncontrolled manner, the “Network Vehicle State Manager” in the gateway controls and monitors the individual network transition points in bus idle. In this context, the gateway sends out its sleep readiness to the individual networks according to a predefined sequence (rules).

The same applies in reverse for waking. When a network is woken up by a connected control unit, the gateway wakes up the other networks in this state. The networks then “fall asleep” again as described above.

Other functions

The gateway also supports AfterSales Service in vehicle fault finding by providing comprehensive system and diagnostic functions for monitoring network communication.

The gateway provides vehicle energy management as an additional function. This function supports optimisation of battery charging during driving as well as minimization of the closed-circuit current by switching off comfort functions and networks when the vehicle is stationary.



Online engine immobilizer 5 / Component protection

The electronic engine immobilizer 5 protects the vehicle from unauthorized use. The 5th generation engine immobilizer used for the first time in the Panamera has been enhanced for the Cayenne with the introduction of component protection. In order to achieve a higher degree of security, the immobilizer is distributed over several components:

- Vehicle key with transponder
- Immobilizer master (front-end electronics)
- Electromechanical steering lock
- Engine control unit (DME)
- Anti-theft alarm system master (rear-end electronics)

Vehicle key

The vehicle key has a radio interface and a transponder interface. Using the radio interface, the user can actively operate the central locking system, i.e. the vehicle can be locked and unlocked.

A transponder interface is used for the function in the ignition lock. The data is exchanged between the key and the ignition lock via this interface. A battery is not required in the key for this interface. With the optional equipment "Porsche Entry & Drive", the key has an additional radio interface for near-field communication/detection of approaching of the vehicle (125 kHz). The central locking (open/close function) responds via the normal radio interface (433 MHz).

Communication between the vehicle key and the immobilizer master is encrypted. Vehicle access with the remote control and access with "Porsche Entry & Drive" involve the transfer of 32 bits (4 bytes) of encrypted data. This produces approx. 4 million variants. To start the vehicle, 64 bits (8 bytes, remote control/Porsche Entry & Drive) of encrypted data is transferred for authentication of the key.



Vehicle key with transponder

Electronic ignition lock

The ignition lock accommodates the vehicle key in the basic variant. The inserted vehicle key can be authenticated via the transponder interface in the ignition lock. To do this, the ignition lock converts the radio information into LIN signals for communication with the immobilizer master.

The ignition lock has three positions for operation:

- OFF
- Ignition (Terminal 15)
- Start engine (Terminal 50)

The vehicle key is reset from the “Start engine” position to the “Ignition” position automatically. The “Ignition” position has a detent so that the position can be uniquely identified at all times. The vehicle key can only be removed in the “OFF” position. For vehicles with Tiptronic transmission, the selector lever must be in the “P” position.

With the optional equipment “Porsche Entry & Drive”, the ignition lock contains an operating element. The operating element remains in the ignition lock at all times. In this case, the valid key is authenticated via the radio interface between the vehicle key and immobilizer master.

Immobilizer master (front-end electronics)

The immobilizer master decides when to release the immobilizer. All components of the immobilizer must be authenticated by the master in this case. The immobilizer master functionality is integrated in the front-end electronics.

In addition to the driving authorization functions, this control unit contains:

- Exterior/interior light functions
- Central locking, Entry & Drive access function
- Terminal management (15, 30, 50)
- Control systems (e.g. electrically adjustable steering column, Servotronic, passenger compartment sensor)

Electromechanical steering column lock

The electromechanical steering lock serves to block the steering by mechanical means, in order to prevent unauthorized use of the vehicle. The electromechanical steering lock is installed in the steering system and can only be removed after dismantling the steering column. As a component of the electronic immobilizer, the electromechanical steering lock must be authenticated for release of the ignition by the immobilizer master.



Electronic ignition lock



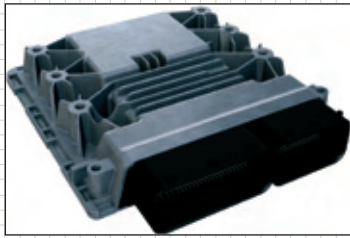
Electronic ignition lock with operating element



Control unit for front-end electronics



Control unit for electronic steering column lock



DME control unit

Engine control unit (DME)

The engine control unit is authenticated by the immobilizer master via the CAN bus. Since the immobilizer master and the engine control unit cannot be on the same CAN bus, the messages are routed via a gateway. Only with positive authentication is the injection system released by the engine control unit as a requirement for engine operation.

Activating the engine immobilizer

The engine immobilizer is activated in the engine control unit by switching the ignition off. The engine control unit discards the internal release when the ignition is switched off and must obtain a new release from the immobilizer master the next time the ignition is switched on.

In the basic equipment, the electromechanical steering lock is activated by removing the vehicle key when the vehicle is stationary. The electromechanical steering lock blocks the steering system mechanically and discards the internal release of the engine immobilizer.

With the optional equipment “Porsche Entry & Drive”, the electromechanical steering lock is activated after the ignition is switched off and the driver's door is opened, but no later than when locking up the vehicle. All variants prevent locking of the electromechanical steering lock when the ignition is on or the engine is running.

