



Audi A4 1995 ➤

Motronic Fuel Injection and ignition system (4-cyl.)							
07.96 ➤							
Engine ID	ADR	AFY					

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Edition 07.1996

List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi A4 1995 ➤

Motronic Fuel Injection and ignition system (4-cyl.) 07.96 ➤

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system



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

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01 - Self-diagnosis

1 - Self-diagnosis

1.1 - Self-diagnosis

1.2 - Technical data of self-diagnosis

Equipment

- ◆ Fault memory: Permanent and volatile memory¹⁾
- ◆ Rapid data transfer

1) Will be cancelled after 50th engine start if fault has not occurred again.

Available functions

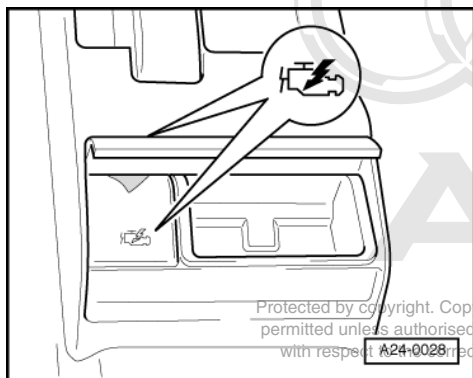
Function	Ignition switched on	Engine idling
01 Interrogating control unit version	x	x
02 Interrogating fault memory	-	x
03 Final control diagnosis	x	-
04 Starting basic setting	x	x
05 Erasing fault memory	x	x
06 End of output	x	x

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Function	Ignition switched on	Engine idling
07 Encoding control unit	x	x
08 Reading measured value block	x	x

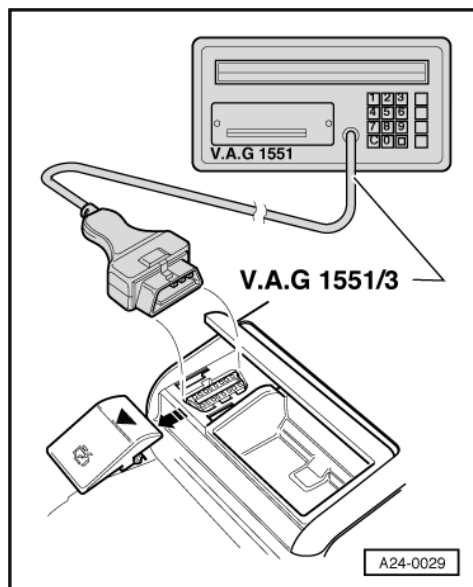


1.3 - Connecting fault reader V.A.G 1551 and selecting engine electronics control unit



Test conditions

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



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

-> Indicated on display:

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

* Appears alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on the function required:

- Switch on ignition
- or
- Start engine => Page 1, "Selectable functions" table.
- Switch on printer with the print switch (warning lamp in button lights up).
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

Rapid data transfer HELP
Enter address word XX

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Rapid data transfer Q
01 - Engine electronics

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

-> If the display shows one of the messages shown, run through the fault finding procedure as described in the diagnosis management Fault Finding Programme.

Rapid data transfer HELP
Control unit does not answer

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

Rapid data transfer HELP
Communication problem

Rapid data transfer HELP
K wire not switching to earth

Rapid data transfer HELP
K wire not switching to positive

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

8D0907557.. 1.8L R4/5V MOTR AT
D.. □
Coding 04031 WSC 12345

- 8D0907557.. Control unit number (see also spare parts programme)
 - 1.8L Engine capacity
 - R4/5V In line engine, 4 cylinders, 5 valves
 - MOTR Motronic
 - HS Manual gearbox
 - AT Automatic gearbox
 - D.. Data status (software version) of control unit
 - Coding 04031 Coding of control unit
 - WSC 12345 Workshop Code from V.A.G 1551 used to perform the last encoding

- Press the =>key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX



1.4 - Interrogating and erasing fault memory

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

Only if 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 "Interrogate fault memory" function and confirm entry with Q key.

-> The display shows the number of stored faults or "No fault recognised".

X faults detected

If no fault is stored:

- Press the ➡key.

If one or more faults are stored:

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

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- Locate and eliminate faults listed on printout as per fault table => Page 4.
- Press keys 0 and 5 for the function "Erase fault memory" and confirm entry with Q key.

-> Indicated on display:

Rapid data transfer
Fault memory is erased.

Note:

If the ignition is switched off between interrogating the fault memory and erasing the fault memory, then the fault memory will not be erased.

- 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.

1.5 - Fault table

Note:

- ♦ The fault code 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 the current flow diagram. This is particularly relevant for faults recorded as "occurring sporadically" (SP).

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
------------------------------	---------------------------	------------------	--------------

00515 Hall sender G40 Open circuit / short to positive	- Open circuit or short circuit to positive - Sensor disc out of position - G40 defective	- No engine power at full throttle - Exhaust emission values not OK - High fuel consumption	- Checking Hall sender =>Page 86
Short circuit to earth	- Short circuit to earth - G40 defective		
00532 Supply voltage Signal too high	- Excess voltage from assisted start - Alternator defective	- Damage to the engine control unit	- Check battery voltage

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
00532 Supply voltage Signal too small	- Voltage supply less than 10 V for more than 1 second - Poor wiring to engine control unit - Battery discharged - Current drain with ignition off	- Engine will not start - Various performance problems culminating in engine cutting out - Learning procedure for throttle valve control unit not possible	- Check supply voltage for engine control unit => Page 71 - Check battery charge level
00543 Maximum revs exceeded	- Engine over revving (e.g. wrong gear engaged) - Engine speed above 7100 rpm	- Possible engine damage	- Rectify mechanical damage

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
00561 Mixture adaptation Adaptation limit (add) exceeded	- Fuel system pressure too low	- Vehicle bucking	- Fill up vehicle, check fuel system pressure => Page 41
Adaptation limit (mul) exceeded	- Incorrect signal from air mass meter	- Increased fuel consumption	- Check air mass meter => Page 75
	- Leaks in exhaust system as far as catalytic converter	- Possibly rough idling	- Rectify leaks
	- Unmetered air downstream of air mass meter	- Vehicle bucking	
	- Coked injectors		- Checking injection quantity => Page 43

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
00561			



Mixture adaptation Adaptation limit (add) not reached	- Fuel pressure too high	- Jolting may occur	- Fill up vehicle, check fuel system pressure => Page 24-14
Adaptation limit (mul) not reached	- Incorrect signal from air mass meter - Fuel in engine oil (possibly due to short journeys) - Injectors leaking	- Increased fuel consumption - Poor idling may occur - Formation of black smoke, soot deposits on spark plugs	- Check air mass meter => Page 24-69 - Drive vehicle on a motorway for 15 minutes or change oil Read measured value block, Display Group 8 => Page 01-71 - Check injection quantity => Page 24-18

Note:

- ♦ add = additive, i.e. fault only has an effect during idling.
- ♦ (mul) = multiplicative, i.e. fault occurs throughout the entire engine speed range and load range.

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Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
00670 Sensor for throttle valve actuator - G127			
Signal too small	- Short circuit to earth - Fault in power supply to -G127 - -G127 defective	- Idling speed too high - No idling speed control - Load change jolt on accelerator release	- Perform adaptation of the throttle valve control unit => Page 65
Signal too high	- Open circuit or short circuit to positive - Fault in earth supply to -G127 - -G127 defective	- Air conditioning compressor only activated at high engine speeds	- Check throttle valve control unit => Page 65
Implausible signal	- Throttle valve sticking - Fault in line connection to -G127		

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
01119 Gear recognition signal Open circuit / short to positive	- Open circuit or short circuit to positive - -F125 defective	- Brief and slightly more pronounced engine speed fluctuations when engaging or disengaging a gear	- Check wiring to -F125 multifunction switch => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
Short circuit to earth	- Short circuit to earth - -F125 defective		- Interrogate fault memory for gearbox => Automatic Gearbox 01M; Repair Group 01; Self-diagnosis, Electrical check; Perform self-diagnosis Self-diagnosis, Electrical check; Perform self-diagnosis

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
01120 Camshaft adjustment 1 Mechanical fault	- Oil pressure too low		- Check oil pressure => Mechanical; Repair Group 17; Remove and re-fit lubrication system components. Remove and re-fit lubrication system components.
	- Mechanical camshaft adjuster is defective	- Poor performance	- Renew camshaft adjuster => Mechanical; Repair Group 15; repair valve gear; remove and refit camshaft adjuster. repair valve gear; remove and refit camshaft adjuster.

Note on fault code 01120:

Fault is only stored 1 minute after starting and at a coolant temperature of more than 60°C.

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Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
01165 Throttle control unit -J338 Control limit not reached	- Throttle valve sticking - Positioner mechanism sticking	- High idling speed - Load change jolt on accelerator release	- Check throttle valve control unit => Page 65
Control limit exceeded			
Regulating difference	- Open circuit to throttle valve actuator (V60)		- Check throttle valve actuator => Page 70

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
01182 Altitude adaption Signal outside tolerance	- Throttle valve potentiometer (G69) defective	- Starting problems - Poor throttle response - Starting problems	- Check throttle valve potentiometer => Page 67
	- Incorrect throttle valve control unit fitted		- Check spare part reference number
	- Unmetered air - Air cleaner blocked		- Test intake system

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
01247 Solenoid valve 1 for activated charcoal filter -N80 Short circuit to earth	- Short circuit to earth - -N80 defective	- Possibility of bucking in part load range	- Check solenoid valve 1 for active carbon canister => Page 63
	Short circuit to positive	- Car may smell of petrol	



Output open.	- Use current flow diagram - -N80 defective		
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Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
01249 Injector, cylinder 1 -N30			
01250 Injector, cylinder 2 -N31			
01251 Injector, cylinder 3 -N32			
01252 Injector, cylinder 4 -N33			
Short circuit to earth	- Short circuit to earth - Injector defective	- Irregular engine running - Engine stops	- Checking injectors => Page 46
Short circuit to positive	- Short circuit to positive - Injector defective		
Output open.	- Use current flow diagram - Injector defective		

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
01259 Fuel pump relay -J17. Open/short circuit to earth	- Use current flow diagram - Fuel pump relay - -J17 defective	- Engine will not start - Engine stops - Several faults may be recorded	- Check fuel pump relay => Page 49
	- Short circuit to earth	- Fuel pump runs continuously when ignition is on	
Short circuit to positive	- Short circuit to positive	- Engine will not start - Engine stops - Several faults may be recorded	

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16486 Air mass meter -G70 Signal too small	- Open circuit or short to earth - -G70 defective	- Scarcely perceptible change in performance	- Check air mass meter => Page 75
	- Unmetered air - Air cleaner blocked		- Test intake system
16487 Air mass meter -G70 Signal too high	- Open circuit or short to positive - -G70 defective	- Scarcely perceptible change in performance	- Check air mass meter => Page 75

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16496 Sensor for intake air temperature - G42			

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
Signal too small	- Short circuit to earth - -G42 defective	- Emergency operation (substitute value constant +19.5°C)	- Check sensor for intake air temperature => Page 74
16497 Sensor for intake air temperature - G42 Signal too high	- Open circuit or short circuit to positive - -G42 defective	- Emergency operation (substitute value constant +19.5°C)	- Check sensor for intake air temperature => Page 74

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16500 Coolant temperature sender - G62 Implausible signal	- Moisture or corrosion in connector plug - Loose contact - -G62 defective	- Cold start problems at very low temperatures - Engine running problems when warm	- Check sensor for coolant temperature =>Page 73
16501 Coolant temperature sender - G62 Signal too small	- Short circuit to earth - -G62 defective	- Increased fuel consumption - Emissions not OK	
16502 Coolant temperature sender - G62 Signal too high	- Open circuit or short to positive - -G62 defective		

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16505 Throttle valve potentiometer - G69 Implausible signal	- Moisture or corrosion on plug connector - -G69 defective	- Jolting on acceleration - Rough idling	- Check throttle valve potentiometer => Page 67
16506 Throttle valve potentiometer - G69 Signal too small	- Open circuit or short to earth - -G69 defective	- Jolting on acceleration - Load change jolt on accelerator release	- Check throttle valve potentiometer => Page 67
16507 Throttle valve potentiometer - G69 Signal too high	- Open circuit or short to positive - -G69 defective	- Jolting on acceleration - Load change jolt on accelerator release	- Check throttle valve potentiometer => Page 67

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16514			



Bank 1, probe 1 Electr. fault in circuit	- Corrosion due to moisture on connector - Short circuit between signal line for lambda probe and reference earth wire for lambda probe	- Lambda control not working (mixture formation is controlled)	- Check lambda probe signal line and actuation => Page 56
	- Signal line amplitude too small (lambda probe contaminated or probe slot clogged, dirty)	- Rough idling - Emissions not OK - Increased fuel consumption	- Check lambda control => Page 53

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16515 Bank 1, probe 1 Voltage too low	- Short to earth or short to screening in lambda probe signal line - Short to earth or short to screening in lambda probe reference earth line	- Lambda control not working (mixture formation is controlled) - Rough idling - Emissions not OK - Increased fuel consumption	- Check lambda probe signal line and actuation => Page 56
16516 Bank 1, probe 1 Voltage too high	- Short to positive in signal wire		

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16518 Bank 1, probe 1 No activity	- Short to earth in reference earth line - Lambda probe defective (dirty)	- Rough idling - Emissions not OK	- Check lambda control => Page 53
	- Lambda probe heating not functioning	- Increased fuel consumption - Soot on spark plugs	- Check lambda probe heating => Page 55
16519 Bank 1, probe 1 Electrical fault in heating circuit	- Line break or short circuit	- Lambda probe heating not functioning	- Check lambda probe heating => Page 55

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16705 Engine speed sender -G28 Implausible signal	- Sensor disc loose or bent	- Poor starting - Engine misfiring	- Remove oil sump and test sender disc
	- -G28 defective - Loose contact - Open circuit in screening		- Check engine speed sensor => Page 72
16706 Engine speed sender -G28			

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No signal	- Line break or short circuit - G28 loose or defective	- Engine will not start - Engine cuts out	- Check engine speed sensor => Page 72
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Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16711 Knock sensor 1 -G61 16716 Knock sensor 2 -G66 Signal too small	- Knock sensor loose or corrosion on connector - Open circuit or short to earth - Knock sensor defective	- High fuel consumption - Poor performance	- Tightening torque for knock sensor: 20 Nm - Check knock sensor => Page 84

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
16885 Vehicle speed signal Implausible signal	- Open circuit between - G22 speedometer sensor and dash panel insert - Open circuit between dash panel insert and engine control unit - G22 defective - Dash panel insert defective.	- Engine control unit does not deactivate air conditioner compressor - Poor load change performance	- Check speed signal => Page 80
16989 Control unit faulty	- Engine control unit defective	- Engine will not start	- Replace engine control unit => Page 38

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17733 Knock control, cyl. 1 17734 Knock control, cyl. 2 17735 Knock control, cyl. 3 17736 Knock control, cyl. 4 Control limit reached	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. - Poor quality fuel (less than RON 91) - Knock sensor tightened to incorrect torque - Abnormal engine running noise (ancillaries loose)	- High fuel consumption - Poor performance - Irregular engine running	- Fill up with petrol of at least RON 91 - Tighten knock sensor (20 Nm) - Check knock control => Page 84

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17913 -F60 idling switch.			



Does not close / open circuit	- Throttle cable setting - Floor mat pressing down on accelerator pedal	- Idling speed too high	- Adjust throttle cable => 4-cylinder engine, mechanical components; Repair Group 20; fuel supply; repair throttle mechanism fuel supply; repair throttle mechanism
	- Throttle valve sticking - Open circuit or short circuit to positive - -F60 defective	- Idling speed control not functioning - Idling speed too high - Load change jolt on accelerator release - Air conditioning compressor only activated at high engine speeds	- Testing idling switch => Page 66
17914 -F60 idling switch. Does not open / short to earth	- Moisture in throttle valve connector - Short circuit to earth - -F60 defective		

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17915 Idling system learned value Lower limit reached	- Unmetered air upstream of throttle valve control unit	- Idling speed too high	- Check intake system
17916 Idling system learned value Upper limit reached	- Intake system blocked (air filter or intake duct)	- Poor performance	- Check intake system

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17920 Valve for intake manifold changeover function -N156 Short circuit to positive	- Short to positive in wiring between -N156 and engine control unit -J220 - -N156 defective	- Lack of acceleration.	- Check intake manifold changeover valve -N156 => Page 15, final control diagnosis
	- Output for -N156 in engine control unit -J220 is defective (control unit defective)		- Replace engine control unit =>Page 24-7

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Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17923 Valve for intake manifold changeover function -N156 Short circuit to earth	- Short to positive in wiring between -N156 and engine control unit -J220 - -N156 defective	- Lack of acceleration.	- Check intake manifold changeover valve -N156 => Page 15, final control diagnosis

	- Output for -N156 in engine control unit -J220 is defective (control unit defective)		- Replace engine control unit =>Page 24-7
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Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17924 Valve for intake manifold changeover function -N156 Open circuit	- Open circuit in wiring between -N156 and engine control unit -J220 - Fault in power supply to -N156 - -N156 defective	- Lack of acceleration	- Check intake manifold changeover valve -N156 => Page 15 , final control diagnosis
	- Fuse defective		- Check fuse => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder
	- Output for -N156 in engine control unit -J220 is defective (control unit defective)		- Replace engine control unit =>Page 24-7

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17934 Bank 1, camshaft adjustment solenoid valve, -N205 Short circuit to positive	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.	- Poor performance	- Check valve 1 for camshaft adjuster -N205 => Page 15 , final control diagnosis
	- Short to earth or positive between valve 1 for camshaft adjuster -N205 and engine control unit -J220		
	- Camshaft adjustment solenoid valve 1 -N205 is defective - Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 24-7

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17935 Bank 1, camshaft adjustment solenoid valve, -N205 Short circuit to earth	- Short to earth or positive between valve 1 for camshaft adjuster -N205 and engine control unit -J220	- Poor performance	- Check valve 1 for camshaft adjuster -N205 => Page 15 , final control diagnosis
	- Camshaft adjustment solenoid valve -N205 is defective		



Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 24-7

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17936 Bank 1, camshaft adjustment solenoid valve, -N205 Open circuit	- Open circuit between camshaft adjuster valve -N205 and engine control unit -J220 - Fault in power supply to -N156 - Camshaft adjustment solenoid valve -N205 is defective - Fuse defective	- Poor performance	- Check valve 1 for camshaft adjuster -N205 => Page 15, final control diagnosis
	- Faulty signal input in engine control unit (control unit defective)		- Check fuse => "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder - Replace engine control unit =>Page 24-7

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Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17953 Throttle valve control Faulty	- Use current flow diagram - Throttle valve stiff or dirty - -G69 and -G127 faulty	- Idling speed too high - Load change jolt on accelerator release	- Check throttle valve control unit =>Page 65
17966 Throttle valve drive Electrical fault in circuit	- Short circuit to earth - Short circuit to positive - Throttle valve actuator (V60) defective	- Idling speed too high	- Check throttle valve actuator => Page 70 .

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17967 Throttle valve control unit - J338 Fault in basic setting	- Idling switch open or line break - Throttle valve sticks and will not close - Pulse detected by engine speed sensor	- Adaptation of throttle valve control unit not performed	- Check throttle valve control unit =>Page 65
17972			

Throttle valve control unit - J338 Undervoltage in basic setting	- Voltage less than 10 V during basic setting		- Check battery voltage
---	---	--	-------------------------

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
17978 Engine control unit blocked	- Attempted tampering - Short circuit in communication line - Immobilizer control unit defective/missing	- Engine starts but cuts out again immediately	- Adapt control unit for engine electronics to electronic immobiliser => Page 38 - Test electronic immobiliser: => Repair Group 96; Servicing electronic immobiliser

Output on V.A.G 1551 printer	Possible cause of trouble	Possible effects	Fault remedy
18010 Power supply terminal 30 Voltage too low	- Battery disconnected - Use current flow diagram	- All learned values erased	- Erase fault memory and continue to monitor vehicle - Checking control unit power supply => Page 71
18020 Engine control unit incorrectly encoded	- Engine control unit incorrectly encoded	- Engine running problems - Increased emissions - Various faults in fault memory	- Encoding control unit => Page 19

1.6 - Final control diagnosis

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 changeover valve -N156



(only vehicles with intake manifold changeover function)

7. Camshaft adjuster 1 (Valve 1 for camshaft adjuster -N205)
(only vehicles with camshaft adjuster)

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

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Rapid data transfer Q
03-Final control diagnosis

Checking injectors

- Confirm input with Q key.

