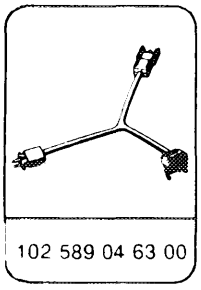
07.1-190 Testing electronic diesel system (EDS) - Turbodiesel

A. Engine 602.96 in Model 201 Federal Model Year 1987
B. Engine 603.96 in Models 124 and 126 Federal and California Model Year 1986/87
C. Engines 602.962 and 603.970, Model Year 1990

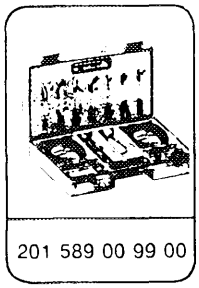
Test conditions

- Coolant temperature approx. 80°C
- Air-conditioning: **OFF**
- Shift selector lever position P
- Fuse in over-voltage protection relay in order
- Battery voltage report 12 volt at over-voltage protection between jacks 1 and 5

Special tools



102 589 04 63 00



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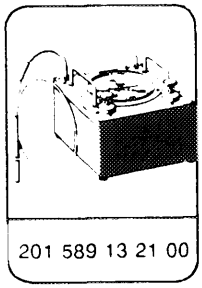
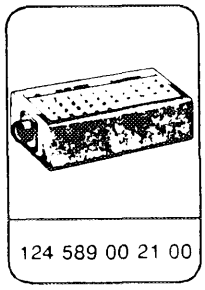
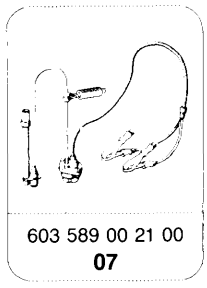


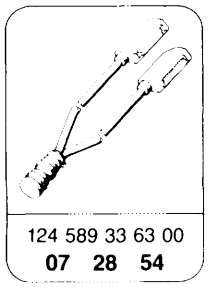
201 589 13 21 00



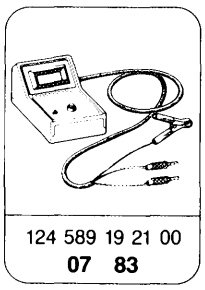
124 589 00 21 00



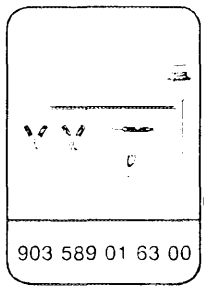
603 589 00 21 00
07



124 589 33 63 00
07 28 54



124 589 19 21 00
07 83



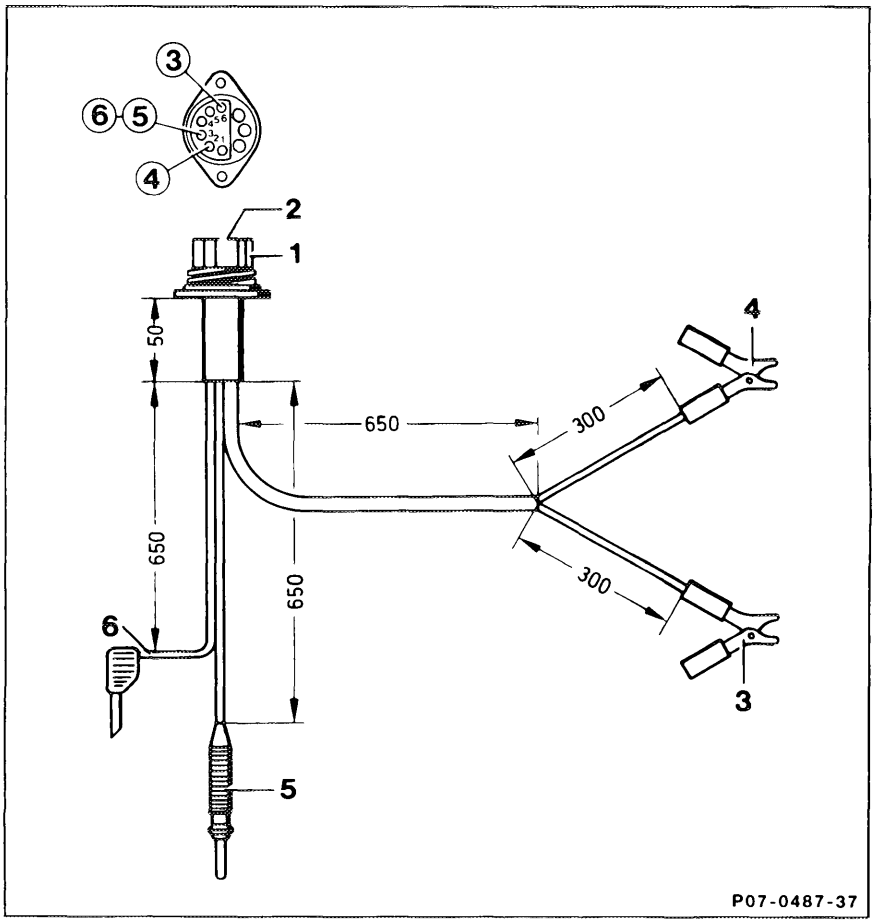
903 589 01 63 00

Commercial tools

Multimeter	e.g.	Sun, DMM-5
Digital testers	e.g.	Sun, EMT-1019/Master 3 Sun, DIT 9000 All-Test, 3610-MB Bosch, MOT 002.01
Y distributor		117 078 01 45
Lambda control tester	e.g.	Bosch KDJE-P600 Hermann L 115

Test cable
shop-made

Test cable (X11)



Pin assignment of test socket
Position 3 to jack 6
Position 4 to jack 2
Position 5 to jack 3
Position 6 to jack 3

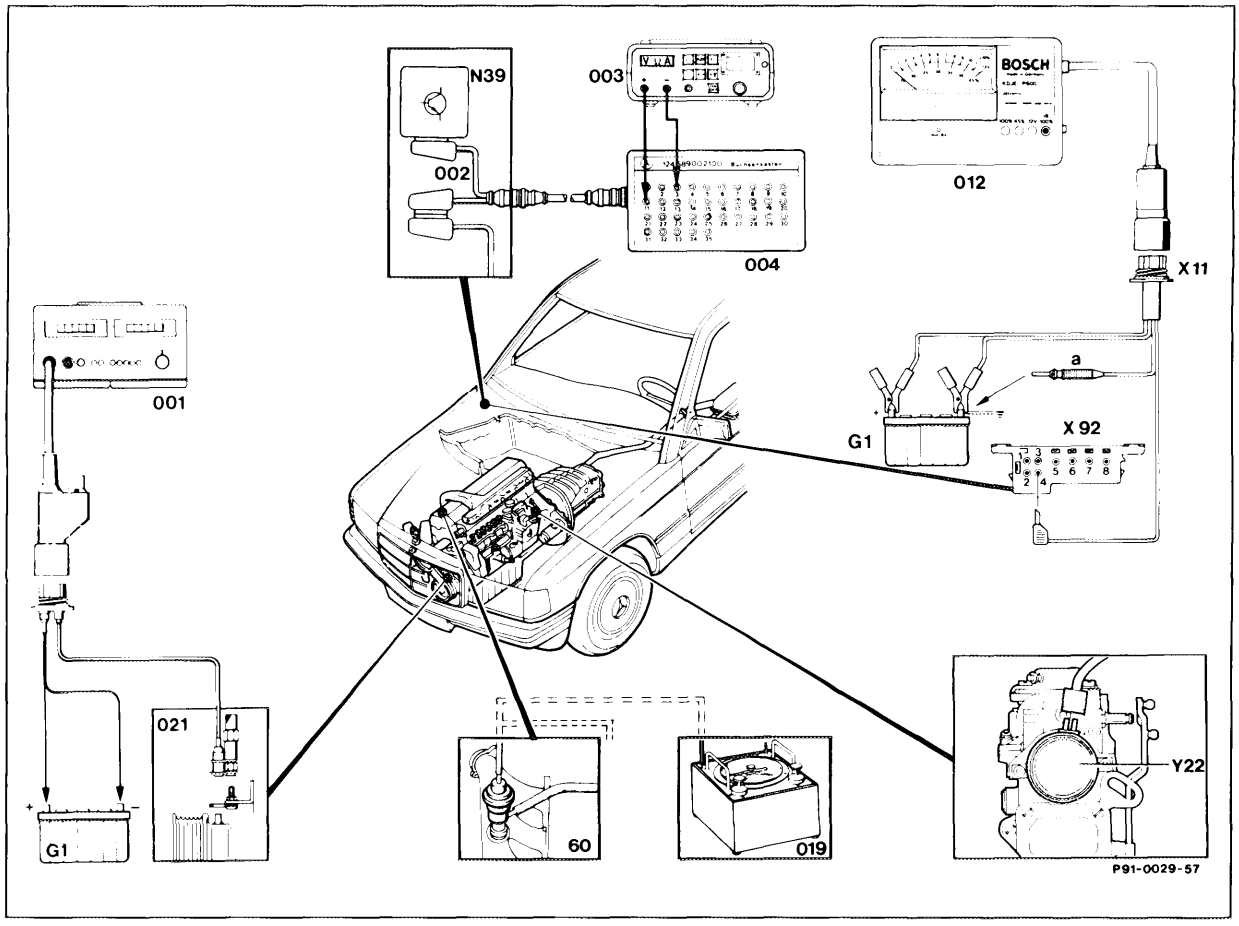
Scope of parts

Position	Designation	Part no.	Quantity/dimension
1	Test socket	123 545 00 26	1
2	Jacks	001 545 28 26	3
–	Cable	Commercial	Length as per drawing
3	Terminal, red	Commercial	1
4	Terminal, black	Commercial	1
5	Connector	Commercial	Ø 4.8 mm
6	Connector	Commercial	Ø 4 mm

A. Engine 602.96 in Model 201 Federal Model Year 1987

a) Testing
b) Testing components
c) Testing electronic idle speed control

a) Testing



Digital tester (001) and pulse counter (021)	connect, disconnect.
Lambda control tester (012)	connect to battery (G1) and test connector (X92). Connect, disconnect, press 100% IR switch.

Contact box (004)	connect, disconnect with test cable (002) to EDS control unit (N39).
Vacuum tester (019)	connect, disconnect with Y distributor at EGR valve.
Digital tester (003)	connect, disconnect to contact box (004).
Fuse at over-voltage protection (K1/1)	test.
Selector lever	move into position "P".
Air-conditioning/automatic climate control	off.
Engine	bring to operating temperature (coolant temperature to 80°C).

Note
When performing the test work, the air intake hose between the air flow sensor and exhaust gas turbocharger must be fitted, otherwise no signal will pass from the air flow sensor to the EDS control unit (N39).

Connector "**a**"	hold approx. 1 second to battery ground 100% readout.
Connector "**a**"	remove. 0% readout, no fault in system. Readout fluctuates, fault in system (refer to troubleshooting table).

Note
One pulse = 0% – 100% – 0%.

The number of pulses indicates which electrical component is faulty.

Repeat test until there are no further pulses displayed.

Trouble-shooting table

Fault readout	Component or circuit not operating
1	Engine speed sensor (L3)
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1) electrical faults
4	Altitude sensor (B18)
5 [1])	Exhaust control circuit, electrical and mechanical faults a. Exhaust gas recirculation valve EGR (60) b. Vacuum transducer (Y31/1) c. Air flow sensor (B2/1)
8	Coolant temperature sensor (B11/4)
9	Intake air temperature sensor in air flow sensor (B2/1a)
10	Reference resistor (R18/2) exhaust gas recirculation (EGR)
11	Resistance trimming plug (R18/1) idle speed control (ELR)

[1]) Hold engine speed above 1200 rpm for at least 5 seconds, otherwise no readout.

Double connector of ELR solenoid Y22	Disconnect and fit on again (at least 3 seconds). Engine speed increases briefly.
Engine	Run engine at approx. 1200 rpm and approx. 250 mbar. Briefly apply full throttle. Vacuum drops to 0 mbar.
Engine	off.
EGR valve	Pressurize EGR valve with approx. 300 mbar vacuum. EGR valve audibly closes.

b) Testing components

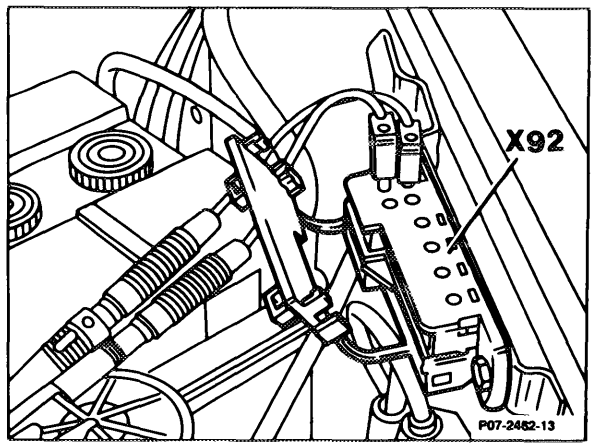
Fault readout "1"

Testing engine speed signal
Connect multimeter to test connector (X92), jacks 1 and 2. Press button "V~". Engine at idle.

Readout: >2.8 V~

Yes	No

End of test



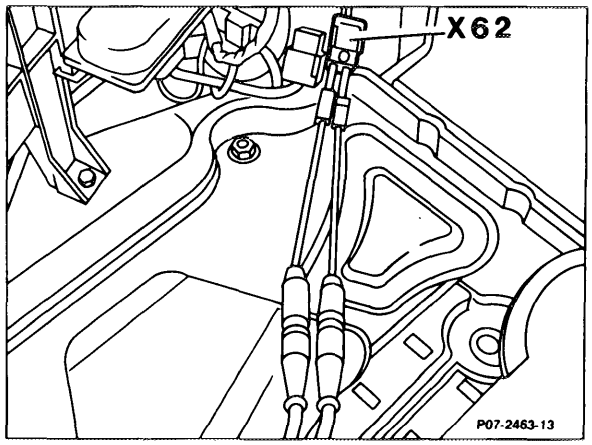
Engine off. Separate plug connection (X62). Press button "Ω" and test resistance with multimeter.

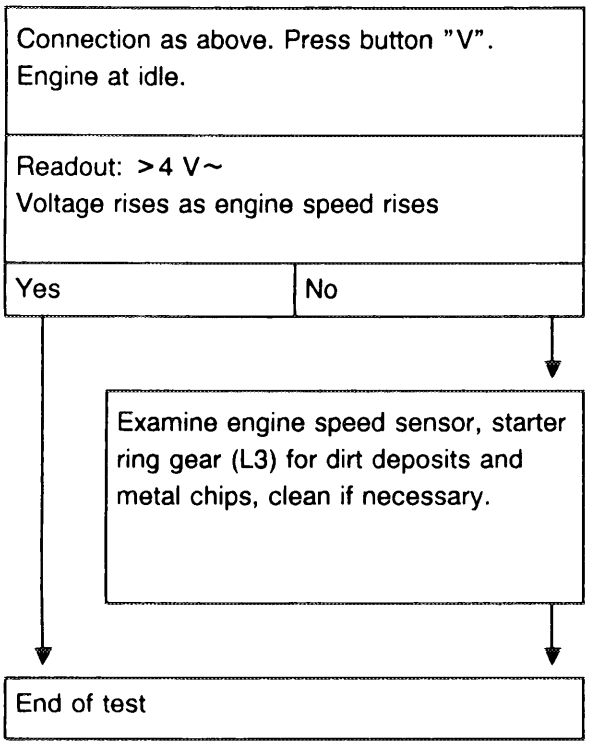
Readout: 0.4–2.5 kΩ

Yes	No

Replace engine speed sensor (L3)

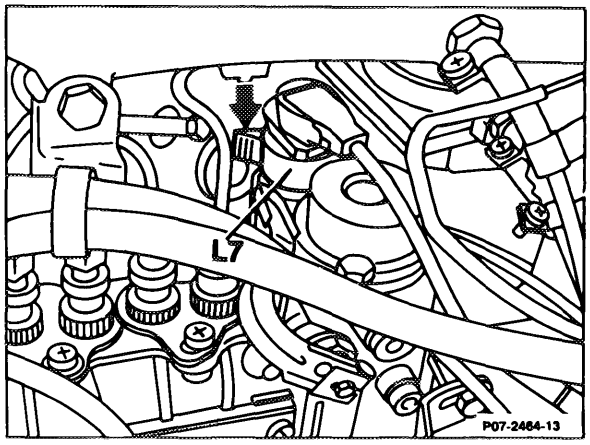
End of test




Connection as above. Press button "V".
Engine at idle.
Readout: >4 V~
Voltage rises as engine speed rises
Yes
No
Examine engine speed sensor, starter ring gear (L3) for dirt deposits and metal chips, clean if necessary.
End of test

Fault readout "2"

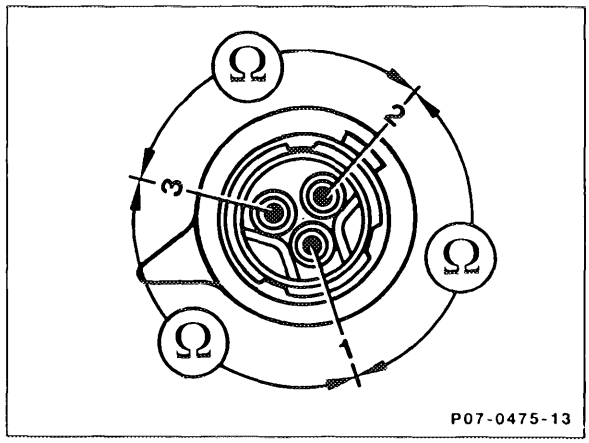
Testing control rod travel sensor (L7)
Engine off. Turn anti-twist lock (arrow) counter-clockwise and detach connector on the injection pump. Press multimeter button "Ω". Test resistance according to drawing.



