3.2 Engine 120

Diagnosis - Diagnostic Trouble Code (DTC) Memory

Preliminary work: . . . . . Engine Test and Adjustment, DM, 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 lines to the engine must be disconnected at both purge control valves and closed with plugs. 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.

⚠

The DTC's of both LH-SFI control modules (N3/2 and N3/3) must be read. Indicated DTC's in the left or right cylinder banks, if any, should be checked with the socket box tester (see 23).

LH-SFI Control Module Self-Adaptation Feature
A self-adaptation feature for the emission control system is incorporated into the LH-SFI control modules.
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 modules conduct a self-adaptation process whereby the correction factors are continuously calculated and permanently stored.

After eliminating the mentioned malfunction 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").

After performing repair work on the fuel injection system, the LH-SFI control modules will also adapt themself during the course of operation.

⚠

The LH-SFI control modules should not be switched (left to right – right to left).

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 yet determined.

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.

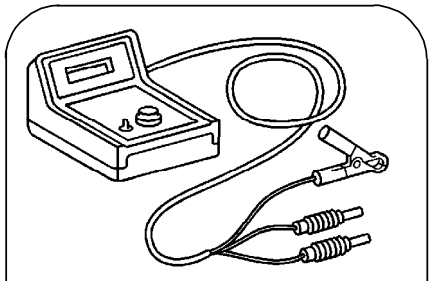
e) Ignition: **ON**
f) Repeat DTC readout. The number "1" (no DTC stored) must appear.

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.

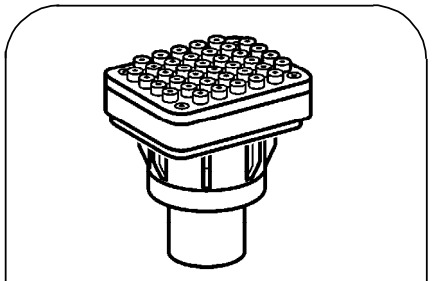
Diagnosis - Diagnostic Trouble Code (DTC) Memory

Special Tools



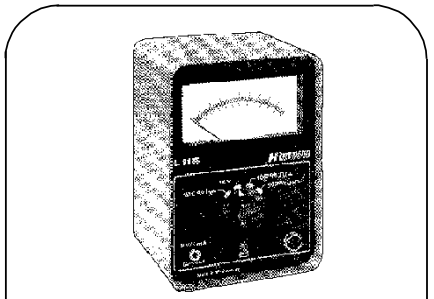
124 589 19 21 00

Pulse counter



140 589 14 63 00

Adapter

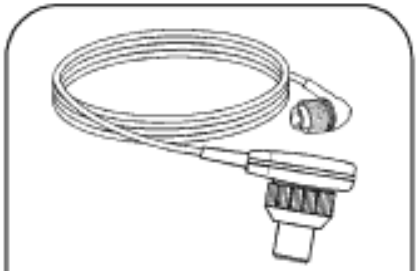


909 589 09 21 00

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 X11/2 and X11/3

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:

Left LH-SFI control module	Socket	5
Right LH-SFI control module	Socket	4
Left DI control module	Socket	18
Right DI control module	Socket	17
Base module	Socket	8
EA/CC/ISC control module	Socket	7
Diagnostic module	Socket	19

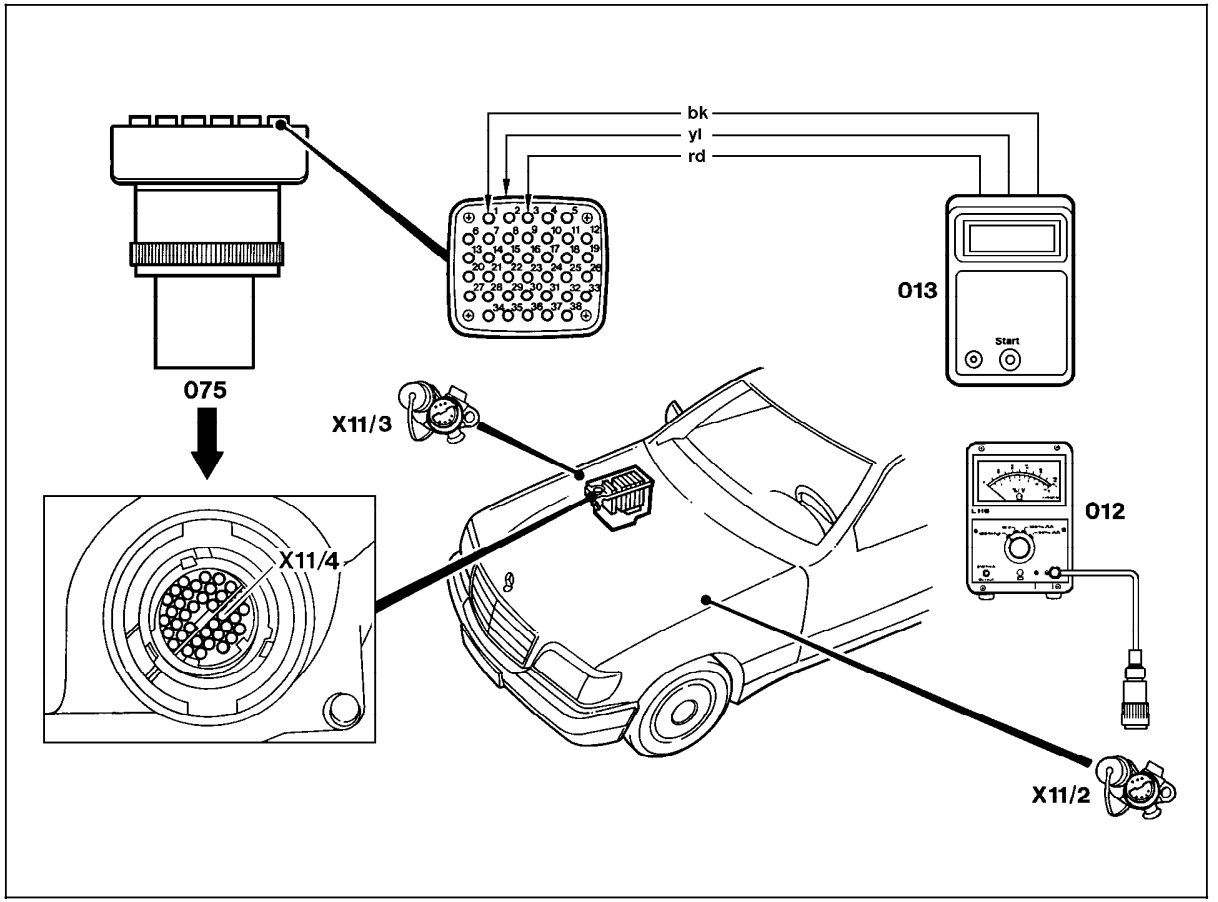


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Figure 1

012	On-off ratio tester
013	Impulse counter scan tool
075	Impulse counter scan tool adaptor
X11/2	Left diagnostic socket (9-pole)
X11/3	Right 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 X11/2 and X11/3

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:

Left LH-SFI control module	Socket	5
Right LH-SFI control module	Socket	4
Left DI control module	Socket	18
Right DI control module	Socket	17
Base module	Socket	8
EA/CC/ISC control module	Socket	7
Diagnostic module	Socket	19
Engine rpm signal (TN, output)	Socket	13
Right bank on-off ratio	Socket	14
Left bank on-off ratio	Socket	15
Circuit 31	Socket	1
Circuit 30	Socket	3

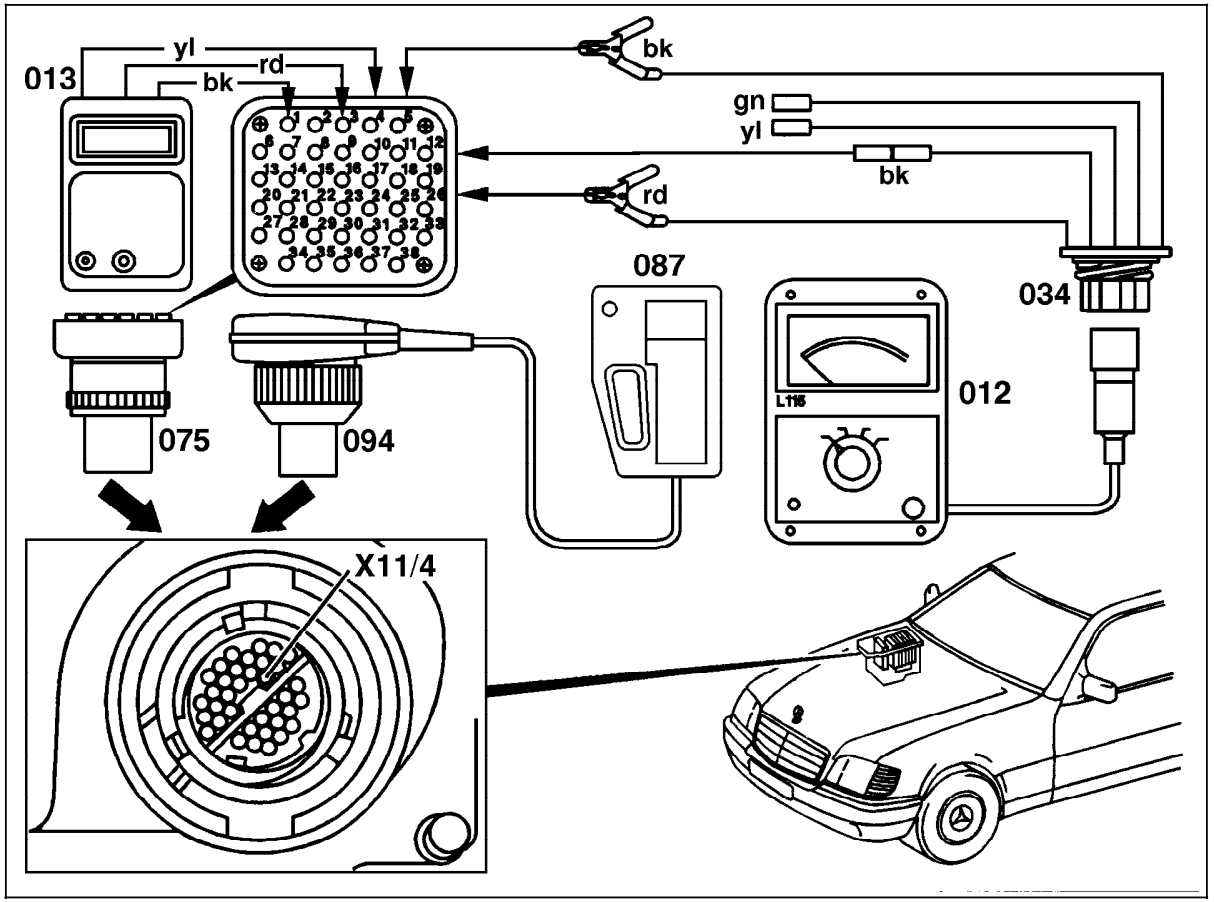

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Figure 2

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 ⇒ 16.0
20	WOT (full load) recognition active	23 ⇒ 16.0
30	Engine coolant temperature < 70 °C or >110 °C	23 ⇒ 10.0, 11.0
40	Not used	
50	Input signals OK	
60	TN-signal (rpm signal) or CMP sensor signal not present while starting	23 ⇒ 13.0 – 15.0
70	Starter engaged	23 ⇒ 9.1
80	CAN-data exchange defective	23 ⇒ 39.0
90	Fuel safety shut-off active	Check EA (see DM, Engines, Volume 3, Section 6.3)

[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 ⇒ 16.0
20	Output of fuel injectors or one or more fuel injectors have open circuit	23 ⇒ 32.0, 33.0
30	Left or right ECT sensor (B11/9 or B11/10)	23 ⇒ 10.0 – 11.1
40	Left or right hot wire MAF sensor (B2/3 or B2/4)	23 ⇒ 6.0 – 7.0
50 [2]	Left or right O2S 1 (before TWC) (G3/3 or G3/4) not operational or defective, open circuit	23 ⇒ 19.0 – 20.0
60	Left or right CMP sensor (L5/2 or L5/3)	23 ⇒ 15.0
70	TN-signal (rpm signal)	23 ⇒ 13.0 – 14.0
80	CAN-data exchange defective	23 ⇒ 39.0 Either EA/CC/ISC control module or DI control module not transmitting.
90	Vehicle speed signal	Check EA (see DM, Engines, Volume 3, Section 6.3)
95	Deceleration shut-off active	Check EA (see DM, Engines, Volume 3, Section 6.3)
100	No voltage at left or right LH-SFI control module (N3/2 or N3/3)	23 ⇒ 1.0 – 3.0

1) Observe Preparation for Test, see 22.

2) Needle oscillates if all monitored signals are OK.

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	Left or right ECT sensor (B11/9 or B11/10) sensor circuit 1, open/short circuit	23 ⇒ 10.0 – 10.2
3	Left or right ECT sensor (B11/9 or B11/10) sensor circuit 2, open/short circuit	23 ⇒ 11.0 – 11.2
4 [2]	Voltage at left or right hot wire MAF sensor (B2/3 or B2/4) insufficient or too high, or open circuit in ground wire at hot wire MAF sensor	23 ⇒ 6.0 – 7.0
5	Not used	–
6	Not used	–
7	TN-signal (rpm signal) incorrect or open/short circuit	23 ⇒ 13.0
8	Left or right CMP sensor (L5/2 or L5/3) signal, open/short circuit	23 ⇒ 15.0
9	Starter signal (circuit 50) missing, open/short circuit	23 ⇒ 9.1
10 [3]	CTP (idle) recognition from EA/CC/ISC control module (N4/1), short circuit	23 ⇒ 16.0
11 [4]	AIR pump system, open/short circuit	23 ⇒ 24.0

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 ⇒ 8.0
13	Left or right IAT sensor (B17/5 or B17/6), open/short circuit	23 ⇒ 12.0 – 12.1
14	Not used	–
15	Not used	–
16 [5]	Left or right EGR switchover valve (Y27/2 or Y27/3), open/short circuit	23 ⇒ 21.0 – 21.1
17 [6]	No CAN data transmission with EA/CC/ISC control module (N4/1)	23 ⇒ 39.0 or N4/1 not transmitting.
18	No CAN data transmission with left or right DI control module (N1/4 or N1/5)	23 ⇒ 39.0 or N1/4 or N1/5 not transmitting.
19	No CAN data transmission between left and right LH-SFI control module	23 ⇒ 39.0
20	No CAN data transmission from left or right LH-SFI control module (N3/2 or N3/3)	Replace N3/2 or N3/3.
21	Left or right O2S 1 (before TWC) (G3/3 or G3/4), open/short circuit	23 ⇒ 19.0

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 17 can be displayed even if no fault is present.

Diagnosis – Diagnostic Trouble Code (DTC) Memory

c) LH-SFI Control Module DTC R3eadout

DTC 	Possible cause	Test step/Remedy [1]
22	O2S 1 heater, open/short circuit	23 ⇒ 20.0 – 20.1
23	Left or right purge control valve (Y58/2 or Y58/3), open/short circuit	23 ⇒ 25.0 – 25.1
24	Not used	–
25	Left or right adjustable camshaft timing solenoid (Y49/1 or Y49/2), open/short circuit	23 ⇒ 27.0 – 27.1
26	Upshift delay switchover valve (Y3/3), open/short circuit	23 ⇒ 33.0
27	Left or right injectors (Y63 or Y64), open/short circuit	23 ⇒ 31.0
28	Left or right LH-SFI control module coding, open circuit	23 ⇒ 41.0

[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 ⇒ 13.0
Engine starts poorly and accelerates poorly	Left or right hot wire MAF sensor (B2/3 or B2/4) defective Left or right ECT sensor (B11/9 or B11/10) defective	23 ⇒ 6.0 – 7.0 23 ⇒ 10.0 – 11.0
Engine does not start	No voltage supply from base module (N16/1) FP relay module (K27/1 or K27/2) defective Left or right ECT sensor (B11/9 or B11/10) defective Injector control and injection timing	23 ⇒ 1.0 – 5.0 23 ⇒ 9.0 34 ⇒ 2.0 23 ⇒ 10.0 – 11.0 23 ⇒ 32.0
Engine runs uneven at CTP (idle)	Left or right EGR valve defective Injector control and injection timing	23 ⇒ 23.0 23 ⇒ 32.0
Engine has insufficient engine output	Left or right camshaft timing adjustment defective	23 ⇒ 27.0 – 28.0

[1] Observe Preparation for Test, see 22.

Electrical Test Program - Component Locations

Engine 120

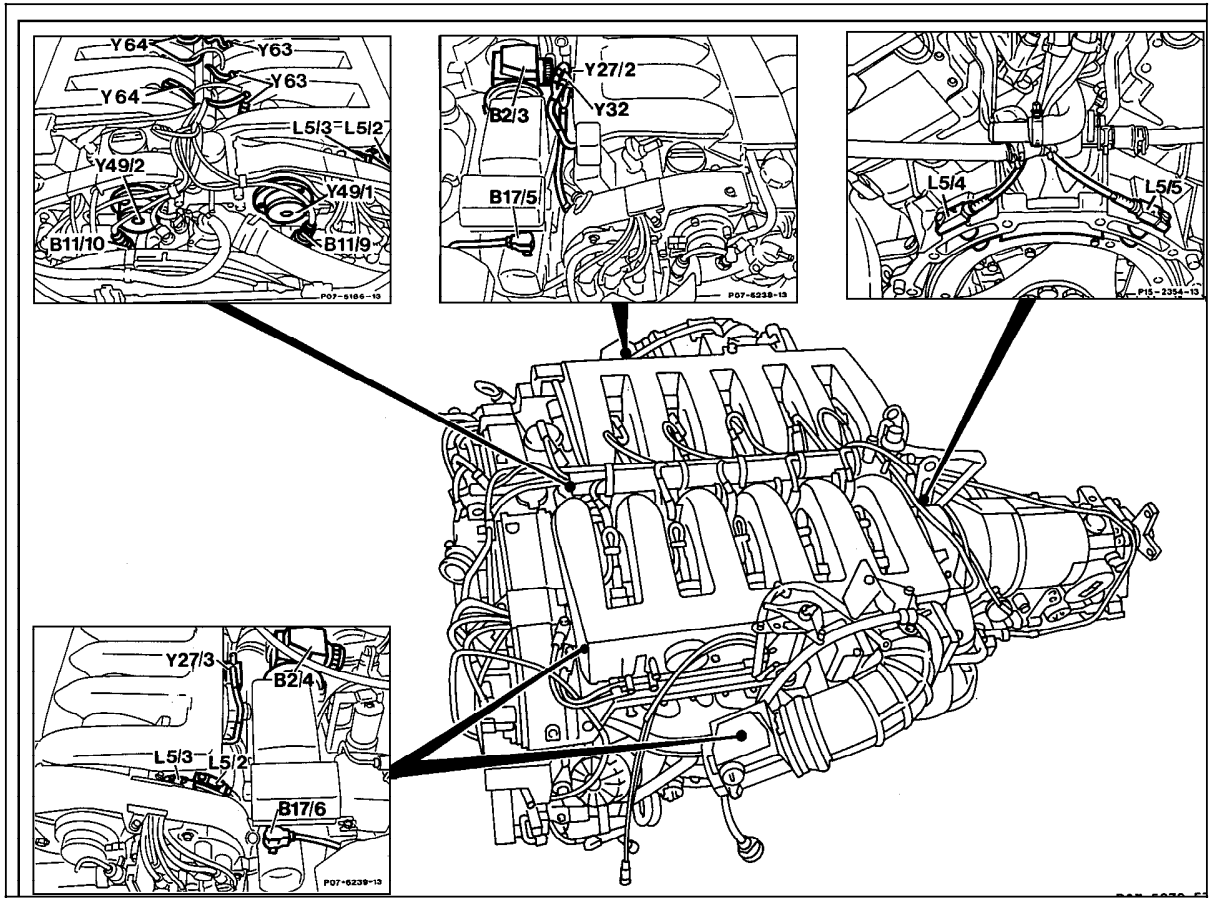

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Figure 1

B2/3	Left hot wire MAF sensor (located on right side of engine)
B2/4	Right hot wire MAF sensor (located on left side of engine)
B11/9	Left ECT sensor
B11/10	Right ECT sensor
L5/2	Left CMP sensor
L5/3	Right CMP sensor
L5/4	Left CKP sensor
L5/5	Right CKP sensor
Y27/2	Left EGR switchover valve (located on right side of engine)
Y27/3	Right EGR switchover valve (located on left side of engine)
Y32	AIR pump switchover valve
Y49/1	Left adjustable camshaft timing solenoid
Y49/2	Right adjustable camshaft timing solenoid
Y63	Left injectors
Y64	Right injectors

