Service Training

Self-study Programme 397

2007 Radio/Navigation Systems

Design and Function

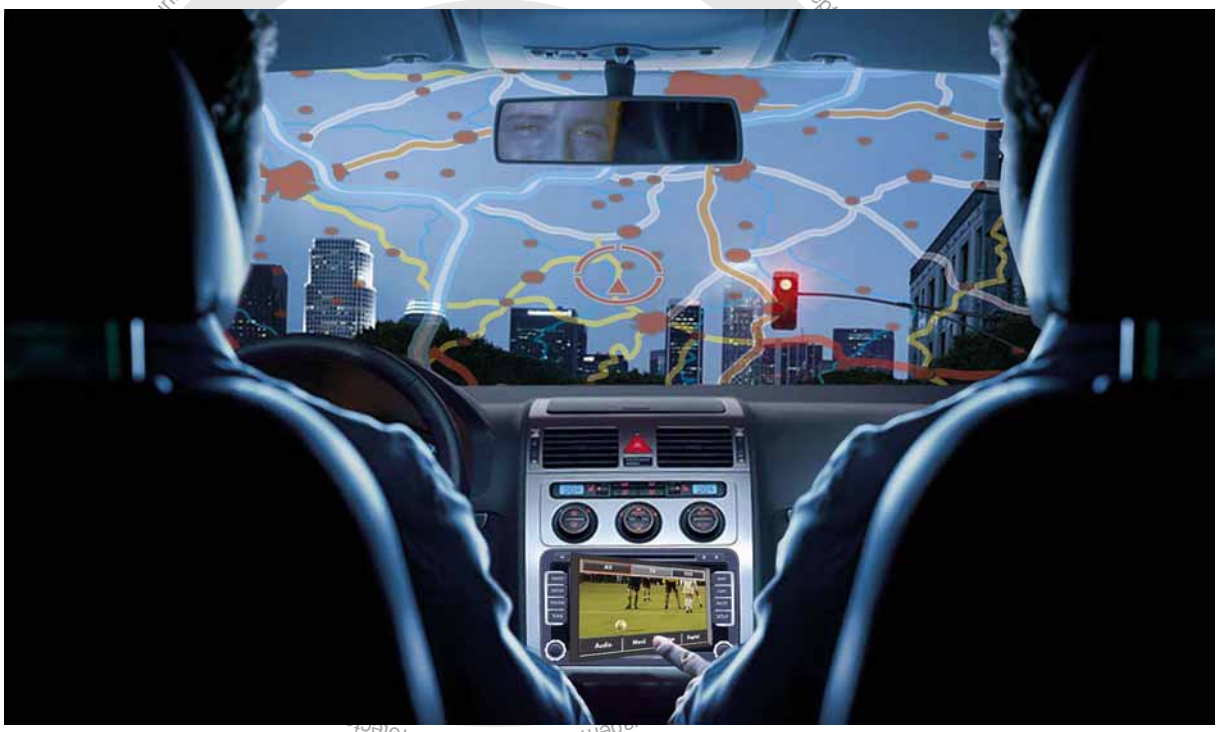
Today, due to the speed of technical development and the continuing growth in traffic density, it is increasingly important to provide car drivers with navigation systems in the form of orientation aids that support them while driving and do not create an additional distraction.

Customers expect systems that are simple and intuitive to use. Users are aware of some of the possibilities of today's navigation systems from private, non-automotive life.

Since these units are used in vehicles and not as a standalone system, but as part of a complex technical network, their adaptation to motorised vehicles requires some time.

In order to also take into account the increased amount of time that drivers spend in their cars today, Volkswagen has focussed on a collection of infotainment functions that make the time spent in the vehicle as pleasant as possible and entertaining.

You will also find basic information on the topics of radio and radio navigation in self-study programmes no. 199 "The Radio Navigation System" and no. 342 "Radio Systems 2006".



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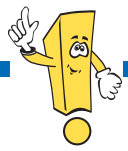

Important Note

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.

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Introduction

Navigation units were used for the first time at Volkswagen Group in the Audi A8 model year 1994. The display, controls and CD drive were still accomodated in separate locations at this time. The CD drive was in the boot of the car, for example.

The acoustic guidance came from a separate loudspeaker. This system was also fitted in the Passat from model year 1997.

Display in combi instrument

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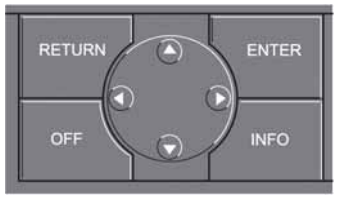

Navigation system controls

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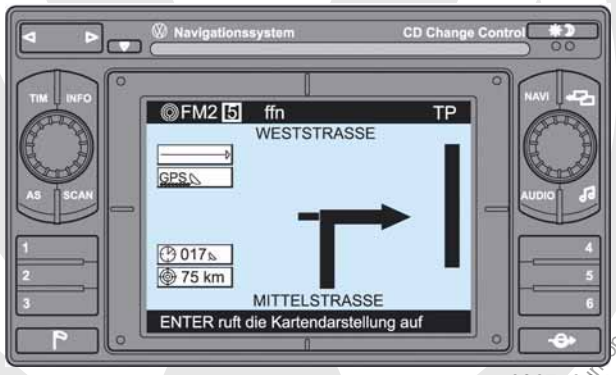
S397_003

Drive for navigation DVD in boot

The navigation and radio functions were combined in a new generation of units from model year 1999. The units consisted of the radio receiver unit, the navigation computer, the navigation and audio CD drive, a colour display and the controls for radio, CD player and navigation. Depending on the type of unit, an external aerial diversity box for switching between the aerials was available.

The colour screen now allowed the map to be displayed for navigation guidance instead of icons. In addition, the directions were displayed in the dash panel insert display.
The acoustic navigation guidance was now heard over the vehicle audio system.



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Volkswagen radio navigation unit in model year 1999

The two radio navigation systems RNS 300 and RNS 510 represent the current development stage in the field of vehicle navigation at Volkswagen.

The RNS 510, in particular, with its large number of integrated components and interfaces to other units and systems represents a complex infotainment system that unites a large number of functions like radio, TV, CD and DVD playback, navigation as well as telephone operation.

The scope of functions and user-friendliness have been increased considerably by using a touch sensitive screen on the RNS 510.

In the following section, basic functions like, for example, the corridor function on the RNS 300 or the display functions of the RNS 510 are explained.

S397_006

RNS 300 radio/navigation system

RNS 510 radio/ navigation system

S397_032

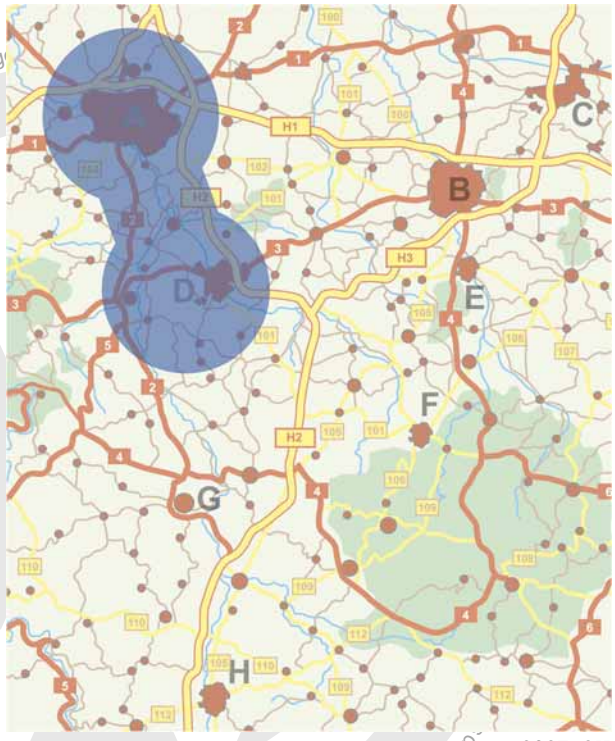
Please refer to the corresponding operating manuals for detailed information on use of the numerous functions in the radio/navigation systems.

Basic Functions of 2007 Radio Navigation Systems

Corridor function

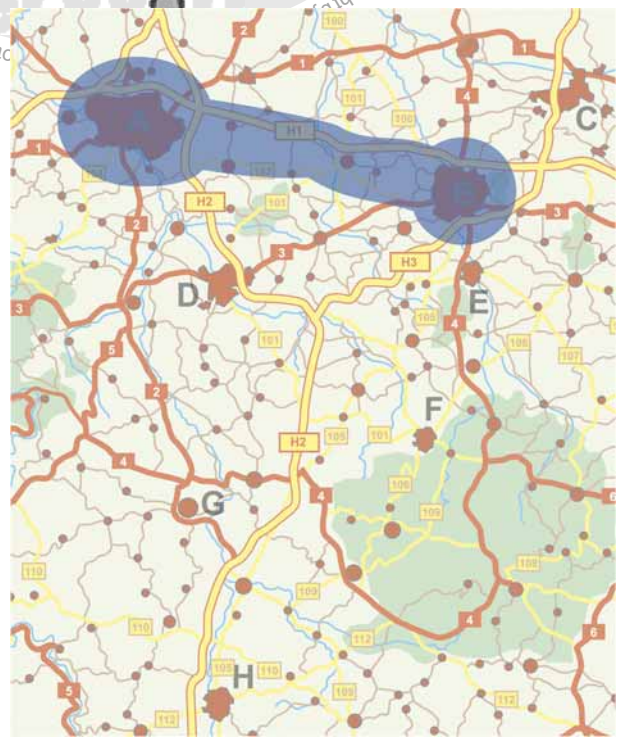
This function on the RNS 300 allows navigation without the navigation CD being inserted. The radio/navigation system is capable of temporarily storing the complete calculated route.
This does not just involve the storage of the exact order of the roads to be taken, but also the areas bordering on the route.

These bordering areas form the navigation corridor. This process takes a maximum of 15 to 20 minutes depending on the length of the route to be saved or the data quantity involved.
This allows you to remove the navigation CD after completing the process so you can put a music CD into the navigation system CD drive in the meantime, for example.



Short distance – wide corridor S397_011

The form and area of the saved corridor varies depending on the length of the programmed route as only a limited amount of information can be stored in the memory. A larger area is recorded for the start and destination area than for the simple A to B route.
If the route to be navigated is extended, the start and destination area as well as the corridor width becomes smaller. If you leave the corridor, the navigation system will ask the driver to insert the navigation CD again to calculate a new route.



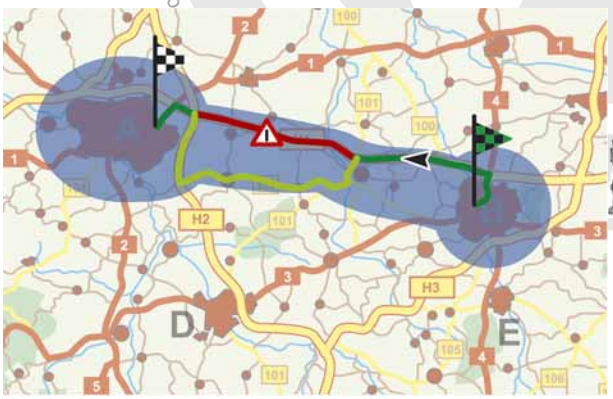
Medium distance – narrow corridor S397_010

S397_009

Long route - smaller corridor

On very long navigation routes, the memory is only sufficient for the streets immediately along the route and a narrow start and destination area.
In this case, the navigation system asks the driver to insert the navigation CD as soon as he leaves the route list so that a new route can be calculated.

As the surrounding area is saved for shorter navigation routes in addition to the simple route, dynamic navigation is possible to a certain extent in this case without having to insert the navigation CD again.
A new destination can in principle be entered within the saved corridor.
Once a corridor has been saved, it is only deleted automatically on the RNS 300 after 72 hours unless the old data is overwritten due to a new route calculation with a different start and destination.
Due to the automatic storage duration, the RNS 300 has an increased stand-by power consumption.



S397_017

Dynamic navigation within the corridor

The corridor function is not necessary on the RNS 510 radio/navigation system as the whole navigation DVD is copied to the navigation unit hard drive.

Original navigation route

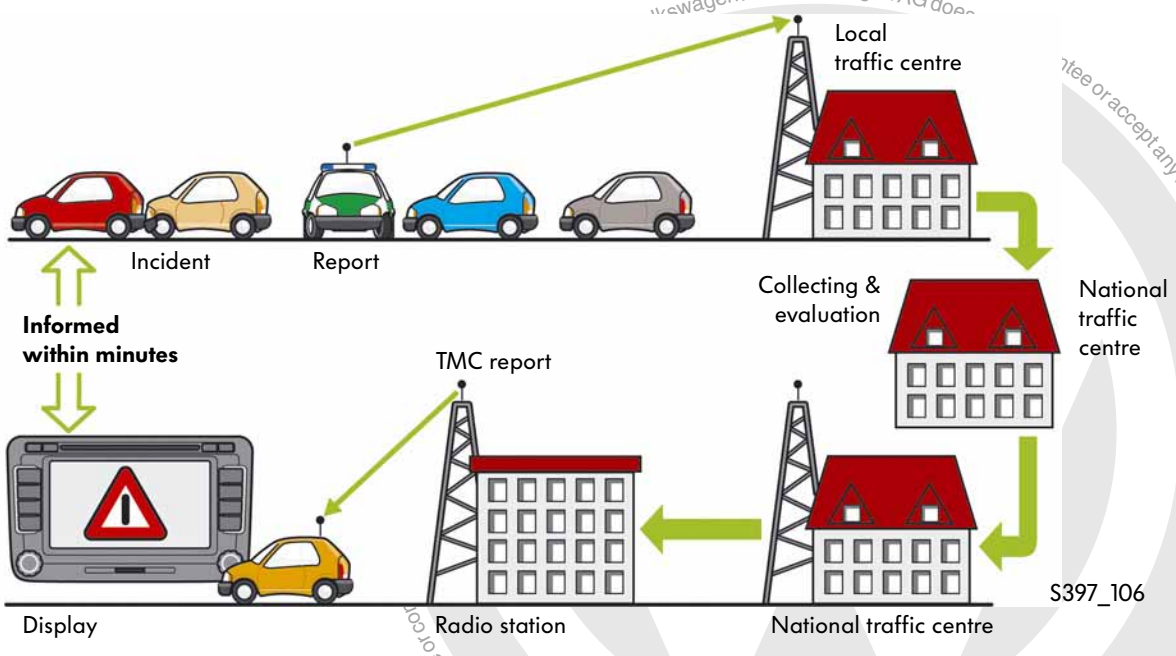
Alternative route

Blocked route section

S397_096b

Traffic Message Channel (TMC)

TMC is part of the Radio Data Systems RDS that has been used in Europe since 1987. TMC provides drivers with the latest traffic reports via radios and navigation systems free of charge. Incoming traffic reports, for example, from the police or recovery services are collected at the local and national traffic centres. The reports are forwarded to radio stations who encode these messages digitally and transmit them in the background of radio broadcasts with other RDS data like, for example, the station name.



How it works

A TMC-capable reception unit receives these reports, decodes them and outputs them in text form on the display or acoustically as speech.
Navigation systems use the TMC data to calculate alternative routes.

The coding for a TMC message consists of a code number from the event table, a code number from the list of all national roads and point locations (localisation table) as well as an expiry time.
The latter indicates how long the TMC message will be valid. The coding uses the internationally valid ALERT-C-STANDARD.

There is therefore, for example, a list of all national roads (localisation table) for Germany, Belgium, Denmark, France etc.
Localisation and event tables are stored on the navigation CD or DVD.
The TMC messages are displayed in the language that has been set in the reception unit.

Text	Code	N	Q	T	D	U	C	R
1st service level								
Traffic problem	1			D	1	U	1	A50
Slow-moving traffic	101			D	1	U	1	A1
Jam	102			D	1	U	1	A101
Tailback longer than 1km	103			D		U	1	A39

Extract from an event table (example) S397_113

Code	Type	Road number	Name	Geogr. coordinates north value	Geogr. coordinates east value	Direction
001	Town	- - - -	Wolfsburg	52°25'17.25"	10°46'59.13"	
002	Town	- - - -	Braunschweig	52°16'01.44"	10°31'20.80"	
003	Junction	A27/A7	Walsrode	52°47'11.99"	09°40'14.57"	H
004	Intersection	A2	Braunschweig North	52°18'52.91"	10°31'03.23"	
005	Intersection	A2/A39	Wolfsburg/ Königsluther	52°18'30.82"	10°43'38.00"	WOB

Extract from a localisation table (simplified example) S397_108

The event table contains all possible traffic incidents, for example, traffic jams, accidents, ice and road works.

The localisation table contains the names and ID numbers of all motorways, A roads and country roads. The current localisation table "LT Version 6.0" contains around 24,000 point locations (POINT LOCATION) and 12,000 area locations (AREA LOCATION). Using the TMC coding, it is therefore clearly defined which incident occurred at which location in which direction.

In order for a navigation unit to evaluate TMC messages, the navigation system needs to read the localisation table and event table from the navigation CD/DVD.

TMC on RNS 300

In the RNS 300 radio/navigation system, the localisation table that is required for TMC reception is also downloaded from the navigation CD into the memory just for the area of the corridor.
This means that,when there is a traffic jam report, not all data for the new route calculation is available if the navigation CD is not in the CD drive.

