

Audi A3 1997 ➤

Motronic injection and ignition system (4-cyl. turbo)

Engine ID	AMK	BAM							
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Edition 10.2003



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List of Workshop Manual Repair GroupsList of Workshop Manual
Repair GroupsList of Workshop Manual Repair Groups
Audi A3 1997 ➤

Motronic injection and ignition system (4-cyl. turbo)
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Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system



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

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01 - Self-diagnosis

1 - Self-diagnosis of Motronic system

1.1 - Self-diagnosis of Motronic system

1.2 - Technical data of self-diagnosis

Features

- ◆ Data transfer between control unit and vehicle diagnostic, testing and information system VAS 5051 is carried out in "self-diagnosis" mode.
- ◆ The fault memory is a non-volatile memory and thus independent of the power supply.
- ◆ Faults related to the electronic throttle are additionally indicated by the warning lamp for the electronic throttle control ("EPC warning lamp") which is situated in the dash panel insert.
- ◆ If the engine control unit detects faults which result in deterioration of exhaust emissions, these faults will be indicated by illumination of exhaust gas warning lamp-K83. Significance of exhaust warning lamp -K83 => Page 73 .
- ◆ Each time after erasing the fault memory the readiness code must be renewed => Page 33 .

1.3 - Safety precautions

Note the following points if testers and measuring instruments have to be used during a road test:

Important

- ◆ Always install testers and measuring instruments on the back seat and have a second person operate them from there.
- ◆ If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.

1.4 - Connecting vehicle diagnostic, testing and information system VAS 5051 and select functions

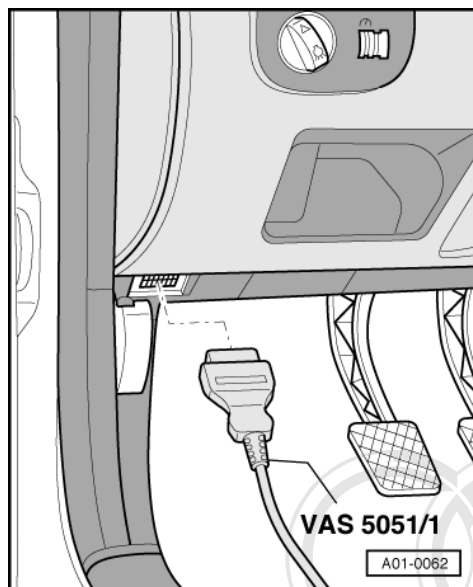
Test requirements:

- Fuses for engine electronics OK

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

- Fuel pump relay OK: checking =>Page 93 .

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- Battery voltage at least 12.7 V
- Earth connections on engine and gearbox OK.

Procedure

- -> Connect up vehicle diagnostic, testing and information system VAS 5051 with diagnostic wire VAS 5051/1.

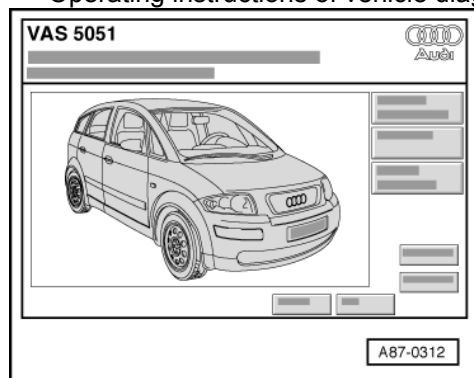
Important

Note the safety precautions => Page **1** .

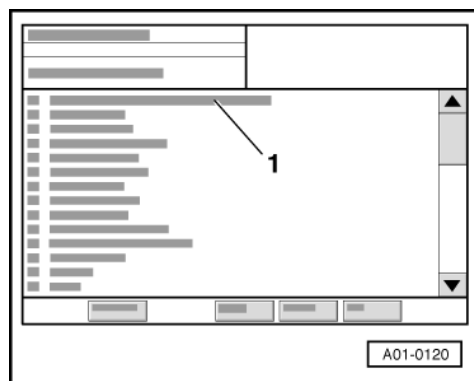
Note:

A fault message appears on the display:

=> Operating instructions of vehicle diagnostic, testing and information system VAS 5051



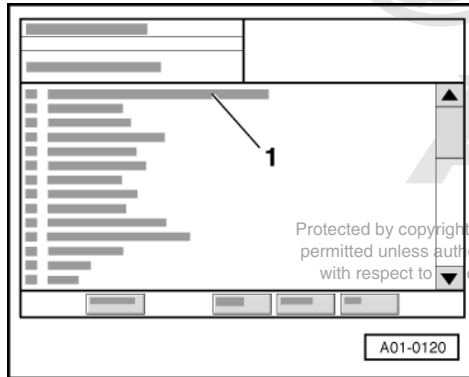
- > Display on VAS 5051:
- Press the "vehicle self-diagnosis" key.



-> Display on VAS 5051:

Note:

The automatic test sequence is carried out by pressing "00 - Interrogate fault memory - Total system" in selection -1-, i.e. the fault memories of all vehicle systems with self-diagnosis capability are interrogated.



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-> Display on VAS 5051:

Depending on which function is required => "Diagnostic functions" table, Page 4 :

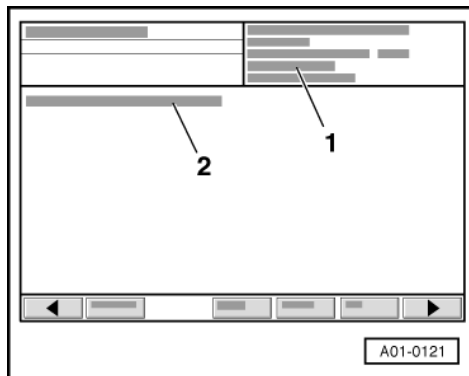
- Switch the ignition on.

or

- Start the engine.

- Select vehicle system "01 - Engine electronics" in selection -1-.

- Wait until the next display appears.



-> Display on VAS 5051:

1 - Control unit identification of the engine control unit => Page 3

2 - Control unit identification of the immobiliser => Page 4

Control unit identification Engine control unit (example)	
01 - Engine electronics	Vehicle system
06A906018..	Part-No.; assignment => Parts List



1.8L1)R4/5VT2)G3)00034)	1) Engine capacity 2) In line engine, 4 cylinders, 5 valves, turbo 3) - G = cruise control system activated 4) - no display = no cruise control system or - cruise control system not activated Control unit data status (software type)
Code 10710:	Code of control unit (check =>Page 26)
Dealership No. 12345	Workshop code of VAS 5051 with which encoding was last performed

Control unit identification, immobiliser (example)

WAUZZZ8LZ1A016096 1) AUZ7Z0Y1554764 2)	1) 17-digit vehicle identification no. (Chassis number) 2) 14-digit ident no. for immobiliser
--	--



- Press the ► key.

-> Display on VAS 5051:

1 - Selection of diagnostic functions:

Diagnostic functions	Ignition on, engine stopped	Engine idling	Vehicle running	Page
02 Interrogating fault memory	no	yes	yes	5
03 Final control diagnosis	yes	no	no	20
04 Basic setting	yes	yes	yes	24
05 Eraseing fault memory	yes	yes	yes	5
06 End of output	yes	yes	yes	7
07 Encoding control unit	yes	no	no	26
08 Reading measured value block	yes	yes	yes	28
09 Reading individual measured value	no	no	no	-
10 Adaption	no	no	no	-
11 Log-in procedure	no	no	no	-

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2 - Interrogating and erasing fault memory

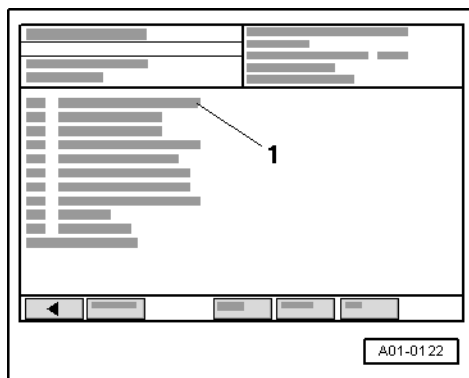
2.1 - Interrogating and erasing fault memory

2.2 - Interrogating fault memory

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. When doing this, the engine should be idling.

Note:

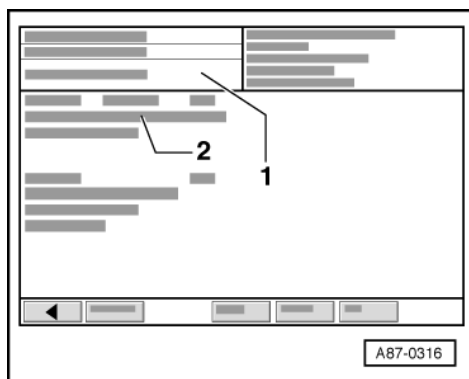
If the engine will not start, turn it for at least 5 seconds with the starter and then always leave the ignition on.



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-> Display on VAS 5051:

- Under -1- select diagnostic function "02 - Interrogate fault memory".



-> Display on VAS 5051:

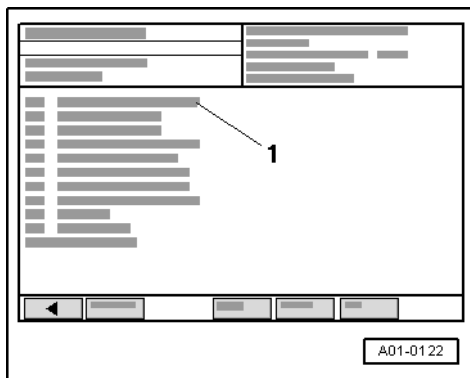
- 1 - Content of the fault memory:
 - 0 Faults recognised
 - or
 - X Faults recognised
- 2 - Faults
 - Fault code
 - Fault location
 - Fault type

A - If faults were recognised:

- Print out the screen content or the self-diagnosis report.



- Exit function "02 - Interrogate fault memory" by pressing the ◀ key.



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-> Display on VAS 5051:

- Rectify the fault(s) as specified in fault table => Page 8 .
- Reselect diagnostic function "02 - Interrogate fault memory" and erase the fault memory => Page 6 .
- Select the diagnostic function "06 - End output" in the selection => Page 7 .

B - If no fault was recognised:

- Select the diagnostic function "06 - End output" in the selection => Page 7 .

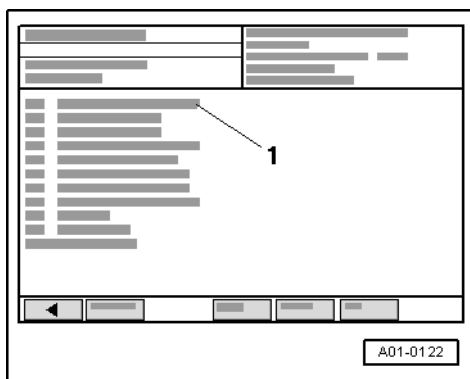
Important tips:

- ♦ If no fault is stored in the fault memory the fault memory should not be erased unnecessarily as the readiness code is reset.
- ♦ If the fault memory is erased the readiness code must be produced again => Page 33 .

2.3 - Erase fault memory

Note:

If it is not possible to erase fault memory, interrogate it once again and remedy faults.



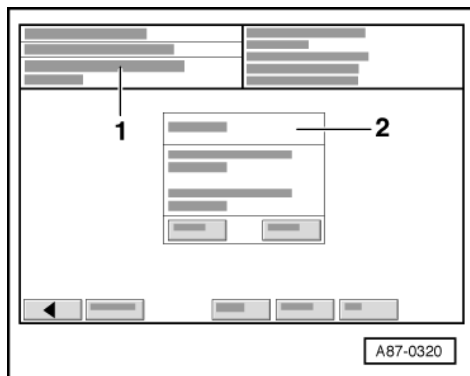
Preconditions:

- Fault memory interrogated => Page 5 .
- All faults rectified.

After fault memory has been successfully interrogated:

-> Display on VAS 5051:

- Under -1- select diagnostic function "05 - Erase fault memory".



-> Display on VAS 5051:

- 1 - - No display (before erasing)
or
- Fault memory erased

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Note:

The following message appears in display zone -1-: "Fault memory not yet interrogated", if the operational sequence was not adhered to exactly. The fault memory can only be erased, if the fault memory has been interrogated beforehand.

- 2 - Note:
Should the function be carried out?
Note: Data will be erased!

- Press the "OK"-key in display -2-.
- Exit function "05 - Erase fault memory" by pressing the ◀ key.
- Interrogate fault memory again after carrying out the repairs.

Note:

This erases faults that have been stored whilst the fault was being rectified, for example, faults that have arisen as a result of connectors being detached.

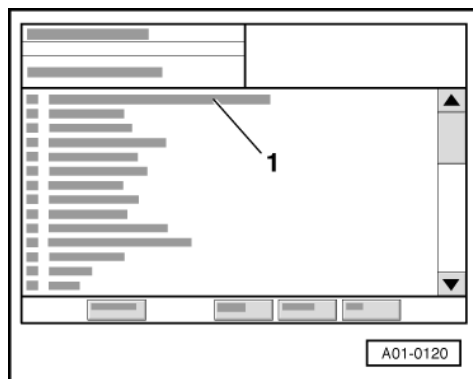
- If the fault memory is erased the readiness code must be produced again => Page 33 .

2.4 - End of output



-> Display on VAS 5051:

- Under -1- select the diagnostic function "06 - End output".



-> Display on VAS 5051:

- Switch off ignition when this display appears and detach diagnostic connector.

2.5 - Fault table

Notes:

- ♦ If faults occur in the monitored sensors and components, these are stored in the fault memory together with an indication of type of fault.
- ♦ Faults related to EPC are additionally indicated by the warning lamp for the electronic throttle control ("EPC warning lamp") which is situated in the dash panel insert. Notes on EPC system =>Page **130** .
- ♦ Faults which cause the exhaust emission to deteriorate are displayed with an exhaust warning lamp in the dash panel insert. Notes on exhaust warning lamp =>Page **73** .
- ♦ The fault table is sorted according to the 5-digit fault code on the left.
- ♦ If a stored fault does not appear within the next 40 engine starts, the fault code will be automatically erased.
- ♦ Sporadic faults (fault occurring from time to time) are indicated as "sporadic" on the display. The word "sporadic" signifies individually occurring, random faults.
- ♦ Do not immediately replace components indicated as faulty by the VAS 5051 but: first check the wiring and connectors of these components against the current flow diagram. Also check the earth connections against current flow diagram. This is particularly relevant for faults recorded as "sporadic"..
- ♦ If the connector is unplugged from engine control unit or if the battery is disconnected, all the stored values in the control unit will be erased. However, the contents of the fault memory are retained. If the engine is then started, it may run rough for a short period. In this case, the engine should be run at idle for a few minutes until the adaption process is concluded.
- ♦ After erasing the fault memory =>Page **33** .

2.6 - Fault codes 16395 - 17624

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0011	16395	Bank 1, advanced camshaft adjustment Specified value not achieved 1)	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components. Repair group 15: Checking camshaft timing control
P0012	16396	Bank 1, camshaft adjustment Specified value not achieved 1)	

Fault code		Fault readout	Fault remedy
P0101	16485	Air mass meter -G70 Implausible signal 1)	- Check air mass meter => Page 97
P0102	16486	Air mass meter -G70 Signal too small 1)	
P0103	16487	Air mass meter -G70 Signal too great 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0106	16490	Intake manifold pressure/air pressure =>G71/-F96 Implausible signal 1) 2)	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger
P0112	16496	Intake air temperature sender - G42 Signal too small 1)	- Check the intake air temperature sender =>Page 185.
P0113	16497	Intake air temperature sender - G42 Signal too great 1)	
P0116	16500	Coolant temperature sender -G62 Implausible signal 1)	- Check coolant temperature sender =>Page 191
P0117	16501	Coolant temperature sender -G62 Signal too small 1)	
P0118	16502	Coolant temperature sender -G62 Signal too great 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73.

2) The intake manifold pressure is determined by the boost pressure sender -G31 (in place of displayed -G71), the air pressure is determined by altitude sender -F96 (in engine control unit).

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0130	16514	Bank 1, probe 1 Electrical fault in circuit 1)	- Check lambda probe and lambda control upstream of catalytic converter => Page 104
P0133	16517	Bank 1, probe 1 Signal too slow 1)	
P0136	16520	Bank 1, probe 2 Electrical fault in circuit 1)	- Check lambda probe and lambda control downstream of catalytic converter => Page 115
P0137	16521	Bank 1, probe 2 Voltage too low 1)	
P0138	16522	Bank 1, probe 2 Voltage too high 1)	
P0139	16523	Bank1, probe 2 Signal too slow 1)	



Fault code		Fault readout	Fault remedy
P0140	16524	Bank 1, probe 2 No activity 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0236	16620	Boost pressure sender -G31 Implausible signal 1)	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger
P0237	16621	Boost pressure sender -G31 Signal too small 1)	
P0238	16622	Boost pressure sender -G31 Signal too great 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0300	16684	Misfire detected 1)	- Check the fuel pressure. =>Page 81 - Check spark plugs and ignition wiring - Ignition coils with output stages Checking => Page 174 - Test misfire detection => Page 204 - Refuel the vehicle
P0301	16685	Cyl. 1 misfire detected 1)	
P0302	16686	Cyl. 2 misfire detected 1)	
P0303	16687	Cyl. 3 misfire detected 1)	
P0304	16688	Cyl. 4 misfire detected 1)	
P0321	16705	Engine speed sender -G28 Implausible signal 1)	- Check engine speed sender =>Page 189 .
P0322	16706	Engine speed sender -G28 no signal 1) 3)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page **131** .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0327	16711	Knock sensor 1 -G61 Signal too small 1)	- Check knock sensor => Page 199
P0328	16712	Knock sensor 1 -G61 Signal too great 1)	
P0332	16716	Knock sensor 2 -G66 Signal too small 1)	
P0333	16717	Knock sensor 2 -G66 Signal too great 1)	
P0341	16725	Camshaft position sensor => sender -G40 Implausible signal 1)	- Check Hall sender => Page 201

Fault code		Fault readout	Fault remedy
P0342	16726	Camshaft position sensor => sender -G40 Signal too small 1)	
P0343	16727	Camshaft position sensor => sender -G40 Signal too great 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0420	16804	Bank1, catalytic converter system Inefficient 1)	- Produce readiness code => Page 33 . If the same fault is displayed again replace the catalytic converter. => 4-cylinder Engine (5-valve turbo), Mechanics; Repair group 26; Removing and installing parts of exhaust system Removing and installing parts of exhaust system
P0441	16825	Fuel tank breather system Through flow faulty 1)	- Check solenoid valve 1 for activated charcoal filter => Page 127

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0501	16885	Vehicle speed signal Implausible signal 1)	- Check speed signal =>Page 156 .
P0506	16890	Idling speed regulation Engine speed below specified value 1)	- Check throttle valve control part =>Page 132 .
P0507	16891	Idling speed regulation Engine speed above specification	- Check hose connections (valve for secondary air inlet); Check intake system for leakages (unmetered air) => Page 101 .
P0560	16944	Voltage supply Implausible signal	- Check supply voltage for control unit => Page 195
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	
P0571	16955	Brake light switch -F4) Implausible signal	- Check brake light switch and brake pedal switch => Page 147

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

4) The brake pedal switch -F47 is monitored in addition to the brake light switch -F47.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P0601	16985	Control unit defective 1)	- Replace engine control unit =>Page 64
P0604	16988	Control unit defective 1)	
P0605	16989	Control unit defective 1)	



Fault code		Fault readout	Fault remedy
P0685	17069	Main relay => -J271 Open circuit 1)	- Check power supply relay -J271 for Motronic => Page 179
P0686	17070	Main relay => -J271 Short to earth 1)	
P0687	17071	Main relay => -J271 Short to positive 1)	
P0688	17072	Main relay, load circuit => -J271 Open circuit 1) 3)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp => Page **131**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1102	17510	Bank 1, probe 1, heating circuit Short to positive 1)	- Lambda probe heating upstream of catalytic converter: Checking => Page 113
P1103	17511	Bank 1, probe 2, heating circuit Too inefficient 1)	
P1105	17513	Bank 1, probe 2, heating circuit Short to positive 1)	- Check lambda probe heating downstream of catalytic converter => Page 122
P1111	17519	Lambda control Bank1 System too lean	
P1112	17520	Lambda control Bank1 System too rich	- Check Lambda control upstream of catalytic converter =>Page 104 .
P1114	17522	Bank 1, probe 2 Internal resistance too high 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1115	17523	Bank 1, probe 1, heating circuit Short to earth 1)	- Check lambda probe heating upstream of catalytic converter => Page 113
P1116	17524	Bank 1, probe 1, heating circuit Open circuit 1)	
P1117	17525	Bank 1, probe 2, heating circuit Short to earth 1)	- Check lambda probe heating downstream of catalytic converter => Page 122
P1118	17526	Bank 1, probe 2, heating circuit Open circuit 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1127	17535	Bank 1, mixture adaption (mult.) System too rich	- Perform road test (fuel in oil) Check fuel system pressure => Page 101 .

Fault code		Fault readout	Fault remedy
P1128	17536	Bank 1, mixture adaption (mult.) System too lean	- Check lambda probe upstream of catalytic converter =>Page 81

Note:

mult. = multiplicative means that the fault occurs throughout the entire speed range and load range.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1136	17544	Bank 1, mixture adaption (add.) System too lean	- Perform road test (fuel in oil) Check fuel system pressure => Page 101 . - Check lambda probes downstream of catalytic converter =>Page 127
P1137	17545	Bank 1, mixture adaption (add.) System too rich	
P1143	17551	Load recognition Control limit exceeded 1)	- Check air mass meter => Page 132 .

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73** .

Note:

add. = additive means that fault only has effect during idling

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1149	17557	Lambda control Bank1 Implausible control value	- Check lambda probe learned values and lambda control => Page 101 .
P1171	17579	Angle sender 2 for throttle valve actuator -G188 Implausible signal 1) 3)	- Test angle sender for throttle valve actuator => Page 139
P1172	17580	Angle sender 2 for throttle valve actuator -G188 Signal too small 1)3)	
P1173	17581	Angle sender 2 for throttle valve actuator -G188 Signal too great 1) 3)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73** .

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page **131** .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1176	17584	Bank 1, lambda correction downstream of cat Control limit achieved1)	- Check lambda probe ageing of lambda probe upstream of catalytic converter => Page 115
P1198	17606	Bank 1, probe 2, heating circuit Electrical fault	- Check lambda probe heating downstream of catalytic converter => Page 122
P1200	17608	Air recirculation valve for turbo-charger -N249 Mechanical fault	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger



Fault code		Fault readout	Fault remedy
P1213	17621	Injector, cylinder 1 -N30 Short to positive 1)	- Check injectors =>Page 81
P1214	17622	Injector, cylinder 2 -N31 Short to positive 1)	
P1215	17623	Injector, cylinder 3 -N32 Short to positive 1)	
P1216	17624	Injector, cylinder 4 -N33 Short to positive 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73.

2.7 - Fault codes 17633 - 18261

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1225	17633	Injector, cylinder 1 -N30 Short to earth 1)	- Check injectors =>Page 81
P1226	17634	Injector, cylinder 2 -N31 Short to earth 1)	
P1227	17635	Injector, cylinder 3 -N32 Short to earth 1)	
P1228	17636	Injector, cylinder 4 -N33 Short to earth 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1237	17645	Injector, cylinder 1 -N30 Open circuit 1)	- Check injectors =>Page 81
P1238	17646	Injector, cylinder 2 -N31 Open circuit 1)	
P1239	17647	Injector, cylinder 3 -N32 Open circuit 1)	
P1240	17648	Injector, cylinder 4 -N33 Open circuit 1)	
P1250	17658	Fuel level too low	- Follow-on fault =>Note Refuel vehicle, erase fault memory Interrogate fault memory of dash panel insert => Electrical System; Repair group 01; Dash panel insert self-diagnosis Dash panel insert self-diagnosis

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73.

Note:

The fault "Fuel level too low" is stored only in conjunction with misfiring or faults concerning lambda control if too little fuel is or was in the tank. The fault is stored in the control unit as static fault and is not set as a sporadic fault even if the vehicle is refuelled in the meantime.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1287	17695	Air recirculation valve for turbocharger -N249 Open circuit 1)	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger
P1288	17696	Air recirculation valve for turbocharger -N249 Short to positive 1)	
P1289	17697	Air recirculation valve for turbocharger -N249 Short to earth 1)	
P1296	17704	Fault in cooling system	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 19; Removing and installing parts of cooling system
P1297	17705	Connection: turbocharger - throttle valve Loss of pressure	- Check throttle valve for dirt =>Page 135 - Check charge air system with turbocharger => 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1325	17733	Knock control cylinder 1 Control limit reached	- Check knock control => Page 196
P1326	17734	Knock control cylinder 2 Control limit reached	
P1327	17735	Knock control cylinder 3 Control limit reached	
P1328	17736	Knock control cylinder 4 Control limit reached	
P1335	17743	Engine torque monitoring 2 Control limit exceeded 1) 3)	- Extreme leakage, check intake air system for leaks (unmetered air) =>Page 185 .
P1336	17744	Engine torque monitoring Control limit exceeded	- Check air mass meter => Page 191 .

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73 .

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page 131 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		



P1340	17748	Camshaft/crankshaft position sensor Incorrect assignment 1)	- Unscrew Hall sender and check whether the rotor ring was correctly mounted at the camshaft. (If not correctly installed, the detent lug is flattened when the securing bolt is tightened.) Additionally check engine valve timing. => 4-cylinder Engine (5-valve, Turbo), Mechanical Components; Repair group 13; Dismantling and assembling engine; Removing and installing toothed belt Dismantling and assembling engine; Removing and installing toothed belt
P1355	17763	Ignition actuation, cylinder 1 Open circuit 1)	- Ignition coils with output stages Checking => Page 174
P1356	17764	Ignition actuation, cylinder 1 Short to positive 1)	
P1357	17765	Ignition actuation, cylinder 1 Short to earth 1)	
P1358	17766	Ignition actuation, cylinder 2 Open circuit 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1359	17767	Ignition actuation, cylinder 2 Short to positive 1)	- Ignition coils with output stages Checking => Page 174
P1360	17768	Ignition actuation, cylinder 2 Short to earth 1)	
P1361	17769	Ignition actuation, cylinder 3 Open circuit 1)	
P1362	17770	Ignition actuation, cylinder 3 Short to positive 1)	
P1363	17771	Ignition actuation, cylinder 3 Short to earth 1)	
P1364	17772	Ignition actuation, cylinder 4 Open circuit 1)	
P1365	17773	Ignition actuation, cylinder 4 Short to positive 1)	
P1366	17774	Ignition actuation, cylinder 4 Short to earth 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1386	17794	Control unit defective 1)	- Replace engine control unit =>Page 64
P1387	17795	Control unit defective 1)	
P1388	17796	Control unit defective 1) 3)	
P1410	17818	Tank breather valve -N80 Short to positive 1)	- Check solenoid valve 1 for activated charcoal filter => Page 127
P1425	17833	Tank breather valve -N80 Short to earth 1)	

Fault code		Fault readout	Fault remedy
P1426	17834	Tank breather valve -N80 Open circuit 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73 .

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page 131 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1453	17861	Exhaust gas temperature sender 1 -G235 Open circuit / short to positive	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 26; Checking exhaust gas temperature control
P1454	17862	Exhaust gas temperature sender 1 -G235 Short to earth	
P1455	17863	Exhaust gas temperature sender 1 -G235 Implausible signal	
P1456	17864	Exhaust gas temperature control, bank 1 Control limit reached	
P1461	17869	Exhaust gas temperature control, bank 1 Implausible signal	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1501	17909	Fuel pump relay -J17 Short to earth 1)	- Check fuel pump relay =>Page 93 .
P1502	17910	Fuel pump relay -J17 Short to positive 1)	
P1523	17931	Crash signal from airbag control unit Implausible signal 5)	=> Body, Self-diagnosis; Repair group 01; Self-diagnosis of airbag system
P1529	17937	Camshaft timing control Short to positive 1)	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 15; Checking camshaft timing control
P1530	17938	Camshaft timing control Short to earth 1)	
P1531	17939	Camshaft timing control Open circuit 1)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73 .

5) The fault is stored with the relevant signal from airbag control unit.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1539	17947	Clutch pedal switch -F36 Implausible signal 1)	- Check clutch pedal switch =>Page 151 .



Fault code		Fault readout	Fault remedy
P1541	17908	Fuel pump relay -J17 Open circuit 1)	- Check fuel pump relay =>Page 93 .
P1542	17950	Angle sender for throttle valve actuator -G187 Implausible signal 1) 3)	- Check angle sender for throttle valve actuator => Page 139
P1543	17951	Angle sender for throttle valve actuator -G187 Signal too small 1) 3)	
P1544	17952	Angle sender for throttle valve actuator -G187 Signal too great 1)3)	
P1545	17953	Throttle valve control Malfunction 1) 3)	- Check throttle valve control part =>Page 132 .

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73 .

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page 131 .

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1546	17954	Boost pressure control solenoid valve N75 Short to positive	=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger
P1547	17955	Boost pressure control solenoid valve N75 Short to earth	
P1548	17956	Boost pressure control solenoid valve N75 Open circuit	
P1550	17958	Boost pressure Control difference	
P1555	17963	Maximum boost pressure exceeded	
P1556	17964	Boost pressure control Regulating limit not reached	
P1557	17965	Boost pressure control Control limit exceeded	

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1558	17966	Throttle valve actuator -G186 Electrical fault in circuit 1) 3)	- Check throttle valve control part =>Page 132
P1559	17967	Throttle valve control part -J338 Fault in basic setting 1)	- Perform adaption =>Page 132
P1560	17968	Maximum engine speed exceeded	- Rectify mechanical damage
P1564	17972	Throttle valve control part -J338 Undervoltage during basic setting	- Charge battery, repeat basic setting
P1565	17973	Throttle valve control part -J338 Lower stop not reached 1) 3)	- Check throttle valve control part =>Page 132 .

Fault code		Fault readout	Fault remedy
P1568	17976	Throttle valve control part -J338 Mechanical fault 1) 3)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73 .

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page 131 .

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Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1569	17977	CCS switch -E45 Implausible signal	=> Electrical System; Repair group 01; Self-diagnosis for the cruise control system (CCS)
P1570	17978	Engine control unit disabled	- Adapt electronic immobiliser to engine control unit => Electrical System; Repair group 01; Immobiliser self-diagnosis
P1579	17987	Throttle valve control part -J338 Adaption not started	- Perform adaption of throttle valve control part in accordance with preconditions => Page 132 .
P1602	18010	Voltage supply, terminal 30 Voltage too low	- Check supply voltage for control unit => Page 195

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1603	18011	Control unit defective 1)	- Replace engine control unit =>Page 64
P1604	18012	Control unit defective 1) 3)	
P1609	18017	Crash cut-off was activated (crash caused) 6)	=> Body, Self-diagnosis; Repair group 01; Self-diagnosis of airbag system After final control diagnosis of airbag system erase fault memory of the engine control unit =>Page 5

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page 73 .

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page 131 .

6) The fault is stored with the relevant signal from airbag control unit, also with final control diagnosis of the airbag system.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1610	18018	Control unit defective	- Replace engine control unit =>Page 64
P1612	18020	Engine control unit incorrectly coded 1)	- Code engine control unit =>Page 26
P1630	18038	Accelerator position sender -G79 Signal too small 1)3)	- Check accelerator position sender =>Page 143 .
P1631	18039	Accelerator position sender -G79 Signal too great 1) 3)	
P1633	18041	Accelerator position sender 2 -G185 Signal too small 1)3)	
P1634	18042	Accelerator position sender 2 -G185 Signal too great 1) 3)	



Fault code		Fault readout	Fault remedy
P1639	18047	Sender 1/2 for accelerator pedal position -G79 +G185 Implausible signal 1) 3)	

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

3) With this fault, engine control unit switches on EPC warning lamp in dash panel insert. Notes on EPC warning lamp =>Page **131**.

Fault code		Fault readout	Fault remedy
SAE	V.A.G		
P1640	18048	Control unit defective 1)	- Replace engine control unit =>Page 64
P1648	18056	Drive train data bus defective 1)	- Check data exchange between engine control unit and other CAN-control units =>Page 163
P1649	18057	Drive train data bus No message from ABS control unit	
P1650	18058	Drive train data bus No message from dash panel	
P1654	18085	Read out fault memory of instrument cluster	=> Electrical System; Repair group 01; Dash panel insert self-diagnosis
P1682	18090	Drive train data bus Implausible message from ABS-SG	- Check data exchange between engine control unit and other CAN-control units =>Page 163
P3078	19534	Throttle valve control part Insufficient air flow at idle	- Clean throttle valve control part =>Page 138

1) When this fault occurs within three driving cycles (engine running at least 5 seconds) the engine control unit switches on the exhaust warning lamp in dash panel insert. Notes on exhaust warning lamp => Page **73**.

3 - Final control diagnosis

3.1 - Final control diagnosis

Notes:

- The final control diagnosis can only be performed with the engine stopped and the ignition switched on.
- The electric fuel pump runs throughout the final control diagnosis.
- During actuator diagnosis, the individual actuators (with the exception of the injectors) are operated in turn for about one minute unless the next actuator is selected by pressing the ▶ key.
- The control elements can be checked acoustically or by way of touch.
- The final control diagnosis is terminated if the engine is started or if an engine speed pulse is detected.
- Before restarting the final control diagnosis the engine must be started and the ignition switched off and on again.

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

Actuation sequence
1 Solenoid valve 1 for activated charcoal filter -N80
2 Boost pressure control solenoid valve -N75
3 Camshaft timing control
4 Air recirculation valve for turbocharger -N249

Actuation sequence
5 Injector, cylinder 1 -N30
6 Injector, cylinder 3 -N32
7 Injector, cylinder 4 -N33
8 Injector, cylinder 2 -N31

Test requirements:

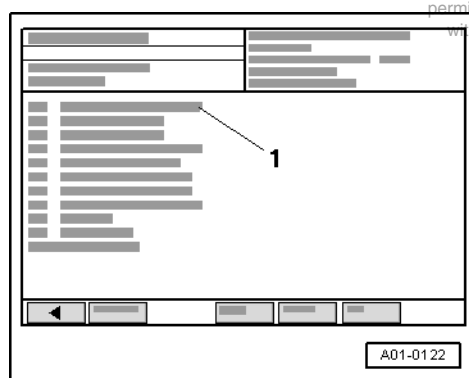
- Fuses for engine electronics OK

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

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. When doing this, the engine should be idling.

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-> Display on VAS 5051:

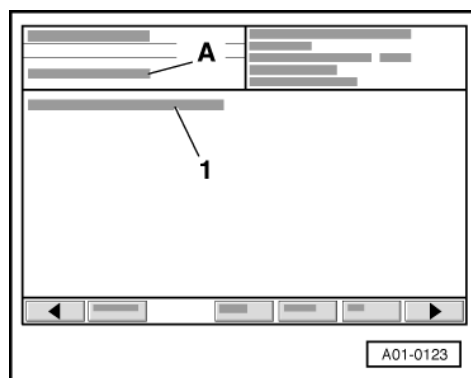
- Under -1- select the diagnostic function "03 - Final control diagnosis".

Note:

*Fuel pump relay should respond, fuel pump should run, flow noise at fuel pressure regulator is clearly audible
If fuel pump does not run, check actuation*

=>Page 95.

Actuating activated charcoal filter system solenoid valve (tank breather valve)



-> Display on VAS 5051:



- A - 1st control element in test
- 1 - Fuel tank breather valve -N80

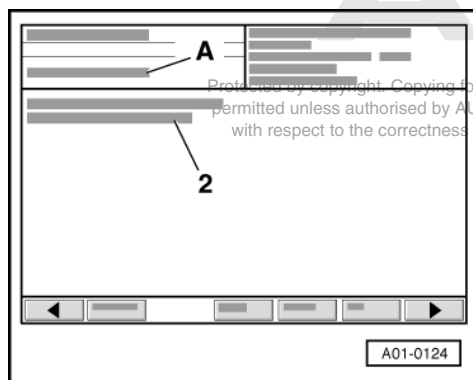
- ♦ This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the ▶ key.

If the valve is not actuated (does not click).

- Check solenoid valve 1 for activated charcoal filter -N80 => Page 127 .

Actuating solenoid valve for boost pressure control

- Press the ▶ key.



-> Display on VAS 5051:

- A - 2nd control element in test
- 2 - Solenoid valve for boost pressure limitation -N75

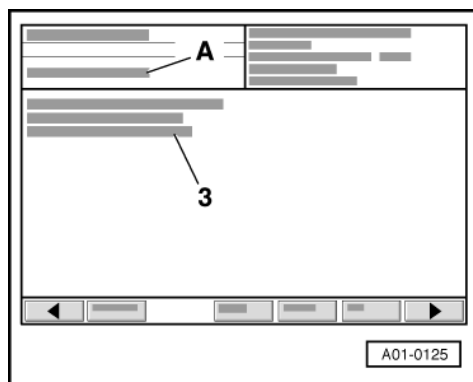
- ♦ This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the ▶ key.

If the valve is not actuated (does not click).

=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Charge air system with turbocharger Charge air system with turbocharger

Actuating camshaft adjustment valves

- Press the ▶ key.



-> Display on VAS 5051:

- A - 3rd control element in test

3 - Camshaft timing control

- ◆ This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the ▶ key.

If the valve is not actuated (does not click).

- Check camshaft adjustment valves:

=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 15; Checking camshaft timing control Checking camshaft timing control

Actuating air recirculation valve for turbocharger

- Press the ▶ key.



-> Display on VAS 5051:

- A - 4th control element in test
- 4 - Air recirculation for turbocharger -N249

- ◆ This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the ▶ key.

If the valve is not actuated (does not click).

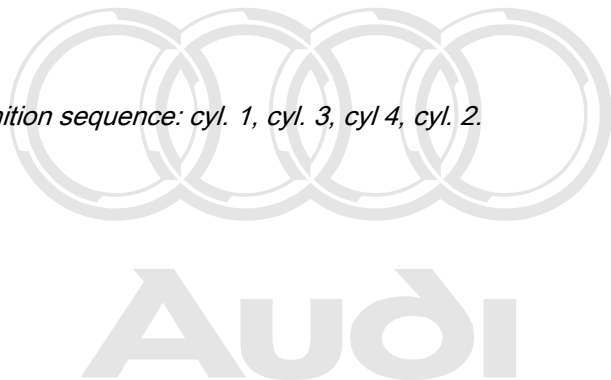
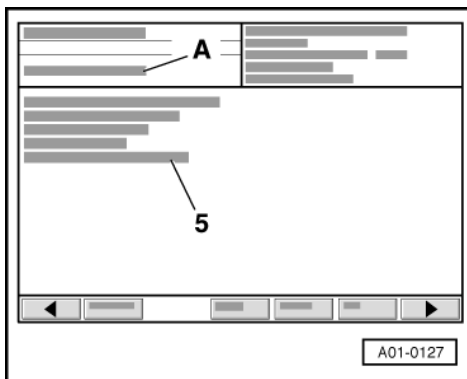
=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Charge air system with turbocharger Charge air system with turbocharger

Actuating injectors

Note:

The injectors are actuated according to the ignition sequence: cyl. 1, cyl. 3, cyl 4, cyl. 2.

- Press the ▶ key.



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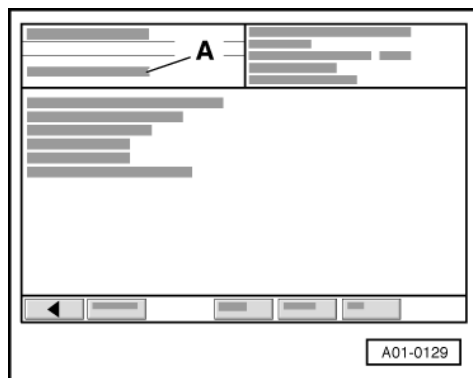
-> Display on VAS 5051:

- A - 5th control element in test
- 5 - Injector, cylinder 1 -N30

- Press the ▶ key.
- ♦ After pressing the ▶ key the injector must click five times.
- Use this procedure to check all the injectors in sequence.

If one of the injectors is not actuated (does not click):

- Test injectors => Page **81**.
- After activating the last injector (cylinder 2) press the ▶ key.



-> Display on VAS 5051:

- A - control element test is completed

- Exit the function "03 - Final control diagnosis" by pressing the ◀ key.

Note:

Before restarting the final control diagnosis the engine must be started and the ignition switched off and on again.

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4 - Basic setting

4.1 - Basic setting

With engine stopped and ignition switched on, the following operation can be carried out with the "Function 04" basic setting:

- ♦ Adaption of the throttle valve control part to the engine control unit =>display group 60
(=>Page **132**)

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

- ♦ Adaption process of the Lambda control =>Page **106**

Test conditions for operations with engine running

- No faults stored in fault memory
- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the test).

- Air conditioning switched off.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.

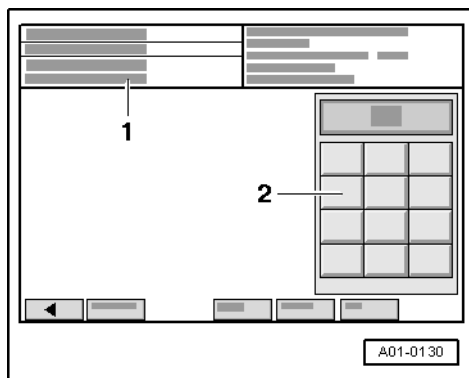


or after each required process:

- Start the engine.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter the desired display group number (three figures) in zone -2- and confirm the entry by pressing the Q key.

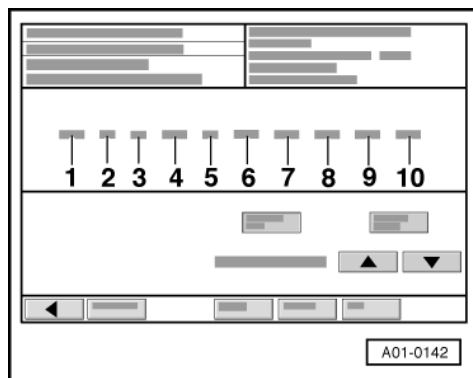
Example:

- Enter "000" for "display group number 000" and confirm entry with Q key.

Note:

After the display group number is selected, the activated charcoal filter valve is closed and the air conditioner compressor is switched off.

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-> Display on VAS 5051:

- 1 - Display group 0
- 2 - Display zone 1 2 3 4 5 6 7 8 9 10

- Exit the function "04 - Basic setting" by pressing the ◀ key.

Display group 000 (decimal readouts)												
▪ Engine idling (coolant temperature not less than 80 °C)												
1	2	3	4	5	6	7	8	9	10	◀ Display zones	Specified value	Corresponds to
										Learned value for mixture formation partial load	64...192	-25...25%
										Learned value for mixture formation idling	82...174	-9...9%
										Control value for mixture formation	96...160	-25...25%
										Learned value for torque loss at idle	112...144	-3...3%
										Idling torque	112...164	-3.0...7.0%
										Throttle valve angle	1...10	0.3...4.0%
										Vehicle voltage	142...206	10...14.5 V
										Engine speed (idling speed)	72...84	700...820 rpm
										Engine load (no consumption units)	14...34	10...25%
										Coolant temperature (requirement for basic setting)	180...210	80...110 °C

5 - Encoding control unit

5.1 - Encoding control unit

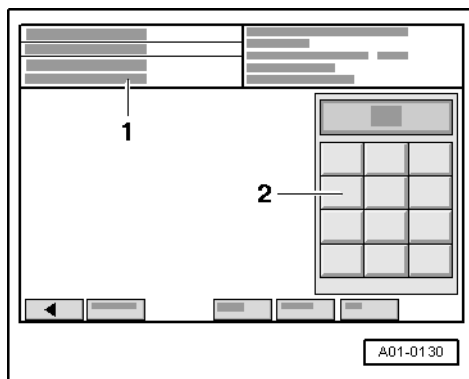
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- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.



-> Display on VAS 5051:

- Under -1- select diagnostic function "07 - Encode control unit".



-> Display on VAS 5051:

- 1 - Enter code word
max. input value = 32767

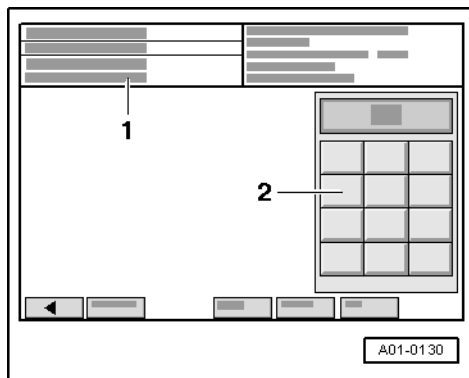
- Enter control unit code in zone -2- in line with encoding table => Page 28.

Key to code

XX		Country/emissions		
	X	Drive/auxiliary functions		
		X	Gearbox	
			X	Vehicle type

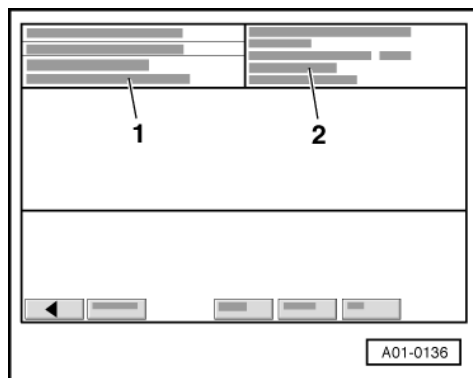
Example of encoding	
10710	EU3 (emission standard), 4-wheel drive without traction control system, 6-speed manual gearbox, Audi A3

- Confirm entry with Q key.



-> Display on VAS 5051:

- 1 - Encoding is carried out
- Wait until the next display appears.



-> Display on VAS 5051:

- 1 - Encoding is carried out in the vehicle system
- 2 - Control unit identification with new code (previous code in brackets)

- Exit function "07 - Encode control unit" by pressing the ◀ key.

5.2 - Encoding table

Country/emissions	10	EU3 (emission standard)
Drive/auxiliary functions	6	Four-wheel drive without traction control system
	7	Four-wheel drive with traction control system
Gearbox	1	6-speed Manual Gearbox
Vehicle type	0	Audi A3

6 - Reading measured value block

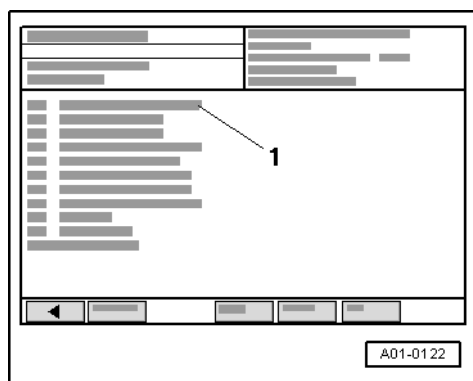
6.1 - Reading measured value block

Test requirements:

- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.

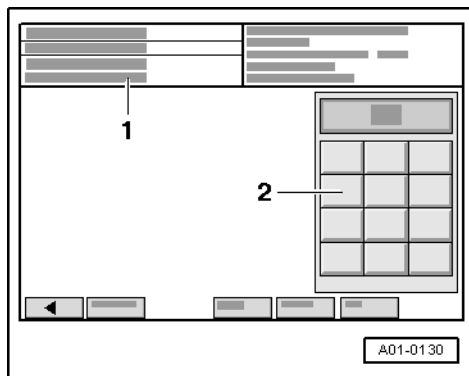
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



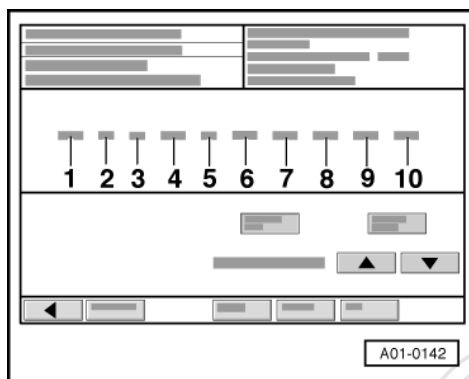
-> Display on VAS 5051:

1 - Enter display group
 max. input value = 255

- Enter the desired display group number (three figures) in zone -2- and confirm the entry by pressing the Q key.

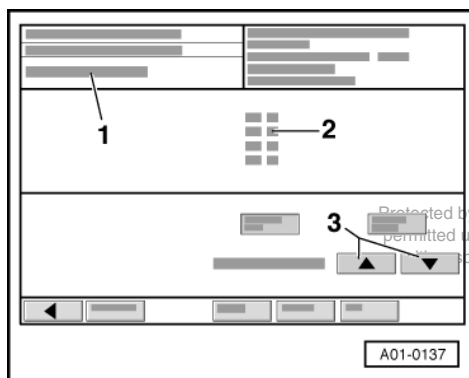
Note:

The choice of display group depends on the particular functions and components to be tested.



-> Display on VAS 5051 for display group 000:

- 1 - Display group 0
- 2 - Display zone 1 2 3 4 5 6 7 8 9 10





-> Display on VAS 5051 for display group 001: 255:

- 1 - Display group X
- 2 - Display zone 1
- Display zone 2
- Display zone 3
- Display zone 4

Notes:

- ♦ If a display zone is empty, no display is read out.
- ♦ To change to another display group, proceed as follows:

Display group	VAS 5051
Higher	Press s key
Lower	Press t key

- Exit the function "08 - Read measured value block" by pressing the ◀ key.

7 - Readiness code

7.1 - Readiness code

The readiness code appears as an 8-digit display on measured value block 086, display zone 1. Each of the 8 digits is allocated to a particular emission-related system.

The function of each of these systems is checked by the self-diagnosis and the relevant position for the system in the 8-digit display is changed from "1" to "0" in a test sequence which must be fully completed.

The readiness code produced after successful completion of the test sequence is then "0 0 0 0 0 0 0 0" (measured value block 086, display zone 1).

If an individual test has been completed, but is "not OK", a fault is entered in the fault memory. Interrogating fault memory
=>Page 5 .

The readiness code is set to

"0 1 1 0 1 1 0 1" if:

- ♦ the fault memory has been erased,
- ♦ the voltage supply to the engine control unit has been interrupted (e.g. the connector detached, battery disconnected).
- ♦ a new engine control unit has been installed

In this case the readiness code must be reproduced =>Page 33 .

Note:

When driving with varying loads the exhaust relevant tests are initiated by the control unit and the readiness code generates itself. In this case the concluding control possibility is omitted, i.e. it is not obvious whether the vehicle was handed over to the customer without any faults.

