01-1

On Board Diagnostic (OBD)

Function

The Multiport Fuel Injection (MFI) system is equipped with an Engine Control Module (ECM) -J220- with On Board Diagnostic (OBD) capability.

When malfunctions occur in sensors or components monitored by OBD, Diagnostic Trouble Codes (DTC) are stored in DTC memory.

Stored DTCs are identified using the VAG1551 Scan Tool (ST) ⇒ page 01-16 .

After the necessary repairs are completed, DTC memory must be erased ⇒ page 01-49 .

OBD II legal regulations require a display (readiness code) that shows inspection readiness for the annual exhaust emissions test. The readiness code shows that every component and/or system that affects exhaust emissions, which can lead to the Malfunction Indicator Lamp (MIL) being switched on, has been operated at least once with positive results.

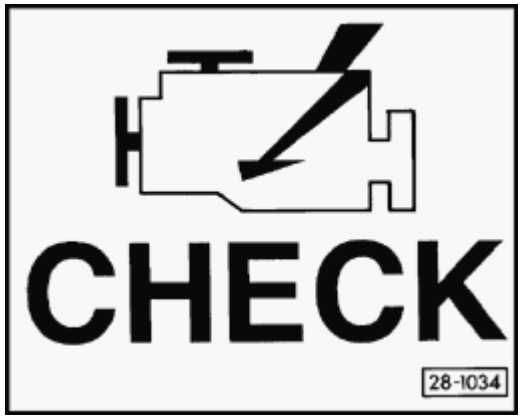
The readiness code is reset and/or erased and must be regenerated every time DTC memory is erased, the power supply to the ECM -J220- is interrupted (example: when connecting

VAG1598/22 test box), or the battery has been disconnected ⇒ page 01-73 .

01-2

Malfunction Indicator Lamp (MIL) function, checking

If a malfunction is recognized by the Engine Control Module (ECM) or the Transmission Control Module (TCM), this is indicated by the MIL coming on.



Malfunction Indicator Lamp (MIL)

Note:

When a recognized malfunction switches on the MIL, it will either blink or light continuously. In either case, DTC memory must be checked ⇒ page 01-16 .

- *If the MIL starts to blink, there is a malfunction that can lead to damage of the Three Way Catalytic Converter (TWC). In this case, driving should only continue using reduced power. The malfunction must be rectified as quickly as possible.*
- *If the MIL lights continuously, there is a malfunction that affects exhaust emissions. In this case, DTC memory must be checked, and the malfunction must be rectified as quickly as possible.*
- *Some malfunctions may occur without causing the MIL to come on. When driveability or performance problems are reported, and there is no indication from the MIL, the operation of the MIL must be checked. In addition, DTC memory must be checked, as there may be malfunctions stored that do not switch the MIL on immediately.*

01-3

Checking function

- Switch ignition on.

  MIL must light up.

- If MIL does not light when ignition is switched on, check wiring to MIL as follows:

Cause:	Remedy:
MIL is not triggered, or does not light, due to faulty wiring or open circuit.	- Switch ignition off. - Connect VAG1598/22 test box. - Connect jumper wire to bridge test box sockets 2 and 17. - Switch ignition on. • MIL must light up. If MIL does not light: - Switch ignition off. - Check bulb for MIL. If bulb is OK: - Check wiring for open circuit between MIL and Motronic ECM -J220- using applicable wiring diagram.

	If wiring is OK:
Malfunction: ▶	Motronic ECM -J220- is faulty; replace (⇒ page 01-68). Check and erase Diagnostic Trouble Code (DTC) memory and generate new readiness code ⇒ page 01-73 .

01-4

If MIL lights up when ignition is switched on, continue checking as follows:

- Start engine and let run at idle.

  MIL must go out after a few seconds.

If MIL does not go out:

- Check Diagnostic Trouble Code (DTC) memory ⇒ page 01-16 .

If there are no malfunctions stored in DTC memory:

Cause:	Remedy:
MIL is triggered continuously due to short circuit to Ground.	- Switch ignition off. - Connect VAG1598/22 test box. - Check resistance between test box socket 17 and vehicle Ground, specified value: ∞ Ω (no continuity) If the specified value is not obtained: - Check for short circuit to Ground in wiring from Motronic Engine Control Module (ECM) -J220- to MIL. - Trace malfunction using applicable wiring diagram and repair as necessary.
	If there is no continuity, and no short circuit to Ground:

Malfunction:	▶	Motronic ECM -J220- is faulty; replace (⇒ page 01-68). Check and erase Diagnostic Trouble Code (DTC) memory and generate new readiness code ⇒ page 01-73 .

01-5

On Board Diagnostic (OBD) technical data

Memory

- Temporary memory and permanent memory. If the engine control module is disconnected from the Battery Positive Voltage (B+) supply, the readiness code and learning values will be erased. Any malfunctions stored in DTC memory are not erased.

Data output

- Rapid data transfer

- Additional malfunction indication by Malfunction Indicator Lamp (MIL) lighting up

ECM identification

⇒ page 01-8 ; VAG1551 Scan Tool (ST), connecting and selecting "Engine Electronics" address word 01

ECM functions

- The Motronic ECM -J220- performs different OBD functions, carried out with the ignition switched on or with the engine running. Following are the conditions required to carry out each of the specific functions.

Address words:

Address word 00: Automatic Test Sequence	Ignition switched on -or- Engine running at idle
Address word 01: Engine Electronics	Ignition switched on -or- Engine running at idle
Address word 33: OBD II (generic scan tool)	Ignition switched on -or- Engine running at idle

01-6

Functions under "Engine Electronics" address word 01:

Function 01: Check Control Module Version	Ignition switched on -or- Engine running at idle
Function 02: Check DTC Memory	Engine running at idle, otherwise crank engine with starter motor for at least 5 sec., then do not switch ignition off
Function 03: Output Diagnostic Test Mode	Ignition switched on
Function 04: Basic Setting	Engine running at idle
Function 07: Code Control Module	Ignition switched on
Function 08: Read Measuring Value Block	Ignition switched on -or- Engine running at idle -or- Driving

01-7

Modes under address word 33:

Mode 1: Transfer diagnostic data	Ignition switched on -or- Engine running at idle
Mode 2: Transfer operating conditions	Ignition switched on -or- Engine running at idle
Mode 3: Check DTC memory	Ignition switched on -or- Engine running at idle
Mode 4: Erase diagnosis information	Ignition switched on -or- Engine running at idle
Mode 5: Output of HO2S signals	Ignition switched on -or- Engine running at idle
Mode 6: Transfer measuring values	Ignition switched on -or- Engine running at idle
Mode 7: Check DTC memory	Ignition switched on -or- Engine running at idle

- Under Address word 33, Modes 1-7 can be addressed.
- Under Mode 1, individual measuring values can be displayed. Mode 1 is not recommended for use in an Audi Service department, because these values can be displayed much more precisely using address word 01 and "Basic Setting" function 04 or "Read Measuring Value Block" function 08.
- Mode 2 shows the operating conditions under which the stored malfunctions were recognized.
- With Mode 3, DTC memory is checked-with Mode 4, DTC memory is erased.
- Mode 5 shows the statistical value of the oxygen sensors as mandated by law. As these values have no direct bearing on oxygen sensor diagnosis, Mode 5 is of no particular value in an Audi Service department.
- Under Mode 6, values can be checked for components and systems that are not continuously monitored.

- *With Mode 7 all malfunctions can be checked, even if they have not switched on the Malfunction Indicator Lamp (MIL) (if the MIL has not been switched on, there is no malfunction recognized under Mode 3)*

01-8

VAG1551/VAG1552 Scan Tool (ST), connecting and selecting "Engine Electronics" address word 01

WARNING!

- ***When driving or riding in an airbag-equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and the airbag increase the risk of injury in an accident.***

- ***During a test drive in an airbag-equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a second technician.***

Required special tools and test equipment

- VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable

Note:

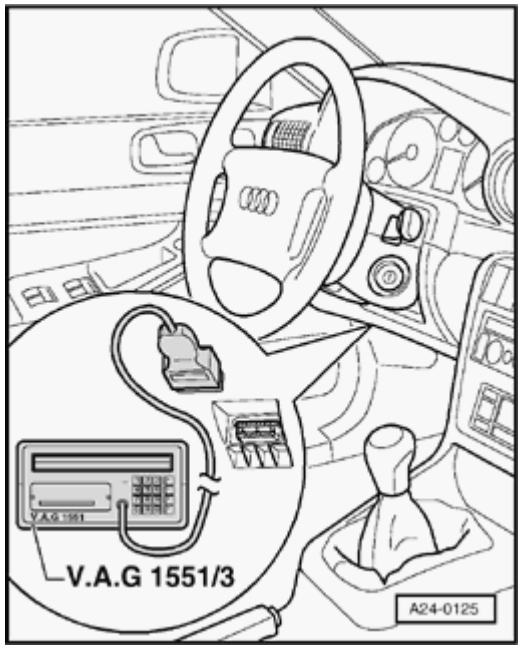
VAG1552 can also be used, but there is no print-out capability.

Requirements

- Fuses for engine electronics OK

- Battery Positive Voltage (B+) OK (at least 11 volts)
- Engine and transmission GND connections OK ⇒ Electrical Wiring Diagrams, Troubleshooting & Component Locations binder
- Fuel pump relay OK

01-9



Connecting

- Locate Data Link Connector (DLC), under driver's knee bar to left of steering wheel.
- Connect VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable to DLC.
- Switch ignition on, or start engine, depending on function to be selected (⇒ page 01-5).

Notes:

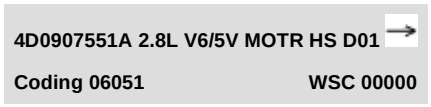
- *If scan tool displays do not appear as indicated:*

⇒ *Scan tool operating instructions*

- *If "Error in communication link" is displayed, disconnect adapter cable at scan tool, reconnect, and repeat procedure.*

- Operate scan tool and advance through program sequence by following display:
  - Press button -1- to select "Rapid data transfer" operating mode 01.
  - Press buttons -0- and -1- to insert "Engine Electronics" address word 01, and press -Q- button to confirm input.

01-10



Indicated on display (ECM identification and coding, example)

4D0 _ _ _	Engine Control Module (ECM) Part No.
2.8 L	Engine displacement
V6/5V	Engine type:
	V-engine, 6-cylinder, 5-valve
MOTR	Motronic
HS	Manual transmission
AT	Automatic transmission
D..	ECM software version
Coding	ECM coding
	Coding variations ⇒ page 01-14
WSC 12345	Plant number: indicates where VAG1551 scan tool was used for last coding and/or adaptation (as long as factory coding has not been changed, WSC 00000 is displayed)

01-11

Notes:

If the ECM version that corresponds to the vehicle is not displayed, replace ECM ⇒ page 01-68 . Incorrect ECM coding leads to:

- *Performance problems (e.g. jerky shifting, abrupt load changes, etc.)*
- *Increased fuel consumption*
- *Elevated exhaust gas values*
- *Reduction in transmission service life*
- *Storage of non-existent malfunctions in DTC memory*
- *Necessary functions not being carried out (oxygen sensor control, actuation of EVAP canister system, etc.)*

- Press → button to advance through program sequence.

Rapid data transfer HELP	
Select function XX	

Indicated on display

- Continue as specified in procedures for specific OBD functions.

01-12

Code Control Module (scan tool function 07)

If vehicle coding information is not as specified, or if the ECM has been replaced, the ECM must be coded as follows.

Required special tools and test equipment

- VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable

Coding procedure

- Connect VAG1551/VAG1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (ignition switched on) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -7- to select "Code Control Module" function 07, and press -Q- button to confirm input.

Code Control Module HELP **Input code number XXXXX (0-32000)**	Indicated on display

- Input applicable code number for vehicle, and press -Q- button to confirm input. ECM coding variations ⇒ page 01-14 .

Function is unknown or →	If indicated on display:

cannot be carried out at the moment	Incorrect code number has been entered.

01-13

4D0907551A 2.8L V6/5V MOTR HS D01 →	
Coding 06051	**WSC 00000**

Rapid data transfer	**HELP**
Select function XX	

➢ Indicated on display (ECM identification and coding, e.g. 06051)

- Press → button to advance through program sequence.

➢ Indicated on display

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

Notes:

The Motronic ECM -J220- only uses the code that has been entered after the ignition has been switched off once. Incorrect coding leads to:

- *Performance problems (e.g. jerky shifting, abrupt load changes, etc.)*
- *Increased fuel consumption*
- *Elevated exhaust gas values*
- *Storage of non-existent malfunctions in DTC memory*
- *Reduction in transmission service life*

01-14

ECM coding variations

Country/Emissions	Drivetrain/Options	Transmission	Vehicle type
00 = ----------	0 = Front-wheel-drive without traction control (ASR)	0 = 5-speed manual	0 = ---------- ------
01 = ----------	1 = Front-wheel-drive with traction control (ASR)	1 = ----------	1 = A4
02 = ----------	2 = All-wheel-drive without traction control (ASR)	2 = ----------	2 = ---------- ------
03 = ----------	3 = All-wheel-drive with traction control (ASR)	3 = ----------	3 = ---------- ------
04 = ----------	4 = ----------	4 = ----------	4 = ---------- ------
05 = ----------	5 = ----------	5 = Automatic trans. 01V	5 = ---------- ------
06 = USA, equipped with EVAP system Leak Detection Pump (LDP)	6 = ----------	6 = ----------	6 = ---------- ------

01-15

Code number structure (example)					
USA vehicle with Leak Detection Pump (LDP):	0	6			
Front-wheel-drive without traction control (ASR):			0		
Automatic transmission 01V:				5	
Audi A4:					1
Code number:	0	6	0	5	1

Note:

Vehicles with traction control (ASR) can be recognized by the ASR control light in the instrument cluster or by ABS/ASR On Board Diagnostic (OBD).

⇒ Repair Manual, Brake System, Repair Group 01

01-16

Check DTC Memory (scan tool function 02)

Required special tools and test equipment

- VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable

Checking

- Connect VAG1551/VAG1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (engine running at idle) ⇒ page 01-8 .

Note:

If engine does not start:

- Operate starter to crank engine for approx. 6 seconds, then do not switch ignition off.

- Press PRINT button to switch scan tool printer on (indicator light in button lights up).

Rapid data transfer	**HELP**
Select function XX	

Indicated on display

- Press buttons -0- and -2- to select "Check DTC Memory" function 02, and press -Q- button to confirm input.

01-17

X DTC recognized	⇐	Indicated on display (number of stored malfunctions, or "No DTC recognized")

Note:

If scan tool displays do not appear as indicated:

⇒ *Scan tool operating instructions*

If one or more malfunctions are stored:

Stored malfunctions are displayed one after another, and are printed out along with applicable DTCs.

Rapid data transfer HELP **Select function XX**	⇐	Indicated on display (after all stored malfunctions)

If no DTCs are recognized:

- Press → button to advance through program sequence.
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.
- Repair malfunctions according to Diagnostic Trouble Code (DTC) table ⇒ page 01-18 .
- Erase DTC memory ⇒ page 01-49 .

01-18

Diagnostic Trouble Code (DTC) table

Notes:

- *The DTC table is organized according to SAE and VAG diagnostic trouble codes.*
- *The column labeled "MIL" specifies the MIL switching condition associated with that DTC.*
- *DTCs that do not switch on the MIL after the malfunction is recognized by the ECM are identified by the MIL switching condition "Off."*
- *DTCs that do switch on the MIL immediately after the malfunction is recognized by the ECM are identified by the MIL switching condition "Immed."*
- *DTCs that are recognized by the ECM and switch on the MIL after two consecutive driving cycles (Dcy) are identified by the MIL switching condition "2 Dcy."*
- *Always correct malfunctions that are designated "immediately" as soon as possible, followed by those malfunctions that are designated "2 Dcy."*
- *When all repairs have been completed, erase DTC memory (⇒ page 01-49) and then generate new readiness code ⇒ page 01-73 .*
- *DTCs that are recognized as a result of intermittent malfunctions, or DTCs that are not erased after repairs, are classified as sporadic malfunctions. These are identified by the designation "SP" appearing in the display.*
- *A sporadic malfunction will be erased if it no longer occurs after 50 driving cycles during which the engine reaching*

operating temperature.

01-19

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0102	16486	Mass or Volume Air Flow Circ. Low Input	2 Dcy	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-68
P0103	16487	Mass or Volume Air Flow Circ. High Input		
P0112	16496	Intake Air Temp. Circ. Low Input	2 Dcy	- Check Intake Air Temperature (IAT) sensor -G42- ⇒ page 24-82
P0113	16497	Intake Air Temp. Circ. High Input		
P0116	16500	Engine Coolant Temp. Circ. Range/Performance	2 Dcy	- Check Engine Coolant Temperature (ECT) sensor -G62- ⇒ page 24-75
P0117	16501	Engine Coolant Temp. Circ. Low Input		
P0118	16502	Engine Coolant Temp. Circ. High Input		
P0121	16505	Throttle/Pedal Pos. Sensor A	2	

		Circ. Range/Performance	Dcy	- Check Throttle Position (TP) sensor -G69- ⇒ page 24-128
P0122	16506	Throttle/Pedal Pos. Sensor A Circ. Low Input		
P0123	16507	Throttle/Pedal Pos. Sensor A Circ. High Input		

01-20

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0130	16514	O2 Sensor Circ., Bank1-Sensor1 Malfunction	2 Dcy	- Check Heated Oxygen Sensor (HO2S) -G39- and O2S control (bank 1, sensor1) ⇒ page 24-22
P0131	16515	O2 Sensor Circ., Bank1-Sensor1 Low Voltage		
P0132	16516	O2 Sensor Circ., Bank1-Sensor1 High Voltage		
P0133	16517	O2 Sensor Circ., Bank1-Sensor1 Slow Response	2 Dcy	- Check HO2S -G39- aging (bank 1, sensor1) ⇒ page 24-60
P0134	16518	O2 Sensor Circ., Bank1-Sensor1 No Activity Detected	2 Dcy	- Check HO2S -G39- and O2S control (bank 1, sensor1) ⇒ page 24-22
P0136	16520	O2 Sensor Circ., Bank1-Sensor2 Malfunction	2 Dcy	- Check Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- (bank 1, sensor 2) ⇒ page 24-42

P0137	16521	O2 Sensor Circ., Bank1-Sensor2 Low Voltage		
P0138	16522	O2 Sensor Circ., Bank1-Sensor2 High Voltage		
P0140	16524	O2 Sensor Circ., Bank1-Sensor2 No Activity Detected		

01-21

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0150	16534	O2 Sensor Circ., Bank2-Sensor1 Malfunction	2 Dcy	- Check Heated Oxygen Sensor (HO2S) -G108- and Oxygen Sensor (O2S) control (bank 2, sensor 1) ⇒ page 24-22
P0151	16535	O2 Sensor Circ., Bank2-Sensor1 Low Voltage		
P0152	16536	O2 Sensor Circ., Bank2-Sensor1 High Voltage		
P0153	16537	O2 Sensor Circ., Bank2-Sensor1 Slow Response	2 Dcy	- Check HO2S -G108- aging (bank 2, sensor 1) ⇒ page 24-63
P0154	16538	O2 Sensor Circ., Bank2-Sensor1 No Activity Detected	2 Dcy	- Check HO2S -G108- and O2S control (bank 2, sensor 1) ⇒ page 24-22
P0156	16540	O2 Sensor Circ., Bank2-Sensor2 Malfunction	2 Dcy	- Check O2S 2 behind Three Way Catalytic Converter (TWC) -G131- (bank 2, sensor 2) ⇒ page 24-52

P0157	16541	O2 Sensor Circ., Bank2-Sensor2 Low Voltage		
P0158	16542	O2 Sensor Circ., Bank 2-Sensor2 High Voltage		
P0160	16544	O2 Sensor Circ., Bank2-Sensor2 No Activity Detected		

01-22

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0300	16684	Random/Multiple Cylinder Misfire Detected	2 Dcy / blink	- Fuel level too low, check fuel level and add if necessary - Check misfire detection ⇒ page 28-16 - Check fuel injectors ⇒ page 24-102 - Carry out output Diagnostic Test Mode (DTM) ⇒ page 01-51 - Check engine speed (RPM) sensor -G28- ⇒ page 24-88
P0301	16685	Cyl. 1 Misfire Detected		
P0302	16686	Cyl. 2 Misfire Detected		
P0303	16687	Cyl. 3 Misfire Detected		
P0304	16688	Cyl. 4 Misfire Detected		
P0305	16689	Cyl. 5		

		Misfire Detected		
P0306	16690	Cyl. 6 Misfire Detected		

01-23

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0321	16705	Ign./Distributor Eng. Speed Inp. Circ. Range/Performance	2 Dcy	- Check engine speed (RPM) sensor - G28- ⇒ page 24-88
P0322	16706	Ign./Distributor Eng. Speed Inp. Circ. No Signal	Immed.	

Note on misfire malfunctions:

For malfunctions that may be caused by low fuel volume (i.e. combustion misfire) a low-fuel malfunction (DTC "P1250") is also stored when there is less than 2 gallons of fuel remaining in the tank.

01-24

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0327	16711	Knock Sensor1 Circ. Low Input	Immed.	- Check knock sensors and knock sensor control ⇒ page 28-8
P0328	16712	Knock Sensor1 Circ. High Input		
P0332	16716	Knock Sensor2 Circ. Low Input		
P0333	16717	Knock Sensor2 Circ. High Input		
P0411	16795	Sec. Air Inj. Sys. Incorrect Flow Detected	2 Dcy	- Check Secondary Air Injection (AIR) system ⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 26
P0422	16806	Main Catalyst, Bank1 Efficiency Below Threshold	2 Dcy	- Check Heated Oxygen Sensor (HO2S) -G39- and O2S control (bank 1, sensor1) ⇒ page 24-22

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0432	16816	Main Catalyst, Bank2 Efficiency Below Threshold	2 Dcy	- Check HO2S -G108- and O2S control (bank 2, sensor 1) ⇒ page 24-22
P0441	16825	EVAP Emission Contr. Sys. Incorrect Purge Flow	Off	- Check Evaporative Emissions (EVAP) canister purge regulator valve -N80- ⇒ output Diagnostic Test Mode (DTM), ⇒ page 01-51
P0442	16826	EVAP Emission Contr. Sys. (Small Leak) Leak Detected	Off	- Check Evaporative Emission (EVAP) system ⇒Repair Manual, Fuel Supply System, Repair Group 20
P0455	16839	EVAP Emission Contr. Sys. (Gross Leak) Leak Detected	Off	- Check Evaporative Emission (EVAP) system ⇒Repair Manual, Fuel Supply System, Repair Group 20
P0501	16885	Vehicle Speed Sensor Range/Performance	2 Dcy	- Check vehicle speed signal ⇒ page 24-168

01-26

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0506	16890	Idle Control System RPM Lower Than Expected	2 Dcy	- Check idle speed ⇒ page 24-16 - Check throttle valve control module ⇒ page 24-128 - Check fuel pressure, fuel pressure regulator, and residual fuel pressure ⇒ page 24-111
P0507	16891	Idle Control System RPM Higher Than Expected		
P0601	16985	Internal Contr. Module Memory Check Sum Error	2 Dcy	Replace ECM ⇒ page 01-68
P0604	16988	Internal Contr. Module Random Access Memory (RAM) Error		
P1102	17510	O2 Sensor Heating Circ., Bank1-Sensor1 Short to B+	2 Dcy	- Check Oxygen Sensor (O2S) heater -Z19- (bank 1, sensor 1, before TWC) ⇒ page 24-34
P1105	17513	O2 Sensor Heating Circ., Bank1-Sensor2 Short to B+	2 Dcy	- Check O2S heater -Z29- (bank 1, sensor 2, behind TWC) ⇒ page 24-52

P1107	17515	O2 Sensor Heating Circ., Bank2-Sensor1 Short to B+	2 Dcy	- Check O2S heater -Z28- (bank 2, sensor 1, before TWC) ⇒ page 24-34

01-27

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1110	17518	O2 Sensor Heating Circ., Bank2-Sensor2 Short to B+	2 Dcy	- Check O2S heater -Z30- (bank 2, sensor 2, behind TWC) ⇒ page 24-52
P1127	17535	Long Term Fuel Trim mult., Bank1 System too Rich 1)	2 Dcy	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-68 - Check Heated Oxygen Sensor (HO2S) -G39- (bank 1, sensor 1) and O2S control ⇒ page 24-22 - Check Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- (bank 1, sensor 2) and O2S control ⇒ page 24-42 - Check fuel pressure, fuel pressure regulator and residual fuel pressure ⇒ page 24-111 - Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51

1) The term "mult." = multiplicative; applies to entire engine speed (RPM) and load range.

01-28

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1128	17536	Long Term Fuel Trim mult., Bank1 System too Lean 1)	2 Dcy	- Check Heated Oxygen Sensor (HO2S) -G39- (bank 1, sensor 1) and O2S control ⇒ page 24-22 - Check Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- (bank 1, sensor 2) and O2S control ⇒ page 24-42 - Check fuel pressure, fuel pressure regulator and residual fuel pressure ⇒ page 24-111 - Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51 - Check EVAP canister purge regulator valve ⇒ output Diagnostic Test Mode (DTM), ⇒ page 01-51

1) The term "mult." = multiplicative; applies to entire engine speed (RPM) and load range.

01-29

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1129	17537	Long Term Fuel Trim mult., Bank2 System too Rich 1)	2 Dcy	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-68 - Check Heated Oxygen Sensor (HO2S) 2 -G108- (bank 2, sensor 1) and O2S control ⇒ page 24-22 - Check Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131- (bank 2, sensor 2) and O2S control ⇒ page 24-42 - Check fuel pressure, fuel pressure regulator and residual fuel pressure ⇒ page 24-111 - Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51

1) The term "mult." = multiplicative; applies to entire engine speed (RPM) and load range.

01-30

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1130	17538	Long Term Fuel Trim mult., Bank2 System too Lean 1)	2 Dcy	- Check Heated Oxygen Sensor (HO2S) 2 -G108- (bank 2, sensor 1) and O2S control ⇒ page 24-22 - Check Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131- (bank 2, sensor 2) and O2S control ⇒ page 24-42 - Check fuel pressure, fuel pressure regulator and residual fuel pressure ⇒ page 24-111 - Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51 - Check EVAP canister purge regulator valve ⇒ output Diagnostic Test Mode (DTM), ⇒ page 01-51

1) The term "mult." = multiplicative; applies to entire engine speed (RPM) and load range.

01-31

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1136	17544	Long Term Fuel Trim Add. Fuel, Bank1 System too Lean 2)	2 Dcy	- Check intake air system for leaks ("false air") ⇒ page 24-126 - Check Heated Oxygen Sensor (HO2S) -G39- (bank 1, sensor 1) and O2S control ⇒ page 24-22 - Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-68 - Check fuel pressure, fuel pressure regulator and residual fuel pressure ⇒ page 24-111 - Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51

2) The term "Add." = additive; applies only with engine running at idle speed.

01-32

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1137	17545	Long Term Fuel Trim Add. Fuel, Bank1 System too Rich 2)	2 Dcy	- Check Heated Oxygen Sensor (HO2S) -G39- (bank 1, sensor 1) and O2S control ⇒ page 24-22 - Check fuel pressure, fuel pressure regulator and residual pressure ⇒ page 24-111 - Check exhaust system for leakage ⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 26

2) The term "Add." = additive; applies only with engine running at idle speed.

01-33

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1138	17546	Long Term Fuel Trim Add. Fuel, Bank2 System too Lean 2)	2 Dcy	- Check intake air system for leaks ("false air") ⇒ page 24-126 - Check Heated Oxygen Sensor (HO2S) 2 -G108- (bank 2, sensor 1) and O2S control ⇒ page 24-22 - Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-68 - Check fuel pressure, fuel pressure regulator and residual fuel pressure ⇒ page 24-111 - Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51

2) The term "Add." = additive; applies only with engine running at idle speed.

01-34

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1139	17547	Long Term Fuel Trim Add. Fuel, Bank2 System too Rich 2)	2 Dcy	- Check Heated Oxygen Sensor (HO2S) 2 -G108- (bank 2, sensor 1) and O2S control ⇒ page 24-22 - Check fuel pressure, fuel pressure regulator and residual pressure ⇒ page 24-111 - Check exhaust system for leakage ⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 26
P1141	17549	Load Calculation Cross Check Range/Performance	2 Dcy	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-68 - Check throttle valve control module ⇒ page 24-128
P1171	17579	Throttle Actuation Potentiometer Signal 2 Range/Performance 1)	Immed.	- Check throttle actuation potentiometer ⇒ page 24-136 .

1) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immediately after the malfunction has been recognized. Significance of MIL ⇒ page 01-2 .

2) The term "Add." = additive; applies only with engine running at idle speed.

01-35

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1176	17584	O2 Correction Behind Catalyst, B1 Limit Attained	Off	- Check intake air system for leaks ("false air") ⇒ page 24-126 - Check Heated Oxygen Sensor (HO2S) aging (bank 1, sensor 1) ⇒ page 24-60 - Check Oxygen Sensor (O2S) heater -Z29- (bank 1, sensor 2) ⇒ page 24-52 - Check O2S behind TWC (bank 1, sensor 2) ⇒ page 24-42
P1177	17585	O2 Correction Behind Catalyst, B2 Limit Attained	Off	- Check intake air system for leaks ("false air") ⇒ page 24-126 - Check Heated Oxygen Sensor (HO2S) 2 aging (bank 2, sensor 1) ⇒ page 24-63 - Check Oxygen Sensor (O2S) 2 heater -Z29- (bank 2, sensor 2) ⇒ page 24-52 - Check O2S 2 behind TWC (bank 2, sensor 2) ⇒ page 24-42

01-36

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1196	17604	O2 Sensor Heater Circ., Bank1-Sensor1 Electrical Malfunction	2 Dcy	- Check Oxygen Sensor (O2S) heater -Z19- (bank 1, sensor 1) ⇒ page 24-34
P1197	17605	O2 Sensor Heater Circ., Bank2-Sensor1 Electrical Malfunction	2 Dcy	- Check Oxygen Sensor (O2S) heater -Z28- (bank 2, sensor 1) ⇒ page 24-34
P1198	17606	O2 Sensor Heater Circ., Bank1-Sensor2 Electrical Malfunction	2 Dcy	- Check Oxygen Sensor (O2S) heater -Z29- (bank 1, sensor 2) ⇒ page 24-52
P1199	17607	O2 Sensor Heater Circ., Bank2-Sensor2 Electrical Malfunction	2 Dcy	- Check Oxygen Sensor (O2S) heater -Z30- (bank 2, sensor 2) ⇒ page 24-52
P1213	17621	Cyl.1-Fuel Inj. Circ. Short to B+	Immed.	- Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51
P1214	17622	Cyl.2-Fuel Inj. Circ. Short to B+		- Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51

01-37

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1215	17623	Cyl.3-Fuel Inj. Circ. Short to B+		- Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51
P1216	17624	Cyl.4-Fuel Inj. Circ. Short to B+		- Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51
P1217	17625	Cyl.5-Fuel Inj. Circ. Short to B+		- Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51

01-38

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1218	17626	Cyl.6-Fuel Inj. Circ. Short to B+	Immed.	- Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51
P1225	17633	Cyl.1-Fuel Inj. Circ. Short to Ground		
P1226	17634	Cyl.2-Fuel Inj. Circ. Short to Ground		
P1227	17635	Cyl.3-Fuel Inj. Circ. Short to Ground		
P1228	17636	Cyl.4-Fuel Inj. Circ. Short to Ground		
P1229	17637	Cyl.5-Fuel Inj. Circ. Short to Ground		

P1230	17638	Cyl.6-Fuel Inj. Circ. Short to Ground		

01-39

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1237	17645	Cyl.1-Fuel Inj. Circ. Open Circuit	Immed.	- Check fuel injectors ⇒ page 24-102 and ⇒ Output Diagnostic Test Mode (DTM) ⇒ page 01-51
P1238	17646	Cyl.2-Fuel Inj. Circ. Open Circuit		
P1239	17647	Cyl.3-Fuel Inj. Circ. Open Circuit		
P1240	17648	Cyl.4-Fuel Inj. Circ. Open Circuit		
P1241	17649	Cyl.5-Fuel Inj. Circ. Open Circuit		
P1242	17650	Cyl.6-Fuel Inj. Circ. Open Circuit		

01-40

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1250	17658	Fuel Level Too Low	Off	- Fuel volume less than 2 gallons; add fuel - Check "fuel level low" signal ⇒ page 24-176 - Check fuel level sensor signal and fuel gauge ⇒ *Repair Manual, Electrical Equipment, Repair Group 01 (instrument cluster diagnostics, Read Measuring Value Block)*

Note on misfire malfunctions:

For malfunctions that may be caused by low fuel volume (i.e. combustion misfire) a low-fuel malfunction (DTC "P1250") is also stored when there is less than 2 gallons of fuel remaining in the tank.