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 129

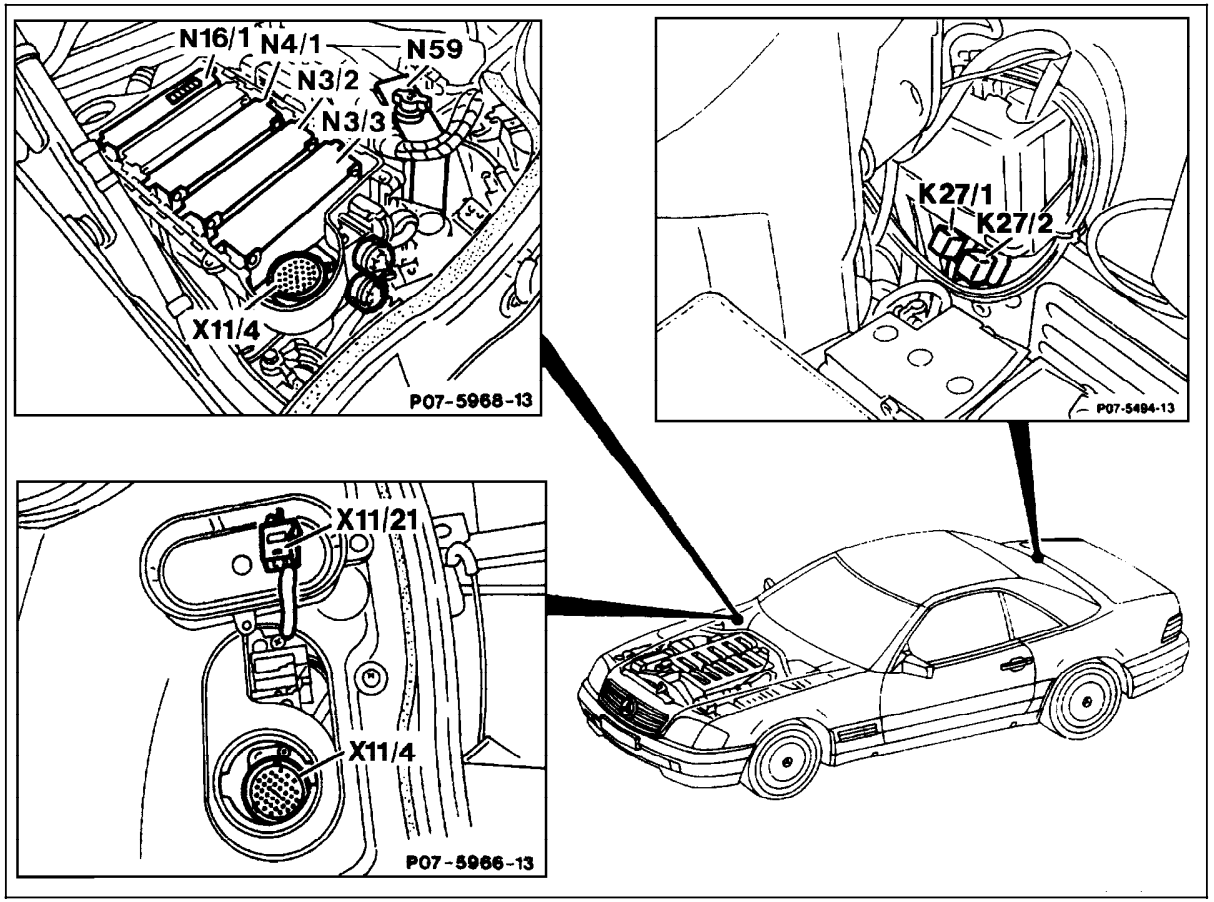

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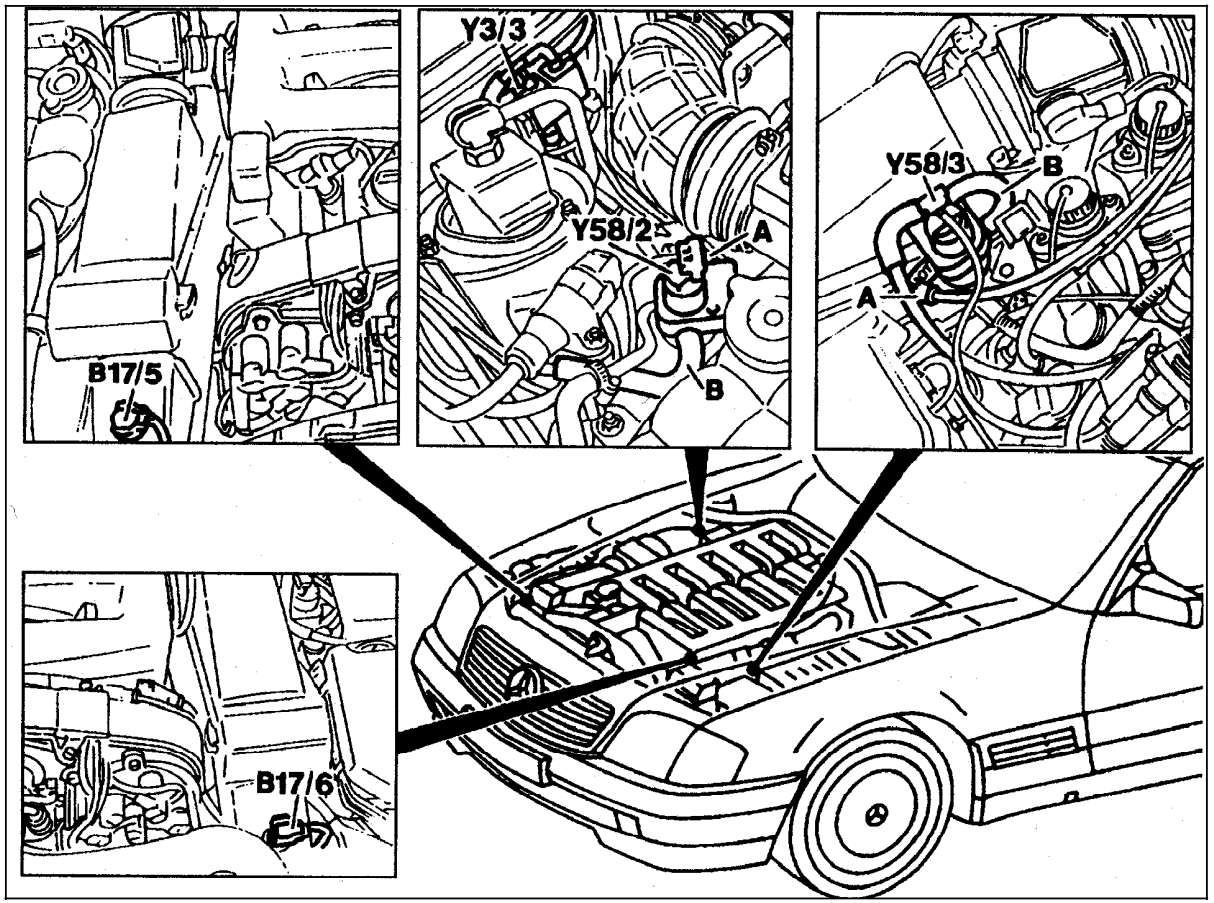
Figure 2

K27/1	FP 1 and 2 relay module 1
K27/2	FP 1 and 2 relay module 2
N3/2	Left LH-SFI control module
N3/3	Right 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



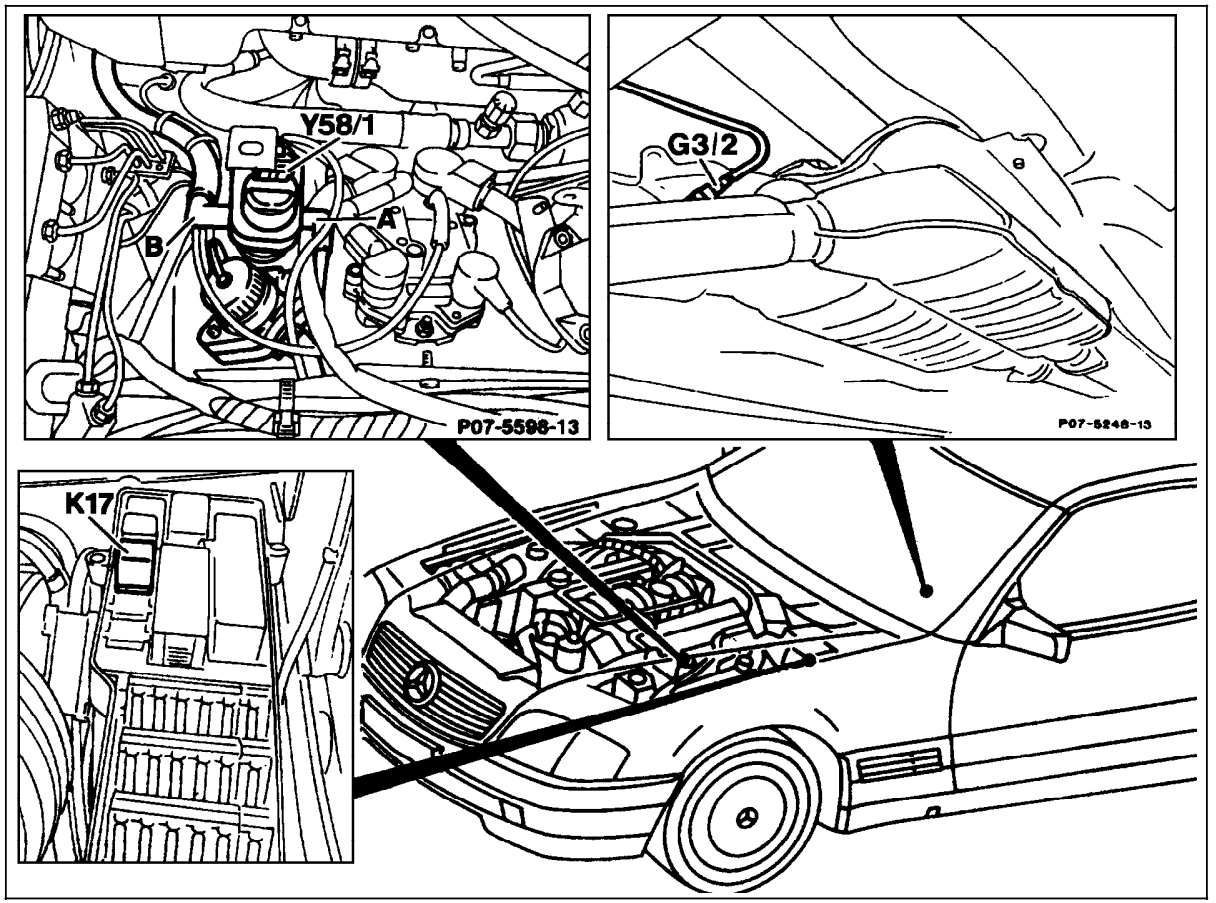
U07-5915-57

Figure 3

B17/5	Left IAT sensor (located on right side of engine)
B17/6	Right IAT sensor (located on left side of engine)
Y3/3	Upshift delay switchover valve
Y58/2	Left purge control valve (located on right side of engine
Y58/3	Right purge control valve (located on left side of engine
A	Purge line to engine
B	Purge line to charcoal canister

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 129



U07-5906-57

Figure 4

G3/3	Left O2S 1 (before TWC)
G3/4	Right O2S 1 (before TWC)
K17	AIR relay module

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 129

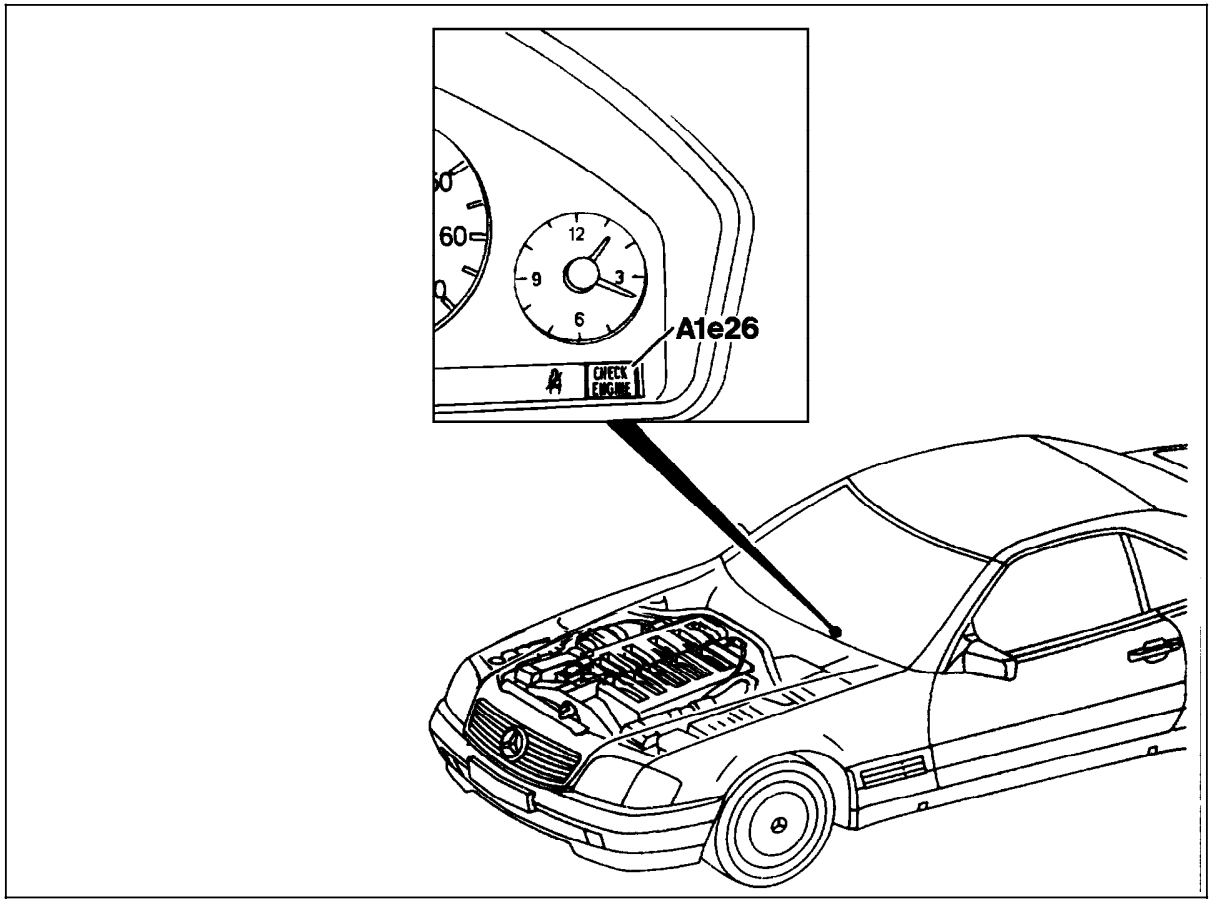


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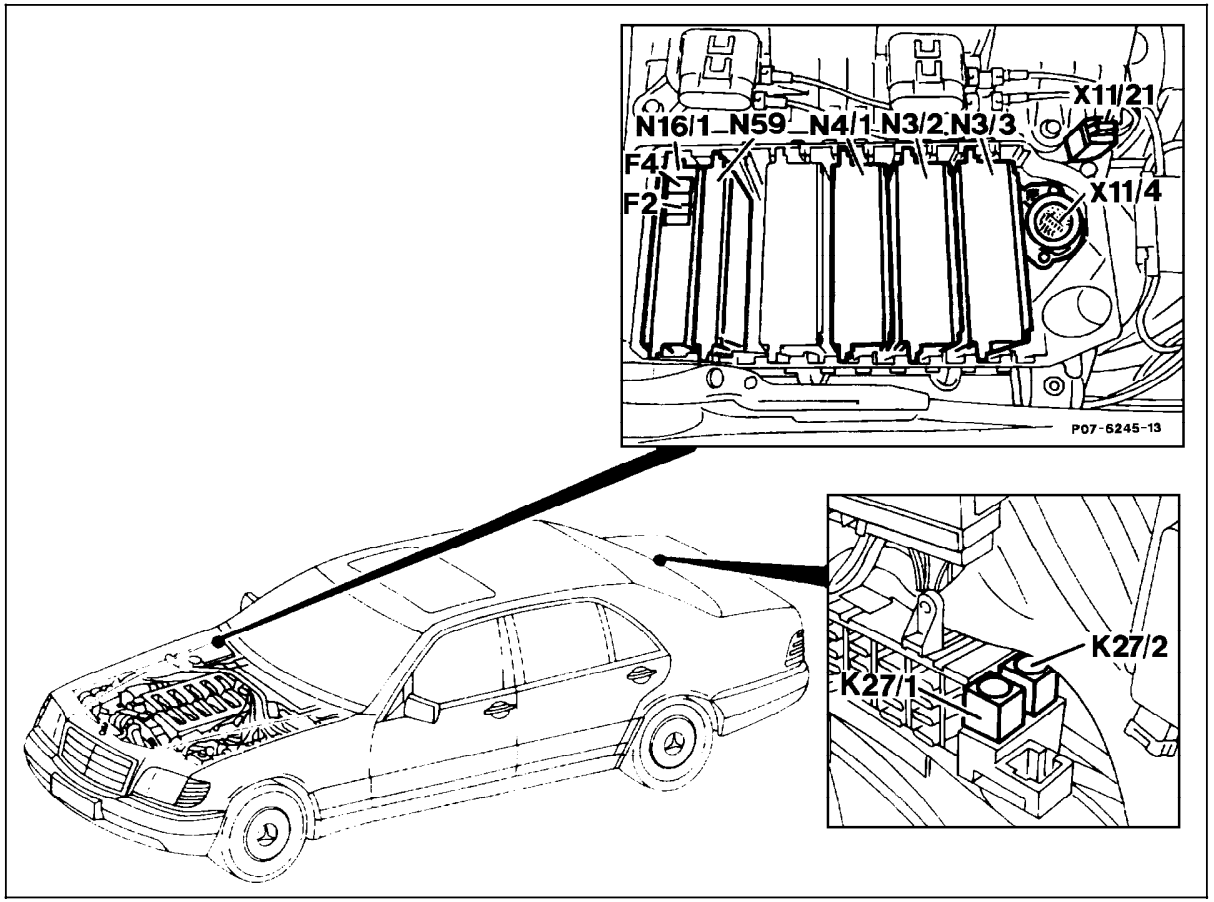
Figure 5
A1e26 “CHECK ENGINE” MIL

