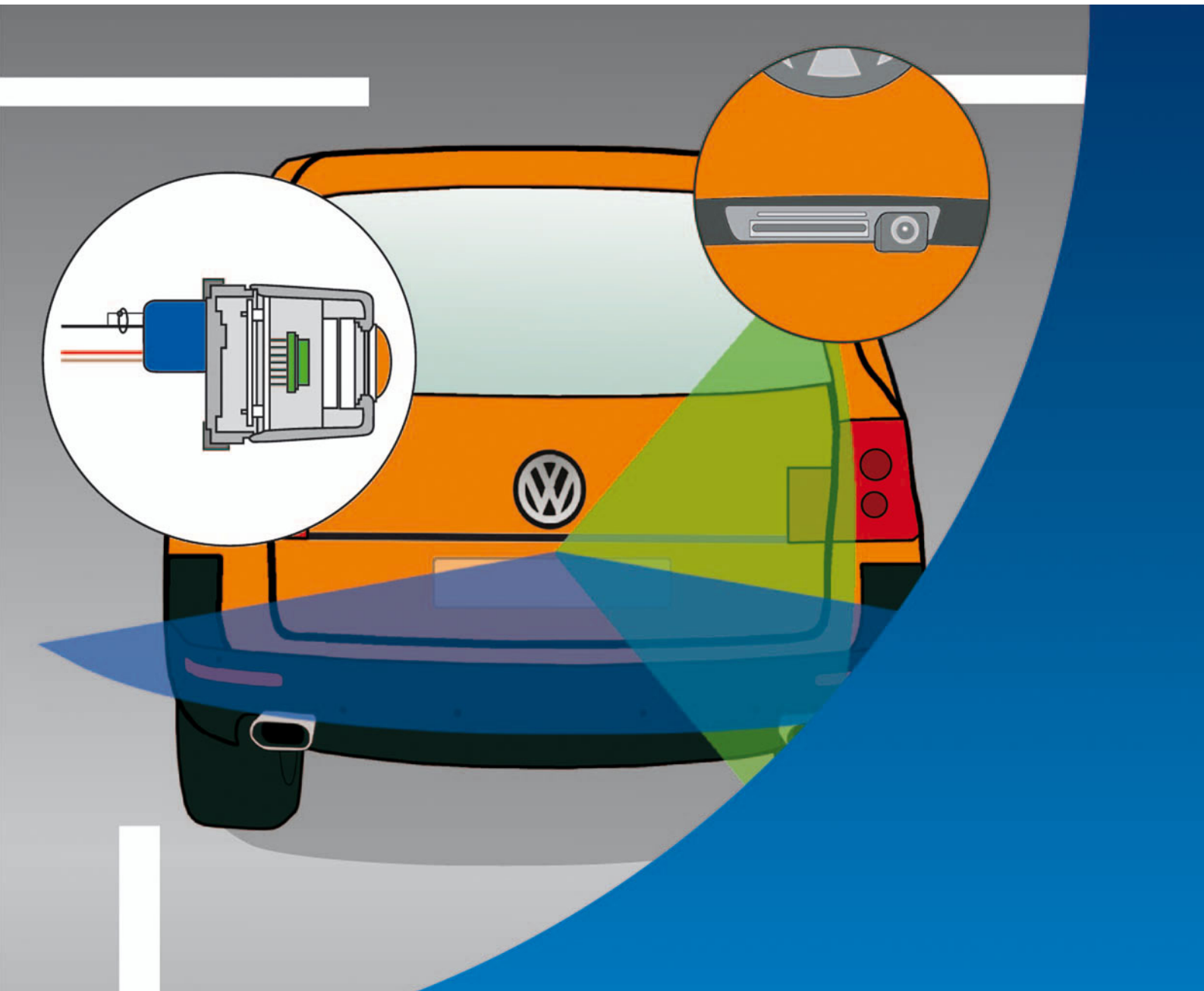
Service Training

# Self-study Programme 407

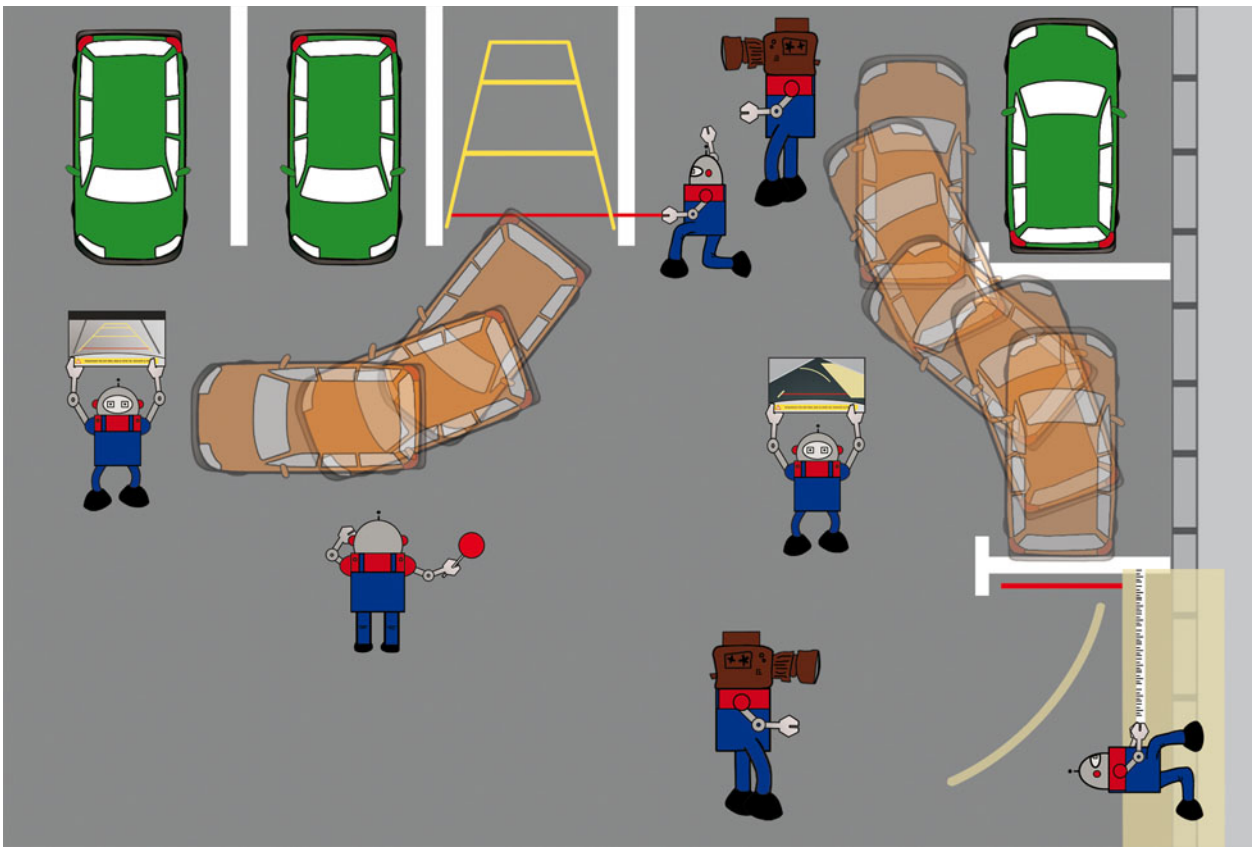
# Reversing Camera System

Design and Function



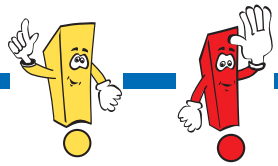
Driver assist systems are developed to relieve the burden on drivers due to the increasingly dense traffic and the flood of information they have to deal with. These aids support drivers in certain traffic situations or take over driving procedures either completely or partly.

One example is the reversing camera system from Volkswagen. It supports the driver when manoeuvring backwards and reversing into parking spaces.



