9.3 ME - SFI (ME2.0) Contents

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Diagnosis - Diagnostic Trouble Code (DTC) Memory

Preliminary v	work:	Engine Test Adia	ustment. Engines	(SMS Job)	No 07-1100
Tomininary v	WOIN	Engine rest, Auj	usunoni, Engines	CONTO, DOD	140. 07-1100

↑ WARNING!

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch igntion components.

Persons with heart pacemakers are not to perform repairs on this type of ignition system..

Electronic ignition systems produce dangerous high voltages on both the primary circuit and the secondary (ignition) circuits. Due to the high voltages produced, contact with any of the voltage carrying components can be dangerous to your health (burns, heart palpatations, cardiac arrest etc).

- Igntion must be turned OFF prior to performing any repair work on the igntion system.
- Do not come in contact or remove with any of the ignition components while the engine is cranking or idling.
- Wear rubber soled shoes.
- Disconnect connectors for CKP sensor at sensor or control module.
- If repairs require that the ignition be turned on, then dangerous voltages will be present through out the entire ignition system.
- No exposed metal connectors or sending units may be installed in the ignition wires.

№ WARNING!

Risk of fatal injury from being pulled into rotating vehicle parts.

Do not reach into rotating parts.

Wear closed and tight-fitting work clothes.

Protect vicinity of rotating vehicle components from unauthorized access.

↑ WARNING!

Risk of explosion from fuel igniting, risk of poisoning from inhaling and swallowing fuel as well as risk of injury to eyes and skin from contact with fuel.

No fire, sparks, exposed flames or smoking.

Pour fuels only into suitable and appropriately marked containers.

Wear protective clothing when handling fuel.

Possible hazards

Risk of explosion, poisoning and injury

Fuels are highly inflammable and toxic if inhaled. Fuel may cause skin damage. Contact with gasoline fuel, for example, removes the natural oils on the skin. Fuel vapors are explosive, invisible and spread out at floor level. They are toxic if inhaled and have a narcotic effect in high concentrations.

Protective measures/guidelines

- Pay attention to national safety regulations and provisions.
- No fire, sparks, exposed flames or smoking.
- Ensure that the place of work is adequately ventilated.
- Never drain or pour in fuels over assembly pits.
- Store drained fuel in suitable and sealed containers.
- Immediately eliminate any fuel spills which have been spilled out of the container.

Continued on next page:

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Note regarding diagnostic trouble code (DTC) readout:

The engine control module (N3/10) for the ME-SFI system is equipped with diagnostic trouble code (DTC) memory. Malfunctions are recognized and stored as DTC's and are distinguished as follows:

- Malfunctions which are constantly present,
- Intermittent contact malfunctions which have occured during a trip and have been stored.

The DTC memory is erased when the vehicle's battery is disconnected.

Malfunctions which are no longer present, are automatically erased as follows:

- After three trips the "CHECK ENGINE" MIL goes out.
- After an additional 40 warm-up periods the DTC is automatically erased.
- "CHECK ENGINE" MIL is illuminated if the fault was stored on the previous driving-cycle.

A warm-up period or trip is defined as follows:

Warm-up period

- Engine coolant temperature at start < 35° C,
- Engine coolant temperature increases to > 70° C.

Trip

- Engine running for > 20 minutes,
- Engine oil temperature > − 7° C,
- Engine speed > 500 rpm,
- All emission related logic chain functions already there were checked during previous trips.

Driving-cycle (for a test) consists of:

- Engine start
- Completion of test,
- Shutting engine: OFF

The stored DTC's can be read at the data link connector (X11/4) **using the HHT only**, with the ignition switched "**ON**" or with the "engine running". Readout via an on-off ratio readout or impulse counter scan tool has been eliminated.

AS required b law, the DTC's can be read out using the Generic Scan Tool, by connecting scan tool to the diagnostic connector (X11/4), based on the SAE, ISO 9141-2 standards.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Conducting work on a vehicle with exposed flame (e.g. welding etc.)

 Prior to commencing such work, remove appropriate parts of the fuel system and seal open fuel lines with plugs.

First-aid measures

- Clean contaminated/exposed skin with water and soap.
- Change contaminated clothing as quickly as possible.
- If fuel gets into the eyes, rinse out eyes immediately with water, and contact a doctor, if necessary.

To Avoid Damage to the Ignition System

- To avoid damage to the engine control module, connect/disconnect the control module connectors only with the ignition: OFF.
- Circuit 1 of the ignition coil may not be shorted to ground, e.g. theft deterence.
- Only original equipment should be installed in the ignition system.
- Do not operate the ignition system at cranking speed unless the entire igntion harness is connected.
- Do not perform any tests (grounding of ignition cable 4 disconnecting a spark plug connector or pulling cable 4 out of the ignition coil) at cranking or idle speed.

- The high output side of the ignition system must carry at least 2 k Ω of load (spark plug connector).
- If assisting a disabled vehicle and it becomes necessary to perform an igntion spark test, perform this test only on one ignition/sark plug.
 Ensure a good ground connection to the spark plug.
- ME SFI: the ignition system is to be turned OFF, when cranking engine to perform compression tests, additionally, it is necessary to disconnect connector 2 from the control module.
- **i** Engine 120 has separate ignition and fuel injection system.



Readout via the impulse counter scan tool is not possible.

Note:

Symbol for emission related malfunctions which lead to the activation of the CHECK ENGINE MIL when a certain test cycle was performed and a fault was recognized.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Note regarding mixture preparation self-adaptation:

The Lambda control system determines the fuel injection duration so precisely that the fuel/air ratio is kept constant at Lambda level 1 (equals 14.7 kg air to 1 kg fuel) under all operating conditions.

Should malfunctions occur in the form of:

- Intake air leaks.
- Injector wear or carbon build-up,
- Engine wear,
- Transition resistance in MAF sensor.
- Defective diaphragm pressure regulator,
- Defective purge control valve,

the engine control module (ME-SFI, 2.0) automatically performs a mixture adjustment.

The degree of correction is constantly calculated and permanently stored. The self-adaptation is performed additive at idle and multiplicative under partial load. The correction towards rich or lean is \pm 1.0 milliseconds (injection duration) at idle and the factor 0.68 – 1.32 at partial load. After repair work is performed, the engine control module will automatically adapt itself again.

Note regarding drive authorization system (DAS 3): Model Year 1998, models 202, 208 and 210

Vehicles with ME-SFI (ME 2.0) are equipped with DAS 3. DAS is activated from the DAS control module (N54/1) via the CAN data bus to the engine control module.

Upon activation of the DAS, the engine control module renders the fuel injection system inoperative. The activation or deactivation is accomplished only with the electronic ignition key. As soon as the electronic ignition key is inserted in the steering lock, the DAS control module receives a signal and activates the engine control via the CAN data bus.

The locking and unlocking of the vehicle, using the mechanical key has no effect on the DAS system.

The engine control module and the DAS control module are "married" to one another through identification codes. The identification codes can not be erased (see HHT nominal values "DAS", menu selection 3/7).

Therefore, swapping the engine or RCL control module from one vehicle to another is not possible!

Diagnosis - Diagnostic Trouble Code (DTC) Memory



If an exchange engine control module is installed for test purposes, up to 40 start attempts can be performed before the engine and DAS control modules "marry" to one another. Prior to perfroming the first start, the engine control module must be version coded using the HHT. Additionally, the code number and VIN must be entered (see HHT nominal values "DAS", menu selection 3/7).

Note regarding version coding:

The engine control module is equipped with a version coding feature. The coding must be performed with the Hand-Held Tester (automatically or manually, see Notes for HHT "Version coding" 11/5) upon installation of a new control module.

The following vehicle version data must be determined for coding:

- Vehicle model,
- Engine,
- Manual/automatic transmission
- Non-catalytic converter (non-TWC),
- Country version,
- 30 km/h limitation

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Notes regarding automatic recognition of the mechanical end stop and wide open position of the throttle valve from the actuator:

The end stops of the throttle valve is determined by the actuator and stored in the engine control module.

After replacing the control module or actuator, the mechanical end stop and wide open position must again be determined and recorded. Thereby allowing learned data to be erased with the HHT and new data to be learned. When the new engine control module is connected for the first time to circuit 30 (B+), the engine control module performs a self-adaptation of the actuator with the ignition "ON" (lower mechanical end stop and wide open position of the throttle valve).

Requirements for learning process:

- Selector lever in position P/N,
- · Vehicle standing still,
- Engine off,
- Engine coolant temperature between 5° C and 100° C,
- Accelerator pedal not applied.

When all requirements are met, turn **ignition ON for at least 60 seconds**, then turn **ignition OFF for at least 10 seconds**.

The learned value is stored in memory, only after the first 10 start cycles, provided the voltage supply has not been interrupted. Should the battery be disconnected after the 9th start cycle, the re-learning process must be performed again.

Notes regarding VSS sensor adaption for rough running engine test:

After the replacement of the ME-SFI control module, CKP sensor (L5), starter ring gear or motor mount, a sensor adaption must be performed:

- Engine coolant temperature approx. > 70 °C,
- Drive vehicle on road.

Vehicles up to 01/98:

- With selector lever in position 4: Increase engine rpm to approx.
 2,500 rpm and then coast until engine rpm is approx. < 1,500 rpm.
- With selector lever in position 2: Increase engine rpm to approx.
 6,100 rpm and then coast until engine rpm is approx. < 4,100 rpm.
 Again increase engine rpm to approx.
 6,100 rpm and then coast until engine rpm is approx. < 3,000 rpm.
- Using the HHT, determine if VSS sensor adaption has taken place.

Vehicles as of 02/98:

- With selector lever in position 3: Increase engine rpm to approx. 2,100 rpm and then hold a 50% engine load for approx. 30 seconds.
- Using the HHT, determine if VSS sensor adaption has taken place.

Notes regarding performance/speedometer test:

Disconnecting the ESP/ASR/ETS/ABS control modules is not allowed. The engine control module and transmission control module rely on these modules to supply the VSS data via the CAN bus.

To disable the brake and engine regulation function of the ESP/ASR/ETS/ABS control modules: (continued on 11/7)

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Notes for HHT

A. Working without HHT

- Ignition: OFF.
- Connect HHT adapter to data link connector (X11/4).
- Bridge sockets 1 and 6.
- Engine: Start (BAS/ESP or BAS/ASR MIL must illuminate!).

B. Working with HHT

- Ignition: **OFF**.
- Disconnect front axle VSS sensor connector (BAS/ESP or BAS/ASR MIL must illuminate!).

When work is completed, reconnect VSS sensor connector and erase DTC's with HHT!

Fault search with HHT

Diagnostic trouble code (DTC) memory: Select "Current DTC's". If the actual condition changes, e.g. when wiggling a connector, the change is reported optically and acoustically so that troubleshooting can be performed directly with the HHT.

Version coding with HHT

a) Before replacement of the engine control module, the existing code number must be read and stored with the HHT (menu selection 5 "Version coding"). After installation of the new control module, the previously read code number must be entered.

i

If returning a new control module to a PDC, the code number must be erased.

b) If the code number can **not** be read, the vehicle equipment/version must be determined, the corresponding code number obtained from the Spare Parts Microfiche (group 54) and manually entered with the HHT.

Loose connections

Loose connections are stored if they occur several times in a certain time period. Therefore, they can appear only as "Stored DTC's" and never as "Current DTC's".

Nominal values

All nominal values relative to the actual values shown on the HHT are listed in the Diagnostic Manual, Engines, Volume 1, section A.

• Actual value for engine speed

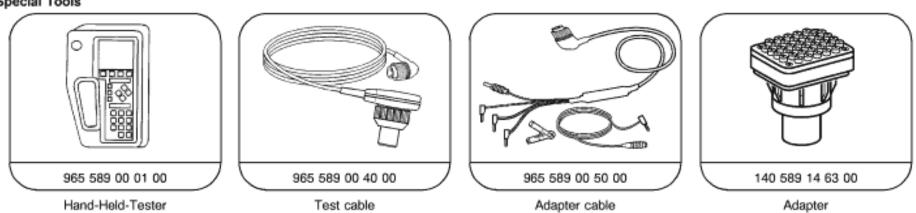
For engine speed, the HHT display indicates the closed throttle speed (CTP) nominal value calculated by the control module on the left, and the rpm actual value on the right. Both values should differ from each other only slightly. Permissible tolerances are not yet determined.

Drive authorization system (DAS) X

Upon replacement the engine control module must be version coded using the HHT. Additionally, the code number and VIN must be entered (see HHT nominal values "DAS", menu selection 3/7).

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Special Tools



Diagnosis - Diagnostic Trouble Code (DTC) Memory

Connection Diagram - Hand-Held Tester (HHT)

- Connect HHT (087) with test cable (097) to data link connector (X11/4)
- Ignition: ON 2.
- 3. As per display in HHT:
 - a) read out/erase DTC memory
 - b) read out actual values
 - c) perform activations
 - d) program control modules
- Disconnect HHT

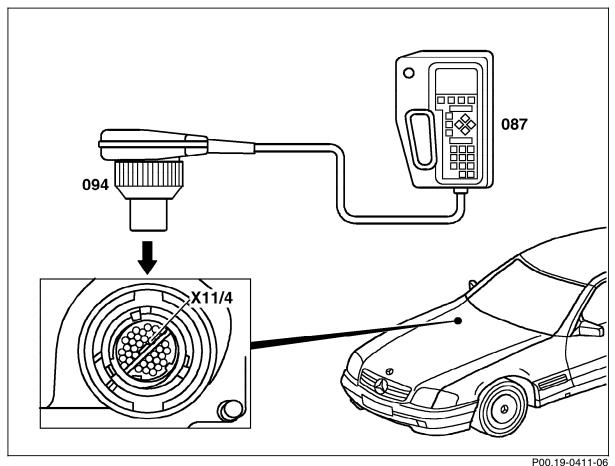


Observe system specific notes, which are described in the beginning of each chapter. Erase all stored faults which come about when tests or simulations are performed, upon completion of the repairs.

Figure 1

087 Hand-Held Tester 094 Multiplexer cable

Data link connector (DTC readout) (38-pole) X11/4



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Diagnosis – Diagnostic Trouble Code (DTC) Memory

Prerequisites for readout of DTC memory



Risk of severe injury when touching ignition parts which produce high voltages. Do not touch igntion components.

Persons with heart pacemakers are not to perform repairs on this type of ignition system.



Readout via the impulse counter scan tool is not possible.

Note:

Symbol for emission related malfunctions which lead to the activation of the CHECK ENGINE MIL when a certain test cycle was performed and a fault was recognized in the prior trip cycle. The CHECK ENGINE MIL will illuminate immediately if a "TWC damaging" missfire is found.

Preparation for Test:

- Connect HHT with test cable to data link connector (X11/4), readout DTC fault codes.
- 2. Review 22,
- 3. Review 11, 21, 23, 24, 31, 33,
- 4. Perform Test and adjustment of engine, see DM, Engines, Vol. 1, section B, if necessary.
- 5. Ignition: **ON**

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC	Possibl	e cause	Test step/Remedy 1)
	SAE nomenclature	Explanation	
_	No malfunction in system		In case of complaint, perform 23, 24, 25 or 26 in its entirety.
PO 100	MAF circuit malfunction	Hot film MAF sensor (B2/5) DTC description	23⇒ 4.0 11/26
P0 105 Only (SA)	MAP circuit malfunction	Pressure sensor (B28) DTC description	23⇒ 6.0 11/27
PO 110	IAT circuit malfunction	IAT sensor (in Hot film MAF sensor B2/5) DTC description	23⇒ 5.0 11/28
PO 115	ECT circuit malfunction	ECT sensor (B11/4) DTC description	23⇒ 8.0 11/29
PO 120	Throttle position circuit malfunction	Actual value potentiometer in EA/CC/ISC actuator (M16/6) DTC description	25⇒ 3.0 11/30

¹⁾ Observe Preparation for Test, see 22.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC		Possib	le cause	Test step/Remedy 1)
		SAE nomenclature	Explanation	
PO 130		O2S 1 circuit malfunction	A. O2S 1 (before TWC) (G3/4) B. O2S 1 (before TWC) (G3/4), voltage increase insufficient DTC description	23⇒ 11.0 11/31
PO 133		O2S 1 circuit slow response	A O2S 1 (before TWC) (G3/4), ageing correction value exceeded B O2S 1 (before TWC) (G3/4), ageing time period too long C O2S 1 (before TWC) (G3/4), ageing O2S 1 sensor response too slow DTC description	23⇒ 11.0 11/32
PO 135		O2S 1 heater circuit malfunction	O2S 1 heater (before TWC) (G3/4) DTC description	23 ⇒ 13.0 11/34
PD 136 Only	USA	O2S 2 circuit malfunction	O2S 2 (after TWC) (G3/6) DTC description	23 ⇒ 15.0 11/31
PO 140		O2S 1 circuit malfunction	O2S 1 (before TWC) (G3/4) DTC description	23⇒ 11.0 11/31
PD 141 Only	USA	O2S 1 heater circuit malfunction	O2S 1 (after TWC) (G3/6) DTC description	23⇒ 17.0 11/34
PO 150		O2S 1 circuit malfunction	A O2S 1 heater (before TWC) (G3/3) B O2S 1 heater (before TWC) (G3/3), voltage increase too slow DTC description	23⇒ 10.0 11/31

¹⁾ Observe Preparation for Test, see 22.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC	Possibl	e cause	Test step/Remedy 1)
	SAE nomenclature	Explanation	
P0 153	O2S 1 circuit slow response	A O2S 1 heater (before TWC) (G3/3), ageing correction value exceeded B O2S 1 heater (before TWC) (G3/3), ageing time period too long C O2S 1 heater (before TWC) (G3/3), ageing O2S 1 sensor response too slow DTC description	23⇒ 10.0 11/32
PO 155	O2S 2 heater circuit malfunction	Left O2S 1 heater (before TWC) (G3/3) DTC description	23⇒ 12.0 11/34
P0 156 Only (ISA)	O2S 2 circuit malfunction	Left O2S 2 (after TWC) (G3/5) DTC description	23⇒ 14.0 11/31
PO 160	O2S 2 heater circuit malfunction	Left O2S 1 heater (before TWC) (G3/3) DTC description	23⇒ 14.0 11/31
PD 161 Only (ISA)	O2S 2 heater circuit malfunction	Right O2S 2 heater (after TWC) (G3/5) DTC description	23⇒ 16.0 11/34
PO 170	Fuel trim malfunction	A Self adaptation of fuel mixture "partial load", right cylinder bank, at limit from engine control module (N3/10). B Self adaptation of fuel mixture "CTP", right cylinder bank, at limit from engine control module (N3/10). DTC description	Intake air leak, injectors, diaphragm pressure regulator, engine wear. 11/35

¹⁾ Observe Preparation for Test, see 22.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC	Possible	e cause	Test step/Remedy 1)
	SAE nomenclature	Explanation	
PD 173	Fuel trim malfunction	 A Self adaptation of fuel mixture "partial load", left cylinder bank, at limit from engine control module (N3/10). B Self adaptation of fuel mixture "CTP", left cylinder bank, at limit from engine control module (N3/10). DTC description 	Intake air leak, injectors, diaphragm pressure regulator, engine wear. 11/35
PO 201	Injector circuit malfunction - cyl. 1	Injector (Y62y1) – cylinder 1 DTC description	23⇒ 18.0 11/36
PO 202	Injector circuit malfunction - cyl. 2	Injector (Y62y2) – cylinder 2 DTC description	23⇒ 19.0 11/36
PO 203	Injector circuit malfunction - cyl. 3	Injector (Y62y3) – cylinder 3 DTC description	23 ⇒ 20.0 11/36
PO 204	Injector circuit malfunction - cyl. 4	Injector (Y62y4) – cylinder 4 DTC description	23 ⇒ 21.0 11/36
PO 205	Injector circuit malfunction - cyl. 5	Injector (Y62y5) – cylinder 5 DTC description	23 ⇒ 22.0 11/36
PO 206	Injector circuit malfunction - cyl. 6	Injector (Y62y6) – cylinder 6 DTC description	23 ⇒ 23.0 11/36

¹⁾ Observe Preparation for Test, see 22.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC	Possibl	Test step/Remedy 1)	
	SAE nomenclature	Explanation	
PO 300	Random misfire detected	A Random misfire B Random misfire, TWC damaging DTC description	$24 \Rightarrow 11.0 - 17.0$ $36 \Rightarrow 1.0 - 2.0$ Compression pressure $11/37$
PO 301	Cylinder 1 misfire detected	A Cylinder 1 misfire B Cylinder 1 misfire, TWC damaging DTC description	$24 \Rightarrow 11.0$ $24 \Rightarrow 17.0$ $36 \Rightarrow 1.0 - 2.0$ Compression pressure $11/37$
PO 302	Cylinder 2 misfire detected	A Cylinder 2 misfire B Cylinder 2 misfire, TWC damaging DTC description	$24 \Rightarrow 12.0$ $24 \Rightarrow 17.0$ $36 \Rightarrow 1.0 - 2.0$ Compression pressure $11/37$
PO 303	Cylinder 3 misfire detected	A Cylinder 3 misfire B Cylinder 3 misfire, TWC damaging DTC description	$24 \Rightarrow 13.0$ $24 \Rightarrow 17.0$ $36 \Rightarrow 1.0 - 2.0$ Compression pressure $11/37$

