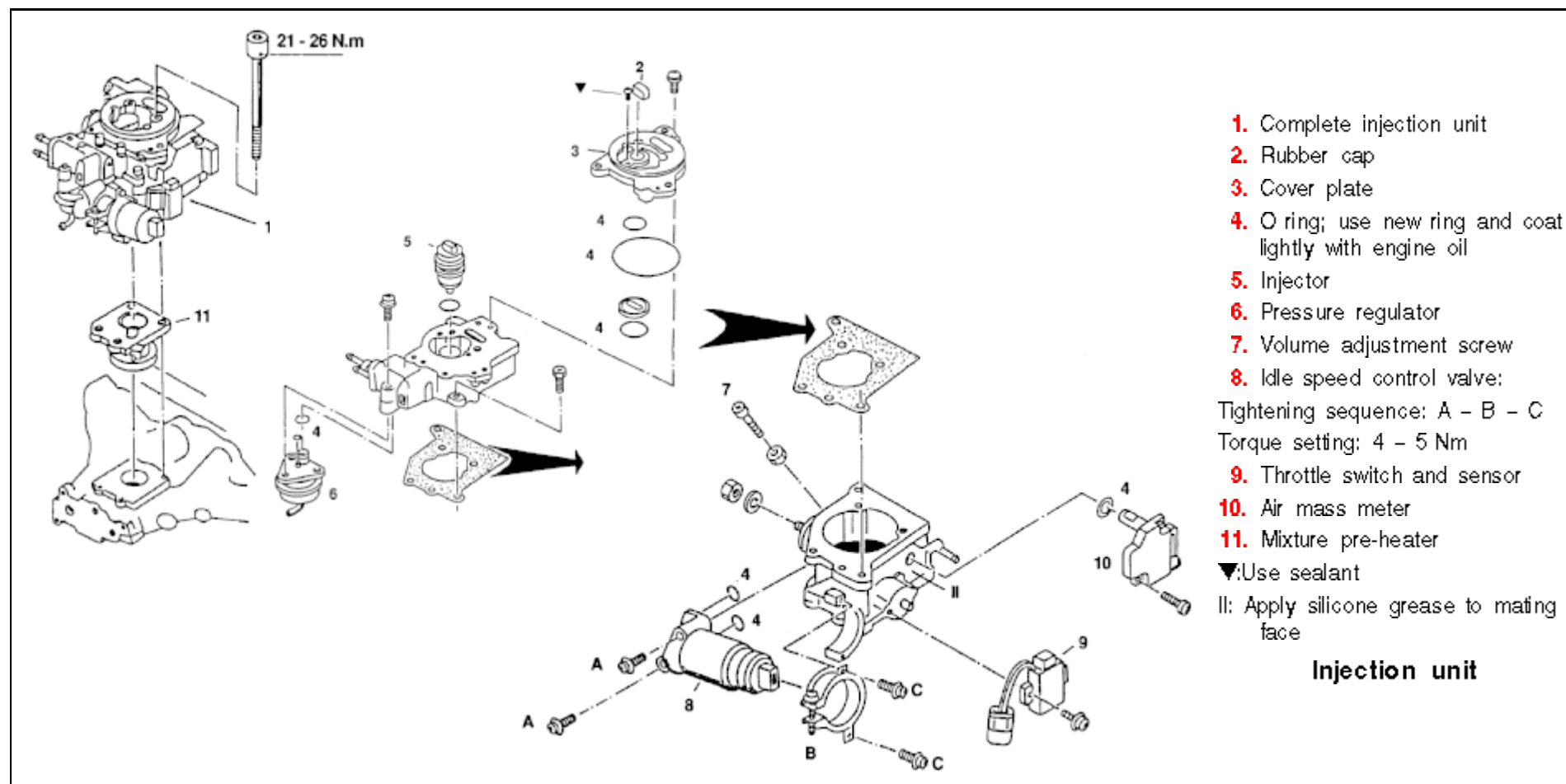


Mixture and exhaust emission control systems

Injection unit



Throttle switch check and adjustments

Bring the engine to operating temperature, disconnect the throttle switch connector. Check that the idle speed is 750/min. Then run the engine at 2000/min and slowly drop the engine speed. The throttle switch must close at 1050 ± 50 /min; the resistance between the connector pins at that moment must be 0 Ω . If necessary, adjust the throttle switch. To do this, slacken the securing bolts and turn the unit.

