













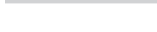




## AUDI A8 '03 - Electrical Components

### Self Study Programme 287

This Self Study Programme contains information on data bus networking (topology) and electrical components in the Audi A8 '03.

An understanding of the interaction of the components and distributed functions forms the necessary basis for successful fault-finding.

### Wiring

-  Convenience CAN
-  Drive system CAN
-  Adaptive cruise control CAN
-  Dash panel insert CAN
-  MOST bus
-  LIN bus
-  Diagnosis CAN
-  Bidirectional wire
-  Reception wire
-  Transmission wire
-  Discrete wire
-  Wireless transmission – transmission signal
-  Wireless transmission – reception signal
-  Follow-up function
-  Prerequisite

This introduction contains explanatory notes to clarify the meanings of certain terms, designations and symbols used in this Self Study Programme.

More detailed information can be found in the following Self Study Programmes:

- SSP 282 – Audi A8 '03 Technical Features
- SSP 286 – New Data Bus Systems – LIN, MOST, Bluetooth™
- SSP 288 – Audi A8 '03 Distributed Functions
- SSP 289 – Adaptive cruise control in the Audi A8 '03
- SSP 293 – Audi A8 '03 Infotainment

### Components and symbols

①

A number is used to designate the information sequence described in the corresponding text. The green circle symbolises the start of an information sequence.



The green arrow indicates input information.



The blue arrow indicates output information.

The layout of the individual components such as control units, switches or control elements as illustrated corresponds to the actual arrangement in the vehicle. Component designations are explained on the basis of their identifiers in the relevant text.



Components marked in red indicate the function master within a sequence of operations.



Components marked in yellow indicate the substitute master.



### Definition of terms

#### Data bus network (topology)

The topology provides a general outline of the way in which control units fitted in the vehicle are interlinked by way of data bus systems.

It thus becomes clear which bus systems are used by the control units to exchange data.

#### Distributed functions

This term indicates that several control units are required to exchange information in order to implement a function.

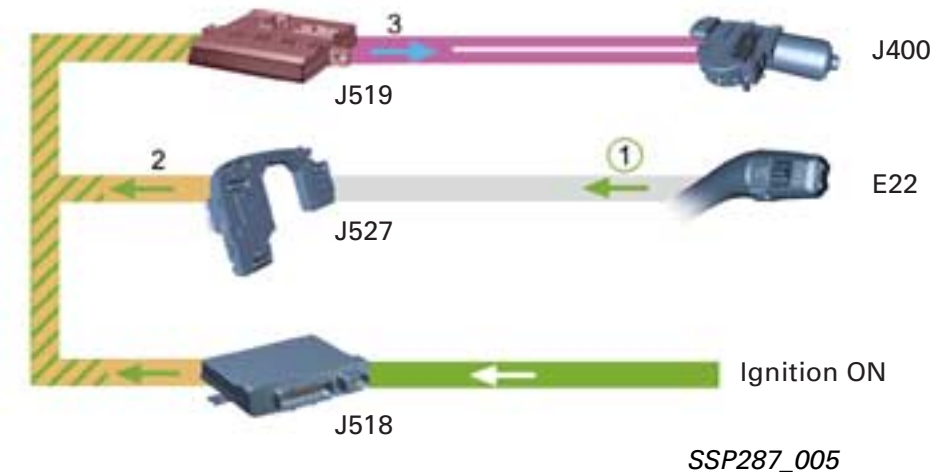
#### Function master

With distributed functions, one control unit is always responsible for the entire sequence of operations. The function master control unit gathers all input information. The requests resulting from this are then transmitted in the form of a message on the data bus system and read into the control units concerned for corresponding actuation of the appropriate connected components.

#### Substitute master

In the event of function master failure affecting major functions, the task of the function master is assumed by a control unit provided for this purpose and designed to maintain the sequence of operations (possibly with certain restrictions).

#### Example: Wiper speed 1 function



#### Prerequisite

Ignition switched on by way of electric ignition/starter switch or Advanced Key, so that entry and start authorisation control unit J518 transmits terminal 15 and 75x information to convenience CAN.

1 The intermittent wiper switch E22 transmits the information "Wiper speed 1" to the steering column electronics control unit J527.

2 The steering column electronics transmits the information "Wiper speed 1" to the onboard power supply control unit J519.

3 The onboard power supply control unit transmits the information "Wiper speed 1" via the LIN to the wiper motor control unit J400. The wiper motor control unit actuates the integrated motor.



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Door control units J386 to J389 .....	68
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The Self Study Programme contains information on design features and functions.

**The Self Study Programme is not intended as a Workshop Manual.**

**Values given are only intended to help explain the subject matter and relate to the software version applicable at the time of SSP compilation.**

Use should always be made of the latest technical publications when performing maintenance and repair work.

**New**



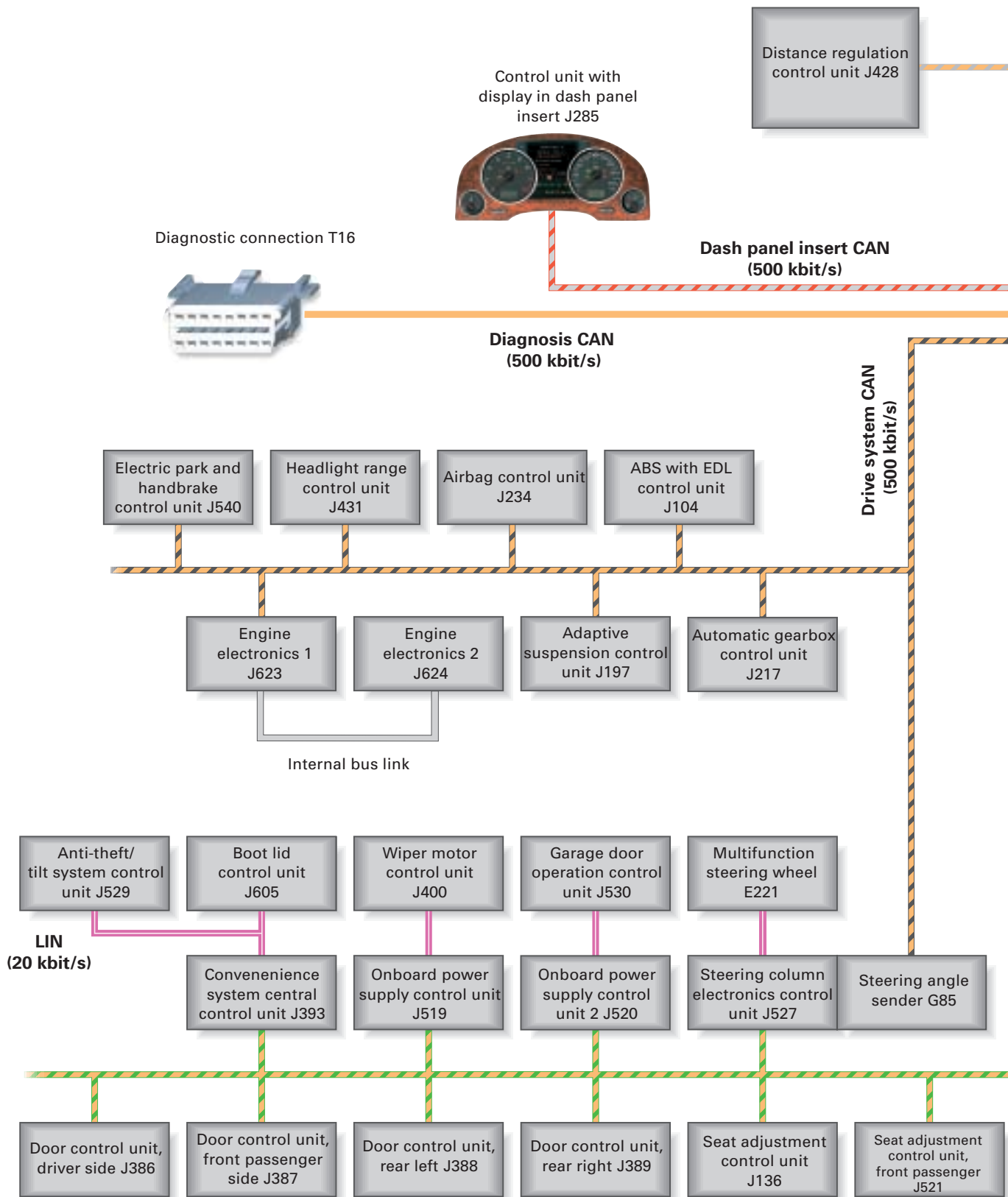
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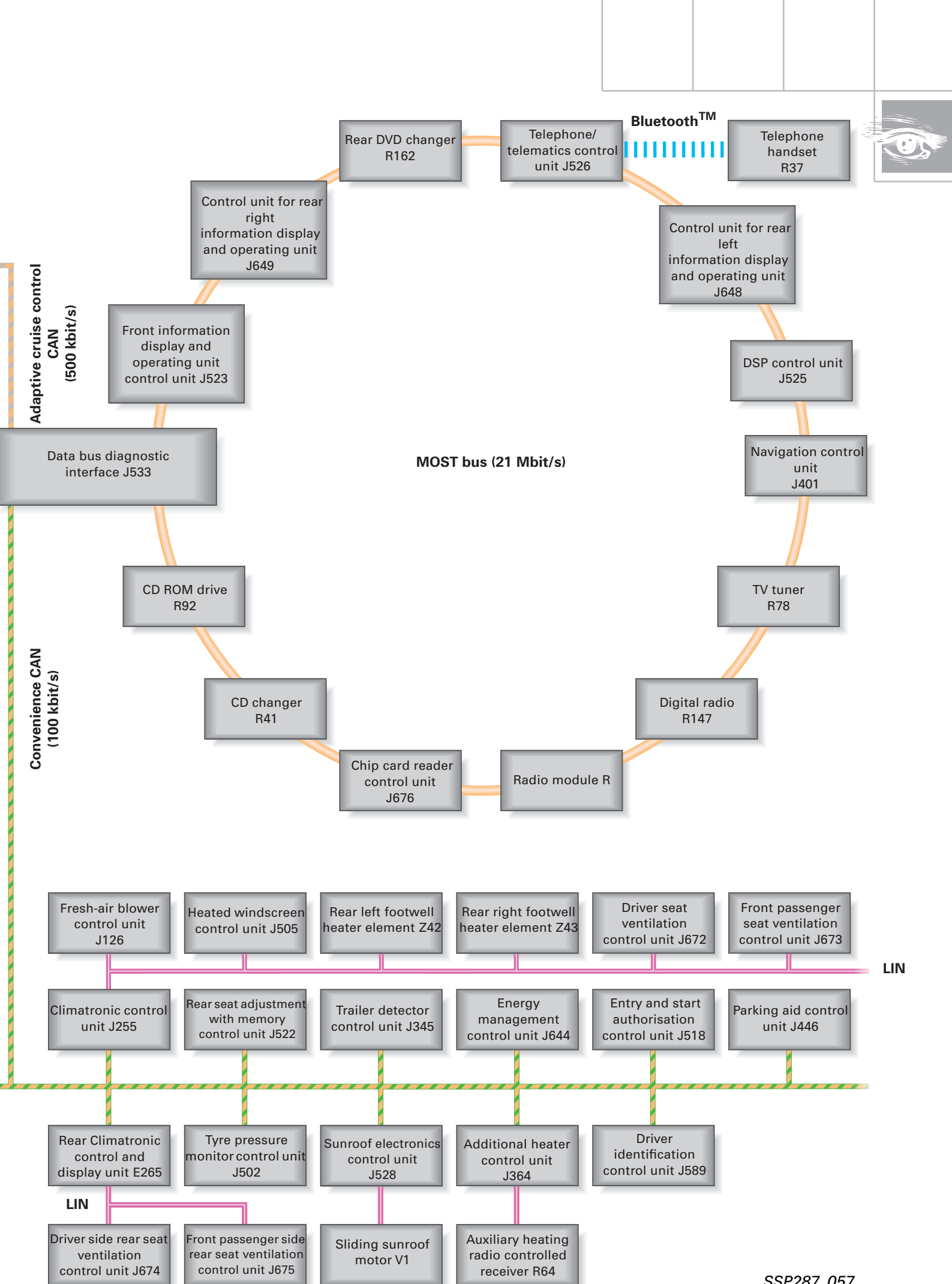


# Introduction



## Bus topology

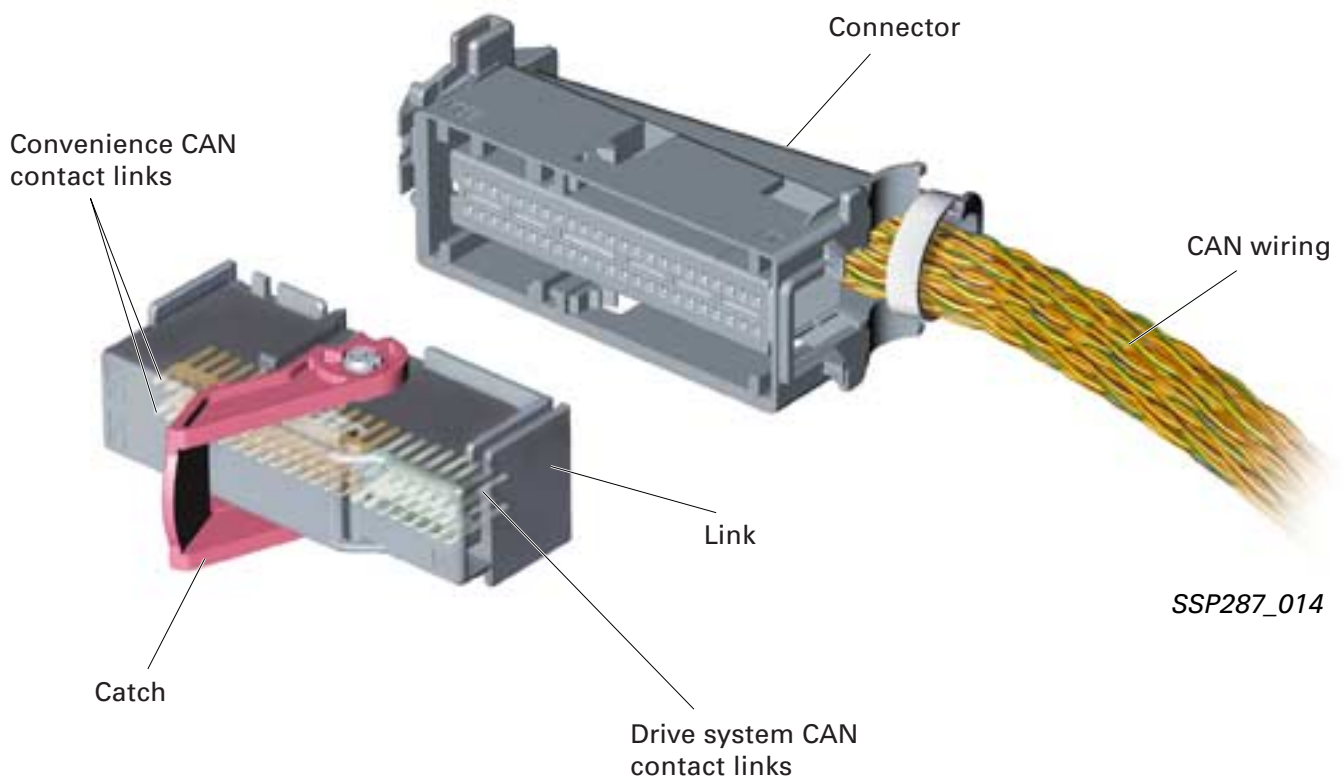




# Control Units



## Drive system CAN/ convenience CAN connectors




Two CAN bus connectors are used in the Audi A8 '03. The connectors form the central junction for both the convenience and the drive system CAN.

All CAN wires of the respective bus system control units are attached to the connectors.

## Fitting locations

The connectors are installed on the right and left sides of the dash panel behind the end trim. The catch has to be unfastened before a link can be detached.

The pin assignments of the two connectors are different in left and right-hand drive vehicles.

 The pin assignments can be found in the appropriate Workshop Manual or under "Vehicle information" in assisted fault-finding.



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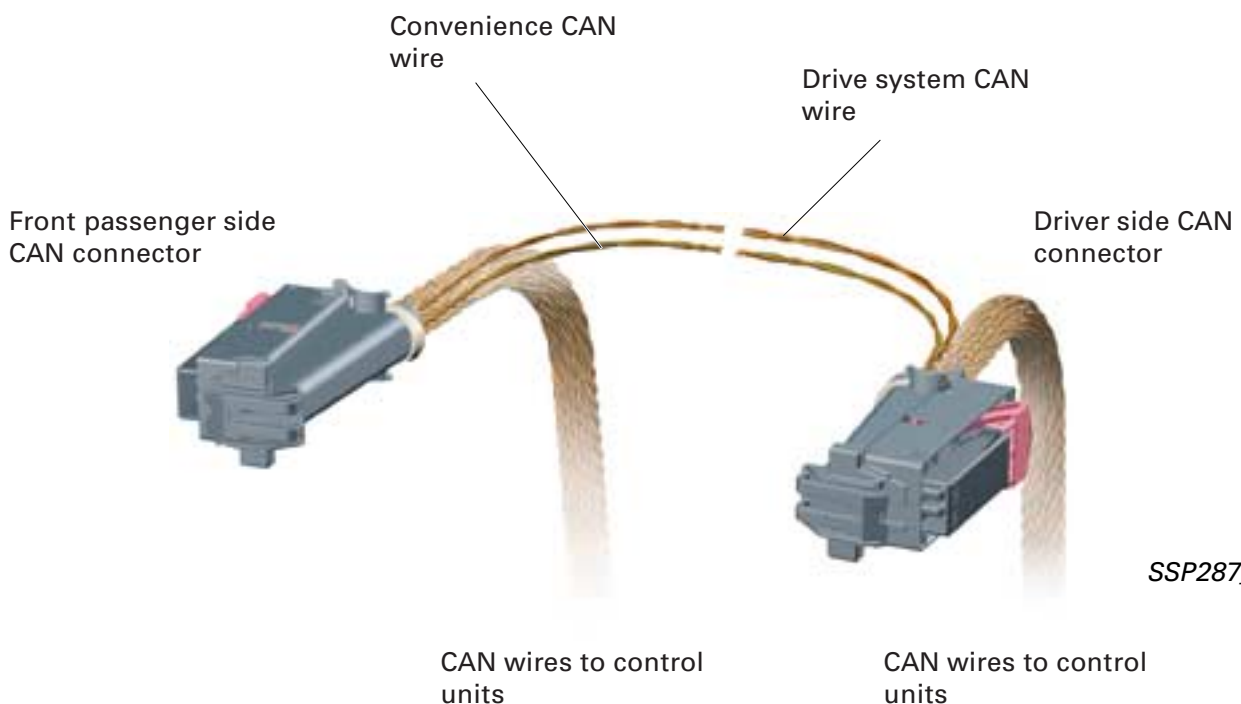
# Control Units

## Star connection

All drive system and convenience CAN control units are linked to the corresponding connector in star configuration.

Some of the control units of a bus system are linked to the right connector, whereas the others are linked to the left connector.

In turn, the left and right connectors are interlinked by a CAN wire so that ultimately all convenience CAN control units are interlinked, as are those of the drive system CAN.



## Test box

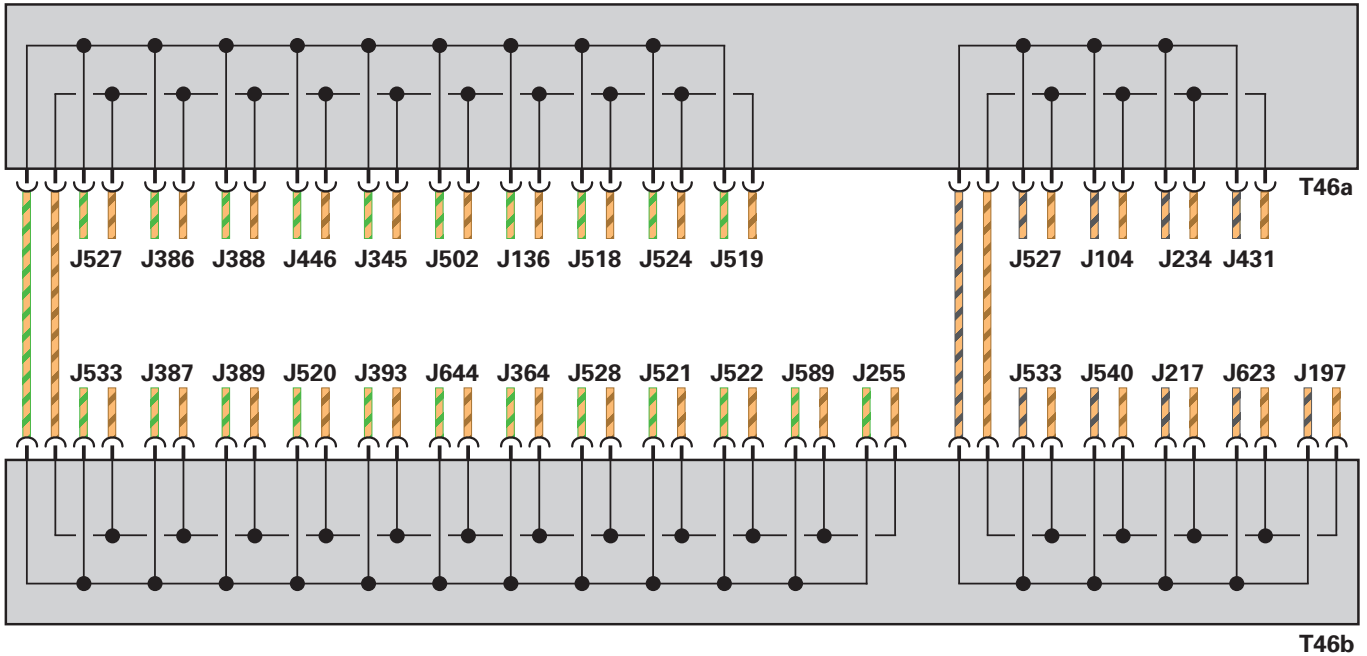
Use is made for the CAN connectors of the test box 1598/38.

This test box makes it possible to access the individual drive system and convenience CAN control unit wires with the digital storage oscilloscope of VAS 5051. Individual control units can also be disconnected from the bus system during fault-finding.

This is necessary, for example, when trying to localise CAN bus short circuits. The link connecting the CAN wires of the individual control units is inserted at the test box and can also be checked.



## Block diagram



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## Key

J104	ABS with EDL control unit	J524	Rear information display and operating unit control unit
J136	Seat adjustment with memory control unit	J527	Steering column electronics control unit
J197	Adaptive suspension control unit	J528	Sunroof electronics control unit
J217	Automatic gearbox control unit	J533	Data bus diagnostic interface
J234	Airbag control unit	J540	Electric park and handbrake control unit
J255	Climatronic control unit	J589	Driver identification control unit
J345	Trailer detector control unit	J623	Engine control unit
J364	Additional heater control unit	J644	Energy management control unit
J386	Door control unit, driver side	T46a	46-pin, black connector at left CAN breaker
J387	Door control unit, front passenger side	T46b	46-pin, black connector at right CAN breaker
J388	Door control unit, rear left		
J389	Door control unit, rear right		
J393	Convenience system central control unit		
J431	Headlight range control unit		
J446	Parking aid control unit		
J502	Tyre pressure monitor control unit		
J518	Entry and start authorisation control unit		
J519	Onboard power supply control unit		
J520	Onboard power supply control unit 2		
J521	Seat adjustment with memory control unit, front passenger		
J522	Seat adjustment with memory control unit, rear		

## Colour code

	= Convenience CAN High
	= Convenience CAN Low
	= Drive system CAN High
	= Drive system CAN Low



# Control Units

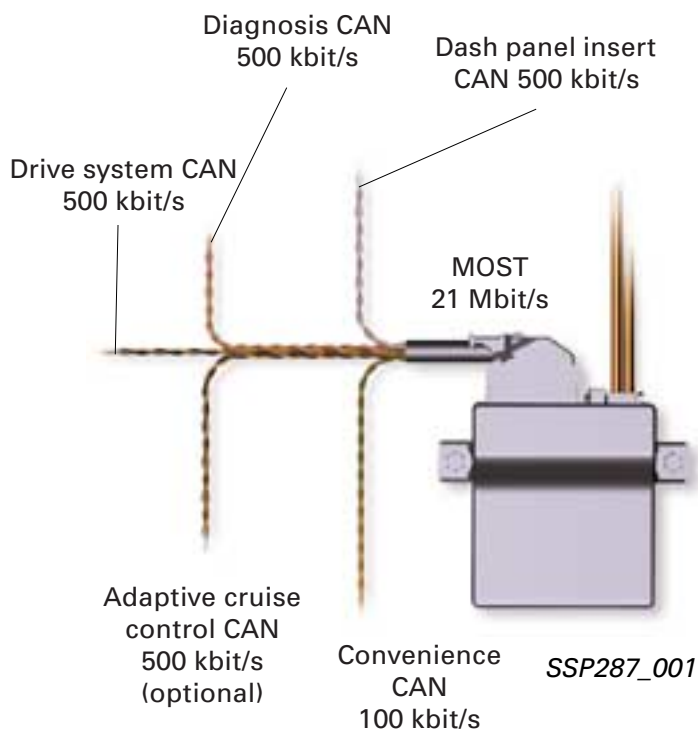


## Data bus diagnostic interface J533 (gateway)

The wide range of interlinked vehicle functions necessitates the use of several data bus systems on account of the capacity required for handling the great volume of data to be transmitted.

The data bus diagnostic interface is a network gateway for data bus systems, the principal function of which is to form the interface between the various independent data bus systems in the vehicle.

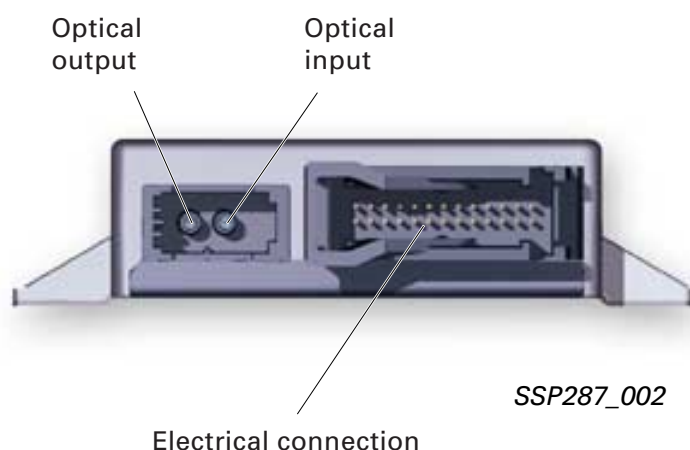
In the past, the gateway function was integrated into the dash panel insert. A separate control unit is employed in the Audi A8 '03 to cope with the large number of functions distributed over various control units and requiring a high level of data transfer between the control units of the different bus systems.



### Versions

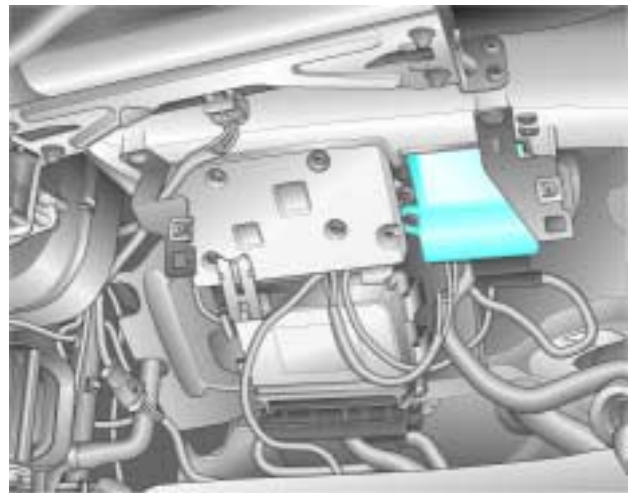
Two different data bus diagnostic interface J533 versions are used in the Audi A8 '03: One with connection to the optional adaptive cruise control (ACC) system and the other without this connection.

Both versions however feature a connection for the MOST optical data bus fitted as standard.