-> Indicated on display:

Final control diagnosis
Injector, cylinder 1 -N30

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- Turn the throttle mechanism on the throttle valve control unit to open the idling switch.

The injector should click five times.

If the injector does not click:

- Check the injectors => Page 46
- Press the ➡key.
- Turn the throttle mechanism on the throttle valve control unit to open the idling switch.

In this way, all the injectors are checked one after the other

Actuation of activated charcoal filter system solenoid valve

- Press the ➡key.

-> Indicated on display:

Final control diagnosis
Solenoid valve 1 for activated charcoal
filter -N80

The injector valve should click.

If the injector does not click:

- Check the -N80 solenoid valve 1 for the activated carbon canister =>Page 63.

Operate the intake manifold changeover function (only vehicles with intake manifold changeover function)

- Press the ➡key.

-> Indicated on display:

Final control diagnosis
Intake manifold changeover valve -N156

The injector valve should click.

If the injector does not click:

- Check intake manifold changeover valve -N156 => Page 58 .

Operate camshaft adjuster

(only vehicles with camshaft adjuster)

- Press the =>key.

-> Indicated on display:

Final control diagnosis
Camshaft adjustment 1

The injector valve should click.

If the injector does not click:

- Check camshaft adjustment valve => Page 87 .
- Press the =>key.

Note:

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

1.7 - Basic setting

With the engine stopped, the following operation can be performed with the basic setting function:

- ◆ Adaptation of the throttle valve control unit to the engine control unit => Display Group 98

With the engine running, the following operations can be performed with the basic setting function:

- ◆ Learning process for lambda control
=> each display group
- ◆ Fault finding by selective activation and deactivation of the lambda control => Display Group 99
- ◆ Check the ignition timing
=> Display Group 95

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

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:



Default setting HELP
Enter display group number XX

- Enter required display group number and press Q to confirm entry.

-> Display readout (for example):

System in basic setting 98
1 2 3 4

Display group 8 during idling (warm engine, coolant temperature not below +85°C)

To carry out the learning process of the lambda control, the solenoid valve for the active carbon canister is closed and the air conditioning compressor is switched off when a display group is selected.

System in basic setting 8 => ◀ Indicated on display			
4.37 ms	0.4 %	0.1 %	λ-Adaptation
Tank breather ▪ λ-Adaptation Mixture formation learning process in progress (solenoid valve 1 for active carbon canister closed) ▪ Tank breather active: conditions for learning mixture formation not met (solenoid valve 1 for active carbon canister closed)			
Learned value for mixture formation at part load (multiplicative) ▪ - 8...+ 8 %: OK ▪ Outside tolerance: Check lambda control => Page 52			
Learned value for mixture formation at idling speed (additive) ▪ - 10...+ 10 %: OK ▪ Outside tolerance: Check lambda control => Page 52			
Injection period (per engine cycle) ▪ 1.70...5.00 ms: OK ▪ < 1.70 ms: High proportion from tank breather system => Page 62 ▪ > 5.00 ms: Engine loaded=> Switch off consumption units			

Display group 95 during idling (warm engine, coolant temperature not below +85°C)

With this display group, the idling stabilisation is blocked and a fixed ignition angle of 12° before TDC is output.

System in basic setting 95 => ◀ Indicated on display			
860 rpm	2.25 ms	12.0°BTDC	93.5 °C
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Coolant temperature			
Ignition timing			
▪ Specified as fixed value by engine control unit			
Engine load (injection period per crankshaft revolution)			
Engine speed			

Display group 98 with ignition on

The learning process (adaptation) of the throttle valve control unit to the engine control unit is carried out and checked with this display group.

System in basic setting 98 => ◀ Indicated on display
--

4.420 V	3.880 V	Idling	ADP. OK	
				Adaptation status ▪ ADP. OK OK ▪ ADP. running . Adaptation is currently being carried out => wait ▪ ADP ERROR Fault occurred during adaptation =>Check throttle valve control unit - Page 65
				Operating status ▪ Idling: OK ▪ Other display: Idling switch open => check - Page 66
				Voltage from throttle valve actuator -G127 ▪ No specified value
				Voltage from throttle valve potentiometer -G69 ▪ No specified value

Display group 99 during idling (warm engine, coolant temperature not below +85°C)

For fault search, it is possible to jump between "basic setting" and "read measurement value block" by pressing keys 4 and 8. This specifically switches the lambda control off and on.

System in basic setting 99				⇒	◀ Indicated on display
860 rpm	93.5 oC	0.0 %		λ-control OFF	
					Lambda control switched off
					Control value for mixture formation (lambda control)
					Coolant temperature
					Engine speed

Read measured value block 99				⇒	◀ Indicated on display
860 rpm	93.5 °C	- 0.7 %		λ-control ON	
					Lambda control switched on
					Control value for mixture formation (lambda control)
					Coolant temperature
					Engine speed

1.8 - Encoding control unit

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

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

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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



-> Indicated on display:

Encoding control unit Q
Enter code number xxxxx (0-32000)

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

Encoding variants =>Page 20

Compose the code number as follows (example):

Member State of the European Union	04
FWD without traction control system	0
5-speed manual gearbox	0
Audi A4	1
Code number	04 0 0 1

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

8D0907557.. 1.8L R4/5V MOTR HS
D..
Coding 04001 WSC 12345

- Switch ignition off and then on again.

Note:

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

- 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.

Encoding variants for the engine control unit

Country/emissions	Drive/auxiliary functions	Gearbox	Vehicle type
00 = ---	0 = FWD without traction control system	0 = 5-speed manual gearbox	0 = ---
01 = ---	1 = ---	1 = ---	1 = Audi A4
02 = Non Member State of the European Union (MVEG I)	2 = 4WD without traction control system	2 = ---	2 = ---
03 = ---	3 = ---	3 = Automatic transmission 01N	3 = ---
04 = Member states of the European Union (MVEG II)	4 = ---	4 = ---	4 = ---
05 = ---	5 = ---	5 = ---	5 = ---
06 = ---	6 = ---	6 = ---	6 = ---
07 = ---	7 = ---	7 = ---	7 = ---
08 = China and Confederation of Independent States (CIS)	8 = ---	8 = ---	8 = ---

1.9 - Reading measured value block

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

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

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

-> Indicated on display:

Read measured value block HELP
 Enter display group number XX

- Enter required display group number and press Q to confirm entry.

-> Display readout (for example):

Read measurement block 0
 1 2 3 4 5 6 7 8 9 10
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Display groups

Display group no.	Indicated on display	Designation
00	Read measured value 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 idling speed air mass 7 = Learned value for idling air mass 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 group no.	Indicated on display	Designation
01	Read measured value 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
02	Read measured value block 2	1 = Engine speed
Basic function	1 2 3 4	2 = Engine load (injection period per crankshaft revolution) 3 = Injection period (per engine cycle) 4 = Intake air mass
03	Read measured value block 3	1 = Engine speed
Basic function	1 2 3 4	2 = Battery voltage 3 = Coolant temperature



Display group no.	Indicated on display	Designation
		4 = Intake air temperature

Display group no.	Indicated on display	Designation
04 Idling stabilisation	Read measured value block 4 1 2 3 4	1 = Throttle valve angle 2 = Learned value for idling stabilisation with manual gearbox and with automatic gearbox with no gear engaged 3 = Learned value for idle stabilisation for automatic gearbox with gear engaged 4 = Operating status Idling Part load Full throttle Overrun Enrichment
05 Idling speed stabilisation	Read measured value block 5 1 2 3 4	1 = Engine speed (actual) 2 = Engine speed (specified) 3 = Control value for idle stabilisation (idling speed control) 4 = Intake air mass

Display group no.	Indicated on display	Designation
06 Idling speed stabilisation	Read measured value block 6 1 2 3 4	1 = Engine speed 2 = Control value for idle stabilisation (idling speed control) 3 = Control value for mixture formation (lambda control) 4 = Ignition timing
07 Lambda control	Read measured value block 7 1 2 3 4	1 = Control value for mixture formation (lambda control) 2 = Lambda probe voltage 3 = Signal ratio of ACF solenoid 1 -N80 4 = Correction factor for mixture formation with active fuel tank breather system
08 Lambda learned values	Read measured value block 8 1 2 3 4	1 = Injection period (per engine cycle) 2 = Learned value for mixture formation at idling speed (additive) 3 = Learned value for mixture formation at part load (multiplicative) 4 = Fuel tank breather system: TB active Fuel tank breather system active TB not active Fuel tank breather system not active λ-Adaptation Fuel tank breather system not active, learning process for mixture formation in progress

Display group no.	Indicated on display	Designation
09 Lambda	Read measured value block 9 1 2 3 4	1 = Engine speed 2 = Control value for mixture formation (lambda control)

Display group no.	Indicated on display	Designation
learned values		3 = Lambda probe voltage 4 = Learned value for mixture formation at idling speed (additive)
10 Fuel tank breather	Read measured value block 10 1 2 3 4	1 = Signal ratio of ACF solenoid 1 -N80 2 = Correction factor for mixture formation with active fuel tank breather system 3 = Fill level of active carbon canister -N80 4 = Air from fuel tank breather system as a proportion of total airflow
11 Fuel consumption	Read measured value block 11 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Speed 4 = Fuel consumption

Display group no.	Indicated on display	Designation
12 Fuel consumption	Read measured value block 12 1 2 3 4	1 = Engine speed 2 = Battery voltage 3 = Fuel consumption 4 = Ignition timing
13 Knock system	Read measured value 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
14 Knock system	Read measured value block 14 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing retardation by knock control, cylinder 1 4 = Ignition timing retardation by knock control, cylinder 2

Display group no.	Indicated on display	Designation
15 Knock system	Read measured value 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
16 Knock system	Read measured value 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
17 Catalyst heat-up	Read measured value block 17 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Energy balance for catalyst heating 4 = Ignition timing



Display group no.	Indicated on display	Designation												
18 Altitude adaptation	Read measured value block 18 1 2 3 4	1 = Engine speed 2 = Engine load without altitude correction 3 = Engine load with altitude correction 4 = Correction factor for mixture formation based on air density (altitude)												
19 Torque reduction	Read measured value block 19 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Gearbox intervention <table><tr><td>1</td><td>X</td><td>X</td><td>(Ignore)</td></tr><tr><td>X</td><td>0</td><td>X</td><td>Torque reduction</td></tr><tr><td>X</td><td>X</td><td>1</td><td>(Ignore)</td></tr></table> 4 = Ignition timing	1	X	X	(Ignore)	X	0	X	Torque reduction	X	X	1	(Ignore)
1	X	X	(Ignore)											
X	0	X	Torque reduction											
X	X	1	(Ignore)											

Display group no.	Indicated on display	Designation
20 Operating statuses	Read measured value block 20 1 2 3 4	1 = Engine speed 2 = Selector lever position Neutral Gear selected. Selector lever in position P or N Selector lever at 1, 2, 3, D, or manual gearbox 3 = Air conditioner A/C low (Ignore) 4 = AC compressor Compr. OFF Air conditioning compressor off Compr. ON Air conditioner compressor on
21 Operating statuses Lambda system	Read measured value block 21 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Coolant temperature 4 = Lambda control λ-Control OFF Lambda control off λ-Control ON Lambda control on

Display group no.	Indicated on display	Designation
22	Read measured value block 22 1 2 3 4	(Ignore)
23 Throttle valve valve control unit	Read measured value block 23 1 2 3 4	1 = Learning demand display 1 X X X X X Potentiometer characteristics learned X 0 X X X X Adaptation to engine control unit completed X X 0 X X X Upper stop position learned by throttle valve potentiometer -G69 X X X 0 X X Lower stop position learned by throttle valve potentiometer -G69 X X X X 0 X Upper stop position learned by throttle valve actuator -G127 X X X X X 0 Lower stop position learned by -G127 throttle valve positioner 2 = Lower stop of throttle valve positioner 3 = Emergency running stop for throttle valve positioner

	4 = Upper stop of throttle valve actuator
--	---

Display group no.	Indicated on display	Designation
24 Knock system	Read measured value block 24 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing 4 = Total of ignition timing retardation for cylinders 1 to 4
25	Read measured value block 25 1 2 3 4	1 = Operating status: Idling Part load Full throttle Overrun Enrichment 2 = Setting deviation of Hall sender -G40 3 = Control: Intake manifold changeover function Camshaft timing control 4 = Active camshaft adjustment angle °KW

Display group no.	Indicated on display	Designation
26	Read measured value block 26 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Control: Intake manifold changeover function Camshaft timing control 4 = Active camshaft adjustment angle °crankshaft
27	Read measured value block 27 1 2 3 4	1 = Operating status: Idling Part load Full throttle Overrun Enrichment 2 = Setting deviation of Hall sender -G40 3 = Coolant temperature 4 = Resistance of lambda probe heating

Display group no.	Indicated on display	Designation
28...94		Vacant
95 Basic function	Read measured value block 95 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing 4 = Coolant temperature
96	Read measured value block 96 1 2 3 4	(Ignore)



97	Read measured value block 97 1 2 3 4	(Ignore)
----	---	----------

Display group no.	Indicated on display	Designation
98 Throttle valve control unit	Read measured value block 98 1 2 3 4 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.	1 = Voltage from throttle valve potentiometer (G69) 2 = Voltage from throttle valve actuator (G127) 3 = Operating status Idling Part load Full throttle Overrun Enrichment 4 = Adaptation status (ADP = adaptation) ADP. running Adaptation in progress ADP. OK Adaptation successfully completed ADP ERROR An error has occurred in the adaptation process

Display group no.	Indicated on display	Designation
99 Lambda system	Read measured value block 99 1 2 3 4	1 = Engine speed 2 = Coolant temperature 3 = Control value for mixture formation (lambda control) 4 = Lambda control λ-Control OFF Lambda control off λ-Control ON Lambda control on

1.10 - Specified display values

Display group 00 during idling (warm engine, coolant temperature not below +85°C)

Read measured value block 0 190 44 78 191 9 128 129 137 127 128 ➔								◀ Display readout
								Learned value for mixture formation 118...138 OK => Display group 08, Page 30)
								Learned value for mixture formation 115...141 OK => Display group 08, Page 30)
								Control value for mixture formation 78...178 OK (=> Display Group 07, Page 29)
								Learned value for idle stabilisation 112...144 OK (=> Display group 04, Page 28)
								Control value for idle stabilisation 118...138 OK (=> Display Group 05, Page 28)
								Throttle valve angle: 0...12 OK (=> Display Group 01, Page 27)
								Battery voltage 146...212 OK (=> Check power supply, Page 71)
								Engine speed: 76...96 OK (=> Check idling speed, Page 39)
								Engine load: 17...50 OK (=> Display group 01, Page 27)
								Coolant temperature: 170...204 OK (=> Display group 03, Page 27)

Display group 01 during idling (warm engine, coolant temperature not below +85°C)

Read measured value block 1 ⇒ ◀ Indicated on display			
860 rpm	2.20 ms	3 <°	12.0° BTDC
Ignition timing ▪ 12.0° BTDC OK ▪ < 12.0° BTDC: Engine loaded => Switch off consumption units Throttle valve angle ▪ 0...5 <°: OK. ▪ > 5 <°: No adaptation of throttle valves control unit => Page 65 ▪ Throttle cable incorrectly adjusted => adjust ▪ Throttle valves control unit defective => replace Engine load (injection period per crankshaft revolution) ▪ 0.85...2.50 ms: OK ▪ < 0.85 ms: Unmetered air downstream of airflow meter => Check intake system ▪ fuel pressure too high => check - Page 41 ▪ > 2.50 ms: Engine loaded => Switch off consumption units Engine speed ▪ 820...900 rpm OK ▪ Outside tolerance: Check idling speed => Page 39			

Display group 2 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 2 ⇒ ◀ Indicated on display			
860 rpm	2.20 ms	4.37 ms	3.7 g/s
Intake air mass ▪ 2.0 ... 4.0 g/s: OK ▪ < 2.0 g/s: Unmetered air downstream of airflow meter => Check ▪ > 4.0 g/s: Engine loaded => Switch off consumption units Injection period (per engine cycle) ▪ 2.00...5.00 ms: OK ▪ < 2.00 ms: High proportion from tank breather system => Page 62 ▪ > 5.00 ms: Engine loaded => Switch off consumption units Engine load (injection period per crankshaft revolution) ▪ 0.85...2.50 ms: OK ▪ < 0.85 ms: Unmetered air downstream of airflow meter => Check intake system ▪ fuel pressure too high => check - Page 41 ▪ > 2.50 ms: Engine loaded => Switch off consumption units Engine speed ▪ 820...900 rpm OK ▪ Outside tolerance: Check idling speed => Page 39			

Display group 03 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 3 ⇒ ◀ Indicated on display			
860 rpm	13.580 V	93.6 °C	37.9 °C



			Intake air temperature (at sensor for intake air temperature -G42) ▪ In the event of a line break, a constant temperature of 19.5 °C will be displayed as a substitute value.
			Coolant temperature (at coolant temperature sensor -G62) ▪ 80...105 °C OK ▪ < 80 °C: Run engine until warm
			Battery voltage ▪ 10.000 - 14.500 V: OK ▪ Outside tolerance: Check supply voltage from engine control unit => Page 71
			Engine speed ▪ 820...900 rpm OK ▪ Outside tolerance: Check idling speed => Page 39

Display group 04 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 4			⇒	◀ Indicated on display
3 <°	0.27 g/s	- 0.04 g/s	Idling	
				Operating status ▪ Idling: OK ▪ Other display: Check idling speed => Page 66
				Learned value for idle stabilisation for automatic gearbox with gear engaged ▪ - 1.70 1.70 g/s: OK ▪ Less than 1.70 g/s: Unmetered air downstream of throttle valve => Check ▪ Higher than +1.70 g/s: Engine loaded => Switch off consumption units ▪ Intake system blocked => check
				Learned value for idling stabilisation with manual gearbox and with automatic gearbox with no gear engaged ▪ - 1.70 +1.70 g/s: OK ▪ Less than 1.70 g/s: Unmetered air downstream of throttle valve => Check ▪ Higher than +1.70 g/s: Engine loaded => Switch off consumption units ▪ Intake system blocked => check
				Throttle valve angle ▪ 0...5 <°: OK. ▪ > 5 <°: No adaptation of throttle valves control unit => Page 65 ▪ Throttle cable incorrectly adjusted => adjust ▪ Throttle valves control unit defective => replace

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Display group 5 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 5			⇒	◀ Indicated on display
860 rpm	860 rpm	0.7 %	3.7 g/s	
				Intake air mass ▪ 2.0... 4.0 g/s: OK ▪ < 2.0 g/s: Unmetered air downstream of airflow meter => Check ▪ > 4.0 g/s: Engine loaded => Switch off consumption units
				Control value for idle stabilisation (idling speed control) ▪ - 10 ... + 10 %: OK

	Required engine speed demanded by engine control unit ▪ 820 ... 900 rpm OK
Engine speed (actual)	▪ 820 ... 900 rpm OK ▪ Outside tolerance: Check idling speed => Page 39

Display group 6 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 6	⇒	◀ indicated on display
860 rpm	0.7 %	0.3 % 12°BTDC
		Ignition timing ▪ 12.0°BDTC OK ▪ < 12.0°BDTC: Engine loaded => Switch off consumption units
		Control value for mixture formation (lambda control) ▪ - 10 ... + 10 %: OK ▪ Outside tolerance: Check lambda control => Page 52
		Control value for idle stabilisation (idling speed control) ▪ - 10...+ 10 %: OK
Engine speed		▪ 820 ... 900 rpm OK ▪ Outside tolerance: Check idling speed => Page 39

Display group 7 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 7	⇒	◀ Indicated on display
- 0.7 %	0.755 V	6 % 0.87
		Correction factor for mixture formation with active fuel tank breather system ▪ < 1.00: Tank breather supplying rich mixture, lambda control reduces the quantity injected ▪ = 1.00: No fuel tank breather function or fuel tank breather supplying ideal mixture ($\lambda = 1$) ▪ > 1.00: Tank breather supplying lean mixture, lambda control increases the quantity injected
		Signal ratio of ACF solenoid 1 -N80 ▪ 0 %: Solenoid valve closed ▪ 99 %: Solenoid valve open
		Lambda probe voltage (relative to reference earth: 260...300 mV) ▪ Voltage constantly fluctuates back and forth between 0.1 V and 1.0 V: OK ▪ - 0.1 ... + 0.3 V: Large amount of residual oxygen, mixture too lean ▪ 0.7 ... 1.0 V: Small amount of residual oxygen, mixture too rich ▪ Constant 0.45...0.50 V: Lambda probe not functioning ▪ => Check lambda control - Page 52
		Control value for mixture formation (lambda control) ▪ - 10...+ 10 %: OK ▪ Outside tolerance: Check lambda control => Page 52