S407_001

**NEW**



**Important Note**

**The self-study programme shows the design and function of new developments.**
**The contents will not be updated.**

For current testing, adjustment and repair instructions, refer to the relevant service literature.

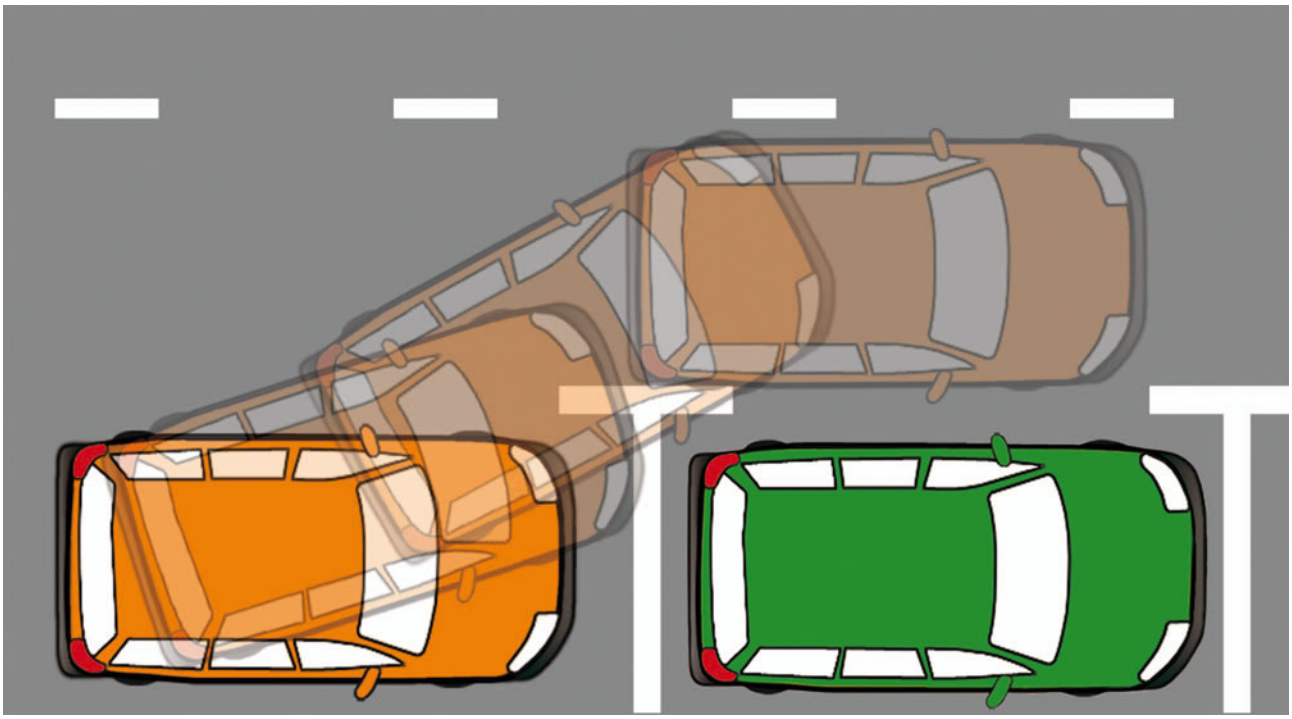
# Contents

# Introduction

## Reversing Camera System

The reversing camera system assists the driver while reversing by showing the driver what is behind the vehicle on a screen.

The system is activated when terminal 15 is ON and/ or the engine is running by selecting reverse gear on vehicles with manual gearbox or by selecting “R” on vehicles with automatic gearbox.



S407_002

The reversing camera system cannot replace the driver’s judgement.
The driver is still legally responsible for their vehicle.

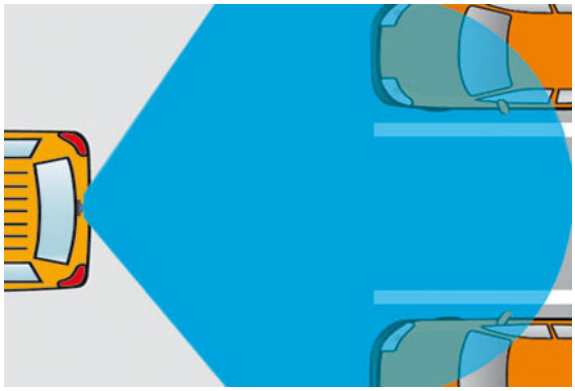
# System requirements

Equipping a vehicle with the reversing camera system has the following technical requirements:

- reversing camera,
- reversing camera system control unit and
- display screen (e.g. radio or radio/navigation system with video output).

**Reversing camera**

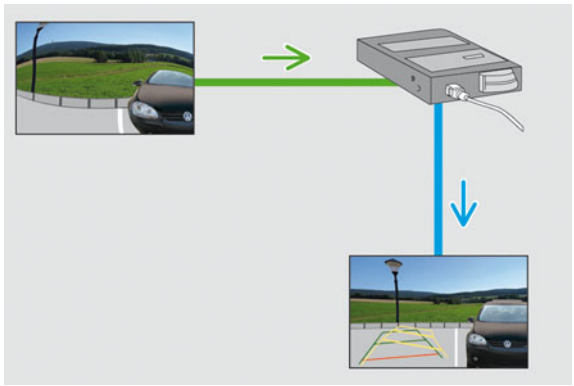
Used for visualisation of area behind the vehicle.



S407_003

**Reversing camera system control unit**

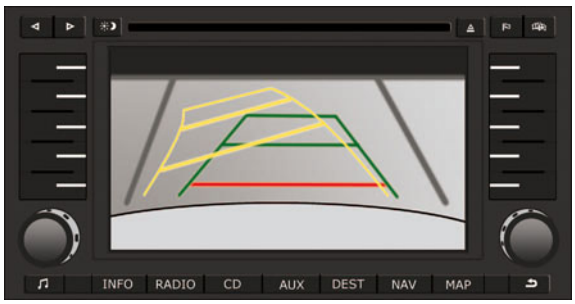
Processes the picture from the reversing camera and transmits it to the screen if the defined requirements are met.



S407_004

**Display screen**
**(e.g. radio or radio/navigation system with video output)**

Shows the picture processed by the reversing camera system control unit on the display screen.

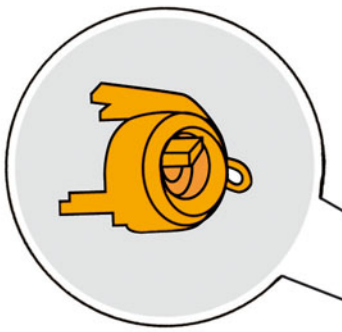



S407_005

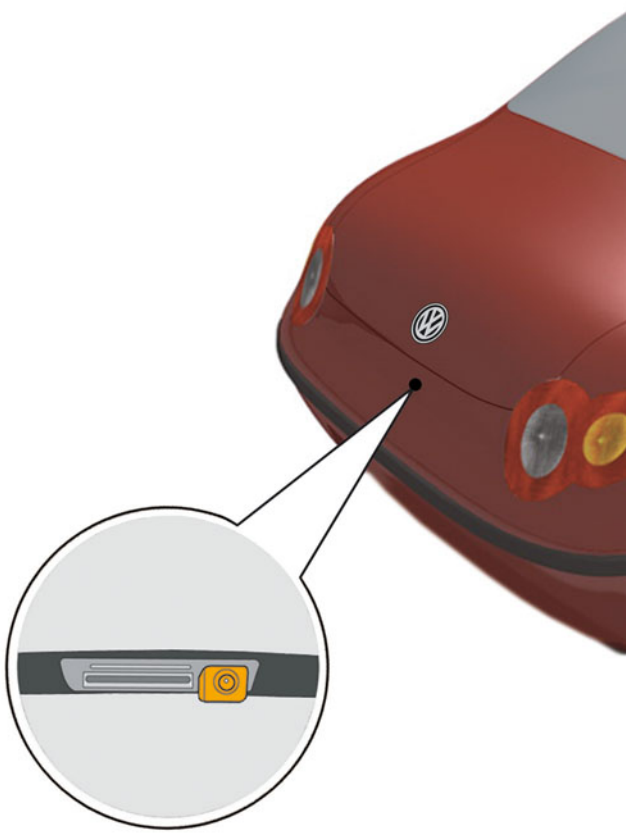
## Overview of system components and their locations

Volkswagen's reversing camera system was introduced with the 2007 Touareg. The illustration opposite provides an overview of the locations of the components that are required for use of the reversing camera system.