Dashpot checking and adjustment

Engine at operating temperature: Check that the idle speed is 750/min. Turn the throttle lever by hand. Check that the dashpot rod just touches the lever at 2600 ± 400 /min. If necessary, turn the adjustment screw on the lever.

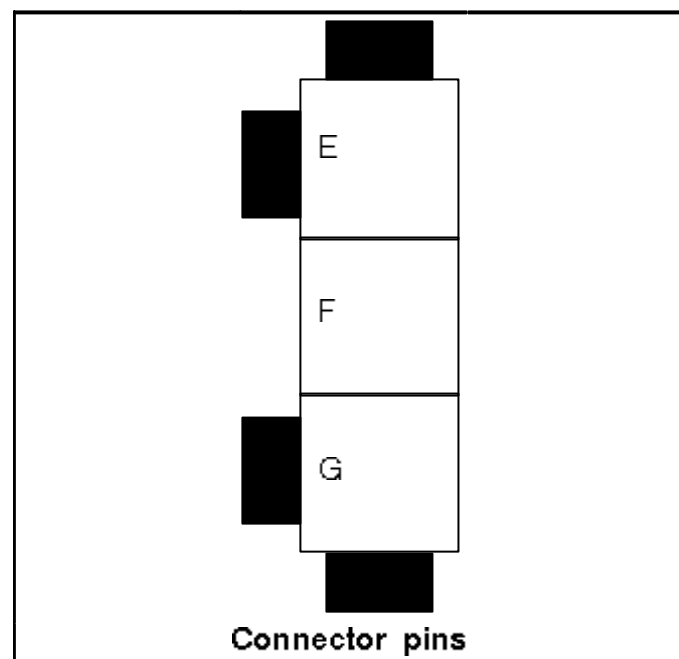
Checking idle speed control valve

Remove the control valve from the injection unit.

Note: Prevent any oil or solvent from entering the control valve. Don't knock or tap the valve. Dismantle the control valve.

Measure the resistance between the connector pins.

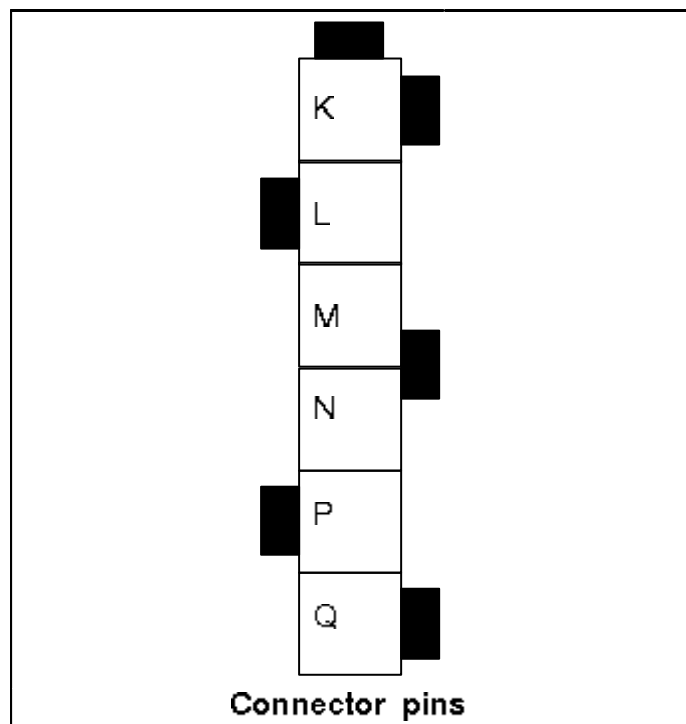
E and F:	8,5 - 9,5 Ω
F and G:	9,5 - 10,5 Ω



The resistance between the connector pins and the housing must be infinity. Apply battery voltage to pins E(-) and F(+). Check that the slide in the air exhaust port is fully closed. Apply battery voltage to pins G(-) and F(+). Check that the slide in the air exhaust port is fully open. The slide air gap must be 0 - 2 mm with no voltage on the pins.