¹⁾ Observe Preparation for Test, see 22.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC	Possibl	e cause	Test step/Remedy 1)
	SAE nomenclature	Explanation	
PO 304	Cylinder 4 misfire detected	A Cylinder 4 misfire B Cylinder 4 misfire, TWC damaging DTC description	$24 \Rightarrow 14.0$ $24 \Rightarrow 17.0$ $36 \Rightarrow 1.0 - 2.0$ Compression pressure $11/37$
PO 305	Cylinder 5 misfire detected	A Cylinder 5 misfire B Cylinder 5 misfire, TWC damaging DTC description	$24 \Rightarrow 15.0$ $24 \Rightarrow 17.0$ $36 \Rightarrow 1.0 - 2.0$ Compression pressure 11/37
PO 306	Cylinder 6 misfire detected	A Cylinder 6 misfire B Cylinder 6 misfire, TWC damaging DTC description	$24 \Rightarrow 16.0$ $24 \Rightarrow 17.0$ $36 \Rightarrow 1.0 - 2.0$ Compression pressure $11/37$
PO 325	KS 1 circuit malfunction	Right KS 1 (A16g1) DTC description	Wiring, connector, A16g1 11/40
PO 330	KS 2 circuit malfunction	Left KS 2 (A16g2) DTC description	Wiring, connector, A16g2 11/40

¹⁾ Observe Preparation for Test, see 22.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC	Possib	le cause	Test step/Remedy 1)
	SAE nomenclature	Explanation	
PO 335	CKP sensor circuit malfunction	CKP sensor (L5) DTC description	24 ⇒ 9.0 11/41
PO 341	CMP sensor circuit range/performance	Camshaft Hall-effect sensor (B6/1) DTC description	24 ⇒ 10.0 11/41
PO 370	Angle deviation between camshaft and crankshaft	Angle deviation between camshaft and crankshaft	Check basic adjustment of camshaft
PO 400	Exhaust gas recirculation flow malfunction	Exhaust gas recirculation malfunction (logic chain) DTC description	23 ⇒ 27.0 11/42
PD 410 Only (USA)	Air injection system malfunction	AIR system malfunction (logic chain) DTC description	23 ⇒ 24.0– 26.0 11/43
PO 422	TWC (right) efficiency below threshold	TWC efficiency below threshold DTC description	Replace right TWC 11/45
PO 432	TWC (left) efficiency below threshold	TWC efficiency below threshold DTC description	Replace left TWC 11/45
PD 440 Only (SA)	EVAP system malfunction	EVAP malfunction (logic chain) DTC description	23 ⇒ 30.0 − 31.0 11/47
P[] 441 Only (SA)	EVAP system malfunction (function)	Purge control valve (Y58/1) function DTC description	23 ⇒ 29.0 − 30.0 11/47
PD 442 Only (SA)	EVAP system leak detected (small leak)	EVAP system, small leak DTC description	23 ⇒ 31.0 11/47

¹⁾ Observe Preparation for Test, see 22.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC		Possible	e cause	Test step/Remedy 1)
		SAE nomenclature	Explanation	
PO 443		EVAP system purge control valve circuit malfunction	Purge control valve (Y58/1) DTC description	23 ⇒ 29.0 11/51
PD 446 (Only (ISA)	EVAP system vent control malfunction	A. Activated charcoal canister shut-off valve (Y58/4) (logic chain) B. End stage activated charcoal canister shut-off valve (Y58/4) DTC description	$23 \Rightarrow 32.0,$ $23 \Rightarrow 33.0,$ $N3/10$ $11/52$
PO 450 (Only (ISA)	EVAP system pressure sensor malfunction	A. Fuel tank pressure sensor (B4/3) electrical fault B. Fuel tank pressure sensor (B4/3) electrical fluctuations DTC description	23 ⇒ 33.0 Charcoal canister plugged.
PO 455 (Only USA	EVAP system leak detected (large leak)	EVAP system, large leak Fuel tank pressure sensor (B4/3) (voltage supply) DTC description	$23 \Rightarrow 31.0$ $23 \Rightarrow 33.0$ $11/48$
PO 460		Fuel level sensor circuit low input	Fuel tank level too low DTC description (missfire)	Readout instrument cluster memory 11/46

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possib	le cause	Test step/Remedy 1)
	SAE nomenclature	Explanation	
PO 500	VSS sensor malfunction	A VSS left front B VSS left rear DTC description (speed signal)	Test ASR, ESP see DM, Chassis and Drivetrain, Vol. 3, section 9.0 and 10.2 11/54
PO 507	ISC rpm higher than expected	Idle control system, unplausible DTC description	25 ⇒ 1.0 − 3.0 11/55
PO 560	System voltage malfunction	Voltage supply to engine control module (N3/10) DTC description (voltage supply at engine control module)	23 ⇒ 1.0 – 2.0 11/56
PO 565	Cruise control switch	CC switch with variable speed (S40/4)	Not (USA)
PO 600	Serial communication link malfunction	CAN bus from ESP/SPS control module (N47-5) DTC description (CAN distorted)	23 ⇒ 34.0 11/57
PO 604	Internal control module random Access memory (RAM) error	A Engine control module (N3/10) B Engine control module (N3/10)	(N3/10)
PO 605	Internal control module read only memory (ROM) error	Engine control module (N3/10)	(N3/10)
PO 700	Transmission control system malfunction Gear unplausi. or transmission leak, Command valve sticks in pressure position	Read DTC memory of transmission control module. DTC description DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/58

¹⁾ Observe Preparation for Test, see 22.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC	Possibl	e cause	Test step/Remedy 1)
	SAE nomenclature	Explanation	
PO 702	Transmission control system electrical Transmission control module Solenoid valves, voltage supply	Read DTC memory of transmission control module. DTC description DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/60 11/61
PD 715	Input/turbine speed sensor circuit malfunction, RPM sensor function	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/62
PO 720	Output speed sensor circuit malfunction, (CAN fault)	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/64
PO 730	Incorrect gear ratio	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/65
PO 740	Torque converter lock-up clutch circuit malfunction	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/66
P0 743	Torque converter clutch circuit electrical	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/67

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy 1)
	SAE nomenclature	Explanation	
PO 748	Pressure control solenoid electrical, Modulating press. reg. solenoid valv., Shift pressure reg. solenoid valve	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/68 11/69
PO 753	Shift solenoid A electrical 1-2/4-5 solenoid valve	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/70
PO 758	Shift solenoid B electrical 2-3 shift solenid valve	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/71
PO 763	Shift solenoid C electrical 3-4 shift solenoid valve	Read DTC memory of transmission control module. DTC description	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 11/72
PO 801	Engine/climate control electric cooling fan malfunction	Engine/climate control electric cooling fan (M4/3)	23 ⇒ 36.0
PO 802	Resonance intake mainfold switchover valve malfunction	Resonance intake mainfold switchover valve (Y22/6)	23 ⇒ 28.0
PO 809	Angle deviation between camshaft and crankshaft	Angle deviation between camshaft and crankshaft	Check basic adjustment of camshaft.

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy 1)
	SAE nomenclature	Explanation	
PO 811	CAN from electronic ignition lock	CAN from electronic ignition lock.	23 ⇒ 34.0
PI 031	O2 sensors (G3/3, G3/4) reversed	O2 sensors (G3/3, G3/4) reversed.	Check proper connection of O2 sensors in ETM.
רו ודו	Oil sensor	Oil sensor (level, temperature, quality)(B40), Oil temperature implausible.	23 ⇒ 35.0
PI 178	Oil sensor	Oil sensor (level, temperature, quality)(B40), Oil level implausible.	23 ⇒ 35.0
PI 179	Oil sensor	Oil sensor (level, temperature, quality)(B40), Oil quality implausible.	23 ⇒ 35.0
PI 180	Oil sensor	Oil sensor (level, temperature, quality)(B40), Oil temperature too high.	23 ⇒ 35.0
PI 181	Engine/climate control electric cooling fan	Faulty	23 ⇒ 36.0
PI 185	Oil sensor	Oil sensor (level, temperature, quality)(B40), water in oil.	23 ⇒ 35.0
PI 186	Fuel safety shut-off recognized	EA/CC/ISC actuator (M16/6)	25 ⇒ 3.0 – 4.0, EA/CC/ISC actuator (M16/6) sticks or jammed, Check intake system for residue.
P1 225	Resonance intake manifold switchover valve	Resonance intake manifold switchover valve (Y22/6)	23 ⇒ 28.0

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC		Possible cause		Test step/Remedy 1)
		SAE nomenclature	Explanation	
PI 233		Throttle valve setting element	Throttle valve setting element (M16/6) sticks due to icing	Replace element.
PI 386		Knock sensor control from ECM (N3/10) at end stop	Knock sensor regulation from engine control module (N3/10) at end stop DTC description	Increased knock tendency due to bad fuel, carbon in combustion chamber or mechanical damage. 11/73
PI 400		EGR valve vacuum transducer	EGR valve vacuum transducer (Y31/1) faulty DTC description	23 ⇒ 27.0 11/74
P1 420	Only USA	AIR pump switchover valve	AIR pump switchover valve (Y32) DTC description	23 ⇒ 25.0 11/75
PI 453	Only (USA)	AIR relay module, AIR pump	Relay module, AIR pump (K40/4k3) in relay module (K40) DTC description	23 ⇒ 24.0 11/75
PI 491			Refrigerant pressure in A/C system too high	Check automatic A/C system.
PI 542		Pedal value sensor	Pedal value sensor (B37) DTC description	25 ⇒ 1.0 – 2.0 11/76

Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy 1)
	SAE nomenclature	Explanation	
P1 570	CAN signal from DAS control module to engine control module	 A. Start attempted with "locked" DAS B. CAN signal from DAS control module (N54/1) to engine control module (N3/10) interrupted. C. Engine control module (ME-SFI) and DAS control module are not compatible. 	User error, Check correct operation of DAS, see DM, Body and Accessories, Vol. 1, 4.9, 4.10 23 ⇒ 34.0 Check control modules and part no.
PI 580	EA/CC/ISC actuator	Throttle valve setting element (M16/6) DTC description	25 ⇒ 3.0 – 4.0 11/77
PI 584	Stop lamp switch	Stop lamp switch (S9/1)	Test ETS, ASR see DM, Chassis & Drivetrain, Vol. 3, 10.2
PI 603	CAN from EIS		25 ⇒ 34.0
PI 605		Poor road/traction condition recognition signal (via comparison of VSS rpm signals	Test ASR/ESP see DM, Chassis and Drivetrain, Vol. 3, Section 9, 10.2
PI 642		Engine control module incorrectly coded (coded for MT, vehicle has AT)	Check version coding and correct, see 11
PI 643		Engine control module incorrectly coded (coded for MT, vehicle has AT) or No CAN transmission from transmission control module (N15/3)	Check version coding and correct, see 11, Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2, 23

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC	Possible cause		Test step/Remedy 1)
	SAE nomenclature	Explanation	
P1 644		Transmission version can not be checked due to low voltage at transmission control module (N15/3)	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23
PI 747	CAN signal from ETC	A. CAN failure: Transmission protection malfunction from transmission control module (N15/3) B. CAN failure: Instrument cluster	Test ETC, see DM, Chassis & Drivetrain, Vol. 1, section 2.3, 23 Test instrument cluster (A1), see DM,
		DTC description	Body & Accessories, Vol. 1 11/57

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0100	Hot film MAF sensor (B2/5)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Limit signals, MAF (B2/5)
Magnitude: lower limit Lower threshold limit Upper threshold limit Test duration	At idle approx. 4-35 kg/h (1.3-1.7 v) min. 16kg/h, if throttle plate angle is greater than 14° approx. 50-900 kg/h, ECM map based on engine rpm and throttle plate angle. approx. 5 sec. per limit.
Tested pre-requisites	No fault in throttle plate adjustment

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0105	Pressure sensor (B28)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Limit values, Pressure sensor (B28)
Magnitude: lower limit Lower threshold limit Upper threshold limit Test duration	min -60 mbar, with engine rpm over 1300 rpm approx. 0 mbar, if throttle plate angle is greater than 80° approx. 500-1200 mbar, ECM map dependent on engine rpm and throttle plate angle. approx. 5 sec. per limit.
Test pre-requisites	Lock time period of 30 seconds after start exceeded and no fault in the throttle plate angle.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC POHO	IAT sensor (in Hot film MAF sensor B2/5)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Limit values, IAT sensor
Lower threshold limit Upper threshold limit Test duration	> 300k Ω (approx50°C) < 92 Ω (approx. +150°C) approx. 1 sec.
Hint	With faults, the reserve value of +20°C is used. Should the signal become plausible, the signal from the IAT is subsequently used again.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC POIIS	ECT sensor (B11/4)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency, test duration	Continuously
Tested signal or condition	Limit values, ECT sensor (B11/4)
Lower threshold limit Upper threshold limit Plausibility	> 80 k Ω (approx 39°C) < 45 Ω (approx. +170°C) The temperature raise is compared to a stored baseline value. Independent of start temperature and engine rpm, a value of +15°C after 120-1200 sec. must be attained.
i	With faults, the reserve value from the temperature base value is used. Should the signal become plausible, the signal from the ECT sensor is subsequently used again.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0120	Actual values-potentiometer in EA/CC/ISC actuator (M16/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply, Actual values-potentiometer 1 or 2
Actual values potentiometer 1 Actual values potentiometer 2	Voltage must be between 0.275 V and 4.83 V Voltage must be between 0.176 V and 4.74 V

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC POI30	Right 02S 1 (before TWC)
DTC P0(36	Right 02S 2 (after TWC) (only USA)
DTC POI40	Right 02S 1 (before TWC)
DTC PDISD	Left 02S 2 (before TWC)
DTC P0/56	Left 02S 2 (after TWC) (only (USA)
DTC P0160	Left 02S 1 (before TWC)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	A. Limit values, 02 sensor signal B. Sensor status exchange
A. 02 sensor limit value signal Lower threshold limit value Upper threshold limit Test duration B. Sensor status exchange	<-0.15V > 1.5 V approx. 5 sec. With 02 heater on (approx. 220sec.), the sensor signal does not remain in the voltage window (0.4-0.6V) for longer then 15 seconds.
Test pre-requisites	 engine rpm approx. 1000-2000 engine load approx. 15-50% catalytic converter temperature > 380°C release Lambda regulation
Also see: 11/78	Via testing, all electrical connection faults of the 02 sensors before and after the catalytic converters are recognized (harness open circuits and shorts/high ohmic valueshorts to ground or positive). • The 02 sensor signal wire has a high ohmic short circuit or limited voltage increase. • The 02 sensor signal wire has a open circuit. With a cold 02 sensor: a high ohmic short circuit to positive or a short to ground on control module ME ** ** If the 02 sensor signal wire ground is shorted to positive, the control module ME will be destroyed.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0(33	Right 02S 1 (before TWC)
DTC P0153	Left 02S 2 (before TWC)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	A. Correction factor exceeded B. Time period too long
A. correction factor exceeded B. Time period too long Test duration	approx. ±1.2 sec. > 5 sec. (average value via 15 measurements) up to 190 sec.
Test pre-requisites	 engine rpm approx. 1000-2000 engine load approx. 15-50% catalytic converter temperature > 380°C Lambda correction effective no faults with effective function of catalytic converter no faults with 02 sensor heating

continued.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PD(33 DTC PD(53	Right 02S 1 (before TWC) Left 02S 2 (before TWC)
Test sequence	The engine control module determines the the mid value of Lambda. This value is compared to the stored value for optimal exhaust gas value. With numerous of excessive values, a correction value for the lambda regulation is determined. With the correction factor (value with a new 02 sensor approx 0) the aging of the 02 sensor before the catalytic converter is equalized within certain limits. With exceeded values beyond the correction values, the 02 sensor before the catalytic converter must be replaced. Additionally, the timespan of the sensor before the catalytic converter is evaluated. If there is no 02 sensor condition interexchange, then the lambda regulation is not active and the two sensor regulation will not take place. With the 02 sensor signals after the catalytic converter, the effectiveness of the catalytic converter is monitored.
i Also see: 11/79	Time span for 02 sensor before catalytic converter too long: 02 sensor located after the catalytic converter is no longer monitored. Correction factor of the 02 sensor before the catalytic converter exceeded: the 02 sensor after the catalytic converter is to be further monitored. If a fault is for both the 02 sensor before and after the catalytic converter is recorded, then usually the 02 sensor behind the catalytic converter is faulty.

DTC P0(35	Right 02S 1 (before TWC)
DTC POINI	Right 02S 2 (after TWC)
DTC P0155	Left 02S 2 (before TWC)
DTC PDIEI	Left 02S 2 (after TWC)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Calculated resistance value of the 02 sensor heating
Lower threshold limit	< 2.0 Ω (approx. 6 A at 12 V)
Upper threshold limit	> 10 Ω (approx. 1.2 A at 12 V)
	Fault code is also set, if the time period of the 02 sensors suddenly exceeds 25 seconds within a
	driving-cycle.
Test pre-requisites	Engine running, 02 sensor heating ON and a heating time of 220 sec. has elapsed.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC POITO	Right cylinder bank
DTC POITS	Left cylinder bank
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, activation of Check Engine (MIL), after two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Limit values of self adaption of mixture formation
A. Limit threshold value for idle B. Limit threshold value for part load	approx. ± 1.0 ms (approx. 25% of injection time at idle) 0.7-1.3 factor
Also see: 11/80	For the self adaption of the mixture formation to attain a new value, a drive time of approx. 30 minutes with lambda regulation is required. The coolant temperature at time of start must be < 60°C.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0201	Injector 1 (Y62y1)
DTC P0202	Injector 2 (Y62y2)
DTC P0203	Injector 3 (Y62y3)
DTC P0204	Injector 4 (Y62y4)
DTC P0205	Injector 5 (Y62y5)
DTC P0206	Injector 6 (Y62y6)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage and amp supply to each indivdual injector
Test requirements: Battery voltage between 8 - 17 V	Voltage and amp supply to each indivdual injector
Limit threshold value: short to positive	> 4.2A
Limit threshold value: short to ground	< 2.5 V
Wire has open circuit	no voltage at injector, approx. 4 - 8 volts at load free output of the engine control module ME
Test duration	approx. 1 sec.
i	The activation of each indivdual injector is checked for harness opens and shorts to ground or positive.
	Shorts to ground and open circuits are recognized with a locked endstage, where else a short to
	positive is recognized with a conducting endstage.
	With a fault detected, the endstage is immediately no longer activated.
()	With a short to ground, the indivdual injector remains continuously open.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0300	Random misfire
DTC P0301	Misfire, cyl. 1
DTC P0302	Misfire, cyl. 2
DTC P0303	Misfire, cyl. 3
DTC P0304	Misfire, cyl. 4
DTC P0305	Misfire, cyl. 5
DTC P0306	Misfire, cyl. 6
DTC P0460	Fuel level in fuel tank too low
DTC P0462	Fuel level in fuel tank too low
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, activation of Check Engine (MIL), after two in sequence driving-cycles with faults
	A. Misfire (emissions limit)
	Activation of Check Engine (MIL), after two in sequence driving-cycles with faults
	B. TWC damaging
	Activation of Check Engine (MIL), immediately upon misfiring
Test frequency	Continuously
Tested signal or condition	Count of recognized combustion misfires (recognition via uneven running engine evaluation)
Limit threshold values:	A. max. 20 combustion misfires within 1000 engine revolutions B. max. 4-35 combustion misfires within 200 engine revolutions (ECM map dependent of engine rpm and load i.e. 4 misfires at medium engine rpm and load, 35 misfires at idle w/o load)

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0300	Random misfire
DTC P0301	Misfire, cyl. 1
DTC P0302	Misfire, cyl. 2
DTC P0303	Misfire, cyl. 3
DTC P0304	Misfire, cyl. 4
DTC P0305	Misfire, cyl. 5
DTC P0306	Misfire, cyl. 6
DTC P0460	Fuel level in fuel tank too low
DTC P0462	Fuel level in fuel tank too low
Test pre-requisites	- engine rpm approx. 450-6000 rpm
	- engine rpm variation less than 1900/rpm per sec.
	- engine load variation < 50% per second
	- engine start undertaken less then 5 seconds ago
	- no ESP interaction
	- CKP sensor adaption in coast range has been accomplished
	- no rough road conditions recognized (via CAN from ASR/ESP control modules, attained via
	comarison of VSS signals)
	contained to the digitale)
	- no faults from camshaft Hall-effect sensor (B6/1)

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0301 DTC P0302 DTC P0303 Misfire, cyl. 1 Misfire, cyl. 2 DTC P0303 DTC P0304 Misfire, cyl. 3 DTC P0305 Misfire, cyl. 4 DTC P0305 DTC P0306 DTC P0306 DTC P0306 DTC P0307 Misfire cyl. 6 DTC P0307 Misfire cyl. 6 DTC P0308 Tile level in fuel tank too low Tell evel in fuel tank too low Tell evel in fuel tank too low If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is Ok. If the value has changed considerably, (beyond 2m² then the activated ignition circuit in circuit is Ok. If the value has changed considerably, (beyond 2m² then the activated ignition circuit is ok. If the value has changed considerably, (beyond 2m² then the activated ignition circuit is ok. If the value has changed considerably, (beyond 2m² then the activated ignition circuit is ok. If the value has changed considerably, (beyond 2m² then the activated ignition circuit is ok. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or ignition coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes P0460 and P0462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfires due to additional causes: Misfires due to considered as well.		
Misfire, cyl. 2 DTC P0303 Misfire, cyl. 3 DTC P0304 Misfire, cyl. 4 DTC P0305 Misfire, cyl. 5 DTC P0306 DTC P0306 DTC P0460 DTC P0462 If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or ignition coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes P0460 and P0462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0300	Random misfire
DTC P0303 Misfire, cyl. 3 Misfire, cyl. 4 DTC P0305 Misfire, cyl. 5 DTC P0306 Misfire, cyl. 6 DTC P0460 DTC P0462 If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, ignition lead or ignition coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes P0460 and P0462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0301	Misfire, cyl. 1
Misfire, cyl. 4 DTC P0305 DTC P0306 DTC P0460 DTC P0460 DTC P0462 If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If signition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the activated ignition circuit has a fault: spark plug, ignition lead or ignition coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes P0460 and P0462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0302	Misfire, cyl. 2
DTC P0305 DTC P0460 DTC P0460 DTC P0460 DTC P0460 DTC P0460 DTC P0460 If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes P0460 and P0462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0303	Misfire, cyl. 3
Misfire, cyl. 6 DTC P0460 Tuel level in fuel tank too low If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceeded as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes P0460 and P0462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0304	Misfire, cyl. 4
Fuel level in fuel tank too low Fuel level in fuel tank too low If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PQ460 and PQ462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0305	Misfire, cyl. 5
Fuel level in fuel tank too low If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PU460 and PU462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0306	Misfire, cyl. 6
If too many misfires occurr in one cylinder, then that cylinder will be turned off (cylinder selective fuel shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes P□ԿြԵ are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0460	Fuel level in fuel tank too low
shut-off). Misfire due to ignition system faults: If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PUHED and PUHED are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	DTC P0462	Fuel level in fuel tank too low
If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceeded as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PIHED and PIHED are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults	i	
addition to the misfire, start at the ignition system first. Max. rough running per cylinder is 3m² if this value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PUHED and PUHED are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		Misfire due to ignition system faults:
value is exceeded, then proceed as follows: 1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PUHED and PUHED are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		If ignition does not occur, misfires will result. If there are faults stored in the ignition system, in
1. turn off one of the ignition circuits, using the SDS/HHT 2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PUHGU and PUHGZ are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		
2. Observe rough running of the affected cylinder: if the value has changed very little, (up to approx. 2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PUHED and PUHED are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		
2m², then the remaining ignition circuit is OK. If the value has changed considerably, (beyond 2m² then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil. Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PU460 and PU462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		
Misfire due to fuel starvation: With recognized misfires, with a low fuel level in the fuel tank the DTC codes PIHED and PIHED are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		
With recognized misfires, with a low fuel level in the fuel tank the DTC codes PU460 and PU462 are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		then the activated ignition circuit has a fault: spark plug, igntion lead or igntion coil.
are set, thus this information indicates a misfire due to low fuel level in fuel tank. Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		
Misfire due to additional causes: Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		With recognized misfires, with a low fuel level in the fuel tank the DTC codes P0460 and P0462
Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults		
		Misfire due to additional causes:
of the engine must be considered as well.		Misfires can be caused by the fuel injection system, additional faults may be stored, mechanical faults
		of the engine must be considered as well.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0325	Right KS (A16g1)
DTC P0330	Left KS (A16g2)
Fault memory and activation of Check Engine (MIL)	Fault is immediately stored in memory Check Engine (MIL) is not activated
Test frequency	Continuously
Tested signal or condition	Knock sensor signal (in control module determined comparison via amplitude)
Lower threshold limit Upper threshold limit	approx. 0.10V approx. 4.98V
Test pre-requisites	 engine at operating temperature engine rpm > 2000/rpm engine load > 40% knock regulation not active
i	With faults, a safety ignition timing retart setting on all cylinders.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0335	CKP sensor signal (L5)
Fault memory and activation of Check Engine (MIL)	Two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	CKP sensor (L5) signal (flywheel tooth count)
Lower threshold limit Upper threshold limit	(60 -2 teeth) - 1 tooth 60 -2 teeth) + 1 tooth
Test duration	aprox. 5 sec.