Basic Functions of 2007 Radio Navigation Systems

Dynamic navigation

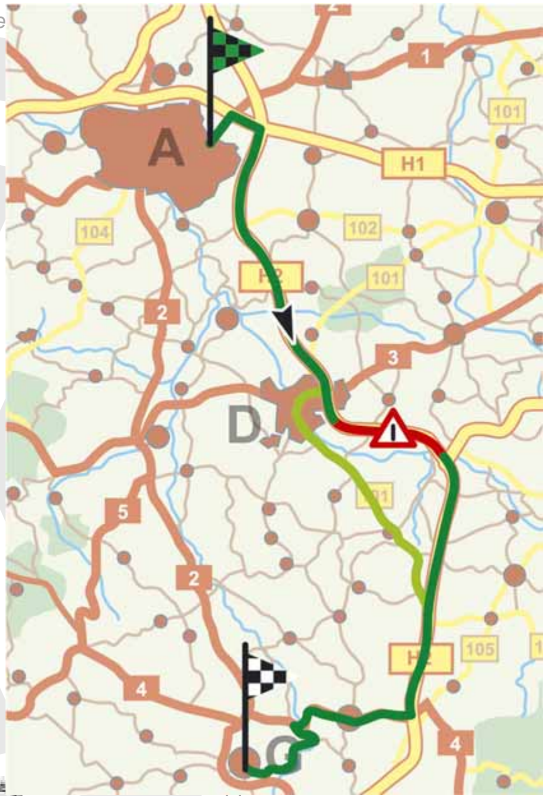
Basic principle

The dynamic navigation allows the navigation system to automatically provide the driver with a suitable reaction to a traffic incident. Depending on the severity of a recognised problem (blockage, tailback length, jam speed, closure etc.) on the calculated route, it may be a good idea to avoid the congestion area.

The requirement for this is that automatic traffic reports (TMC messages) are received and can be processed. The route for the rest of the journey is always recalculated whenever a traffic jam is reported. The route is also re-calculated when the traffic jam report is cleared.

The route is re-calculated in accordance with the set route options (depending on system type e.g. fast, short, economical).
In this case, the route with the reported jam is also taken into consideration in the calculation as a possible alternative, however, it is given another weighting or another priority than it had in the original, jam-free state.
Therefore the alternative route could correspond with the original route.

If the TMC options are set to “manual”, the driver needs to confirm the alternative route after the route has been recalculated. The calculated route and time is displayed compared with the original route.



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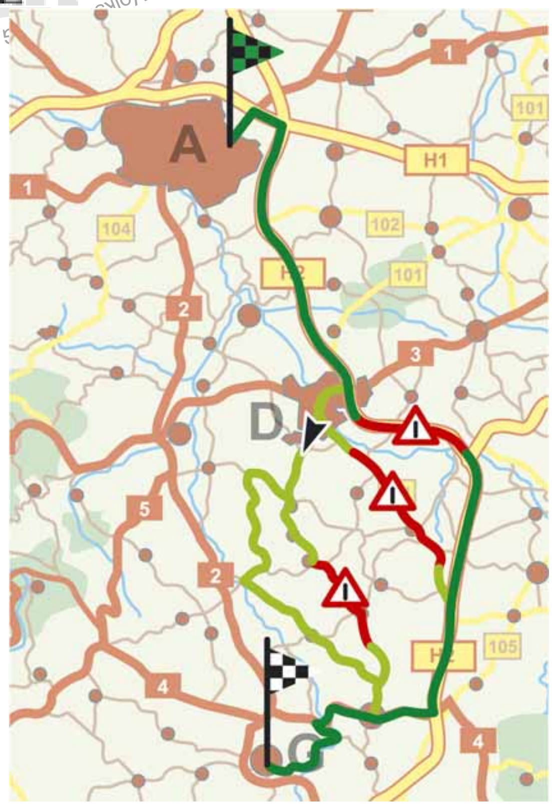
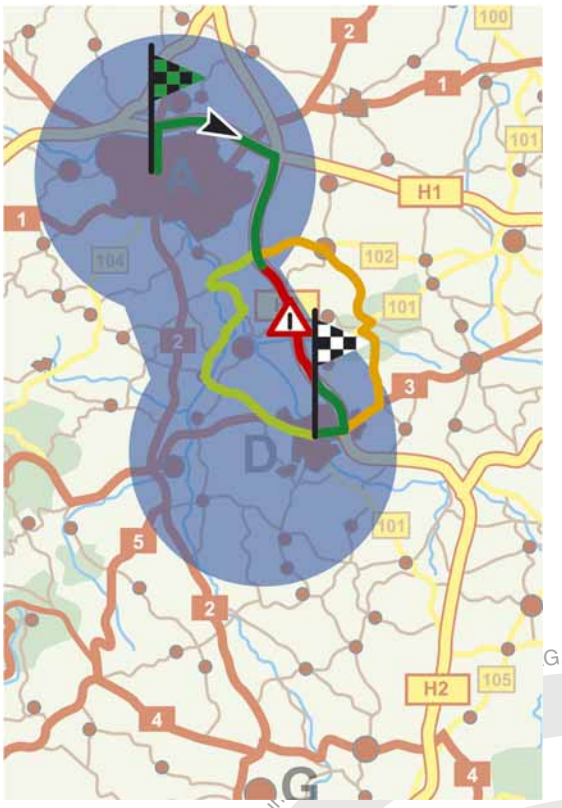


S397_018

Dynamic navigation for corridor function

If the RNS 300 radio/navigation system calculates a navigation route, it is possible, to a certain extent, to use dynamic navigation without having to insert the navigation CD again particularly when short and medium navigation routes within the saved corridor are involved.
This can, however, only work if the road network within the corridor permits.

In the adjacent example, the navigation system can offer the driver an alternative route (light green) to the original route (dark green) within the corridor. The orange route cannot be calculated as a route by the system as the road is outside the corridor.



S397_016

Original navigation route

Alternative route

Blocked route section

Alternative route outside corridor

S397_096

When using the dynamic navigation, it should be remembered that, depending on the set route option (see page 12) the TMC messages currently almost only refer to motorways and only to a small extent to A roads.
Country and local roads are not covered by TMC messages.
In some cases, it is possible for the navigation system to lead the driver to an alternative route via country roads in good time ahead of congestion on a motorway when using dynamic navigation, but the driver may end up in a longer jam that was not detected.

Route calculation

Route options

Navigation system users have a choice of three different route options so they can decide whether they, for example, want to reach the destination on a fast or shorter route or a mixture of both.

- Short route
- Fast route
- Economic route

Short route

For the short route, the respective shortest route sections are added up to connect the start and destination point. The routes possible are compared and the route is taken as a route list with the shortest kilometre distance.
The shortest route distance is chosen between two junctions in a route section. Each route crossing or road entrance represents a junction in digital form.

Influencing variables like speed limits or the statistically possible average speed are also not taken into consideration with this route option as long as no other settings like “Avoid motorways” or “Dynamic navigation” are enabled. In this way, it is possible for the journey to take longer despite the shortest route being taken.

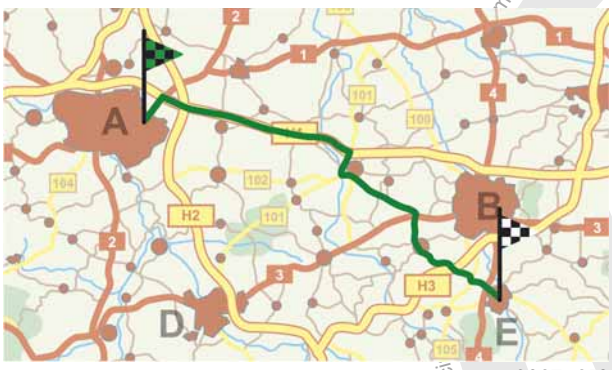
S397_012

Fast route

S397_014

When this route option is selected, the navigation system takes the road class (motorway, national road, country road, local road), the speed limits for these roads as well as a statistically expected average speed into consideration. This results in a time only calculation for the route assessment.
This means that a detour may be involved in some cases to obtain the shortest journey time.

Economic route



S397_013

When this route option is selected, the route planning takes a mixed calculation of time and route distance as a basis.
The route is calculated with a distance proportion of 30% and time proportion of 70%.

Please note:
In this example, the difference between the fast and economic route guidance is in the second route section. In the economic setting, the shorter, but slower route is preferred over the faster, but longer route under the aspect of the most favourable ratio of route to duration.

RNS 300 Radio/Navigation System

The RNS 300 is the entry-level version of the radio/navigation systems. It has the following controls and display elements on the front.

Drive slot for an audio or navigation CD

Set audio and volume levels

Info
repeats the last speech message during route guidance and shows the current destination, the current position and the current geo coordinates.

Radio
switches to radio mode and displays the radio main menu.

On/off switch and volume control
Pressing the knob switches the radio/navigation system on and off. Turning the control adjusts the volume of the audio output.
This also applies to the acoustic telephone and navigation output.

CD
Switches to audio CD mode or to an external CD changer or MP3 player.

Backwards button
Controls the active audio source, e.g. jump to previous audio CD track or to the preceding radio station. Press longer: Rewind audio track

Eject CD
If you do not remove the CD within 10 seconds, it will be drawn in again.

Set flag destination
When you press this button, the navigation system stores the current vehicle position in the destination memory.

The four unlabelled **function buttons** (soft buttons) on the right and left change their function depending on the selected menu.

Screen
5" monochrome display with a resolution of 240 x 128 pixels

Setup
allows general settings for the current area, e.g. settings for radio operation, screen settings etc.

S397_005

Back
to higher menu point for the last setting up to the main menu of a selected menu.

Traffic
shows traffic messages of current TMC station.

Menu button
Rotary press knob for selecting and confirming menus, submenus or values. The menu button does not have a mechanical start and end point.

Nav
switches to the navigation main menu

Forwards button
Controls the active audio source, e.g. jump to next audio CD track or to the next radio station.
Press longer:
Fast forward audio track

RNS 300 Radio/Navigation System

Features and controls on RNS 300

Features

- Output stage with 4 x 20 Watt output, optionally two or four loudspeakers can be connected
- 5" monochrome display with a resolution of 240 x 128 pixels
- RDS, FM and AM Europe radio
- FM single tuner with an aerial
- Integrated CD drive
- Playback functions for MP3 data
- Navigation symbols shown in dash panel insert display (only on Highline version of control unit with display in dash panel insert)
- Route guidance using symbols and speech
- Navigation also possible without inserting navigation CD (corridor function)
- TMC function
- CD navigation (data CD for different countries)
- Optionally compatible with mobile phone preparation and hands-free system
- Optionally compatible with multifunction steering wheel
- Optionally compatible with external CD changer (CDC)

Controls

The RNS 300 is operated with hard buttons and soft buttons.

Hard buttons

Hard buttons are buttons, switches, sliders or control knobs on an electronic unit that have permanent and fixed function assignments. Hard buttons can be recognised from a permanent label on the control.

S397_019

There are currently no plans to combine the RNS 300 radio/navigation system with the Volkswagen sound system.

S397_020

Soft buttons

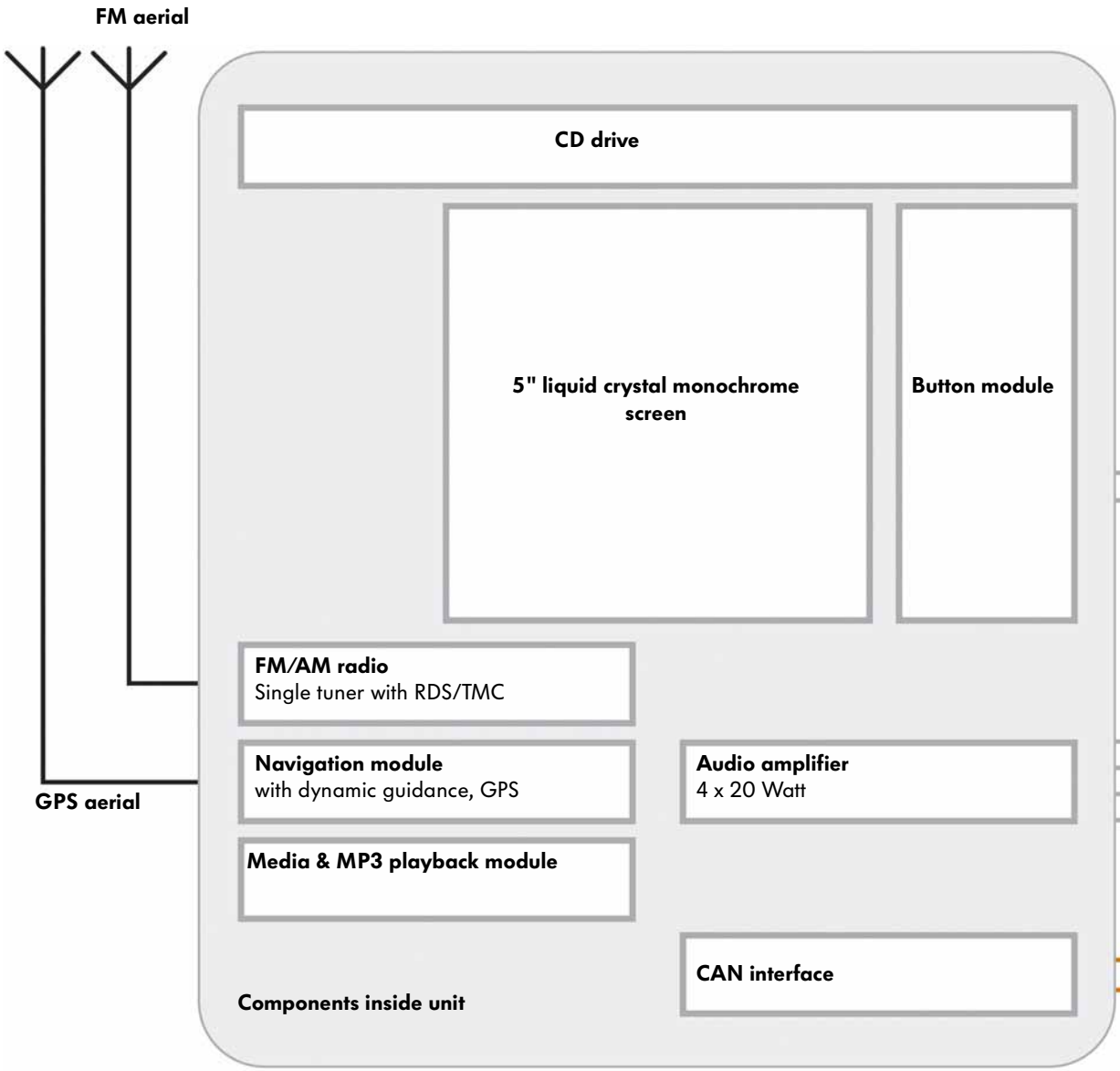
The four buttons on the left and right next to the display are soft buttons on the RNS 300 radio/ navigation system.
Unlike the hard buttons, the functions assigned to these buttons change depending on the current mode (e.g. radio, navigation, CD player etc.).
The soft button label changes on the display depending on which function you are using.

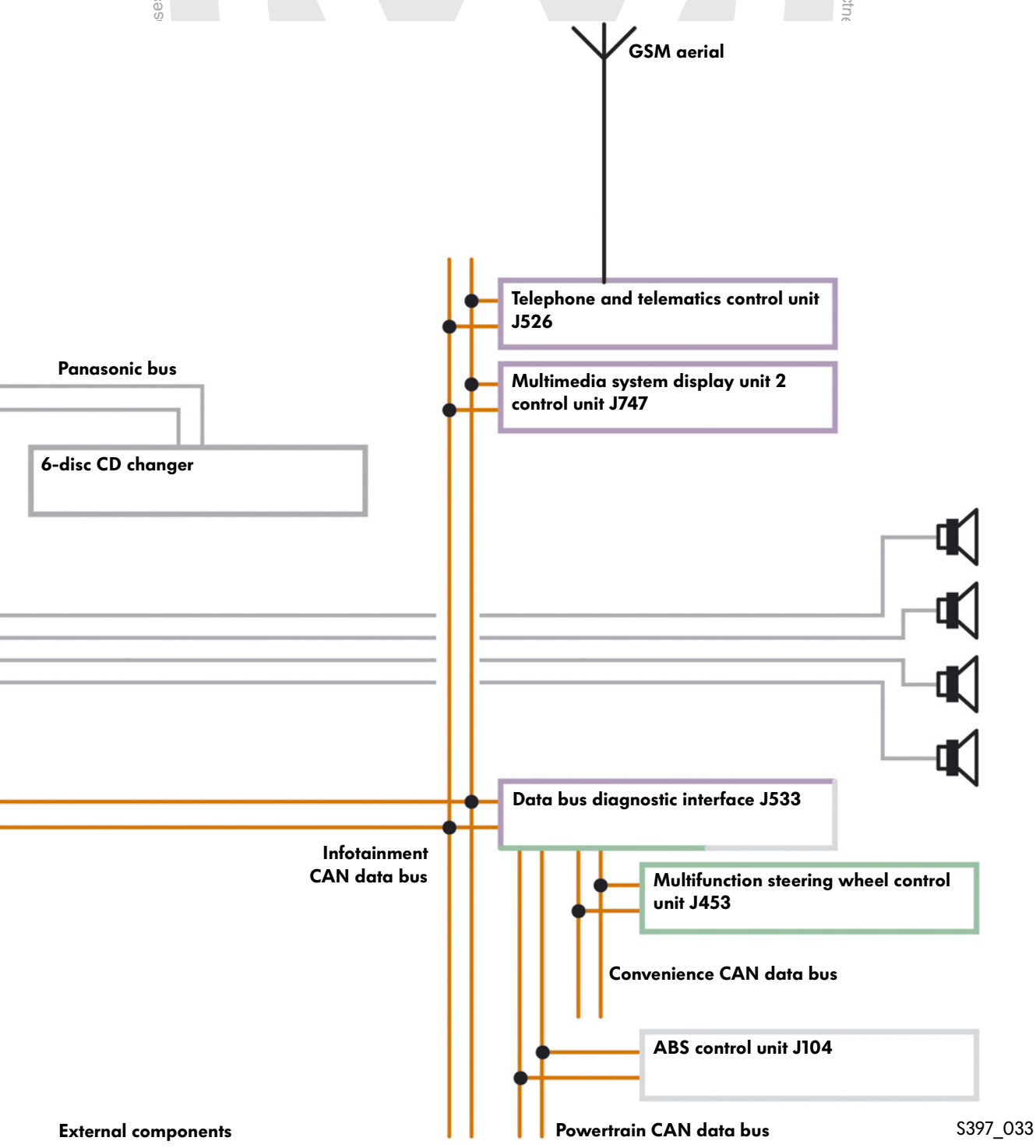
The use of soft buttons gives a unit more variations possible, for example new functions to be added in future software updates. This flexibility is also advantageous if different button functions are required for different export countries.
Hard and soft buttons can also be programmed so that different functions are carried out depending on whether you press the button briefly or hold it down.