## Fitting location

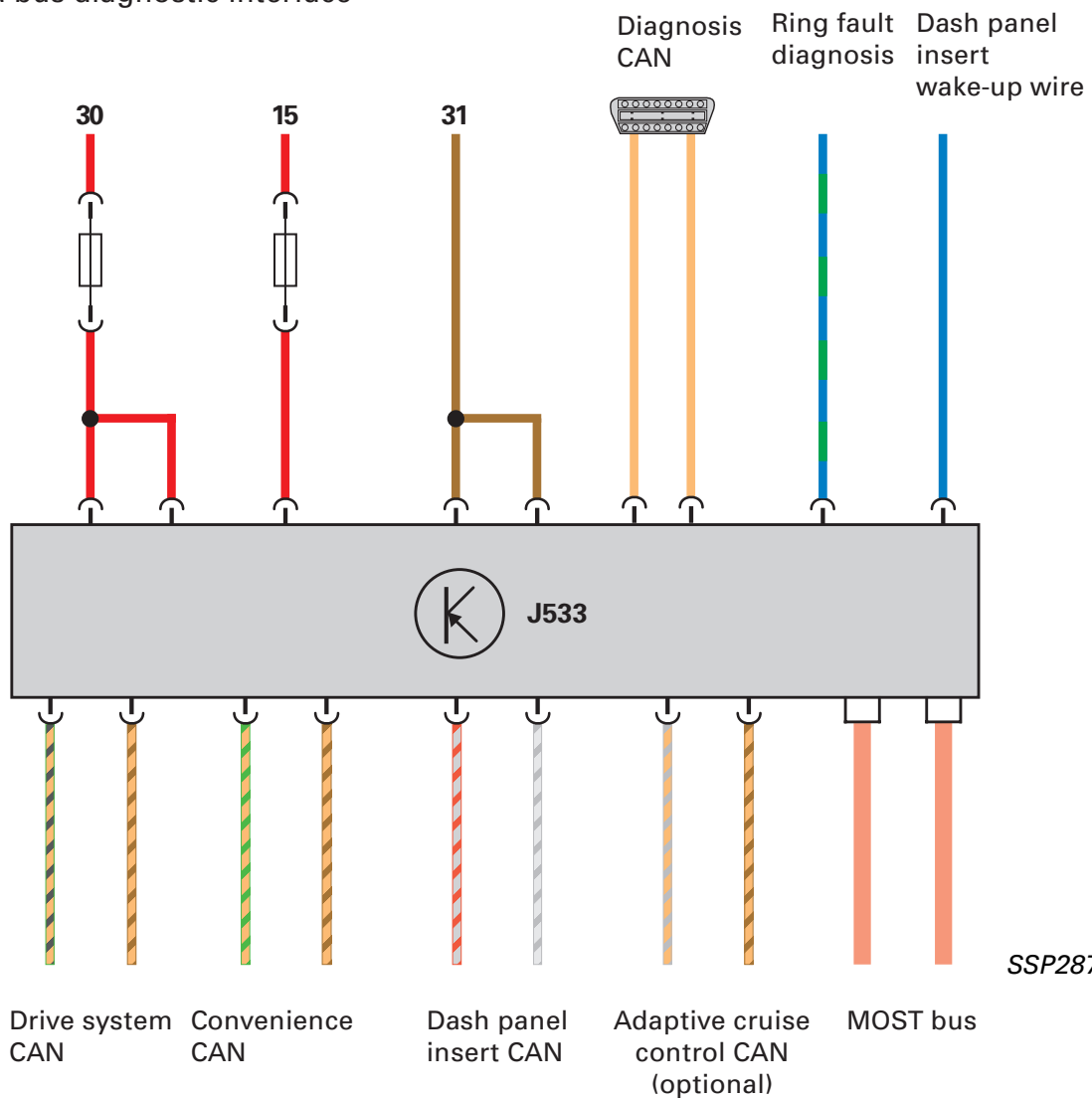
In the Audi A8 '03, the data bus diagnostic interface is installed at the module holder behind the glove box.



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## Block diagram

J533 Data bus diagnostic interface



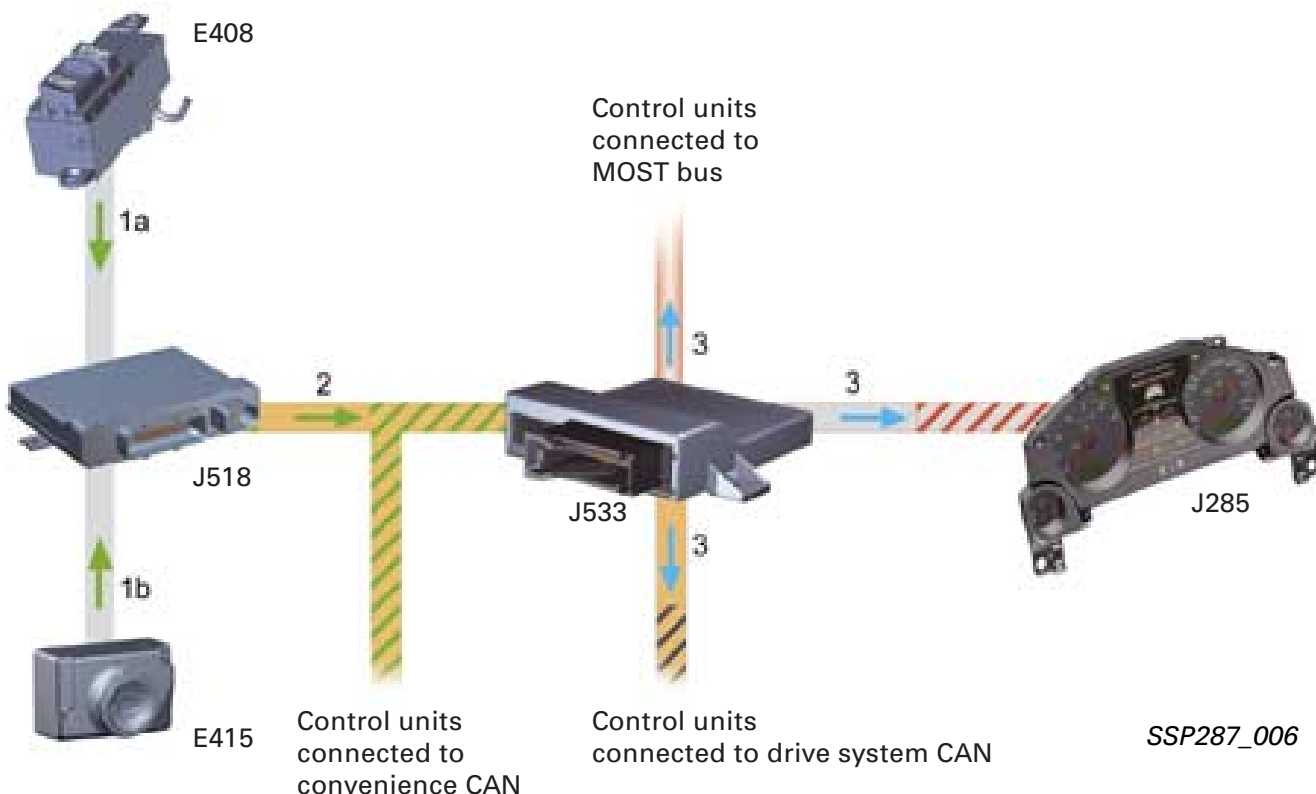
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# Control Units

## Data exchange

Example: Transmission from terminal 15



The data bus diagnostic interface J533 implements the exchange of data between the various data bus systems.

To do so, it transmits data with a short propagation time from one data bus system to the other.

In this process, not all data from one bus system are transmitted to the next, but rather only the data required by the system concerned.

1a The terminal 15 information is transmitted by the entry and start authorisation button E408 via a discrete wire to the entry and start authorisation control unit J518.

or

1b Transmission from terminal 15 to the entry and start authorisation control unit J518 is effected via a discrete wire by actuating the entry and start authorisation switch E415.

2 The entry and start authorisation control unit relays the information via the convenience CAN to the data bus diagnostic interface.

3 The information is read in by the data bus diagnostic interface J533 and transmitted to the drive system CAN, dash panel insert CAN (control unit with display in dash panel insert J285) and MOST bus. The information is thus available to all connected control units.

## Master functions

The data bus diagnostic interface is the master for:

- Drive system CAN continued operation
- MOST ring fault diagnosis
- Data bus system sleep and wake-up

### Drive system CAN continued operation

Terminal 15 continued operation for various control units connected to the drive system CAN (refer to entry and start authorisation control unit) is sustained until the data bus diagnostic interface transmits a command for termination of continued operation to the drive system CAN.

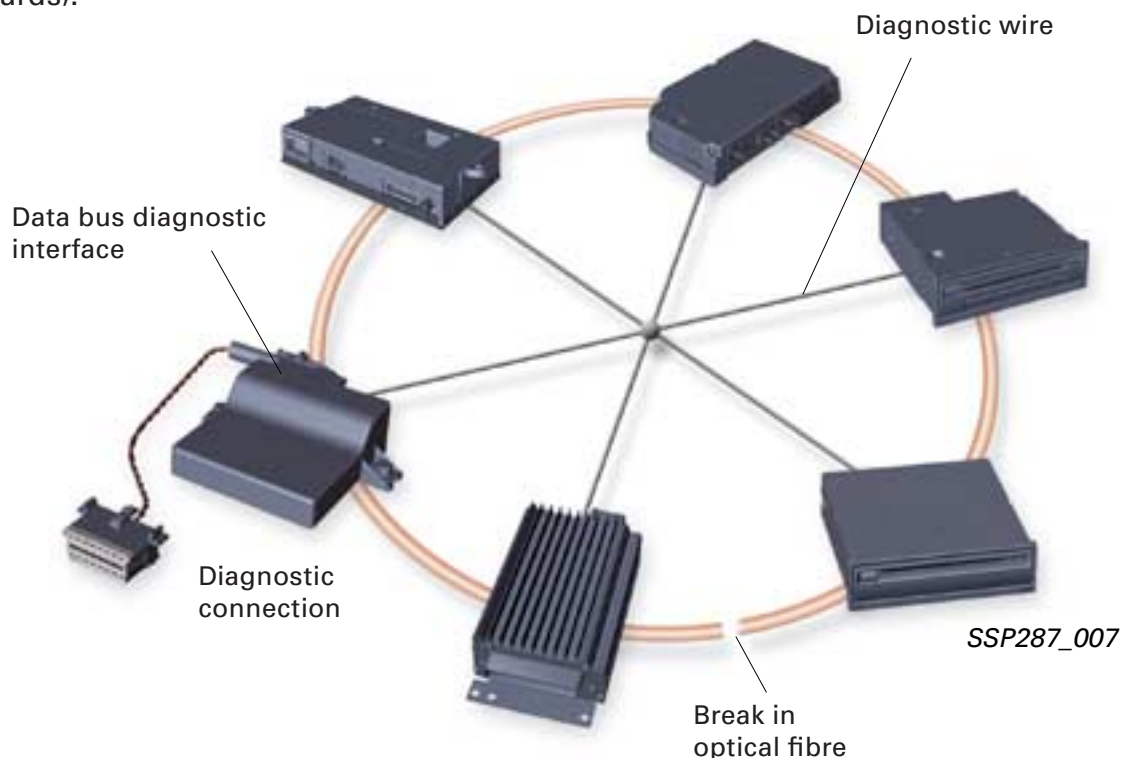
### MOST ring fault diagnosis

The data bus diagnostic interface is the diagnosis manager for the MOST bus. This is responsible for ring fault diagnosis and transmits the diagnosis data of the control units in the MOST bus to the data bus diagnostic interface.

Ring fault diagnosis for the MOST bus is initiated by way of the final control diagnosis in the data bus diagnostic interface (refer to SSP 286 - New Data Bus Systems, Page 41 onwards).

### Sleep and wake-up mode

The data bus diagnostic interface is the master for sleep and wake-up modes in the vehicle. When all control units connected to the convenience CAN indicate "sleep readiness", the gateway transmits the sleep command to the CAN bus and the connected control units switch to sleep status. The sleep status of the individual control units and bus systems can be read out in the Audi A8 '03 from the measured value blocks of the data bus diagnostic interface.



# Control Units



## Diagnosis

The data bus diagnostic interface enables data to be exchanged between the diagnosis unit and the individual control units in the vehicle. In this process, the control unit diagnosis data are transmitted via the corresponding data bus system to the diagnostic interface and from there via the diagnostic connector to the diagnosis unit (refer to SSP 286 under "Diagnosis CAN", Page 50).

The data bus diagnostic interface retains diagnostic capability even without terminal 15 ON. This is however subject to the restriction that no write operations, such as encoding, can be implemented.

The ignition must be on for starting diagnosis, as the 500 kbit/s diagnosis CAN has no wake-up capability.

## Measured value blocks

The data bus diagnostic interface is provided with measured value blocks in which communication, one-wire diagnosis and sleep mode are displayed.

If there is communication with a control unit fitted in the vehicle, this is indicated in the measured value block by a 1. If there is no communication with a control unit fitted in the vehicle or encoded, this is indicated by a 0.

If a control unit is in one wire mode, this is indicated by "1 wire". In the Audi A8 '03, the measured value block for one-wire diagnosis is only available in the diagnostic interface. The "sleep readiness" of the control units is indicated by "S". If the vehicle is in diagnosis mode, the bus systems do not switch to sleep mode even if all control units are indicating "sleep readiness".

Assisted fault-finding	Audi	V05.02 18/06/2002
Functional test	Audi A8 2003>	
J533 - Display measured value blocks	2003 (3) Saloon BFM 4.2l Motronic / 246 kW	
Measured value block 130		
Two-wire Convenience data bus Electr. CE 1 Electronic central electrics Central 0 Convenience system central module Driver's door 1 wire Driver's door electronics		
1.Functional description		
←	Measurement	Jump
	Print	Help
		→

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## Control element test

The following control element tests are available in the data bus diagnostic interface as part of assisted fault-finding:

- Start of ring fault diagnosis (refer to SSP 286, Page 41)
- Start of ring fault diagnosis with dB reduction (refer to SSP 286, Page 43)
- Transmission of sleep command

On transmitting the sleep command by way of the final control diagnosis (terminal 15 must be off), the drive system CAN and convenience CAN are switched to sleep mode by the data bus diagnostic interface. Switching of the convenience CAN to sleep mode is however only possible if no other control unit is keeping the bus awake, for example on account of a fault.



## Gateway fitting list

On entering diagnosis mode, a detailed list containing the control units fitted in the vehicle and their current status is read out from the data bus diagnostic interface. The gateway fitting list can be displayed in the self-diagnosis main menu or via assisted fault-finding. The fitting list (also referred to as configuration table) shows whether all control units have been properly encoded, as well as their fault status.

If, for example, a control unit has been fitted but not encoded, this is indicated in the fitting list as "Not registered". If a control unit has been encoded, but there is no communication with it, this may be due to a fault or non-installation. This control unit is then labelled "Not obtainable".

Vehicle self-diagnosis	Audi	V05.02 18/06/2002
Gateway fitting list	Audi A8 2003> 2003 (3)	
Communication link	Saloon BFM 4.2l Motronic / 246 kW	
01 - Engine electronics	OK	
61 - Battery control	Fault	
02 - Gearbox electronics	OK	
42 - Driver's door electronics	Fault	
52 - Front passenger's door electronics	OK	
62 - Rear left door electronics	Fault	
72 - Rear right door electronics	Fault	
03 - Brake electronics	Fault	
53 - Parking brake	Fault	
34 - Adaptive suspension	OK	
05 - Entry and start authorisation	OK	
15 - Airbag	Fault	
55 - Headlight range control	Fault	

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VAS display	Significance
OK	Communication OK
Not obtainable	The control unit is registered (encoded) in the gateway but there is no communication with it
Fault	A fault entry has been stored in the control unit
Not registered	The control unit is not registered in the gateway (not encoded), but it has been fitted/there is communication with this control unit

# Control Units

## Encoding



The encoding informs the data bus diagnostic interface of which control units are fitted in the vehicle.

In addition to the familiar encoding, the function "Read/write long encoding" is provided in the diagnostic interface. After selecting this function, a list containing the address words of all possible control units in the vehicle is called up in the diagnosis tester in the usual sequence.

Control units can then be selected/rejected. Pressing the "Continue" key transfers the encoding to the control unit.

After encoding the diagnostic interface with "long encoding", a fitting list should be read out to check whether all control units in the vehicle have been correctly encoded in the gateway.

Vehicle self-diagnosis	19 - Data bus diagnostic interface
Read/write long encoding	4E0910468 4E0907468- *
	Gateway H04 X200
	Long encoding
	Dealership number 6794
01 - Engine electronics	Encoded
61 - Battery control	Encoded
02 - Gearbox electronics	Encoded
42 - Driver's door electronics	Encoded
52 - Front passenger's door electronics	Encoded
62 - Rear left door electronics	Encoded
72 - Rear right door electronics	Encoded
03 - Brake electronics	Encoded
53 - Parking brake	Encoded
34 - Adaptive suspension	Not encoded
05 - Entry and start authorisation	Encoded
15 - Airbag	Encoded
55 - Headlight range control	Encoded
65 - Tyre pressure monitoring	Encoded

Navigation buttons: Measurement, Jump, Print, Help

SSP287\_013



## Energy management control unit J644

Use is made for the first time in the Audi A8 '03 of a battery and energy management control unit.

The increase in the number of electronic components and controls in the vehicle gives rise to a far greater power requirement. The uncontrolled tapping of power can cause a major drop in the level of electrical energy available in all vehicle statuses.

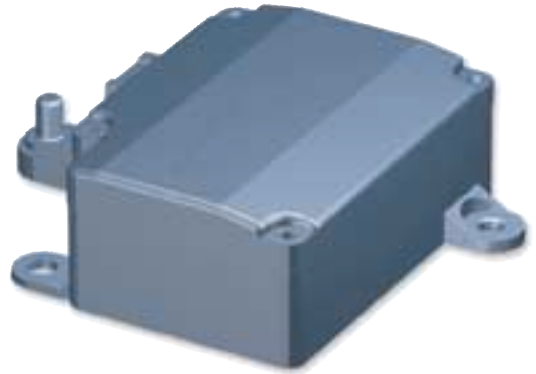
The principal tasks of the energy management control unit are to monitor the battery charge, to regulate loads via the CAN in extreme circumstances, to minimise current consumption by deactivating functions and to ensure optimum charging voltage. The aim is to avoid excessive battery discharge and thus ensure that the vehicle can always be started.

### Fitting location

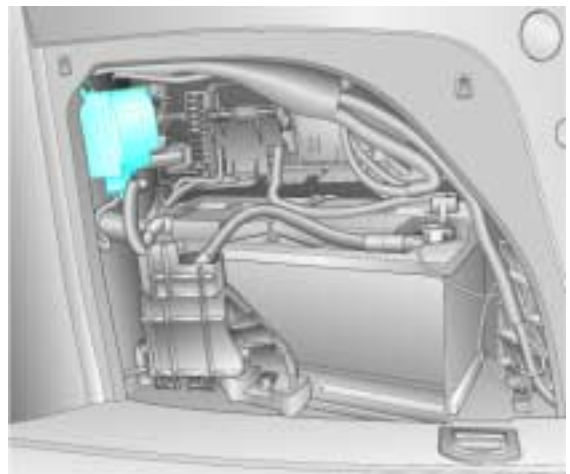
The energy management control unit J644 is installed on the right of the luggage compartment in the immediate vicinity of the battery.

### Functions

The energy management control unit J644 is responsible for constant monitoring of the battery, which includes checking the state of charge (SOC) and starting capability. The control unit regulates the optimum alternator charging voltage with the engine running. It can implement load shedding (reduce the number of loads) and increase idling speed. To reduce the closed-circuit current with the engine OFF, the energy management control unit can deactivate loads via the CAN in extreme circumstances and thus prevent excessive battery discharge.



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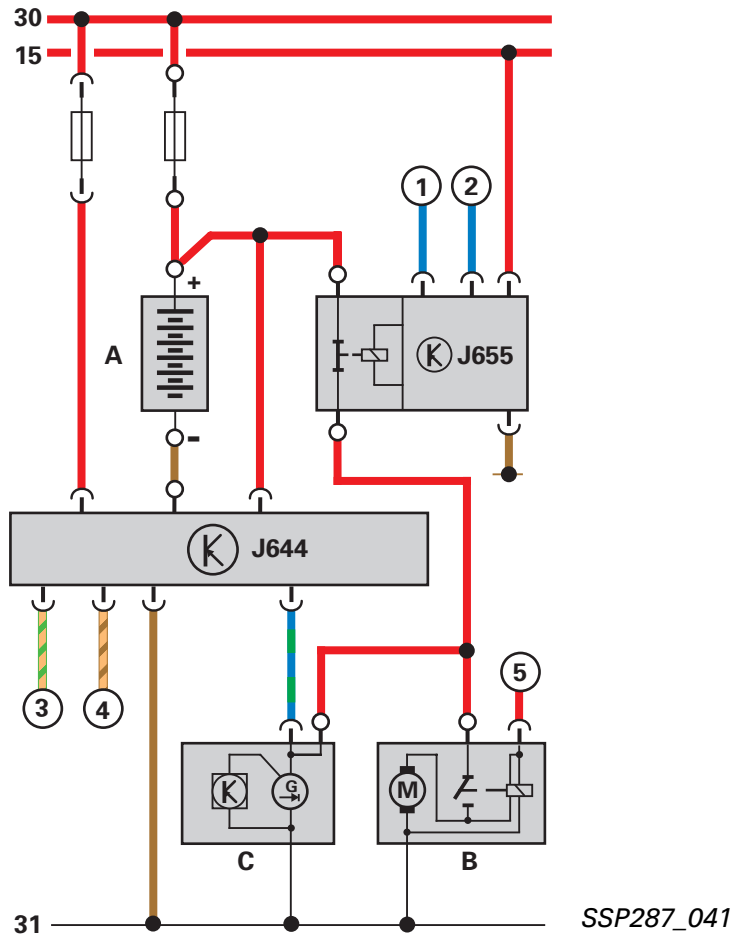


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# Control Units

## Block diagram



SSP287\_041

### Key

A Battery

B Starter

C Alternator

J644 Energy management control unit

J655 Battery cut-off relay

### Additional signals

① Airbag control unit J234

② Airbag control unit J234

③ Convenience CAN High

④ Convenience CAN Low

⑤ Terminal 50 (from starter relay 2 J695)

## System outline

### CAN inputs

- Ambient temperature
- Engine speed
- Coolant temperature
- Standing time
- Ignition/starter switch
- Heated windscreen
- Heated rear window
- Specified idling speed feedback
- Load shedding request
- Heating system load shedding
- Alternator activation

### CAN outputs

- Drive system deactivation stage
- Idling speed increase
- Deactivation stages
- Load shedding
- Alternator load torque
- Alternator power input
- Battery manager/battery voltage
- Heating system deactivation
- Charge
- Starting capability
- Deactivation stage 6
- Terminal DFM – BEM (battery energy manager)
- Load shedding feedback
- Alternator load response
- Alternator fault
- Infotainment deactivation
- Battery manager service fault
- Heavy-duty heating system status
- Heavy-duty heating system control status
- Emergency load deactivation active

Convenience CAN High

Convenience CAN Low

Inputs via BSI\*

- DF signal (alternator capacity utilisation)
- Alternator mechanical fault
- Alternator electrical fault
- Alternator high-temperature regulation

Outputs via BSI\*

- Specified alternator voltage
- Start load response
- Drive load response

\* BSI = Bit-synchronous interface

# Control Units



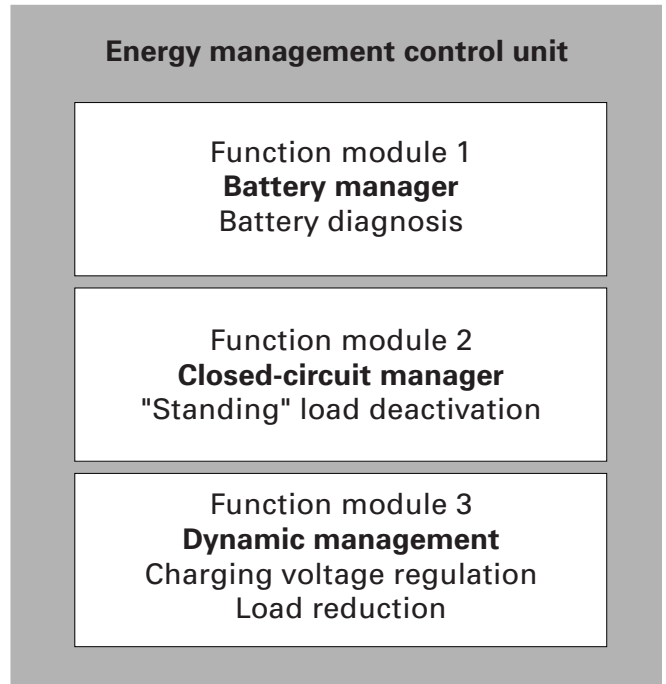
## Function modules

The tasks of the energy management control unit J644 are distributed over three function modules, which are active in different vehicle statuses.

Function module 1 is the battery manager. This is responsible for battery diagnosis (always active).

Function module 2 is the closed-circuit manager. It deactivates "standing" loads as required (engine not running).

Function module 3 is responsible for dynamic management, in other words for charging voltage regulation and load reduction (engine running).



## Function module action

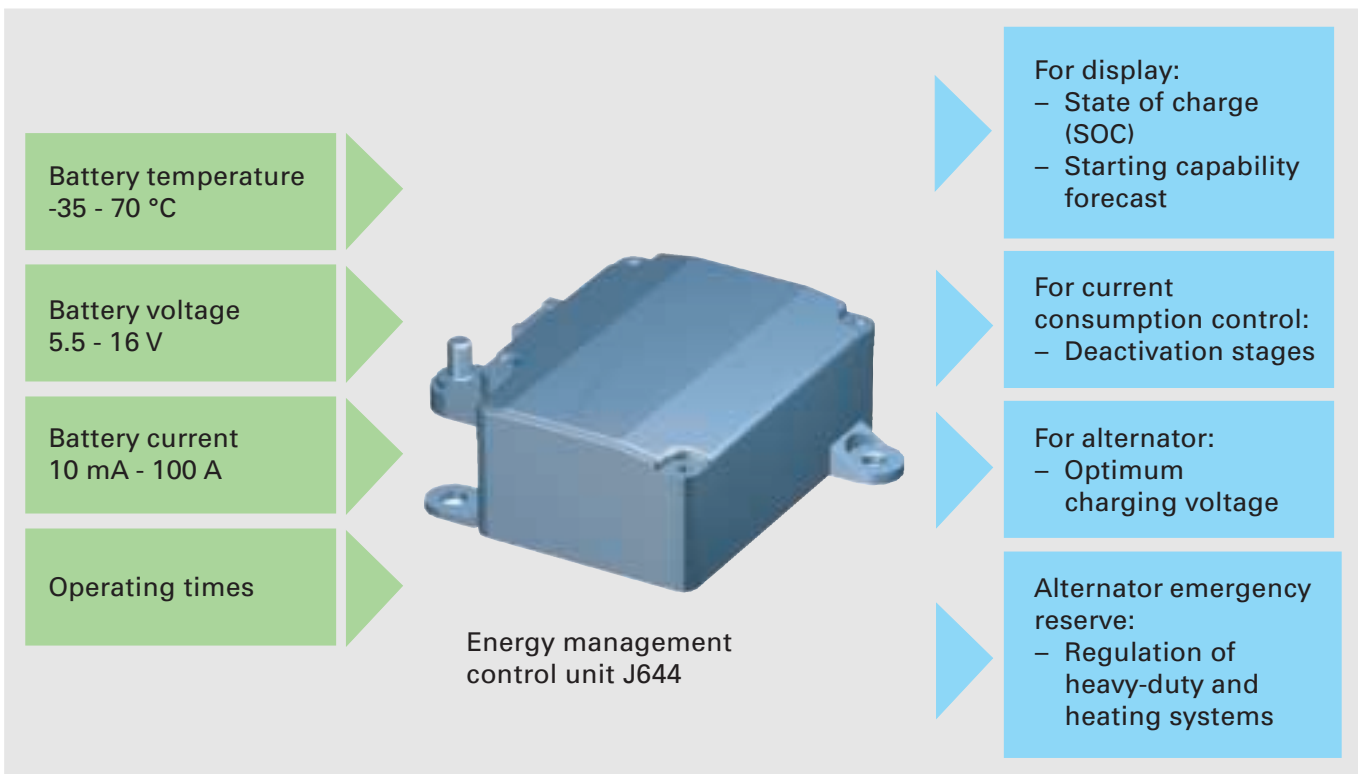
The three function modules are active in specific vehicle statuses. A distinction is made between three vehicle statuses:

Vehicle status	Battery manager	Closed circuit manager	Dynamic management
Terminal 15 OFF	Active	Active	
Terminal 15 ON, engine not running	Active	Active	
Terminal 15 ON, engine running	Active		Active

## Battery manager

For implementation of battery diagnosis, the battery manager in the energy management control unit has to establish the following data:

- Battery temperature
- Battery voltage
- Battery current
- Operating times



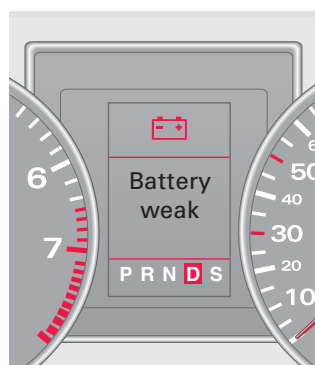
The battery current and battery temperature are measured in the control unit and the battery temperature converted to the battery by means of an algorithm. The battery voltage on the other hand is measured at the battery positive terminal.

# Control Units



## Battery status display

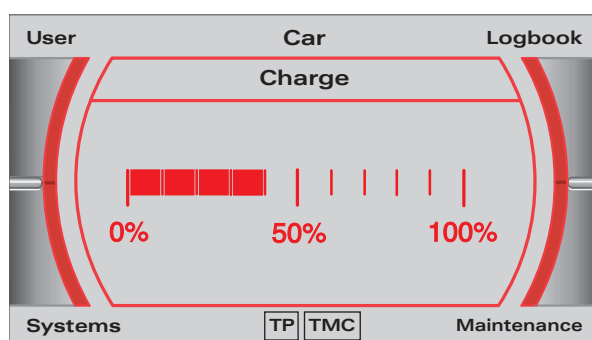
The starting capability and current charge are displayed in the dash panel insert. These two quantities form the basis for closed-circuit and dynamic management. The alternator is provided with the optimum charging voltage via an interface.



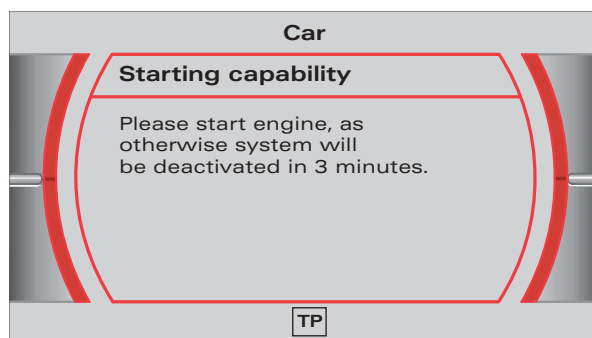
## MMI displays

The battery charge can be called up via the CAR function in the MMI. The display takes the form of a bar with 10 % increments. A charge of between 60 and 80 % is normal.

Running electrical loads over a lengthy period with the engine switched off discharges the battery. If the starting capability of the engine is jeopardised by this, the MMI displays a request to start the engine to prevent automatic system deactivation in the next three minutes.