Checking air mass meter

Note: Before removing the air mass meter, first disconnect the throttle switch from the injection unit. Hold the air mass meter vertical when removing it to prevent damage to the hot wire holder. Don't touch the hot wire.



Apply battery voltage to pins M(-) and P(+). Measure the voltage between pins K and N. This should be 1,5 - 2,0 V. Again measure the voltage, with air blowing along the hot wire. The voltage should be 2,5 - 4,0 V.

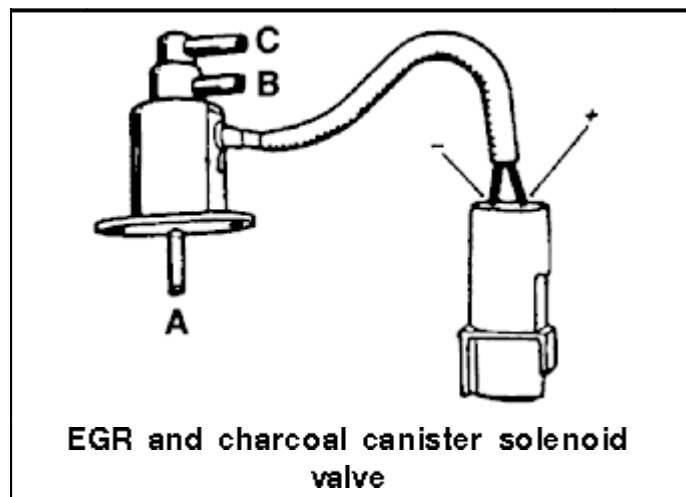
Checking fuel pressure

Release the fuel pressure. Remove the fuel pump fuse. This is fuse No. 8 on the top row in the fuse box, to the left below the dashboard. Start the engine. Switch the starter motor 3 times on after the engine has stalled. Switch the ignition off. Fit a manometer between the fuel supply pipe and the connection on the injection unit. Refit the fuel pump fuse. Start the engine. Check for fuel leaks.

The fuel pressure with engine at idle speed should be 0,98 bar. Release the fuel pressure. Re-connect the supply pipe to the injection unit.

EGR and charcoal canister solenoid valve

Disconnect the connector. With an Ohmmeter check for continuity between both connector pins. Disconnect all vacuum hoses from the valve. Check for connection between A, B and C, see the illustration. B and C are connected when the solenoid valve is inactive. A and B are connected with battery voltage on the connector pins (= activated solenoid valve).



EGR control valve

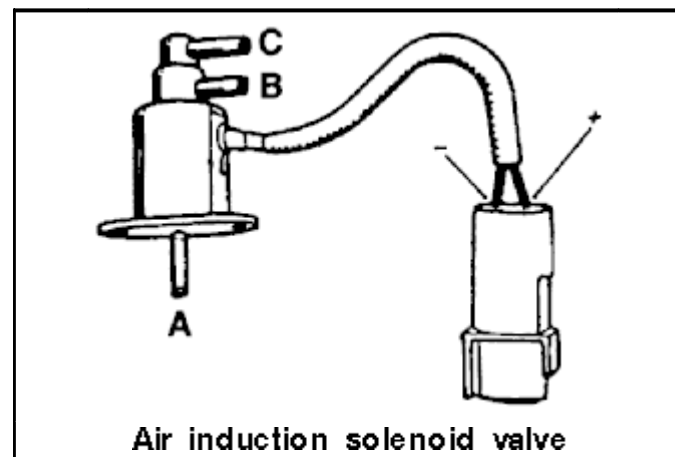
Apply vacuum to the vacuum diaphragm. The valve must be fully open at minimum 120 mmHg vacuum.