Readout:
Terminals 1 and 2 = approx. 25 ± 2 Ω
Terminals 1 and 2 = approx. 25 ± 2 Ω
Terminals 2 and 3 = approx. 50 ± 2 Ω

Yes	No

Replace injection pump.

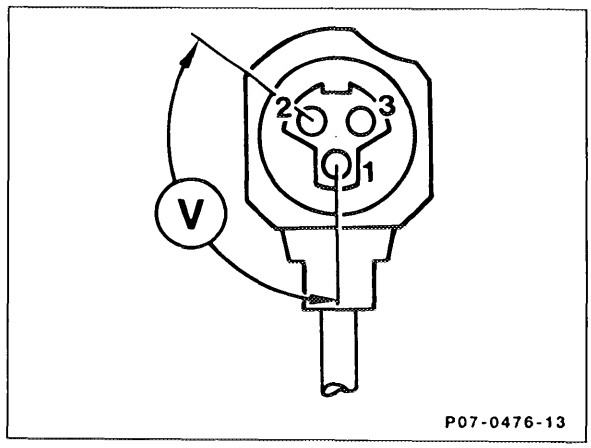


Engine off. Ignition on
Press multimeter button "V = ". Measure voltage between the jacks 1-2.

Readout approx. 10 volts

Yes	No

Rectify interrupt according to wiring diagram.
Replace control unit (N39).



End of test

Fault readout opening "3"

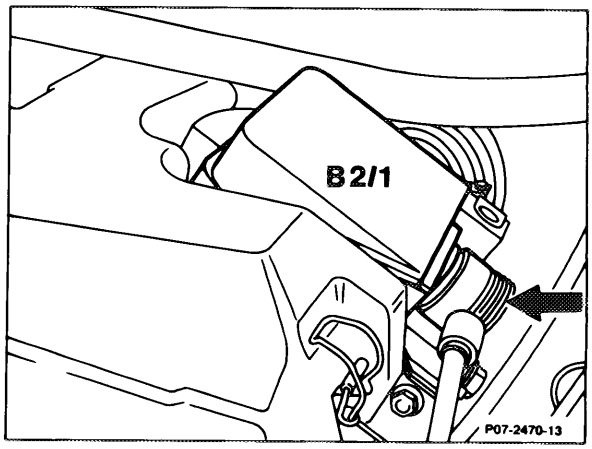
Testing airflow sensor potentiometer (B2/1)

Engine off. Detach connector (arrow) from airflow sensor. Multimeter button Ω. Measure resistance between jacks 1 and 3 on airflow sensor.

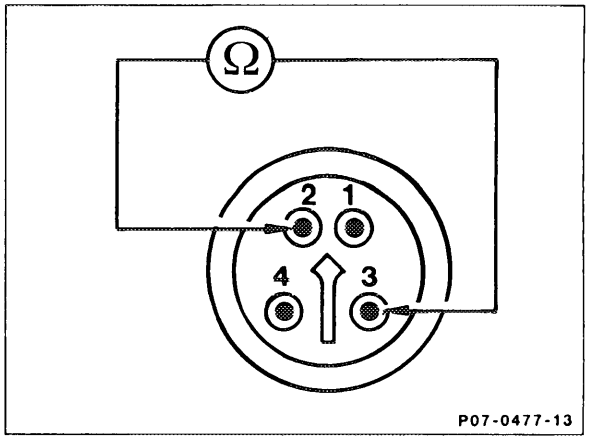
Readout:
airflow sensor plate in idle position = approx. 50–200 Ω

airflow sensor plate fully deflected = approx. 560–1100 Ω

Yes	No



Examine airflow sensor plate for ease of movement and fouling. Replace airflow sensor if necessary.

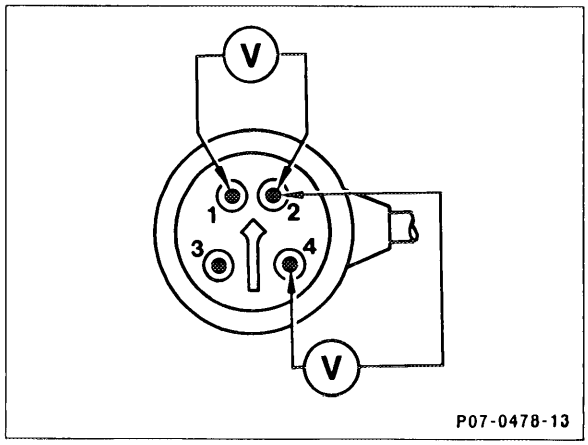


Engine off, ignition: **ON**. Press multimeter button "V=". Measure voltage between jacks 1 and 2 or 2 and 4, resp.

Readout: approx. 5 volts

Yes	No

Rectify interrupt according to wiring diagram
Replace control unit (N39).



End of test

Note

If airflow sensor removed, also perform "Testing air temperature sensor (B2/1a)" (Fault readout 9).

Fault readout "4"

Testing altitude sensor (B18)
Engine off. Ignition key in position "2". Press multimeter button "V=". Measure voltage between jacks 1 - 2.

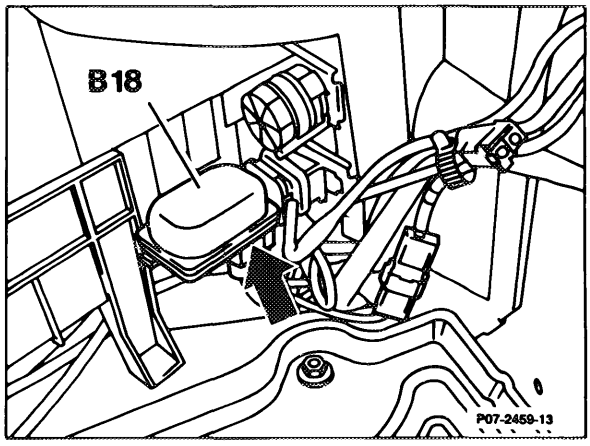
Readout: approx. 5 volts

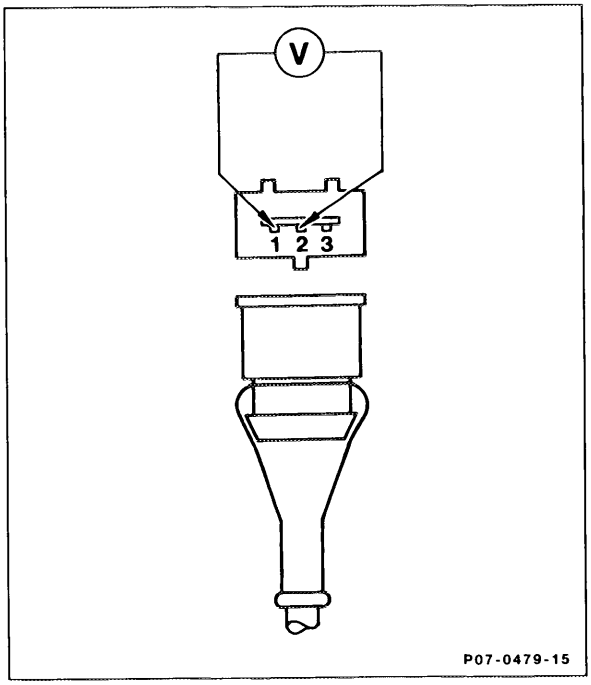
Yes	No

Rectify interrupt according to wiring diagram.
Replace control unit (N39) if necessary.

Replace altitude sensor.

End of test





Fault readout "5"

Testing exhaust control circuit

a) Test EGR valve (60) when engine not running

Pressurize EGR valve approx. 300 mbar vacuum. Detach vacuum line.

EGR valve closes audibly and is felt to close.

Yes	No

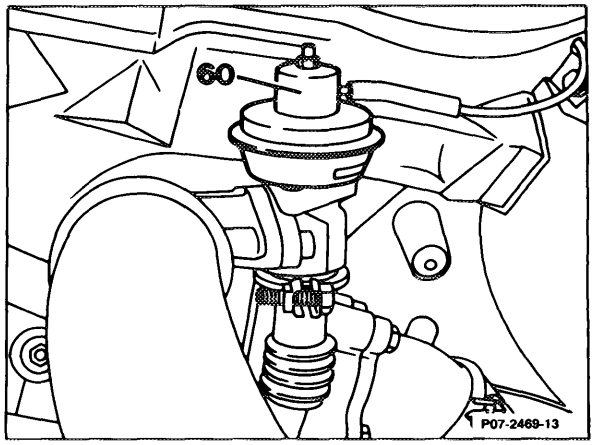
Remove EGR valve and pressurize vacuum tester with approx. 520 mbar.

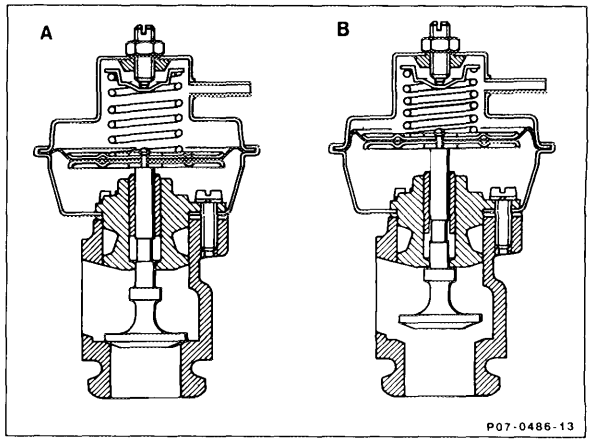
EGR valve rises approx. 5 mm off its seat (end stop).

Detach vacuum line. EGR valve must be heard to close.

If one of these test steps is not successful, replace EGR valve.

End of test





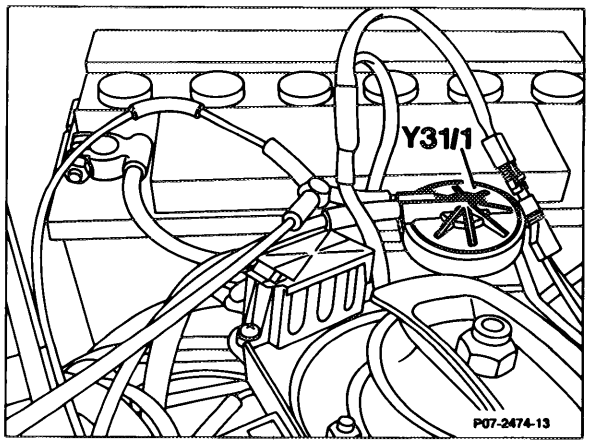
A closed
B open

b) Testing vacuum transducer (Y31/1)

Connect vacuum tester with Y distributor to vacuum transducer (Y31/1). Connect multimeter with test cable to transducer (Y31/1). Press button "A". Increase engine speed until approx. 250 mbar is reached.

Note

Ensure that connector of vacuum transducer (Y31/1) is correctly connected.



Refer to diagram for specified values.
Example: 250 mbar = 400-500 mA

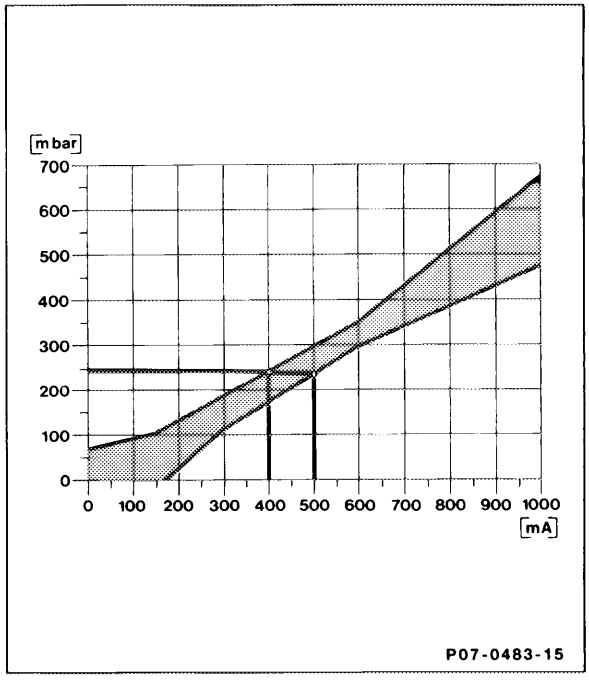
Current at vacuum transducer

0 mA too low too high

Check that vacuum vent (black) and filter are clear.

Check that supply line (blue) is clear. Check whether there is an interruption in vacuum line (white/purple/brown) between transducer and EGR valve. If vacuum line and vacuum are in order, replace vacuum transducer (Y31/1).

End of test



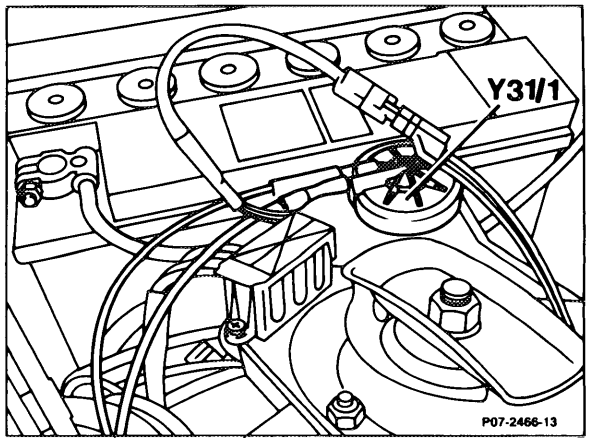
Engine off. Glow start switch in position "2". Detach double connector on EGR vacuum transducer (Y31/1), and measure voltage with multimeter button "V=".

Readout: approx. 12 volts

Yes	No

Rectify interrupt according to wiring diagram. Replace control unit (N39), if necessary.

End of test

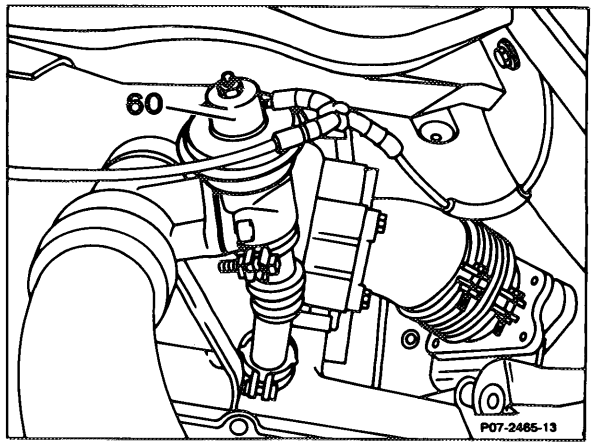


Connect vacuum tester with Y distributor to EGR valve (60). Take reading of vacuum at 850 rpm. Accelerate briefly, vacuum drops.

Yes	No

Replace vacuum transducer (Y31/1). Check mechanical operation of air flow sensor (B2/1) (refer to section "c"). If these components are in proper order, replace control unit (N39).

End of test



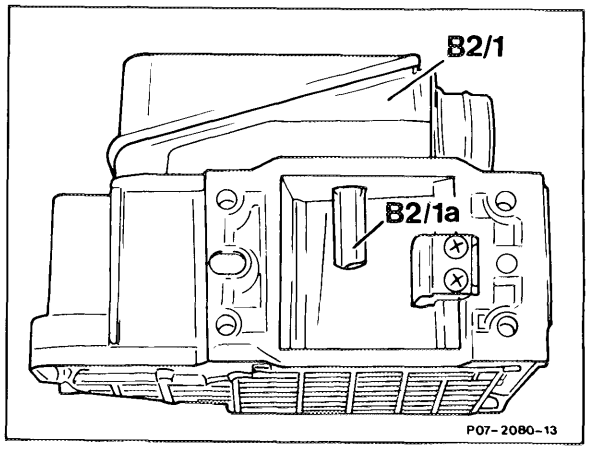
c) Check mechanical operation of air flow sensor (B2/1).

Check ease of operation of air flow sensor flap. Air flow sensor flap must not stick.

