

Service.



Self-Study Programme 235

The Multi-Function Steering Wheel

Design and Function



MULTI-FUNCTIONS

STEERING

CRUISE CONTROL SYSTEM

AIRBAG

RADIO

CASSETTE

CD PLAYER



...

...

TELEPHONE

HORN

HEIGHT ADJUSTMENT

REACH ADJUSTMENT

MULTI-TALENT

235_022

Raising the comfort for the driver of a vehicle has always been a high priority for the vehicle constructor.

The concept of positioning regularly used switches and safety elements on the steering wheel is the aim of this endeavour.

Originally the regulators for the accelerator and the ignition timing were positioned next to the horn contact, today in addition to the horn we find levers and buttons for the headlights, turn signals, cruise control system, radio, telephone, CD player etc.

Apart from this, the steering wheel contains functional elements such as the airbag and, under certain conditions, a vibration damper.

Such a versatile steering wheel is known as a multi-function steering wheel (MFW).

NEW



**Important
Note**



**The Self-Study Programme presents the design
and function of new developments!
The contents are not updated.**

Please always refer to the relevant Service literature for current test, adjustment and repair instructions.



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- Self-diagnosis
- Function diagram

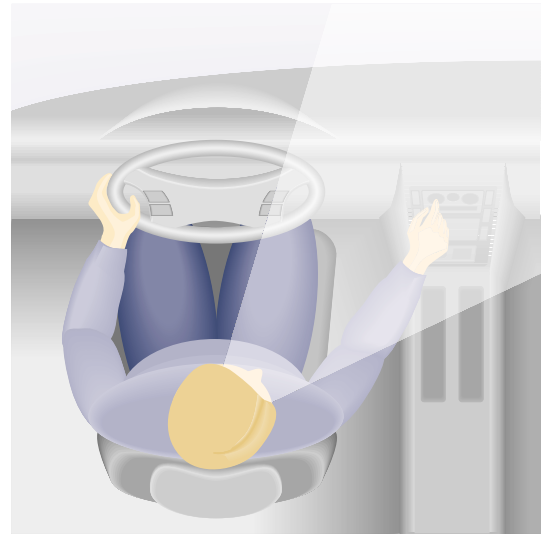


Introduction



At the moment the driver must remove his hand from the steering wheel, or even take their eye off the road ahead, to adjust the volume of a radio, select another radio station or to operate the cassette/CD player.

The driver's attention is distracted from the road ahead and therefore dangerous situations may be recognised too late, or even provoked.



235_009

Telephoning in the vehicle, whilst driving, creates an even more critical situation.

With some hands-free systems the handset must be held in the hand to dial or send a telephone number.

Even the use of speed-dial functions may severely distract a driver.

To reduce these moments of danger and to increase the convenience factor still further, some of the regularly used functions for

- the radio,
 - the cruise control system (CCS)
 - and the operation of the telephone
- have been integrated into the rocker switches in the steering wheel.

Such an equipped steering wheel is known as a Multi-function steering wheel (MFW).



235_010

Description

Two switch modules are integrated into the left and right-hand sides of the airbag unit in the multi-function steering wheel next, to the horn controls.

These modules are rocker switches each with two functions.

These buttons can remotely control

- the radio,
- the cruise control system (CCS)
- and the telephone.

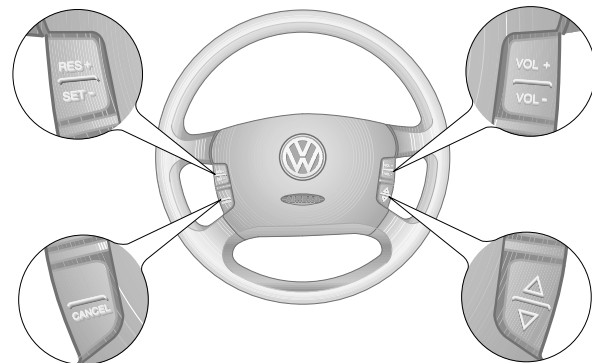
An additional button is integrated into the back of the left-hand button module to switch-off the illumination of the buttons.

There is a short delay when switching the illumination ON/OFF.

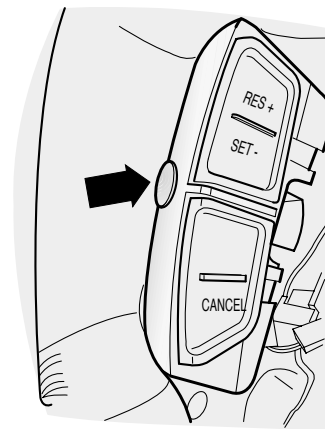
The electrical connections between the steering wheel electronics and the onboard supply is established via a coil connector in the steering wheel.

The transfer of data between individual components is via a single wire data bus.

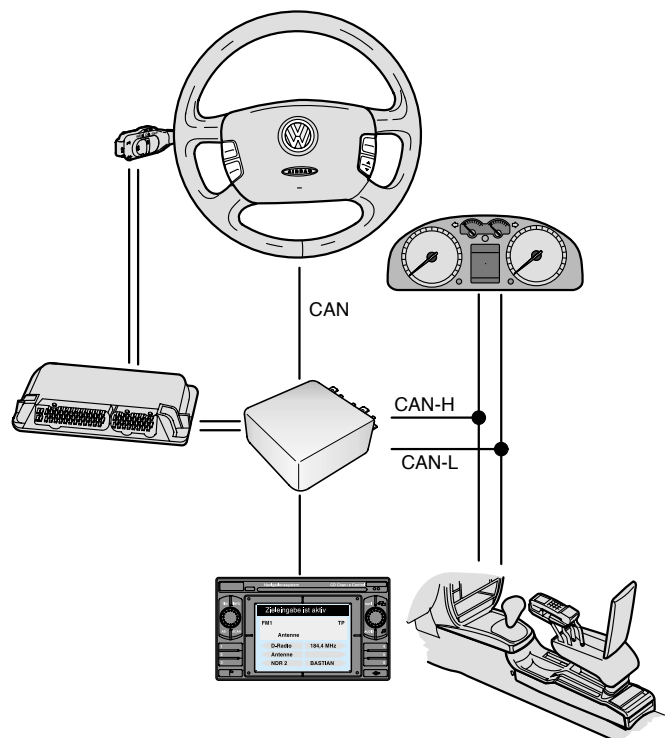
The central display of the combi-instrument in the dash panel insert (Highline display), displays the radio station, the CD title/number or the name and telephone number stored on the telephone SIM card when audio/telephone system is in operation.