01-41

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1325	17733	Cyl.1-Knock Contr. Limit Attained	Off	- Check knock sensors and knock sensor control ⇒ page 28-8
P1326	17734	Cyl.2-Knock Contr. Limit Attained		
P1327	17735	Cyl.3-Knock Contr. Limit Attained		
P1328	17736	Cyl.4-Knock Contr. Limit Attained		
P1329	17737	Cyl.5-Knock Contr. Limit Attained		
P1330	17738	Cyl.6-Knock Contr. Limit Attained		
P1337	17745	Camshaft Pos. Sensor, Bank1 Short to Ground	2 Dcy	- Check Camshaft Position (CMP) sensor 2 -G163- ⇒ page 28-5
P1338	17746	Camshaft Pos. Sensor, Bank1		

		Open Circ./Short to B+		
P1386	17794	Internal Control Module Knock Control Circ. Error	2 Dcy	- Replace ECM ⇒ page 01-68

01-42

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1391	17799	Camshaft Pos. Sensor, Bank2 Short to Ground	2 Dcy	- Check Camshaft Position (CMP) sensor -G40- ⇒ page 28-2
P1392	17800	Camshaft Pos. Sensor, Bank2 Open Circ./Short to B+		
P1410	17818	Tank Ventilation Valve Circ. Short to B+	2 Dcy	- Check Evaporative Emissions (EVAP) canister purge regulator valve ⇒ output Diagnostic Test Mode (DTM), ⇒ page 01-51
P1421	17829	Sec. Air Inj. Valve Circ. Short to Ground	Immed.	- Check Secondary Air Injection (AIR) system ⇒ output Diagnostic Test Mode (DTM), ⇒ page 01-51
P1422	17830	Sec. Air Inj. Sys. Contr. Valve Circ. Short to B+		
P1425	17833	Tank Vent Valve Short to Ground	2 Dcy	- Check Evaporative Emissions (EVAP) canister purge regulator valve ⇒ output Diagnostic Test Mode (DTM), ⇒ page 01-51

P1426	17834	Tank Vent Valve Open		

01-43

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1432	17840	Sec. Air Inj. Valve Open	2 Dcy	- Check Secondary Air Injection (AIR) system ⇒ output Diagnostic Test Mode (DTM), ⇒ page 01-51
P1433	17841	Sec. Air Inj. Sys. Pump Relay Circ. Open		
P1434	17842	Sec. Air Inj. Sys. Pump Relay Circ. Short to B+		
P1435	17843	Sec. Air Inj. Sys. Pump Relay Circ. Short to Ground		
P1436	17844	Sec. Air Inj. Sys. Pump Relay Circ. Electrical Malfunction		
P1471	17879	EVAP Emission Contr. LDP Circ. Short to B+	Off	- Check Leak Detection Pump (LDP) ⇒ page 24-124
P1472	17880	EVAP Emission Contr. LDP		

		Circ. Short to Ground		
P1473	17881	EVAP Emission Contr. LDP Circ. Open Circ.		
P1476	17884	EVAP Emission Contr. LDP Circ. Malfunction/Insufficient Vacuum	Off	- Check Evaporative Emission (EVAP) system ⇒Repair Manual, Fuel Supply System, Repair Group 20
P1477	17885	EVAP Emission Contr. LDP Circ. Malfunction		

01-44

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1500	17908	Fuel Pump Relay Circ. Electrical Malfunction	Immed.	- Check fuel pump relay and relay actuation ⇒ page 24-95
P1501	17909	Fuel Pump Relay Circ. Short to Ground		
P1502	17910	Fuel Pump Relay Circ. Short to B+		
P1505	17913	Closed Throttle Pos. Switch Does Not Close/Open Circ.	2 Dcy	- Check throttle body and throttle valve control module ⇒ page 24-128
P1512	17920	Intake Manifold Changeover Valve Circ. Short to B+	Immed.	- Check Intake Manifold Tuning (IMT) valve (change-over valve) ⇒ page 24-154
P1515	17923	Intake Manifold Changeover Valve Circ. Short to Ground		
P1516	17924	Intake Manifold Changeover Valve Circ. Open		

P1519	17927	Intake Camshaft Contr., Bank1 Malfunction	2 Dcy	- Check camshaft adjustment ⇒ page 28-29
P1522	17930	Intake Camshaft Contr., Bank2 Malfunction		

01-45

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1543	17951	Throttle Actuation Potentiometer Signal too Low	2 Dcy	- Check throttle drive and angle sensor for throttle drive ⇒ page 24-136
P1544	17952	Throttle Actuation Potentiometer Signal too High		
P1545	17953	Throttle Pos. Contr. Malfunction		
P1558	17966	Throttle Actuator Electrical Malfunction		
P1559	17967	Idle Speed Contr. Throttle Pos. Adaptation Malfunction (Adaptation of throttle valve control module to engine control module interrupted by application of accelerator pedal or by starting engine.)	Off	- Check adaptation of throttle valve control module to Engine Control Module (ECM) ⇒ page 24-150
P1560	17968	Maximum Engine Speed Exceeded	Off	- Carry out engine mechanical repairs as necessary

01-46

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1564	17972	Idle Speed Contr. Throttle Pos. Low Voltage During Adaptation (Supply voltage under 10 V during adaptation of throttle valve control module to engine control module.)	Off	- Check voltage supply to ECM ⇒ page 24-90
P1565	17973	Idle Speed Contr. Throttle Pos. Lower Impact Not Attained (Lower specification not attained during adaptation of throttle valve control module to engine control module, e.g., accelerator pedal cable incorrectly adjusted, throttle body dirty, etc.)	2 Dcy	- Clean throttle body - Check accelerator pedal cable adjustment ⇒Repair Manual, Fuel Supply System, Repair Group 20
P1600	18008	Power Supply (B+) Terminal 15 Low Voltage	Immed.	- Check voltage supply to Engine Control Module (ECM) ⇒ page 24-90

01-47

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1602	18010	Power Supply (B+) Terminal 30 Low Voltage	Off	- Check voltage supply to ECM ⇒ page 24-90
P1606	18014	Rough Road Spec Engine Torque ABS-ECU Electrical Malfunction	Off	- Check ABS control module signal for rough road recognition ⇒ page 24-174
P1612	18020	Electronic Control Module Incorrect Coding (Vehicle with automatic transmission is coded for manual transmission.)	Immed.	- Code ECM ⇒ page 01-12
		Electronic Control Module Incorrect Coding (Vehicle with ASR is not coded for ASR)	Off	

01-48

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1624	18032	MIL Request Sign. active	Immed.	- Check DTC memory for Transmission Control Module (TCM) and correct malfunctions ⇒ Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01
P1626	18034	CAN-Bus Missing Message from Transm. Contr.	2 Dcy	- Check CAN-Bus ⇒ page 24-172
P1640	18048	Internal Contr. Module (EEPROM) Error	2 Dcy	- Replace ECM ⇒ page 01-68
P1681	18089	Contr. Unit Programming Programming not Finished	Immed.	- Replace ECM ⇒ page 01-68
P1690	18098	Malfunction Indicator Light Malfunction	Off	- Check wire from ECM to Malfunction Indicator Light (MIL) ⇒ page 01-2

Note for DTC P1624/18032:

If this malfunction is detected by the Transmission Control Module (TCM), the MIL is switched on by the ECM. In this case, the ECM stores the malfunction "MIL Request Sign. active" (DTC P1624/18032). After repairing the malfunction, erase DTC memory of the ECM.

01-49

Erase DTC Memory (scan tool function 05)

Required special tools and test equipment

- VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable

Test condition

- Malfunction(s) repaired

Note:

If DTC memory has been erased, generate new readiness code ⇒ *page 01-73* .

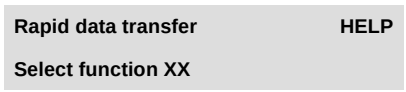
Erasing

- Connect VAG1551/VAG1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP
Select function XX

Indicated on display

- Press buttons -0- and -2- to select "Check DTC Memory" function 02, and press -Q- button to confirm input.
- Press → button to advance through program sequence until all stored malfunctions have been displayed.



Indicated on display

01-50

- Press buttons -0- and -5- to select "Erase DTC Memory" function 05, and press -Q- button to confirm input.

Rapid data transfer →

DTC Memory is erased

Indicated on display

- Press → button to advance through program sequence.

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.
- Road test.

⇒ Safety precautions for road testing vehicle page 24-9

- Initiate "Automatic Test Sequence" by pressing -0- button twice to insert address word 00.
- Check readiness code ⇒ page 01-70 . If DTC memory has been erased, or ECM has been disconnected, generate readiness code ⇒ page 01-73 .

01-51

Output Diagnostic Test Mode (DTM) (scan tool function 03)

Notes:

- *The output Diagnostic Test Mode (DTM) can be activated only with ignition switched on and the engine not running.*
- *The output DTM is interrupted if the engine is started, or if a rotary pulse from the ignition system is recognized.*
- *When operating in the output DTM, the individual output signals are actuated until the program sequence is advanced by pressing the →button.*
- *Output signals are checked by listening for the sound of the component being actuated, or feeling for mechanical evidence of actuation, such as clicking, vibration, etc.*
- *Without letting the engine run, briefly switch the ignition off for approx. 20 seconds before repeating the output checks.*
- *During the entire output DTM sequence, the electric fuel pump will run.*

- *The output DTM will be interrupted after 10 minutes.*

- *Component locations ⇒ page 24-1*

01-52

The following components are actuated in sequence:

1. Cylinder 1 fuel injector -N30-
2. Cylinder 2 fuel injector -N31-
3. Cylinder 3 fuel injector -N32-
4. Cylinder 4 fuel injector -N33-
5. Cylinder 5 fuel injector -N83-
6. Cylinder 6 fuel injector -N84-
7. EVAP canister purge regulator valve -N80-
8. Secondary AIR solenoid valve -N112-
9. Secondary AIR pump relay -J299-
10. Intake manifold tuning valve -N156-

    (change-over valve)
11. Camshaft adjustment 1 (Valves -1- and -2- for camshaft adjustment, -N205- and -N208-)

Required special tools and testing equipment

- VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable

Test conditions

- Fuse for Engine Control Module (ECM) OK
- Closed Throttle Position (CTP) switch -F60- OK
- Fuel pump relay OK

01-53

Test sequence

- Connect VAG1551/VAG1552 scan tool and insert "Engine Electronics" address word 01 (ignition on) ⇒ page 01-8 .

Rapid data transfer HELP
Select function XX

Indicated on display

- Press buttons -0- and -3- to select "Output Diagnostic Test Mode" function 03.

Rapid data transfer Q
03 - Output Diagnostic Test Mode

Indicated on display

Fuel injectors:

- Press -Q- button to confirm input.

Output Diagnostic Test Mode →
Cylinder 1 Fuel Injector-N30

Indicated on display

Note:

The fuel pump relay must be activated, the fuel pump must run, and you must clearly hear the flow of fuel in the fuel pressure regulator. If the fuel pump does not run, check fuel pump relay and connections ⇒ page 24-95 .

- Operate throttle valve at throttle body.

  As soon as the Closed Throttle Position (CTP) switch opens, cylinder 1 fuel injector must be actuated (click) 5 times.

01-54

To check remaining fuel injectors:

- Press → button and open the throttle valve again.

  As soon as the Closed Throttle Position (CTP) switch opens, the applicable fuel injector must be actuated (click) 5 times.

- Repeat for each fuel injector.

To skip individual tests:

- Press → button to advance through program sequence.

If one or more of the fuel injectors is not actuated:

- Check fuel injectors ⇒ page 24-102 .

01-55

EVAP canister purge regulator valve -N80-:

- Press → button.

Output Diagnostic Test Mode →
EVAP Canister Purge Regulator Valve-N80

Indicated on display

The valve will click until pressing the → button to advance the program sequence.

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

- Check EVAP canister purge regulator valve ⇒ page 24-116 .

Secondary Air Injection (AIR) solenoid valve -N112-:

- Press → button.

Output Diagnostic Test Mode →
Secondary Air Injection Valve-N112

Indicated on display

The valve will click until pressing the → button to advance the program sequence.

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

- Check secondary air injection solenoid valve -N112- ⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 26.

01-56

Secondary Air Injection (AIR) pump relay -J299-:

- Press → button.

Output Diagnostic Test Mode →

Secondary Air Injection Relay-J299

Indicated on display

The relay will be actuated and turn on the secondary AIR pump motor until pressing the → button to advance the program sequence.

If the relay is not actuated (does not click) or the motor does not run:

- Check secondary air injection pump relay -J299- ⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 26.

Intake manifold tuning valve -N156- (change-over valve):

- Press → button.

Output Diagnostic Test Mode →

Intake Manifold Changeover Valve-N156

Indicated on display

The valve will click until pressing the → button to advance the program sequence.

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

- Check intake manifold tuning valve -N156- ⇒ page 24-116 .

01-57

Valves -1- and -2- for camshaft adjustment, -N205-, -N208-:

- Press → button.

Output Diagnostic Test Mode → **Camshaft Adjustment 1**	⮜	Indicated on display

Valves 1 and 2 for camshaft adjustment, -N205- and -N208-, are actuated (click) until pressing the → button to advance the program sequence and end the output DTM.

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

- Check valves for camshaft adjustment ⇒ page 28-29
- Press → button.

Rapid data transfer **HELP** **Select function XX**	⮜	Indicated on display

Note:

Before selecting "Output Diagnostic Test Mode" function 03 again, switch off the ignition for approx. 20 seconds.

01-58

Basic Setting (scan tool function 04)

Notes:

- *The specified values for the "Basic Setting" and "Read Measuring Value Block" functions are described in the respective component test descriptions.*
- *Disconnecting the battery or the Engine Control Module (ECM) harness connector will erase all learned values and the readiness code. Diagnostic Trouble Code (DTC) memory, however, will not be erased. After reconnecting the battery and/or the ECM, the engine may idle unevenly and there may be some temporary loss of driveablity. If so, let the engine run at idle for a few minutes until the learning process has been completed.*
- *No learning will take place if a malfunction affecting engine regulation is stored in DTC memory (this does not include sporadic malfunctions).*
- *Basic settings are established with the engine running.*
- *In "Basic Setting" display groups 60 or 98, with the engine stopped and the ignition switched*

on, adaptation of the throttle valve control module -J338- takes place. Adaptation of throttle valve control module -J338- (with "Basic Setting" function 04 and display group 60) ⇒ page 24-150 .

- *In "Basic Setting" display groups 88 or 99, oxygen sensor control is switched off. This makes it possible to check for malfunctions that may be caused by oxygen sensor control being switched on or off. In the selected display group, press buttons -4- and -8- to switch back and forth between "Read Measuring Value Block" function 08 and "Basic Setting" function 04.*

01-59

Notes:

After selecting "Basic Setting" function 04, the ECM takes the following actions:

- *EVAP canister purge regulator valve is closed*
- *A/C compressor is switched off*

Requirements

- Vehicle stationary, engine running at idle
- Accelerator pedal not depressed
- Selector lever in "P" or "N" position
- No malfunctions stored in DTC memory
- Engine coolant temperature at least 80 ° C (176 ° F)
- All electrical consumers switched off (coolant fan must not run during test)

  A/C switched off (press "-" button on A/C

- control head repeatedly until the display is erased)

01-60

Test sequence

- Connect VAG1551/VAG1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Operate scan tool while observing messages on display:

Note:

By pressing the HELP button an overview of possible functions will be printed out.

- Press buttons -0- and -4 to select "Basic Setting" function 04, and press -Q- button to confirm input.

System in Basic Setting Q **Input display group number XXX**	Indicated on display

Note:

Display group number 0 (000) is used as an example to demonstrate the procedure.

01-61

To change to another display group:

Display group	VAG1551	VAG1552
higher	Press -3- button	Press ↑ button
lower	Press -1- button	Press ↓ button
skip	Press -C- button	Press -C- button

- Press -0- button three times to input display group number 0 (000), and press -Q- button to confirm input.

System in Basic Setting →

1 2 3 4 5 6 7 8 9 10

➢ Indicated on display

Notes:

- *In display group 0 the measuring values are displayed in decimal form.*
- *The display can be printed out by pressing the PRINT button.*

- If specified values were attained in all display fields, press → button to advance through program sequence.

Rapid data transfer **HELP**

Select function XX

➢ Indicated on display

-
Press buttons -0- and -6- to select "End Output" function 06, and press

-Q- button to confirm input.

- If one of the specified values is not attained ⇒ page 01-63 evaluation of display group 000.
- Continue by using procedures in "Corrective action" column.

01-62

Display group 000 (display in decimal values)											
• Engine running at idle; ECM in "Basic Setting" function 04											
Display fields											**Specified value**	**Corresponds to**
1	2	3	4	5	6	7	8	9	10	Idle learn value (additive) for O2S control, bank 2	115-141	-0.65 to +0.65 ms
										Idle learn value (additive) for O2S control, bank 1	115-141	-0.65 to +0.65 ms
										O2S control bank 2 (if outside of tolerance, conduct test drive)	77-179	-10 to +10 %
										O2S control bank 1 (if outside of tolerance, conduct test drive)	77-179	-10 to +10 %
										Learn value-idle air flow	118-138	-5.0 to +5.0 kg/h
										Idle air control value	118-138	-5.0 to +5.0 kg/h
										Throttle angle	0-12	0-5 ∠°
										Engine speed (with electrical consumers switched off) All-wheel drive vehicles Front-wheel drive vehicles	 62-74 74-86	 620-740 RPM 740-860 RPM
										Engine load (with electrical consumers switched off)	20-50	1.0-2.5 ms

Engine coolant temperature (necessary for "Basic Setting")	170-204	80-105 °C

01-63

Display group 000-evaluation

Display field 1	Possible malfunction cause	Corrective action
greater than 204	♦ Engine coolant temperature (ECT) sensor - G62-	- Check ECT sensor ⇒ page 24-75
less than 170	♦ Engine coolant temperature (ECT) sensor - G62-	- Check ECT sensor ⇒ page 24-75
	♦ Coolant thermostat faulty (open)	- Check thermostat ⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 19
Display field 2	**Possible malfunction cause**	**Corrective action**
greater than 50	♦ Electrical consumers switched on	- Switch off electrical consumers
	♦ Oxygen Sensor (O2S) control at limit	- Check HO2S and O2S control before TWC ⇒ page 24-22 - Check HO2S aging, bank 1, sensor 1 (before TWC) ⇒ page 24-60 - Check HO2S aging, bank 2, sensor 1 (before TWC) ⇒ page 24-63
less than 20	♦ Intake air leaks ("false air")	- Check intake air system for leaks ⇒ page 24-126

	♦ Fuel pressure regulator faulty or hose disconnected	- Check fuel pressure regulator ⇒ page 24-111

01-64

Display field 3	Possible malfunction cause	Corrective action
less than 62 (all-wheel drive) or less than 74 (front-wheel drive)	♦ Drive range selected ♦ Throttle valve control module faulty	- Move selector lever to "P" or "N" position - Check idle speed ⇒ page 24-16 - Check throttle valve control module ⇒ page 24-128
less than 74 (front-wheel drive)	♦ Supply voltage (terminal 15) to terminal 10 of Engine Control Module (ECM) missing	- Check supply voltage (terminal 15) to terminal 10 of ECM using applicable wiring diagram
greater than 74 (all-wheel drive) or greater less than 86 (front-wheel drive)	♦ Closed Throttle Position (CTP) switch open ♦ Throttle valve control module faulty ♦ Intake air leaks ("false air")	- Check idle speed ⇒ page 24-16 - Check throttle valve control module ⇒ page 24-128 - Check intake air system for leaks ⇒ page 24-126

01-65

Display field 4	Possible malfunction cause	Corrective action
less than 0	(Not possible)	---
greater than 12	♦ Adaptation of throttle valve control module to ECM not complete	- Check adaptation of throttle valve control module ⇒ page 24-150
greater than 12	♦ Throttle Position (TP) sensor in throttle valve control module faulty	- Check throttle valve control module ⇒ page 24-128
greater than 12	♦ Throttle valve mechanism sticking ♦ Contamination in intake air ducting near throttle valve	- Check by visual inspection and repair as necessary
greater than 12	♦ Accelerator pedal cable adjustment	- Adjust accelerator pedal cable ⇒ *Repair Manual, Fuel Supply System, Repair Group 20*
Display fields 5 + 6	**Possible malfunction cause**	**Corrective action**
less than 118	♦ Intake air leaks ("false air") after throttle valve	- Check intake air system for leaks ⇒ page 24-126
greater than 138	♦ Increased engine load	- Switch off electrical consumers
	♦ Throttle valve mechanism sticking ♦ Contamination in intake air ducting near throttle valve	- Check by visual inspection and repair as necessary

01-66

Display fields 7 + 8	Possible malfunction cause	Corrective action
less than 77	♦ Mixture too rich-oxygen sensor control adjusts toward too lean ♦ Oxygen sensor control at limit ♦ Too much fuel vapor from EVAP canister ♦ Fuel pressure regulator faulty, or hose disconnected	- Check HO2S and O2S control before TWC ⇒ page 24-22 - Check fuel pressure regulator ⇒ page 24-111
greater than 179	♦ Mixture too lean-oxygen sensor control adjusts toward too rich ♦ Intake air leaks ("false air") ♦ Fuel injector(s) faulty ♦ Oxygen sensor control at limit ♦ Secondary air system	- Check HO2S and O2S control before TWC ⇒ page 24-22 - Check intake air system for leaks ⇒ page 24-126 - Check fuel injector(s) ⇒ page 24-102 - Check secondary air system ⇒ Output Diagnostic Test Mode (DTM), page 01-51 and ⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 26
128	♦ Too little fuel ♦ Oxygen sensor control blocked	- Check fuel level in tank - Check HO2S and O2S control before TWC ⇒ page 24-22

Display field 9 + 10	Possible malfunction cause	Corrective action
less than 115 or greater than 141	♦ Display group 32, evaluating ⇒ page 24-27	

VAG1598/22 test box, connecting

Notes:

- *Switch the ignition off and wait at least 10 seconds before disconnecting the Engine Control Module (ECM) harness connector.*
- *Disconnecting the battery or the Engine Control Module (ECM) harness connector will erase all learned values and the readiness code. Diagnostic Trouble Code (DTC) memory, however, will not be erased. After reconnecting the battery and/or the ECM, the engine may idle unevenly and there may be some temporary loss of driveablity. If so, let the engine run at idle for a few minutes until the learning process has been completed.*

- Switch ignition off.

- Disconnect ECM.

- Connect VAG1598/22 adapter cable to ECM harness connector.

- Generate readiness code ⇒ page 01-73 .

Note:

If the DTC memory has been erased or the ECM was disconnected from its power supply, a new readiness code must be generated ⇒ page 01-73 .

01-68

Engine Control Module (ECM), replacing

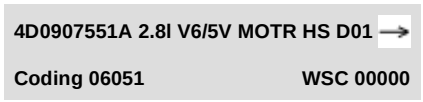
Notes:

- *Switch the ignition off and wait at least 10 seconds before disconnecting the Engine Control Module (ECM) harness connector.*
- *Disconnecting the battery or the Engine Control Module (ECM) harness connector will erase all learned values and the readiness code. After reconnecting the battery and/or the ECM, the engine may idle unevenly and there may be some temporary loss of driveablity. If so, let the engine run at idle for a few minutes until the learning process has been completed* ⇒ *page 01-58* *.*
- *After installation of a new ECM, set ECM coding and carry out adaptation of the throttle valve control module -J338-.*

If the ECM has been replaced, carry out the following steps in the sequence listed.

- Connect VAG1551/VAG1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ page 01-8 .

Indicated on display (ECM identification and coding)



- Print out ECM coding and compare with code table ⇒ page 01-14 .

01-69

- Press → button.

Rapid data transfer HELP

Select function XX

➢ Indicated on display

- Switch ignition off.
- Replace faulty ECM.
- Check ECM coding ⇒ page 01-12 .
- Carry out adaptation of throttle valve control module -J388- to ECM ⇒ page 24-150 .
- Generate readiness code ⇒ page 01-73 .

Note:

If the DTC memory has been erased or the ECM was disconnected from its power supply, a new readiness code must be generated ⇒ page 01-73 .

Readiness code

Readiness code, checking

Note:

The readiness code will be erased:

- *When Diagnostic Trouble Code (DTC) memory is erased*
- *When the Engine Control Module (ECM) harness connector is disconnected (e.g. to connect VAG1598/22 test box)*
- *When the battery is disconnected*

Required special tools and test equipment

- VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable

Checking

- Connect VAG1551/VAG1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ page 01-8 .

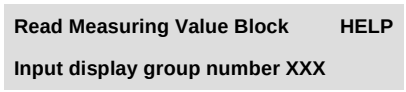
Rapid data transfer HELP



Indicated on display

Select function XX

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -8- and -6- to input display group number 86 (086), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

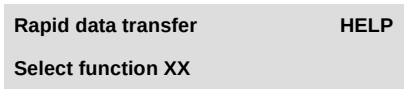
- Check readiness code values in display field 1.

  Specified value: 00000000

Note:

The readiness code is generated as soon as only zeros are shown in display field 1.

- Press → button.



Indicated on display

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

If the readiness code was not generated, generate readiness code again ⇒ page 01-73 .

- Check readiness code ⇒ page 01-70 . If DTC memory has been erased, or ECM has been disconnected from B+, generate readiness code again ⇒ page 01-73 .

Explanation of 8-digit readiness code

Readiness code is generated only when all display values = 0								
1	2	3	4	5	6	7	8	Diagnosis
							0	Three Way Catalytic Converter (TWC)
						0		TWC heating (not applicable / always "0")
					0			EVAP system and fuel tank leak detection test
				0				Secondary Air Injection (AIR) system
			0					Air conditioning system (diagnosis not applicable / always "0")
		0						Oxygen Sensor (O2S) control
	0							Oxygen Sensor (O2S) heating
0								Exhaust Gas Recirculation (EGR) system (not applicable / always "0")

Readiness code, generating

Required special tools and test equipment

- VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable

Test requirements

- No malfunctions stored in DTC memory
- Engine not stopped (ignition not switched off) during the test
- Vehicle not moving
- All electrical consumers switched off (coolant fan must not run during test)

Test sequence

- Connect VAG1551/VAG1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ page 01-8 .

01-74

Step 1: Check DTC memory

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -2- to select "Check DTC Memory" function 02, and press -Q- button to confirm input.

No DTC recognized	Indicated on display

If one or more DTCs are stored:

- Repair cause of malfunction.
- Erase DTC memory.
- Stop engine, start engine again, and road test.

⇒ Safety precautions for road testing vehicle page 24-9

- Check DTC memory again and erase.

If no DTCs were recognized:

- Press → button.

01-75

Step 2: Erase DTC memory

Rapid data transfer **HELP** **Select function XX**	Indicated on display

- Press buttons -0- and -5- to select "Erase DTC Memory" function 05, and press -Q- button to confirm input.

Note:

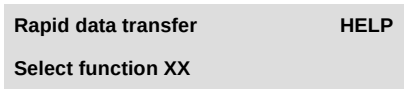
When erasing DTC memory, the readiness code is also erased.

Rapid data transfer → **DTC Memory is erased**	Indicated on display

- Press → button.

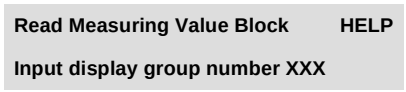
01-76

Step 3: Adaptation of throttle valve control module to ECM



Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



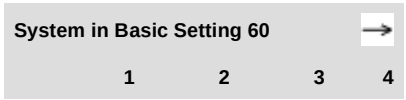
Indicated on display

- Press buttons -0-, -6- and -0- to input display group number 60 (060), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Press -4- button to select "Basic Setting" function 04 (adaptation of throttle valve control module to ECM)



Indicated on display (1-4 = display fields)

01-77

- Check specified values in display fields 3 and 4:

	Display fields			
	1	2	3	4
Display group 60: Adaptation of throttle valve control module to Engine Control Module (ECM)				
Display	xxx ∠ °	xxx ∠ °	Idle Part Throt Full Throt Decel Enrich	ADP.runs ADP. OK ADP.ERROR
Indicated	Throttle valve angle	Throttle drive angle	Operating condition	Adaptation status
Specified value	---	---	Idle	ADP. OK

If "ADP. ERROR" is indicated in display field 4:

- Check DTC memory ⇒ page 01-16 .

If the specified value "ADP. OK" is indicated in display field 4:

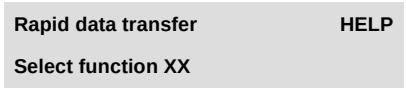
- Press → button.

01-78

Step 4:

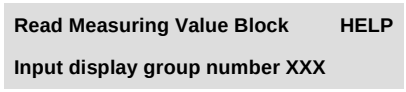
- Start engine and let run at idle.

Step 5: Oxygen Sensor (O2S) control operating condition



Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -3- and -0- to input display group number 30 (030), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Increase engine speed to 1800-2200 RPM.

- Hold at 1800-2200 RPM until specified value "111" is shown in all of display fields 1 - 4 (⇒ table).

	Display fields			
	1	2	3	4
Display group 30: Oxygen Sensor (O2S) control operating condition, Bank 1 and Bank 2				
Display	xxx	xxx	xxx	xxx
Indicated	Status of Heated Oxygen Sensor (HO2S), bank 1, sensor 1, before TWC	Status of Heated Oxygen Sensor (HO2S) 2, bank 1 sensor 2, after TWC	Status of Heated Oxygen Sensor (HO2S), bank 2, sensor 1, before TWC	Status of Heated Oxygen Sensor (HO2S) 2, bank 2 sensor 2, after TWC
Specified value	111	111	111	111
Evaluation ⇒ page 01-80				

If one of the specified values is not indicated:

- Check DTC memory ⇒ page 01-16 .

If the specified values for display fields 1-4 are not indicated:

- Continue to hold engine speed at 1800-2200 RPM.

01-80

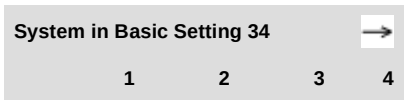
Explanation of 3-digit value in display fields 1 and 2:

When display = 1			
1	2	3	
		1	Oxygen Sensor (O2S) control active
	1		Heated Oxygen Sensor (HO2S) operational
1			Oxygen Sensor (O2S) heater ON

Step 6: Oxygen sensor aging (time period)

- Press button -4- to select "Basic Setting" function 04.

- Press button -3- four times to advance to display group number 34.



Indicated on display (1-4 = display fields)

- Hold engine speed at 1800-2200 RPM until display changes from "Test OFF" to "Test ON" in display field 4.

01-81

- Continue to hold at 1800-2200 RPM until specified value "B1-S1. OK" is indicated in display field 4.

	Display fields			
	1	2	3	4
Display group 34: Oxygen sensor aging, Bank 1 (time period of oxygen sensor)				
Display	xxxx RPM	xx.xx ms	xx.xx s	Test OFF/Test ON B1-S1 OK/ B1-S1 n. OK
Indicated	Engine speed (increments of 40 RPM)	Engine load	Time period of HO2S before TWC, bank 1, sensor 1	Diagnostic status Diagnostic result
Range	0-6800 RPM	0.00-12.75 ms	0.00-5.00 s	---
Specified value	1800-2200 RPM	0.80-2.00 ms	0.20-2.10 s	B1-S1 OK

If "B1-S1 n. OK" is indicated in display field 4:

- Check DTC memory ⇒ page 01-16 .

If the specified value "B1-S1 OK" is indicated in

display field 4:

- Continue to hold engine speed at 1800-2200 RPM.

- Press button -3- once to advance to display group number 35.

01-82

System in Basic Setting 35 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Hold engine speed at 1800-2200 RPM until display changes from "Test OFF" to "Test ON" in display field 4.
- Continue to hold at 1800-2200 RPM until specified value "B2-S1 OK" is indicated in display field 4.

	Display fields			
	1	2	3	4
Display group 35: Oxygen sensor aging, Bank 2 (time period of oxygen sensor)				
Display	xxxx RPM	xx.xx ms	xx.xx s	Test OFF/Test ON B2-S1 OK/ B2-S1 n. OK
Indicated	Engine speed (increments of 40 RPM)	Engine load	Time period of HO2S before TWC, bank 2, sensor 1	Diagnostic status Diagnostic result
Range	0-6800 RPM	0.00-12.75 ms	0.00-5.00 s	---
Specified	1800-2200 RPM	0.80-	0.20-2.10 s	B2-S1 OK

value		2.00 ms		

If "B1-S1 n. OK" is indicated in display field 4:

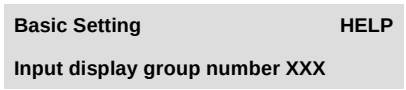
- Check DTC memory ⇒ page 01-16 .

If the specified value "B1-S1 OK" is indicated in display field 4:

- Continue to hold engine speed at 1800-2200 RPM.
- Press -C- button.

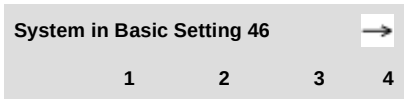
01-83

Step 7: Three Way Catalytic Converter (TWC) diagnosis



Indicated on display

- Press buttons -0-, -4- and -6- to input display group number 46 (046), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Hold engine speed at 1800-2200 RPM until display changes from "Test OFF" to "Test ON" in display field 4.
- Continue to hold at 1800-2200 RPM until specified value "Cat B1 OK" is indicated in display field 4.

Note:

The test time for TWC diagnosis is approx. 60 seconds.

01-84

	Display fields			
	1	2	3	4
Display group 46: Three Way Catalytic Converter (TWC), Bank 1 diagnosis				
Display	x.xx	x	xx.x s	Test OFF/Test ON Cat B1 OK/ Cat B1 n. OK
Indicated	Amplitude ratio	Exceeded diagnosis range	Test time of TWC diagnosis	Diagnostic status Diagnostic result
Range	0.00-1.00	0-9	00.0-60.0	---
Specified value	0.00-0.26	0-2	60.0 s	Cat B1 OK

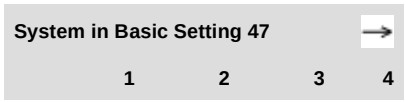
If "Cat B1 n. OK" is indicated in display field 4:

- Check DTC memory ⇒ page 01-16 .

If specified value "Cat B1 OK" is indicated in display field 4:

- Continue to hold engine speed at 1800-2200 RPM.

- Press button -3- once to advance to display group number 47.



Indicated on display (1-4 = display fields)

01-85

- Hold engine speed at 1800-2200 RPM until display changes from "Test OFF" to "Test ON" in display field 4.

- Continue to hold at 1800-2200 RPM until specified value "Cat B2 OK" is indicated in display field 4.

Note:

The test time for TWC diagnosis is approx. 60 seconds.

	Display fields			
	1	2	3	4
Display group 47: Three Way Catalytic Converter (TWC), Bank 2 diagnosis				
Display	x.xx	x	xx.x s	Test OFF/Test ON Cat B2 OK/ Cat B2 n. OK
Indicated	Amplitude ratio	Exceeded diagnosis range	Test time of TWC diagnosis	Diagnostic status Diagnostic result
Range	0.00-1.00	0-9	00.0-60.0	---
Specified value	0.00-0.26	0-2	60.0 s	Cat B2 OK

If "Cat B2 n. OK" is indicated in display field 4:

- Check DTC memory ⇒ page 01-16 .

If specified value "Cat B2 OK" is indicated in display field 4:

- Press -C- button.

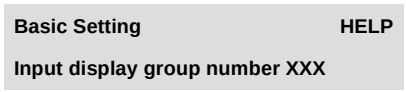
01-86

Step 8: Evaporative Emissions (EVAP) system and fuel tank leak detection

Note:

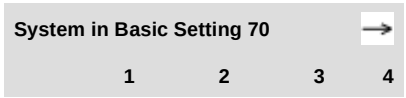
During this diagnosis there should be no engine load, otherwise the diagnosis is interrupted and can only be restarted after pressing the accelerator pedal momentarily.

- Start engine and let run at idle.



➢ Indicated on display

- Press buttons -0-, -7- and -0- to input display group number 70 (070), and press -Q- button to confirm input.



➢ Indicated on display (1-4 = display fields)

If the diagnosis is initiated by the ECM, the display changes from "Test OFF" to "Test ON" in display field 4.

- Let engine continue to run at idle until the specified value "EVAP OK" is indicated in display field 4.

Note:

If the display changes from "Test ON" to "Test OFF" during the diagnosis, briefly accelerate the engine to reset and repeat the test.

01-87

	Display fields			
	1	2	3	4
Display group 70: Evaporative Emissions (EVAP) canister purge regulator valve diagnosis				
Display	xxx %	xx.x %	xx.xx g/s	Test OFF/Test ON EVAP OK/ EVAP n. OK
Indicated	Opening of EVAP canister purge regulator valve during diagnosis	Oxygen sensor control deviation during diagnosis	Idle Air Control (IAC) valve deviation during diagnosis	Diagnostic status Diagnostic result
Range	0 - 100 %	-25.0 to +25.0 %	-2.78 to +2.85 g/s	---
Specified value	0 - 93 %	-15.0 to +15.0 %	-1.00 to 0.00 g/s	EVAP OK

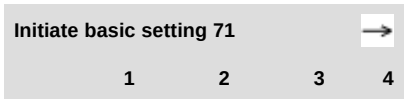
If "EVAP n. OK" is indicated in display field 4:

- Check DTC memory ⇒ page 01-16 .

If the specified value "EVAP OK" is indicated in display field 4:

- Press -3- button to input display group number 71.

01-88



Indicated on display (1-4 = display fields)

- Start engine and let run at idle.

If the diagnosis is initiated by the ECM, the display changes from "Test OFF" to "Test ON" in display field 4.

- Let engine continue to run at idle until the specified value "Syst. OK" is indicated in display field 4.