DTC P0341	CMP sensor signal (B6/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	CMP sensor (B6/1)
Plausibility	
No signal:	within 2 engine revolutions, the signal must change from 0 to 1 and from 1 to 0
Count:	max. of 1 signal changeover (1 to 0 and 0 to 1) per engine revolution.
Test pre-requisites	engine rpm 25 - 600
	no faults from CKP sensor (L5).
i	To minimize damage to the catalytic converter, a missing signal from the Hall sensor or improper
	synchronization, results in fuel shutoff.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0400	EGR valve vacuum transducer (Y31/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	One per drive
Tested signal or condition	Intake manifold pressure
Limit threshold value Test duration	Vacuum in manifold must decrease by 54 mbar when exhaust gas recirculation flow is active approx. 2 sec.
Test pre-requisites	 no fault from EGR valve vacuum transducer (Y31/1) no fault from pressure sensor (B28) injector shut off is active engine rpm approx. 900-1700 and constant vehicle altitude location is under 8000 ft
i	If the requirement are met, then the intake manifold pressure is measured and subsequently the exhaust gas recirculation is briefly activated.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0410	Air injection system
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Once per driving cycle.
Tested signal or condition	Lambda regulation
Limit threshold value	Lambda regulation factor approx. +23% ("rich" - detent stop)
Test duration	approx. 10 sec.
Test pre-requisites	- engine at idle
	- vehicle stationary
	- air injection pump has been activated 1x after engine start
	- no faults with voltage supply to exhaust gas recirculation valve (Y31/1), air pump switchover
	valve (Y32) and electrical air pump (M33)
	- no faults with exhaust gas recirculation system
	- no faults with throttle setting element (M16/6)
	- no combustion misfires
	- no faults with 02 sensor before catalytic converter, aging
	- no faults with CAN Databus
	- self adaption of mixture formation not at limit values
	- outside air pressure over approx. 780 hPa (since the test will not be done above 8000 ft)
	- engine coolant temperature < 90°C
	- Lambda regulation released
	- A/C is off

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0410	Air injection system
Test sequence	With the start of the logic chain, all functions for the self adaption of the mixture formation are locked. The exhaust gas recirculation valves are closed and the current lambda regulation factor is attained. Thereafter air injection follows. The mixture must lean out. As a result the lambda regulation factor reacts with an increase of approx. 23%.
i	If the requirements change during the test, the test is as a result stopped and is later restarted again.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0422	TWC right efficiency
DTC P0432	TWC left efficiency
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage relationship (amplitudes) between sensors before catalytic converters and sensors after catalytic converters
Limit threshold value	02 sensor signal after catalytic converter is max. 75% of 02 sensor signal before catalytic converter
Test duration	approx. 170 sec.
Test pre-requisites	 engine rpm 1000-2700 engine load approx. 22% to 52% catalytic converter temperature > 380°C lambda regulation released and lambda > 0.4 no faults with 02 sensors (signal, heating, aging) no combustion misfires

Continued.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0422	TWC left efficiency (continued)
DTC P0432	TWC right efficiency
i Also see: 11/81	The catalytic converter is evaluated for its oxygen storing capability. Within the required engine rpm and load ranges many mesurements need to be accomplished. The results are compared to a map and from that faults are recognized. The amplitude of the 02 sensors after the catalytic converters must be smaller then the amplitude of the 02 sensors before the catalytic converters. (Hint; if for example, a monolith was left out within the catalytic converter, then the 02 sensors signals both before and after the catalytic converters would be identical). If the fault codes for the catalytic converter and the 02 sensor before stored at the same time, then replace the 02 sensor before the catalytic converter first. If thereafter, no more catalytic converter fault is present, then the catalytic converter is slightly reduced in effectiveness, but does not need to be replaced.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0440	Evap. system malfunction (leak)
DTC P0441	Purge control valve (function)
DTC P0442	Evap. system leak (small)
DTC P0455	Evap. system leak (large)
Fault memory Activation of Check Engine (MIL) or motor diagnostics	After completion ot test cycle time period and faults Two in sequence driving-cycles with faults
Test frequency	Once per drive-cycle
Tested signal or condition	Pressure values per fuel tank pressure sensor (B4/3)
Large leak test	Vacuum of approx. 0.4 mbar per second is not attained.
Small leak test	Loss of vacuum within closed system is 15% greater the achieved vacuum values during the large leak test above.
Test duration	approx. 30 sec

Continued.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0440	Evap. system malfunction (leak)
DTC P0441	Purge control valve (function)
DTC P0442	Evap. system leak (small)
DTC P0455	Evap. system leak (large)
Test pre-requisites	- engine at idle
	- vehicle stationary
	- lock time of approx. 16 min. after engine start has elapsed or fuel mixture adaption occurrs.
	- lambda regulation released
	- air injection is not active
	- outside air pressure over approx. 780 hPa (since the test will not be done above 8000 ft)
	- little saturation of activated charcoal cannister
	- lambda is > 0.9 during the testing
	– with a fuel tank level of <1/4 and > 3/4 only the large leak test is undertaken
	- if the fuel within the fuel tank sloshes greatly (large pressure variations), the fuel tank pressure
	sensor (B4/3) rocognizes same and stops the test.
	- no fault at activated charcoal cannistershut-off valve (Y58/4)
	– no fault at fuel tank pressure sensor (B4/3)
	- no fault with fuel level sensor
	- no fault with purge valve (Y58/1) function (open/close)
i	The DTC P0455 is stored in memory, if the fuel tank pressure sensor (B4/3) is defective.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Evaporative System
Engine 119 shown without On-board
Refueling Vapor Recovery

The leak test for the EVAP system must detect leaks of 1mm in diameter. By law no fuel vapors are to be admitted to atmosphere.

Figure 1

75 Fuel tank

77 Actvated charcoal cannister

93 Fuel tank expansion reservoir

A Activated charcoal cannister to purge valve hose

B Purge valve to intake manifold hose

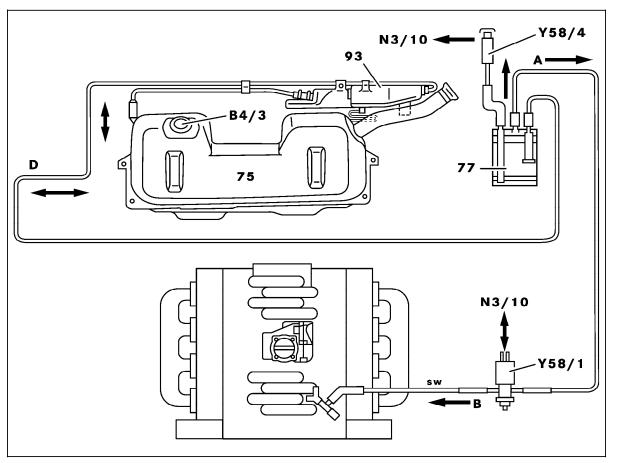
D Fuel tank to activated charcoal cannister hose

B4/3 Fuel tank pressure sensor

N3/10 Engine control module (ME-SFI)

Y58/1 Purge control vlave

Y58/4 Activated charcoal canister shut-off valve



P47.30-0284-06

Function

The leak test (logic chain) is acomplished in two phases:

- · Large leak test
- Small leak test

Continued...

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Function (continued)

1. Large leak test

The activated charcoal cannister shut-off valve (Y58/4) is closed and the purge valve (Y58/1) is opened. As a result, the intake manifold vacuum reaches the fuel tank and is evaluated by the fuel tank pressure sensor (B4/3).

If no vacuum is established (i.e. approx. -4mbar within 10 seconds) a large leak is present (fuel tank cap open, loose hose connection etc.).



If the engine control module (N3/10) recognizes a large leak within the fuel system, the fuel reserve indicator lamp (A1e4) in the instrument cluster will blink as a result.

2. Small leak test

If the large leak test results in no fault then a small leak test is performed. Once a vacuum of -7mbar is achieved, the purge control valve (Y58/1) is closed and the vacuum is evaluated for an additional 30 seconds.

The vaccum must remain consistant during this time period. Should a leak be detected, then a fault is recognized.

After the test, the activated charcoal cannister shut-off valve (Y58/4) is opened.

The purge control valve (Y58/1) is checked for proper function via activation at the same time.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

ртс РОЧЧЭ	Purge control valve (Y58/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage or amps at purge control valve (Y58/1)
Limit threshold values	
Short to ground	Voltage < 4 V
Short to positive	Amps > 4.2 A
Open circuit	No voltage at purge control valve (approx. 4-8 V at output stage).
Test duration	approx. 1 second
i	The activation of the purge control valve is checked for harness opens and shorts to ground or positive. Shorts to ground and open circuits are recognized with a locked endstage, where else a short to positive is recognized with a conducting endstage. With a fault detected, the endstage is immediately no longer activated.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0446	Activated charcoal cannister shut-off valve (Y58/4)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply at activated charcoal cannister shut-off valve (Y58/4)
Limit threshold values, voltage supply	
Short to ground	Voltage < 4 V
Short to positive	Amps > 4.2 A
Open circuit	No voltage at activated charcoal cannister shut-off valve (approx. 4-8 V) at output stage.
i	The activation of the activated charcoal cannister shut-off valve is checked for harness opens and shorts to ground or positive. Shorts to ground and open circuits are recognized with a locked endstage, where else a short to positive is recognized with a conducting endstage. With a fault detected, the endstage is immediately no longer activated.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0450	Fuel tank pressure sensor (B4/3)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Once per driving-cycle
Tested signal or condition	Fuel tank pressure sensor (B4/3) electrical fault Fuel tank pressure sensor (B4/3) signal flucuations
A Lower threshold limit Upper threshold limit Test duration B	> 4.7 V (relates to approx. 35 mbar positive pressure) < 0.1 V (relates to approx60 mbar vacuum) approx. 10 sec.
Signal sequence	The fuel tank pressure, with active recirculation can pulsate at max. 2 mbar (0.1 V), otherwise the activated charcoal cannister maybe plugged.
Test pre-requisites	- engine at idle
i	the test is run independent of the evap. system leak test. The sensor is tested for an electrical fault (short circuit, short to ground or positive). If the sensor voltage is below or above values, a fault is present. Base line for fuel tank pressure sensor: -50 mbar approx. 0.5 V; 0 mbar approx. 3.0 V; +30 mbar approx. 4.5 V. If the sensor is "hung",a constant signal yet plausible signal can be present. In this case, a large leak will be present in the evap. system.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0500	VSS signal
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults, stored in DTC memory Check Engine (MIL) is not activated (illuminated)
Test frequency	Continuously
Tested signal or condition	A VSS signal left front B VSS signal left rear
Limit threshold values Test duration	After approx. 8 miles per hr vehicle speed, the VSS signals must be recognized approx. 5 sec.
Plausibility	Requirement after approx. 25 miles per hr vehicle speed: VSS front minus VSS rear < ± 18 miles per hr
Test duration	approx. 30 sec.
Test pre-requisites	 engine rpm approx. 2500-4500 engine load > 40% transmission selector lever in D
i	The wheel speed (VSS signal) is recognized and evaluated via the ASR or ESP control module (G-wagen ABS). The ME-SFI control module receives the VSS signal via the CAN databus. Readout DTC memory (i.e. driving on dynometer) for ME-SFI and ASR or ME-SFI and ESP control modules.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0507	ISC control system unplausible
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Engine rpm
Upper threshold limit value Lower threshold limit test duration	Nominal value + 200 rpm Nominal value - 100 rpm approx. 30 sec. If the activation of the actuator motor within actuator (via the ME control module) is performed, then the new value must be attained within 25 sec.
Test pre-requisites	 Engine temperature > 20° C Climate control system: OFF Vehicle stationary

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0560	Battery voltage at ME-SFI control module
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Battery voltage at the control module ME
Limit threshold value Test duration	Voltage must be between approx. 8 V and 17.5 V approx. 5 sec.
Test pre-requisites	- Time period of 180 sec. has elapsed since start

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0600	CAN bus from ASR/ESP control module (not on G-Wagen)
DTC PI747	CAN bus from ETC or instrument cluster
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	CAN communication
Test duration	approx. 15 sec.
i	The data transmission between the control modules is monitored via the CAN controller within the ME-
Also see: 11/82	SFI control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC POTOD	Transmission control system malf. (gear ratio unplausible, transmission leak)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Monitor time and test frequency	Continuously
Tested signal or condition	Calculated gear ratios relationship out of tolerance
Acceptable gear ratios	-0.20 to 0.20 1st and 2nd gear -0.05 to 0.050 3rd gear -0.03 to 0.030 4th and 5th gear -0.2 to 0.20 Reverse gear
Test duration	approx. 2 sec.
Test pre-requisites	- engine rpm > 400- output shaft rpm > 180rpm (12 miles per hr)- no shift undertaken
Test sequence	If there is no shift undertaken, then the ETC control module recognizes the gear ratio relationship for the gear in use. If the acceptable gear ratio is out of tolerance or the gear recognition is unplausible, then the modulator pressure is adjusted to its highest value after approx. 5 seconds. Should the gear ratio remain out of tolerance or the gear recognition is unplausible then after 1 second a DTC is stored.
i	The calculated gear ratios are calculated from the following values: N2 rpm, N3 rpm and outputshaft rpm (via rear wheel VSS). Faults are noted by the ETC control module and sent via CAN data bus to the ME-SFI control module. DTC storage and activation of the CHECK ENGINE (MIL) occur via the ME-SFI control module. Readout additional DTC 5I from ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0700	Command valve sticks in pressure position
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Calculated gear ratio relationship out of tolerance
Acceptable gear ratios	-0.20 to 0.20 1st and 2nd gear -0.05 to 0.050 3rd gear -0.03 to 0.030 4th and 5th gear -0.2 to 0.20 Reverse gear
Test duration	approx. 2 sec.
Test pre-requisites	 - engine rpm > 400 - output shaft rpm > 180 rpm (12 miles per hr) - no shift undertaken
Test sequence	After each shift procedure, the shift pressure is reduced gradually. If the activated shift components drag after the pressure reduction, the command valve will bind in the shift phase (pressure) side. Shift components which drag will be recognized via the gear ratio relationship tolerances
i	The calculated gear ratios are calculated from the following values: N2 rpm, N3 rpm and outputshaft rpm (via rear wheel VSS). Faults are noted by the ETC control module and sent via CAN data bus to the ME-SFI control module. DTC storage and activation of the CHECK ENGINE (MIL) occur via the ME-SFI control module. Readout additional DTC 5I, 52 from ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PO702	Transmission control system malf. (electrical)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Faults within ETC control module - CAN data bus communication - Unacceptable version coding - Internal memory (RAM, ROM, EEPROM)
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTCs 56–65 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PO702	Voltage supply to solenoid valves
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply to solenoid valves
Lower threshold limit value Upper threshold limit value	approx. 8.5 V (longer then approx. 0.1 sec.) approx. 15 V (longer then approx. 0.1 sec.)
Test sequence	The solenoid valves are supplied battery voltage via the ETC control module. The difference in value between battery voltage and supplied battery voltage to the solenoid valves is monitored by the ETC control module.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC III in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PONS	RPM sensor function, voltage supply
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	– RPM sensor voltage supply– N2 rpm– N3 rpm
RPM sensor voltage supply	
Lower threshold limit value	< 4.8 V
Upper threshold limit value	> 7.2 V
N2, N3 rpm signals	Signals recognized and plausible
Test duration	approx. 1 sec.
Test pre-requisites	- engine rpm > 450
N2 rpm sensor	- right rear wheel rpm (VSS) > 250
	- left rear wheel rpm (VSS) > 250
	- 3rd or 4th gear recognized
N3 rpm sensor	- output shaft rpm > 180 rpm (12 miles per hr)
	- no shift undertaken

Continued

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PONS	RPM sensor function, voltage supply
Test sequence	After a predetermined engine and wheel rpm, the rpm sensor signals must be recognized. For the N3 rpm signal, 3rd or 4th gear must be engaged.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC II, I2, I3 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PO720	CAN fault recognition
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Wheel rpm (VSS) is checked for plausibility via ETC control module which receives the signal via the ASR and ESP control modules (G-wagen = ABS control module) via the CAN data bus
Test duration	approx. 1 sec.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 22, 23, 38 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0730	Incorrect gear ratio
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Comparison of known gear ratio and engaged gear (calculated gear ratio) is at least 6X negative
Test pre-requisites	 2nd, 3rd, 4th or 5th gear recognized engine rpm > 450 output shaft rpm > 180 rpm (12 miles per hr) no shift undertaken
i	The calculated gear ratios are calculated from the following values: N2 rpm, N3 rpm and outputshaft rpm (via rear wheel VSS). Faults are noted by the ETC control module and sent via CAN data bus to the ME-SFI control module. DTC storage and activation of the CHECK ENGINE (MIL) occur via the ME-SFI control module. Readout additional DTC 55 from ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0740	Torque converter lock-up clutch
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Friction value of torque converter lock-up clutch
Test sequence	The friction value is monitored via during torque converter lock-up by noting rpm differences. Should the values be out of tolerance numerous times, a DTC fault is noted.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 53 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0743	PWM solenoid valve (Y3/6y6)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	PWM solenoid valve engagement quality
Lower threshold limit value Upper threshold limit value	< 5 % > 94%
Test duration	1 sec.
i	Faults are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 5 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PO748	Modulating pressure regulating solenoid valve (Y3/6y1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Monitor time and test frequency	Continuously
Tested signal or condition	Activation of modulating pressure regulating solenoid valve
Limit values	
Short to ground	< 0.4 V
Lower threshold limit value, voltage	approx. 8.5 V
Upper threshold limit value, voltage	approx. 15 V
Lower threshold limit value, amps	approx. 0.300 A
Upper threshold limit value, amps	approx. 0.700 A
Test duration	1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control
	module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation
	of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 5 in
	ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PO748	Shift pressure regulating solenoid valve (Y3/6y2)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Activation of shift pressure regulating solenoid valve (Y3/6y2)
Limit values	
Short to ground	< 0.4 V
Lower threshold limit value, voltage	approx. 8.5 V
Upper threshold limit value, voltage	approx. 15 V
Lower threshold limit value, amps	approx. 0.300 A
Upper threshold limit value, amps	approx. 0.700 A
Test duration	1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control
	module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation
	of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 7 in
	ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0753	1-2/4-5shift solenoid valve (Y3/6y3)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply to 1-2/4-5shift solenoid valve (Y3/6y3)
Limit values	
Lower threshold limit value, voltage	approx. 8.5 V
Upper threshold limit value, voltage	approx. 15 V
Short to ground	< 0.4 V
Lower threshold limit value, amps	approx. 0.300 A
Upper threshold limit value, amps	approx. 0.700 A
Test duration	approx. 1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 2 in ETC control module.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC P0758	2-3 shift solenoid valve (Y3/6y5)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply to 2-3 shift solenoid valve (Y3/6y5)
Limit values	
Lower threshold limit value, voltage	approx. 8.5 V
Upper threshold limit value, voltage	approx. 15 V
Short to ground	< 0.4 V
Lower threshold limit value, amps	approx. 0.300 A
Upper threshold limit value, amps	approx. 0.700 A
Test duration	approx. 1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout additional DTC 3 in ETC control module.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC P0763	3-4 shift solenoid valve (Y6/3y4)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage supply to 3-4 shift solenoid valve (Y6/3y4)
Limit values Lower threshold limit value, voltage Upper threshold limit value, voltage Short to ground Lower threshold limit value, amps Upper threshold limit value, amps Test duration	approx. 8.5 V approx. 15 V < 0.4 V approx. 0.300 A approx. 0.700 A approx. 1 sec.
i	Faults (open circuit, short or short within solenoid while activating) are recognized via the ETC control module and are sent via the CAN data bus to the ME-SFI control module. DTC memory and activation of the CHECK ENGINE MIL are done via the ME-SFI control module. Readout ETC control module.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC P1386	Knock sensor control in N3/10
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, fault is stored immediately Check Engine (MIL) is not activated (illuminated)
Test frequency	After each deactivation of the knock sensor control
Tested signal or condition	Hardware test of knock sensor control
Test pre-requisites	- engine at operating temperature - engine load is decreasing (deactivate knock sensor control)
i	Fault must appear at least 10 times.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC PI400	EGR valve vacuum transducer (Y31/1)	
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults	
Test frequency	Continuously	
Tested signal or condition	Voltage/amps to EGR valve vacuum transducer (Y31/1)	
Limit threshold values		
Short to ground	approx. < 2.5 Volts	
Short to positive (+12 V)	approx. > 4.2 Amps	
Open circuit	no voltage at EGR valve vacuum transducer (approx. 4-8 V)	
Test duration	approx. 1 sec	
Test pre-requisites	Battery voltage must be between approx. 8 V and 17.1 V	
i	Tested are shorts and open circuits (shorts to ground and to positive).	
	Shorts to ground and open circuits are recognized with a locked endstage, where else a short to	
	positive is recognized with a conducting endstage.	
	With a fault the endstage is no longer activated.	