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 140



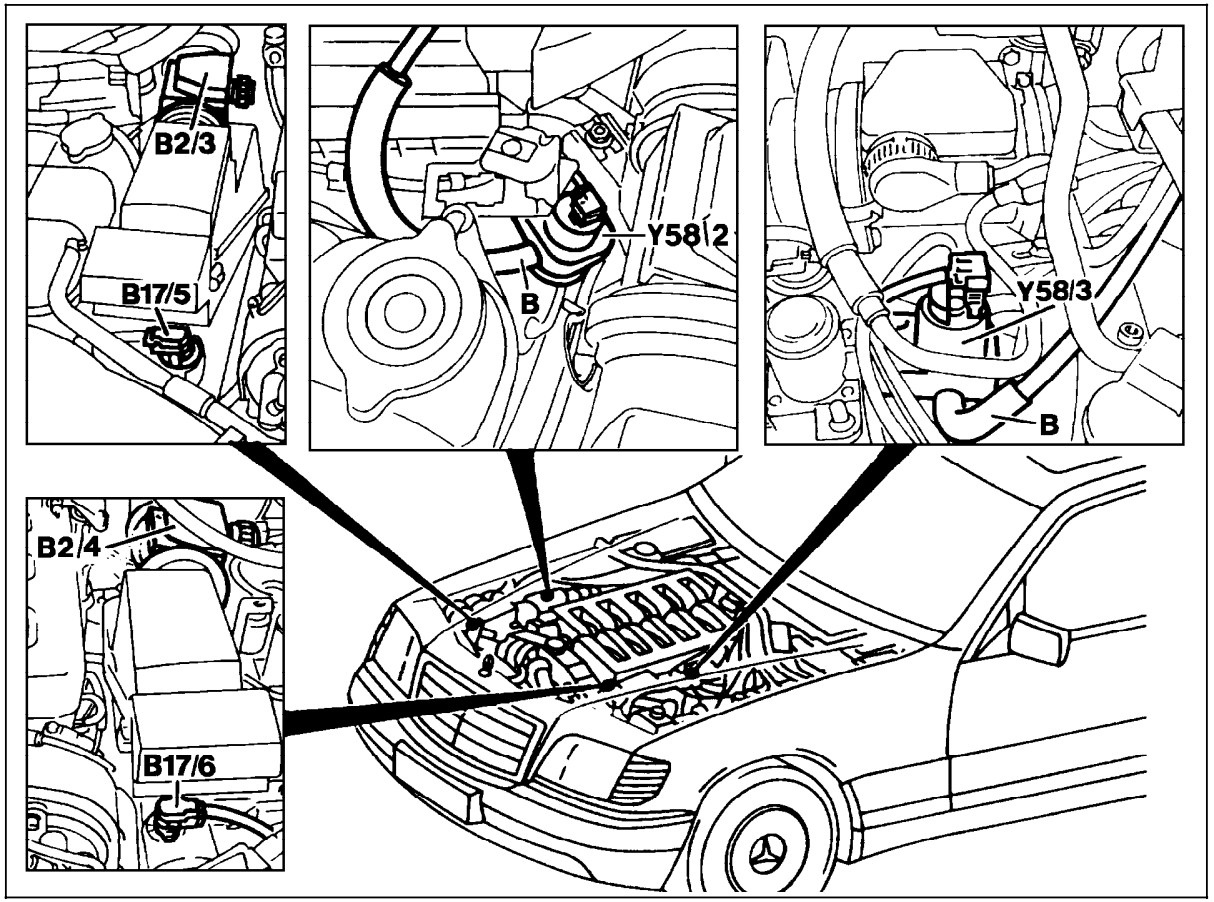
U07-5918-57

Figure 6

K27/1	FP 1 and 2 relay module 1
K27/2	FP 1 and 2 relay module 2
N3/2	Left LH-SFI control module
N3/3	Right 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 140



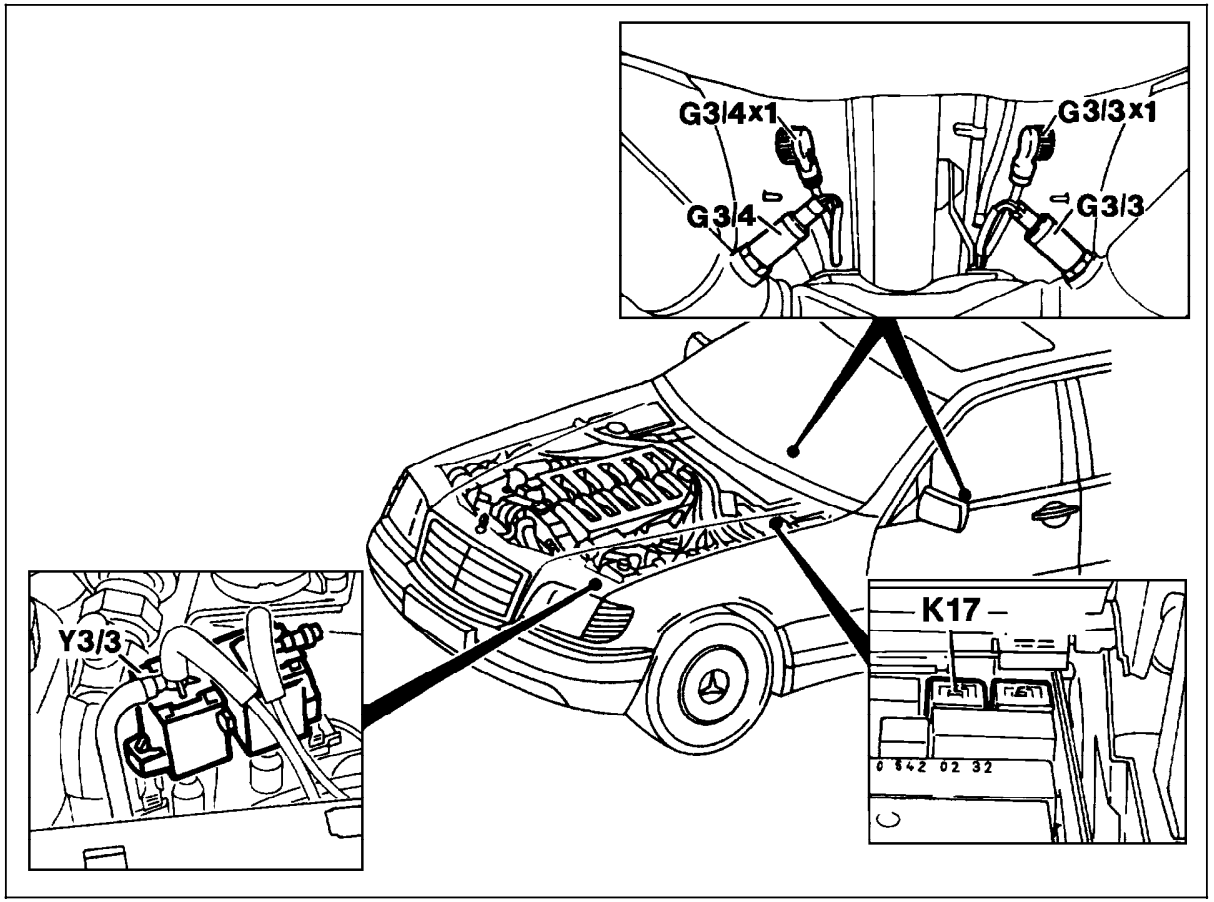
P07-5919-57

Figure 7

B2/3	Left hot wire MAF sensor (located on right side of engine)
B2/4	Right hot wire MAF sensor (located on left side of engine)
B17/5	Left IAT sensor (located on right side of engine)
B17/6	Right IAT sensor (located on left side of engine)
Y58/2	Left purge control valve (located on right side of engine)
Y58/3	Right purge control valve (located on left side of engine)
B	Purge line to charcoal canister

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 140



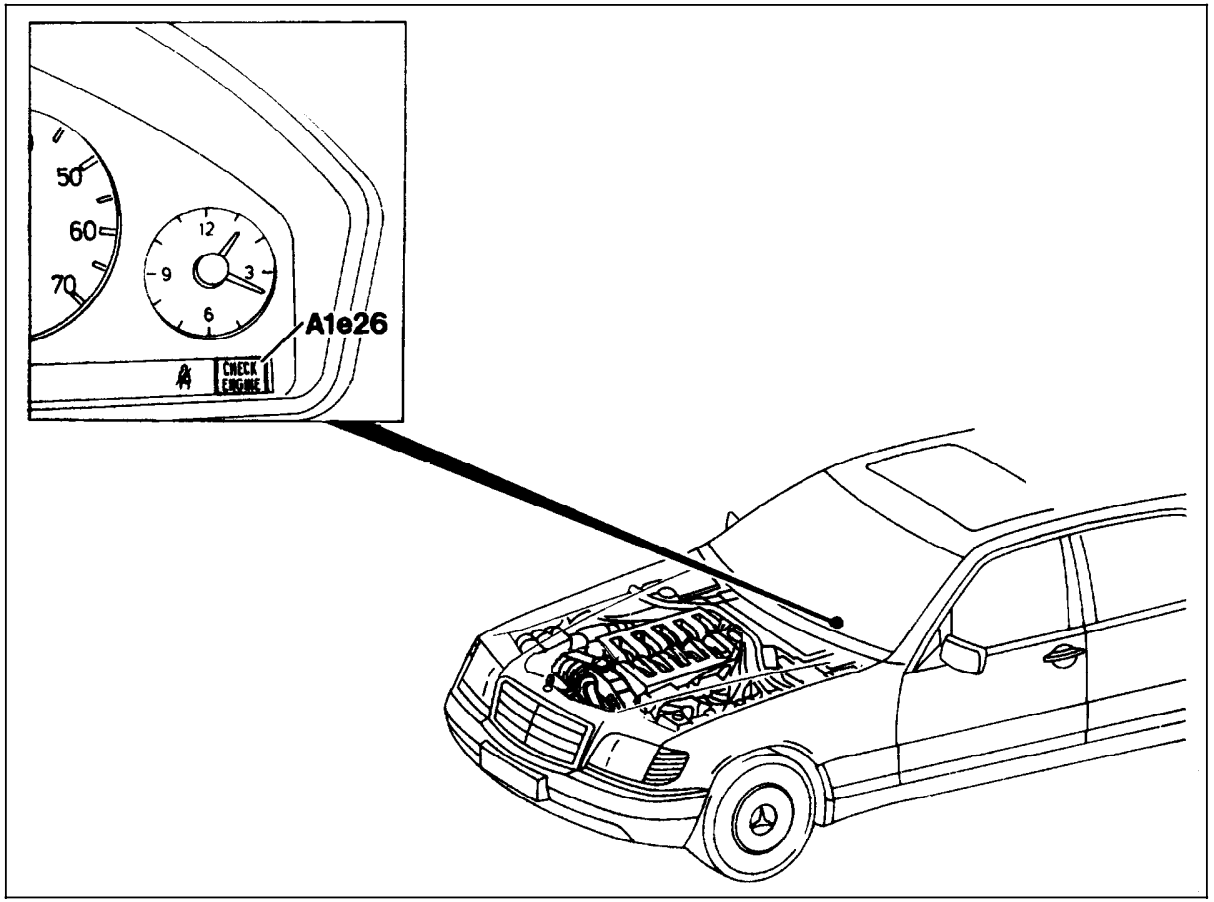
U07-5920-57

Figure 13

G3/3	Left O2S 1 (before TWC)
G3/4	Right O2S 1 (before TWC)
K17	AIR relay module
Y3/3	Upshift delay switchover valve

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 140

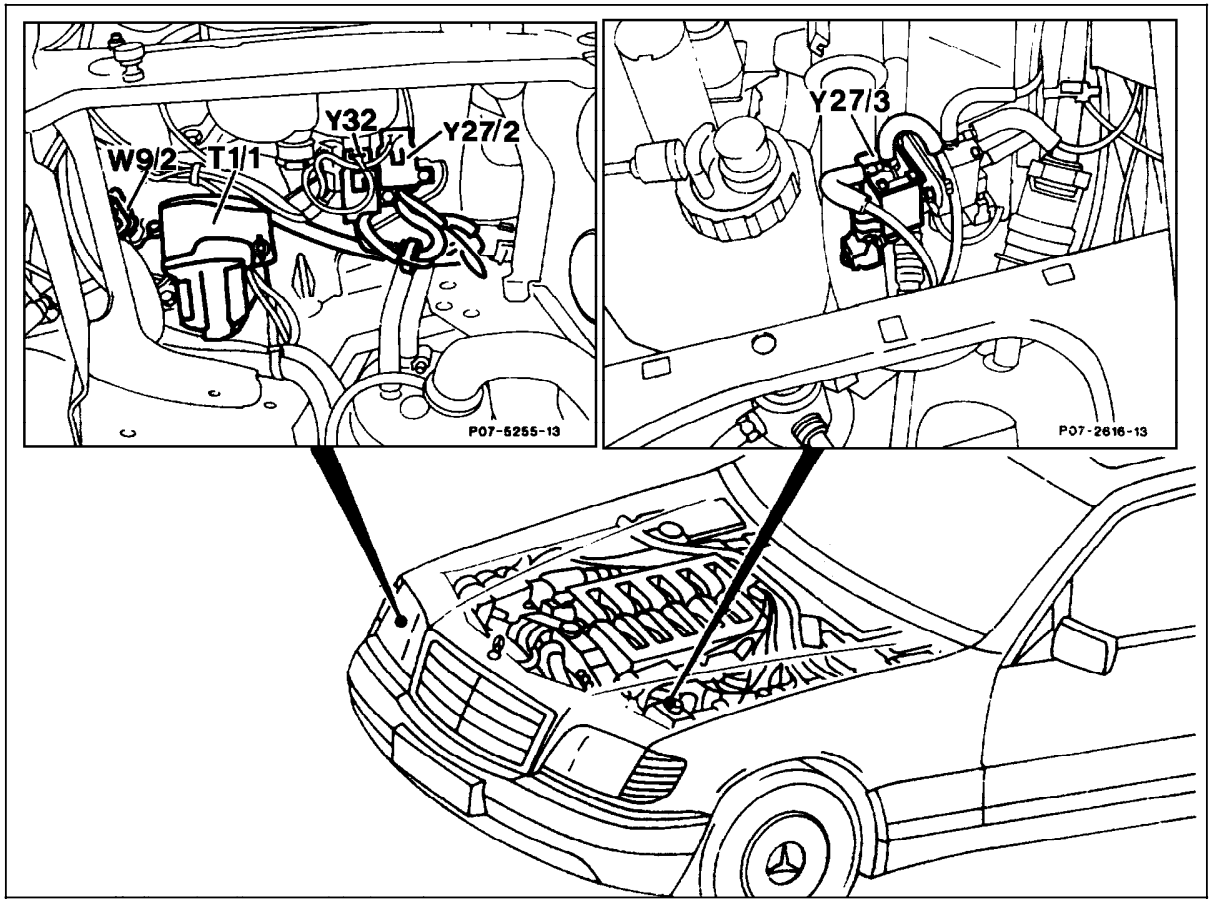


U07-5927-57

Figure 14
A1e26 “CHECK ENGINE” MIL

Electrical Test Program - Component Locations

Engine and Passenger Compartment
Model 140



P07-5921-57

Figure 1

Y27/2	Left EGR switchover valve (located on right side of engine)
Y27/3	Right EGR switchover valve (located on left side of engine)
Y32	AIR pump switchover valve

Electrical Test Program – Preparation for Test

Preparation for Test

1. Ignition: **OFF**
2. Remove LH-SFI control module (N3/2 or N3/3).
3. After determining which LH-SFI control module (N3/2) and/or (N3/3) is indicating a malfunction, connect socket box with contact module 140 589 02 63 00 and contact box to respective LH-SFI control module (left, right or both one after another) according to connection diagram.
4. **Test steps 1.2 – 1.4, 2.2 – 2.6, 4, 5 and 35 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 become active 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 129, 140

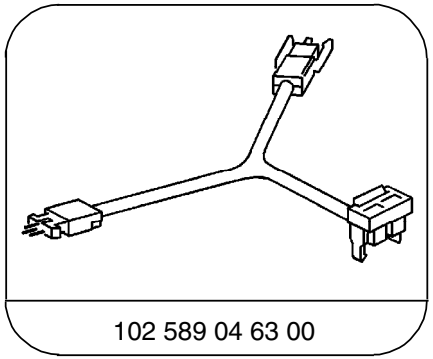
Note regarding “Test Connection” column:

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

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

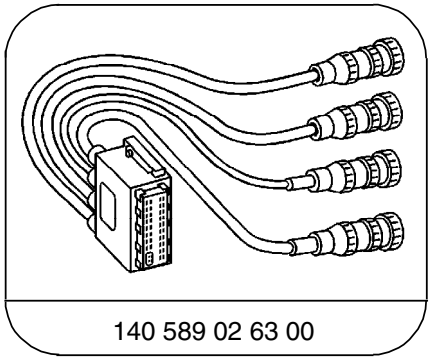
Electrical Test Program – Preparation for Test

Special Tools



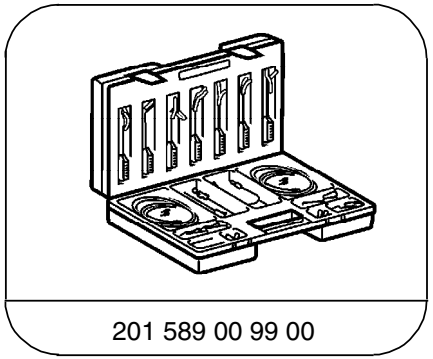
102 589 04 63 00

Test cable



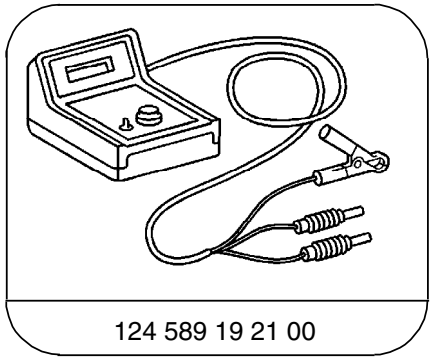
140 589 02 63 00

Contacting module 2



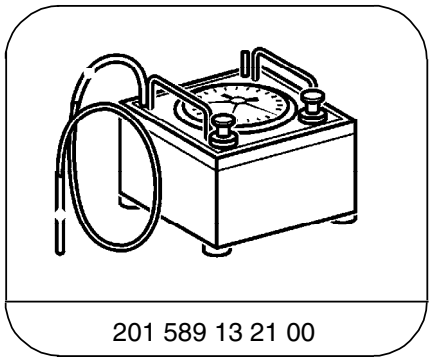
201 589 00 99 00

Electrical connecting set



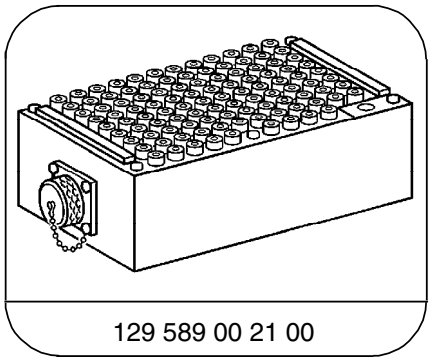
124 589 19 21 00

Pulse counter



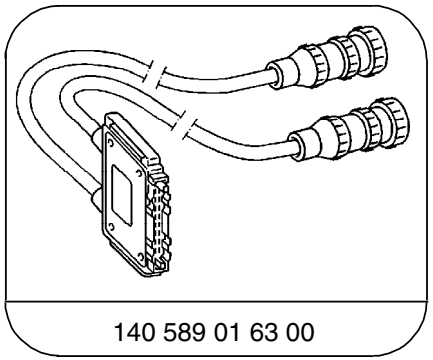
201 589 13 21 00

Tester



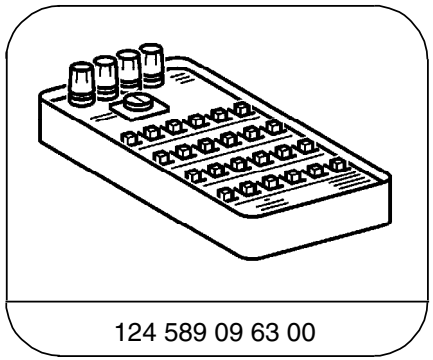
129 589 00 21 00

126-pin socket box



140 589 01 63 00

Contacting module 1

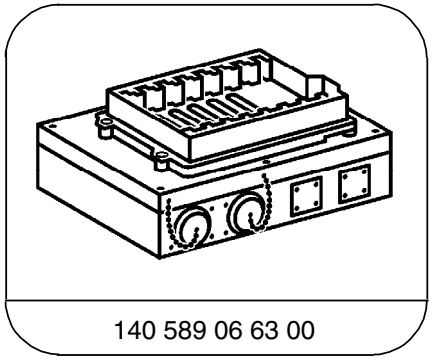


124 589 09 63 00

Ohm decade

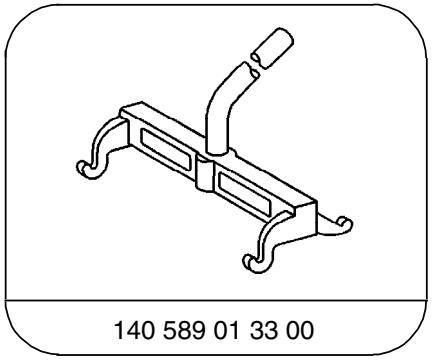
Electrical Test Program – Preparation for Test

