3.1 Engines 104, 119

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Preliminary work: . . . . . Engine Test and Adjustment, Engines, Volume 1

On-Off Ratio Test

The on-off ratio tests the operation of the O2S (Lambda) control system and additionally, recognizes certain malfunctions present during the test. Malfunctions are distinguished between those that occur with the **Ignition: ON** and those that occur with the **Engine: at CTP (idle).**
The on-off ratio can be checked with the on-off ratio tester or with the engine analyzer. For this purpose, the purge line to the engine must be disconnected at the purge control valve and closed with a plug. Check on-off ratio at closed throttle speed and at 2500 rpm. A readout of 50% or an oscillating needle indicates that all input signals and the O2S control system are OK. Readouts of 10% to 90% or 95% refer to a particular malfunction source (see Malfunction Tables). In addition, after testing the on-off ratio, an impulse readout **must be performed** using the impulse counter scan tool.

Diagnostic Trouble Code (DTC) Readout with Impulse Counter Scan Tool.

Malfunctions which occur while starting or with the engine running are recorded by a malfunction counter. Malfunctions are assigned a specific value according to malfunction severity (e.g. hot wire MAF sensor 128, ECT sensor 32). The malfunction counter counts in stages up to a threshold value of 255. After reaching the threshold value of 128, intermittent malfunctions are stored into memory after switching off the ignition. Malfunctions which affect engine operation (128) are immediately stored into DTC memory by the malfunction counter after switching off the ignition.

If a malfunction is no longer present during a subsequent engine start or engine operation, the total value recorded by the malfunction counter is reduced by 1 every time the engine is switched off. This procedure repeats itself until the malfunction counter is cleared.

Stored malfunctions (DTC's) can be read with the impulse counter scan tool at the data link connector (X11/4). (Also see DM, Engines, Volume 2, section 5.)

⚠

The DTC memory readout must be performed with the engine OFF and the ignition switched ON.

Malfunctions occurring in the following areas are stored immediately:

- CMP sensor,
- Hot-wire MAF sensor,
- Injectors.

A malfunction of the following is stored after more than 2 trips:

- TN-signal (input).

The memory remains active even if the vehicle's battery is disconnected.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

DTC's can be read with the impulse counter scan tool. Numbers ranging from 1 to 32 may appear on the display of the impulse counter scan tool. The number 1 indicates: No DTC recognized in system.
All further numbers refer to a particular malfunction source. If there are multiple system malfunctions, the malfunction assigned with the lowest number will be displayed first.
If the DTC number indicated first reappears after more than two DTC readouts, then no further malfunctions are stored in the system's memory.
After eliminating all malfunctions, they must be **cleared individually and the ignition must be switched off for a minimum of 15 seconds.**
In case of engine running complaints, the DTC memory must be read and the malfunction must be eliminated before proceeding with any additional repairs.

LH-SFI Control Module Self-Adaptation Feature
A self-adaptation feature for the emission control system is incorporated into the LH-SFI control module.
If malfunctions of the:

- Hot-wire MAF sensor,
- Injectors,
- Purge control valve,
- Diaphragm pressure regulator,
- Purge valve

occur or if intake air leaks are present, the LH-SFI control module conducts a self-adaptation process whereby the correction factors are continuously calculated and permanently stored.

After eliminating the mentioned malfunctions or after trial installation of a LH-SFI control module from another vehicle, the LH-SFI control module's self-adaptation feature must be reset to its mean value (see "Resetting LH-SFI Control Module's Self-Adaptation Feature to Mean Value" 11/4 or with HHT menu selection 5 "Self-Adaptation").
The LH-SFI control module will also adapt itself during the course of vehicle operation.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Notes for 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.

- 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 as shown on the HHT are listed in the DM, Engines, Volume 1, section A.

- Actual values for ECT, IAT and MAF.
  In case of an open or short circuit, the actual value is immediately replaced by a substitute value which is very close to the actual value. Therefore, a fault can not be recognized clearly. A readout of the fault is possible only via the diagnostic trouble code (DTC) memory.

- Actual value for engine rpm.
  In case of the engine rpm’s, the HHT display shows the closed throttle (idle) speed nominal value calculated by the control module on the left, and on the right, the rpm actual value. Both values should differ from each other only slightly. The permissible tolerances are not known.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Preparation for Test with Impulse Counter Scan Tool

- Connect impulse counter scan tool and on-off ratio tester according to connection diagram.
- **Reading Diagnostic Trouble Code (DTC) Memory**
  a) Ignition: **ON**
  b) Press start button for 2 to 4 seconds.
  c) Read and record DTC readout.
  d) Press start button again for 2 to 4 seconds.
  e) Read and record DTC readout.
  Repeat steps d) and e) until the first DTC reappears.

Clearing Diagnostic Trouble Code (DTC) Memory

a) Press start button for 2 to 4 seconds (DTC readout appears).
b) Wait 3 seconds, press start button for 6 to 8 seconds, thereby clearing the previously displayed DTC from memory.
c) Each stored DTC must be cleared individually.
d) Ignition: **OFF** and wait 15 seconds.

Check if all stored DTC's are eliminated.

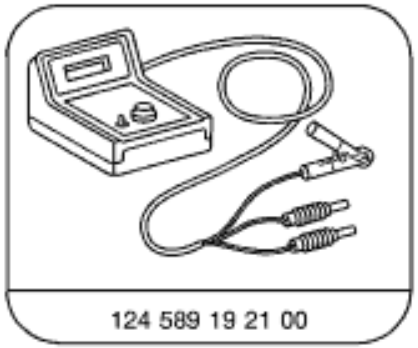
e) Ignition: **ON**
f) Repeat DTC readout. The number "1" (no DTC stored) must appear.

Resetting LH-SFI Control Module's Self-Adaptation Feature to Mean Value

After the number "1" appears on the display, press start button for 6 to 8 seconds.
Ignition: **OFF** and wait 30 seconds.

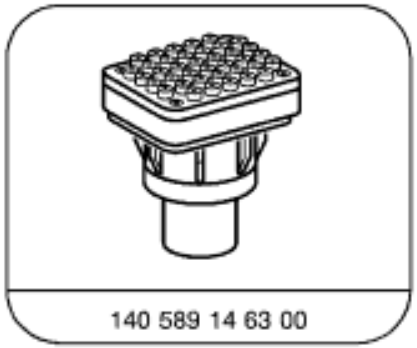
Diagnosis – Diagnostic Trouble Code (DTC) Memory

Special Tools



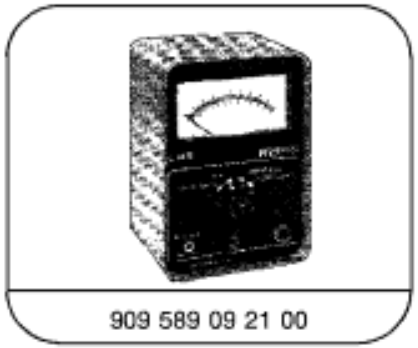
124 589 19 21 00

Pulse counter



140 589 14 63 00

Adapter



909 589 09 21 00

On-Off Ratio Tester

965 589 00 01 00

Hand-Held-Tester

965 589 00 40 00

Test cable

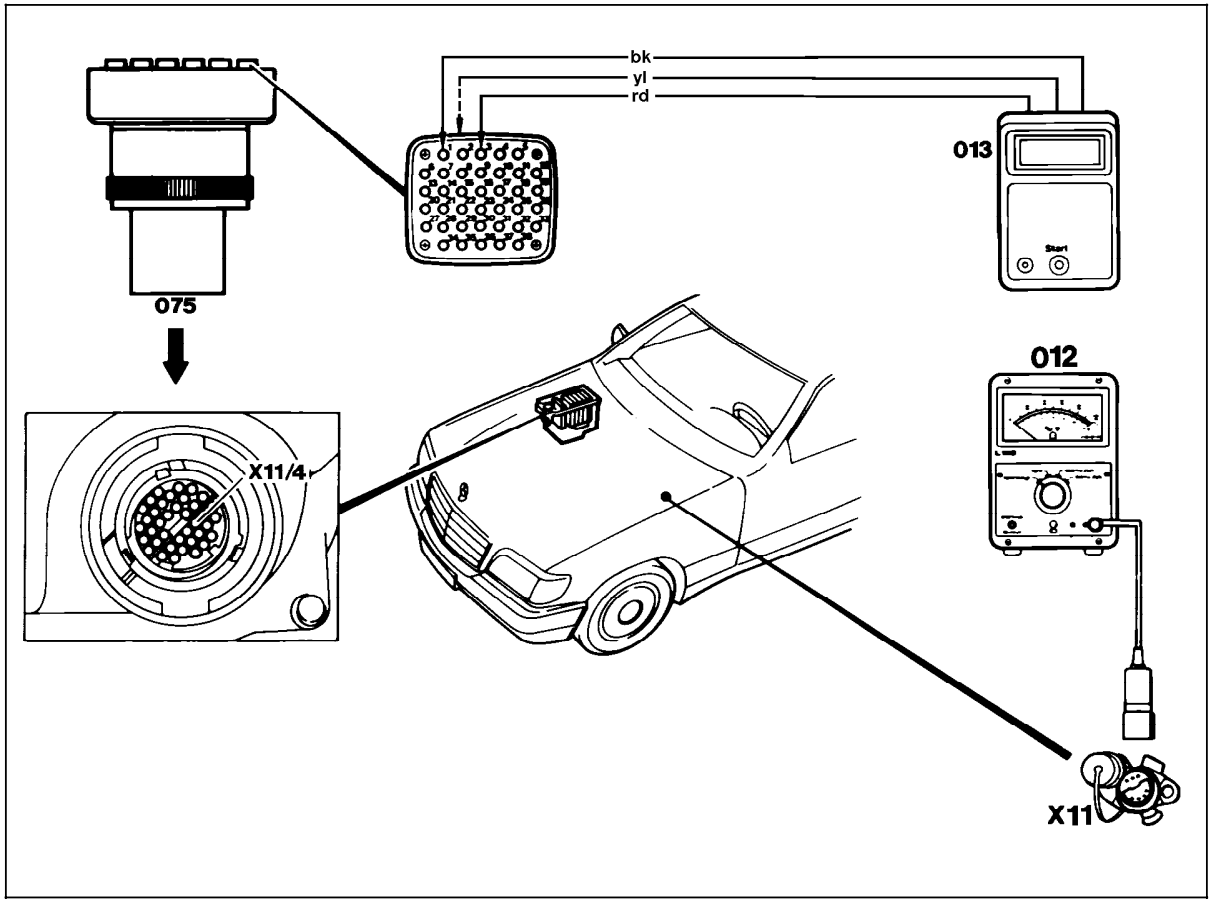
Diagnosis – Diagnostic Trouble Code (DTC) Memory

Connection Diagram - Impulse Counter Scan Tool and On-Off Ratio Tester or Engine Analyzer with Diagnostic Socket X11

Note:

Connect red wire of impulse counter scan tool to socket 3, black wire of impulse counter scan tool to socket 1, yellow wire of impulse counter scan tool as follows:

LH-SFI control module	Socket 4
DI control module	Socket 17
Base module	Socket 8
EA/CC/ISC control module	Socket 7
Diagnostic module	Socket 19



U07-5004-57

Figure 1

012	On-off ratio tester
013	Impulse counter scan tool
075	Impulse counter scan tool adaptor
X11	Diagnostic socket (9-pole)
X11/4	Data link connector (DTC readout)

Diagnosis – Diagnostic Trouble Code (DTC) Memory

Connection Diagram - Impulse Counter Scan Tool/ Hand-Held Tester and On-Off Ratio Tester without Diagnostic Socket X11

Note:

Connect red wire of impulse counter scan tool to socket 3, black wire of impulse counter scan tool to socket 1, yellow wire of impulse counter scan tool as follows:

LH-SFI control module	Socket	4
Base module	Socket	8
EA/CC/ISC control module	Socket	7
Diagnostic module	Socket	19
RPM signal (TN output)	Socket	13
On-off ratio readout	Socket	14
Circuit 31	Socket	1
Circuit 30	Socket	3

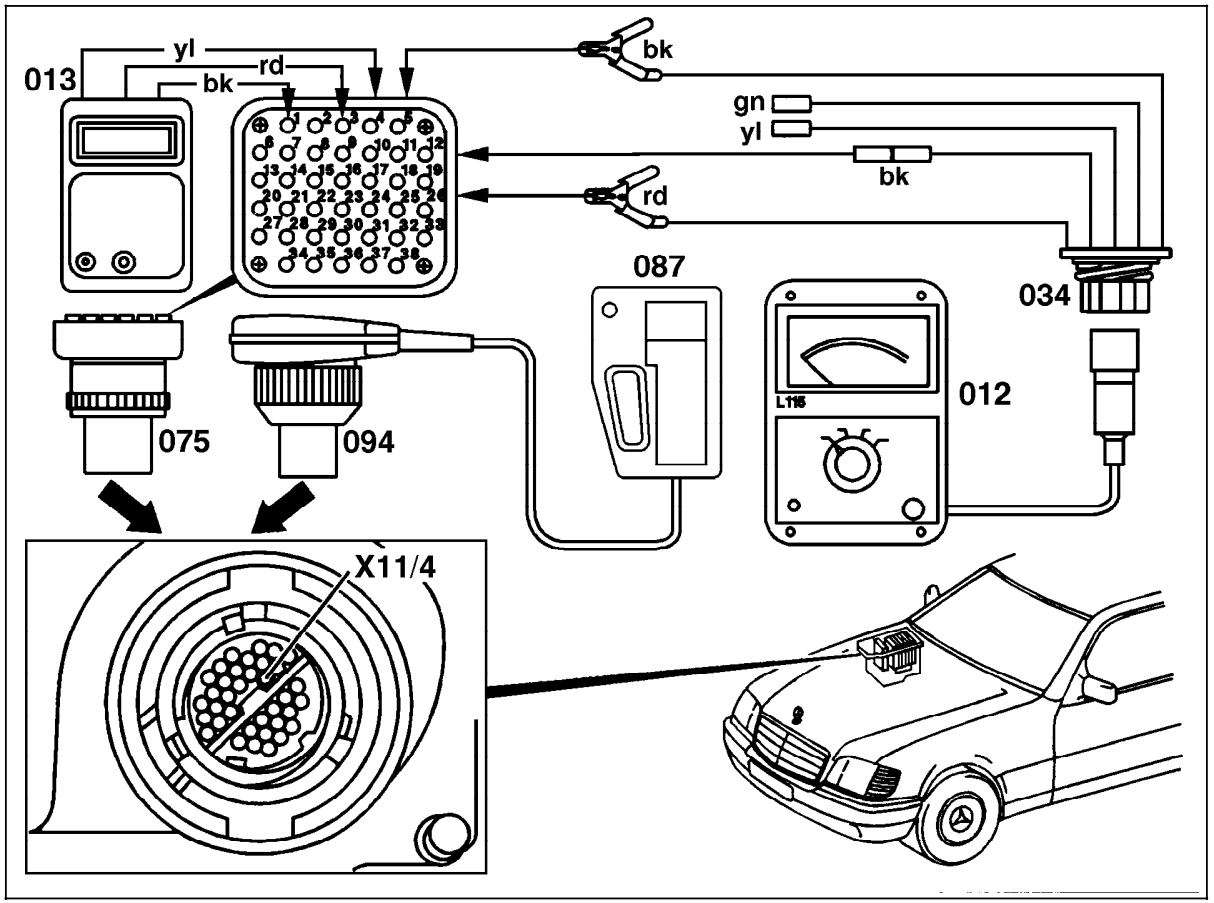


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Figure 2

012	On-off ratio tester
013	Impulse counter scan tool
034	Test cable Red alligator clip to socket 3 Black alligator clip to socket 1 Black male plug to socket 14 Green male plug not connected Yellow male plug not connected
075	Impulse counter scan tool adaptor
087	Hand-Held Tester (optional with impulse counter scan tool
094	Multiplex cable
X11/4	Data link connector (DTC readout)

Diagnosis – Diagnostic Trouble Code (DTC) Memory

a) On-Off Ratio Test, Ignition: ON

On–Off Ratio %	Possible cause	Test step/Remedy [1]
0	Voltage supply from socket 3 of data link connector (X11/4) open circuit	Repair harness
10	CTP (idle) recognition inactive	23 ⇒ 15.0
20	WOT (full load) recognition active	23 ⇒ 15.0
30	Engine coolant temperature < 70 °C or >110 °C	23 ⇒ 9.0, 10.0
40	Not used	
50	Input signals OK	
60	TN-signal (rpm signal) or CMP sensor signal not present while starting	23 ⇒ 12.0 – 14.0
70	Starter engaged	23 ⇒ 8.1
80	CAN-data exchange defective	23 ⇒ 39.0
90	Fuel safety shut-off active	Check CC/ISC (see DM, Engines, Volume 3, Section 7.1) or Check EA (see DM, Engines, Volume 3, Section 6.2)

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

b) On-Off Ratio Test, Engine: at CTP (idle)

On–Off Ratio %	Possible cause	Test step/Remedy [1]
0	Short circuit to battery + in wire to data link connector (X11/4), socket 3	Repair harness
10	CTP (idle) recognition applied constantly	23 ⇒ 15.0
20	Output of fuel injectors or one or more fuel injectors have open circuit	23 ⇒ 32.0, 33.0
30	ECT sensor (B11/2)	23 ⇒ 9.0, 10.1
40	Hot wire MAF sensor (B2/2)	23 ⇒ 5.0, 6.0
50 [2]	O2S 1 (before TWC) (G3/2) not operational or defective, open circuit	23 ⇒ 18.0 – 19.1
60	CMP sensor (L5/1)	23 ⇒ 14.0
70	TN-signal (rpm signal)	23 ⇒ 12.0, 13.0
80	CAN-data exchange defective	23 ⇒ 39.0 – 40.0 Either EA/CC/ISC control module, CC/ISC control module or DI control module not transmitting.

[1] Observe Preparation for Test, see 22.

[2] Needle oscillates if all monitored signals are OK.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

b) On-Off Ratio Test, Engine: at CTP (idle)

On–off Ratio %	Possible cause	Test step/Remedy [1]
90	Vehicle speed signal (VSS)	Check CC/ISC (see DM, Engines, Volume 3, section 7.1) or Check EA (see DM, Engines, Volume 3, section 6.2)
95	Deceleration shut-off active	Check CC/ISC (see DM, Engines, Volume 3, section 7.1) or Check EA (see DM, Engines, Volume 3, section 6.2)
100	No voltage at LH-SFI control module (N3/1)	23 ⇒ 1.0 – 3.0

[1] Observe Preparation for Test, see 22.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

c) LH-SFI Control Module DTC Readout

DTC	Possible cause	Test step/Remedy [1]
1	No malfunction in system	–
2	ECT sensor (B11/2) sensor circuit 1, open/short circuit	23 ⇒ 9.0
3	ECT sensor (B11/2) sensor circuit 2, open/short circuit	23 ⇒ 10.0
4 [2]	Voltage at hot wire MAF sensor (B2/2) insufficient or too high, or open circuit in ground wire at hot wire MAF sensor	23 ⇒ 5.0 – 6.0
5	Not used	–
6	Not used	–
7	TN-signal (rpm signal) incorrect or open/short circuit	23 ⇒ 12.0
8	CMP sensor (L5/1) signal, open/short circuit	23 ⇒ 14.0
9	Starter signal (circuit 50) missing, open/short circuit	23 ⇒ 8.1
10 [3]	CTP (idle) recognition from EA/CC/ISC control module (N4/1) or CC/ISC control module (N4/3), short circuit	23 ⇒ 15.0
11 [4]	Secondary air injection system, open/short circuit	23 ⇒ 23.0

1) Observe Preparation for Test, see 22.
2) DTC 4 can be displayed on vehicles up to 7/91 even if no fault is present.
3) DTC 10 can be displayed on vehicles up to 7/91 even if no fault is present.
4) DTC 11 can be displayed on vehicles up to 7/91 even if no fault is present.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

c) LH-SFI Control Module DTC Readout

DTC	Possible cause	Test step/Remedy [1]
12	Burn-off control for hot wire MAF sensor, open/short circuit	23 ⇒ 7.0
13	IAT sensor (B17/7), open/short circuit	23 ⇒ 11.0
14	Not used	–
15	Not used	–
16 [5]	EGR switchover valve (Y27), open/short circuit	23 ⇒ 20.0
17 [7]	No CAN data transmission with EA/CC/ISC control module (N4/1) or CC/ISC control module (N4/3)	23 ⇒ 39.0 or N4/1 or N4/3.
18 [6]	No CAN data transmission with DI control module (N1/3)	23 ⇒ 39.0 or N1/3.
19	Not used	–
20	No CAN data transmission from LH-SFI control module (N3/1)	23 ⇒ 40.0
21	O2S 1 (before TWC) (G3/2), open/short circuit	23 ⇒ 18.0

1) Observe Preparation for Test, see 22.
5) DTC 16 can be displayed on vehicles up to 7/91 even if no fault is present.
6) DTC 18 can be displayed on vehicles up to 7/91 even if no fault is present.
7) DTC 17 can be displayed even if no fault is present.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

c) LH-SFI Control Module DTC Readout

DTC	Possible cause	Test step/Remedy [1]
22	O2S 1 heater, open/short circuit	23 ⇒ 19.0
23	Purge control valve (Y58/1), open/short circuit	23 ⇒ 24.0
24 **(Engine 119 only)**	Left adjustable camshaft timing solenoid (Y49/1), open/short circuit	23 ⇒ 27.0
25	Adjustable camshaft timing solenoid, engine 104 (Y49) or right adjustable timing solenoid, engine 119 (Y49/2), open/short circuit	23 ⇒ 26.0
26	Upshift delay switchover valve (Y3/3), open/short circuit	23 ⇒ 34.0
27	Injectors (Y62), open/short circuit	23 ⇒ 32.0
28	LH-SFI control module coding, open circuit	23 ⇒ 43.0
29 **(Model 124.034 only)**	1GR start relay module (K29/1), open/short circuit	23 ⇒ 44.0

[1] Observe Preparation for Test, see 22.

Diagnosis – Complaint Related Diagnostic Chart

Complaint/Problem	Possible cause	Test step/Remedy [1]
Engine starts poorly	No TN-signal (rpm signal)	23 ⇒ 12.0
Engine starts poorly and accelerates poorly	Hot wire MAF sensor (B2/2) defective ECT sensor (B11/2) defective	23 ⇒ 5.0 – 6.0 23 ⇒ 9.0 – 10.0
Engine does not start	No voltage supply from base module (N16/1) FP relay module (K27) defective ECT sensor (B11/2) defective Injector control and injection timing	23 ⇒ 1.0 – 4.0 23 ⇒ 8.0 34 ⇒ 2.0 23 ⇒ 9.0 – 10.0 23 ⇒ 33.0
Engine runs uneven at CTP (idle)	EGR valve defective Injector control and injection timing	23 ⇒ 22.0 23 ⇒ 33.0
Engine has uneven idle and insufficient engine output	Camshaft timing adjustment defective	23 ⇒ 26.0 – 29.0

[1] Observe Preparation for Test, see 22.

