PORSCHE

Technical Manual

Boxster

Technical Information

Repair

Contents:

Group 0
Diagnosis
Part 1 (up to Repair Group 45)

WKD 483 521

TITEL.CHP

Foreword

The workshop documentation for the Boxster model has the designation **"Boxster" Technical Manual** and contains **Technical Information** as well as instructions on **Repairs**.

The integration of the technical information published in the "Boxster" Technical Manual with the descriptive matter on repairs provides the user with a complex reference work that combines into one book associated or cross-referenced material of relevance to workshops and originating from various information media.

The "Boxster" Technical Manual consists of 15 folders, subdivided into the following Groups

0	Entire vehicle – General
0	Diagnosis, part 1 (up to Repair Group 45) *1
0	Diagnosis, part 2 (as of Repair Group 69) *2
1	Engine, part 1 (up to Repair Group 13) *3
1	Engine, part 2 (as of Repair Group 15) *4
2	Fuel, exhaust, engine electronics
3	Transmission, manual transmission
3	Transmission, automatic transmission
4	Running gear
5	Body
6	Body equipment, exterior
7	Body equipment, interior
8 / 9	Air conditioning / Electrics
9	Circuit diagrams, part 1 (up to and including the '99 model) *5
9	Circuit diagrams, part 2 (as of the '00 model) *6

*1 The two folders with Group 0 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 0 – Diagnosis, part 1" **(up to Repair Group 45)**.

*2 The **second folder** "Group 0 – Diagnosis, part 2" **(as of Repair Group 69)** includes the further Repair Groups belonging to Group 0.

*3 The two folders with Group 1 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 1 – Engine, part 1" **(up to Repair Group 13)**.

*4 The **second folder** "Group 1 – Engine, part 2" **(as of Repair Group 15)** includes the further Repair Groups belonging to Group 1.

*5 The two folders with Group 9 are to be regarded as one folder; i.e. file the "Technical Information" notices only in front of the repair descriptions in the folder "Group 9 – Circuit diagrams, part 1" **(up to the '99 model)**.

*6 The **second folder** "Group 9 – Circuit diagrams, part 2" **(as of the '00 model)** includes the further circuit diagrams belonging to Group 9.

The "Boxster" Technical Manual has the same structure in each folder, with the following breakdown for all Groups:

- **Title page, "Boxster" Technical Manual**
  > Foreword

- **Title page: "Technical Information"**
  > Table of Contents, Technical information
  > Technical information

- **Title page: "Repair"**
  > Repair Groups: overview
  > Table of Contents, repairs
  > General / technical data
  > Instructions on repairs

As can be seen from the breakdown, the published Technical Information is in the front part of each folder – numbered according to the Groups. The Table of Contents assigned to each Group will be periodically updated.

Following the Technical Information, separated by a title page, the instructions on repairs – assigned according to the Groups or broken down into Repair Groups – are included in the folder.

The instructions on repairs will be extended and updated by means of supplements.

Note

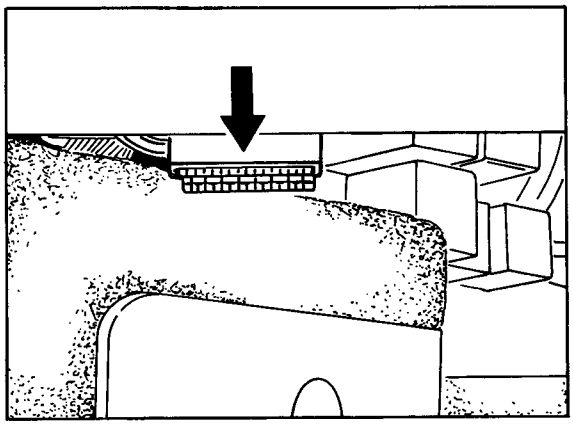
Sheets that already exist in the "Boxster" Technical Manual and are updated or revised and thereby exchanged by a supplement are designated "Replacement sheet". Revisions or technical modifications on pages of these replacement sheets are identified for the user with a vertical bar at the margin.

0 Diagnosis, part 1 (up to Repair Group 45)

Printed in Germany - 34, 1999 986TOC

Installation location, diagnostic socket

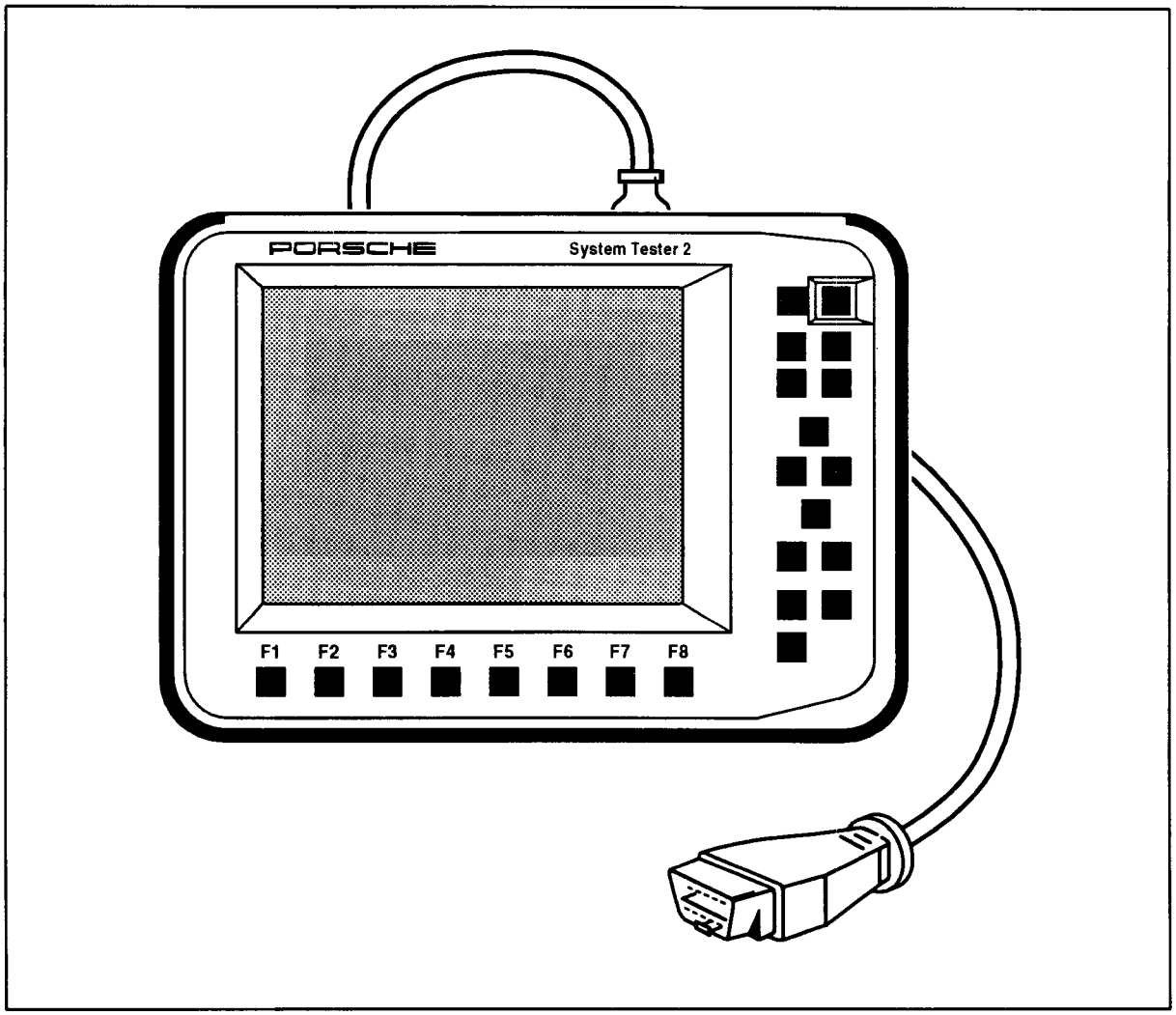
The diagnostic socket for the tester is located inside the vehicle near to the driver (left-hand drive vehicles) or the passenger (right-hand drive vehicles) below the instrument panel.