Special Tools



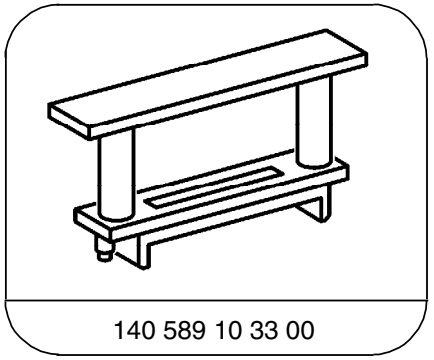
140 589 06 63 00

Contacting box



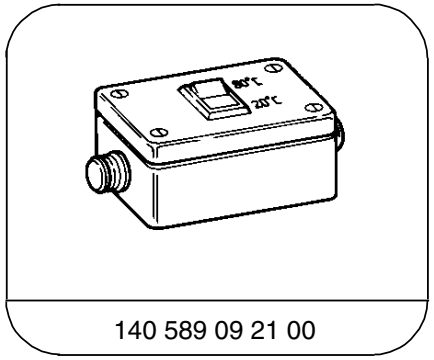
140 589 01 33 00

Mounting lever



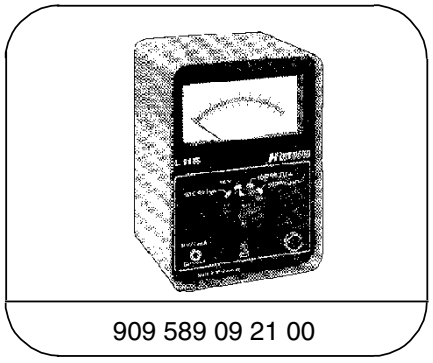
140 589 10 33 00

Spacer



140 589 09 21 00

Simulator



909 589 09 21 00

On-Off Ratio Tester

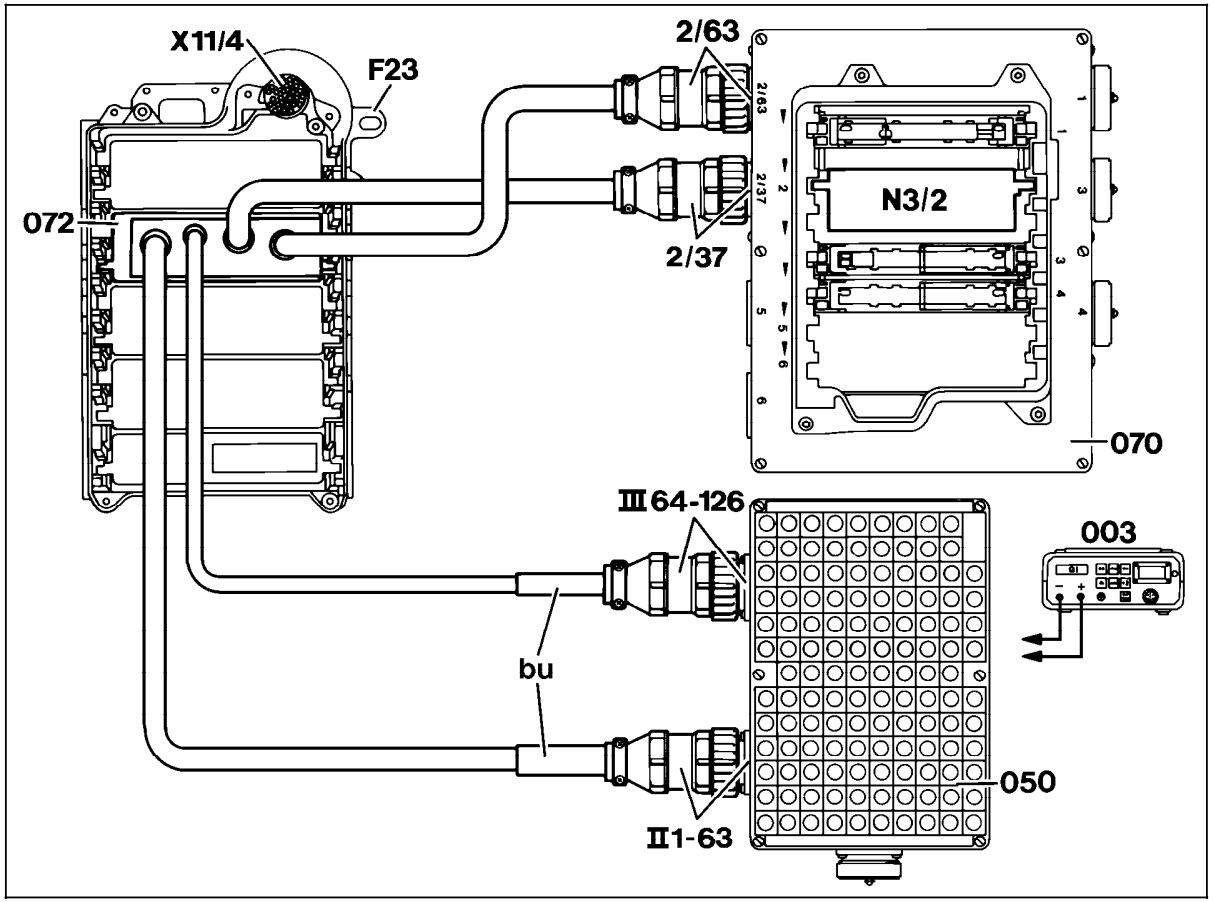
Conventional tools, test equipment

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
Left LH-SFI Control Module (N3/2)
Model 129



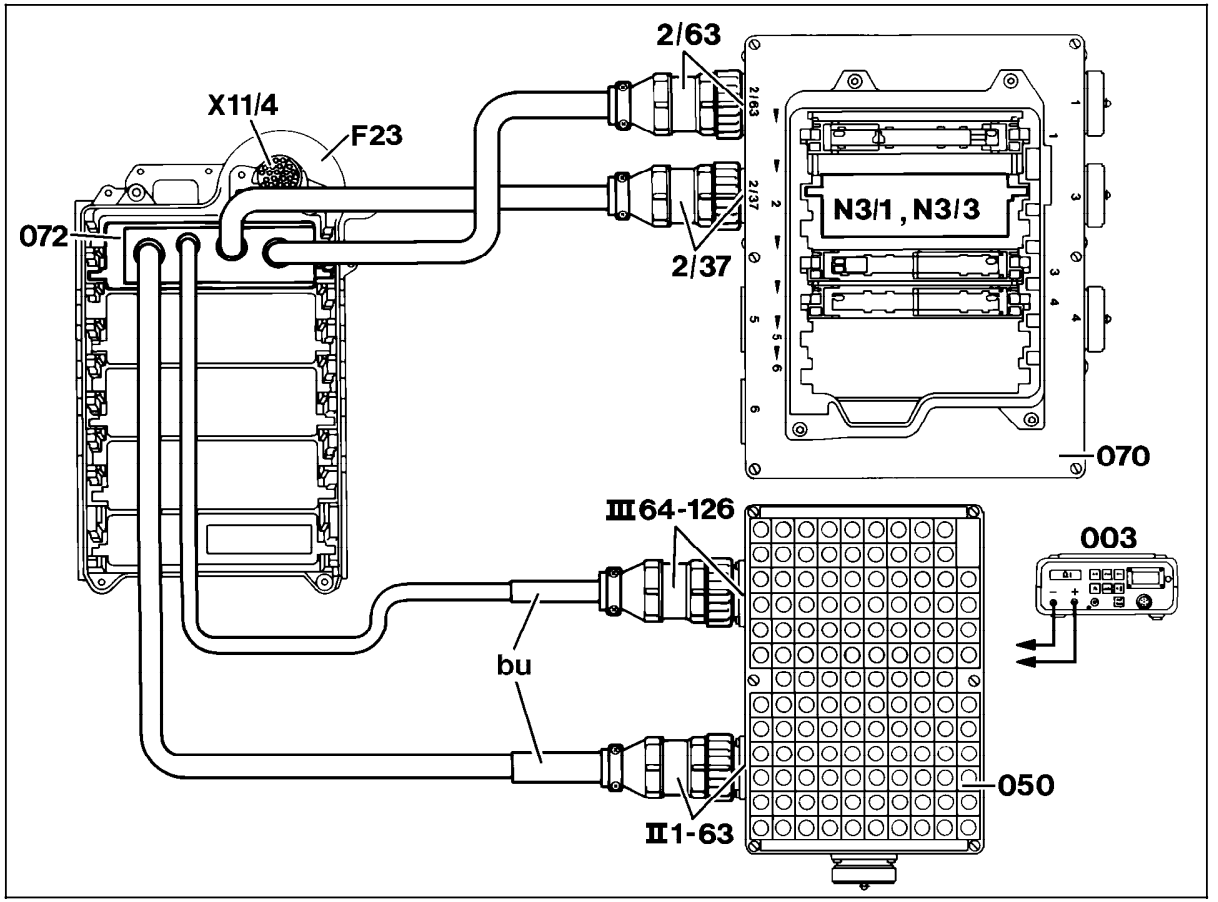
U07-5639-57

Figure 1

003	Multimeter
050	Socket box (126-pole)
070	Contact box
072	Contact module
F23	Module box
N3/2	Left LH-SFI control module
X11/4	Data link connector (DTC readout)
bu	blue

Electrical Test Program – Preparation for Test

Connection Diagram - Socket Box
Right LH-SFI Control Module (N3/3)
Model 129



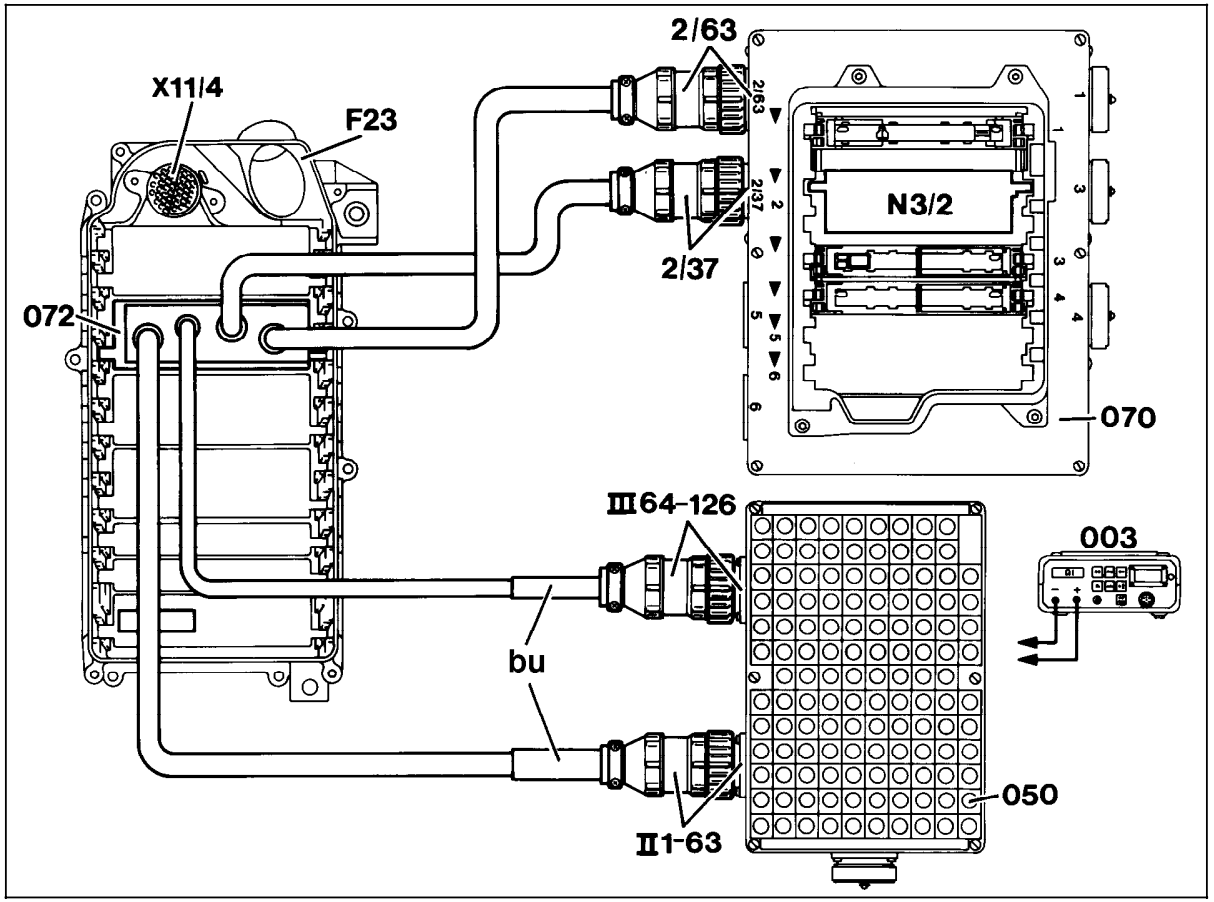
U07-5638-57

Figure 2

003	Multimeter
050	Socket box (126-pole)
070	Contact box
072	Contact module
F23	Module box
N3/1	LH-SFI control module
N3/3	Right LH-SFI control module
X11/4	Data link connector (DTC readout)
bu	blue

Electrical Test Program – Preparation for Test

Connection Diagram - Socket Box
Left LH-SFI Control Module (N3/2)
Model 140



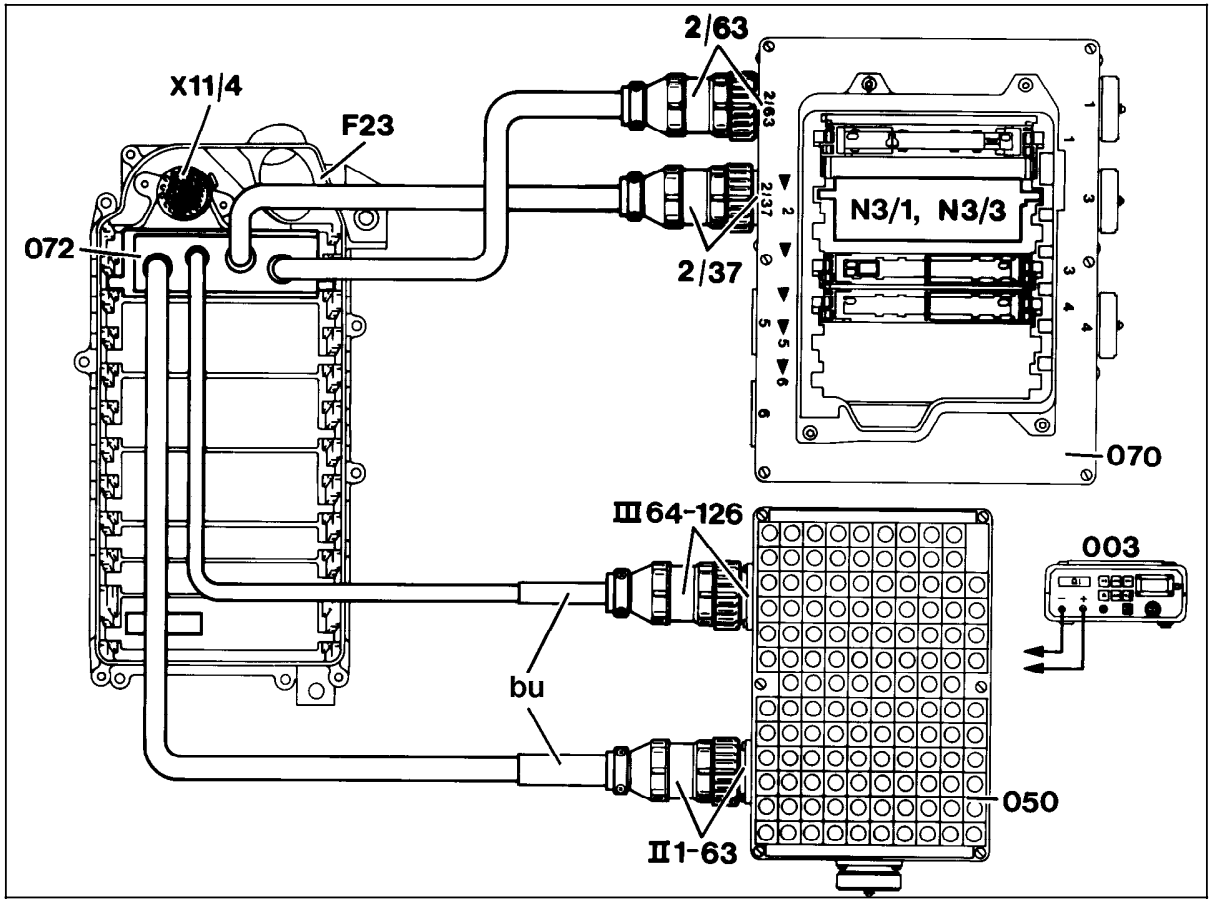
U07-0729-57

Figure 3

003	Multimeter
050	Socket box (126-pole)
070	Contact box
072	Contact module
F23	Module box
N3/2	Left LH-SFI control module
X11/4	Data link connector (DTC readout)
bu	blue