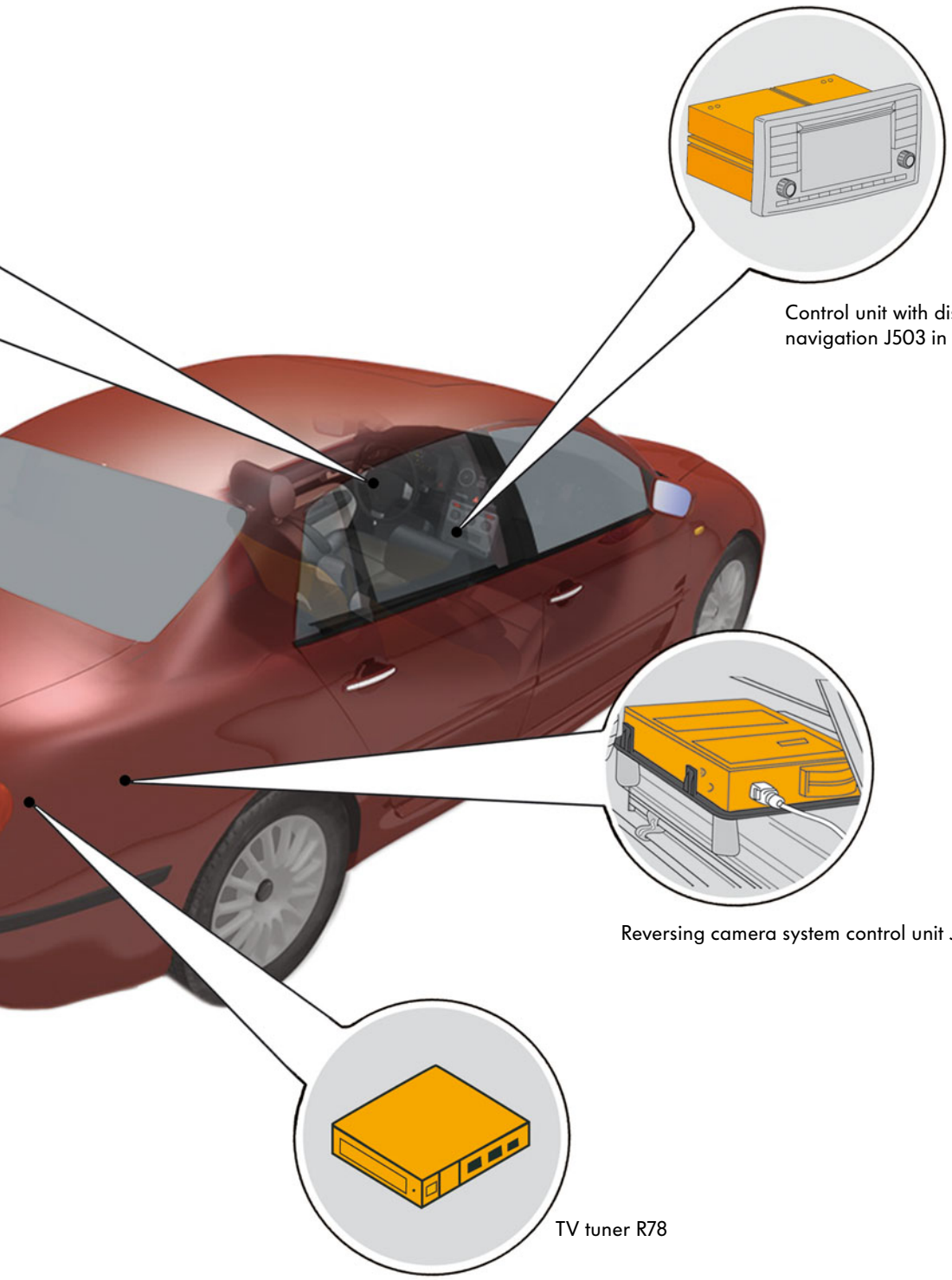
The reversing camera R189 and the reversing camera system control unit J772 together with the control unit with display for radio and navigation J503 form the main components of this system.



Steering angle sender G85



Reversing camera R189
in rear lid handle



Control unit with display for radio and navigation J503 in dash panel

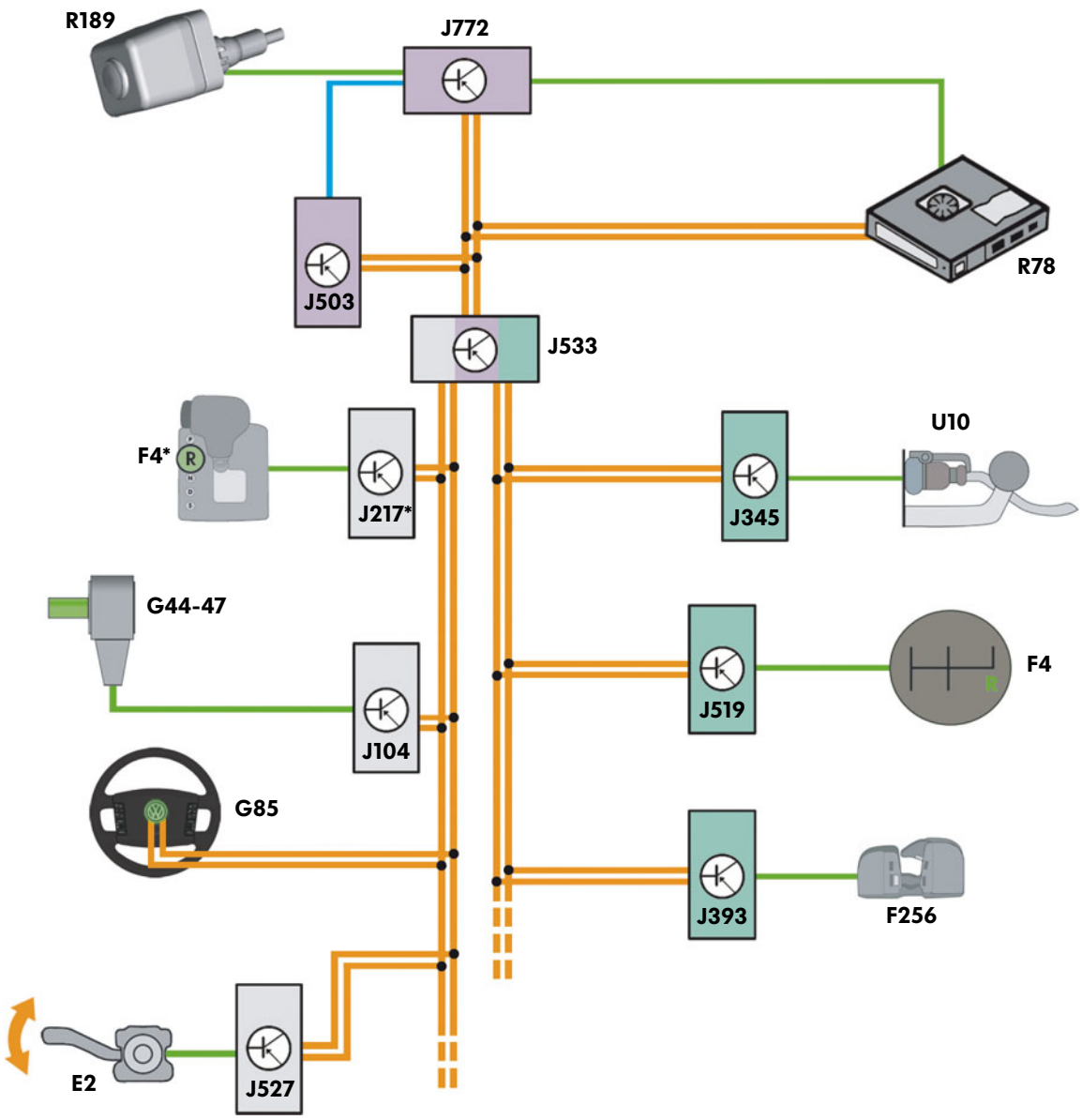
Reversing camera system control unit J772