7.2 - Reading out readiness code

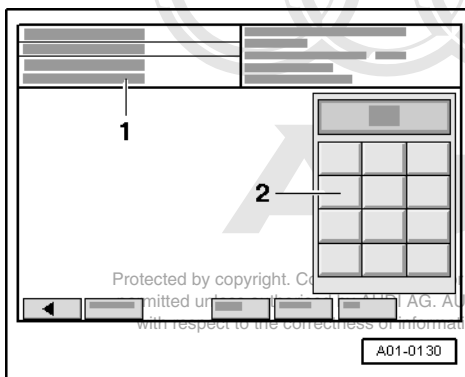
Test sequence



- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.

-> Display on VAS 5051:

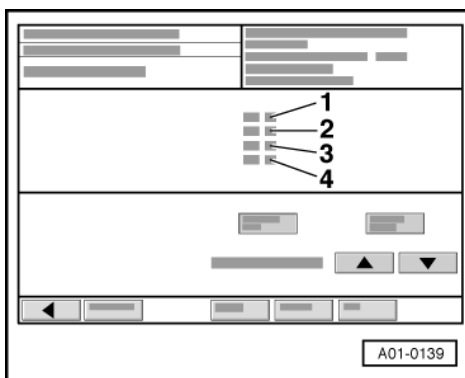
- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

1 - Enter display group
 max. input value = 255

- Enter "086" for "display group number 086" in zone -2- and confirm the entry by pressing the Q key.





-> Display on VAS 5051:

- Check readiness code in display zone -1-.
 - Specified value: 0 0 0 0 0 0 0

	Display zones			
	1	2	3	4
Display group 086: Readiness code				
Display	0 0 0 0 0 0 0	X X X X X X X X	X X X X X X X X	
Display	Ready bits Completed tests	Individual tests performed	Individual tests performed	
Range	1 = not completed 0 = completed	1 = not completed 0 = completed	1 = not completed 0 = completed	
Specified value	0 0 0 0 0 0 0	X X X X X X X X	X X X X X X X X	
Note:	Explanation of readiness code => Page 32			

Note on display zone 1:

Display zone 1 is the most important. This display indicates which system has been checked by the self-diagnosis since the last time the fault memory was erased or since installation of a new control unit. After erasing the fault memory, all testable values are set to "1" and then to "0" after successful completion of the test.

X	X	X	X	X	X	X	X	Notes on display group 086, display zone 1
								Catalytic converter diagnosis - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 33 . Display always 0
								Activated charcoal filter system - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 33 . Display always 0
								Display always 0 Display always 0
								Lambda probes - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 33 .
								Lambda probe heater - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code - =>Page 33 . Display always 0

Note:

The readiness code is only produced when all display digits in display zone 1 are set to "0".

If the specification "0 0 0 0 0 0 0" is achieved in display zone 1:

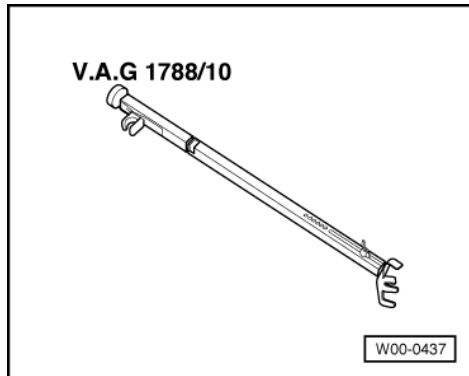
- Press the ◀ key.
- Interrogate fault memory to check =>Page 5 (there must not be any stored faults).

If specified value is not attained:

- Produce the readiness code => Page 33 .

7.3 - Producing the readiness code

Special tools and workshop equipment required



- ♦ Engine speed controller V.A.G 1788/10

Preconditions:

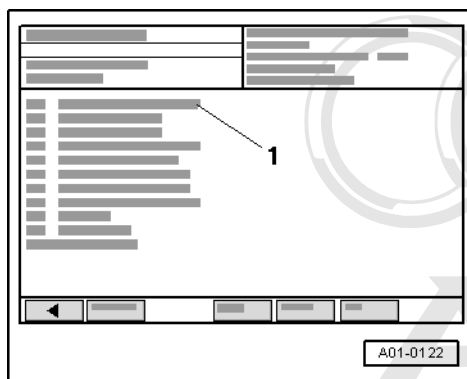
- Vehicle stationary.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.
- Coolant temperature at least 80 °C=>display group 004, display zone 3). Important: Warm up engine as far as possible by means of a road test.

Important note:

If the test result is immediately displayed as "OK" after selecting a display group during an operation, the test has already been performed and you can continue with the next operation.

Operation 1: Interrogating fault memory

Test conditions:

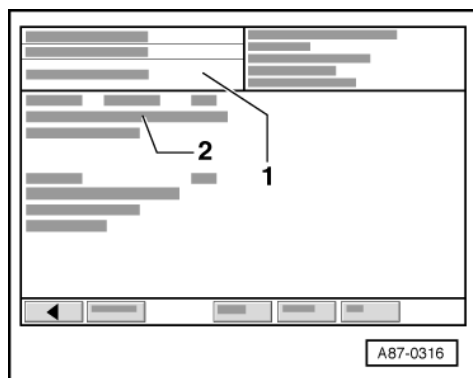


- Engine stopped, ignition switched on
- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.

-> Display on VAS 5051:



- Under -1- select diagnostic function "02 - Interrogate fault memory".



-> Display on VAS 5051:

- 1 - Content of the fault memory:
 - 0 Faults recognised
 - or
 - X Faults recognised
- 2 - Faults
 - Fault code
 - Fault location
 - Fault type

If a fault is stored:

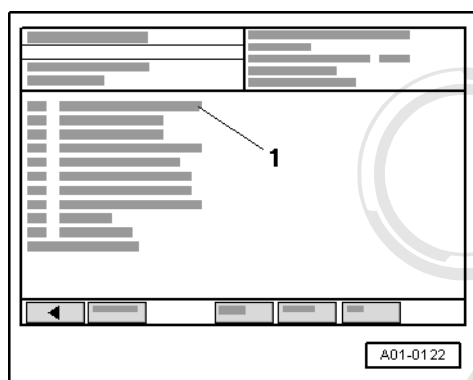
- Rectify fault and erase the fault memory. Perform a road test and interrogate the fault memory again to check.

If no fault is stored:

- Press the ◀ key.

Operation 2: Erase fault memory

Test conditions:



- Engine stopped, ignition switched on

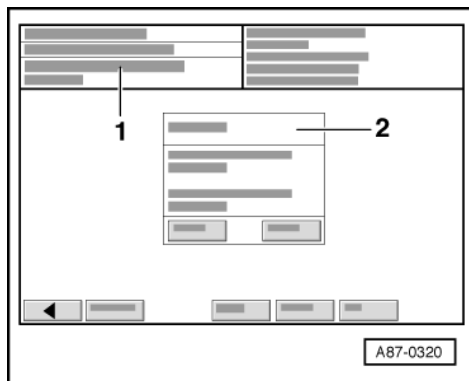
-> Display on VAS 5051:

- Under -1- select diagnostic function "05 - Erase fault memory".

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Note:

The readiness code is reset when the fault memory is erased and must therefore be reproduced.



-> Display on VAS 5051:

- 1 - - No display (before erasing)
- or
- Fault memory erased
- 2 - Note:

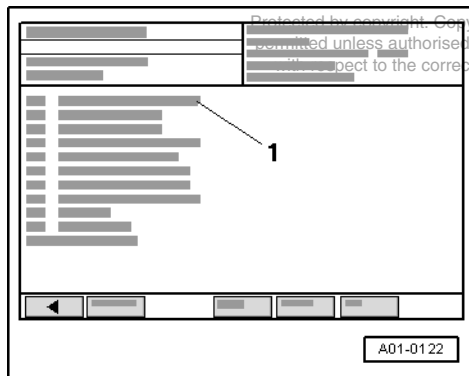
Should the function be carried out?

Note: Data will be erased!

- Press the "OK"-key in display -2-.
- Press the ◀ key.

Operation 3: Adapting the throttle valve control part to the engine control unit

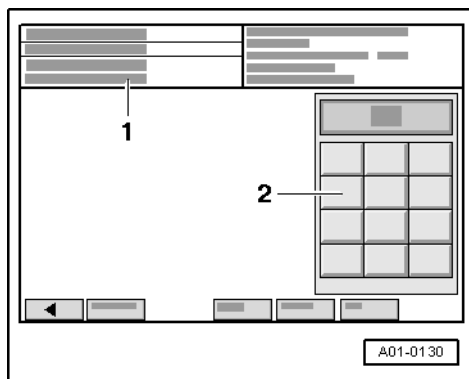
Test conditions:



- Engine stopped, ignition switched on

-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".

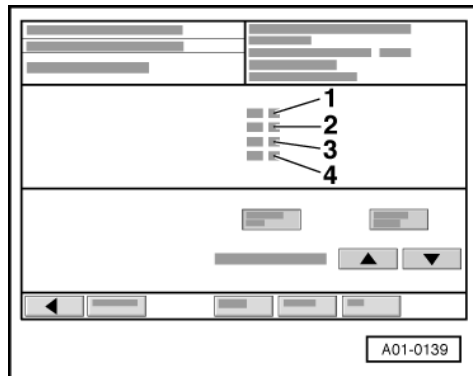




-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "060" for "display group number 060" in zone -2- and confirm the entry by pressing the Q key.



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-> Display on VAS 5051:

- Check specifications in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 060: Adaption of throttle valve control part				
Display	xx %	xx %	x	---
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption stage counter	Adaption status
Range			0...8	ADP process running ADP OK ERROR
Specified value	3...93 %	97...3 %	8	ADP OK
Note:			The adaption stage counter reaches the number 8 after adaption (some numbers may also be skipped).	If "ERROR" is displayed: Interrogate fault memory => Page 135

Note on display zone 3:

During adaption, various digits are displayed in display zone 3 which represent the relevant adaption status. The most crucial factor is not the way in which the adaption stage counter (display zone 3) behaves during the adaption process, but that the specification "ADP OK" is displayed after adaption in display zone 4.

If specification "ADP OK" is attained:

- Perform the next operation.

Operation 4: Checking operating status of lambda control

- Start the engine.

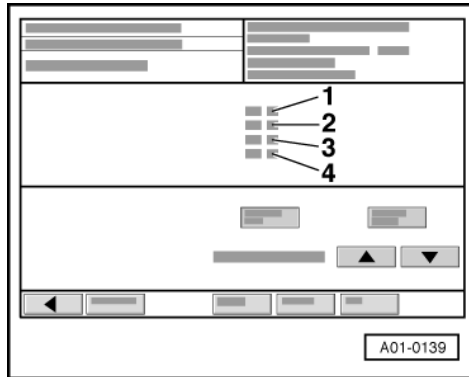
Note:

If necessary, after the engine starts reselect vehicle system "01 - Engine electronics" and diagnostic function "04 - Basic setting".

- Install the engine speed controller V.A.G 1788/10 on the accelerator and increase the engine speed to 2000 rpm.

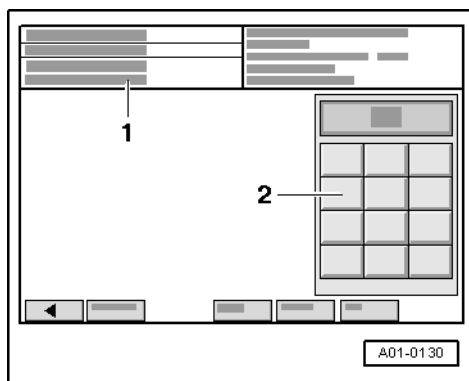
Test conditions:

- Engine running at 2000 rpm.



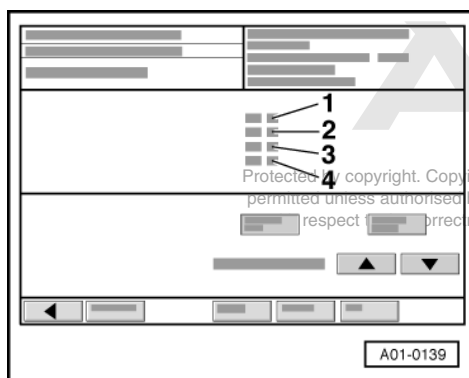
-> Display on VAS 5051:

- Press the ◀ key.



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "030" for "display group number 030" in zone -2- and confirm the entry by pressing the Q key.





-> Display on VAS 5051:

- Check lambda probe status in display zones -1- and -2-.

Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 030: Lambda probe status				
Display	X X X		X X X	
Display	Lambda probe status, bank 1, probe 1		Lambda probe status, bank 1, probe 2	
Range	0 = off 1 = on		0 = off 1 = on	
Specified value	1 1 1		1 1 0	

Significance of 3-digit readout of display group 030			
X	X	X	Display zones 1 and 2:
		X	Lambda control 0 = not active; 1 = active
	X		Lambda probe condition: 0 = not active; 1 = active
X			Condition of lambda probe heating: 0 = not active; 1 = active

Notes:

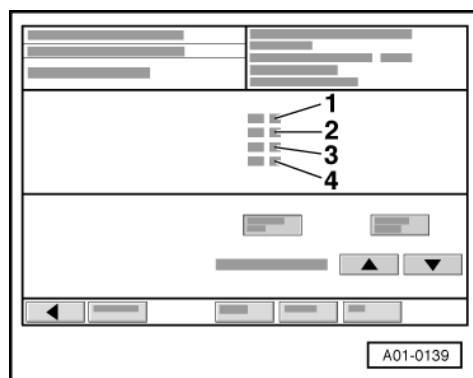
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- ♦ The first digit of the 3-digit display (heating) fluctuates between 0 and 1 at certain operating points
- ♦ The lambda control of lambda probe downstream of catalytic converter (bank 1, probe 2) is not active without engine load, i.e. the display of the 3-digit display is 0.
- Only continue with the test if the displays have reached "111" in display zone 1 and "110" in display zone 2 at least once.

Operation 5: Diagnosis of ageing of lambda probe upstream of catalytic converter

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the s key 4 times in order to change to display group 034.
- Check specification in display zone -4-.

Note:

It may take a few minutes until the result of the diagnosis is obtained.

	Display zones			
	1	2	3	4
Display group 034: Diagnosis of lambda probe ageing, lambda probe upstream of catalytic converter (bank 1)				
Display	xxxx rpm	xxx °C	x.x	---
Display	Engine speed	Exhaust gas temperature	Dynamics factor	Diagnosis status
Range				Test OFF Test ON B1-P1 OK B1-P1 NOK
Specified value	2000 rpm	Above 350 °C	0.5...2.0	B1-P1 OK
Note:				If "B1-P1 NOK" is displayed: Interrogate fault memory => Page 5.

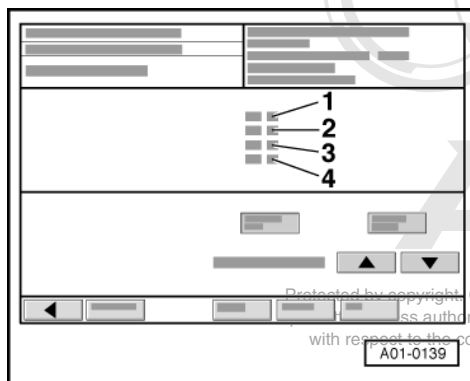
If specification "B1-P1 OK" is attained:

- Perform the next operation.

Operation 6: Diagnosis of lambda probe condition downstream of catalytic converter.

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- To switch to display group 036 press the s key twice.
- Check specification in display zone -2-.

	Display zones			
	1	2	3	4
Display group 036: Lambda probe condition downstream of catalytic converter (Bank 1).				
Display	x.xxx V	---		
Display	Lambda probe voltage bank 1, probe 2	Diagnosis status		
Range		Test OFF Test ON B1-P2 OK B1-P2 NOK		



Display zones			
Specified value	0.100...0.950 V	B1-P2 OK	
Note:		If "B1-S2 NOK" is displayed: Interrogate fault memory => Page 5	

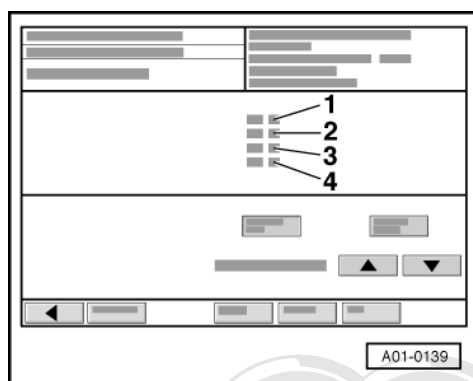
If specification "B1-P2 OK" is attained:

- Perform the next operation.

Operation 7: Diagnosis of lambda control system

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- To switch to display group 037 press the s key.
- Check specification in display zone -4-.

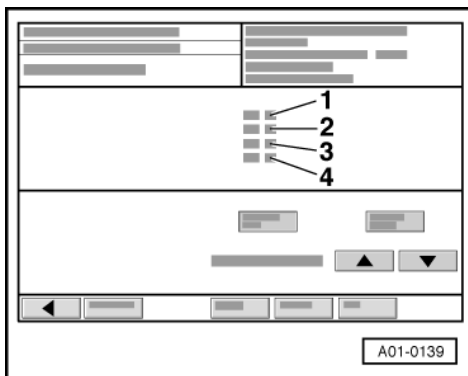
	Display zones			
	1	2	3	4
Display group 037: Lambda control system diagnosis (bank 1)				
Display	xxx %	x.xxx V	x.xx	---
Display	Load	Lambda probe voltage bank 1, probe 2	Lambda correction value between Bank 1, Probe 1 and Bank 1, Probe 2	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	12...30 %	0.100...0.950 V	lower than 0.02	Syst. OK
Note:				If "Syst. NOK" is displayed: Interrogate fault memory => Page 5

If specification "Syst. OK" is attained:

- Perform the next operation.

Operation 8: Diagnosis of ageing of lambda probe downstream of catalytic converter

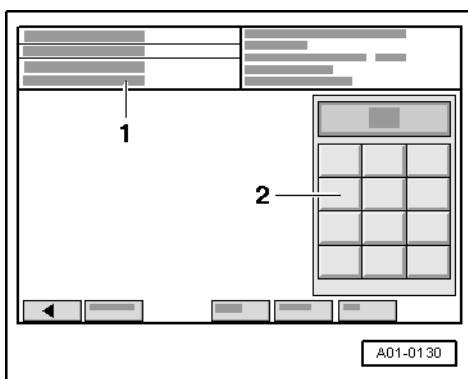
Test conditions:



- Engine continues to run at 2000 rpm.

-> Display on VAS 5051:

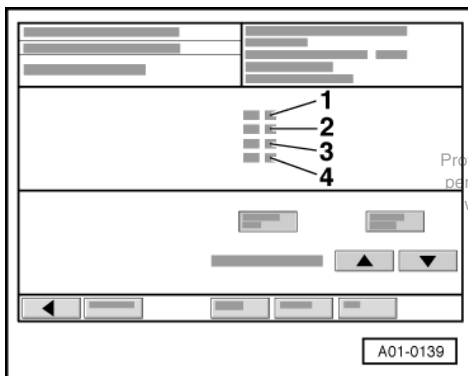
- Press the ◀ key.



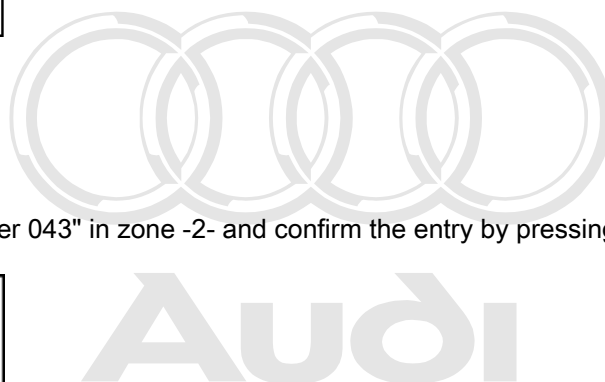
-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "043" for "display group number 043" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:



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- Check specification in display zone -4-.

	Display zones			
	1	2	3	4
Display group 043: Diagn. of lambda probe ageing, lambda probe downstream of catalytic converter (bank 1)				
Display	xxxx rpm	xxx °C	x.xxx V	---
Display	Engine speed	Exhaust gas temperature	Lambda probes-voltage bank 1, probe 2	Diagnosis status
Range				Test OFF Test ON B1-P2 OK B1-P2 NOK
Specified value	2000 rpm	Above 350 °C	0.100...0.950 V	B1-P2 OK
Note:				If "B1-S2 NOK" is displayed: Interrogate fault memory => Page 5

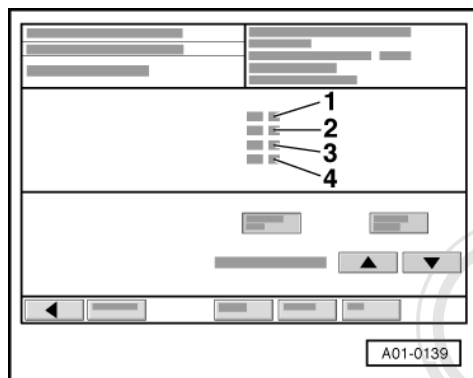
If specification "B1-P2 OK" is attained:

- Perform the next operation.

Operation 9: Catalytic converter diagnosis

Test conditions:

- Engine continues to run at 2000 rpm.



-> Display on VAS 5051:

- Select the s key three times in order to change to display group 046.
- Check specifications in display zones -2- and -4-.

Note:

The test duration for the catalytic converter diagnosis is approx 60 seconds. in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

	Display zones			
	1	2	3	4
Display group 046: Catalytic converter diagnosis (bank 1)				
Display	xxxx rpm	xxx °C	x.xx	---
Display	Engine speed	Exhaust gas temperature	Measurement Catalytic conversion	Diagnosis status

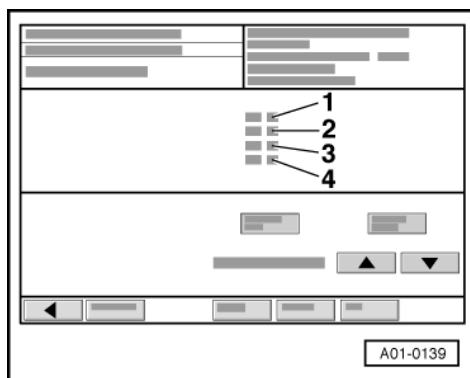
Range	Display zones			
				Test OFF Test ON Cat. B1 OK Cat. B1 NOK
Specified value	2000 rpm	Above 320 °C	0.0...0.32	Cat. B1 OK
Note:		As long as the exhaust temperature is not within the specified range the test is not initiated. If necessary, increase or decrease speed.		If "Cat. B1 NOK" is displayed: Interrogate fault memory => Page 5. If no fault is stored, replace the catalytic converter.

If specification "Cat. B1 OK" is attained:

- Perform the next operation.

Operation 10: Diagnosis of fuel tank breather valve

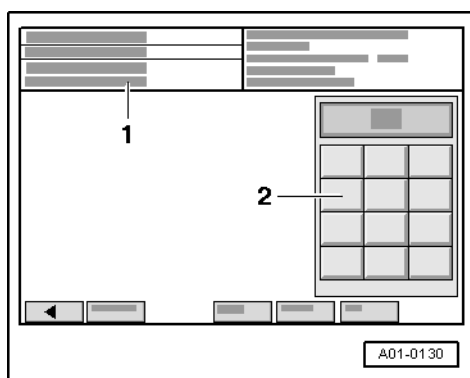
- Remove speedometer V.A.G 1788/10 and let engine run at idling speed.



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Test conditions:

- Engine running at idling speed
- > Display on VAS 5051:
- Press the ◀ key.



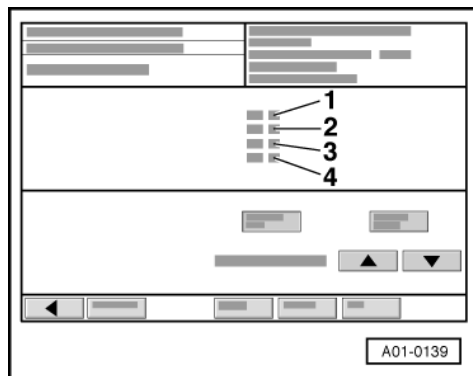
-> Display on VAS 5051:

- 1 - Enter display group



max. input value = 255

- Enter "070" for "display group number 070" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specification in display zone -4-.

Note:

If the test is not initiated or the display jumps from "Test ON" to "Test OFF", accelerate briefly to repeat the test.

	Display zones			
	1	2	3	4
Display group 070: Diagnosis of fuel tank breather valve				
Display	xx %	xx %		---
Display	Opening angle of fuel tank breather valve	Lambda control Mean value		Diagnosis status
Range				Test OFF Test ON FTBV OK FTBV NOK Cancel
Specified value	0...99 %	below -7 % or greater than 7% (check)		FTBV OK
Note:	Protected by copyright. Copying for private or commercial purposes is not permitted unless authorised by AUDI AG. AUDI AG does not accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.			If "FTBV NOK" is displayed: Interrogate fault memory => Page 127 .

If specification "FTBV OK" is attained:

- Press the ◀ key.

Operation 11: Reading out readiness code

- Read out the readiness code => Page 31 .

24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing 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:

- ♦ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ♦ To run engine at starting speed without actually starting it (for example, in order to test compression), unplug connector from the output stage of the ignition coils and also the connectors on the injectors.
- ♦ In the case of some tests, a fault may be recognised and stored by the control unit. At the end of all tests and repairs, therefore, the fault memory should be interrogated and, if necessary, erased. After erasing the fault memory the readiness code must be produced => Page 33
- ♦ Always switch off the ignition before washing the engine.
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

Important

The fuel system is pressurised! Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

Note the following points if testers and measuring instruments have to be used during a road test:

Important

- ♦ **Always install testers and measuring instruments on the back seat and have a second person operate them from there.**
- ♦ **If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.**

1.3 - Rules for cleanliness

When working on the fuel supply/injection system, carefully observe to the following 6 cleanliness rules:

- ♦ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ♦ Place removed parts on a clean surface and cover. Use lint-free 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.
- ♦ Separated electrical connectors:
Protect from dirt and moisture.



Make sure connections are dry when attaching.

1.4 - Technical data

Engine code letters		AMK (1.8 l / 5V / 154 kW engine) BAM (1.8 l / 5V / 165 kW engine)
Idling speed Not adjustable - controlled by the idling speed stabilisation		700 ... 820 rpm ¹⁾
Engine speed limitation by deactivation of injectors		approx. 6800 rpm
Fuel pressure at idling speed	Vacuum hose connected	approx. 2.5 bar
	Vacuum hose detached	approx. 3.0 bar
Holding pressure after 10 minutes		at least 1.5 bar
Injectors	Spray pattern	Two-hole nozzle / same for all injectors
	Injection quantity (30 s)	179 ± 14 ml
	Resistance (ambient temperature)	12 ... 13 Ω

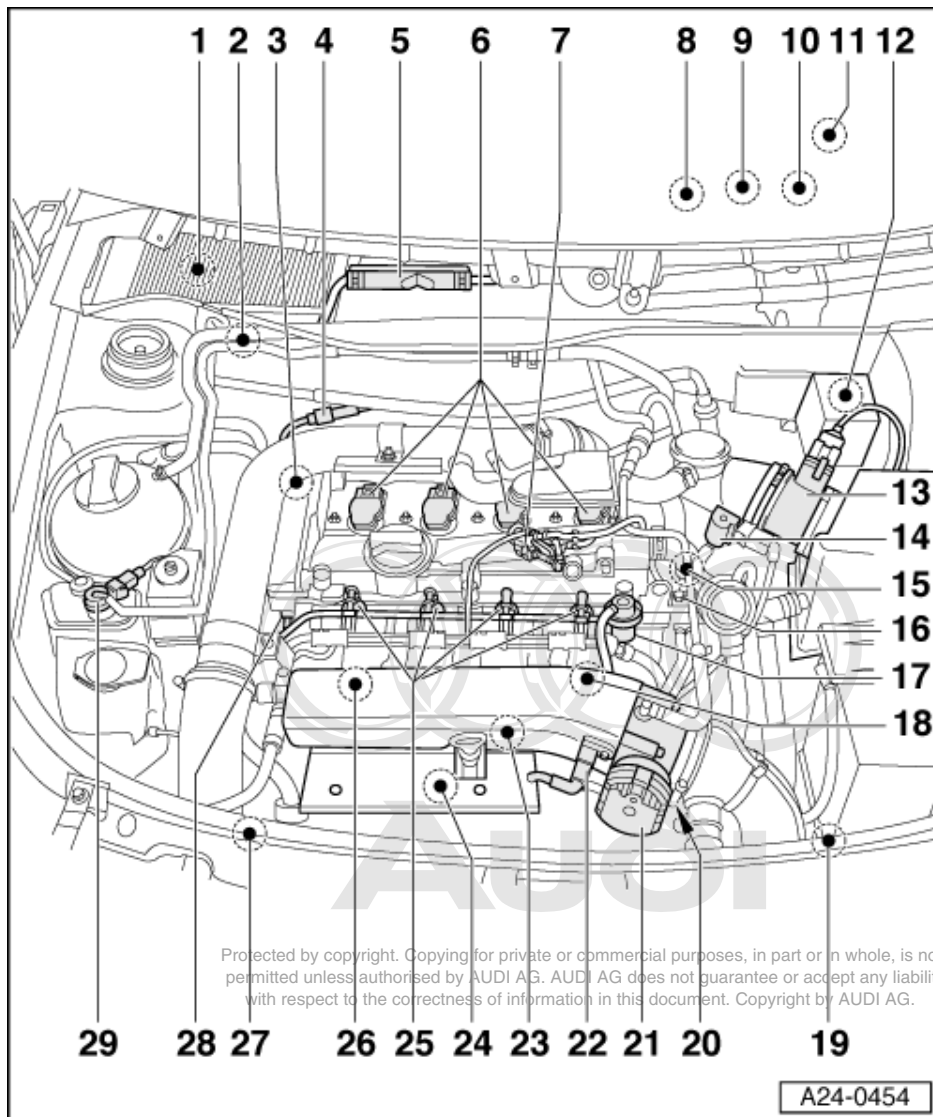
1) Current values:

=> Exhaust Emissions Test binder



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1.5 - Fitting locations overview

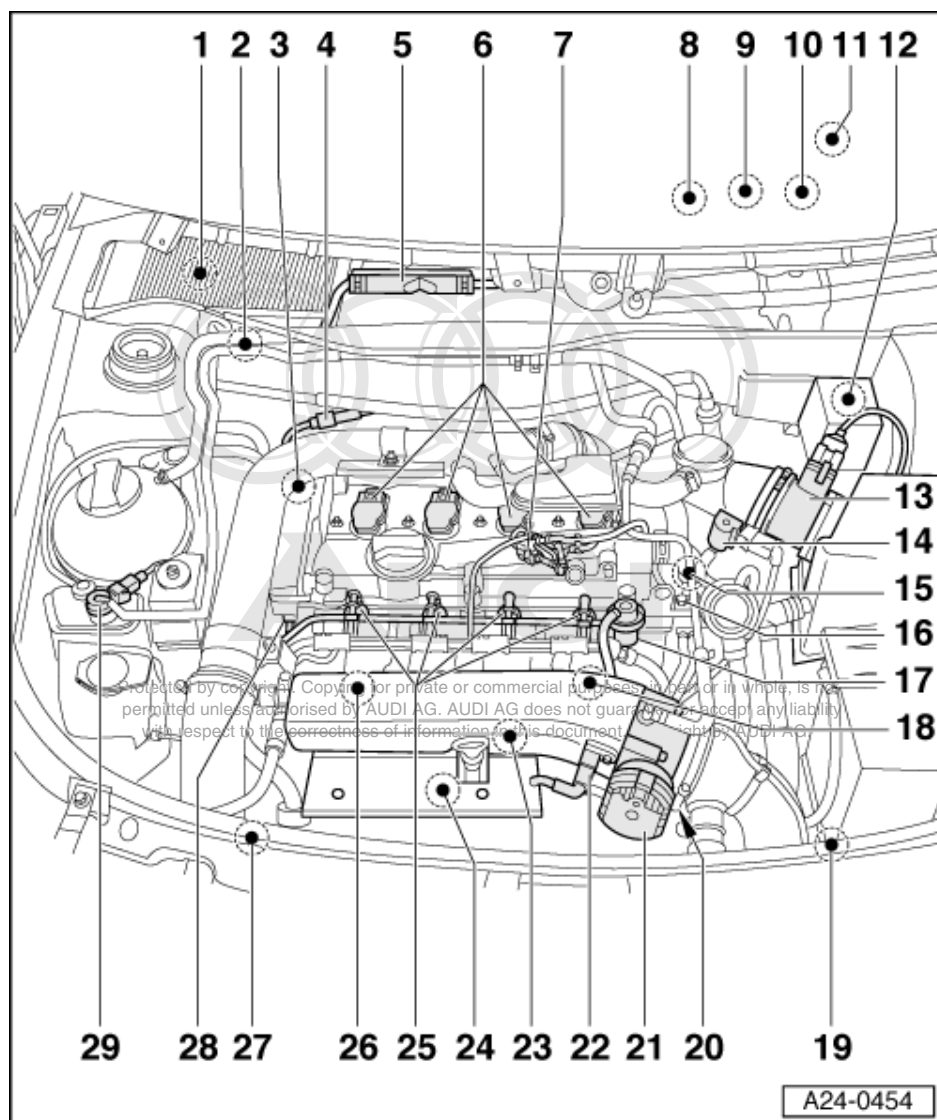


1 Lambda probe downstream of catalytic converter -G130 with heater for lambda probe -Z29

- ♦ Fitting location => Fig. 56
- ♦ Check lambda probe and lambda control downstream of catalytic converter => Page 115
- ♦ Check lambda probe heating downstream of catalytic converter => Page 122
- ♦ Removing and installing
=>Page 125.

2 4-way connector

- ♦ For lambda probe downstream of catalytic converter -G130 and heater for lambda probe -Z29 (brown)
- ♦ Fitting location => Fig. 56

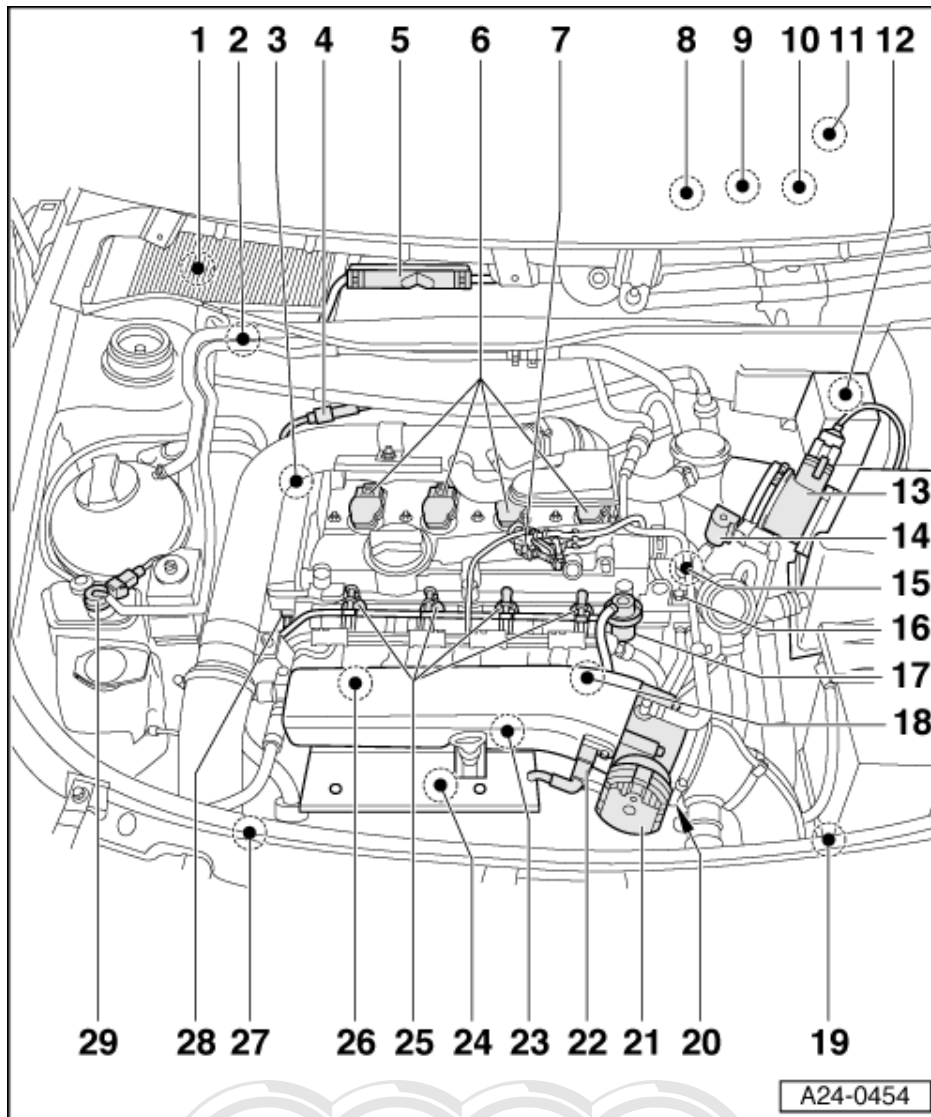


3 Lambda probe upstream of catalytic converter -G39 and heater for lambda probe -Z19

- ◆ Constant lambda probe
- ◆ Check lambda probe and lambda control upstream of catalytic converter => Page 104
- ◆ Check lambda probe ageing upstream of catalytic converter => Page 110
- ◆ Check lambda probe heating upstream of catalytic converter => Page 113
- ◆ Removing and installing
=>Page 125 .

4 6-pin connector

- ◆ for lambda probe upstream of catalytic converter -G39 and heater for lambda probe -Z19 (black)



5 Engine control unit -J220

- ◆ Check power supply to engine control unit => Page 195 .
- ◆ Procedure following interruption of voltage supply => Page 64
- ◆ Replacing => Page 64 .

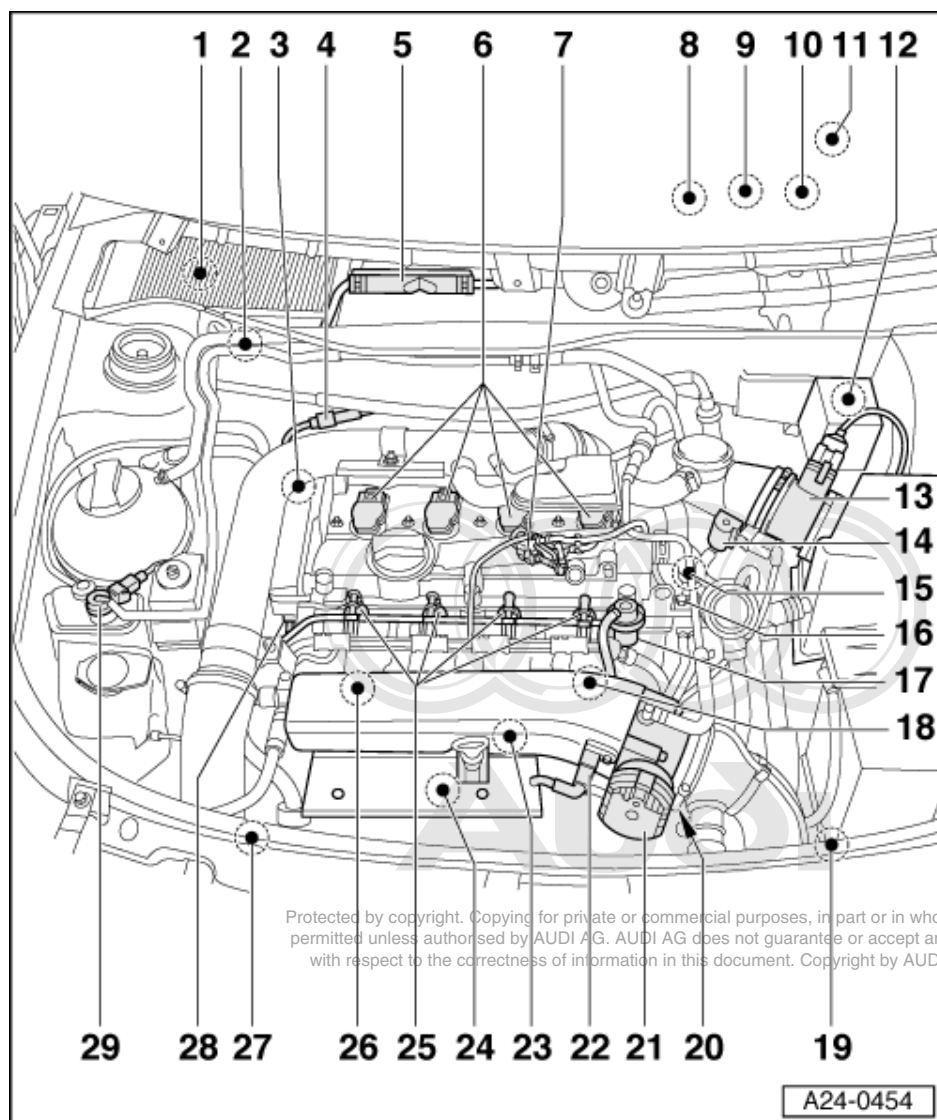
6 Ignition coils

- ◆ Cylinder 1 -N
- ◆ Cylinder 2 -N128
- ◆ Cylinder 3 -N158
- ◆ Cylinder 4 -N163
- ◆ Checking => Page 174

7 Air recirculation valve for turbocharger -N249

- ◆ Fitting location:
=> Fig. 55
- ◆ Checking:

=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger Checking charge air system with turbocharger



8 Accelerator pedal position sender -G79 and sender 2 for accelerator pedal position -G185

- ♦ Fitting location
=> Fig. 55
- ♦ Checking => Page 143

9 Brake light switch -F and brake pedal switch -F47

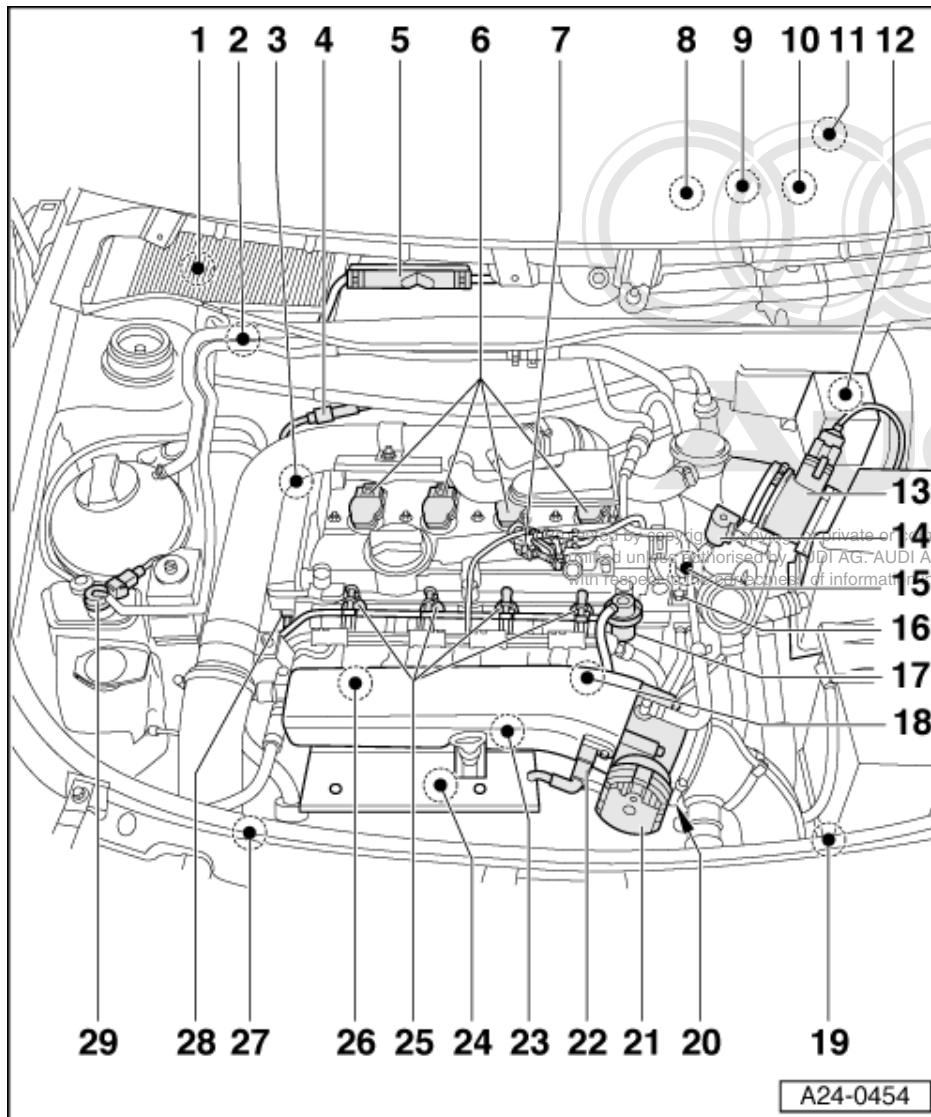
- ♦ Fitting location
=> Fig. 57

10 Clutch pedal switch -F36

- ♦ Fitting location
=> Fig. 58

11 Instrument cluster:

- ♦ with warning lamp for electronic throttle control -K132
- ♦ with exhaust warning lamp -K83 MIL (Malfunction Indicator Lamp)



12 Checking power supply relay for Motronic system -J271

- ♦ Fitting location
=> Fig. 56
- ♦ Checking => Page 179

13 Air mass meter -G70

- ♦ Checking => Page 97

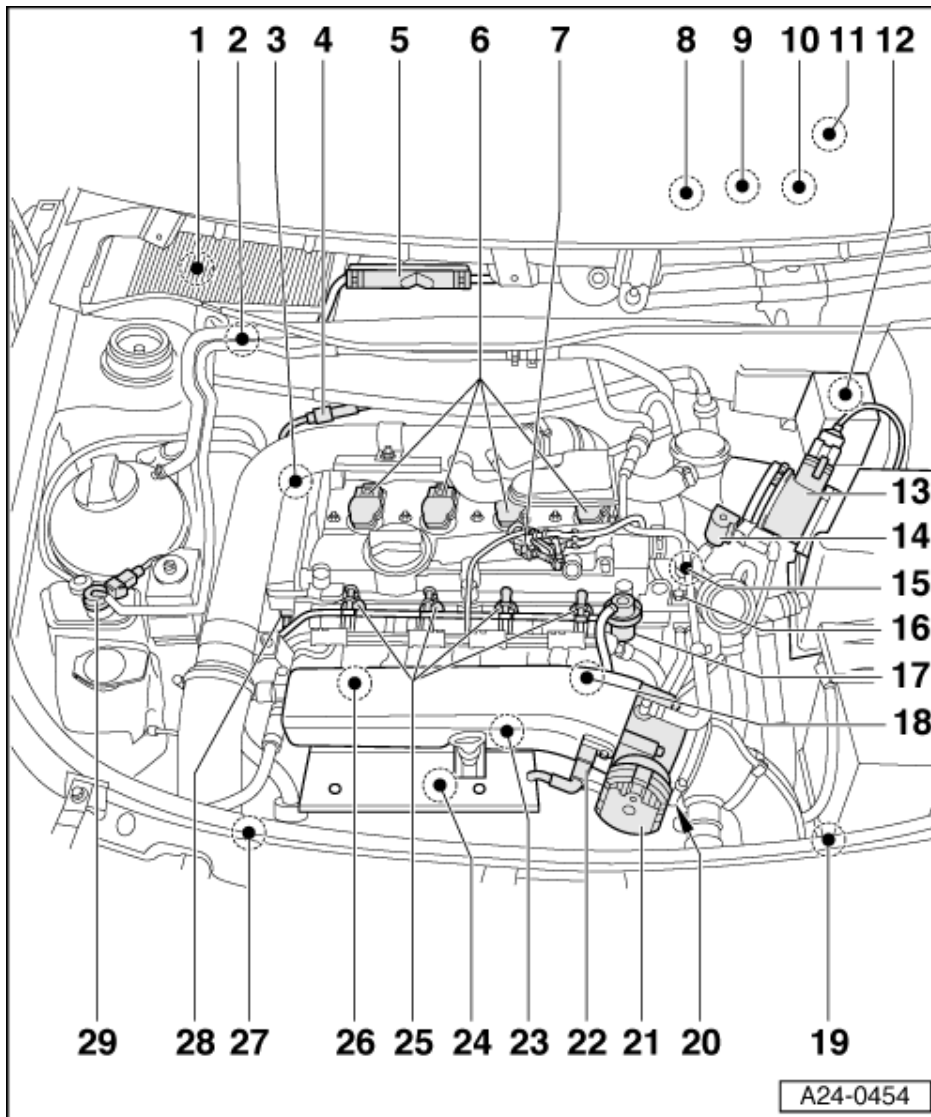
14 Boost pressure control solenoid valve -N75

- ♦ Checking:

=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger Checking charge air system with turbocharger

15 Coolant temperature sender -G62

- ♦ Checking => Page 191
- ♦ If necessary, release cooling system pressure before removal

**16 Camshaft adjustment solenoid valve 1 -N205**

=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 15; Checking camshaft timing control
Checking camshaft timing control

17 Fuel pressure regulator

- ♦ Checking => Page 77

18 Knock sensor 2 -G66**19 Boost pressure sender -G31**

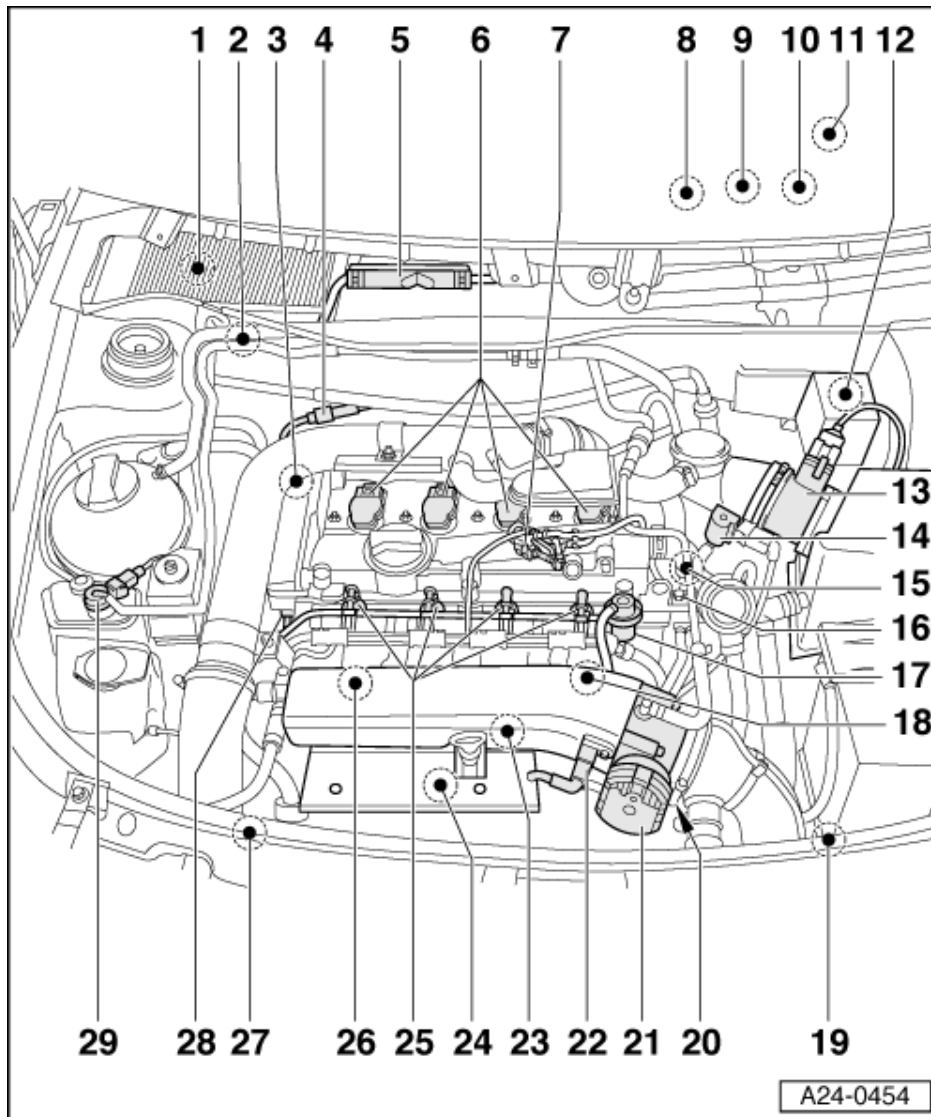
- ♦ bolted in top of charge air cooler
- ♦ Checking:

=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 21; Checking charge air system with turbocharger
Checking charge air system with turbocharger

20 Engine speed sender -G28

- ♦ Checking => Page 189

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21 Throttle valve control part -J338

- ♦ with throttle valve drive -G186, angle sender for throttle valve drive -G187 and angle sender 2 for throttle valve drive -G188
- ♦ Checking => Page 132
- ♦ Carry out adaption on replacing => Page 132

22 Intake air temperature sender -G42

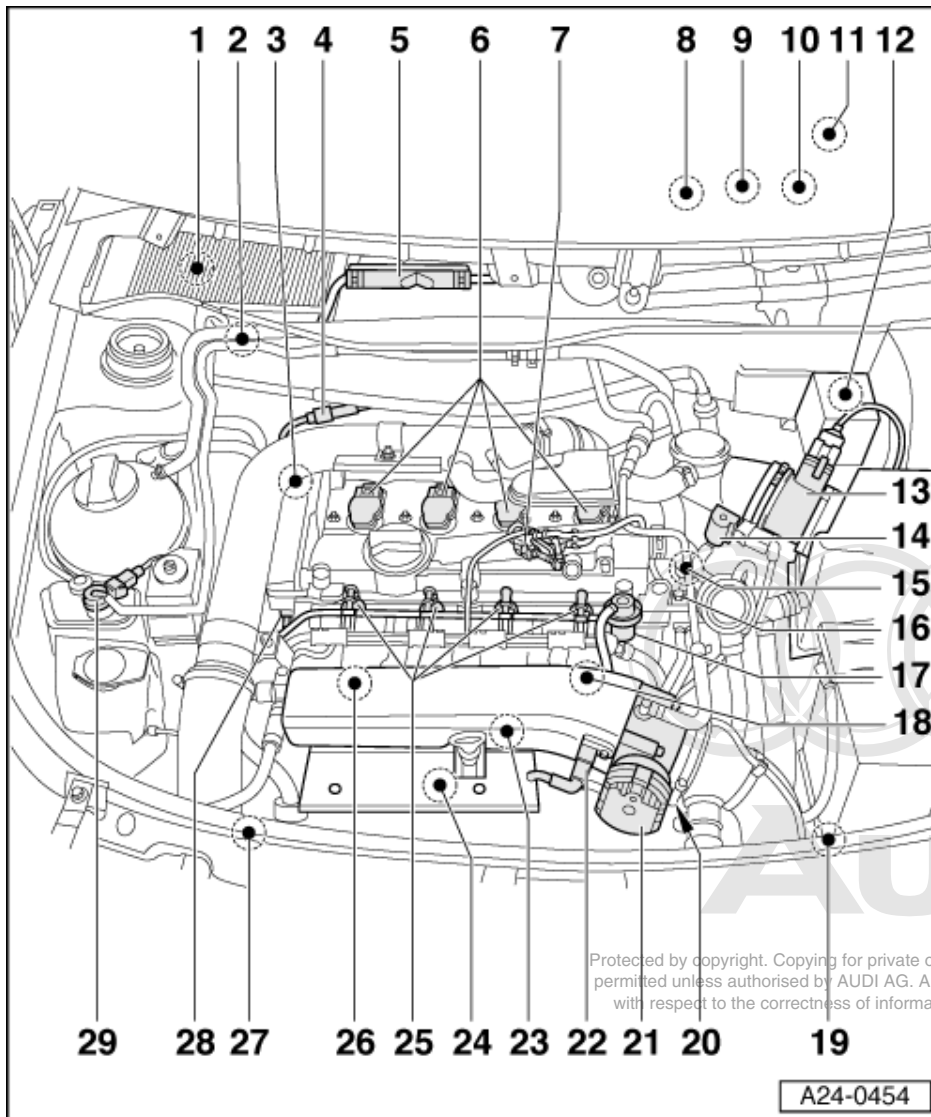
- ♦ Checking => Page 185

23 3-pin connector

- ♦ For engine speed sender -G28

24 Exhaust gas temperature sender 1 -G235

- ♦ Temperature sensor located in turbocharger



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25 Injectors

- ♦ Cylinder 1 -N30
- ♦ Cylinder 2 -N31
- ♦ Cylinder 3 -N32
- ♦ Cylinder 4 -N33
- ♦ Checking => Page 81
- ♦ Removing and installing
=>Page 89 .