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## Charge warning lamp (alternator lamp)

The charge warning lamp is located in the rev counter in the dash panel insert. In contrast to previous Audi vehicles, the lamp is however actuated by the energy management control unit.



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## Closed-circuit manager

The function of the closed-circuit manager in the energy management control unit J644 is to request control units to deactivate loads as required.

It is active with terminal 15 OFF and terminal 15 ON/engine OFF.

If the vehicle is stationary, the closed-circuit current must be reduced to such an extent that the battery is only slightly discharged and starting is possible even after a long standing time. If the battery charge is not sufficient to be able to supply all "standing" loads, convenience and infotainment load functions are deactivated. The loads to be deactivated by a control unit are specified in deactivation stages on a hierarchical basis (refer to Page 28).

The loads/functions deactivated by a control unit are indicated under "Vehicle information" in the assisted fault-finding routine.

Control unit loads are deactivated in six stages.

The lower the battery charge, the higher the deactivation stage. The necessary deactivation stage is provided by the energy management control unit via the data bus systems. The dash panel insert informs the driver of restrictions to functions.

As regards diagnosis, it should be remembered that an activated deactivation stage may be the cause of a restricted function. Activation of a deactivation stage is stored as a fault in the fault memory of the energy management control unit.



Assisted fault-finding	Audi	V05.02 18/06/2002
Function/component selection	Audi A8 2003> 2003 (3) Saloon BFM 4.2l Motronic / 246 kW	
Vehicle information Dynamic and closed-circuit management General Closed-circuit deactivation stage 1 Closed-circuit deactivation stage 2 Closed-circuit deactivation stage 3 Closed-circuit deactivation stage 4 Closed-circuit deactivation stage 5 Closed-circuit deactivation stage 6		
◀	Measurement	Vehicle self-diagnosis
	Jump	Print
	Help	▶

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# Control Units



## Deactivation stages

The individual deactivation stages are initiated by the energy management control unit in line with the charge of the vehicle battery.

The deactivation stages result in the following:

- Deactivation stage 1  
Convenience CAN loads are deactivated.
- Deactivation stage 2  
Initiation of this stage results in deactivation of additional convenience CAN loads. Certain infotainment system restrictions are implemented.
- Deactivation stage 3  
Reduction of the closed-circuit current is initiated.
- Deactivation stage 4 – Transportation mode  
This deactivation stage is activated by way of the diagnosis unit and cannot be initiated independently by the energy management control unit.
- Deactivation stage 5  
The auxiliary heater is deactivated.
- Deactivation stage 6  
Bus system wake-up action is reduced.

## Deactivation stages 1 - 3

In stages 1 - 3, loads are deactivated by the control units in the vehicle to prevent further battery discharge.

Examples of deactivation stages for onboard power supply control unit 2:

Load	Stage 1	Stage 2	Stage 3
MMI opening/closing	Active	Inactive	Inactive
Headlight washing	Inactive	Inactive	Inactive
Washer fluid heating	Inactive	Inactive	Inactive



#### Deactivation stage 4

The fourth stage is the transportation mode, which can be initiated via the diagnosis unit. The transportation mode is designed to greatly reduce battery discharge in the event of lengthy vehicle standing times or long-distance transportation.

An adaption channel for activation is provided for this purpose in the energy management control unit J644. In channel 1 "Transportation mode", it is possible to select either 0 = Normal mode or 1 = Transportation mode.

Virtually all convenience functions are deactivated in transportation mode to ensure maximum standing time without battery discharge. This is necessary for example during transportation overseas.

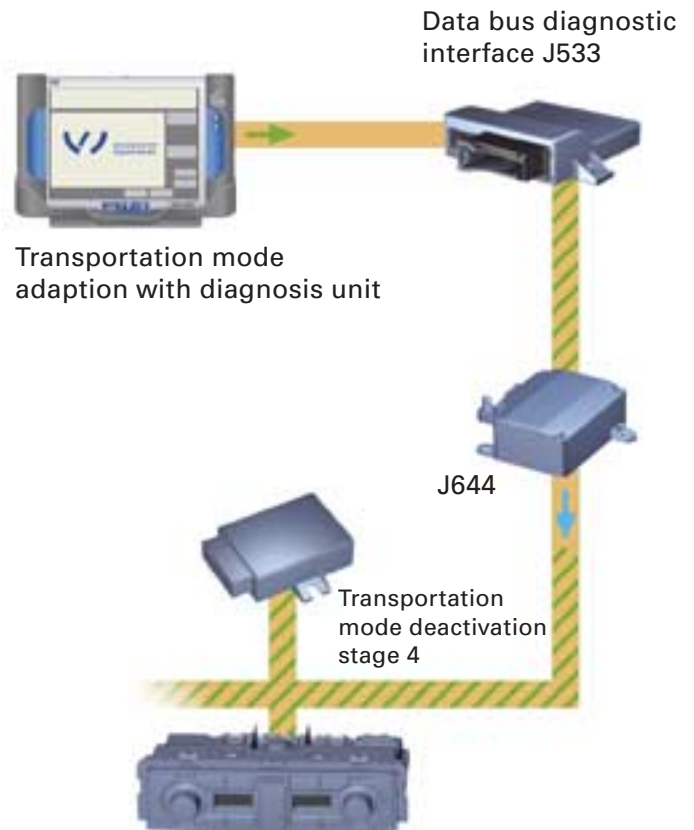
#### Deactivation stage 5

The auxiliary heater is deactivated in this stage.

#### Deactivation stage 6

In stage 6, the bus system control units are only wakened with terminal 15 ON and on entering the vehicle. All other sources of bus system wake-up are suppressed.

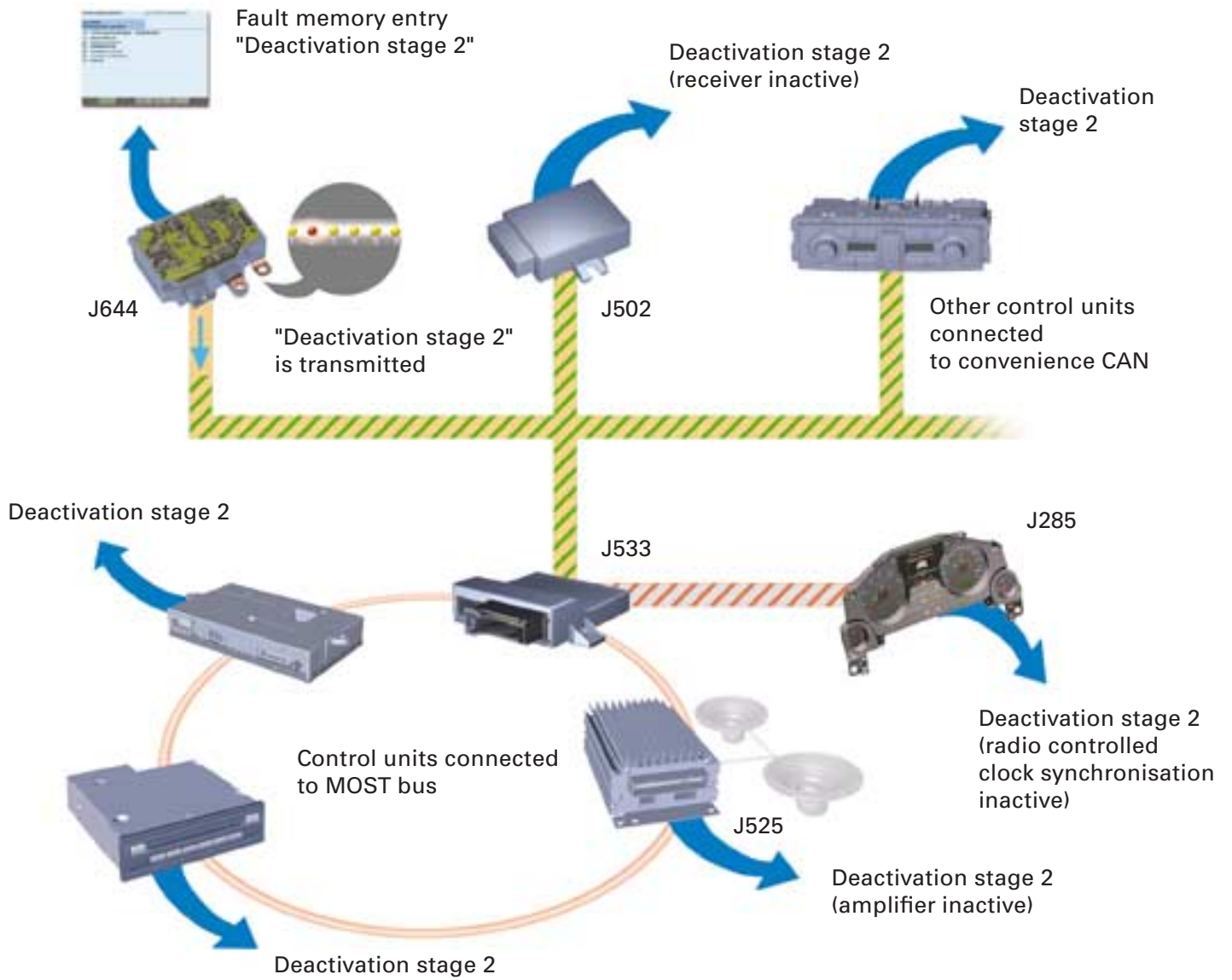
As starting capability is only just retained in deactivation stage 6, it must not be possible for every source to trigger control unit wake-up in order to save power. This also applies to infotainment components and means that it is not possible to use the telephone in stage 6. The reserve battery ensures that emergency and breakdown calls can still be made.



SSP287\_040

# Control Units

## Operating principle



SSP287\_043

The energy management control unit J644 transmits the necessary deactivation stage to the data bus as required.

After reading in the information, the control units connected to the bus systems deactivate the loads specified for each deactivation stage. For this purpose, the loads to be deactivated in the corresponding deactivation stage are stored in each control unit.

In the example the energy management control unit transmits deactivation stage 2 to the convenience CAN. The convenience CAN control units then deactivate the loads/ functions stipulated for deactivation stage 2. These are specified in the software of the corresponding control unit.

For example, the tyre pressure monitor control unit J502 deactivates the aerial receiver to save power. The data bus diagnostic interface J533 distributes the information "Deactivation stage 2" to the other bus systems. In turn, the control units connected to the other bus systems then all react by deactivating the loads stipulated for deactivation stage 2.

The control unit with display in dash panel insert J285, which is connected to the dash panel insert CAN, deactivates the radio controlled clock receiver to save power or the digital sound package control unit J525 connected to the MOST bus deactivates the audio amplifier.



# Control Units

## Gradual closed-circuit current reduction



The closed-circuit current reduction stages extend the possible vehicle standing time, as the closed-circuit current decreases with each deactivation stage. There is however no calculation function for standing time extension.

If the driver gets into the vehicle, all functions are quickly re-established.

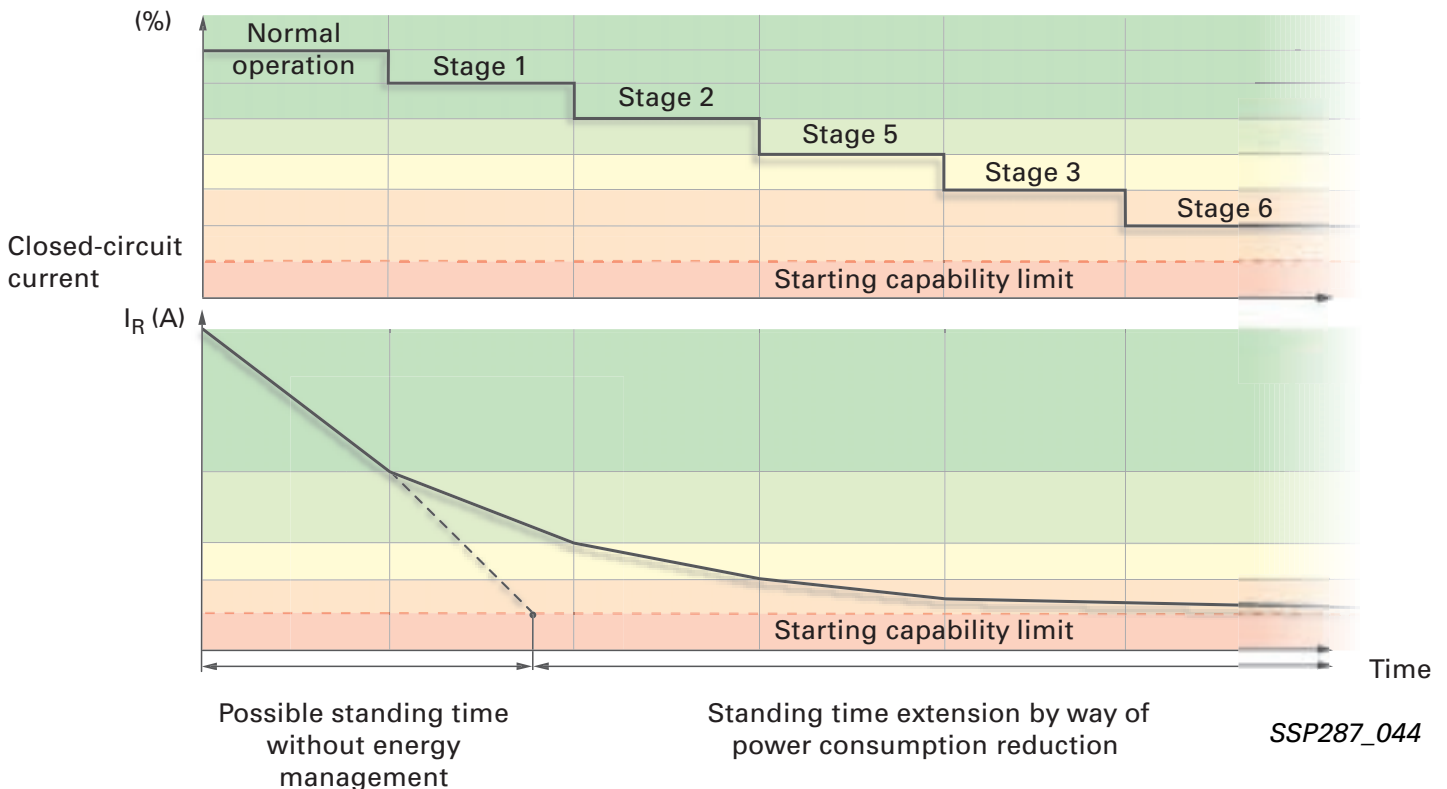
Deactivation stage 4 is however a special case. It cannot be initiated by the vehicle alone, use must be made of the diagnosis unit.

Deactivation stage 2 is activated immediately if a closed-circuit current  $> 50$  mA is determined after a standing time of three hours.

Switching on the engine resets all previously active deactivation stages. Connection of a battery charger to a battery connected in the vehicle also deactivates all deactivation stages (refer to Battery charging on Page 36). This does not however apply to deactivation stage 4 – Transportation mode.

The priority setting for the deactivation stages is thus 1-2-5-3-6. The designations for the individual stages were established during system development.

State of charge (SOC)



## Systems involved

The following systems are involved in load deactivation by way of the closed-circuit manager module in the energy management control unit:

- MOST bus
  - Front information display and operating unit control unit J523
  - CD ROM drive R92
  - CD changer R41
  - TV tuner R78
  - Digital radio R147
  - Radio module R
  - Navigation system control unit J401
  - Digital sound package control unit J525
  - Telephone/telematics control unit J526
  - Aerials
  - Chip card reader control unit J676
- Convenience CAN
  - Sunroof electronics control unit J528
  - Seat adjustment with memory control unit J136
  - Seat adjustment with memory control unit, front passenger J521
  - Seat adjustment with memory control unit, rear J522
  - Climatronic control unit J255
  - Additional heater control unit J364
  - Convenience system central control unit J393
  - Onboard power supply control unit J519
  - Onboard power supply control unit 2 J520
  - Door control unit J386
  - Door control unit J387
  - Door control unit J388
  - Door control unit J389
  - Entry and start authorisation control unit J518
  - Tyre pressure monitor control unit J502
  - Control unit with display in dash panel insert J285
  - Driver identification control unit J589

The loads/functions deactivated are indicated in the assisted fault-finding routine under "Vehicle information" as part of the "Function and component selection" section.

## Alternator

Use is made in the Audi A8 '03 of a water-cooled 190 A alternator from Hitachi.

The rated currents of the alternator incorporated into the engine cooling circuit are as follows:

- At alternator speed  $n = 1800$  rpm (corresponding to engine idling)  $I_n = 130$  A
- At alternator speed  $n = 6000$  rpm  $I_n = 190$  A

Further information on the water-cooled alternator can be found in SSP 268 – "The 6.0 l W12 engine in the Audi A8 - Part 2".



SSP287\_122



# Control Units



## Dynamic management

The function of the dynamic management system is to distribute the power generated to the individual systems as required and to provide the battery with sufficient charging current.

It is active when the engine is running.

Main tasks:

- Battery voltage regulation
- Load shedding
- Regulation of heavy-duty heating systems
- Idling speed increase
- Alternator activation
- Alternator control dynamics

The dynamic energy manager monitors electrical system capacity utilisation by measuring electrical system voltage, battery current and alternator capacity utilisation.

To ensure a stable power supply, the power available in the electrical system is distributed as required.

Three control stages are available for this purpose.

Control stages		Heating system control conditions
1	<b>Continuous power regulation</b>	Electrical system overload due to utilisation of full alternator capacity accompanied by drop in battery charging voltage to below specified values
2a	<b>Partial emergency shutdown</b>	Only in the event of a fault (or briefly, < 10 s, with no fault memory entry): <ul style="list-style-type: none"> <li>- Permanent power overload (&gt; 10 s), electrical system cannot be stabilised by way of simple regulation as part of continuous heating system control, battery charged (starting jeopardised)</li> <li>- Alternator fault (fault memory entry 02252)</li> <li>- Alternator high-temperature regulation (fault memory entry 02253)</li> <li>- Load shedding by engine control unit (e.g. high alternator load is reduced on speed dip); only possible for 10 s -&gt; no fault storage</li> </ul>
2b	<b>Full emergency shutdown</b>	Only in the event of a fault (or briefly, < 15 s, with no fault memory entry): <ul style="list-style-type: none"> <li>- Severe undervoltage in electrical system (&lt; 11.5 V for &gt; 1.5 s or &lt; 10.8 V for &gt; 0.5 s)</li> </ul> Note: Full emergency shutdown on starting is also set up to 15 s after starting depending on engine control unit release. There is no fault memory entry in this case as deactivation is only for a very restricted period and is not registered by the driver.



		Control stages		
		1 Continuous power regulation	2a Partial emergency shutdown	2b Full emergency shutdown
Heating system	Maximum power	Minimum power	Minimum power	Minimum power
Heated rear window	approx. 320 W	0 W	0 W	0 W
Heated windscreen	1000 W	250 W	250 W	0 W
Seat heating	Front: 2 x 100 W Rear: 2 x 80 W	Front: 2 x 25 W Rear: 2 x 20 W	Front: 2 x 25 W Rear: 2 x 20 W	0 W
Rear additional heater	2 x 250 W	2 x 50 W	2 x 50 W	0 W
Steering wheel heating	approx. 100 W	No restriction	0 W	0 W
Jet and fluid hose heating	20 to 100 W	No restriction	0 W	0 W
Mirror heating	2 x 30 W	No restriction	0 W	0 W

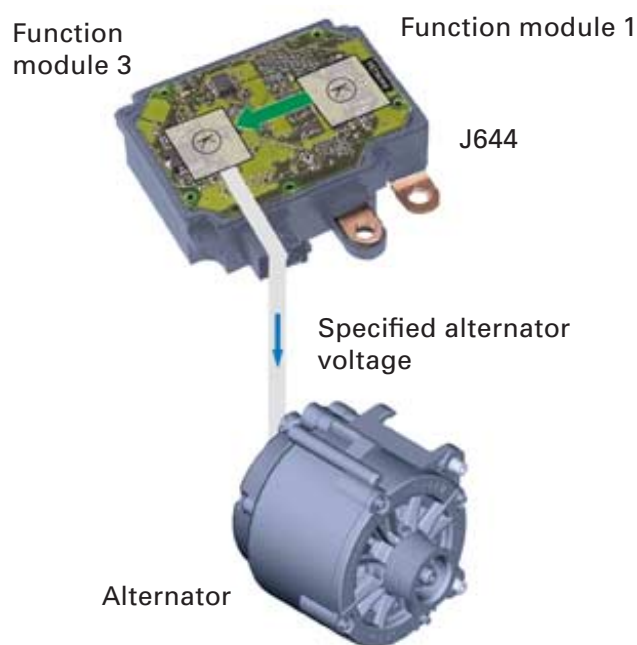
# Control Units



## Battery voltage regulation

The energy management control unit J644 informs the alternator of the specified alternator voltage required via a data wire (bit-synchronous interface). This voltage is then set by the alternator. The battery manager (function module 1) determines the specified value from battery temperature and battery charge. The specified value established is then transferred in the control unit to the dynamic management (function module 3), which relays the value to the alternator.

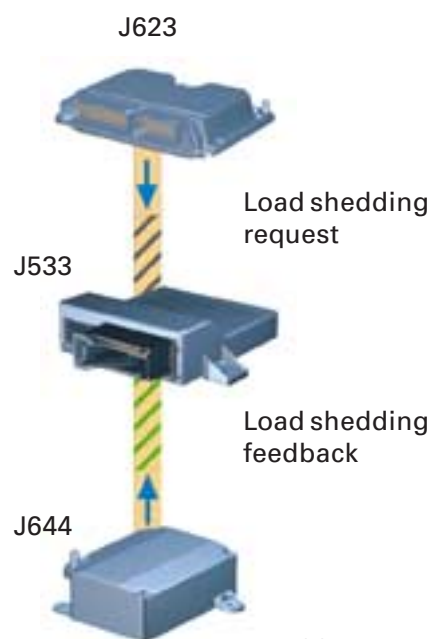
The assisted fault-finding routine contains measured value blocks for checking the specified alternator voltage and communication via the data wire. The specified alternator voltage can be altered for diagnosis purposes as part of final control diagnosis.



SSP287\_020

## Load shedding

The energy management control unit can reduce the engine load (e.g. on accelerating) if so requested by the engine control unit. If the engine control unit requests load shedding, the energy management system reduces heavy-duty loads in the first stage and alternator voltage in the second stage to lower the level of alternator power input. For this purpose, the energy management control unit transmits a request via the convenience CAN to the Climatronic control unit J255, which regulates various heating systems, such as heated windscreen, seat heating, heated rear window and additional heater.



SSP287\_062

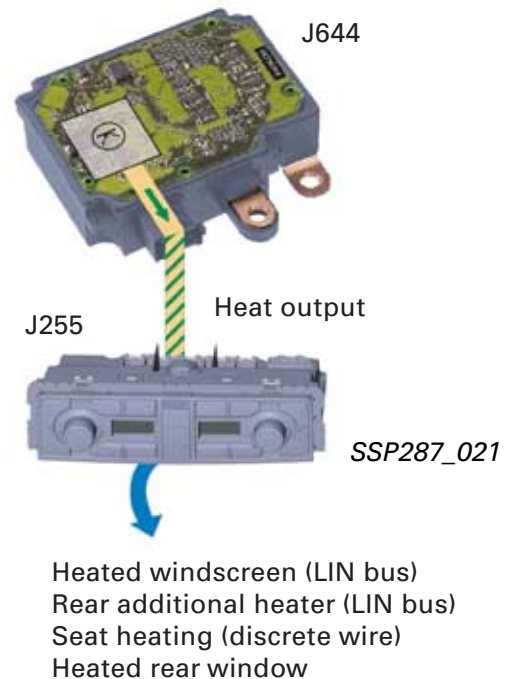


## Regulation of heavy-duty heating systems

By way of the Climatronic control unit J255, the energy management control unit J644 infinitely regulates the heat output of

- Windscreen
- Rear window
- Rear additional heater
- and seat heating

In doing so, it determines the maximum heat output which can be provided.



## Idling speed increase

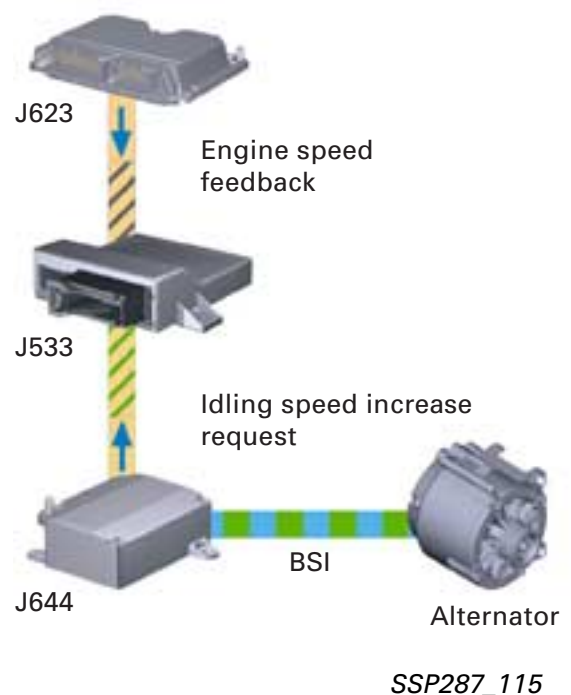
To ensure optimum electrical system supply and battery charging, the energy management system can request the engine control unit to increase the idling speed in stages (7 % and 12 %).

### Alternator activation (start load response)

On starting the engine, the alternator power input is minimised in order to optimise the starting process.

### Alternator control dynamics (drive load response)

When the heated rear window is switched on, the alternator voltage is not increased immediately, but rather adjusted within 3, 6 or 9 s as a function of engine speed and temperature. This continuous, infinitely variable regulation of the alternator torque results in uniform engine loading.



# Control Units



## Fault memory entry

Activation of a deactivation stage by the energy management control unit restricts the functioning of certain systems. A fault memory entry is made in the energy management control unit, e.g.:

- Alternator mechanical fault
- Alternator electrical fault
- Alternator high-temperature regulation

The accompanying data for the corresponding fault memory entries contains additional information, such as mileage or date at/on which a fault was stored.

Vehicle self-diagnosis	61 - Battery control
02 - Interrogating fault memory	4E0915181
1 fault detected	ENERGY MANAGER H02 0070
	Dealership number 0
02275	000
Closed circuit stage 4	
Measurement	Vehicle self-diagnosis
Jump	Print
Help	

SSP287\_022

## Measured value blocks

Assisted fault-finding permits call-up of measured values, such as

- Specified alternator voltage
- Battery voltage
- Busbar temperature
- Battery temperature
- State of charge (SOC)
- Communication with alternator
- Mean closed-circuit current value
- Emergency shutdown
- Closed-circuit deactivation
- Internal battery resistance, charge loss

in the measured value blocks.

Assisted fault-finding	Audi	V05.02 18/06/2002
Functional test	Audi A8 2003>	
J644 - Display measured value blocks	2003 (3)	
	Saloon	
	BFM 4.2l Motronic / 246 kW	
Measured value block 1		
14.4 V		
Specified alternator voltage		
13.75 V		
Battery voltage		
54.84 %		
DF signal		
3 s		
Load response time		
Measurement	Jump	Print
Help		

SSP287\_023

## Final control diagnosis

Final control diagnosis can be used to alter the specified alternator voltage for diagnosis purposes.

Specified alternator voltages of 15 V and 13.5 V can be set.

It must then be possible to measure the value correspondingly set as alternator specification at the alternator terminal.

Assisted fault-finding	Audi	V05.02 18/06/2002
Functional test	Audi A8 2003>	
	2003 (3)	
	Saloon	
	BFM 4.2l Motronic / 246 kW	
Selection		
This test is intended for implementation of control element tests for the energy management control unit. The following control element tests can be performed.		- 1 -
		- 2 -
		- 3 -
1. Specified alternator voltage 15 V		
2. Specified alternator voltage 13.5 V		
3. End of program		
←	Measurement	Vehicle self-diagnosis
	Jump	Print
		Help
		→

SSP287\_054

## Service work

### Battery diagnosis

In the Audi A8 '03, the battery is tested by the energy management control unit. Checking the battery with a load test is no longer necessary. Assisted fault-finding permits call-up of the "Function and component selection" menu, from which the battery test is started. The control unit determines the state of charge (SOC), internal battery resistance and energy flow and uses these to calculate whether the battery is OK, charged or in need of replacement.



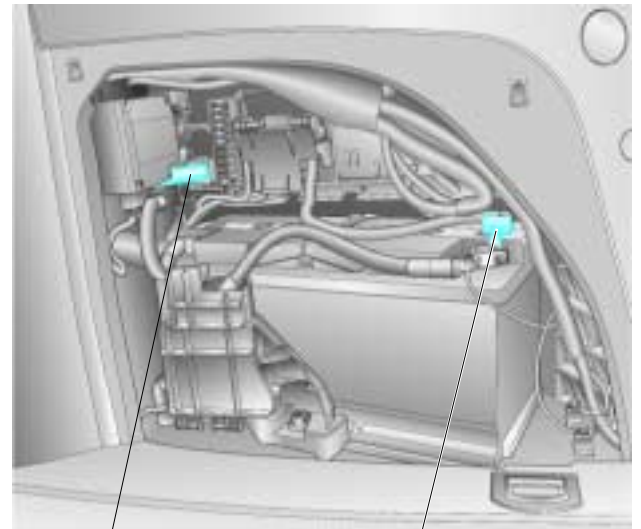
# Control Units



## Battery charging

The battery charger must be connected with the external starting tap at the battery positive terminal and the negative terminal at the external starting pin. The battery should always be re-charged in the vehicle. This enables the energy management control unit to incorporate the charging current into the battery value calculations. When working on the vehicle with terminal 15 ON and engine off, a battery charger should always be connected up, as otherwise functions may be deactivated on account of excessive current consumption.

The chargers used must be capable of supplying a stabilised current of at least 30 A.