Display group 8 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 8				⇒	◀ Indicated on display
4.37 ms	0.4 %	0.1 %	TB active		
					Tank breather ▪ TB active. Solenoid valve for active carbon canister is pulsed ▪ Tank breather active: Solenoid valve 1 for active carbon canister closed ▪ λ-Adaptation Mixture formation learning process in progress (solenoid valve 1 for active carbon canister closed)
					Learned value for mixture formation at part load (multiplicative) ▪ - 8...+ 8 %: OK ▪ Outside tolerance: Check lambda control => Page 52
					Learned value for mixture formation at idling speed (additive) ▪ - 10...+ 10 %: OK ▪ Outside tolerance: Check lambda control => Page 52
					Injection period (per engine cycle) ▪ 1.70 ... 5.00 ms: OK ▪ < 1.70 ms: High proportion from tank breather system => Page 62 ▪ > 5.00 ms: Engine loaded => Switch off consumption units

Display group 9 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 9				⇒	◀ indicated on display
860 rpm	- 0.7 %	0.755 V	0.4 %		
					Learned value for mixture formation at idling speed (additive) ▪ - 10...+ 10 %: OK ▪ Outside tolerance: Check lambda control => Page 52
					Lambda probe voltage (relative to reference earth: 260...300 mV) ▪ Voltage constantly fluctuates between 0.1...+ 0.3 V and 0.7...1.0 V: OK ▪ - 0.1...+ 0.3 V: Large amount of residual oxygen, mixture too lean ▪ 0.7...1.0 V: Small amount of residual oxygen, mixture too rich ▪ Constant 0.45...0.50 V: Lambda probe not functioning ▪ => Check lambda control - Page 52
					Control value for mixture formation (lambda control) ▪ - 10...+ 10 %: OK ▪ Outside tolerance: Check lambda control => Page 52
					Engine speed ▪ 820...900 rpm OK ▪ Outside tolerance: Check idling speed => Page 39

Display group 10 on idling (warm engine, coolant temperature not less than +85 °C)

Read measured value block 10				⇒	◀ Indicated on display
9 %	0.87	17	0.02		

			Air from fuel tank breather system as a proportion of total airflow ▪ 0.00: Tank breather not active ▪ 0.30: 30% of the intake air is from tank breather
			Fill level of activated charcoal filter ▪ - 3 %: No petrol vapour in active carbon canister ▪ + 32 %: Active carbon canister completely filled with petrol vapour
			Correction factor for mixture formation with active fuel tank breather system ▪ < 1.00: Tank breather supplying rich mixture, lambda control reduces the quantity injected ▪ = 1.00: No fuel tank breather function or fuel tank breather supplying ideal mixture ($\lambda = 1$) ▪ > 1.00: Tank breather supplying lean mixture, lambda control increases the quantity injected
			Signal ratio of ACF solenoid 1 -N80 ▪ 0 %: Solenoid valve closed ▪ 99 %: Solenoid valve open

Display group 13 at full throttle (test drive in 3rd gear, coolant temperature not less than +85 °C)

Important Fault reader V.A.G 1551 must be operated by a second person.

Read measured value block 13	⇒	▪ Indicated on display
2.3°crankshaft 1.9°crankshaft 2.5°crankshaft 2.4°crankshaft		
		Ignition timing retard, 0.0...12.0°KW: OK ▪ Deviation of cylinders relative to one another less than 6.0°crankshaft: OK ▪ Deviation greater than 6.0°crankshaft: loose ancillaries, mechanical damage, corrosion on connectors ▪ All cylinders greater than 12.0°crankshaft: poor fuel, knock sensor defective, loose ancillaries
		Ignition timing retardation by knock control, cylinder 4
		Ignition timing retardation by knock control, cylinder 3
		Ignition timing retardation by knock control, cylinder 2
		Ignition timing retardation by knock control, cylinder 1

Display Group 16 at idling speed

Read measured value block 16	⇒	▪ Indicated on display
0.800 V 0.840 V 0.800 V 0.760 V		
		Knock sensor signals of all cylinders ▪ Deviation of cylinders relative to one another less than 0.500 V: OK ▪ Deviation greater than 0.500 V. loose ancillaries, mechanical damage, corrosion on connectors
		Knock sensor signal, cylinder 4
		▪ 0.400...1.400 V: OK



		Knock sensor signal, cylinder 3 ▪ 0.400...1.400 V: OK
		Knock sensor signal, cylinder 2 ▪ 0.400...1.400 V: OK
		Knock sensor signal, cylinder 1 ▪ 0.400...1.400 V: OK

Display Group 18 at idling speed

Read measured value block 18 ➔				▪ Indicated on display
860 rpm	2.20 ms	2.15 ms	- 0.7 %	
				Correction factor for mixture formation based on air density (altitude) ▪ No specified value ▪ - 30.0 %: corresponding to an air pressure of approx. 700 mbar (30 % under 1000 mbar) ▪ + 20.0 %: corresponding to an air pressure of approx. 1200 mbar (20 % under 1000 mbar)
				Engine load (injection period per crankshaft revolution) after altitude correction ▪ No specified value
				Engine load (injection period per crankshaft revolution) ▪ 0.85...2.50 ms: OK ▪ < 0.85 ms: Unmetered air downstream of airflow meter => Check intake system ▪ fuel pressure too high => check - Page 41 ▪ > 2.50 ms: Engine loaded => Switch off consumption units
				Engine speed ▪ 820...900 rpm OK ▪ Outside tolerance: Check idling speed => Page 39

Display group 23 with ignition switched on (engine not running)

Read measured value block 23 ➔				▪ Indicated on display
100000	84.3 %	75.2 %	23.9 %	
				Upper stop of throttle valve actuator ▪ 18...54 %: OK ▪ Outside tolerance: Perform adaptation of the throttle valve control unit ▪ => Page 65 ▪ Throttle valve control unit defective ▪ => replace
				Emergency running stop for throttle valve positioner ▪ 67...83 %: OK ▪ Outside tolerance: Perform adaptation of the throttle valve control unit ▪ => Page 65 ▪ Throttle valves control unit defective => replace
				Lower stop of throttle valve positioner ▪ 72...95 %: OK ▪ Outside tolerance: Perform adaptation of the throttle valve control unit ▪ => Page 65 ; Throttle valve control unit defective => replace
				Learning demand display ▪ 100000: OK ▪ Other display: Perform adaptation of the throttle valve control unit => Page 65

Display group 25, Control: Intake manifold changeover function and camshaft timing control

Read measured value block 25			⇒	◀ Indicated on display
Idling	-30...+30 °crankshaft	X 0 0	-3...+21 °crankshaft	
			Active camshaft timing angle	
			▪ Camshaft in normal position = 3.0... 3,0°crankshaft	
			▪ Camshaft in normal position = -15.0... 21,0°crankshaft	
			Operating status:	
			▪ X 0 X = Intake manifold changeover function: OFF (short intake manifold)	
			▪ X X 0 = Camshaft timing control: OFF (retarded)	
			▪ Value "0" = Condition not satisfied, actuation not active	
			▪ Value "1" = Condition satisfied, actuation active	
			▪ Value "X" = not applicable	
Phase sensor (Hall sender) setting deviation				
Operating status: Idling, part load, full load, overrun, enrichment				

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Display group 26, Control: Intake manifold changeover function and camshaft timing control

Read measured value block 26			⇒	◀ Indicated on display
rpm	ms	X 0 0	-3...+21 °crankshaft	
			Active camshaft timing angle ▪ Camshaft in normal position = 3.0... 3,0°crankshaft ▪ Camshaft in normal position = -15.0... 21,0°crankshaft	
			Operating status: ▪ X 0 X = Intake manifold changeover function: OFF (short intake manifold) ▪ X X 0 = Camshaft timing control: OFF (retarded) ▪ Value "0" = Condition not satisfied, actuation not active ▪ Value "1" = Condition satisfied, actuation active ▪ Value "X" = not applicable	
Engine load (injection period per crankshaft revolution) =>Display group 01				
Engine speed =>Display group 01				

Note re Display zone 4:

There are only two positions for the adjustable camshaft, namely the normal and the switched position. In order to bring about the switched position for the camshaft, the vehicle must be accelerated at low speed (approx. 1000 rpm) in 2nd gear with the throttle pressed fully down. If the camshaft timing control actuation is active, see display zone 3, then it is possible to detect from display zone 4 whether any timing adjustment for the camshaft has actually taken place (feedback). If timing control is not active, then check whether full load has been detected (camshaft timing control becomes active only at full load!).

Display group 99 during idling (warm engine, coolant temperature not below +85°C)

For fault search, it is possible to jump between "basic setting" and "read measurement value block" by pressing keys 4 and 8. This specifically switches the lambda control off and on.



Read measured value block 99				⇒	◀ Indicated on display
860 rpm	93.5°C	- 0.7 %	λ-Control ON		
			Lambda control switched on		
			Control value for mixture formation (lambda control)		
			Coolant temperature		
			Engine speed		

Basic setting 99				⇒	◀ Indicated on display
860 rpm	93.5°C	0.0 %	λ-Control OFF		
			Lambda control switched off		
			Control value for mixture formation (lambda control)		
			Coolant temperature		
			Engine speed		



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24 - Mixture preparation, Injection

1 - Servicing the Motronic injection system

1.1 - Servicing the Motronic injection system

1.2 - Safety precautions

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 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, to check the compression), unplug the connector from the power output stage for the ignition coils and the connectors from the injectors. After completing the work, interrogate the fault memory.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.3 - Rules for cleanliness

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

- ◆ Thoroughly clean all connections and the surrounding area before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Do not use fluffy cloths!
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components:
Only remove replacement parts from packaging immediately prior to installation.
Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- ◆ When the system is open:
Do not work with compressed air if this can be avoided.
Do not move vehicle unless absolutely necessary.

1.4 - Technical data

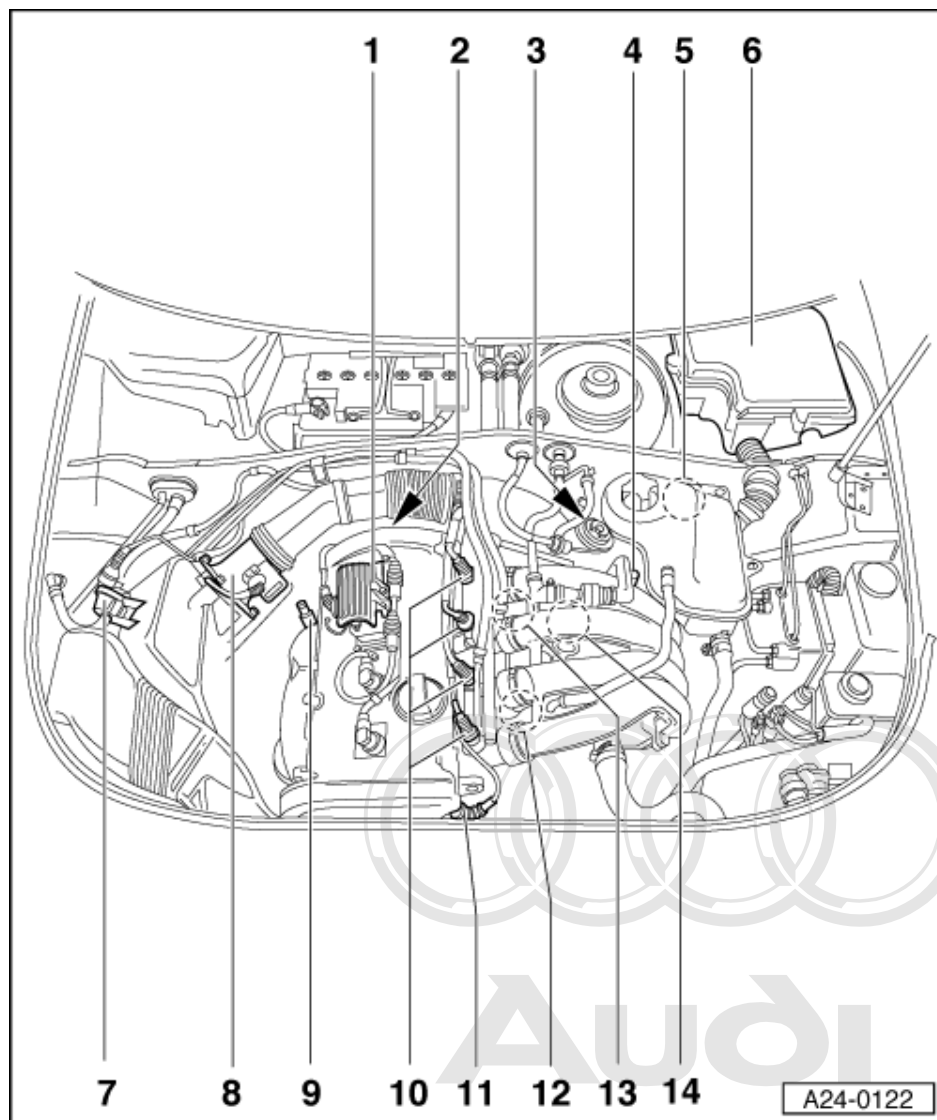
Engine code letters	ADR (1.8l/5V/92 KW engine without intake manifold changeover function/ without camshaft timing control)
	ADR (1.8l/5V/92 KW engine with intake manifold changeover function/ with camshaft timing control)
	AFY (1.8l/5V/92 KW engine without intake manifold changeover function/ without camshaft timing control)
Idling speed (not adjustable)	780...900 rpm
Engine speed limiter by shutting off injectors	6800 rpm
Fuel pressure (at idling speed) Vacuum hose connected	approx. 3.5 bars



Vacuum hose disconnected	approx. 4 bars	
Holding pressure after 10 minutes	at least 2.5 bar gauge	
Injectors	Spray pattern	Two hole nozzle
	Injection quantity (30 s)	85...105 ml
	Resistance (room temperature) ¹⁾	11...13 ω

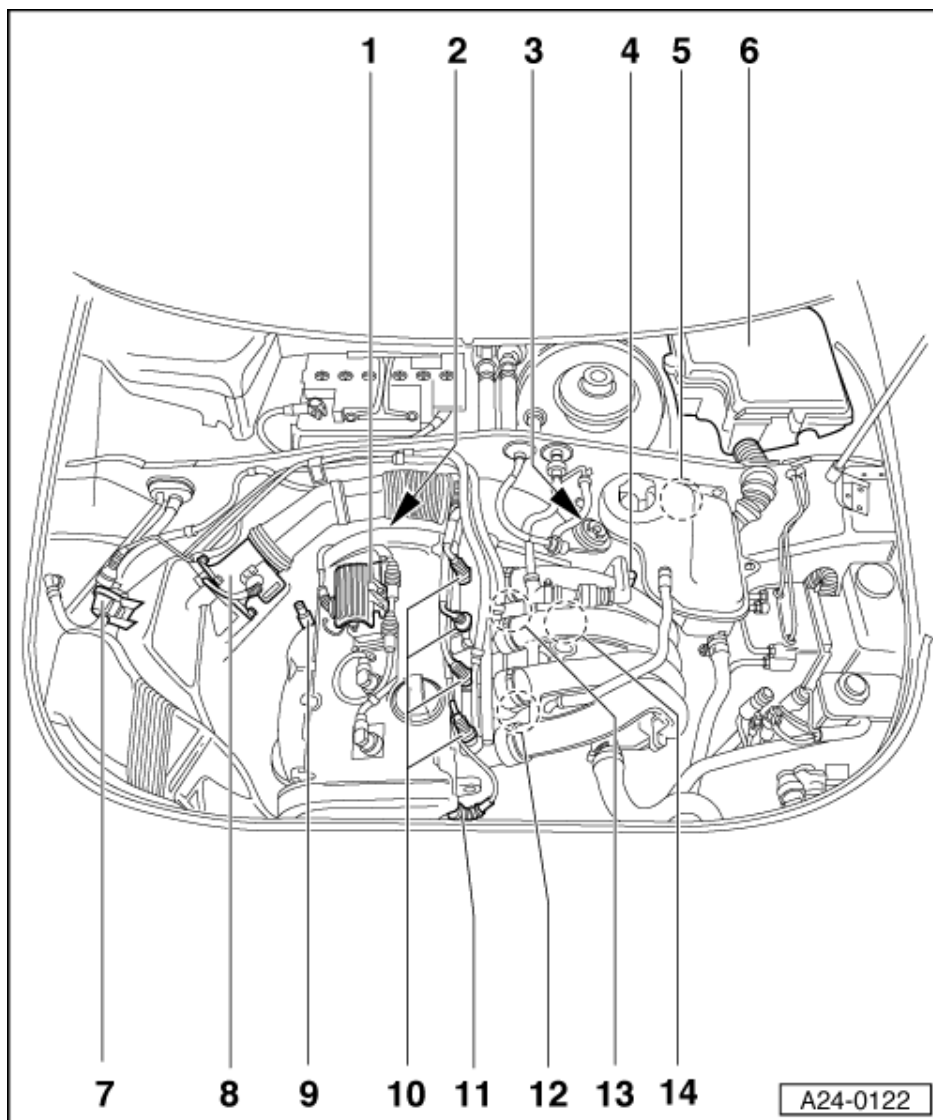
1) When the engine is at operating temperature the resistance of the injectors is increased by approx. 4 - 6 ω .

1.5 - Fitting locations - Overview



- 1 Ignition coils (N and N128) with output stage (N122)
- 2 Sensor for coolant temperature (G62)
- 3 Throttle valve control part (J338)
- 4 Intake air temperature sensor (G42)
- 5 Connector
 - ◆ For Lambda probe and Lambda probe heating (black)
 - ◆ For engine speed sensor (grey)
 - ◆ Knock sensor 1 (green)
 - ◆ Knock sensor 2 (blue)

6 Engine control unit



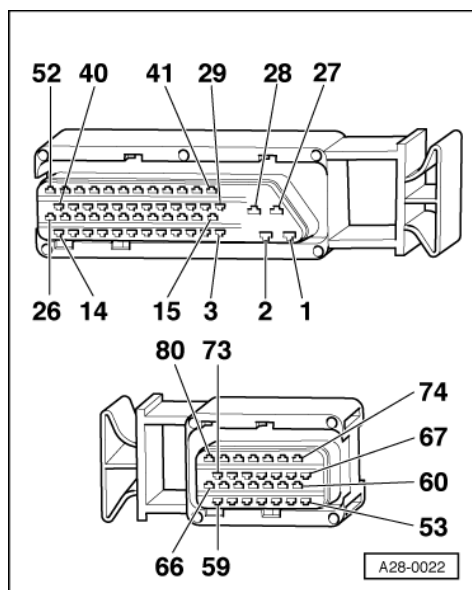
- 7 Activated charcoal filter solenoid valve 1 (N80)
- 8 Air mass meter (G70)
- 9 Lambda probe (G39) with lambda probe heating -(Z19)
- 10 Injector (N30...N33)
- 11 Hall sender (G40)
- 12 Knock sensor 1 (G61)
- 13 Knock sensor 2 (G66)
- 14 Engine speed sensor (G28)



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



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Note:

- ♦ 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 the auxiliary cables from adapter set V.A.G 1594.
 - ♦ The contact numbers of the plugs and the socket numbers in the test box are identical.
- With ignition switched off, unplug connectors from control unit.
 - Connect test box to wiring harness connector.
 - Carry out test as described in the appropriate repair procedures.

Warning

To prevent damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

1.7 - Renewing engine control unit

Removal and installation

Fitting location => Fitting locations overview, Page 36

Switch off ignition before pulling off or attaching control unit connector.

- Encode control unit => Page 19.
- Carry out adaptation of the throttle valve control unit => Page 65

Adapting engine electronics control unit to electronic immobilizer

Test conditions

- Authorised vehicle key available
- Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 using cable V.A.G 1551/3.
- Switch the ignition on.
- Press key 1 for "Rapid data transfer".

- Press keys 2 and 5 for address word "Immobilizer" and confirm entry by pressing Q.
- Press the ⇒key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Adaptation
Enter channel number XX

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

-> Indicated on display:

Adaptation Q
Erase learned values?

- Confirm input with Q key.

-> Indicated on display:

Adaptation
Learnt values have been erased

- Finish adjustment by pressing ⇒ key.

Note:

The engine control unit identity is read into the immobilizer control unit the next time the ignition is switched on.