Yes	No

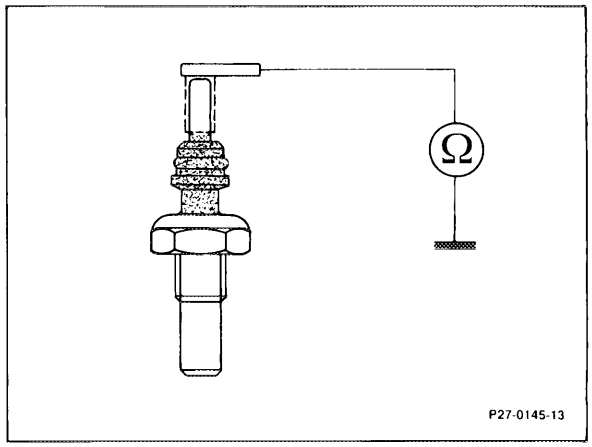
Replace air flow sensor (B2/1).

End of test



Fault readout "8"

Testing coolant temperature sensor (B11/4)
Engine off. Detach connector at coolant temperature sensor. Test resistance to ground with multimeter position "Ω".



Refer to diagram of "coolant temperature sensor and intake air" for specified value.

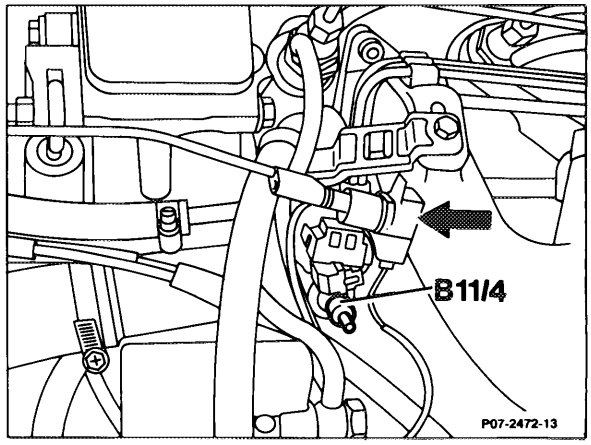
Yes	No

Replace temperature sensor (B11/4)

Test voltage at 1-pin connector (arrow) with multimeter in position "volts".
Ignition: **ON**.

Readout: approx. 5 volts

Yes	No



Rectify interrupt according to the wiring diagram. Replace control unit (N39).

End of test

Fault readout "9"

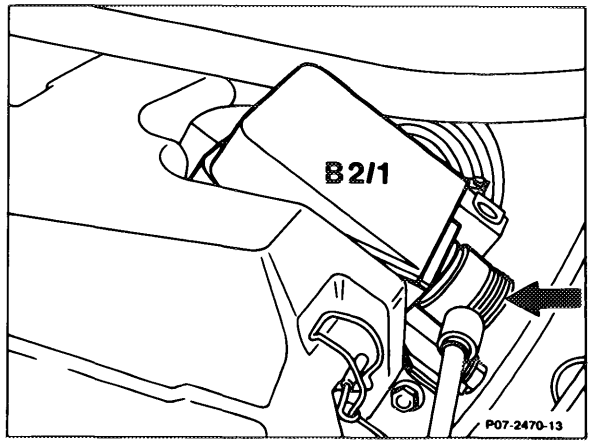
Testing air temperature sensor (B2/1a)
Engine off. Detach connector (arrow) from air flow sensor. Multimeter button "Ω". Test resistance according to table.

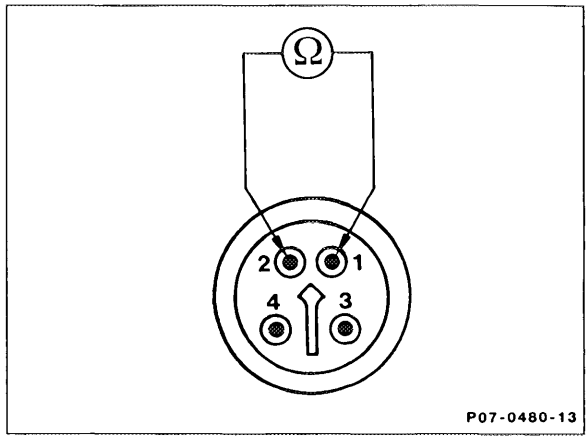
Refer to diagram for specified value.

Yes	No

Replace air flow sensor.

End of test





Coolant temperature sensor and intake air

Temperature in °C	Resistance ± 10%	Voltage in V ± 100%
20	2.5 kΩ	3.85
30	1.7 kΩ	3.47
40	1.18 kΩ	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	185 Ω	0.99

Testing reference resistor (R18/2)
Detach resistance trimming plug. Turn off engine. Ignition: **ON**. Press multimeter button "V = ". Check voltage.

Readout: approx. 5 volts

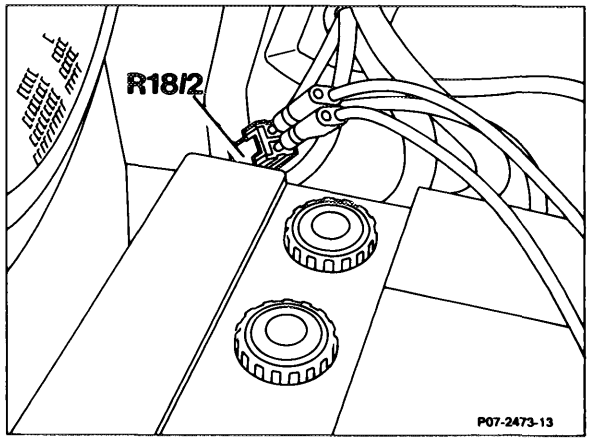
Yes	No

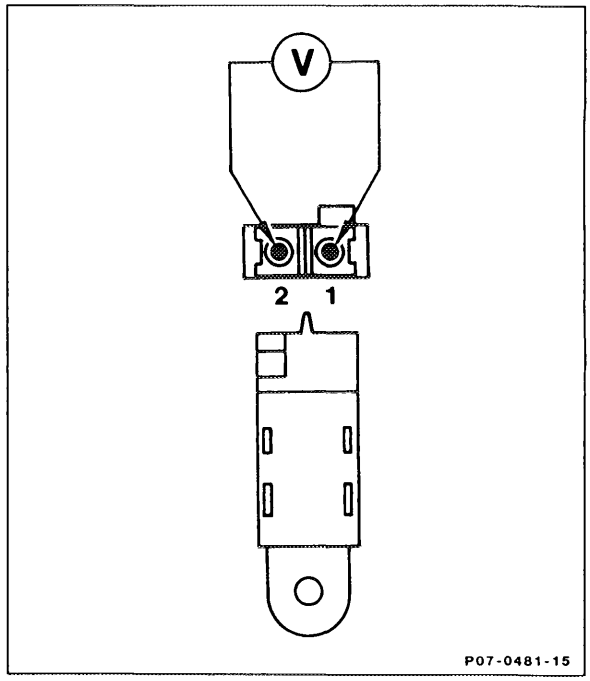
Rectify interrupt according to wiring diagram.

Replace resistance trimming plug (R18/2).

End of test

Note
When replacing the resistance trimming plug (R18/2), fit only plug with an identical part no.





Testing ELR resistance trimming plug (R18/1)
Detach resistance trimming plug. Engine off. Ignition: **ON**. Press multimeter button "V = ". Check voltage.

Readout: approx. 5 volts

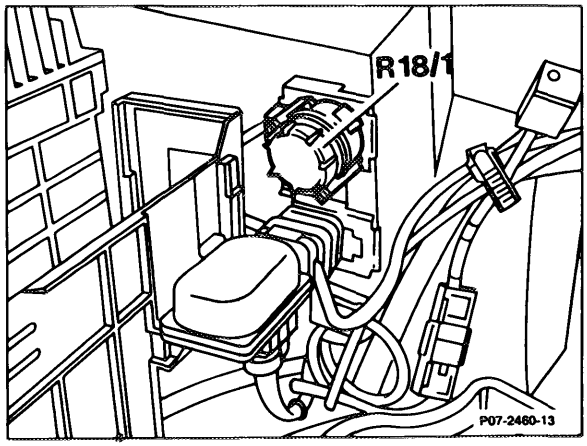
Yes	No

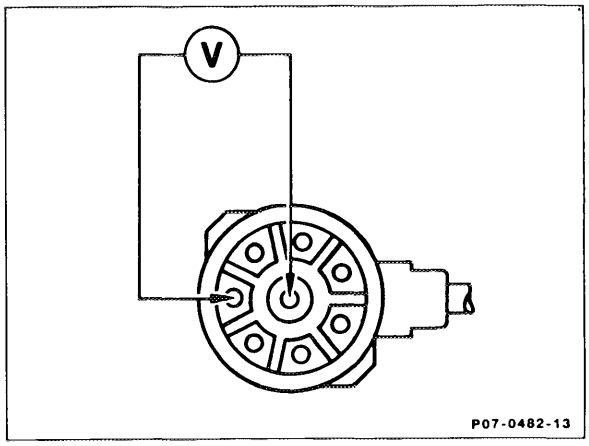
No → Rectify interrupt according to wiring diagram. Replace control unit (N39).

Yes → Replace ELR resistance trimming plug.

End of test

Note
The resistance trimming plug ELR (R18/1) is installed in position "4".





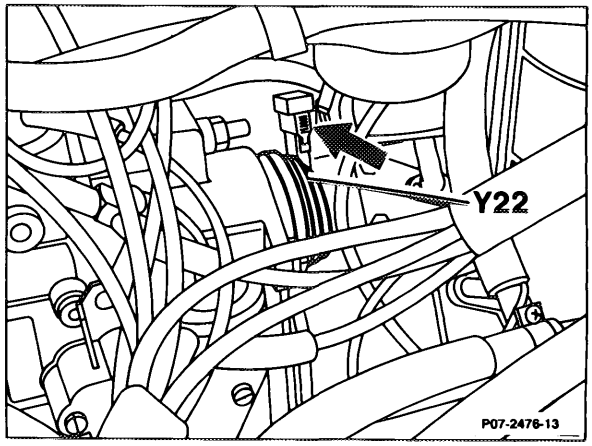
c) Testing electronic idle speed control

Testing idle speed control

Engine at idle. Detach double connector (arrow) at actuator (Y22) for at least 3 sec. and refit.

When connecting, idle speed. increases briefly.

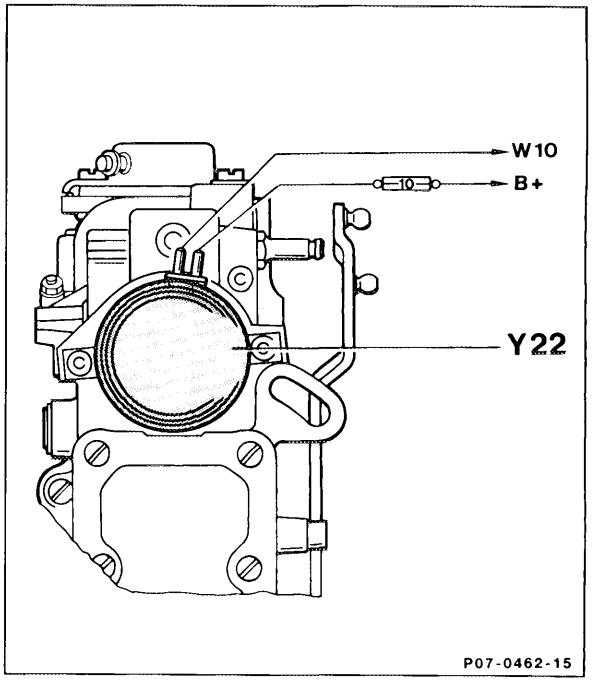
Yes	No



Briefly (max 3 sec.) apply battery voltage (approx. 12V) to actuator (Y22).

Note
Actuator (Y22) is damaged if battery voltage is applied for longer than 3 sec.
Engine speed increases.

Yes	No

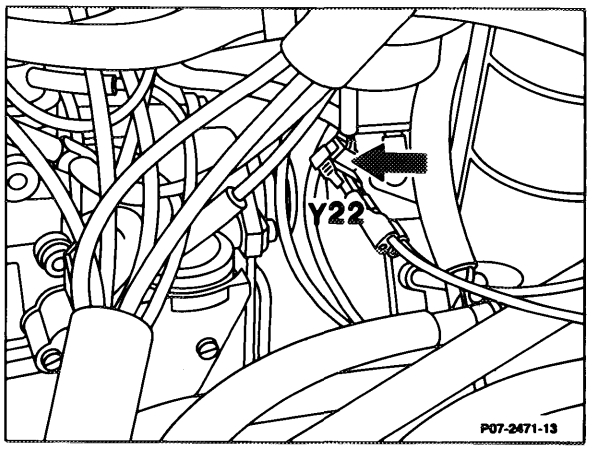


Replace actuator.

Engine at idle. Detach double connector (arrow) at actuator (Y22) and measure voltage with multimeter button "V".
Measure voltage.

Display approx. 12 volts

Yes	No



Test resistance trimming plug ELR (R18/1).
Rectify interrupt according to wiring diagram.
Replace EDS control unit (N39), if necessary.

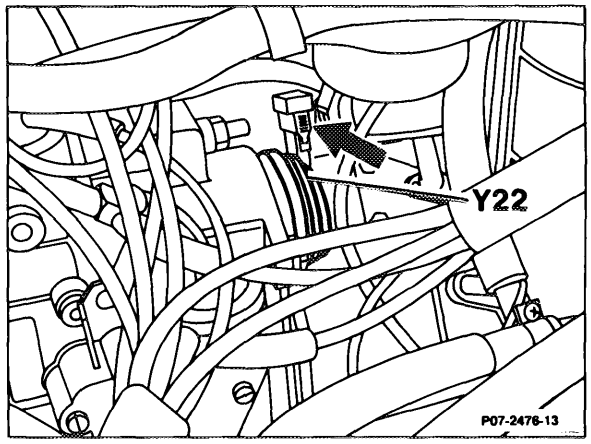
Engine at idle. Detach double connector at actuator (Y22). Test idle speed.

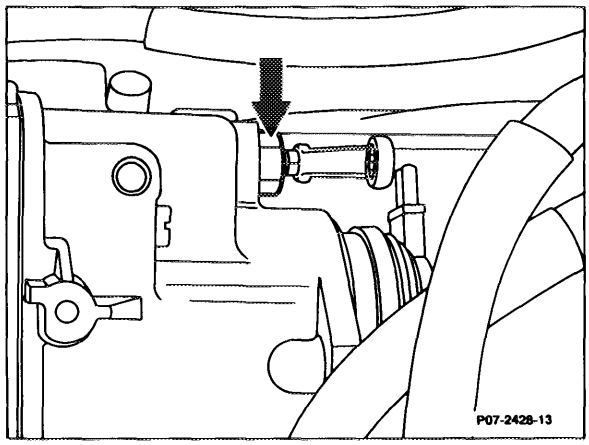
Specification: 620 ± 40 rpm

Yes	No

Set idle speed. Loosen locking nut (arrow) for this step.

End of test

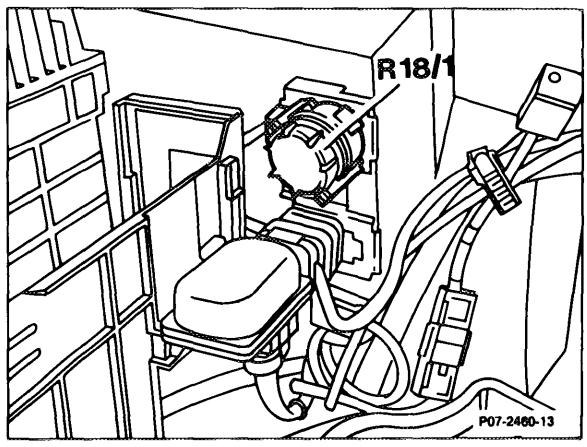




Setting idle speed by means of resistance trimming plug (R18/1)

If problems occur regarding idle, idle speed can be altered.

The positions of the resistance trimming plug are listed in the table below.