SSP287\_068

External starting pin

External starting tap



Rapid charging of the battery in the vehicle is not permitted.



Heed the battery and equipment manufacturers' specifications when charging the battery. Also pay attention to the information on the battery itself.

## Battery replacement

On battery replacement, the new battery must be adapted by way of the diagnosis tester. The menu item "Battery manager encoding" is provided in the assisted fault-finding routine in the list of systems with self-diagnosis capability in the battery manager. The battery serial number has to be entered for encoding. This is marked on the battery.

## External starting

For external starting, the starter cable earth is to be connected to the external starting pin and the positive cable to the external starting tap.

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# Control Units



## Control unit with display in dash panel insert J285



SSP287\_077

Instrument illumination controls

Auto-Check system

Reset button for trip recorder

The dash panel insert in the Audi A8 '03 has been modified with respect to the predecessor model. Certain functions have been changed.

New features:

- No gateway
- Immobilizer function no longer in dash panel insert
- Modified vehicle-speed signal input
- No immobilizer warning lamp
- Modified fuel gauge G1
- Modified coolant-temperature gauge

### Gateway

On account of additional new functions, the data bus diagnostic interface (gateway) J533 is now designed as a separate, external control unit.

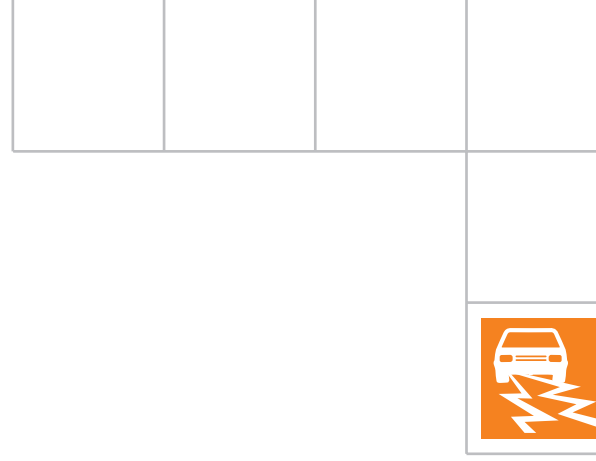
### Immobilizer

The immobilizer function has been incorporated into the entry and start authorisation control unit J518.

Adaption to the immobilizer is therefore no longer necessary on replacing dash panel insert.



There is thus no longer any connection between an immobilizer fault and the dash panel insert.



### **Immobilizer warning lamp**

The immobilizer warning lamp has been discontinued. In the event of a key identification fault, a signal is transmitted by the entry and start authorisation control unit J518. "Safe" then appears in the mileage display.

This display is also used to show the number of keys to be matched and the number already matched on vehicle key adaption.

### **Vehicle-speed signal**

The vehicle-speed signal is now supplied by the ABS with EDL control unit J104 via the drive system CAN.



The wheel circumference must be available to the dash panel insert to ensure correct evaluation of the vehicle-speed signal.

The permissible wheel circumferences are included in the encoding and selected by way of assisted fault-finding.

### **Fuel gauge G1**

The input signal is now provided by four fuel gauge senders in the fuel tank, all of which are evaluated separately.

Fuel gauge sender operation is described in SSP 282 – Audi A8 '03 Technical Features.

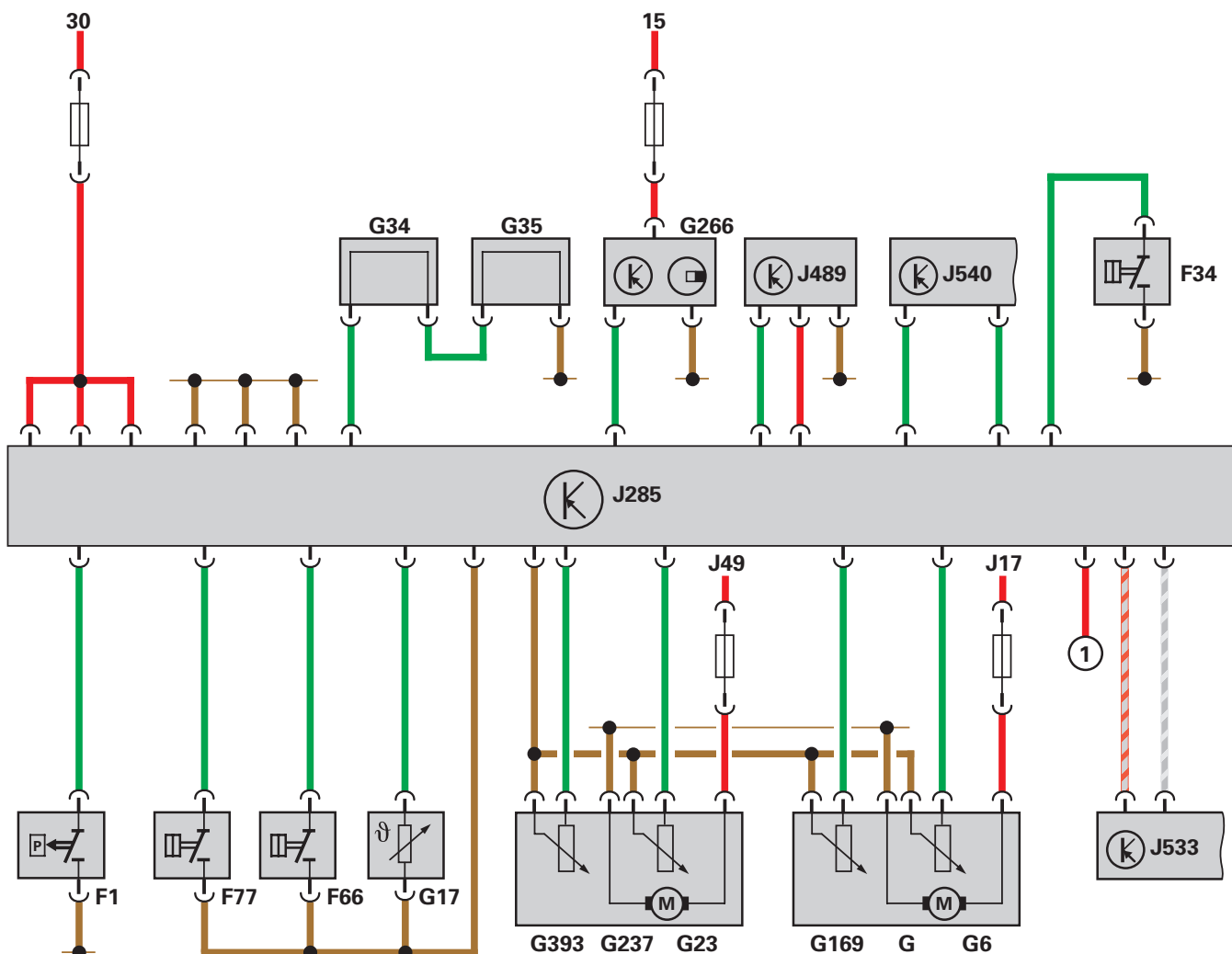
### **Coolant-temperature gauge G21**

The input signal for the coolant-temperature gauge is no longer supplied by the coolant-temperature sender G62, but rather it is transmitted by the engine control unit to the dash panel insert.



# Control Units

## Block diagram



SSP287\_036

## Key

F1	Oil pressure switch	J17	Fuel pump relay
F34	Brake fluid level warning contact	J49	Electric fuel pump 2 relay
F66	Coolant shortage indicator switch	J285	Control unit with display in dash panel insert
F77	Windscreen washer fluid warning contact	J489	Radio controlled clock receiver
G	Fuel gauge sender	J533	Data bus diagnostic interface
G6	Fuel pump (pre-supply pump)	J540	Electric park and handbrake control unit
G17	Ambient temperature sensor		
G23	Fuel pump		
G34	Brake lining/pad wear sender, front left		
G35	Brake lining/pad wear sender, front right		
G169	Fuel gauge sender 2		
G237	Fuel gauge sender 3		
G266	Oil level/oil temperature sender		
G393	Fuel gauge sender 4		

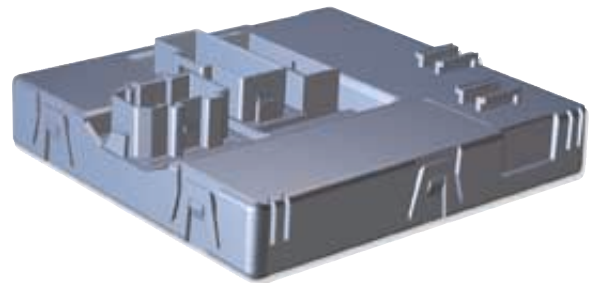
## Additional signal

① Terminal 58s



## Convenience system central control unit J393

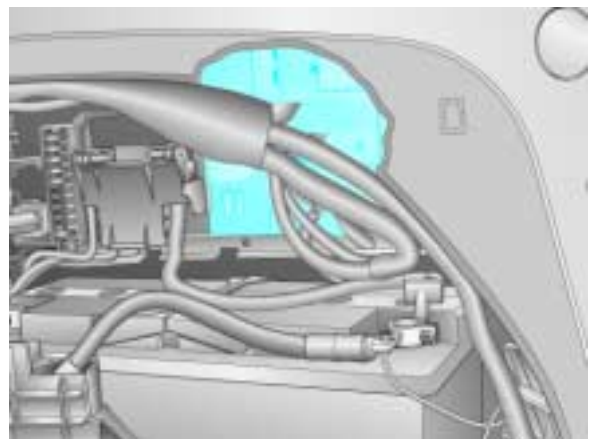
Use is made in the Audi A8 '03 of the familiar convenience system central control unit J393 from the Audi A2 and Audi A4. The tasks and functions have been adapted accordingly to suit the requirements of the Audi A8. The control unit is connected to the convenience CAN.



SSP287\_048

### Fitting location

The convenience system central control unit is installed at the rear right of the luggage compartment above the battery.



SSP287\_069

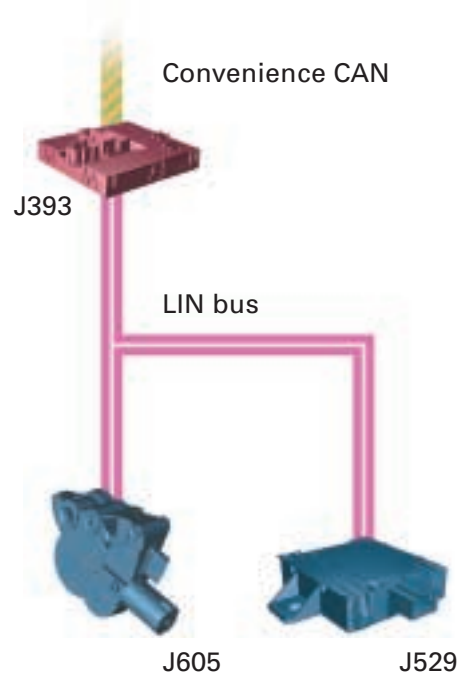
### Master functions

The master functions of the convenience system central control unit are as follows:

- LIN master for boot lid control unit J605 and anti-theft/tilt system control unit J529
- Central locking master
- Flashing signal master
- Anti-theft alarm master

### LIN master

As LIN master for the LIN slaves (boot lid control unit J605 and anti-theft/tilt system control unit J529), the convenience system central control unit is designed to provide all the information required by the LIN slaves to execute their functions on the LIN bus and to call up the necessary data for function implementation from the LIN slaves.



SSP287\_070



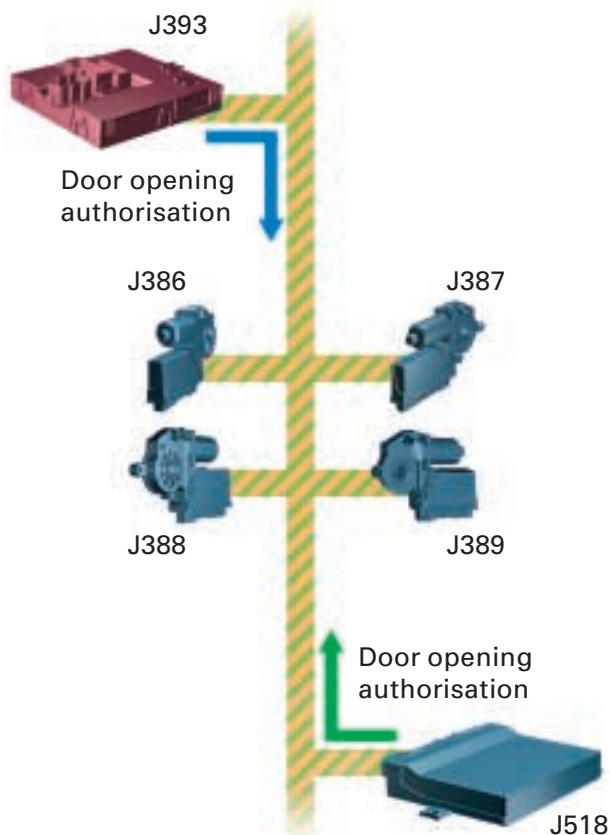
# Control Units



## Central locking master

As central locking master, the task of the convenience system control unit is to control the central locking function. By way of the convenience CAN, the control unit reads in the door opening authorisation from the entry and start authorisation control unit J518. The convenience system central control unit then transmits the command for opening/closing the doors to the door control units via the convenience CAN.

! Central locking control is described in SSP 288 - Audi A8 '03 Distributed Functions.



SSP287\_071

## Flashing signal master

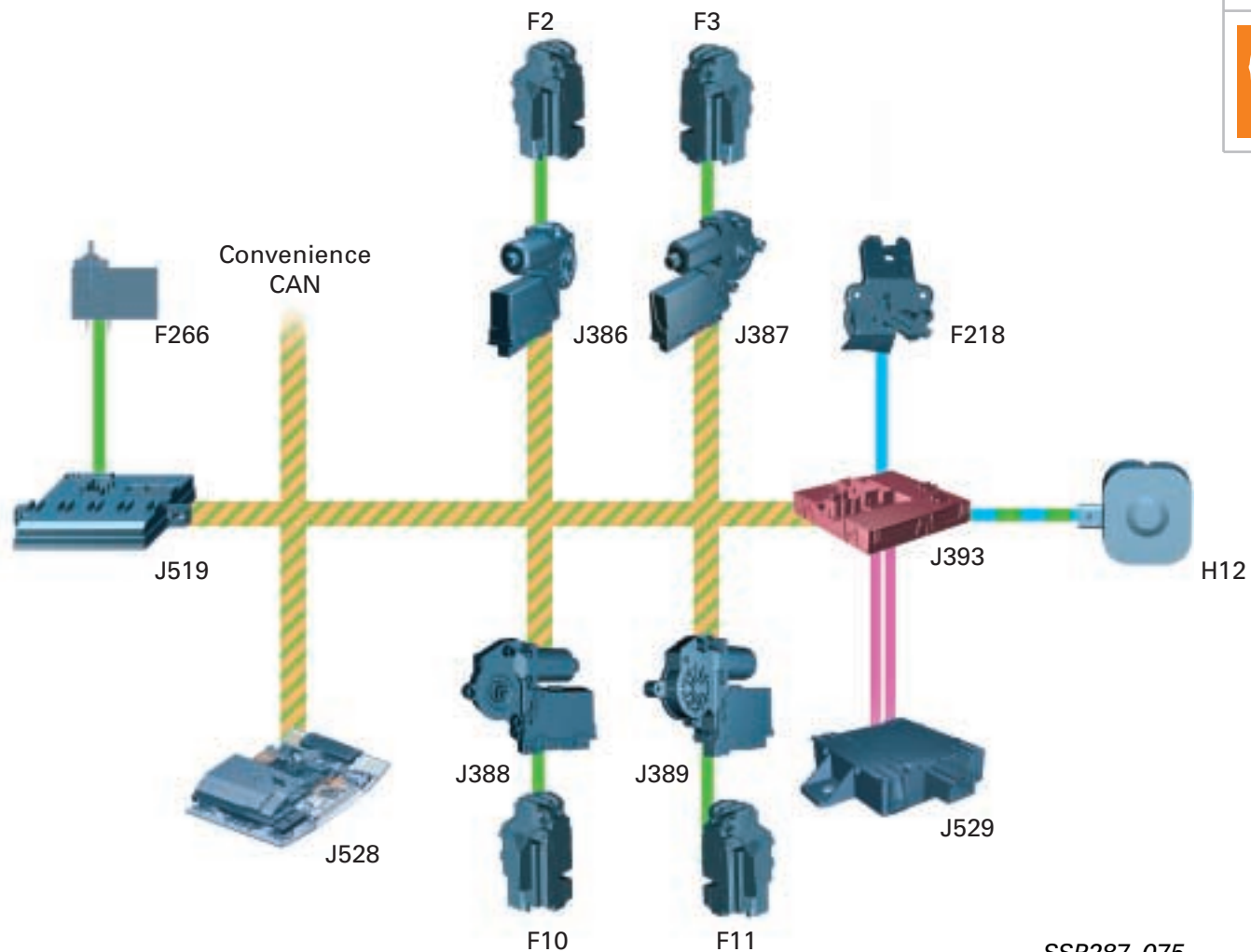
As flashing signal master, the convenience system central control unit evaluates the incoming flashing mode requests and passes the corresponding flashing mode to the convenience CAN in line with the internal priority list.

Flashing modes include turn signals, motorway signalling, anti-theft alarm flashing and central locking system flashing.

As several flashing requests may be received simultaneously, priorities must be assigned to flashing modes. The control units involved in the "flashing" function read in the flashing mode from the convenience CAN and actuate their outputs accordingly.

! Control of the flashing signal system is also described in SSP 288 - Audi A8 '03 Distributed Functions.

## Diebstahlwarnanlagenmaster



SSP287\_075

As anti-theft alarm master, the control unit evaluates the corresponding vehicle monitoring information and actuates the anti-theft output media as required.

All components are simultaneously primed/deactivated. When the anti-theft alarm system is primed, all door contacts, the bonnet contact, the boot lid contact, the passenger compartment and vehicle tilt are monitored.

F2	Door contact switch – driver side
F3	Door contact switch – front passenger side
F10	Rear left door contact switch
F11	Rear right door contact switch
F218	Boot lid central locking switch
F266	Bonnet contact switch
H12	Alarm horn
J386	Door control unit, driver side
J387	Door control unit, front passenger side
J388	Door control unit, rear left
J389	Door control unit, rear right
J393	Convenience system central control unit
J519	Onboard power supply control unit
J528	Sunroof electronics control unit
J529	Anti-theft/tilt system control unit



# Control Units



## Actuation

### Rear left and right footwell lights

The convenience system central control unit actuates the rear footwell lights.

The actuation time and brightness value are specified by the sunroof electronics control unit J528.

### Rear roller blind

The rear roller blind can be operated with the rear roller blind switch or via the rear roof console. The rear roller blind switch is read in by the Climatronic control unit and transmitted to the convenience CAN. The rear roof module operating unit information is read in by the sunroof electronics control unit and transmitted to the convenience CAN. The convenience system central control unit reads in the rear roller blind actuation information from the convenience CAN and actuates the rear roller blind motor accordingly.

E149 Rear roller blind switch

E467 Rear roof console

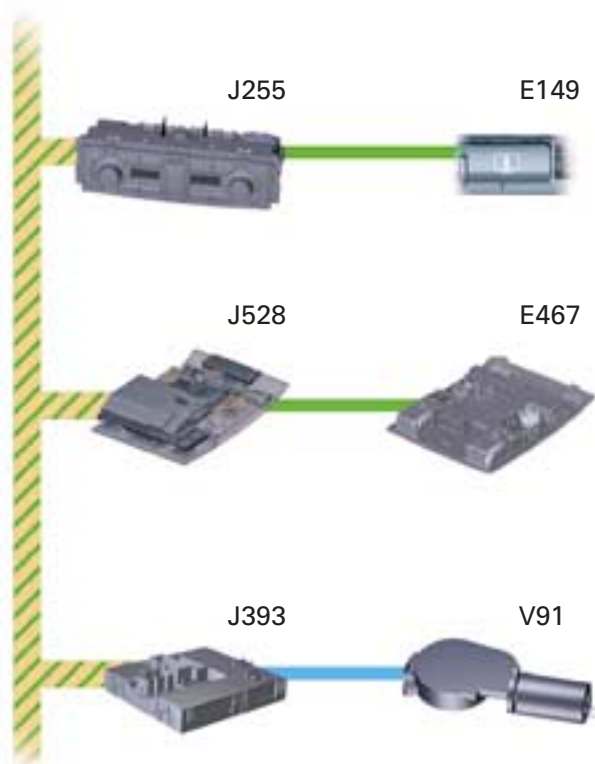
J255 Climatronic control unit

J393 Convenience system central control unit

J528 Sunroof electronics control unit

V91 Rear roller blind motor

### Convenience CAN



SSP287\_076

### Luggage compartment lights

Opening the boot lid causes the convenience system central control unit to actuate the luggage compartment light W3, the left luggage compartment light W18 and the right luggage compartment light W35. The lighting is switched off with terminal 15 ON when the boot lid is closed or the vehicle speed exceeds 2 km/h.

With terminal 15 OFF, the lighting is again switched off by the control unit on closing the boot lid or on completion of the maximum operating time of 10 minutes. Following time-based deactivation, the lighting can only be re-activated if the driver's or front passenger's door and the boot lid are opened or terminal 15 is activated.

## Heated rear window Z1

The convenience system central control unit actuates the heated rear window via the heated rear window relay J9. The relay actuation information is supplied to the convenience system central control unit by the Climatronic control unit.



## System outline

The convenience system central control unit J393 receives the following input signals:

- Boot lid soft touch
- Lock cylinder CLOSED
- Brake light switch
- Brake light signal from ABS with EDL control unit J104
- Crash input
- Boot lid contact
- Tank filler flap detection
- Boot lid power latching system feedback

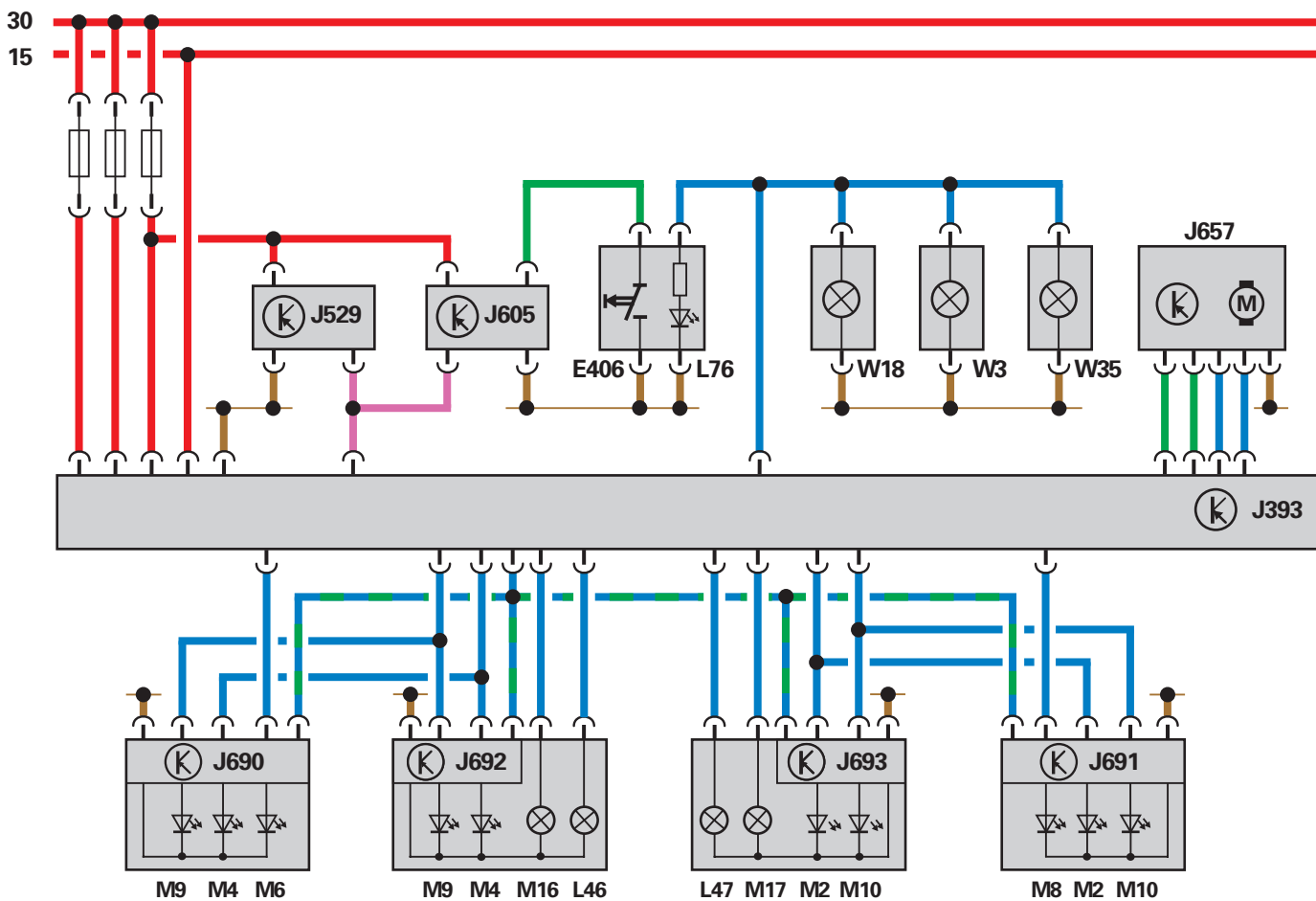


The convenience system central control unit J393 actuates the following loads:

- Rear left and right footwell lights
- Luggage compartment lights
- Rear roller blind motor V91
- Fuel tank filler flap central locking actuator F219
- Boot lid control unit J605
- Boot lid power latching system
- Boot lid release motor V139
- Left and right turn signal indicator (LED)
- High-level brake light (LED)
- Left and right tail light (LED)
- Left and right brake light (LED)
- Rear left and rear right brake light (LED)
- Left and right reversing light
- Left and right rear fog light
- Number plate light
- Heated rear window Z1
- Alarm horn H12

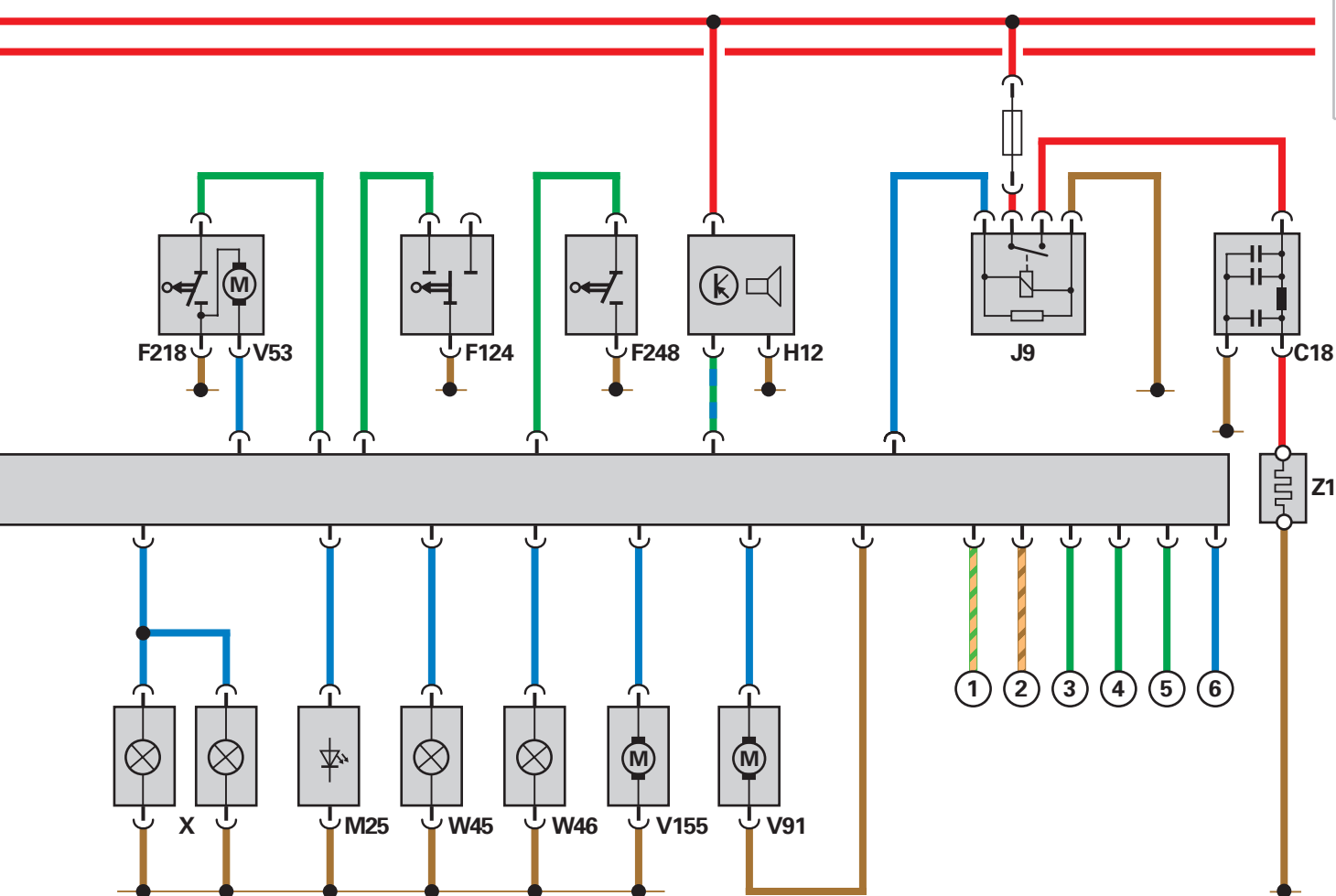
# Control Units

## Block diagram



## Key

C18	Windscreen aerial suppression filter	J690	Left tail light control unit
E406	Boot lid close button in luggage compartment	J691	Right tail light control unit
F124	Contact switch in lock cylinder for boot lid anti-theft alarm system/central locking system	J692	Tail light control unit for lights on left in boot lid
F218	Boot lid central locking switch	J693	Tail light control unit for lights on right in boot lid
F248	Release button for boot lid lock cylinder	L46	Rear fog light bulb, left
H12	Alarm horn	L47	Rear fog light bulb, right
J9	Heated rear window relay	L76	Button illumination
J393	Convenience system central control unit	M2	Tail light bulb, right
J529	Anti-theft/tilt system control unit	M4	Tail light bulb, left
J605	Boot lid control unit	M6	Turn signal bulb, rear left
J657	Power latching control unit	M8	Turn signal bulb, rear right
		M9	Brake light bulb, left
		M10	Brake light bulb, right
		M16	Reversing light bulb, left
		M17	Reversing light bulb, right
		M25	High-level brake light bulb



SSP287\_035

- V53 Central locking motor, boot lid
- V91 Rear roller blind motor
- V155 Tank filler flap locking motor
  
- W3 Luggage compartment light
- W18 Left luggage compartment light
- W35 Right luggage compartment light
- W45 Rear left footwell light
- W46 Rear right footwell light
  
- X Number plate light
  
- Z1 Heated rear window

**Additional signals**

- ① Convenience CAN High
- ② Convenience CAN Low
- ③ Brake light switch F
- ④ ESP brake signal from ABS with EDL control unit J104
- ⑤ Crash signal from airbag control unit J234
- ⑥ "Doors OPEN" signal to adaptive suspension control unit J197



# Control Units

## Tail light actuation



SSP287\_030

Some of the rear light units are of diode type (turn signal indicators, tail lights and brake lights). Each has an integrated microprocessor for actuation.