Electrical Test Program - Component Locations

Engine 104

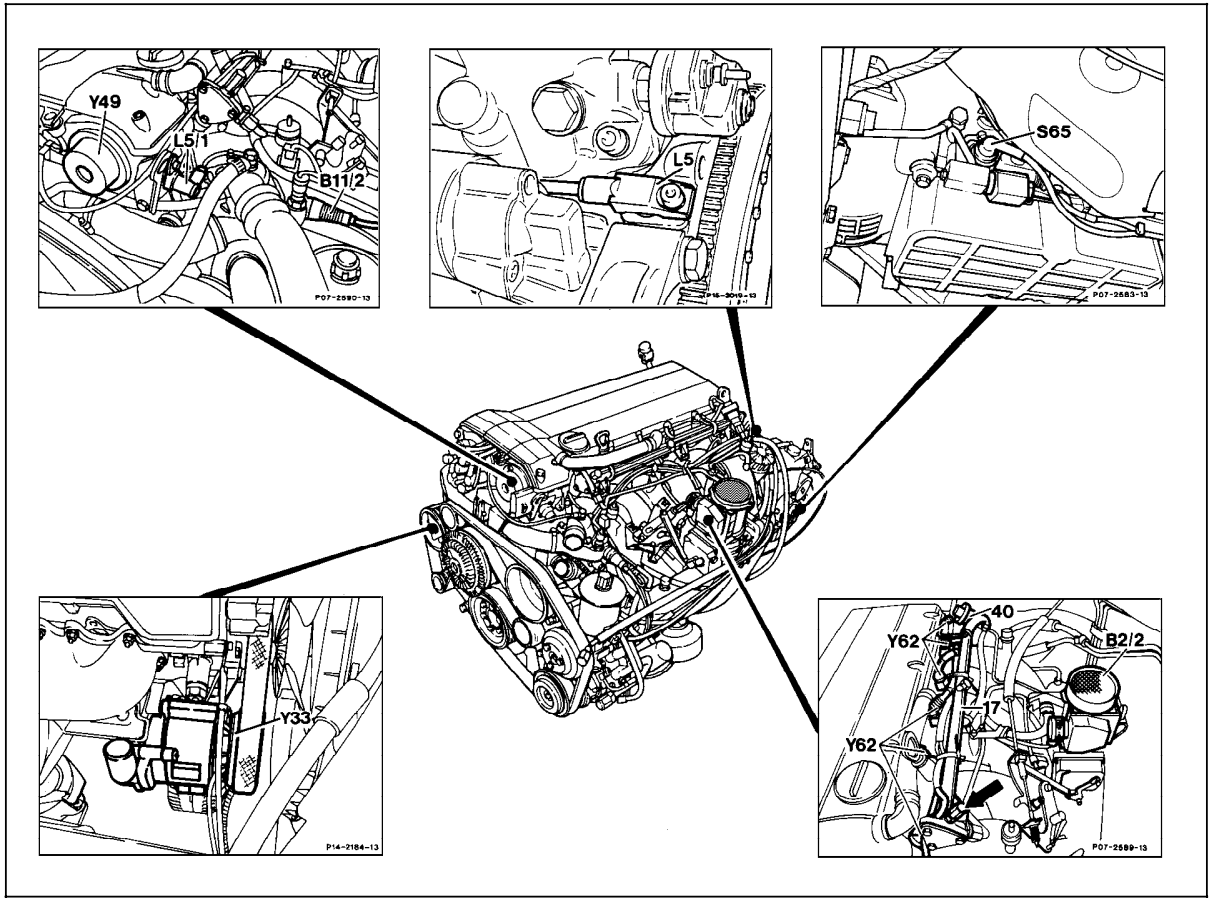

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Figure 1

B2/2	Hot wire MAF sensor
B11/2	ECT sensor (4-pole)
L5	CKP sensor
L5/1	CMP sensor
Y33	Electromagnetic AIR pump clutch
Y49	Adjustable camshaft timing solenoid
Y62	Injectors

Electrical Test Program - Component Locations

Engine 119

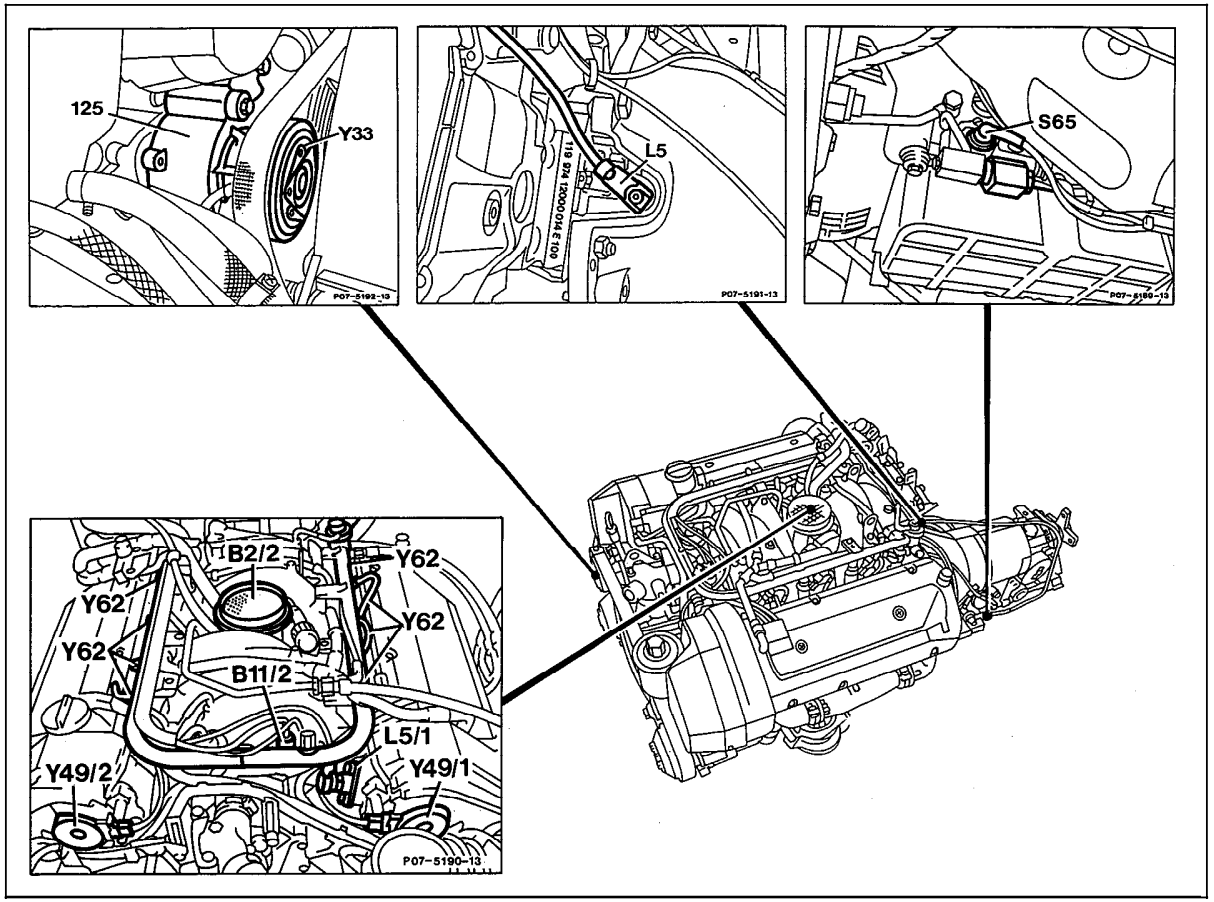

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Figure 2

B2/2	Hot wire MAF sensor
B11/2	ECT sensor (4-pole)
L5	CKP sensor
L5/1	CMP sensor
Y33	Electromagnetic AIR pump clutch
Y49/1	Left adjustable camshaft timing solenoid
Y49/2	Right adjustable camshaft timing solenoid
Y62	Injectors
125	AIR pump

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 124

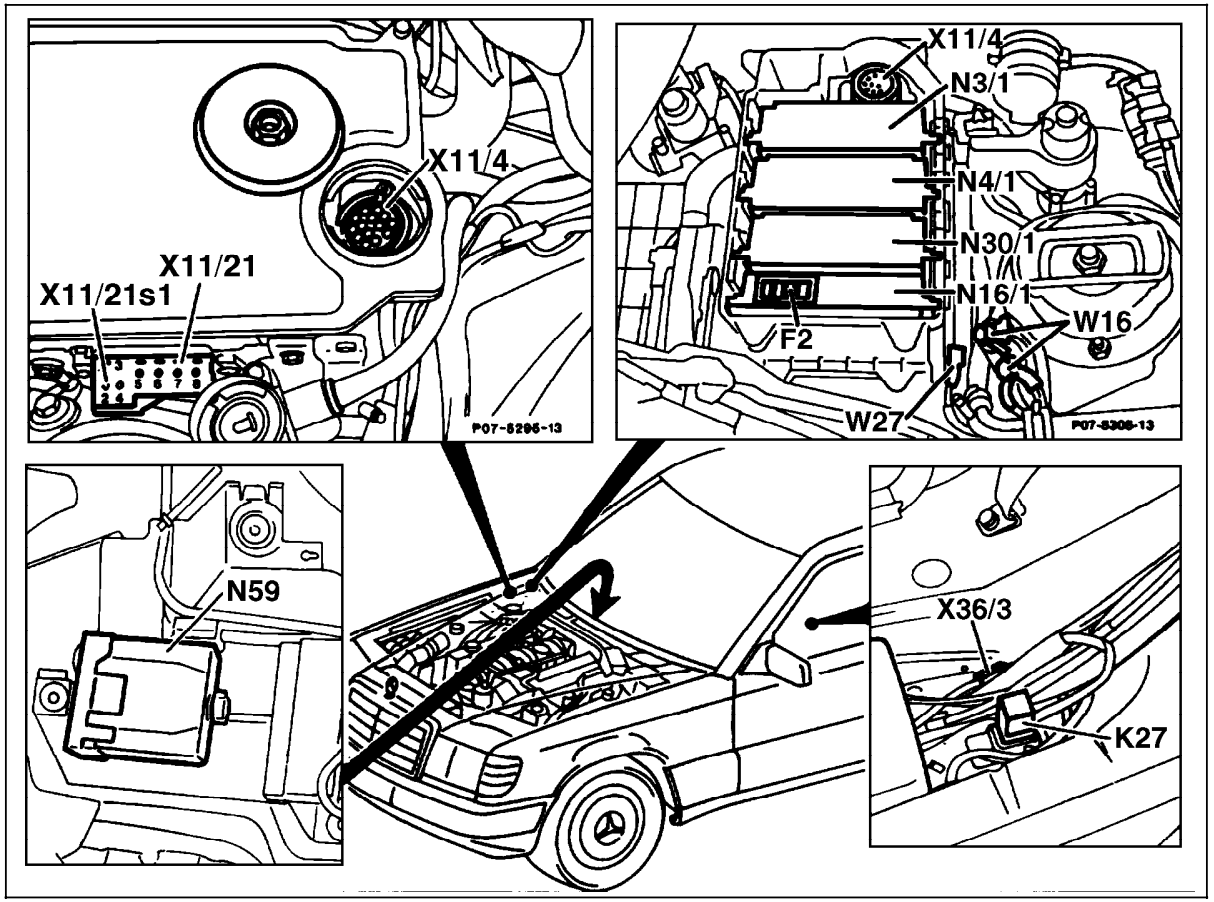

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Figure 3

K27	FP relay module
N3/1	LH-SFI control module
N4/1	EA/CC/ISC control module
N16/1	Base module (BM)
N59	Diagnostic module (OBD I)
X11/4	Data link connector (DTC readout)
X11/21	Diagnostic module test connector (3-pole)
	(USA) - California
X11/21s1	Pushbutton (with LED) (USA) - California
X36/3	FP harness connector (2-pole)

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 124

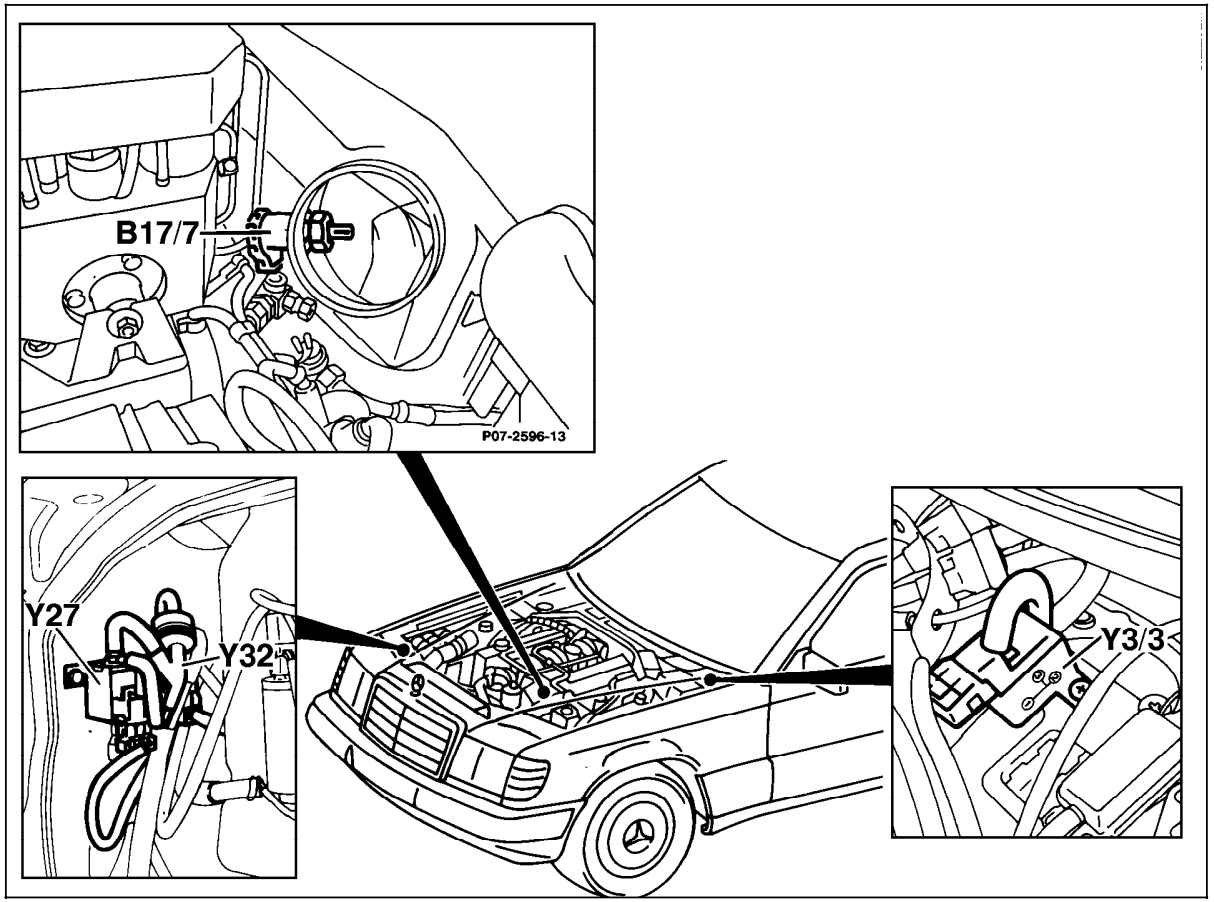

Figure 4

B17/7	IAT sensor
Y3/3	Upshift delay switchover valve
Y27	EGR switchover valve
Y32	AIR pump switchover valve

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 124

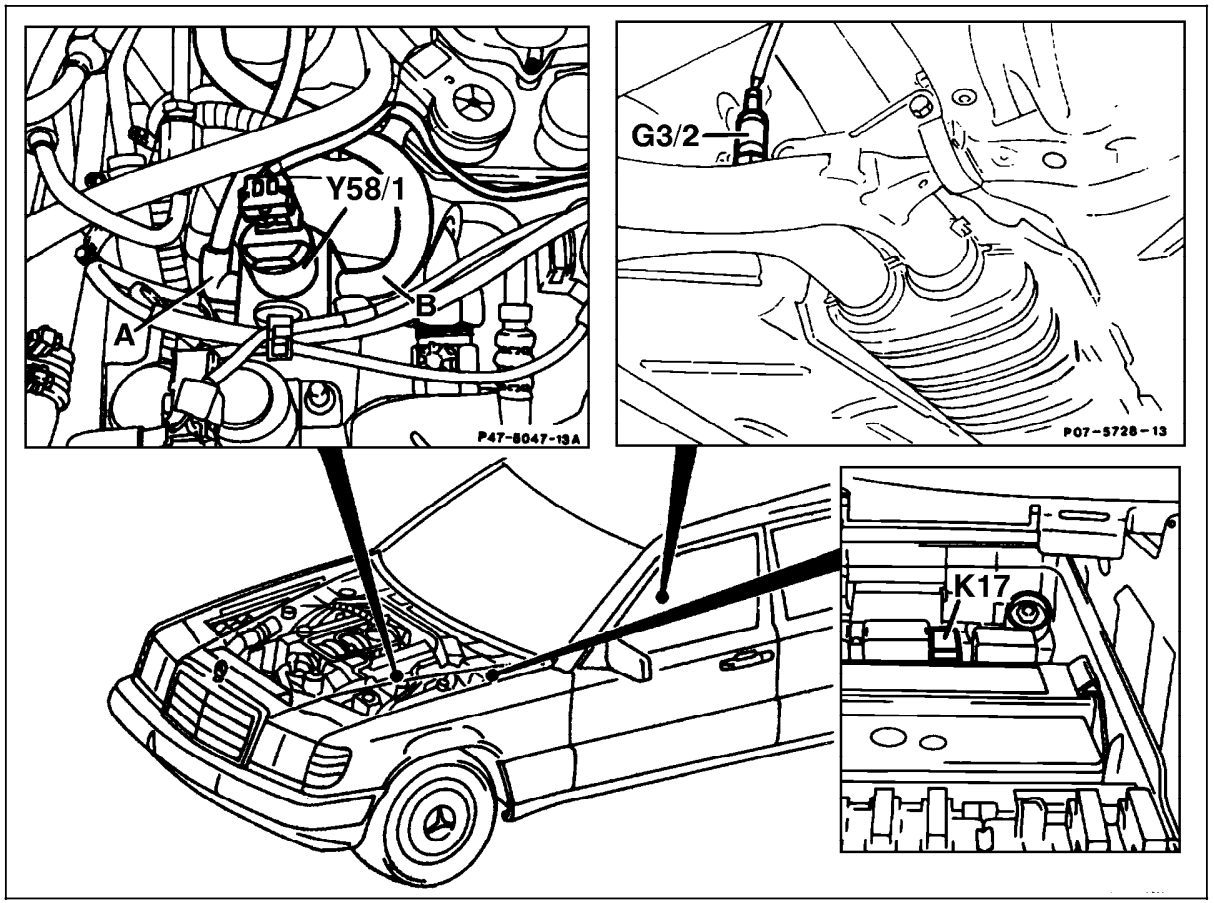

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Figure 5

G3/2	O2S 1 (before TWC)
K17	AIR relay module
Y58/1	Purge control valve
A	Purge line to engine
B	Purge line to charcoal canister

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 124

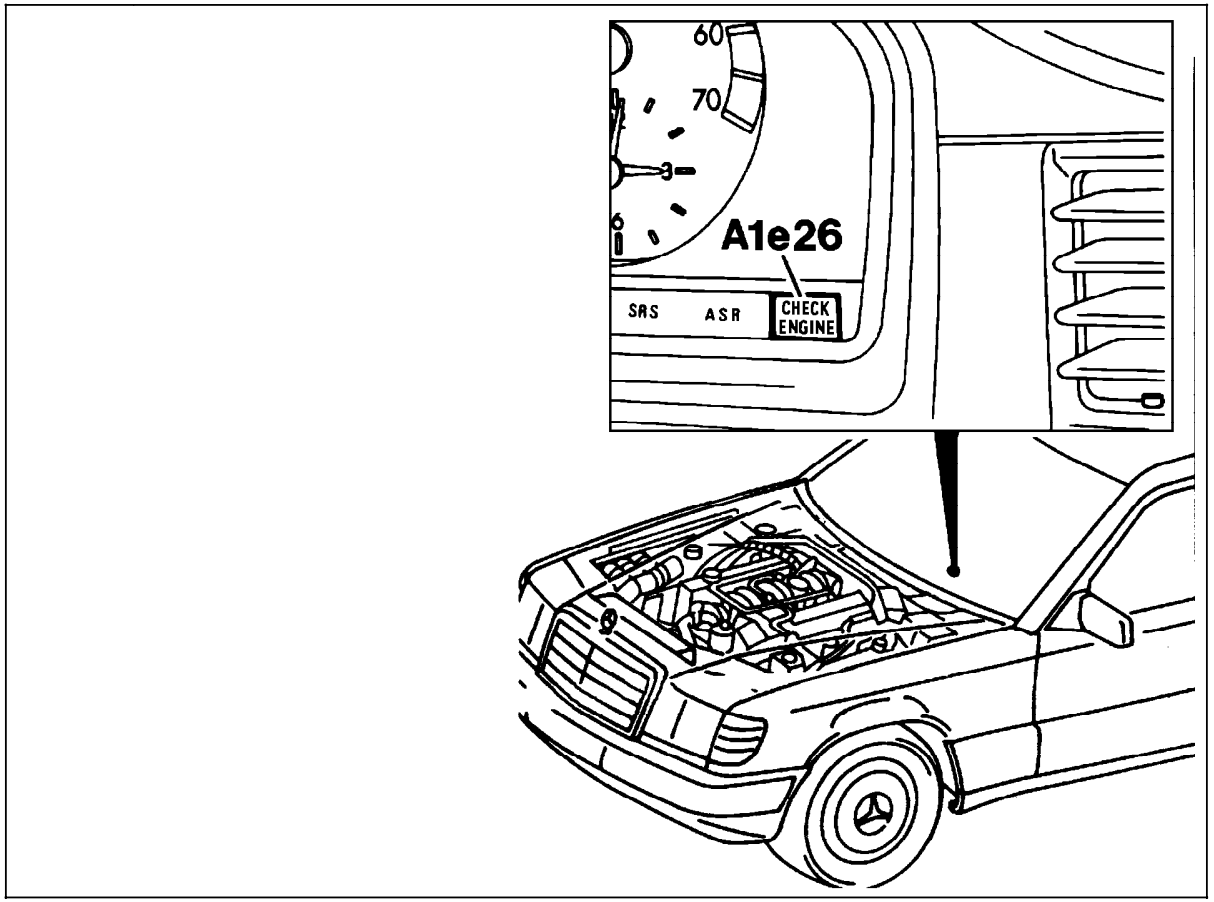

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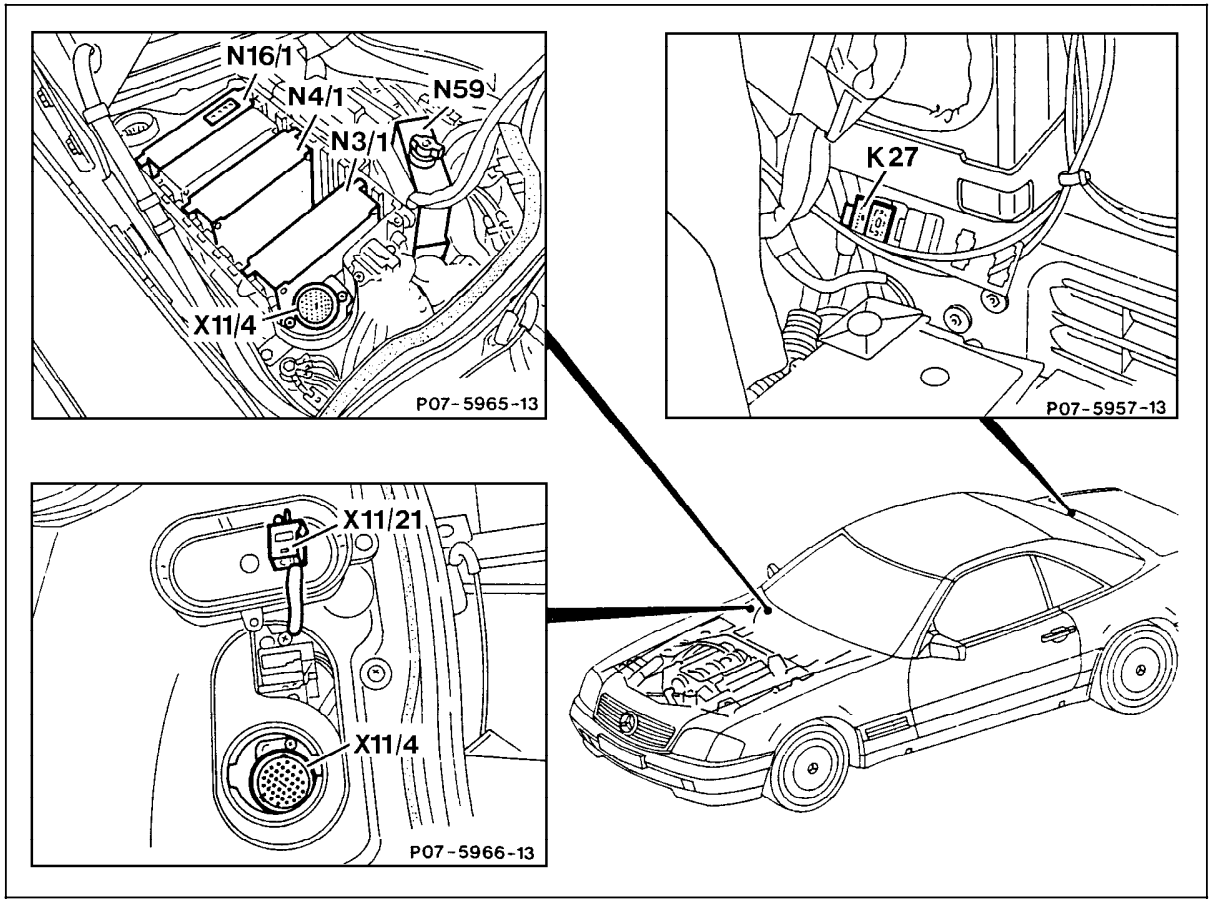
Figure 6
A1e26 “CHECK ENGINE” MIL

