

Audi A4 1995 ➤

Simos injection and ignition system (4-cylinder)

Engine ID	AHL	ARM							
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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups Audi A4 1995 ➤

Simos injection and ignition system (4-cylinder)
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Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system



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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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01 - Self-diagnosis

1 - Self-diagnosis

1.1 - Self-diagnosis

1.2 - Function

The control unit for the fuel injection and ignition system is equipped with a fault memory.

If faults occur in the sensors and components being monitored, they will be stored in the fault memory together with an indication of the type of fault.

The stored faults are output after initiating the fault display
=> Page 4 .

This fault memory must be erased once the faults have been eliminated => Page 4 .

A fault relating to the function of the Lambda control system can only be interrogated after a test drive of at least 10 minutes duration.

The fault memory also stores faults caused by temporary open circuits or loose contacts. These are displayed as sporadic faults (SP), and if they do not re-occur after 40 more engine starts they are automatically erased.

Note:

Sporadic faults are faults which only occur occasionally (sporadic = at irregular intervals, intermittent).

1.3 - Technical data of self-diagnosis

Equipment

- ♦ Fault memory: Non-volatile memory¹⁾
 - 1) Will be erased after 40th engine start if fault has not occurred again.
- ♦ Rapid data transfer

Control unit identification

=> Page 2 ; connecting fault reader V.A.G 1551 and selecting engine electronics control unit

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Selectable functions

Function	Requirement	
	Engine not running, ignition on	Engine idling
01 Interrogate control unit versions	yes	yes
02 Interrogate fault memory	yes	yes



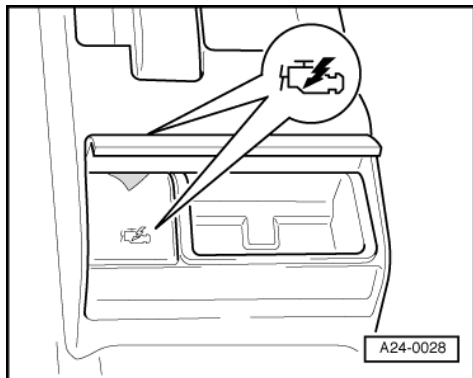
03 Final control diagnosis	yes	no
04 Introduction of basic setting	yes	no
05 Erase fault memory	yes	yes
06 End output	yes	yes
07 Code control unit	yes	no
08 Read measured value block	yes	yes

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1.4 - Connecting fault reader V.A.G 1551 and selecting engine control unit

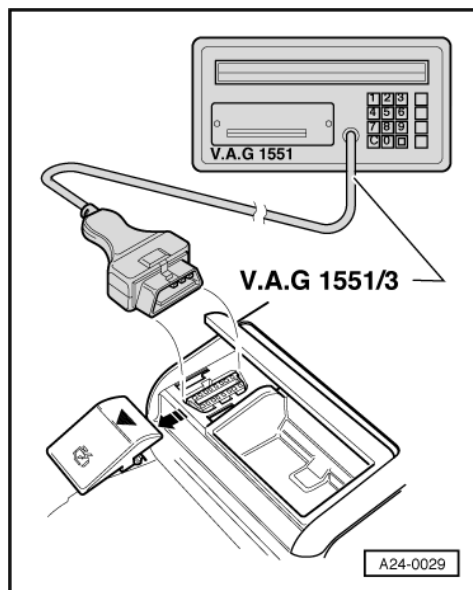
Note:

The vehicle system tester V.A.G 1552 can be used instead of the fault reader V.A.G 1551, however a print-out is not possible.



Test conditions

- Battery voltage at least 11 V
 - Earth connections on engine and gearbox OK.
 - Fuse OK.
- -> Open rear ashtray and remove cover for diagnostic connector.



- -> Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.

-> Indicated on display:

V.A.G - SELF-DIAGNOSIS HELP 1 - Rapid data transfer 2 - Flash code output
--

Note:

If using V.A.G 1551 and test cards with program levels from -D/5.0- onwards the engine control unit can be selected directly via "Rapid data transfer". The self-diagnosis function can be used with program levels from -D/6.0- onwards.

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on the function required:

- Switch ignition on.

or

Start engine => Page 1, Table "Selectable functions".

- Switch on printer with the Print button (Warning lamp in button lights up).
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

Rapid data transfer HELP Enter address word XX
--

Rapid data transfer Q 01 - Engine electronics

-> Press keys 0 and 1 for address word "Engine electronics" and confirm entry by pressing the Q key.

-> If the display shows one of the messages reproduced here, run through the fault-finding procedure as described in the Fault-Finding Programme for diagnosis wiring.

Rapid data transfer HELP Control unit does not answer

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

Rapid data transfer HELP Fault in communication build up
--

Rapid data transfer HELP K wire not switching to earth
--

Rapid data transfer HELP K wire not switching to positive

-> The control unit identification will appear on the display of the V.A.G 1551. For example:

3B0907557A 1.6l R4/2V SIMOS HS D01 Coding 00000 WSC XXXXX
--

- ◆ 3B0 907 557 A = Part No. of the control unit (see Parts List for latest control unit version)
- ◆ 1.6 ltr. = engine capacity
- ◆ R4/2V = engine type (in-line engine, 4-cyl., 2 valves per cylinder)



- ♦ SIMOS = designation of injection and ignition system
Si-Mos = Siemens Motorsteuerung (engine management)
- ♦ HS = manual gearbox (hand shift)
AT = automatic gearbox
- ♦ D.. = data level (software version) of control unit
- ♦ Coding = coding variant of control unit
=> Page 21 .
- ♦ WSC = Workshop code

If the coding differs from the vehicle version, then:

- Check control unit coding => Page 21 ,
Coding Simos control unit
- Press =>key.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

Note:

Press the HELP key to obtain a printout of the functions which are available.

1.5 - Interrogating and erasing fault memory

Note:

The vehicle system tester V.A.G 1552 can be used instead of the fault reader V.A.G 1551, however a print-out is not possible.

- Connect fault reader V.A.G 1551 (or V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 2 .)

Only when engine does not start:

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- Interrogate fault memory with ignition switched on.
- Switch on printer with the Print button
(Warning lamp in button lights up).

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Operate fault reader according to the information on the display:
- Press keys 0 and 2 for function "Interrogate fault memory" and confirm entry with Q key.

-> The number of faults stored or "No fault recognised!" will be shown on the display.

X Faults recognised!

If no fault is stored:

- Press =>key.

If one or more faults are stored:

The faults stored will be displayed and printed out one after the other.
Then the display will show:

- Locate and eliminate faults printed out as per fault table
=> Page 5.
- Press keys 0 and 5 for the function "Erase fault memory" and confirm entry with Q key.

-> Indicated on display:

Rapid data transfer
Fault memory is erased!

Note:

If the ignition is switched off between interrogating the fault memory and erasing the fault memory, the fault memory will not be erased. It is therefore important to follow the procedure exactly, i.e. first interrogate the fault memory and then erase it.

- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

1.6 - Fault table

Notes:

- ◆ The following table (arranged by fault code number) lists all the faults which the engine control unit can recognise and which can appear on the V.A.G 1551 printer display.
- ◆ The fault table is listed according to the 5 digit fault code on the left.
- ◆ If a fault occurs only occasionally or if the fault memory is not erased after the repair has been carried out, the fault will appear on the display as a "sporadically occurring fault" (SP).
- ◆ Explanation of the fault types (e.g. "open circuit/short circuit to earth"):

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=> Fault reader operating instructions

- ◆ Before renewing components indicated as being defective, check the wiring and connectors for these components as well as the earth connections using the current flow diagrams. This is particularly important for faults which are displayed as "occurring sporadically" (SP).
- ◆ Sporadic faults are faults which only occur occasionally (e.g. loose contacts). "Sporadic" means "intermittent" or "at irregular intervals".

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00282 Throttle valve positioner - V60-1) Short circuit	- Open circuit or short to earth or positive, or short between wires	- Cold start problems	- Rectify open circuit or short using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations
Blocked or without voltage	- V60 defective/sticking	- Cold idling problems - Jerky load changes	- Test throttle valve control part =>Page 76.
Connector	- Cables interchanged	- Mechanical emergency running (-J338) recognised	



Upper stop value	- Engine control unit defective		- Fit a new engine control unit =>Page 50 .
Signal outside tolerance			
Regulating difference			

1) The throttle valve positioner V60 is a component of the throttle valve control part J338.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00305 Fuel consumption indicator signal Short circuit to positive	- Short to positive in wiring between engine control unit and on-board computer		Test wiring using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations

Note:

The fuel consumption indicator signal comes from the engine control unit and is used by the on-board computer to calculate the fuel consumption.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00513 Engine speed sender -G28 No signal	- Open circuit or short to earth or positive in signal wire - Open circuit or short to positive in earth wire - Open circuit in screening for -G28 - -G28 defective - Faulty signal input in engine control unit (control unit defective)	- Engine no longer runs up to cut-off speed (engine speed governed to about 5100 rpm) - Reduced power - Engine starts reluctantly or not at all when cold (cold start problems) - Engine starts reluctantly or not at all when warm (hot start problems)	- Test -G28 =>Page 106 . - Read measured value block, Display Group 01 =>Page 30 . - Fit a new engine control unit =>Page 50 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00513 Engine speed sender -G28 Implausible signal	- Metal particles on engine speed sender -G28 - Gap between -G28 and sender wheel too large	- Engine no longer runs up to cut-off speed (engine speed governed to about 5100 rpm) - Reduced power - Engine starts reluctantly or not at all when cold (cold start problems)	- Test -G28 =>Page 106 . - Read measured value block, Display Group 01 =>Page 30 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
		- Engine starts reluctantly or not at all when warm (hot start problems)	

Notes on fault code 00513:

- ◆ The presence of metal particles can result in additional signals.
- ◆ If the gap between the sender and the sender wheel is too large or if the sender wheel is damaged, the signals may not be sent or may be too small to be picked up.
- ◆ A loose sender wheel (or loose sender) may result in uneven signal transmission.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00515 Hall sender -G40 No signal	- Fault in power supply or earth connection for -G40	- Engine no longer runs up to cut-off speed (engine speed governed to about 5100 rpm)	- Test -G40 =>Page 115 .
Implausible signal	- Faulty signal input in engine control unit (control unit defective) - Open circuit or short to positive or earth in signal wire between -G40 and engine control unit	- Engine starts reluctantly or not at all when cold (cold start problems) - Engine starts reluctantly or not at all when warm (hot start problems)	- Rectify open circuit or short using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations
Continued on next page			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00515 Hall sender -G40 (cont.) - Fault type - see previous page	- -G40 defective - Toothed belt has slipped (signal not being sent at the expected time) - Loose contact - Rotor ring defective (bent or cracked)	- Loss of power - See previous page for other possible effects	- Check valve timing => Mechanics; Repair Group 13; Dismantling and assembling engine; Removing, installing and tensioning toothed belt Dismantling and assembling engine; Removing, installing and tensioning toothed belt

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00516 Idling switch -F601)			



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Open/short circuit to positive	- Open circuit or short to positive or earth in signal wire between -F60 and engine control unit	- Engine running problems when pulling away	- Test throttle valve control part =>Page 76 . Rectify open circuit or short using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations
Short circuit to earth	- -F60 defective - Throttle valve sticking - Floor mat pressing down on accelerator - Throttle cable setting	- Engine running problems in transition from idling/overrun to part throttle - Idling speed outside specified range	- Check throttle cable => Mechanics; Repair Group 20; Removing and installing parts of fuel supply system; Adjusting throttle cable Removing and installing parts of fuel supply system; Adjusting throttle cable
Continued on next page			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00516 Idling switch -F601) Fault type - see previous page	- Moisture in plug connector for throttle valve control part - Faulty signal input in engine control unit (control unit defective)	- See previous page	- Fit a new engine control unit =>Page 50 .

1) The idling switch F60 is a component of the throttle valve control part J338.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00518 Throttle valve potentiometer - G691) Open/short circuit to positive	- Open circuit in earth wire - Short to positive in wiring - -G69 defective	- Jerky load changes	- Test -G69 =>Page 76 , Testing throttle valve control part
Open/short circuit to earth	- -G69 defective - Open circuit - Short to earth in signal wire between -G69 and engine control unit	- Poor throttle response	- Rectify short or open circuit using current flow diagram
Implausible signal	- Loose contact		
Continued on next page			

1) The throttle valve potentiometer G69 is a component of the throttle valve control part J338.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00518			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Throttle valve potentiometer - G691) Implausible signal (cont.)	- G69 defective - Moisture or corrosion on plug connector for potentiometer - Faulty signal input in engine control unit (control unit defective)	- See previous page	- See previous page - Fit a new engine control unit =>Page 50

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- 1) The throttle valve potentiometer G69 is a component of the throttle valve control part J338.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00520 Air mass/flow meter -G70/ G19 Short circuit to positive Open/short circuit to earth	- Open circuit or short to positive or earth in signal wire between -G70 and engine control unit - Fault in power supply to -G70 - -G70 defective - Faulty signal input in engine control unit (control unit defective)	- Engine running problems - Engine starts reluctantly or not at all when cold (cold start problems) - Engine starts reluctantly or not at all when warm (hot start problems) - Engine idles unevenly or not at all when cold and during warm-up - Idling speed outside tolerance range	- Test -G70 =>Page 61 - Read measured value block, Display Group 00 =>Page 27 . - Fit a new -G70 - Fit a new engine control unit =>Page 50 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00522 Coolant temperature sender -G62 Open/short circuit to positive Short circuit to earth Implausible signal	- Open circuit or short to positive or earth in wiring between -G62 and engine control unit - -G62 defective - Faulty earth connection for -G62 - Faulty signal input in engine control unit (control unit defective) - Loose contact or corrosion due to moisture in connector plug	- Cold start problems at very low temperatures - Engine running problems during warm-up - Increased fuel consumption - Increased emissions - Unsatisfactory performance	- Read measured value block, Display Group 00 =>Page 27 . - Test -G62 =>Page 108 - Fit a new engine control unit =>Page 50 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00523 Intake air temperature sender -G42			



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Short circuit to earth	- Open circuit or short to positive or earth in wiring between -G42 and engine control unit	- Hot start problems	- Read measured value block, Display Group 00 =>Page 27 .
Open/short circuit to positive	- -G42 defective	- Poor throttle response when cold and during warm-up; pick-up problems when throttle opened	- Test -G42 =>Page 102 .
	- Faulty earth connection for -G42	- Engine idles unevenly or not at all when cold and during warm-up	- Fit a new engine control unit =>Page 50 .
	- Faulty signal input in engine control unit (control unit defective)		

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00524 Knock sensor 1 -G61 Defective	- -G61 defective		- Test -G61 =>Page 113 .
Implausible signal	- Knock sensor loose (tightening torque: 20 Nm) or corrosion on connector	- Reduced power	
	- Open circuit or short to positive/earth or to screening for signal wire between knock sensor and engine control unit	- High fuel consumption	- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations
	- Faulty signal input in engine control unit (control unit defective)		- Fit a new engine control unit =>Page 50 .
	- Loose ancillaries causing knock sensor to receive additional signals (from vibrations)		

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00525 Lambda probe -G39 Output open	- Open circuit or short to earth or positive in signal wire between -G39 and engine control unit	- No lambda control	- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations
Short circuit to earth	- Faulty earth connection for -G39	- Rough idling	- Test lambda control =>Page 67 .
Implausible signal	- Corrosion due to moisture in plug connector for lambda probe heating - Z19 or lambda probe - G39	- Increased fuel consumption	- Read measured value block, Display Group 01 or 99.
Signal outside tolerance	- Lambda probe heating not functioning	- Soot on spark plugs	
	- -G39 defective	- Emissions not OK	

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V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
	- Faulty signal input in engine control unit (control unit defective)		- Fit a new engine control unit =>Page 50 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00530 Throttle valve positioner/potentiometer -G881) Open/short circuit to positive	- Open circuit or short to earth or positive in signal wire between - G88 and engine control unit	- Idling speed positioner deactivated; engine idles with a mechanically regulated air flow through the emergency running slot - Different idling speed	- Perform adaption of throttle valve control part =>Page 77 .
Open/short circuit to earth	- Open circuit in earth wire between -G88 and engine control unit	- Cold start problems - Cold idling problems	- Test throttle valve control part =>Page 76 .
Implausible signal	- -G88 defective or loose contact in connector for throttle valve control part -J338	- Hard load changes	
Continued on next page			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00530 Throttle valve positioner/potentiometer -G881)(cont.) Fault type - see previous page	- Faulty signal input in engine control unit (control unit defective) - Contact resistance due to moisture in connector for throttle valve control part -J338 - Connector incorrectly wired	- Reduced power - Rough idling	- Fit a new engine control unit =>Page 50 .

1) The throttle valve positioner/potentiometer -G88 is a component of the throttle valve control part -J338.

The throttle valve positioner/potentiometer (variable resistance; activated by the throttle valve positioner) informs the engine control unit of the status of the throttle valve positioner.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00533 Idling control Upper stop value	- Throttle valve positioner - V60 sticking - Air cleaner blocked	- Engine running problems - High fuel consumption	- Test throttle valve control part =>Page 76 . - Test air intake system for leaks (unmetered air) =>Page 66 .
Lower stop value	- Unmetered air downstream of throttle valve - Injector defective	- Fuel odours	- Test injectors =>Page 54 .



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
	- Fuel pressure regulator defective		- Fit a new fuel pressure regulator

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00537 Lambda control Upper stop value	- Short to earth in signal wire between lambda probe and engine control unit - Injector(s) defective (blocked) - Fuel pressure regulator defective - Fuel pump defective	- No lambda control - Engine running problems	- Test lambda probe and lambda control =>Page 67 . - Test injectors =>Page 54 . - Test fuel pressure regulator and holding pressure =>Page 52 . - Test fuel pump => Mechanics; Repair Group 20; Removing and installing parts of fuel system; Testing fuel pump Removing and installing parts of fuel system; Testing fuel pump - Fill up fuel tank
Lower stop value	- Fuel tank empty		
	- See next page		

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00537 Lambda control (continued) Lower stop value	- Solenoid valve 1 for activated charcoal filter - N80 leaking/sticking - Injector(s) defective (not closing fully) - Fuel pressure regulator defective	- No lambda control - Engine running problems	- Test -N80 =>Page 19 . - Test injectors =>Page 54 . - Test fuel pressure regulator and holding pressure =>Page 52 .

Note:

- ♦ If the fault "Lambda control upper stop value" is recorded, this means that the lambda control has reached the "mixture enrichment" regulating limit. However, the lambda probe is still detecting a "lean" mixture.
- ♦ If the fault "Lambda control lower stop value" is recorded, this means that the lambda control has reached the "mixture leaning down" regulating limit. However, the lambda probe is still detecting a "rich" mixture.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00545 Engine/gearbox electrical connection Short circuit to positive	- Open circuit or short to positive or earth in wiring between engine control unit and gearbox control unit	- See Workshop Manual for automatic gearbox => Automatic Gearbox 01N; Repair Group 01; Fault table Fault table	- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Short circuit to earth	- Faulty signal output from engine control unit (engine control unit defective)		- Fit a new engine control unit =>Page 50 .
Undefined switch condition	- Fault in automatic gearbox or in control unit for automatic gearbox		- Interrogate fault memory of control unit for automatic gearbox => Automatic Gearbox 01N; Repair Group 01; Function of self-diagnosis Function of self-diagnosis

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00609 by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG. Ignition output 1 Short circuit to positive	- Open circuit or short to positive in wiring between engine control unit and output stage of ignition coil - Faulty earth connection for output stage of ignition coil - Ignition coil output stage defective - Engine control unit defective	- Starting problems - Very rough running in all engine load ranges - Severe loss of power	- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test twin-spark injection system with two ignition coils =>Page 100 . - Fit a new engine control unit => Page 50 .
00610 Ignition output 2 Short circuit to positive	- See fault code 00609	- See fault code 00609	- See fault code 00609

Note:

Ignition outputs 1 and 2 are the outputs on the engine control unit via which the engine control unit activates the output stage of the ignition coils.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00625 Speed signal Implausible signal	- Open circuit or short in signal wire between dash panel insert and engine control unit - Short circuit in signal wire between speedometer and another control unit which uses the road speed signal - Faulty signal input in engine control unit		- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Fit a new engine control unit =>Page 50 .

Note:

If fault code 00625 is recorded the engine control unit assumes a fixed substitute value of 5 km/h.



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00635 Lambda probe heating before Cat. Defective	- Open circuit or short to positive or earth in wiring between engine control unit and lambda probe - Output stage in engine control unit defective (engine control unit defective) - Lambda probe defective - Fuel pump relay or fuel pump relay activation defective	- Rough idling - Emission problems	- Test lambda control =>Page 67 . Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Fit a new engine control unit =>Page 50 . - Fit a new lambda probe - Test fuel pump relay and activation =>Page 58 .

Notes:

- ♦ The positive power supply to the lambda probe heating comes via the fuel pump relay.
- ♦ The earth connection for the lambda probe heating is provided by the engine control unit, i.e. the entire current supply for the lambda probe heating comes via the engine control unit.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00668 Vehicle voltage, terminal 30 Open circuit	- Open circuit in power supply from terminal 30, e.g. loose contact in power supply wiring to engine control unit		- Test power supply using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01087 Basic setting not carried out Implausible signal	Conditions for basic setting (adaption of throttle valve control part) not fulfilled: - Ignition not switched on - Engine running - Idling speed switch not closed - Implausible voltage signals from throttle valve potentiometer and throttle valve positioner potentiometer (control unit not receiving clear voltage signal; throttle valve not fully closed) - Throttle valve positioner sticking or mechanically damaged	- Engine control unit cannot learn stop values for throttle valve control part because conditions have not been fulfilled (see "Possible causes of fault")	- Read measured value block, Display Group 01 or 98 =>Page 77 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Continued on next page			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01087 Basic setting not carried out Implausible signal (cont.)	- Battery voltage too low (less than 8V) - Fault in fault memory - Throttle valve control part defective - Engine control unit defective	- See previous page	- Read measured value block, Display Group 05 - Interrogate fault memory - Fit a new throttle valve control part - Fit a new engine control unit =>Page 50 .

Important note:

Before fitting new parts, always test the old parts and check the wiring.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01126 Engine speed signal Defective	- Open circuit or short to positive or earth in signal wire between engine control unit and dash panel insert - Faulty signal input in dash panel insert - Faulty signal output from engine control unit (control unit defective)	- Rev counter not functioning	- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Fit a new dash panel insert - Fit a new engine control unit =>Page 50 .

Note on fault code 01126:

In this case the "engine speed signal" is not the signal from the engine speed sender (located on the crankshaft) to the engine control unit, but rather the signal from the engine control unit to the dash panel insert. This signal is also used for various other systems (e.g. rev counter, air conditioner etc.).

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01177 Engine control unit Defective	- Engine control unit defective	- Engine might not start	- Fit a new engine control unit =>Page 50 .
01242 Output stages in control unit Defective	- Output stages in control unit overheating	- Engine will not start	- Fit a new engine control unit =>Page 50 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01243 Intake manifold change-over valve - N156			



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Output open	- Open circuit or short to positive or short to earth in the wiring between - N156 and engine control unit	- Poor acceleration	- Test -N156 => Page 19
Short to positive	- Voltage supply for N156 defective		
Short to earth	- N156 defective - Engine control unit signal output defective (engine control unit defective)		- Replace engine control unit =>Page 50 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01247 Solenoid valve 1 for activated charcoal filter -N80			
Short circuit to positive	- Open circuit or short to positive or earth in wiring between -N80 and engine control unit	- Rough idling	- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations
Short circuit to earth	- Fault in power supply to -N80	- Car may run jerkily at part throttle	- Test -N80 =>Page 74 .
Output open	- -N80 defective - Faulty signal output from engine control unit (control unit defective)	- Vehicle possibly smells of fuel	- Fit a new engine control unit =>Page 50 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01249 No.1 cyl. injector -N30			
Short circuit to positive	- Open circuit or short to positive or earth in wiring between engine control unit and injector	- Engine idles roughly or cuts out	- Test injectors =>Page 54 .
Short circuit to earth	- Injector defective		
Output open	- Fault in power supply to injector - Faulty signal output from engine control unit (control unit defective)		- Fit a new engine control unit =>Page 50 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01250 No. 2 cyl. injector -N31			
Short circuit to positive	=>Cyl.1 fault code 01249	=>Cyl.1 fault code 01249	=>Cyl.1 fault code 01249
Short circuit to earth			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Output open			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01251 No. 3 cyl. injector -N32 Short circuit to positive Short circuit to earth Output open	=>Cyl.1 fault code 01249	=>Cyl.1 fault code 01249	=>Cyl.1 fault code 01249
01252 No. 4 cyl. injector -N33 Short circuit to positive Short circuit to earth Output open	=>Cyl.1 fault code 01249	=>Cyl.1 fault code 01249	=>Cyl.1 fault code 01249

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01259 Fuel pump relay -J17 Defective	- Open circuit or short to positive in wiring between engine control unit and fuel pump relay - Fuel pump relay defective - Faulty signal output from engine control unit (control unit defective)	- If the wiring has an open circuit or short to positive, the engine will not run.	- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test fuel pump relay =>Page 58 . - Fit a new engine control unit =>Page 50 .

Note:

If fault code 01259 is recorded, components which are supplied with power via the fuel pump relay may also register as faulty.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01312 Data bus drive defective	- Fault in data bus wiring or malfunction in one of the control units linked into the data bus	- Engine performance problems (jerks during gearchange or when opening and closing throttle) - No ESP function	- Test data transmission between engine / gearbox / ABS =>Page 95 .
01315 Gearbox control unit No communication	- Fault in data bus wiring to gearbox control unit	- Engine performance problems (jerks during gearchange or when opening and closing throttle)	- Test data transmission between engine / gearbox / ABS =>Page 95 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01316			



Brake control unit No communication	- Fault in data bus wiring to ABS control unit	- No ESP function 1)	- Test data transmission between engine / gearbox / ABS =>Page 95 . Check coding of ABS control unit => Running gear, Self-diagnosis; Repair group 01; Self-diagnosis, Electrical check Self-diagnosis, Electrical check
Interrogate fault memory	- Speed signal from ABS control unit not OK	- Engine performance problems (jerks when opening and closing throttle)	- Interrogate fault memory of ABS control unit and rectify fault according to instructions => Running gear, Self-diagnosis; Repair group 01; Self-diagnosis, Electrical check Self-diagnosis, Electrical check

1)"Electronic Stability Program"

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01656 Crash signal Short to positive	- Short circuit to positive in wiring between engine control unit and airbag control unit	- Airbag control unit will not cut off fuel supply to engine after a crash in which airbags are triggered	- Test crash signal or wiring from airbag control unit to engine control unit =>Page 95
Short to earth	- Short circuit to earth in wiring between engine control unit and airbag control unit		
Implausible	- Loose contact in wiring between airbag control unit and engine control unit		

Notes:

- ♦ The fault "Crash signal; Short to positive" will be recorded in the memory if the duty cycle of the pulse width-modulated signal from the airbag control unit exceeds 89%, or if there is a short circuit to positive in the wiring. See next page for additional notes.

Additional notes:

- ♦ The fault "Crash signal; Short to earth" will be recorded in the memory if the duty cycle of the pulse width-modulated signal from the airbag control unit is below 11%, or if there is a short circuit to earth in the wiring.
- ♦ The fault "Crash signal; Implausible" will be recorded in the memory if the duty cycle of the pulse width-modulated signal from the airbag control unit is between 25% and 75%, i.e. in a range which is not normally possible. (This indicates a malfunction in the airbag control unit).

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V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
18017			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Crash switch-off triggered	- Vehicle has had an accident in which airbags have been triggered; or final control diagnosis has been performed on airbag control unit	- Engine cuts out, but can be started again afterwards	- Test crash signal =>Page 95

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17978 Engine control unit blocked	- Attempted tampering - Open circuit or short to positive or earth in signal wire between engine control unit and immobilizer control unit - Control electronics for immobilizer defective/missing - Attempt made to start vehicle with unauthorised key - Engine control unit not adapted to control electronics for immobilizer	- Engine starts but cuts out again immediately	- Rectify short or open circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Fit a new immobilizer control unit - Fit a new engine control unit =>Page 50 . - See Workshop Manual => Electrical System; Repair Group 96; Servicing immobilizer - Perform adaption of engine control unit to control electronics for immobilizer =>Page 50 .

1.7 - Final control diagnosis

Notes:

- ♦ The final control diagnosis can only be performed with the ignition switched on and the engine not running.
- ♦ The final control diagnosis is terminated if the engine is started or if an engine revolution pulse is detected.
- ♦ During the final control diagnosis the individual control elements are actuated in turn for about 50 seconds each unless the programme is deliberately advanced to the next control element by pressing the =>key.
- ♦ The control elements can be tested either by listening or by touching.
- ♦ If the final control diagnosis is to be repeated without first running the engine briefly, switch off the ignition for about 2 seconds.
- ♦ Once the final control diagnosis has been completed, the engine cannot be re-started until the ignition has been switched off and on again.
- ♦ The ignition and injection systems are disabled during the final control diagnosis.

The final control diagnosis activates the following components in the stated sequence:

1. Fuel pump relay (-J17)
2. Activated charcoal filter solenoid valve 1 (-N80)
3. Intake manifold change-over valve -N156 (on vehicles without intake manifold change-over function the display will show exhaust gas recirculation valve -N18; this display can be disregarded)

Test conditions

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the ignition must be switched on.



(Connecting fault reader and selecting engine electronics control unit => Page **2**.)

-> Indicated on display:

Rapid data transfer **HELP**
Select function XX

- Operate fault reader according to the information on the display:
- Press keys 0 and 3 for the function "Final control diagnosis".

