



Audi A3 1997 ➤

Motronic Injection and Ignition System (4-cyl.) 08.97 ➤

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized 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

Engine ID AGN

Edition 09.1997

List of Workshop Manual Repair GroupsList of Workshop Manual
Repair GroupsList of Workshop Manual Repair Groups

Audi A3 1997 ➤

Motronic Injection and Ignition System (4-cyl.) 08.97 ➤

Repair Group

01 - Self diagnosis

24 - Mixture preparation, Injection

28 - Ignition system



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.

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.

**All rights reserved.
No reproduction without prior agreement from publisher.**

Contents

01 - Self diagnosis	1
1 Self-diagnosis	1
1.1 Self-diagnosis	1
1.2 Technical data of self-diagnosis	1
1.3 Connecting fault reader V.A.G 1551 and selecting engine electronics control unit	1
2 Interrogating and erasing fault memory	3
2.1 Interrogating and erasing fault memory	3
2.2 Fault table	4
2.3 Fault codes 00282 to 16502	4
2.4 Fault codes 16505 to 18259	14
3 Final control diagnosis	23
3.1 Final control diagnosis	23
4 Basic setting	24
4.1 Basic setting	24
5 Coding control unit	26
5.1 Coding control unit	26
6 Reading measured value block	26
6.1 Reading measured value block	26
6.2 Display Groups 000 to 007	31
6.3 Display Groups 008 to 099	41
24 - Mixture preparation, Injection	52
1 Servicing Motronic injection system	52
1.1 Servicing Motronic injection system	52
1.2 Safety precautions	52
1.3 Rules for cleanliness	52
1.4 Technical data	53
1.5 Fitting locations overview	54
1.6 Wiring and component check with test box V.A.G 1598/22	56
1.7 Renewing engine control unit	57
1.8 Testing idling speed	58
1.9 Checking fuel pressure regulator and holding pressure	59
1.10 Testing injection quantity, leak-tightness and spray pattern of injectors	61
1.11 Checking injectors	63
1.12 Testing fuel pump relay and activation	65
1.13 Checking air mass meter	68
2 Testing lambda control	70
2.1 Testing lambda control	70
2.2 Poor performance after cold start	71
2.3 Testing operation	72
2.4 Checking Lambda probe heating	73
2.5 Testing lambda probe signal wiring and activation	74
2.6 Removing and installing lambda probe	76
3 Testing intake manifold change-over function	76
3.1 Testing intake manifold change-over function	76
3.2 Testing operation	76
3.3 Testing vacuum system	77
3.4 Testing intake manifold change-over valve	78
4 Testing fuel tank breather system	80
4.1 Testing fuel tank breather system	80
4.2 Testing solenoid valve 1 for activated charcoal filter	80
5 Testing throttle valve control part (vehicles without cruise control)	82



5.1	Testing throttle valve control part (vehicles without cruise control)	82
5.2	Function	82
5.3	Performing adaption of throttle valve control part (vehicles without cruise control)	83
5.4	Testing idling speed switch (vehicles without cruise control)	85
5.5	Testing throttle valve positioner sender and throttle valve potentiometer (vehicles without cruise control)	85
6	Testing throttle valve control part (vehicles with cruise control)	87
6.1	Testing throttle valve control part (vehicles with cruise control)	87
6.2	Function	87
6.3	Performing adaption of throttle valve control part (vehicles with cruise control)	87
6.4	Testing idling speed switch (vehicles with cruise control)	89
6.5	Testing throttle valve positioner sender and throttle valve potentiometer (vehicles with cruise control)	90
7	Testing auxiliary signals	92
7.1	Testing auxiliary signals	92
7.2	Testing air conditioner compressor shut-off	92
7.3	Testing engine speed adaption when air conditioner cuts in	93
7.4	Testing clutch pedal switch	94
7.5	Testing power steering pressure switch	96
7.6	Checking engine speed signal	97
7.7	Testing speed signal	97
7.8	Testing data exchange between Motronic, ABS and gearbox (CAN bus)	99
28	- Ignition system	101
1	Testing ignition system	101
1.1	Testing ignition system	101
1.2	Safety precautions	101
1.3	Technical data for ignition system	101
1.4	Testing twin-spark ignition system with two ignition coils	101
1.5	Checking intake air temperature sender	103
1.6	Checking engine speed sender	104
1.7	Testing coolant temperature sender	106
1.8	Checking control unit voltage supply	108
1.9	Testing knock sensors	109
1.10	Checking Hall sender	111
2	Testing camshaft timing control	113
2.1	Testing camshaft timing control	113
2.2	Testing solenoid valve for camshaft adjustment	114



01 - Self diagnosis

1 - Self-diagnosis

1.1 - Self-diagnosis

1.2 - Technical data of self-diagnosis

Equipped with

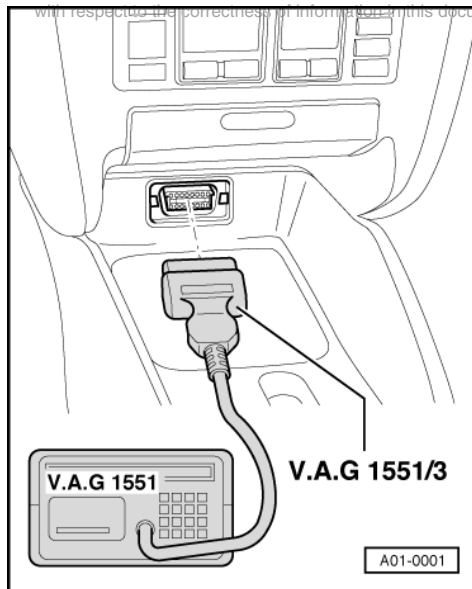
- ◆ Fault memory: Non-volatile memory and volatile memory¹⁾
 - ◆ Rapid data transfer
- 1) Will be cancelled after 50th engine start if fault has not occurred again.

Control unit identification

The control unit version is displayed when fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 is connected and the engine control unit is selected => Page **1**.

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

This document is a technical document. It is not to be used for any other purpose. It is not to be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without the prior written permission of 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 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.
- -> Unclip cover for diagnostic connections.
- Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.

-> Indicated in display

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

1) appears alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on the function required, see table of selectable functions => Page 3.

- Switch ignition on.

or

- Start the engine.
- 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.

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

06A906018.. 1.8l	R4/5V MOTR HS
V..□	
Coding 04000	WSC 06388

- | | |
|----------------|---|
| - 06A906018.. | Control unit number (see Parts List) |
| - 1.8 ltr. | Engine capacity |
| - R4/5V | In-line engine, 4 cylinders, 5 valves per cylinder |
| - MOTR | Motronic |
| - HS | HS = manual gearbox |
| AT | AT = automatic transmission |
| - GRA (or CCS) | Only appears on vehicles with cruise control system |
| - V.. | Software version in control unit |
| - Coding 04000 | Control unit coding |
| - WSC 06388 | Workshop Code of the V.A.G 1551 with which the last coding was performed. |

- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

Note:

-> 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

Selectable functions

Fault reader V.A.G 1551 or V.A.G 1552	Ignition on, engine not running	Engine idling	Vehicle being driven	Page
Address words				
01 Engine electronics	Yes	Yes	Yes	
00 Automatic test sequence	Yes	Yes	Yes	
Functions				
01 Interrogate control unit version	Yes	Yes	Yes	1
02 Interrogate fault memory	No	Yes	Yes	3
03 Final control diagnosis	No	Yes	No	23
04 Basic setting	No	Yes	Yes	24
05 Erase fault memory	Yes	Yes	Yes	3
06 End output	Yes	Yes	Yes	3
07 Code control unit	Yes	No	No	26
08 Read measured value block	Yes	Yes	Yes	26

2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

- 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 1.)

Note:

Only when engine does not start:

- Interrogate fault memory with ignition switched on.

-> Indicated on display:



Rapid data transfer HELP
 Select function XX

- Press keys 0 and 2 for function "Interrogate fault memory" and confirm entry with Q key.

-> Indicated on display:

No fault recognised

- Press =>key.

or

-> Indicated on display:

X faults recognised

If the printer on the fault reader is switched on the stored faults will be displayed and printed out in sequence.

- Locate and eliminate faults printed out as per fault table
=> Page 4.
- Press =>key.
- 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 fault memory and erasing fault memory, the fault memory will not be erased.

- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

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.

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

2.2 - Fault table

Notes:

- ♦ The fault table is listed according to the 5 digit fault code on the left.
- ♦ Before renewing components indicated as being faulty, check the wiring and connectors to these components as well as the earth connections using current flow diagram. This is particularly relevant if faults are output as "occurring sporadically" (SP).

2.3 - Fault codes 00282 to 16502

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00282 Throttle valve positioner -V60			

Implausible signal	- Throttle valve sticking - Fault in wiring for throttle valve positioner	- Idling speed too high - Idling speed control switches to emergency running mode - Cruise control system is switched off	- Perform adaption of throttle valve control part (procedure for vehicles with cruise control) => Page 90 - Rectify open circuit or short circuit using current flow diagram - Test cruise control system => Electrical system; Repair group 96
--------------------	--	---	---

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00282 Throttle valve positioner -V60 Adaption limit exceeded	- Throttle valve positioner - -V60 defective	- Idling speed too high - Idling speed control switches to emergency running mode - Cruise control system is switched off	- Perform adaption of throttle valve control part (procedure for vehicles with cruise control) => Page 90 - Test cruise control system => Electrical system; Repair group 96

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 for errors or the correctness of information published here. Copyright by AUDI AG.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00515 Hall sender -G40 Short circuit to earth	- Short to earth in wiring between Hall sender -G40 and engine control unit - -G40 defective - Signal input in engine control unit faulty - (control unit defective)	- No power at full throttle - Emission values not OK - High fuel consumption	- Rectify short circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test -G40 =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00515 Hall sender -G40 Open/short circuit to positive	- Open circuit or short circuit to positive in signal wire between Hall sender -G40 and engine control unit - -G40 defective - Phase window out of line - Faulty signal input in engine control unit - (control unit defective)	- No power at full throttle - Emission values not OK - High fuel consumption	- Rectify short circuit or open circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test -G40 =>Page 111 - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00532 Supply voltage Signal too great	- Supply voltage greater than 16 V	- Damage to engine control unit	- Check voltage



	- Excess voltage from assisted start - Defective alternator		- Read measured value block, Display Group 003, display zone 2 => Page 37
Signal too small	- Supply voltage less than 10 V - Defective fuse - Poor earth connection to engine control unit - Battery discharged - Current drain when ignition is off	- Idling speed not within tolerances	- Check voltage supply to engine control unit => Page 108 - Check fuse - Read measured value block, Display Group 003, display zone 2 => Page 37 - Check battery charge level

Notes on fault code 00532:

- ♦ If the fault is shown as a sporadic fault, ignore the fault message on the display. This fault is often stored when the engine is left idling for a long period with a number of electrical consumers switched on and causing heavy discharging of the battery.
- ♦ The fault message "Signal too low" is stored if the supply voltage falls below 10.00 V for more than 1 second. (The control unit will not function at less than 6.5 V.)
- ♦ The unit does not check for low signals when the engine is being started since the voltage may fall below 10.00 V during starting.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00543 Maximum revs exceeded	- Engine over-revved - (e.g. wrong gear engaged)	- Possible engine damage	- Rectify mechanical damage

Notes on fault code 00543:

This fault message appears if the engine speed exceeds 7100 rpm.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00561 Mixture adaptation Adaption limit (add) exceeded	- Fuel system pressure too low	- Car may run jerkily	- Fill car up with petrol and check fuel system pressure => Page 59
Adaption limit (mul) exceeded	- Incorrect signal from air mass meter - Leaks in exhaust system before catalytic converter - Unmetered air downstream of air mass meter - Carbon on injectors	- Increased fuel consumption - Rough idling	- Test air mass meter => Page 68 - Repair leaks - Check injection quantity => Page 61

Notes:

- ♦ (add) = additive, i.e. fault only occurs during idling
- ♦ (mul) = multiplicative, i.e. fault occurs over the entire engine speed range and at all throttle openings.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00561 Mixture adaptation Adaption limit (add) not reached	- Fuel system pressure too high	- Car may run jerkily	- Fill up with petrol and check fuel system pressure => Page 59
Adaption limit (mul) not reached	- Incorrect signal from air mass meter - Fuel in engine oil (maybe from short journeys) - Injectors leaking	- Increased fuel consumption - Rough idling at times - Black smoke, soot on spark plugs	- Test air mass meter => Page 68 - Take car for 15-minute run on motorway or change oil Read measured block value, Display Group 008 => Page 41 - Check injection quantity => Page 61

Notes:

- ♦ (add) = additive, i.e. fault only occurs during idling
- ♦ (mul) = multiplicative, i.e. fault occurs over the entire engine speed range and at all throttle openings.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00670 Throttle valve positioner sender - G127 Signal too small	- Short to earth in signal wire between throttle valve positioner sender - G127 and engine control unit Continued ▼	- Idling speed positioner deactivated - engine idles with mechanically regulated air flow through the emergency running slot (slightly increased idling speed)	- Perform adaption of throttle valve control part => Page 87

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00670 Throttle valve positioner sender - G127	(Fault code 00670 continued) - Fault in power supply to throttle valve positioner - Defective throttle valve positioner - Faulty signal input in engine control unit - (control unit defective)	- Load change jolt when easing off accelerator - AC compressor not activated at low engine speeds	- Fit a new engine control unit => Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00670 Throttle valve positioner sender - G127			



Signal too great	- Open circuit or short to positive in signal wire - between throttle valve positioner sender - G127 and engine control unit Continued ▼	- Idling speed positioner deactivated - engine - idles with mechanically regulated air flow through the emergency running slot (slightly increased idling speed)	- Perform adaption of throttle valve control part => Page 87
------------------	---	---	---

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00670 Throttle valve positioner sender - G127 Signal too great	(Fault code 00670 continued) - Defective earth connection to throttle valve positioner - Defective throttle valve positioner - Faulty signal input in engine control unit - (control unit defective)	- Load change jolt when easing off accelerator - AC compressor not activated at low engine speeds	- Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00670 Throttle valve positioner sender - G127 Implausible signal	- Throttle valve jamming Continued ▼	- Idling speed positioner deactivated - engine - idles with mechanically regulated air flow through the emergency running slot (slightly increased idling speed)	- Perform adaption of throttle valve control part => Page 87

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00670 Throttle valve positioner sender - G127 Implausible signal	(Fault code 00670 continued) - Fault in wiring to throttle valve positioner - Basic setting for throttle valve control part not performed	- Load change jolt when easing off accelerator - AC compressor not activated at low engine speeds	- Rectify open circuit or short circuit using current flow diagram => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations

Protected by copyright. Copying for non-commercial purposes without permission 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.

Notes on fault code 00670:

- ♦ The throttle valve positioner sender is located in the throttle valve control part -J338.
- ♦ The sender is a potentiometer which signals the position of the throttle valve positioner to the control unit.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00671 CCS Switch -E45 Undefined switch position	- Cruise control system switch -E45 defective - Open circuit or short circuit in wiring	- Cruise control system switched off	- Test cruise control system => Electrical system; Repair group 96

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01119 Gear recognition signal Open/short circuit to positive	- Open circuit or short to positive in signal wiring - between engine control unit and multi-function switch -F125 - -F125 defective - Faulty signal input in engine control unit - (control unit defective)	- Brief and slightly more pronounced engine speed fluctuations than usual when engaging or disengaging gear	- Test wiring to multi-function switch -F125 => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Interrogate fault memory for gearbox => Automatic gearbox 01M; Repair group 01; Performing self-diagnosis - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01119 Gear recognition signal Short circuit to earth	- Short to earth in signal wiring between engine control unit and multi-function switch -F125 - -F125 defective (earth contact not broken when engaging gear)	- Brief and slightly more pronounced engine speed fluctuations than usual when engaging or disengaging gear	- Test wiring to multi-function switch -F125 => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Interrogate fault memory for gearbox => Automatic gearbox 01M; Repair group 01; Performing self-diagnosis

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01120 Camshaft timing control 1 Mechanical fault	- Fault in power supply to camshaft adjustment valve -N205 - Open circuit / short to earth or positive in wiring between camshaft adjustment valve and engine control unit - Camshaft adjustment valve -N205 defective	- Lack of torque at lower end of engine speed range (1300 - 3600 rpm)	- Check camshaft adjustment valve -N205 => Page 114



	- Mechanical camshaft - adjuster defective		- Read measured value block, Display Group 025 or 026=> Page 49 - Fit a new camshaft adjuster
--	---	--	---

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01165 Throttle valve control part - J338			
Regulating limit not reached	- Throttle valve jamming - Positioner mechanism - jamming	- Increased idling speed	- Read measured value block, Display Group 023 => Page 47
Regulating limit exceeded	- Fault (open circuit / short to positive or earth) in - wiring to throttle valve positioner -V60	- Load change jolt when easing off accelerator	- Test throttle valve control part -J338 => Page 24-62 - Test throttle valve control part -J338 (procedure for vehicles with cruise control) => Page 87
Regulating difference	- Throttle valve positioner sender -G127 defective - -V60 defective - Faulty signal output in engine control unit - (control unit defective)		- Fit a new engine control unit=>Page 57

Note:

If fault code 01165 is stored in the fault memory, fault code 17953 will also be stored next time the engine is started.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01182 Altitude adaption Signal outside tolerance	- Throttle valve potentiometer - G69 defective - Incorrect throttle valve unit installed - Unmetered air entering system - Air cleaner obstructed	- Difficult to start - Poor acceleration - Difficult to pull away	- Test throttle valve potentiometer -G69 => Page 90 - Check Part No. - Rectify leak - Fit a new air cleaner

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01247 Activated charcoal filter solenoid valve 1 -N80			
Short circuit to earth	- Short to earth between activated charcoal filter solenoid valve -N80 and engine control unit - -N80 defective	- Car may run jerkily at part throttle	- Test -N80 => Page 80
Short circuit to positive	- Short to positive between -N80 and engine control unit - -N80 defective	- Car may smell of petrol	- Read measured value block, Display Group 010 => Page 42

Output open	- Open circuit in wiring between -N80 and fuse - Open circuit in wiring between -N80 and engine control unit		- Rectify open or short circuit (see Current Flow Diagram) => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test fuse
	- Fuse defective - -N80 defective		

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01249 No.1 cyl. injector -N30 Short circuit to earth	- Short to earth in wiring between injector and engine control unit - Injector defective	- Engine runs unevenly or cuts out	- Test injectors => Page 63
Short circuit to positive	- Short to positive in wiring between injector and engine control unit - Injector defective		
Output open	- Open circuit in wiring between injector and engine control unit - Fuse defective - Open circuit in wiring between injector and fuse - Injector defective		- Test fuse - Rectify short circuit or open circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01250 No. 2 cyl. injector -N31 Short circuit to earth	=> Cylinder 1, fault code 01249	=> Cylinder 1, fault code 01249	=> Cylinder 1, fault code 01249
Short circuit to positive			
Output open			
01251 No. 3 cyl. injector -N32 Short circuit to earth	=> Cylinder 1, fault code 01249	=> Cylinder 1, fault code 01249	=> Cylinder 1, fault code 01249
Short circuit to positive			
Output open			

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



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01259 Fuel pump relay -J17 Open/short circuit to earth	- Open circuit or short to earth between fuel pump relay -J17 and engine control unit - Fault in power supply to -J17 - Fuel pump relay -J17 defective	- Open circuit: - engine will not run - Short to earth: engine will continue to run normally but use more current with ignition on because relay is constantly picked up and fuel pump runs continuously, even when engine is not running	- Rectify open circuit or short circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test fuel pump relay -J17 => Page 65
Short circuit to positive	- Short to positive in wiring between fuel pump relay -J17 and engine control unit		

Note:

If fault code 01259 has been stored, fault codes 01247, 01249, 01250, 01251, 01252 or 17935 could also be stored, since the components to which they relate receive their power from the fuel pump relay.

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.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01314 Control unit defective	- Engine control unit defective	- Cruise control system not working	- Fit a new engine control unit => Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16486 Air mass meter -G70 Signal too small	- Unmetered air between air mass meter -G70 and engine - Air cleaner obstructed - Fault in power supply to -G70 - Open circuit or short to earth in signal wiring - between -G70 and engine control unit - -G70 defective - Faulty signal input in engine control unit - (control unit defective)	- Emergency running mode (substitute value based on throttle angle and engine speed), so no noticeable effect on performance	- Locate and rectify leak - Fit a new filter element - Read measured value block, Display Group 002 => Page 36 - Rectify short circuit or open circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test -G70 =>Page 68 - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16487 Air mass meter -G70 Signal too great	- Short to positive in signal wire between air mass meter -G70 and engine control unit	- Emergency running mode (substitute value based on throttle angle and engine speed), so no noticeable effect on performance	- Read measured value block, Display Group 002 => Page 36

	- Defective earth connection to -G70 - -G70 defective - Faulty signal input in engine control unit - (control unit defective)		- Test -G70 => Page 68 - Fit a new engine control unit =>Page 57
--	--	--	---

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16496 Intake air temperature sender - G42 Signal too small	- Short to earth in wiring between intake air temperature sender - G42 and engine control unit - -G42 defective - Faulty signal input in engine control unit - (control unit defective)	- Emergency running mode - the display shows a - substitute value calculated by the engine control unit	- Read measured value block, Display Group 003, display zone 4 => Page 37 - Test -G42 => Page 103 - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16497 Intake air temperature sender - G42 Signal too great	- Open circuit or short to positive in wiring between intake air temperature sender -G42 and engine control unit - -G42 defective - Defective earth connection to -G42 - Faulty signal input in engine control unit - (control unit defective)	- Emergency running mode - the display shows a - substitute value calculated by the engine control unit	- Read measured value block, Display Group 003, display zone 4 => Page 37 - Test -G42 => Page 103 - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16500 Coolant temperature sender - G62 Implausible signal	- Coolant temperature sender -G62 delivering an implausible signal because of a loose contact or - corrosion (moisture) on connector plug - Faulty signal input in engine control unit - (control unit defective)	- Difficulty with cold starting, especially at very low temperatures - Poor performance in warm-up phase - Increased fuel consumption - Increased emissions	- Read measured value block, Display Group 003 => Page 106 - Fit a new engine control unit =>Page 57

**Note on fault code 16500:**

The temperature curve between 20°C and 60°C is compared with a model temperature curve stored in the control unit. The model curve rises less sharply than the actual curve. If there is a fault which causes the actual temperature to rise too slowly, the real values will coincide with those in the model curve at a certain point. The engine control unit recognises the fault as implausible.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16501 Coolant temperature sender - G62 Signal too small	- Short to earth in wiring - between coolant temperature sender -G62 and engine control unit - -G62 defective - Faulty signal input in engine control unit - (control unit defective)	- Difficulty with cold starting, especially at very low temperatures - Poor performance in warm-up phase - Increased fuel consumption - Increased emissions	- Read measured value block, Display Group 003 =>Page 37 - Test -G62 =>Page 106 - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16502 Coolant temperature sender - G62 Signal too great	- Open circuit or short to positive in wiring between coolant temperature sender -G62 and engine control unit - -G62 defective - Defective earth connection to -G62 - Faulty signal input in engine control unit - (control unit defective)	- Difficulty with cold starting, especially at very low temperatures - Poor performance in warm-up phase - Increased fuel consumption - Increased emissions	- Read measured value block, Display Group 003 => Page 37 - Test -G62 =>Page 106 - Fit a new engine control unit =>Page 57

Note on fault codes 16500, 16501 and 16502:

If one of the above faults is detected, the control unit adopts a substitute value from the model curve stored in the control unit.

2.4 - Fault codes 16505 to 18259

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16505 Throttle valve potentiometer -G69 Implausible signal	- Moisture / corrosion in connector on throttle valve potentiometer -G69	- Jerky acceleration	- Test throttle valve potentiometer -G69 => Page 90

	- G69 defective	- Uneven idling speed - control	
--	-----------------	------------------------------------	--

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16506 Throttle valve potentiometer -G69 Signal too small	- Short to earth in signal wire between -G69 and engine control unit - Fault in power supply to -G69 - -G69 defective	- Load change jolt when easing off accelerator	- Rectify short circuit or open circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16507 Throttle valve potentiometer -G69 Signal too great	- Open circuit or short to positive in signal wire between -G69 and engine control unit - Defective earth connection to -G69 - -G69 defective	- Jerky acceleration - Load change jolt when easing off accelerator	- Test throttle valve potentiometer -G69 => Page 90

Note on fault code 16505:

The air flow rate (air mass) is compared with the throttle valve angle at each different engine speed.