235_020



235_026



235_018



Some models have a vibration damper in the multi-function steering wheel (MFW) to reduce vibrations.



MFW design

Variants

The multi-function steering wheel is available in two different versions:



Audio/CCS variant

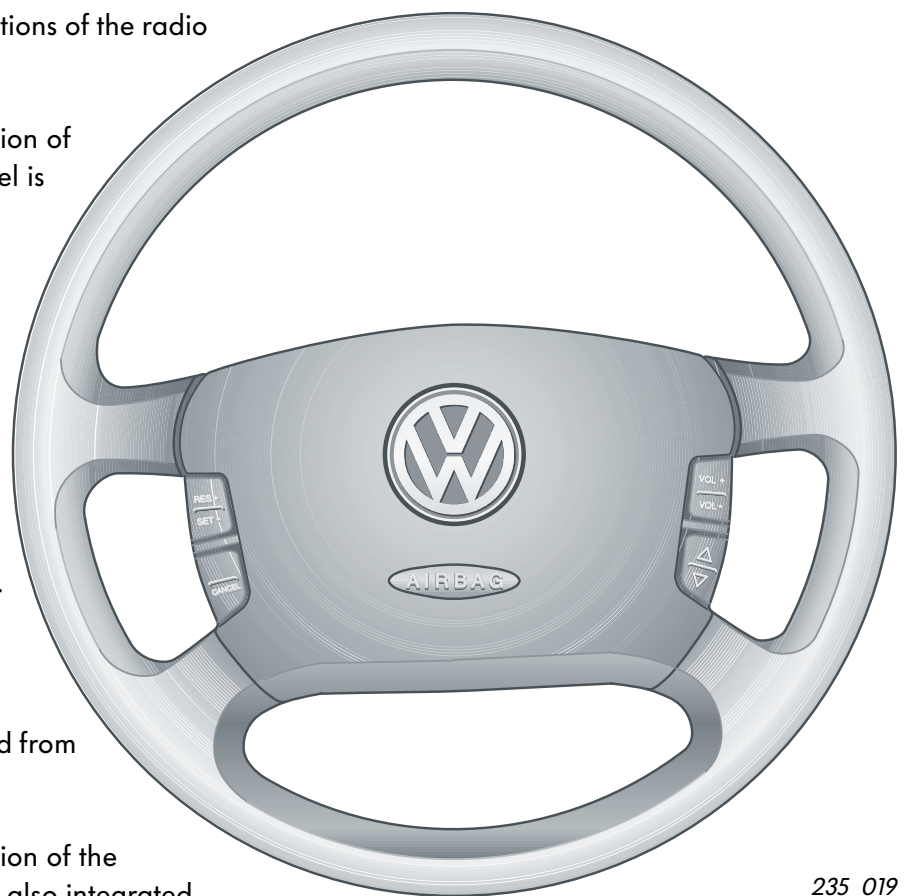
MFW can remotely control functions of the radio and CCS.

A button to control the illumination of the buttons on the steering wheel is also integrated.

Audio/CCS/telephone variant

In addition to the above mentioned functions, the fitted telephone can also be controlled from the steering wheel.

A button to control the illumination of the buttons on the steering wheel is also integrated.



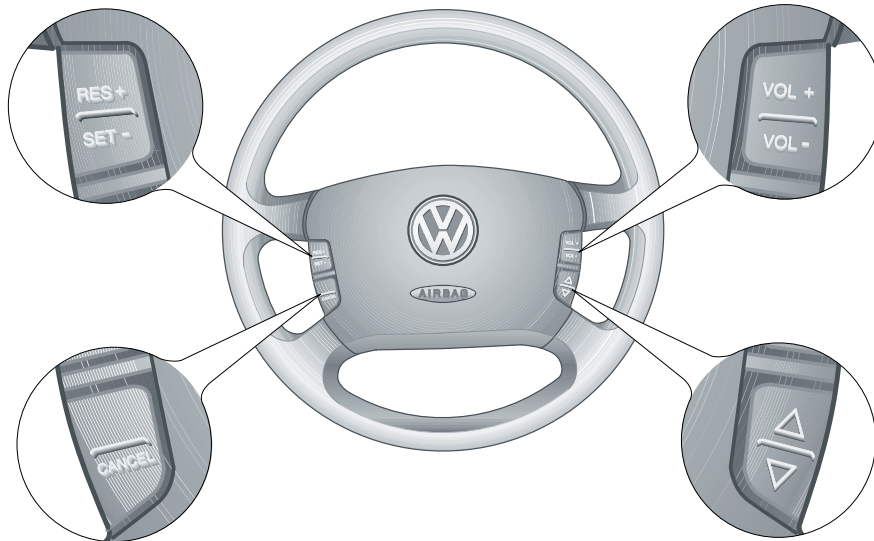
235_019



With both variants of MFW, the selection of radio, cassette or CD changer operation is made directly on the radio unit as before.