26 Knock sensor 1 -G61

27 Power steering pressure switch -F88

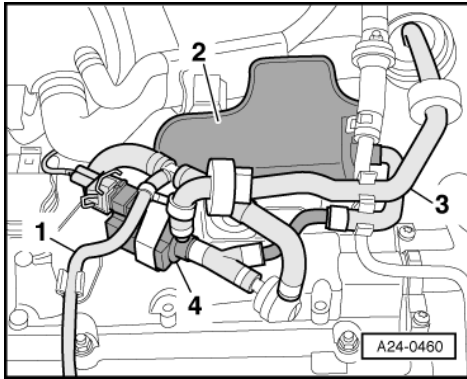
- ♦ Fitting location
=> Fig. 56

28 Hall sender -G40

- ♦ Checking => Page 201

29 Solenoid valve 1 for activated charcoal filter -N80

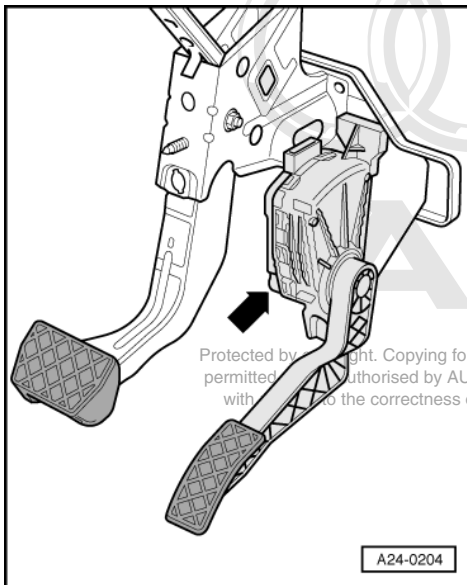
- ♦ Checking => Page 127



-> Fig.1 Fitting location of air recirculation valve for turbocharger -N249

♦ Fitting location: On the cylinder head cover

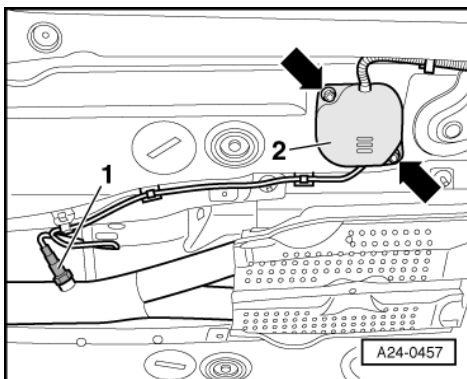
- 1 - To connection on intake manifold
- 2 - Vacuum reservoir
- 3 - To mechanical air recirculation valve
- 4 - Air recirculation for turbocharger -N249



-> Fig.2 Fitting location for accelerator pedal position sender -G79 and sender 2 for accelerator pedal position -G185

Note:

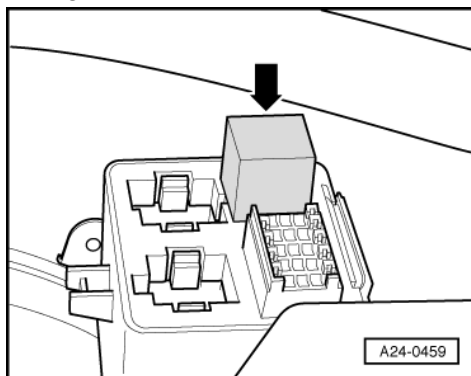
Figure shows layout in LHD vehicles.



-> Fig.3 Fitting location of lambda probe downstream of catalytic converter and protective cover for connector

- 1 - Lambda probe downstream of catalytic converter -G130 with heater for lambda probe -Z29
- 2 - Protective cover for connector

The connector for the lambda probe and heater for lambda probe is accessible once the protective cover on the right of the vehicle floor has been removed -arrows-.

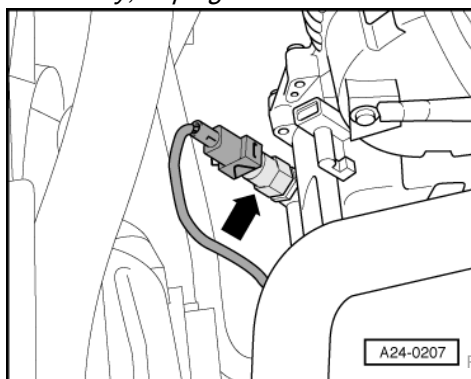


-> Fig. 4 Fitting location of power supply relay for Motronic -J271

- ♦ under left cover at bulkhead

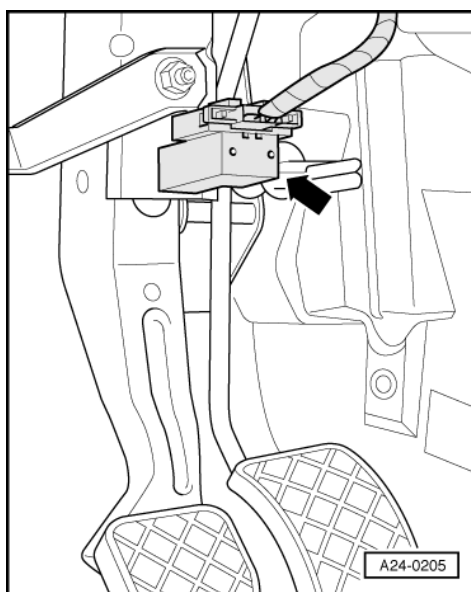
Note:

To remove the protective cover in vehicles with dome strut, detach and lower relay holder at the bulkhead. If necessary, unplug connectors from air mass meter.



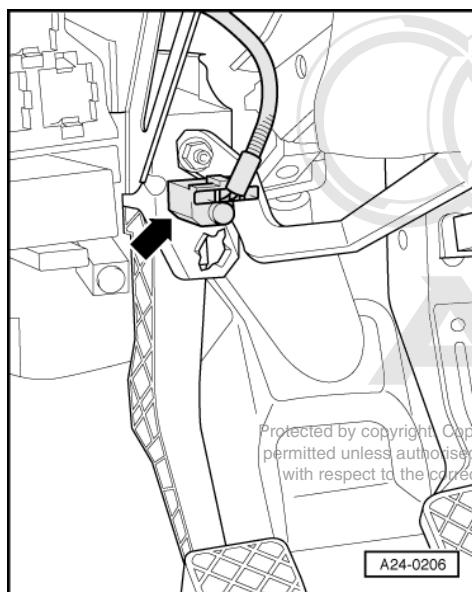
-> Fig.5 Fitting location of power steering pressure switch

-F88



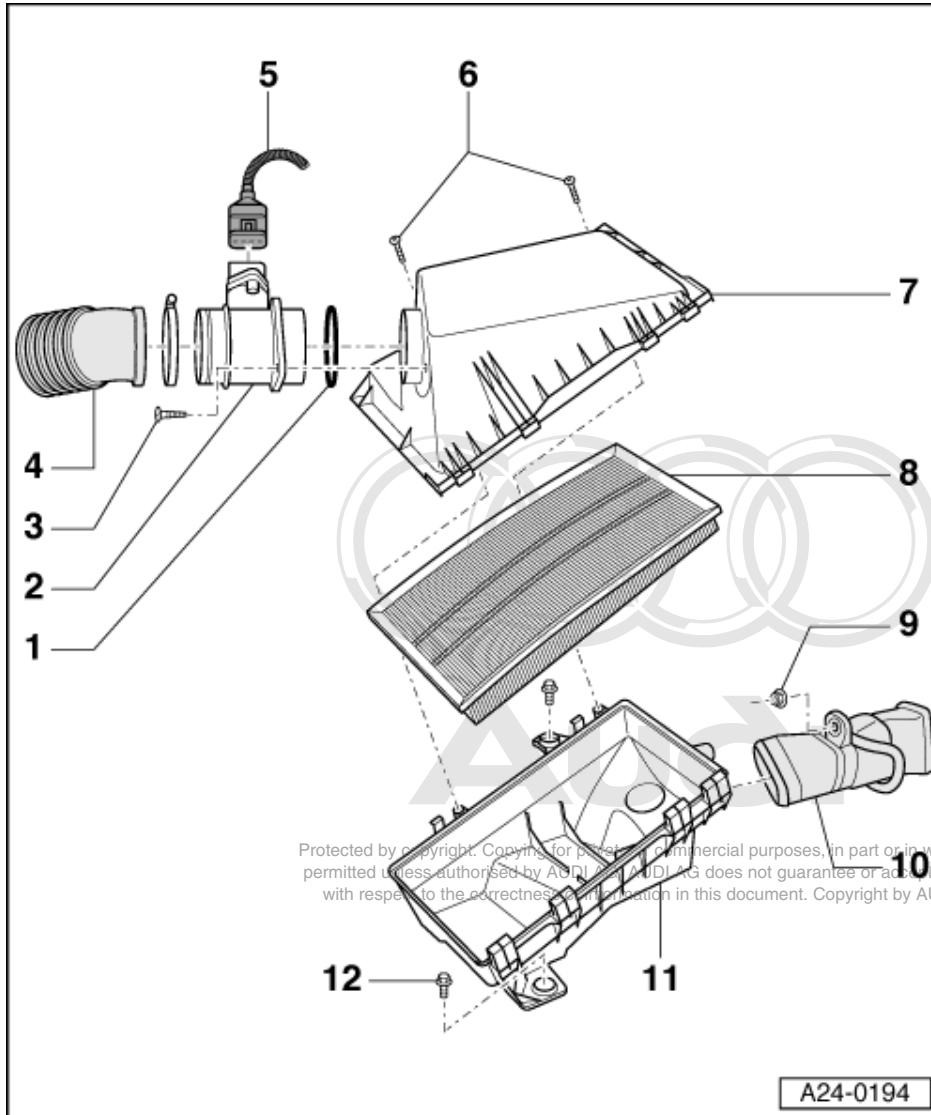
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-> Fig.6 Fitting location of brake light switch -F and brake pedal switch -F47

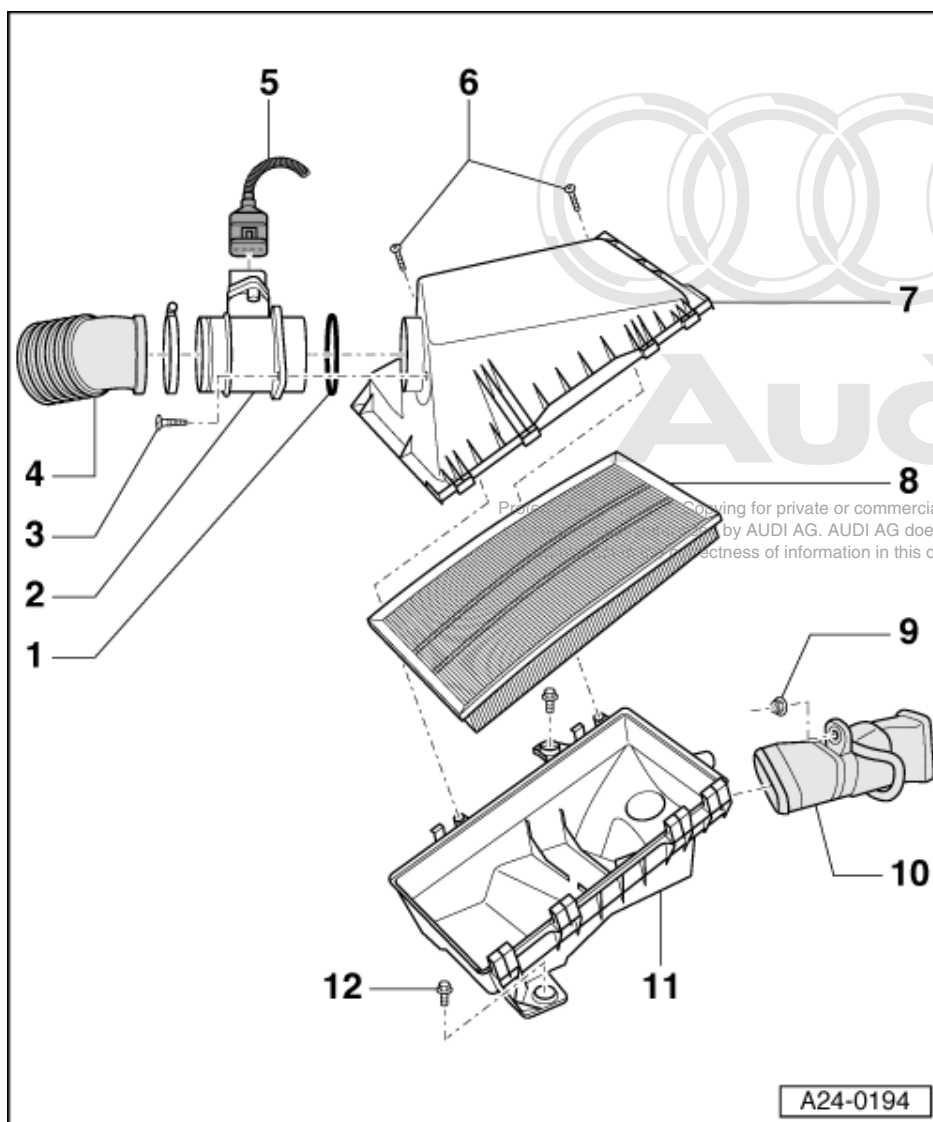


-> Fig.7 Fitting location of clutch pedal switch -F36

1.6 - Dismantling and assembling air cleaner



- 1 Sealing ring
- 2 Air mass meter -G70
- 3 Cross head screw
- 4 Air duct
- 5 5-pin connector
- 6 Cross head screw
- 7 Top part of air cleaner
- 8 Filter element



- 9 Nut- 10 Nm
 10 Air intake connection piece
 11 Bottom part of air cleaner
 12 Hexagon bolt - 10 Nm

1.7 - Wiring and component check with test box V.A.G 1598/31

For the procedure for engine control units which are fitted with a protective metal housing, refer to => Page 60.

Notes:

- ◆ The test box V.A.G 1598/31 is designed in such a way that it can be connected simultaneously to the engine control unit wiring harness and to the engine control unit itself.
- ◆ This has the advantage that the electronic motor control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ Whether the engine control unit has to be additionally connected to the test box or not is described in the respective test procedures.

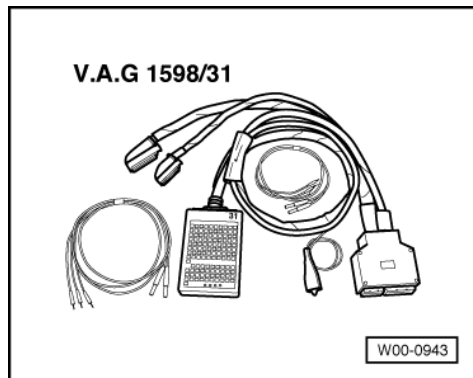


- ♦ Always use adapter set V.A.G 1594 A for connecting up measuring instruments (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A etc.)

Important

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

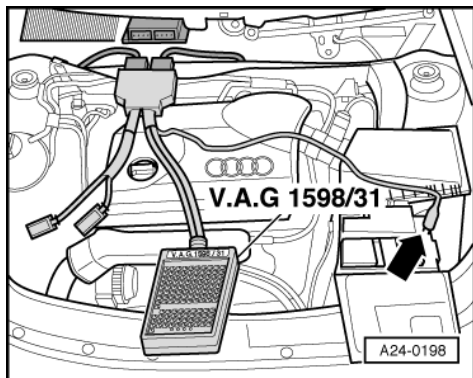
Special tools and workshop equipment required



- ♦ V.A.G 1598/31

Procedure

- Switch ignition off.



- Remove engine control unit => Page 65 .
- -> Connect V.A.G 1598/31 test box to connectors of wiring harness. Connect the earth clip on the test box (not visible on the figure) to earth. Whether or not the engine control unit has to be additionally connected to the test box is described in the respective test procedures.
- Carry out test as described in the appropriate repair procedures.

Important note:

After reinstalling the engine control unit the following operations must be performed:

- Perform adaption of throttle valve control part -J338 => Page 132 .
- Interrogate fault memory and erase, if necessary => Page 5 .
- If the fault memory is erased the readiness code must be produced again => Page 33 .

The following procedure applies to engine control units which are fitted with a protective sheet-metal housing.

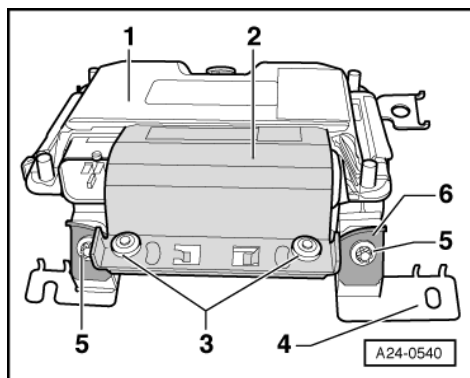
Notes:

- ♦ The test box V.A.G 1598/31 is designed in such a way that it can be connected simultaneously to the engine control unit wiring harness and to the engine control unit itself.

- ◆ This has the advantage that the electronic motor control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ Whether the engine control unit has to be additionally connected to the test box or not is described in the respective test procedures.
- ◆ Always use adapter set V.A.G 1594 A for connecting up measuring instruments (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A etc.)

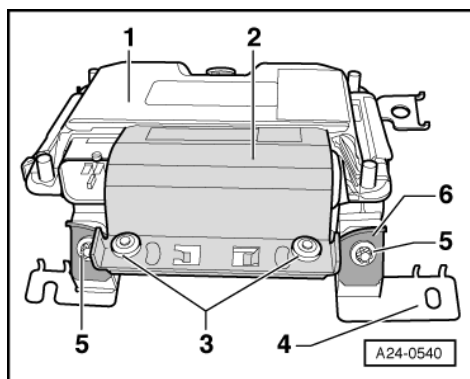
Procedure

- Switch ignition off.
- Detach the windscreen wiper arms.
- Remove the cover for plenum chamber and lay aside towards the windscreen.



Note:

Item -1- in the illustration shows the engine control unit with protective housing.

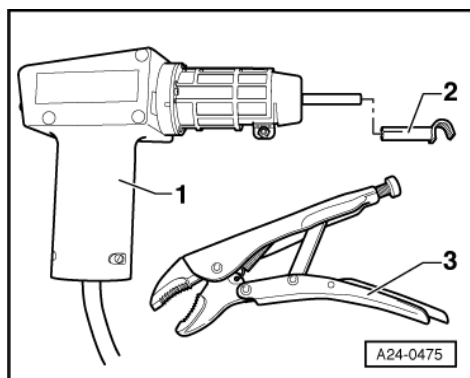


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-> As a deterrent against unauthorised access to the connectors for the engine control unit, the engine control unit -1- is fitted with a sheet-metal housing -4- by means of a locking device -2- and shear bolts -3-.

The thread of the shear bolts is coated with a locking compound in order to make removal of the shear bolts more difficult.

To ensure that the connectors of the engine control unit can be unplugged (e.g. when connecting the test box), the locking device -2- must be detached from the sheet-metal housing. This procedure is described below.



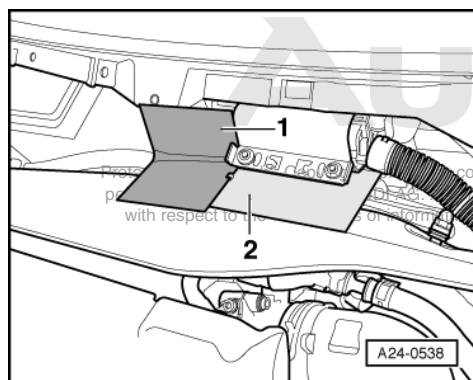
The following tools are required:

- ♦ -> Hot air blower -1- (from wiring harness repair set VAS 1978)
- ♦ Commercially available vice-grip wrench

Procedure:

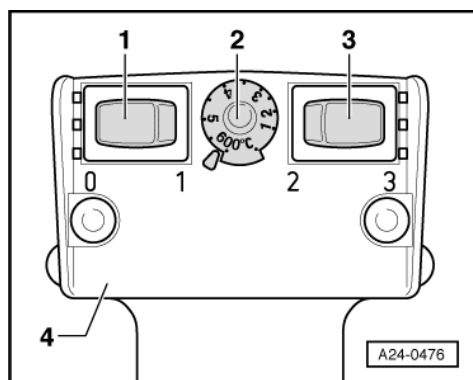
Important

In order to rule out the possibility of damage (burning) to wiring, connectors, insulation and control units, the following operations must be adhered to exactly. Please note the operating instructions for the hot air blower.



-> In order to prevent damage to wiring and connectors, steel plates must be used as a shield (items -1- and -2-).

This is to prevent overheating of the connector housing and the wiring harness.



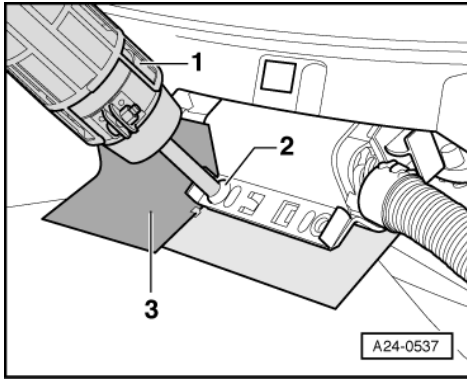
- -> Please adjust the hot air blower as shown in the illustration, i.e., the potentiometer for temperature regulation -2- is set to maximum heat and the two-step switch for air flow -3- to position 3.

Note:

Next, the bolt of the locking device must be heated using the hot air blower. With this step, the bonding effect of the locking compound on the thread of the shear bolts is reduced, facilitating removal of the shear bolts.

Important

When heating the thread of the locking device, the shear bolts and parts of the sheet-metal housing reach a high temperature. Take care not to get burned. Ensure that as far as possible only the thread is heated, and no nearby parts. If necessary, cover up such parts.



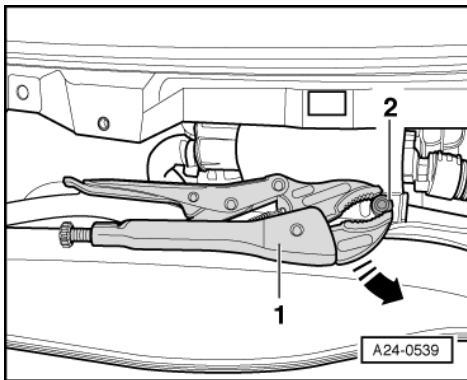
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- -> Direct the nozzle -1- of the hot air blower at the bolt -2- of the locking device.

Note:

Please be particularly careful here, as the connector for the control unit is located in the immediate vicinity.

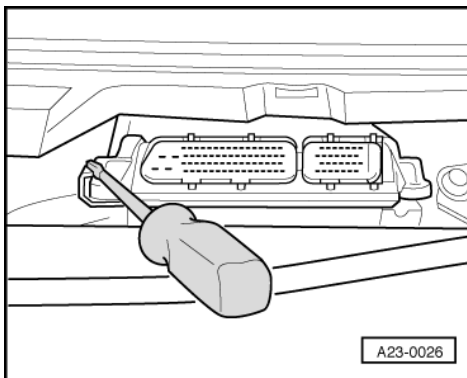
- Switch on the hot air blower and heat the thread for approx. 20 to 25 seconds.



- -> Then hold the bolt head -2- with the vice-grip wrench -1- and screw the bolt out in the direction of the arrow.
- To deter unauthorised access, the locking device has been attached in such a manner as to make a full revolution of the vice-grip wrench impossible.

The procedure for the second shear bolt is identical. Please be particularly careful here, as the connector for the control unit is located in the immediate vicinity.

- After removal of the second bolt, the locking device for the connector can be detached.

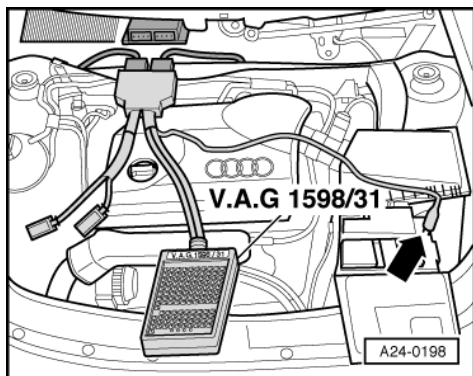




Note:

Once the retainer has been bent to one side, the control unit can be pulled forwards slightly. When reinstalling, the retainer can be bent back.

- Release the connector latches and detach the control unit connectors.



- -> Connect V.A.G 1598/31 test box to connectors of wiring harness. The earth clip on the test box (not visible in the illustration) must be connected to earth. Whether or not the engine control unit has to be additionally connected to the test box is described in the respective test procedures.
- Carry out test as described in the appropriate repair procedures.

Installation is performed in the reverse sequence; the engine control unit must be installed with a sheet-metal housing (locking device). New shear bolts must be used.

Important note:

After reinstalling the engine control unit the following operations must be performed:

- Perform adaption of throttle valve control part -J338 => Page 132 .
- Interrogate fault memory and erase, if necessary => Page 5 .
- If the fault memory is erased the readiness code must be produced again => Page 33 .

1.8 - Procedure following interruption of voltage supply

Important note:

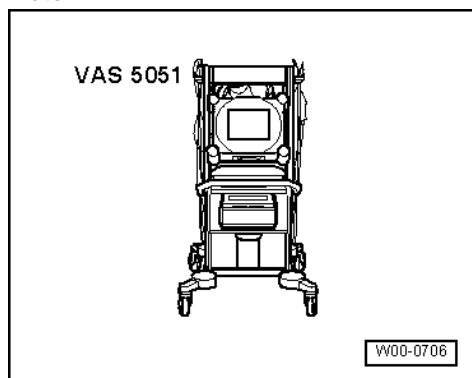
After reconnecting the voltage supply the following operations must be performed:

- Perform adaption of throttle valve control part -J338 => Page 132 .
- Interrogate fault memory and erase, if necessary => Page 5 .
- If the fault memory is erased the readiness code must be produced again => Page 33 .

1.9 - Replacing engine control unit

The following procedure applies to engine control units which are not fitted with a locking device (anti-tamper protection). For the procedure for engine control units with locking device, refer to => Page 66 .

Note:



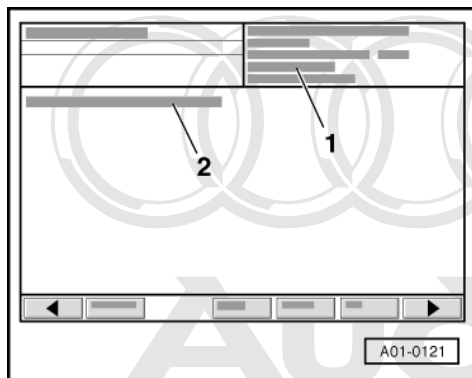
When the engine control unit is disconnected, the learned values are erased but the contents of the fault memory remain intact.

Special tools and workshop equipment required

- ◆ VAS 5051 with VAS 5051/1

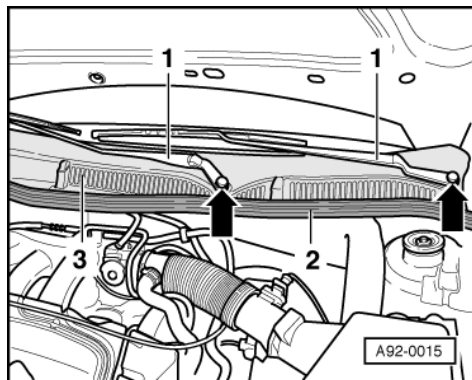
Removing

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.

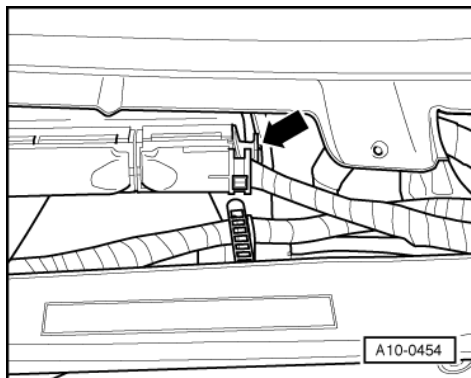


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- 1 - Control unit identification of the engine control unit => Page 3
- 2 - Control unit identification of the immobiliser => Page 4
- Always start by displaying and printing out the control unit identification.
- Compare code to encoding versions => Page 28 .



- Switch ignition off.
- Lever off cover caps on wiper arms with a screwdriver.
- -> Release the hexagon nuts -arrows- by a few turns.
- Release the wiper arms -1- from the pivot shaft by tilting them slightly.
- Remove hexagon nuts completely and remove wiper arms.
- Detach the rubber seal -2- of the plenum chamber cover.



- Remove the plenum chamber cover -3- and lay aside towards the windscreen.
- -> Release the connector catches -arrow- and unplug the control unit connector.

Installing

Installation is carried out in the reverse order; note the following:

- Bend back the bracket retainer tab.

Important note:

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

- Interrogate fault memory and erase, if necessary => Page 5 .
- Perform adaption of throttle valve control part -J338 => Page 132 .
- Note instructions for encoding new engine control unit => Page 26 .
- In vehicles with cruise control (recognisable from steering column switch), this should be freed in engine control unit:

=> Electrical System; Repair group 01; Cruise control system self-diagnosis; Checking cruise control system
Cruise control system self-diagnosis Checking cruise control system

- Adapt immobiliser to engine control unit.

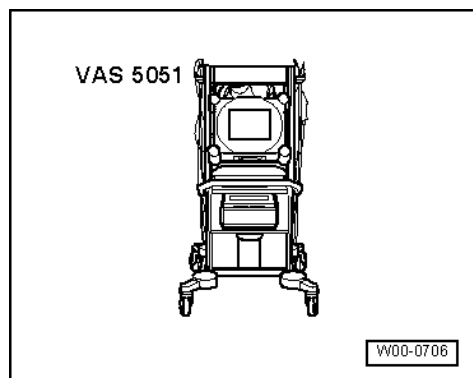
=> Electrical System; Repair group 01; Immobiliser self-diagnosis; Adaption after renewal of engine control unit
Immobiliser self-diagnosis Adaption after renewal of engine control unit

- Produce the readiness code => Page 33 .

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Procedure for engine control units with locking device (anti-tamper protection)

Note:



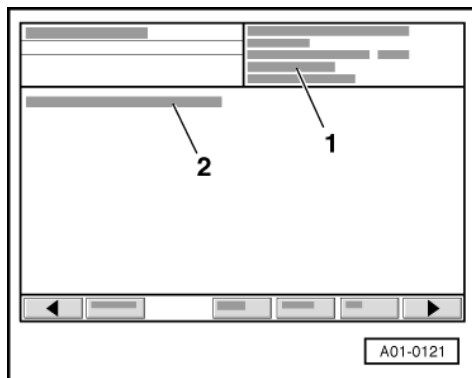
When the engine control unit is disconnected, the learned values are erased but the contents of the fault memory remain intact.

Special tools and workshop equipment required

- ◆ VAS 5051 with VAS 5051/1

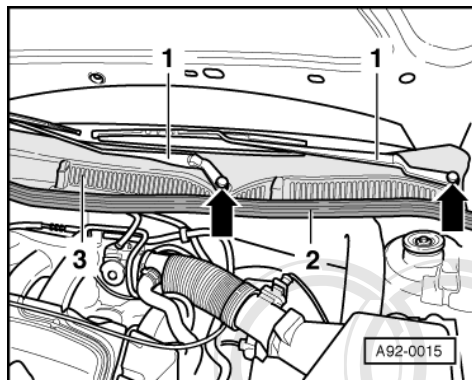
Removing

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 - Engine electronics" in the selection. For this purpose, the ignition must be switched on.



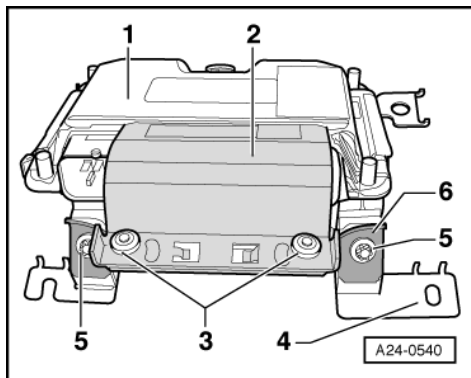
-> Display on VAS 5051:

- 1 - Control unit identification of the engine control unit => Page 3
- 2 - Control unit identification of the immobiliser => Page 4
- Always start by displaying and printing out the control unit identification.
- Compare code to encoding versions => Page 28 .



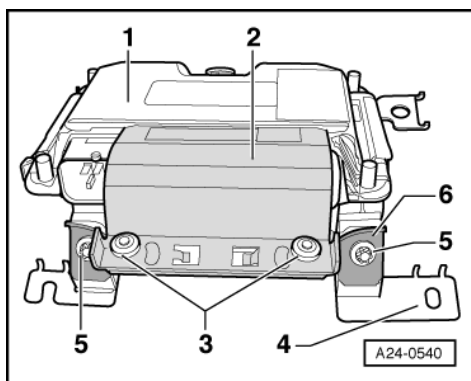
- Switch ignition off.
- Lever off cover caps on wiper arms with a screwdriver.
- -> Release the hexagon nuts -arrows- by a few turns.
- Release the wiper arms -1- from the pivot shaft by tilting them slightly.
- Remove hexagon nuts completely and remove wiper arms.
- Detach the rubber seal -2- of the plenum chamber cover.
- Remove the plenum chamber cover -3- and lay aside towards the windscreen.

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Note:

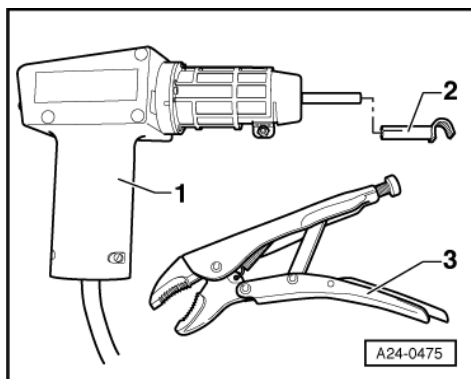
Item -1- in the illustration shows the engine control unit with a protective housing.



-> In order to make access to the connectors for the engine control unit more difficult (anti-tamper protection), the engine control unit -1- is fitted with a sheet-metal housing -4- by means of a locking device -2- and shear bolts -3-.

The thread of the shear bolts is coated with a locking compound in order to make removal of the shear bolts more difficult.

To ensure that the connectors of the engine control unit can be unplugged (e.g. when connecting the test box or replacing the engine control unit), the locking device -2- must be detached from the sheet-metal housing. This procedure is described below.



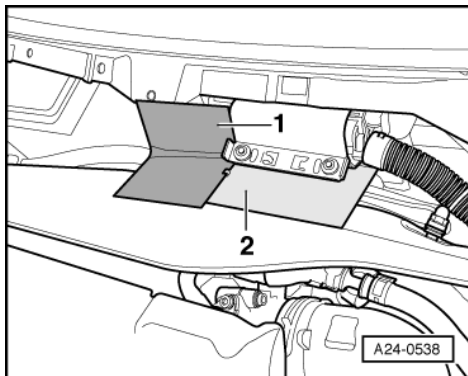
The following tools are required:

- ◆ -> Hot air blower -1- (from wiring harness repair set VAS 1978)
- ◆ Commercially available vice-grip wrench

Procedure:

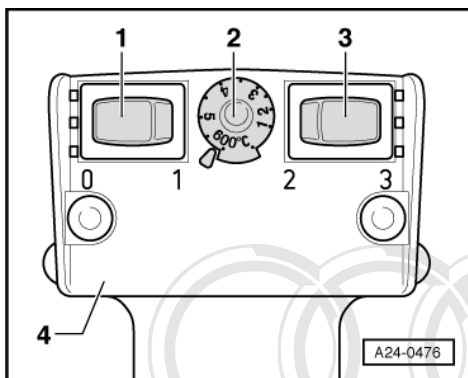
Important

In order to rule out the possibility of damage (burning) to wiring, connectors, insulation and control units, the following operations must be adhered to exactly. Please note the operating instructions for the hot air blower.



-> In order to prevent damage to wiring and connectors, steel plates must be used as a shield (items -1- and -2-).

This is to prevent overheating of the connector housing and the wiring harness.



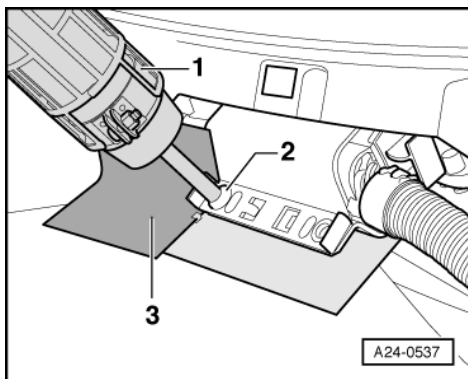
- -> Please adjust the hot air blower as shown in the illustration, i.e., the potentiometer for temperature regulation -2- is set to maximum heat and the two-step switch for air flow -3- to position 3.

Note:

Next, the bolt of the locking device must be heated using the hot air blower. With this step, the bonding effect of the locking compound on the thread of the shear bolts is reduced, facilitating removal of the shear bolts.

Important

When heating the thread of the locking device, the shear bolts and parts of the sheet-metal housing reach a high temperature. **Take care not to get burned! Ensure that as far as possible only the thread is heated, and no nearby parts. If necessary, cover up such parts.**



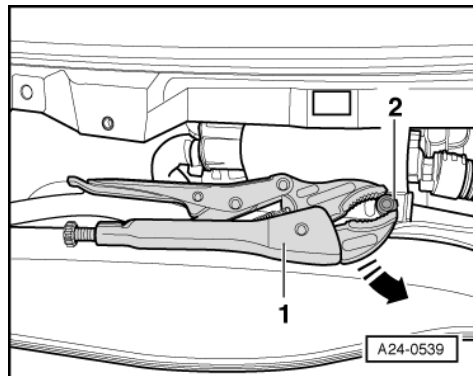


- -> Direct the nozzle -1- of the hot air blower at the bolt -2- of the locking device.

Note:

Please be particularly careful here, as the connector for the control unit is located in the immediate vicinity.

- Switch on the hot air blower and heat the thread for approx. 20 to 25 seconds.

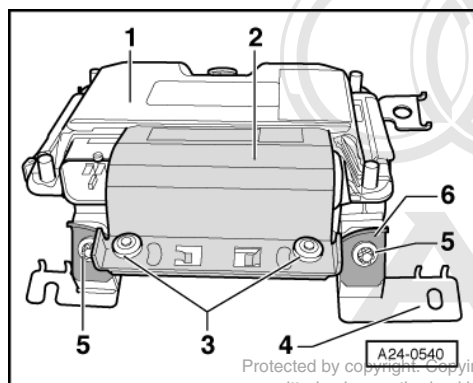


- -> Then hold the bolt head -2- with the vice-grip wrench -1- and screw the bolt out in the direction of the arrow.
- In order to enhance anti-tamper protection, the locking device has been attached in such a manner as to make a full revolution of the vice-grip wrench impossible.

The procedure for the second shear bolt is identical. Please be particularly careful here, as the connector for the control unit is located in the immediate vicinity.

- After removing the second bolt, the windscreen wiper system must be removed.

=> Electrical System; Repair group 92; Windscreen wiper system; Removing and installing windscreen wiper system



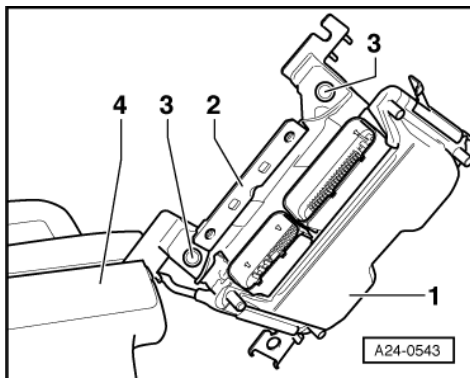
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Important

The control unit must not be pulled by the locking device -6- as the control unit would be placed under stress and may become damaged.

- Remove the engine control unit with the retaining bracket.

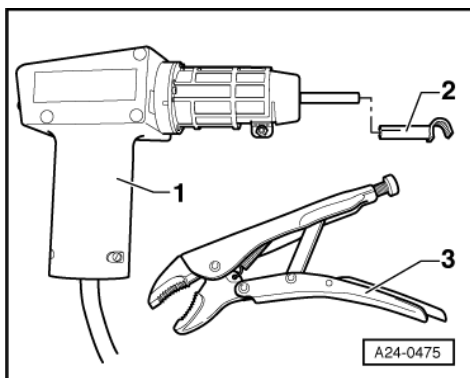
The removed locking device must now be detached from the retaining bracket. The control unit must only be pulled out once the locking device has been removed.



-> In order to make removal of the the engine control unit -1- more difficult (anti-tamper protection), the locking device -2- is bolted to the sheet-metal housing with shear bolts -3-.

The thread of the shear bolts is coated with a locking compound in order to make removal of the shear bolts more difficult.

- Clamp the bracket in a vice.



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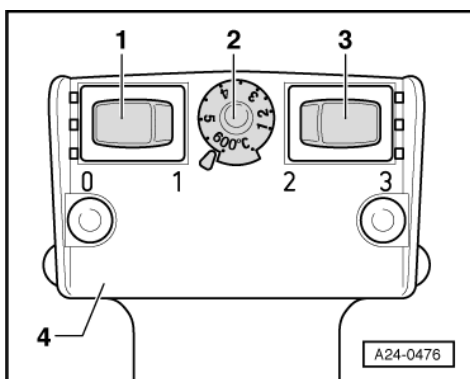
The following tools are required:

- ◆ -> Hot air blower -1- (from wiring harness repair set VAS 1978)
- ◆ Commercially available vice-grip wrench

Procedure:

Important

In order to rule out the possibility of damage (burning) to wiring, connectors, insulation and control units, the following operations must be adhered to exactly. Please note the operating instructions for the hot air blower.



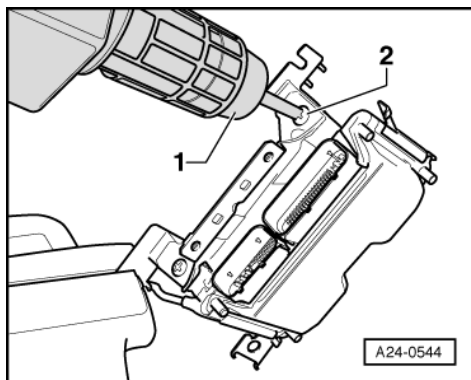
- -> Please adjust the hot air blower as shown in the illustration, i.e., the potentiometer for temperature regulation -2- is set to maximum heat and the two-step switch for air flow -3- to position 3.

Note:

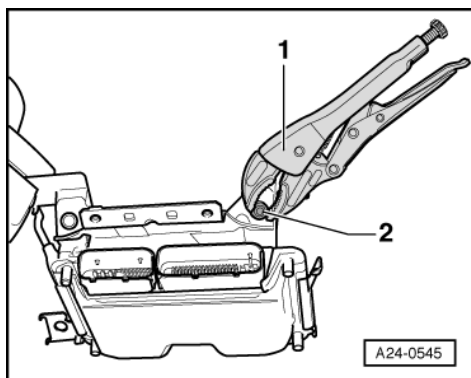
Next, the bolt of the locking device must be heated using the hot air blower. With this step, the bonding effect of the locking compound on the thread of the shear bolts is reduced, facilitating removal of the shear bolts.

Important

When heating the thread of the locking device, the shear bolts and parts of the sheet-metal housing reach a high temperature. Take care not to get burned. Ensure that as far as possible only the thread is heated, and no nearby parts. If necessary, cover up such parts.



- -> Direct the nozzle -1- of the hot air blower at the bolt -2- of the locking device.
- Switch on the hot air blower and heat the thread for approx. 20 to 25 seconds.



- -> Then hold the bolt head -2- with the vice-grip wrench -1- and screw the bolt out in the direction of the arrow.
- In order to enhance anti-tamper protection, the locking device has been attached in such a manner as to make a full revolution with the vice-grip wrench impossible.

The procedure for the second shear bolt is identical. Please be particularly careful here, as the connector for the control unit is located in the immediate vicinity.

The engine control unit can now be detached from the sheet-metal housing.

- Take out old engine control unit and install new engine control unit.

Installing

Installation is carried out in the reverse order; note the following:

- Bend back the bracket retainer tab.