-> Indicated on display:

Rapid data transfer **Q**
03 Final control diagnosis

Activating fuel pump relay (J17):

- Confirm input with Q key.

-> Indicated on display:

Final control diagnosis
Fuel pump relay J17

The fuel pump relay will click (i.e. switch on and off) continuously for about 50 seconds unless the programme is deliberately advanced to the next control element by pressing the ➔key.

Note:

During the activation of the fuel pump relay the fuel pump must be heard to run at intervals.

If the relay does not click:

- Test fuel pump relay and activation =>Page **58** .
- Press ➔key.

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-> Indicated on display:

Final control diagnosis
Solenoid valve 1 for activated charcoal
filter N80

Solenoid valve 1 for activated charcoal filter -N80 will click (i.e. switch on and off) continuously for about 50 seconds unless the programme is deliberately advanced to the next control element by pressing the ➔key.

- If the valve is not activated (i.e. does not click), test solenoid valve for activated charcoal filter -N80 => Page **74** .
- Press ➔key.

On vehicles without intake manifold change-over function:

-> Indicated on display:

Final control diagnosis
Exhaust gas recirculation valve -N18

Note:

This display can be ignored.

On vehicles with intake manifold change-over function:

-> Indicated on display:

Final control diagnosis
Intake manifold change-over valve -N156

This valve will click (i.e. switch on and off) continuously for about 50 seconds unless the programme is deliberately advanced by pressing the ➡key.

- If the valve is not activated (i.e. does not click), test intake manifold change-over valve -N156 => Page 81 .
- Press ➡key.

Note:

The message "Final control diagnosis END" will appear briefly on the display.

-> Indicated on display:

Function is unknown or
cannot be carried out at the moment

The final control diagnosis is complete.

- Press ➡key.

Note:

Before selecting function 03 again, switch the ignition off for about 2 seconds.

1.8 - Performing basic setting of engine

Note:

*As part of the basic setting of the engine, the engine control unit is adapted to the throttle valve control part with the ignition on and the engine **not running**.*

Adaption of the engine control unit to the throttle valve control part (under function 04, "Basic setting") must be performed each time either the engine control unit or the throttle valve control part or both are removed or renewed.

Performing adaption of throttle valve control part =>Page 77 .

1.9 - Coding Simos control unit

If the appropriate code for the vehicle is not displayed or if the control unit has been renewed, the control unit must be coded as follows.

Note:

Always print out the control unit identification of the "old" control unit.

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the ignition must be switched on.
(Connecting fault reader and selecting engine electronics control unit => Page 2 .)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 7 for the function "Code control unit" and confirm entry with Q key.

-> Indicated on display:



Code control unit Q
Input code number xxxxx (0-32000)

- Enter the correct code number for the vehicle and confirm by pressing Q.

Note:

See next page for a list of the possible coding variants that can be selected.

List of possible codings for "AHL" engine; see Page 22 for coding variants of "ARM" engine.

Coding	For vehicles with
04001	Manual gearbox
04031	Automatic gearbox

-> The display on fault reader V.A.G 1551 will show the control unit identification.

3B0907557A 1.6l R4/2V SIMOS HS D01
Coding 00000 WSC XXXXX

Note:

If an unauthorised code number is entered:

-> Indicated on display:

Function is unknown or
cannot be carried out at the moment

- Repeat procedure, entering correct code number.
- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

Codings for vehicles with "ARM" engine

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the ignition must be switched on.
(Connecting fault reader and selecting engine electronics control unit=>Page 2.)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 7 for the function "Code control unit" and confirm entry with Q key.

-> When this display appears:

Code control unit Q
Input code number xxxxx (0-32000)

- Enter the correct control unit coding according to the coding table=>Page 23.

The coding is made up as follows:

XX		Country / emission standard
X		Power train / additional functions
	X	ESP (Electronic Stability Program)

	X	Gearbox
--	---	---------

Example of possible coding	
04001	EU-II (emission standard), vehicle without ESP; vehicle with manual gearbox

1.10 - Coding table

Country / emission standard	02	Emission standard: "Rest of the world" (not Europe)
	04	Emission standard: EU II (MVEG II)
	07	Emission standard: EU II-D3
Power train / additional functions	0	Enter "0" for all vehicles at this position
ESP (Electronic Stability Program)	1	Vehicles with ESP (Electronic Stability Program)
	0	Vehicles without ESP (Electronic Stability Program)
Gearbox	1	Vehicles with manual gearbox
	3	Vehicles with automatic gearbox

Note:

An incorrect coding results in:

- ◆ Engine running faults
- ◆ Increased fuel consumption
- ◆ Increased emissions
- ◆ Faults stored in fault memory which are not actually present
- ◆ Reduced gearbox life (On cars with automatic gearbox, the engine torque is not reduced during gearshifts.)

1.11 - Read measured value block

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 2.)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block
Enter display group number xxx

- Enter relevant Display Group number (3 figures) and confirm entry by pressing Q.

Example: To select Display Group 5, press keys 0, 0 and 5.

Note:

To change to another display group proceed as follows:

Display group	V.A.G 1551	V.A.G 1552
Higher	Press key 3	Press ↑ key



Display group	V.A.G 1551	V.A.G 1552
Lower	Press key 1	Press ↓ key

Test conditions

- No faults stored in fault memory
=> Page 4, interrogating fault memory
- Vehicle stationary, engine idling, throttle valve closed
- Coolant temperature at least 80 °C
- Electrical consumers switched off
- Air conditioner switched off
- On vehicles with automatic gearboxes, the selector lever must be in either P or N position.

1.12 - Display Group overview with test table**Display Group 00 (block of ten)**

Display zone	Meaning
1	Intake air temperature
2	Engine control unit power supply voltage
3	Coolant temperature
4	Intake air mass
5	Lambda probe voltage
6	Injection period; additive learned value
7	Condition of lambda control
8	Throttle valve angle
9	Injection period
10	Engine speed

Display Group No.	Indicated on display	Meaning
01 Basic values	Read measured value block 1 1 2 3 4	1 = Engine speed 2 = Coolant temperature 3 = Lambda probe voltage 4 = Throttle valve adaption requirements
02 Basic values	Read measured value block 2 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Road speed 4 = Operating status of engine
03 Basic values	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Throttle valve angle 4 = Duty cycle of throttle valve positioner

Display Group No.	Indicated on display	Meaning
04 Basic values	Read measured value block 4 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Injection period 4 = Air mass
05 Basic values	Read measured value block 5 1 2 3 4	1 = Engine speed 2 = Engine control unit power supply voltage

Display Group No.	Indicated on display	Meaning
		3 = Coolant temperature 4 = Intake air temperature
06 Altitude adaption	Read measured value block 6 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Throttle valve angle 4 = Altitude correction factor

Display Group No.	Indicated on display	Meaning
07 Idling speed setting	Read measured value block 7 1 2 3 4	1 = Throttle valve angle 2 = Idling speed learned value (without gear engaged) 3 = Idling speed learned value (with gear engaged) 4 = Operating status of engine
08 Idling speed stabilisation	Read measured value block 8 1 2 3 4	1 = Engine speed 2 = Idling speed specification for stationary vehicle 3 = Idling speed control 4 = Intake air mass
09 Idling speed air requirement	Read measured value block 9 1 2 3 4	1 = Idling speed regulation 2 = Adaption status of throttle valve control part 3 = Coolant temperature 4 = Engine speed
10 Lambda control and ACF system	Read measured value block 10 1 2 3 4	1 = Lambda control 2 = Lambda probe voltage 3 = Duty cycle of solenoid valve 1 for activated charcoal filter -N80 4 = Lambda correction factor with active fuel tank breather system

Display Group No.	Indicated on display	Meaning
11 Lambda learned values	Read measured value block 11 1 2 3 4	1 = Injection period 2 = Lambda learned value for idling 3 = Lambda learned value for part throttle 4 = Status of fuel tank breather valve (TBV)
12 Lambda learned values	Read measured value block 12 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Lambda control 4 = Lambda probe voltage
13 Fuel consumption	Read measured value block 13 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Road speed 4 = Fuel consumption
14 Knock control	Read measured value block 14 1 2 3 4	1 = Ignition timing retardation by knock control, cylinder 1 2 = Ignition timing retardation by knock control, cylinder 2 3 = Ignition timing retardation by knock control, cylinder 3



Display Group No.	Indicated on display	Meaning
		4 = Ignition timing retardation by knock control, cylinder 4

Display Group No.	Indicated on display	Meaning
15 Knock control	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Ignition timing retardation by knock control, cylinder 1 4 = Ignition timing retardation by knock control, cylinder 2
16 Knock control	Read measured value block 16 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Ignition timing retardation by knock control, cylinder 3 4 = Ignition timing retardation by knock control, cylinder 4
17 Knock control	Read measured value block 17 1 2 3 4	1 = Knock sensor voltage signal, cylinder 1 2 = Knock sensor voltage signal, cylinder 2 3 = Knock sensor voltage signal, cylinder 3 4 = Knock sensor voltage signal, cylinder 4
18 Torque reduction	Read measured value block 18 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Ignition timing retardation during gearshift 4 = Ignition timing

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Display Group No.	Indicated on display	Meaning
19 Operating status	Read measured value block 19 1 2 3 4	1 = Engine speed 2 = Selector lever position 3 = Air conditioner 4 = Air conditioner compressor
20 Operating status of lambda control	Read measured value block 20 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Coolant temperature 4 = Operating status of lambda control
21 Adaption status of throttle valve control part	Read m'd value block 21 1 2 3 4	1 = Adaption status of throttle valve control part 2 = Min. stop of throttle valve 3 = Emergency running position of throttle valve 4 = Max. stop of throttle valve
22 Position of camshaft in relation to	Read m'd value block 22 1 2 3 4	1 = Engine speed 2 = Intake air mass 3 = Number of teeth on crankshaft-mounted sender wheel when Hall sender switches from - to +

Display Group No.	Indicated on display	Meaning
crankshaft		4 = Number of teeth on crankshaft-mounted sender wheel when Hall sender switches from + to -

Display Group No.	Indicated on display	Meaning
23...96		(Unallocated)
97	Read measured value block 97	For factory use only
98 Adaption of throttle valve control part	Read measured value block 98 1 2 3 4	1 = Throttle valve potentiometer voltage 2 = Throttle valve positioner potentiometer voltage 3 = Adaption status of throttle valve control part 4 = Adaption status (e.g. adaption in progress, fault during adaption)
99 Lambda control status	Read measured value block 99 1 2 3 4	1 = Engine speed 2 = Coolant temperature 3 = Lambda control 4 = Lambda control status

1.13 - Reading measured value block: Display Groups 00 (block of ten) to 10

Display group 00 (decimal displayed value)										
▪ Engine running at idling speed										
Display zones										Specification
1	2	3	4	5	6	7	8	9	10	Corresponds to
									Engine speed (idling speed)	24...30
									Injection period	760...960 rpm1)
									Throttle valve angle	2...5
									Operating status of lambda control	2...16
									Injection period (additive learned value) for lambda control	1...8 <°
									Lambda probe voltage	see measured value block 99 2)
									Intake air mass	0...50
									Coolant temperature	-0.5...+0.5 ms
									Engine control unit power supply voltage	0...50
									Intake air temperature	18...52
										98...280 mg/stroke
										80...105 °C
										110...145
										11...14.5 V
										70...160
										4.5...72 °C

1) Up-to-date specifications:

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=> Exhaust emissions test binder

2) Display zone 7 gives a decimal figure indicating the operating status of the lambda control. The operating status of the lambda control is represented by an 8-digit bit sequence in Display Group 99, display zone 4
=>Page 39 .



Evaluating display group 00

Display zone 1: Intake air temperature		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
lower than 70 1)	- Intake air temperature sender - Wiring for intake air temperature sender	- Test intake air temperature sender => Page 102
higher than 160 1)		
Display zone 2: Engine control unit power supply voltage		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
lower than 110	- Alternator defective, battery heavily discharged - Heavy demand on electrical system shortly after starting due to high charging current and ancillaries - Contact resistance in power supply or earth connection for engine control unit - Current drain when ignition is switched off	- Test voltage, charge battery Increase revs slightly for a few minutes and switch off ancillaries Test power supply to engine control unit =>Page 112 Eliminate current drain
higher than 145	- Voltage regulator in alternator defective - Excess voltage from assisted start or high-speed charging	- Test voltage; if necessary, fit a new voltage regulator Interrogate fault memory =>Page 4

1) Depends upon ambient temperature and time vehicle is parked.

Display zone 3: Coolant temperature		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
lower than 170	- Engine too cold - Coolant temperature sender or wiring to engine control unit	- Test drive if necessary - Test coolant temperature sender -G62 =>Page 108
higher than 205	- Radiator dirty - Radiator fan not working - Coolant thermostat defective - Coolant temperature sender or wiring to engine control unit	- Clean radiator - Check operation of radiator fan - Test thermostat - Test coolant temperature sender -G62 =>Page 108
Display zone 4: Intake air mass		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
lower than 18	- Large quantity of unmetered air between intake manifold and air mass meter - Air mass meter or wiring to engine control unit	- Eliminate leak - Test air mass meter =>Page 61
higher than 52	- Gear engaged (automatic gearbox) - Engine load from ancillaries - Air mass meter or wiring to engine control unit	- Put selector lever in P or N position - Remove load (power assisted steering) or switch off ancillaries (e.g. air conditioner) - Test air mass meter =>Page 61

Display zone 5: Lambda probe voltage		
V.A.G 1551 readout	Possible causes of fault	Fault remedy

Readout not alternating (lambda control at rich or lean stop limit; see Display Group 99)	- Large quantity of unmetered air - Defective spark plug - Fuel system pressure too high or too low - Defective injector - Coolant temperature sender -G62 - Solenoid valve 1 for activated charcoal filter -N80 - Lambda probe heating not working - Lambda probe defective or dirty	- Eliminate source of air leak - Test spark plugs - Test fuel system pressure and holding pressure =>Page 67 - Read measured value block, Display Group 99
--	--	--

Display zone 5: Lambda probe voltage		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
constant 255	- Short to positive through: - Lambda probe -G39 or - Signal wire or - Engine control unit	- Test lambda probe =>Page 67
constant 80	- Open circuit through: - Lambda probe -G39 or - Signal wire or - Engine control unit	- Test lambda probe =>Page 67
constant 0	- Short to earth through: - Lambda probe -G39 or - Signal wire or - Engine control unit	- Test lambda probe =>Page 67

Display zone 6: Injection period (additive learned value) for lambda control (see also Display Group 11)		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
low lambda learned values	- Lambda learned values low for idling and normal for part throttle; possibility of oil dilution (too much fuel in oil) - Injector(s) leaking - Fuel pressure too high - Solenoid valve 1 for activated charcoal filter -N80 is constantly open - Air mass meter -G70 defective - Lambda probe heating defective or lambda probe dirty	- See Display Group 11, display zones 2 and 3 - Problem eliminated after motorway drive or oil change - Test injectors =>Page 70

Display zone 6: Injection period (additive learned value) for lambda control		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
high lambda learned values	- Lambda learned values high for idling and lower for part throttle; possibility of unmetered air around intake manifold - Injector blocked - Fuel pressure too low - Unmetered air between -G70 and throttle valve - Unmetered air at manifold gasket - Lambda probe heating defective or lambda probe dirty	- Eliminate faults - See Display Group 11, display zones 2 and 3 - Check injection quantity=>Page 70

Display zone 7: Operating status of lambda control		
- The operating status of the lambda control is represented by a bit sequence (8-digit number block) in Display Group 99, display zone 4.		



Display zone 8: Throttle valve angle		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
lower than 2	- Throttle valve potentiometer in throttle valve control part -J338 defective or incorrectly adjusted - Unmetered air between intake manifold and air mass meter, resulting in increased idling speed; the throttle valve control part will try to regulate the idling speed back to the specified level	- Test throttle valve control part -J338 =>Page 76 - Eliminate sources of air leak
higher than 16	- Adaption of throttle valve control part -J338 not performed - Throttle valve potentiometer in throttle valve control part -J338 defective or incorrectly adjusted - Throttle cable incorrectly adjusted - Throttle valve sticking	- Perform adaption of throttle valve control part -J338 =>Page 76 - Adjust throttle cable - => Mechanics; Repair Group 20; Removing and installing parts of fuel supply system; Adjusting throttle cable

Display zone 9: Injection period		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
lower than 2	- Large quantity of fuel from the ACF system - Wrong injectors installed (delivery rate too high) - Fuel pressure regulator defective	- Test solenoid valve for activated charcoal filter =>Page 52
higher than 5	- Increased engine load due to electrical consumers, air conditioner switched on, gear engaged, power assisted steering on full lock	- Remove load
Display zone 10: Engine speed (idling speed)		
V.A.G 1551 readout	Possible causes of fault	Fault remedy
lower than 24	- Throttle valve control part -J338 sticking or defective	- Test throttle valve control part =>Page 76
higher than 30	- Throttle valve control part -J338 sticking or defective - Large quantity of unmetered air; idling speed stabilisation can no longer compensate	- Test throttle valve control part =>Page 76 - Eliminate air leak

Display Group 01: Basic values

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Read measured value block 1 ⇒				◀ Indicated on display
760...960 rpm	80...105 °C	0.00...1.00 V	00000X10	
				Throttle valve adaption requirements (see next page) 1)
				Lambda probe voltage - see Display Group 00
				Coolant temperature - see Display Group 00
				Engine speed (idling speed) - see Display Group 00

1) The space marked with an "X" may contain either a 0 or a 1.

Note on display zone 4:

Relevance of figures in 8-digit number block for throttle valve adaption requirements:

x	x	x	x	x	x	x	x	Significance when display = 1
1								Fault identified by self-diagnosis 2)
	1							Signal from automatic gearbox
		1						Air conditioner switched on
			1					Idling speed switch open 1)
				1				Fault in Lambda control
					1			Throttle valve open (angle check) 1)
						1		Engine running 1)
							1	Coolant temperature less than 80 °C

1) A figure "1" in this position means it will not be possible to perform an adaptation of the throttle valve control part.

2) A figure "1" in this position means that the self-diagnosis has identified a fault which may not yet have been recorded in the fault memory. If the self-diagnosis has identified a fault relating to the throttle valve control part it will not be possible to perform an adaption of the throttle valve control part using the "Basic setting" function.

Display Group 02: Basic values

Read measured value block 2	⇒	◀ Indicated on display
760...960 rpm	100...280 mg/stroke	0 km/h
		0100
		Operating status of engine
		Road speed
		Intake air mass - see Display Group 00
		Engine speed (idling speed) - see Display Group 00

Note on display zone 4:

Significance of figures in 4-digit number block for operating status of engine:

Significance when display = 1				
x	x	x	x	Operating status of engine
1				Overrun
	1			Idling
		1		Part throttle
			1	Full throttle

Display Group 03: Basic values

Read measured value block 3	⇒	◀ Indicated on display
760...960 rpm	100...280 mg/stroke	1...8 <°
		-100...100 %



			Duty cycle of throttle valve positioner
			Throttle valve angle - see Display Group 00
			Intake air mass - see Display Group 00
			Engine speed (idling speed) - see Display Group 00

Display Group 04: Basic values

Read measured value block 4				⇒	◀ Indicated on display
760...960 rpm	100...280 mg/stroke	2...5 ms	1.8...5 g/s		
			Intake air mass		
			Injection period - see Display Group 00		
			Intake air mass - see Display Group 00		
			Engine speed (idling speed) - see Display Group 00		

Display Group 05: Basic values

Read measured value block 5				⇒	◀ Indicated on display
760...960 rpm	11...14.5 V	80...105 °C	10...70 °C		
			Intake air temperature - see Display Group 00		
			Coolant temperature - see Display Group 00		
			Engine control unit power supply voltage - see Display Group 00		
			Engine speed (idling speed)		

Display Group 06: Altitude adaption

Read measured value block 6				⇒	◀ Indicated on display
760...960 rpm	100...280 mg/stroke	1...8 <°	0.7...1.3		
			Altitude correction factor		
			Throttle valve angle		
			Intake air mass - see Display Group 00		
			Engine speed (idling speed) - see Display Group 00		

Display Group 07: Idling speed setting

Read measured value block 07				⇒	◀ Indicated on display
1...8 <°	0.9...1.1	0.9...1.1	0100		
			Operating status of engine		
			Idling speed learned value (with gear engaged)		
			Idling speed learned value (without gear engaged)		
			Throttle valve angle		

Note on display zone 4:

Significance of figures in 4-digit number block for operating status of engine:

Significance when display = 1				
x	x	x	x	Operating status of engine
1				Overrun
	1			Idling
		1		Part throttle
			1	Full throttle

Note:

Measured value block 7 is for information only and has no significance for fault-finding in the workshop.

Display Group 08: Idling speed stabilisation

Read measured value block 08		⇒		◀ Indicated on display
760...960 rpm	830...860 rpm	-2...35 %	1.8...5 g/s	
Intake air mass				
Idling speed stabiliser				
Specified idling speed when vehicle is stationary				
Engine speed (idling speed) - see Display Group 00				

Display Group 09: Idling speed air requirement

Read measured value block 09		⇒		◀ Indicated on display
-2...35 %	0000	80...105 °C	760...960 rpm	
Engine speed				
Coolant temperature				
Throttle valve control part adaption status				
Idling speed stabiliser				

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Relevance of figures in 4-digit number block for adaption status of throttle valve control part:

"1" signifies:				
x	x	x	x	Adaption status
1				A fault has occurred during adaption of the throttle valve control part; interrogate fault memory => Page 4
	1			No current in throttle valve control part (duty cycle = 0)
		1		Adaption terminated because battery voltage is too low (less than 8V)
			1	Idling speed switch open (switch position check)



Display Group 10: Lambda control and ACF system

Read measured value block 10 ⇒				◀ Indicated on display
-25...25 %	0.00...1.00 V	0...10 %	-10...15 %	
				Lambda correction factor with active fuel tank breather system
				Duty cycle of solenoid valve 1 for activated charcoal filter -N80
				Lambda probe voltage
				Lambda control

Note:

Measured value block 10 is for information only and has no relevance for fault-finding in the workshop.

1.14 - Reading measured value block: Display Groups 11 to 99

Display Group 11: Lambda learned values

Read measured value block 11 ⇒				◀ Indicated on display
2...5 ms	-0.50...0.50 ms	0.85...1.15	xxxxxxx1)	
				Status of fuel tank breather valve (TBV) 1)
				Lambda learned value for part throttle
				Lambda learned value for idling
				Injection period

- 1) The spaces marked with an "X" may contain either a 0 or a 1.

Note on display zone 4:

Significance of figures in 8-digit number block for status of fuel tank breather valve:

x	x	x	x	x	x	x	x		Significance when display = 1
0									Vacant
	1								Transition to vapour content check via fuel tank breather valve
		1							Transition to fuel tank breather valve minimum operating level
			1						Transition to fuel tank breather valve closure
				1					Vapour content check via fuel tank breather valve
					1				Fuel tank breather valve operating normally
						1			Fuel tank breather valve minimum operating level
							1		Fuel tank breather valve closed

Display Group 12: Lambda learned values

Read measured value block 12 ⇒				◀ Indicated on display
760...960 rpm	100...280 mg/stroke	-25...25 %	0.00...1.00 V	

			Lambda probe voltage
			Lambda control
			Intake air mass - see Display Group 00
			Engine speed (idling speed)

Display Group 13: Fuel consumption

Read measured value block 13	760...960 rpm	100...280 mg/stroke	0 km/h	⇒ 0.5...1.5 ltr/h	◀ Indicated on display
					Fuel consumption
					Road speed
					Intake air mass - see Display Group 00
					Engine speed (idling speed)

Note:

Measured value block 13 is for information only and has no relevance for fault-finding in the workshop.

Display Group 14: Knock control

Read measured value block 14	0.0 °cr/shaft	0.0 °cr/shaft	0.0 °cr/shaft	0.0 °cr/shaft	⇒	◀ Indicated on display
						Ignition timing retardation by knock control, cylinder 4
						Ignition timing retardation by knock control, cylinder 3
						Ignition timing retardation by knock control, cylinder 2
						Ignition timing retardation by knock control, cylinder 1

Display Group 15: Knock control

Read measured value block 15	760...960 rpm	100...280 mg/stroke	0.0 °cr/shaft	0.0 °cr/shaft	⇒	◀ Indicated on display
						Ignition timing retardation by knock control, cylinder 2
						Ignition timing retardation by knock control, cylinder 1
						Intake air mass - see Display Group 00
						Engine speed

Display Group 16: Knock control

Read measured value block 16	760...960 rpm	100...280 mg/stroke	0.0 °cr/shaft	0.0 °cr/shaft	⇒	◀ Indicated on display
						Ignition timing retardation by knock control, cylinder 4
						Ignition timing retardation by knock control, cylinder 3
						Intake air mass - see Display Group 00
						Engine speed

**Note:**

- ♦ As soon as knocking is detected the knock control must retard the ignition angle in order to prevent engine damage.

Display Group 17: Knock control

Read measured value block 17				⇒	◀ Indicated on display
0.4...1.3 Vss	0.4...1.3 Vss	0.4...1.3 Vss	0.4...1.3 Vss		
					Knock sensor voltage signal, cylinder 4
					Knock sensor voltage signal, cylinder 3
					Knock sensor voltage signal, cylinder 2
					Knock sensor voltage signal, cylinder 1

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Display Group 18: Torque reduction on automatics

Read measured value block 18				⇒	◀ Indicated on display
760...960 rpm	100...280 mg/stroke	x.x °cr/shaft	0...10 °before TDC		
					Ignition timing
					Ignition timing retardation during gearshift
					Intake air mass - see Display Group 00
					Engine speed (idling speed) - see Display Group 00

Note on display zones 3 and 4:

The ignition timing retardation during a gearshift occurs so rapidly that it cannot always be detected by the V.A.G 1551/1552. The ignition timing value shown in display zone 4 is for information only and has no relevance for fault-finding in the workshop.

Display Group 19: Operating status

Read measured value block 19				⇒	◀ Indicated on display
760...960 rpm	0	0	0		
					Air conditioner compressor (0 = off; 1 = on)
					Air conditioner (0 = off; 1 = on)
					Selector lever position (0 = neutral; 1 = gear engaged)
					Engine speed (idling speed) - see Display Group 00

Note on display zones 2, 3 and 4:

On vehicles with manual gearbox and no air conditioner these display zones may show either 0 or 1.

Display Group 20: Operating status of lambda control (see also Display Group 99)

Read measured value block 20				⇒	◀ Indicated on display
760...960 rpm	100...280 mg/stroke	80...105 °C	0XXX011X		

			Operating status of lambda control 1)
			Coolant temperature - see Display Group 00
			Intake air mass - see Display Group 00
			Engine speed - see Display Group 00

1) The spaces marked with an "X" may contain either a 0 or a 1.

Note on display zone 4:

Relevance of figures in 8-digit number block for operating status of lambda control:

x	x	x	x	x	x	x	x	"1" signifies:
1								Fault recorded in memory during diagnosis; interrogate fault memory =>Page 4 .
	0							Not allocated
		0						Not allocated
			1					Restricted operation mode
				1				Lambda control at stop limit
					1			Lambda control switched on
						1		Lambda probe functioning
							1	Mixture status: 1 = rich mixture 0 = lean mixture

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Note:

For a more detailed explanation of the 8-digit number block, see Display Group 99 =>Page 39 .

Display Group 21: Adaption status of throttle valve control part (see Display Group 98)

Read measured value block 21	0000	70...93 %	67...87 %	=> 6...39 %	Indicated on display
					Max. stop of throttle valve
					Emergency running stop of throttle valve
					Min. stop of throttle valve
					Adaption status of throttle valve control part

Note on display zone 1:

Relevance of figures in 4-digit number block for adaption status of throttle valve control part:

				"1" signifies:
x	x	x	x	Adaption status of throttle valve control part
1				A fault has occurred during adaption of the throttle valve control part; interrogate fault memory =>Page 4
	1			No current in throttle valve control part (no duty cycle)
		1		Adaption terminated because battery voltage is too low (less than 8V)
			1	Idling speed switch open (switch position check)

**Note:**

Measured value block 21 is for information only and has no relevance for fault-finding in the workshop.

Display Group 22: Position of camshaft in relation to crankshaft

Read measured value block 22 ⇒				◀ Indicated on display
760...960 rpm	100...280 mg/stroke	27...29	87...89	
			Number of teeth on crankshaft-mounted sender wheel when Hall sender switches from + to -	
			Number of teeth on crankshaft-mounted sender wheel when Hall sender switches from - to +	
		Intake air mass - see Display Group 00		
Engine speed - see Display Group 00				

Notes on display zones 3 and 4:

- The engine speed sender on the crankshaft transmits both an engine speed signal and a reference mark signal. The reference mark signal is generated by a gap in the sender wheel.
- The Hall sender rotor ring on the camshaft has a 180° division so that for one half of each camshaft revolution it covers the window on the Hall sender and for the other half-revolution the window is exposed.
- To synchronise the components when starting, the engine control unit records the instant when the rotor ring begins to cover the window (signal change from - to +) and the instant when it begins to expose the window (signal change from + to -).
- When the reference mark signal on the crankshaft is detected, the engine control unit counts the number of teeth on the crankshaft-mounted sender wheel. As soon as it has counted between 27 and 29 teeth after the gap, the signal sent by the Hall sender on the camshaft should change from - to + (rotor ring begins to cover window). After between 87 and 89 teeth, with the crankshaft already making its second revolution, the Hall sender signal should change from + to - (rotor ring begins to expose window).
- If the signal does not change within the tooth ranges specified above, this may mean that the toothed belt has slipped.

Display Group 97

This Display Group is for factory use only.

The values shown have no relevance for fault-finding in the workshop.

