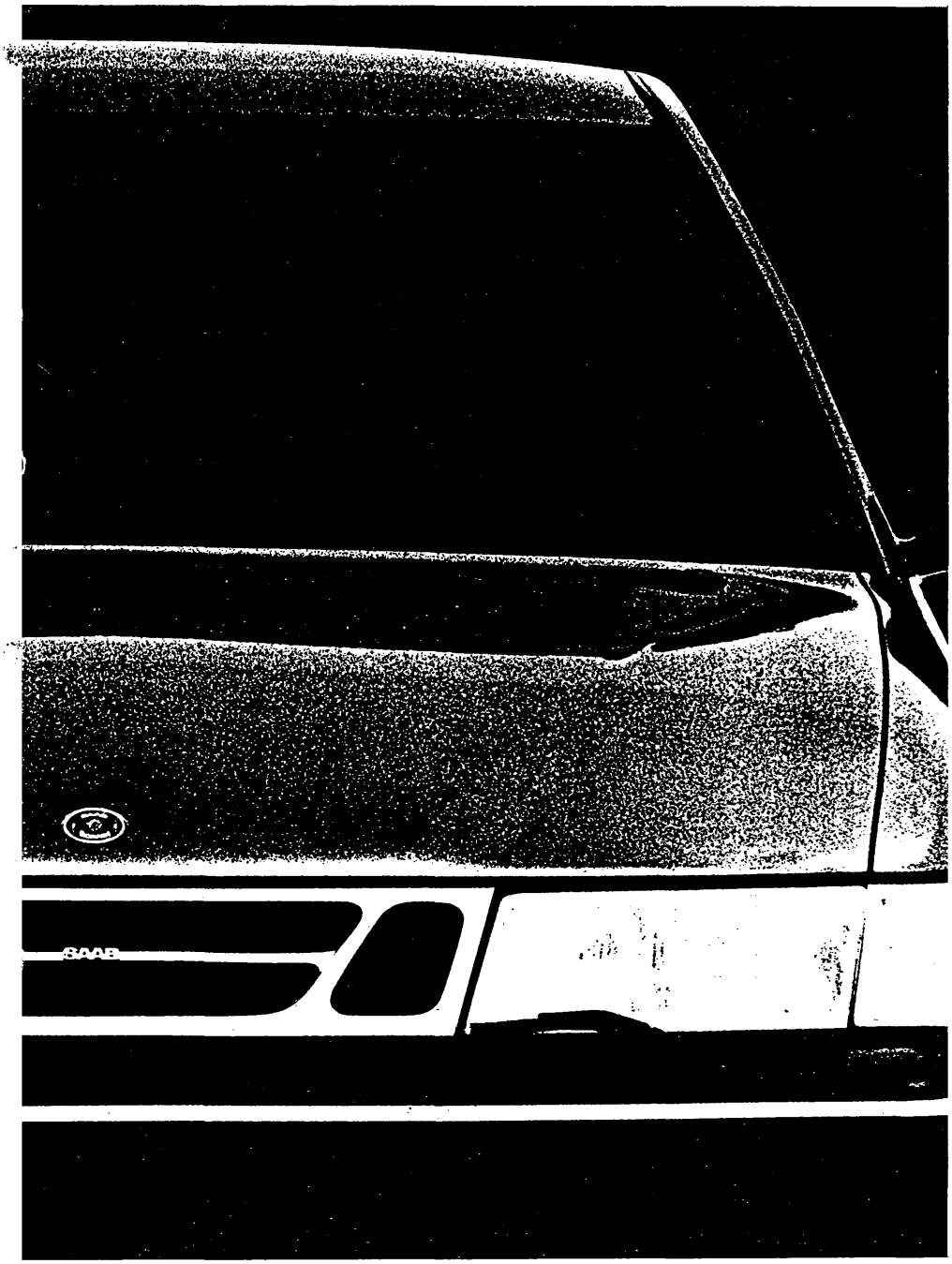
Saab 9000

Service Manual



M 1985-96

ENG

1:5 Diagnosis and Fault tracing

Saab 9000

SERVICE MANUAL

1:5 Diagnosis and fault tracing

M 1985 - 1996

Foreword

This book contains:
- Readings, control module connections
- Diagnostic trouble codes
- ISAT scan tool menu structure for systems with integrated fault diagnosis in the Saab 9000, M1985-1996.

This book has been produced for use as an aid during fault diagnosis. Stored trouble codes can be read with
1 ISAT scan tool
2 Flashing codes
3 System test units

The book gives no instructions as to how a fault is corrected, but refers instead to the Service Manual where appropriate action is described.

- This book replaces Service Manual 1:5 "Diagnosis and fault tracing" M1986 - 1995

Warning, Important and Note

The headings "Warning", "Important" and "Note" occur from time to time in the Service Manual. They are used to draw the attention of the reader to information of special interest and seriousness. The importance of the information is indicated by the three different headings and the difference between them is explained below.

⚠ WARNING

Warns of the risk of material damage and grave injury to mechanics and the driver, as well as serious damage to the car.

Important

Points out the risk of minor damage to the car and also warns the mechanic of difficulties and time-wasting mistakes.

Note

Hints and tips on how the work can be done in a way that saves time and labour. This information is not supplied for reasons of safety.

Market codes

The codes refer to market specifications

AT	Austria	GB	Great Britain
AU	Australia	GR	Greece
BE	Belgium	IS	Iceland
CA	Canada	IT	Italy
CH	Switzerland	JP	Japan
DE	Germany	ME	Middle East
DK	Denmark	NL	Netherlands
ES	Spain	NO	Norway
EU	Europe	SE	Sweden
FE	Far East	US	USA
FI	Finland	UC	US California
FR	France		

Production: Service Support, Saab Automobile AB, Trollhättan, Sweden

Diagnostic methods

Fault diagnosis

Before starting fault diagnosis

Electronic systems are sometimes suspected of being faulty when, in fact, the fault is in the engine itself or in other auxiliary systems. Remember to check the following points before starting fault diagnosis on the systems:

- battery condition
- engine condition
- charging system
- other auxiliary systems
- cable connections
- grounding points

Successful fault tracing on the systems requires both thorough knowledge of the system and access to diagnostic instruments.

As the systems' inbuilt self-diagnosis continuously monitors and registers most of the faults, both permanent and intermittent, that may arise, it is very easy to pinpoint a fault with the diagnostic instruments, attend to it and then check that the system is free of faults.

Diagnostic methods

Fault diagnosis can be carried out using various methods. The same system can be analyzed using one or more diagnostic methods.

- Special test units
- Lamp-flash codes
- ISAT scan tool

To make it easier to take readings on the various systems, the measuring points can be "moved out" using a breakout box (BOB). The breakout box is connected to the system's control module.

In connection with fault diagnosis

In the fault diagnosis routine, which is found in the service manual for each system, "Check lead from ... to ... " appears frequently.

In certain cases, the leads are routed through connectors or distribution points, and these should then be checked for breaks/short circuits.

Note possible risks of interference from components connected to the lead in question.

Also check that leads are not damaged or are not properly grounded. Always check that you use the correct wiring diagram for the car, model year and type of system.

Systems with diagnosis by means of special test units

System	-M87	M88	M89	M90	M91	M92	M93	M94	M95	M96
ABS	•	•	•	•	•					
AIRBAG			•	•	•					
CRUISE CONTROL	•	•	•	•	•					
LH 2.2	•	•	•	•						
LH 2.4		•	•	•	•					
EZK	•	•	•	•	•	•	•			

Systems with diagnosis by means of lamp-flash codes

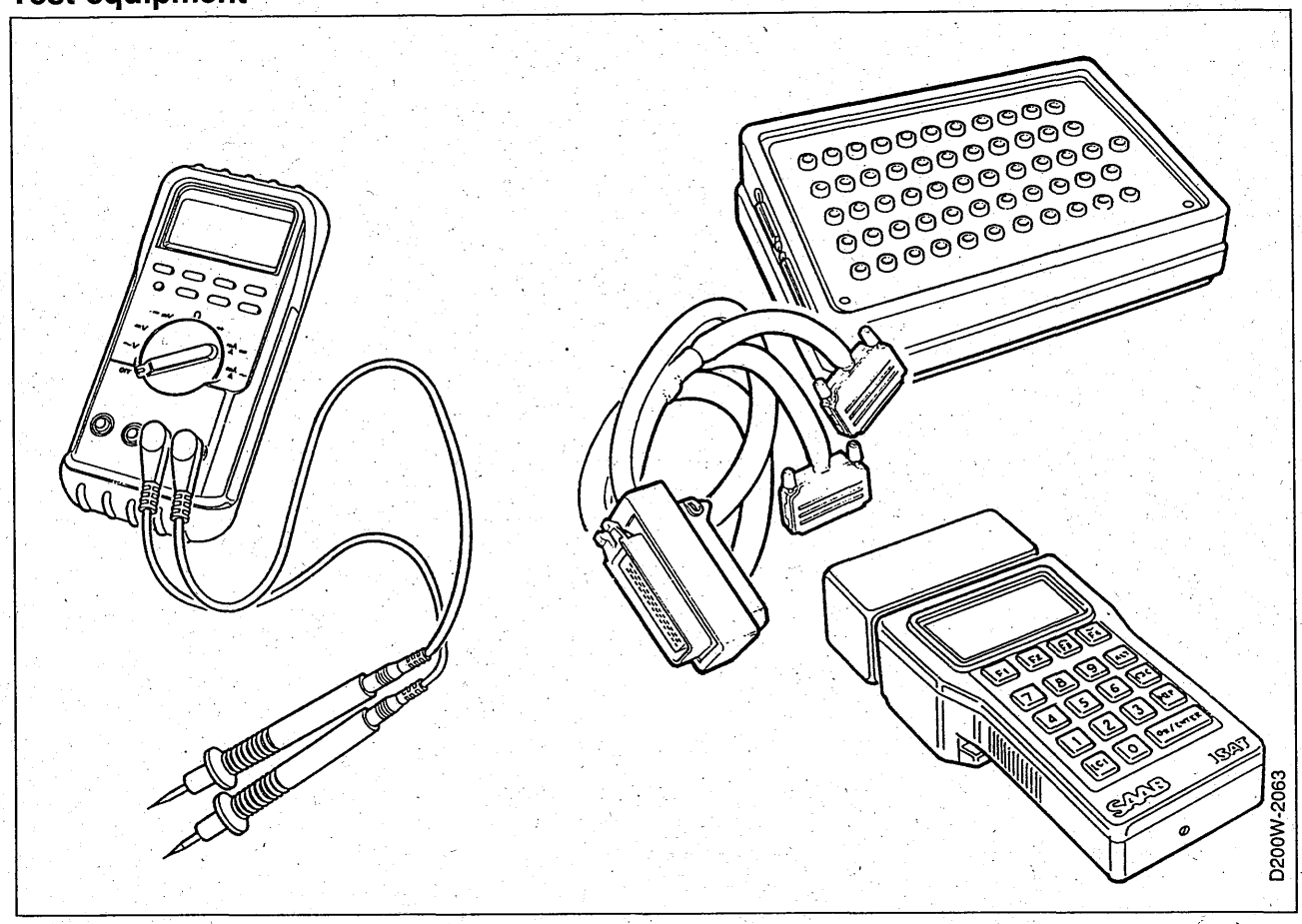
System	-M87	M88	M89	M90	M91	M92	M93	M94	M95	M96
ABS				•	•					
EZK	•	•	•	•	•	•	•			
LH 2.4		•	•	•	•	•	•			
LH 2.4.1				•						
LH 2.4.2					•	•	•			
Motronic 2.8.1									•	•
Trionic							•	•	•	•

Systems with diagnosis by means of an ISAT scan tool

System	-M87	M88	M89	M90	M91	M92	M93	M94	M95	M96
ABS						•	•	•	•	•
ACC				•	•	•	•	•	•	•
AIRBAG						•	•	•	•	•
Anti-theft alarm									•	•
DI-DI/APC		•	•	•	•	•	•			
EDU				•	•	•	•	•	•	•
ETS					•	•	•	•	•	
LH 2.4				•	•	•	•			
LH 2.4.1				•						
LH 2.4.2					•	•	•			
Motronic 2.8.1									•	•
SEAT MEMORY L					•	•	•	•	•	•
SEAT MEMORY R					•	•	•	•	•	•
TC/ABS					•	•	•	•	•	
TCS									•	•
Trionic							•	•	•	•

General test methods

Test equipment



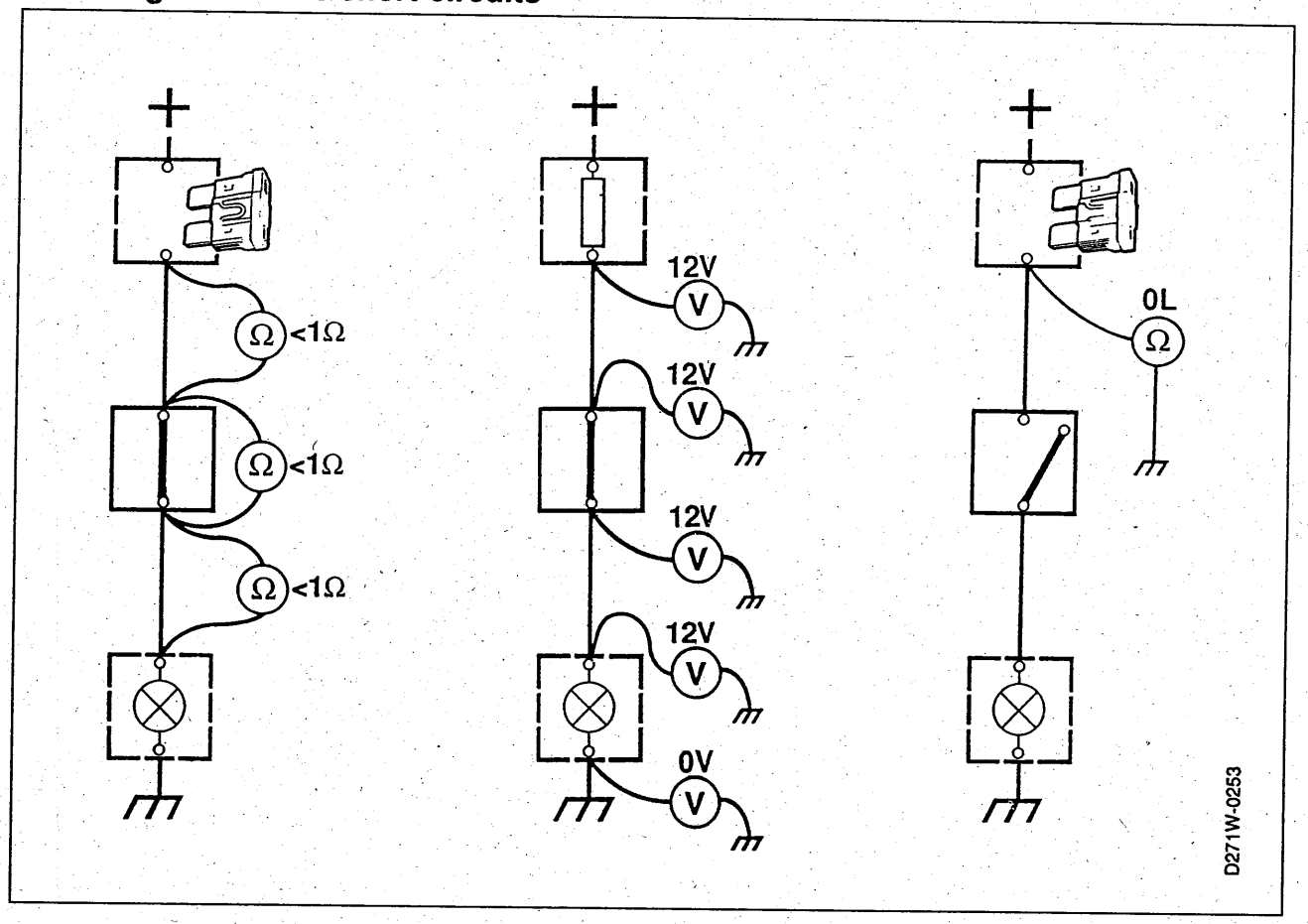
Suitable instruments for fault diagnosis on the car's electrical system are an ISAT scan tool, voltmeter and ohmmeter.
Use a voltmeter or ISAT scan tool to measure the voltage in a circuit.
Use an ohmmeter or ISAT scan tool to check for short circuits or breaks in wiring harnesses, connectors, switches and contacts.

Important

Be extremely careful when measuring resistance if the car battery is connected. Regular electrical equipment that is not switched off could be the cause of spurious and erroneous instrument readings and easily give rise to incorrect information.
Disconnection of the battery is **not** recommended as many sub-systems store information in their memories that is erased when power is lost.

General test methods (contd.)

Checking for breaks/short circuits



Breaks (resistance measurement)

1 Make sure that the component or lead that is to be checked is not live.

2 With the instrument set for measuring resistance, connect the probes to each side of the component or lead to be checked.

For wiring harnesses, the resistance should normally be less than 1 Ohm. There is a specified value that applies to individual components.

Breaks (voltage measurement)

1 Connect any load.

2 With the instrument set for voltage measurement, connect the black probe to a good ground and the red probe to the lead side.

3 Start at the output on the control module/switch, measuring away from it and continue on towards the load. When the voltage disappears, you have just passed the break.

4 Start at the input to the control module/ consumer, measuring away from the power source and move gradually in towards the control module/switch. When the voltage disappears, the break has been passed.

Short circuit to ground (resistance measurement)

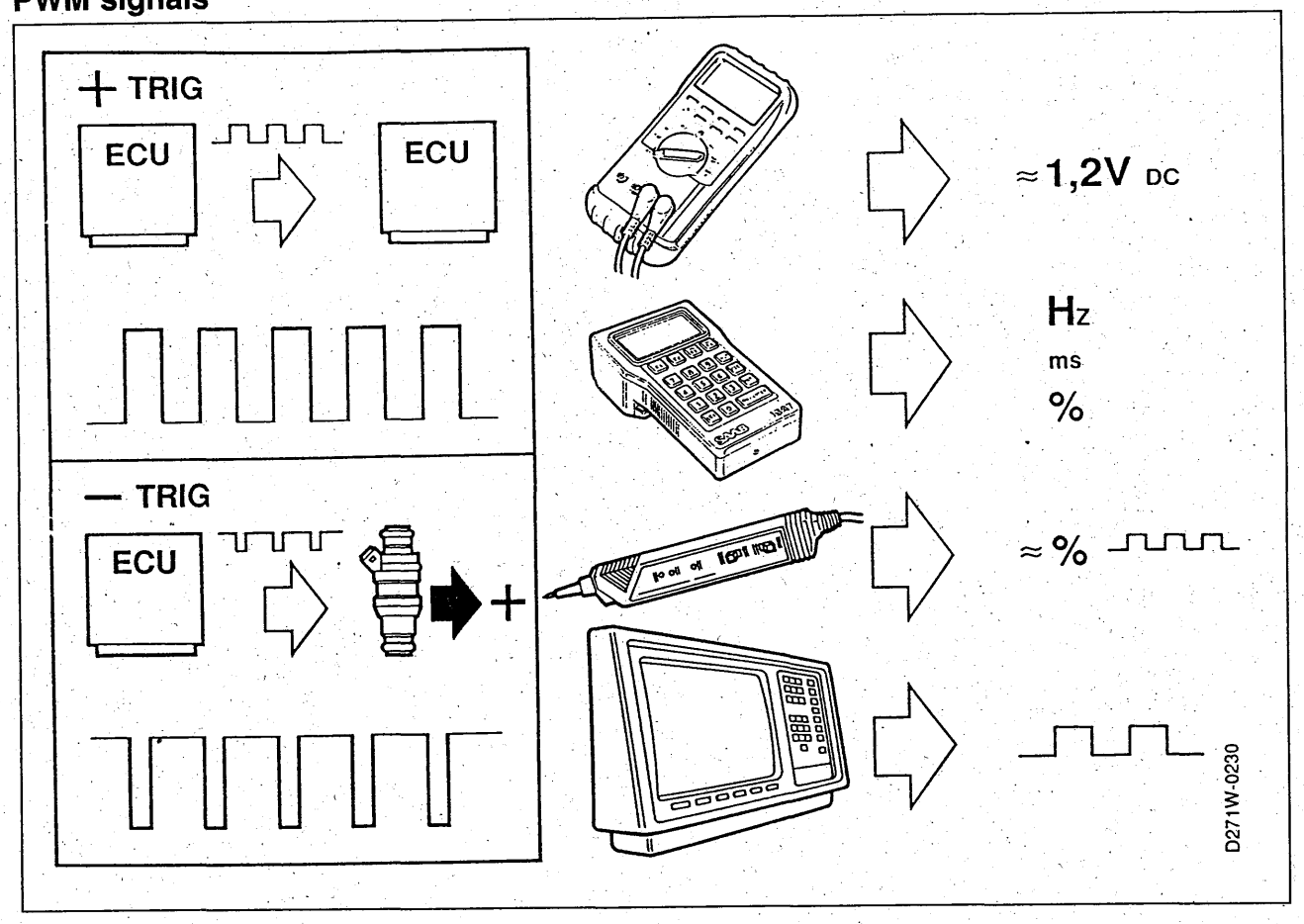
1 Make sure that the lead to be checked is not live and that any load is disconnected.

2 With the instrument set for measuring resistance, connect one of the probes to the load side of the wiring harness and the other probe to a good grounding point in the car.

3 Carefully touch the wiring and check at the same time that the instrument continues to show infinite resistance (OL).

General test methods (contd.)

PWM signals



Measuring PWM

PWM **signals** , that is to say communication **between** control modules, are always positive triggered, i.e. the pulse is a battery positive (B+) pulse. Other PWM outputs (inputs) are generally negative-triggered, for example the injectors which are constantly positive powered and pulsed with ground from the control module.

Measuring with voltmeter

If you measure PWM with a voltmeter, the voltmeter will show the average voltage on the cable. This means that the average voltage increases as the pulse ratio increases.
Using the voltmeter it is possible to obtain a rough estimate of the pulse ratio. With a pulse ratio of 9%, about 1.2 V (0.09 x 13 V = 1.17 V) will often be obtained.
In the case of positive-triggered PWM, connect the red test lead to the cable and the black test lead to a good grounding point.
In the case of negative triggered PWM, connect the black test lead to the cable and the red test lead to battery positive (B+).
If the voltmeter is equipped with a Smooth feature, use this.

Measuring with an ISAT scan tool or multimeter with pulse measuring feature

Connect the red test lead to the cable and the black test lead to a good grounding point. Select positive or negative trigger. Frequency, pulse duration and pulse ratio can then be measured.

Measuring with Logic Probe

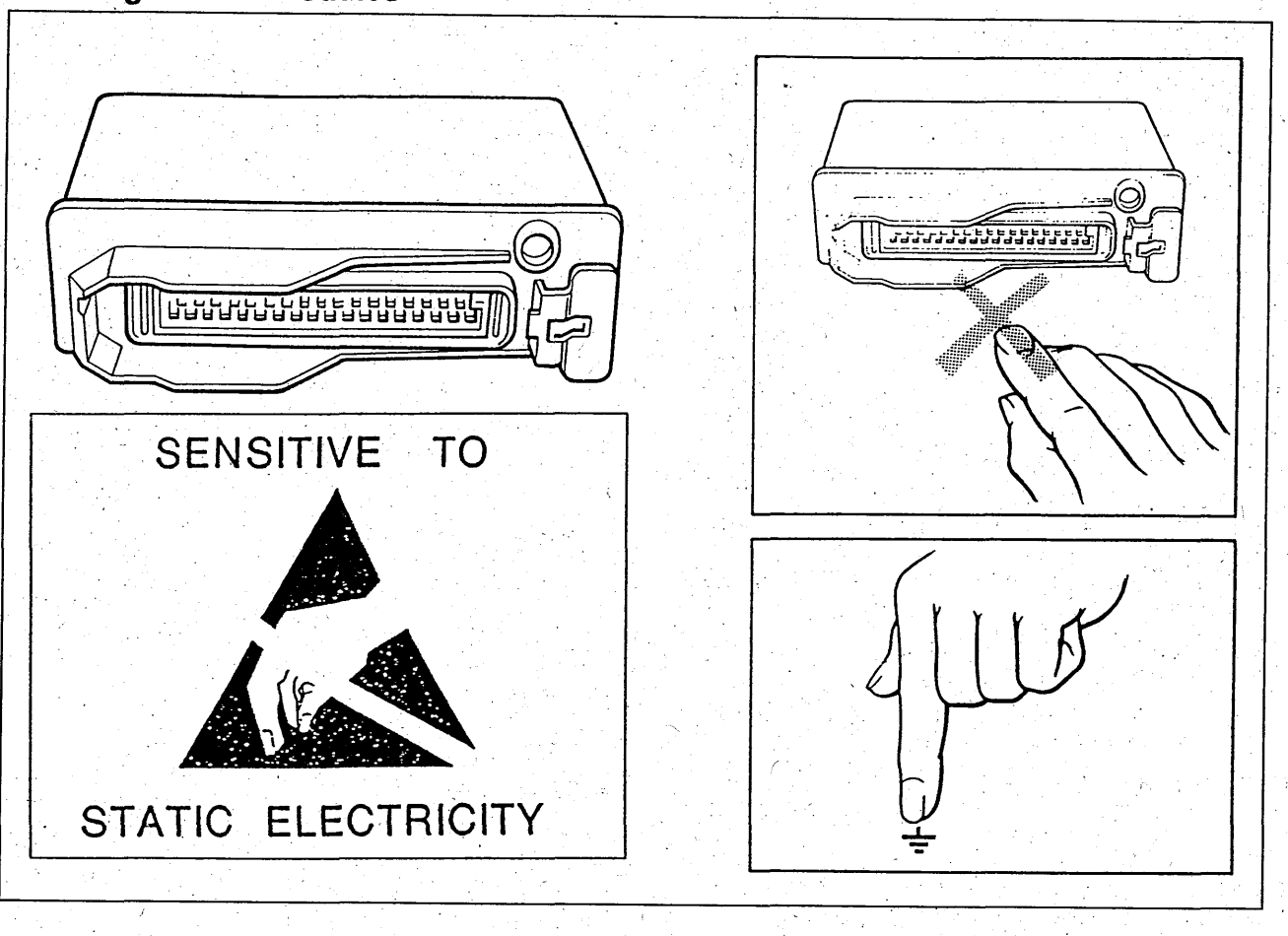
Connect to battery positive (B+) and a good ground and then place the tip of the probe on the cable. The Logic Probe will show whether pulses are present and give a rough estimate of the pulse ratio.

Measuring with an oscilloscope

Frequency and pulse duration can be read at the same time to obtain a picture of the pulses. This shows how pulse width changes when the value of the information changes.
For more information on PWM signals, see Service Manual 3:2 "Electrical system, Wiring diagrams".

General test methods (contd.)

Handling control modules



All control modules are more or less sensitive to static electricity and, if handled carelessly, may be damaged so seriously that they no longer work properly. For this reason, it is important that the following rules are followed at all times when a control module is removed or replaced for any reason.

- Avoid unplugging or removing the control module unless absolutely necessary.
- Never touch the connector pins and never place the control module in such a way that the connector pins touch anything else.
- Before unpacking a new control module, ground the packaging to the car's bodywork. Open the packaging as short a time as possible before fitting the module.
- Avoid wearing clothes made of synthetic materials and shoes with insulating rubber soles.
- When working with the control module, it is important to ground yourself regularly. This is especially important when you have been sitting in the car, when you have changed position or moved around the car and when working in climates with very dry air (e.g. winter in cold markets).
- Furthermore, always handle control modules which are suspected of being defective in the same way. This will greatly improve the chances of determining the cause of the fault.

General test methods (contd.)

Remember when fault tracing

1 SDA Mk II must always be connected to the ISAT scan tool.

2 Up to M1995 the data link connector and/or diagnostic socket is located under the right-hand front seat. In -M1994 cars there are two data link connectors (one green and one black) while M1995- cars have only one (green). M1996 and later cars have one data link connector located under the steering wheel.

3 Read and note diagnostic trouble codes stored in all systems before the battery and the control module are disconnected.

4 If no communication can be achieved between the ISAT scan tool and the control module, first check that the fuses are intact and that there is supply voltage to the fuses.

Then check the leads between the control module and the data link connector.

5 Also check that the voltage supply and the ground to the data link connector are correct and that the connector pins are not damaged and are secure.

6 There are lists of diagnostic trouble codes in each section.

Important

Diagnostic trouble codes should be used only for purposes of diagnosing faults. It is not absolutely certain that they indicate a faulty component.

7 To avoid damage to control modules and components, the ignition switch must be OFF when the BOB is connected or connectors unplugged.

8 Check that the control module grounding connections and supply voltages are correct.

9 It could sometimes be necessary to unplug connectors to check that contacts and pins are not damaged and are correctly fitted.
Reconnect all connectors and clear all diagnostic trouble codes. If possible, start/drive the car and check if the fault(s) remain.

If a faulty contact is suspected, use contact spray KONTAKT 61 (part No. 45-30 04 520) on the female pins and connector.

Important

Contact spray or grease must not be used on the oxygen sensor connectors.

10 Where indicated, 12 V is to be regarded as a level and not as an absolute value. Test readings may be directly proportional to battery voltage but 0.5-1.5 V may be lost due to an internal voltage drop in the control module's driver stage.

11 Where indicated, 0 V is to be regarded as a level and not as an absolute value. Due to an internal voltage drop in the control module's driver stage, measurements taken between the control module pins and ground could produce a reading of about 0.5-1.5 V, although this is given as 0 V in "Readings, control module connections".

12 Never switch from one unit to another (for example from volts, via amps to ohms) on the meter, without first having unplugged the instrument test leads.

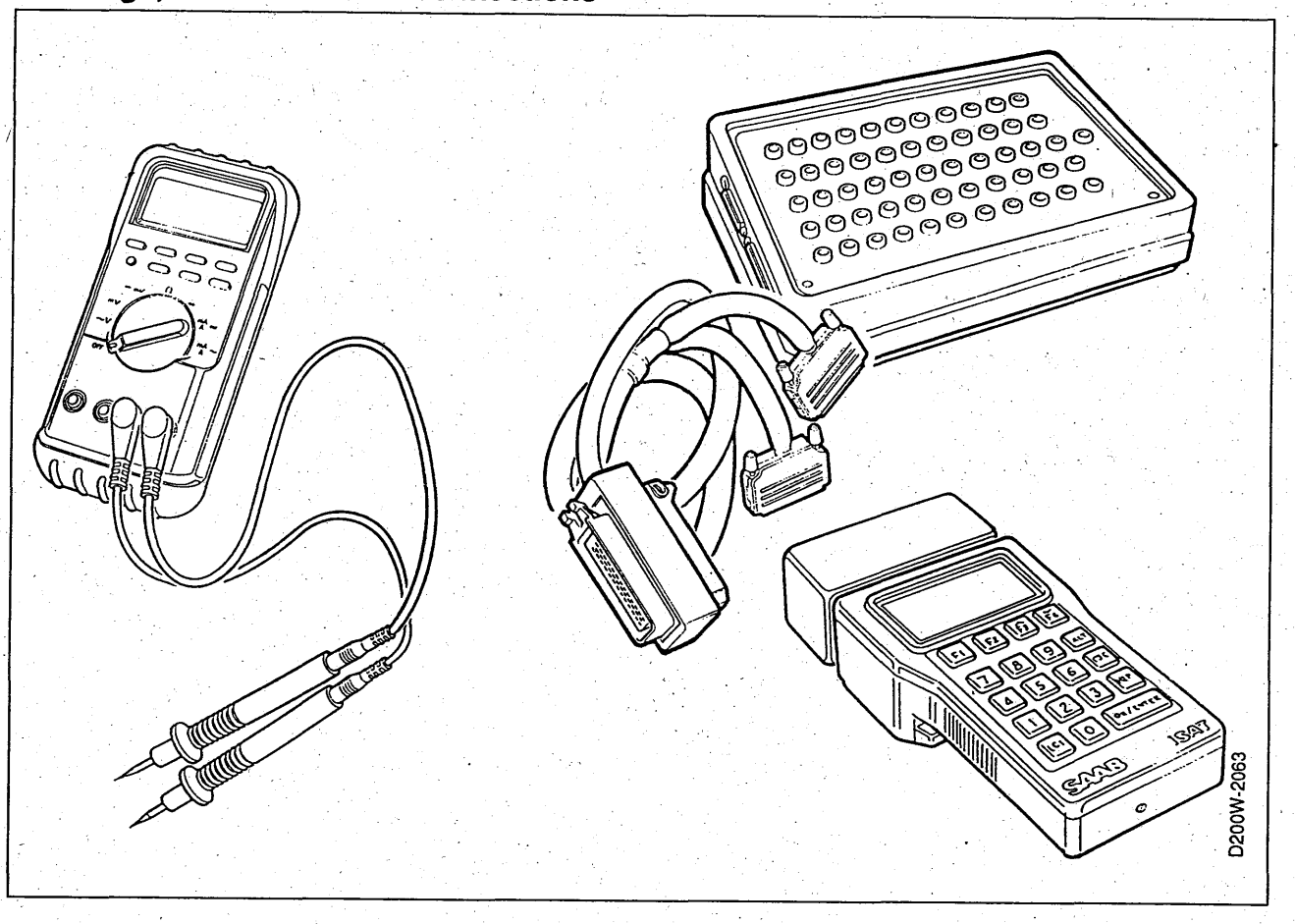
13 Resistance readings should always be taken with the ignition at OFF.

Important

After checking, always clear the fault memory using the command "CLEAR FAULT CODES".All systems can be cleared using the command "CLEAR ALL".

General test methods (contd.)

Readings, control module connections



Readings and instructions for reading voltage levels on the control module are listed under each heading.

Points to remember:

- Unless otherwise stated, all voltage measurements are taken with all components connected and with the ignition switch at ON.
- Readings are taken using the breakout box (BOB) connected between the control module and the control module connector.
- Some of the readings should be taken with the engine idling.
- Several voltage levels must be regarded as guiding values. Your common sense should tell you whether a reading is correct or not.
- If any reading is incorrect, use the wiring diagram to find out which cables, connectors or components should be checked.
- All readings are under normal working conditions (i.e. warm engine).
- Specified test readings are for a calibrated Fluke 88/97.
- The readings %(+) and ms(+) show the pulse ratio and pulse width of the signal. A test instrument with pulse ratio and pulse width measurement should be used. The sign (+) designates positive trigger pulses, TRIG+.

LH system test unit

Testing equipment consists of an instrument, a cable for voltage supply, a test lead with double connectors and a magnetic pressure sensor.
There are two designs of test lead:

- 25-pin, for cars with LH 2.2
- 35-pin, for cars with LH 2.4

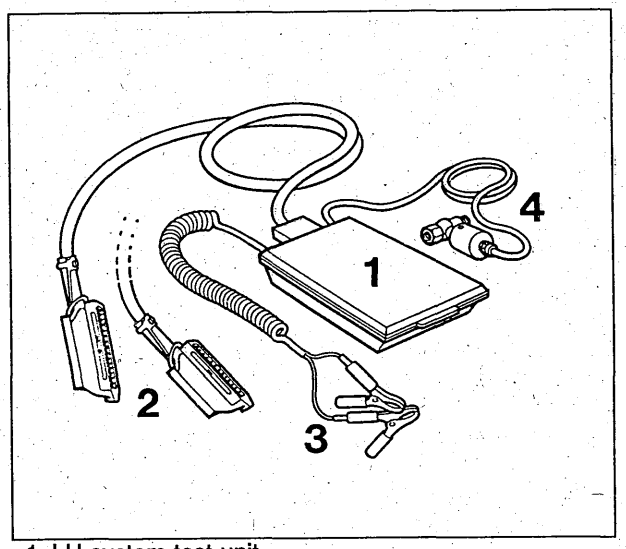
Power supply

Power supply +12V is connected to the battery with battery clamps.

Pressure sensor

The pressure sensor is connected to the LH system to measure fuel pressure.

Measuring range: 0-10 bar
Pressure class: 1%



1 LH system test unit
2 Signal cable, between control module and test unit
3 Cable with battery clamps
4 Pressure sensor for measuring fuel pressure

Connection to car

The connection is made between the control module and the car's wiring harness with a double connector (male-female type) and a 2 metre long replaceable cable.

1 Uncover the control module by removing the cover plate over the false bulkhead space on the left-hand side.

   If the car is equipped with ABS brakes, remove the ABS control module and its bracket.

   Remove the control module retaining screws.

2 Connect the instrument by connecting the cable with the double connector between the control module and the car's wiring harness.

   For cars with LH 2.2, a 25-pin connector is used and for cars with LH 2.4, a 35-pin connector is used.

3 In order to avoid damage caused by crushing, run the cables between the door and the body where the sealing strip divides and then in under the rear edge of the bonnet on the left-hand side.

Connect the clamps to the battery, first negative (-) and then positive (+).

Important

Check that the battery terminals are clean so that the connection is good. Always make sure that the power cable is connected to the instrument before the connection is made to the battery.

LH system test unit (contd.)

Before starting work

Before starting fault diagnosis with the LH tester, it is advisable to check first, via the built-in fault diagnosis system in LH 2.4 cars, that there are no intermittent faults stored in the LH control module.

When connecting the LH tester to the system, the power supply to the control module is interrupted, resulting in the control module's fault memory being cleared and the direct possibility of detecting intermittent faults disappearing.

This is also the case when one of the battery leads is disconnected.

In a computerized fault tracing system such as the LH system test unit, programmed values are used as references for certain parameters that are to be checked.

The reference level in the software must be balanced at a level where any faults are detected within what in certain cases are very narrow limits. This means that in these cases, a fault might sometimes be detected without any fault actually existing.

This can only happen under operating conditions that are significantly different from normal driving conditions.

The following are examples of faults that can be detected under these circumstances:

LH 2.2	LH 2.4	
E0020	E013	Warming up too slow, i.e. thermostat fault or lengthy idling in extremely cold conditions.
E020	E020	Lengthy engine braking, signal level from oxygen sensor faulty.
E207	E207	Wide open throttle acceleration for long period; mass air flow sensor voltage abnormally high.
E113	E118	Engine rpm excessive, overrevving cut-out tripped, boost pressure too high.

It is often the case that the fuel injection system is suspected of being faulty, when the fault is actually in the engine itself or in the electrical system. Check the following before testing the injection system:

- Battery condition
- Charging system
- Ignition system (setting, spark plugs, cables, distributer cap, rotor, etc.)
- Battery connections and grounding point
- Engine condition (compression, vacuum in intake manifold, etc.)
- Air leakage in turbo/intake system

In certain cases, it may be an advantage to quickly check the main relay and the pump relay as follows:

1 Unplug the connectors from the LH control module and the mass air flow sensor.

2 Connect a breakout box (BOB).

3 **LH 2.2**
Ground pins 17 and 21 to pin 25.
LH 2.4
Ground pins 20 and 21 to pin 17.

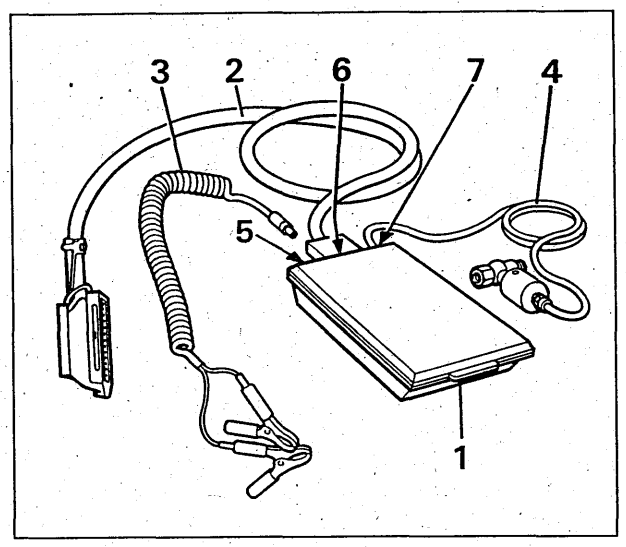
4 Check that current is supplied to:
LH 2.2 on:
pins 9 and 13 (LH control module)
pin 2 or pin 5 (mass air flow sensor)
pin 2 (IAC valve)
fuse 14 (fuel pump relay)
LH 2.4 on:
pins 9 and 18 (LH control module)
pin 5 (mass air flow sensor)
fuse 14 (fuel pump relay)

ABS system test unit

Saab's ABS system test unit has been developed to ensure that it is possible to carry out servicing and fault diagnosis on Saab's antilock brake system in an efficient and reliable manner.

The test equipment consists of the following components:

1 Test instrument
2 Signal cable with double 35-pin connector
3 Cable for power supply
4 Pressure sensor with connecting hose
5 Socket for connection of power cable
6 Socket for connection of signal cable
7 Fitting for connection of hose to pressure sensor.



Three different tests can be carried out with the test equipment:

a. Automatic test of each wheel speed sensor with signal cable and the pressure in the brake system accumulator.
b. Manual valve test.
c. Manual test of each wheel speed sensor with signal cable and the pressure in the brake system accumulator.

ABS system test unit (contd.)

Connecting the test instrument

1 Turn the ignition switch to OFF.

2 Remove the cover plate from over the false bulkhead space on the left-hand side.

Remove the control module securing clip.

Remove the control module.

3 Connect the signal cable with the 35-pin connector between the control module and the connector in the car's wiring harness.

Secure the connector with a cable tie around the control module and its connector.

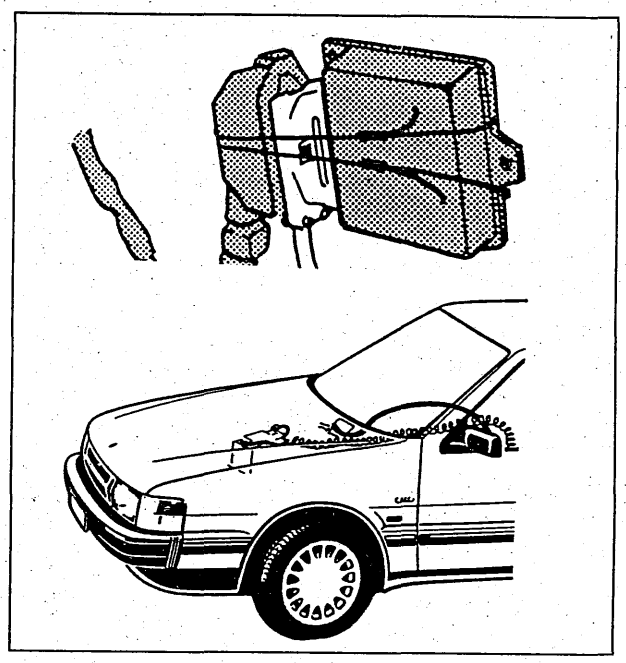
Pass the cable in through the front side window.

Connect it to the socket on the test instrument.

4 Connect the power supply cable clamps to the battery (negative terminal first).

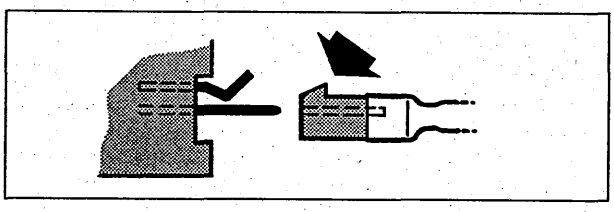
Run the power cable in through the front side window and connect it to the socket on the test instrument.

The program then automatically selects "ABS type I"



Important

When the 35-pin connector is connected to the ABS system tester, the power supply cable must also be connected. If it is not, the electronic circuits in the ABS tester could be ruined. This applies if the ABS tester is connected for a long period without testing taking place.
In order to avoid damage to the test instrument when it is connected to the power supply cable, make sure that the connector is plugged into the right socket.



⚠ WARNING

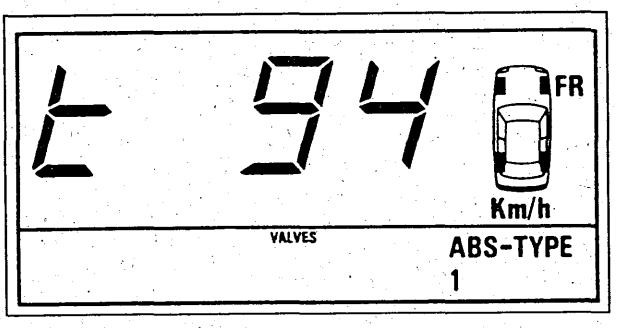
The ignition switch must be turned to the OFF position before the signal cable connector is unplugged from the control module. Otherwise, there is a danger of destroying the control module.

ABS system test unit (contd.)

Selecting the type of ABS system

When the test instrument is powered, the test program automatically selects "ABS type 1". This corresponds to a toothed wheel with 94 teeth, which was fitted in all model year 1989 and earlier Saab cars.

The letter "t" (stands for teeth) is shown on the display as well as "94", which indicates the number of teeth. The text "ABS type 1" is also displayed, which is the automatically selected system.



On model year 1990 and later cars, the number of teeth is changed to 46, which means that "ABS type 2" must be selected for these cars.

Selection of ABS type should be made within 4 seconds after connecting the power supply, by simultaneously pressing the two function keys. The text "t 46" and "ABS type 2" is then displayed.

After selection of the ABS system, the program automatically goes over to "Manual test sequence" after a couple of seconds.

Diagnostic trouble code 009

When using the ABS system tester on model year 1990 cars, the test unit always registers diagnostic trouble code 009. The reason for 009 is that the voltage level between pins 9 and 10 on the electronics unit in model year 1990 cars is significantly lower than on electronics units in earlier model year cars and the ABS tester registers this as a fault. If this diagnostic trouble code is displayed in combination with other diagnostic trouble codes, 009 should be rectified last. If the ABS warning lamp is lit and only fault code 009 is displayed, follow the recommended action for this diagnostic trouble code.

ABS system test unit (contd.)

Connecting the pressure sensor

> ⚠ **WARNING**
>
> Before starting work, the brake system must be depressurized. Press the brake pedal about 20 times or until there is a noticeable resistance in the pedal.

1 Remove the fuse holder from model year 1990 and later cars.

2 Remove the pressure accumulator using an 8 mm Allen key.

3 Fit the connecting hose to the hydraulic unit.

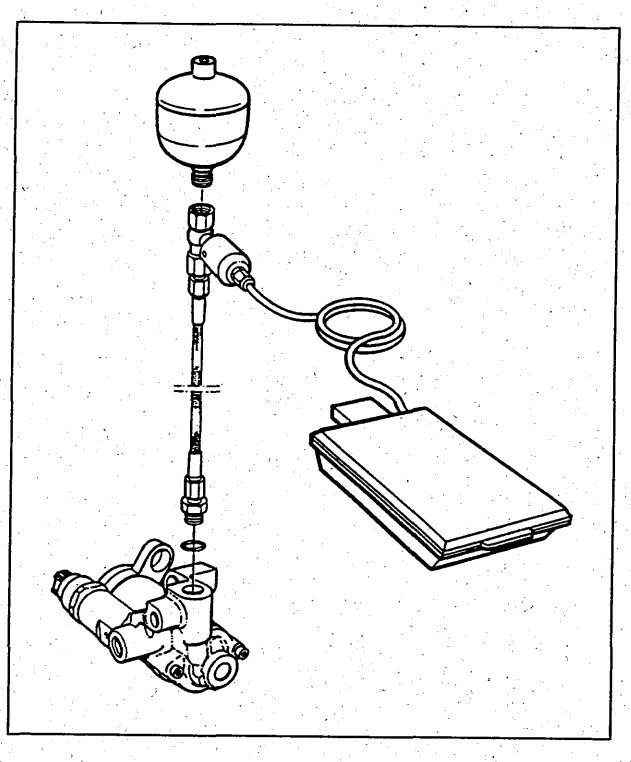
4 Fit the pressure sensor to the hose.

5 Fit the pressure accumulator to the pressure sensor.

Position the pressure accumulator so that the bonnet can be closed.

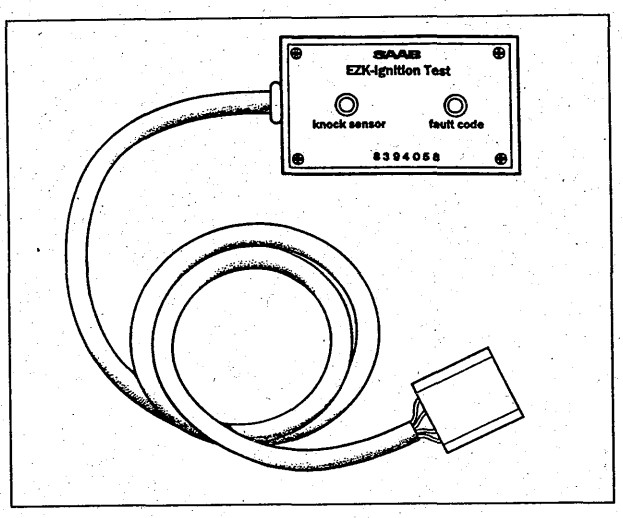
6 Refit the fuse holder temporarily.

Before removing the pressure sensor, the brake system should again be depressurized.



EZK system test unit

In Saab'sEZK ignition system, there is an automatic fault tracing feature. When testing performance or carrying out fault diagnosis, stored diagnostic trouble codes can be read using a test instrument. The test instrument LEDs (one green and one red) give the reason for any fault with flashing codes. The flashes on the green LED correspond to the flashes of the malfunction indicator (**CHECK ENGINE**) lamp and the diagnostic trouble code is read from the fault diagnosis schedule. Flashing of the red diode indicates knocking.



Connection and obtaining readouts of diagnostic trouble codes

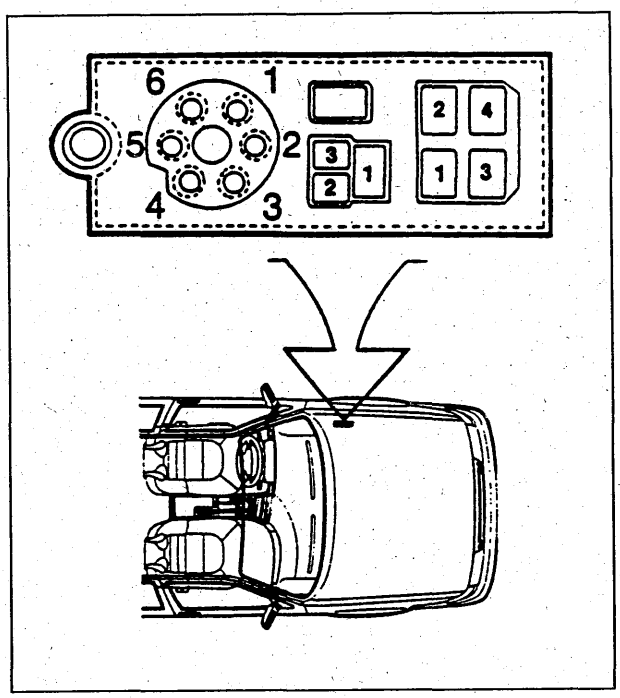
1 Connect the system test unit to the 4-pin socket.

NOTE: The ignition must be off.

2 Switch on the ignition and start the engine. Check that the LED for fault indication (green) is lit for about 2 seconds while the starter motor is working.

3 Let the engine run until it reaches its normal working temperature. At some stage during the warm-up process, engine speed must momentarily go over 2300 rpm.

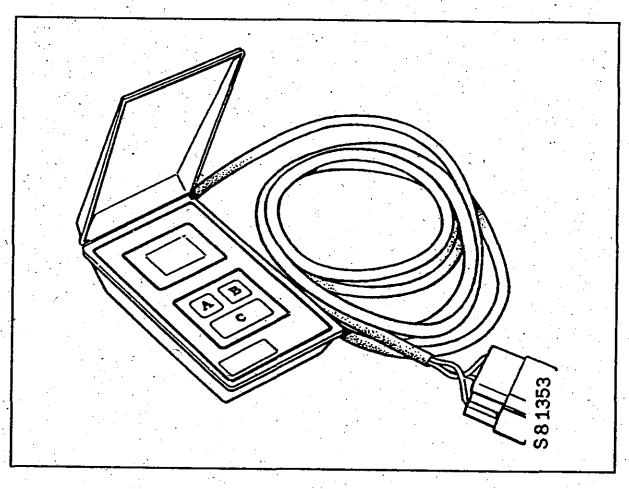
4 Allow the engine to idle and note the number of flashes from the LEDs. Read the cause of the fault.



Airbag system test unit

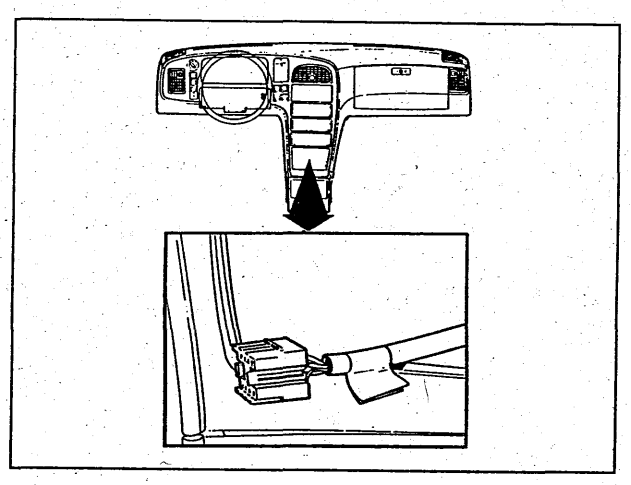
Saab's SRS system test unit consists of an instrument with connecting cable and connector.

All faults that arise in the system, permanent or intermittent, are stored in the control module and can be read using the test unit.



Connection to car

The test unit is connected to the special SRS data link connector, located under the radio compartment. Connection is via a connector and a 1 metre long cable.



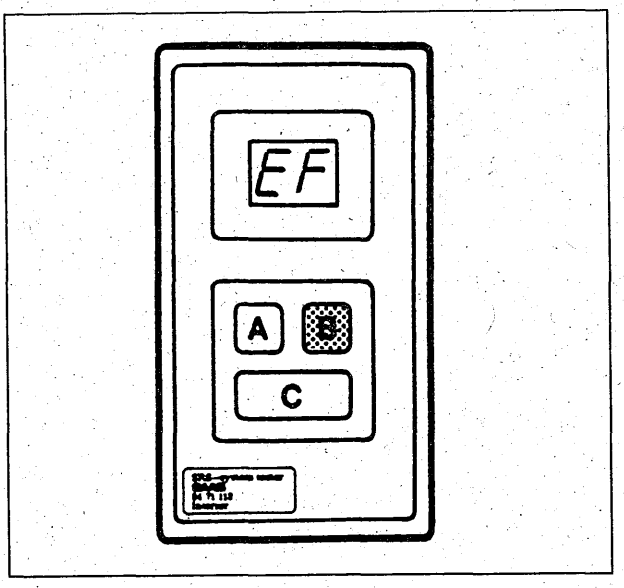
Airbag system test unit (contd.)

Checking external faults (such as in the wiring harness or sensors)

1 Press "B". "EF" shows on the display.

2 Then press "C".

When "C" is pressed for the first time, the SRS code (system designation) is displayed. When it is pressed for the second time, the program version, etc. is displayed as in the table.



Ex.	Explanation
41	SRS system designation
03	Program version
01	Number of hours of fault* (first fault)
15	Number of minutes of fault* (first fault) (Displayed in intervals of 5 minutes)
2d	Diagnostic trouble code (2 digits/characters)

* If the time exceeds 99 hours and 55 minutes, 99 hours and 99 minutes is shown.
If there are several faults stored, the test unit proceeds (when "C" is next pressed) directly to the next diagnostic trouble code followed by type of fault. When all faults have been gone through, "EF" is shown on the display. If "C" is then pressed, the test unit starts again from the beginning and shows the code for SRS (system designation) and so on.

Airbag system test unit (contd.)

Checking internal faults (in the control module)

1 Press "A". "IF" is shown on the display.

2 Then press "C".

Procedure and code sequence are the same as for external faults.

Clearing stored faults

1 Press "A" and "C" at the same time. The display shows "Er".

2 Then press "C".

When "C" is pressed for the first time the code for SRS (system designation) is shown. When it is depressed for the second time, the software version is shown, and the third press clears all faults. If clearing is correctly carried out, "01" is displayed. If not, "02" is displayed. (If "02" is displayed, clearing must be repeated).

If the airbag has been activated, the diagnostic trouble codes cannot be cleared.

Control module number

Every control module has its own number which is read by pressing "A" and "B" at the same time. The display will then show "tn". Press "C" repeatedly to read the entire number. The number consists of ten digits which are shown in pairs.

Fault diagnosis

Important

Before working on the system, the following must be done:

- Disconnect the negative cable from the battery.
- Unscrew the steering wheel centre pad (airbag module) and unplug the connector on the back of the airbag.
- Connect reference resistor 84 71 153 to the connector.

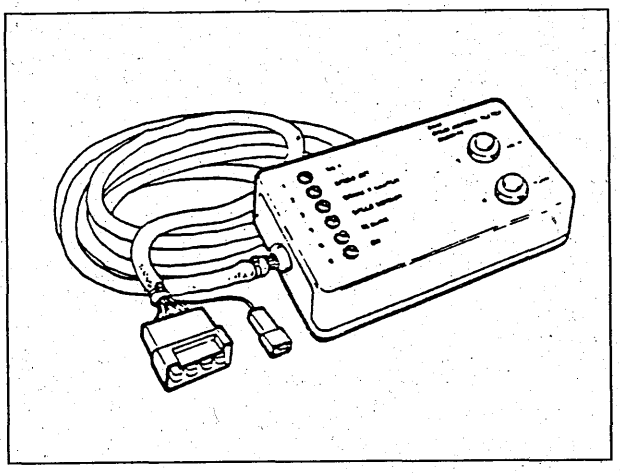
It will then not be necessary to wait 20 minutes after disconnecting the battery.

Also note the following:

- Splicing of SRS cables is not permitted. Splicing can give rise to malfunctioning, making the system unserviceable and even cause personal injury.
- If a connector is unplugged when the ignition is on, this is registered as a fault in the system. The fault does not disappear until it has been cleared.
- Permanent fault = a fault registered by the control module that is still present at the moment the ignition switch is turned to OFF.
- Intermittent fault = a fault that is registered by the control module which is **not** present at the moment the ignition switch is turned to OFF.

Cruise control system test unit

This test unit has been developed to facilitate fault diagnosis and to avoid unnecessary replacement of fault-free components in the cruise control system on model year M1991 and earlier cars.



Connecting the test instrument

1 Unplug the connectors from the electronics unit (one 8-pin and one 1-pin) and connect them the test box wiring harness.

2 Set the cruise control switch to OFF and switch on the ignition. Check that the diodes marked 1, 3 and 5 light up.

NOTE: LED 5 is most likely to light up when the car is moving.

Fault diagnosis using self-diagnostics

The fault diagnosis systems can be used for two main purposes:

- Fault diagnosis, stored faults
- Testing of components and signals (LH)

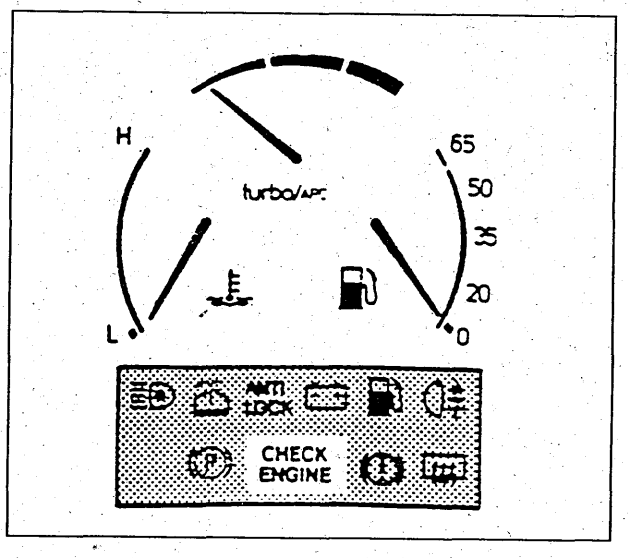
Stored faults

Faults that arise intermittently are often difficult to locate. Certain electronic systems have an inbuilt memory that makes it possible to localize and rectify this type of fault after it has occurred.

By following the instructions below, which describe how the system's memory is activated, the malfunction indicator (CHECK ENGINE) lamp in the car's dashboard will provide information on stored faults in the form of flashes (lamp-flash codes).

A certain combination of short flashes, e.g. 1+2+3+2+2 represents a particular fault. Using a list of diagnostic trouble codes, the significance of 12322 can be looked up and the fault can be rectified. In the same way, you can activate diagnostic trouble codes for faults 2 and 3 and via flashes on the malfunction indicator "CHECK ENGINE" lamp read the code in the list of diagnostic trouble codes.

Up to three faults can be stored in the control module memory, and these can be activated during fault diagnosis and give information on the type of fault. Serious faults are given priority, which in practice means that they must be attended to before the control module stores any non-"A" faults.



Testing of components and signals

It is advisable to carry out this test in conjunction with diagnosis of stored faults.

The test consists partly of checking certain key components in the LH system and partly of checking important control module signals.

In this test as well, the malfunction indicator "CHECK ENGINE" lamp will flash codes of the same type as for stored faults. In this case, however, the code is not a diagnostic trouble code but an identification code which shows which component or which signal is being tested.

Important

All reading and testing is interrupted when the ignition switch is turned to OFF.

If a serious fault is repeated, this is recorded in the memory each time the fault arises and the malfunction indicator "CHECK ENGINE" lamp lights up. When the fault is rectified, the memory may therefore need emptying for the diagnostic trouble code to "disappear". When in doubt, test drive the car.

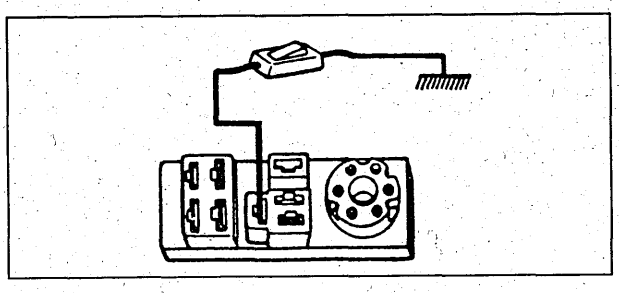
Fault diagnosis using self-diagnostics (contd.)

Reading stored faults

Important

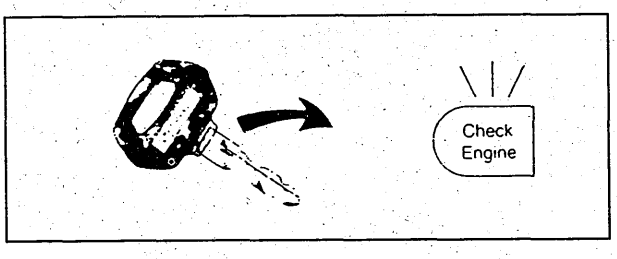
Read through the entire starting sequence before the ignition switch is turned to ON.

1 Ground pin 3 in the three-pin data link connector in the engine bay on the left-hand side. Use cable with switch, part No. 83 93 886.
NOTE: Make sure that the switch is OFF.



2 Use the malfunction indicator "CHECK ENGINE" lamp to read diagnostic trouble codes.

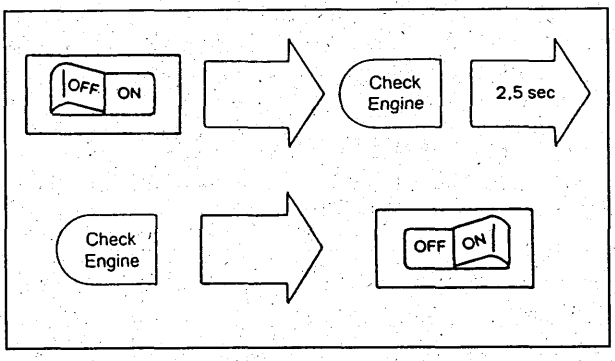
3 Turn the ignition switch to ON.
The "CHECK ENGINE" (MIL) lamp lights up.



4 Set the switch to "ON" (pin 16 of the control module is grounded).
The "CHECK ENGINE" (MIL) lamp goes out.

5 Watch the malfunction indicator "CHECK ENGINE" lamp carefully. After about 2.5 seconds it gives a short flash, which means that the first diagnostic trouble code is activated.
Switch the switch to OFF directly after the flash.

6 The first diagnostic trouble code (of three possible) is activated and will be displayed in the form of short flashes of the malfunction indicator "CHECK ENGINE" lamp directly after the activation signal.



Important

The diagnostic trouble code starts and ends with a long flash of the malfunction indicator "CHECK ENGINE" lamp. These long flashes are not part of the actual fault code, but serve as start and stop signals.
If the engine is switched off during the test, the diagnostic trouble code "12231" will be obtained as the first fault, i.e. no engine speed signal. Crank the starter motor for about 5 seconds. If the trouble code disappears the ignition signal is OK and the fault is to be found elsewhere.
As soon as confirmation is received, the switch is returned to the drive position and testing continues.

Fault diagnosis using self-diagnostics (contd.)

Next diagnostic trouble code

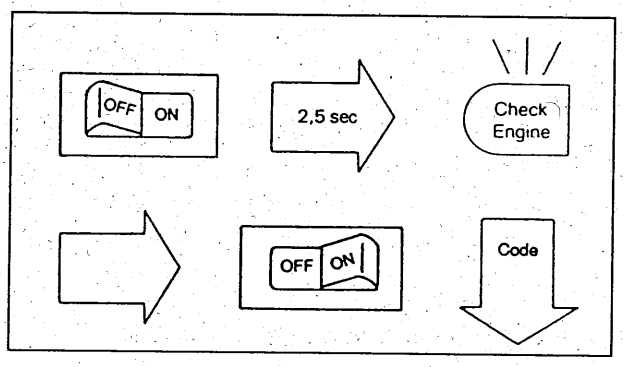
With the switch at OFF, the next diagnostic trouble code (if any) is not activated in the control module memory, but diagnostic trouble code "12112" is repeated again and again.

To check if there are two or more faults in the system, proceed as below.

7 Set the switch to ON.

8 After **a short flash** , set the switch to OFF.

Diagnostic trouble code No. 2 will then be displayed in the same way as diagnostic trouble code No. 1.



If there are more faults stored, this will be shown in the same way as the first fault, but with a separate diagnostic trouble code.

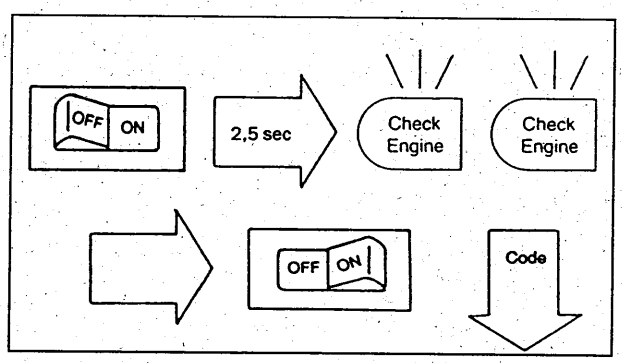
9 Any third trouble code is also read in the same way. If there is no third fault stored or all faults have been rectified, this is indicated by a series of long flashes.

Start from the beginning again

If for any reason, you want to repeat the diagnostic trouble codes from the start, this is done as follows:

1 Set the switch to ON.

2 After **two short flashes** , set the switch to OFF and diagnostic trouble code No. 1 will be repeated.

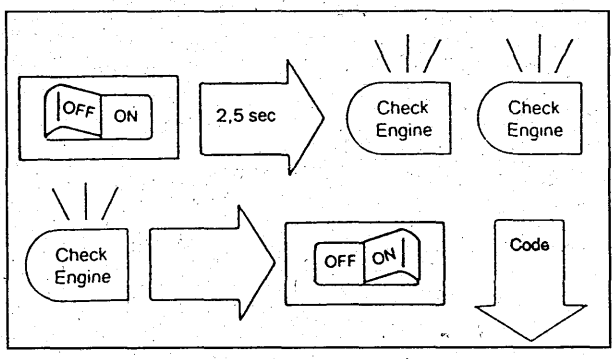


Fault diagnosis using self-diagnostics (contd.)

Clearing the memory

1 Set the switch to ON.

2 After **three short flashes** , set the switch to OFF.
The memory is now cleared.



Important

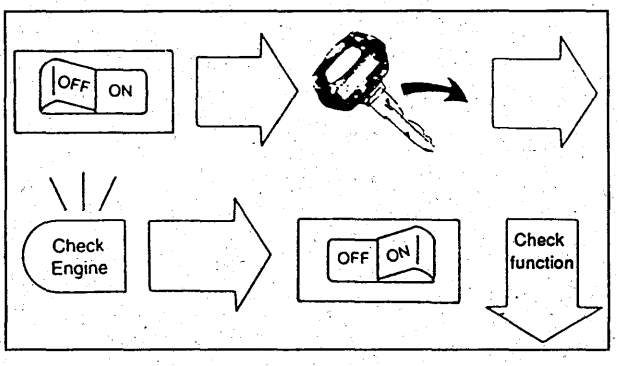
The memory can only be cleared after the code "00000" has been displayed (end of diagnostic trouble codes).

Testing of components and signals

Testing is carried out starting from point 1 and covers all points up to point 7, see table. Connection is the same as for "Fault diagnosis, stored faults".

1 Set the switch to ON.

2 Switch on the ignition and wait for **one short flash** of the malfunction indicator (CHECK ENGINE) lamp, after which the switch is immediately set to OFF.
At the same time as the lamp flashes, the fuel pump should start. If not, the pump is faulty. Listen and check fuel pressure if necessary.



Important

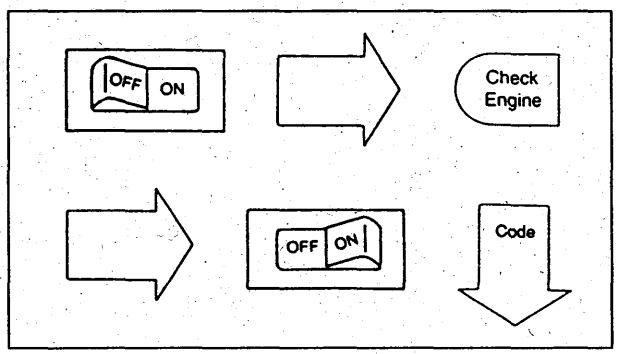
The fuel pump only runs for 1 second. No ID code is given during this test.