12 · 96

Printed in Germany, 1996 9860_1

Operating instructions, Porsche System Tester 2



General information

Use

The Porsche System Tester 2 is a modular, portable diagnostic and measuring system. It can be used in any location to perform diagnostic tests on electronic control modules.

The Tester consists of a computer unit, a main memory, a hard disk, a VGA display panel, a nickel metal hydride battery and a measuring unit for measurement of current, voltage and resistance values.

The Porsche System Tester 2 can be operated with the built-in keys or using a connectable country-specific PS/2 keyboard (option).

Data and measured values can be printed out on one of the ten DIN A4 printers currently approved by Porsche.

The integrated LCD panel is used as the display. A monitor can also be connected (VGA connection).

If a printer or PS/2 keyboard is connected, the corresponding device type must be set under Configuration in the start-up screen.

The Tester thus can be used to check all systems that possess a diagnostic interface conforming with the ISO standard.

The following tasks can be performed:

- Reading out the control-module identification
- Reading out the fault memory
- Erasing the fault memory
- Testing the drive links
- Testing the input signals
- Reading out actual values
- Control module programming
- Current, voltage and resistance measurements

Malfunctions

The Porsche System Tester 2 is a high-quality electronic device. In order to prevent damage to the unit due to improper use, please observe the operating instructions.

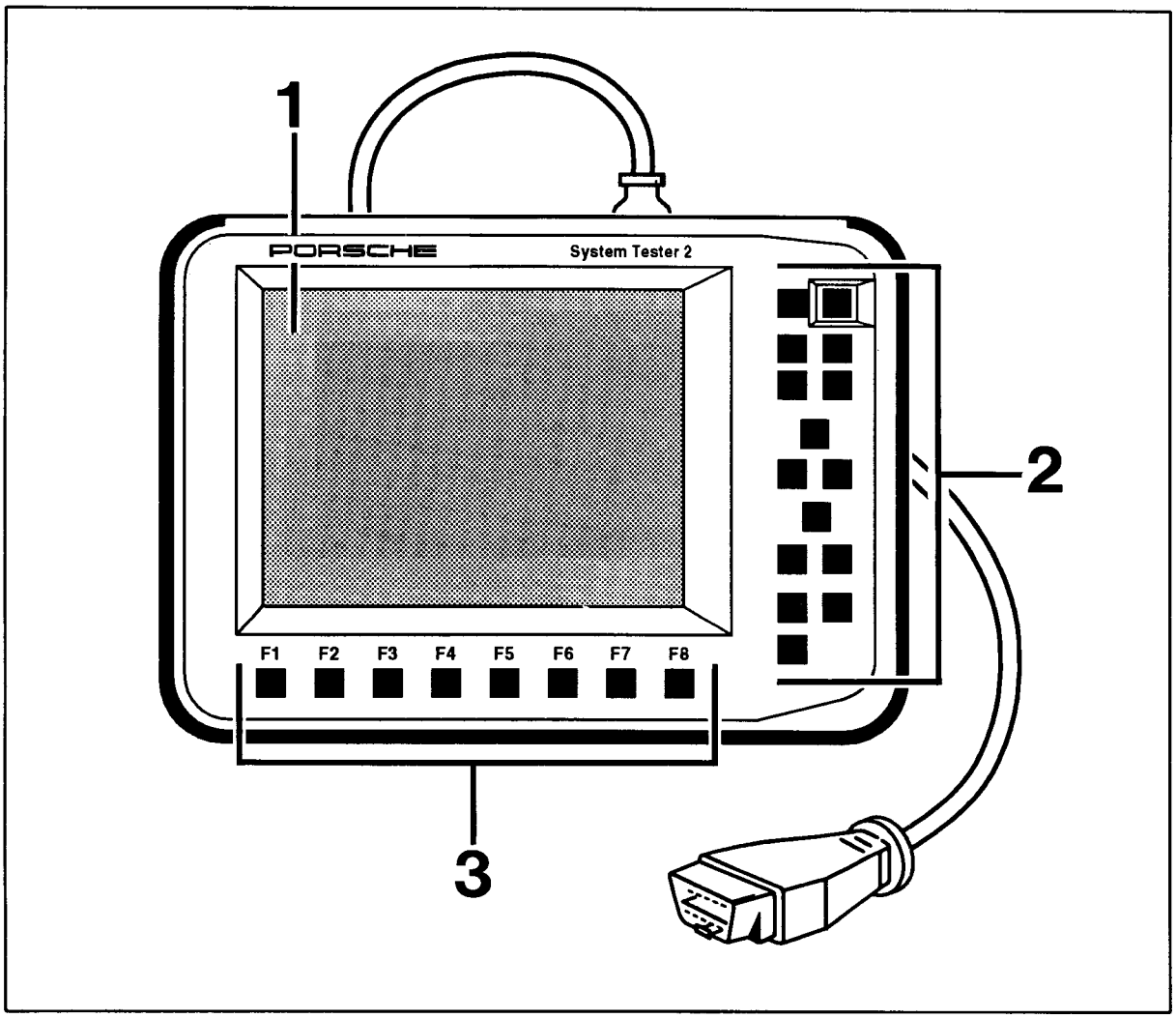
If the Tester no longer responds when any key is pressed, it must be set to a defined state:

1. Press the F1 and F8 keys in addition to the "ON/OFF" key.

2. Release the "ON/OFF" key, then the F1 and F8 keys.

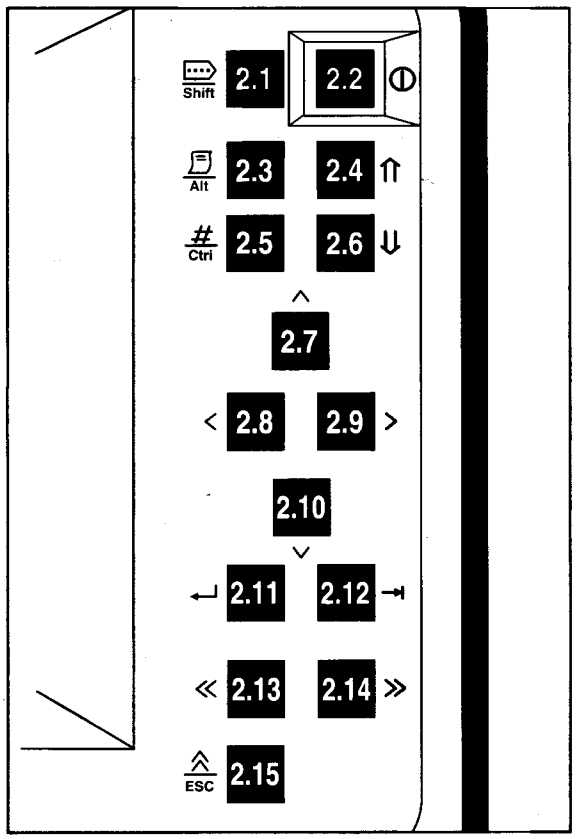
Perform this switch-off procedure only if the unit no longer responds when any key is pressed. This procedure can damage the hard disk under certain circumstances if it is performed during normal operation. It may be necessary to repeat input of data created within this diagnostic application.