Electrical Test Program – Preparation for Test

Connection Diagram - Socket Box
Right LH-SFI Control Module (N3/3)
Model 140



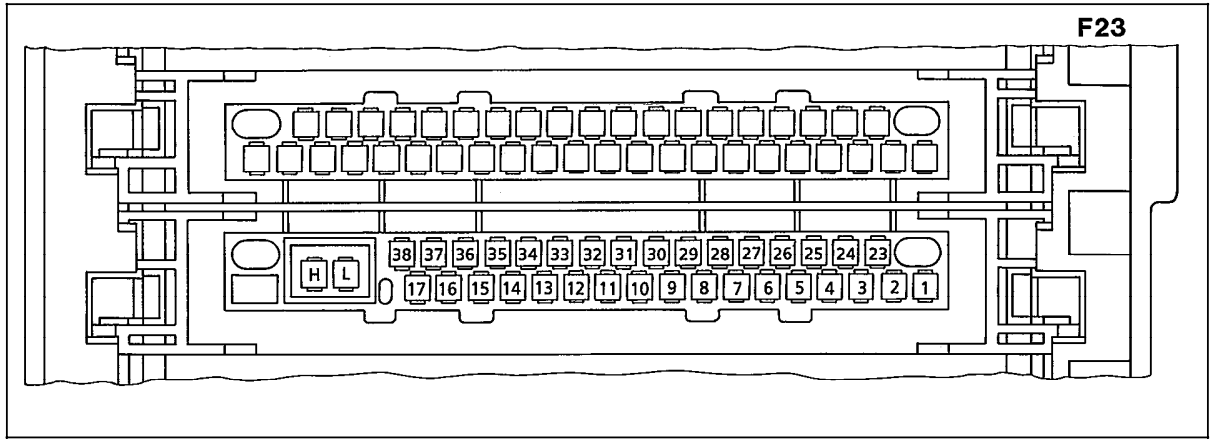
U07-0728-57

Figure 4

003	Multimeter
050	Socket box (126-pole)
070	Contact box
072	Contact module
F23	Module box
N3/1	LH-SFI control module
N3/3	Right LH-SFI control module
X11/4	Data link connector (DTC readout)
bl	blue

Electrical Test Program – Preparation for Test

Layout
LH-SFI Control Module Connector “1” – Interior



P07-5171-53

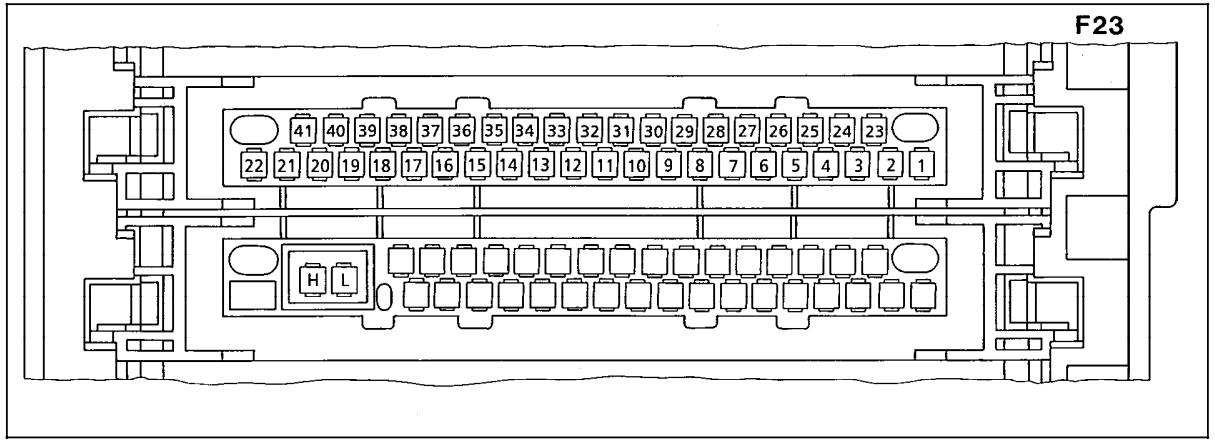
Figure 5

1	Not used
2	Ground coding (left LH-SFI control module N3/2 only)
3 – 8	Not used
9	Fuel consumption gauge (right LH-SFI control module N3/3 only)
10	Not used
11	CTP (idle) recognition from EA/CC/ISC control module
12	Not used
13	Diagnostic wire
14	Diagnostic wire insulation
15 – 22	Not used
23	Ground (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	Safety fuel shutoff from EA/CC/ISC control module
31 – 33	Not used
34	Starter signal, circuit 50
35	Ground (electronics - W15/1)
36	Voltage supply, circuit 87
37	Grround (model 129: module box bracket - W27, model 140: electronics output ground - W15)
38	Not used
L	CAN (–) Controller area network (LH-SFI, DI, EA/CC/ISC and ABS/ASR control modules)
H	CAN (+) Controller area network (LH-SFI, DI, EA/CC/ISC and ABS/ASR control modules)

Electrical Test Program – Preparation for Test

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

Figure 6



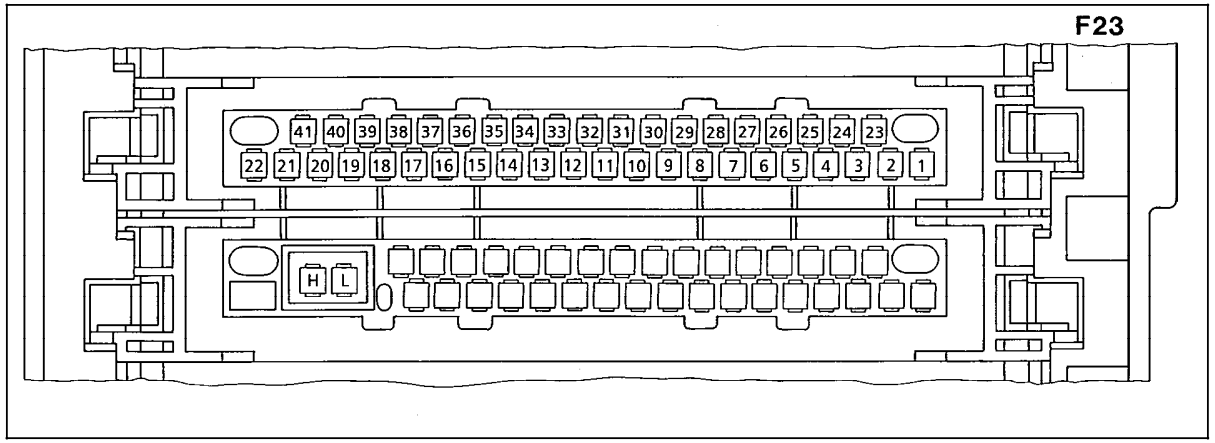
P07-5170-53

1	Not used
2	Injector N3/2 (9), N3/3 (4)
3	Injector N3/2 (7), N3/3 (6)
4	Injector N3/2 (8), N3/3 (5)
5	TN-signal (rpm signal) (input)
6	CMP sensor signal
7	Not used
8	IAT sensor
9	O2S 1 (before TWC) heater
10 – 12	Not used
13	O2S 1 (before TWC) wire insulation
14	O2S 1 (before TWC)
15	O2S 1 (before TWC) ground
16	Sensor ground
17	Hot wire MAF sensor signal
18	ECT sensor, circuit 2
19	AIR relay module (right LH-SFI control module N3/3 only)
20	Upshift delay control (right LH-SFI control module N3/3 only)
21 – 22	Not used

Electrical Test Program – Preparation for Test

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

Figure 7



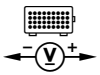
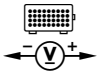
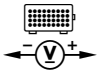
P07-5170-53

23	Hot wire MAF sensor voltage supply
24	Not used
25	Injector N3/2 (11), N3/3 (2)
26	Injector N3/2 (10), N3/3 (3)
27	Injector N3/2 (12), N3/3 (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	Not used
41	Adjustable camshaft timing solenoid, N3/2 left, N3/3 right

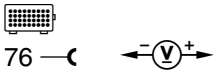
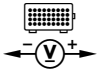
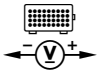
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
1.0		**LH-SFI control module (N3/2 or N3/3)** Voltage supply Circuit 30	N3/2 or N3/3 64 (1.23) — V — 67 (1.26)	Ignition: **ON**	11 – 14 V	⇒ 1.1 – 1.4
1.1		Ground connection	N3/2 or N3/3 64 (1.23) — V — X11/4 — 2	Ignition: **ON**	11 – 14 V	Wiring, **Model 129** Ground (module box bracket) (W27, Figure 3) **Model 140** Ground (electronics output ground - right footwell) (W15, Figure 13).
1.2		Base module (N16/1) Voltage supply Circuit 30	N16/1 28 (1.28) — V — 1 (1.1)	Ignition: **OFF** **Connect socket box to N16/1.** Ignition: **ON**	11 – 14 V	Wire to terminal block (X4/10) (Figures 1 – 2).

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 right LH-SFI control module (N3/3) Circuit 30	N16/1  29 (1.29) — 12 (1.12)	Ignition: **ON**	11 – 14 V	N16/1.
1.4	8	⚠ **DTC readout from base module (N16/1)** Voltage supply from N16/1 to left LH-SFI control module (N3/2) Circuit 30	N16/1  29 (1.29) — 11 (1.11)	Ignition: **ON**	11 – 14 V	N16/1.
2.0		**LH-SFI control module (N3/2 or N3/3)** Voltage supply Circuit 87/M1e	N3/2 or N3/3  76 (1.35) — 77 (1.36)	Ignition: **ON**	11 – 14 V	⇒ 2.1 – 2.6

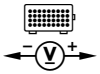
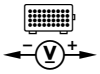
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
2.1		Ground, electronics (W15/1) (right footwell)	N3/2 or N3/3 — X11/4  76 — (1.35) — 2	Ignition: **ON**	11 – 14 V	W15/1.
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, Ignition/starter switch (S2/1).
2.3		Base module (N16/1) Voltage supply Circuit 15	N16/1  28 — (1.28) — 15 (1.15)	Ignition: **ON** Ignition: **OFF**	11 – 14 V < 1 V	Wiring, Fuse.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
2.4		Output ground, base module (N16/1)	N16/1 (28) (1.28) — V — X11/4 (2) and N16/1 (29) (1.29) — V — X11/4 (2)	Ignition: **ON**	11 – 14 V 11 – 14 V	Ground wire W15/1.
2.5		⚠ **DTC readout from base module (N16/1)** Voltage supply (fused) for right LH-SFI control module (N3/3)	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.
2.6		⚠ **DTC readout from base module (N16/1)** Voltage supply (fused) for left LH-SFI control module (N3/2)	N16/1 (28) (1.28) — V — (26) (1.26)	Ignition: **ON** Ignition: **OFF**	11 – 14 V < 1 V	Fuse (F4) 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 (N3/2 or N3/3)** Voltage supply Circuit 87	N3/2 or N3/3  78 (1.37) — V — 65 (1.24)	Ignition: **ON**	11 – 14 V	Wiring, ⇒ 3.1.
3.1		Ground output (W15) (right footwell)	N3/2 or N3/3  78 (1.37) — V — X11/4 — 2	Ignition: **ON**	11 – 14 V	Ground, output (W15, right footwell).
4.0		⚠ **DTC readout from base module (N16/1)** Voltage supply for right bank injectors (Y64)	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.

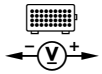
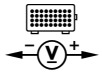
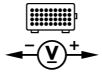
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
5.0		⚠ **DTC readout from base module (N16/1)** Voltage supply for left bank injectors (Y63)	N16/1 28 (1.28) — 18 (2.18)	**Connect socket box to N16/1.** Ignition: **ON** Ignition: **OFF**	11 – 14 V < 1 V	Fuse (F4) at N16/1, N16/1.
6.0	Ч 2)	**Hot wire MAF sensor (B2/3 or B2/4)** Voltage at hot wire	N3/2 or N3/3 34 (2.34) — 17 (2.17)	Ignition: **ON** Engine: **at Idle**	1.0 – 1.2 V 1.3 – 1.7 V 1)	Wiring, ⇒ 6.1, ⇒ 7.0, B2/3 or B2/4.
6.1		Hot wire MAF sensor (B2/3 or B2/4) Voltage supply	N3/2 or N3/3 64 (1.23) — 23 (2.23)	Ignition: **ON**	11 – 14 V	LH-SFI control module (N3/2 or N3/3), ⇒ 7.0
7.0	Ч 2)	**Ground wire for hot wire MAF sensor (B2/3 or B2/4)**	N3/2 or N3/3 34 (2.34) — 76 (1.35)	Ignition: **OFF**	< 6 Ω	Ground wire (W16) (front spring tower).

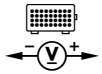
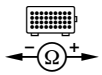
1) Voltage increases with increasing rpm.

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

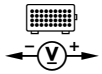
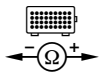
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
8.0	12	**Hot wire MAF sensor (B2/3 or B2/4)** Burn-off control	N3/2 or N3/3  76 (1.35) — 37 (2.37)	Ignition: **OFF** Unplug N3/2 or N3/3, wait for 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, B2/3 or B2/4, LH-SFI control module (N3/2 or N3/3).
9.0	9	**FP relay module (K27/1 or K27/2)** Control	N3/2 or N3/3  66 (1.25) — 65 (1.24)	Engine: **Start**	11 – 14 V while cranking.	⇒ 9.1, N3/2 or N3/3.
9.1		Starter signal circuit 50	N3/2 or N3/3  64 (1.23) — 75 (1.34)	Engine: **Start**	11 – 14 V while cranking.	Wiring.

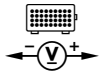
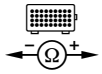
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
10.0		**ECT sensor (B11/9 or B11/10)** Voltage at sensor circuit 1	N3/2 or N3/3  16 (2.16) — V — 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%	⇒ 10.1, LH-SFI control module (N3/2 or N3/3).
10.1		Resistance Sensor circuit 1	N3/2 or N3/3  16 (2.16) — Ω — 18 (2.18)	Ignition: **OFF** Disconnect N3/2 or N3/3 from contact box (070).	Nominal values, see ⇒ 10.0	Wiring, ⇒ 10.2
10.2		Resistance ECT sensor (B11/9 or B11/10) Sensor circuit 1	B11/9 or B11/10  2 — Ω — 4	Connector on B11/9 or B11/10 unplugged.	Nominal values, see ⇒ 10.0, Connection see Figure 20.	B11/9 or B11/10.

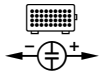
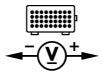
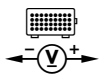
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
11.0	∃	**ECT sensor (B11/9 or B11/10)** Voltage at sensor circuit 2	N3/2 or N3/3  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%	Wiring, ⇒ 11.1, LH-SFI control module (N3/2 or N3/3).
11.1		Resistance Sensor circuit 2	N3/2 or N3/3  16 (2.16) — Ω — 31 (2.31)	Ignition: **OFF** Disconnect N3/2 or N3/3 from contact box (070).	Nominal values, see ⇒ 11.0	Wiring, ⇒ 11.2
11.2		Resistance ECT sensor (B11/9) or (B11/10) Sensor circuit 2	B11/9 or B11/10 1 — Ω — 3	Connector on B11/9 or B11/10 unplugged.	Nominal values, see ⇒ 11.0, Connection see Figure 20.	B11/9 or B11/10.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
12.0		**IAT sensor (B17/5 or B17/6)** Voltage	N3/2 or N3/3  16 (2.16) — 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%	⇒ 12.1, LH-SFI control module (N3/2 or N3/3).
12.1		Resistance	N3/2 or N3/3  16 (2.16) — 8 (2.8)	Ignition: **OFF** Disconnect N3/2 or N3/3 from socket box.	Nominal values, see ⇒ 12.0	Wiring, B17/5 or B17/6.

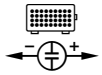
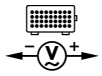
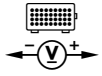
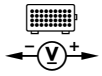
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
13.0		**TN-signal (rpm signal) – input** from DI control module (N1/4 or N1/5)	N3/2 or N3/3 [1] 76 (1.35) — 5 (2.5)  N3/2 or N3/3 [2] 76 (1.35) — 5 (2.5) 	Engine: **Start** Engine: **at Idle**	Signal, see Figure 17. 5 – 7.5 V	Wiring, DI control module (N1/4 or N1/5), LH-SFI control module (N3/2 or N3/3).
14.0		**TN-signal (rpm signal) – output** Right LH-SFI control module (N3/3)	N3/3 76 (1.35) — 69 (1.28) 	Engine: **Start** Engine: **at Idle**	5 – 7.5 V	Wiring, N3/3, Base module (N16/1).

[1] Test with oscilloscope.

[2] Test with multimeter only if oscilloscope is not available.

Electrical Test Program – Test

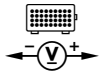
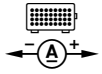
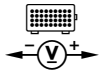
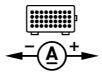
⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
15.0		**CMP sensor (L5/2 or L5/3) signal** from DI control module (N1/4 or N1/5)	N3/2 or N3/3 [1]  77 (1.36) — 6 (2.6) N3/2 or N3/3 [2]  77 (1.36) — 6 (2.6)	Engine: **Start** Engine: **at Idle**	Signal, see Figure 16. 0.8 – 1.8 V	Wiring, L5/2 or L5/3 (Test, see DM, Engines, Vol. 2, section 5.2), N1/4 or N1/5.
16.0		[6] **CTP (idle) recognition signal** from EA/CC/ISC actuator (M16/3 or M16/4)	N3/2 or N3/3  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, M16/3 or M16/4 (Test see DM, Engines, Vol. 3, section 6.2), EA/CC/ISC control module (N4/1).
17.0		**Fuel safety shut-off** from EA/CC/ISC actuator (M16/3 or M16/4)	N3/2 or N3/3  76 (1.35) — 71 (1.30)	Ignition: **ON**	2.2 – 11 V (Fluctuates on an even rhythmic cycle).	Wiring M16/3 or M16/4 (Test, see DM, Engines, Vol. 3, section 6), N4/1.

1) Test with oscilloscope.
2) Test with multimeter only if oscilloscope is not available.
6) The DTC "I0" can be displayed on vehicles up to 7/91 even if no fault exists.

Electrical Test Program – Test

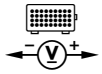
⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
18.0		**Fuel safety shut-off**	N3/2 or N3/3 76 (1.35) — 71 (1.30)	Engine: **Start** and apply WOT (full throttle).	Engine speed surges between 1200 – 1600 rpm.	LH-SFI control module (N3/2 or N3/3).
19.0	21	**O2S 1 (before TWC) (G3/3 or G3/4)** Signal	N3/2 or N3/3 15 (2.15) — V — 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, G3/3 or G3/4, ⇒ 19.1, ⇒ 19.2, ⇒ 20.0.
19.1		Insulation, O2S 1 wire	N3/2 or N3/3 13 (2.13) — Ω — 14 (2.14)	Ignition: OFF Disconnect N3/2 or N3/3 from contact box (070).	∞ Ω	Wiring.
19.2		O2S 1 control from LH-SFI control module (N3/2 or N3/3)	N3/2 or N3/3 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	N3/2 or N3/3.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
20.0	22	**O2S 1 (before TWC) heater (G3/3 or G3/4)** Control signal	N3/2 or N3/3  15 (2.15) — V — 9 (2.9)	Engine: **at Idle** Engine coolant temperature > 80 °C	11 – 14 V	⇒ 20.1, LH-SFI control module (N3/2 or N3/3).
20.1		O2S 1 (before TWC) heater Current draw	N3/2 or N3/3  9 (2.9) — A — 77 (1.36)	Disconnect N3/2 or N3/3 from contact box (070). Ignition: **ON**	0.6 – 3.4 A	Wiring, G3/3 or G3/4.
21.0	16 [6]	**EGR switchover valve (Y27/2 or Y27/3)** Control signal	N3/2 or N3/3  39 (2.39) — V — 77 (1.36)	Engine: **at Idle** Engine coolant temperature > 60 °C Accelerate briefly	11 – 14 V	⇒ 22.0 – 23.0, Wiring, N3/2 or N3/3.
21.1		Current draw	N3/2 or N3/3  64 (1.23) — A — 39 (2.39)	Disconnect N3/2 or N3/3 from contact box (070). Ignition: **ON**	0.3 – 0.5 A	Wiring, Y27/2 or Y27/3.