TV tuner R78

S407_006

# Design

## System schematics




S407_007

The reversing camera system function is achieved through the interaction of different vehicle subsystems via the CAN data bus system.

E2 Turn signal switch

F4 Reversing light switch

F256 Rear lid lock unit

G44 Rear right speed sensor

G45 Front right speed sensor

G46 Rear left speed sensor

G47 Front left speed sensor

G85 Steering angle sender

J104 ABS control unit

J217 Automatic gearbox control unit*

J345 Trailer detector control unit

J393 Convenience system central control unit

J503 Control unit with display for radio and navigation

J519 Onboard supply control unit

J527 Steering column electronics control unit

J533 Data bus diagnostic interface

J772 Reversing camera system control unit

R78 TV tuner

R189 Reversing camera

U10 Trailer socket

* Only vehicles with automatic gearbox

Powertrain CAN data bus

Convenience CAN data bus

Infotainment CAN data bus

Sensor, input signal

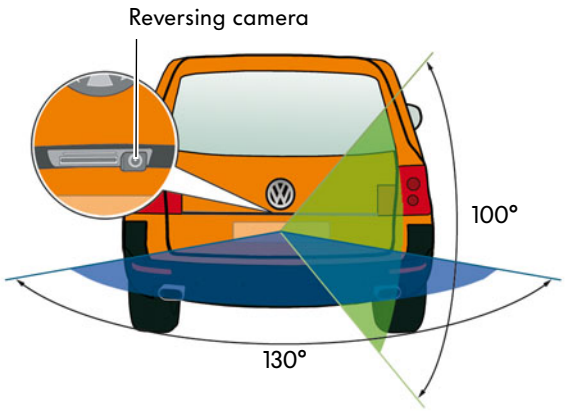
Actuator, output signal

Data bus line

## System components

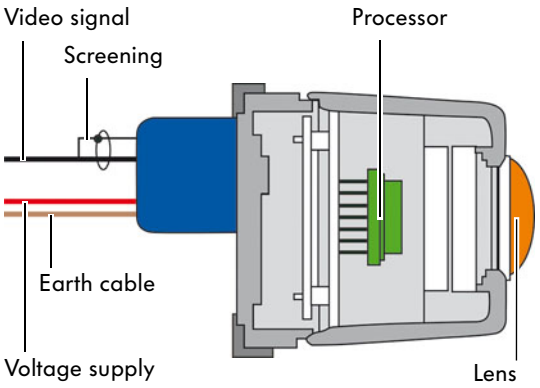
### Reversing camera

The reversing camera is a wide-angle camera that Volkswagen have managed to build into the rear lid handle thanks to its compact design. The camera covers the area behind the vehicle. The picture is extremely distorted due to the lens opening angle that is 130° horizontal and 100° vertical and first needs to be corrected by the reversing camera system control unit.




S407_008

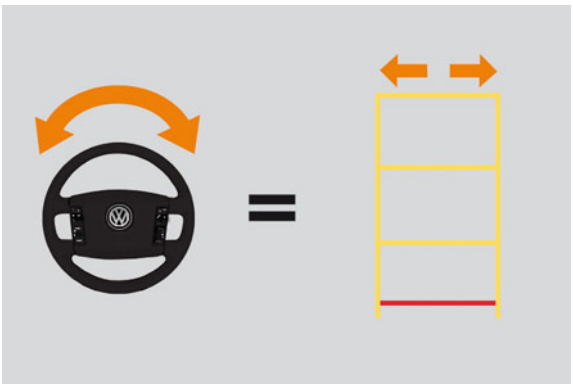
The processor (with integrated chip) mirrors the captured image. Mirroring is necessary so that the left-hand side of the vehicle is shown on the left of the display screen. The picture is converted into electrical signals and transmitted to the reversing camera system control unit. The reversing camera is connected to the reversing camera system control unit via three cables (power supply, earth cable and video signal with integrated screening).




S407_009

### Steering angle sender

The steering angle of the steering wheel is determined via the steering angle sender. The reversing camera system control unit generates dynamic helper lines and integrates them in the camera picture on the basis of this information. They move in the same direction and in sync with the steering wheel. If the steering angle sender is not adapted, helper lines will not be displayed and a fault memory entry will be stored in the control unit.

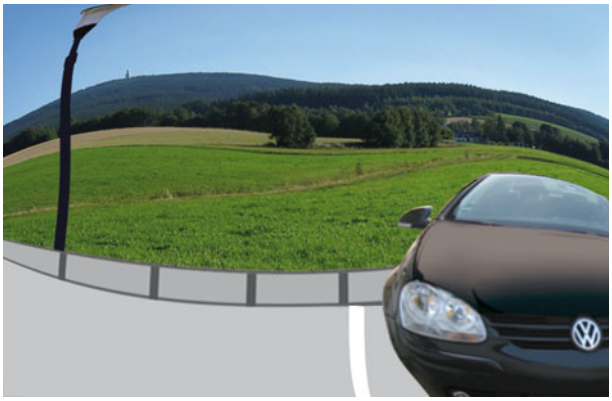


S407_010

**Reversing camera system control unit**

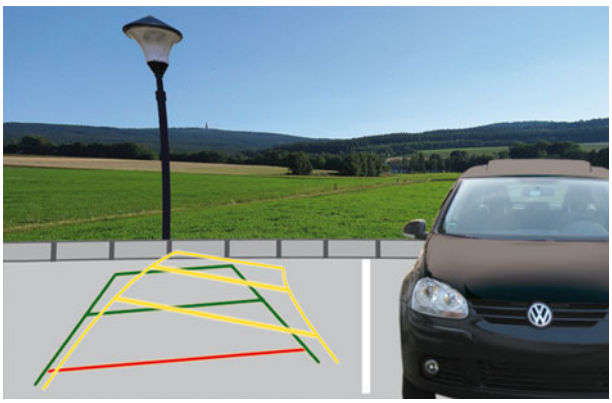
The reversing camera system control unit has the task of processing the images supplied by the camera and preparing them for output on the display screen. This includes rectifying the supplied image and adding the helper lines. The reversing camera system control unit displays the respective static and dynamic helper lines depending on the selected parking mode. If the reversing camera system is activated, the reversing camera system supplies power to the reversing camera and switches it on. The reversing camera system control unit has two video inputs to which the TV tuner (optional) and reversing camera are connected. If required, the camera image or the TV picture is automatically transmitted to the radio/ navigation system display screen via a video switch integrated in the reversing camera system control unit.

Before processing by the reversing camera system control unit



S407_011

After processing by the reversing camera system control unit



S407_012

**Control unit with display unit for radio and navigation**

The camera image is shown on the radio/navigation system display screen with the static and dynamic helper lines. The required parking mode can be selected using the control buttons. It is also possible to adjust the colour, contrast and brightness or switch off the picture.