Diagnosis - Diagnostic Trouble Code (DTC) Memory

DTC PI420	AIR pump switchover valve (Y32)
DTC PI453	AIR relay module, AIR pump
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Via the amp measurement of each endstage, the voltage supply of the relay air pump in relay module (K40) and AIR pump switchover valve (Y32) is evaluated.
Limit threshold values	Air injection: OFF : max. of 3 volts are allowed at the output side. Air injection: ON : a min. of 9 volts must be at the output side.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PISH2	Pedal value sensor (B37)
Fault memory	At end of test duration and fault, two in sequence driving-cycles with faults, Check Engine (MIL) is not illuminated, fault is stored immediately.
Test frequency	Continuously
Tested signal or condition	Voltage signal 1 and 2 are compared (of potentiometers and Hall sensors).
Difference at idle Difference at full load Plausibility	< 8 % < 25 % comparison of signals 1 and 2 to air mass value
Test duration	approx. 30 sec.
Test pre-requisites	The "lock time" of 60 seconds after engine start has elapsed.
i	A fault is stored if the voltage differnece is gretaer than 8% (up to 60% turn angle of the pedal value sensor) or gretaer than 25% (as of 60% turn angle of the pedal value sensor). For comparison, the voltage signals 2 with 2 are multiplied. With the production start up of engine 112 and 113, a pedal sensor with Hall sensors has been phased in. If faults are noted, emergency run is activated.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC PISBO	EA/CC/ISC actuator (M16/1)
Fault memory and activation of Check Engine (MIL)	At end of test duration and fault, two in sequence driving-cycles with faults
Test frequency	Continuously
Tested signal or condition	Voltage comparison of actual values potentiometer 1 and actual values potentiometer 2
Plausibility	- Voltage difference can be up to 1° of the throttle plate angle. - Comparison of throttle plate angle and pedal value sensor position.

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Figure 1

02 sensor voltage as shown on engine 137

G/3 Sensor signal sensitivity ok

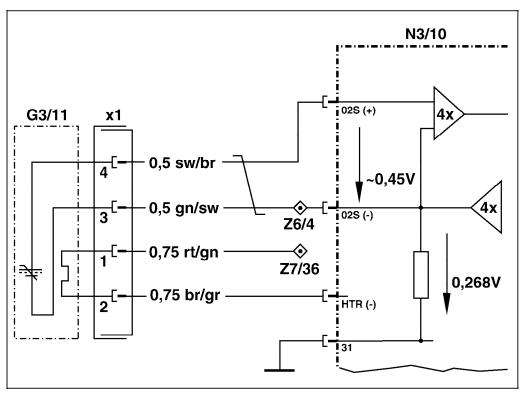
X1 Connector

- 1 Circuit 78 Sensor heating
- 2 Sensor heating ground
- 3 Sensor signal ground
- 4 Sensor signal (approx. 0.45 V at λ = 1 and 02 sensor at operating temperature.

N3/10 control module ME

4X measurement amplifier for sensor signal and sensor ground evaluation switching 0.268 V opposite voltage based on ground circuit 31

Z6/4 Connector socket sensor signal ground (4 02 senosrs, engine 137 only) Z7/36 Connector socket circuit 87



P07.61-2531-11

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Figure 2 Two 02 sensor regulation

- 1 02 sensor signal before CAT.
 a Voltage peak for Rich lean changeover (B) or
 Lean rich changeover (c)
- 2 Lambda regulation without correction
- 3 Lambda regulation with correction (d), time delay (+TV) towards Rich
- 4 Lambda regulation with correction (e), time delay (+TV) towards Lean

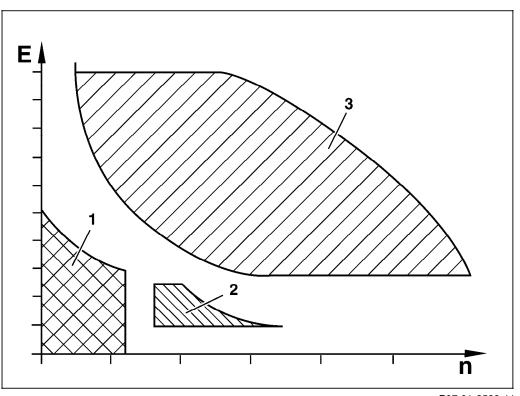
P07.61-0383-06

Engine 112 9.3 ME - SFI (ME2.0)

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Figure 3 Fuel mixture - self adaption

- Idle range
- Range between idle and part load
- Part load range
- Injection amount Engine rpm



P07.61-2529-11

9.3 ME - SFI 11/80 Diagnostic Manual • Engines • 10/01

Diagnosis – Diagnostic Trouble Code (DTC) Memory

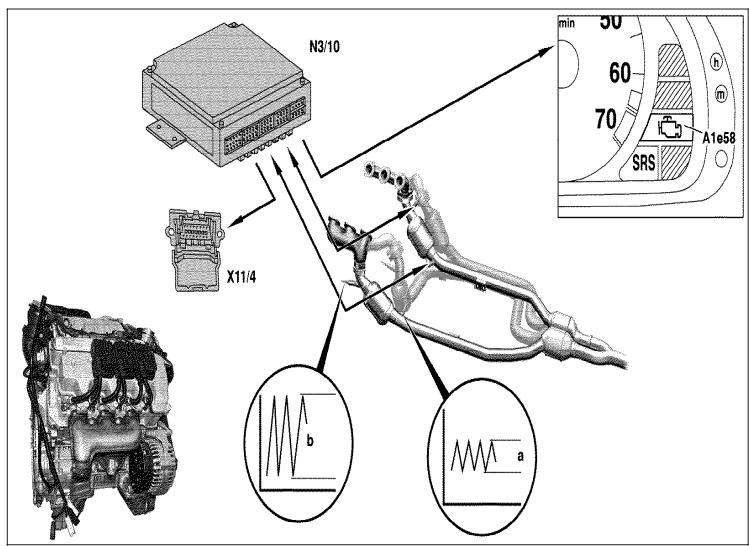


Figure 4
Engine 112 (not (SA)) shown

A1e58 Engine diagnostic indicator lamp

N3/10 Control module ME X11/4 Data link connector (DTC readout

a Amplitude of 02 sensor signal after CAT

b Amplitude of 02 sensor signal before CAT

P49.10-2116-09

Diagnosis – Diagnostic Trouble Code (DTC) Memory

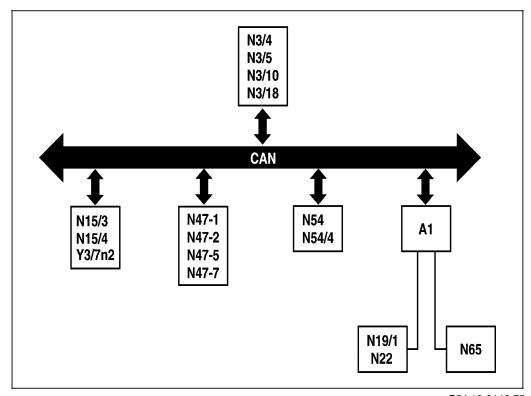
Figure 5
Engine CAN data bus
Models 129, 140, 163, 170, 202, 203, 208 210

Instrument cluster

Y3/7n2 FWD control module (not USA)

Α1

N3/4 Engine control module (HFM-SFI) Engine maangement monolith control module (not USA) N3/5 N3/10 Engine control module (ME-SFI) N15/3 ETC control module N15/4 Automatic clutch control module (not USA) N19/1 A/C pushbutton control module AAC control unit and module N47-1 ASR/SPS control module N47-2 ETS/SPS control module N47-5 ESP/BAS control module N47-7 ABS control module N54 RCL control module N54/4 DAS radio frequency/infrared control module Pulse module (traction systems, HCS,ATA, AAC)



P54.18-2146-75

Diagnosis - Complaint Related Diagnostic Chart - Injection/Ignition

↑ WARNING!

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch igntion components.

Persons with heart pacemakers are not to perform repairs on this type of ignition system..

Electronic ignition systems produce dangerous high voltages on both the primary circuit and the secondary (ignition) circuits. Due to the high voltages produced, contact with any of the voltage carrying components can be dangerous to your health (burns, heart palpatations, cardiac arrest etc).

- Igntion must be turned OFF prior to performing any repair work on the igntion system.
- Do not come in contact or remove with any of the ignition components while the engine is cranking or idling.
- Wear rubber soled shoes.
- Disconnect connectors for CKP sensor at sensor or control module.
- If repairs require that the ignition be turned on, then dangerous voltages will be present through out the entire ignition system.
- No exposed metal connectors or sending units may be installed in the ignition wires.

! WARNING!

Risk of fatal injury from being pulled into rotating vehicle parts.

Do not reach into rotating parts.

Wear closed and tight-fitting work clothes.

Protect vicinity of rotating vehicle components from unauthorized access.

↑ WARNING!

Risk of explosion from fuel igniting, risk of poisoning from inhaling and swallowing fuel as well as risk of injury to eyes and skin from contact with fuel.

No fire, sparks, exposed flames or smoking.

Pour fuels only into suitable and appropriately marked containers.

Wear protective clothing when handling fuel.

Possible hazards

Risk of explosion, poisoning and injury

Fuels are highly inflammable and toxic if inhaled. Fuel may cause skin damage. Contact with gasoline fuel, for example, removes the natural oils on the skin. Fuel vapors are explosive, invisible and spread out at floor level. They are toxic if inhaled and have a narcotic effect in high concentrations.

Protective measures/guidelines

- Pay attention to national safety regulations and provisions.
- No fire, sparks, exposed flames or smoking.
- Ensure that the place of work is adequately ventilated.
- Never drain or pour in fuels over assembly pits.
- Store drained fuel in suitable and sealed containers.
- Immediately eliminate any fuel spills which have been spilled out of the container.

Continued on next page:

Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

Conducting work on a vehicle with exposed flame (e.g. welding etc.)

 Prior to commencing such work, remove appropriate parts of the fuel system and seal open fuel lines with plugs.

First-aid measures

- Clean contaminated/exposed skin with water and soap.
- Change contaminated clothing as quickly as possible.
- If fuel gets into the eyes, rinse out eyes immediately with water, and contact a doctor, if necessary.

To Avoid Damage to the Ignition System

- To avoid damage to the engine control module, connect/disconnect the control module connectors only with the ignition: OFF.
- Circuit 1 of the ignition coil may not be shorted to ground, e.g. theft deterence.
- Only original equipment should be installed in the ignition system.
- Do not operate the ignition system at cranking speed unless the entire igntion harness is connected.
- Do not perform any tests (grounding of ignition cable 4 disconnecting a spark plug connector or pulling cable 4 out of the ignition coil) at cranking or idle speed.

- The high output side of the ignition system must carry at least 2 k Ω of load (spark plug connector).
- If assisting a disabled vehicle and it becomes necessary to perform an igntion spark test, perform this test only on one ignition/sark plug.
 Ensure a good ground connection to the spark plug.
- ME SFI: the ignition system is to be turned OFF, when cranking engine to perform compression tests, additionally, it is necessary to disconnect connector 2 from the control module.
- **i** Engine 120 has separate ignition and fuel injection system.



Readout via the impulse counter scan tool is not possible.

Note:

Symbol for emission related malfunctions which lead to the activation of the CHECK ENGINE MIL when a certain test cycle was performed and a fault was recognized.

Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

⚠ WARNING!

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components.

Persons with heart pacemakers are not to perform repairs on this type of ignition system.

Preparation for Test:

- 1. Review 11, 21, 22, 23, 24, 31, 33,
- 2. Connect HHT with test cable) to data link connector (X11/4), Readout DTC fault codes.

Complaint/Problem	Possible cause	Test step/Remedy 1)	Actual value Engine test Menu item
Engine starts and accelerates poorly when cold	Injector (Y62) activation and injection duration. Hot film MAF sensor (B2/5). ECT sensor (B11/4). Ignition voltage too low. Intake air leak.	$23 \Rightarrow 18.0 - 23.0$ $23 \Rightarrow 4.0 - 5.0$ $23 \Rightarrow 8.0$ $24 \Rightarrow 17.0$ Remedy air leak.	3/11 2/11 4/11 - -
Engine does not start	Voltage supply from engine control module (N3/10) is missing. Malfunction of drive authorization system (DAS). Fuel pumps defective. No compression due to high oil pressure. Ignition voltage too low.	$23 \Rightarrow 1.0 - 3.0$ $23 \Rightarrow 34.0$ $34 \Rightarrow 2.0$ Check compression and oil pressure. $24 \Rightarrow 17.0$	- DAS 1/1 - -
Engine has uneven idle	Injector (Y62) activation and injection duration. Intake air leak.	23 ⇒ 18.0 – 23.0 Remedy air leak.	3/11

¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

Complaint/Problem	Possible cause	Test step/Remedy 1)	Actual value Engine test Menu item
Engine has insufficient output	TWC flow restricted. O2S 1 (G3/3 or G3/4) (before TWC). ECT sensor (B11/4). Hot film MAF sensor (B2/5). Resonance intake manifold does not function Knock control at adjustment stop	Check exhaust back pressure, see DM, Engines, Vol. 1, section A, "Engine Output" $23 \Rightarrow 10.0 - 13.0$ $23 \Rightarrow 8.0$ $23 \Rightarrow 4.0$ $23 \Rightarrow 28.0$ Knock sensors	- 8/11 4/11 2/11 - 2/11
Engine runs unevenly (shakes)	Injector (Y62) activation and injection duration. Injector leaking, spray pattern. O2S 1 (G3/3 or G3/4) (before TWC). Ignition voltage too low. Compression on one or more cylinders too low. Intake air leak. Exhaust gas recirculation valve leaks/sticks	$23 \Rightarrow 18.0 - 23.0$ $36 \Rightarrow 1.0 - 2.0$ $23 \Rightarrow 10.0 - 13.0$ $24 \Rightarrow 17.0$ Check compression. Remedy air leak. Replace valve.	3/11 - 8/11 - - -
Engine runs unevenly (misfires)	Ignition voltage too low. Hot film MAF sensor (B2/5).	$24 \Rightarrow 17.0$ $23 \Rightarrow 4.0$	_ 2/11
Engine surges after cold start	Intake air leak.	Remedy air leak.	_
Transition failure during warm-up	ECT sensor (B11/4). Hot film MAF sensor (B2/5). Intake air leak.	$23 \Rightarrow 8.0$ $23 \Rightarrow 4.0$ Remedy air leak.	4/11 2/11 -

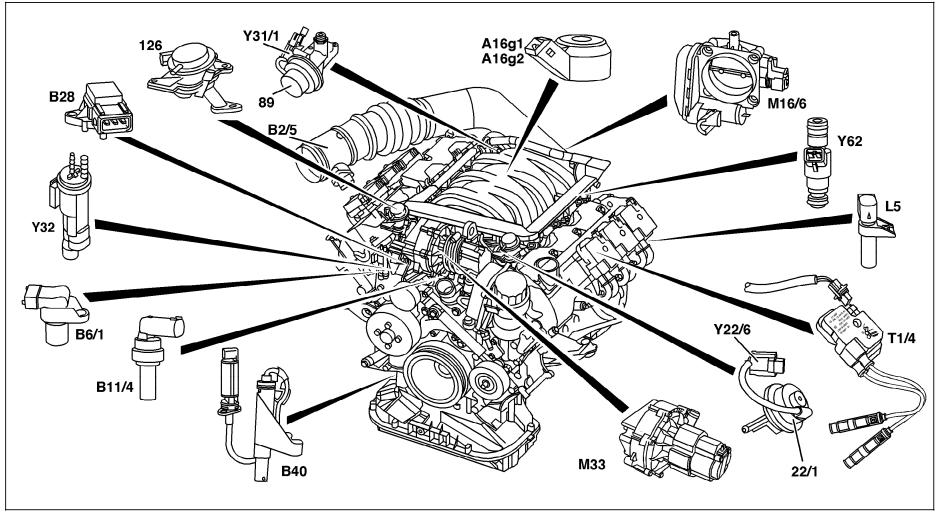
¹⁾ Observe Preparation for Test, see 22.

Diagnosis – Complaint Related Diagnostic Chart – Injection/Ignition

Complaint/Problem	Possible cause	Test step/Remedy 1)	Actual value Engine test Menu item
Transition failure when warm or increased fuel consumption	O2S 1 (G3/3 or G3/4) (before TWC). Purge control valve (Y58/1) stuck in open position.	$23 \Rightarrow 10.0 - 13.0 \\ 23 \Rightarrow 29.0 - 30.0$	8/11 4/11
Engine bucks, jerks	Hot film MAF sensor (B2/5). Ignition voltage too low. O2S 1 (G3/3 or G3/4) (before TWC).	$23 \Rightarrow 4.0-5.0$ $24 \Rightarrow 17.0$ $23 \Rightarrow 10.0-13.0$	2/11 - 8/11
EA is in "limp-home" mode	Nominal value potentiometer in pedal value sensor (B37). EA/CC/ISC actuator actual value potentiometer.	$25 \Rightarrow 1.0 - 2.0$ $25 \Rightarrow 3.0$	5/11 5/11

¹⁾ Observe Preparation for Test, see 22.