[6] 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
22.0		**EGR switchover valve (Y27/2 or Y27/3)** Vacuum control	35 —  — 10	**Test connection note:** Connect vacuum tester to EGR valve with Y-fitting. N3/2 or N3/3 plugged in. Engine: **at Idle** Engine coolant temperature > 60 °C. Accelerate briefly.	> 400 mbar	Vacuum lines, EGR valve, Y27/2 or Y27/3.
23.0		**Left or right EGR valve** Mechanical test		**Test connection note:** Connect vacuum tester directly to left or right EGR valve. Using vacuum tester, apply 500 mbar vacuum. Disconnect vacuum line on EGR valve	Left or right EGR valve closes audibly.	EGR valve.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
24.0	II [1]	***Right cylinder bank only*** **AIR relay module (K17)** Control signal	N3/3 19 (2.19) — V — 77 (1.36)	Unplug right ECT sensor (B11/10) 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.	⇒ 24.1, N3/3.
24.1		AIR relay module (K17) Current draw	N3/3 64 (1.23) — A — 19 (2.19)	Disconnect right LH-SFI control module (N3/3) from contact module (072). Ignition: **ON**	0.1 – 0.3 A	Wiring, K17.
25.0	23	**Purge control valve (Y58/2 or Y58/3)** Control signal	N3/2 or N3/3 38 (2.38) — Ω — 77 (1.36)	Engine: **at Idle** and at operating temperature.	After approx. 1 minute, purge control valve Y58/2 or Y58/3, (Figure 14 and 15) must cycle noticeable. Signal, see Figure 26.	⇒ 25.1, ⇒ 26.0. LH-SFI control module (N3/2 or N3/3).
25.1		Current draw	N3/2 or N3/3 64 (1.23) — A — 38 (2.38)	Disconnect N3/2 or N3/3 from contact module (072). Ignition: **ON**	0.2 – 0.4 A	Wiring, Y58/2 or Y58/3.

[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
26.0		**Purge control valve (Y58/2 or Y58/3)** Vacuum control		**Test connection note:** Connect vacuum tester to Y58/2 or Y58/3 (Figure 14 and 15), connection (B). Engine: **at Idle** and at operating temperature. Increase engine speed slowly to max. 3000 rpm.	After approx. 1 minute, > 400 mbar	Vacuum lines, ⇒ 25.0, Y58/2 or Y58/3.
27.0	25	**Left or right adjustable camshaft timing solenoid (Y49/1 or Y49/2)** Current draw	Y49/1 or Y49/2 1 — (A) — 2	**Test connection note:** 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	⇒ 27.1, ⇒ 28.0, N3/2 or N3/3.
27.1		Resistance	N3/2 or N3/3 41 (2.41) — (Ω) — 77 (1.36)	Disconnect LH-SFI control module (N3/2 or N3/3) from contact box (070).	4 – 6 Ω	Wiring, Y49/1 or Y49/2.

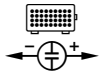
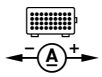
Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
28.0		**Left or right adjustable camshaft timing solenoid (Y49/1 or Y49/2)** Mechanical operation	N3/2 or N3/3  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.	⇒ 27.0 Mechanical camshaft adjustment (see SMS, Job No. 05-216).
29.0	6	***Non-USA vehicles only. Continue to next test step.***				
30.0	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
31.0	27	**Injectors (Y63 or Y64)** Resistance and assignment (N3/3) right cylinder bank / (N3/2) left cylinder bank Cyl. 1 / 12 Cyl. 2 / 11 Cyl. 3 / 10 Cyl. 4 / 9 Cyl 5 / 8 Cyl. 6 / 7	N3/2 or N3/3  27 (2.27) — 77 (1.36) 25 (2.25) — 77 (1.36) 26 (2.26) — 77 (1.36) 2 (2.2) — 77 (1.36) 4 (2.4) — 77 (1.36) 3 (2.3) — 77 (1.36)	**Test connection note:** Connect ohmmeter to socket box for each subsequent injector. Disconnect N3/2 or N3/3 from contact box (070). Connector on injector connected. Connector on injector unplugged.	14 – 16 Ω ∞ Ω	Wiring, Y63 or Y64, Wires reversed.

Electrical Test Program – Test

⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
32.0		**Injectors (Y63) or (Y64)** Control and injection time	N3/2 or N3/3 	**Test connection note:** For connection information on individual injectors, see ⇒ 31.0. **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 18 and 19)	Wiring, ECT sensor (B11/9 or B11/10), IAT sensor (B17/5 or B17/6), O2S 1 (before TWC) (G3/3 or G3/4). LH-SFI control module (N3/2 or N3/3).
33.0	26 [4]	***Right cylinder bank only*** **Upshift delay switchover valve (Y3/3)** [3] Current draw	N3/3  64 (1.23) — 20 (2.20)	Disconnect right LH-SFI control module (N3/3) from contact box (070). Ignition: **ON**	 450 ± 80 mA	Wiring, Y3/3.

[3] On vehicles as of 7/91.

[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
34.0		**Pneumatic upshift delay** [3] Vacuum control and sealing	N3/3 64 (1.23) — 20 (2.20)	**Test connection note:** Connect vacuum tester to upshift delay switchover valve (Y3/3) according to Figure 22 and connect bridge to socket box. Engine: **at Idle**	 > 400 mbar	Vacuum lines, Y3/3.
35.0	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, ⇒ 35.1
35.1		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.	 950 ± 80 mA	Wiring, Y3, Kickdown switch (S16/6).

[3] On vehicles as of 7/91.

Electrical Test Program – Test

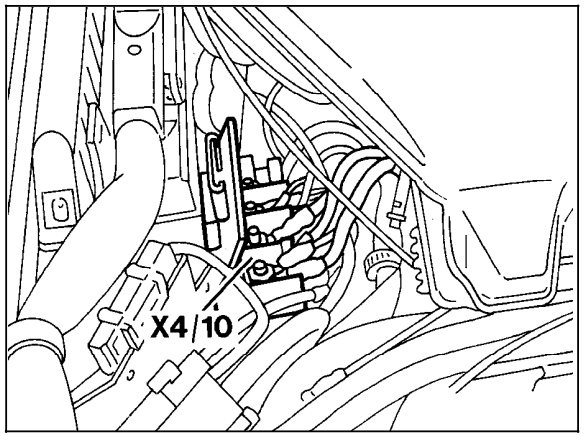
⇒		Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
36.0		**Diagnostic wire activation**	N3/2 or N3/3 76 (1.35) — V — 54 (1.13)	Engine: **ON**	11 – 14 V	Wiring, N3/2 or N3/3.
37.0	15	***Right cylinder bank only*** **Fuel consumption indicator (A1p10)**	N3/3 76 (1.35) — V — 50 (1.9)	Engine: **at Idle** and briefly depress accelerator pedal.	> 0.5 V	Wiring, N3/3, A1p10.
38.0		***Left cylinder bank only*** **Serial data bus coding**	N3/2 43 (1.2) — V — 67 (1.26)		11 – 14 V	Wiring to electronics ground (W15/1).
39.0	17 18 6) 19	**Serial data bus (CAN)**	N3/3 L — Ω — H	Ignition: **OFF** Remove contact module or N3/3 and measure resistance directy at CAN connector for right LH-SFI control module (Figure 23).	55 – 65 Ω	Data line, ⇒ 39.1 ⇒ 39.2

6) 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
39.1		**CAN element in left DI control module (N1/4)**	N1/4 3 — (–) Ω (+) — 4	Disconnect connector (B) on N1/4 and measure directly on control module (Figure 24).	115 – 125 Ω	N1/4.
39.2		**CAN element in right DI control module (N1/5)**	N1/5 3 — (–) Ω (+) — 4	Disconnect connector (B) on N1/5 and measure directly on control module (Figure 24).	115 – 125 Ω	N1/5.
40.0	28	**Coding,** LH-SFI control module (N3/2 or N3/3)	N3/2 or N3/3 30 (2.30) — (–) V (+) — 77 (1.36)	Ignition: **ON**	11 – 14 V	Wiring.
41.0		***Non-USA vehicles only. Continue to next test step.***				
42.0	15	***Non-USA vehicles only. Continue to next test step.***				

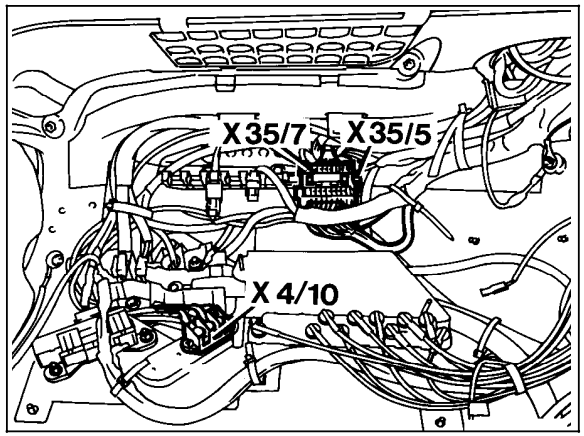
Electrical Test Program – Test



P07-5970-13

Figure 1
Model 129

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



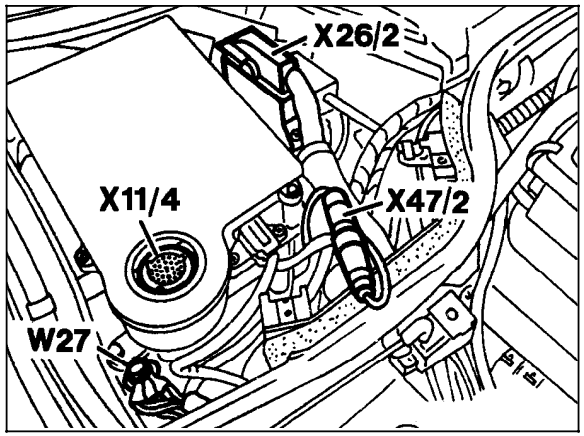
P07-2623-13

Figure 2
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)



P07-5961-13

Figure 3
Model 129

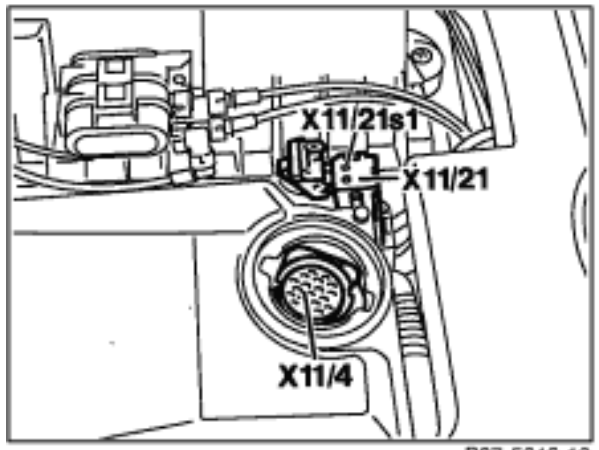
W27 Ground (module box bracket)

X11/4 Data link connector (DTC readout)

X26/2 Engine separation point connector

X47/2 CMP sensor intermediate connector

Electrical Test Program – Test



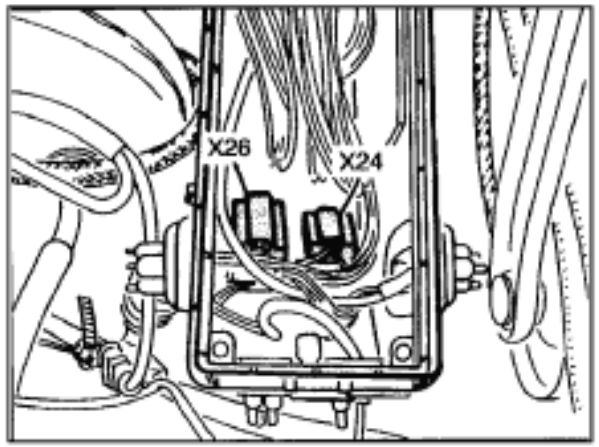
P07-5246-13

Figure 4
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

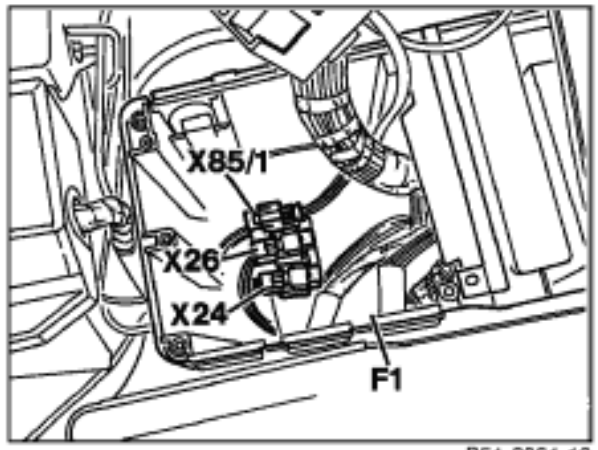


0154-34186-1

Figure 5
Model 129

X24 Headlamp harness connector

X26 Interior/engine connector



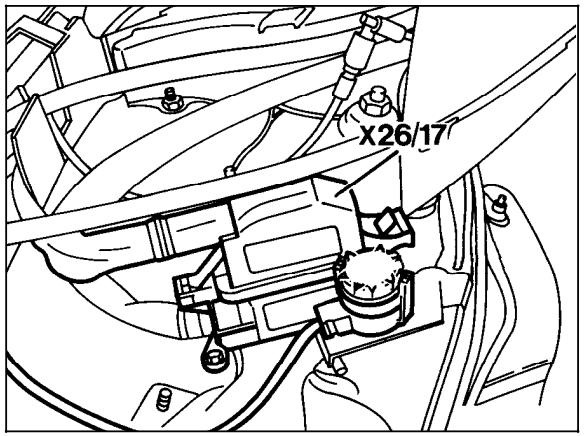
P54-2864-13

Figure 6
Model 140

X24 Headlamp harness connector

X26 Interior/engine connector

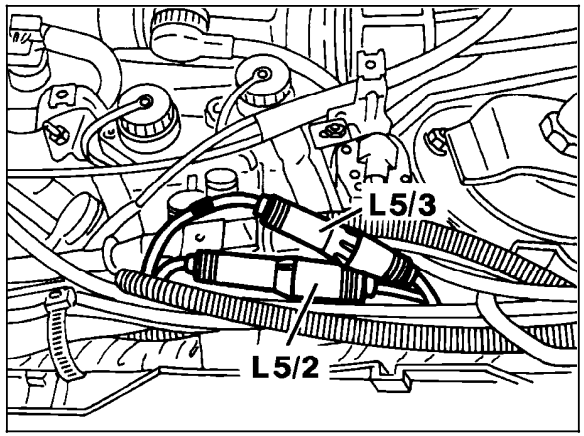
Electrical Test Program – Test



P07-2588-13

Figure 7
Model 140

X26/17 Engine separation point connector

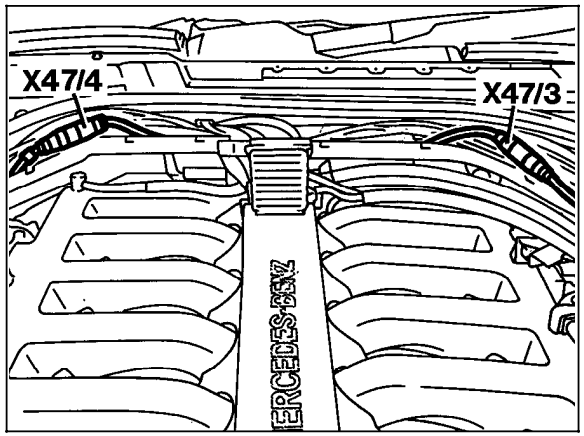


P07-5967-13

Figure 8
Model 129

X47/3 Left CMP sensor intermediate connector

X47/4 Right CMP sensor intermediate connector



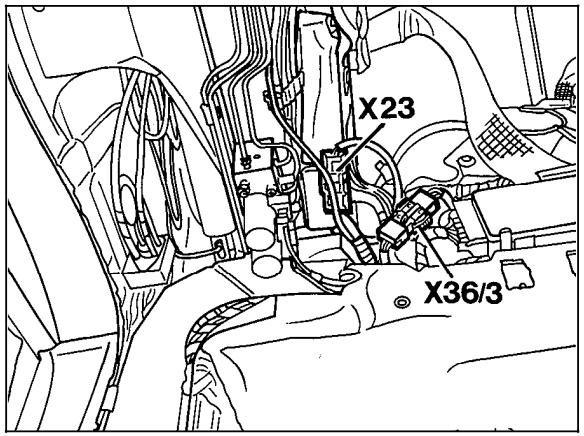
P07-5219-13

Figure 9
Model 140

X47/3 Left CMP sensor intermediate connector

X47/4 Right CMP sensor intermediate connector

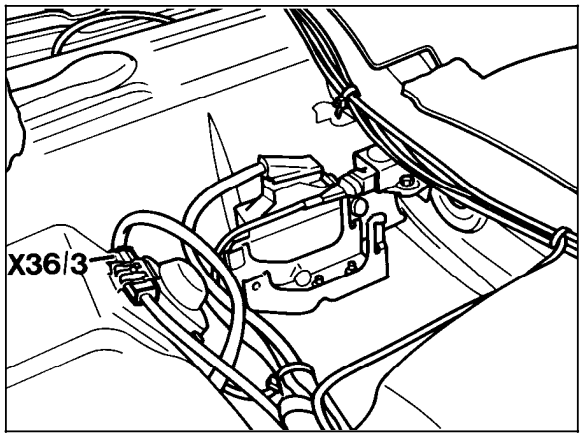
Electrical Test Program – Test



P54-2036-13

Figure 10
Model 129

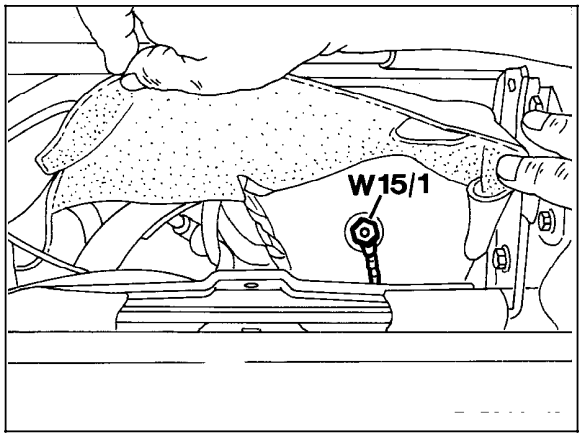
X36/3 FP harness connector (2-pole)



P07-2573-13

Figure 11
Model 140

X36/3 FP harness connector (2-pole)

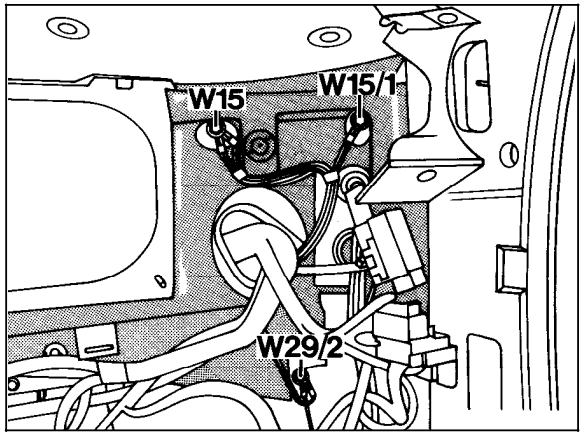


P07-5963-13

Figure 12
Model 129

W15/1 Ground (electronics - right footwell)