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1.8 - Checking idling speed

The idling speed is specified by the engine control unit and is not adjustable.

Test conditions

- Coolant temperature at least 80°C.
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Selector lever in position P or N
- Throttle cable setting OK
- Read measured value block, Display Group 3, engine at idling speed =>Page 21

-> Indicated on display:

Read measurement block 3			
860 rpm	13.580 V	93.65 C	
43.95 C			

- Check display in display zone 3.

Read measurement block 3			
860 rpm	13.580 V	93.65 C	43.95
C			

-> Specified value: at least 80°C



Do not continue with check until coolant temperature is reached.

- Check display in display zone 1.

Read measurement block 3
860 rpm 13.580 V 93.65 C 43.95
C

-> Specification: 820...900 rpm

If the specification is not obtained:

- Press C key.
- Press keys 2 and 0 for "Display Group 20" and confirm entry by pressing Q key.

-> Indicated on display:

Read measurement block 20
860 rpm Neutral A/C-Low
Compr. OFF

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- Check display in display zone 2.

Read measurement block 20
860 rpm Neutral A/C-Low Compr.
OFF

-> Specification: Neutral (automatic gearbox)

For cars with manual gearboxes, the display will always show "Driving position engaged".

- If necessary, set the selector lever to P or N.
- Check display in display zone 4.

Read measurement block 20
860 rpm Neutral A/C-Low Compr.
OFF

-> Specification: Compr. OFF

For vehicles with no air conditioning system, "Compr. off" is always shown.

- If necessary, switch off air conditioning system.
- Check display in display zone 1.

Read measurement block 20
860 rpm Neutral A/C-Low Compr.
OFF

-> Specification: 820...900 rpm

If the specification is not obtained:

- Press C key.
- Press keys 0 and 4 for "Display Group 4" and confirm entry by pressing Q key.

-> Indicated on display:

Read measurement block 4
3 -5 0.27 g/s - 0.00
g/s Idling speed

- Check display in display zone 4.

Read measurement block 4
3 -5 0.27 g/s - 0.00 g/s
Idling speed

-> Specification: Idling

If another readout appears on the display:

- Check the idling switch => Page 66 .
- Check display in display zone 1.

Read measurement block 4			
3 -5	0.27 g/s	-	0.00 g/
s	Idling speed		

-> Specified value: 0...5 <°

If the specification is not obtained:

- Check the adaptation of the throttle valve control unit => Page 65 .

If the specification is obtained:

- Press C key.
- Press keys 0 and 5 for "Display Group 5" and confirm entry by pressing Q key.

-> Indicated on display:

Read measurement block 5			
860 rpm	860 rpm	0.7 %	3.7
g/s			

- Check display in display zone 1.

Read measurement block 5			
860 rpm	860 rpm	0.7 %	3.7 g/
s			

-> Specification: 820...900 rpm

If the idling speed is too low, the following faults are possible:

- ◆ Engine under load
- ◆ Throttle valve control unit not adapted to engine control unit.
- ◆ Throttle valve control unit defective.

If the idling speed is too high, the following faults are possible:

- ◆ Unmetered air in intake system.
- ◆ Throttle valve control unit not adapted to engine control unit.
- ◆ Throttle valve control unit defective.
- ◆ Solenoid valve for activated carbon canister constantly open.

1.9 - Testing fuel pressure regulator and holding pressure

Test conditions

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- Fuel pump relay OK, testing => page 49 .
 - Fuel pump OK
 - Fuel filter OK
 - Battery voltage OK.

Note:

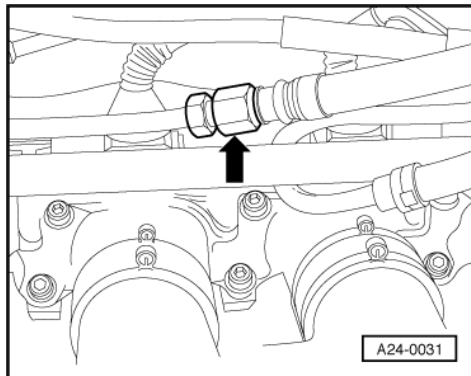
The fuel pressure regulator regulates the fuel pressure according to the intake manifold pressure at the throttle valve unit.



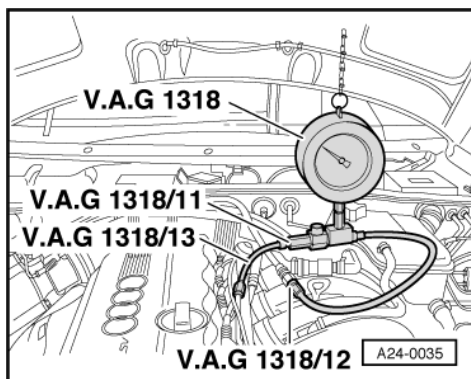
Warning

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

- Briefly open the fuel tank filler cap (to release pressure).
- Cover the pressurised screw connection with a cloth.

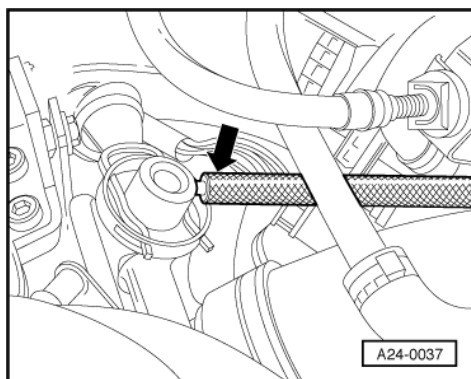


- -> Open the screw connection -arrow- and catch escaping fuel in a cloth.



- Connect pressure gauge V.A.G 1318 to fuel supply pipe using adapters 1318/11, 1318/12 and 1318/13.
- -> Open cut-off valve on pressure gauge. The lever points in the direction of flow.
- Start the engine and run at idling speed.
- Measure the fuel pressure.

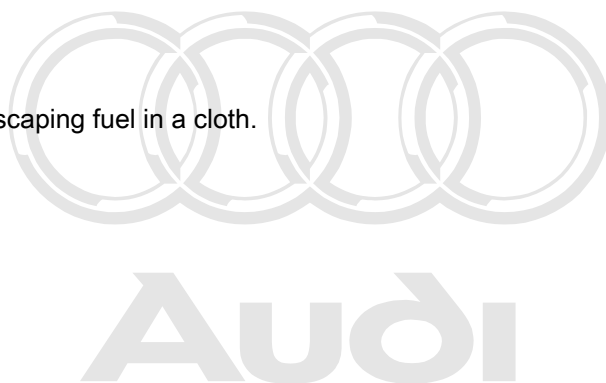
Specification: approx. 3.5 bar



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

The fuel pressure should rise to approx. 4.0 bar.

- Reconnect vacuum hose.
- Switch off ignition.



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- Observe pressure drop on gauge.

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

If the holding pressure drops below 2.5 bars:

- 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 V.A.G 1318 (valve lever at right angles to direction of flow).
- Observe pressure drop on gauge.

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

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

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

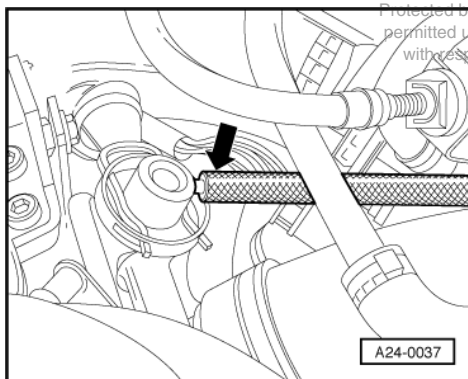
- ♦ Union between pressure gauge and fuel supply pipe leaking
- ♦ Supply pipe leaking at fuel tank
- ♦ Non-return valve in fuel pump leaking

=> 4-cylinder engine, mechanical components; Repair Group 20; remove and install fuel pump remove and install fuel pump

Note:

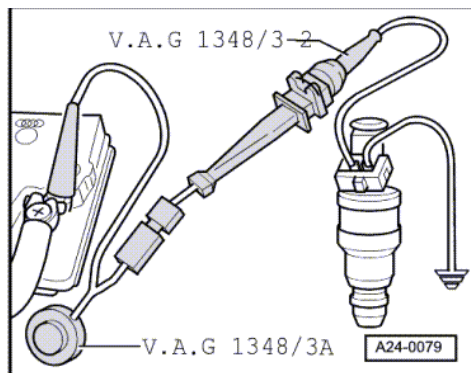
To disconnect the pressure gauge, close the cut-off valve, unscrew the union on adapter V.A.G 1318/12, then open the cut-off valve to drain off excess fuel into a suitable container.

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



Test conditions

- Fuel pressure OK, testing =>page 41 .
- -> Pull vacuum hose -arrow- off fuel pressure regulator.
- Unplug connectors from injectors and from Hall sender.
- Unbolt the fuel manifold from the intake manifold and pull it upwards and off the intake manifold together with the injectors.



- Place the injector which is to be tested into measuring glass of 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 the final control diagnosis => Page 15 .

-> Indicated on display:

Final control diagnosis
Injector, cylinder 1 -N30

The fuel pump must be running.

- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops a minute should escape from each injector.
- If the fuel loss is greater, switch off the fuel pump (terminate final control diagnosis) and renew the faulty injector.

Note:

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

- Activate the V.A.G 1348/3 A remote control for 30 seconds.
- Perform measurements on all injectors.
- Once all four injectors have been actuated, place the measuring glasses on a level surface.

Specification: 85 ... 105 ml

If the specified result is not attained for all injectors:

- Test fuel pressure =>Page 41 .

If the specified results are not attained for one injector:

- Renew injector.

Note:

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

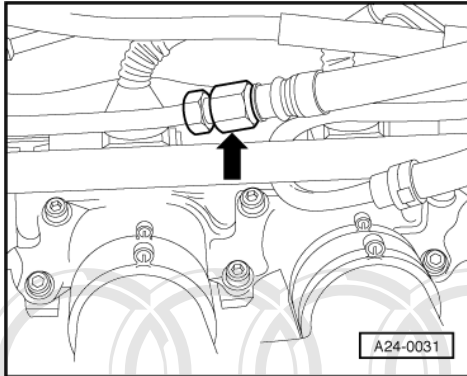
Installation of the fuel manifold together with injectors is performed in the reverse sequence. The following points should be noted when installing:

- 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.
- Check to make sure that the retainer clamps are properly seated.

1.11 - Removing and installing injectors

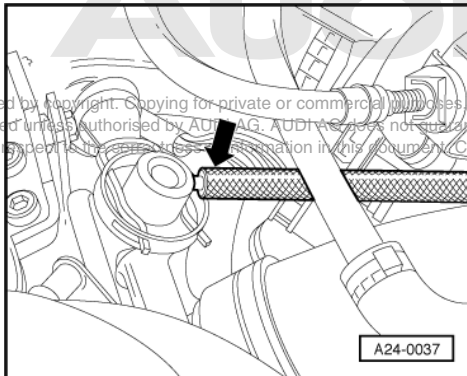
Warning

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



Removing

- Briefly open the fuel tank filler cap (to release pressure).
- Cover the pressurised screw connection with a cloth.
- -> Open the screw connection -arrow- and catch escaping fuel in a cloth.



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- -> Pull vacuum hose -arrow- off fuel pressure regulator.
- Unplug connectors from injectors and from Hall sender.
- Unbolt the fuel manifold from the intake manifold and pull it upwards and off the intake manifold together with the injectors.
- Withdraw the retention clamp at the injector/fuel rail connection and pull the injector out of the fuel rail.

Installing

Note:

- ◆ Fit new O-rings. (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.)
- ◆ Check to make sure that the retainer clamps are properly seated.
- Moisten the O-rings with clean engine oil.
- Push injectors vertically into the fuel rail until they meet a stop and secure with retainer clamps.
- Insert fuel rail with the secured injectors on the intake manifold and press in evenly until a stop is met.



- Place fastening screws in position, press intake manifold gently by hand in the direction of the intake manifold and tighten fastening screws.

Further installation takes place in the reverse sequence to removal.

1.12 - Checking injectors

Electrical checks on injectors

- Start final control diagnosis and actuate injectors => Page 15.

-> Indicated on display:

Final control diagnosis
Injector, cylinder 1 -N30

- Turn the throttle mechanism on the throttle valve control unit to open the idling switch.

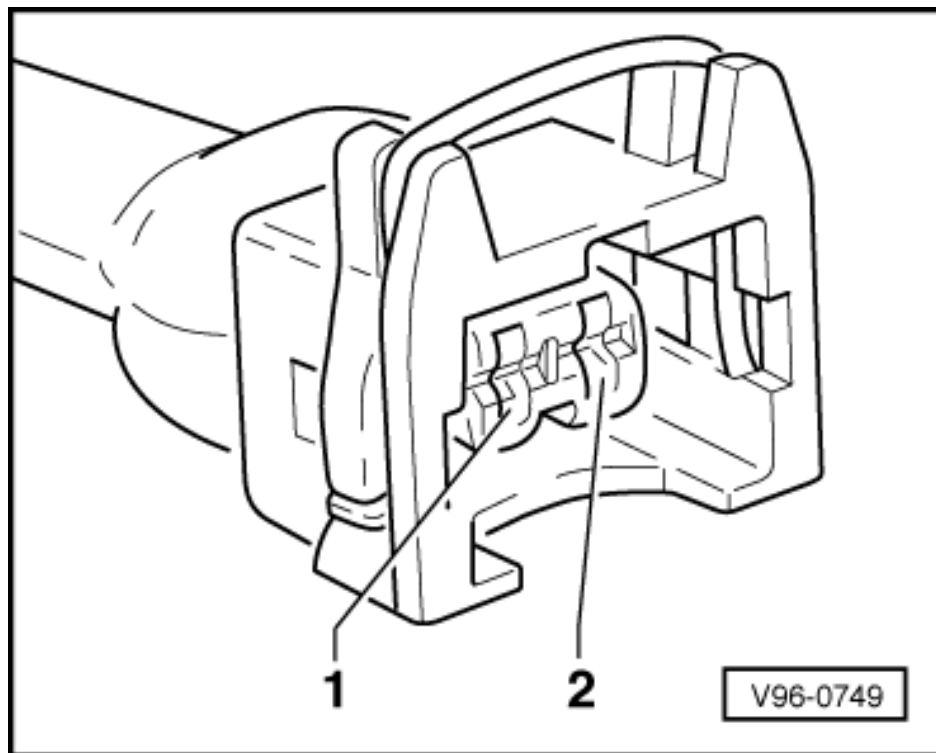
The injector should click five times.

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If the injector clicks:

- Activate the next injector.

If the injector does not click:



- Remove connector from the injector which is to be tested.
- -> Connect the V.A.G 1527 diode test lamp between contact 1 and contact 2 in the connector.
- Repeat the final control diagnosis and again actuate the injector.

The diode test lamp should flash five times.

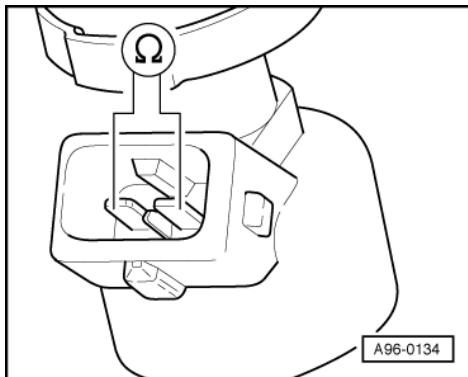
Note:

Diode test lamps with a low current consumption do not go out completely between the flashing pulses, but continue to glow slightly and become much brighter during the flashing pulses.

If the diode test lamp does not flash:

- Check the voltage supply
=> Page 47 .

If the diode test lamp flashes:



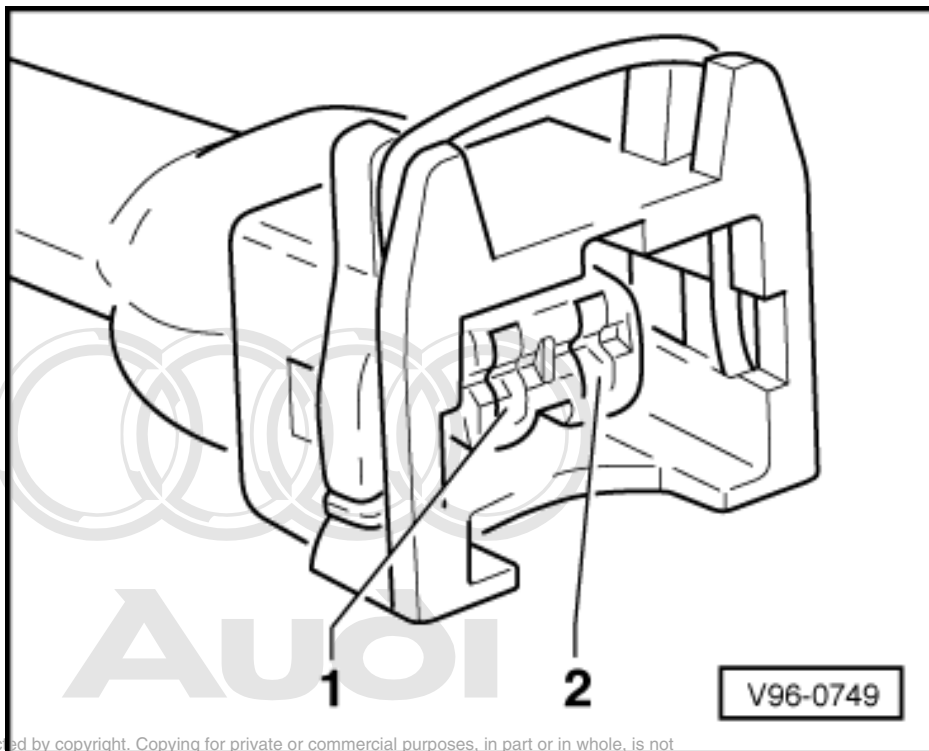
- -> Connect multimeter to valve to measure resistance

Specification: 11...13 Ω

If the specification is not obtained:

- Renew injector.

Checking power supply



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- Remove connector from the injector which is to be tested.

- -> Connect the multimeter (voltage measurement range) to contact 1 on the connector and to earth.

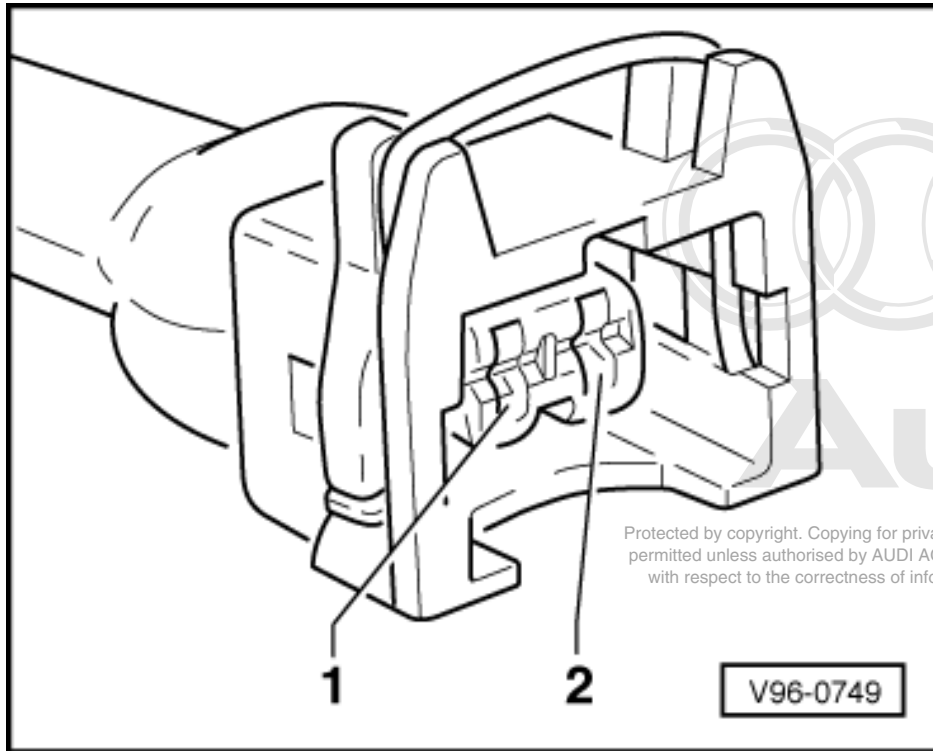
- Operate starter for a few seconds (the engine can be allowed to start).

Specification: The diode test lamp should light up.