The diodes are arranged in a matrix. If one diode fails, the other diodes for this function continue to light.

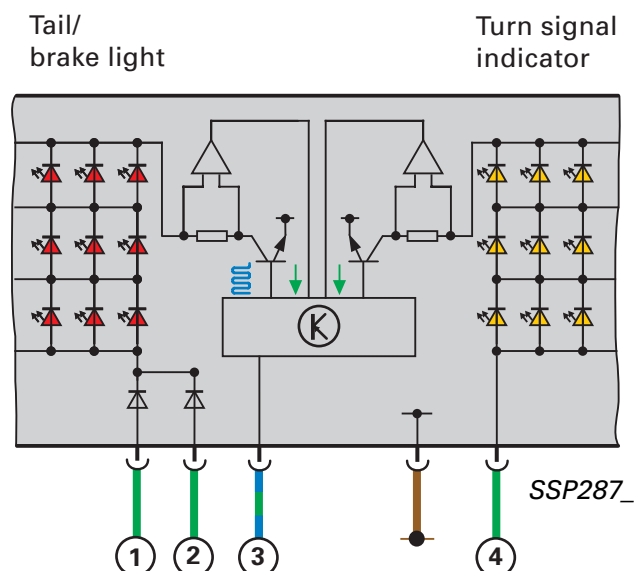
The microprocessor governs whether the red LEDs operate as tail light (approx. 10 % PWM signal) or as brake light (approx. 97 % PWM signal).

This simplifies the wiring and various emergency functions can be implemented.

Total failure or malfunctioning of the internal transistor is detected by the microprocessor, which transmits a fault message to the convenience system central control unit J393.

The turn signal LEDs are actuated in the same manner as the tail light LEDs, however there is no PWM control.

- ① Tail light signal
- ② Brake light signal
- ③ Bidirectional wire from convenience system central control unit
- ④ Indicator signal



SSP287\_117



## Boot lid control unit J605

The boot lid control unit provides extra convenience when opening and closing the boot lid. The electromechanical drive system with a motor and magnetic clutch is controlled electronically and responds to requests from the convenience system central control unit.

The current position status and the switching status of the boot lid closing button are signalled to the convenience system central control unit.

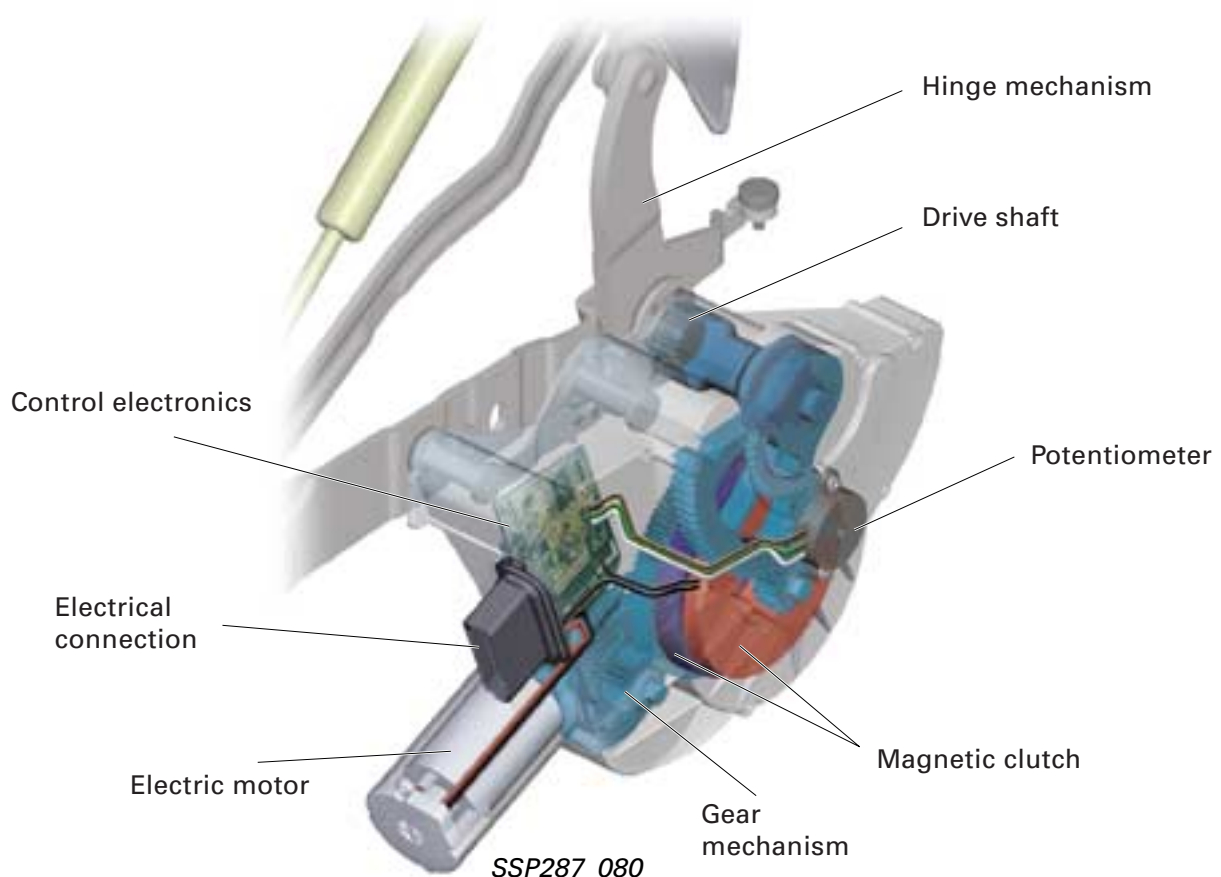
### Operation

Opening/closing involves engagement of the magnetic clutch and starting of the motor. During movement, the current position of the boot lid is detected via the potentiometer and compared to the previous value. If there are no problems, the boot lid is moved into the desired end position, where the drive is switched off.

The boot lid control sequence is measured by way of an integrated potentiometer. This permits

- Detection of the end positions
- Detection of excess force and thus implementation of obstruction safeguard through evaluation of the rate of change

In the event of an obstruction or opposing force during opening/closing, movement is halted by disengaging the magnetic clutch and the motor comes to a stop. If it was being closed, the boot lid is opened again (obstruction safeguard).



# Control Units



The boot lid control unit receives the input signal from the boot lid close button in luggage compartment E406.



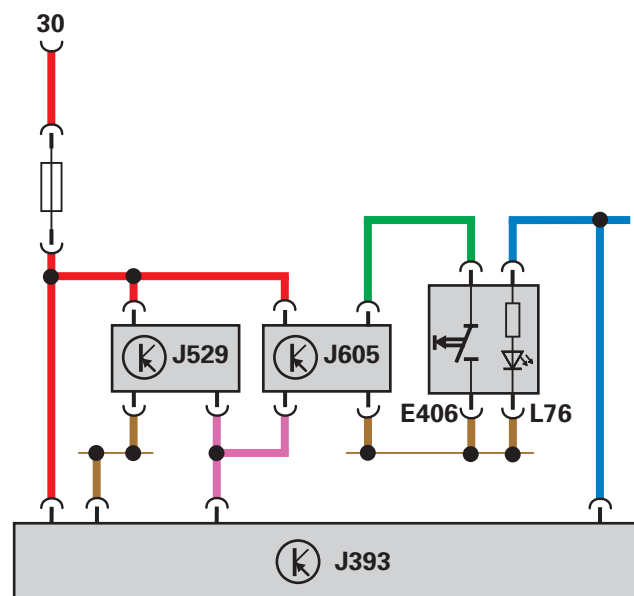
For safety reasons, the boot lid cannot be closed from the operating points in the remote control key, in the driver's door or on the outside of the boot lid.



SSP287\_081

## Block diagram

- E406 Boot lid close button in luggage compartment
- J393 Convenience system central control unit
- J529 Anti-theft/tilt system control unit
- J605 Boot lid control unit
- L76 Button illumination



SSP287\_082

## Fitting location

The boot lid control unit is located behind the side panel at the top right and is flanged to the right boot lid hinge.



SSP287\_083

## Anti-theft/tilt system control unit J529

As in the Audi A4 '01, use is made of a tilt sensor to prevent unauthorised tow-starting.

The tilt sensor in the Audi A8 '03 is an independent control unit. The anti-theft/tilt system control unit is connected to the convenience system central control unit J393 via a LIN bus link.

### Design

The internal design and mode of operation have been modified as compared to the tilt sensor in the Audi A4 '01.

The control unit contains the sensor element, the microcontroller and a LIN transceiver.

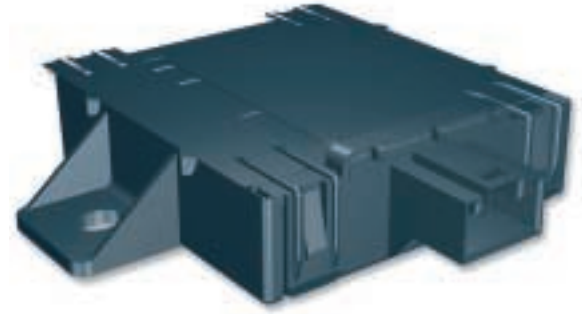
The sensor consists of a moving earth element suspended between two capacitor plates by means of springs. The capacitor plate connections are routed into the microcontroller.

### Operation

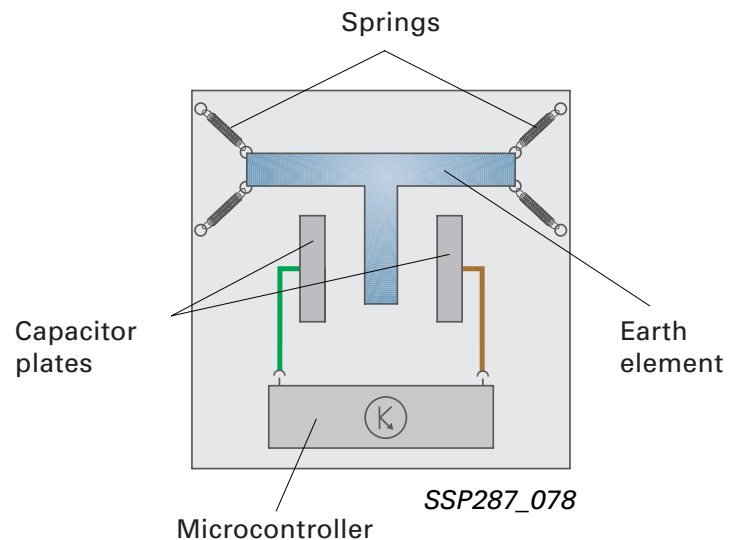
A change in the horizontal position of the control unit moves the earth element between the capacitor plates within the spring travel range.

A voltage is applied to the capacitor plates. Movement of the earth element produces a change in capacitance between the plates.

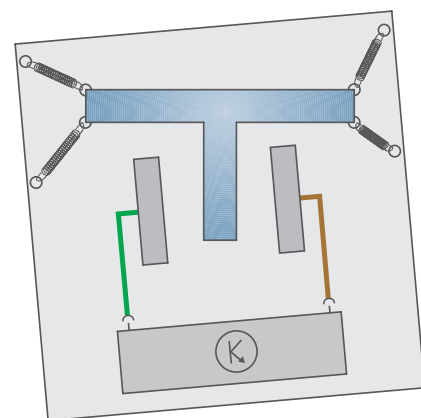
This voltage signal is recognised as a change in vehicle tilt by the microcontroller. The measuring range of the sensor is  $\pm 25^\circ$ . The change in capacitance is evaluated with an accuracy of  $0.1^\circ$ .



SSP287\_047



SSP287\_078



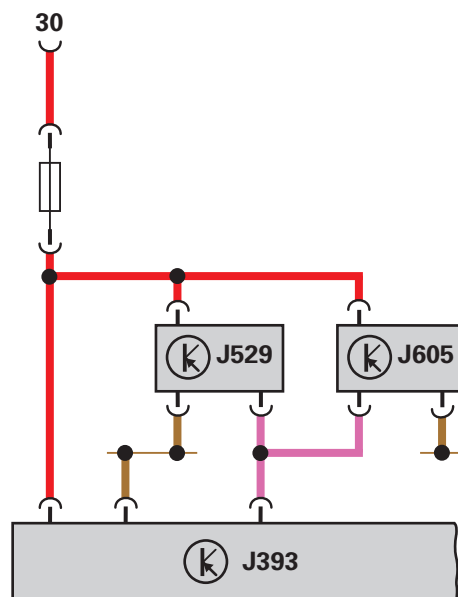
SSP287\_079

# Control Units



## Block diagram

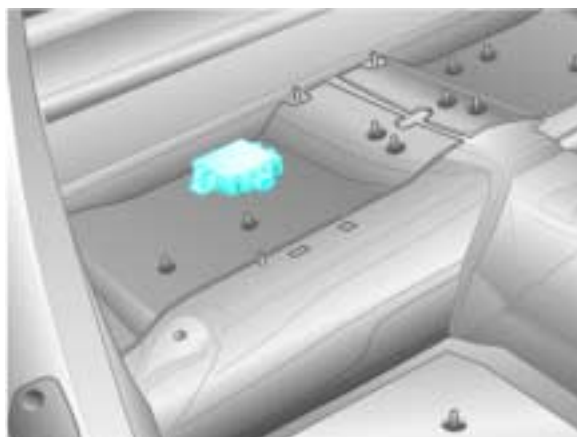
- J393 Convenience system central control unit
- J529 Anti-theft/tilt system control unit
- J605 Boot lid control unit



SSP287\_074

## Fitting location

The anti-theft/tilt system control unit is located on the right beneath the rear seat bench.



SSP287\_029

## Diagnosis

The absolute tilt angles can be displayed in the measured value blocks.

In addition, with the anti-theft alarm primed, it is also possible to read out the change in angle with respect to the angle on priming the anti-theft alarm.

Diagnosis for the anti-theft/tilt system control unit is performed by way of the central convenience electronics.

# Onboard power supply control unit J519

## Functions

The onboard power supply control unit was first used in the Audi A4 '01. It is also fitted with appropriately modified functions and actuation processes in the Audi A8 '03. The onboard power supply control unit is designed to read in various switches and actuate certain outputs.

## Master functions

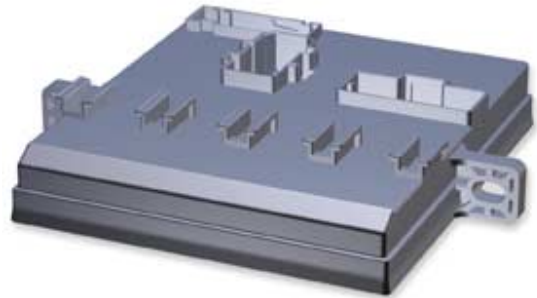
The master functions of the onboard power supply control unit are as follows:

- LIN master for wiper motor control unit J400 (refer to wiper motor for functions)
- Light master

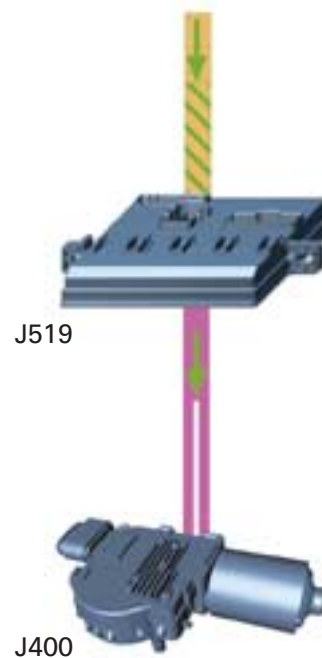
As light master, the task of the onboard power supply control unit is to provide all control units concerned with the required type of lighting, e.g. side lights, via the data transfer systems to enable the control units to actuate the appropriate control elements. In addition, it monitors operation of the front external vehicle lights. This takes the form of cold and warm lamp monitoring. Exterior lighting control is described in SSP 288 – Audi A8 '03 - Distributed Functions.

## Substitute master function

The onboard power supply control unit assumes the substitute master function for the convenience system central control unit J393. In other words, if the convenience system control unit is disconnected from the CAN bus or defective, the onboard power supply control unit transmits the flashing signal information to the CAN bus (refer to SSP 288 – Audi A8 '03 - Distributed Functions).



SSP287\_045

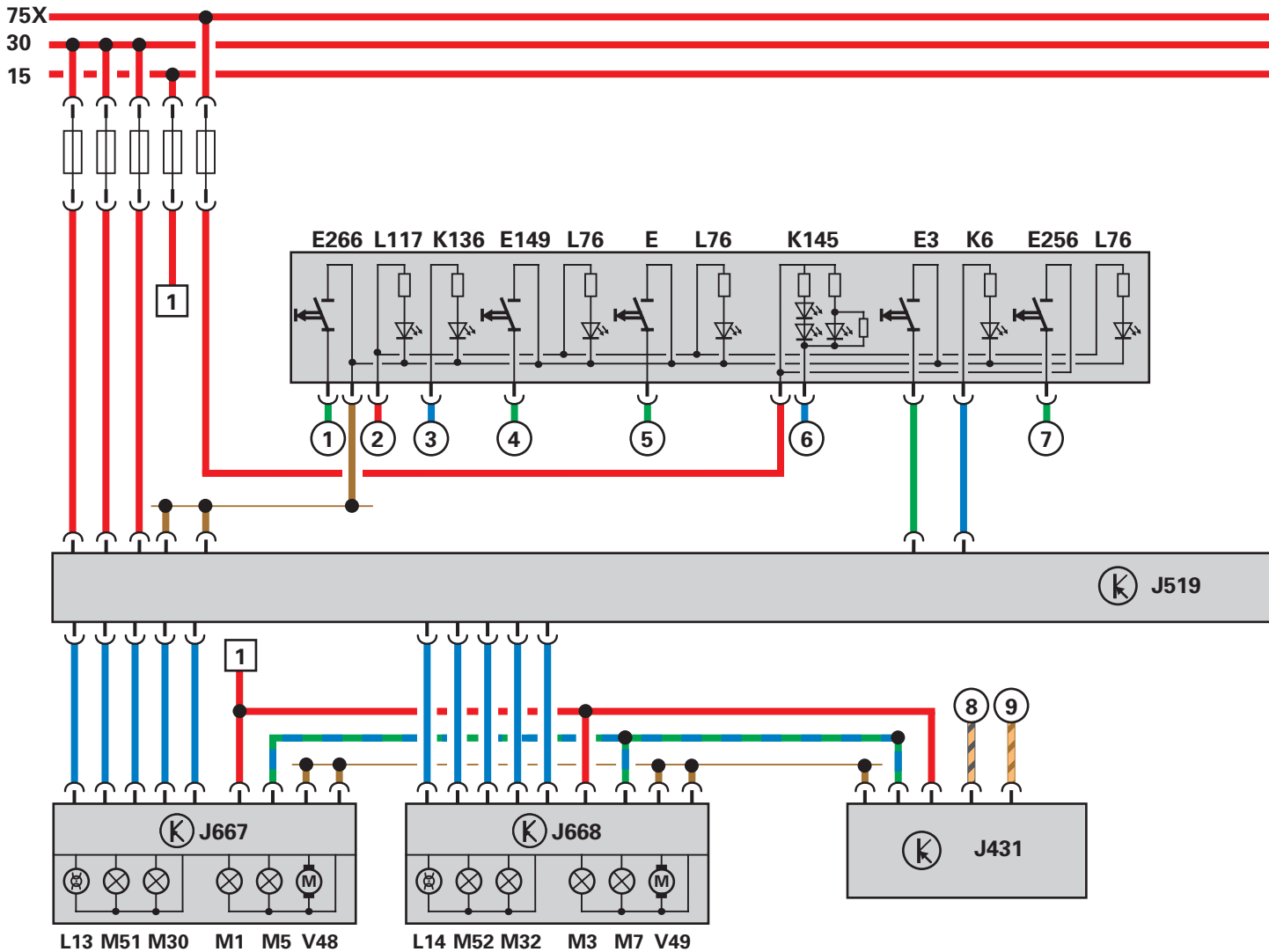


SSP287\_032



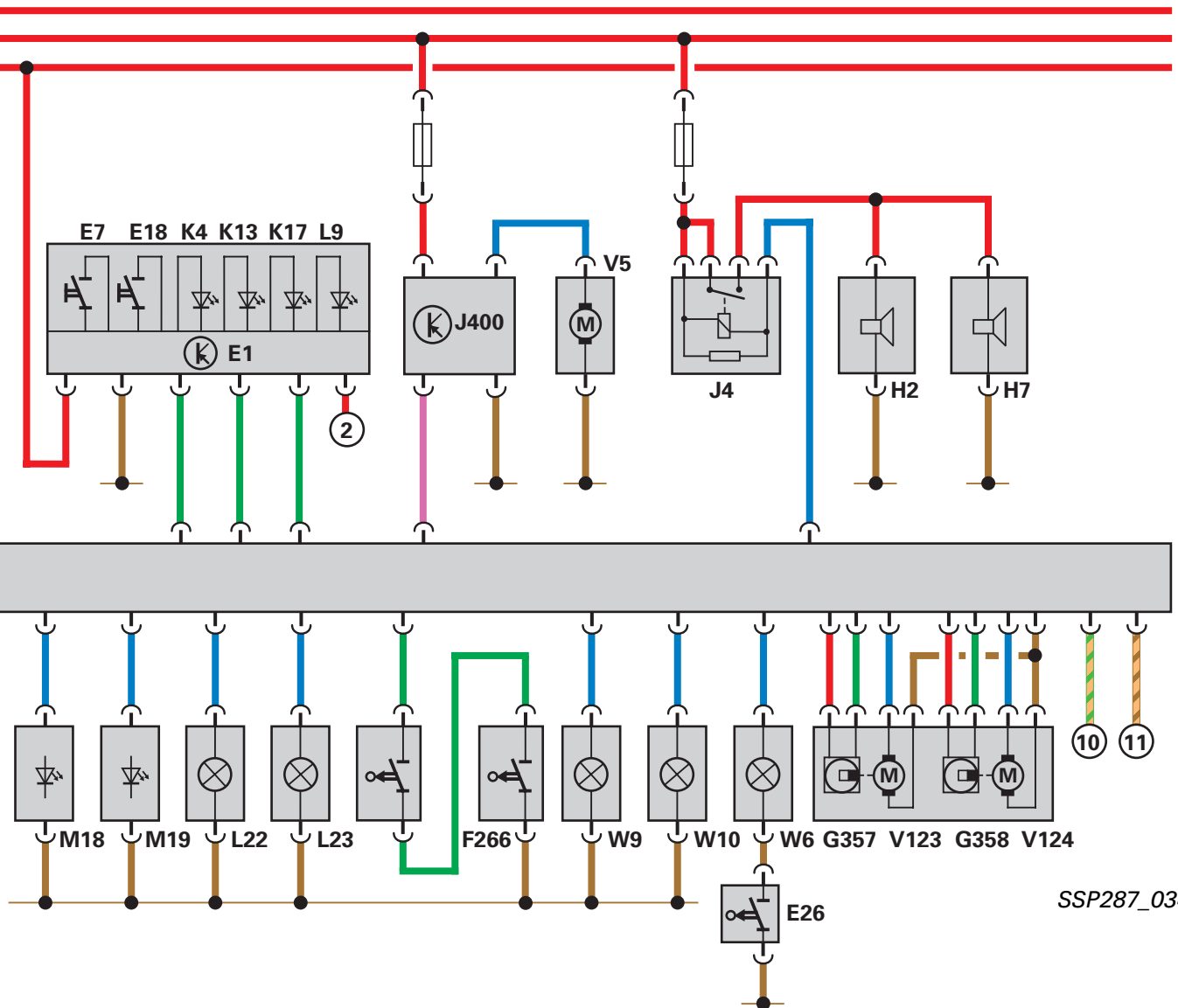
# Control Units

## Block diagram



## Key

E1	Light switch	K4	Side light warning lamp
E3	Hazard warning light switch	K6	Hazard warning light system warning lamp
E7	Fog light switch	K13	Rear fog light warning lamp
E18	Rear fog light switch	K17	Fog light warning lamp
E26	Glove box light switch	K136	Parking aid warning lamp
E149	Rear roller blind switch	K145	Airbag disabled warning lamp, front passenger side
E256	TCS/ESP button	L9	Light switch light bulb
E266	Parking aid button	L13	Left gas-discharge lamp
E462	Open/close button for front display	L14	Right gas-discharge lamp
F266	Bonnet contact switch	L22	Fog light bulb, left
G357	Steering column adjustment sender, vertical	L23	Fog light bulb, right
G358	Steering column adjustment sender, axial	L76	Button illumination
H2	High-tone horn	L117	Parking aid switch illumination
H7	Low-tone horn	M1	Side light bulb, left
J4	Dual-tone horn relay	M3	Side light bulb, right
J400	Wiper motor control unit	M5	Turn signal bulb, front left
J431	Headlight range control unit	M7	Turn signal bulb, front right
J519	Onboard power supply control unit	M18	Side turn signal bulb, left
J667	Power output module for left headlight	M19	Side turn signal bulb, right
J668	Power output module for right headlight		



SSP287\_034

- M30 Main beam bulb, left
- M32 Main beam bulb, right
- M51 Static cornering light, left
- M52 Static cornering light, right
- V5 Windscreen washer pump
- V48 Headlight range control motor, left
- V49 Headlight range control motor, right
- V123 Steering column adjustment motor, vertical
- V124 Steering column adjustment motor, axial
- W6 Glove box light
- W9 Left footwell light
- W10 Right footwell light

**Additional signals**

- ① Parking aid control unit J446
- ② Terminal 58s
- ③ Parking aid control unit J446
- ④ Climatronic control unit J255
- ⑤ Multimedia operating unit E380
- ⑥ Airbag control unit J234
- ⑦ ABS with EDL control unit J104
- ⑧ Drive system CAN High
- ⑨ Drive system CAN Low
- ⑩ Convenience CAN High
- ⑪ Convenience CAN Low

# Control Units

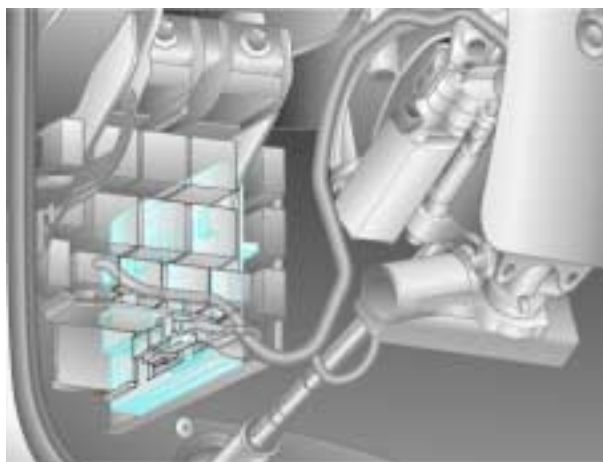
## Versions

There are two versions of the onboard power supply control unit:

- Low-line
- High-line (with electrical steering column adjustment)

## Fitting location

The onboard power supply control unit is installed at lower front left behind fuse box.



SSP287\_053

## Energy management

### Deactivation stages

In the event of a low battery charge, load deactivation must be performed by the energy management control unit J644 (refer to energy management control unit). The necessary deactivation stage is transmitted on the CAN bus and read in by the onboard power supply control unit.

### Transportation mode

If transportation mode is activated by the diagnosis unit in the energy management control unit, the onboard power supply control unit deactivates various loads and functions to minimise closed-circuit current.



## System outline

The onboard power supply control unit receives the following input signals:

- Hall sensor 1 for steering column adjustment height
- Hall sensor 2 for steering column adjustment depth
- Bonnet switch for anti-theft alarm
- Rotary light switch
- Hazard warning button
- Reversing light switch (manual gearbox)



The onboard power supply control unit J519 actuates the following loads:

- Front left and right turn signal indicators
- Left and right side turn signal indicators
- Front left and right side lights
- Left and right dipped beam
- Left and right main beam
- Left and right fog light
- Front left and right footwell lights
- Horn
- Steering column adjustment
- Hazard warning button illumination
- Glove box light



# Control Units

## Diagnosis

### Measured value blocks

Measured value blocks are available, for example, for the following functions:



Inputs	Remarks
Terminal 30	
Rotary light switch	Positions
Hazard warning button	OFF/ON
Steering column adjustment	Axial/vertical position Status (up, down, etc.)
Bonnet contact	OFF/ON

Outputs	Remarks
Light control	e.g. left side light OFF/ON
Front footwell lights	OFF/ON Brightness value
Horn	OFF/ON

Inputs via CAN	Remarks
Main beam	OFF/ON
Headlight flasher	OFF/ON
Turn signal	OFF/ON
Vehicle-speed signal	km/h
Wipe/wash	Status
Terminal 15	OFF/ON
Terminal X	OFF/ON
Terminal 50	OFF/ON

Inputs via LIN	Remarks
Wipe	OFF/ON
Wash	OFF/ON
Park position	OFF/ON

## Basic settings

Basic steering column adjustment setting can be made with the high-line version.