Inlet air temperature control vacuum diaphragm

The vacuum diaphragm operates a control valve that controls the mixture of cool outside air and warm exhaust air in the air filter intake tube. The valve opens at 50 mmHg. It is fully open at 100 mmHg vacuum.

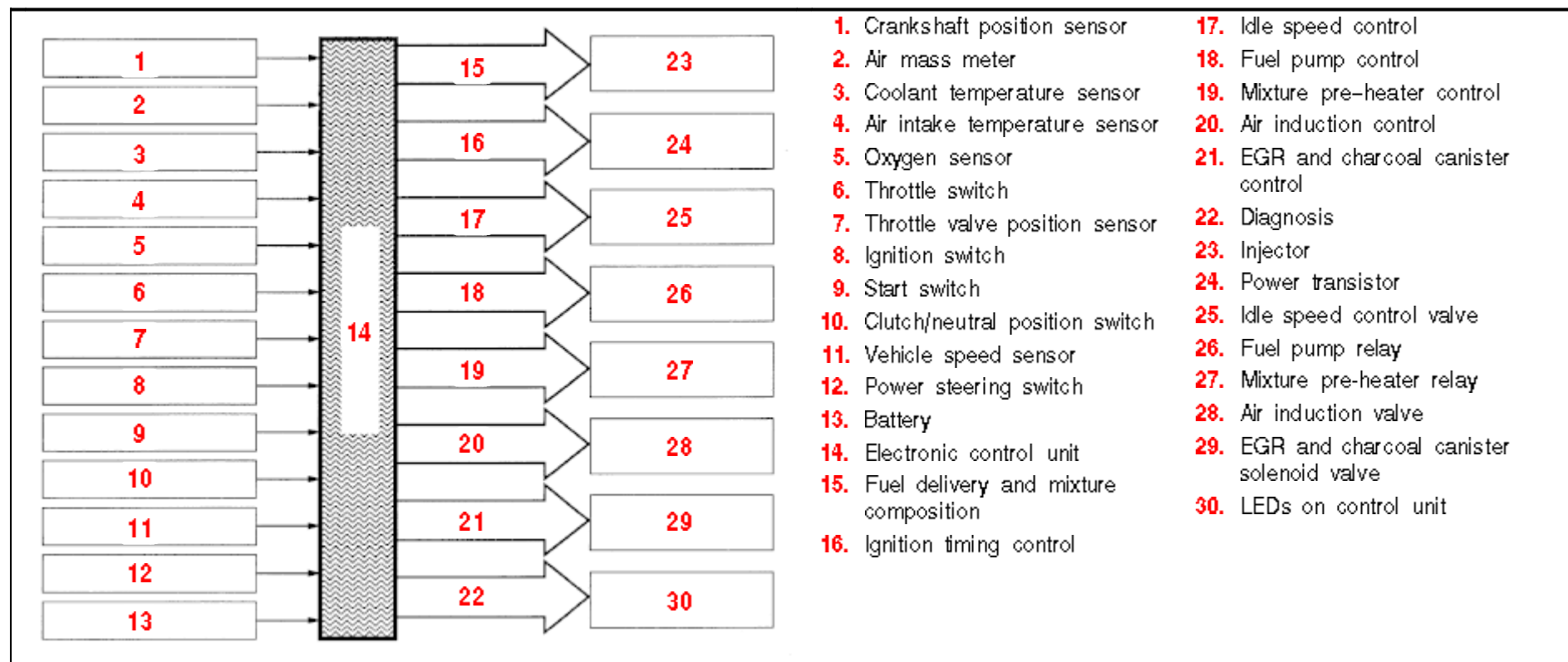
Air induction solenoid valve

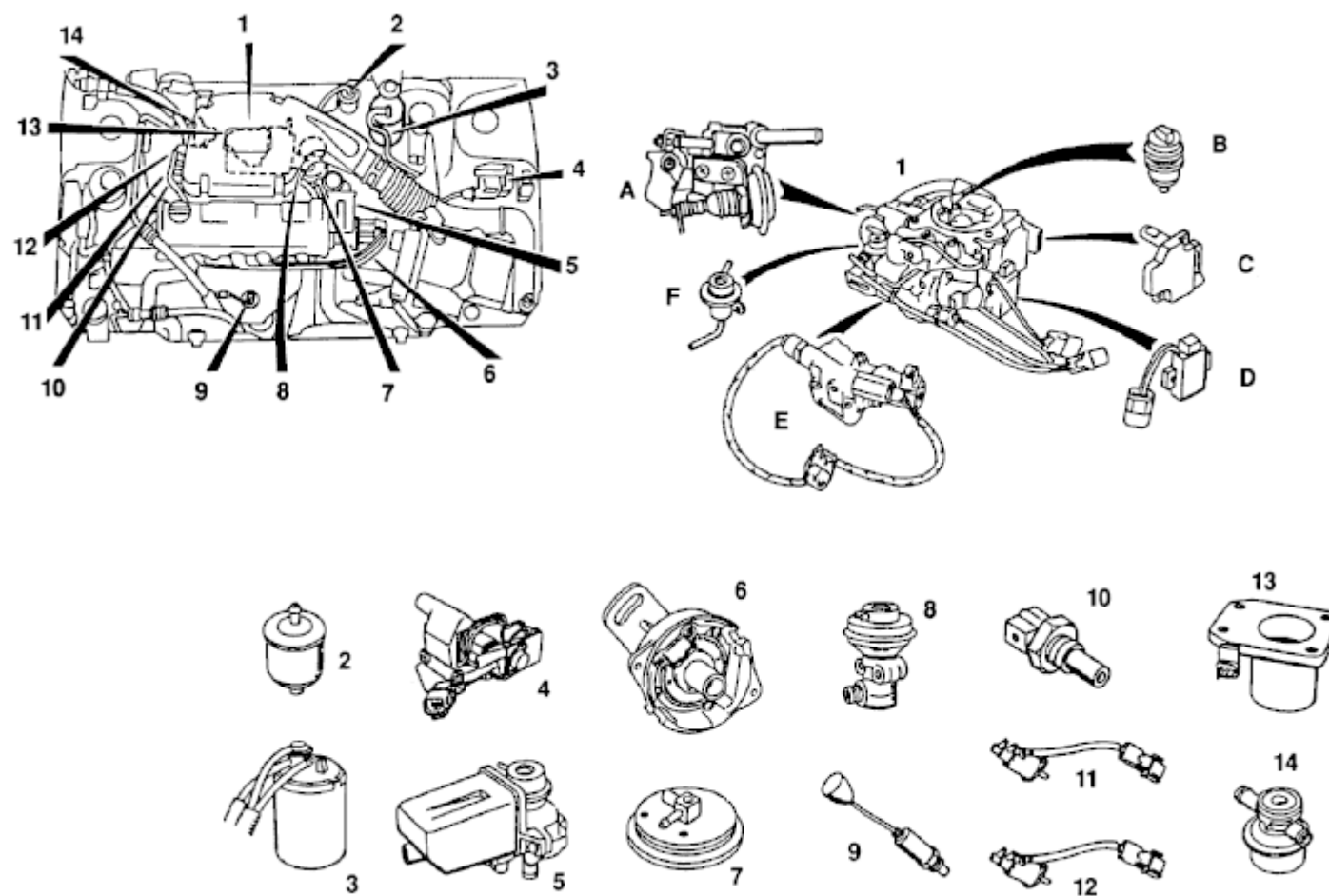
Disconnect the connector. With an Ohmmeter check for continuity between both connector pins. Disconnect all vacuum hoses from the valve. Check the connection between A, B and C, see the illustration. B and C are connected with non active solenoid valve. A and B are connected with battery voltage on the connector pins (= active solenoid valve).