If the diode test lamp lights up:

- Check wiring => Page 48

If the diode test lamp does not light up:



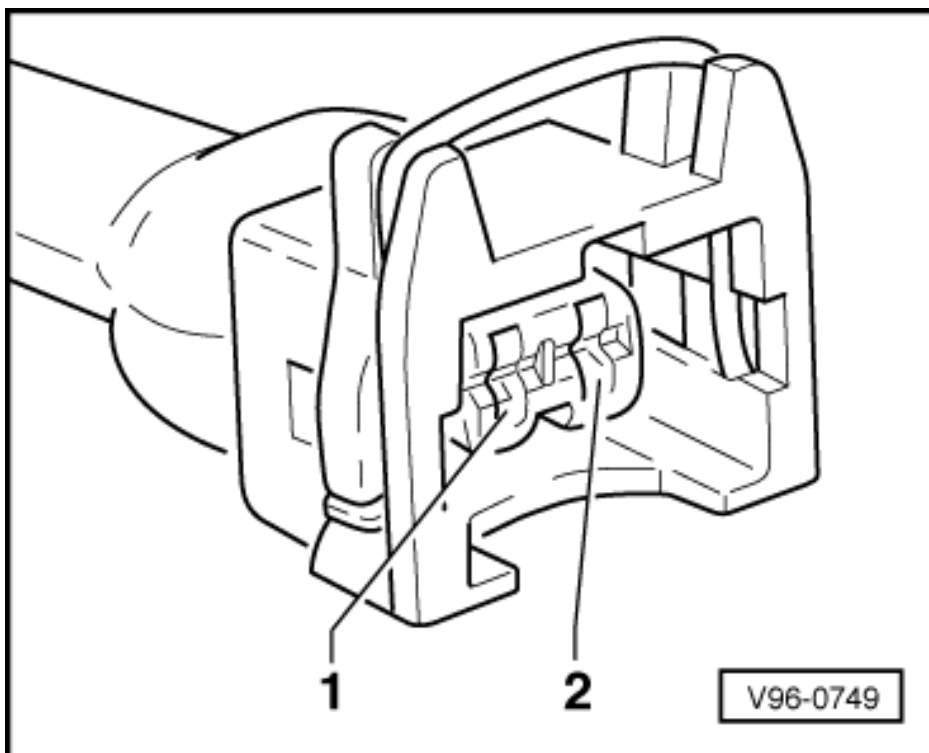
- -> Check wiring connection from Contact 1 to the fuse for injector.

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

Checking wiring

- Switch off ignition.
- Remove connector from the injector which is to be tested.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38.

The following wiring connections should be checked for open circuits and/or short to positive or negative.



Cylinder	2-pin connector on wiring harness, contact.	Test box V.A.G 1598/22, socket
1	2	73
2	2	80
3	2	58
4	2	65

- Rectify any open/short circuit as necessary.

1.13 - Checking fuel pump relay

Voltage is supplied to the fuel pump and some injection system components via the fuel pump relay (J17).

The condition for the closing of the fuel pump relay (J17) is that the engine should be turning. i.e. the relay is only connected to earth (via the engine control unit) when engine speed pulses are detected in the engine control unit.

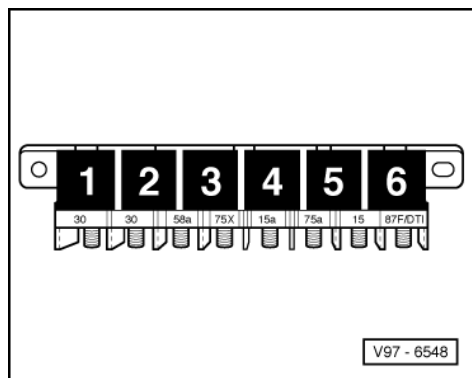
Test conditions

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- Battery voltage OK.

Functional testing of fuel pump relay

- Start actuator diagnosis and activate an injector => Page 15 .

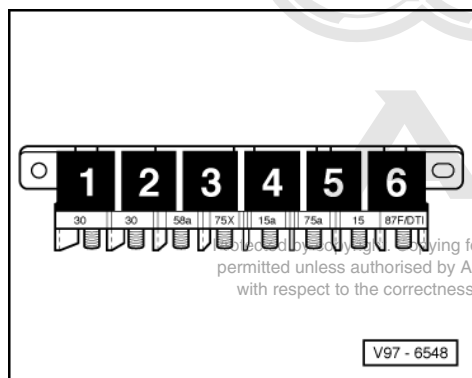


-> The fuel pump relay (central electrics, relay position 6) must pick up ...

- If the relay does not pick up, test activation of fuel pump relay =>Page 50
... and the fuel pump must run.
- If the fuel pump does not run, check activation for fuel pump and components
=>Page 51

Checking actuation of fuel pump relay

- Switch off ignition.

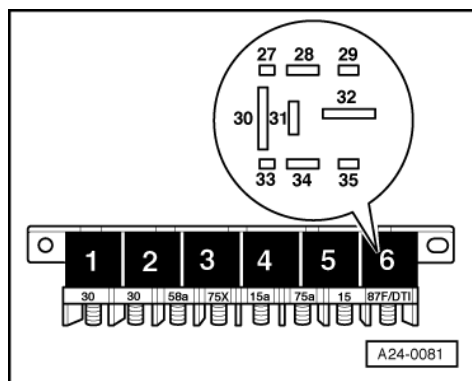


- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .
- Connect together sockets 4 and 2 on the test box using an auxiliary cable from V.A.G 1594.
- Switch the ignition on.

-> Specification: The fuel pump relay (central electrics, relay position 6) must pick up ...

If the relay pulls now, but not during final control diagnosis:

- Renew engine control unit



If the relay does not pull:

- Switch off ignition.
- -> Remove fuel pump relay from relay base (central electrics, relay position 6).
- Connect the multimeter to contact 2 of relay socket and earth to measure voltage.

- Switch the ignition on.

Specification: approx. battery voltage

If the specification is not obtained:

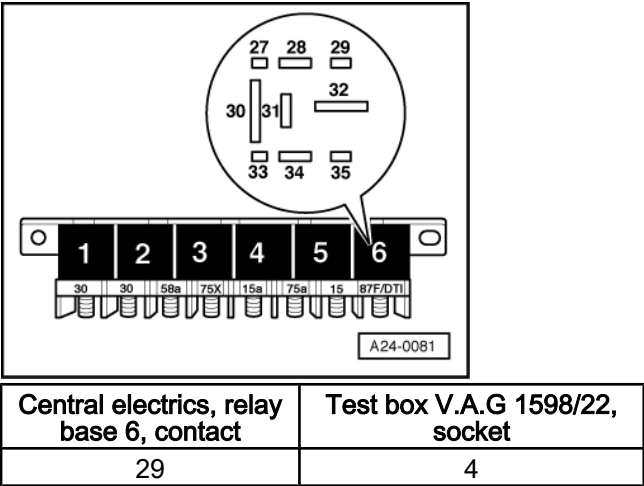
- Check the wiring.

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

If the specification is obtained:

- Switch off ignition.

The following wiring connections should be checked for open circuits and/or short to positive or negative.

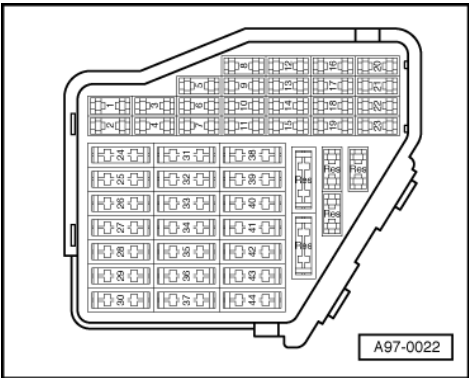


- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Renew the fuel pump relay (J17).

Checking actuation of fuel pump and components



- -> Withdraw the fuses 28, 29 and 34.
- Start actuator diagnosis and activate an injector => Page 15 .



- Connect the multimeter for voltage measurement to the left-hand and right-hand contacts of the following fuses:

Fuse No.	Specified value at left or right contact
28	approx. battery voltage
29	approx. battery voltage
34	approx. battery voltage

If the specification is not obtained:

- Check the wiring.

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

If no wiring fault is detected:

- Renew the fuel pump relay (J17).

2 - Checking lambda control

2.1 - Checking 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 rich" (low level of residual oxygen) is between about 0.7 and 1.0 V (referenced to reference earth).

The voltage signal for "Mixture weak" (high residual oxygen) is between about - 0.1 and + 0.3 V (referred to reference earth).

During the transition from "rich" to "lean" and vice versa ($\lambda = 1.0$), there is a voltage jump from 0.7 ... 1.1 V to - 0.1 ... +0.3 V or 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".

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.
- ♦ Probe poisoned by leaded fuel, test with "PLUMBTESMO" test strip for lead content.
- ♦ Contact resistance in signal wiring or reference earth line.
- ♦ Lambda probe too cold; lambda probe heating not working.
- ♦ Lambda control switched off (control unit has recognised a fault in the injection system => , interrogate fault memory).
- ♦ Lambda probe damaged by contact spray or similar product. (The contact spray is drawn into the probe through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effects.)
- ♦ 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

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

Test conditions

- No fault stored in fault memory
=> Page 4 , Interrogate fault memory.
- Read measured value block, Display Group 21, engine at idling speed =>Page 21 .

Warning
Second person is required to operate V.A.G 1551.

- Take the vehicle for a test drive.

-> Indicated on display:

```
Read measurement block 21
      860 rpm      2.15 ms      13.75
C              l-Control OFF
```

- Check display in display zone 4.

Specified value: λ -Control OFF (lambda control not active)

If the engine running problems occur before the lambda control cuts in, the following faults are possible:

- ♦ Carbon deposits on the inlet valves.
- ♦ Unmetered air in intake system.
- ♦ Fuel supply system defective.

The lambda control cuts in at a probe temperature of approx. 300 °C. The time it takes for this temperature to be reached is influenced by the following factors:

- ♦ Ambient temperature (summer or winter)
- ♦ Operating conditions after starting
- ♦ Operation of lambda probe heating.

-> Indicated on display:

```
Read measurement block 21
      860 rpm      2.15 ms      34.25 C
l-Control ON
```

- Check display in display zone 4.

Specified value: λ -Control ON (lambda control active)

If the engine running problems only occur after the lambda control sets in:

- Check operation => Page 53

2.3 - Checking function

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Checking lambda probe voltage

- Read measured value block, Display Group 21, engine at idling speed =>Page 21 .

-> Indicated on display:

```
Read measurement block 21
      860 rpm      2.15 ms      34.25 C
l-Control ON
```

- Check display in display zone 4.



Specified value: λ -Control ON (lambda control active)

Do not continue with check until lambda control is active.

- Press C key.
- Press keys 0 and 9 for "Display Group 9" and confirm entry by pressing Q key.

-> Indicated on display:

Read measurement block 9				
860 rpm	0.7 %	0.755 V	0.4	
%				

- Check display in display zone 3.

Read measurement block 9				
860 rpm	- 0.7 %	0.185 V	0.4 %	

-> Specified value: Display fluctuates between - 0.1 V and 1.0 V.

Note:

The voltage must fluctuate about 15 - 30 times per minute.

If the voltage fluctuates too slowly, the following faults are possible:

- ♦ Lambda probe heating defective
- ♦ Lambda probe defective

-> If a constant voltage of 0.45 ... 0.50 V is displayed, the following faults are possible:

Read measurement block 9				
860 rpm	0.7 %	0.475 V	0.4	
%				

- ♦ Line break to lambda probe.
- ♦ Lambda probe heating defective
- ♦ Lambda probe defective

-> If the display shows a constant voltage reading of - 0.1 ... +0.3 V (mixture too lean), this means that the lambda control has reached the control stop in the "enrich" direction but the lambda probe is still registering "Mixture too lean". The following faults are possible:

Read measurement block 9				
860 rpm	- 0.7 %	0.185 V	0.4 %	

- ♦ Unmetered air in intake system.
- ♦ Fuel pressure too low

-> If the display shows a constant voltage reading of + 0.7 ... 1.0 V (mixture too rich), this means that the lambda control has reached the control stop in the "lean" direction but the lambda probe is still registering "Mixture too rich". The following faults are possible:

Read measurement block 9				
860 rpm	0.7 %s	0.830 V	0.4 %	

- ♦ Intake system blocked
- ♦ Fuel pressure too high
- ♦ Solenoid valve for activated carbon canister constantly open.

Check learned value for mixture formation.

The mixture adaptation system has learning ability, i.e. the lambda control can recognise differences between various engines (injector nozzle delivery, compression, fuel pressure etc.) and compensates by adjusting the pre programmed basic injection periods in the map in the control unit. The injection periods are extended or

reduced until a mixture of $\lambda = 1$ is achieved. The difference between the actual injection period and the basic injection time programmed in the map is given in %

- Read measured value block, Display Group 8, engine at idling speed =>Page 21 .

-> Indicated on display:

Read measurement block 8
4.37 ms 0.4 % 0.1 % TB
active

- Check display in display zone 2.

Specification: - 10...+ 10 %

- Check display in display zone 3.

Specification: - 8...+ 8 %

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

If the learned value is too high, the following faults are possible:

- ♦ Unmetered air in intake system.
- ♦ Unmetered air at exhaust manifold.
- ♦ Airflow meter defective
- ♦ Fuel pressure too low
- ♦ Injector clogged

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

If the learned value is too low, the following faults are possible:

- ♦ Oil dilution (high petrol content in oil)
- ♦ Airflow meter defective
- ♦ Fuel pressure too high
- ♦ Injector leaking
- ♦ Solenoid valve for activated carbon canister constantly open.

2.4 - Checking lambda probe heating

- Read measured value block, Display Group 25, engine at idling speed =>Page 21 .

-> Indicated on display:

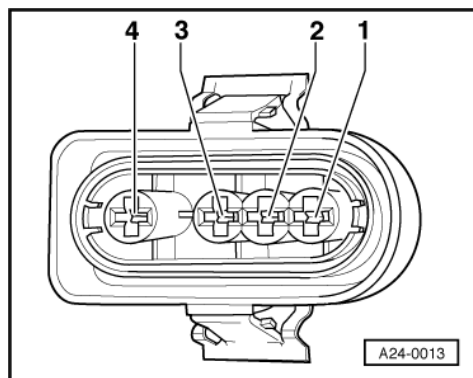
Read measurement block 25
Idling speed 0.35 crankshaft
87.2 5C 8.7 Ohm

- Check display in display zone 4.

Specification: 6...15 Ohm

If the specification is not obtained:

- Switch off ignition
- Disconnect the connector to the lambda probe => Installation locations - Overview - Page 36 .



- ➔ Connect the multimeter (voltage measurement range) to contact 1 on the connector and to earth.
- Operate the starter briefly (the engine may start briefly).

Specification: approx. battery voltage

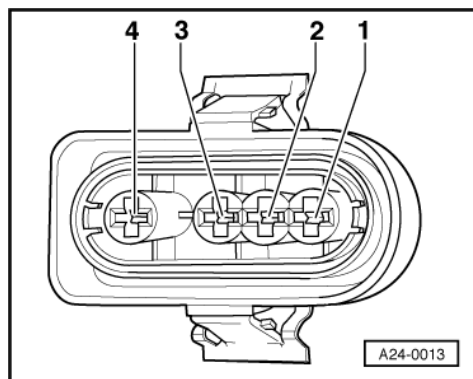
If the specification is not obtained:

- Check the wiring.

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

If the specification is obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .



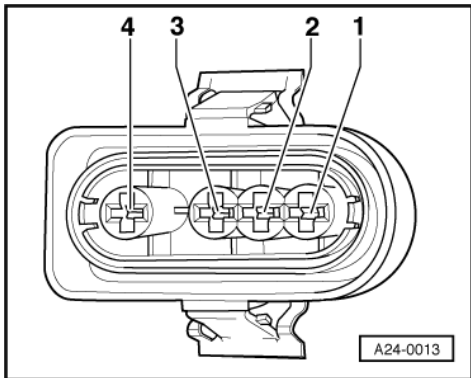
The following wiring connections should be checked for open circuits and/or short to positive or negative.

4-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket
2	27

- Rectify any open/short circuit as necessary.

2.5 - Testing lambda probe signal wiring and activation

- Disconnect the connector to the lambda probe => Installation locations - Overview - Page 36 .
- Switch the ignition on.

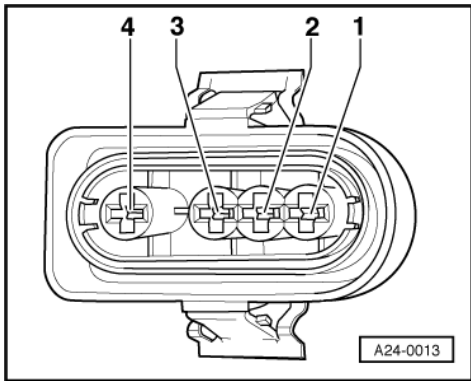


- -> Connect the multimeter for voltage measurement to the following contacts on the connector:

4-pin connector on the wiring harness, contact.	Specification
3 + earth	280 ± 20 mV
3 + 4	450 ± 50 mV

If the specified values are not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .



The following wiring connections should be checked for open circuits and/or short to positive or negative.

4-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket
3	25
4	26

- Rectify any open/short circuit as necessary.

2.6 - Removing and installing lambda probe

Removing

- Disconnect the connector to the lambda probe => Installation locations - Overview - Page 36 .
- Unscrew the lambda probe using V.A.G 3337/9.

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Installing

Installation is performed in the reverse sequence.

Tightening torque: 50 Nm

Note:

The screw thread on the lambda probe is coated with assembly paste. This paste must not be allowed to penetrate the openings on the probe.

3 - Checking intake manifold changeover function

3.1 - Checking intake manifold changeover function

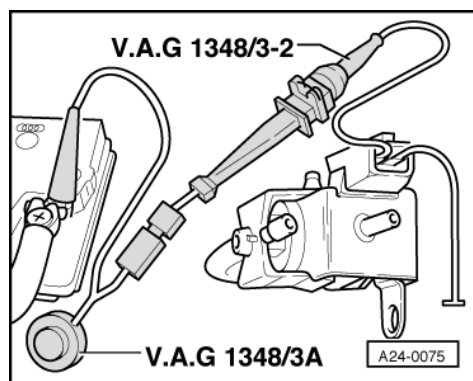
3.2 - Checking function

- Apply a sudden increase in engine speed (petrol surge). The vacuum unit for the intake manifold changeover function must pick up. (Fitting location: front left-hand side of intake manifold).

If the changeover is not taking place, carry out the following tests:

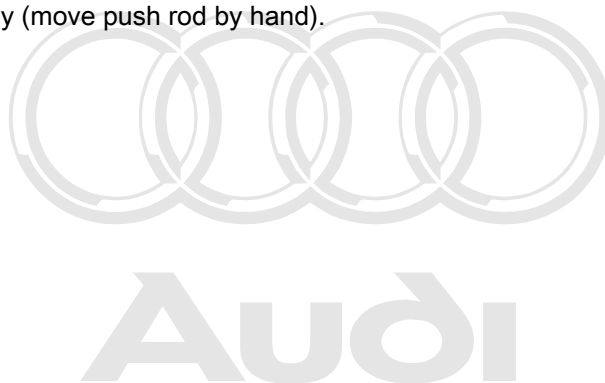
- Check intake manifold changeover function valve N156 (apply final control diagnosis => Page 61).
- Checking vacuum reservoir for leaks
=> Page 58
- Check that vacuum hoses are properly connected and free of leaks and obstructions.
- Check that changeover mechanism operates freely (move push rod by hand).

3.3 - Checking vacuum system



- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.
- Switch off ignition.
- Unplug connector from intake manifold changeover valve -N156.
- -> Connect one of the contacts of -N156 to engine earth using test leads and crocodile clamp from V.A.G 1594.
- Connect second 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 approx. 2 to 3 minutes; throughout this period, the vacuum unit should remain energised.