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 129



U07-5904-57

Figure 7

K27	FP relay module
N3/1	LH-SFI control module
N4/1	EA/CC/ISC control module
N16/1	Base module (BM)
N59	Diagnostic module (OBD I)
X11/4	Data link connector (DTC readout)
X11/21	Diagnostic module test connector (3-pole)
	(USA) - California

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 129

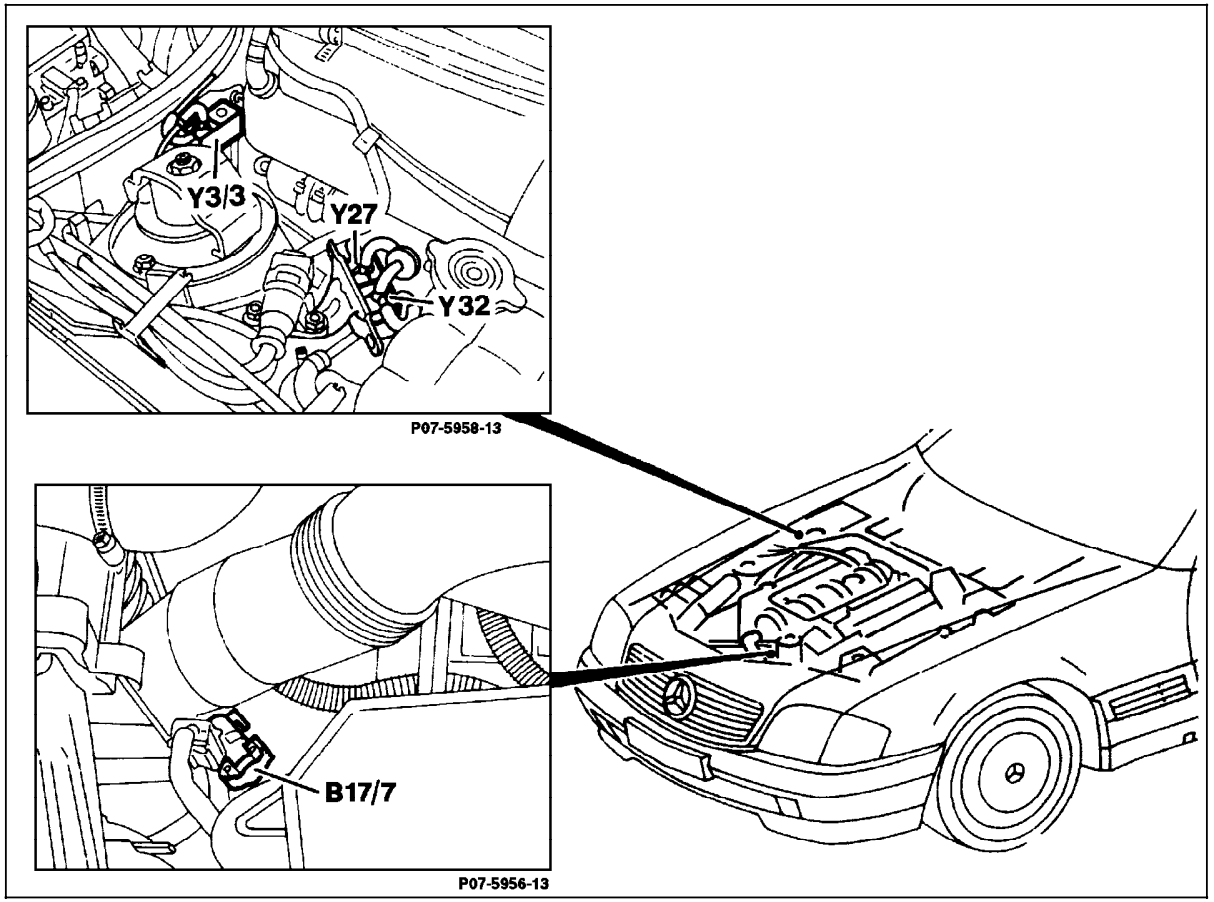
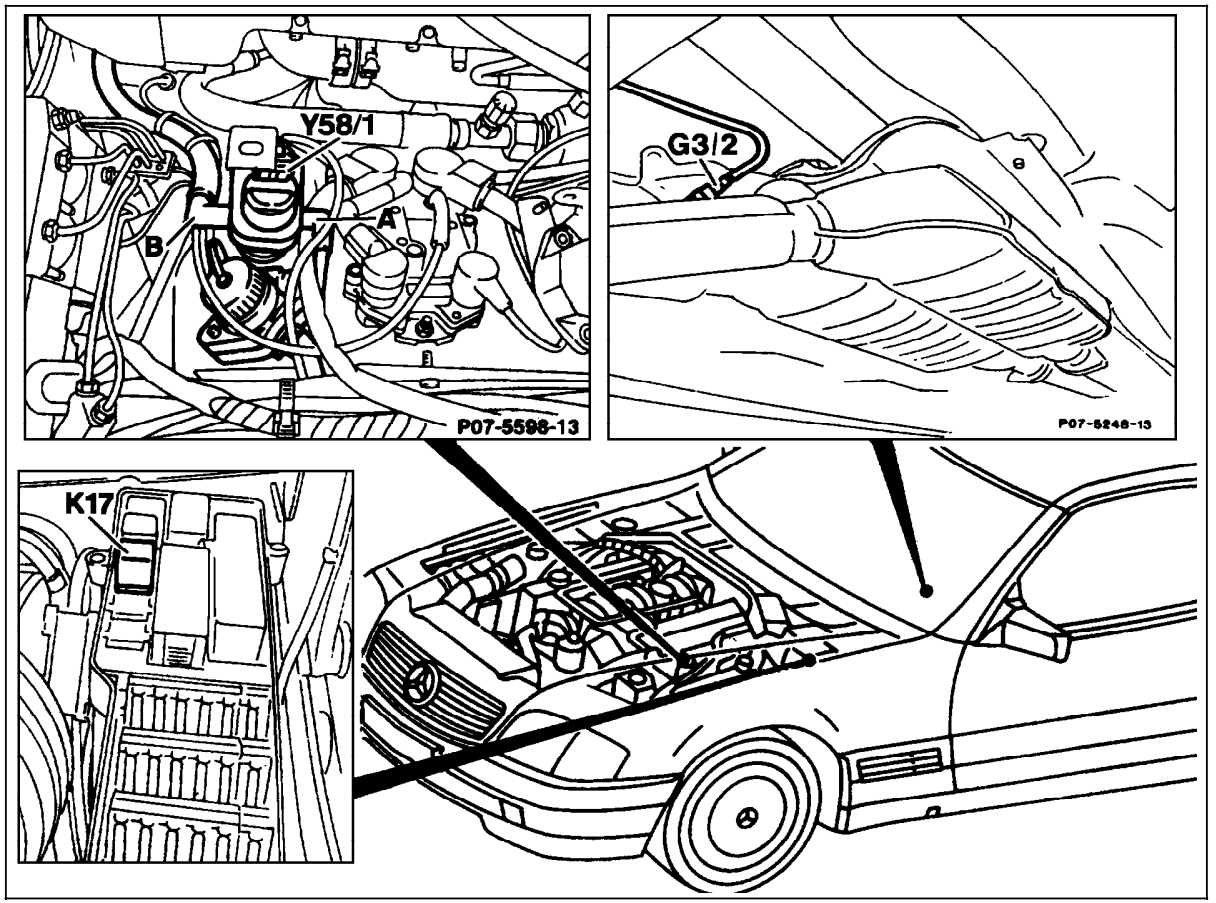


Figure 8

B17/7	IAT sensor
Y3/3	Upshift delay switchover valve
Y27	EGR switchover valve
Y32	AIR pump switchover valve

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 129



U07-5906-57

Figure 9

G3/2	O2S 1 (before TWC)
K17	AIR relay module
Y58/1	Purge control valve
A	Purge line to charcoal canister
B	Purge line to engine

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 129

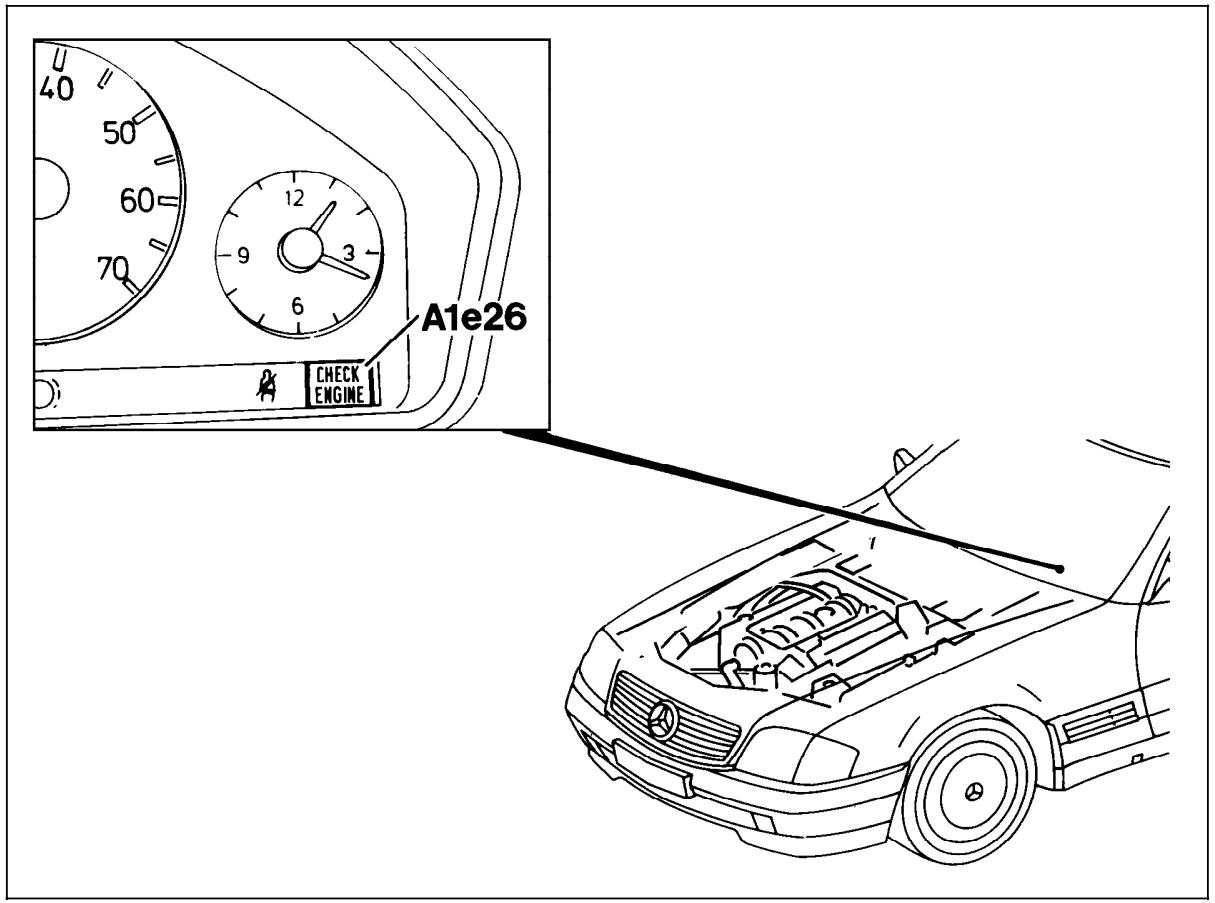


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Figure 10
A1e26 “CHECK ENGINE” MIL

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 140

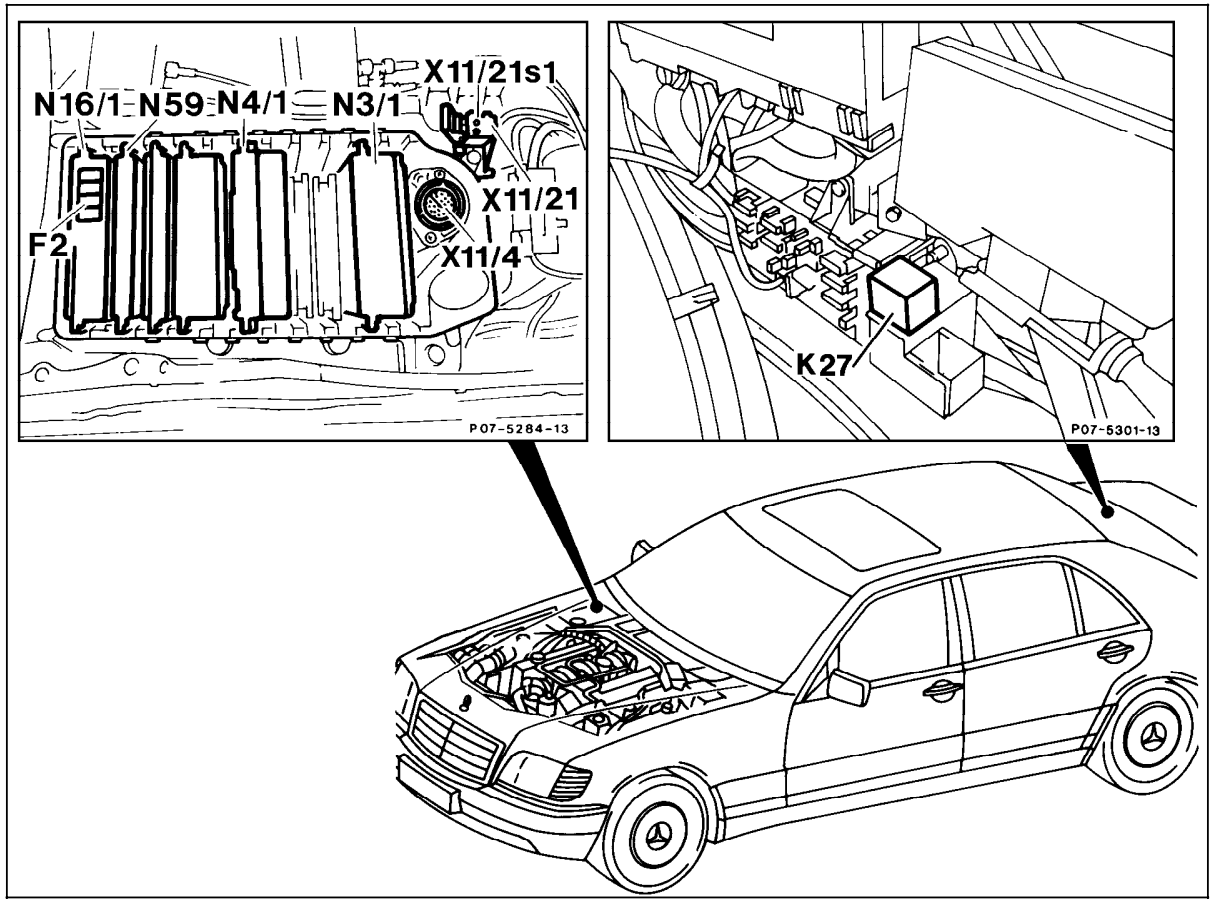

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Figure 11

K27	FP relay module
N3/1	LH-SFI control module
N4/1	EA/CC/ISC control module
N16/1	Base module (BM)
N59	Diagnostic module (OBD I)
X11/4	Data link connector (DTC readout)
X11/21	Diagnostic module test connector (3-pole)
	(USA) - California
X11/21s1	Pushbutton (with LED) (USA) - California

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 140

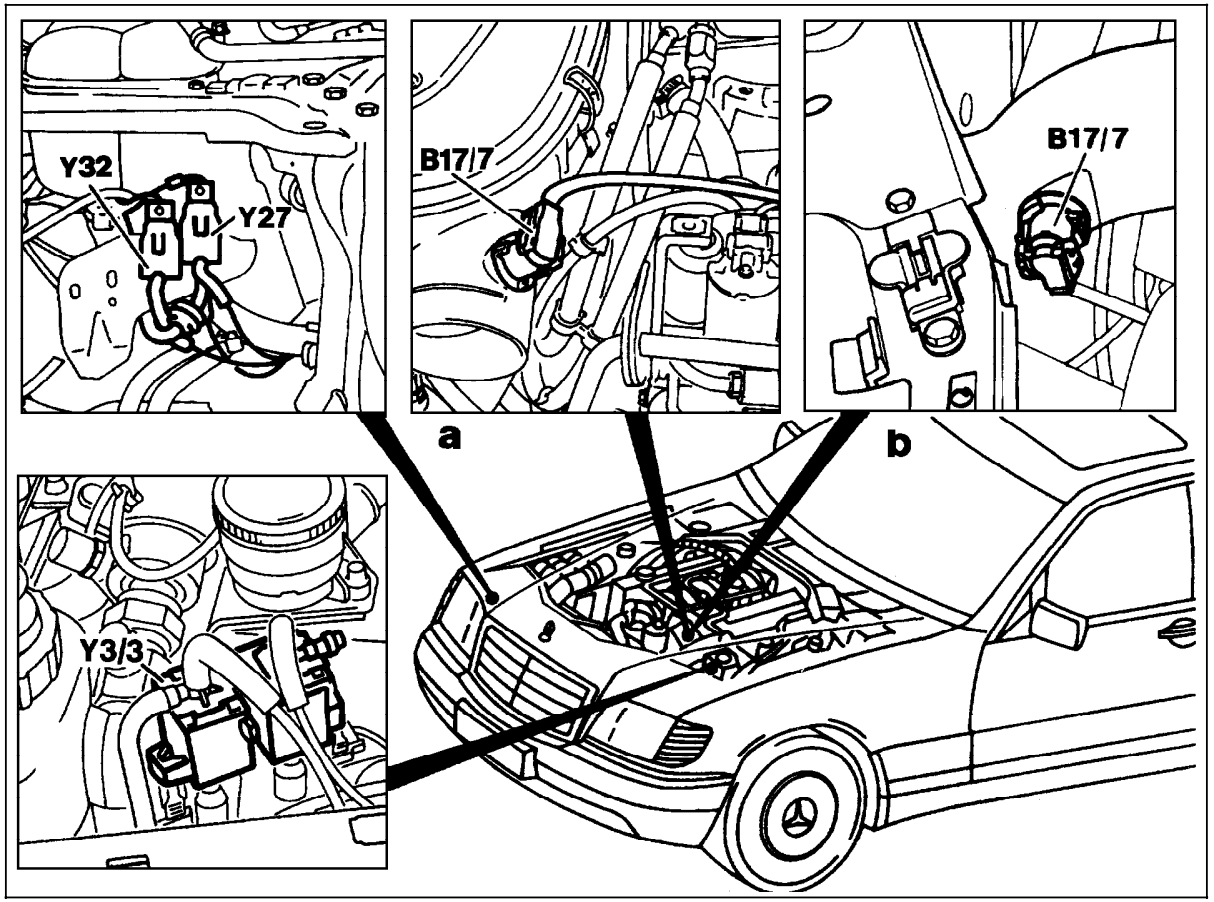
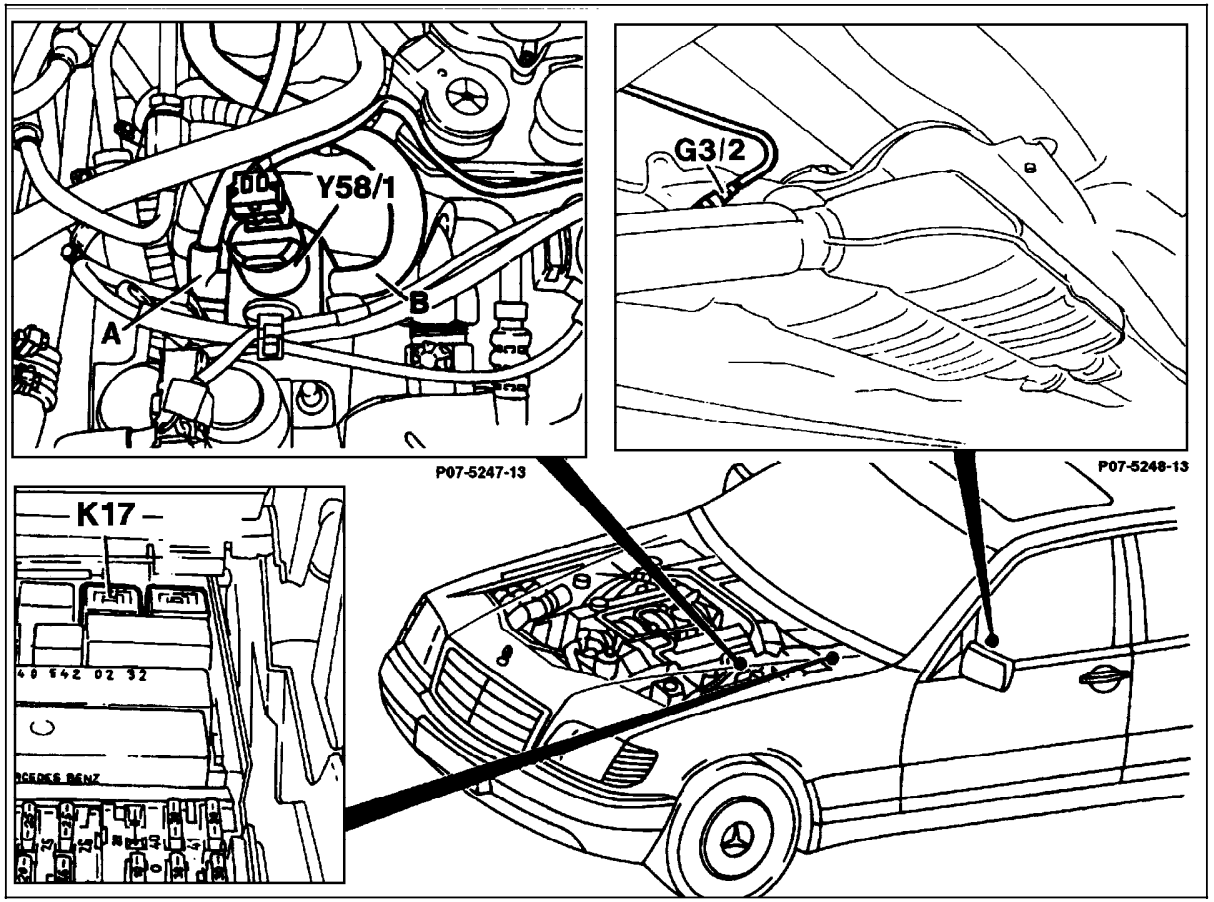