Problems during operation are indicated to the user via the information line (info line). Example: "Diagnosis Card not inserted".



Design of the Tester

1 9.5" LCD panel,
monochrome
Resolution: 640 x 480 pixels (picture elements)



2 Keypad
2.1 Jump key
Used to change to the selection menu for control module-specific functions

2.2 On/Off switch

2.3 Print key
To print out data, measured values, screen display (hardcopy), working log and warranty log

2.4 This key is used to jump to the beginning

2.5 Used in combination with key 2.4 or 2.6 to control the brightness

2.6 This key is used to jump to the end

2.7 Used to move the cursor up

2.8 Used to move the cursor to the left

2.9 Used to move the cursor to the right **and** to select drive links, input signals and actual values

2.10 Used to move the cursor down

2.11 Enter key

2.12 Used to change the active screen part

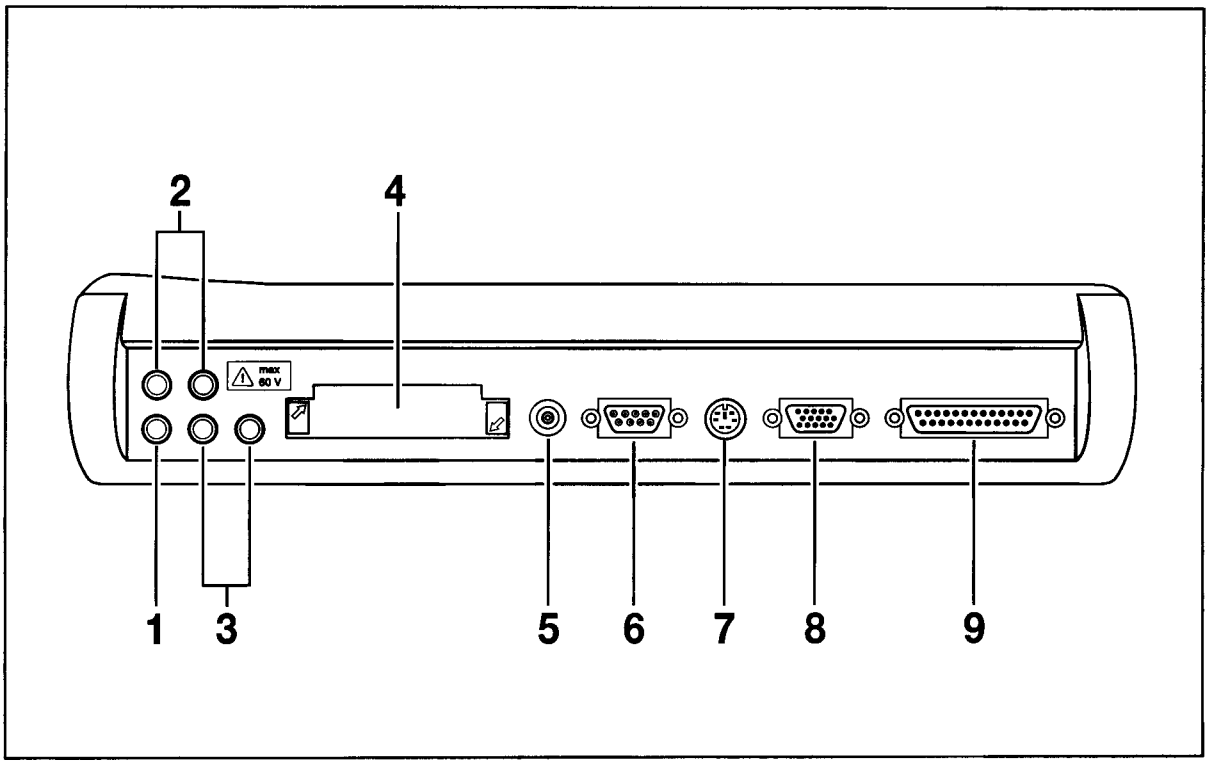
2.13 Back key

2.14 Continue key

2.15 Escape key

3 Softkeys
Softkeys can be have different functions. The functions are displayed at the bottom edge of the screen.

Connections



1 – Ground connection

2 – Connections for voltage and resistance measurements.

3 – Connections for current measurements with a clamp-on ammeter.

4 – Two slots for PCMCIA cards. The upper slot is for the Diagnosis Card.

5 – Socket for mains power supply unit.

6 – Serial port for connection of a mouse.

7 – Connection socket for a PS/2 keyboard.

8 – Socket for VGA monitor.

9 – Parallel port for connection of a printer or a CD- ROM drive.

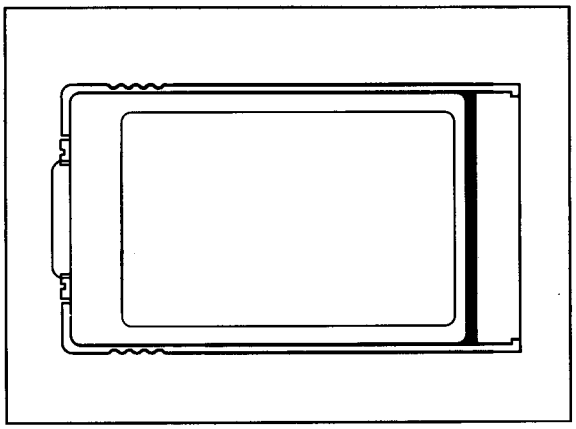
Note

Before current, voltage or resistance measurements: Use the ground

lead to connect the ground socket (1) to the vehicle ground point prior

to connecting the diagnosis lead.

Diagnosis Card



612 - 96

The Diagnosis Card is the interface between the Porsche System Tester 2 and the vehicle.

The Diagnosis Card is responsible for the diagnosis reports, control-module programming voltage and for voltage supply to the Porsche

System Tester 2 via the vehicle battery.

The Diagnosis Card can be left in the Tester.

Voltage supply

Three types of voltage supply are possible for the Porsche System Tester 2:

- Internal rechargeable battery (operating time approx. 20 min)
- Vehicle battery (supply via plugged-on diagnosis lead, Diagnosis Card)
- Mains power supply.

Before putting the unit into operation, make sure that the mains voltage and the voltage specified on the mains power supply unit are the same.

Adjusting illumination of LCD panel

Press key 2.5 and key 2.4
➠Display brighter

Press key 2.5 and key 2.6
➠Display darker

Working log

During diagnosis, e.g. when the fault memory is being read out, a "save" symbol appears near the softkeys. This item is saved in the working log if the corresponding softkey is pressed. The working log can be printed out with key 2.3. It is thus possible to document all stored faults, for example.

Starting diagnosis

1. Connect the Porsche System Tester 2 to the diagnostic socket (data link connector) in the vehicle.

2. Switch on the Porsche System Tester 2 (it will be ready for operation in approx. 60 seconds).

3. Switch on the ignition.

4. Select the vehicle type and initiate diagnosis with key 2.14.
   The Porsche System Tester 2 starts to search for control modules and then lists all control modules it finds. Control modules that are not installed (e.g. Tiptronic control module on vehicles with manual transmission) are displayed in grey.