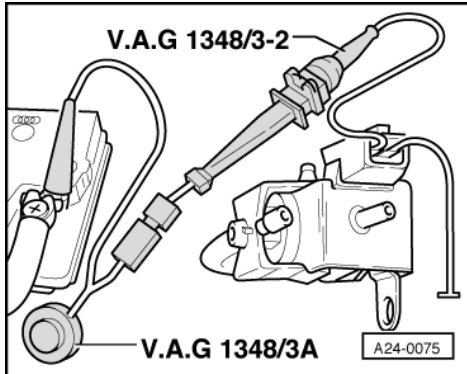
If the vacuum unit returns to its original "rest" position, carry out the following test:



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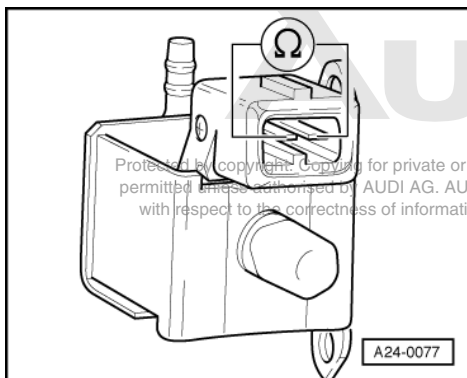
- Disconnect vacuum hoses from vacuum unit for intake manifold changeover system.
- Connect hand vacuum pump V.A.G 1390 to vacuum unit.
- Operate hand pump and check whether changeover function is working.
- Check vacuum unit for leaks. (The vacuum unit should not return to rest position until the hand pump is vented to atmosphere.)
- If necessary, renew vacuum unit.

If the vacuum unit is not energised, check -N156 as follows for blockage:



- -> Connect one of the contacts of -N156 to engine earth using test leads and crocodile clamp from V.A.G 1594 .
- Connect second 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.
- Check valve for obstructions (remove vacuum hoses and blow through).
- If necessary, renew intake manifold changeover valve.
- If no faults have been found in any of the tests so far, check the vacuum system for leaks.

3.4 - Testing intake manifold changeover valve



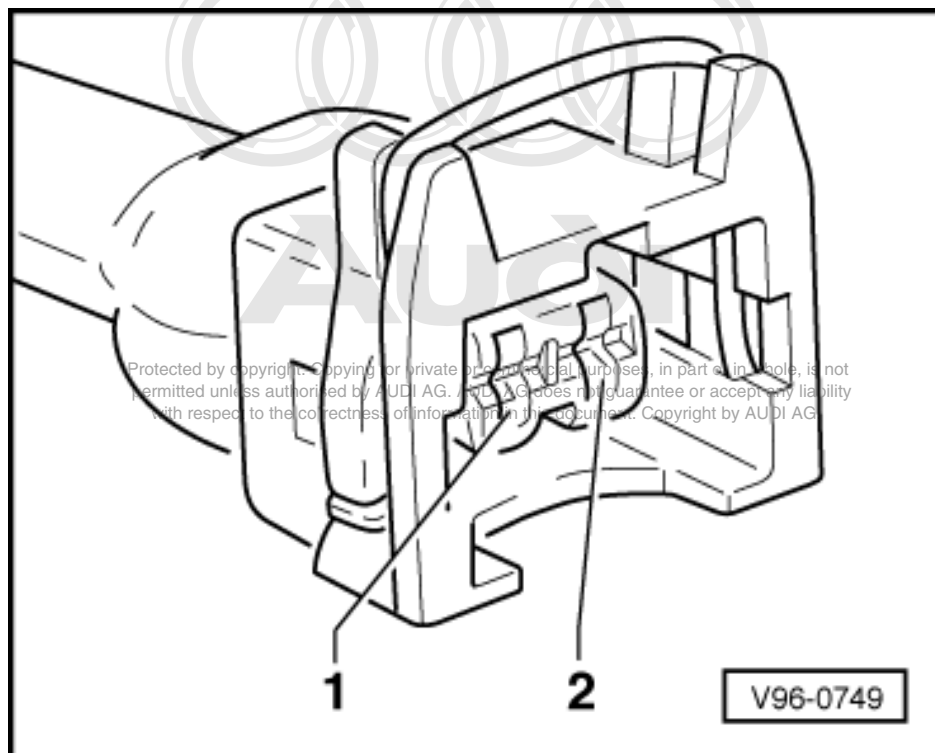
Electrical test of intake manifold changeover valve -N156

Fitting location =>Page **36** .

- Unplug connector from intake manifold changeover valve -N156.
- -> Measure resistance between the injector contacts using V.A.G 1526.

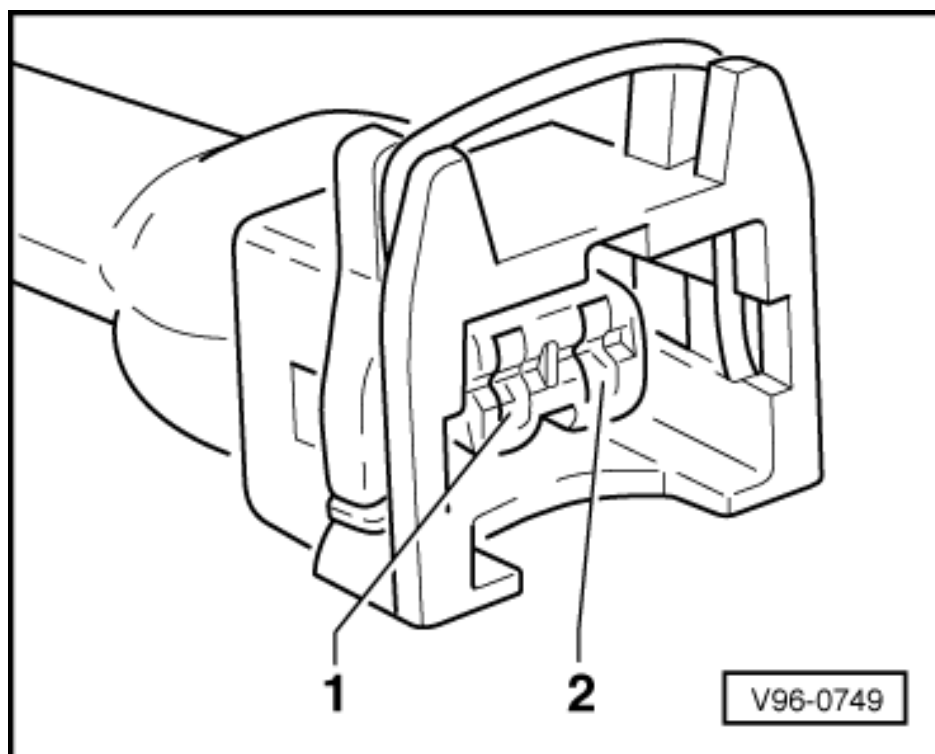
Specification: 25...35 Ohms

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



Testing power supply to intake manifold changeover valve -N156

- -> Remove connector from valve for intake manifold changeover function -N156.



- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1 (positive) on connector using cables from adapter set V.A.G 1594.
- Operate the starter briefly.

The diode test lamp should light up.

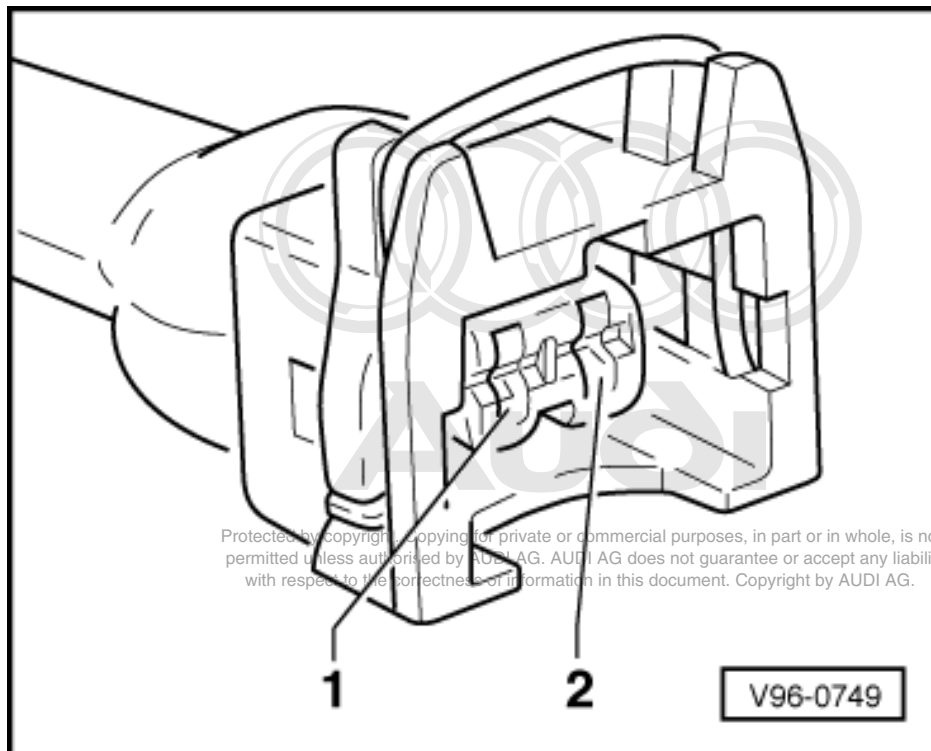
If the diode test lamp does not light up, carry out the following tests:

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

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

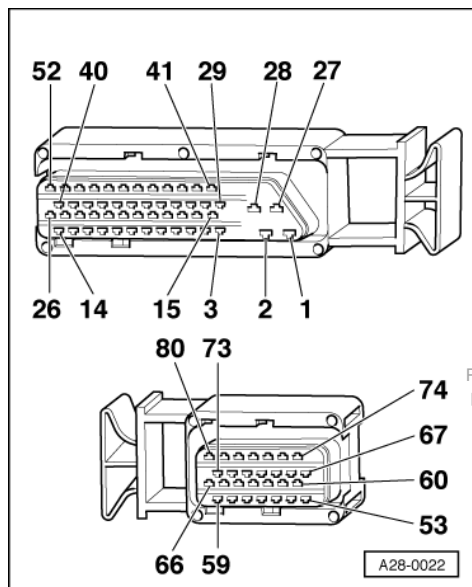
Specification: max. 1 Ω .

- Check the fuel pump relay and actuation => Page 49 .



Testing activation of intake manifold changeover valve

- -> Connect diode test lamp V.A.G 1527 between contacts 1 and 2 on connector for intake manifold changeover valve using cables from adapter set V.A.G 1594.
- Start the final control diagnosis => Page 15 . The diode test lamp should flash when the intake manifold changeover valve is being 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 38 .
- If the diode test lamp lights up continuously, test for short to earth in wiring between contact 2 on connector for intake manifold changeover valve and socket 64 on V.A.G 1598/22 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 64 on test box.



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Specification: max. 1 ω .

- -> Rectify the short-circuit or open-circuit as appropriate.
- If no open circuits or short circuits are found, fit a new engine control unit =>Page 38 .

4 - Checking fuel tank breather

4.1 - Checking fuel tank breather

4.2 - Checking function

If the lambda control is active, the tank breather system is under closed-loop control. The venting of the active carbon canister is active for 12 minutes (cycled) and closed for 1 minute.

If the lambda control is not active, the tank breather system has open-chain control. The venting of the active carbon canister is cycled with a specified signal ratio.

- Read measured value block, Display Group 10, engine at idling speed =>Page 21 .

-> Indicated on display:

Read measurement block 10			
9 %	0.87	17	0.23

- Observe readouts in display zones 1 and 4.

Display zone 1	Display zone 4	Possible cause of fault
0 %	0.00	▪ OK, Fuel tank breather system not active.
1...99 %	0.01...0.30	▪ OK, Fuel tank breather system active.

- Let the vehicle run at idle for a few minutes so that both operating conditions, "active" and "not active" can be checked.

4.3 - Testing solenoid valve 1 for activated charcoal filter

Checking function

- Pull off hoses from solenoid valve 1 for active carbon canister -N80
=> Fitting locations - Overview - Page 36 .
- Connect auxiliary hose.
- Start actuator diagnosis and actuate solenoid valve 1 for active carbon canister -N80 =>Page 15 .

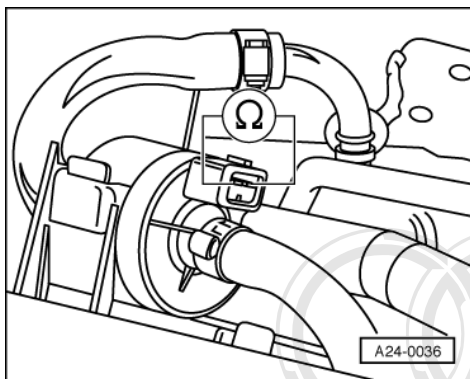
-> Indicated on display:

Final control diagnosis
Solenoid valve 1 for activated charcoal
filter -N80

The valve should click ...

- If the valve does not click, electrically check the solenoid valve for active carbon canister => Page 63 .
... and should open and close (check by blowing into the auxiliary hose).
When there is no electrical signal the solenoid valve remains closed.
- If the valve does not open and close correctly, renew solenoid valve 1 for active carbon canister.

Electrical check for solenoid valve 1 for active carbon canister (N80)



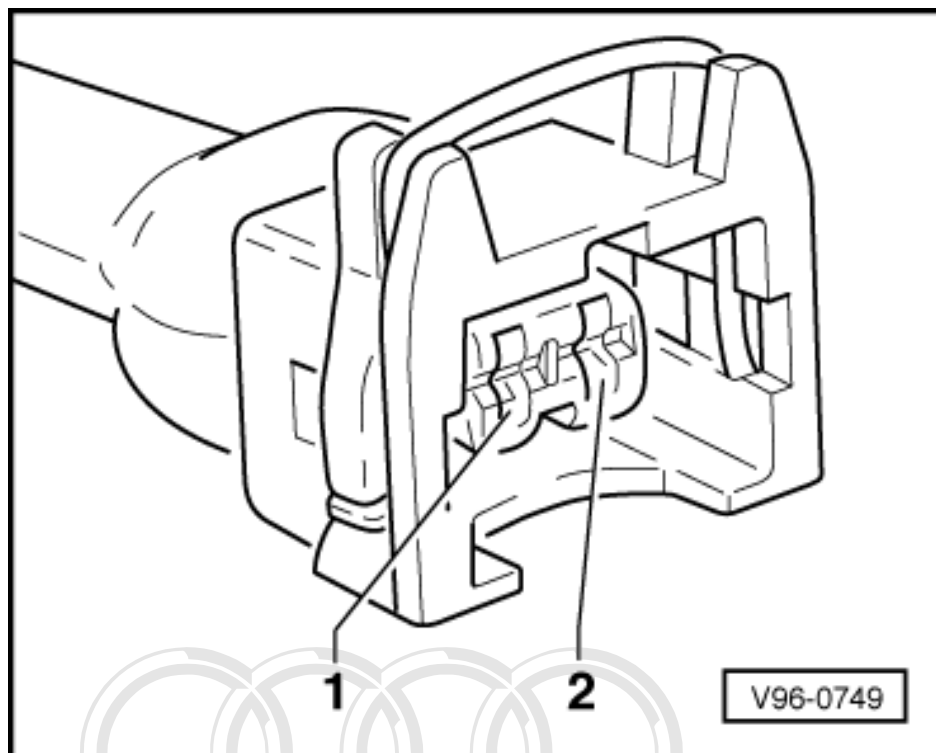
- Unplug the connector from the valve
=> Fitting locations - Overview - Page 36 .
- -> Connect multimeter to valve to measure resistance

Specification: 22...30 Ω .

If the specification is not obtained:

- Renew solenoid valve 1 for active carbon canister (N80).

If the specification is obtained:



- ➔ Connect the multimeter (voltage measurement range) to contact 1 on the connector and to earth.
- Operate the starter briefly (the engine may start briefly).

Specification: approx. battery voltage

If the specification is not obtained:

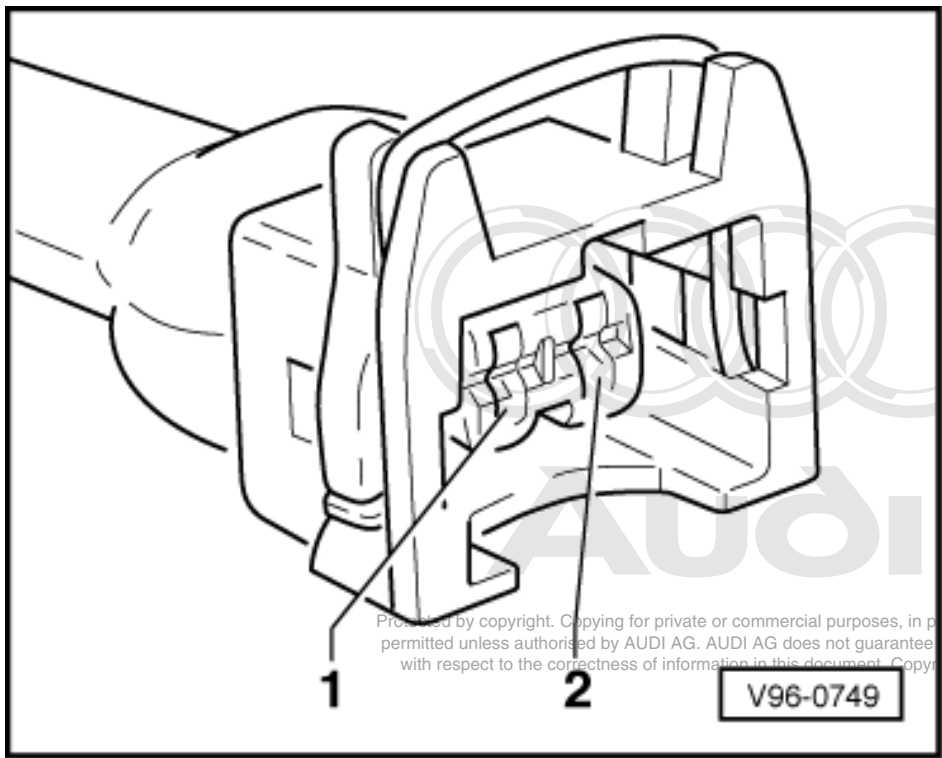
- Check the wiring.

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

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If the specification is obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
- => Page 38 .



The following wiring connections should be checked for open circuits and/or short to positive or negative.

2-pin connector on wiring harness, contact.	Test box V.A.G 1598/22, socket
2	15

- Rectify any open/short circuit as necessary.

5 - Checking throttle valve control unit

5.1 - Checking throttle valve control unit

5.2 - Adaptation of the throttle valve control unit to the engine control unit

The idle stabilisation requires the engine control unit to know the stop positions of the throttle valve positioner (V60) and the potentiometer characteristics of the throttle valve positioner sensor (G127) and throttle valve potentiometer (G69).

The learning process (adaptation) is necessary if:

- ◆ The voltage supply to the engine control unit has been interrupted (e.g. the battery disconnected).
- ◆ The throttle valve control unit was replaced.
- ◆ The engine control unit has been renewed.
- ◆ The fault number 17967 exists in the fault memory.

The learning process (adaptation process) is performed:

- ◆ Automatically if the ignition is switched on once for at least 6 seconds without actuating the starter or the accelerator pedal.



- ♦ By initiating the "Basic setting", Display Group 98, with the engine stopped.
- Select "Basic setting", Display Group 98, with engine stopped => Page 17 .

-> Indicated on display:

Default setting 98			
4.420 V	3.880 V		
Idle	ADP. running		

After you have pressed the Q key, the throttle valve positioner is run to min and to max, and to five intermediate positions, and the control unit stores the respective throttle valve angle in the non-volatile memory. This process takes no more than 10 seconds. The throttle then moves into the start position for approx. 20 s, then into the rest position (no electrical supply).

-> Indicated on display:

Default setting 98			
4.420 V	3.880 V	Idle	ADP.
OK.			

Adaptation has been successfully carried out.

-> If one of these messages appears on the display, the adaptation would then be terminated.

Default setting 98			
4.420 V	3.880 V	Idle	
ADP. ERROR			

Following faults are possible:

Function is unknown or cannot be performed at the moment
--

- ♦ Engine started during adaptation.
- ♦ Battery voltage less than 10 V
- ♦ Throttle control cable not OK
- ♦ Wiring connection between throttle valve control unit and engine control unit defective.
- ♦ Throttle valve control unit defective.

5.3 - Testing idling switch

- Read measured value block, Display Group 98, engine stopped =>Page 21

-> Indicated on display:

Read measurement block 98			
4.420 V	3.880 V	Idle	ADP.
OK.			

- Check display in display zone 3.

Read measurement block 98			
4.420 V	3.880 V	Idle	ADP. OK.

-> Specification: Idling

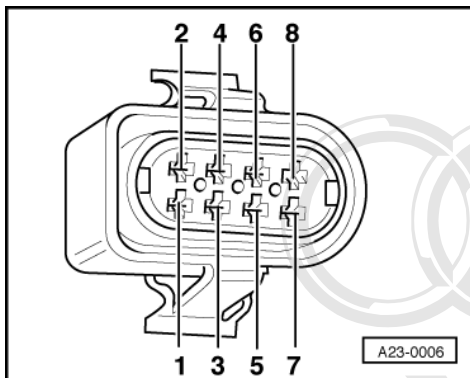
- Press accelerator pedal.