Notes on fault codes 16505, 16506 and 16507:

- ♦ If one of the above faults is detected, the control unit adopts a substitute value derived from the engine speed.
- ♦ If a fault develops with both the throttle valve potentiometer and the air mass meter at the same time, the emergency running function cannot operate and therefore the engine will cut out.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16514 Bank1 - Probe1 Electrical fault in current circuit	- Corrosion due to moisture in plug connection for lambda probe heating -Z19 or lambda probe -G39 - Short circuit between signal wiring for lambda probe and reference earth wiring for lambda probe - Amplitude in signal wiring too small (lambda probe -G39 contaminated or probe slits blocked/dirty)	- Lambda closed-loop control switches to open-loop control - Rough idling - Emission levels not OK - Increased fuel consumption	- Rectify short circuit or open circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test lambda control =>Page 72 - Read measured value block, Display Group 007 =>Page 47

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16515 Bank 1 - Probe 1			



Voltage too low	- Short to earth or short to screening in lambda probe signal wire - Short to earth or short to screening in lambda probe reference earth wire - Lambda probe defective	- Lambda closed-loop control switches to open-loop control - Rough idling - Emission levels not OK - Increased fuel consumption	- Rectify short circuit or open circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test lambda control =>Page 40 - Read measured value block, Display Group 021 =>Page 47
-----------------	---	--	--

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16516 Bank 1 - Probe 1 Voltage too high	- Short to positive in signal wiring - Lambda probe defective	- Lambda closed-loop control switches to open-loop control - Rough idling	- Rectify short circuit or open circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test lambda control =>Page 72 - Read measured value block, Display Group 007 =>Page 40
16518 Bank 1 - Probe 1 No activity	- Lambda probe defective (dirty) - Open circuit in wiring between lambda probe heating and engine control unit - Lambda probe heating not functioning	- Increased fuel consumption - Emission levels not OK - Spark plugs become covered with soot	- Read measured value block, Display Group 021 =>Page 47 - Test lambda probe heating =>Page 73

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16519 Bank1 - Probe1 Heating current circuit electrical fault	- Open circuit or short circuit	- Lambda probe heating not functioning	- Test lambda probe heating =>Page 73
16705 Engine speed sender -G28 Implausible signal	- Engine speed sender -G28 loose - Sender wheel loose	- Engine misfires	- Test engine speed sender -G28 =>Page 104

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16706 Engine speed sender -G28 No signal	- Open circuit or short to positive or earth in signal wiring	- Engine will not start	- Rectify open circuit or short circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations

	- Open circuit or short to positive in earth wiring - G28 loose or defective - Open circuit in connection to screening for -G28 - Faulty signal input in engine control unit - (control unit defective)	- Engine cuts out	- Test -G28 =>Page 104 - Fit a new engine control unit =>Page 57
--	---	---	---

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16711 Knock sensor 1 -G61 Signal too small	- Knock sensor loose or corrosion on plug - Open circuit in sender earth wiring between knock sensor and engine control unit	- High fuel consumption - Poor performance	- Tightening torque for knock sensor: 20 Nm
16716 Knock sensor 2 -G66 Signal too small	- Open circuit or short to earth or screening in signal wire between knock sensor and engine control unit - Knock sensor defective - Faulty signal input in engine control unit - (control unit defective)		- Read measured value block, Display Group 016 => Page 45 - Test knock sensor => Page 109 - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16885 Vehicle speed signal Implausible signal	- Vehicle speed sender defective - Open circuit or short circuit between vehicle speed sender and speedometer - Open circuit or short circuit between dash panel insert and engine control unit - Speedometer defective	- Air conditioner compressor does not cut out at full throttle in 1st gear - Idling speed deviates briefly from specified speed - Poor load change performance - Malfunction in systems which use road speed signal	- Test road speed signal => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Read measured value block, Display Group 011, display zone 3 => Page 43 - Rectify open circuit or short circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test road speed signal => Page 97

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16989 Control unit defective			



	- Engine control unit defective	- Engine will not start	- Fit a new engine control unit => Page 57
--	---------------------------------	-------------------------	--

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17733 Knock control Cyl. 1 Control limit reached	- Poor-quality fuel (less than RON 91) - Abnormal engine noise (ancillaries loose) - Open circuit in screening for knock sensor 1 or 2 - Loose contact in connector - Wrong tightening torque on knock sensor	- High fuel consumption - Poor performance - Engine runs unevenly - Vehicle will not reach top speed	- Fill up with petrol (at least RON 91) - Test knock sensor => Page 109 - Rectify open circuit or short circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Read measured value block, Display Groups 014 and 015 => Page 44 - Tighten knock sensor (20Nm)

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17734 Knock control Cyl. 2 Control limit reached	=> Knock control Cyl. 1 Fault code 17733	=> Knock control Cyl. 1 Fault code 17733	=> Knock control Cyl. 1 Fault code 17733
17735 Knock control Cyl. 3 Control limit reached	=> Knock control Cyl. 1 Fault code 17733	=> Knock control Cyl. 1 Fault code 17733	=> Knock control Cyl. 1 Fault code 17733
17736 Knock control Cyl. 4 Control limit reached	=> Knock control Cyl. 1 Fault code 17733	=> Knock control Cyl. 1 Fault code 17733	=> Knock control Cyl. 1 Fault code 17733

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17913 Idling speed switch -F60 Does not close/open circuit	- Throttle valve sticking - Accelerator cable setting - Floor mat pressing down on accelerator - Open circuit or short to positive between idling speed switch -F60 and engine control unit - -F60 defective	- Load change jolt when easing off accelerator - Idling speed not within the specified range - Air conditioner compressor only cuts in at high engine speed	- Test idling speed switch => Page 85 - Adjust accelerator cable => 4-cyl. Engine, Mechanics; Repair Group 20; Removing and installing parts of fuel supply system; Servicing accelerator cable - Removing and installing parts of fuel supply system; Servicing accelerator cable - Rectify short circuit or open circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations

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.

	- Faulty signal input in engine control unit - (control unit defective)		- Fit a new engine control unit =>Page 57
--	--	--	---

V.A.G 1551 print-out 17914 Idling speed switch -F60 Does not open / short to earth	Possible causes of fault	Possible effects	Fault remedy
	- Moisture in throttle valve connector - Short to earth between idling speed switch -F60 and engine control unit - F60 defective - Faulty signal input in engine control unit - (control unit defective)	- Idling speed closed-loop control switches to open-loop control - Idling speed not within the specified range - Load change jolt when easing off accelerator - Air conditioner compressor only cuts in at high engine speed	- Test idling speed switch => Page 85 - Rectify short circuit or open circuit - => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out 17915 Idling system learned value Lower limit attained	Possible causes of fault	Possible effects	Fault remedy
	- Unmetered air entering system upstream of throttle valve control part	- High idling speed	- Rectify leak
17916 Idling system learned value Upper limit attained	- Intake system obstructed (air cleaner or intake passage)	- No power	- Check intake system

V.A.G 1551 print-out 17920 Intake manifold changeover valve -N156 Short circuit to positive	Possible causes of fault	Possible effects	Fault remedy
	- Short to positive in wiring between intake manifold change-over valve -N156 and engine control unit - N156 defective - Faulty signal input in engine control unit - (control unit defective)	- N156 does not open (loss of power above 4700 rpm)	- Test -N156 => Page 76 - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out 17923 Intake manifold changeover valve -N156 Short circuit to earth	Possible causes of fault	Possible effects	Fault remedy
	- Short to earth in wiring between intake manifold changeover valve -N156 and engine control unit	- N156 does not open (loss of power above 4700 rpm)	- Test -N156 => Page 76



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
	- N156 defective - Faulty signal input in engine control unit - (control unit defective)		- Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17924 Intake manifold changeover valve -N156 Open circuit	- Open circuit in wiring between intake manifold changeover valve -N156 and engine control unit - Fault in power supply to -N156 - N156 defective - Faulty signal input in engine control unit - (control unit defective)	- N156 does not open (loss of power above 4700 rpm)	- Test -N156 => Page 78 - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17934 Bank 1, camshaft adjustment valve =>-N205 Short circuit to positive	- Short to positive between camshaft adjustment valve -N205 and engine control unit - Valve -N205 defective - Fuse defective - Faulty signal input in engine control unit - (control unit defective)	- Loss of torque at low engine speeds - (1300-3600 rpm)	- Rectify open circuit or short circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test -N205 => Page 114 - Test fuse - Fit a new engine control unit =>Page 57

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17935 Bank 1, camshaft adjustment valve =>-N205 Short circuit to earth	- Short to earth between camshaft adjustment valve -N205 and engine control unit - Valve -N205 defective	- Loss of torque at low engine speeds - (1300-3600 rpm)	- Rectify open circuit or short circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations - Test -N205 => Page 114

	- Fuse defective		- Test fuse
--	------------------	--	-------------

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17936 Bank 1, camshaft adjustment valve =>-N205 Open circuit	- Open circuit between - camshaft adjustment valve -N205 and engine control unit - Fuse defective	- Loss of torque at low engine speeds - (1300-3600 rpm)	- Rectify open circuit or short circuit => Current Flow Diagrams, Electrical Fault-Finding & Fitting Locations Test -N205 => Page 114 - Test fuse

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17953 Throttle valve control Malfunction	- Fault in power supply or earth connection for throttle valve potentiometer -G69 and throttle valve positioner sender -G127 - Open circuit in signal wire for -G69 and -G127 - G69 and -G127 defective - Throttle valve stiff or dirty	- Increased idling speed - Load change jolt when easing off accelerator	- Read measured value block, Display Group 023 => Page 47 - Test throttle valve control part -J338 =>Page24-62 - Test throttle valve control part (procedure for vehicles with cruise control) => Page 87

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 or information in this document. Copyright by AUDI AG.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17967 Throttle valve control part -J338 Fault in basic setting	- Idling speed switch open - Minimum stop not reached (jamming)		- Perform adaption of throttle valve control part => Page 38

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17972 Throttle valve control part -J338 Low voltage at basic setting	- Voltage less than 10V - during basic setting		- Test voltage and read measured value block, Display Group 003, display zone 2=> Page 37

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17978 Engine control unit blocked			



	- Attempted tampering - Short circuit in signal wire - Immobilizer control unit defective/missing	- Engine starts but cuts out again immediately	- Perform adaption of engine control unit to immobilizer => Electrical system; Repair group 01; Self-diagnosis of immobilizer; Adaption procedure after replacing engine control unit - Self-diagnosis of immobilizer; Adaption procedure after replacing engine control unit - Test electronic immobilizer => Electrical system; Repair group 96; Servicing immobilizer
--	---	--	--

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 for the correctness of information in this document. Copyright by AUDI AG.

Note on fault code 17978:

If an attempt is made to start the car with an unmatched key, the control unit will register a static fault. If the car is then started with a correctly matched key, the fault will be re-classified as a sporadic fault.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
18010 Voltage supply terminal 30 Voltage too low	- Battery was disconnected - Permanent power supply to control unit was disconnected, or open circuit		- Test power supply to engine control unit => Page 108

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
18020 Engine control unit incorrectly coded	- Engine control unit incorrectly coded	- Loss of performance - Increased emissions - Various faults in fault memory	- Code control unit => Page 26

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
18034 CAN-Bus No message from gearbox CU	- Fault in data transmission wires to gearbox control unit	- Automatic gearbox switches to emergency running mode - Engine running problems (jerky gearshifts, load change jolts)	- Test data exchange between Motronic, ABS and gearbox (CAN bus) => Page 99
18259 CAN-Bus			

No message from ABS CU	- Fault in data transmission wires to ABS control unit	- Electronic stability program (ESP) not functioning	- Test data exchange between Motronic, ABS and gearbox (CAN bus) => Page 99
------------------------	--	--	--

3 - Final control diagnosis

3.1 - 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 speed pulse is detected.
- ◆ During the final control diagnosis, individual control elements continue to be actuated until the test programme is 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 starting the engine briefly, switch off the ignition for approx. 20 seconds.
- ◆ The electric fuel pump runs continuously throughout the final control diagnosis.
- ◆ The final control diagnosis is terminated after 10 minutes.

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

1. Injector, cylinder 1 -N30
 2. Injector, cylinder 2 -N31
 3. Injector, cylinder 3 -N32
 4. Injector, cylinder 4 -N33
 5. Solenoid valve 1 for activated charcoal filter -N80
 6. Intake manifold change-over valve -N156
 7. Camshaft adjustment 1 (camshaft adjustment valve 1 -N205)
- 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 1.)

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

- Press keys 0 and 3 for the function "Final control diagnosis".

-> Indicated on display:

Rapid data transfer Q
 03 Final control diagnosis

- Confirm input with Q key.

-> Indicated on display:

Final control diagnosis
 Injector, cylinder 1 -N30

- Turn the throttle mechanism at the throttle valve control part. As soon as the idling speed switch opens, the injector for cylinder 1 will click five times.
Press the ⇒ key to advance the programme to the next injector. (It is also possible to advance the programme without testing each injector.)



- Use this procedure to test all the injectors in sequence.
- Test any injectors which are not actuated (i.e. do not click)
=>Page **63**.
- Press =>key.

-> Indicated on display:

Final control diagnosis
ACF solenoid 1 -N80

This solenoid valve will continue to be actuated (i.e. will click) until the => key is pressed to advance the programme to the next control element.

- If the valve is not actuated (i.e. does not click), test activated charcoal filter system solenoid valve 1 -N80
=> Page **80**.
- Press =>key.

-> Indicated on display:

Final control diagnosis
Intake manifold press. change valve -
N156

The valve must click.

Valve does not click:

- Test intake manifold changeover valve -N156 (intake manifold pressure change valve)=>Page **76**.
- Press =>key.

-> Indicated on display:

Final control diagnosis
Camshaft timing control 1

This valve will continue to be actuated (i.e. will click) until the final control diagnosis is terminated by pressing the => key.

- If the valve is not actuated (i.e. does not click), check camshaft adjustment valve
=> Page **114**.
- Press =>key.

Note:

Before selecting function 03 "Final control diagnosis" again, switch off the ignition for approx. 20 seconds.

4 - Basic setting

4.1 - Basic setting

With the engine not running, the following operation can be performed in the basic setting mode:

- ♦ Adaption of throttle valve control part to engine control unit
=>Display Group 098

With the engine running, the following operations can be performed in the basic setting mode:

- ♦ Learning process for lambda control
=>relevant Display Group
- ♦ Fault-finding by switching lambda control on and off
=>Page **50**, Display Group 099

Test conditions for operations with engine running

- Coolant temperature at least 80 °C
 - Electrical consumers switched off (radiator fan must not run during the check)
 - Air conditioner switched off
 - Gear selector lever in P or N position
 - No faults stored in fault memory
- 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 1.)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 4 for function "Basic setting" and confirm entry by pressing Q.

-> Indicated on display:

Introduction of basic setting HELP
Input display group number XXX

- Select the required display group number from the Display Group Overview in the "Read measured value block" section.

Note:

Display Group 001 is used here as an example to illustrate the procedure.

- Enter "001" for Display Group 001.

-> Indicated on display:

Basic setting Q
Enter display group number 001

- Press Q to confirm entry.

-> Indicated on display:

System in basic setting 1
1 2 3 4

Notes:

- ◆ Press the PRINT key at any time to print out the message currently being displayed.
 - ◆ Before selecting more display groups, press C.
- If all the display zones show the specified values, press the ⇒ 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.



5 - Coding control unit

5.1 - Coding 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.

- 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 1.)

-> 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
Enter code number xxxxx	(0-32000)

- Enter the appropriate code number for this vehicle and confirm with Q key.

Coding	For vehicles with
04030	Automatic gearbox
04000	Manual gearbox

-> The control unit identification will be displayed on fault reader V.A.G 1551, as in this example.

06A906018.. 1.8l	R4/5V MOTR HS
V..□	
Coding 04000	WSC 06388

- 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.
- Switch ignition off and then on again.

Note:

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.

The next time the ignition is switched on the newly entered coding will be activated.

6 - Reading measured value block

6.1 - Reading measured value block

Test conditions

- Coolant temperature at least 80 °C
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Gear selector lever in P or N position

- No fault stored in fault memory
- 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 1.)

-> 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 and confirm entry with Q key.

-> Indicated on display:

Read measured value block 0
 1 2 3 4 5 6
 7 8 9 10

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
Lower	Press key 1	Press ↓ key
Skip	Press key C	Press key C

Display group overview

Display Gr. number	Indicated on display	Meaning
000	Read measured val. block 00	1 = Coolant temperature
Basic function	1 2 3 4 5 6 7 8 9 10	2 = Engine load 3 = Engine speed 4 = Battery voltage 5 = Throttle valve angle 6 = Control value for air mass at idling speed 7 = Learned value for air mass at idling speed 8 = Control value for mixture formation (lambda control value) 9 = Learned value for mixture formation (lambda learned value) 10 = Learned value for mixture formation (lambda learned value)

Display Gr. number	Indicated on display	Meaning
001	Read measured val. block 1	1 = Engine speed
Basic function	1 2 3 4	2 = Engine load (injection period per crankshaft revolution) 3 = Throttle valve angle 4 = Ignition timing
002	Read measured val. block 2	1 = Engine speed

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.



Display Gr. number	Indicated on display	Meaning
Basic function	1 2 3 4	2 = Engine load (injection period per crankshaft revolution) 3 = Corrected injection period per engine cycle 4 = Intake air mass
003 Basic function	Read measured val. block 3 1 2 3 4	1 = Engine speed 2 = Battery voltage 3 = Coolant temperature 4 = Intake air temperature

Display Gr. number	Indicated on display	Meaning
004 Idling speed stabilisation	Read measured val. block 4 1 2 3 4	1 = Throttle valve angle 2 = Idling air mass, learned (automatics: not in drive position) 3 = Idling air mass, learned (automatics: drive engaged) 4 = Operating state: Idling Part throttle Full throttle Overrun Enrichment
005 Idling speed stabilisation	Read measured val. block 5 1 2 3 4	1 = Idling speed (actual) 2 = Idling speed (specified) 3 = Idling speed control 4 = Air mass

Display Gr. number	Indicated on display	Meaning
006 Idling speed stabilisation	Read measured val. block 6 1 2 3 4	1 = Idling speed 2 = Idling speed control 3 = Lambda mixture control 4 = Ignition timing
007 Lambda control and ACF system	Read measured val. block 7 1 2 3 4	1 = Lambda mixture 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
008 Lambda learned values	Read measured val. block 8 1 2 3 4	1 = Injection period 2 = Lambda learned value for idling (additive) 3 = Lambda learned value for part throttle (multiplicative) 4 = Fuel tank breather system: TB active = fuel tank breather system active TB not active = fuel tank breather system not active

Display Gr. number	Indicated on display	Meaning
009	Read measured val. block 9	1 = Engine speed (actual)

Display Gr. number	Indicated on display	Meaning
Lambda learned values	1 2 3 4	2 = Lambda mixture control 3 = Lambda probe voltage 4 = Lambda learned value for idling (additive)
010 Fuel tank breather	Read measured val. block 10 1 2 3 4	1 = Duty cycle of solenoid valve 1 for activated charcoal filter -N80 2 = Lambda correction factor with active fuel tank breather system 3 = Fill level of activated charcoal filter -N80 4 = ACF purging rate
011 Fuel consumption	Read measured val. block 11 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Road speed 4 = Fuel consumption

Display Gr. number	Indicated on display	Meaning
012 Fuel consumption	Read measured val. block 12 1 2 3 4	1 = Engine speed 2 = Battery voltage 3 = Fuel consumption 4 = Ignition timing
013 Knock control	Read measured val. block 13 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 4 = Ignition timing retardation by knock control, cylinder 4
014 Knock control	Read measured val. block 14 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Ignition timing retardation by knock control, cylinder 1 4 = Ignition timing retardation by knock control, cylinder 2

Display Gr. number	Indicated on display	Meaning
015 Knock control	Read measured val. block 15 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing retardation by knock control, cylinder 3 4 = Ignition timing retardation by knock control, cylinder 4
016 Knock control	Read measured val. block 16 1 2 3 4	1 = Knock sensor signal, cylinder 1 2 = Knock sensor signal, cylinder 2 3 = Knock sensor signal, cylinder 3 4 = Knock sensor signal, cylinder 4
017 Catalyst heating	Read measured val. block 17 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Energy balance for catalyst heating 4 = Ignition timing

Display Gr. number	Indicated on display	Meaning
018 Altitude	Read measured val. block 18 1 2 3 4	1 = Engine speed 2 = Engine load (without altitude adaption) from air mass meter



Display Gr. number	Indicated on display	Meaning
adaption		3 = Engine load (after altitude adaption) from throttle valve angle 4 = Altitude correction factor
019 Torque reduction	Read measured val. block 19 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Signals from: Pressure switch for power-assisted steering Gearshift Clutch pedal switch 4 = Ignition timing
020 Operating conditions	Read measured val. block 20 1 2 3 4	1 = Engine speed 2 = Gear selector lever position 3 = Air conditioner 4 = Air conditioner compressor

Display Gr. number	Indicated on display	Meaning
021 Operating conditions for lambda control	Read measured val. block 21 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Coolant temperature 4 = Lambda control OFF/ON
022		Ignore
023 Throttle valve positioner adaption	Read measured val. block 23 1 2 3 4	1 = Learning requirement display 2 = Min. stop of throttle valve positioner 3 = Emergency running stop of throttle valve positioner 4 = Max. stop of throttle valve positioner

Display Gr. number	Indicated on display	Meaning
024 Knock control	Read measured val. block 24 1 2 3 4	1 = Engine speed (actual) 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing 4 = Total ignition timing retardation for cylinders 1 to 4
025 Camshaft timing control	Read measured val. block 25 1 2 3 4	1 = Operating state: Idling Part throttle Full throttle Overrun Enrichment 2 = Hall sender -G40 (°crankshaft angle) 3 = Control: Camshaft adjustment 4 = Activated camshaft adjustment angle in °crankshaft angle

Display Gr. number	Indicated on display	Meaning
026 Camshaft timing control	Read measured val. block 26 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Control function: Camshaft adjustment 4 = Activated camshaft adjustment angle in °crankshaft angle
027...065		Ignore
066 Cruise control	Read measured val. block 66 1 2 3 4	1 = Road speed (actual) 2 = Switch positions (brakes, clutch and cruise control enabled) 3 = Road speed (specified) 4 = Switch positions (driver-operated switches)
067...097		Ignore

Display Gr. number	Indicated on display	Meaning
098 Throttle valve control part adaption	Read measured val. block 98 1 2 3 4	1 = Throttle valve potentiometer voltage 2 = Idling speed potentiometer voltage 3 = Operating state: idling / part load 4 = Adaption status: Adaption in progress Adaption OK Adaption ERROR
099 Lambda control	Read measured val. block 99 1 2 3 4	1 = Engine speed 2 = Coolant temperature 3 = Lambda mixture control 4 = Lambda mixture control ON/OFF

6.2 - Display Groups 000 to 007

Display Group 000 when idling (engine warm, coolant temperature not less than + 80°C)

Display zone	Specified display value	Equivalent measured val.	Meaning
1	170...204	80...105 °C	Coolant temperature (required for basic setting)
2	20...50	1.0...2.5 ms	Engine load (electrical consumers off)
3	76...88	760...880 rpm	Engine speed (electrical consumers off)
4	146...212	10...14.5	Battery voltage
5	0...12	0...5°	Throttle valve angle
6	118...138	-2.5...+2.5 kg/h	Idling speed air mass control value (idling speed control)
7	112...144	-4...+4 kg/h	Idling speed air mass learned value
8	78...178	-10...+10 %	Control value for mixture formation (lambda control value) - additive (If value is outside tolerance, take vehicle for test drive.)
9	243...255 or 0...+12	-0.64...+0.64 ms	Learned value for mixture formation (lambda learned value) - additive (If value is outside tolerance, take vehicle for test drive.)



Display zone	Specified display value	Equivalent measured val.	Meaning
10	118...138	-8...+8 %	Learned value for mixture formation (lambda learned value) - multiplicative (If value is outside tolerance, take vehicle for test drive.)

Notes on display zones 9 and 10:

- ♦ The additive learned value changes the injection period by a fixed amount of time which is not determined by the basic injection period.
- ♦ The multiplicative learned value changes the injection period by a percentage amount which is determined by the basic injection period.

Test table, Display Group 000:

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1	higher than 204	- Coolant temperature sender -G62 - Wiring to engine control unit	- Test -G62 => Page 106
	lower than 170	- Coolant temperature sender -G62 - Wiring to engine control unit - Coolant thermostat constantly open	- Test -G62 => Page 106 - Test coolant thermostat

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
2	higher than 50	- Air conditioner on - Electrical consumers on - Lambda control at rich or lean limit of adjustment - Air conditioner compressor running even though air conditioner is off	- Switch off air conditioner - Switch off consumers - Test lambda control =>Page 72 - Test AC compressor control =>Page 92
	lower than 20	- Unmetered air downstream of air mass meter - Unmetered air downstream of throttle valve - Vacuum hose disconnected - Fuel pressure regulator	- Rectify fault

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	lower than 76	- Gear engaged (automatic gearbox) - Additional load on engine from ancillaries - Throttle valve control part -J338 jamming or defective	- Move selector lever to P or N - Remove load caused by ancillaries (e.g. air conditioner, power steering) - Test throttle valve control part - J338 =>Page 24-62 Test throttle valve control part - J338 (procedure for vehicles with cruise control) =>Page 87
	higher than 88	- Idling speed switch -F60 open or defective - Large quantity of unmetered air (idling speed stabiliser cannot compensate)	- Interrogate fault memory and test/adjust idling speed switch - Rectify leak

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted. This document contains technical data and may be subject to change without notice. Audi AG. Copyright by AUDI AG.