	Display fields			
	1	2	3	4
Display group 71: Fuel tank leak detection				
Display	Reed op. Reed cl.	Small leak/large leak disconnection	Syst.Test Check Check end	Test OFF/Test ON Syst. OK/ Syst. n.OK
Indicated	Status: Reed contact	Error message	System status	Diagnostic status Diagnostic result
Range	---	---	---	---
Specified value	Reed op.	---	Check end	Syst. OK

01-89

Notes:

If display field 4 changes from "Test ON" to "Test OFF" and "Abort" appears in display field 2, repeat the diagnosis of fuel tank leak detection. Shut the engine off, start the engine again and repeat the leak detection test.

Diagnosis conditions for fuel tank leak detection:

- *Intake Air Temperature (IAT) must be less than 60° C (140° F) ⇒display group 4, display field 4 (the temperature can be reduced by opening the hood).*
- *The throttle valve angle for vehicles with automatic transmissions must be smaller than 10∠° ⇒ display group 3, display field 3*
- *The throttle valve angle for vehicles with manual transmissions must be smaller than 10∠° ⇒ display group 3, display field 3*

If "Syst. n. OK" is indicated in display field 4:

- Check DTC memory ⇒ page 01-16 .

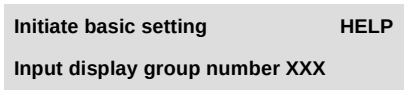
If the specified value "Syst. OK" is indicated in display field 4:

- Press → button.

01-90

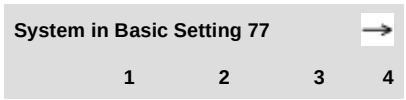
Step 9: Secondary Air Injection (AIR) system diagnosis

- Start engine and let run at idle.



➢ Indicated on display

- Press buttons -0-, -7- and -7- to input display group number 77 (077), and press -Q- button to confirm input.



➢ Indicated on display (1-4 = display fields)

If the diagnosis is initiated by the ECM, the display changes from "Test OFF" to "Test ON" in display field 4.

- Let engine continue to run at idle until the specified value "Syst. OK" is indicated in display field 4.

01-91

	Display fields			
	1	2	3	4
Display group 77: Secondary air injection system diagnosis				
Display	xx.x %	xx. x %	xx.x ° C	Test OFF/Test ON Syst. OK/ Syst. n.OK
Indicated	O2S control deviation during diagnostics Bank 1	O2S control deviation during diagnostics Bank 2	Coolant temperature	Diagnostic status Diagnostic result
Range	---	---	-46.5 to +141.5 ° C	---
Specified value	---	---	greater than 70.0 ° C	Syst. OK

If "Syst. n. OK" is indicated in display field 4:

- Check DTC memory ⇒ page 01-16 .

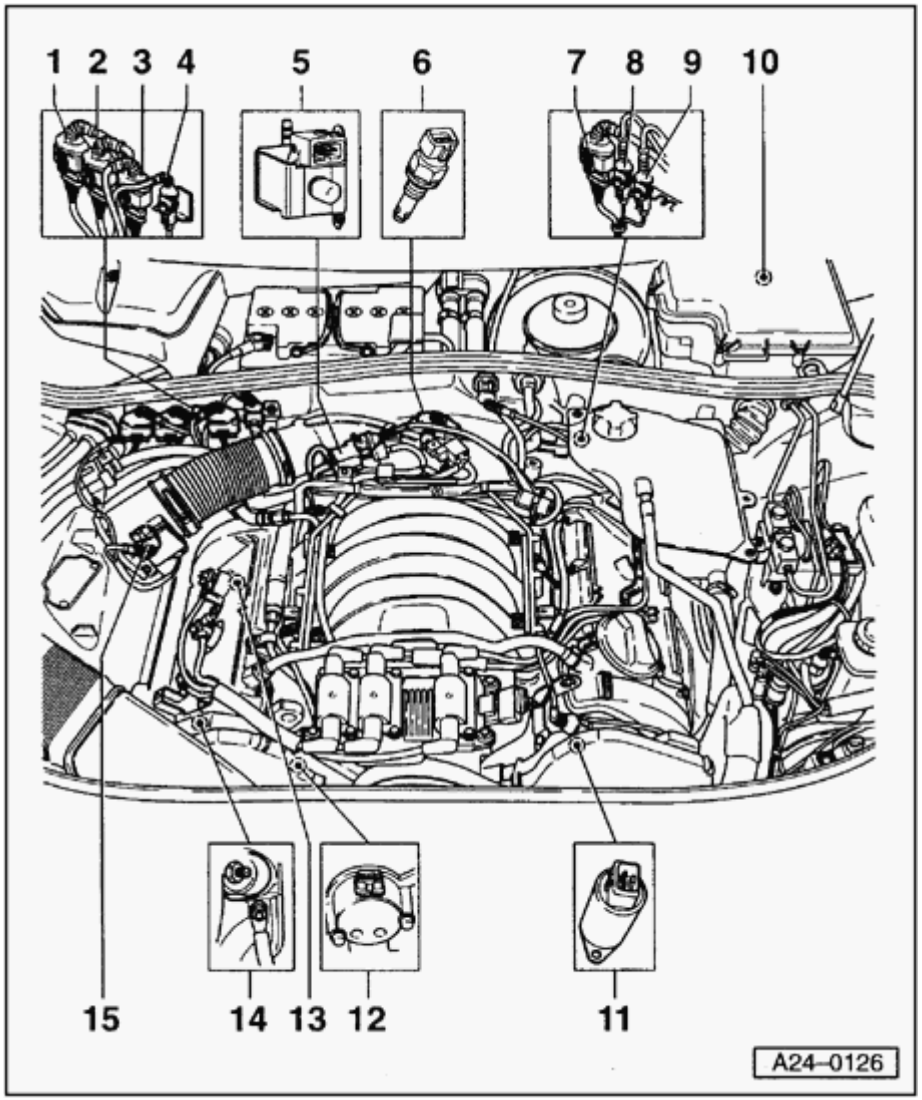
If the specified value "Syst. OK" is indicated in display field 4:

- Press → button.

Step 10: Check readiness code

- Check readiness code ⇒ page 01-70 .

24-1



Motronic Multiport Fuel Injection (MFI) and ignition system

Component locations

Data Link Connector (DLC)

- Located under knee bar, left side of steering wheel

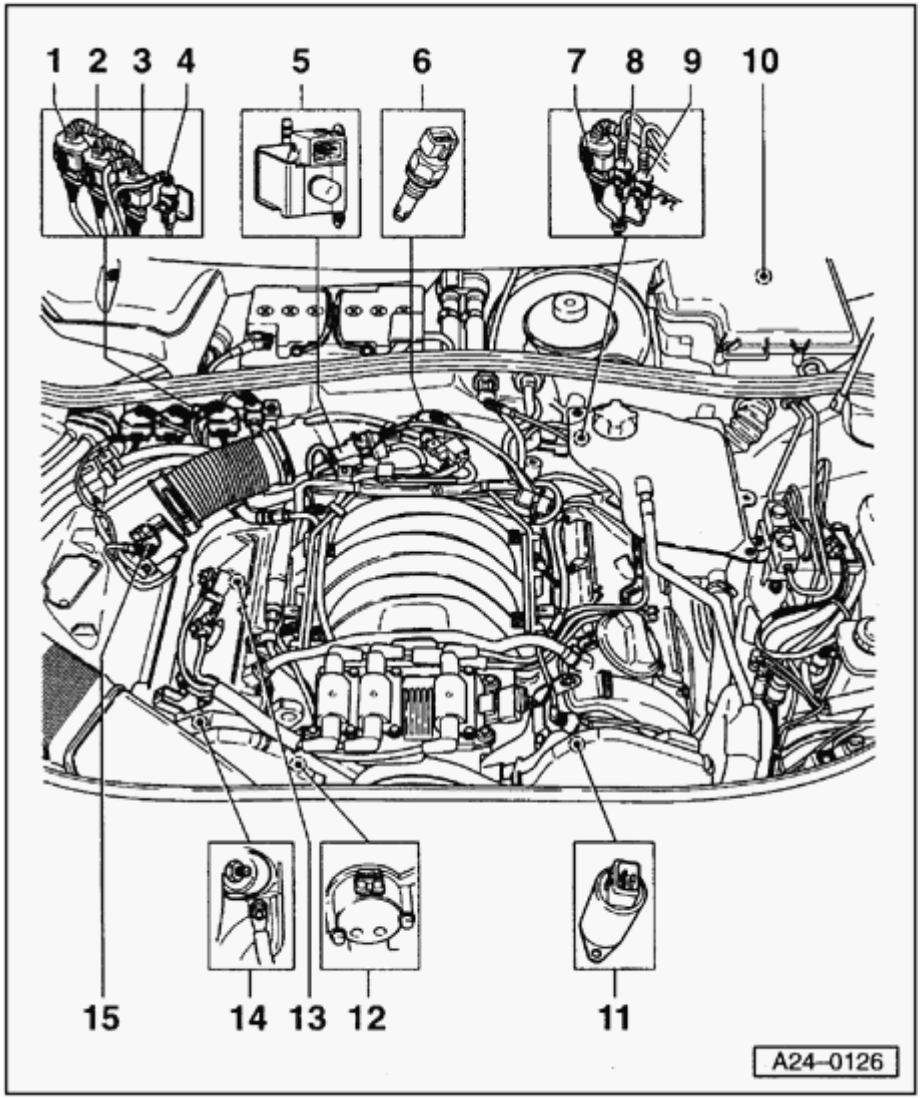
Fuel pump relay

- Position 6 on relay panel in driver's side footwell

Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130-, with Oxygen Sensor (O2S) heater -Z29-

- Bank 1, sensor 2
- In exhaust system behind TWC

24-2

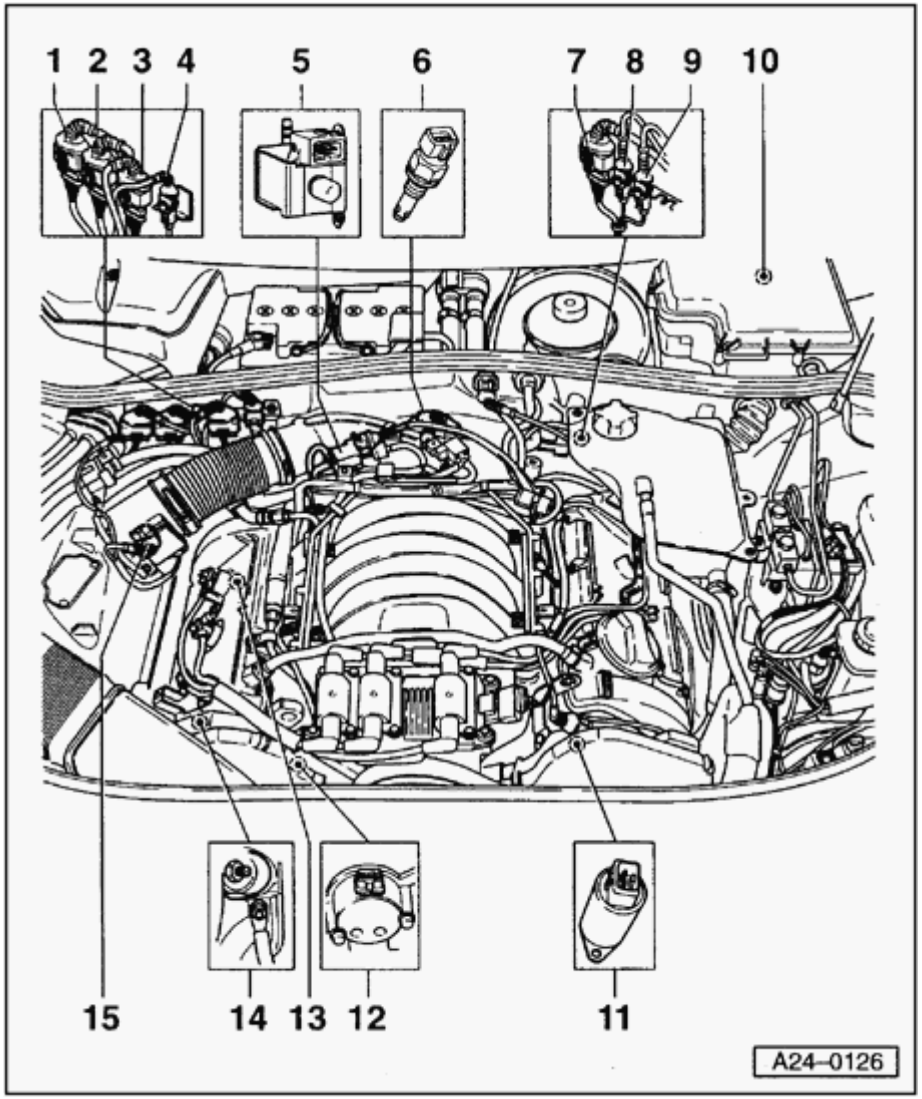


Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131-, with Oxygen Sensor (O2S) heater -Z30-

- Bank 2, sensor 2
- In exhaust system behind TWC

EVAP system Leak Detection Pump (LDP) -V144-

- In left-rear wheelhousing behind splash shield



1 - Harness connector

- For O2S behind TWC -G130- and O2S heater -Z29-
- 4-pin connector, green
- For bank 1, sensor 2

2 - Harness connector

- For O2S 2 behind TWC -G131- and O2S 2 heater -Z30-
- 4-pin connector, brown
- For bank 2, sensor 2

3 - Harness connector

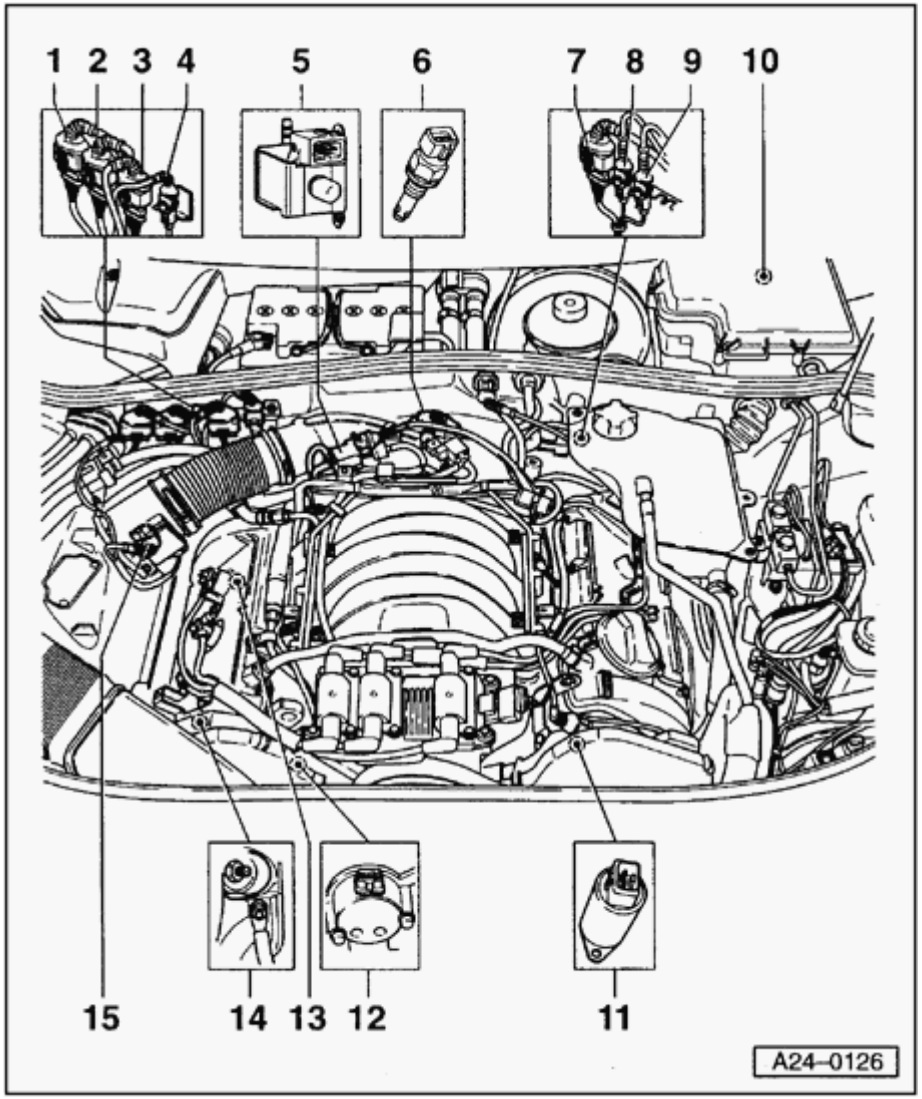
- For HO2S -G39- with O2S heater -Z19-
- 4-pin connector, black
- For bank 1, sensor 1

4 - Harness connector

- For Knock Sensor (KS) 1 -G61-
- 3-pin connector, blue

5 - Secondary Air Injection (AIR) solenoid valve -N112-

24-4



6 - Intake Air Temperature (IAT) sensor -G42-

7 - Harness connector

- For HO2S 2 -G108- with O2S heater -Z28-
- 4-pin connector, black
- For bank 2, sensor 1

8 - Harness connector

- For Knock Sensor (KS) 2 -G66-
- 3-pin connector, blue

9 - Harness connector

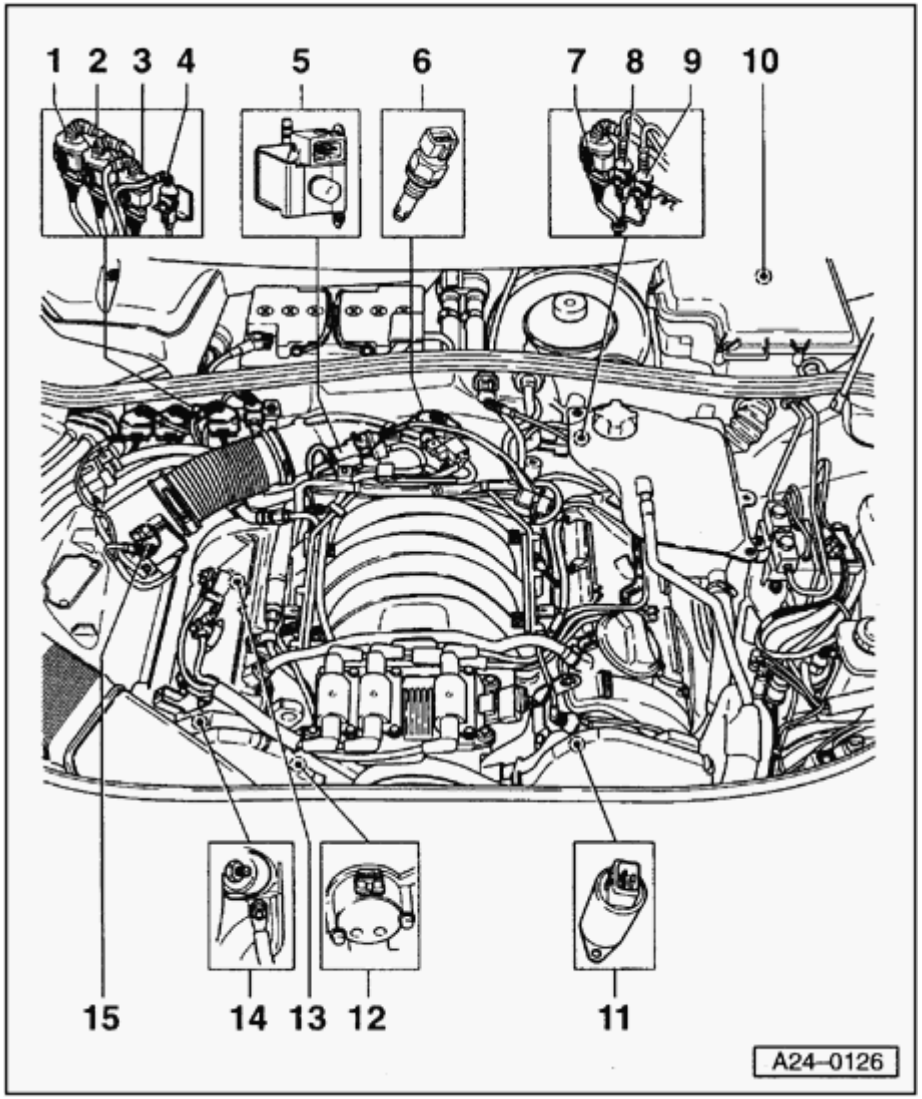
- For engine speed (RPM) sensor -G28-
- 3-pin connector, gray

10 - Electronics box (E-box)

Contains:

- Motronic Engine Control Module (ECM) -J220-
- Secondary Air Injection (AIR) pump relay -J299-

24-5



11 - Valve 2 for camshaft adjustment -N208-

12 - Camshaft Position (CMP) sensor -G163-, bank 1

13 - Heated Oxygen Sensor (HO2S) -G39- with Oxygen Sensor (O2S) heater -Z19-

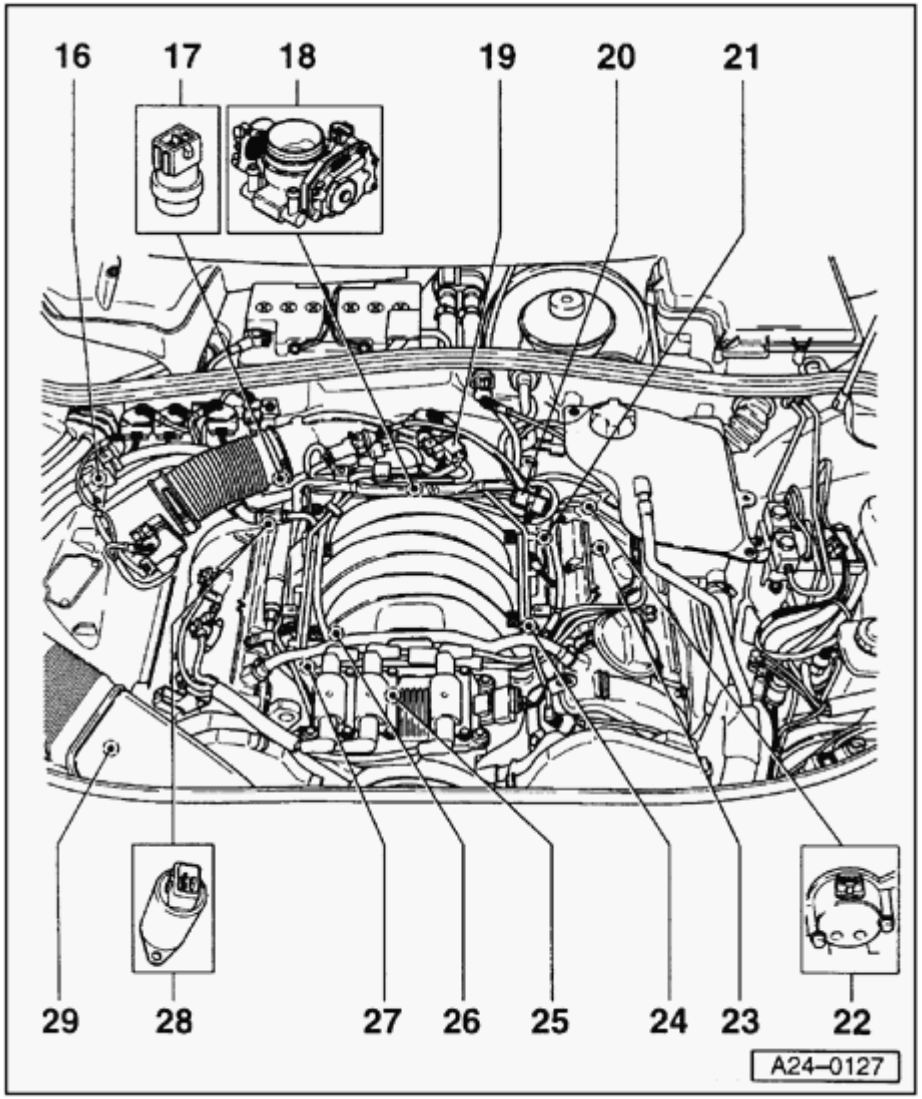
- Bank 1, sensor 1

14 - Ground (GND) connection

- To right engine support

15 - Mass Air Flow (MAF) sensor -G70-

24-6



16 - EVAP canister purge regulator valve -N80-

17 - Engine Coolant Temperature (ECT) sensor -G62-

- 4-pin connector
- In coolant pipe behind right cylinder head (Bank 1)

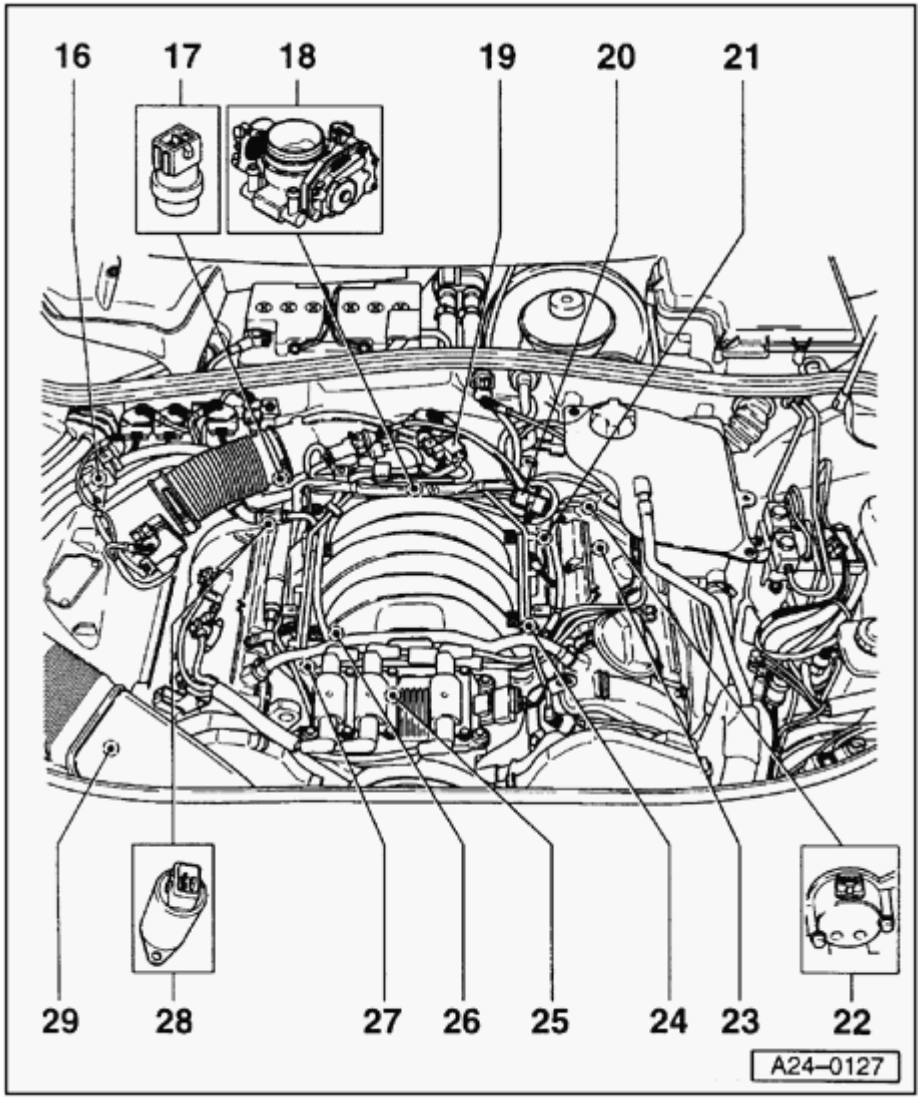
18 - Throttle valve control module -J338-

Includes:

- Throttle drive -G186-
- Angle sensor 1 for throttle drive -G187-
- Throttle Position (TP) sensor -G69-
- Closed Throttle Position (CTP) switch -F60-

19 - Intake Manifold Tuning (IMT) valve -N156- (change-over valve)

20 - Fuel pressure regulator



21 - Engine speed (RPM) sensor -G28-

- In transmission housing above differential

22 - Camshaft Position (CMP) sensor -G40-, bank 2

23 - Heated Oxygen Sensor (HO2S) 2 -G108- with Oxygen Sensor (O2S) heater -Z28-

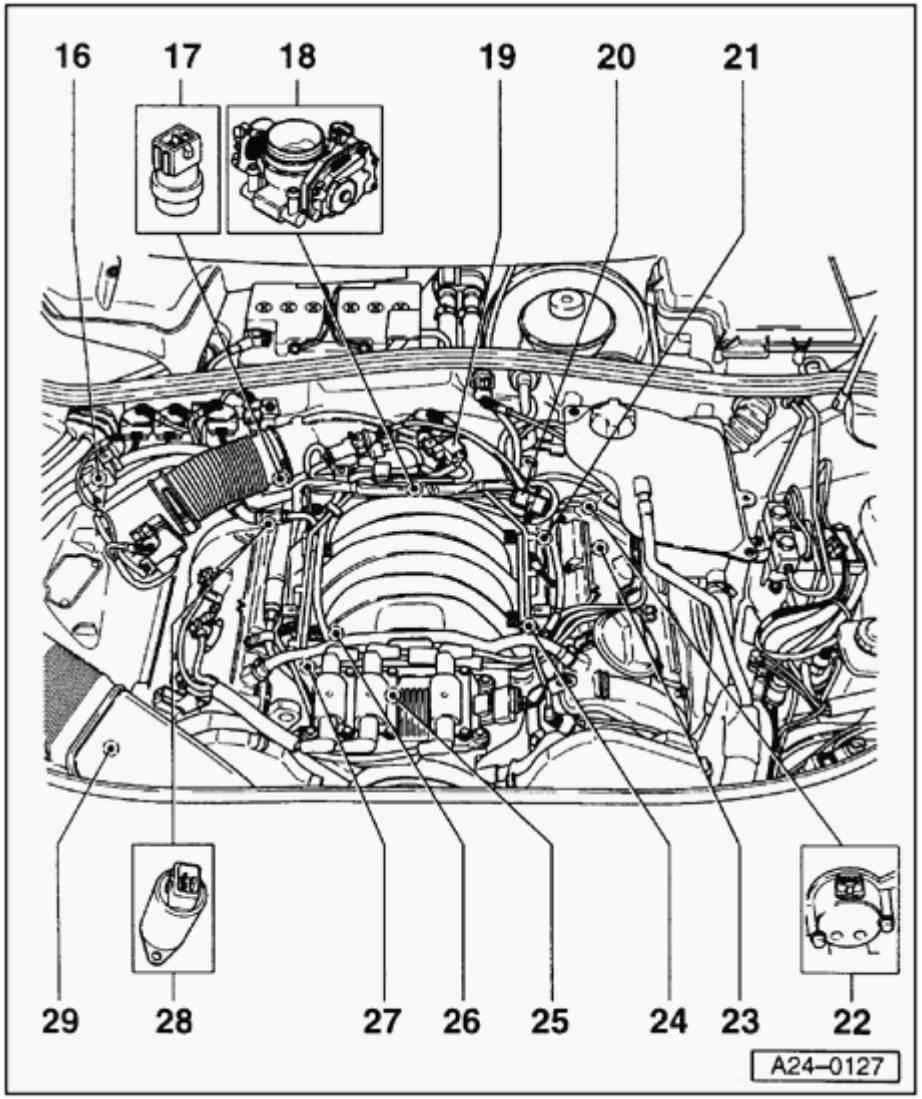
- Bank 2, sensor 1

24 - Knock Sensor (KS) 2 -G66-

25 - Ignition coils and power output stage

Includes:

- Ignition coil -N-
- Ignition coil 2 -N128-
- Ignition coil 3 -N158-
- Power output stage -N122-



26 - Knock Sensor (KS) 1 -G61-

27 - Fuel injectors

- Cylinder 1: -N30-
- Cylinder 2: -N31-
- Cylinder 3: -N32-
- Cylinder 4: -N33-
- Cylinder 5: -N83-
- Cylinder 6: -N84-

28 - Valve 1 for camshaft adjustment -N205-

29 - Secondary Air Injection (AIR) pump motor -V101-

Safety precautions

WARNING!

- ***Fire hazard! Do not smoke, work near heaters or open flame, or have anything nearby that could ignite fuel. The fuel system is under pressure. Before opening, cover connections with a rag, and open carefully to release pressure.***

- ***When driving or riding in an airbag-equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and the airbag increase the risk of injury in an accident.***

- ***During a test drive in an airbag-equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a second technician.***

WARNING!

Be alert when working on or near the engine and ignition wires. High secondary ignition voltage can cause serious personal injury and damage vehicle components.

- ***DO NOT touch or disconnect ignition system wires when the engine is running or being cranked at starting RPM.***
- ***DO NOT operate the starter if fuel injectors are removed.***

Be sure the ignition is switched OFF, when:

- ***Disconnecting or connecting the battery, ignition wires, or test equipment leads***
- ***Disconnecting fuel injection system wiring***
- ***Washing the engine or engine compartment.***

BEFORE cranking the engine at starting RPM (e.g. for compression testing) disable ignition and fuel injection systems:

- ***Disconnect connector for ignition coil power***

output stage, and fuse for fuel pump.

- ***Disconnect harness connectors from all fuel injectors.***
- ***Afterward, erase Diagnostic Trouble Code (DTC) memory.***

24-11

CAUTION!

BEFORE disconnecting the battery:

- ***Stop the engine.***
- ***Be sure the ignition is switched OFF (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***
- ***Be sure of the proper radio code (for vehicles equipped with coded anti-theft radio).***

Be sure the battery negative (-) cable is disconnected, when:

- ***Working on the electrical system***
- ***Resistance (spot) welding or electric arc welding anywhere on the vehicle.***

When connecting and disconnecting electrical test equipment (LED voltage tester, multimeter, etc.):

- ***Be sure the ignition is switched OFF.***
- ***Use correct adapters from the VW1594***

connector test kit.

For any work affecting the Engine Control Module (ECM):

- ***BEFORE disconnecting the ECM harness connector, switch the ignition OFF and WAIT at least 20 seconds. Failure to do so may damage the ECM.***

- ***DO NOT connect any outside voltage source to stimulate an output signal at the ECM.***

24-12

Rules of cleanliness

CAUTION!

Whenever carrying out work on the fuel supply and fuel injection systems, carefully observe the following rules of cleanliness.

- Thoroughly clean fuel system line and hose connections and the surrounding area before disconnecting.

- Place removed components on a clean surface and cover. Use plastic sheeting or paper. Do not use fluffy rags that could leave lint!

- Carefully cover over or seal any components that have been opened if repairs are not carried out immediately.

- Install only clean parts:

  - Do not remove replacement parts from the packaging until immediately before they are to be installed.

  - Do not use parts that have been stored without packaging (e.g. in toolboxes, etc.).

- When the fuel system is opened:

  - Avoid working with compressed air whenever possible.

  - Avoid moving the vehicle if possible.

24-13

Technical data

Engine code	AHA	
Engine idle speed (with consumers switched off) not adjustable, maintained by Idle Air Control (IAC)	All-wheel drive vehicles	620-740 RPM
	Front-wheel drive vehicles	740-860 RPM
Engine speed (RPM) upper limit actuated by switching off fuel injectors	approx. 6500 RPM	
Fuel system pressure at idle	With pressure regulator vacuum hose connected	approx. 3.2-3.8 bar (46-55 psi)
	With pressure regulator vacuum hose disconnected	approx. 3.8-4.2 bar (55-61 psi)
Residual fuel pressure after 10 minutes	Cold engine	approx. 2.2 bar (32 psi)
	Warm engine	approx. 3.0 bar (44 psi)
Fuel injectors	Spray pattern	approx. the same for all fuel injectors
	Resistance 1)	

		13.5-15.5 ohms (Ω)

1) Engine at room temperature; with the engine at normal operating temperature the resistance increases by approx. 4-6 ohms.