RNS 300 Radio/Navigation System

Networking principle

In addition to the internal networking of the different device components like the radio or CD drive, the RNS 300 is connected to other control units via the CAN data bus so that all functions of the radio/navigation unit are distributed over several control units.





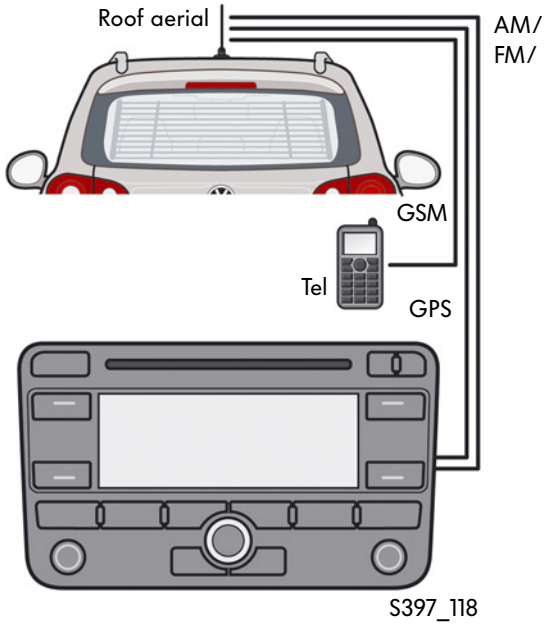
RNS 300 Radio/Navigation System

RNS 300 aerial concept

The aerial system for the RNS 300 radio/navigation system may differ depending on the vehicle type.

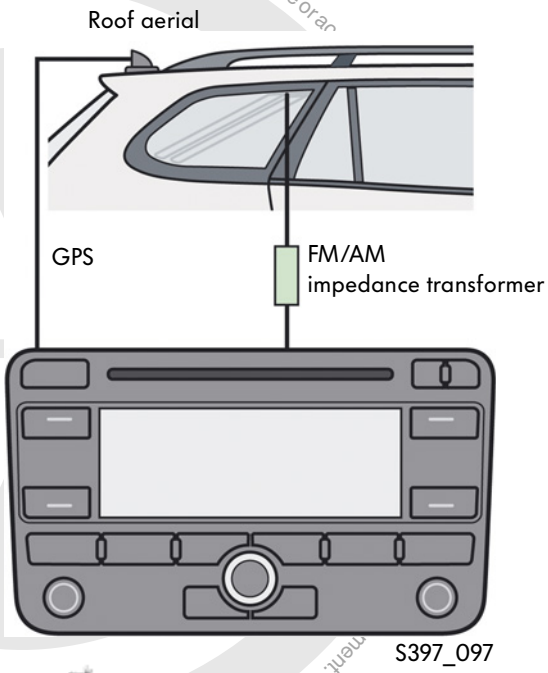
Aerial system in the Tiguan

If the Tiguan is equipped with the RNS 300, it will have a roof aerial that is connected to the GPS and the AM/FM tuner module in the radio/navigation system and the GSM module in the mobile phone. The aerial structure in the rear windscreen is not used. Compared with the Golf, the AM/FM blocking circuits as well as the AM/FM impedance transformers are omitted.



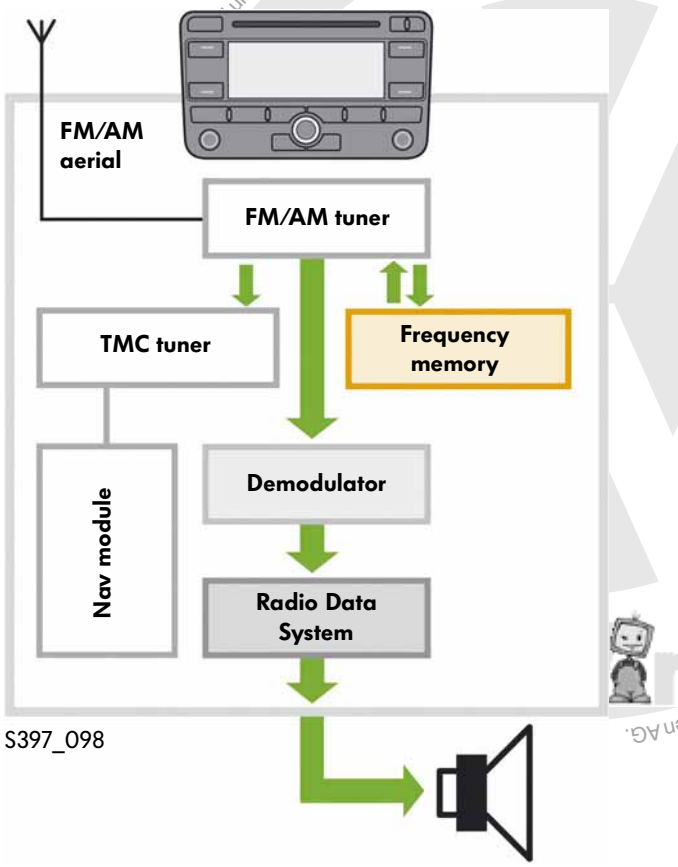
Aerial system in Golf estate

When the RNS 300 is fitted in the Volkswagen Golf Estate, the aerial system available with the basic equipment consists of an AM/FM window aerial in the right-hand side window and the shark fin aerial on the vehicle roof.
No blocking circuits are required since the aerial structure is only on the side window.



Single-tuner principle

Radio/navigation systems with an FM tuner work according to the single-tuner principle, those with two FM tuners according to the twin-tuner principle.



S397_098

The RNS 300 radio/navigation system has one single FM tuner. The RNS saves all received frequencies for a recognised station in a station list. When changing stations, the unit then selects the frequency with the best reception from the list.
The reception frequency is always updated to the frequency with the best reception when the unit is switched on and off as well as when you switch between different radio stations.

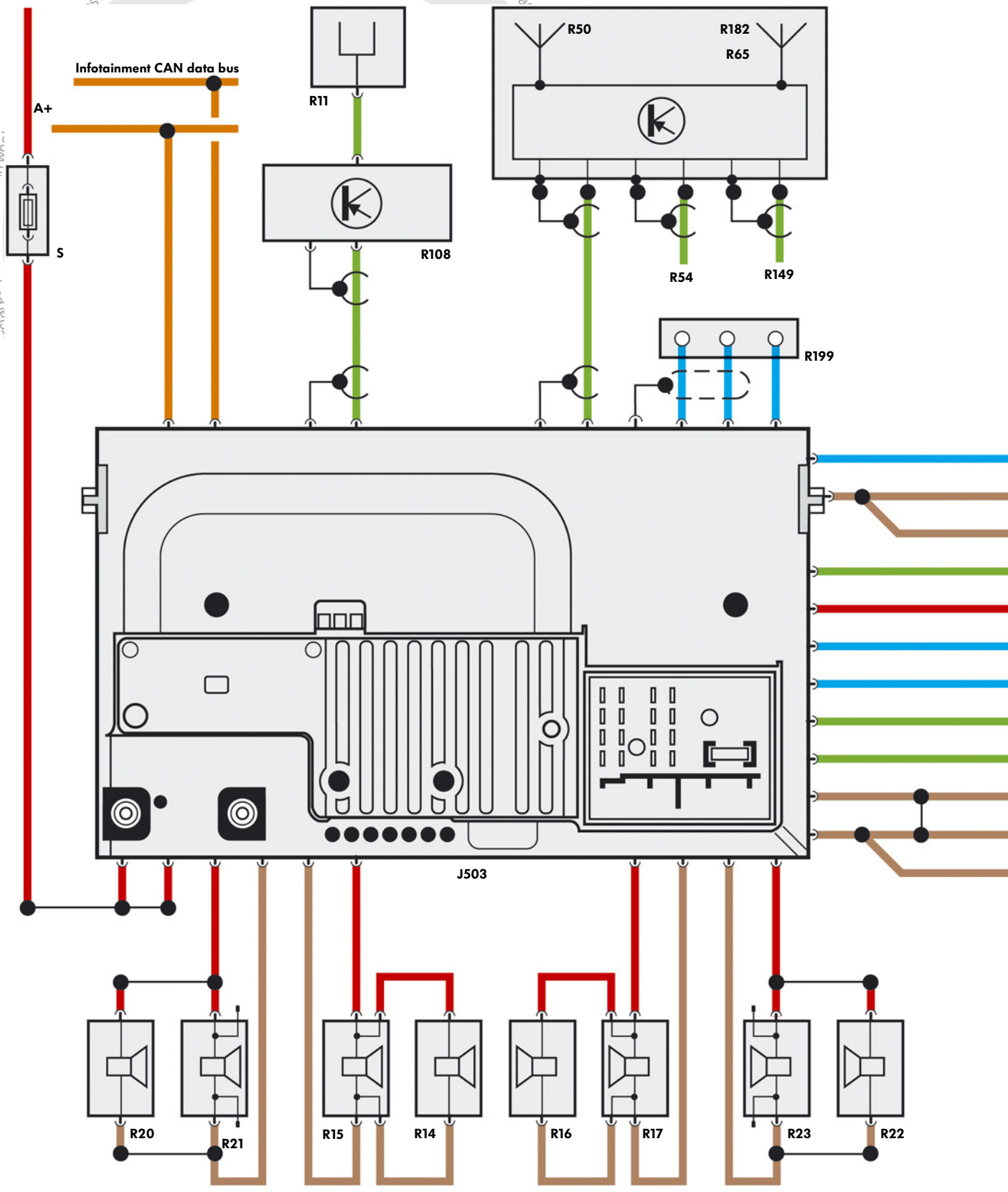
If the FM tuner detects that the reception quality of the selected radio station is deteriorating, it will switch to a different broadcasting station with better reception quality.
The switch-over pause is sometimes perceived as a minimal radio mute pause.

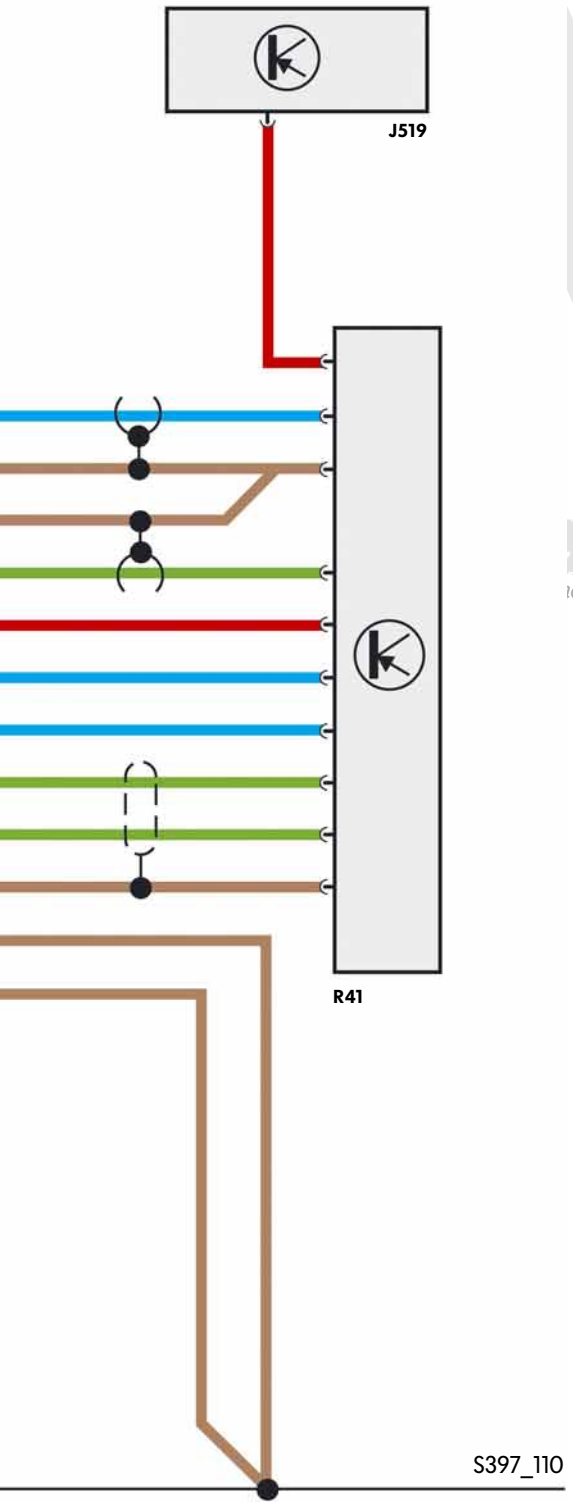
In the single-tuner principle, the simultaneous evaluation of TMC broadcasting information and thus dynamic navigation is also possible if a TMC-compatible station is set. The TMC-compatible station needs to be set as a second FM tuner and is not available to evaluate the TMC message parallel to another station.

If a single-tuner system leaves the reception area of a station, the system may in some cases lose the station if the reception quality of all stored broadcasting stations is not sufficient and the reception frequencies were not updated by a manual change of radio station.

RNS 300 Radio/Navigation System

Functional diagram





Legend

J503	Control unit with display for radio and navigation
J519	Onboard supply control unit
R11	Aerial
R14	Rear left treble loudspeaker
R15	Rear left bass loudspeaker
R16	Rear right treble loudspeaker
R17	Rear right bass loudspeaker
R20	Front left treble loudspeaker
R21	Front left bass loudspeaker
R22	Front right treble loudspeaker
R23	Front right bass loudspeaker
R41	CD changer*
R50	GPS aerial
R54	Mobile telephone*
R65	Telephone aerial
R108	Left aerial module
R149	Remote control receiver for auxiliary coolant heater*
R182	Auxiliary heater aerial
R199	Connection for external audio sources*
S	Fuse
A	Battery

* depending on equipment

The functional diagram shows the RNS 300 radio navigation system in the Touran.

- Input signal
- Output signal
- Positive
- Earth
- CAN data bus

RNS 510 Radio/Navigation System

This radio/navigation system currently has the largest number of functions among all radio/navigation systems from Volkswagen. One basic difference in the RNS 510 system architecture from the RNS 300 is a built-in hard drive and the touch-sensitive screen.

CD/DVD drive slot
For audio CDs, MP3 CDs, audio DVDs, navigation DVDs and video DVDs

Backwards and forwards button
They affect the respective active audio or video source.

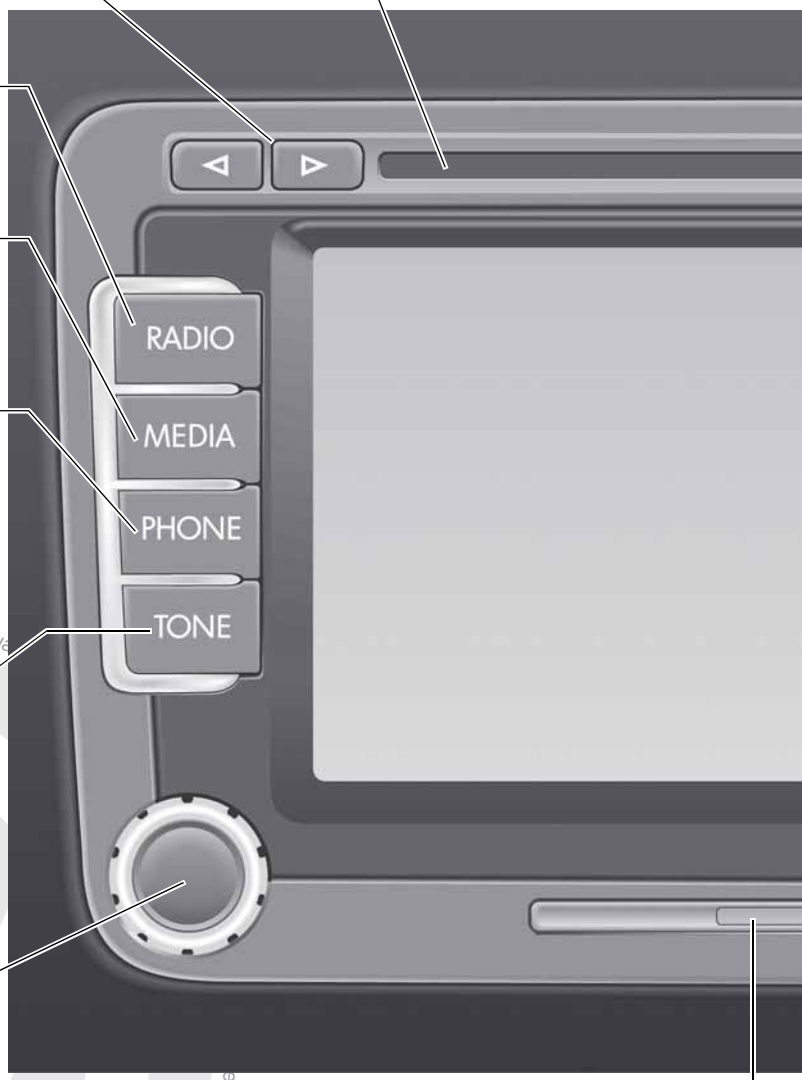
Radio
Switches to the radio main menu.