Button assignment

Audio/CCS variant



235_020

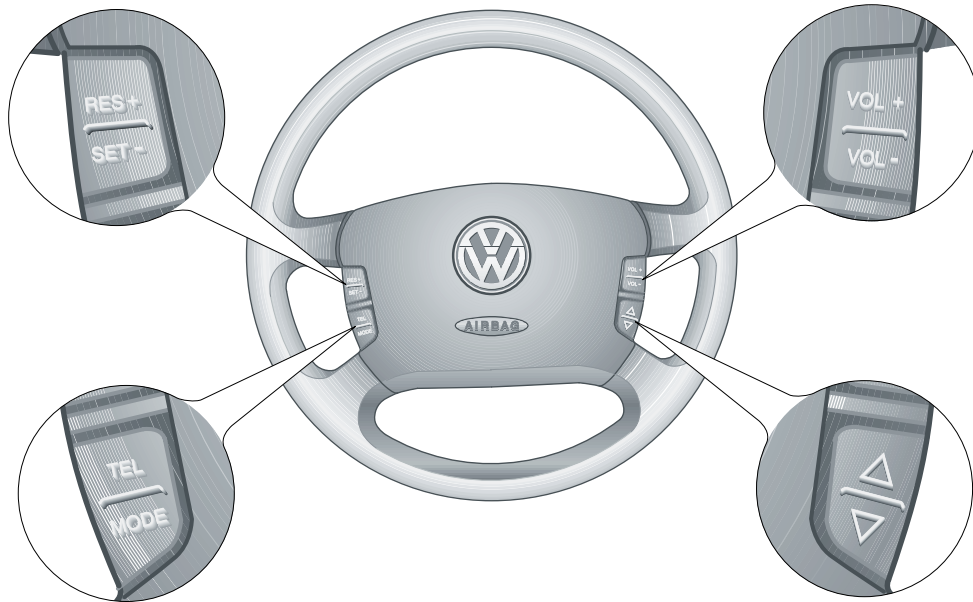
Button module	Button symbol	Function	Significance
Right	VOL +	Volume "up" Louder	Increases volume
	VOL -	Volume "down" Quieter	Decreases volume
	△	Scroll "up" Station search up	Radio: Station search, up Cassette: Fast forward CD: Title search forwards Telephone: Scroll up
	▽	Scroll "down" Station search down	Radio: Station search, down Cassette: Fast rewind CD: Title search backwards Telephone: Scroll down
Left	RES +	Resume Resume stored speed	Speed of vehicle will increase or will be resumed
	SET -	Set Store or reduced speed	Current speed will be stored or reduced
	Vacant	Vacant	Blocked mechanically
	CANCEL	CCS off;	Switches CCS off
Rear		Button illumination	Button illumination ON/OFF



MFW Design

Button assignment

Audio/CCS/telephone variant



235_021

The lower rocker of the left-hand button module is assigned differently to the Audio/CCS variant.

Button module	Button symbol	Function	Significance
Lower left	TEL	Telephone	Initiate call Accept call End call
	MODE	Change-over	For radio/CC/CD: switch to telephone mode For telephone: switch to radio mode
Lower right	△	Search telephone book	Search telephone book upwards
	▽		Search telephone book downwards

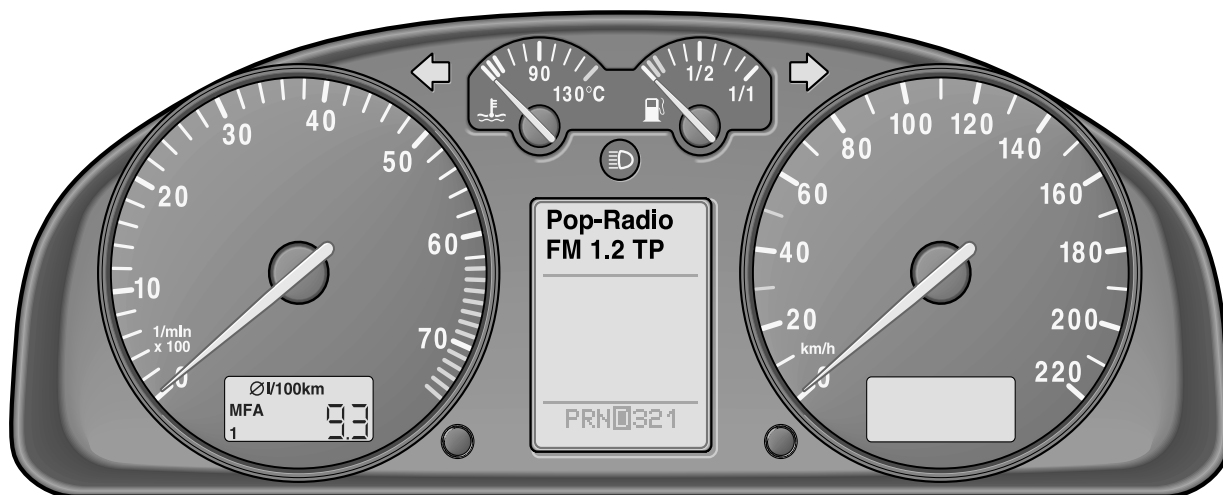
The CCS function "CANCEL" is controlled from the CCS switch.

The functions for the horn and airbag remain unchanged.

Display

Highline display

Example: Radio mode



235_012

MODE	Radio	Compact cassette (CC)	CD player	Telephone
Display	Pop-Radio FM 1.2 TP	TAPE ◀ ▶	CD 02 TR 09	MEIER 0234567
Significance	Station name Station frequency	Cassette forwards or rewind	CD number Title number	Name or telephone number of subscriber *

- * The name of the subscriber is displayed when the name is stored. Otherwise the number transmitted will be displayed or "Call", will be displayed when no number is transmitted.