3 To proceed to test No. 2, i.e. injectors, set the switch to ON.

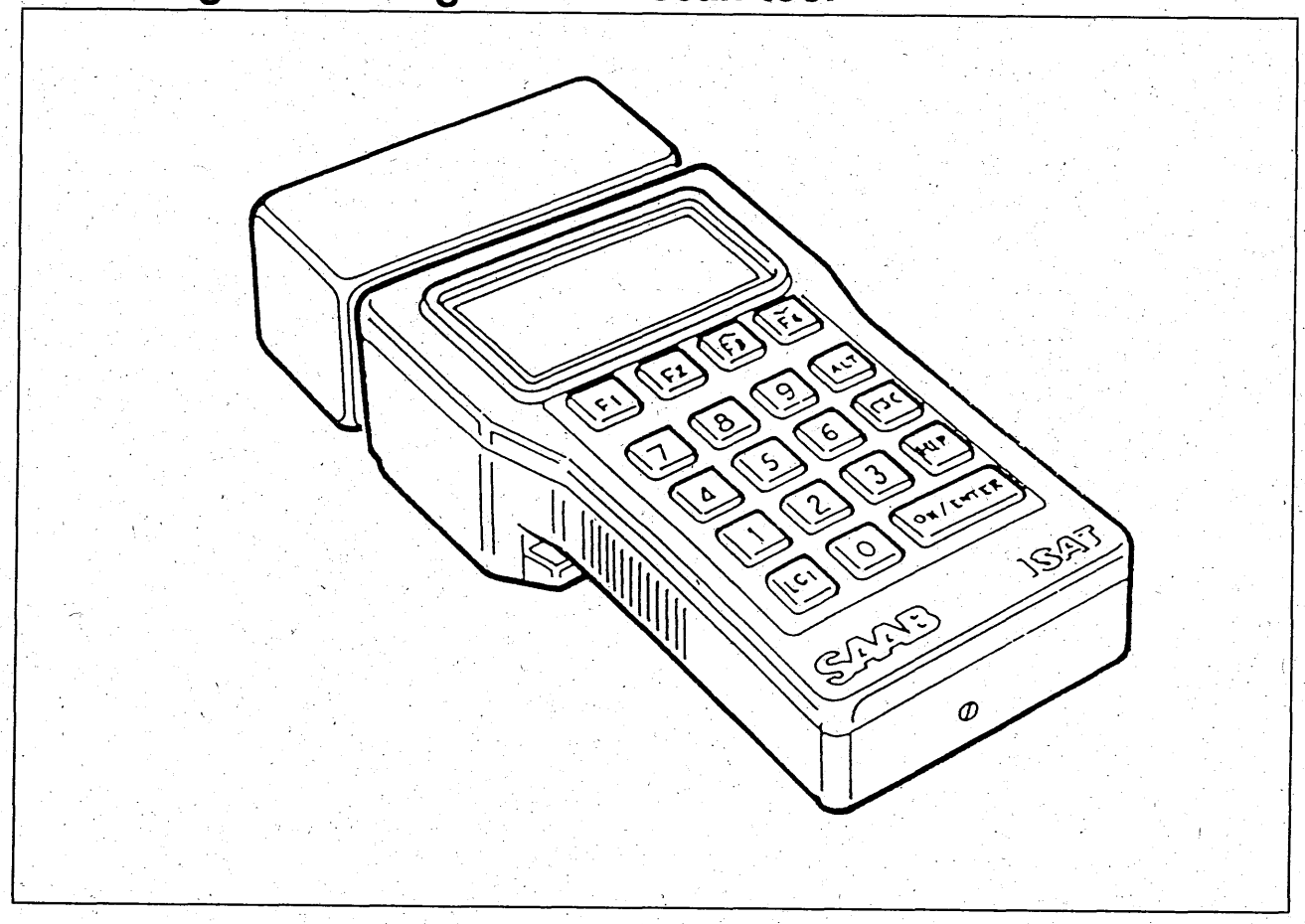
4 After **one short flash** , switch to OFF.
A code is now displayed in the same way as during "Fault diagnosis, stored faults", i.e. one long flash starts and ends the actual code, which consists only of short flashes.

Check by listening that the injectors are working.

5 Run through the remaining points in the table in the same way. Set the switch to ON — wait for a short flash — switch to OFF.



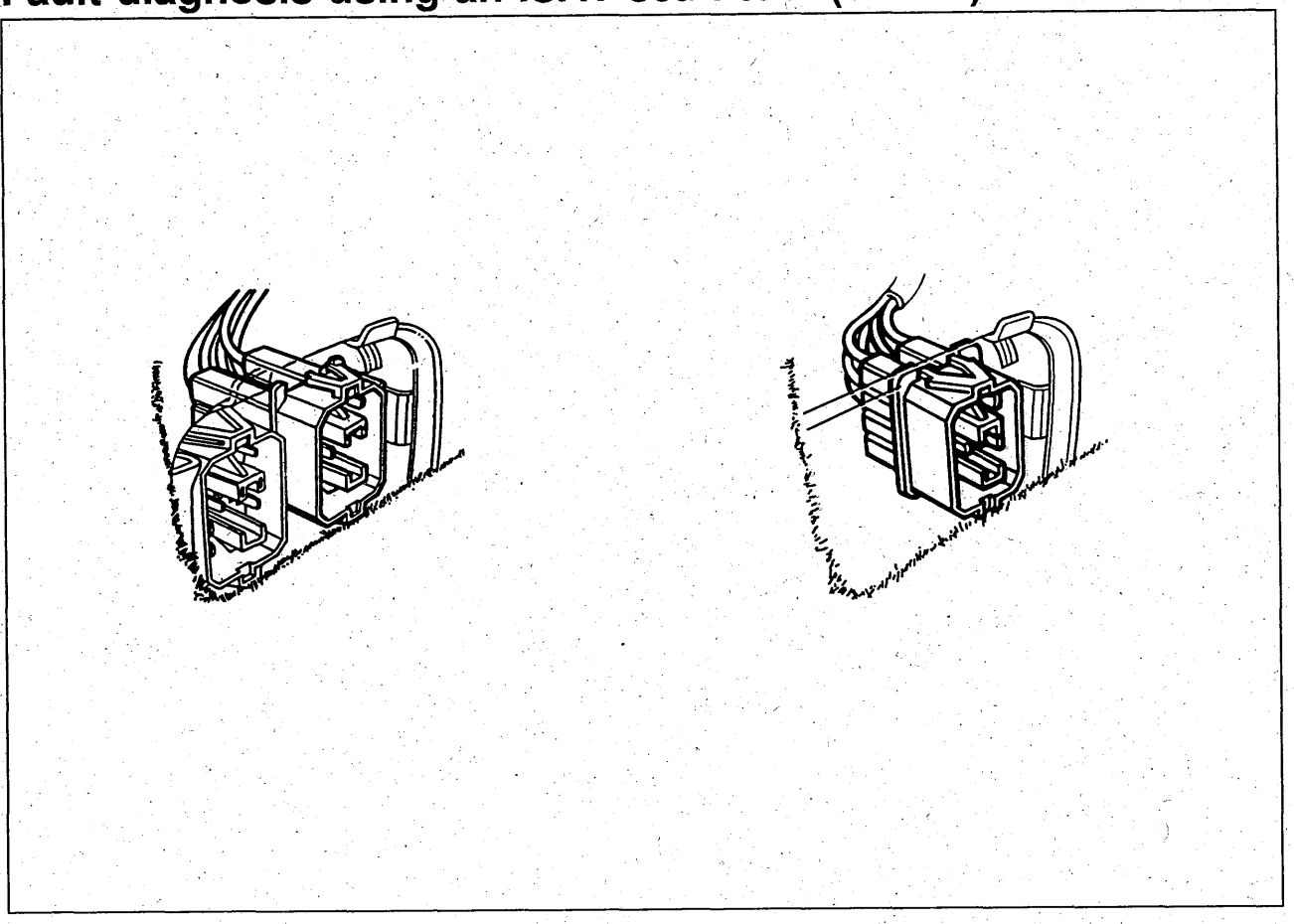
Fault diagnosis using an ISAT scan tool



The ISAT (Intelligent**SA**ab**T**ester) scan tool is primarily intended for fault diagnosis on electronic systems designed with self-diagnosis, such as Saab DI, LH, TCS, EDU, ACC 2, etc. In this type of system, any faults that arise, including intermittent faults, are diagnosed and stored in the system's control module (ECU). Using the ISAT scan tool, the fault information stored in the system is copied and the fault is presented in the form of a five digit code on the ISAT scan tool display.

For information on how the instrument works and how to operate it, see Service Manual 1:4 ISAT scan tool.

Fault diagnosis using an ISAT scan tool (contd.)



Data link connector -M1994

The car has two data link connectors
- Black (347)
- Green (348)

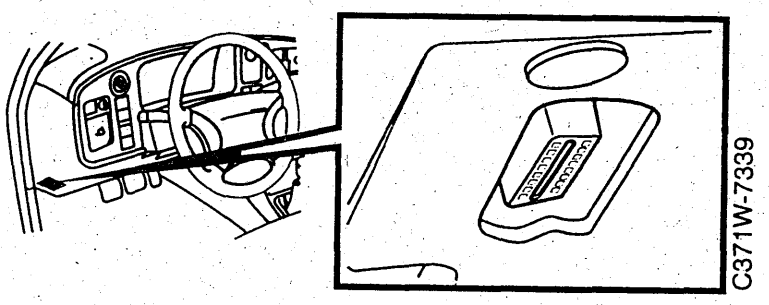
Pin	System (Black)	System (Green)
1	K line	K line
2	LH/EZK/LUCAS (L line)	EDU (L line)
3	DI/APC (L link)	ACC (L line)
4	ETS (L line)	ABS (L line)
5	No connection	Left-hand seat with memory (L line)
6	No connection	Right-hand seat with memory (L line)
7	No connection	No connection
8	No connection	Airbag (L line)
9	B+	B+
10	Ground	Ground

Data link connector M1995

The car has one data link connector
- Green (348)

Pin	System
1	K line
2	Motronic 2.8.1 (L line)
3	ETS (L line)
4	ABS (L line)
5	Seat with memory (L line)
6	No connection
7	No connection
8	No connection
9	B+
10	Ground

Fault diagnosis using an ISAT scan tool (contd.)



Data link connector M1996

The car has one data link connector (348)

Pin	System
1	No connection
2	No connection
3	No connection
4	Ground
5	Ground
6	Motronic 2.8.1 (L line)
7	Motronic 2.8.1/5.2/Trionic/anti-theft alarm (VSS)
8	ABS/ACC/EDU/Driver's seat with memory/SRS/Anti-theft alarm (not VSS)/TCS
9	No connection
10	No connection
11	Driver's seat with memory (L line)
12	No connection
13	No connection
14	Fuel pump
15	ABS (L line)
16	B+

Fault diagnosis using an ISAT scan tool (contd.)

ISAT scan tool points to remember

Communication with Trionic

Communication between the ISAT scan tool and the Trionic control module is normally possible

- With the ignition switch ON
- When idling.

Fault diagnosis that requires communication at engine speeds higher than 2500 rpm is difficult to accomplish.

At high engine speeds, the Trionic gives priority to its basic functions and the diagnostic function can be switched off. The result of this is that the Trionic is not able to achieve communication with the ISAT scan tool. The ISAT scan tool then shows "CONTACT NOT MADE".

Communication with ACC -M1994

Communication between the ISAT scan tool and the ACC -M1994 can cause general communication problems with all electronic systems in the car (green connector). The reason is that the ACC system does not meet certain specifications for communication. Unfortunately, this also affects other electronic systems in the car.

If problems are a nuisance, disconnect the ACC system in the following way:

- Turn the ignition switch to OFF.
- Remove fuses 1 and 17 for the ACC system
- Turn the ignition key to ON.

Diagnosis of other electronic systems in the car can now be carried out.

Static electricity, ESD

See the text on page 5. This applies especially to the ISAT scan tool. Electrostatic discharges on the ISAT scan tool display can destroy it.

Connection

Connecting and disconnecting the ISAT scan tool to and from the data link connector **must be done with the ignition switch OFF** .

Ending communication

After completed diagnosis, when communication between the selected system and the ISAT scan tool is to be ended, the command "END" is recommended.

ISAT scan tool software freeze

When using the ISAT scan tool, the software can freeze, where the screen either freezes or goes blank.

The cause is internal software faults in the ISAT scan tool. It does not help to press keys, and the only way to reset the ISAT scan tool program is to disconnect the internal batteries and short the two terminals.

Important

A faulty battery can jeopardize communication between the car and the ISAT scan tool.

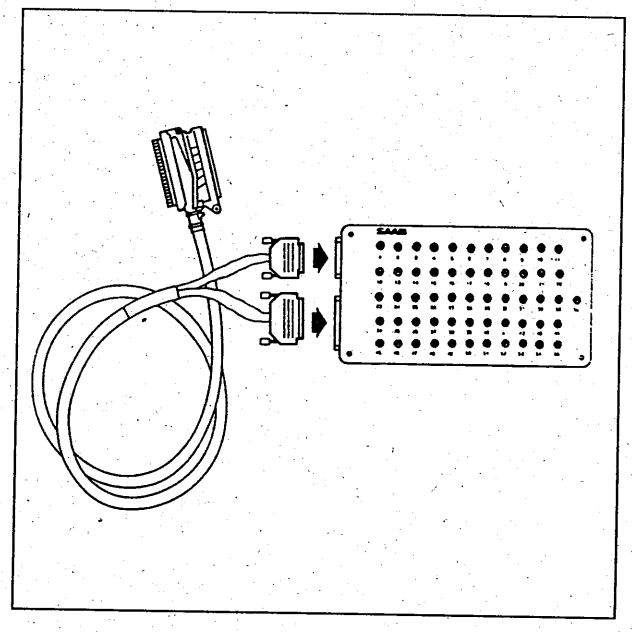
Breakout box (BOB)

The breakout box (BOB), part No. 86 11 006, is used on certain systems to facilitate control module testing when diagnosing faults.

The breakout box is connected between connector and control module using a special test cable assembly which switches the test points out to numbered sockets on the breakout box to facilitate reading.

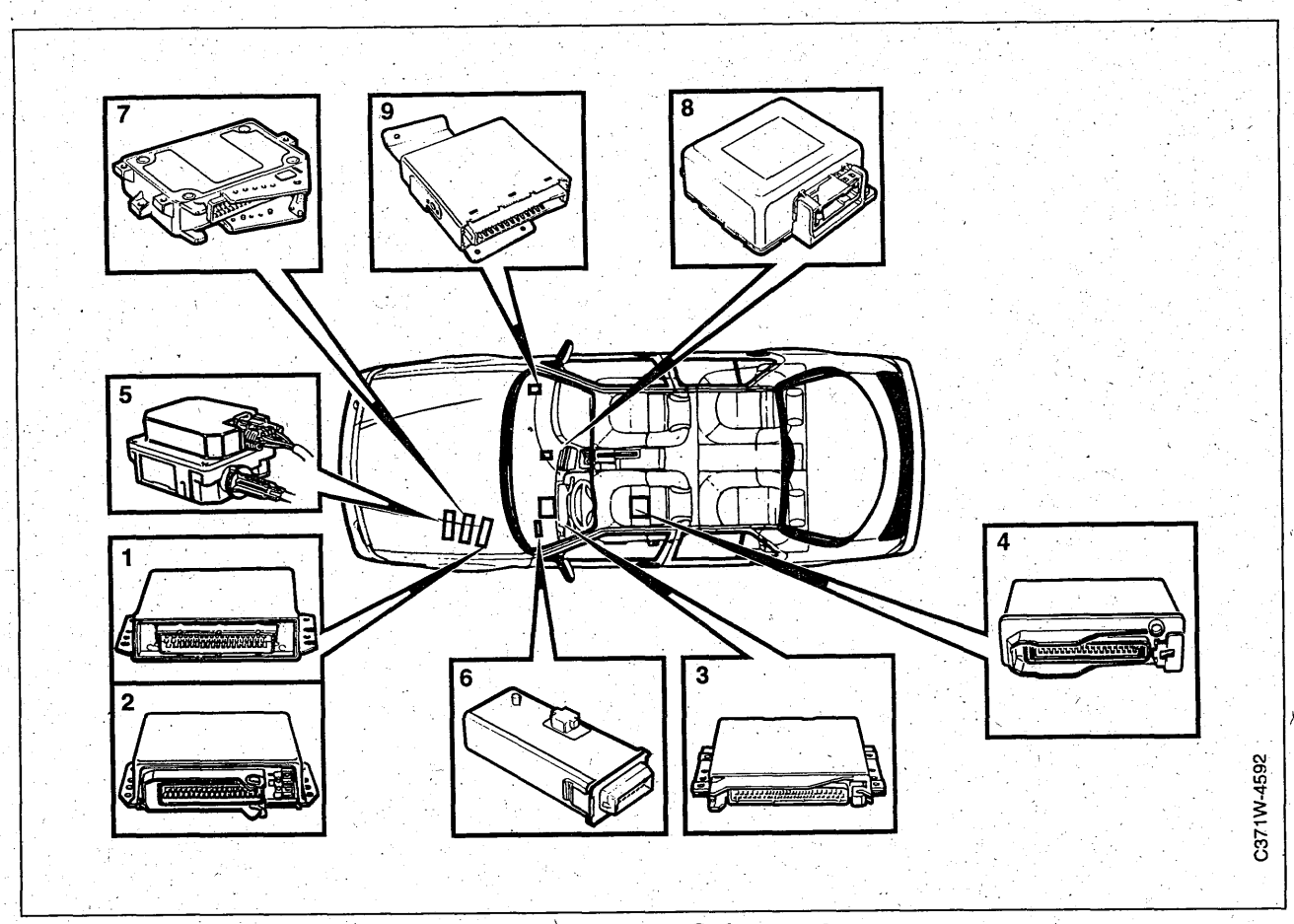
Each individual system has a special test cable assembly.

For further information about test cable assemblies, see Service Manual 1:3 "Special tools".



Location of control modules

M1996



Engine management system

1 **Trionic**

2 **Motronic 2.8.1**
The control modules are located on a bracket in the false bulkhead space. The bracket is mounted on the left-hand side of the front upper bulkhead partition.

3 **Motronic 5.2**

4 **TCS V6**
The TCS control module is located on a bracket under the LH front seat.

Comfort systems

5 **Cruise control**
The control module is located beside the battery tray.

6 **Central locking system**
The control module is located on a bracket on the far left-hand side under the dashboard.

Safety systems

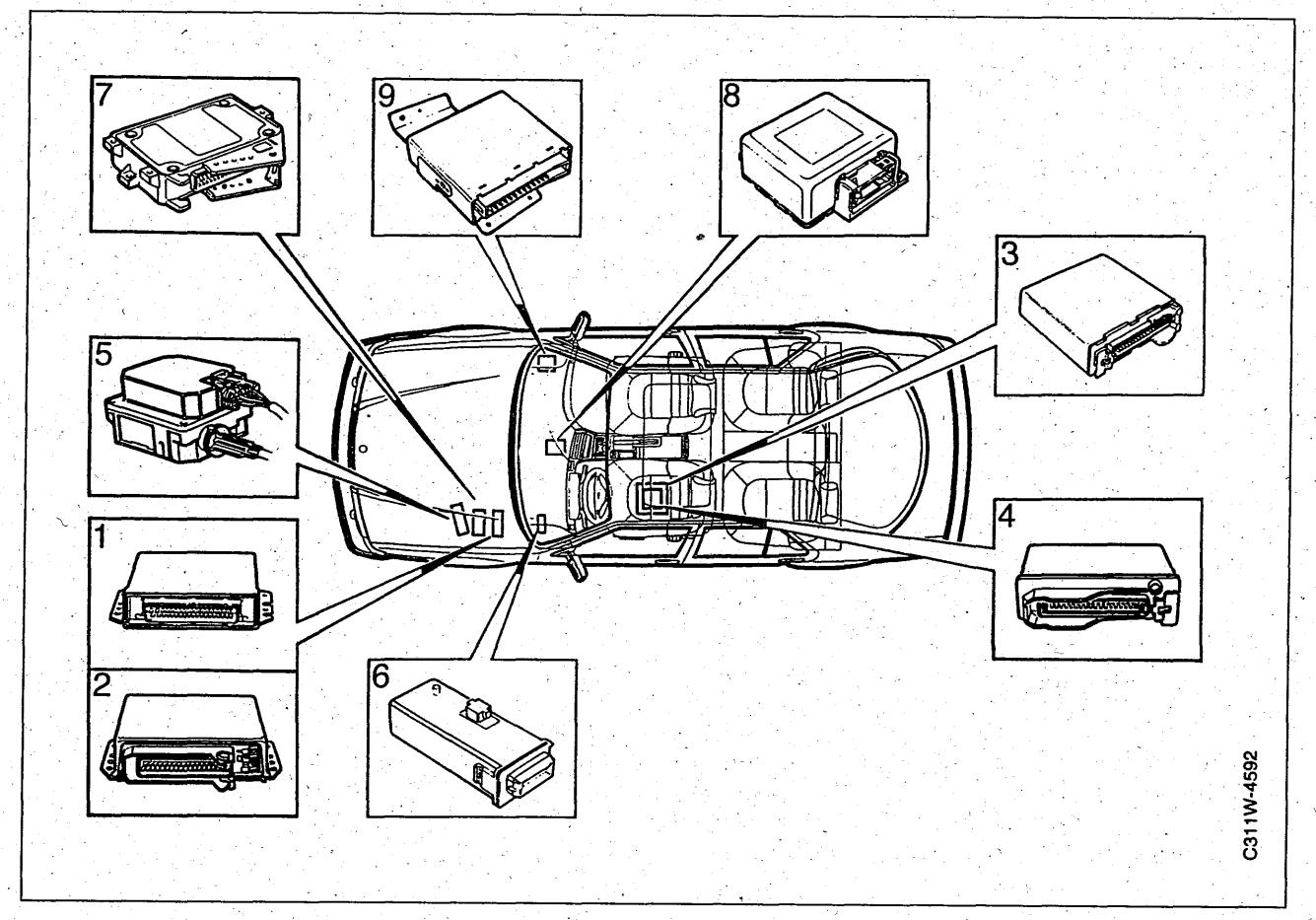
7 **ABS**
The ABS control module is mounted on the battery tray.

8 **SRS (Airbag)**
The SRS control module (airbag and belt tensioner) is located on a bracket in the front part of the centre console under the dashboard.

9 **Anti-theft alarm**
The control module is located behind the glove box and knee shield on the right-hand side behind the dashboard.

Location of control modules (contd.)

M1995



Engine management system

1 **Trionic**

2 **Motronic**
The control modules are located on a bracket in the false bulkhead space. The bracket is mounted on the left-hand side of the front upper bulkhead partition.

3 **ETS**

4 **TTS**
The control modules are located on a bracket under the left-hand front seat.

Comfort systems

5 **Cruise control**
The control module is located beside the battery tray.

6 **Central locking system**
The control module is located on a bracket on the far left-hand side under the dashboard.

Safety systems

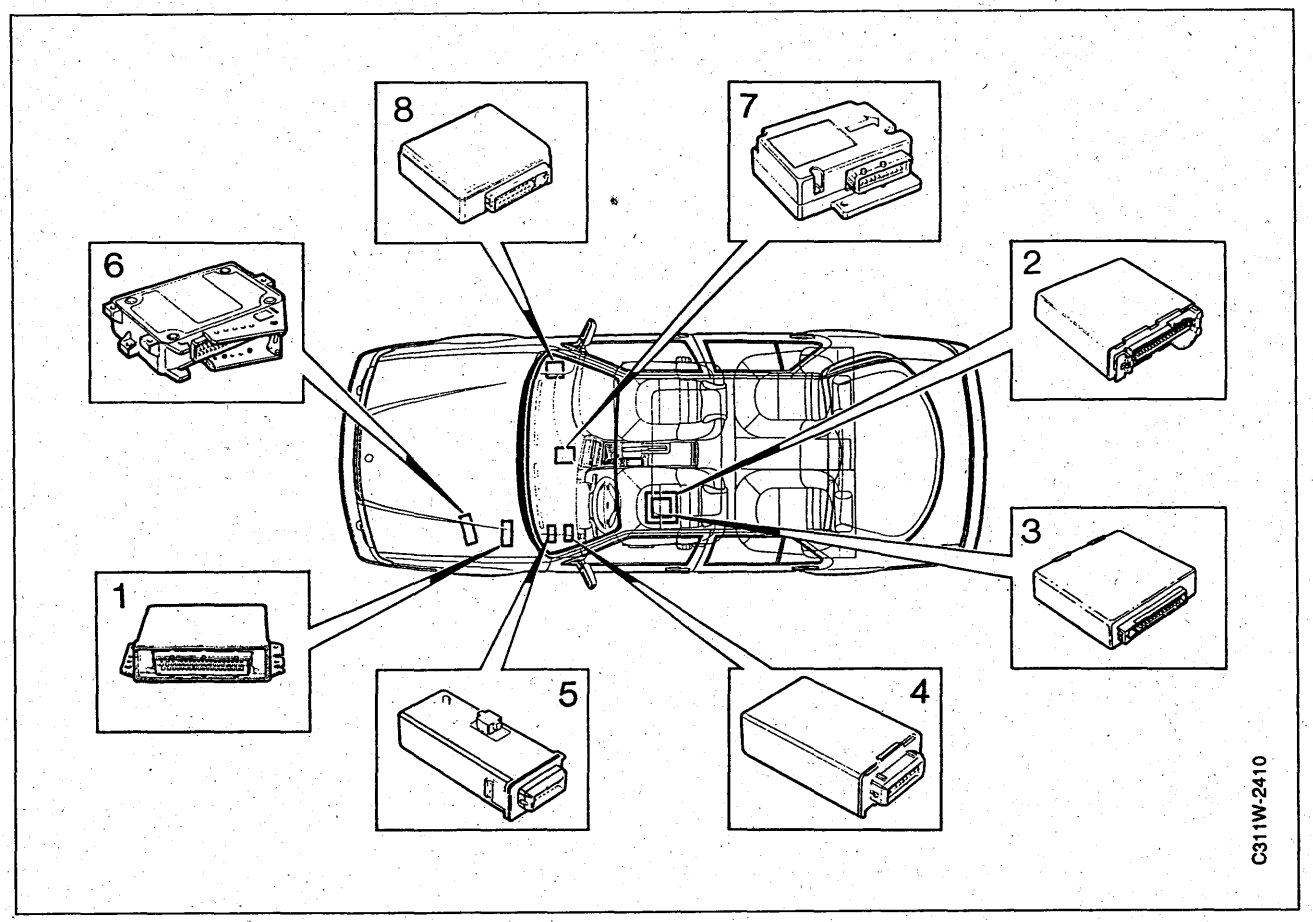
7 **ABS or TC/ABS**
The ABS or TC/ABS control module is fitted on the battery tray.

8 **SRS (Airbag)**
The SRS control module (airbag and belt tensioner) is located on a bracket in the front part of the centre console under the dashboard.

9 **Anti-theft alarm**
The control module is located behind the glove box and knee shield on the right-hand side behind the dashboard.

Location of control modules (contd.)

M1994



Engine management system

1 **Trionic**
The control module is located on a bracket in the bulkhead partition space. The bracket is fitted to the left-hand side of the upper front bulkhead partition.

2 **ETS**

3 **ASR**
The ETS control module is located on a bracket under the left-hand front seat. On cars with a traction control system for cars with automatic transmission, there is also an ASR control module fitted on top of the ETS control module.

Comfort systems

4 **Cruise control**

5 **Central locking system**
The control modules are located on a bracket at far left under the dashboard.

Safety systems

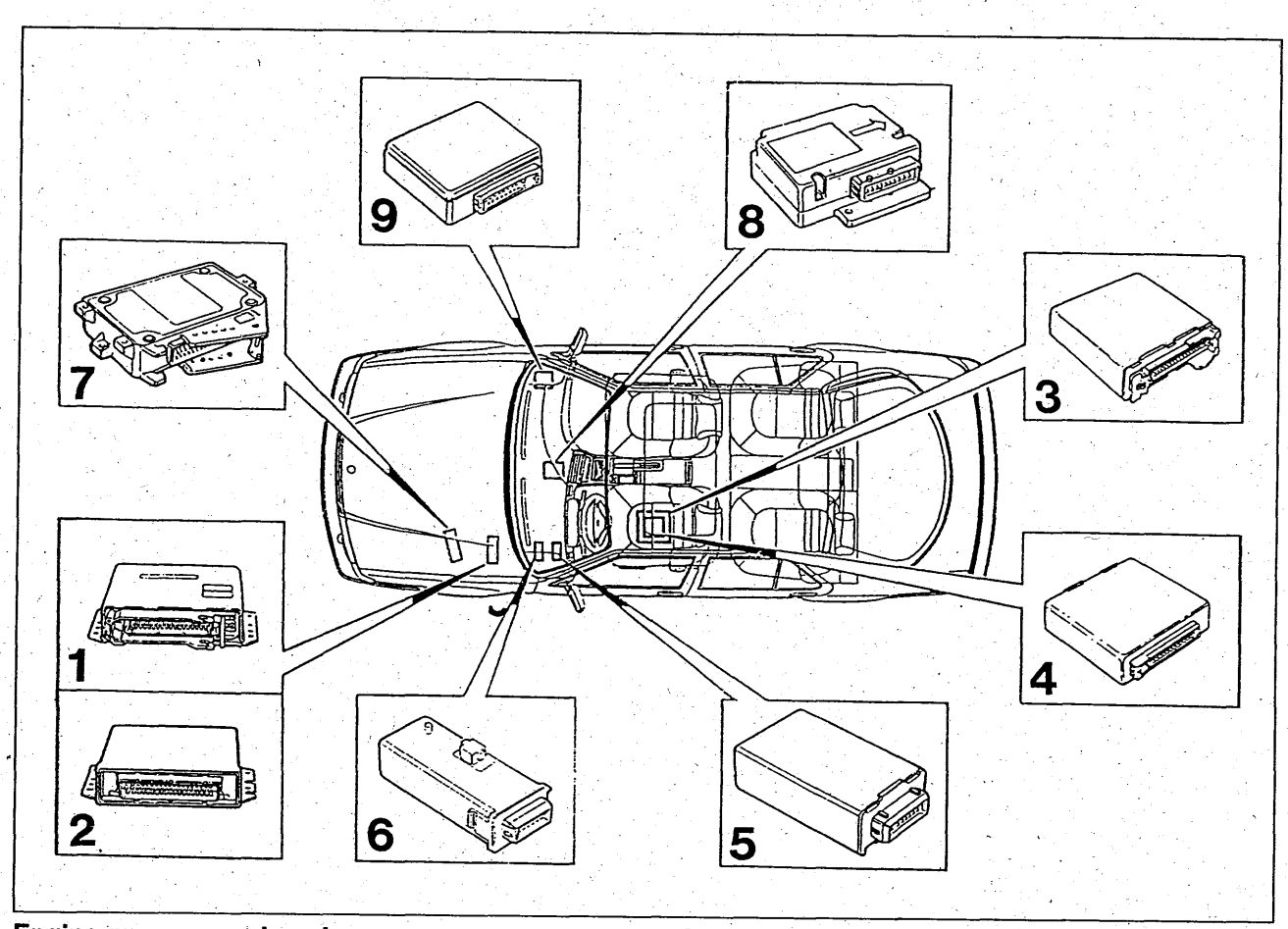
6 **ABS or TC/ABS**
The ABS or TC/ABS control module is fitted on the battery tray.

7 **Airbag**
The airbag control module is located on a bracket in the front part of the centre console under the dashboard and also controls the belt tensioners.

8 **Anti-theft alarm**
The anti-theft alarm control module is located behind the glove box and knee shield on the right-hand side behind the dashboard.

Location of control modules (contd.)

M1993



Engine management system

1 **LH and DI (EZK)**

2 **Trionic**
The LH and DI (or EZK) or Trionic control modules are located on a bracket in the bulkhead partition space. The bracket is located on the left-hand side of the upper front bulkhead partition.

3 **ETS**

4 **ASR**
The ETS control module is located on a bracket under the left-hand front seat. On cars with a traction control system for cars with automatic transmission, there is also an ASR control module fitted on top of the ETS control module.

Comfort systems

5 **Cruise control**

6 **Central locking system**
The cruise control and central locking control modules are mounted on a bracket on the far left under the dashboard.

Safety systems

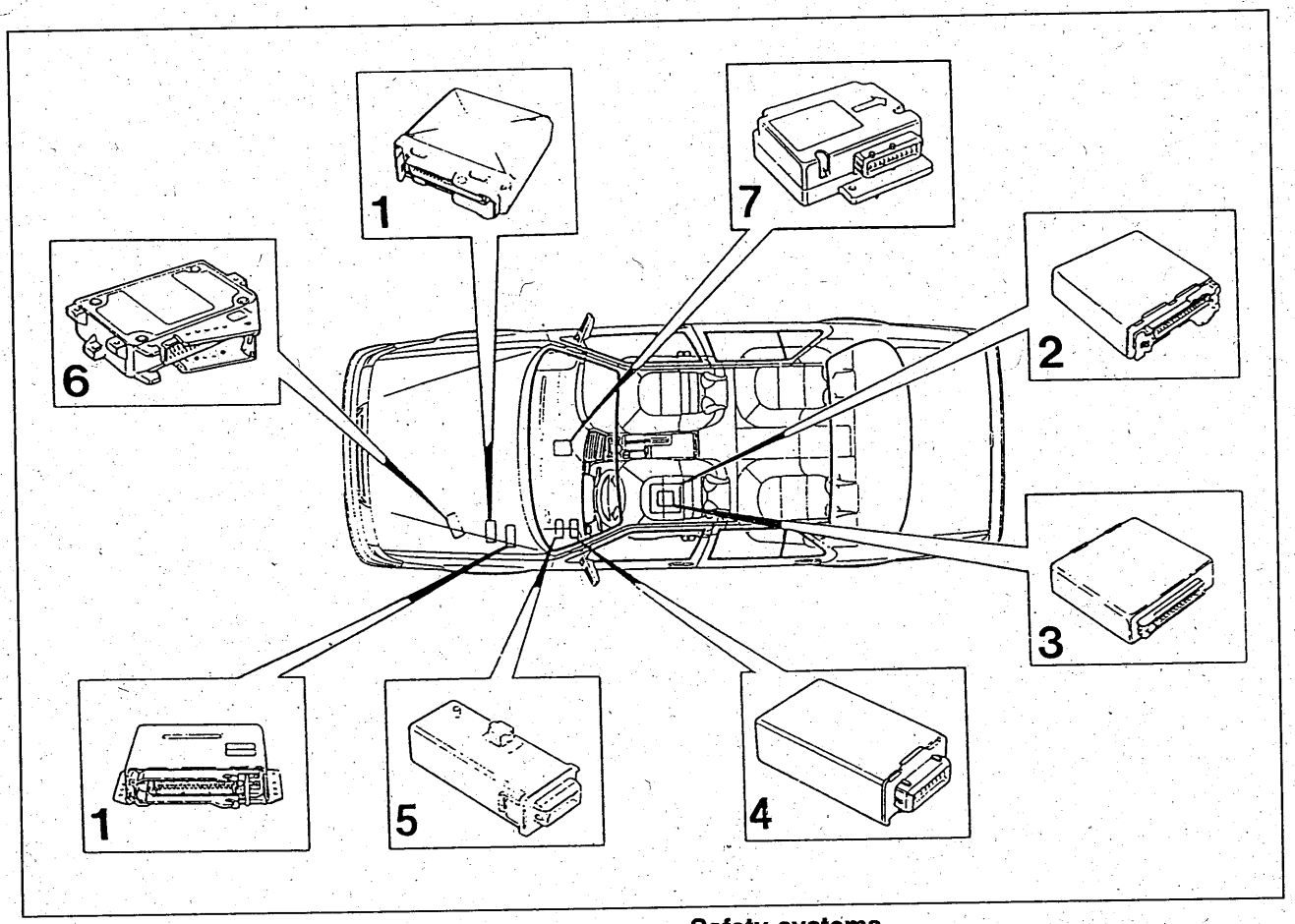
7 **ABS or TC/ABS**
The ABS or TC/ABS control module is mounted on the battery tray.

8 **Airbag and belt tensioner**
The airbag and belt tensioner control modules are located on a bracket in the front part of the centre console under the dashboard.

9 **Anti-theft alarm**
The anti-theft alarm control module is placed behind the glove box and knee shield on the right-hand side in the cabin.

Location of control modules (contd.)

M1992



Engine management system

1 **LH, DI and DI/APC (EZK)**
The control modules for LH, DI and DI/APC (or EZK) are located on a bracket in the bulkhead partition space. The bracket is mounted on the left-hand side of the upper front bulkhead partition.

2 **ETS**

3 **ASR**
The ETS control module is located on a bracket under the left-hand front seat. On cars with a traction control system for cars with automatic transmission, there is also an ASR control module fitted on top of the ETS control module.

Comfort systems

4 **Cruise control**

5 **Central locking system**
The cruise control and central locking control modules are mounted on a bracket on the far left under the dashboard.

Safety systems

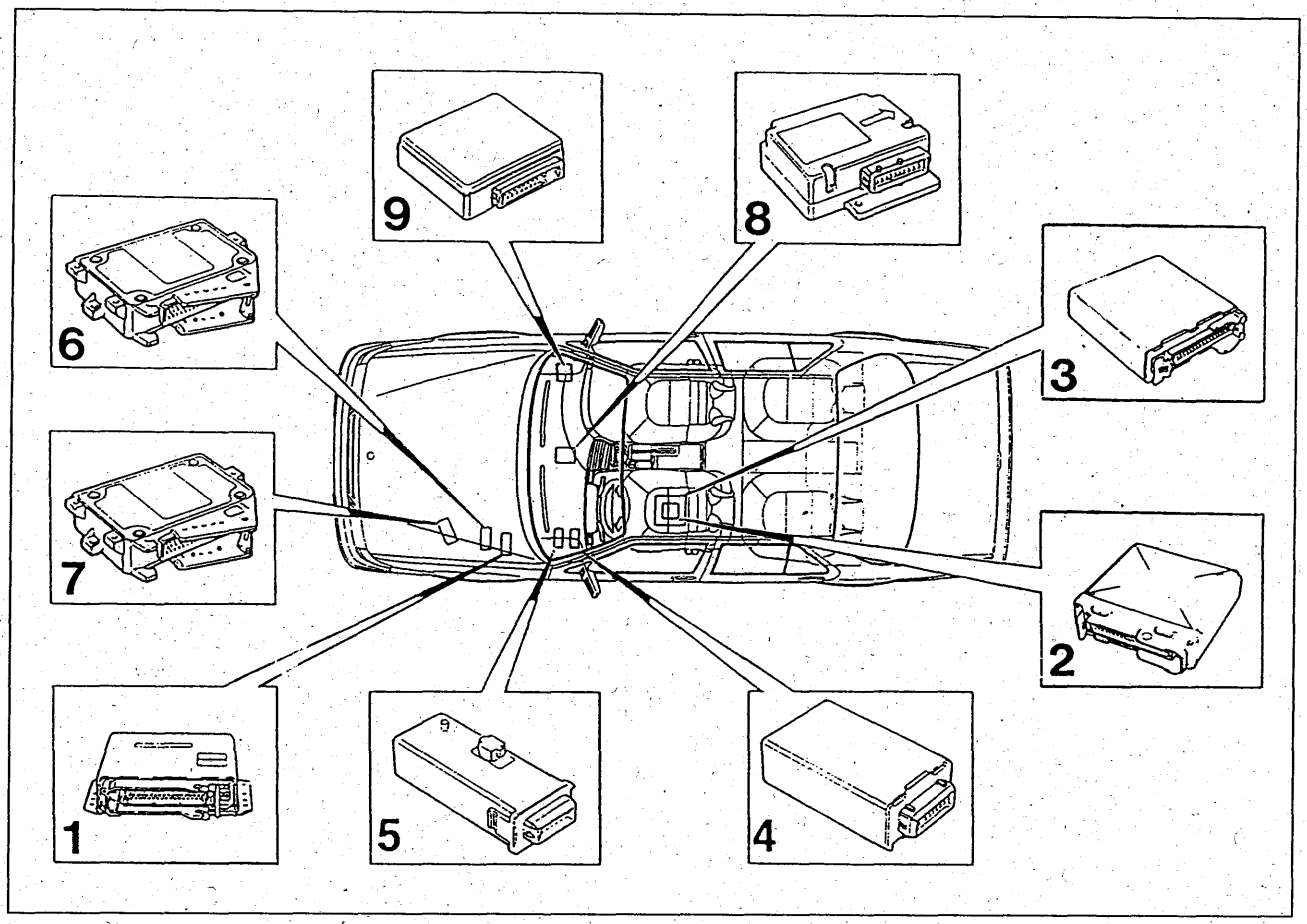
6 **ABS or TC/ABS**
The ABS or TC/ABS control module is mounted on the battery tray.

7 **Airbag and belt tensioner**
The airbag and belt tensioner control modules are located on a bracket in the front part of the centre console under the dashboard.

8 **Anti-theft alarm**
The anti-theft alarm control module is placed behind the glove box and knee shield on the right-hand side in the cabin.

Location of control modules (contd.)

M1991



Engine management system

1 **LH**
The LH control module is located on a bracket in the bulkhead partition space. The bracket is mounted on the left-hand side of the upper front bulkhead partition.

2 **DI-DI/APC (EZK)**
The DI-DI/APC (or EZK) control module is located under the left-hand front seat next to the ETS control module.

3 **ETS**
The ETS control module is located on a bracket under the left-hand front seat.

Comfort systems

4 **Cruise control**

5 **Central locking system**
The cruise control and central locking control modules are mounted on a bracket on the far left under the dashboard.

Safety systems

6 **ABS**
The ABS control module is located on a bracket in the bulkhead partition space.

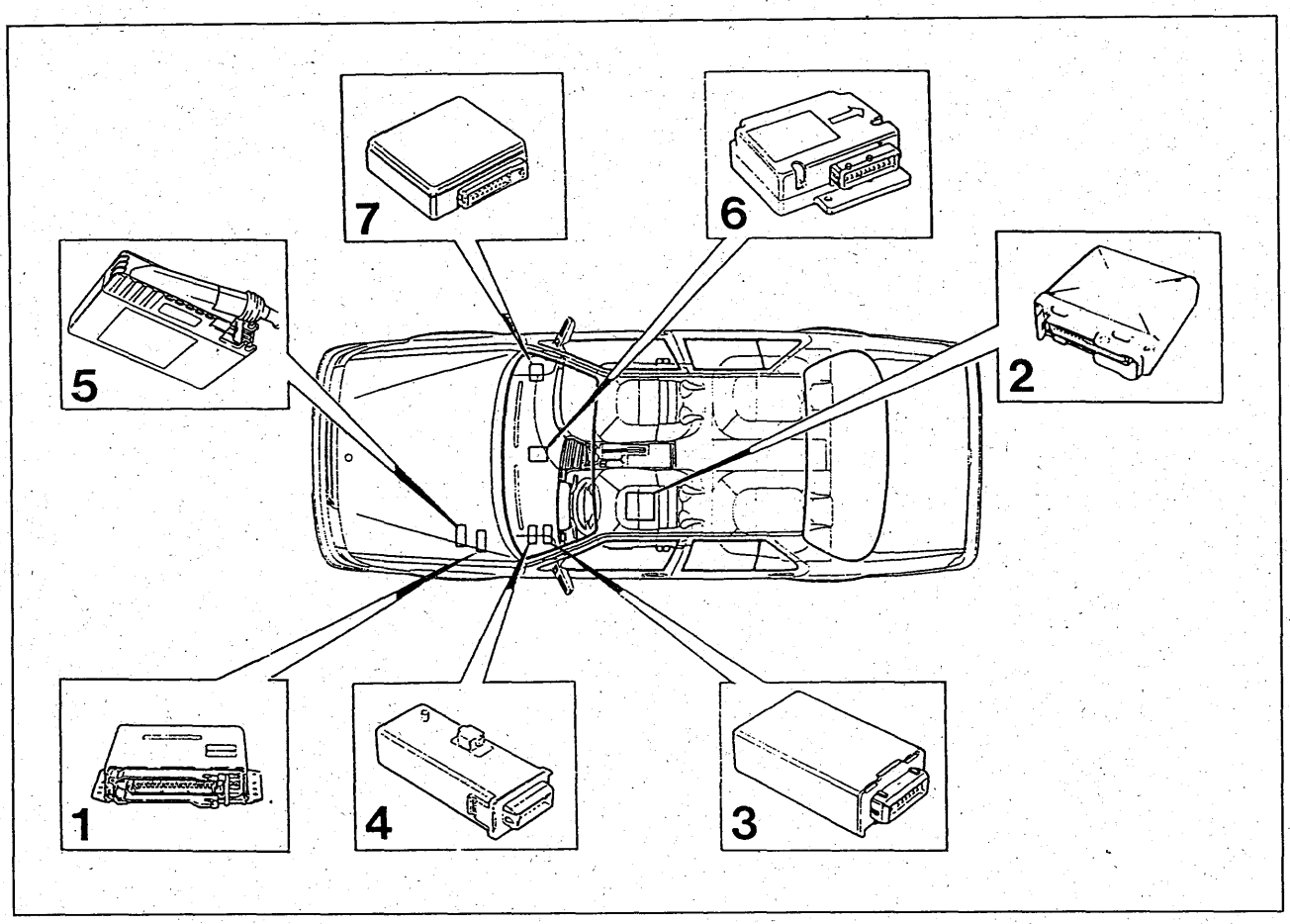
7 **TC/ABS**
The TC/ABS control module is mounted on the battery tray.

8 **Airbag and belt tensioner**
The airbag and belt tensioner control modules are located on a bracket in the front part of the centre console under the dashboard.

9 **Anti-theft alarm**
The anti-theft alarm control module is placed behind the glove box and knee shield on the right-hand side in the cabin.

Location of control modules (contd.)

M1990



Engine management system

1 **LH**
The control module is located on a bracket in the bulkhead partition space. The bracket is fitted to the left-hand side of the upper front bulkhead partition.

2 **DI-DI/APC (EZK)**
The DI-DI/APC (or EZK) control module is located on a bracket under the left-hand front seat.

Comfort systems

3 **Cruise control**

4 **Central locking system**
The cruise control and central locking control modules are mounted on a bracket on the far left under the dashboard.

Safety systems

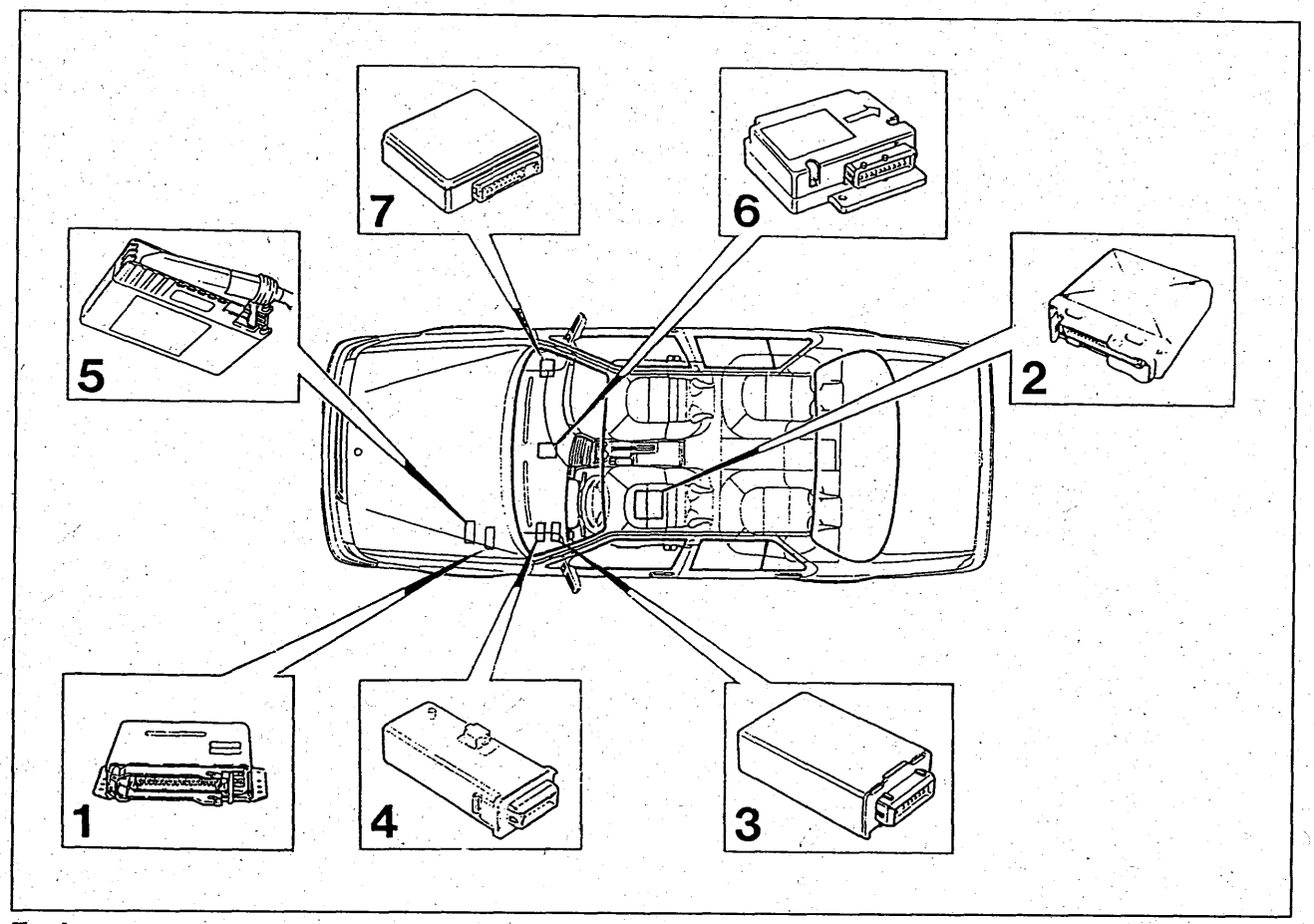
5 **ABS**
The ABS control module is located on a bracket in the bulkhead partition space.

6 **Airbag and belt tensioner**
The airbag and belt tensioner control modules are located on a bracket in the front part of the centre console under the dashboard.

7 **Anti-theft alarm**
The anti-theft alarm control module is placed behind the glove box and knee shield on the right-hand side in the cabin.

Location of control modules (contd.)

M1989



Engine management system

1 **LH**
The control module is located on a bracket in the bulkhead partition space. The bracket is fitted to the left-hand side of the upper front bulkhead partition.

2 **DI/APC (EZK)**
The DI/APC (or EZK) control module is located on a bracket under the left-hand front seat.

Comfort systems

3 **Cruise control**

4 **Central locking system**
The cruise control and central locking control modules are mounted on a bracket on the far left under the dashboard.

Safety systems

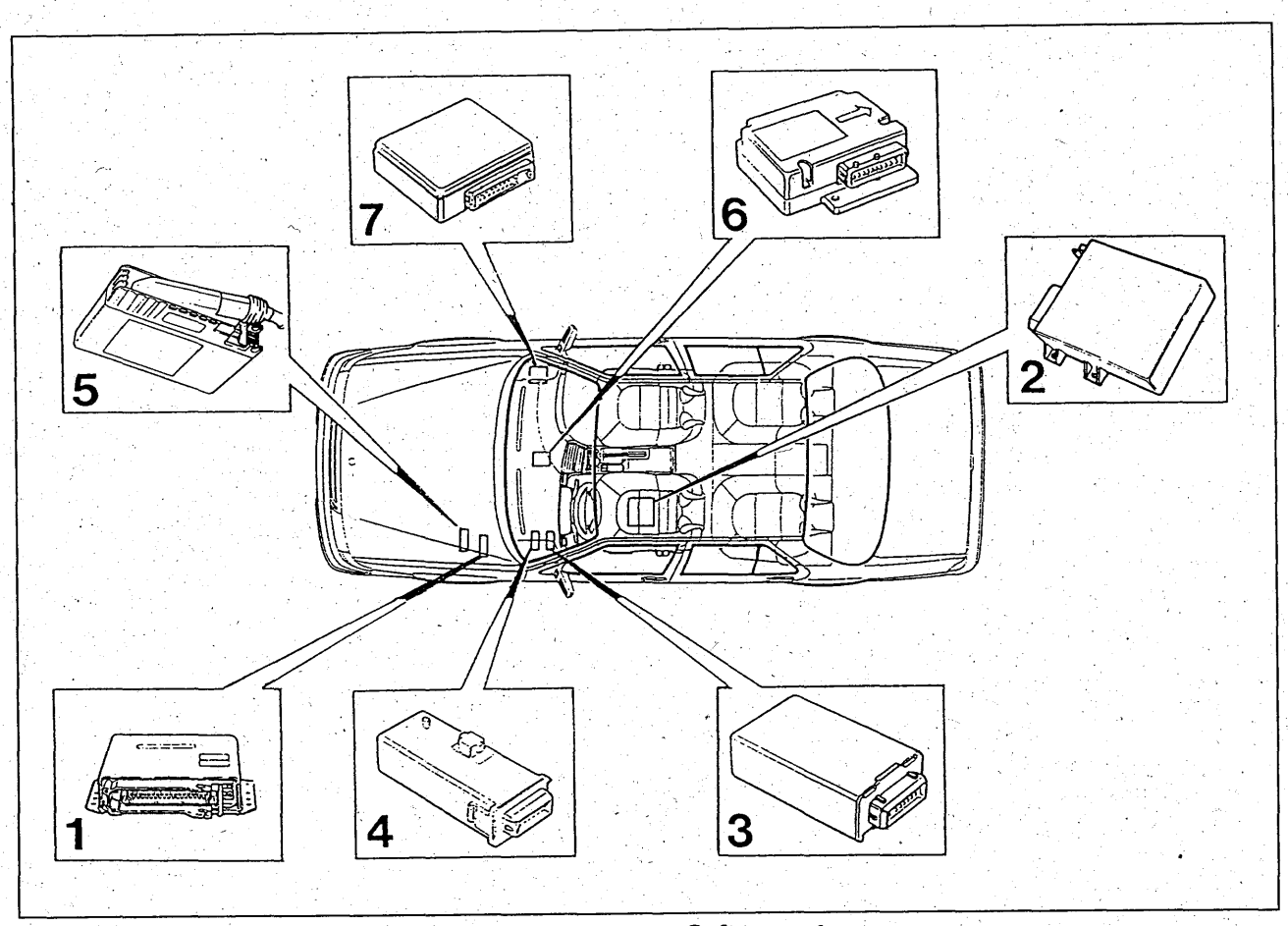
5 **ABS**
The ABS control module is located on a bracket in the bulkhead partition space.

6 **Airbag and belt tensioner**
The airbag and belt tensioner control modules are located on a bracket in the front part of the centre console under the dashboard.

7 **Anti-theft alarm**
The anti-theft alarm control module is placed behind the glove box and knee shield on the right-hand side in the cabin.

Location of control modules (contd.)

M1988



Engine management system

1 **LH**
The control module is located on a bracket in the bulkhead partition space. The bracket is fitted to the left-hand side of the upper front bulkhead partition.

2 **DI (EZK), APC**
The APC and DI (or EZK) control modules are located on a bracket under the left-hand front seat.

Comfort systems

3 **Cruise control**

4 **Central locking system**
The cruise control and central locking control modules are mounted on a bracket on the far left under the dashboard.

Safety systems

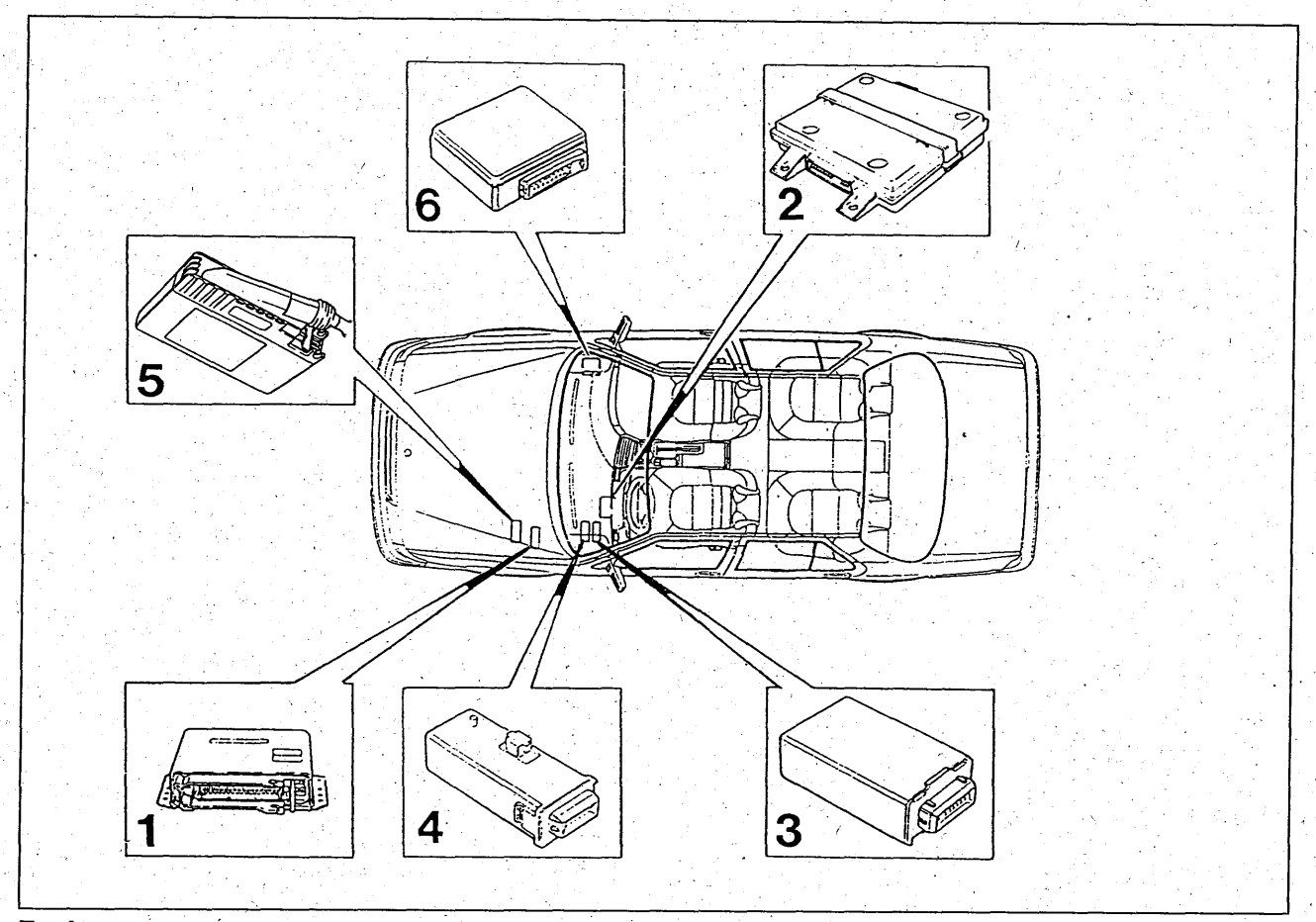
5 **ABS**
The ABS control module is located on a bracket in the bulkhead partition space.

6 **Belt tensioners**
The belt tensioner control module is located on a bracket in the front part of the centre console under the dashboard.

7 **Anti-theft alarm**
The anti-theft alarm control module is placed behind the glove box and knee shield on the right-hand side in the cabin.

Location of control modules (contd.)

M1987



Engine management system

1 **LH**
The LH control module is located on a bracket in the bulkhead partition space. The bracket is mounted on the left-hand side of the upper front bulkhead partition.

2 **APC (EZK)**
The APC (or EZK) control module is located on a bracket on the far left under the dashboard.

Comfort systems

3 **Cruise control**

4 **Central locking system**
The cruise control and central locking control modules are mounted on a bracket on the far left under the dashboard.

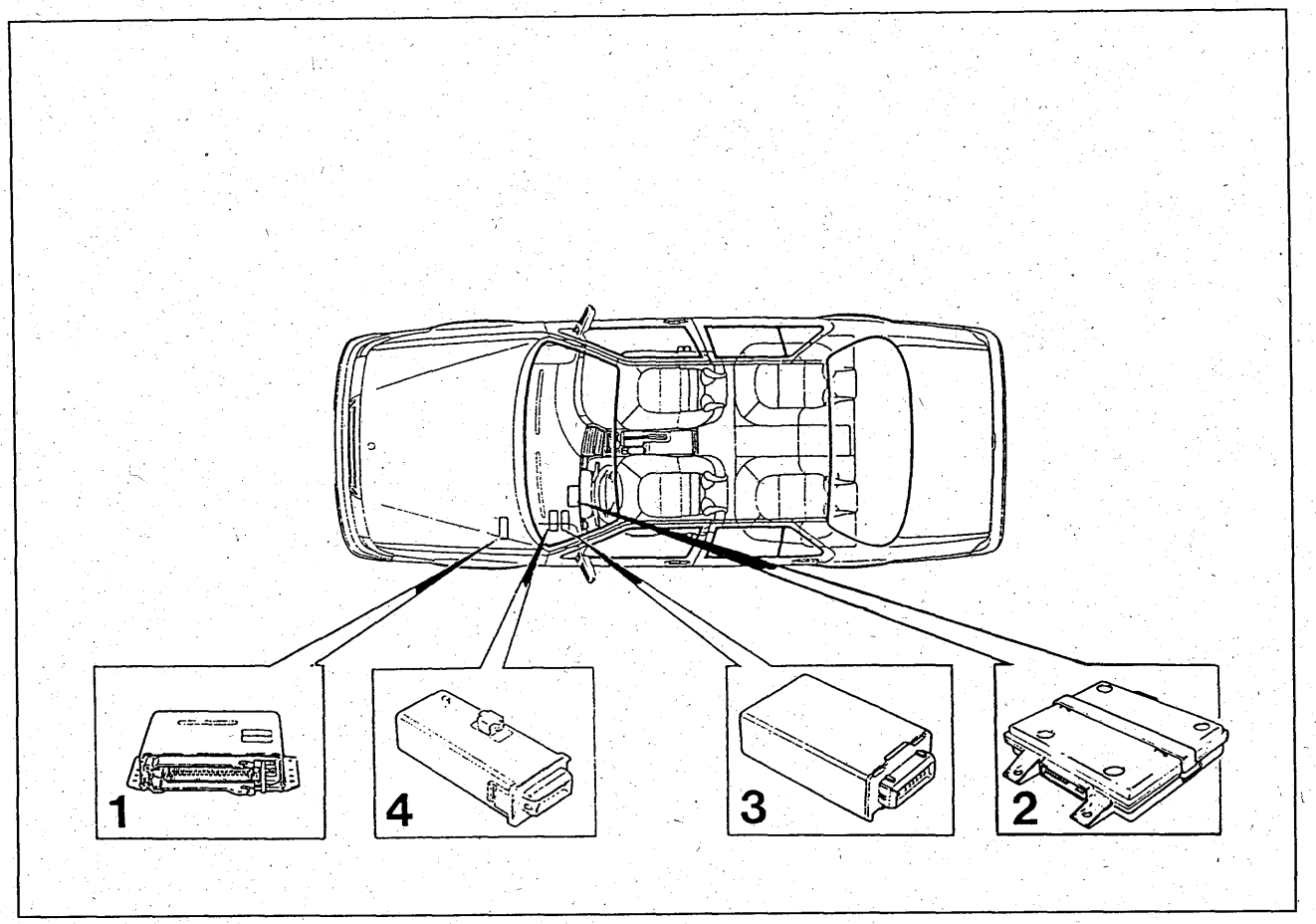
Safety systems

5 **ABS**
The ABS control module is located on a bracket in the bulkhead partition space.

6 **Anti-theft alarm**
The anti-theft alarm control module is placed behind the glove box and knee shield on the right-hand side in the cabin.

Location of control modules (contd.)

-M1986



Engine management system

1 **LH**
The LH control module is located on a bracket in the bulkhead partition space. The bracket is mounted on the left-hand side of the upper front bulkhead partition.

2 **APC (EZK)**
The APC (or EZK) control module is located on a bracket on the far left under the dashboard.

Comfort systems

3 **Cruise control**

4 **Central locking system**
The cruise control and central locking control modules are mounted on a bracket on the far left under the dashboard.

Engine

TCS (4-cyl.)

Fault tracing hints (M1991 and early M1992)

Components in these cars before a certain date of manufacture have sometimes not met quality requirements. These problems, sometimes in combination with faulty contacts or incorrect settings, can cause the system to switch to limp-home mode with the result that the customer complains or the car comes into the workshop for repair.

Two types of limp-home mode can arise:

- The system goes out of limp-home mode when restarted
- The system must be corrected/reset using an ISAT scan tool

Fault diagnosis and localization of the faults can sometimes be difficult to carry out, which is why we have provided the following summary of causes and recommended action.

Causes of fault

Faults can of course arise for other reasons besides those given below. However, we would like to point out certain special factors that have proved to be responsible for the majority of driveability problems. This applies to the following:

- **24-pin connector** in the main wiring harness (front bulkhead partition). Faulty contact due to oxidation caused by water leakage.
- **Grounding points G7 and G15** . Resistance too high due to poor contact.
- **Throttle cable** . Cable position incorrectly set.
- **Control valve** . Component fault (leakage) can arise up to date of manufacture 0391.
- **Non-return valve** (leakage).
- **Pedal position sensors** . Component fault can arise up to date of manufacture 101 (=w10 year 91).
- **Throttle body (throttle position sensor).** Component fault can arise up to serial number 117885.

Action

In the case of a fault in the TCS system (limp-home mode), start fault diagnosis as follows:

1 Read and note the diagnostic trouble codes registered using the ISAT scan tool.

2 Check the throttle cable and adjust it if necessary so that there is maximum play in the cable. The play should be at least 1 mm (see page 173 in Service Manual 2:5).

3 Unplug the 24-pin connector in the main wiring harness and check whether it contains any moisture and water. If it does, change the rubber seal, part No. 43 52 936.

Wipe the connector dry and use contact spray Kontakt 61, part No. 45-30 04 520, on the female pins (sockets). Then plug in and unplug the connector several times to remove any oxide deposits.

4 Check grounding points G7 (engine, 2) and G15 (beside the TSI socket).

5 Check that the non-return valve is correctly located.

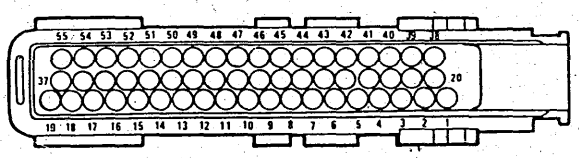
After this first check and correction measures, if necessary, clear all diagnostic trouble codes and test drive the car to see if it returns to the limp-home mode or if any warning lamps light up.

If the fault(s) remain, conduct fault diagnosis as described under each diagnostic trouble code.

TCS (4-cyl.) (contd.)

Checking voltage TC/ABS

Checking should be done with the breakout box (BOB) connected, all components connected and the ignition switch turned to ON. All readings are taken on the BOB.



[M)]TCS manual only
[A)]TCS automatic transmission only

Pin	Circuit/function	Colour	Check	See 2:5, page
1	Ground	BK	Check that the voltage drop to ground (G7) is less than 0.1 V.	-
2	FL outlet valve (valve activated when control module connects it to ground).	YE/RD	See "Checking resistance" on page 153 in Service Manual 2:5.	122
3	Power supply from main relay (ABS).	GN/RD or YE/WH	With relay activated = 12 V. Relay not activated (fault in system) = less than 2 V.	104
4[M]	Communication between TC/ABS and ETS (digital signal to pin 32 on ETS control module).	BK/WH	With engine running = approx. 5 V (readings near 0 or 10 V indicate a fault in the circuit).	133
5	No connection.			
6	No connection.			
7[M]	TCS indicator lamp (control module grounds lamp when the system is activated).	BN/RD	Lamp out = approx. 12 V. Lamp on = approx. 0 V.	146
8	Pressure and level warning circuit (goes to pin 51).	BU	Switch closed = approx. 5-10 V (pressure/level = OK). Switch open = 0 V (pressure/level = low).	107
9[A]	RR speed signal (digital signal to ASR control module).	GN	Check with logic probe: continuous "PULSE" without rotating wheel (test pulse). Frequency increases with increased wheel speed.	119
10[A]	FL Wheel speed signal (digital signal to ASR control module).	YE	Check with logic probe: continuous "PULSE" without rotating wheel (test pulse). Frequency increases with increased wheel speed.	113
11[A]	FR Wheel speed signal (digital signal to ASR control module).	BU	Check with logic probe: continuous "PULSE" without rotating wheel (test pulse). Frequency increases with increased wheel speed.	115
12[A]	RL Wheel speed signal (digital signal to ASR control module).	GY	Check with logic probe: continuous "PULSE" without rotating wheel (test pulse). Frequency increases with increased wheel speed.	117
13[M]	TC block pressure switch (signal voltage to switch).	BN/WH	Brake off = approx. 8 V (switch closed). Brake on = approx. 10 V (switch open).	139
14	To pump relay, pin 87 (detects position of relay contacts).	YE	Pump relay operated = 12 V. Pump relay released = 0 V.	110
15	No connection.			
16	No connection.			
17	No connection.			
18	No connection.			