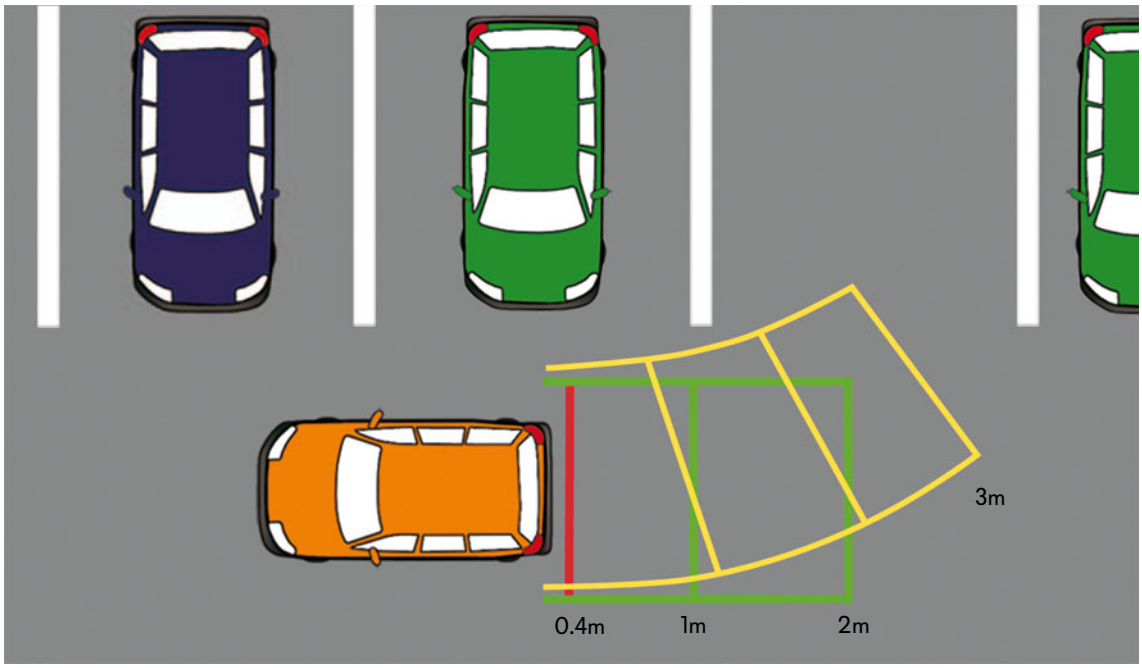
# How Reversing Camera System Works

## Parking modes

The reversing camera system from Volkswagen has two different parking modes (parking mode 1 and parking mode 2) that can be selected depending on the parking situation.

### Parking mode 1

This parking mode is suitable for reversing into parking spaces or reversing manoeuvres in narrow streets or garage entries. The green static helper lines show the vehicle outline lengthened by 2 metres and widened by approx. 25cm on the left and right. The red static helper line shows a distance of 0.4m. The yellow dynamic helper lines show the current steering angle and are placed at a distance of 1m.



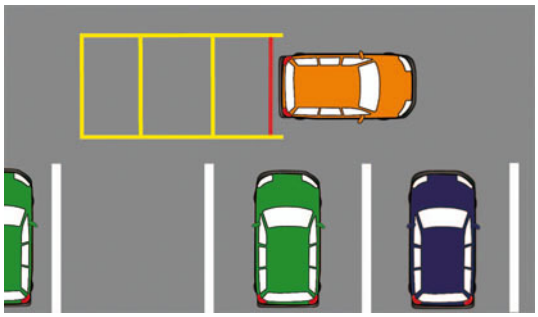

S407_013

- Static helper line (0.4m behind the vehicle)
- Static helper lines (vehicle outline widened by 25cm on the left and right)
- Dynamic helper lines (current steering angle, from steering wheel)

S407_034

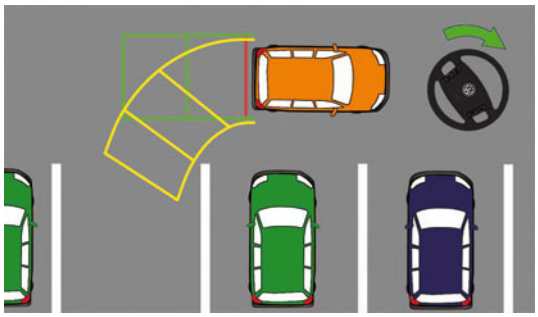
**In the following section, a parking procedure with parking mode 1 is shown.**

The reversing camera system is activated by selecting reverse gear or “R” gear. The picture from the reversing camera is shown on the display screen with the helper lines for this parking mode. The current steering angle is shown by the yellow dynamic helper lines on the screen.



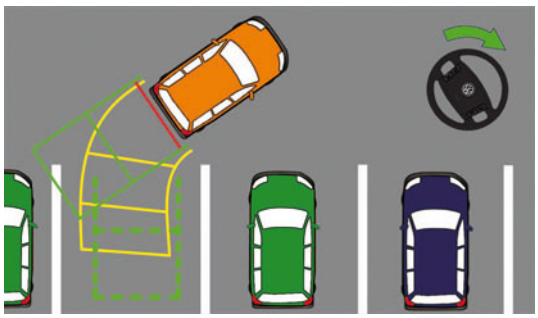
S407_014

The steering angle should be corrected by turning the steering wheel until you can drive into the parking space. The vehicle should be reversed slowly. You need to check the steering angle and correct it, if necessary.



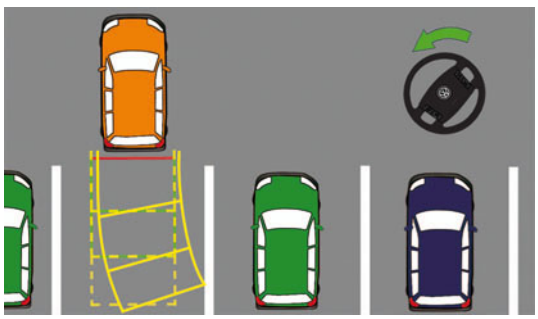
S407_015

Manoeuvre the vehicle until the green static helper line is parallel to the parking space markings (dotted line).



S407_016

Correct the steering angle until the yellow dynamic helper lines cover the green static helper lines (straight ahead). You can now reverse the vehicle to the final parking position.