Important note:

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

- Interrogate fault memory and erase, if necessary => Page 5 .
- Perform adaption of throttle valve control part -J338 => Page 132 .
- Note instructions for encoding new engine control unit => Page 26 .
- In vehicles with cruise control (recognisable from steering column switch), this should be freed in engine control unit:

=> Electrical System; Repair group 01; Cruise control system self-diagnosis; Checking cruise control system
 Cruise control system self-diagnosis Checking cruise control system

- Adapt immobiliser to engine control unit.

=> Electrical System; Repair group 01; Immobiliser self-diagnosis; Adaption after renewal of engine control unit
 Immobiliser self-diagnosis Adaption after renewal of engine control unit

- Produce the readiness code => Page 33 .

1.10 - Exhaust warning lamp -K83 in dash panel insert

If the engine control unit detect faults which result in deterioration of exhaust emissions, these faults will be indicated by illumination of exhaust gas warning lamp.

After switching on the ignition the engine control unit switches on the EPC warning lamp. Shortly after starting the engine the exhaust warning lamp goes out if the engine control unit does not detect a fault through which the exhaust emissions deteriorate and if the actuation of the lamp is OK from the engine control unit.

If faults which cause the exhaust emission to deteriorate are detected when operating the engine the engine control unit switches on the exhaust warning lamp. (These faults are listed in the fault table). At the same time, an entry is made in the engine control unit fault memory.

When switched on, the exhaust gas warning lamp may flash or illuminate constantly. In any case the fault memory must be interrogated => Page 5

Continuous illumination:

A fault is present which causes deterioration of the exhaust emission. Interrogate fault memory for Motronic-control unit or automatic gearbox (if available).

If there is a drive problem or a customer query and the exhaust warning lamp is not illuminated the fault memory must be interrogated. Faults which do not switch on the exhaust warning lamp immediately but only after recognising the fault after restarting the engine can also be stored.

Flashing:

A fault is present which under these driving conditions will cause damage to the catalytic converter (e.g. mis-firing). In this case driving may only continue at reduced power.

1.11 - Checking exhaust warning lamp -K83

Functional check on warning lamp

- Switch the ignition on.
 - The fault lamp for self-diagnosis (exhaust warning lamp) must illuminate.
- Start the engine.



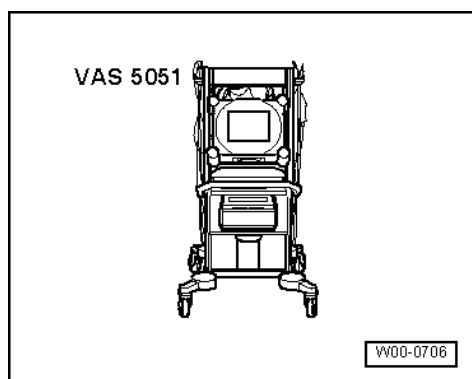
- Shortly after starting the engine the exhaust warning lamp goes out if no exhaust emission relevant fault is stored in the fault memory.

Note:

The switch-on signal for the fault lamp is transferred via CAN bus to the dash panel insert by the engine control unit. Check the data exchange between engine control unit and other CAN-control units =>Page **163**

1.12 - Checking idling speed

Special tools and workshop equipment required



- ♦ VAS 5051 with VAS 5051/1

Test requirements:

- No leaks in exhaust system
- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.
- Pressure gauge not connected.

Notes:

- ♦ The idling speed cannot be adjusted.
- ♦ The idling speed is tested during the basic setting of the engine.
- ♦ During basic setting, the solenoid valve for the activated charcoal filter (valve -N80) is closed and the air conditioner compressor is switched off.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 - Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.
- Interrogate fault memory => Page **5**. The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Perform road test and interrogate the fault memory again to make sure it is clear.
- Leave engine idling.

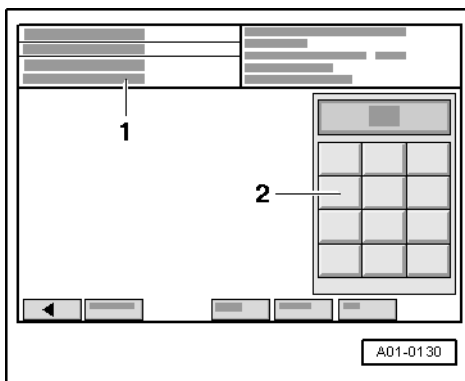
Important

The electric radiator fan should not be running.



-> Display on VAS 5051:

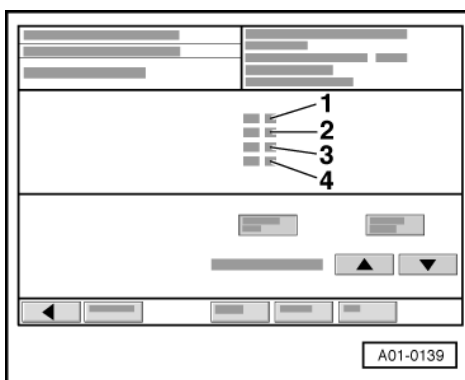
- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "056" for "display group number 056" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check whether the engine speed in the display zone -1- (actual speed) is within the permitted tolerance range.



Audi

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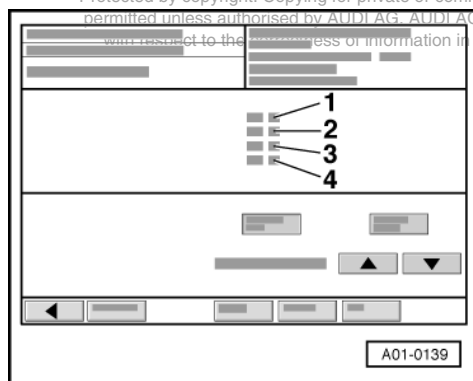


	Display zones			
	1	2	3	4
Display group 056: Idling speed stabilisation at operating temperature				
Display	xxx rpm	xxx rpm	x.x %	X X X X X
Display	Engine speed (actual)	Engine speed (specified)	Idling speed control Change in torque	Operating conditions
Specified value	700...820 rpm	760 rpm	x.x %	0 0 0 0
Note:	If the specification is not attained =>Page 76			Significance of figures =>Page 77 .

Notes:

- ♦ The engine speed in display zone 1 (actual speed) is the actual engine speed.
- ♦ The engine speed in display zone 2 (specified speed) is a theoretical value calculated by the engine control unit.
- ♦ During idling, the engine control unit always tries to adapt the actual engine speed to the specified engine speed.
- ♦ This means that during idling the actual engine speed must always approximate to the specified engine speed.
- ♦ Display zones 3 and 4 are there for information but are irrelevant to the control of the engine idling speed.

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-> Display on VAS 5051:

If specified value is attained:

- Exit the function "04 - Basic setting" by pressing the ◀ key.

If specified value is not attained:

- Interrogate fault memory again =>Page 5 .
- If the fault memory is erased the readiness code must be produced again => Page 33 .

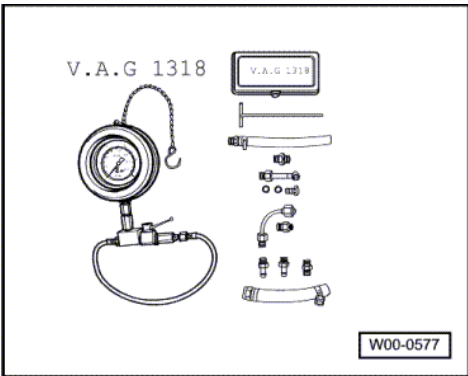
If the idling speed is too high or too low and there are no faults stored in the fault memory, carry out the following tests marked with a dot:

- Check intake air system for unmetered air => Page 101 .
- Check throttle valve control part =>Page 132 .
- Check whether solenoid valve for activated charcoal filter is continuously open =>Page 127 .
- Perform adaption of throttle valve control part =>Page 132 .

Significance of 5-digit readout of display group 056

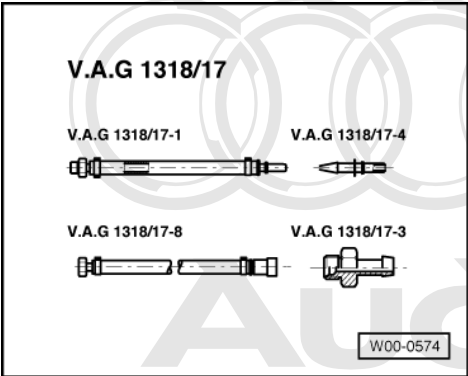
x	x	x	x	x	Display zone 4
				0	Air conditioner compressor: 0 = air conditioner compressor off; 1 = air conditioner compressor on
			0		Display always 0
		0			Air conditioning, ready for maximum heating or cooling
	0				Display always 0
0					Power steering pressure 0 = no signal from power steering pressure switch 1 = signal from power steering pressure switch (full steering lock, fast steering movement)

1.13 - Checking system pressure, fuel pressure regulator and holding pressure



Special tools and workshop equipment required

- ♦ V.A.G 1318
- ♦ V.A.G 1318/7



- ♦ V.A.G 1318/17 (2x)
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Fuel pressure regulator regulates fuel pressure as a function of intake pressure. As a result, the pressure drop at the injectors remains constant for each engine speed and load range.

Test requirements:

- Fuel pump relay OK; checking =>Page 93 .



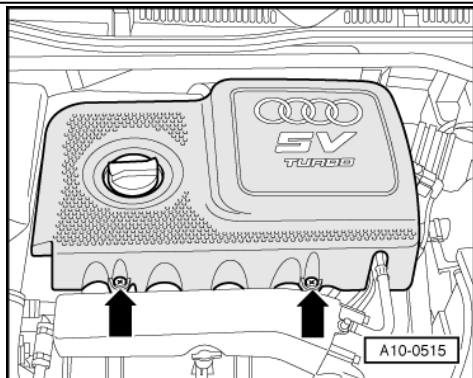
- Fuel pump OK; checking:

=> Fuel Supply - Petrol Engines; Repair group 20

- Fuel filter OK
- Battery voltage at least 12.7 V

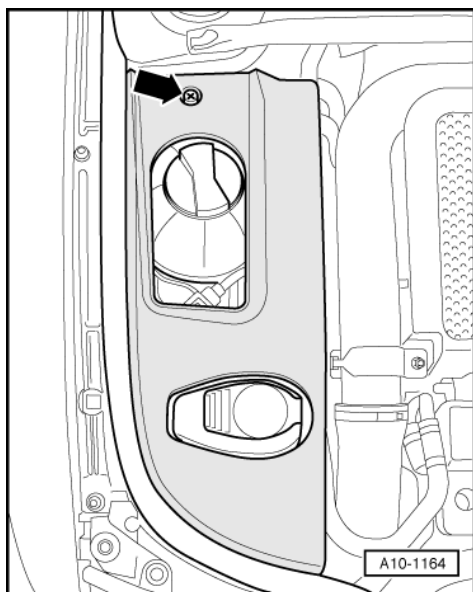
Important

The fuel system is pressurised! Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

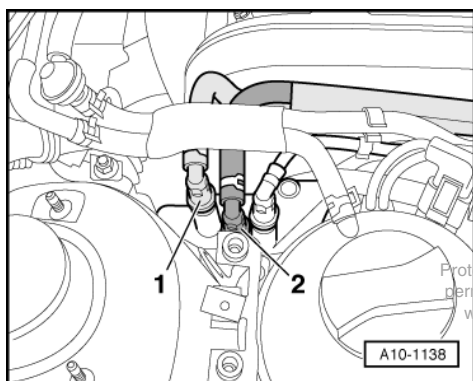


Checking system pressure

- -> Remove engine cover -arrows-.

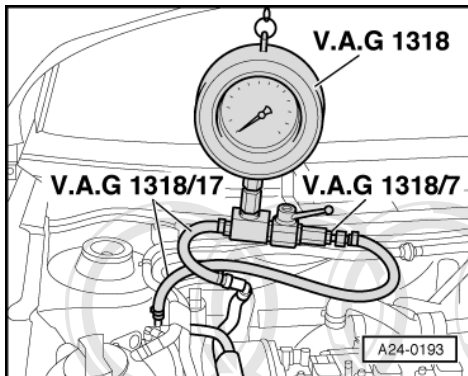


- -> Remove bolt -arrow- and remove cover over expansion tank -arrow-.

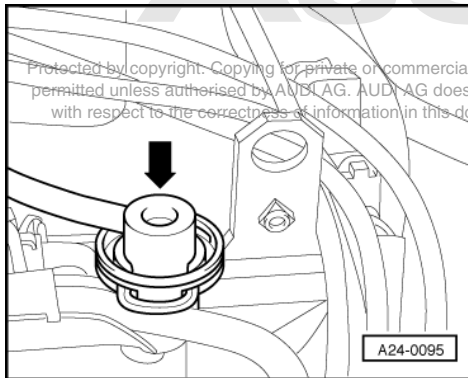


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- Briefly open the fuel tank filler cap (to release pressure).
- -> Disconnect fuel feed line -1- (press release tab).



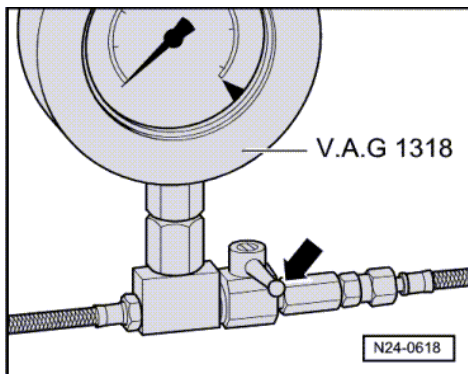
- -> Connect pressure gauge V.A.G 1318 with adapters 1318/7 and 1318/17 (2 off) to the feed line.
- Open cut-off valve on pressure gauge. The lever points in the direction of flow.
- Start the engine and run at idling speed.
- Measure the fuel pressure.
 - Specified value: approx. 2.5 bar



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

If the holding pressure drops below 1.5 bar:

- Start the engine and run at idling speed.



- -> Allow the pressure to build up, then switch off the ignition. At the same time close the cut off valve on the pressure gauge V.A.G 1318 (valve lever at right angles to direction of flow -arrow-).



- Observe pressure drop on gauge.

If the pressure now does not drop:

- Check fuel pump non return valve.

If the pressure drops again:

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

If the pressure now does not drop:

- Renew the fuel pressure regulator.

If the pressure drops again:

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

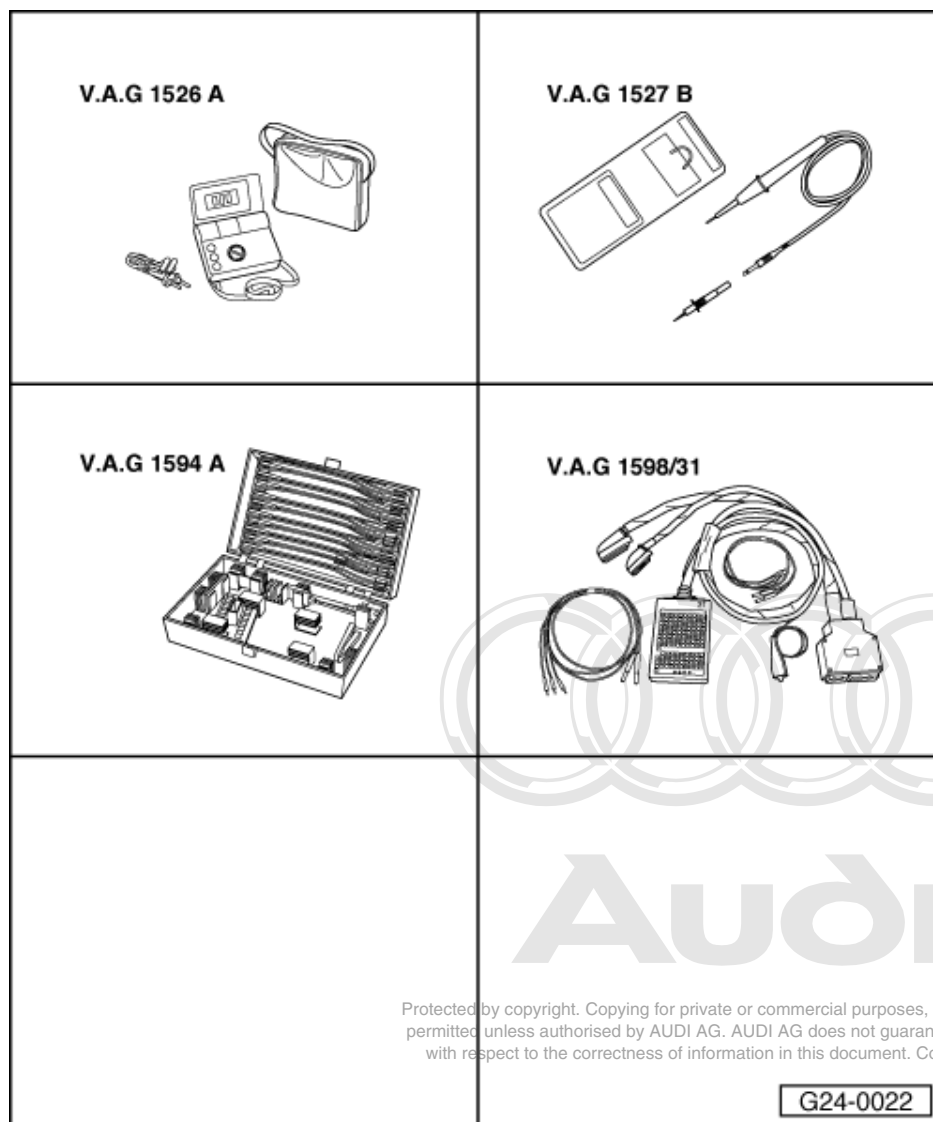
Note:

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



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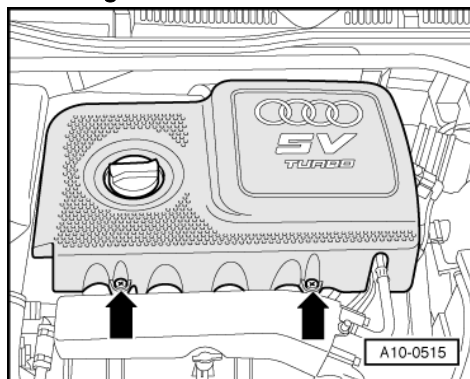
1.14 - Checking injectors



Special tools and workshop equipment required

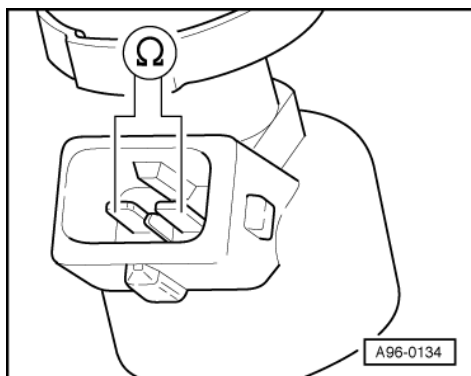
- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

Checking internal resistance





- -> Remove engine cover-arrows-.
- Unplug connector on injector to be checked.



- -> Connect multimeter to injector to measure resistance.
- Specified value: 12 ... 13 ω (at room temperature)

If specified value is not attained:

- Replace injector.

If specified value is attained:

- Check the power supply.

Checking power supply

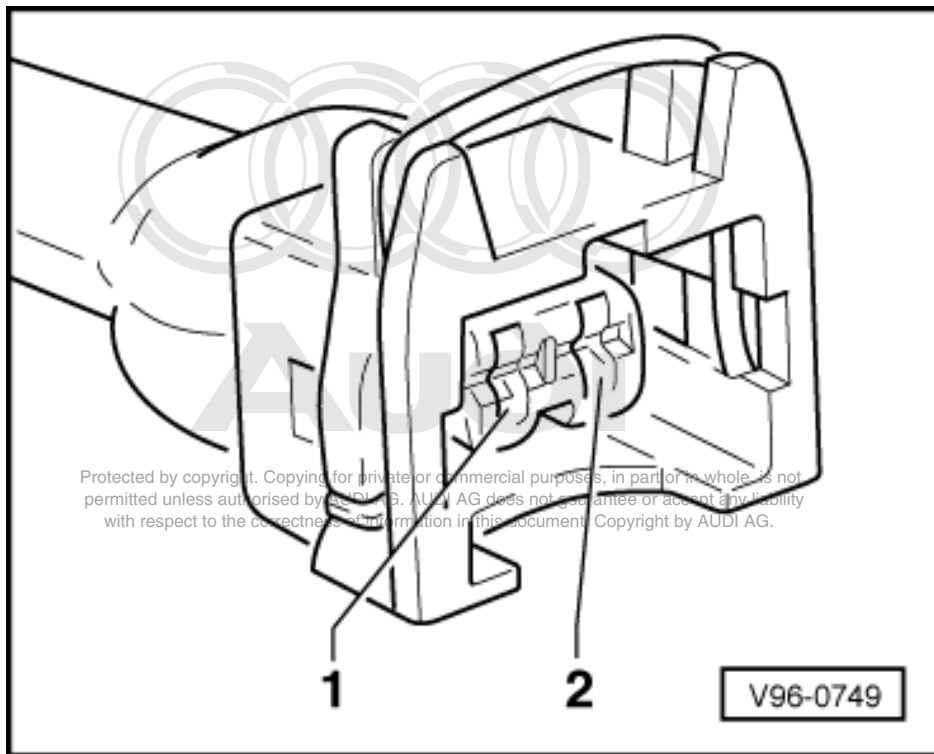
Test requirements:

- Fuse for injectors OK

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

- Fuel pump relay OK; checking =>Page **93** .

- Unplug connector on injector to be checked.



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth

- Switch the ignition on.
 - The LED should illuminate.

If the LED does not illuminate:

- Check wiring connection between contact 1 and fuse for injector for open circuit:

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

- Rectify open circuit, if necessary.

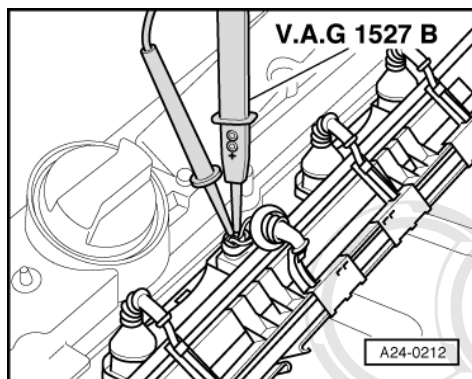
If the LED illuminates:

- Checking injector actuation

Checking actuation

Test requirements:

- Internal resistance of the valve OK
- Push back rubber grommet of plug of injector but leave plug attached.



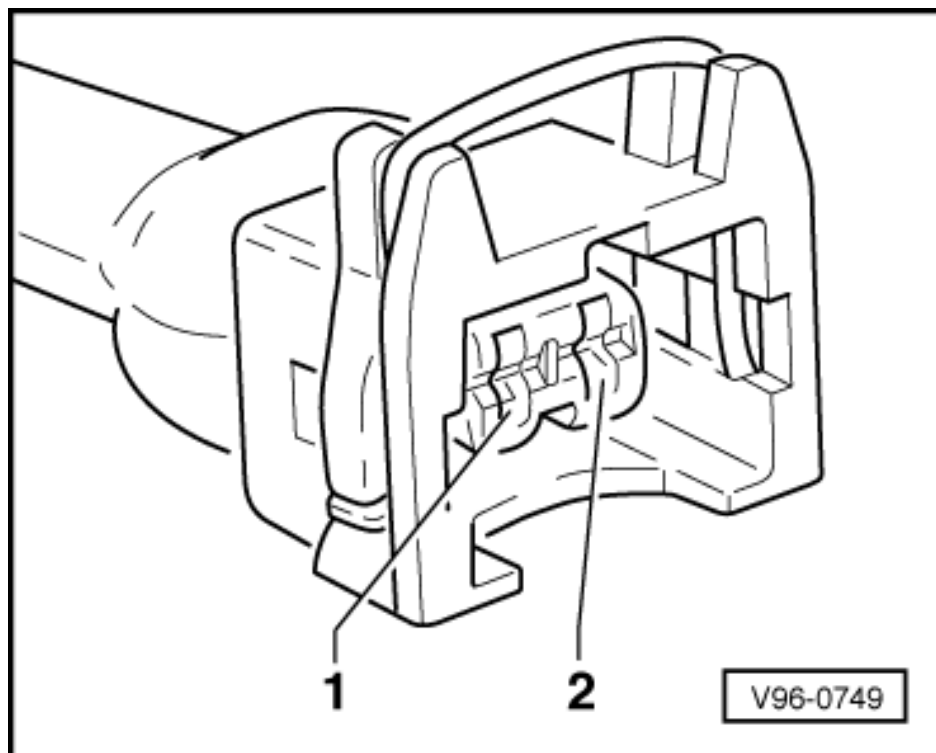
- -> Connect up voltage tester V.A.G 1527 B between receptacles 2 (signal) and 1 (positive).
- Operate the starter briefly (the engine may start).
 - The LED should flash.

Note:

Voltage testers with a low current draw continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become slightly brighter when actuated.

If LED does not flash:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

Cylinder	Injector connector Contact	Test box V.A.G 1598/31 Socket
1	2	96
2	2	89
3	2	97
4	2	88

- Rectify any open/short circuit as necessary.

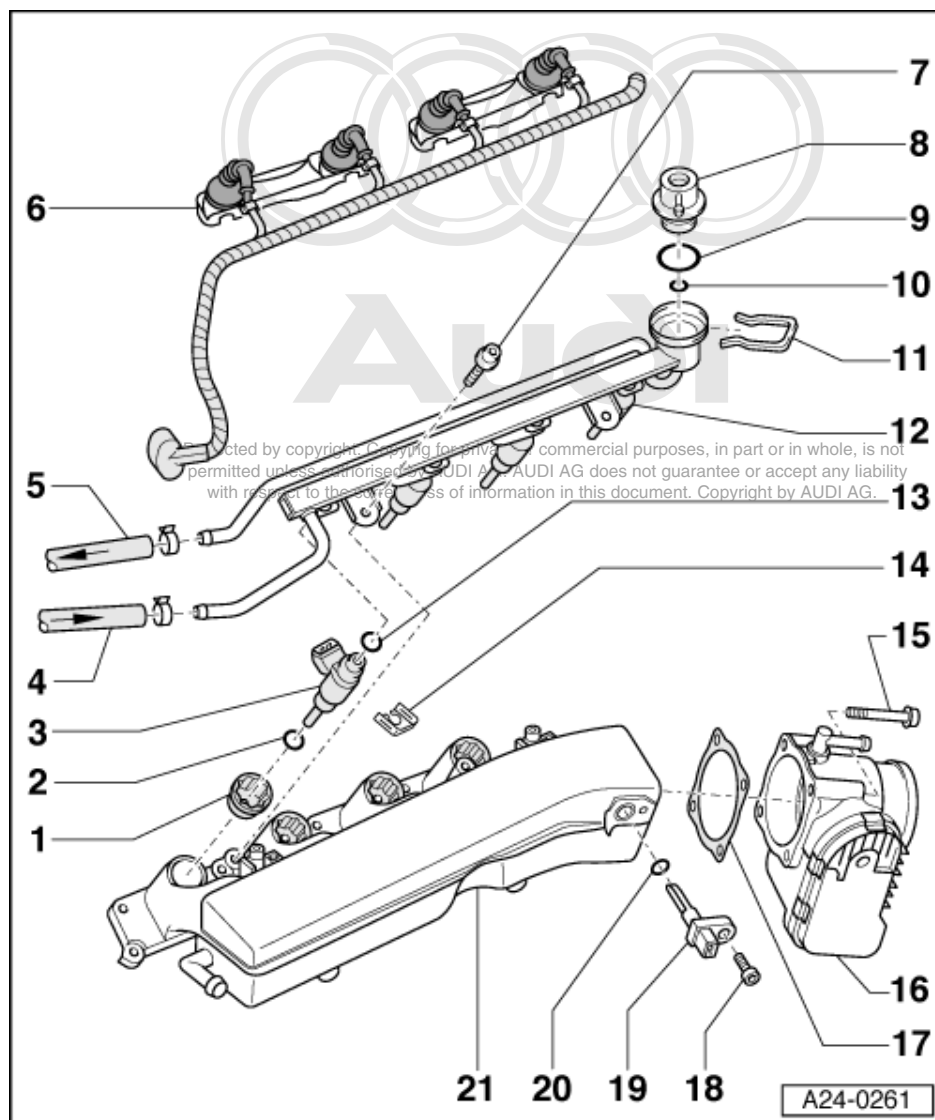
If the wiring is OK:

- Replace engine control unit => Page 64 .



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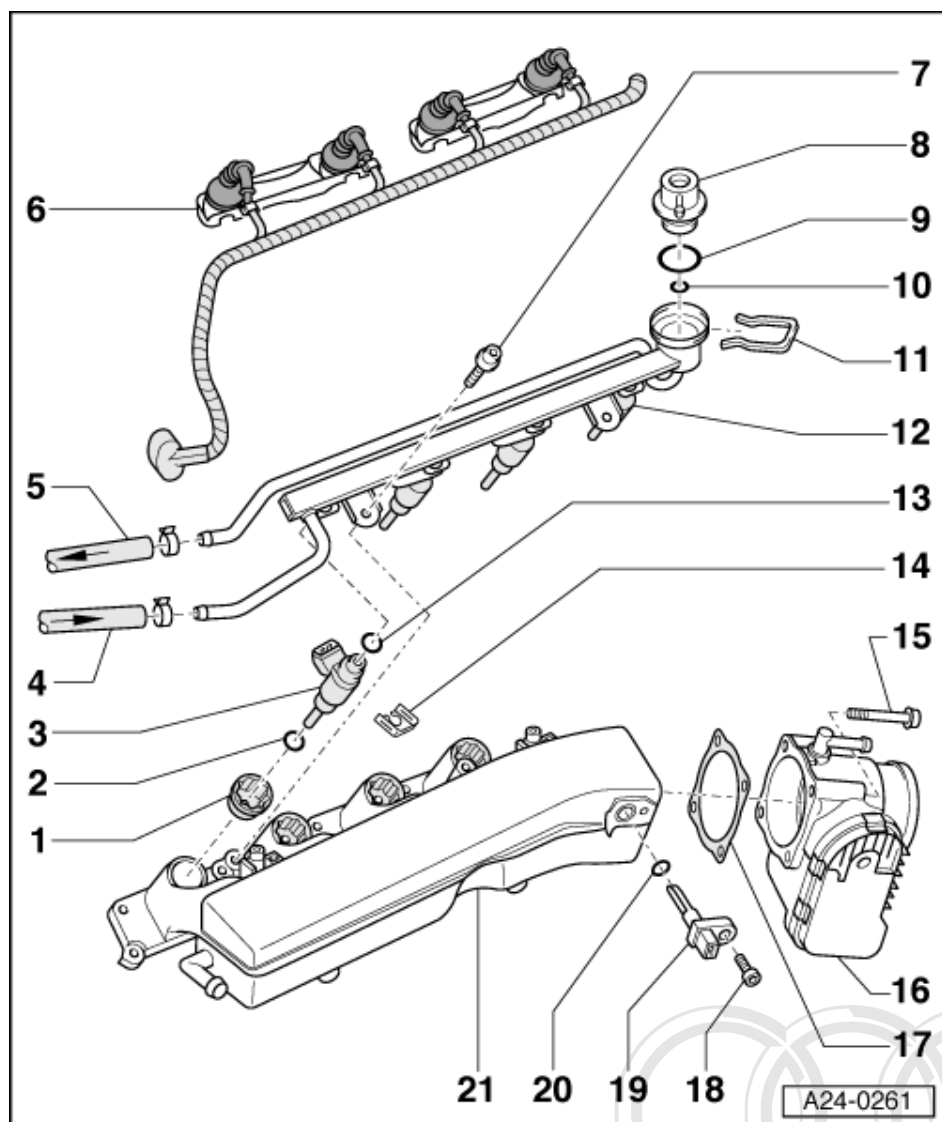
1.15 - Dismantling and assembling fuel rail with injectors



- 1 Insert for injector**
 -3 Nm
 ♦ Install using earth connection
 ♦ Earth connection

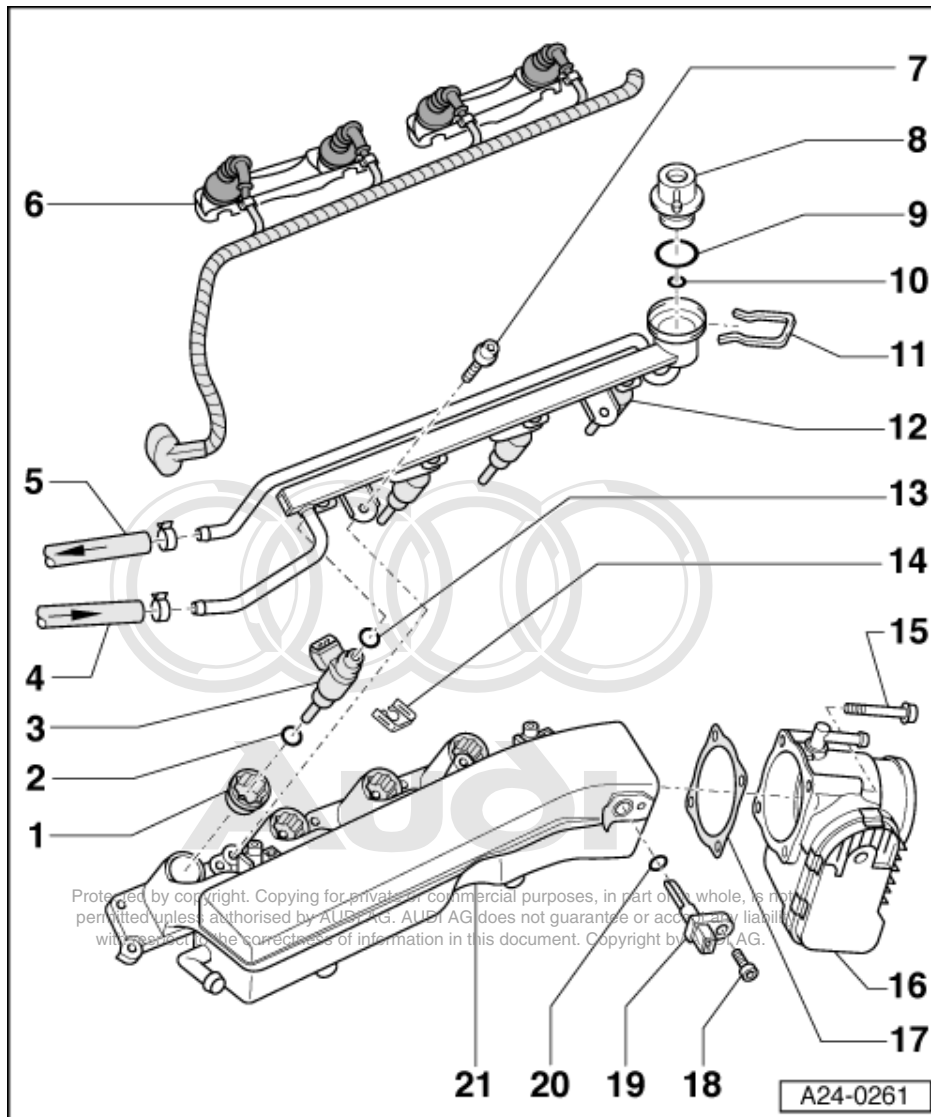
=> Parts List

- 2 O-ring**
 ♦ Removing and installing
 =>Page 89 .
 ♦ Replace
 ♦ moisten with clean engine oil.
- 3 Injector**
 ♦ Removing and installing
 =>Page 89 .



- 4 Supply hose
- 5 Return hose
- 6 Connector
 - ◆ For injectors
 - ◆ 4 off
- 7 Hexagon socket-head bolt - 10Nm
- 8 Fuel pressure regulator
- 9 O-ring
 - ◆ Replace
- 10 O-ring
 - ◆ Replace
- 11 Bracket
- 12 Fuel rail

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13 O-ring

- ◆ Removing and installing
=>Page 89 .
- ◆ Replace
- ◆ Moisten with clean engine oil.

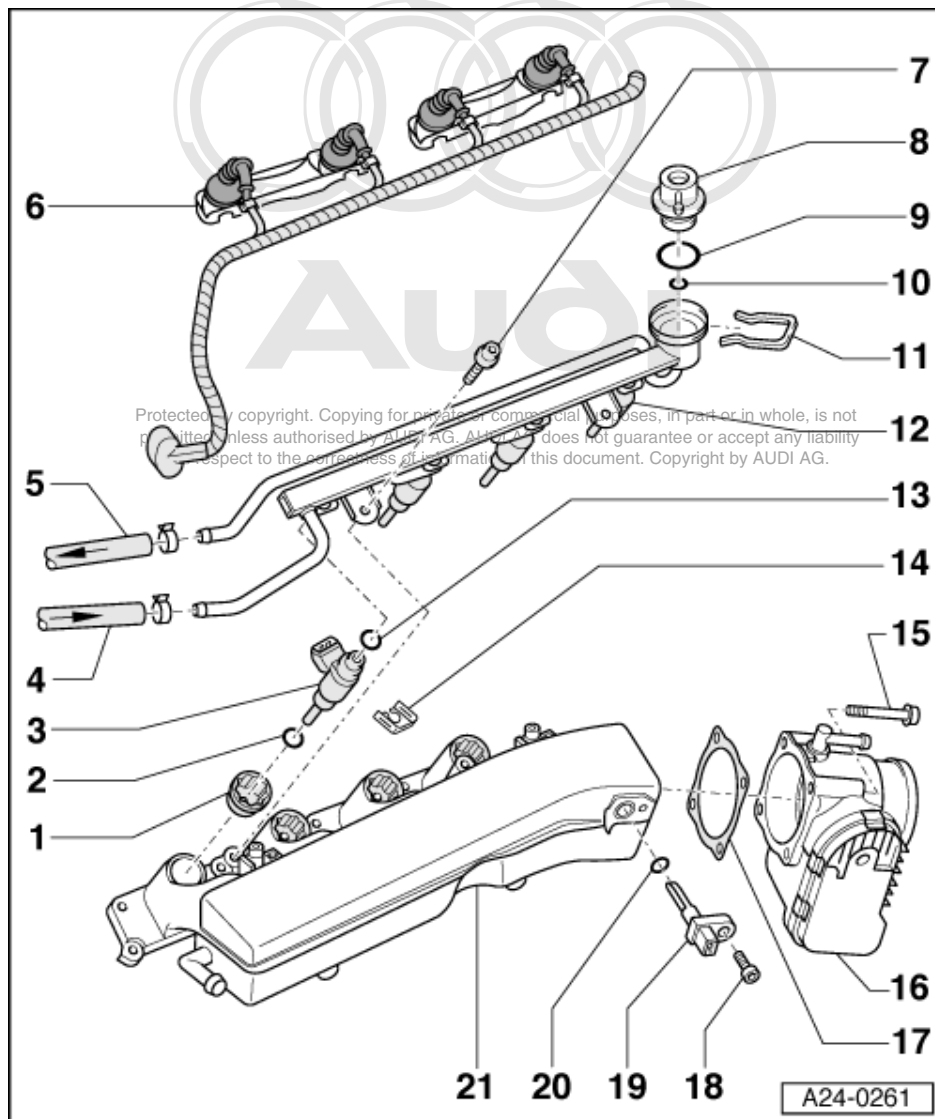
14 Bracket

- ◆ Ensure it is positioned correctly on injector and fuel rail

15 10 Nm

16 Throttle valve control part -J338

- ◆ With throttle valve drive -G186, angle sender for throttle valve drive -G187 and angle sender 2 for throttle valve drive -G188



17 Gasket

- ♦ Replace

18 10 Nm

19 Intake air temperature sender -G42

20 O-ring

- ♦ Replace

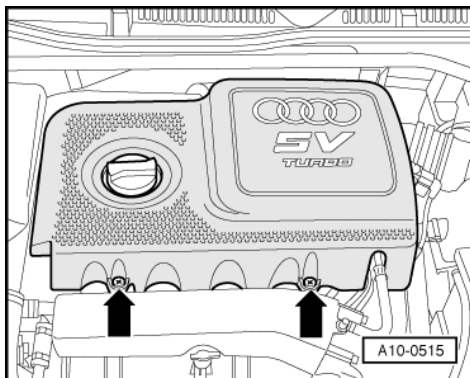
21 Inlet manifold

- ♦ Removing:

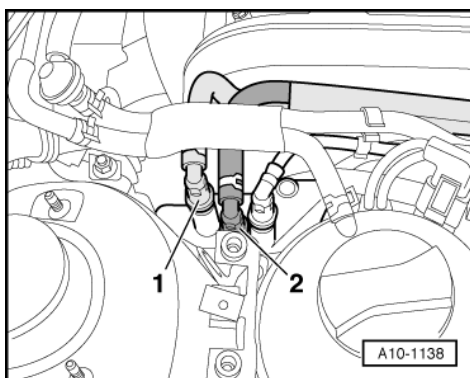
=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 15; Removing and installing cylinder head; Removing and installing intake manifold Removing and installing cylinder head Removing and installing intake manifold

1.16 - Removing and installing injectors

Removing



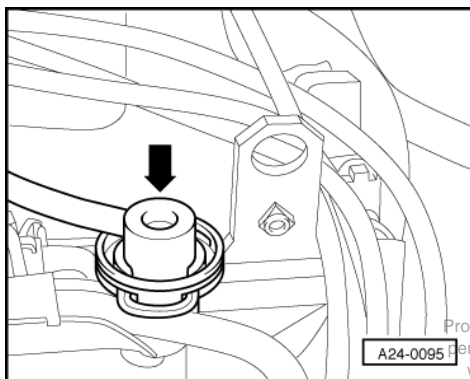
- -> Remove engine cover-arrows-.
- Disconnect wires/unplug connectors from:
 - Intake air temperature sender -G42
 - Hall sender -G163
 - Throttle valve control part -J338



Important

The fuel system is pressurised! Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

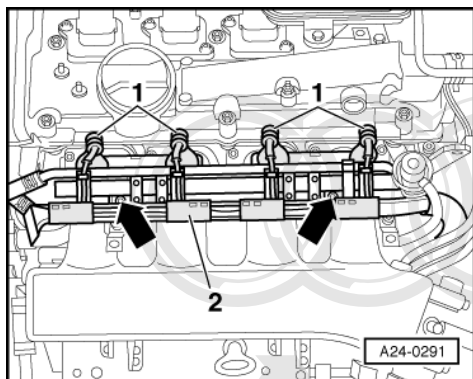
- -> Disconnect the fuel feed line -1- and fuel return line -2-, (press release tabs).



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- -> Disconnect the vacuum hose from the fuel pressure regulator -arrow-.



- -> Detach connectors -1-.
- Detach wiring duct -2-.
- Remove 2 hexagon socket head bolts -arrows- for the fuel rail.
- Pull fuel rail complete with injectors evenly off the intake manifold and place it on a clean cloth in the engine compartment.
- Detach retainer and detach injector.

Note:

Replacement of fuel rail involves disconnecting the fuel hoses.

Installing

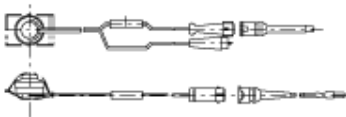
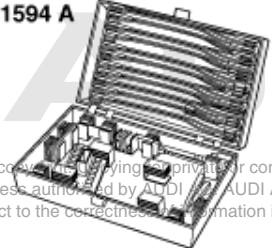
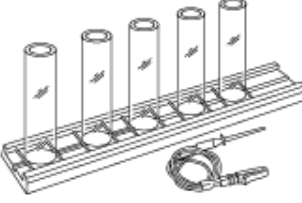
Install in reverse order, paying attention to the following:

- Replace the O-rings at all detached connections. (when renewing the front O-ring, ensure that the plastic cap is not removed from the injector head. The O-ring must be pulled off over the plastic cap).
- Coat the O-rings with clean engine oil.
- Make sure that the injectors are installed in the correct positions.
- Check to make sure that the retainer clamps are properly seated.
- Position fuel rail with secured injectors on intake manifold and press evenly into place.

Tightening torque

Component	Nm
Fuel rail to intake manifold	10

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

V.A.G 1348/3A 	V.A.G 1594 A  Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
V.A.G 1598/31 	V.A.G 1602 
	G24-0044

Special tools and workshop equipment required

- ◆ V.A.G 1348/3A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ V.A.G 1602

Test requirements:

- Fuel pressure OK, checking =>Page 77 .

Test sequence

- Remove fuel rail with injectors fitted from intake manifold => Page 89 . Fuel hoses remain connected.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .

Leak test

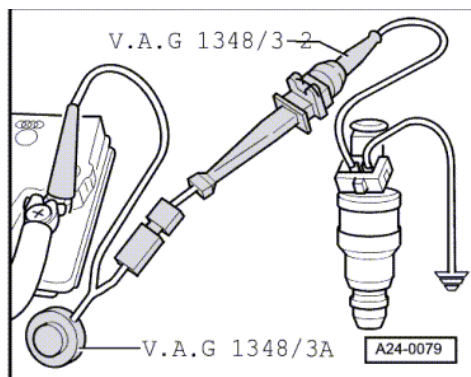
- Jumper contacts 1 and 65 at test box with leads from adapter set V.A.G 1594A.
- Switch the ignition on.
 - The fuel pump should run.



- 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 fuel pump (remove cable bridge) and replace defective injector => Page 89 ;

Checking injection quantity

- Place the injector which is to be tested into measuring glass of injection quantity tester V.A.G 1602.

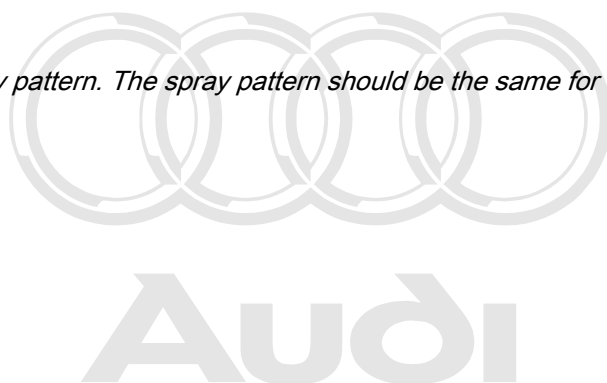


- -> Connect one of the injector contacts to the engine earth using a test cable and crocodile clip from V.A.G 1594 A.
- Connect second contact of injector with remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable to positive.
- Jumper contacts 1 and 65 at test box with leads from adapter set V.A.G 1594A.
- Switch the ignition on.
 - The fuel pump should run.
- Activate remote control V.A.G 1348/3A for 30 seconds.
- Perform measurements on all injectors.
- Once all four injectors have been actuated, place measuring glasses on a level surface.
 - Specification per injector: 179 ± 14 ml
- If measured values for one or more injectors are outside tolerance, switch off fuel pump (switch off ignition) and replace defective injector => Page 89 .
- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure => Page 77 .

Note:

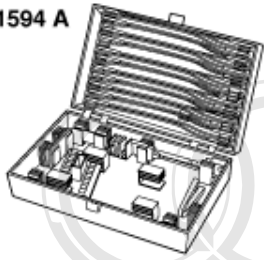
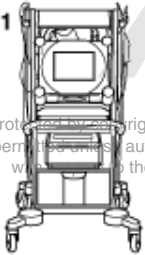
When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

- Install injectors with fuel rail => Page 90 .



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1.18 - Checking pump relay -J17 and actuation

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	VAS 5051 
	G24-0021

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

Fitting location => Fitting locations overview, Page 47

The fuel pump and certain components of the injection system are supplied with power by way of the fuel pump relay -J17.

The fuel pump relay -J17 is only energised when the engine is running, 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 requirements:

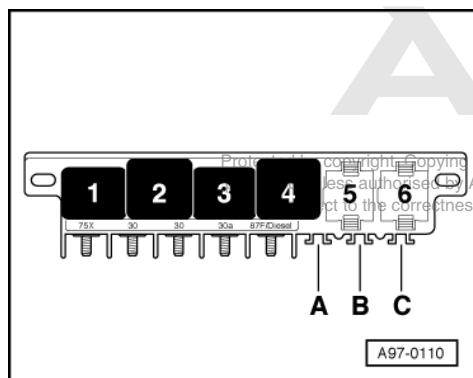
- Battery voltage at least 12.7 V

Functional check of fuel pump relay

- Remove driver's storage compartment.

=> General Body Assembly, Interior; Repair group 68; Storage compartments, covers; Removing driver's storage compartment Storage compartments, covers Removing driver's storage compartment

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.
- Initiate final control diagnosis =>Page 20 and actuate ACF solenoid valve -N80.



- -> Fuel pump relay (in the central electrics, passenger's footwell on the left, position 4) should respond and fuel pump should run.
- Exit the function "03 - Final control diagnosis" by pressing the ◀ key.

A - If relay does not respond:

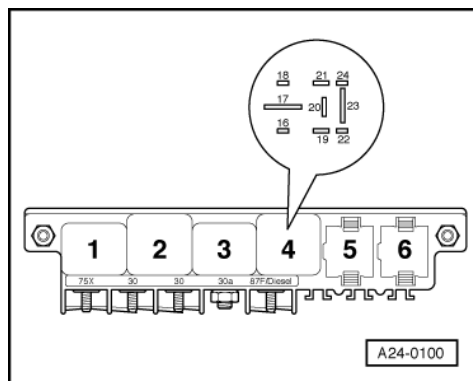
- Check voltage supply of fuel pump relay => Page 94 .
- Check actuation of fuel pump relay
=>Page 95 .

B - If relay is responds but fuel pump does not run:

- Check voltage supply for fuel pump and components (via fuel pump relay) =>Page 96 .

Checking voltage supply of fuel pump relay

- Disconnect fuel pump relay.



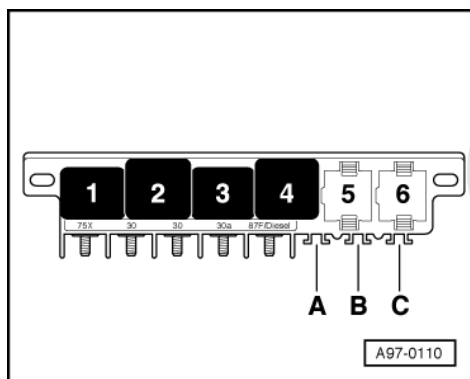
- -> Connect the multimeter to contact 17 of relay socket and to earth to measure voltage.
- Specified value: approx. battery voltage

If specified value is not attained:

- Replace central electrics.

Checking actuation of fuel pump relay

- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59.
- Jumper contacts 1 and 65 at test box with leads from adapter set V.A.G 1594A.
- Switch the ignition on.



- -> Fuel pump relay (on central electrics in passenger's footwell on the left, position 4) must respond.