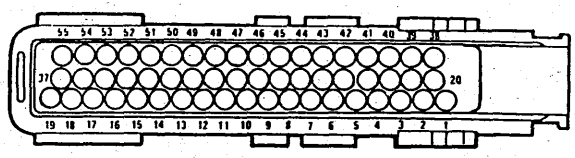
Pin	Circuit/function	Colour	Check	See 2:5, page
19	Ground	BK	Check that voltage drop to ground is less than 0.1 V.	-
20	FL inlet valve (valve activated when circuit grounded via control module).	GN/WH	See "Checking resistance" on page 154 in Service Manual 2:5.	121
21	FR outlet valve (valve activated when circuit grounded via control module).	BU/RD	See "Checking resistance" on page 154 in Service Manual 2:5.	124
22	No connection.			
23	Data link L (commands **from ISAT scan tool** to control module).	YE		99 p.5
24[M]	TC/ABS-ETS communication (digital signal to ETS, pin 29).	GN/WH	With engine running - approx. 5 V (readings near 0 or 10 V indicate a fault in the circuit). If a logic probe is used, "PULSE" should be shown continuously.	133
25	No connection.			
26[M]	TC block pressure switch (voltage signal from switch).	BK/WH	Brake off = approx. 8 V (switch closed). Brake on = 0 V (switch open).	139
27	Ground screen, RR wheel speed sensor.	BK/GN	Measure voltage (AC) between pins 27 and 45. When wheel rotated 1 turn/second, the voltage should be about 0.1 - 0.5 V.	119
28	Ground screen, RL wheel speed sensor.	YE/GN	Measure voltage (AC) between pins 28 and 46. When wheel rotated 1 turn/second, the voltage should be about 0.1 - 0.5 V.	117
29	Ground screen, FR wheel speed sensor.	BU/GN	Measure voltage (AC) between pins 29 and 47. When wheel rotated 1 turn/second, the voltage should be about 0.1 - 0.5 V.	115
30	Ground screen, FL wheel speed sensor.	GY/GN	Measure voltage (AC) between pins 30 and 48. When wheel rotated 1 turn/second, the voltage should be about 0.1 - 0.5 V.	113
31	No connection.			
32	Brake light signal (from brake light switch).	BU	Brake off = 0 V. Brake on = 12 V.	137
33	Voltage from main relay (ABS).	YE	Relay activated (system working) = 12 V. Relay not activated (fault in system) = <2 V.	104
34	Actuating signal for relay (control module activates relay by grounding the circuit).	GN	Relay not activated = 12 V. Relay activated = approx. 1 V or less.	104
35[M]	Current (+30 circuit).	RD	12 V	104
36	Rear outlet valve (control module activates the valve by grounding the circuit).	BU/WH	See "Checking resistance" on page 154 in Service Manual 2:5.	126
37[M]	TC block NO valve (control module activates the valve by grounding the circuit).	YE	See "Checking resistance" on page 155 in Service Manual 2:5.	128
38	FR inlet valve (control module activates valve by grounding the circuit).	RD/WH	See "Checking resistance" on page 155 in Service Manual 2:5.	123
39	Main valve (control module activates valve by grounding the circuit).	BK	See "Checking resistance" on page 155 in Service Manual 2:5.	127

Pin	Circuit/function	Colour	Check	See 2:5, page
40[M]	TC block NC valve (control module activates valve by grounding the circuit).	BU/GY	See "Checking resistance" on page 155 in Service Manual 2:5.	129
41	No connection.			
42	Data link K (data from control module **to ISAT scan tool**).	BU		99 p.5
43	No connection.			
44[M]	TCS CTRL lamp	BU	Lamp off = 12 V. Lamp on = <2 V.	142
45	RR wheel speed sensor signal.	GN	Check the voltage (AC) between pins 45 and 27. When the wheel rotates 1 turn/second, the sensor signal should be approx. 0.1-0.5 V.	119
46	RL Wheel speed sensor signal.	GN	Check the voltage (AC) between pins 46 and 28. When the wheel rotates 1 turn/second, the sensor signal should be approx. 0.1-0.5 V.	117
47	FR Wheel speed sensor signal.	GN	Check the voltage (AC) between pins 47 and 29. When the wheel rotates 1 turn/second, the sensor signal should be approx. 0.1-0.5 V.	115
48	FL Wheel speed sensor signal.	GN	Check the voltage (AC) between pins 48 and 30. When the wheel rotates 1 turn/second, the sensor signal should be approx. 0.1-0.5 V.	113
49	No connection.			
50	Pump relay, pin 85 (detects relay status).	BK	Control circuit not activated (pressure switch open) = 12 V. Control circuit activated (pressure switch closed) = <1 V.	111
51	Pressure and level warning circuit (goes to pin 8).	BN	System OK (switches closed) = 5-10 V. System fault (a switch open) = approx. 1.5 V.	107
52	ANTI LOCK lamp	WH	Lamp off = 12 V. Lamp on = <2 V.	140
53	Current (+54 circuit).	RD	12 V when ignition switch is in ON position.	104
54	Rear inlet valve (control module activates the valve by grounding the circuit).	BN/WH	See "Checking resistance" on page 155 in Service Manual 2:5.	125
55	No connection.			

TCS (4-cyl.) (contd.)

Checking resistance TC/ABS

The resistance readings listed below should be checked with the breakout box (BOB) connected, the control module **disconnected** and with the ignition **off** .
All readings are taken on the breakout box.



M)TCS manual only
A)TCS automatic transmission only

Pin	Circuit/function	Colour	Check	See 2:5, page
1	Ground	BK	Less than 1 ohm to battery ground	-
2	FL Outlet valve (control module activates the valve by grounding the circuit)	YE/RD	Resistance between pins 2 and 3 should be about 3-4 ohms	122
3	Power supply from relay (ABS)	GN/RD or YE/WH	Check lead to relay pin 30	104
4M	Communication between TC/ABS and ETS (digital signal to ETS, pin 32)	BK/WH	Check the lead to ETS pin 32 Check that there is no short to ground	133
5	No connection.			
6	No connection.			
7M	TCS lamp (control module grounds the circuit when the system is activated)	BN/RD	See "Checking voltage" on page 148 of Service Manual 2:5	146
8	Pressure and level warning circuit (to pin 51)	BU	Check that the circuit is whole between pins 8 and 51 when the pressure accumulator is charged.	107
9A	RR speed signal (digital signal to ASR control module).	GN	See "Checking voltage" on page 148 of Service Manual 2:5	119
10A	FL Wheel speed signal (digital signal to ASR control module)	YE	See "Checking voltage" on page 148 of Service Manual 2:5	113
11A	FR Wheel speed signal (digital signal to ASR control module).	BU	See "Checking voltage" on page 148 of Service Manual 2:5	115
12A	RL Wheel speed signal (digital signal to ASR control module).	GY	See "Checking voltage" on page 148 of Service Manual 2:5	117
13M	TC block pressure switch (voltage signal **to switch**)	BN/WH	Check that the circuit is whole between pins 13 and 26 (brake pedal not depressed)	139
14	From pump relay pin 87 (gives position of relay contacts)	YE	Check the lead to pump relay, pin 87.	110
15	No connection.			
16	No connection.			
17	No connection.			
18	No connection.			
19	Ground	BK	Less than 1 ohm to battery ground	-
20	FL Inlet valve (control module activates the valve by grounding the circuit)	GN/WH	Resistance between pins 20 and 3 should be 6-7 ohms.	121

Pin	Circuit/function	Colour	Check	See 2:5, page
21	FR Inlet valve (control module activates valve by grounding circuit)	BU/RD	Resistance between pins 21 and 3 should be 3-4 ohms.	124
22	No connection.			
23	Data link L (data **from ISAT scan tool** to the control module)	YE		99 p.5
24M	Communication between TC/ABS and ETS (digital signal to ETS, pin 29)	GN/WH	Check the lead to ETS pin 29 Check that there is no short to ground	133
25	No connection.			
26M	TC block pressure switch (voltage signal **from switch**)	BK/WH	Check that the circuit is whole between pins 26 and 13 (brake pedal not depressed)	139
27	Ground screen, RR wheel speed sensor.	BK/GN	Resistance between pins 27 and 45 should be about 1100 ohms	119
28	Ground screen, RL wheel speed sensor.	YE/GN	Resistance between pins 28 and 46 should be about 1100 ohms	117
29	Ground screen, FR wheel speed sensor.	BU/GN	Resistance between pins 29 and 47 should be about 1100 ohms	115
30	Ground screen, FL wheel speed sensor.	GY/GN	Resistance between pins 30 and 48 should be about 1100 ohms	113
31	No connection.			
32	Brake light signal (from brake light switch)	BU	See "Checking voltage" on page 150 of Service Manual 2:5	137
33	Voltage from main relay (ABS).	YE	Check the lead to the main relay, pin 30	104
34	Control signal for main relay (control module activates the relay by grounding the circuit)	GN	Check the lead to the main relay, pin 86	104
35M	Power supply (+30 circuit)	RD	See "Checking voltage" on page 150 of Service Manual 2:5	104
36	Rear outlet valve (control module activates the valve by grounding the circuit)	BU/WH	Resistance between pins 36 and 3 should be about 3-4 ohms	126
37M	TC block NO valve (control module activates the valve by grounding the circuit)	YE	Resistance between pins 37 and 3 should be 6-8 ohms.	128
38	FR inlet valve (control module activates valve by grounding the circuit).	RD/WH	Resistance between pins 38 and 3 should be 6-7 ohms.	123
39M	Main valve (control module activates valve by grounding the circuit).	BK	Resistance between pins 39 and 3 should be 4-5 ohms.	127
40M	TC block NC valve (control module activates valve by grounding the circuit).	BU/GY	Resistance between pins 40 and 3 should be 6-8 ohms.	129
41	No connection.			
42	Data link K (data from the control module **to the ISAT scan tool**)	BU		99 p.5
43	No connection.			
44M	TCS CTRL lamp	BU	See "Checking voltage" on page 151 of Service Manual 2:5	142

Pin	Circuit/function	Colour	Check	See 2:5, page
45	Output signal from RR wheel speed sensor	GN	Resistance between pins 45 and 27 should be about 1100 ohms	119
46	Output signal from RL wheel speed sensor	GN	Resistance between pins 46 and 28 should be about 1100 ohms	117
47	Output signal from FR wheel speed sensor	GN	Resistance between pins 47 and 29 should be about 1100 ohms	115
48	Output signal from FL wheel speed sensor	GN	Resistance between pins 48 and 30 should be about 1100 ohms	113
49	No connection.			
50	Pump relay, pin 85 (monitors relay status)	BK	Check the lead to pump relay pin 85 and check that the circuit is grounded when the pressure switch is closed (accumulator not pressurized).	111
51	Pressure and level warning circuit (to pin 8)	BN	Check the continuity of the circuit between pins 51 and 8 when the accumulator is pressurized.	107
52	ANTI LOCK lamp	WH	See "Checking voltage" on page 151 of Service Manual 2:5	140
53	Power supply (+54 circuit)	RD	See "Checking voltage" on page 151 of Service Manual 2:5	104
54	Rear inlet valve (the valve is activated by the control module grounding the circuit)	BN/WH	Resistance between pins 54 and 3 should be 6-7 ohms.	125
55	No connection.			

TCS (4-cyl.) (contd.)

Diagnostic trouble codes TC/ABS

Permanent	Intermittent	Component/Signal	See 2:5, page
32251	22251	Main relay not working properly	104
35321	25321	Brake light switch not working properly	137
36521	26521	Pressure switch not working properly	139
36522	26522	Safety circuit pins 8-51, shorting to +12 V	107
44221	24221	FL wheel speed sensor, no signal	113
44222	24222	FR wheel speed sensor, no signal	115
44223	24223	RL wheel speed sensor, no signal	117
44224	24224	RR wheel speed sensor, no signal	119
44251	24251	FL wheel speed sensor, faulty signal (compare wheel speed)	113
44252	24252	FR wheel speed sensor, faulty signal (compare wheel speed)	115
44253	24253	RL wheel speed sensor, faulty signal (compare wheel speed)	117
44254	24254	RR wheel speed sensor, faulty signal (compare wheel speed)	119
44291	24291	FL wheel speed sensor, faulty signal (<40 km/h)	113
44292	24292	FR wheel speed sensor, faulty signal (<40 km/h)	115
44293	24293	RL wheel speed sensor, faulty signal (<40 km/h)	117
44294	24294	RR wheel speed sensor, faulty signal (<40 km/h)	119
4422A	2422A	FL wheel speed sensor, faulty signal (>40 km/h)	113
4422B	2422B	FR wheel speed sensor, faulty signal (>40 km/h)	115
4422C	2422C	RL wheel speed sensor, faulty signal (>40 km/h)	117
4422D	2422D	RR wheel speed sensor, faulty signal (>40 km/h)	119
53421	33421	FL inlet valve, not working	121
53422	33422	FL outlet valve, not working	122
53423	33423	FR inlet valve, not working	123
53424	33424	FR outlet valve, not working	124
53425	33425	Rear inlet valve, not working	125
53426	33426	Rear outlet valve, not working	126
53427	33427	Main valve, not working	127
53428	33428	NO traction valve, not working	128
53429	33429	NC traction valve, not working	129
-----	234B1	FL outlet valve, hydraulic fault	130
-----	234B2	FR outlet valve, hydraulic fault	130
-----	234B3	Rear outlet valve, hydraulic fault	130
-----	234B4	Rear outlet valve, hydraulic fault	130
-----	775B1	Control module fault	131
-----	775B2	Control module fault, RAM	132
E7061	F7061	No communication with ETS	133

TCS (4-cyl.) (contd.)

TC/ABS command codes

Code	Function/component	Display text
259	Reads speed signal from FL wheel speed sensor	Example: 80020 = 20 km/h
25A	Reads speed signal from FR wheel speed sensor	Example: 80020 = 20 km/h
25B	Reads speed signal from RL wheel speed sensor	Example: 80020 = 20 km/h
25C	Reads speed signal from RR wheel speed sensor	Example: 80020 = 20 km/h
200	Gives status of TC block pressure switch	8B100 = closed (brake not applied) 8B000 = open (brake applied)
201	Gives status of pressure and level warning switch (safety circuit)	8B100 = closed (pressure and level = OK) 8B000 = open (pressure and level = low)
202	Gives status of brake light switch	8B100 = closed (brake applied) 8B000 = open (brake not applied)
800	Communication over	
900	Clears all diagnostic trouble codes	

TCS (4-cyl.) (contd.)

Voltage readings, TCS manual

- All readings should be taken with all components connected and with the ignition switch in the Drive position.
- Readings can be taken on the back of the control module connector or, preferably, using the break-out box (BOB) connected between the control module and the control module connector.
- Some of the readings should be taken with the engine idling.
- Be careful not to connect the ETS control module connector the wrong way round.
- A large number of voltage levels are only approximate. Use common sense when assessing whether a reading is correct or not.
- If a reading is incorrect, use the wiring diagram to see which cables, connectors or components should be further investigated.

Pin	Circuit/function	Colour	Check	See 2:5, page
1	Ground	BK	Check the voltage drop to ground. This should be less than approx. 0.1 V.	180
2	Pedal position sensor, reference voltage	YE/RD	About 5 V	210
3	Throttle position sensor, reference voltage	YE/WH	About 5 V	210
4	Pedal position sensor, ground	YE	0.1-0.2 V	206
5	Throttle position sensor, ground	WH	0.1-0.2 V	204
6	Charge air bypass valve, control signal	GY	Not activated = 12 V Activated = approx. 0 V	256
7	No connection.			
8	No connection.			
9	Data link L **from ISAT scan tool** to control module	YE/WH	12 V	161 p.5
10	Input signal from wheel speed sensor	GN/RD	Should alternate between 0 and 12 V when both front wheels are rotated by hand at the same time (or when the car is pushed forward)	189
11	No connection.			
12	Engine speed signal	OG	At least 2 V when running starter motor Approx. 3 V when idling (may increase slightly with increased rpm)	187
13	Main relay control circuit (the control module grounds the circuit when it receives current (+15 circuit) provided that there is no fault in the ETS system)	BU	Not activated = 12 V Activated = <1.5 V	229

Pin	Circuit/function	Colour	Check	See 2:5, page
14	Accelerator pedal, safety switch	GY/WH	Pedal not depressed = approx. 1 V Pedal depressed halfway = approx. 7-9 V	217
15	Brake light switch	WH	Brake pedal not depressed = 0 V Brake pedal depressed = 12 V	224
16	Throttle position sensor, position signal	BU/WH	Approx. 4 V when idling which decreases to approx. 0.1 V at wide open throttle. The throttle butterfly must be opened by hand, see 2:5, page 233 for information.	204
17	Pedal position sensor, position signal	GN/YE	Approx. 0.1 V when idling increasing to approx. 4 V at wide open throttle.	206
18	Cruise control "RESUME"	YE	"RESUME" activated = 12 V "RESUME" not activated = 0 V	257
19	Cruise control "SET"	RD/WH	"SET" activated = 12 V "SET" not activated = 0 V	257
20	Throttle motor	GN		233
21	Throttle motor	GN/WH		233
22	Power supply from main relay	BU/RD	Relay activated = 12 V Relay not activated = approx. 0 V	229
23	TCS CTRL lamp	VT/WH	Lamp on = <2 V Lamp out = 12 V	142
24	No connection.			
25	Current (+15 circuit)	GN/WH	Ignition on = 12 V Ignition off = approx. 0 V	183
26	Throttle angle, output signal to LH and DI	YE	Signal pulse width should increase as the throttle opens. Use the ISAT scan tool PULSE feature.	-
27	Engine load signal Tq	WH	Signal frequency should increase with engine load. Use the ISAT scan tool PULSE feature.	200
28	Throttle body safety switch	BK/WH	Throttle butterfly closed = approx. 1 V Throttle butterfly open at least halfway = 7-10 V	215
29	Communication signal To TC/ABS pin 24 on cars with manual gearbox To ASR pin 14 on cars with automatic transmission	GN/WH	With car stationary and engine idling = approx. 5 V Readings near 0 or 10 V indicate a fault in the circuit.	185
30	No connection.			
31	Cruise control, "ON"/"OFF"	RD	At "ON" = 12 V At "OFF" = 0 V	257
32	Communication signal To TC/ABS pin 4 on cars with manual gearbox To ASR pin 2 on cars with automatic transmission	BK/WH	With car stationary and engine idling = approx. 5 V Readings near 0 or 10 V indicate a fault in the circuit.	185
33	Temperature sensor	YE	Voltage varies with temperature: Approx. 4.0 V -20°C (-4°F) Approx. 2.3 V +20°C (68°F) Approx. 0.5 V +80°C (176°F)	227

Pin	Circuit/function	Colour	Check	See 2:5, page
34	Data link K, data from control module **to ISAT scan tool**	BU/WH		161 p.5
35	Control signal to safety valve	BN/WH	Valve activated (system working) = approx. 1.0 V Valve not activated (system disconnected) = 0 V (may be battery voltage if the main relay is still activated)	231
36	Brake and clutch switches	WH	No pedal depressed = 12 V Either pedal depressed = <1 V	221
37	A/C connection	YE	A/C connected (or ACC in A/C mode) = approx. 10-12 V A/C not connected (or ACC in ECON mode) = 0 V	259
38	A/C relay control circuit	BK	A/C relay activated = approx. 1 V A/C relay not activated (connection made) = approx. 10-12 V A/C relay not activated (no connection made) = 0 V	259

TCS (4-cyl.) (contd.)

Voltage readings, TCS automatic transmission

- All readings should be taken with all components connected and with the ignition switch in the drive position.
- Readings can be taken on the back of the control module connector or, preferably, using the break-out box (BOB) connected between the control module and the control module connector.
- Some of the readings should be taken with the engine idling.
- Be careful to connect the ETS control module correctly.
- A large number of voltage levels are only approximate. Use common sense when assessing whether a reading is correct or not.
- If a reading is incorrect, use the wiring diagram to see which cables, connectors or components should be further investigated.

Pin	Circuit/function	Colour	Check	See 2:5, page
1	Pedal position sensor, position signal connected to ETS pin 17	GY/GN	Approx 0.1 V when idling, increasing to approx 4 V at wide open throttle	206
2*)	Communication with ETS, connected to ETS pin 32	BK/WH	With car stationary and engine idling = approx. 5 V Readings near 0 or 10 V indicate a fault in the circuit.	253
3	Throttle position sensor, position signal connected to ETC pin 16	BU/WH	Approx. 4 V when idling, decreasing to approx. 0.1 V at wide open throttle	204
4	No connection.			
5	No connection.			
6	No connection.			
7	Pedal position sensor, reference voltage connected to ETS pin 2	YE/RD	About 5 V	206
8*)	RL wheel speed signal digital input signal from ABS pin 12	GY	With a logic probe, a stable "PULSE" should be shown If the wheel is rotated, the "PULSE" frequency should increase the faster the wheel rotates.	196
9*)	FR wheel speed signal digital input signal from ABS pin 11	BU	With a logic probe, a stable "PULSE" should be shown If the wheel is rotated, the "PULSE" frequency should increase the faster the wheel rotates.	194
10*)	FL wheel speed signal digital input signal from ABS pin 10	YE	With a logic probe, a stable "PULSE" should be shown If the wheel is rotated, the "PULSE" frequency should increase the faster the wheel rotates.	192

Pin	Circuit/function	Colour	Check	See 2:5, page
11	KDW position sensor, reference voltage	YE/RD	About 5 V	208
12	Current (+15 circuit) connected to ETS pin 25	GN/WH	Ignition on = 12 V Ignition off = 0 V	183
13	Ground	BK	Check voltage drop to ground. Should be less than 0.1 V	229
14*)	Communication with ETS connected to ETS pin 29	YE	With car stationary and engine idling = approx. 5 V Readings near 0 or 10 V indicate a fault in the circuit.	253
15	KDW position sensor, ground	RD	About 0.1 - 0.2 V	208
16	DRIVE signal	OG	Selector lever in R, D, 3, 2 or 1 = 12 V Selector lever in N or P = approx. 0 V	212
17	No connection.			
18	Engine speed	OG	At least 2 V when starter motor running Approx. 3 V when idling and may be higher at higher rpm	187
19	TCS lamp The control module grounds the circuit when the TCS is connected	BN/WH	Lamp out = 12 V Lamp on = 0 V	146
20	Throttle position sensor, reference voltage connected to ETS pin 3	YE/WH	About 5 V	204
21*)	RR wheel speed signal digital input signal from ABS pin 9	GN	With a logic probe, a stable "PULSE" should be shown If the wheel is rotated, the "PULSE" frequency should increase the faster the wheel rotates.	198
22	KDW position sensor, position signal	BU/RD	With the KDW motor in a fixed position about "halfway" = approx. 2.5 V	208
23*)	KDW motor	BU/WH		184
24*)	KDW motor	WH		184
25	Power supply from main relay	BU/RD	Relay activated = 12 V Relay not activated = approx. 0 V	178

**) Digital signals (PWM). Check with pulse meter, logic probe or oscilloscope.*

TCS (4-cyl.) (contd.)

Diagnostic trouble codes, TCS

[M)]TCS manual only
[A)]TCS automatic transmission only

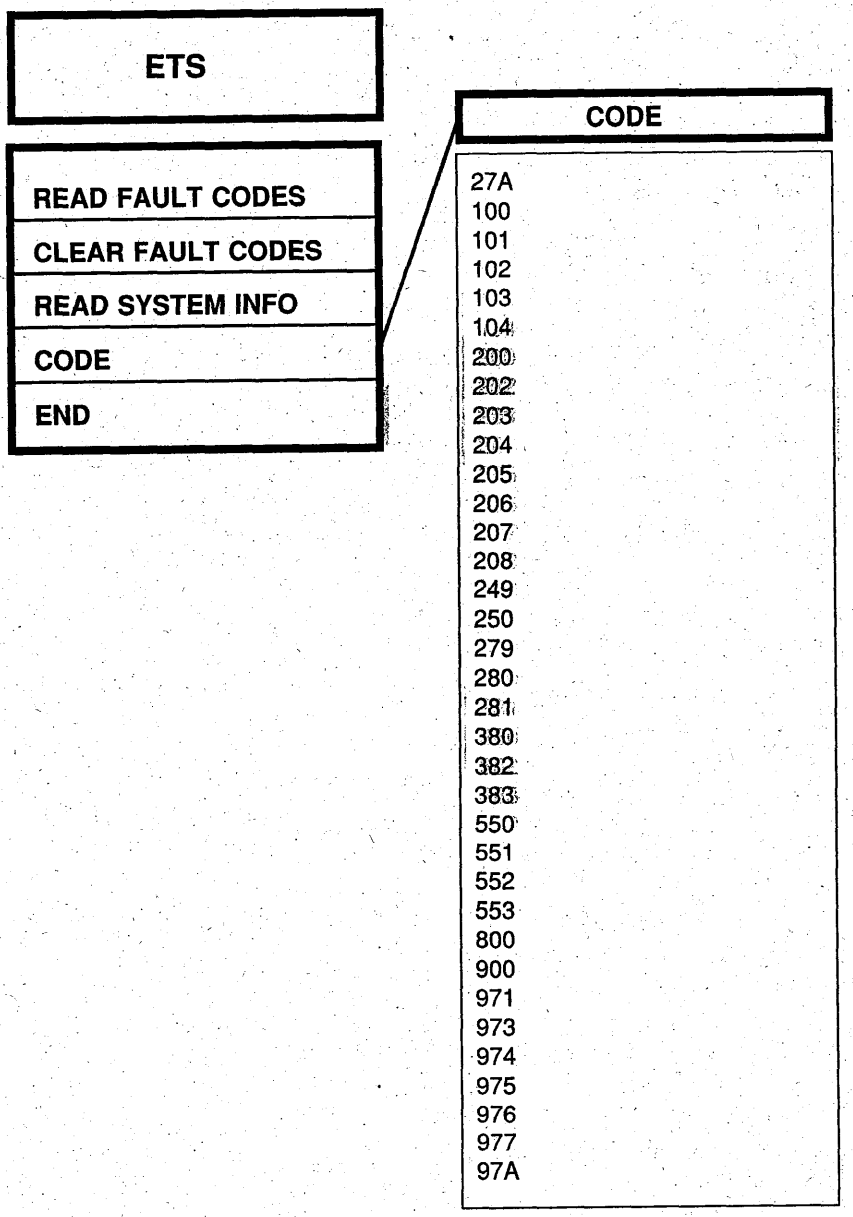
Permanent	Intermittent	Faulty function/component	Action, see 2:5, page
42220	22220	No +30 circuit current on pin 22	178
42241	22241	Battery voltage too high, >18 V	181
42252	22252	Battery voltage too low, <6 V	182
42320	22320	No +15 circuit signal on pin 25 despite detection of Td (engine speed) pulses	183
43691[A)]	23691	KDW actuator motor, control of cable not working (towards idling)	184
43692[A)]	23692	KDW actuator motor, control of cable not working (towards wide open throttle)	184
44020[M)]	24020	Communication with TC/ABS interrupted	185
44021[M)]	24021	No communication with TC/ABS	185
44090[M)]	24090	Faulty signal from TC/ABS	185
44221	24221	No engine speed signal	200
44260	24260	Signals from TC/ABS and gearbox speed sensor do not coincide	189
44261	24261	Signals from TC/ABS and gearbox speed sensor do not coincide	189
44262[A)]	24262	No signal from wheel speed sensors/ABS control module	191
44290	24290	Speed signal disrupted	189
44291	24291	Signals from TC/ABS and gearbox speed sensor do not coincide	189
44295[A)]	24295	No signal from FL wheel speed sensor	192
44296[A)]	24296	No signal from FR wheel speed sensor	194
44297[A)]	24297	No signal from RL wheel speed sensor	196
44298[A)]	24298	No signal from RR wheel speed sensor	198
44390	24390	Td (engine speed) signal indicates >7000 rpm	187
44391	24391	Td (engine speed) signal increasing too quickly	187
44420	24420	No Tq (engine load) signal	200
44490	24490	Tq (engine load) signal disrupted/high during deceleration	187
44690	24690	Incorrect Td/Tq (engine speed/engine load) ratio	202
44691[A)]	24691	No engine speed signal to ASR	203
45240	25240	Throttle position sensor, signal too high	204
45241	25241	Pedal position sensor, signal too high	206
45242	25242	Throttle position sensor, signal ground too high	204
45243	25243	Pedal position sensor, signal ground too high	206
45244[A)]	25244	KDW position sensor, signal ground too high	208
45245[A)]	25245	KDW position sensor, signal voltage too high	208
45250	25250	Throttle position sensor, signal too low	204
45251	25251	Pedal position sensor, signal too low	206
45252	25252	Throttle position sensor, signal ground too low	204
45253	25253	Pedal position sensor, signal ground too low	206
45254[A)]	25254	KDW position sensor, signal ground too low	208
45255[A)]	25255	KDW position sensor, signal voltage too low	208

Permanent	Intermittent	Faulty function/component	Action, see 2:5, page
45290	25290	Throttle position sensor, faulty signal	204
45291	25291	Pedal position sensor, faulty signal	206
45292[A)]	25292	Discrepancies in signals from ETS to throttle and pedal position sensors	210
45360	25360	Pedal switch, constantly above idling speed	217
45391[A)]	25391	No detection of N/P positions after starting	212
45720	25720	Throttle switch, constantly off	215
45721	25721	Pedal switch, constantly off	219
45722	25722	Brake switch and, in cars with manual gearbox, clutch switch faulty	221
45723	25723	Brake signal from brake light switch, but not from TC/ABS	223
45724	25724	Brake signal from TC/ABS, but not from brake light switch	224
45770	25770	Throttle switch, constantly on	215
45771	25771	Pedal switch, constantly on	219
45780	25780	Throttle switch, voltage too high	213
45781	25781	Pedal switch, voltage too high	217
45791[A)]	25791	KD point not detected	226
457B1[A)]	257B1	KDW not connected	226
457B2[A)]	257B2	KDW not adjusted	226
46221	26221	Temperature sensor, temperature too low	227
46271	26271	Temperature sensor, temperature too high	227
53240	33240	Main relay, current too high	229
53250	33250	Main relay, current too low	229
53270	33270	Main relay, constantly activated	229
53440	33440	Safety valve, current too high	231
53450	33450	Safety valve, current too low	231
53630	33630	Throttle motor, malfunction	233
55780	35780	Throttle switch, voltage too low	213
55781	35781	Pedal switch, voltage too low	217
58341	38341	Idling speed too slow	235
58351	38351	Idling speed too fast	235
62490	72490	Control module fault, PID regulator	255
67190	77190	Control module fault, RAM fault	255
67191	77191	Control module fault, ROM fault	255
67192	77192	Control module fault, EEPROM fault	255
67193	77193	Control module fault, EEPROM fault	255
67196	77196	Control module fault, time function	255
67290	77290	Control module fault, D/A converter	255
672B1[A)]	772B1	Control module fault, D/A converter for KDW motor	237
67390	77390	Control module fault, speed control <20 km/h	255
67391	77391	Control module fault, speed control >48 km/h	255
67590	77590	Internal monitoring (Watchdog 1)	255
67591	77591	Control module fault, reset function	255
67592	77592	Internal monitoring (Watchdog 2)	255
67593	77593	Control module fault, safety switch 30	255

Permanent	Intermittent	Faulty function/component	Action, see 2:5, page
67594	77594	Control module fault, safety switch 31	255
67595	77595	Control module fault, safety switch 32	255
675B0	-----	Control module, calibration interrupted/not performed	238
675B1	-----	Control module, calibration not possible	239
675B2	-----	Control module, engine version not specified	240
675B3[A)]	775B3	Control module fault, EEPROM fault	241
675B4[A)]	775B4	Control module fault, monitoring (Watchdog)	242
675B5[A)]	775B5	Control module fault, ROM fault	241
68170	78170	Control module fault, software fault (system relay)	255
68331[A)]	78331	Short circuit in KDW motor	243
68340	78340	Control module fault, transistor for system relay	255
68341	78341	Control module fault, safety valve	255
68342	78342	Control module fault, TCS CTRL lamp	255
68390	78390	Throttle control faulty	245
68391	78391	Control module fault, GR flip-flop	255
683B0	783B0	Throttle control faulty (oscillation in throttle butterfly)	248
683B1[A)]	783B1	KDW motor not in rest position when power off	249
E7590	D7590	Safety system, malfunction	250
E75B1[A)]	D75B1	Communication fault, serial interface	253
E75B2[A)]	D75B2	Communication fault, break/short-circuit to ground	253
E75B3[A)]	D75B3	Communication fault, cannot be re-established	253

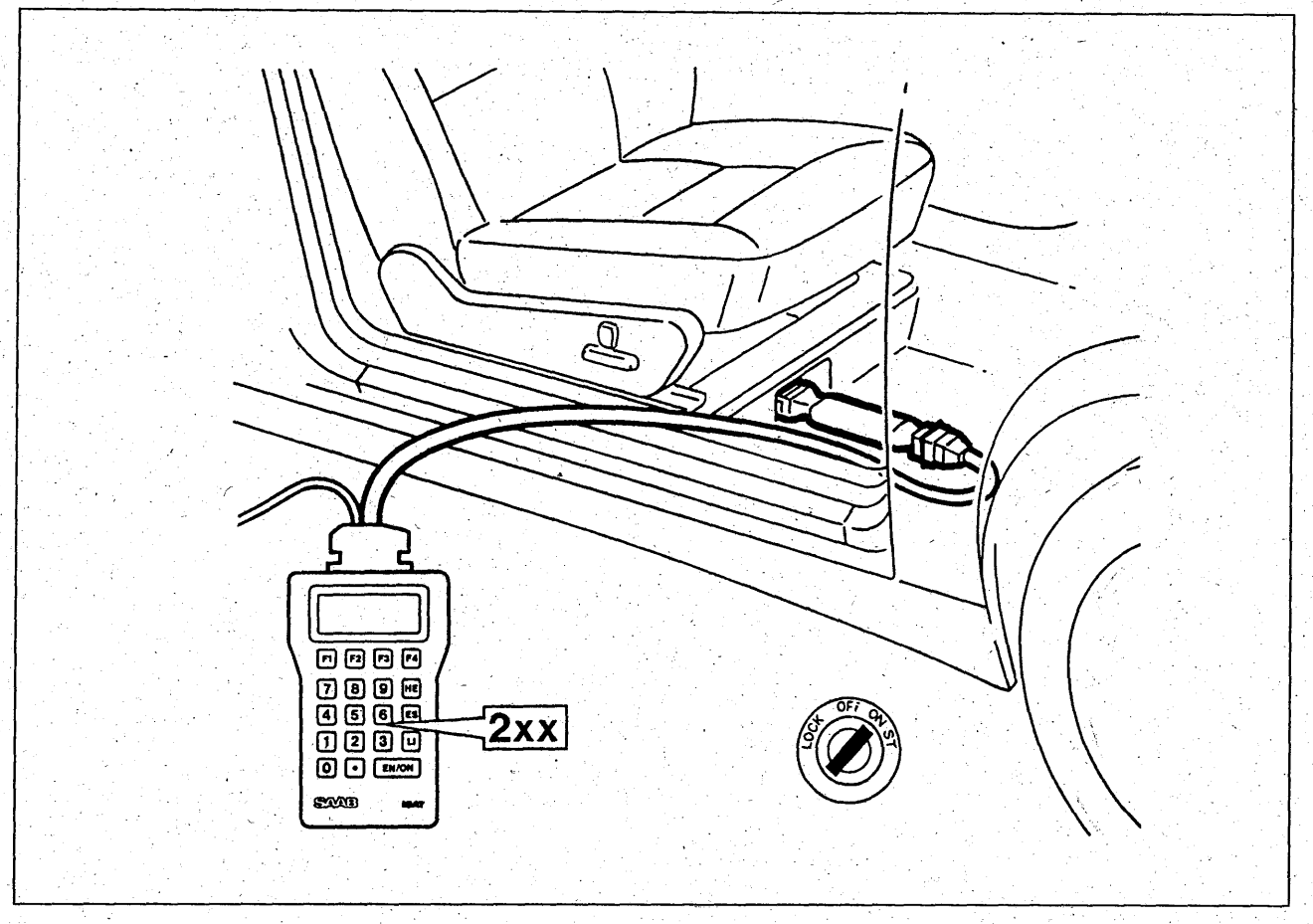
TCS (4-cyl.) (contd.)

Menu structure for command codes



TCS (4-cyl.) (contd.)

ETS command codes



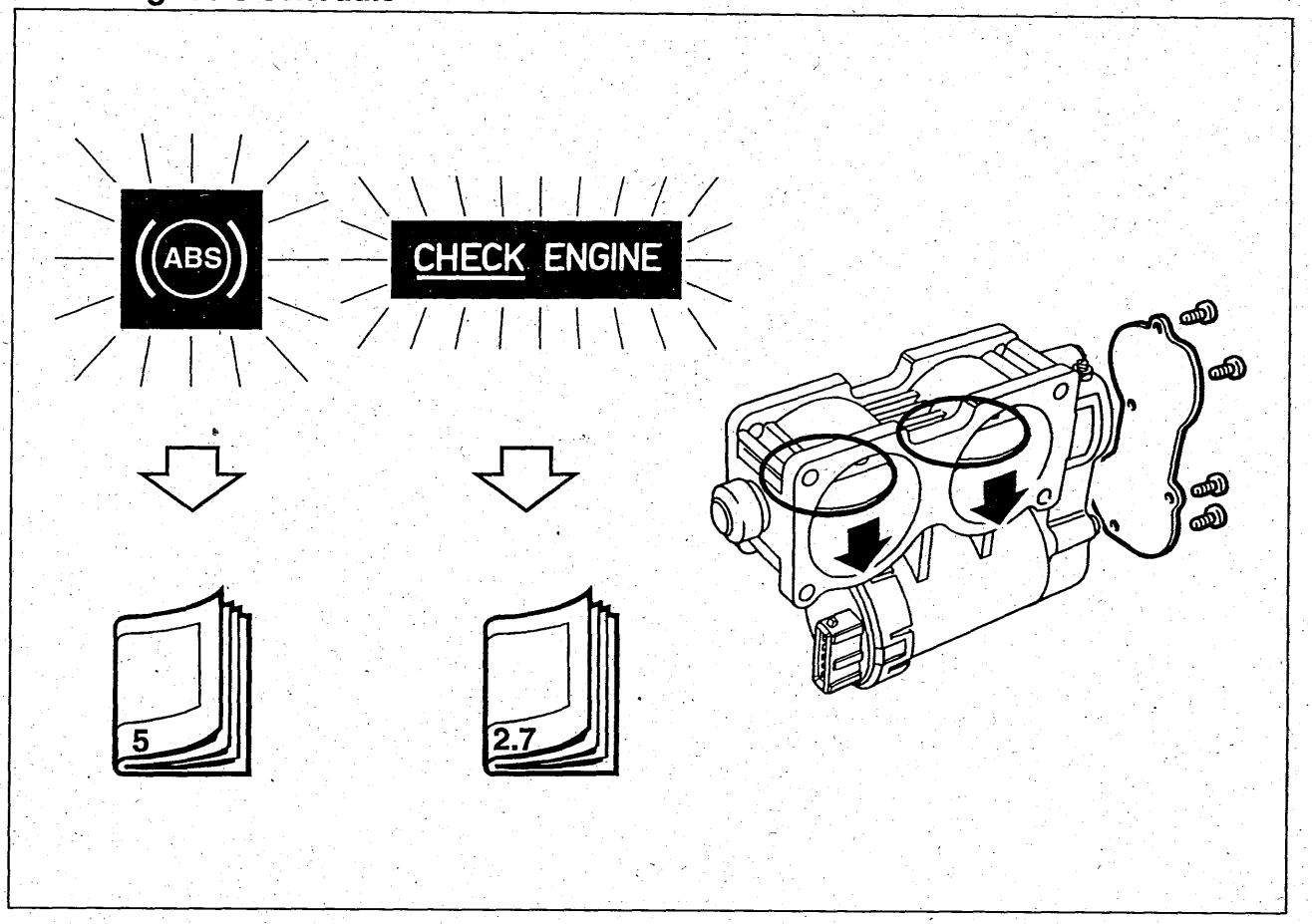
Code	Command function	ISAT ST display text
27A	Accelerator pedal travel in %	E.g. 80033=33%
100	Transfer all diagnostic trouble codes to the ISAT scan tool	----
101	Transfer 1st diagnostic trouble code + counter	E.g. 58351 80255 = diagnostic trouble code 58351 generated 255 times
102	Transfer 2nd diagnostic trouble code + counter	
103	Transfer 3rd diagnostic trouble code + counter	
104	Transfer 4th diagnostic trouble code + counter	
200	A/C relay, reads current status	8B100=activated 8B000=not activated
202	Cruise control, ON/OFF status	8B102=ON 8B002=OFF
203	Cruise control, SET status	8B103=ON 8B003=OFF

Code	Command function	ISAT ST display text
204	Cruise control, RESUME status	8B104=ON 8B004=OFF
205	Brake and clutch switches, status	8B105=ON 8B005=OFF
206	Brake light switch status	8B106=ON 8B006=OFF
207	Safety switch, accelerator pedal	8B107=ON 8B007=OFF
208	Safety switch, throttle body	8B108=ON 8B008=OFF
249	Engine speed	803500 = 3500 rpm
250	Engine coolant temperature in °C	E.g. 800-15=-15°C 800+35=+35°C 80 <-20= <-20°C 80>+50=>+50°C
279	Throttle butterfly opening angle in %	E.g. 80030=30%
280	Speed	80110=110 km/h
281	Engine load signal Tq (pulse width in µs)	Idling = approx. 25 µs Full load = approx. 500 µs
380	Gives EPROM manufacturing number	80 XX RELYY HH:MM DD.MM.YYYY
382	Gives ETS control module part number	80YYYYYY
383	Gives ETS control module serial number	80ZZZZZZ
550	A/C relay activated, 0.2 Hz	8A550
551	Activates safety valve (1 Hz)	8A551
552	Activates charge air bypass valve (1 Hz)	8A552
553	Activates TCS CTRL lamp 1(Hz)	8A553
800	Ends communication	----
900	Clears diagnostic trouble codes	11111
971*	Basic setting	8A971=in progress 8D971=completed
973*	Calibration, warm engine	8A973
974*	Basic setting, idling speed	8A974
975	Shows engine version	See 976-977
976	Stores data on B202 Turbo	802.0T
977	Stores data on B234 Turbo, manual	802.3TS
97A	Stores data on B234 Turbo, automatic	802.3TA

*) For a more detailed description of the calibration procedure, see Service Manual 2:5, pages 171-176.

TCS (6-cyl.)

Fault diagnosis schedule



1 If the ANTI LOCK lamp is on, always begin fault diagnosis in the ABS system.
2 If the malfunction indicator (CHECK ENGINE) lamp is on, always start fault diagnosis in the Motronic system.
3 With the ignition switched off, check that the throttle butterfly can freely be moved to the closed position and that it is easily returned to the open position with spring force.

Important

In order to establish communication between the ISAT and the TCS control module, the following must be observed:

- the ignition switch must be in the Drive position
- engine speed must be <1500 rpm (if the engine is running)
- communication with the TCS system must established

The ISAT scan tool cannot establish communication with the system if:

- the circuit to pin 9 of the control module is faulty
- pins 13/30 are not correctly grounded
- pins 28/32 do not have the correct voltage
- the circuit to pin 3 is shorted to battery positive (B+)

TCS (6-cyl.) (contd.)

Readings, control module connections

Unless otherwise stated, the ignition switch must be in the ON position. All readings are approximate.

Pin	Co-lour	Component/Function	In/ Out	Test conditions	Reading	Between X-Y	See 2:5, page
1	BK/ WH	TCS OFF/ON	In	TCS switch ON (pushed in)	B+	32 - 1	18
				TCS switch OFF (not pushed in)	0 V		
2		No connection.					
3	YE/ WH	Position sensor, TCS throttle, reference voltage	Out		approx. 5V	3 - 13	20
4		No connection.					
5	RD/ WH	Disengagement of cruise control	Out	Activate with ISAT scan tool: ON	B+	5 - 13	25
				Activate with ISAT scan tool: OFF	0 V		
6	OG	Engine speed	In	Idling	40 Hz (LP LO HI)	6 - 13	23
7	BU	Wheel speed FR	In		14.25 Hz (LP **HI** LOp)	7 - 13	22
				Rotate FR wheel approx. 1/2 turn/s	46 Hz (LP **HI** LOp)		
8	GN	Wheel speed RR	In		14.25 Hz (LP **HI** LOp)	8 - 13	22
				Rotate RR wheel approx. 1/2 turn/s	46 Hz (LP **HI** LOp)		
9	BU/ WH	Data link K	In/ Out	ISAT scan tool connected	B+	9 - 13	15
				ISAT scan tool not connected	0 V		
10		No connection.					
11	YE	Position signal, main butterfly (from MOTRONIC). Engine temp. signal (from Motronic)	In	Idling	1.2 V 100 Hz 9% (+) 0.9 ms (+) (LP **LO** HI)	11 - 13	21
				Ignition ON, starter motor running.	0.25-1.0 V 100 Hz 2-8.2% (+) 0.2-0.82 ms (+) (LP **LO** HI)		
12	BN/ WH	TCS lamp	Out	Activate with ISAT scan tool: ON	B+	32 - 12	16
				Activate with ISAT scan tool: OFF	0 V		
13	BK	Ground	In		<0.1 V	13 - B-	14
14		No connection.					
15		No connection.					
16		No connection.					

Pin	Co-lour	Component/Function	In/ Out	Test conditions	Reading	Between X-Y	See 2:5, page
17		No connection.					
18	GN/ WH	Throttle motor Important Clear any diagnostic trouble codes after this test.	Out	Activate with ISAT scan tool: BUTTERFLY CLOSING ON	3.5 V 500 Hz 35% (+) 0.7 ms (+) (LP LO HI)	18 - 35	19
				As above + open throttle by hand (max. 5 s)	8-11 V		
				As above + close butterfly **additionally** by hand (max 5 secs)	minus 8 to minus 11 V		
19		No connection.					
20	WH	Position sensor, TCS throttle butterfly, ground	Out		B+	32 - 20	20
21	GY	Disengagement of full-load enrichment	Out		6 V 31 Hz 50% (+) 16 ms (+) (LP Hlp LOp)	21 - 13	26
				TCS activated	6 V 62 Hz 50% (+) 8 ms (+) (LP HI LO)		
22		No connection.					
23	WH	Brake light switch	In	Brakes applied	B+	23 - 13	24
				Brakes not applied	0 V		
24	GY	RL Wheel speed	In		14.25 Hz (LP **HI** LOp)	24 - 13	22
				Rotate RL wheel approx. 1/2 turn/s	46 Hz (LP **HI** LOp)		
25	YE	FL wheel speed	In		14.25 Hz (LP **HI** LOp)	25 - 13	22
				Rotate wheel FL approx. 1/2 turn/s	46 Hz (LP **HI** LOp)		
26	VT/ WH	TCS OFF lamp	Out	Turn off the TCS system using switch: lamp ON	B+	32 - 26	17
				Activate TCS system using switch: lamp OFF	0 V		
27	BU/ WH	Position sensor, TCS throttle butterfly, output	In	Activate with ISAT scan tool: BUTTERFLY CLOSING ON	approx. 1.2 V	27 - 13	20
				Activate using ISAT scan tool: BUTTERFLY CLOSING OFF	approx. 4.4 V		

Pin	Co-lour	Component/Function	In/ Out	Test conditions	Reading	Between X-Y	See 2:5, page
28	GN/ WH	Current (+15 circuit)	In		<0.5 V	B+ - 28	13
				Ignition OFF	B+		
29		No connection.					
30	BK	Ground	In		<0.1 V	30 - B-	14
31		No connection.					
32	RD	Power supply	In		<0.5 V	B+ - 32	13
33		No connection.					
34		No connection.					
35	GN	Throttle motor	Out	See pin 18		18 - 35	19

TCS (6-cyl.) (contd.)

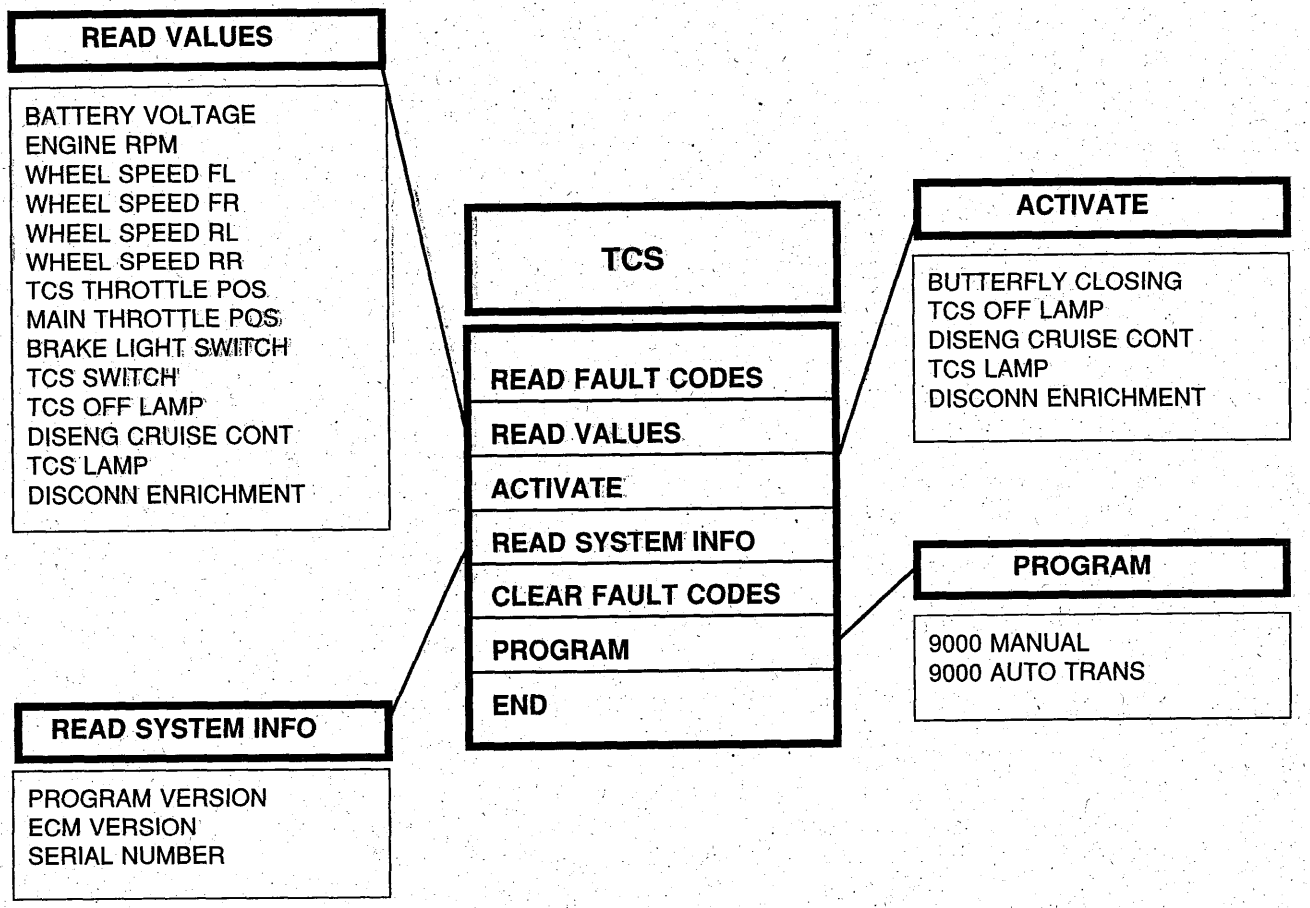
Diagnostic trouble codes

Engine running or ignition switch in ON position

Diagnostic trouble code	Faulty function/component	TCS-OFF	ISAT ST display text	See 2:5, page
B1192	TCS switch, shorting to ground	ON	FAULT XX P/I B1192 TCS SWITCH SHORTING TO GROUND	45 (18)
B1302	Position sensor TCS throttle butterfly, shorting to ground/open circuit	ON	FAULT XX P/I B1302 TCS THROTTLE SENSOR SHORT TO GND/OPEN	39 (19)
B1303	Position sensor TCS throttle butterfly, shorting to B+/open circuit	ON	FAULT XX P/I B1303 TCS THROTTLE SENSOR SHORT BATT+/OPEN	39 (19)
B1371	Wheel speed FL, no signal	ON	FAULT XX P/I B1371 WHEEL SPEED FL FAULTY SIG/NO SIG	42 (22)
B1376	Wheel speed FR, no signal	ON	FAULT XX P/I B1376 WHEEL SPEED FR FAULTY SIG/NO SIG	42 (22)
B1381	Wheel speed RL, no signal	ON	FAULT XX P/I B1381 WHEEL SPEED RL FAULTY SIG/NO SIG	42 (22)
B1386	Wheel speed RR, no signal	ON	FAULT XX P/I B1386 WHEEL SPEED RR FAULTY SIG/NO SIG	42 (22)
B1406	Position signal, main throttle butterfly, faulty	ON	FAULT XX P/I B1406 MAIN THROTTLE POS SIGNAL INCORRECT	46 (21)
B1407	Position signal, main throttle butterfly, short-circuit to ground	ON	FAULT XX P/I B1407 MAIN THROTTLE POS SHORT TO GROUND	46 (21)
B1408	Position signal main throttle butterfly, shorting to B+/open circuit	ON	FAULT XX P/I B1408 MAIN THROTTLE POS SHORT BATT+/OPEN	46 (21)
B1605	TCS control module, control module fault	ON	FAULT XX P/I B1605 CONTROL MODULE INTERNAL FAULT	38 (12)
B1610	Control module not programmed	ON	FAULT XX P/I B1610 CONTROL MODULE NOT PROGRAMMED	50 (35)
B1710	Engine speed, no signal	ON	FAULT XX P/I B1710 ENGINE RPM SIGNAL FAULTY SIG/NO SIG	41 (23)
B2433	TCS throttle body, shorting to B+ or ground	ON	FAULT XX P/I B2433 THROTTLE MOTOR SHORT BATT+/GROUND	47 (19)
B2434	TCS throttle body, open circuit/mechanical fault	ON	FAULT XX P/I B2434 THROTT HOUSING/MOTOR OPEN/MECH FAULT	48 (19)

TCS (6-cyl.) (contd.)

Menu structure for command codes



TCS (6-cyl.) (contd.)

READ VALUES

	ISAT ST display	Function
1	BATTERY VOLTAGE XX.X V	Shows control module supply voltage
2	ENGINE RPM XXXX rpm	Engine speed (shows 450 rpm as lowest value)
3	WHEEL SPEED FL XXX km/h	FL wheel speed (shows 3 km/h as lowest speed)
4	WHEEL SPEED FR XXX km/h	FR wheel speed (shows 3 km/h as lowest speed)
5	WHEEL SPEED RL XXX km/h	RL wheel speed (shows 3 km/h as lowest speed)
6	WHEEL SPEED RR XXX km/h	RR wheel speed (shows 3 km/h as lowest speed)
7	TCS THROTTLE POS XX %	This figure is the pulse ratio of the TCS throttle position signal from the TCS control module (9-92%)
8	MAIN THROTTLE POS XX %	This figure is the pulse ratio of the main throttle position signal from the Motronic control module to the TCS control module (9-92%)
9	BRAKE LIGHT SWITCH ON/OFF	Shows status of brake light switch
10	TCS SWITCH ACTIVE/NOT ACTIVE	Shows status of TCS switch ("ACTIVE" only when the switch is held depressed)
11	TCS OFF LAMP ON/OFF	Shows whether the TCS control module turns on the TCS OFF lamp
12	DISENG CRUISE CONT ON/OFF	Shows whether the TCS control module disengages the cruise control system
13	TCS LAMP ON/OFF	Shows whether the TCS control module turns on the TCS lamp and whether it activates the TCS function in the TCM control module
14	DISCONN ENRICHMENT ON/OFF	Shows whether the TCS control module sends the "disconnect full-load enrichment" signal to the Motronic control module (the ISAT scan tool display alternates between ON and OFF when the function is activated)

TCS (6-cyl.) (contd.)

ACTIVATE

Note

When a system feature is activated with the ISAT scan tool, this means that the TCS control module is doing something which is not functionally normal. Consequently, diagnostic trouble codes may be generated in other systems that are dependent on the TCS.

Important

The activate functions should always be used with discretion.

When activating throttle closure, engine torque greatly decreases.

Activation of "disengage full-load enrichment" will cause the engine to stop.

- Always deactivate an activated function before proceeding in the ISAT scan tool menu.
- Always clear any diagnostic trouble codes that have been generated in the Motronic or TCM system after finishing work.

	ISAT ST display	Function
1	BUTTERFLY CLOSING ON/OFF	The TCS control module closes the TCS throttle almost completely
2	TCS OFF LAMP FUNCTION ON/OFF	The TCS control module activates the TCS OFF lamp
3	DISENG CRUISE CONT FUNCTION ON/OFF	The TCS control module disengages the cruise control system
4	TCS LAMP FUNCTION ON/OFF	The TCS control module activates the TCS lamp and the TCS program in the TCM control module
5	DISCONN ENRICHMENT FUNCTION ON/OFF	The TCS control module sends battery positive (B+) to the Motronic control module for disengagement of full-load enrichment. The Motronic control module interprets this as fuel shut-off and the engine stops (used only to check the wiring).

TCS (6-cyl.) (contd.)

READ SYSTEM INFO

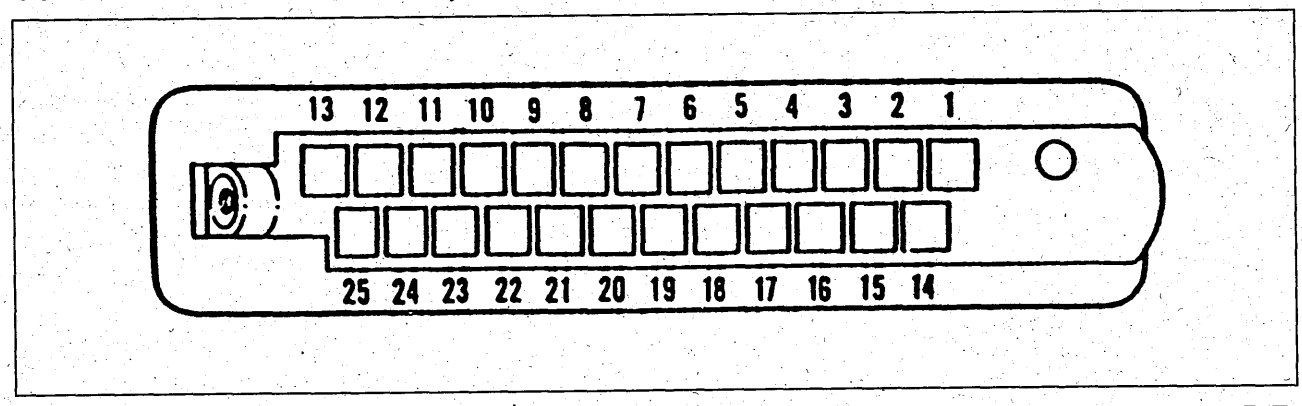
	ISAT scan tool display	Function
1	PROGRAM VERSION	Shows current program version in the TCS control module
2	ECM VERSION	Shows the control module version number
3	SERIAL NUMBER	Shows the serial number of the control module

PROGRAM

	ISAT scan tool display	Function
1	PROGRAMMED FOR 900 MANUAL 900 AUTO TRANS 9000 MANUAL 9000 AUTO TRANS CHANGE/OK	Shows the gearbox variant for which the TCS control module is programmed
2	TYPE OF GEARBOX 900 MANUAL 9000 AUTO TRANS	Enables the control module to be programmed for the type of gearbox concerned

LH

Control module connections, LH 2.2

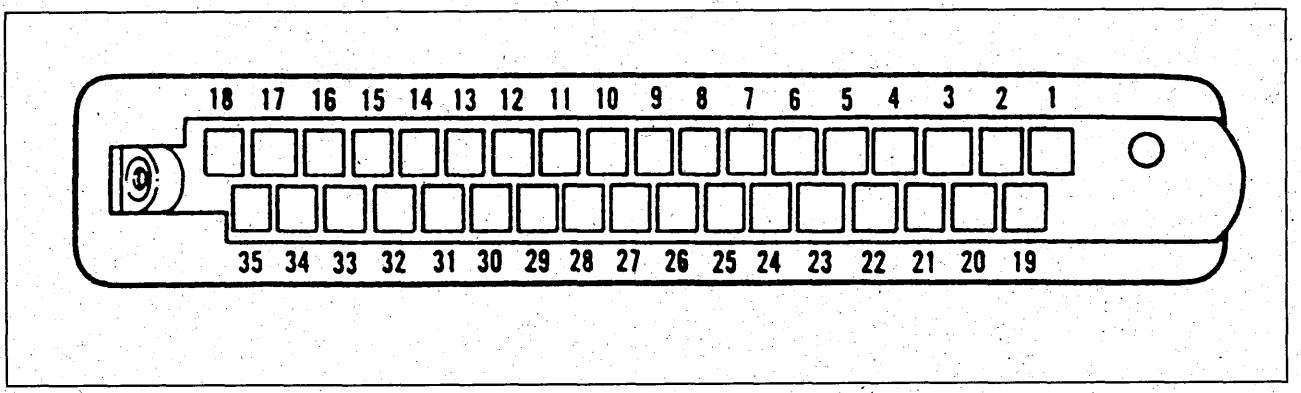


Pin	Colour	Component/Function	In/ Out	Reading	Remarks
1	BU	Engine speed signal	In	6.5 V >8 V	M1986- During starter motor cranking At idling speed
2	YE	Temperature sensor	In	4.0-0.5 V	-20°C - +80°C
3	GY	Throttle position switch (idling speed)		0 V 5 V	At idling speed Above idling speed
4	OG	Signal, "Drive" position (Aut)	In	B+ 0 V	R, D, 1, 2 and 3 P, N and manual gearbox
5	BK	Signal ground		0 V	Separate from power ground
6	BU/WH	Mass air flow sensor, ground signal	In	0 V	Separate from power ground
7	OG	Mass air flow sensor, signal	In	2 V 5 V	Idling Full load
8	RD/WH	Mass air flow sensor, burn-off	Out	4 V 0 V	During burn-off In other cases
9	GY/WH	Power supply from main relay	In	B+	
10	BU/WH	Idle air control valve	Out	6-11 V	Idling
11	BK	Grounding point, control module		0 V	Separate from power ground
12	GN/RD	Throttle position switch (wide open throttle)		0 V 5 V	Wide open throttle Idling
13	GN/RD	Injectors, control signal	Out	7.1 Hz 2.5-4.5 ms	Use the ISAT scan tool's pulse measurement function and check that the frequency increases as the throttle is opened
14	WH	Mass air flow sensor		~2 V	
15	BK	Grounding point for coding (certain versions)		0 V	
16	RD/WH	Idle speed increase (A/C compressor)	In	B+ 0 V	A/C engaged A/C disengaged
17	VT	Pump relay		~1 V B+	Activated Ignition on
18	GN/WH	Main fuse box, positive terminal (+15)		B+	
19	VT/WH	CHECK ENGINE (MIL) lamp	Out	B+ 1 V	Off on

Pin	Colour	Component/Function	In/ Out	Reading	Remarks
20	WH	**-M1988:** Oxygen sensor	In	0.6-1.0 V 0-0.4 V	Rich Lean
		M1989-: PRE-IGNition, DI/APC		0 V 6.5 V 12 V	PRE-IGNition enrichment No enrichment Knocking enrichment
21	YE/WH	Main relay control circuit	Out	~1 V B+	Ignition on Ignition off
22	GN	Lambda pulse ratio, test socket			
23	YE/RD	Idle air control valve	Out	6-12 V	Idling
24	BU/RD	Engine load signal, Tq (9000 Turbo with DI and 9000 i/S with EZK)	Out		Use the ISAT scan tool's pulse measurement function and check that the frequency changes as the throttle is opened
25	BK/WH	Grounding point, power ground		0 V	Separate from signal ground

LH (contd.)

Readings, control module connections LH 2.4 and 2.4.1

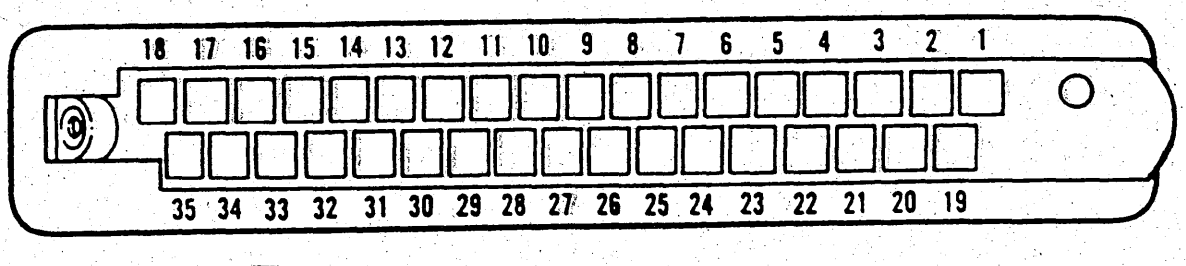


Pin	Colour	Component/Function	In/ Out	Reading	Remarks
1	BU	Engine speed signal	In	6.5 V >8 V	With starter motor running When idling
2	GY	Throttle position switch (idling speed)		0 V (closed) ~11 V (open)	Idling Above idling speed
3	GN/RD	Throttle position switch (wide open throttle) Cars with ETS: Throttle butterfly angle from ETS		0 V (closed) ~11 V (open) ~0.5 V 10 V	At wide open throttle Before wide open throttle Idling speed Full load
4	RD	Branch point (+30 circuit)	In	B+	
5	BK	Signal ground		0 V	Separate from power ground
6	BU/WH	Mass air flow sensor, ground signal	In	0 V	Separate from power ground
7	OG	Mass air flow sensor, signal	In	~2 V ~5 V	Idling Full load
8	RD/WH	Mass air flow sensor, burn-off	Out	4 V 0 V	During burn-off In other cases
9	GY/WH	Power supply from main relay	In	B+	
10		No connection.			
11	GN/RD	Relay, A/C Time-delay relay, A/C			LH 2.4.1 LH2.4
12	BU/WH	Data link K Data link connector, pin 1	In/ Out		
13	YE	Temperature sensor	In	4-0.5 V	-20°C - +80°C
14	GN/WH	A/C / ACC, load signal (not ETS)	In	12 V 0 V	AUTO (closed antifrost thermostat) ECON, OFF
15	GN/GY	Jumper connection for cold-starting valve		12 V 0 V	Valve fitted Valve not fitted
16	GN/RD	Data link L Data link connector, pin 2	In/ Out		
17	BK/WH	Chassis ground		0 V	Separate from signal ground

Pin	Colour	Component/Function	In/ Out	Reading	Remarks
18	GN/WH	Injectors	Out	7.1 Hz 2.5-4.4 ms	Use the ISAT scan tool's pulse measurement function and check that the frequency increases as the throttle is opened
19	YE/WH	EGR valve (California, M1990)	Out	B+ <B+	Not activated Activated
20	VT	Fuel pump control circuit		1 V B+	Activated Ignition on
21	YE/WH	Main relay control circuit	Out	1 V B+	Ignition on Ignition off
22	VT/WH	CHECK ENGINE lamp (MIL)	Out	B+ 1 V	Off on
23	YE/WH	EGR, temperature sensor (California, M1990)	In	4.5 V <4.5 V	EGR closed EGR open
24	GN	Oxygen sensor	In	0.6-1.0 V 0-0.4 V	Rich Lean
25	BU/RD	Engine load signal, Tq (EZK/DI)	Out		Use the ISAT scan tool's pulse measurement function and check that the frequency changes as the throttle is opened
26	WH	SHIFT UP lamp (USA)	Out	B+ 0 V	Not activated Activated
27	YE/RD	EVAP canister purge valve	Out	B+ 1 V	Open valve Closed valve
28	WH	PRE-IGNition, DI/APC	In	0 V 6.5 V 12 V	PRE-IGNition enrichment No enrichment Knocking enrichment
29	GY/WH	Coding	In	12 V	Automatic transmission
30	OG	Idling speed increase, automatic	In	B+ 0 V	R, D, 1, 2 and 3 P, N and manual gearbox
31	GN/RD	Consumption signal to EDU	Out		Use the ISAT scan tool's pulse measurement function and check that the frequency increases as the throttle is opened
32	BN	Cold-starting valve	Out	B+ 0 V	Not activated Activated (<-15°C)
33	BU/WH	Idle air control valve	Out	5-11 V	No-load idling
34	GN	Speed sensor LH 2.4.1 and LH 2.4 (USA)	In	6 V 0 V/12 V	Rotating wheel Stationary wheel
35	GN/WH	Power supply (+15 circuit)	In	B+	Ignition on

LH (contd.)

Readings, control module connections LH 2.4.2



Pin	Colour	Component/Function	In/ Out	Readings:	Remarks
1	BU	Engine speed signal from ignition system	In	6.5 V >8 V	With starter motor running When idling
2	GY	Throttle position sensor	In	0.2 V 4.0 V	Idling Full load
3	GN/RD	Throttle angle signal to DI/APC (PWM) Cars with ETS: Throttle angle signal from ETS	Out	1 V 10 V ~0.5 V ~10 V	Idling Full load Idling Full load
4	RD	Power supply (+30 circuit)	In	B+	
5	BK	Signal ground		0 V	Separate from power ground
6	BU/WH	Mass air flow sensor, ground signal	In	0 V	Separate from power ground
7	OG	Mass air flow sensor, signal	In	2 V 5 V	Idling Full load
8	RD/WH	Mass air flow sensor, burn-off	Out	4 V 0 V	During burn-off In other cases
9	GY/WH	Power supply from main relay	In	B+	
10	GN/RD	Throttle position sensor, reference voltage	Out	5 V	
11	GN/RD	A/C relay, control circuit	Out	B+ 0 V	A/C not connected A/C connected
12	BU/WH	Data link K	In/ Out		
13	YE	Engine temperature sensor	In	4.0-0.5 V	-20°C - +80°C
14	GN/WH	A/C/ACC, load signal	In	12 V 0 V	AUTO (provided that the antifrost thermostat is connected) ECON, OFF
15	GN/GY	Idle air control valve, opening control signal	Out	7-11 V	Unloaded, idling and with warm engine
16	GN/RD	Data link L	In/ Out		
17	BK/WH	Power ground		0 V	

Pin	Colour	Component/Function	In/ Out	Readings:	Remarks
18	GN/RD	Injectors	Out	7.1 Hz 2.5-4.5 ms	Use the ISAT scan tool's pulse measurement function and check that the frequency increases as the throttle is opened
19		Not used			
20	VT	Fuel pump relay control circuit		1 V B+	Activated Ignition on
21	YE/WH	Main relay control circuit	Out	1 V B+	Ignition on Ignition off
22	VT/WH	CHECK ENGINE lamp (MIL)	Out	B+ 1 V	Off On
23	YE/WH	Mass air flow sensor		~2 V	Cars without catalytic converter
24	GN	Oxygen sensor	In	0.6-1.0 V 0-0.4 V	Rich Lean
25	BU/RD	Engine load signal, Tq	Out	1.0-4.5 V	Use the ISAT scan tool's pulse measurement function and check that the frequency changes as the throttle is opened
26	WH	SHIFT UP lamp (US manual)	Out	B+ 0 V	Not activated Activated
27	YE/RD	EVAP canister purge valve	Out	B+ 1 V	Open valve Closed valve
28	WH	PRE-IGNition	In	0 V 6.5 V 12 V	PRE-IGNition enrichment No enrichment Knocking enrichment
29	GY/WH	Coding	In		Not used
30	OG	DRIVE signal	In	B+ 0 V	R, D, 1, 2 and 3 P, N and manual gearbox
31	GN/RD	Consumption signal to EDU	Out		Use the ISAT scan tool's pulse measurement function and check that the frequency changes as the throttle is opened
32	-	Cold-starting valve (certain versions)	Out	B+ 0 V	Not activated Activated (<-15°C)
33	BU/WH	Idle air control valve, closing control signal	Out	5-11 V	No-load idling
34	GN	Speed sensor	In	6 V 0 V/12 V	Rotating wheel Stationary wheel
35	GN/WH	Power supply (+15 circuit)	In	B+	Ignition on

LH (contd.)