Display Group 98: Adaption of throttle valve control part

Read measured value block 98			⇒	• Indicated on display
3.70...4.75 V	2.28...4.75 V	0000	00	
			Adaption status	
			Adaption status of throttle valve control part	
			Voltage of throttle valve positioner potentiometer -G88	
Voltage of throttle valve potentiometer -G69				

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Note on display zone 3:

Relevance of figures in 4-digit number block for adaption status of throttle valve control part:

Significance when display = 1				
x	x	x	x	Adaption status of throttle valve control part



- ♦ Continued on next page

Notes on 8-digit number block in Display group 99, display zone 4 (cont.):

- ♦ Normally the first bit (Mixture status) should fluctuate constantly between "0" and "1".
- ♦ If the fourth bit is a "1" (Lambda control at stop limit), the first bit (Mixture status) will indicate which stop limit the lambda control is working at, i.e. rich or lean.
- ♦ If the first bit remains constantly at "1", this means that the lambda control is at the "lean" stop limit but that the lambda probe is still registering a "rich" mixture.
- ♦ If the first bit remains constantly at "0", this means that the lambda control is at the "rich" stop limit but that the lambda probe is still registering a "lean" mixture.
- ♦ The functions of the lambda probe and the lambda control are counterposed, i.e. when the lambda probe is registering "rich" the lambda control must lean down the mixture, and when the lambda probe is registering "lean" the lambda control must enrich the mixture.
- ♦ The lambda control cannot be switched off manually.



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24 - Mixture preparation, Injection

1 - Servicing Simos injection system

1.1 - Servicing Simos injection system

1.2 - Safety precautions

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Warning!

The fuel system is pressurised. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully pulling off the hose or cap.

To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- ◆ Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- ◆ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ To run the engine at starting speed without actually starting it (for example, in order to test compression), unplug the connector from the output stage of the ignition coils and also the connectors on the injectors. After completing the work, interrogate and erase the fault memory.
- ◆ Always switch off the ignition before cleaning the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.3 - Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following "5 rules":

- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths!
- ◆ Carefully cover over or seal opened components if the repair cannot be completed immediately.
- ◆ Only install clean components:
Only unpack replacement parts immediately prior to installation.
Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- ◆ When the system is open:
Do not work with compressed air if this can be avoided.
Do not move vehicle unless absolutely necessary.

1.4 - Technical data

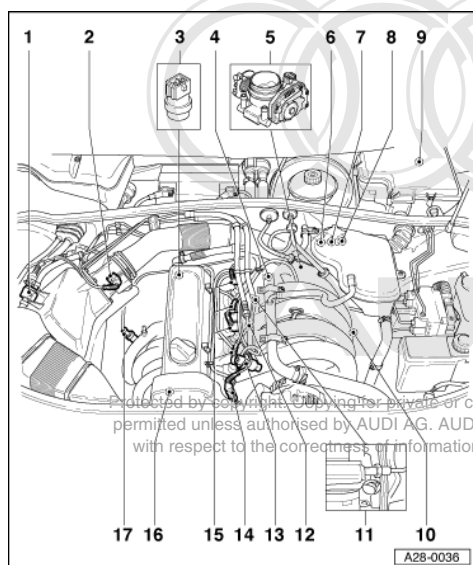
Engine code letters	AHL, ARM
Idling speed Not adjustable - controlled by the idling speed stabilisation	760...960 rpm



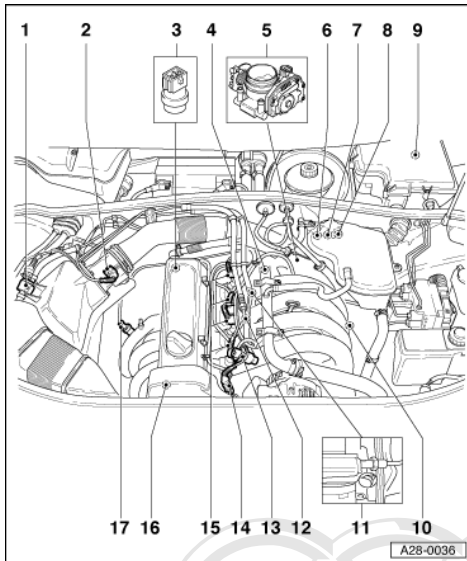
Engine speed limiter - shuts off injectors	approx. 6500 rpm	
Fuel pressure at idling speed	Vacuum hose connected	approx. 3.5 bar
	Vacuum hose disconnected	approx. 4 bar
Holding pressure after 10 minutes	at least 2.5 bar	
Injectors	Spray pattern	Same for all injectors
	Resistance (room temperature) 1)	14...17 ω

1) When the engine is at operating temperature the resistance is increased by approx. 4...6 ω .

1.5 - Fitting locations overview



- 1 **Activated charcoal filter solenoid valve 1 (N80)**
- 2 **Air mass meter (G70)**
- 3 **Coolant temperature sender (G62)**
- 4 **Ignition coils (N and N128) with output stage (N122)**
 - ♦ Tightening torque for securing bolts: 9 Nm.
- 5 **Throttle valve control part (J338)**
 - ♦ Tightening torque for securing bolts: 9 Nm.
- 6 **4-pin connector**
 - ♦ For lambda probe and lambda probe heating
- 7 **3 pin connector**
 - ♦ For engine speed sender
 - ♦ Grey
- 8 **3 pin connector**
 - ♦ For knock sensor 1 (G61)



9 Simos injection and ignition system control unit (J361)

10 Intake air temperature sender (G42)

11 Engine speed sender (G28)

12 Knock sensor 1 (G61)

13 Fuel pressure regulator

14 3 pin connector

- ♦ For phase sensor (Hall sender) -G40
- ♦ Black

15 Injectors (N30...N33)

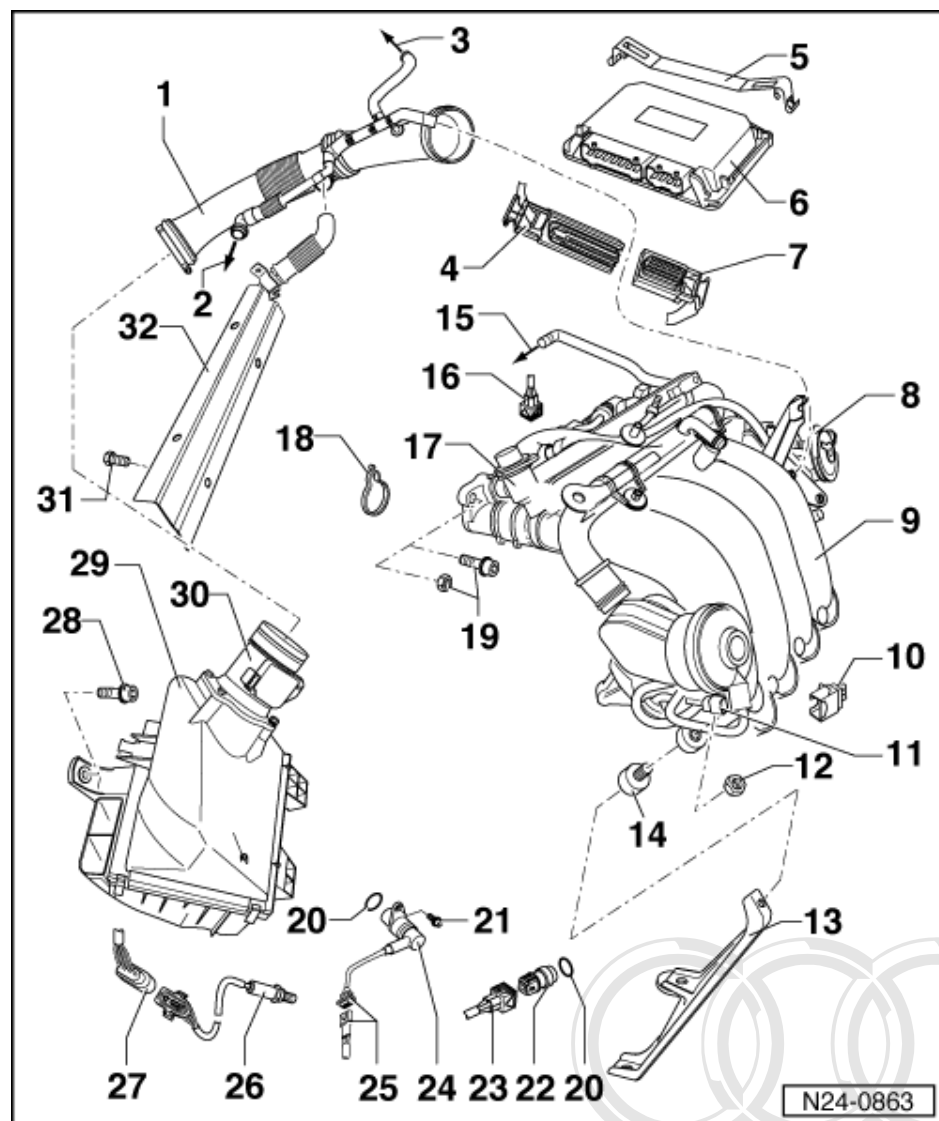
16 Phase sensor (Hall sender) -G40

- ♦ Beneath camshaft sprocket

17 Lambda probe (G39) with lambda probe heating (Z19)

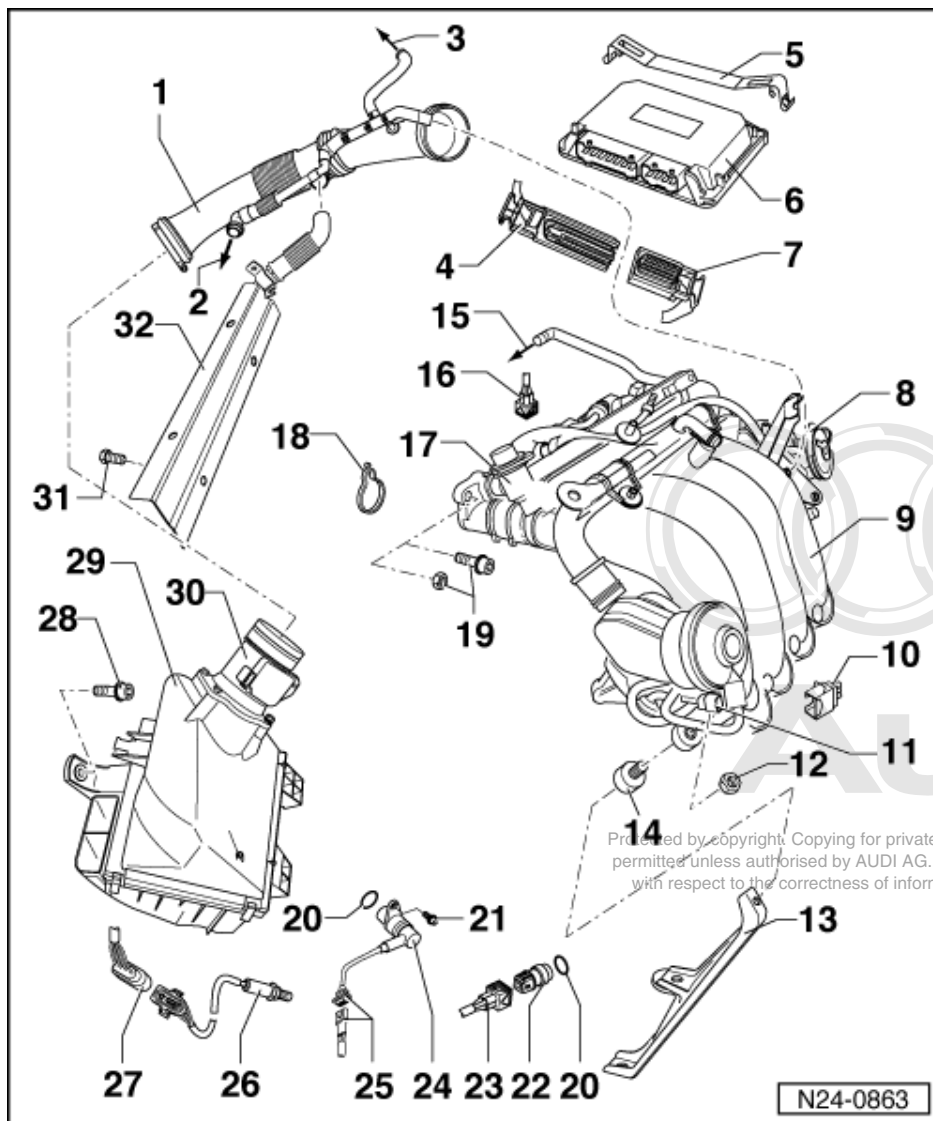
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1.6 - Removing and installing parts of fuel injection system (vehicles with intake manifold change-over function)



- 1 Intake hose
- 2 To cylinder head cover
- 3 To activated charcoal filter solenoid valve (-N80)
- 4 Connector, 52-pin
 - ♦ For engine control unit
 - ♦ Only disconnect or connect with ignition switched off
 - ♦ Release to disconnect
- 5 Securing plate
 - ♦ For engine control unit

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6 Engine control unit

(Control unit for Simos injection and ignition system -J361)

- ♦ Fitting location: In protective housing, plenum chamber, left

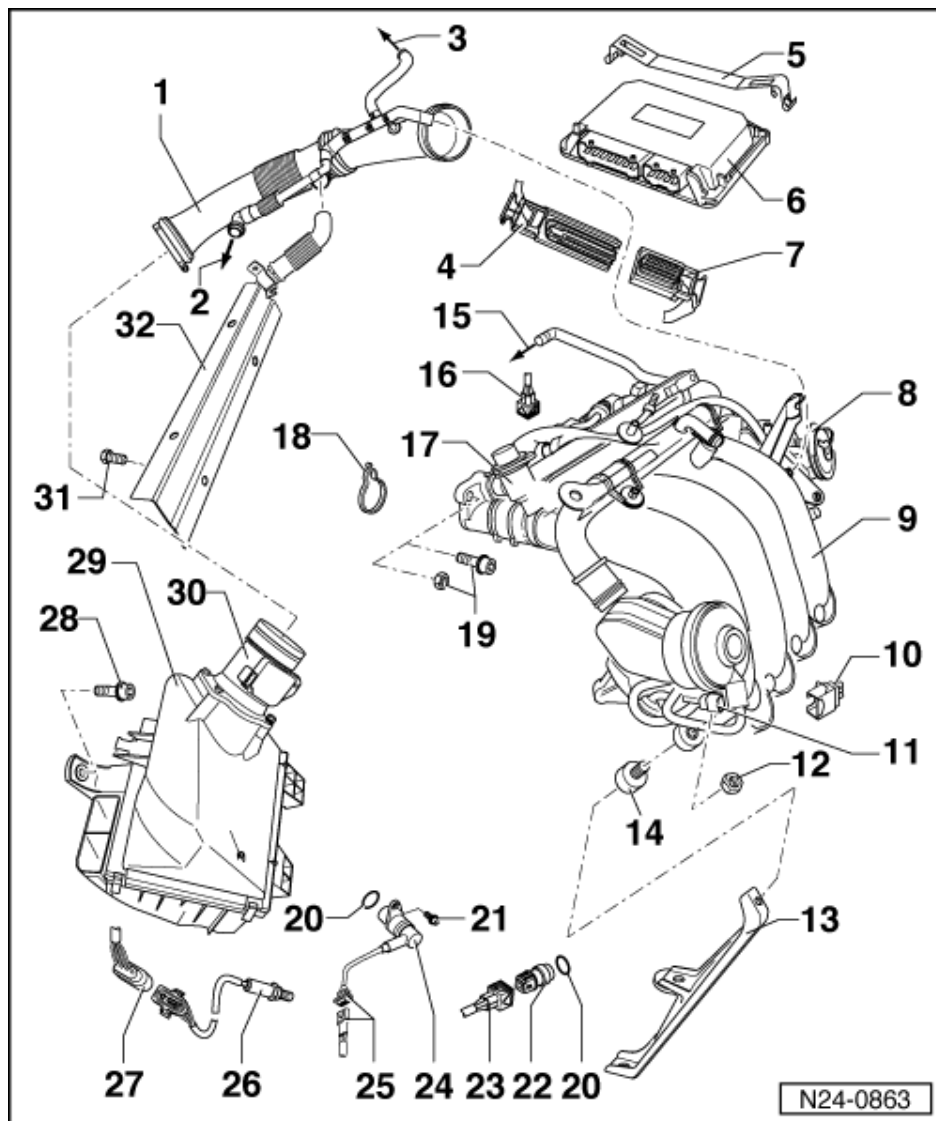
7 Connector, 28 pin

- ♦ For engine control unit
- ♦ Only disconnect or connect with ignition switched off
- ♦ Release to disconnect

8 Throttle valve control part (J338)*

9 Intake manifold

- ♦ Removing and installing parts of intake manifold change-over mechanism=>Page 86



10 Connector

- ◆ Black, 2-pin
- ◆ For twin path intake manifold change-over valve (N156)

11 Intake manifold change-over valve (-N156)

- ◆ Checking intake manifold change-over function=>Page 81

12 10 Nm

13 Support

- ◆ Between intake manifold and compact bracket

14 Bonded rubber mounting

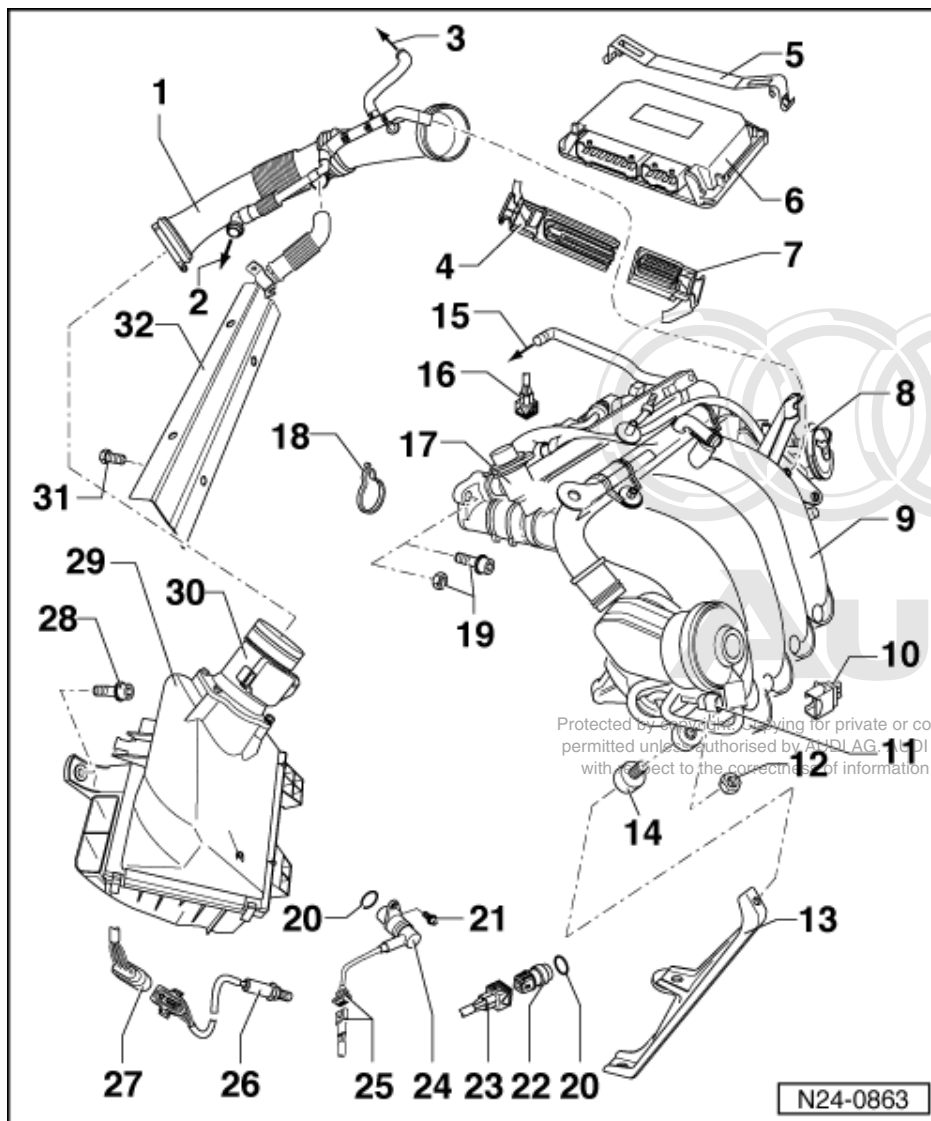
15 To connection

- ◆ On cylinder head

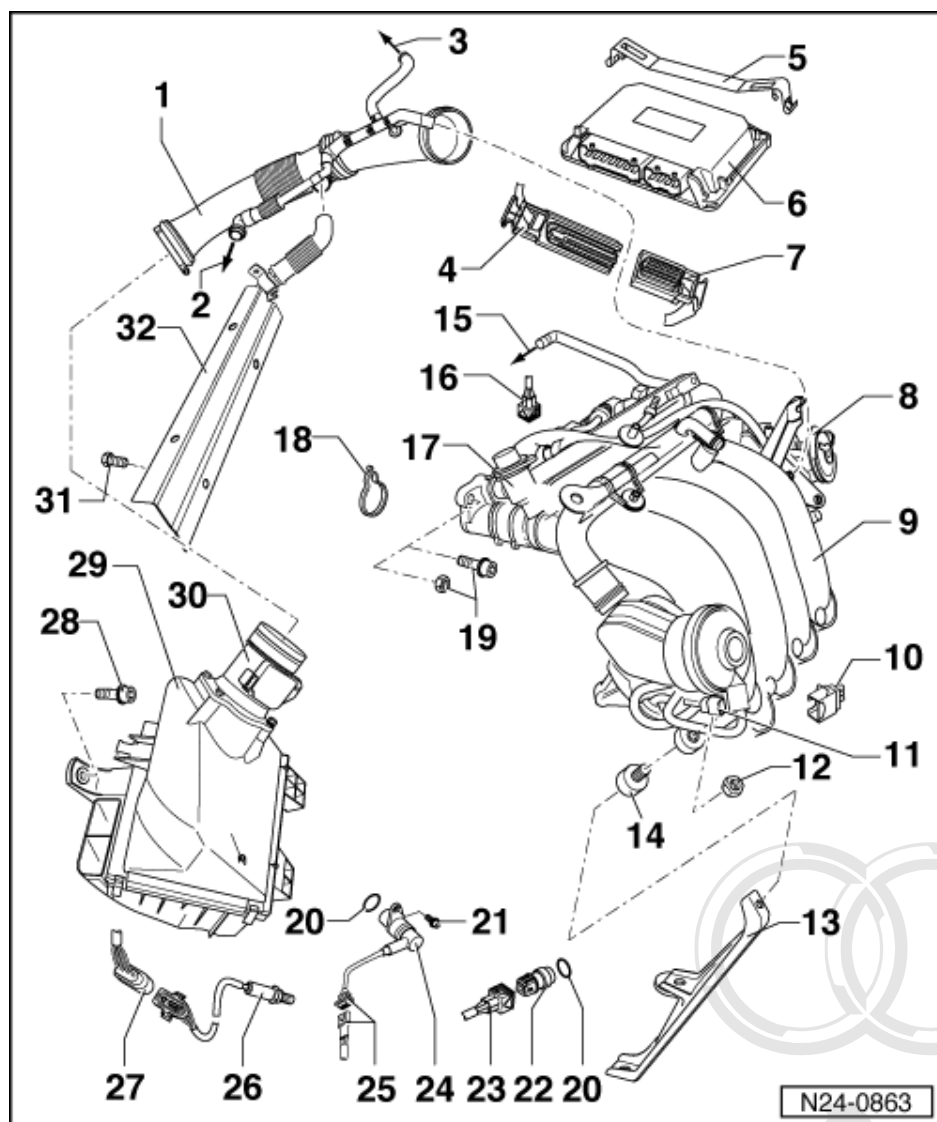
16 Connector

- ◆ Black, 2-pin
- ◆ For injector (N30...N33)

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- 17 Fuel rail
 18 Seal
 ♦ Renew
 19 20 Nm
 20 O ring
 ♦ Renew if damaged
 21 10 Nm
 22 Coolant temperature sender (-G62)
 ♦ Blue, with temperature gauge sender (-G2)
 ♦ For engine control unit
 ♦ If necessary release pressure in cooling system before removing
 23 Connector
 ♦ 4 pin
 ♦ Wiring chamber 1 and wiring chamber 3 for G62



24 Engine speed sender (-G28)

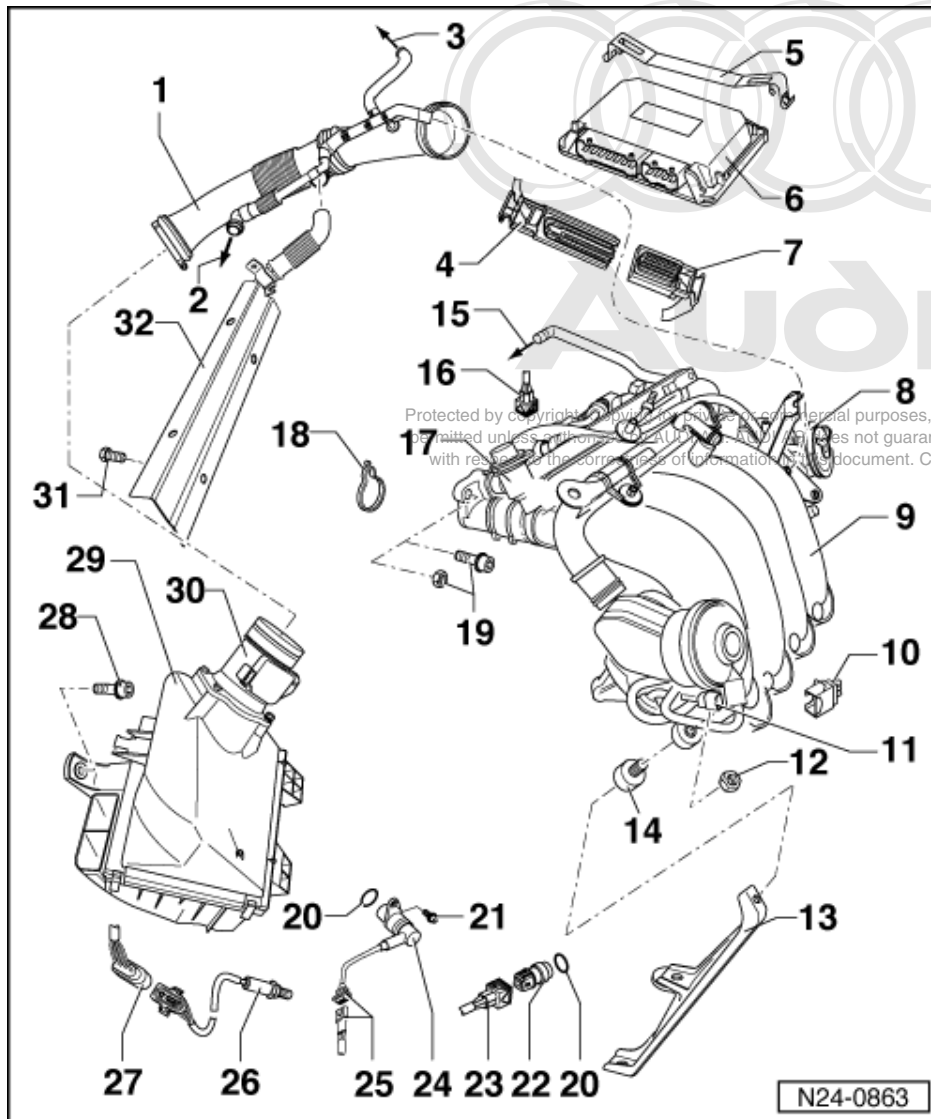
25 3 pin connector

- ◆ For engine speed sender
- ◆ Grey
- ◆ Secured to the bulkhead on left (below expansion tank)

26 Lambda probe (-G39), 55 Nm

- ◆ Fitting location: front pipe
- ◆ Grease only the threads with "G5"; "G5" must not get into the slots on the probe body
- ◆ Probe heating voltage supply via fuel pump relay (-J17)

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27 4-pin connector

- ♦ For Lambda probe and Lambda probe heating
- ♦ Secured to the bulkhead on left (below expansion tank)

28 20 Nm

29 Air cleaner

30 Air mass meter (-G70) with intake air temperature sender (-G42)

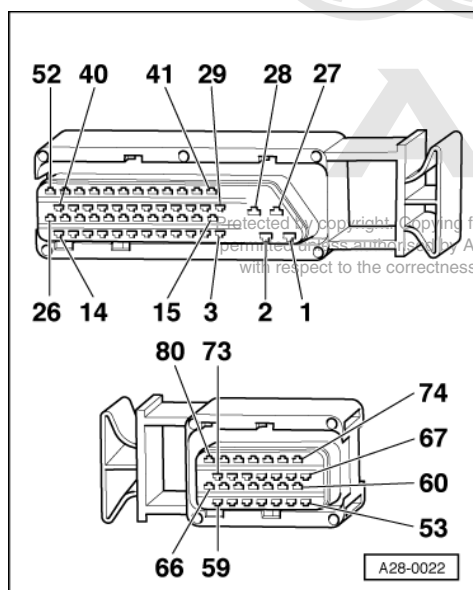
31 20 Nm

32 Resonator



1.7 - Wiring and component check with test box V.A.G 1598/22

Notes:



- ♦ Use the hand multimeter V.A.G 1526 or the multimeter V.A.G 1715 and the diode test lamp V.A.G 1527 for the checks.
 - ♦ To connect the testers to the test box use aux. cables from adapter set V.A.G 1594.
 - ♦ The contact numbers of the plugs and the socket numbers in the test box are identical.
- With ignition switched off, pull plug connector off control unit.
 - Connect test box to wiring harness connector.
 - Carry out test as described in the repair instructions.