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
		- Throttle valve control part -J338 jamming or defective	- Test throttle valve control part - J338 =>Page 24-62 Test throttle valve control part - J338 (procedure for vehicles with cruise control) =>Page 87

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
4	lower than 146	- Alternator defective, battery charge very low - Heavy demand on electrical system shortly after starting due to high charging current and ancillaries - Contact resistance in positive voltage supply or earth connection for engine control unit - Current drain when ignition is switched off	- Test voltage and charge battery - Increase revs for a few minutes and switch off ancillaries - Test voltage supply to engine control unit =>Page 108 - Eliminate current drain
	higher than 212	- Voltage regulator in alternator defective - Excess voltage from assisted start or rapid charging	- Test voltage and if necessary fit a new voltage regulator - Interrogate fault memory =>Page 3

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
5	lower than 0	- Not possible	
	higher than 12	- Basic setting of throttle valve control part not performed - Throttle cable wrongly adjusted - Throttle valve potentiometer in throttle valve control part defective - Throttle valve mechanism jamming	- Perform adaption of throttle valve control part => Page 3 - Adjust throttle cable => 4-cyl. engine (5-valve), 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 - Rectify fault or (if necessary) fit a new throttle valve
6	lower than 118	- Unmetered air downstream of throttle valve	- Rectify leak
	higher than 138	- Increased engine load due to ancillaries	- Reduce load by switching off ancillaries

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
7	lower than 112	- Unmetered air downstream of throttle valve	- Rectify leak
	higher than 144	- Increased engine load due to ancillaries	- Reduce load by switching off ancillaries
8	lower than 78	- Mixture too rich; lambda mixture control compensating by leaning out mixture - Large quantity of fuel from ACF system (not at basic setting) - Leak in vacuum hose on fuel pressure regulator	- Press down on accelerator pedal at 20-second intervals until learning process has been completed - Renew vacuum hose



Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
		- Lambda learned values at limit	- Check lambda learned values, Display Group 008 => Page 41

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
8	higher than 178	- Mixture too lean; lambda mixture control compensating by enriching mixture - Unmetered air - Injectors defective - Lambda learned values at limit	- Check injection quantity => Page 61 - Rectify leak - Check lambda learned values, Display Group 008 => Page 41
	Readout fluctuates or remains constant at 128	- Fuel reserve too low - Lambda mixture control is on - open-loop control	- Ensure that fuel tank contains at least 10 litres of fuel
9	lower than 243 or higher than 12		- Display Group 008, display zones 2 and 3 => Page 41
10	lower than 118 or higher than 138		- Display Group 008, display zones 2 and 3 => Page 41

Display Group 001 - Basic function:

Read measured value block 1 760...880 rpm 1.0....2.5 ms 0...5 <° ⇒ 6...12 ° before TDC		• Indicated on display
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. Throttle valve angle Readout on display between 80 and 90<° with accelerator fully pressed down. If a fault is identified in the throttle valve potentiometer, a fixed substitute value of 35 <° is displayed. Engine load Idling speed shown in steps of 40 rpm		Ignition timing

Test table, Display Group 001

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1	lower than 760 rpm	- Gear engaged (automatic gear-box) - Increased engine load due to ancillaries - Throttle valve control part -J338 jamming or defective	- Move selector lever to P or N - Remove load caused by ancillaries (e.g. air conditioner, power steering) - Test throttle valve control part - J338 => Page 24-62 Test throttle valve control part - J338 (procedure for vehicles with cruise control) => Page 87
	higher than 880 rpm	- Idling speed switch -F60 open or defective - Large quantity of unmetered air - (idling speed stabiliser cannot compensate)	- Interrogate fault memory => Page 3 - Rectify leak

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
		- Throttle valve control part -J338 jamming or defective - Air conditioner not switched off	- Test throttle valve control part - J338 => Page 24-62 - Test throttle valve control part - J338 (procedure for vehicles with cruise control) =>Page 87 - Switch off air conditioner

Test table, Display Group 001

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
2	lower than 1.0	- Values lower than 1.0 can only occur when driving on overrun	
	higher than 2.5	- Rough idling (engine not running on all cylinders) - Air mass meter -G70 defective - Throttle valve control part -J338 defective - Electrical consumers on - Steering wheel on full lock - Gear engaged (automatic gear-box)	- Injector or spark plug defective - Interrogate fault memory => Page 3 - Test throttle valve control part - J338 => Page 24-62 - Test throttle valve control part - J338 (procedure for vehicles with cruise control) =>Page 87 - Switch off consumers - Return steering wheel to centre - Move selector lever to P or N

Test table, Display Group 001

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	lower than 0 <°	- Not possible	
	higher than 5 <°	- Basic setting of throttle valve control part -J338 not performed - Throttle valve potentiometer in throttle valve control part -J338 defective or incorrectly adjusted - Throttle cable setting - Throttle valve sticking	- Perform adaption of throttle valve control part =>Page 87 - Test throttle valve control part - J338 => Page 24-62 - Test throttle valve control part - J338 (procedure for vehicles with cruise control) =>Page 87 - Adjust throttle cable => 4-cyl. engine (5-valve), Mechanics; Repair group 20; Removing and installing parts of fuel supply system; Adjusting throttle cable - Rectify fault

Test table, Display Group 001

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
4	less than 6°before TDC	- Electrical consumers on - Steering wheel on full lock - Gear engaged (automatic gear-box)	- Switch off consumers - Return steering wheel to centre - Move selector lever to P or N



Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
	more than 12° before TDC	- Unmetered air	- Rectify leak

Display Group 002 - Basic function:

Read measured value block 2		⇒	• Indicated on display
760...880 rpm	1.0...2.5 ms	2.0...5.0 ms	2.0...4.0 g/s
Intake air mass			
Corrected injection period per engine cycle			
Engine load - theoretical injection period per crankshaft revolution			
Idling speed shown in steps of 40 rpm			

Test table, Display Group 002 Copyright 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.

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display Group 001, display zone 1 => Page 34	
2		- See Display Group 001, display zone 2 => Page 34	

Test table, Display Group 002

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	lower than 2.0	- Large quantity of fuel from activated charcoal filter system (ACF) - Wrong type of injectors fitted - (delivery rate too high)	- Test solenoid valve for activated charcoal filter => Page 80 - Check injection quantity => Page 61
	higher than 5.0	- Increased engine load (electrical consumers on, air conditioner on, gear engaged or power steering on full lock)	- Remove load
4	lower than 2.0	- Large quantity of unmetered air - between intake manifold and air mass meter	- Rectify leak
	higher than 4.0	- Gear engaged (automatic gearbox) - Increased engine load due to ancillaries	- Move selector lever to P or N - Remove load (e.g. air conditioner, power steering)

Notes on Display Group 002:

- Display zone 2 shows the injection period corresponding to the intake air mass and the engine load when idling. The value is a calculated (i.e. theoretical) value which for technical reasons only relates to a single crankshaft revolution. The engine load when idling is the load created by the internal friction which the engine has to overcome and the power required to drive the ancillaries. The intake air mass is shown in display zone 4.
- Display zone 3 shows the injection period for a complete engine cycle, i.e. two crankshaft revolutions.
- However, the value shown in display zone 3 is a corrected value corresponding to the actual injection period. It will not be double the value shown in display zone 2. The correction takes into account factors such as the following:

- Lambda mixture control

- Fuel intake from the activated charcoal filter

- Air density, air temperature

- Voltage of electrical system (faster or slower opening of injectors)

- ♦ For example, if the engine takes in unmetred air, only the calculated value in display zone 2 (injection period per crankshaft revolution) should change. The lambda mixture control will ensure that the actual injection period per complete engine cycle remains at the specified value.

Display Group 003 - Basic function:

Read measured value block 3	⇒	Indicated on display
760...880 rpm	10..14.5 V	80..105 °C
		Intake air temperature
		Coolant temperature
		Battery voltage
		Engine speed shown in steps of 40 rpm

Note on display zone 4:

It is not possible to give specified values as the display readout is heavily affected by the ambient temperature.

Test table, Display Group 003

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display Group 001, display zone 1 => Page 34	

Test table, Display Group 003

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
2	lower than 10 V	- Alternator defective, battery charge very low - Heavy demand on electrical system shortly after starting due to high charging current and ancillaries - Contact resistance in voltage supply or earth connection for engine control unit - Current drain when ignition is switched off	- Test voltage and charge battery - Increase revs for a few minutes and switch off ancillaries - Test voltage supply to engine control unit => Page 108 - Eliminate current drain
	higher than 14.5 V	- Voltage regulator in alternator defective - Excess voltage from assisted start or rapid charging	- Test voltage and if necessary fit a new voltage regulator - Interrogate fault memory =>Page 3

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not 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.

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	lower than 80°C	- Engine too cold	- Take vehicle for test drive



Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
		- Coolant temperature sender or - wiring to engine control unit	- Test coolant temperature sender -G62 =>Page 106
	higher than 105°C	- Radiator dirty - Radiator fan not working - Thermostat defective - Coolant temperature sender or - wiring to engine control unit	- Clean radiator - Check function - Test thermostat - Test coolant temperature sender -G62 => Page 106
4	constant 19.5°C	- Fault detected in intake air - temperature sender -G42	- Interrogate fault memory =>Page 3
		- Intake air temperature sender - G42	- Test -G42 =>Page 103

Note on display zone 3:

With fault code 16500, the temperature rise between 20°C and 60°C is compared with a model temperature curve stored in the control unit. The model curve rises less sharply than the actual temperature curve. If a fault causes the actual temperature values to rise too slowly, the real values will coincide with those in the model curve at a certain point. The engine control unit recognises the fault as implausible.

Display Group 004 - Idling speed stabilisation:

Read measured value block 4	⇒	• Indicated on display
0....5	-1.7...+1.7	Idling
<°	g/s	g/s
		Operating state (idling, part/full throttle, enrichment, overrun)
		Idling speed air mass, learned (automatic gearbox with gear engaged).
		On cars with manual gearboxes the display will always show "0".
		Idling speed air mass, learned (gear not engaged on automatic gearbox)
		Throttle valve angle

Test table, Display Group 004

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display Group 001, display zone 3 => Page 34	
2	lower than -1.7 g/s	- Unmetered air downstream of throttle valve	- Rectify leak
	higher than +1.7 g/s	- Increased load due to ancillaries - Constriction (foreign bodies) in - intake tract	- Switch off air conditioner and electrical consumers - Eliminate constriction (remove foreign bodies)

Notes on display zones 2 and 3:

- ♦ The display shows how far the learned values of the idling speed stabilisation have "drifted away" from the pre-programmed mean value. With a new engine the display will show a positive value because of the greater friction; with an engine that has been run in it will show a negative value. A value of -1.7 g/s combined with an excessively low value in Display Group 005, display zone 3, indicates the presence of unmetered air.
- ♦ The value displayed is calculated on the basis of information from the throttle valve potentiometer. It is not measured by the air mass meter.

Note on display zone 4:

The following operating states may be shown:

- ◆ Idling
- ◆ Part throttle
- ◆ Full throttle
- ◆ Overrun
- ◆ Enrichment (full-throttle enrichment)

Display Group 005 - Idling speed stabilisation (idling):

Read measured value block 5		⇒		◀ Indicated on display
780...880 rpm	800 / 860 rpm	-10...+10 %	2.0...4.0 g/s	
		Air mass		
		Idling speed control		
		Engine speed (specified) shown in steps of 10 rpm Manual gearbox: 800 rpm (air conditioner on or off) Automatic gearbox: 800 rpm (air conditioner off) Automatic gearbox: 860 rpm (air conditioner on)		
		Engine speed (actual) shown in steps of 10 rpm Display: max. 2550 rpm in steps of 10 rpm		

Notes on display zone 3:

- ◆ The air mass requirement varies with changing load conditions during idling, even though the engine speed remains the same.
- ◆ The change in air mass during idling is shown as a percentage. As soon as the change has been compensated for by the idling speed stabilisation learning process, the mean value is restored. The amount of deviation from the mean value depends on the extent of the load change (e.g. as a result of switching electrical consumers on or off).
- ◆ The learning process proceeds in small stages each time the idling speed switch closes. If the deviation is large, several stages are required. In such cases the accelerator must be blipped at intervals of approx. 20 seconds. Each blip activates a further stage in the learning process.
- ◆ The amount by which the learned value has "drifted away" is then shown in Display Group 004, display zone 2. The values from the idling speed control remain outside the tolerance if the learned values in Display Group 004, display zone 2, have reached the limits of adjustment (stop values).
- ◆ Stop values: -1.7 and +1.7 g/s

Notes on display zone 4:

- ◆ With fault code 00670, throttle valve positioner: constant engine speed of 840 rpm and air throughput of 2.8 g/s
- ◆ With fault codes 00670, 16505, 16506 and 16507, throttle valve positioner and throttle valve potentiometer, the digital idling speed stabilisation (DIS) is switched off and the system sets a constant engine speed of approx. 1000 rpm and an air mass of 2.8 g/s.

Display Group 006 - Idling speed stabilisation:

Read measured value block 6		⇒		◀ Indicated on display
760...880 rpm	-10...+10 %	-10...+10 %	6...12° before TDC	
		Ignition timing		
		Lambda mixture control		
		Idling speed control		



Idling speed shown in steps of 10 rpm

Test table, Display Group 006

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display Group 001, display zone 1 => Page 34	
2		- See Display Group 005, display zone 3 => Page 39	

Test table, Display Group 006

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
3	Outside tolerance range	- Negative value = mixture too rich. - Result: lambda control leans out the mixture - Positive value (+ sign not shown) = mixture too lean. Result: lambda control enriches the mixture - Unmetered air - Injector defective - Lambda learned value at limit of adjustment	- Wait 30 seconds until display has settled - Rectify leak - Check injection quantity => Page 61 - Check lambda learned values, Display Group 008 => Page 41
4		- See Display Group 001, display zone 4 => Page 34	

Notes on display zone 3:

- ♦ The readout should fluctuate around 0. If the display shows a constant 0, this means that the lambda mixture control has switched from closed-loop control to open-loop control because of a fault in the lambda control function. Interrogate the fault memory=>Page 3.
- ♦ Lambda control operating state: check Display Group 021, display zone 4 => Page 47.

Display Group 007 - Lambda control and ACF system:

Read measured value block 7	⇒	Indicated on display
-10...+10 %	0...1 V	0.3...1.1
Lambda correction factor with active tank breather system Duty cycle of solenoid valve 1 for activated charcoal filter system -N80 Duty cycle 0 means -N80 is closed. Duty cycle 99 means -N80 is fully open.		
Lambda probe voltage		
Lambda mixture control		

Notes on display zone 2:

- ♦ The voltage signal for "Mixture too rich (low residual oxygen)" is between about 0.7 and 1.0 V (based on reference earth).
- ♦ The voltage signal for "Mixture too lean (high residual oxygen)" is between about -0.1 and +0.3 V (based on reference earth).
- ♦ The transition from "rich" to "lean" ($\lambda = 1.0$) is accompanied by a voltage jump from between 0.7 and 1.0 V to between -0.1 and +0.3, V and vice versa.

- ♦ 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".

Notes on display zone 4:

- ♦ A display readout of 0.3 means that the engine is being supplied with a very rich mixture from the ACF system. The lambda control therefore has to reduce the injection quantity to 30%.
- ♦ A display readout of 1.0 means either that the ACF system is supplying an ideal mixture (i.e. no adjustment necessary) or that the ACF valve is closed. (Adaption =>Display Group 008, display zone 4)
- ♦ A display readout of between 1.01 and 1.2 means that the mixture being supplied by the ACF system is too lean. The lambda control therefore has to enrich the mixture.

6.3 - Display Groups 008 to 099

Display Group 008 - Lambda learned values:

Read measured value block 08				⇒	◀ Indicated on display
2.0...5.0 ms	-10...+10 %	-8...+8 %	TB active or TB n. active		
			"TB active" (TB = fuel tank breather system) means that solenoid valve 1 for activated charcoal filter is opening and closing at intervals (i.e. is active) for a period of between 6 and 16 minutes. "TB n. active" means that solenoid valve 1 for activated charcoal filter remains closed (i.e. is not active) for a period of 1 minute.		
			Lambda learned value at part throttle (multiplicative)		
			Lambda learned value when idling (additive)		
Injection period					

Test table, Display Group 008

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
1		- See Display Group 002, display zone 3 => Page 36	
2 and 3	Low lambda learned values	- Low lambda learned values for idling and normal lambda learned values for part throttle: oil may be diluted with petrol (high petrol content in oil) - Leak in injector - Fuel pressure too high - Solenoid valve 1 for activated charcoal filter -N80 constantly open - Air mass meter -G70 defective - Lambda probe heating defective or lambda probe dirty	- Disappears after motorway run or oil change Display Group 007, display zone 2 => Page 40 - Test injector =>Page 63 - Check fuel pressure => Page 59 - Test -N80 => Page 80 - Test -G70 => Page 68 - Test lambda probe heating => Page 73

**Note on display zones 2 and 3:**

Low learned values mean that the engine is running too rich, and the lambda control compensates by leaning out the mixture.

Test table, Display Group 008

Display zone	Readout on V.A.G 1551	Cause of fault	Fault remedy
2 and 3	High lambda learned values	- High lambda learned values for idling and lower lambda learned - values for part throttle: unmetered air possible around intake manifold - Injector blocked - Values in display zones 2 and 3 too high: air mass meter -G70 defective - Fuel pressure too low - Unmetered air between -G70 and throttle valve - Unmetered air at manifold gasket - Lambda probe heating defective or lambda probe dirty	- Rectify fault - Display Group 007, display zone 2 => Page 40 - Check injection quantity =>Page 61 - Test -G70 =>Page 68 - Check fuel pressure =>Page 59 - Rectify fault - Test lambda probe heating =>Page 73

Notes on display zones 2 and 3:

- ♦ High learned values mean that the engine is running too lean, and the lambda control compensates by enriching the mixture.
- ♦ If there is no voltage in the control unit, all the learned values will be set to zero.

Display Group 009 - Lambda learned values:

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.

Read measured value block 9				⇒	◀ Indicated on display
760...880 rpm	-10...+10 %	0...1.0 V	-10...+10 %		
Lambda learned value for idling (additive)					
Lambda probe voltage					
Lambda control					
Engine speed shown in steps of 10 rpm					

Display Group 010 - Fuel tank breather system:

Read measured value block 10				⇒	◀ Indicated on display
0...99 %	0.3...1.1	-5...+45	0.00...0.30		
Purging rate of activated charcoal filter (ACF): Readout "0.00" = nothing supplied from ACF system Readout "0.30" = 30% of intake air mass supplied from ACF system					
Fill level of activated charcoal filter system: -3 means there is no petrol vapour in the activated charcoal filter system. +32 means the activated charcoal filter system is full of petrol vapour.					

Lambda correction factor for active fuel tank breather system
Duty cycle for solenoid valve 1 for activated charcoal filter (ACF)

Note on display zone 4:

The display shows the percentage of the overall intake volume which is supplied via the ACF system.

Display Group 011 - Fuel consumption:

Read measured value block 11	⇒	Indicated on display
760...880 rpm	1.0...2.5 ms	0 km/h
		0.5...1.5 ltr/h
Fuel consumption: The specified value shown on the display relates only to idling without additional load from ancillaries (automatic gearbox, air conditioner, alternator, power steering pump).		
Road speed		
Engine load		
Engine speed shown in steps of 40 rpm		

Notes on display zone 2:

- ◆ The maximum engine load falls by around 10% for every 1000 m above sea level.
- ◆ The maximum engine load also falls by up to 10% at very high ambient temperatures.
- ◆ The values when driving at full throttle should be no less than the following:

- approx. 7.5 ms at 4000 rpm

- approx. 6.5 ms at 6000 rpm

Display Group 012 - Fuel consumption:

Read measured value block 12	⇒	Indicated on display
760...880 rpm	10...14.5 V	0.5...1.5 ltr/h
		6...12° before TDC
Ignition timing - see Display Group 001, display zone 4 =>Page 34		
Fuel consumption - see Display Group 011, display zone 4 =>Page 43		
Battery voltage - see Display Group 003, display zone 2 =>Page 37		
Engine speed - see Display Group 001, display zone 1=>Page 34		

Display Group 013 - Knock control:

Read measured value block 13	⇒	Indicated on display
0..15° crankshaft	0..15° crankshaft	0..15° crankshaft
		0..15° crankshaft
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		

**Notes on Display Group 013:**

- ♦ The knock control operates at engine loads of 40% or more.
- ♦ At engine loads of more than 40% the display will show the current (instantaneous) ignition timing retardation values. At engine loads of less than 40% the display will show the last values used (constant readout).
- ♦ If there is audible knocking and no perceptible ignition timing retardation, increase the engine speed to above 3500 rpm for 5 seconds in order to activate the knock sensor fault recognition (diagnosis) function.
- ♦ If there is a significant difference between the ignition timing retardation value for one of the cylinders and the values for the other cylinders, the following faults are possible:

- Loose ancillaries

- Corrosion on plug connector

- Engine damage (e.g. oil burning because of defective piston)

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.

Notes continued:

- ♦ If the ignition timing retardation values for all the cylinders are high, the following faults are possible:

- Corrosion on plug connector

- Wrong tightening torque (should be 20 Nm)

- Open circuit in wiring

- Knock sensor defective

- Loose ancillaries

- Poor-quality fuel (less than RON 95)

Display Group 014 - Knock control:

Read measured value block 14 ⇒				♦ Indicated on display
760...880 rpm	1.0...2.5 ms	0..15° crankshaft	0..15° crankshaft	
			Ignition timing retardation by knock control, cylinder 2	
			Ignition timing retardation by knock control, cylinder 1	
			Engine load (injection period per revolution)	
			Engine speed shown in steps of 40 rpm	

Note on Display Group 014:

With this display group it is possible to check the ignition timing retardation for cylinders 1 and 2 at certain engine speeds and under certain load conditions.

Display Group 015 - Knock control:

Read measured value block 15 ⇒				♦ Indicated on display
760...880 rpm	1.0...2.5 ms	0..15° crankshaft	0..15° crankshaft	
			Ignition timing retardation by knock control, cylinder 4	
			Ignition timing retardation by knock control, cylinder 3	
		Engine load (injection period per revolution)		

Engine speed shown in steps of 40 rpm

Notes on Display Group 015:

- ♦ With this display group it is possible to check the ignition timing retardation for cylinders 3 and 4 at certain engine speeds and under certain load conditions.
- ♦ Causes of ignition timing retardation: Display Group 013=>Page 43 .

Display Group 016 - Knock control (idling):

Read measured value block 16				⇒	◀ Indicated on display
0.4...2.0 V	0.4...2.0 V	0.4...2.0 V	0.4...2.0 V		
					Knock sensor signal, cylinder 4
					Knock sensor signal, cylinder 3
					Knock sensor signal, cylinder 2
					Knock sensor signal, cylinder 1

Notes on Display Group 016:

- ♦ If the difference between the highest and lowest knock control signals is more than 50%, this may be due to corrosion on the plug connector.
- ♦ If no faults are found as a result of the electrical test of the knock sensor (including wiring and connector), check the engine for loose ancillaries and mechanical damage. See Display Group 013=>Page 43 .
- ♦ At higher engine speeds and engine loads the voltage signal displayed for the knock sensors can reach values of up to 5.1 volts.

Display Group 017 - Catalytic converter heating:

Read measured value block 17				⇒	◀ Indicated on display
760...880 rpm	1.0...2.5 ms	0...100 %	6...12° before TDC		
					Ignition timing
					Energy balance for catalyst heating
					Engine load (injection period per revolution)
					Engine speed shown in steps of 40 rpm

Notes on Display Group 017:

- ♦ To bring the catalyst up to operating temperature as quickly as possible after a cold start, the idling speed is increased and the ignition timing retarded. In the part throttle range only the ignition timing retardation remains activated.
- ♦ The rapid catalyst heating function is activated at starting temperatures of -9 to +39°C.

Notes continued:

- ♦ The function is aborted under the following conditions:

- Engine speed greater than 4000 rpm
- Engine load greater than 7.0 ms
- Fault registered in fault memory for air mass meter and coolant temperature sender



- Energy balance greater than 1.0
- Road speed greater than 55 km/h
- Altitude correction factor less than -20% (Display Group 018)
- ♦ When the function is aborted the display readout for the energy balance remains frozen and is reset to zero the next time the engine is started.

Display Group 018 - Altitude adaption:

Read measured value block 18				⇒	◀ Indicated on display
760...880 rpm	1.0...2.5 ms	0.5...3.0 ms	-50...+15 %		
			Altitude correction factor		
			Engine load from throttle valve angle		
		Engine load from air mass meter			
Engine speed shown in steps of 40 rpm					

Notes on Display Group 018:

- ♦ The engine control unit compares the load signal from the air mass meter with a load value calculated on the basis of the throttle valve angle and the engine speed. The difference between the two values is the altitude correction factor.
- ♦ At an altitude of approx. 400 m above sea level and under normal weather conditions, altitude adaption is not necessary.
- The correction factor at sea level is approx. 0%.
- At an altitude of 2000 m the correction factor is approx. -20%.
- ♦ The altitude adaption affects the following functions:
 - Determining of injection quantity for starting
 - Intake manifold pulsation compensation

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 for the correctness of information in this document. Copyright by AUDI AG.