Table for testing components and signals

ID code	Component/Signal	Remarks
12411	Injectors	Listen
12412	IAC valve	The valve alternates between open and closed once every second. Listen
12413	ELCD valve	The valve alternates between open and closed once every second. Listen
12414	EGR valve	Listen
12415	A/C	Listen
12421	Drive signal, aut.	Lamp stops flashing when changing from "N" to "D"
12424	Throttle position switch, closed throttle signal	Lamp stops flashing when the accelerator pedal is depressed.
12431	Throttle position sensor, wide open throttle signal	The lamp stops flashing when the accelerator pedal is fully depressed
12432	Fuel signal	Listen (pump runs for about 1 second)

LH (contd.)

Diagnostic trouble codes

ISAT ST code	Lamp-flash code	LH test code	Notes	Faulty component/signal	See 2:3, page
42241/22241 42251/22251 42252/22252 42291/22291	12232	E004		Voltage too high (>16 V) Voltage too low (<1 V) Voltage too low (<10 V) Voltage <10 V or >16 V	92
		E009 E018 E109	LH 2.2	Main relay, power supply absent or too low	94
42440/22440	12224	E020 E024		Fuel-air mixture too rich, no oxygen sensor control (integrator in end position)	96
		E020	LH 2.2	Fuel-air mixture too rich, no oxygen sensor control (integrator in end position)	98
42441/22441 42442/22442 42451/22451 42452/22452	12112 12111			Fuel-air mixture too rich at idling speed Fuel-air mixture too rich when car is driven Fuel-air mixture too lean at idling speed Fuel-air mixture too rich at idling speed	100
44221/24221	12254 12231	E001		No engine rpm pulses	102
44261/24261	12243			Speed signal absent or incorrect	104
44671/24671	12253	E328		Open-circuit/short-circuited signal from DI system	106
45641/25641 45651/25651 45691/25691	12221	E207 E107 E007		Signal from mass air flow sensor too high Signal from mass air flow sensor too low Signal from mass air flow sensor too high or too low	108
45723/25723	12244			DRIVE signal absent or incorrect	112
45771/25771 45772/25772	12212 12213 12251	E102 E103	LH 2.4.2	Signal from throttle position sensor absent or shorted to ground or battery	114
45771/25771 45772/25772	12212 12213 12251	E002 E003 E102 E103	LH 2.4 and 2.4.1	Signal from throttle position switch absent or shorted to ground or battery	116
45771/25771 45772/25772	12212 12213 1225		ETS	Throttle position information incorrect	118
		E002 E103	LH 2.2	Signal from throttle position switch absent or shorted to ground or battery	120
46221/26221 46271/26271	12214	**LH 2.4/ 2.4.1/2.4.2:** E013 E113 **LH 2.2:** E002 E102		Temperature sensor (NTC) faulty. No signal or short circuit.	122
46391/26391	12245			EGR temperature sensor, signal incorrect or absent	124

ISAT ST code	Lamp-flash code	LH test code	Notes	Faulty component/signal	See 2:3, page
58121/38121	12242	E008 E108		Mass air flow sensor burn-off function absent Mass air flow sensor burn-off function constantly activated (short-circuit to ground)	128
58321/38321	12222		LH 2.4.2	Idle air control valve faulty	132
58321/38321	12222	E033	LH 2.4 and 2.4.1	Idle air control valve faulty	134
		E010 E023	LH 2.2	Idle air control valve faulty	136
LH 2.4: 58322/38322 **LH 2.4.2:** 58372/38372 58382/38382	12252			Control circuit for EVAP canister purge valve faulty Control circuit for EVAP canister purge valve, open circuit/short circuit to ground Control circuit for EVAP canister purge valve, short circuit to battery positive (B+)	138
58371/38371	12241	E218	LH 2.4/ 2.4.1/2.4.2	Injectors, faulty	140
		E213	LH 2.2	Injectors, faulty	142
67192	12233			Control module defective, fault in EPROM (internal memory)	144

LH (contd.)

Command codes

Important

Use of the ISAT scan tool could lead to a breakdown in communication with the LH 2.4.1 and LH 2.4.2 systems when any of the following command codes is used:

22A - 22B - 23A - 239 - 249 - 250 - 279

That is because these command codes are not programmed in the software of all LH control modules. In the event of a communication breakdown, contact will have to be re-established between the ISAT scan tool and the LH system concerned.

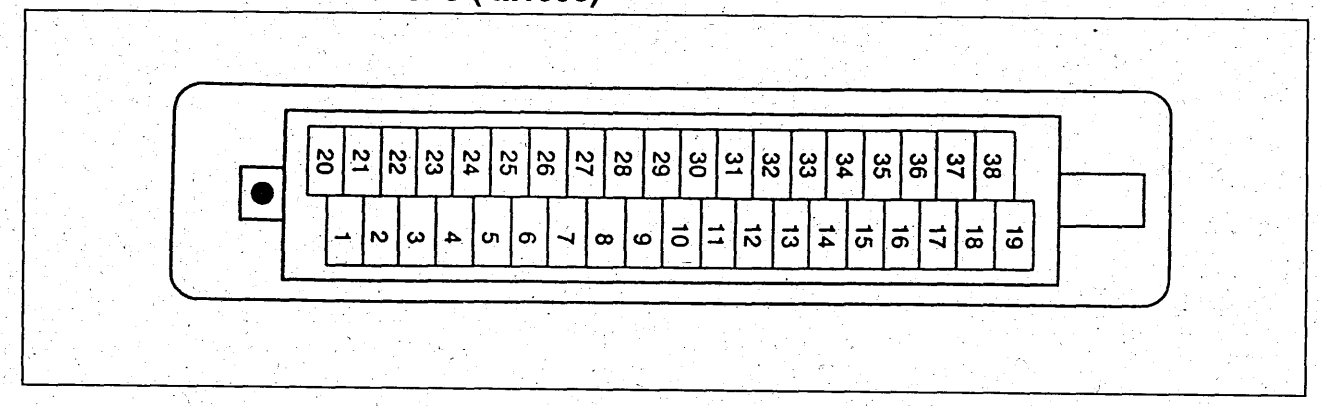
Code	Function/signal	Display text/example	LH 2.4.2	LH 2.4 LH 2.4.1
22A	Mass air flow sensor	803.6 = 3.6 V 804.7 = 4.7 V	X	
22B	Battery voltage	8010.6 = 10.6 V 8007.3 = 7.3 V	X	
23A	EGR, pulse ratio	80000 = 0% (injector closed) 80012 = 12% 80027 = 27%	X	
100	All diagnostic trouble codes are transferred from the control module memory to the ISAT scan tool		X	X
200	Check A/C status	8B100 = activated 8B000 = not activated (not ETS cars)	X	X
201	Throttle position	8B101 = closed throttle position 8B001 = normal position 8B301 = full load position 8B103 = closed throttle-full load	X	X
202	EVAP canister purge valve, position	8B002 = open 8B102 = closed	X	X
203	DRIVE signal status	8B103=active 8B003=not active	X	X
204	Shift indication (SHIFT UP)	8B104=lamp on 8B004=lamp off	X	
205	Oxygen sensor status	8B105 = lean 8B305 = rich 8B005 = inactive	X	X
206	PRE IGNition signal*)	8B106=pre-ignition enrichment 8B006=knocking enrichment	X	
207	Ignition pulses	8B007 (=no pulses present) 8B107 (=pulses present)	X	X

Code	Function/signal	Display text/example	LH 2.4.2	LH 2.4 LH 2.4.1
239	IAC valve pulse ratio	80035=35% 80043=43% (not ETS cars)	X	
249	Engine speed	801000 = 1000 rpm 805500 = 5500 rpm	X	
250	Coolant temperature	800-30=-30°C 80+130=+130°C	X	
279	Throttle angle in degrees (°)	E.g. 80030=30° (not ETS cars)	X	
382	Control module code	The last 4 digits in Bosch spare part number	X	X
550	Activates A/C function	8A550=activated	X	X
552	Activates injectors	8A552 (15 Hz and 1.5 ms opening duration)	X	X
553	Activated IAC valve (1 Hz)	8A553 (not ETS cars)	X	X
554	Activates EVAP canister purge valve (1 Hz)	8A554 from control module memory to ISAT scan tool	X	X
555	Activates EGR (1 Hz)	8A555=activated (only where fitted)	X	X
800	Ends communication		X	X
900	Clears all diagnostic trouble codes and resets all adaptive values to basic level	11111	X	X
930	Resets all adaptive values to basic level	11011	X	X

*)When working normally, the ISAT scan tool should show 8B006 and 8B106 alternately.

DI-DI/APC

Control module connections (-M1990)

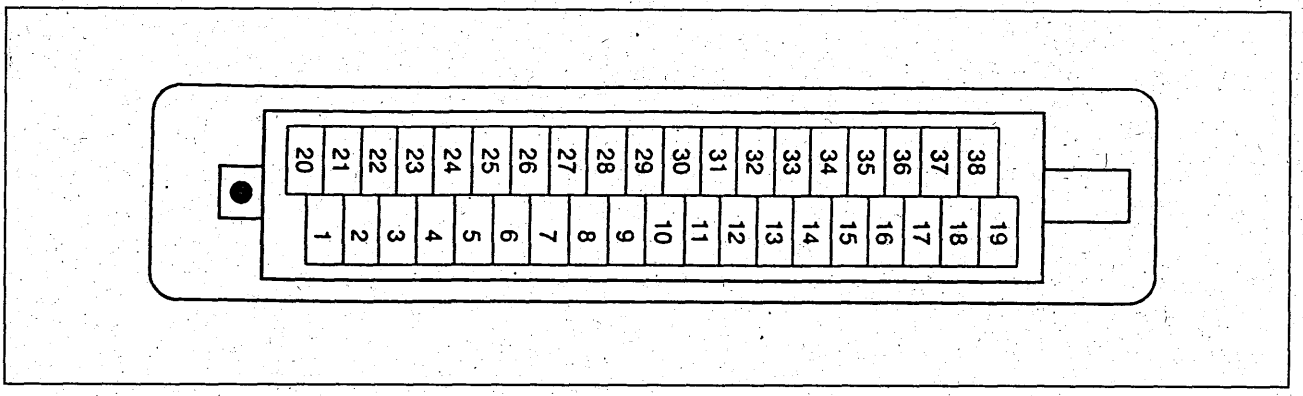


Pin	Colour	Component/Function	Remarks
1-3		No connection.	
4	BU/WH	Data link connector, pin 1	
5	BN	Combustion signal, cyl 3+4	
6	RD	Voltage to crankshaft position sensor	
7	YE/WH	Ground connection for MIL (CHECK ENGINE lamp)	
8	GN/RD	Wide open throttle signal, throttle position switch	
9		No connection.	
10	GN	Boost pressure control valve, pin 1	
11	GY	Knock sensor signal	
12		No connection.	
13	BK	Ground connection at intake manifold grounding point	
14	WH	Signal from pressure sensor, pin 1	
15	BK	Ground connection for crankshaft position sensor	
16		No connection.	
17	BK	Ground connection for pressure sensor, pin 2	
18	GY	Trigger signal, cyl 4	
19	GN	Trigger signal, cyl 2	
20	RD	Power supply to pressure sensor terminal 3	
21	GN/WH	Ignition voltage (+15 circuit)	
22	RD	Current (+30 circuit) via fuse 23	
23	GN/RD	Signal from crankshaft position sensor	
24	BN/WH	Data link connector, pin 3	
25	YE	Combustion signal, cyl 1+2	
26	WH	PRE IGN/knocking enrichment, terminal 28	
27-28		No connection.	
29	BU	Ignition pulse	
30		Screening. Ground to knock sensor.	
31		No connection.	
32	WH	Signal when brake activated	
33	BU	Boost pressure control valve, pin 3	
34		No connection.	
35	GN	Signal when cruise control disengaged	
36	BU/RD	Engine load signal Tq to terminal 25	

Pin	Colour	Component/Function	Remarks
37	BU	Trigger signal, cyl 3	
38	OG	Trigger signal, cyl 1	

DI-DI/APC (contd.)

Readings, control module connections (M1991-)



Pin	Colour	Component/Function	Voltage	Remarks
1	RD/BU	Coding cable	0 V 6-7 V 12 V	Jumper-connected to ground Not connected Jumper-connected to battery positive (B+)
2.3		No connection.		
4	BU/WH	Data link K, pin 3		
5	BN	Combustion signal, cyl 3+4	0 V	
6	RD	Voltage to crankshaft position sensor	Approx. 12 V	
7	YE/WH	MIL (CHECK ENGINE lamp) in EDU 3	0 V 11-12 V	On Off
8	GN/RD	Throttle position signal (LH 2.4 without TCS only)	0 V 10-12 V	Wide open throttle Closed throttle
9		No connection.		
10	GN	Boost pressure control valve, pin 1, turbo only	12 V	Not activated
11	GY	Knock sensor signal	0 V	
12		No connection.		
13	BK	Ground connection		
14	WH	Intake air temperature sensor (turbo only)	0-5 V	
15	BK	Ground connection for crankshaft position sensor		
16		No connection.		
17	BK	Ground connection for temperature sensor		
18	GY	Trigger signal, cyl 4	12 V	
19	GN	Trigger signal, cyl 2	12 V	
20		No connection.		
21	GN/WH	Current (+15 circuit)	12 V	
22	RD	Current (+30 circuit)	12 V	
23	GN/RD	Signal from crankshaft position sensor	0 V 5 V	opening screen
24	BN/WH	Data link L, pin 3	10-12 V	
25	YE	Combustion signal, cyl 1+2	0 V 5 V	low high

Pin	Colour	Component/Function	Voltage	Remarks
26	WH	Enrichment, PRE IGN/knocking (engine running, normal function)	12 V 6-7 V 12 V	Ignition on LH 2.4.2 LH 2.4
27	GY	Throttle position switch, closed throttle (LH 2.4 without TCS)	0 V 10-12 V	Closed throttle position normal position
28		No connection.		
29	BU	Engine speed signal	approx. 6.5 V 10-12 V	When starting When running
30		Ground (screen) for knock sensor		
31	GN/RD	Throttle angle signal (LH 2.4.2 and LH 2.4 with TCS) Vacuum switch, cruise control (LH without TCS)	1 V approx. 11 V 12 V 0 V	Closed throttle Wide open throttle Not active Active (closed vacuum switch)
32	WH	Brake signal (turbo only)	0 V 12 V	Not applied Applied
33	BU	Boost pressure control valve, pin 3 (turbo only)	12 V	not activated
34	GN/GY	Speed sensor signal (turbo only)	0 or 12 V 0-5 V	Stationary When driving
35	GN/RD	Current from main relay	12 V	
36	BU/RD	Engine load signal Tq	<1 V	Use the ISAT's scan tool PULSE feature or command code
37	BU	Trigger signal, cyl 3	12 V	
38	OG	Trigger signal, cyl 1	12 V	

DI-DI/APC (contd.)

Diagnostic trouble codes

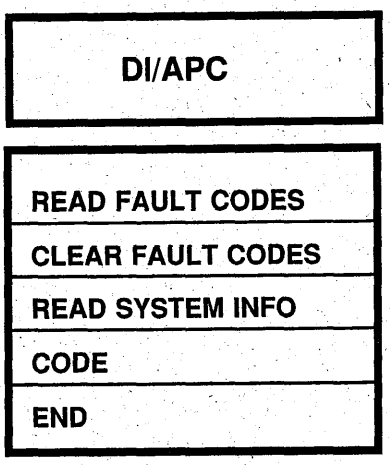
Permanent	Intermittent	Faulty component/function	See 2:6, page	See 0 "Old news", page
429B0	229B0	M1991-: Coding fault. Engine starts but runs on basic boost pressure only.		25**)
44261	24261	M1991-: No speed signal (Turbo)		24**)
44360	24360	Crankshaft position sensor, signal not OK	36*)	
44460	24460	Engine load signal (Tq), faulty		27**)
44461	24461	Adaptation fault, outside limits	50*)	
44660	24660	PRE IGNition fault	46*)	
44661	24661	Knock sensor, faulty signal	38*)	
44662	24662	Combustion, synchronization fault	48*)	
46660	26660	Pressure sensor, malfunction (M1991 and earlier only)	40*)	
45260	25260	M1991-: Throttle position sensor, signal not OK (LH 2.4.2 or TCS)		15**)
45360	25360	Brake signal not OK	42*)	
46391	26391	M1991-: Intake air temperature sensor, signal not OK		20**)
60000	-----	Internal monitoring (Watchdog)	54*)	
60001	-----	ROM fault	54*)	
60002	-----	RAM fault	54*)	
11111	11111	Reply code for OK		
"" ----	----	Throttle position switch, incorrect signal from wide open throttle/closed throttle switch (LH 2.4 without TCS), perhaps adaptation fault 44461/24461		17**)
----	----	Boost pressure too low		22**)
----	----	High fuel consumption		23**)
----	----	Cruise Control system, signal absent or not OK (B202 cat. without TCS)		28**)

*) Since Service Manual 2:6 "DI/APC system" M1989- is to be superseded by Service Manual 2:6 "DI/APC system" M1989-1993, these page references will be inaccurate. When the new manual comes out, consult the "Fault diagnosis" section.

**) These references to pages in Service Manual 0 "Old news" will be inaccurate when Service Manual 2:6 "DI/APC system" M1989-1993 is distributed. When the new manual comes out, consult the "Fault diagnosis" section.

DI-DI/APC (contd.)

Menu structure for command codes



DI-DI/APC (contd.)

Command codes (-M1990), ISAT scan tool

Code	Component/Function	Display text/Voltage (V)
300	Brake signal	8B000=not activated/0 V 8B100=activated/battery voltage
301	Cruise control (LH 2.4 cat. without TCS)	8B100=activated/0 V *) 8B000=not activated/11 V *)
302	Crankshaft position sensor	8B000=screen open/0 V 8B100=screen closed/5 V
303	Combustion signal, synchronization	8B000 = 1+2 high and 3+4 low 8B200 = 1+2 low and 3+4 high 8B300 = 1+2 high and 3+4 high
304	Throttle position switch, wide open throttle switch	8B100 = wide open throttle switch open 8B000 = wide open throttle switch closed
320	Pressure sensor status	E.g. 8B036 = 3.6 V
329	Knock sensor, signal level	E.g. 8B001 = 0.1 V
450	Activates ignition sparks	-
451	Activates boost pressure control valve	-
452	Activates MIL (CHECK ENGINE lamp) (flashes)	-
453	Activates enrichment (turbo only)	11111 = correct function
454	Activates engine speed signal	

DI-DI/APC (contd.)

Command codes (M1991-), ISAT scan tool

Code	Component/Function	Display text/Voltage (V)
200	Brake signal	8B000=not activated/0 V 8B100=activated/battery voltage
201	Cruise control (LH 2.4 cat. without TCS)	8B100=activated/0 V *) 8B000=not activated/11 V *)
202	Crankshaft position sensor	8B000=screen open/0 V 8B100=screen closed/5 V
203	Ignition synchronization (all cylinders)	8B300 5 V (combustion signal high) 8B000 1 V (combustion signal low)
204	Throttle position switch, wide open throttle switch (LH 2.4/LH 2.4.2)	80000=closed throttle (engine running) **) 80100=wide open throttle (engine running) **)
220	Pressure sensor status	80022 (Ex.) 2.2 V (M1991)
229	Knock sensor, signal level	80004 (Ex.) 0.4 V
27A	Current ignition dwell angle	89+15=15° BTDC (M1991-) 80-05=5° ATDC
280	Engine type, cat/no cat	E.g. B202L.cat-165E (1991-)
282	EPROM part No.	E.g. PGM.NO. 912614
283	Number of times knocking recorded (turbo only)	8B0x3=where x is the number times knocking has been recorded (M1991-)
285	Control module part No.	E.g. ECU.NO. 7859721 (M1991-)
286	Coding (connector jumper connection) (turbo only)	8E300:Control module pin 1 to 12 V 8E200:Control module pin 1 to ground 8E100:Control module pin 1 not connected (no jumper connection) 8E000:other=invalid combinations
287	Engine load signal Tq	80015= 15 µs pulse width
450	Activates ignition sparks	11111
451	Activates boost pressure control valve (turbo only)	11111
452	Activates MIL (CHECK ENGINE lamp) (flashes)	11111
453	Activates enrichment (turbo only)	11111/12-0 V
454	Activates engine speed signal	11111 ***) (Crankshaft must be 10-45° BTDC; enter 202 and adjust the position of the car until the ISAT scan tool display changes from 8B100 to 8B000
456	Activates wide open throttle signal 0-12 V (1 Hz)	(B202.L with LH 2.4 cat) ****)

Code	Component/Function	Display text/Voltage (V)
457	Activates closed throttle position 0-12 V (1 Hz)	(B202.L with LH 2.4 cat) ****)

*) *This is the opposite as compared with earlier model year cars.*
**) *New reading from 1991 onwards.*
***) *Remove the fuel pump fuse before using the command*
****) *The throttle must not be fully open/closed when checking each signal. Tip: Position the throttle butterfly halfway open using a screwdriver.*

Important

Command codes 450 to 457 inclusive activate each function for about 1 minute.

EZK

The EZK ignition system has an automatic fault diagnosis feature which uses diagnostic trouble codes to pinpoint the fault. These diagnostic trouble codes can be read using an EZK system tester connected to the data link connector.

The diagnostic trouble codes are given with flashes on either the green or the red LED of the EZK system tester.

These diagnostic trouble codes can then be interpreted using the table of diagnostic trouble codes below. The figures in the table correspond to the number of flashes on each diode.

Diagnostic trouble codes, self diagnosis

The table gives the number of flashes for the **Green** and **Red** LEDs.

Green	Red	Cause of fault	Action
1	-	Not applicable	-
2	-	Not applicable	-
3	-	Not applicable	
4	-	A. Knock sensor and cable	Use an ohmmeter to check the screened cable between the knock sensor and the control module. Connect the ohmmeter test leads to terminals 12 and 13 of the control module connector, viewed from the cable side. Change the cable if the circuit is intact. Otherwise, connect a lead across the knock sensor terminals. **NOTE** Peel back the rubber shroud and connect the lead on the cable side. Take a reading between terminals 12 and 13 of the control module connector. Change the cable if there is a break or short in the circuit. Change the knock sensor if there is no break or short in the circuit.
		B. Inside the control module	Change the control module
5	-	Incorrect input signal	Check the blue-red (BU/RD) lead between terminal 24 of the connector and terminal 8 of the control module in the ignition system (remove the covers from the connectors and take readings on the terminals from the cable side). If the lead is OK, fit a replacement LH system control module.
	Sporadically	Indicates knocking	Normal position
	Continuous	Maximum downward adjustment	Check if there is extreme engine vibration (loose panels, broken engine mounts, etc.). Rectify the causes of this vibration.

Motronic 2.8.1

Readings, control module connections

> = greater than; < = less than; ≈ = approximately equal to; ~ = alternating voltage

Pin	Colour	Component/Function	In Out	Test conditions	Reading	Across	See 2:7 page
1	BU	Ignition coil, cyl. 1+4	Out		B+	1 - 19	39/150
				750 ± 50 rpm	≈ 7 % (-) (**HI** LOp)		
2	BK	Ground, ignition	In	750 ± 50 rpm	<0.1 V	2 - B-	26/139
3	VT	Fuel pump relay	Out		0 V	3 - 18	25/156
				750 ± 50 rpm	B+		
4	BN/ WH	Idle air control (IAC) valve	Out	750 ± 50 rpm*)	3.5-5.5 V	4 - 18	48/129
					100 Hz 25-45% (-) 2.5-4.5 ms (-) (HI LO)	4 - 19	
5	YE/ RD	EVAP canister purge valve	Out	750 ± 50 rpm, check that valve is activated using an ISAT scan tool	≈ 0.1 V	5 - 18	49/113
					15 Hz 5% (-) 3.0 ms (-) (**HI** LOp)	5 - 19	
6	WH	Inner flap	Out	Activate with ISAT scan tool Select "ACTIVATE" Select "VARIABLE INTAKE" Select "INNER FLAP"	12 V/0 V	6 - 18	50/133
7	OG	Mass air flow sensor	In	750 ± 50 rpm*)	≈ 0.8 V	7 - 30	31/78
				2500 ± 50 rpm*)	≈ 1.5 V		
				Wide open throttle, max rpm*)	≈ 4.6 V		
8	BK	Camshaft position sensor	In	750 ± 50 rpm	≈ 4.5 V ≈ 6.2 Hz≈ 11% (-) (LOp)	8 - 14	30/110
9	GN	Vehicle speed	In	Raise one front wheel and rotate it	≈ 6 V ≈ 50% (-) (Hlp LOp)	9 - 14	37/167

Pin	Colour	Component/Function	In Out	Test conditions	Reading	Across	See 2:7 page
10	BK	Oxygen sensor, reference ground	In	750 ± 50 rpm	<0.05 V	10 - B-	26/139
11	GN	Rear knock sensor	In	4000 rpm	>20 mV~	11 - 30	35/104
12	GN/RD	Throttle position sensor (power supply)	Out	Ignition ON	5 V	12 - 19	32/86
13	GY/RD	Data link (L)	In/Out	ISAT scan tool not connected	≈ 5 V	13 - 19	56
				ISAT scan tool connected	≈ 8.5 V		
14	BK	Ground, injectors	In	750 ± 50 rpm	<0.1 V	14 - B-	26/139
15	GN	Injector, cyl. 5	Out		B+	15 - 19	41/123
				750 ± 50 rpm	6.2 Hz 3.0 ms (-) (**HI** LOp)		
16	BU	Injector, cyl. 2	Out		B+	16 - 19	41/117
				750 ± 50 rpm	6.2 Hz 3.0 ms (**HI** LOp)		
17	GY	Injector, cyl. 1	Out		B+	17 - 19	41/115
				750 ± 50 rpm	6.2 Hz 3.0 ms (**HI** LOp)	17 - 37	
18	RD	Battery positive voltage (+30 circuit) (memory)	In	750 ± 50 rpm	<0.5 V	18 - B+	24
19	BK	Ground, control module circuitry	In	750 ± 50 rpm	<0.1 V	19 - B+	26
20	BU/WH	Ignition coil, cyl. 2+5	Out		B+	20 - 19	39/150
				750 ± 50 rpm	≈ 7 % (-) (**HI** LOp)		
21	BU/RD	Ignition coil, cyl. 3+6	Out		B+	21 - 19	39/150
				750 ± 50 rpm	≈ 7 % (-) (**HI** LOp)		
22	WH	CHECK ENGINE	Out	Ignition ON, MIL (CHECK ENGINE lamp) on	B+	22 - 18	55/135
				750 ± 50 rpm, MIL (CHECK ENGINE lamp) out	≈ 0 V		
23		No connection.					

Pin	Colour	Component/Function	In Out	Test conditions	Reading	Across	See 2:7 page
24	BK	Ground, other output stages	In	750 ± 50 rpm	<0.1 V	24 - B-	26/139
25	GN/ RD	A/C relay	Out	750 ± 50 rpm, A/C ON	B+	18 - 25	53/137
				750 ± 50 rpm, A/C OFF	0 V		
				Activate with ISAT scan tool, select "ACTIVATE", select "A/C RELAY"	B+/0 V	12 - 25	
26	YE	Secondary air injection pump relay	Out	Activate with ISAT scan tool, select "ACTIVATE", select "SECOND. AIR RELAY"	B+/0 V	18 - 26	52/127
27	YE/ GY	Battery voltage (+15 circuit)	In		<0.5 V	27 - B+	24/139
28	GN/ WH	Rear oxygen sensor	In	750 ± 50 rpm, closed loop active	0.1-0.9 V	28 - 10	44/88
29	GN	Front knock sensor	In	4000 rpm	>30 mV~	29 - 30	35/107
30	BK	Sensor ground	Out	750 ± 50 rpm	<0.1 V	30 - B-	26
31	BN	Outer flap	Out	Activate with ISAT scan tool "ACTIVATE" "VARIABLE INTAKE" "OUTER FLAP"	12 V/0 V	31 - 18	50/131
32		No connection.					
33	VT	Injector, cyl. 6	Out		B+	19 - 33	41/125
				750 ± 50 rpm	6.2 Hz 3.0 ms (**HI** LOp)		
34	WH	Injector, cyl. 4	Out		B+	19 - 34	41/121
				750 ± 50 rpm	6.2 Hz 3.0 ms (**HI** LOp)		
35	YE	Injector, cyl. 3	Out		B+	19 - 35	41/119
				750 ± 50 rpm	6.2 Hz 3.0 ms (**HI** LOp)		

Pin	Colour	Component/Function	In Out	Test conditions	Reading	Across	See 2:7 page
36		No connection.					
37	BU/ RD	Power supply via main relay	In		<0.5 V	37 - B+	24/139
38	GY	TCS active	In		31 Hz 50%	38 - 19	54/143
39		No connection.					
40	GN/ WH	A/C in	In	A/C ON	B+	40 - 19	53/137
				A/C OFF	0 V		
41		No connection.					
42	OG	D/R input	In	P, N, manual	0 V	42 - 19	38/164
				R, D, 3, 2, 1	B+		
43	BU	Output, engine speed	Out	750 ± 50 rpm	≈ 6.5 V ≈ 37 Hz 50% (HI LO)	43 - 19	28/102
				2500 rpm	≈ 6.5 V ≈ 125 Hz 50%		
44	OG	Intake air temperature sensor	In	Air temp. about 25°C (77°F)	≈ 3.4 V see also Technical Data	44 - 30	34/81
45	YE/ WH	Engine coolant temperature sensor	In	Engine temp. about 90°C (194°F)	≈ 1.0 V see also Technical Data	45 - 30	33/83
46	YE/ WH	Main relay	Out		B+	46 - 18	25/153
				Ignition OFF	0 V		
47	GN	Front oxygen sensor	In	750 ± 50 rpm, closed loop active	0.1-0.9 V	47 - 10	44/92
48	BK	Crankshaft position sensor, reference ground	In		B+	48 - 18	28/102
49	YE	Crankshaft position sensor, signal input	In	Starter motor running	≈ 2-5 V~ 150-250 Hz	49 - 48	28/102
				750 ± 50 rpm	≈ 5-10 V~ ≈ 725 Hz		
50		No connection.					
51		No connection.					
52		No connection.					

Pin	Colour	Component/Function	In Out	Test conditions	Reading	Across	See 2:7 page
53	BU	Throttle position sensor	In	Closed throttle position	≈ 0.5 V	53 - 30	32/86
				Wide open throttle position	≈ 4.5 V		
54	YE	Throttle position signal	Out		≈ 0.25-1 V 100 Hz	54 - 19	54/169
				750 ± 50 rpm	≈ 1.2 V 100 Hz 9% (+) 0.9 ms (+) (Hlp **LO**)		
				2500 rpm	≈ 2.0 V 100 Hz 15% (+) 1.5 ms (+) (Hlp **LO**)		
55	BU/ WH	Data link (K)	Input/ Output	ISAT scan tool not connected	0 V	55 - 19	56
				ISAT scan tool connected	B+		

*)A/C and all electrical equipment switched off.

Motronic 2.8.1 (contd.)

Diagnostic trouble codes

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0102	Mass air flow sensor, input to control module low, break or short to ground	On	FAULT XX P/I P0102 INDUCTION AIR MASS OPEN/ SHORTING TO GROUND	78
P0103	Mass air flow sensor, input to control module high or shorted to battery positive (B+)	ON	FAULT XX P/I P0103 INDUCTION AIR MASS SHORTING TO BATT+	78
P0112	Intake air temperature sensor, input low or shorted to ground	ON	FAULT XX P/I P0112 INTAKE AIR TEMP SHORTING TO GROUND	81
P0113	Intake air temperature sensor, input high, open circuit or shorted to battery positive (B+)	ON	FAULT XX P/I P0113 INTAKE AIR TEMP OPEN/ SHORTING TO BATT+	81
P0117	Engine coolant temperature sensor, input to control module low or shorted to ground	ON	FAULT XX P/I P0117 COOLANT TEMPERATURE SHORTING TO GROUND	83
P0118	Coolant temperature sensor, input to control module high, open circuit or shorted to battery positive (B+)	ON	FAULT XX P/I P0118 COOLANT TEMPERATURE OPEN/ SHORTING TO BATT+	83
P0122	Throttle position sensor, input low or shorted to ground	ON	FAULT XX P/I P0122 THROTTLE POSITION SHORTING TO GROUND	86
P0123	Throttle position sensor, input high, open circuit or shorted to battery positive (B+)	ON	FAULT XX P/I P0123 THROTTLE POSITION OPEN/ SHORTING TO BATT+	86
P0131	Rear oxygen sensor, input to control module low or shorted to ground	ON	FAULT XX P/I P0131 REAR OXYGEN SENSOR SHORTING TO GROUND	88
P0132	Rear oxygen sensor, input to control module high or shorted to battery positive (B+)	ON	FAULT XX P/I P0132 REAR OXYGEN SENSOR SHORTING TO BATT+	88
P0134	Rear oxygen sensor, no control module input or open circuit.	ON	FAULT XX P/I P0134 REAR OXYGEN SENSOR OPEN CIRCUIT	88
P0151	Front oxygen sensor, input to control module low or shorted to ground	ON	FAULT XX P/I P0151 FRONT OXYGEN SENSOR SHORTING TO GROUND	92
P0152	Front oxygen sensor, input to control module high or shorted to battery positive (B+)	ON	FAULT XX P/I P0152 FRONT OXYGEN SENSOR SHORTING TO BATT+	92
P0154	Front oxygen sensor, no control module input or open circuit	ON	FAULT XX P/I P0154 FRONT OXYGEN SENSOR SHORT GROUND	92

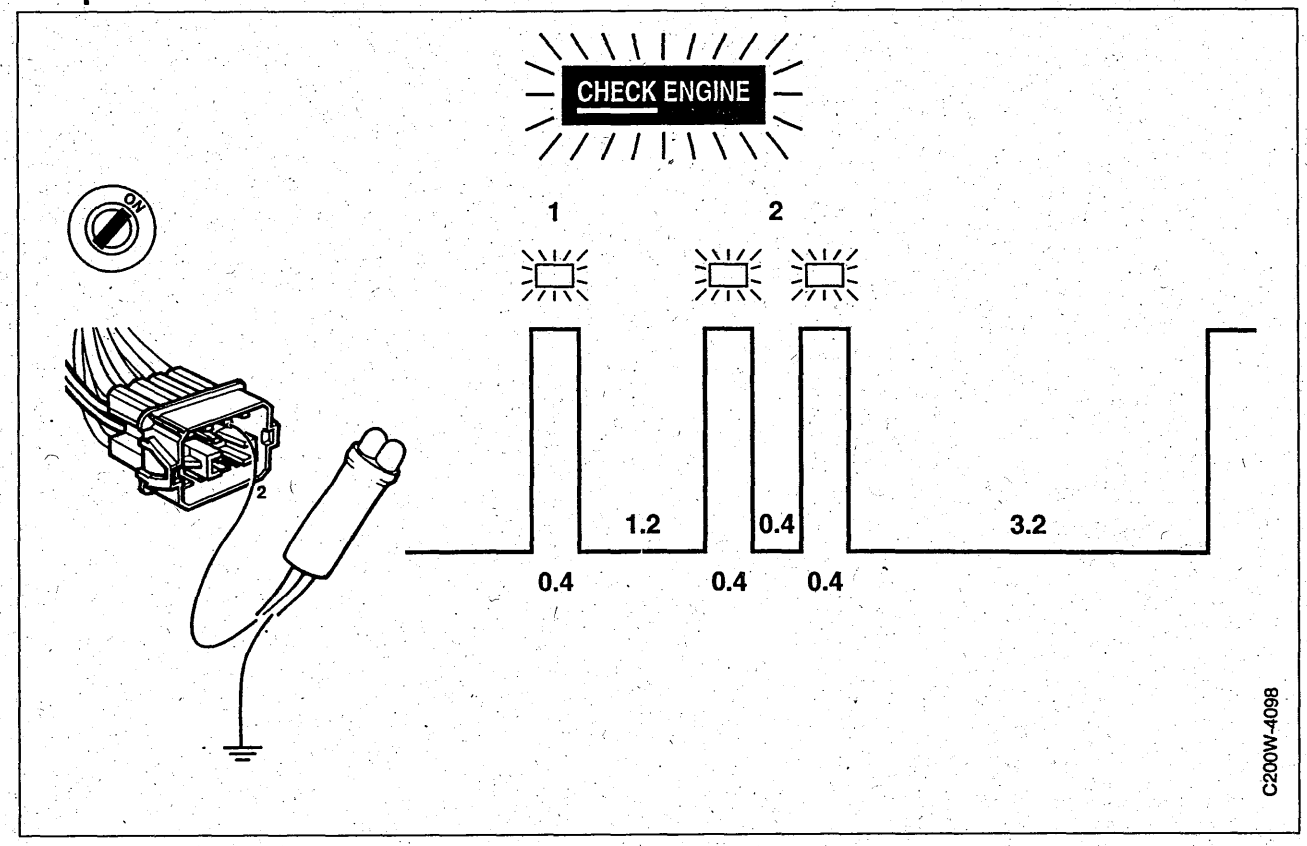
Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0171	Adaptation too lean, rear cylinder bank (cylinders 1-3-5).	ON	FAULT XX P/I P0171 ADAPTATION REAR . LEAN	96
P0172	Adaptation too rich, rear cylinder bank (cylinders 1-3-5).	ON	FAULT XX P/I P0172 ADAPTATION REAR RICH	96
P0174	Adaptation too lean, front cylinder bank (cylinders 2-4-6).	ON	FAULT XX P/I P0174 ADAPTATION FRONT LEAN	99
P0175	Adaptation too rich, front cylinder bank (cylinders 2-4-6).	ON	FAULT XX P/I P0175 ADAPTATION FRONT RICH	99
P0322	Crankshaft position sensor, no control module input		FAULT XX P/I P0322 CRANKSHAFT POSITION NO INPUT	102
P0326	Rear knock sensor, no input to control module/break or short circuit		FAULT XX P/I P0326 KNOCK SENSOR REAR OPEN/SHORTING	104
P0331	Front knock sensor, no input to control module/break or short circuit		FAULT XX P/I P0331 KNOCK SENSOR FRONT OPEN/SHORTING	107
P0336	Crankshaft position sensor, control module input wrong		FAULT XX P/I P0336 CRANKSHAFT POSITION INPUT WRONG	102
P0342	Camshaft position sensor, input to control module low, break or short to ground	ON	FAULT P/I P0342 CAMSHAFT POSITION SHORT TO GROUND	110
P0343	Camshaft position sensor, input to control module high or shorted to battery positive (B+)	ON	FAULT XX P/I P0343 CAMSHAFT POSITION , OPEN/ SHORTING TO BATT+	110
P0605	Control module fault	ON	FAULT XX P/I P0605 CONTROL MODULE INTERNAL FAULT	112
P1001	EVAP canister purge valve, output from control module low, open circuit or short to ground	ON	FAULT XX P/I P1001 EVAP VALVE OPEN/ SHORTING TO GROUND	113
P1002	EVAP canister purge valve, output from control module high or shorted to battery positive (B+)	ON	FAULT XX P/I P1002 EVAP VALVE SHORTING TO BATT+	113
P1011	Injector, cylinder 1		FAULT XX P/I P1011 INJECTOR 1 OPEN/ SHORTING TO GROUND	115
P1012	Injector, cylinder 1		FAULT XX P/I P1012 INJECTOR 1 SHORTING TO BATT+	115

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P1021	Injector, cylinder 2		FAULT XX P/I P1021 INJECTOR 2 OPEN/ SHORTING TO GROUND	117
P1022	Injector, cylinder 2		FAULT XX P/I P1022 INJECTOR 2 SHORTING TO BATT+	117
P1031	Injector, cylinder 3		FAULT XX P/I P1031 INJECTOR 3 OPEN/ SHORTING TO GROUND	119
P1032	Injector, cylinder 3		FAULT XX P/I P1032 INJECTOR 3 SHORTING TO BATT+	119
P1041	Injector, cylinder 4		FAULT XX P/I P1041 INJECTOR 4 OPEN/ SHORTING TO GROUND	121
P1042	Injector, cylinder 4		FAULT XX P/I P1042 INJECTOR 4 SHORTING TO BATT+	121
P1051	Injector, cylinder 5		FAULT XX P/I P1051 INJECTOR 5 OPEN/ SHORTING TO GROUND	123
P1052	Injector, cylinder 5		FAULT XX P/I P1052 INJECTOR 5 SHORTING TO BATT+	123
P1061	Injector, cylinder 6		FAULT XX P/I P1061 INJECTOR 6 OPEN/ SHORTING TO GROUND	125
P1062	Injector, cylinder 6		FAULT XX P/I P1062 INJECTOR 6 SHORTING TO BATT+	125
P1206	Relay for secondary air injection pump, output from control module low, open circuit or short to ground	ON	FAULT XX P/I P1206 SECONDARY AIR RELAY OPEN/ SHORTING TO GROUND	127
P1207	Secondary air injection pump relay, output from control module high or shorted to battery positive (B+)	ON	FAULT XX P/I P1207 SECONDARY AIR RELAY SHORTING TO BATT+	127
P1211	Idle air control valve, output from control module low, open circuit or short to ground		FAULT XX P/I P1211 IAC VALVE OUTPUT LOW/OPEN SHORTING TO GROUND	129
P1212	Idle air control valve, output from control module high or shorted to battery positive (B+)		FAULT XX P/I P1212 IAC VALVE SHORTING TO BATT+	129

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P1236	Valve for switching intake manifold, output from control module low, open circuit or short to ground		FAULT XX P/I P1236 INTAKE OUTER FLAP BREAK/ SHORT GROUND	131
P1237	Valve for switching intake manifold, output from control module high or shorted to battery positive (B+)		FAULT XX P/I P1237 INTAKE OUTER FLAP SHORT CIRCUIT B+	131
P1246	Valve for switching intake manifold, output from control module low, open circuit or short to ground		FAULT XX P/I P1246 INTAKE INNER FLAP BREAK/ SHORT GROUND	133
P1247	Valve for switching intake manifold, output from control module high or shorted to battery positive (B+)		FAULT XX P/I P1247 INTAKE INNER FLAP SHORT CIRCUIT B+	133
P1251	MIL (CHECK ENGINE lamp), output from control module low or shorted to ground		FAULT XX P/I P1251 CHECK-ENGINE LAMP OPEN/ SHORTING TO GROUND	135
P1252	CHECK ENGINE lamp (MIL), output from control module high or shorted to battery positive (B+)		FAULT XX P/I P1252 CHECK-ENGINE LAMP SHORTING TO BATT+	135
P1450	A/C relay, output from control module low, open circuit or short to ground		FAULT XX P/I P1450 AC RELAY OPEN/ SHORTING TO GROUND	137
P1451	A/C relay, output from control module high or shorted to battery positive (B+)		FAULT XX P/I P1451 AC RELAY SHORTING TO BATT+	137
P1500	Battery voltage lower than 10 V or higher than 16 V.		FAULT XX P/I P1500 BATTERY VOLTAGE VOLTAGE WRONG	139
P1601	Fuel pump relay, output from control module high or shorted to battery positive (B+)		FAULT XX P/I P1601 FUEL PUMP RELAY SHORTING TO BATT+	141
P1602	Fuel pump relay, output from control module low, break or short to ground		FAULT XX P/I P1602 FUEL PUMP RELAY OPEN/ SHORTING TO GROUND	141
P1630	TCS active (test signal), signal low, open circuit or shorted to ground		FAULT XX P/I P1630 TCS FULL LOAD OPEN/ SHORTING TO GROUND	143
P1631	TCS active (test signal), signal high or shorted to battery positive (B+)		FAULT XX P/I P1631 TCS TEST SIGNAL SHORTING TO BATT+	143

Motronic 2.8.1 (contd.)

Lamp-flash codes

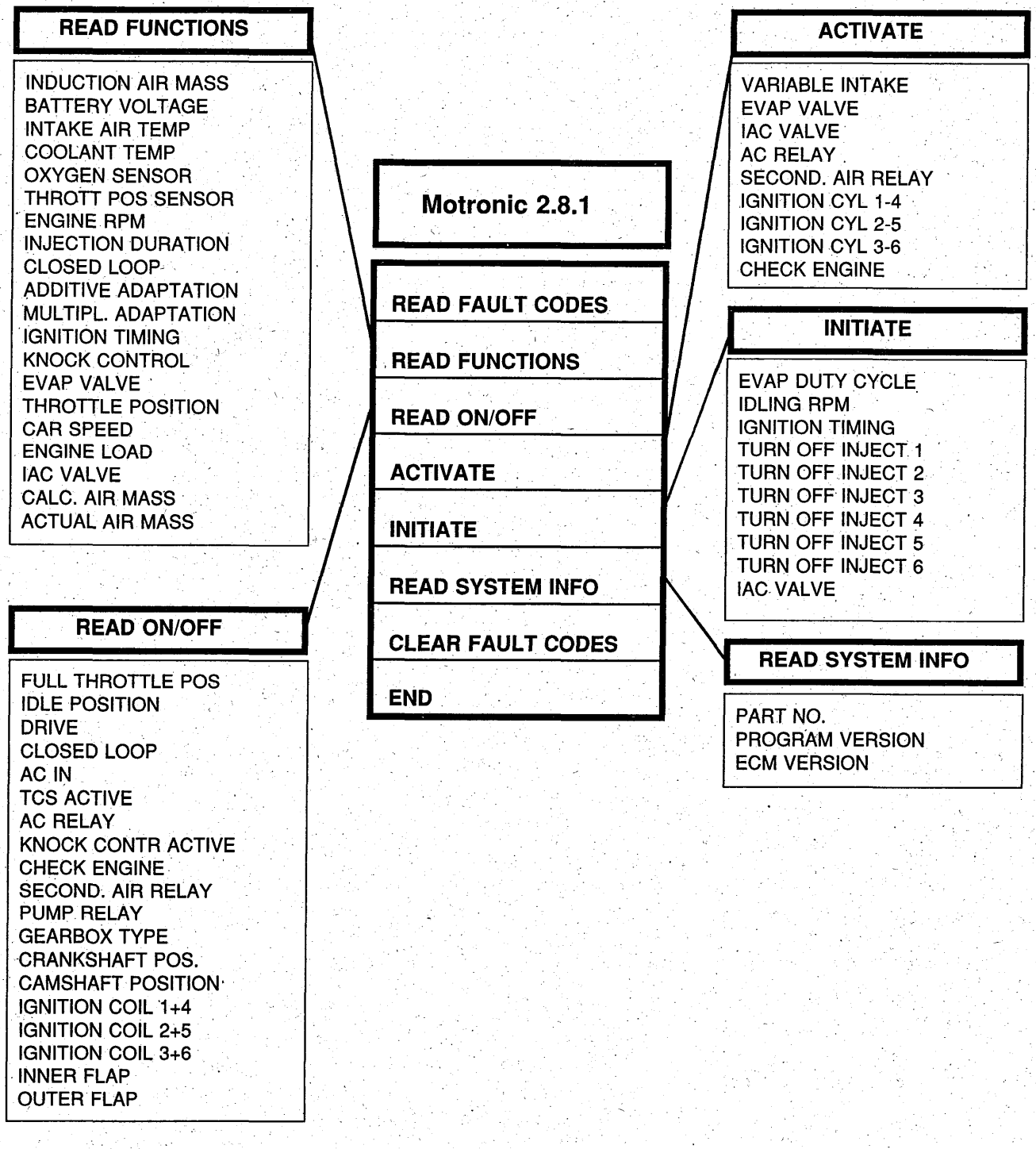


Turn the ignition switch to the ON position and ground pin 2 (M1995) or pin 6 (M1996) of the data link connector. Use test lamp 86 11 857.
The lamp-flash codes can be read as long as the pin is grounded.

Lamp-flash code	Function	Diagnostic trouble code	Fault diagnosis, see 2:7, page
11	Relay, secondary air injection	P1206, P1207	127
12	No fault		
21	Mass air flow sensor	P0102, P0103	78
31	Intake air temperature sensor	P0112, P0113	81
41	Engine coolant temperature sensor	P0117, P0118	83
51	Throttle position sensor	P0122, P0123	86
61	Rear oxygen sensor	P0131, P0132, P0134	88
62	Front oxygen sensor	P0151, P0152, P0154	92
71	Adaptation, rear cylinder bank (cyl 1-3-5)	P0171, P0172	96
72	Adaptation, front cylinder bank (cyl 2-4-6)	P0174, P0175	99
81	EVAP canister purge valve	P1001, P1002	113
91	Control module fault (internal memory)	P0605	112

Motronic 2.8.1 (contd.)

Menu structure for command codes



Motronic 2.8.1 (contd.)

READ FUNCTIONS

No.	ISAT ST display	Function
1	INDUCTION AIR MASS X.X V / X.XX g/s	Shows the input voltage of the MASS AIR FLOW SENSOR (control module, pin 7) in V and the associated intake air mass in g/s. Conversion is carried out according to the characteristics of the mass air flow sensor: g/s = f (V). See "Technical data". Operating range: 0.0-5.5 V.
2	BATTERY VOLTAGE XX.X V	Displays the control module's power supply (+15 circuit). Operating range: 0.0-17.4 V.
3	INTAKE AIR TEMP X.X V / XXX °C	Shows the input voltage (control module, pin 44) from the intake air temperature sensor in the intake manifold in V and associated temperature in °C. Conversion is carried out according to the characteristics of the temperature sensor: °C = f (Ω). Operating range: 0.0-5.0 V.
4	COOLANT TEMP X.X V / XXX°C	Shows the input voltage (control module, pin 45) from the engine coolant temperature sensor in V and associated temperature in °C. Conversion is carried out according to the characteristics of the temperature sensor: °C = f (Ω). Operating range: 0.0-5.0 V.
5	REAR OXYGEN SENSOR X.XX V	Shows the input voltage (control module, pin 28) from the rear oxygen sensor, cylinder bank 1-3-5, in V. Operating range: 0.00-1.25 V.
	FRONT OXYGEN SENSOR X.XX V	Shows the input voltage (control module, pin 47) from the front oxygen sensor, cylinder bank 2-4-6, in V. Operating range: 0.00-1.25 V.
6	THROTT POS SENSOR X.X V	Shows the throttle position sensor's input voltage (control module, pin 53) in V. Operating range: 0.0-5.0 V.
7	ENGINE RPM XXXX RPM	Shows engine speed in rpm. Operating range: 0-10240 rpm.
8	INJECTION DURATION XX.X ms	Shows the injection duration for cylinder 1 in ms. Operating range: 0.0-98.7 ms.
9	CLOSED LOOP REAR ±XX %	Shows the working range of closed loop control. At limit values, the diagnostic trouble codes "Adaptation lean" and "Adaptation rich" are generated. Operating range: ±25 %.
	CLOSED LOOP FRONT ±XX %	Shows the working range of closed loop control. At limit values, the diagnostic trouble codes "Adaptation lean" and "Adaptation rich" are generated. Operating range: ±25 %.

No.	ISAT ST display	Function
10	ADDITIVE REAR X.XXX ms	Shows the additive injection duration correction. Adaptation takes place at idling speed. Operating range: 0.0-0.384 ms.
	ADDITIVE FRONT X.XXX ms	Shows the additive injection duration correction. Adaptation takes place at idling speed. Operating range: 0.0-0.384 ms.
11	MULTIPL. FRONT ±XX %	Shows the multiplicative injection duration correction. Adaptation takes place while the car is being driven. Operating range: ±25 %.
	MULTIPL. REAR ±XX %	Shows the multiplicative injection duration correction. Adaptation takes place while the car is being driven. Operating range: ±25 %.
12	IGNITION TIMING XXX DEGREES	Shows the ignition timing (dwell angle) for cylinder 1 in degrees before top dead centre (BTDC). Operating range: 78-(-144) degrees.
13	KNOCK CONTROL XXX DEGREES	Shows the ignition retard in degrees when knocking occurs in cylinder 1. Operating range: 0-128 degrees.
14	EVAP VALVE XXX.X%	Shows the extent of EVAP canister purge valve opening expressed in %. Operating range: 0-100 %.
15	THROTTLE POSITION XXX.X%	Shows the degree of throttle opening expressed in %. Operating range: 9-100 %.
16	CAR SPEED XXX KM/H	Shows the speed of the car in km/h. Operating range: 0-255 km/h.
17	ENGINE LOAD XX.XX ms	Shows internal control module quantity, which is proportional to the current engine load. Operating range: 0-12.25 ms.
18	IAC VALVE XXX.X% OPEN	Shows the opening angle of the IAC valve in %. Operating range: 0-100 %.
19	CALC. AIR MASS XXX.X g/s	Shows the air flow calculated by the control module that has to pass the IAC valve for attainment of the correct idling speed. Operating range: 0-17 g/s.
20	ACTUAL AIR MASS XXX.X g/s	Shows the air flow through the IAC valve (mass air flow sensor value less adapted leakage flow across the throttle butterfly) as measured by the control module. Operating range: 0-17 g/s.

Motronic 2.8.1 (contd.)

READ ON/OFF

No.	ISAT ST display	Function
1	FULL THROTTLE POS YES/NO	Shows the input from the throttle position sensor. YES at wide open throttle, otherwise NO
2	IDLE POSITION YES/NO	Shows the input from the throttle position sensor. YES at closed throttle, otherwise NO
3	DRIVE YES/NO	Shows the position of the automatic transmission selector lever. YES for R, D, 3, 2 or 1. NO for P and N.
4	CRANKSHAFT POS. ACTIVE/INACTIVE	Shows the input from the crankshaft position sensor. ACTIVE if the sensor is working, INACTIVE if the sensor is faulty
5	CLOSED LOOP REAR YES/NO	Shows whether closed loop control is engaged for the rear cylinder bank.
	CLOSED LOOP FRONT YES/NO	Shows whether closed loop control is engaged for the front cylinder bank.
6	AC IN ON/OFF	Shows whether the ICE signal requesting A/C engagement is activated.
7	IGNITION COIL 1+4 ACTIVE/INACTIVE	Shows whether the control module sends pulses to ignition coil 1+4.
8	IGNITION COIL 2+5 ACTIVE/INACTIVE	Shows whether the control module sends pulses to ignition coil 2+5.
9	IGNITION COIL 3+6 ACTIVE/INACTIVE	Shows whether the control module sends pulses to ignition coil 3+6.
10	TCS ACTIVE YES/NO	Shows whether the TCS is activated (working). The ISAT Scan Tool shows "YES" and "NO" alternately when the TCS is activated.
11	AC RELAY ON/OFF	Shows the current status of the A/C relay.
12	CAMSHAFT POSITION ACTIVE/INACTIVE	Shows the input from the camshaft position sensor. ACTIVE if the sensor is working, INACTIVE if it is faulty
13	KNOCK CONTR ACTIVE YES/NO	Shows whether the control module's knock control calculation routines are functional.
14	CHECK ENGINE ON/OFF	Shows MIL (CHECK ENGINE lamp) status.
15	OUTER FLAP ACTIVE/INACTIVE	Shows whether the intake manifold's outer flap is activated or not.
16	INNER FLAP ACTIVE/INACTIVE	Shows whether the intake manifold's inner flap is activated or not.
17	SECOND. AIR RELAY ON/OFF	Shows the status of the secondary air injection pump relay
18	PUMP RELAY ON/OFF	Shows the status of the fuel pump relay.

No.	ISAT ST display	Function
19	GEARBOX TYPE MAN/AUT	Shows the type of gearbox.

Motronic 2.8.1 (contd.)

ACTIVATE

Note

When a system function is activated with the ISAT Scan Tool, the Motronic control module is made to do something that it would not otherwise do in the course of its normal operation. This may cause diagnostic trouble codes to be generated in other systems which are dependent on the Motronic system.

Activation should only be done with the ignition switch in the Drive position and in Neutral gear. If activation is done in any other gear, the ISAT scan tool should show SELECT NEUTRAL.

Important

The activate functions should always be used with discretion.

- Always deactivate an activated function before proceeding further in the ISAT Scan Tool menu.
- Always clear any trouble codes generated in the Motronic system, or in any other system, when you are through with fault diagnosis.

No.	ISAT ST display	Function
1	VARIABLE INTAKE INNER/OUTER FLAP FUNCTION ON/OFF ACTIVE 0.5 Hz/30s	The menu "VARIABLE INTAKE""has a submenu consisting of two commands, "INNER FLAP"" and "OUTER FLAP".". "VARIABLE INTAKE" -"OUTER FLAP" -"INNER FLAP" The Motronic control module activates either of the flaps, depending on the command selected.
2	EVAP VALVE ACTIVE 0.5 Hz/30 s	The Motronic control module activates the purge valve.
3	IAC VALVE ACTIVE 0.5 Hz/30 s	The Motronic control module activates the idle air control (IAC) valve.
4	AC RELAY FUNCTION ON/OFF ACTIVE 0.5 Hz/30 s	The Motronic control module activates the A/C relay.
5	SECOND. AIR RELAY FUNCTION O N/OFF ACTIVE 0.5 Hz/30 s	The Motronic control module activates the secondary air injection pump relay and the pump starts
6	IGNITION CYL 1-4 FUNCTION ON/OFF ACTIVE 0.5 Hz/30 s	The Motronic control module activates the ignition coil for cylinders 1+4
7	IGNITION CYL 2-5 FUNCTION ON/OFF ACTIVE 0.5 Hz/30 s	The Motronic control module activates the ignition coil for cylinders 2+5
8	IGNITION CYL 3-6 FUNCTION ON/OFF ACTIVE 0.5 Hz/30 s	The Motronic control module activates the ignition coil for cylinders 3+6
9	CHECK ENGINE FUNCTION ON/OFF ON OFF	The Motronic control module activates the CHECK ENGINE function.

Motronic 2.8.1 (contd.)

INITIATE

Note

When a system function is initiated with the ISAT Scan Tool, the Motronic control module is made to do something that it would not otherwise do in the course of its normal operation. This may cause diagnostic trouble codes to be generated in other systems which are dependent on the Motronic system.

Initiation is only done with the engine idling. When activating with a gear selected, the ISAT scan tool should show ENGINE IDLING.

Important

The initiate functions should always be used with discretion.

- Always reset an activated function to its original value before proceeding in the ISAT scan tool menu.
- Always clear any trouble codes generated in the Motronic system, or in any other system, when you are through with fault diagnosis.
- The operating range of the various commands is wide and unlimited . Exercise care and vary the entered command only round the normal idling speed parameters. See further in "Technical description".

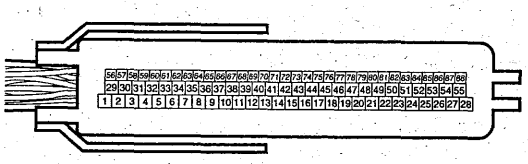
No.	ISAT ST display	Function
1	EVAP DUTY CYCLE --.- % + -	Shows the duty cycle of the EVAP canister purge valve in %. A reading of 50% is obtained on engagement, which can be adjusted in steps of ±0.4 %. Operating range: 0-100 %.
2	IDLING RPM ----RPM + -	Shows idling speed in rpm. A reading of 1000 rpm is obtained on engagement, which can be adjusted in steps of ±10 rpm. Operating range: 0-2300 rpm.
3	IGNITION TIMING --.- GRAD + -	Shows the ignition timing in degrees at idling speed. A reading of 10.5 degrees is obtained on engagement, which can be adjusted in steps of ±0.75 degrees. Operating range: 106-(-84)° BTDC.
4	TURN OFF INJECT 1	Enables injector 1 to be turned off.
5	TURN OFF INJECT 2	Enables injector 2 to be turned off.
6	TURN OFF INJECT 3	Enables injector 3 to be turned off.
7	TURN OFF INJECT 4	Enables injector 4 to be turned off.
8	TURN OFF INJECT 5	Enables injector 5 to be turned off.
9	TURN OFF INJECT 6	Enables injector 6 to be turned off.
10	IAC VALVE -- % CLOSED + -	Shows the opening angle of the IAC valve in %. A reading of 50% is obtained on engagement, which can be regulated in steps of ± 0.4 %. Operating range: 0-100 %.

Motronic 2.8.1 (contd.)

READ SYSTEM INFO

No.	ISAT ST display	Function
1	PART NO. XX XX XXX	Shows Saab's 7-digit part number for the control module.
2	PROGRAM VERSION XXXXXXXXXX	Shows Bosch's 10-digit part number for the software.
3	ECM VERSION XXXXXXXXXX	Shows Bosch's 10-digit part number for the control module.

Motronic 5.2 (OBD II)



C248W-9773

Readings, control module connections

> = greater than; < = less than; ≈ = approximately equal to; ~ = alternating voltage
(LP = LOGIC PROBE; P = select pulse; p = visible pulses)

Pin	Colour	Component/Function	In/Out	Test conditions	Reading	Across	See 2:7 page
1	BU/RD	Ground/rear heated oxygen sensor preheating, banks 1 and 2	Out	750 ± 50 rpm Active closed loop at ≈ 5 Hz pulse	≈ 7 V	1 - 34	48
				750 ± 50 rpm Active closed loop	≈ 0.4 V		
				Remove fuse 28.	0 V		
2	BN/WH	Idle air control valve (closing)	Out	750 ± 50 rpm	100 Hz 6 - 8 ms (-) 60 - 80% (-) (LP **HI** LOp)	2 - 34	52
3	GY	Injector, cylinder 1	Out		B+	3 - 6	44
				750 ± 50 rpm	6.2 Hz 2-4 ms (LP **HI** LOp)		
4	YE	Injector, cylinder 3	Out		B+	4 - 6	44
				750 ± 50 rpm	6.2 Hz 2-4 ms (LP **HI** LOp)		
5	GN	Injector, cylinder 5	Out		B+	5 - 6	44
				750 ± 50 rpm	6.2 Hz 2-4 ms (LP **HI** LOp)		
6	BK	Power ground, injectors	In	750 ± 50 rpm	<0.1 V	6 - B-	29
7	BN	Variable intake manifold (outer flap)	Out	750 ± 50 rpm	B+	7 - 34	55
				>3200 rpm	≈ 0 V		
8	WH	CHECK ENGINE	Out	CHECK ENGINE on	≈ 0 V	8 - 34	60
				750 ± 50 rpm MIL (CHECK ENGINE) off	≈ 10 V		
9		No connection.					
10		No connection.					
11		No connection.					

Pin	Colour	Component/Function	In/Out	Test conditions	Reading	Across	See 2:7 page
12	GN/WH	A/C in	In	A/C ON	B+	12 - 28	57
				A/C OFF	0 V		
13		No connection.					
14		No connection.					
15		No connection.					
16	OG	Intake air temperature sensor	In	Air temp. about 25°C (77°F)	≈ 3.4 V See also Technical data	16 - 71	37
17	OG	Mass air flow sensor	In	750 ± 50 rpm A/C and all electrical equipment turned off	≈ 0.8 V	17 - 4519	34
				2500 ± 50 rpm A/C and all electrical equipment turned off. No load.	≈ 1.5 V		
18	YE	Front heated oxygen sensor, cylinder bank 2	In	750 ± 50 rpm Active closed loop	0.1-0.9 V	18 - 46	47
19	YE	Front heated oxygen sensor, cylinder bank 2	In	750 ± 50 rpm Active closed loop	0.1-0.9 V	19 - 46	47
20	BU	Reference ground, crankshaft position sensor	In		B+	26 - 20	31
21		No connection.					
22		No connection.					
23		No connection.					
24		No connection.					
25		No connection.					
26	RD	+30	In	750 ± 50 rpm	<0.5 V	B+ - 26	27
27	YE/WH	Main relay	Out		B+	B+ - 27	28
				Ignition OFF	0 V		
28	BK	Ground, control module circuitry	In	750 ± 50 rpm	<0.1 V	28 - B-	29
29	BU/WH	Idle air control valve (opening)	Out	750 ± 50 rpm	100 Hz 20 - 40% (-) 2 - 4 ms (-) (LP **HI** LOp)	29 - 34	52

Pin	Colour	Component/Function	In/Out	Test conditions	Reading	Across	See 2:7 page
30	BU/RD	Ground, oxygen sensor preheating, banks 1 and 2	In	750 ± 50 rpm Active closed loop at 5 Hz pulse	≈ 7 V	30 - 34	51
				750 ± 50 rpm Active closed loop	≈ 0.4 V		
				Remove fuse 28.	0 V		
31	BU	Injector, cylinder 2	Out		B+	31 - 6	44
				750 ± 50 rpm	6.2 Hz 2-4 ms (LP **HI** LOp)		
32	WH	Injector, cylinder 4	Out		B+	32 - 6	44
				750 ± 50 rpm	6.2 Hz 2-4 ms (LP **HI** LOp)		
33	VT	Injector, cylinder 6	Out		B+	33 - 6	44
				750 ± 50 rpm	6.2 Hz 2-4 ms (LP **HI** LOp)		
34	BK	Ground, other output stages	In	750 ± 50 rpm	<0.1 V	34 - B-	29
35	WH	Variable intake manifold (inner flap)	Out	750 ± 50 rpm	B+	35 - 34	55
				Wide open throttle acceleration up to 4100 rpm	≈ 0 V		
36	GN/RD	A/C relay	Out	750 ± 50 rpm A/C ON	B+	26 - 36	57
				750 ± 50 rpm A/C OFF	≈ 0 V		
37	YE	Relay, secondary air injection	Out	Active	≈ 0.5 V	37 - 34	56
				Not active	B+		
38	BK	Camshaft position sensor	In	750 ± 50 rpm	≈ 6.2 Hz ≈ 11% (-) (LP **HI** LOp)	38 - 71	33
39		No connection.					
40	YE	Front knock sensor	In	4000 rpm	>30 mV ac	40 - 71	38
41		No connection.					
42		No connection.					

Pin	Colour	Component/Function	In/Out	Test conditions	Reading	Across	See 2:7 page
43		No connection.					
44	BU	Throttle position sensor	In	Idling	≈ 0.5 V	44 - 71	35
				Wide open throttle	≈ 4.5 V also see Technical Data		
45	BK	Reference ground, mass air flow sensor	In	750 ± 50 rpm	<0.1 V	45 - B-	30, 34
46	BK	Reference ground, oxygen sensors	In	750 ± 50 rpm Active closed loop	≈ 0.7 V	46 - 34	30
47		No connection.					
48		No connection.					
49	BU	Ignition coil, cylinders 1 4	Out	750 ± 50 rpm	≈ 5% (-) (LP **HI** LOp)	49 - 55	42
50	BU/ WH	Ignition coil, cylinders 2 5	Out	750 ± 50 rpm	≈ 5% (-) (LP **HI** LOp)	50 - 55	42
51	BU/ RD	Ignition coil, cylinders 3 6	Out	750 ± 50 rpm	≈ 5% (-) (LP **HI** LOp)	51 - 55	42
52		No connection.					
53	GN/ RD	Power supply, throttle position sensor and tank pressure sensor	Out		5 V	53 - 71	35
54	BU/ RD	Power supply from main relay	In		<0.5 V	B+ - 54	28
55	BK	Power ground, ignition	In	750 ± 50 rpm	<0.1 V	55 - B-	29
56	GN/ WH	+15 circuit (via anti-theft alarm control module)	In		<0.5 V	B+ - 56	27, 28
57		No connection.					
58		No connection.					
59		No connection.					
60		No connection.					
61	YE/ RD	EVAP canister purge valve	Out	750 ± 50 rpm, see 2:7 page 53 for operating conditions	7.5 Hz 15 Hz 30 Hz (LP **HI** LOp)	61 - 34	53
62		No connection.					
63	VT	Fuel pump relay	Out		≈ B+	63 - 34	28
				750 ± 50 rpm	<0.5 V		
64		No connection.					

Pin	Colour	Component/Function	In/Out	Test conditions	Reading	Across	See 2:7 page
65		No connection.					
66		No connection.					
67		No connection.					
68	GY	TCS test	In	Test signal	31 Hz	68 - 34	58
				TCS active when driving	62 Hz		
69	OG	D/R input	In	P, N, Manual	≈ 0 V	69 - 28	41
				R, D, 3, 2, 1	≈ B+		
70	YE	Rear knock sensor	In	4000 rpm	>30 mV ac	70 - 71	38
71	BK	Sensor ground	Out	750 ± 50 rpm	<0.1 V	71 - B-	30
72		No connection.					
73	VT/ WH	Low fuel level	In	Fuel level lamp ON	≈ 1.5 V	73 - 71	59
				Fuel level lamp OUT	≈ 6 V		
74	YE/ WH	Engine coolant temperature sensor	In	Engine temp. 90°C (194°F)	≈ 1.0 V see also Technical Data	74 - 71	36
75		No connection.					
76	YE	Rear heated oxygen sensor cylinder bank 2	In	750 ± 50 rpm Active closed loop	0.1-0.9 V	76 - 46	51
77	YE	Rear heated oxygen sensor cylinder bank 1	In	750 ± 50 rpm Active closed loop	0.1-0.9 V	77 - 46	51
78	YE	Crankshaft position sensor, signal input	In	Starter motor cranking	≈ 2-5 V ac 150-250 Hz	78 - 20	31
				750 ± 50 rpm	≈ 5 - 10 V ac ≈ 725 Hz		
79	BU	Car speed from RH front wheel	In		≈ 14 Hz (LP **HI** LOp)	79 - 28	40
				Rotate RH front wheel at about 1/2 turn per second	≈ 46 Hz (LP **HI** LOp)		
80	BU	Engine speed	Out	750 ± 50 rpm	≈ 6.5 V ≈ 37 Hz	80 - 28	32
81		No connection.					

Pin	Colour	Component/Function	In/Out	Test conditions	Reading	Across	See 2:7 page
82	YE	Throttle position signal	Out		0.25-1.0 V	82 - 28	35
				750 ± 50 rpm	≈ 160 Hz ≈ 9% (+) ≈ 0.5 ms (+) (LP Hlp **LO**)		
83		No connection.					
84		No connection.					
85		No connection.					
86		No connection.					
87		No connection.					
88	BU/ WH	Data link (K)	In/Out	ISAT scan tool not connected	0 V	88 - 34	61
				ISAT scan tool connected	B+		

Motronic 5.2 (OBD II) (contd.)