Media
Switches to CD, DVD, HDD, SD or AUX playback mode depending on what medium is available.

Phone
Shows the telephone main menu.
If a premium phone preparation is not connected, this button is simply used to mute the audio output.

Tone
Switches to the main menu for audio output values on the radio/navigation system. There you can set the sound balance, sound levels etc.

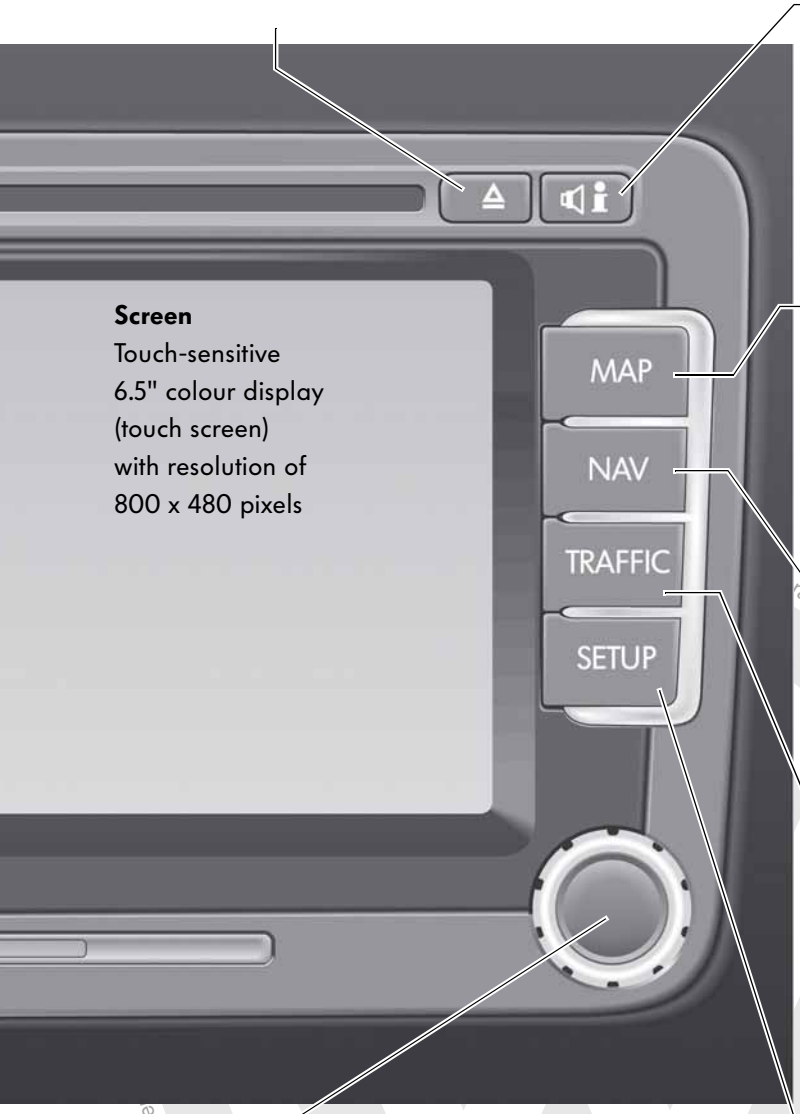
On/off switch and volume control
Pressing the rotary press knob, switches the unit on and off. Turning it adjusts the volume of the audio output. The two rotary pushbuttons on the unit do not have mechanical end points.



SD card reader slot
You can insert SD memory cards e.g. with MP3 music data for audio playback into this slot.

In the Touareg, the SD card reader is vertical on the left-hand side of the screen. (see page 37)

Button for ejecting medium
Pressing this button ejects the inserted audio, navigation or video CD/DVD. If you do not remove the medium within 10 seconds, the unit will draw the CD or DVD in again.



S397_007

Playback driving instruction
This button plays back the current guidance instruction for the selected route.

Screen
Touch-sensitive 6.5" colour display (touch screen) with resolution of 800 x 480 pixels

MAP
Calls up map display from current navigation DVD or switches to a split-screen display.

NAV
Starts or switches to navigation mode and shows the navigation main menu.

TRAFFIC
Shows the current TMC messages from the set station.

Right-hand rotary pushbutton
Depending on the set function, this knob can be used, for example, to switch between music tracks, manual selection of a radio station or to set the scale of the map display in navigation mode.

SETUP
Takes you to the main menu for configuring radio/navigation system features like, for example, screen, radio, video etc.

RNS 510 Radio/Navigation System

Features and controls on RNS 510

Features

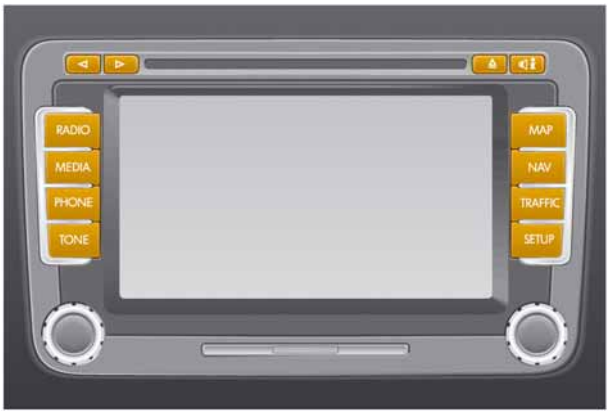
- Output stage with 4 x 20 Watt output, optionally two or four loudspeakers can be connected
- RDS, FM and AM Europe radio
- FM twin tuner with internal diversity
- SDARS tuner (depending on equipment)
- Integrated DVD drive
- Touch-sensitive 6.5" multi-colour display (MFD) with a resolution of 800 x 480 pixels
- Media support for MP3 and WMA audio data
- Navigation symbols shown in dash panel insert display
- Route guidance with symbols, map display and speech
- Maps also displayed in 3D bird's eye view (three-dimensional display)
- Integrated drive hard for storing navigation and audio data (navigation also possible without inserting navigation DVD)
- TMC function
- DVD navigation (data DVD for western or eastern Europe)
- DVD audio function
- DVD video function
- DAB (country-specific, used at a later date)
- Integrated SD memory card reader
- Optionally compatible with Volkswagen TV tuner
  Optionally compatible with mobile phone preparation including hands-free system
- Optionally compatible with multifunction steering wheel
- Speech control (depending on country, later introduction)
- Optionally compatible with reversing camera (Rear-View)

Due to the large number of functions included or modules as well as the PC technology on which the RNS 510 is based, it takes a few seconds longer to start (boot) the unit than with previous navigation systems.

Support of the Media Device Interface (MDI), e.g. for an iPod or other external, compatible storage media, will be added at a later date.

Controls

Hard buttons and soft buttons are also used to operate the RNS 510.
However, the touch-sensitive screen (touch screen) has brought a new operating philosophy for the soft buttons to the vehicle.



S397_023

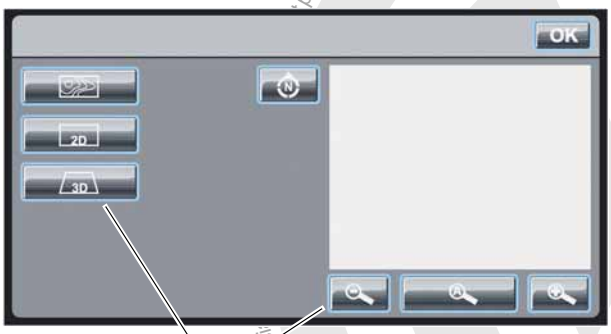
Hard buttons

The controls with fixed assignments are at the side and at the top of the RNS 510 touch screen.

Soft buttons

All other buttons required for operation of the RNS 510 appear as buttons reproduced with graphics on the touch screen surface.

This has the advantage that a “virtual” button can show its label in the respective local language. Furthermore it can always be placed on the screen in a position that seems to be logical with regard to user-friendliness, subject or graphics.
This combined display and operation concept allows more possibilities in the design of the screen interface. This is also increasingly important for expected software updates as there is greater flexibility.



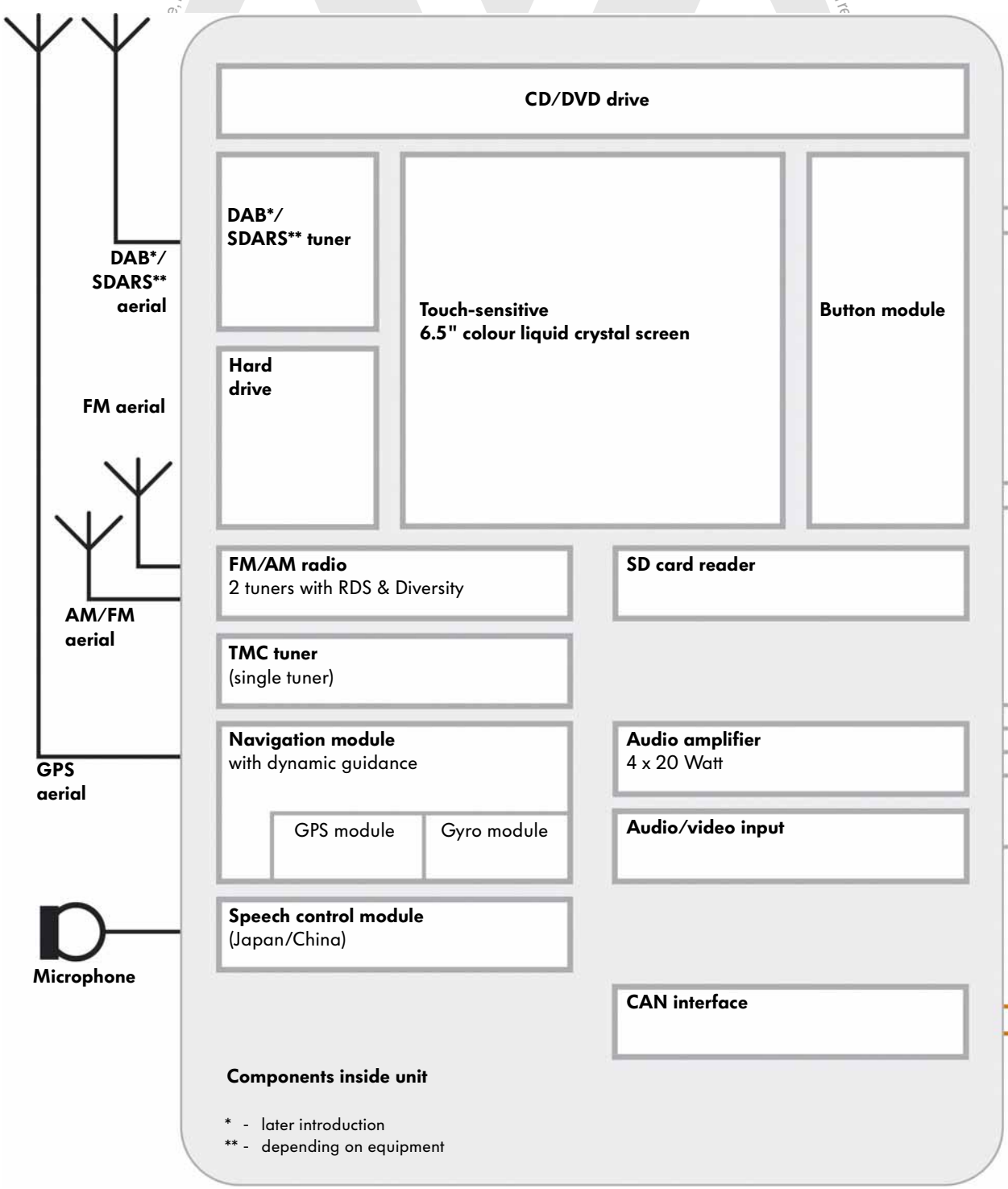
S397_022

Virtual buttons on touch screen

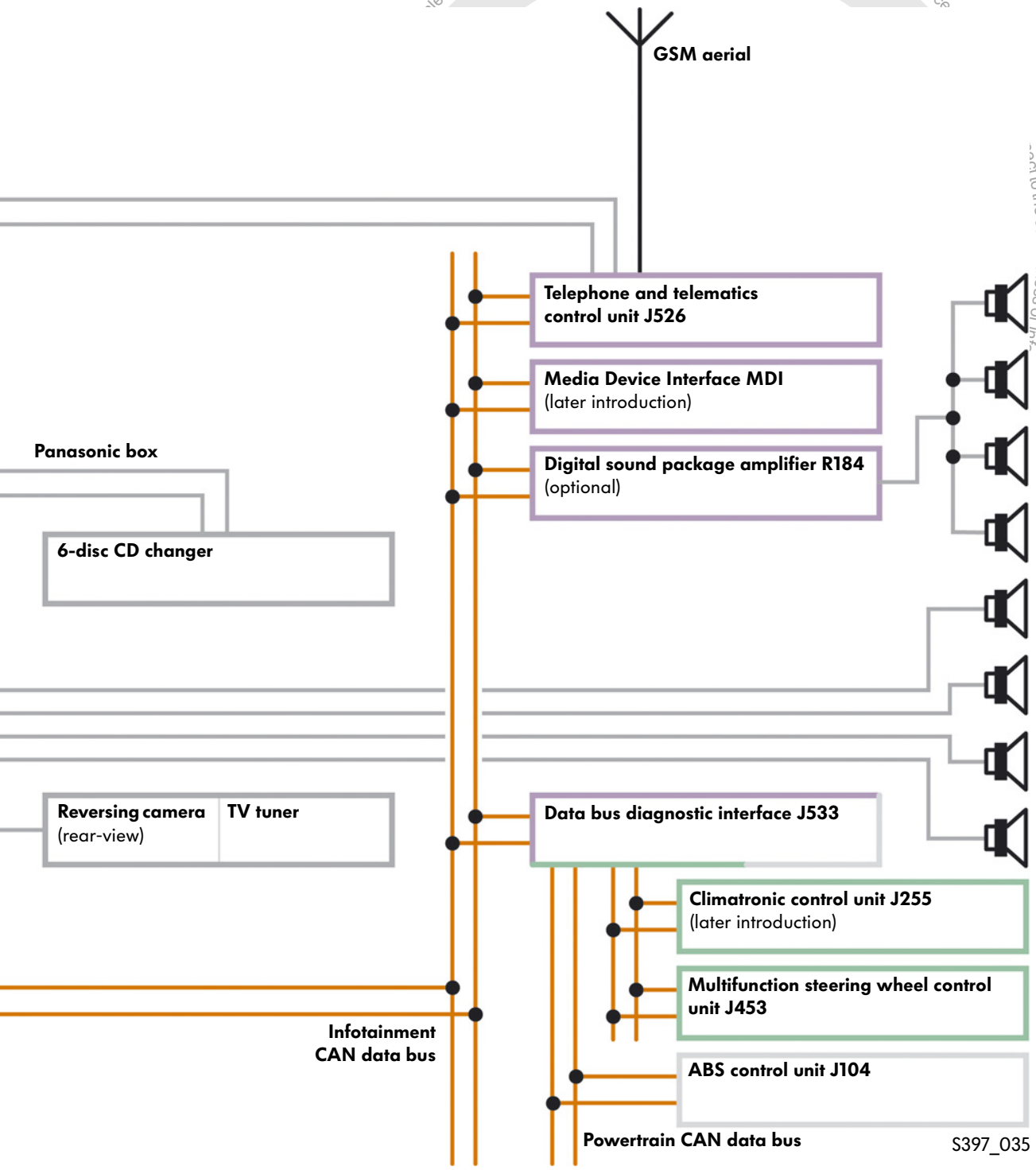
RNS 510 Radio/Navigation System

Networking principle

The networking possibilities for the RNS 510 are by far more complex than on the RNS 300. For this reason, the adjacent diagram can only provide an overview without looking at the interaction or all usage possibilities.