Note

If no control modules are detected, check whether the ignition is on or whether terminal 15 is present on the diagnostic socket.

If faults are stored in a control module, this is identified with the # symbol as before.

Automatic switch-off

The Porsche System Tester 2 switches itself off after an Off-delay if

- no voltage is supplied via the mains power supply unit or via the vehicle battery

  or

- no data are being transferred via an interface (no key pressed, no communication with control module).

The Off-delay time can be changed in the Configuration menu. The default Off-delay time is 3 minutes.

Automatic switch-off is preceded by a rhythmic beeping

sound (10 seconds). The Porsche System Tester 2 will remain

switched on if the mains power supply is connected or a key is

pressed within this time.

Software update

The software can be updated using the supplied CD-ROM

drive. 1. Connect CD-ROM drive with the Porsche System Tester 2.

2. Connect Porsche System Tester 2 and the CD-ROM drive to the

mains power supply unit.

3. Load CD-ROM in the drive and close the drive.

4. Switch on the Porsche System Tester 2.

5. Select "Software installation" in the Configuration menu.

24 01 Diagnosis/Troubleshooting DME

Diagnosis/Troubleshooting

DME

System M 08

Printed in Germany - 23, 1998 98624D1

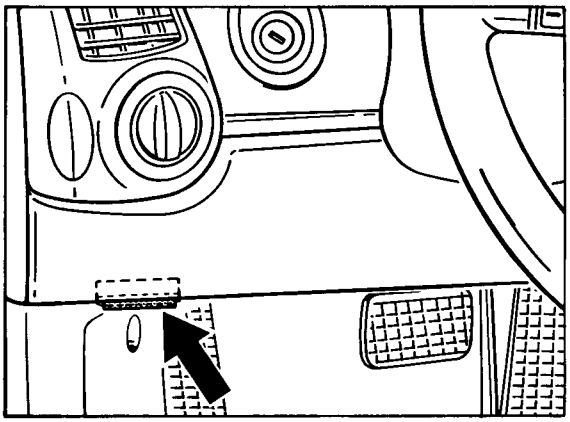
Contents overview

General information

Diagnosis

Monitoring of signals by the DME control module permits the system to perform reliable and exact diagnosis. Furthermore, certain additional functions such as the drive links test and input signals test can be activated and checked with the Porsche System Tester 2.

The fault memory can be read out and erased with the new Porsche System Tester 2. The data link connector is located below the knee guard on the driver's side.



625 - 96

General

A further-developed Motronic **(DME)** system with the designation M 5.2.2 is installed to produce the injection signal, to calculate the ignition timing angle, to realise adaptive controls of various systems, and to perform diagnostic functions.

Essential characteristics of the DME

- Electronic map-based ignition with stationary high-voltage distribution
- Sequential injection
- Mixture controlled separately for each cylinder bank
- Adaptive stereo oxygen sensor closed-loop control
- Floating oxygen sensors

  Oxygen sensor heating controlled via ground side
- Hall-effect sensor installed on inlet camshaft for cylinder bank 1 - 3

  Control of VarioCam valves for cylinder banks 1 - 3 and 4 - 6
- New hot film mass air flow sensor
- Intake air temperature sensor installed in hot film mass air flow sensor

  Cylinder-charging control with new two-winding IACV (positioner)
- Adaptive throttle potentiometer

  Adaptive knock regulation
- Oil temperature measurement
- New temperature sensor for engine temperature measurement and analogue display in the instrument cluster
- Engine compartment temperature sensor to control the engine compartment purge fan
- Radiator fan control by the DME control module
- Starting relay activation and disabling
- Control of the A/C compressor relay

  Activation of the Check Engine light in the event of misfires damaging to the catalytic converter

  Torque reduction upon Traction Control demand by means of ignition timing retardation and injection suppression
- Electronically controlled ventilation of the carbon canister
- Airbag control module switches off fuel pump in the event of an accident
- Programmed idle speed changed in the case of Tiptronic vehicles and engaged transmission range
- Torque reduction during shifting operations of the Tiptronic transmission
- Facility to inject disturbances for testing the oxygen sensor control loop (e.g. for inspection and maintenance)

Additionally for USA vehicles:

- Complete scope of OBD II functions with activation of the Check Engine light
- Secondary air system
- Two additional oxygen sensors behind the catalytic converters
- Additional Hall-effect sensor for camshaft of cylinder bank 4 - 6

Printed in Germany – 4, 1996 98624D1

Overview of the possible menus

The following menus can be called up with the Porsche System Tester 2:

- Identification
- Fault memory
- Erase fault memory
- Drive links
- Input signals
- Actual values
- Coding

Identification

The diagnosis software number and the control module part number are displayed here.

Fault memory

All faults detected by the control module are stored in the fault memory according to the fault code.

Erase fault memory

The fault memory can be erased with this menu.

Drive links

The following drive links can be tested with the Porsche System Tester 2:

passive (only ignition on)

IACV (idle speed positioner)

A/C compressor

Fuel evaporative valve

Engine compartment purge fan

Secondary air fan (USA)

Check Engine

Engine fan stage 1 + 2

Fuel pump relay

Rpm signal pulse (e.g. at tachometer)

active (engine running)

Deactivation of injection valves

Switch of the VarioCam system, cylinders 1 - 3

Switch of the VarioCam system, cylinders 4 - 6

Input signals

The following input signals can be tested:

Idle detection

Wide open throttle detection

A/C compressor switch

Reference mark signal

Transmission range switch (with Tiptronic)

Fuel reserve signal

Start enable switch (with manual transmission)

Actual values

The following actual values can be tested:

Supply voltage in V

Hot film mass air flow sensor voltage in V

Engine temperature in °C

Intake air temperature in °C

Engine compartment temperature in °C

Engine oil temperature in °C

Engine speed in rpm

Vehicle speed in km/h

Load signal in ms/revolution

Throttle potentiometer in %

Air mass in kg/h

Spec. air mass in kg/h

Adaptation values, Range 1 (TRA)

Adaptation values, Range 2 (FRA)

Adaptation values during tank ventilation (FTEA)

Ignition timing angle in °crk

Oxygen sensing

Oxygen sensor voltages ahead of catalytic converter

Oxygen sensor voltages behind catalytic converter (USA)