MFW design

When in telephone mode additional display texts are activated.

They equate to the standard operating texts displayed by a mobile telephone etc.



Following texts can, for example, appear on the display:

Connection to transmitter is not possible; connection will be disconnected

No telephone (SIM) card in telephone unit

Enter PIN code

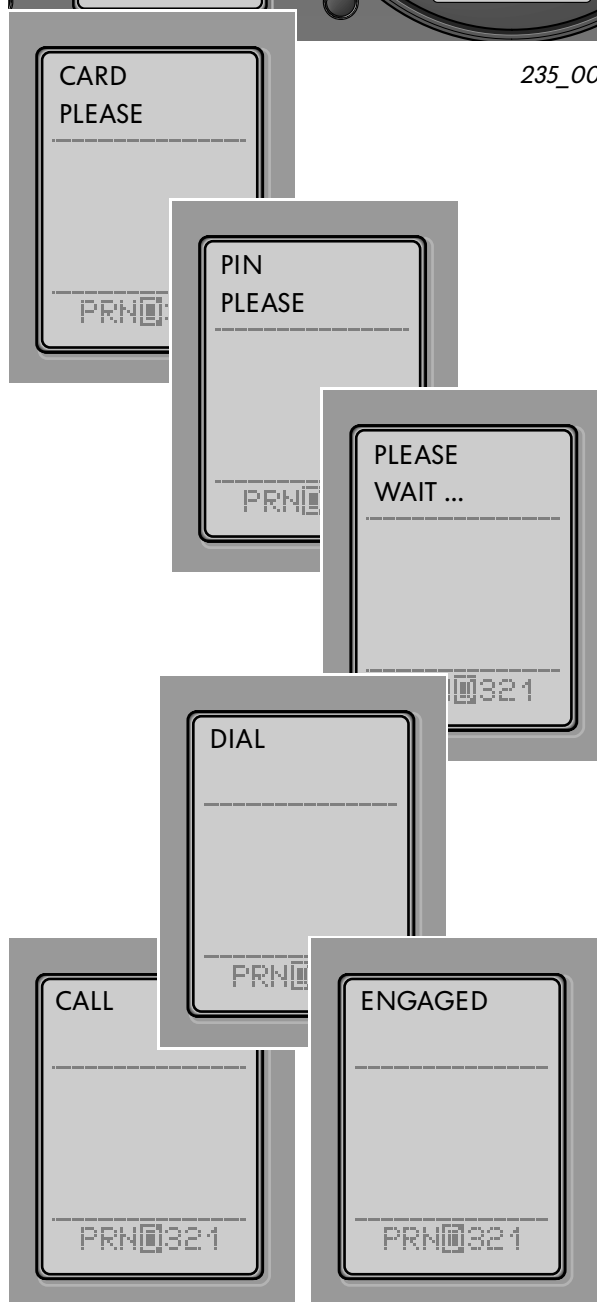
Telephone (SIM) card being read

Incoming call

Line engaged



235_005



235_006

Operation

Example: telephone

Incoming call

- Telephone rings, **“CALL”** e.g. appears in central display; press **“TEL”** on left-hand button module
- The hands-free system switches to **“ON”** automatically
- When the telephone number of the caller is stored on the telephone SIM card, the callers name appears on the central display of the combi-instrument
- **Telephone** as normal
- Once call has ended press **“TEL”** button
- The hands-free system switches to **“OFF”** automatically
- Call ended **“END CALL”**
- With **“MODE”** button you can return to radio mode

or

if the function “Accept calls automatically” is activated:

- The hands-free system switches automatically to **“ON”** after 3 rings
- **Telephone** as normal
- The subscriber ends call and the hands-free system automatically switches to **“OFF”**

Outgoing call

- Depress **“MODE”** button to change to function **“TEL”**; use button **“△”** and **“▽”** (lower right-hand button module), to scroll through the telephone book until the required name or telephone number appears on the central display of the combi-instrument; Once the item desired appears press **“TEL”** button and telephone dials the number displayed; **“DIAL”** appears in the central display
- Once the subscriber has accepted the call the hands-free system switches to **“ON”**
- If the number dialled is engaged then **“ENGAGED”** appears on the central display
- Calls are ended by pressing the **“TEL”** button; the hands-free system switches to **“OFF”**
- Call ended **“END CALL”**
- With **“MODE”** button you can return to radio mode