External components



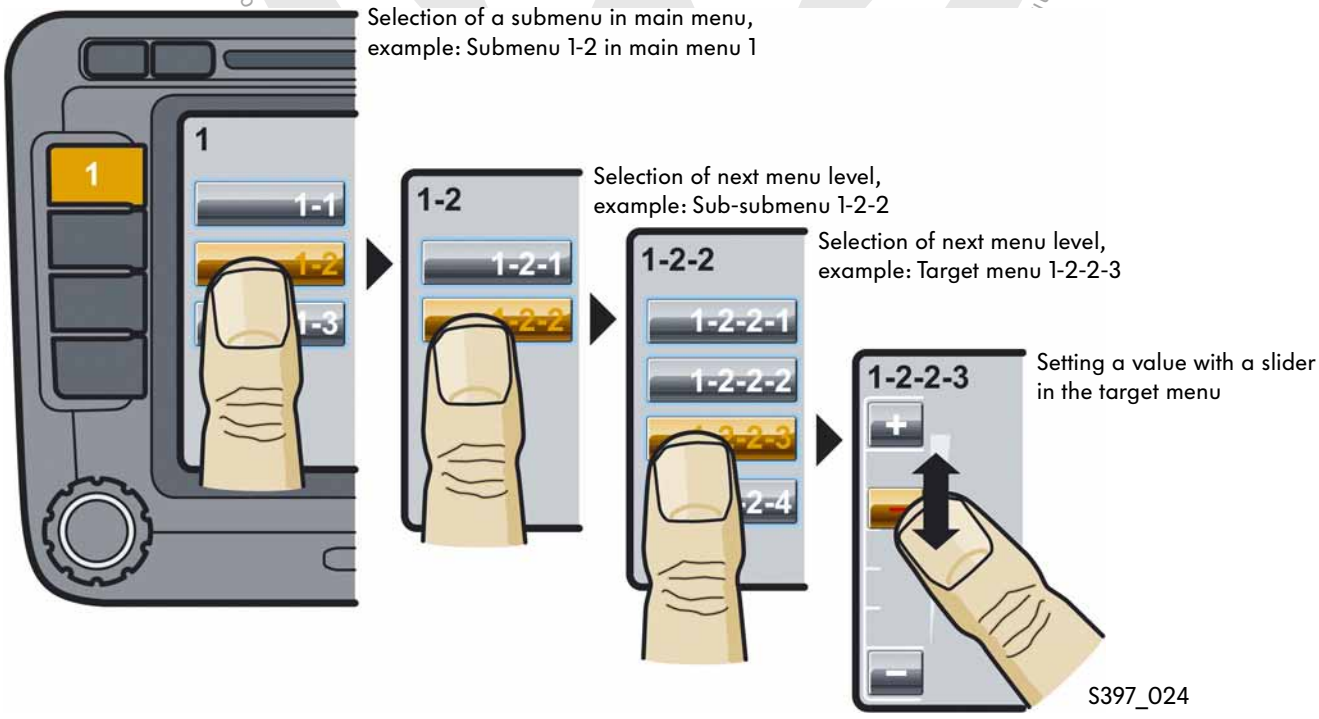
Touch-sensitive display (touch screen)

The screen forms an interface between technology and humans on multimedia systems.
It allows a large amount of complex information to be provided in a simple and well-organised way.
By using touch-sensitive screens, the user can be provided with a larger quantity of information and choices than before thanks to the freely programmable virtual buttons without making the display area and the dimensions of the unit itself too large.
This has been achieved with a complex menu structure through which users can navigate with the aid of the virtual buttons.

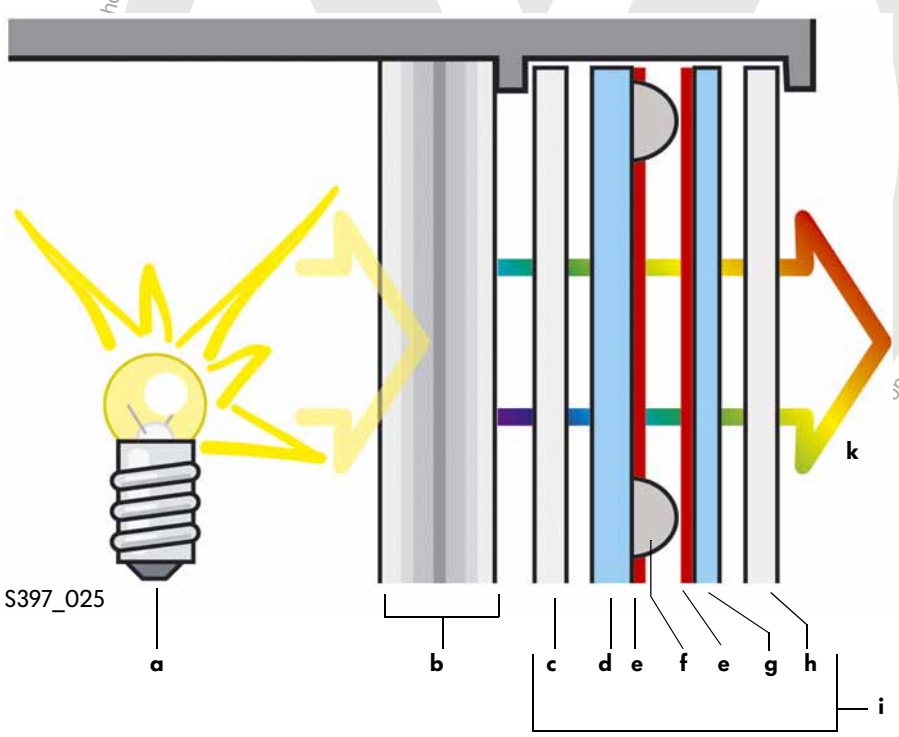
The advantages of the touch screen technology are:

- Any button shapes and sizes can be reproduced virtually.
  They are freely programmable as are the submenus and in-screen displays.
- The button labels can be shown in the local language.
- The screen display and the functions can be configured in any way and at any time with later software upgrades.
- Direct operation (finger, glove)
- Touch recognition from 10g touching pressure
- Low power consumption (approx. 1 mA)

Example of using the touch screen to select a path to a target menu within a menu structure



Structure of a touch screen



Legend

a Light source in monitor
b TFT display
c Delay layer
d Glass base layer
e Coating of conductive indium tin oxide alloy
f Spacer dots
g Flexible outer layer of glass
h Polarisation filter
i Touch-sensitive components
k Screen picture

The screen on the RNS 510 radio/navigation system has several layers.
The touch-sensitive surface is placed in front of the actual screen (TFT display). On this unit, it is made up of a rigid glass layer that is 1.1mm thick and a flexible outer layer also made from glass that is 0.2mm thick. These two glass layers are separated from each other by non-conductive spacers, called spacer dots.
Both glass layers have a conductive layer of indium tin oxide on the surfaces facing each other. This is required for the touch screen function.

A delay layer is applied between the TFT display surface and the two glass layers.
It has the task of changing the polarisation of the light waves of the monitor picture.

The outer glass layer of the touch screen has a polarisation film to reduce reflections. Despite this, the reflections that occur are partly caused by the use of glass materials that are slightly higher than those on touch-sensitive screens with a flexible outer layer made from polyester.

Please treat the outer layer of the touch screen with care to avoid damaging it.

RNS 510 Radio/Navigation System

How the touch screen works

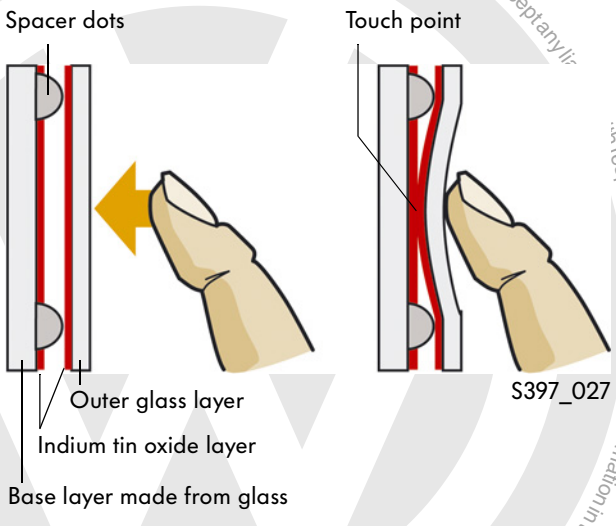
The touch screen used on the RNS 510 radio navigation system works according to the resistive principle. This means that the touch recognition uses resistance-based technology.

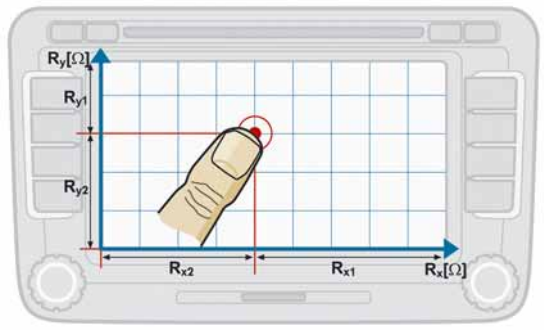
When you touch the touch screen, the outer glass layer is pressed against the glass base layer. The two indium tin oxide coatings, which are separated by the spacer dots when the screen is not touched, come into electrical contact.

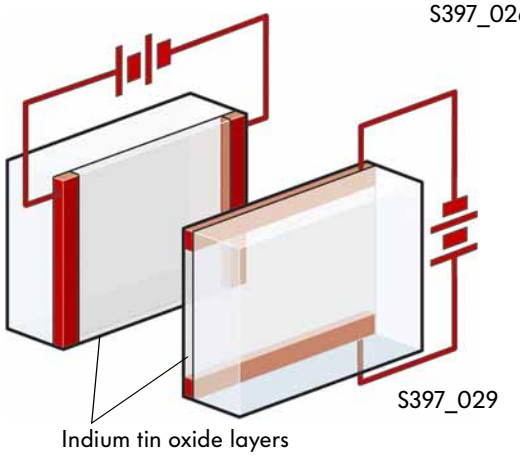
To simplify explanation, you can imagine the touch-sensitive surface that is formed by the two indium tin oxide-coated glass layers as a coordinate system. Each touch point on this surface can be located with a horizontal and vertical distance from the edge of the monitor. Electrical resistances are used as values for the horizontal and vertical distances.

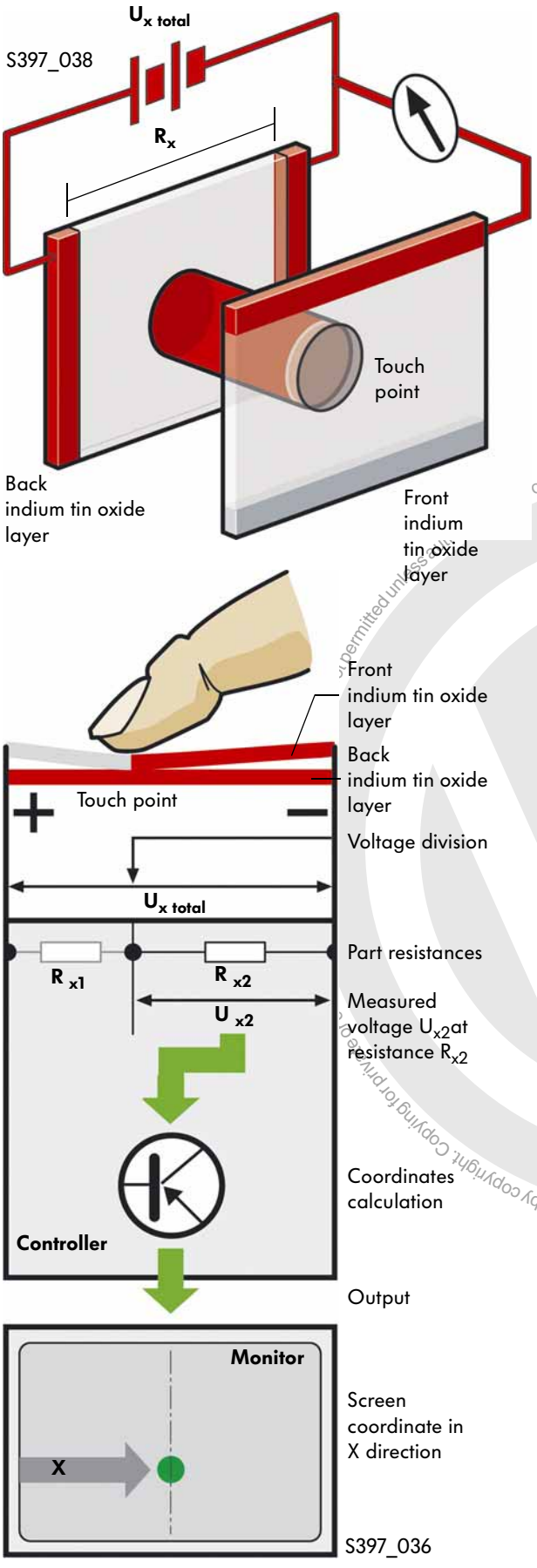
A horizontal and vertical coordinate value is determined by current flow direction of the two coatings being turned 90° towards each other. A direct voltage of 5 volts is applied 25 times per second alternating to the upper or lower indium tin oxide layer.

The touch screen signals are evaluated via a separate controller in the radio/navigation system.









The horizontal and vertical monitor coordinates are determined based on the principle of the voltage divider. Another example of this functioning principle is the potentiometer.

To clarify the procedures taking place in the touch-sensitive layer of the touch screen, we will break down the process into two steps:

- measurement in horizontal direction and
- measurement in vertical direction

Measurement in horizontal direction

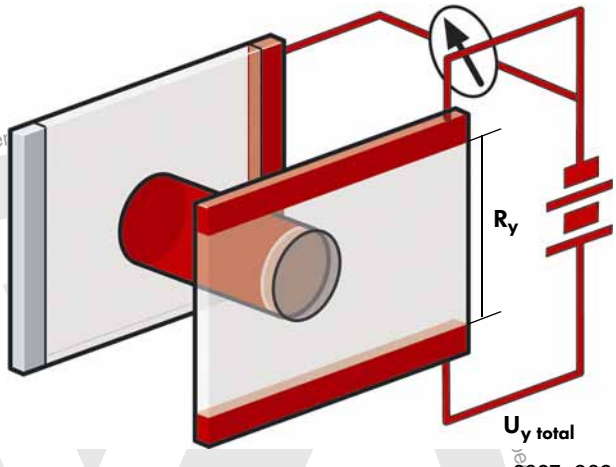
The touch screen controller first applies a voltage of 5 volt ($U_{x\ total}$) to the rear indium tin oxide layer so that a current flows through this coating in horizontal direction (X-direction).
The total path between the two voltage poles has a fixed resistance R_x.

When the touch screen is touched, an electrical contact is created from the front to the back layer. The contact point divides the total resistance between the two voltage poles of the rear coating into the two part resistances R_{x1} and R_{x2}. The controller now measures the voltage U_{x2} at part resistance R_{x2} with the help of the top coating. The controller uses the measured voltage to calculate the value for the distance from the touch point to the edge of the monitor and thus determines the X-coordinate of the touch point on the screen.

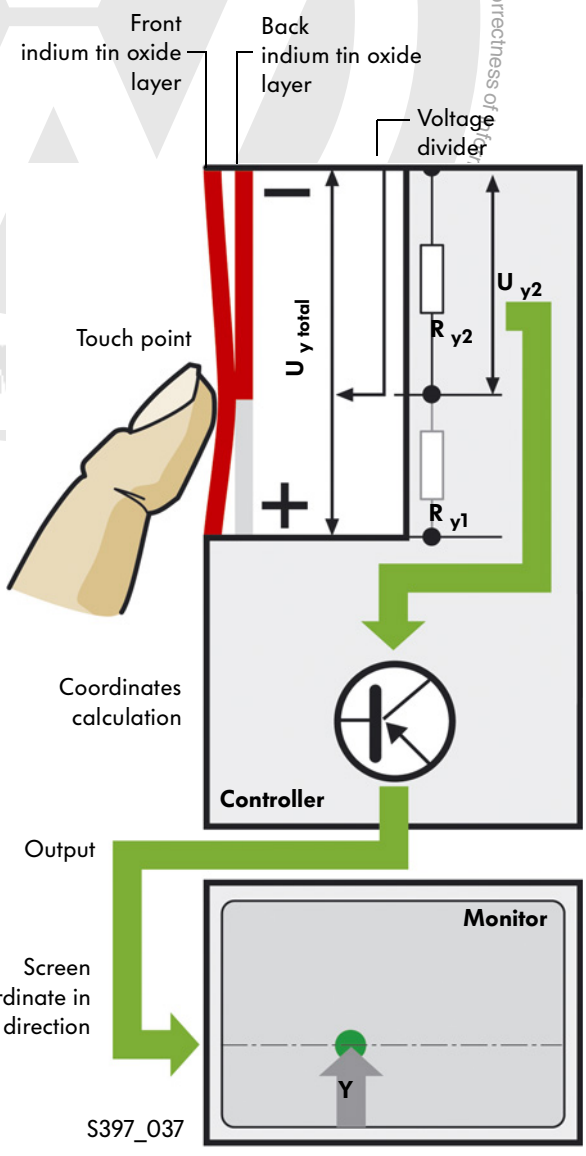
Measurement in vertical direction

To determine the second coordinate of the touch point, the controller applies the voltage ($U_{y\ total}$) of 5 volt to the front indium tin oxide layer. The current now flows in vertical direction (Y-direction). There is also a fixed resistance R_y between the two voltage poles here. When the screen is touched, two part resistances R_{y1} and R_{y2} occur again in accordance with the principle of voltage division. The controller measures the voltage U_{y2} at resistance R_{y2} and uses it to calculate the vertical coordinate value of the touch point.