Figure 12

B17/7	IAT sensor (a=Engine 104, b=Engine 119)
Y3/3	Upshift delay switchover valve
Y27	EGR switchover valve
Y32	AIR pump switchover valve

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 140



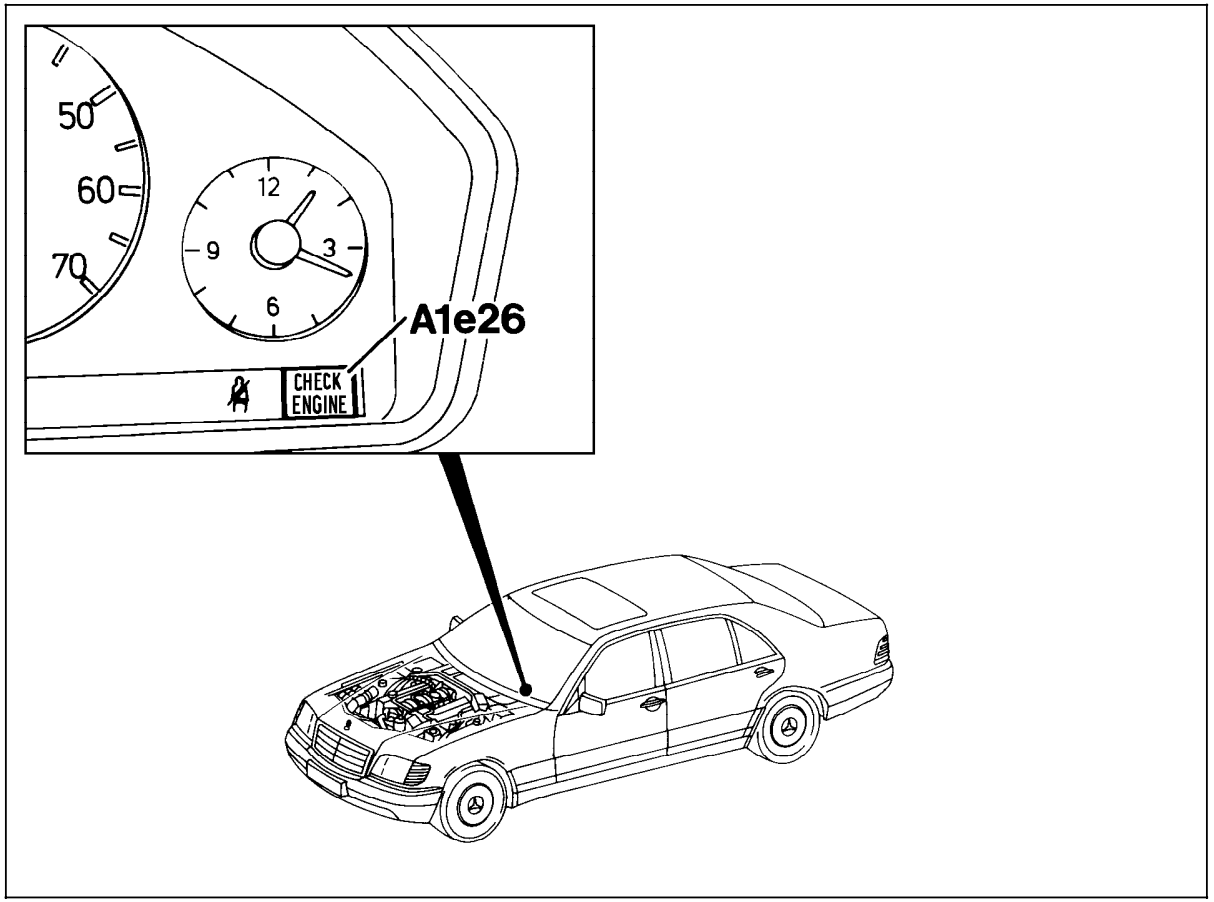
U07-5910-57

Figure 13

G3/2	O2S 1 (before TWC)
K17	AIR relay module
Y58/1	Purge control valve
A	Purge line to charcoal canister
B	Purge line to engine

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 140



U07-5911-57

Figure 14
A1e26 “CHECK ENGINE” MIL

Electrical Test Program – Preparation for Test

Preliminary work:
Diagnosis - Diagnostic Trouble Code (DTC) Memory 11

Preparation for Test

1. Ignition: **OFF**
2. Remove LH-SFI control module (N3/1).
3. Connect socket box with contact module 140 589 02 63 00 and contact box to LH-SFI control module (N3/1) according to connection diagram.
4. **Test steps 1.2, 1.3, 2.2 – 2.5, 4 and 36 only!**
   Ignition: **OFF**
   Remove base module (N16/1) and connect socket box with contact module 140 589 01 63 00 and contact box to base module (see DM, Chassis and Drivetrain, Volume 1, section 1, 22).

⚠

- When performing test and adjustment work, the engine rpm should only be raised using the accelerator pedal.
  If the engine speed is raised via the control linkage in the engine compartment, the“limp-home” mode will bec activated and will be registered as a DTC in the EA/CC/ISC control module. The ASR MIL will also come on.

- If installing a LH-SFI control module from another vehicle, the control module’s self-adaptation feature must be reset to its mean value (see 11).

Wiring diagrams:

Electrical Troubleshooting Manual, Models 124, 129, 140

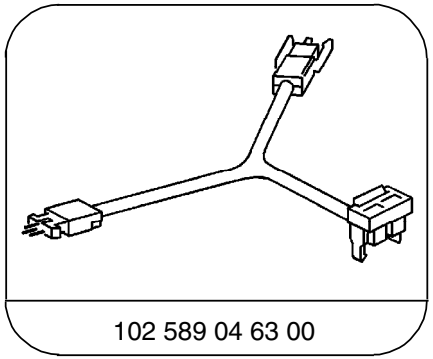
Note regarding “Test Connection” column:

The numbers indicated in parentheses, for example, ⇒ 1.0 (1.23) signify:

1= Connector 1 on wiring diagram,
23= Socket 23 on wiring diagram.

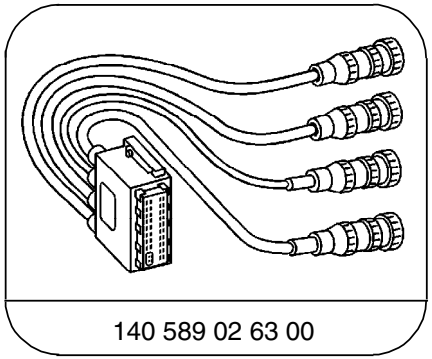
Electrical Test Program – Preparation for Test

Special Tools



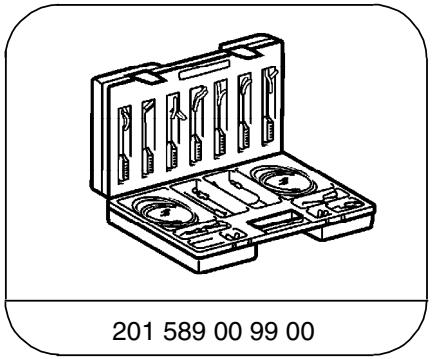
102 589 04 63 00

Test cable



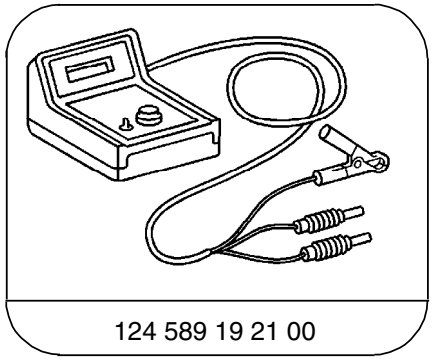
140 589 02 63 00

Contacting module 2



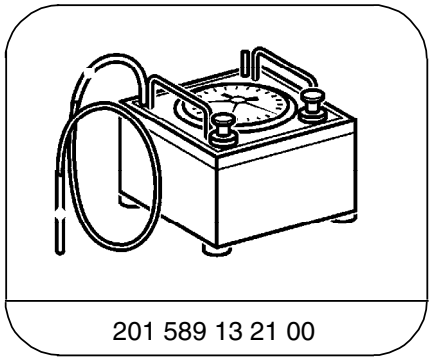
201 589 00 99 00

Electrical connecting set



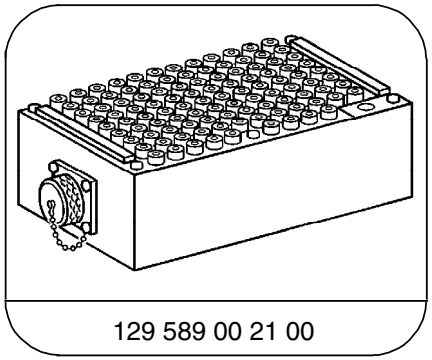
124 589 19 21 00

Pulse counter



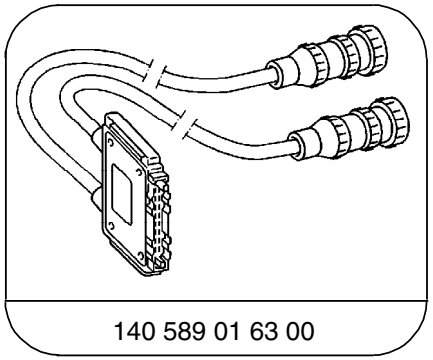
201 589 13 21 00

Tester



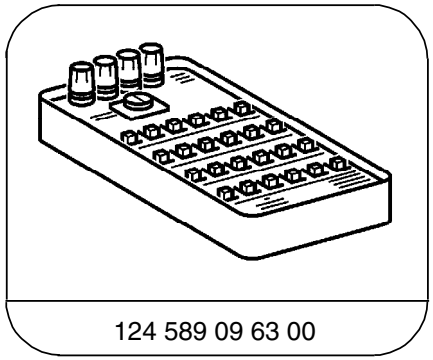
129 589 00 21 00

126-pin socket box



140 589 01 63 00

Contacting module 1

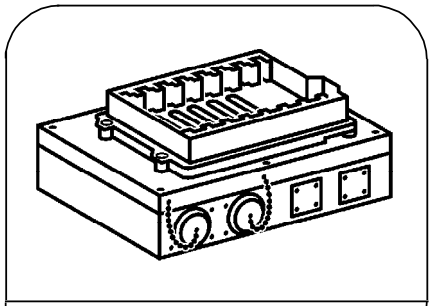


124 589 09 63 00

Ohm decade

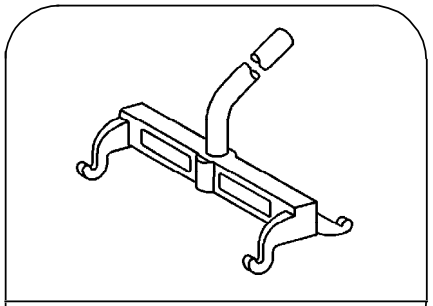
Electrical Test Program – Preparation for Test

Special Tools



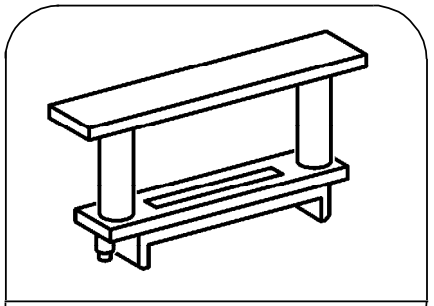
140 589 06 63 00

Contacting box



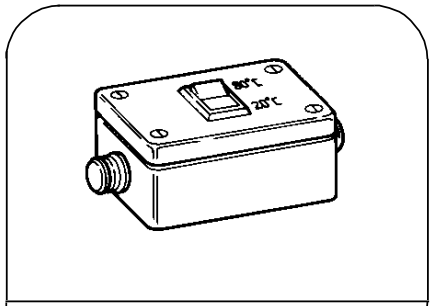
140 589 01 33 00

Mounting lever



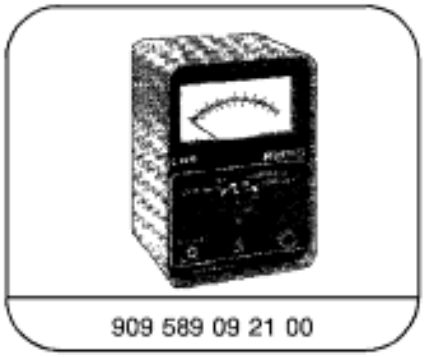
140 589 10 33 00

Spacer



140 589 09 21 00

Simulator



909 589 09 21 00

On-Off Ratio Tester

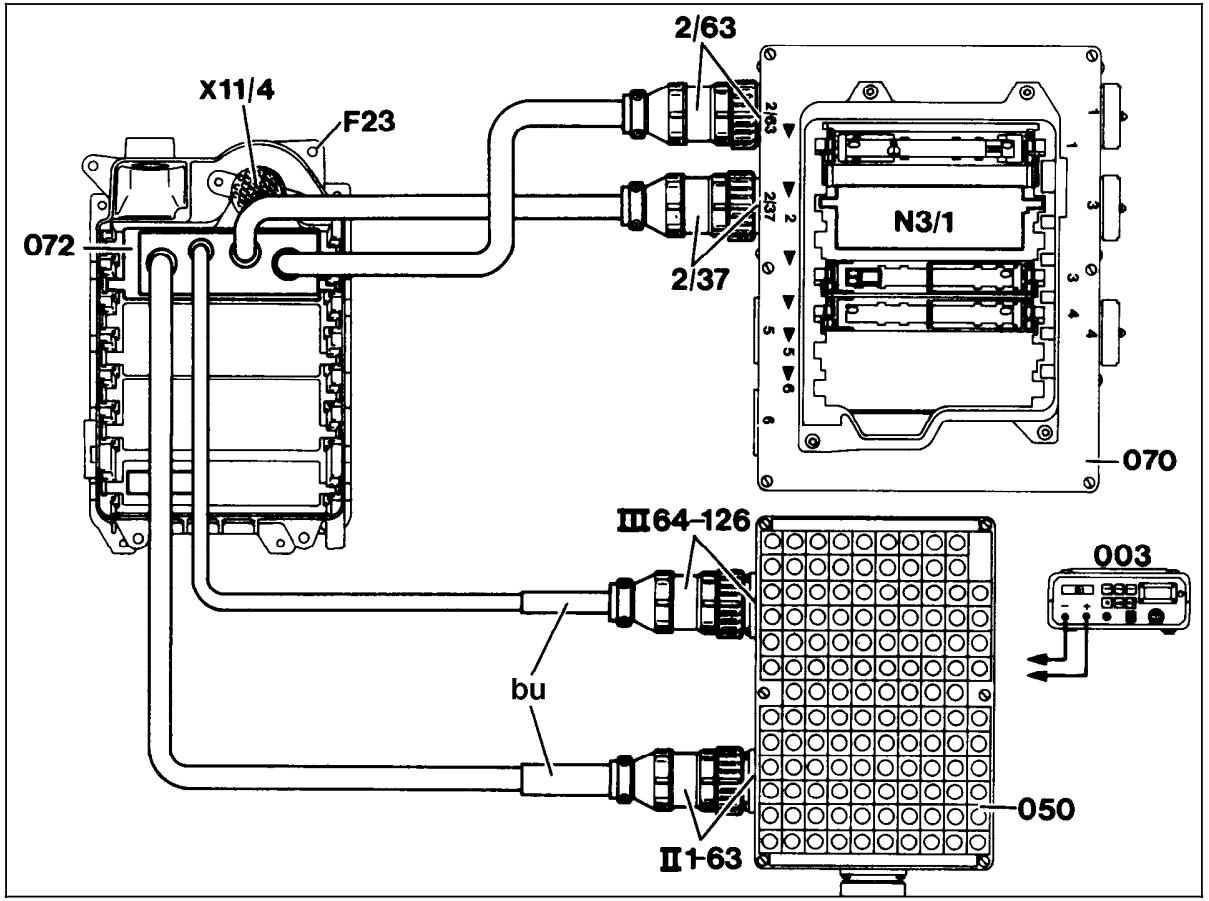
Conventional tools, test equipment

Description	Brand, model, etc.
Multimeter [1]	Fluke models 23, 83, 85, 87
Engine analyzer [1]	Bear DACE (Model 40-960) Sun MEA-1500MB

[1] Available through the MBUSA Standard Equipment Program.

Electrical Test Program – Preparation for Test

Connection Diagram - Socket Box
Models 124 and 129



U07-0727-57

Figure 1

003	Multimeter
050	Socket box (126-pole)
070	Contact box
072	Contact module
F23	Module box
N3/1	LH-SFI control module
X11/4	Data link connector (DTC readout)
bu	blue

Electrical Test Program – Preparation for Test

Connection Diagram - Socket Box
Model 140

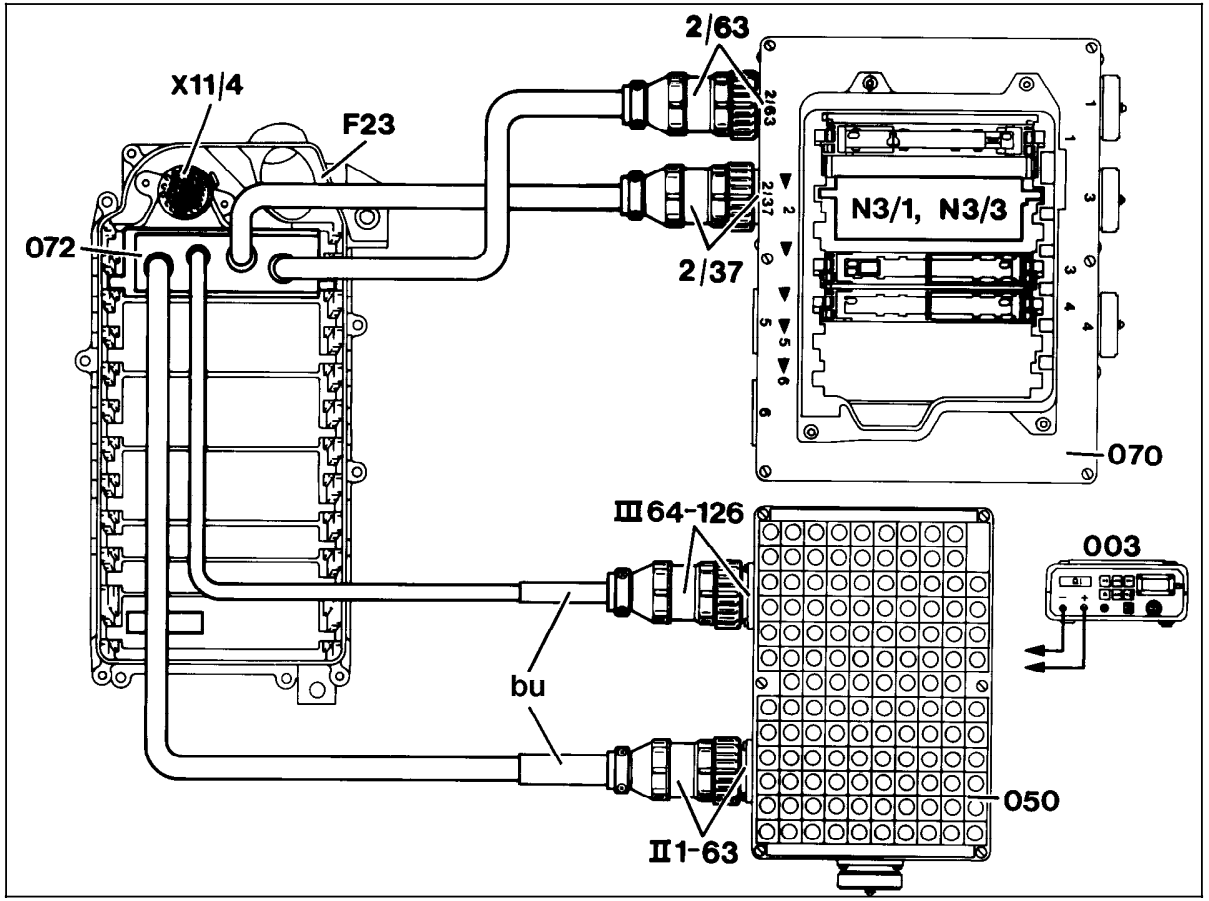


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Figure 2

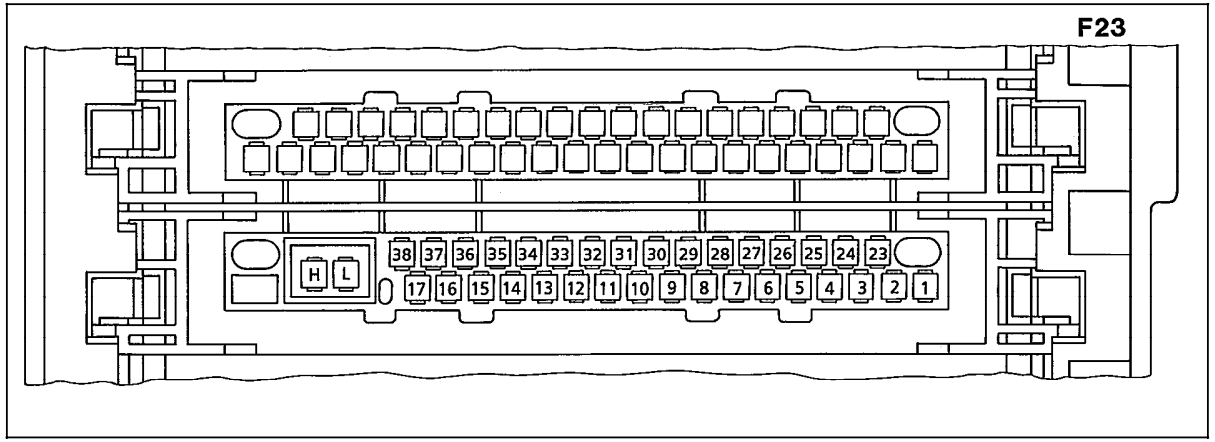
003	Multimeter
050	Socket box (126-pole)
070	Contact box
072	Contact module
F23	Module box
N3/1	LH-SFI control module
X11/4	Data link connector (DTC readout)
bu	blue