Fuel injection system, servicing

Servicing ignition system ⇒ page 28-1

Notes:

- *Fuel hoses in the engine compartment must be secured with spring-type clamps. Screw-type clamps or equivalent must not be used.*
- *The Engine Control Module (ECM) has On Board Diagnostic (OBD) capability, and is equipped with Diagnostic Trouble Code (DTC) memory. Before repairing or adjusting any components or systems, first check DTC memory. Also check all vacuum connections for leaks ("false air").*
- *For proper operation of electrical and electronic components, a Battery Positive Voltage (B+) supply of at least 11.5 volts is required.*
- *Do not use any gasket sealers or other automotive chemical compounds that contain silicone. Traces of silicone drawn into the engine pass unburned into the exhaust and can damage the oxygen sensors.*
- *Do not use any electrical contact sprays or equivalent near oxygen sensor connections.*

Proper oxygen sensor function requires reference to outside air via the cable. If any contact spray reaches the oxygen sensor, it can cause damage or improper function.

- *During some tests, malfunctions are recognized by the ECM and stored in DTC memory. For this reason, always check DTC memory (⇒ page 01-16) after all tests and repairs, and erase DTC memory as necessary.*

24-15

Safety precautions ⇒ page 24-9

Rules of cleanliness ⇒ page 24-12

Technical data ⇒ page 24-13

Idle speed, checking

Notes:

- *Idle speed, ignition timing and CO-content cannot be adjusted.*
- *Idle speed is maintained by the Throttle valve control module.*
- *CO-content is maintained and adjusted by Oxygen Sensor (O2S) control. Malfunctions in O2S control are recognized by On Board Diagnostic (OBD) and stored in DTC memory.*

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable

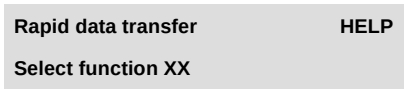
24-17

Test conditions

- Fuses for engine electronics OK
- No malfunctions stored in DTC memory ⇒ page 01-16
- Engine Coolant Temperature (ECT) at least 80 ° C (176 ° F)
- All electrical consumers switched off (radiator coolant fan must not run during test)
- A/C switched off
- Exhaust system free of leaks
- Automatic transmission selector lever in "P" or "N" position
- Throttle valve in Closed Throttle Position (CTP); for Accelerator Pedal (AP) cable adjustment ⇒ Repair Manual, Fuel Supply System, Repair Group 20

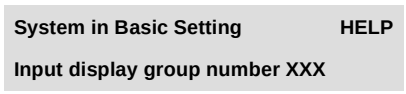
Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .



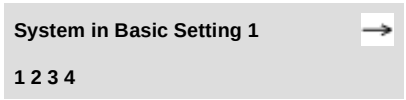
➢ Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" function 04, and press -Q- button to confirm input.



➢ Indicated on display

- Press buttons -0-, -0- and -1- to input display group number 1 (001), and press -Q- button to confirm input.



➢ Indicated on display (1-4 = display fields)

Note:

After selecting function 04, the ECM initiates the following:

- *EVAP canister purge regulator valve is closed*
- *A/C compressor is switched off*

- Briefly raise engine speed (acceleration burst) and let engine run at idle for another 2 minutes.

24-19

- Compare display with specified values (display fields 1-4):

	Display fields			
	1	2	3	4
Display group 1: Engine idle speed				
Display	xxxx RPM	xx.x °C	xx.x%	xx.x %
Indicates	Idle speed (in 40 RPM steps)	Engine Coolant Temperature (ECT)	Oxygen Sensor (O2S) control, Bank 1	Oxygen Sensor (O2S) control, Bank 2
Range	0 - 6800 RPM	-48.0 - 143.2 °C (-54 - 289 °F)	-25.0 to +25.0 %	-25.0 to +25.0 %
Specified value	620 - 740 RPM (all-wheel drive)	80.0 ° - 105.0 °C (176 - 221 °F)	-10.0 to +10.0 % value must change by at least 2 %	-10.0 to +10.0 % value must change by at least 2 %
	740 - 860 RPM (front-wheel drive)			
	If not as specified ⇒Evaluation of display group 1 ⇒ page 24-21	---	If not as specified: - Check HO2S and O2S control before TWC ⇒ page 24-22	

24-20

If displayed values are OK (as specified):

- Press → button.

- Press buttons -0- and -6- to insert "End Output" address word 06, and press -Q- button to confirm input.

- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Note:

The increased idle speed for vehicles with front-wheel drive is achieved if there is voltage (from terminal 15er) supplied to terminal 10 of the Engine Control Module (ECM).

24-21

Evaluation of display group 1

Display Group: 1		
Display field: 1	**Possible malfunction cause**	**Corrective action**
less than 620 (all-wheel drive) or less than 740 (front-wheel drive)	♦ Driving mode engaged ♦ Adaptation of throttle valve control module -J338- to engine control module cannot be conducted ♦ Throttle valve control module malfunction	- Move selector lever into "P" or "N" position - Carry out adaptation of throttle valve control module -J338- to ECM ⇒ page 24-150 - Check -J338- ⇒ page 24-128
less than 740 (front-wheel drive)	♦ B+ (15) to terminal 10 of ECM missing	- Check voltage supply to terminal 10 on ECM per wiring diagram
greater than 740 (all-wheel drive)	♦ Adaptation of throttle valve control module -J338- to engine control module cannot be conducted ♦ Closed Throttle Position (CTP) switch open ♦ Throttle valve control module malfunction	- Carry out adaptation of throttle valve control module -J338- to ECM ⇒ page 24-150 - Check -J338- ⇒ page 24-128

or greater than 860 (front-wheel drive)		
	♦ Intake air leaks ("false air")	- Check intake air system for leaks ⇒ page 24-126

24-22

Heated Oxygen Sensor (HO2S) and Oxygen Sensor (O2S) control before TWC, checking

Notes:

- *Connector for Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) - G39- (bank 1, sensor 1): 4-pin, black.*
- *Connector for Heated Oxygen Sensor (HO2S) 2 before Three Way Catalytic Converter (TWC) - G108- (Bank 2, sensor 1): 4-pin, black.*
- *Component location* ⇒ *page 24-1*

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit

- Wiring diagram

Test conditions

- Engine Coolant Temperature (ECT) at least 80° C (176° F)

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	Indicated on display

- Press buttons -0-, -3- and -2- to input display group number 32 (032), and press -Q- button to confirm input.

Read Measuring Value Block 32 → **1 2 3 4**	Indicated on display (1-4 = display fields)

24-24

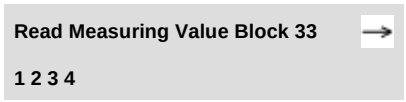
- Check learning values for Oxygen Sensor (O2S) control before TWC (display fields 1-4):

	Display fields			
	1	2	3	4
Display group 32: Oxygen Sensor (O2S) control learning values (before TWC)				
Display	xx.x %	xx.x %	xx.x %	xx.x %
Indicates	O2S control learning value at idle (additive) (before TWC) Bank 1, Sensor 1	O2S control learning value at part load (multiplicative) (before TWC) Bank 1, Sensor 1	O2S control learning value at idle (additive) (before TWC) Bank 2, Sensor 1	O2S control learning value at part load (multiplicative) (before TWC) Bank 2, Sensor 1
Range	-25.0 to +25.0 %	-25.0 to +25.0 %	-25.0 to +25.0 %	-25.0 to +25.0 %
Specified value	-10.0 to +10.0 % (can vary slightly)	-10.0 to +10.0 % (can vary slightly)	-10.0 to +10.0 % (can vary slightly)	-10.0 to +10.0 % (can vary slightly)
	If not as specified ⇒ Evaluation of display group 32, page 24-27			

If displayed values are OK (as specified):

- Press -C- button.

- Press buttons -0-, -3- and -3- to input display group number 33, and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

24-25

- Check Oxygen Sensor (O2S) control before TWC (display fields 1-4):

	Display fields			
	1	2	3	4
Display group 33: Oxygen Sensor (O2S) control (before TWC)				
Display	xx.x %	x.xxx V	xx.x %	x.xxx V
Indicates	O2S control Bank 1, Sensor 1 (before TWC)	O2S voltage Bank 1, Sensor 1 (before TWC)	O2S control Bank 2, Sensor 1 (before TWC)	O2S voltage Bank 1, Sensor 1 (before TWC)
Range	-25.0 to +25.0 %	0.000-1.000 V	-25.0 to +25.0 %	0.000-1.000 V
Specified value	-10.0 to +10.0 % value must change by at least 2 %	0.000 to 1.000 V value must fluctuate at least 30 times per minute, and change by at least 0.3 volts	-10.0 to +10.0 % value must change by at least 2 %	0.000 to 1.000 V value must fluctuate at least 30 times per minute, and change by at least 0.3 volts
	If not as specified ⇒ page 24-26 , Continuation	If not as specified ⇒ page 24-28 , Evaluation of display group 33	If not as specified ⇒ page 24-26 , Continuation	If not as specified ⇒ page 24-28 , Evaluation of display group 33

24-26

Continuation

If the value in either display field 1 or 3 is NOT OK, or if the value does not fluctuate by at least 2 %:

- Road test to condition oxygen sensor(s) (eliminate possible contamination) and repeat test.

If the value in either display field 1 or 3 is still NOT OK, or if it still does not fluctuate by at least 2 %:

- Check Oxygen Sensor (O2S) heater(s) ⇒ page 24-34 .

If the value in either display field 1 or 3 remains constant:

- Check oxygen sensor voltage(s) (display fields 2 and 4).

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

24-27

Evaluation of display group 32

Display group: 32 Display fields: 1-4	Possible malfunction cause	Corrective action
O2S control learning value: -25.0 to -10.0 %	♦ Engine oil dilution (when part load learning value is normal ⇒ display fields 2 and 4)	- Change engine oil, or carry out extensive road test and check again
	♦ Fuel pressure too high	- Check fuel pressure regulator ⇒ page 24-111
	♦ Fuel injector leaking	- Check fuel injectors ⇒ page 24-102
	♦ Oxygen Sensor (O2S) heater malfunction	- Check O2S heater ⇒ page 24-34
O2S control learning value: 10.0 to 25.0 %	♦ Intake air leaks ("false air") or exhaust manifold leaks (when partial load learning value is normal ⇒ display fields 2 and 4)	- Check intake air system for leaks ⇒ page 24-126 - Check exhaust system for leaks ⇒ Repair Manual, 2.8 Liter V6 5V General, Engine, Repair Group 26
	♦ Fuel pressure too low	- Check fuel pressure regulator ⇒ page 24-111
	♦ Oxygen Sensor (O2S) heater malfunction	- Check O2S heater ⇒ page 24-34

	♦ Fuel injector does not open, or partially opens	- Check fuel injectors ⇒ page 24-102
O2S control learning value: constant 0.0 %	♦ Oxygen sensor control learning not active	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-68

24-28

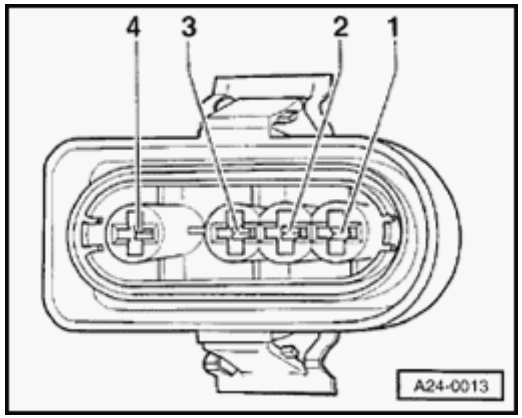
Evaluation of display group 33

Display group: 33 Display fields: 2, 4	Possible malfunction cause	Corrective action
approx. 0.435 V	♦ Open circuit in wiring between HO2S connector terminal 4 and ECM	- Check reference voltage ⇒ page 24-29
approx. 0.435 V	♦ Open circuit in wiring between HO2S connector terminal 3 and ECM	
approx. 1.085 V	♦ Short circuit to positive (B+) between HO2S connector terminal 4 and ECM	- Check HO2S wiring, bank 1, sensor 1 ⇒ page 24-30 - Check HO2S wiring, bank 2, sensor 1 ⇒ page 24-32
approx. 0.000 V	♦ Short circuit to Ground between HO2S connector terminal 4 and ECM	

24-29

Checking HO2S reference voltage (Banks 1, 2)

- Disconnect 4-pin connector for respective HO2S.



- Connect multimeter US1119 (Fluke 83 or equivalent) between harness connector terminals 3 and 4 (to ECM), using adapter cables from VW1594 connector test kit.
- Start engine and measure voltage.

  Specified value: 0.40-0.50 volts
- Switch ignition off.

If voltage is NOT OK:

- Check HO2S wiring.
  - Bank 1, sensor 1 ⇒ page 24-30 .
  - Bank 2, sensor 1 ⇒ page 24-32 .

If voltage is OK:

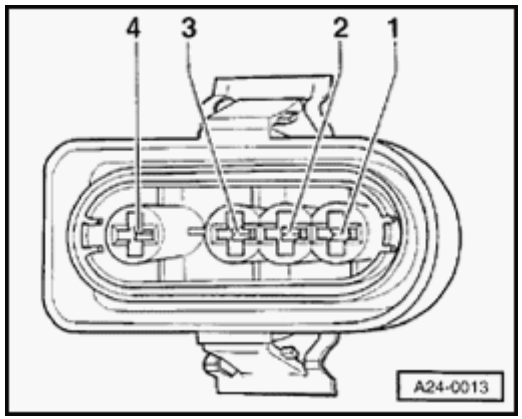
- Replace respective Heated Oxygen Sensor (HO2S).

24-30

Checking HO2S wiring, bank 1, sensor 1

- Disconnect 4-pin connector (black) for HO2S - G39-.

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .



- Check wiring for open circuit between ECM/test box and 4-pin HO2S harness connector (to ECM).
  - Connector terminal 3 to ECM/test box socket 25
  - Connector terminal 4 to ECM/test box socket 26
  - Specified value: max. 1.5 Ω
- Check wiring for short circuits between terminals of 4-pin connector, and between connector and ECM/test box.
  - Connector terminal 4 to ECM/test box socket 25
  - Specified value: ∞ Ω
- Check wiring for short circuits to wiring harness shielding.
  - Connector terminal 4 to ECM/test box socket 14
  - Connector terminal 3 to ECM/test box socket 14
  - Specified value: ∞ Ω

24-31

If wiring is OK:

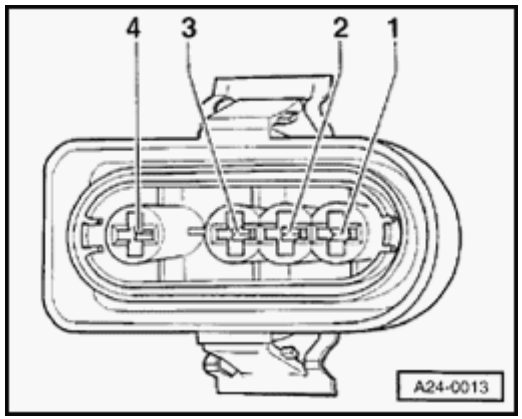
- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-32

Checking HO2S wiring, bank 2, sensor 1

- Disconnect 4-pin connector (black) for HO2S - G108-.

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .



- Check wiring for open circuit between ECM/test box and 4-pin HO2S harness connector (to ECM).
  - Connector terminal 3 to ECM/test box socket 39
  - Connector terminal 4 to ECM/test box socket 40
  - Specified value: max. 1.5 Ω
- Check wiring for short circuits between terminals of 4-pin connector, and between connector and ECM/test box.
  - Connector terminal 4 to ECM/test box socket 39
  - Specified value: ∞ Ω
- Check wiring for short circuits to wiring harness shielding.
  - Connector terminal 3 to ECM/test box socket 14
  - Connector terminal 4 to ECM/test box socket 14
  - Specified value: ∞ Ω

24-33

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Oxygen Sensor (O2S) heater before TWC, checking

Notes:

- *Connector for Oxygen Sensor (O2S) heater - Z19- (bank 1, sensor 1): 4-pin, black.*
- *Connector for Oxygen Sensor (O2S) 2 heater - Z28- (Bank 2, sensor 1): 4-pin, black.*
- *Component locations* ⇒ *page 24-1* .

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagram

Test requirements

- Fuse for Oxygen Sensor (O2S) heater(s) OK
- Engine Coolant Temperature (ECT) at least 80° C (176° F)

24-35

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP
Select function XX

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP
Input display group number XXX

Indicated on display

- Press buttons -0-, -4- and -0- to input display group number 40 (040), and press -Q- button to confirm input.

Read Measuring Value Block 40 →
1 2 3 4

Indicated on display (1-4 = display fields)

24-36

- Compare display and specified values (display fields 1 and 2):

	Display fields			
	1	2	3	4
Display group 40: Oxygen Sensor (O2S) heating (before and after TWC)				
Display	xx.x Ω	Htg.bC.ON/Htg.bC.OFF	xx.x Ω	Htg.aC.ON/Htg.aC.OFF
Indicates	Resistance of O2S heater (before TWC) (B1-S1 and B2-S1)	O2S heater ON or O2S heater OFF (before TWC) (B1-S1 and B2-S1)	Resistance of O2S heater (after TWC) (B1-S2 and B2-S2)	O2S heater ON or O2S heater OFF (after TWC) (B1-S2 and B2-S2)
Range	0.0 - 65.0 Ω	---	---	---
Specified value	2.4 - 9.2 Ω	Htg.bC.ON	---	---
	If not as specified ⇒ page 24-37 , Continuation		---	---

If displayed values are OK (as specified):

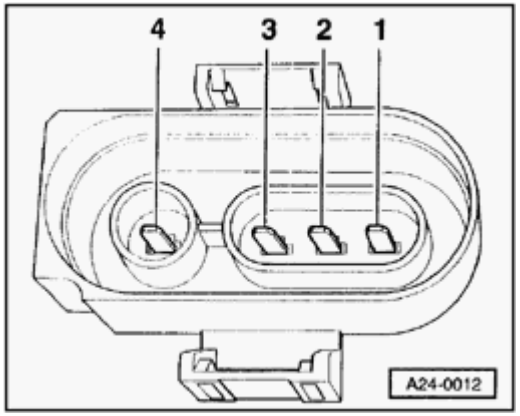
- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm

input.

- Switch ignition off.

Continuation



- Disconnect 4-pin connector (black) for respective Heated Oxygen Sensor (HO2S).

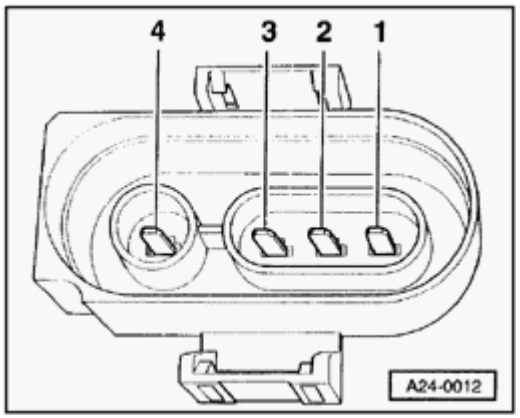
- Connect multimeter US1119 (Fluke 83 or equivalent) between HO2S connector terminals 1 and 2, using VW1594 connector test kit.
- Measure resistance.

  Specified value: 0.0-19.9 Ω

If resistance is NOT OK:

- Replace respective Heated Oxygen Sensor (HO2S).

24-38



If resistance is OK:

- Switch multimeter to 20 VDC measuring range.

- Connect multimeter between harness connector terminals 1 and 2 (to ECM), using VW1594 connector test kit.
- Measure voltage supply and check display in display group 40, display field 2.

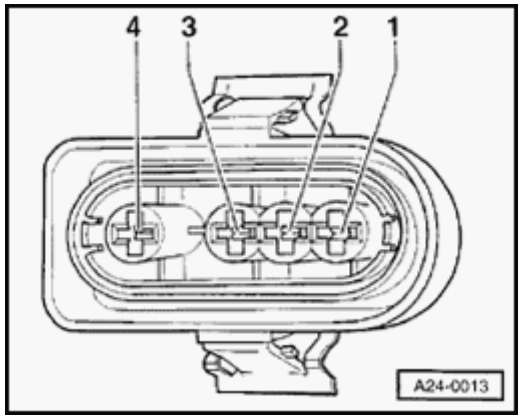
If display = Htg.bC.ON:

- Specified value: 11.0-14.5 volts

If display switches between "Htg.bC.ON" and "Htg.bC.OFF:"

- Specified value: 0.0-12.0 volts (oscillating)

24-39



If there is no voltage:

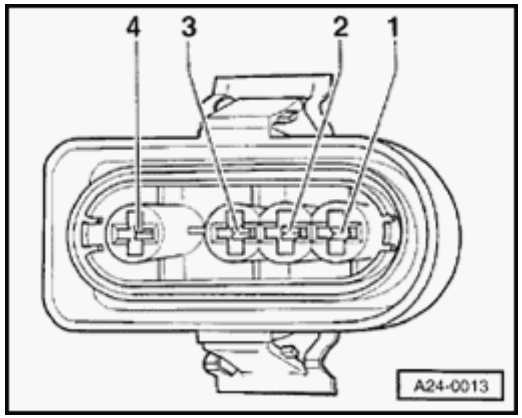
- Connect multimeter between harness connector terminal 1 (to ECM) and vehicle Ground, using VW1594 connector test kit.

  Specified value: 11.0-14.5 volts

If there is still no voltage:

- Check wiring between terminal 1 and relay panel using appropriate wiring diagram.

24-40



If there is voltage:

- Connect multimeter between harness connector terminal 2 (to ECM) and Battery Positive Voltage (B+), using VW1594 connector test kit.
- Measure voltage supply and check display in display group 40, display field 2.

If display = Htg.bC.ON:

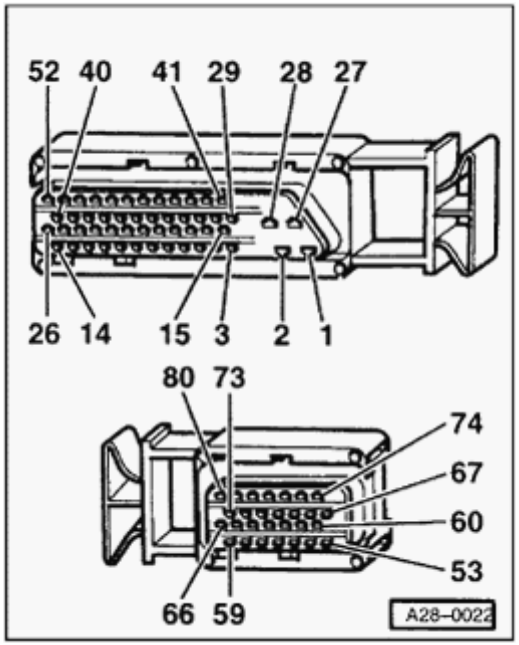
- Specified value: 11.0-14.5 volts

If display switches between "Htg.bC.ON" and "Htg.bC.OFF:"

- Specified value: 0.0-12.0 volts (oscillating)

- Switch ignition off.

24-41



If there is no voltage:

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

- Check wiring for open circuit between ECM/test box and 4-pin HO2S harness connector (to ECM).
  - Connector terminal 2 to ECM/test box socket 27
  - Specified value: max. 1.5 Ω

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ page 01-68
- Initiate adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-42

Oxygen Sensor (O2S) and Oxygen Sensor (O2S) control behind TWC, checking

Notes:

- *Connector for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- (bank 1, sensor 2): 4-pin, green*
- *Connector for Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131- (bank 2, sensor 2): 4-pin, brown*
- *Component locations* ⇒ *page 24-1*

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit

- Wiring diagram

Test requirements

- Engine Coolant Temperature (ECT) at least 80° C (176° F)

Function test

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -3- and -6- to input display group number 36 (036), and press -Q- button to confirm input.

Read Measuring Value Block 36 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Compare display and specified values (display fields 1-4):

	Display fields			
	1	2	3	4
Display group 36: Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC), Banks 1, 2				
Display	x.xxx V	Test OFF/Test ON B1-S2 ok B1-S2 n.ok	x.xxx V	Test OFF/Test ON B2-S2 ok B2-S2 n.ok
Indicates	Voltage supply to O2S behind TWC (Bank 1, Sensor 2)	Diagnostic status Diagnostic result	Voltage supply to O2S 2 behind TWC (Bank 2, Sensor 2)	Diagnostic status Diagnostic result
Range	0.000 - 1.000 V	---	0.000 - 1.000 V	---
Specified value	0.000 - 1.000 V (can oscillate slightly)	B1-S2 OK	0.000 - 1.000 V (can oscillate slightly)	B2-S2 OK
	If not as specified ⇒ page 24-45 , Continuation			

24-45

Continuation

- Road test to condition oxygen sensor (eliminate possible contamination) and repeat test.

If the values are still NOT OK:

- Check Oxygen Sensor (O2S) heater(s) ⇒ page 24-52 .

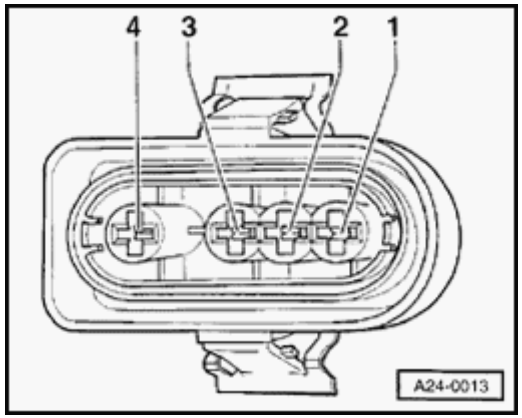
- Briefly accelerate engine over 3000 RPM.

If the value in either display field 1 or field 3 remains constant:

page ⇒ Page 24-46 , Evaluation of display group 36.

Evaluation of display group 36

Display group: 36 Display fields: 1, 3	Possible malfunction cause	Corrective action
approx. 0.435 V	♦ Open circuit in wire -4- between oxygen sensor and ECM	- Check reference voltage ⇒ page 24-47
approx. 0.440 V	♦ Open circuit in wire -3- between oxygen sensor and ECM	
approx. 1.085 V	♦ Short circuit to B+ in wire -4- between oxygen sensor and ECM	- Check O2S wiring, bank 1, sensor 2 ⇒ page 24-48 - Check O2S wiring, bank 2, sensor 2 ⇒ page 24-50
approx. 0.000 V	♦ Short circuit to Ground in wire -4- between oxygen sensor and ECM	



Checking O2S reference voltage

- Disconnect 4-pin connector for respective Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC).

- Connect multimeter US1119 (Fluke 83 or equivalent) between harness connector terminals 3 and 4 (to ECM), using adapter cables from VW1594 connector test kit.
- Start engine and measure voltage.

  Specified value: 0.40 to 0.50 volts
- Switch ignition off.

If voltage is NOT OK:

- Check O2S wiring.
  - Bank 1, sensor 2 ⇒ page 24-48 .
  - Bank 2, sensor 2 ⇒ page 24-50 .

If voltage is OK:

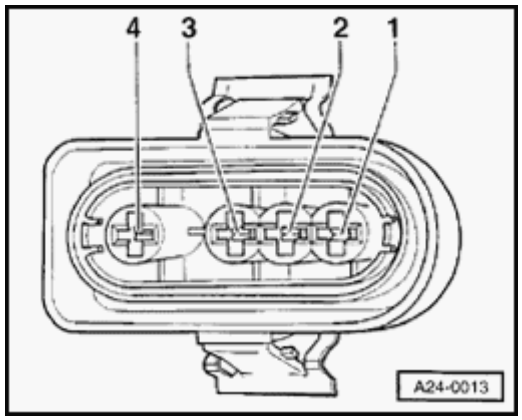
- Replace respective O2S behind TWC.

24-48

Checking O2S wiring, bank 1, sensor 2

- Disconnect 4-pin connector (green) for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130-.

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .



- Check wiring for open circuit between ECM/test box and 4-pin O2S harness connector (to ECM).
  - Connector terminal 3 to ECM/test box socket 51
  - Connector terminal 4 to ECM/test box socket 52
  - Specified value: max. 1.5 Ω
- Check wiring for short circuits between terminals of 4-pin connector.
  - Connector terminal 4 to ECM/test box socket 51
  - Specified value: ∞ Ω
- Check shielding wire for short circuit to sensor wires.
  - Connector terminal 4 to ECM/test box socket 14
  - Connector terminal 3 to ECM/test box socket 14
  - Specified value: ∞ Ω

24-49

If wiring is OK:

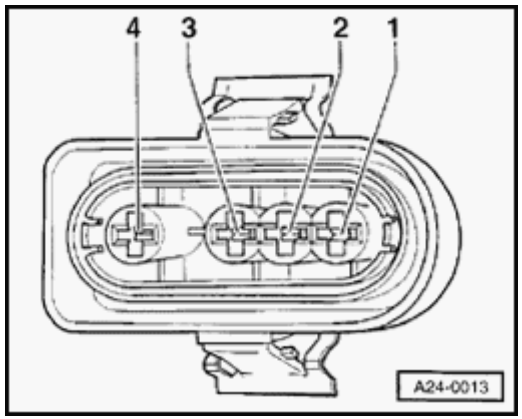
- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-50

Checking O2S wiring, bank 2, sensor 2

- Disconnect 4-pin connector (brown) for Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131-.

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .



- Check wiring for open circuit between ECM/test box and 4-pin O2S harness connector (to ECM).
  - Connector terminal 3 to ECM/test box socket 38
  - Connector terminal 4 to ECM/test box socket 50
  - Specified value: max. 1.5 Ω
- Check wiring for short circuits between terminals of 4-pin connector.
  - Connector terminal 4 to ECM/test box socket 38
  - Specified value: ∞ Ω
- Check shielding wire for short circuit to sensor wires.
  - Connector terminal 4 to ECM/test box socket 14
  - Connector terminal 3 to ECM/test box socket 14
  - Specified value: ∞ Ω

24-51

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Oxygen Sensor (O2S) heater behind TWC, checking

Notes:

- *Connector for Oxygen Sensor (O2S) heater (behind TWC) -Z29- (bank 1, sensor 2): 4-pin, green*
- *Connector for Oxygen Sensor (O2S) 2 (behind TWC) -Z30- (bank 2, sensor 2): 4-pin, brown*
- *Component locations* ⇒ *page 24-1*

Required special tools and test equipment

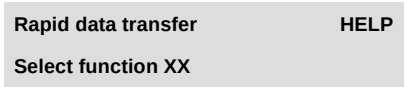
- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagram

Test requirements

- Fuse for Oxygen Sensor (O2S) heater OK
- Engine Coolant Temperature (ECT) at least 80° C (176° F)

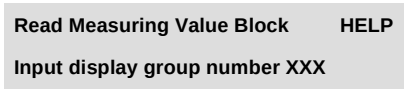
Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .



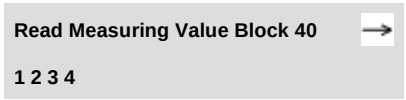
➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



➢ Indicated on display

- Press buttons -0-, -4- and -0- to input display group number 40 (040), and press -Q- button to confirm input.



➢ Indicated on display (1-4 = display fields)

24-54

- Compare display and specified values (display fields 3 and 4):

	Display fields			
	1	2	3	4
Display group 40: Oxygen Sensor (O2S) heating (before and after TWC)				
Display	xx.x Ω	Htg.bC.ON/Htg.bC.OFF	xx.x Ω	Htg.aC.ON/Htg.aC.OFF
Indicates	Resistance of O2S heater (before TWC) (B1-S1 and B2-S1)	O2S heater ON or O2S heater OFF (before TWC) (B1-S1 and B2-S1)	Resistance of O2S heater (after TWC) (B1-S2 and B2-S2)	O2S heater ON or O2S heater OFF (after TWC) (B1-S2 and B2-S2)
Range	---	---	0.0 - 65.0 Ω	---
Specified value	---	---	2.4 - 9.2 Ω	Htg.aC.ON
	---	---	If not as specified ⇒ page 24-55 , Continuation	

If displayed values are OK (as specified):

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm

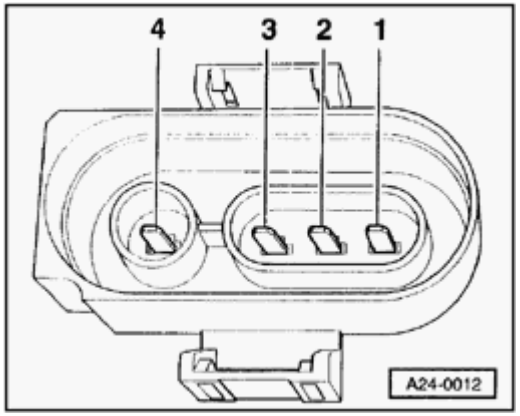
input.

- Switch ignition off.

24-55

Continuation

- Disconnect 4-pin connector for respective Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC).



- Connect multimeter US1119 (Fluke 83 or equivalent) between HO2S connector terminals 1 and 2, using VW1594 connector test kit.
- Measure resistance.

  Specified value: 0.00-19.9 Ω

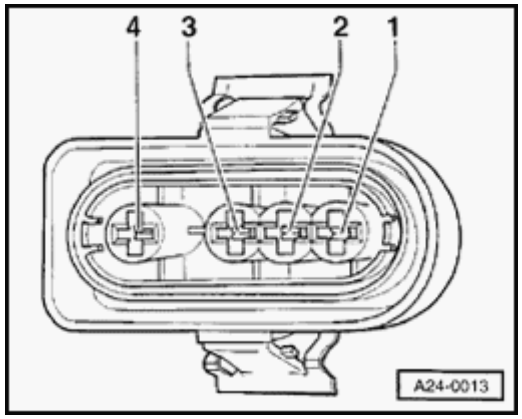
If resistance is NOT OK:

- Replace respective Oxygen Sensor (O2S) behind TWC.

If resistance is OK:

- Switch multimeter to 20 VDC measuring range.

24-56



- Connect multimeter between harness connector terminals 1 and 2 (to ECM), using VW1594 connector test kit.
- Measure voltage supply and check display in display group 40, display field 4.

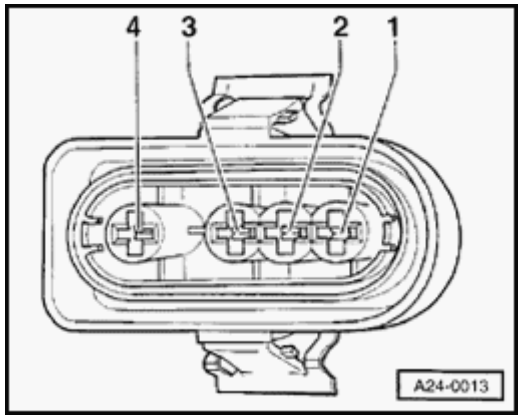
If display = Htg.aC.ON:

- Specified value: 11.0-14.5 volts

If display is switching between "Htg.aC.ON" and "Htg.aC.OFF"

- Specified value: 0.0-12.0 volts (oscillating)

24-57



If there is no voltage:

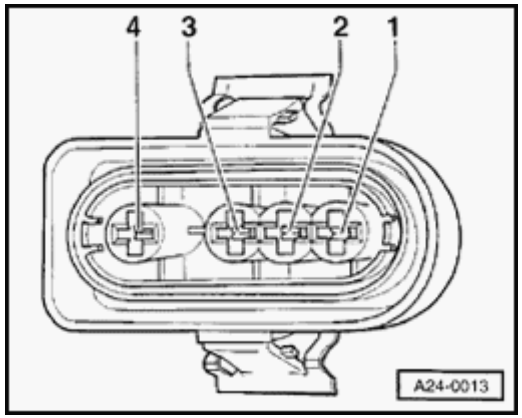
- Connect multimeter between harness connector terminal 1 (to ECM) and vehicle Ground, using VW1594 connector test kit.