Warning!

To prevent damage to the electronic components, switch to the respective measuring range before connecting the measuring cable and observe the test prerequisites.

Note:

After re-connecting the engine control unit, perform adaption of engine control unit to throttle valve control part

=>Page **77**.

1.8 - Renewing engine control unit

Removing and installing

Fitting location => Fitting locations overview, Page **42**

Always make sure the ignition is switched off before fitting or unplugging the control unit connector.

Note:

After installing the new engine control unit the following operations must be performed:

- Code control unit => Page **21**.
- Perform adaption of throttle valve control part
=> Page **77**.

- Adaption of engine electronics control unit to electronic immobilizer => Page **51** .

Adapting engine electronics control unit to electronic immobilizer

Test conditions

- Authorized vehicle key required
- Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.
- Switch on ignition.
- Press key 1 for "Rapid data transfer".
- Press keys 2 and 5 for address word "Immobilizer" and confirm entry with Q key. (On vehicles with immobilizer in dash panel insert, enter address word "17".)
- Press the =>key.

-> Indicated on display:

Rapid data transfer HELP Select function XX

- Press keys 1 and 0 for function "Adaption" and confirm entry with Q key.

-> Indicated on display:

Adaption Feed in channel number XX

- Press key 0 twice for "Channel number 0" and confirm entry with Q key.

-> Indicated on display:

Adaption Q Erase learnt values?

- Confirm input with Q key.

-> Indicated on display:

Adaption Learnt values have been erased
--

- Conclude adaption by pressing => key.

Note:

The identity of the engine control unit is read into the immobilizer control unit when next switching the ignition on.

1.9 - Testing idling speed

Test conditions

- No leaks in exhaust system
- Coolant temperature at least 80 °C
- Throttle valve in idling position

=> 4-cylinder Engine, Mechanics; Repair group 20; Removing and installing parts of the fuel supply system; Servicing accelerator cable Removing and installing parts of the fuel supply system Servicing accelerator cable

- Electrical consumers switched off
- Air conditioner switched off
- Pressure gauge not connected



- Selector lever in position P or N

Testing idling speed**Notes:**

- ♦ The idling speed cannot be adjusted.
- ♦ The idling speed is regulated by the engine control unit via the throttle valve control part.
- Interrogate fault memory =>Page 4 . The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Take vehicle for a test drive and interrogate the fault memory again to make sure it is clear.
- Run the engine at idling speed.
- Switch off air conditioner.
- Switch off rear window heating.
- Place selector lever in P or N position (automatic gearboxes).
- Read measured value block (select function 08, Display Group 01 =>Page 30).

-> Indicated on display:

Read measured value block 1			
1	2	3	4

- Read off idling speed from display zone 1.

Specification: 760...960 rpm

- Press =>key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- If the value does not match the specification, interrogate the fault memory again =>Page 4 .

If the idling speed is too high or too low and there are no faults recorded in the fault memory, carry out the following tests:

- Testing idling speed switch =>Page 79 .
- Large quantity of unmetered air => see "Read measured value block", Display Group 03, 08 or 99.
- Test throttle valve control part =>Page 76 .

1.10 - Checking fuel pressure regulator and holding pressure**Test conditions**

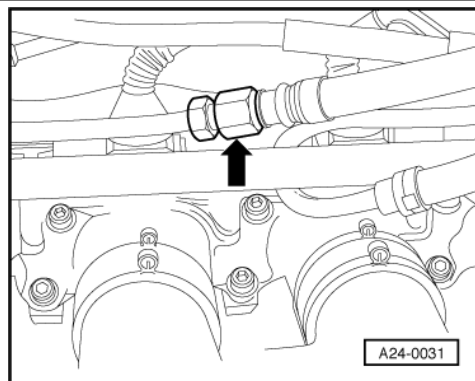
- Fuel pump relay OK; testing => Page 58 .
- Fuel pump OK
- Fuel filter OK
- Battery voltage OK

Note:

The fuel pressure regulator regulates the fuel pressure according to the intake manifold pressure at the throttle valve unit.

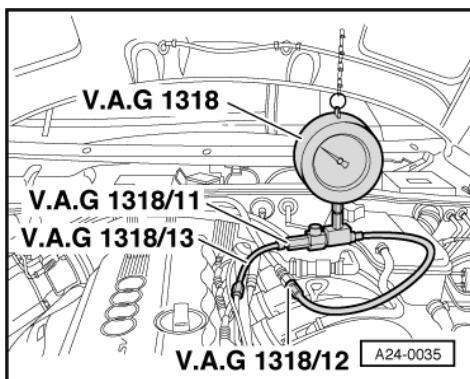
Warning!

Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.



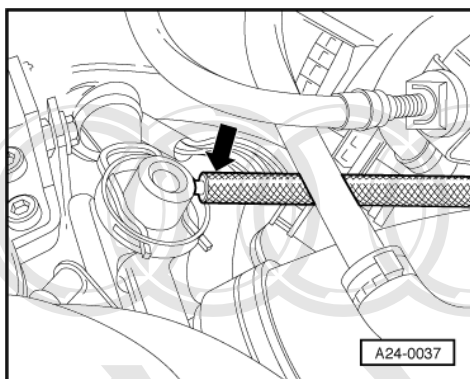
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- -> Open the union -arrow- and catch escaping fuel with a cloth.
- Connect pressure gauge V.A.G 1318 into fuel supply pipe using adapters 1318/11, 1318/12 and 1318/13.



- -> Open cut-off valve on pressure gauge (valve handle points in direction of flow).
- Start the engine and run at idling speed.
- Measure fuel pressure.

Specification: approx. 3.5 bar



- -> Pull vacuum hose -arrow- off fuel pressure regulator.

The fuel pressure must increase to approx. 4.0 bar.

Reconnect vacuum hose.

Switch off ignition.

- Observe pressure drop on gauge.

After 10 minutes the remaining pressure should be at least 2.5 bar.

If the holding pressure drops below 2.5 bar:

- Start the engine and run at idling speed.
- Switch ignition off after the pressure has built-up. At the same time close pressure gauge cut-off tap (lever at 90° to throughflow direction).
- Observe pressure drop on gauge.

If the pressure does not drop, the following faults are possible:

- ◆ Fuel pressure regulator defective
- ◆ Injectors leaking
- ◆ Unions on pressure gauge downstream of cut-off valve leaking

If the pressure drops again, the following faults are possible:

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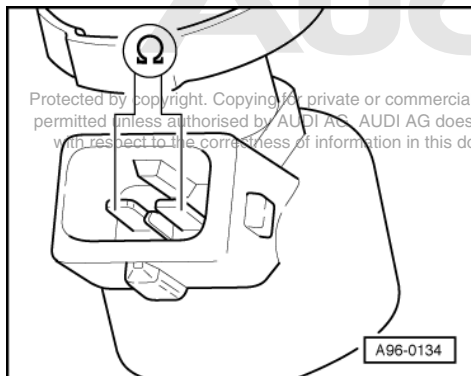
- ♦ Union between pressure gauge and fuel supply pipe leaking
- ♦ Supply pipe leaking at fuel tank
- ♦ Return valve in fuel pump leaking

=> 4-cylinder Engine, Mechanics; Repair Group 20; Removing and installing fuel pump Removing and installing fuel pump

Note:

When disconnecting the pressure gauge, close the cut-off valve, unscrew the union on adapter V.A.G 1318/12, then open the cut-off valve to drain off excess fuel into a suitable container.

1.11 - Checking injectors



A - Electrical testing of injectors

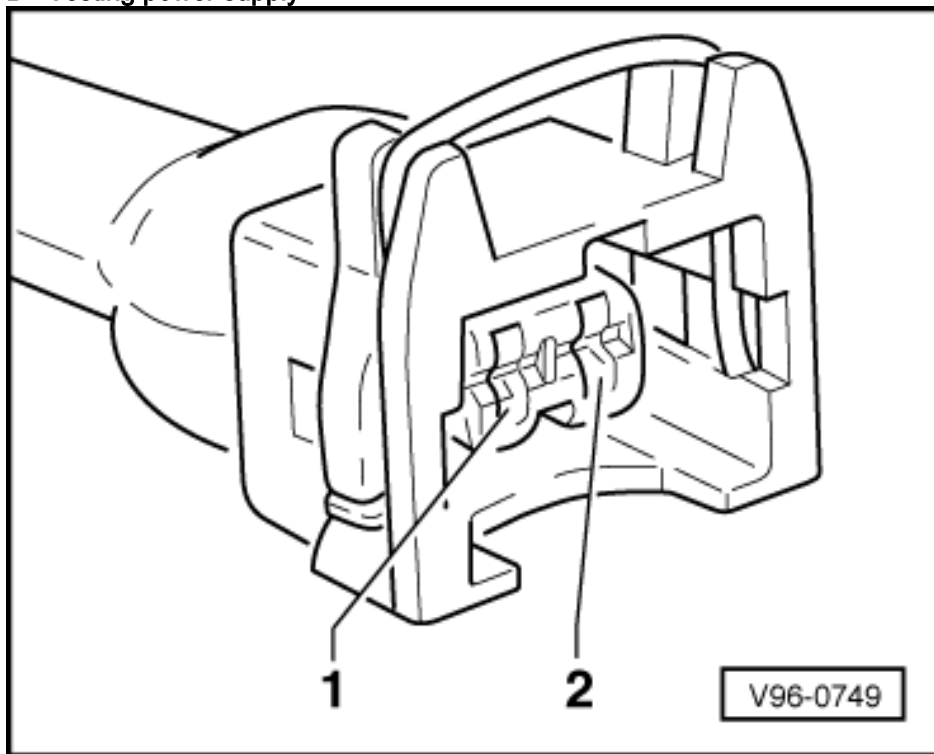
- Remove plug connector from the injector which is to be tested.
- -> Measure resistance between the injector contacts using V.A.G 1526.

Specification: 14...17 Ω .

When the engine is warm the resistance will be approx. 4...6 Ω higher.

- If the measured value is not as specified, renew the injector.

B - Testing power supply



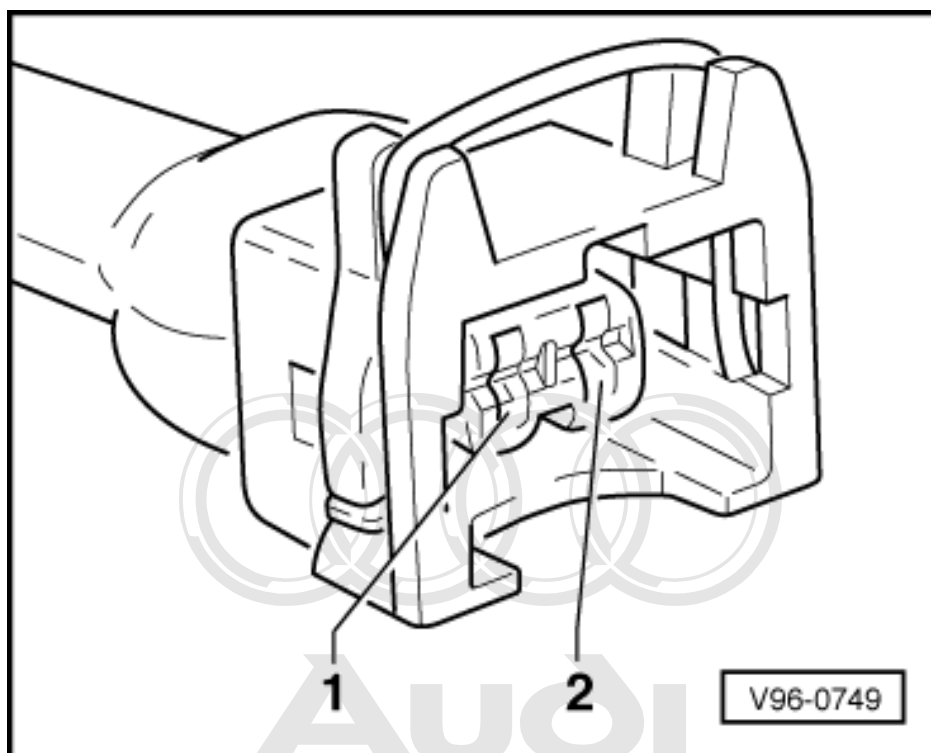
Test conditions

- Fuel pump relay OK; testing =>Page 58 .
- Fuse for injectors OK

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Remove plug connector from the injector which is to be tested.
- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1 on the connector.
- Operate starter for a few seconds (the engine can be allowed to start). The diode test lamp should light up.
- If the diode test lamp does not light up, test for open circuits in the wiring between contact 1 and the fuse for the injectors. If necessary, rectify open circuit.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder



- If the diode test lamp lights up, test activation of injectors.

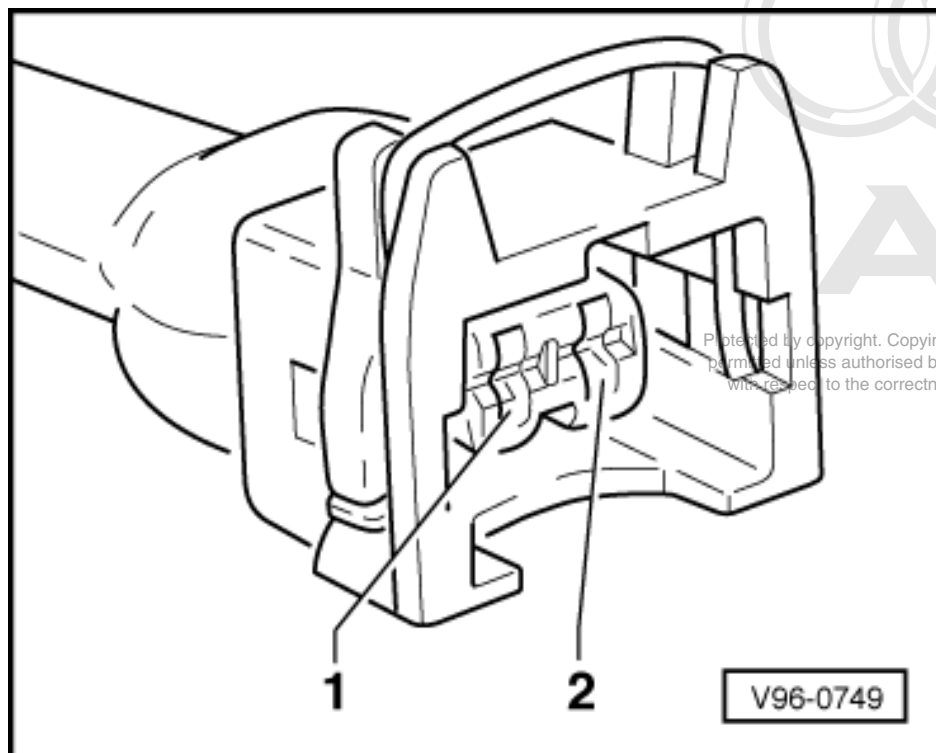
C - Testing activation of injectors

- Remove plug connector from the injector which is to be tested.
- -> Connect diode test lamp V.A.G 1527 between the battery positive terminal (+) and contact 2 on the connector.
- Operate starter for a few seconds (the engine can be allowed to start).

Specification: the diode test lamp should start flashing.

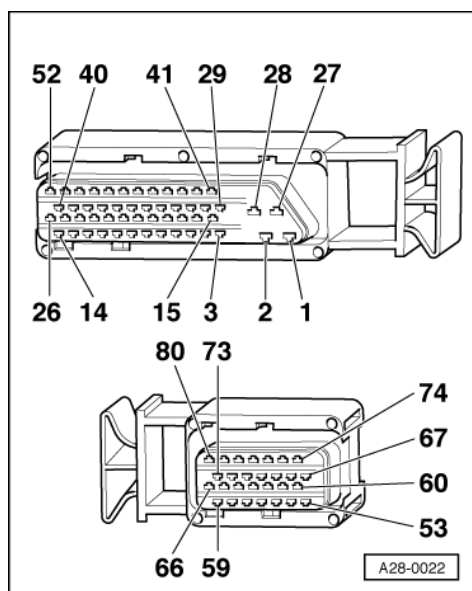
Note:

Diode test lamps with a low current draw continue to glow faintly between impulses from the engine control unit (rather than going out completely) and become much brighter when receiving an impulse.



If the diode test lamp does not flash:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 50 .
- -> Test for open circuit or short to positive in the wiring between the engine control unit and contact 2 on the plug connector for the injector being tested.



Contact 2 on connector for injector, Cylinder No.	Test box V.A.G 1598/22 or control unit connector
1	73
2	80
3	58

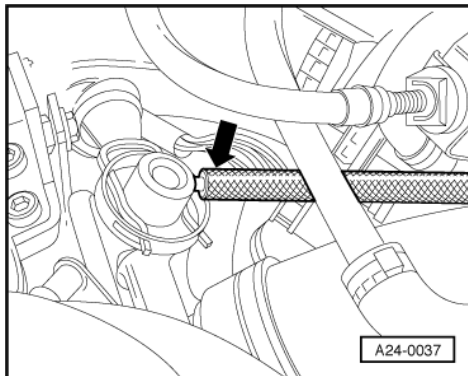
Contact 2 on connector for injector, Cylinder No.	Test box V.A.G 1598/22 or control unit connector
4	65

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit
=> Page 50 .

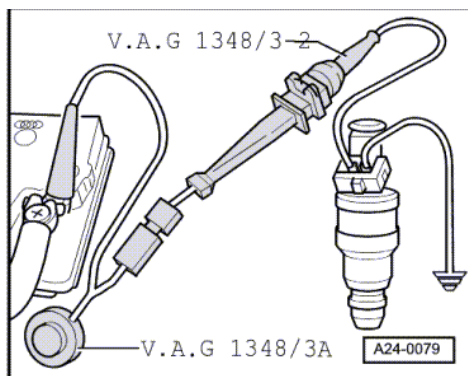
1.12 - Testing injection quantity, leak-tightness and spray pattern of injectors

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Test conditions



- Fuel pressure OK; testing => Page 52 .
- Remove cover from fuel manifold.
- -> Pull vacuum hose -arrow- off fuel pressure regulator.
- Unplug connectors from injectors and from Hall sender.
- Release wires for injectors and Hall sender from plastic clip on fuel manifold.
- Unbolt fuel manifold from intake manifold and pull it upwards and off the intake manifold together with the injectors.
- Place the injector which is to be tested into a measuring glass from injection quantity tester V.A.G 1602.



- -> Connect one of the injector contacts to engine earth using test cable and crocodile clamp from V.A.G 1594.
- Connect second injector contact to positive using remote control V.A.G 1348/3 A, adapter cable V.A.G 1348/3-2 and auxiliary cable.
- Start final control diagnosis and select solenoid valve 1 for activated charcoal filter -N80 => Page 19 . This activates the fuel pump, which will run for about 50 seconds.
- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops of fuel should escape from each injector during the 50-second running period.
- If the fuel loss is greater, switch off the fuel pump (terminate final control diagnosis) and renew the faulty injector.



- Start final control diagnosis again and select solenoid valve 1 for activated charcoal filter -N80.

Note:

The final control diagnosis cannot be re-started until the ignition has been switched off briefly.

- Immediately after selecting ACF solenoid valve (fuel pump will run for approx. 50 seconds), activate remote control V.A.G. 1348/3 A for 30 seconds.

Note:

When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

- Repeat test (i.e. start final control diagnosis) for all injectors.
- Once all four injectors have been actuated, place measuring glasses on a level surface.

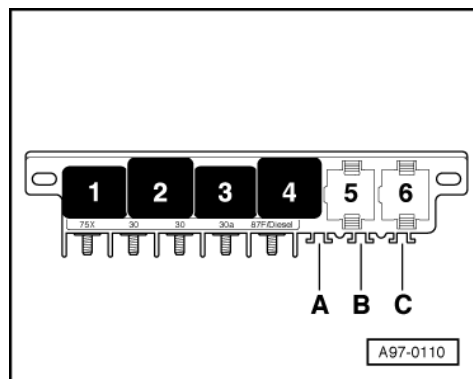
Specification: 85...105 ml.

- If the measured value for one or more of the injectors is outside the tolerance range, switch off the fuel pump (terminate final control diagnosis) and renew the defective injector.
- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure => Page 52 .

Installation of the fuel manifold together with injectors is performed in the reverse sequence. The following points should be noted when installing:

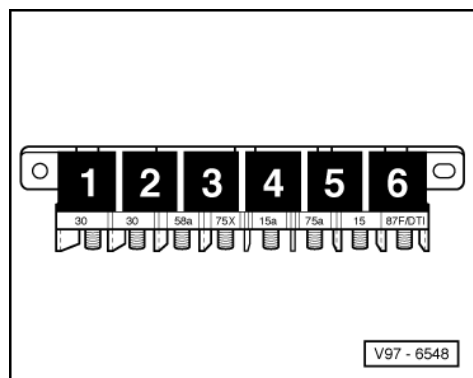
- Renew the O-rings at all opened connections. (When renewing the front O-ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- Moisten the O-rings with clean engine oil.
- Make sure that the injectors are installed in the correct positions.
- Check to make sure that the retainer clamps are properly seated.

1.13 - Testing fuel pump relay and activation

Note:

The fuel pump relay is located in the central electrics unit in the driver's footwell:

-> in plug-in position 4, if the central electrics unit has 4 fixed relay plug-in positions (that cannot be unclipped).

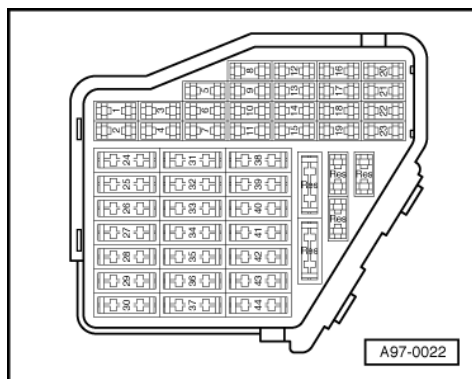


-> in plug-in position 6, if the central electrics unit has 6 fixed relay plug-in positions.

Always refer to the Current flow diagram for the necessary information.

A - Testing fuel pump relay -J17

- Remove storage bin in front left-hand footwell.



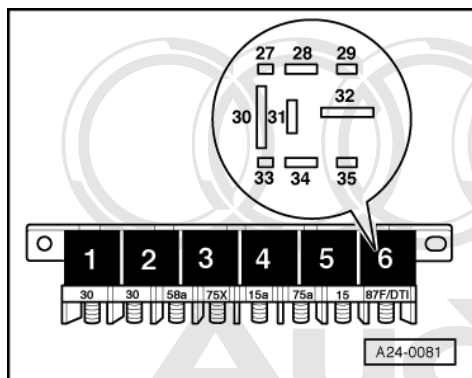
- -> Remove fuel pump fuse from fuse holder and connect diode test lamp V.A.G 1527 between earth and one of the two contacts for the fuel pump fuse.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Operate the starter briefly.

The fuel pump relay should pick up (can be felt and heard) and the diode test lamp should light up.

- If the fuel pump relay does not pick up, test activation
=> Page 60.
- If the fuel pump relay picks up but the diode test lamp does not light up, repeat the test on the other contact.



- -> If the diode test lamp still does not light up, test for open circuit in wiring between fuel pump fuse and contact 30 in relay position 6. If necessary, rectify open circuit.

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 => Current flow diagrams, Electrical fault finding and Fitting locations binder

- If the power supply, activation and wiring for the fuel pump relay are OK, fit a new fuel pump relay.



B - Testing power supply and activation of fuel pump relay

Note:

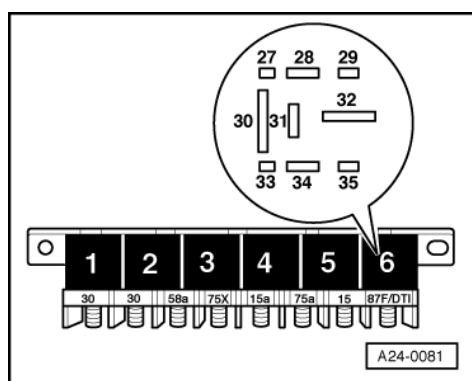
Activation of the fuel pump relay can also be tested using the final control diagnosis.

=>Page 19.

- Remove fuel pump relay -J17 from central electrics, relay position 6.

Testing power supply

- Switch ignition on.

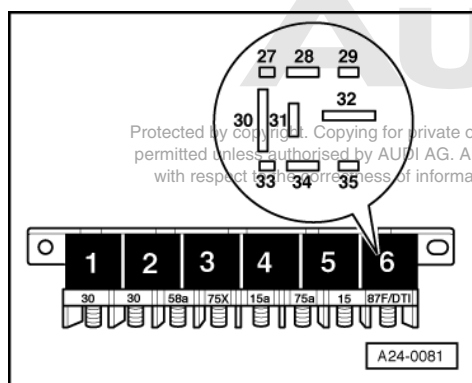


- -> Connect hand-held multimeter V.A.G 1526 between earth and contact 28 in relay socket (positive; terminal 15 from ignition switch). Disconnect, then re-connect between earth and contact 32 in relay socket (permanent positive; terminal 30 from battery).

Specification: approx. battery voltage in each case

- If the values are not as specified, rectify the open circuit.

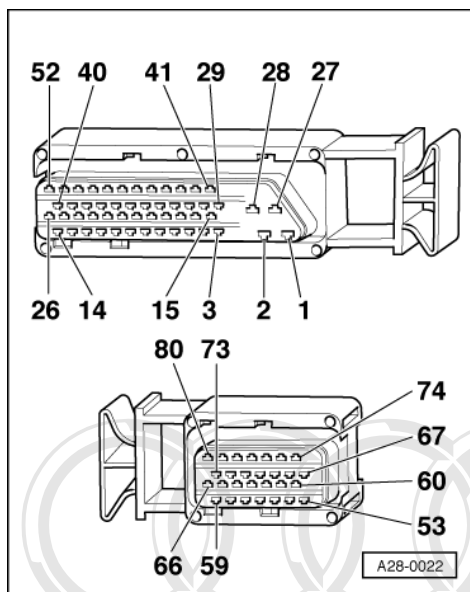
=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations



Testing activation

- -> Connect diode test lamp V.A.G 1527 between positive and contact 29 in relay socket (earth connection via engine control unit).
- Operate the starter briefly.
- The diode test lamp should light up and remain lit when the starter is operated.

Note:



Diode test lamps with a low current draw do not go out completely but continue to glow faintly until the starter is operated.

- If the activation, wiring and power supply for the fuel pump relay are OK but the fuel pump relay still does not pick up, fit a new fuel pump relay.

If the diode test lamp does not light up, test the wiring as follows:

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-> Connect test box V.A.G 1598/22 to wiring harness for engine control unit

=> Page 50.

- Connect hand-held multimeter between contact 29 in relay socket and socket 4 on the test box, then test wiring for open circuits.
- Rectify open circuit if necessary.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- If there is no open circuit and the diode test lamp still does not light up, fit a new engine control unit
=> Page 50.
- Refit the fuel pump fuse.

1.14 - Testing air mass meter (vehicles without intake manifold change-over function)

Testing operation

Test conditions

- Vehicle stationary, engine idling
- Read measured value block (function 08) and select Display Group 02 => Page 31.

-> Indicated on display:

Read measured value block	2
1	2
3	4



Display zone 2 shows the intake air mass (milligrams per stroke).

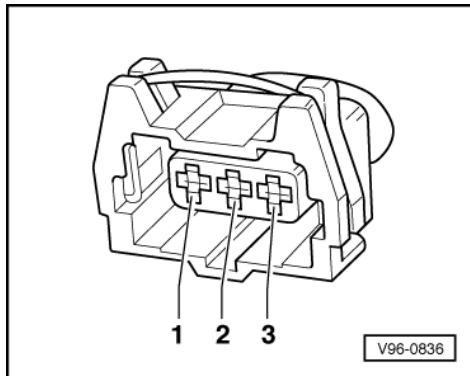
Specification: 100...280 mg/H (mg/stroke)

- If the values are not as specified or if the fault memory has recorded a fault relating to the air mass meter, test the power supply to the air mass meter => Page 62 .

Testing power supply to air mass meter

- Test fuse for air mass meter.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

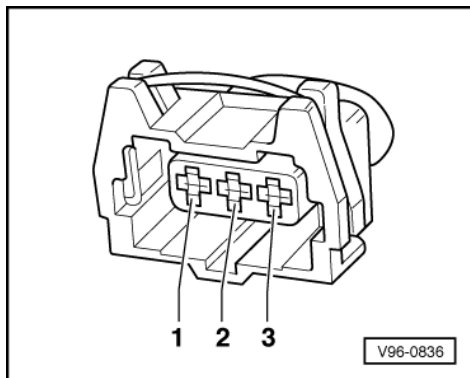


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- -> If the fuse is OK, unplug the connector from -G70 and connect diode test lamp V.A.G 1527 between engine earth and contact 3 on the connector.
- Operate the starter briefly (engine can be allowed to start briefly). The diode test lamp should light up.
- -> If the diode test lamp does not light up, test for open circuit and short to earth in the wiring between the fuse and contact 3 on the connector. If necessary, repair the wiring.