Electrical Test Program – Component Locations



Components on engine, Model 163

P07.61-0520-09

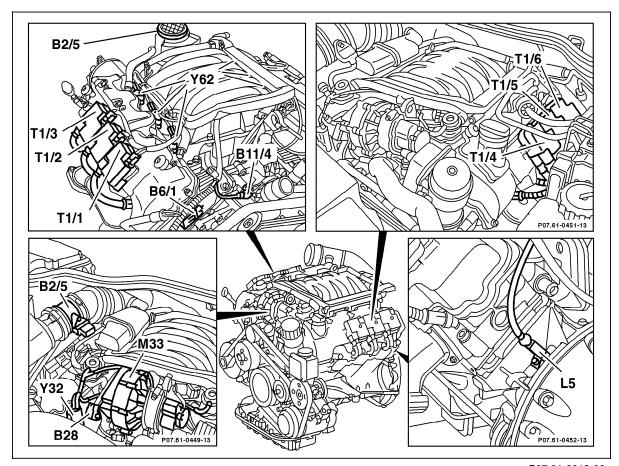
Figure 1

Electrical Test Program – Component Locations

Components on engine Model 163

Figure 2

B2/5 Hot film MAF sensor B6/1 Camshaft Hall-effect sensor B11/4 ECT sensor Pressure sensor (only USA) B28 CKP sensor L5 AIR pump (only USA) M33 T1/1 Ignition coil 1 Ignition coil 2 T1/2 Ignition coil 3 T1/3 Ignition coil 4 T1/4 T1/5 Ignition coil 5 T1/6 Ignition coil 6 Air pump switchover valve (only USA) Y32 Y62 Injectors



P07.61-2013-06

Electrical Test Program – Component Locations

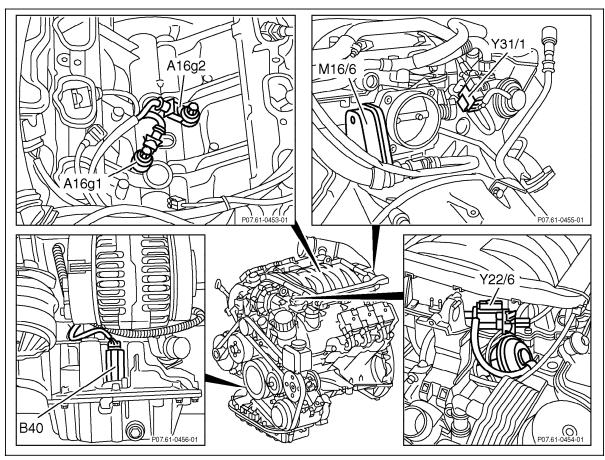
Components on engine Model 163

Figure 3

A16g1 KS 1 (right side of engine) A16g2 KS 2 (left side of engine) M16/1 EA/CC/ISC actuator

Y22/6 Resonance intake mainfold switchover valve

Y31/1 EGR valve vacuum transducer B40 Oil sensor (level/temperature/quality)



P07.61-0460-06

Electrical Test Program – Component Locations

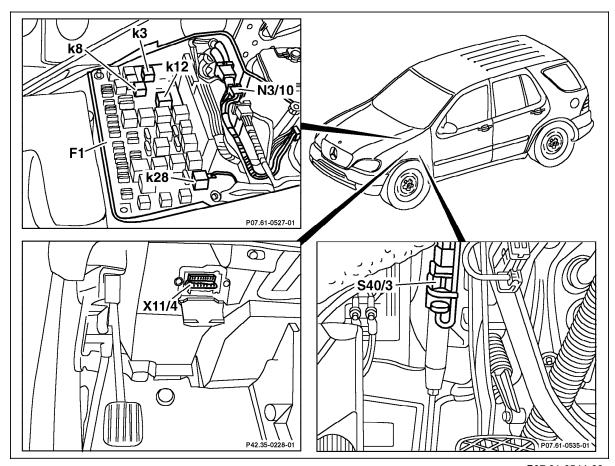
Engine Compartment Model 163

Figure 4

F1 Fuse and relay box with: k3 fuel pump relay k8 starter relay k12 circuit 15 relay

k28 secondary air injection pump relay (only USA)

N3/10 Engine control module (ME-SFI)
S40/3 Clutch pedal switch (not (USA))
X11/4 data link connector (DTC readout)



P07.61-0544-06

Electrical Test Program – Component Locations

Engine compartment Model 163

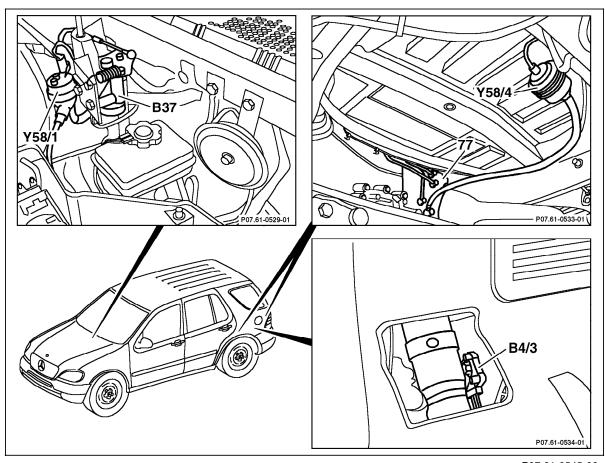
Figure 5

B4/3 Fuel tank pressure sensor (only USA)

B37 Pedal value sensor Y58/1 Purge control valve

Y58/4 Activated charcoal canister shut-off valve (only USA)

77 Activated charcoal canister



P07.61-0545-06

Electrical Test Program – Component Locations

Engine compartment Model 163

Figure 6

A1e26 "CHECK ENGINE" MIL (only USA)

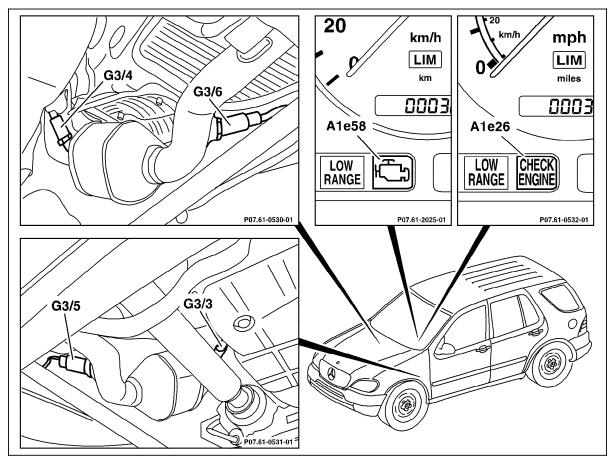
A1e58 Engine diagnostics indicator lamp (not USA)

G3/3 Left 02S 1 (before TWC)

G3/4 Right 02S 1 (before TWC)

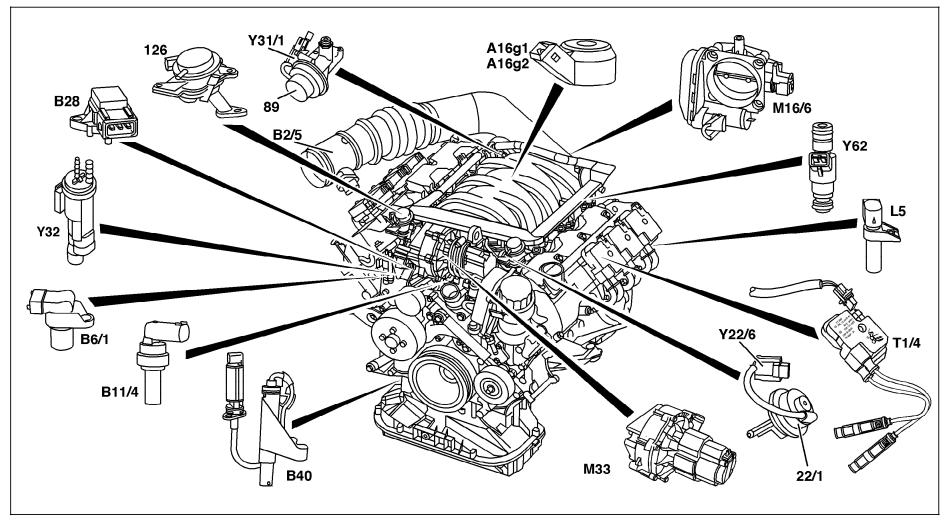
G3/5 Left 02S 2 (after TWC) (only USA)

G3/6 Right 02S 2 (after TWC) (only USA)



P07.61-2028-06

Electrical Test Program – Component Locations



Components on engine, Models 202/208

P07.61-0520-09

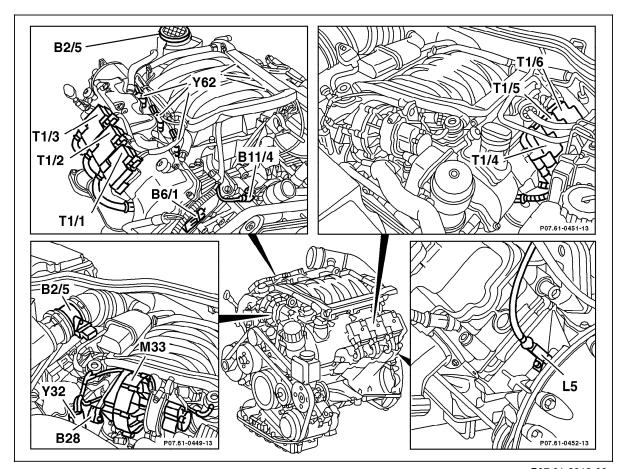
Figure 7

Electrical Test Program – Component Locations

Components on engine Models 202/208

Figure 8

B2/5 Hot film MAF sensor B6/1 Camshaft Hall-effect sensor B11/4 ECT sensor Pressure sensor (only USA) B28 CKP sensor L5 AIR pump (only USA) M33 T1/1 Ignition coil 1 Ignition coil 2 T1/2 Ignition coil 3 T1/3 Ignition coil 4 T1/4 T1/5 Ignition coil 5 T1/6 Ignition coil 6 Air pump switchover valve (only USA) Y32 Y62 Injectors



P07.61-2013-06

Electrical Test Program – Component Locations

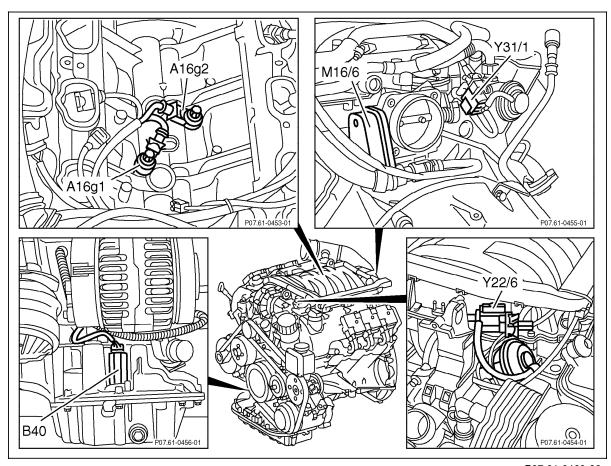
Components on engine Models 202/208

Figure 9

A16g1 KS 1 (right side of engine) A16g2 KS 2 (left side of engine) M16/1 EA/CC/ISC actuator

Y22/6 Resonance intake mainfold switchover valve

Y31/1 EGR valve vacuum transducer B40 Oil sensor (level/temperature/quality)



P07.61-0460-06

Electrical Test Program – Component Locations

Engine compartment Models 202/208

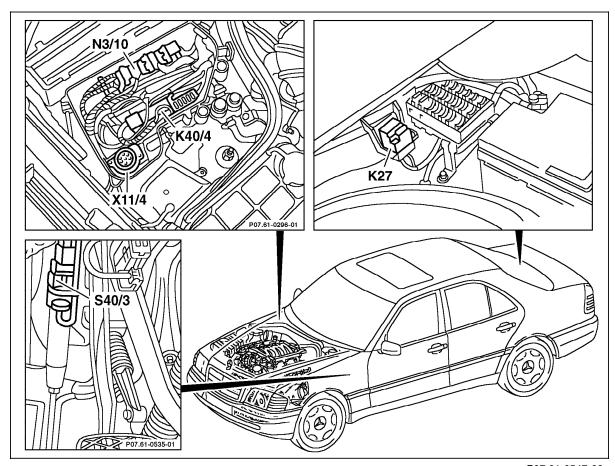
Figure 10

K27 FP relay module
K40/4 Passenger-side fuse and relay module box with:
k2 starter relay
k3 relay module AIR pump (only (USA))

N3/10 Engine control module (ME-SFI)

S40/3 Clutch pedal switch (not (USA))

X11/4 Data link connector (DTC readout) (38-pole)



P07.61-0547-06

Electrical Test Program – Component Locations

Engine compartment Models 202/208

Figure 11

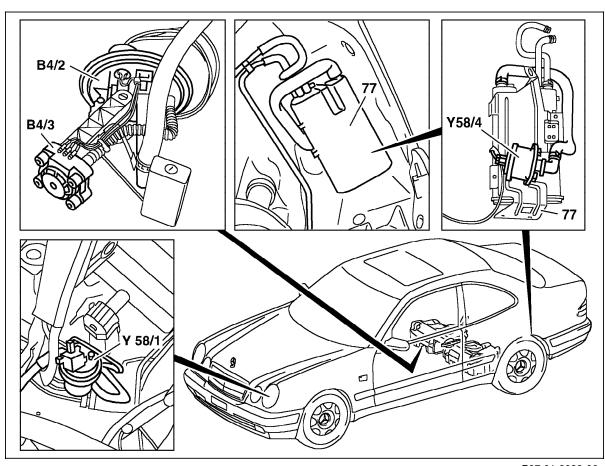
B4/2 Right fuel level sensor

B4/3 Fuel tank pressure sensor (only USA)

Y58/1 Purge control valve

Y58/4 Activated charcoal canister shut-off valve (only USA)

77 Activated charcoal canister



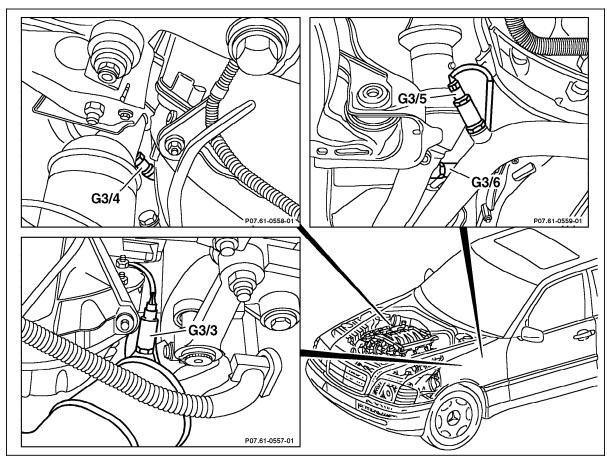
P07.61-2032-06

Electrical Test Program – Component Locations

Engine compartment Models 202/208

Figure 12

G3/3 Left 02S 1 (before TWC)
G3/4 Right 02S 1 (before TWC)
G3/5 Left 02S 2 (after TWC) (only (USA))
G3/6 Right 02S 2 (after TWC) (only (USA))



P07.61-0549-06

Electrical Test Program – Component Locations

Engine compartment Models 202/208

Figure 13

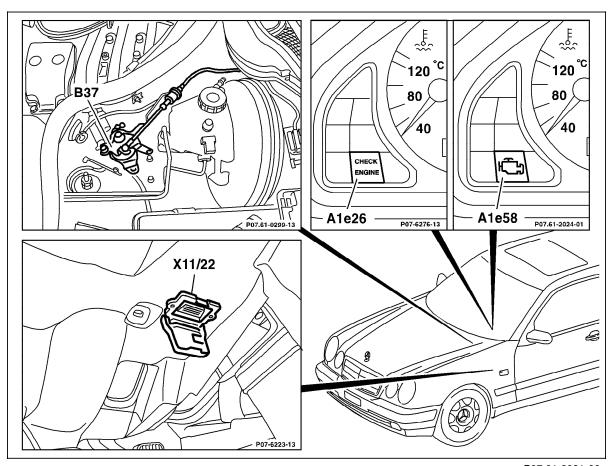
A1e26 "CHECK ENGINE " MIL (only USA)

A1e58 Engine diagnostics indicator lamp (not (USA))

B37 Pedal value sensor

X11/22 Diagnostic module (OBD II) generic scan tool

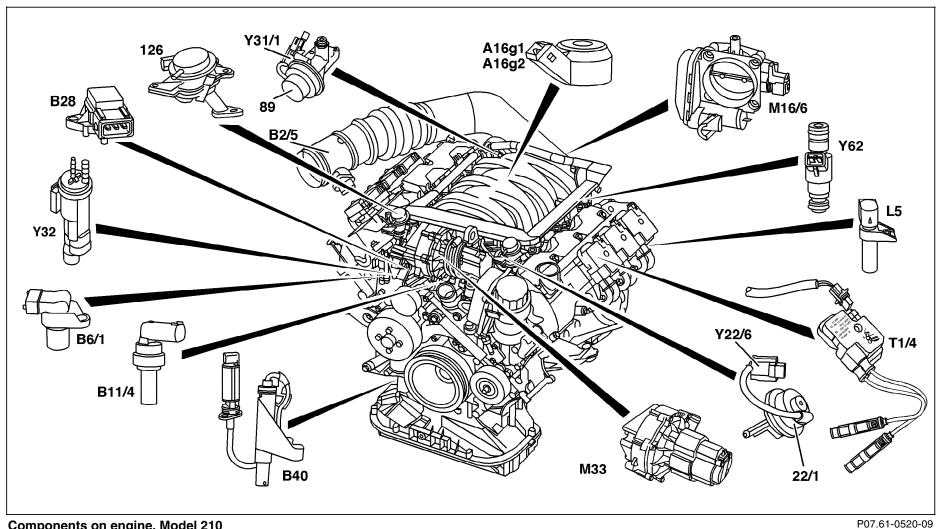
connector (only USA)



P07.61-2031-06

Engine 112 9.3 ME - SFI (ME2.0)

Electrical Test Program – Component Locations



Components on engine, Model 210

Figure 14

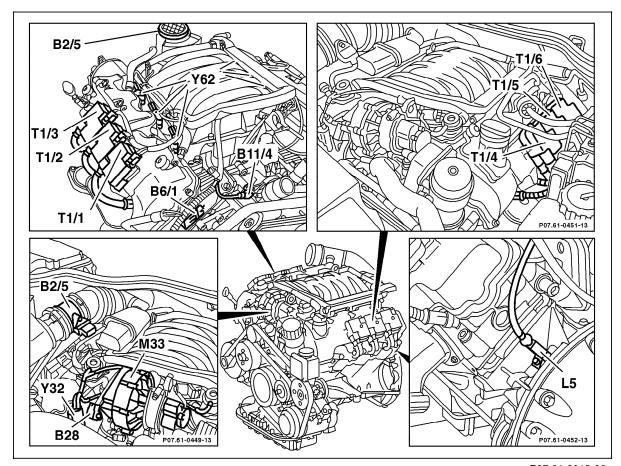
9.3 ME - SFI 21/14 Diagnostic Manual • Engines • 10/01

Electrical Test Program – Component Locations

Components on engine Model 210

Figure 15

B2/5 Hot film MAF sensor B6/1 Camshaft Hall-effect sensor B11/4 ECT sensor Pressure sensor (only USA) B28 CKP sensor L5 AIR pump (only USA) M33 T1/1 Ignition coil 1 Ignition coil 2 T1/2 Ignition coil 3 T1/3 Ignition coil 4 T1/4 T1/5 Ignition coil 5 T1/6 Ignition coil 6 Air pump switchover valve (only USA) Y32 Y62 Injectors



P07.61-2013-06

Electrical Test Program – Component Locations

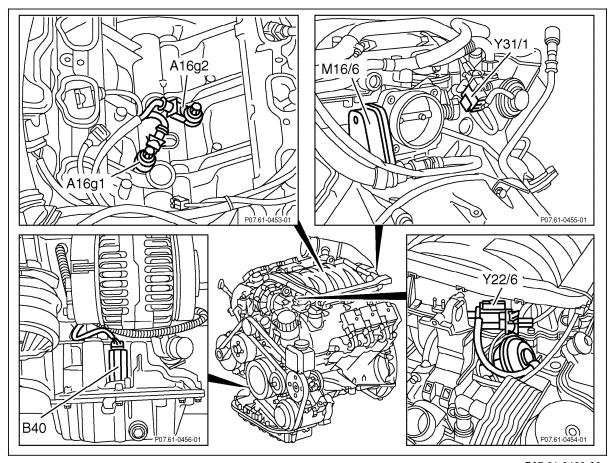
Components on engine Model 210

Figure 16

A16g1 KS 1 (right side of engine) A16g2 KS 2 (left side of engine) M16/1 EA/CC/ISC actuator

Y22/6 Resonance intake mainfold switchover valve

Y31/1 EGR valve vacuum transducer B40 Oil sensor (level/temperature/quality)



P07.61-0460-06

Electrical Test Program – Component Locations

Engine Compartment Model 210

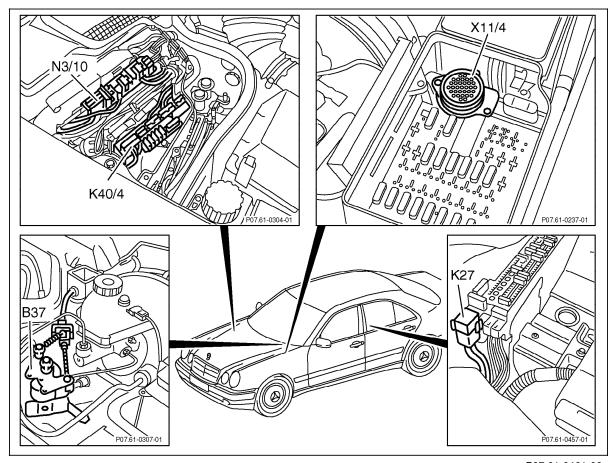
Figure 17

B37 Pedal value sensor
K27 FP relay module
K40/4 Passenger-side fuse and relay module box with:
k2 Starter relay

k3 relay module Air pump (only USA)

N3/10 Engine control module (ME-SFI)

X11/4 Data link connector (DTC readout) (38-pole)



P07.61-0461-06

Electrical Test Program – Component Locations

Engine Compartment Model 210

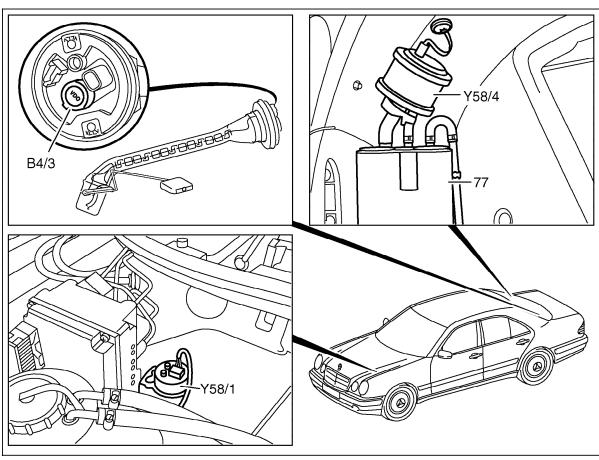


B4/3 Fuel tank pressure sensor (only USA)

Y58/1 Purge control valve

Y58/4 Activated charcoal canister shut-off valve (only USA)

77 Activated charcoal canister



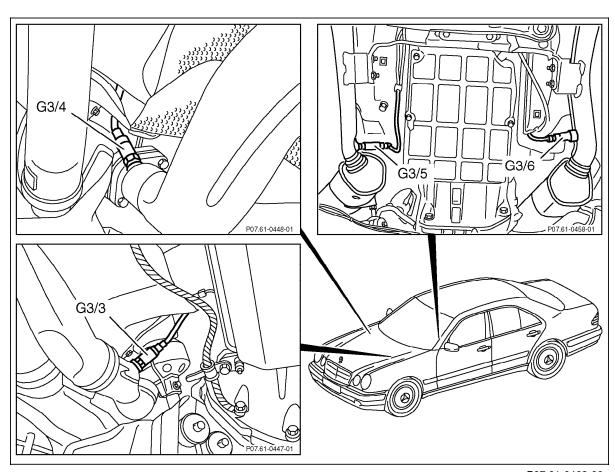
P07.61-0288-06

Electrical Test Program – Component Locations

Engine Compartment Model 210

Figure 19

G3/3 Left O2S 1 (before TWC)
G3/4 Right O2S 1 (before TWC)
G3/5 Left O2S 2 (after TWC) (only USA)
G3/6 Right O2S 2 (after TWC) (only USA)



P07.61-0462-06

Electrical Test Program – Component Locations

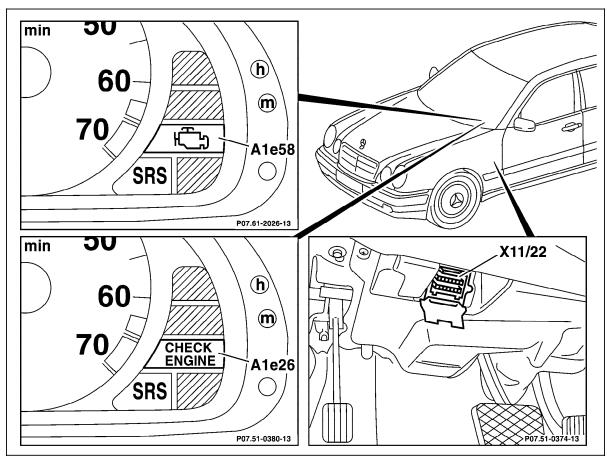
Engine Compartment Model 210

Figure 20

A1e26 "CHECK ENGINE MIL" (only USA)

A1e58 Engine diagnostics indicator lamp (not USA)

X11/22 Diagnostic module (OBD II) generic scan tool
connector (only USA)



P07.61-2034-06

Electrical Test Program – Preparation for Test

№ WARNING!