– GA 16i engine

Both the fuel injection and ignition are controlled by a micro-computer which makes use of various sensors and actuators, see the wiring diagram. The electronic control unit is located under the RH front seat.





- 1.** Injection unit
 - 1A:** Throttle valve position control
 - 1B:** Injector
 - 1C:** Air mass meter
 - 1D:** Throttle switch and -sensor
 - 1E:** Idle speed control unit: a. Idle speed fine-control solenoid valve; b. Extra idle control solenoid valve S; c. Extra idle control solenoid valve K
 - 1F:** Pressure regulator
 - 2.** Fuel filter
 - 3.** Charcoal canister
 - 4.** Ignition coil with power transistor
 - 5.** Air induction control valve
 - 6.** Crankshaft position sensor
 - 7.** Flap valve
 - 8.** EGR control valve*
 - 9.** Oxygen sensor
 - 10.** Coolant temperature sensor
 - 11.** Air induction solenoid valve
 - 12.** EGR and charcoal canister solenoid valve*
 - 13.** Mixture pre-heater
 - 14.** Extra air valve
- *EGR= Exhaust gas recirculation

GA 16i engine management system components location

Fault finding

The various diagnoses can be made by reading out the green and red LED at the top of the electronic control unit. The control unit should be removed from under the RH front seat, the connector remains connected.

The diagnostic system recognizes 5 positions:

Positions I and II:	Mixture composition control.
Position III:	Control unit self diagnosis.
Position IV:	Actuator checks.
Position V:	Drive test diagnosis.

The diagnosis position selection procedure is as follows:

Switch on the ignition. With a screwdriver turn the diagnostic switch fully clockwise and wait until the LEDs blink. The diagnostic switch is located at the side of the control unit, to the right of the two LEDs. The number of LED blinks indicates the diagnostic position. Turn the switch fully anti-clockwise as soon as the required blink code appears.

If the ignition is switched off and then on again, the diagnostic system will always automatically revert to position I.

Fault memory erasing

The memory is erased when:

- The battery earth lead is disconnected.
- After selecting diagnostic position III, position IV is selected.

Note: If the diagnostic switch remains turned fully clockwise, it will continue blinking in sequence I, II, III, IV, V, I, etc. without the memory being erased.

Diagnostic positions I and II: Mixture composition check

Position I.

With ignition on but engine off, both the green and red LED will light

With engine running at 2000 min the green LED is constantly on or off and the red LED constantly off, if the oxygen sensor is still cold. If the oxygen sensor is warm, the green LED must blink approx. 9 times per 10 seconds; off is rich mixture, on is lean mixture. The red LED does not light.

Position II.

With ignition on and engine off, the green LED will light but not the red LED

With engine running at 2000/min both LEDs are constantly on or off, if the oxygen sensor is still cold.

If the oxygen sensor is warm, the green LED must blink approx. 9 times per 10 seconds; off is rich mixture, on is lean mixture. The red LED will not light if the mixture exceeds 5% too rich, blinks synchronous with the green LED if the mixture formulation is correct and lights constantly if the mixture exceeds 5% too lean.

Diagnostic position III: Control unit self diagnosis

The control unit stores faults in the engine management system even if these are only intermittent. Using both LEDs the faults can be read out as a blinking code. The number of blinks of the green LED indicates the units, the number of blinks of the red LED indicates the tens. Fault code 13 is thus indicated by 1 blink of the red followed by 3 blinks of the green LED

If the engine will not start, the starter motor must be operated for at least 2 seconds, after which the self diagnostic procedure can be carried out.

A fault code may be erased by switching on the starter motor 50 times after the fault code has appeared.

Fault codes

- Code 11: Crankshaft position sensor circuit
- Code 12: Air mass meter circuit
- Code 13: Coolant temperature sensor circuit
- Code 14: Vehicle speed sensor circuit
- Code 21: No ignition signal in primary circuit
- Code 23: Throttle switch circuit
- Code 25: Fine idle speed control circuit
- Code 31: Electronic control unit
- Code 33: Oxygen sensor circuit
- Code 43: Throttle valve position sensor circuit
- Code 55: No fault in named circuits.