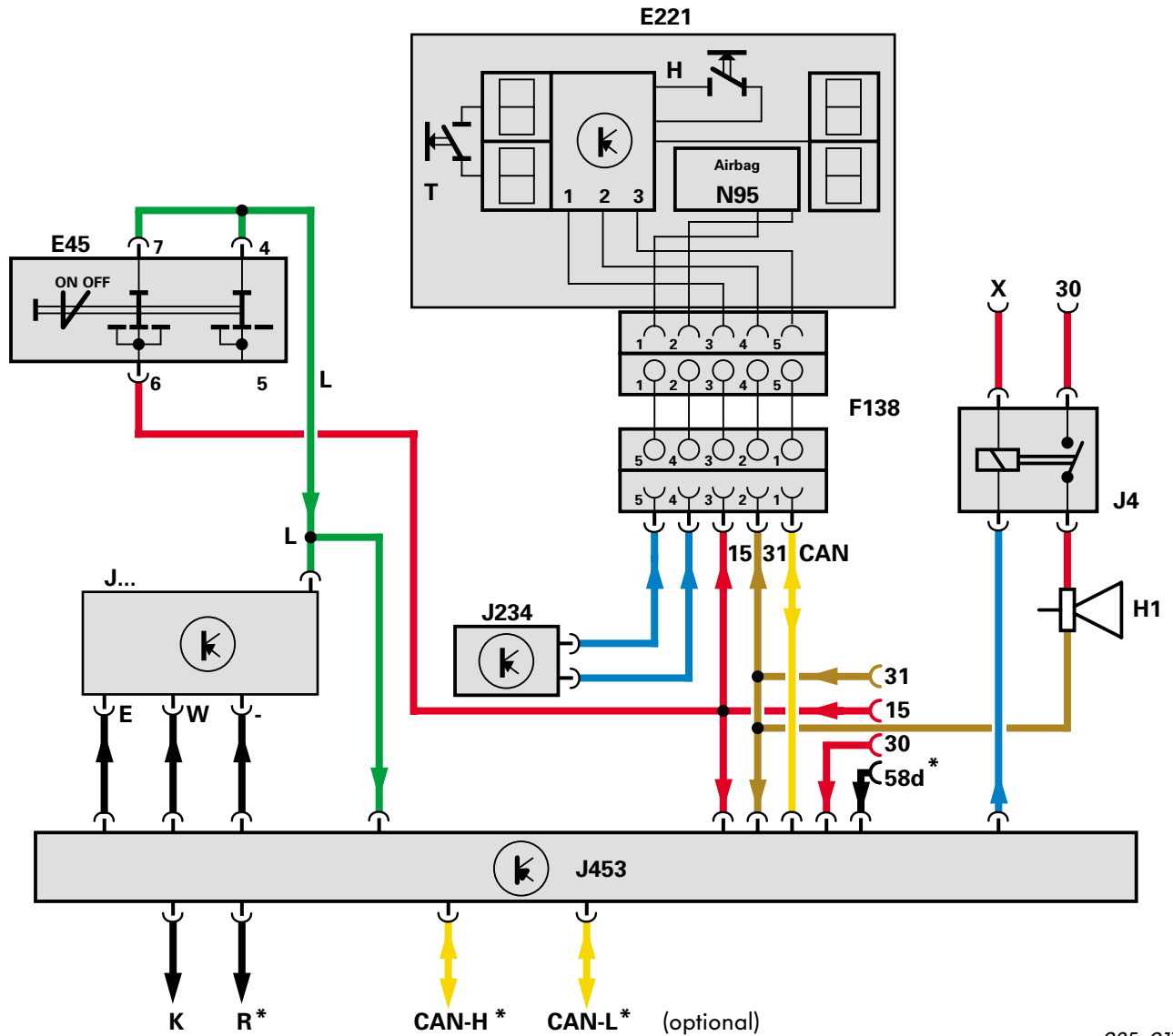
Note:

Pressing once:
jumps to next entry;
Pressing longer (approx. 2 seconds);
scrolls through alphabetically;



Electrical circuits

Block circuit diagram



235_017

E 45	CCS switch	J234	Airbag control unit
E221	Multi-function steering wheel (steering wheel operating unit)	J453	Multi-function steering wheel control unit
F138	Coil connector	K	Diagnostic connection
H	Horn plate	N95	Airbag igniter, driver's side
H1	Horn	R	Radio
J...	Engine control unit	T	Button for illumination of button module
J4	Dual tone horn relay		

* when CAN, then R and 58d are omitted

Coil connector

Design and function

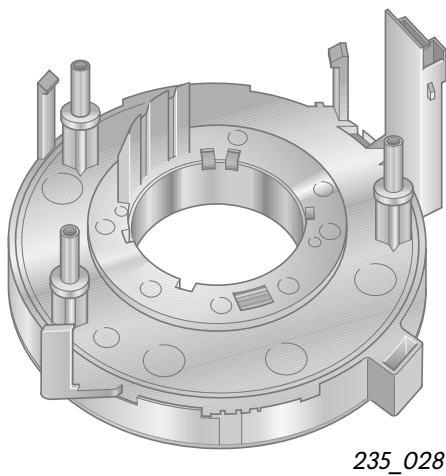
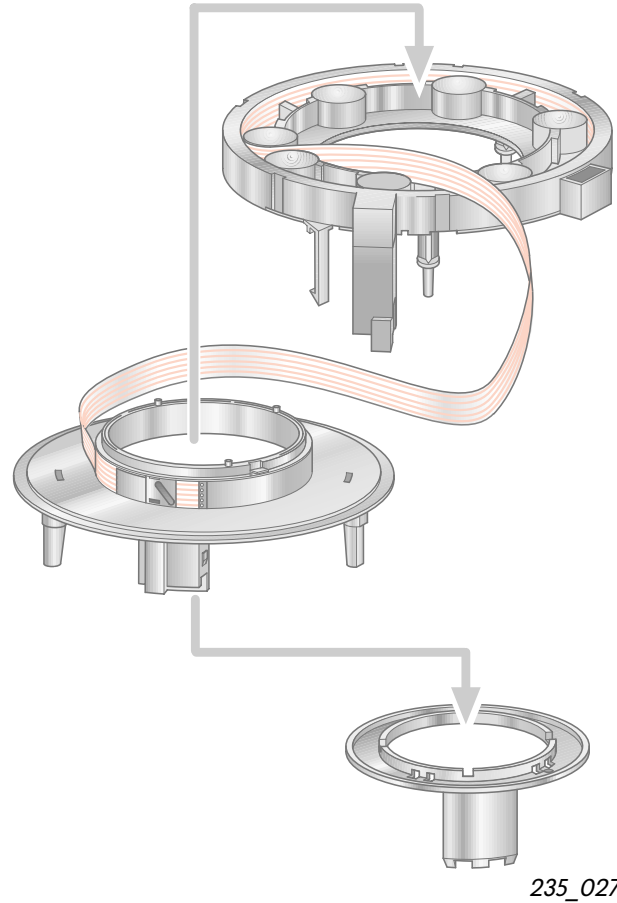
The electrical connection between the rotating steering wheel, with its steering wheel electronics, and the onboard electrics is provided by a highly flexible coil connector.