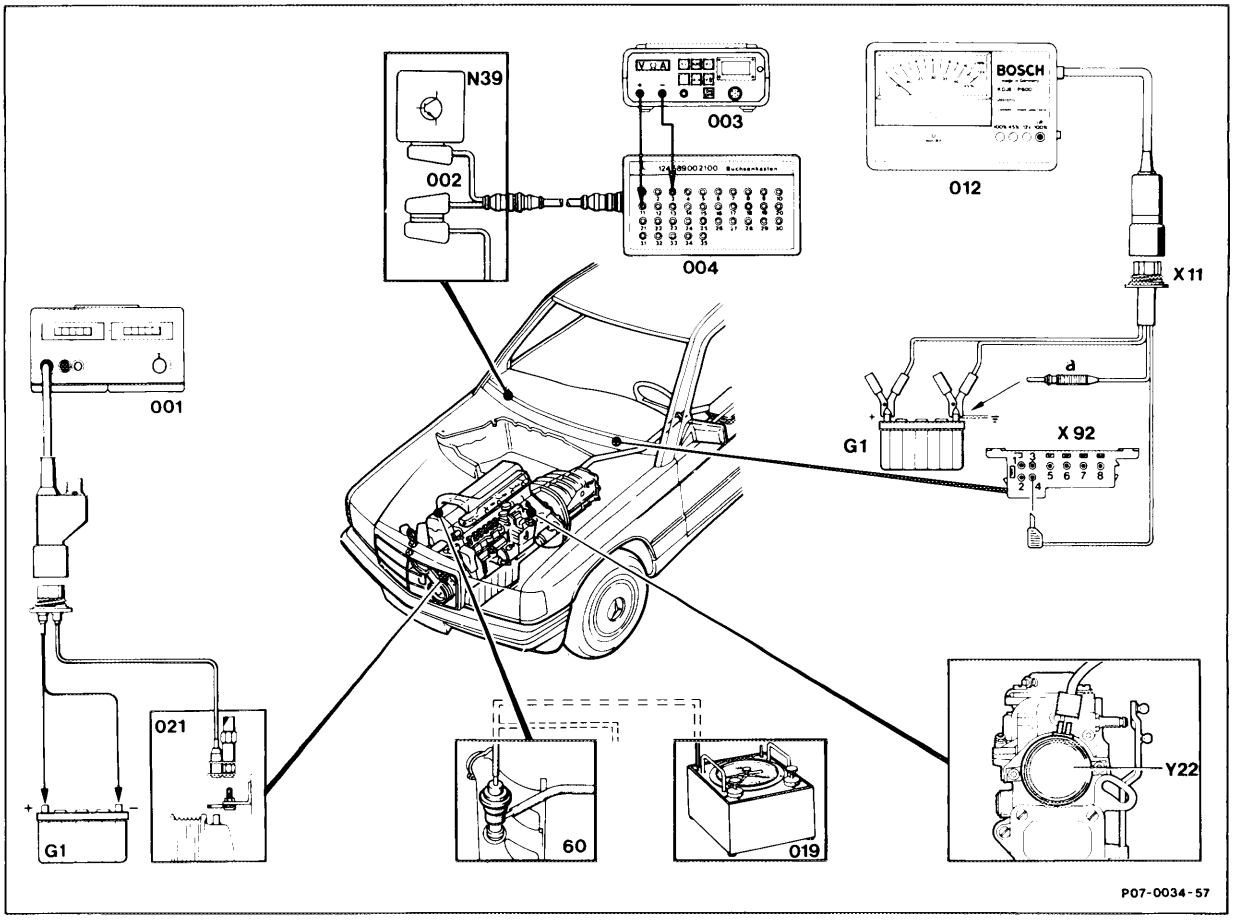


Position of resistance trimming plug	Idle speed in rpm
1	610 ± 20
2	630 ± 20
3	650 ± 20
4	680 ± 20
5	700 ± 10
6	720 ± 20
7	740 ± 20

B. Engine 603.96 in Models 124 and 126 Federal and California Model Year 1986/87

a) Testing
b) Testing components
c) Testing electronic idle speed control

a) Testing



Digital tester (001) and pulse counter (021)	connect, disconnect.
Lambda control tester (012)	connect, disconnect to battery (G1) and with adaptor to test connector (X92).
Contact box (004)	connect, disconnect with test cable (002) to EDS control unit (N39).
Vacuum tester (019)	connect, disconnect with Y distributor at EGR valve.
Digital multimeter (003)	connect, disconnect to contact box (004).
Fuse at over-voltage protection (K1/1)	test.
Selector lever	move into position "P".
Air-conditioning/automatic climate control	switch off.
Engine	bring to operating temperature (Coolant temperature approx. 80°C)

Note

When performing the test work, the air intake hose between the air flow sensor and exhaust gas turbocharger must be fitted, otherwise no signal will be sent from the air flow sensor to the control unit (N39).

Connector "**a**"	hold approx. 1 second to battery ground; 100% readout.
Connector "**a**"	remove; 0% readout, no fault in system. Readout fluctuates, fault in system (refer to troubleshooting table).

Note

One pulse = 0% – 100% – 0%

The number of pulses indicates which component is defective.

Repeat test step until no further pulses are displayed.

Trouble-shooting table

Fault readout	Component or circuit not operating
1	Engine speed sensor (L3)
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1) electrical faults
4	Altitude sensor (B18)
5 [1])	Exhaust gas control circuit, electrical and mechanical faults a. Exhaust gas recirculating valve EGR (60) b. Vacuum transducer EGR (Y31/1) c. Air flow sensor (B2/1) d. Test recirculating air valve (137b) e. Test vacuum transducer, recirculating air valve (Y31)
8	Coolant temperature sensor (B11/4)
9	Air temperature sensor in air flow sensor (B21a)
10	Reference resistor (R18/2) exhaust gas recirculation (EGR)
11	Resistance trimming plug (R18/1) idle speed control (ELR)

[1]) Hold engine speed above 1200 rpm for at least 5 seconds, otherwise no readout.

Double connector	connect, disconnect to ELR actuator Y22 (at least 3 seconds).
	Engine speed increases briefly.
Engine	Run at approx. 1200 rpm and set approx. 250 mbar vacuum. Briefly apply full throttle. Vacuum drops to 0 mbar.
Engine switched off, pressurize EGR valve	with approx. 300 mbar vacuum and pull off further.
	EGR valve audibly closes.

b) Testing components

Fault readout "1"

Testing engine speed signal

Connect multimeter to test connector (X29/4) jacks 1 and 2. Set multimeter to "V~". Engine at idle.

Readout: >2.8 V~

Yes	No

→ End of test

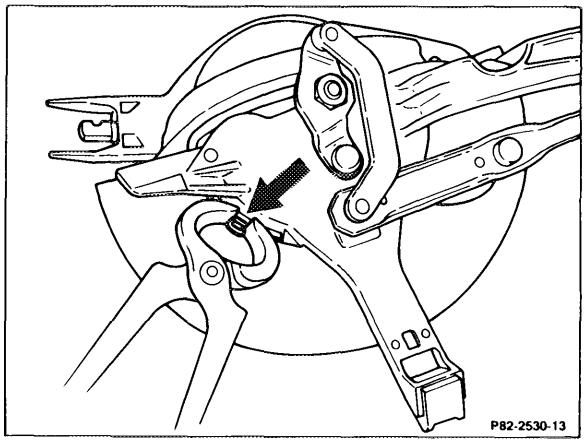
Engine off. Separate plug connection (X62). Connect multimeter and press button "Ω". Test resistance.

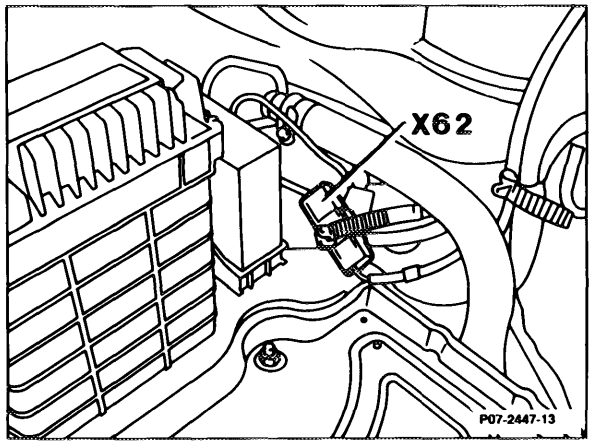
Readout: 0.4–2.5 kΩ

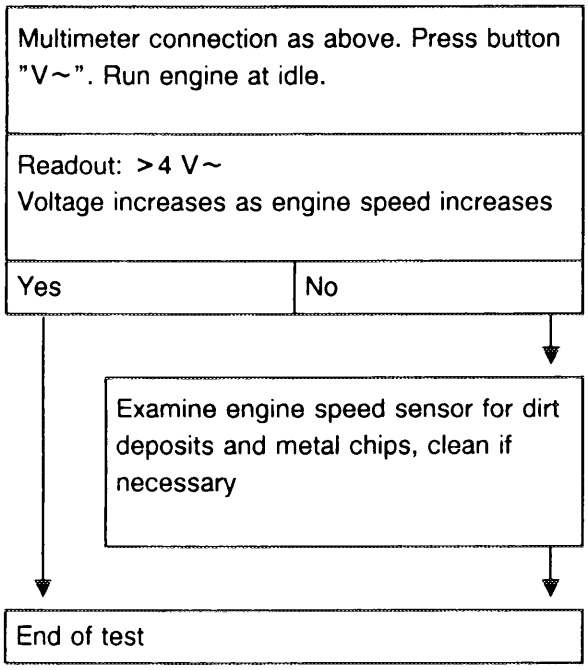
Yes	No

→ Replace engine speed sensor (L3).

→ End of test






Multimeter connection as above. Press button "V~". Run engine at idle.
Readout: >4 V~
Voltage increases as engine speed increases
Yes
No
Examine engine speed sensor for dirt deposits and metal chips, clean if necessary
End of test

Fault readout "2"

Testing control rod travel sensor (L7)
Engine off. Turn anti-twist lock to the left (arrow). Detach connector on the injection pump. Press multimeter button "Ω".
Test resistance.

Readout:
Terminals 1 and 2 = approx. 25 ± 2 Ω
Terminals 1 and 3 = approx. 25 ± 2 Ω
Terminals 2 and 3 = approx. 50 ± 2 Ω

Yes	No

Replace injection pump.

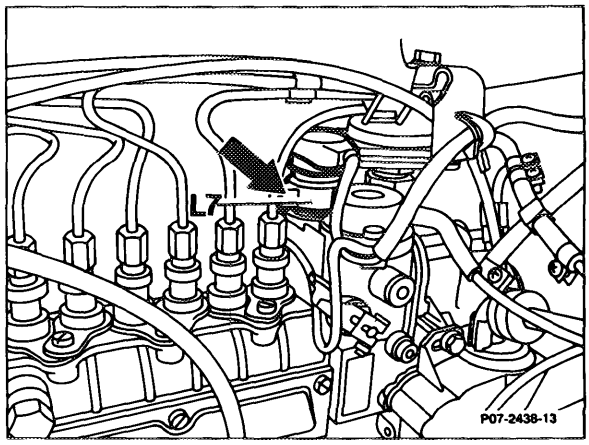
Engine off. Ignition on. Press button "V=" on multimeter.
Test voltage between terminals 1 and 2 on control rod travel sensor.

Readout approx. 10 volts

Yes	No

Rectify interrupts according to wiring diagram.
Replace EDS control unit (N39) if necessary.

End of test

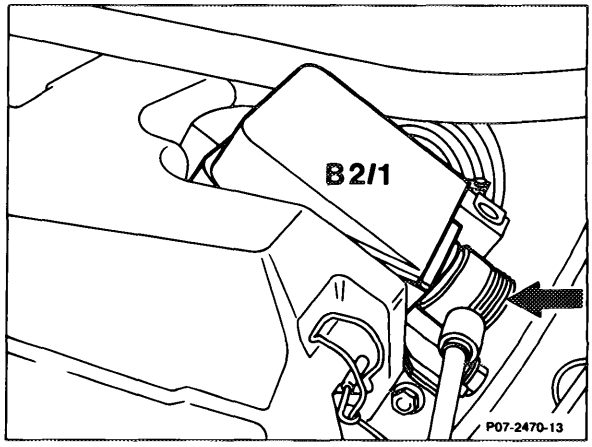


Note
Replace EDS control unit, if fault readout "2" continues to be displayed.

Fault readout "3"

Testing air flow sensor potentiometer (B2/1)

Engine off. Detach connector (arrow) from air flow sensor potentiometer. Press multimeter button "Ω". Measure resistance between terminals 2 and 3 on the air flow potentiometer.

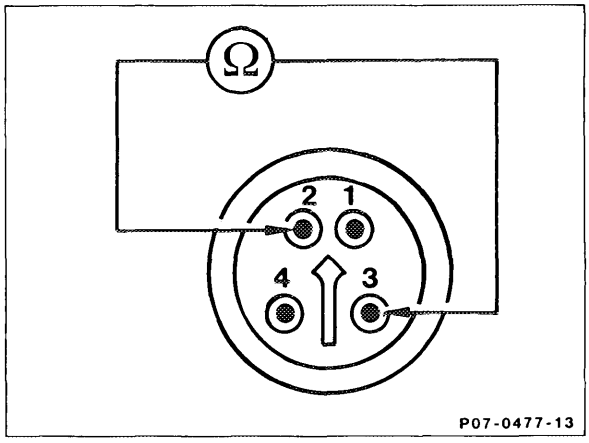


Specification:

Air flow sensor plate in idle position	= approx. 50–200 Ω
Air flow sensor plate fully open	= approx. 560–1100 Ω

Yes	No

Examine air flow sensor plate for dirt deposits and signs of jamming. Replace air flow sensor potentiometer if necessary.

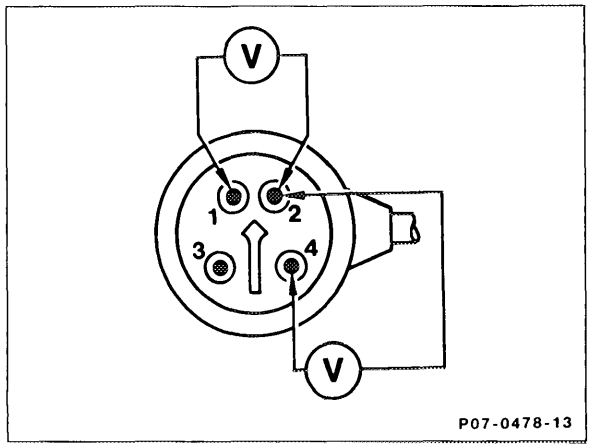


Engine off. Ignition: **ON**. Press multimeter button "V = ". Measure voltage between terminals 1 and 2 or 2 and 4, respectively.

Readout: approx. 5 volts

Yes	No

Rectify interrupt according to wiring diagram.
Replace control unit (N39).



End of test

Note

If air flow sensor potentiometer has been removed, also perform "Testing air temperature sensor (B2/1a)" (fault readout 9).

Fault readout "4"

Testing altitude sensor (B18)
Engine off. Steering lock in position "2".
Detach connector (arrow) from altitude sensor.
Press button "V=" on multimeter and test voltage between terminals 1 and 2 on connector for altitude sensor.

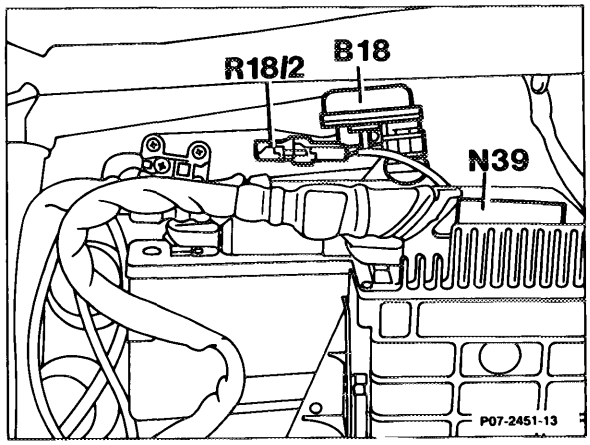
Readout: approx. 5 volts

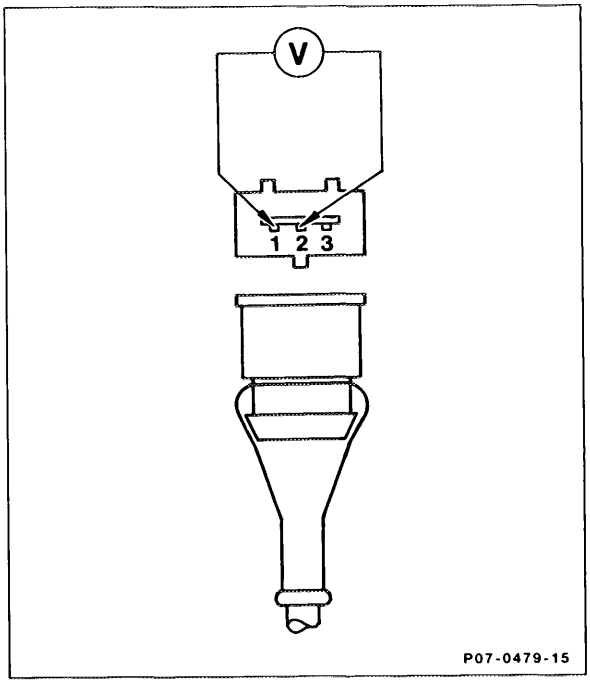
Yes	No

Rectify line interrupt according to wiring diagram. Replace EDS control unit (N39), if required.

Replace altitude sensor (B18).

End of test





Testing exhaust control loop

a) Testing EGR valve (60) when engine not running.

Pressurize EGR valve with approx 300 mbar vacuum. Detach vacuum line.

EGR valve closes audibly and can be felt closing.