  Specified value: 11.0-14.5 volts

If there is still no voltage:

- Check wiring between terminal 1 and relay panel using appropriate wiring diagram.

24-58



If there is voltage:

- Connect multimeter between harness connector terminal 2 (to ECM) and Battery Positive Voltage (B+), using VW1594 connector test kit.
- Measure voltage supply and check display in display group 40, display field 4.

If display = Htg.aC.ON:

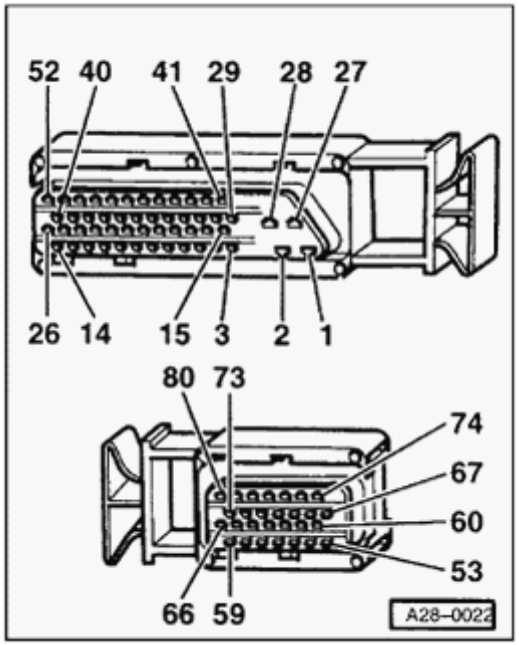
- Specified value: 11.0-14.5 volts

If display switches between "Htg.aC.ON" and "Htg.aC.OFF:"

- Specified value: 0.0-12.0 volts (oscillating)

- Switch ignition off.

24-59



If specified value is not attained:

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

- Check wiring for open circuit between ECM/test box and 4-pin O2S harness connector (to ECM).
  - Connector terminal 2 to ECM/test box socket 28
  - Specified value: max. 1.5 Ω

If wiring is OK:

- Replace ECM -J220- ⇒ page 01-68
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-60

Oxygen Sensor (O2S) aging, bank 1, sensor 1, checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable

Test requirements

- Engine Coolant Temperature (ECT) at least 80 ° C (176 ° F)

Function test

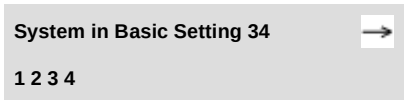
- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" function 04, and press -Q- button to confirm input.

System in Basic Setting HELP **Input display group number XXX**	Indicated on display

- Press buttons -0-, -3- and -4- to input display group number 34 (034), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

24-61

- Increase engine speed to 1800-2200 RPM.

- Maintain engine speed at 1800-2200 RPM until display field 4 changes from "Test OFF" to "Test ON."

- Maintain engine speed at 1800-2200 RPM and compare display with specified values for oxygen sensor aging (before TWC) in display fields 3 and 4).

Note:

To be sure that the temperature is within the specified range, the specified RPM has to be maintained for at least 1 minute.

	Display fields			
	1	2	3	4
Display group 34: Oxygen sensor aging (time period check of oxygen sensor) bank 1, sensor 1				
Display	xxxx RPM	xx.xx ms	xx.xx s	Test OFF/Test ON B1-S1 OK/B1-S1 n.OK
Indicates	Engine speed (in 40 RPM steps)	Engine load	Time period Bank 1, Sensor 1	Diagnostic status Diagnostic result
Range	0 - 6800 RPM	0.00 - 12.75 ms	---	---

Specified value	1800 - 2200 RPM	0.8 - 2.5 ms	0.20 - 2.10 s	B1-S1 OK
	---	---	If not as specified ⇒ page 24-62 , Continuation	

24-62

Continuation

If displayed value is NOT OK (not as specified):

- Road test to condition oxygen sensor (eliminate possible contamination) and repeat test.

If displayed value is still NOT OK:

- Replace HO2S -G39-.

- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-63

Oxygen Sensor (O2S) aging, bank 2, sensor 1, checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable

Test requirements

- Engine Coolant Temperature (ECT) at least 80 ° C (176 ° F)

Function test

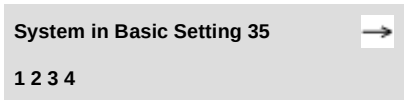
- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" function 04, and press -Q- button to confirm input.

System in Basic Setting HELP **Input display group number XXX**	Indicated on display

- Press buttons -0-, -3- and -5- to input display group number 35 (035), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

24-64

- Increase engine speed to 1800-2200 RPM.

- Maintain engine speed at 1800-2200 RPM until display field 4 changes from "Test OFF" to "Test ON."

- Maintain engine speed at 1800-2200 RPM and compare display with specified values for oxygen sensor aging (before TWC) in display fields 3 and 4).

Note:

To be sure that the temperature is within the specified range, the specified RPM has to be maintained for at least 1 minute.

	Display fields			
	1	2	3	4
Display group 35: Oxygen sensor aging (time period check of oxygen sensor) bank 2, sensor 1				
Display	xxxx RPM	xx.xx ms	xx.xx s	Test OFF/Test ON B2-S1 OK/B2-S1 n.OK
Indicates	Engine speed (in 40 RPM steps)	Engine load	Time period Bank 2, Sensor 1	Diagnostic status Diagnostic result
Range	0 - 6800 RPM	0.00 - 12.75 ms	---	---

Specified value	1800 - 2200 RPM	0.8 - 2.5 ms	0.20 - 2.10 s	B2-S1 OK
	---	---	If not as specified ⇒ page 24-65 , Continuation	

24-65

Continuation

If displayed value is NOT OK (not as specified):

- Road test to condition oxygen sensor (eliminate possible contamination) and repeat test.

If displayed value is still NOT OK:

- Replace HO2S -G108-.

- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-66

Engine operating conditions (engine electronics), checking

Note:

This test checks whether the Motronic Engine Control Module (ECM) -J220- recognizes the engine operating conditions.

Required special tools and test equipment

- VAG1551 or VAG1552 scan tool with VAG1551/3 adapter

Test requirements

- Engine oil temperature at least 80 °C (176 °F)

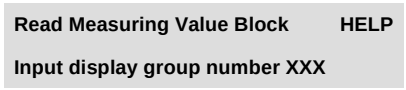
Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer **HELP**	
Select function XX	

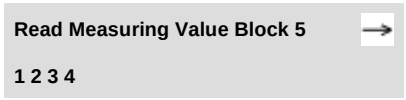
Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -0- and -5- to input display group number 5 (005), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

24-67

- Check engine operating conditions (display field 4):

	Display fields			
	1	2	3	4
Display group 5: Engine electronics-operating conditions				
Display	xxx RPM	xx.xx ms	xxx km/h	Idle Part throt Full throt 1) Decel Enrich
Indicates	Engine speed (in 40 RPM steps)	Engine load	Vehicle speed	Operational condition
Range	0 - 6800 RPM	0.00 - 12.75 ms	---	---
Specified value	620 - 740 RPM (all-wheel drive) or 740 - 860 RPM (front-wheel drive)	1.00 - 2.50 ms	0 km/h	Idle: "Idle"

				Throttle slightly open: "Part throt"
				Throttle quickly closed: "Decel"
				Quick acceleration over 3000 RPM: "Enrich"
1) Possible only while driving				

If displayed values are NOT OK (not as specified):

- Check free movement of accelerator pedal and cable.

- Check throttle valve control module ⇒ page 24-128 .

Mass Air Flow (MAF) sensor, checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagram

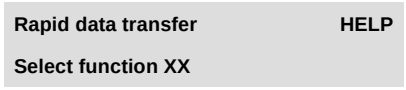
Test requirements

- All electrical consumers switched off (coolant fan must not run during test).
- A/C must be switched off
- Fuse for MAF sensor OK

24-69

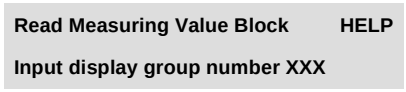
Test sequence

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .



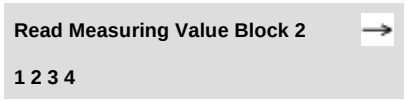
Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -0- and -2- to input display group number 2 (002), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Compare display with specified values for engine load (display fields 2 and 4):

24-70

	Display fields			
	1	2	3	4
Display group 2: Load measurement				
Display	xxx RPM	xx.xx ms	xx.xx ms	xx.x g/s
Indicates	Engine speed (in 40 RPM steps)	Engine load	Injection time	Mass air flow
Range	0 - 6800 RPM	0.00 - 12.75 ms	0.00 - 20.00 ms	0.0 - 140 g/s
Specified value	620 - 740 RPM (all-wheel drive) or 740 - 860 RPM (front-wheel drive)	1.00 - 2.50 ms	2.00 - 5.00 ms	2.8 - 5.6 g/s
	2520 RPM	0.80 - 2.50 ms	1.60 - 5.00 ms	10.0 - 15.0 g/s
	---	If not as specified ⇒ page 24-71 ,	---	If not as specified ⇒ page 24-72 ,

		Evaluation of display group 2, display field 2		Evaluation of display group 2, display field 4

If displayed values are OK (as specified):

- Press → button to advance program sequence.
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.
- Switch ignition off.

24-71

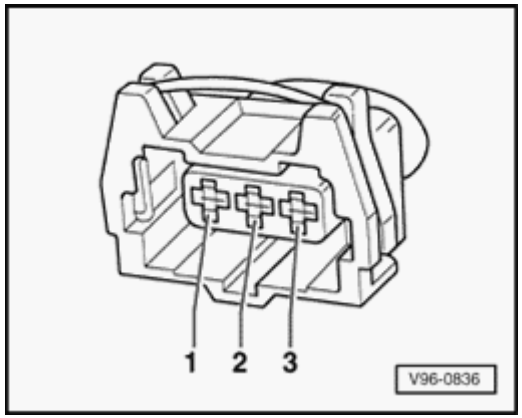
Evaluation of display group 2, display field 2

Display group: 2 Display field: 2	Possible malfunction cause	Corrective action
less than 1.00 ms	♦ Smaller values can only occur while driving during deceleration	
more than 2.50 ms	♦ Shift lever in drive range (auto. transmission) ♦ Engine is affected by additional consumers	- Move shift lever into P or N - Eliminate load (A/C, power steering, generator)
	♦ Poor idle (does not run on all cylinders)	- Check and spark plugs ⇒ page 28-21 (checking ignition coils) - Check fuel injectors ⇒ page 24-102
	♦ Throttle valve control module -J338- faulty	- Check throttle valve control module ⇒ page 24-128

Evaluation of display group 2, display field 4

Display group: 2 Display field: 4	Possible malfunction cause	Corrective action
less than 2.8 g/s	♦ Large amount of false air between intake air duct and Mass Air Flow (MAF) sensor	- Check intake air system for leaks (false air) ⇒ page 24-126
larger than 5.6 g/s	♦ Shift lever in drive range (auto. transmission) ♦ Engine affected by additional consumers	- Move shift lever into P or N - Eliminate load (A/C, power steering, generator)
	♦ Open circuits in wire 1 or 2 between MAF sensor and ECM	- Check voltage supply ⇒ page 24-73
	♦ Open circuit in wire 3 between MAF sensor and relay panel	- Check wiring ⇒ page 24-73

24-73



Checking voltage supply

- Disconnect 3-pin harness connector from Mass Air Flow sensor (MAF).
- Connect multimeter US1119 (Fluke 83 or equivalent) between harness connector terminals 2 (Ground) and 3 (B+), using adapter cables from VW1594 connector test kit.

  Specified value: 9.0-14.5 volts

If there is no voltage:

- Switch ignition off.
- Check wiring using applicable wiring diagram.

Checking wiring

- Switch ignition off.
- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .
- Check wiring for open circuits, between ECM/test box and 3-pin MAF sensor harness connector.
  - Connector terminal 1 to ECM/test box socket 13
  - Connector terminal 2 to ECM/test box socket 12
  - Specified value: max. 1.5 Ω

24-74

- Check wiring for short circuits between terminals of 3-pin connector, and between connector and ECM/test box.
  - Connector terminal 1 to ECM/test box socket 12
  - Specified value: ∞ Ω
- Switch multimeter to 20 VDC measuring range.
- Check wiring at 3-pin connector for short circuit to B+ (battery positive voltage), according to applicable wiring diagram.
  - Connector terminal 1 to vehicle Ground
  - Connector terminal 2 to vehicle Ground
  - Specified value: 0 volts

If wiring is OK:

- Replace Mass Air Flow sensor (MAF) -G70-.
- Check readiness code ⇒ page 01-70 . If

Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Engine Coolant Temperature (ECT) sensor, checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagram

Test requirements

- Engine cold

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	Indicated on display

- Press buttons -0-, -0- and -4- to input display group number 4 (004), and press -Q- button to confirm input.

Read Measuring Value Block 4 → **1 2 3 4**	Indicated on display (1-4 = display fields)

24-77

- Compare display with specified value for engine coolant temperature sensor (display field 3):

	Display fields			
	1	2	3	4
Display group 4: General engine data				
Display	xxx RPM	xx.xxx V	xxx.x °C	xxx.x °C
Indicates	Engine speed (in 40 RPM steps)	Battery Positive Voltage (B+)	Engine coolant temperature	Intake air temperature
Range	0 - 6800 RPM	0.000 - 16.500 V	-46.5 to 141.0	-46.5 to 141.0
Specified value	0 RPM	10.000 - 14.500 V	approx. ambient temperature 1), 2)	---
	---	---	If specified value is not attained ⇒ page 24-79 , Evaluation of display group 4	---

1) After a long standing period (approx. 12 hours).

2) If indicated temperature deviates significantly from the ambient temperature, check ECT sensor wiring for resistance or open circuits.

24-78

Continuation

- Start engine and let run at idle.

  - Temperature value must increase evenly

If NOT:

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

- Replace Engine Coolant Temperature (ECT) sensor -G62-.

Notes:

- *Temperature is displayed in increments of 1.5 ° C.*

- *If malfunctions occur within certain temperature ranges while the engine is running, and the temperature values do not increase without interruption, the temperature signal is*

intermittently interrupted and the sensor must be replaced.

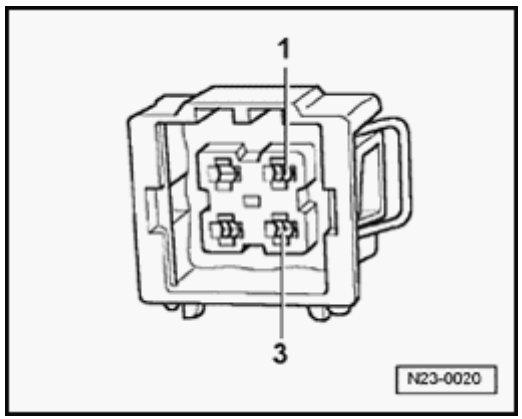
Evaluation of display group 4

Display group: 4 Display field: 3	Possible malfunction cause	Corrective action
approx. -46.5 ° C	♦ Open circuit or short circuit in wiring to B+	- Check wiring ⇒ page 24-79
approx. 141.0 ° C	♦ Short circuit to Ground	

Checking wiring

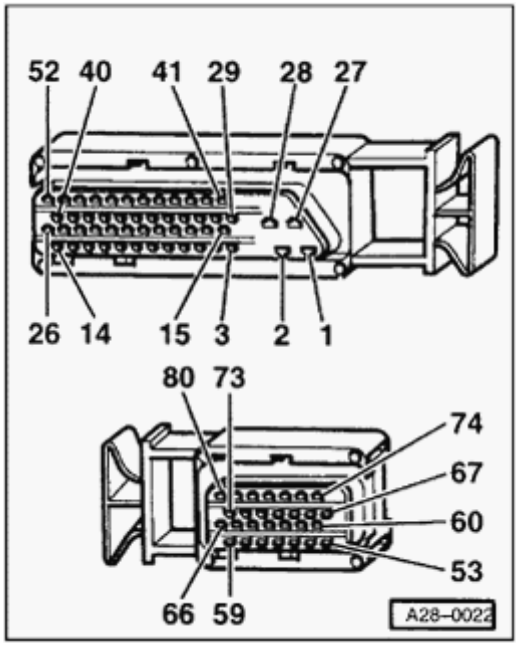
- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

- Disconnect 4-pin connector from ECT sensor - G62-.



- Check wiring resistance for open circuit between ECM/test box and 4-pin ECT sensor connector.
  - ♦ Connector terminal 1 to ECM/test box socket 53
  - ♦ Connector terminal 3 to ECM/test box socket 67
  - ♦ Specified value: max. 1.5 Ω

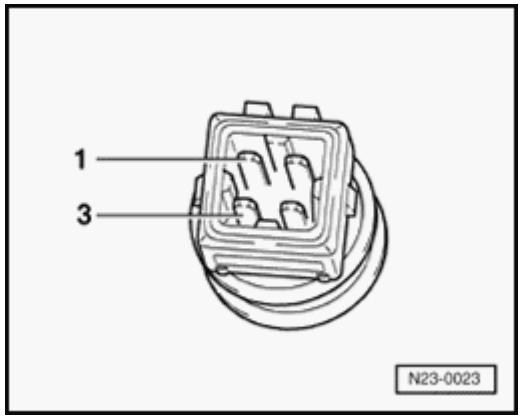
24-80



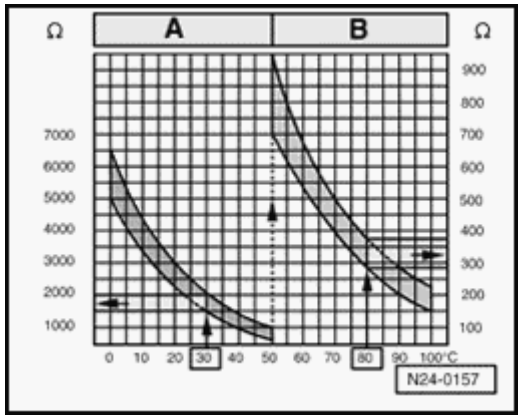
- Check wiring for short circuit between ECM/test box and 4-pin harness connector according to wiring diagram.
  - Connector terminal 1 to vehicle Ground
  - Connector terminal 1 to ECM/test box socket 67
  - Connector terminal 1 to terminal 3
  - Connector terminal 3 to vehicle Ground
  - Specified value: $\infty\ \Omega$
- Check wiring between ECM and 4-pin harness connector for short circuit to battery B+.
  - Connector terminal 1 to vehicle Ground
  - Connector terminal 3 to vehicle Ground
  - Specified value: 0 volts

24-81

If wiring is OK:



- Check ECT sensor resistance across terminal 1 (signal) and terminal 3 (ground).
- Check measured resistance value for appropriate temperature range using graph below (N24-0157).
  - Range A: 0-50 ° C (32-122 ° F)
  - Range B: 50-100 ° C (122-212 ° F)



Examples:

- At 30 ° C, ECT sensor resistance should be 1500-2000 Ω
- At 80 ° C, ECT sensor resistance should be 275-375 Ω

If resistance is NOT OK:

- Replace Engine Coolant Temperature (ECT) sensor -G62-.
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Intake Air Temperature (IAT) sensor, checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagram
- Chilling spray (commercially available)

24-83

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	Indicated on display

- Press buttons -0-, -0- and -4- to input display group number 4 (004), and press -Q- button to confirm input.

Read Measuring Value Block 4 → **1 2 3 4**	Indicated on display (1-4 = display fields)

24-84

- Compare displayed value with specified value for intake air temperature (display field 4):

	Display fields			
	1	2	3	4
Display group 4: General engine data				
Display	xxx RPM	xx.xxx V	xxx.x °C	xxx.x °C
Indicates	Engine speed (in 40 RPM steps)	Battery Positive Voltage (B+)	Engine coolant temperature	Intake air temperature
Range	0 - 6800 RPM	0.000 - 16.500 V	-46.5 to 141.0	-46.5 to 141.0
Specified value	0 RPM	10.000 - 14.500 V	---	approx. ambient temperature 1), 2)
	---	---	---	Continuation ⇒ page 24-85 , Evaluation of display group 4

1) After a long standing period (approx. 12 hours).

2) If indicated temperature deviates significantly from the ambient temperature, check IAT sensor wiring for resistance or open circuits.

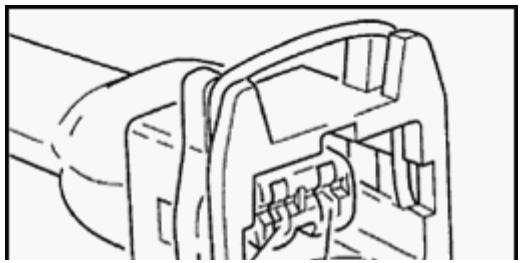
24-85

Evaluation of display group 4

Display group: 4 Display field: 4	Possible malfunction cause	Corrective action
constant 25.5 ° C	♦ Open or short circuit in wiring to B+	- Check wiring ⇒ page 24-85
	♦ Short circuit to ground	
approx. ambient temperature	♦ Signal intermittently interrupted	- Check IAT sensor ⇒ Continuation of test page 24-87

Wiring, checking:

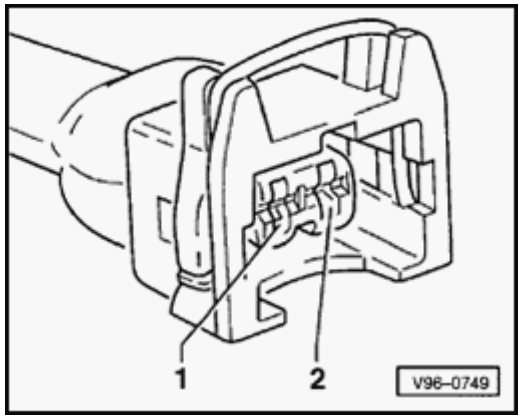
- Switch ignition off.
- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .
- Disconnect 2-pin connector from Intake Air Temperature (IAT) sensor -G42-.



- Check wiring for open circuit, between ECM/test box and 2-pin IAT harness connector (to ECM).
  - ♦ Connector terminal 1 to ECM/test box socket 54
  - ♦ Connector terminal 2 to ECM/test box socket 67

- Specified value: max. 1.5 Ω

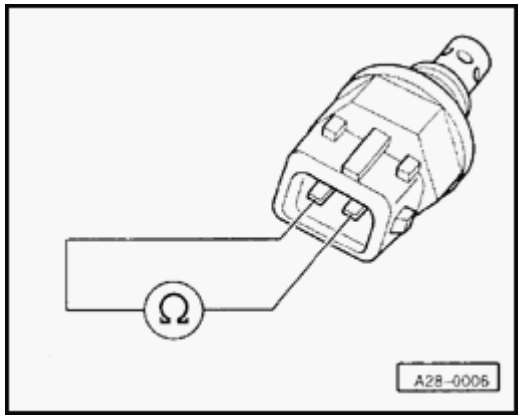
24-86



- Check wiring for short circuit between ECM/test box and 2-pin harness connector according to wiring diagram.
  - Connector terminal 1 to vehicle Ground
  - Connector terminal 1 to ECM/test box socket 67
  - Connector terminal 1 to terminal 2
  - Specified value: ∞ Ω
- Check wiring between ECM and 2-pin harness connector for short circuit to battery B+.

  Specified value: 0 volts

If wiring is OK:



- Check resistance across terminals of IAT sensor -G42-.

  Specified value at approx. 20 °C (68 °F): approx. 1.5-3.5 kΩ

If resistance is NOT OK:

- Replace intake air temperature sensor -G42-.

24-87

Continuation of test

(when IAT sensor indicates approx. ambient temperature)

- Without disconnecting harness connector, remove IAT sensor -G42-.

- Monitor intake air temperature value in display field 4.

- Spray sensor with commercially available chilling spray and check temperature value in display field 4.

  - Temperature value must decrease

If NOT:

- Replace intake air temperature sensor -G42-.

- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Engine Speed (RPM) sensor, checking

Note:

Component locations ⇒ *page 24-1*

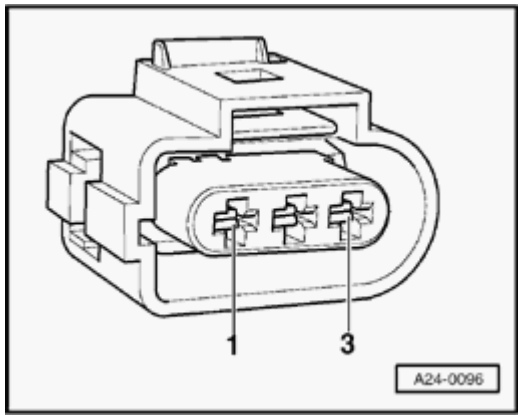
Required special tools and test equipment

- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagram

Checking

- Disconnect 3-pin harness connector from engine speed sensor.
- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

24-89



- Check wiring for open circuit between ECM/test box and 3-pin harness connector.
  - Connector terminal 1 to ECM/test box socket 67
  - Connector terminal 2 to ECM/test box socket 63
  - Connector terminal 3 to ECM/test box socket 56
  - Specified value: max. 1.5 Ω
- Check wiring for short circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 2 to ECM/test box socket 67
  - Connector terminal 1 to ECM/test box socket 63
  - Connector terminal 1 to ECM/test box socket 56
  - Specified value: ∞ Ω

If wiring is OK:

- Replace engine speed (RPM) sensor -G28-.
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-90

Voltage supply to Engine Control Module (ECM), checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagram

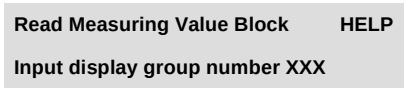
Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ page 01-8 .

Rapid data transfer HELP
Select function XX

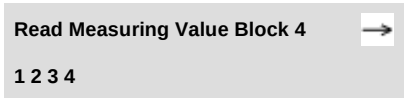
Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -0- and -4- to input display group number 4 (004), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

24-91

- Check battery positive voltage (B+) in display field 2.

	Display fields			
	1	2	3	4
Display group 4: General engine data				
Display	xxx RPM	xx.xxx V	xxx.x °C	xxx.x °C
Indicates	Engine speed (in 40 RPM steps)	Battery Positive Voltage (B+) Terminal 15	Engine coolant temperature	Intake air temperature
Range	0 - 6800 RPM	0.000 - 16.500 V	-46.5 to 141.0	-46.5 to 141.0
Specified value	0 RPM	10.000 - 14.500 V	---	---
	---	If not as specified ⇒ page 24-92 , Evaluation of display group 4	---	---

If displayed value is OK (as specified):

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

24-92

Evaluation of display group 4

Display group: 4 Display field: 2	Possible malfunction cause	Corrective action
If "Control module does not answer" is displayed	♦ Fuse for ECM faulty	- Replace fuse
	♦ Open circuit in wiring	- Check voltage supply at terminal 15 ⇒ page 24-94
Displayed value changes between 10.0 - 14.5 V	♦ Intermittent connection	- Check voltage supply at terminal 15 ⇒ page 24-94 - Check voltage supply at terminal 30 ⇒ page 24-93
0.0 - 10.0 V	♦ Battery discharged/faulty ♦ Voltage regulator faulty	- Check battery - Check generator - Check voltage regulator
14.5 - 16.5 V	♦ Generator faulty ♦ Voltage regulator faulty	- Check generator - Check voltage regulator

Checking voltage supply at terminal 30

- Switch ignition off.

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

- Connect multimeter US1119 (Fluke 83 or equivalent) between ECM/test box sockets 2 (Ground) and 3 (B+), using adapter cables from VW1594 connector test kit.

  Specified value: 10-14.5 volts

If voltage is NOT OK:

- Check wiring according to applicable wiring diagram.

24-94

Checking voltage supply at terminal 15

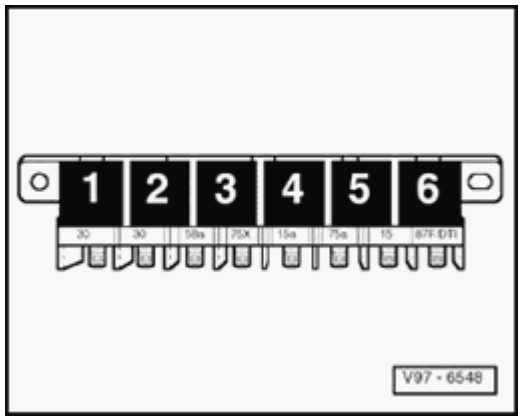
- Switch ignition off.
- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .
- Connect multimeter between ECM/test box sockets 1 (B+) and 2 (Ground), using adapter cables from VW1594 connector test kit.
- Switch ignition on, and check voltage.

  Specified value: 10-14.5 volts

If voltage is NOT OK:

- Check wiring according to applicable wiring diagram.
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

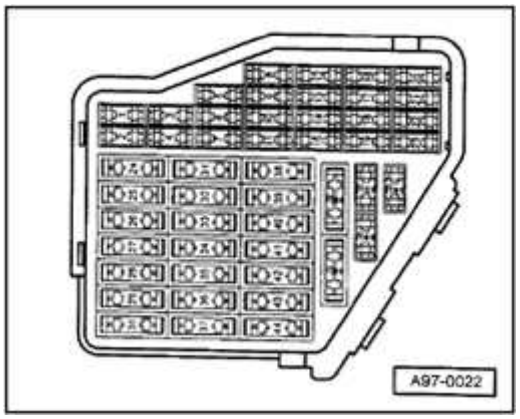
Fuel pump relay and connections, checking



➢ The fuel pump relay is located at relay position 6 on the relay panel on the left side under the instrument panel.

Checking function of fuel pump relay -J17-

- Remove storage shelf in left-front footwell.



➢
- Remove fuses 28, 29 and 34 from fuse panel.
- Connect VAG1527B LED voltage tester between Ground and one of the two terminals for fuse 28.
- Briefly crank starter.
  - ♦ LED test light must light up.
  - ♦ Fuel pump relay must be actuated (can be felt and heard)

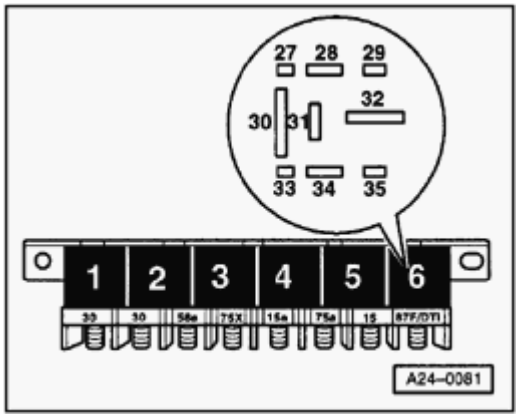
24-96

If the fuel pump does not respond:

- Check fuel pump relay actuation ⇒ page 24-99 .

If the LED test light does not light up:

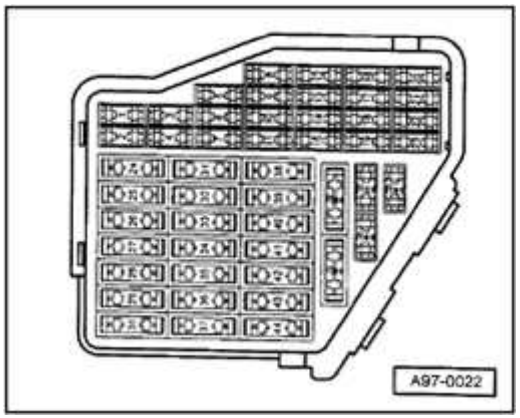
- Repeat test at other terminal of fuse 28.



➢ If the LED light still does not light up:

- Check wiring for open or short circuits between fuse 28 and terminal 30 at relay position 6, using the applicable wiring diagram. Repair wiring as necessary.

  Specified value: max. 1.5 Ω



➢

- Connect VAG1527B LED voltage tester between Ground and one of the two terminals for fuse 29.

Note:

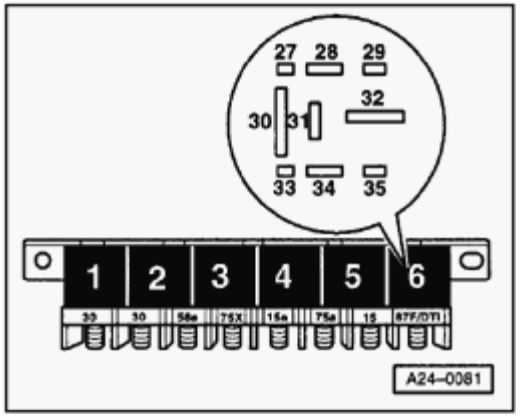
This step lets the fuel pump run without the engine running. The closed throttle position switch must be closed during the test, or the selected fuel injector will discharge fuel when it is actuated 5 times.

- Initiate output Diagnostic Test Mode (DTM) and advance to test of cylinder 1 fuel injector -N30- ⇒ page 01-51 .
  - LED test light must light up
  - Fuel pump relay must be activated
  - Fuel pump must run

24-97

If the LED test light does not light up:

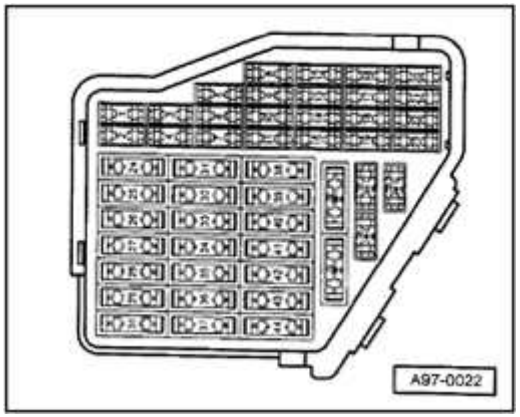
- Repeat test at other terminal of fuse 29.



➢ If the LED test light still does not light up:

- Check wiring for open circuit between fuse 29 and terminal 30 at relay position 6, using the applicable wiring diagram. Repair wiring as necessary.

  Specified value: max. 1.5 Ω



➢

- Connect VAG1527 LED voltage tester between Ground and one of the two terminals of fuse 34.

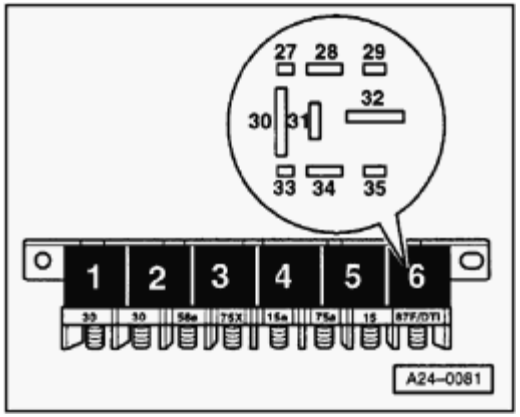
Note:

This step lets the fuel pump run without the engine running. The closed throttle position switch must be closed during the test, or the selected fuel injector will discharge fuel when it is actuated 5 times.