Electrical Test Program – Preparation for Test

Layout

LH-SFI Control Module Connector "1" – Interior

Figure 3



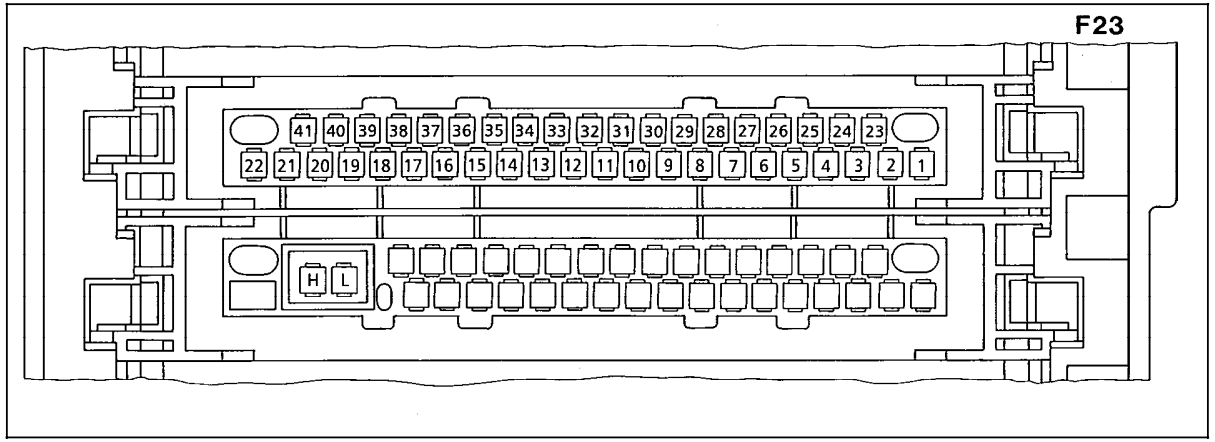
P07-5171-53

1 – 8	Not used
9	Fuel consumption gauge
10	Not used
11	CTP (idle) recognition from EA/CC/ISC control module or CC/ISC control module
12	Not used
13	Diagnostic wire
14	Diagnostic wire insulation
15 – 22	Not used
23	Ground (model 124: component compartment - W16, model 129: module box bracket - W27, model 140: electronics output ground - W15)
24	Voltage supply, circuit 87
25	FP relay module
26	Voltage supply, circuit 30
27	Not used
28	TN-signal (rpm signal) output
29	Not used
30	Fuel safety sut-off from EA/CC/ISC or CC/ISC control module
31 - 33	Not used
34	Starter signal, circuit 50
35	Ground (model 124: module box bracket - W27, model 129, 140: electronics, right footwell - W15/1)
36	Voltage supply, circuit 87
37	Ground (model 124: component compartment - W1 6, model 129: module box bracket - W27, model 140: electronics output ground - W15)
38	Not used
L	CAN (–) Controller area network (LH-SFI, DI, ABS/ASR, EA/CC/ISC, CC/ISC control modules)
H	CAN (+) Controller area network (LH-SFI, DI, ABS/ASR, EA/CC/ISC, CC/ISC control modules)

Electrical Test Program – Preparation for Test

Layout
LH-SFI Control Module Connector "2" – Engine Compartment

Figure 4

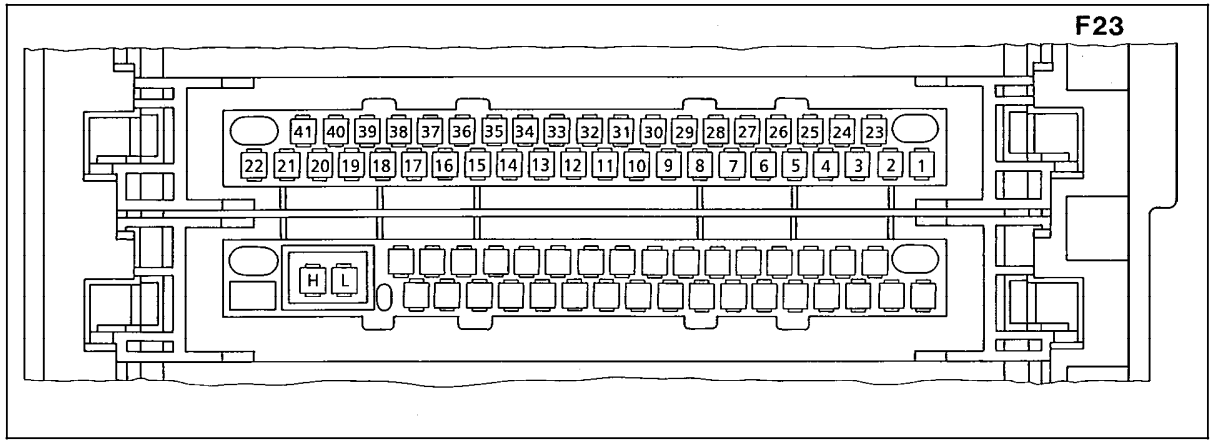


P07-5170-53

1	Injector (2) (engine 119 only)
2	Injector (engine 104 [4], engine 119 [3])
3	Injector (engine 104 [6], engine 119 [8])
4	Injector (5)
5	TN-signal (rpm signal) (input)
6	CMP sensor signal
7	Not used
8	IAT sensor
9	O2S 1 heater
10 – 12	Not used
13	O2S 1 wire insulation
14	O2S 1 (before TWC)
15	O2S 1 ground
16	Sensor ground
17	Hot wire MAF sensor signal
18	ECT sensor, circuit 2
19	AIR relay module
20	Upshift delay control
21	Not used
22	Right adjustable camshaft timing solenoid (engine 119 only)

Electrical Test Program – Preparation for Test

Layout
LH-SFI Control Module Connector "2" – Engine Compartment (continued)

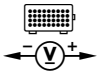


P07-5170-53

Figure 5

23	Hot wire MAF sensor voltage supply
24	Injector (7) (engine 119 only)
25	Injector (engine 104 [2], engine 119 [6])
26	Injector (engine 104 [3], engine 119 [4])
27	Injector (1)
28 – 29	Not used
30	Coding (ground)
31	ECT sensor, circuit 1
32 – 33	Not used
34	Hot wire MAF sensor ground
35	Not used
36	On-off ratio measurement output
37	Burn-off signal for hot wire MAF sensor
38	Purge control valve
39	EGR switchover valve
40	1 GR start relay module (K29/1) Model 124.034 only
41	Left adjustable camshaft timing solenoid

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
1.0		**LH-SFI control module (N3/1)** Voltage supply Circuit 30	N3/1  64 (1.23) — V — 67 (1.26)	Ignition: **ON**	11 – 14 V	⇒ 1.1 – 1.3
1.1		Ground connection	N3/1  64 (1.23) — V — X11/4 — 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 124** Ground, component compartment (W16, Figure 9) **Model 129** Ground (module box bracket) (W27, Figure 5) **Model 140** Ground (electronics output ground - right footwell) (W15, Figure 17).
1.2		Base module (N16/1) Voltage supply Circuit 30	N16/1  28 (1.28) — V — 1 (3.1) 29 (1.29) — V — 1 (3.1)	Ignition: **OFF** **Connect socket box to N16/1.** Ignition: **ON**	11 – 14 V	Wire to terminal block (X4/10) (Figures 1 – 3).

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
1.3	9	⚠ **DTC readout from base module (N16/1)** Voltage supply from N16/1 to LH-SFI control module (N3/1) Circuit 30	N16/1 28 (1.28) — 12 (1.12)	Ignition: **ON**	11 – 14 V	N16/1.
2.0		**LH-SFI control module (N3/1)** Voltage supply Circuit 87/M1e	N3/1 76 (1.35) — 77 (1.36)	Ignition: **ON**	11 – 14 V	⇒ 2.1 – 2.5
2.1		Ground connection	N3/1 76 (1.35) — X11/4 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 124** Ground, module box bracket (W27, Figure 9) **Models 129 and 140** Ground, electronics (right footwell) (W15/1, Figure 16 and 17).
2.2		Base module (N16/1) Voltage supply Circuit 15 unfused	N16/1 28 (1.28) — 34 (1.34)	**Connect socket box to N16/1.** Ignition: **ON** Ignition: **OFF**	11 – 14 V < 1 V	Wiring, Ignition/starter switch (S2/1), Wiring, S2/1.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
2.3		Base module (N16/1) Voltage supply Circuit 15	N16/1 28 (1.28) — V — 15 (1.15)	Ignition: **ON** Ignition: **OFF**	11 – 14 V < 1 V	Wiring, Fuse.
2.4		Output ground, base module (N16/1)	N16/1 28 (1.28) — V — X11/4 2 N16/1 29 (1.29) — V — X11/4 2	Ignition: **ON**	11 – 14 V 11 – 14 V	Ground wire.
2.5		⚠ **DTC readout from base module (N16/1)** Voltage supply (fused) for LH-SFI control module (N3/1)	N16/1 28 (1.28) — V — 7 (1.7)	Ignition: **ON** Ignition: **OFF**	11 – 14 V < 1 V	Fuse (F2) at N16/1, N16/1.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
3.0		**LH-SFI control module (N3/1)** Voltage supply Circuit 87	N3/1 78 (1.37) — V — 65 (1.24)	Ignition: **ON**	11 – 14 V	Wiring, ⇒ 3.1
3.1		Ground connection	N3/1 78 (1.37) — V — X11/4 2	Ignition: **ON**	11 – 14 V	**Model 124** Ground, component compartment (W16) **Models 129 and 140** Ground, electronics output ground (W15, right footwell)
4.0		⚠ **DTC readout from base module (N16/1)** Voltage supply for injectors	N16/1 28 (1.28) — V — 38 (2.38)	**Connect socket box to N16/1** Ignition: **ON** Ignition: **OFF**	 11 – 14 V < 1 V	Fuse (F2) at N16/1.
5.0	Ч 1)	**Hot wire MAF sensor (B2/2)** Voltage at hot wire	N3/1 34 (2.34) — V — 17 (2.17)	**Connect socket box to N3/1** Ignition: **ON** Engine: **at Idle**	 1.0 – 1.2 V 1.3 – 1.7 V 2)	Wiring, ⇒ 5.1, ⇒ 6.0, B2/2.

1) The DTC "Ч" can be displayed on vehicles up to 7/91 even if no fault exists.

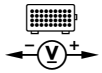
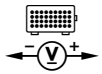
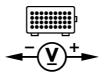
2) Voltage increases with increasing rpm.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
5.1		Hot wire MAF sensor (B2/2) Voltage supply	N3/1 64 (1.23) — V — 23 (2.23)	Ignition: **ON**	11 – 14 V	LH-SFI control module (N3/1).
6.0	Ч 1)	**Ground wire for hot wire MAF sensor (B2/2)**	N3/1 34 (2.34) — Ω — 76 (1.35)	Ignition: **OFF**	< 6 Ω	Ground wire (W11) (engine ground).
7.0	12	**Hot wire MAF sensor (B2/2)** Burn-off control	N3/1 76 (1.35) — V — 37 (2.37)	Ignition: **OFF** Unplug LH-SFI control module (N3/1), wait approx. 5 sec. and then plug back in again. Engine: **Start** Engine coolant temperature > 60 °C. Engine speed > 2000 rpm for 15 seconds. Turn off engine.	After approx. 4 sec., 3 – 5 V for approx. 1 sec. Simultaneous visual check: hot-wire glows briefly.	Wiring, B2/2, LH-SFI control module (N3/1).

1) The DTC “Ч” can be displayed on vehicles up to 7/91 even if no fault exists.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
8.0	9	**FP relay module (K27)** Control signal	N3/1  66 (1.25) — 65 (1.24)	Engine: **Start**	11 – 14 V while cranking.	⇒ 8.1, LH-SFI control module (N3/1).
8.1		Starter signal Circuit 50	N3/1  64 (1.23) — 75 (1.34)	Engine: **Start**	11 – 14 V while cranking.	Wiring.
9.0	2	**ECT sensor (B11/2)** Voltage at sensor circuit 1	N3/1  16 (2.16) — 18 (2.18)	Ignition: **ON**	°C V Ω 20 3.5 2500 30 3.1 1700 40 2.7 1170 50 2.3 830 60 1.9 600 70 1.5 435 80 1.2 325 90 1.0 245 100 0.8 185 ± 5% ± 5%	⇒ 9.1, N3/1.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
9.1		Resistance Sensor circuit 1	N3/1 16 (2.16) — Ω — 18 (2.18)	Ignition: **OFF** Disconnect N3/1 from contact box (070).	Nominal values, see ⇒ 9.0	Wiring, ⇒ 9.2.
9.2		Resistance ECT sensor (B11/2) Sensor circuit 1	B11/2 2 — Ω — 4	Connector on B11/2 unplugged.	Nominal values, see ⇒ 9.0, Connection see Figure 24.	B11/2.
10.0	∃	**ECT sensor (B11/2)** Voltage at sensor circuit 2	N3/1 16 (2.16) — V — 31 (2.31)	Ignition: **ON**	°C V Ω 20 3.5 2500 30 3.1 1700 40 2.7 1170 50 2.3 830 60 1.9 600 70 1.5 435 80 1.2 325 90 1.0 245 100 0.8 185 ± 5% ± 5%	⇒ 10.1, LH-SFI control module (N3/1).

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
10.1		Resistance Sensor circuit 2	N3/1 16 (2.16) — Ω — 31 (2.31)	Ignition: **OFF** Disconnect N3/1 from contact box (070).	Nominal values, see ⇒ 10.0	Wiring, ⇒ 10.2
10.2		Resistance ECT sensor (B11/2) Sensor circuit 2	B11/2 1 — Ω — 3	Connector on B11/2 unplugged.	Nominal values, see ⇒ 10.0, Connection see Figure 24.	B11/2.
11.0		**IAT sensor (B17/7)** Voltage	N3/1 16 (2.16) — V — 8 (2.8)	Ignition: **ON**	°C V Ω 10 1.8 3700 20 1.5 2500 30 1.2 1700 40 0.9 1170 50 0.6 830 60 0.5 600 70 0.4 435 80 0.3 325 ± 5% ± 5%	⇒ 11.1, LH-SFI control module (N3/1).

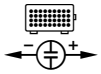
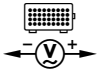
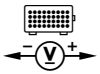
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
11.1		Resistance	N3/1 16 (2.16) — Ω — 8 (2.8)	Ignition: **OFF** Disconnect N3/1 from socket box.	Nominal values, see ⇒ 11.0	Wiring, IAT sensor (B17/7).
12.0		**TN-signal (rpm signal) – input** from DI control module (N1/3)	N3/1 1) 76 (1.35) — ⏚ — 5 (2.5) N3/1 2) 76 (1.35) — V — 5 (2.5)	Engine: **Start** Engine: **at Idle**	Signal, see Figure 21. 5 – 7.5 V	Wiring, N1/3, N3/1.
13.0		**LH-SFI control module (N3/1)** TN-signal (rpm signal) – output	N3/1 1) 76 (1.35) — ⏚ — 69 (1.28) N3/1 2) 76 (1.35) — V — 69 (1.28)	Engine: **Start** Engine: **at Idle**	Signal, see Figure 21. 5 – 7.5 V.	Wiring, N3/1, Base module (N16/1).

1) Test with oscilloscope.

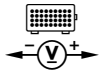
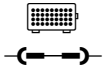
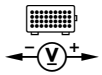
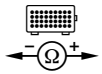
2) Test with multimeter only if oscilloscope is not available.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
14.0		**CMP sensor (L5/1) signal** from DI control module (N1/3)	N3/1 1)  77 (1.36) — 6 (2.6) N3/1 2)  77 (1.36) — 6 (2.6)	Engine: **Start** Engine: **at Idle**	Signal, see Figure 20. 0.8 – 1.5 V	Wiring, L5/1 (Test, see DM, Engines, Vol. 2, section 5.2), N1/3.
15.0		3) **CTP (idle) recognition signal** from EA/CC/ISC actuator (M16/1)	N3/1  76 (1.35) — 52 (1.11)	Ignition: **ON** Accelerator pedal in CTP (idle). Accelerator pedal in WOT (full throttle).	4.8 V 5.5 V	Wiring, M16/1 (Test, see DM, Engines, Vol. 3, section 6.2), EA/CC/ISC control module (N4/1).

1) Test with oscilloscope.
2) Test with multimeter only if oscilloscope is not available.
3) The DTC "I□" can be displayed on vehicles up to 7/91 even if no fault exists.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
16.0		**Fuel safety shut-off** from EA/CC/ISC actuator (M16/1) or CC/ISC actuator (M16/2)	N3/1  76 (1.35) — 71 (1.30)	Ignition: **ON**	2.2 – 11 V	Wiring M16/1 or M16/2 (Test, see DM, Engines, Vol. 3, section 6.2 or 7.1), N4/1 or N4/3.
17.0		**Fuel safety shut-off**	N3/1  76 (1.35) — 71 (1.30)	Engine: **Start** and apply WOT (full throttle).	Engine speed surges between 1200 – 2200 rpm.	N3/1.
18.0	21	**O2S 1 (before TWC) (G3/2)** O2S 1 signal	N3/1  15 (2.15) — 14 (2.14)	Engine: **at Idle** and at operating temperature > 80 °C let engine run for a minimum of 2 minutes.	Oscillates between. –0.2 and +1.0 V by more than 0.3 V	Wiring, G3/2, ⇒ 18.1, ⇒ 18.2, ⇒ 19.0.
18.1		Insulation, O2S 1 wire	N3/1  13 (2.13) — 14 (2.14)	Ignition: **OFF** Disconnect N3/1 from contact box (070).	∞ Ω	Wiring.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
18.2		O2S 1 control from LH-SFI control module (N3/1)	N3/1 14 (2.14) — 76 (1.35)	On-off ratio tester connected. Engine: **at Idle** and at operating temperature > 80 °C	90 – 100% at on-off ratio tester	N3/1.
19.0	22	**O2S 1 (before TWC) heater** Control signal	N3/1 15 (2.15) — V — 9 (2.9)	Engine: **at Idle** Engine coolant temperature > 80 °C	11 – 14 V	⇒ 19.1, N3/1.
19.1		O2S 1 (before TWC) heater Current draw	N3/1 9 (2.9) — A — 77 (1.36)	N3/1 connected in contact box (070). Ignition: **ON**	0.6 – 3.4 A	Wiring, G3/2.
20.0	16 [1]	**EGR switchover valve (Y27)** Control signal	N3/1 39 (2.39) — V — 77 (1.36)	Engine: **at Idle** Engine coolant temperature > 60 °C Accelerate briefly.	11 – 14 V	⇒ 21.0 – 22.0, Wiring, N3/1.

[1] The DTC "16" can be displayed on vehicles up to 7/91 even if no fault exists.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
20.1		EGR switchover valve (Y27) Current draw	N3/1 64 (1.23) — A — 39 (2.39)	Disconnect N3/1 from contact box (070). Ignition: **ON**	0.3 – 0.5 A	Wiring, Y27.
21.0		**EGR switchover valve (Y27)** Vacuum control		**Test connection note:** Connect vacuum tester to EGR valve according to Figure 18. N3/1 plugged in. Engine: **at Idle** Engine coolant temperature > 60 °C. Accelerate briefly.	 > 400 mbar	Vacuum lines, EGR valve, Y27.
22.0		**EGR valve** Mechanical test		**Test connection note:** Connect vacuum tester directly to EGR valve. Using vacuum tester, apply 500 mbar vacuum. Disconnect vacuum line on EGR valve.	 EGR valve closes audibly.	EGR valve.

Electrical Test Program – Test

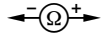
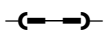
⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
23.0	II [1]	**AIR relay module (K17)** Control signal	N3/1 19 (2.19) — V — 77 (1.36)	Disconnect ECT sensor (B11/2) and simulate 2.5 kΩ at sockets 2 and 4 with resistance substitution unit. Engine: **at Idle**	11 – 14 V for approx. 2 minutes after start **and** AIR pump runs.	⇒ 23.1, N3/1.
23.1		AIR relay module (K17) Current draw	N3/1 64 (1.23) — A — 19 (2.19)	Disconnect N3/1 from contact box (070). Ignition: **ON**	0.1 – 0.3 A	Wiring, K17.
24.0	23	**Purge control valve (Y58/1)** Control signal	N3/1 38 (2.38) — ⏚ — 77 (1.36)	Engine: **at Idle** and at operating temperature.	After approx. 1 minute, purge control valve (Y58/1, Figure 19) must cycle noticeable. Signal, see Figure 31.	⇒ 24.1, ⇒ 25.0. N3/1.
24.1		Current draw	N3/1 64 (1.23) — A — 38 (2.38)	Disconnect LH-SFI control module (N3/1) from contact box (070). Ignition: **ON**	0.2 – 0.4 A	Wiring, Y58/1.