Any touch point on the monitor surface can be clearly determined from the calculated X and Y-coordinates. If an action is programmed for a coordinate point in the software, e.g. pixel of a “Fast forward media” soft button, the system will carry out this command when the screen is touch at this point.



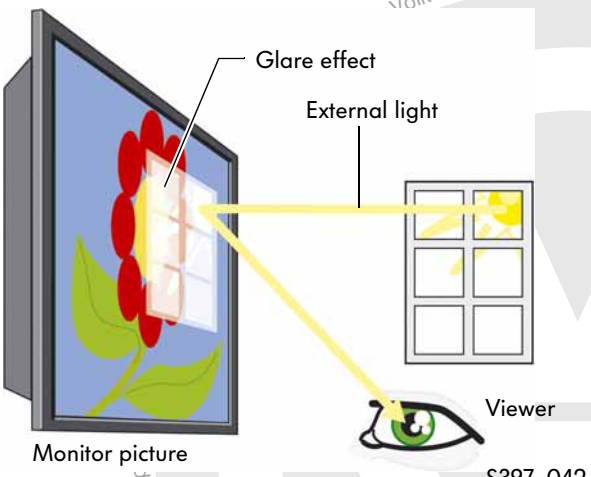
S397_039



S397_037

Polarisation filter on touch screen

Large glare effect without polarisation film

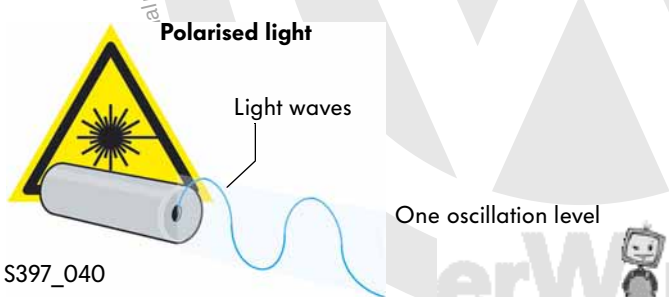


Smooth surfaces like glass reflect light so that the picture on a monitor is difficult to see when light conditions are too bright.

Polarisation filters are used to change the reflection behaviour and thus reduce glare effects. They consist of a plastic film of long, parallel molecule chains.

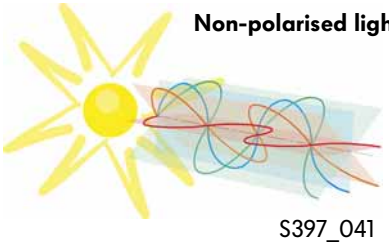
Basics

Polarised light

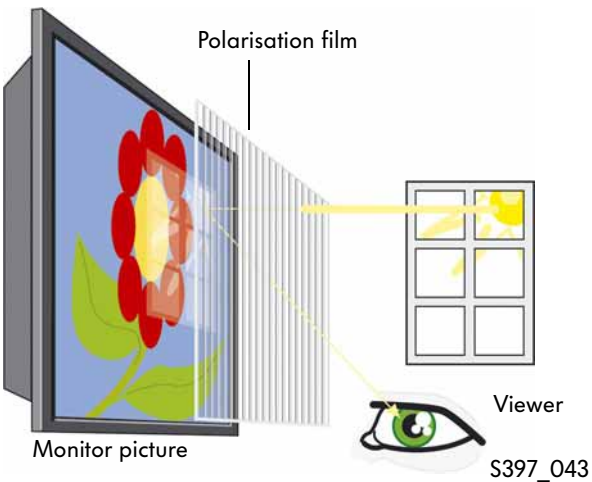


Electromagnetic beams like visible light, can be imagined as waves.
With polarised light, as emitted by lasers, for example, all waves oscillate only on one oscillation level.
With other light sources, for example, like the sun, the oscillations are on many different oscillation levels that are turned against each other. This kind of light is non-polarised light.

Non-polarised light



Lower glare effect thanks to polarisation film



The effect of polarisation films is that only light can pass through the polarisation film that oscillates in one level, which is set by the parallel arrangement of the molecule chains. Waves that oscillate in other levels are absorbed by the film. This means that only a fraction of the external light is reflected and the glare effect is reduced considerably.

RNS 510 Radio/Navigation System

Storage media

The RNS 510 radio navigation system uses an internal hard drive as a storage medium and a reader for digital memory cards (SD cards).

Internal hard drive of RNS 510

The RNS 510 has a 2.5" IDE single-platter hard drive to handle and manage large quantities of data.
(IDE = Integrated Drive Electronics)
Unlike the hard drives used in PCs, the drive used in the RNS 510 is specially designed for automotive use and has been adapted to the associated requirements. This means it is more resistant to vibrations and has a greater working temperature range (-20°C to + 80°C) than conventional hard drives. It also has a reduced standard speed of 4172rpm and a greater error tolerance.

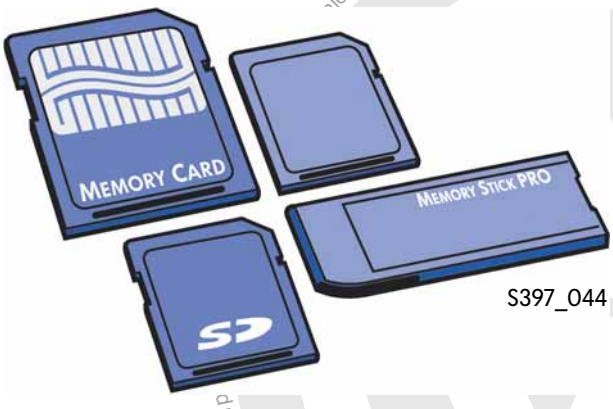
S397_045

The hard drive currently has a memory capacity of 30 gigabytes (Gb) with a fixed partitioning. Approx. 10Gb is for navigation data and approx. 20Gb for media data, for example,
Windows Media Audio data (WMA),
Motion Pictures expert group layer-3 data (MP3),
PLAYLISTS etc.
Therefore only data formats are stored on the hard drive.

It is not possible to store DVD, audio CD, video and CDA data on the media partition of the internal hard drive for copyright reasons as well as for technical reasons with JPEG formats.

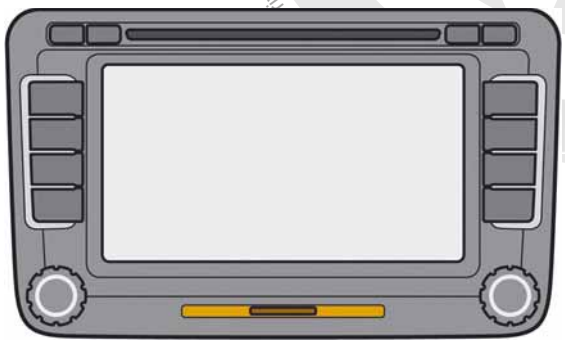
The hard drive is permanently built into the radio/navigation system and not intended for exchange at workshops.

SD card reader



S397_044

Using the reader built into the RNS 510, it is possible to read SD cards as used in mobile devices and PCs. SD stands for “Secure Digital”. SD cards are rewritable storage media (flash memory). The RNS510 can currently read SD cards with a capacity of up to 2 gigabytes. The card is controlled by a controller integrated in the reader.
Depending on the memory card quality, different reading speeds of up to 6Mb per second are possible.
The reader used in the RNS 510 is programmed so that only music and audio data (MP3, WMA and PLAYLISTS) can be uploaded from the memory card to the hard drive. Other data formats are not supported by the device reading program (browser).

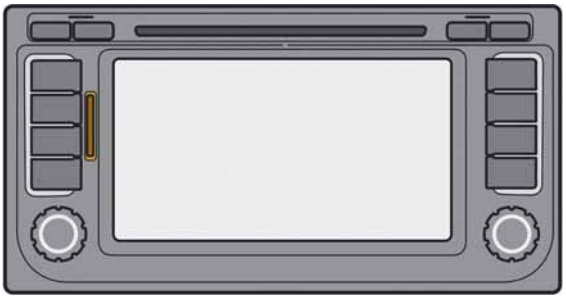


S397_120

Front panel of RNS 510 with SD memory card reader, for example, in Golf, Tiguan, Touran and Passat

It is possible to store the data from the SD memory card on the hard drive. However, it is not possible to transfer data from the hard drive in the radio/ navigation system to an SD memory card (copyright).

The slot for the SD memory cards is on the control panel and is not labelled. Its position depends on the type of vehicle. In the Touareg, the slot is to the left of the display and, in all other variants, it is underneath the display.

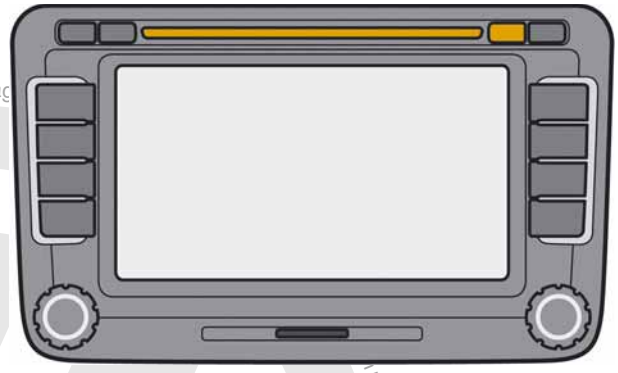


S397_121

Front panel of RNS 510 with SD memory card reader in Touareg

DVD player

Since a DVD drive is used in the RNS 510, it is also possible to play standard video DVDs in addition to reading the navigation DVD that comes with the system. As DVDs (Digital Versatile Discs) use different regional codes (DVD code) depending on the supplier or country of purchase, the DVD player needs to be set to the valid code.
It is possible to switch between different DVD codes in the “Adaptation” diagnosis mode.



S397_066

The DVD player in the RNS 510 supports the following reading formats:

- Navigation DVD data (no navigation CDs)
- DVD video
- DVD audio
- Data CDs and data DVDs with the MP3 and WMA data formats as well as playlists
- Music CDs in CDA format (normal purchased music CD)

S397_046

The MP3, WMA and playlist data formats can also be saved on the internal hard drive.

If sometimes an MP3 track cannot be played back by the DVD player, this could be caused by the DRM copy protection of the track. DRM stands for “Digital Rights Management”. This license is not supported by the RNS 510.

Display functions

S397_102

The touch screen on the RNS 510 radio/navigation system has numerous display functions and display possibilities. In addition to the graphics menus for radio, telephone and various other settings, it can also display real pictures for the TV, video and reversing camera (optional) functions.

A video signal can either be fed in internally via the DVD player or externally via the AV connection on the radio/navigation system.
It is planned for the future to allow adjustment of the air conditioning system with graphics via the touch screen on the radio/navigation system.
An MDI interface is also planned.
MDI stands for “Media Device Interface”. This is an interface to which various electronic devices like, for example, MP3 players, handhelds, USB sticks, external DVD devices and other compatible playback units can be connected and displayed on the touch screen.

The following functions are explained briefly in the following section:

- Menu switch-over support
- Alpha blending
- In-screen menu
- Split-screen function
- Shadowing
- Power down storing
- Store information history HMI

You will find more information on use of the functions in the operating manual for the radio/navigation system.

The screen content shown in the following section is from the radio/navigation system when set to German and serves simply as an example. Please refer to the corresponding operating manuals for the labels of the virtual buttons in other languages.

Menu switch-over support

Depending on the screen interface to be displayed and the associated windows, selection menus and submenus, it takes different amounts of time until all picture information is shown on the screen.

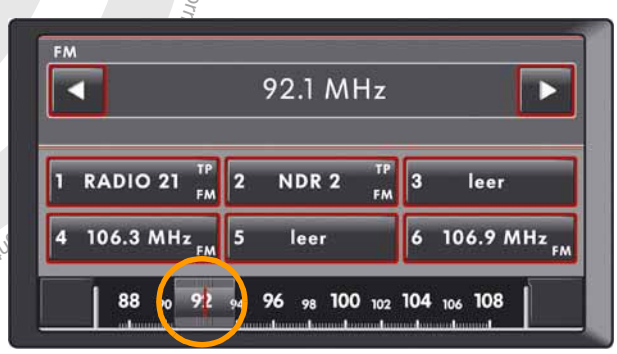
To minimise this time, the data collection for the screen display runs in the background.

The new screen is only displayed once all necessary information is available.

This procedure avoids step by step build up of the screen. This means, however, that there is a short, noticeable reaction time between operation and display.

Alpha blending

The displayed windows and menus are processed graphically and programmed according to function in order to show the different information on the VGA display of the RNS 510 in the easiest way for the user.
One type of preparation is alpha blending, which means the scalable transparency of screen elements like on an in-screen display.
The transparency information is saved in the so-called alpha channel for computer graphics.
This refers to the individual control of each individual pixel on the screen in terms of its transparency and its colour value. Specifying a value for the transparency defines whether the screen pixel reproduces the information from the background image, the superimposed window or a mixture of both.



Screen elements shining through S397_057

Different transparency levels S397_051

Different brightness levels S397_056

The transparency can be achieved in the form of different effects:

- Light glimmering of the background when windows or screen elements are displayed, for example, a volume bar.
- Different transparency levels of a display level like a map interface for navigation display and simultaneous display of submenu
- Different window brightness levels for submenus like control fields and controls, to give the surface an optical structure (3D effect).
- Shimmering of edge or transition area between main and overlaid window to create a feeling of space.

Edges of windows shining through S397_067
S397_068

In-screen menu

In-screen display, i.e. picture-in-picture display, is when a submenu is shown simultaneously in a video or TV picture (also reversing camera).
For example, DVD playback is not affected by permanently visible soft buttons, instead menus are only shown over the actual picture when the screen is touched.

In-screen menu during video playback S397_054

RNS 510 Radio/Navigation System

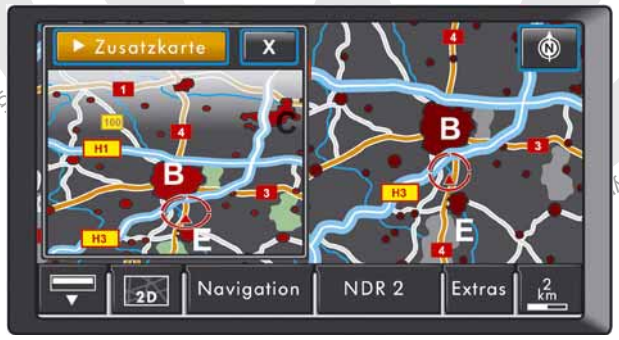
Split-screen function

In “Navigation” mode, the RNS 510 has a function for split-screen display. An additional window is used that is displayed over the current screen content.
This allows additional information to be displayed on the touch screen for the user.
The user can specify whether this additional window is displayed on the left or right.

It is, for example, possible to display the “Compass”, “Additional Map” and “GPS Viewer” submenus in split-screen mode while the map is displayed. If route guidance is active at the same time, the “Symbol Display”, “Overview” and “Manoeuvre List” submenus are also possible.

“Compass” split-screen S397_055

“Manoeuvre List” split-screen S397_074

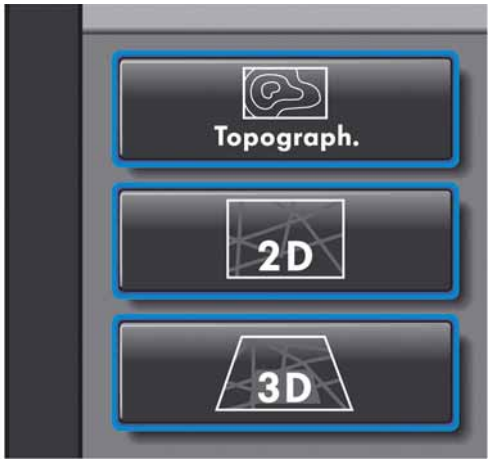


“Additional Map” split-screen (night design) S397_052

“Symbol” split-screen S397_075

“GPS Viewer” split-screen S397_053

“Overview” split-screen S397_072



S397_070

Shadow under virtual buttons

Store information history HMI

When switching from a main menu or start menu to a submenu, the function parameters from the exited window including any control adjustments made are saved. When you return to that menu window, these values are loaded from the memory and displayed again.

Power down storing

The RNS 510 has a power-down storing function to prevent current settings or current route guidance being lost, for example, if the system is accidentally switched off. All current data is stored in the RAM of the unit. When the unit is switched off, the RAM is supplied with power for a further 10 minutes so that the data stored there is not lost. For this reason, the RNS 510 has a higher stand-by current during this time.

If the system is switched on again within 10 minutes, it will load the data from the RAM back into the system so that the current settings are available again or the route guidance started before switch-off can be continued.

Shadowing

The virtual buttons or in-screen menus are emphasised as separate screen elements by means of shadowing. Shadowing means that the displayed button casts a shadow so that it seems raised from the background.

If the system is switched off for longer than 10 minutes, the power supply to the RAM is also interrupted and the data stored there is lost. When switched on again, the system starts with the menu for the last media source.
The media sources are therefore available to the user just after the unit is switched on even though the navigation system is starting up in the background.

Display types in navigation mode

There are three display types or perspectives for displaying maps in navigation mode:

- 2D map display
- topographic 2D display
- 3D bird's eye view

The map can be shown at different scales in all display types.