- Initiate output Diagnostic Test Mode (DTM) and advance to test of cylinder 1 fuel injector -N30- ⇒ page 01-51 .
  - ♦ LED test light must light up
  - ♦ Fuel pump relay must be activated

- Fuel pump must run

24-98



If the LED test light does not light up:

- Repeat test at other terminal of fuse 34.

➢ If the LED test light still does not light up:

- Check wiring for open circuit between fuse 34 and terminal 31 at relay position 6, using the applicable wiring diagram. Repair wiring as necessary.

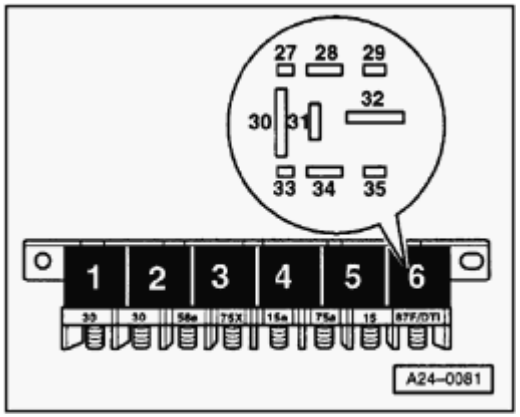
  Specified value: max. 1.5 Ω

Checking fuel pump relay voltage supply and actuation

- Remove fuel pump relay -J17- from relay panel position 6.

Checking fuel pump relay voltage supply

- Switch ignition on.



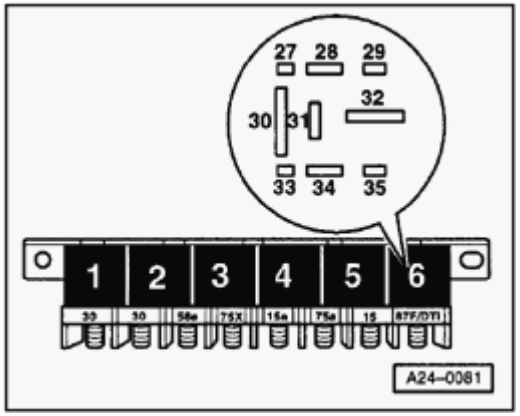
- Connect multimeter US1119 (Fluke 83 or similar) and check for voltage at relay socket:
  - Terminals 28 (B+) and 34
  - Terminals 32 (B+) and 34
  - Specified values: approx. Battery Positive Voltage (B+)

If voltage is NOT OK:

- Repair wiring according to applicable wiring diagram.

24-100

Checking fuel pump relay actuation



- Connect VAG1527B LED voltage tester between relay socket terminals 28 (B+) and 29.

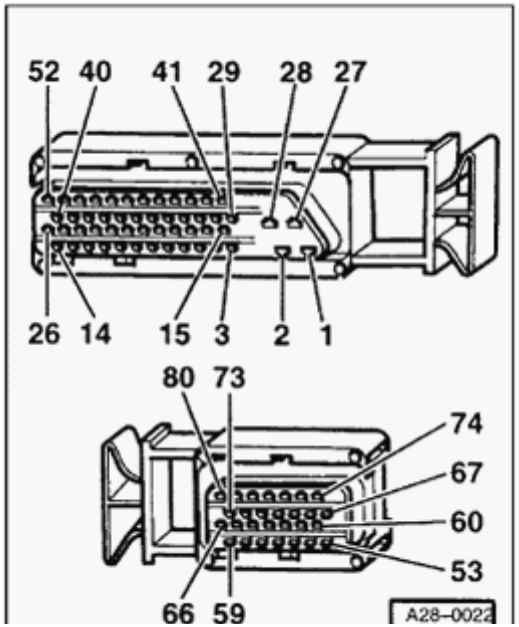
Note:

The LED light will light dimly before and after cranking the starter.

- Briefly crank starter.

  LED test light must light up.

If the LED test light does not light up while cranking the starter, check wiring as follows.



- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 . (Numbers marked on ECM connector match those on test box).
- Connect multimeter US1119 (Fluke 83 or equivalent) to check for open circuit between relay socket terminal 29 and test box socket 4.

  Specified value: max. 1 Ω

If resistance is NOT OK:

- Repair wiring using applicable wiring diagram.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder.*

24-101

If the wiring is OK, but the LED test light does not light up:

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

If the wiring is OK, and the signal to the fuel pump relay is OK:

- Replace fuel pump relay -J17-.
- Reinstall fuses.

Fuel injectors, checking

WARNING!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything nearby that could ignite fuel. The fuel system is under pressure. Before opening, cover connections with a rag, and open carefully to release pressure.

Activating fuel injectors via output Diagnostic Test Mode (DTM) ⇒ page 01-51

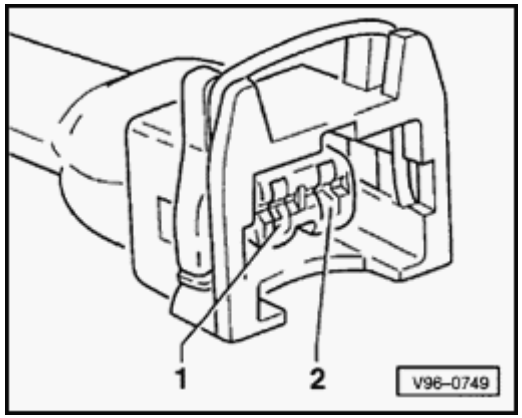
Required special tools and test equipment

- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VAG1527B LED voltage tester
- VW1594 connector test kit
- Wiring diagram

Test requirements

- Fuse for fuel injectors OK
- Engine speed (RPM) sensor OK
- Fuel pump relay OK

24-103



Checking signal from ECM

- Disconnect harness connector from cylinder 1 fuel injector.
- Connect VAG1527B LED voltage tester between connector terminals (to ECM), using adapter cables from VW1594 connector test kit.
- Disconnect harness connectors from fuel injectors for cylinders 2-6.
- Crank starter briefly to check voltage supply for cylinder 1 fuel injector.

  LED must flicker.
- Repeat test for fuel injectors for cylinders 2-6.

24-104

If LED does not flicker:

- Switch ignition off.
- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .
- Check wiring for open circuits between ECM/test box and fuel injector harness connectors:
  - Cyl. 1 fuel injector terminal 2 to ECM/test box socket 73
  - Cyl. 2 fuel injector terminal 2 to ECM/test box socket 80
  - Cyl. 3 fuel injector terminal 2 to ECM/test box socket 58
  - Cyl. 4 fuel injector terminal 2 to ECM/test box socket 65
  - Cyl. 5 fuel injector terminal 2 to ECM/test box socket 72
  - Cyl. 6 fuel injector terminal 2 to ECM/test box socket 79

- Specified value: max. 1.5 Ω

24-105

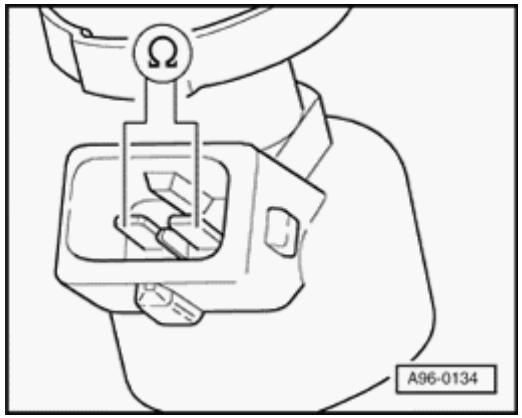
- Check wiring for open circuit between fuel injector connector terminal 1 and relay panel, according to wiring diagram.

  Specified value: max. 15 Ω

- Check wiring for short circuits between wires and connector terminals.

  Specified value: ∞ Ω

Fuel injector resistance, checking



- Check resistance of individual fuel injectors.

  Specified value: 13.5-15.5 Ω

If resistance is NOT OK:

- Replace affected fuel injector.

Fuel injectors, checking for leakage

WARNING!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything nearby that could ignite fuel. The fuel system is under pressure. Before opening, cover connections with a rag, and open carefully to release pressure.

Required special tools and test equipment

- VW1594 connector test kit
- VAG1348/3A remote control connection
- VAG1348/3-2 adapter cable
- VAG1602 fuel analyzer

Test requirement

- Fuel pressure regulator OK ⇒ page 24-111

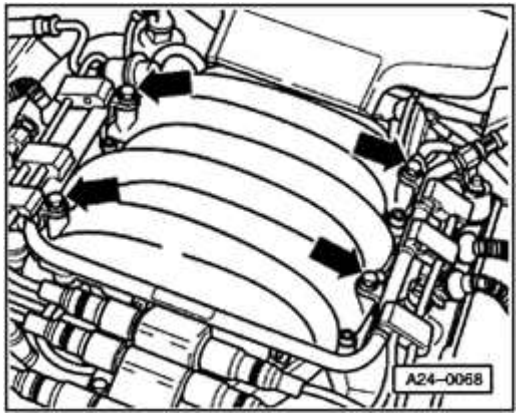
Checking

- Remove intake air hose between MAF sensor and intake air noise muffler.

- Remove vacuum hose from Intake Manifold Tuning (IMT) valve -N156- (change-over valve).

- Remove 5-pin connector from ignition coils, 2-pin connector from valve for camshaft adjustment -N208- (bank 2) and 2-pin connector from camshaft position sensor -G163- (bank 1).

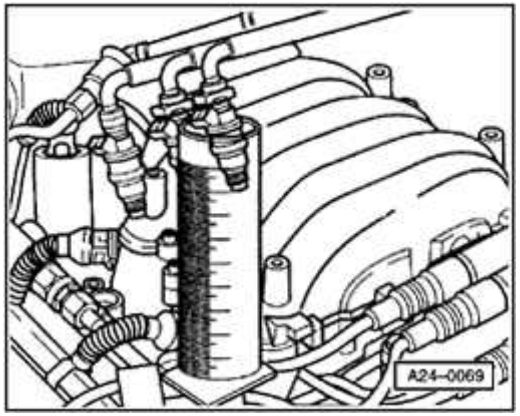
- Disconnect wiring harness from clips on fuel rail.



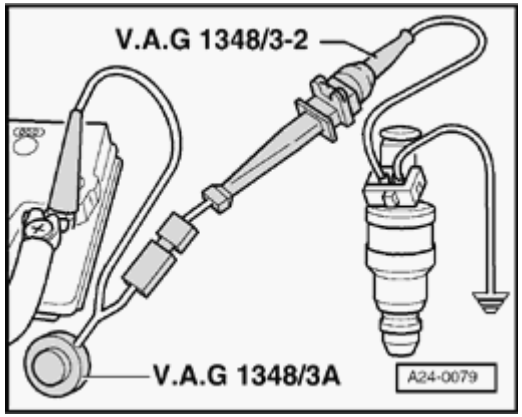
- Disconnect fuel rail from intake manifold and remove fuel lines together with injectors.
- Remove vacuum hose from fuel pressure regulator.
- Remove harness connectors from all injectors.

24-108

Checking injection amount



- Insert injector to be tested into measuring glass of VAG1602 fuel analyzer.
- Connect one terminal of injector being tested to engine ground using test lead from VAG1594.



- Connect second terminal of injector to B+ using VAG1348/3A remote control, VAG1348/3-2 adapter wire and an auxiliary wire.
- Conduct output DTM, actuating cylinder 1 injector -N30- ⇒ page 01-51 (fuel pump must be running).

Note:

This step lets the fuel pump run without the engine running. The closed throttle position switch must be closed during the test, or the selected fuel injector will discharge fuel when it is actuated 5 times.

24-109

- Operate remote VAG1348/3A 30 seconds.

Note:

The spray pattern must be the same for all valves.

Once all three injectors in a single bank have been checked:

- Place three measuring glasses on even surface and check volume.

  Specified volume per injector: 90-125 ml

If the measured volume of one or more injectors is below or above the specified volume:

- Replace malfunctioning injector

- Repeat test to injectors in second bank of cylinders.

If the measured volumes for all injectors are under or over the specified volume:

- Check fuel pressure ⇒ page 24-111 .

Checking for leaks

- Conduct output DTM, actuating cylinder 1 injector -N30- ⇒ page 01-51 (fuel pump must be running).

Note:

This step lets the fuel pump run without the engine running. The closed throttle position switch must be closed during the test, or the selected fuel injector will discharge fuel when it is actuated 5 times.

- Visually check injector for leaks.

  With fuel pump running, only 1 to 2 drops can drip in a minute (per injector).

If fuel loss is greater:

- Replace leaking injector

Installation of the injectors is in reverse order of removal.

- Replace O-rings on all injectors and coat O-rings lightly with clean engine oil.

- Slide injectors (vertically) into position in fuel rail and secure injectors with retaining clips.

- Place fuel rail together with secured injectors on manifold and press fuel rail and secured injectors in evenly.

Fuel pressure, fuel pressure regulator and residual fuel pressure, checking

The fuel pressure regulator controls the fuel pressure depending on intake manifold pressure.

WARNING!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything nearby that could ignite fuel. The fuel system is under pressure. Before opening, cover connections with a rag, and open carefully to release pressure.

Required special tools and test equipment

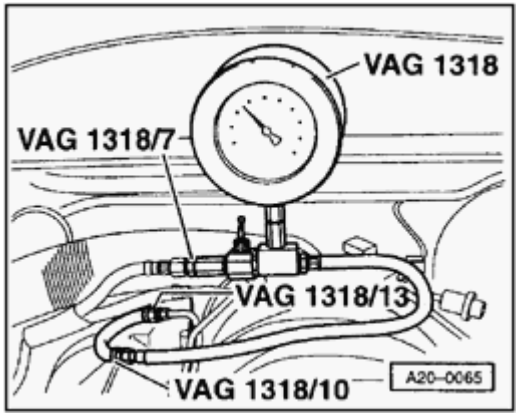
- Pressure tester VAG1318
- Adapter 1318/7
- Adapter 1318/10
- Adapter 1318/13

Test requirements

- Fuel pump delivery rate OK; checking:

⇒ *Repair Manual, Fuel Supply System, Repair Group 20.*

24-112



Checking

- Connect pressure tester VAG1318 between fuel supply line and fuel rail using adapters 1318/7, 1318/10 and 1318/13.

Note:

Shut-off valve of pressure tester must be open (lever parallel to direction of flow).

- Remove vacuum line from fuel pressure regulator (to intake manifold) and block line (using VW 3093).

Note:

For the following test, do not let the engine run unnecessarily with the vacuum hose removed, since the higher fuel pressure causes enrichment of the fuel air mixture. The richer mixture could exceed the O2S control limits and therefore cause a DTC to be stored.

- Switch off all electrical consumers (rear defrost, A/C etc.).
- Start engine and let idle.

Note:

If, during the following pressure test, fuel leaks from the vacuum connection of the fuel pressure regulator, replace the fuel pressure regulator.

- Measure fuel pressure.

Specified value: approx. 3.8-4.2 bar (55.1-60.9 psi)

24-113

If the specified value is not attained:

- Replace fuel pressure regulator and repeat pressure test.

If the specified value is still not obtained:

- Check fuel pump or supply line for damage (e.g. pinched locations); replace if necessary.

If the specified value is exceeded:

- Check return line for damage (e.g. pinch locations); replace if necessary.

- Install vacuum hose on fuel pressure regulator and check for pressure drop on gauge.

  Specification: when vacuum hose is installed, fuel pressure must drop by about 0.5 bar (7 psi).

If pressure does not change, the following tests should be conducted:

- Check vacuum line for leaks (cracks, damage).

- Check vacuum line at intake hose for obstruction; remove hose at fuel pressure

regulator and blow into it.

If there is no leak and vacuum connection has no obstruction:

- Replace fuel pressure regulator.

Checking residual pressure

- Check residual pressure 10 minutes after shutting off engine.
  - Cold engine (min.): approx. 2.2 bar (31.9 psi)
  - Warm engine (min.): approx. 3.0 bar (43.5 psi)

Note:

The higher pressure with a warm engine, caused by fuel expansion, is normal.

If the specified value is not attained:

- Start engine and, after fuel pressure has increased, switch ignition off.
- Close shut off valve on VAG1318 pressure tester.

24-115

If the residual pressure drops (is lower than spec.) again, the following malfunctions are possible.

- Connections for the pressure gauge and fuel lines leaking
- Pre-feed line on fuel reservoir leaking
- Check valve in the electric fuel pump malfunctioning

⇒ *Repair Manual, Fuel Supply System, Repair Group 20, Checking fuel pump check valve*

If retaining pressure does not drop, the following malfunctions are possible:

- Malfunctioning fuel pressure regulator
- Injectors leaking
- Connections for the pressure gauge leaking behind shut-off valve

Note:

To remove the pressure gauge, close the shut-off valve, loosen the connection on the VAG1318/12 adapter and drain excess fuel by opening the shut-off valve into collector container.

Evaporative Emissions (EVAP) canister purge regulator valve, checking

WARNING!

Whenever carrying out work on the fuel supply and/or fuel injection systems, read and carefully follow the Cautions, Warnings, and rules of cleanliness ⇒ ***page 24-9*** .

Note:

Component locations ⇒ *page 24-1*

Required special tools and test equipment

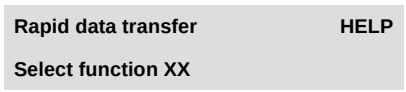
- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable

Test conditions

- Engine coolant temperature at least 80 ° C (176 ° F)

Function check

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .



< Indicated on display

24-117

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -0-, -7- and -0- to input display group number 70 (070), and press -Q- button to confirm input.

Read Measuring Value Block 70 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Press button -4- to select "Basic Setting" function 04 (diagnosis for EVAP canister purge regulator valve is initiated).

Note:

During this diagnosis there should not be any load placed on the engine, otherwise the diagnosis is interrupted and must be started again.

System in Basic Setting 70 →

1 2 3 4

Indicated on display (1-4 = display fields)

If the diagnosis is initiated by the ECM, the display changes from "Test OFF" to "Test ON" in display field 4.

- Continue to run engine at idle until "EVAP OK" is indicated in display field 4.

Note:

If the display changes from "Test ON" to "Test OFF" during the test, accelerate with a brief burst to repeat the test.

24-118

	Display fields			
	1	2	3	4
Display group 70: EVAP canister purge regulator valve				
Display	xxx %	xx.x %	xx.xx g/s	Test OFF/Test ON EVAP OK EVAP n.OK
Indicated	EVAP canister purge regulator valve duty cycle during diagnosis	Oxygen sensor deviation during diagnosis	Idle Air Control (IAC) valve deviation during diagnosis	Diagnosis condition Diagnosis results
Range	0 - 100 %	-25.0 to +25.0 %	-2.70 to +4.16 g/s	---
Specified value	0 - 93 %	- 15.0 to +15.0 %	1.00 - 0.00 g/s	EVAP OK

If "EVAP n.OK" is indicated in display field 4:

- Check for blockage or leaks ⇒ page 24-119 .

If "EVAP OK" is indicated in display field 4:

- Press → button.

Rapid data transfer HELP

Indicated on display

Select function XX

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

Checking for blockage and leaks

The EVAP canister purge regulator valve is closed when power is off.

- Remove EVAP canister purge regulator valve -N80- (component locations ⇒ page 24-1)
- Connect removed valve to harness connector.
- Start output Diagnostic Test Mode (DTM) and select -N80- ⇒ page 01-51 .
- Blow into long connection during output DTM, and check whether valve opens and closes properly. Replace valve if necessary.

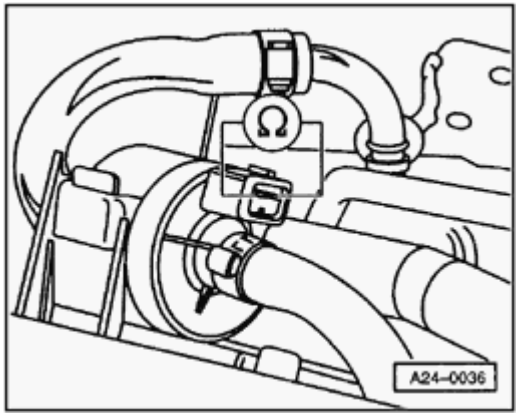
If valve -N80- does not open and close as specified:

- Replace -N80-.

If valve -N80- is OK:

- Check all hose connections between tank and valve for blockage or leaks.

EVAP canister purge regulator valve -N80- electrical test



- Disconnect harness connector from EVAP canister purge regulator valve.

- Connect multimeter US1119 (Fluke 83 or equivalent) and check resistance at across valve terminals.

  Specified value: 22-30 Ω

If resistance is NOT OK:

- Replace EVAP canister purge regulator valve

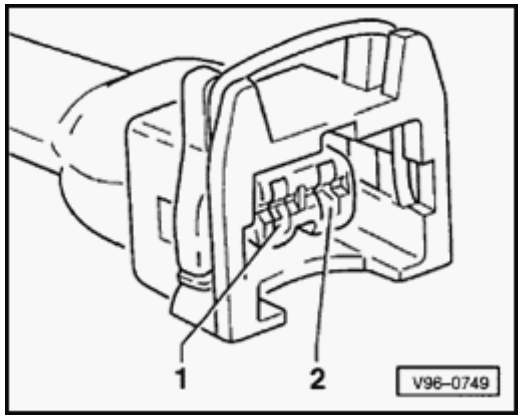
24-121

Checking EVAP canister purge regulator valve voltage supply

Test conditions

- Fuse for EVAP canister purge regulator valve OK

- Disconnect harness connector from EVAP canister purge regulator valve.



- Connect VAG1527B LED voltage tester between connector terminal 1 (B+) and engine Ground.
- Operate starter motor.

  Specified value: LED must light up

If LED test light does not light:

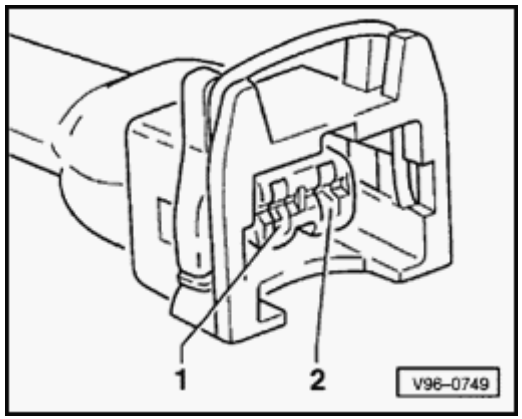
- Check wiring for open circuit between connector terminal 1 and fuse, according to wiring diagram; repair if necessary.

  Specified value: 1.0 Ω max.

If wiring is OK:

- Check fuel pump relay ⇒ page 24-95 .

24-122



Checking signal to EVAP canister purge regulator valve

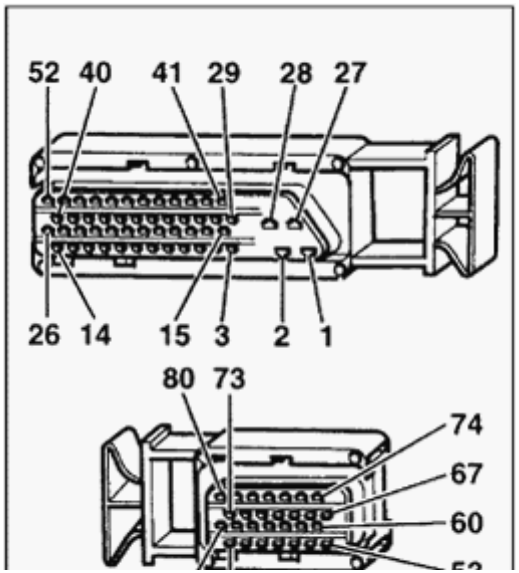
- Connect VAG1527B LED voltage tester between connector terminals 1 (B+) and 2.
- Start output Diagnostic Test Mode (DTM) for EVAP canister purge regulator valve -N80- ⇒ page 01-51 .

  LED must blink

If LED test light does not blink, or stays on:

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

If LED test light does not blink:



- Check wiring between connector terminal 2 and Motronic ECM terminal 15 for open circuit or short circuit to B+.

If LED test light stays on:

- Check wiring between connector terminal 2 and Motronic ECM terminal 15 for short circuit to Ground.

24-123

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

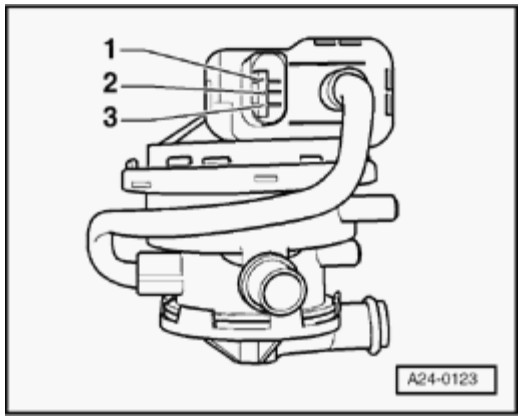
24-124

Leak Detection Pump (LDP), checking

Note:

Component locations ⇒ *page 24-1*

Electrical testing

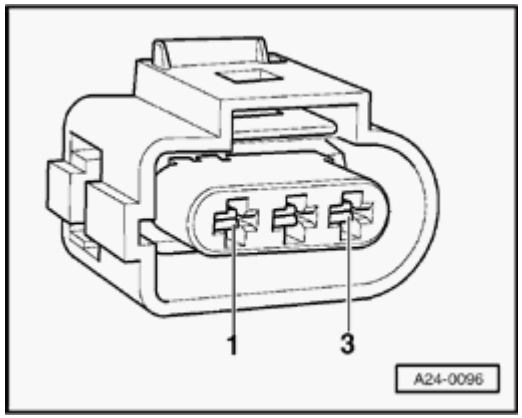


- Disconnect harness connector for LDP -V144-.
- Connect multimeter US1119 (Fluke 83 or equivalent) and check resistance at leak detection pump. Specified values:
  - Connector terminal 1 to terminal 3: 640-720 Ω
  - Connector terminal 2 to terminal 3: 11.0-21.0 Ω

If resistance is NOT OK:

- Replace leak detection pump -V144-.

24-125



Voltage supply, checking

- Disconnect harness connector for LDP -V144-.
- Connect VAG1527B LED voltage tester between connector terminal 3 (B+) and engine Ground.
- Start engine and run engine at idle.

  LED must light up.

If LED tester does not light:

- Check fuse for LDP -V144-.
- Check wiring for open circuit between terminal 3 and fuse, according to wiring diagram.

  Specified value: max. 0.5 Ω.
- Check fuel pump relay and signal to relay ⇒ page 24-95 .

24-126

Intake air system, checking for leaks

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable

- Engine leak detector spray G 001 800 A1

Notes:

- *If there are leaks, intake manifold vacuum will draw in the leak detector spray with outside air. The spray reduces the ability of the fuel/air mixture to ignite, which causes a drop in engine speed and a significant increase in CO-content.*

- *Observe the safety precautions listed on the container.*

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer **HELP**	
Select function XX	

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP

Input display group number XXX

➢ Indicated on display

- Press buttons -0-, -0- and -1- to input display group number 1 (001), and press -Q- button to confirm input.

24-127

Read Measuring Value Block 1 →

1 2 3 4

< Indicated on display (1-4 = display fields)

- Monitor oxygen sensor control in display fields 3 and 4.

	Display fields			
	1	2	3	4
Display group 1: Engine idle speed				
Display	xxxx RPM	xx.x °C	xx.x%	xx.x %
Indicates	Idle speed (in 40 RPM steps)	Engine Coolant Temperature (ECT)	Oxygen Sensor (O2S) control, Bank 1	Oxygen Sensor (O2S) control, Bank 2
Range	0 - 6800 RPM	-48.0 - 143.2 °C (-54 - 289 °F)	-25.0 to +25.0 %	-25.0 to +25.0 %
Specified value	620 - 740 RPM (all-wheel drive)	---	-10.0 to +10.0 % value must change by at least 2 %	-10.0 to +10.0 % value must change by at least 2 %
	740 - 860 RPM (front-wheel drive)			

- Systematically spray parts of intake air system with engine leak detector spray.

If engine speed drops, or the values displayed for oxygen sensor control change:

- Check for leaks in area of intake air system most recently sprayed, and eliminate leaks.

Throttle valve control module, checking

Notes:

- *If the throttle valve control module -J338- is removed and installed, or replaced, adaptation of the throttle valve control module to the Motronic ECM is required* ⇒ *page 24-150* .

- *Component locations* ⇒ *page 24-1*

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagrams

Function

Idle speed stabilization is integrated in the throttle valve control module -J338-. In the housing opposite the throttle valve are Throttle Position (TP) sensor -G69-, Closed Throttle Position (CTP) switch -F60-, throttle drive -G186- and angle sensor -1- for throttle drive -G187-.

The housing should not be opened.

The individual components cannot be replaced or mechanically adjusted. All adjustments are accomplished by the VAG1551 Scan Tool (ST) using the "Basic Setting" function 04.

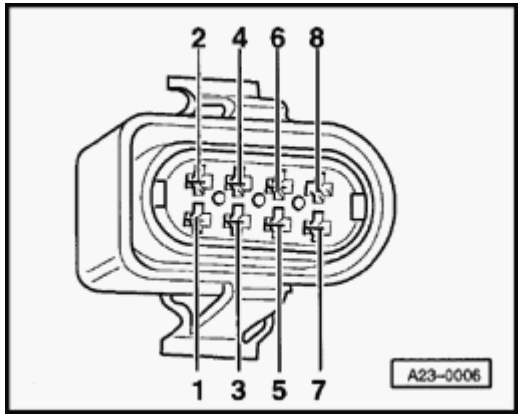
If the complete throttle valve control module is without power (i.e. disconnected), the throttle valve assumes a mechanical closed throttle position that results in an increased idle speed of 1200-1300 RPM (with engine at operating temperature).

If only the Throttle Position (TP) actuator -V60- is without power, the throttle valve also assumes a mechanical closed throttle position (limp-home position), but because the signal from the CTP switch -F60- can still be recognized, a nearly "normal" idle speed of approx. 900 RPM is maintained with a corresponding reduction of the ignition timing advance.

If the Engine Control Module (ECM) recognizes a

malfunction in the angle sensor -1- for throttle drive -G187-, it switches the power off for throttle drive -G186-,and the throttle valve again assumes the mechanical closed throttle position (limp-home position).

Throttle valve control module power supply, checking

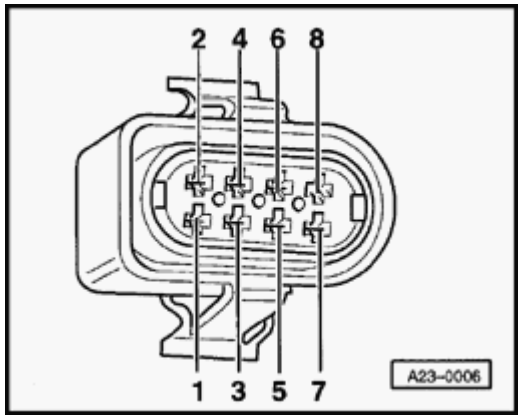


- Disconnect 8-pin harness connector from throttle valve control module -J338-.
- Connect multimeter US1119 (Fluke 83 or equivalent) between harness connector terminals using adapter cables from VW1594 connector test kit.
- Switch ignition on, and check voltage. Specified values:
  - Connector terminals 3 and 7 (Ground): 9.0-14.5 volts
  - Connector terminals 4 and 7 (Ground): 4.0-6.0 volts
- Switch ignition off.

If voltage is NOT OK:

- Connect VAG1598/22 test box ⇒ page 01-67 .
- Check wiring for open circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 3 to ECM/test box socket 69
  - Connector terminal 4 to ECM/test box socket 62
  - Connector terminal 7 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω

24-131



- Check wiring for short circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 7 to ECM/test box socket 69
  - Connector terminal 7 to ECM/test box socket 62
  - Connector terminal 4 to ECM/test box socket 67
  - Specified value: ∞ Ω
- Reconnect throttle valve control module harness connector.

If wiring is OK:

- Replace Motronic Engine Control Module (ECM) -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Closed Throttle Position (CTP) switch, checking

Note:

The Closed Throttle Position (CTP) switch -F60- is inside the throttle valve control module -J338-.

Test conditions

- Throttle valve in closed throttle position; if necessary adjust accelerator pedal cable

⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

- Cruise control adjustment OK

- Power supply for throttle valve control module OK; checking ⇒ page 24-130

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer	HELP
Select function XX	

➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block	HELP
Input display group number XXX	

➢ Indicated on display

24-133

- Press buttons -0-, -0- and -5- to input display group number 5 (005), and press -Q- button to confirm input.

Read Measuring Value Block 5 →

1 2 3 4

< Indicated on display (1-4 = display fields)

- Check Closed Throttle Position (CTP) switch (display field 4):

	Display fields			
	1	2	3	4
Display group 5: Engine electronics				
Display	xxx RPM	xx.xx ms	xxx km/h	Idle Part throt Full throt Decel Enrich
Indicates	Engine speed (in 40 RPM steps)	Engine load	Vehicle speed	Operational condition
Range	0 - 6800 RPM	0.00 - 12.75 ms	---	---
Specified value	620 - 740 RPM (all-wheel drive)	1.00 - 2.50 ms	0 km/h	Throttle closed: "Idle"

	740 - 860 RPM (front-wheel drive)			
				Throttle slightly open: "Part throt"
	---	---	---	If display is NOT OK ⇒ page 24-134 , Continuation

24-134

Continuation

- Switch ignition off.

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

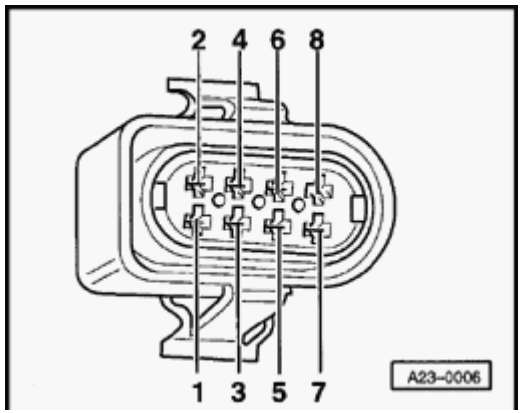
- Connect multimeter US1119 (Fluke 83 or similar) and check resistance between test box sockets 67 and 69.

  Specified value: max. 5.0 Ω

- Open throttle slowly.

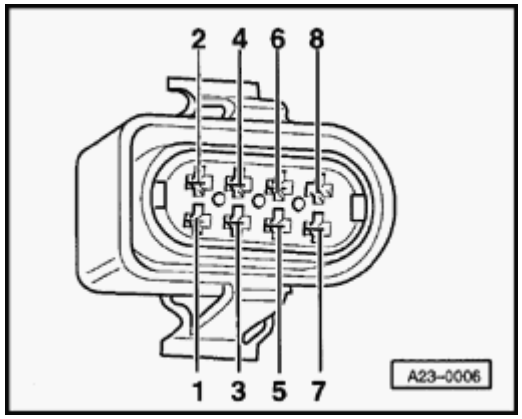
  Specified value: ∞ Ω

If resistance is NOT OK:



- Disconnect 8-pin harness connector for throttle valve control module - J338-.
- Check wiring for open circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 3 to ECM/test box socket 69
  - Connector terminal 7 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω

24-135



- Check wiring for short circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 7 to ECM/test box socket 69
  - Specified value: ∞ Ω
- Reconnect throttle valve control module harness connector.