[1] The DTC “II” can be displayed on vehicles up to 7/91 even if no fault exists.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
25.0		**Purge control valve (Y58/1)** Vacuum control		**Note to test connection:** Connect vacuum tester to Y58/1 (Figure 19), connection (A). Engine: **at Idle** and at operating temperature.	 After approx. 1 minute, > 400 mbar	Vacuum lines, Y58/1.
26.0	25	**Adjustable camshaft timing solenoid (Y49 or Y49/2)** Current draw **Engine 104** (Y49) **Engine 119** right (Y49/2)	Y49 1 — (A) — 2 Y49/2 1 — (A) — 2	**Note to test connection:** Connect test cable (102 589 04 63 00) to solenoid. Engine: **Start** and raise engine speed to approx. 3000 rpm.	 Briefly approx. 1.5 A, then 1 A	⇒ 26.1, ⇒ 28.0, N3/1.
26.1		Resistance **Engine 104** (Y49) **Engine 119** right (Y49/2)	N3/1 41 (2.41) — (Ω) — 77 (1.36)	Disconnect N3/1 from contact box (070).	4 – 6 Ω	Wiring, Y49 or Y49/2.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
27.0	24	***Engine 119 only*** **Left adjustable camshaft timing solenoid (Y49/1)** Current draw	1 —  — 2	**Note to Test connection:** Connect test cable (102 589 04 63 00) to solenoid (Y49/1). Engine: **Start** and raise engine speed to approx. 3000 rpm.	 Briefly approx. 1.5 A, then 1 A	Wiring, ⇒ 27.1, ⇒ 29.0.
27.1		***Engine 119 only*** Resistance	N3/1  22 (2.22) —  — 77 (1.36)	Disconnect N3/1 from contact box (070).	4 – 6 Ω	Wiring, Y49/1.
28.0		**Adjustable camshaft timing solenoid (Y49 or Y49/2)** Mechanical operation **Engine 104** (Y49) **Engine 119** right (Y49/2)	N3/1  41 (2.41) —  — 76 (1.35)	Engine: **at Idle** Bridge socket box sockets for maximum of 10 seconds.	 Engine runs unevenly after approx. 5 sec.	Mechanical camshaft adjustment (see SMS, Job No. 05-216).

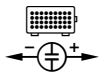
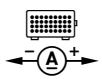
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
29.0		***Engine 119 only*** **Left adjustable camshaft timing solenoid (Y49/1)** Mechanical operation	N3/1  22 (2.22) — 76 (1.35)	Engine: **at Idle** Bridge socket box sockets for maximum of 10 seconds.	Engine runs unevenly after approx. 5 sec.	Mechanical camshaft adjustment (see SMS, Job No. 05-216).
30.0	6	***Non-USA vehicles only.*** ***Continue to next test step.***				
31.0	28	***Non-USA vehicles only.*** ***Continue to next test step.***				

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
32.0	27	**Injectors (Y62)** Resistance and assignment		**Test connection note:** Connect ohmmeter to socket box for each subsequent injector.		Wiring, Y62, Wires reversed, ⇒ 33.0
		Engine 104	N3/1	Ignition: **OFF** Disconnect N3/1 from		
		Cylinder 1	27 — Ω — 77	contact box (070).		
		Cylinder 2	25 — Ω — 77			
		Cylinder 3	26 — Ω — 77			
		Cylinder 4	2 — Ω — 77	Connector on injector	14 – 16 Ω	
		Cylinder 5	4 — Ω — 77	connected.		
		Cylinder 6	3 — Ω — 77			
				Connector on injector unplugged.	∞ Ω	
		Engine 119	N3/1			
		Cylinder 1	27 — Ω — 77	Connector on injector	14 – 16 Ω	Wiring, Injectors (Y62), Wires reversed, ⇒ 33.0
		Cylinder 2	1 — Ω — 77	connected.		
		Cylinder 3	2 — Ω — 77			
		Cylinder 4	26 — Ω — 77	Connector on injector	∞ Ω	
		Cylinder 5	4 — Ω — 77	unplugged.		
		Cylinder 6	25 — Ω — 77			
		Cylinder 7	24 — Ω — 77			
		Cylinder 8	3 — Ω — 77			

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
33.0		**Injectors (Y62)** Control and injection time	N3/1 	**Test connection note:** For connection information on individual injectors, see ⇒ 32.0. **Engine coolant temperature approx. 20 °C** at start → **Engine coolant temperature approx. 80 °C** at idle → accelerate briefly →	 Injection time: approx. 8 ms approx. 3 – 5 ms approx. 17 ms (see signals, Figures 22 and 23)	Wiring, ECT sensor (B11/2), IAT sensor (B17/7), O2S 1 (before TWC) (G3/2). LH-SFI control module (N3/1).
34.0	26 [4]	**Upshift delay switchover valve (Y3/3)** Current draw	N3/1  64 (1.23) — 20 (2.20)	Disconnect N3/1 from contact box (070). Ignition: **ON**	 450 ± 80 mA	Wiring, Y3/3, ⇒ 35.0

[4] The DTC "26" can be displayed on vehicles up to 7/91 even if no fault exists.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
35.0	3)	**Pneumatic upshift delay** Vacuum control and sealing	N3/1 64 (1.23) — 20 (2.20)	**Note to Test connection:** Connect vacuum tester to upshift delay switchover valve (Y3/3) according to Figure 30 and connect bridge to socket box. Engine: **at Idle**	 > 400 mbar	Vacuum lines, Y3/3.
36.0	15	⚠ **DTC readout from base module (N16/1)** **Automatic transmission kickdown valve (Y3)** Voltage supply	N16/1 28 (1.28) — V — 36 (1.36)	**Connect socket box to N16/1.** Engine: **at Idle** Engine: **OFF**	 11 – 14 V < 1 V	Wiring, N16/1, ⇒ 36.1
36.1		⚠ DTC readout from base module (N16/1) Automatic transmission kickdown valve (Y3) Current draw	N16/1 36 (1.36) — A — 34 (1.34)	N16/1 disconnected from contact box (070). Ignition: **ON** Accelerator pedal in wide open throttle position and kickdown switch engaged.	 480 ± 50 mA 1) 950 ± 80 mA 2)	Wiring, Y3, Kickdown switch (S16/6).

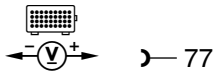
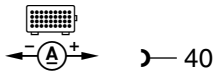
1) 5-speed automatic transmission.
2) 4-speed automatic transmission.
3) On vehicles as of 8/91.

Electrical Test Program – Test

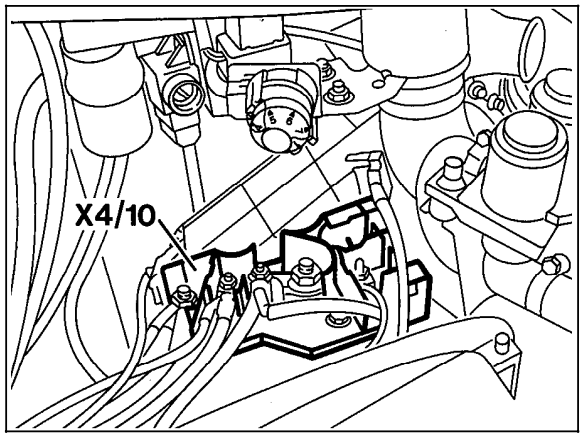
⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
37.0		**Diagnostic wire activation**	N3/1 76 (1.35) — V — 54 (1.13)	Ignition: **ON**	11 – 14 V	Wiring, N3/1.
38.0		**Fuel consumption indicator (A1p10)**	N3/1 76 (1.35) — V — 50 (1.9)	Engine: **at Idle** and briefly depress accelerator pedal.	> 0.5 V	Wiring, N3/1, A1p10.
39.0	17 18 1)	**Serial data bus (CAN)**	N3/1 L — Ω — H	Ignition: **OFF** Remove contact module or N3/1 and measure resistance directly at CAN connector for LH-SFI control module (Figure 25).	115 – 125 Ω	Data line, DI control module (N1/3).
40.0	20	**CAN element in LH-SFI control module (N3/1)** Resistance	N3/1 L — Ω — H	Remove N3/1 and measure resistance directly on LH-SFI control module (Figure 26).	115 – 125 Ω	N3/1.
41.0		***Non-USA vehicles only. Continue to next test step.***				

1) The DTC "18" can be displayed on vehicles up to 7/91 even if no fault exists.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
42.0	15	***Non-USA vehicles only. Continue to next test step.***				
43.0	28	**Coding** LH-SFI control module (N3/1)	N3/1  30 (2.30) 77 (1.36)	Ignition: **ON**	11 – 14 V	Wiring.
44.0	29	**Model 124.034 only** **1GR start relay module (K29/1)** Current draw	N3/1  64 (1.23) 40 (2.40)	Disconnect LH-SFI control module (N3/1) from contact box (070). Ignition: **ON**	200 ± 80 mA	Wiring, K29/1.

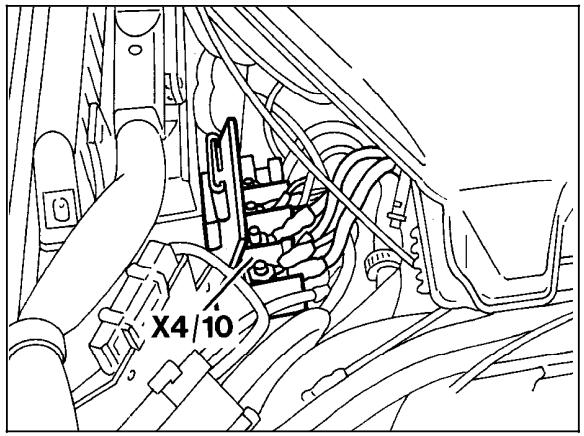
Electrical Test Program – Test



P07-5175-13

Figure 1
Model 124

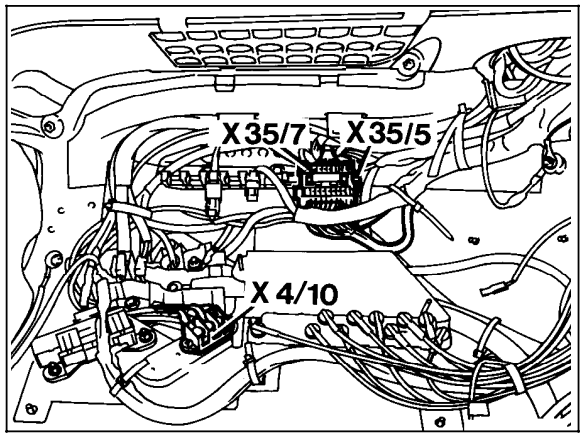
X4/10 Terminal block (circuit 30/circuit 61 battery)



P07-5970-13

Figure 2
Model 129

X4/10 Terminal block (circuit 30/30Ü/61e/87L) (6-pole)



P07-2623-13

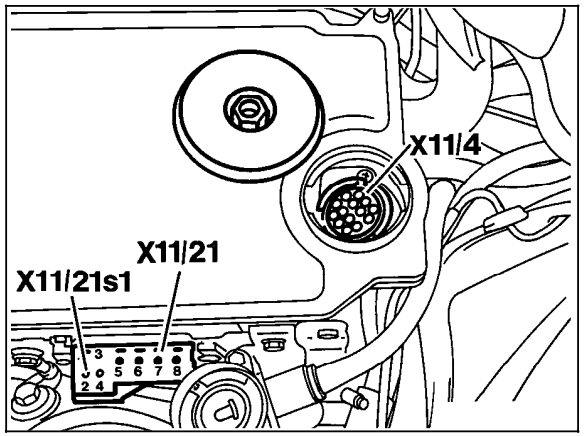
Figure 3
Model 140

X4/10 Terminal block (circuit 30/circuit 61 battery)

X35/5 Module box/taillamp harness separation point (ASR/ASD) (12-pole)

X35/7 Cockpit/module box separation point (18-pole)

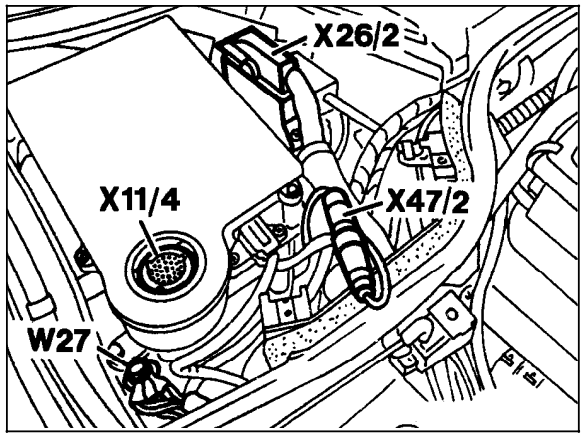
Electrical Test Program – Test



P07-5295-13

Figure 4
Model 124

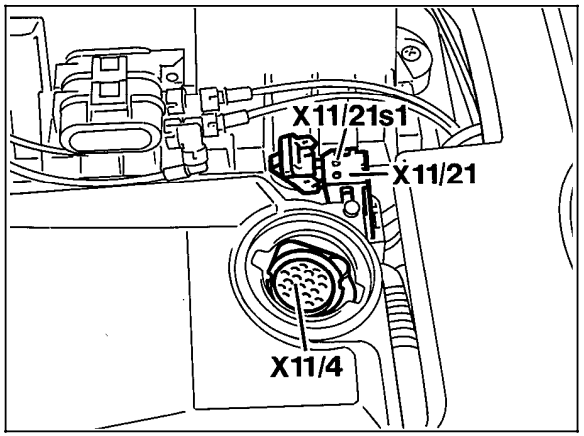
X11/4	Data link connector (DTC readout)
X11/21	Diagnostic module test connector (3-pole) (USA) - California
X11/21s1	Pushbutton (with LED) (USA) - California



P07-5961-13

Figure 5
Model 129

W27	Ground (module box bracket)
X26/2	Engine separation point connector
X47/2	CMP sensor intermediate connector

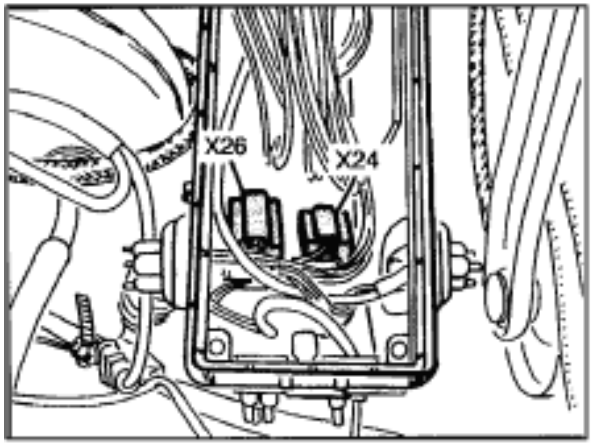


P07-5246-13

Figure 6
Model 140

X11/4	Data link connector (DTC readout)
X11/21	Diagnostic module test connector (3-pole) (USA) - California
X11/21s1	Pushbutton (with LED) (USA) - California

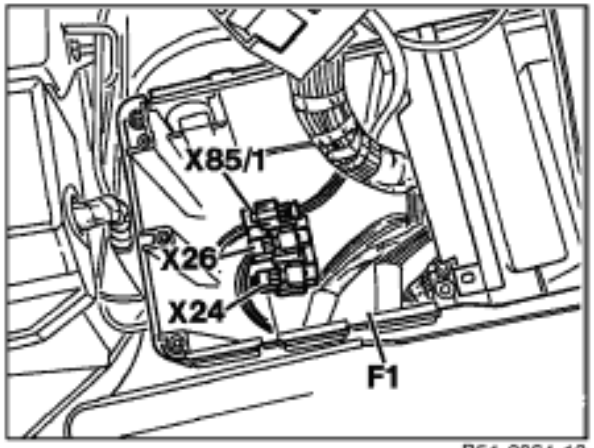
Electrical Test Program – Test



0154-34186-1

Figure 7
Models 124 and 129

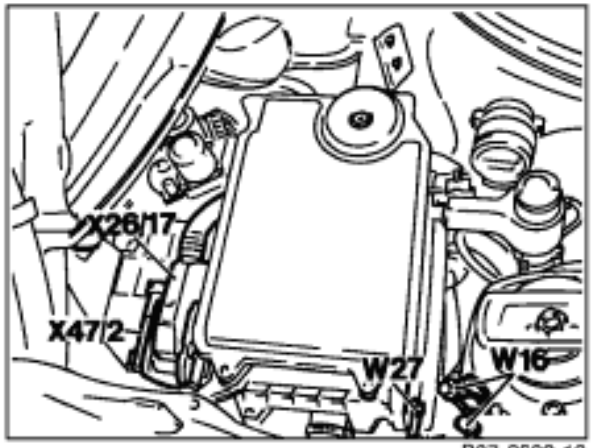
X24 Headlamp harness connector
X26 Interior/engine connector



P54-2864-13

Figure 8
Model 140

F1 Fuse and relay box
X24 Headlamp harness connector
X85/1 A/C harness/engine harness connector
X26 Interior/engine connector

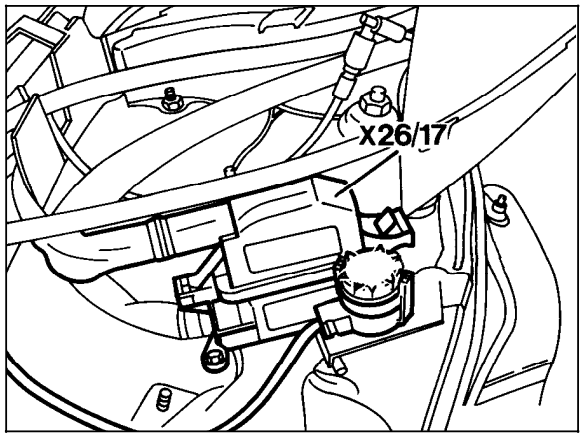


P07-2609-13

Figure 9
Model 124

W16 Ground (component compartment
W27 Ground (module box bracket)
X26/17 Engine separation point connector
X47/2 CMP sensor intermediate connector

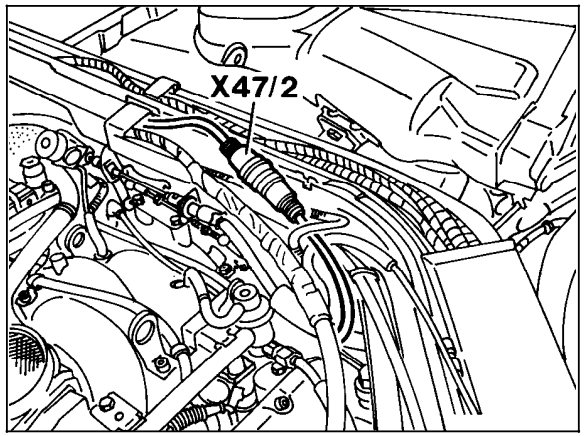
Electrical Test Program – Test



P07-2588-13

Figure 10
Model 140

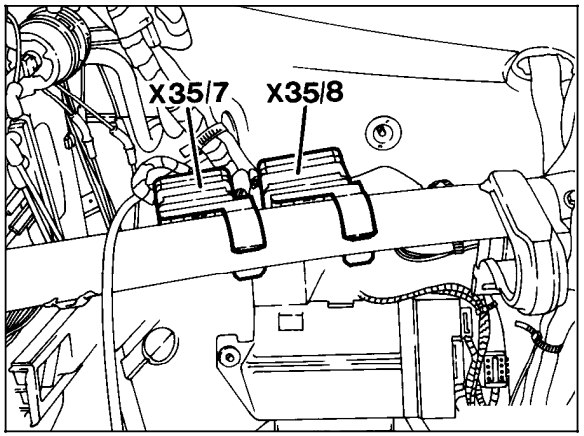
X26/17 LEngine separation point connector



P07-2637-13

Figure 11
Model 140

X47/2 CMP sensor intermediate connector



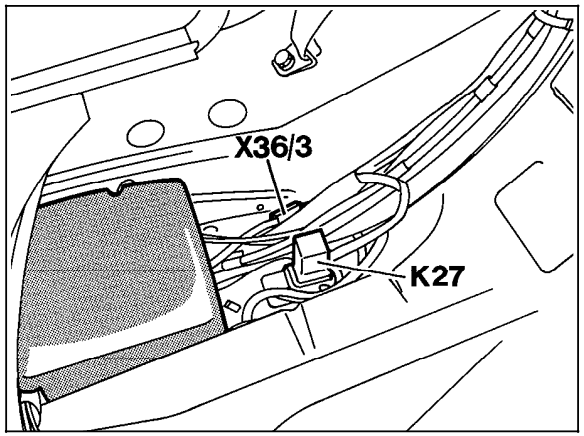
P07-2595-13

Figure 12
Model 124

X35/7 Cockpit/module box separation point (12-pole)

X35/8 Cockpit/module box separation point (EA/CC/ISC) (14-pole)

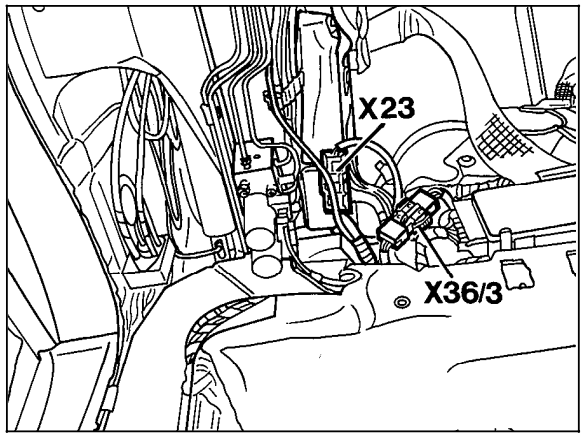
Electrical Test Program – Test



P07-2604-13A

Figure 13
Model 124

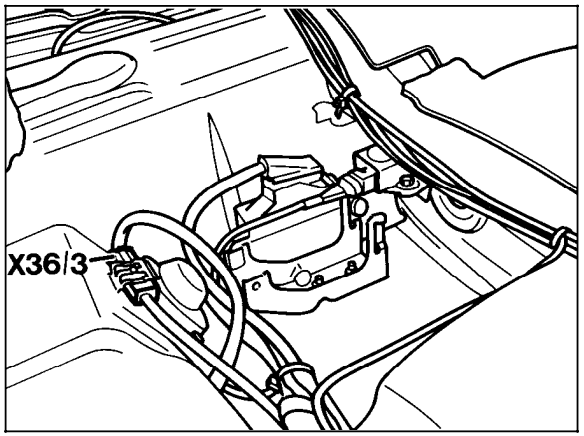
X36/3 FP harness connector (2-pole)



P54-2036-13

Figure 14
Model 129

X36/3 FP harness connector (2-pole)

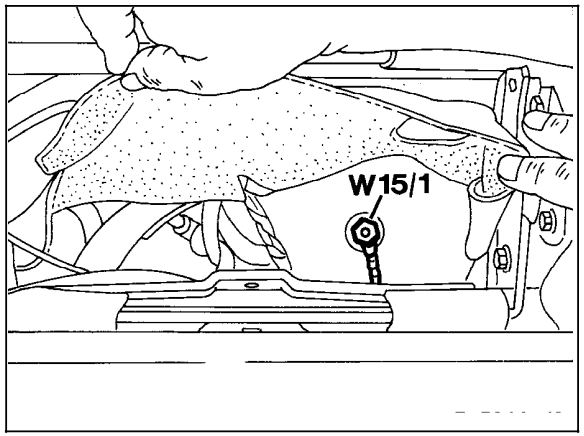


P07-2573-13

Figure 15
Model 140

X36/3 FP harness connector (2-pole)

