

**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:

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

The diagnostic 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 constant 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 21:	No ignition signal in primary circuit
Code 22:	Idle speed control faulty
Code 42:	Throttle valve sensor circuit
Code 44:	No faults 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 switches can be checked:

A. Throttle switch (zero load switch); on, when 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
- Fuel pump

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 be checked. Refer to the wiring diagram 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 8 and 17. On pin 8 the 1°-signal, on pin 17 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 the engine. Measure the input voltage between control unit pin 31 and earth. If the accelerator pedal is depressed, the voltage must change to a value between 0 and approx. 5 V.

### Coolant temperature sensor

All connectors are connected. Start the engine. Check that the input voltage when warming up between control unit pin 23 and earth when warming up changes from approx. 5 V to finally 0 V.

Measure the coolant sensor resistance on the sensor connector pins:

At 20° C	2300 - 2700 $\Omega$
At 50° C	770 - 870 $\Omega$
At 80° C	300 - 330 $\Omega$

### Ignition signal

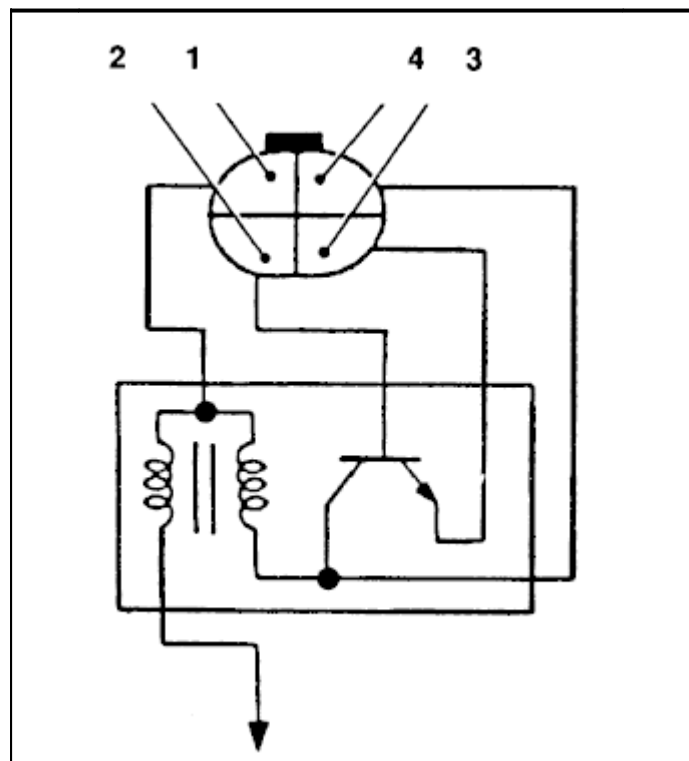
All connectors are connected. Start the engine. Check with a voltage pulse tester for a pulse input voltage between control unit pin 5 and earth.

#### A.

If this is not so, the power transistor must be checked, see the illustration. Disconnect the connector and measure the resistance between the terminals on the ignition coil + power transistor:

multimeter test pin polarity	pin number	continuity
+	1 or 3	no
-	2 or 4	
-	1 or 3	yes
+	2 or 4	

With any deviation the power transistor must be replaced.



B.

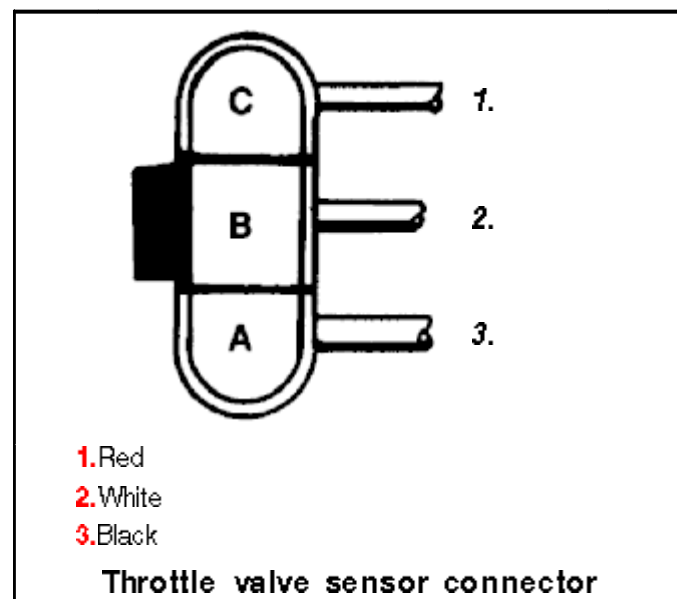
If pulse voltage is present, check the input voltage between control unit pin 3 and earth. This must be battery voltage.