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components.

Persons with heart pacemakers are not to perform repairs on this type of ignition system.

- 1. Review 11, 21, 22, 23, 24, 31, 33, 35, 36,
- Review section 0.
- 3. Connect HHT and readout DTC memory, see 11,
- 4. Ignition: OFF
- 5. Connect test cable with socket box to engine control module (N3/10).

i

Connector with red marking is not required at this time since the engine control module has presently no function installed for it. When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.

Note:

The test program is divided into four sections:

- 23 SFI Test
- 24 Ignition System Test
- 25 EA System Test
- 26 CC System Test

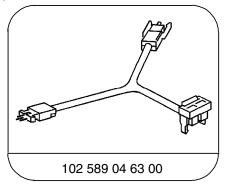
Note regarding "Test Connection" column:

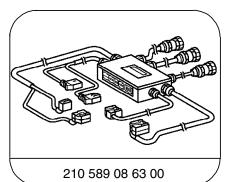
The numbers indicated in parentheses, for example, \Rightarrow 1.0 (2A) signify:

- 2 = Socket 2 on wiring diagram.
- A = Connector A on wiring diagram,

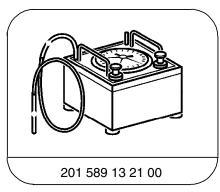
Electrical Test Program – Preparation for Test

Special Tools







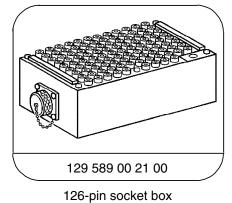


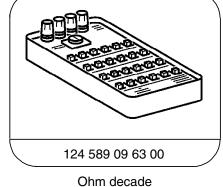
Test cable

145-pin test cable

Electrical connecting set

Tester





Test equipment; See MBUSA Standard Service Equipment Program

oot oddipmont, ood maada oo maa aa						
Description	Brand, model, etc.					
Digital multimeter	Fluke models 23, 77 III, 83, 85, 87					
	Bear DACE Hermann Electronic					

Electrical Test Program – Preparation for Test

↑ WARNING!

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch igntion components. Persons with heart pacemakers are not to perform repairs on this type of ignition system.

Electronic ignition systems produce dangerous high voltages on both the primary circuit and the secondary (ignition) circuits. Due to the high voltages produced, contact with any of the voltage carrying components can be dangerous to your health (burns, heart palpatations, cardiac arrest etc).

- Ignition must be turned OFF prior to performing any repair work on the igntion system.
- Do not come in contact or remove with any of the ignition components while the engine is cranking or idling.
- Wear rubber soled shoes.
- Disconnect connectors for CKP sensor at sensor or control module.
- If repairs require that the ignition be turned on, then dangerous voltages will be present through out the entire ignition system.
- No exposed metal connectors or sending units may be installed in the ignition wires.



P15.11-0001-01

Electrical Test Program – Preparation for Test

To Avoid Damage to the Ignition System

- To avoid damage to the engine control module, connect/disconnect the control module connectors only with the ignition: OFF.
- Circuit 1 of the ignition coil may not be shorted to ground, e.g. theft deterence.
- Only original equipment should be installed in the ignition system.
- Do not operate the ignition system at cranking speed unless the entire igntion harness is connected.
- Do not perform any tests (grounding of ignition cable 4 disconnecting a spark plug connector or pulling cable 4 out of the ignition coil) at cranking or idle speed.
- The high output side of the ignition system must carry at least 2 $k\Omega$ of load (spark plug connector).
- CFI/LH-SFI: The DI control module, which is mounted on the wheel

Ensure a good ground connection to the spark plug.

disconnect connector 2 from the control module.

sensor (L5).

arch, is coated with a heat absorbing paste to enhance the dissapation of heat, therefore do not remove the foil strip, since this has no effect on the heat dissapation.

If assisting a disabled vehicle and it becomes necessary to perform an

igntion spark test, perform this test only on one ignition/sark plug.

ME - SFI: the ignition system is to be turned OFF, when cranking

engine to perform compression tests, additionally, it is necessary to

CFI/LH-SFI: disconnect connector(s) on DI control module for CKP

i Engine 120 has separate ignition and fuel injection system

Using Test Equipment

- Ensure that the engine and ignition are OFF when connecting/ disconnecting test equipment to a coil.
- Connect the secondary voltage measuring equipment on the corresponding secondary ignition lead only when engine is stopped and ignition is OFF.
- If the circuit breaker is activated (power balance test), and the engine stalls, then the test procedure with this tester cannot be performed.
- Do not connect a test lamp to circuit 1 and 15 of the ignition coil.

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Electrical Test Program - Preparation for Test

Connection Diagram - Socket Box

Note:

When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.



Connector with red marking is not required at this time since the engine control module has presently no function installed for it.

Figure 1

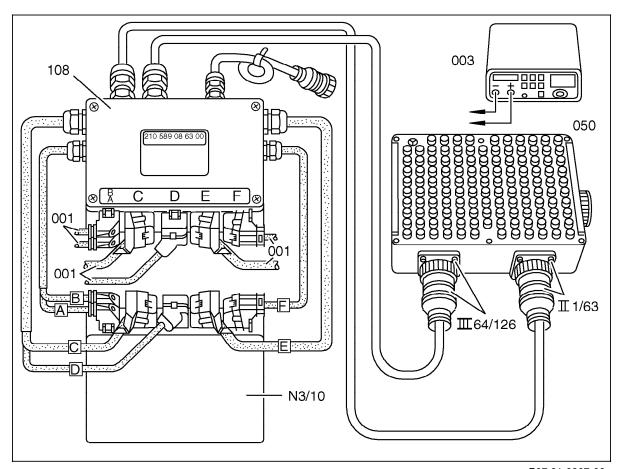
001 Engine control module connectors

003 Digital multimeter050 Socket box (126-pole)

108 Test cable

N3/10 Engine control module (ME-SFI)
II1/63 Socket box and test cable connections
III64/126 Socket box and test cable connections

A-F Connections



P07.61-0267-06

Electrical Test Program – Preparation for Test

Connector Layout - Engine Control Module

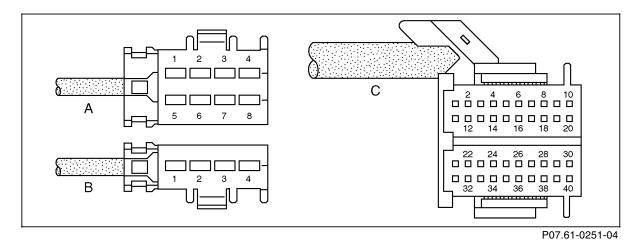


Figure 2

1A 2A	Left O2S 1 heater (before TWC) Voltage supply (circuit 87), fused
3A	Ground, Model 163/202/208/210:
4A	component compartment W16
4A 5A	OS 1 hoster (hefere TWC)
	O2S 1 heater (before TWC)
6A	Engine/climate control electric cooling fan control
7A	Ground, Model 163: component compartment W16/6
	Model 202/208/210: component compartment W16
8A	Ground, Model 163: component compartment W16/6
	Model 202/208/210: component compartment W16
1B	O2S 2 heater (right after TWC) (only USA)
2B	O2S 2 heater (left after TWC) (only USA)
3B	Diagnosis connection (data link connector)
4B	Voltage supply (circuit 30)

1C - 20C	_
21C	Purge control valve
22C	Pedal value sensor
	(+ nominal value potentiometer 1)
23C	Pedal value sensor
	(– nominal value potentiometer 1)
24C	Pedal value sensor
	(nominal value potentiometer 1 wiper)
25C	Pedal value sensor
	(nominal value potentiometer 2 wiper)
26C	Pedal value sensor
	(– nominal value potentiometer 2)
27C	Pedal value sensor

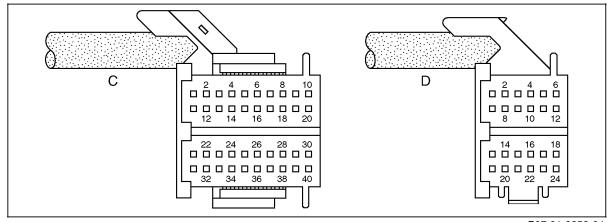
(+ nominal value potentiometer 2)

28C	AIR pump relay module (only USA)
29C	Fuel pump relay module
30C	_
31C	Right O2S 1 ground (right before TWC)
32C	Right O2S 1 signal (right before TWC)
33C	Left O2S 1 signal (left before TWC)
34C	Left O2S 1 ground (left before TWC)
35C-37C	-

ME - SFI (ME2.0) Engine 112 9.3

Electrical Test Program – Preparation for Test

Connector Layout - Engine Control Module



P07.61-0252-04

Figure	3
--------	---

38C	Data link connector (engine rpm signal)	7D	Right O2S 2 ground (right after TWC) (only USA)
39C 40C	Data link connector (ME-SFI DTC's) Signal (circuit 50)	8D	Right O2S 2 signal (right after TWC) (only USA)
400	Signal (circuit 50)	9D	Left O2S 2 signal (left after TWC) (only USA)
40	ED relevine dule (KOZ)	10D	Left O2S 2 ground (left after TWC) (only USA)
1D	FP relay module (K27)	11D	CAN data bus "H"
2D	Activated charcoal canister shut-off	12D	CAN data bus "L"
	valve (only USA)	13D	Variable speed limit regulation (without DAS 3 only)
3D	Starter relay	14D	Backup lamp switch
4D	Ground, fuel tank pressure	15D	_
	sensor (only USA)	16D	Crash signal (as of 06/98)
5D	Signal, fuel tank pressure	17D	Kick-down switch (only MT as of 06/98)
30	° '	18D	-
	sensor (only (USA)	19D	P/N recognition with AT
6D	Voltage supply 5 V for fuel tank pressure sensor	20D	CC switch (accelerate/set) (without DAS 3 only)
	(only USA)	21D	CC switch (decelerate/set) (without DAS 3 only)
6D	Voltage supply 5 V for fuel tank pressure sensor	22D	CC switch (resume) (without DAS 3 only)
	(amb (IISA)	23D	CC switch (control contact) (without DAS 3 only)
	(only (only)	24D	CC switch (off) (without DAS 3 only)

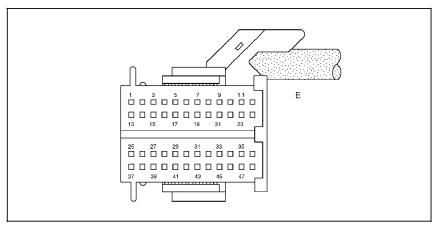
Injector cyl. 2 1E 2E Injector cyl. 5 3E-4E

5E EGR switchover valve

9.3 ME - SFI 22/7 Diagnostic Manual • Engines • 10/01

Electrical Test Program – Preparation for Test

Connector Layout - Connector 1, interior for ME-SFI control module



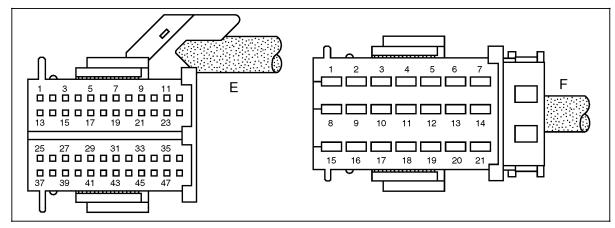
P07.61-0253-05

Figure 4

9			
6E – 9E	_	28E	ETC sensor ground
10E	AIR pump switchover valve(only (USA))	29E	ECT sensor signal
11E	Air pump switchover valve (only	30E	_
12E	December intoles manifold quitabours value	31E	EA/CC/ISC actuator (actual value potentiometer 1
	Resonance intake manifold switchover valve		wiper)
13E	Injector cyl. 3	32E	EA/CC/ISC actuator (actual value potentiometer
14E	Injector cyl. 6		ground)
15E	Voltage supply 5 V, oil	33E	Actual value potentiometer voltage supply
105	sensor (level/temperature/quality)	34E	EA/CC/ISC actuator (actual value potentiometer 2
16E	Ground for oil sensor (level/temperature/quality)		wiper)
17E	Signal for oil sensor (level/temperature/quality)	35E - 36E	
18E – 21E	-	37E	CKP sensor ground
22E	Voltage supply 5 V, pressure sensor (only (USA))	38E	CKP sensor signal
23E	Pressure sensor signal (only (USA))	39E	Camshaft Hall-effect sensor ground
23L		40E	Camshaft Hall-effect sensor signal
24E	Pressure sensor ground (only (USA))		ournerran oncor concor orginal
25E	Injector cyl. 1		
26E	Injector cyl. 4		
27E	AIR pump relay in relay module (only (USA))		
	/ in parity roley in roley modulo (only)		

Electrical Test Program – Preparation for Test

Connector Layout - Engine Control Module



P07.61-0254-04

Figure 5

41E	KS 1 ground (right cylinder side of engine)	1F	EA/CC/ISC actuator (-)	13F	Ignition coil T1/4, a cyl. 4
42E	KS 1 signal (right cylinder side of engine)	2F	EA/CC/ISC actuator (+)	14F	Ignition coil T1/4, b cyl. 4
43E	KS 2 ground (left cylinder side of engine)	3F	_	15F	Ground, Model 163: component compartment W16,
44E	KS 2 signal (left cylinder side of engine)	4F	Ignition coil T1/5 b cyl. 5		Model 202/208/210: component compartment
45E	IAT sensor (in hot film MAF sensor)	5F	Ignition coil T1/5 a cyl. 5		W16/6
46E	Hot film MAF sensor voltage supply 5 V	6F	Ignition coil T1/3 a cyl. 3	16F	Ignition coil T1/2, b cyl. 2
47E	Hot film MAF sensor signal	7F	Ignition coil T1/3 b cyl. 3	17F	Ignition coil T1/2, a cyl. 2
48E	Hot film MAF sensor ground	8F	Ground, Model 163: component compartment W16,	18F	Ignition coil T1/6, b cyl. 6
			Model 202/208/210: component compartment	19F	Ignition coil T1/6, a cyl. 6
			W16/6	20F	Ignition coil T1/1, a cyl. 1
		9F – 12F	_	21F	Ignition coil T1/1, b cyl. 1

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection		Test condition	Nominal value	Possible cause/remedy
1.0	PO 560	Engine control module (ME-SFI) (N3/10) Voltage supply Circuit 30 U	N3/10 □□□□□ 3 — ((3A)) — 12 (4B)	Ignition: ON	11 – 14 V	⇒ 1.1 ⇒ 1.2
1.1		Ground wire, Output ground	N3/10 3 — (— Y + (3A) 7 — (— Y + (7A) 112 — (— Y + (8F) 119 — (— Y + (15F)	X11/4		11 – 14 V	Wiring, Models 202, 208, 210: Output ground (W16/6), right component compartment. Model 163: Ground (W16), component compartment. ⇒ 1.2

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.2		Voltage supply Circuit 30	N3/10 X11/4	Ignition: ON	11 – 14 V	Wiring, Passenger-side fuse and relay module (K40/4). or Fuse and relay box (F1).
2.0	PO 560	Engine control module (ME-SFI) (N3/10) Voltage supply Circuit 87 U	N3/10 8 — — — — — — 2 (8A) (2A)	Ignition: ON	11 – 14 V	⇒ 2.1 – 2.2
2.1		Electronics ground	N3/10	Ignition: ON	11 – 14 V	Wiring, Models 202, 208, 210 Output ground (W16/6), right component compartment. Model 163: Ground (W16), component compartment.
2.2		Voltage supply Circuit 87	_	Ignition: ON Model 163: Connect socket 4 to 16- pole test connector Ignition: OFF	11 – 14 V < 1 V	Wiring, Passenger-side fuse and relay module (K40/4). or Fuse and relay box (F1).

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
3.0	Starter relay Models 202, 208, 210: (K40/4k2) in passenger-side fuse and relay module box (K40/4) Model 163: (F1k8) in fuse and relay box Activation		ECT temperature > 20 ° C Vehicle with AT Ignition/starter switch (S2/1): position 3 (start position): crank engine briefly	11 – 14 V or if engine does not start in approx. 5 seconds.	⇒ 3.1, Engine control module (N3/10)
3.1	Starter signal circuit 50	N3/10 8 — 32 (8A) (40C)		11 – 14 V while starting.	Wiring, Ignition/starter switch (S2/1)

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
4.0	PO 100	Hot film MAF sensor (B2/5) Hot film signal	N3/10 □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□	Ignition: ON Engine: at Idle Engine coolant temperature >70°C	0.9 – 1.1 V 1.3 – 1.7 V Increasing rpm, increasing voltage.	⇒ 4.1 – 4.3, Wiring, Air intake system leak, B2/5
4.1		Hot film MAF sensor (B2/5) Voltage supply 5 V		Disconnect MAF sensor (B2/5) connector and measure directly on socket 4 (brown/yellow). Ignition: ON	4.7 – 5.2 V	Wiring, N3/10
4.2		Ground wire for hot film MAF sensor (B2/5)	B2/5	Disconnect MAF sensor (B2/5) connector and measure directly on socket 3 (brown). Ignition: ON	4.7 – 5.2 V	Wiring.