Display Group 019 - Torque reduction (automatic gearbox)

Read measured value block 19			⇒	◀ Indicated on display
760...880 rpm	1.0...2.5 ms	1 0 1 1	6...12° crankshaft	
			Ignition timing	
			Operating status: 1 X 1 X = no signal from pressure switch for power steering 0 X 1 X = signal from pressure switch for power steering (steering wheel at full lock) X 1 1 X = no gearshift signal X 0 1 X = gearshift signal X X 1 1 = no signal from clutch pedal switch (clutch not depressed) X X 1 0 = signal from clutch pedal switch (clutch depressed)	
			Engine load	
Engine speed shown in steps of 40 rpm				

Notes on Display Group 019, display zone 3:

- ♦ This display group shows whether the engine control unit is receiving the gearshift signal from the gearbox control unit.

- ♦ Due to the very short signals the retardation of the ignition timing is not always recognised and therefore not displayed on V.A.G 1551/1552.

Notes continued:

- ♦ The power steering pressure switch is used to stabilise the idling speed when the steering wheel is at full lock (right or left).
- ♦ Testing power steering pressure switch -F88=>Page 96 .
- ♦ The clutch pedal switch has the following functions:
 - Smoothing out load change jolts
 - Preventing excess engine revving when changing up to a higher gear
 - Cruise control system (if fitted)
- ♦ Testing clutch pedal switch=>Page 94 .

Display Group 020 - Operating conditions:

Read measured value block 20 ⇒				◀ Indicated on display
760...880 rpm	Neutral Gear engag	A/C-High A/C-Low	Compr.ON Compr.OFF	
				Air conditioner compressor ON/OFF On vehicles with no air conditioner the display will always read "Compr.OFF".
				Air conditioner High = high hot/cold air output Low = low hot/cold air output On vehicles with no air conditioner the display will always read "AC-Low".
				Selector lever in Neutral or with gear engaged On vehicles with manual gearboxes the display will always read "Neutral".
Engine speed shown in steps of 10 rpm				

Display Group 021 - Operating conditions for lambda control:

Read measured value block 21 ⇒				◀ Indicated on display
760...880 rpm	1.0...2.5 ms	° C	λctrl.OFF λctrl.ON	
				Lambda control OFF/ON
				Coolant temperature
				Engine load
Engine load shown in steps of 40 rpm				

Notes on Display Group 021:

- ♦ The lambda control is activated by the engine control unit on the basis of the engine temperature, the engine temperature when starting and the intake air temperature.
- ♦ When the lambda control is switched off the engine runs according to the map stored in the control unit.

Display Group 023 - Adaption of throttle valve positioner:

Read measured value block 23 ⇒				◀ Indicated on display
01000000	73...97 %	54...83 %	6...43 %	
				Max. stop of throttle valve positioner -V60
				Emergency running stop of throttle valve positioner -V60
				Min. stop of throttle valve positioner -V60



Learning requirement display

Note on display zone 1:

If the display does not show the specified value, perform adaption of throttle valve control part -J338 => Page 83.

Note on display zone 2, 3 and 4:

The display will show the stop values learned at the last basic setting.

Note on display zones 1, 2, 3 and 4:

If the display still does not show the specified value even after the basic setting has been performed, check the wiring for open circuits or short circuits and also check the plug connections for dirt or corrosion before fitting a new throttle valve control part.

X	X	X	X	X	X	X	X	Relevance of figures in 8-digit display
								1 = (irrelevant)
								2 = Min. stop learning process for throttle valve positioner sender -G127
								0 = learning process completed; learning process OK
								1 = learning process not completed; learning process not OK
								3 = Max. stop learning process for throttle valve positioner sender -G127
								0 = learning process completed; learning process OK
								1 = learning process not completed; learning process not OK
								4 = Min. stop learning process for throttle valve potentiometer -G69
								0 = learning process completed; learning process OK
								1 = learning process not completed; learning process not OK
								5 = Max. stop learning process for throttle valve potentiometer -G69
								0 = learning process completed; learning process OK
								1 = learning process not completed; learning process not OK
								6 = (irrelevant)
								7 = Match throttle valve potentiometer -G69 with throttle valve positioner sender -G127
								0 = matching process needs to be carried out
								1 = matching process complete; match achieved
								8 = (irrelevant)

Display Group 024 - Knock control:

Read measured value block 24	⇒	◀ Indicated on display
760...880 rpm	1.0...2.5 ms	6...12° ° cr/shaft before TDC
		Total ignition timing retardation for cylinders 1 to 4
		Ignition timing
		Engine load
		Engine speed shown in steps of 40 rpm

Notes on Display Group 024:

- ♦ The knock control must retard the ignition timing as soon as knocking is detected in order to prevent damage to the engine.
- ♦ Ignition timing retardation increases the exhaust temperature, which means there is a risk that the catalyst (catalytic converter) will overheat.
- ♦ Retarding the ignition timing in all the cylinders by, for example, 3° in relation to the crankshaft has exactly the same effect as retarding it by 12° in only one of the cylinders.

- ♦ To avoid overheating, a richer mixture is supplied when the total ignition timing retardation exceeds approx. 10° at full throttle. This has the effect of reducing the exhaust temperature.

Display Group 025 - Camshaft timing control:

Read measured value block 25			⇒	◀ Indicated on display
Idling	-30...+30 ° cr/shaft	X X0	-3....+22 ° cr/shaft	
			Camshaft position with camshaft timing control active Camshaft in normal position: -3.0 ... 3.0°crankshaft angle Camshaft in adjusted position: 15.0 ... 22.0°crankshaft angle	
			Operating state: X X0 = camshaft timing control not active (late) X X1 = camshaft timing control active X 0X = intake manifold changeover function not active X 1X = intake manifold changeover function active (X = irrelevant)	
			Adjustment discrepancy with phase sender (Hall sender)	
Operating state: idling, part throttle, full throttle, overrun, enrichment				

Notes on Display Group 025:

See Display Group 026 => Page 49.

Display Group 026 - Camshaft timing control:

Read measured value block 26			⇒	◀ Indicated on display
760...880 rpm	1.0...2.5 ms	X X0	-3....+22 ° cr/shaft	
			Camshaft position with camshaft timing control active Camshaft in normal position: -3.0 ... 3.0°crankshaft angle Camshaft in adjusted position: 15.0 ... 22.0°crankshaft angle	
		Operating state: X X0 = camshaft timing control not active (late) X X1 = camshaft timing control active X 0X = intake manifold changeover function not active X 1X = intake manifold changeover function active (X = irrelevant)		
	Engine load			
Engine speed				

Note on display zone 4:

The adjustable camshaft has only two positions, i.e. the normal position (timing control not active) and the adjusted position (timing control active). If the camshaft timing control has been activated (see display zone 3), display zone 4 will show whether the camshaft position has in fact been adjusted (feedback signal).

Display Group 066 - Cruise control system, engine running at idling speed:

Read measured value block 66		⇒	◀ Indicated on display
km/h	X X X X	km/h	X X X X



			Switch positions (driver-operated controls) 0000= cruise control switched on 0011= cruise control switched off (switch engaged) 0010= cruise control switches off before engagement point 0100= "SET" button pressed in 1000= "RES" ("resume") button pulled
			Specified road speed. The display will show the last road speed that was set before the cruise control system was switched off (switch engaged in "OFF" position) or before the engine was switched off.
			Brake and clutch switch positions; cruise control status (enabled or not enabled) 1000=cruise control enabled 1111=brake depressed (brake light switch) 1111=brake depressed (brake pedal switch) 1110=clutch depressed
Actual road speed			

Note:

If the readouts are not as specified, test the cruise control system.

=> Electrical system; Repair group 96

Display Group 098 - Adaption of throttle valve control part:

Basic setting 98		⇒	◀ Indicated on display
0...5 V	0...5 V	Idling Part throt	ADP. runs ADP. O.K. ADP ERROR
			Adaption state ADP. = adaption of throttle valve control part
			Operating state
			Voltage of potentiometer for idling speed positioner
			Voltage of throttle valve potentiometer

Note on display zone 4:

ADP. = Adaption. Checking adaption of throttle valve control part=>Page 87 (procedure for vehicles with cruise control).

Display Group 099 - Lambda control:

Read measured value block 99		⇒	◀ Indicated on display
760...880 rpm	°C	-10...+10 %	λ ctrl. OFF λ ctrl. ON
			Lambda control OFF/ON Basic setting 04: λctrl. OFF Read measured value block 08: λctrl. ON
			Lambda control
			Coolant temperature
			Engine speed

Notes on Display Group 099:

- ♦ To assist fault-finding, the lambda mixture control function is deactivated when Display Group 099 is selected in "Basic setting" mode (function 04) and activated when it is selected in "Read measured value block" mode (function 08).
- ♦ The lambda mixture control function is automatically re-activated by exiting from function 04 "Basic setting".
- ♦ By pressing the keys 4 and 8 on the V.A.G 1551 it is possible to switch back and forth between function 04 "Basic setting" and function 08 "Read measured value block".



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.



24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection 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, 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 operate the engine at starting speed without actually starting it (for example, in order to test compression), unplug the connector from the power output stage for the ignition coils and also the plug connectors on the injectors. After completing the work, interrogate 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.

Observe following if test and measuring instruments are required during a test drive:

- ♦
- ♦

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. Do not use fluffy cloths!
- ♦ Carefully cover opened components or seal, if the repair cannot be carried out 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.

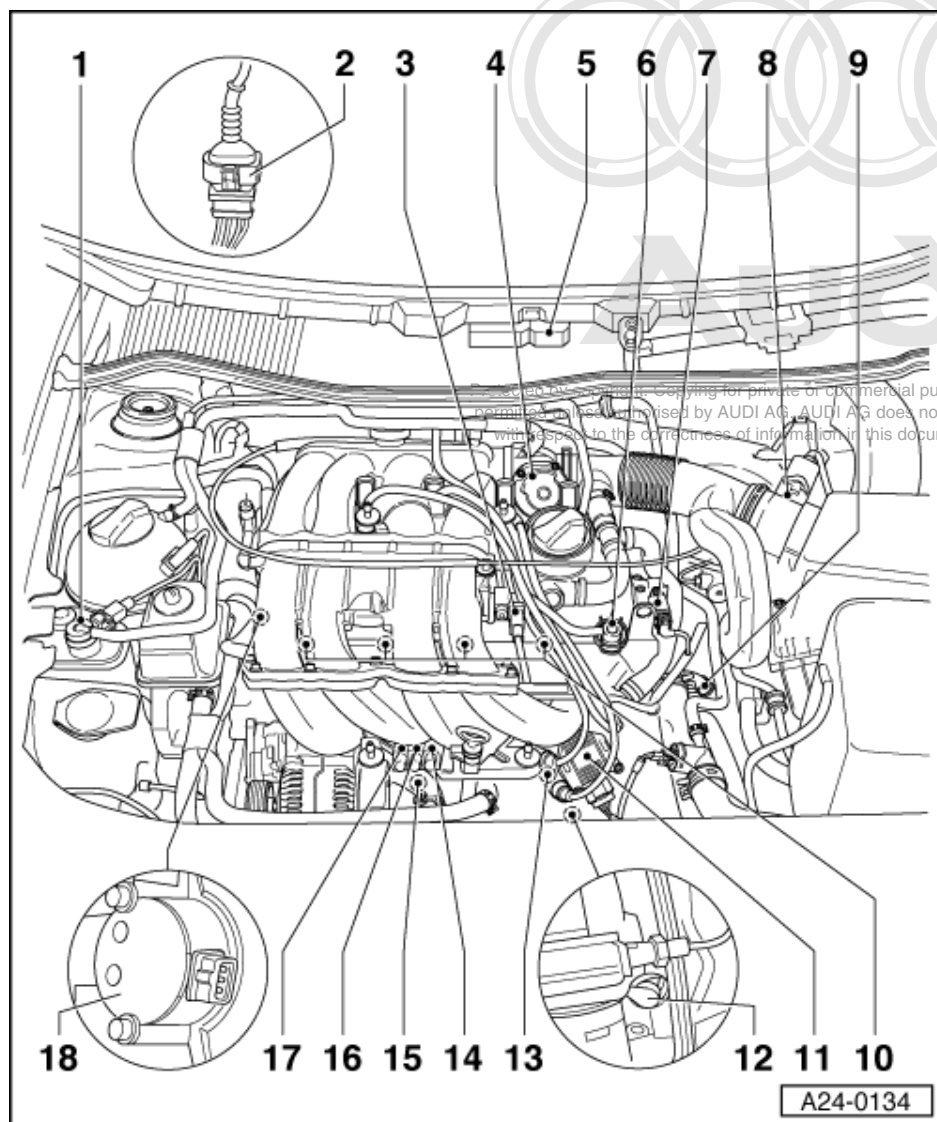
1.4 - Technical data

Engine code	AGN	
Idling speed Not adjustable - controlled by the idling speed stabilisation	Manual / automatic gearbox: 800 rpm (air conditioner switched off or no air conditioner fitted) Manual / automatic gearbox: 880 rpm (air conditioner switched on)	
Engine speed limiter - shuts off injectors	6800 rpm	
Fuel pressure at idling speed	Vacuum hose connected	approx. 2.5 bar
	Vacuum hose disconnected	approx. 3 bar
Holding pressure after 10 minutes	at least 1.5 bar	
Injectors	Spray pattern	Two-hole injector
	Injection qty. (30 s)	85....105 ml
	Resistance (room temperature) ¹⁾	13....18 ω

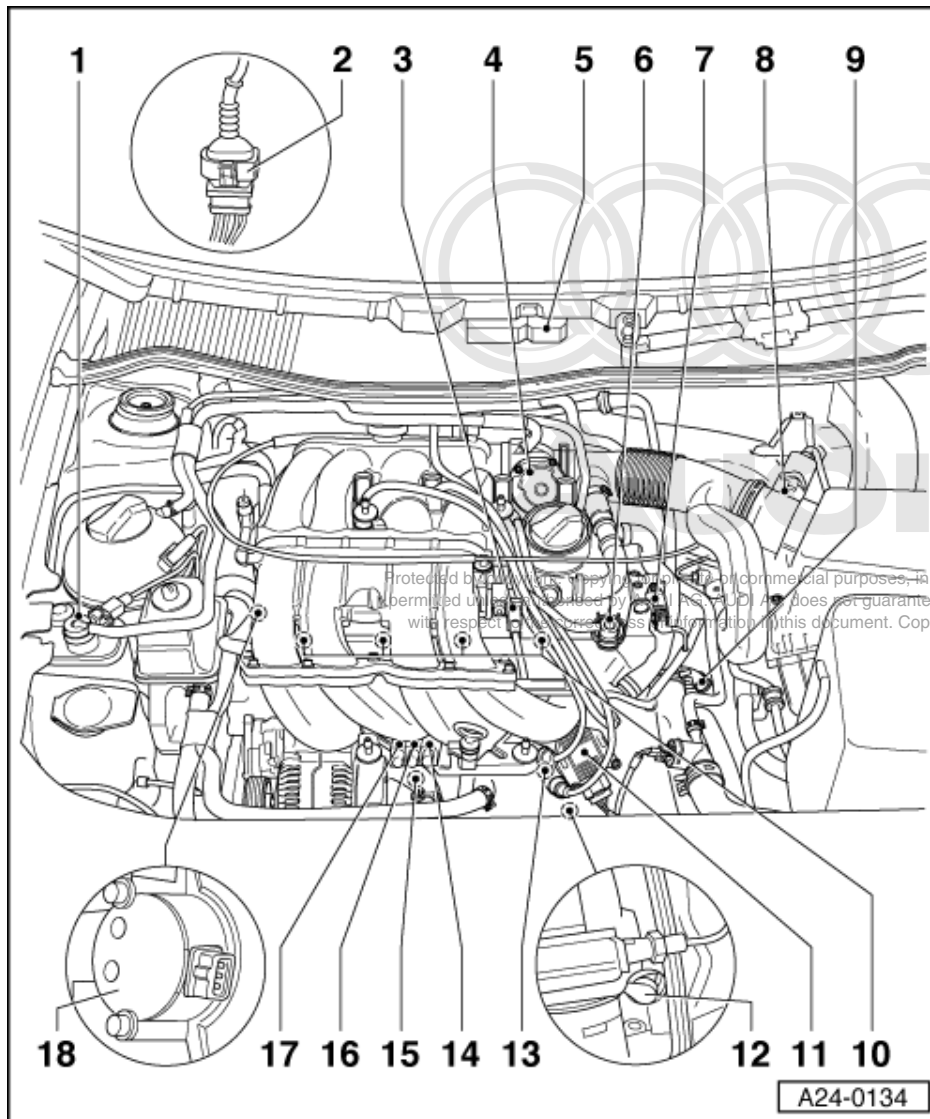
1) When the engine is at operating temperature the resistance is increased by approx. 4...6 ω .



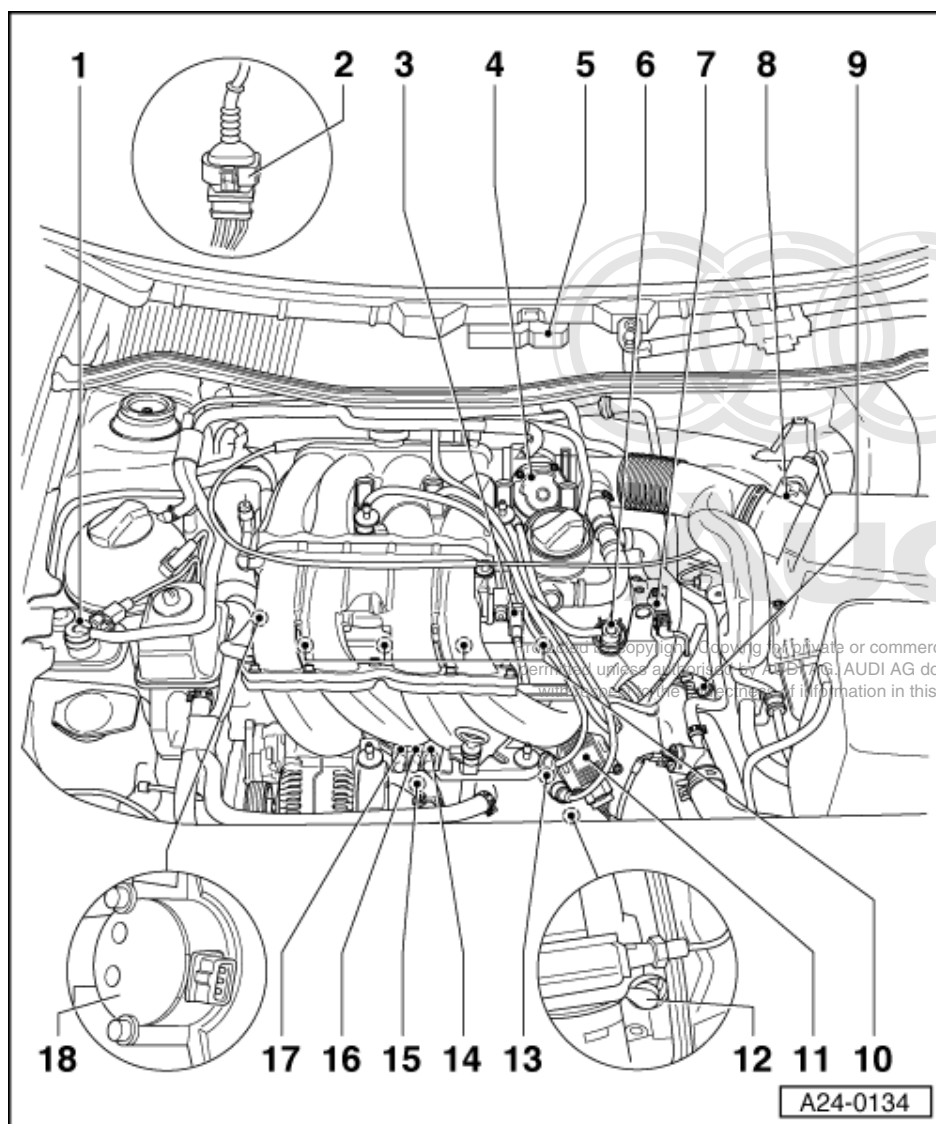
1.5 - Fitting locations overview



- 1 Activated charcoal filter solenoid valve 1 (N80)
- 2 4 pin connector
 - ◆ For Lambda probe and Lambda probe heating
 - ◆ Located on underside of car on right-hand side
- 3 Intake manifold change-over valve (N156)
- 4 Throttle valve control part (J338)
- 5 Engine control unit (J220)
- 6 Fuel pressure regulator



- 7 Camshaft adjustment valve (N208)
 8 Air mass meter (G70)
 ♦ With intake air temperature sender (G42)
 ♦ 5-pin connector
 9 Coolant temperature sender (G62)
 10 Injector (N30...N33)
 11 Ignition coils (N and N128) with output stage (N122)
 12 Engine speed sender (G28)
 13 Knock sensor 2 (G66)
 14 3 pin connector
 ♦ For knock sensor 2



15 Knock sensor 1 (G61)

16 3 pin connector

- ◆ For engine speed sender

17 3 pin connector

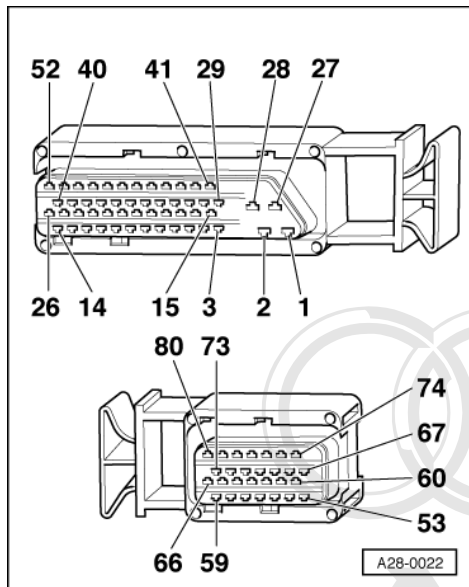
- ◆ For knock sensor 1

18 Hall sender (G40)

1.6 - 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 auxiliary cables from adapter set V.A.G 1594.



- ◆ -> The contact numbers on the connector correspond to the socket numbers on the test box.
- With the ignition switched off, unplug connector from control unit.
- Connect test box to wiring harness connector.
- Carry out check according to relevant repair operations.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized 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.

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 adaptation of throttle valve control part.

=>Page **83** (procedure for vehicles without cruise control)

=>Page **87** (procedure for vehicles with cruise control)

1.7 - Renewing engine control unit

Fitting location => Fitting locations overview, Page **54**

Special tools, testers and auxiliary items

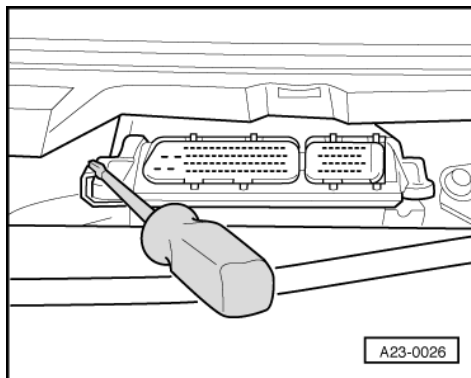
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3

Note:

When the engine control unit is disconnected the learned values are erased but the contents of the fault memory remain intact.

Removing

- Switch off ignition.



- Remove the windscreen wiper arms (screw connections) and take off the plenum chamber cover.

Note:

To remove the cover, first disconnect the hoses and plugs for the spray nozzles.

- -> Use a screwdriver to press lug on bracket to one side, then pull engine control unit towards the front of the vehicle to remove.
- Release the plug holders and disconnect the control unit plugs.

Installing

Installation is performed in the reverse sequence.

Note:

During the initial learning phase of the basic setting operation for the engine the idling may be slightly rough and the engine may pull a little unevenly.

- Code control unit => Page 26 .
- Perform adaption of throttle valve control part
=>Page 87 (procedure for vehicles with cruise control)
- Perform adaption of engine control unit to immobilizer control unit

=> Electrical system; Repair group 01; Self-diagnosis of immobilizer; Adaptation procedure when engine control unit is replaced Self-diagnosis of immobilizer Adaptation procedure when engine control unit is replaced

1.8 - Testing idling speed

Notes:

- ♦ The idling speed cannot be adjusted.
- ♦ The idling speed is tested during the basic setting of the engine.

Test conditions

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

=> 4-cylinder engine (5-valve), Mechanics; Repair group 20; Fuel supply system; Servicing throttle mechanism
Fuel supply system Servicing throttle mechanism

- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Pressure gauge not connected

- Selector lever in position P or N

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3

Testing idling speed

- Interrogate fault memory=>Page 3 .
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 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 and Display Group 05 =>Page 39).

-> Indicated on display:

Read	measured	value	block	5
1	2	3	4	

- Read off idling speed from display zone 1.