Ambient pressure in mbar

Signal from airbag control module

CO adjustment

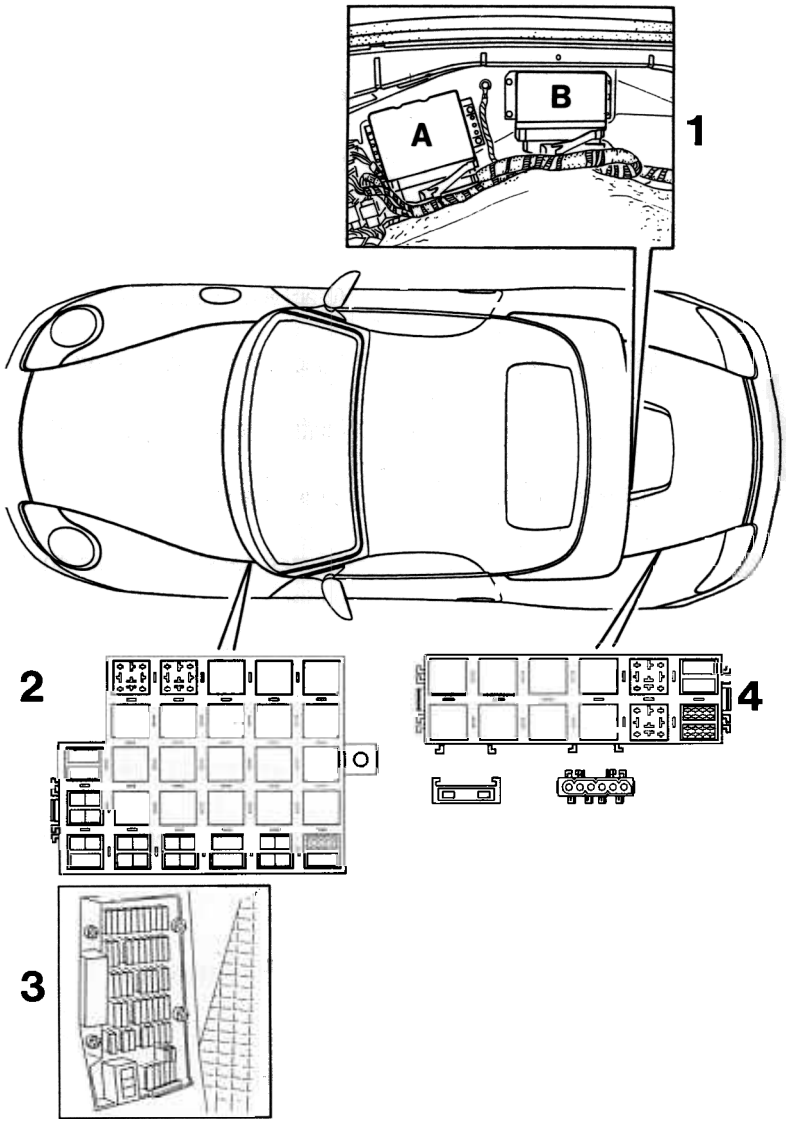
CO adjustment is possible only on vehicles without catalytic converter.

Vehicle data

Control module programming

Printed in Germany – 4, 1996 98624D1

DME component arrangement in the vehicle



560 - 96

Components

1 Control modules
A – DME control module
B – Tiptronic control module

2 Relay support 1 (on left in driver's footwell)

3 Fuse carrier (on left in driver's footwell)

4 Relay carrier 2 (on left rear in luggage compartment)

Assignment on relay support and on fuse support

Relay carrier 1 (in the footwell)

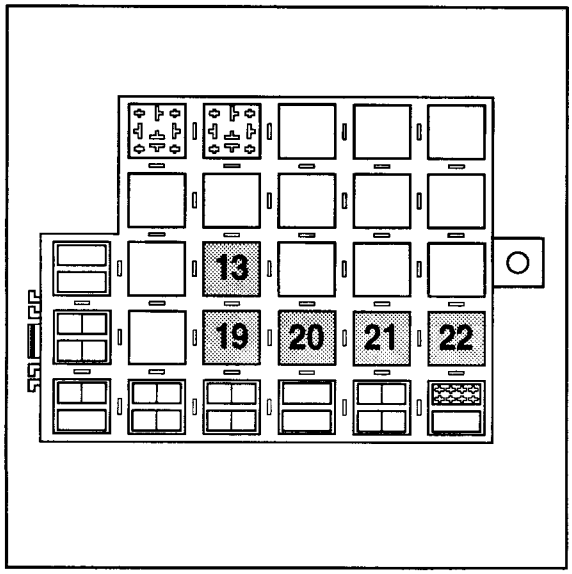
Fuel pump
Relay at connection point 13

Radiator fan 1 – Stage 1
Relay at connection point 19

Radiator fan 1 – Stage 2
Relay at connection point 20

Radiator fan 2 – Stage 1
Relay at connection point 21

Radiator fan 2 – Stage 2
Relay at connection point 22



655 - 96

Relay carrier 2 (in the rear)

DME relay at connection point 1

Ignition/oxygen sensor relay
at connection point 2

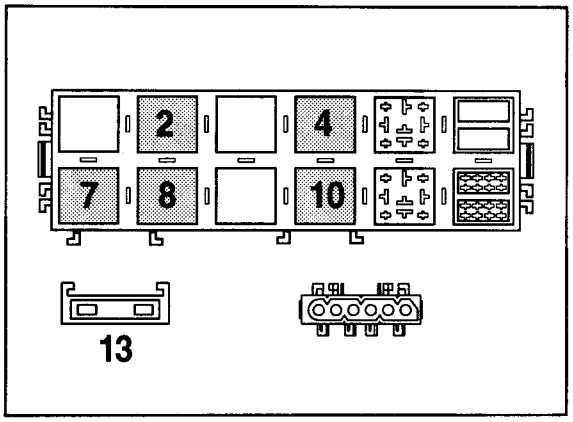
A/C compressor relay
at connection point 4