## Control element test

The control element test can be used to check the following:

- Hazard warning light system warning lamp K6
- Side light bulb, left M1
- Side light bulb, right M3
- Dipped beam bulb, left M29
- Dipped beam bulb, right M31
- Main beam bulb, left M30
- Main beam bulb, right M32
- Fog light bulb, left L22
- Fog light bulb, right L23
- Left turn signal indicators
- Right turn signal indicators
- Left footwell light W9
- Right footwell light W10
- Wiper upper reversing position
- Wiper lower reversing position
- Windscreen washer pump V5
- Dual-tone horn relay

## Encoding

Encoding must be performed in the onboard power supply control unit for

- Daytime driving light
- Assistant lighting system
- Type of headlight
- Footwell lighting

for example.

# Control Units



## Wiper motor control unit J400

The wiper motor control unit J400 combines the control electronics for the individual wiper functions and the wiper motor in one component.

As LIN slave control unit it is connected to the onboard power supply control unit J519.



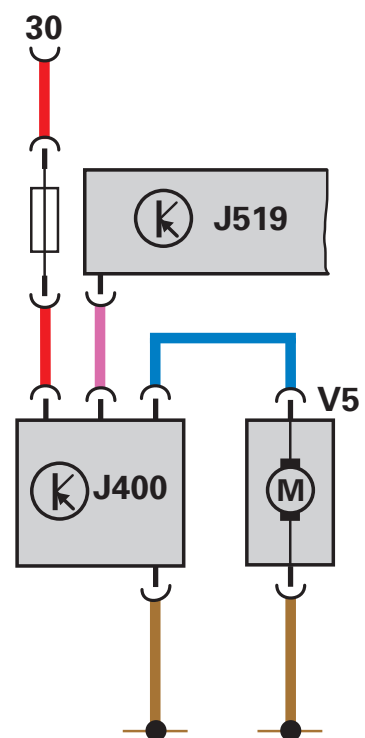
SSP287\_051

### Functions

- Actuation of windscreen washer pump V5
- Control of wipe angle functions

### Block diagram

- J400 Wiper motor control unit  
J519 Onboard power supply control unit  
V5 Windscreen washer pump



SSP287\_063

### Bonnet contact switch F266

Opening the bonnet with the wiper motor running causes the motor to come to an immediate halt. If the windscreen washer pump is active on opening the bonnet, then this is also switched off. Opening of the bonnet is detected by two contact switches connected to the onboard power supply control unit J519.

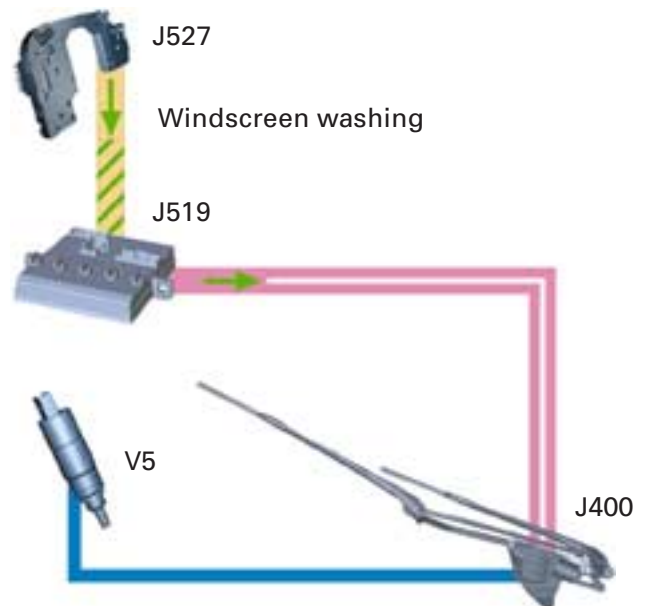


## Operation

By way of the LIN bus, the onboard power supply control unit provides the wiper motor control unit with all the information required to implement the wiper function.

### ► Actuation of windscreen washer pump V5

The windscreen washer pump V5 actuation information is transmitted by the steering column electronics control unit J527 to the convenience CAN. The onboard power supply control unit J519 receives this information and relays it via the LIN bus to the wiper motor control unit J400, which then actuates the windscreen washer pump V5 and activates the wipers if these are not yet in operation.



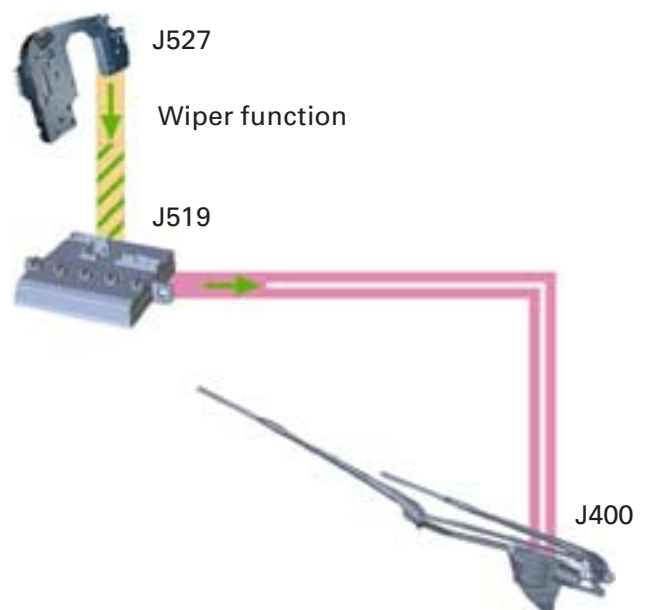
SSP287\_064

### ► Actuation of wiper function

The wiper functions

- Intermittent
- Intermittent speeds
- Flick wipe
- Wipe speed 1
- Wipe speed 2

are made available to the onboard power supply control unit by the steering column electronics control unit J527 via the convenience CAN. The onboard power supply control unit J519 transmits a message with the desired wiper function via the LIN bus to the wiper motor control unit J400.



SSP287\_065

# Control Units



## Onboard power supply control unit 2 J520

The onboard power supply control unit 2 J520 has been fitted for the first time in the Audi A8 '03. The great load on all other control units necessitated the installation of an additional control unit.

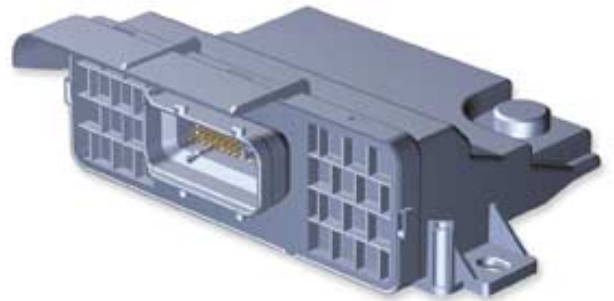
The following components are actuated:

- Servotronic solenoid valve N119
- Hose heater for windscreen washer system
- Headlight washer system relay J39
- Garage door operation control unit J530
- Left and right pop-up washer jet motors V248, V249
- Display opening mechanism for front information and display and operating unit control unit J685
- Terminal 58d (gate illumination)

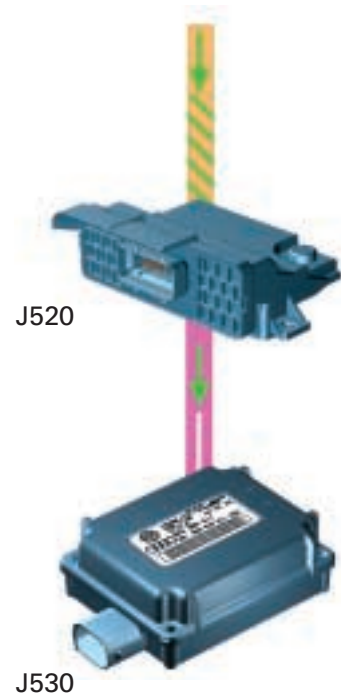
### Master functions

The master functions of the onboard power supply control unit 2 J520 are as follows:

- LIN master for garage door operation control unit J530 (for functions, refer to Pages 76/77)

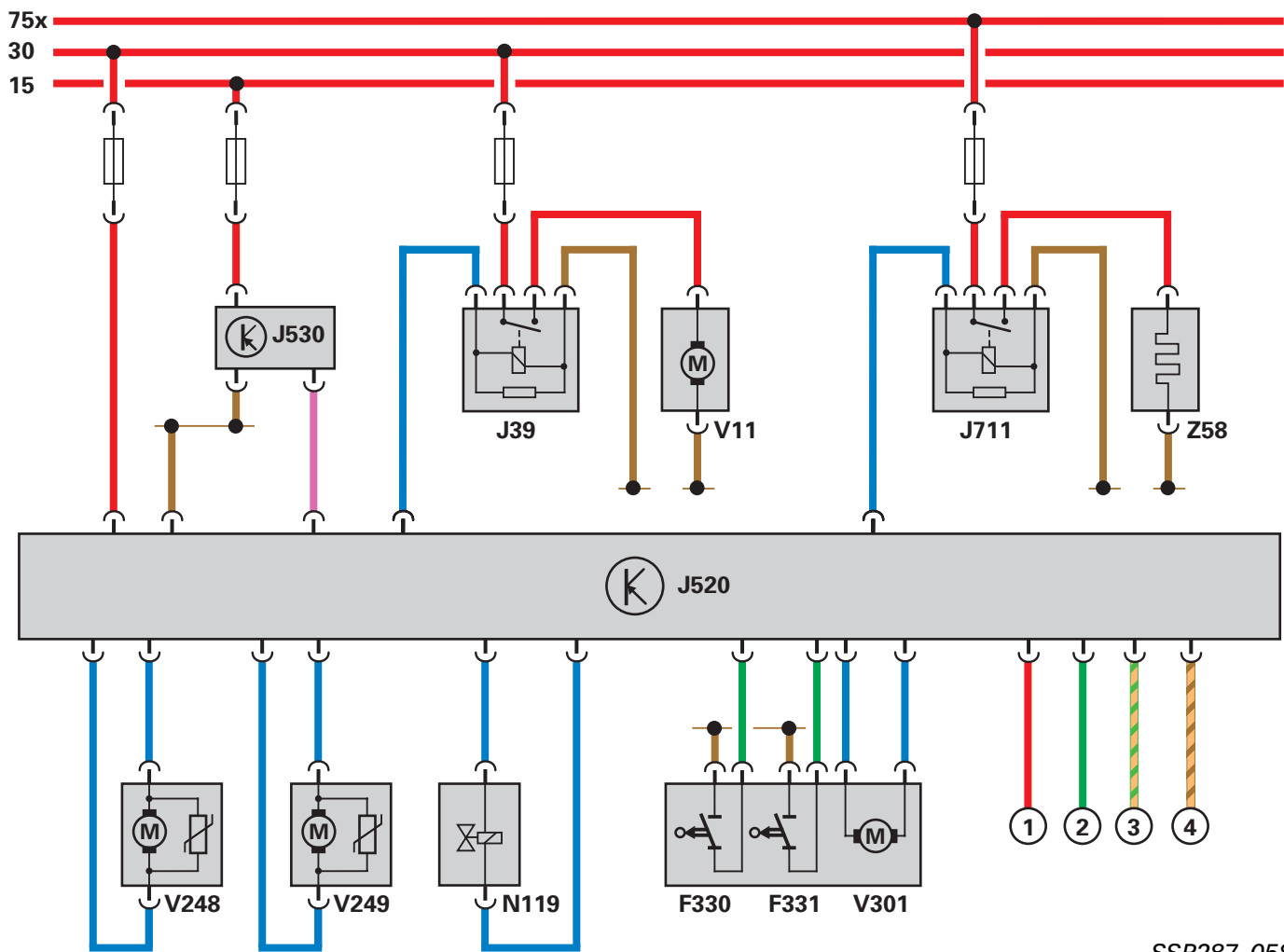


SSP287\_046



SSP287\_056

## Block diagram



SSP287\_058

### Key

- F330 Open display limit switch
- F331 Close display limit switch
- J39 Headlight washer system relay
- J520 Onboard power supply control unit 2
- J530 Garage door operation control unit
- J711 Washer fluid heater relay
- N119 Servotronic solenoid valve
- V11 Headlight washer system pump
- V248 Pop-up washer jet motor, left headlight washer system
- V249 Pop-up washer jet motor, right headlight washer system
- V301 Open/close display motor
- Z58 Heated fluid hoses

### Additional signals

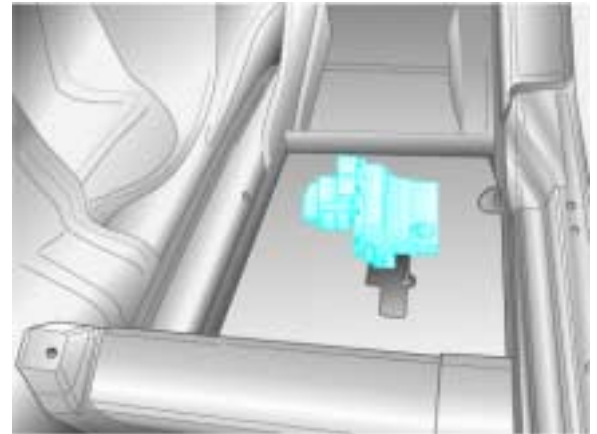
- ① Selector lever illumination (terminal 58d)
- ② Multimedia operating unit E380 (signal for MMI display "OPEN/CLOSE")
- ③ Convenience CAN High
- ④ Convenience CAN Low



# Control Units

## Fitting location

The onboard power supply control unit 2 J520 is located beneath the front passenger's seat.

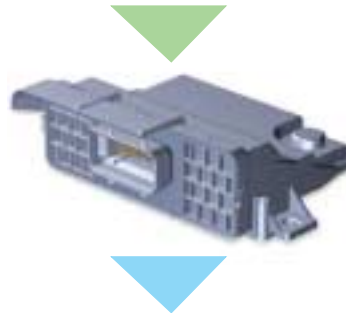


SSP287\_028

## System outline

The onboard power supply control unit 2 J520 receives the following input signals:

- Open/close display limit switches F330 and F331 for front information and display and operating unit control unit J685
- Open display during wake-up of bus systems (refer to SSP 293 – Audi A8 '03 Infotainment)

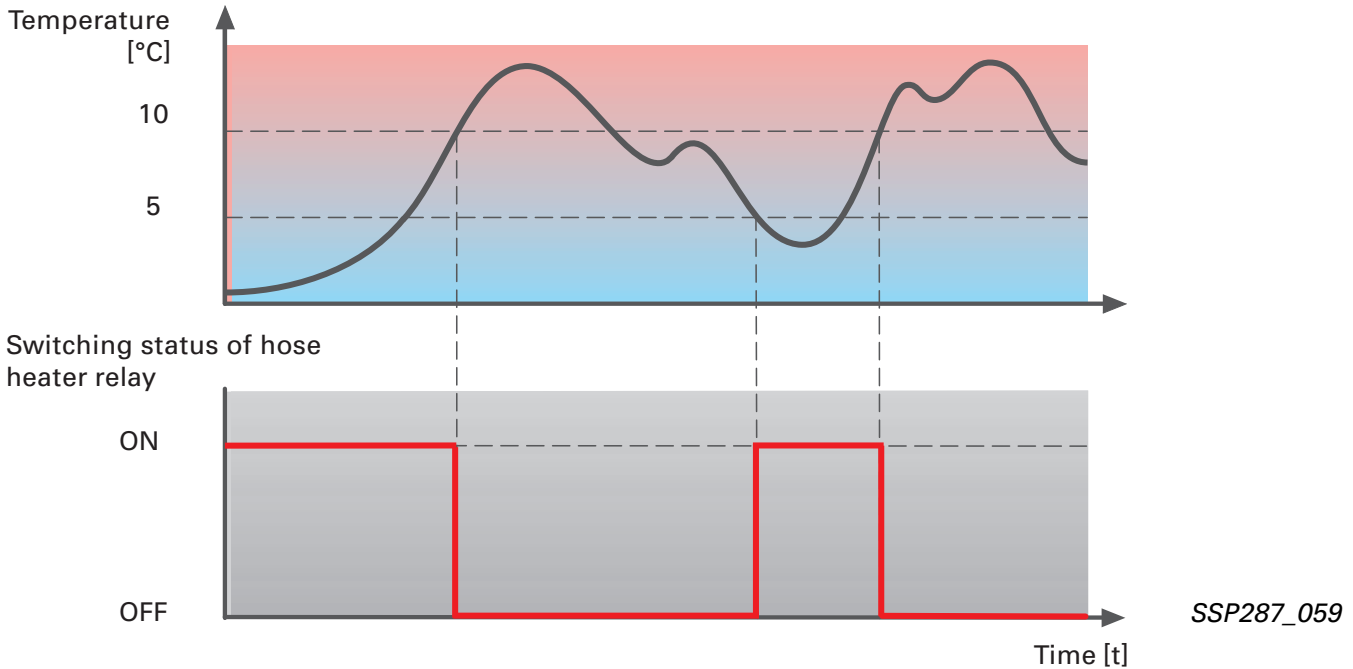


The onboard power supply control unit 2 actuates the following loads:

- Servotronic solenoid valve N119 (refer to SSP 292 – adaptive air suspension in the Audi A8 '03)
- Hose heater for windscreen washer system
- Headlight washer system relay J39 (fluid pump), left and right pop-up washer jet motor V248 and V249
- Opening of display for front information and display and operating unit control unit (for operation, refer to SSP 293 – Audi A8 '03 Infotainment)
- Terminal 58d for gate illumination



## Hose heater for windscreen washer system

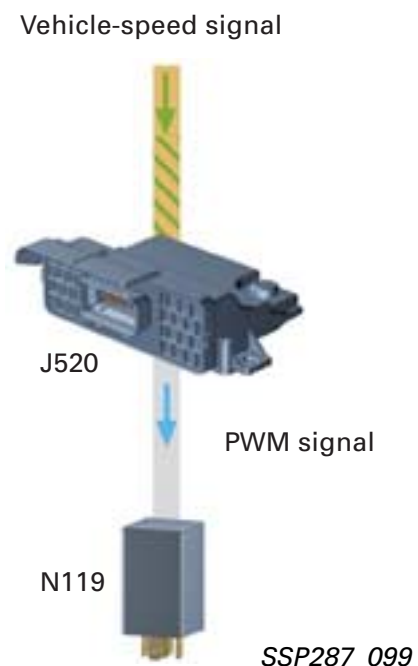


The windscreen washer system hose heater is actuated via a relay energised by the onboard power supply control unit 2 J520.

The hose heater is switched as a function of ambient temperature. It is switched off at + 10 °C. If the temperature drops below + 5 °C, the heater is switched on again.

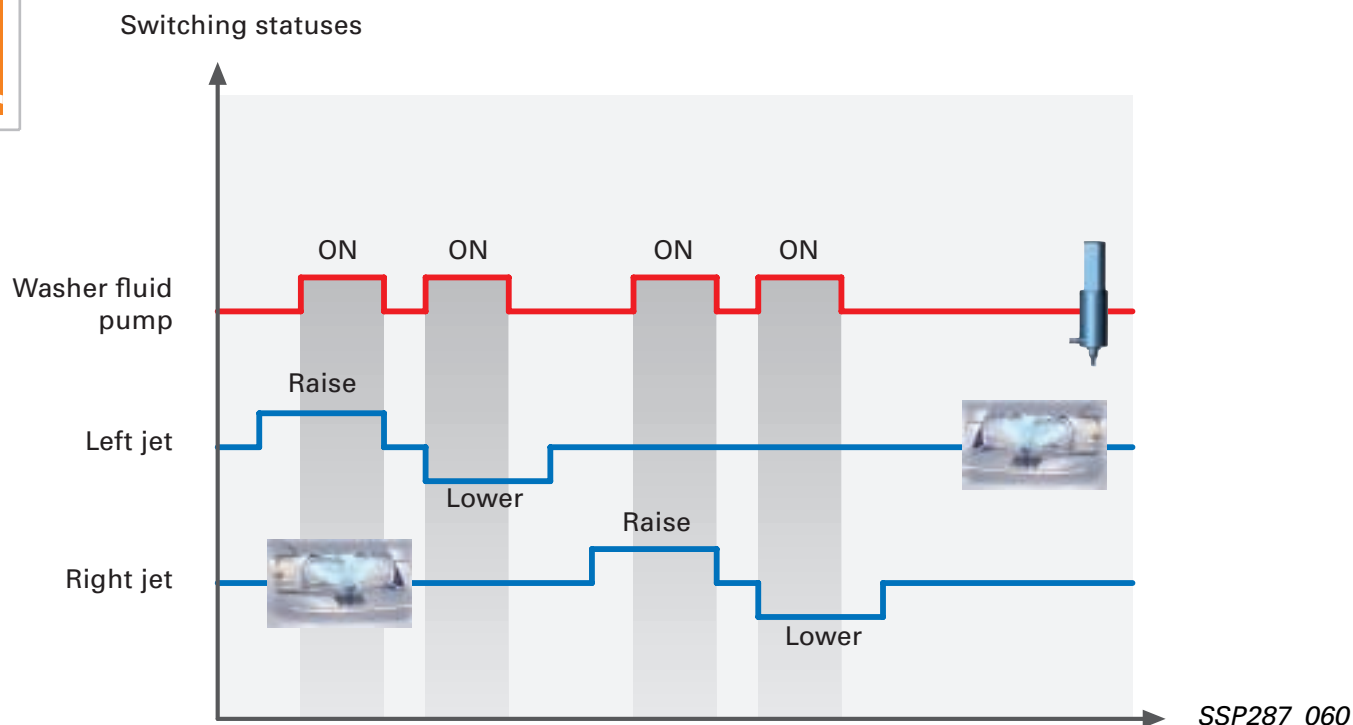
## Servotronic solenoid valve N119

The Servotronic solenoid valve is actuated by the onboard power supply control unit 2 J520 by way of a pulse-width modulated signal. Current measurement is performed in the control unit on the earth end for pulse width regulation. Depending on vehicle speed, the current flowing through the solenoid valve (corresponds to voltage at resistor) is regulated to 0 ... 800 mA by the control unit. The onboard power supply control unit 2 receives the vehicle-speed signal from the convenience CAN.



# Control Units

## Headlight washer system



The onboard power supply control unit 2 J520 actuates one washer fluid pump and two pop-up washer jet motors. The washer fluid pump is actuated via the headlight washer system relay J39, which is energised by the onboard power supply control unit 2.

The pop-up washer jet motors are switched directly by the control unit. As washing takes place during raising and lowering, the fluid jet is thoroughly distributed.

The headlight washer system jets do not clean the twin lights simultaneously, but rather consecutively, so as to prevent any loss of lighting power.

## Energy management

### Deactivation stages

The onboard power supply control unit 2 also deactivates loads/functions if a corresponding deactivation stage is transmitted on the CAN bus by the energy management control unit. The functions deactivated are indicated under "Vehicle information" in the assisted fault-finding routine.

### Transportation mode

Transportation mode causes loads/functions to be deactivated in the onboard power supply control unit 2. The information for initiation of the transportation mode is supplied to the onboard power supply control unit 2 via the bus systems by the energy management control unit (refer to energy management control unit).

## Diagnosis

### Measured value blocks

Measured value blocks are available, for example, for the following functions:

- Display opening/closing function for front information and display and operating unit control unit
- Headlight washer system
- Hose heater
- Garage door opening
- Energy manager deactivation stages
- Servotronic
- Component protection
- Communication

### Control element test

The control element test can be used to check the following functions:

- Opening/closing display for front information and display and operating unit control unit
- Terminal 58d
- Servotronic full/no power assistance
- Raise pop-up washer jet for left headlight washer system
- Raise pop-up washer jet for right headlight washer system
- Headlight washer system fluid pump
- Hose heater
- Garage door opener buttons 1/2/3

### Encoding

Encoding must be performed in onboard power supply control unit 2 for the following

- Servotronic (with/without)
- Garage door opening (with/without)
- Headlight washer system (with/without)
- Heated wipe/wash fluid reservoir (with/without)
- Terminal 58d (type of gearbox)

for example.



# Control Units



## Door control units J386 to J389

Door control units were used for the first time in the Audi A2. They are fitted with appropriately modified functions and actuation processes in the Audi A8 '03. The door control units are designed to read in all switches in the corresponding door and to actuate the motors, lights and heaters fitted in the doors.

### Substitute master function

The driver side door control unit J386 assumes control of the central locking system in the event of failure of the convenience system central control unit J393. If the driver side door control unit detects a break in communication with the convenience system central control unit, the information of the driver side door control unit is evaluated directly by the other door control units.

In this case, it is no longer possible to open the vehicle by way of remote control or Advanced Key function.

### "Ambiente" lighting in doors (optional)

"Ambiente" lighting refers to lights which are active whilst driving. Certain "ambiente" lighting components are also integrated into the interior door trim, for example the light strip in the door pocket and the vertical light in the interior trim.

The light strip in the door pocket is actuated by the door control unit with the terminal 58s function. The level of the variable "ambiente" lighting is set via the multimedia interface and stored in the sunroof electronics control unit. As interior light master, the sunroof electronics control unit supplies the door control units with these settings by way of the convenience CAN. The door control units actuate the vertical light in the door trim as PWM signal.

### Diagnosis

Address words 42, 52, 62 and 72 "Door electronics" are available for diagnosis.



SSP287\_087

### Versions

Low-line and high-line versions are available. The high-line version features the following additional functions

- Automatic anti-dazzle mirror and
- Mirror folding



SSP287\_098



The door control units receive the following input signals:

- Window lifter switch
- Interior locking switch
- Door contact switch
- Central locking actuators
- Central locking actuators (safe)
- Outer door handle switch (optional)
- Contact sensor, outer door handle (optional)
- Luggage compartment release switch E164
- Tank filler flap remote release switch E204
- Child safety lock switch E254
- Mirror adjustment changeover switch E48
- Mirror adjustment switch E43
- Mirror with folding function, adjustment switch E168
- Alarm system OFF switch E217 (optional)
- Interior monitor switch E183 (optional)

**Additionally for front doors:**

- Memory operating unit
- Mirror position sender
- Mirror disengaging switch

**Additionally for driver's door:**

- Contact switch in lock cylinder, driver side F241

**Rear passenger's side only:**

- Remote control button, front passenger seat (optional) E351



The door control units actuate the following loads:

- Central locking motors
- Central locking motors (safe)
- Door warning lights
- Entry lights
- Door opener lighting
- Door pocket light strips (optional)
- Vertical light for door trim (optional)
- Outer door handle lighting (optional)

**Additionally for rear doors:**

- Rear ashtray light

**Additionally for front doors:**

- Mirror adjustment motors
- Mirror folding motors
- Heated exterior mirrors
- Automatic anti-dazzle exterior mirror
- Ambient lighting

**Additionally for driver's door:**

- Central locking warning lamps
- Vehicle inclination sender warning lamp (optional) K188
- Interior monitoring off warning lamp (optional) K162

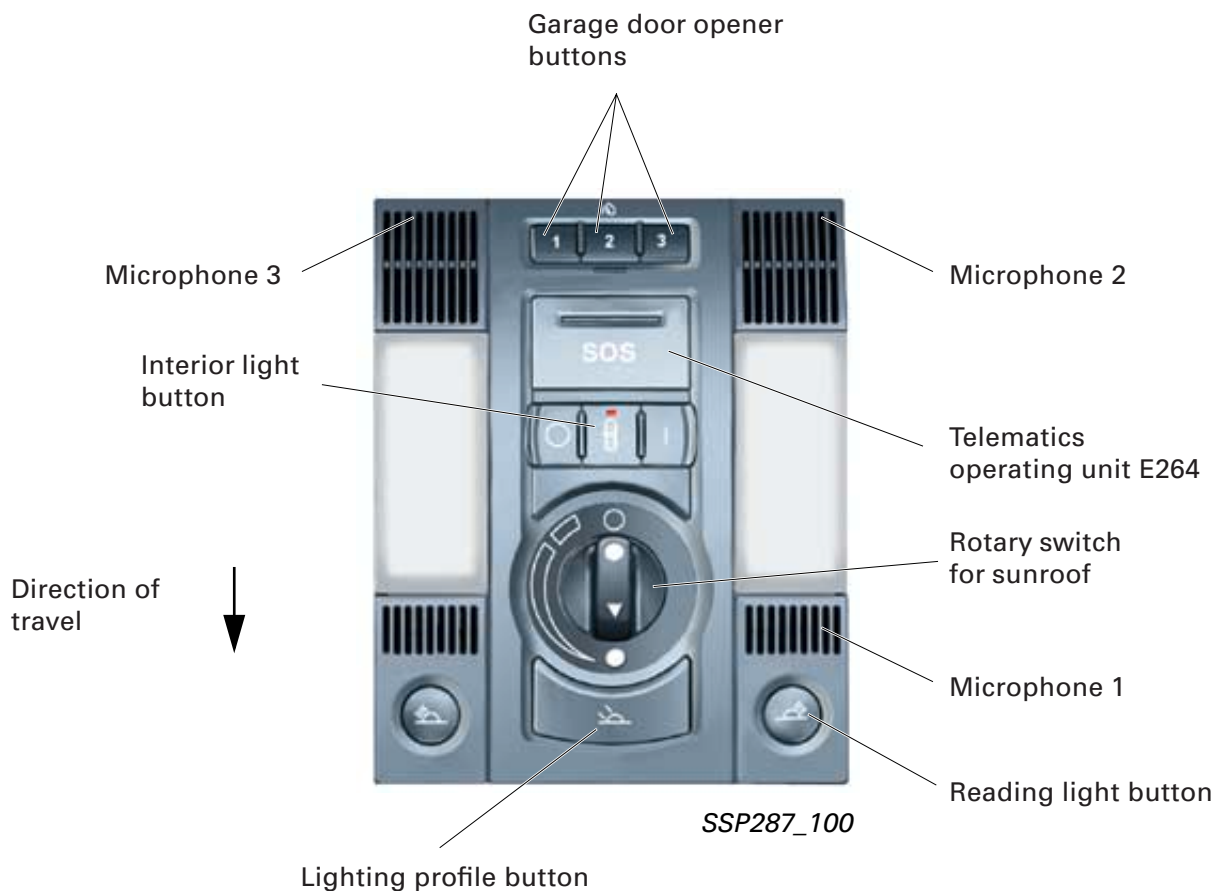
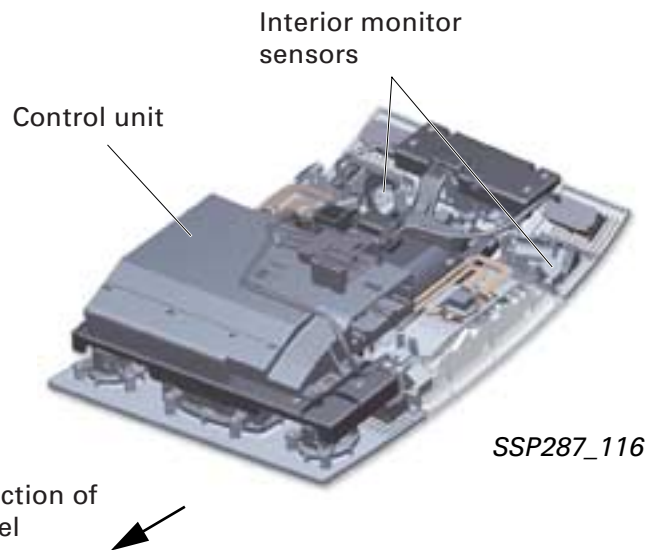
# Control Units



## Sunroof electronics control unit J528

In view of the wide range of front roof module functions, this takes the form of an independent control unit in the Audi A8 '03.