Specification: 760...880 rpm

- Press =>key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- If the readout does not match the specification, interrogate the fault memory again=>Page 3 .

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 85
- Large quantity of unmetered air=>see "Basic setting" of engine, Display Groups 001, 005 and 008.
- Test throttle valve control part
=>Page 87 (procedure for vehicles with cruise control)

1.9 - Checking fuel pressure regulator and holding pressure

Note:

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

Test conditions

- Fuel pump relay OK; testing => Page 65 .
- Fuel pump OK
- Fuel filter OK
- Battery voltage OK.

Special tools, testers and auxiliary items

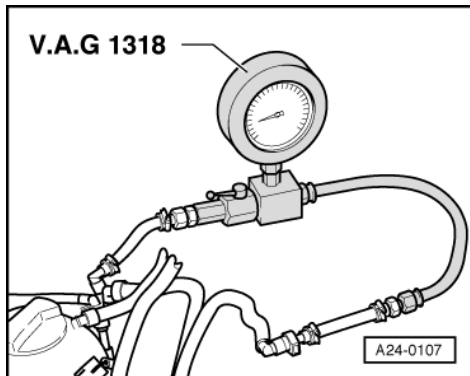
- ♦ Pressure tester V.A.G 1318
- ♦ Adapter 1318/8
- ♦ Adapter 1318/9
- ♦ Adapter 1318/17



Warning!

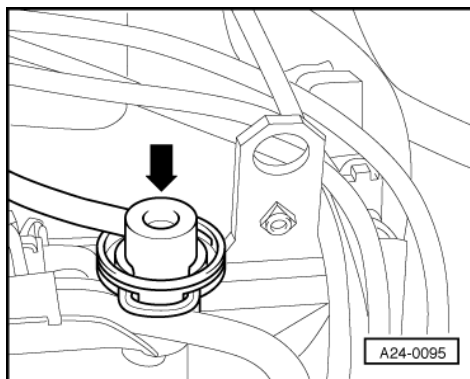
Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

- Pull fuel supply hose (white marking) off fuel supply pipe.
- Connect pressure gauge V.A.G 1318 to fuel supply pipe using adapters 1318/8, 1318/9 and 1318/17.



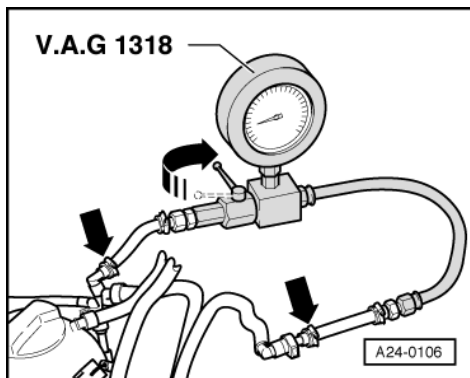
- -> Open cut-off valve on pressure gauge (valve handle points in direction of flow).
- Start the engine and run at idling speed.
- Measure fuel pressure.

Specification: approx. 2.5 bar

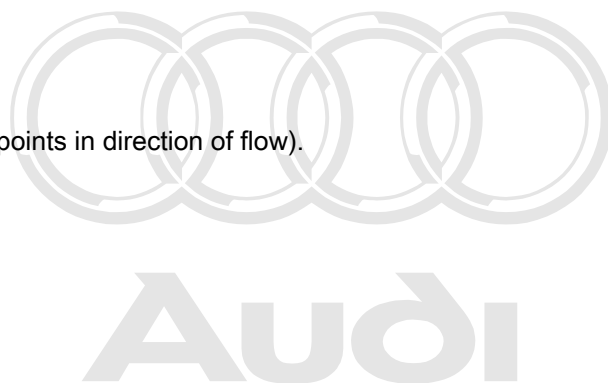


- -> Pull vacuum hose off fuel pressure regulator. The fuel pressure should increase to approx. 3.0 bar
- Switch off ignition.
- Check leak-tightness and holding pressure by watching the gauge indicator fall. After 10 minutes the remaining pressure should be at least 1.5 bar.

If the holding pressure drops below 1.5 bar:



- Start the engine and run at idling speed.
- -> Allow the pressure to build up, then switch off the ignition. At the same time close the cut-off valve on the pressure gauge (valve handle at right angles to direction of flow).



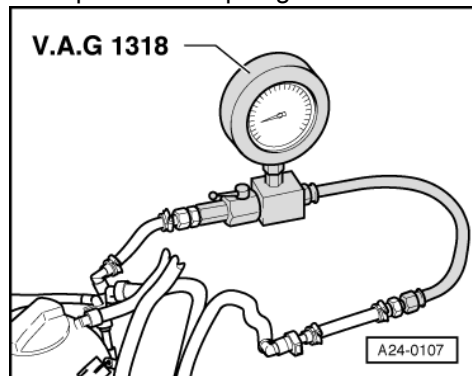
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Observe pressure drop on gauge.

If the pressure does not drop:

- Check fuel pump non-return valve.

If the pressure drops again:



- -> Open cut-off valve on pressure gauge V.A.G 1318 (valve handle points in direction of flow).
- Start the engine and run at idling speed.
- Allow the pressure to build up, then switch off the ignition. At the same time pinch the return hose (with blue marking) firmly together.

If the pressure does not drop:

- Renew fuel pressure regulator.

If the pressure drops again:

- Check pipe connections, O-rings on fuel manifold and injectors for leaks.
- Check pressure gauge for leaks.

Note:

Before removing the pressure gauge release fuel pressure by opening the cut-off tap. When doing this hold a container over the connection.

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

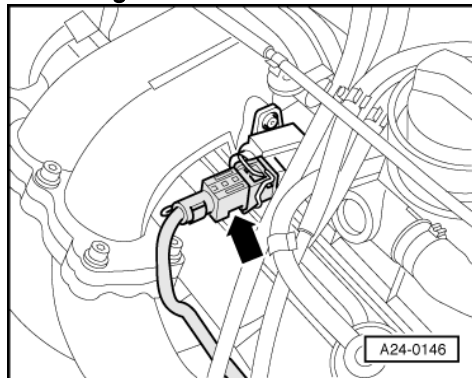
Test conditions

- Fuel pressure OK; testing => Page 59 .

Special tools, testers and auxiliary items

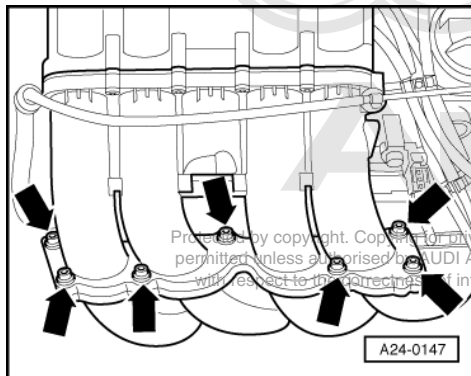
- ◆ Remote control V.A.G 1348/3A with adapter cable V.A.G 1348/3-2
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ◆ Adapter set V.A.G 1594
- ◆ Measuring unit V.A.G 1602

Removing fuel manifold

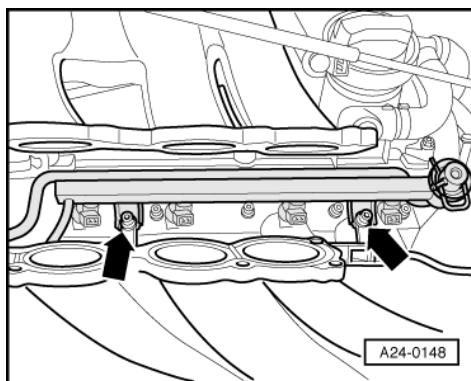




- Unplug spark plug connectors from all 4 spark plugs.
- Disconnect vacuum hose from T-piece on top of intake manifold and lay it over to the left.
- -> Unplug connector -arrow- on intake manifold changeover valve -N156.



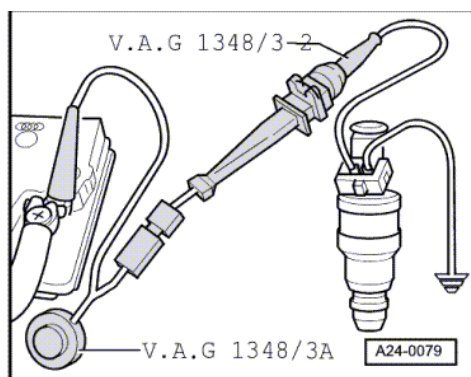
- Disconnect vacuum hose from fuel pressure regulator.
- -> Remove hexagon socket head bolts -arrows- securing upper section of intake manifold.
- Pivot up the upper section of the intake manifold.
- Unplug connectors from injectors.



- -> Unscrew bolts -arrows- securing fuel manifold to lower section of intake manifold, then lift fuel manifold off intake manifold together with injectors.

Test sequence

- 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 => Page 23. The fuel pump must be running.
- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops should escape per minute from each injector.

- If the fuel loss is greater, switch off the fuel pump (terminate final control diagnosis) and renew the faulty injector.
- If necessary, repeat the final control diagnosis.

Note:

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

- Activate remote control V.A.G 1348/3 A for 30 seconds.
- Carry out measurement on 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 59.

Note:

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

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.

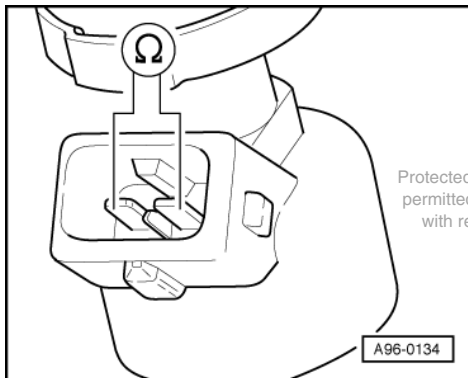
1.11 - Checking injectors

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Diode test lamp V.A.G 1527
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22

A - Electrical testing of injectors

- Remove connector from the injector which is to be tested. If necessary, pivot up the upper section of the intake manifold (=>Page 61) in order to reach the connector.



- -> Measure resistance between the injector contacts using V.A.G 1526.

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.



Specification: 13...18 ω .

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

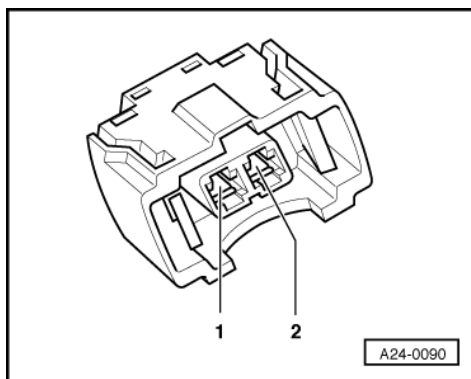
- If the measured value is not as specified, renew the injector.

B - Testing power supply

Test conditions

- Fuse for injectors OK
- Remove connector from the injector which is to be tested. If necessary, pivot up the upper section of the intake manifold (=>Page 61) in order to reach the connector.

Noted by copyright: copying for private or commercial purposes without the prior written consent of Audi AG is prohibited. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by Audi AG.



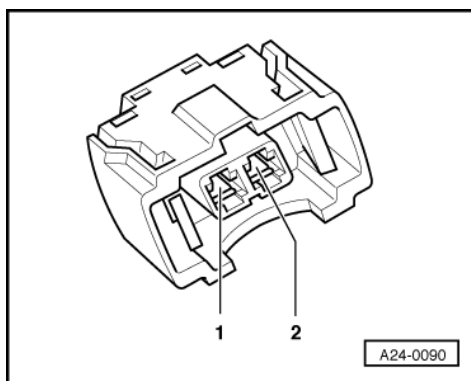
- -> Connect diode test lamp V.A.G 1527 between contact 1 and engine earth.
- Operate starter for a few seconds (the engine can be allowed to start). The diode test lamp should light up.
- If the diode test lamp does not light up, test for open circuits in the wiring between contact 1 and the fuse for 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 connector from the injector which is to be tested. If necessary, pivot up the upper section of the intake manifold (=>Page 61) in order to reach the connector.



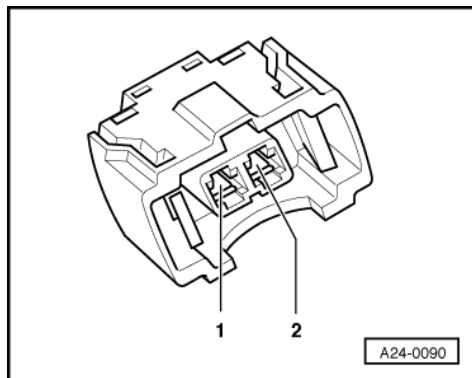
- -> Connect diode test lamp V.A.G 1527 between contact 2 and positive terminal of battery.
- Operate starter for a few seconds (the engine can be allowed to start).

Specification: the diode test lamp should start flashing.

Note:

Diode test lamps with a low current draw continue to glow faintly between flashes (rather than going out completely) and become much brighter during the flashes.

- If the diode test lamp does not start flashing:
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 56 .

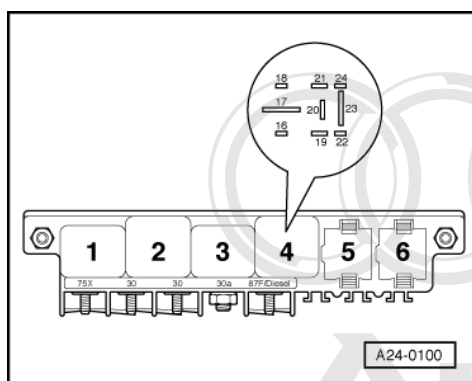


- -> Test for open circuit or short to positive in the wiring between the engine control unit and contact 2 on the plug connector for the injector being tested.

Contact 2 on plug connector for injector	Test box V.A.G 1598/22 or - J220
1	73
2	80
3	58
4	65

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit
=> Page 57 .

1.12 - Testing fuel pump relay and activation



Note:

-> The fuel pump relay is located in the central electrics in the left-hand footwell, relay position 4.

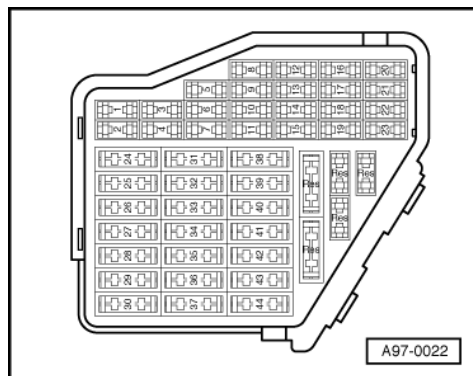
Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Diode test lamp V.A.G 1527
- ◆ Adapter set V.A.G 1594



- ♦ Test box V.A.G 1598/22

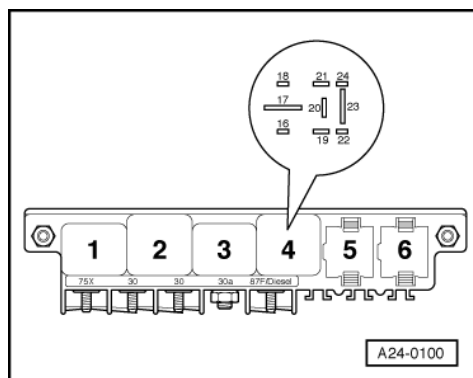
A - Testing fuel pump relay -J17



- Remove storage bin in front left-hand footwell.
- ➔ Remove fuse 28 from fuse holder and connect diode test lamp V.A.G 1527 between earth and one of the two contacts for fuse 28.
- 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 picks up but the diode test lamp does not light up, repeat the test on the other contact.



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.

- ➔ If the diode test lamp still does not light up, test for open circuits in the wiring between fuse 28 and contact 23 in relay position 4.

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

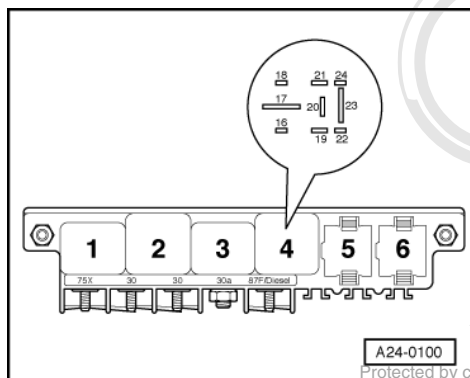
- If no open circuit is detected, fit a new fuel pump relay.
- If the fuel pump relay does not pick up, test activation
=> Page 66 .
- If the power supply and activation are OK, fit a new fuel pump relay.

B - Testing power supply and activation of fuel pump relay

- Remove fuel pump relay -J17 from central electrics, relay position 4.

Testing power supply

- Switch ignition on.

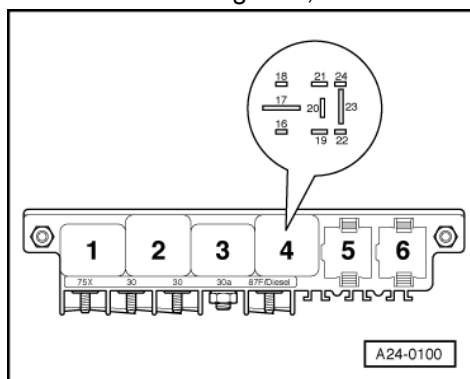


- -> Connect hand-held multimeter V.A.G 1526 first to contact 19 (positive) and earth on relay panel, then to contact 17 (positive) and earth on relay panel.

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 binder

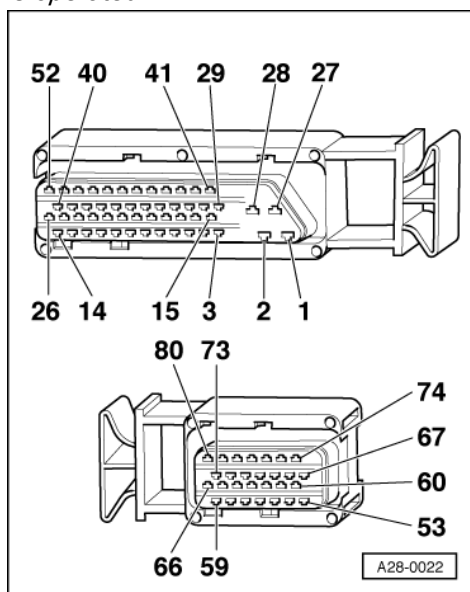


Testing activation

- -> Connect diode test lamp V.A.G 1527 to contact 16 (earth) and positive.
- 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 diode test lamp does not light up, test the wiring as follows:

- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=>Page 56 .
- Connect hand-held multimeter between contact 16 on relay panel and socket 4 on the test box, then test wiring for open circuits.
- Rectify any open circuits.

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

- If there is no open circuit and the diode test lamp does not light up, fit a new engine control unit => Page 57 .
- If both the fuel pump relay activation and the wiring are OK, fit a new fuel pump relay.
- Refit fuse 28.

1.13 - Checking air mass meter

Special tools, testers and auxiliary items

- ♦ Diode test lamp V.A.G 1527
- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22

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.

Testing operation

- Select "Read measured value block" (function 08) and Display Group 002=>Page 36 .

-> Indicated on display:

Read measured value block				2
1	2	3	4	

Display zone 4 will show the intake air mass in grams per second.

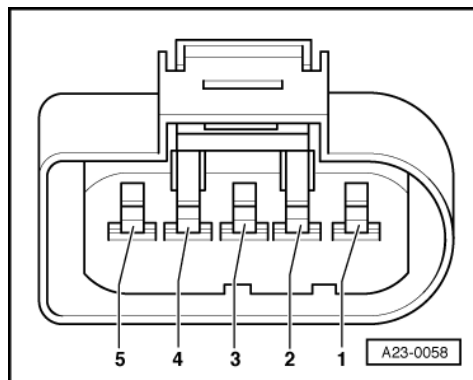
Specification: 2.0....4.0 g/s

- If the value is not as specified or if the fault memory has recorded a fault related to the air mass meter, test the power supply to the air mass meter => Page 68 .

Testing power supply to air mass meter

- Test fuse for air mass meter.

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

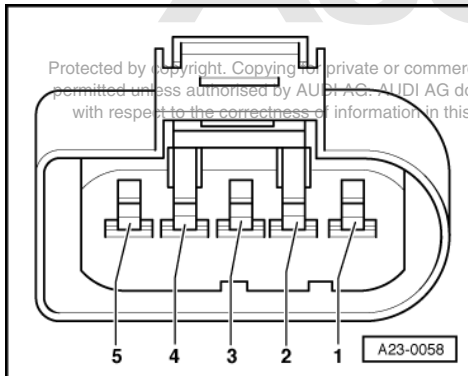


- -> If the fuse is OK, connect diode test lamp V.A.G 1527 between engine earth and contact 2 on the connector.
- Operate the starter briefly (engine can be allowed to start briefly). The diode test lamp should light up.

- If the diode test lamp does not light up, test for open circuit or short to earth in wiring between fuse and contact 2 on the connector. Repair any wiring faults.

=> 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 65.



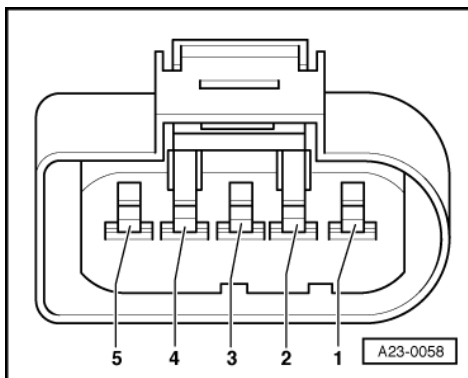
- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 2 on the connector.
- Operate the starter briefly (the engine can be allowed to start briefly). The diode test lamp should light up.

If the LED does not light up:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 56.
- Test for open circuit and short to positive or earth in wiring between connector on air mass meter and engine control unit. Repair any wiring faults.

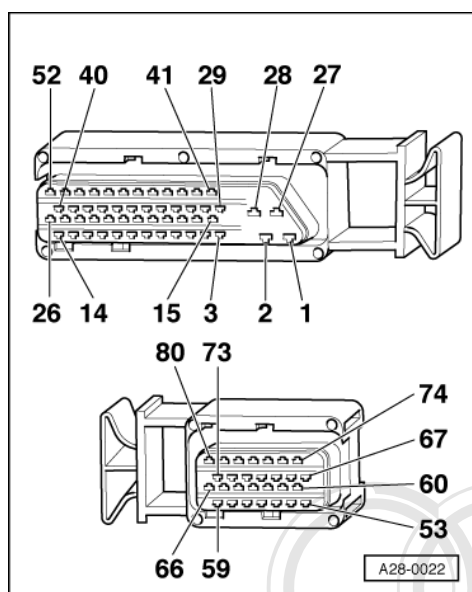
Plug connector for air mass meter G70	Test box V.A.G 1598/22 or J220
4	11

- If the power supply is OK, test the signal wiring
=> Page 69.



Testing signal wiring for air mass meter

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 56.
- -> 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 J220
5	13
3	12

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

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 for the correctness of information in this document. Copyright by AUDI AG.

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 1.1 V (based on reference earth).

The voltage signal for "Mixture too lean (high residual oxygen)" is between about -0.1 and +0.3 V (based on reference earth).

The transition from "rich" to "lean" is accompanied by a voltage jump from between 0.7 and 1.1 V to between -0.1 and +0.3 V (based on reference earth) 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 wiring or reference earth wiring.
- ♦ Lambda probe too cold; lambda probe heating not working.
- ♦ Lambda control switched off (control unit has detected a fault in the injection system); =>Interrogating fault memory and Reading measured value block, Display Group 21.
- ♦ 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.

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3

Testing vehicle under cold-start conditions:

- Select "Read measured value block" (function 08) and Display Group 007=>Page **40**.

-> Indicated on display:

Read measured value block 7			
1	2	3	4

Display zone 2 shows the voltage of the lambda probe signal.

Engine cold or lambda control not running: 0.45...0.50 V.

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.

Important:

Secure fault reader to rear seat and operate from this location. When doing this, always observe the relevant safety precautions => Page **52**.

- Take vehicle for a test drive and watch display zone 2.

-> When the lambda control cuts in the voltage signal should fluctuate between the 0.0...+0.3 V range and the +0.7...+1.0 V range.

Read measured value block 7			
1	0.780V	3	4

Voltages of more than +0.7 V indicate a rich fuel mixture (low oxygen level in exhaust gas).

Voltages of less than +0.3 V indicate a lean fuel mixture (high oxygen level in 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 **72**.

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 008. If the values are not as specified, rectify the fault.
- Check also the measured value blocks in function 04 (Basic setting). The solenoid valve for the activated charcoal filter -N80 is closed for this function.
- ♦ The lambda control can be switched on and off as required using Display Group 099. Press keys 4 and 8 to switch back and forth between "Basic setting" (lambda control off) and "Read measured value block" (lambda control on).

2.3 - Testing operation

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 for errors or omissions in this document. Copyright by AUDI AG.

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- Select "Read measured value block" (function 08) and Display Group 003=>Page **37** .

-> Indicated on display:

Read measured value block 3			
1	2	3	4

Do not proceed with the test until the coolant temperature shown in display zone 3 has reached at least 80°C.

- Press C key.
- Press keys 0, 0 and 7 for Display Group 007 and confirm entry with key Q.