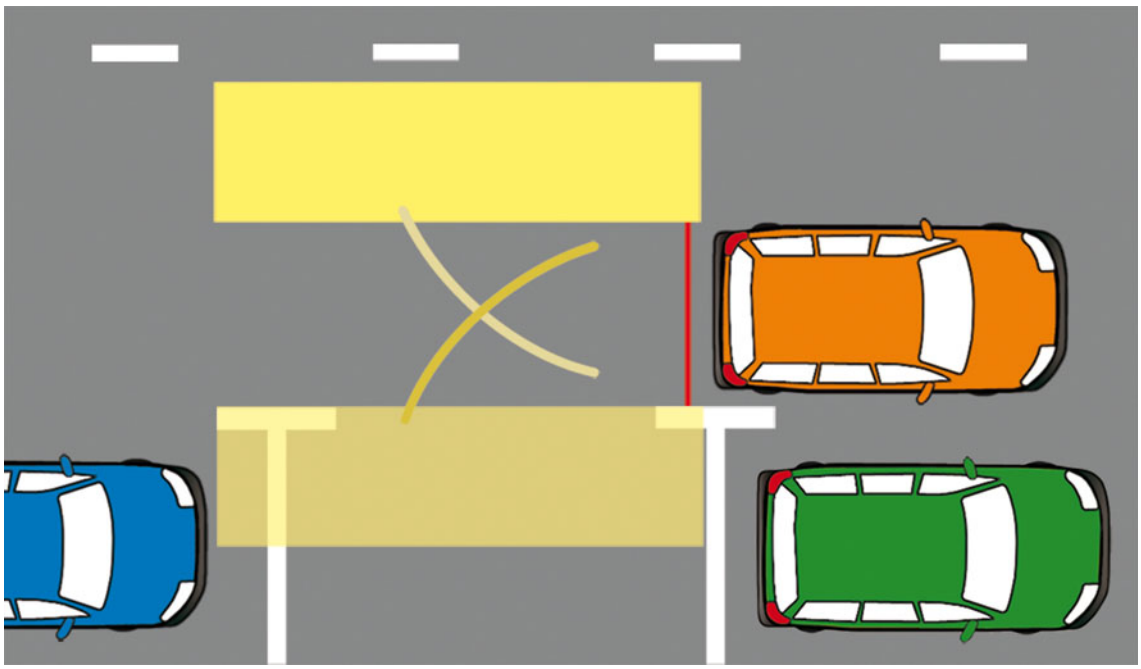


S407_017

# How Reversing Camera System Works

**Parking mode 2**

This parking mode is suitable for reversing into parking spaces parallel to the kerb. You can use the yellow helper lines to check whether a parking space is large enough for the vehicle. The helper areas are shown on the left and right. You select the side with the turn signal.



S407_018

Static helper line (0.4m behind the vehicle)
Static helper line (determination of steering point), right-hand parking space
Static helper line (determination of steering point), left-hand parking space

Static helper field (determination of target parking space), on right

Static helper field (determination of target parking space), on left

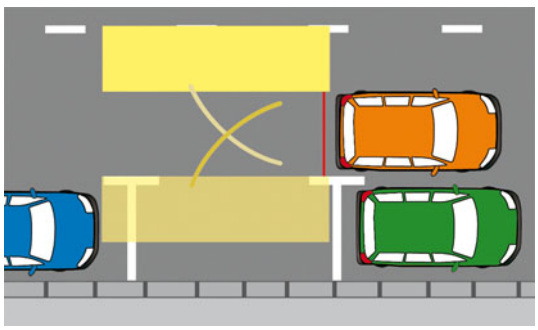
S407_033

The reversing camera system is always activated in parking mode 1. Parking mode 2 needs to be selected manually.

The method for switching from parking mode 1 to parking mode 2 depends on the model and is described in the owners manual.

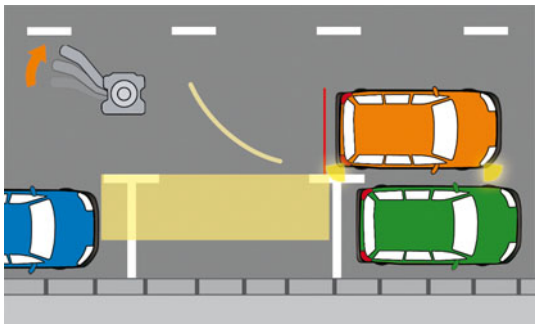
**In the following section, a parking procedure with parking mode 2 is shown.**

After selecting parking mode 2, two static helper fields appear on the radio/navigation system display screen with the related helper lines. The helper fields are 6.7m long regardless of the vehicle type and indicate the space that is required for the parking procedure.



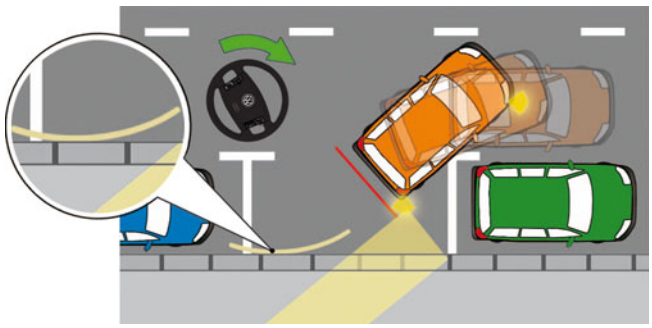
S407_019

The helper field that is not required together with the related static helper lines is hidden when you set the turn signal. The vehicle should be positioned as normal and reversed until the helper field is against the vehicle behind the parking space.



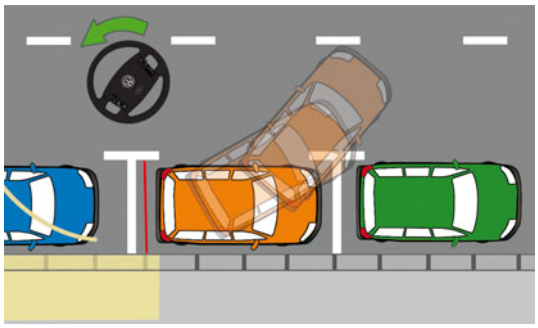
S407_020

The steering wheel should be turned fully towards the selected parking space while the vehicle is stationary. The vehicle should be reversed until the yellow static helper line touches the kerb (steering point).



S407_021

The steering wheel should be turned fully in the opposite direction while the vehicle is stationary. The vehicle should then be reversed until it is parallel with the kerb. Turn the wheels to the straight ahead position to move into the final parking position.



S407_022

# How Reversing Camera System Works

**Trailer operation**

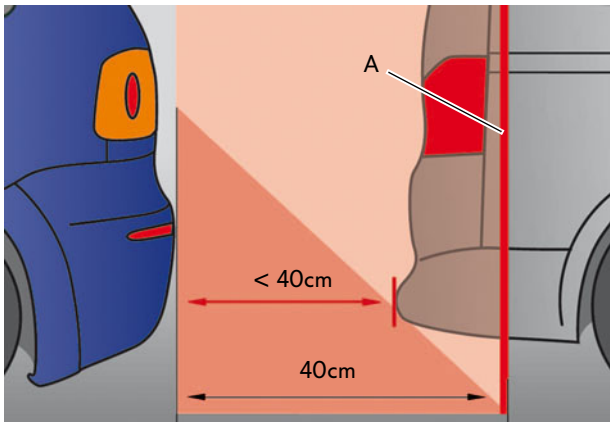
When a trailer is attached and the rear lid is open no helper lines are shown on the display screen. This function is deactivated by the reversing camera system control unit as soon as a trailer is detected by the trailer detector control unit. The reversing camera system can be used to support manoeuvres when a trailer is attached. The movement of the tow bar can be followed on the display screen. It is useful when you are hitching a trailer as you can see the ball of the tow coupling on the display screen.

**System limitations**

The camera picture is reproduced slightly delayed and not in real-time due to processing in the reversing camera system control unit. As the display is two-dimensional, protruding, pointed obstacles are hard to depict and thus very difficult to recognise.

**Safety information**

The red static helper line (A), marks a distance of 40cm from the rear of the vehicle to the floor. This distance (red arrow) is reduced when obstacles have an overhang (e.g. high vehicles with protruding bumper)

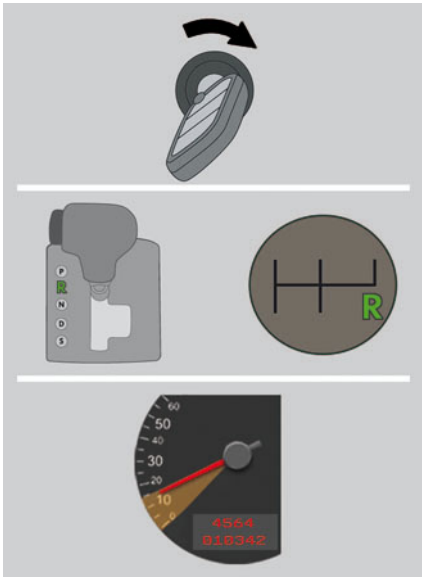



S407_023

The reversing camera system serves as a support system. It cannot replace looking in the exterior and interior mirrors.