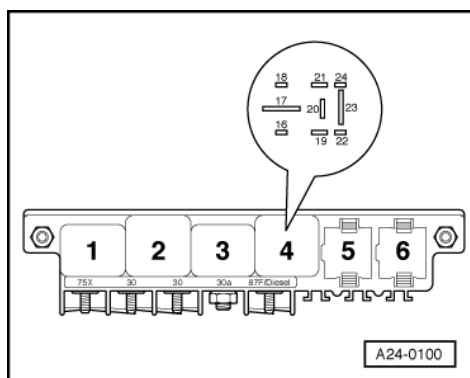
If the relay responds now, but not during final control diagnosis:

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- Replace engine control unit => Page 64.

If the relay does not respond:

- Switch ignition off.
- Disconnect cable link.
- Disconnect fuel pump relay.



- -> Connect multimeter as follows to measure voltage.

Central electrics in driver's footwell on left, position 4 Contact	Measure to
19	Engine earth

- Switch the ignition on.
 - Specified value: approx. battery voltage

If specified value is not attained:

- Check the wiring connections.

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

If specified value is attained:

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

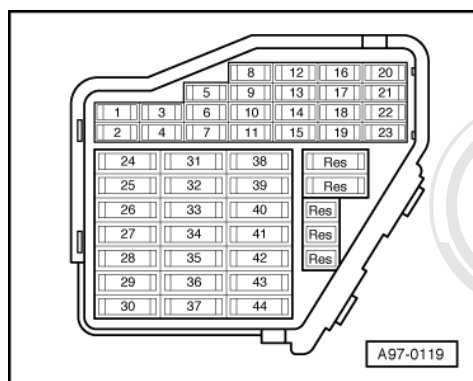
Central electrics in driver's footwell on left, po- sition 4 Contact	Test box V.A.G 1598/31 Socket
16	65

- Rectify any open/short circuit as necessary.

If no fault is found:

- Replace the fuel pump relay -J17.
- Reconnect engine control unit.

Checking voltage supply of fuel pump and components



- -> Disconnect fuses S228, S232, S234 and S243 (positions 28, 32, 34 and 43) in fuse holder.
- Initiate final control diagnosis =>Page 20 and actuate ACF solenoid valve -N80.
- To measure the voltage, connect multimeter to earth and to one of the contacts of the following fuses in the fuse holder.

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Fuse	Specified value at one of the contacts
S228	approx. battery voltage
S232	approx. battery voltage
S234	approx. battery voltage
S243	approx. battery voltage

If the specified values are not obtained:

- Repeat the test at the other contact of the fuse base.

If the specifications are still not attained:

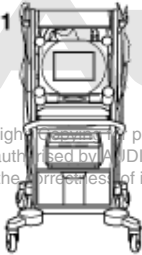
- Check the wiring connections.

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

If no fault is found:

- Replace the fuel pump relay -J17.
- Reinsert the fuses.

1.19 - Checking air mass meter -G70

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	VAS 5051  Protected by copyright. This document, 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.
	G24-0021

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

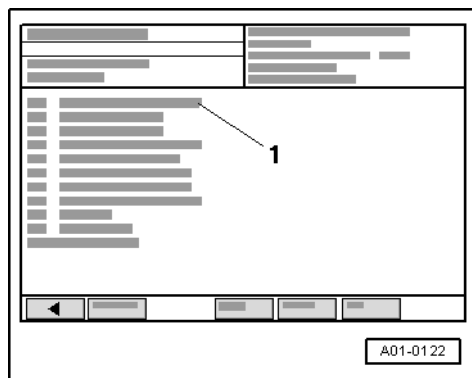
Fitting location => Fitting locations overview, Page **47**

Test requirements:

- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioning switched off.

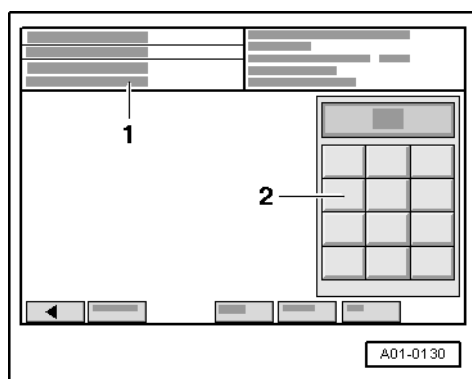
Checking function

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



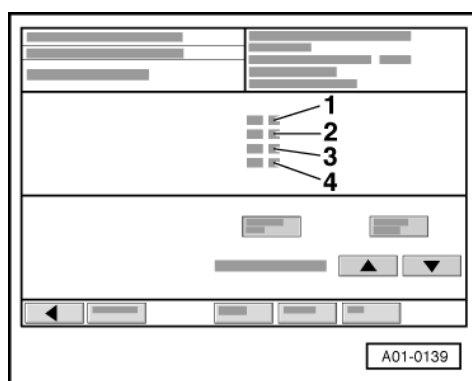
-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "002" for "display group number 002" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specifications for load recognition in display zones -3- and -4-.

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	Display zones			
	1	2	3	4

Display zones				
Display group 002: Intake air mass at idle and operating temperature				
Display	xxx rpm	xxx %	xx.x ms	xxx.x g/s
Display	Engine speed	Load	Average injection period	Air mass
Specified value	700...820 rpm	10...25 %	1.0...4.0 ms	2.0...4.5 g/s
Note:	---	---	If specified value is not attained: Evaluation => Page 99	

If specified value is attained:

- Exit the function "04 - Basic setting" by pressing the ◀ key.

Evaluation of display group 002

Display zone: 3	Possible causes of fault	Fault remedy
Less than 1.0 ms	- Lower values can only occur when vehicle is on overrun	
Greater than 4.0 ms	- Engine load from ancillaries	- Eliminate load (air conditioner system/ power steering/alternator)
	- Poor idling (not running on all cylinders)	- Check spark plugs Check injectors =>Page 81
	- Throttle valve control part -J338 defective	- Check throttle valve control part =>Page 132 .
Display zone: 4	Possible causes of fault	Fault remedy
Less than 2.0 g/s	- Large quantity of unmetered air between intake manifold and air mass meter - Voltage supply to air mass meter or wiring to engine control unit	- Check for leaks (unmetered air) in intake air system => Page 99
Greater than 4.5 g/s	- Engine load from ancillaries	- Eliminate load (air conditioner system/ power steering/alternator)
	- Voltage supply to air mass meter or wiring to engine control unit	- Check voltage supply and/or wiring => Page 99

Checking voltage supply to air mass meter

Test requirements:

- Fuse for air mass meter OK.

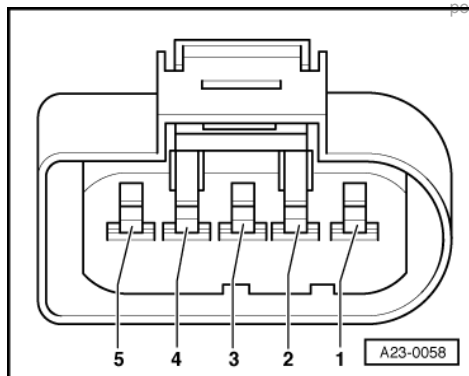
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Fuel pump relay OK; checking =>Page **93** .

Note:

Voltage supply to air mass meter is from fuel pump relay.

- Detach connector from air mass meter.



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- -> Connect multimeter as follows to measure voltage.

Connector Contact	Measure to
2	Engine earth

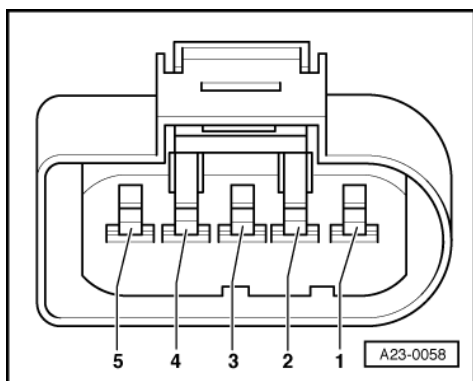
- Operate the starter briefly (the engine may start).
 - Specified value: approx. battery voltage

If specified value is not attained:

- Check the wiring from contact 2 on the connector via the fuse to the fuel pump relay for open circuit or short to earth:

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

- Rectify any open/short circuit as necessary.



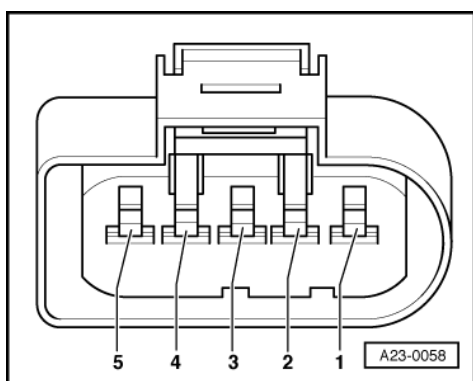
- -> Connect hand-held multimeter to contacts 2 and 3 of the connector to measure voltage.
- Operate the starter briefly (the engine may start).
 - Specified value: approx. battery voltage

Note:

Engine control unit earth is present at contact 3 of the connector.

If specified value is not attained:

- Check the wiring connections
=>Page 101 .



- -> Connect hand-held multimeter to contacts 3 and 4 of the connector to measure voltage.
 - Specified value: approx. 5 V

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If specified value is not attained:



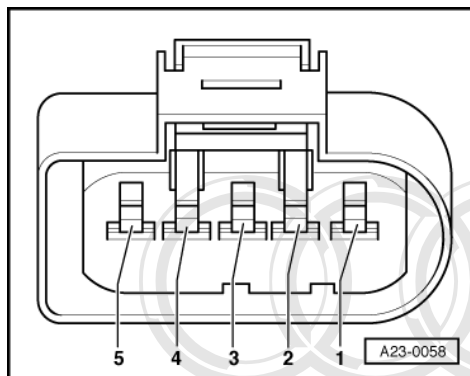
- Check the wiring connections
=>Page 101 .

Checking wiring to air mass meter.

Note:

The signal wire is also checked during the wiring check.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
3	27
4	53
5	29

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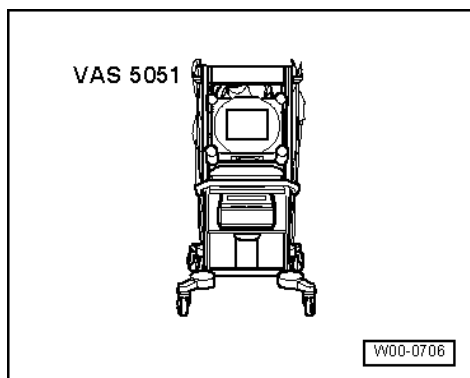
- Rectify any open/short circuit as necessary.
- Additionally check all wires for short to one another.

If the wiring is OK:

- Renew air mass meter (G70).

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

Special tools, workshop equipment and other items required





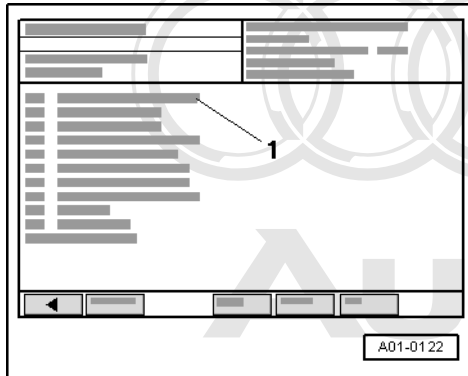
- ♦ VAS 5051 with VAS 5051/1
- ♦ Engine leak detector spray G 001 800 A1

Notes:

- ♦ The vacuum in the intake system will cause the leak detector spray to be drawn in with the unmetered air. The leak detector spray reduces the ignitability of the mixture. This leads to a drop in engine speed and to a significant increase of the CO content.
- ♦ The safety precautions listed on the container must be adhered to.

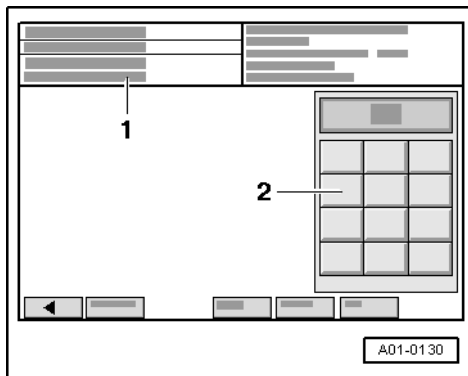
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



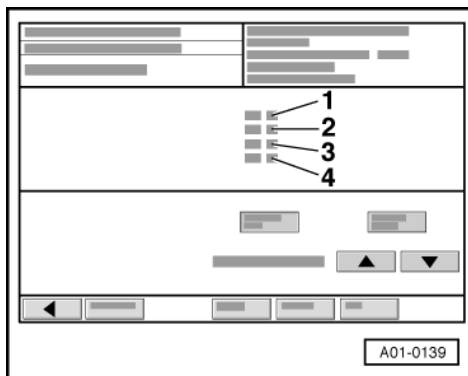
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "001" for "display group number 001" in zone -2- and confirm the entry by pressing the Q key.

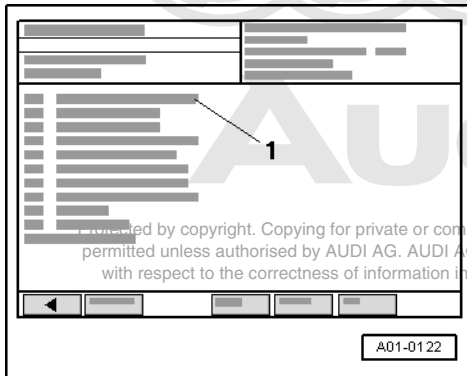


-> Display on VAS 5051:

- Note engine speed in display zone -1-.
- Systematically spray parts of the intake system with engine leak detector spray.

If engine speed drops:

- Check sprayed areas of intake system for leaks and rectify if necessary.
- Exit the function "08 - Read measured value block" by pressing the ↵ key.



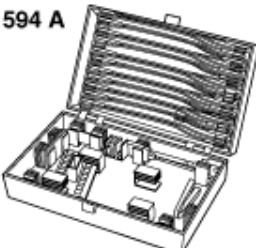
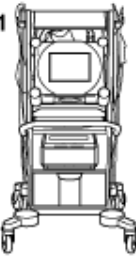
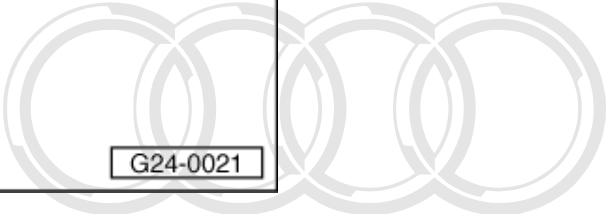
-> Display on VAS 5051:

- Under -1- select the diagnostic function "06 - End output".
- Switch ignition off.



2 - Checking lambda control

2.1 - Checking lambda control

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	VAS 5051 
	 G24-0021

2.2 - Checking lambda probe and lambda control upstream of catalytic converter

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

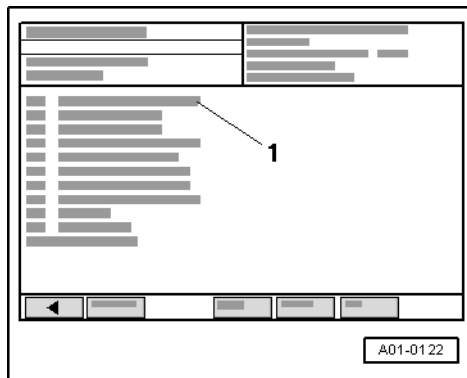
Test requirements:

- No leaks in exhaust system
- Coolant temperature at least 80 °C.

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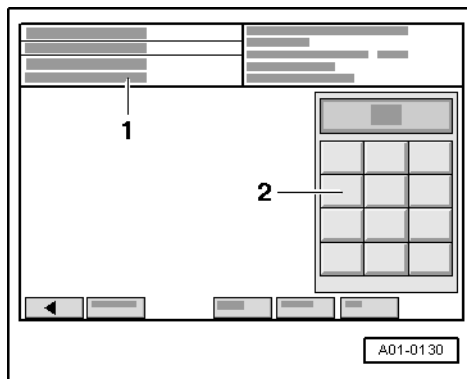
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



-> Display on VAS 5051:

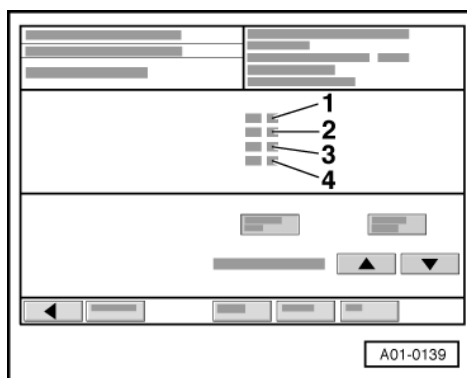
- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

1 - Enter display group
 max. input value = 255

- Enter "030" for "display group number 030" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:



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- Check specification in display zone -1-.

Notes:

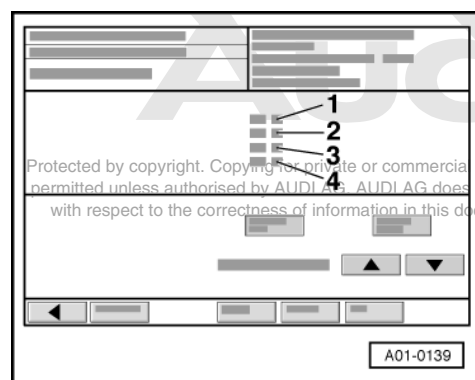
- ♦ By increasing the engine speed the specified values are achieved more quickly.
- ♦ The "lambda probe status" indicates the condition of the lambda control and the lambda probes.

	Display zones			
	1	2	3	4
Display group 030: Lambda probe status				
Display	X X X	X X X		
Display	Lambda probe status, bank 1, probe 1	Lambda probe status, bank 1, probe 2		
Range	0 = off 1 = on	0 = off 1 = on		
Specified value	1 1 1	1 1 0		
Note:	If the specification is not attained =>Page 106			

Significance of 3-digit readout of display group 030			
X	X	X	Display zones 1 and 2:
		X	Lambda control 0 = not active; 1 = active
	X		Lambda probe condition: 0 = not active; 1 = active
X			Condition of lambda probe heating: 0 = not active; 1 = active

Note:

The first digit of the 3-digit display (heating) fluctuates between 0 and 1.



-> Display on VAS 5051:

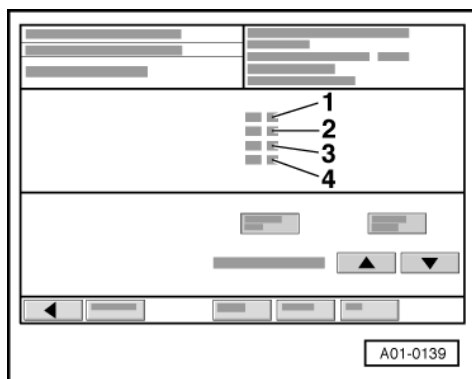
- Only continue the test if the display in display zone -1- has reached "111" at least once.

Checking lambda probe learned values and lambda control

- To switch to display group 032 press the s key twice.
- Check the lambda learned values in display zones -1- and -2-.

	Display zones			
	1	2	3	4
Display group 032: Lambda learned values				
Display	xx.x %	xx.x %		

Display	Display zones		
	Lambda learned value bank 1, probe 1 at idle (additive)	Lambda learned value bank 1, probe 1 on part throttle (multiplicative)	
Specified value	-9.0...9.0 %	-25.0...25.0 %	
Note:	If the specification is not attained =>Page 108		



-> Display on VAS 5051:

- To switch to display group 033 press the s key.
- Check the lambda control in display zones -1- and -2-.

	Display zones		
	1	2	3 4
Display group 033: Lambda control			
Display	xx.x %	x.xxx V	
Display	Lambda control bank 1, probe 1	Lambda probe voltage Bank1, Probe 1	
Specified value	In range -10.0... 10.0 % value must fluctuate at least 2 %	0.130...3.600 V	
Note:	If specified value is not attained => Contin-		If specified value is not achieved => Evalua-

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Note on display zone 2:

Displayed is the lambda probe voltage signal which was prepared and smoothed in the engine control unit. 1.5 V in the display corresponds to Lambda 1.

(cont.)

If the specified result is not achieved in display zone, or if the value does not fluctuate by at least 2%:

- Perform test drive to free Lambda from any possible residues and repeat the test.

If the specified result is not achieved in display zone 1 3, or if the value does not fluctuate by at least 2%, even after the test drive:

- Check basic voltage => Page 108 .
- Check the Lambda probe heating upstream of catalytic converter => Page 113 .
- Check the lambda probe upstream of catalytic converter for ageing =>Page 110 .



Evaluating display group 032

Display zone: 1 / 2	Possible causes of fault	Fault remedy
Lambda learned values below specified range	- Leakage in intake area (pressure side between turbocharger and intake manifold)	- Check intake system for leaks and rectify unmetered air =>Page 101 .
	- Oil dilution	- Carry out oil change or drive vehicle fairly fast on out-of-town roads
	- High oil consumption	
	- Air mass meter defective	- Check air mass meter =>Page 97 .
	- Solenoid valve for activated charcoal filter stuck open	- Check solenoid valve for activated charcoal filter => Page 127 .
	- Fuel pressure too high	- Check fuel pressure regulator =>Page 77 .
	- Injector not closing	- Check injectors =>Page 81
	- Lambda probe heating defective - Lambda probe defective	- Check lambda probe heating =>Page 113 .

Evaluating display group 032

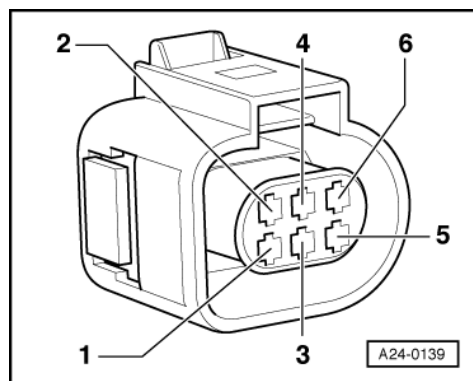
Display zone: 1 / 2	Possible causes of fault	Fault remedy
Lambda learned values above specified range.	- Unmetered air in intake area	- Check intake system for leaks and rectify unmetered air =>Page 101 .
	- Fuel pressure too low	- Check fuel pressure regulator =>Page 77 .
	- Air mass meter defective	- Check air mass meter =>Page 97 .
	- Lambda probe heating defective - Lambda probe defective	- Check lambda probe heating =>Page 113 .
	- Injector only opens partially or not at all	- Check injectors =>Page 81
	- Activated charcoal filter system solenoid valve sticking	- Check solenoid valve for activated charcoal filter => Page 127 .

Evaluating display group 033

Display zone: 2	Possible causes of fault	Fault remedy
Greater than 4.800 V	- Short to positive in wiring between lambda probe and control unit - Lambda probe defective	- Check lambda probe wiring of lambda probe upstream of catalytic converter =>Page 109 .
Less than 0.130 V	- Short to earth in wiring between lambda probe and control unit - Lambda probe defective	- Replace lambda probe upstream of catalytic converter

Checking basic voltage

- Unplug 6-pin connector (black) to lambda probe upstream of catalytic converter -G39.



- -> Connect multimeter between contacts 1 and 5 to measure voltage.
- Switch the ignition on.
 - Specified value: 0.400 ... 0.500 V
- Switch ignition off.

If specified value is not attained:

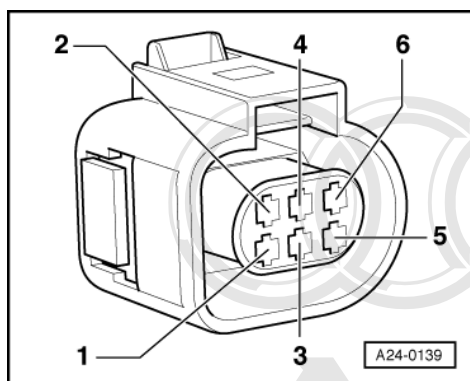
- Check the Lambda probe wiring.

If specified value is attained:

- Replace the lambda probe upstream of catalytic converter.
-G39.

Checking lambda probe wiring

- Unplug 6-pin connector (black) to lambda probe upstream of catalytic converter -G39.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



- -> Test for open circuit in the following wiring connections.

Connector Contact	Test box V.A.G 1598/31 Socket
1	70
2	71
5	51
6	52

- Rectify open circuit, if necessary.

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

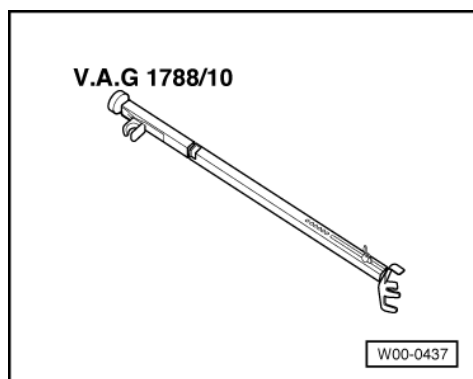
- Check for shorts between the two lines.

If the wiring is OK:

- Replace engine control unit => Page 64 .

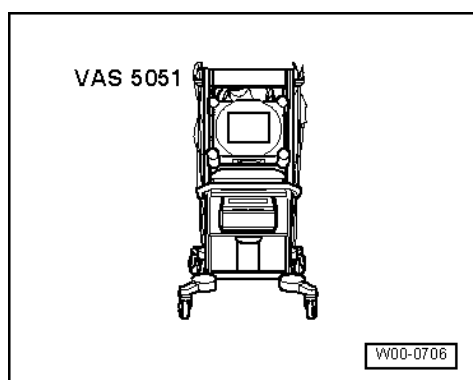


2.3 - Checking lambda probe ageing upstream of catalytic converter



Special tools and workshop equipment required

- ♦ -> V.A.G 1788/10 speedometer



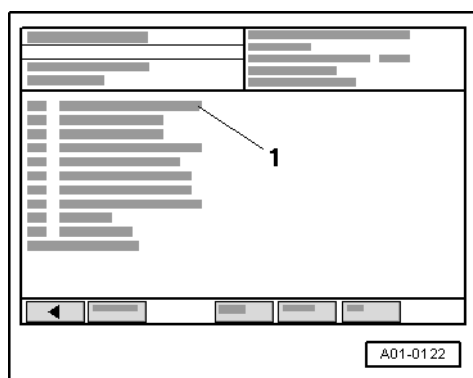
- ♦ VAS 5051 with VAS 5051/1

Test requirements:

- Coolant temperature at least 80 °C.

Test sequence

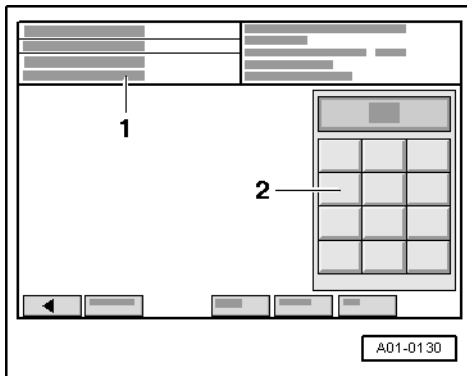
- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



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-> Display on VAS 5051:

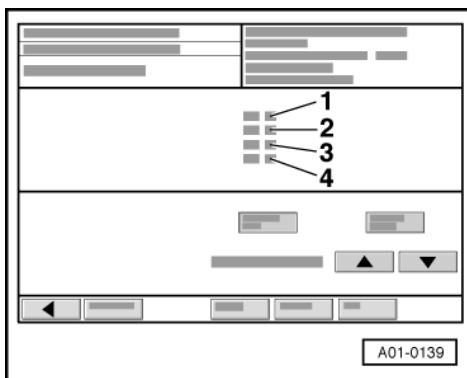
- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

1 - Enter display group
 max. input value = 255

- Enter "034" for "display group number 034" in zone -2- and confirm the entry by pressing the Q key.
- Set engine speed to 1800...2200 rpm using engine speed controller V.A.G 1788/10.



-> Display on VAS 5051:

- Check specification in display zone -4-.

Note:

This process can take a few minutes.

	Display zones			
	1	2	3	4
Display group 034: Diagnosis lambda probe ageing.				
Display	xxxx rpm	xxx °C	x.x	---
Display	Engine speed	Exhaust gas temperature	Dynamics factor	Diagnosis status
Range				Test OFF Test ON B1-P1 OK B1-P1 NOK
Specified value	1800...2200 rpm	Above 350 °C	0.5...2.0	B1-P1 OK



	Display zones		
Note:			If specification not attained => ContinuePage 112

Note on display zone 2:

Calculated value from engine speed and load.

Note on display zones 3 and 4:

The dynamics factor is the characteristic for the ageing of the lambda probe. The lower the dynamics factor the more advanced is the ageing of the lambda probe.

(cont.)

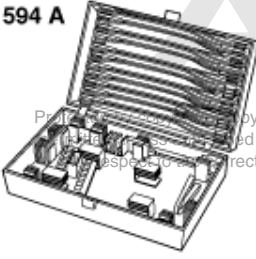
If specification in display zone 3 or 4 is not attained:

- Perform test drive to free Lambda from any possible residues and repeat the test.

If specified value in display zone 3 or 4 is not attained, even after a test drive has been performed:

- Replace the lambda probe 1 upstream of catalytic converter.
-G39.

2.4 - Checking lambda probe heater -Z19 for lambda probe upstream of catalytic converter

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	
	G24-0020

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31

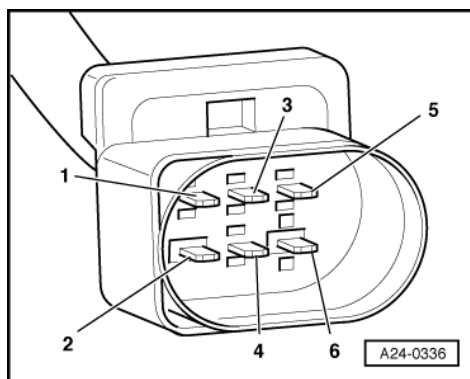
Test requirements:

- Coolant temperature at least 80 °C.
- Fuse for Lambda probe heating OK.

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

Test sequence

- Unplug 6-pin connector (black) to lambda probe upstream of catalytic converter -G39.



- -> Connect multimeter between contacts 3 and 4 to measure resistance.
- Specified value at room temperature 2.5 ... 10 ω

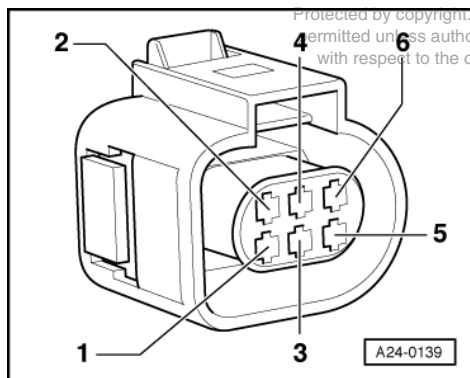
If specified value is not attained:

- Replace the lambda probe 1 upstream of catalytic converter.
- G39.

If specified value is attained:

- Checking the voltage supply to the Lambda probe heating.

Checking voltage supply for lambda probe heating



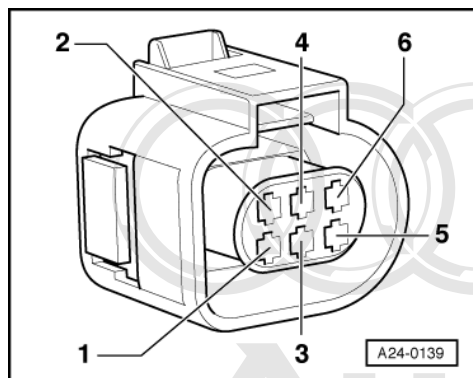
- -> Connect multimeter between contacts 3 and 4 to measure voltage.
- Start the engine.
- Specified value: approx. battery voltage



Note:

Points at which Lambda probe heating is switched on and off by engine control unit can be observed in "Reading measured value block" function, display group number 041 and display zone 2.

If no voltage is present:



- -> Connect multimeter as follows to measure voltage.

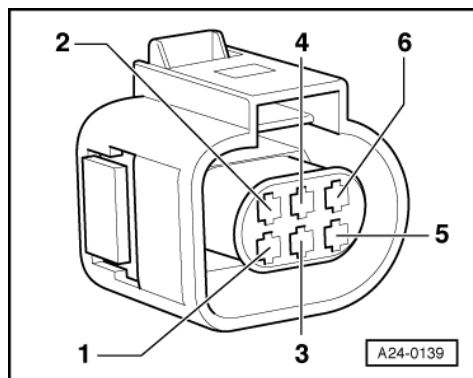
Connector Contact	Measure to
3 (positive)	Vehicle earth

- Operate starter briefly.
 - Specified value: approx. battery voltage

If no voltage is present:

- Checking the wiring from contact 3 on the connector via the fuse to the fuel pump relay for an open circuit:

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



If voltage supply is OK:

- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
4 (earth actuation by engine control unit)	Battery positive

- Start the engine.

- Specified value: approx. battery voltage

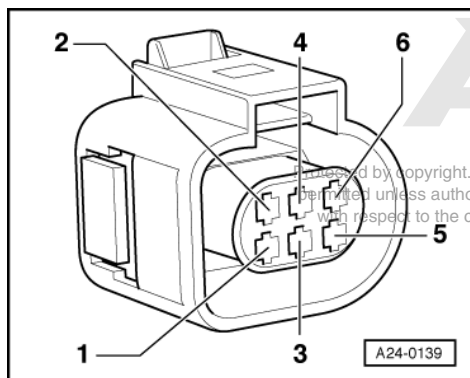
Note:

Points at which Lambda probe heating is switched on and off by engine control unit can be observed in "Reading measured value block" function, display group number 041 and display zone 2.

- Switch ignition off.

If no voltage is present:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



- -> Checking for open circuit in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
4	5

- Rectify open circuit, if necessary.

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

If wiring is OK but there is no earth connection for the Lambda probe heating:

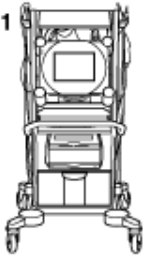
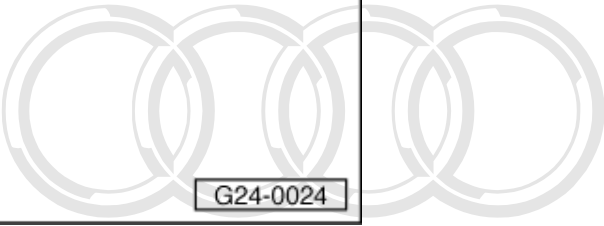
- Replace engine control unit => Page 64 .

2.5 - Checking lambda probe and lambda control downstream of catalytic converter

Note:

The lambda probe upstream of catalytic converter (Bank 1, probe 1) changes to Lambda 1. If this lambda probe is damaged, e.g. through contamination or overheating, the control value can be changed. Deviations from Lambda 1 are recorded by the lambda probe downstream of the catalytic converter (Bank 1, Probe 2). If these deviations are recognised downwards or upwards it influences the control upstream of the catalytic converter in such a way that it is generally raised or lowered accordingly.



V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	V.A.G 1788/10 
VAS 5051 	 G24-0024

Special tools and workshop equipment required

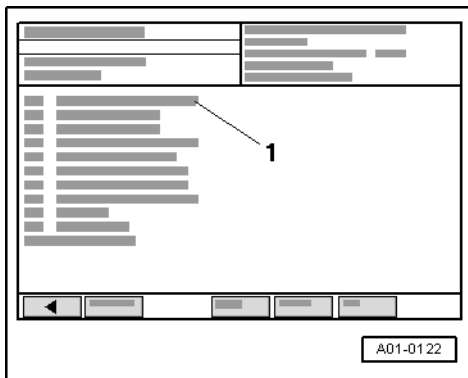
- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ V.A.G 1788/10
- ♦ VAS 5051 with VAS 5051/1

Test requirements:

- No leaks in exhaust system
- Coolant temperature at least 80 °C.

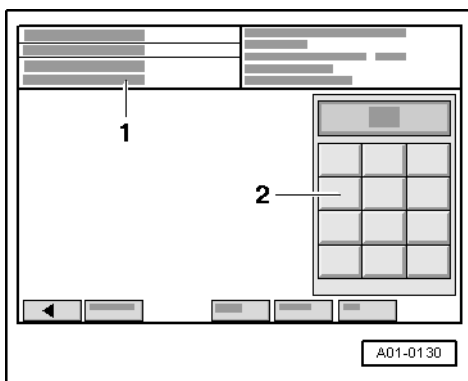
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



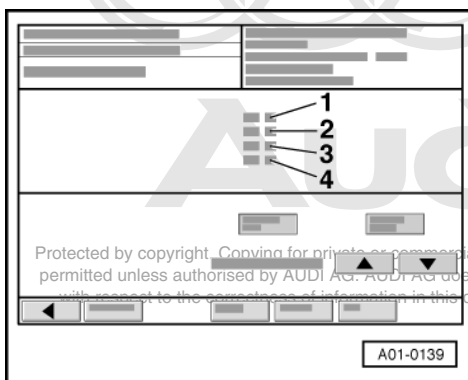
-> Display on VAS 5051:

- Under -1- select the diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "030" for "display group number 030" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Checking specification in display zone -2-.

Notes:

- ♦ By increasing the engine speed the specified values are achieved more quickly.



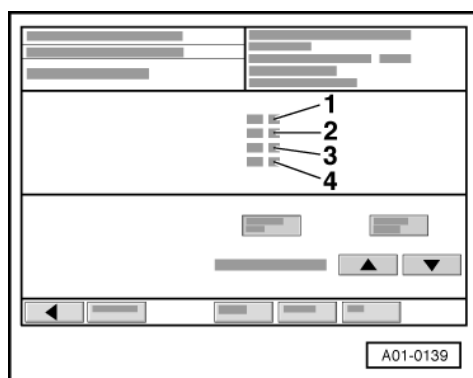
- ♦ The "lambda probe status" indicates the condition of the lambda control and the lambda probes.

	Display zones			
	1	2	3	4
Display group 030: Lambda status at idle				
Display	X X X	X X X		
Display	Lambda probe status, bank 1, probe 1	Lambda probe status bank 1, probe 2		
Range	0 = off 1 = on	0 = off 1 = on		
Specified value	1 1 1	1 1 0		
Note:	If the specification is not attained =>Page 122			

Significance of 3-digit readout of display group 030			
X	X	X	Display zones 1 and 2:
		X	Lambda control 0 = not active; 1 = active
	X		Lambda probe condition: 0 = not active; 1 = active
X			Condition of lambda probe heating: 0 = not active; 1 = active

Notes:

- ♦ The first digit of the 3-digit display (heating) fluctuates between 0 and 1.
- ♦ The lambda control of the lambda probe downstream of catalytic converter (B1-S2) is inactive without engine load.

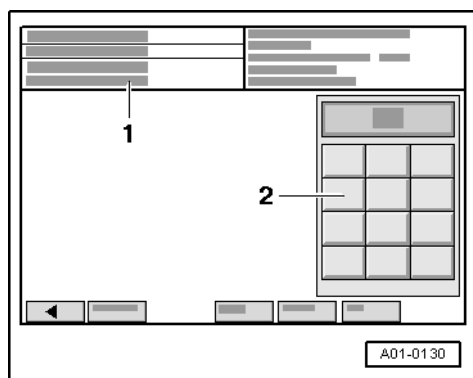


-> Display on VAS 5051:

- Only continue the test if the display in display zone -2- has reached "110" at least once.

Checking lambda control downstream of catalytic converter

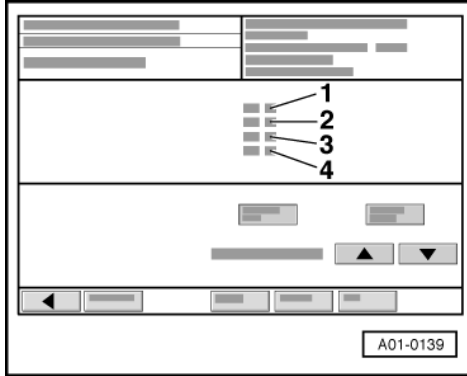
- Set engine speed to 2000 rpm using engine speed controller V.A.G 1788/10.
- Press the ◀ key.



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "037" for "display group number 037" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Checking lambda probe voltage in display zone -2-.
- Checking lambda correction value in display zone-3- and the diagnosis result in display zone -4-.

	Display zones			
	1	2	3	4
Display group 037: Diagnosis, lambda control system				
Display	xxx %	x.xxx V	x.xx	---
Display	Engine load	Lambda probes-voltage bank 1, probe 2	Lambda correction value between Bank 1, Probe 1 and Bank 1, Probe 2	Diagnosis status
Range				Test OFF Test ON Syst. OK Syst. NOK
Specified value	12...30 %	0.100...0.950 V	lower than 0.02	Syst. OK
Note:		If specified value is not attained: Evaluation =>Page 119		If "Syst. NOK" is displayed: Interrogate fault memory => Page 5

Note on display zone 2:

The lambda probe voltage Bank 1, probe 2 should be kept as constant as possible. Strong voltage fluctuations indicate a damaged catalytic converter.

Evaluating display group 037

Display zone: 2	Possible causes of fault	Fault remedy
(constant approx. 0.450 V)	- Open circuit in line 4 between lambda probe and control unit - Open circuit in line 3 between lambda probe and control unit	- Checking basic voltage => Page 120



Greater than 0.950 V	- Short to positive in line 4 between lambda probe and control unit	- Checking lambda probe wiring downstream from catalytic converter =>Page 121 .
Less than 0.100 V	- Short to earth in line 4 between lambda probe and control unit	

(cont.)

If specification in display zone 3 or 4 is not attained:

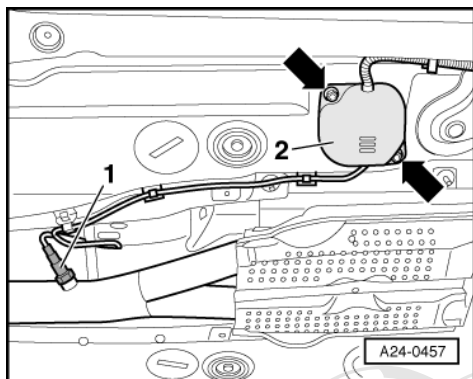
- Perform test drive to free Lambda from any possible residues and repeat the test.

If specified value in display zone 3 or 4 is not attained, even after a test drive has been performed:

- Replace the lambda probe upstream of catalytic converter.
-G39.

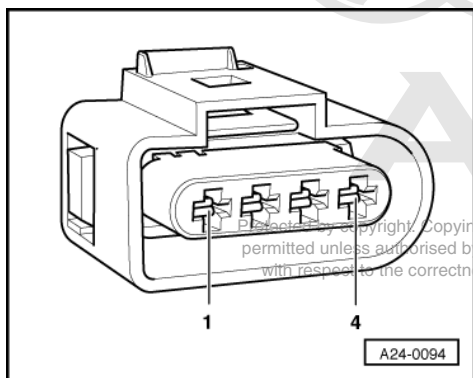
Note:

If the lambda probe voltage is OK and the lambda correction value is still above 0.02 even after test drive was performed it indicates an aged lambda probe upstream of catalytic converter.



Checking basic voltage

- -> Unscrew protective cover -2- -arrows-.
- Unplug 4-pin connector (brown) for lambda probe downstream of catalytic converter -G130.



- -> Connect multimeter between contacts 3 and 4 to measure voltage.
- Switch the ignition on.
 - Specified value: 0.400 ... 0.500 V
- Switch ignition off.

If specified value is not attained:

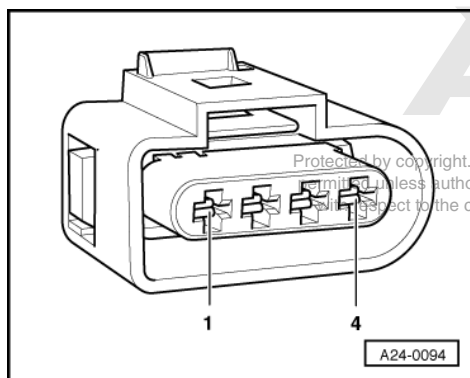
- Check the Lambda probe wiring.

If specified value is attained:

- Replace lambda probe downstream of catalytic converter -G130.

Checking lambda probe wiring

- Unplug 4-pin connector (brown) for lambda probe downstream of catalytic converter -G130.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



- -> Test for open circuit in the following wiring connections.

Connector Contact	Test box V.A.G 1598/31 Socket
3	68
4	69

- Rectify open circuit, if necessary.

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

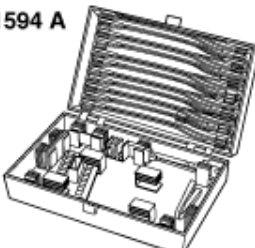
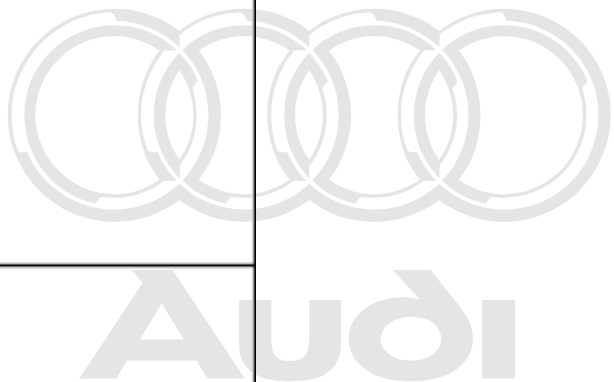
- Check for shorts between the two lines.

If the wiring is OK:

- Replace engine control unit => Page 64 .



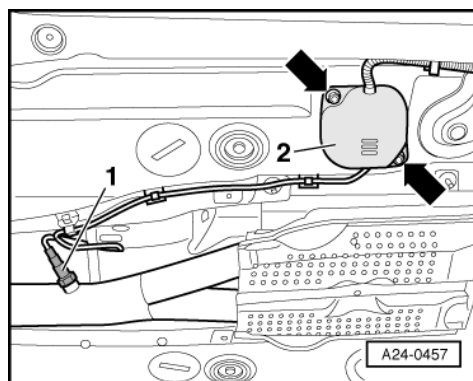
2.6 - Checking lambda probe heater -Z29 for lambda probe downstream of catalytic converter

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	
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Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31

Test requirements:

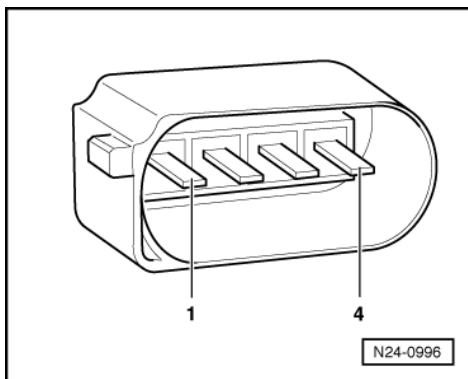


- Coolant temperature at least 80 °C.
- Fuse for Lambda probe heating OK.

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

Test sequence

- -> Unscrew protective cover -2- -arrows-.
- Unplug 4-pin connector (brown) for lambda probe downstream of catalytic converter -G130.



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- -> Connect multimeter between contacts 1 and 2 to measure resistance.
- Specified value at room temperature 6.4 ... 47.5 Ω

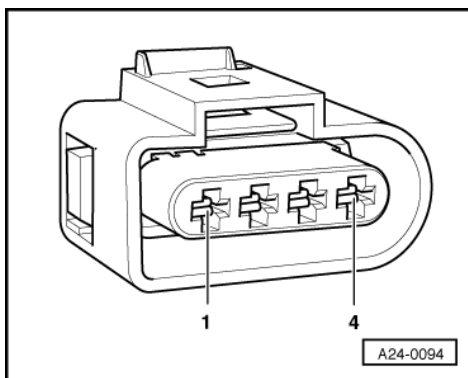
If specified value is not attained:

- Replace lambda probe downstream of catalytic converter -G130.

If specified value is attained:

- Check the voltage supply to the Lambda probe heating.

Checking voltage supply for lambda probe heating

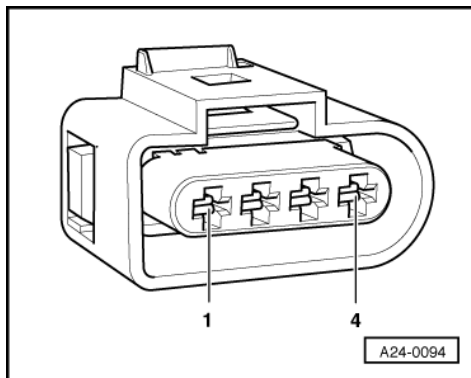


- -> Connect multimeter between contacts 1 (positive) and 2 (earth) to measure voltage.
- Start the engine.
- Specified value: approx. battery voltage

Note:

Points at which Lambda probe heating is switched on and off by engine control unit can be observed in "Reading measured value block" function, display group number 041 and display zone 4.

If no voltage is present:



- -> Connect multimeter as follows to measure voltage:

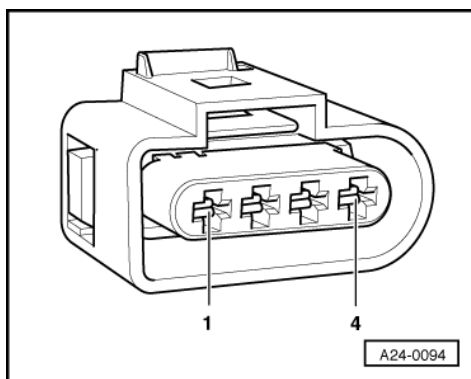
Connector Contact	Measure to
1 (positive)	Vehicle earth

- Operate starter briefly.
 - Specified value: approx. battery voltage

If no voltage is present:

- Checking the wiring from contact 1 on the connector via the fuse to the fuel pump relay for an open circuit:

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



If voltage supply is OK:

- -> Connect multimeter as follows to measure voltage:

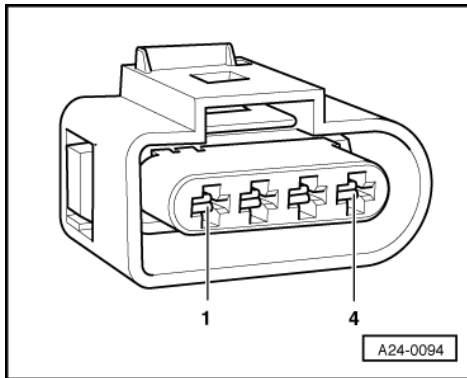
Connector Contact	Measure to
2 (earth actuation by engine control unit)	Battery positive

- Start the engine.
 - Specified value: approx. battery voltage, may fluctuate
- Switch ignition off.