-> Indicated on display:

Read measured value block 7			
1	2	3	4

Display zone 2 will show the voltage of the lambda probe signal.

- If the lambda probe voltage reading fluctuates very slowly, test the lambda probe heating => Page **73** .
- If the display shows a constant lambda probe voltage reading of between 0.45 and 0.50 V, this means there is an open circuit in the signal wiring. Test wiring=>Page **74** .
- If the display shows a constant voltage reading of between 0.0 and +0.3 V (mixture too lean), this means that the lambda control has reached the maximum enrichment limit but the lambda probe is still registering "Mixture too lean".
- If the display shows a constant voltage reading of between +0.7 and 1.0 V (mixture too rich), this means that the lambda control has reached the maximum leaning-down limit but the lambda probe is still registering "Mixture too rich".
- Press C key.
- If the lambda probe is functioning properly, check the lambda learned values.
- Press keys 0, 0 and 8 for Display Group 008 and confirm entry by pressing key Q.

-> Indicated on display:

Read measured value block 8			
2ms	-0.7 %	-0.5 %	TB
active			

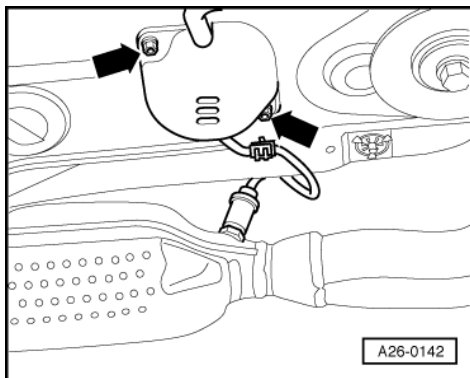
The mixture adaption system has learning ability, i.e. the lambda control can recognise differences between engines (injector nozzle delivery, cylinder compression, fuel pressure, etc.) and compensates by adjusting the pre-programmed basic injection periods mapped in the control unit. The injection periods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

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

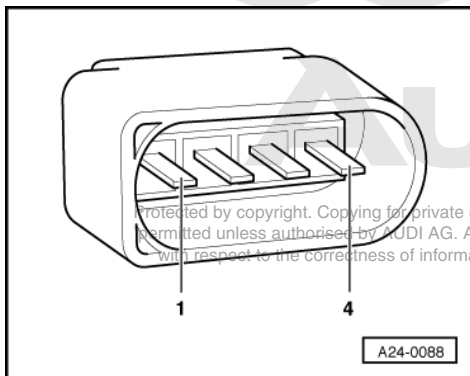
Specifications: => Page 41 .

2.4 - Checking Lambda probe heating

Special tools, testers and auxiliary items



- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Adapter set V.A.G 1594
- The lambda probe heating circuit is monitored by the self-diagnosis system.
- Interrogate fault memory=>Page 3 .
- -> Unbolt protective cover for lambda probe connector on right-hand side under floor panel.
- Unplug 4-pin connector for lambda probe -G39.



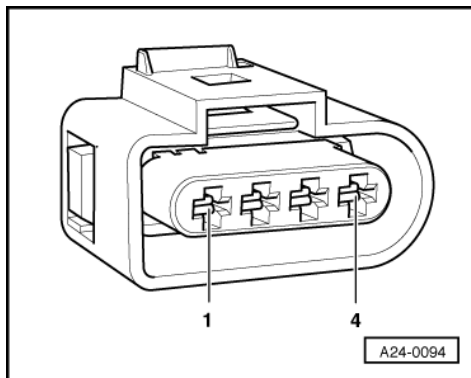
- -> Test for open circuit (measure resistance) by connecting V.A.G 1526 between contacts 1 and 2 of the lambda probe plug connector.

Note:

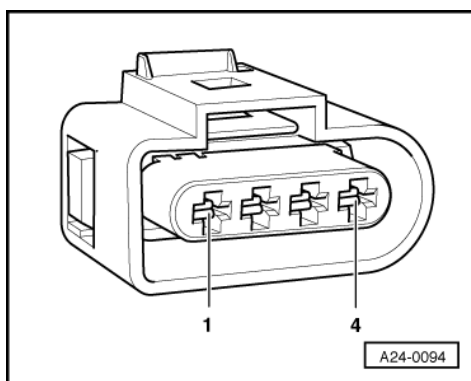
The resistance of the heating element at room temperature is approx. 1...5 Ω . With even a small temperature rise this value will increase sharply.

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

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



- Test fuse for lambda probe heating.
- -> If the fuse is OK, connect diode test lamp V.A.G 1527 between engine earth and contact 1 of plug on wiring harness.
- 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.
- Test for open circuit in wiring between contact 2 of plug on wiring harness (earth wire) and contact 27 on the engine control unit. Rectify any open circuits.
- 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 65 .

2.5 - Testing lambda probe signal wiring and activation

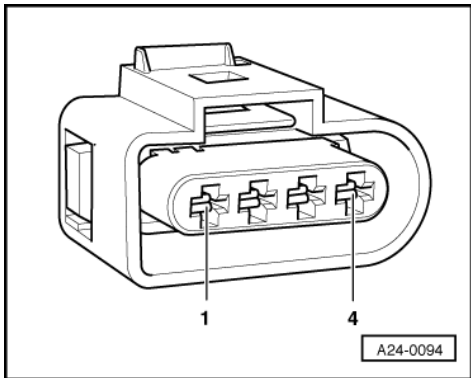
Note:

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

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22
- Interrogate fault memory=>Page 3 .

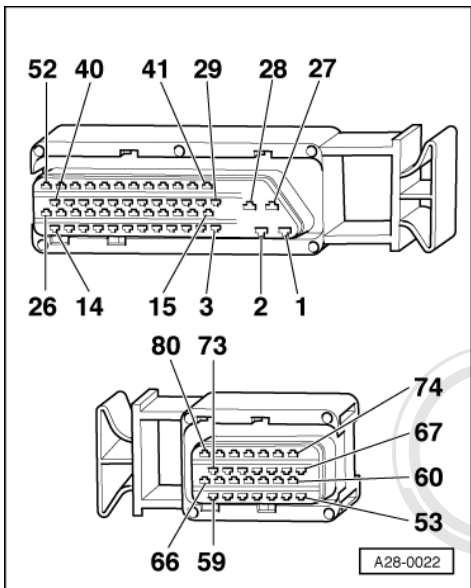
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- If a fault in the lambda probe has been registered and the lambda probe heating is OK, unplug the lambda probe connector.
- -> 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.
- Switch ignition on.

Specification: 450 ± 50 mV.

- If the reading is not as specified, connect test box 1598/22 to the wiring harness for the engine control unit =>Page 56 .



- -> Test the following wiring connections for open circuits or short circuits to positive or earth and rectify if necessary:

Lambda probe Bank 1 -G39

Contact on wiring harness plug	Test box V.A.G 1598/22 or J220
3	25
4	26

- If the wiring is OK, fit a new engine control unit =>Page 57 .

2.6 - Removing and installing lambda probe

Special tools, testers and auxiliary items

- ♦ Ring spanner for lambda probe 3337/9
- ♦ Hot paste G 052 112 A3 (for bolts)

Removing

- Unplug the lambda probe connector.
- Unscrew the lambda probe using ring spanner 3337/9.

Installing

When installing, note the following points:

Notes:

- ♦ 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 intake manifold change-over function

3.1 - Testing intake manifold change-over function

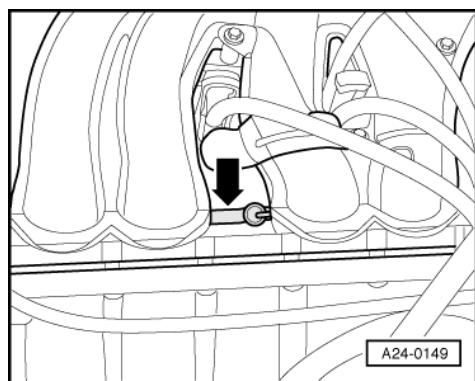
This test should only be carried out if the vehicle is losing power.

The intake manifold change-over function switches over from the long intake tract to the short intake tract at about 4700 rpm.

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.

3.2 - Testing operation

- Increase the engine speed by pressing briefly on the accelerator.



- -> The push-rod (-arrow-) on the vacuum unit for the intake manifold change-over function should move sideways.

If the push-rod does not move, carry out the following tests:

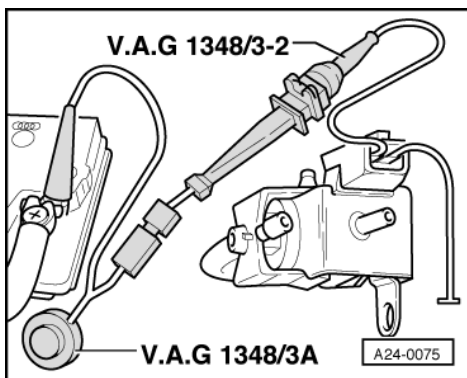
- Test intake manifold change-over valve -N156 by performing final control diagnosis => Page 79 .

- Test vacuum reservoir for leaks =>Page 77 .
- Check that vacuum hoses are properly connected and free of leaks and obstructions.
- Check that change-over mechanism operates freely (move push-rod by hand).

3.3 - Testing vacuum system

Special tools, testers and auxiliary items

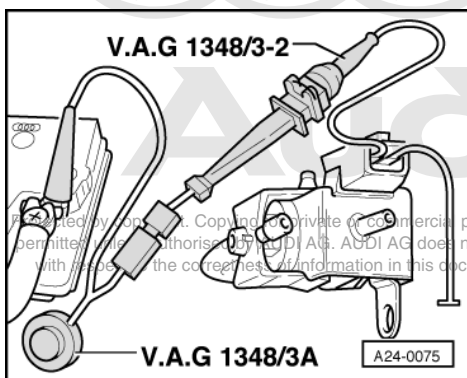
- ◆ Remote control V.A.G 1348/3A with adapter cable V.A.G 1348/3-2
- ◆ Hand vacuum pump V.A.G 1390
- ◆ Adapter set V.A.G 1594
- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.



- Switch off ignition.
- Unplug connector from intake manifold change-over valve -N156.
- -> Connect one of the contacts on the solenoid valve to engine earth using test leads and crocodile clamp from V.A.G 1594.
- Connect the second contact on the solenoid valve to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and an auxiliary cable.
- Operate remote control V.A.G 1348/3A for about 2 or 3 minutes. During this time the vacuum unit should remain in the "pulled-in" position.

If the vacuum unit returns to its original "rest" position, carry out the following test:

- Disconnect vacuum hoses from T-piece (hoses lead to vacuum unit for intake manifold change-over system).
- Connect hand-held vacuum pump V.A.G 1390 to vacuum unit.
- Operate hand-held vacuum pump and check whether change-over function is working.
- Test vacuum unit for leaks. (The vacuum unit should not return to the "rest" position while a vacuum is being maintained via the hand pump.)
- If necessary, renew vacuum unit.
- If the vacuum unit does not pull, test -N156 for obstructions as follows:



Reproduced by permission. Copying for private or commercial purposes, in part or in whole, is not permitted without authorisation 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.



- -> Connect one of the contacts on -N156 to engine earth using test leads and crocodile clamp from V.A.G 1594.
- Connect the other contact on -N156 to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A.
- Test valve for obstructions (remove vacuum hoses and blow through).
- If necessary, renew intake manifold change-over valve.
- If no faults have been found in any of the tests so far, test the vacuum system for leaks.

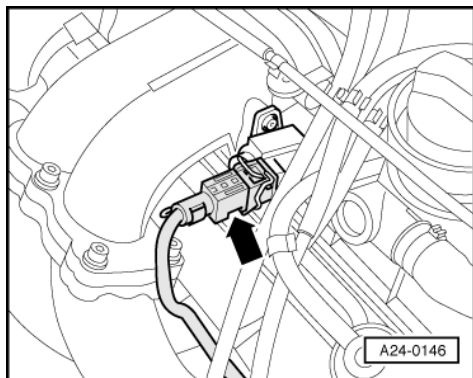
3.4 - Testing intake manifold change-over valve

Copyright © 1997 Audi AG. This document is not permitted to be reproduced, stored in a retrieval system, or used 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.

Fitting location => Page **54** .

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Diode test lamp V.A.G 1527
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22

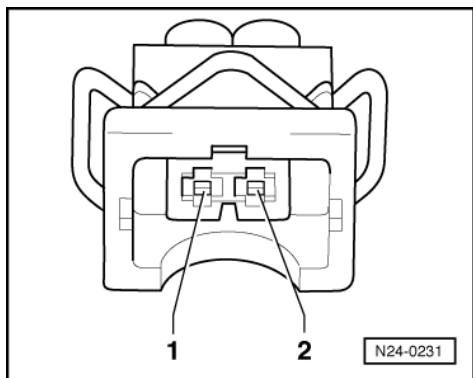


Electrical test of intake manifold change-over valve -N156

- -> Unplug connector -arrow- from intake manifold change-over valve -N156.
- Measure resistance between valve contacts using V.A.G 1526.

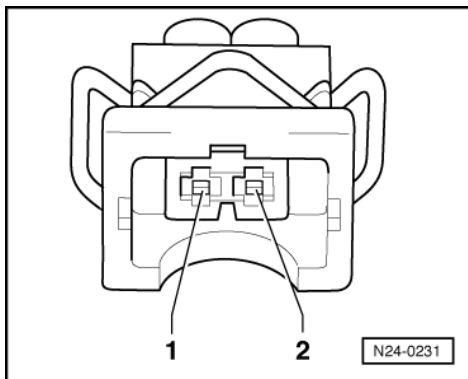
Specification: 25...35Ω

- If the reading does not match the specification, renew intake manifold change-over valve -N156.



Testing power supply to intake manifold change-over valve -N156

- ➔ Unplug connector from intake manifold change-over valve -N156.



- ➔ Connect diode test lamp V.A.G 1527 between engine earth and contact 1 on connector using test leads from auxiliary cable set V.A.G. 1594.
- Operate the starter briefly.

Specification: The diode test lamp should light up.

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

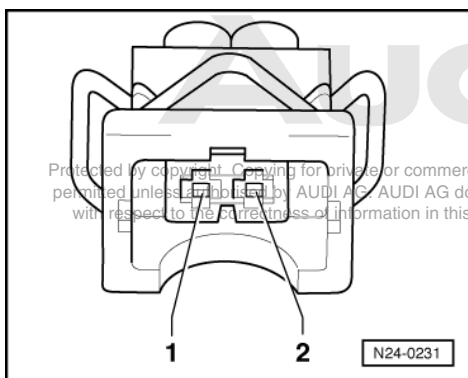
- Test fuse for -N156.
- Test for open circuit in wiring between fuse and contact 1 on connector for intake manifold change-over valve using current flow diagram.

⇒ Current flow diagrams, Electrical fault finding and Fitting locations binder

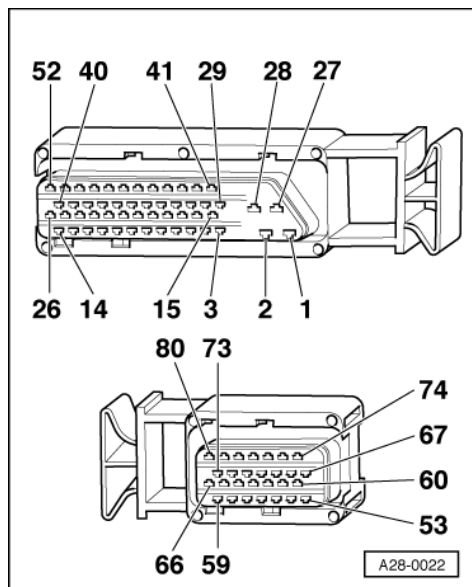
Specification: max. 1 Ω.

- Test fuel pump relay and activation
⇒ Page 65 .

Testing activation of intake manifold change-over valve



- ➔ Connect diode test lamp V.A.G 1527 between contacts 1 (positive) and 2 on connector for intake manifold change-over valve using test leads from auxiliary cable set V.A.G 1594.
- Perform final control diagnosis ⇒ Page 23 . The diode test lamp should flash when the intake manifold change-over valve is activated.
- If the diode test lamp does not flash or lights up continuously, connect test box V.A.G 1598/22 to wiring harness for engine control unit ⇒ Page 56 .
- If the diode test lamp lights up continuously, test for short circuit to earth in wiring between socket 64 on test box V.A.G 1598/22 and contact 2 on connector for intake manifold change-over valve.



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

Specification: max. 1 Ω .

- Rectify any short circuits to earth or open circuits.
- If no short circuits or open circuits are found, fit a new engine control unit => Page 57 .

4 - Testing fuel tank breather system

4.1 - Testing fuel tank breather system

4.2 - Testing solenoid valve 1 for activated charcoal filter

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Diode test lamp V.A.G 1527
- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ♦ Adapter set V.A.G 1594

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the express written authorisation 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.

Testing for leaks

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

- Disconnect hoses from solenoid valve for activated charcoal filter -N80.
- Connect plug to solenoid valve.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80 =>Page 23 .
- While final control diagnosis is running, blow into the solenoid valve to check whether it opens and closes properly. If necessary, fit a new solenoid valve.

Electrical test of -N80 (ACF valve)

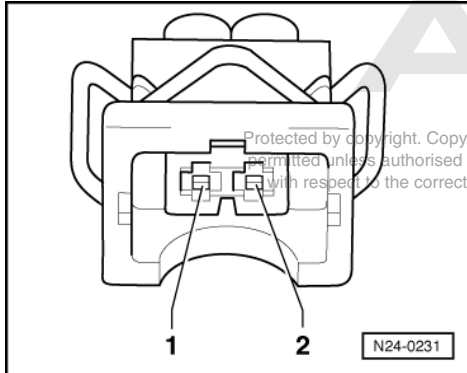
- Unplug connector on ACF valve.

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

Specification: 22...30 Ω .

- 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.

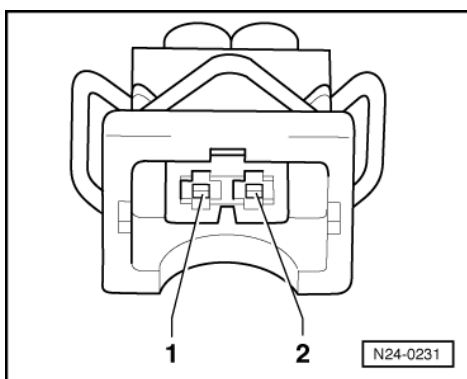
Test conditions

- 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: The 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 65.

Testing ACF valve activation

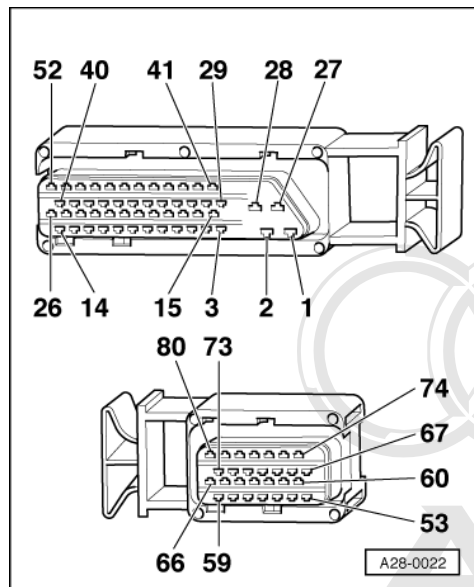
- ➔ Connect diode test lamp V.A.G 1527 between contacts 2 and 1 (positive) of plug connector.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80



=>Page 23 .

Specification: The diode test lamp should flash.

- If the diode test lamp does not flash or lights up continuously, connect test box V.A.G 1598/22 to wiring harness for engine control unit => Page 56 .



- -> 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.

Specification: max. 1 Ω .

- 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 57 .

5 - Testing throttle valve control part (vehicles without cruise control)

5.1 - Testing throttle valve control part (vehicles without cruise control)

Note:

CCS = cruise control system

5.2 - Function

The throttle valve control part also controls the idling speed stabilisation. 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. All adjustments are made via the basic setting function on V.A.G 1551. When there is no electrical signal the throttle valve is moved mechanically to a pre-determined position. The throttle valve positioner is responsible for damping the action of the throttle valve as it closes.

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A

- ◆ Diode test lamp V.A.G 1527
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22

5.3 - Performing adaption of throttle valve control part (vehicles without cruise control)

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

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

Test conditions

- No faults stored in fault memory
=>Interrogating fault memory, Page 3
- 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 1.)

Note:

The adaption process for the throttle valve control part will be aborted in the following cases:

- ◆ If the engine is started or if the accelerator is depressed while the adaption process is running.

-> 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 098 and confirm entry with Q key.

-> Indicated on display:

System in basic setting	98
x.xxx V x.xxx V	Idling
ADP.runs	

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.

When the Q key is pressed the throttle valve positioner moves to the "Min." position and several intermediate positions, and the control unit records the various throttle valve angles in its non-volatile memory. The throttle valve then remains in the start position for a brief period before closing.

-> Indicated on display:

System in basic setting	98
x.xxx V x.xxx V	Idling
ADP. 0.K.	

- Press the=>key to terminate the adaption process.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.

Note:

-> If one of the following messages appears on the display, this means that the adaption process has been aborted.



Basic setting 98
x.xxx V x.xxx V Idling
ADP.n.OK

Basic setting 98
x.xxx V x.xxx V Idling
ERROR

Function is unknown or
cannot be carried out at the moment

If the adaption process is aborted by the control unit, the cause could be one of the following:

- ♦ 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 accelerator cable.
- ♦ Battery voltage too low.
- ♦ Throttle valve control part or wiring is defective.
- ♦ The engine was started or the accelerator was depressed while the adaption process was running.

After an interruption the fault "Basic setting not completed, fault in basic setting" is stored in fault memory. When next switching on ignition the basic setting is automatically performed again.

Fault-finding:

- If the adaption process was aborted, proceed as follows:
- Press the ➡key.
- Interrogate fault memory.

No-faults recognised

-> If no faults are detected, check whether the idling speed switch opens and closes when the accelerator is depressed.

(Testing idling speed switch=>Page 85 .)

Idling switch does not open
Short circuit to earth

-> If one of the following faults is detected, check whether the idling speed switch opens and closes when the accelerator is depressed. (Testing idling speed switch=>Page 85 .)

Idling switch does not close
Open circuit

Voltage supply
Signal too small

-> If this fault is displayed, test the voltage supply to the engine control unit (voltage at terminal 30 on engine control unit has dropped below 10 V). Testing voltage supply to engine control unit=>Page 108 .

Throttle valve positioner sender -G127
Signal too small / too great

-> If one of the following faults is displayed, test throttle valve positioner sender -G127 and throttle valve potentiometer -G69=>Page 85 .

Throttle valve potentiometer -G69
Signal too small / too great

Throttle valve positioner sender -
G127
□
Implausible signal

- Repair faults, then repeat adaption of throttle valve control part.

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.

5.4 - Testing idling speed switch (vehicles without cruise control)

- Select "Read measured value block" (function 08) and Display Group 098=>Page 50 .

-> Indicated on display:

Read measured value block	98
x.xxx V x.xxx V	
Idling	

Display zone 3 should read "Idling".

- Gradually open throttle valve.

-> Indicated on display:

Read measured value block	98
x.xxx V x.xxx V Part	
throt	

Display zone 3 should read "Part throt" (part throttle).

- Gradually release throttle valve.

-> Indicated on display:

Read measured value block	98
x.xxx V x.xxx V	
Idling	

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.

Display zone 3 should read "Idling" again.

- 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.
- Measure resistance between sockets 67 and 69 using hand-held multimeter V.A.G 1526.

Specification: continuity (throttle valve closed)

- Open throttle slightly.

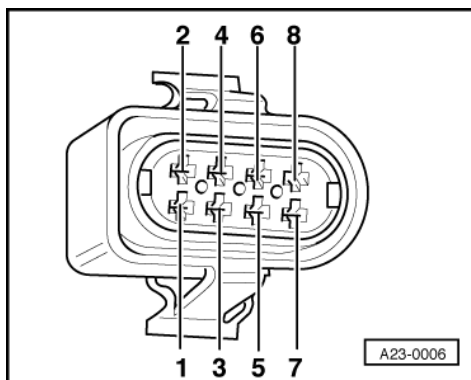
Specification: idling speed switch should open (no continuity)

- If the value is not as specified, test for open circuit in wiring and check for dirt on the contacts. If necessary, clean the contacts and perform adaption process.
- 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 83 .
- If it is not possible to start the adaption of the throttle valve control part or if the procedure cannot be successfully completed, disconnect the throttle cable.
- Repeat adaption of throttle valve control part
=>Page 83 .
- If it is not possible to start the adaption of the throttle valve control part or if the procedure cannot be successfully completed, fit a new throttle valve control part.
- Repeat adaption of throttle valve control part
=>Page 83 .

5.5 - Testing throttle valve positioner sender and throttle valve potentiometer (vehicles without cruise control)

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.