**Switching on conditions**

The following conditions need to be met before the reversing camera system is used:



Terminal 15 ON and/or engine running

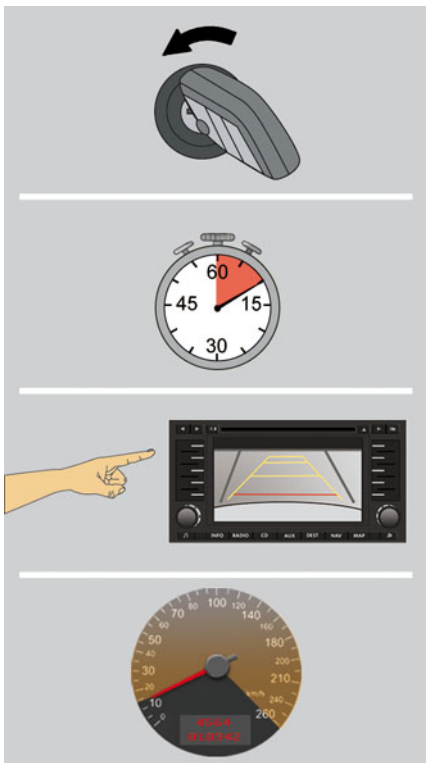
Reverse gear or “R” selected

Speed below 15km/h

S407_024

**Switching off conditions**

The reversing camera system is switched off under the following conditions:



Terminal 15 OFF

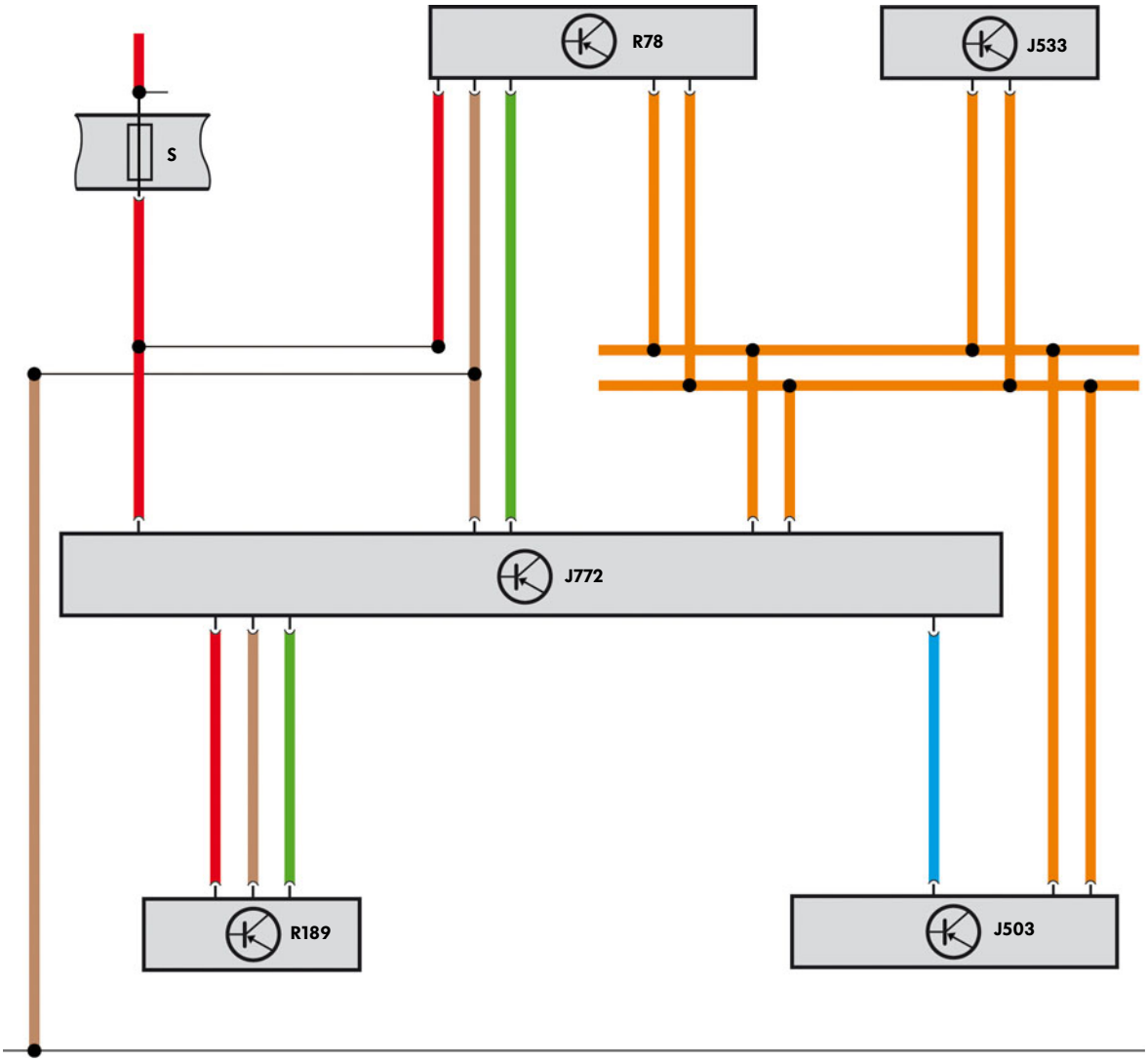
or 10 seconds after deselecting reverse gear or “R”

or by switching off manually on the display screen

or at speeds above 15km/h.
If reverse gear or “R” is selected, only the display screen will be switched off. The picture will appear again when the speed falls below 10km/h again.

S407_025

# Functional Diagram




S407_026

**J503** Control unit with display for radio and navigation

**J533** Data bus diagnostic interface

**J772** Reversing camera system control unit

**R78** TV tuner

**R189** Reversing camera

**S** Fuse

Input signal
Output signal
Positive
Earth
CAN data bus

# Service

**Diagnosis**

The VAS 5051 vehicle diagnosis, measuring and information system and the VAS 5052 vehicle diagnosis and service information system can be used for the reversing camera system.

S407_027

S407_028

S407_029

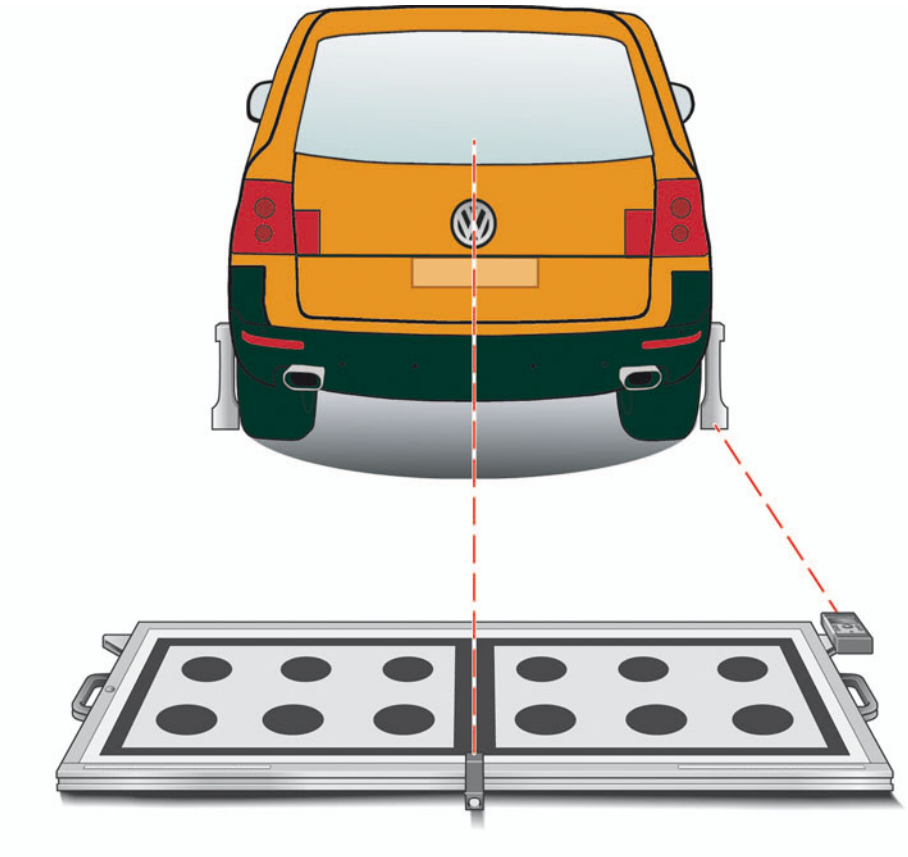
The following work can be carried out with the diagnosis testers:

- Reading data blocks
- Reading the reversing camera system control unit code and re-coding it
- Calibrating the reversing camera system

Please refer to the workshop manuals for detailed information on the diagnosis possibilities for the reversing camera system.