Not all circuits are included in the self diagnostic system. For the test values of the more important circuits, see chapter 2: Switches, valves and sensors.

Diagnostic position IV: Actuator checks

The following actuators may be checked:

- A. Throttle switch (zero load switch); on, when the accelerator pedal is depressed.
- B. Start switch (in ignition switch)
- C. Vehicle speed sensor

A and B:

When a switch is turned on or off, the red LED must go on or off.

C.

The green LED must light when the vehicle speed exceeds 20 km/h.

Diagnostic position V: Driving test diagnosis

When driving with a fault in the following components a fault code will be generated:

- Crankshaft position sensor: 180°-signal or 1°-signal
- Ignition signal
- Air mass meter output signal

Fault codes occurring during this test are not stored in the fault memory.

With the engine running and the LEDs don't blink for at least 5 minutes, no faults have been registered.

Switches, valves and sensors

In this chapter only specific checks and test values are given. For a complete diagnosis must the supply voltages, earth connections, connections and wiring must all be checked.

Refer to the wiring diagram appended at the end of this chapter.

Not all components shown in the diagram are described here, because some of these circuits can be measured without further advice.

Note: Under input voltage is understood: The voltage of a signal going to the control unit from a switch, valve or sensor. Under output voltage is understood: The voltage of a signal, going from the control unit to a switch, valve or sensor.

Note: When measuring resistances, the connectors must always be disconnected!

Crankshaft position sensor

All connectors are connected. Start the engine. Using a voltage pulse tester, check for a pulse input voltage at control unit pins 22, 32 and 21, 31. On pins 22 and 32 the 1°-signal, on pins 21 and 31 the 180°-signal.

Check that the crankshaft position sensor wiring makes no contact with the HT leads. Check the rotor disc for damage.

Air mass meter

All connectors are connected. Start engine and idle. Measure the input voltage between control unit pin 15 and earth. This should be approx. 1,0 V.

Coolant temperature sensor

Measure the resistance of the coolant temperature sensor on the sensor connector pins:

At 20° C: approx. 2500 Ω

At 80° C: approx. 330 Ω

Vehicle speed sensor

Disconnect the 16 pin control unit multiplug. Ensure that both front wheels are clear of the ground. Turn one of the front wheels by hand. At the same time measure the resistance between control unit connector pin 33 and earth.

Note: Don't touch the control unit pins!

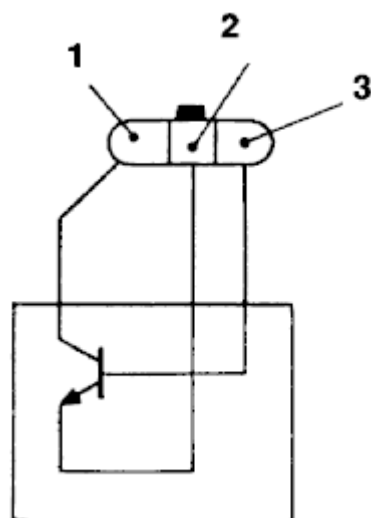
The resistance must continuously fluctuate between 0 and infinity.

Ignition signal

All connectors are connected. Start the engine. Using a pulse voltage tester check for a pulse input voltage between control unit pin 1 and earth.

A.

If this is not the case, check the power transistor, see the illustration. Disconnect the connector. Measure the resistance between the power transistor pins:

**Power output transistor**

multimeter test pin polarity	pin number	continuity
+	1	no
-	2 or 3	
-	1	yes
+	2 or 3	

With any deviation, replace the power transistor.

B.

If pulse voltage is present, check the input voltage between control unit pin 3 and earth. This must be battery voltage

Throttle switch

Disconnect the throttle switch connector. Start the engine. Check that the supply voltage on the centre connector pin relative to earth is approx. 9 V.