Start-inhibit relay
at connection point 7

Engine compartment fan relay
at connection point 8

Secondary air pump relay
at connection point 10

Secondary air pump fuse
on fuse support 13

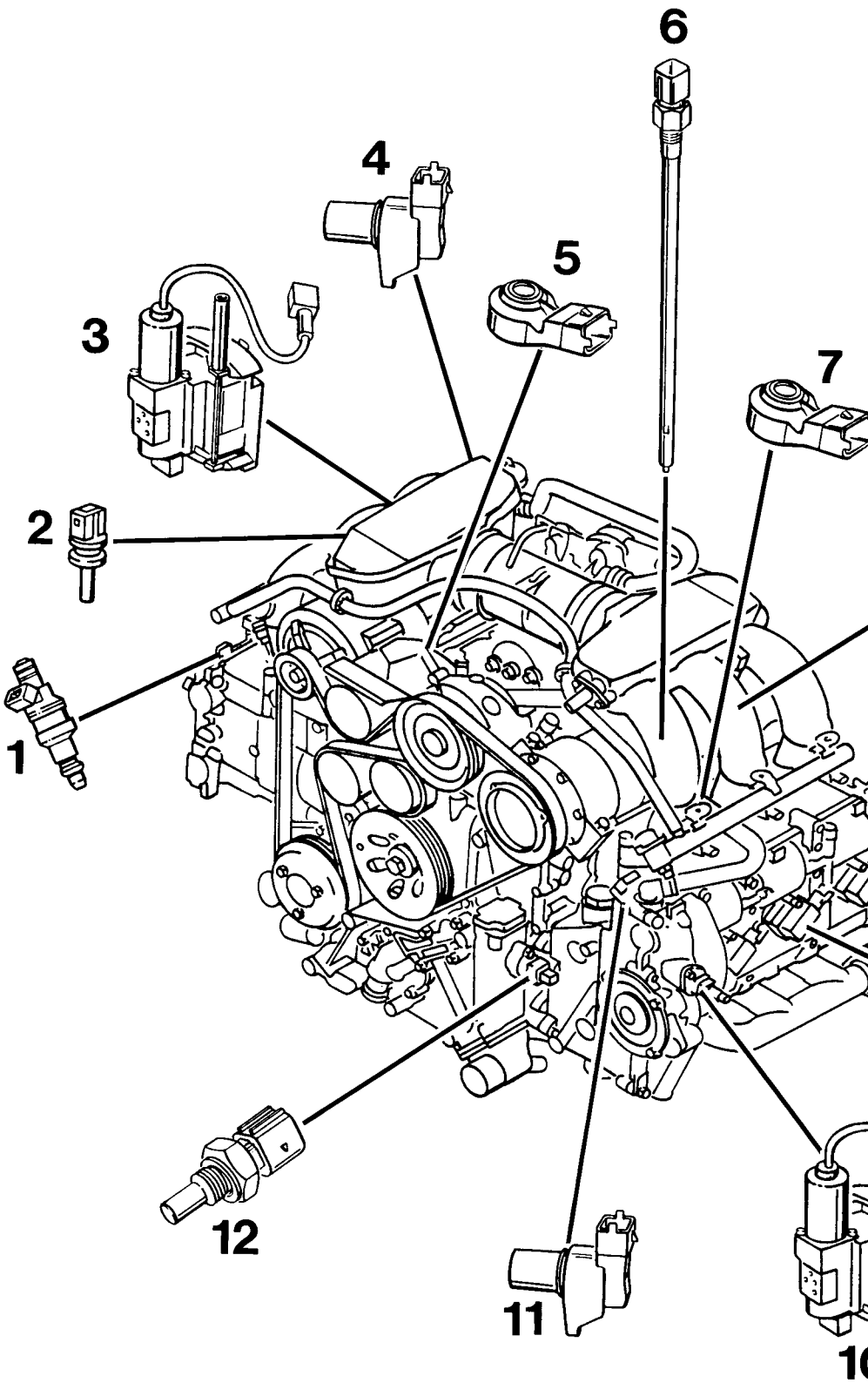


656 - 96

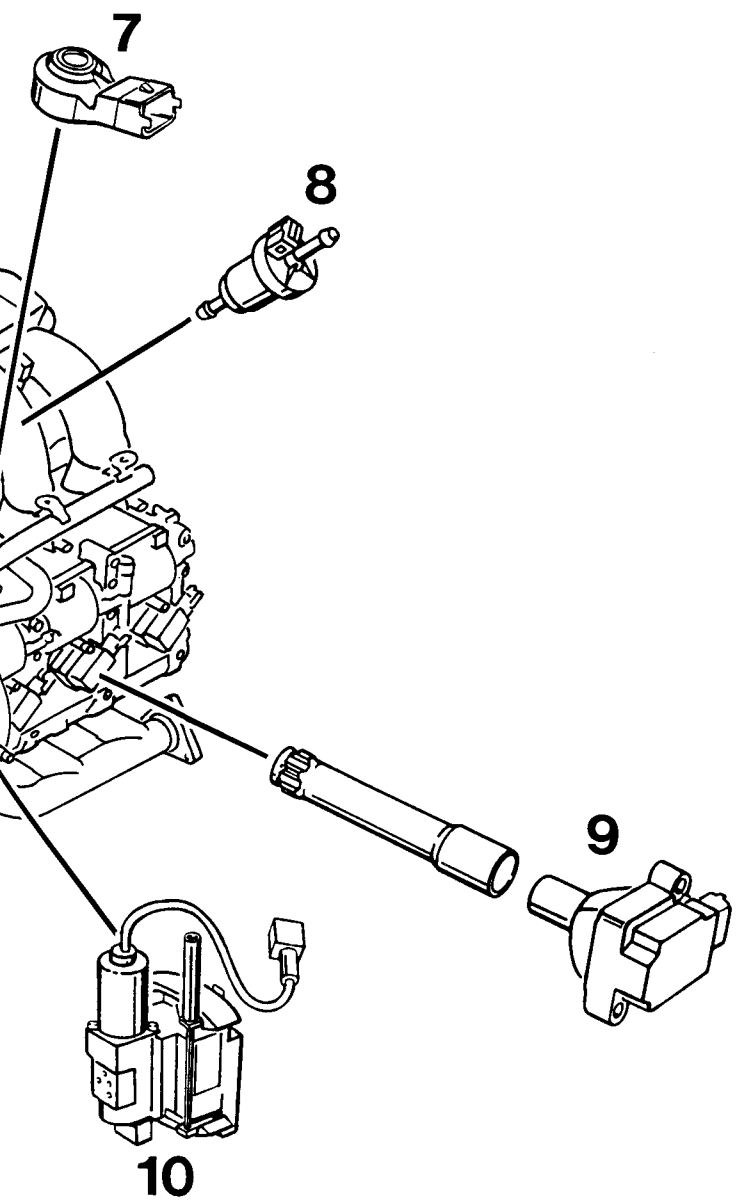
Printed in Germany – 4, 1996 98624D1

Components on the engine

Front view



Printed in Germany – 4, 1996 98624D11



Designation

1 – Injection valve

2 – Temperature switch for engine temperature

3 – Tensioning element (camshaft adjuster VarioCam)

4 – Hall-effect sensor

5 – Knock sensor

6 – Oil temperature sender/oil level sensor

7 – Knock sensor

8 – Tank vent (fuel evaporative valve)

9 – Individual coil/spark plug connector

10 – Tensioning element (camshaft adjuster VarioCam)

11 – Hall-effect sensor

12 – Temperature sender (coolant)

Function of components

1. Injection valves

The valve coils consist of brass and have an internal resistance of approximately 12 Ω. The injection valves are activated sequentially, and the electrical leads therefore must not be swapped. The change in the quantity injected is controlled by the DME control module via variable valve opening times.

2. Temperature switch for the engine compartment fan

An NTC thermistor is installed between the intake pipes of cylinders 1 and 2 in order to measure the engine compartment temperature. The DME control module activates the engine compartment fan depending on the respective engine compartment temperature and various additional factors.

3. Tensioning element (camshaft adjuster VarioCam)

In order to increase torque and improve cylinder charging, the engine is equipped with two VarioCam drive links installed in the chain tensioners of the camshafts.
The two drive links are actuated via solenoid valves, which are in turn activated by the DME control module.

4. Hall-effect sensor

A plug-in Hall-effect sensor is installed in the cylinder head at the 3rd cylinder of cylinder bank 1 - 3 in order to detect the ignition TDC of the 1st cylinder. The Hall signal is produced by a rotor fastened on the inlet camshaft of cylinder bank 1 - 3.
In addition to detection of ignition TDC of the 1st cylinder and the associated allocation of injection signals (sequential), ignition signals (stationary high-voltage distribution) and knock-sensor signals (knock regulation), the Hall signal is also used for diagnosis of the VarioCam system in the Boxster.

5. Knock sensor

Function
If the knock-sensor voltage, in combination with an amplification factor calculated by the control module, reaches a maximum voltage threshold, the DME control module interprèts this as "knocking". When knocking is detected, the calculated ignition timing angle is retarded by a crankshaft angle of 2.25° at the corresponding cylinder (cylinder selective). The maximum retardation per cylinder depends on the engine rpm and can be up to 15° crk behind the nominal ignition timing angle.
When knocking is no longer detected, the ignition timing angle is returned to its optimum value in small increments.

Safety function
If the DME control module detected a fault on knock sensor 1, knock sensor 2, the Hall-effect sensor, or an error in calculation of the engine

Printed in Germany – 4, 1996 98624D1

load signal, the DME control module will retard the calculated ignition timing angle by 9° crk as from the condition "Knock regulation active" and as from a fixed engine and intake air temperature.

6. Oil temperature sender

The DME control module uses the oil temperature to calculate the switching rpm for the VarioCam system. The oil temperature sender and oil level sender form a single component that is screwed into the crankcase.

7. Knock sensor

See Item 5.