2D map display

This view is a conventional map view from above. The map is a so-called theme map, in this case a road map focussing on the roads. The surrounding area is shown in the background and is reduced to a graphical distinction of inhabited areas, free spaces, wooded areas and water. The display can be set to driving or north alignment.

2D map display S397_050

Topographic 2D display

The topographic display corresponds with a special two-dimensional view of the countryside. In addition to built-up areas, it shows water, wooded areas and green areas by means of a colour distinction and height differences on the terrain. The display can be set to driving or north alignment like the 2D map display.

Colour height distinction in the topographic map display S397_104

3D bird's eye view

The same map section in bird's eye view setting

S397_049

This virtual 3D view corresponds with a "tilted" 2D-map view and gives you the impression that you are looking at the map landscape from a raised point. The surface display still corresponds with a two-dimensional view that has been given a feeling of perspective by rotating the map surface.

This map display can only be aligned with the driving direction.

Zoom types in navigation mode

The navigation mode has three different zoom functions for displaying the details on the map:

- Manual zoom
- Autozoom
- Orientation zoom

Manual zoom

S397_077

Selection of enlargement level with manual zoom using the right-hand rotary knob

Activating the manual zoom disables all automatic zoom settings. You can use the right-hand rotary knob to set the map scale in 30 steps from 25m/cm up to 500km/cm. The m/cm or km/cm measurement figure describes the number of metres or kilometres on the original landscape per centimetre of map on the screen.

Autozoom

This is a dynamic zoom function that is constantly adapted. When it is switched on, the navigation system calculates the best display scale depending on the road class being used and the distance to the next manoeuvre point.
The road classes are divided into the following five categories:

- Residential roads
- Urban roads
- District roads
- Country roads
- Motorways

There are therefore five standard starting zoom values. Depending on the type of manoeuvre point, the autozoom function is also called crossroads or exit zoom.

Manoeuvre points are all features that can occur on the roads, for example, entrances, crossroads, motorway slip roads and motorway junctions.
The largest possible zoom factor is set as you approach a relevant manoeuvre point so that both the current vehicle position and also the manoeuvre point can be seen at the same time on the screen.

Once the manoeuvre point has been passed and the next one is still a sufficient distance away, the system switches back to the previous display scale or the standard zoom value for that particular road class.

If the autozoom function is activated in an off-road position, the current scale will be maintained until an on-road position is recognised and the autozoom function becomes active.
If the driver is using waypoint mode, i.e. driving to route points set by the user, autozoom is not possible.

The driver or the user cannot influence the autozoom function manually.

Automatic selection of the best display size

S397_073
S397_079

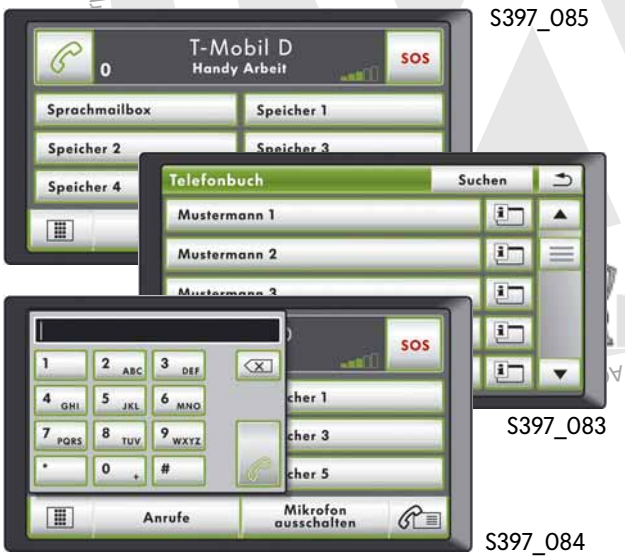
Orientation zoom

S397_105

This is a convenience function for quick orientation via the current position on the map.
The navigation system automatically and smoothly zooms out from the current display by a scale factor of 10, e.g. from 500 m/cm to 5,000 m/cm and then back.

Above a display scale of 75 km/cm, the orientation zoom is only available to a limited extent as the maximum displayable zoom level of 500 km/cm does not allow the system to zoom out by a factor of 10.

Telephone menu



S397_085

S397_083

S397_084

Due to the large operating and display area of the touch screen, it has been possible to use a separate menu to operate the telephone on the RNS 510.
This also includes a keypad that can be called up for manual dialling with buttons in a user friendly size.

Upon introduction of the new “Premium Light” mobile phone preparation, the separate 10-button keypad for manual dialling in the dashboard for the “Premium” mobile phone preparation was discontinued.
If a vehicle is not equipped with the RNS 510 or with other devices that have a touch screen, for example, the RCD 510 radio, it is only possible to operate the “UMPP Premium Light” with the multifunction steering wheel or alternatively with the steering column switch depending on the vehicle model and equipment.

RNS 510 Radio/Navigation System

Vehicle-specific user interfaces

On the RNS 510 radio/navigation system, a large number of the controls appear on the touch screen as described.
Furthermore there are different pre-programmed user interface designs for this system depending on the vehicle type. There are three different coding variants for the RNS 510 that can be selected and activated with the VAS tester.
The memory requirement for the displays stored for each version is 2Mb each.

There are four different dim values available for all versions that can be set via the menu.

The user interfaces for radio, navigation and telephone in the Tiguan, Eos, Golf Plus, Sharan NF and Passat

Radio

Navigation

Telephone

S397_090
S397_087
S397_093

The user interfaces for radio, navigation and telephone in the Touran, T5 Multivan, Touareg, Caddy and CC/Coupé

Radio

Navigation

Telephone

S397_089
S397_086
S397_092

The user interfaces for radio, navigation and telephone in the Golf R32, Golf GTI/GT, Scirocco and Passat R36

Radio

Navigation

Telephone

S397_091
S397_088
S397_094

RNS 510 data protocols

In data processing, a protocol is the method for exchanging data between computers. The protocol, for example, the File Transfer Protocol FTP, is to a certain extent the language in which computers “converse”. In order for the computers to communicate, they need to speak the same language.

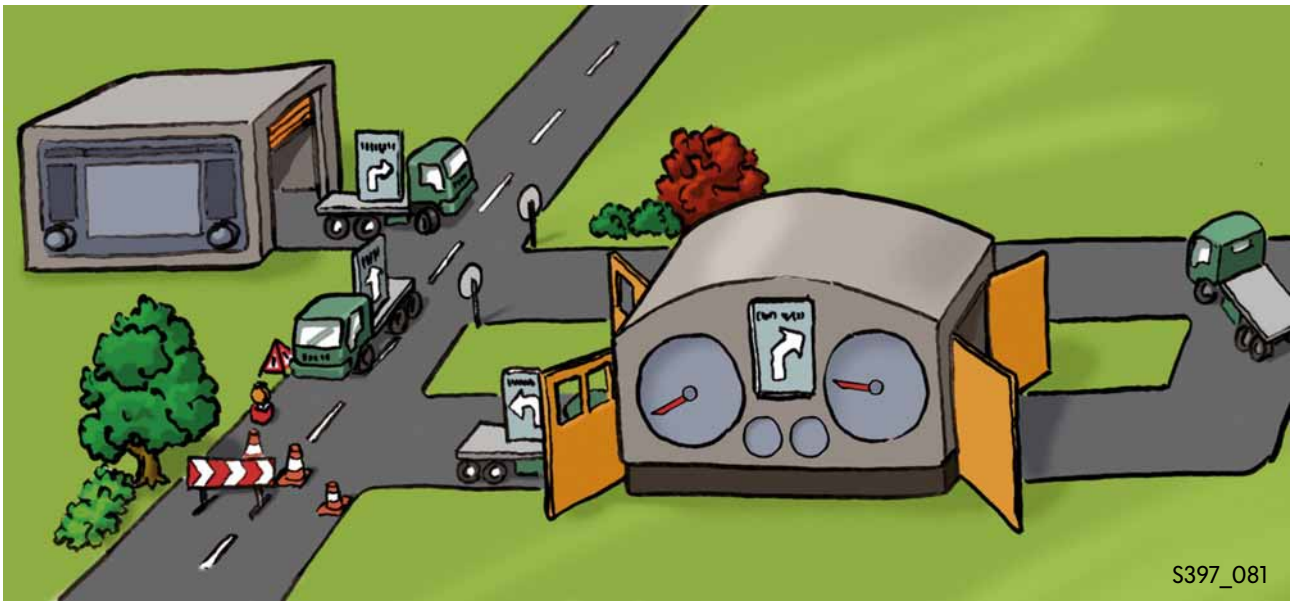
The RNS 510 uses two different protocols to transfer data between the control unit with display in dash panel insert and the navigation system or other control units that exchange display data:

- the DDP display data protocol and
- the BAP operating and display protocol.

DDP display data protocol

In this communication language between the navigation system and dash panel insert, the RNS 510 takes over control of the display data that should be displayed on the screen for the Highline version.
A fixed and constant data channel is set up between the two components via the CAN data bus lines.
The display data protocol runs parallel to the CAN data protocol for function and diagnosis data.

The telephone preparation control unit also controls the display data in the control unit with display in dash panel insert, for example, using the display data protocol.
The current control units with display in dash panel insert can currently only process this protocol.



BAP operating and display protocol

This new data protocol represents the future communication protocol for display data.
The aim is to switch all control units that exchange display and operating data over to this new standard.

The BAP operating and display protocol does not assign a fixed data channel, but instead the control unit supplying the display data transmits this data universally in BAP format to the CAN data bus.
This kind of data provision is also called broadcasting because of similarities with radio.

In radio, the stations are also broadcast by the transmitter for general reception.

The displaying control unit, in this example, the control unit with display in dash panel insert, reads and displays the data supplied by the radio/navigation system. This means that the control unit with display in dash panel insert is itself responsible for controlling the display. In this case, it would continue to watch the BAP data packages and only update its display when new BAP message content is actually available.

One more specific example is the display of telephone data via the radio/navigation system.
The data from the mobile telephone operating electronics control unit J412 is received, read and displayed by the RNS 510 radio/navigation system as a displaying control unit using this data protocol.

S397_103

Further CAN signals for communication

The radio/navigation system uses a large number of messages and being a display control unit which is incorporated into the CAN data bus this has numerous control functions.

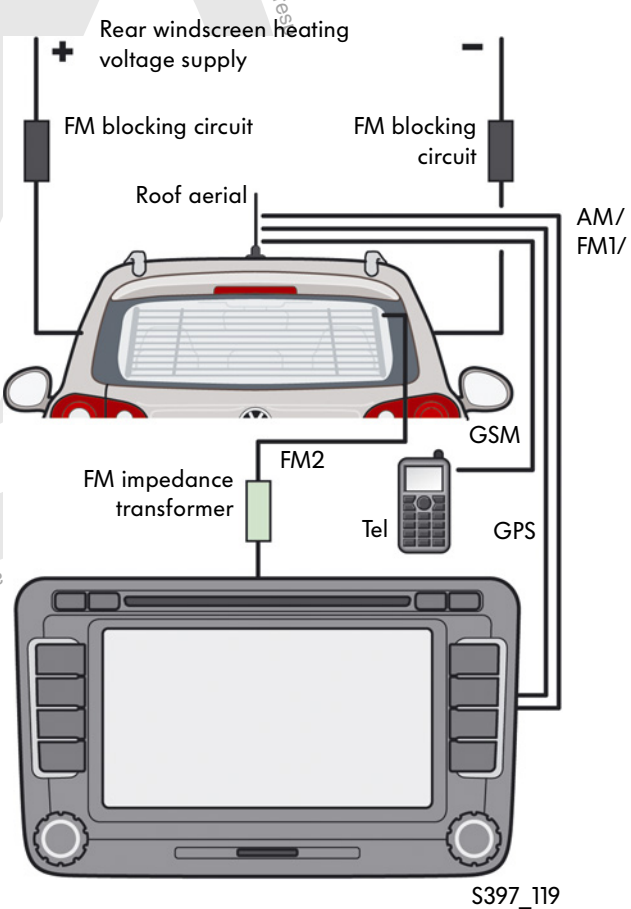
For example, it receives the following information via the CAN data bus protocol:

Onboard supply control unit	Dim signal, terminal status, reversing light
Data bus diagnostic interface	Time, date, target component list, speed signal (Gala), pulse signal (navigation), transport mode, vehicle platform info
Control unit with display in dash panel insert	Convenience code, display language
Telephone and telematics control unit	Telephone message (mute request)
Multifunction steering wheel control unit	Control via the multifunction steering wheel
Reversing camera system control unit	Reversing camera display
TV tuner	TV display

RNS 510 aerial concept

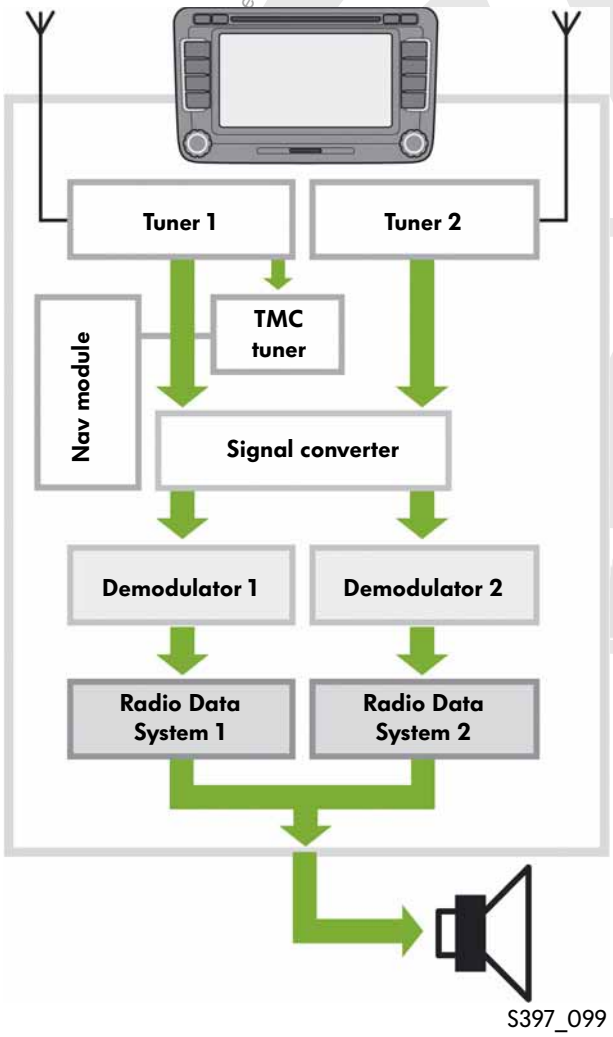
The aerial system has two rear windscreen aerials and a roof aerial if we take the Tiguan as an example.

AM and FM reception as well as the signals for the navigation system (GPS) and the telephone (GSM) are received via the roof aerial. An aerial structure in the rear windscreen of the Tiguan is used to connect the second FM tuner. An FM impedance transformer is required for this connection. Furthermore the rear windscreen heating circuit needs to be decoupled from the onboard supply signals with two FM blocking circuits.



S397_119

Twin-tuner principle



S397_099

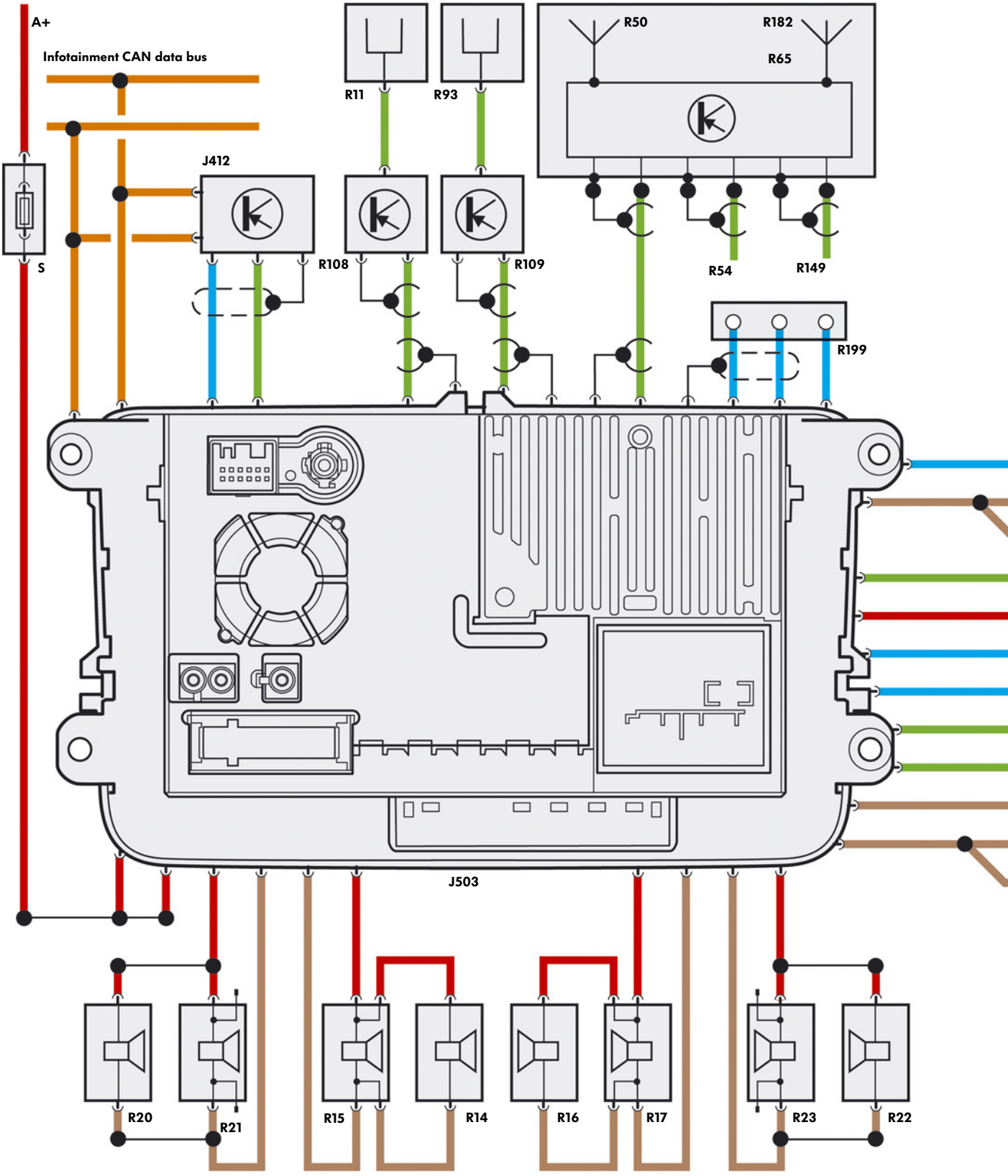
Two different, processed aerial signals are required for the twin-tuner principle. This is achieved by means of a spatial separation of the aerials and separate amplification of the signals.
These aerial signals are used either as alternating or individually or as a sum of both signals depending on the reception quality.
This means that one of the two internal tuners is responsible for the current reception of the station being listened to while the other receives the associated RDS data and simultaneously searches for broadcasting stations with better reception quality in the background. If it does find a better quality reception, the two reception tuners swap roles. This process is called switch diversity.