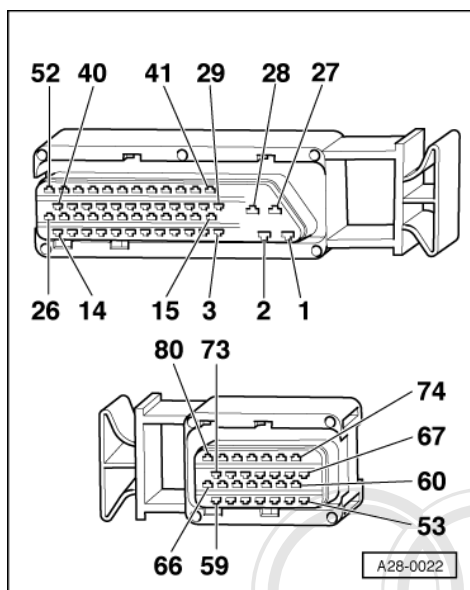
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If the fuse and the wiring are OK but the diode test lamp still does not light up, test the fuel pump relay => Page 58 .
- If the power supply to the air mass meter is OK, test the signal wire => Page 62 .



Testing signal wiring for air mass meter

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 50 .
- -> Test wiring from plug connector on air mass meter...



- -> ... to engine control unit for open circuit and short to positive or earth. Rectify if necessary.

Plug connector for air mass meter G70	Test box V.A.G 1598/22 or control unit connector
1	13
2	12

- If the wiring is OK, fit a new air mass meter -G70.

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1.15 - Testing air mass meter (vehicles with intake manifold change-over function)

Note:

In vehicles with intake manifold change-over function, the intake air temperature sender is integrated in the air mass meter, and is therefore not fitted as a separate component on the engine.

Testing operation

Test conditions

- Coolant temperature at least 80 °C
- Electrical consumers switched off (radiator fan must not run during test)
- Air conditioner switched off
- On vehicles with automatic gearbox, the selector lever must be in position "P" or "N".
- Fuse for air mass meter OK

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
 (Connecting fault reader and selecting engine electronics control unit=>Page 2.)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	



- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block	HELP
Input display group number XXX	

- Press keys 0, 0 and 1 for "Display group number 1" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

Read measured value block	1
1 2 3 4	

- Check whether the coolant temperature is above 80 °C in display zone 2.
- Change to display group 2 as follows:
V.A.G 1551: Press key 3
V.A.G 1552: Press key ↑

-> Indicated on display:

(1...4 = Display zones)

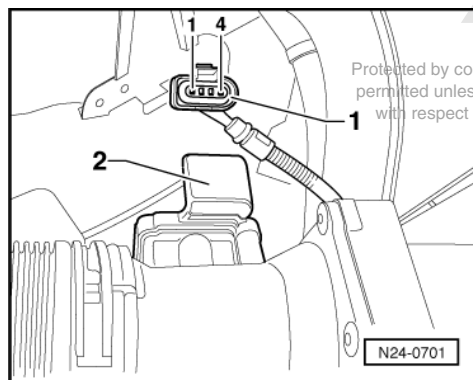
Read measured value block 2
1 2 3 4

Display zone 2 shows the intake air mass (milligrams per stroke).

Specification: 100...280 mg/stroke

- Press the ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.
- If the values are not as specified or if the fault memory has recorded a fault relating to the air mass meter, test the power supply to the air mass meter=>Page 62 .

Testing power supply to air mass meter



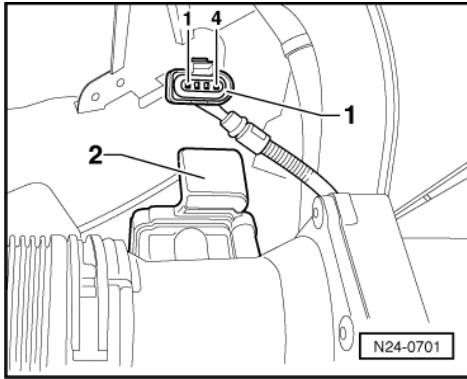
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- Test fuse for air mass meter.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- -> If fuse is OK, disconnect 4-pin connector -1- from air mass meter -2-.
- Connect multimeter to measure voltage on connector contacts 3 and engine earth.
- Start engine and run at idling speed.

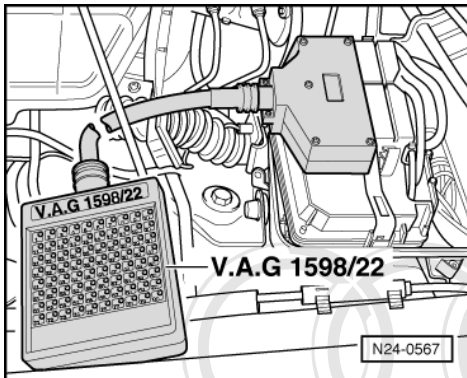
Specification: 11...15V.



- Switch off ignition.
- -> If multimeter indicates zero voltage, test for open circuit and short to earth in wiring between fuse and contact 3 on connector. If necessary, repair wiring.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

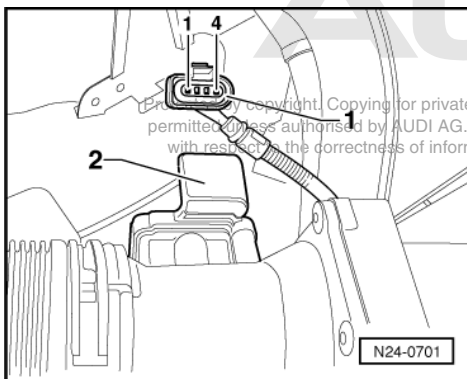
- If the fuse and the wiring are OK but the meter still indicates zero voltage, test the fuel pump relay=>Page 58.



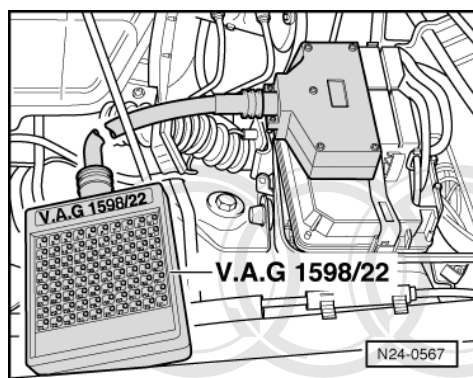
- If the power supply is OK, test the signal wire.

Testing signal wiring for air mass meter

- -> Connect test box V.A.G 1598/22 to control unit wiring harness.



- -> Test wiring from plug connector on air mass meter...



- -> ... to engine control unit for open circuit and short to positive or earth. Rectify if necessary.

Plug connector for air mass meter G70	Test box V.A.G 1598/22 or control unit connector
1	13
2	12

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- If the wiring is OK, fit a new air mass meter G70.

1.16 - Checking intake air system for leaks (unmetered air)

Checking with engine leak detector spray G 001 800 A1

Notes:

- ♦ The vacuum in the intake system will cause the leak detector spray to be drawn in with the outside air. The leak detector spray reduces the ignitability of the mixture. This leads to a drop in engine speed and to a significant increase of the CO content.
- ♦ The safety precautions listed on the container must be adhered to.
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 2.)

-> Indicated on display:

Rapid data transmission HELP
Select function XX

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block
Enter Display Group number XXX

- Press keys 0, 0 and 1 for "Display Group 01" and confirm entry by pressing Q.

-> Indicated on display:

(1...4 = Display zones)

Read measured value block 1
1 2 3 4

- Note engine speed in display zone 1.
- Note Lambda probe voltage in display zone 3 and the area it fluctuates in.
- Systematically spray parts of the intake system with engine leak detector spray.

Engine speed or Lambda probe voltage does not change:

- Press the $\Rightarrow$ key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

If the engine speed drops or the Lambda probe voltage changes:

- Press the $\Rightarrow$ key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Check sprayed areas of intake system for leaks and rectify if necessary.

2 - Testing lambda control

2.1 - Testing lambda control

The lambda probe compares the oxygen content in the air with the residual oxygen content in the exhaust gas and sends a voltage signal to the control unit.

The voltage signal for "Mixture too rich" (low residual oxygen) is between about 0.7 and 1.0 V.

The voltage signal for "Mixture too lean" (high residual oxygen) is between about 0.0 and +0.3 V.

The transition from "rich" to "lean" is accompanied by a voltage jump from between 0.7 and 1.0 V to between 0.0 and +0.3 V, and vice versa ($\lambda = 1.0$).

Because of the sharp voltage jump the lambda control cannot maintain a constant ideal mixture composition of $\lambda = 1.0$. The system fluctuates continuously between "slightly too lean" and "slightly too rich".

If the voltage does not change or only changes slowly the following faults are possible:

- ◆ Slots or holes in probe head are blocked.
- ◆ Lambda probe has been subjected to excessive thermal stress.
- ◆ Contact resistance in signal wire or earth wire.
- ◆ Lambda probe too cold; lambda probe heating not working.
- ◆ Lambda control switched off (control unit has registered a fault in the injection system; interrogate fault memory and read measured value block, Display Group 99).
- ◆ Lambda probe damaged by contact spray or similar product. (The contact spray is drawn through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effect.)
- ◆ Lambda probe damaged by silicone vapours. (The engine draws in traces of any silicone-based sealants that may have been used. The silicone does not burn and damages the lambda probe.)

2.2 - Poor performance after cold start

Test conditions

- No faults relating to lambda control function recorded in fault memory. If faults are recorded, rectify them and erase the fault memory.

The time it takes for the lambda control to cut in (lambda probe temperature must be approx. 300°C) is mainly determined by the following factors:

- ◆ Ambient temperature (summer/winter)
- ◆ Operating conditions after starting
- ◆ Functioning of lambda probe heating

If faults occur after a cold start, check whether the problem arises before or after the lambda control cuts in.



Testing vehicle under cold-start conditions:

- Select function 08 "Read measured value block" and Display Group 99
=>Page **39**.

-> Indicated on display:

Read measured value block 99
1 2 3 4

Display zone 4 will show the lambda control status.

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*Relevance of figures in 8-digit number block in display zone 4 (see also Page **39**):*
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Display zone 4	Meaning of readout
1XXXXXXX	Fault recorded in memory during diagnosis
X1XXXXXX	Unallocated
XX1XXXXX	Unallocated
XXX1XXXX	Restricted operation mode
XXXX1XXX	Lambda control at stop limit
XXXXX1XX	Lambda control switched on
XXXXXX1X	Lambda probe functioning
XXXXXXX1	Mixture status 1 = rich mixture 0 = lean mixture

After cold start:

-> Indicated on display:

Read measured value block 99
1 2 3 XXXXX00X

Notes:

- ♦ The lambda probe will not start functioning immediately after a cold start (lambda probe too cold).
- ♦ The lambda control is activated once the lambda probe is functioning.
- Take the vehicle for a test drive and watch display zone 4.

Warning!

The V.A.G 1551 must be operated by a second person.

-> The lambda control cannot cut in unless it is switched on and the lambda probe is functioning.

Read measured value block 99
1 2 3 XXXXX11X

The readout for the mixture status (on the far right of the 8-digit number block) should fluctuate continuously between "0" and "1".

A "1" in the space for "Mixture status" indicates that the air/fuel mixture is too rich (too little residual oxygen in the exhaust gas).

A "0" in the space for "Mixture status" indicates that the air/fuel mixture is too lean (too much residual oxygen in the exhaust gas).

- If the engine performance is poor before the lambda control cuts in, the lambda control is not the cause of the problem.
- If the performance only becomes poor after the lambda control has cut in, test the operation of the lambda control

=> Page 69 .

Notes:

- ♦ If the performance improves once the lambda control has cut in, this means that the lambda control is counteracting the problem (e.g. unmetered air or defective injector, etc.). Check the lambda learned values to confirm this.
- Select "Read measured value block" (function 08) and Display Group 11.
- Compare the actual values (displayed on the test apparatus) with the specifications.

2.3 - Testing operation

- Select "Read measured value block" (function 08) and Display Group 01
=> Page 30 .

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-> Indicated on display:

Read measured value block 1			
1	2	3	4

Do not proceed with the test until the coolant temperature shown in display zone 2 has reached at least 80 °C.

Display zone 3 will show the voltage of the lambda probe signal.

- If the lambda probe voltage reading fluctuates very slowly, test the lambda probe heating => Page 70 .
- Press →key.
- Select "Read measured value block" (function 08) and Display Group 99
=> Page 39 .

-> Indicated on display:

Read measured value block 99			
1	2	3	4

Display zone 4 will show the status of the Lambda control.

Relevance of figures in 8-digit number block in display zone 4 (see also Page 39):

Display zone 4	Meaning of readout
1XXXXXXX	Fault recorded in memory during diagnosis
X1XXXXXX	Unallocated
XX1XXXXX	Unallocated
XXX1XXXX	Restricted operation mode
XXXX1XXX	Lambda control at stop limit
XXXXX1XX	Lambda control switched on
XXXXXX1X	Lambda probe functioning
XXXXXXX1	Mixture status: 1 = rich mixture 0 = lean mixture

-> Indicated on display:

Read measured value block 99			
1	2	3	XXXX111X

If the lambda control has reached one of its stop limits (i.e. if the "Lambda control at stop limit" space contains a "1"), the "Mixture status" space will indicate which of the stops the lambda control is at.

-> Indicated on display:



Read measured value block 99			
1	2	3	XXXX1111

If the Lambda control has reached a stop limit and the "Mixture status" space is showing a "1" continuously, this means that the Lambda control is at the maximum leaning-down limit but the Lambda probe is still registering "Mixture too rich".

-> Indicated on display:

Read measured value block 99			
1	2	3	XXXX1110

If the Lambda control has reached a stop limit and the "Mixture status" space is showing a "0" continuously, this means that the Lambda control is at the maximum enrichment limit but the Lambda probe is still registering "Mixture too lean".

Note:

If the Lambda control remains at either of the stop limits ("too rich" or "too lean") for a certain period of time a fault will be recorded in the fault memory.

- If the Lambda control is functioning properly, check the Lambda learned values.
- Press C key.
- Press keys 0, 1 and 1 for display group 11 and confirm entry by pressing Q.

Note:

The mixture adaption system has learning ability, i.e. the Lambda control can recognise differences between various engines (injector nozzle delivery, compression, fuel pressure etc.) and compensates by adjusting the pre-programmed basic injection periods in the map in the control unit. The injection periods are extended or reduced until a mixture composition of " $\lambda = 1$ " is achieved.

-> Indicated on display:

Read measured value block 11			
1	2	3	4

Display zone 2 shows the Lambda learned value for idling.

- ♦ Positive learned value (+...ms): Pre-programmed basic injection period is too short, actual injection period ...ms longer in order to achieve a " $\lambda = 1$ " mixture composition.
- ♦ Negative learned value (-...ms): Pre-programmed basic injection period is too long, actual injection period ...ms shorter in order to achieve a " $\lambda = 1$ " mixture composition.

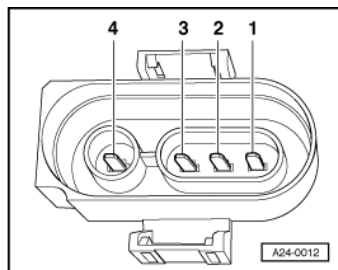
Display zone 3 shows the Lambda learned value for part throttle.

- ♦ Values greater than 1: Pre-programmed basic injection period is too short, actual injection period longer in order to achieve a " $\lambda = 1$ " mixture composition.
- ♦ Values less than 1: Pre-programmed basic injection period is too long, actual injection period shorter in order to achieve a " $\lambda = 1$ " mixture composition.

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Specifications: => Page 34 .

2.4 - Checking Lambda probe heating

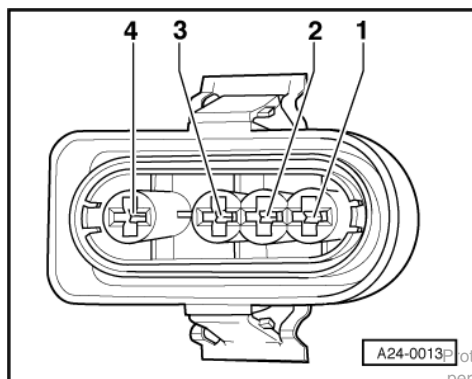


- The lambda probe heating circuit is monitored by the self-diagnosis system.
- Interrogate fault memory => Page 4 .
- Unplug 4-pin connector for lambda probe.
 Fitting location => Page 42 .
- -> Use V.A.G 1526 to measure resistance between contacts 1 and 2 on lambda probe connector.

Note:

The resistance of the heating element at room temperature is approx. 1...5 ω . With even a small temperature rise this value will increase sharply.

- If an open circuit is detected, fit a new lambda probe.



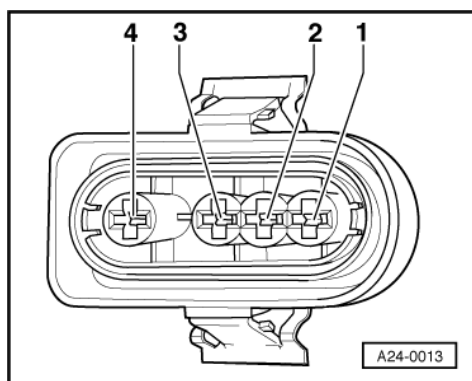
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If the heating element has continuity, test the power supply for the lambda probe heating as follows:

- Test fuse for lambda probe heating.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

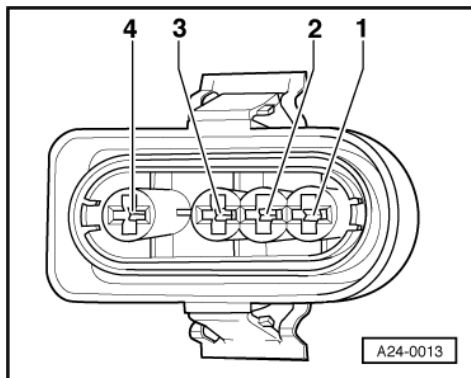
- -> If the fuse is OK, connect diode test lamp V.A.G 1527 between engine earth and contact 1 of wiring harness connector.
- Operate the starter briefly (the engine can be allowed to start briefly). The diode test lamp should light up.



- -> If diode test lamp does not light up, test for open circuit or short to earth in wiring between fuse and contact 1 of plug on wiring harness. Rectify open/short circuit if necessary.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If both the fuse and the wiring are OK but the diode test lamp still does not light up, test the fuel pump relay => Page 58 .
- Switch off ignition.
- Connect test box V.A.G 1598/22 to wiring harness for control unit
 =>Page 50 .



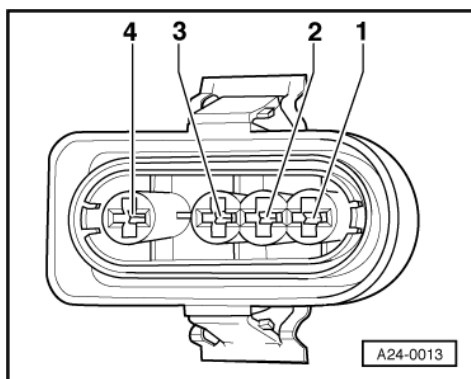
- -> Test for open circuit in wiring between contact 2 on 4-pin wiring harness connector (earth connection via engine control unit) and contact 27 on engine control unit. If necessary, rectify open circuit.
- If all the test results obtained so far have been OK, fit a new engine control unit
=>Page 50 .

2.5 - Testing lambda probe signal wiring and activation

Note:

The lambda probe signal is monitored by the self-diagnosis system.

- Interrogate fault memory =>Page 4 .
- If a fault in the lambda probe has been registered and the lambda probe heating is OK, unplug the lambda probe connector.

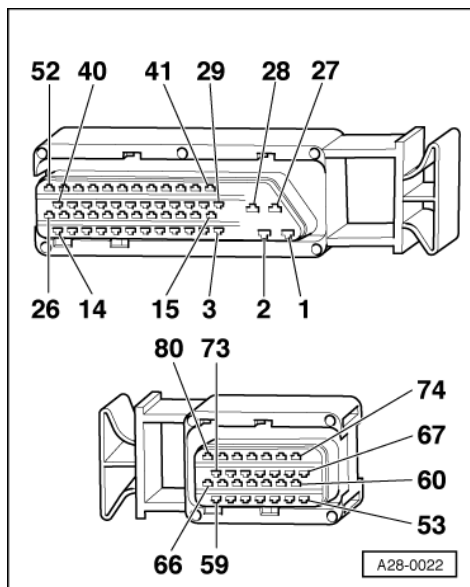


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- Switch ignition on.
- -> Test voltage by connecting hand-held multimeter V.A.G 1526 (measuring range 2 V) between contacts 3 and 4 of plug on wiring harness.

Specification: approx. 1.56 V.

- Switch off ignition.
- If the reading is not as specified, connect test box 1598/22 to the wiring harness for the engine control unit
=>Page 50 .



- -> Test the following wiring connections for open circuits and shorts to positive or earth; if necessary, rectify the fault.

Lambda probe Bank 1 -G39

Contact No. on wiring harness plug	Test box V.A.G 1598/22 or control unit connector
3	25
4	26

- If the wiring is OK, fit a new engine control unit
 =>Page 50 .

2.6 - Removing and installing lambda probe

Removing

- Unplug the lambda probe connector.
 Fitting location => Page 42 .
- Unscrew the lambda probe using V.A.G 3337/9.

When installing, note the following points:

Notes:

- ♦ When installing, the lambda probe wire must be secured in exactly the same position as before in order to avoid contact between the wire and the exhaust pipe.
- ♦ Tightening torque: 50 Nm.
- ♦ The screw thread on the lambda probe is coated with a special paste. This paste must not be allowed to penetrate the openings on the probe.

3 - Testing fuel tank breather system

3.1 - Testing fuel tank breather system

3.2 - Testing solenoid valve 1 for activated charcoal filter

Testing for leaks

When there is no electrical signal the solenoid valve remains closed.

- Disconnect hose from solenoid valve 1 for activated charcoal filter -N80.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80
=>Page 19.
- While final control diagnosis is running, blow into solenoid valve to check whether it opens and closes properly. If necessary, fit a new solenoid valve.

Electrical test of -N80 (ACF valve)

- Unplug connector on ACF valve.
- Measure resistance between contacts on valve using hand-held multimeter V.A.G 1526.

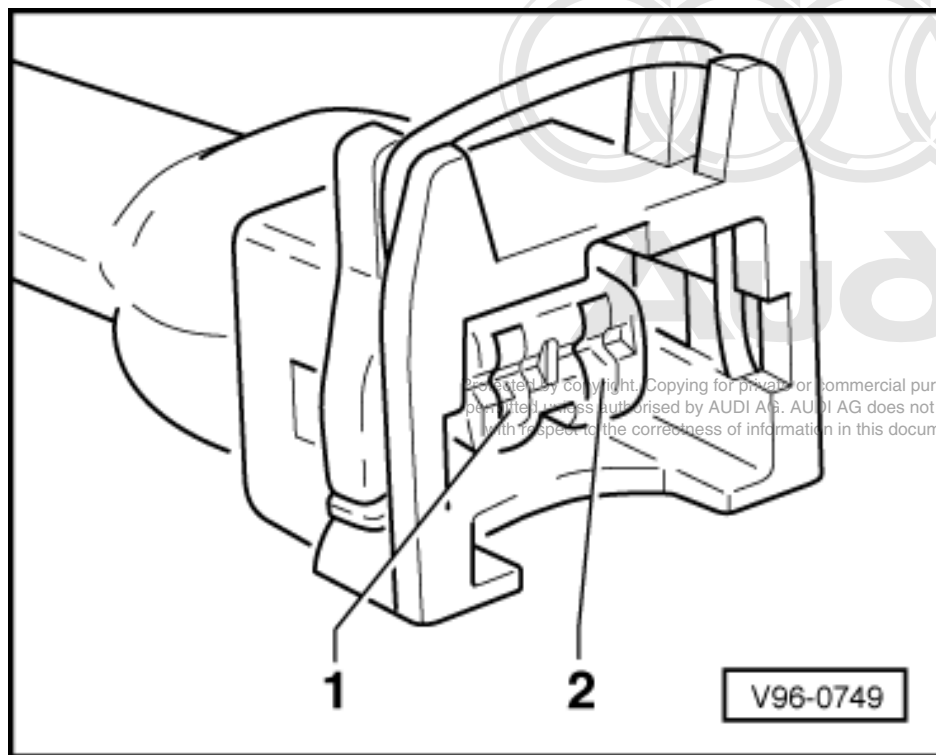
Specification: 22...30 Ω .

When the engine is warm the resistance will be approx. 4...6 Ω higher.

- If the value is not as specified, fit a new ACF valve.

Testing power supply to ACF valve

Note:



The ACF valve receives its power supply via the fuel pump relay.

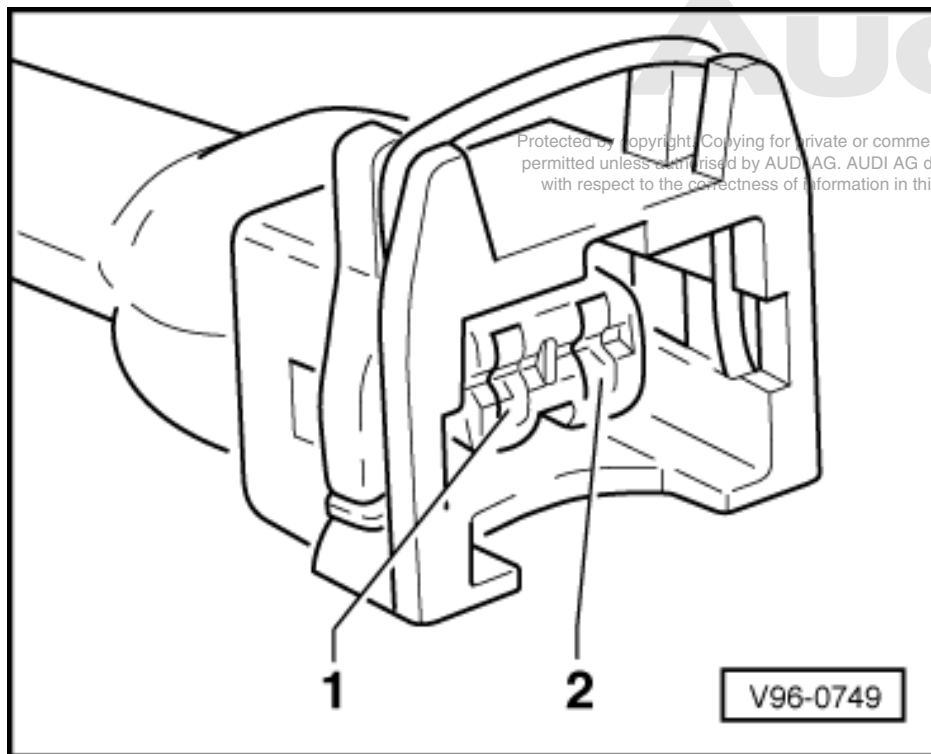
Test conditions

- Fuse for ACF valve OK
- Unplug connector on ACF valve.
- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1 on the connector.
- Operate starter.

Specification: diode test lamp should light up.

- If diode test lamp does not light up, test for open circuit between contact 1 and fuse. Rectify open circuit if necessary.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder



- If wiring is OK, test fuel pump relay
=> Page 58 .

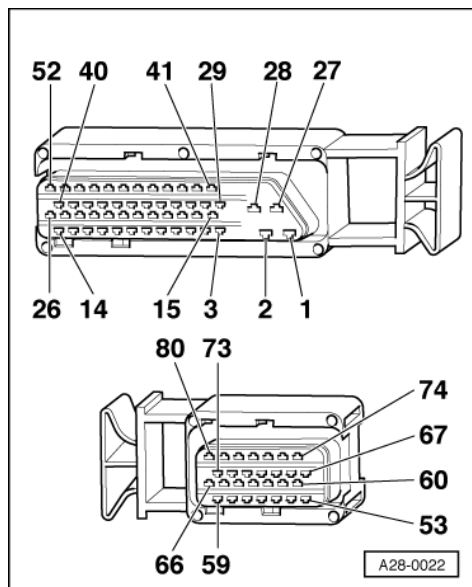
Testing ACF valve activation

- -> Connect diode test lamp V.A.G 1527 between contact 2 (earth connection via engine control unit) and contact 1 (positive, from fuel pump relay) on the connector.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80
=>Page 19 .

Specification: diode test lamp should start flashing.

If the diode test lamp does not flash or lights up continuously:

- Switch off ignition.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 50 .



- -> If the diode test lamp lights up continuously, test for short circuit to earth in wiring between contact 2 on ACF valve connector and socket 15 on test box.
- If the diode test lamp does not flash, test for open circuits and short circuits to positive in the wiring between contact 2 on ACF valve connector and socket 15 on test box.
- If necessary, rectify short circuit to earth or open circuit.
- If no short circuit or open circuit is found, fit a new engine control unit => Page 50 .

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4 - Testing throttle valve control part

4.1 - Testing throttle valve control part

4.2 - Testing operation

The throttle valve control part also incorporates the idling speed stabiliser.

The throttle valve potentiometer, idling speed switch, throttle valve positioner and potentiometer for throttle valve positioner are located inside the housing opposite the cable pulley.

The housing must not be opened. This means that the two potentiometers, the idling speed switch and the throttle valve positioner cannot be adjusted manually or replaced.

All adjustments are made via the "Basic setting" function on the V.A.G 1551.

When there is no electrical signal the throttle valve is moved mechanically to a pre-determined position, which causes the engine to idle at a higher speed when warm.

The throttle valve positioner is responsible for damping the action of the throttle valve as it closes.

The angle to which the throttle valve positioner can open the throttle valve is limited, i.e. it cannot open it to full throttle (for example).

4.3 - Performing adaption of throttle valve control part

The adaption process enables the engine control unit to learn the stop positions of the throttle valve control part with the ignition switched on and the engine not running.

If the throttle valve control part -J338 or the engine control unit is removed and refitted or replaced, or if the power supply to the engine control unit is interrupted, an adaption must be performed.