For exchange of data with other control units, the sunroof electronics control unit is connected to the convenience CAN. There is a link with the sliding sunroof motor V1 by way of the LIN bus.





## Function

The sunroof electronics control unit is the function master for the interior lighting distributed function. There is no substitute master.

It assumes the following control functions in the Audi A8 '03:

- Control of lighting profiles (interior lighting)
- Sunroof control signals

The control unit reads in the following signals and relays them on the convenience CAN:

- Interior monitor without anti-theft alarm is relayed to the convenience system central control unit J393
- EC interior mirror is relayed to all door control units J386, J387, J388 and J389
- Light sensor signal is relayed to onboard power supply control unit J519
- Humidity and windscreen temperature sender signal is relayed to Climatronic control unit J255
- Garage door opener button is relayed to onboard power supply control unit 2 J520

In addition, interior lighting control signals are transmitted via discrete wires to the rear roof console E467.

## Lighting profiles

Certain preset profiles can be selected for the interior lighting via the MMI (CAR function). These profiles provide vehicle lighting conditions to suit the driving situation and individual requirements.

Benefits:

- Greater clarity in the vehicle
- Improved driving conditions
- More pleasant atmosphere



SSP287\_100



If lighting profile "OFF" has been selected in the MMI, the interior lighting is not switched on when the light button in the roof module is pressed.

# Control Units



The following lighting profiles are available:

## Highway profile

Actuation of

- Front right and left door trim vertical light
- Rear right and left door trim vertical light

## City profile

Actuation of

- Driver's footwell light (50 %)
- Front passenger's footwell light (50 %)
- Rear footwell lights (30 %)
- Front, rear right and rear left door trim vertical light (100 %)
- Front and rear interior lights (15 %)

## Cockpit profile

Actuation of

- Driver's footwell light (50 %)
- Front passenger's footwell light (50 %)
- Front, rear right and rear left door trim vertical light (100 %)

## Rear profile

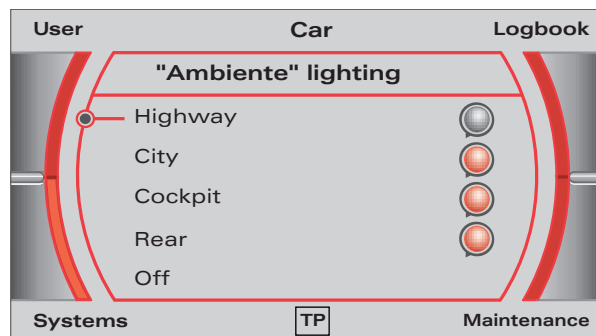
Actuation of

- Rear footwell lights (30 %)
- Rear right and left door trim vertical light (100 %)
- Rear interior lights (15 %)

## Restriction of functions

The following are deactivated in the event of active load intervention by the battery and energy management system:

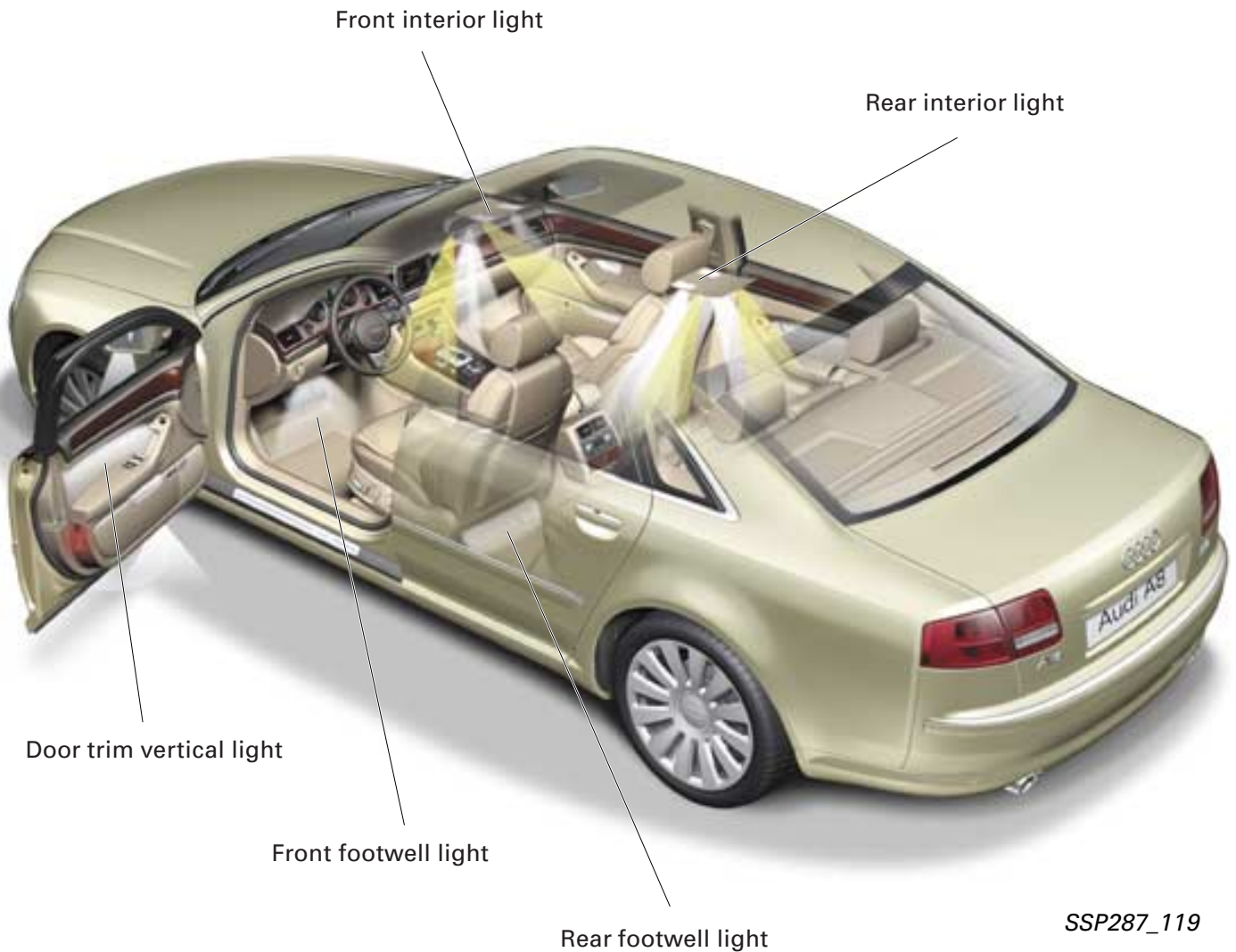
- Interior lighting
- Sunroof
- Light/humidity sensor
- Interior mirror



SSP287\_114



## Interior lights actuated by lighting profiles



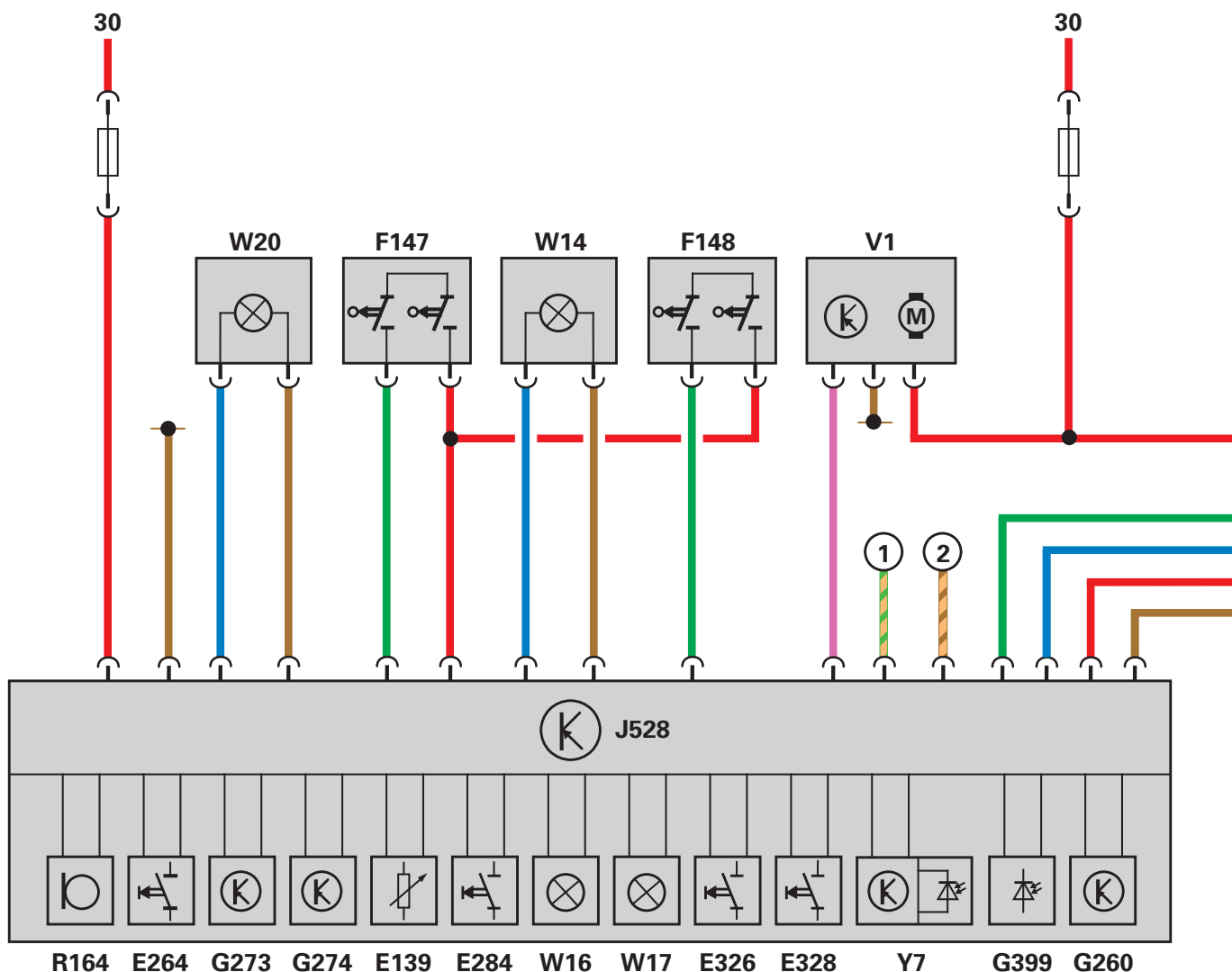
## Diagnosis

The sunroof electronics control unit is incorporated into the vehicle self-diagnosis function by means of address word 38. Individual encoding can be performed with VAS 5051 by way of assisted fault-finding and on the basis of vehicle equipment.

All input and output signals can be displayed via the "Measured value block" function. The diagnosis unit only indicates the last 5 faults; the oldest fault code in each case is overwritten.

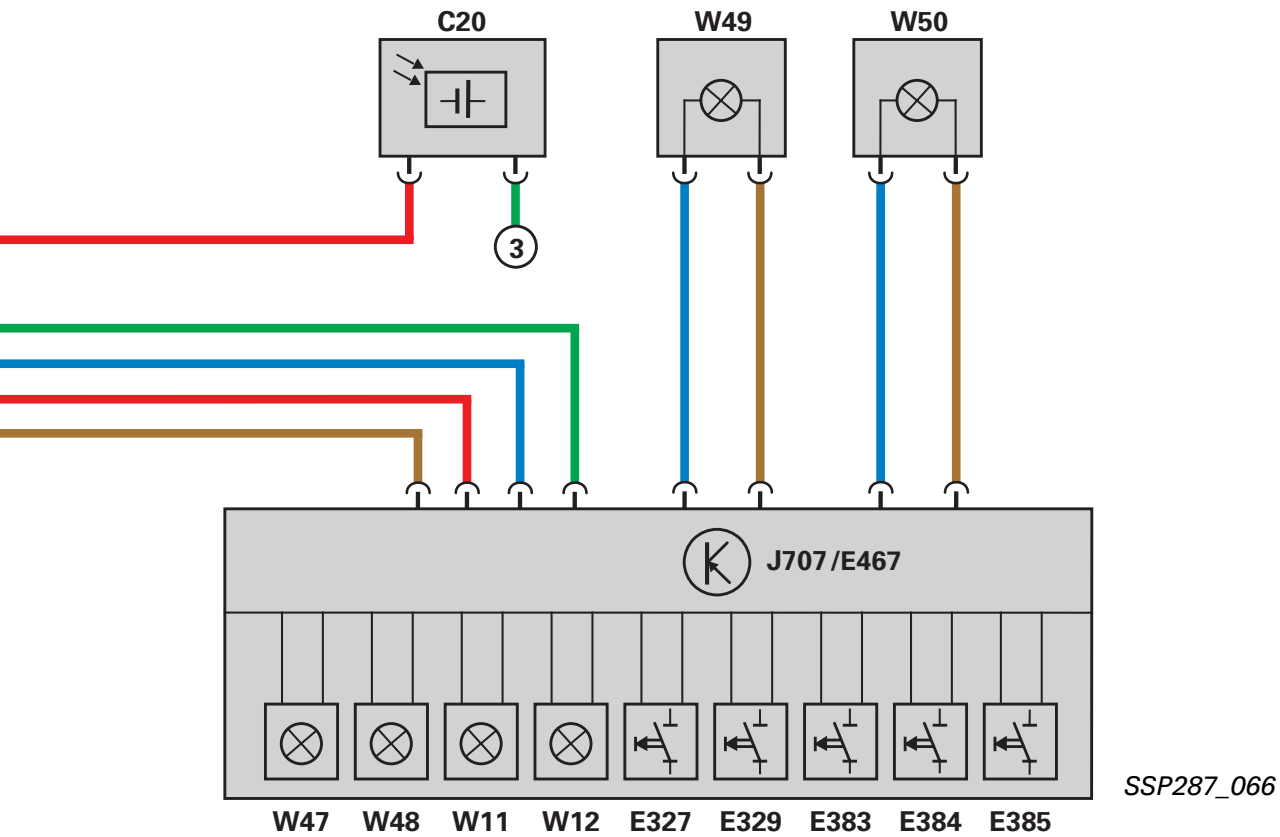
# Control Units

## Block diagram



## Key

- |      |                                      |      |  |
|------|--------------------------------------|------|--|
| C20  | Solar cells                          | G260 | Humidity sender, air conditioner                   |
| E139 | Sliding sunroof adjustment regulator | G273 | Interior monitoring sensor                         |
| E264 | Telematics operating unit            | G274 | Interior monitoring sensor                         |
| E284 | Garage door operating unit           | G399 | Light sensor                                       |
| E326 | Front interior light button          | J528 | Sunroof electronics control unit                   |
| E327 | Rear interior light button           | R164 | Microphone unit in front roof module               |
| E328 | Front reading light button           | V1   | Sliding sunroof motor                              |
| E329 | Rear reading light button            | W11  | Rear left reading lamp                             |
| E383 | Rear left roller blind button        | W12  | Rear right reading lamp                            |
| E384 | Rear right roller blind button       | W14  | Illuminated vanity mirror, front passenger side    |
| E385 | Rear switch for rear roller blind    | F147 | Vanity mirror contact switch, driver side          |
| E467 | Rear roof console                    | F148 | Vanity mirror contact switch, front passenger side |



- W16 Left interior light
- W17 Right interior light
- W20 Illuminated vanity mirror, driver side
- W47 Rear left interior light
- W48 Rear right interior light
- W49 Illuminated vanity mirror, rear left
- W50 Illuminated vanity mirror, rear right
- Y7 Automatic anti-dazzle interior mirror

#### Additional signals

- ① Convenience CAN High
- ② Convenience CAN Low
- ③ Fresh-air blower control unit J126

# Control Units



## Garage door operation control unit J530

The garage door operation control unit J530 permits remote control of the garage door drive mechanism by the driver using the controls in the vehicle. Up to three different garage door drive mechanisms (or other compatible systems) can be matched to three buttons in the front roof module.



SSP287\_052

### Control

Control is implemented by way of three buttons in the front roof module. System matching is implemented with the genuine remote control unit of the garage door drive mechanism manufacturer. The indicator light in the roof module must flash for this. The vehicle turn signal indicators provide feedback on correct implementation of the matching procedure.



Indicator lamp

SSP287\_111

### Fitting location

The garage door operation control unit is no longer located in the sun visor, but rather behind the front left bumper.

This change in location was necessary because the windscreen is made of a special insulating glass which would prevent propagation of the radio waves.



SSP287\_113



## Function master

The master control unit for the garage door operation control unit is the onboard power supply control unit 2 J520. Both are interlinked by way of the LIN. There is no substitute master function.

## Operation

The garage door operation buttons can be actuated by way of the sunroof electronics.

The sunroof electronics control unit J528 transmits the information "Button 1", "Button 2" or "Button 3" on the convenience CAN.

The information is read in by the onboard power supply control unit 2 and relayed via the LIN to the garage door operation control unit.

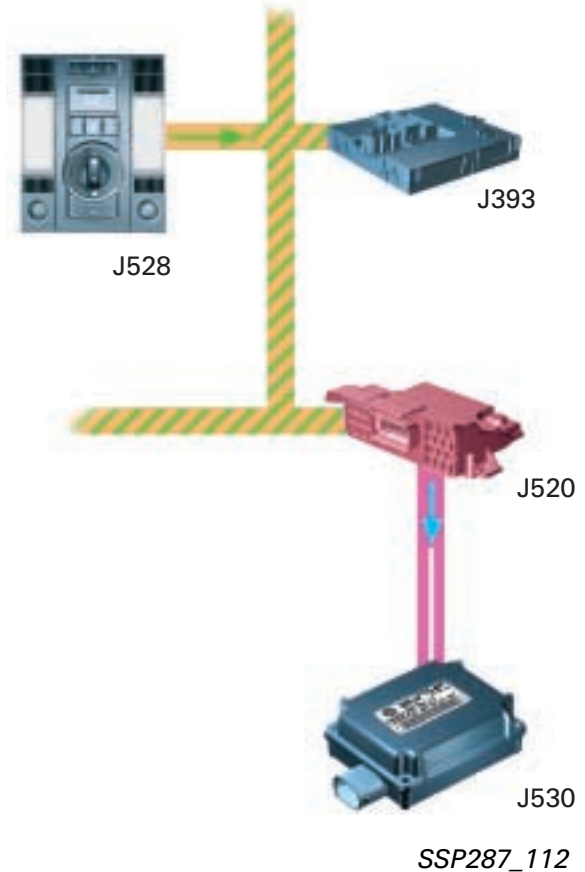
The corresponding command stored in the garage door operation control unit is transmitted by means of radio waves and the matching garage door or other compatible systems open(s).

## Distributed functions

The signals learned and the remote control encoding for the garage doors are stored in the garage door operation control unit J530.

The confirmation flashing function is stored in the convenience system central control unit J393.

The onboard power supply control unit 2 is the LIN master for the garage door operation control unit J530.



## Restriction of functions

Active load intervention by the battery management system does not result in deactivation.

## Component protection

The garage door operation control unit forms part of the component protection system by way of the master control unit J520; this must be released.

## Self-diagnosis

The control unit is provided with self-diagnosis capability by means of address word 4F (electronic central electrics 2).

# Control Units



## Entry and start authorisation control unit J518

### Functions

The entry and start authorisation control unit is the central control unit for

- Key recognition
- Evaluation of ignition/starter switch (entry and start authorisation switch E415)
- Remote control
- Immobilizer
- Component protection
- Advanced Key functions
- Terminal 15 continued operation



SSP287\_050

### Terminal control

All terminal functions relating to

- S-contact
- P-contact
- Terminal 15
- Terminal 75
- Terminal 50

are controlled by the entry and start authorisation control unit. The signals "S-contact", "P-contact" and "Terminal 15 continued operation" are only available as CAN information.

### Versions

Two versions of the entry and start authorisation control unit

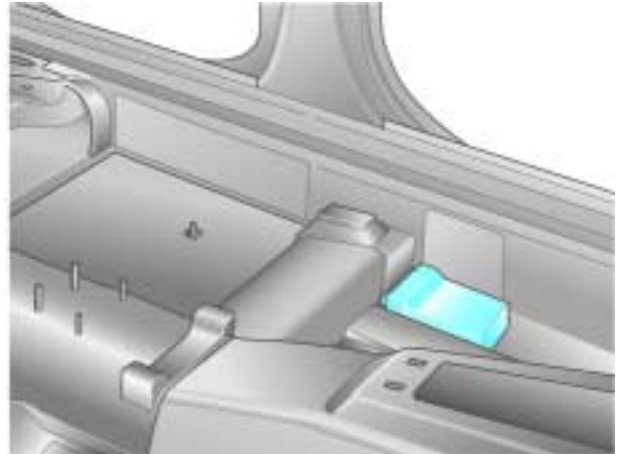
- With and without Advanced Key functions and
- For various country-specific remote control radio frequencies

may be fitted.



## Fitting location

The entry and start authorisation control unit is located in the footwell beneath the driver's seat.



SSP287\_033

## Diagnosis

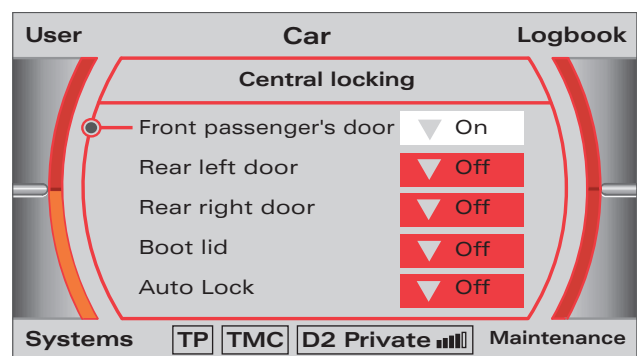
The entry and start authorisation control unit has diagnosis capability even when ignition is not switched on.

## CAR systems

The driver can choose between

- Simultaneous unlocking of all doors and
- Separate unlocking of each door

in the multimedia interface.



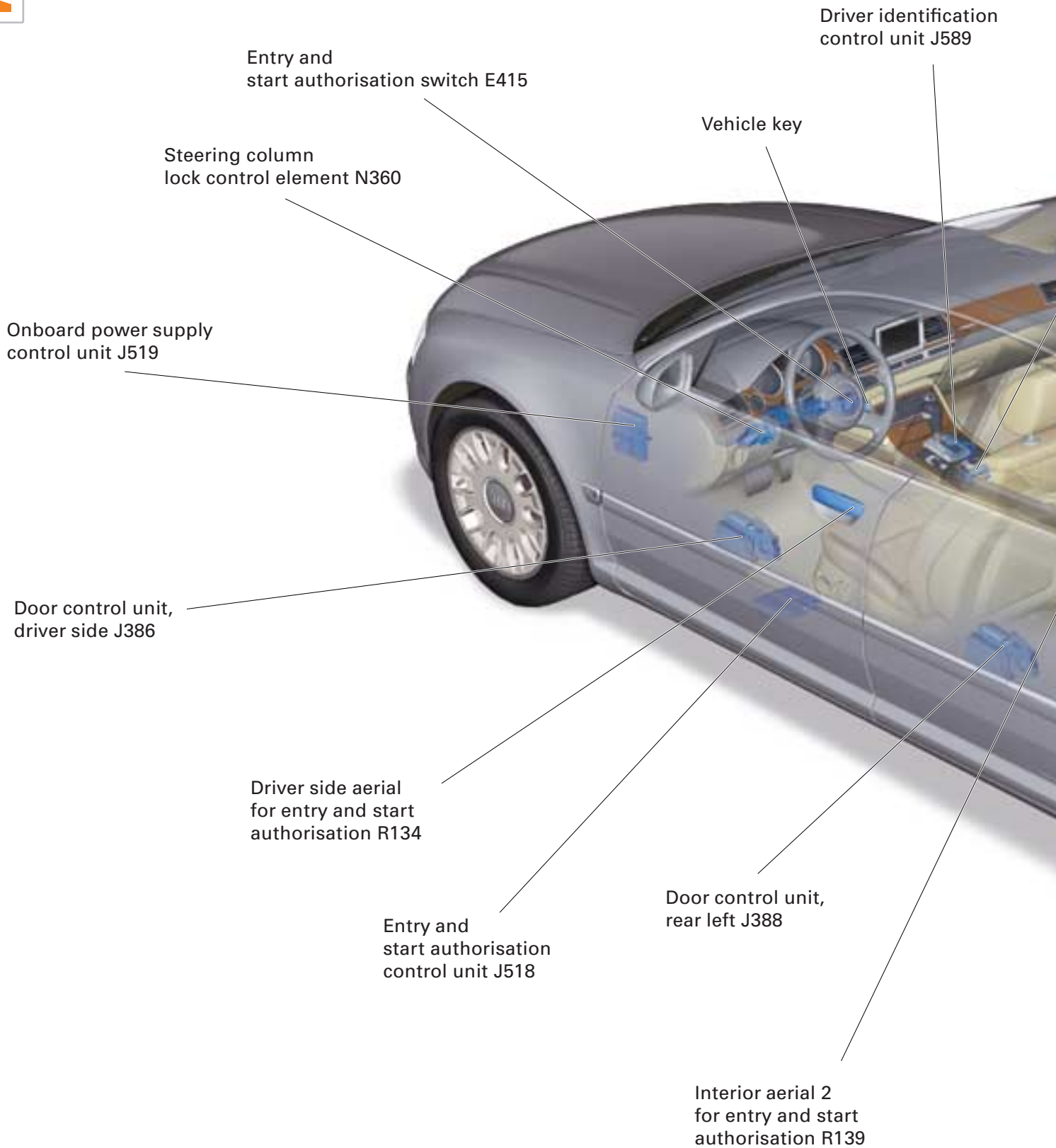
The "immobilizer" and "component protection" functions are described in SSP 294 – VAS 5051 online link.