Rear-end electronics (anti-theft alarm system master)

The alarm system function is integrated into the rear-end electronics. The alarm system has no effect on driving authorization. However, the same processes are used to release the engine immobilizer and deactivate the alarm system.

Deactivation of the alarm system therefore also involves encryption, with data exchange via the CAN bus.



Control unit for rear-end electronics

Component protection

Component protection is a new function on the Cayenne. In addition to the online engine immobilizer 5 functions, the gateway and airbag control unit functions are incorporated into the integrated system. If one of these control units is replaced, it must first be taught with the online teaching function. The component protection menu item must then be selected and the instructions followed.

Front-end electronics

The Cayenne has front-end electronics, which are largely identical to the functions already introduced in the Panamera (see SIT Panamera). Windshield heating has been added for the first time.

The windshield heating can be switched on and off when the engine is running using the button in the front operating and A/C unit. The active mode is indicated by means of an LED in the button. The windshield heating is dependent on the outside temperature and switches off automatically after approx. 1 to 4 minutes.



Windshield heating switch

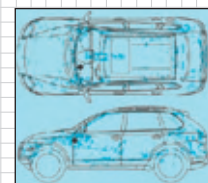
Rear-end electronics

The rear-end electronics are essentially the same as the functions similar to the Panamera. Changes have been made to the control of the roll-up sunblinds in the rear doors and the rear spoiler, which is not electrically adjustable as it is on the Panamera. The DC/DC converter of the Start Stop system on the Cayenne is connected to the gateway via LIN instead of the rear-end electronics, while diagnosis is performed in the gateway.

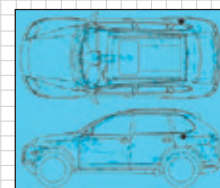


Note!

There is a new online teaching function for Cayenne, the Airbag and Gateway are taught to the vehicle utilizing this function.

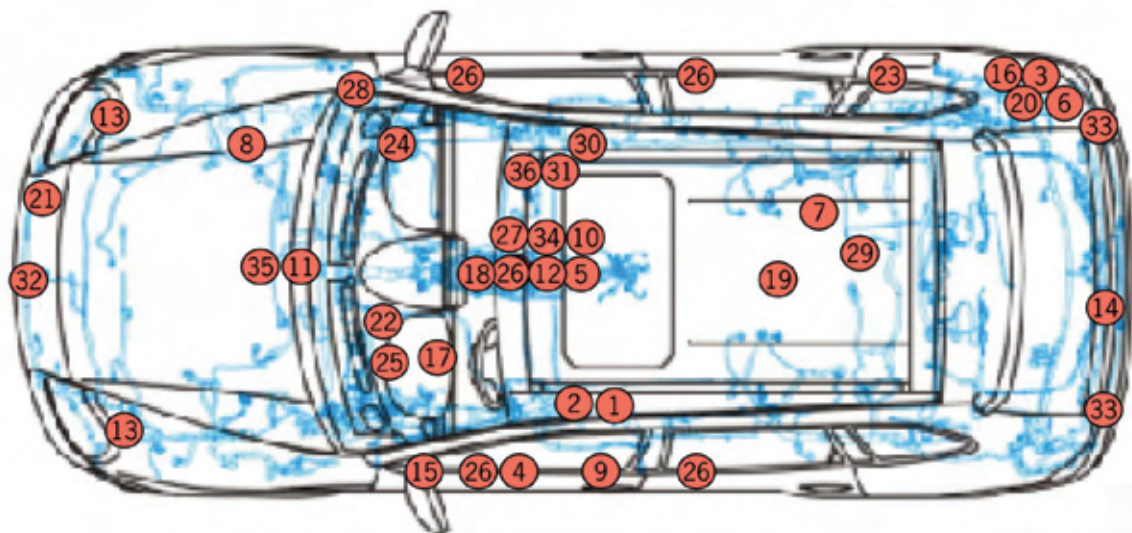


Installation position of front-end electronics



Installation position of rear-end electronics

Component overview



- | | |
|--------------------------|------------------------------------|
| 1 Battery | 19 AC Unit rear |
| 2 Main Fusebox/HSB | 20 TV-Tuner (Not USA) |
| 3 Electric parking brake | 21 Home Link |
| 4 ParkAssist | 22 BCM front |
| 5 Chassis switch | 23 BCM rear |
| 6 PASM, Air suspension | 24 DC/DC |
| 7 PDCC | 25 Gateway |
| 8 PSM | 26 Door modules |
| 9 RDK, outside | 27 All wheel drive |
| 10 Sensor cluster | 28 DME |
| 11 Wiper | 29 ECKSM (Fuel Pump) |
| 12 Sliding roof | 30 Limited Slip Differential |
| 13 ECU ALWR/PDLS | 31 Tiptronic (electrical oil pump) |
| 14 Power Liftgate | 32 ACC |
| 15 ParkAssist | 33 SWA (BSD Lane Change) |
| 16 ECU Trailer | 34 Airbag |
| 17 Instrument Cluster | 35 Alarm horn |
| 18 AC Unit front | 36 Seat occupancy |