8. Fuel evaporative valve

A solenoid valve is installed in the line between the intake housing and carbon canister. The flow direction of the one-way valve is stamped into the plastic housing. The valve is fitted below the intake pipe for cylinder 5.
The fuel evaporative valve is closed when de-energised. When the ignition is switched on, the DME control module applies positive voltage to the fuel evaporative valve via terminal 54. When the engine has started and the operating conditions listed beside this column have been reached, the fuel evaporative valve is connected to ground by the DME control module as well (but via terminal 61) and opens.

9. Individual ignition coil

The individual ignition coil and the spark plug are connected via a spark plug connector with an internal resistance of approx. 2.5 kΩ. The individual ignition coil is provided with positive voltage (terminal 3) and negative voltage (terminal 2) via the electrical lead on the keyed 3-pole plug contact. Terminal 1 on the individual ignition coil leads to the ignition driver. The coils are energised when the injection, ignition and oxygen-sensor relay is closed.

10. Tensioning element (camshaft adjuster)

See under Item 3.

11. Hall-effect sensor

See under Item 4.

12. Engine coolant temperature sensor

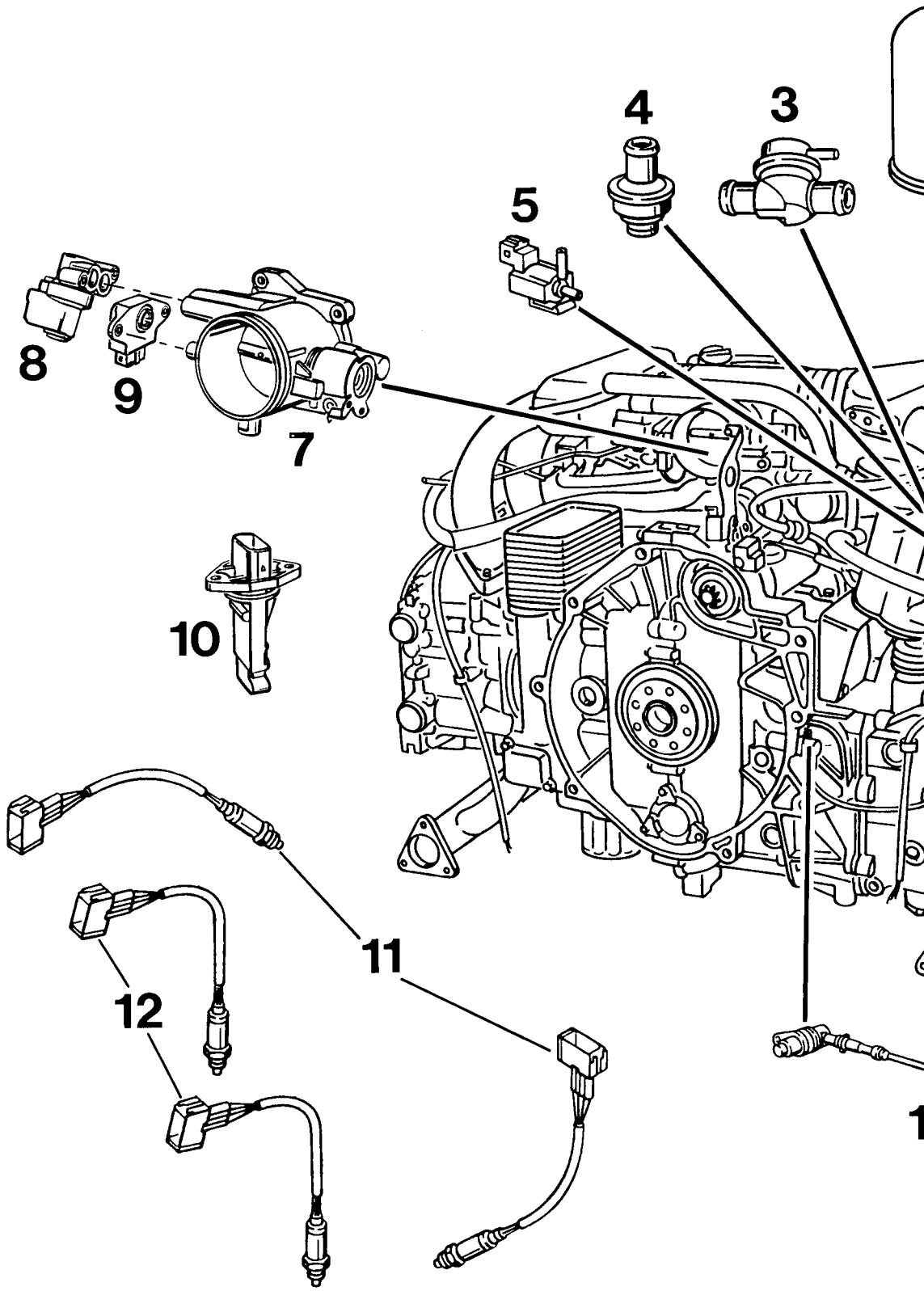
The engine temperature sender is designed as a double NTC thermistor. The control module uses the temperature sender signal to calculate the injection signal during the warm-up phase in order to enrich the mixture when the engine is started, to calculate the ignition timing angle during the warm-up phase and to control the electric fans. One temperature-dependent resistance (resistance measured between contacts 2 and 3 in the connector housing) provides the signal for indication of the engine coolant temperature in the instrument cluster, and the other temperature-dependent resistance (measured between contacts 1 and 4 in the connector housing) informs the

DME control module about the coolant temperature.
The engine coolant temperature sensor is screwed into the coolant guide housing.