Diagnostic trouble codes

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0102	Mass air flow sensor Control module input low, open circuit or shorting to ground.	ON	FAULT XX P0102 INDUCTION AIR MASS OPEN/SHORTING TO GROUND	80
P0103	Mass air flow sensor Control module input high, shorting to battery positive (B+).	ON	FAULT XX P0103 INDUCTION AIR MASS SHORTING TO BATT+	80
P0112	Intake air temperature sensor, control module input. Shorting to ground.	ON	FAULT XX P0112 AIR INTAKE TEMP SHORT TO GROUND	84
P0113	Intake air temperature sensor, control module input. Open circuit or shorting to battery positive (B+).	ON	FAULT XX P0113 AIR INTAKE TEMP OPEN CIRCUIT/SHORT CIRCUIT B+	84
P0116	Engine coolant temperature sensor Temperature increase on start of engine less than that calculated by control module.	ON	FAULT XX P0116 ECT SENSOR MALFUNCTION	88
P0117	Engine coolant temperature sensor, control module input. Shorting to ground.	ON	FAULT XX P0117 ECT SENSOR SHORT CIRCUIT GND	92
P0118	Engine coolant temperature sensor, control module input. Open circuit or shorting to battery positive (B+).	ON	FAULT XX P0118 ECT SENSOR OPEN CIRCUIT/SHORT CIRCUIT B+	92
P0122	Throttle position sensor, control module input. Shorting to ground.	ON	FAULT XX P0122 TP SENSOR SHORT CIRCUIT GND	96
P0123	Throttle position sensor, control module input. Open circuit or shorting to battery positive (B+).	ON	FAULT XX P0123 TP SENSOR OPEN CIRCUIT/SHORT CIRCUIT B+	96
P0130	Front heated oxygen sensor, bank 1. Malfunction	ON	FAULT XX P0130 O2S BANK1 SENSOR1 MALFUNCTION	100
P0131	Front heated oxygen sensor, bank 1, control module input. Shorting to ground.	ON	FAULT XX P0131 O2S BANK1 SENSOR1 SHORT TO GROUND	100
P0132	Front heated oxygen sensor, bank 1, control module input. Shorting to battery positive (B+).	ON	FAULT XX P0132 O2S BANK1 SENSOR1 SHORTING TO B+	100
P0133	Front heated oxygen sensor, bank 1. Alternating between rich and lean too slow.	ON	FAULT XX P0133 O2S BANK1 SENSOR1 LOW FREQUENCY	100
P0134	Front heated oxygen sensor, bank 1, control module input. Break	ON	FAULT XX P0134 O2S BANK1 SENSOR1 OPEN CIRCUIT	100
P0136	Rear heated oxygen sensor, bank 1. Malfunction	ON	FAULT XX P0136 O2S BANK1 SENSOR2 MALFUNCTION	106

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0137	Rear heated oxygen sensor, bank 1, control module input. Shorting to ground.	ON	FAULT XX P0137 O2S BANK1 SENSOR2 SHORT TO GROUND	106
P0138	Rear heated oxygen sensor, bank 1, control module input. Shorting to battery positive (B+).	ON	FAULT XX P0138 O2S BANK1 SENSOR2 SHORTING TO B+	106
P0139	Rear heated oxygen sensor, bank 1. Alternating between rich and lean too slow.	ON	FAULT XX P0139 O2S BANK1 SENSOR2 LOW FREQUENCY	106
P0140	Rear heated oxygen sensor, bank 1, control module input. Break	ON	FAULT XX P0140 O2S BANK1 SENSOR2 OPEN CIRCUIT	106
P0150	Front heated oxygen sensor, bank 2. Malfunction	ON	FAULT XX P0150 O2S BANK2 SENSOR1 FUNCTION INCORRECT	112
P0151	Front heated oxygen sensor, bank 2, control module input. Shorting to ground.	ON	FAULT XX P0151 O2S BANK2 SENSOR1 SHORT CIRCUIT GND	112
P0152	Front heated oxygen sensor, bank 2, control module input. Shorting to battery positive (B+).	ON	FAULT XX P0152 O2S BANK2 SENSOR1 SHORT CIRCUIT B+	112
P0153	Front heated oxygen sensor, bank 2. Alternating between rich and lean too slow.	ON	FAULT XX P0153 O2S BANK2 SENSOR1 LOW FREQUENCY	112
P0154	Front heated oxygen sensor, bank 2, control module input. Break	ON	FAULT XX P0154 O2S BANK2 SENSOR1 OPEN CIRCUIT	112
P0155	Front heated oxygen sensor, bank 2, control module input. Current in preheating circuit too high.	ON	FAULT XX P0155 O2S BANK2 SENS1 PREHEATING HIGH CURRENT	118
P0156	Rear heated oxygen sensor, bank 2. Malfunction	ON	FAULT XX P0156 O2S BANK2 SENSOR2 FUNCTION INCORRECT	122
P0157	Rear heated oxygen sensor, bank 2, control module input. Shorting to ground.	ON	FAULT XX P0157 O2S BANK2 SENSOR2 SHORT CIRCUIT GND	122
P0158	Rear heated oxygen sensor, bank 2, control module input. Shorting to battery positive (B+).	ON	FAULT XX P0158 O2S BANK2 SENSOR2 SHORT CIRCUIT B+	122
P0159	Rear heated oxygen sensor, bank 2. Alternating between rich and lean too slow.	ON	FAULT XX P0159 O2S BANK2 SENSOR2 LOW FREQUENZY	122
P0160	Rear heated oxygen sensor, bank 2, control module input. Break	ON	FAULT XX P0160 O2S BANK2 SENSOR2 OPEN CIRCUIT	122
P0161	Rear heated oxygen sensor, bank 2, control module input. Current in preheating circuit too high.	ON	FAULT XX P0161 O2S BANK2 SENSOR2 PREHEATING HIGH CURRENT	128
P0300	Random misfiring in one of the cylinders.	ON	FAULT XX P0300 RANDOM MISFIRE	132

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0301	Misfiring in cylinder 1.	ON	FAULT XX P0301 MISFIRE CYL 1	142
P0302	Misfiring in cylinder 2.	ON	FAULT XX P0302 MISFIRE CYL 2	142
P0303	Misfiring in cylinder 3.	ON	FAULT XX P0303 MISFIRE CYL 3	142
P0304	Misfiring in cylinder 4.	ON	FAULT XX P0304 MISFIRE CYL 4	142
P0305	Misfiring in cylinder 5.	ON	FAULT XX P0305 MISFIRE CYL 5	142
P0306	Misfiring in cylinder 6.	ON	FAULT XX P0306 MISFIRE CYL 6	142
P0327	Knock sensor, bank 1, control module input. Open circuit or shorting to ground or battery positive (B+).	ON	FAULT XX P0327 KNOCKSENSOR BANK1 OPEN CIRCUIT/SHORT CIRCUIT	150
P0332	Knock sensor, bank 2, control module input. Open circuit or shorting to ground or battery positive (B+).	ON	FAULT XX P0332 KNOCKSENSOR BANK2 OPEN CIR./SHORT CIR.	154
P0335	Crankshaft position sensor, control module input. No signals.		FAULT XX P0335 CRANKSHAFT POSITION NO INPUT	158
P0336	Crankshaft position sensor, control module input. Malfunctioning, gap in toothed wheel (slotted ring) undefinable.		FAULT XX P/I P0336 CRANKSHAFT POSITION INPUT WRONG	158
P0341	Camshaft position sensor, control module input. Malfunction	ON	FAULT XX P0341 CAMSHAFT POSITION INPUT WRONG	164
P0410	Secondary air injection Incorrect air flow.	ON	FAULT XX P0410 SECONDARY AIR FLOW WRONG	168
P0411	Secondary air injection Air flow too weak.	ON	FAULT XX P0411 SECONDARY AIR FLOW WEAK	168
P0412	Secondary air injection control valve, control module output. Shorting to battery positive (B+).		FAULT XX P0412 SECOND AIR VALVE SHORT CIRCUIT B+	
P0413	Secondary air injection control valve, control module output. Break		FAULT XX P0413 SECOND AIR VALVE OPEN CIRCUIT	
P0414	Secondary air injection control valve, control module output. Shorting to ground.		FAULT XX P0414 SECOND AIR VALVE SHORT CIRCUIT GND	
P0422	Catalytic converter, bank 1 Malfunction	ON	FAULT XX P0422 CATAL. CONV. BANK1 MALFUNCTION	178
P0432	Catalytic converter, bank 2 Malfunction	ON	FAULT XX P0432 CATAL. CONV. BANK2 MALFUNCTION	182
P0441	EVAP system. Malfunction	ON	FAULT XX P0441 EVAP VALVE FLOW WRONG	186

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0501	Vehicle speed, input signal to control module. Incorrect signal.	ON	FAULT XX P0501 CAR SPEED SIGNAL INCORRECT	190
P0562	Battery voltage Low voltage level.		FAULT XX P0562 BATTERY VOLTAGE LOW	194
P0563	Battery voltage High voltage level.		FAULT XX P0563 BATTERY VOLTAGE HIGH	194
P0601	Control module fault (internal fault) Defective read memory.	ON	FAULT XX P0601 CONTROL MODULE INTERNAL FAULT INTERNAL ROM	196
P0604	Control module fault (internal fault) Defective write memory.	ON	FAULT XX P0604 CONTROL MODULE INTERNAL FAULT INTERNAL RAM	196
P1102	Front heated oxygen sensor, bank 1, control module input. Current in preheating circuit much too high.	ON	FAULT XX P1102 O2S BANK1 SENSOR1 PREHEATING HIGH CURRENT	200
P1105	Rear heated oxygen sensor, bank 1, control module input. Current in preheating circuit much too high.	ON	FAULT XX P1105 O2S BANK1 SENSOR2 PREHEATING HIGH CURRENT	204
P1115	Front heated oxygen sensor, bank 1, control module input. Current in preheating circuit much too low.	ON	FAULT XX P1115 O2S BANK1 SENSOR1 PREHEATING LOW CURRENT	200
P1117	Rear heated oxygen sensor, bank 1, control module input. Current in preheating circuit much too low.	ON	FAULT XX P1117 O2S BANK1 SENSOR2 PREHEATING LOW CURRENT	204
P1123	Additive adaptation, bank 1. Min value.	ON	FAULT XX P1123 ADD. ADAPTATION BANK1 MINIMUM VALUE	208
P1124	Additive adaptation, bank 1. Max value.	ON	FAULT XX P1124 ADD. ADAPTATION BANK1 MAXIMUM VALUE	208
P1125	Additive adaptation, bank 2. Min value.	ON	FAULT XX P1125 ADD. ADAPTATION BANK2 MINIMUM VALUE	208
P1126	Additive adaptation, bank 2. Max value.	ON	FAULT XX P1126 ADD. ADAPTATION BANK2 MAXIMUM VALUE	208
P1127	Multiplicative adaptation, bank 1. Min value.	ON	FAULT XX P1127 MULTI.ADAPT. BANK1 MINIMUM VALUE	208
P1128	Multiplicative adaptation, bank 1. Max value.	ON	FAULT XX P1128 MULTI.ADAPT. BANK 1 MAXIMUM VALUE	208
P1129	Multiplicative adaptation, bank 2. Min value.	ON	FAULT XX P1129 MULTI.ADAPT. BANK2 MIN VALUE	208
P1130	Multiplicative adaptation, bank 2. Max value.	ON	FAULT XX P1130 MULTI.ADAPT. BANK2 MAX VALUE	208

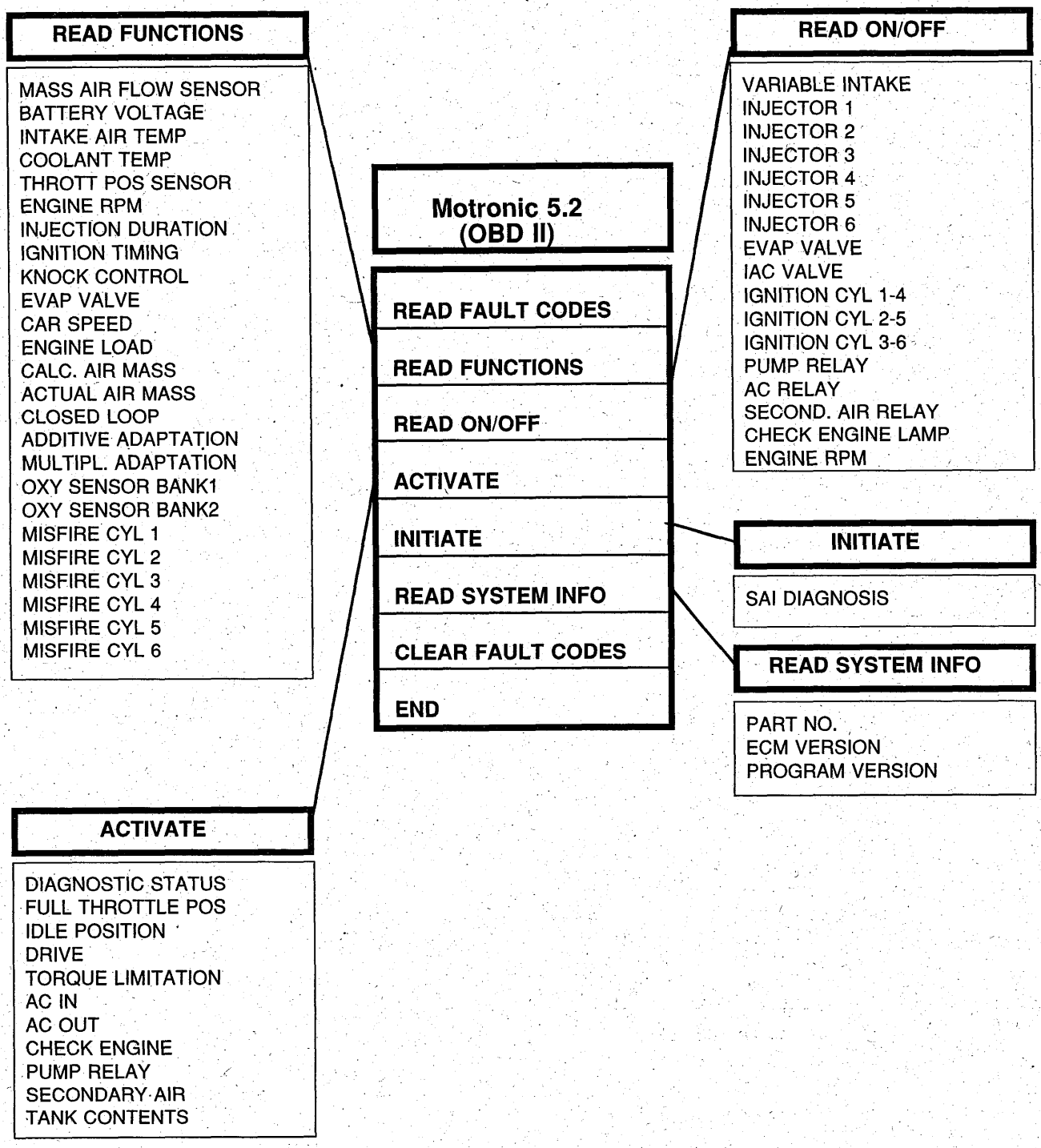
Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P1170	Variable intake manifold, outer flap, control module output Break	ON	FAULT XX P1170 POWERST. OUTER VIM OPEN CIRCUIT	214
P1171	Variable intake manifold, outer flap, control module output Shorting to ground.	ON	FAULT XX P1171 POWERST. OUTER VIM SHORT CIRCUIT GND	214
P1172	Variable intake manifold, outer flap, control module output Shorting to battery positive (B+).	ON	FAULT XX P1172 POWERST. OUTER VIM SHORT CIRCUIT B+	214
P1213	Injector, cylinder 1, control module output. Shorting to battery positive (B+).		FAULT XX P1213 INJECTOR CYL 1 SHORT CIRCUIT B+	218
P1214	Injector, cylinder 2, control module output. Shorting to battery positive (B+).		FAULT XX P1214 INJECTOR CYL 2 SHORT CIRCUIT B+	218
P1215	Injector, cylinder 3, control module output. Shorting to battery positive (B+).		FAULT XX P1215 INJECTOR CYL 3 SHORT CIRCUIT B+	218
P1216	Injector, cylinder 4, control module output. Shorting to battery positive (B+).		FAULT XX P1216 INJECTOR CYL 4 SHORT CIRCUIT B+	218
P1217	Injector, cylinder 5, control module output. Shorting to battery positive (B+).		FAULT XX P1217 INJECTOR CYL 5 SHORT CIRCUIT B+	218
P1218	Injector, cylinder 6, control module output. Shorting to battery positive (B+).		FAULT XX P1218 INJECTOR CYL 6 SHORT CIRCUIT B+	218
P1225	Injector, cylinder 1, control module output. Open circuit or shorting to ground.		FAULT XX P1225 INJECTOR CYL 1 OPEN CIRCUIT/SHORT CIRCUIT GND	218
P1226	Injector, cylinder 2, control module output. Open circuit or shorting to ground.		FAULT XX P1226 INJECTOR CYL 2 OPEN CIRCUIT/SHORT CIRCUIT GND	218
P1227	Injector, cylinder 3, control module output. Open circuit or shorting to ground.		FAULT XX P1227 INJECTOR CYL 3 OPEN CIRCUIT/SHORT CIRCUIT GND	218
P1228	Injector, cylinder 4, control module output. Open circuit or shorting to ground.		FAULT XX P1228 INJECTOR CYL 4 OPEN CIRCUIT/SHORT CIRCUIT GND	218
P1229	Injector, cylinder 5, control module output. Open circuit or shorting to ground.		FAULT XX P1229 INJECTOR CYL 5 OPEN CIRCUIT/SHORT CIRCUIT GND	218
P1230	Injector, cylinder 6, control module output. Open circuit or shorting to ground.		FAULT XX P1230 INJECTOR CYL 6 OPEN CIRCUIT/SHORT CIRCUIT GND	218

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P1386	Control module, electronic circuitry for processing knock sensor signals. Internal fault.		FAULT XX P1386 ECM INTERNAL FAULT KNOCKREGL.	222
P1396	Crankshaft position sensor, control module input. Malfunctioning, toothed wheel (slotted ring) has too many ribs.		FAULT XX P1386 CRANKSHAFT POSITION INPUT WRONG	158
P1410	EVAP canister purge valve, control module output. Shorting to battery positive (B+).		FAULT XX P1410 EVAP VALVE SHORTING TO B+	224
P1425	EVAP canister purge valve, control module output. Shorting to ground.		FAULT XX P1425 EVAP VALVE SHORT CIRCUIT GND	224
P1426	EVAP canister purge valve, control module output. Break		FAULT XX P1426 EVAP VALVE OPEN CIRCUIT	224
P1501	Fuel pump relay, control module output. Shorting to ground.		FAULT XX P1501 POWER STAGE FUEL PUMP SHORT CIRCUIT GND	228
P1502	Fuel pump relay, control module output. Shorting to battery positive (B+).		FAULT XX P1502 POWER STAGE FUELPUMP SHORTING TO B+	228
P1510	Idle air control valve, open function, control module output. Shorting to battery positive (B+).		FAULT XX P1510 IAC VALVE OPEN SHORT CIRCUIT B+	232
P1512	Variable intake manifold, inner flap, control module output Shorting to battery positive (B+).	ON	FAULT XX P1512 POWERST. INNER VIM SHORT CIRCUIT B+	236
P1513	Idle air control valve, open function, control module output. Shorting to ground.		FAULT XX P1513 IAC VALVE OPEN SHORT CIRCUIT GND	232
P1514	Idle air control valve, open function, control module output. Break		FAULT XX P1514 IAC VALVE OPEN OPEN CIRCUIT	232
P1515	Variable intake manifold, inner flap, control module output Shorting to ground.	ON	FAULT XX P1515 POWERST. INNER VIM SHORT CIRCUIT GND	236
P1516	Variable intake manifold, inner flap, control module output Break	ON	FAULT XX P1516 POWERST. INNER VIM OPEN CIRCUIT	236
P1541	Fuel pump relay, control module output. Break		FAULT XX P1541 POWER STAGE FUEL PUMP OPEN CIRCUIT	228
P1551	Idle air control valve, close function, control module output. Break		FAULT XX P1551 IAC-VALVE CLOSED OPEN CIRCUIT	232
P1552	Idle air control valve, close function, control module output. Shorting to ground.		FAULT XX P1552 IAC VALVE CLOSED SHORT CIRCUIT GND	232

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P1553	Idle air control valve, close function, control module output. Shorting to battery positive (B+).		FAULT XX P1553 IAC VALVE CLOSED SHORT CIRCUIT B+	232
P1585	Fuel level less than 10 litres.		FAULT XX P1585 TANK FUEL LEVEL LOW	240
P1669	TCS active, input signal to control module. Open circuit or shorting to ground or battery positive (B+).		FAULT XX P1669 TCS SIGNAL OPEN CIRCUIT/SHORT CIRCUIT	242
P1691	CHECK ENGINE, output signal from control module. Break	ON	FAULT XX P1691 CHECK ENGINE OPEN CIRCUIT	246
P1692	CHECK ENGINE, output signal from control module. Short to ground	ON	FAULT XX 1692 CHECK ENGINE SHORT CIRCUIT GND	246
P1693	CHECK ENGINE, output signal from control module. Shorting to battery positive (B+).	ON	FAULT XX P1693 CHECK ENGINE SHORT CIRCUIT B+	246

Motronic 5.2 (OBD II) (contd.)

Menu structure for command codes



Motronic 5.2 (OBD II) (contd.)

READ FUNCTIONS

Values for the different commands are stored in the control module's internal memory. These values are updated continuously, some of them as soon as the ignition switch is turned to the ON position but most require the engine to be started.

When the engine is stopped, the control module saves the latest value and displays it next time the ignition switch is turned to the ON position. The value in question is then not relevant for a command requiring the engine to have been started. The ISAT scan tool then shows an incorrect reading.

ISAT ST display	Function
AIR MASS SENSOR X.X V X.X g/s	Shows the MASS AIR FLOW SENSOR's input voltage (control module, pin 17) in V and the associated intake air mass in g/s. Conversion is carried out according to the characteristics of the mass air flow sensor: g/s = f (V). Se "Technical data". Operating range: 0.0-5.5 V.
BATTERY VOLTAGE XX.X V	Shows the control module's power supply, +15 circuit (control module pin 56). Operating range: 0.0-17.4 V.
INDUCTION AIR TEMP X.X V XX.X °C	Shows the input voltage (control module, pin 16) from the intake air temperature sensor in the intake manifold in V and associated temperature in °C. Conversion is carried out according to the characteristics of the temperature sensor: °C = f (Ω). Operating range: 0.0-0.5 V.
COOLANT TEMP X.X V XX.X°C	Shows the input voltage (control module, pin 74) from the engine coolant temperature sensor in V and associated temperature in °C. Conversion is carried out according to the characteristics of the temperature sensor: °C = f (Ω). Operating range: 0.0-5.0 V.
THROTT POS SENSOR XX.X V	Shows the throttle position sensor's input voltage (control module, pin 44) in V. Operating range: 0.00-1.25 V.
ENGINE RPM XXXX RPM	Shows engine speed in rpm. Operating range: 0-6550 rpm.
INJECTION DURATION X.X ms	Shows the injection duration for cylinder 1 in ms. Operating range: 0.0-98.7 ms.
IGNITION TIMING X.X DEGREES	Shows the ignition timing (dwell angle) for cylinder 1 in degrees before top dead centre (BTDC). Operating range: 78-(-144) degrees.
KNOCK CONTROL XX DEGREES	Shows the ignition retard in degrees when knocking occurs in cylinder 1. Operating range: 0-128 degrees.
EVAP VALVE XXX.X%	Shows the extent of EVAP canister purge valve opening expressed in %. Operating range: 0-100 %.
CAR SPEED XXX KM/H	Shows the speed of the car in km/h. Operating range: 0-255 km/h.
ENGINE LOAD XX.XX ms	Shows internal control module quantity, which is proportional to the current engine load. Operating range: 0-12.25 ms.
CALC. AIR MASS XXX.X g/s	Shows the air flow calculated by the control module that has to pass the IAC valve for attainment of the correct idling speed. Operating range: 0-17 g/s.
ACTUAL AIR MASS XX.X g/s	Shows the air flow through the IAC valve (mass air flow sensor value less adapted leakage flow across the throttle butterfly) as measured by the control module. Operating range: 0-17 g/s.

ISAT ST display	Function
CLOSED LOOP BANK1 ±XX.X%	Shows the working range of closed loop control FOR CYLINDER BANK 1-3-5. At limit values, the diagnostic trouble codes "Adaptation lean" and "Adaptation rich" are generated. Operating range: ±25 %.
CLOSED LOOP BANK2 ±XX.X%	Shows the working range of closed loop control FOR CYLINDER BANK 2-4-6. At limit values, the diagnostic trouble codes "Adaptation lean" and "Adaptation rich" are generated. Operating range: ±25 %.
ADDITIVE BANK 1 X.XX ms	Shows the additive injection duration correction for cylinder bank 1-3-5. Adaptation takes place at idling speed. Operating range: 0.0 ± 0.512 ms.
ADDITIVE BANK 2 X.XX ms	Shows the additive injection duration correction for cylinder bank 2-4-6. Adaptation takes place at idling speed. Operating range: 0.0 ± 0.512 ms.
MULTIPL BANK 1 XX.X%	Shows the multiplicative injection duration correction for cylinder bank 1-3-5. Adaptation takes place while the car is being driven. Operating range: ±25 %.
MULTIPL BANK 2 XX.X%	Shows the multiplicative injection duration correction for cylinder bank 2-4-6. Adaptation takes place while the car is being driven. Operating range: ±25 %.
OXY SENSOR 1 X.X V	Shows the input voltage (control module, pin 19) from the front oxygen sensor, cylinder bank 1-3-5, in V. Operating range: 0.00-1.25 V.
OXY SENSOR 2 X.X V	Shows the input voltage (control module, pin 77) from the rear oxygen sensor, cylinder bank 1-3-5, in V. Operating range: 0.00-1.25 V.
OXY SENSOR 1 X.X V	Shows the input voltage (control module, pin 18) from the front oxygen sensor, cylinder bank 2-4-6, in V. Operating range: 0.00-1.25 V.
OXY SENSOR 2 X.X V	Shows the input voltage (control module, pin 76) from the rear oxygen sensor, cylinder bank 2-4-6, in V. Operating range: 0.00-1.25 V.
MISFIRE CYL 1 XXX	Shows the number of misfires for cylinder 1. Operating range: 0-255.
MISFIRE CYL 2 XXX	Shows the number of misfires for cylinder 2. Operating range: 0-255.
MISFIRE CYL 3 XXX	Shows the number of misfires for cylinder 3. Operating range: 0-255.
MISFIRE CYL 4 XXX	Shows the number of misfires for cylinder 4. Operating range: 0-255.
MISFIRE CYL 5 XXX	Shows the number of misfires for cylinder 5. Operating range: 0-255.
MISFIRE CYL 6 XXX	Shows the number of misfires for cylinder 6. Operating range: 0-255.

Motronic 5.2 (OBD II) (contd.)

READ ON/OFF

Values for the different commands are stored in the control module's internal memory. These values are updated continuously, some of them as soon as the ignition switch is turned to the ON position but most require the engine to be started.

When the engine is stopped, the control module saves the latest value and displays it next time the ignition switch is turned to the ON position. The value in question is then not relevant for a command requiring the engine to have been started. The ISAT scan tool then shows an incorrect reading.

ISAT ST display	Function
DIAGNOSTIC STATUS • EVAP • CATAL. CONV. BANK1 • CATAL. CONV. BANK2 • OXY SENSOR BANK1 • OXY SENSOR BANK2 • PREHEAT BANK1 • PREHEAT BANK2 • SECONDARY AIR • TRIP OBDII • DRIVING CYCLE • WARM-UP CYCLE	The "DIAGNOSTIC STATUS" command has a submenu in which different functions are shown: EVAP, CATALYTIC CONVERTER BANK1 and BANK2, OXYGEN SENSOR BANK1 and BANK2, PREHEATING BANK1 and BANK2 and SECONDARY AIR show whether the control module has run through the diagnostics program since the last time the car was started. The ISAT scan tool shows this with the text "NOT READY" or "READY", as appropriate. TRIP OBD II shows whether the car has completed a defined OBD II drive cycle. The ISAT scan tool shows this with the text "NOT READY" or "READY", as appropriate. DRIVE CYCLE shows whether the car has complete a defined drive cycle; closed loop on both banks plus about two minutes. The ISAT scan tool shows this with the text "NOT READY" or "READY", as appropriate. WARMUP CYCLE shows whether the car has completed a defined OBD II warm-up cycle: an increase in engine temperature of at least 22°C to at least 71°C.
FULL THROTTLE POS YES/NO	Shows the input from the throttle position sensor. YES at wide open throttle, otherwise NO.
IDLE POSITION YES/NO	Shows the input from the throttle position sensor. YES at closed throttle, otherwise NO
DRIVE YES/NO	Shows the position of the automatic transmission selector lever. YES for R, D, 3, 2 or 1. NO for P and N.
TORQUE LIMITATION YES/NO	Shows status if torque limitation requested by the transmission control module.
AC IN ON/OFF	Shows whether the ICE signal requesting A/C engagement is activated.
AC OUT ON/OFF	Shows the current status of the A/C relay.
CHECK ENGINE ON/OFF	Shows the status of the CHECK ENGINE lamp (MIL).
PUMP RELAY ON/OFF	Shows the status of the fuel pump relay.
SECONDARY AIR ON/OFF	Shows the status of the secondary air injection pump relay
TANK CONTENTS LOW/HIGH	Shows the status of the tank contents, i.e. whether the main instrument display panel indicates low fuel level.

Motronic 5.2 (OBD II) (contd.)

ACTIVATE

Note

When a system function is activated with the ISAT Scan Tool, the Motronic control module is made to do something that it would not otherwise do in the course of its normal operation. This may cause diagnostic trouble codes to be generated in other systems which are dependent on the Motronic system.

Activation should only be carried out with the ignition switch in the ON position and the gear lever in neutral.

Important

The activate functions should always be used with discretion.

- Always deactivate an activated function before proceeding further in the ISAT Scan Tool menu.
- Always clear any diagnostic trouble codes generated in the Motronic system when you have finished fault diagnosis.

ISAT ST display	Function
INNER/OUTER FLAP ACTIVE 0.5 Hz/30 s	TheVARIABLE INTAKE menuhas a sub-menu consisting of two commands,INNER FLAP and OUTER FLAP. The Motronic control module activates either flap, according to the command selected.
INJECTOR 1 ACTIVE 0.5 Hz/30 s	The Motronic control module activates the injector for cylinder 1.
INJECTOR 2 ACTIVE 0.5 Hz/30 s	The Motronic control module activates the injector for cylinder 2.
INJECTOR 3 ACTIVE 0.5 Hz/30 s	The Motronic control module activates the injector for cylinder 3.
INJECTOR 4 ACTIVE 0.5 Hz/30 s	The Motronic control module activates the injector for cylinder 4.
INJECTOR 5 ACTIVE 0.5 Hz/30 s	The Motronic control module activates the injector for cylinder 5.
INJECTOR 6 ACTIVE 0.5 Hz/30 s	The Motronic control module activates the injector for cylinder 6.
EVAP VALVE ACTIVE 0.5 Hz/30 s	The Motronic control module activates the EVAP canister purge valve.
IAC VALVE ACTIVE 0.5 Hz/30 s	The Motronic control module activates the idle air control (IAC) valve.
IGNITION CYL 1-4 ACTIVE 30 s	The Motronic control module activates the ignition coil for cylinders 1+4.
IGNITION CYL 2-5 ACTIVE 30 s	The Motronic control module activates the ignition coil for cylinders 2+5.
IGNITION CYL 3-6 ACTIVE 30 s	The Motronic control module activates the ignition coil for cylinders 3+6.
PUMP RELAY ACTIVE 0.5 Hz/30 s	The Motronic control module activates the fuel pump relay.
AC RELAY ACTIVE 0.5 Hz/30 s	The Motronic control module activates the A/C relay.
SECOND. AIR RELAY ACTIVE 0.5 Hz/30 s	The Motronic control module activates the secondary air injection system relay.

ISAT ST display	Function
CHECK ENGINE LAMP ACTIVE 0.5 Hz/30 s	The Motronic control module activates the CHECK ENGINE function.
ENGINE RPM ACTIVE 30 s	The Motronic control module puts out an engine speed signal corresponding to about 1000 rpm.

Motronic 5.2 (OBD II) (contd.)

INITIATE

Note

The OBD II diagnostic functions for secondary air injection (SLS) are initiated at a late stage in the drive cycle. Initiation commands which force the control module to carry out on-board diagnostics are therefore provided so that repair shops and the production plant can check that the system is in perfect working order..

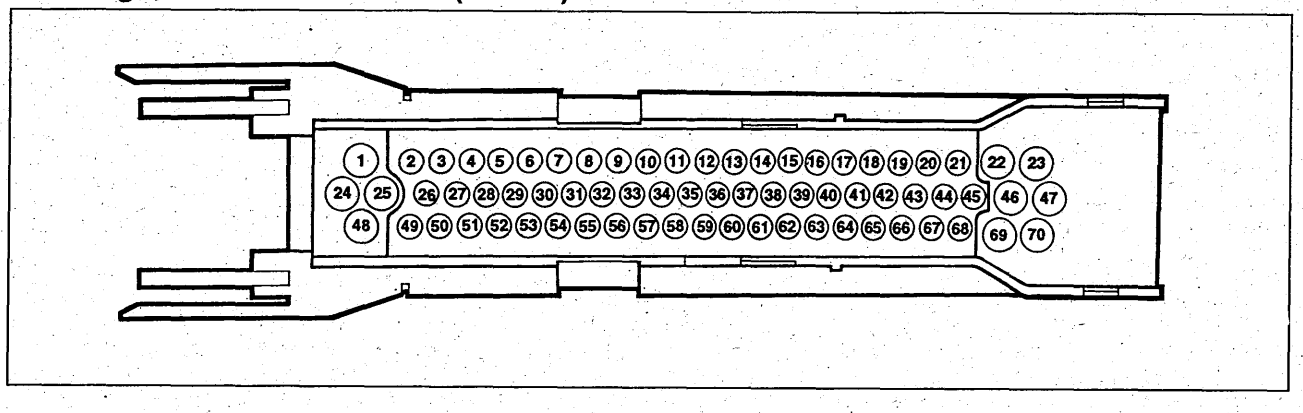
ISAT ST display	Function
SAI DIAGNOSIS READY/NOT READY	The Motronic control module is ordered to carry out OBD II diagnosis.

READ SYSTEM INFO

ISAT ST display	Function
PART NO. XXX XXXX	Shows Saab's 7-digit part number for the control module.
ECM VERSION XXXXXXXXXX	Shows Bosch's 10-digit part number for the control module.
PROGRAM VERSION XXXXXXXXXX	Shows Bosch's 10-digit part number for the software.

Saab Trionic (without OBD II)

Readings, ECM connections (M1993)



Unless otherwise stated, all readings should be taken via a breakout box (BOB) with the ignition in Drive and all components and connectors plugged in.

Pin	Colour	Component/Function	In/ Out	Voltage	Remarks
1	RD	Power supply (+30 circuit)	In	12 V	
2	GN	Boost pressure control valve	Out	*)	Pin 3
3	GN/RD	Injector, cylinder 1	Out	12 V	When idling
4	GN/RD	Injector, cylinder 2	Out	12 V	When idling
5	GN/RD	Injector, cylinder 3	Out	12 V	When idling
6	GN/RD	Injector, cylinder 4	Out	12 V	When idling
7		No connection.			
8		No connection.			
9	BN/WH	Trigger/ignition signal cyl 1	Out	*)	When idling
10	GN	Trigger/ignition signal cyl 2	Out	*)	When idling
11	BU	Trigger/ignition signal cyl 3	Out	*)	When idling
12	GY	Trigger/ignition signal cyl 4	Out	*)	When idling
13	WH	Torque limiting boost pressure	In	*) 0 V	Selector lever in R Other positions
14	OG	Selector lever position N/D	In	0 V 12 V	Selector lever P,N Selector lever R,D,1,2,3
15	WH	Brake signal	In	12 V 0 V	On Off
16		No connection.			
17	YE	Detecting cylinders 1 and 2	In	approx. 1 V	When idling
18	BN	Detecting cylinders 3 and 4	In	approx. 1 V	When idling
19		No connection.			
20		No connection.			
21	YE/RD	Signal from EVAP canister purge valve	In	0 V 12 V	Closed Open
22	GY	Manifold absolute pressure sensor	In	0.4-4.75 V	Barometric pressure=approx. 1.9 V
23	GY	Oxygen sensor	In	0-1.5 V	Pin 4
24	BK/WH	Power ground	In		G7 (intake manifold)

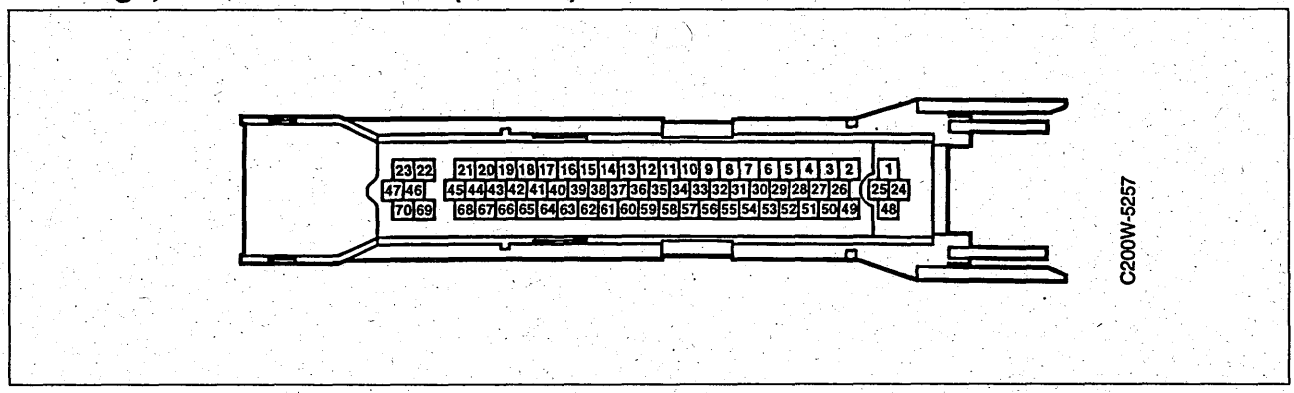
Pin	Colour	Component/Function	In/ Out	Voltage	Remarks
25	BK/WH	Power ground	In		G7 (intake manifold)
26	GN	Boost pressure control valve	Out	12 V	Pin 1
27	YE/RD	Signal to EVAP canister purge valve	Out	0 V 12 V	Closed Open
28		No connection.			
29		No connection.			
30		No connection.			
31	YE/WH	Main relay	Out		Grounds main relay, pin 85
32	GN	CHECK ENGINE	Out		Grounds lamp (on)
33	BU/WH	Diagnostics	Out		Data link connector, ISAT scan tool, pin 1
34	GN/RD	Fuel consumption	Out	5-15 mV	When idling
35	YE/RD	Engine load signal Tq	Out	PWM	With TCS only
36	RD	Cruise control (not TCS)	In		
37		No connection.			
38	BU	2-Speed radiator fan	In	0 V 12 V	On (position 1 only) Off
39	GN	Vehicle speed	In	0-12 V	From speedometer
40	GN/RD	Crankshaft position sensor	In	0-12 V	
41		No connection.			
42	GN/RD	Throttle position sensor (not TCS)	Out	About 5 V	
43	BU/WH	Manifold absolute pressure sensor	Out	About 5 V	Pin 3
44	OG	Knock sensing, ignition discharge module	In	10-30 mV	When idling
45	GY	Throttle position sensor	In	0.2-4.5 V	Pin 3 (not TCS)
46	BK	Intake air temperature sensor	In	0.2-4.0 V	90°C = approx. 1 V (pin 2)
47	BK	Reference ground	In		G7 (intake manifold)
48	RD	Power supply (+30 circuit)	In	12 V	
49	BU/RD	Idle air control (IAC) valve	Out	approx. 5V	When idling (not TCS)
50	BK	Oxygen sensor, preheating	Out	12 V	When sensor cold
51		No connection.			
52		No connection.			
53		No connection.			
54	GN/RD	A/C relay	Out		Grounds A/C relay, pin 85
55	BN	SHIFT UP	Out		
56	VT	Fuel pump relay	Out		Grounds relay, pin 85
57		Throttle position	In	0.7-12 V	With TCS
58	BU	Engine speed	Out	approx. 1 V	At 2000 rpm on tachometer
59	GN/WH	Idling speed compensation A/C / ACC	In	0 V 12 V	On (TCS) Off
				12 V 0 V	On (not TCS) Off
60	GN/WH	Ignition switch (+15 circuit)	In	12 V	
61		No connection.			
62	GY	Data link connector 444			Production only
63	RD	Data link connector 444			Production only

Pin	Colour	Component/Function	In/ Out	Voltage	Remarks
64	RD	Crankshaft position sensor	Out	12 V	Pin 1
65	RD/WH	Data link connector 444			Production only
66	BK	Signal ground (not TCS) Reference ground (TCS)	In		
67	BK/WH	Signal ground	In		
68	YE	Engine coolant temperature sensor	In		Pin 1
69		No connection.			
70		No connection.			

*)This reading is 1 V less than battery voltage, i.e. battery voltage 12 V minus 1 V = 11 V.

Saab Trionic (without OBD II) (contd.)

Readings, ECM connections (M1994-)



> = greater than; < = less than; ≈ = approximately equal to; ~ = alternating current
Pins without additional comments are not connected.
(LP = Logic Probe, P = select pulse, p = visible pulses).

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
1	PK/ WH	+30	In	Idling	B+ - 1	<0.5 V	33/28
2	GN/ BK	Boost pressure control valve	Out		1 - 2	1.2 V	51/146
					2 - 25	90 Hz 17.5% (-) 1.9 ms (-) (LP HI LO)	51/146
3	GN/ WH	Injector 1	Out	850 ± 50 rpm	1 - 3	0.2 V	46/114
					3 - 25	7.1 Hz 2.5-4.5 ms (-) (**HI** LOp)	46/114
4	BU/ WH	Injector 2	Out	850 ± 50 rpm	1 - 4	0.2 V	46/114
					4 - 25	7.15 Hz 2.5-4.5 ms (-) (**HI** LOp)	46/114
5	VT/ WH	Injector 3	Out	850 ± 50 rpm	1 - 5	0.2 V	46/114
					5 - 25	7.15 Hz 2.5-4.5 ms (-) (**HI** LOp)	46/114
6	GY/ WH	Injector 4	Out	850 ± 50 rpm	1 - 6	0.2 V	46/114
					6 - 25	7.15 Hz 2.5-4.5 ms (-) (**HI** LOp)	46/114
7-8		No connection.					
9	OG/ BK	Trigger 1	Out	850 ± 50 rpm	1 - 9	1.2 V	41/119
					9 - 25	7.1 Hz 8.3% (- 11 ms (-) (**HI** LOp)	41/119

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
10	GN/ YE	Trigger 2	Out	850 ± 50 rpm	1 - 10	1.2 V	41/119
					10 - 25	7.1 Hz 8.3% (-) 11 ms (-) (**HI** LOp)	41/119
11	BU/ RD	Trigger 3	Out	850 ± 50 rpm	1 - 11	1.2 V	41/119
					11 - 25	7.1 Hz 8.3% (-) 11 ms (-) (**HI** LOp)	41/119
12	GY/ RD	Trigger 4	Out	850 ± 50 rpm	1 - 12	1.2 V	41/119
					12 - 25	7.1 Hz 8.3% (-) 11 ms (-) (**HI** LOp)	41/119
13	WH	Reversing light switch, manual	In		13 - 25	0 V	
				Gear R	13 - 25	B+	
14		DRIVE	In	P, N	14 - 25	0 V	62/136
				R, D, 1, 2, 3	14 - 25	B+	62/136
15	VT	Brake light switch	In	Brake pedal not depressed	15 - 25	0 V	52/138
				Brake pedal depressed	15 - 25	B+	52/138
16		No connection.					
17	YE/ BN	Combustion cyl 1+2	In	850 ± 50 rpm	17 - 25	≈1.5 V 15-30 Hz (**LO** Hlp)	170/117
18	BN/ RD	Combustion cyl 3+4	In	850 ± 50 rpm	18 - 25	≈1.5 V 15-30 Hz (**LO** Hlp)	170/117
19-20		No connection.					
21	YE/ GY	EVAP canister purge valve Diagnostics	In	ISAT scan tool activates EVAP canister purge valve in Trionic	21 - 25	6-7 V 8 Hz 50 % (-) 60 ms (-) (Hlp LOp)	54/101
22	BU/ BN	Pressure sensor	In		22 - 67	100 kPa = 1.9 V also see Technical Data	36/75
23	GN	Oxygen sensor	In	850 ± 50 rpm and engine warm	23 - 47	0.1-0.9 V	40/87
24	BK	Main ground	In	850 ± 50 rpm	24 - B-	<0.1 V	34
25	BK	Main ground	In	850 ± 50 rpm	25 - B-	<0.1 V	34

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
26	BU	Boost pressure control valve	Out		1 - 26	0 V	51/146
				ISAT scan tool activates boost pressure control valve in Trionic	26 - 25	90 Hz 17.5% (-) 1.9 ms (-) (LP P HI LO)	51/146
27	YE/ GY	EVAP canister purge valve	Out	ISAT scan tool activates EVAP canister purge valve in Trionic	27 - 25	6-7 V 8 Hz 50% (-) 60 ms (-) (LP HI LO)	54/101
28-30		No connection.					
31	BU/ GY	Main relay	Out		31 - 25	B+	55/124
				ISAT scan tool activates IAC valve	31 - 25	0 V	55/124
32	YE/ GN	CHECK ENGINE	Out	Turn the ignition switch from OFF to ON.	32 - 25	<0.5 V	60/139
				After 3 s	32 - 25	B+	60/139
33	GY/ BK	Diagnostics	In/Out	ISAT scan tool not connected	33 - 25	≈ 6.5 V	59
				ISAT scan tool connected	33 - 25	B+	59
34	GN/ RD	Fuel consumption signal	Out	850 ± 50 rpm	34 - 25	7.1 Hz 2.5-4.5 ms (-)	
35	YE/ BK	Cars without ETS Engine load signal (A/C and all current consumers switched off)	Out	850 ± 50 rpm	35 - 67	28 Hz ≈ 25 µs (+)	36/75
				2500 rpm	35 - 67	85 Hz ≈ 40 µs (+) (LP P HI **LO**)	36/75
		Cars with ETS	Out	850 ± 50 rpm	35 - 67	28 Hz ≈ 60 µs (+)	36/75
				2500 ± 50 rpm	35 - 67	85 Hz ≈ 170 µs (+) (LP P HI **LO**)	36/75
36	BU/ GN	Cruise control	In		36 - 25	B+	52
				Activate CC diagnostics mode, press SET/RES	36 - 25	0 V	52
37		Secondary air injection, diagnostics	In	ISAT scan tool activates secondary air injection control valve	37 - 25	B+ 0 V	
38		No connection.					
39	PK/ BK	Speed signal	In	Raise one front wheel and rotate it	39 - 25	≈ 6 V 50 Hz (Hlp LOp)	58/104
40		No connection.					

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
41	YE	Crankshaft position sensor	In	850 ± 50 rpm	41 - 67	5-10 V~ ≈ 825 Hz (LP HI LO)	35/98
42	BN/ WH	Throttle position sensor	Out		42 - 67	5 V	39/84
43	GY	Pressure sensor	Out		43 - 67	5 V	36/75
44	OG	Knock signal	In	850 ± 50 rpm	44 - 67	50-100 mV~ (LP P LO)	43/96
45	GN/ BN	Throttle position sensor	In		45 - 67	Idling ≈ 0.5 V also see Technical data	39/84
46	WH/ BK	Intake air temperature sensor	In		46 - 67	40°C = 1.5 V also see Technical Data	37/78
47	BK	Oxygen sensor, reference ground	In	850 ± 50 rpm	25 - 47	<0.05 V	34
48	PK/ WH	+30		850 ± 50 rpm	B+ - 48	<0.5 V	33
49	BU/ VT	Idle air control (IAC) valve	Out	850 ± 50 rpm	1 - 49	3.5-6.0 V	28/107
				A/C and all electrical loads switched off.	49 - 25	500 Hz 30-50% 0.5-0.9 ms (LP HI LO)	28/107
50	BK/ WH	Oxygen sensor, preheating	Out	850 ± 50 rpm	50 - 25	≈0.3 V	40/91
				Remove fuse No. 28	50 - 25	0 V	40/91
51		No connection.					
52	YE	Relay, secondary air injection	Out	ISAT scan tool activates secondary air injection control valve	52 - 25	B+	
					32 - 25	0 V	
53		No connection.					
54	RD/ WH	A/C out	Out	ISAT scan tool activates A/C in Trionic	54 - 25	B+/<0.5 V	57/141
55	BU/ YE/	SHIFT UP	Out	Turn the ignition switch from OFF to ON.	55 - 25	<0.5 V	61/139
				After 3 s	55 - 25	B+	61/139
56	WH	Fuel pump relay	Out		56 - 25	B+	56/128
				ISAT scan tool activates oxygen sensor preheating in Trionic	56 - 25	0 V	56/128

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
57	GN/ OG	Throttle position signal (cars without ETS)	Out	850 ± 50 rpm	57 - 25	≈1 V 100 Hz 9% (+) 0.9 ms (+) (LP HI **LO**)	39/84
	YE	Throttle position signal (cars with ETS)	In	850 ± 50 rpm	57 - 67	≈0.7 V 200 Hz 5% (+) 0.26 ms (+)	39/84
58	GN/ RD	Engine speed signal	Out	850 ± 50 rpm	58 - 25	≈ 0.5 V 28 Hz (LP Hlp **LO**)	35/98
59	GN/ GY	A/C in	In	M1995: ISAT scan tool activates A/C in EDU M1994: A/C button ON/OFF	59 - 25	B+	57/141
					59 - 25	0 V	57/141
60	YE/ GY	+15	In		B+ - 60	<0.5 V	33
61		No connection.					
62-63		For production only					
64		No connection.					
65		For production only					
66	BK	Reference ground, engine coolant temperature	In		66 - 25	<0.05 V	34/81
67	BK	Sensor ground	Out		67 - 25	<0.05 V	34
68	YE/ WH	Engine coolant temperature sensor	In		68 - 66	90°C = 0.41 V also see Technical Data	38/81
69-70		No connection.					

Saab Trionic (without OBD II) (contd.)

Diagnostic trouble codes

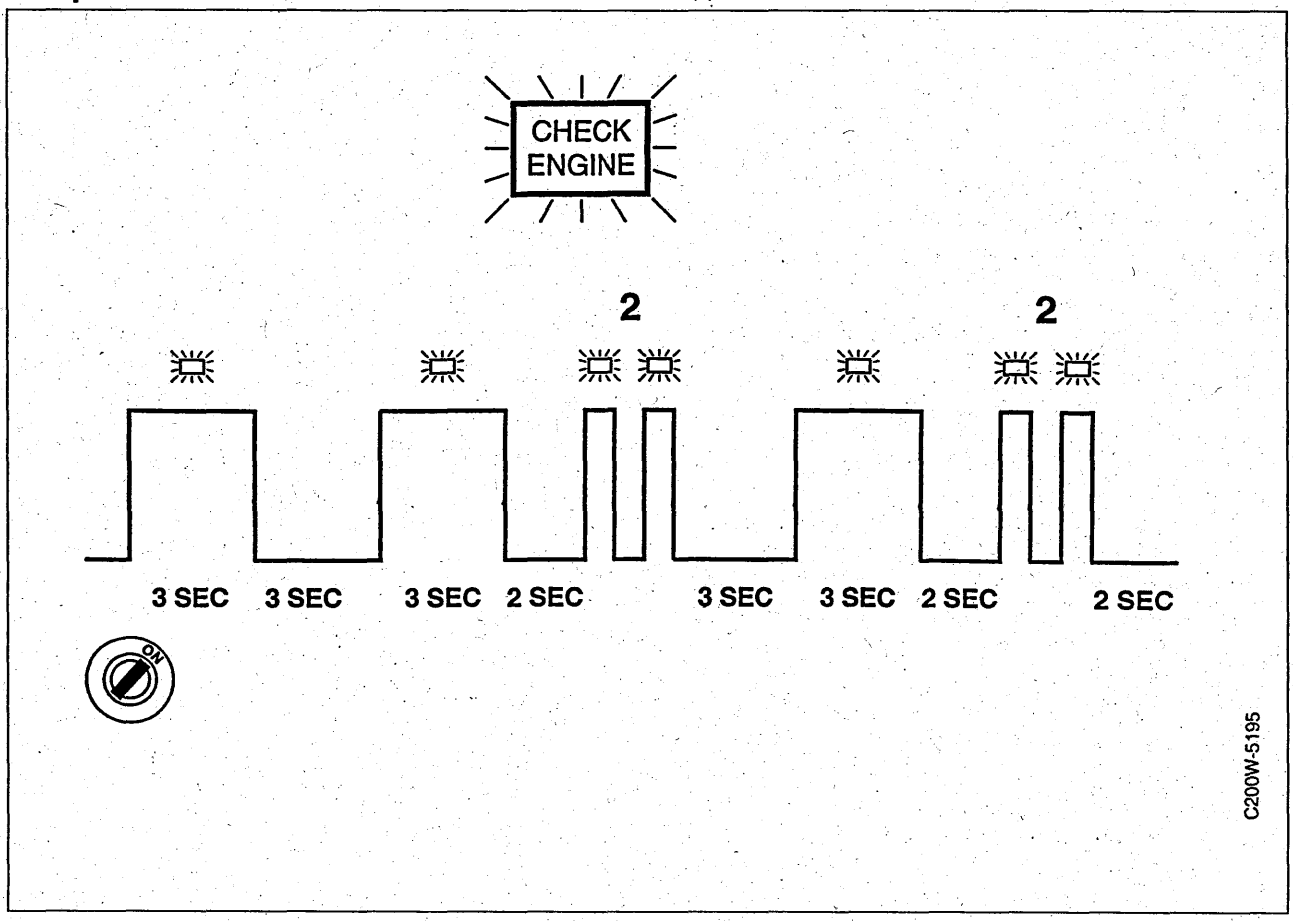
Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0105	Manifold absolute pressure (MAP) sensor. General diagnostic trouble code for pressure sensor function.	ON	FAULT XX P0105 INTAKE PRESSURE FUNCTION INCORRECT	82
P0106	Manifold absolute pressure (MAP) sensor. Vacuum hose leakage. Faulty sensor.	ON	FAULT XX P0106 INTAKE PRESSURE INPUT INCORRECT	82
P0107	Manifold absolute pressure (MAP) sensor. Control module input shorting to ground.	ON	FAULT XX P0107 INTAKE PRESSURE SHORT TO GROUND	82
P0108	Manifold absolute pressure (MAP) sensor. Control module input, shorting to battery positive (B+) or open circuit.	ON	Fault XX P0108 INTAKE PRESSURE OPEN CIRCUIT/SHORT TO B+	82
P0110	Intake air temperature sensor General diagnostic trouble code for temperature sensor operation.	ON	Fault XX P0110 INTAKE AIR TEMP FUNCTION INCORRECT	85
P0112	Intake air temperature sensor Control module input shorting to ground.	ON	FAULT XX P0112 INDUCTION AIR TEMP SHORT TO GROUND	85
P0113	Intake air temperature sensor Control module input, shorting to battery positive (B+) or open circuit.	ON	FAULT XX P0113 INDUCTION AIR TEMP OPEN CIRCUIT/SHORT TO B+	85
P0115	Engine coolant temperature sensor General diagnostic trouble code for temperature sensor operation.	ON	FAULT XX P0115 COOLANT TEMPERATURE FUNCTION INCORRECT	Without ETS, p. 88 With ETS, p. 91
P0117	Engine coolant temperature sensor Control module input shorting to ground.	ON	FAULT XX P0117 COOLANT TEMPERATURE SHORT TO GROUND	Without ETS, p. 88 With ETS, p. 91
P0118	Engine coolant temperature sensor Control module input, shorting to battery positive (B+) or open circuit.	ON	FAULT XX P0118 COOLANT TEMPERATURE OPEN CIRCUIT/SHORT TO B+	Without ETS, p. 88 With ETS, p. 91
P0120	Throttle position sensor General diagnostic trouble code for throttle position sensor operation.	ON	FAULT XX P0120 THROTTLE POSITION FUNCTION INCORRECT	Without ETS, p. 94 With ETS, p. 98

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0121	Throttle position sensor Sensor malfunction.	ON	FAULT XX P0121 THROTTLE POSITION INPUT FAULTY	94
P0122	Throttle position sensor Control module input shorting to ground.	ON	FAULT XX P0122 THROTTLE POSITION SHORT TO GROUND	Without ETS, p. 94 With ETS, p. 98
P0123	Throttle position sensor Control module input, shorting to battery positive (B+) or open circuit.	ON	FAULT XX P0123 THROTTLE POSITION OPEN CIRCUIT/SHORT TO B+	94
P0130	Oxygen sensor General diagnostic trouble code for oxygen sensor operation.	ON	FAULT XX P0130 OXYGEN SENSOR FUNCTION INCORRECT	101
P0131	Oxygen sensor Maximum lean mixture.	ON	FAULT XX P0131 OXYGEN SENSOR LEAN	101
P0132	Oxygen sensor Maximum enrichment.	ON	FAULT XX P0132 OXYGEN SENSOR RICH	101
P0135	Preheating, oxygen sensor. Current outside limits.	ON	FAULT XX P0135 OXYGEN SENSOR NO PREHEATING	107
P0170	Adaptation. All-embracing diagnostic trouble code for the adaptation function.	ON	FAULT XX P0170 ADAPTATION FUNCTION INCORRECT	110
P0171	Adaptation. Lean mixture.	ON	FAULT XX P0171 ADAPTATION LEAN	110
P0172	Adaptation. Rich mixture.	ON	FAULT XX P0172 ADAPTATION RICH	110
P0325	Knock signal from the ignition discharge module incorrect (NOTE: no knock sensor).	-	FAULT XX P0325 KNOCK SENSOR OPEN CIRCUIT	112
P0335	Crankshaft position sensor. Malfunction.	-	FAULT XX P0335 CRANKSHAFT POS SENS FUNCTION INCORRECT	115
P0410	Relay, secondary air injection control valve. Malfunction.	ON	FAULT XX P0410 SECONDARY AIR RELAY MALFUNCTION	118
P0413	Relay, secondary air injection control valve. Voltage too high, open circuit.	ON	FAULT XX P0413 SECONDARY AIR RELAY OPEN CIRCUIT	118
P0414	Relay, secondary air injection. Voltage too low, short circuit.	ON	FAULT XX P0414 SECONDARY AIR RELAY SHORT CIRCUIT GND	118

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0443	EVAP canister purge valve. General diagnostic trouble code for EVAP canister purge valve operation.	ON	FAULT XX P0443 EVAP VALVE FUNCTION INCORRECT	121
P0444	EVAP canister purge valve. Control module output, open circuit.	ON	FAULT XX P0444 EVAP VALVE OPEN CIRCUIT	121
P0445	EVAP canister purge valve. Control module output, short circuit to ground.	ON	FAULT XX P0445 EVAP VALVE SHORT TO GROUND	121
P0500	Vehicle speed. Input signal from main instrument display panel's speedometer. General diagnostic trouble code for vehicle speed.	-	FAULT XX P0500 VEHICLE SPEED FUNCTION INCORRECT	124
P0501	Vehicle speed. Input signal outside limits.	-	FAULT XX P0501 VEHICLE SPEED SIGNAL INCORRECT	124
P0502	Vehicle speed. No input signal.	-	FAULT XX P0502 VEHICLE SPEED OPEN CIRCUIT	124
P0505	Idle air control valve. Malfunction.	-	FAULT XX P0505 IAC VALVE FUNCTION INCORRECT	126
P0605	Control module. Internal fault.	-	FAULT XX P0605 CONTROL MODULE INTERNAL FAULT	130
P1322	Malfunction in ETS. Engine switched off (safety concept).	-	FAULT XX P1322 ENGINE RPM SIGNAL WRONG	131
P1500	Battery voltage. Outside limits.	-	FAULT XX P1500 BATTERY VOLTAGE VOLTAGE INCORRECT	133

Saab Trionic (without OBD II) (contd.)

Lamp-flash codes

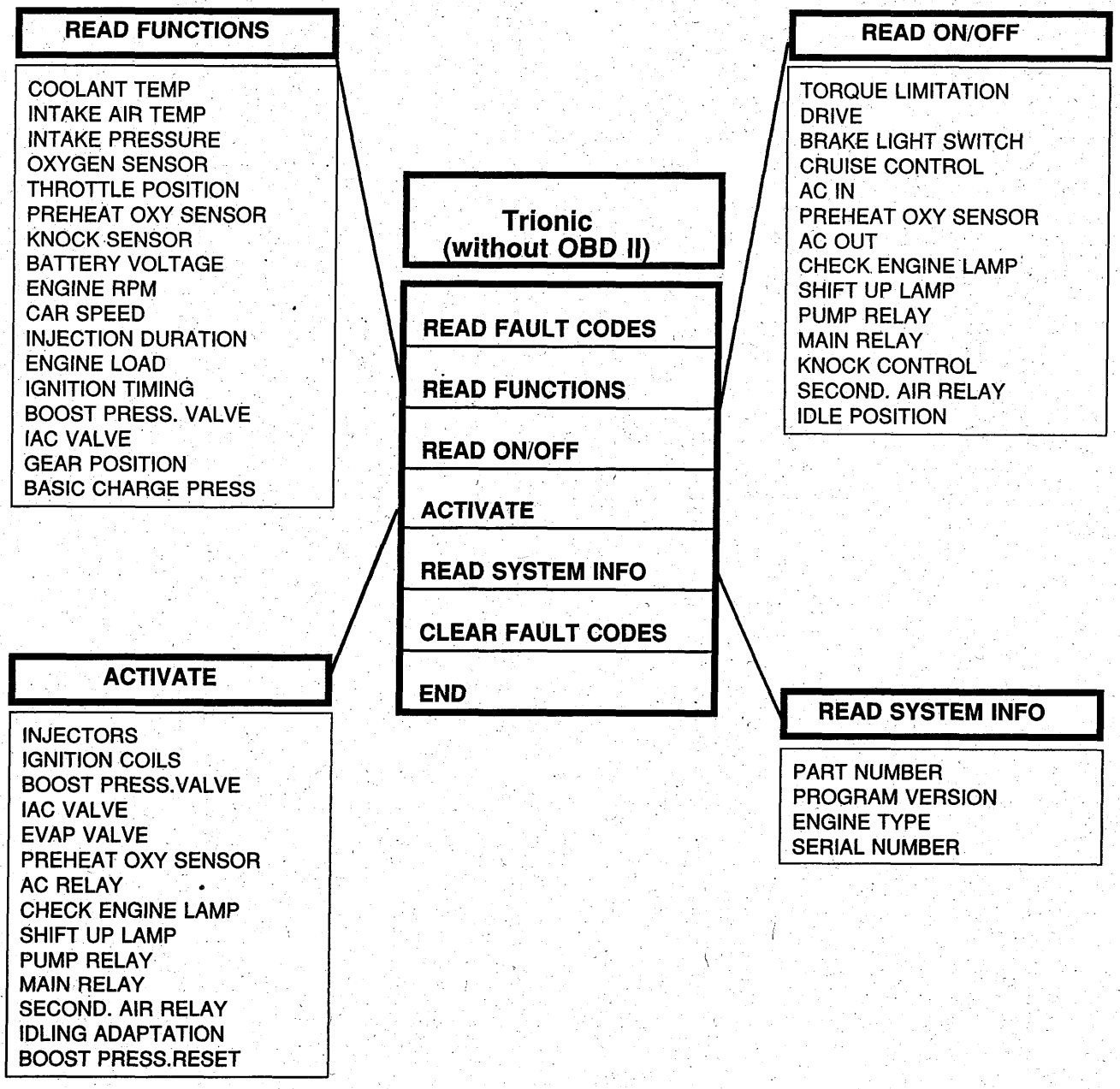


Turn the ignition switch to ON. After about 6 seconds the malfunction indicator (CHECK ENGINE) lamp goes out for a moment before coming on again for 3 seconds. The flashing codes then follow.

Number of flashes	Function	ISAT ST code	Fault diagnosis, see 2:7, page	
			-M1993	M1994-
2	Manifold absolute pressure (MAP) sensor.	P0105, P0106, P0107, P0108	82	82
3	Intake air temperature sensor	P0110, P0112, P0113	85	85
4	Engine coolant temperature sensor	P0115, P0117, P0118	89	88, 91
5	Throttle position sensor	P0120, P0121, P0122, P0123	92	94, 98
6	Oxygen sensor	P0130, P0131, P0132	95	101
7	Adaptation	P0170, P0171, P0172	94	110
8	EVAP canister purge valve	P0443, P0444, P0445	100	121
9	Control module, internal fault	P0605		130

Saab Trionic (without OBD II) (contd.)

Menu structure for command codes



Saab Trionic (without OBD II) (contd.)

READ FUNCTIONS

ISAT ST display	Function
COOLANT TEMP XXX°C	General engine coolant temperature. See "Test readings, control module connections", pin 68.
INTAKE AIR TEMP XXX°C	Current intake air temperature. See "Test readings, control module connections", pin 46.
INTAKE PRESSURE XXX kPa	Current intake air pressure. See "Test readings, control module connections", pin 22.
OXYGEN SENSOR X.XX V	Current oxygen sensor voltage. See "Test readings, control module connections", pin 23.
THROTTLE POSITION XX.X%	Current throttle position i % of 5 V. See "Test readings, control module connections", pin 45.
PREHEAT OXY SENSOR XXXX mA	Internal Trionic status indicating prevailing current consumption in oxygen sensor preheating circuit.
KNOCK SENSOR X.XX V	Internal Trionic status indicating current knock level.
BATTERY VOLTAGE XX.X V	Current battery voltage. See "Test readings, control module connections", pin 60.
ENGINE RPM XXXX RPM	Current engine speed. See "Test readings, control module connections", pin 58.
CAR SPEED XXX km/h	Current car speed. See "Test readings, control module connections", pin 39.
INJECTION DURATION XXX ms	Internal Trionic status indicating opening time of relevant injector.
ENGINE LOAD XX.XX µs	Internal Trionic status indicating current engine load.
IGNITION TIMING XX.X DEGREES	Internal Trionic status indicating current ignition timing.
BOOST PRESS. VALVE XX.X% OPEN	Internal Trionic status indicating opening angle of boost pressure control valve. The higher the value, the higher the boost pressure.
IAC VALVE XX.X% OPEN	Internal Trionic status indicating opening angle of idle air control valve.
GEAR POSITION U,R,1,2,3,4,5	Present gear position. The gear position is calculated in the Trionic system on the basis of current input data (engine rpm, car speed). U stands for "Undefined".
BASIC CHARGE PRESS	**If the boost pressure function in the Trionic system works:** The ISAT scan tool displays "BOOST PRESSURE". **If the boost pressure function in the Trionic system is not working:** The cause of the fault is shown on the ISAT scan tool display (KNOCK CONTROL/ BRAKE ACTIVE/ PRESSURE SENSOR FAULT/ CRUISE CONTROL ON/ GEAR R/ BATTERY VOLTAGE)

Saab Trionic (without OBD II) (contd.)

READ ON/OFF

ISAT ST display	Function
TORQUE LIMITATION ON 12 V/ OFF 0 V	Input from reversing light switch. See "Test readings, control module connections", pin 13.
DRIVE ON 12 V/ OFF 0 V	Input signal from gear position sensor on cars with automatic transmission. See "Test readings, control module connections", pin 14.
BRAKE LIGHT SWITCH ON 12 V/ OFF 0 V	Input from brake light switch. See "Test readings, control module connections", pin 15.
CRUISE CONTROL ON 0 V/ OFF 12 V	Input from Cruise Control system's control module. See "Test readings, control module connections", pin 36.
AC IN ON 12 V/ OFF 0 V	**M1995-** Input signal from EDU via antifrost thermostat. See "Test readings, control module connections", pin 59. **M1994** Input signal from antifrost thermostat.
PREHEAT OXY SENSOR ON/OFF	Internal Trionic status indicating whether oxygen sensor preheating circuit is activated (ON).
AC OUT ON 0 V/ OFF 12 V	Output to A/C relay/compressor. See "Test readings, control module connections", pin 54.
CHECK ENGINE LAMP ON 0 V/ OFF 12 V	Output to main instrument display panel. See "Test readings, control module connections", pin 32.
SHIFT UP LAMP ON 0 V/ OFF 12 V	Output to main instrument display panel. See "Test readings, control module connections", pin 55.
PUMP RELAY ON 0 V/ OFF 12 V	Output to fuel pump relay. See "Test readings, control module connections", pin 56.
MAIN RELAY ON 0 V/ OFF 12 V	Output to main relay. See "Test readings, control module connections", pin 31.
KNOCK CONTROL YES/NO	Internal Trionic status indicating whether ignition is retarded as a result of knock control.
SECOND. AIR RELAY ON 0 V/ OFF 12 V	Output to secondary air injection relay. See "Test readings, control module connections", pin 52.
IDLE POSITION YES/NO	Internal Trionic status indicating whether engine is idling or not.

Saab Trionic (without OBD II) (contd.)

ACTIVATE

ISAT ST display	Function
INJECTORS	This command has a sub-menu as follows: • INJECTOR CYL 1 • INJECTOR CYL 2 • INJECTOR CYL 3 • INJECTOR CYL 4 The relevant injector is activated for 10 seconds at a frequency of 10 Hz.
IGNITION COILS	This command has a sub-menu as follows: • IGNITION CYL 1 • IGNITION CYL 2 • IGNITION CYL 3 • IGNITION CYL 4 The relevant ignition coil is activated for 10 seconds at a frequency of 200 Hz.
BOOST PRESS.VALVE	The boost pressure control valve is activated for 10 seconds at a frequency of 90 Hz.
IAC VALVE	The idle air control valve is activated for 10 seconds with a current of 0.6 A.
EVAP VALVE	The EVAP canister purge valve is activated for 10 seconds at frequency of 8 Hz.
PREHEAT OXY SENSOR	Oxygen sensor preheating is activated for 10 seconds.
AC RELAY	The A/C relay/compressor is activated for 10 seconds at a frequency of 1 Hz.
CHECK ENGINE LAMP	The CHECK ENGINE lamp (MIL) is activated for 10 seconds at a frequency of 1 Hz.
SHIFT UP LAMP	The SHIFT UP lamp is activated for 10 seconds at a frequency of 1 Hz.
PUMP RELAY	The fuel pump relay is activated for 10 seconds at a frequency of 1 Hz.
MAIN RELAY	The main relay is activated for 10 seconds at a frequency of 1 Hz.
SECOND. AIR RELAY	The secondary air injection relay is activated for 10 seconds at a frequency of 1 Hz.
IDLING ADAPTATION	This command is used for forced adaptation of the throttle position when idling.
BOOST PRESS.RESET	This command is used for resetting boost pressure adaptation.