**Calibration**

The reversing camera system requires calibration so that the picture from the reversing camera is replicated correctly.



S407_030

The reversing camera system needs calibration after the following work procedures among others:

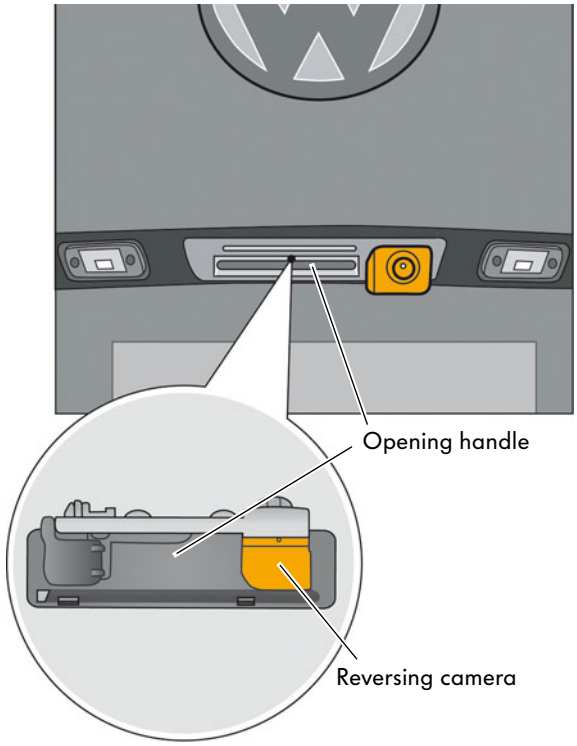
- Removal/fitting or replacement of the rear lid handle
- Removal/fitting or replacement of reversing camera
- Replacement of the reversing camera system control unit

For more detailed information on further conditions and calibration of the reversing camera system, please refer to the workshop manuals.

# Service

**Fitting/removal**

The reversing camera is integrated in the rear lid handle. It can be replaced separately, however. The reversing camera system should be calibrated after the handle or reversing camera is removed or replaced.




S407_031

For more detailed information on removal of the reversing camera and calibration of the reversing camera system, please refer to the workshop manuals.

**Cleaning/care**

The reversing camera lens has a dirt-resistant coating. Despite this dirt cannot be ruled out because of weather conditions. This should be removed by the driver. Dirt on the reversing camera lens results in poor picture quality and is not detected by the reversing camera system control unit.

You can use normal commercially available alcohol-based glass cleaners and dry, lint-free cloths to clean the lens.

# Test Yourself

**Which answers are correct?**
One or several of the answers could be correct.

**1. Which statements about the reversing camera system control unit are correct?**

☐ a) The reversing camera system control unit only works in conjunction with the TV tuner.

☐ b) The reversing camera system control unit provides the voltage supply for the reversing camera.

☐ c) The reversing camera system control unit calibrates itself automatically.

☐ d) The reversing camera system control unit rectifies the reversing camera picture and adds the static and dynamic helper lines.

**2. When is the reversing camera activated?**

☐ a) When terminal 15 is ON and/or the engine is running and reverse gear is selected.

☐ b) As soon as a trailer is detected.

☐ c) At speeds below 25 km/h.

**3. Complete this sentence:**
**If the steering angle sensor is not adapted...**

☐ a) ...no picture is transmitted by the reversing camera.

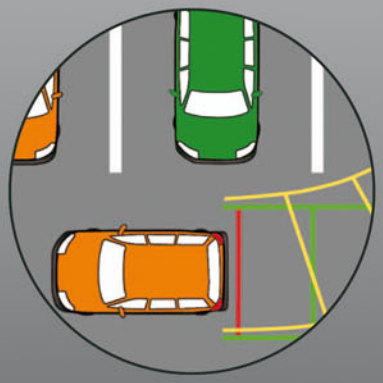
☐ b) ...the functioning of the reversing camera system is not impaired.

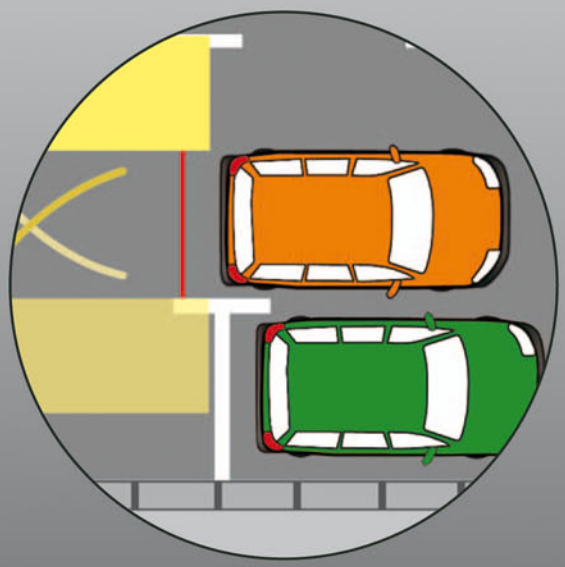
☐ c) ...the picture from the reversing camera is transmitted without helper lines.

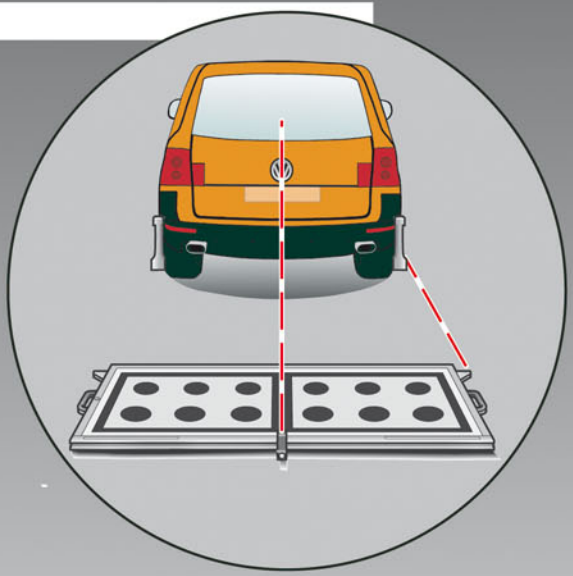
**Answers**

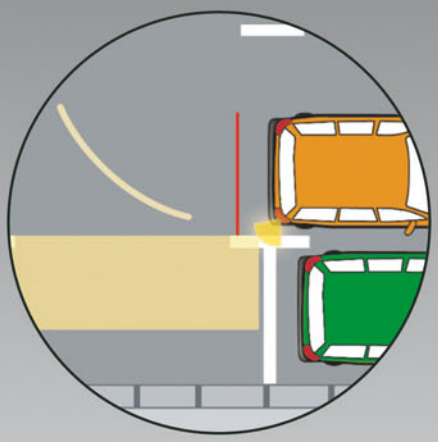
1. b), d); 2. a); 3. c)

407







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Service Training VSQ-1
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