Yes	No

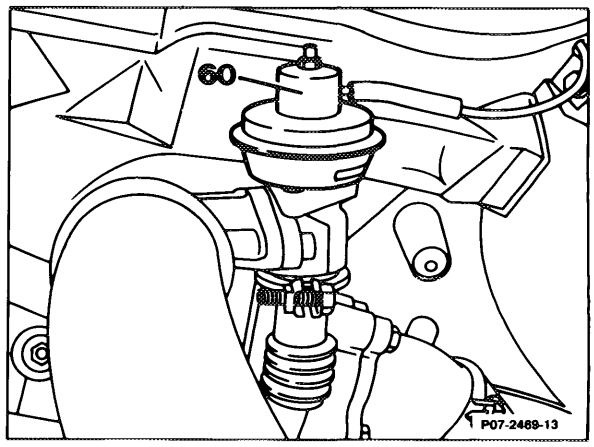
Remove EGR valve and pressurize with approx 520 mbar with vacuum tester.

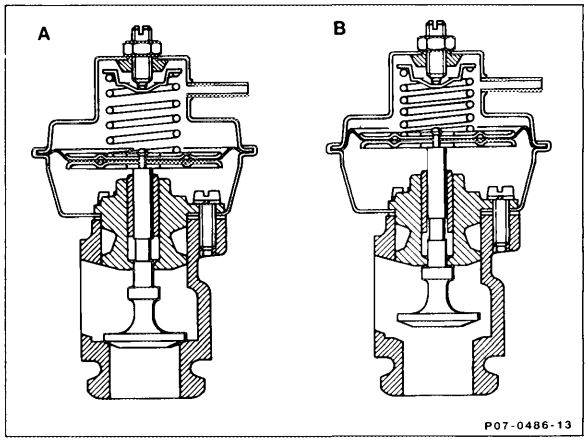
EGR valve lifts approx. 5 mm off seat (end stop).

Detach vacuum line. EGR must close audibly.

If one of these test steps is not successful, replace EGR valve.

End of test





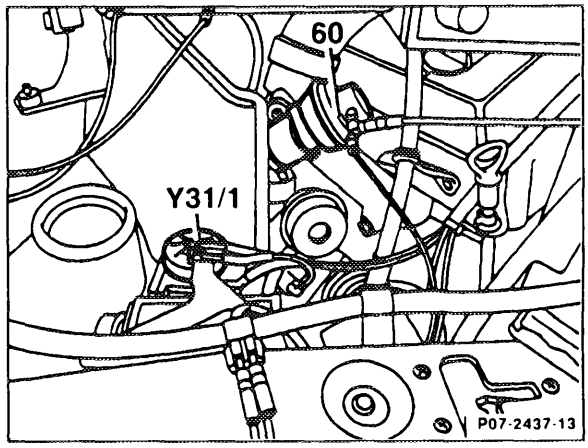
A closed
B open

b) Test EGR vacuum transducer (Y31/1)

Connect vacuum tester with Y distributor to EGR valve (60). Connect multimeter with test cable between vacuum transducer (Y31/1) and cable harness. Press button "mA". Allow engine to run and increase engine speed until approx. 250 mbar is reached.

Note

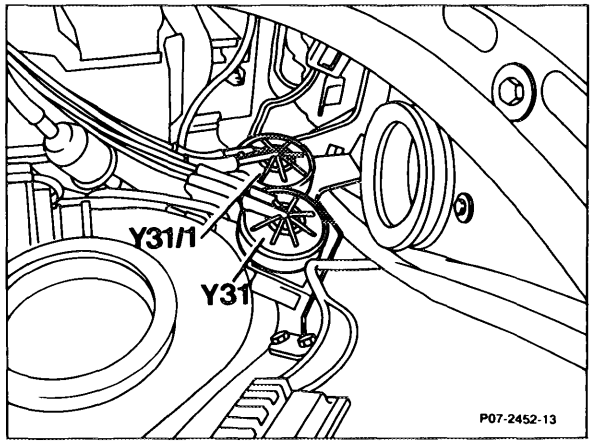
Ensure that connector of vacuum transducer (Y31 and Y31/1) is correctly connected.



Refer to diagram for specified values.
Example: 250 mbar = 400 to 500 mA.

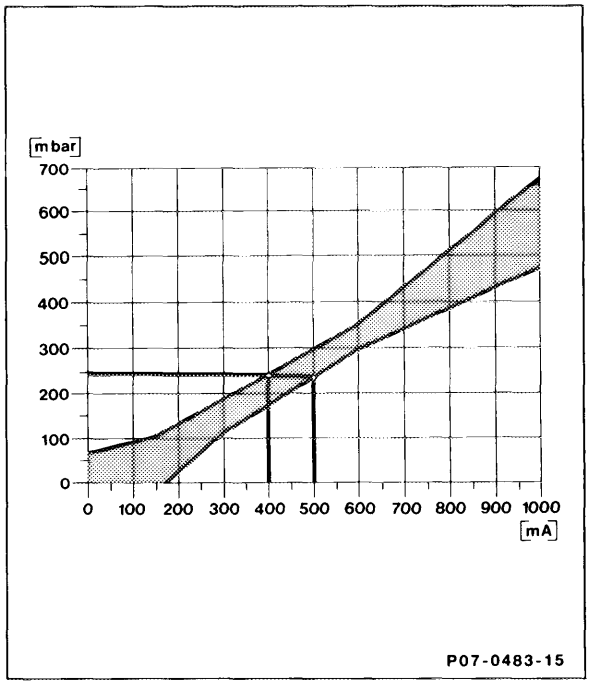
Current at vacuum transducer

0 mA too low too high



Check that air admission (black) to car interior and filter are clear.

Check whether the vacuum supply line (white/brown) is blocked. Check whether there is an interruption in vacuum line (white/purple/brown) between transducer and EGR valve. Test vacuum pump. If vacuum lines and vacuum pump are in order, replace EGR vacuum transducer (Y31/1).



End of test

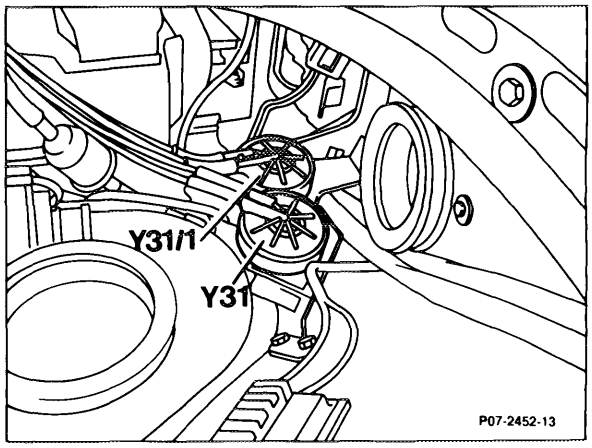
Engine off. Glow start switch in position "2". Detach double connector at vacuum transducer (Y31/1). Test voltage at 2-pin plug connection with multimeter button "V".

Readout: approx. 12 volts

Yes	No

Rectify interrupt in accordance with wiring diagram. Replace EDS control unit, if necessary.

End of test

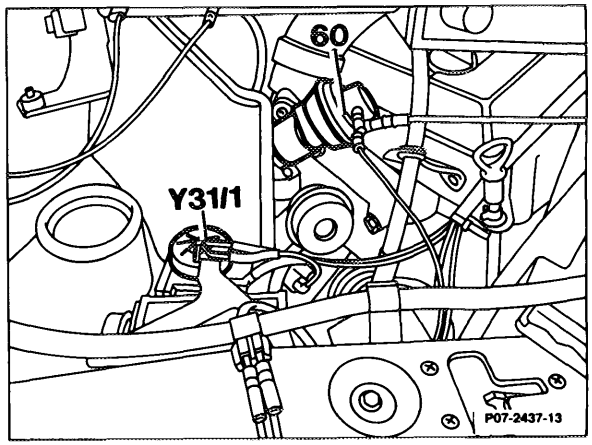


Connect EGR vacuum transducer (Y31/1) with Y distributor to EGR valve (60). Run engine at 1200 rpm and take reading of vacuum. Accelerate briefly, vacuum drops.

Yes	No

Replace EGR vacuum transducer (Y31/1). Check air flow sensor (B2/1) to determine whether it operates properly (refer to section "c"). Replace EDS control unit (N39), if necessary.

End of test



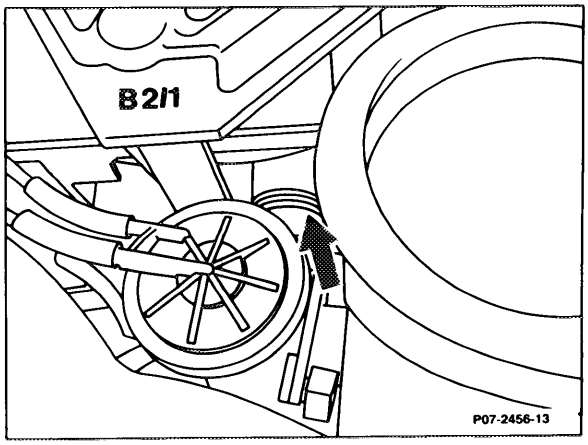
c) Mechanical check of air flow sensor potentiometer (B2/1)

Check air flow sensor plate for ease of movement and dirt. Air flow sensor plate must not stick.

Yes	No

Replace air flow sensor potentiometer (B2/1).

End of test



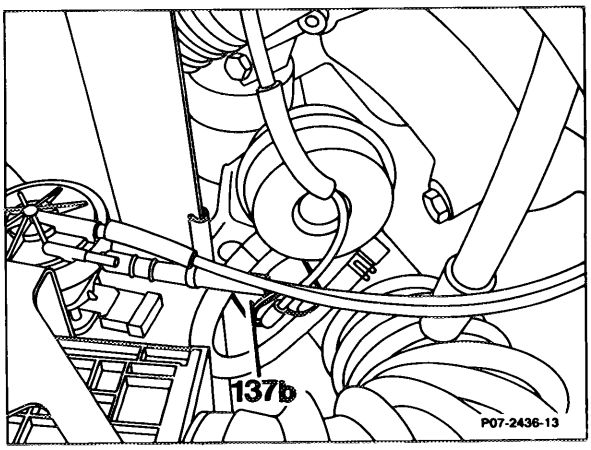
d) Testing recirculating air valve (137b)

Connect vacuum tester to recirculating air valve and apply a vacuum of 400 mbar. The vacuum must not drop by more than 50 mbar within 1 minute.

Yes	No

Replace circulating air valve (137b).

End of test



e) Testing vacuum transducer of recirculating air valve (Y31)

Connect vacuum tester with Y distributor between recirculating air valve (137b) and vacuum transducer of recirculating air valve (Y31). Connect multimeter with test cable to vacuum transducer. Press button "mA".

Test values at the following speeds:

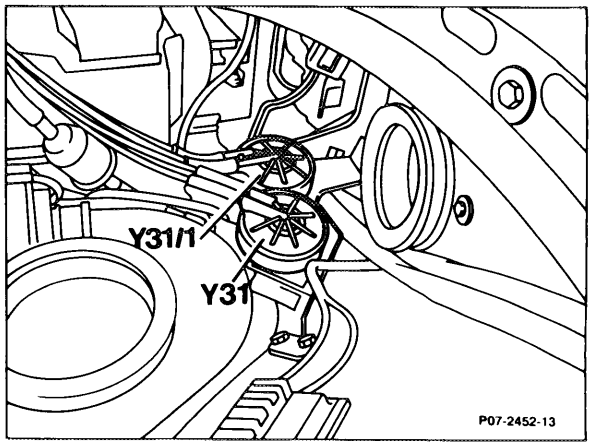
Speed	mbar	mA
Idle speed	max. 60	0
approx. 1300	approx. 500 [1]) [1]) refer to diagram	approx. 900
Test data in order	Vacuum not in order	Current not in order

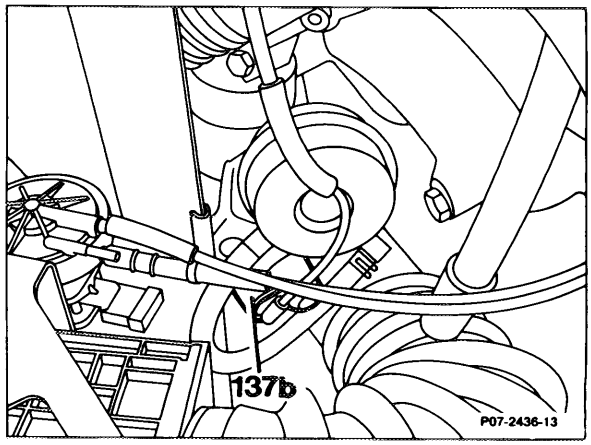
End of test

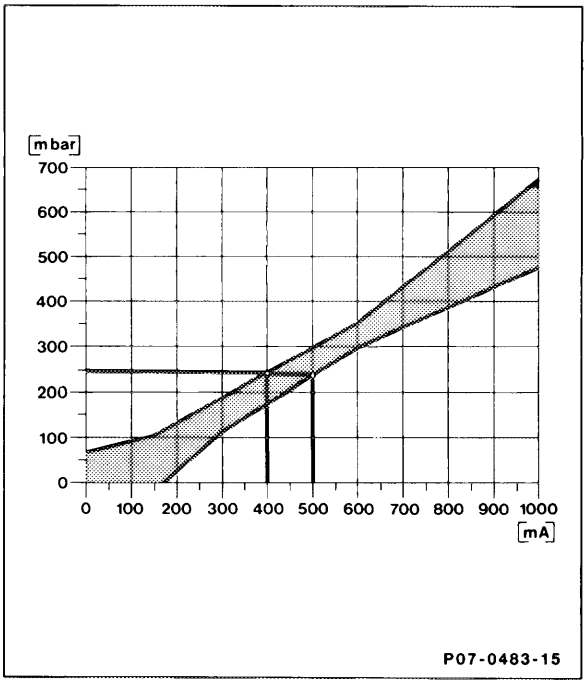
Vacuum reading too high:
Check that the air admission line (black) to car interior and filter is clear.

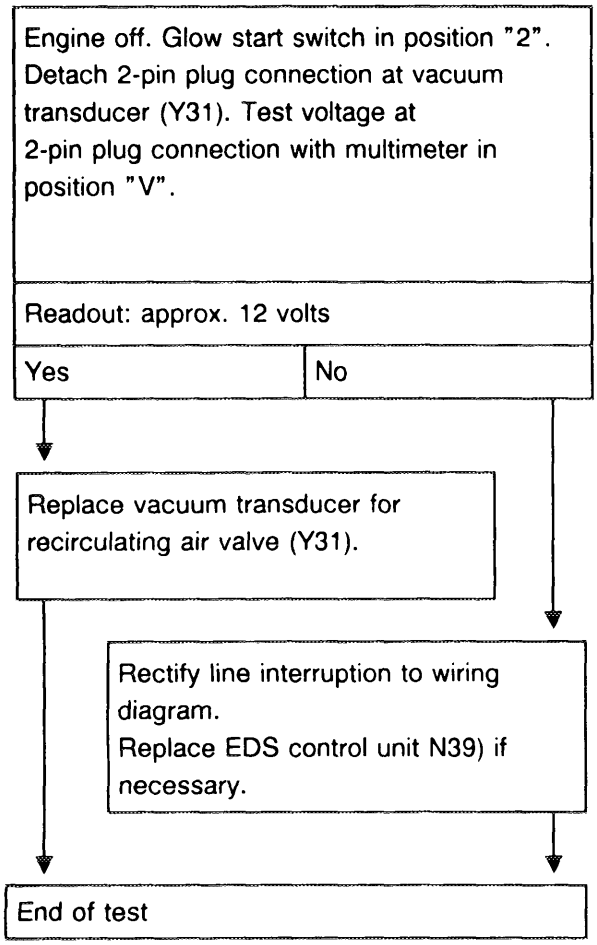
Vacuum reading too low:
Check whether the vacuum supply line (white/brown) is clear. Check whether vacuum line between recirculating air valve vacuum transducer (Y31) and recirculating air valve is in order. If all the above-mentioned components are in order, replace vacuum transducer for recirculating air valve (Y31).

End of test








Engine off. Glow start switch in position "2". Detach 2-pin plug connection at vacuum transducer (Y31). Test voltage at 2-pin plug connection with multimeter in position "V".
Readout: approx. 12 volts
Yes
No
Replace vacuum transducer for recirculating air valve (Y31).
Rectify line interruption to wiring diagram.
Replace EDS control unit N39) if necessary.
End of test

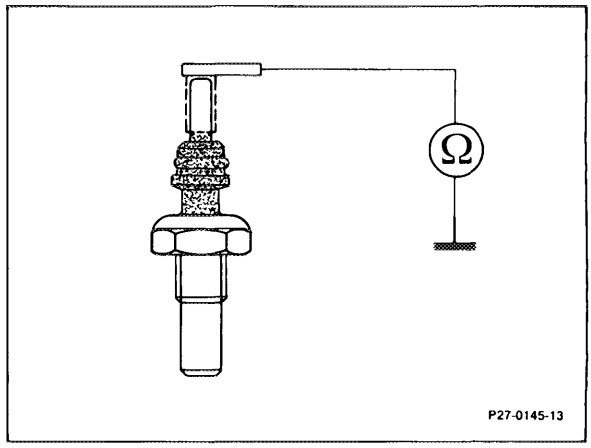
Testing coolant temperature sensor (B11/4)

Engine off. Detach connector on coolant temperature sensor. Test resistance to ground with multimeter position "Ω".