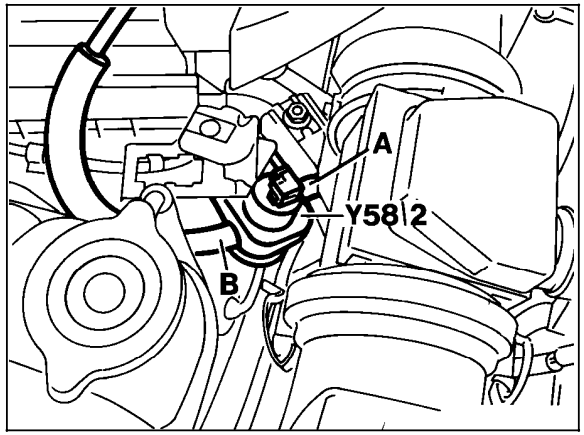
Electrical Test Program – Test



P54-2796-13

Figure 13
Model 140

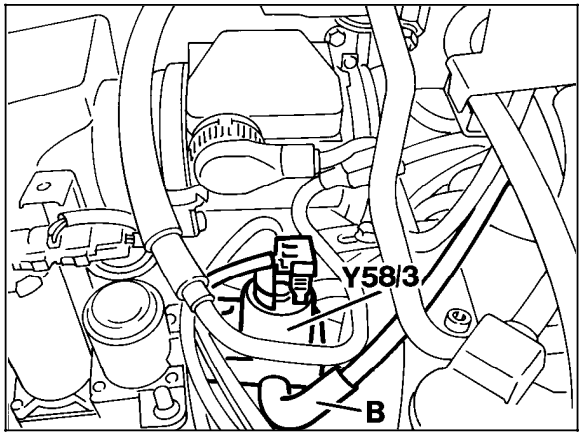
W15	Ground (electronics output ground - right footwell)
W15/1	Ground (electronics - right footwell)
W29/2	Ground (right A-pillar)



P07-5240-13A

Figure 14

Y58/2	Left purge control valve
A	Purge line to engine
B	Purge line to charcoal canister

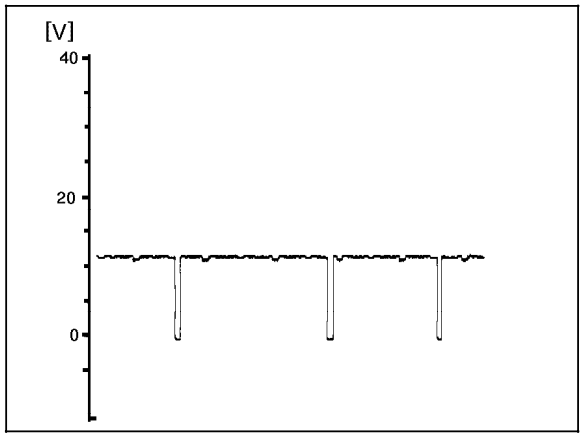


P47-5056-13

Figure 15

Y58/3	Right purge control valve
A	Purge line to engine
B	Purge line to charcoal canister

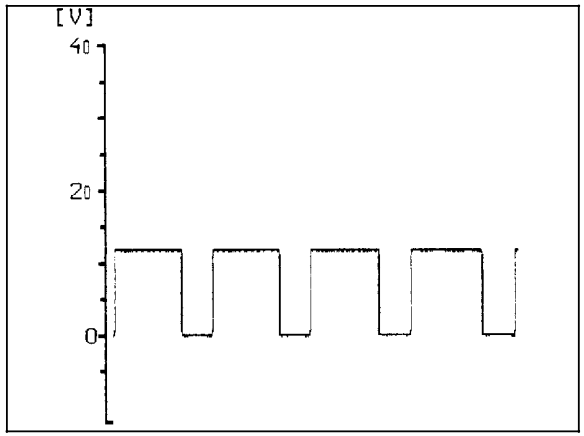
Electrical Test Program – Test



P07-0724-13

Figure 16

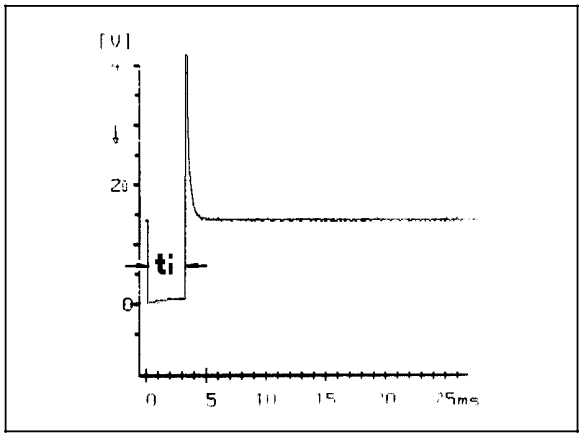
Processed CMP sensor signal from DI control module



P15-0370-13

Figure 17

TN-signal



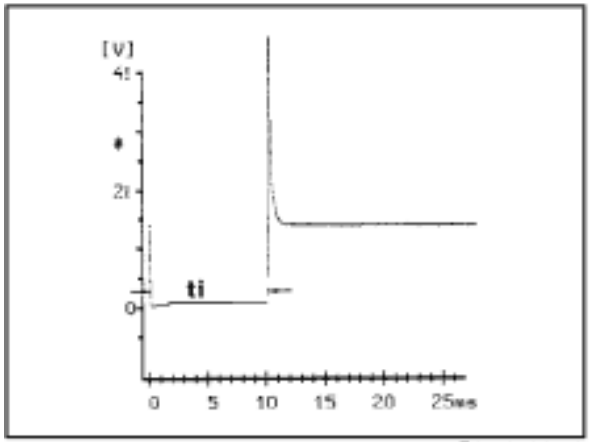
P07-0699-13

Figure 18

Injection time signal “ti” of injectors at closed throttle position

ti = Injection time

Electrical Test Program – Test

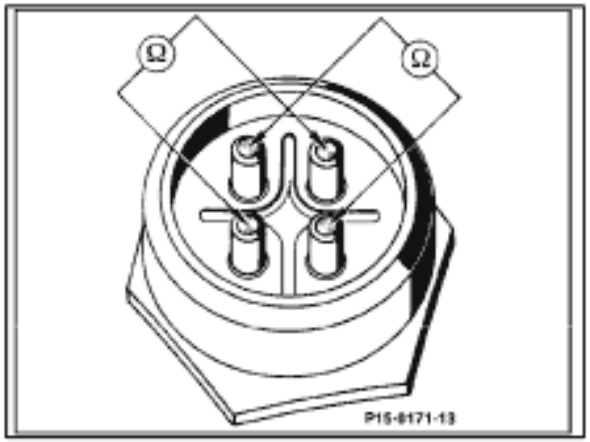


P07-0700-13

Figure 19
Model

Injection time signal "ti" of injectors when briefly accelerating

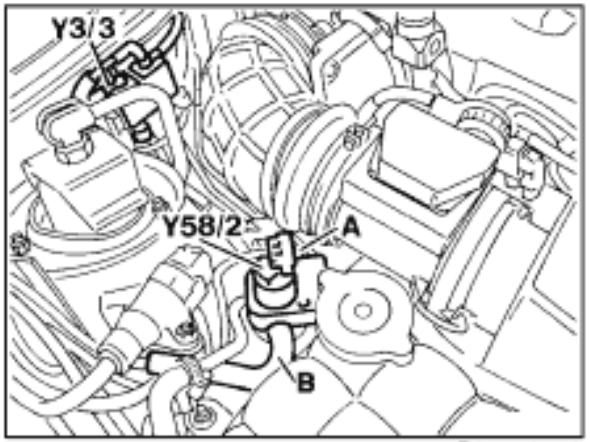
ti = Injection time



P15-0171-13

Figure 20
Model

ECT sensor (B11/9 or B11/10)

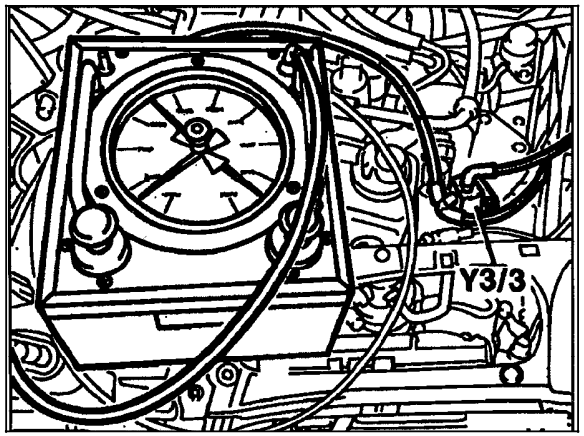


P07-5495-13

Figure 21
Model 129

Y3/3 Upshift delay switchover valve

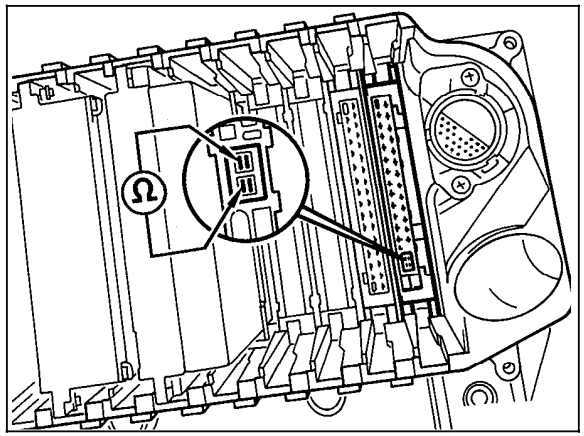
Electrical Test Program – Test



P07-5221-13

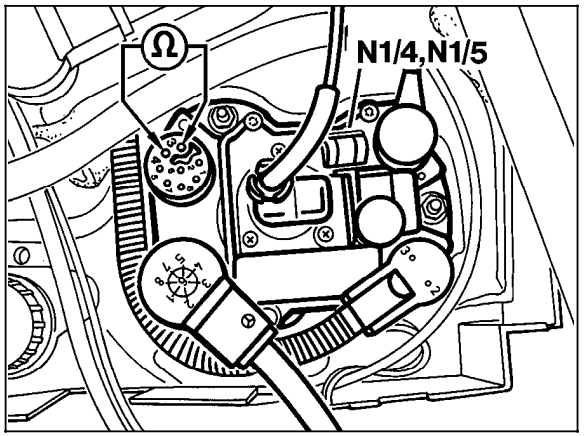
Figure 22
Model 140

Y3/3 Upshift delay switchover valve



P07-5160-13

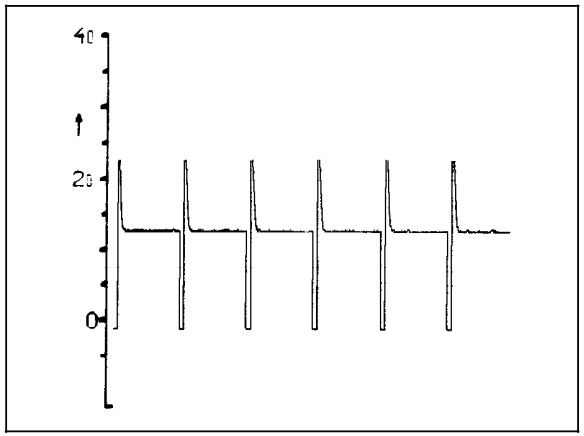
Figure 23



P15-5058-13

Figure 24

Electrical Test Program – Test



P07-5330-13

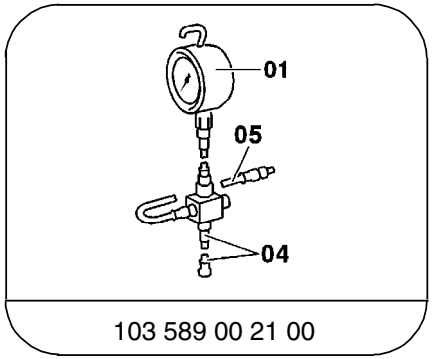
Figure 25

Purge control valve signal

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

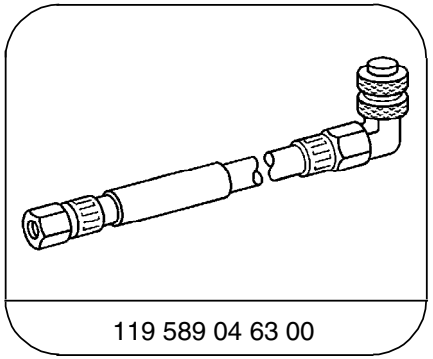
- Connect pressure gauge to test connection
- After completing test, using measurement glass (055), release fuel pressure and allow residual fuel to drain into glass (see Figures 1).

Special Tools



103 589 00 21 00

Tester

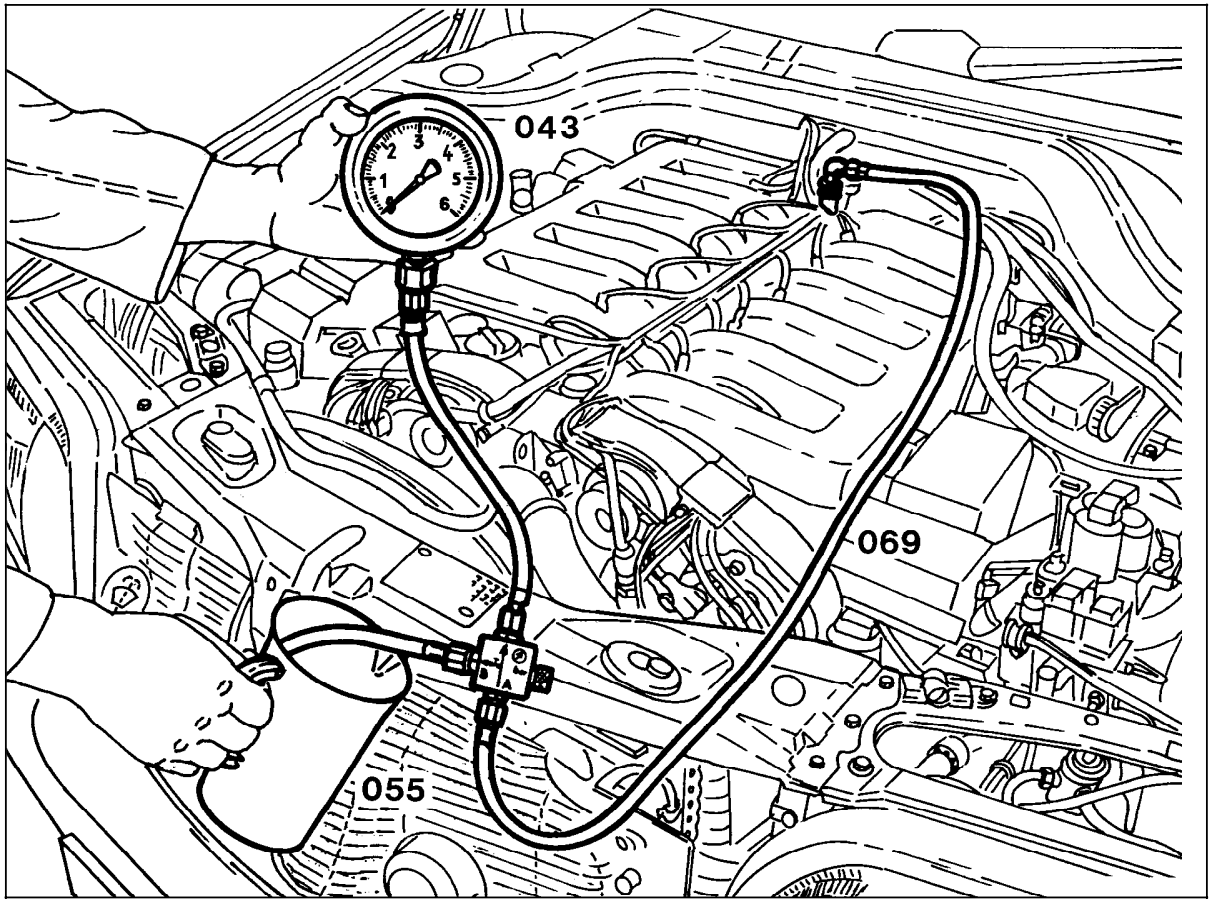


119 589 04 63 00

Pressure hose

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

Connection Diagram
Engine 120



P07-2639-57

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)

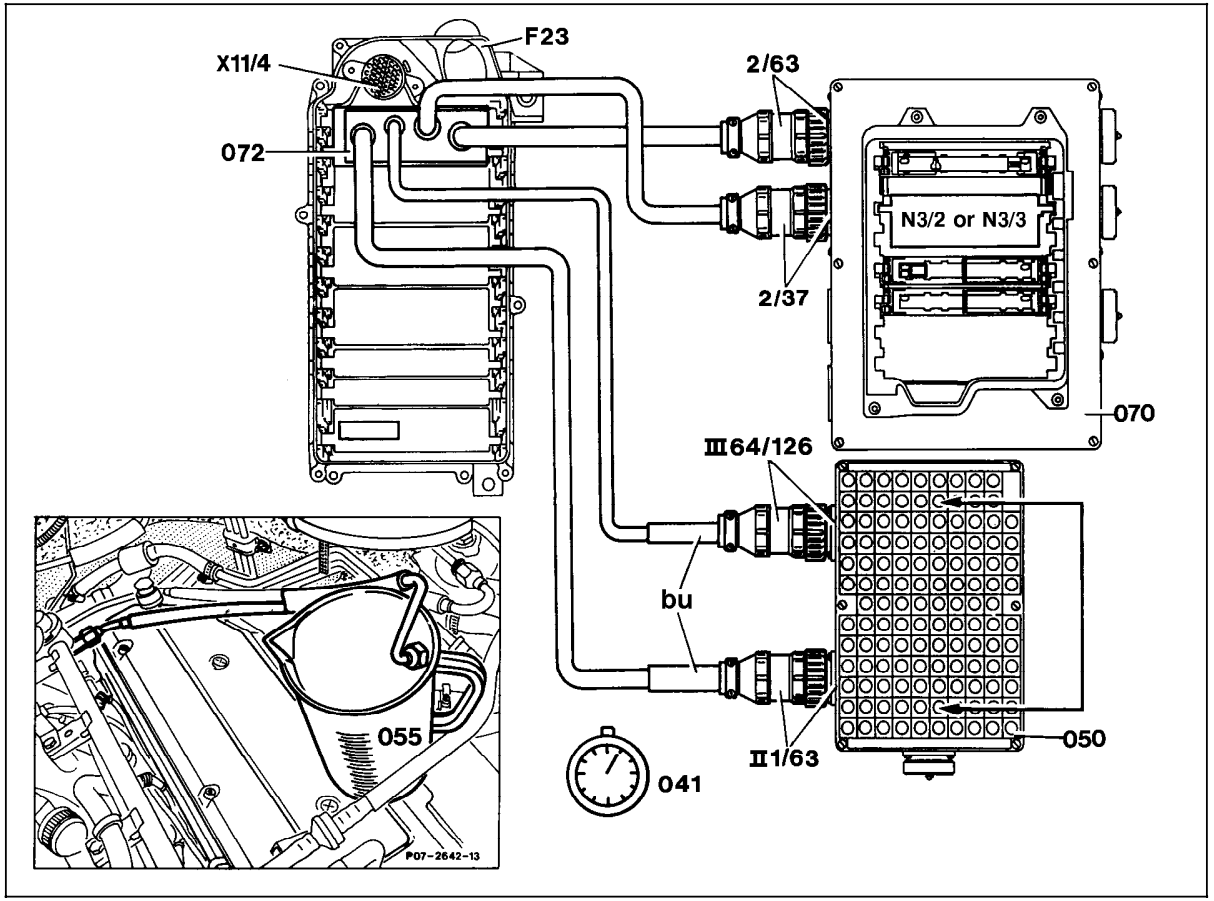
Test step **DTC**	Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy [1]
⇒ 1.0	**Fuel pressure** at idle (**with** vacuum)	Pressure gauge connected to test connection.	Engine: **at closed throttle speed** Valve on pressure gauge closed.	3.2 – 3.6 bar	Check fuel pumps 34, Replace diaphragm pressure regulator.
⇒ 2.0	**Fuel pressure** at idle (**without** vacuum)	Pressure gauge connected to test connection.	Engine: **at closed throttle speed** 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 approx. 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 left LH-SFI control module (N3/2) or right LH-SFI control module (N3/3).