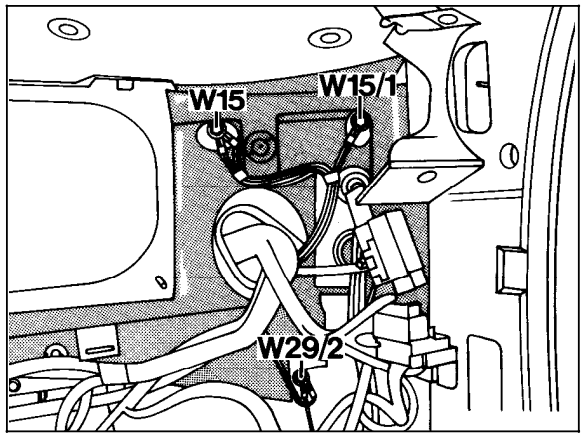
Electrical Test Program – Test



P07-5963-13

Figure 16
Model 129

W15/1 Ground (electronics - right footwell)



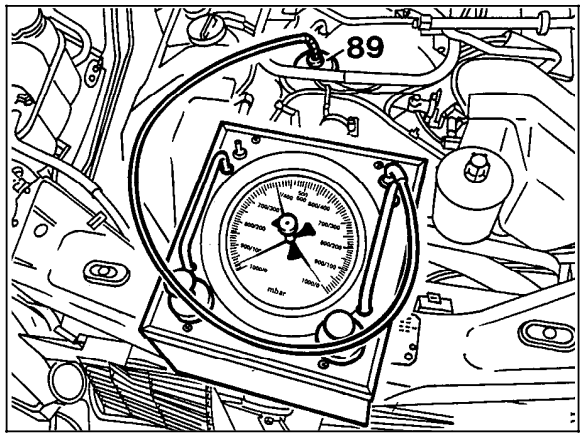
P54-2796-13

Figure 17
Model 140

W15 Ground (electronics output ground - right footwell)

W15/1 Ground (electronics - right footwell)

W29/2 Ground (right A-pillar)

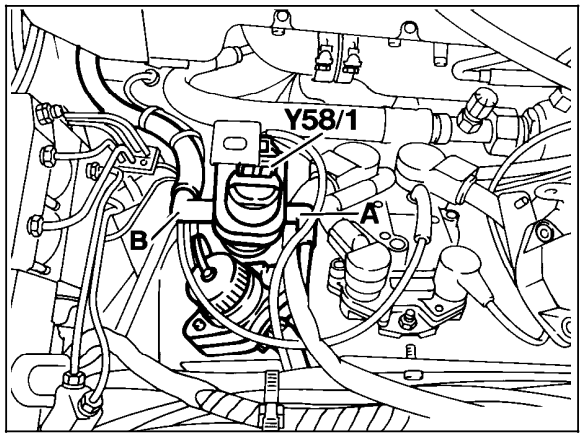


P07-5146-13

Figure 18
Engine 119

89 EGR valve

Electrical Test Program – Test



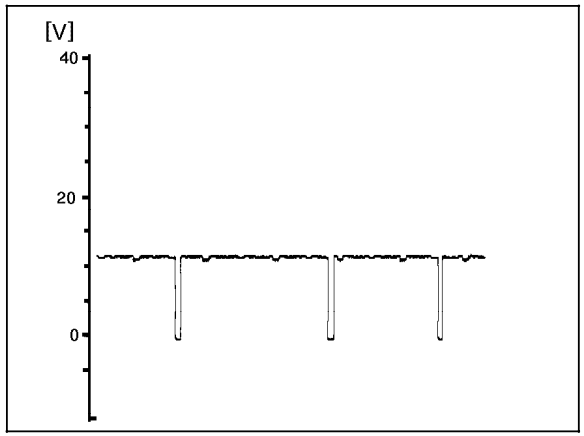
P07-5598-13

Figure 19
Engine 104, 119

Y58/1 Purge control valve

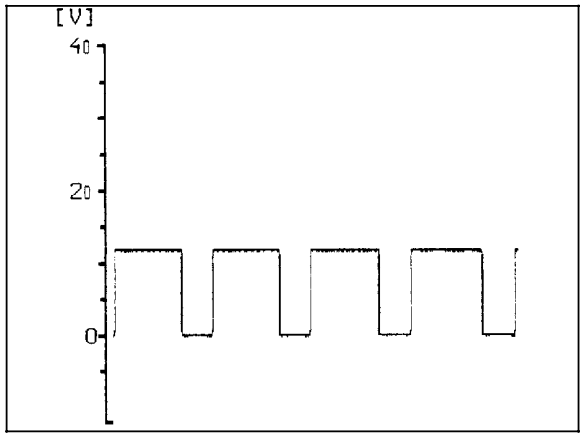
A Purge line to charcoal canister

B Purge line to engine



P07-0724-13

Figure 20
Processed CMP sensor signal from DI control module



P15-0370-13

Figure 21
TN-signal

Electrical Test Program – Test

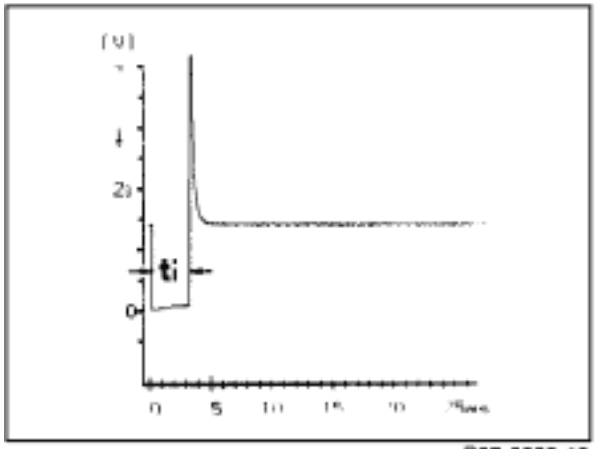


Figure 22
Injection time signal "ti" of injectors at CTP (idle)

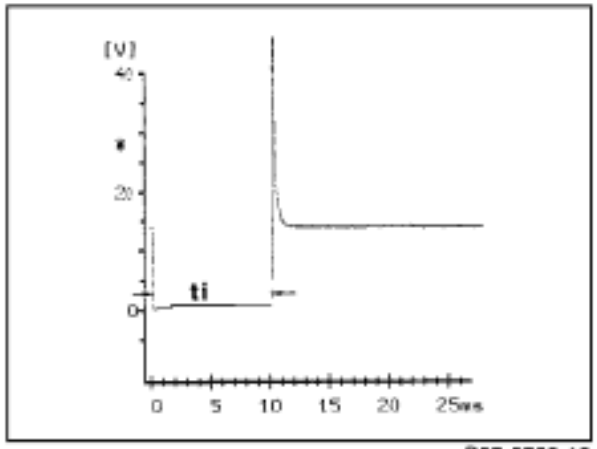


Figure 23
Injection time signal "ti" of injectors when briefly accelerating

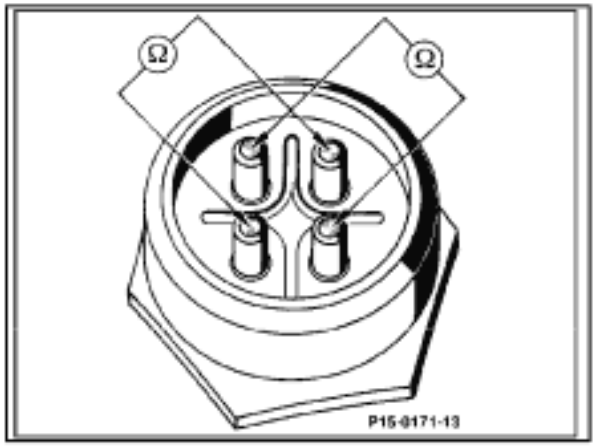
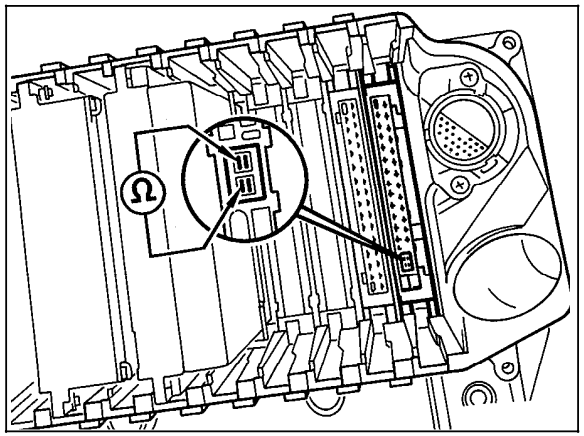


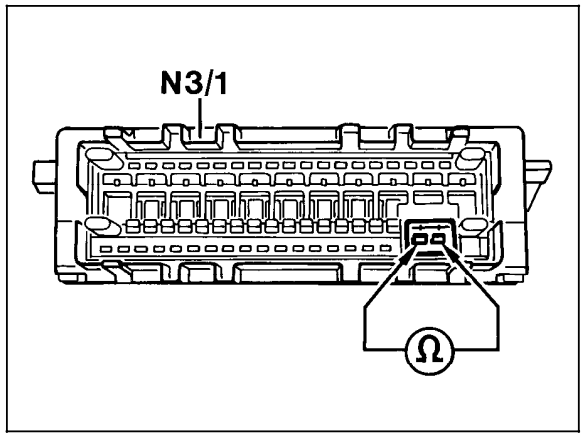
Figure 24
ECT sensor

Electrical Test Program – Test



P07-5160-13

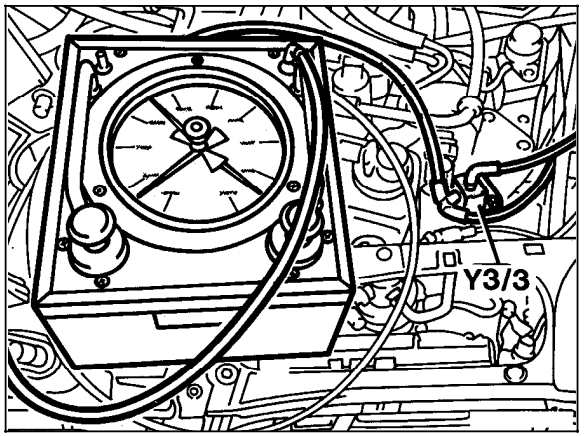
Figure 25



P07-5159-13A

Figure 26

N3/1 LH-SFI control module



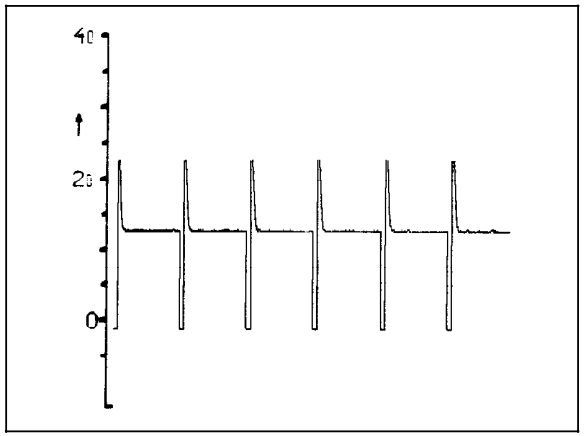
P07-5221-13A

Figure 27

Model 124

Y3/3 Upshift delay switchover valve

Electrical Test Program – Test



P07-5330-13

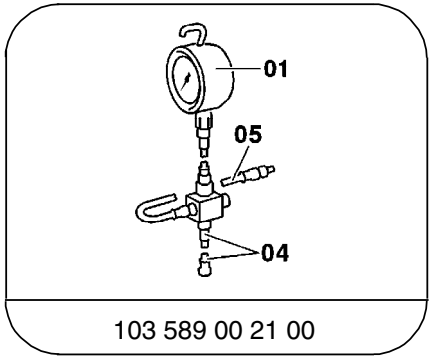
Figure 28

Purge control valve signal

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

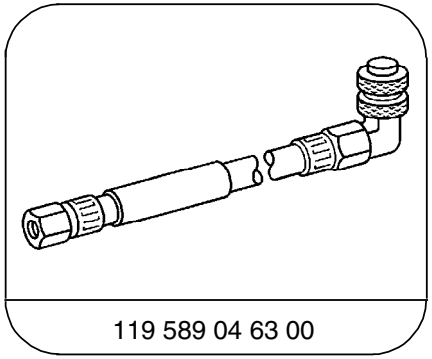
- Connect pressure gauge to test connection
- After completing test, using measurement glass (055), release fuel pressure and allow residual fuel to drain into glass (see Figures 1 and 2).

Special Tools



103 589 00 21 00

Tester

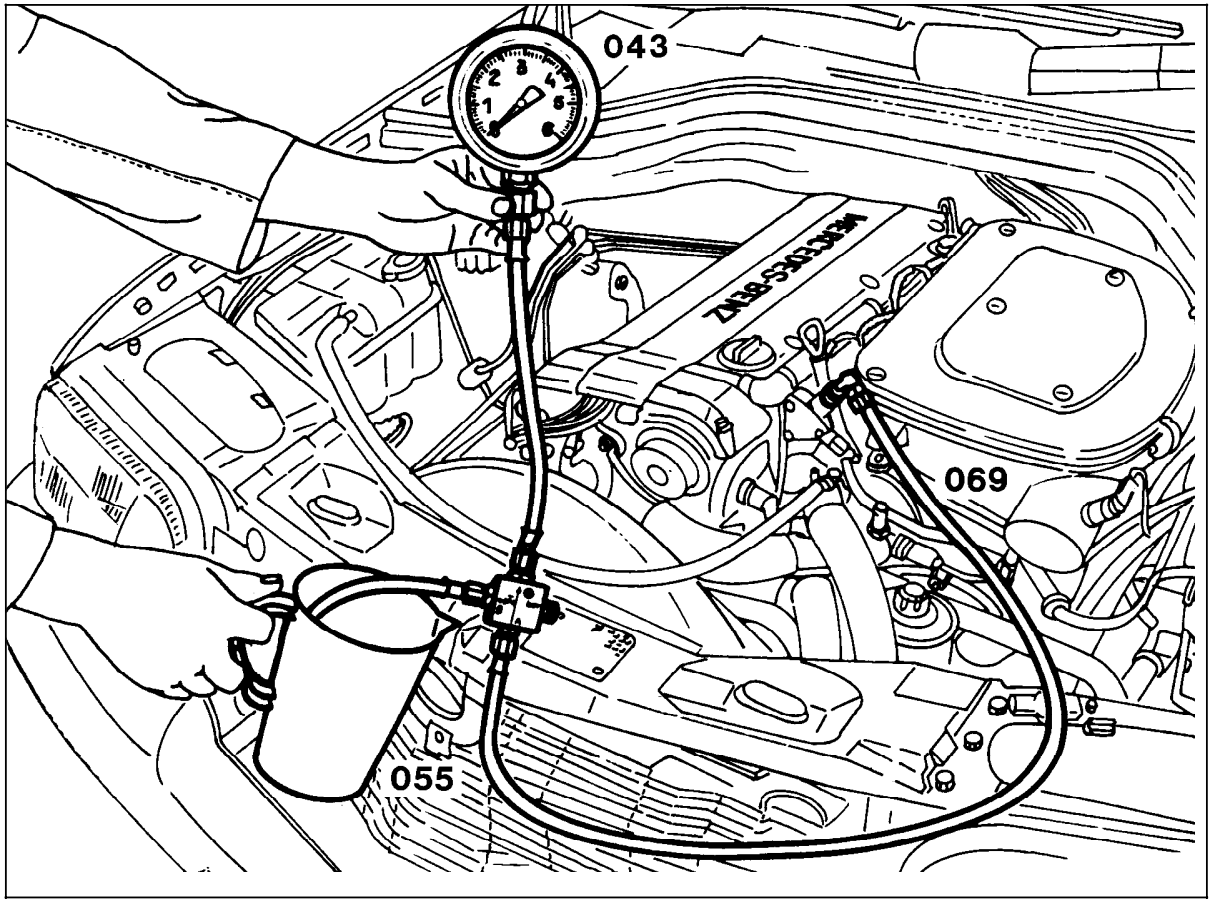


119 589 04 63 00

Pressure hose

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

Connection Diagram
Engine 104



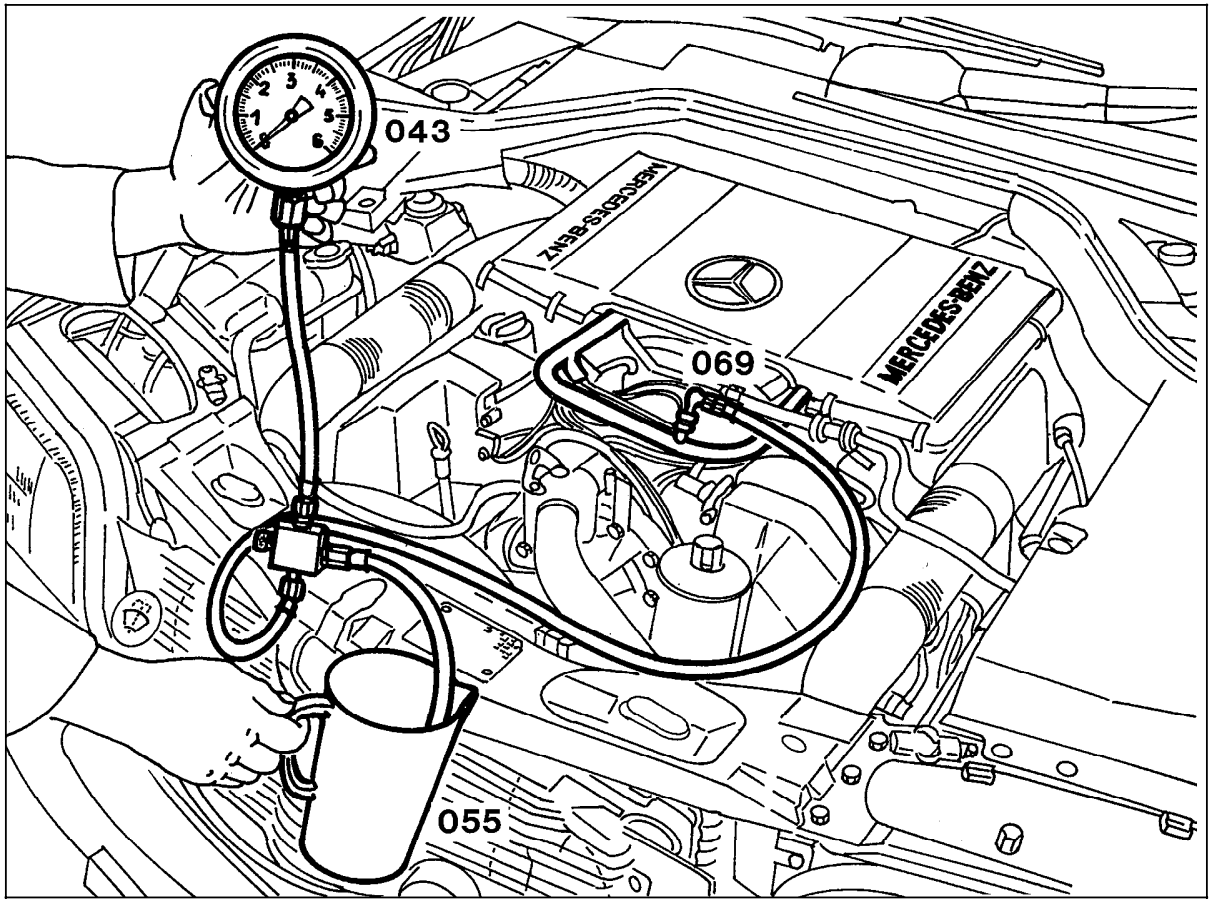
P07-2640-57

Figure 1

043	Pressure gauge (103 589 00 21 00)
055	Measurement glass
069	Pressure hose (119 589 04 63 00)

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

Connection Diagram
Engine 119



P07-2641-57

Figure 2

043	Pressure gauge (103 589 00 21 00)
055	Measurement glass
069	Pressure hose (119 589 04 63 00)

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

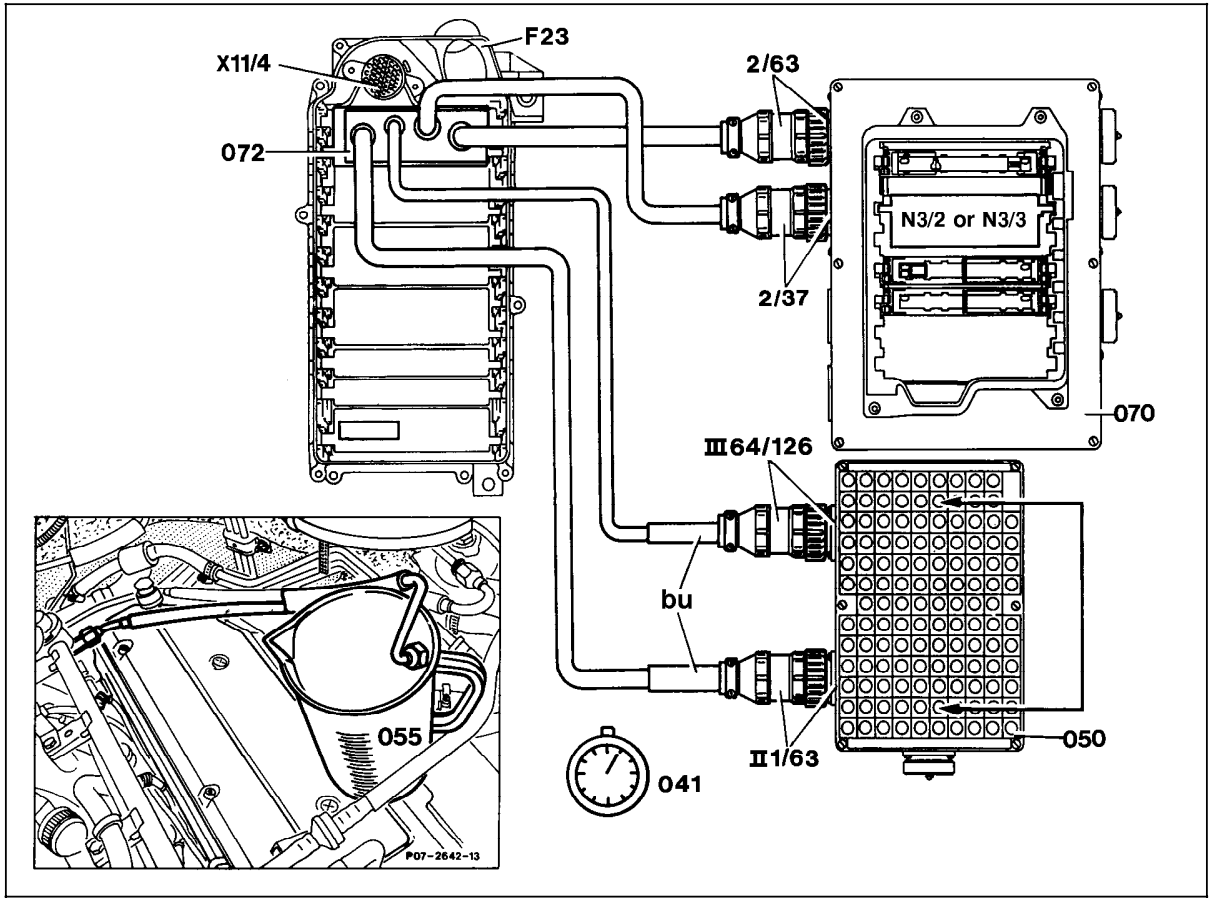
Test step **DTC**	Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy [1]
⇒ 1.0	**Fuel pressure** at idle (with vacuum)	Pressure gauge connected to test connection.	Engine: **at Idle** Valve on pressure gauge closed.	3.2 – 3.6 bar	Check fuel pumps 34, Replace diaphragm pressure regulator.
⇒ 2.0	**Fuel pressure** at idle (without vacuum)	Pressure gauge connected to test connection.	Engine: **at Idle** Disconnect vacuum hose from diaphragm pressure regulator.	3.7 – 4.2 bar	Replace diaphragm pressure regulator.
⇒ 3.0	**Fuel system internal leakage**	Pressure gauge connected to test connection.	Shut off engine. After 30 minutes	> 3.0 bar >2.5 bar	If pressure drops quickly, replace check valve in fuel pumps. If pressure drops slowly, check injectors 36, Replace diaphragm pressure regulator or O-rings on diaphragm pressure regulator.