If wiring is OK:

- Replace throttle valve control module -J338-.
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Throttle drive and angle sensor for throttle drive, checking

Note:

Throttle drive -G186- and angle sensor -1- for throttle drive -G187- are located in the throttle valve control module -J338-.

Test conditions

- Throttle valve in closed throttle position; if necessary adjust accelerator pedal cable

⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

- Cruise control adjustment OK
- Power supply for throttle valve control module OK; checking ⇒ page 24-130
- Engine coolant temperature at least 80 ° C (176 ° F)
- Automatic transmission selector lever in "P" or "N"

24-137

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	⮜	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	⮜	Indicated on display

- Press buttons -0-, -5- and -5- to input display group number 55 (055), and press -Q- button to confirm input.

Read Measuring Value Block 55 → **1 2 3 4**	⮜	Indicated on display (1-4 = display fields)

- Compare display with specified values for idle air control (display fields 1-4):

24-138

	Display fields			
	1	2	3	4
Display group 55: Idle control				
Display	xxx RPM	x.xx g/s	x.xx g/s	xxxx
Indicates	Engine speed RPM (in steps of 10 RPM)	Regulating value-idle mass air flow (idle air control)	Learning value-idle mass air flow	Operating conditions
Range	0 - 2550 RPM	-2.78 to +2.85 g/s	-1.67 to +3.34 g/s	---
Specified value	620 - 740 RPM (all-wheel drive) or 740 - 860 RPM (front-wheel drive)	-1.39 to +1.39 g/s	-1.39 to +1.39 g/s	0000 (all-wheel drive) and/or 0100 (front-wheel drive)
	If engine speed is NOT OK ⇒ page 24-141 , Continuation	If display is NOT OK ⇒ page 24-139 , Evaluation of display group 55		Explanation ⇒ page 24-140

If displayed values are OK:

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

Evaluation of display group 55

Display group: 55 Display fields: 2 + 3	Possible malfunction cause	Corrective action
above 1.39 g/s	♦ Increased load because of switched-on consumers	- Switch off electrical consumers
	♦ Throttle valve mechanism sticking ♦ Air passage in area of throttle valve contaminated	- Visually check, repair if necessary
below -1.39 g/s	♦ Intake air leak (false air) behind throttle valve	- Check intake air system for leaks (false air) ⇒ page 24-126 - Check exhaust system ⇒ Repair Manual, 2.8 Liter V6 5V General, Engine, Repair Group 26

24-140

Explanation of 4-digit display

Explanation when display field is = 0				
x	x	x	x	**Display group 55**
			0	A/C compressor off (0 = A/C compressor off; 1 = A/C compressor on)
		0		Shift lever in P or N (0 = Shift lever in P or N; 1 = Shift lever in 2/3/4/R/D)
	0			Idle air control boost (0 = no idle air control boost, for all-wheel drive vehicles; 1 = idle air control boost, for front-wheel drive vehicles)
0				always "0"

Note:

The increased idle speed (raised rpm) on vehicles with front-wheel drive is attained if there is power supplied (B+, 15er) to terminal 10 of the engine control module.

24-141

Continuation

- Switch ignition off.

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

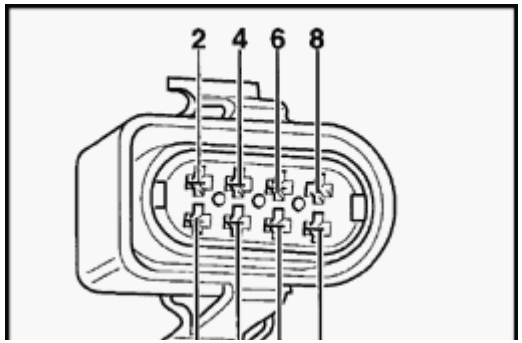
- Switch ignition on.

- With throttle valve in closed throttle position, connect multimeter US1119 (Fluke 83 or equivalent), and check resistance between ECM/test box sockets 59 and 66.

  Specified value: 3-200 Ω

If resistance is NOT OK:

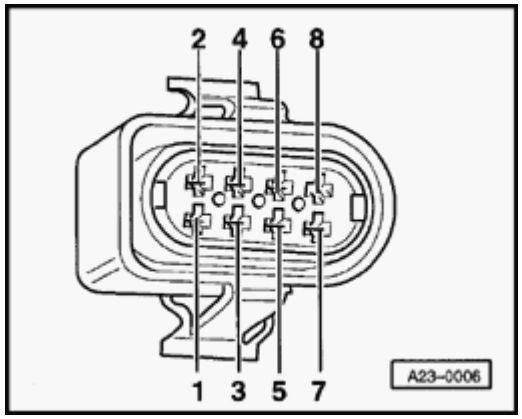
- Disconnect 8-pin harness connector from throttle valve control module -J338-.



- Check wiring for open circuit between ECM/test box and 8-pin throttle valve control module harness connector.
  - Connector terminal 1 to ECM/test box socket 66
  - Connector terminal 2 to ECM/test box socket 59
  - Connector terminal 7 to ECM/test box socket 67

- Connector terminal 8 to ECM/test box socket 74
- Specified value: max. 1.5 Ω

24-142



- Check wiring of 8-pin connector for short circuit between wires, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 59
  - Connector terminal 1 to ECM/test box socket 74
  - Connector terminal 1 to ECM/test box socket 67
  - Connector terminal 2 to ECM/test box socket 67
  - Connector terminal 2 to ECM/test box socket 74
  - Connector terminal 7 to ECM/test box socket 74
  - Specified value: $\infty\ \Omega$

If wiring is OK:

- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Throttle Position (TP) sensor, checking

Note:

The Throttle Position (TP) sensor -G69- is located inside the throttle valve control module -J338-.

Test conditions

- Throttle valve in closed throttle position; if necessary adjust accelerator pedal cable

⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

- Cruise control adjustment OK

- Power supply for throttle valve control module OK; checking ⇒ page 24-130

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched; engine not running) ⇒ page 01-8 .

Rapid data transfer HELP
Select function XX

➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP
Input display group number XXX

➢ Indicated on display

24-144

- Press buttons -0-, -0- and -3- to input display group number 3 (003), and press -Q- button to confirm input.

Read Measuring Value Block 3 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Compare display with specified values for throttle angle, (display field 3):

	Display fields			
	1	2	3	4
Display group 3: Load measurement				
Display	xxx RPM	xx.x g/s	xxx ∠°	xx.x ° BTDC
Indicates	Engine speed (in 40 RPM steps)	Mass air flow	Throttle angle	Ignition timing
Range	0 - 6800 RPM	---	0 - 90 ∠°	0.0° - 50.0° BTDC
Specified value	0 RPM	---	0 - 5 ∠°	0.0°
	---	---	If not as specified ⇒ page 24-146 , Evaluation of display group 3	---

- Open throttle valve slowly while monitoring degree (°) value in display field 3.

  Value must increase uniformly over the entire range.

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

Note:

The values displayed in display field 3 depend on the calibration of the Throttle Position (TP) sensor and do not correspond with the actual throttle valve opening in degrees. The maximum displayed value is 90.0 ∠°.

If the throttle angle value does not increase uniformly:

- Replace throttle valve control module -J338-.

- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .

- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Evaluation of display group 3

Display group: 3 Display field: 3	Possible malfunction cause	Corrective action
0.0 ∠ °	♦ Open circuit or short circuit to B+ in signal wire between throttle position sensor -G69- and engine control module ♦ Malfunction in Ground for -G69-	- Check wiring ⇒ page 24-147
99.0 ∠ °	♦ Short circuit to Ground in signal wire between throttle position sensor -G69- and engine control module ♦ Malfunction in voltage supply for -G69-	

24-147

Checking wiring

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

- Connect multimeter US1119 (Fluke 83 or equivalent), using adapter cables from VW1594 connector test kit.

- Measure resistance to check for short circuit between test box sockets 2 (Ground) and 75 (signal wire).

  - Test box sockets 2 and 75

  - Specified value: ∞ Ω

- Switch multimeter to voltage (20 VDC) measuring range.

- Switch ignition on.

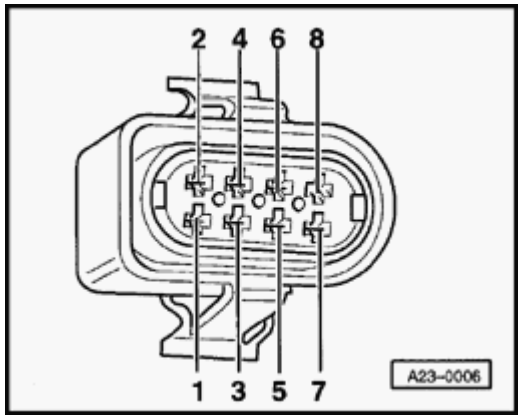
- Check wiring for short circuit to B+.

  Note voltage reading if applicable (if not 0 volts).

- Switch ignition off.

- Continue test, depending on whether or not voltage was measured ⇒ page 24-148 or page ⇒ Page 24-149 .

24-148



Continuation (with measured voltage)

- Disconnect 8-pin harness connector from throttle valve control module -J338-.

If measured voltage was approx. 5 volts:

- Connect multimeter US1119 (Fluke 83 or equivalent), using adapter cables from VW1594 connector test kit.
- Measure resistance to check for short circuit between test box sockets 62 (power supply) and 75 (signal wire).
  - Test box sockets 62 and 75
  - Specified value: $\infty\ \Omega$

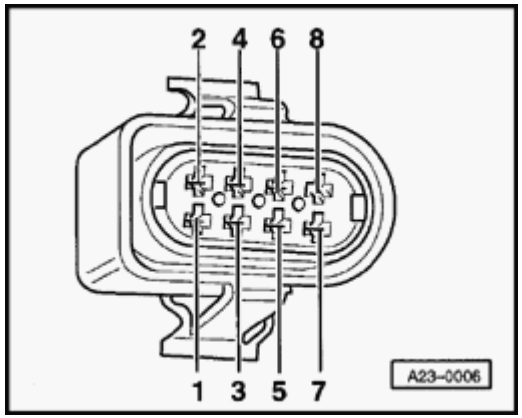
If measured voltage was approx. battery positive voltage (B+):

- Check wiring at 8-pin connector, terminal 5 for short circuit to battery B+.

24-149

Continuation (with no measured voltage)

- Disconnect 8-pin harness connector from throttle valve control module -J338-.



- Check wiring for open circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 5 to ECM/test box socket 75
  - Specified value: max. 1.5 Ω

If wiring is OK:

- Replace throttle valve control module -J338-.
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Throttle valve control module, adaptation to Engine Control Module (ECM)

If the throttle valve control module -J338- is removed and installed, or replaced, adaptation of the throttle valve control module to the Motronic ECM is required.

During "adaptation" with ignition switched on and the engine not running, the Motronic ECM "learns" the closed throttle position (CTP), wide open throttle (WOT) and other positions of the throttle valve control module, and a characteristic curve of the relationship between Throttle Position (TP) sensor -G69- and angle sensor for throttle drive -G187-.

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable

Test conditions

- No malfunctions stored in DTC memory ⇒ page 01-16

- Throttle valve in closed throttle position; if necessary adjust accelerator pedal cable

⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

- Cruise control adjustment OK

- Power supply for throttle valve control module OK; checking ⇒ page 24-130

24-151

Test procedure

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on; engine not running) ⇒ page 01-8 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" function 04, and press -Q- button to confirm input.

System in Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -6- and -0- to input display group number 60 (060), and press -Q- button to confirm input.

System in Basic Setting 60 →

1 2 3 4

Indicated on display (1-4 = display fields)

Notes:

- *After confirming input of display group 60, adaptation is started. The Throttle Position (TP)sensor is positioned in the closed throttle, wide open throttle and limp-home positions. Following this procedure, other intermediate steps will create a characteristic curve of the relationship between Throttle Position (TP) sensor -G69- and angle sensor for throttle drive -G187-.*
- *The Motronic ECM stores these values in permanent memory. Afterward, the throttle valve assumes the starting position.*

24-152

- Compare display with specified values (display fields 1-4):

	Display fields			
	1	2	3	4
Display group 60: Basic setting-throttle valve control module				
Display	xxx ∠ °	xxx ∠ °	Idle Part throt Full throt Decel Enrich	ADP runs ADP. OK ADP. ERROR
Indicates	Throttle valve angle	Throttle drive angle	Operating condition	Adaptation condition
Range	0 - 90 ∠ °	---	---	---
Specified value	1 - 10 ∠ ° (automatic trans.) 1 - 20 ∠ ° (manual trans.)	---	Idle	ADP. runs
	0 - 5 ∠ °	0 - 5 ∠ °	Idle	ADP. OK

				(ADP. ERROR indicates unsuccessful adaptation)
	If displayed values are NOT OK: - Check DTC memory (⇒ page 01-16) - Check throttle valve control module (⇒ page 24-128)			

24-153

- End adaptation as soon as possible after 30 seconds by pressing →button.

If displayed values are OK:

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

Intake Manifold Tuning (IMT) system

Notes:

- *The change-over of the manifold from long to short intake path occurs at approx. 4500 RPM.*

- *Component location* ⇒ *page 24-1*

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- VAG1348/3A remote control connection
- VAG1348/3-2 adapter cable
- VAG1390 hand pump

- Wiring diagrams

Intake Manifold Tuning (IMT) function, checking

Note:

The following test should only be conducted if performance deficiencies occur.

- Increase engine rpm clearly above 4500 RPM.

  Intake manifold tuning vacuum solenoid must be actuated (solenoid is located on intake manifold, left-front, under the ignition coils).

If the vacuum solenoid is not actuated:

- Check intake manifold tuning valve -N156- (change-over valve) ⇒ page 24-156 .

- Check vacuum system for leaks ⇒ page 24-162 .

- Check that vacuum lines are correctly installed, do not leak and are not blocked.

- Check change-over mechanism for ease of movement (activate change-over linkage by hand).

Intake Manifold Tuning (IMT) valve, checking

Notes:

- *Without current the tuning -N156- is closed.*
- *Component locations* ⇒ *page 24-1*

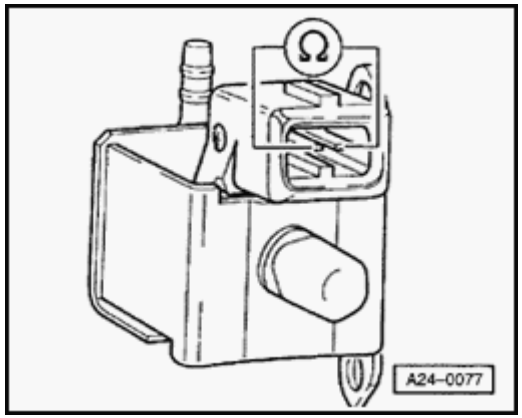
Checking flow and for leaks

- Remove intake manifold tuning valve -N156-.
- After removing, re-connect valve -N156- to harness connector.
- Conduct output Diagnostic Test Mode (DTM) for intake manifold tuning valve -N156- ⇒ page 01-51 .
- Blow through hose to valve output DTM and make sure that -N156- opens and closes correctly.

If -N156- does not open and close:

- Replace intake manifold tuning valve -N156-.

24-157



Electrical check of intake manifold tuning valve -N156-

- Disconnect harness connector from intake manifold tuning valve.

- Connect multimeter for resistance measurement between contacts.

  Specified value: 25-35 Ohms.

If the specified value is not attained:

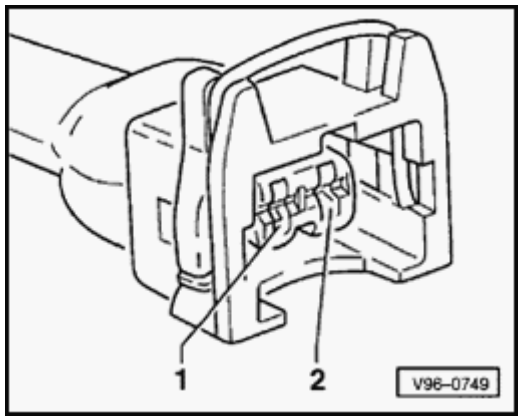
- Replace intake manifold tuning valve.

24-158

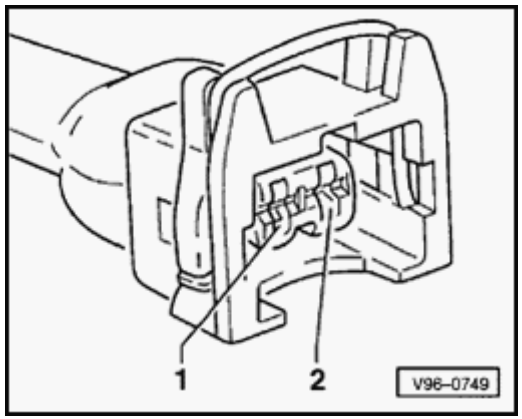
Checking voltage supply for intake manifold tuning valve -N156-

Test requirements

- Fuse for for intake manifold tuning valve OK



- Disconnect harness connector from intake manifold tuning valve.



- Connect LED test lamp VAG1527 with wires from test kit VAG1594 between terminal 1 (B+) of 2-pin connector and engine Ground.
- Crank starter.

  LED must light up.

If LED does not light up:

- Check fuse for -N156-

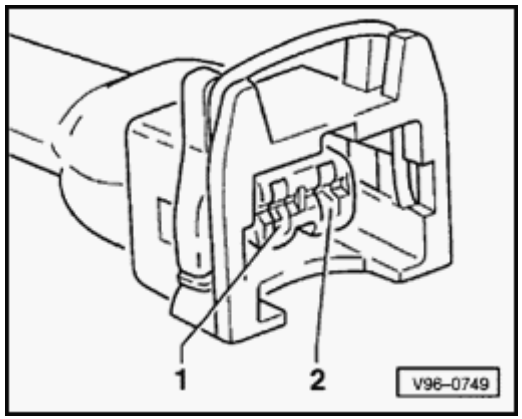
24-159

- Check wiring from terminal 1 of 2-pin connector to fuse per wiring diagram for continuity.

  Specified value: max. 1 Ohm

If wiring is OK:

- Check fuel pump relay and signal to relay ⇒ page 24-95 .



Checking signal for intake manifold tuning valve -N156-

- Connect LED test lamp VAG1527 with wires from test kit VAG1594 between terminals of 2-pin connector for -N156-.
- Conduct output Diagnostic Test Mode (DTM) for intake manifold tuning valve -N156- ⇒ page 01-51 .

  When the intake manifold tuning valve is activated the LED must flash.

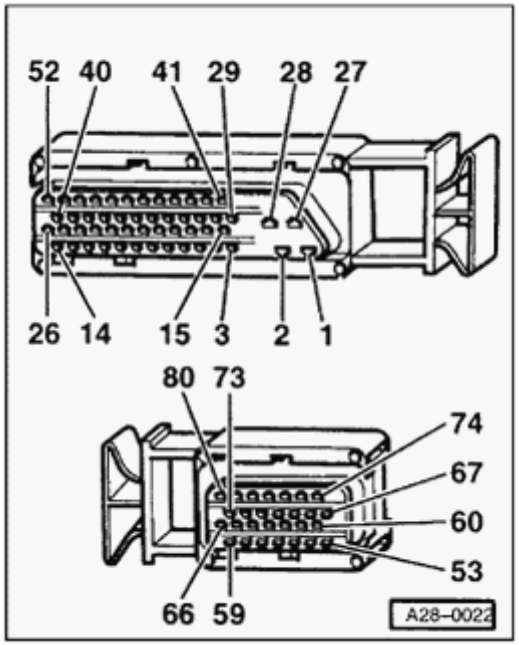
If LED does not flash or stays on continuously:

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

If LED does not flash:

- Check wiring from terminal 2 of 2-pin connector to terminal 64 of test box for continuity and short circuit to B+ per wiring diagram.

24-161



If LED stays on continuously:

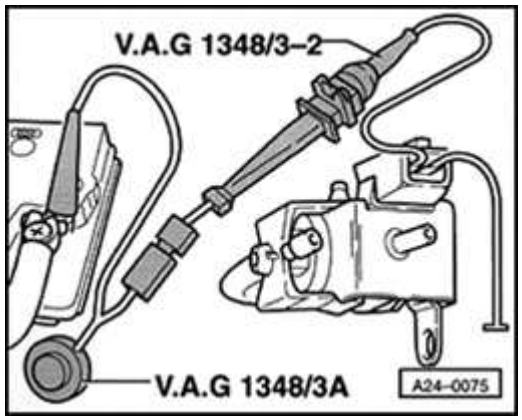
- Check wiring from terminal 2 of 2-pin connector to terminal 64 of test box for ground per wiring diagram.

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

Vacuum system, checking for leaks

- Let engine run 2 to 3 minutes at idle (for vacuum to build up).
- Switch ignition off.
- Remove 2-pin connector from intake manifold tuning valve -N156- (change-over valve).



- Connect jumper wire (from VAG1594) from one terminal of -N156- to engine ground.
- Use VAG1248/3A remote, adapter wire VAG1348/3-2 and auxiliary wire to connect second terminal of -N156- to B+.
- Activate intake manifold tuning valve -N156-, using remote control VAG1348/3A, for approx. 2 to 3 min.

  The vacuum solenoid must remain actuated during this time.

24-163

If vacuum solenoid releases, check solenoid as follows:

- Remove vacuum line from vacuum solenoid for intake manifold change-over.
- Connect VAG1390 hand pump to vacuum solenoid.
- Activate VAG1390 hand pump and watch change-over process.
- Check vacuum solenoid for leaks.

  Vacuum solenoid should not return to initial position as long as vacuum is being applied by hand pump.

If vacuum solenoid returns:

- Replace vacuum solenoid.

24-164

Auxiliary signals, checking

Signal from A/C compressor, checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagrams

Test conditions

- A/C functions OK
- A/C is switched off
- Vehicle at room temperature-above 15 ° C (59 ° F)

  No malfunctions stored in Diagnostic Trouble

- Code (DTC) memory ⇒ page 01-16 .

Checking

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -5- and -0- to input display group number 50 (050), and press -Q- button to confirm input.

Read Measuring Value Block 50 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Switch on A/C (lowest temperature and highest fan position).

- Compare display with specified values for A/C (in display field 4).

	Display fields			
	1	2	3	4
Display group 50: Signals to Engine Control Module (ECM)				
Display	xxxx RPM	xxxx RPM	A/C-LOW A/C-HIGH	Compr. ON Compr. OFF
Indicates	Actual engine speed (in 10 RPM steps)	Specified engine speed (in 10 RPM steps)	IAC boost	A/C compressor status
Range	0 - 2550 RPM	---	---	---
Specified value	620 - 740 RPM (all-wheel drive) or 740 - 860 RPM (front-wheel drive)	680 RPM (all-wheel drive) or 800 RPM (front-wheel drive)	A/C-LOW (all-wheel drive) or A/C-HIGH (front-wheel drive)	Compressor on: Comp. ON Compressor off: Comp. OFF
	---	---	---	If not as specified ⇒ page 24-167 , Continuation

Notes:

- *The A/C compressor is switched off during acceleration when the car is stationary or at slow speed.*
- *At wide open throttle the A/C compressor is switched off by the Transmission Control Module (TCM) (via the kick down switch).*

24-167

Continuation

If the displayed values are NOT OK:

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

- Check wiring for open circuit, short circuit to B+ or short circuit to Ground between ECM/test box terminal 8 and either A/C control head -E87- or Transmission Control Module (TCM).

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If the wiring is OK:

- Check function of A/C control head -E87-.

⇒ *Repair Manual, Heating & Air Conditioning, Repair Group 01*

- Carry out electrical testing of automatic transmission.

⇒ Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01

- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-168

Vehicle speed signal, checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagrams

Test conditions

- Vehicle Speed Sensor (VSS) OK; checking:

⇒ *Repair Manual, Electrical Equipment, Repair Group 90*

Notes:

- *To check Vehicle Speed Sensor -G68-, the vehicle must be driven. A second technician is required to operate the scan tool during the road test.*

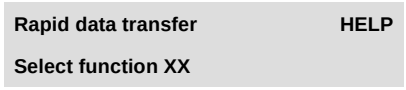
- *Read safety precautions for test driving vehicles while using test equipment ⇒ page 24-9 .*

- *The speed signal is generated by the vehicle speed sensor (at the transmission), and processed at the speedometer/odometer in the instrument cluster.*

24-169

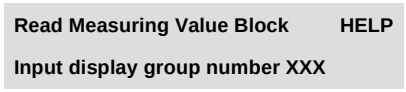
Test procedure

- Connect VAG1551 or VAG1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .



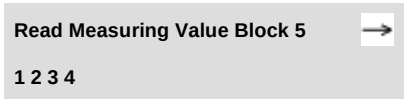
Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -0- and -5- to input display group number 5 (005), and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Road test and compare indicated vehicle speed with value in display field 3 (2nd technician required, ⇒ Safety precautions ⇒ page 24-9).

	Display fields			
	1	2	3	4
Display group 5: General engine data				
Display	xxx RPM	xx.xx ms	xxx km/h	Idle Part throt Full throt Decel Enrich
Indicates	Engine speed (in 40 RPM steps)	Engine load	Vehicle speed	Operating condition
Range	0 - 6800 RPM	0.00 - 12.75 ms	0 - 326 km/h	---
Specified value	---	---	Approx. vehicle speed	---
	---	---	If no vehicle speed is displayed ⇒ page 24-171 , Continuation	---

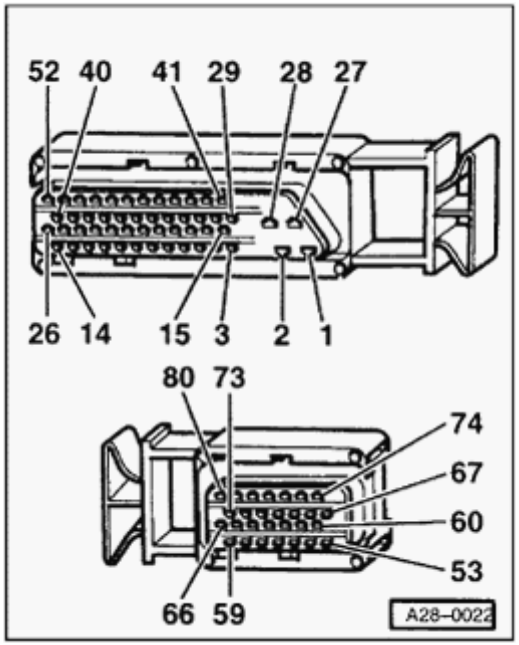
If displayed value is OK:

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch off ignition.

24-171



Continuation

If no speed was indicated:

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .
- Connect VAG1527B LED voltage tester between ECM/test box sockets 3 (B+) and 20 (signal).
- Lift vehicle at left-front until wheel is free.
- Switch ignition on and rotate left-front wheel by hand.

  LED must blink (very brief blink)

Notes:

- *The right-front wheel must not rotate; block it if necessary.*
- *For LEDs with little voltage consumption, the LED lights up at half strength when the ignition is switched on.*

If the LED does not blink:

- Check wiring from ECM connector, terminal 20 to instrument cluster for open circuit or short circuit ⇒ Electrical Wiring Diagrams, Troubleshooting & Component Locations binder.

If the wiring is OK and the LED does not blink:

⇒ *Repair Manual, Electrical Equipment, Repair Group 90*

- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code

(DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-172

CAN-Bus, checking

When a CAN-Bus malfunction is indicated during a check of DTC memory of the Engine Control Module (ECM), refer to the following test to eliminate the malfunction.

Note:

- *The information exchange occurs between the Engine Control Module (ECM) and the Transmission Control Module (TCM) via a CAN-Bus.*
- *All signals are carried by 2 wires between the ECM and the TCM.*

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- VW1594 connector test kit
- Wiring diagrams

24-173

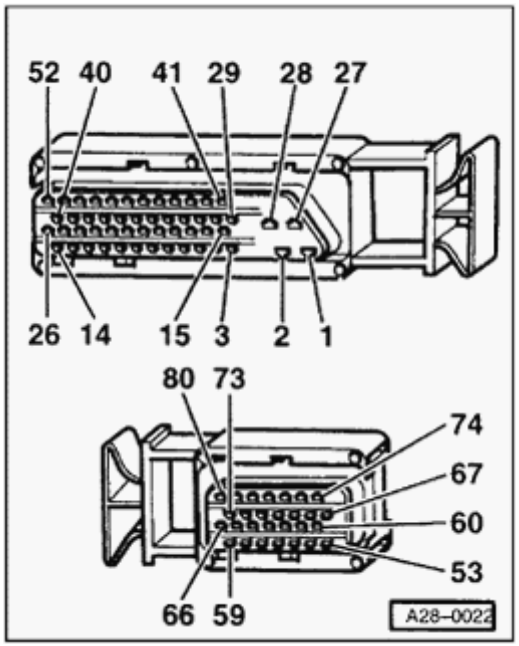
Checking

- Check DTC memory of Transmission Control Module (TCM).

⇒ Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01

If a DTC regarding the CAN-Bus wire is also stored in the TCM:

- Switch ignition off.



- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .
- Check wires from terminal 29 and terminal 41 of test box to transmission control module for open or short circuit per wiring diagram.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If wiring is OK:

- Replace Transmission Control Module (TCM) and Engine Control Module (ECM) as necessary and in sequence.

24-174

Rough road signal from ABS/EDL control module, checking

Notes:

- *When the ABS/EDL control module senses a wheel spinning, it produces the rough road signal. When the ECM recognizes the rough road signal, the misfire recognition is switched off.*

- *Check the rough road signal only when the trouble code 18014 "Rough Road Spec Engine Torque ABS-ECU Electrical Malfunction" is stored. The possible "Misfire" malfunction is in this case a subsequent malfunction that can be disregarded.*

- *The wiring and the rough road signal are monitored by the ECM.*

- *Emissions testing on a front-wheel drive vehicle with ABS/EDL, during which only the front wheels turn while the rear wheels are stationary, can result in the DTC 18014 being stored in DTC memory. Therefore, the fuse for the ABS/EDL control module must be removed. After the test, check DTC memory for the ABS/EDL control module and the ECM. Then erase DTC memory.*

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box

24-175

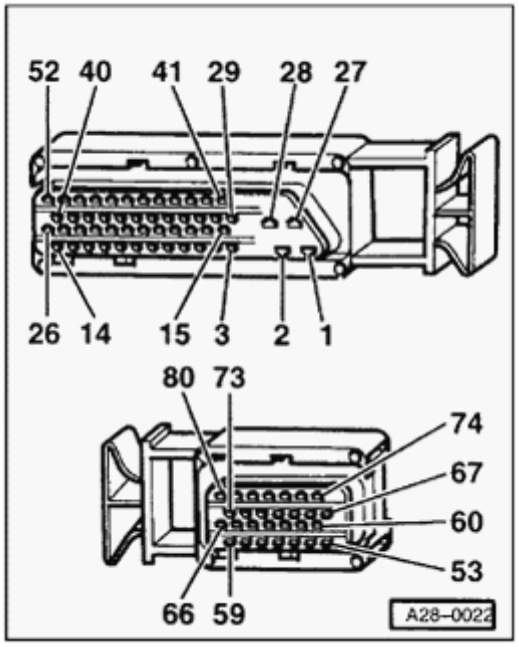
Test requirements

- ECM coding OK ⇒ page 01-14

Test sequence

- Switch ignition off.

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .



- Check signal wiring between ECM/test box terminal 45 and ABS control module for short circuit or open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If the wiring is OK:

- Replace ABS control module.

If the malfunction occurs again after the ABS control module has been replaced:

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code

(DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

24-176

Fuel level signal, checking

Notes:

- *If there is too little fuel in the fuel reservoir (less than 2 gallons) combustion misfiring and/or fuel system malfunctions could occur. In this case the malfunction "Fuel level too low" is stored in the DTC memory (SAE P1250 / VAG 17658).*
- *This malfunction always occurs with combustion misfiring or fuel system malfunctions.*
- *In general eliminate all other malfunctions first.*

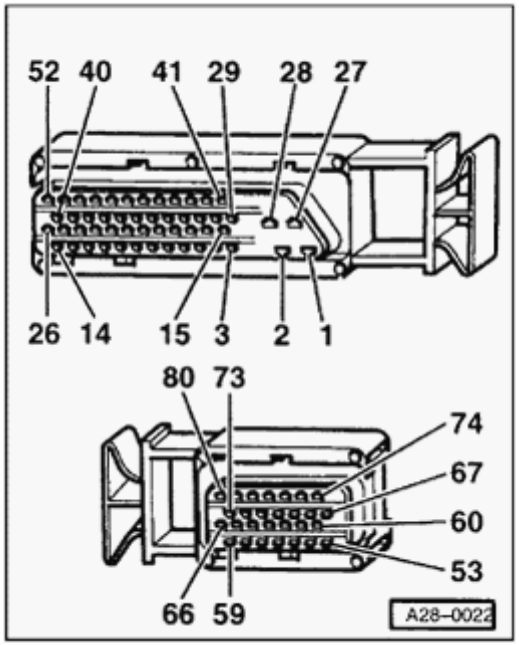
- Fill fuel tank of vehicle (at least 20 ltr, or 5.25 gal).
- Check and then erase DTC memory ⇒ page 01-16 .
- Check readiness code ⇒ page 01-70 .
- Generate new readiness code ⇒ page 01-73 .

24-177

- Conduct a test drive (⇒ Safety precautions ⇒ page 24-9).

- Check DTC memory of ECM ⇒ page 01-16 .

If only the DTC "Fuel level too low" (SAE P1250 / VAG 17658) is stored in the DTC memory.



- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .
- Check wire from terminal 21 of test box to instrument cluster for open circuit or short circuit per wiring diagram.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

28-1

Motronic ignition system

Technical data, spark plugs

Engine code		AHA
Engine idle RPM • Idle RPM cannot be adjusted, is corrected by Idle Air Control (IAC)		620 - 740 RPM (all-wheel drive)
	740 - 860 RPM (front-wheel drive)	
RPM limit • Operates by shutting off fuel injectors		approx. 6500 RPM
Ignition timing • Ignition timing cannot be adjusted; it is determined by the Engine Control Module (ECM)		
Firing order		1-4-3-6-2-5
Spark plugs	Tightening torque	30 Nm (22 ft lb)
	Part No. 1)	101 000 035 HJ (NGK)
	Manufacturer's code (if applicable)	BKR 6 EKUB (NGK)
	Electrode gap - mm	1.6 mm
	Maintenance interval	⇒ Owner's Manual

1) Part numbers listed here are for reference only. Always check with your Parts department for the latest information.

28-2

Camshaft Position (CMP) sensor -G40-, checking

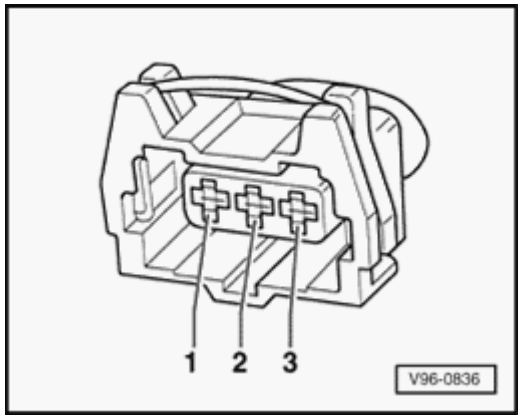
Notes:

- *Camshaft Position (CMP) sensor -G40- is located on the rear of the left cylinder head (bank 2).*
- *Checking -G163-* ⇒ *page 28-5*
- *Component location* ⇒ *page 24-1*

Required special tools and test equipment

- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagrams

28-3



Checking

- Disconnect 3-pin harness connector from Camshaft Position (CMP) sensor -G40-.