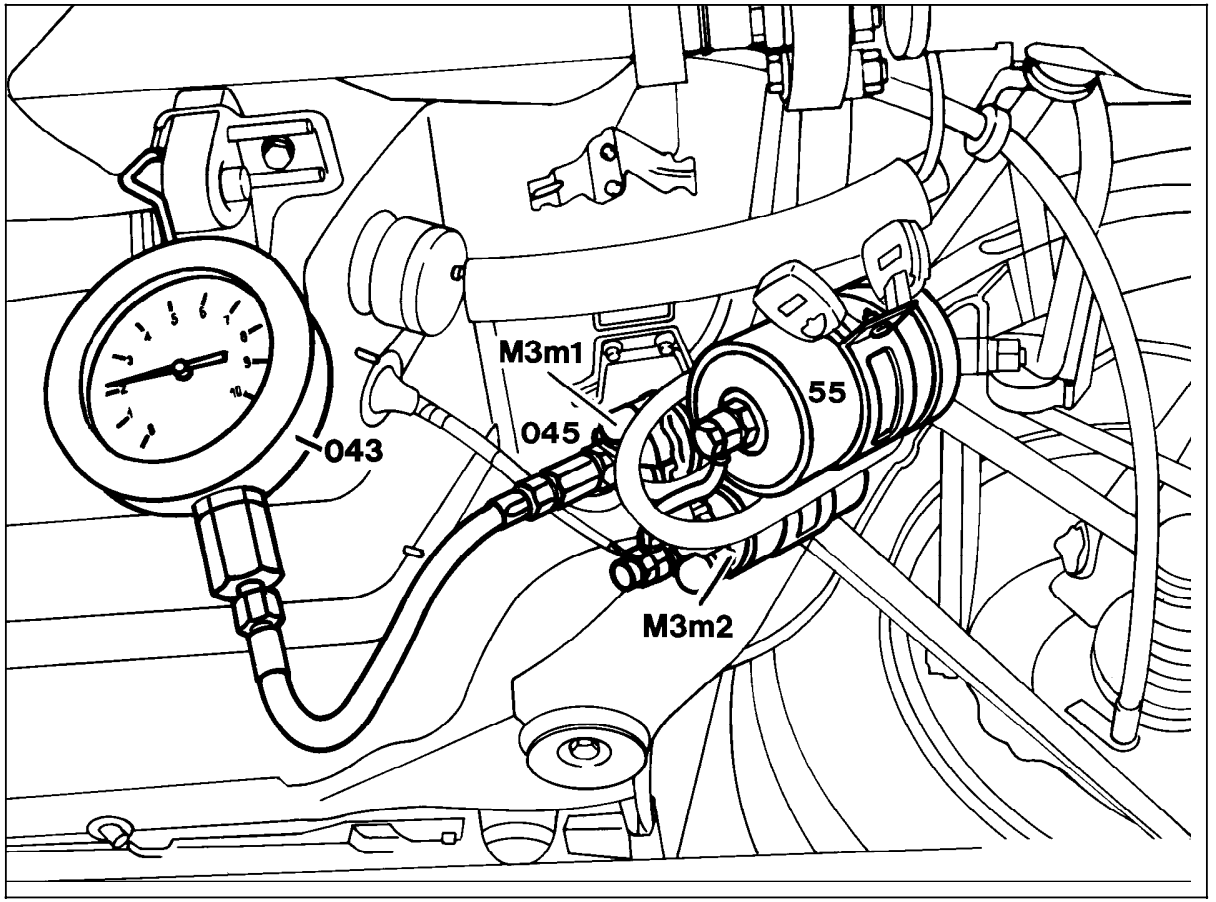
U07-5005-57

Figure 1

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



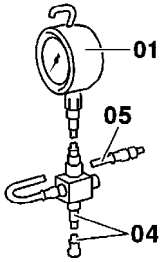
P07-2645-57

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

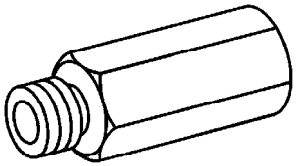
Hydraulic Test Program - Preparation for Test (Fuel Pump Test)

Special Tools



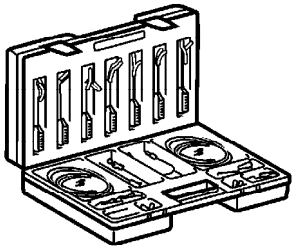
103 589 00 21 00

Tester



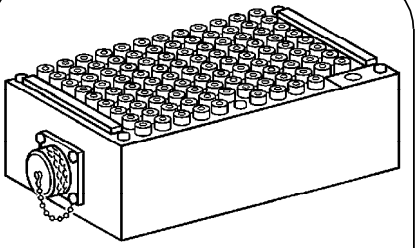
103 589 02 63 00

Adapter



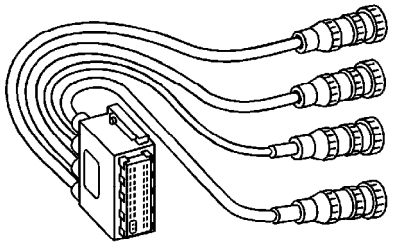
201 589 00 99 00

Electrical connecting set



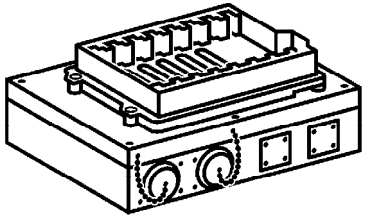
129 589 00 21 00

126-pin socket box



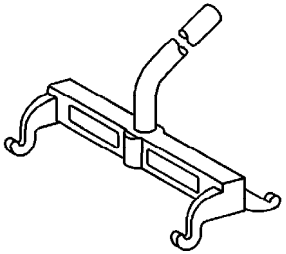
140 589 02 63 00

Contacting module 2



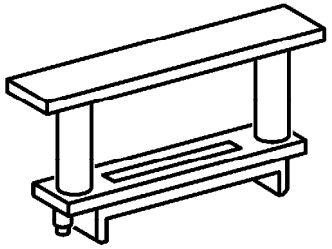
140 589 06 63 00

Contacting box



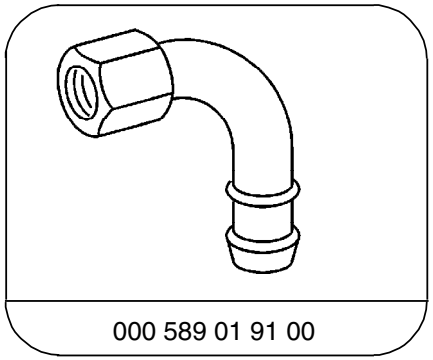
140 589 01 33 00

Mounting lever



140 589 10 33 00

Spacer



000 589 01 91 00

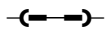
Elbow fitting

Equipment

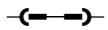
Fuel hose, 500 mm long (20 in.)	local purchase
Measuring glass (1 liter minimum)	local purchase
Stop watch	local purchase
Multimeter [1)]	Fluke Model 23, 83, 85, 87

1) Available through the MBUSA Standard Equipment Program.

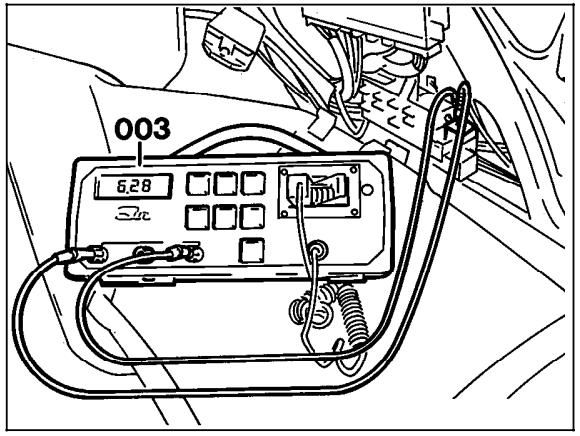
Hydraulic Test Program - Test (Fuel Pump Test)

Test step **DTC**	Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
⇒ 1.0	**Fuel pumps** Delivery capacity	N3/2 or N3/3  66  76 (1.25) (1.35)	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), ⇒ 2.0 ⇒ 3.0 Replace fuel filter.
⇒ 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.

Hydraulic Test Program - Test (Fuel Pump Test)

Test step **DTC**	Test scope	Test connection	Test condition	Nominal value	Possible cause/Remedy
⇒ 3.0	**Fuel pressure** after fuel pump 1	N3/2 or N3/3  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)



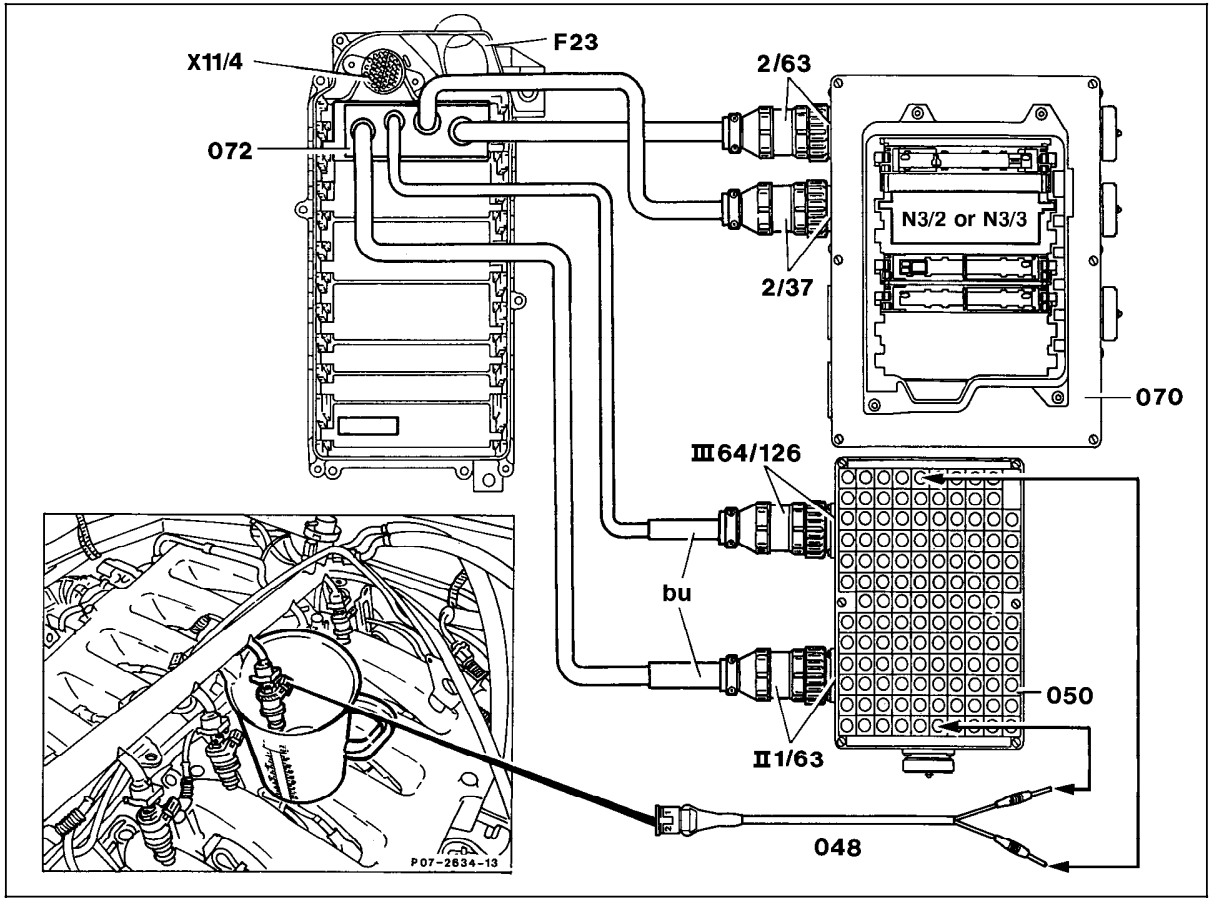
P07-2644-13

Figure 1

003 Multimeter

Hydraulic Test Program - Preparation for Test (Injector Test)

1. Connect socket box to left LH-SFI control module (N3/2) or right LH-SFI control module (N3/3).
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.



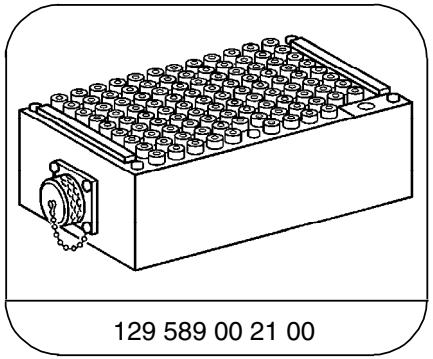
U07-5015-57

Figure 1

047	Fuel hose
048	Self-made harness
050	Socket box (126-pole)
055	Measuring glass
070	Contact box
072	Contact module
bu	blue

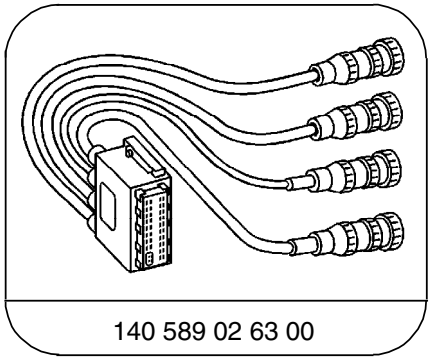
Hydraulic Test Program - Preparation for Test (Injector Test)

Special Tools



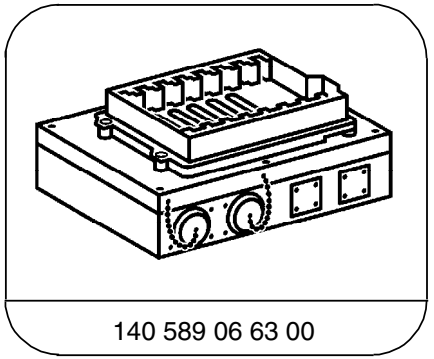
129 589 00 21 00

126-pin socket box



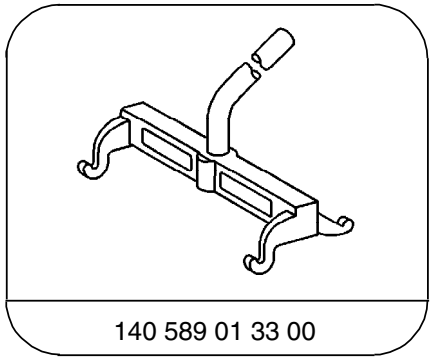
140 589 02 63 00

Contacting module 2



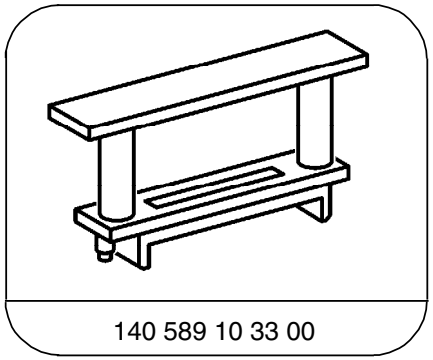
140 589 06 63 00

Contacting box



140 589 01 33 00

Mounting lever



140 589 10 33 00

Spacer

Equipment

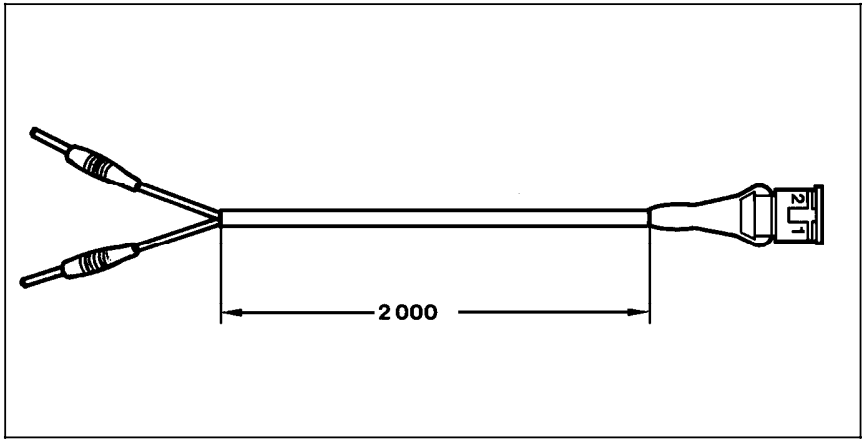
Measuring glass (1 liter minimum)	local purchase

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.)



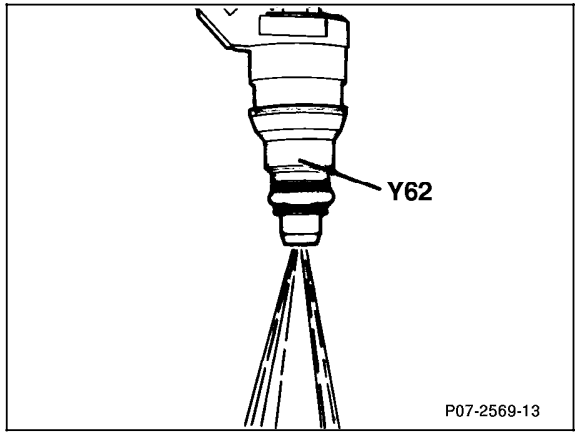
Connector layout
Position 1 = red
Position 2 = brown

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	N3/2 or N3/3  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	N3/2 or N3/3  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

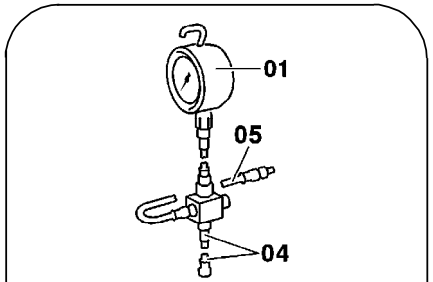
Figure 1

Acceptable injector spray pattern.

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

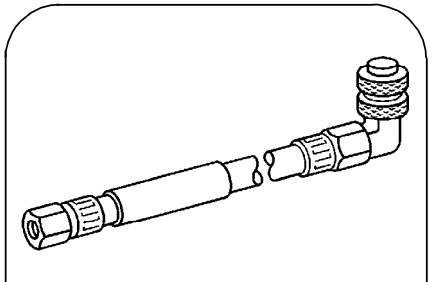
- Connect pressure gauge on test connection (31/1).
- After completing test, using measurement glass (055), release fuel pressure and allow residual fuel to drain into glass (31/1).

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.