If no voltage is present:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .

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- -> Checking for open circuit in the following wiring connections:

Connector Contact	Test box V.A.G 1598/31 Socket
2	63

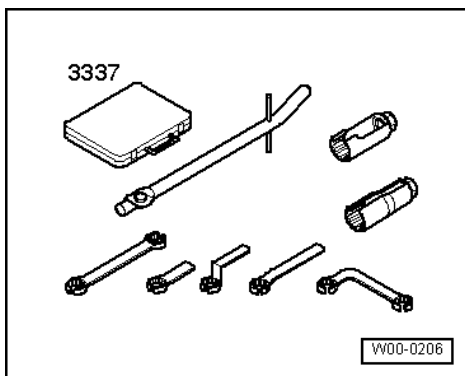
- Rectify open circuit, if necessary.

If wiring is OK but there is no earth connection for the Lambda probe heating:

- Replace engine control unit => Page 64 .

2.7 - Removing and installing lambda probe

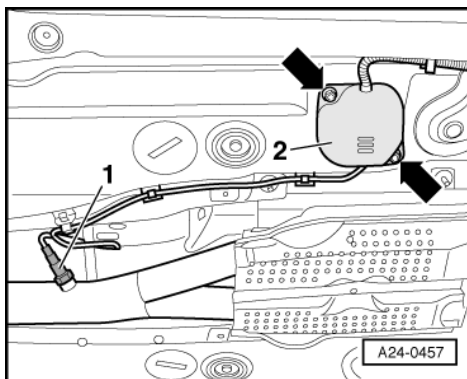
Special tools, workshop equipment and other items required



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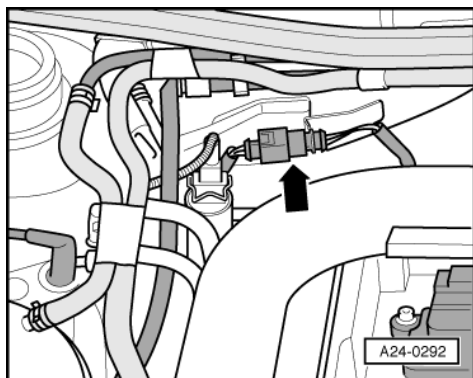
- ◆ Ring spanner set 3337
- ◆ High-temperature lubricant G 052 112 A3

Procedure





- -> Lambda probe downstream of catalytic converter: Detach protective cover -2- -arrows-.
- Unplug connector for lambda probe -1- and expose wiring.

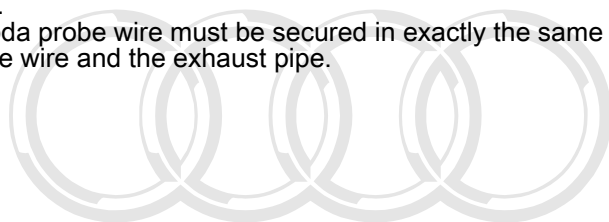


- -> Lambda probe upstream of catalytic converter: Unplug connector for lambda probe -arrow- and expose wiring.
- Screw out Lambda probe using special tool 3337.

When installing, note the following points:

Notes:

- ♦ 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.
- ♦ Tightening torque 55 Nm.
- ♦ When installing, the lambda probe wire must be secured in exactly the same position as before in order to avoid contact between the wire and the exhaust pipe.

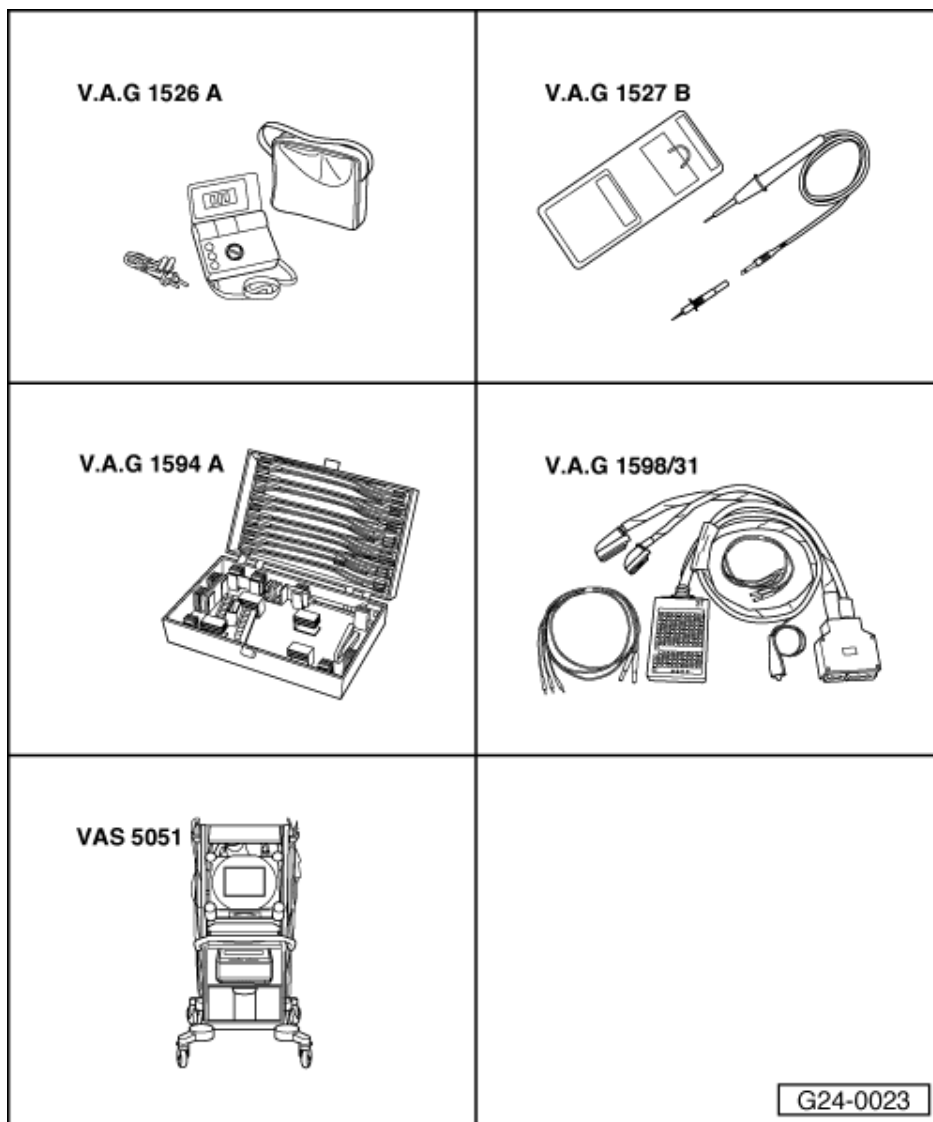


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3 - Checking fuel tank breather

3.1 - Checking fuel tank breather



3.2 - Checking activated charcoal filter system solenoid valve 1 -N80

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

Testing for leaks

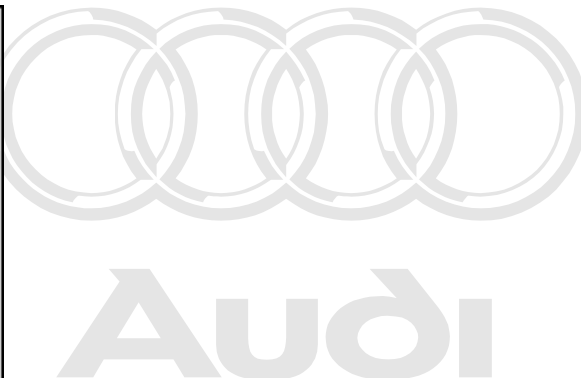
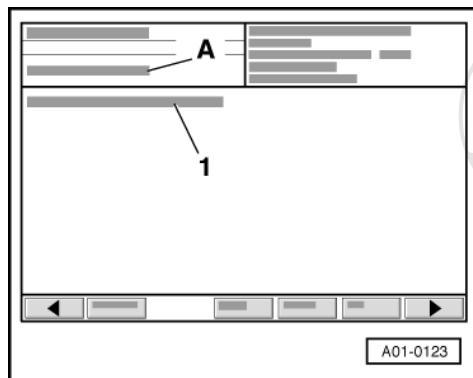
ACF solenoid valve -N80 remains closed when deenergised.

- Disconnect hoses from ACF valve but leave the electrical connector plugged in.
- Connect auxiliary hose to one connection of ACF valve.

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- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.
- Initiate final control diagnosis and actuate ACF solenoid valve -N80 =>Page **20** .



-> Display on VAS 5051:

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- A - 1st control element in test
- 1 - Fuel tank breather valve -N80

- ♦ The valve should click...
- ♦ ...and should open and close (check by blowing into the auxiliary hose).

If the injector does not click:

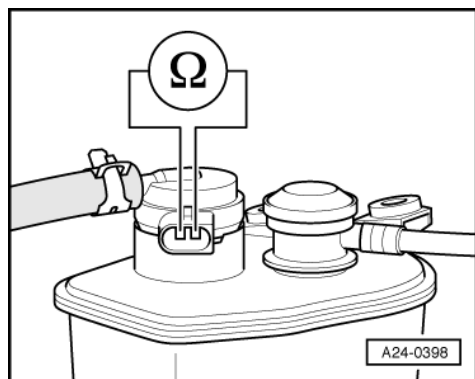
- Checking internal resistance to ACF valve.

If valve does not open or close properly:

- Replace -N80 solenoid valve for activated charcoal filter.

Checking internal resistance

- Unplug connector on ACF valve.



- -> Connect multimeter between contacts 1 and 2 on valve to measure resistance.
- Specified value: 22 ... 30 ω

If specification is not attained:

- Replace -N80 solenoid valve for activated charcoal filter.

If specified value is attained:

- Check the voltage supply

=>Page 129 .

Checking power supply

Test requirements:

- Fuse for ACF valve OK.

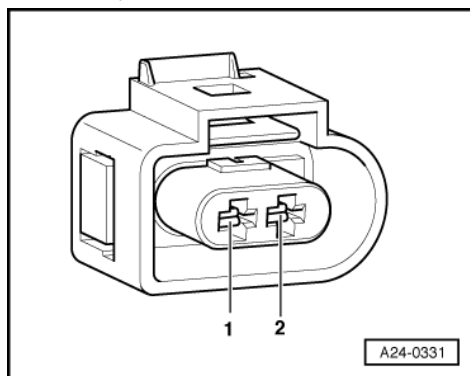
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Fuel pump relay OK; checking =>Page 93 .

Note:

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

- **Unplug connector on ACF valve**



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth

- Operate the starter briefly (the engine may start).
- The LED should illuminate.

If the LED does not illuminate:

- Check the wiring from contact 1 on the connector via the fuse to the fuel pump relay for an open circuit:

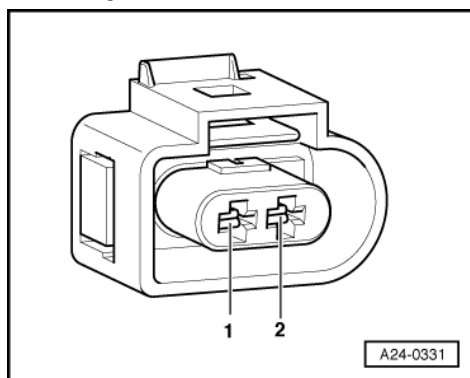
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify open circuit, if necessary.

If the LED illuminates:

- Check actuation.

Checking actuation

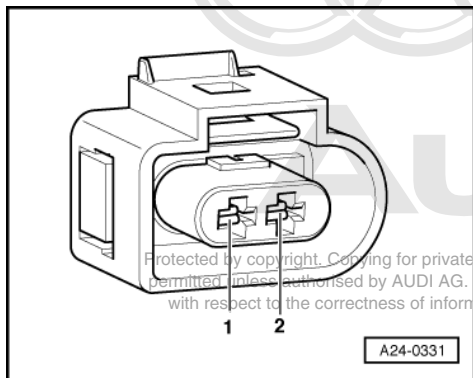




- -> Connect voltage tester V.A.G 1527 B to contacts 1 (positive) and 2 of the connector.
- Initiate final control diagnosis and actuate ACF solenoid valve -N80 =>Page **20** .
 - The LED should flash.

If the LED lamp does not flash or if it illuminates continuously:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page **59** .



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

Connector Contact	Test box V.A.G 1598/31 Socket
2	64

- Rectify any open/short circuit as necessary.

If the wiring is OK:

- Replace engine control unit => Page **64** .

4 - Checking electronic engine power control (electronic throttle)

4.1 - Checking electronic engine power control (electronic throttle)

4.2 - Function of the electronic throttle system

In the electronic throttle system, the throttle valve is not operated by a cable connected to the accelerator pedal. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is communicated to the engine control unit by two accelerator position sensors (variable resistances located in a single housing) connected to the accelerator pedal.

The position of the accelerator pedal (decided by the driver) is one of the main input parameters to the engine control unit.

The throttle valve is actuated, over the full range of engine speed and power, by an electric motor (throttle valve actuator) in the throttle valve control part.

The throttle valve actuator moves the throttle valve as instructed by the engine control unit.

With the ignition switched on and the engine not running, the engine control unit controls the throttle valve precisely in accordance with the signals from the accelerator position senders. This means that when the ac-

celerator is pressed half way down, the throttle valve actuator opens the throttle valve to an equivalent extent; the throttle valve is then about half open.

When the engine is running (and under load), the engine control unit can open and close the throttle valve independently of the accelerator position senders.

As an example, the throttle valve can be fully open even though the accelerator pedal is only pressed half way down. This has the advantage of preventing throttle losses at the throttle valve.

Under certain engine load conditions, markedly improved emission and consumption figures are also attained.

The engine torque necessary can be provided by the engine control unit by an optimum combination of throttle opening and boost pressure.

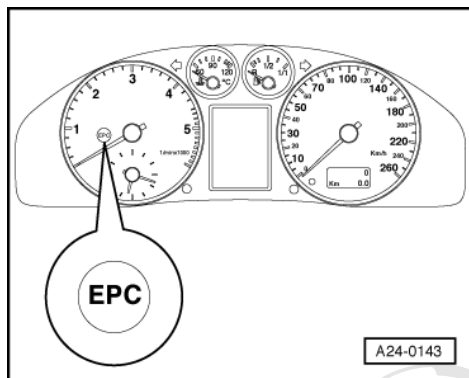
It would be erroneous to believe that the "electronic throttle" comprises only one or two components. The electronic throttle is much rather a system which includes all the components which contribute to determining, controlling and monitoring the throttle valve position, e.g. the accelerator position sender, the throttle valve control part, the EPC warning lamp, the engine control unit...)

4.3 - Fault lamp for electronic throttle in dash panel insert

Note:

The electronic throttle control fault lamp - K132 is also known as the EPC warning lamp.

"EPC" is an abbreviation for Electronic Power Control and refers to the electronic throttle control system.



-> Location of the EPC warning lamp

When the ignition is switched on, the engine control unit checks all the components of importance to the electronic throttle system.

After switching on the ignition the engine control unit switches on the EPC warning lamp. The EPC lamp goes out shortly after starting the engine, if, on the one hand, the engine control unit does not detect any faults in the EPC system, and, on the other, if actuation of the lamp by the engine control unit is OK.

If a fault is detected in the electronic throttle system while the engine is running, the engine control unit switches on the EPC warning lamp. (These faults are listed in the fault table). At the same time, an entry is made in the engine control unit fault memory.

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4.4 - Checking electronic throttle control fault lamp -K132

Functional check on warning lamp

- Switch the ignition on.
 - The engine control unit switches on the EPC lamp.
- Start the engine.
 - Shortly after starting the engine the exhaust warning lamp goes out if no fault in relation of the electronic throttle is stored in the fault memory.

Note:

*The switch-on signal for the fault lamp is transferred via CAN bus to the dash panel insert by the engine control unit. Check the data exchange between engine control unit and other CAN-control units =>Page **163***

4.5 - Checking throttle valve control part -J338

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The following components are located in the housing of the throttle valve control part.

- ♦ Throttle valve drive -G186 (This is an electric motor which is activated by the engine control unit. This electric motor opens the throttle valve against the force of a spring).
- ♦ Angle sender 1 for throttle valve actuator -G187
- ♦ Angle sender 2 for throttle valve actuator -G188

Notes:

- ♦ Housing of throttle valve control part must not be opened.
- ♦ The angle senders are in the form of potentiometers (variable resistances). They provide the position of the throttle valve to the engine control unit completely independently of one another.
- ♦ The potentiometers cannot be adjusted mechanically. The settings are carried out in diagnostic function "04 - basic setting" with the vehicle diagnostic, testing and information system VAS 5051.

4.6 - Performing adaption of throttle valve control part

The adaption process enables the engine control unit to learn the various positions of the throttle valve with the ignition switched on and the engine not running. These positions are stored in the control unit. The feedback signal indicating the position of the throttle valve comes from the two throttle valve actuator angle senders.

If the throttle valve unit -J338 or the engine control unit are removed, installed or replaced or if the voltage supply from the engine control unit is interrupted, adaption must always be performed.

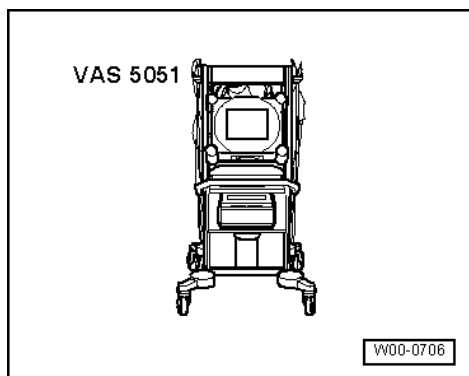
The learning process (adaption process) is performed:

- ♦ Automatically if the ignition is switched on once for at least 10 seconds without actuating the starter or the accelerator pedal and the engine control unit recognises "adaption requirement". In this case, however, it is not obvious whether the adaption process was successful or not. Adaption requirement is recognised if stored voltage values from the angle senders do not coincide with current measured voltage values in a certain tolerance band.
- ♦ By initiating the basic setting (Function 04) of display group 060 with ignition switched on.

Note:

Engine will not start during automatic adaption.

Special tools and workshop equipment required

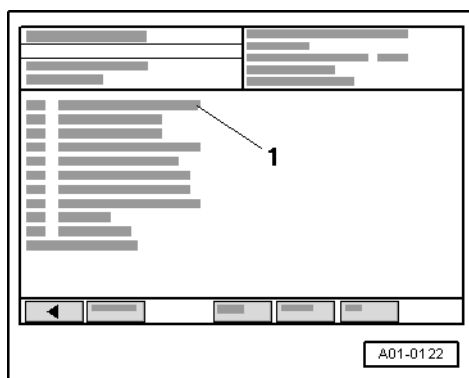


- ♦ VAS 5051 with VAS 5051/1

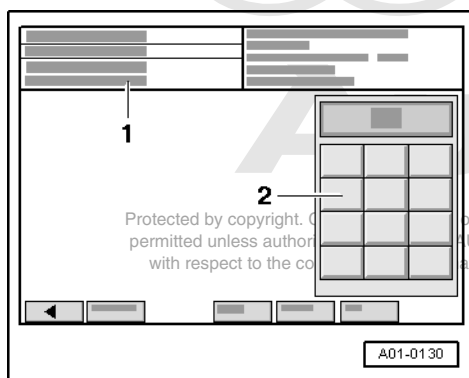
Preconditions:

- No faults stored in fault memory; interrogate fault memory => Page 5 .
- Engine stopped, ignition switched on
- Accelerator pedal not depressed.
- Coolant temperature 10 ... 95 °C
- Intake air temperature 10 ... 90 °C
- Voltage supply to engine control unit greater than 12.7 V, Testing =>Page 195 .

Procedure



- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.
- > Display on VAS 5051:
- Under -1- select the diagnostic function "04 - Basic setting".





-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

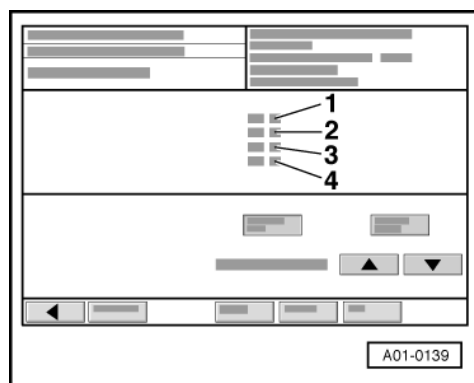
- Enter "060" for "display group number 060" in zone -2- and confirm the entry by pressing the Q key.

After the Q key is pressed, the throttle valve actuator is first disconnected from the electricity supply.

In this condition, the throttle valve is pulled into an emergency running position by a mechanical spring which is located in the throttle valve control part. The values supplied by the two angle senders in this emergency running position are stored in the engine control unit.

The throttle valve is then opened by a predetermined amount. When this value is reached, the throttle valve actuator is again disconnected from the electricity supply. The mechanical spring should then close the throttle valve to the previously learned emergency running position within a specified period of time (spring test).

The throttle valve actuator then closes the throttle valve; the values supplied by the angle sensors in the throttle valve control part are stored in the engine control unit.



If the engine control unit disconnects the throttle valve actuator from the electricity supply while the vehicle is being driven, the result will be an increased and fluctuating idling speed and a very poor throttle response.

-> Display on VAS 5051:

- Check specifications for throttle valve control part in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 060: Adaption of throttle valve control part				
Display	xx %	xx %	x	---
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Adaption stage counter	Adaption status
Range			0...8	ADP process running ADP OK ERROR
Specified value	3...93 %	97...3 %	8	ADP OK
Note:			After adaption the adaption stage counter reaches figure 8. (Figures may be skipped)	If "ERROR" is displayed: Interrogate fault memory =>Page 135

Note:

"ADP" in display zone 4 stands for "Adaption".

Note:

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

- ◆ The throttle valve cannot close completely (e.g. dirt).
- ◆ The battery voltage is too low.
- ◆ Throttle valve control part or wiring is defective.
- ◆ Engine was started or accelerator was actuated during the adaption process.
- ◆ Distortion of throttle valve housing (check screw connection).

When adaption process is interrupted, message "Function is unknown or cannot be carried out at the moment" is displayed on tester. The next time the ignition is switched on (for several seconds), the adaption process is automatically performed again.

- Exit the function "04 - Basic setting" by pressing the **1** key.

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4.7 - Checking throttle valve for dirt

Fitting location => Fitting locations overview, Page **47**

Requirements:

- Genuine air cleaner fitted; air cleaner O.K.
 - Intake air system O.K.
 - Fuel pressure O.K.
 - Fuel tank breather system O.K.
 - Injectors O.K.
 - Coolant temperature above 80°C.
 - Lambda probe learned values and lambda control O.K.
- =>Page **135** .

Work sequence=>Page **136**

Testing lambda probe learned values and lambda control

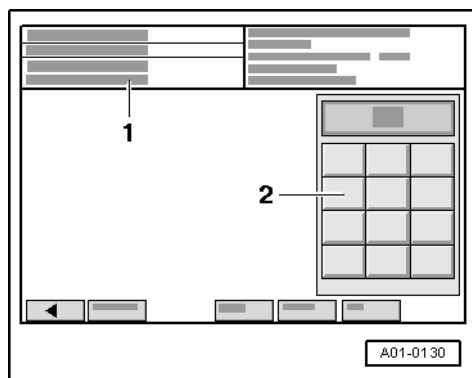
Test sequence

- Connect the vehicle diagnostic, testing and information system VAS 5051 => Page **1** , and select the vehicle system "01 - Engine electronics" from the menu. When doing this the engine should be idling.



-> Display on VAS 5051:

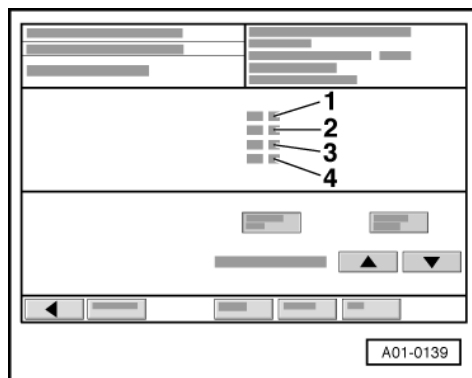
- Select the diagnosis function "04 - Basic settings" from the menu -1-.



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-> Display on VAS 5051:

- 1 - Enter display group
(figures up to 255)
- Using keypad -2-, enter "032" to select "Display group 032" and confirm entry with Q button.



-> Display on VAS 5051:

- Check readout in display zone -2-.

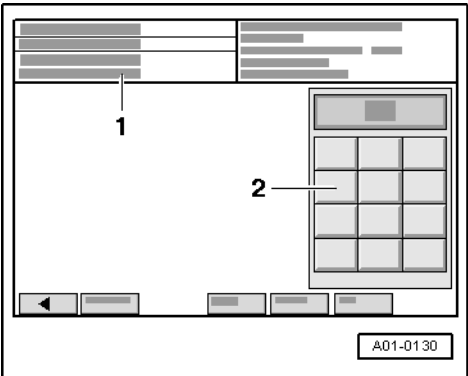
	Display zones			
	1	2	3	4
Display Group 032: Lambda learned values				
Display	xx.x %	xx.x %		
Indicates	Lambda learned value, Bank 1, Probe 1 at idling speed (additive)	Lambda learned value, Bank 1, Probe 1 at part throttle (multiplicative)		
Specification	-9.0...9.0 %	-25.0...25.0 %		

Work sequence =>Page 136

Work sequence

- Unplug electrical connector from air mass meter.

- Connect the vehicle diagnostic, testing and information system VAS 5051 => Page 1 , and select the vehicle system "01 - Engine electronics" from the menu. When doing this the engine should be idling.

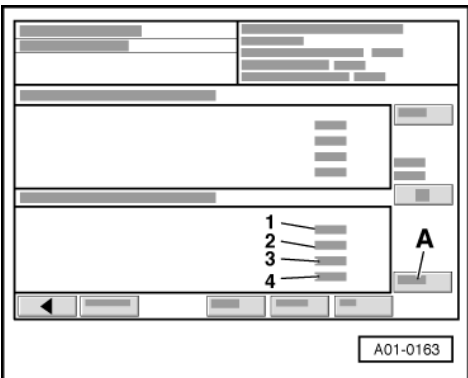


Test requirement:

- With engine idling, select "address word" 01 and function "initiating basic setting" by pressing "04".

-> Display on VAS 5051:

- 1 - Enter display group
- Using the keypad -2-, enter "107" to select "Display group 107" and confirm entry with Q key.



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-> Display on VAS 5051:

- Check readout in display zone -4-.

	Display zones			
	1	2	3	4
Display group 107: Lambda control - short test				
Display	xxx rpm	x.x %	x.x %	Test ON
Indicates	Engine speed (actual)	Lambda control average (bank 1)	Lambda control average (bank 2)	Status of diagnosis
Range				Test OFF Test ON Syst. O.K. Syst. n.O.K.
Specification				Syst. O.K.

If the specification "Syst O.K." is attained in in display field 4:



- Press the ◀ button.
- Again connect air mass meter.
- Perform the next work step in the fault table to continue fault finding.

If the specification "SYST. O.K." is not attained in display zone 4:

- Press the ◀ button.
- Clean the air duct in the throttle valve control part with a lint-free cloth and cleaning solvent.
- Again perform adaption of throttle valve control part=>Page 132 .
- Repeat test procedure: lambda control - short test, measured value block 107 in basic setting 04.
- Again connect air mass meter.
- Erase fault memory=>Page 6 .
- Perform road test observing notes on safety precautions=>Page 45
- Fault memory interrogated=>Page 5 .

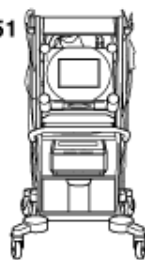
4.8 - Cleaning throttle valve control part

Fitting location => Fitting locations overview, Page 47

- Clean the air duct in the throttle valve control part with a lint-free cloth and cleaning solvent.
- Again perform adaption of throttle valve control part=>Page 132 .
- Erase fault memory=>Page 6 .
- Perform road test observing notes on safety precautions
=>Page 45
- Fault memory interrogated=>Page 5 .

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4.9 - Checking angle sender for throttle valve actuator

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	VAS 5051 
	G24-0021

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

The throttle valve drive angle sensors -G187 and -G188 signal the position of the throttle valve to the engine control unit. Both angle senders are located in the throttle valve control part.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.

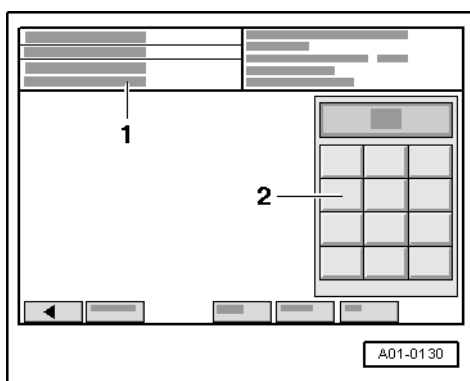
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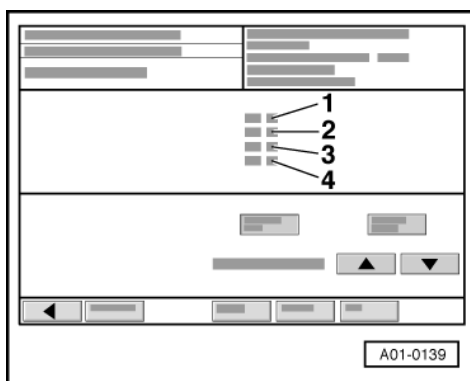
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "062" for "display group number 062" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specified values for electronic throttle potentiometer voltages in display zones -1- and -2-.

	Display zones			
	1	2	3	4

Display zones				
Display group 062: Electronic throttle potentiometer voltages				
Display	xx %	xx %	xx %	xx %
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Sender 1 for accelerator pedal posi- tion	Sender 2 for accelerator pedal posi- tion
Specified value	3...93 %	97...3 %	12...97 %	4...49 %

Note:

The engine control unit converts and displays the voltage readings from the angle senders as percentages of 5 V. (A 5 Volt supply corresponds to 100%).

- Observe readouts in display zones 1 and 2.
- Slowly depress accelerator pedal.

Percentage displayed in zone 1 should rise evenly. The tolerance range from 3...93 % is not fully utilised.

Percentage displayed in zone 2 should fall evenly. The tolerance range from 97...3 % is not fully utilised.

Notes:

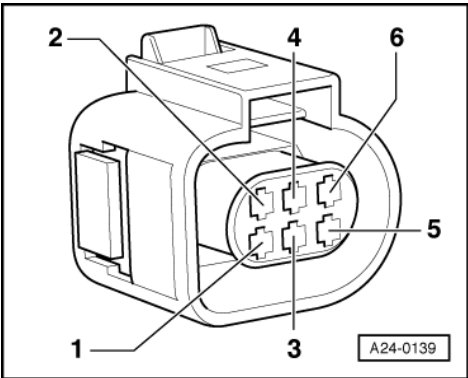
- ♦ The reason why the value in display zone 1 rises and that in zone 2 falls is that the potentiometers (angle senders) in the throttle valve control part operate in opposite directions.
- ♦ This means that the voltage picked off by one of the angle senders runs in the direction of 5 V. (As the throttle is opened, the voltage becomes greater and the percentage increases).
- ♦ The voltage picked off by the angle sender 2 runs from 5 V in the direction of 0 V. (As the throttle is opened, the voltage becomes smaller and the percentage decreases).
- Exit the function "08 - Read measured value block" by pressing the ↵ key.

If the displays are not as described:

- Check throttle valve control part voltage supply and wiring =>Page 141 . Pay particular attention to connectors, which may be detached or corroded.
- Check the accelerator position senders =>Page 143 .

Checking the voltage supply to the throttle valve control part.

- Unplug the connector from the throttle valve control part.
- Switch the ignition on.



- -> Connect multimeter as follows to measure voltage:

Connector Contact	Specified value
2 + earth	approx. 5 V

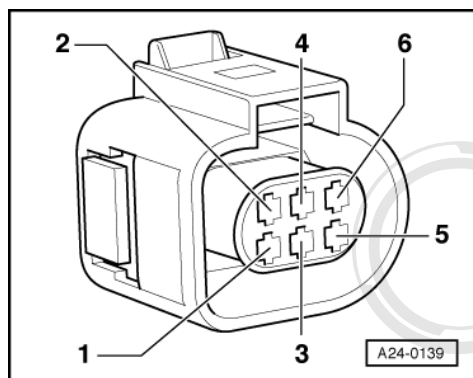


Connector Contact	Specified value
2 + 6	approx. 5 V

If the specified values are not obtained:

- Check wiring between engine control unit and throttle valve control part
=>Page **142** .

Checking wiring



- -> Unplug the connector from the throttle valve control part.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page **59** .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:

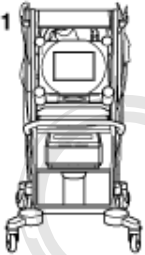
Connector Contact	Test box V.A.G 1598/31 Socket
1	92
2	83
3	117
4	84
5	118
6	91

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace throttle valve control part.

4.10 - Checking accelerator position sender

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	VAS 5051 
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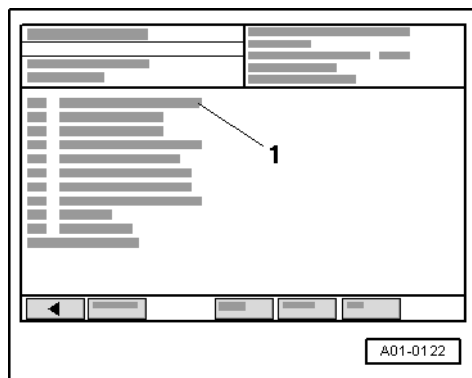
Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

Both accelerator pedal position sensors -G79 and -G185 are located on the accelerator pedal and completely independently signal the driver's requirements to the engine control unit. Both senders are located in one housing.

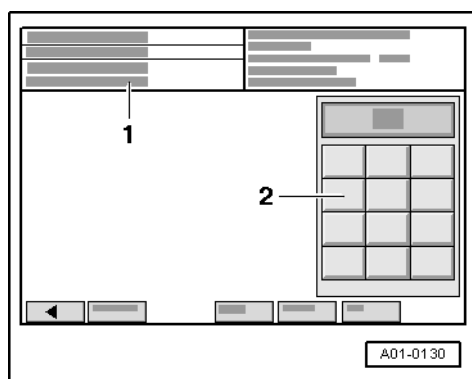
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.



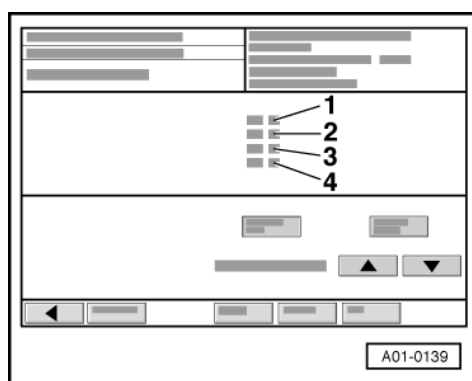
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

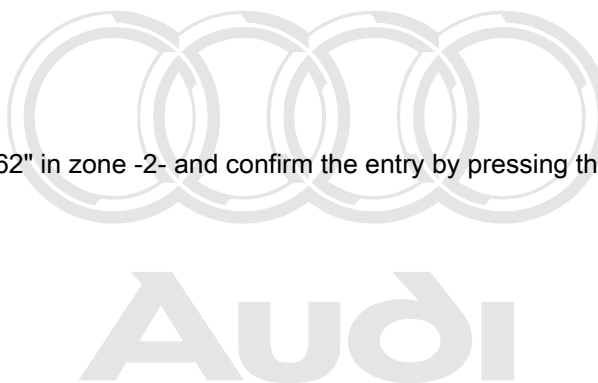
- 1 - Enter display group
max. input value = 255
- Enter "062" for "display group number 062" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check specified values for electronic throttle potentiometer voltages in display zones -3- and -4-.

	Display zones			
	1	2	3	4



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Display zones				
Display group 062: Electronic throttle potentiometer voltages				
Display	xx %	xx %	xx %	xx %
Display	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	Sender 1 for accelerator pedal posi- tion	Sender 2 for accelerator pedal posi- tion
Specified value	3...93 %	97...3 %	12...97 %	4...49 %

Note:

The engine control unit converts and displays the voltage readings from the angle senders as percentages of 5 V. (A 5 Volt supply corresponds to 100%).

- Observe readouts in display zones 3 and 4.
- Slowly depress accelerator pedal.

Percentage displayed in zone 3 should rise evenly. The tolerance range from 12...97 % is not fully utilised.

Percentage displayed in zone 4 should also rise evenly. The tolerance range from 4...49 % is not fully utilised.

Note:

The value displayed in zone 3 must always be about twice as large as that in zone 4.

- Exit the function "08 - Read measured value block" by pressing the ↵ key.

If the displays are not as described:

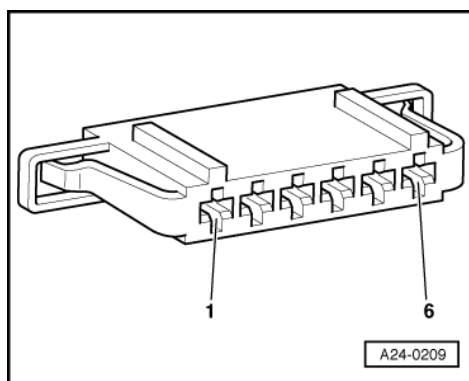
- Check voltage supply and wiring for accelerator position sensor.

Checking voltage supply for accelerator position senders

- Remove driver's storage compartment.

=> General Body Assembly, Interior; Repair group 68; Storage compartments, covers; Removing driver's storage compartment Storage compartments, covers Removing driver's storage compartment

- Detach connector for accelerator position sensors.
- Switch the ignition on.



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- -> Connect multimeter as follows to measure voltage:

Connector Contact	Specified value
1 + earth	approx. 5 V
1 + 5	approx. 5 V
2 + earth	approx. 5 V



Connector Contact	Specified value
2 + 3	approx. 5 V

If specifications are attained:

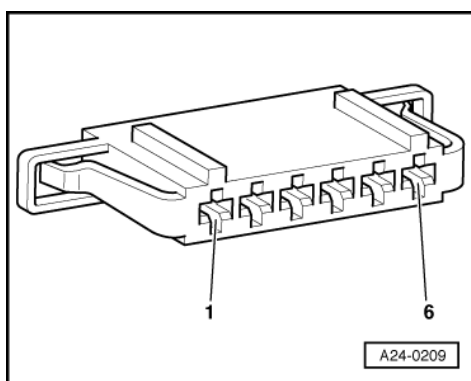
- Additionally check signal wires.

If the specified values are not obtained:

- Check wiring between engine control unit and accelerator position senders.

Checking wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
1	72
2	73
3	36
4	35
5	33
6	34

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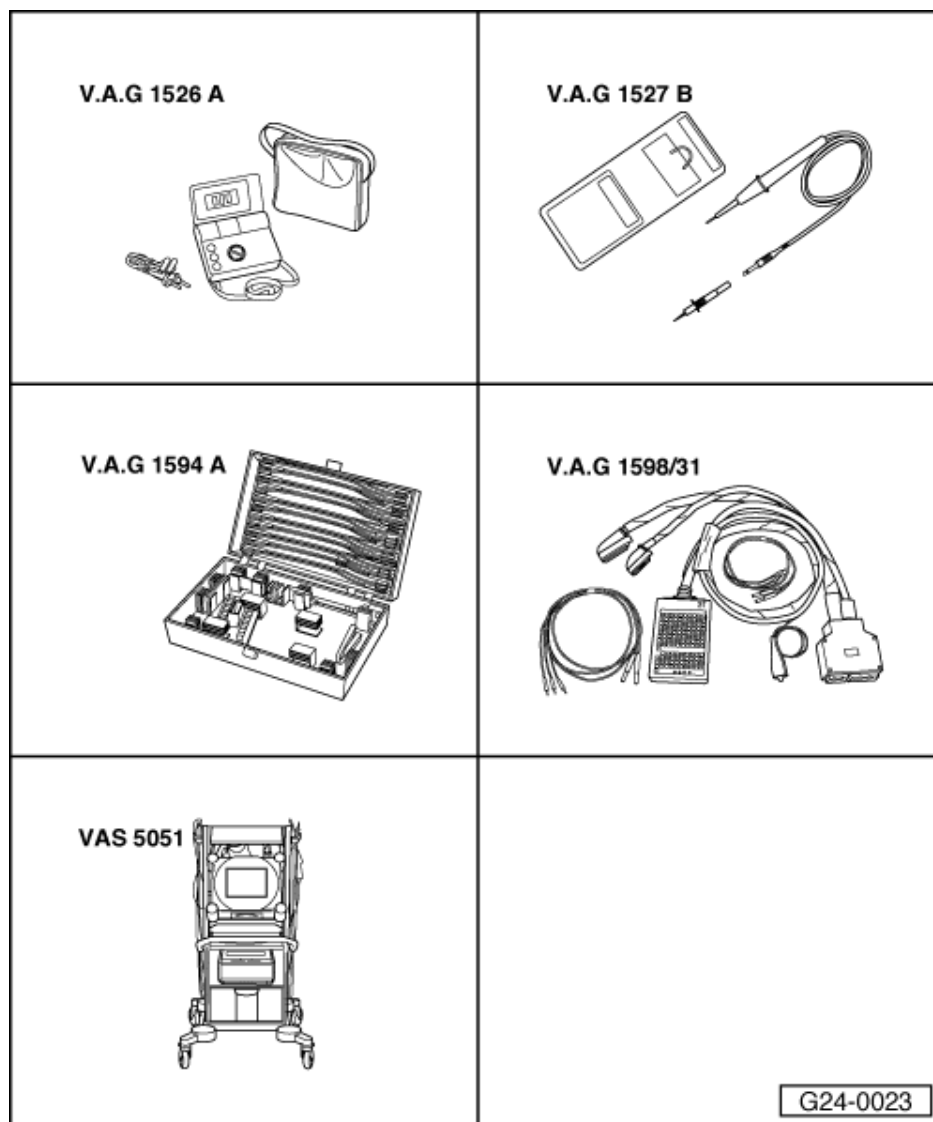
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace accelerator position senders.

=> Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle control Servicing throttle control

4.11 - Checking brake light switch and brake pedal switch



Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

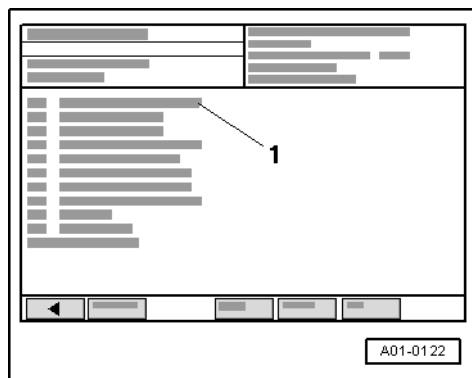
Note:

Command from accelerator pedal sender (potentiometer) to engine control unit for opening throttle valve is suppressed for safety reasons when brake is pressed. For this purpose, the control unit requires signals from both the brake light switch and the brake pedal switch.

If the brakes are actuated when the accelerator pedal is held at a constant position, the engine speed is immediately reduced to idling speed. Incorrectly adjusted switches may lead to unwanted regulating actions.

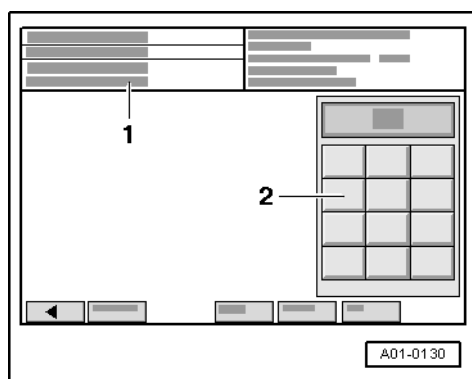
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.



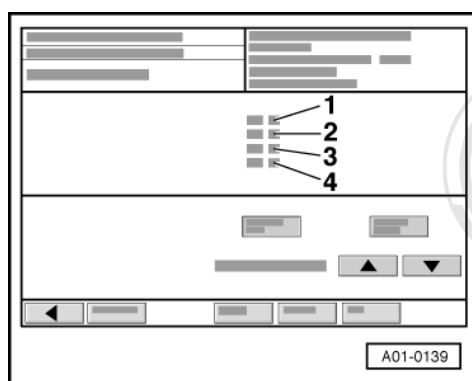
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "066" for "display group number 066" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check brake light/brake pedal switch in display zone -2-

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	Display zones			
	1	2	3	4

Display zones				
Display group 066: Signals to engine control unit				
Display	xxx km/h	XXXX	xxx km/h	XXXX
Display	ACTUAL speed	Switch settings	SPECIFIED speed	Switch settings
Range		XX00 XX11		
Specified value		XX00 (with brake pedal not pressed)		
		XX11 (with brake pedal pressed)		
Note:		Value: X = no meaning. Switching points are slightly offset		

- Exit the function "08 - Read measured value block" by pressing the ↵ key.

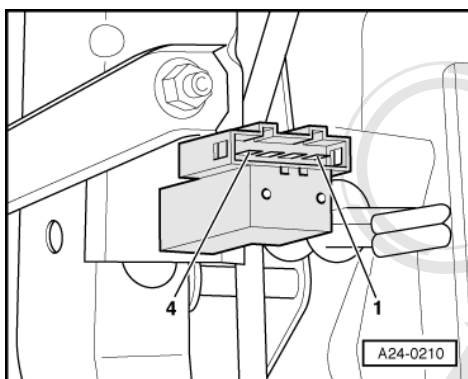
If the display is not as described:

Check switch

- Remove driver's storage compartment.

=> General Body Assembly, Interior; Repair group 68; Storage compartments, covers; Removing driver's storage compartment Storage compartments, covers Removing driver's storage compartment

- Unplug connector from brake light/brake pedal switch.



- -> Connect multimeter between contacts 1 and 4 to measure resistance.
 - Specified value: $\infty\omega$ (no continuity)
- Press brake pedal.
 - Specified value: approx. 0 ω
- Connect multimeter between contacts 2 and 3 to measure resistance.
 - Specified value: approx. 0 ω
- Press brake pedal.
 - Specified value: $\infty\omega$ (no continuity)

If the specified values are not obtained:

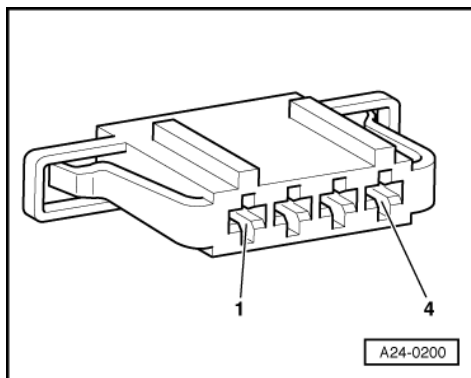
- Replace brake light/brake pedal switch.

If specifications are attained:

- Check the power supply.



Checking power supply



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Car body earth point

- The LED should illuminate.

Connector Contact	Measure to
2	Car body earth point

- Switch the ignition on.
- The LED should illuminate.

If the LED does not illuminate:

- Check the wiring between contact 1 and 2 of connector for open circuit/short to earth:

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

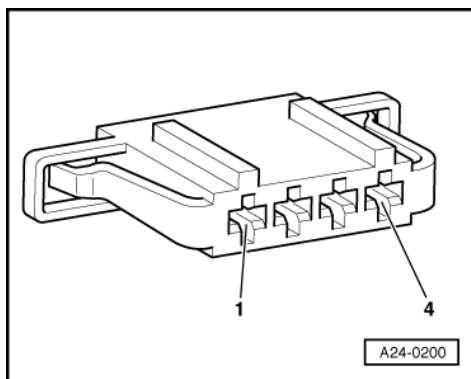
- Rectify any open/short circuit as necessary.

If the LED illuminates:

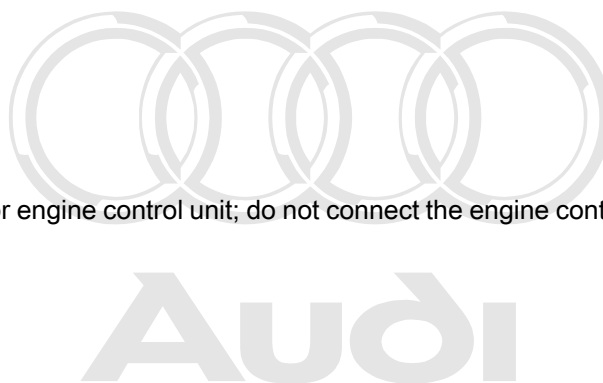
- Check actuation.

Checking actuation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

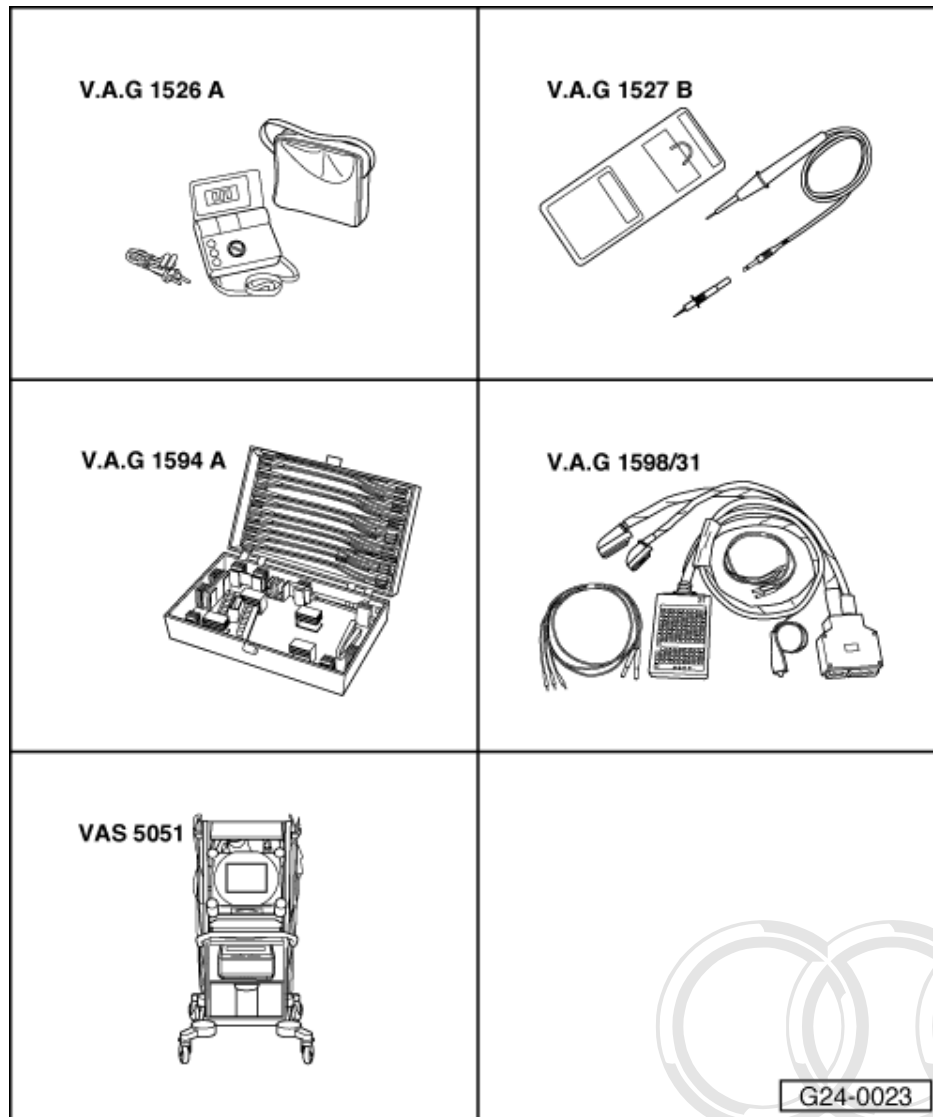


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Connector Contact	Test box V.A.G 1598/31 Socket
3	55
4	56

- Rectify any open/short circuit as necessary.