Test conditions

- No faults stored in fault memory
=> Page 4 , interrogating fault memory
- Idling speed switch closed
Testing=>Page 79 .
- Throttle valve closed (throttle valve angle check by engine control unit), throttle cable correctly adjusted

=> Mechanics; Repair Group 20; Removing and installing parts of fuel system; Adjusting throttle cable. Removing and installing parts of fuel system Adjusting throttle cable.

- Engine not running, ignition switched on
- Power supply to engine control unit more than 8 V
Testing =>Page 112 .
- Connect fault reader V.A.G 1551 (or V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the ignition must be switched on.
(Connecting fault reader and selecting engine electronics control unit => Page 2 .)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 4 for the function "Introduction of basic setting" and confirm entry with Q key.

-> Indicated on display:

Basic setting	HELP
Input display group number XXX	

- Press keys 0, 9 and 8 for "Display Group 98" and confirm entry by pressing Q.

-> Indicated on display:

System in basic setting 98			
x.xx V	x.xx V	0000	01

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When Q is pressed the throttle valve positioner will move to the minimum stop limit (throttle valve closed) and to the maximum stop limit (throttle valve open).

The control unit records the voltage reading for each position in its non-volatile memory.

This process takes no more than 10 seconds. The throttle valve then remains still without receiving any electrical signals (voltage 0).

-> Indicated on display:

System in basic setting 98			
x.xx V	x.xx V	0100	00

The adaption of the engine control unit to the throttle valve control part is now complete.

Note:

If one of the following readouts appears on the display, this means that the adaption has not been completed successfully:

-> Indicated on display:



System in basic setting 98
x.xx V x.xx V 1100 10

Note:

Relevance of figures in display zone 3:

Display zone 3	Meaning of readout
1XXX	Fault recorded in memory during diagnosis; interrogate fault memory =>Page 4 .
X1XX	No current in throttle valve control part (duty cycle = 0)
XX1X	Adaption terminated because battery voltage is too low
XXX1	Idling speed switch open (position check); testing =>Page 79

Relevance of figures in display zone 4: see next page

Relevance of figures in display zone 4:

Display zone 4	Meaning of readout
1X	Fault recorded in memory during diagnosis; interrogate fault memory =>Page 4
X1	Adaption of throttle valve control part in progress

-> Indicated on display:

Basic setting not completed Implausible signal

Notes:

- ♦ See Fault Table, fault code 01087
- ♦ If the adaption process for the throttle valve control part is unsuccessful, the reason can be determined by checking Display Group 01 ("Read measured value block" with ignition switched on) =>Page 30 .
- ♦ If the adaption process is unsuccessful, check the test requirements =>Page 77 .
- ♦ Make sure that the first test requirement has been met, then perform another adaption of the engine control unit to the throttle valve control part =>Page 77 .Repeat the same procedure (if necessary) for each remaining test requirement.

Note:

If the adaption of the control unit is interrupted, the reason could be one of the following:

- ♦ The requirements for the adaption of the engine control unit to the throttle valve control part have not been met. For a list of the requirements, see Fault Table, fault code 01087.
- ♦ The throttle valve cannot reach the mechanical idling stop because of a build-up of dirt (e.g. oil carbon deposits) or an incorrectly adjusted throttle cable.
- ♦ Throttle valve control part or wiring is defective.

After an interruption the fault "Basic setting not completed; Implausible signal" is recorded in fault memory.

The next time the ignition is switched on the engine control unit will try to perform the adaption again.

- End the engine basic setting by pressing the→ key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.

4.4 - Testing idling speed switch

- Run engine at idling speed.
- Select "Read measured value block" (function 08) and Display Group 02 => Page 31 .

-> Indicated on display:

Read measured value block 2			
1	2	3	0100

Check readout in display zone 4.

Note:

Relevance of figures in display zone 4:

Display zone 4	Meaning of readout
1XXX	Overrun
X1XX	Idling
XX1X	Part-throttle
XXX1	Full throttle

The readout for idling should be "1".

- Open throttle slowly.

-> Indicated on display:

Read measured value block 2			
1	2	3	0010

The readout for idling should be "0" and the readout for part-throttle should be "1". (When the throttle valve is opened the idling speed switch is also opened.)

- If the display is not as specified, switch off ignition and connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 50 .
- Measure resistance between sockets 67 and 69 using hand-held multimeter V.A.G 1526.

Specification: continuity (no resistance; throttle valve closed)

- Open throttle slightly.

Specification: idling speed switch should open (no continuity; infinite resistance)

- If the value is not as specified, test wiring and contacts for open circuit, damage and dirt using current flow diagram. Remove dirt and replace damaged parts as necessary

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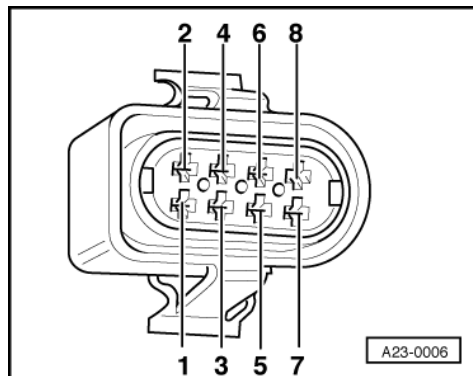
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Perform adaption of engine control unit to throttle valve control part => Page 77 .
- If the value is still not as specified, check the throttle valve for dirt or stiffness and clean if necessary.
- Repeat adaption of throttle valve control part => Page 77 .
- If it is not possible to start the adaption or if the adaption cannot be completed, fit a new throttle valve control part.
- Perform adaption of throttle valve control part => Page 77 .

4.5 - Testing throttle valve positioner sender and throttle valve potentiometer

Testing sender voltage readings

- Disconnect the 8-pin plug on the throttle valve control part.



- Switch on ignition.
- -> Measure voltage between contacts 4 and 7 on the 8-pin plug using hand-held multimeter V.A.G 1526.

Specification: at least 4.8 V

If the value is as specified, reconnect the 8-pin plug.

- Start the engine.
- Read measure value block (function 08) and select Display Group 98 => Page 38.

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-> Indicated on display:

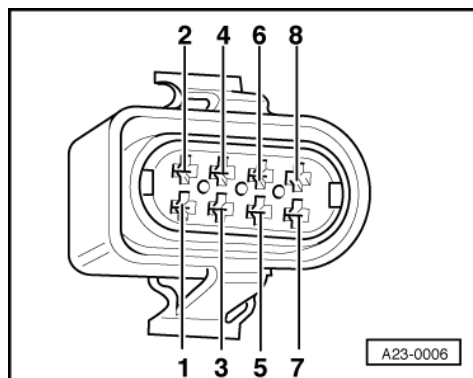
Read measured value block 98

1 2 3 4

The values in display zone 1 (throttle valve potentiometer voltages) should be between 3.70 and 4.75 volts.

The values in display zone 2 (throttle valve potentiometer voltages) should be between 2.28 and 4.75 volts.

- If the values are not as specified, switch off the ignition.
- Connect test box V.A.G. 1598/22 to wiring harness for engine control unit
=> Page 50.



- Disconnect the 8-pin plug on the throttle valve control part.
- -> Test for open circuit between the test box and the 8-pin plug using multimeter V.A.G 1526.
- Use the multimeter to test the wires for short circuits with each other.

Contact on 8-pin plug	Contact on test box
1	66

Contact on 8-pin plug	Contact on test box
2	59
3	69
4	62
5	75
7	67
8	74

- Rectify any open circuits and remove any dirt that may be on the contacts. Erase fault memory and perform adaption of throttle valve control part => Page 77 .
- If the value is still not as specified, check the throttle valve for dirt and stiffness. Clean if necessary.
- Repeat adaption of throttle valve control part => Page 77 .
- If it is not possible to start the adaption or if the adaption cannot be completed, fit a new throttle valve control part.
- Perform adaption of throttle valve control part => Page 77 .
- If it is not possible to start the adaption or if the adaption cannot be completed, fit a new engine control unit => Page 50 .
- If it is not possible to complete the adaption with the new engine control unit, try performing the adaption again with the old throttle valve control part which was removed => Page 77 .

5 - Testing intake manifold change-over function

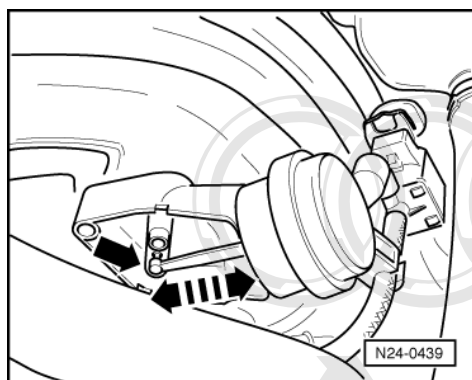
5.1 - Testing intake manifold change-over function

This test should only be carried out if the engine is losing power.

The operation of the intake manifold change-over valve is dependent on the engine load and engine speed.

Testing function

- Run engine at idling speed for 2 or 3 minutes (to build up a vacuum which is required to operate the intake manifold change-over function).



- With engine not running and ignition switched on, start final control diagnosis and select intake manifold change-over valve -N156
=>Page 19 .

-> The vacuum unit for the intake manifold change-over valve should pull and release alternately (until vacuum supply in integral vacuum reservoir is used up). When the engine is not running, the vacuum is sufficient for approx. 4 change-overs. Location of vacuum unit (vacuum actuator):=>Page 86)

If the change-over is not taking place, carry out the following tests:

- Test intake manifold change-over valve -N156 (perform final control diagnosis=>Page 84).
- Make sure that vacuum hoses are properly connected and free of blockages and leaks.



- Make sure that change-over mechanism can move freely (actuate linkage by hand).

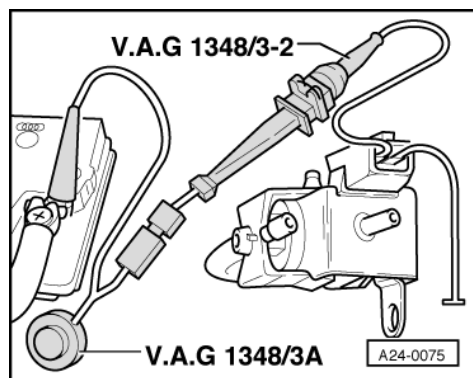
Testing vacuum system

- Run engine at idling speed for 2 or 3 minutes (to build up a vacuum which is required to operate the intake manifold change-over function).

Note:

The vacuum reservoir is part of the intake manifold and cannot be renewed separately.

- Switch off ignition.
- Unplug 2-pin connector from intake manifold change-over valve.

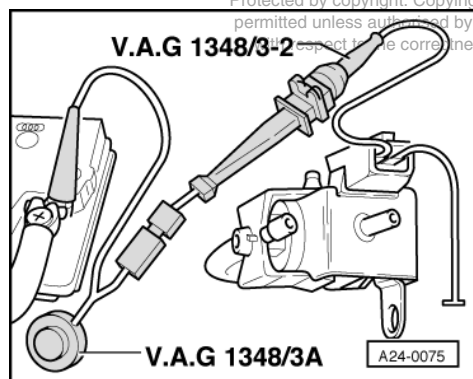


- -> Connect one of the contacts on solenoid valve to engine earth using test cable and crocodile clamp from V.A.G 1594.
- Connect second contact on solenoid valve to positive via remote control V.A.G 1348/3A using adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A for 2 or 3 minutes. During this time the vacuum unit should remain in the pulled-in position.

If the vacuum unit returns to rest position, test the vacuum unit as follows:

- Disconnect vacuum hoses from vacuum unit for intake manifold change-over valve.
- Connect hand pump V.A.G 1390 to vacuum unit.
- Operate hand pump and observe change-over action.
- Test vacuum unit for leaks. (The vacuum unit should not return to rest position until the hand pump is vented to atmosphere.)
- If necessary, fit a new vacuum unit.

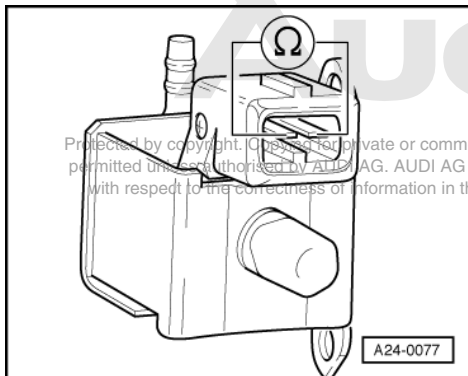
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- If the vacuum unit does not pull, check to ensure clear passage through -N156 as follows:
- -> Connect one of the contacts on -N156 to engine earth using test cables and crocodile clamp from V.A.G 1594.
- Connect second contact on -N156 to positive via remote control V.A.G 1348/3A using adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A.
- Check to ensure clear passage through valve (disconnect vacuum hoses and blow through).

- If necessary, fit a new intake manifold change-over valve.

5.2 - Checking intake manifold change-over valve



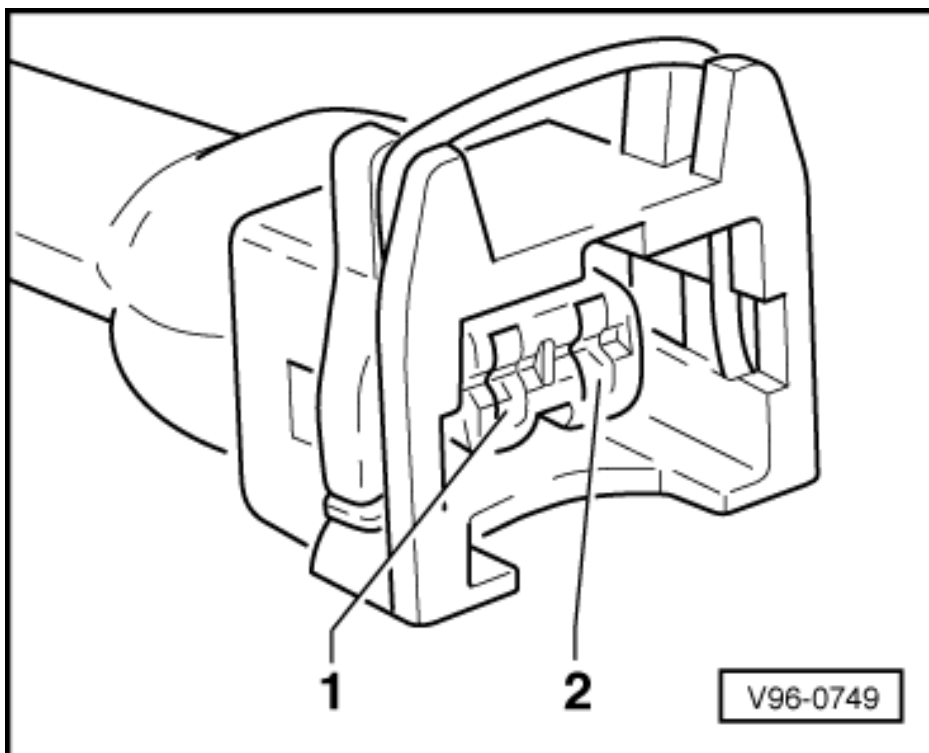
Electrical test of intake manifold change-over valve

-N156

Fitting location => Page 86 .

- Unplug connector on intake manifold change-over valve.
- -> Measure resistance at intake manifold change-over valve.
- Specification: 25 ... 35 ohm

If the value is not as specified, fit a new valve.



Testing power supply to intake manifold change-over valve

-N156

- -> Unplug connector for intake manifold change-over valve.
- Connect diode test lamp V.A.G 1527 between engine earth and contact 1 (positive) on connector using cables from adapter set V.A.G 1594.
- Operate starter briefly (the engine can be allowed to start).

Specification: The diode test lamp should light up.

If the diode test lamp does not light up, carry out the following tests:

- Test fuse for -N156.
- Test for open circuit in wiring between fuse and contact 1 on connector for intake manifold change-over valve using current flow diagram.

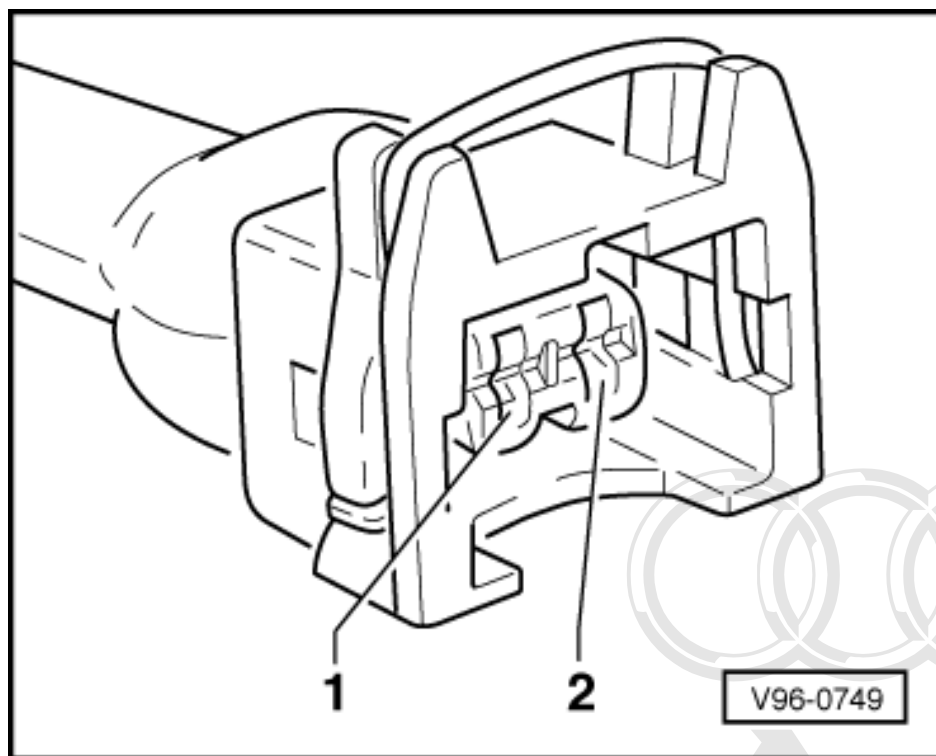
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Specification: max. 1 ohm

- Test fuel pump relay and activation

=>Page 58 .

Testing activation of intake manifold change-over valve



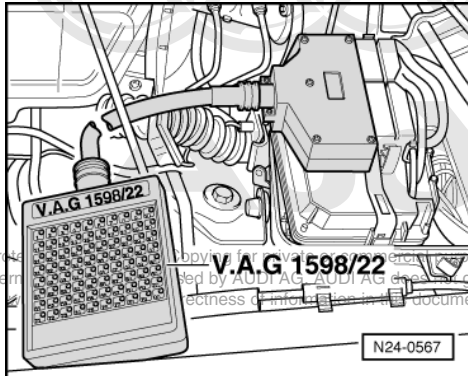
- -> Connect diode test lamp V.A.G 1527 between contacts 1 (positive) and 2 (activation signal from engine control unit) on connector for intake manifold change-over valve using cables from adapter set V.A.G 1594.
- Start final control diagnosis=>Page 19 . The diode test lamp should flash when the intake manifold change-over valve is being activated.
- If the diode test lamp does not flash or if it lights up continuously, connect test box V.A.G 1598/22 to wiring harness for engine control unit

=>Page 50 .

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- If the diode test lamp lights up continuously, test for short to earth in wiring between contact 2 on connector for intake manifold change-over valve and socket 64 on test box.
- If the diode test lamp does not flash, test for open circuit or short to positive in wiring between contact 2 on connector for intake manifold change-over valve and socket 64 on test box.

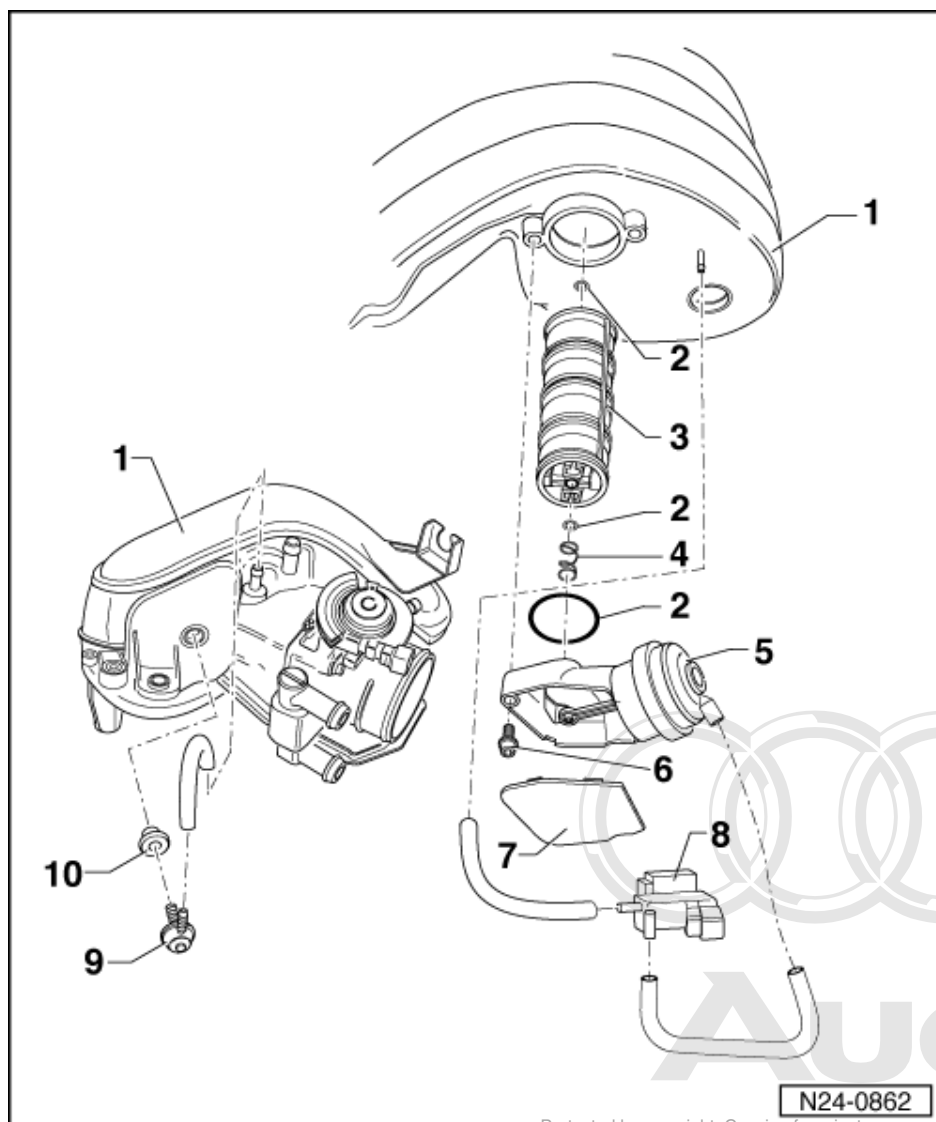
Specification: max. 1 ohm



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- -> If necessary, rectify open circuit or short to earth.
- If there is no open circuit and no short circuit, fit a new engine control unit
=> Page 50 .

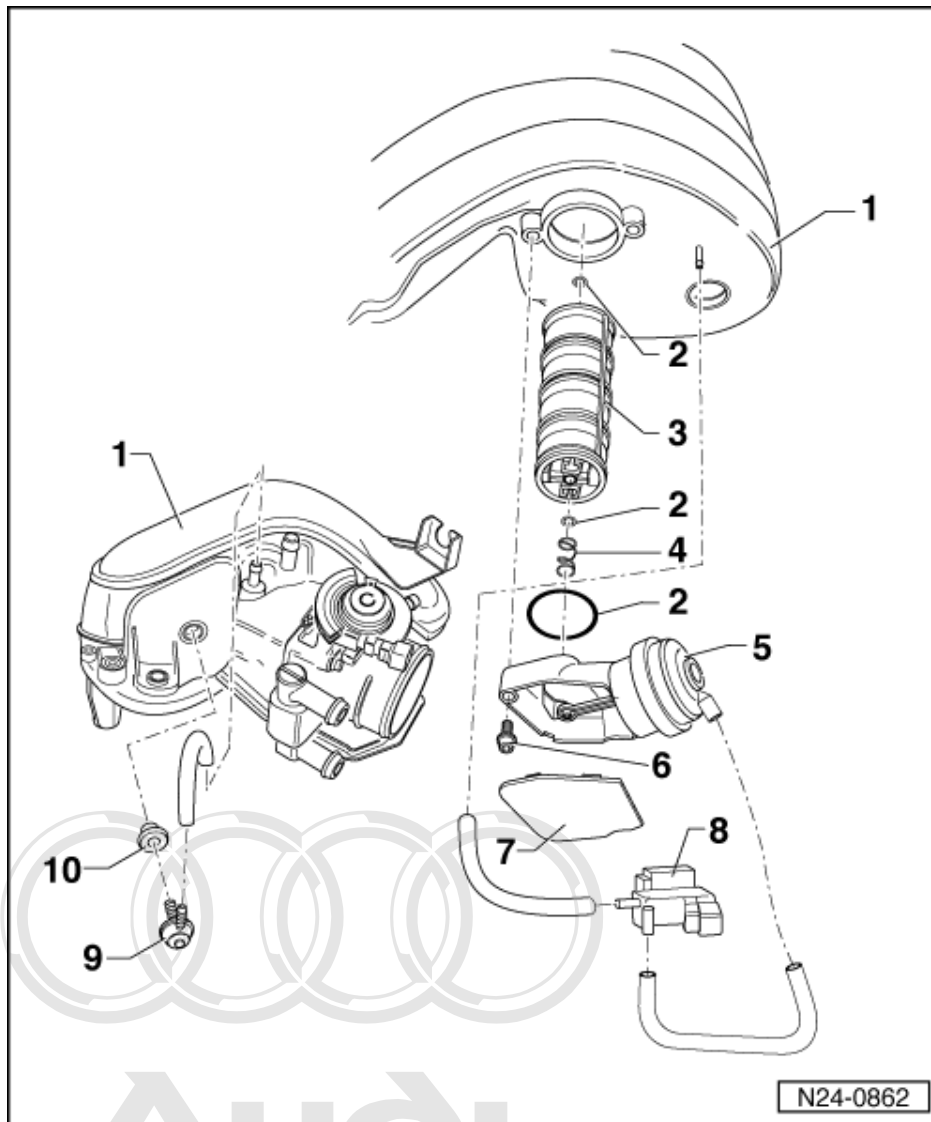
5.3 - Removing and installing parts of intake manifold change-over



N24-0862

- 1 Intake manifold
- 2 Seal
 - ♦ Renew if damaged
- 3 Change-over barrel
- 4 Spring
- 5 Vacuum control element
- 6 10 Nm
- 7 Cover
- 8 Intake manifold change-over valve (N156)
 - ♦ Resistance: 25...35 ω

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9 Non-return valve

- ♦ Installation position: Grey side faces intake manifold

10 Rubber grommet

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6 - Testing auxiliary signals

6.1 - Testing auxiliary signals

6.2 - Testing air conditioner compressor shut-off

Notes:

- ♦ The air conditioner compressor signal from the operating and display unit informs the engine control unit that the compressor is due to cut in shortly.
- ♦ The engine control unit can send a signal via the same wire to shut off the air conditioner compressor.
- ♦ On vehicles with manual gearbox the air conditioner compressor is shut off at full throttle in first gear.



- ♦ On vehicles with automatic gearbox there is no air conditioner compressor shut-off.

Test conditions

- Air conditioner functioning properly
- No faults recorded in fault memory of engine control unit
- Interior temperature of more than +15°C
- Connect fault reader V.A.G 1551
=> Page 2.
- Start the engine.
- Select "Read measured block value" (function 08) and Display Group 19.
- Switch off air conditioner.

-> Indicated on display:

Read measured value block 19			
X	X	0	0

Display zone 3 should read "0" (air conditioner operating status).

Display zone 4 should read "0" (air conditioner compressor).

- Switch on air conditioner by pressing "Auto" key and selecting lowest temperature. The air conditioner compressor should run.

-> Indicated on display:

Read measured value block 19			
X	X	1	1

Display zone 3 should read "1" (air conditioner operating status).

Display zone 4 should read "1" (air conditioner compressor).

- Take vehicle for a test drive in first gear (press down sharply on accelerator at low engine speed).

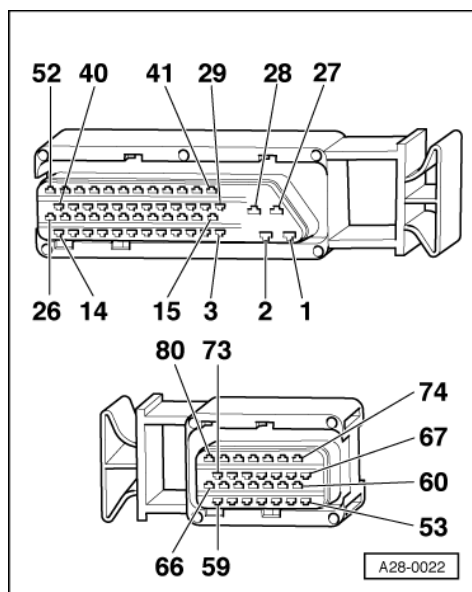
Warning!

The V.A.G 1551 must be operated by a second person.

-> Indicated on display:

Read measured value block 19			
X	X	1	0

When accelerating, display zone 4 should read "0" (the air conditioner compressor is switched off during acceleration).



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- -> If the readouts are not as specified, switch off the engine and connect test box V.A.G 1598/22 to wiring harness for engine control unit => Page 50.
- Using current flow diagram, test for open circuit and short to earth or positive in wiring between air conditioner operating and display unit -E87 and contact 8 on engine control unit

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If there are no faults in the wiring, test operation of air conditioner operating and display unit -E87.