Read measurement block 98			
4.420 V	3.880 V	Part load	ADP.
OK.			

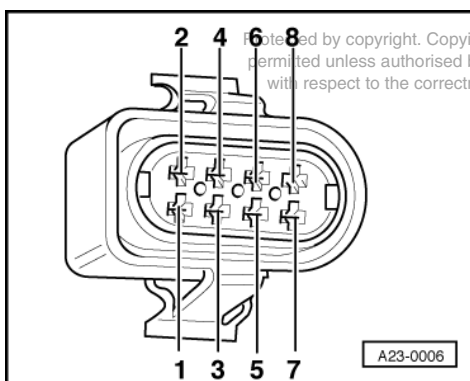
-> Specification: Part load

If the specification is not obtained:

- Switch off ignition.



- ➔ Disconnect the connector from the throttle valve control unit.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .



The following wiring connections should be checked for open circuits and/or short to positive or negative.

8-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket
3	69
7	67

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace the throttle valve control unit (J338).

5.4 - Testing throttle valve potentiometer

The throttle valve potentiometer (G69) informs the engine control unit of the position of the throttle valve.

- Read measured value block, Display Group 01, engine stopped =>Page 21

➔ Indicated on display:

Read measurement block 1
0 rpm 0.00 ms 4
-5 12.05 before TDC

- Check display in display zone 3.

Read measurement block 1
0 rpm 0.00 ms 4 -5
12.05 before TDC



-> Specified value: 0...5 <°

- Slowly floor accelerator pedal.

Read measurement block 1	
0 rpm	0.00 ms
12.00 before TDC	86 -5

-> Specified value: The readout in display zone 3 should increase steadily until it reaches 85 - 90 <° (with accelerator pedal fully depressed).

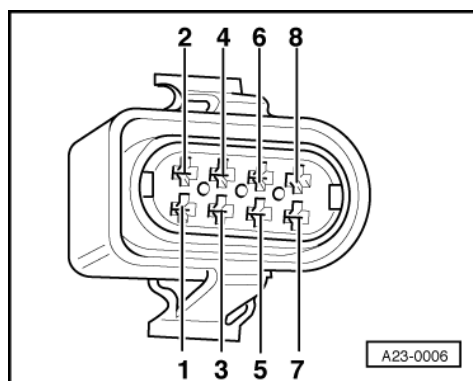
If either the initial or the final specification is not achieved:

- Check accelerator cable setting

=> Engine mechanics; Repair group 20

If the display does not change or only changes irregularly:

- Switch off ignition.

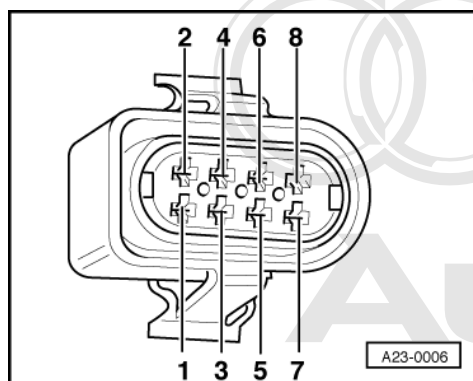


- -> Disconnect the connector from the throttle valve control unit.
- Connect the multimeter (voltage measurement range) to contact 4 on the connector and to earth.
- Switch the ignition on.

Specification: approx. 5 V

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
- => Page 38 .

The following wiring connections should be checked for open circuits and/or short to positive or negative.



8-pin connector on the wiring harness, contact	Test box V.A.G 1598/22, socket
4	62
5	75

7	67
---	----

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace the throttle valve control unit (J338).

5.5 - Testing throttle valve actuator sensor

The sensor for the throttle valve positioner (G127) informs the engine control unit of the position of the throttle valve positioner (V60).

- Read measured value block, Display Group 98, engine at idling speed =>Page 21

-> Indicated on display:

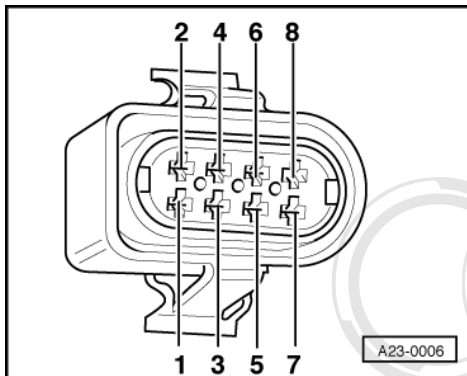
Read measurement block 98			
4.420 V	3.880 V	Idle	ADP.
OK.			

- Check display in display zone 2.

Specification: 0.500...4.900 V

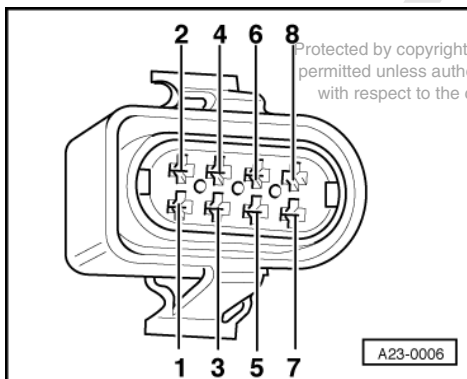
If the specification is not obtained:

- Switch off ignition.



- -> Disconnect the connector from the throttle valve control unit.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38.

The following wiring connections should be checked for open circuits and/or short to positive or negative.



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8-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket
4	62
7	67
8	74

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace the throttle valve control unit (J338).

5.6 - Testing throttle valve actuator

The throttle valve positioner (V60) is an electric motor. When the engine is idling, it actuates the throttle valve via a gear mechanism in order to control the idling speed.

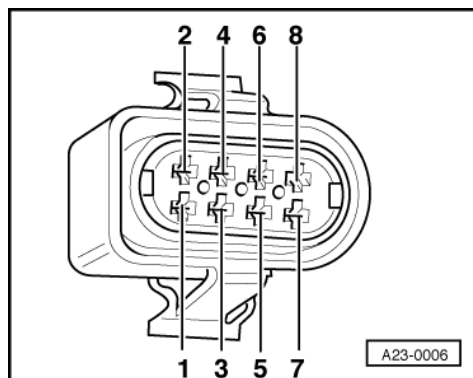
- Select "Basic setting", Display Group 98, with engine stopped => Page 17 .

-> Indicated on display:

Default setting 98		
4.420 V	3.880 V	Idle
ADP. running		

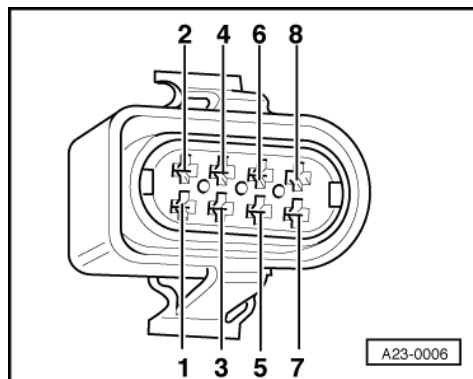
After the Q key is pressed, the throttle valve positioner runs to the min and max limit stops (visual and audio cues on throttle valve control unit).

If the throttle valve positioner does not move:



- Switch off ignition.
- -> Disconnect the connector from the throttle valve control unit.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .

The following wiring connections should be checked for open circuits and/or short to positive or negative.



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8-pin connector on the wiring harness, contact	Test box V.A.G 1598/22, socket
1	66
2	59

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace the throttle valve control unit (J338).

6 - Testing control unit input values

6.1 - Testing control unit input values

6.2 - Checking control unit power supply

Test conditions

- Battery voltage OK.
- Read measured value block, Display Group 3, engine stopped =>Page 21

-> Indicated on display:

Read measurement block 3		
860 rpm	12.760 V	18.65 C
17.85C		

- Check display in display zone 2.

Specification: approx. battery voltage

If the specification is not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .
- Connect multimeter between the following contacts on the test box to test the voltage:

	Test box, socket.	Specification
Ignition off	3 + 2	approx. battery voltage
Ignition on	1 + 2	approx. battery voltage

If the specified values are not obtained:

- Check the wiring.

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



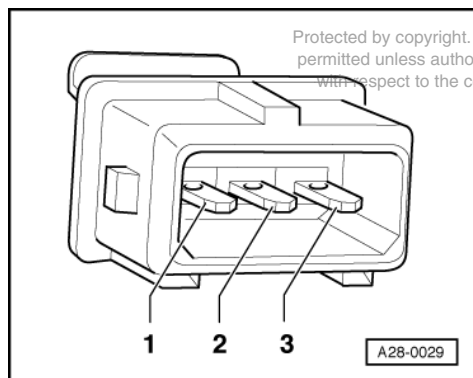
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6.3 - Checking engine speed sender

The engine speed sender is a combined speed sender and reference mark sender. If it fails the engine will cut out.

- Switch off ignition.
- Remove connector from injection pump => Installation position overview, Page 36 .



- -> Connect multimeter between contacts 1 and 2 on the sender connector to measure resistance.

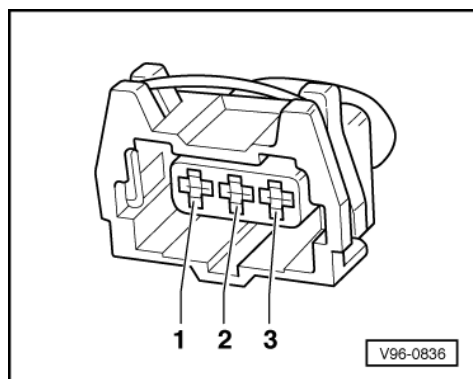
Specification: 480...1000 Ω

If the specification is not obtained:

- Renew engine speed sensor (G28)

If the specification is obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .



The following wiring connections should be checked for open circuits and/or short to positive or negative.

3-pin connector on the wiring harness contact.	Test box V.A.G 1598/22, socket
1	56
2	63
3	2

- Rectify any open/short circuit as necessary.

6.4 - Checking coolant temperature sender

- Read measured value block, Display Group 03, cold engine at idling speed => Page 21 .

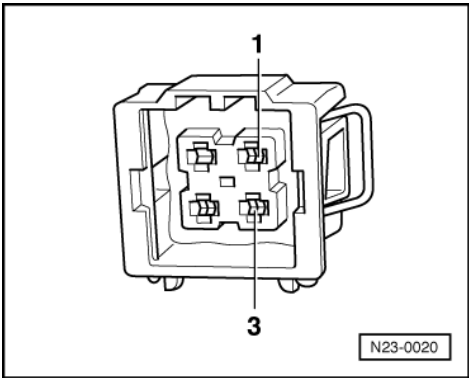
-> Indicated on display:

Read measurement block 3
860 rpm 13.580 V 17.65 C
16.95 C

- Observe display in display zone 3.

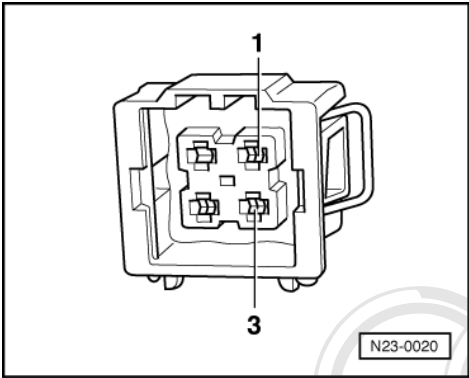
Specification: The temperature reading should increase at a uniform rate.

If there is no realistic readout in display zone 3:



- Switch off ignition.
- -> Pull off the connector on the sensor => Installation locations Overview, Page 36 .
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .

The following wiring connections should be checked for open circuits and/or short to positive or negative.



4-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket
1	53
3	67

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace coolant temperature sender (G62).

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6.5 - Checking intake air temperature sender

- Read measured value block, Display Group 03, cooled stationary engine =>Page 21

-> Indicated on display:

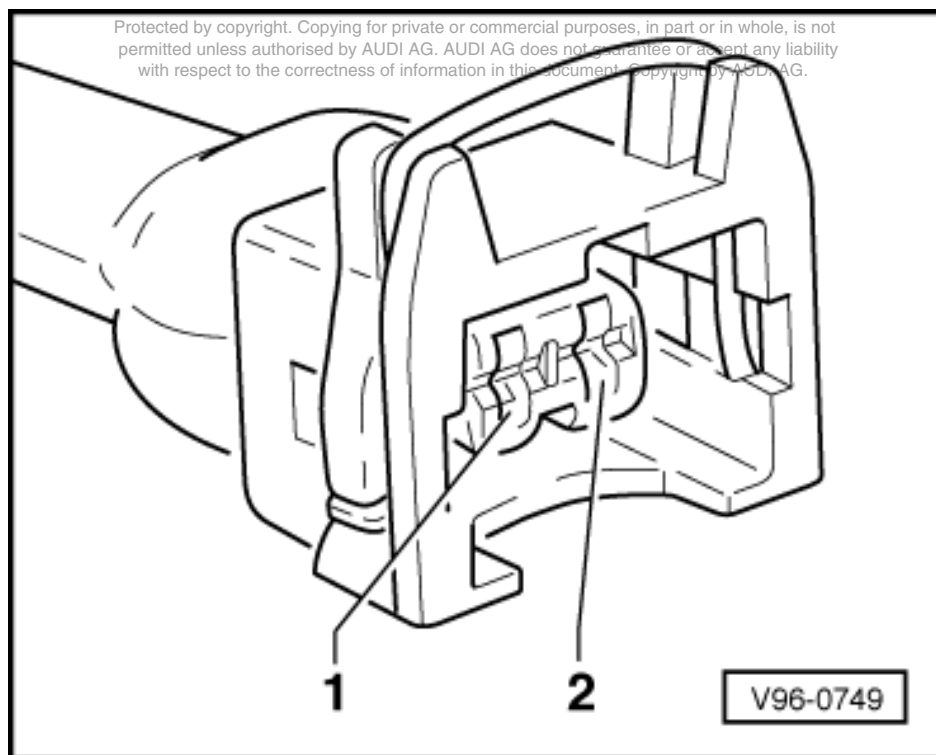
Read measurement block 3		
860 rpm	13.580 V	17.65 C
16.95C		

- Check display in display zone 4.

Specification: approx. the same as the ambient temperature

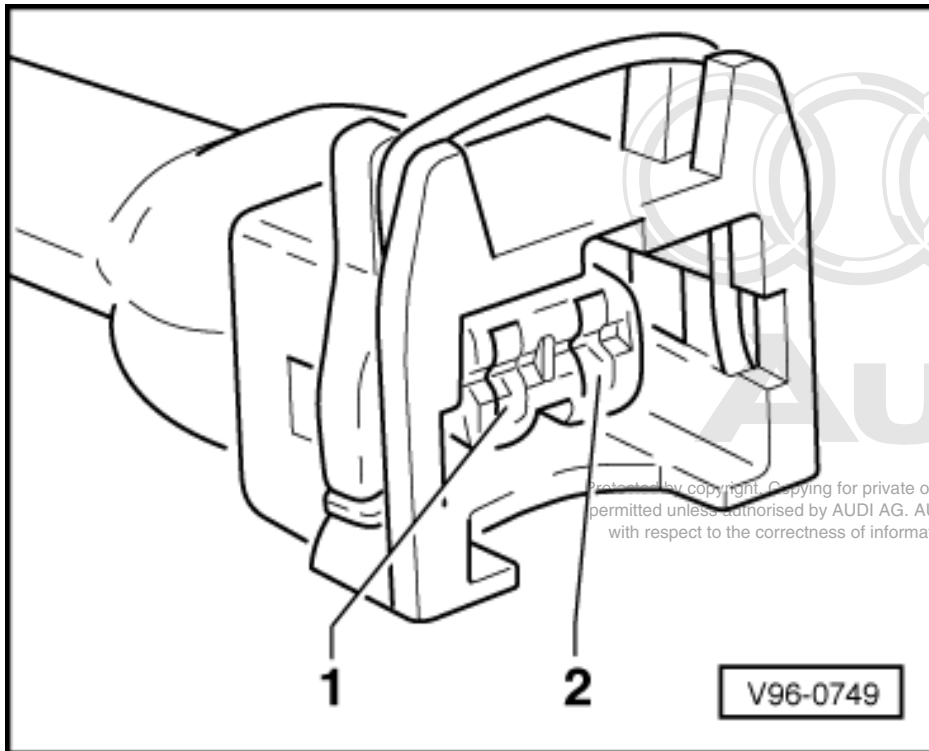
In the event of an open circuit the wiring to the sensor, a substitute value of 19.5°C will be displayed.

If there is no realistic readout in display zone 4:



- Switch off ignition.
- -> Pull off the connector on the sensor => Installation locations Overview, Page 36 .
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .

The following wiring connections should be checked for open circuits and/or short to positive or negative.



2-pin connector on wiring harness, contact.	Test box V.A.G 1598/22, socket
1	54
2	67

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Fit a new intake air temperature sensor (G42).

6.6 - Testing air mass meter

- Read measured value block, Display Group 2, engine at idling speed =>Page 21

-> Indicated on display:

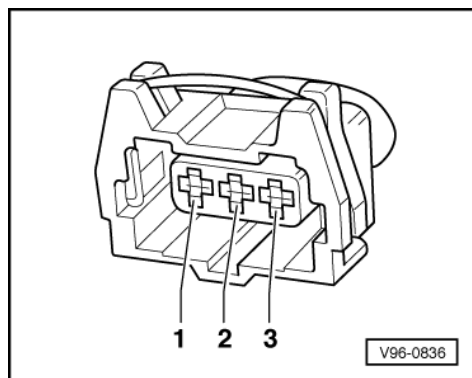
Read measurement block 2
1 2 3 4

- Check display in display zone 4.

Specification: 2.0 - 4.0 g/s:

If the specification is not obtained:

- Switch off ignition.
- Remove connector from air mass meter =>Installation position overview, page 36
- Switch the ignition on.



- ➔ Connect the multimeter for voltage measurement to the following contacts on the connector:

3-pin connector on the wiring harness contact	Specification
3 + earth	Battery voltage
3 + 2	Battery voltage

If the specified values are not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page **38** .

The following wiring connections should be checked for open circuits and/or short to positive or negative.

3-pin connector on the wiring harness contact	Test box V.A.G 1598/22, socket
1	13
2	12
3	to fuse

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace air mass meter (G70).



7 - Checking auxiliary signals

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7.1 - Checking auxiliary signals

7.2 - Testing signals from/to automatic gearbox

A - Gear change signal

This signal causes the ignition timing to be briefly retarded (torque reduction) during gearshifts in order to smooth out the jolts experienced when changing gear.

- Read measured value block, Display Group 19, engine at idling speed =>Page **21**

-> Indicated on display:

Read measurement block 19
860 rpm 2.20 ms 1 1
1 8.55 before TDC

- Observe display in display zone 3.
- Specification: X 1 X

Warning
Second person is required to operate V.A.G 1551.

- Take the vehicle for a test drive.

Read measurement block 19
860 rpm 2.20 ms 0 1 1
4.55 before TDC

-> Observe display zone 3 during a gear change.

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Specification: X 0 X

If the specification is not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page **38**.

The following wiring connections should be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Automatic gearbox control unit, contact
23	=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- Rectify any open/short circuit as necessary.

B - Accelerator pedal position signal

This signal is required for load-dependent calculation of the gearshift times.

The signal is monitored by the self diagnosis (fault memory, read measured value block) of the automatic gearbox control unit.

Signal testing

=> Automatic gearbox; Repair Group 01

C - Engine speed signal

This signal is required for calculating how to smooth out the gearshifts.

Signal testing

=> Checking engine speed signal, Page **79**

D - Selector lever position signal

This signal is required for idling speed stabilisation.

When a gear is selected, the idling speed is reduced in order to alleviate vehicle "creeping".

- Read measured value block, Display Group 20, engine at idling speed =>Page **21**

-> Indicated on display:



Read measurement block 20
860 rpm Neutral A/C-Low
Compr. OFF

- Observe display in display zone 2.

Specification: Neutral

- Operate the footbrake and engage a gear.

Read measurement block 20
860 rpm Gear selected A/C-Low Compr.
OFF

-> Specification: Gear selected.

If the specification is not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .

The following wiring connections should be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Automatic gearbox control unit, contact
22	=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- Rectify any open/short circuit as necessary.