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
4.3		Hot film MAF sensor (B2/5) Voltage supply 12 V	104 -(- (() +) - 2	Disconnect MAF sensor (B2/5) connector and connect plus of voltmeter to socket 2 (red/blue). Ignition: ON	11 – 14 V	Wiring, Passenger-side fuse and relay module (K40/4). or Fuse and relay box (F1f11).
5.0	PO 110	IAT sensor in hot film MAF sensor (B2/5) Voltage	N3/10 104 — 101 (48E) (45E)		°C V 10 3.1 20 2.7 30 2.2 40 1.8 50 1.4 60 1.1 ±5%	⇒ 5.1 N3/10

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
5.1		IAT sensor Resistance	N3/10 104 — 101 (48E) (45E)	Ignition: OFF Disconnect connector E on engine control module (N3/10).	oC Ω 10 3600 20 2420 30 1660 40 1170 50 850 60 600 ± 5%	Wiring, B2/5
6.0	PO 105	Only (USA) Pressure sensor (B28) Sensor signal		Connect vacuum tester to pressure sensor (B28) using Y-fitting (see Figure 1). Ignition: ON Engine: at Idle	> 3.5 V < 2 V and vacuum climbs to > 500 mbar.	Vacuum line, Wiring, B28, N3/10
		Pressure sensor (B28) Voltage supply	N3/10 80 — 78 (24E) (22E)	Ignition: ON	4.7 – 5.3 V	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
7.0	FP relay module Models 202/208/210: (K27) Model 163: (F1k3) in fuse and relay box Activation	N3/10 21 — 2 (29C) (2A)	Ignition: ON The activation of the FP occurs only once after ignition "ON". For the next activation, the engine must have run briefly.	11 – 14 V for approx. 1 sec.	Fuses, Wiring, K27 or F1k3, N3/10
	Current draw (K27) or (F1k3)	N3/10 8 — — — — — 21 (8A) (29C)	Engine: Start Ignition: ON	11 – 14 V during cranking and while engine runs. 0.1 – 0.3 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
8.0	PO 115	ECT sensor (B11/4) Voltage	N3/10	Ignition: ON	°C V 20 3.4 30 2.9 40 2.4 50 1.9 60 1.5 70 1.2 80 0.9 90 0.7 100 0.5 ±5 %	⇒ 8.1, N3/10
8.1		Resistance (B11/4)	N3/10 84 — 5 — 85 (28E) (29E)	Ignition: OFF Disconnect connector E on engine control module (N3/10).	°C Ω 20 3090 30 2000 40 1330 50 900 60 630 70 440 80 320 90 230 100 170 ±5 %	Wiring, ⇒ 8.2

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
8.2	ECT sensor (B11/4) Resistance	B11/4 1 - ② + 2	Disconnect connector on ECT sensor (B11/4).	°C Ω 20 3090 30 2000 40 1330 50 900 60 630 70 440 80 320 90 230 100 170 ±5 %	B11/4
9.0	Engine control module (N3/10) TN-signal output	N3/10 8—(——————————————————————————————————	Test with oscilloscope. Engine: Start or Engine: at Idle Test with multimeter only if oscilloscope is not available.	Signal: see Figure 2. 7.5 – 9.0 V	Wiring, N3/10

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
10.0	PO 150 PO 153 PO 160	Left O2S 1 (before TWC) (G3/3) O2S signal	N3/10 26 — — — — — — — — — — — — — — — — — — —	If ECT > 80 ° C, run engine at idle for at least two minutes.	fluctuates from - 0.2 V to + 1.0 V, by more than 0.3 V	⇒ 12.0, Wiring, G3/3
11.0	PO 130 PO 133 PO 140	Right O2S 1 (before TWC) (G3/4) O2S signal	N3/10 23 — (31C) (3	If ECT > 80 ° C, run engine at idle for at least two minutes.	fluctuates from - 0.2 V to + 1.0 V, by more than 0.3 V	⇒ 13.0, Wiring, G3/4
12.0	PO 155	Left O2S 1 (before TWC) (G3/3) O2S heater Activation		If ECT > 80° C, run engine at idle for at least 2 minutes.	11 – 14 V	Fuses, Wiring, G3/3, N3/10
		O2S 1 (G3/3) Current draw		Disconnect connector A on engine control module N3/10 Ignition: ON	1.0 – 4.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
13.0	PO 135	Right O2S 1 (after TWC) (G3/4) O2S heater Activation	N3/10 5 — (— () ± →) — (24)		11 – 14 V	Fuses, Wiring, G3/4, N3/10
		O2S 2 (G3/4) Current draw	N3/10 3 — (—————————————————————————————————		1.0 – 4.5 A	
14.0	PO 156 PO 160	Only (ISA) Left O2S 2 (after TWC) (G3/5) O2S signal	N3/10 (10D) (9E	''	The mV range of 450 - 500 mV must be exceeded or not attained within 1 minute.	⇒ 16.0, Wiring, G3/5, N3/10
			N3/10 3 — (— —) — 6 (3A) (10E 3 — (— —) — 2 (3A) (280	box.	Air pump runs. Voltage changes within 60 seconds to < 40 mV	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection		Test condition	Nominal value	Possible cause/remedy
15.0	PO 136	Only (ISA) Right O2S 2 (after TWC) (G3/6) O2S signal	N3/10 39 — (—————————————————————————————————) — 40 (8D)	If ECT > 80° C, run engine at 2000-3000 rpm for approx. 2 minutes.	The mV range of 450 - 500 mV must be exceeded or not attained within 1 minute.	⇒ 17.0, Wiring, G3/6, N3/10
			N3/10		Engine: at Idle		
			3 — (— —)— (3A)		Bridge sockets on socket box.	Air pump runs. Voltage changes within 60 seconds to	
			(3A)	(28C)		< 40 mV	
16.0	PO 161	Only (USA) Left O2S 2 (after TWC) (G3/5) O2S heater Activation	N3/10 10 — (—— Y) —— (2B)		Engine: at Idle If ECT > 80° C, run engine at idle for at least 2 minutes.	11 – 14 V or voltage fluctuates between 11 – 14 V.	Fuses, Wiring, G3/5, N3/10
		O2S 2 (G3/5) Current draw	N3/10) — 10 (2B)	Disconnect connector B on engine control module N3/10 Ignition: ON	1.0 – 4.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test conn	ection		Test condition	Nominal value	Possible cause/remedy
17.0	P0 141	Only (ISA) Right O2S 2 (after TWC) (G3/6) O2S heater Activation	9 — ((1B)	_	-2	If ECT > 80° C, run engine at idle for at least 2 minutes.	11 – 14 V or voltage fluctuates between 11 – 14 V.	Fuses, Wiring, G3/6, N3/10
		O2S 2 (G3/6) Current draw	3 — ((3A)	O		Disconnect connector B on engine control module Ignition: ON	1.0 – 4.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
18.0	PO 201	Injector (Y62y1) Activation and injection time	N3/10 81 — (—————————————————————————————————	A) ECT approx. 80° C	(signal: see	Fuses, Wiring, Y62y1, N3/10, Further possibilities: ECT sensor (B11/4), IAT sensor in hot film MAF sensor
		Resistance (Y62y1)	N3/10 81 — (25E)	Ignition: OFF 2 A)	Figures 3 and 4) 14 – 18 Ω	(B2/5), O2S 1 (G3/3 or G3/4).

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test conr	nection		Test condition	Nominal value	Possible cause/remedy
19.0	PO 202	` ' '		N3/10		• •	Injection time:	Fuses,
		Activation and injection time	 57 — (• 0	at start:	approx. 8 ms	Wiring,
			(1E)	- D -) — 2 (2A)	ECT approx. 80° C		Y62y2, N3/10,
			(12)		(27)		approx. 3 – 5 ms	146/16,
						accelerate briefly:	''	Further possibilities:
							(signal: see	ECT sensor (B11/4),
							Figures 3 and 4)	IAT sensor in hot film MAF sensor
								(B2/5),
								O2S 1 (G3/3 or G3/4).
		Resistance (Y62y2)		N3/10		Ignition: OFF	14 – 18 Ω	
				+				
			57 — ($\leftarrow \Omega$) —2			
			(1E)		(2A)			

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
20.0	PO 203	Injector (Y62y3) Activation and injection time	N3/10 (69 — (→ -(+)+ → 2 (2A)	at start:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see Figures 3 and 4)	Fuses, Wiring, Y62y3, N3/10 Further possibilities: ECT sensor (B11/4), IAT sensor in hot film MAF sensor (B2/5),
		Resistance (Y62y3)	N3/10 □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□	Ignition: OFF	14 – 18 Ω	O2S 1 (G3/3 or G3/4).

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection		Test condition	Nominal value	Possible cause/remedy
21.0	PO 204	Injector (Y62y4) Activation and injection time	N3/10) — 2 (2A)	at start: ECT approx. 80° C at idle: accelerate briefly:	Injection time: approx. 8 ms approx. 3 – 5 ms approx. 14 ms (signal: see Figures 3 and 4)	Fuses, Wiring, Y62y4, N3/10 Further possibilities: ECT sensor (B11/4), IAT sensor in hot film MAF sensor
		Resistance (Y62y4)	N3/10 	> — 2 (2A)	Ignition: OFF	14 – 18 Ω	(B2/5), O2S 1 (G3/3 or G3/4).

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
22.0	PO 205	Injector (Y62y5) Activation and injection time	N3/10 58 — — — — — — — 2 (2E) (2A)	ECT approx. 80° C at idle: accelerate briefly:	(signal see	Fuses, Wiring, Y62y5, N3/10 Further possibilities: ECT sensor (B11/4),
		Resistance (Y62y5)	N3/10 □□□□□ 58 — (→ □① + → 2 (26E) (2A)	Ignition: OFF	Figures 3 and 4)	IAT sensor in hot film MAF sensor (B2/5), O2S 1 (G3/3 or G3/4).

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test conr	nection		Test condition	Nominal value	Possible cause/remedy
23.0	PO 206	Injector (Y62y6)		N3/10		ECT approx. 20° C	Injection time:	Fuses,
		Activation and injection time				at start:	approx. 8 ms	Wiring,
			70 ~	- +) —2			Y62y6,
			(14E)		(2A)	ECT approx. 80° C		N3/10
						at idle:	approx. 3 – 5 ms	
						accelerate briefly:	approx. 14 ms	Further possibilities:
							(signal: see	ECT sensor (B11/4),
							Figures 3 and 4)	IAT sensor in hot film MAF sensor
								(B2/5),
								O2S 1 (G3/3 or G3/4).
		Resistance (Y62y6)		N3/10		Ignition: OFF	14 – 18 Ω	
		ricsistance (102yo)				igintion. Of I	14 10 22	
			70 — (<u></u> Ω+→) —2			
			(14E)	\odot	(2A)			
			(1-1-)		(27)			

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
24.0	P1 453	Only USA AIR relay module Models 202/208/210: (K17), in Passenger-side fuse and relay module box (K40/4) Model 163: in fuse and relay box (F1k28) Activation	N3/10 20 — — — — — — 2 (28C) (2A)		11 – 14 V for approx. two minutes and AIR pump runs.	Fuses, Wiring, K40/4 or F1k28, N3/10
		Current draw (K40/4) or (F1k28)	N3/10 3 — → — 20 (3A) (28C)	Ignition: ON	0.1 – 0.3 A	
25.0	P1 420	Only (ISA) AIR pump switchover valve (Y32) Activation	N3/10 	Disconnect ECT sensor (B11/4) connector. Simulate 2.5 k Ω resistance at sockets 1 and 2 with resistance substitution unit. Engine: at Idle	11 – 14 V for approx. two minutes and AIR pump runs.	Fuses, Wiring, Y32, N3/10
		Current draw (Y32)	N3/10 3 — — — — 66 (3A) (10E)	Ignition: ON	0.3 – 0.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test conr	nection		Test condition	Nominal value	Possible cause/remedy
26.0	PO 410	Only (ISA) AIR system (logic chain)	23 — ((31C)	N3/10) — 24 (32C)	Note: The O2S 1 signal before TWC is measured. If ETC > 80°C run engine at idle for at least 2 minutes.	The O2S voltage oscillates in the area of -0.2 V and +1.0 V	Y32, AIR combi valve, AIR pump no output.
			3—((3A) 3—((3A)	N3/10 (> — 66 (10E) > — 20 (28C)	Bridge sockets on socket box	AIR pump runs. Voltage changes to < 100 mV within 20 seconds	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
27.0	PO 400 PI 400	EGR valve vacuum transducer (Y31/1) Activation and vacuum control	N3/10 61 — 2 (5E) (2A)	Note regarding test: This test is not possible on Models 163 and 210 4MATIC Note to test connection: Connect vacuum tester to EGR valve vacuum transducer, after removing the MAF sensor with air box.		Fuses, Wiring, N3/10, Y31/1
			N3/10	Engine: at idle ETC > 60°C Vehicle at approx. 3000/rpm while on dynamometer	< 1 V and < 10 mbar vacuum. 1 – 7 V and 80 – 220 mbar vacuum.	
		Current draw (Y31/1)	3—(———————————————————————————————————	Ignition: ON	0.3 – 0.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
28.0	PO 802 PI 225	Resonance intake manifold switchover valve (Y22/6) Activation	N3/10 68 — — — — — 2 (12E) (2A)	Engine: Start Engine: at idle Engine: accelerate briefly to > approx. 3900 rpm	< 1 V 9 – 14 V and vacuum applied to valve.	Fuses, Wiring, Y22/6, N3/10
		Current draw (Y22/6)	N3/10 3 — ← — — 68 (3A) (12E)	Ignition: ON	0.3 – 0.5 A	
29.0	PO 441 PO 443	Purge control valve (Y58/1) Activation	N3/10 	Engine: at Idle and at operating temperature.	After approx. 2 minutes, purge control valve (Y58/1) must noticeably cycle, Signal: see Figure 5.	⇒ 30.0, Fuses, Wiring, Y58/1, N3/10
		Current draw (Y58/1)	N3/10 □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□	Ignition: ON	0.3 – 0.5 A	

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
30.0	PO 441	Purge control valve (Y58/1) Vacuum control		Connect vacuum tester to purge control valve (Y58/1) between purge line to charcoal canister. Engine at operating temperature and at idle.	After approx. 2 minute, > 50 mbar and needle oscillates, Y58/1 must cycle.	Vacuum lines, Y58/1
31.0	PO 440 PO 446 PO 455	Only USA Purge system Leaks Activated charcoal canister shut-off valve (Y58/4) Activated	N3/10 3—(——) —— 34 (3A) (2D)	Disconnect purge line (A) to charcoal canister on purge control valve (Y58/1). Connect vacuum tester to purge line. Ignition: ON Apply approx. 25 mbar of vacuum.	After approx. 1 minute, < 5 mbar vacuum loss.	Fuel tank cap, Purge line to charcoal canister, Purge line from charcoal canister to Y58/4, Charcoal canister, Y58/1, Y58/4, B4/3

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection		Test condition	Nominal value	Possible cause/remedy
32.0	PO 446	Only (USA) Activated charcoal canister shut-off valve (Y58/4) Current draw	N3/10 3 — (3A) — (3A)) — 34 (2D)	Ignition: ON	0.5 – 0.9 A	Fuses, Wiring, Y58/4
33.0	PO 450	Only USA Fuel tank pressure sensor (B4/3) Sender signal Activated charcoal canister shut-off valve (Y58/4) is activated	N3/10 36 — • • • • • • • • • • • • • • • • • •	> —37 (5D) > —34 (2D)	Disconnect purge line (A) to charcoal canister on purge control valve (Y58/1). Connect vacuum tester to purge line. Ignition: ON Apply approx. 25 mbar of vacuum.	> 2.9 V < 2.3 V	⇒ 33.1, Wiring, Vacuum line, Charcoal canister clogged, B4/3
33.1		Only USA Fuel tank pressure sensor (B4/3) Voltage supply	N3/10 ∭∭ 36 — (→ - (¥) + → (4D)) — 38 (6D)	Ignition: ON	4.7 – 5.3 V	N3/10

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
34.0	PO 600 PO 811 P1 570 P1 603 P1 747	CAN data bus	N3/10 	Ignition: OFF 44 2D)	55 – 65 Ω	⇒ 34.1 – 34.2 Data line.
34.1		CAN element in electronic ignition lock control module (N73) or DAS radio frequency/infrared control module (N54/1) or Instrument cluster (A1) Resistance	N3/10 (11D) (1	Ignition: OFF Disconnect connector D from engine control module N3/10.	115 – 125 Ω	Wiring, Model 202, 208, 210: N73, Model 163: A1
34.2		CAN element in engine control module (N3/10) Resistance	N3/10 (11D) (1	Ignition: OFF Disconnect connector D from test cable and reconnect connector D to N3/10	115 – 125 Ω	N3/10

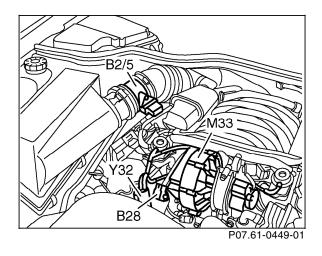
Electrical Test Program – Sequential Multiport Fuel Injection System Test

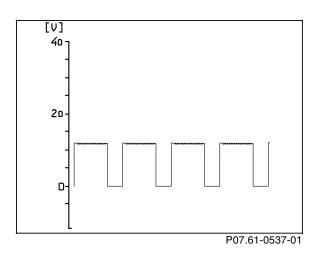
\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
35.0	PI 178 PI 179 PI 180 PI 185	Oil sensor (level/ temperature/quality) (B40)	N3/10 72 — (—————————————————————————————————	Duration: 50ms Test with multimeter only if oscilloscope is not available. Ignition: ON	Signal: see Figure 6 0.3 - 3 V, voltage jumps	⇒ 35.1, oil level, oil quality, wiring, B40
35.1		Voltage supply (B40)	N3/10 72 — (— ① —) — 7 (16E) (15		4.7 – 5.3 V	N3/10

Electrical Test Program – Sequential Multiport Fuel Injection System Test

\Rightarrow	0	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
36.0	PO 801 PI 181	With engine/climate control electric cooling fan only Engine/climate control electric cooling fan control module (N76)	N3/10 3 — (— () + —) — 6 (3A) (6A)	Engine: at idle ECT< 70° C Ignition: ON	1 – 1.9 V and cooling fan is stationary.	Wiring, N76, N3/10
		Activation		A/C: ON	2 – 4 V and cooling fan runs.	
				ECT > 85° C	between 2.5 – 12.5 V and cooling fan speed is based on activation.	
37.0		Diagnosis line Activation	N3/10 3 — — — — 31 (3A) (39C)	Ignition: ON	11 – 14 V	Wiring, N3/10
38.0	PI 681	Vehicles as of 06/98 Crashsignal	N3/10 8— (——••)— 48 (8A) (16D)	Ignition: ON	< 1 V	Wiring, Readout DTC memory for SRS

Electrical Test Program – Sequential Multiport Fuel Injection System Test





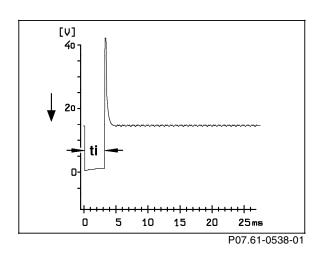


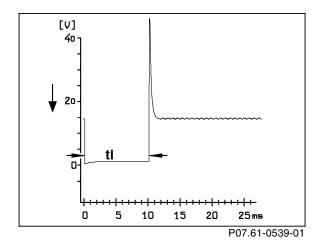
Figure 1

B28 Pressure sensor only USA

Figure 2 TN signal

Figure 3
Injection duration "ti" at CTP

Electrical Test Program – Sequential Multiport Fuel Injection System Test



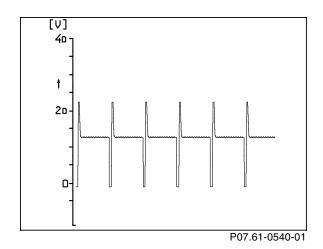


Figure 4
Injection duration "ti" at WOT

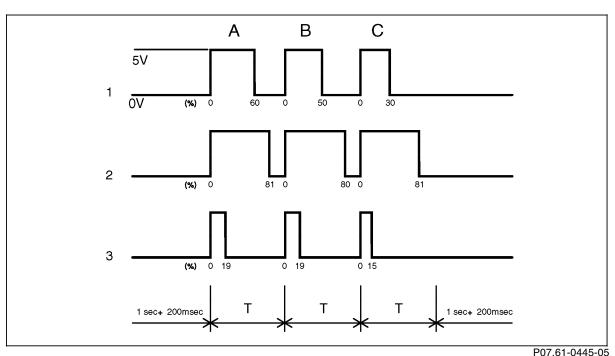
Figure 5
Y58/1 Purge control valve

Electrical Test Program – Sequential Multiport Fuel Injection System Test

Figure 6

Oil Sensor (B40) Signal Survey

- Sensor signal sensitivity ok
- Sensor signal sensitivity > 80%
 - A Oil temperature > +160° C
 - B Oil level > 80mm
 - C Oil quality good
- 3 Sensor signal sensitivity < 20%
 - A Oil temperature < -40° C
 - B Oil level < 0 mm
 - C Oil quality poor



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Electrical Test Program – Ignition System Test

∴ WARNING!

type of ignition system.

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components. Persons with heart pacemakers are not to perform repairs on this

Preparation for Test:

- 1. Review 11, 21, 22 entirely.
- 2. Ignition: OFF
- 3. Connect test cable with socket box to engine control module (N3/10), as per connection diagram, see 22

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0	PO 560	Engine control module (N3/10) Voltage supply circuit 30	N3/10 □□□□□ 3 — (→ □V →) — 1: (3A) (4E)		11 – 14 V	⇒ 1.1 – 1.2
1.1		Ground wire	l	2 4 2	11 – 14 V	Wiring, Model 202/208/210: Output ground (W16/6), right component compartment. Model 163: Ground (W16), component compartment. ⇒ 1.2

Electrical Test Program – Ignition System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.2		Voltage supply circuit 30	X11/4 1 — (→ () → 12	Ignition: ON Model 163: Connect socket 4 to 16- pole connector.	11 – 14 V	Wiring, Passenger-side fuse and relay module box (K40/4) or Fuse and relay box (F1).
2.0	PO 560	Engine control module (N3/10) Voltage supply circuit 87	N3/10 		11 – 14 V	⇒ 2.1 – 2.2
2.1		Electronics ground	N3/10 		11 – 14 V	Wiring, Models 202/208/210: Output ground (W16/6), right component compartment. Model 163: Ground (W16), component compartment.
2.2		Voltage supply circuit 87	X11/4 1 — (→ () +) — 2	Ignition: ON Model 163: Connect socket 4 to 16- pole connector. Ignition: OFF	11 – 14 V < 1 V	Wiring, Passenger-side fuse and relay module box (K40/4) or fuse and relay box (F1f22).

Electrical Test Program – Ignition System Test

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
3.0	Ignition coil (T1/1) Cylinder 1 Voltage supply Primary coil a	N3/10 3 — 124 (3A) (20F) N3/10		11 – 14 V	Wiring, Models 202/208/210: Fuses in passenger-side fuse and relay module box (K40/4f6), Model 163:
	Voltage supply Primary coil b	3 — 125 (3A) (21F)			Fuse and relay box (F1f26), Ignition coil (T1/1).
4.0	Ignition coil (T1/2) Cylinder 2 Voltage supply Primary coil a	N3/10 3 — — — — 121 (3A) (17F)	Ignition: ON	11 – 14 V	Wiring, Models 202/208/210: Fuses in passenger-side fuse and relay module box (K40/4f6), Model 163:
	Voltage supply Primary coil b	N3/10 3 → 120 (3A) (16F)			Fuse and relay box (F1f26), Ignition coil (T1/2).

Electrical Test Program – Ignition System Test

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
5.0	Ignition coil (T1/3) Cylinder 3 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 — — — — — — — — — — — — — — — — — —	Ignition: ON	11 – 14 V	Wiring, Models 202/208/210: Fuses in passenger-side fuse and relay module box (K40/4f6), Model 163: Fuse and relay box (F1f26), Ignition coil (T1/3).
6.0	Ignition coil (T1/4) Cylinder 4 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 — — — — — — — — — — — — — — — — — —	Ignition: ON	11 – 14 V	Wiring, Models 202/208/210: Fuses in passenger-side fuse and relay module box (K40/4f6), Model 163: Fuse and relay box (F1f26), Ignition coil (T1/4)

Electrical Test Program – Ignition System Test

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
7.0	Ignition coil (T1/5) Cylinder 5 Voltage supply Primary coil a Voltage supply Primary coil b	N3/10 3 — — — — — — 109 (3A) N3/10 N3/10 N3/10 N3/10 N3/10 N3/10	Ignition: ON	11 – 14 V	Wiring, Models 202/208/210: Fuses in passenger-side fuse and relay module box (K40/4f6), Model 163: Fuse and relay box (F1f26), Ignition coil (T1/5).
8.0	Ignition coil (T1/6) Cylinder 6 Voltage supply Primary coil a Voltage supply Primary coil b	(3A) (4F) N3/10 3 — 123 (3A) (19F) N3/10 N3/10 N3/10 N3/10 (18F)	Ignition: ON	11 – 14 V	Wiring, Models 202/208/210: Fuses in passenger-side fuse and relay module box (K40/4f6), Model 163: Fuse and relay box (F1f26), Ignition coil (T1/6).