Refer to diagram for specified values "coolant temperature sensor and intake air". Test resistance at two temperature measuring points. Example:
20 °C : 2.5 kΩ 80 °C : 327 Ω

Yes	No

→ Replace coolant temperature sensor (B11/4).

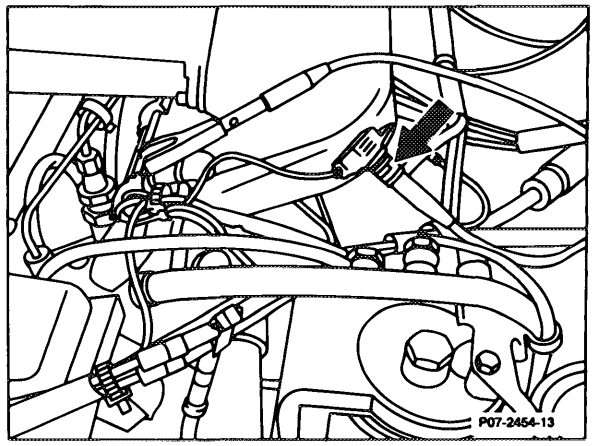


Ignition: **ON**. Test voltage at 1-pin connector (arrow) with multimeter in position V.

Readout: approx. 5 volts

Yes	No

→ Rectify line interruption.
Replace EDS control unit (N39) if necessary.



End of test

Coolant temperature sensor and intake air

Temperature in °C	Resistance (± 10%)	Voltage in V (± 10%)
20	2.5 kΩ	3.85
30	1.7 kΩ	3.47
40	1.18 kΩ	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	185 Ω	0.99

Fault readout "9"

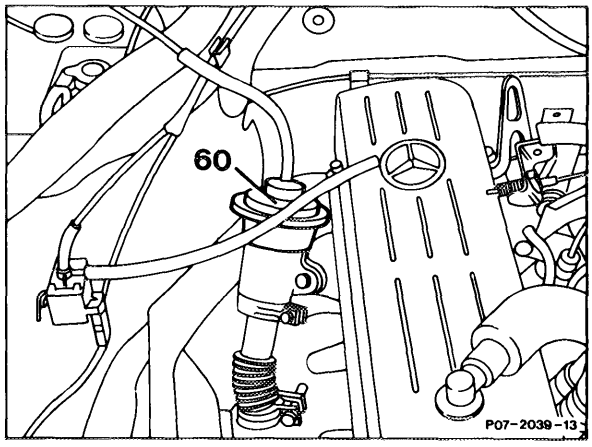
Testing air temperature sensor (B2/1a)
Engine off. Detach connector (arrow) from air flow sensor (B2/1). Connector multimeter and press button "Ω". Test resistance.

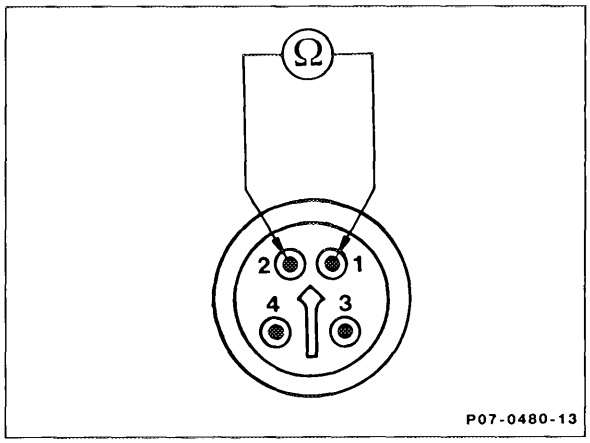
Refer to table "coolant temperature sensor and intake air" for specified value.

Yes	No

Replace air flow sensor.

End of test





Coolant temperature sensor and intake air

Temperature in °C	Resistance (± 10%)	Voltage in V (± 10%)
20	2.5 kΩ	3.85
30	1.7 kΩ	3.47
40	1.18 kΩ	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	185 Ω	0.99

Testing reference resistor (R18/2)
Detach reference resistor. Engine off. Ignition: **ON**. Press multimeter button "V = ". Check voltage.

Readout: approx. 5 volts

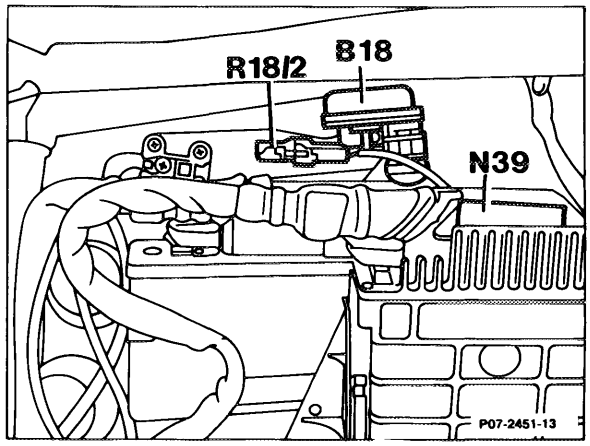
Yes	No

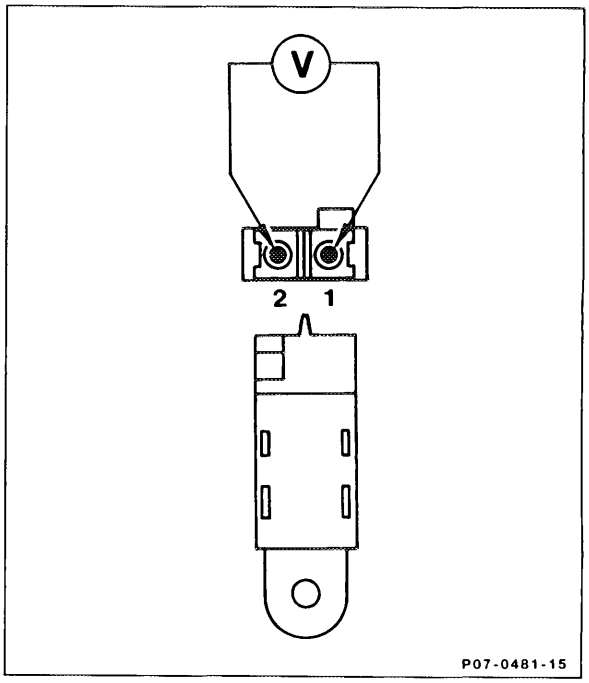
Rectify interrupt according to wiring diagram.

Replace reference resistor (R18/2).

End of test

Note
When replacing the reference resistor (R18/2) fit only a plug with an identical part number.





Fault readout "11"

Testing ELR resistance trimming plug (R18/1)
Detach ELR resistance trimming plug.
Engine off. Ignition: **ON**. Press multimeter button "V = ". Test voltage.

Readout: approx. 5 volts

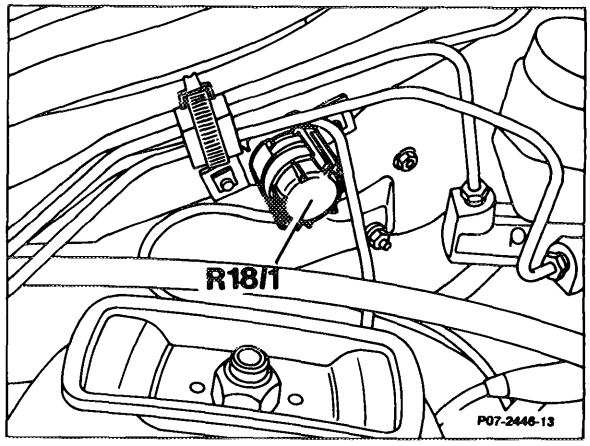
Yes	No

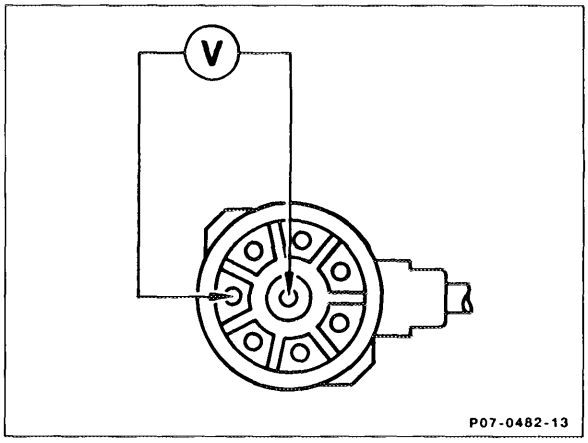
Rectify line interruption in accordance with wiring diagram. Replace EDS control unit (N39) if necessary.

Replace ELR resistance trimming plug.

End of test

Note
The ELR resistance trimming plug (R18/1) is installed in position "4".





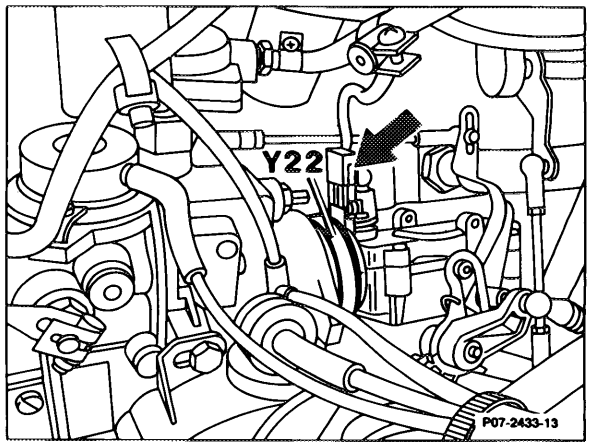
c) Testing electronic idle speed control

Testing idle speed control

Engine at idle. Detach 2-pin connector (arrow) at actuator (Y22) for at least 3 sec. and refit.

When connecting, idle speed briefly increases.

Yes	No

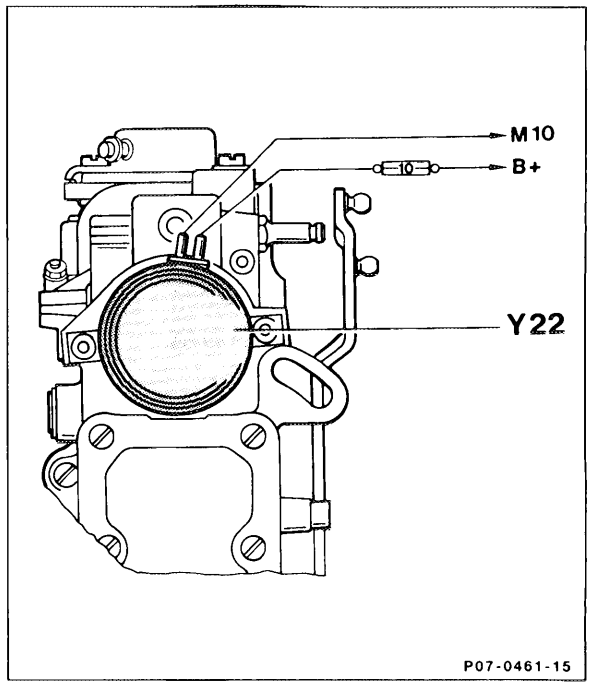


Briefly (max. 3 sec.) apply battery voltage (approx. 12 V) to actuator (Y22).

Note
The actuator is damaged if voltage is applied to the actuator (Y22) for longer than 3 s.

Engine speed increases.

Yes	No

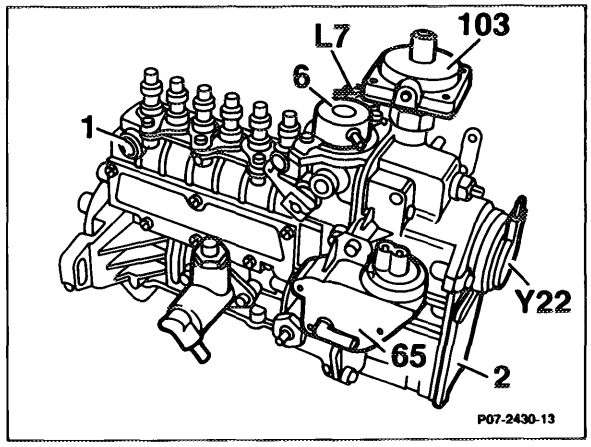


Replace actuator.

Engine at idle. Detach 2-pin connector at actuator (Y22) and measure voltage with multimeter, button "V".

Readout approx. 12 volts

Yes	No

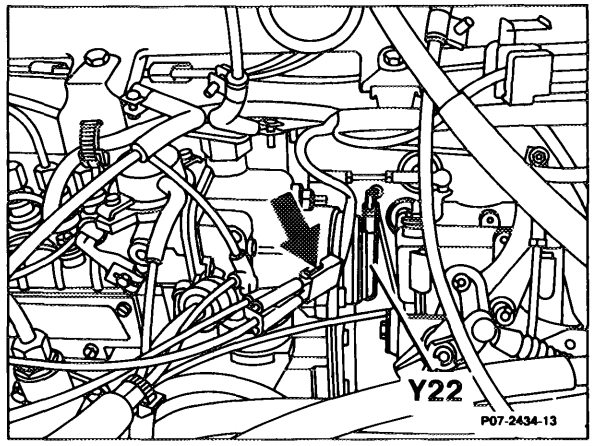


Test fuse for over-voltage protection relay (1).
Test lines for interrupt according to wiring diagram.
Replace EDS control unit (N39) if necessary.

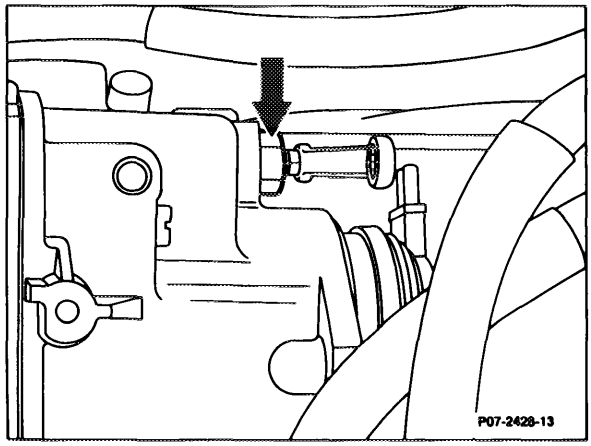
Engine at idle. Detach 2-pin connector (arrow) at actuator (Y22).
Check idle speed.

Specification: 570 ± 40 rpm

Yes	No



Loosen locking nut and set idle speed (arrow).



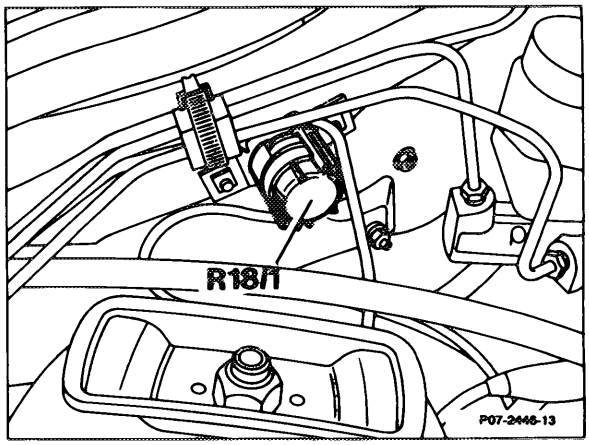
End of test

Setting idle speed by means of resistance trimming plug (R18/1)

If problems occur with respect to idle speed, the idle speed can be altered.

The coded plug positions are listed in the table below.