=> Air conditioner; Repair Group 01; Self-diagnosis for air conditioner Self-diagnosis for air conditioner

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6.3 - Testing engine speed adaption when air conditioner cuts in

Notes:

- ♦ When the air conditioner is switched on a positive signal is sent to contact 10 on the engine control unit.
- ♦ The signal causes the engine control unit to maintain a constant idling speed despite the varying power requirement of the air conditioner.

Test conditions

- Air conditioner functioning properly
- No faults recorded in air conditioner fault memory
- Interior temperature more than +15 °C
- Connect fault reader V.A.G 1551
=> Page 2.
- Start the engine (operating temperature).
- Switch off rear window heating.
- Select "Read measured value block" (function 08) and Display Group 19.

-> Indicated on display:

Read measured value block 19
 1 2 3 4

Display zone 1: Idling speed

Display zone 3: Signal from air conditioner

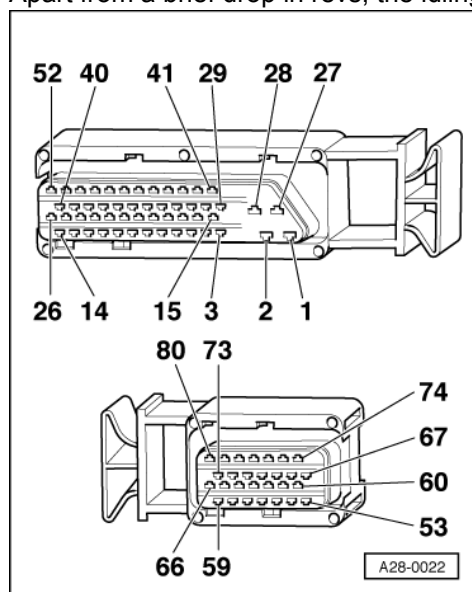
Display zone 4: Air conditioner compressor operating status

- Switch on air conditioner by pressing "Auto" key and selecting the lowest temperature. The air conditioner compressor should run.

Display zone 3 should read "1".

Display zone 4 should read "1" (air conditioner compressor on).

Apart from a brief drop in revs, the idling speed should remain constant.





- -> If idling speed does not remain constant, switch off engine and connect test box V.A.G 1598/22 to wiring harness for engine control unit => Page 50 .
- Test for short or open circuit in wiring between contact 10 on engine control unit and air conditioner operating and display unit -E87 using current flow diagram.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If there are no wiring faults, test the operation of the air conditioner operating and display unit.

=> Heating, air conditioner; Repair Group 01; Self-diagnosis for air conditioner Self-diagnosis for air conditioner

6.4 - Checking selector lever position on automatic gearbox

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Notes:

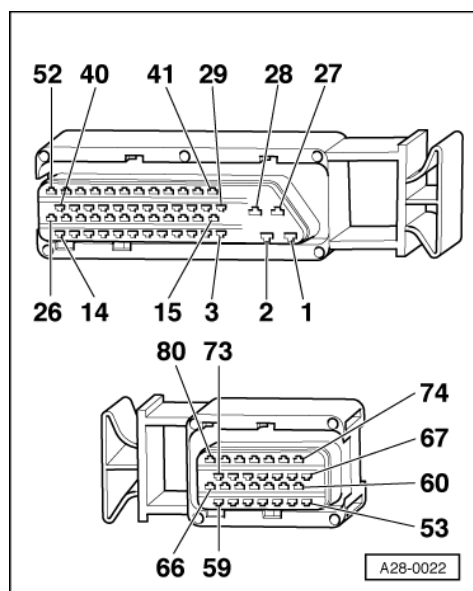
- ♦ The automatic gearbox control unit -J217 informs the engine control unit whether a gear is engaged (selector lever in position 1, 2, 3, R or D) or not (selector lever in position P or N).
- ♦ When the selector lever is in position P or N the automatic gearbox control unit -J217 makes an earth connection to contact 22 on the engine control unit.
- Connect fault reader V.A.G 1551 => Page 2 .
- Switch ignition on.
- Select "Read measured value block" (function 08) and Display Group 19.

-> Indicated on display:

Read measured value block 19			
1	2	3	4

Display zone 2 should read "0" (selector lever in position P or N).

- Operate the footbrake and engage a gear (selector lever in position 1, 2, 3, R or D).

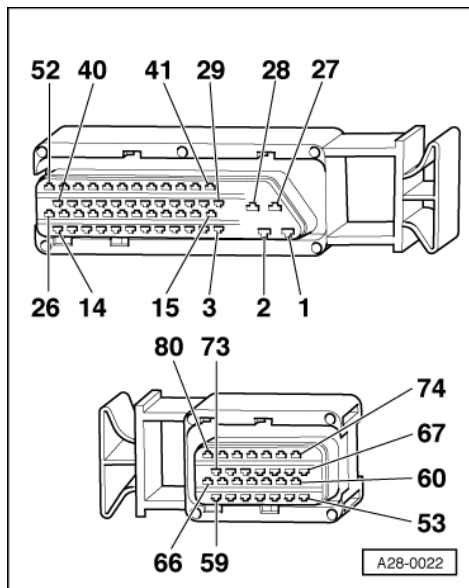


Display zone 2 should read "1".

- -> If the display readout is not as specified, connect test box V.A.G 1598/22 to the wiring harness for the engine control unit
=> Page 50 .
- Connect diode test lamp between socket 3 (terminal 30) and socket 22.

The diode test lamp should light up when the selector lever is in position P or N.

When a gear is engaged (selector lever in position 1, 2, 3, R or D) the diode test lamp should go out.



- -> If the diode test lamp lights up continuously or does not light up at all, test for open circuit or short to positive or earth in wiring between contact 22 on engine control unit and automatic gearbox control unit - J217.

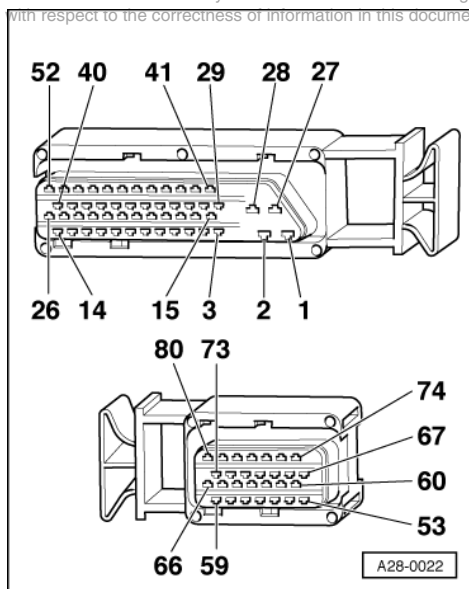
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If there are no faults in the wiring, test the multi-function switch.

=> Automatic Gearbox 01N; Repair Group 01; Gearbox - Electrical test Gearbox - Electrical test

6.5 - Checking engine speed signal

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The engine speed signal is taken from contact 6 on the engine control unit. The signal is used by the automatic gearbox control unit to calculate the gearshift intervals and is also required for other functions, including the rev counter display on the dash panel insert.

- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=>Page 50 .
- Test for open circuit in wiring between dash panel insert and contact 6 on the test box, using current flow diagram

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

6.6 - Testing throttle valve position

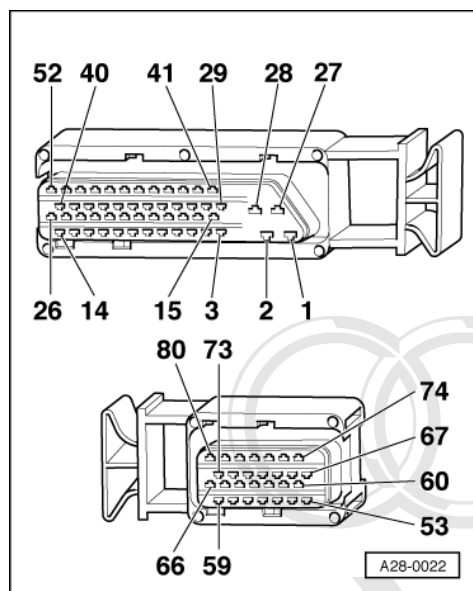
Notes:

- ♦ In conjunction with the engine speed signal this signal enables the automatic gearbox control unit to calculate the gearshift intervals.
- ♦ The signal is a square wave signal and is taken from contact 7 on the engine control unit.

- Connect fault reader V.A.G 1551 =>Page 2 .
- Start self-diagnosis on gearbox control unit.

=> Automatic Gearbox 01N; Repair Group 01; Self-diagnosis Self-diagnosis

- If the gearbox control unit displays fault 00638 "Engine/gearbox electrical connection 2", interrogate fault memory of engine control unit => Page 4 .
- If the engine control unit has recorded a fault relating to the throttle valve potentiometer, rectify this fault first. (In this case the fault in the gearbox is merely a result of the fault in the potentiometer.)



- -> If no fault related to the throttle valve potentiometer is in the memory, connect test box V.A.G 1598/22 to wiring harness for engine control unit => Page 50 .
- Test for open circuit or short to positive or earth in wiring between gearbox control unit and contact 7 on engine control unit connector.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

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6.7 - Testing speed signal

Notes:

- ◆ The road speed signal is generated by the road speed sender -G68 (on the gearbox) and is processed in the dash panel insert.
- ◆ The processed signal goes to contact 20 on the engine control unit and is used for idling speed stabilisation and for the damping of load change jolts when changing gear.
- Connect fault reader V.A.G 1551 => Page 2 .
- Start the engine.
- Select "Read measured value block" (function 08) and Display Group 2.

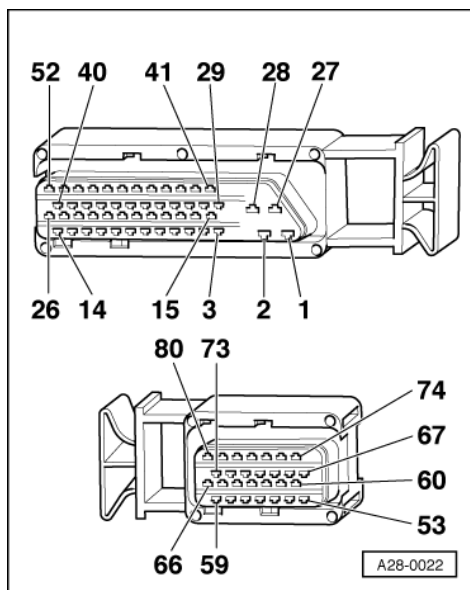
-> Indicated on display:

Read measured value block 2
1 2 3 4

Warning!

The V.A.G 1551 must be operated by a second person.

- Take vehicle for a test drive and check whether the road speed appears in display zone 3.
- If the road speed does not appear, raise the vehicle (preferably using a lifting platform) until the front left wheel is clear of the ground.



- -> Connect test box V.A.G. 1598/22 to wiring harness for engine control unit =>Page 50 .
- Connect diode test lamp between socket 3 (positive) and socket 20 (road speed signal).
- Switch on the ignition and turn the front left wheel by hand.
- The diode test lamp should flash (very brief flashes).

Note:

If necessary, hold the front right wheel to prevent it from turning.

- If the diode test lamp does not flash, test for open circuit or short to positive or earth in wiring between dash panel insert and contact 20 on engine control unit connector.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

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6.8 - Checking gearbox intervention signal when a gear is shifted

Notes:

- ♦ This signal is produced by the automatic gearbox control unit during a gearshift. The signal enables the ignition timing to be briefly retarded by varying amounts (torque reduction) depending on the road speed and engine speed. This smooths out the slight jerk as the gear engages.
 - ♦ The signal is a square wave signal which is fed to contact 23 on the engine control unit.
 - ♦ Because the signal is very brief the V.A.G. 1551 does not always recognise the command to retard the ignition timing.
- Connect fault reader V.A.G 1551 => Page 2.
 - Take the vehicle for a test drive and select "Read measured value block" (function 08) and Display Group 1 => Page 30.

Warning!

The V.A.G 1551 must be operated by a second person.

-> Indicated on display during gearshift:

Read measured value block 1			
1	2	3	X1XXXXXX

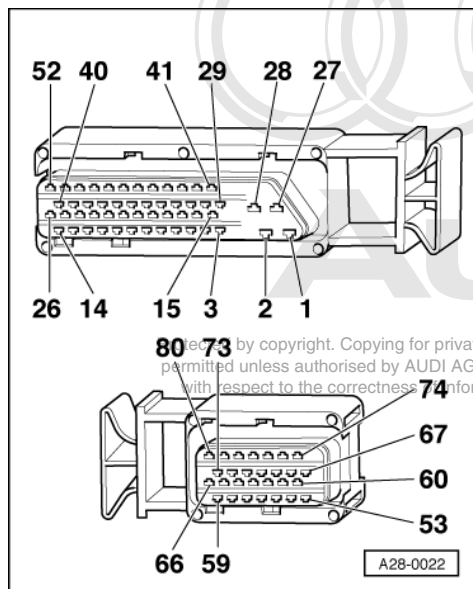
Readout: X 0 X X X X X = without gearshift

Readout: X 1 X X X X X = with gearshift

Value: X = (no meaning)

Note:

When the gearbox control unit gives the command for the ignition timing to be retarded the readout will change briefly from "0" to "1".



- The wiring connection to the gearbox control unit is monitored by the gearbox self-diagnosis (fault code 00545).
 - -> When changing gear, if the measured value block does not indicate that a reduction in torque is required, or if fault code 00545 appears (gearbox control unit), connect test box V.A.G 1598/22 to the wiring harness for the engine control unit.
- => Page 50

- Test for open circuit or short to positive or earth in wiring between gearbox control unit and contact 23 on the engine control unit.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

6.9 - Testing crash signal

The crash signal ("Crash switch-off triggered") is transmitted to the engine control unit by the airbag control unit.

If the airbag control unit transmits the crash signal to the engine control unit (in case of an accident or if a final control diagnosis for the airbag system is carried out), the engine control unit switches off the fuel pump. The engine stops but can be restarted immediately (e.g. to move the vehicle out of the danger zone).

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=>Page 50 .

Test for open circuit and short to positive or earth in the following wiring connection:

Test box V.A.G 1598/22, socket	Airbag control unit contact
24	=> Current flow diagrams, => Electrical fault-finding => and Fitting locations binder

Resistance in wiring: not more than 1.5 Ohm

- Rectify short circuit or open circuit if necessary.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If wiring is OK: interrogate fault memory of airbag control unit:

6.10 - Testing data exchange between engine control unit / ABS control unit / gearbox control unit

Notes:

- ◆ The exchange of data between the various control units is carried out via a data bus.
- ◆ The term "CANdata bus" refers to a system for transmitting and distributing data.
- ◆ The wires which connect the control units and convey the data between them are called data wires.
- ◆ Data are transmitted via these data wires in serial form (i.e. in a specific sequence) to the connected control units.

Testing bus system

If the fault table instructs you to test the data exchange between the engine control unit, gearbox control unit and ABS control unit:

- Call up the relevant "Control unit identification" and check the part Nos. to make sure that the vehicle is fitted with the correct engine control unit, gearbox control unit (if fitted) and ABS control unit. Also check that the control units are correctly coded. If the correct control units are installed in the vehicle:
- Interrogate fault memory of gearbox control unit (if fitted)

=> Automatic gearbox; Repair group 01; Performing self-diagnosis Performing self-diagnosis

- Interrogate fault memory of ABS control unit

=> Running gear, Front-wheel drive and 4WD; Repair group 01; Self-diagnosis, Electrical check Self-diagnosis, Electrical check

If faults have been stored relating to the "Data bus drive" or to data transmission: "No message from"

- Switch off ignition

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit=>Page 50 .

- Referring to Current flow diagram, test data wires from engine control unit, pin 31 and pin 29 to gearbox control unit (if fitted) and to ABS control unit for open circuit and short circuit

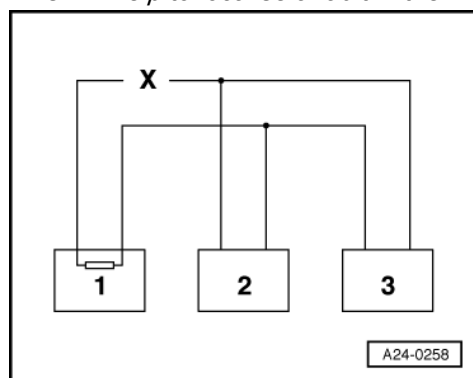
=> Current flow diagrams, Electrical fault finding and Fitting locations

- If wiring is OK, replace the engine control unit, gearbox control unit or ABS control unit as a trial measure.

If there are three or more control units in the vehicle linked via a "two-wire data bus system", the following systematic method is recommended when tracing faults:

- Read out and compare the faults registered in the control units.

This will help to localise a fault in the wiring.



Example 1:

From the faults present in the fault memories, you can see that control unit 1 has no connection to control units 2 or 3.

Control unit	Faults registered in fault memory:
1	- No message from control unit 2 - No message from control unit 3
2	- No message from control unit 1
3	- No message from control unit 1

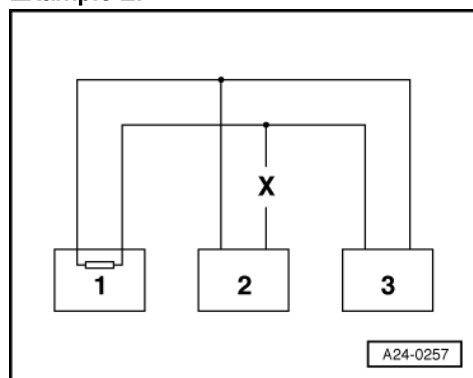
- Switch off ignition

- Disconnect the control units which are linked by the bus wires and check whether there is an open circuit in one of the bus wires

=> Current flow diagrams, Electrical fault finding and Fitting locations

- If no fault can be found in the bus wires replace control unit 1.

Example 2:



From the faults present in the fault memories, you can see that control unit 2 has no connection to control units 1 or 3.

Control unit	Faults registered in fault memory:
1	- No message from control unit 2
2	- No message from control unit 1 - No message from control unit 3
3	- No message from control unit 2

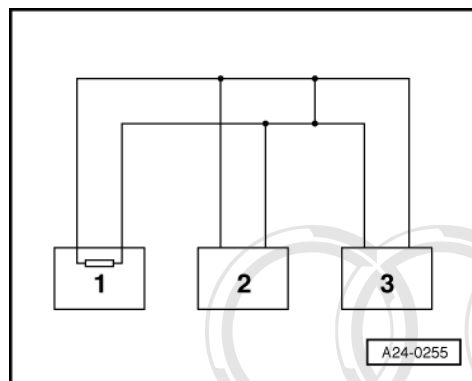
- Switch off ignition.
- Disconnect the control units which are linked by the bus wires and check whether there is an open circuit in one of the bus wires

=> Current flow diagrams, Electrical fault finding and Fitting locations

- If no fault can be found in the bus wires replace control unit 2.

Example 3:

From the faults present in the fault memories, you can see that none of the control units are able to transmit or receive signals.

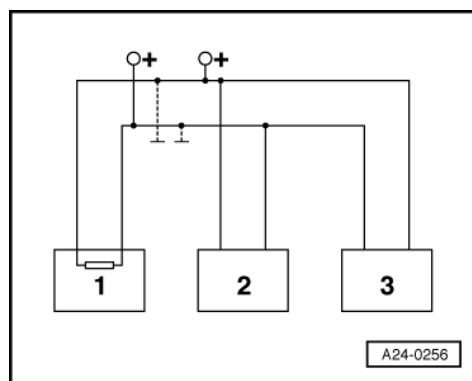


Control unit	Faults registered in fault memory:
1	- Data bus drive defective
2	- Data bus drive defective
3	- Data bus drive defective

- Switch off ignition
- -> Disconnect the control units which are linked by the bus wires and check for a short circuit between the bus wires

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=> Current flow diagrams, Electrical fault finding and Fitting locations



- -> Check the bus wires for short to positive and short to earth.



If the cause of the fault "Data bus drive defective" cannot be found in the data bus wires, check whether one of the control units is causing the fault.

At this stage all the control units which communicate via the CAN data bus are disconnected. The ignition is switched off.

- Connect one of the control units.
- Connect faultreader V.A.G 1551. Switch on the ignition and erase the fault memory of the control unit which has just been connected. End output from fault reader with function 06 "End output".
- Switch the ignition off and then on again.
- Leave the ignition switched on for 10 seconds. Then interrogate the fault memory of the control unit that has just been connected, using the fault reader.
- If the fault "Data bus drive defective" is now indicated, replace the control unit which has just been connected.
- If the fault "Data bus drive defective" is not indicated, connect the next control unit, and repeat the above procedure.



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28 - Ignition system

1 - Testing ignition system

1.1 - Testing ignition system

1.2 - Safety precautions

Warning!

The fuel system is pressurized! Before loosening hose connections or opening the test connection, place a cloth around the connection. Then carefully pull hose off or remove the plug.

To prevent injuries to persons and/or damage to the fuel injection and ignition system, note the following points:

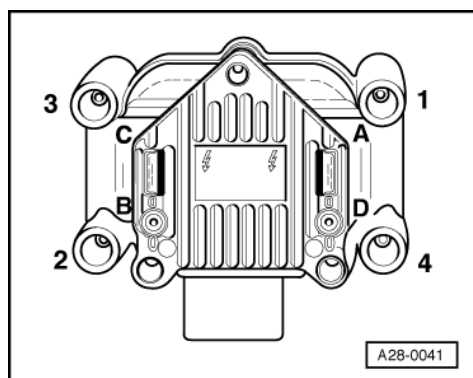
- ◆ Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- ◆ The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ In order to run the engine at starting speed without actually starting it (e.g. to test compression), unplug the connectors from the output stage of the ignition coils and from all the injectors. After completing the work, interrogate the fault memory.
- ◆ The ignition must always be switched off when cleaning the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.3 - Technical data for ignition system

Engine code letters	AHL, ARM
Idling speed Not adjustable - controlled by the idling speed stabilisation	760...960 rpm
Engine speed limiter - shuts off injectors	approx. 6500 rpm
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Ignition system	Twin-spark ignition system with two ignition coils
Spark plugs	Manufacturer's code1): F7LTCR (Bosch) Part No.1): 101 000 051 AA (Bosch) Tightening torque: 30 Nm
Spark plug connectors	Resistance approx. 5 kw
Firing order	1-3-4-2

- 1) For updates, see Exhaust Emissions Test

1.4 - Designation of ignition coil terminals



- -> The diagram shows the ignition coil with its high voltage terminals. From this diagram you can check whether the spark plug leads are connected to the ignition coil in the correct order. This also prevents wrong connections when replacing spark plug leads:

Ignition output "A" of ignition coil => Cylinder 1

Ignition output "B" of ignition coil => Cylinder 2

Ignition output "C" of ignition coil => Cylinder 3

Ignition output "D" of ignition coil => Cylinder 4

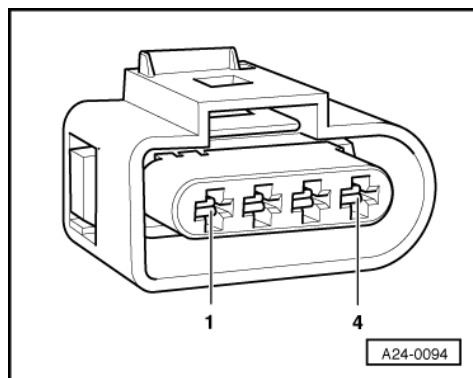
1.5 - Testing twin-spark ignition system with two ignition coils

Fitting location => Page **42** . Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Note:

The ignition coils and output stage are combined as a single component and cannot be renewed separately.

- Unplug 4-pin connector from ignition coils.



Testing earth connection to output stage

- -> Connect diode test lamp V.A.G 1527 between battery positive terminal and contact 4 (earth) of the connector. The diode test lamp should light up.

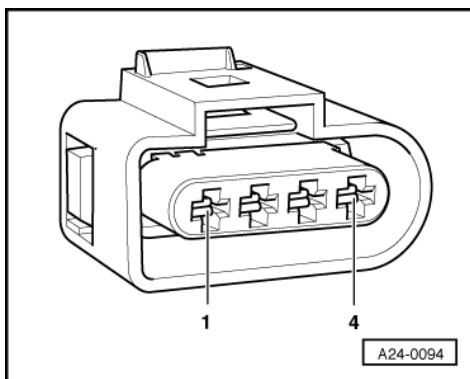
- If the diode test lamp does not light up, test wiring between earth and contact 4 on 4-pin connector and rectify any open circuits.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Testing power supply to ignition coils

Test requirement:

- Fuse for ignition coils OK
- Unplug 4-pin connector from ignition coils.
- Switch ignition on.



- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 2 (positive) of the connector.

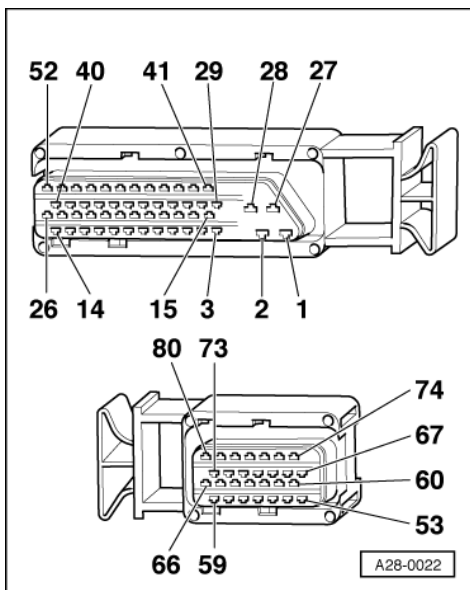
Specification: the diode test lamp should light up.

- If the result is not as specified, test wiring using current flow diagram. Rectify any faults and if necessary replace the fuse.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Testing activation

- Unplug the connectors from all four injectors (to prevent injection from occurring without ignition).
- Connect diode test lamp V.A.G 1527 between engine earth and contact 1 of the 4-pin connector for the ignition coil.
- On cars with manual gearbox, make sure that the gearstick is in neutral when carrying out the following step.
- Have a second person operate the starter for a few seconds and check the diode test lamp. The diode test lamp should flash.



- Connect diode test lamp V.A.G 1527 between engine earth and contact 3 of the 4-pin connector for the ignition coil.
- Have a second person operate the starter for a few seconds and check the diode test lamp. The diode test lamp should flash.
- -> If the diode test lamp does not flash, test for open circuit or short to positive or earth in wiring between engine control unit and 4-pin connector for ignition coil using current flow diagram. (Connecting test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 50 .)
- Rectify any open circuits or short circuits.

Contact on 4-pin connector for output stage	Contact on control unit connector
1	71
3	78

- If no open circuits or short circuits are found, fit a new engine control unit
=> Page 50 .
- If the ignition wires, the power supply to the ignition coils and the output stage activation are OK but there is still no ignition spark, fit new ignition coils with output stage.
- To do this, remove securing bolts for coolant tank and place tank to one side.
- Remove throttle valve control part (seal off coolant hoses).
- Renew ignition coils with output stage.

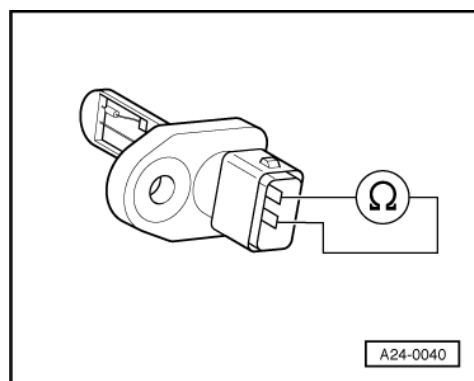
Notes:

- ♦ Installation is carried out in the reverse sequence.
- ♦ Renew seals and gaskets.
- ♦ Tightening torque for securing bolts on ignition coil with output stage and on throttle valve control part: 9 Nm
- ♦ After installation, perform adaption of throttle valve control part
=>Page 77 .

1.6 - Testing intake air temperature sender (vehicles without intake manifold change-over function)

Notes:

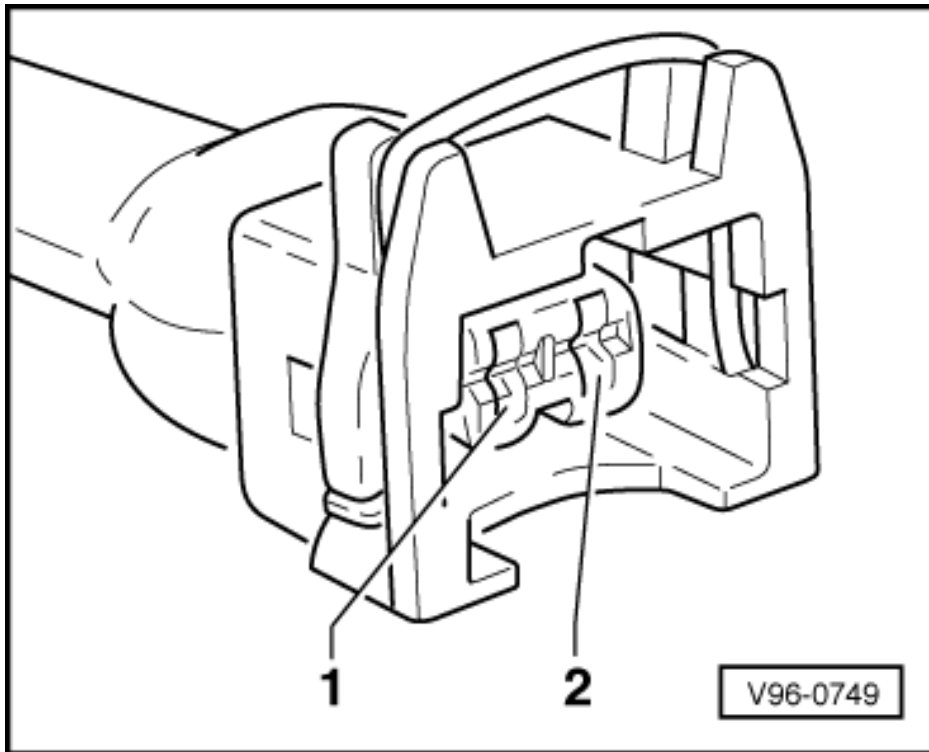
- ♦ For testing operation of intake air temperature sender, see also "Reading measured value block" Display Group 05, display zone 4.