With increased desires for more comfort and safety, ever more functions are being controlled from the steering wheel. The number of available conductors is limited.

The multi-function steering wheel uses a coil connector with five conductors. These circuits are printed on a highly flexible strip.

The five conductors are used for:

- the triggering of the driver's airbag (2 conductors),
- the current supply for the operating units in the steering wheel (2 conductors) and
- the CAN wiring (1 conductor)



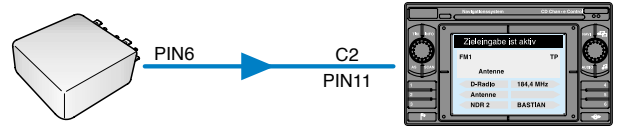
The coil connector fitted into the steering angle sender G85 functions analogously.

F138 Airbag coil connector

Electrical circuits

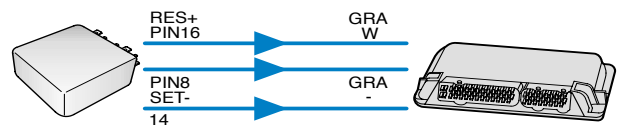
Data transfer

... between multi-function steering wheel control unit and radio is via the remote control interface for the radio/RNS (radio connector C 2, pin 11).



235_001

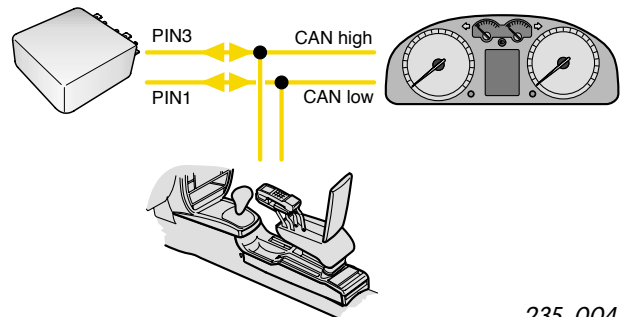
... from multi-function steering wheel control unit to engine control unit to remotely control the cruise control system (CCS) direct via the wiring (pin 16 and 8) and CANCEL CCS.



235_002

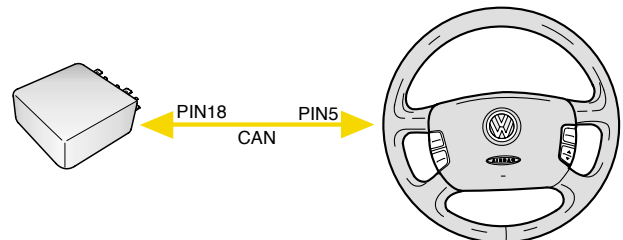
... from multi-function steering wheel control unit to dash panel insert for the displays and telephone interface via the convenience data bus (Infotainment CAN).

The function of the telephone is not implemented into the hardware or the software of the multi-function steering wheel, but is a component part of the telephone system.



235_004

... from multi-function steering wheel control unit to steering wheel electronics via the coil connector.



235_003

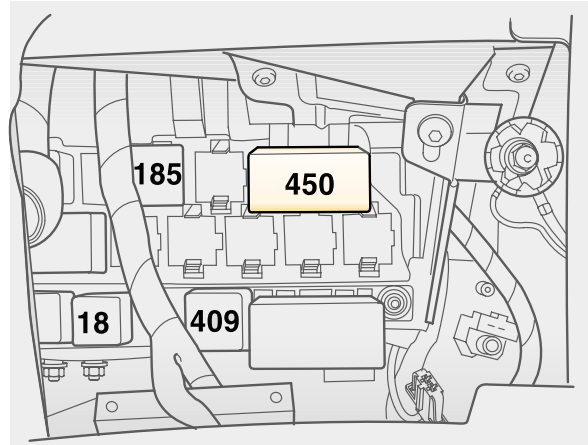


Contact assignment of multi-function steering wheel

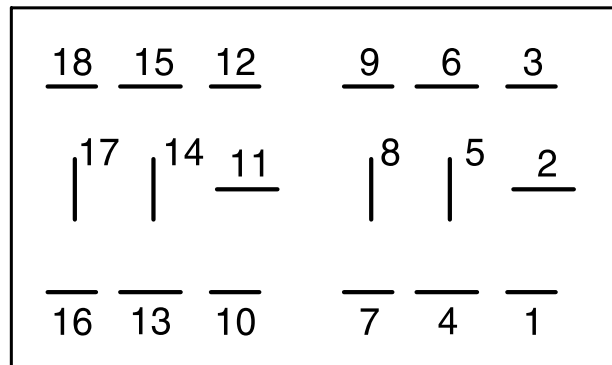
The multi-function steering wheel (MFW) control unit is located in a double relay housing on the central electrics relay carrier as relay No. 450.

The pin assignment is shown in the following table.