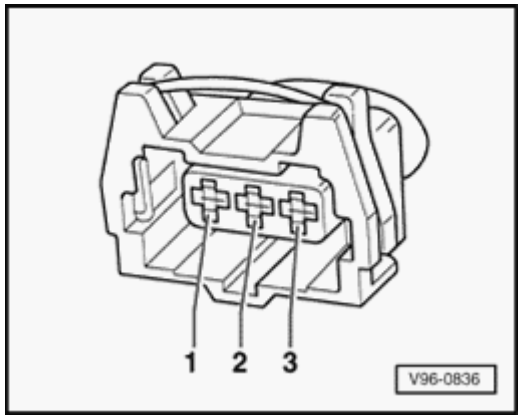
- Connect multimeter US1119 (Fluke 83 or equivalent) to measure voltage across CMP connector terminals 1 (B+) and 3 (Ground), using adapters from VW1594 connector test kit.
- Switch ignition on.
- Measure voltage between terminals 1 and 3.

  Specified value: 9-14.5 volts
- Switch ignition off.

If voltage is OK:

- Connect VAG1598/22 test box to Motronic ECM harness connector ⇒ page 01-67 .
- Check wiring for open circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 11
  - Connector terminal 2 to ECM/test box socket 44
  - Connector terminal 3 to ECM/test box socket 14
  - Specified value: max. 1.5 Ω

28-4



- Check wiring for short circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 3 to ECM/test box socket 44
  - Connector terminal 3 to ECM/test box socket 11
  - Connector terminal 2 to ECM/test box socket 11
  - Specified value: ∞ Ω

If wiring is OK (and voltage across terminals 1 and 3 is OK):

- Replace Camshaft Position (CMP) sensor -G40-.

If wiring is OK (but still no voltage across terminals 1 and 3):

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 .

  If Diagnostic Trouble Code (DTC) memory has been erased, or ECM has been disconnected, generate new readiness code ⇒ page 01-73 .

28-5

Camshaft Position (CMP) sensor 2 -G163-, checking

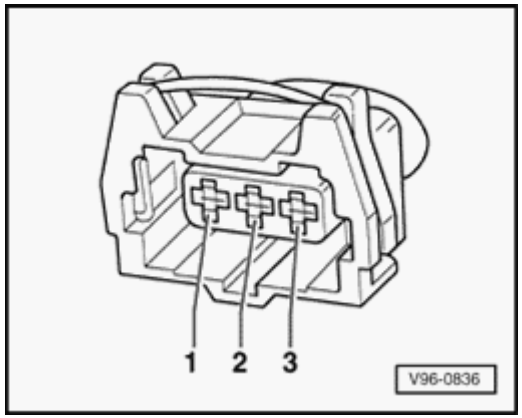
Notes:

- *Camshaft Position (CMP) sensor 2 -G163- is located on the front of the right cylinder head (Bank 1).*
- *Checking -G40-* ⇒ *page 28-2*
- *Component location* ⇒ *page 24-1*

Required special tools and test equipment

- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagrams

28-6



Checking

- Disconnect 3-pin harness connector from Camshaft Position (CMP) sensor 2 -G163-.

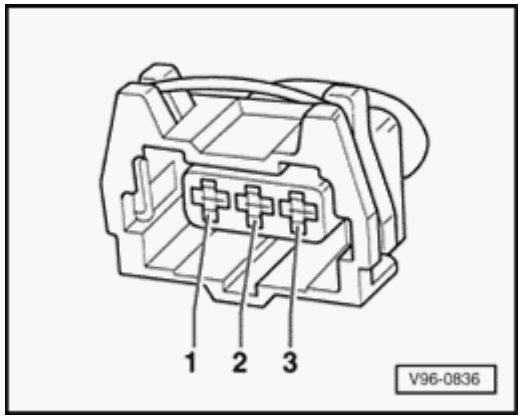
- Connect multimeter US1119 (Fluke 83 or equivalent) to measure voltage across CMP connector terminals 1 (B+) and 3 (Ground), using adapters from VW1594 connector test kit.
- Switch ignition on.
- Measure voltage between terminals 1 and 3.

  Specified value: 9-14.5 volts
- Switch ignition off.

If voltage is OK:

- Connect VAG1598/22 test box to Motronic ECM harness connector ⇒ page 01-67 .
- Check wiring for open circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 11
  - Connector terminal 2 to ECM/test box socket 76
  - Connector terminal 3 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω

28-7



- Check wiring for short circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 3 to ECM/test box socket 76
  - Connector terminal 3 to ECM/test box socket 11
  - Connector terminal 2 to ECM/test box socket 11
  - Specified value: ∞ Ω

If wiring is OK (and voltage across terminals 1 and 3 is OK):

- Replace Camshaft Position (CMP) sensor 2 -G163-.

If wiring is OK (but still no voltage across terminals 1 and 3):

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 .

  If Diagnostic Trouble Code (DTC) memory has been erased, or ECM has been disconnected, generate new readiness code ⇒ page 01-73 .

28-8

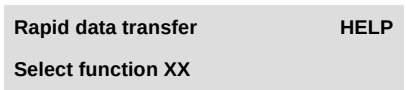
Knock sensor and knock sensor control, checking

Required special tools and test equipment

- VAG1551/1552 Scan Tool (ST) with VAG1551/3 adapter cable
- VAG1598/22 test box
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit
- Wiring diagrams

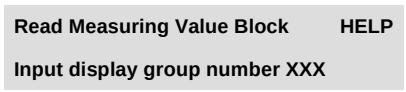
Checking

- Connect VAG1551/1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .



Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

28-9

- Press buttons corresponding to following display group numbers and press -Q- button to confirm input.

  - 022: Display group 22, for cylinders 1 and 2
  - 023: Display group 23, for cylinders 3 and 4
  - 024: Display group 24, for cylinders 5 and 6

Read Measuring Value Block 22 →

1 2 3 4

Indicated on display (1-4 = display groups)

Note:

The test must be carried out during a road test because the knock sensor system is only active with engine speed greater than 2600 RPM and engine load greater than 3 ms.

- Road test and compare display with specified values for knock sensor system in display field 1-4.

WARNING!

A second technician is required to operate the VAG1551 scan tool during the road test. Safety precautions ⇒ ***page 24-9*** .

28-10

	Display fields			
	1	2	3	4
Display group 22 1): Knock control				
Display	xxx RPM	xx.xx ms	xx.x °	xx.x °
Display	Engine speed (in 40 RPM steps)	Engine load	Ignition angle correction 1	Ignition angle correction 2
Work range	0 - 6800 RPM	0.00 - 12.75 ms	0.0 - 12.0 ° (crankshaft)	0.0 - 12.0 ° (crankshaft)
Specified Value	... RPM (test drive)	... ms (test drive)	0.0 - 10.0 ° (crankshaft)	0.0 - 10.0 ° (crankshaft)
	---	---	If displayed values are NOT OK ⇒ page 28-11 , Evaluating display groups 22, 23, 24	

1) Display also valid for display groups 23 (cyls. 3 and 4) and 24 (cyls. 5 and 6) .

If displayed values are OK:

- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Check readiness code ⇒ page 01-70 .

  If Diagnostic Trouble Code (DTC) memory has been erased, or ECM has been disconnected, generate new readiness code ⇒ page 01-73 .

28-11

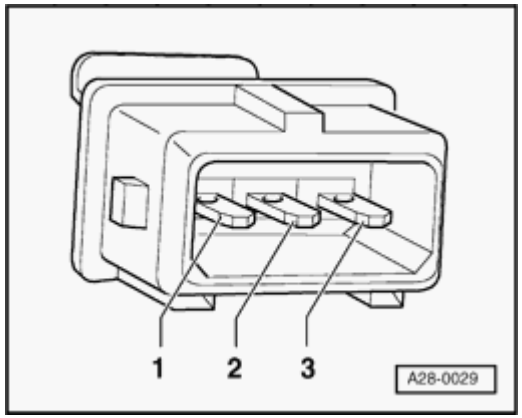
Evaluation of display groups 22, 23 and 24

Display groups: 22, 23 and 24	Possible malfunction cause	Corrective action
Display fields: 3, 4		
All cylinders retarded more than 10 ° (crankshaft)	♦ Knock sensor faulty	- Continuation ⇒ page 28-12
	♦ Connector corroded	
	♦ Knock sensor incorrectly torqued	- Loosen knock sensor and tighten to 20 Nm (15 ft lb)
	♦ Components loose on engine	- Tighten components
	♦ Poor fuel quality	- Change fuel
Value for one cylinder different from the others	♦ Connector corroded	- Continuation ⇒ page 28-12
	♦ Engine damage	- Check compression ⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 15
	♦ Components loose on engine	- Tighten components

28-12

Continuation

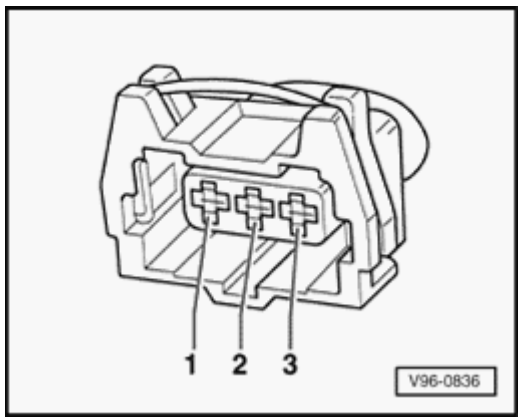
- Disconnect 3-pin connector from Knock Sensor (KS) 1 -G61-.



- Connect multimeter US1119 (Fluke 83 or equivalent) to measure resistance between connector terminals, using adapters from VW1594 connector test kit.
  - Connector terminals 1 and 2
  - Connector terminals 1 and 3
  - Connector terminals 2 and 3
  - Specified value: ∞ Ω

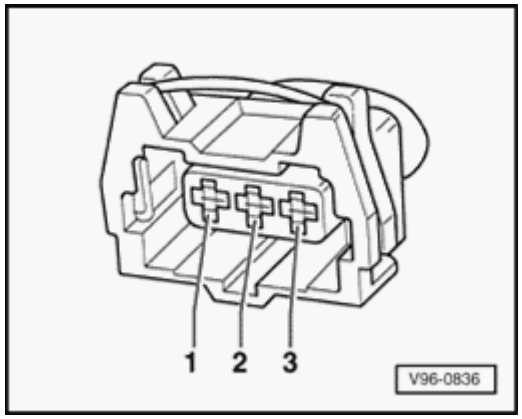
If resistance is OK (no continuity):

- Connect VAG1598/22 test box to Motronic ECM harness connector ⇒ page 01-67 .



- Check wiring for open circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 68
  - Connector terminal 2 to ECM/test box socket 67
  - Connector terminal 3 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω

28-13



- Check wiring for short circuits between terminals of 3-pin connector, and between connector and ECM/test box.
  - Connector terminal 2 to ECM/test box socket 68
  - Connector terminal 3 to ECM/test box socket 68
  - Specified value: ∞ Ω

If the wiring is OK:

- Loosen knock sensor and tighten to 20 Nm (15 ft lb).

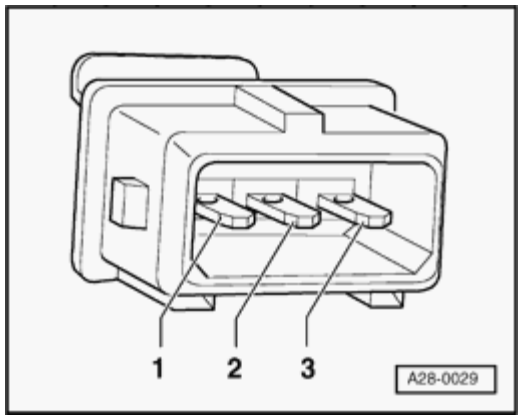
If the malfunction still exists (stored in DTC memory):

- Replace Knock Sensor (KS) 1 -G61-.
- Check readiness code ⇒ page 01-70 .

  If Diagnostic Trouble Code (DTC) memory has been erased, or ECM has been disconnected, generate new readiness code ⇒ page 01-73 .

28-14

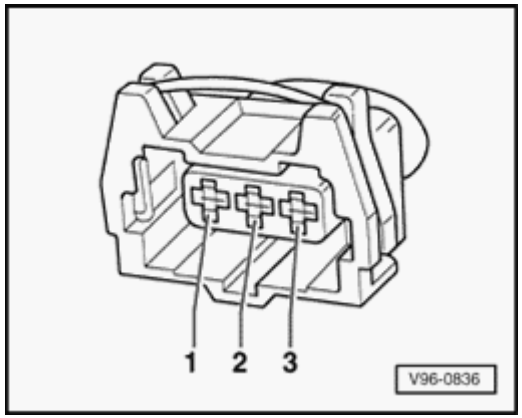
- Disconnect 3-pin connector from Knock Sensor (KS) 2 -G66-.



- Connect multimeter US1119 (Fluke 83 or equivalent) to measure resistance between connector terminals, using adapters from VW1594 connector test kit.
  - Connector terminals 1 and 2
  - Connector terminals 1 and 3
  - Connector terminals 2 and 3
  - Specified value: ∞ Ω

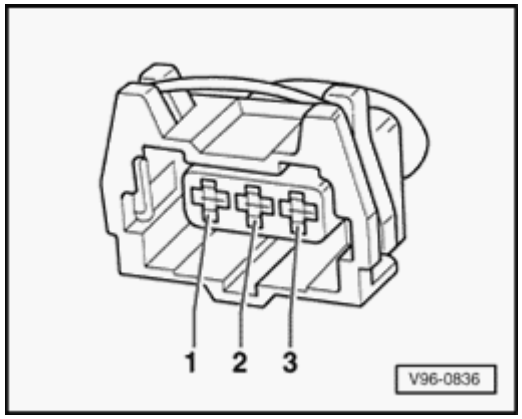
If resistance is OK (no continuity):

- Connect VAG1598/22 test box to Motronic ECM harness connector ⇒ page 01-67 .



- Check wiring for open circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 60
  - Connector terminal 2 to ECM/test box socket 67
  - Connector terminal 3 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω

28-15



- Check wiring for short circuits between terminals of 3-pin connector, and between connector and ECM/test box.
  - Connector terminal 2 to ECM/test box socket 60
  - Connector terminal 3 to ECM/test box socket 60
  - Specified value: ∞ Ω

If the wiring is OK:

- Loosen knock sensor and tighten to 20 Nm (15 ft lb).

If the malfunction still exists (stored in DTC memory):

- Replace Knock Sensor (KS) 2 -G66-.
- Check readiness code ⇒ page 01-70 .

  If Diagnostic Trouble Code (DTC) memory has been erased, or ECM has been disconnected, generate new readiness code ⇒ page 01-73 .

28-16

Misfire recognition, checking

Required special tools and test equipment

- VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter cable

Checking

- Connect VAG1551/1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP

Select function XX

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -0-, -1- and -4- to input display group number 14 (014), and press -Q- button to confirm input.

Read Measuring Value Block 14 →

1 2 3 4

Indicated on display (1-4 = display groups)

28-17

- Compare displayed values with specified values for misfire recognition (display fields 3-4):

	Display groups			
	1	2	3	4
Display group 14: Misfire recognition				
Display	xxx RPM	xx.xx ms	xxx	activated deact
Indicates	Engine speed (in 40 RPM steps)	Engine load	Misfire harmful to emissions (total)	Misfire recognition status
Range	0 - 6800 RPM	0.00 - 12.75 ms	---	---
Specified value	620 - 740 RPM (all-wheel drive)	1.0 - 2.5 ms	30	activated
	740 - 860 RPM (front-wheel drive)			
	---	---	If displayed values are NOT OK ⇒ page 28-18 , display groups 15, 16	

If displayed values are OK:

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Check readiness code ⇒ page 01-70 .

  If Diagnostic Trouble Code (DTC) memory has been erased, or ECM has been disconnected, generate new readiness code ⇒ page 01-73 .

28-18

If displayed values are NOT OK:

- Press -C- button.

- Press buttons -0-, -1- and -5- to input display group number 15 (015), and press -Q- button to confirm input.

Read Measuring Value Block 15 →

1 2 3 4

Indicated on display (1-4 = display groups)

- Compare displayed values with specified values for misfire recognition (display fields 1-4):

	Display groups			
	1	2	3	4
Display group 15: Misfire recognition				
Display	xxx	xxx	xxx	activated deact
Indicates	Misfire harmful to emissions, Cyl. 1	Misfire harmful to emissions, Cyl. 2	Misfire harmful to emissions, Cyl. 3	Misfire recognition status
Range	500	500	500	---
Specified value	0 - 5	0 - 5	0 - 5	activated
	If displayed values are NOT OK ⇒ page 28-20 , Evaluation of display groups 15 and 16			

28-19

If displayed values are OK:

- Press -C- button.

- Press buttons -0-, -1- and -6- to input display group number 16 (016), and press -Q- button to confirm input.

Read Measuring Value Block 16 →

1 2 3 4

Indicated on display (1-4 = display groups)

- Compare displayed values with specified values for misfire recognition (display fields 1 and 4):

	Display groups			
	1	2	3	4
Display group 16: Misfire recognition				
Display	xxx	xxx	xxx	activated deact
Indicates	Misfire harmful to emissions, Cyl. 4	Misfire harmful to emissions, Cyl. 5	Misfire harmful to emissions, Cyl. 6	Misfire recognition status
Range	500	500	500	---
Specified value	0 - 5	0 - 5	0 - 5	activated
	If displayed values are NOT OK ⇒ page 28-20 , Evaluation of display groups 15 and 16			

28-20

Evaluation of display groups 15 and 16

Display groups: 15 and 16 Display fields: 2 and 3	Possible malfunction cause	Corrective action
greater than 5	♦ Ignition coil faulty ♦ Spark plug connector faulty ♦ Spark plug faulty ♦ Power output stage for ignition coil faulty	- Check ignition coils -N-, -N128- and -N158- with power output stage -N122 ⇒ page 28-21
	♦ Fuel injector faulty ♦ Not enough fuel	- Check fuel injectors ⇒ page 24-102 - Check fuel in tank

28-21

Ignition coils and power output stage, checking

Notes:

- *The ignition coils and power output stage are one component.*
- *Measuring the primary resistance of the ignition coils is not possible.*
- *Measure secondary resistance first with ignition wires connected to the ignition coil via the spark plug connector of the respective cylinder (with this method the interference resistances of the ignition cables are also measured).*
- *Component locations* ⇒ *page 24-1*

Required special tools and test equipment

- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit

Test conditions

- No fuel injector malfunction stored in DTC

memory

28-22

Checking

- Check DTC memory ⇒ page 01-16 .

  - There must be no malfunctions stored

- If DTC memory is not clear (malfunctions recognized):

  - Make necessary repairs and erase DTC memory.

  - Stop engine and start engine again.

  - Road test.

  - Check and erase DTC memory again.

- By briefly disconnecting fuel injector connectors with engine running, check which cylinder is misfiring, or not firing at all.

A misfiring cylinder can also be isolated by examining the spark plugs (for a carbon-fouled plug).

-
  Interchange spark plug with one from cylinder

that is OK.

If a different cylinder now misfires:

- Replace faulty spark plug.

If the original cylinder misfires:

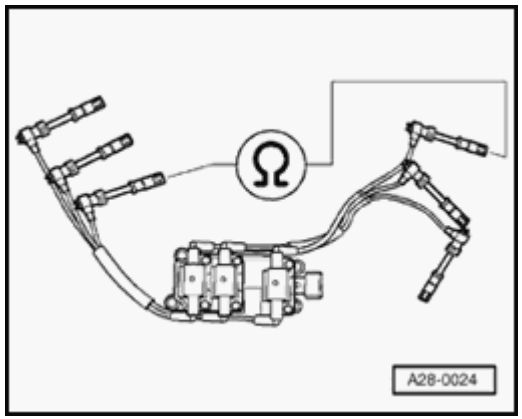
- Check ignition coil ⇒ page 28-23 .

28-23

Checking ignition coils -N-, -N128- and -N158-

- Disconnect 5-pin connector from ignition coil assembly.

- Remove ignition wires from spark plugs.



- Using multimeter and adapters from VAG1594 connector test kit, measure resistance between both spark plug connectors of respective ignition circuit (across coil).

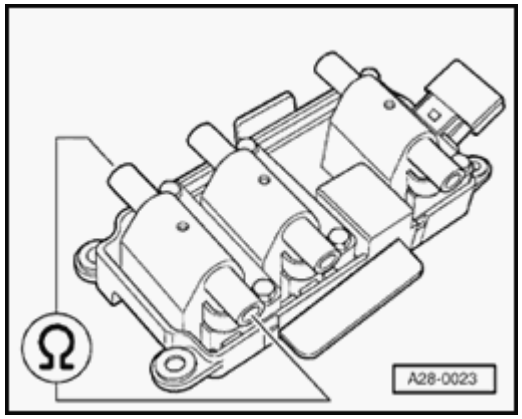
  Specification: approx. 18-25 kΩ.

If resistance is NOT OK:

- Remove ignition wires from ignition coils and measure resistance between ends of respective ignition wires.

  Specification: approx. 4.0-6.0 kΩ

28-24



- Using multimeter and adapters from VAG1594 connector test kit, measure resistance across both ignition wire connectors of respective ignition coil.

  Specification: 8.0-14.0 kΩ

If resistance values are not as specified:

- Replace coils.

If resistance values are OK:

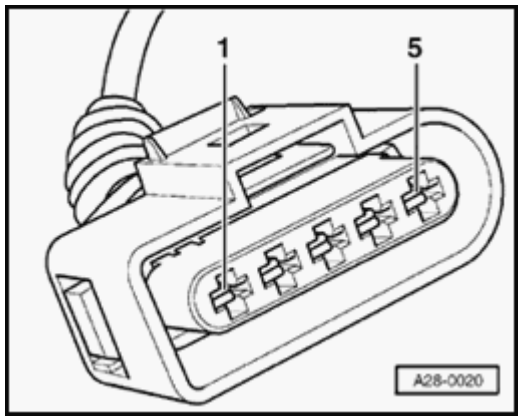
- Check signal for power output stage ⇒ page 28-25 .

28-25

Checking signal for power output stage

- Remove connectors from all 6 injectors (DTC memory will have to be checked and erased later).

- Switch ignition on.



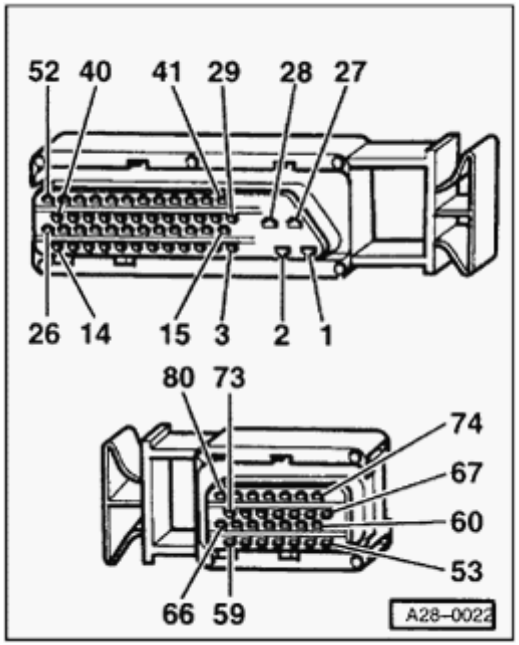
- Connect LED tester VAG1527 between engine ground and connector terminal 3.
- Crank starter for several seconds.

  LED in voltage tester must flash.
- Repeat test on 5-pin connector terminals 4 and 5.

If LED flashes:

- Replace ignition coils -N-, -N128- and -N158- with power output stage -N122-.

28-26



If LED does not flash:

- Connect VAG1598/22 test box to ECM harness connector ⇒ page 01-67 .

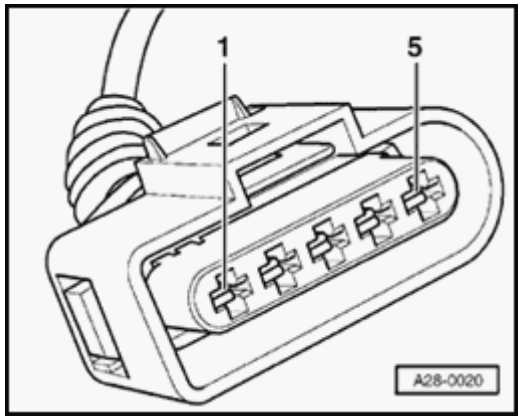
- Check wiring between ECM/test box and 5-pin connector for continuity and/or short circuit per wiring diagram.
  - Connector terminal 3 to ECM/test box socket 71
  - Connector terminal 4 to ECM/test box socket 78
  - Connector terminal 5 to ECM/test box socket 70

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 .

  If Diagnostic Trouble Code (DTC) memory has been erased, or ECM has been disconnected, generate new readiness code ⇒ page 01-73 .

28-27



Checking ground for power output stage

- Disconnect 5-pin connector from ignition coils.

- Connect VAG1527 LED voltage tester between B+ and terminal 2 (ground) of connector.

  LED in tester must light up.

If LED does not light up:

- Check wires for open circuit per wiring diagram.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

28-28

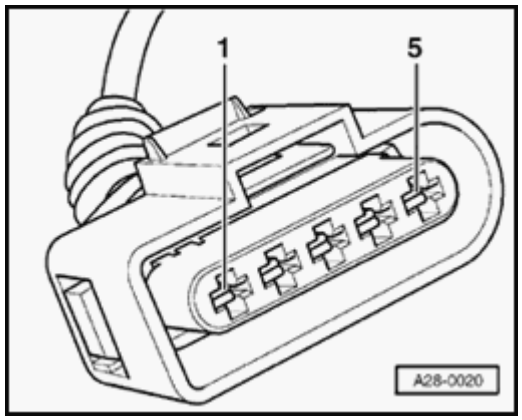
Checking voltage supply of ignition coils

Test requirement

- Fuse for ignition coils OK

- Disconnect 5-pin connector from ignition coils.

- Switch ignition on.



- Connect VAG1527 LED voltage tester between engine ground and terminal 1 (B+) of connector.

  LED in tester must light up.

If LED does not light up:

- Check wires for open circuit per wiring diagram.
- Check fuse for ignition coils.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

28-29

Camshaft adjustment system, checking

Required special tools and test equipment

- VAG1551 Scan Tool (ST) with VAG1551/3 adapter cable
- Multimeter US1119 (Fluke 83 or equivalent)
- VW1594 connector test kit

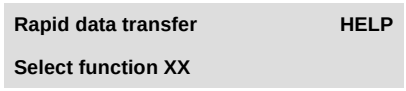
Function

The camshaft adjustment is dependent on engine speed and load. The electrical solenoid valves for camshaft adjustment (-N205- and -N208-) are switched to apply oil pressure to the mechanical camshaft adjusters, which adjusts the camshaft timing.

28-30

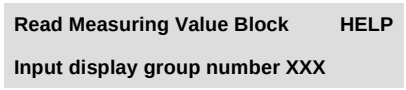
Camshaft adjustment function, checking

- Connect VAG1551/1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (engine running at idle) ⇒ page 01-8 .



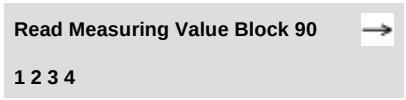
Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -9- and -0- to input display group number 90 (090), and press -Q- button to confirm input.



Indicated on display (1-4 = display groups)

Notes:

Display field 2 indicates whether the engine control module has activated the camshaft adjustment.

- *"CS-ctrlOFF:" camshaft adjustment is not active.*
- *"CS-ctrlON:" camshaft adjustment is active (this can only be attained during a test drive)*

Display fields 3 and 4 show whether the camshaft adjustment did actually occur (via input from sensors):

- *Normal Position: -3.0° to 6.0° KW.*
- *Shifted position: 16.0° KW to 25.0° KW.*

28-31

Note:

If, during the test drive, display field 3 and/or 4 displays a value between 6.0° KW and 16.0° KW, the electrical valves for camshaft adjustment have switched the oil pressure to the respective mechanical camshaft adjuster, but it cannot attain the correct end position (e.g. due to sluggishness).

WARNING!

A second technician is required to operate the VAG1551 scan tool during the road test. Safety precautions ⇒ ***page 24-9*** ***.***

- Accelerate from rest in 1st gear (manual) or with selector lever in "2" position (automatic).

- Check specified values for camshaft adjustment (display fields 2-4)

28-32

	Display fields			
	1	2	3	4
Display group 90: Camshaft adjustment				
Display	xxx RPM	CS-ctrlOFF CS-ctrlON	± x,x ° KW	± x,x ° KW
Indicates	Engine speed (in 40 RPM steps)	Camshaft adjustment off/on	Response of camshaft adjustment Bank 1	Response of camshaft adjustment Bank 2
Work range	1000 - 5000 RPM	---	-3.0 to 25.0 ° KW	-3.0 to 25.0 ° KW
Specified Value	620 - 740 RPM (all-wheel drive) or 740 - 860 RPM (front-wheel drive)	CS-ctrlOFF	-3.0 to 6.0 ° KW (normal position)	-3.0 to 6.0 ° KW (normal position)
	....RPM (test drive)	CS-ctrlON	16.0 to 25.0 ° KW (shifted position)	16.0 to 25.0 ° KW (shifted position)

	---	If the specified values are not attained, check solenoid valves for camshaft adjustment ⇒ page 28-33 .

If specified values are attained:

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

28-33

Valves for camshaft adjustment, checking

Note:

Installation location ⇒ *page 24-1*

- Connect VAG1551/1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ page 01-8 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -3- to select "Output Diagnostic Test Mode" function 03.

Rapid data transfer Q **03 - Output Diagnostic Test Mode**	Indicated on display

- Press -Q- button to confirm input.

Output Diagnostic Test Mode → **Camshaft adjustment 1**	Indicated on display

- Check using output DTM and activate camshaft adjustment ⇒ page 01-51 .

  Valves 1 and 2 for camshaft adjustment, -N205- and -N208-, must click audibly.

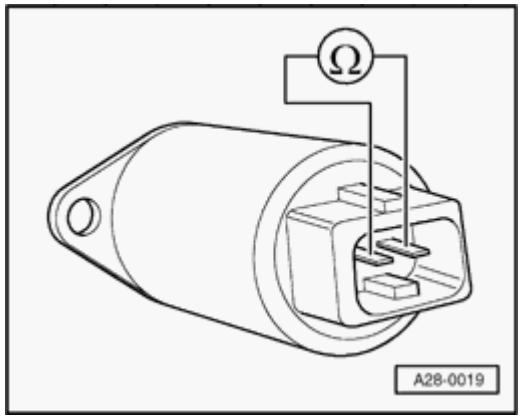
If the valves do not click:

- Check as described in test procedures that follow.

28-34

Checking solenoid valves for camshaft adjustment electrically

- Disconnect harness connector from valve.



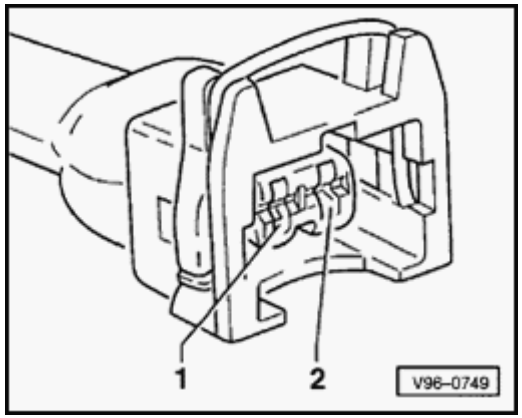
- Using multimeter with auxiliary wires from VAG1594, measure resistance across terminals on valve.

  Specified value: 10-18 ohms

If resistance is not as specified:

- Replace solenoid valve.

28-35



Checking voltage supply of valves for camshaft adjustment

- Disconnect harness connector from valve.

- Connect LED tester VAG1527 between engine ground and terminal 1 of connector (B+).
- Crank starter for several seconds (engine can start).

  LED in voltage tester must light up.

If LED does not light up, conduct the following tests:

- Check fuse for valves for camshaft adjustment.
- Check wiring from terminal 1 on 2-pin connector to fuse for continuity per wiring diagram.

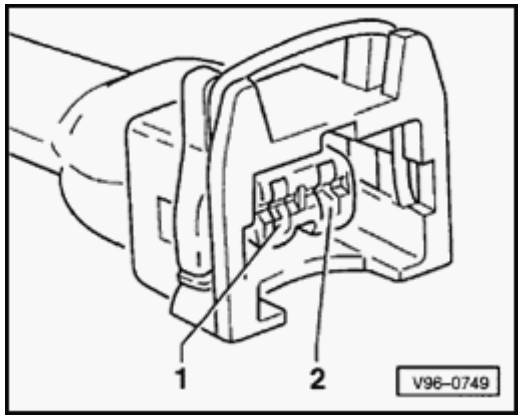
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Check fuel pump relay and signal to relay ⇒ page 24-95 .

28-36

Checking signal to valves for camshaft adjustment

- Disconnect harness connector from valve.



- Connect LED tester VAG1527 between connector terminals 1 and 2.
- Check using output DTM and activate camshaft adjustment ⇒ page 01-51 .

  LED must flash.

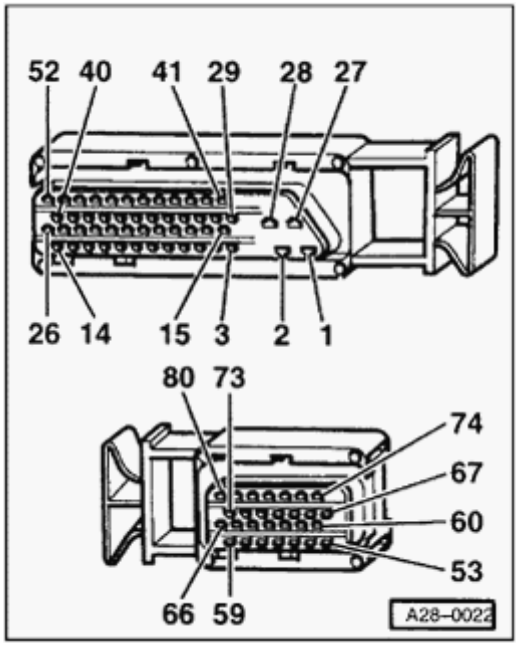
If LED does not flash or stays on continuously:

- Connect VAG1598/22 test box to Motronic ECM harness connector (⇒ page 01-67) and proceed as follows:

If LED does not flash:

- Check wiring from terminal 2 of connector for valve to terminal 55 of ECM/test box for continuity and short circuit to B+.

28-37



If LED stays lit constantly:

- Check wiring between valve connector terminal 2 and ECM/test box terminal 55 for short circuit to Ground.

  Specified value: max. 1 Ω.

If the wiring is OK:

- Replace Motronic ECM -J220- ⇒ page 01-68 .
- Carry out adaptation of throttle valve control module to ECM ⇒ page 24-150 .
- Check readiness code ⇒ page 01-70 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ page 01-73 .

If no malfunction has been found in any of the previous tests:

- Replace respective mechanical camshaft adjuster.

⇒ Repair Manual, 2.8 Liter V6 5V Engine Mechanical, Repair Group 15.