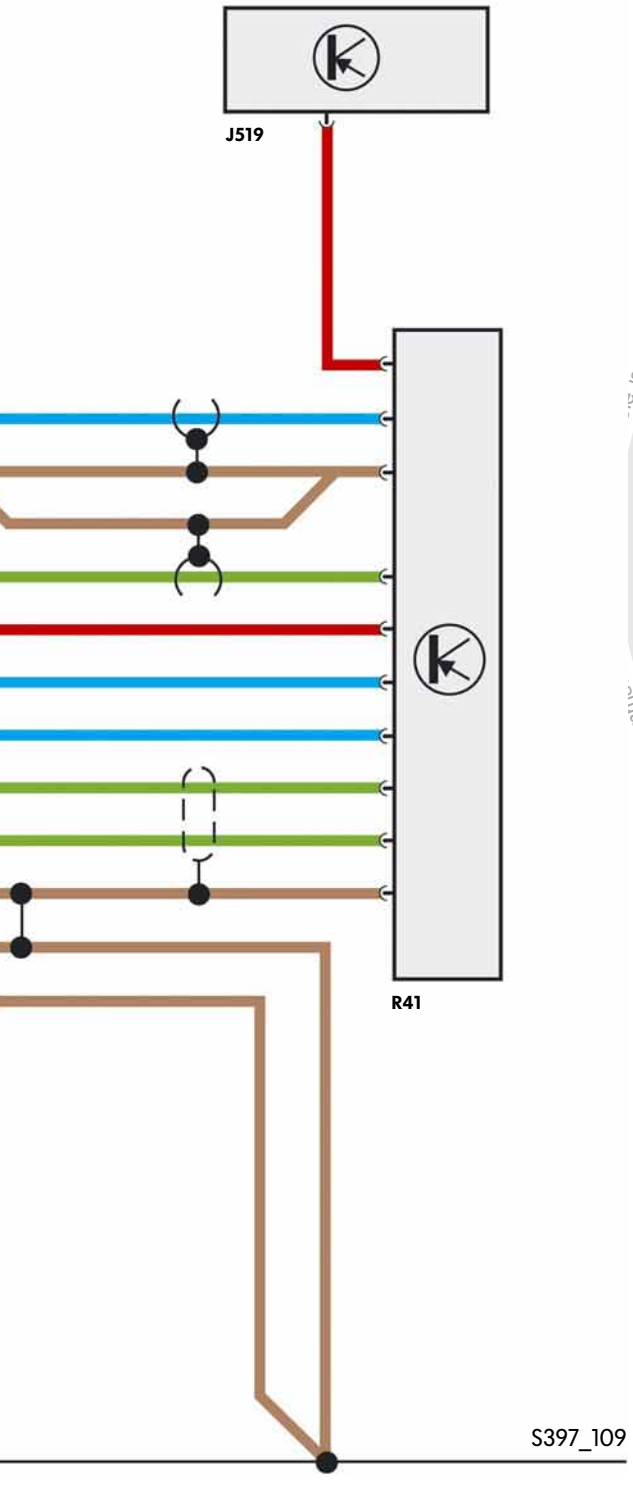
If the reception power as measured in decibels (dB) falls below a certain value, both aerial signals are used at the same time to obtain the station signals by being adaptively combined. The aim is to create the largest possible space between the station and interference signal (interference voltage space). This process is called phase diversity.

Furthermore a third tuner for receiving TMC messages is permanently connected to one of the aerial inputs. These messages are required for dynamic navigation.

RNS 510 Radio/Navigation System

Functional diagram





Legend

J412	Mobile telephone operating electronics control unit*
J503	Control unit with display for radio and navigation
J519	Onboard supply control unit
R11	Aerial
R14	Rear left treble loudspeaker
R15	Rear left bass loudspeaker
R16	Rear right treble loudspeaker
R17	Rear right bass loudspeaker
R20	Front left treble loudspeaker
R21	Front left bass loudspeaker
R22	Front right treble loudspeaker
R23	Front right bass loudspeaker
R41	CD changer*
R50	GPS aerial
R54	Mobile telephone*
R65	Telephone aerial
R93	Radio aerial 2
R108	Left aerial module
R109	Right aerial module
R149	Remote control receiver for auxiliary coolant heater*
R182	Auxiliary heater aerial
R199	Connection for external audio sources*
S	Fuse
A	Battery

* depending on equipment

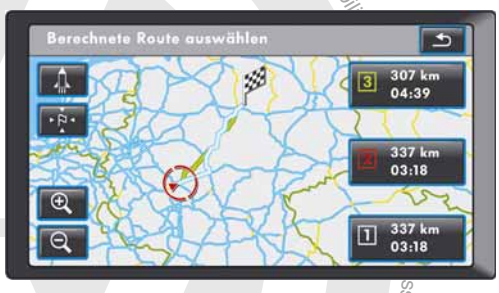
The functional diagram shows the RNS 510 radio navigation system in the Touran.

Input signal
Output signal
Positive
Earth
CAN data bus

Demo mode on RNS 510

The demo mode can be selected via the navigation menu setup under “Further navigation settings” to demonstrate the navigation functions of the RNS 510 or for self-study.

After activating route guidance, you can choose between three demo routes corresponding with the three route options. Once you select one of these route options, the RNS 510 sets off on a virtual route. This means it simulates a journey on the demo route with all displays and functions on the RNS 510.
The demo route guidance can only be started when the vehicle is stationary and is cancelled when the vehicle pulls away.



S397_080

Display and announcement language

On the RNS 300 and RNS 510, the display is always in the same language as the acoustic navigation announcements. A radio/navigation system normally takes the language from the control unit with display in dash panel insert. The control unit with display in dash panel insert also transmits the so-called “language message” to the CAN data bus that is then evaluated by the RNS, for example.

The speech output on the radio/navigation system can also be set or changed manually regardless of the CAN message from the control unit with display in dash panel insert.

If the language message is not received by the radio/navigation system, the last set language remains active. When used for the first time, the preset language is English.

Switch-off time

If you turn off the ignition while the radio/navigation system is switched on or switch on the system without “Ignition on”, the RNS will remain active for a further 30 minutes and then automatically switch off.
This function was previously called hour mode or hour logic.
The switch-off time of 30 minutes also applies to the simple Volkswagen radio models from model year 2008.

Special information for use of the radio/navigation systems

RNS 510

Copying navigation data to the navigation partition of the internal hard drive

Only the content **of one** navigation DVD can be copied to the hard drive built into the RNS 510 even though the partition could actually hold a larger quantity of data (max. 10Gb) than the 4.7Gb on a single-layer DVD. Therefore it is not possible, for example, to save both the data from the western European navigation DVD **and** the eastern European DVD at the same time on the internal hard drive.
The reason for this restriction to the content of one DVD is that a larger data quantity can be expected in the future in particular for countries with large road networks. For example, the navigation DVD for the USA is already a dual-layer DVD with a data capacity of approx. 8.5Gb.

S397_111

S397_112

If the data from one navigation DVD has been s aved on the navigation partition and you insert a DVD for another region or a different version of the same navigation DVD, the system will ask you in a selection window whether the stored data should be overwritten or the inserted DVD should be used temporarily.
In the latter case, the navigation system simply loads the data required for the current navigation into its RAM without overwriting the navigation partition. This means that if you eject the DVD, the current route guidance from the temporary DVD will immediately be interrupted.

Service

Loading times

Depending on the amount of data on the navigation DVD, it may take between 20 and 90 minutes to save it to the internal hard drive.

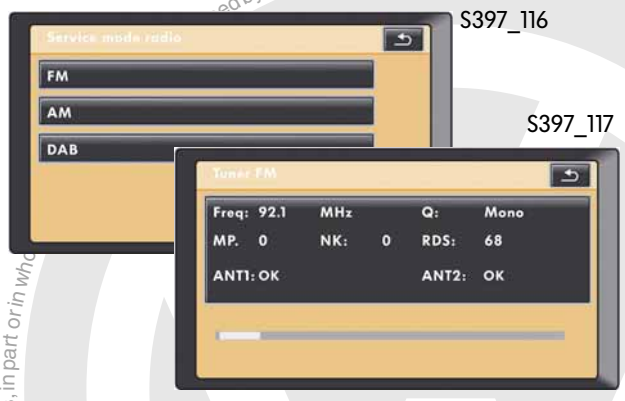
Compatibility

The navigation DVD for the RNS 510 is only suitable for use in the RNS 510 and cannot not be used in other navigation systems.

Radio service mode on RNS 300 and RNS 510

In this mode, you can, for example, carry out a physical diagnosis of the aerial function with a resistance measurement or the reception quality of the available stations by determining the current field strength.

To access this function on the RNS 510, you need to press the Setup button for longer than 10 seconds.
On the RNS 300 radio/navigation system, you need to hold down the sound button for between 5 and 10 seconds.
The unit then switches to radio service mode when you let go of the button.



Service mode display on RNS 510

ANT1: Electrical connection to aerial 1
openload - Electrical interruption in aerial path
OK - Aerial path OK
ANT2: Electrical connection to aerial 2
openload - Electrical interruption in aerial path
OK - Aerial path OK

The following values are displayed:
Frequ: Currently set frequency in MHz
Q: Quality of received signal
0 - No signal
Poor - Weak signal
Mono - Signal is only suitable for mono operation
Stereo - Ideal reception quality
MP: Multipath interference due to multipath reception
Display range 0 - 9
0 - No fault
9 - Maximum interference
NK: Neighbouring channel interference
Display range 0 - 9
0 - No interference
9 - String interference from neighbouring station
RDS: Quality of RDS signal
Display range 0 - 99
0 - Ideal RDS reception
99- Poor RDS reception
e.g. station name not displayed
Possible – Only frequency is displayed

Alert-C standard

Advice and Problem Location for European Road Traffic, Version C
The Alert-C standard is laid down in ISO 14819-1.
It defines the coding for events and their position in TMC messages.

Point Location, Area Location

Two types of location descriptions that are used by the German Federal Highway Research Institute to describe points, routes or areas in the localisation table.

Playlist

List with a special playback order for audio tracks stored in a data directory on an audio CD/DVD.
For example, to work on the RNS 510, the list needs to be in the same directory or folder as the tracks to be played.

List of abbreviations used

AM - Amplitude modulation

AUX - Auxiliary
Additional connection channel for audio media

BAP - Control and display protocol

CD - Compact disc
Optical storage medium, data is burnt with a laser onto a plastic disc with metal coating.
CDs can, for example, hold 800 MB of data.

CDA - CD audio track
Audio track on video CD/DVD

CDC - Compact Disc Changer (CD changer)

DAB - Digital Audio Broadcast

DDP - Display Data Protocol

DRM - Digital Rights Management
Standard for the digital copyright

DVD - Digital Versatile/Video Disc
Further development of optical storage media with a storage capacity of 4.7 Gb on single-layer coated DVDs (single layer DVD, DVD±R, DVD±RW) and 8.5 Gb on double-layer coated DVDs (dual/double-layer, DVD±R-DL, DVD-RW±DL).
In the near future, DVDs with 15 to 30 Gb storage capacity will be available (high-density DVD, HD-DVD).

FM - Frequency modulation

GPS - Global Positioning Satellite system
Global satellite-supported orientation and positioning system originally used by the military

GSM - Global System for Mobile communications
Standard for digital mobile telecommunications networks that is also used for data transfer as well as text messages (SMS).

Glossary

JPEG - JPG; Joint Photographic Experts Group
Special image data format that works with high compression algorithms so that the image data only requires a small amount of memory.

MDI - Media Device Interface
Universal interface for external playback units and storage media

MP3 - Motion Pictures expert group layer 3 (MPEG Layer 3)
Compression standards for video, audio and image formats.

LF - Low frequency

PDA - Personel Digital Assistant
Compact, portable small computer for calendar function, notes etc.

RDS - Standardised system for transferring non-audio additional information for radio e.g. station names, audio titles etc.

SD - Secure Digital card
Small and robust memory cards, e.g. for digital photo, MP3 players etc.

SDARS - Satellite Digital Audio Radio Services
A digital radio standard for commercial satellite radio in North America

TFT - Thin Film Transistor Display (TFT display)

TMC - Traffic Message Channel
A digital service in radio for transmission of traffic messages

UMPP - Universal Mobile Phone Preparation

USB - Universal Serial Bus
Universal serial interface between different computers and peripheral devices

WMA - Windows Media Audio
Special audio format under Microsoft Windows

WVGA - Wide VGA (Wide Video Graphics Array)
Special monitor resolution for wide screens with an aspect ratio of 16:9 or 18:10.

Which answers are correct?

One or several of the answers could be correct.

1. When the corridor function is selected on the RNS300 radio navigation system, ...

☐ a) dynamic navigation is not possible.

☐ b) dynamic navigation limited to the corridor area is also possible when the navigation CD is not inserted.

☐ c) the full dynamic navigation function is possible.

2. TMC is the abbreviation for:

____

3. Which statements are correct?

☐ a) Hard buttons are unit buttons made from hard plastic, soft buttons from soft material like rubber, for example.

☐ b) Hard buttons are keys used to protect the RNS devices against theft.

☐ c) Hard buttons are buttons with a single function.

☐ d) Soft buttons change their function depending on the selected menu or submenu.

☐ e) Soft buttons are only on touch-sensitive screens.

4. Which method does the touch-sensitive screen on the RNS 510 use to determine the horizontal and vertical monitor coordinates?

☐ a) The voltage divider principle.

☐ b) The measurement of electrical resistances.

☐ c) The capacitive measuring principle.

☐ d) The coupling of vertically and horizontally aligned induction loops.

Test Yourself

5. The light waves of polarised light ...

☐ a) oscillate on opposing oscillation levels.

☐ b) cannot be reflected by smooth surfaces.

☐ c) oscillate only on one level.

6. The basic differences between the RNS 300 and RNS 510 are:

☐ a) an internal hard drive in the RNS 300

☐ b) an internal hard drive in the RNS 510

☐ c) a touch-sensitive 6.5" monochrome display on the RNS 510

☐ d) a 5" colour display on the RNS 300

☐ e) an SD card reader in the RNS 300

☐ f) a reception module with two radio tuners and a TMC tuner in the RNS 510

☐ g) a reception module with two radio tuners in the RNS 300

7. Which media formats are supported by the RNS 510 radio/navigation system?

☐ a) DVD video and audio data, music CDs, data CDs and DVDs with WMA and JPEG data.

☐ b) Navigation CDs and DVDs, DVD video and MP3.

☐ c) Navigation DVD, data CDs and DVDs with WMA and MP3 data as well as playlists.

☐ d) (S)VCD, JPEG and DivX data.

8. In which format can data be saved on the internal hard drive in the RNS 510?

☐ a) Video formats of DVDs and JPEG data.

☐ b) WMA and MP3 formats of data CDs and DVDs.

☐ c) Audio formats of DVDs.

☐ d) CDA formats of music CDs.

9. Which statements are correct?

☐ a) The DDP display data protocol sets up a fixed and constant data channel via the CAN data bus lines for data transfer between the two components.

☐ b) The DDP display data protocol addresses each control unit via a separate data line (LIN bus).

☐ c) The BAP operating and display protocol transmits the data to be displayed universally to the CAN data bus. This is then only evaluated by the control units that require this data, however.

Answers

1. b); 2. Traffic Message Channel; 3. c), d); 4. a), b); 5. c); 6. b), c), f); 7. c); 8. b);9. a), c)

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