Contact	Function
1	Convenience data bus, low (CAN-L)
2	Reserved
3	Convenience data bus, high (CAN-H)
4	CCS OFF
5	Remote control of radio
6	Diagnostic cable K
7	Reserved
8	CCS SET
9	Dual tone horn relay
10	Terminal 31
11	Reserved
12	Terminal 15
13	Terminal 30
14	CANCEL CCS
15	Terminal 58d
16	CCS RES
17	Reserved
18	Data bus for steering wheel electronics



235_007



235_014

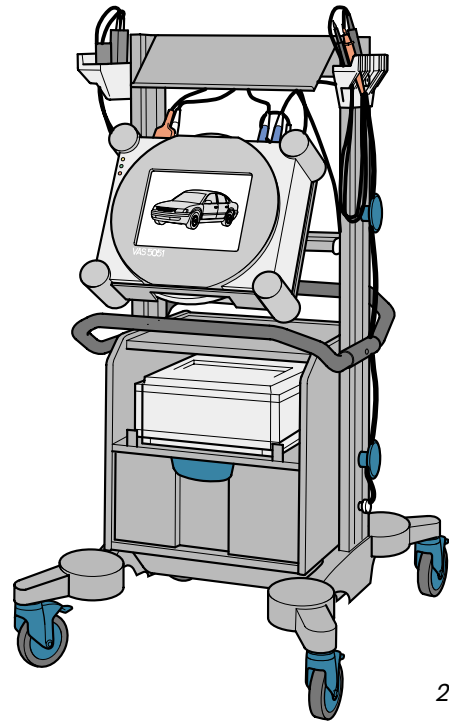
Technical status October 2000

Electrical circuits

Self-diagnosis

Vehicle Diagnosis, Testing and Information System can be used for the following diagnosis functions:

- 01 - Interrogate control unit version
- 02 - Interrogate fault memory
- 03 - Final control diagnosis
- 04 - Not used
- 05 - Erase fault memory
- 06 - End output
- 07 - Code control unit
- 08 - Read measured value (data) block



235_029

Address word for self-diagnosis

16 - Steering wheel electronics

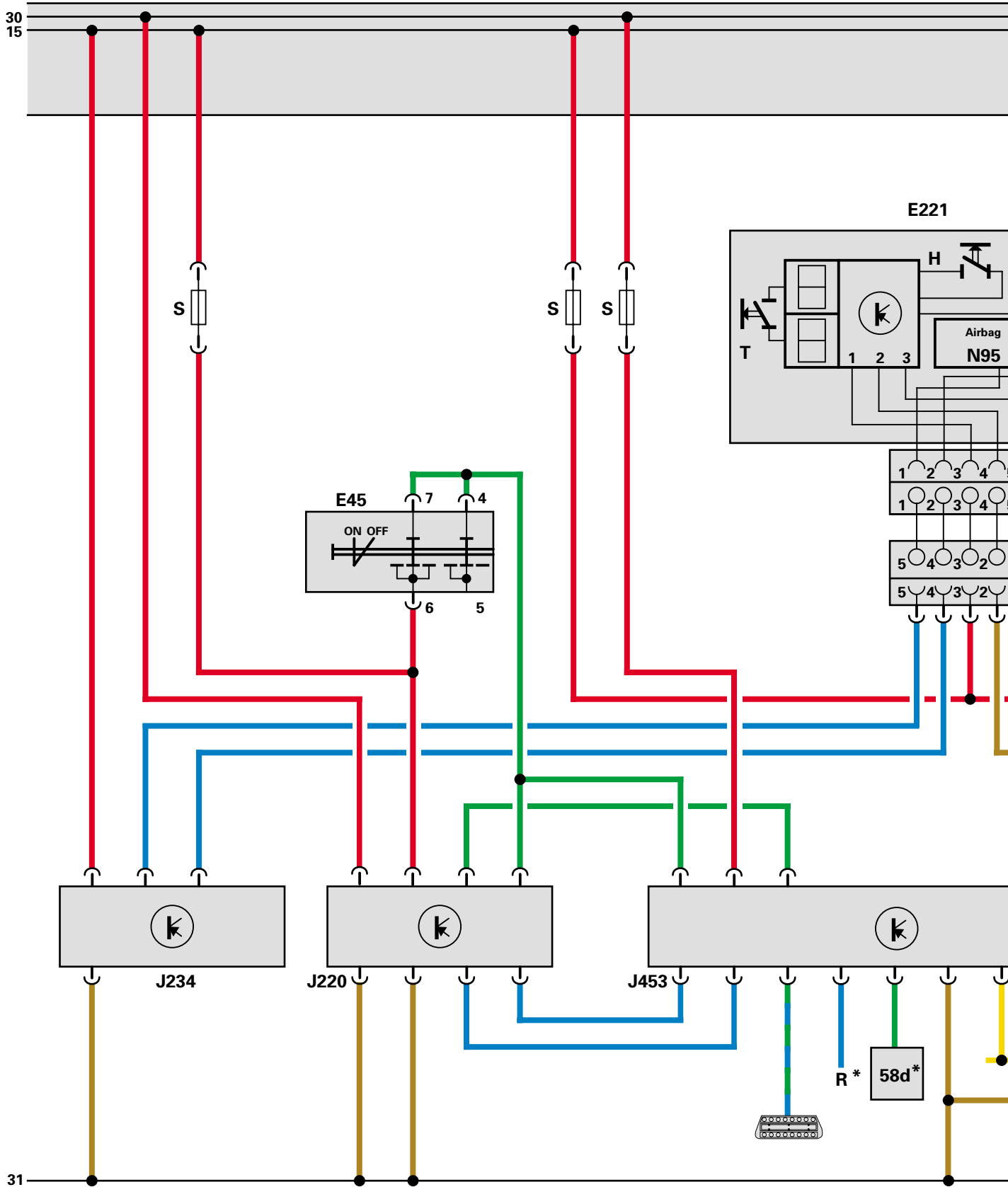
<p>01 - Interrogate control unit version</p>	<div style="border: 1px solid black; padding: 5px;"> <p>1J0907487 Steering wheel electronics xx.xx—></p> <p>Coding: 00008 WSC</p> </div>
<p>02 - Interrogate fault memory</p>	<p>01426 Operating unit in steering wheel E221 No communication, Implausible signal; 65535 Control unit defective</p>
<p>03 - Final control diagnosis</p> <p>Following functions are activated one after the other:</p> <p>Radio louder Radio quieter Radio station search upwards Radio station search downwards MODE Telephone memory Next item in telephone memory END</p>	<p>Radio volume increases audibly Radio volume decreases audibly Seeks next radio station, display Seeks previous radio station, display Changes between audio and telephone modes Seeks first name in telephone memory, display Seeks next name in telephone memory, display End of final control diagnosis</p>