### Idle speed control valve

All connectors are connected. Start the engine. Check with a voltage pulse tester for pulse output voltage between both the upper and the lower control valve connector pin and earth.

### Throttle valve position sensor

All connectors are connected. Switch on the ignition. Measure the throttle valve position sensor input voltage between the sensor connector pin C and earth; this should be approx. 5 V. Check, under the same conditions, if the input voltage between control unit pin 19 and earth rises from approx. 0,5 to 5 V in proportion to the accelerator pedal being depressed further.



**Oxygen sensor**

All connectors are connected. Start the engine. Bring to operating temperature. Run the engine at high speed and measure the input voltage between control unit pin 24 and earth. The voltage must fluctuate between 0 and 1,5 V.

**Intake air temperature sensor**

All connectors are connected. Start the engine. Check that the input voltage when warming up between control unit pin 21 and earth changes from approx. 5 V to finally 0 V. Measure the intake air temperature sensor resistance on the sensor connector pins:

At 20° C	2300 - 2700 $\Omega$
At 50° C	770 - 870 $\Omega$
At 80° C	300 - 330 $\Omega$

**Throttle switch**

All connectors are connected. Start the engine. Check if the input voltage on the switch centre connector pin relative to earth is approx. 9 V.

**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 29 and earth.

**Note:** Don't touch the control unit pins!

The resistance must continuously fluctuate between 0 and infinity.

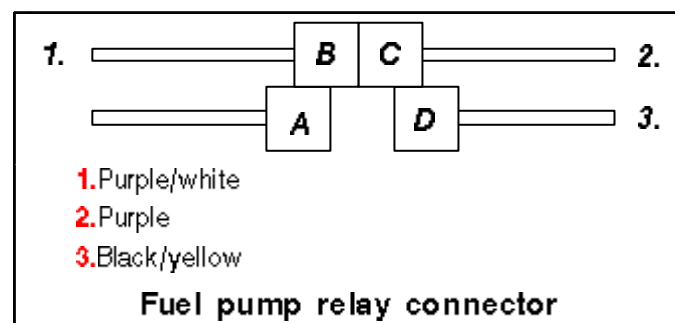
**Clutch and neutral position switch**

Disconnect the 20 pin control unit multiplug. Switch on the ignition. Measure the resistance between control unit connector pin 10 and earth.

**Note:** Don't touch the control unit pins! With a gear engaged and the clutch depressed, the resistance must be infinity. In all other cases the resistance must be 0.

**Fuel pump and relay**

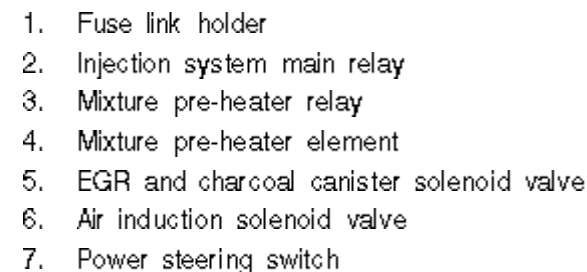
The relay, and the fuel pump, are activated for 5 seconds after the ignition is switched on. Remove the fuel pump relay. The output voltage on relay connector pin D relative to earth must be 0 V for 5 seconds after switching on the ignition.



**Control unit supply and earth circuit**

All connectors are connected. Switch on the ignition. Measure the input voltage on control unit pins 27 and 35 relative to earth. This must be battery voltage.

Ignition off. Disconnect the 15 and 16 pin connectors from the control unit. Measure the resistance between pins 28, 36, 107, 112, 113 and earth. This should be 0  $\Omega$ .



20. Clutch switch
21. Neutral position switch
22. Crankshaft position sensor
23. Distributor
24. Spark plugs
25. Ignition coil and power transistor
26. Resistance 2,2 k $\Omega$
27. Capacitor
28. Ignition switch

l: Earth on engine block

II: Earth on body

B = Black; BR = Brown; G = Green; GY = Grey;  
L = Blue; LG = Light green; OR = Orange; P  
= Pink; PU = Purple; R = Red; SB = Light  
blue; W = White; Y = Yellow

Combination:  $X_i/Y$  = wire coloured  $X_i$ , marked with a  $Y$  coloured stripe.

**E 16i engine management system wiring diagram, except coupé and Florida/Station Wagon (part 1)**