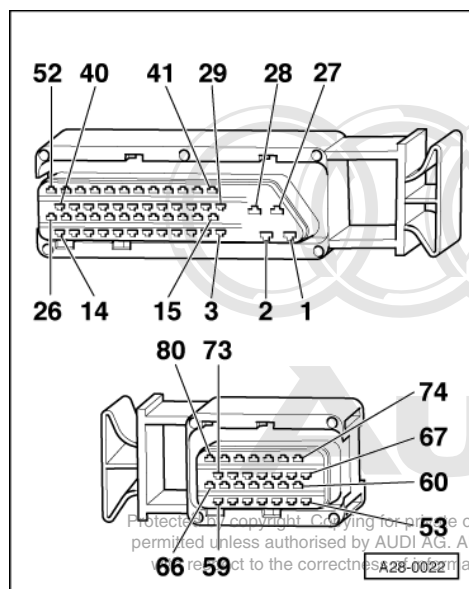
- ♦ Fitting location of intake air temperature sender
=> Page 42 .
- ♦ Engine cooled to room temperature (approx. 20 °C).
- Unplug connector from intake air temperature sender.
- -> Connect ohmmeter to intake air temperature sender.

Temperature °C	Resistance kΩ
-20	approx. 13.8

Temperature °C	Resistance kw
0	approx. 5.5
20	approx. 2.4
40	approx. 1.1
60	approx. 0.6



- If the value does not match the specification, fit a new intake air temperature sender.
- If the value does match the specification, test the wiring between the sender connector and the engine control unit as follows:
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
 =>Page 50 .
- -> Test wiring between 2-pin connector for sender ...



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- -> ... and engine control unit for open circuit and short to positive or earth using current flow diagram.

Contact on 2-pin connector	Contact on control unit connector or test box
1	54
2	67

- If no faults have been found in any of the above tests, fit a new engine control unit.
=>Page 50 .

1.7 - Testing intake air temperature sender (vehicles with intake manifold change-over function)

Note:

In vehicles with intake manifold change-over function, the intake air temperature sender (-G42) is integrated in the air mass meter. The sender therefore no longer exists as a separate component on the engine.

- Connect fault reader V.A.G 1551 (V.A.G 1552). Then switch on ignition and select engine control unit with "Address word 01".
(Connecting fault reader and selecting engine control unit
=> Page 2 .)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block	HELP
Input display group number XXX	

- Press keys 0, 0 and 5 for "Display group number 5" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

Read measured value block 5
1 2 3 4

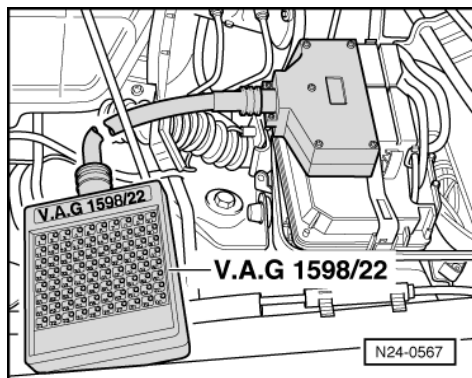
Functional check of sender

- Note intake air temperature figure in display zone 4.

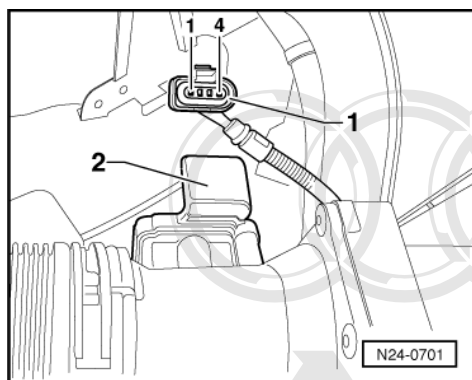
Display	Cause	Continuation of check
60 °C	Open circuit or short to positive	=> Page 105
	Short to earth	
Approx. ambient temperature ¹⁾	---	=> Page 106

- 1) If a temperature is displayed which deviates greatly from the ambient temperature of the sender, check sender wiring for contact resistance.

Continuation of check:

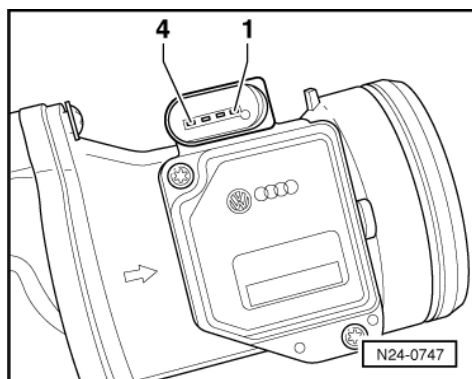


- Switch off ignition.
- -> Connect test box V.A.G 1598/22 to control unit wiring harness.

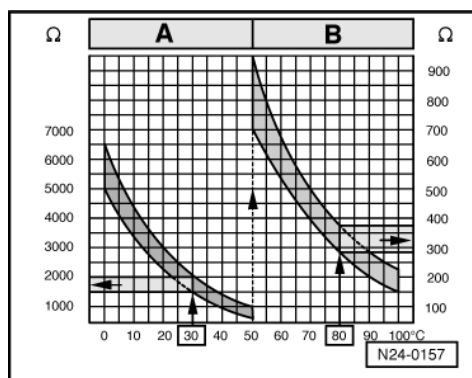


- -> Pull 4 pin connector -1- off air mass meter -2-.
- Check wiring between test box and 4 pin connector for open circuit using current flow diagram.
 Contact 2 + socket 12
 Contact 4 + socket 9 (on vehicles with data bus system /ESP;
 on other vehicles: socket 54)
 resistance: max 1.5Ω
- Additionally check for short circuits between the wires
 Specification: $\infty\Omega$

If no fault in wire is detected:



- -> Test resistance between contacts 2 and 4 of sender.



→ Scale A shows resistance values for temperature range 0...50 °C and scale B the values for temperature range 50...100 °C.

Examples:

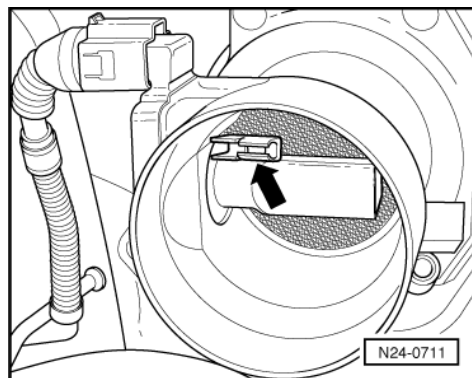
- ♦ 30 °C corresponds to a resistance from 1500...2000 Ω
- ♦ 80 °C corresponds to a resistance from 275...375 Ω

If the specification is not obtained:

- Replace air mass meter (G70) together with intake air temperature sender (G42).

Continuation of check when display = ambient temperature:

- Remove intake hose between air mass meter and throttle valve control part.
- Note intake air temperature value in display zone 4.



- → Spray sender -arrow- with commercial chilling agent whilst observing the temperature value. The temperature value must decrease.
- Press →key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

1.8 - Checking engine speed sender

Note:

- ♦ The engine speed sender is a combined speed sender and reference mark sender.
- ♦ The engine can run without a signal from the -G28. It is also possible (with considerable difficulty) to start the engine without a signal from the -G28 (emergency running function).

- ♦ For testing the operation of the engine speed sender, see also "Reading measured value block", Display Group 03, display zone 1.

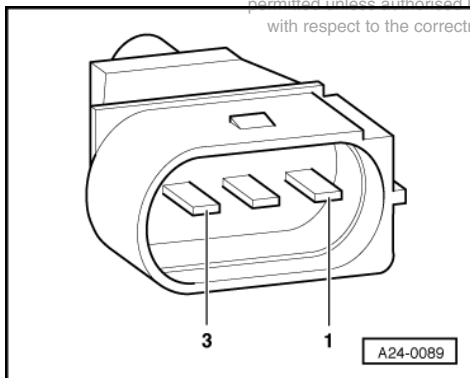
Testing engine speed sender

Fitting location of sender and connector

=> Page 42.

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- Unplug connector for engine speed sender (grey connector).

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- -> Connect hand-held multimeter V.A.G 1526 (resistance test range) to contacts 2 and 3 on connector for engine speed sender using test lead from V.A.G 1594.

Specification: approx. 730...1000 ω

Note:

The resistance value for the engine speed sender is based on a temperature of 20 °C.

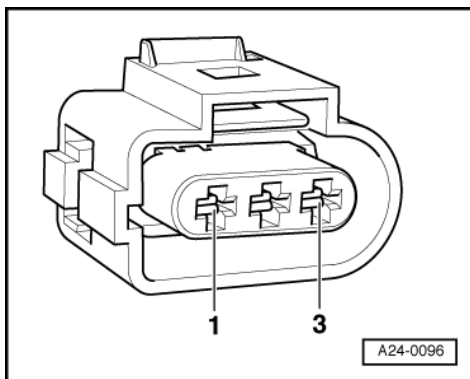
- If the value does not match the specification, fit a new engine speed sender.
- If the value does match the specification, connect hand-held multimeter (resistance measurement range) to contacts 2 and 1 (earth) and to contacts 3 and 1 (earth).

Specification: $\infty\omega$ (open circuit) in each test

- If the value does not match the specification, fit a new engine speed sender.

Notes:

- ♦ To do this, remove securing bolts for coolant tank and place tank to one side.
- ♦ Remove intake manifold support between sump and intake manifold. (Tightening torque when re-installing: 23 Nm)
- ♦ Remove engine speed sender.
- If the value does match the specification, test the wiring between the sender connector and the engine control unit as follows:





- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 50 .
- -> Test continuity of screening between contact 1 on engine speed sender connector and earth point on car body.

Specification: max. 1 ω .

- Test continuity of earth wire from contact 2 on sender connector to socket 63 on test box.

Specification: max. 1 ω .

- Test continuity of signal wire from contact 3 on sender connector to socket 56 on test box.

Specification: max. 1 ω .

- If the values are not as specified, rectify short or open circuit in wiring between sender connector and control unit connector.

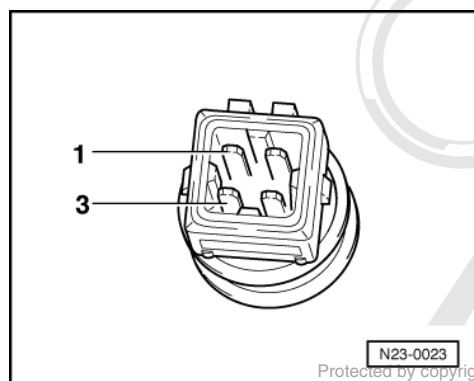
Contact on sender connector	Contact on control unit connector
1	Car body earth point
2	63
3	56

- If no open circuits or short circuits are found, fit a new engine control unit =>Page 50 .

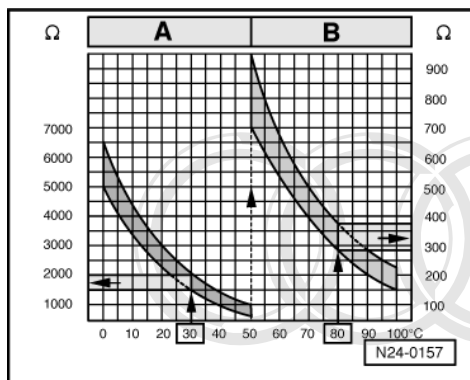
1.9 - Testing coolant temperature sender (version with square connector)

Notes:

- ♦ Testing sender with oval connector
=>Page 110
- ♦ For testing the operation of the coolant temperature sender, see also "Reading measured value block", Display Group 01, display zone 2.
- ♦ Fitting location of coolant temperature sender
=> Page 42 .



- Unplug connector on coolant temperature sender.
- -> Test resistance between contact 1 (earth) and contact 3 (signal) on sender.



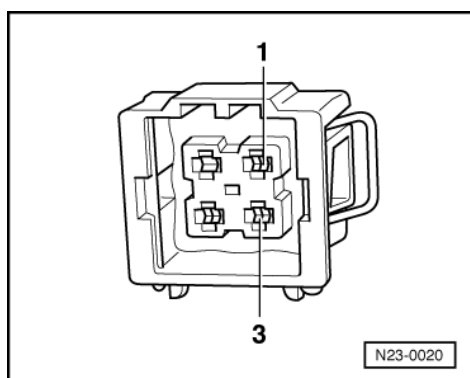
Scale A shows resistance values for temperature range 0...50 °C and scale B the values for temperature range 50...100 °C.

Examples:

- ◆ 30 °C corresponds to a resistance from 1500...2000 Ω
- ◆ 80 °C corresponds to a resistance from 275...375 Ω

- If the value does not match the specification, fit a new sender.

If the value does match the specification, test the wiring between the sender and the engine control unit as follows:



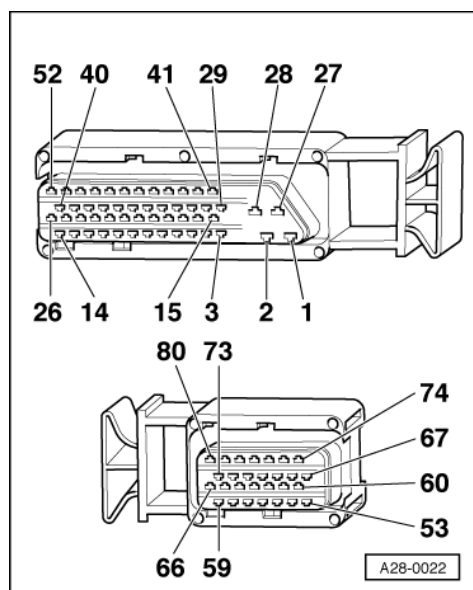
- Connect test box V.A.G 1598/22 to the wiring harness for the engine control unit.
=> Page 50
- -> Test for open circuit in earth wire between contact 3 on coolant temperature sender connector and socket 67 on test box.

Specification: max. 1 Ω .

- Test for open circuit in signal wire between contact 1 on coolant temperature sender connector and socket 53 on test box.

Specification: max. 1 Ω .

- Test for short circuits between the two wires.



- -> If values do not match specifications, rectify short circuits or open circuits in wiring between coolant temperature sender connector and control unit connector.

Contact on sender connector	Contact on control unit connector or test box
1	53
3	67

- If there are no short circuits or open circuits and the coolant temperature sender is OK, fit a new engine control unit.
=> Page 50

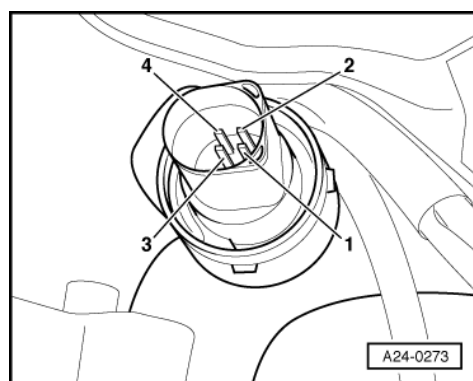
Testing coolant temperature sender with oval connector

Notes:

- ♦ For testing the operation of the coolant temperature sender, see also "Reading measured value block", Display Group 01, display zone 2.
- ♦ Fitting location of coolant temperature sender
=> Page 42 .

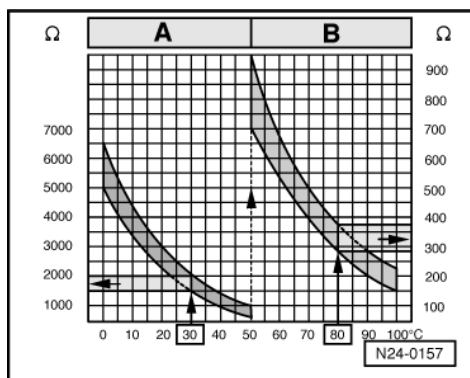
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- Unplug connector from coolant temperature sender.



- -> Connect multimeter (resistance test range) between contacts 3 and 4 on sender.

Scale A shows resistance values for temperature range 0...50°C and scale B the values for temperature range 50...100°C.

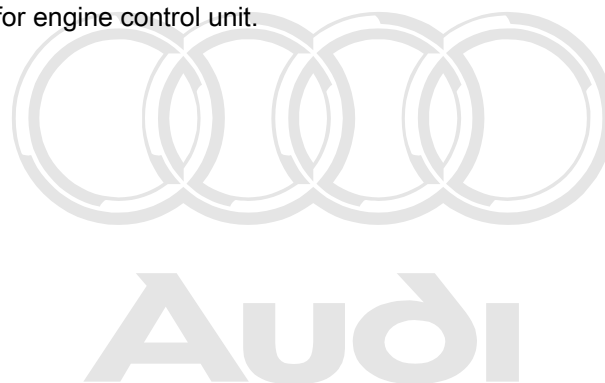
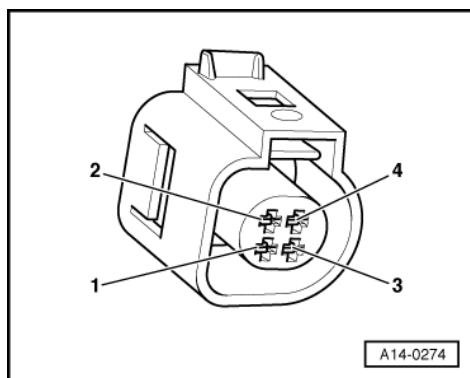


-> Examples:

- ◆ 30 °C corresponds to a resistance from 1500...2000 ω
- ◆ 80°C corresponds to a resistance from 275...375 ω

If the value does not match the specification:

- Renew coolant temperature sender
- Connect testbox V.A.G 1598/22 to wiring harness for engine control unit.



- -> Test the following wiring connections for open circuit and short circuit to earth or positive:

Connector contact	Test box V.A.G 1598/22 socket
3	67
4 (signal)	53

- Test for short circuits between the two wires.
- Repair open circuit or short circuit in wiring as required.

If wiring is OK:

- Renew engine control unit=>Page 50 .

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1.10 - Checking control unit voltage supply

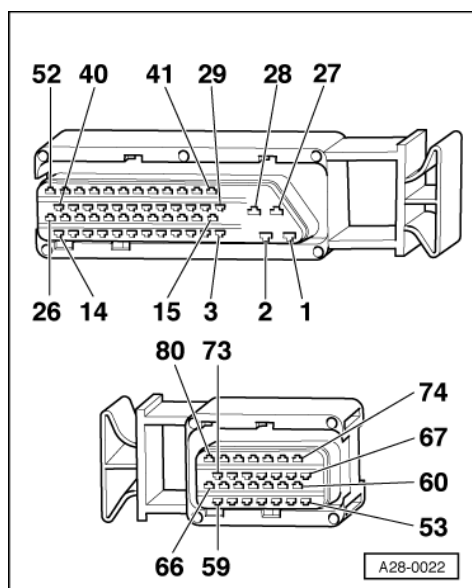
Note:

For testing the power supply to the engine control unit, see also "Reading measured value block", Display Group 05, display zone 2.

Test requirements:

- Fuse for engine control unit OK
- Battery voltage at least 11 V
- Alternator OK
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=> Page 50
- Switch ignition on.
- Connect diode test lamp V.A.G 1527 to socket 1 (live positive supply via ignition switch) and earth.

The diode test lamp should light up.



- -> If the diode test lamp does not light up, test for open circuit in wiring between fuse and contact 1 on control unit connector using current flow diagram. If necessary, rectify open circuit.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If diode test lamp V.A.G 1527 does light up, connect diode test lamp between socket 1 on control unit connector (positive supply via ignition switch) and socket 2 on control unit connector (earth connection for engine control unit).

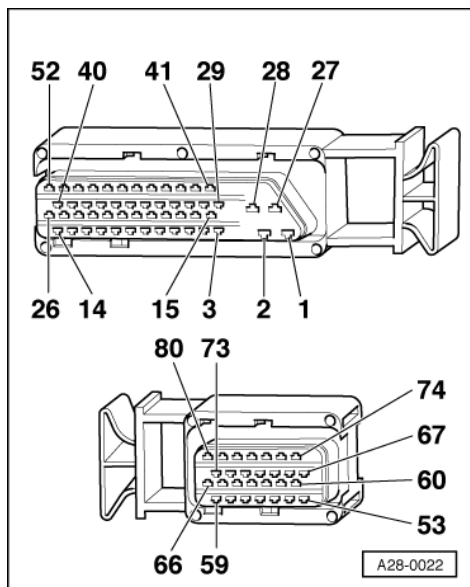
The diode test lamp should light up.

- -> If the diode test lamp does not light up, test for open circuit in wiring between earth and contact 2 on control unit connector. If necessary, rectify open circuit.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Connect diode test lamp V.A.G 1527 to socket 3 (permanent live) and earth.

The diode test lamp should light up.



- -> If the diode test lamp does not light up, test for open circuit in wiring between central electrics and contact 3 on control unit connector using current flow diagram. If necessary, rectify open circuit.

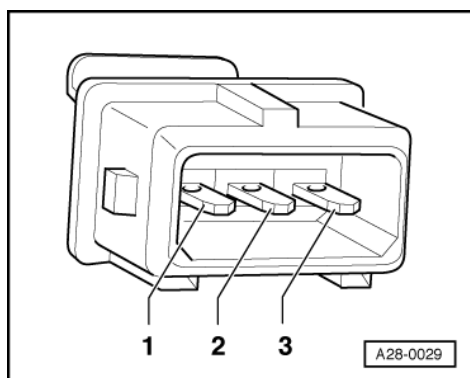
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

1.11 - Testing knock sensor

Notes:

- ◆ For testing the operation of the knock sensors, see "Reading measured value block", Display Groups 14, 15, 16 and 17.
- ◆ Fitting locations of plug connector and knock sensor
=> Page 42.
- ◆ It is not possible to carry out an electrical test of the knock sensors themselves; interrogate fault memory
=> Page 4.
- ◆ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ◆ Check connectors for corrosion.
- ◆ Use only gold-plated contacts when repairing the contacts in the plug connectors for the knock sensors.

Testing knock sensor wiring

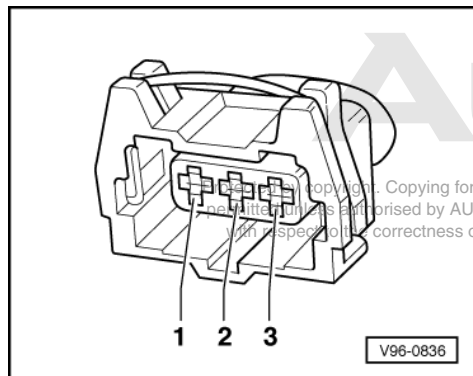


- Unplug knock sensor connector in engine compartment.
- -> Test for short circuits between all three contacts in the knock sensor connector. There must be no connection between any of the wires.
- If there is a connection between the contacts, fit a new knock sensor.

Testing wiring from knock sensors to engine control unit

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 50 .
- Test for open circuit and for short to positive/earth or between wires in the wiring between the knock sensor and engine control unit using the current flow diagram.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder



-> Identification of contacts in plug connector:

Signal wire	Earth wire	Screening
1	2	3

- Test continuity of signal wire of knock sensor 1 (-G61) from contact 1 on connector in engine compartment to socket 68 on test box.

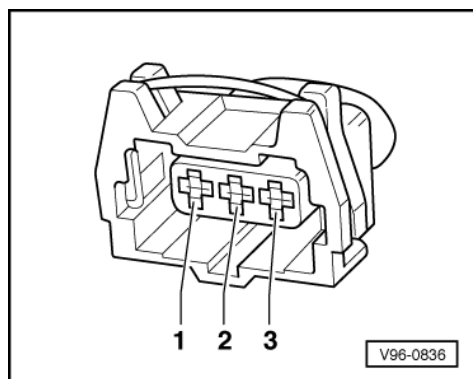
Specification: max. 1 ω .

- Test continuity of earth wire of knock sensor 1 (-G61) from contact 2 on connector in engine compartment to socket 67 on test box.

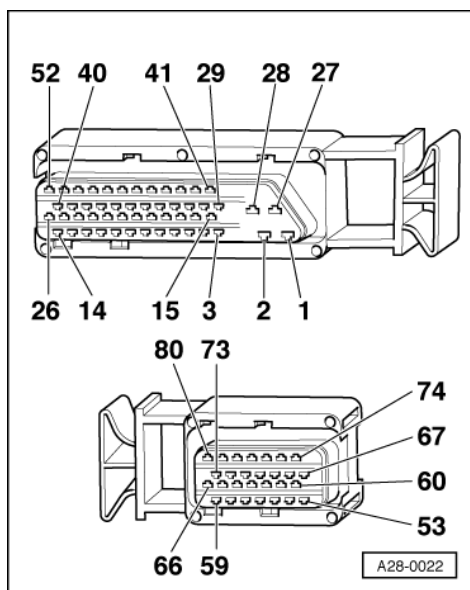
Specification: max. 1 ω .

- Test continuity of screening on wiring for knock sensor 1 (-G61) between earth and contact 3 on connector in engine compartment.

Specification: max. 1 ω .



- -> If the values do not match the specifications, rectify the short circuits or open circuits.



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- -> Knock sensor 1

Contact on connector for sensor	Contact on control unit connector
1 (signal)	68
2 (earth)	67
3 (screening)	Earth

1.12 - Checking Hall sender

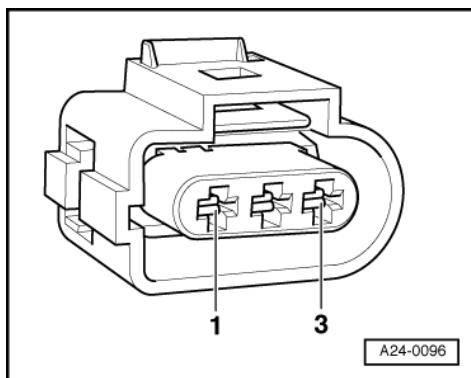
Fitting location of Hall sender => Page **42**.

Notes:

- ◆ The Hall sender is located beneath the camshaft sprocket.
- ◆ If no Hall sender signal is received, the knock sensor signals can no longer be assigned to the cylinders. If this happens, the knock control system is deactivated and the ignition timing is slightly retarded in order to prevent knocking.
- ◆ Even if no Hall sender signal is received, the engine will continue to run and can also be re-started. The reason for this is as follows:
 - The fact that the control unit is out of phase by one crankshaft revolution does not have any noticeable effect on the injection system.
 - The fuel is injected upstream of the closed inlet valve instead of while the inlet valve is open. This has only a minor influence on the quality of the air/fuel mixture.
 - With the twin-spark ignition system an ignition spark is produced for each cylinder after every crankshaft revolution, and not after alternate revolutions as is normally the case.
- Unplug connector from Hall sender.
- Switch ignition on.

Note:

The connector contacts are numbered on the back of the connector.



- -> Connect hand-held multimeter V.A.G 1526 (voltage test range) between contact 1 (positive) and contact 3 (earth) on Hall sender connector. Make sure not to bend the contacts.

Specification: 4.5 ... 5.5 V

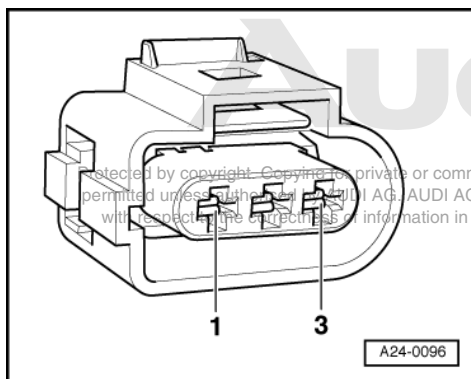
- -> Connect hand-held multimeter V.A.G 1526 (voltage test range) between contacts 2 and 3 (earth) on Hall sender connector. Make sure not to bend the contacts.

Specification: 4.5 ... 5.5 V

- If the values are as specified, fit a new Hall sender.

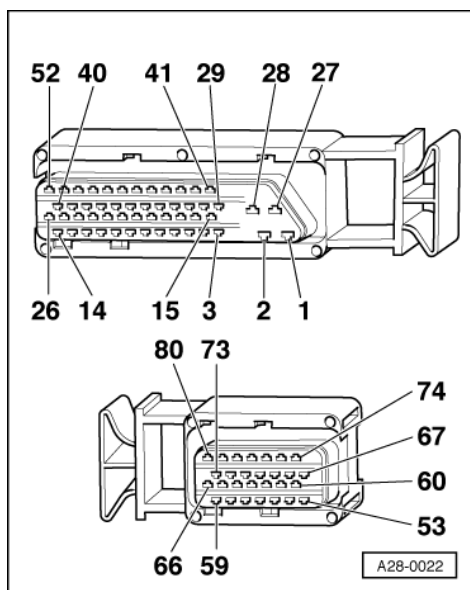
Note:

The Hall sender receives its power supply from the engine control unit.



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- If the values are not as specified, test wiring between the Hall sender and engine control unit as follows:
- Switch off ignition.
- Connect test box V.A.G 1598/22 to the wiring harness for the engine control unit.
=> Page 50
- -> Test wiring from Hall sender...



- -> ...to engine control unit for open circuit and short to positive or earth.

Contact on 3-pin connector for Hall sender	Contact on control unit connector
1 (positive)	62
2 (signal)	76
3 (earth)	67

- If the wiring is OK but the voltage readings are not as specified, fit a new engine control unit =>Page 50 .