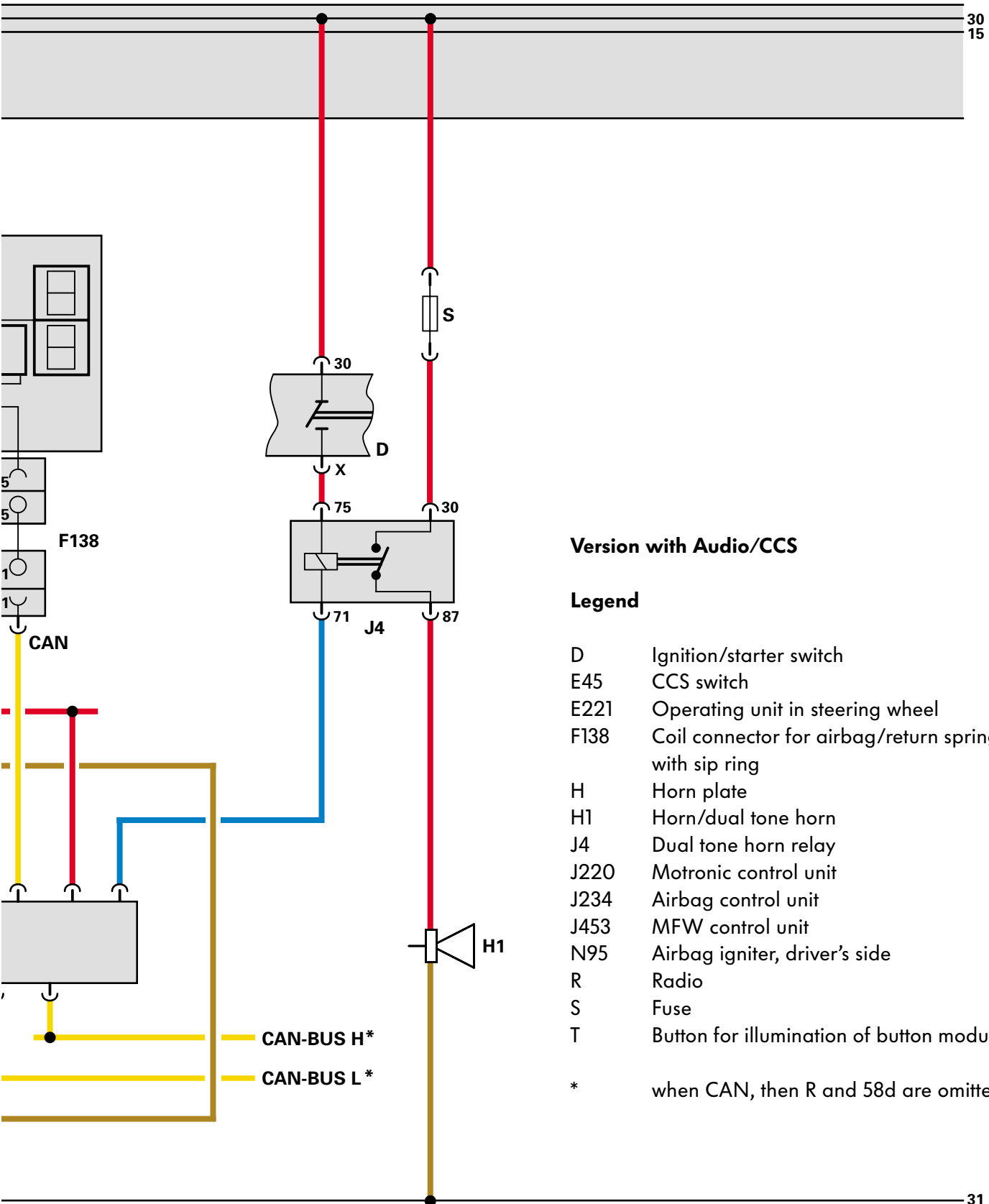
<p>07 - Code control unit</p> <p>e.g. 00008</p>	<p>Audio/CCS</p>
<p>08 - Read measured value block (data block)</p> <p>001</p> <ul style="list-style-type: none"> - Quieter button - Louder button - Search down button - Search up button <p>002</p> <ul style="list-style-type: none"> - CCS RES button - CCS SET button <p>003</p> <ul style="list-style-type: none"> - Telephone button - MODE/CCS OFF button 	<p>Quieter (button not operated)</p> <p>Louder (button not operated)</p> <p>Down (button not operated)</p> <p>UP (button not operated)</p> <p>RES/+ (button not operated)</p> <p>SET/- (button not operated)</p> <p>not operated/operated</p> <p>not operated/operated</p>



Electrical circuits

Function diagram, example: version Audio/CCS





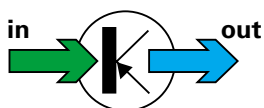
Version with Audio/CCS

Legend

- D Ignition/starter switch
 - E45 CCS switch
 - E221 Operating unit in steering wheel
 - F138 Coil connector for airbag/return spring with sip ring
 - H Horn plate
 - H1 Horn/dual tone horn
 - J4 Dual tone horn relay
 - J220 Motronic control unit
 - J234 Airbag control unit
 - J453 MFW control unit
 - N95 Airbag igniter, driver's side
 - R Radio
 - S Fuse
 - T Button for illumination of button module
- * when CAN, then R and 58d are omitted



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