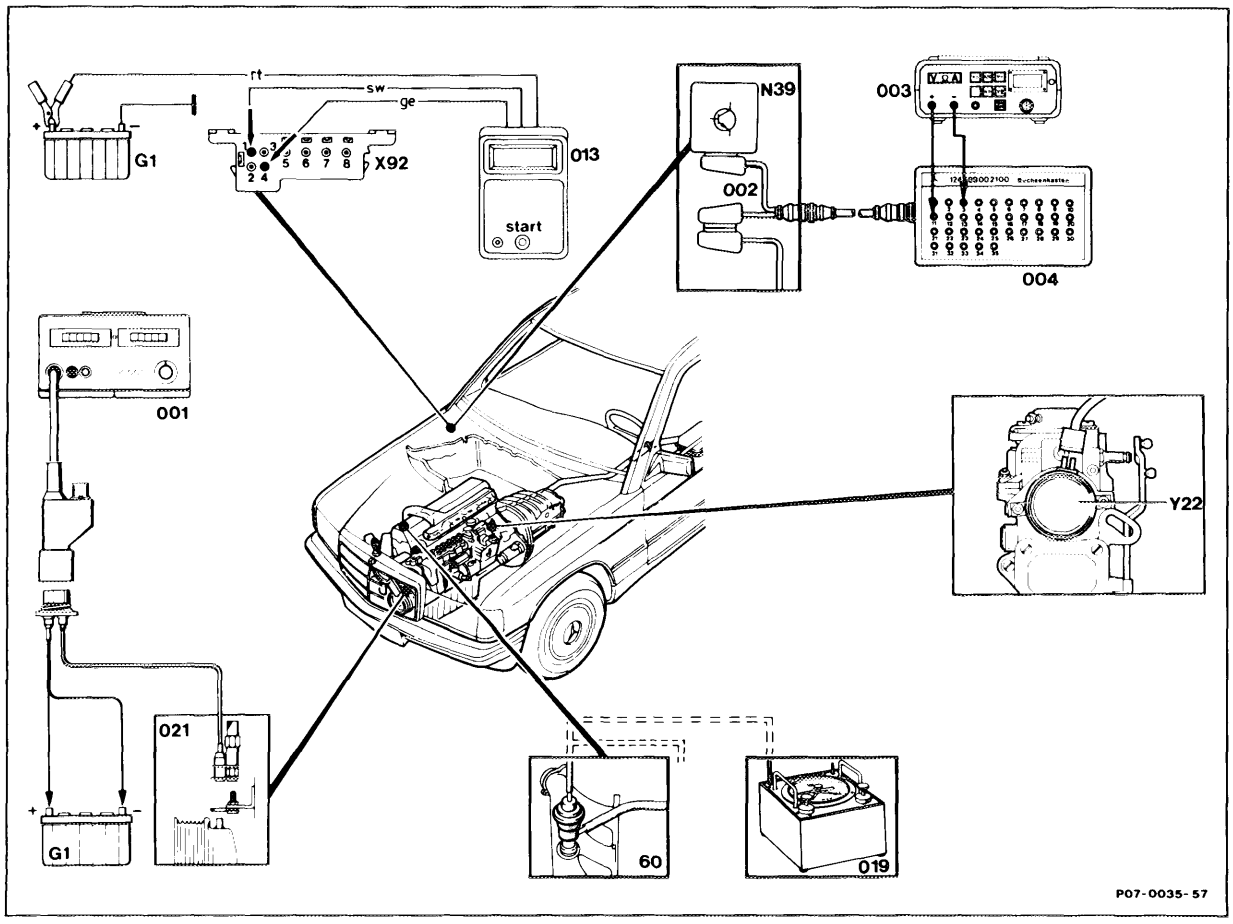
Position of resistance trimming plug	Idle speed in rpm
1	570 ± 20
2	590 ± 20
3	610 ± 20
4	630 ± 20
5	650 ± 20
6	670 ± 20
7	700 ± 20



C. Engines 602.962 and 603.970 Model Year 1990

a) Testing
b) Testing with pulse counter
c) Trouble-shooting schedule
d) Test program with contact box
(Engine 602.962)
e) ELR, EGR function test, P2 control
f) Test program with contact box
(Engine 603.970)
g) ELR and EGR function test (Engine 603.970)

a) Testing



Digital tester (001) and pulse counter (021)	disconnect, connect.
Pulse counter (013)	connect, disconnect to battery (G1) and with adaptor to test connector (X92 or X11/4).
Contact box (004)	connect, disconnect with test cable (002) to EDS control unit (N39).
Digital multimeter (003)	connect, disconnect at contact box (004).
Vacuum tester (019)	connect, disconnect with Y distributor at EGR valve.
Fuse at over-voltage protection (K1/1)	test.
Selector lever	move into position "P".
Air-conditioning/automatic climate control	switch off.
Engine	bring to operating temperature (coolant temperature approx. 80°C).
Start button of pulse counter (013)	operate for 2–4 seconds.
Display	read off and note.
Start button	press again. If no new display appears, there is no further fault in the system.

Engine 602.962

The number of pulses indicate whether and which component is faulty and whether components in the control circuit are faulty.

Pulse readout	Component/controlloop
1 [3])	All functions "in order"
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1)
4	EDS control unit (N39) atmospheric pressure sensor
5 [2])	Vacuum transducer (Y31/1) or fault in exhaust control loop
6	EDS control unit (N39) internal power supply
7	Engine speed sensor (L3)
8	Coolant temperature sensor (B11/4)
9	Intake air temperature sensor (B2/1a)
10	Not assigned
11 [1])	ELR actuator or vacuum transducer (Y31/1)
12	Not assigned
13	EDS control unit (N39) defective (internal memory)
14	Pressure sensor (B5/1), EDS defective
15	Vacuum transducer, charge pressure control (Y31/2) pressure transducer pressure control flap (Y31/3) or faults in charge pressure control loop

[1]) Readout only in the case of short-circuit.
[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
[3]) In the event of complaints perform functional test on ELR, EGR, P2 control.

Engine 603.970

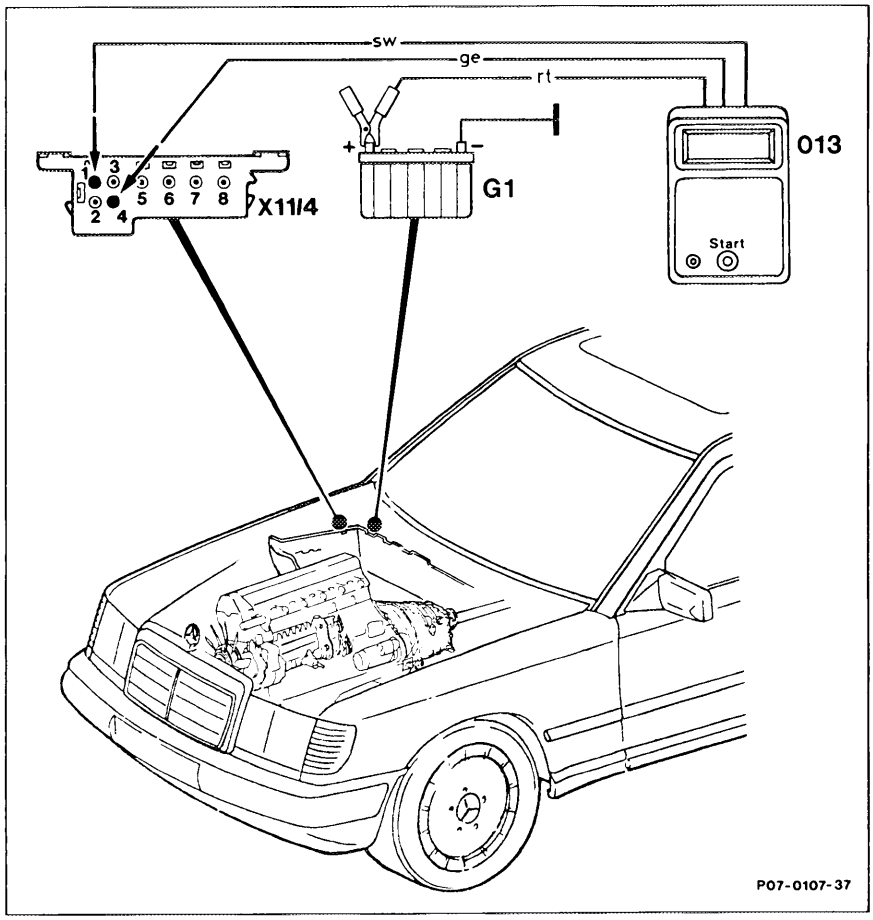
The number of pulses indicates whether and which component is faulty and whether components in the control circuit are faulty.

Pulse readout	Component/control loop
1 [3])	All functions "in order"
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1)
4	EDS control unit (N39) altitude sensor
5 [2])	Vacuum transducer (Y31/1) or fault in exhaust control loop
6	EDS control unit (N39) Internal power supply
7	Engine speed sensor (L3)
8	Coolant temperature sensor (B11/4)
9	Intake air temperature sensor (B2/1a)
10	Power supply
11 [1])	ELR actuator or vacuum transducer (Y31/1)
12	Not assigned
13	EDS control unit (N39) defective

[1]) Readout only in case of short-circuit.
[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
[3]) In the event of complaints, perform ELR and EGR function tests.

b) Testing with pulse counter

Connection diagram



013 Pulse counter
G1 Battery
X11/4 Test connector for diagnostics

A Model 124
B Model 126

Assignment (X11/4)
1 Ground
2 TD signal
3 Pulse output
Exhaust test signal (only for production tuning)
4 Pulse readout, control unit (EDS)

Notes regarding pulse readout

If a problem occurs but no fault is indicated on the pulse readout, perform the function test, section "7.4".
The number 1 indicates no fault detected in the electronic system. All other numbers are assigned to a particular fault group.
The numbers from 1 to 11 appear on the display panel of the pulse counter.
If the LED U-Batt appears after connecting, pulse counter and power supply for pulse counter are in order.

Testing

1 Connect pulse counter as shown in the connection diagram.

Note
LED U-Batt in display panel must light up; if not:
a) test fuse of pulse counter.
b) test jack 1 of test connector (X11/4) to battery positive (11–14 V).
c) test jack 4 of test connector (X11/4) to jack 1 (6–12 V).

2 Engine at idle.

3 Operate start button for between 2 and 4 seconds.

4 Take readout of pulse output and note.
Display "1" = no fault
Greater than "1" = fault in system

5 Again press start button for between 2 and 4 seconds. If no further fault exists in system, the previous readout appears once again.

6 Repeat until the first fault is diplayed again.

7 Rectify noted faults (pulse readout) according to trouble-shooting schedule.

8 Perform component test.

Erasing fault memory
After a fault has been rectified, the pulse display must be erased as follows:

9 Operate start button and readout the rectified fault, then press start button for 6–8 seconds.

Note
Each display pulse must be erased **individually**.
The fault is eliminated and erased when the fault code no longer appears on the fault display.
Display of a number larger than 1, further faults in system.

c) Trouble-shooting schedule

Engine 602.962

The number of pulses indicates whether and which component is faulty and whether components in the control circuit are faulty.

Pulse readout	Component/control loop
1 [3])	All functions "in order"
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1)
4	EDS control unit (N39) atmospheric pressure sensor
5 [2])	Vacuum transducer (Y31/1) or faults in exhaust control loop
6	EDS control unit (N39) internal power supply
7	Engine speed sensor (L3)
8	Engine coolant sensor (B11/4)
9	Intake air temperature sensor (B2/1a)
10	Not assigned
11 [1])	ELR actuator or vacuum transducer (Y31/1)
12	Not assigned
13	EDS control unit (N39) defective (internal memory)
14	Pressure sensor (B5/1), EDS defective
15	Vacuum transducer, charge pressure control (Y31/2). Vacuum transducer, pressure control flap (Y31/3) or fault in charge pressure control circuit

1) Readout only in the case of short-circuit.
2) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
3) In the event of complaints perform functional test on ELR, EGR, P2 control.

Engine 603.970

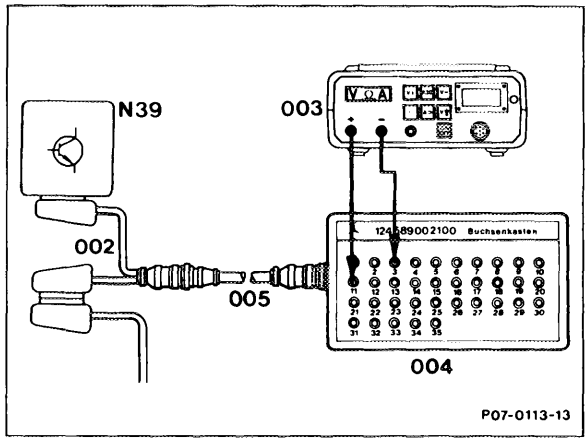
The number of pulses indicates whether and which component is faulty and whether components in the control circuit are faulty.

Pulse readout	Component/control loop
1 [3])	All functions "in order"
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1)
4	EDS control unit (N39) atmospheric pressure sensor
5 [2])	Vacuum transducer (Y31/1) or faults in exhaust control loop
6	EDS control unit (N39) Internal power supply
7	Engine speed sensor (L3)
8	Coolant temperature sensor (B11/4)
9	Intake air temperature sensor (B2/1a)
10	Power supply
11 [1])	ELR actuator or vacuum transducer (Y31/1)
12	Not assigned
13	EDS control unit (N39) faulty

[1]) Readout only in the case of short-circuit.
[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
[3]) In the event of complaints perform ELR and EGR function test.

d) Test program with contact box (Engine 602.962)

Connection diagram contact box



002 25-pin test cable 124 589 33 63 00
003 Multimeter
004 35-pin contact box 124 589 00 21 00
005 Test cable 124 589 34 63 00
N39 EDS control unit

Symbols for test instruments:

Contact box
Multimeter
Jack
Pin
Voltage measurement (volt, direct voltage)
Resistance measurement (ohm)

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
1	1.0	–	–	–	
2	2.0 Control rod travel sensor (L7)	N39 4 Ω 5 4 Ω 6 4 Ω 3 4 Ω 1	Ignition: **OFF** EDS control unit disconnected	50 ± 4 Ω 25 ± 2 Ω ∞ Ω ∞ Ω	Replace control rod travel sensor or injection pump Cables

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[2]	2.1 Control rod travel sensor (L7)	L7 2 — Ω — 3	Ignition: **OFF** Connector on control rod travel sensor (L7) disconnected	50 ± 4 Ω	Replace control rod travel sensor or injection pump
		L7 2 — Ω — 1		25 ± 2 Ω	Replace control rod travel sensor or injection pump
	2.2 Cables	N39 4 — Ω — L7 3	Ignition: **OFF** Connector on control rod travel sensor (L7) disconnected	< 1 Ω	Cable interrupt
		N39 5 — Ω — L7 2		< 1 Ω	Cable interrupt
		N39 6 — Ω — L7 1	Ignition: **OFF**	< 1 Ω	Cable interrupt
3	3.0 Air flow sensor potentiometer (B2/1)	N39 3 — V — 24	Ignition: **ON** EDS control unit (N39) connected	5 ± 0.5 V	EDS control unit (N39)
		3 — V — 10		< 0.5 V	Cables Test value in order although fault was stored. Cause: Air flow sensor plate jammed briefly during starting; replace air flow sensor if necessary.
		N39 3 — V — 10	Engine at idle	1.7 ± 0.2 V [1]	EDS control unit (N39)

[1]) Voltage rises as speed increases.

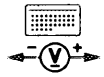
On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[3]	3.1 Air flow sensor potentiometer (B2/1)	N39 3 – Ω + 24	Ignition: **OFF** EDS control unit (N39) disconnected	500–1200 Ω	Air flow sensor potentiometer (B2/1)
		N39 3 – Ω + 10	Air flow sensor in off position	50–200 Ω	Air flow sensor potentiometer (B2/1)
		N39 3 – Ω + 10	Air flow sensor plate fully deflected	560–1100 Ω	Air flow sensor potentiometer (B2/1)
	3.2 Cables	N39 10 – Ω + B2/1 ⟩— 3	Connector on air flow sensor potentiometer (B2/1) disconnected	< 1 Ω	Cable interrupt
		N39 24 – Ω + B2/1 ⟩— 4		< 1 Ω	Cable interrupt
4	4.0	–	–	–	Replace EDS control unit (N39) (atmospheric pressure sensor)
5 [2])	5.0 Vacuum transducer (Y31/1)	N39 18 – V + 1	Engine 900 rpm ±50		
	EGR valve	Vacuum at EGR valve	approx. 300 mbar [4])	> 3 V [4])	Supply line black/white leaking. Air admission line (black) blocked. Air admission filter (62a) dirty. Supply line black/white or vacuum line black (rubber) blocked or leaking. Vacuum transducer (Y31/1). Cables, EDS control unit, air flow sensor potentiometer, EGR valve

[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.