Electrical Test Program – Ignition System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
9.0	PO 335	CKP sensor (L5) Signal	N3/10 93 — — — — 94 (37E) (38E)	Test with oscilloscope. Starter: Crank Engine: at Idle	Signal: see Figure 1 and 3.	⇒ 1.1, Teeth on starter ring gear.
		Voltage	N3/10 93 — — — — — 94 (37E) (38E)	Test with multimeter only if oscilloscope is unavailable. Starter: Crank Engine: at Idle	> 2.0 V > 5 V Voltage increases with increasing rpm.	
9.1		Resistance of CKP sensor (L5)		Ignition: OFF Unplug connector E on engine control module (N3/10).	(at 20°C): 600 – 1200 Ω	Wiring, L5

Electrical Test Program – Ignition System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
10.0	PO 341	Camshaft Hall-effect sensor (B6/1) Hall-effect signal	N3/10 95 — (→ - ⊕ + →) — 9 (39E) (40E		Signal: see Figure 2 and 3.	⇒ 10.1, Wiring, B6/1
		Voltage	N3/10 96 — (— ① —)— (40E) (2A		1.2 – 2.2 V Value changes.	
10.1		Voltage supply to camshaft Hall-effect sensor (B6/1)	B6/1 1 — (→ - ① → ·) —	Ignition: ON Disconnect connector from Hall-effect sensor (B6/1) and test directly on sockets 1 (brown/green) and 3 (red/blue) of connector.	11 – 14 V	Wiring.

Electrical Test Program – Ignition System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
11.0	PO 300 PO 301	Primary voltage Ignition coil (T1/1), Cylinder 1 Primary circuit a	N3/10 124—(———————————————————————————————————	Test connection Note: Individual primary pattern Range: 400 V Duration: 100%	200 – 350 V	⇒ 11.1
		Primary circuit b	N3/10 125—(———————————————————————————————————	Starter: Crank		
11.1		Primary winding of T1/1 Primary circuit a and b	N3/10 124—(———————————————————————————————————	Ignition: OFF	$0.9-1.6~\Omega$ The resistance of a single coil at 20° C is approx. $0.6~\Omega$.	Wiring, T1/1
12.0	PO 300 PO 302	Primary voltage Ignition coil (T1/2), Cylinder 2 Primary circuit a	N3/10 121—(——————————————————————————————————	Test connection Note: Individual primary pattern Range: 400 V Duration: 100%	200 – 350 V	⇒ 12.1
		Primary circuit b	N3/10 120—(———————————————————————————————————	Starter: Crank		

Electrical Test Program – Ignition System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
12.1		Primary winding of T1/2 Primary circuit a and b	N3/10 120—(- ① +)—121 (16F) (17F)	Ignition: OFF	$0.9-1.6~\Omega$ The resistance of a single coil at 20° C is approx. $0.6~\Omega$.	Wiring, T1/2
13.0	PO 300 PO 303	Primary voltage Ignition coil (T1/3), Cylinder 3 Primary circuit a	N3/10 110—(——————————————————————————————————	Test connection Note: Individual primary pattern Range: 400 V Duration: 100% Starter: Crank	200 – 350 V	⇒ 13.1
		Primary circuit b	111— (———————————————————————————————————			
13.1		Primary winding of T1/3 Primary circuit a and b	N3/10 110—(—— ——)—111 (6F) (7F)	Ignition: OFF	$0.9-1.6~\Omega$ The resistance of a single coil at 20° C is approx. $0.6~\Omega$.	Wiring, T1/3

Electrical Test Program – Ignition System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
14.0	PO 300 PO 304	Primary voltage Ignition coil (T1/4), Cylinder 4 Primary circuit a	N3/10 	Test connection Note: Individual primary pattern Range: 400 V Duration: 5 millisec.	200 – 350 V	⇒ 14.1
		Primary circuit b	N3/10 118—(——————————————————————————————————	Starter: Crank		
14.1		Primary winding of T1/4 Primary circuit a and b	N3/10 117— (——②+—)—118 (13F) (14F)	Ignition: OFF	$0.9-1.6~\Omega$ The resistance of a single coil at 20° C is approx. $0.6~\Omega$.	Wiring, T1/4
15.0	PO 300 PO 305	Primary voltage Ignition coil (T1/5), Cylinder 5 Primary circuit a	N3/10 109—(———————————————————————————————————	Duration: 5 millisec.	200 – 350 V	⇒ 15.1
		Primary circuit b	N3/10 108—(———————————————————————————————————	Starter: Crank		

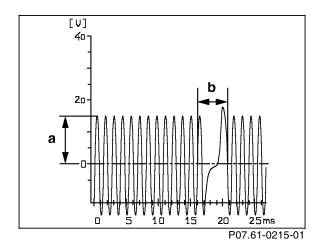
Electrical Test Program – Ignition System Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
15.1		Primary winding of T1/5 Primary circuit a and b	N3/10 108—(Ignition: OFF	$0.9-1.6~\Omega$ The resistance of a single coil at 20° C is approx. $0.6~\Omega$.	Wiring, T1/5
16.0	PO 300 PO 306		N3/10 123—(———————————————————————————————————	Test connection Note: Individual primary pattern Range: 400 V Duration: 5 millisec. Starter: Crank	200 – 350 V	⇒ 16.1
16.1		Primary winding of T1/6 Primary circuit a and b	N3/10 122—(—— ① —— 123 (18F) (19F)	Ignition: OFF	$0.9-1.6~\Omega$ The resistance of a single coil at 20° C is approx. $0.6~\Omega$.	Wiring, T1/6

Electrical Test Program – Ignition System Test

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
17.0		Engine analyzer - -(‡)+-	Test connection Note: See DM, Engines, Vol. 1, section C Starter: Crank	8 – 20 kV The resistance of the secondary winding can not be measured due to an installed diode.	Spark plugs, N3/10

Electrical Test Program – Ignition System Test



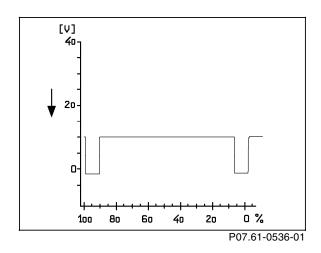


Figure 1
CKP sensor (L5) signal, shown at idle
b=2 missing teeth for cylinder 1 recognition

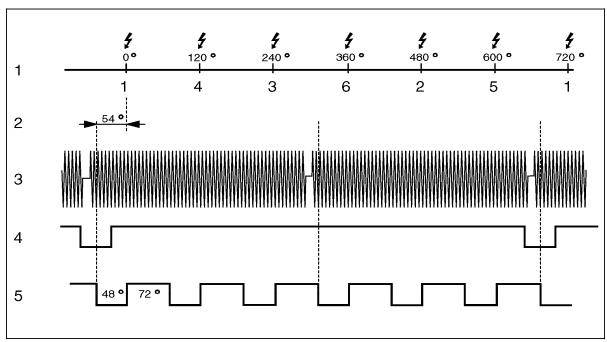
Figure 2 Camshaft Hall-effect sensor (B6/1) signal

Electrical Test Program – Ignition System Test

Signal survey

Figure 3

- 1 Crank angle (CKA)
- 2 Cylinder
- 3 CKP sensor (L5) signal
- 4 Camshaft Hall-effect sensor (B6/1) signal
- 5 Engine rpm signal TNA



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Electrical Test Program – Electronic Accelerator (EA) Test

∴ WARNING!

Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components. Persons with heart pacemakers are not to perform repairs on this type of ignition system.

Preparation for Test:

- 1. Review 11, 21, 22 entirely.
- 2. Readout DTC's in engine control module (N3/10), review 11
- 3. Ignition: OFF
- 4. Connect test cable with socket box to engine control module (N3/10), as per connection diagram (see section 0).

\Rightarrow		Test scope	Test connection		Test condition	Nominal value	Possible cause/remedy
1.0	PI 542 PO 507	Pedal value sensor (B37) Signal Nominal value potentiometer 1	N3/10) — 16 (24C)	Ignition: ON Accelerator pedal position: CTP WOT with kick-down	0.2 – 0.5 V 4.3 – 4.8 V	⇒ 1.1, Wiring, B37
1.1		Voltage supply Nominal value potentiometer 1 (Hall-sensor)	N3/10) — 14 (22C)	Ignition: ON	4.75 – 5.25 V	Wiring, N3/10
2.0	PI 542 PO 507	Pedal value sensor (B37) Signal Nominal value potentiometer 2	N3/10 18 — (— ① — (26C)) — 17 (25C)	Ignition: ON Accelerator pedal position: CTP WOT with kick-down	0.1 – 0.4 V 2.1 – 2.5 V	⇒ 2.1, Wiring, B37

Electrical Test Program – Electronic Accelerator (EA) Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
2.1		Voltage supply Nominal value potentiometer 2	N3/10 18 — (—————————————————————————————————	Ignition: ON	2.25 – 2.75 V	Wiring, N3/10
3.0	PO 507 PO 120 PI 186 PI 580	EA/CC/ISC actuator (M16/6) Signal Actual value potentiometer 1	N3/10 	Ignition: ON Accelerator pedal position: CTP WOT or kick-down	4.0 – 4.6 V < CTP value	⇒ 3.1, Wiring, M16/6
		Actual value potentiometer 2	N3/10 88 — (— V —) — 90 (32E) (34E)	Accelerator pedal position: CTP WOT or kick-down	0.3 – 0.9 V > CTP value	
3.1		Voltage supply Actual value potentiometers 1 and 2	N3/10 	Ignition: ON	4.75 – 5.25 V	Wiring, N3/10

Electrical Test Program – Electronic Accelerator (EA) Test

\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
4.0	PI 1186 PI 580	EA/CC/ISC actuator (M16/6) Activation of actuator motor	l e e e e e e e e e e e e e e e e e e e	Ignition: ON Engine: at Idle ECT > 70 °C	0.8 – 2.3 V 1.0 – 2.5 V Value oscillates.	Wiring, M16/6, N3/10
		Actuator motor resistance	N3/10 105 — 106 (1F) (2F)	Ignition: OFF	< 10 Ω	
5.0		With AT only P/N recognition	N3/10 51 — — — — — — 2 (19D) (2A)	Ignition: ON Selector lever position: P/N R, D, 4, 3, 2, 1	11 – 14 V < 2.0 V	Wiring, Test ETC, see DM, Chassis & Drivetrain, Vol. 1.
6.0		Manual Transmission only Clutch engage/release switch (S40/2) Signal	N3/10 51 — — — — — 2 (19D) (2A)	'	< 1.0 V	Wiring, S40/2

Electrical Test Program – Electronic Accelerator (EA) Test

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
7.0	Manual Transmission only Backup lampswitch (S16/2) Signal	N3/10 3 — 46 (3A) (14D)		< 1.0 V	Wiring, S16/2

9.3 ME - SFI Engine 112

Electrical Test Program – Cruise Control (CC) Test



Risk of severe injury when touching ignition parts which produce high voltages. Do not touch ignition components.

Persons with heart pacemakers are not to perform repairs on this type of ignition system.

1. Review 22 entirely.

9.3 ME - SFI Engine 112

Electrical Test Program – Cruise Control (CC) Test

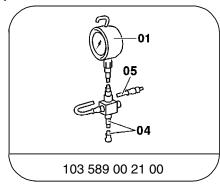
\Rightarrow		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
1.0	PO 565	CC switch (S40) V Decelerate/set	N3/10 □□□□ 3 —	Ignition: ON CC switch not activated.	< 1 V	Wiring, S40
		V Decelerate/set	(3A) (21D)	Decelerate activated.	11 – 14 V	
		SP Memory recall	N3/10 3 — — — — 54 (3A) (22D)	Memory activated.	11 – 14 V	
		B Accelerate/set	N3/10 □□□□□ 3 — () +	Accelerate activated.	11 – 14 V	
		A Off	N3/10 □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□	CC switch not activated. Off activated.	11 – 14 V < 1 V	
		Control contact		CC switch not activated. CC switch in position: Activate decelerate/ accelerate/memory/off	< 1 V	

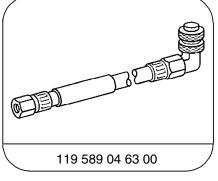
Hydraulic Test Program – Preparation for Test (Fuel System Pressure and Internal Leakage Test)

Preparation for Test

- 1. Review 11, 21, 22, 23, 24, 31, 33 entirely,
- 2. Review section 0,
- 3. Connect pressure gauge to test connection.
- 4. After completing test, using measurement glass (055), release fuel pressure and allow residual fuel to drain into glass (see Figure 1).

Special Tools





Tester Pressure hose

Hydraulic Test Program – Preparation for Test (Fuel System Pressure and Internal Leakage Test)

Connection Diagram

043 069 055

Figure 1

043 Pressure gauge, part no. 103 589 00 21 00

055 Measuring glass

069 Pressure hose, part no. 119 589 04 63 00

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Hydraulic Test Program – Test (Fuel System Pressure and Internal Leakage Test)

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy 1)
1.0	Fuel pressure at idle (with vacuum)	Pressure gauge connected to test connection.	Engine: at Idle Valve on pressure gauge closed.	3.7 – 4.2 bar	Check fuel pumps 34, Diaphragm pressure regulator.
2.0	Fuel system internal leakage test	Pressure gauge connected to test connection.	Engine: OFF	> 3.0 bar	If the pressure drops quickly: Replace check valve in fuel pumps.
			After 30 minutes	> 2.5 bar	If the pressure drops slowly: check injectors, see: 36 ⇒ 1.0, 2.0, Replace diaphragm pressure.

Observe Preparation for Test, see 31.

Hydraulic Test Program – Preparation for Test (Fuel Pump Test)

Connection Diagram - Delivery Test

Connect socket box tester to engine control module (N3/10)

Note:

When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.

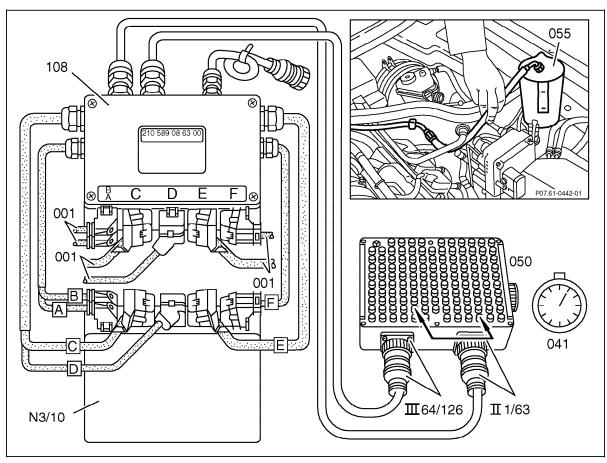
Figure 1

001 Engine control module connectors A-F 041 Stop watch 050 Socket box tester, 126 pole 055 Measuring glass

108 Test cable

N3/10 Engine control module (ME-SFI) II1/63 Connectors, socket box

III64/126 Connectors, socket box

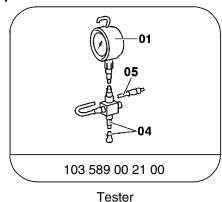


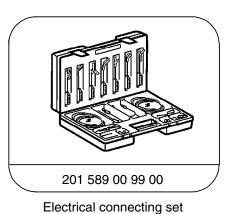
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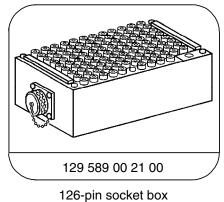
ME - SFI 33/1 9.3 Diagnostic Manual • Engines • 10/01

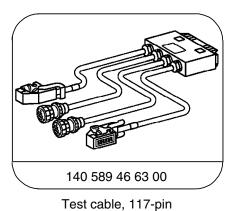
Hydraulic Test Program – Preparation for Test (Fuel Pump Test)

Special Tools









Conventional tools, test equipment

The state of the s					
Description	Brand, model, etc.				
Multimeter 1)	Fluke models 23, 83, 85, 87				
Stop watch	Local purchase				
Measuring glass (1 liter minimum)	Local purchase				

¹⁾ Available through the MBUSA Standard Equipment Program.

Hydraulic Test Program – Test (Fuel Pump Test)

Preparation for Test:

- 1. Review 11, 21, 22, 23, 24, 31, 33,
- 2. Review section O,
- 3. Connect socket box to engine control module (N3/10).



When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.

\Rightarrow	•	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy 1)
1.0		Fuel pump Delivery capacity	N3/10 	Disconnect fuel return hose from fuel line and place end in measuring glass. Ignition: ON	1 liter of fuel within 35 seconds.	Check fuel lines for restrictions (kinks and dents). Replace fuel filter or diaphragm pressure regulator, ⇒ 2.0
2.0		Fuel pumps Current draw		Models 202/208/210: Remove FP relay module (K27), connect multimeter on sockets 2 and 8. Model 163: Remove fuel pump relay (F1k3), connect multimeter on sockets 30 and 87. Ignition: ON	4 – 9 A	Fuel pump

¹⁾ Observe Preparation for Test, see 33.

Hydraulic Test Program – Preparation for Test (Injector Test)

Preparation for Test

- 1. Review section O,
- 2. Review 11, 21, 22, 23, 24, 31, 33,
- 3. Connect socket box tester to engine control module (N3/10).
- 4. Disconnect 2-pole connectors on injectors.
- Remove fuel rail with injectors, thereby **not** disconnecting the fuel feed and return lines.
- 6. Connect self-made harness (048) to each injector one after another.
- 7. Hold each injector in measuring glass one after another.



When disconnecting the connectors on the engine control module remove center connector (D) first, when reconnecting connectors install center connector (D) last.

Figure 1

001 Engine control module connectors A–F

048 Self made harness

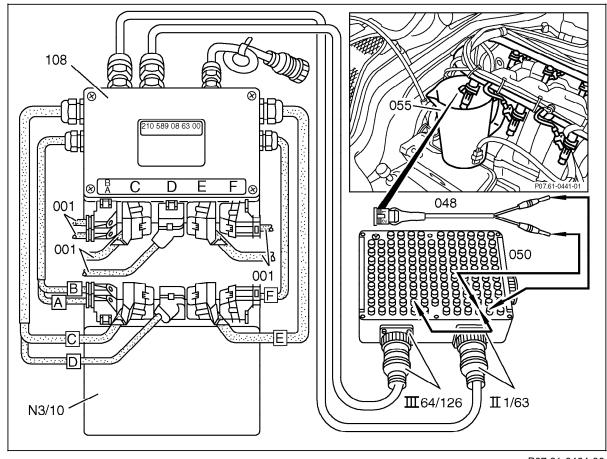
050 Socket box tester, 126 pole

055 Measuring glass

108 Test cable

N3/10 Engine control module (ME-SFI)

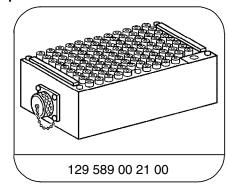
III /63 Connectors, socket box Connectors, socket box

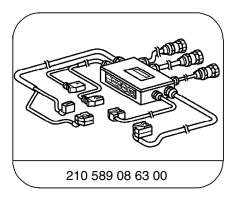


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Hydraulic Test Program – Preparation for Test (Injector Test)

Special Tools





126-pin socket box

145-pin test cable

Conventional tools, test equipment

Description	Brand, model, etc.
Measuring glass (1 liter minimum)	Local purchase

Hydraulic Test Program – Preparation for Test (Injector Test)

Self made harness

Consists of:

1x Connector (140 545 35 28)

2x Contact spring (004 545 56 26)

1x Banana plug (red)

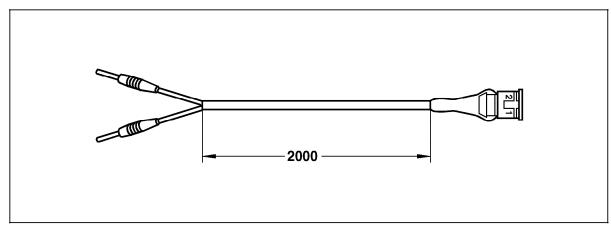
1x Banana plug (black)

2.2m Wire (red, 1.5 mm)

2.2m Wire (brown, 1.5 mm)

2.2m Harness tubing (6mm diameter)

Connector layout 1=red 2=brown



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Hydraulic Test Program – Test (Injector Test)

\Rightarrow	Test scope	Test connection	Test condition	Nominal value	Possible cause/remedy
1.0	Injectors Leakage test	N3/10 3 (3A) 21 (29C)	Fuel rail and fuel injectors removed. Ignition: ON	Injectors must not drip.	⇒ 2.0, Replace any dripping injectors.
2.0	Injectors Operation and spray pattern test	N3/10 3 (3A) 21 (29C)	Ignition: ON Hold each injector (one after another) into a container and, using the self-made test harness, manually activate the injector by connecting harness banana plugs to socket box sockets 3 (–) and 2 (+).	Injectors must spray evenly (Figure 1).	Replace defective injectors.

Hydraulic Test Program – Test (Injector Test)

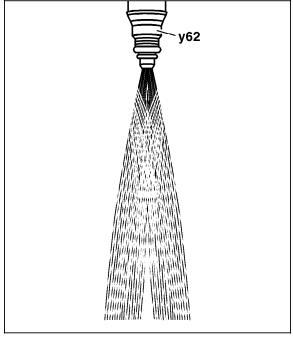


Figure 1 Y62 Injector Correct spray pattern

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