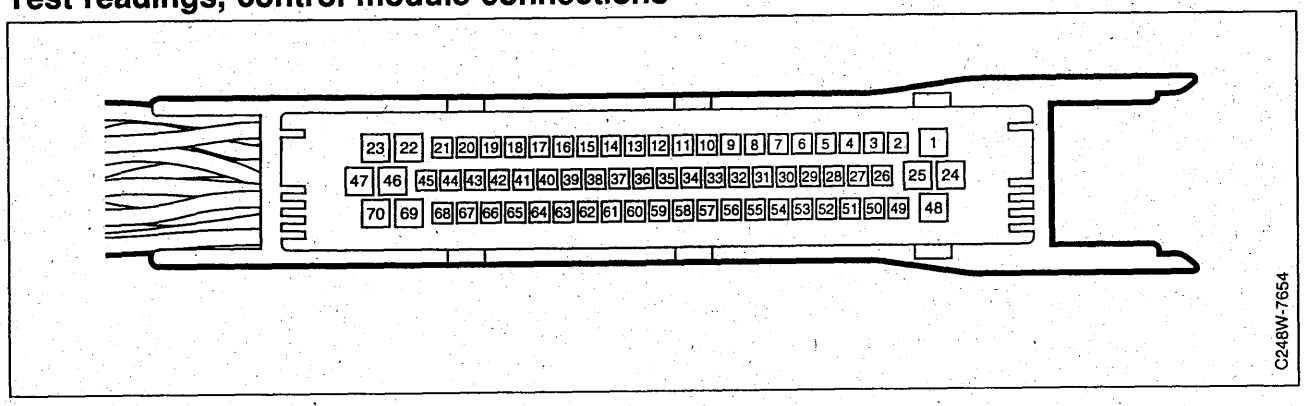
Saab Trionic (without OBD II) (contd.)

READ SYSTEM INFO

ISAT ST display	Function
PART NUMBER XXX XXXX	The Trionic control module part number.
PROGRAM VERSION XXX XXXX	The Trionic control module program version.
ENGINE TYPE XX XXX XXXX X	The engine version programmed in the Trionic control module.
SERIAL NUMBER XXX XXXX	The serial number of the Trionic control module.

Saab Trionic (OBD II)

Test readings, control module connections



> = greater than; < = less than; ≈ = approximately equal to; ~ = alternating current
Pins without additional comments are not connected.
(LP = Logic Probe, P = select pulse, p = visible pulses).

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
1	PK/ WH	+30	In	850 ± 50 rpm	B+ - 1	<0.5 V	28
2	GN/ BK	Boost pressure control valve	Out	850 ± 50 rpm	2 - 25	90 Hz 17.5% (-) 1.9 ms (-) (LP HI LO)	52/204
3	GN/ WH	Injector 1	Out	850 ± 50 rpm	3 - 25	7.1 Hz 2.5-4.5 ms (-) (LP **HI** LOp)	41/148
4	BU/ WH	Injector 2	Out	850 ± 50 rpm	4 - 25	7.1 Hz 2.5-4.5 ms (-) (LP **HI** LOp)	41/148
5	VT/ WH	Injector 3	Out	850 ± 50 rpm	5 - 25	7.1 Hz 2.5-4.5 ms (-) (LP **HI** LOp)	41/148
6	GY/ WH	Injector 4	Out	850 ± 50 rpm	6 - 25	7.1 Hz 2.5-4.5 ms (-) (LP **HI** LOp)	41/148
7		No connection.					
8		No connection.					
9	OG/ BK	Trigger 1	Out	850 ± 50 rpm	9 - 25	7.1 Hz 8.3 % (-) 11 ms (-) (LP **HI** LOp)	36/148
10	GN/ YE	Trigger 2	Out	850 ± 50 rpm	10 - 25	7.1 Hz 8.3 % (-) 11 ms (-) (LP **HI** LOp)	36/148
11	BU/ RD	Trigger 3	Out	850 ± 50 rpm	11 - 25	7.1 Hz 8.3 % (-) 11 ms (-) (LP **HI** LOp)	36/148
12	GY/ RD	Trigger 4	Out	850 ± 50 rpm	12 - 25	7.1 Hz 8.3% (-) 11 ms (-) (LP **HI** LOp)	36/148

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
13	WH	Reversing light switch, manual	In		13 - 25	0 V	53/267
				Gear R	13 - 25	B+	53/267
14	OG	DRIVE	In	P, N	14 - 25	0 V	63/256
				R, D, 1, 2, 3	14 - 25	B+	63/256
15	VT	Brake light switch	In	Brake pedal not depressed	15 - 25	0 V	53/210
				Brake pedal depressed	15 - 25	B+	53/210
16		No connection.					
17	YE/ BN	Combustion cyl 1+2	In	850 ± 50 rpm	17 - 25	15-30 Hz (LP **LO** Hlp)	37/148
18	BN/ RD	Combustion cyl 3+4	In	850 ± 50 rpm	18 - 25	15-30 Hz (LP **LO** Hlp)	37/148
19		No connection.					
20		No connection.					
21	YE/ GY	EVAP canister purge valve Diagnostics	In	850 ± 50 rpm, warm engine and valve active	21 - 25	8 Hz 10% (-) 12 ms (-) (LP **HI** LOp)	55/180
22	BU/ BN	Pressure sensor	In		22 - 67	100 kPa = 1.9 V also see Technical Data	31/100
23	GN	Front heated oxygen sensor	In	850 ± 50 rpm and engine warm	23 - 47	0.1-0.9 V	44/120
24	BK	Main ground	In	850 ± 50 rpm	24 - B-	<0.1 V	29
25	BK	Main ground	In	850 ± 50 rpm	25 - B-	<0.1 V	29
26	BU	Boost pressure control valve	Out	1000-1500 rpm	26 - 25	90 Hz 17.5% (-) 1.9 ms (-) (LP P HI LO)	52/204
27	YE/ GY	EVAP canister purge valve	Out	850 ± 50 rpm, warm engine and valve active	27 - 25	8 Hz 10% (-) 12 ms (-) (LP **HI** LO)	55/180
28		No connection.					
29		No connection.					
30		No connection.					
31	BU/ GY	Main relay	Out		31 - 25	B+	56/244
				Start the engine.	31 - 25	<0.5 V	56/244
32	YE/ GN	CHECK ENGINE	Out		32 - 25	<0.5 V	61/268
				Engine running and CHECK ENGINE lamp (MIL) out	32 - 25	B+	61/268
33	GY/ BK	Diagnostics	In/Out	ISAT scan tool not connected	33 - 25	≈ 6.5 V	60/272
				ISAT scan tool connected	33 - 25	B+	60/272

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
34	GN/ RD	Fuel consumption signal	Out	850 ± 50 rpm	34 - 25	7.1 Hz 2.5-4.5 ms (-) (LP HI LOp)	50/266
35		No connection.					
36	BU/ GN	Cruise control	In		36 - 25	≈ 10 V	53
				CC active	36 - 25	<0.5 V	53
37		No connection.					
38	YE	Low fuel level	In	Low fuel warning lamp in main instrument display panel on	38 - 25	<0.5 V	64/202
				Low fuel warning lamp in main instrument display panel out	38 - 25	≈ 10 V	64/202
39	PK/ BK	Speed signal	In	Raise one front wheel and rotate it	39 - 25	≈ 6 V 50% (LP Hlp LOp)	30/184
40		No connection.					
41	YE	Crankshaft position sensor	In	850 ± 50 rpm	41 - 67	5-10 V~ ≈ 825 Hz (LP HI LO)	30/162
42	BN/ WH	Throttle position sensor	Out		42 - 67	5 V	34/112
43	GY	Pressure sensor	Out		43 - 67	5 V	31/100
44	OG	Knock signal	In	850 ± 50 rpm	44 - 25	50-100 mV~ (LP P LO)	39/158
45	GN/ BN	Throttle position sensor	In		45 - 67	Idling ≈ 0.5 V also see Technical data	34/112
46	WH/ BK	Intake air temperature sensor	In	40°C (104°F)	46 - 67	1.5 V see also technical data	32/104
47	BK	Oxygen sensor, reference ground	In	850 ± 50 rpm	47 - 67	0-1 V	29
48	PK/ WH	+30	In	850 ± 50 rpm	B+ - 48	<0.5 V	28
49	BU/ VT	Idle air control (IAC) valve	Out	A/C and all electrical loads switched off.	49 - 25	500 Hz 25-50% 0.5-1.0 ms (LP HI LO)	54/188
50	BK/ WH	Front heated oxygen sensor, preheating	Out	850 ± 50 rpm	50 - 25	≈ 0.5 V	44/124
				Remove fuse No. 28	50 - 25	0 V	44/124
51	BK/ WH	Rear heated oxygen sensor, preheating	Out	850 ± 50 rpm, coolant temp. >50°C (122°F)	51 - 25	≈ 0.5 V	49/132
				Remove fuse No. 28	51 - 25	0 V	49/132
52		No connection.					
53		No connection.					

Pin	Colour	Component/Function	In/ Out	Test conditions	Across	Reading	Function/ fault diagnosis, see 2:7, page
54	RD/ WH	A/C out	Out	850 ± 50 rpm, A/C ON	54 - 25	<0.5 V	58/260
				850 ± 50 rpm, A/C OFF	54 - 25	B+	58/260
55	BU/ YE/	SHIFT UP	Out	When ignition switched turned to the ON position	55 - 25	<0.5 V	62/268
				After 3 s	55 - 25	B+	62/268
56	WH	Fuel pump relay	Out		56 - 25	B+	57/250
				850 ± 50 rpm	56 - 25	<0.5 V	57/250
57		No connection.					
58	GN/ RD	Engine speed signal	Out	850 ± 50 rpm	58 - 25	28 Hz (LP **LO** Hlp)	30/162
59	GN/ GY	A/C in	In	850 ± 50 rpm, A/C ON	59 - 25	B+	58/260
				850 ± 50 rpm, A/C OFF	59 - 25	0 V	58/260
60	YE/ GY	+15	In		B+ - 60	<0.5 V	28
61		No connection.					
62	BK/ WH	For production only					
63	GN	For production only					
64		No connection.					
65	YE	For production only					
66	BK	Reference ground, engine coolant temperature	In		66 - 25	<0.05 V	29/116
67	BK	Sensor ground	Out		67 - 25	<0.05 V	29
68	YE/ WH	Engine coolant temperature sensor	In	90°C (194°F)	68 - 66	0.41 V see also Technical data	33/116
69		No connection.					
70	GN	Rear heated oxygen sensor	In	850 ± 50 rpm	70 - 47	0.1-0.9 V	49/128

Saab Trionic (OBD II) (contd.)

Diagnostic trouble codes

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0105	Manifold absolute pressure sensor. All-embracing diagnostic trouble code for pressure sensor operation.	ON	FAULT XX P0105 INTAKE PRESSURE FUNCTION INCORRECT	100
P0106	Manifold absolute pressure sensor. Vacuum hose leakage. Sensor malfunction.	ON	FAULT XX P0106 INTAKE PRESSURE INPUT INCORRECT	100
P0107	Manifold absolute pressure sensor. Control module input shorting to ground.	ON	FAULT XX P0107 INTAKE PRESSURE SHORT TO GROUND	100
P0108	Manifold absolute pressure sensor. Control module input shorting to battery positive (B+) or open circuit.	ON	FAULT XX P0108 INTAKE PRESSURE OPEN CIRCUIT/SHORT TO B+	100
P0110	Intake air temperature sensor. All-embracing diagnostic trouble code for temperature sensor operation.	ON	FAULT XX P0110 INTAKE AIR TEMP FUNCTION INCORRECT	104
P0112	Intake air temperature sensor. Control module input shorting to ground.	ON	FAULT XX P0112 INDUCTION AIR TEMP SHORT TO GROUND	104
P0113	Intake air temperature sensor. Control module input shorting to battery positive (B+) or open circuit.	ON	FAULT XX P0113 INDUCTION AIR TEMP OPEN CIRCUIT/SHORT TO B+	104
P0115	Engine coolant temperature sensor. All-embracing diagnostic trouble code for temperature sensor operation.	ON	FAULT XX P0115 COOLANT TEMPERATURE FUNCTION INCORRECT	108
P0117	Engine coolant temperature sensor. Control module input shorting to ground.	ON	FAULT XX P0117 COOLANT TEMPERATURE SHORT TO GROUND	108
P0118	Engine coolant temperature sensor. Control module input shorting to battery positive (B+) or open circuit.	ON	FAULT XX P0118 COOLANT TEMPERATURE OPEN CIRCUIT/SHORT TO B+	108
P0120	Throttle position sensor. All-embracing diagnostic trouble code for throttle position sensor operation.	ON	FAULT XX P0120 THROTTLE POSITION FUNCTION INCORRECT	112

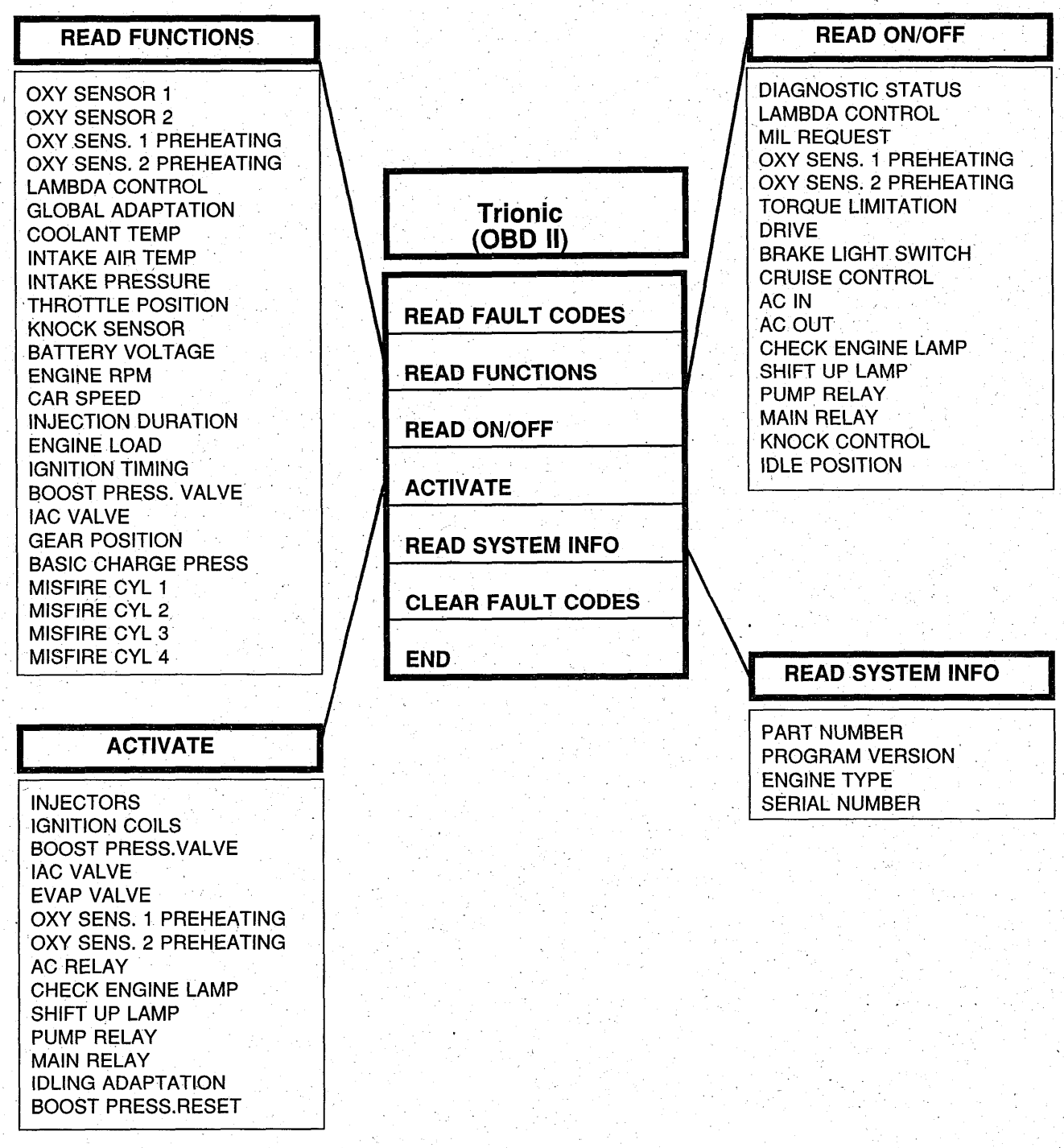
Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0121	Throttle position sensor. Sensor malfunction.	ON	FAULT XX P0121 THROTTLE POSITION INPUT FAULTY	112
P0122	Throttle position sensor. Control module input shorting to ground.	ON	FAULT XX P0122 THROTTLE POSITION SHORT TO GROUND	112
P0123	Throttle position sensor. Control module input shorting to battery positive (B+) or open circuit.	ON	FAULT XX P0123 THROTTLE POSITION OPEN CIRCUIT/SHORT TO B+	112
P0125	Engine coolant temperature sensor. Insufficient temperature increase.	ON	FAULT XX P0125 COOLANT TEMPERATURE TEMP INCREASE SLOW	116
P0130	Front heated oxygen sensor. All-embracing diagnostic trouble code for oxygen sensor operation.	ON	FAULT XX P0130 OXY SENSOR 1 MALFUNCTION	120
P0132	Front heated oxygen sensor. Shorting to battery positive (B+).	ON	FAULT XX P0132 OXY SENSOR 1 SHORT CIRCUIT B+	120
P0133	Front heated oxygen sensor. Poor response to change in fuel-air mixture.	ON	FAULT XX P0132 OXY SENSOR 1 LOW FREQUENCY	120
P0135	Preheating, front heated oxygen sensor. Current outside limits.	ON	FAULT XX P0135 OXY SENSOR 1 NO PREHEATING	124
P0136	Rear heated oxygen sensor. All-embracing diagnostic trouble code for oxygen sensor operation.	ON	FAULT XX P0136 OXY SENSOR 2 MALFUNCTION	128
P0138	Rear heated oxygen sensor. Shorting to battery positive (B+).	ON	FAULT XX P0138 OXY SENSOR 2 SHORT CIRCUIT B+	128
P0140	Rear heated oxygen sensor. Shorting to ground or open circuit.	ON	FAULT XX P0140 OXY SENSOR 2 OPEN CIRCUIT/ SHORT CIRCUIT GND	128
P0141	Preheating, rear heated oxygen sensor. Current outside limits.	ON	FAULT XX P0141 OXY SENSOR 2 NO PREHEATING	132
P0170	Adaptation. All-embracing diagnostic trouble code for the adaptation function.	ON	FAULT XX P0170 ADAPTATION FUNCTION INCORRECT	136
P0171	Adaptation. Lean mixture.	ON	FAULT XX P0171 ADAPTATION LEAN	136
P0172	Adaptation. Rich mixture.	ON	FAULT XX P0172 ADAPTATION RICH	136

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0300	Misfiring, randomly in several cylinders.	ON	FAULT XX P0300 RANDOM MISFIRE	140
P0301	Misfiring, cylinder 1	ON	FAULT XX P0301 MISFIRE CYL 1	148
P0302	Misfiring, cylinder 2	ON	FAULT XX P0302 MISFIRE CYL 2	148
P0303	Misfiring, cylinder 3	ON	FAULT XX P0303 MISFIRE CYL 3	148
P0304	Misfiring, cylinder 4	ON	FAULT XX P0304 MISFIRE CYL 4	148
P0327	No knocking signal from ignition discharge module.	ON	FAULT XX P0327 KNOCK SENSOR OPEN CIRCUIT SHORT CIRCUIT B+/GND	158
P0335	Crankshaft position sensor. Malfunction.	ON	FAULT XX P0335 CRANKSHAFT POS SENS FUNCTION INCORRECT	162
P0340	Camshaft position sensor. Malfunction.	ON	FAULT XX P0340 CAMSHAFT POSITION MALFUNCTION	168
P0441	EVAP canister purge valve. Low flow.	ON	FAULT XX P0441 EVAP VALVE FLOW INCORRECT	176
P0443	EVAP canister purge valve. All-embracing diagnostic trouble code for EVAP function.	ON	FAULT XX P0443 EVAP VALVE FUNCTION INCORRECT	180
P0444	EVAP canister purge valve. Control module output, open circuit.	ON	FAULT XX P0444 EVAP VALVE OPEN CIRCUIT	180
P0445	EVAP canister purge valve. Control module output shorting to ground.	ON	FAULT XX P0445 EVAP VALVE SHORT TO GROUND	180
P0500	Vehicle speed. Input signal from main instrument display panel's speedometer. General diagnostic trouble code for vehicle speed.	ON	FAULT XX P0500 VEHICLE SPEED FUNCTION INCORRECT	184
P0501	Vehicle speed. Input signal outside limits.	ON	FAULT XX P0501 VEHICLE SPEED SIGNAL INCORRECT	184
P0502	Vehicle speed. No input signal.	ON	FAULT XX P0502 VEHICLE SPEED OPEN CIRCUIT	184
P0505	Idle speed control. Malfunction.	ON	FAULT XX P0505 IDLE FUNCTION INCORRECT	188
P0506	Idle speed control. Idling speed too low.	ON	FAULT XX P0506 IDLE RPM LOW	188

Diagnostic trouble code (SAE)	Faulty function/component	CHECK ENGINE	ISAT ST display text	See 2:7, page
P0507	Idle speed control. Idling speed too high.	ON	FAULT XX P0507 IDLE RPM HIGH	188
P0605	Control module. Internal fault, program fault.	ON	FAULT XX P0605 CONTROL MODULE INTERNAL FAULT	194
P1170	Closed loop. Malfunction.	ON	FAULT XX P1170 CLOSED LOOP MALFUNCTION	196
P1171	Closed loop. Lean mixture.	ON	FAULT XX P1171 CLOSED LOOP LEAN	196
P1172	Closed loop. Rich mixture.	ON	FAULT XX P1172 CLOSED LOOP RICH	196
P1416	Tank level. Low level in conjunction with misfiring or fault in fuel system.		FAULT XX P1416 FUEL LEVEL LOW	202
P1549	Boost pressure control. Malfunction.	ON	FAULT XX P1549 BOOST PRESSURE MALFUNCTION	204
P1576	Brake light switch. Shorting to battery positive (B+).	ON	FAULT XX P1576 BRAKE LIGHT SWITCH SHORT CIRCUIT B+	210
P1577	Brake light switch. Open circuit.	ON	FAULT XX P1576 BRAKE LIGHT SWITCH OPEN CIRCUIT	210

Saab Trionic (OBD II) (contd.)

Menu structure for command codes



Saab Trionic (OBD II) (contd.)

READ FUNCTIONS

ISAT ST display	Function
OXY SENSOR 1 X.XX V	Current oxygen sensor voltage. Range of measurement: 0-2.0 V.
OXY SENSOR 2 X.XX V	Current oxygen sensor voltage. Range of measurement: 0-2.0 V.
OXY SENS. 1 PREHEATING XXXX mA	Internal Trionic status indicating present current consumption of oxygen sensor's heating circuit. Range of measurement: 0-3000 mA.
OXY SENS. 2 PREHEATING XXXX mA	Internal Trionic status indicating present current consumption of oxygen sensor's heating circuit. Range of measurement: 0-3000 mA.
LAMBDA CONTROL XX.X%	Internal Trionic status indicating present closed loop value. Range of measurement: -25% - +25%.
GLOBAL ADAPTATION XX%	Internal Trionic status indicating present global adaptation value. Range of measurement: -100% - +100%.
COOLANT TEMP XXX°C	Current engine coolant temperature. Range of measurement: -40°C - +127°C.
INTAKE AIR TEMP XXX°C	Current intake air temperature. Range of measurement: -40°C - +127°C.
INTAKE PRESSURE XXX kPa	Current intake pressure. Range of measurement: 0-255 kPa.
THROTTLE POSITION XX.X%	Current throttle position in % of 5 V. Range of measurement: 0-100%.
KNOCK SENSOR X.XX V	Internal Trionic status indicating current knock level. Range of measurement: 0-2.55 V.
BATTERY VOLTAGE XX.X V	Present battery voltage. Range of measurement: 0-20 V.
ENGINE RPM XXXX RPM	Current engine speed. Range of measurement: 0-6500 rpm.
CAR SPEED XXX km/h	Present car speed. Range of measurement: 0-255 km/h.
INJECTION DURATION XXX ms	Internal Trionic status indicating opening duration of relevant injector. Range of measurement: 0-25 ms.
ENGINE LOAD XX.XX µs	Internal Trionic status indicating current engine load. Range of measurement: 0-512 µs.
IGNITION TIMING XX.X DEGREES	Internal Trionic status indicating current ignition timing (dwell angle). Range of measurement: -20° - +36° BTDC.
BOOST PRESS. VALVE XX.X% OPEN	Internal Trionic status indicating opening angle of boost pressure control valve. The higher the value, the higher the boost pressure. Range of measurement: 0-100%.

IAC VALVE XX.X% OPEN	Internal Trionic status indicating opening angle of idle air control valve. Range of measurement: 0-100%.
GEAR POSITION U,R,1,2,3,4,5	Present gear position. The gear position is calculated in the Trionic system on the basis of current input data (engine rpm, car speed). U stands for "Undefined".
BASIC CHARGE PRESS	**If the boost pressure function in the Trionic system works:** The ISAT scan tool displays "BOOST PRESSURE" **If the boost pressure function in the Trionic system is not working:** The cause of the fault is shown on the ISAT scan tool display: KNOCK CONTROL/ BRAKE ACTIVE/ PRESSURE SENSOR FAULT/ BATTERY VOLTAGE / BOOST PRESS. VALVE
MISFIRE CYL 1 XXXX	Internal Trionic status which indicates misfiring in cylinder 1. The value increases when misfiring occurs and decreases when combustion is correct. Range of measurement: 0-4000.
MISFIRE CYL 2 XXXX	Internal Trionic status which indicates misfiring in cylinder 2. The value increases when misfiring occurs and decreases when combustion is correct. Range of measurement: 0-4000.
MISFIRE CYL 3 XXXX	Internal Trionic status which indicates misfiring in cylinder 3. The value increases when misfiring occurs and decreases when combustion is correct. Range of measurement: 0-4000.
MISFIRE CYL 4 XXXX	Internal Trionic status which indicates misfiring in cylinder 4. The value increases when misfiring occurs and decreases when combustion is correct. Range of measurement: 0-4000.

Saab Trionic (OBD II) (contd.)

READ ON/OFF

ISAT ST display	Function
DIAGNOSTIC STATUS	This command has the following sub-menus: • EVAP • CATALYTIC CONVERTER • O2S 1 • REAR OXYGEN SENSOR • OXY SENSOR PREHEAT • TRIP OBD II Each command produces an answer indicating whether the corresponding OBD II diagnosis has been monitored. Answer: "READY"/"NOT READY".
LAMBDA CONTROL YES/NO	Internal Trionic status indicating whether closed loop is active (YES).
MIL REQUEST YES/NO	Input signal from transmission control module indicating whether the transmission has stored any emission-related OBD II diagnostic trouble code (YES).
OXY SENSOR 1 PREHEATING ON/OFF	Internal Trionic status indicating whether oxygen sensor preheating circuit is activated (ON).
OXY SENSOR 2 PREHEATING ON/OFF	Internal Trionic status indicating whether oxygen sensor preheating circuit is activated (ON).
TORQUE LIMITATION ON/OFF	Input from transmission control module, see "Test readings, control module connections".
DRIVE ON/OFF	Input signal from transmission control module indicating gear position. Range of measurement: P, N = "OFF" = 0 V D, 3, 2, 1 = "ON" = 12 V.
BRAKE LIGHT SWITCH ON/OFF	Input from brake light switch. "ON" = 12 V, "OFF" = 0 V
CRUISE CONTROL ON/OFF	Input signal from Cruise Control system's control module. "ON" = 0 V, "OFF" = 12 V.
AC IN ON/OFF	Input signal from ICE via antifrost thermostat. "ON" = 12 V, "OFF" = 0 V.
AC OUT ON/OFF	Output to A/C relay/compressor. "ON" = 0 V, "OFF" = 12 V.
CHECK ENGINE LAMP ON/OFF	Output to main instrument display panel. "ON" = 0 V, "OFF" = 12 V.
SHIFT UP LAMP ON/OFF	Output to main instrument display panel. "ON" = 0 V, "OFF" = 12 V. See "Test readings, control module connections", pin 55.
PUMP RELAY ON/OFF	Output to fuel pump relay. "ON" = 0 V, "OFF" = 12 V.
MAIN RELAY ON/OFF	Output to main relay. "ON" = 0 V, "OFF" = 12 V.

KNOCK CONTROL YES/NO	Internal Trionic status indicating whether ignition retarded on account of knock control (YES).
IDLE POSITION YES/NO	Internal Trionic status indicating whether idle position present (YES).

Saab Trionic (OBD II) (contd.)

ACTIVATE

ISAT scan tool display	Function
INJECTORS	This command has a submenu as follows: • INJECTOR CYL 1 • INJECTOR CYL 2 • INJECTOR CYL 3 • INJECTOR CYL 4 Each injector is activated for 10 seconds at a frequency of 10 Hz.
IGNITION COILS	This command has a submenu as follows: • IGNITION CYL 1 • IGNITION CYL 2 • IGNITION CYL 3 • IGNITION CYL 4 Each ignition coil is activated for 10 seconds at a frequency of 200 Hz.
BOOST PRESS.VALVE	The boost pressure control valve is activated for 10 seconds at a frequency of 90 Hz.
IAC VALVE	The idle air control valve is activated for 10 seconds with a current of 0.6 A.
EVAP VALVE	The EVAP canister purge valve is activated for 10 seconds at frequency of 8 Hz.
OXY SENS. 1 PREHEATING	Oxygen sensor preheating is activated for 10 seconds.
OXY SENS. 2 PREHEATING	Oxygen sensor preheating is activated for 10 seconds.
AC RELAY	The A/C relay/compressor is activated for 10 seconds at a frequency of 1 Hz.
CHECK ENGINE LAMP	The CHECK ENGINE lamp (MIL) is activated for 10 seconds at a frequency of 1 Hz.
SHIFT UP LAMP	The SHIFT UP lamp is activated for 10 seconds at a frequency of 1 Hz.
PUMP RELAY	The fuel pump relay is activated for 10 seconds at a frequency of 1 Hz.
MAIN RELAY	The main relay is activated for 10 seconds at a frequency of 1 Hz.
IDLING ADAPTATION	This command is used for forced adaptation of the throttle position when idling.
BOOST PRESS.RESET	This command is used for resetting boost pressure adaptation.

Saab Trionic (OBD II) (contd.)

READ SYSTEM INFO

ISAT scan tool display	Function
PART NUMBER XXX XXXX	The Trionic control module part number.
PROGRAM VERSION XXX XXXX	The Trionic control module program version.
ENGINE TYPE XX XXX XXXX X	The engine version programmed in the Trionic control module.
SERIAL NUMBER XXX XXXX	The serial number of the Trionic control module.

Turbo system

Constituent components

Symptom	Cause of fault	See 2:4, page
The boost pressure control (BPC) valve works at idling speed (irregular chattering sound).	Idling speed too low.	291-5
	Break in the electrical lead between the pressure sensor and the control module.	291-5
	Faulty pressure sensor.	291-5
	Poor contact/break in the wiring between the knock sensor and the control module.	291-5
	Knock sensor loose.	291-5
	Faulty knock sensor.	291-5
	Faulty control module.	291-5
	Electrical interference.	291-5
The boost pressure control valve does not work when the APC system is checked in the car.	There is no voltage to the control module between terminals 14 (+) and 6 (-). **Important** The wiring harness connector should be plugged into the control module when taking readings.	291-6
	Loose contact in the knock sensor connector. Open circuit in the lead between the knock sensor and control module.	291-6
	Knock sensor loose.	291-6
	Faulty knock sensor.	291-6
	Boost pressure control valve not working despite receiving <5 V. **Important** The BPC valve connector should be plugged in.	291-6
	Faulty pressure sensor.	291-6
	Faulty control module.	291-6

Fault diagnosis schedule, basic charge pressure

Symptom	Cause of fault	See 2:4, page
Basic charge pressure cannot be adjusted as described.	Faulty wastegate.	291-1
	Seizing of the bearing between the diaphragm unit and the push rod.	291-1
	Blocked restriction in BPC valve hose nipple to turbocharger (connection marked "C").	291-1

Fault diagnosis schedule, maximum charging pressure

Symptom	Cause of fault	See 2:4, page
Maximum charging pressure too low (low engine output).	Charge pressure incorrectly set (-M1989).	291-2
	Poor contact in the wiring between pressure sensor and control module or between pressure sensor and ground or in the knock sensor connector. Break in the wiring between knock sensor and control module and between pressure sensor and control module.	291-2
	Faulty knock sensor.	291-2
	Faulty pressure sensor.	291-2
	BPC valve not opening.	291-2
	Faulty control module.	291-2
	Knock sensor registering abnormal engine vibration.	291-2
	Faulty spring or push rod seizing in diaphragm unit.	291-2
	Faulty turbocharger.	291-2
Boost pressure too high (includes large overrun of boost pressure during acceleration) pressure switch opens.	Hose leaking between turbocharger and BPC valve.	291-3
	Hose leaking between BPC valve and diaphragm unit.	291-3
	Diaphragm unit leaking.	291-3
	Hose to pressure sensor leaking.	291-3
	Faulty pressure sensor.	291-3
	BPC valve not closing due to piston seizing.	291-3
	Blocked restriction in BPC valve hose nipple to turbocharger (connection marked "C").	291-3
	Basic charge pressure incorrect.	291-3
	Short circuit in pressure sensor signal lead.	291-3
	Faulty control module.	291-3
	Bearing between wastegate housing and flap valve seizing.	291-3
	Bearing between push rod and diaphragm unit seizing.	291-3
Boost pressure normal, but no reduction of boost pressure despite constant knocking.	APC system not working.	291-4
	Poor contact in knock sensor cable.	291-4
	Knock sensor loose.	291-4
	Faulty knock sensor.	291-4
	Faulty control module.	291-4
	Bearing between wastegate housing and flap valve seizing.	291-4
	Bearing between push rod and diaphragm unit seizing.	291-4

Electrical system

EDU

Diagnostic trouble codes (-M1989), self-tests

Code	Explanation
F1	Fault in transmission range switch or wiring (automatic only)
F2	Short circuit in outside air temperature sensor
F3	Short circuit in fuel level sensor
F4	Uncertain function in trip computer

If outside temperature is not shown despite F2 not being shown, this could mean that the sensor signal has been lost or that trip computer DCC has not been installed.

Important

In the event of the EDU malfunctioning, check the 8-pin connector behind the main instrument display panel before changing the EDU´n. If one half or the entire EDU is not lit, start by checking if the lamps are intact.

EDU (contd.)

Test readings, control module connections (M1990-1994)

Readings should be taken with the ignition switch in the ON position.

Pin	Colour	Component/Function	In/ Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page
1	RD	+30	In			1 - 21	29
2	OG	ACC	Out				
3	BU	DCC	Out				
4-7		No connection.					
8	GN/ RD	Fuel pulses	In	Idling	0.2-0.6 V 14-1100 Hz	8 - 21	31
9	WH	Speed signal (M1990)	In	Rotate front wheels 1 revolution/s 20 km/h	Alternates between 0 and 11 V 14 Hz	9 - 21	31
	GN	Speed signal (M1991-)					
10-11		No connection.					
12	VT/ WH	MIL (CHECK ENGINE lamp) (M1990-1993)	In	On Out	0 V 12 V	12 - 21	42
	YE/ WH	MIL (CHECK ENGINE lamp) (M1994-)					
13		No connection.					
14	BN/ WH	INFO button (M1990)	In	Pressed Released	0 V 12 V	14 - 21	43
	BN/ RD	INFO button (M1991-)					
15	GN/ RD	R button	In	Pressed Released	0 V 12 V	15 - 21	43
16	BN/ WH	Engine oil level sensor	In	On Out	0 V 12 V	16 - 21	42
17	BN	Engine coolant level sensor	In	On Out	0 V 12 V	17 - 21	42
18	BU	Selector lever position sensor	In	Position P,R,3,2 Position N,D,1 and man.	0 V 12 V	18 - 21	41
19	YE	Selector lever position sensor	In	Position R,N,D,3 Position P,2,1 and man.	0 V 12 V	19 - 21	41
20	WH	Selector lever position sensor	In	Position D,3,2,1 Position P,R,N and man.	0 V 12 V	20 - 21	41
21	BK	Ground	In		<0.1 V	21 - B-	
22		No connection.					
23	GY	Temperature signal	In	Normal	12 V 950-1000 Hz	23 - 21	39
24	GN	Fuel gauge	In	Full tank Empty tank	0 V 12 V	24 - 21	35

Pin	Colour	Component/Function	In/ Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page
25	GY	Fuel level warning lamp	In	On Out	0 V 12 V	25 - 21	35
26	BK	Ground					
27		No connection.					
28	BK	Outside temperature sensor	In		1.5-5 V	28 - 35	39
29-31		No connection.					
32	BN/ WH	Rheostat, instrument lighting	In	Zero position Max. brightness	0 V 12 V	32 - 21	29
33	WH	Fuel level sensor	In	Empty tank Full tank Take reading with the connector plugged into the control module	0.4 V 0.3 V	33 - 26	35
34		No connection.					
35	WH	Outside temperature sensor	Out	Take reading with the connector plugged into the control module	1.5-5 V	35 - 28	39
36	YE	Light sensor	In	Min. light intensity Max. light intensity	0 V 12 V	36 - 21	30
37	YE	+15	In		12 V	37 - 21	29
38	BU	Diagnostics					
39	GN	Diagnostics					

EDU (contd.)

Diagnostic trouble codes (M1990-1994), ISAT scan tool

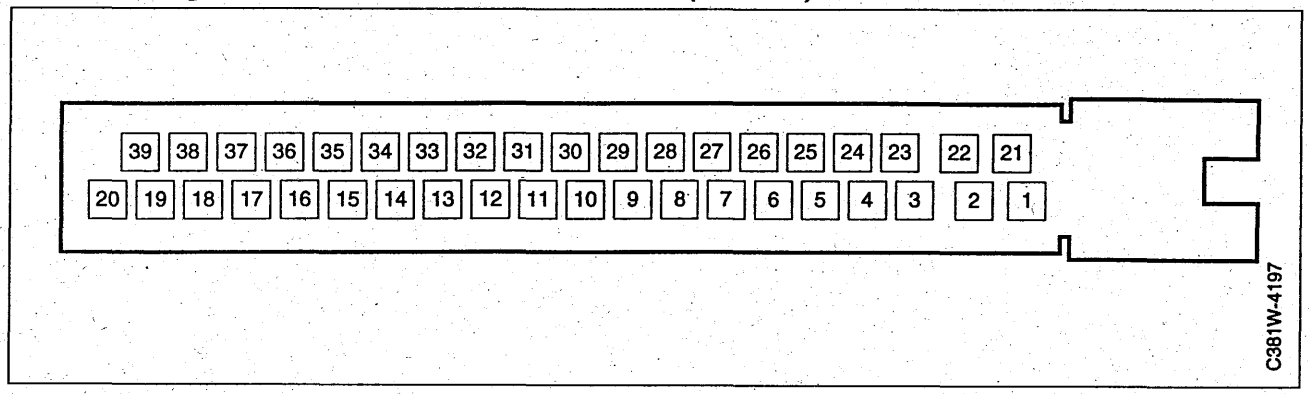
Permanent	Intermittent	Type of fault	See 3:5, page
11111		System without faults	
45362	25362	Fault in selector lever position sensor (automatic transmission)	41
45522	25522	Fuel level sensor, open circuit	35
45532	25532	Fuel level sensor, short circuit	35
46222	26222	May be displayed if the EDU has not been programmed for the car after being changed	
46322	26322	Outside temperature sensor, break	39
46391	26391	Diagnostic trouble codes in ACC unit No outside temperature signal from EDU control module	39
96692	69992	Internal fault in EDU control module	
F2		Diagnostic trouble code in DCC unit (shown on display) No outside temperature signal from EDU control module	39

Command codes EDU, ISAT scan tool

For command codes for EDU trip computer, see Service Manual 3:5 "Programmable trip computer EDU" M1990-1994, page 55.

EDU (contd.)

Test readings, control module connections (M1995-)



> = greater than; < = less than.
Pins without comments are not used.

Pin	Colour	Component/Function	In/ Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page
1	RD	Battery voltage (+30 circuit)	In		<0.5 V	1 - B+	24
2		No connection.					
3	OG	ACC wake up	In	Command from ACC No command	12 V 0 V	3 - 21	40
4	YE/ WH	A/C	Out	ISAT Scan tool activates A/C ON OFF	 12 V 0 V	4 - 21	39
5	BU	Radiator fan, stage 1	Out	ISAT Scan tool activates A/C ON OFF	 0 V 12 V	5 - 21	37/84
6	BU/ WH	Radiator fan, stage 2	Out	ISAT Scan tool activates A/C ON OFF	 0 V 12 V	6 - 21	37/854
7		No connection.					
8	GN/ RD	Fuel pulses	In	Idle, warm engine Motronic Saab Trionic	 6.25 Hz 3 ms 7.5 Hz 2.5 ms	8 - 21	329
9	GN	Speed signal	In	Rotate front wheels 1 revolution/s 20 km/h	Alternates between 0 and 11 V 12 Hz	9 - 21	28
10	YE	A/C	Out	ISAT scan tool activates A/C or ACC ON OFF	 12 V 0 V	10 - 21	38/79
	YE/ WH	ACC					

Pin	Colour	Component/Function	In/ Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page
11		No connection.					
12	YE/ WH	CHECK ENGINE	In Out	On Out	0 V 12 V	12 - 21	34/80
13		No connection.					
14	BN/ RD	INFO button	In	Pressed Released	0 V 12 V	14 - 21	26/70
15	GN/ RD	R button	In	Pressed Released	0 V 12 V	15 - 21	26/70
16		No connection.					
17	BN	Engine coolant level sensor	In	On Out	0 V 12 V	17 - 21	35
18	BU	Selector lever position sensor A	In	Position P,R,3,2 Position.N,D,1 and man.	0 V 12 V	18 - 21	33/66
19	YE	Selector lever position sensor B	In	Position R,N,D,3 Position P,2,1 and man.	0 V 12 V	19 - 21	33/66
20	WH	Selector lever position sensor C	In	Position D,3,2,1 Position P,R,N and man.	0 V 12 V	20 - 21	41
21	BK	Ground	In		<0.1 V	21 - B-	24
22	GN/ WH	Power supply to fuel/temp. gauge	Out		1 V lower than B+	22 - 21	42
23	BK	Outside temperature sensor	Out		Varies between 7 and 13 V	23 - 21	41
24	GN	Fuel gauge	Out	Full tank Empty tank	approx. 9 V approx. 1 V	24 - 21	42
25	GY	Lamp, low fuel level	Out	Activate with ISAT Scan Tool Lamp ON Lamp OFF	 0 V 12 V	25 - 21	31
26	BK	Ground, fuel level sensor	In		<0.1 V	26 - 21	30
27	OG	Ground, engine coolant temperature sensor	In		<0.1 V	27 - 21	36
28	BK	Ground, outside temperature sensor	In		<0.1 V	28 - 21 V	32
29		No connection.					
30	YE	Engine temperature instrument	Out		1-9 V depending on coolant temperature	30 - 21	42
31		No connection.					
32	BN/ WH	Rheostat, instrument lighting	In	 Zero position Max. brightness	13 - 100% PWM approx. 2 V 12 V	32 - 21	27
33	WH	Fuel level sensor	In	Empty tank Full tank	approx. 0.4 V approx. 3 V	33 - 21	30

Pin	Colour	Component/Function	In/ Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page
34	YE	Coolant temperature	In		0-1 V depending on coolant temperature	34 - 21	36
35	WH	Outside temperature sensor	In		1.5-5 V depending on temperature	35 - 21	32
36	YE	Light sensor	In	Min. brightness Max. brightness	0 V 10 V	36 - 21	27
37	YE	+15	In		<0.5 V	37 - B+	24
38	BU	Diagnostics	In/ Out	ISAT scan tool connected ISAT scan tool not connected	12 V 5 V	38 - 21	25

EDU (contd.)

Diagnostic trouble codes (M1995-)

Diagnostic trouble code (SAE)	Faulty function/component	ISAT ST display text	See 3:5, page
B1102	Radiator fan, stage 2 - relay shorted to battery positive (B+)	FAULT X P/I B1102 RAD FAN HIGH RELAY SHORT TO BATTERY +	59
B1103	Radiator fan, stage 2 - relay break	FAULT X P/I B1103 RAD FAN HIGH RELAY OPEN CIRCUIT	60
B1104	Radiator fan, stage 1 - relay shorted to battery positive (B+)	FAULT X P/I B1104 RAD FAN LOW RELAY SHORT TO BATTERY +	61
B1312	Coolant temperature sensor - shorted to ground	FAULT X P/I B1312 COOLANT TEMPERATURE SHORTING TO GROUND	62
B1313	Engine coolant temperature sensor - shorted to battery positive (B+)	FAULT X P/I B1313 COOLANT TEMPERATURE OPEN CIRCUIT SHORT TO BATT+	63
B1605	Control module - internal fault	FAULT X P/I B1605 ECU FAULT	92
B1722	Fuel level sensor, shorted to ground	FAULT X P/I B1722 FUEL LEVEL SENSOR SHORTING TO GROUND	64
B1723	Fuel level sensor - open circuit	FAULT X P/I B1723 FUEL LEVEL SENSOR OPEN CIRCUIT	64
B1745	Outside temperature, no signal	FAULT X P/I B1745 OUTDOOR TEMPERATURE NO SIGNAL	65
B1775	Selector lever position sensor faulty	FAULT X P/I B1775 TRANS.RANGE SWITCH INPUT WRONG	66

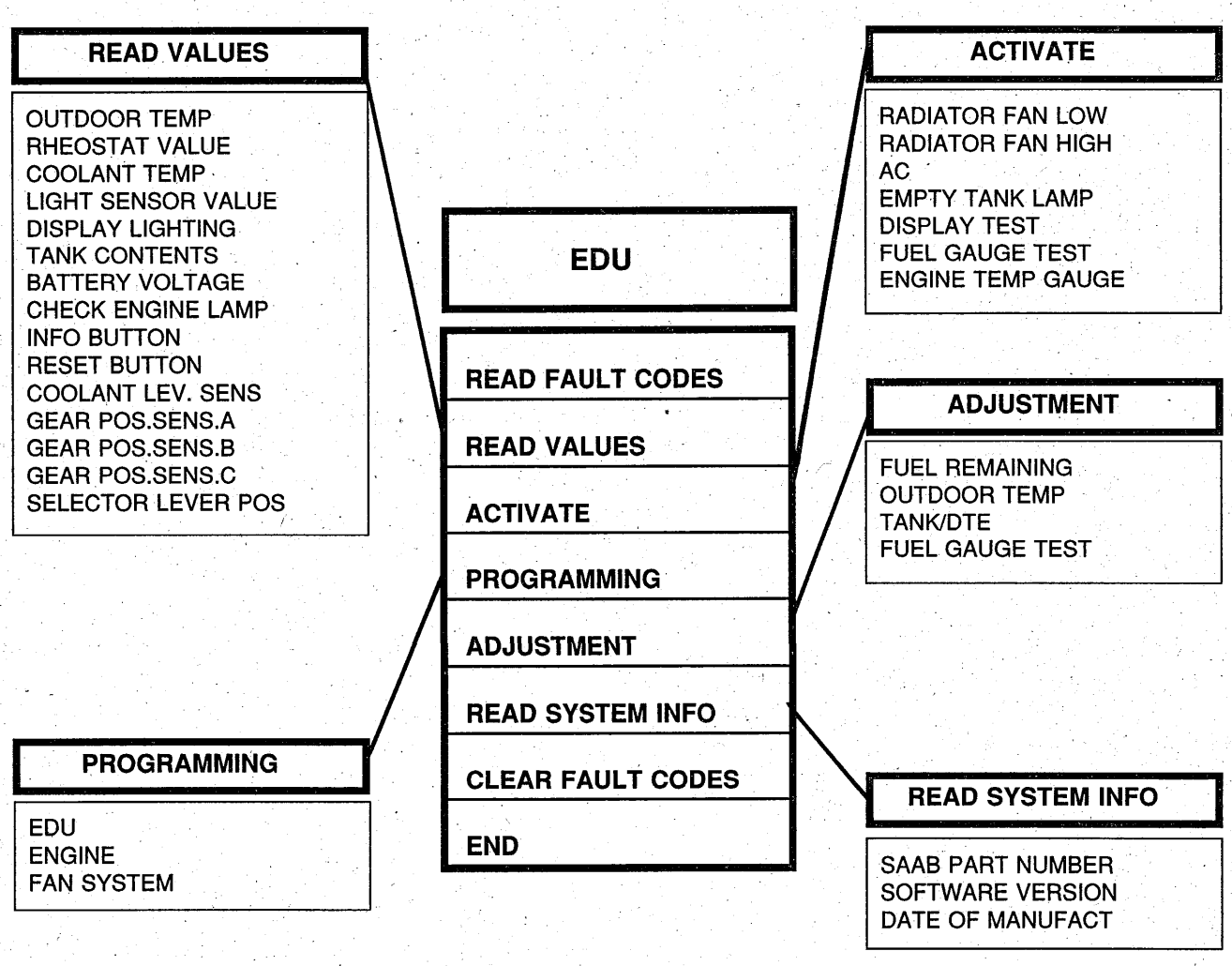
EDU (contd.)

Faults without diagnostic trouble codes (M1995-)

Fault symptom	Component/Function	See 3:5, page
Display blank	Power supply	67
Dim display in strong sunlight	Light sensor	69
EDU control module does not respond when buttons are pressed	INFO and R buttons	70
Parts of the display are dark	Bulbs	95
L/km: Instantaneous fuel consumption shows maximum when driving	Fuel consumption	72
L/km: Instantaneous fuel consumption shows minimum	Fuel consumption	73
MPG: Instantaneous fuel consumption shows minimum when driving	Fuel consumption .	72
MPG: Instantaneous fuel consumption shows maximum	Fuel consumption	73
The fuel level warning lamp does not light up or is on continuously, but the fuel gauge shows normal readings	Fuel level and range indication	74
The fuel gauge shows zero or maximum, but the range indicator and tank gauge show normal readings	Fuel level and range indication	75
The fuel gauge shows zero and the right-hand direction indicator lamp lights up dimly with the rheostat at minimum and brightly with the rheostat at maximum.	Fuel level and range indication	75
Fuel gauge and D.T.E. are faulty	Fuel gauge float arm	77
Permanently high outside temperature reading	Outside temperature sensor	78
A/C not working and fault traced to circuit in the EDU.	A/C	79
CHECK (MIL) functions do not light up when the ignition switch is turned to ON or go out when the engine is started	CHECK (MIL) functions	80, 82
Radiator fan not working (1st stage in 2-speed fan)	Radiator fan	84
Radiator fan, stage 2 not working	Radiator fan	85
Engine temperature display not working.	Engine temperature display	86

EDU (contd.)

Menu structure for command codes (M1995-)



EDU (contd.)

READ VALUES (M1995-)

ISAT ST display	Function
OUTDOOR TEMP XX °C YY °F	Shows outside temperature in °C and °F
RHEOSTAT VALUE XXX %	Shows the rheostat value in % (0 - 100%) Light on gives a value between 13 and 100% Light off gives the value 100%.
COOLANT TEMP XXX °C YYY °F	Shows the coolant temperature in °C and °F
LIGHT SENSOR VALUE XX.X V	Shows cabin light value in V (0-10 V)
DISPLAY LIGHTING XXX%	Shows the display lighting in % (0 - 100%)
TANK CONTENTS XX Litres YY US Gallons ZZ Imp gallons	Shows the contents of the tank in liters, US gallons or Imp. gallons
BATTERY VOLTAGE XX.X V	Shows battery voltage in V
CHECK ENGINE LAMP ON 0 V OFF 12 V	Shows the status of the malfunction indicator (CHECK ENGINE) lamp
INFO BUTTON ON 0 V OFF 12 V	Shows the status of the INFO button
RESET BUTTON ON 0 V OFF 12 V	Shows the status of the R button
COOLANT LEV. SENS ON 12 V OFF 0 V	Shows the status of the coolant level sensor
GEAR POS.SENS.A ON 0 V OFF 12 V	Status of transmission range sensor A
GEAR POS.SENS.B ON 0 V OFF 12 V	Status of transmission range sensor B
GEAR POS.SENS.C ON 0 V OFF 12 V	Status of transmission range sensor C
SELECTOR LEVER POS	Shows the selector lever positionP, R,N, D, 3,2, 1

EDU (contd.)

ACTIVATE (M1995-)

ISAT ST display	Function
RADIATOR FAN LOW ON OFF	Radiator fan, low speed activated
RADIATOR FAN HIGH ON OFF	Radiator fan, high speed activated
AC ON OFF	The A/C compressor is activated (the signal is sent to the engine management system)
EMPTY TANK LAMP ON OFF	Warning lamp for empty tank, ON/OFF
DISPLAY TEST IN PROGRESS...	All EDU functions on the display go to maximum brightness
FUEL GAUGE (0-70) LITRES	Select the number of litres on the ISAT scan tool. The gauge reading should correspond to the number of litres selected
ENGINE TEMP GAUGE (0-147°C)	Select temperature on the ISAT scan tool. The gauge reading should correspond to the selected temperature

EDU (contd.)

READ SYSTEM INFO (M1995-)

ISAT ST display	Function
PART NUMBER XX XX XXX	Part number of the EDU control module
SOFTWARE VERSION XXXXXXXXXX	Program version of the EDU control module
DATE OF MANUFACT XXXXXXXXXX	Date of manufacture of the EDU control module

PROGRAMMING/ADJUSTMENT (M1995-)

When a replacement EDU 3 unit is fitted, it must be programmed using an ISAT scan tool. Select "PROGRAMMING" in the EDU menu and answer the ISAT scan tool's questions.

Programming can also be used to verify values already programmed.

Note

When programming, the display can flash and the temperature/fuel gauges fluctuate up and down. This is caused by the programming voltage and is perfectly normal.

For programming/adjusting, see Service Manual 3:5 "Programmable EDU trip computer", pages 52 to 58.

DCC

Diagnostic trouble codes, self- test

Code	Cause of fault
F1	Internal fault in DCC
F2	No temperature signal from EDU. (M1990-: If there is a fault in the outside temperature sensor, this can also be indicated on the EDU.)

Cruise control

Fault diagnosis (M1985-1994)

The instrument described can no longer be ordered. Instead, a BOB and a multimeter should be used.

1 Connect the test instrument.

2 Set the cruise control switch to OFF and turn the ignition switch to ON.

Check that LEDs 1, 3 and 5 light up.

NOTE: LED 5 is most likely to light up when the car is moving.

- If diode 1 does not light up, check the power supply to the electronic unit.
- If diode 3 does not light, check the pedal switches and wiring harnesses for these.
- If diode 5 does not light up, drive the car and check the vehicle speed sensor at the speedometer and the wiring harness for it.

3 Press the brake pedal and check that diode 3 goes out. Release the pedal (diode lights up).
Manual gearbox: Press the brake pedal and check that diode 3 goes out again.
- If there is a fault, check the operation and adjustment of the relevant pedal switch as well as the wiring harness (short to ground).

4 Set the cruise control switch to ON and check that LED 9 lights up.
- If the LED does not light up, check the switch and wiring harness.

5 Press the "SET" button and check that LED 2 lights up when the button is held pressed.
- If LED 2 does not light up, check the switch and wiring harness.

6 Press the switch to position "RES" and check that LED 6 lights up when the button is held pressed.
- If LED 6 does not light up, check the switch and wiring harness.

7 Press the "VALVE" button on the test box and listen for whether the cruise control pump is activated.
- If the pump does not work, check the valve and the wiring harness.

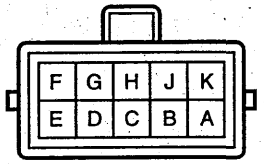
8 Press the "PUMP" button on the test box and listen for whether the pump is working.
- If the pump does not work, check the pump and the wiring harness.

9 Pump and valve can also be checked while driving. If the "PUMP" button is pressed, the throttle opens. When "VALVE" is pressed (or the clutch/brake pedal is pressed) throttle opening ceases.
- If this does not happen, check the vacuum system.

If the tests in points 1 to 9 give the correct result, the fault lies in the electronic unit.

Cruise control system (contd.)

Test readings, control module connections (M1995-)



C368W-4224

Pin	Colour	Component/ Function	In/ Out	Test conditions	Reading	Across
1 (A)	GN	Switch	In	Switch set to ON position Ignition switched ON	12 V	1 - 5
2 (B)	GY/GN	Switch	In	Switch held in SET position Ignition switched ON	12 V	2 - 5
3 (C)	GY	Switch	In	Switch held in RES position Ignition switched ON	12 V	3 - 5
4 (D)	YE/GN	Brake pedal switch	In	Automatic transmission D, 1, 2, 3 Pedal not depressed Pedal depressed	 12 V 0 V	4 - 5
				Manual Pedal not depressed Pedal depressed	 12 V 0 V	4 - 5
		Clutch pedal switch	In	Manual Pedal not depressed Pedal depressed	 12 V 0 V	4 - 5
5 (E)	BK	Power ground	In		12 V	5 - B+
6 (F)	BN/WH	Ignition (+54 circuit)	In	Ignition switch in ON position	12 V	6 - 5
7 (G)	VT or BU/GN	Brake light switch	In	Brake pedal depressed Brake pedal not depressed	12 V 0 V	7 - 5
8 (H)	BN/YE or YE/WH	CRUISE indicator lamp	Out	Lamp out Lamp on	0 V 12 V	8 - 5
9 (J)	BU/GN	Communication with Saab Trionic	Out	In diagnostics mode ON/OFF SET RESUME	 12 V	9 - 6
10 (K)	BK/GN	Speed signal	In	Car driven slowly forward	approx. 6 V	10 - 5

Cruise control system (contd.)

Diagnostics mode (M1995-)

System diagnostics performed without ISAT scan tool.
Start fault diagnosis by checking:

1 Fuses, se 3:5, page 16.
2 Ignition, see 3:5, page 17
3 Grounding, see 3:5, page 18.
4 The pins of the control module connector for possible slide-out.

Fault diagnosis is carried out in the diagnostics mode. To enter the diagnostics mode, see the table below.

To leave the diagnostics mode, increase speed to above 32 km/h (20 mph) or turn the ignition switch to the OFF position.

If you happen to make a mistake in the diagnostics mode, you will automatically be returned to point 5 and will have to continue from there.

	Action	CRUISE lamp	Item checked	See 3:5, page
1	Engine switched off and handbrake applied.			
2	Automatic transmission: selector lever in position N (P, R) Manual gearbox: clutch pedal depressed.			
3	Press SET and RES at the same time and hold them pressed while the engine is starting.			
	The CRUISE lamp should light up to confirm that you are in diagnostics mode.	Lights up Remains out	ON function SET function RESUME function CRUISE lamp	27 21 24 44
4	First release the SET button and then the RES button.	Goes out Remains on	SET function RESUME function	21 24
5	Press the SET button.	Lights up Remains out	SET function	21
6	Release the SET button.	Goes out Remains on	SET function	21
7	Move the switch to the RES/-- position	Lights up Remains out	RESUME function	24
8	Release RES/-	Goes out Remains on	RESUME function	24
9	Move the switch to the TIP/OFF position.	Lights up Remains out	TIP/OFF function	19
10	Release TIP/OFF.	Goes out Remains on	TIP/OFF function	19
11	Automatic transmission: shift to D (3, 2, 1) Manual gearbox: release the clutch pedal	Lights up Remains out	Automatic transmission: Selector lever position sensor Manual gearbox: Clutch pedal switch	30 33
12	Depress the brake pedal.	Goes out Remains on	Brake pedal switch Automatic transmission Manual gearbox	32 35

	Action	CRUISE lamp	Item checked	See 3:5, page
13	Release the brake pedal.	Lights up Remains out	Brake pedal switch Automatic transmission Manual gearbox	32 35
14	Automatic transmission: shift to N (P, R) Manual gearbox: depress the clutch pedal	Goes out Remains on	Automatic transmission: Selector lever position sensor Manual gearbox: Clutch pedal switch	30 33
15	Depress the brake pedal and keep it depressed for about 5 seconds After about 5 seconds	Lights up Remains out Goes out Remains on	Brake light switch Control module	36 48
16	Release the brake pedal.	Slight increase in engine idling speed No increase in engine idling speed	Stepping motor/cable	41
17	Drive off slowly	Lamp flashes in time with the speed Lamp does not flash	Speed signal	42

Anti-theft alarm

Test readings, control module connections (-M1994)

Pin	Colour	Function	In/ Out	Test conditions	Reading	Across
1	RD	+30	In	Service switch turned clockwise Service switch turned anticlockwise	12 V 0 V	1 - 2
2	BK	Ground	In		12 V	2 - B+
3	GN/WH	+15	In	Ignition ON	12 V	3 - 2
4	GY	Door switches	In	Reading taken when the delay period for interior lighting has elapsed (about 20 seconds after door closed). All doors closed Any door open	12 V 0 V	4 - 2
5	WH	Bonnet switch	In	Bonnet closed Bonnet open	12 V 0 V	5 - 2
6	BK	Switch, luggage compartment lighting	In	Tailgate closed Tailgate open	12 V 0 V	6 - 2
7		No connection.				
8	BU/BK	Level alarm trigger signal	In/ Out	Deactivated alarm Activated alarm Triggering alarm	12 V 12 V 0 V for about 1 s	8 - 2
9	VT	Switch for disengaging ultrasound and level alarm Position 1 = open Position 0 = closed	In	Ultrasound not fitted Ultrasound fitted with: Switch in position 1 Switch in position 0	12 V 12 V 0 V	9 - 2
10		Signal for disengaging ultrasound unit when using cabin heater	In	Cabin heater ON	12 V	10 - 2
11	BK/WH	Radio/accessory		Lead grounded Lead not grounded	0 V approx. 10 V	11 - 2
12	BU	Siren with battery back-up		Alarm not triggered Alarm triggered	12 V approx. 0.5 V	12 - 2
13	RD	Power supply to level sensor	Out	Alarm deactivated Alarm activated	0 V 12 V	13 - 2
14	BN	Horn	Out	Alarm triggered	12 V (pulses)	14 - 2
15	YE/WH	+50	In	Ignition switch in START position	12 V	15 - 2
16	YE	Starter motor interlock	Out	Ignition switch in START position Alarm deactivated Alarm activated	 12 V 0 V	16 - 2
17	RD	+30	In	Service switch turned clockwise Service switch turned anticlockwise	12 V 0 V	17 - 2

Pin	Colour	Function	In/ Out	Test conditions	Reading	Across
18	BU/WH	Left-hand direction indicators	Out	Alarm activated	12 V (pulses)	18 - 2
19	RD/WH	Right-hand direction indicators	Out	Alarm activated	12 V (pulses)	19 - 2
20	BK	Ground	In		12 V	20 - B+
21	GN	Central locking control, locking	Out	Central locking not activated Central locking locked	12 V 0 V for 1-6 s	21 - 2
22		No connection.				
23	BK	Ground	In		12 V	23 - B+
24	RD	Central locking control, unlocking	Out	Central locking not activated Central locking, unlocking	12 V 0 V for 1-6 s	24 - 2
25		No connection.				

3-pin connector for connecting ultrasound alarm

Pin	Colour	Function	In/ Out	Test conditions	Reading	Across
1	GN/BK	Triggering alarm	In	Alarm deactivated Alarm activated Triggering	12 V 12 V 0 V for about 2 s	1 - ground
2	BN	Ground	Out		12 V	2 - B+
3	RD	Power supply	Out	Alarm deactivated Alarm activated	0 V 12 V	3 - ground

Anti-theft alarm (contd.)

Test readings, control module connections (M1995)

Pin	Component/ Function	In/Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page.
1	Aerial remote transmitter, signal	In				24/64
2	LED	Out	Activate with ISAT Scan Tool, Select "LED" "OFF" "ON"	 <0.5 V 2 V	2 - 13	22/58
3	Tailgate switch	In	Tailgate closed Tailgate open	12 V 0 V	3 - 13	15/70
4	Door switches	In	Door closed Door open Delay approx. 18 s	12 V 0 V	4 - 13	15/60
5	Glass breakage sensor, ground	In	Ignition "OFF"	<5 Ohm	5 - 13	16/65
6	Central locking system, unlocking	In	Deactivate alarm with key, front doors - normal position - key position, unlock	 12 V 0 V for 0.75 s	6 - 13	27/60
7	Glass breakage sensor, input	In	Central locking, unlocking (car key)	0.3 V	7 - 5	16/65
8	Starter relay, power supply (+50 circuit)	Out	Starter motor running Ignition "ON" (+15 circuit)	12 V 0 V	13 - 8	21/51
9	Fuel pump relay	Out	Ignition "ON" (+15 circuit) Alarm armed (when idling)	12 V 0 V	13 - 9	21/56
10	+15	Out	Ignition "ON" (+15 circuit)	12 V	10 - 13	18/68
11	Horn	Out	Activate with ISAT Scan Tool, Select "HORN" "OFF" "ON"	 12 V 0 V	11 - 13	19/69
12	Direction indicators	Out	Activate with ISAT Scan Tool Select "FLASHERS" "OFF" "ON"	 0 V 12 V	12 - 13	20/67
13	Power ground	In		<0.1 V	13 - B-	12/-
14	Aerial ground	In	Ignition "OFF"	<5 Ohm	14 - 13	24/64
15	Key, tailgate	In	Arm alarm Locked position Unlocked position Key in tailgate lock	12 V	15 - 13	27/75
16	Switch, bonnet	In	Bonnet open Bonnet closed	0 V 12 V	16 - 13	15/62

Pin	Component/ Function	In/Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page.
17	Central locking system, locking	In	Arm alarm from driver's door normal position locking key position	 12 V 0 V for 0.75 s	17 - 13	27/60
18	Door indication, driver's door	In	Open door Closed door	0 V 12 V	18 - 13	-/78
19	Data link, K	In/Out	ISAT scan tool connected ISAT scan tool not connected	12 V 0 V	19 - 13	32/49
20	+50	In	Starter motor running Ignition "ON" (+15 circuit)	12 V 0 V	20 - 13	21/51
21	+15 circuit (4-cyl) +30 circuit (6-cyl)	In	Ignition "ON" (+15 circuit)	<0.5 V	21 - B+	18/56
22	+15 circuit (4-cyl) +30 circuit (6-cyl) Power supply, Trionic/Motronic	Out	Ignition "ON" (+15 circuit)	<0.5 V	22 - B+	21/56
23	Unlocking tailgate using remote control	In	Activate with ISAT Scan Tool Select "TAILGATE" "ON" "OFF" or remote control	 12 V 0 V	23 - 13	26/72
24	Direction indicators	Out	Activate with ISAT Scan Tool Select "FLASHERS" "OFF" "ON"	 0 V 12 V	24 - 13	20/67
25	+30	In		<0.5 V	25 - B+	12/-

Anti-theft alarm (contd.)

Diagnostic trouble codes (M1995)

Diagnostic trouble code (SAE)	Faulty function/component	ISAT ST display text	See 3:5, page
B1193	Horn - break/open circuit	FAULT XX B1193 HORN OPEN CIRCUIT	45
B1605	Control module - internal fault	FAULT XX B1605 CONTR MODULE INTERN	47

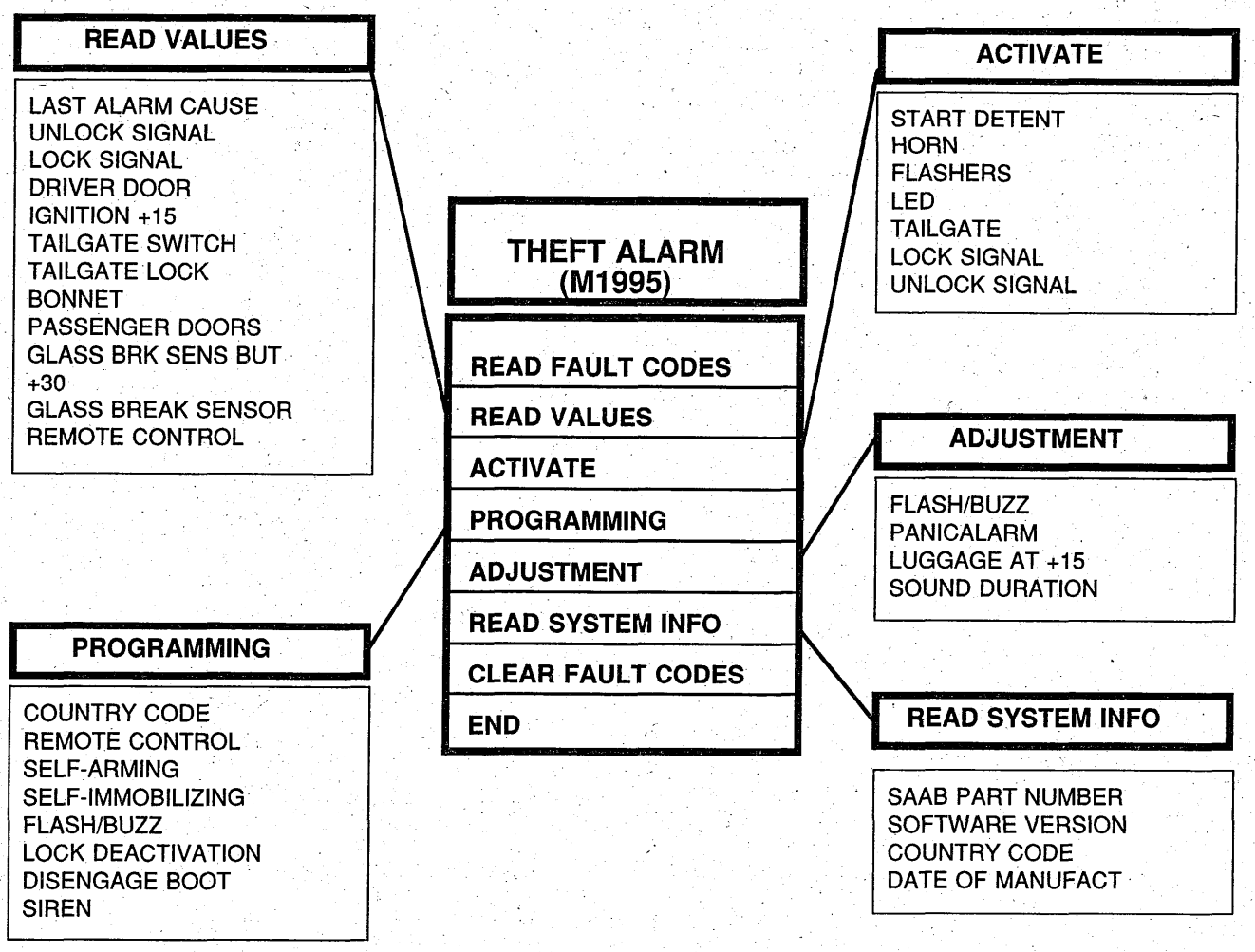
Anti-theft alarm (contd.)