[1] Observe Preparation for Test, see 22.

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

Connection Diagram - Delivery Test

- Connect socket box to LH-SFI control module (N3/1).



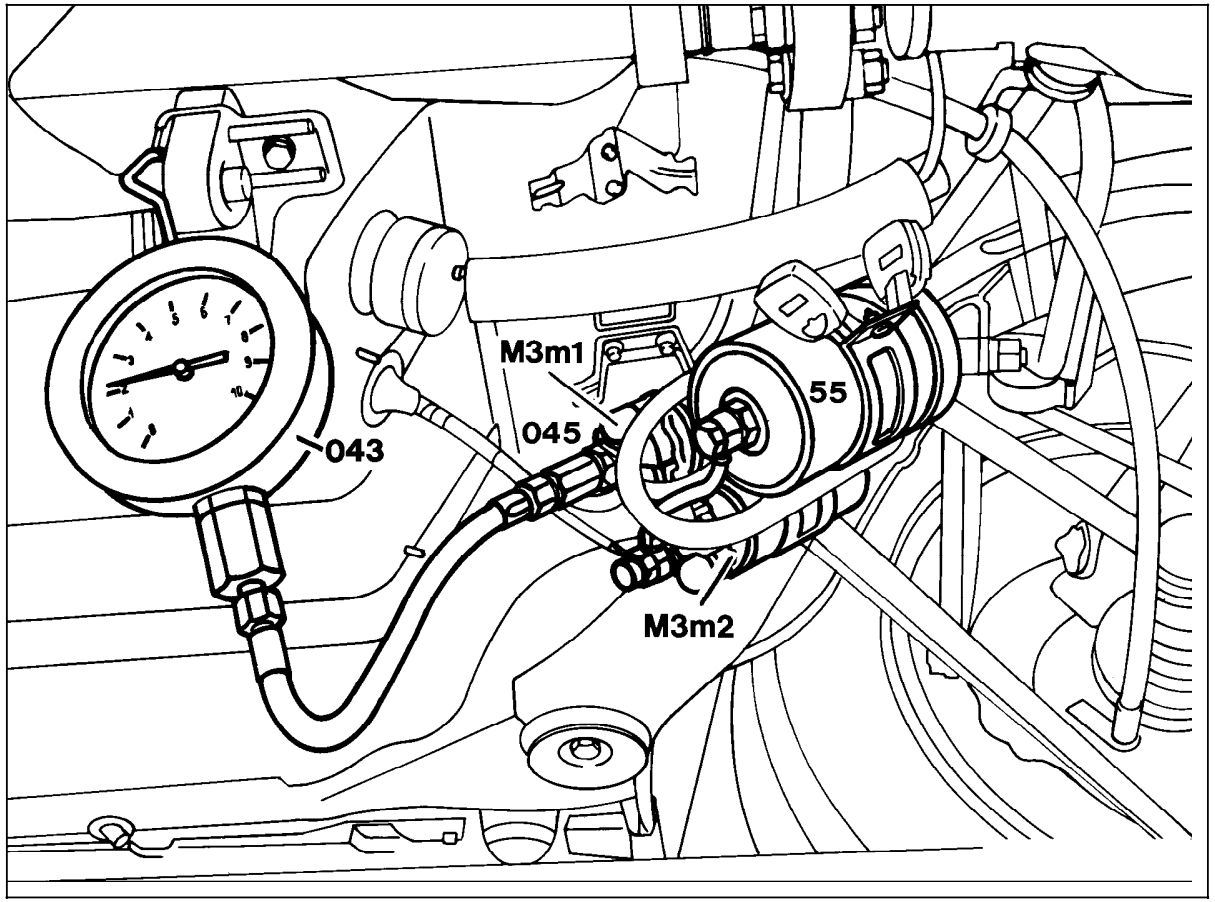
U07-5005-57

Figure 1

003	Multimeter
041	Stop watch
050	Socket box (126-pole)
055	Measuring glass
070	Contact box
072	Contact module
bu	blue

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

Connection Diagram - Fuel Pump Pressure Test



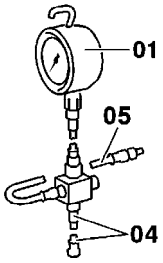
P07-2645-57

Figure 2

043	Pressure gauge (103 589 00 21 00)
045	Adaptor (103 589 02 63 00)
55	Fuel filter
M3m1	Fuel pump 1
M3m2	Fuel pump 2

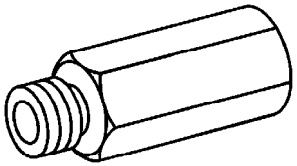
Hydraulic Test Program - Preparation for Test (Fuel Pump Test)

Special Tools



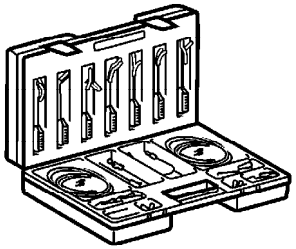
103 589 00 21 00

Tester



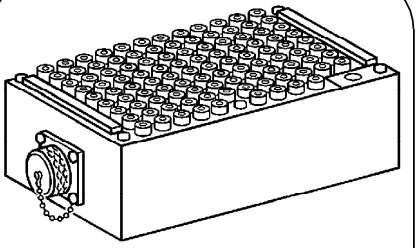
103 589 02 63 00

Adapter



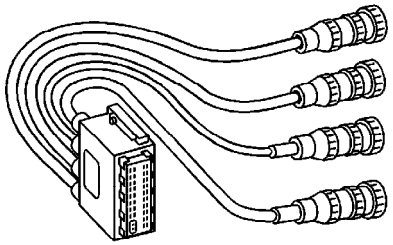
201 589 00 99 00

Electrical connecting set



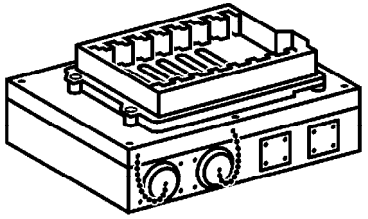
129 589 00 21 00

126-pin socket box



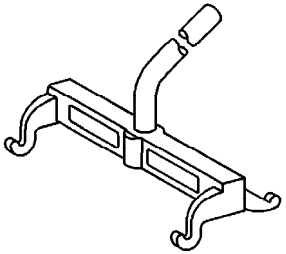
140 589 02 63 00

Contacting module 2



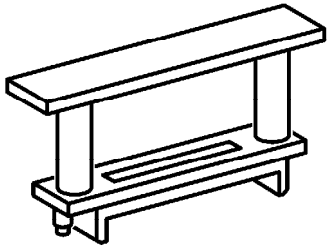
140 589 06 63 00

Contacting box



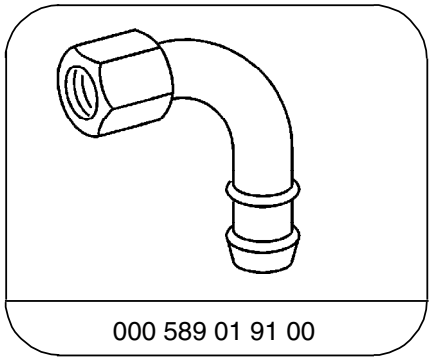
140 589 01 33 00

Mounting lever



140 589 10 33 00

Spacer



Elbow fitting

Equipment

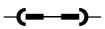
Fuel hose, 500 mm long (20 in.)	local purchase
Measuring glass (1 liter minimum)	local purchase
Stop watch	local purchase
Multimeter [1)]	Fluke Model 23, 83, 85, 87

1) Available through the MBUSA Standard Equipment Program.

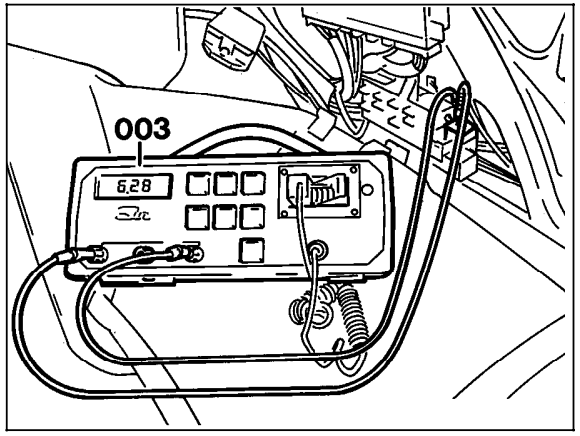
Hydraulic Test Program - Test (Fuel Pump Test)

Test step **DTC**	Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
⇒ 1.0	**Fuel pumps** Delivery capacity	N3/1 66 (1.25) — 76 (1.35)	**Models 124.034/036** Connect special tool fitting part no. 000 589 01 91 00 and fuel hose to diaphragm pressure regulator instead of fuel return line. Place other end of fuel hose in measuring glass. **Model 129 and 140** Disconnect fuel return line at separation point. Hold fuel hose in measuring glass. Ignition: **ON**	1 liter after maximum 35 seconds	Check fuel lines for restrictions (kinks and dents), Replace fuel filter, ⇒ 2.0 ⇒ 3.0

Hydraulic Test Program - Test (Fuel Pump Test)

Test step **DTC**	Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
⇒ 2.0	**Fuel pumps** Current draw	 Connect to sockets 1 and 3 (Figure 1)	Unplug FP relay module. Ignition: **ON**	 4 – 8 A	Fuel pump 1 or 2, **Note:** If current draw is > 8 A, also replace FP relay module.
⇒ 3.0	**Fuel pressure** after fuel pump 1	N3/1  66 (1.25)  76 (1.35)	Unscrew cap on fuel pump 1 (M3m1), Connect adaptor (045) and pressure gauge (043). Ignition: **ON** Read fuel pressure. Disconnect pressure gauge (043) and adaptor (045) and check for leaks.	 1 – 3 bar	 Fuel pressure < 1 bar: Voltage at fuel pump 1 < 11 V, Replace fuel pump 1 (M3m1). Fuel pressure > 3 bar: Voltage at fuel pump 2 < 11 V, Replace fuel pump 2 (M3m2).

Hydraulic Test Program - Test (Fuel Pump Test)



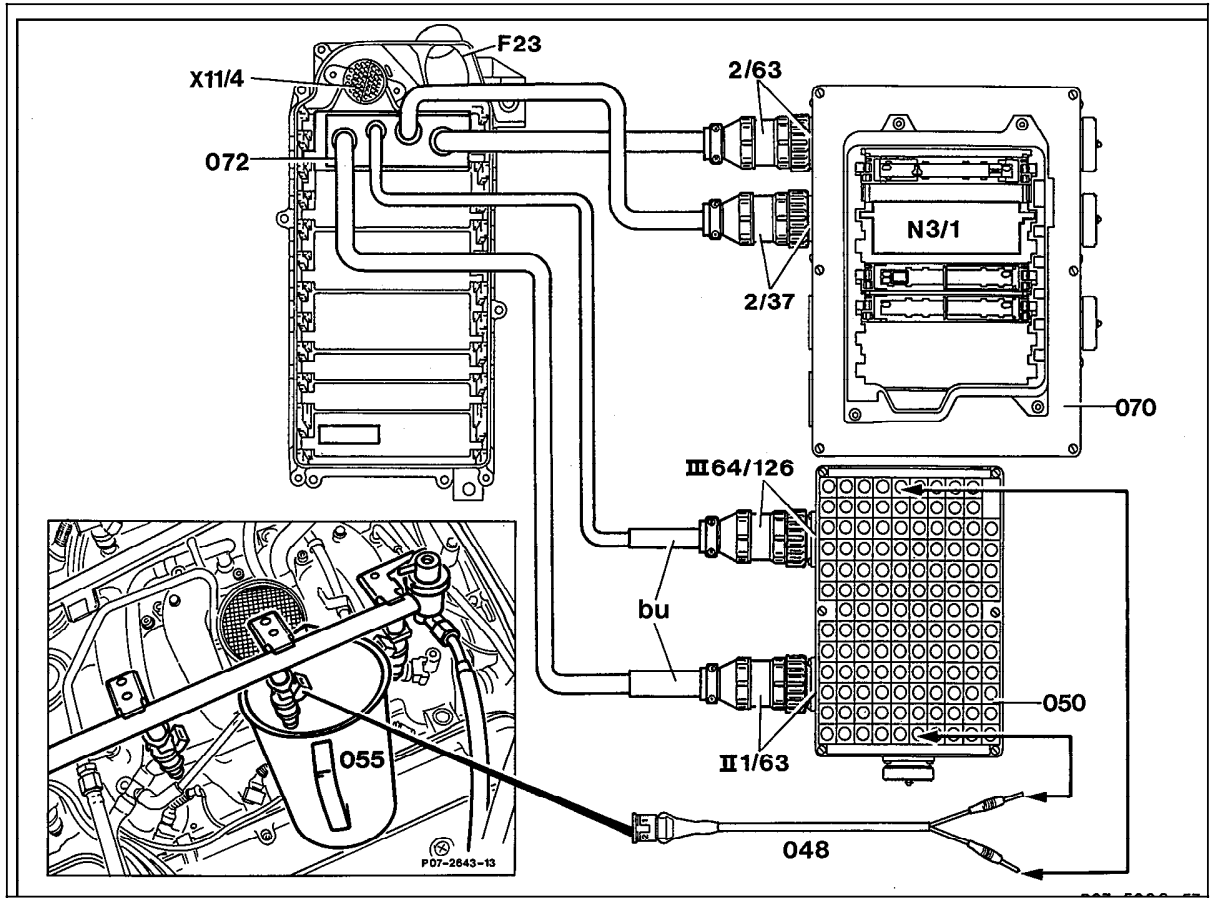
P07-2644-13

Figure 1

003 Multimeter

Hydraulic Test Program - Preparation for Test (Injector Test)

1. Connect socket box to LH-SFI control module (N3/1).
2. Unplug 2-pole connectors on injectors.
3. Remove fuel rail with injectors, thereby **not** disconnecting the fuel feed and return lines.
4. Connect self-made harness (048) one after another to each injector.
5. Hold each injector one after another into measuring glass.



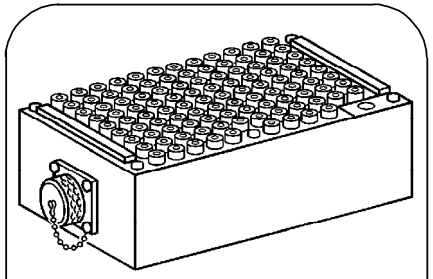
P07-5006-57

Figure 1

N3/1	LH-SFI control module
048	Self-made harness
050	Socket box (126-pole)
055	Measuring glass
070	Contact box
072	Contact module
bu	blue

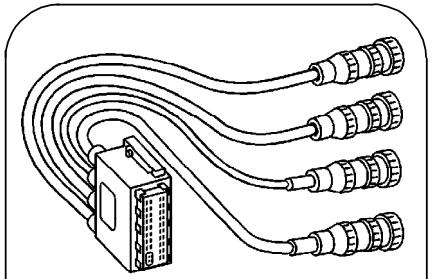
Hydraulic Test Program - Preparation for Test (Injector Test)

Special Tools



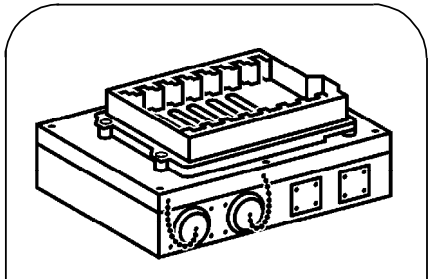
129 589 00 21 00

126-pin socket box



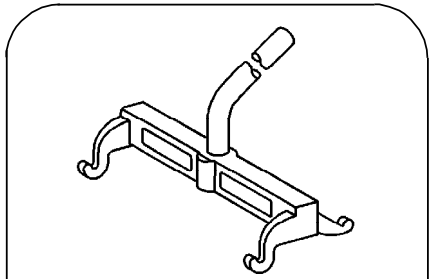
140 589 02 63 00

Contacting module 2



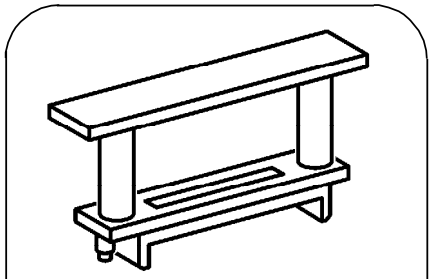
140 589 06 63 00

Contacting box



140 589 01 33 00

Mounting lever



140 589 10 33 00

Spacer

Equipment

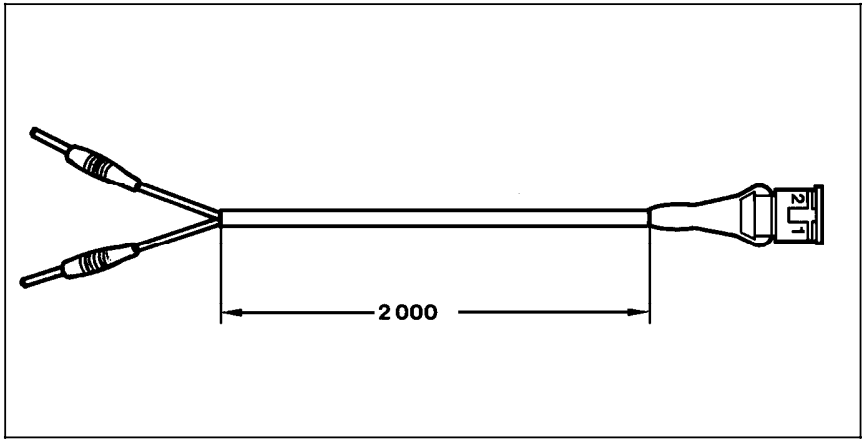
Measuring glass (1 liter minimum)	local purchase

Hydraulic Test Program - Preparation for Test (Injector Test)

Self-made Tool

Test harness consisting of:

1X	Connector 140 545 35 28
2X	Contact spring 004 545 56 26
1X	Banana plug (red)
1X	Banana plug (black)
2.2 m	Wire (red, 1.5 mm dia.)
2.2 m	Wire (brown, 1.5 mm dia.)
2 m	Harness tubing (6 mm dia.)



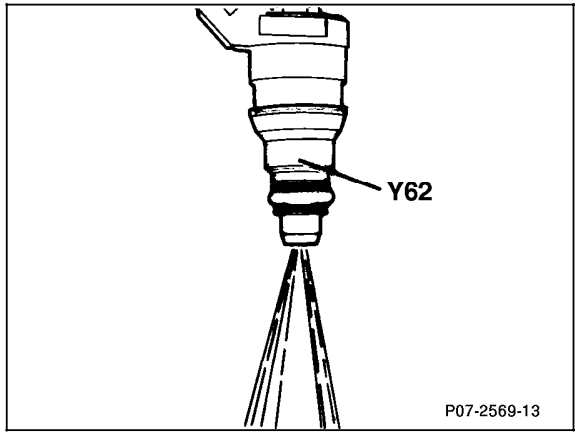
Connector layout
Position 1 = red
Position 2 = brown

P07-0625-33

Hydraulic Test Program - Test (Injector Test)

Test step **DTC**	Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
⇒ 1.0	**Injectors** Leakage test	N3/1 66 (1.25) — 76 (1.35)	Fuel rail with injectors removed. Ignition: **ON**	Injectors must not drip.	Replace dripping injectors.
⇒ 1.1	**Injectors** Operation and spray pattern test	N3/1 66 (1.25) — 76 (1.35)	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 64 (–) and 65 (+).	Injectors must spray evenly (Figure 1).	Replace defective injectors.

Hydraulic Test Program - Test (Injector Test)



P07-2569-13

Figure 1

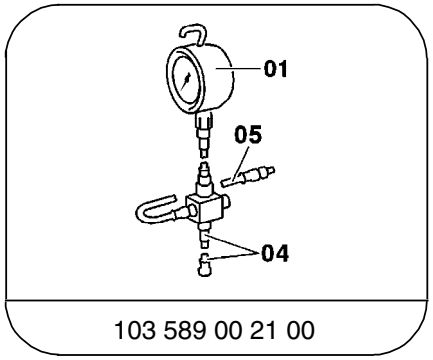
Acceptable injector spray pattern.

Hydraulic Test Program - Preparation for Test (Cold Start Test)

Preliminary work:
Engine Test, Adjustment . . . . . Engines, Volume 1

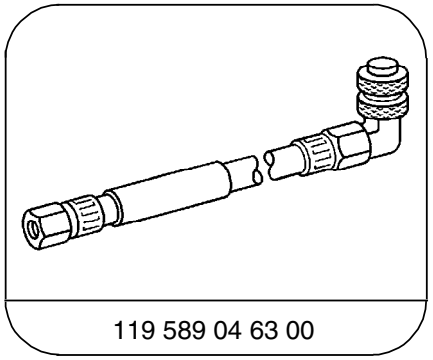
- Connect pressure gauge on test connection (31/1).
- After completing test, using measurement glass (055), release fuel pressure and allow residual fuel to drain into glass (31/1).

Special Tools



103 589 00 21 00

Tester



119 589 04 63 00

Pressure hose

Equipment

Engine analyzer [1]	Bear DACE (Model 40-960) Sun MEA-1500MB

[1] Available through the MBUSA Standard Equipment Program.

Hydraulic Test Program - Test (Cold Start Test)

Test step **DTC**	Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy [1]
⇒ 1.0	**Cool engine with blower** (or let vehicle stand over night)	Pressure gauge connected to test connection.	Engine: **at Idle** Valve on pressure gauge closed.	3.2 – 3.6 bar	Check fuel pumps 34.
⇒ 2.0	**Voltages at cranking speed**	Engine analyzer connected	Engine: **Start**	DM, Engines, Volume 1, Section A	Distributor Ignition System, Section 5.
⇒ 2.1	**Ignition oscilloscope picture**	Engine analyzer connected	Engine: **Start**	DM, Engines, Volume 1, Section C	Distributor Ignition System, Section 5.

[1] Observe Preparation for Test, see 22.