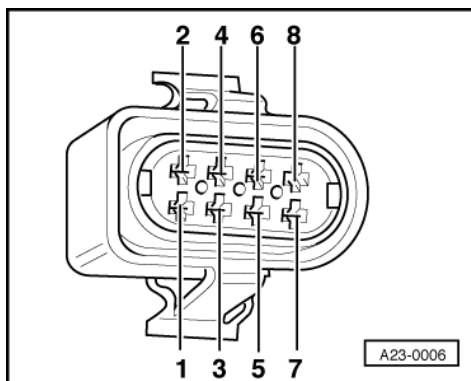
- Start the engine.
- Select "Read measured value block" (function 08) and Display Group 098=>Page 50 .

➔ Indicated on display:

Read measured value block	98
4.420 V	3.080 V
Idling	

The values in display zones 1 and 2 should be between 0.5 and 4.9 V.

- If the values are not as specified, switch off the ignition.
- Connect test box V.A.G 1598/22 to the wiring harness for the engine control unit
=> Page 57 .
- 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.

Contact on 8-pin plug	Contact on test box
1	66
2	59
3	69
4	62
5	75
6	-
7	67



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the prior written consent of 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.

Contact on 8-pin plug	Contact on test box
8	74

- Use the multimeter to test the wires for short circuits with each other.
- Rectify any open circuits and remove any dirt from the contacts. Erase fault memory and perform adaption of throttle valve control part=>Page 83 .
- 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 83 .
- If it is not possible to start the adaption or if the procedure cannot be successfully completed, fit a new throttle valve control part.
- Repeat adaption of throttle valve control part=>Page 83 .
- If it is not possible to start the adaption or if the procedure cannot be successfully completed, fit a new engine control unit
=>Page 57 .

6 - Testing throttle valve control part (vehicles with cruise control)

6.1 - Testing throttle valve control part (vehicles with cruise control)

Note:

CCS = cruise control system

6.2 - Function

The throttle valve control part also controls the idling speed stabilisation. 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. All adjustments are made via the basic setting function on V.A.G 1551. When there is no electrical signal the throttle valve is moved mechanically to a pre-determined position. The throttle valve positioner is responsible for damping the action of the throttle valve as it closes.

Special tools, testers and auxiliary items

- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Diode test lamp V.A.G 1527
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22

6.3 - Performing adaption of throttle valve control part (vehicles with cruise control)

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

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the written permission of Audi AG.

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

Test conditions

- No faults stored in fault memory



=>Interrogating fault memory, Page 3

- 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 1 .)

Note:

The adaption process for the throttle valve control part will be aborted in the following cases:

- ♦ If the engine is started or if the accelerator is depressed while the adaption process is running.

-> 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 098 and confirm entry with Q key.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted. The copyright holder is Audi AG. No liability is accepted for any damage or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

-> Indicated on display:

System in basic setting	98
x.xxx V x.xxx V	Idling
ADP.runs	

When the Q key is pressed the throttle valve positioner moves to the "Min." position and several intermediate positions, and the control unit records the various throttle valve angles in its non-volatile memory. The throttle valve then remains in the start position for a brief period before closing.

-> Indicated on display:

System in basic setting	98
x.xxx V x.xxx V	Idling
ADP. O.K.	

- Press the→key to terminate the adaption process.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.

Note:

-> If one of the following messages appears on the display, this means that the adaption process has been aborted.

Basic setting	98
x.xxx V x.xxx V	Idling
ADP.n.OK	

Basic setting	98
x.xxx V x.xxx V	idling
ERROR	

Function is unknown or cannot be carried out at the moment

If the adaption process is aborted, the cause could be one of the following:

- ♦ 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 accelerator cable.
- ♦ Battery voltage too low.
- ♦ Throttle valve control part or wiring is defective.

- ♦ The engine was started or the accelerator was depressed while the adaption process was running.

After an interruption the fault "Basic setting not completed, fault in basic setting" is stored in fault memory. When next switching on ignition the basic setting is automatically performed again.

Fault-finding:

- If the adaption process was aborted, proceed as follows:
- Press the =>key.
- Interrogate fault memory.

No-faults recognised

-> If no faults are detected, check whether the idling speed switch opens and closes when the accelerator is depressed.

(Testing idling speed switch=>Page 89 .)

Idling switch does not open
Short to earth

-> If one of the following faults is detected, check whether the idling speed switch opens and closes when the accelerator is depressed.

(Testing idling speed switch=>Page 89 .)

Idling switch does not close
Open circuit

Voltage supply
Signal too small

-> If this fault is displayed, test the voltage supply to the engine control unit (voltage at terminal 30 on engine control unit has dropped below 10 V). Testing voltage supply to engine control unit=>Page 108 .

Throttle valve positioner sender -G127
Signal too small / too great

-> If one of the following faults is displayed, test throttle valve positioner sender -G127 and throttle valve potentiometer -G69=>Page 90 .

Throttle valve potentiometer -G69
Signal too small / too great

Throttle valve positioner sender -
G127
Implausible signal

- Repair faults, then repeat adaption of throttle valve control part.

6.4 - Testing idling speed switch (vehicles with cruise control)

- Select "Read measured value block" (function 08) and Display Group 098=>Page 50 .

-> Indicated on display:

Read measured value block 98
x.xxx V x.xxx V
Idling

Display zone 3 should read "Idling".

- Gradually open throttle valve.

-> Indicated on display:

Read measured value block 98
x,xxx V x,xxx V Part
throt

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.



Display zone 3 should read "Part throt" (part throttle).

- Gradually release throttle valve.

-> Indicated on display:

Read measured value block	98
x.xxx V	x.xxx V
Idling	

Display zone 3 should read "Idling" again.

- 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.
- Measure resistance between sockets 67 and 69 using hand-held multimeter V.A.G 1526.

Specification: continuity (throttle valve closed)

- Open throttle slightly.

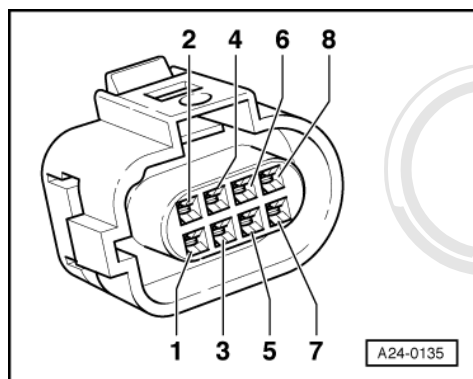
Specification: idling speed switch should open (no continuity)

- If the value is not as specified, test for open circuit in wiring and check for dirt on the contacts. If necessary, clean the contacts and perform adaption process.
- 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 87 .
- If it is not possible to start the adaption of the throttle valve control part or if the procedure cannot be successfully completed, disconnect the throttle cable.
- Repeat adaption of throttle valve control part
=>Page 87 .
- If it is not possible to start the adaption of the throttle valve control part or if the procedure cannot be successfully completed, fit a new throttle valve control part.
- Repeat adaption of throttle valve control part
=>Page 87 .

6.5 - Testing throttle valve positioner sender and throttle valve potentiometer (vehicles with cruise control)

Testing sender voltage readings

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



- Switch on ignition.
- -> Measure voltage between contacts 5 and 2 on the 8-pin plug using hand-held multimeter V.A.G 1526.

Specification: at least 4.8 V

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.

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

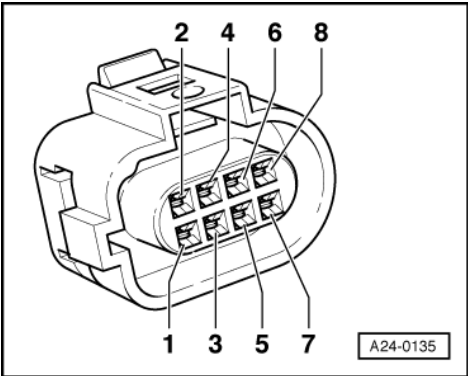
- Start the engine.
- Select "Read measured value block" (function 08) and Display Group 098=>Page 50 .

-> Indicated on display:

Read measured value block	98
4.420 V	3.080 V
Idling	

The values in display zones 1 and 2 should be between 0.5 and 4.9 V.

- If the values are not as specified, switch off the ignition.
- Connect test box V.A.G 1598/22 to the wiring harness for the engine control unit
=> Page 57 .
- 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.

Contact on 8-pin plug (vehicles with CCS)	Contact on test box
1	74
2	67
3	-
4	75
5	62
6	69
7	59
8	66

- Use the multimeter to test the wires for short circuits with each other.
- Rectify any open circuits and remove any dirt from the contacts. Erase fault memory and perform adaption of throttle valve control part=>Page 87 .
- 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 87 .
- If it is not possible to start the adaption of the throttle valve control part or if the procedure cannot be successfully completed, disconnect the throttle cable.
- Repeat adaption of throttle valve control part
=>Page 87 .
- If it is not possible to start the adaption of the throttle valve control part or if the procedure cannot be successfully completed, fit a new throttle valve control part.
- Repeat adaption of throttle valve control part=>Page 87 .
- If it is not possible to start the adaption of the throttle valve control part or if the procedure cannot be successfully completed, fit a new engine control unit=>Page 57 .



7 - Testing auxiliary signals

7.1 - Testing auxiliary signals

7.2 - Testing air conditioner compressor shut-off

Notes:

- ♦ The air conditioner compressor signal informs the engine control unit that the compressor will be switched on in 140 ms.
- ♦ The engine control unit can send a signal via the same wire to shut off the air conditioner compressor.
- ♦ The engine control unit will shut off the air conditioner compressor in the following circumstances:
 - Sharp acceleration (full throttle)
 - In emergency running mode (back-up)
 - If the coolant temperature exceeds 120°C

Test conditions

- Air conditioner functioning properly
- No faults recorded in fault memory of engine control unit
- Interior temperature of more than +15°C

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22
- Connect fault reader V.A.G 1551
=> Page 1.
- Start the engine.
- Read measured value block (function 08) and select Display Group 20.

-> Indicated on display:

Read measured value block	20
1 2 3 4	

- Switch off air conditioner.

Display zone 4 should read "Compr.OFF".

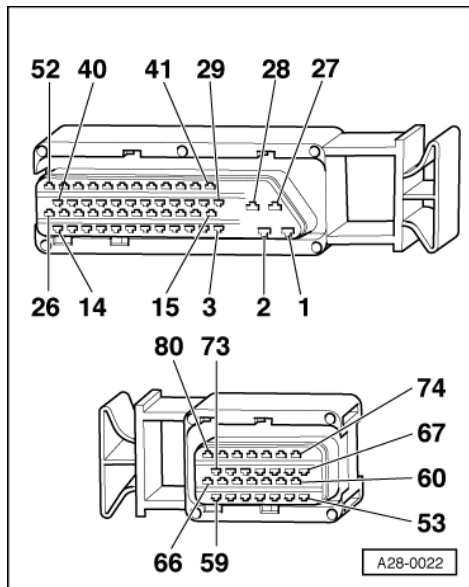
- Switch on the air conditioner by pressing the "Auto" key. The compressor should run.

Display zone 3 should read "A/C-High".

Display zone 4 should read "Compr.ON".

- Floor and release the accelerator quickly (short blip).

When the accelerator is floored quickly, the readout in display zone 4 should jump from "ON" to "OFF" for a few seconds (compressor shut-off during acceleration).



- -> If the display readout is not as specified, switch off the engine and connect test box V.A.G 1598/22 to the wiring harness for the engine control unit => Page 56 .
- Using the current flow diagram, test for open circuit and short to earth or positive in wiring between air conditioner 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.

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

7.3 - 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

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 in respect to the correctness of information in this document. Copyright by AUDI AG.

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22

- Connect fault reader V.A.G 1551
=> Page 1 .
- Start the engine (operating temperature).
- Switch off rear window heating.
- Read measured value block (function 08) and select Display Group 20.

-> Indicated on display:



Read measured value block				20
1	2	3	4	

Display zone 1: Idling speed

Display zone 3: Signal from air conditioner

Display zone 4: Signal from air conditioner compressor

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

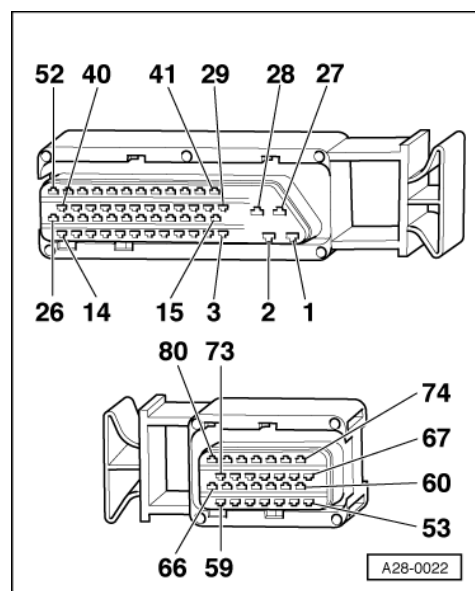
Display zone 4 should read "Compr.ON".

Apart from a brief drop (lasting less than 1 second), the idling speed should remain the same.

If the idling speed does not remain constant, check whether the engine control unit is receiving the signal from the air conditioner.

Display zone 3 should read "A/C-High".

Display zone 4 should read "Compr.ON".



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 for damages and consequences arising from the use of this information.

- -> If the signal is not being received, switch off the engine and connect test box V.A.G 1598/22 to the wiring harness for the engine control unit
=> Page 56.

- Using the current flow diagram, test for open circuit and short to earth or positive in wiring between air conditioner and contact 10 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.

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

7.4 - Testing clutch pedal switch

This signal prevents engine speed fluctuations and load change jolts when the clutch is disengaged. The signal is also required for the cruise control system.

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Diode test lamp V.A.G 1527
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22

- Select "Read measured value block" (function 08) and Display Group 019=>Page 46 .

-> Indicated on display:

Read	measured	value	block	19
1	2	3	4	

- Check display in display zone 3.

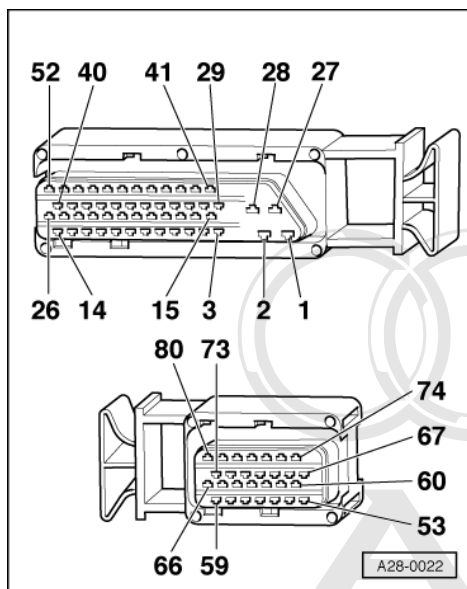
Specification: X X 1 = clutch pedal not depressed

- Depress clutch pedal.

Specification: X X 0 = clutch pedal depressed

Value: X = (no meaning)

- If the readout on the display is not as specified, unplug the connector from the clutch pedal switch.
- Switch on ignition.
- Connect diode test lamp V.A.G 1527 between engine earth and contact 1 on the connector.



Specification: The diode test lamp should light up.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized 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.

- If diode test lamp does not light up, test the fuse and test for open circuits in wiring from contact 1. Repair any faults.

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

- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=>Page 56 .
- Test for open circuit and short circuit in wiring between contact 9 on engine control unit and contact 2 on connector for clutch pedal switch.

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



7.5 - Testing power steering pressure switch

The power steering pressure switch is used to stabilise the idling speed when the steering wheel is at full lock (left or right).

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22

- Select "Read measured value block" (function 08) and Display Group 019=>Page 46 .
- Start the engine.

-> Indicated on display:

Read measured value block	19
1 2 3 4	

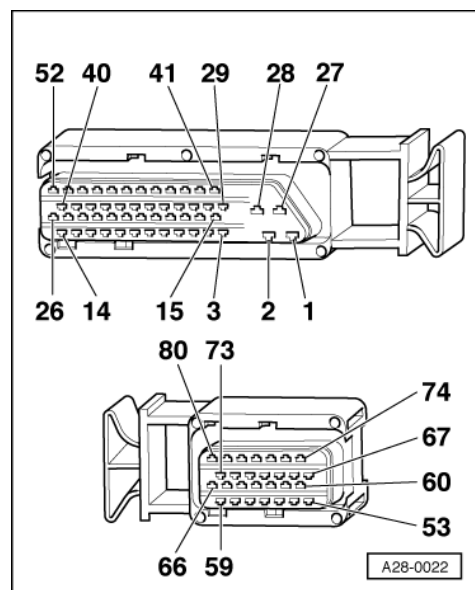
- Check display in display zone 3.

Specification: 1 X X = no signal from power steering pressure switch

- Turn steering wheel to full lock (left or right).

Specification: 0 X X = signal from power steering pressure switch

Value: X = (no meaning)



- -> If the readout on the display is not as specified, connect test box V.A.G 1598/22 to wiring harness for engine control unit => Page 56 .
- Test the following wiring connections for open circuits or short circuits to positive or earth and rectify if necessary:

Contact on connector for pressure switch	Test box V.A.G 1598/22 or -J220
1	49
2	14



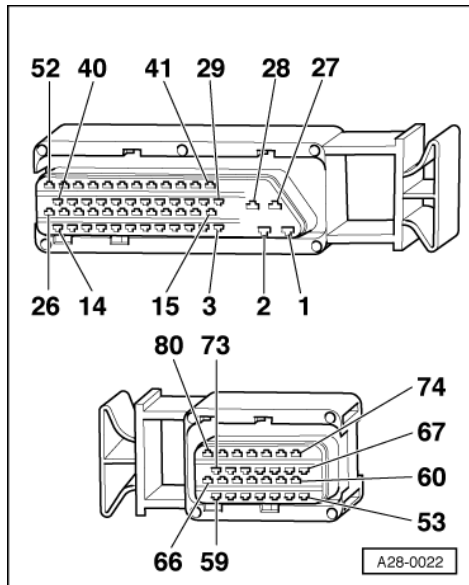
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

7.6 - Checking engine speed signal

Note:

The engine speed signal is taken from contact 6 on the engine control unit. This signal is required for the rev counter on the dash panel insert and for other control units.

Special tools, testers and auxiliary items



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.

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22
- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=>Page 56 .
- 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

7.7 - Testing speed signal

Notes:

- ◆ The road speed signal is produced by the road speed sender and 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.

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22
- Connect fault reader V.A.G 1551
=> Page 1 .
- Switch ignition on.



- Select "Read measured value block" (function 08) and Display Group 011.

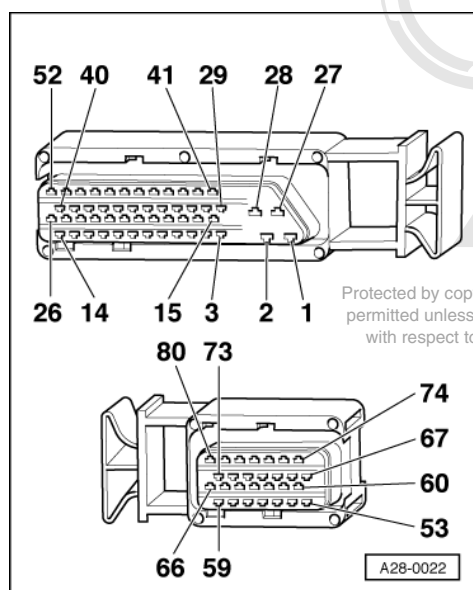
-> Indicated on display:

Read measured value block	11
1 2 3 4	

Important:

Secure fault reader to rear seat and operate from this location. When doing this, always observe the relevant safety precautions => Page 52 .

- Take vehicle for a test drive and check whether the road speed appears in display zone 3.
- If the road speed is not displayed, lift vehicle at the front left until the wheel is off the ground.



- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=>Page 56 .
- Connect diode test lamp between socket 3 (positive) and socket 20 (signal).
- Switch on the ignition and turn the front left wheel by hand.
- The diode test lamp should flash (very brief flashes).

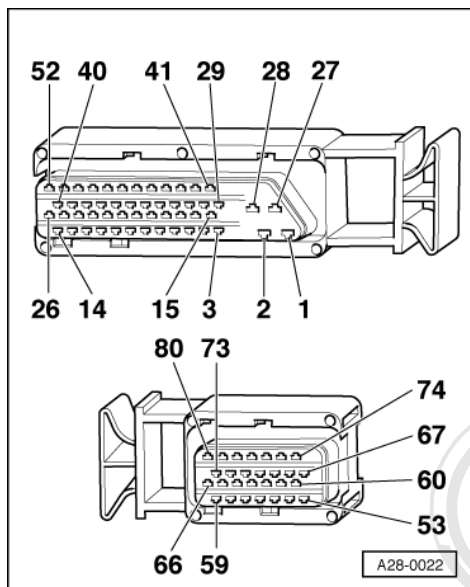
Note:

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

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

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

- The wiring connection to the gearbox control unit is monitored by the gearbox self-diagnosis (fault code 00545).



- ➔ If no torque reduction is displayed on the measured value block during a gearshift, or if fault code 00545 appears (on the gearbox control unit), connect test box V.A.G 1598/22 to the wiring harness for the engine control unit.
=> Page 56
- Test for open circuits or short circuits in the wiring between the gearbox control unit and contact 23 on the engine control unit.

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

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.

7.8 - Testing data exchange between Motronic, ABS and gearbox (CAN bus)

The fault table indicates that the CAN bus has to be tested.

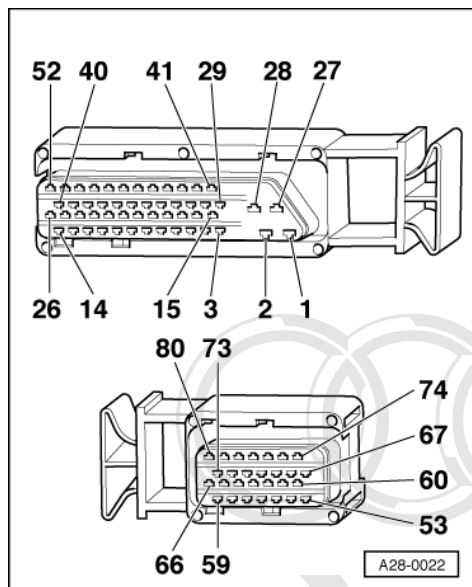
Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22

- Interrogate fault memories of ABS control unit and gearbox control unit.

If a fault relating to the CAN bus is indicated:

- Switch off ignition.



- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit=>Page 56 .
- Test for open circuit or short circuit in wiring between gearbox control unit, ABS control unit and contacts 29 and 41 on engine control unit.

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

Information in this document is for informational purposes only. It is not intended to be used for any other purpose. The use of this document is 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.

- If the wiring is OK, try to locate the fault by replacing first the ABS control unit, then the gearbox control unit and finally the engine control unit, one after the other.

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, the following must be noted:

- ◆ 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 for 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	AGN
Engine speed sender	Resistance approx. 450...1000 ω
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	Tightening torque 30 Nm
Spark plug connectors	Resistance approx. 5 kw
Firing order	1-3-4-2
Maximum engine speed limited by Motronic: Cut-off speed	6800 $\pm$ 40 rpm

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

Fitting location => Page 54 .

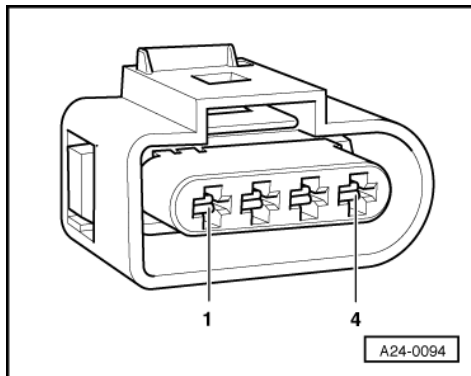
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Note:

The ignition coils and the output stage are combined as a single component.

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Diode test lamp V.A.G 1527
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22



- Unplug 4-pin connector from ignition coils.

Testing earth connection to output stage

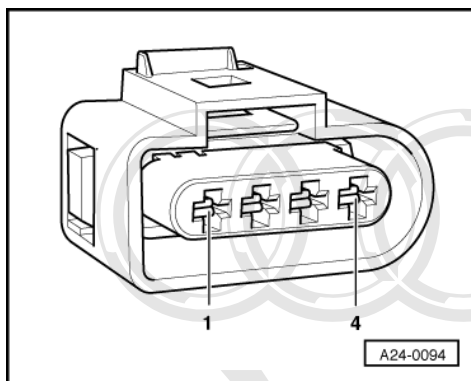
- -> Connect diode test lamp V.A.G 1527 between battery positive terminal and contact 4 (earth) of the connector. The diode test lamp should light up.
- If the diode test lamp does not light up, test wiring using current flow diagram and rectify any open circuits.

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

Testing power supply to ignition coils

Test requirement:

- Fuse for ignition coils must be 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.