4.12 - Checking clutch pedal switch -F36



Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

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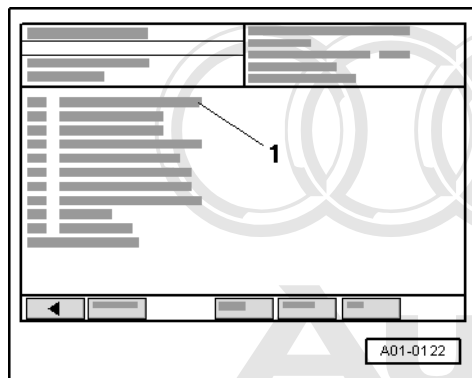


Note:

This signal is designed to prevent speed overshoots and jerkiness on switching from throttle open to throttle closed and vice versa when disengaging clutch. It is needed for the cruise control system.

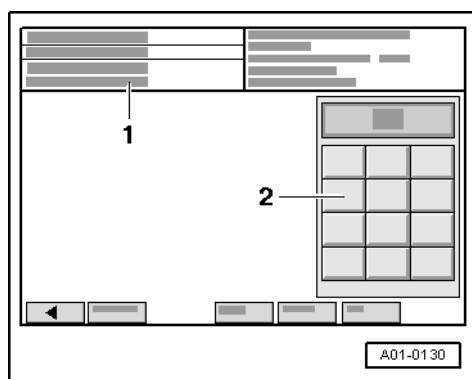
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.



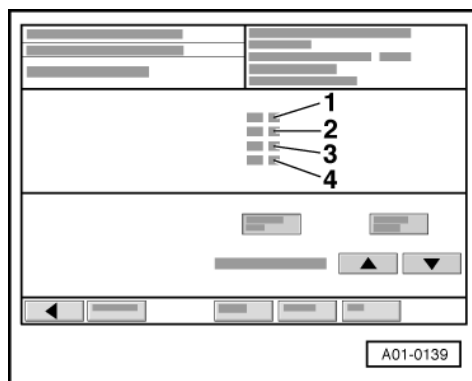
-> Display on VAS 5051:

- Under -1-, select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "066" for "display group number 066" in zone -2- and confirm the entry by pressing the Q key.



- > Display on VAS 5051:
- Check clutch pedal switch in display zone -2-.

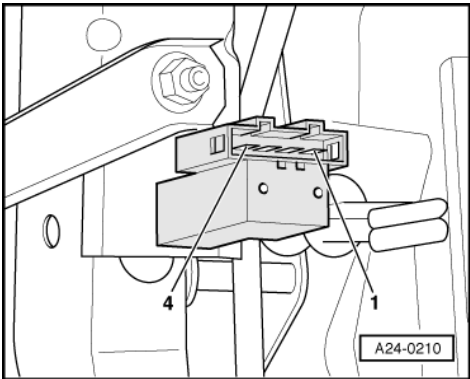
	Display zones			
	1	2	3	4
Display group 066: Signals to engine control unit				
Display	xxx km/h	XXXX	xxx km/h	XXXX
Display	ACTUAL speed	Switch settings	SPECIFIED speed	Switch settings
Range		X0XX X1XX		
Specified value		X0XX (clutch pedal not pressed)		
		X1XX (clutch pedal pressed)		
Note:		Value: X = no meaning		

- Exit the function "08 - Read measured value block" by pressing the ↵ key.

If the display is not as described:

Check switch

- Remove driver's storage compartment.
- => General Body Assembly, Interior; Repair group 68; Storage compartments, covers; Removing driver's storage compartment Storage compartments, covers Removing driver's storage compartment
- Unplug the connector from clutch pedal switch.



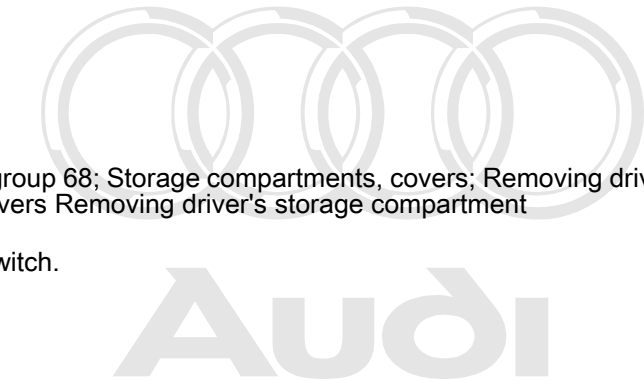
- -> Connect multimeter between contacts 2 and 3 to measure resistance.
 - Specified value: approx. 0 ω
- Operate clutch pedal.
 - Specified value: $\infty\omega$ (no continuity)

If specified value is not attained:

- Replace clutch pedal switch.

If specified value is attained:

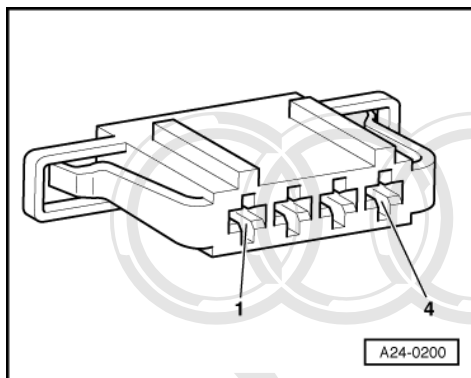
- Check the power supply.



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Checking power supply



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
2	Car body earth point

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- Switch the ignition on.
 - The LED should illuminate.

If the LED does not illuminate:

- Check the wiring from contact 2 of the connector to fuse for open circuit:

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

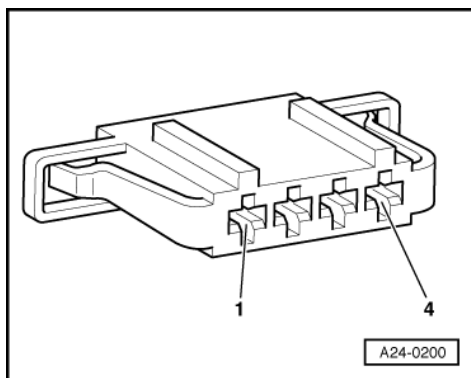
- Rectify open circuit, if necessary.

If the LED illuminates:

- Check actuation.

Checking actuation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



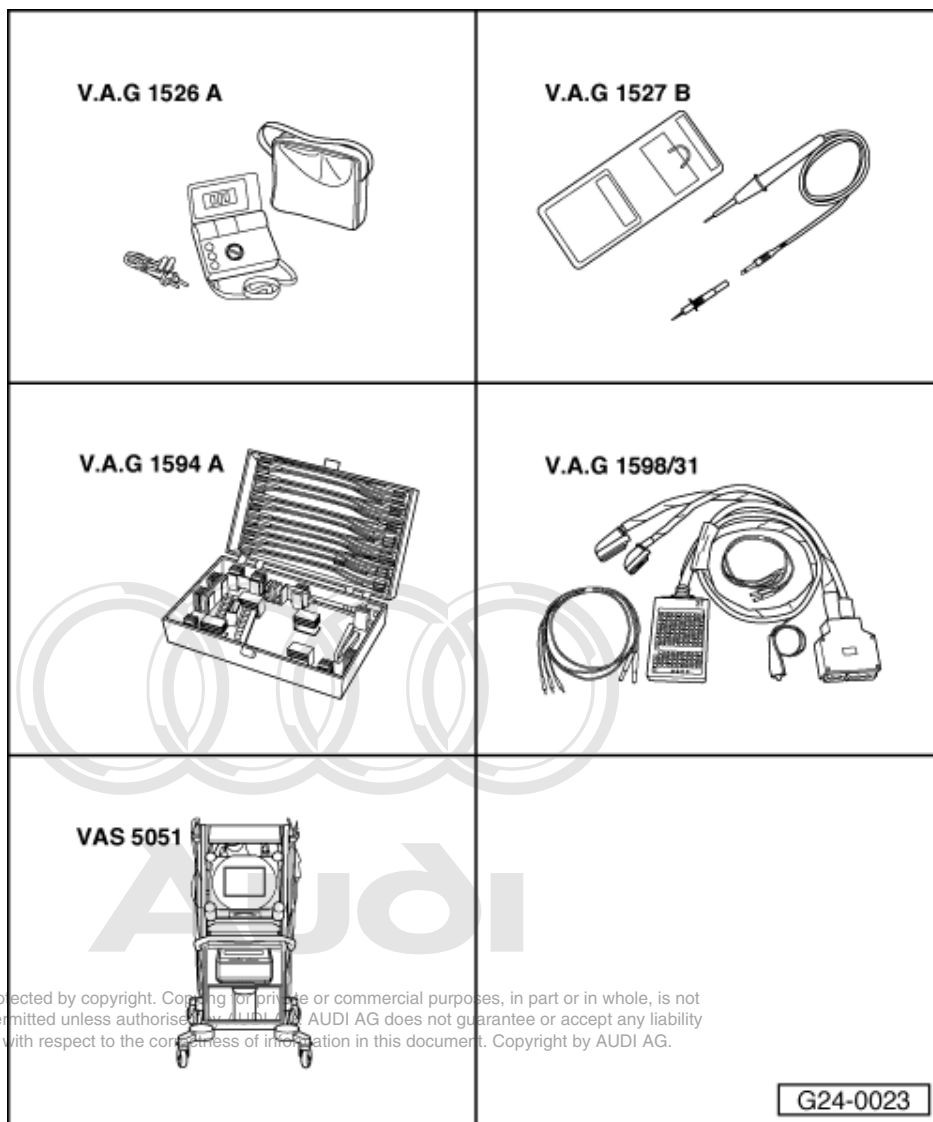
- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598/31 Socket
3	39

- Rectify any open/short circuit as necessary.

5 - Checking auxiliary signals

5.1 - Checking auxiliary signals



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Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31
- ♦ VAS 5051 with VAS 5051/1

5.2 - Checking engine speed signal

Note:

The engine speed signal is output at contact 37 of the engine control unit. The signal is necessary, among other things, for the engine speed display in the dash panel insert.



- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/31 Socket	Instrument cluster: Contact
37	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

5.3 - Checking vehicle speed signal

Notes:

- ♦ The speed signal is generated by the speedometer sender -G22 (at the gearbox) and processed in the dash panel insert.
- ♦ The processed signal goes to contact 54 on the engine control unit and is used for idling speed stabilisation and for the damping of load change jolts when changing gear.

Test requirements:

- Speedometer function and display OK, fault-finding:

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

Test sequence

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Important

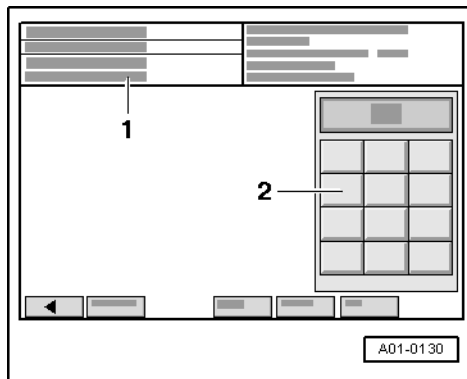
To avoid danger of accident when performing measurement and test drives, observe safety precautions => Page 45 .

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "005" for "display group number 005" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Take vehicle for a test drive and check whether the vehicle speed appears in display zone -3-.
- If the road speed does not appear, raise the vehicle (preferably using a lifting platform) until the front left wheel is clear of the ground.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .
- Connect voltage tester V.A.G 1527 B to sockets 3 (positive) and 54 (vehicle speed signal) of test box V.A.G 1598/31.
- Switch on the ignition and turn the front left wheel by hand.
 - The diode test lamp should flash (very brief flashes).

If LED does not flash: 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.

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

Test box V.A.G 1598/31 Socket	Instrument cluster: Contact
54	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

5.4 - Checking air conditioner compressor shut-off

Notes:

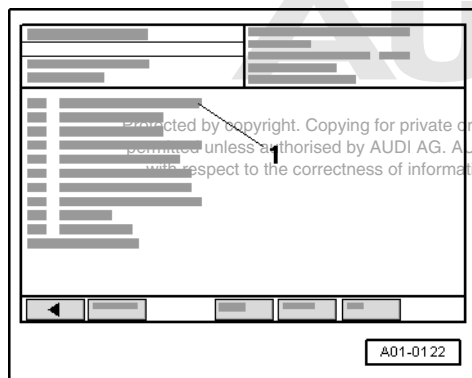
- ♦ The air conditioning compressor signal informs the engine control unit that the compressor will be switched on in 140 ms.
- ♦ The engine control unit can send a signal via the same wire to shut off the air conditioner compressor.
- ♦ The engine control unit will shut off the air conditioning compressor in the following cases:
 - During powerful acceleration (full throttle in first gear)
 - In the emergency program (emergency running mode)
 - After initiating of basic setting (Function 04)

Test requirements:

- Air conditioning system OK
- No faults stored in fault memory of engine control unit
- Vehicle at ambient temperature (warmer than + 15 °C)

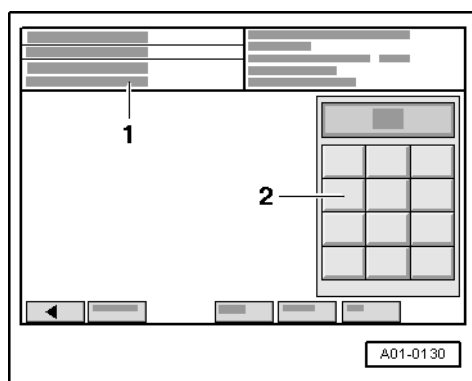
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



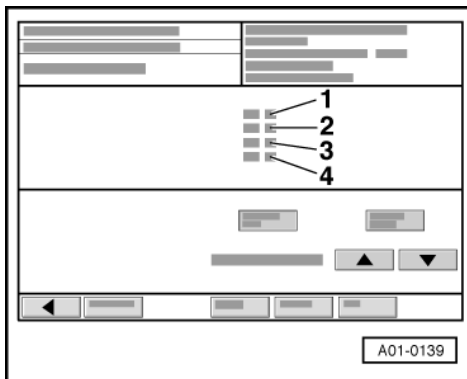
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



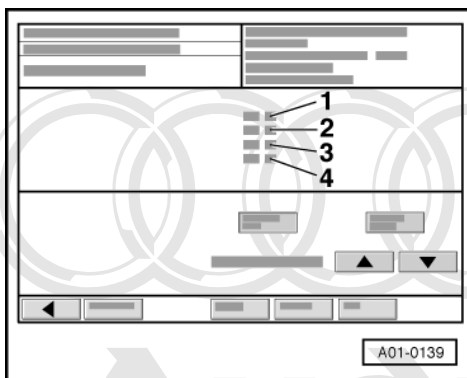
-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "050" for "display group number 050" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Switch off air conditioner.
 - Specified value in display zone -4-: Compr. OFF
- Switch on air conditioning with "auto" button and set air conditioning to maximum cooling/heating. The compressor must run.
 - Specified value in display zone -4-: Compr. ON
- Fully depress accelerator pedal suddenly and release again (brief burst of throttle).



-> Display on VAS 5051:

- Specification in display zone -4-: Display switches for several seconds from "Compr. ON" to "Compr. OFF" (compressor shut-off on vehicle acceleration)

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If the readout in display zone is not as described:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/31 Socket	Operating and display unit -E87 Contact
41	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.
- If there are no faults in the wiring, check the operation of air conditioning.

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

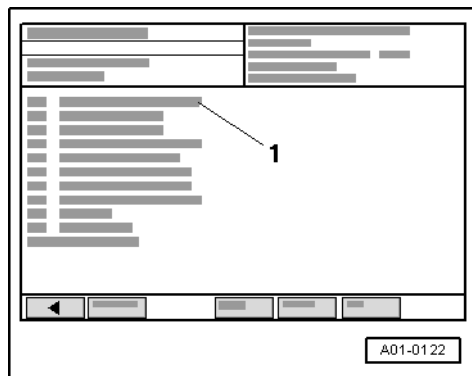


5.5 - Checking power steering pressure switch -F88

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

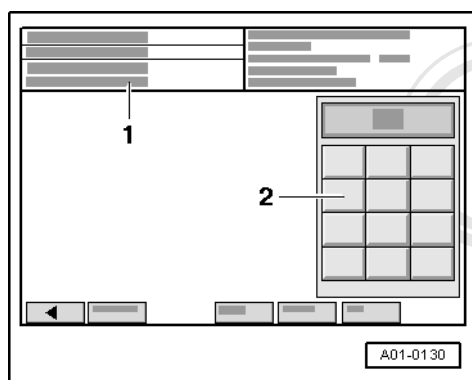
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".

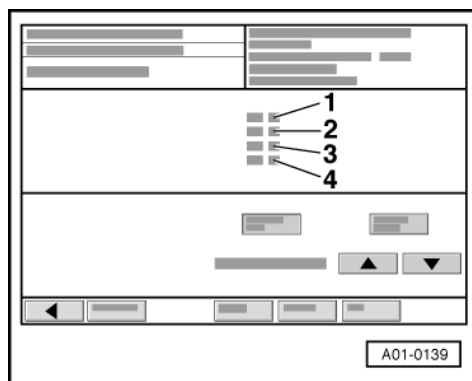


-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

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- Enter "056" for "display group number 056" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

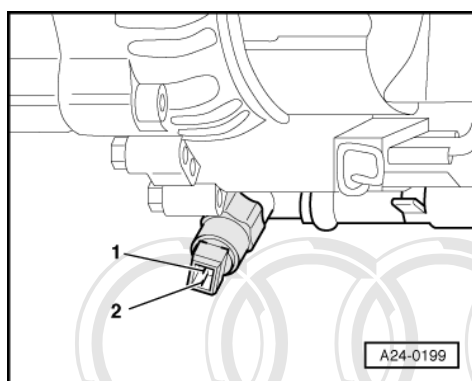
- Check the power steering pressure switch in display zone-4-

	Display zones			
	1	2	3	4
Display group 056: Idling stabilisation when idling at operating temperature				
Display	xxx rpm	xxx rpm	x.x %	X X X X X
Display	Engine speed (actual)	Engine speed (specified)	Idling speed control Change in torque	Operating conditions
Range				0XXXX 1XXXX
Specified value				▪ Steering in straight-ahead position or slightly off-centre: 0XXXX
				▪ Full steering lock or fast steering movement: 1XXXX
Note:				Value: X = no meaning

If the display is not as described:

Check switch

- Unplug the connector for power steering pressure switch -F88 at the power steering pump.



- -> Connect multimeter to switch to measure resistance.
- Start the engine.
 - Specified value: $\infty \omega$ (no continuity)
- Turn the steering wheel to full lock position to right/left.
 - Specified value: approx. 0ω

If the display does not change:

- Replace the power steering pressure switch -F88.

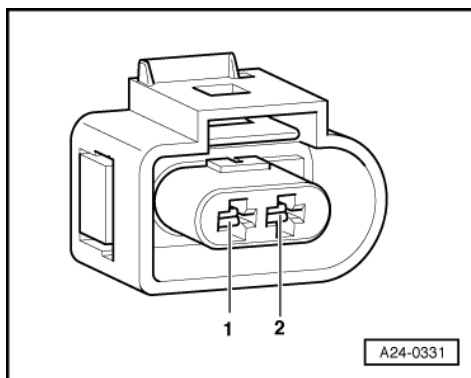
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If the display changes:

- Check the wiring connections
=>Page 161 .

Checking wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
1	49
2	50

- Rectify any open/short circuit as necessary.

5.6 - Checking wiring for crash signal

The engine control unit receives the crash signal ("Crash cut-off was activated") from the airbag control unit.

The airbag control unit sends the crash signal to the engine control unit (during an accident or if a final control diagnosis is carried out relating to the airbag system), the engine control unit switches off the fuel pump, which stops the engine. It can however be restarted (e.g. to move vehicle out of danger area)

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/31 Socket	Control unit for Airbag -J234 Contact
67	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.
- => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

If no wiring fault is detected:

- Interrogate fault memory of airbag control unit:

=> Body, Self-diagnosis; Repair group 01; Self-diagnosis of airbag system BTU (Basic Triggering Unit) with side airbag; Interrogating fault memory Self-diagnosis of airbag system BTU (Basic Triggering Unit) with side airbag Interrogating fault memory

5.7 - Checking consumption signal for vehicle computer

Note:

The consumption signal is transferred to the dash panel insert via CAN bus by the engine control unit. Check the data exchange between engine control unit and other CAN-control units =>Page **163**

5.8 - Checking fuel level signal wiring

Notes:

- ◆ The signal is used for finding the cause for certain recognised faults (e.g. misfiring).
- ◆ The signal for fuel tank level is transferred from the dash panel insert via CAN bus to the engine control unit. Check the data exchange between engine control unit and other CAN-control units =>Page **163**

5.9 - Checking the data exchange between engine control unit and other CAN-capable control units

Notes:

- ◆ Data is exchanged between individual control units by means of a bus system.
- ◆ "CAN bus" is used to describe a system that transports and distributes data.
- ◆ The wires between the control units that are used to transfer the data are known as signal wires.
- ◆ Data is transmitted via data wires in sequence, i.e. in a specific order to the connected control units (e.g. engine rpm and accelerator pedal position).

Checking the bus system

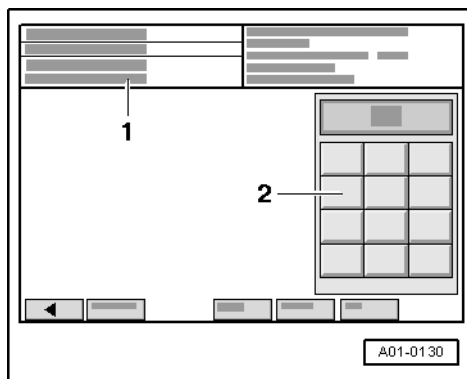
The fault table instructed you to check the data exchange between the engine control unit and CAN-capable control units.

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the ignition must be switched on.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".





-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

Note:

The measured value blocks 125 and 126 indicate CAN drive users.

- Enter "125" for "display group number 125" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check displays in display zones -1- to -4-.

CAN-capable control units are displayed with the engine control unit:

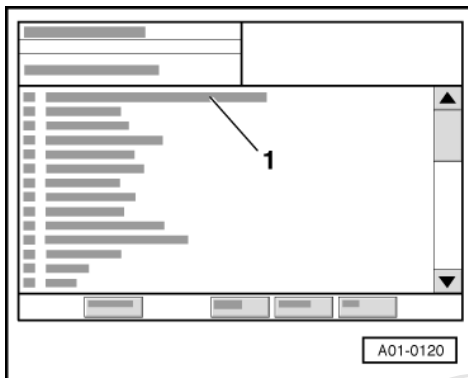
- No display: Engine control unit not CAN-capable
- Display 1: CAN-capable control unit is a data bus user
- Display 0: CAN-capable control unit is not user of the Databus
- Select the font=symbol charset=fontspecific code=115 TeX="\sigma ' descr='[\sigma]' -key in order to change to display group 126.
- Check in the same way with display group number 126.



- Exit the function "08 - Read measured value block" by pressing the ↵ key.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "06 - End output".



-> Display on VAS 5051:

- Under -1- select the diagnostic function "00 - interrogate fault memory - whole system".
- The fault memory is then interrogated for all systems in the vehicle which are capable of self-diagnosis

If a control unit answers with its identification, the number of faults stored or "No fault detected" appears on the display.

Any system faults that are stored are displayed successively. The VAS 5051 will then transmit the next address word.

If a fault is displayed relating to "Data bus drive" or "...CAN bus":

- Check that the engine control unit and other CAN-capable control units installed are suitable for this vehicle (part no. and code).

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If the correct control units are installed:

- Check that multiple connectors for control units are properly seated.

If the multi-pin connectors are firmly seated:

- Check the CAN bus system.

Checking a "two-wire bus system"

The communication between three or more control units is carried out over a "two-line bus system".

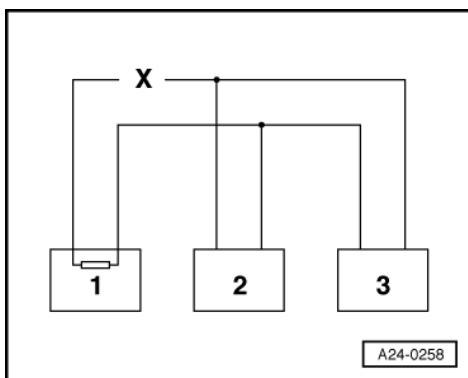
- Evaluate the faults stored in the control units.

Note:

This helps to localise wiring faults.

Example 1:

The faults stored in the fault memories indicate that the control unit 1 does not communicate with control units 2 and 3.





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

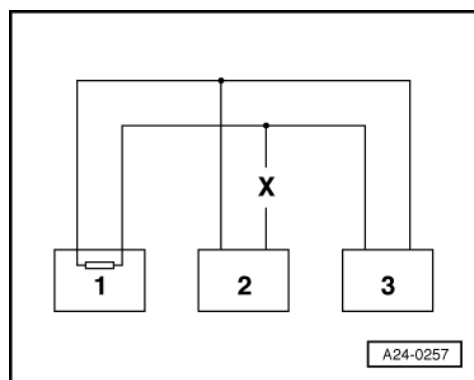
- Switch ignition off.
- Disconnect the control units linked to one another via the bus wires and investigate whether there is an open circuit between the bus wires.

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

- If no fault can be detected in the bus wires exchange control unit 1.

Example 2:

The faults stored in the fault memories indicate that the control unit 2 does not communicate with control units 1 and 3.



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

- Switch ignition off.
- Disconnect the control units linked to one another via the bus wires and investigate whether there is an open circuit between the bus wires.

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

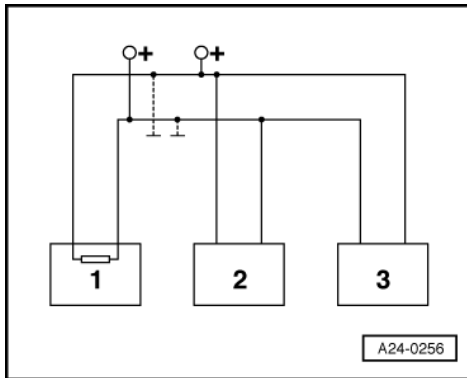
- If no fault can be detected in the bus lines exchange control unit 2.

Example 3:

The faults stored in the fault memories indicate that sending or receiving is not possible in any of the control units.

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

- Switch ignition off.



- -> Disconnect the control units that are linked to one another by the bus wires and check the bus wires for short circuits to positive and earth.

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

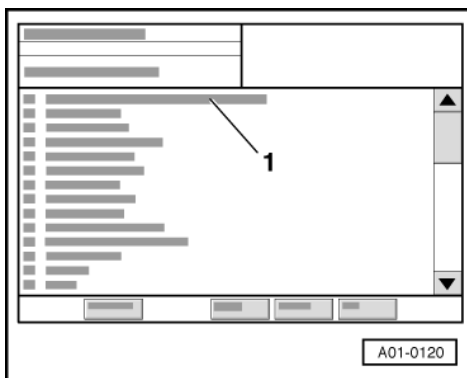
If cause of fault "Data bus drive defective" cannot be found in bus lines check whether one of the control units is responsible for the fault.

Test requirements:

- Vehicle diagnosis, measurement and information system VAS 5051 connected and vehicle self-diagnosis selected => Page 1 .

All the control units that communicate via the CAN data bus are still disconnected. Ignition is switched off.

- Connect one of the control units.
- Switch the ignition on.



-> Display on VAS 5051:

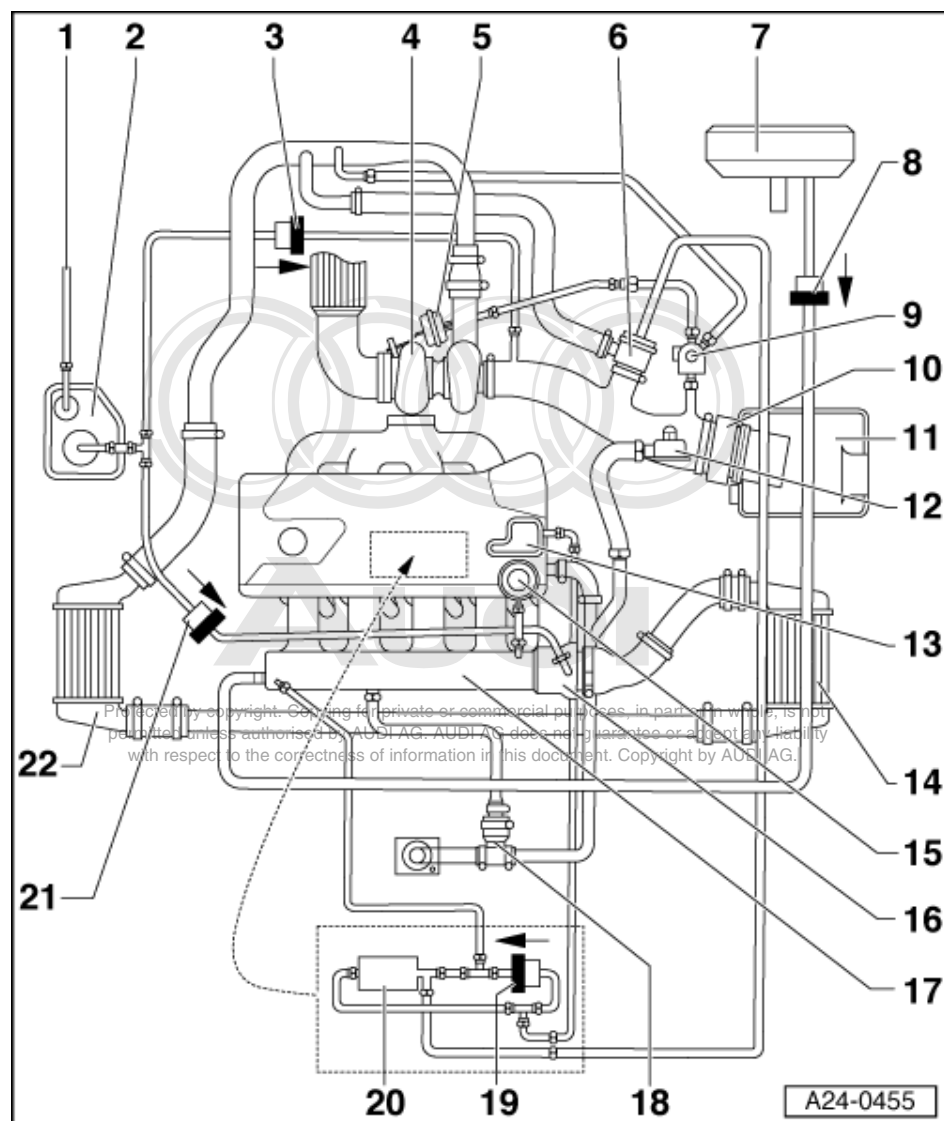
- Select the applicable vehicle system under -1-.
- Interrogate and erase fault memory in the control unit which has just been connected.
- Press the ◀ key.
- Under -1- select the diagnostic function "06 - End output".
- Switch the ignition off and then on again.
- Leave the ignition switched on for 10 seconds. Then interrogate the fault memory of the control unit that has just been connected, using the fault reader.
- If the fault "Data bus drive defective" is now indicated, replace the control unit which has just been connected.
- If fault "Signal wire defect" is not read out, connect the next control unit and repeat the procedure.



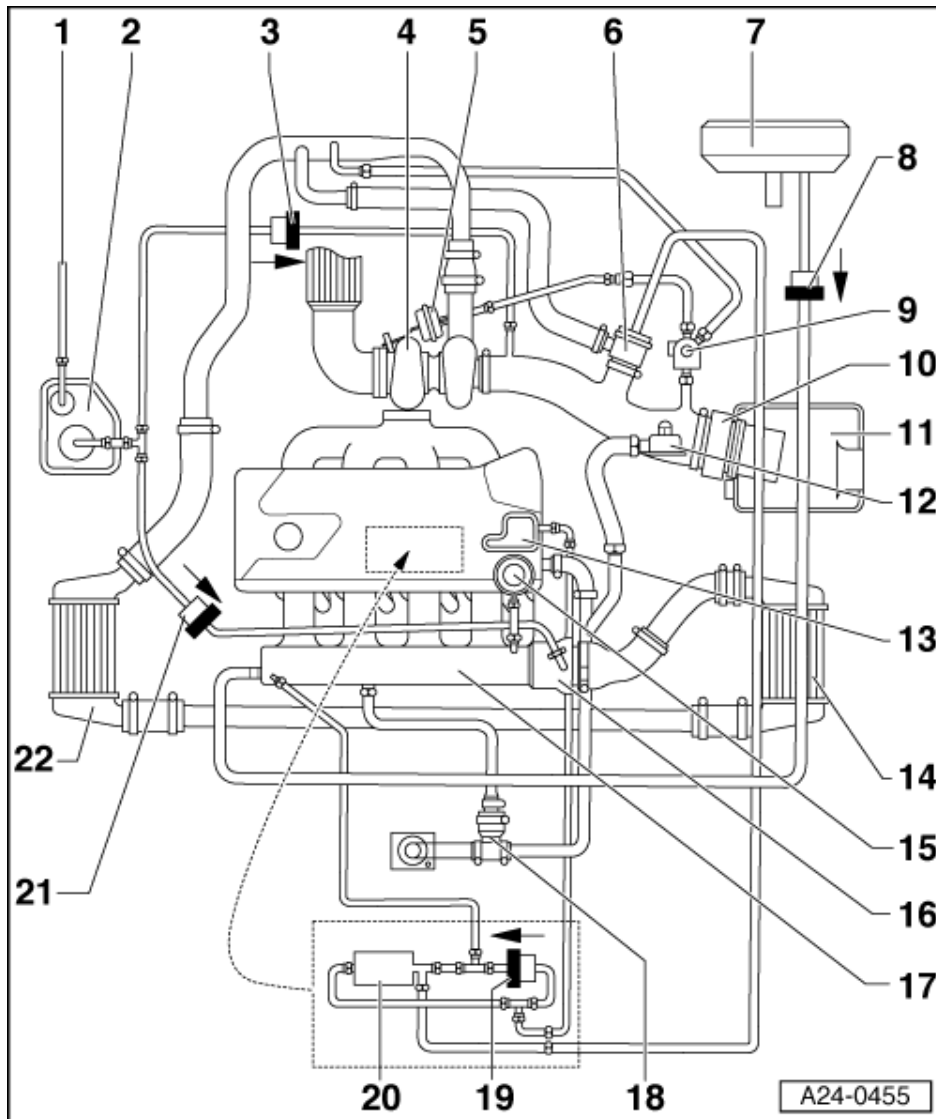
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6 - Vacuum diagram

6.1 - Vacuum diagram



- 1 From fuel tank
- 2 Activated charcoal filter
 - ♦ with solenoid valve 1 for actuated charcoal filter -N80
- 3 Non return valve for ACF
 - ♦ between ACF and intake manifold in front of exhaust turbocharger
 - ♦ Note installation position (light side/ dark side) as shown in Fig, arrow faces in direction of flow
- 4 Turbocharger
- 5 Vacuum unit for boost pressure control
- 6 Mechanical air recirculation valve



7 Brake servo

8 Non-return valve

- ♦ between brake servo and intake manifold
- ♦ Note installation position (light side/ dark side) as shown in Fig, arrow faces in direction of flow

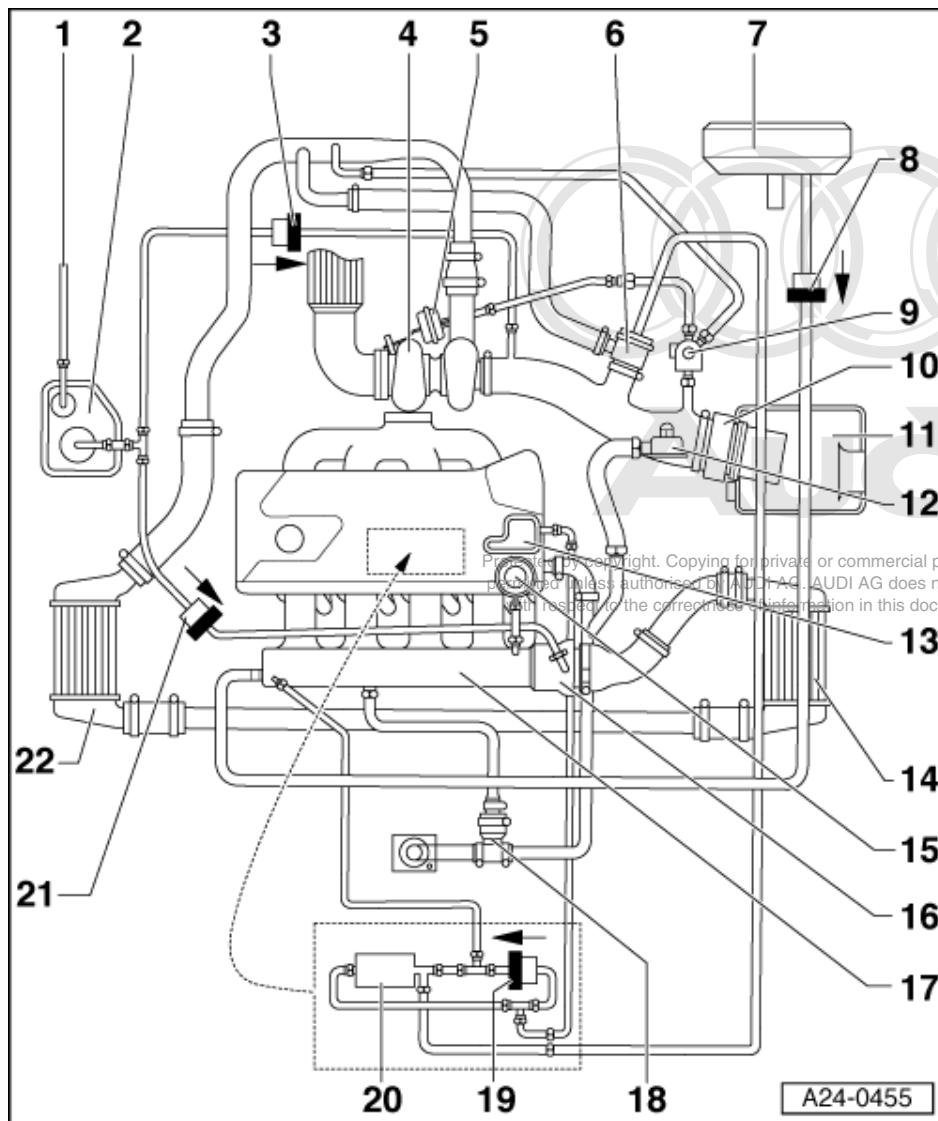
9 Boost pressure control solenoid valve N75

10 Air mass meter -G70

11 Air cleaner

12 Crankcase breather pressure regulating valve

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13 Vacuum reservoir

- ♦ screwed onto cylinder head cover

14 Charge air cooler

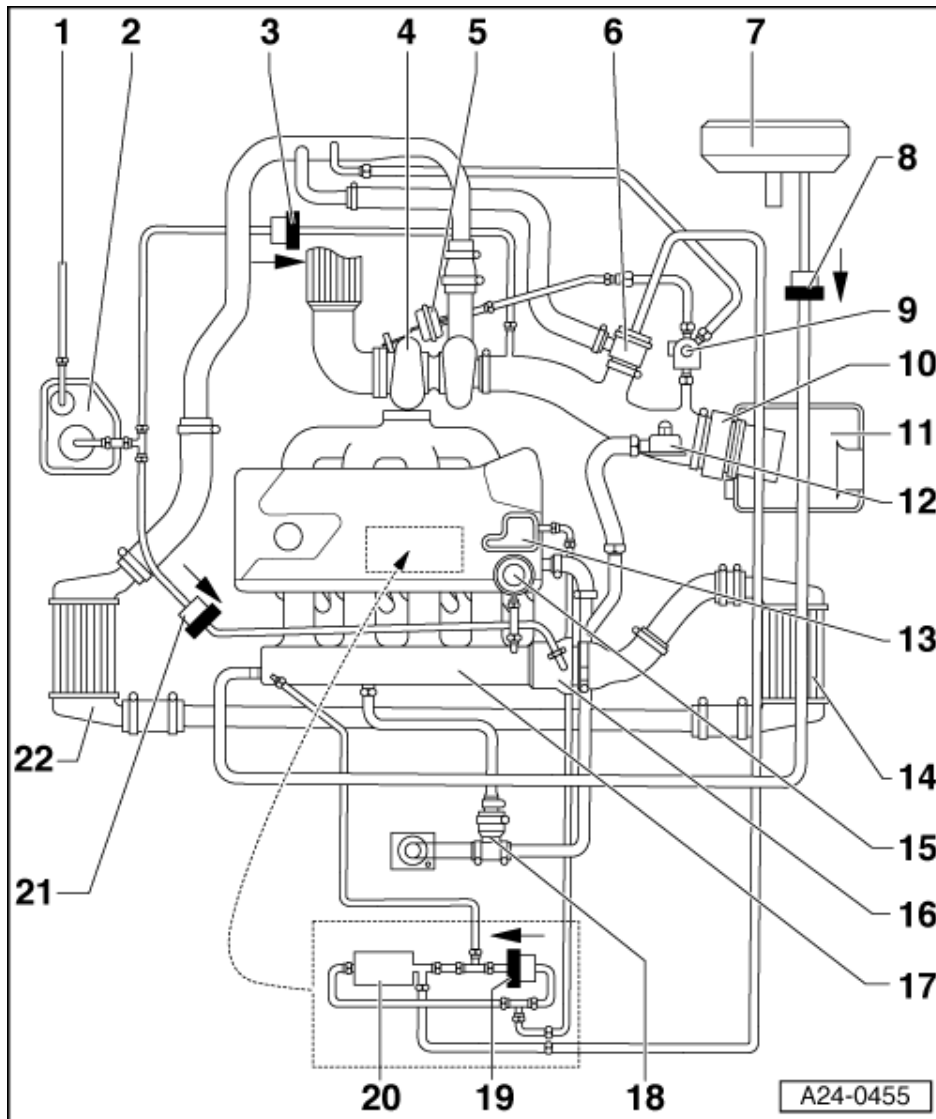
- ♦ with boost pressure sender - G31

15 Fuel pressure regulator
16 Throttle valve control part -J338
17 Inlet manifold

- ♦ With intake air temperature sender -G42

18 Crankcase breather
19 Non-return valve

- ♦ Note installation position (light side/ dark side) as shown in Fig, arrow faces in direction of flow



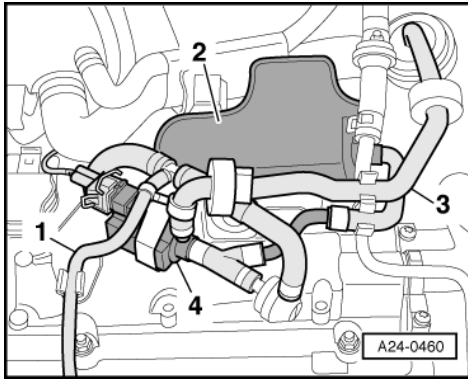
**20 Air recirculation valve for turbocharger
-N249**

- ◆ Fitting location
=> Fig. 172

21 Non-return valve

- ◆ between ACF and intake manifold
- ◆ Note installation position (light side/ dark side) as shown in Fig, arrow faces in direction of flow

22 Charge air cooler



-> Fig.1 Fitting location of air recirculation valve for turbocharger -N249

- ♦ Fitting location: On the cylinder head cover

- 1 - To connection on intake manifold
- 2 - Vacuum reservoir
- 3 - Mechanical air recirculation valve
- 4 - Air recirculation for turbocharger -N249



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28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

1.2 - General notes on ignition system

- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ◆ A voltage of at least 12.7 V is necessary for satisfactory functioning of the electrical components.
- ◆ In the case of some tests, a fault may be recognised and stored by the control unit. At the end of all tests and repairs, therefore, the fault memory should be interrogated and, if necessary, erased.
- ◆ If the engine starts briefly and then stops after fault search, repair or tests on components, this may be because the immobiliser is blocking the engine control unit. The fault memory must then be interrogated and, if necessary, adaption carried out on the control unit.

1.3 - Safety precautions

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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 ignition system wiring. This also applies to HT cables and measuring instrument leads.
- ◆ To run engine at starting speed without actually starting it (for example, in order to test compression), unplug connector from the output stage of the ignition coils and also the connectors on the injectors.
- ◆ In the case of some tests, a fault may be recognised and stored by the control unit. At the end of all tests and repairs, therefore, the fault memory should be interrogated and, if necessary, erased. After erasing the fault memory the readiness code must be produced => Page 33 .
- ◆ Always switch off the ignition before washing the engine.

1.4 - Technical data

Engine code letters	AMK (1.8 l / 5V / 154 kW engine) BAM (1.8 l / 5V / 165 kW engine)
Idling speed Not adjustable - controlled by the idling speed stabilisation	700...820 rpm 1)
Engine speed limitation shuts off injectors	approx. 6800 rpm
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Ignition system	Individual coil system with 4 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs 1)	Tightening torque 30 Nm

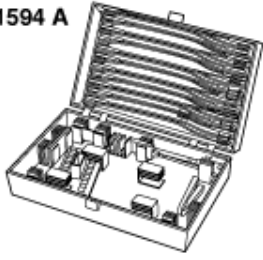


Firing order	1-3-4-2
--------------	---------

1) Current values:

=> Exhaust Emissions Test binder

1.5 - Checking ignition coils with output stages

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/31 
	G24-0022

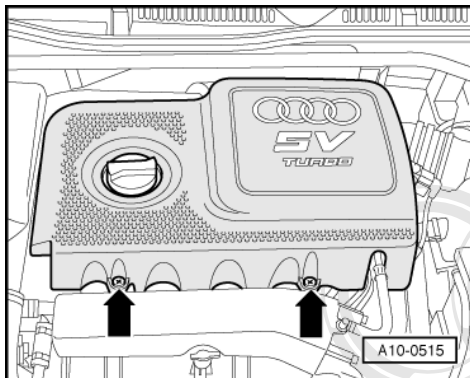
Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31

Test sequence

Note:

The ignition coil and the output stage are combined in a common component.



- -> Remove engine cover-arrows-.

Identify an inoperative or misfiring cylinder as follows:

- Test misfire detection => Page 204 .

If misfires are detected:

- Continue checking the indicated cylinder => "If the defective cylinder has been detected".

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If no misfires were detected:

- Disconnect connectors from the injectors in sequence with the engine running, and observe how the engine runs.

or

- Compare the spark plugs of all cylinders with each other and check for soot on the electrodes.

If the defective cylinder has been identified:

- Replace the spark plug of the defective cylinder with one from another cylinder.

If the fault moves with the spark plug:

- Renew the spark plug.

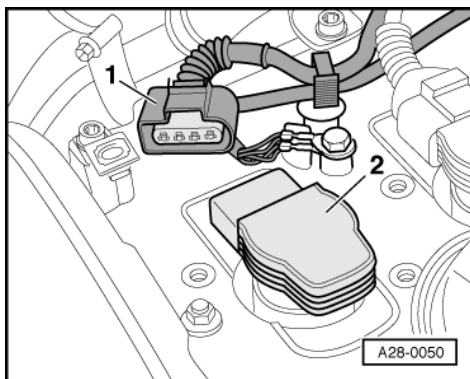
If the fault remains in the same cylinder:

- Replace the ignition coil from the defective cylinder with one from another cylinder.

If the fault moves with the ignition coil:

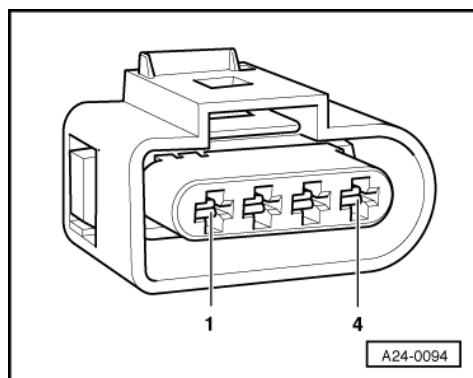
- Replace the ignition coil.

Checking earth connection





- -> Unplug 4-pin connector -1- from ignition coil -2-.



- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
2	Battery positive
4	Battery positive

- The LED should illuminate.

If the LED does not illuminate:

- Check the wiring connections.

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

If the LED illuminates:

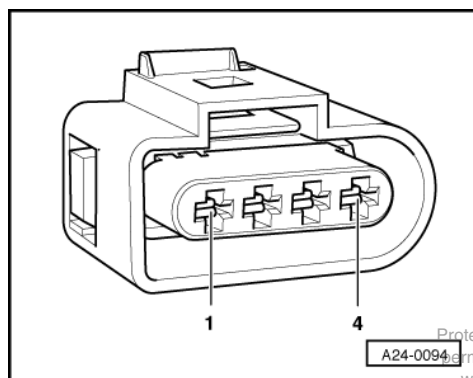
- Check the power supply.