[4]) Apply full throttle briefly, vacuum and voltage drops. The test values are reference values.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[5] [2])	5.1 Cables	N39 18 — Ω — Y31/1 1	Ignition: **OFF** Connector on vacuum transducer (Y31/1) detached	< 1 Ω	Cable interrupt
		N39 1 — Ω — Y31/1 2		< 1 Ω	Cable interrupt
6	6.0	–	–	–	Internal power supply. Replace EDS control unit
7	7.0 Engine speed sensor (L3)	N39 3 — V — 20	Engine at idle EDS control unit disconnected	> 3 V [1])	Engine speed sensor, distance, dirt, cables
	7.1 TD signal	N39 3 — V — 25	Engine at idle EDS control unit connected	> 3.5 V [6])	Cable (N39) to (X11/4) Short circuit or EDS control unit
	7.2 Engine speed sensor (L3)	N39 3 — Ω — 20	Ignition: **OFF** EDS control unit disconnected	Beru [5]) 527 Ω ± 10 % VDO [5]) 1900 Ω ± 10 %	Engine speed sensor (L3) Cables
		L3x 1 — Ω — 2	Plug connector (L3x) detached	Beru [5]) 527 Ω ± 10 % VDO [5]) 1900 Ω ± 10 %	Engine speed sensor (L3) (M27)

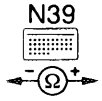
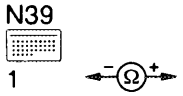
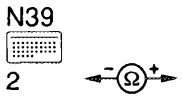
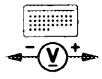
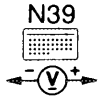
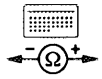
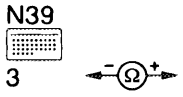
[1]) Voltage rises as speed increases.
[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
[5]) Measured at 20 °C ambient temperature (for each 10 °C change in ambient temperature the resistance changes by 4%).
[6]) Voltage drops by approx. 0.5 V and stabilises.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[7]	7.3 Cables	N39 20  L3x 2		< 1 Ω	Cable interrupt
		N39 3  L3x 1		< 1 Ω	Cable interrupt
8	8.0 Coolant temperature sensor (B11/4)	N39 3  9	Ignition: **ON** EDS control unit connected	[3])	Coolant temperature sensor, cables, EDS control unit
	8.1 Coolant temperature sensor (B11/4)	N39 14  9	Ignition: **OFF** EDS control unit connected	[3])	Coolant temperature sensor
		⊥  B11/4	Plug connector (B11/4) detached	[3])	Coolant temperature sensor
	8.2 Cable	N39 9  B11/4	Ignition: **OFF** EDS control unit disconnected	< 1 Ω	Cable interrupt
9	9.0 Intake air temperature sensor (B2/1a)	N39 3  22	Ignition: **ON** EDS control unit connected	[3])	Temperature sensor, intake air, air flow sensor, cables, EDS control unit

[3]) Refer to table of coolant temperature sensor and intake air.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[9]	9.1 Intake air temperature sensor (B2/1a)	N39 3 Ω 22	Ignition: **OFF** EDS control unit disconnected	[3]	Cable to intake air temperature sensor Temperature sensor
		B2/1 1 Ω 2	Connector on air flow sensor (B2/1) disconnected	[3]	Intake air temperature sensor
	9.2 Cables	N39 22 Ω B2/1 1	Ignition: **OFF** EDS control unit disconnected Connector on air flow sensor potentiometer (B2/1) detached	< 1 Ω	Cable interrupt
		N39 3 Ω B2/1 2		< 1 Ω	Cable interrupt
10	10.0 Power supply	N39 14 V 1	Engine approx. 1500 rpm	11–14 V	Alternator regulator Lima Voltage > 18 V
11 [1]	11.0 ELR actuator (Y22)	N39 3 V 2	EDS control unit connected	11–14 V	Actuator (Y22) Cables
		N39 2 V 1	Ignition: **ON** Engine at idle	2.5 ± [2] 0.5 V	EDS control unit (N39)

[1]) Readout only in the case of short-circuit.
[2]) Reference value, voltage drops as speed increases.
[3]) Refer to table of coolant temperature sensor and intake air.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[11] [1])	11.1	N39  1 2	Ignition: **OFF** EDS control unit disconnected	4 ± 1 Ω	Actuator (Y22) Cables
	11.2 Cables	N39  1 Y22 2	Ignition: **OFF** Detach connector at actuator (Y22)	< 1 Ω	Cable interrupt
		N39  2 Y22 1		< 1 Ω	Cable interrupt
13					Internal memory Replace EDS control unit (N39)
14	14.0 Pressure sensor (B5/1)	N39  3 12	Ignition: **ON** EDS control unit connected	> 5 V	Pressure sensor Pressure lines Electrical cables
	14.1 Pressure sensor (B5/1)	N39  3 17	Engine at idle	> 1.5 V 0 mbar	Pressure sensor Pressure lines Electrical cables
		Pressure tester with Y distributor on pressure sensor	Apply full throttle briefly	Voltage rises, pressure rises > 500 mbar	
	14.2 Pressure sensor (B5/1)	N39  3 12	Ignition: **OFF** EDS control unit detached	1.4 ± 0.2 kΩ	
	14.3 Cables	N39  3 B5/1 3		< 1 Ω	Cable interrupt

[1]) Readout only in the case of short-circuit.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[14]	14.4 Cables	N39 12 — Ω — B5/1 2	Ignition: **OFF** EDS control unit disconnected	< 1 Ω	Cable interrupt
	14.5 Cables	N39 17 — Ω — B5/1 1	Ignition: **OFF** EDS control unit disconnected	< 1 Ω	Cable interrupt
15	15.0 Vacuum transducer (Y31/2)	N39 7 — V — 1	Engine at idle EDS control unit connected	Approx. 0.4 V < 100 mbar	Vacuum transducer (Y31/2) Vacuum lines EDS control unit
	Vacuum unit, pressure control flap	Vacuum tester with Y distributor on vacuum transducer (Y31/2) Output (OUT)	Increase speed slowly to approx. 2000 rpm	Vacuum increases Voltage rises	
	15.1 Cables	N39 7 — Ω — Y31/2 1	Ignition: **OFF** EDS control unit disconnected Connector on (Y31/2) detached	< 1 Ω	Cable interrupt
	15.2 Cables	N39 1 — Ω — Y31/2 2	Connector on (Y31/2) detached	< 1 Ω	Cable interrupt
	15.3 Vacuum transducer (Y31/3)	N39 8 — V — 1	Engine at idle EDS control unit connected	Approx. 4 V < 300 mbar	Vacuum transducer (Y31/3) Vacuum lines EDS control unit
	Vacuum unit, charge pressure control valve	Vacuum tester with Y distributor on vacuum transducer (Y31/3) Output (OUT)	Increase speed slowly to approx. 2000 rpm	Voltage drops Vacuum drops	Vacuum transducer (Y31/3) Vacuum lines EDS control unit

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[15]	15.4 Cables	N39  1  Y31/3 2	Ignition: **OFF** EDS control unit disconnected	< 1 Ω	Cable interrupt
		N39  8  Y31/3 1		< 1 Ω	Cable interrupt

Coolant temperature sensor and intake air

Temperature in °C	Resistance (± 10%)	Voltage in V (± 10%)
20	2.5 kΩ	3.85
30	1.7 kΩ	3.47
40	1.18 kΩ	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	185 Ω	0.99

e) ELR , EGR function test, P2 control

Note
This test is to be performed when in the event of complaint concerning the pulse readout, no fault is displayed.

Engine 602.962 with P2 control

Test step/ test scope	Test connection/ test instrument	Operation/ requirement	Specification	Possible cause/ remedy
1.0 Idle speed control	Revolution counter with TDC generator	Engine at idle Coolant temperature approx. 80°C	680 rpm ±20	Actuator, injection pump, engine speed sensor, EDS control unit (N39), refer to test steps 7 and 11
		Plug detached from actuator	610 rpm ±20	Set speed at injection pump. Injection pump
2.0 Exhaust control circuit	Connect vacuum tester with Y distributor to EGR valve	Engine running at 900 rpm ±50 and approx 300 mbar. Briefly apply full throttle	Vacuum drops	Perform mechanical test on vacuum transducer (Y31/1) and air flow sensor (B2/1). EDS control unit (N39) EGR valve
3.0 EGR valve	Connect vacuum tester directly to EGR valve.	Engine off Pressurize EGR valve with 300 mbar and disconnect again.	EGR valve audibly closes	Replace EGR valve.

Test step/ test scope	Test connection/ test equipment	Operation/ requirement	Specifi- cation	Possible cause/remedy
4.0 Charge pressure control Vacuum unit Charge pressure control valve	Connect vacuum tester (020) with Y distributor to output (OUT) from vacuum transducer (Y31/3)	Engine at idle Slowly increase speed to approx 2000 rpm	>300 mbar Vacuum reduces	Vacuum supply Vacuum line Vacuum transducer (Y31/3) EDS control unit (N39)
4.1 Vacuum unit Pressure control flap (100)	Connect vacuum tester (020) with Y distributor to vacuum unit pressure control flap (100)	Engine at idle Slowly increase speed to approx. 2000 rpm	<100 mbar Vacuum increases	Vacuum supply Vacuum line Vacuum transducer (Y31/2) Pressure line on pressure sensor (B5/1) EDS control unit

f) Test program with contact box (Engine 603.970)

Symbols for test instruments:


Contact box


Multimeter


Jack

Pin


Voltage measurement (volt, direct voltage)


Resistance measurement (ohm)

On/off ratio readout	Test step/ test scope	Test instrument/ test connection	Operation/ requirement	Specification	Possible cause/remedy
1	1.0	–	–	–	No fault stored
2	2.0 Control rod travel sensor (L7)	N39 4 – 5 4 – 6 4 – 3 4 – 1	Ignition: **OFF** EDS control unit disconnected	50 ±4 Ω 25 ±2 Ω ∞ ∞	Replace control rod travel sensor or injection pump. Cables
	2.1 Control rod travel sensor (L7)	L7 2 – 3	Ignition: **OFF** Connector on control rod travel sensor (L7) detached	50 ±4 Ω	Replace control rod travel sensor or injection pump
		L7 2 – 1	Connector control rod travel sensor (L7) detached	25 ±2 Ω	Replace Control rod travel sensor (L7) or injection pump
3	3.0 Air flow sensor potentio-meter (B2/1)	N39 3 – 24	Ignition: **ON** EDS control unit (N39) connected	5 ±0,5 V	Air flow sensor potentiometer Cables Test value in order. Fault was, however, stored.

On/off ratio readout	Test step/ test scope	Test instrument/ test connection	Operation/ requirement	Specification	Possible cause/remedy
[3]	[3.0]	N39 3 (V) 10		< 0.5 V	Cause: Air flow sensor plate jams during starting, replace air flow sensor if necessary EDS control unit (N39)
		N39 3 (V) 10	Engine at idle	1.4 ± 0.2 V	
	3.1 Air flow sensor potentiometer (B2/1)	N39 3 (Ω) 24	Ignition: **OFF** EDS control unit (N39) disconnected	500–1200 Ω	Air flow sensor potentiometer (B2/1)
		N39 3 (Ω) 10	Air flow sensor plate in off position	50–200 Ω	Air flow sensor potentiometer (B2/1)
		N39 3 (Ω) 10	Air flow sensor plate fully deflected	560–1100 Ω	Air flow sensor potentiometer (B2/1)
	3.2 Cables	N39 10 (Ω) B2/1 — 3	Connector on air flow sensor potentiometer (B2/1) detached	< 1 Ω	Cable interrupt
		N39 24 (Ω) B2/1 — 4		< 1 Ω	Cable interrupt
4	4.0				Replace atmospheric pressure sensor, EDS control unit (N39)

[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.

On/off ratio readout	Test step/ test scope	Test instrument/ test connection	Operation/ requirement	Specification	Possible cause/remedy
5 [2]	5.0 Vacuum transducer (Y/31/1) EGR valve	N39 18 (V) 1 Vacuum at EGR valve	Engine 900 rpm ±50 [4] approx. 300 mbar [4]	 >3 V [4]	Supply line (red/brown) leaking Air admission line (black) blocked. Air admission filter closed (62a). Supply line (red/brown) or vacuum line (rubber) closed or interrupted. Vacuum transducer (Y31/1). Cables, EDS control unit, air flow sensor potentiometer, EGR valve
	5.1 Cables	N39 18 (Ω) Y31/1 — 1	Connector on vacuum transducer (Y31/1) detached	<1 Ω	Cable interrupt
		N39 1 (Ω) Y31/1 — 2		<1 Ω	Cable interrupt
6	6.0	–	–	–	Internal power supply Replace EDS control unit (N39)
7	7.0 Engine speed sensor (L3)	N39 3 (V) 20	Engine at idle EDS control unit disconnected	>3 V [1]	Engine speed sensor, distance, dirt, cables
	7.1 TD signal	N39 3 (V) 25	Engine at idle EDS control unit connected	>2.8 V [6]	Cable N39 closed (X11/4) Short-circuit or EDS control unit (N39)

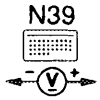
[1]) Voltage increases as speed increases.
[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
[4]) Apply full throttle briefly, vacuum and voltage drops. The test values are reference values.
[6]) Voltage falls by approx. 0.5 V and stabilizes.

On/off ratio readout	Test step/ test scope	Test instrument/ test connection	Operation/ requirement	Specification	Possible cause/remedy
[7]	7.2 Engine speed sensor (L3)	N39 3 — Ω — 20	Ignition: **OFF** EDS control unit detached	Beru [5] 527 Ω ± 10 % VDO [5] 1900 Ω ± 10 %	Engine speed sensor (L3) Cables
		L3x 1 — Ω — 2	Plug connector (L3x) separated	Beru [5] 527 Ω ± 10 % VDO [5] 1900 Ω ± 10 %	Engine speed sensor (L3)
	7.3 Cables	N39 20 — Ω — L3x 2		< 1 Ω	Cable interrupt
		N39 3 — Ω — L3x 1		< 1 Ω	Cable interrupt
8	8.0 Coolant temperature sensor (B11/4)	N39 3 — V — 9	Ignition: **ON** EDS control unit connected	[3]	Coolant temperature sensor, cables, EDS control unit
	8.1 Coolant temperature sensor (B11/4)	N39 3 — Ω — 9	Ignition: **OFF** EDS control unit disconnected	[3]	Coolant temperature sensor, cable
		⊥ — Ω — B11/4	Plug connector (B11/4) detached	[3]	Coolant temperature sensor (B11/4)
	8.2 Cable	N39 9 — Ω — B11/4	Ignition: **OFF** EDS control unit disconnected	< 1 Ω	Cable interrupt

[3] Refer to table for coolant temperature sensor and intake air.
[5] Measured at 20°C ambient temperature (for each 10°C change in ambient temperature the resistance changes by 4%).

On/off ratio readout	Test step/ test scope	Test instrument/ test connection	Operation/ requirement	Specification	Possible cause/remedy
9	9.0 Intake air temperature sensor (B2/1a)	N39 3 (V) 22	Ignition: **ON** EDS control unit connected	[3]	Intake air temperature sensor, air flow sensor (B2/1), cables, EDS control unit
	9.1 Intake air temperature sensor (B2/1a)	N39 3 (Ω) 22	Ignition: **OFF** EDS control unit disconnected	[3]	Cable to intake air temperature sensor, temperature sensor
		B2/1 1 (Ω) 2	Connector on air flow sensor (B2/1) detached	[3]	Intake air temperature sensor
	9.2 Cables	N39 22 (Ω) B2/1 1	Ignition: **OFF** EDS control unit disconnected Connector on air flow sensor (B2/1) detached	< 1 Ω	Cable interrupt
	9.3	N39 3 (Ω) B2/1 2		< 1 Ω	Cable interrupt
10	10.0 Power supply	N39 14 (V) 1	Engine approx. 1500 rpm	11–14 V	Alternator regulator Lima Voltage > 18 V
11 [1]	11.0 ELR actuator (Y22)	N39 3 (V) 2	Ignition: **ON** EDS control unit connected	11–14 V	Actuator (Y22) Cables EDS control unit (N39)

[1] Readout only in event of short-circuit.
[2] Reference value, voltage drops as speed increases.
[3] Refer to table for coolant temperature sensor and intake air.

On/off ratio readout	Test step/ test scope	Test instrument/ test connection	Operation/ requirement	Specification	Possible cause/remedy
[11] [1])	[11.0]	N39  2 1	Engine at idle	2.5 ± [2]) 0.5 V	
	11.1	N39  1 2	Ignition: **OFF** EDS control unit detached	4 ± 0.5 Ω	ELR actuator Cables
	11.2 Cables	N39  1 Y22 2	Ignition: **OFF** Connector on actuator (Y22) detached	< 1 Ω	Cable interrupt
		N39  2 Y22 1		< 1 Ω	Cable interrupt
13					Replace EDS control unit (N39)

[1]) Readout only in the event of short-circuit.
[2]) Reference value, voltage drops as speed increases.

Coolant temperature sensor and intake air

Temperature in °C	Resistance (± 10%)	Voltage in V (± 10%)
20	2.5 kΩ	3.85
30	1.7 kΩ	3.47
40	1.18 kΩ	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	185 Ω	0.99

g) ELR and EGR function test (Engine 603.970)

Test step/ test scope	Test instrument/ test connection	Operation/ requirement	Specifi- cation	Possible cause/ remedy
Idle speed control	Speed sensor with TDC sensor	Engine at idle coolant temperature approx. 80°C	630 rpm ±50	Actuator, injection pump, engine speed sensor (L3), EDS control unit, refer to test steps 6 and 10
		Plug from actuator detached	580 rpm ±20	Set speed at injection pump, injection pump
Exhaust control loop	Connect vacuum tester with Y distributor to EGR valve	Engine at 900 rpm ±50 and approx. 300 mbar apply full throttle briefly	Vacuum drops	Perform mechanical test on vacuum transducer (Y31/1) Air flow sensor (B2/1) EDS control unit EGR valve
EGR valve	Connect vacuum tester directly to EGR valve	Engine off Pressurize EGR valve with 300 mbar and disconnect again	EGR valve closes audibly	Replace EGR valve