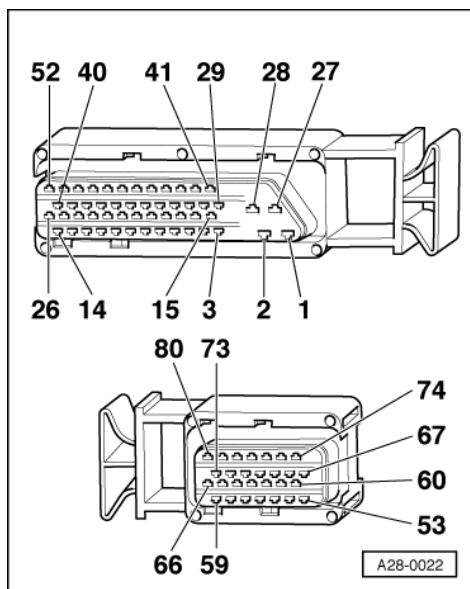
- If specified results are not obtained, test for open circuit using current flow diagram. Rectify any open circuits and test the fuse.

This document is a technical specification of Audi AG. It is not intended to be used for any other purpose. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by Audi AG.

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

Testing activation

- Unplug connectors from all 4 injectors.
- Switch ignition on.
- Connect diode test lamp V.A.G 1527 between engine earth and contact 1, then between engine earth and contact 3.
- Operate the starter for a few seconds in each case. The diode test lamp should flash each time.



- -> If the diode test lamp does not flash, test for open circuits or short circuits in wiring between connector and engine control unit using current flow diagram. (Connect test box V.A.G 1598/22 to wiring harness for engine control unit.)
- 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 to earth are found, fit a new engine control unit.
=> Page 57

1.5 - Checking intake air temperature sender

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without express authorisation 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.

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22
- Read measured value block, Display Group 003, engine cold and not running=>Page 37 .

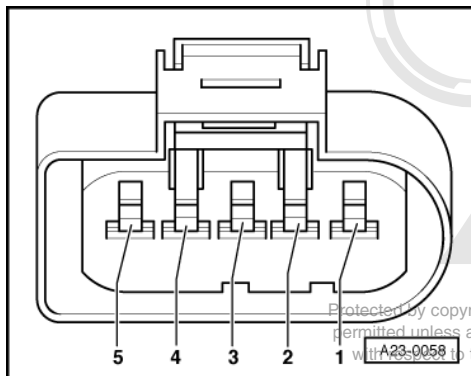
-> Indicated on display:

Read measured value block 3
0 rpm 12.8 V 15.9 5C 16.7
5C

- Check display in display zone 4.

If an implausible value is displayed:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 56 .
- Disconnect connector for air mass meter
=>Fitting locations overview, Page 54 .



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.

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

5-pin connector on wiring harness, contact	Test box V.A.G 1598/22, socket
1	40
3	12

- Rectify any open/short circuit as necessary.
- If the wiring is OK but the display values are still implausible, fit a new air mass meter.

1.6 - Checking engine speed sender

Fitting location of sender and connector

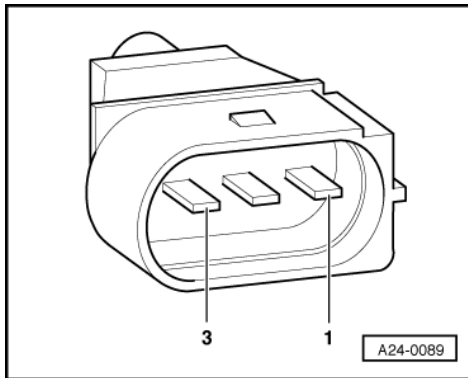
=> Page 54 .

Note:

- ♦ The engine speed sender is a combined speed sender and reference mark sender. Without a signal from the -G28 the engine cannot be started. If the signal from the -G28 fails while the engine is running, the engine will cut out immediately.
- ♦ For testing the operation of the engine speed sender, see also "Reading measured value block", Display Group 003, display zone 1.

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22
- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.



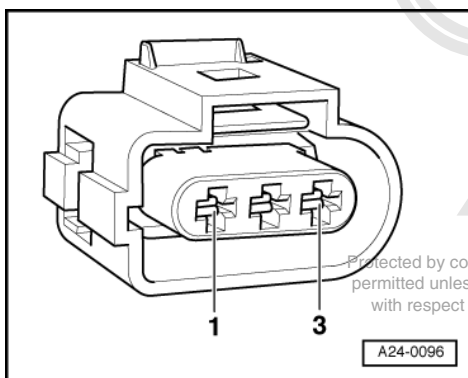
- Unplug connector for engine speed sender (grey connector).
- ➔ Connect hand-held multimeter V.A.G 1526 (resistance test range) to contacts 2 and 3 on connector in connector support bracket using test lead from V.A.G 1594.

Specification: approx. 450...1000 ω

- 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 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.
- 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 56.



- ➔ Test continuity of screening from contact 1 on sender connector to socket 67 on test box.

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 do not match the specifications, rectify short circuits or open circuits between sender connector and connectors on engine control unit.



Contact on sender connector	Contact on control unit connector
1	67
2	63
3	56

- If no open circuits or short circuits are found, fit a new engine control unit =>Page 57 .

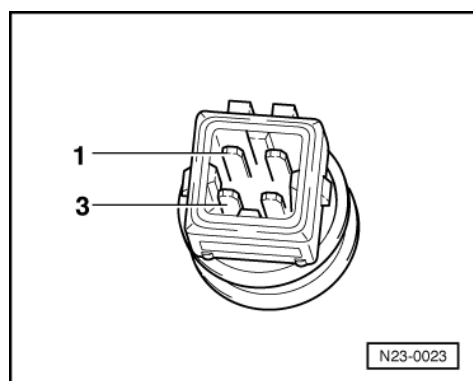
1.7 - Testing coolant temperature sender

Notes:

- ♦ For testing the operation of the coolant temperature sender, see also "Reading measured value block", Display Group 003, display zone 3.
- ♦ Fitting location of coolant temperature sender
=> Page 54 .

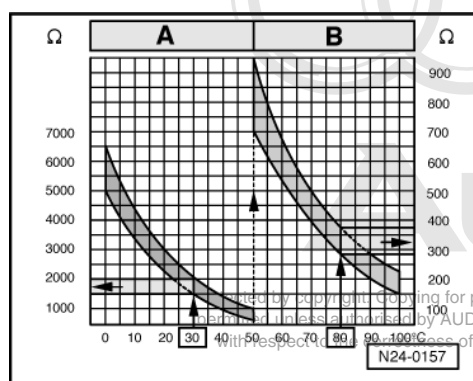
Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ♦ Adapter set V.A.G 1594



- ♦ Test box V.A.G 1598/22

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



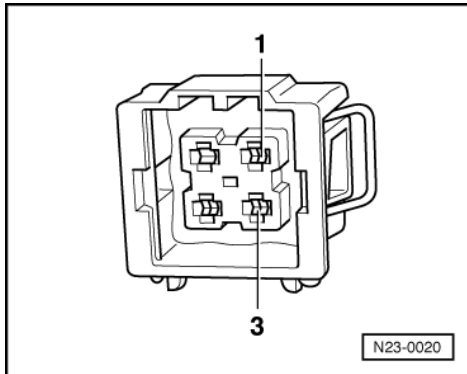
-> Area A shows resistance values for temperature range 0...50°C and area B the values for temperature range 50...100°C.

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 **56**



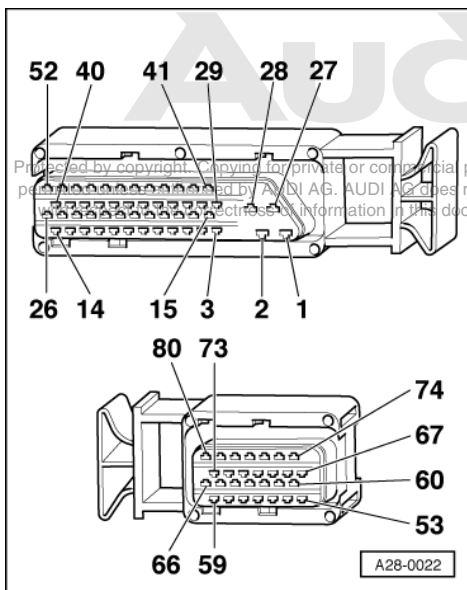
- -> Test for open circuit in earth wire between contact 1 on coolant temperature sender connector and socket 67 on test box.

Specification: max. 1 ω .

- Test for open circuits in signal wire between contact 3 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	67
3	53

- If there are no short circuits or open circuits and the coolant temperature sender is OK, fit a new engine control unit.
=> Page 57

1.8 - Checking control unit voltage supply

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:

For testing the voltage supply to the engine control unit, see also "Reading measured value block", Display Group 003, display zone 2.

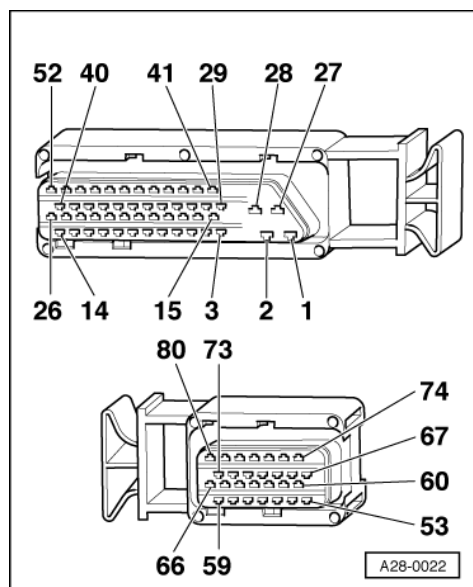
Test requirements:

- Fuse for engine control unit OK
- Battery voltage at least 11 V
- Alternator OK

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
 - ♦ Diode test lamp V.A.G 1527
 - ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
 - ♦ Adapter set V.A.G 1594
 - ♦ Test box V.A.G 1598/22
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=> Page 56
 - Switch ignition on.
 - Connect diode test lamp V.A.G 1527 to socket 1 (live positive supply via ignition switch) and earth.

Specification: The diode test lamp should light up.



- -> If the diode test lamp does not light up, test for open circuits using the current flow diagram and rectify if necessary.

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

- If diode test lamp V.A.G 1527 lights up, connect diode test lamp to socket 1 (live positive supply via ignition switch) and socket 2 (earth connection).

Specification: The diode test lamp should light up.

- If the diode test lamp does not light up, test wiring using current flow diagram and rectify any open circuits.

=> 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.

Specification: The diode test lamp should light up.

- If the diode test lamp does not light up, test wiring between central electrics and contact 3 on control unit connector using the current flow diagram. Rectify any open circuits.

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

1.9 - Testing knock sensors

Notes:

- ◆ To test the operation of the knock sensors, use the function "Read measured value block", Display Groups 012, 013, 014 and 015.
- ◆ Fitting locations of plug connectors and knock sensors
=> Page 54.
- ◆ It is not possible to carry out an electrical test of the knock sensors themselves. The test is performed using the function "Interrogate fault memory"=>Page 3.
- ◆ 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.

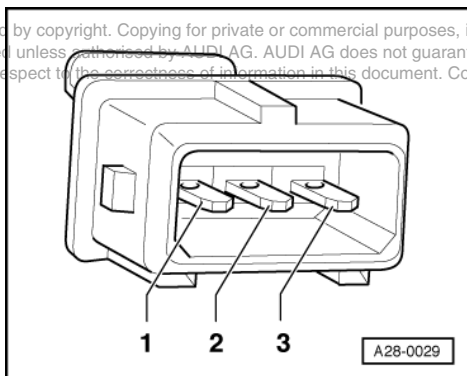
Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ◆ Adapter set V.A.G 1594
- ◆ Test box V.A.G 1598/22

Testing knock sensor wiring

- Unplug the connector for the relevant knock sensor in the engine compartment.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized 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.



- -> Test for short circuits between all three contacts in the knock sensor connector. There must be no connection between any of the wires.

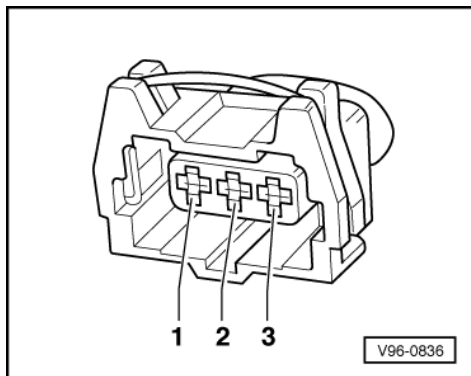


- If there is a connection between the contacts, fit a new knock sensor.

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 **56**.
- Using the current flow diagram, test for continuity and short circuits in the wiring between the sender and engine control unit.

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



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.

-> 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) from contact 3 on connector in engine compartment to socket 67 on test box.

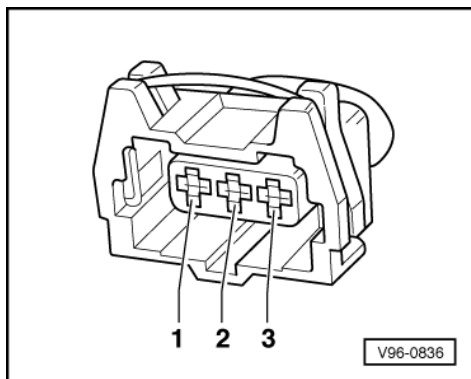
Specification: max. 1 ω .

- Test continuity of signal wire of knock sensor 2 (-G66) from contact 1 on connector in engine compartment to socket 60 on test box.

Specification: max. 1 ω .

- Test continuity of earth wire of knock sensor 2 (-G66) from contact 2 on connector in engine compartment to socket 67 on test box.

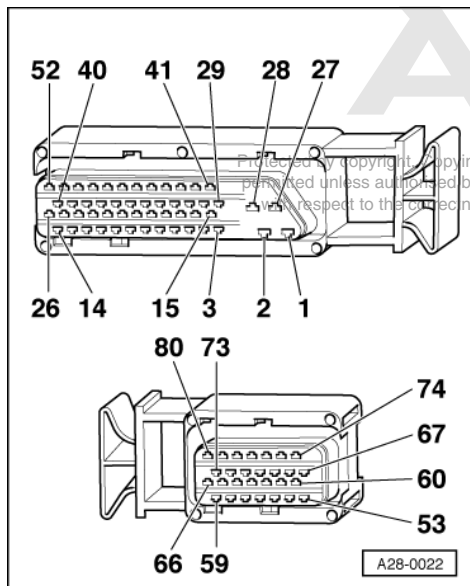
Specification: max. 1 ω .



- Test continuity of screening on wiring for knock sensor 2 (-G66) from contact 3 on connector in engine compartment to socket 67 on test box.

Specification: max. 1 ω .

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



- -> Knock sensor 1

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

- Knock sensor 2

Contact on connector for sensor	Contact on control unit connector
1 (signal)	60
2 (earth)	67
3 (screening)	67

1.10 - Checking Hall sender

Fitting location of Hall sender => Page 54 .

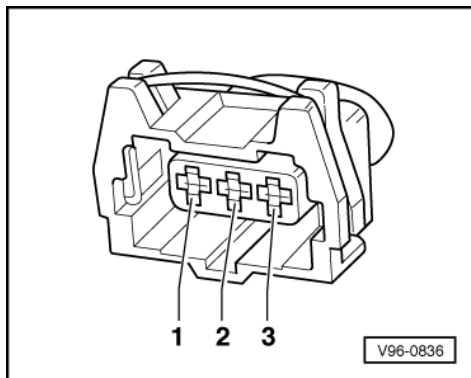
Notes:

- ◆ Under normal operating conditions the signal from the Hall sender tells the engine control unit the ignition position for cylinder 1.
- ◆ 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 injection system is one revolution out of phase does not have any noticeable effect. If this happens, 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 engine revolution, and not after alternate revolutions as is normally the case.

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Diode test lamp V.A.G 1527
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22



- -> Connect diode test lamp V.A.G 1527 to contacts 1 and 2 of the Hall sender connector from behind (without unplugging the connector from the Hall sender).

Note:

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

- Operate starter for a few seconds.
- The diode test lamp should flash briefly after every second revolution of the engine.
- Unplug connector from Hall sender.
- Switch ignition on.
- Connect hand-held multimeter V.A.G 1526 to contacts 1 (positive) and 3 (earth) of the Hall sender connector.

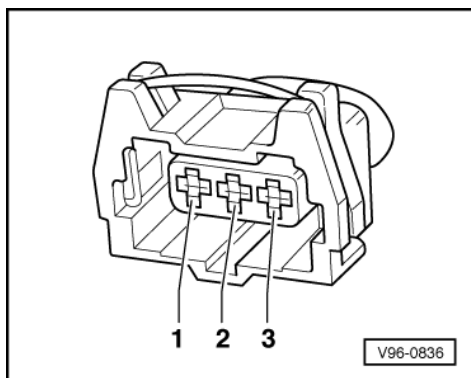
Specification: 4.5 ... 5.5 V

- Connect hand-held multimeter V.A.G 1526 to contacts 2 and 3 of the Hall sender connector.

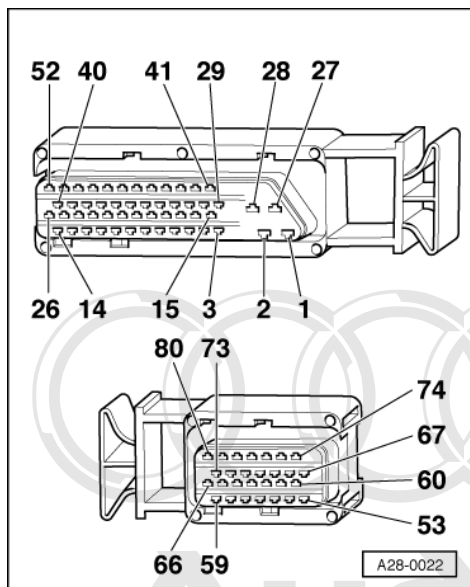
Specification: approx. battery voltage

- If the voltage readings match the specifications but the diode test lamp does not flash, fit a new Hall sender.
- If the voltage readings do not match the specifications, test the wiring as follows:
- Connect test box V.A.G 1598/22 to the wiring harness for the engine control unit.

=> Page 56



- -> Test the wiring from the Hall sender...



- -> ... to the engine control unit for open circuits and short circuits 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 all the test results so far have been OK but a fault related to the camshaft sensor (Hall sender) is displayed again after erasing the fault memory as a test measure, the cause may be as follows:
 - Rotor aperture for Hall sender misaligned
 - Unbolt Hall sender, then check to ensure that the rotor ring is correctly aligned on the camshaft. If incorrectly installed, the catch will be pressed flat when the securing screw is tightened.
 - If the rotor ring is correctly aligned, check the position of the camshaft in relation to the crankshaft.

=> 4-Cylinder engine (5-valve), Mechanics; Repair group 15; Cylinder head, valve gear; Removing and installing camshafts and camshaft adjuster
Cylinder head, valve gear Removing and installing camshafts and camshaft adjuster

Note on signal testing with an oscilloscope:

The centre point of the window of the Hall sender must lie on the third downwards side of the engine speed signal after the reference mark gap.

2 - Testing camshaft timing control

2.1 - Testing camshaft timing control

Testing operation

The timing of the inlet camshaft is controlled according to engine load and engine speed. The electrically operated camshaft adjustment valve transmits oil pressure to the mechanical camshaft adjuster as required.

Test conditions

- Engine temperature at least 80°C



Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- Run engine at idling speed.
- Select "Read measured value block" (function 08) and Display Group 025=>Page 49 .

-> Indicated on display:

Read measured value block 25			
1	2	3	4

- Check readout in display zone 3.

Specification: X X 0

Camshaft timing control is not activated.

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.

Important:

Secure fault reader to rear seat and operate from this location. When doing this, always observe the relevant safety precautions => Page 52 .

- Take the car for a test drive.
- Accelerate from a low speed (1000 rpm) in 2nd gear at full throttle.
- Increase the engine speed by pressing sharply on the accelerator and watch the readout in display zone 3.

-> Indicated on display:

Read measured value block 25			
1	2	3	4

Specification: X X 1

Value X = (no meaning)

Camshaft timing control is activated.

Note:

Display zone 4 will show whether the position of the camshaft has in fact changed.

Specification without adjustment: -3.0 to 3.0° crankshaft angle

Specification with adjustment: 15.0 to 22.0° crankshaft angle

- If the values do not match the specifications, test the camshaft adjustment valve => Page 114 .

2.2 - Testing solenoid valve for camshaft adjustment

Fitting location of solenoid valve =>Page 54 .

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Diode test lamp V.A.G 1527
- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3
- ♦ Adapter set V.A.G 1594
- ♦ Test box V.A.G 1598/22
- Switch ignition on.

- Start final control diagnosis and select camshaft timing control => Page 23 .

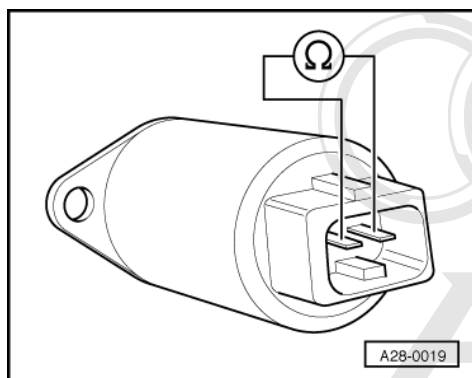
-> Indicated on display:

Final control diagnosis
Camshaft timing control 1

When the camshaft timing control is activated the solenoid valve should click audibly.

If the valve does not click, switch off the ignition.

- Unplug connector from solenoid valve -N205.



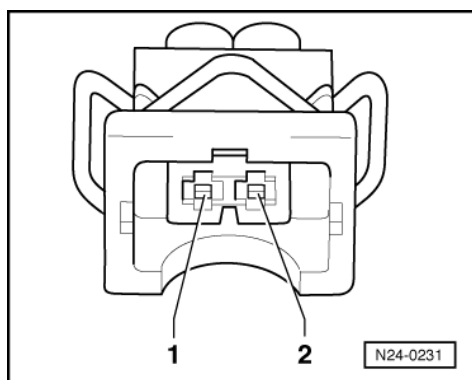
- -> Measure the resistance between the solenoid valve contacts using V.A.G 1526.

Specification: 12 ...16 Ω . 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.

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

Testing power supply to camshaft adjustment valve -N205

- Unplug connector on solenoid valve -N205.



- -> Connect diode test lamp V.A.G 1527 to contact 1 on connector and to engine earth using auxiliary leads from V.A.G 1594.
- Operate starter for a few seconds. The engine can be allowed to start.

Specification: The diode test lamp should light up.

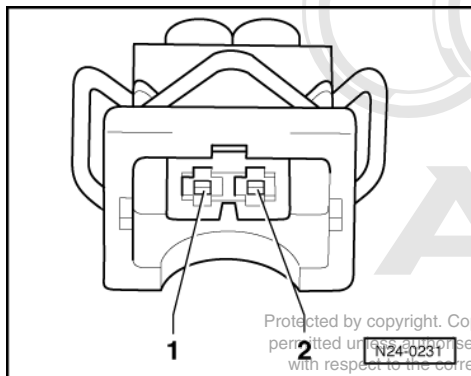
If the diode test lamp does not light up, carry out the following tests:

- Test fuse for camshaft adjustment valve.
- Test for open circuit in wiring between contact 1 of connector for camshaft adjustment valve and fuse.

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

- Test fuel pump relay and activation
=> Page **65** .

Testing activation of camshaft timing control



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.

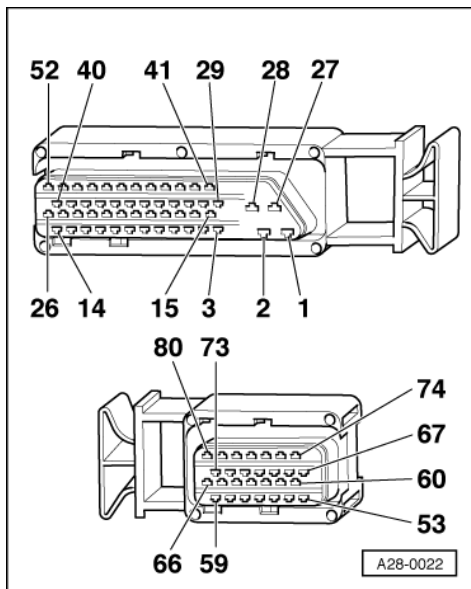
- -> Connect diode test lamp V.A.G 1527 to contact 1 (positive) and contact 2 on valve connector using auxiliary leads from V.A.G 1594.
- Start final control diagnosis and select camshaft timing control => Page **23** .

-> Indicated on display:

Final control diagnosis
Camshaft timing control 1

When the camshaft timing control is activated the diode test lamp should start flashing.

- 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 **56** .



- -> If the diode test lamp lights up continuously, test for short to earth in wiring between contact 2 on connector and contact 55 on test box

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

- If the diode test lamp does not flash, test for open circuit and short to positive in wiring between contact 2 on connector and contact 55 on test box.

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

- Rectify any short circuits to earth or open circuits if found.
- If no short circuits or open circuits are found, fit a new engine control unit => Page **57** .
- If the wiring connections are OK, fit a new mechanical camshaft adjuster

=> 4-Cylinder engine (5-valve), Mechanics; Repair Group 15; Cylinder head, valve gear; Removing and installing camshafts and camshaft adjuster. Cylinder head, valve gear Removing and installing camshafts and camshaft adjuster.



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.