Faults without diagnostic trouble codes (M1995)

Fault symptom	Component/Function	See 3:5, page
ISAT Scan tool cannot make contact with control module	Fault diagnosis, data link connector	49
Starter motor not working Alarm not triggered when armed. Starter motor runs at different ignition positions	Fault diagnosis, starter motor interlock (+50 circuit)	51
The alarm is not set off when the ignition is switched on	Fault diagnosis, +15 circuit	54
Fuel pump relay not working	Fault diagnosis, power supply (+15/+30 circuit) to fuel pump relay	56
LED does not light up	Fault diagnosis, LED	58
Doors disconnected from alarm	Fault diagnosis, door switches in central locking system	60
Alarm is not triggered when bonnet is opened and alarm is armed	Fault diagnosis, bonnet switch	62
The remote control does not work	Fault diagnosis, remote control	64
Glass breakage sensor not working	Fault diagnosis, glass breakage sensor	65
Direction indicators on continuously/do not light up	Fault diagnosis, direction indicators	67
The horn sounds continuously	Fault diagnosis, horn	69
Tailgate disconnected from alarm, LED flashes during delay period	Fault diagnosis, luggage compartment lighting switch	70
Tailgate/driver's door cannot be disarmed with key	Fault diagnosis, remote control, tailgate opening	72
Central locking system, tailgate	Fault diagnosis, microswitch in tailgate, opening with key	75
Door indication not working when driver's door opened	Fault diagnosis, door indication, driver's door	78
The alarm is not armed after delay period of interior lighting with time delay	Fault diagnosis, delayed arming due to delayed interior lighting	81
Alarm sounds falsely	Fault diagnosis, false alarm	82

Anti-theft alarm (contd.)

Menu structure for command codes (M1995)



Anti-theft alarm (contd.)

READ VALUES(M1995)

ISAT scan tool command	Function	ISAT scan tool display
LAST ALARM CAUSE	Displays the last 10 alarm causes There are 6 possible alarm causes 1.Tailgate 2.Bonnet 3.Driver's door 4.Passenger doors 5.Glass breakage sensor 6.Ignition	1.TAILGATE 2.BONNET 3. ---- : : : : 10. ---
UNLOCK SIGNAL	Shows "ON"" when door receives unlock signal, otherwise "OFF"".	ON OFF
LOCK SIGNAL	Shows "ON"" when door receive lock signal, otherwise "OFF"".	ON OFF
DRIVER DOOR	Shows whether the door is open or closed.	OPEN CLOSED
IGNITION +15	Shows whether the ignition is on or off.	ON OFF
TAILGATE SWITCH	Shows whether the tailgate is open or closed.	OPEN CLOSED
TAILGATE LOCK	Shows whether the tailgate is locked or unlocked.	OPEN CLOSED
BONNET	Shows whether the bonnet is open or closed.	OPEN CLOSED
PASSENGER DOORS	Shows whether any of the passenger doors is open or closed.	OPEN CLOSED
GLASS BRK SENS BUT	Shows whether the glass breakage sensor has been disconnected with the button.	ON OFF
+30		ON OFF
GLASS BREAK SENSOR	Shows the value from the glass breakage sensor.	0-255
REMOTE CONTROL	Shows which button has been pressed on the remote control. Also functions on a remote control that has not been programmed.	NO BUTTON LH BUTTON RH BUTTON

Anti-theft alarm (contd.)

ACTIVATE (M1995)

ISAT scan tool command	Function	ISAT scan tool display
START DETENT	"ON" activates the starter motor interlock. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
HORN	"ON" activates the horn. It otherwise shows whether the anti-theft alarm's control module output is active or not.	ON OFF
FLASHERS	"ON" activates the direction indicators. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
LED	"ON" activates the LED. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
TAILGATE	"ON" activates unlocking of the tailgate. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
LOCK SIGNAL	"ON" activates door locking via the central locking system. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
UNLOCK SIGNAL	"ON" activates unlocking of the doors via the central locking system. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF

Anti-theft alarm (contd.)

PROGRAMMING(M1995)

ISAT scan tool command	Function	ISAT scan tool display
COUNTRY CODE	To select a country-adapted or customized alternative for the alarm and to select siren with battery back-up.	GERMANY GREAT BRITAIN SWITZERLAND HOLLAND OWN ALTERNATIVE SIREN
REMOTE CONTROL	To program and deprogram one or more (max. 4) remote controls for the car. "PROGRAMMING" for programming a remote control "DEPROGRAMMING" for deprogramming a remote control "DEPROGRAM ALL" to deprogram all remote controls simultaneously.	 PROGRAMMING DEPROGRAMMING DEPROGRAM ALL
SELF-ARMING	To select the self-arming function. "OFF" to cancel the self-arming function. "AT +15 OFF" occasion when the function is to be engaged. "+15 OFF, DOOR CLOSED" occasion when the function is to be engaged. "TIME BEFORE ACTIV" to select the time until self-arming. "ACTIVATION TIME" to select the time during which the function is to remain activated.	 OFF AT +15 OFF +15 OFF, DOOR CLOSED TIME BEFORE ACTIV ACTIVATION TIME
SELF-IMMOBILIZING	To select the self-immobilizing function (3-circuit breaking). "ON" to select the function. "OFF" to cancel the function. "TIME BEFORE ACTIV" to select the time until self-immobilizing. "ACTIVATION TIME" to select the time during which the function is to remain activated.	 ON OFF TIME BEFORE ACTIV ACTIVATION TIME
FLASH/BUZZ	To select the characteristics of the flashing/sound confirmation when one of the buttons on the remote control is pressed. "ORIGINAL VALUE" gives the same characteristics as when first supplied. "ADJUSTMENT" to change the characteristics of the confirmation.	 ORIGINAL VALUE ADJUSTMENT
LOCK DEACTIVATION	Allows the alarm to be armed/disarmed with the key. "OFF" if the remote control only can be used. "ON" if the car key and remote control can both be used.	 OFF ON

ISAT scan tool command	Function	ISAT scan tool display
DISENGAGE BOOT	Allows the option of opening the tailgate using the key when the alarm is armed.	
	"OFF" if the remote control only can be used.	OFF
	"ON" if the car key and remote control can both be used.	ON
SIREN	Programming for siren with battery back-up.	
	"ON" if the siren is to be included.	ON
	"OFF" to cancel the siren.	OFF

Anti-theft alarm (contd.)

ADJUSTMENT(M1995)

ISAT scan tool command	Function	ISAT scan tool display
FLASH/BUZZ	To adjust the configuration of the flash/ sound confirmation if "ADJUSTMENT" is selected when programming "FLASH/BUZZ".	
	"LOCK" allows adjustment of confirmation on locking.	LOCK
	"UNLOCK" allows adjustment of confirmation on unlocking.	UNLOCK
	"SEL FLASH TIME" to adjust flashing confirmation.	SEL FLASH TIME
	"SEL SOUND TIME"" to adjust acoustic confirmation.	SEL SOUND TIME
PANICALARM	The panic alarm feature quickly sets off the alarm when the left-hand button on the remote control is pressed for 2.25 seconds.	PANICALARM
	"OFF" to cancel the function. "ON" to select the function.	OFF ON
LUGGAGE AT +15	Allows opening of the tailgate with the ignition switch in the "ON" position.	LUGGAGE AT +15
	"OFF" to cancel the function. "ON" to select the function.	OFF ON
SOUND DURATION	Allows the possibility of changing the character of the sound by selecting different sound times.	SOUND DURATION
	"5 - 10 - 15 - 20 - 25 - 30 ms"	10 ms

READ SYSTEM INFO (M1995)

ISAT scan tool command	Function	ISAT scan tool display
SAAB PART NUMBER	Shows the Saab part number for the anti-theft alarm.	PART NO. XX XXX XXX
SOFTWARE VERSION	Shows which software version the anti-theft alarm is equipped with.	SOFTWARE VERSION:XX XXX XXX
COUNTRY CODE	Shows the selected country code and the option to select another country code.	VALUE IS GERMANY
DATE OF MANUFACT	Shows the date of manufacture of the control module.	DATE OF MANUFACT: XX XX XX

Anti-theft alarm (contd.)

Test readings, control module connections, not VSS (M1996)

Pin	Component/ Function	In/Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page.
1	Aerial remote transmitter, signal	In	Not measurable with conventional instruments			29/98
2	LED	Out	Activate with ISAT Scan Tool, Select "LED" "OFF" "ON"	 <0.5 V 2 V	2 - 13	27/86
3	Tailgate switch	In	Tailgate closed Tailgate open	12 V 0 V	3 - 13	18/112
4	Door switches	In	Door closed Door open	12 V 0 V	4 - 13	18/90
5	Glass breakage sensor, ground	In	Ignition "OFF"	<5 Ohm	5 - 13	19/102
6	Central locking system, unlocking	Out	Disarm the alarm with the remote control (or key if programmed) - normal position - key position, unlock Requires multimeter with min/max facility. If minimum is selected, 0 V will be obtained. A conventional multimeter will drop from about 7 V to about 1.5-3 V.	 B+ 0 V i 0.75 s	6 - 13	34/90
7	Glass breakage sensor, input	In	Central locking, unlocking (car key)	0.3 V	7 - 5	19/102
8	Starter relay, power supply (+50 circuit)	Out	Starter motor running Ignition "ON" (+15 circuit)	12 V 0 V	13 - 8	25/68
9	Fuel pump relay	Out	Ignition "ON" (+15 circuit) Alarm armed (when idling)	12 V 0 V	13 - 9	25/82
10	+15	In	Ignition "ON" (+15 circuit)	12 V	10 - 13	21/74
11	Horn	Out	Activate with ISAT Scan Tool Select "HORN" "OFF" "ON"	 12 V 0 V	11 - 13	23/110
12	Direction indicators	Out	Activate with ISAT Scan Tool Select "FLASHERS" "OFF" "ON"	 0 V B+	12 - 13	24/106
13	Power ground	In		<0.1 V	13 - B-	14/-
14	Aerial ground	In	Ignition "OFF"	<5 Ohm	14 - 13	29/98

Pin	Component/ Function	In/Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page.
15	Not used					
16	Switch, bonnet	In	Bonnet open Bonnet closed	0 V 12 V	16 - 13	18/94
17	Central locking system, locking	Out	Arm the alarm with the remote control (or key if programmed) - normal position - key position, lock Requires multimeter with min/max facility. If minimum is selected, 0 V will be obtained. A conventional multimeter will drop from about 7 V to about 1.5-3 V.	 B+ 0 V i 0.75 s	17 - 13	34/90
18	Pictogram switch	In	Open door Closed door	0 V 12 V	18 - 13	18/124
19	Data link, K	In/Out	ISAT scan tool connected ISAT scan tool not connected	12 V 0 V	19 - 13	39/64
20	+50	In	Starter motor running Ignition "ON" (+15 circuit)	12 V 0 V	20 - 13	21/68
21	Fuel pump relay (4-cyl) +30 circuit (6-cyl)	In	Ignition "ON" (+15 circuit)	<0.5 V	21 - B+	21/74
22	+15 circuit (4-cyl) +30 circuit (6-cyl) Power supply, Trionic/Motronic	Out	Ignition "ON" (+15 circuit)	<0.5 V	22 - B+	21/74
23	Unlocking tailgate using remote control	Out	Activate with ISAT Scan Tool Select "TAILGATE" "ON" "OFF" or remote control	 12 V 0 V	23 - 13	33/116
24	Direction indicators	Out	Activate with ISAT Scan Tool Select "FLASHERS" "OFF" "ON"	 0 V B+	24 - 13	24/106
25	+30	In		<0.5 V	25 - B+	14/78

Anti-theft alarm (contd.)

Diagnostic trouble codes, not VSS (M1996)

Diagnostic trouble code (SAE)	Faulty function/component	ISAT ST display text	See 3:5, page
B1193	Horn - break/open circuit	FAULT XX B1193 HORN OPEN CIRCUIT	56
B1605	Control module - internal fault	FAULT XX B1605 CONTR MODULE INTERN	60

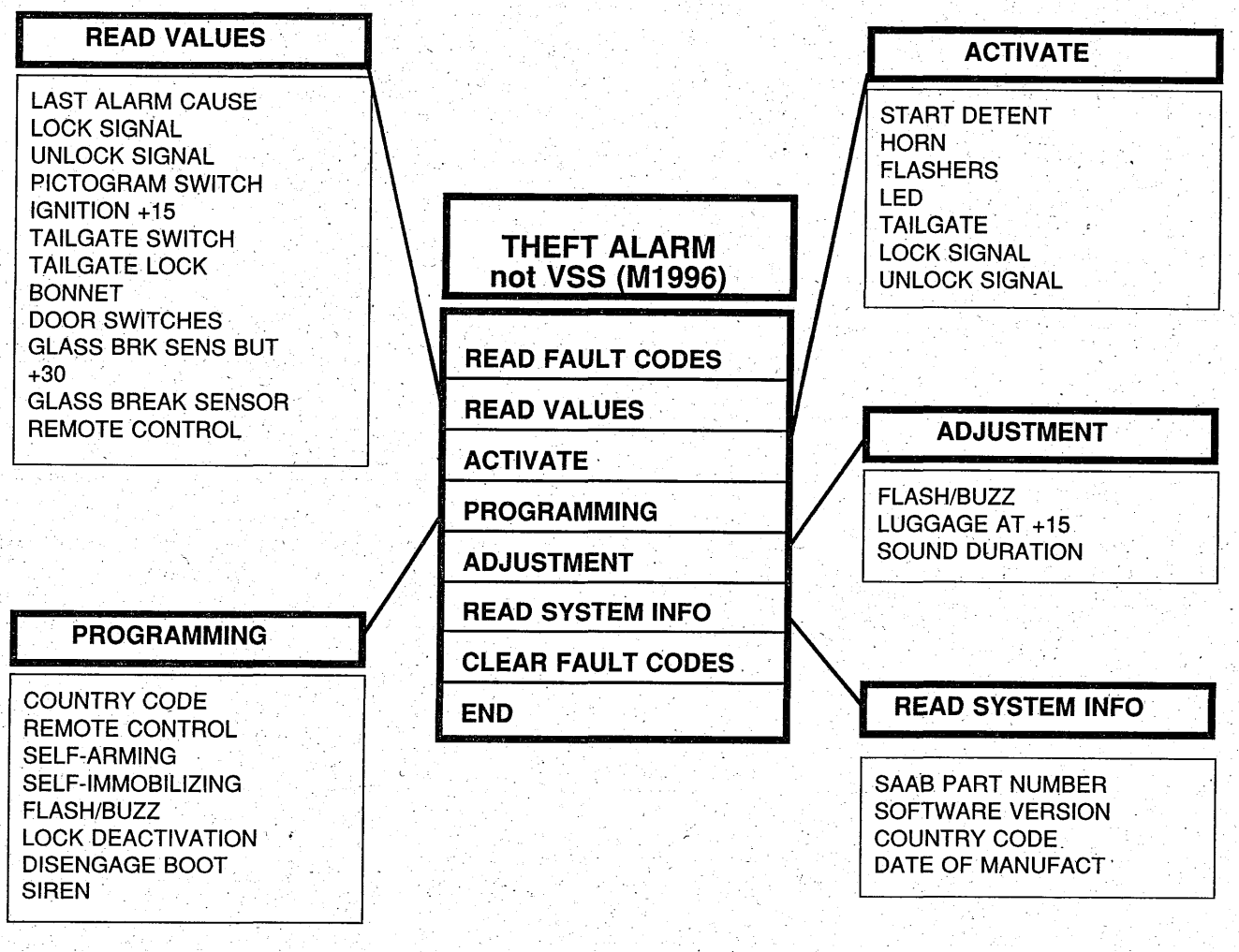
Anti-theft alarm (contd.)

Faults without diagnostic trouble codes, not VSS (M1996)

Fault symptom	Component/Function	See 3:5, page
ISAT Scan tool cannot make contact with control module	Fault diagnosis, data link connector	64
Starter motor not working Alarm not triggered when armed. Starter motor runs at different ignition positions	Fault diagnosis, starter motor interlock (+50 circuit)	68
The alarm is not set off when the ignition is switched on	Fault diagnosis, +15 power supply circuit	74
The anti-theft alarm does not work.	Fault diagnosis, power supply (+30 circuit)	78
Fuel pump relay not working	Fault diagnosis, fuel pump relay	82
LED does not light up	Fault diagnosis, LED	86
Doors disconnected from alarm	Fault diagnosis, door switches, central locking system	90
Alarm is not triggered when bonnet is opened and alarm is armed	Fault diagnosis, bonnet switch	94
The remote control does not work	Fault diagnosis, remote control	98
Glass breakage sensor not working	Fault diagnosis, glass breakage sensor	102
Direction indicators on continuously/do not light up	Fault diagnosis, direction indicators	106
The horn sounds continuously	Fault diagnosis, horn	110
Tailgate disconnected from alarm, LED flashes during delay period	Fault diagnosis, luggage compartment lighting switch	112
Tailgate/driver's door cannot be disarmed with key	Fault diagnosis, remote control, tailgate opening	116
Central locking system, tailgate	Fault diagnosis, microswitch in tailgate, opening with key	120
Door indication not working when driver's door opened	Fault diagnosis, door indication, driver's door	124
The alarm is not armed after delay period of interior lighting with time delay	Fault diagnosis, delayed arming due to delayed interior lighting	128
Alarm sounds falsely	Fault diagnosis, false alarm	130

Anti-theft alarm (contd.)

Menu structure for command codes, not VSS (M1996)



Anti-theft alarm (contd.)

READ VALUES, not VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
LAST ALARM CAUSE	Displays the last 9 alarm causes There are 6 possible alarm causes: 1.Tailgate 2.Bonnet 3.Pictogram switch 4.Passenger doors 5.Glass breakage sensor 6.Ignition The ISAT scan tool display will be cleared if the "CLEAR FAULT CODES" command is entered.	1.TAILGATE 2.BONNET 3.PICTOGRAM SWITCH 4.PASSENGER DOORS 5.GLASS BREAK SENSOR 6.IGNITION : 9. ---
LOCK SIGNAL	Shows "ACTIVE" when the door receives a lock signal, otherwise shows "NOT ACTIVE".	ACTIVE NOT ACTIVE
UNLOCK SIGNAL	Shows "ACTIVE" when the door receives an unlock signal, otherwise shows "NOT ACTIVE".	ACTIVE NOT ACTIVE
PICTOGRAM SWITCH	Shows whether the driver's door is open or closed. Shows status of pictogram switch.	OPEN CLOSED
IGNITION +15	Shows whether the ignition is on or off.	ON OFF
TAILGATE SWITCH	Shows whether the tailgate is open or closed.	OPEN CLOSED
TAILGATE LOCK	Shows whether the tailgate is locked or unlocked.	OPEN CLOSED
BONNET	Shows whether the bonnet is open or closed.	OPEN CLOSED
DOOR SWITCHES	Shows whether any of the passenger doors is open or closed.	OPEN CLOSED
GLASS BRK SENS BUT	Shows whether the glass breakage sensor has been disengaged by the button.	ON OFF
+30	Shows battery condition. "LOW" = less than 9 V "OK" = more than 9 V	ON OFF
GLASS BREAK SENSOR	Shows the value from the glass breakage sensor.	0-255
REMOTE CONTROL	Shows which button has been pressed on the remote control. Also functions on a remote control that has not been programmed.	NO BUTTON LH BUTTON RH BUTTON

Anti-theft alarm (contd.)

ACTIVATE, not VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
START DETENT	"ON" activates the starter motor interlock. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
HORN	"ON" activates the horn. It otherwise shows whether the anti-theft alarm's control module output is active or not.	ON OFF
FLASHERS	"ON" activates the direction indicators. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
LED	"ON" activates the LED. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
TAILGATE	"ON" activates unlocking of the tailgate. Otherwise, it shows whether the anti-theft alarm control module output is active or not.	ON OFF
LOCK SIGNAL	"ON" activates door locking via the central locking system. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
UNLOCK SIGNAL	"ON" activates unlocking of the doors via the central locking system. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF

Anti-theft alarm (contd.)

PROGRAMMING, not VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
COUNTRY CODE	To select a country-adapted or customized alternative for the alarm and to select siren with battery back-up.	GERMANY GREAT BRITAIN SWITZERLAND HOLLAND OWN ALTERNATIVE SIREN
REMOTE CONTROL	To program and deprogram one or more (max. 4) remote controls for the car. "PROGRAMMING" for programming a remote control "DEPROGRAMMING" for deprogramming a remote control "DEPROGRAM ALL" to deprogram all remote controls simultaneously.	 PROGRAMMING DEPROGRAMMING DEPROGRAM ALL
SELF-ARMING	To select the self-arming function. "OFF" to cancel the function. "AT +15 OFF" occasion when the function is to be engaged. "+15 OFF,DOOR CLOSED" occasion when the function is to be engaged. "TIME BEFORE ACTIV" to select the time until self-arming. "ACTIVATION TIME"to select the time during which the function is to remain activated.	 OFF AT +15 OFF +15 OFF,DOOR CLOSED TIME BEFORE ACTIV ACTIVATION TIME
SELF-IMMOBILIZING	For selecting the self-immobilizing function. "ON" to select the function. "OFF" to cancel the function. "TIME BEFORE ACTIV" to select the time until self-immobilizing. "ACTIVATION TIME" to select the time the function is to remain activated.	 ON OFF TIME BEFORE ACTIV ACTIVATION TIME
FLASH/BUZZ	To select the characteristics of the flashing/sound confirmation when one of the buttons on the remote control is pressed. "ORIGINAL VALUE" gives the same characteristics as when first supplied. "ADJUSTMENT" to change the characteristics of the confirmation.	 ORIGINAL VALUE ADJUSTMENT
LOCK DEACTIVATION	Allows the alarm to be armed/disarmed with the key. "OFF" if the remote control only can be used. "ON" if the car key and remote control can both be used.	 OFF ON

ISAT scan tool command	Function	ISAT scan tool display
DISENGAGE BOOT	Allows the option of opening the tailgate using the key when the alarm is armed.	
	"OFF" if the remote control only can be used.	OFF
	"ON" if the car key and remote control can both be used.	ON
SIREN	Programming for siren with battery back-up.	
	"ON" if the siren is to be included.	ON
	"OFF" to cancel the siren.	OFF

Anti-theft alarm (contd.)

ADJUSTMENT, not VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
FLASH/BUZZ	To adjust the configuration of the flash/ sound confirmation if "ADJUSTMENT" is selected when programming "FLASH/BUZZ".	
	"LOCK" allows adjustment of confirmation on locking.	LOCK
	"UNLOCK" allows adjustment of confirmation on unlocking.	UNLOCK
	"SEL FLASH TIME" to adjust flashing confirmation.	SEL FLASH TIME
	"SEL SOUND TIME"" to adjust acoustic confirmation.	SEL SOUND TIME
LUGGAGE AT +15	Allows opening of the tailgate with the ignition switch in the "ON" position.	LUGGAGE AT +15
	"OFF" to cancel the function.	OFF
	"ON" to select the function.	ON
SOUND DURATION	Allows the possibility of changing the character of the sound by selecting different sound times.	SOUND DURATION
	"5 - 10 - 15 - 20 - 25 - 30 ms"	10 ms

READ SYSTEM INFO, not VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
SAAB PART NUMBER	Shows the Saab part number for the anti-theft alarm.	PART NO. XX XXX XXX
SOFTWARE VERSION	Shows which software version the anti-theft alarm is equipped with.	SOFTWARE VERSION:XX XXX XXX
COUNTRY CODE	Shows the selected country code and the option to select another country code.	VALUE IS GERMANY
DATE OF MANUFACT	Shows the date of manufacture of the control module.	DATE OF MANUFACT: XX XX XX

Anti-theft alarm (contd.)

Test readings, control module connections, VSS (M1996)

Pin	Component/ Function	In/Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page.
1	Aerial remote transmitter, signal	In	Not measurable with conventional instruments			29/98
2	LED	Out	Activate with ISAT Scan Tool Select "LED" "OFF" "ON"	 <0.5 V 2 V	2 - 13	27/86
3	Tailgate switch	In	Tailgate closed Tailgate open	B+ 0 V	3 - 13	18/112
4	Door switches	In	Door closed (switch open) Door open (switch closed)	B+ 0 V	4 - 13	18/90
5	Not used					
6	Central locking system, unlocking	Out	Disarm the alarm with the remote control - normal position - unlock position Requires multimeter with min/max facility. If minimum is selected, 0 V will be obtained. A conventional multimeter will drop from about 7 V to about 1.5-3 V.	 7 V 0 V i 0.75 s	6 - 13	32/98
7	Glass breakage sensor, input	In	- normal position - knock/scrape with bunch of keys	0 V 2-4 V	7 - 13	19/102
8	Not used					
9	Immobilizing input	In	Ignition "ON" (+15) Ignition "OFF" Ignition "OFF", key removed	B+ B+ 0 V	9 - 13	26/150
10	+15	In	Ignition "ON"	B+	10 - 13	22/-
11	Horn	Out	Activate with ISAT Scan Tool, Select "HORN" "OFF" "ON"	 B+ 0 V	11 - 13	23/110
12	Direction indicators	Out	Activate with ISAT Scan Tool Select "FLASHERS" "OFF" "ON"	 0 V B+	12 - 13	24/106
13	Power ground	In		<0.1 V	13 - B-	15/-
14	Aerial ground	In	Ignition "OFF"	<5 Ohm	14 - 13	29/98

Pin	Component/ Function	In/Out	Test conditions	Reading	Across	Function/ fault diagnosis, see 3:5, page.
15	Not used					
16	Switch, bonnet	In	Bonnet open Bonnet closed	0 V B+	16 - 13	18/94
17	Central locking system, locking	Out	Arm the alarm with the remote control - normal position - lock position Requires multimeter with min/max facility. If minimum is selected, 0 V will be obtained. A conventional multimeter will drop from about 7 V to about 1.5-3 V.	 B+ 0 V i 0.75 s	17 - 13	31/98
18	Pictogram switch	In	Door open (switch closed) Door closed (switch open)	0 V B+	18 - 13	18/124
19	Data link, K	In/Out	ISAT scan tool connected ISAT scan tool not connected	B+ 0 V	19 - 13	39/150
20	Not used					
21	Communication, VSS and engine management system	In	Ignition "ON" (+15) - ISAT scan tool connected - ISAT scan tool not connected	 11 V 4 V	21 - 13	22/-
22	Power supply (+30 circuit), direction indicators	In		<0.5 V	22 - B+	15/146
23	Unlocking tailgate using remote control	Out	Activate with ISAT Scan Tool Select "TAILGATE" "ON" "OFF" or remote control	 B+ 0 V	23 - 13	33/116
24	Direction indicators	Out	Activate with ISAT Scan Tool Select "FLASHERS" "OFF" "ON"	 0 V B+	24 - 13	24/106
25	Power supply (+30 circuit), control module	In		<0.5 V	25 - B+	15/140

Anti-theft alarm (contd.)

Diagnostic trouble codes, VSS (M1996)

Diagnostic trouble code (SAE)	Faulty function/component	ISAT ST display text	See 3:5, page
B1193	Horn - break/open circuit	FAULT XX B1193 HORN OPEN CIRCUIT	56
B1605	Control module - internal fault	FAULT XX B1605 CONTR MODULE INTERN	60

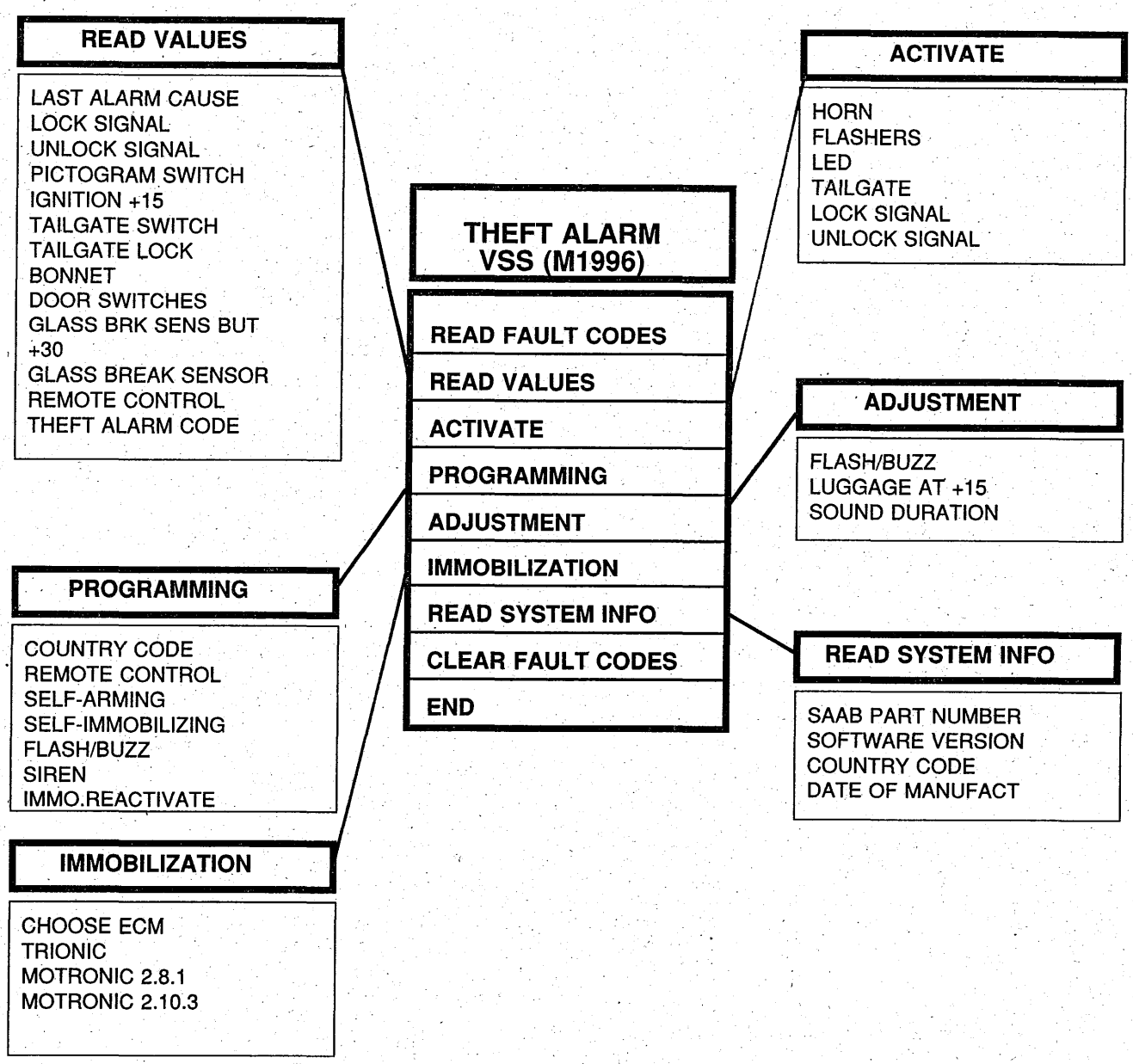
Anti-theft alarm (contd.)

Faults without diagnostic trouble codes, VSS (M1996)

Fault symptom	Component/Function	See 3:5, page
Car fails to start.	Fault diagnosis, engine management system, diagnostic trouble code P1640	134
Car fails to start.	Fault diagnosis, engine management system, diagnostic trouble code P1641	136
Car fails to start. LED flashes with ignition switch in "ST" position.	Fault diagnosis, control module, no power supply (+30 circuit)	140
No immobilization 30 seconds after removal of ignition key	Fault diagnosis, power supply (+B circuit), self-immobilizing does not work	142
Direction indicators do not work.	Fault diagnosis, direction indicators, no power supply (+30 circuit)	146
Car fails to start and no ISAT scan tool communication with VSS.	Fault diagnosis, data link, no communication with engine management system	150

Anti-theft alarm (contd.)

Menu structure for command codes, VSS (M1996)



Anti-theft alarm (contd.)

READ VALUES, VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
LAST ALARM CAUSE	Displays the last 9 alarm causes There are 6 possible alarm causes 1.Tailgate 2.Bonnet 3.Pictogram switch 4.Passenger doors 5.Glass breakage sensor 6.Ignition The ISAT scan tool display will be cleared if the "CLEAR FAULT CODES" command is entered.	1.TAILGATE 2.BONNET 3.PICTOGRAM SWITCH 4.PASSENGER DOORS 5.GLASS BREAK SENSOR 6.IGNITION : 9. ---
LOCK SIGNAL	Shows "ACTIVE" when the door receives a lock signal, otherwise shows "NOT ACTIVE".	ACTIVE NOT ACTIVE
UNLOCK SIGNAL	Shows "ACTIVE" when the door receives an unlock signal, otherwise shows "NOT ACTIVE".	ACTIVE NOT ACTIVE
PICTOGRAM SWITCH	Shows whether the driver's door is open or closed. Shows status of pictogram switch.	OPEN CLOSED
IGNITION +15	Shows whether the ignition is on or off.	ON OFF
TAILGATE SWITCH	Shows whether the tailgate is open or closed.	OPEN CLOSED
TAILGATE LOCK	Shows whether the tailgate is locked or unlocked.	OPEN CLOSED
BONNET	Shows whether the bonnet is open or closed.	OPEN CLOSED
DOOR SWITCHES	Shows whether any of the passenger doors is open or closed.	OPEN CLOSED
GLASS BRK SENS BUT	Shows whether the glass breakage sensor has been disengaged by the button.	ON OFF
+30	Shows battery condition. "LOW" = less than 9 V "OK" = more than 9 V	ON OFF
GLASS BREAK SENSOR	Shows the value from the glass breakage sensor.	0-255
REMOTE CONTROL	Shows which button has been pressed on the remote control. Also functions on a remote control that has not been programmed.	NO BUTTON LH BUTTON RH BUTTON
THEFT ALARM CODE	Shows the status of the alarm code generated by the engine management system.	CORRECT FAULTY ABSENT

Anti-theft alarm (contd.)

ACTIVATE, VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
START DETENT	"ON" activates the starter motor interlock. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
HORN	"ON" activates the horn. It otherwise shows whether the anti-theft alarm's control module output is active or not.	ON OFF
FLASHERS	"ON" activates the direction indicators. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
LED	"ON" activates the LED. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
TAILGATE	"ON" activates unlocking of the tailgate. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
LOCK SIGNAL	"ON" activates door locking via the central locking system. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF
UNLOCK SIGNAL	"ON" activates unlocking of the doors via the central locking system. Otherwise, it shows whether the anti-theft alarm's control module output is active or not.	ON OFF

Anti-theft alarm (contd.)

PROGRAMMING, VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
COUNTRY CODE	To select a country-adapted or customized alternative for the alarm and to select siren with battery back-up.	GERMANY GREAT BRITAIN SWITZERLAND HOLLAND OWN ALTERNATIVE SIREN
REMOTE CONTROL	To program and deprogram one or more (max. 4) remote controls for the car. "PROGRAMMING" to program all remote controls "DEPROGRAM ALL" to deprogram all remote controls simultaneously.	 PROGRAMMING DEPROGRAM ALL
SELF-ARMING	To select the self-arming function. "OFF" to cancel the function. "AT +15 OFF" occasion when the function is to be engaged. "+15 OFF,DOOR CLOSED" occasion when the function is to be engaged. "TIME BEFORE ACTIV" to select the time until self-arming. "ACTIVATION TIME" to select the time the function is to remain activated.	 OFF AT +15 OFF +15 OFF,DOOR CLOSED TIME BEFORE ACTIV ACTIVATION TIME
SELF-IMMOBILIZING	For selecting the self-immobilizing function. "TIME BEFORE ACTIV" to select the time until self-immobilizing.	 TIME BEFORE ACTIV
FLASH/BUZZ	To select the characteristics of the flashing/sound confirmation when one of the buttons on the remote control is pressed. "ORIGINAL VALUE" gives the same characteristics as when first supplied. "ADJUSTMENT" to change the characteristics of the confirmation.	 ORIGINAL VALUE ADJUSTMENT
SIREN	Programming for siren with battery back-up. "ON" if the siren is to be included. "OFF" to cancel the siren.	 ON OFF
IMMO.REACTIVATE	The time between deactivation of the alarm and insertion of the key in the ignition switch is normally 3 minutes (180 seconds). After this period the alarm reverts to immobilized mode. The time can be changed with this command.	30, 60, 90, 120, 150, 180, 210, 240, 270, 300 s

Anti-theft alarm (contd.)

ADJUSTMENT, VSS (M1996)

ISAT scan tool command	Function	ISAT scan tool display
FLASH/BUZZ	To adjust the configuration of the flash/ sound confirmation if "ADJUSTMENT" is selected when programming "FLASH/BUZZ".	
	"LOCK" allows adjustment of confirmation on locking.	LOCK
	"UNLOCK" allows adjustment of confirmation on unlocking.	UNLOCK
	"SEL FLASH TIME" to adjust flashing confirmation.	SEL FLASH TIME
	"SEL SOUND TIME"" to adjust acoustic confirmation.	SEL SOUND TIME
LUGGAGE AT +15	Allows opening of the tailgate with the ignition switch in the "ON" position.	LUGGAGE AT +15
	"OFF" to cancel the function.	OFF
	"ON" to select the function.	ON
SOUND DURATION	Allows the possibility of changing the character of the sound by selecting different sound times.	SOUND DURATION
	"5 - 10 - 15 - 20 - 25 - 30 ms"	10 ms

READ SYSTEM INFO(VSS) (M1996)

ISAT scan tool command	Function	ISAT scan tool display
SAAB PART NUMBER	Shows the Saab part number for the anti-theft alarm.	SAAB PART NUMBER: XX XXX XXX
SOFTWARE VERSION	Shows which software version the anti-theft alarm is equipped with.	SOFTWARE VERSION:XX XXX XXX
COUNTRY CODE	Shows the selected country code and the option to select another country code.	VALUE IS GERMANY
DATE OF MANUFACT	Shows the date of manufacture of the control module.	DATE OF MANUFACT: XX XX XX

IMMOBILIZATION(VSS) (M1996)

ISAT scan tool command	Function	ISAT scan tool display
CHOOSE ECM	For selecting the right engine management system for the car in question.	TRIONIC MOTRONIC 2.8.1 MOTRONIC 2.10.3

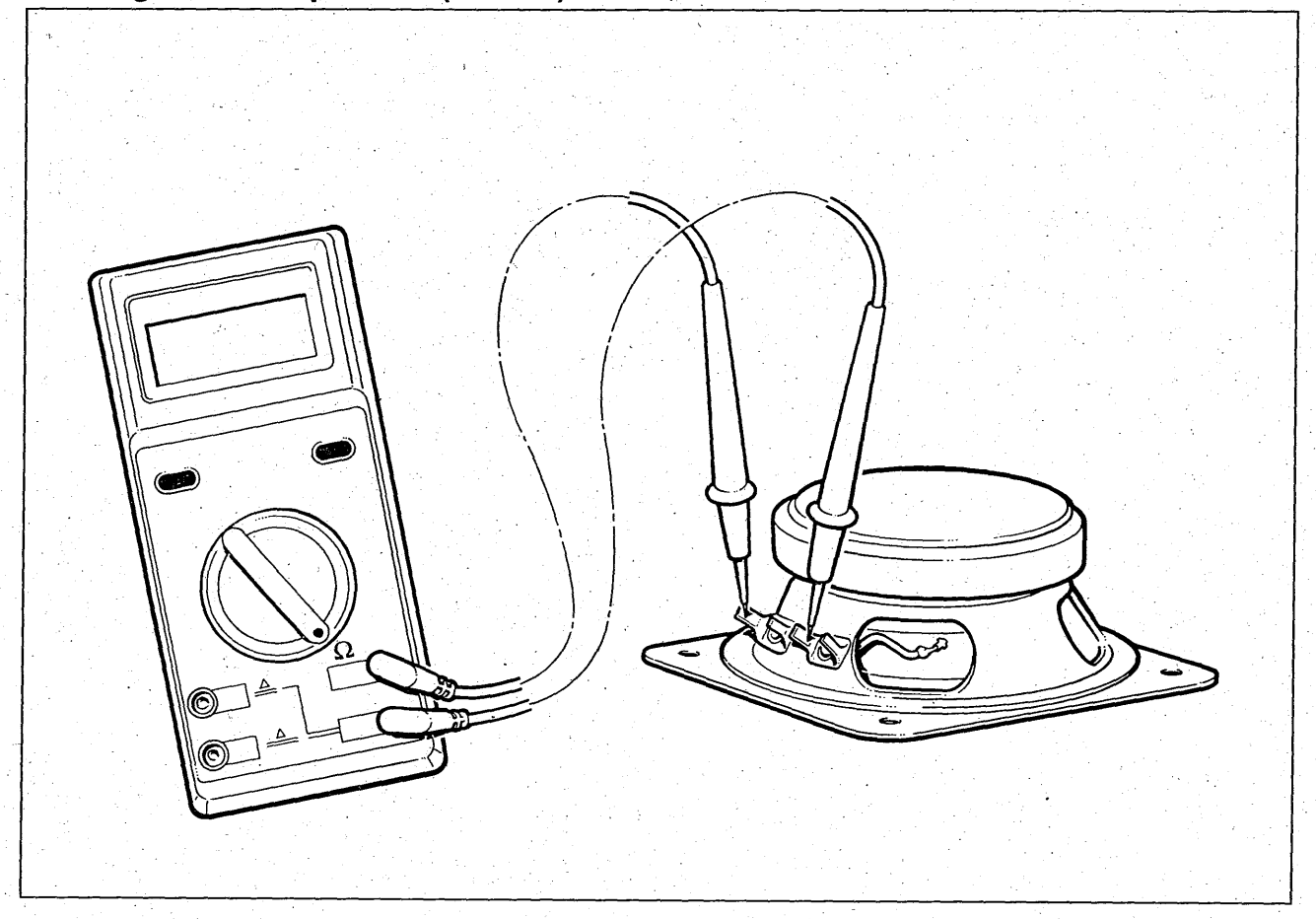
Audio system

Fault diagnosis (-M1994)

Fault symptom	Probable cause	See 3:5, page
No sound at all. Radio display does not light up. The LED in the front amplifier does not light up (this amplifier is only available for CC -M1991 and CD -M1992)	Faulty fuse	Action 1, page 22
CC -M1991 and CD -M1992: No sound at all Radio display lights up LED in front amplifier lights up	Break in ground connection G27	Action 2, page 23
CC/CS M1992- and CD M1993-: No sound at all Radio display lights up	DIN connector not plugged in No power supply to amplifier	Action 8, page 29
CC -M1991 and CD -M1992: No bass sound Weak sound in other loudspeakers	The DIN cable is not connected No power supply to amplifier	**CC -M1991:** Action 3, page 24 **CD -M1992:** Action 4, page 25
CC -M1991 and CD -M1992: No bass sound Normal sound in other speakers	Fuse in bass amplifier blown	**CC -M1991:** Action 5, page 26 **CD -M1992:** Action 6, page 27
CC -M1991 and CD -M1992: Bass sound OK, but no sound from one of the four speakers, FL, FR, RL, RR	Break in speaker circuit	Action 7, page 28
CC/CS M1992- and CD M1993-: No sound from one of the four speakers, FL, FR, RL, RR	Break in speaker circuit	Action 7, page 28
Crackling or scraping noise, loud and sometimes pulsating popping	DIN connector poorly connected	**CC -M1991:** Action 3, page 24 **CD -M1992:** Action 4, page 25 **CC/CS M1992- and CD M1993-:** Action 8, page 29
CC -M1991 and CD -M1992: Loud low-frequency clicking noise	Poor contact in ground connection G27	Action 2, page 23

Audio system (contd.)

Readings across speakers (-M1994)

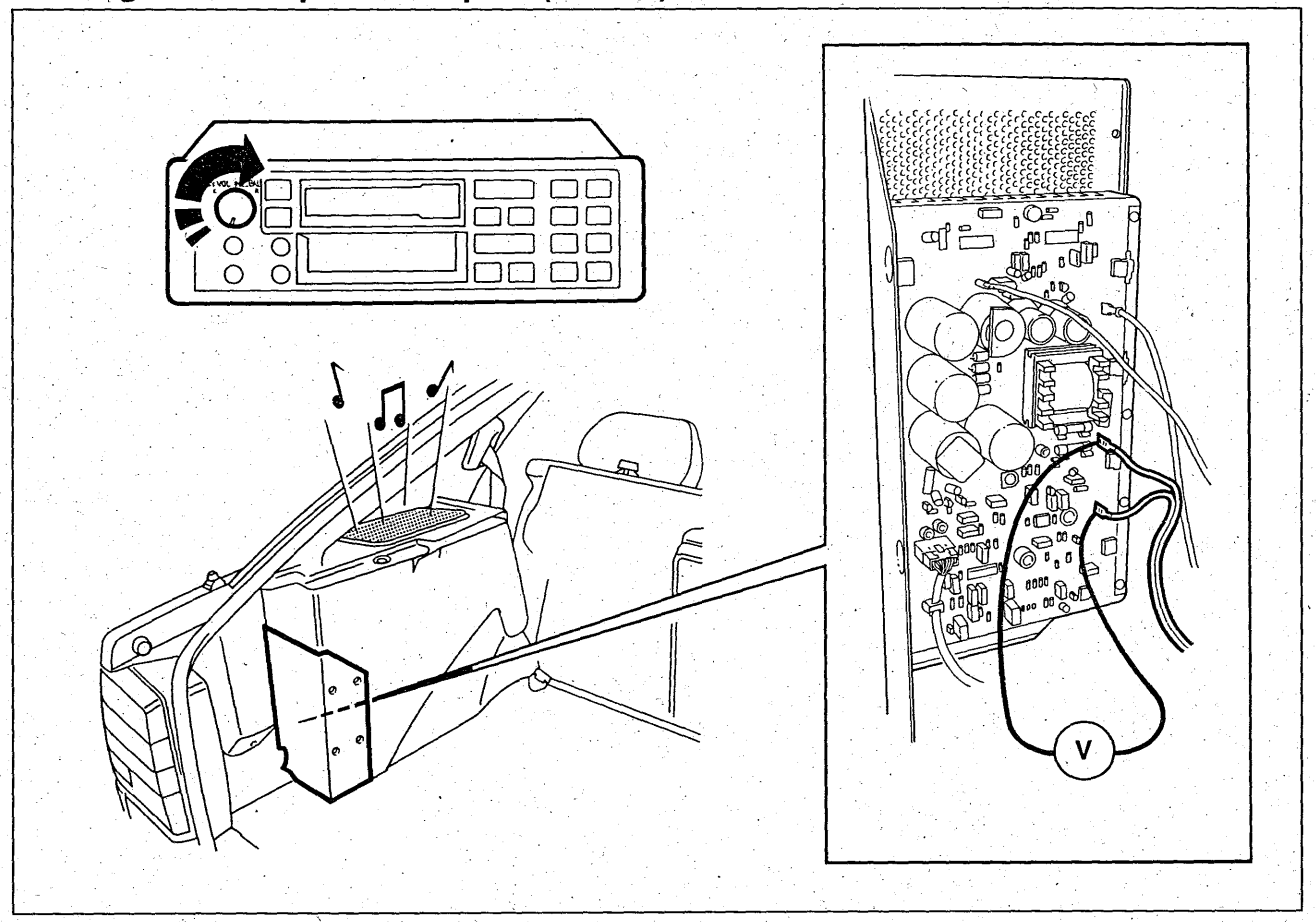


Speaker coil resistance is measured between the speaker
connecting pins with connectors, filters and capacitors disconnected.

Loudspeakers	Reading
Front bass treble	3.0-4.0 Ohms 7.0-8.0 Ohms
CC -M1991 and CD -M1992: Rear bass Rear mid-range Rear tweeter	 6.0-7.0 Ohms 3.0-4.0 Ohms 2.5-3.5 Ohms
CC/CS M1992- and CD M1993-: Rear bass Rear tweeter	 3.0-4.0 Ohms 3.0-4.0 Ohms

Audio system (contd.)

Readings across speaker outputs (-M1994)



	Reading
The speaker outputs on the amplifiers are read with the speakers connected and with speech or music as the source.	0 between 5 and 10 V ~ depending on speaker type, programme material and volume setting.

The reading can be used only to check that the amplifier produces an output signal.
The signal level cannot be used as an indication of a good or bad amplifier.

Audio system (contd.)

Diagnostic trouble codes (M1995-)

If there are any diagnostic trouble codes in the system, these will be shown as diagnostic trouble codes on the display.

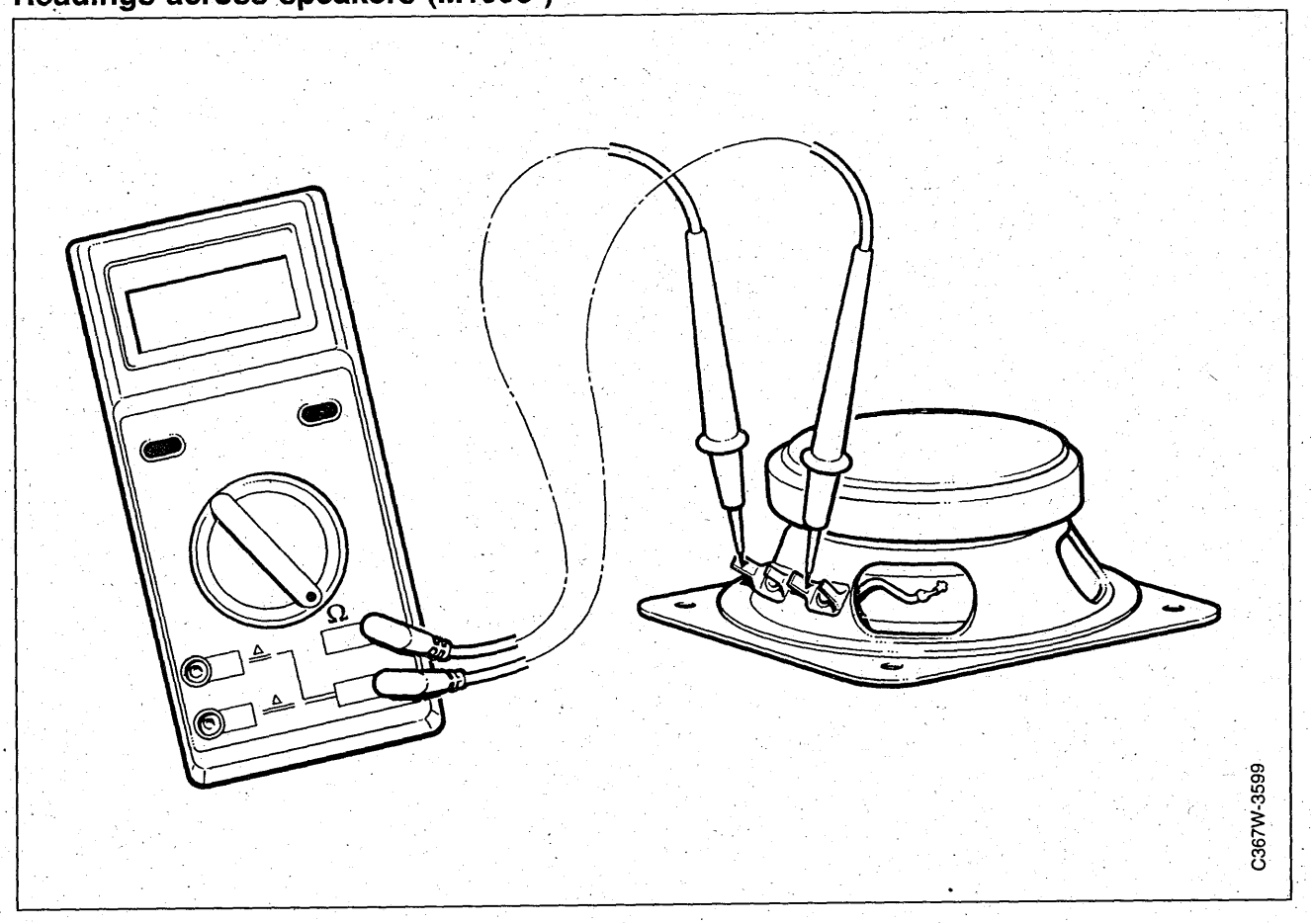
Diagnostic trouble code	Fault symptom	See 3:5, page
TAPE ER8	Cassette cannot be removed	18
TUN ER99	Fault in radio RDS function (not US)	18
CDAC ER1	The internal battery in the CD changer is dead	19
CDAC ER2	Mechanical fault in CD changer.	19
CDAC ER3	Compact disc fault.	20
CDAC ER5	Wrong type of compact disc in the CD changer.	20
CDAC ER6	Compact disc wrong way up.	21

Fault diagnosis without diagnostic trouble codes

Action No.	Fault symptom	See 3:5, page
1	No sound at all. Radio display does not light up. No power.	22
2	No sound at all. Radio display does not light up. (No ground.)	23
3	No sound at all. Radio display lights up.	24
4	No sound from one of the speakers.	25
5	Poor sound from radio. Cassette player working normally. Aerial does not extend.	26
6	Crackling or scraping sound, loud popping.	27
7	Nothing happens when one of the CD buttons on the radio unit is activated.	28

Audio system (contd.)

Readings across speakers (M1995-)



Voice coil resistance is measured between the speaker connecting pins with connectors, filters and capacitors disconnected.

Audio System Premium

Loudspeakers	Reading
Front mid-range treble	3.0-4.5 Ohms 5.0-7.0 Ohms
Rear bass treble	3.0-4.5 Ohms 3.0-4.5 Ohms

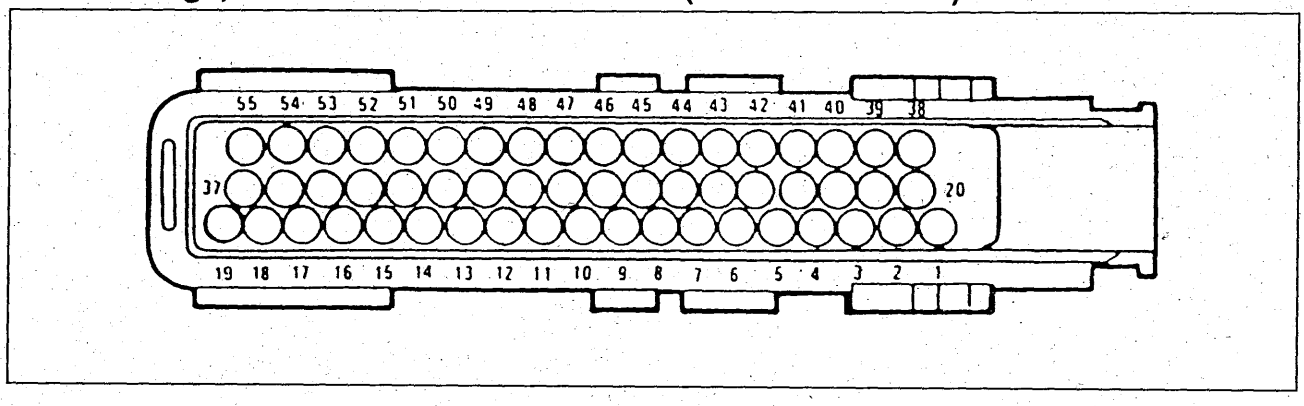
Audio System Prestige

Loudspeakers	Reading
Front mid-range treble	3.0-4.5 Ohms 3.0-4.5 Ohms
Rear bass mid-range treble	2.0-3.0 Ohms 3.0-4.5 Ohms 3.0-4.5 Ohms

Brakes

ABS Mk II

Test readings, control module connections (via breakout box)



Pin	Colour	Component/Function	In/ Out	Voltage	Remarks
1	BK	Power ground	In	0 V	
2	YE/RD	Rear inlet valve	Out	12 V 0 V	Not active Active
3	YE/WH	Power supply via main relay	In	12 V	
4-7		No connection.			
8	BU	Safety circuit (to 51)	In	5-6 V 0 V	Closed Open
9-13		No connection.			
14	YE	Pump relay, pin 87	In	12 V 0 V	relay contact closed relay contact open
15-18		No connection.			
19	BK	Signal ground	In	0 V	
20	GN/WH	Outlet valve FR	Out	12 V 0 V	Not activated Activated
21	BU/RD	Inlet valve, FL	Out	12 V 0 V	
22		No connection.			
23	YE	Data link L	In	12 V	Not activated
24-26		No connection.			
27	BK/GN	Ground, RR wheel sensor	In	0 V	
28	YE/GN	Ground, RL wheel sensor	In	0 V	
29	BU/GN	Ground, FR wheel sensor	In	0 V	
30	GY/GN	Ground, FL wheel sensor	In	0 V	
31		No connection.			
32	BU	Brake light signal	In	12 V 0 V	Brake applied Brake not applied
33	YE	Power supply via main relay	In	12 V	

Pin	Colour	Component/Function	In/ Out	Voltage	Remarks
34	GN	Operating current, main relay	Out	approx. 1 V 12 V	Activated Not activated
35		No connection.			
36	BU/WH	Rear outlet valve	Out	12 V 0 V	Not activated Activated
37		No connection.			
38	RD/WH	FR inlet valve	Out	12 V 0 V	Not activated Activated
39	BK	Main valve	Out	12 V 0 V	Not activated Activated
40-41		No connection.			
42	BU	Data link K	Out	approx. 10 V	
43-44		No connection.			
45	-	RR Wheel sensor	In	0-2.5 V	output signal (AC) *)
46	-	RL wheel sensor	In	0-2.5 V	output signal (AC) *)
47	-	FR Wheel sensor	In	0-2.5 V	output signal (AC) *)
48	-	FL Wheel sensor	In	0-2.5 V	output signal (AC) *)
49		No connection.			
50	BK	Pump relay, pin 85	Out	approx. 1 V 12 V	Activated Not activated
51	BN	Safety circuit (to 8)	Out	5-6 V approx. 1.5 V	Closed Open
52	WH	ANTI LOCK warning lamp	Out	12 V approx. 1.7 V	Off On
53	RD	Power supply (+54 circuit)	In	12 V	
54	BN/WH	FL outlet valve	Out	12 V 0 V	Not activated Activated
55		No connection.			

**) Voltage varies according to wheel speed*

ABS Mk II (contd.)

Diagnostic trouble codes, system test unit

Diagnostic trouble code	Pin No.	Malfunction	See 5:2, page
E001	1	No ground connection	590-27
E002	2	No battery voltage or voltage too low	590-28
E320	3,20	Main relay, function	590-29
E422	4,22	No signal from RR wheel speed sensor	590-30
E523	5,23	No signal from FL wheel sensor	590-30
E624	6,24	No signal from RL wheel sensor	590-30
E725	7,25	No signal from RF wheel sensor	590-30
E008	8	Main relay, no control	590-31
E009	9	Brake fluid level low, brake fluid pressure low	590-32
E010	10	Control module fault	590-32
E011	11	No ground connection	590-33
E014	14	Fault, pump relay/pressure switch	590-34
E015	15	Inlet valve, FR	590-35
E016	16	Rear outlet valve	590-35
E017	17	Rear inlet valve	590-35
E018	18	Main valve	590-35
EE22	sensor	Distance between wheel sensor and toothed wheel not constant, RR	590-36
EE23	sensor	Distance between wheel sensor and toothed wheel not constant, FL	590-36
EE24	sensor	Distance between wheel sensor and toothed wheel not constant, RL	590-36
EE25	sensor	Distance between wheel sensor and toothed wheel not constant, FR	590-36
E032	32	Fault, pump relay	590-37
E132	1,32	Hydraulic pump constantly activated	590-38
E033	33	Outlet valve, FL	590-35
E034	34	Outlet valve, FR	590-35
E035	35	Inlet valve, FL	590-35
PRES	ext	Accumulator pressure too low	590-39

If several diagnostic trouble codes are displayed in combination, they should be investigated and rectified in the following order:

E002	EE24	E001	E033
E442	EE25	E009	E034
E523	E011	E010	E035
E624	E008	E015	E132
E725	E320	E016	PRES
EE22	E014	E017	
EE23	E032	E018	

ABS Mk II (contd.)

Diagnostic trouble codes, self-diagnosis (-M1989)

The control module has no inbuilt self diagnostics, but by temporarily changing to a control module with part number 40 02 176, diagnostic trouble codes can be read using the ANTI LOCK lamp.

1 Remove the ABS control module.
2 Remove the casing from the connector and connect an extra cable to pin 26 (with terminal 91 20 957). Run the cable out of the casing.
3 Press the control pin out of the new control module, connect and fit.
4 Drive the car until the ANTI LOCK lamp lights up and stays on.
5 Turn the ignition switch to OFF and ground the cable.
6 Turn the ignition switch to ON, disconnect the cable from ground and read the diagnostic trouble codes using the ANTI LOCK lamp, see page 188.
7 After reading the diagnostic trouble codes, the original control module should be refitted.

ABS Mk II (contd.)

Diagnostic trouble codes, self-diagnosis (M1990-)

Fault tracing on the ABS using flash-lamp codes is not a replacement for fault diagnosis with the ABS system test unit, but may be a good complement.

Reading flash-lamp codes

1 With the car stationary and the ignition switch in the OFF position, short the data link connector using a suitable lead with the insulation stripped off the ends.

2 Turn the ignition switch to ON. Remove the lead from the data link connector and keep an eye on the ANTI LOCK warning lamp, which now starts flashing.

Reading diagnostic trouble codes can be interrupted at any time by again shorting the data link connector or by turning the ignition switch to OFF.

3 If there is a valve fault, the diagnostic trouble code is displayed only once and the ANTI LOCK lamp then lights continuously. In order to repeat the reading, repeat points 1 and 2 above.

Important

If several valve diagnostic trouble codes are stored, the first fault read must be rectified before the next fault can be read.

In the case of a wheel sensor fault, the diagnostic trouble code will be displayed repeatedly.

Important

If several sensor diagnostic trouble codes are stored, the data link connector must be shorted after each diagnostic trouble code is read in order to proceed to the next.

If there are both valve and sensor faults stored in the control module memory, the valve faults are always read first.

When the data link connector is shorted after the last stored diagnostic trouble code, the ANTI LOCK lamp gives long flashes. If the data link connector is shorted once more, the ANTI LOCK lamp goes over to continuously lit, which means that the fault must be rectified and the diagnostic trouble code cleared.

If there are no diagnostic trouble codes stored in the ABS control module memory, the code 4444 is displayed.

4 To clear the control module memory after a repair, drive the car at a speed of >30 km/h.

Important

In order to be cleared, the diagnostic trouble codes must have been read.

If the ANTI LOCK lamp lights constantly, despite action being taken and the diagnostic trouble code being cleared, there is still some fault remaining in the system.

ABS Mk II (contd.)

Diagnostic trouble codes, self-diagnosis (contd.)

Diagnostic trouble code	Control module Pin No.	Valve block Pin No.	Faulty function/component	Action
1111	-	-	Control module fault	*)
1112	35	2	Inlet valve, FL (IFL)	*)
1114	15	7	Inlet valve, FR (IFL)	*)
1122	17	5	Inlet valve, rear (IR)	*)
1132	16	3	Outlet valve, FL (OFL)	*)
1134	34	6	Outlet valve, FR (OFR)	*)
1142	33	4	Outlet valve, rear (OR)	*)
1222	18	Main valve (MV) connector, pin 1		*)
1233	5, 23	-	Wheel sensor, FL, no signal	*)
1241	7, 25	-	Wheel sensor, FR, no signal	*)
1243	4, 22	-	Wheel sensor, RR, no signal	*)
1311	6, 24	-	Wheel sensor, RL, no signal	*)
1312	9, 10	-	Safety circuit for pressure and level sensor, shorting to +12 V	*)
4444	-	-	System OK, no diagnostic trouble codes in control module memory	*)

*)Action, see SI 590-1131

ABS Mk II (contd.)

Diagnostic trouble codes, ISAT scan tool

All readings on the system are taken with breakout box (BOB) connected.

Important

If no diagnostic trouble codes can be read from the system despite warning lamps being lit, start by checking the safety circuit (pins 8-51)

⚠ WARNING

The breakout box must not be used when driving. Remember that the brake system is a safety system.

Permanent	Intermittent	Component/Signal	Action
32251	22251	Main relay not working properly	*)
	234B1	FL outlet valve, hydraulic fault	*)
	234B2	FR outlet valve, hydraulic fault	*)
	234B3	Rear outlet valve, hydraulic fault	*)
	234B4	Rear outlet valve, hydraulic fault	*)
	2422A	FL wheel speed sensor, faulty signal (>40 km/h)	*)
	2422B	FR wheel speed sensor, faulty signal (>40 km/h)	*)
	2422C	RL wheel speed sensor, faulty signal (>40 km/h)	*)
	2422D	RR wheel speed sensor, faulty signal (>40 km/h)	*)
44221	24221	FL wheel speed sensor, no signal	*)
44222	24222	FR wheel speed sensor, no signal	*)
44223	24223	RL wheel speed sensor, no signal	*)
44224	24224	RR wheel speed sensor, no signal	*)
	24251	FL wheel speed sensor, faulty signal (compare wheel speed)	*)
	24252	FR wheel speed sensor, faulty signal (compare wheel speed)	*)
	24253	RL wheel speed sensor, faulty signal (compare wheel speed)	*)
	24254	RR wheel speed sensor, faulty signal (compare wheel speed)	*)
	24291	FL wheel speed sensor, faulty signal (<40 km/h)	*)
	24292	FR wheel speed sensor, faulty signal (<40 km/h)	*)
	24293	RL wheel speed sensor, faulty signal (<40 km/h)	*)
	24294	RR wheel speed sensor, faulty signal (<40 km/h)	*)
53421	33421	FL inlet valve, not working	*)
53422	33422	FL outlet valve, not working	*)
53423	33423	FR inlet valve, not working	*)
53424	33424	FR outlet valve, not working	*)
53425	33425	Rear inlet valve, not working	*)
53426	33426	Rear outlet valve, not working	*)
53427	33427	Main valve, not working	*)
	36522	Safety circuit pins 8-51, shorting to +12 V	*)
	775B1	Control module fault	*)
	775B2	Control module fault, RAM	*)

*) See Service Information 590-1642, which deals with fault diagnosis of the ABS Mk II using an ISAT scan tool and describes how to rectify the fault.

ABS Mk II (contd.)

Command codes, ISAT scan tool

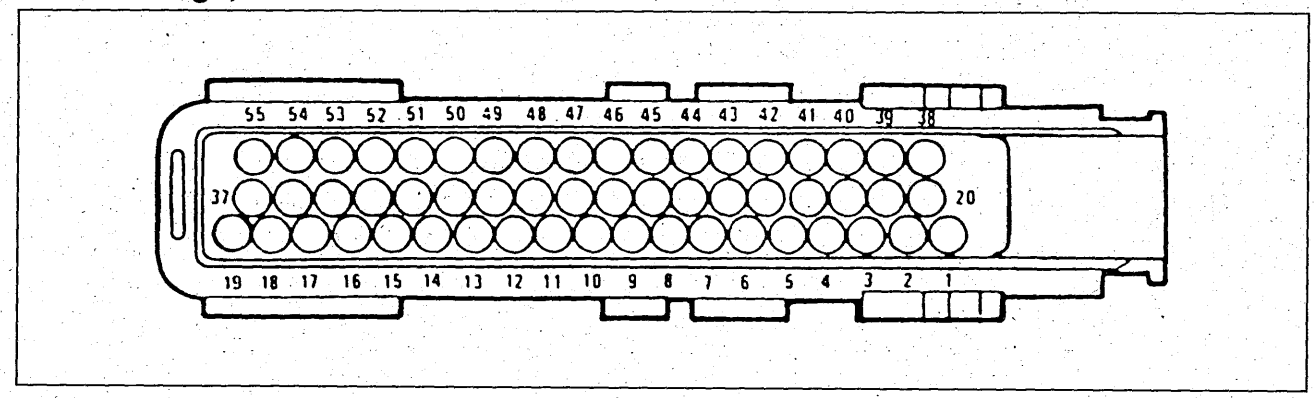
Important

In cases where command codes are used for tests while the car is being driven, remember that contact between the ISAT scan tool and the control module is broken when speed exceeds 20 km/h.

Code	Function/component	Display text
259	Reads speed signal from FL wheel speed sensor	Example: 80020 = 20 km/h
25A	Reads speed signal from FR wheel speed sensor	Example: 80020 = 20 km/h
25B	Reads speed signal from RL wheel speed sensor	Example: 80020 = 20 km/h
25C	Reads speed signal from RR wheel speed sensor	Example: 80020 = 20 km/h
201	Gives status of pressure and level warning switch (safety circuit)	8B100 = closed 8B000 = open
202	Gives status of brake light switch	8B100 = closed 8B000 = open
800	Communication over	
900	Clears all diagnostic trouble codes	

ABS Mk IV

Test readings, control module connections



Pin	Colour	Component/Function	In/ Out	Voltage	Remarks
1	BK	Ground 1	In	0 V	G 15
2	YE/RD	FL outlet valve	Out	PWM neg.	Ref 12 V
3	GN/RD	Power supply (+30 circuit)	In	12 V	
4-8		No connection.			
9	GN	Wheel speed signal RR	Out		To ASR (PWM signal)
10	YE	Wheel speed signal FL	Out		To ASR (PWM signal)
11	BU	Wheel speed signal FR	Out		To ASR (PWM signal)
12	GY	Wheel speed signal RL	Out		To ASR (PWM signal)
13-14		No connection.			
15	BU	Pump relay, pin 85	Out	0 V	Relay ground ref. 12 V (off)
16	BU	Pedal position sensor	In	1-10 V	Depending on position
17		No connection.			
18	BN/RD	Outlet valve RR	Out	PWM neg.	Ref 12 V
19	BK	Ground 2	In	0 V	G 15
20	GN/WH	Inlet valve, FL	Out	PWM neg.	Ref 12 V
21	BU/RD	Outlet valve FR	Out	PWM neg.	Ref 12 V
22		No connection.			
23	YE	Data link L	In		Pin 4
24-26		No connection.			
27	BK/GN	RR Wheel sensor	Out	0 V	Ref. ground
28	YE/GN	RL wheel sensor	Out	0 V	Ref. ground
29	BU/GN	FR Wheel sensor	Out	0 V	Ref. ground
30	GN/GY	FL Wheel sensor	Out	0 V	Ref. ground
31	BK	Pump sensor	Out	approx. 0.7 V ac	Active
32	BU	Brake light switch	In	12 V	0 V off
33	YE	Power supply (+30 circuit)	In	12 V	Over main relay
34	GN	Main relay ground	Out	0 V	Ref 12 V pin 85
35		No connection.			
36	BU/WH	Outlet valve FR	Out	PWM neg.	Ref 12 V
37		No connection.			
38	RD/WH	FR inlet valve	Out	PWM neg.	Ref 12 V

Pin	Colour	Component/Function	In/ Out	Voltage	Remarks
39		No connection.			
40		No connection.			
41	GN	Pedal position sensor	Out	0 V	Ground
42	BU	Data link K	Out		Pin 1
43-44		No connection.			
45	GN	RR Wheel sensor	In	0.15-0.70 V	AC Signal, sine wave
46	GN	RL wheel sensor	In	0.15-0.70 V	AC Signal, sine wave
47	GN	FR Wheel sensor	In	0.15-0.70 V	AC Signal, sine wave
48	GN	FL Wheel sensor	In	0.15-0.70 V	AC Signal, sine wave
49	WH	Pump sensor	In	approx. 0-0.8 V	AC signal
50-51		No connection.			
52	WH	ABS warning lamp ground	Out	0 V	Ref 12 V off
53	RD	Power supply (+54 circuit)	In	12 V	+54
54	BN/WH	Inlet valve RL	Out	PWM neg.	Ref 12 V
55	GY/RD	Inlet valve RR	Out	PWM neg.	Ref 12 V

ABS Mk IV (contd.)