7.3 - Testing signals from/to air conditioning system

Testing air conditioning compressor signal and air conditioning compressor shut-off

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 conditioning compressor in the following cases:

- ♦ During strong acceleration from low road speed for approx. 4 s (recognition from angle change at throttle valve potentiometer and road speed signal).
- ♦ At full load in 1st gear for approx. 12 seconds.
- ♦ If the throttle valve control unit is defective and the engine speed is less than 1500 rpm.
- ♦ After every start, for approx. 6 seconds.
- ♦ During the learning process for idle stabilisation for approx. 15s

Test conditions

- Air conditioning system OK
- No fault stored in fault memory

- Read measured value block, Display Group 20, engine at idling speed =>Page 21

-> Indicated on display:

Read measurement block 20
860 rpm Neutral A/C-Low
Compr. OFF

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- Observe display in display zone 4.

Specification: Compr.OFF

- Switch on air conditioning system.

Read measurement block 20				
860 rpm	Neutral	A/C-Low	Compr.	
OFF				

-> Specification: Compr. ON

- Abruptly floor the accelerator and release again (brief burst of throttle).

Read measurement block 20				
860 rpm	Neutral	A/C-Low	Compr.	
OFF				

-> Specification: Compr. OFF (for a few seconds)

If the specification is not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page **38** .

The following wiring connections should be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Air conditioner operating and display unit, contact
8	=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- Rectify any open/short circuit as necessary.

7.4 - Checking engine speed signal

The engine speed signal is required for the rev counter, air conditioner and automatic gearbox.

However, since the signal cannot be read in the form in which it is generated by the engine speed sender (G28), it has to be processed by the engine control unit.

Identify the engine speed signal as follows:

Dash panel insert

- Observe rev counter reading.

Specification: The current engine speed should be displayed.

Air conditioner

The signal is monitored by the air conditioner self diagnosis function (fault memory, read measured value block).

Signal testing

=> Heating, Air conditioning; Repair Group 01

Specification: The current engine speed should be displayed in the measured values block.

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Automatic gearbox

The signal is monitored by the self diagnosis (fault memory, read measured value block) of the automatic gearbox control unit.

Signal testing

=> Automatic gearbox; Repair Group 01

Specification: The current engine speed should be displayed in the measured values block.

If the engine speed signal specified values is not achieved for all "consumers", the following faults are possible:

- ♦ Open circuit or short circuit between engine control unit and harness connector.

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

- ♦ Short circuit between connector in harness and "consumer".
- ♦ Engine control unit defective.

If the engine speed signal specified value is achieved for at least one "consumer", the following faults are possible:

- ♦ Open circuit in wiring between wiring harness connector and "Consumer"
 - ♦ "Consumer" defective.
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7.5 - Check road speed signal

The road speed signal is required to ensure that the air conditioning compressor is switched off when accelerating and to ensure smoother driving (jolt damping).

Test conditions

- Speedometer OK, checking:

=> Electrical System; Repair Group 90

- Read measured value block, Display Group 11, engine at idling speed =>Page 21

-> Indicated on display:

Read measurement block 19			
860 rpm	2.20 ms	0 km/h	
0.84 l/h			

Warning

Second person is required to operate V.A.G 1551.

- Take the vehicle for a test drive.
- Observe display in display zone 3.

Read measurement block 19			
2430 rpm	5.60 ms	45 km/h	3.38 l/h

-> Specification: The current road speed should be displayed (compare with speedometer).

If the specification is not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .

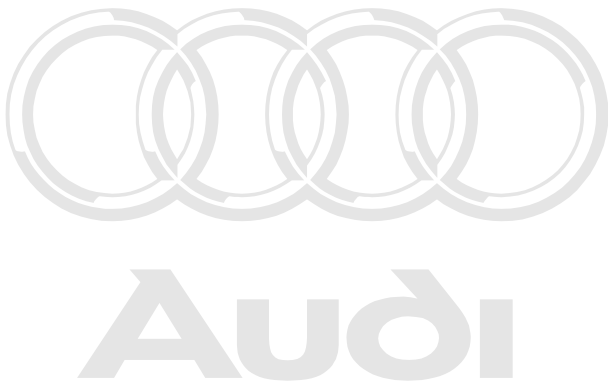
The following wiring connections should be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Dash panel insert, contact
20	=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Establish which electrical "consumers" (e.g. radio, automatic gearbox, air conditioning system etc.) are using the speed signal, disconnect them one by one from the dash panel insert, then keep repeating the test until the cause of the problem has been identified.



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28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

1.2 - Safety precautions

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 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, to check the compression), unplug the connector from the power output stage for the ignition coils and the connectors from the injectors. After completing the work, interrogate the fault memory.
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.3 - Technical data

Engine code letters	ADR (1.8l/5V/92 KW engine without intake manifold change-over function/without camshaft timing control)
	ADR (1.8l/5V/92 KW engine with intake manifold changeover function/with camshaft timing control)
	AFY (1.8l/5V/92 KW engine without intake manifold change-over function/without camshaft timing control)
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. 2 kΩ
Firing order	1-3-4-2
Engine speed limitation by Motronic system Cut-off speed	6800 ± 40 rpm

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

Ignition coils and output stage form a joint component.

This component cannot be tested by conventional measurement media/methods.

If there is a fault in the ignition system:

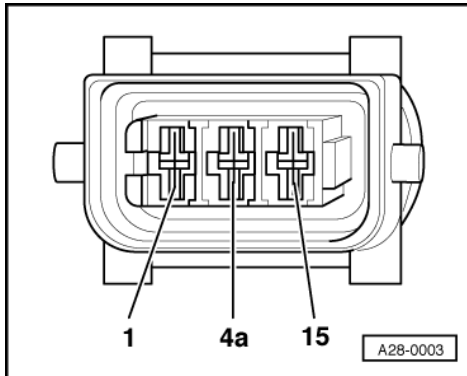
- Check power supply => Page 83
- Checking activation of power output stages

=> Page 83

If no faults are found in the process of tests, but no ignition spark is produced:

- Replace the output stage together with the ignition coils.

Checking power supply



- Unplug connectors on ignition coils.
=> Overview of fitting locations - Page 36 .
- -> Connect the multimeter (voltage measurement range) to contact 4a and to earth.
- Switch the ignition on.

Specification: approx. battery voltage

If the specification is not obtained:

- Check the wiring.

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

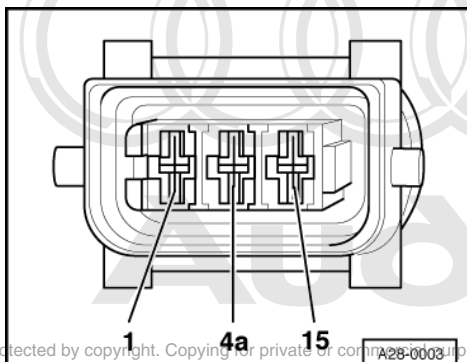
Checking actuation of power output stages

- Pull the connectors off all four injectors.

Note:

It is important to ensure that no fuel is injected during the test, as this would damage the catalytic converter. Therefore, the connectors on the injectors must be unplugged.

- Unplug connectors on ignition coils.
=> Overview of fitting locations - Page 36 .
- Switch the ignition on.



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- -> Connect the V.A.G 1527 diode test lamp to the following contacts on the connector:

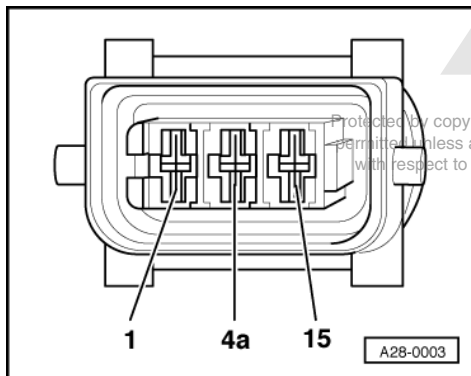


- Operate the starter for a few seconds.

3-pin connector on the wiring harness contact	Specification
1 + earth	Diode test lamp should flash (brief impulse)
15 + earth	

If the specified values are not obtained:

- Switch off ignition.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .



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The following wiring connections should be checked for open circuits and/or short to positive or negative.

3-pin connector on the wiring harness contact	Test box V.A.G 1598/22, socket
1	78
15	71

- Rectify any open/short circuit as necessary.

2 - Checking knock control system

2.1 - Checking knock control system

2.2 - Checking knock sensors

- Read measured value block, Display Group 16, engine at idling speed =>Page 21

-> Indicated on display:

Read measurement block 16		
0.800 V	0.840 V	0.800 V
0.760 V		

- Observe all display zones.

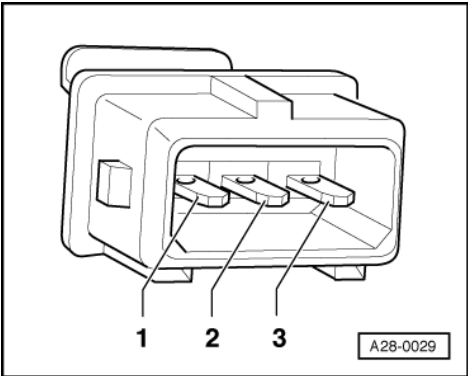
Specification: 0.400...1.400 V:

- Compare the display zones with each other.

Specification: Difference less than 0.500 V.

If the specified values are not obtained:

- Loosen knock sensors and tighten again to 20 Nm.



- Repeat test.

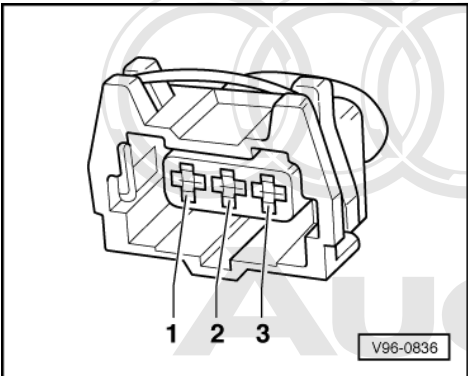
If the specifications are still not attained:

- Unplug the connector for the relevant knock sensor in the engine compartment.
- -> Check for a short circuit 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.

If no wiring fault is detected:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .

The following wiring connections should be checked for open circuits and/or short to positive or negative.



3-pin connector on the wiring harness contact		Test box V.A.G 1598/22, socket
Knock sensor 1 (G61)		
1		68
2		67
3		2
Knock sensor 2 (G66)		
1		60
2		67
3		2

- Rectify any open/short circuit as necessary.

2.3 - Checking Hall sender

The Hall sender indicates the ignition position for cylinder 1.

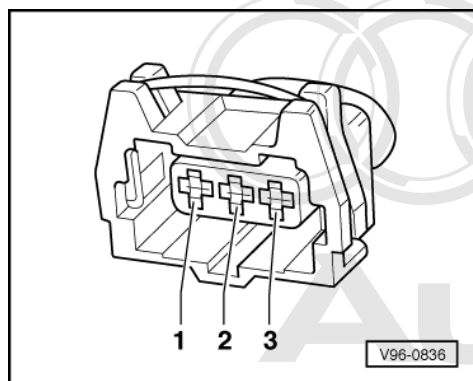
If the Hall sender fails to function, the knock control is switched off and the ignition timing is retarded slightly because the signals can no longer be assigned to the cylinders.

Even without a signal from the Hall sender, the engine will continue to run and can also be restarted.

- 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.
- The fact that the control unit is out of phase by one engine revolution does not have any noticeable effect on the injection system. If this happens, the fuel is injected "upstream" (before 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.

Note on signal testing with an oscilloscope:

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



- Push back the rubber sleeve on the Hall sender connector.
- -> Connect the V.A.G 1527 diode test lamp to contacts 1 and 2 on the Hall sender connector from behind (the connector remains attached to the Hall sender).

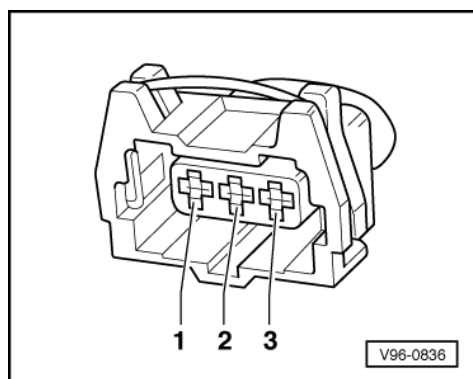
Note:

Receptacles are numbered accordingly on the back of the connector.

- Operate the starter for a few seconds.

The diode test lamp must flash briefly on each second engine revolution.

If the diode test lamp does not flash:



- Unplug the connector from the Hall sender.
- Switch the ignition on.

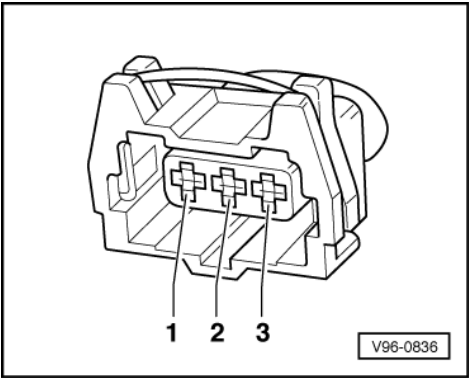
- -> Connect multimeter to measure voltage at contacts 1 and 3 of the connector:
Specification: 4.5 ... 5.5 V
- Connect multimeter to measure voltage at contacts 2 and 3 of the connector:
Specification: approx. battery voltage

If the specification is obtained:

- Renew Hall sender (G40).

If the specification is not obtained:

- Switch off ignition.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=> Page 38 .



The following wiring connections should be checked for open circuits and/or short to positive or negative.

3-pin connector on the wiring harness contact.	Test box V.A.G 1598/22, socket
1	62
2	76
3	67

- Rectify any open/short circuit as necessary.

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3 - Checking camshaft timing control

3.1 - Checking camshaft timing control

3.2 - Function of camshaft timing control

The adjustment of the intake camshaft is dependent on the engine load and engine speed. The exhaust camshafts are not timed.

The solenoid valves for camshaft timing control switch oil pressure to the camshaft adjuster (mechanical adjustment device).



The mechanical camshaft adjusters then time the inlet camshafts of both banks of cylinders towards "advanced", i.e. such that the inlet valves open earlier.

Checking camshaft timing control function

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

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Read measured value block 08
Enter display group number XXX

- Press keys 0, 2 and 5 for "Display group number 25" and confirm entry with the Q key.
- Observe display in display zone 3.

-> Indicated on display:

Read measurement block 25
1 2 3 4

Specification: X X 0

Value: X = (no meaning)

Actuation of camshaft timing not active

- Take the vehicle for a test drive.

Warning

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

=> Page 35.

- Accelerate the vehicle from a slow speed (1000 rpm) in 2nd gear with throttle floored.
- Observe display in display zone 3.

-> Indicated on display:

Read measurement block 25
1 2 3 4

Specification: X X 1

Value: X = (no meaning)

Actuation of camshaft timing active

Note:

- ♦ Display zone 3 indicates whether the engine control unit is or is not actuating the camshaft timing control.
 - "X X 0": Actuation of camshaft timing not active
 - "CAMSHAFT CONTROL ON" Actuation of camshaft timing active ("CAMSHAFT- ON" can only obtained by way of a test drive)
- ♦ Display zone 4 indicates whether adjustment of the camshaft has actually taken place (feedback via Hall sender).
 - Normal position: -3,0°crankshaft...6.0 °crankshaft
 - Switched position: 16,0°crankshaft...25.0°crankshaft

- ♦ If a value between 6.0° crankshaft and 16.0° crankshaft is displayed in fields 3 and/or 4 during test drive, the camshaft adjustment solenoid valves are switching the oil pressure properly to the respective mechanical camshaft adjuster, but this is not able to reach its end position (e.g. on account of stiffness).
- If specification is not reached, then check the valve for camshaft timing control => Page 89 .

3.3 - Checking valve 1 for camshaft timing control

Fitting position of valve 1 for camshaft timing control -N205 =>Page 36 .

- Switch the ignition on.
- Start final control diagnosis and actuate camshaft timing control => Page 15 .

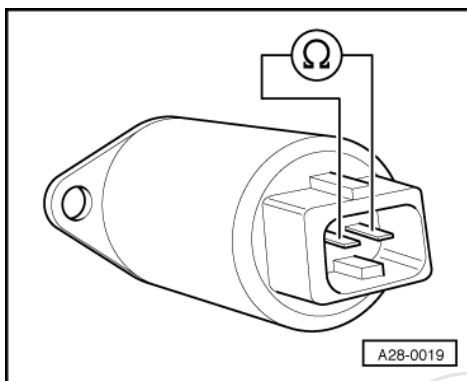
-> Indicated on display:

Final control diagnosis
Camshaft adjustment 1

Upon actuation of camshaft timing control, the valve should give a clearly audible click.

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

- Pull the connector off solenoid valve -N205.

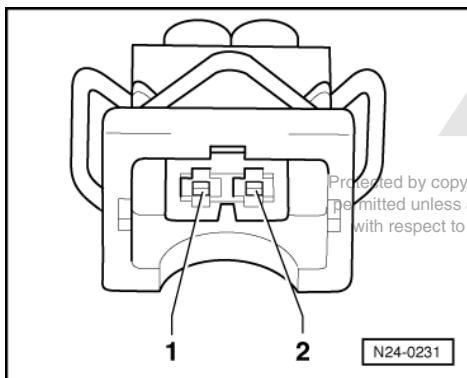


- -> Measure resistance between contacts on valve using hand held multimeter V.A.G 1526.

Specification: 12 ... 16 Ω .

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

Check power supply to valve for camshaft timing control -N205



- Pull the connector off solenoid valve -N205.
- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1 (positive) on connector using cables from adapter set V.A.G 1594.



- Operate the starter for a few seconds. Engine may start.

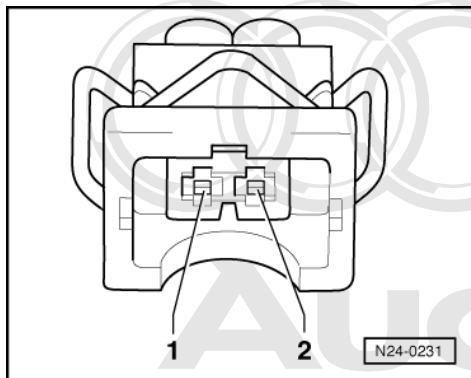
The diode test lamp should light up.

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

- Check the fuse for the valve of the camshaft timing control.
- Check the wiring from contact 1 of the camshaft timing control to fuse for open circuit.

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

- Test fuel pump relay and activation
=> Page 49 .



Checking actuation of camshaft timing control

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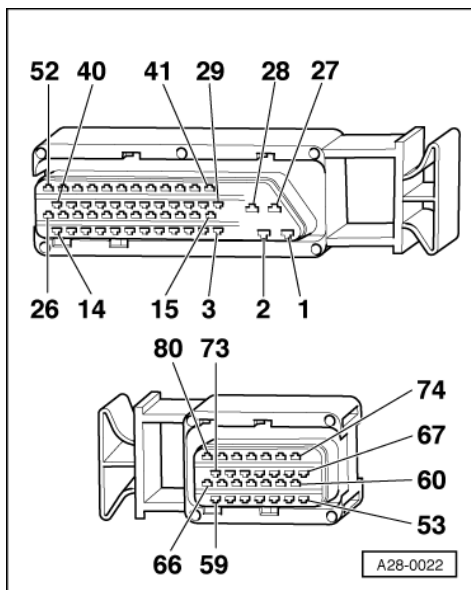
- -> Connect diode test lamp V.A.G 1527 between contacts 1 (positive) and 2 on connector from valve using cables from adapter set V.A.G 1594.
- Start final control diagnosis and actuate camshaft timing control => Page 15 .

-> Indicated on display:

Final control diagnosis
Camshaft adjustment 1

The diode test lamp should flash on and off upon actuation of camshaft adjustment.

- 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 38 .



- -> If the diode test lamp lights up continuously, check the line connection between contact 2 of the connector to contact 55 of the test box for short-circuit to earth.

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

- If the diode test lamp does not flash, check the line connection between contact 2 of the connector to contact 55 of the test box for open-circuit or short-circuit to positive.

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

- Rectify any open/short circuit as necessary.
- If no open circuits or short circuits are found, fit a new engine control unit =>page 38 .
- If none of the tests already performed indicate any fault, then renew the mechanical camshaft adjuster.

=> 4-cylinder Engine, Mechanics; Repair Group 15; Cylinder head, valve gear; Remove and install camshafts and camshaft adjustment Cylinder head, valve gear Remove and install camshafts and camshaft adjustment



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