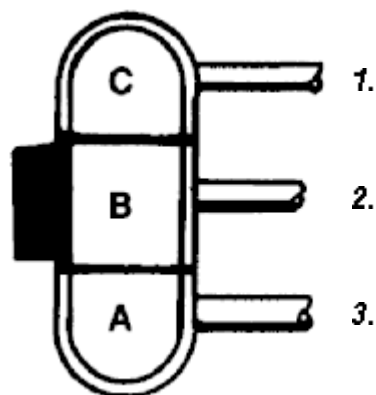
Idle speed fine-control solenoid valve

Disconnect the connector from the solenoid valve. Measure the resistance between the pins; this should be approx. 10 Ω . Re-connect the connector. Start the engine. Bring to operating temperature. Check if the output voltage between control unit pin 114 and earth is approx. 4 - 8 V at idle speed.

Throttle valve position sensor

All connectors are connected. Switch on the ignition. Measure the feed voltage of the throttle valve position sensor between sensor connector pin C and earth; this must be approx. 5 V.

Check, under similar conditions, if the input voltage between control unit pin 19 and earth changes between approx. 0,4 to 4 V, if the accelerator pedal is depressed



- 1.Red
- 2.White
- 3.Black

Throttle valve position sensor connector**Start inhibitor and neutral position switch**

The start inhibitor switch is on when the shift lever is in position N" or P". The neutral position switch is on when the gear lever is in neutral".

Fuel pump

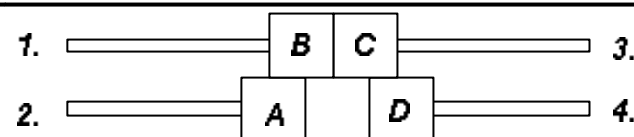
Disconnect the fuel pump connector beneath the rear seat. Switch on the ignition. Check for battery voltage between the connector pin and earth, for 5 seconds after switching the ignition on.

Injector

Check the resistance between the injector connector pins; This should be approx. 1 - 2 Ω .

Mixture pre-heater and relay

The mixture pre-heater only runs when the engine is cold. Remove the relay and start the (cold) engine. Check if the output voltage between pin D and earth is approx. 0,7.



- 1.White
- 2.Green/Yellow
- 3.White/Brown*
- 4.Green/Blue**

* coupé and Florida/Station Wagon: blue/white

** coupé and Florida/Station Wagon: red/yellow

Fuel pump relay connector**Extra idle speed control solenoid valve K (on versions with air-conditioning)**

Start the engine. Bring to operating temperature. Check that the Idle speed rises when the air-conditioning is switched on.

Extra idle speed control solenoid valve S (on versions with power steering)

Start the engine. Bring to operating temperature. Measure the output voltage between control unit connector pin 111 and earth: Approx. 0,9 V with power steering switch on and battery voltage with power steering switch off.

Air induction solenoid valve

Start the engine. Bring to operating temperature. Measure the output voltage between control unit connector pin 102 and earth: Approx. 0,8 V with accelerator pedal released and battery voltage with accelerator pedal depressed.

EGR and charcoal canister solenoid valve

Start the engine. Bring to operating temperature. Measure the output voltage between control unit connector pin 102 and earth: Approx. 0,6 - 0,9 V at idle speed and battery voltage with accelerator pedal depressed.

Octane selector (if fitted)

Remove the switch from the LH side of the dashboard. Disconnect the connector. With the switch in position "SUPER", there should be a current flow between the switch connector pins.

Switch on the ignition. Measure the voltage between the connector pin on the blue/red wire and earth; this should be 7 - 9 V.

Cranking signal

Start the engine. At the same time, measure the input voltage between control unit connector pin 35 and earth. The voltage must be 8 - 12 V.

Control unit feed and earth circuits

All connectors are connected. Switch on the ignition. Measure the feed voltage to control unit pins 39, 47 and 109 relative to earth. This must be battery voltage. Switch ignition off. Disconnect the 12 and 16 pin connectors from the control unit. Measure the resistance between pins 6, 12, 107, 108, 116 and earth. This should be 0 Ω .