Diagnostic trouble codes, ISAT scan tool

Permanent	Intermittent	Component/Signal	See 5:2, page
42251	22251	Main relay not working properly	590-8
	2422A	FL wheel speed sensor, no signal (>40 km/h)	590-10
	2422B	FR wheel speed sensor, no signal (>40 km/h)	590-12
	2422C	RL wheel speed sensor, no signal (>40 km/h)	590-14
	2422D	RR wheel speed sensor, no signal (>40 km/h)	590-16
44221	24221	FL wheel speed sensor, no signal	590-10
44222	24222	FR wheel speed sensor, no signal	590-12
44223	24223	RL wheel speed sensor, no signal	590-14
44224	24224	RR wheel speed sensor, no signal	590-16
	24251	FL wheel speed sensor, faulty signal (compare wheel speed)	590-10
	24252	FR wheel speed sensor, faulty signal (compare wheel speed)	590-12
	24253	RL wheel speed sensor, faulty signal (compare wheel speed)	590-14
	24254	RR wheel speed sensor, faulty signal (compare wheel speed)	590-16
	24291	FL wheel speed sensor, no signal (<40 km/h)	590-10
	24292	FR wheel speed sensor, no signal (<40 km/h)	590-12
	24293	RL wheel speed sensor, no signal (<40 km/h)	590-14
	24294	RR wheel speed sensor, no signal (<40 km/h)	590-16
	24791	Pump fault, not working despite control signal	590-32
44792	24792	Pump fault, working without control signal	590-33
45721	25721	Pedal position sensor	590-31
	334B1	FL outlet valve, hydraulic fault	590-19
	334B2	FR outlet valve, hydraulic fault	590-21
	334B3	Outlet valve RL, hydraulic fault	590-23
	334B4	Outlet valve RR, hydraulic fault	590-25
53421	33421	FL inlet valve, not working	590-18
53422	33422	FL outlet valve, not working	590-19
53423	33423	FR inlet valve, not working	590-20
53424	33424	FR outlet valve, not working	590-21
53425	33425	Inlet valve RL, not working	590-22
53426	33426	Outlet valve RL, not working	590-23
53427	33427	Inlet valve RR, not working	590-24
53428	33428	Outlet valve RR, not working	590-25
	775B1	Control module fault	590-26
	775B2	Control module fault, RAM	590-27
E75B1		Hydraulic fault	590-34

ABS Mk IV (contd.)

Command codes, ISAT scan tool

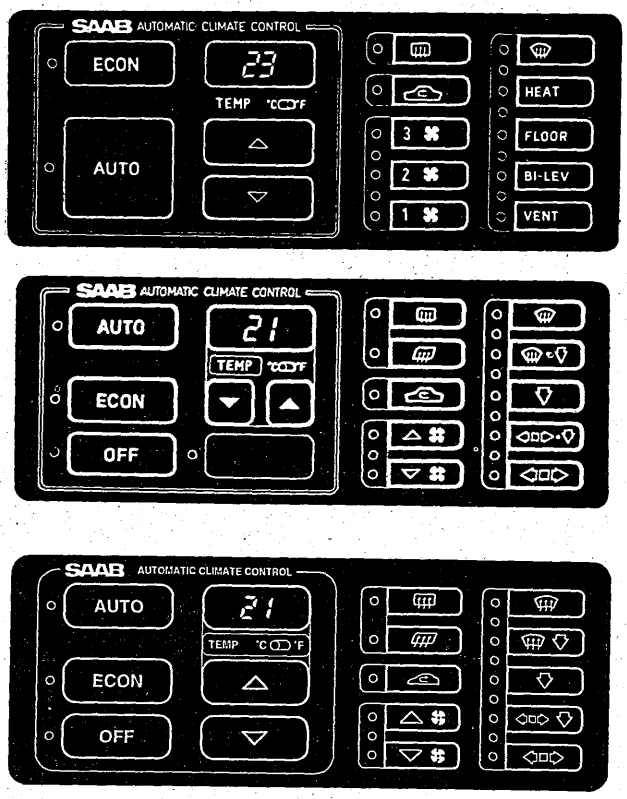
Important

In cases where command codes are used for tests while the car is being driven, remember that contact between the ISAT scan tool and the control module is broken when speed exceeds 20 km/h.

Code	Function/component	Display text
100	Reads all stored diagnostic trouble codes	
201	Pedal position sensor	8B X00 (X=1-7, where 1=pedal not depressed 6=pedal fully depressed 7=hydraulic fault)
202	Brake light switch	8B 000/8B 100 (100=closed, 000=open)
259	FL wheel speed	8B 0XX (XX=km/h)
25A	Wheel speed FR	8B 0XX
25B	RL Wheel speed	8B 0XX
25C	Wheel speed RR	8B 0XX
800	Communication over	
900	Clears all diagnostic trouble codes	11111

Body

ACC



ACC (-M1989)

In order to avoid damage to the electronic circuits in the ACC control module, take the following action:

- Whenever working on the ACC unit, always detach the negative battery lead.
- When arc welding, detach the negative battery cable and the regulator connection and unplug the 25-pin connector from the climate control module.
- When taking readings and diagnosing faults, the 25-pin connector for the climate control module should be detached.
- M1988 and later:

  The heat sink on the ventilation fan speed control is live (+12V) when the ignition is on. If the heat sink is grounded, the speed control is destroyed.

When conducting fault diagnosis (AUTO and VENT pressed simultaneously), the climate control module runs a program. The display then shows the number of faults and gives a diagnostic trouble code for each one.

ACC II (M1990-)

When taking readings and conducting fault diagnosis, both the connectors (one 39-pin and one 12-pin) should be unplugged. All readings should be taken on the connectors and not on the ACC control module.

Stored diagnostic trouble codes in the self-test program can be read using the ISAT scan tool. The number of faults stored is shown on the display for 6 seconds when the ignition is switched on.

ACC (contd.)

Diagnostic trouble codes (-M1989), self-diagnostics

Press AUTO and VENT at the same time and then release them. The ACC control module will then run through a fault diagnosis program (taking about 40 seconds), which is indicated by 88 flashes on the display. After fault diagnosis, the number of faults is shown on the display. Press VENT to read the first diagnostic trouble code. Press again for the next diagnostic trouble code.
Press AUTO to leave the diagnostics mode.

Code	Component/Function	Cause of fault
1C	Cabin temperature sensor	Short circuit
1U	Cabin temperature sensor	Break in circuit
2C	Outside temperature sensor	Short circuit
2U	Outside temperature sensor	Break in circuit
3C	Air mixture sensor	Short circuit
3U	Air mixture sensor	Break in circuit
5C	Air mixing damper motor	Wrong direction of rotation
5U	Air mixing damper motor	Other fault
6C	Air distribution damper motor	Wrong direction of rotation
6U	Air distribution damper motor	Other fault
7C	Motor for recirculation damper	Internal short circuit or blockage
7U	Motor for recirculation damper	Break or short circuit to ground
AC	Control signal in cable 635	Break or short circuit to ground/battery positive (B+)
AU	Ventilation fan motor/speed control	Break in main circuit, motor blocked or fault in speed control
EU	Climate control	

ACC (contd.)

Diagnostic trouble codes (M1990), ISAT scan tool

Permanent	Intermittent	Faulty component/signal
41021	21021	Outside temperature, no signal from EDU
41321	21321	Heater damper motor, current consumption too high
41421	21421	Distribution damper motor, current consumption too high
41621	21621	Solar sensor, communication fault with ACC (no signals)
41631	21631	Solar sensor, component fault.
41D21	21D21	Blended air sensor and interior air sensor, break in sensor ground or short circuit to battery positive (B+)
41E21	21E21	Blended air sensor, break to ACC or short circuit to battery positive (B+)
41F21	21F21	Interior air sensor, break to ACC or short circuit to battery positive (B+)

ACC (contd.)

Diagnostic trouble codes (M1990-1994), ISAT scan tool

ACC unit version is shown on the ISAT scan tool display.

VERSION 2.00
VERSION 2.01
VERSION 2.02

Version	Permanent	Intermittent	Faulty component/signal	See 8:3, page
2.00 2.01	42521	22521	Blended air and interior temperature sensor: Short circuit to battery positive (B+) or lower (pin 2 or 22) Short circuit to battery positive (B+) or more gives 42521 together with 46322 or 46323, or 22521 together with 26322 and 26323, respectively	96
2.00 2.01	46322	26322	Blended air temperature sensor: Break (pin 21 or 22) or short circuit to battery positive (B+) (pin 21)	98
2.00 2.01	46323	26323	Interior temperature sensor: Break (pin 1 or 2) or short circuit to battery positive (B+) (pin 1)	100
2.00 2.01	46391	26391**)	Outside temperature signal from EDU: Communication fault, no temperature pulses. Break or short circuit to ground or battery positive (B+)	102
2.01	53221	33221	Electrically heated rear window, relay: Break, short circuit to battery positive (B+), electrically heated rear window disconnected	104
2.01	53222	33222**)	A/C relay or injection system control module: Short circuit to battery positive (B+) (in ECON mode)	104
2.01	53271	33271	Electrically heated rear window: Short to ground, window connected	104
2.01	53272	33272	A/C relay or injection system control module: Short to ground (in AUTO mode)	104
	53421*)	33421*)	Solenoid valve, rear A/C valve: Open circuit	
2.01	53621	33621	Recirculation flap motor: Short circuit to battery positive (B+)	106
2.00 2.01	53623	33623	Air distribution damper motor: Short circuit to battery positive (B+), open circuit, bridge or internal short circuit in the ACC unit	108
2.00	53623 53673	33623 33673	Air distribution damper motor: Short circuit to battery positive (B+), open circuit, bridge or internal short circuit in the ACC unit	108
2.00 2.01	53624	33624	Air blending flap motor: Short circuit to battery positive (B+), open circuit, bridge or internal short circuit in ACC unit	110
2.01	53624 53674	33624 33674	Air blending flap motor: Short circuit to battery positive (B+), open circuit, bridge or internal short circuit in ACC unit	110
2.01	53671	33671	Recirculation flap motor: Short to ground	106

Version	Permanent	Intermittent	Faulty component/signal	See 8:3, page
2.01	53672	33672	Interior temperature sensor, fan: Short circuit to ground	111
2.01	53673	33673	Air distribution damper, motor: Short to ground	108
2.01	53674	33674	Air blending damper, motor: Short to ground	110
2.00 2.01	66891	-	Solar sensor: Component fault.	113
2.00 2.01	E6891	D6891**)	Solar sensor: Communication fault, no pulses. Break, short circuit to ground or battery positive (B+)	113

*)The diagnostic trouble code may be generated without any fault actually existing and should be dealt with as follows:

1 Clear the DTCs using ISAT scan tool.

2 Start the car and check whether the diagnostic trouble codes recur.
- If they do not, no further action is required.
- If the diagnostic trouble codes do recur, carry out fault diagnosis as described in Service Manual 8:3 "Climate control system".

**)Diagnostic trouble codes may be generated as the result of an incorrectly adapted wiring harness, see 8:3, page 222.

ACC (contd.)

Command codes (M1990-1994), ISAT scan tool

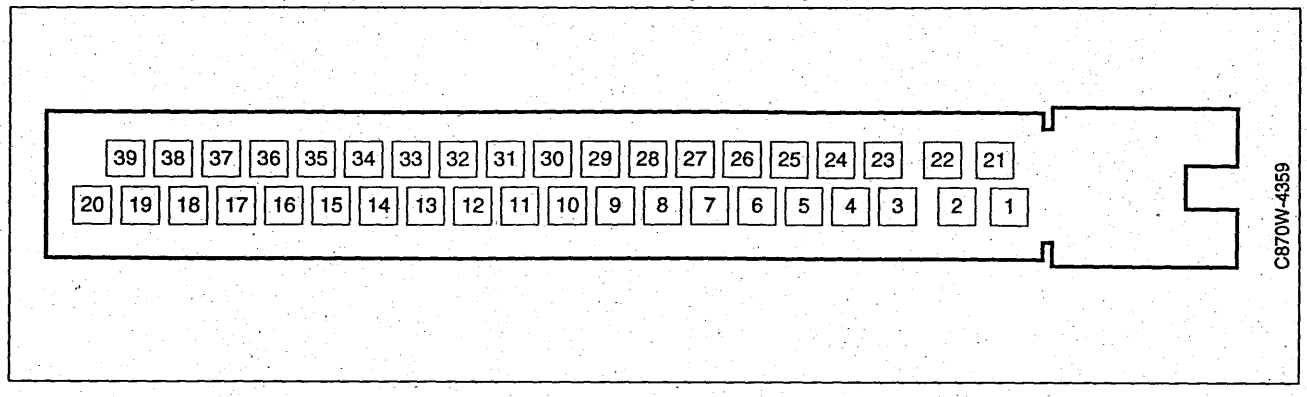
Code	Description
100	Send all stored diagnostic trouble codes
229	Battery voltage to ACC unit, voltage range 0-26.5 V
22A	Fan speed control, signal, 0-5 V
22B	Control signal for rear A/C fan speed control 0 - 5 V
250	Cabin temperature, +10°C - +40°C
251	Outside temperature, -44°C - +50°C
252	Blended air temperature, 0°C - +80°C
270	Control of LED brightness via photo transistor, 0% (dark) - 100% (light)
279	Desired position of air recirculation flap motor, "Fresh air" or "Recirculation"
27A	Desired position of air mixture damper motor, 0% (LO) - 100% (HI)
27B	Desired position of air distribution damper motor, 45° ("ventilation") - 135° ("defrost")
380	Type of solar sensor: Standard or Australia
800	End communication
900	Clear all stored diagnostic trouble codes. Start self-test of ACC system and calibration of damper motors. All previously stored faults cleared.

Important

Commands 27A, 27B and 279 refer to the desired positions of damper motors. This means that it is never possible to know if the motor really has moved the damper to the desired position. This can only be checked visually.

ACC (contd.)

Test readings, control module connections (M1995-)



Unless otherwise stated, the ignition switch should be turned to ON. All readings are approximate.

Pin	Component/Function	In/ Out	Test conditions	Reading	Across	See 8:3, page
1	Ground	In		<0.4 V	1 - B-	49
2	Recirculation motor (F)	Out	Recirculation ON OFF	 1 V lower than battery positive (B+) 0 V	2 - 1	62
3	No connection (prepared for parking heater)	In				58
4	Parking heater	Out	Parking heater off on	 0 V 12 V	4 - 1	58
5	Power supply for solar sensor	Out		12 V	5 - 1	53
6	Solar sensor	In				53
7	Current (+15 circuit)	In		<0.5 V	7 - B+	49
8	No connection.					
9	Power supply for LH door fan	Out	Rear door fans, Not activated Low speed Full speed	 0 V approx. 5 V approx. 10 V	9 - 1	55
10	Power supply for RH door fan	Out	Rear door fans, Not activated Low speed Full speed	 0 V approx. 5 V approx. 10 V	10 - 1	55
11	No connection.					
12	Diagnostics	In/ Out	ISAT scan tool connected ISAT scan tool not connected	12 V 4.5-5.0 V	12 - 1	
13	No connection.					
14	Blended-air temperature sensor, ground	Out		<0.1 V	14 - 1	51

Pin	Component/Function	In/ Out	Test conditions	Reading	Across	See 8:3, page
15	Cabin temperature sensor, ground	Out		<0.1 V	15 - 1	50
16	Power supply for cabin temperature sensor fan	Out		B+	16 - 1	50
17	Power supply for fan control unit	Out		B+	17 - 1	54
18	Outside temperature signal from EDU	In		7-13 V (fluctuating)	18 - 1	52
19	No connection.					
20	Test voltage, ventilation fan	Out	Fan Not activated Full speed	 0 V 5 V	20 - 1	54
21	Recirculation motor (R)	Out	Recirculation ON OFF	 0 V 1 V lower than B+	21 - 1	62
22	Current (+30 circuit).	In		<0.5 V	22 - B+	49
23	Motor, air distributor	Out	Motor not activated	1 V lower than B+	23 - 1	61
24	Motor, air distributor	Out	Motor not activated	approx. 1 V	24 - 1	61
25	Motor, air distributor	Out	Motor not activated	1 V lower than B+	25 - 1	61
26	Motor, air distributor	Out	Motor not activated	approx. 1 V	26 - 1	61
27	Motor, blended air damper	Out	Motor not activated	1 V lower than B+	27 - 1	60
28	Motor, blended air damper	Out	Motor not activated	approx. 1 V	28 - 1	60
29	Motor, blended air damper	Out	Motor not activated	1 V lower than B+	29 - 1	60
30	Motor, blended air damper	Out	Motor not activated	approx. 1 V	30 - 1	60
31	Rheostat	In	Min. brightness Max. brightness	approx. 2 V 12 V	31 - 1	59
32	Blended air temperature sensor	In	At approx. +20°C	approx. 6.6 V	32 - 1	51
33	Cabin temperature sensor	In	At approx. +20°C	approx. 6.4 V	33 - 1	50
34	No connection.					
35	Solar sensor, ground	Out		<0.1 V	35 - 1	53
36	No connection.					
37	No connection.					
38	A/C (to EDU)	Out	AUTO MODE ECON MODE	B+ 0 V	38 - 1	
39	Electrically heated rear window	Out	Electrically heated rear window ON OFF	 B+ 0 V	39 - 1	56

ACC (contd.)

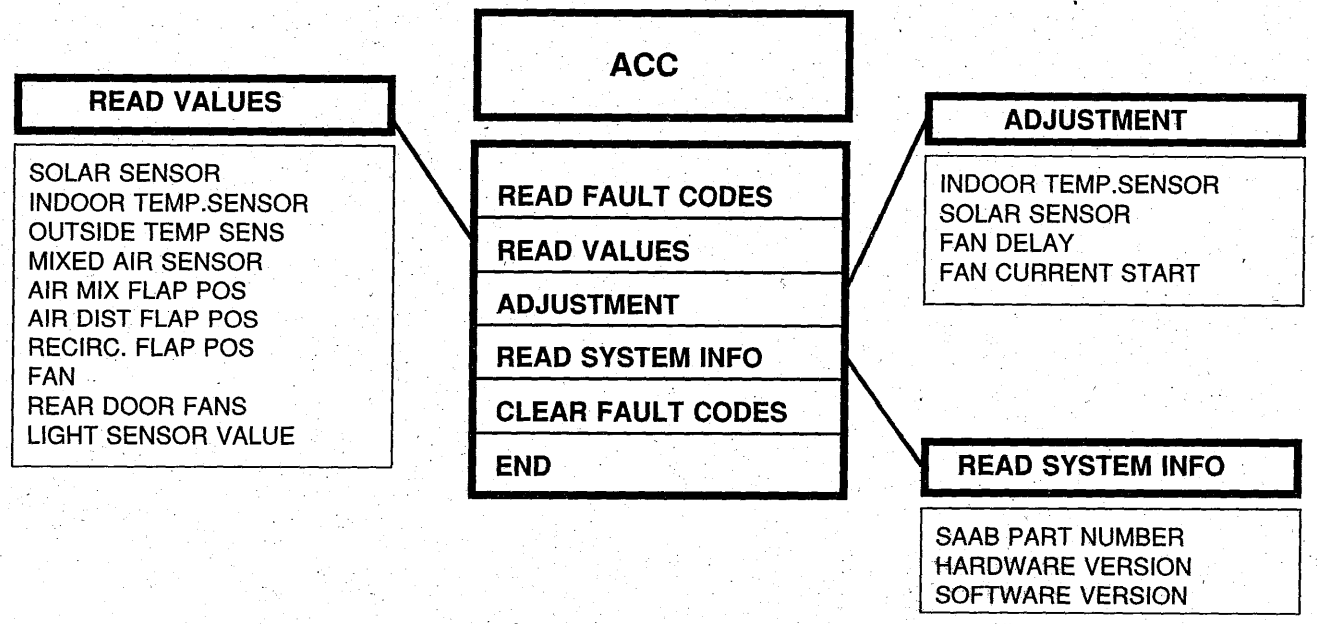
Diagnostic trouble codes (M1995-)

Diagnostic trouble code	Faulty function/component	ISAT ST display text	Action, see 8:3, page
B1341	Solar sensor, component fault.	FAULT X P/I B1341 SOLAR SENSOR COMPONENT FAULT	130
B1343	Solar sensor, open circuit/short circuit.	FAULT X P/I B1343 SOLAR SENSOR OPEN/SHORT CIRCUIT	131
B1348	Blended air temperature sensor, break/short circuit to battery positive (B+)	FAULT X P/I B1348 MIXED AIR SENSOR BREAK/SHORT BATT+	132
B1353	Cabin temperature sensor, break/short circuit to battery positive (B+)	FAULT X P/I B1353 INDOOR TEMP.SENSOR BREAK/SHORT BATT+	134
B1354	Suction fan, cabin temperature sensor, break/short circuit to battery positive (B+)	FAULT X P/I B1354 CABIN TEMP SENSOR BREAK/SHORT BATT+	136
B1355	Suction fan, cabin temperature sensor, short circuit to ground	FAULT X P/I B1355 CABIN TEMP SENSOR SHORTING TO GROUND	137
B1492	A/C, short circuit to battery positive (B+)	FAULT X P/I B1492 AC REQUEST SHORT TO BATT+	138
B1493	A/C, short to ground	FAULT X P/I B1493 AC REQUEST SHORTING TO GROUND	138
B1497	Electrically heated rear window, break	FAULT X P/I B1497 HEATED REAR WINDOW OPEN CIRCUIT	139
B1498	Electrically heated rear window, short to ground	FAULT X P/I B1498 HEATED REAR WINDOW SHORTING TO GROUND	139
B1515	Common sensor ground, short circuit to battery positive (B+)	FAULT X P/I B1515 SENSOR GROUND DEFECTIVE	140
B1605	Control module fault	FAULT X P/I B1605 ECU FAULT	141
B1746	Outside temperature sensor, break/short circuit	FAULT X P/I B1746 OUTSIDE TEMP SENS OPEN/SHORT CIRCUIT	142
B2352	Power supply for the ventilation fan, short circuit to ground.	FAULT X P/I B2352 FAN POWER SUPPLY SHORTING TO GROUND	143
B2402	Air distributor stepping motor, short circuit to ground	FAULT X P/I B2402 AIR DIST FLAP MOTOR SHORTING TO GROUND	144
B2403	Air distributor stepping motor, break (when calibrating)	FAULT X P/I B2403 AIR DIST FLAP MOTOR OPEN CIRCUIT	144
B2412	Recirculation damper motor, short to ground	FAULT X P/I B2412 RECIRC. FLAP MOTOR SHORTING TO GROUND	145
B2413	Air recirculation flap motor, short circuit to battery positive (B+)	FAULT X P/I B2413 RECIRC. FLAP MOTOR SHORT TO BATT+	145

Diagnostic trouble code	Faulty function/component	ISAT ST display text	Action, see 8:3, page
B2437	Rear door fans, shorting to ground	FAULT X P/I B2437 REAR DOOR FAN SHORTING TO GROUND	146
B2438	Rear door fans, break	FAULT X P/I B2438 REAR DOOR FAN OPEN CIRCUIT	146
B2492	Blended air flap stepping motor, shorting to ground	FAULT X P/I B2492 AIR MIX FLAP MOTOR SHORTING TO GROUND	149
B2493	Blended air flap stepping motor, break (during calibration)	FAULT X P/I B2493 AIR MIX FLAP MOTOR OPEN CIRCUIT	149
Fault with no diagnostic trouble code	Ventilation fan motor, not working/faulty control	-	150

ACC (contd.)

Menu structure for command codes (M1995-)



ACC (contd.)

READ VALUES(M1995-)

ISAT scan tool text/commands	Function
SOLAR SENSOR XXXX W/m^2	Shows solar intensity (0-1390 W/m^2).
INDOOR TEMP.SENSOR XX °C XX °F	Shows the number of degrees in Celsius and Fahrenheit for the cabin temperature sensor.
OUTSIDE TEMP SENS XX °C XX °F	Shows the number of degrees in Celsius and Fahrenheit for the outside temperature sensor.
MIXED AIR SENSOR XX °C XX °F	Shows the number of degrees in Celsius and Fahrenheit for the blended air temperature sensor.
AIR MIX FLAP POS XXX%	Shows the position of the blended air flap (0 - 100 %, where 0 % is max. cold and 100 % is max. heat).
AIR DIST FLAP POS XXX°	Shows the position of the air distributor (45-135°).
RECIRC. FLAP POS FRESH AIR MODE/RECIRC. MODE	Shows if the air recirculation flap is in the fresh air position or in the air recirculation position.
FAN CONTROL VOLTAGE X.X V	Shows the ACC control module's fan control voltage.
REAR DOOR FANS XX.X V	Shows the rear door fan voltages.
LIGHT SENSOR VALUE XXX %	Shows the current light intensity in the cabin (0 - 100 %).

ADJUSTMENT(M1995-)

ISAT scan tool text/commands	Function
INDOOR TEMP.SENSOR	Adjustment (±2.5°C) of how the ACC control module interprets the reading from the cabin temperature sensor. See 8:3, page 120.
SOLAR SENSOR	Adjustment of the solar sensor's influence on the ACC control module's control program. See 8:3, page 121.
FAN DELAY	To deactivate the ventilation fan start delay. See 8:3, page 122.
FAN CURRENT START	Adjustment of cabin fan start current. See 8:3, page 123.

READ SYSTEM INFO(M1995-)

ISAT scan tool text/commands	Function
SAAB PART NUMBER	Shows Saab part number.
HARDWARE VERSION	Shows the hardware version.
SOFTWARE VERSION	Shows software version (e.g. 2.3 for M95)

ACC (contd.)

Basic mechanical fault diagnosis

Read fault diagnosis as follows:
Find the probable cause by consulting the columns with crosses. Look up all probable causes of the fault and pick out those which you consider could be the most likely. First carry out all the "easy" checks. Note that the faults are not arranged in "order of probability".

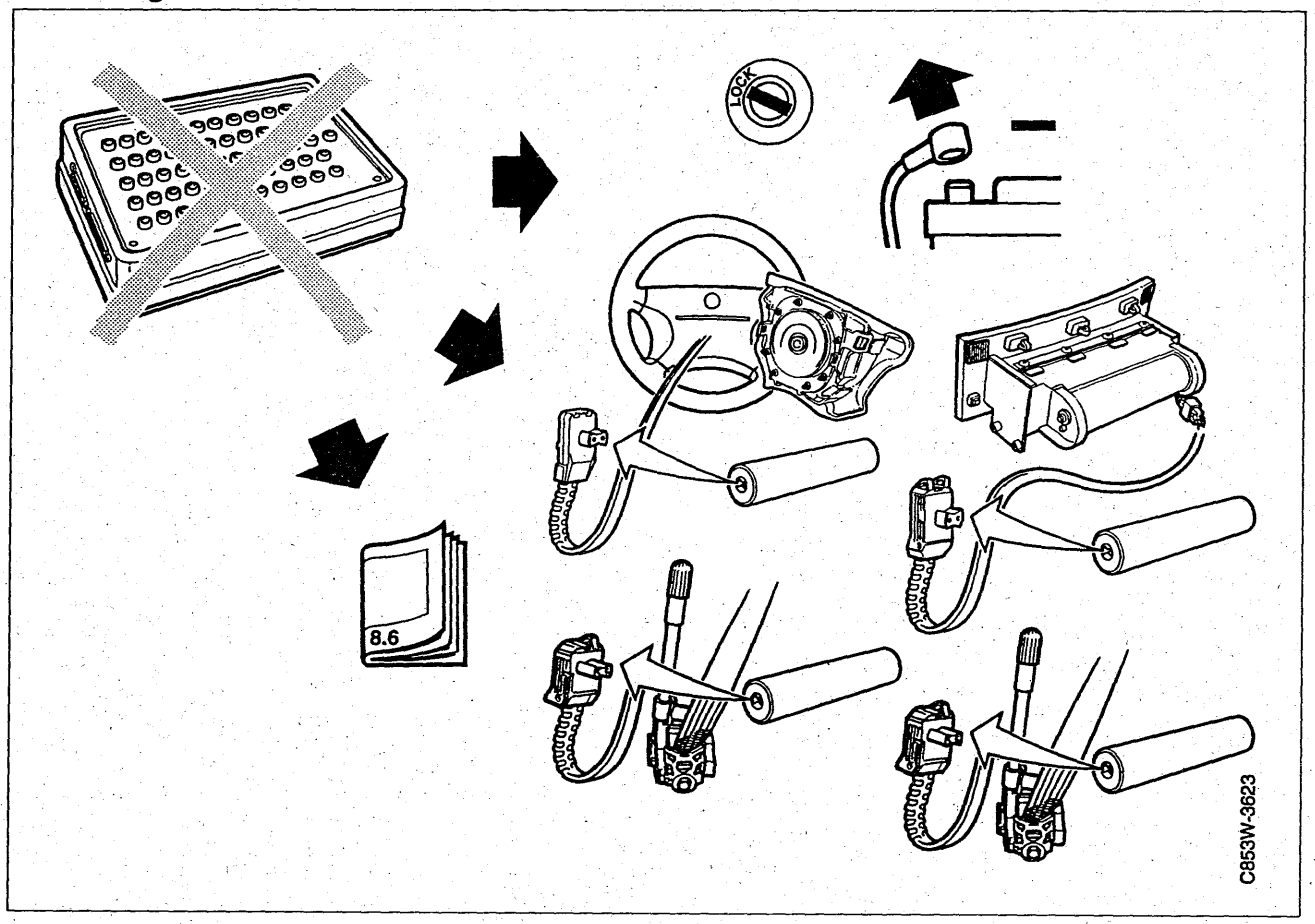
No cooling	Poor cooling	Uneven cooling	Noise	Probable cause	Action
				Electrical faults:	
X				Fuse blown	Check fuses
X				Loose electrical cable or ground connection (compressor not running)	Check all cables
X				Compressor clutch burnt out	Change clutch (see 8:3, page 277)
X				Fan motor not running	Check electrical cable and fan motor
	X	X		Fan motor not working properly (poor connection or open circuit in motor)	Check the fan motor and if necessary fit a replacement
		X	X	Open circuit or poor connection in compressor clutch winding (clutch engaging and disengaging)	Change clutch
			X	Fan motor squeaking or rubbing against fan cowling	Check the position
			X	Noise when starting rear A/C	Fit adapter wiring harness to rear A/C if not already done. See 8:3, page 241)
				Mechanical faults	
X	X		X	Drive belt poorly tensioned	Tension or change belt
	X			Air ducts blocked	Check and clean
	X			Air deflector behind front spoiler incorrectly cut out	Check and adjust cut out (see 8:3, page 304)
			X	Clutch bearing worn or poorly centred	Change bearing
			X	Noise in recirculation position at speeds above 100 km/h	Air leakage at cable lead-through (see 8:3, page 236)
			X	Clearance between pulley and electromagnetic clutch too great	Adjust the clearance. If the starting noise persists, change to driver 43 83 642 with rubber damping (see 8:3, page 277)
	X		X	Compressor worn or poorly attached	Change the compressor and tighten it properly
				System faults:	
X				Antifrost thermostat not engaging compressor	Start by checking that the thermostat is properly inserted in the evaporator. If it was correctly fitted, change it.
X				Expansion valve stuck in open position	Change expansion valve
X				System leaking	Fill system, check for leaks and seal all leaks*.

No cooling	Poor cooling	Uneven cooling	Noise	Probable cause	Action
X				Blockage in hose or component	Check flow through each component
X				No refrigerant in system	Charge system*.
	X			Air filter blocked on air side	Change filter
	X		X	Too little refrigerant in system (whistling sound in evaporator near expansion valve, bubbles in sight glass)	Drain system and recharge
	X			Expansion valve capillary tube damaged (no working medium)	Change expansion valve
	X			Receiver blocked	Change receiver
	X	X		Moisture in system. Cooling capacity good at first (several minutes), then deteriorates. Alternatively, deteriorates at high outside temperatures.	Drain system, change receiver and recharge
	X			Air in system (bubbles in sight glass). Applies to R12.	Drain system, change receiver and recharge
		X		Ice on air side of evaporator	Check that the antifrost thermostat tube is correctly inserted in the evaporator. If it was correct, change the thermostat.
		X		Looseness in antifrost thermostat	Check thermostat and change if necessary
		X		The expansion valve capillary spiral is not well positioned against the evaporator outlet tube or is poorly insulated against air temperature	Check contact and insulation
		X		Difference between antifrost thermostat switch-on and switch-off temperatures too great	Change thermostat
				System overcharged:	
			X	Causes cracking sound or vibration in the high-pressure line, gurgling sound in the compressor, excessive compressor pressure and suction pressure, hissing sound in the expansion valve, bubbles or vapour in the sight glass. If the compressor valves are damaged by overfilling, compressor pressure will be too low.	Drain system and recharge
			X	Too much moisture in the system can cause noise in the expansion valve	Drain system, change receiver and recharge

*If there is a danger of leakage, the system must not be filled completely, 200 grammes of refrigerant at most. See 8:3 "Purging/charging".

Airbag

Fault diagnosis



Before starting fault diagnosis, always do the following:

> ⚠ **WARNING**
>
> No readings may be taken on the SRS before the airbags are disconnected.

- Read the safety and handling instructions.
- Turn the ignition switch to OFF and disconnect the negative cable from the battery.
- Unplug the connector on the rear of the airbag and take apart connector H2-77 connected to the passenger airbag.
- Connect reference resistor 84 71 153 to each connector (wiring harness 86 11 378 is required for connection to the passenger airbag).
- When conducting fault diagnosis on the belt tensioners, reference resistor 84 71 153 is connected to each connector on the belt tensioners.

Also note the following:

- It is forbidden to splice SRS cables. Splicing can cause malfunctioning and render the system unserviceable, and may even cause personal injury.
- If a connector is unplugged when the ignition is ON, this is registered as a fault by the control module. The fault does not disappear until the connector is plugged in and the diagnostic trouble code has been cleared.

Airbag (contd.)

Diagnostic trouble codes (-M1991), system test units

FS 1 = Front sensor, LH
FS 2 = Front sensor, RH
Electric detonator 1 = Electric detonator for airbag
Electric detonator 2 = Electric detonator for belt tensioners
SS = Safety sensor

If several diagnostic trouble codes are registered when reading, external faults (wiring harness and external components) should be rectified first. Then check if there are any diagnostic trouble codes for internal faults (control module) remaining.

Important

Before changing the control module, try clearing the diagnostic trouble code, turning the ignition switch to ON and waiting for at least 40 seconds. Then check if the diagnostic trouble code has returned. If it has, change the control module.

External faults

Diagnostic trouble code	Explanation	Action, see 8:6, page
01	FS 1, closed 1-5 times	Change FS 1 (page 26)
02	FS 1, closed more than 5 times	Change FS 1 (page 26)
03	FS 2, closed 1-5 times	Change FS 2 (page 26)
04	FS 2, closed more than 5 times	Change FS 2 (page 26)
05	FS 1, closed more than 2 s	Change FS 1 (page 26)
06	FS 2, closed more than 2 s	Change FS 2 (page 26)
07	FS 1, shorting to battery positive (B+)	11
08	FS 2, shorting to battery positive (B+)	11
09	FS 1, short to ground	13
0A	FS 2, short to ground	13
0b	FS 1, shorting to battery positive (B+)	15
0C	FS 2, shorting to battery positive (B+)	15
0d	Diagnostic trouble code 2d has been present more than 10 minutes (Diagnostic trouble code 0d exists only in cars fitted with a control module having part number 91 24 074)	47*)
0E	System ground too high	17*)
0F	FS 1, resistance to ground ≥ 3 Ohms	19*)
10	FS 2, resistance to ground ≥ 3 Ohms	19*)
11	FS 1, break in wiring	21*)
12	FS 2, break in wiring	21*)
13	FS 1, wiring resistance too high	23*)
14	FS 2, wiring resistance too high	23*)

Diagnostic trouble code	Explanation	Action, see 8:6, page
17	4700 µF capacitor, capacity too low	Change control module (page 23)
19	Resistance across capacitor 4700 µF too high	Change control module (page 23)
1b	Electric detonator 1, shorting to battery positive (B+)	25
1C	Electric detonator 2, shorting to battery positive (B+)	27
1E	Electric detonator 1, shorting to battery positive (B+)	28
1F	Electric detonator 2, shorting to battery positive (B+)	30
21	Electric detonator 1, short to ground	31
22	Electric detonator 2, short to ground	34
24	Electric detonator 1, short to ground	36
25	Electric detonator 2, short to ground	39
27	Electric detonator 1, break	47*)
28	Electric detonator 2, break	41*)
2A	Electric detonator 1, resistance too low	43
2b	Electric detonator 2, resistance too low	46
2d	Electric detonator 1, resistance too high For cars fitted with a control module having part number 91 24 074, the fault must have been continuous for at least 35 s before the SRS lamp lights up.	47*)
2E	Electric detonator 2, resistance too high	50*)
30	SRS lamp, shorting to battery positive (B+) or ground	52
31	SRS lamp, broken	53
32	Diagnostics unit defective	Change control module (page 23)
33,34	Collision registration, indicates correct detonation. Code arises after a collision when airbag and belt tensioners have detonated correctly.	
35	FS 1, break	21
36	FS 2, break	21
37	Detonation current has passed through Electric detonator 2 without detonation.	Change control module (page 23)
43	Diode D7, shorted or break	Change control module (page 23)
44	Diode D8, shorted or break	Change control module (page 23)

After codes 1-44 have been investigated and action taken, proceed to "Internal faults".

*)If these codes are repeatedly registered as intermittent diagnostic trouble codes and changing components only helps temporarily, see Service Information 853-1532.

Airbag (contd.)

Diagnostic trouble codes (-M1991), system test units
Internal faults

Diagnostic trouble code	Explanation	Action, see 8:6, page
20	This diagnostic trouble code does not indicate any particular fault and should therefore be cleared and disregarded	Try using a new control module and see if the diagnostic trouble code returns after being cleared
39	4700 µF capacitor, voltage too low	Change control module (page 23)
3A	4700 µF capacitor, voltage too high	Change control module (page 23)
3E	Diode D5, shorted or break	Change control module (page 23)
40	Electric detonator 1, defective power source	Change control module (page 23)
41	Electric detonator 2, defective power source	Change control module (page 23)
47	FS 1, defective power source	Change control module (page 23)
48	FS 2, defective power source	Change control module (page 23)
49	SS, wiring break	Change control module (page 23)
4b	SS, closed more than 2 s	Change control module (page 23)
52	IC circuit for measurement defective	Change control module (page 23)
53	5 V voltage regulation defective	Change control module (page 23)
54	EEPROM defective	Change control module (page 23)
55	This diagnostic trouble code does not indicate any particular fault and should therefore be cleared and disregarded	Try using a new control module and see if the diagnostic trouble code returns after being cleared
56	IC circuit for measurement, temperature too high	Change control module (page 23)
57	Microprocessor defective	Change control module (page 23)
58	Multiplexer defective	Change control module (page 23)
59	Power source for leakage current measurement defective	Change control module (page 23)
5A	A/D converter defective	Change control module (page 23)
5b	Monostable flip-flop FS 1, outside limits	Change control module (page 23)
5C	Monostable flip-flop FS 2, outside limits	Change control module (page 23)
5d	Monostable flip-flop SS, outside limits	Change control module (page 23)
5E	Start of collision recording defective	Change control module (page 23)
5F	Start of sensor recording defective	Change control module (page 23)

Airbag (contd.)

Diagnostic trouble codes (M1992-1994), ISAT scan tool

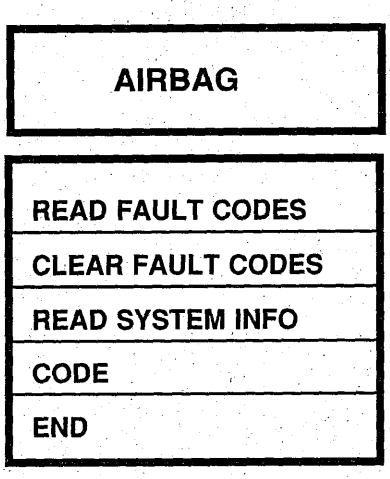
FS 1 = Front sensor LH
FS 2 = Front sensor RH
Electric detonator 1 = Electric detonator for steering wheel airbag
Electric detonator 2 = Electric detonator for LH belt tensioner
Electric detonator 3 = Electric detonator for RH belt tensioner
Electric detonator 4 = Electric detonator for passenger airbag

Permanent	Intermittent	Explanation	Action, see 8:6, page
43A21	23A21	Electric detonator 1, break	64
43A22	23A22	Electric detonator 4, break	66,68
43A24	23A24	Electric detonator 2, break	75*)
43A25	23A25	Electric detonator 3, break	75*)
43A31	23A31	Electric detonator 1, short	73
43A32	23A32	Electric detonator 4, short	69,71
42450	22450	Secondary voltage, break	91
42482	22482	Bulb 2, SRS symbol, shorting to battery positive (B+)	84
45321	25321	FS 1, break	77*)
45322	25322	FS 2, break	78*)
45341	25341	FS 1, resistance to ground too high	80*)
45342	25342	FS 2, resistance to ground too high	80*)
47421	27421	Bulb 1, SRS symbol, broken or open circuit	81
47471	27471	Bulb 1, SRS symbol, short circuit to ground	82
47481	27481	Bulb 1, SRS symbol, shorting to battery positive (B+)	83
67570	77570	Electric detonator 1, short to ground	85
		Electric detonator 2, short to ground	85
		Electric detonator 3, short to ground	85
		Electric detonator 4, short to ground	85
		FS 1, short to ground	85
		FS 2, short to ground	85
67580	77580	Electric detonator 1, shorting to battery positive (B+)	88
		Electric detonator 2, shorting to battery positive (B+)	88
		Electric detonator 3, shorting to battery positive (B+)	88
		Electric detonator 4, shorting to battery positive (B+)	88
		FS 1, shorting to battery positive (B+)	88
		FS 2, shorting to battery positive (B+)	88
67590	-	Control module defective	-
-	77590	Control module defective	92
67592	-	Collision registration	-
E2991	-	System incorrectly programmed	92

*) If these codes are repeatedly registered as intermittent diagnostic trouble codes, and changing components only helps temporarily, see Service Information 853-1532.

Airbag (contd.)

Menu structure for command codes (-M1994)



Airbag (contd.)

Command codes (M1992-1994)

Important

If there are no diagnostic trouble codes stored when command codes 101-105 are used, communication is ended.

Command code	Description
100	Shows all diagnostic trouble codes
101	Shows diagnostic trouble code 1 with time and fault counter. In addition to the diagnostic trouble code, the ISAT scan tool also shows "802419 15" (24=24 hours 19=19 mins 15=15 times), for instance, which means that the fault arose 24 hours and 19 minutes ago, that it is intermittent and has occurred 15 times.
102	Shows diagnostic trouble code 2 with time and fault counter.
103	Shows diagnostic trouble code 3 with time and fault counter.
104	Shows diagnostic trouble code 4 with time and fault counter.
105	Shows diagnostic trouble code 5 with time and fault counter.
380	Shows control module serial number. The ISAT scan tool then shows something like "8B12345678" where 12345678 is the serial number.
381	This command code is present only on M1992-1993 and certain M1994 models with a control module having part number 41 76 368. (These control modules are programmed by the manufacturer.) Shows programming. If the ISAT scan tool shows "8B203", the control module is incorrectly programmed. If the ISAT scan tool shows "8B204", the control module is correctly programmed.
550	Lights bulb 2 in the SRS symbol and allows it to be **on** for about 5 seconds.
551	Lights bulb 1 in the SRS symbol and allows it to **flash** for about 5 seconds.
800	End communication.
900	Clears all diagnostic trouble codes, resets all fault counters and ends communication.
B24	This command code is present only on M1992-1993 and certain M1994 models with a control module having part number 41 76 368. (These control modules are programmed by the manufacturer.) Shows programming. If the ISAT scan tool shows "80100", the programming is correct. If the ISAT scan tool shows "80000", the programming is incorrect.

Airbag (contd.)

Test readings, control module connections (M1995-)

Pin	Colour	Component Function	Test conditions	Reading	Between X-Y	Function/ Fault Diag, page
1	BN	Seat-belt tensioner, driver	Connect reference resistor. Connect BOB. Ignition off.	approx. 2.5 Ohms	1 - 2	24/ as DTC table
2	BU	Seat-belt tensioner, driver	Connect reference resistor. Connect BOB. Ignition off.	approx. 2.5 Ohms	2 - 1	24/ as DTC table
3	BU/ WH	Seat-belt tensioner, passenger	Connect reference resistor. Connect BOB. Ignition off.	approx. 2.5 Ohms	3 - 4	24/ as DTC table
4	YE/ WH	Seat-belt tensioner, passenger	Connect reference resistor. Connect BOB. Ignition off.	approx. 2.5 Ohms	4 - 3	24/ as DTC table
5	GN/ WH	Battery voltage (+15 circuit)	Connect BOB. Ignition on.	approx. 12 V	5 - 6	20/ as DTC table
6	BK	Ground	Connect BOB. Ignition off.	0 Ohms	6 - ground	21/ as DTC table
7	BU	SRS lamp	Connect ISAT. Ignition on. Activate SRS lamp.	SRS lamp should light up.	-	25/ as DTC table
9	GN	Data link connector	Connect BOB. Ignition off.	approx. 0.5 Ohms	9 - 1 (data link connector)	20/ as DTC table
10	OG	Driver airbag	Connect reference resistor. Connect BOB. Ignition off.	3 - 4 Ohms	10 - 11	22/ as DTC table
11	RD	Driver airbag	Connect reference resistor. Connect BOB. Ignition off.	3 - 4 Ohms	11 - 10	22/ as DTC table
13	VT	Passenger airbag	Connect reference resistor. Connect BOB. Ignition off.	approx. 2.5 Ohms	13 - 14	23/ as DTC table
14	GY	Passenger airbag	Connect reference resistor. Connect BOB. Ignition off.	approx. 2.5 Ohms	14 - 13	23/ as DTC table

Airbag (contd.)

Diagnostic trouble codes (M1995-)

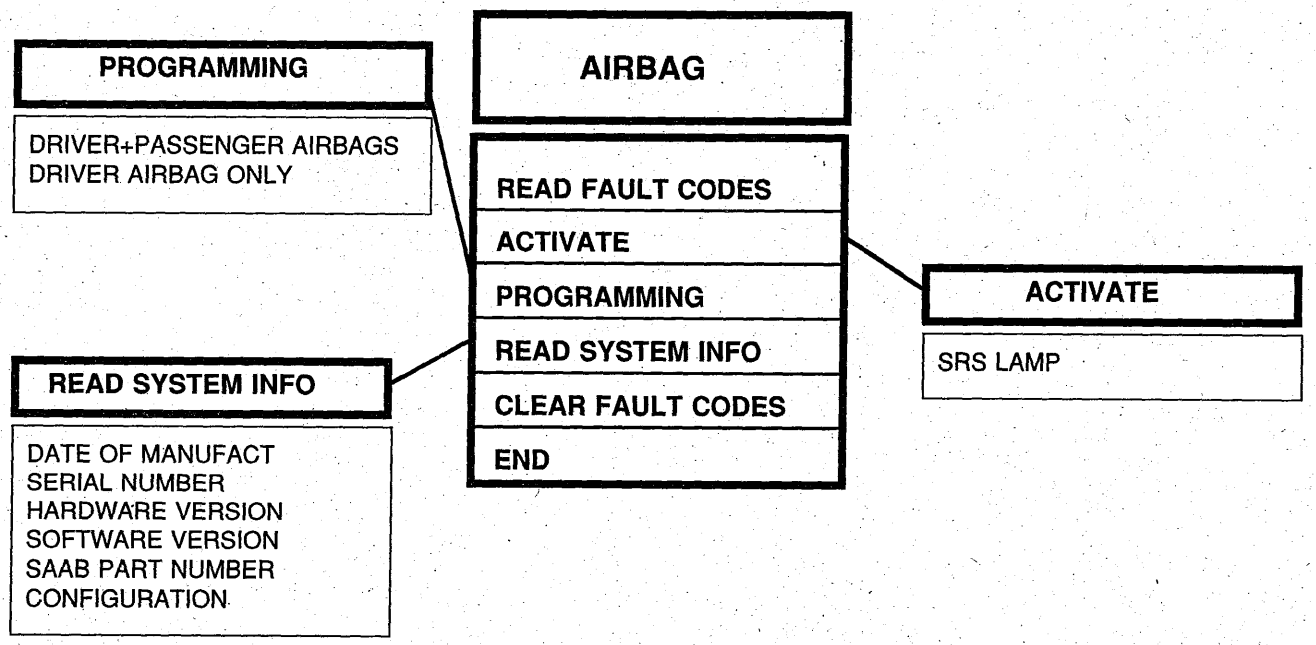
Diagnostic trouble code	Faulty function/component	Fault	ISAT scan tool display text	See 8:6, page
B1227	SRS warning lamp	Short circuit to battery positive (B+).	FAULT X Y B1227 SRS LAMP SHORT TO BATT+ xxxC xxH xxM	36
B1228	SRS warning lamp	Short circuit to ground, break or faulty lamp	FAULT X Y B1228 SRS LAMP SHORTING TO GROUND xxxC xxH xxM	38
B1332	Driver airbag	Break	FAULT X Y B1332 DRIVER AIRBAG OPEN CIRCUIT xxxC xxH xxM	42
B1333	Driver airbag	Short between wires to airbag	FAULT X Y B1333 DRIVER AIRBAG RESISTANCE TOO LOW xxxC xxH xxM	47
B1337	Passenger airbag	Break	FAULT X Y B1337 PASSENGER AIRBAG OPEN CIRCUIT xxxC xxH xxM	50
B1338	Passenger airbag	Short between wires to airbag	FAULT X YB1338 PASSENGER AIRBAG RESISTANCE TOO LOW xxxC xxH xxM	54
B1605	Control module	Internal fault.	FAULT X Y B1605 ECU FAULT xxxC xxH xxM	57
B1610	Control module	Control module is programmed with wrong configuration	FAULT X Y B1610 CONTROL MODULE WRONGLY PROGRAMMED xxxC xxH xxM	57
B1615	Control module	Control module used UP	FAULT X Y B1615 IGNITION CIRCUIT ACTIVATED CRASH xxxC xxH xxM	57
B2332	Driver airbag	Short to ground	FAULT X Y B2332 DRIVER AIRBAG SHORTING TO GROUND xxxC xxH xxM	58
B2333	Driver airbag	Short circuit to battery positive (B+).	FAULT X Y B2333 DRIVER AIRBAG SHORT TO BATT+ xxxC xxH xxM	63
B2337	Passenger airbag	Short to ground	FAULT X Y B2337 PASSENGER AIRBAG SHORTING TO GROUND xxxC xxH xxM	58

Diagnostic trouble code	Faulty function/component	Fault	ISAT scan tool display text	See 8:6, page
B2338	Passenger airbag	Short circuit to battery positive (B+).	FAULT X Y B2338 PASSENGER AIRBAG SHORT TO BATT+ xxxC xxH xxM	63
B2441	Seat-belt tensioner, driver	Break	FAULT X Y B2441 DRIVER BELT TENS. OPEN CIRCUIT xxxC xxH xxM	68
B2442	Seat-belt tensioner, driver	Short to ground	FAULT X Y B2442 DRIVER BELT TENS. SHORTING TO GROUND xxxC xxH xxM	72
B2443	Seat-belt tensioner, driver	Short circuit to battery positive (B+).	FAULT X Y B2443 DRIVER BELT TENS. SHORT TO BATT+ xxxC xxH xxM	76
B2444	Seat-belt tensioner, driver	Short between wires to seat-belt tensioner	FAULT X Y B2444 DRIVER BELT TENS. RESISTANCE TOO LOW xxxC xxH xxM	80
B2446	Seat-belt tensioner, passenger	Break	FAULT X Y B2446 PASS. BELT TENS. OPEN CIRCUIT xxxC xxH xxM	83
B2447	Seat-belt tensioner, passenger	Short to ground	FAULT X Y B2447 PASS. BELT TENS. SHORTING TO GROUND xxxC xxH xxM	72
B2448	Seat-belt tensioner, passenger	Short circuit to battery positive (B+).	FAULT X Y B2448 PASS. BELT TENS. SHORT TO BATT+ xxxC xxH xxM	76
B2449	Seat-belt tensioner, passenger	Short between wires to seat-belt tensioner	FAULT X Y B2449 PASS. BELT TENS. RESISTANCE TOO LOW xxxC xxH xxM	87
No diagnostic trouble code displayed	Control module	No power supply		90

FAULT X = diagnostic trouble code ordinal number
Y = Type of fault: P = permanent, I = intermittent
xxxC = number of times each fault has been registered (0-255)
xxH = number of hours passed since the diagnostic trouble code was first registered (max 40 hours)
xxM = number of minutes passed since the diagnostic trouble code was registered for the first time
BATT+ = Battery positive voltage (BPV)
SHORT = Short circuit

Airbag (contd.)

Menu structure for command codes (M1995-)



Electrically adjustable front seats with memory

Before starting fault diagnosis

Try running all motors in both directions. If the electric seat fuse blows when one of the motors is run, this motor is probably shorted to ground. Rectify the fault and change the fuse.

Fault diagnosis

Connect the ISAT scan tool to the data link connector located under the RH front seat. Turn the ignition switch to ON and call up the control module.

Important

It will no longer be possible to adjust the seat once contact has been established with the ISAT scan tool.

If the ISAT scan tool is unable to establish contact with the control module, see Service Manual 8:3 "Interior equipment",page 852-132.

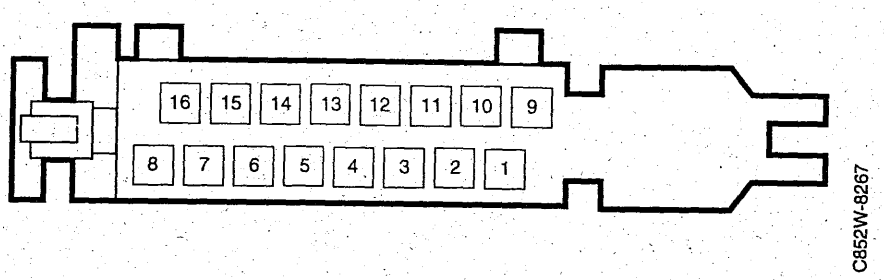
Note the diagnostic trouble codes displayed. Before continuing fault diagnosis, check that the control module is receiving correct input signals from the memory buttons and manual controls by selecting "READ SWITCHES" on the ISAT scan tool. Read one switch at a time by operating the manual control and pressing a memory button. The ISAT scan tool should then display "OPEN" and "CLOSED" respectively.

Diagnostic trouble codes

When carrying out fault diagnosis on the electrically adjustable seats using an ISAT scan tool, both permanent and intermittent faults will be detected. The first digit of the diagnostic trouble code indicates what kind of fault it is: 4 and 5 indicate permanent faults, 2 and 3 intermittent faults.

Electrically adjustable front seats with memory (contd.)

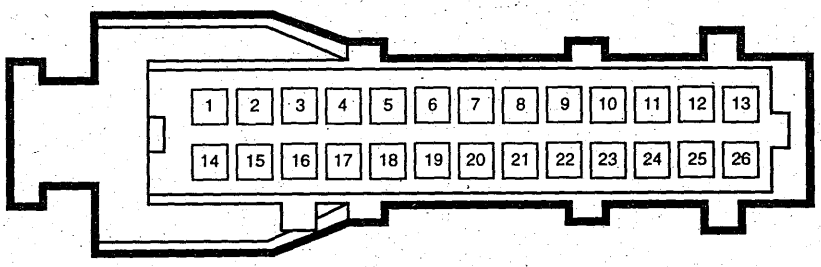
Test readings, control module connections (M1991-1995)



Pin	Colour	Component/Function	Test conditions	In/ Out	Reading	Across
1	YE/WH	Backrest forwards	Button in neutral Button forwards	In	0 V 12 V	1 - ground
2	YE	Backrest backwards	Button in neutral Button backwards	In	0 V 12 V	2 - ground
3	BN/WH	Front down	Button in neutral Button down	In	0 V 12 V	3 - ground
4	BN	Front up	Button in neutral Button up	In	0 V 12 V	4 - ground
5	WH	Memory 3	Button not activated Button depressed	In	0 V 12 V	5 - ground
6	GY	Memory 2	Button not activated Button depressed	In	0 V 12 V	6 - ground
7	OG	Memory 1	Button not activated Button depressed	In	0 V 12 V	7 - ground
8	RD	Power supply (+30 circuit)		Out		8 - ground
9	RD/WH	Power ground		In		9 - ground
10	GN/WH	Rear down	Button in neutral Button down	In	0 V 12 V	10 - ground
11	GN	Rear up	Button in neutral Button up	In	0 V 12 V	11 - ground
12	BU	Seat forwards	Button in neutral Button forwards	In	0 V 12 V	12 - ground
13	BU/WH	Seat rearwards	Button in neutral Button backwards	In	0 V 12 V	13 - ground
14		Not used				
15		Not used				
16	BU	Memory storage	Button not activated Button depressed	In	0 V 12 V	16 - ground

Electrically adjustable front seats with memory (contd.)

Test readings, control module connections (M1996-)
Connection A



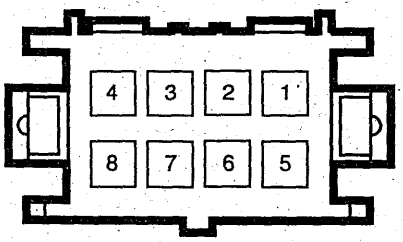
357 Dk(A)

Pin	Colour	Component/Function	Test conditions	In/ Out	Reading	Across
1	RD	Power supply (+30 circuit)		Out		1 - ground
2	OG	Memory 1	Button not activated Button depressed	In	0 V 12 V	2 - ground
3	GY	Memory 2	Button not activated Button depressed	In	0 V 12 V	3 - ground
4	WH	Memory 3	Button not activated Button depressed	In	0 V 12 V	4 - ground
5-11		Not used				
12	BK	Power ground		In/ Out	<0.5 V	12 - ground
13	BK	Power ground		In/ Out	<0.5 V	13 - ground
14-15		Not used				
16		Coding passenger				
17		Coding passenger				
18	BN	Memory storage	Button not activated Button depressed	In	0 V 12 V	18 - ground
19	BU	Seat forwards	Button in neutral Button forwards	In	0 V 12 V	19 - ground
20	BU/WH	Seat rearwards	Button in neutral Button backwards	In	0 V 12 V	20 - ground
21	YE/WH	Backrest forwards	Button in neutral Button forwards	In	0 V 12 V	21 - ground
22	YE	Backrest backwards	Button in neutral Button backwards	In	0 V 12 V	22 - ground
23	BN	Front up	Button in neutral Button up	In	0 V 12 V	23 - ground
24	BN/WH	Front down	Button in neutral Button down	In	0 V 12 V	24 - ground
25	GN	Rear up	Button in neutral Button up	In	0 V 12 V	25 - ground

Pin	Colour	Component/Function	Test conditions	In/ Out	Reading	Across
26	GN/WH	Rear down	Button in neutral Button down	In	0 V 12 V	26 - ground

Electrically adjustable front seats with memory (contd.)

Test readings, control module connections (M1996-) (contd.)
Connection B



357 Dk(B)

C852W-8268

Pin	Colour	Component/Function	Test conditions	In/ Out	Reading	Across
1	RD/WH	KL. 15	Ignition ON	Out	12 V	1 - ground
2-4		Not used				
5	BU	Diagnostics	ISAT scan tool connection	In/ Out	Approx. 12 V	5 - ground
6	RD	KL. 30		In	12 V	6 - ground
7	BK	Power ground		In/ Out	<0.5 V	7 - B-
8	BU	Door switch, driver's door	Door open	In	12 V	8 - ground

Electrically adjustable front seats with memory (contd.)

Diagnostic trouble codes

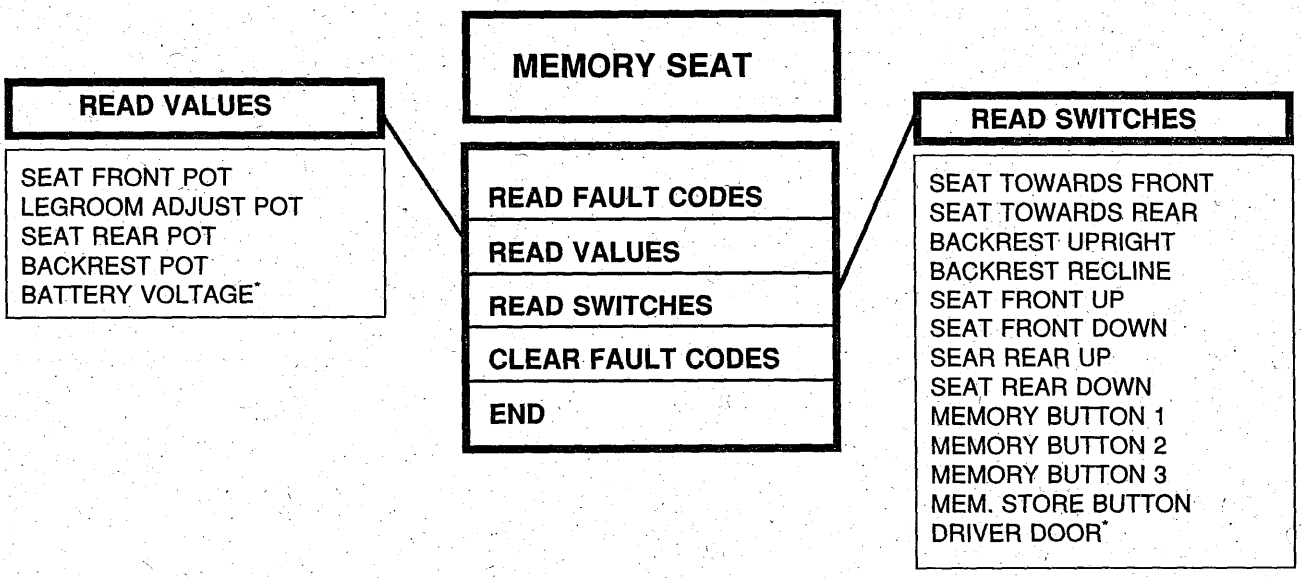
Diagnostic trouble code	Faulty function/component	Fault	ISAT ST display text	See 8:2, page
25221	Seat front edge Potentiometer	Voltage from potentiometer too high (intermittent)	FAULT 1 I 25221 SEAT FRONT POT OPEN/SHORT BATT+	852-103
45221	Seat front edge Potentiometer	Voltage from potentiometer too high (permanent)	FAULT 1 P 45221 SEAT FRONT POT OPEN/SHORT BATT+	852-103
25222	Legroom adjustment Potentiometer	Voltage from potentiometer too high (intermittent)	FAULT 1 I 25222 LEGROOM ADJUST POT OPEN/SHORT BATT+	852-103
45222	Legroom adjustment Potentiometer	Voltage from potentiometer too high (permanent)	FAULT 1 P 45222 LEGROOM ADJUST POT OPEN/SHORT BATT+	852-103
25223	Seat rear edge Potentiometer	Voltage from potentiometer too high (intermittent)	FAULT 1 I 25223 SEAT REAR POT OPEN/SHORT BATT+	852-103
45223	Seat rear edge Potentiometer	Voltage from potentiometer too high (permanent)	FAULT 1 P 45223 SEAT REAR POT OPEN/SHORT BATT+	852-103
25224	Backrest Potentiometer	Voltage from potentiometer too high (intermittent)	FAULT 1 I 25224 BACKREST POT OPEN/SHORT BATT+	852-103
45224	Backrest Potentiometer	Voltage from potentiometer too high (permanent)	FAULT 1 P 45224 BACKREST POT OPEN/SHORT BATT+	852-103
25231	Seat front edge Potentiometer	Voltage from potentiometer too low (intermittent)	FAULT 1 I 25231 SEAT FRONT POT OPEN/SHORT GROUND	852-106
45231	Seat front edge Potentiometer	Voltage from potentiometer too low (permanent)	FAULT 1 P 45231 SEAT FRONT POT OPEN/SHORT GROUND	852-106
25232	Legroom adjustment Potentiometer	Voltage from potentiometer too low (intermittent)	FAULT 1 I 25232 LEGROOM ADJUST POT OPEN/SHORT GROUND	852-106
45232	Legroom adjustment Potentiometer	Voltage from potentiometer too low (permanent)	FAULT 1 P 45232 LEGROOM ADJUST POT OPEN/SHORT GROUND	852-106
25233	Seat rear edge Potentiometer	Voltage from potentiometer too low (intermittent)	FAULT 1 I 25233 SEAT REAR POT OPEN/SHORT GROUND	852-106
45233	Seat rear edge Potentiometer	Voltage from potentiometer too low (permanent)	FAULT 1 P 45233 SEAT REAR POT OPEN/SHORT GROUND	852-106
25234	Backrest Potentiometer	Voltage from potentiometer too low (intermittent)	FAULT 1 I 25234 BACKREST POT OPEN/SHORT GROUND	852-106
45234	Backrest Potentiometer	Voltage from potentiometer too low (permanent)	FAULT 1 P 45234 BACKREST POT OPEN/SHORT GROUND	852-106

Diagnostic trouble code	Faulty function/component	Fault	ISAT ST display text	See 8:2, page
25291	Seat front edge Potentiometer	Adjustment too slow when setting with memory (intermittent)	FAULT 1 I 25291 SEAT FRONT POT CHANGES TO STORED SETTINGS TOO SLOW	852-109
45291	Seat front edge Potentiometer	Adjustment too slow when setting with memory (permanent)	FAULT 1 P 45291 SEAT FRONT POT CHANGES TO STORED SETTINGS TOO SLOW	852-109
25292	Legroom adjustment Potentiometer	Adjustment too slow when setting with memory (intermittent)	FAULT 1 I 25292 LEGROOM ADJUST POT CHANGES TO STORED SETTINGS TOO SLOW	852-109
45292	Legroom adjustment Potentiometer	Adjustment too slow when setting with memory (permanent)	FAULT 1 P 45292 LEGROOM ADJUST POT CHANGES TO STORED SETTINGS TOO SLOW	852-109
25293	Seat rear edge Potentiometer	Adjustment too slow when setting with memory (intermittent)	FAULT 1 I 25293 SEAT REAR POT CHANGES TO STORED SETTINGS TOO SLOW	852-109
45293	Seat rear edge Potentiometer	Adjustment too slow when setting with memory (permanent)	FAULT 1 P 45293 SEAT REAR POT CHANGES TO STORED SETTINGS TOO SLOW	852-109
25294	Backrest Potentiometer	Adjustment too slow when setting with memory (intermittent)	FAULT 1 I 25294 BACKREST POT CHANGES TO STORED SETTINGS TOO SLOW	852-109
45294	Backrest Potentiometer	Adjustment too slow when setting with memory (permanent)	FAULT 1 P 45294 BACKREST POT CHANGES TO STORED SETTINGS TOO SLOW	852-109
33640	All motors	Current consumption >50 A in one of the motors (intermittent)	FAULT 1 I 33640 MOTOR FAULT POWER CONSUMPTION >50 A	852-114
53640	All motors	Current consumption in one of the motors >50 A (permanent)	FAULT 1 P 53640 MOTOR FAULT POWER CONSUMPTION >50 A	852-114
33641	Seat front Motor	Current consumption >50 A (intermittent)	FAULT 1 I 33641 SEAT FRONT MOTOR CONSUMING >50 A	852-114
53641	Seat front Motor	Current consumption >50 A (permanent)	FAULT 1 P 53641 SEAT FRONT MOTOR CONSUMING >50 A	852-114
33642	Legroom adjustment Motor	Current consumption >50 A (intermittent)	FAULT 1 I 33642 LEGROOM ADJUST MOTOR CONSUMING >50 A	852-114
53642	Legroom adjustment Motor	Current consumption >50 A (permanent)	FAULT 1 P 53642 LEGROOM ADJUST MOTOR CONSUMING >50 A	852-114

Diag-nostic trouble code	Faulty function/component	Fault	ISAT ST display text	See 8:2, page
33643	Seat rear Motor	Current consumption >50 A (intermittent)	FAULT 1 I 33643 SEAT REAR MOTOR CONSUMING >50 A	852-114
53643	Seat rear Motor	Current consumption >50 A (permanent)	FAULT 1 P 53643 SEAT REAR MOTOR CONSUMING >50 A	852-114
33644	Backrest Motor	Current consumption >50 A (intermittent)	FAULT 1 I 33644 BACKREST MOTOR CONSUMING >50 A	852-114
53644	Backrest Motor	Current consumption >50 A (permanent)	FAULT 1 P 53644 BACKREST MOTOR CONSUMING >50 A	852-114
77590	Control module fault	(intermittent)	FAULT 1 I 77590 CONTROL MODULE FAULT	852-116
67590	Control module fault	(permanent)	FAULT 1 P 67590 CONTROL MODULE FAULT	852-116

Electrically adjustable front seats with memory (contd.)

Menu structure for command codes



* M1996- only

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From

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Comments/suggestions

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Manual concerned: .....

It is important that Saab technicians in the field regard the Workshop Service Manual as their bible, and we therefore strive to make the manual easy to use and to provide accurate information.

By letting us have your views on this manual you will be helping us to maintain a high standard in our literature.

Note down any comments or suggestions you may have on a sheet of paper or take a copy of this page and send us your views at the above address. For greater convenience, you are also welcome to send your comments by fax, using the telephone number shown.

ENG **Ordering No. 364000.** English edition. Printed in Sweden.

SAAB

Saab Automobile AB
Trollhättan, Sweden

Printed in Sweden, Graphic Systems AB, Gbg 1995.26997