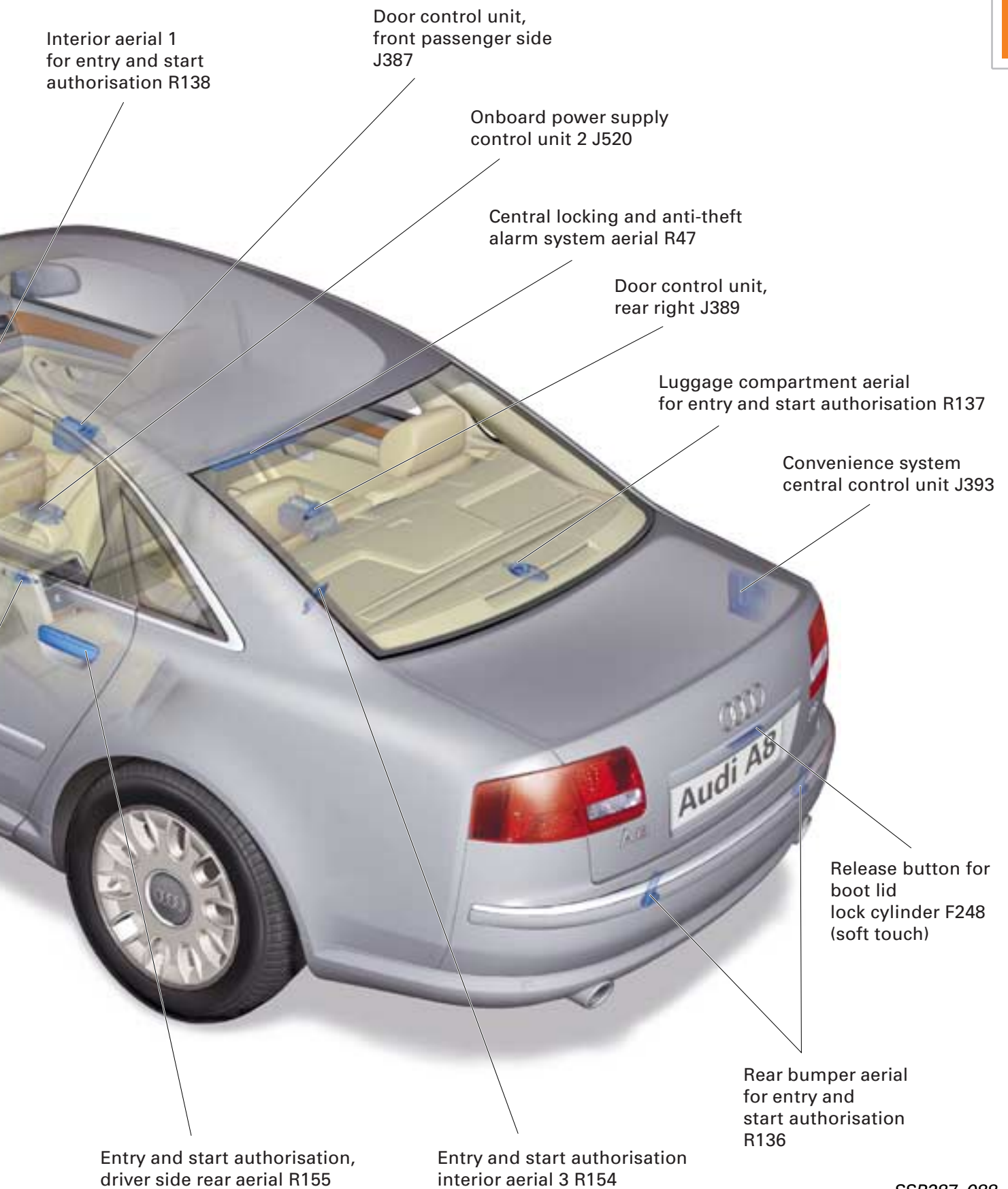
SSP287\_093

# Control Units

## System layout








SSP287\_088

# Control Units

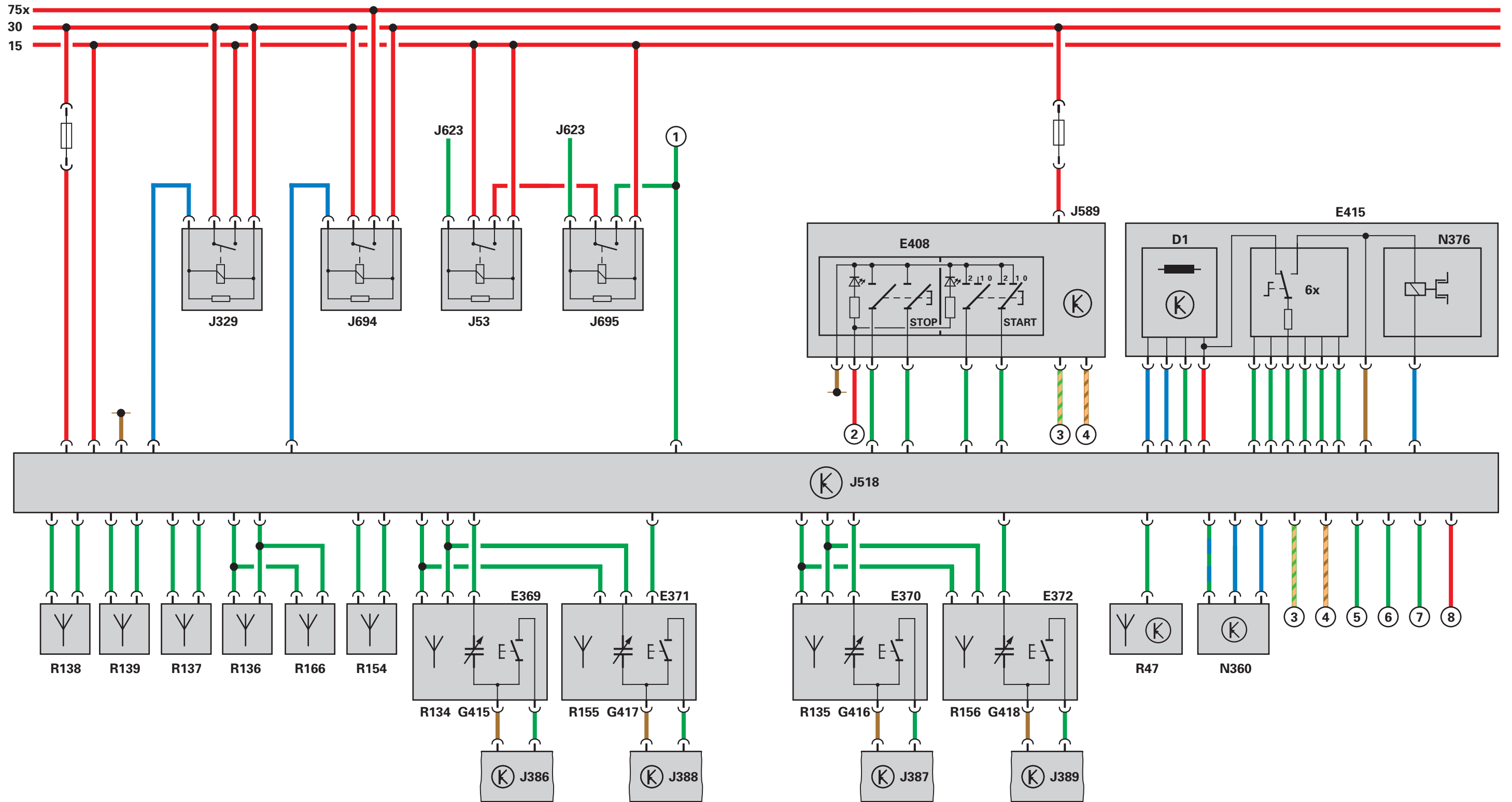
## Block diagram

### Key

- 
- D1 Inhibitor reading unit
- E369 Outer door handle central locking button, driver side
- E370 Outer door handle central locking button, front passenger side
- E371 Outer door handle central locking button, rear left door
- E372 Outer door handle central locking button, rear right door
- E408 Entry and start authorisation button
- E415 Entry and start authorisation switch
- G415 Exterior door handle touch sensor, driver side
- G416 Exterior door handle touch sensor, front passenger side
- G417 Exterior door handle touch sensor, rear left
- G418 Exterior door handle touch sensor, rear right
- J53 Starter motor relay
- J329 Terminal 15 voltage supply relay
- J386 Door control unit, driver side
- J387 Door control unit, front passenger side
- J388 Door control unit, rear left
- J389 Door control unit, rear right
- J518 Entry and start authorisation control unit
- J589 Driver identification control unit
- J623 Engine control unit
- J694 Terminal 75x voltage supply relay
- J695 Starter relay 2
- N360 Steering column lock control element
- N376 Ignition key withdrawal lock magnet
- R47 Central locking and anti-theft alarm system aerial
- R134 Driver side aerial for entry and start authorisation
- R135 Front passenger side aerial for entry and start authorisation
- R136 Rear bumper aerial for entry and start authorisation
- R137 Luggage compartment aerial for entry and start authorisation
- R138 Interior aerial 1 for entry and start authorisation, at multimedia operating unit
- R139 Interior aerial 2 for entry and start authorisation, rear centre
- R154 Entry and start authorisation interior aerial 3, rear centre armrest
- R155 Entry and start authorisation, driver side rear aerial
- R156 Entry and start authorisation, front passenger side rear aerial
- R166 Entry and start authorisation aerial, rear right
- S Fuse

### Additional signals

- ① Terminal 50 (to starter B or engine control unit J623)
- ② Terminal 58s (illumination)
- ③ Convenience CAN High
- ④ Convenience CAN Low
- ⑤ Brake light switch F
- ⑥ Terminal P/N from automatic gearbox control unit J217 (on vehicles with automatic gearbox)
- ⑦ Parking lock auxiliary terminal (automatic gearbox only)
- ⑧ Terminal 15 (CAN)



# Control Units



## Entry and start authorisation switch E415

The entry and start authorisation switch acts as ignition/starter switch.

The lock cylinder of the switch has no mechanical encoding, i.e. it can be turned with any key. The key is identified solely by way of the reading unit D1 with transponder interrogation.

The transponder information is transmitted in encoded form via a 3-wire bus to the entry and start authorisation control unit, where it is evaluated.

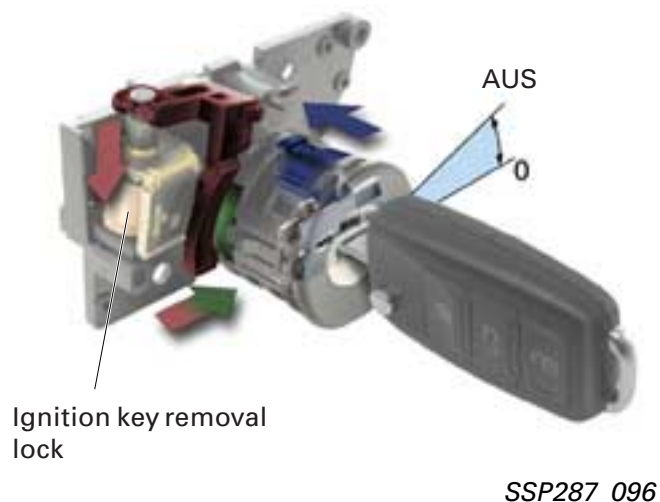
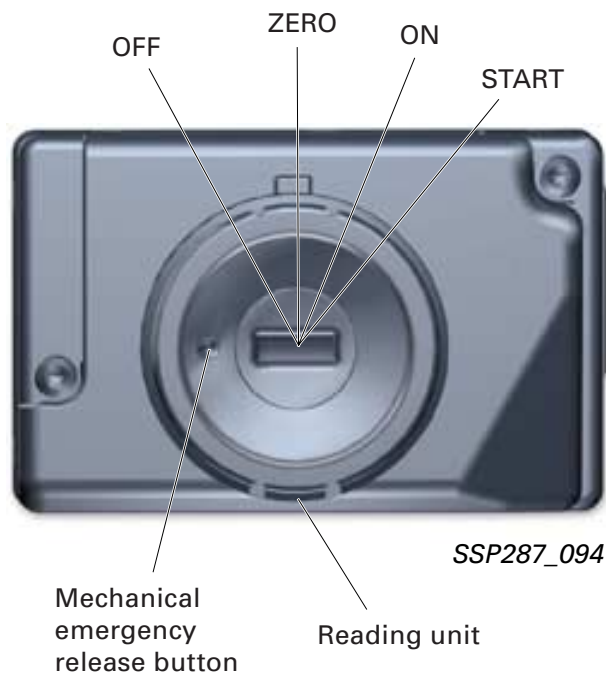
The switch has three non-locking positions. In the same manner as an ignition/starter switch, the switch can be turned to the right with the key to ON and START positions. Turning to the left switches off the ignition. If the key is not actuated, the lock returns to the ZERO position.

The four switch positions (OFF, ZERO, ON, START) are interrogated by way of 6 switches. All 6 signals are evaluated by the entry and start authorisation control unit.

This ensures that the system remains fully operational should one switch fail. In the event of a fault, a message appears on the centre display and a fault memory entry is set.

The switch positions can be interrogated using the control element test.

The ignition key removal lock integrated into the switch locks the key bit in position in the lock. Mechanical emergency release is provided for removing the key in an emergency. Release involves turning the key to the OFF position and pressing the release button, e.g. with a ball-point pen.

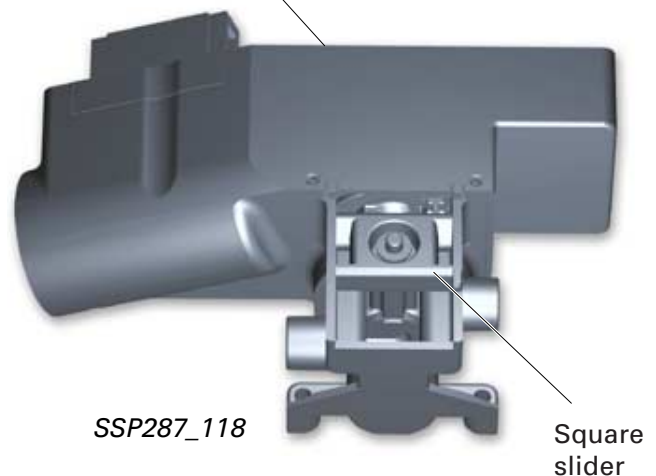


### Steering column lock control element N360

To lock and release the steering column, the steering column lock control element is actuated by the entry and start authorisation control unit via a bidirectional bus. The steering column lock control element is only supplied with voltage by the entry and start authorisation control unit when terminal 15 is OFF. A motor is actuated by the integrated electronics. The locking pin is moved linearly by way of a worm drive and a swash plate.

The locking pin engages in the steering mechanism at a square slider with bevelled inner splines. The linear movement causes the inner splines to lock the steering column. The steering column lock is connected to the steering column by means of shear bolts and cannot be replaced separately.

Drive unit  
(electric motor and worm drive)



### Entry and start authorisation button E408 (optional)

The START button is of two-stage design. The first stage switches on the ignition. The second stage starts the engine. For safety reasons, use is made of a dual-action STOP button with two simultaneously actuated NO contacts. Pressing the STOP button switches off the ignition if the automatic gearbox selector lever is set to "P" or "N". Pressing the button for more than two seconds deactivates the S-contact. Diagnosis for all signals is provided by way of measured value blocks in the entry and start authorisation control unit.



SSP287\_090



# Control Units



## Central locking buttons E369 to E372 (optional)

A button for locking the central locking system is fitted in each door handle. The central locking system can only be locked if a key is recognised by an external aerial on the same side of the vehicle as the key.

## Exterior door handle touch sensors G415 to G418 (optional)

The capacitive sensors are integrated into the outer door handle and are actuated with DC voltage. The entry and start authorisation control unit evaluates the sensor current. One capacitor plate each is integrated into the handle and mount.

The finger recess acts as a dielectric. Insertion of a medium between the capacitor plates alters the capacitance and results in a brief flow of current. This current is detected and evaluated by the entry and start authorisation control unit.

## Entry and start authorisation aerials R134, R135, R138, R155, R156 (optional)

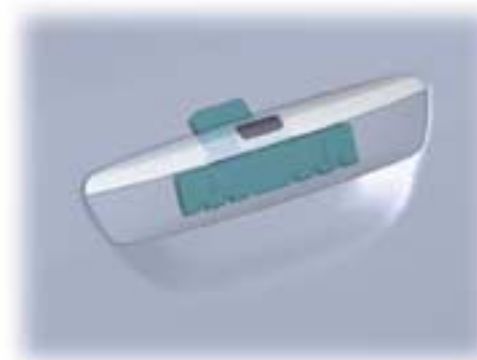
A ferrite aerial is integrated into each outer door handle for the transmission of signals by the entry and start authorisation control unit to the vehicle key. A further ferrite aerial is located at the multimedia operating unit E380.

## Entry and start authorisation aerials R136, R137, R139, R154, R166 (optional)

Air-core coil aerials for key recognition are fitted at the rear of the passenger compartment, in the luggage compartment beneath the rear shelf and in the rear bumper.



SSP287\_095



SSP287\_097



SSP287\_091

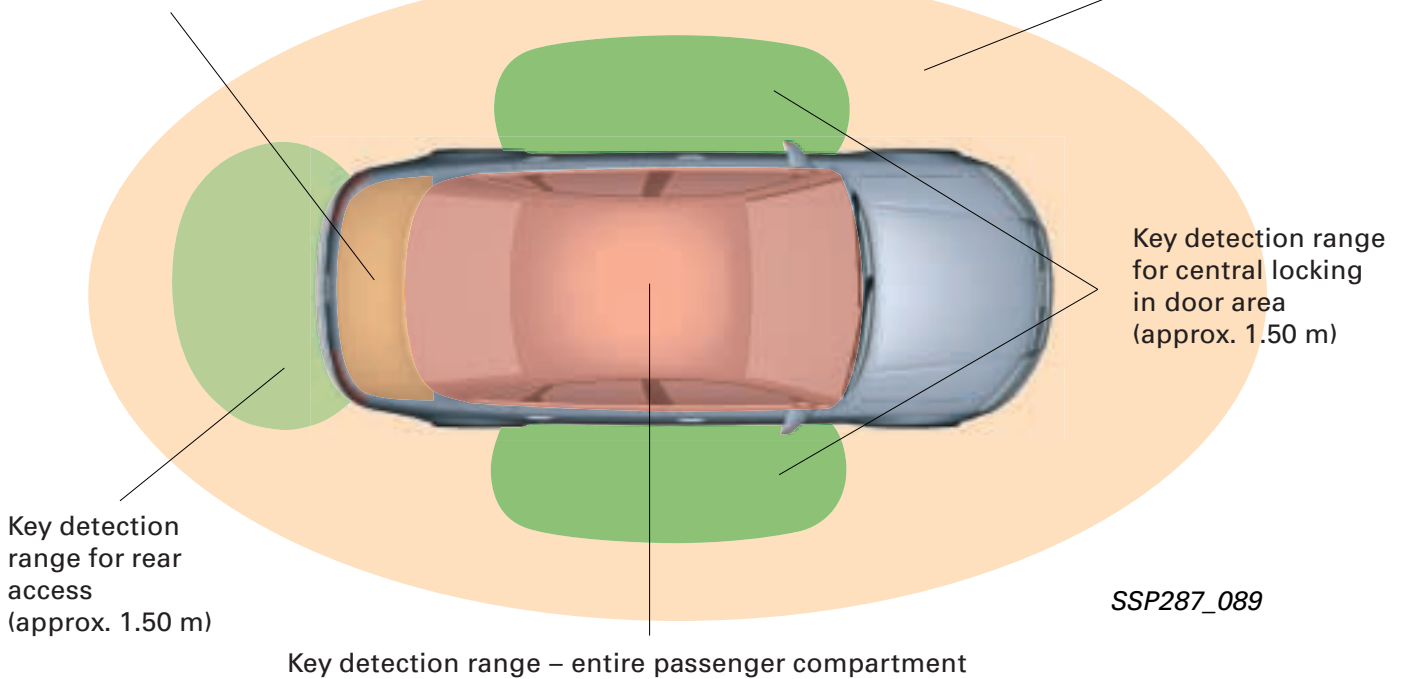


SSP287\_092

## Detection ranges for vehicle key with Advanced Key

Key detection range for luggage compartment

Remote control operation of central locking system  
Convenience locking range: 6 m  
Remote control: > 15 m



Key detection range for rear access (approx. 1.50 m)

SSP287\_089

## Key functions with Advanced Key

If a vehicle key is in the central locking detection range, the vehicle can be unlocked by reaching beneath a handle or locked by pressing a central locking button in the outer door handle. If there are other keys in the passenger compartment when locking, these can no longer be used for starting.

Depending on the settings made in the "Central locking" menu in the MMI, either the entire vehicle can be unlocked or just certain doors (refer to Page 79). Unlocking one door always unlocks the driver's door as well.

If there is a vehicle key in the luggage compartment detection range, the luggage compartment is opened again after it has been locked.

If there is a vehicle key in the passenger compartment, the ignition can be switched on/the engine started by way of the entry and start authorisation button E408. At the same time, the automatic gearbox selector lever must be set to "P" or "N" and the brake pedal pressed.

To stop the engine, the gearbox selector lever must be set to "P" or "N". Keeping the STOP button pressed or opening the driver's door deactivates the S-contact and the electromechanical steering column lock is engaged.

If no key is detected in the passenger compartment with "Advanced Key ON", a message appears in the centre display as soon as

- A window is opened or
- The sunroof is opened or
- A door is opened or
- After accelerating from low speed to in excess of 15 km/h



# Control Units



## Driver identification control unit J589

(one touch memory)

The control unit implements a convenience system which assists the driver in making individual settings for various vehicle systems. It permits the storage of individual settings for four different users in the vehicle.

The control unit is located in the centre console next to the gearstick/selector lever.

### Design

The entry and start authorisation button E408 and driver identification control unit form one physical unit.

The button features an integrated sensor foil with electrical connections which can detect finger contact.

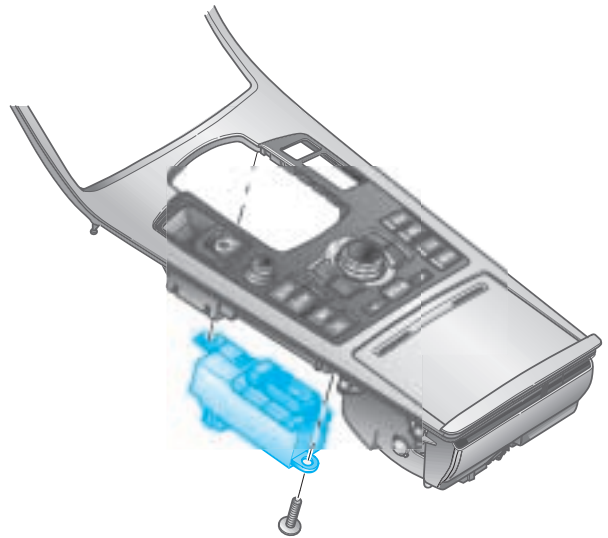
### Operation

On pressing the entry and start authorisation button, the fingerprint is read in via the sensor foil.

Following successful identification of a matched user, a user ID is transmitted to the convenience CAN by the driver identification control unit if terminal S is active.

The user ID is recognised by all control units involved in memory control.

The personalised settings stored are then activated and implemented.



SSP287\_031



SSP287\_011





## Restriction of functions

The following operating statuses result in the restriction of functions:

- Undervoltage < 9 V
- Overvoltage > 15 V
- CAN bus fault
- Component protection active

Possible fault messages in the dash panel insert display and in the front information and display unit (MMI):

- "User not identified"  
Remedy: Finger must be applied again
- "Sensor contaminated"  
Remedy: Clean sensor with a clean lint-free cloth

The user ID is read in by the following components:

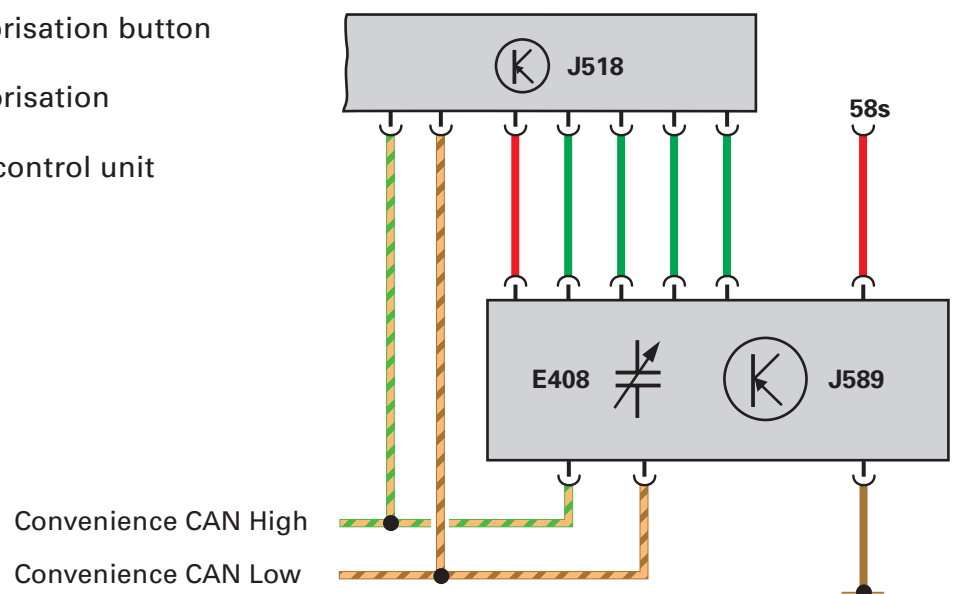
- Sunroof electronics control unit J528
- Parking aid control unit J446
- Data bus diagnostic interface J533
- Convenience system central control unit J393
- Climatronic control unit J255
- Seat adjustment and steering column adjustment with memory control unit J136
- Door control unit, driver side J386

## Block diagram

E408 Entry and start authorisation button

J518 Entry and start authorisation control unit

J589 Driver identification control unit



SSP287\_008

# Control Units



## Fingerprint recognition

The fingerprint recognition function compares a print to the fingerprints stored in the driver identification control unit.

The system is based on the fact that every person has a different fingerprint with particular characteristic features (minutiae) regardless of whether the prints are from the same finger.

For comparison of two fingerprints, at least 80 % of the area being compared must coincide.

To ensure accurate results, the shape of the START button was designed such that the user's finger is always applied in virtually the same position.

The front narrow side of the START button forms a stop to prevent excessive deviation in longitudinal direction.

Due to the combination with the START button, there is a possibility of non-recognition if excessive force (> 12 N) is exerted with wet hands. For this reason, in the case of a second attempt following non-recognition, the system switches to a trigger mode which constantly reads in images and does not evaluate an image until adequate quality has been achieved.

There are very few people who are not suitable for matching to the system because the fingerprint sensor is not able to recognise any usable images. Possible examples include very dry and chafed hands or skin disease. Such people cannot make use of the driver identification system.

Recognition stages:

- 1 Recording of fingerprint by capacitive sensor



SSP287\_103

- 2 Generation of a grey step image



SSP287\_104

- 3 Processing of sensor data in control unit (image processing)



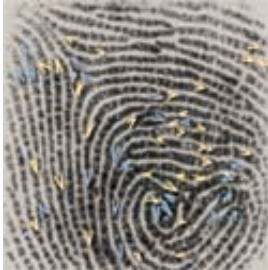
SSP287\_105

- 4 Characteristic feature filtering  
The fingerprint contains information in the form of ridges, branches, whorls and loops.

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- 5 Recognition of characteristic areas (minutiae)



SSP287\_107

- 6 Interlinking of minutiae by way of a complex grid



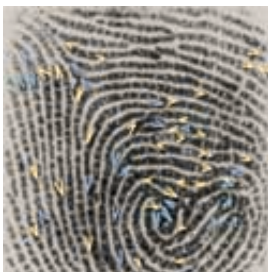
SSP287\_108

- 7 Storage of angle, spacing and number of finger ridges between minutiae as well as type of minutiae



SSP287\_109

- 8 Comparison of characteristic feature list to archive (matched finger)



SSP287\_107

- 9 Following definite identification of the image of the finger concerned, the user ID is transmitted by the driver identification control unit on the convenience CAN.



SSP287\_110

Following successful identification, the name is marked in the MMI user menu under CAR/user.

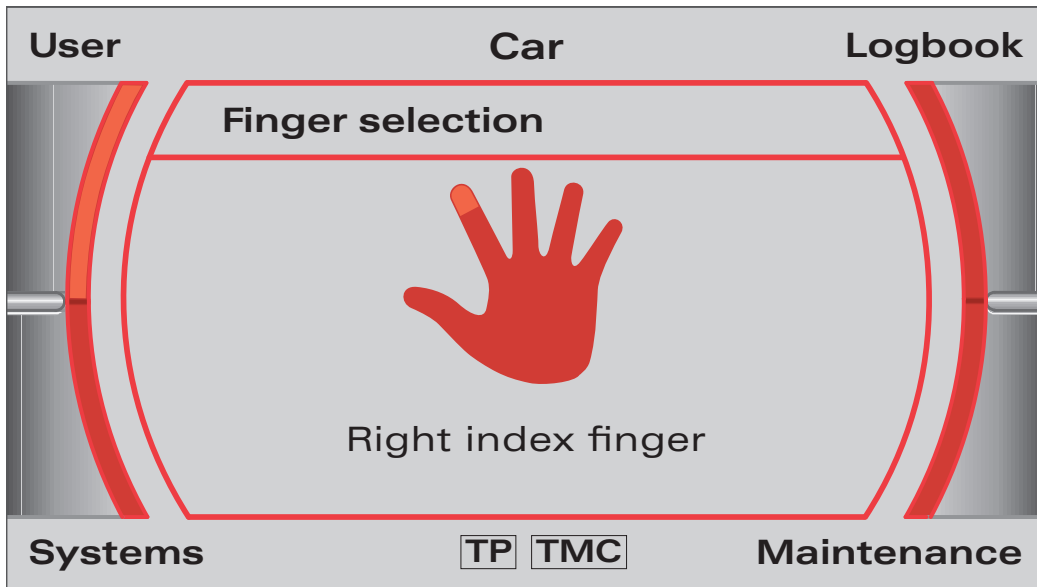
The control units concerned set the values stored for the corresponding user ID.

In the event of non-recognition, the driver is informed by way of a fault message in the dash panel insert display:

"User not identified"

# Control Units

## Matching



SSP287\_101

New user matching is implemented by way of the "CAR" menu in the multimedia interface (MMI) and can be performed for four users. A maximum of 5 fingers can be matched per user.

The MMI provides user prompting for the matching process to ensure optimum image quality.

Finger matching is performed by placing it on the sensor three times in succession with moderate pressure (< 12 N). The first time, the finger should be placed in normal centre position, then approx. 2 mm to the left and finally 2 mm to the right.

Further prints may be necessary depending on image quality. If this is the case, the user will be informed by way of an appropriate prompt in the MMI.

Three finger images must be read in and stored before a person can be identified.

At least one finger must be matched.

To rule out identification problems, it is however appropriate to match two or several fingers.

## Diagnosis

Address word1D - driver identification

Fault entries can occur:

- If supply voltage is exceeded or undershot
- If communication with
  - Entry and start authorisation control unit J518
  - Data bus diagnostic interface J533
  - Energy management control unit J644
  - Door control unit, driver side J386

is interrupted

- In the event of incorrect component protection basic setting/adaption

The faults entered can be processed by way of the assisted fault-finding.

A user ID can be output on the convenience CAN to check user identification.

This only involves implementation of the convenience settings; access to customer personal data (email, etc.) is not possible.



## Adaption

Channel 1 – Erasing of individual user  
by selection of corresponding  
user ID

Channel 2 – Erasing of all users

## Measured value block

All input signals can be displayed.

	<h1>Notes</h1>	