Checking power supply

Test requirements:

- Fuses for engine electronics OK

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



- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
-------------------	------------

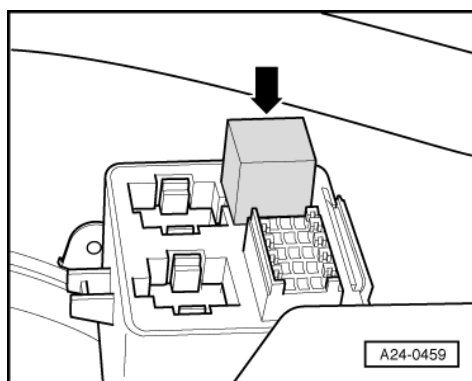
1	Engine earth
---	--------------

- Switch the ignition on.
 - Specified value: approx. battery voltage

If specified value is attained:

- Check actuation of output stages => Page 177 .

If specified value is not attained:

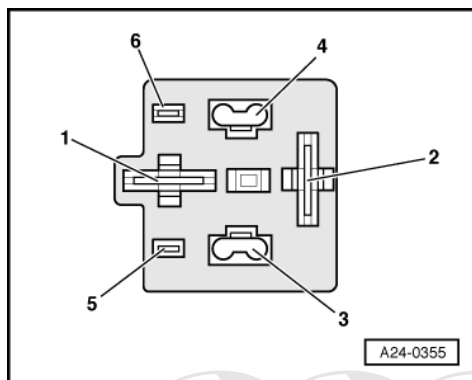


- -> Disconnect the power supply relay -1- under left cover at the bulkhead.

Note:

To remove the protective cover in vehicles with dome strut, detach and lower relay holder at the bulkhead. If necessary, unplug connectors from air mass meter.

- Carry out the following tests (marked with dots):



- -> Check the wiring from the relay carrier under the left cover at the bulkhead, contact 2, to connector at the ignition coil, contact 1.
- Check power supply relay for Motronic -J271 => Page 179 .

If specified value is attained:

- Check actuation.

Checking actuation of power output stages

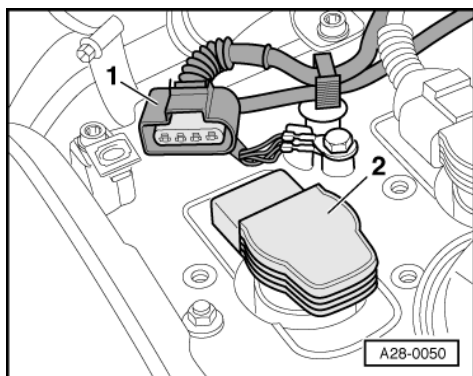
- Unplug connectors from all injectors.

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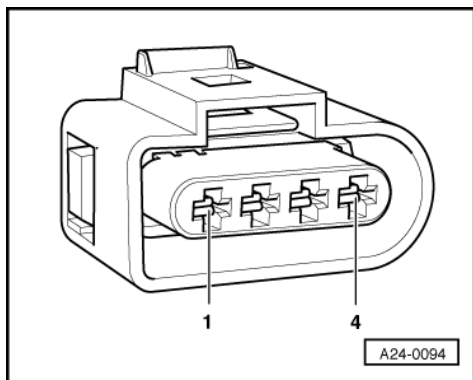


Note:

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.



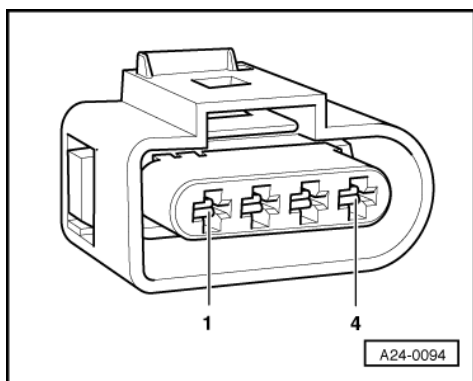
- -> Unplug 4-pin connector -1- from ignition coil -2-.



- -> Connect voltage tester V.A.G 1527 B to contacts 2 and 3 of the connector.
- Operate starter briefly.
 - The diode test lamp should flash (brief flashes).

If the specified values are not obtained:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

Connector Contact	Test box V.A.G 1598/31 Socket
3 (cyl. 1)	102
3 (cyl. 2)	95

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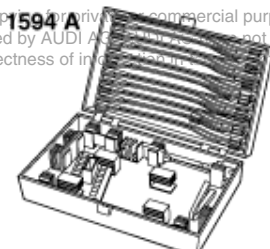
Connector Contact	Test box V.A.G 1598/31 Socket
3 (cyl. 3)	103
3 (cyl. 4)	94

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace the common component ignition coil with output stage.

1.6 - Checking power supply relay for Motronic system -J271

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	
	G24-0020

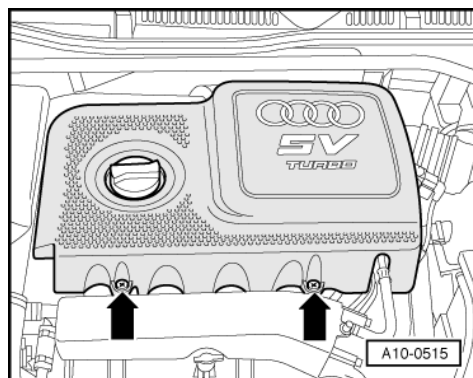
Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/31



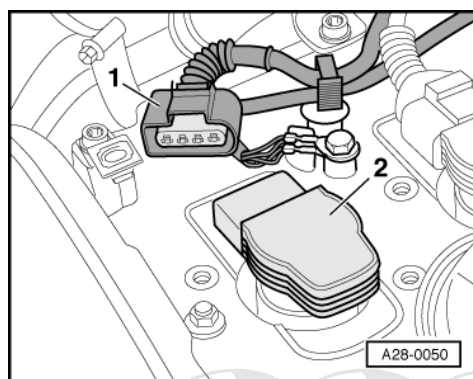
Note:

The power supply relay for Motronic -J271 supplies the ignition coils with output stages as well as the engine control unit on Pin 121 with voltage.

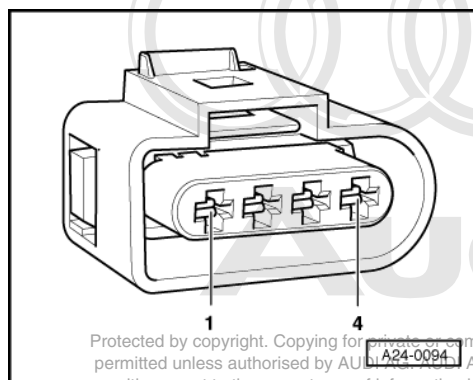


Test sequence

- -> Remove engine cover-arrows-.



- -> Unplug 4-pin connector -1- from one of the ignition coils -2-.



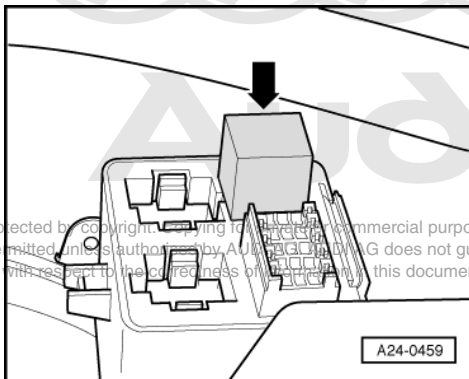
- -> Connect multimeter as follows to measure voltage.

Connector Contact	Measure to
1	Engine earth

- Switch the ignition on.
 - Specified value: approx. battery voltage

If specified value is not attained:

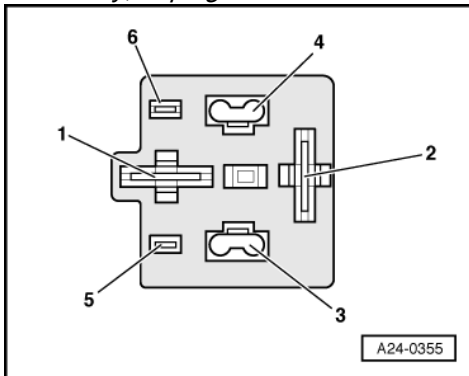
- Switch ignition off.



- -> Disconnect the power supply relay -arrow- under left cover at the bulkhead.

Note:

To remove the protective cover in vehicles with dome strut, detach and lower relay holder at the bulkhead. If necessary, unplug connectors from air mass meter.



- -> Check for open circuit in the following wiring according to wiring diagram:

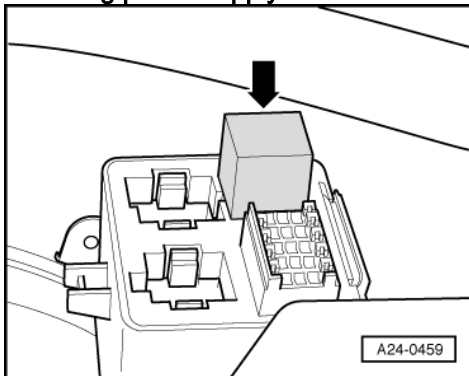
Relay carrier under left cover at the bulkhead Contact	Connection of ignition coils. Contact
2	1

- Rectify open circuit, if necessary.

If the wiring is OK:

- Check the voltage supply of the power supply relay -J171 => Page 181 .
- Check the actuation of the power supply relay -J271 => Page 183 .

Checking power supply

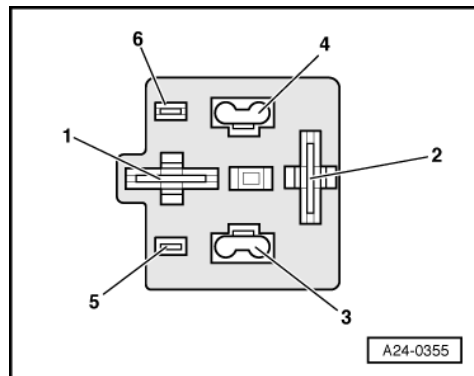




- Switch ignition off.
- -> Disconnect the power supply relay -arrow- under left cover at the bulkhead.

Note:

To remove the protective cover in vehicles with dome strut, detach and lower relay holder at the bulkhead. If necessary, unplug connectors from air mass meter.



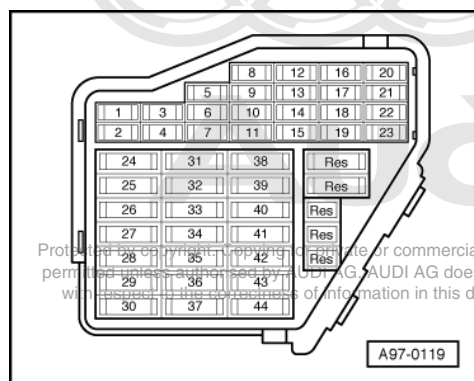
- -> Connect multimeter as follows to measure voltage.

Relay carrier under left cover at the bulkhead Contact	Measure to
1	Engine earth
3	Engine earth

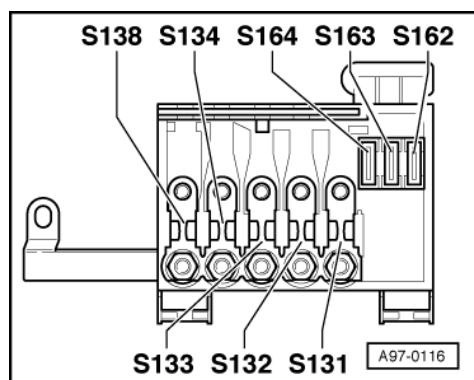
- Specified value: approx. battery voltage

If specified value is not attained:

- Carry out the following tests (marked with dots):



- -> Check fuse S10 (in fuse box, position 10).

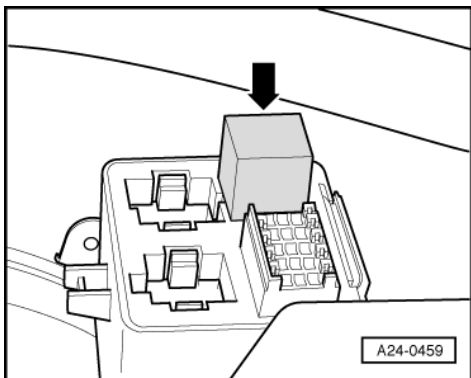


- -> Check fuse S134 (110 A) in main fuse box/battery.
- Check wiring from battery + (terminal 30) via fuse S134 and fuse 10 to power supply relay for Motronic - J271 (under left cover at bulkhead) for open circuit.

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

Checking actuation

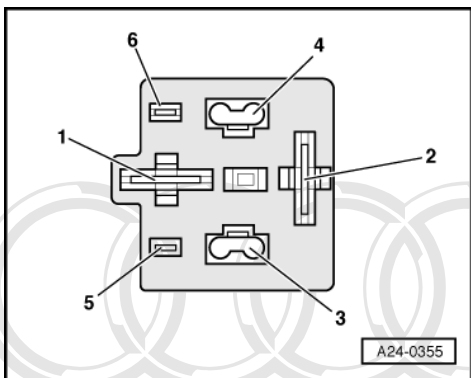
- Switch ignition off.



- -> Disconnect the power supply relay -arrow- under left cover at the bulkhead.

Note:

To remove the protective cover in vehicles with dome strut, detach and lower relay holder at the bulkhead. If necessary, unplug connectors from air mass meter.



- -> Connect multimeter as follows to measure voltage.

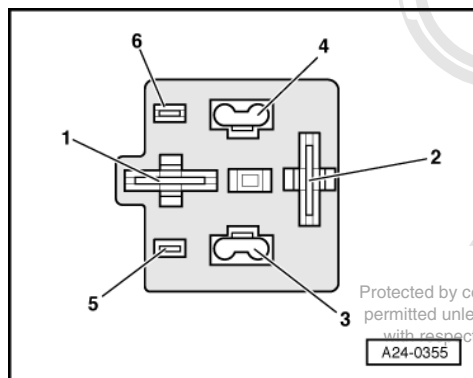
Relay carrier under left cover at the bulkhead Contact	Measure to
5	Battery positive

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- Switch the ignition on.
- Specified value: approx. battery voltage

If specified value is not attained:

- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

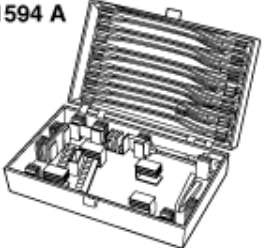
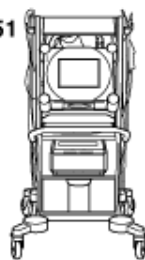
Relay carrier under left cover at the bulkhead Contact	Test box V.A.G 1598/31 Socket
5	21

- Rectify any open/short circuit as necessary.

If no fault is found:

- Replace the power supply relay -J271.

1.7 - Checking intake air temperature sender -G42

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	VAS 5051 
	G24-0021

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31
- ◆ VAS 5051 with VAS 5051/1

Fitting location => Fitting locations overview, Page **47**

Test sequence

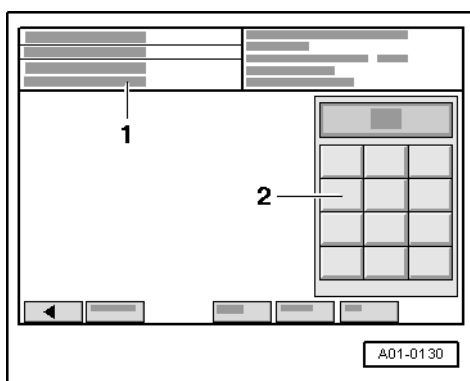
- Connect vehicle diagnostic, testing and information system VAS 5051 => Page **1** and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.

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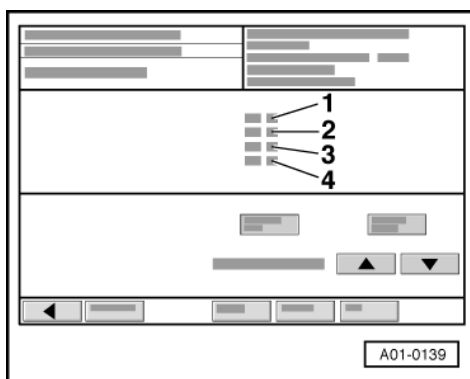
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "004" for "display group number 004" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check intake air temperature sender in display zone -4-.

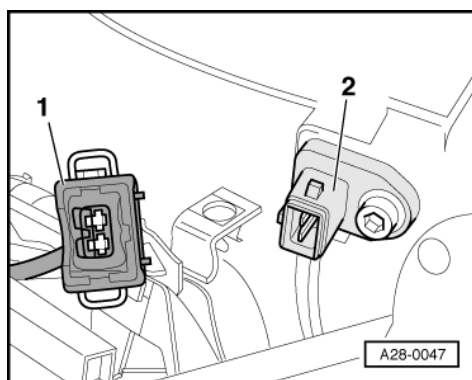
	Display zones			
	1	2	3	4

Display zones				
Display group 004: Intake air temperature with engine idling				
Display	xxxx rpm	xx.x V	xxx.x °C	xxx.x °C
Display	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Range				-48.0...143.0 °C
Specified value	xxxx rpm	12.0...15.0 V	80.0...110.0 °C	Between ambient temperature and up to 110 °C 1)

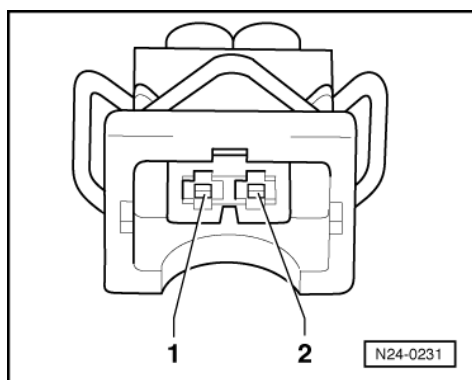
1) If a temperature is displayed which deviates greatly from the ambient temperature of the sender, check sender and sender wiring for contact resistances and open circuit.

- Exit the function "08 - Read measured value block" by pressing the ↵ key.

Checking wiring



- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59.
- -> Unplug connector -1- at coolant temperature sender -G42-2-.



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

Connector Contact	Test box V.A.G 1598/31 Socket
1	85
2	108

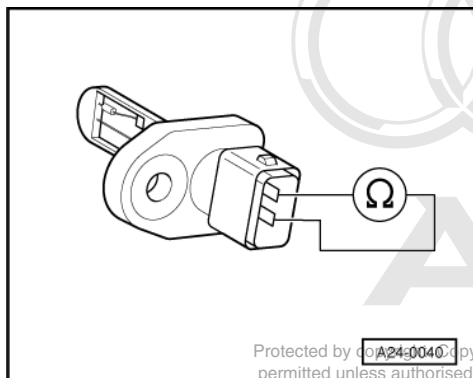
- Test for short circuits between the two wires.
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Check the intake air temperature sender.



Checking sender:



- -> Connect multimeter to sender to measure resistance.

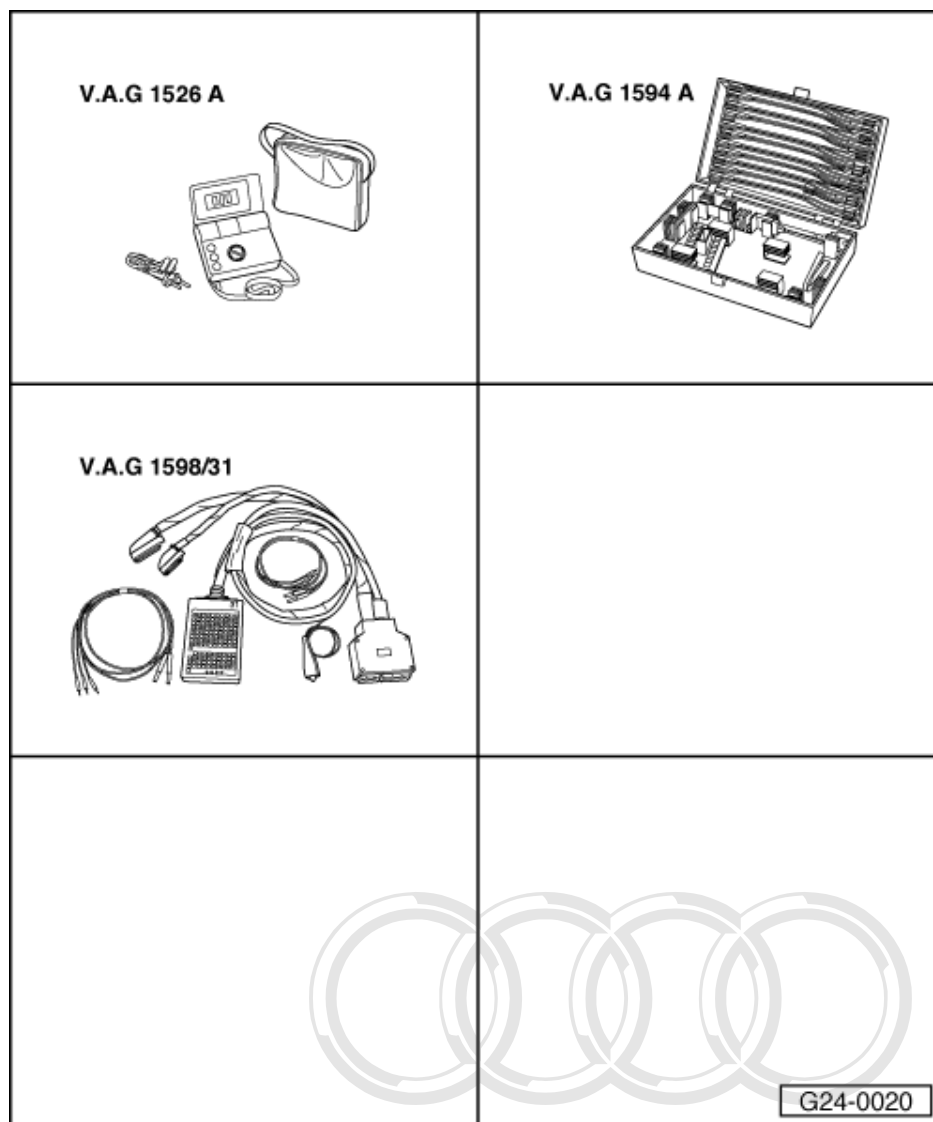
Specifications:

Temperature °C	Resistance kΩ
-20	approx. 13.8
0	approx. 5.5
20	approx. 2.4
40	approx. 1.1
60	approx. 0.6

If specified value is not attained:

- Replace intake air temperature sender.

1.8 - Checking engine speed sender -G28



Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

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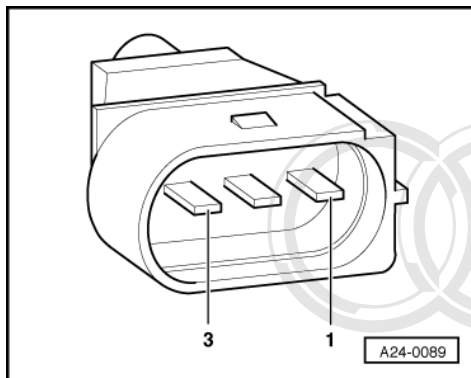
Fitting location => [Fitting locations overview, Page 47](#)

Note:

The engine speed sender is a combined speed sender and reference mark sender. The engine cannot be started without a signal from the -G28 engine speed sender. If the signal from the -G28 engine speed sender fails while the engine is running, the engine will cut out immediately.

Test sequence

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



- -> Connect multimeter between contacts 2 and 3 to measure resistance.
- Specified value: 730...1000 Ω

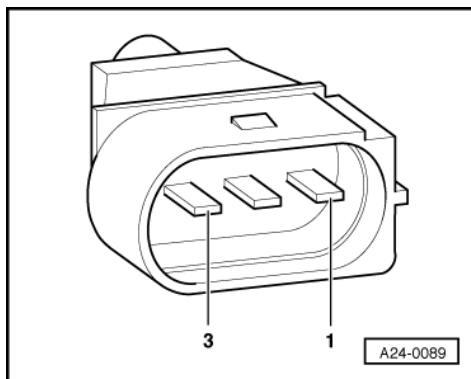
Note:

The resistance value of the engine speed sender is associated with a temperature of 20 °C. The resistance increases if the temperature increases.

If specified value is not attained:

- Fit a new engine speed sender.

If specified value is attained:



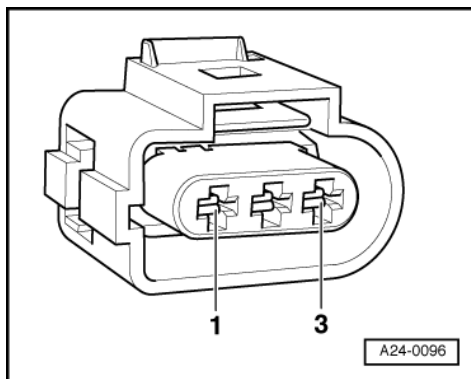
- -> Connect multimeter between contacts 2 and 1 (screen) and 3 and 1 (screen) to measure resistance.
- Specified value: each case $\infty \Omega$ (no continuity)

If specified value is not attained:

- Fit a new engine speed sender.

If specified value is attained:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

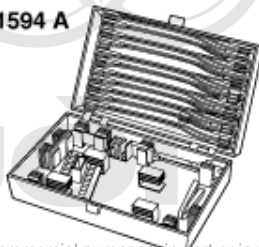
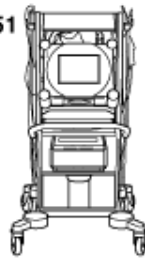
Connector Contact	Test box V.A.G 1598/31 Socket
1 (screening)	108
2 (earth)	90
3 (signal)	82

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace engine control unit => Page 64 .

1.9 - Checking coolant temperature sender -G62

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	VAS 5051 
	G24-0021

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31



- ♦ VAS 5051 with VAS 5051/1

Fitting location => Fitting locations overview, Page 47

Test requirements:

- Engine cold

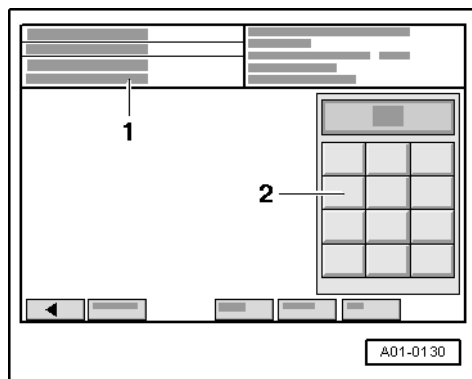
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



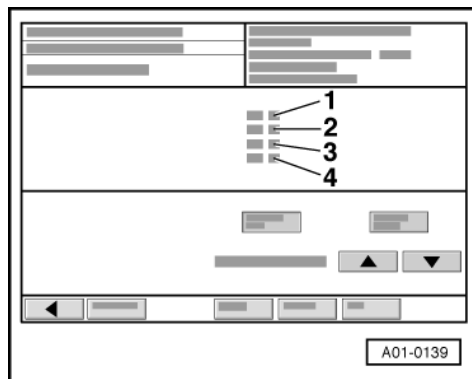
-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255
- Enter "004" for "display group number 004" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

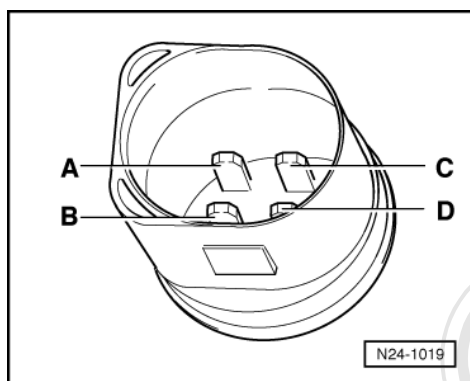
- Check coolant temperature sender in display zone -3-.

	Display zones			
	1	2	3	4
Display group 004: Coolant temperature with engine idling				
Display	xxxx rpm	xx.x V	xxx.x °C	xxx.x °C
Display	Engine speed	Battery voltage	Coolant temperature	Intake air temperature
Range			-48.0...143.0 °C	
Specified value	xxxx rpm	12.0...15.0 V	The temperature reading should increase evenly	from ambient temperature up to 110 °C

- Exit the function "08 - Read measured value block" by pressing the ◀ key.

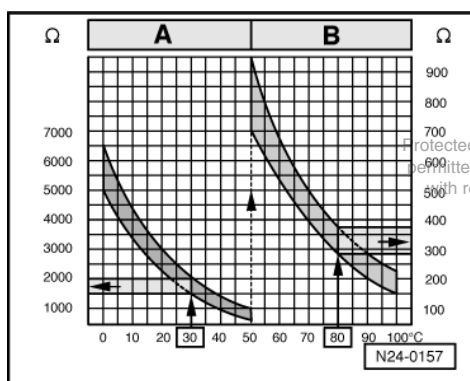
If display zone 3 shows an implausible value:

- Disconnect connector on coolant temperature sender.



- -> Connect multimeter between contacts C and D of sender to measure resistance.

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



-> Sample readings:

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

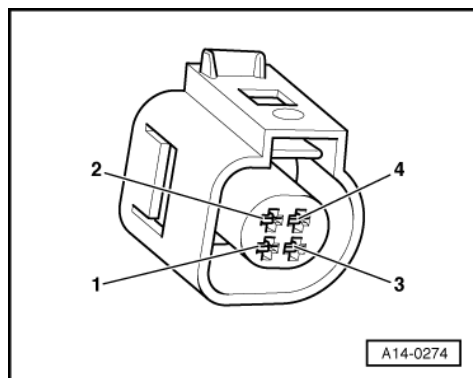
If specified value is not attained:

- Replace coolant temperature sender.



If specified value is attained:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



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

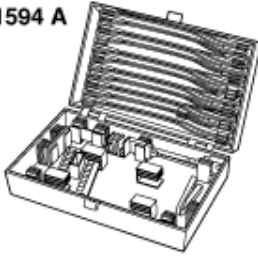
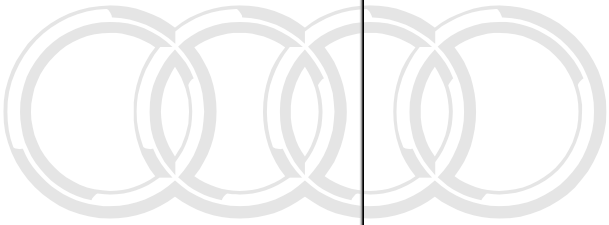
Connector Contact	Test box V.A.G 1598/31 Socket
3 (signal)	93
4	108

- Test for short circuits between the two wires.
- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace engine control unit => Page 64 .

1.10 - Checking control unit power supply

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	
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Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

Test requirements:

- Fuses for engine electronics OK

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

- Battery voltage at least 12.7 V
- Alternator OK

Test sequence

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .



Notes:

- ♦ The positive voltage supply to the engine control unit is provided via contacts 3 and 121 (terminal 15) as well as contact 62 (terminal 30).
- ♦ The earth connection to the engine control unit is provided via contact 1 and contact 2.

- Connect multimeter as follows to measure voltage:

Test box V.A.G 1598/31 Socket	Measure to
1	Battery positive
2	Battery positive
62	Engine earth

- Specified value: approx. battery voltage
- Connect multimeter as follows to measure voltage:

Test box V.A.G 1598/31 Socket	Measure to
3	Engine earth
1211)	Engine earth

1) The power supply relay for Motronic -J271 carries voltage on terminal 121 of engine control units after switching of the ignition for up to 15 minutes.

- Switch the ignition on.
- Specified value: approx. battery voltage

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If the specified values are not obtained:

- Check the wiring connections.

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

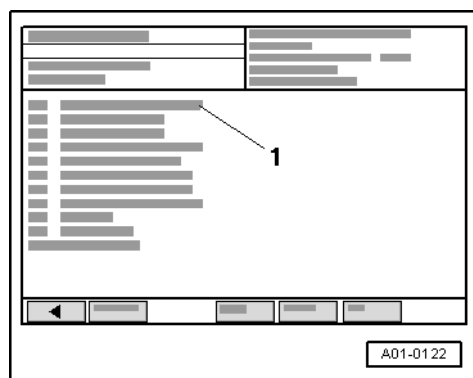
- Check power supply relay for Motronic -J271 => Page 179 .

1.11 - Checking knock control stop

If a fault entry relating to "knock control stop reached" is made, carry out the following checks:

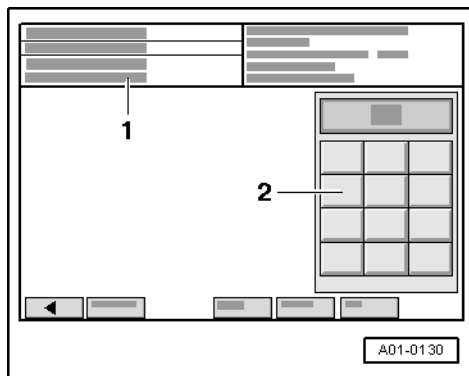
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



-> Display on VAS 5051:

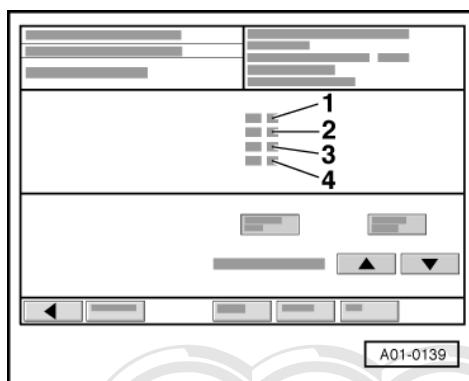
- Under -1- select the diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

1 - Enter display group
max. input value = 255

- Enter "020" for "display group number 020" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check the knock control in display zones -1- to -4-.

	Display zones			
	1	2	3	4
Display group 020: Ignition knock control during driving				
Display	xx.x° KW	xx.x° KW	xx.x° KW	xx.x° KW
Display	Ignition angle retardation cylinder 1 through Knock control	Ignition angle retardation cylinder 2 through Knock control	Ignition angle retardation cylinder 3 through Knock control	Ignition angle retardation cylinder 4 through Knock control
Specified value	0...11.25 °crankshaft	0...11.25 °crankshaft	0...11.25 °crankshaft	0...11.25 °crankshaft
Note:	Evaluation => Page 198			

Note:

The numbers displayed in display zones 1 to 4 represent the actual ignition timing retardation due to the knock control of the individual cylinders. The ignition angle retardation is carried out late in°KW (crankshaft degree).



- Exit the function "08 - Read measured value block" by pressing the ◀ key.

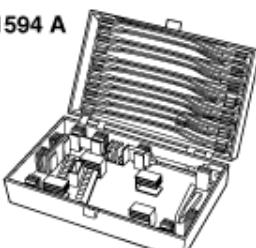
Evaluation ignition angle retardation.

Indicated on display	Possible causes of fault	Fault remedy
All cylinders greater than 11.25 ° KW	- Knock sensor defective	- Check knock sensor => Page 199
	- Connector corroded	
	- Knock sensor incorrectly tight-ened	- Loosen knock sensor and tighten to 20 Nm.
	- Loose components on engine	- Secure components
	- Poor fuel quality	- Change fuel quality (see operating instructions)
One cylinder deviates significantly from the others	- Connector corroded	- Check knock sensor => Page 199
	- Engine fault	- Check compression: => Repair group 15; Removing and installing cylinder head; Check compression Check compression
	- Loose components on engine	- Secure components



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1.12 - Checking knock sensors

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/31 	
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Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

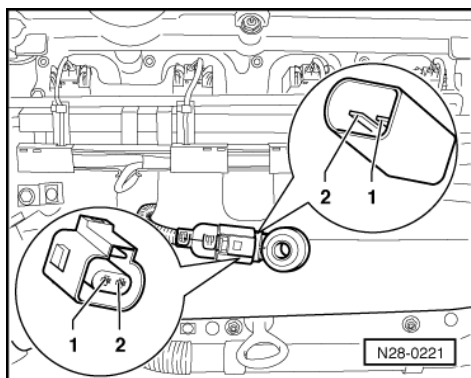
Fitting location => Fitting locations overview, Page **47**

Notes:

- ◆ The knock sensors -G61 and -G62 cannot themselves be tested electrically.
- ◆ Use only gold-plated contacts when repairing the cable connectors for the knock sensors.
- ◆ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ◆ Check connector between knock sensor and wiring harness for corrosion.

Test sequence

- Remove the knock sensor.



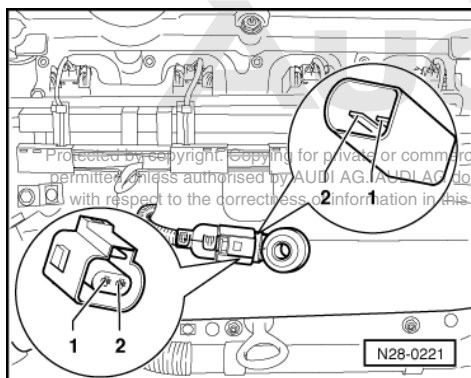
- -> Detach connector.
- Connect multimeter between contacts 1 and 2 on knock sensor to measure resistance.
 - Specified value: $\infty \omega$ (no continuity)

If specified value is not attained:

- Replace the knock sensor.
 - Tightening torque: 20 Nm

If specified value is attained:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:



- -> Knock sensor 1 -G61 (cylinders 1/2)

Connector Contact	Test box V.A.G 1598/31 Socket
1 (signal)	106
2 (earth)	99

- Knock sensor 2 -G66 (cylinders 3/4)

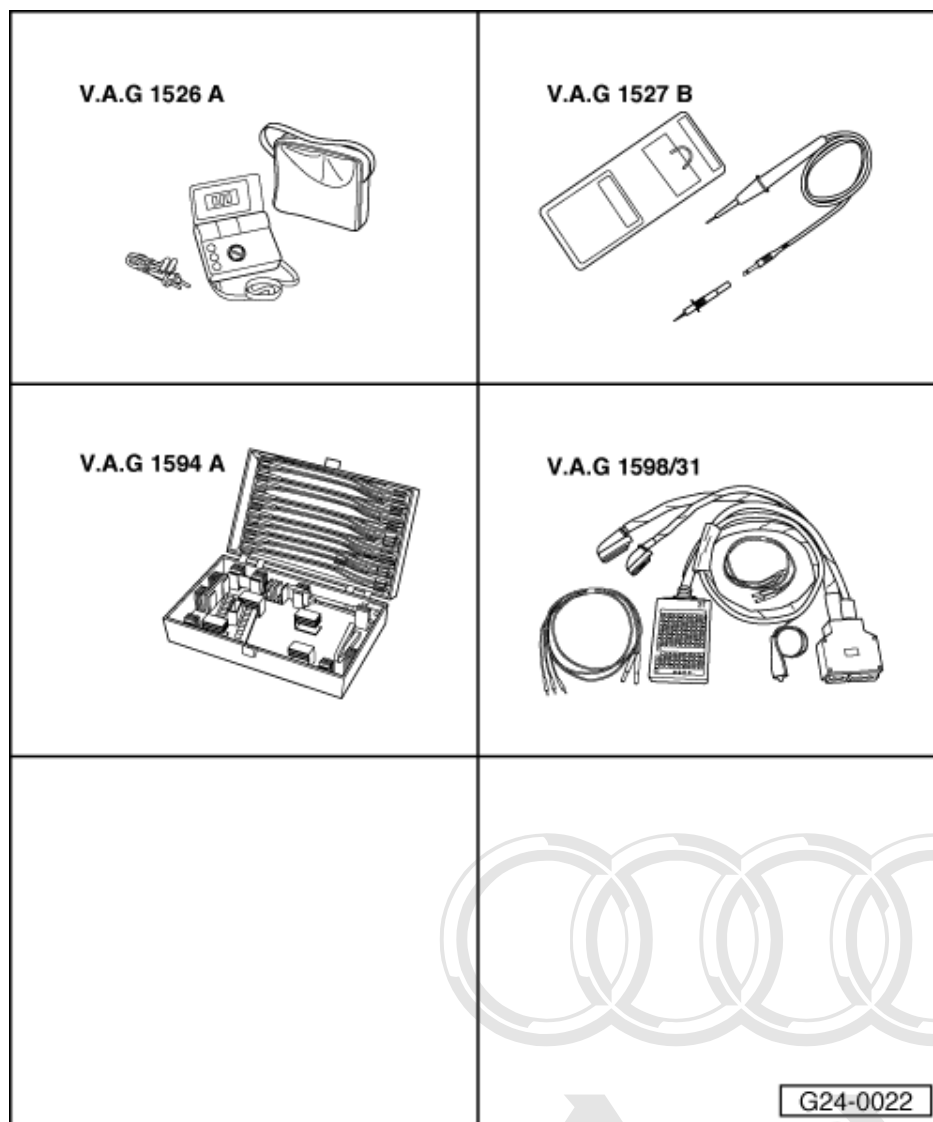
Connector Contact	Test box V.A.G 1598/31 Socket
1 (signal)	107
2 (earth)	99

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace engine control unit => Page 64 .

1.13 - Checking Hall sender -G40



Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/31

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Fitting location => Fitting locations overview, Page **47**

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. Furthermore, the boost pressure of the turbo-charger is lowered.

Even without a signal from the Hall sensor, the engine will continue to run and can also be re started.

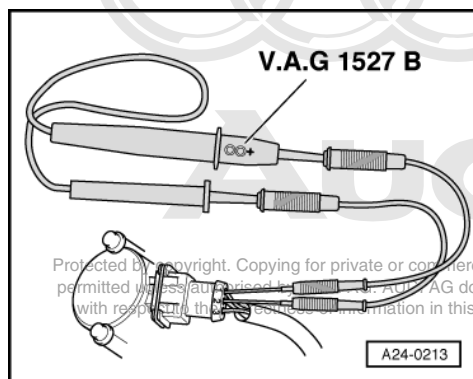
- ◆ When a fault is detected, the engine control unit produces one spark for each cylinder on every crankshaft revolution.



- ♦ The fact that the control unit is out of phase by one engine revolution does not have any noticeable effect on the injection system. Injection is "advanced" (when the inlet valves are closed) rather than when the inlet valves are open. This has only a minor influence on the quality of the air/fuel mixture.

Checking actuation

- Push back rubber grommet of plug of Hall sender back but leave connector attached.



- -> Connect voltage tester V.A.G 1527 B between receptacle 2 (Hall sensor signal) and receptacle 1 (positive).

Note:

Receptacles are numbered accordingly on the back of the connector.

- Operate the starter for a few seconds.
 - The LED should flash.

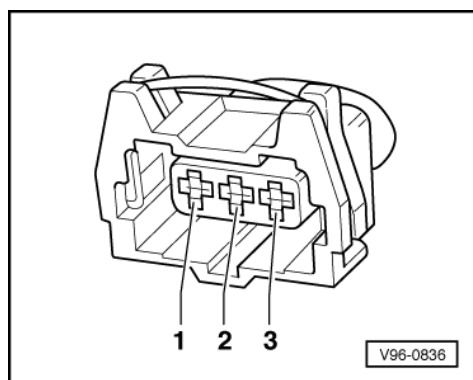
Note:

Voltage testers with a low current consumption continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become much brighter when actuated.

If LED does not flash:

Checking power supply

- Unplug connector from Hall sender.



- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
1	Engine earth

- Switch the ignition on.

- Specified value: approx. 5 V

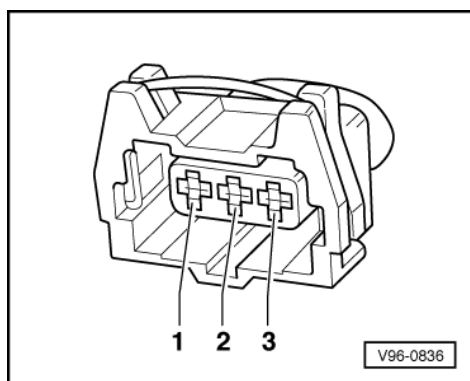
Checking signal wire

- Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
2	Engine earth

- Switch the ignition on.
 - Specified value: approx. battery voltage

Checking earth wire



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

Connector Contact	Measure to
3	Engine earth

- Rectify any open/short circuit as necessary.

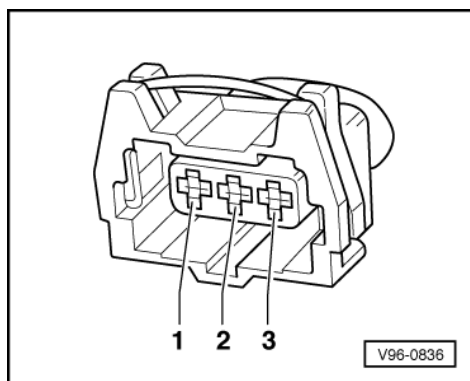
If the specified values are all achieved and the diode test lamp does not flash (measured between contacts 1 and 2 with starter connector attached),

- Fit a new Hall sender.

If the specified values are not obtained:

Checking wiring between Hall sender and engine control unit.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit; do not connect the engine control unit => Page 59 .





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

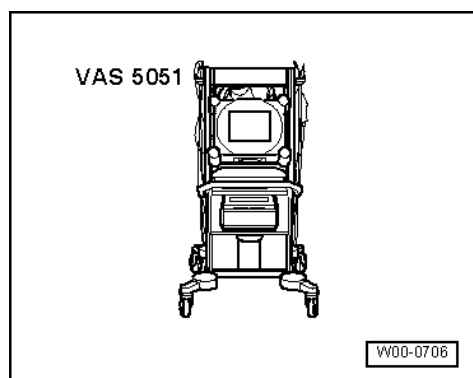
Connector Contact	Test box V.A.G 1598/31 Socket
1 (positive)	98
2 (signal)	86
3 (earth)	108

- Rectify any open/short circuit as necessary.
- If a trial erasure of the fault memory is followed by the replaced indication of a fault relating to the camshaft sensor (Hall sender) although all previous tests were OK, the following faults are possible:
 - Rotor ring for Hall sender misaligned
- Unbolt the Hall sensor, then check to ensure that the rotor ring is correctly aligned on the camshaft.(if it is incorrectly installed, the catch will be pressed flat when the securing screw is tightened).
- If the position of rotor ring is OK, check the position of the camshaft in relation to the crankshaft.

=> 4-cylinder Engine (5-valve Turbo), Mechanical Components; Repair group 15; Servicing valve gear Servicing valve gear

1.14 - Checking misfire detection

Special tools and workshop equipment required



- ♦ VAS 5051 with VAS 5051/1

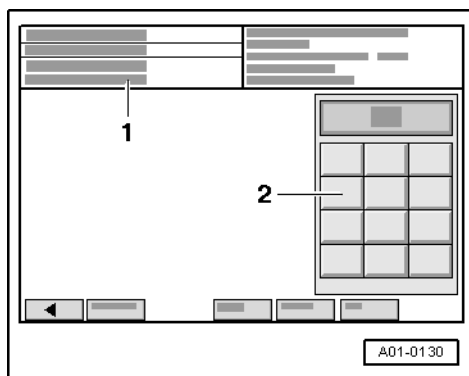
Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 -Engine electronics" in the selection. For this purpose, the engine must be running at idling speed.



-> Display on VAS 5051:

- Under -1- select the diagnostic function "08 - Read measured value block".

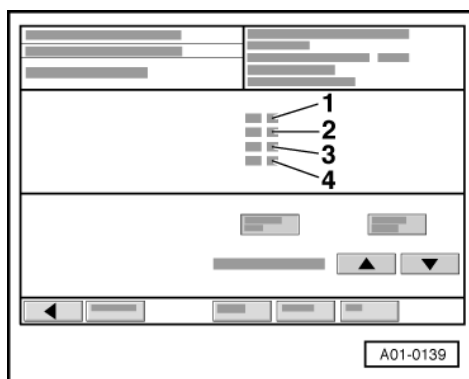


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-> Display on VAS 5051:

- 1 - Enter display group
max. input value = 255

- Enter "014" for "display group number 014" in zone -2- and confirm the entry by pressing the Q key.



-> Display on VAS 5051:

- Check the misfire detection in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 014: Misfire detection				
Display	xxx rpm	xxx %	xxx	---
Display	Engine speed	Load	Total misfires	Misfire detection
Range				activated blocked
Specified value	xxxx rpm	10...25 %	0	activated
Note:			If nominal value is exceeded: Checking misfire of the individual cylinders => Page 206 .	If misfires are to be expected due to the operation (e.g. running warm, push switch off) the misfire recognition is blocked.

If specified value is attained:

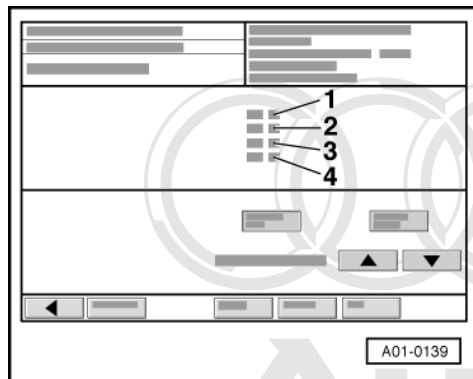


- Exit the function "08 - Read measured value block" by pressing the ◀ key.

If specified value is not attained:

- Select the s key in order to change to display group 015.

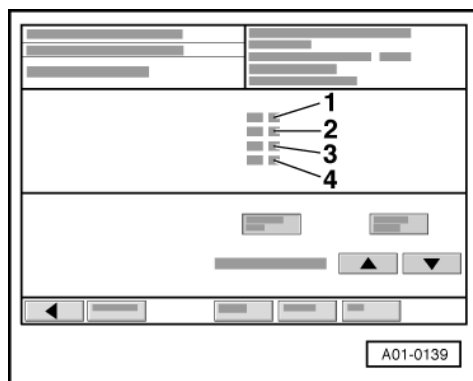
Checking misfire recognition of the individual cylinder



-> Display on VAS 5051:

- Check detection of misfires in display zones 1 to 4.

	Display zones			
	1	2	3	4
Display group 015: Misfire detection of cylinders 1, 2 and 3				
Display	xxx	xxx	xxx	---
Display	Number of misfires in cylinder 1	Number of misfires in cylinder 2	Number of misfires in cylinder 3	Misfire detection
Range				activated blocked
Specified value	0	0	0	activated
Note:	If nominal value is exceeded: Evaluation => Page 207			---



- Select the s -key in order to change to display group 016.

-> Display on VAS 5051:

- Check the misfire detection in display zones -1- and -4-.

	Display zones			
	1	2	3	4
Display group 016: Misfire recognition of cylinder 4.				
Display	xxx			---
Display	Number of misfires in cylinder 4			Misfire detection
Range				activated blocked
Specified value	0			activated
Note:	If nominal value is exceeded: Evaluation => Page 207			---

- Exit the function "08 - Read measured value block" by pressing the ◀ key.

Evaluating display groups 014, 015 and 016:

Qty. Misfire- detection	Possible causes of fault		Fault remedy
Higher than 0	- Defective spark plug - Defective spark plug connector - Ignition coil or output stage defective	- Test spark plugs and ignition wiring Ignition coils with output stages Checking => Page 174	
	- Injector defective	- Check injectors =>Page 81 .	