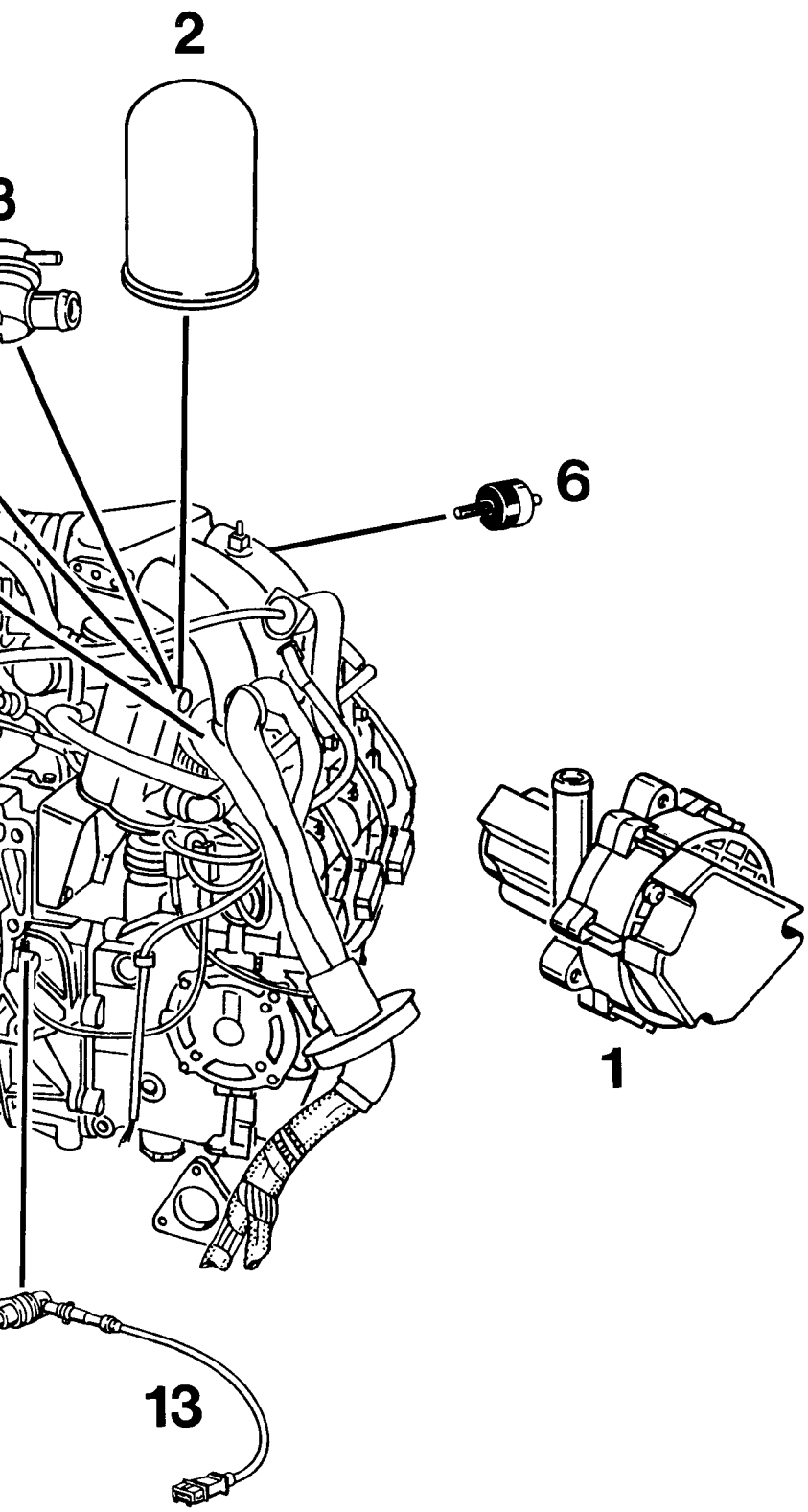
Printed in Germany – 4, 1996 98624D1

Components on the engine

Rear view



Printed in Germany – 4, 1996 98624D11



1 – Secondary air pump

2 – Vacuum reservoir
(only on Tiptronic and OBD II)

3 – Overflow valve

4 – Check valve

5 – Vacuum valve

6 – Check valve

7 – Throttle part

8 – IACV (idle speed positioner)

9 – Throttle potentiometer

10 – Hot film mass air flow sensor with intake air temperature sensor

11 – Oxygen sensors ahead of the catalytic converter

12 – Oxygen sensors behind the catalytic converter

13 – Pulse sender (reference mark sensor/rpm sender)

Components No. 1, 3, 4, 6, 12 are installed only on OBD II vehicles.

1. Secondary air fan

USA vehicles are equipped with a secondary air system in order to reduce pollutants in the exhaust gas during the warm-up phase and to fulfil the emissions limits.
An electric air pump is mounted on the body in the engine compartment for this purpose. It is activated by the DME control module and, via air lines, injects the secondary air behind the exhaust valves.

2. Vacuum reservoir

Ensures the function of vacuum-operated components.

3. Pneumatic switch-over valve

A pneumatic switch-over valve is fitted between the air pump and exhaust valve. It is closed when the secondary air system is inactive and thereby prevents the induction of additional air as a result of flow conditions.

4. Check valve

5. Vacuum valve

6. Check valve

7. Throttle plate part

8. IACV (idle speed positioner)

A two-winding positioner that is screwed directly to the throttle plate part without additional air guide hoses.

9. Throttle potentiometer

The throttle position is determined via a potentiometer fitted on the throttle-plate shaft. The DME control module supplies the potentiometer with a controlled voltage (5 V). Depending on the position of the potentiometer (throttle-plate angle), there is a greater or lesser voltage drop across the potentiometer. The DME also recognises the smallest opening angle of the throttle via the voltage drop or the corresponding current. This is defined as the “idle position”.

Printed in Germany – 4, 1996 98624D1

10. Hot film mass air flow sensor

A new hot film mass air flow sensor with the designation HFM 5 is used on the Boxster. Its housing shape permits installation in one direction only. It is fastened with M 5 Torx screws.
As with the previous mass air flow sensors, the manufacturer performs laser calibration on the new HFM 5 in a so-called "master tube". In other words, a corresponding air mass produces an exactly defined voltage signal.

The hot film mass air flow sensor is fitted in the air cleaner housing at the outlet of the air cleaner. The operating voltage range is 9 - 7 Volt, and the output voltage of the mass air flow sensor (voltage to the DME control module) lies between 0 and 5 Volt. The actual measuring element is supplied with a controlled voltage of 5 Volt from the control module in addition to the voltage supplied by the vehicle electrical system to the mass air flow sensor. This prevents fluctuations in the vehicle voltage, e.g. when loads are switched on, from influencing the measuring process.

Intake air temperature sensor

The intake air temperature sensor is installed in the mass air flow sensor housing and is thus located in the intake air flow. It is supplied with voltage by the DME control module via terminal 43, and is connected together with the HFM 5 on the ground side. The intake air temperature sensor functions according to the NTC principle.
The DME control module uses the signal from the intake air temperature sensor to calculate the substitute load signal if the mass air flow sensor fails. The load calculated by the control module, which depends on the throttle potentiometer, is corrected by the IATS signal. A negative correction is applied to the substitute load signal at high air temperatures.
At the same time, the decreasing air density is compensated. Furthermore, the risk of knocking increases with increasing intake air temperature. The ignition timing is therefore retarded at a high engine temperature (> 90 °C) and high intake air temperature (> 30 °C).

11./12. Oxygen sensors

These sensors are floating, i.e. the DME control module connects ground to the oxygen sensors. The sensors are located in the exhaust-gas flow ahead of the catalytic converter; two sensors are additionally installed behind the catalytic converter on OBD II vehicles.

Oxygen sensor heating

Besides being heated by the exhaust gas, the oxygen sensors are also heated electrically. For this purpose, the oxygen sensor, injection and ignition relay is activated and applies positive voltage to the oxygen sensor heaters after operation of the DME relay.
The DME control module connects ground to the heating resistors.

13. Pulse sender (reference mark sensor/ rpm sender)

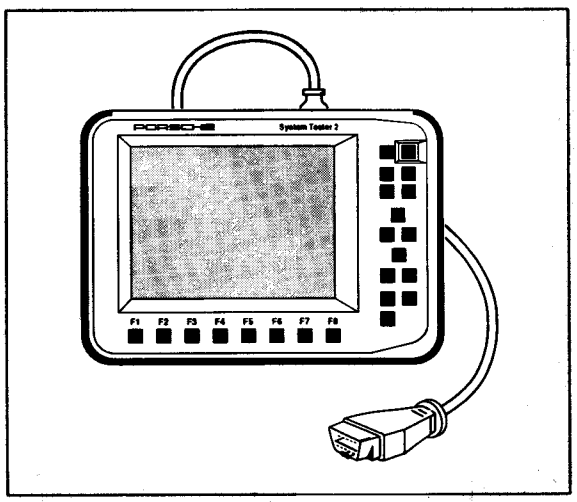
The DME measures the crankshaft rotation with an inductive sender. A pulse wheel is mounted on the flywheel for this purpose. This pulse wheel is a toothed ring stamped from sheet steel and spot-welded on the flywheel. It has 60 teeth. A gap produced by the omission of two teeth is defined as the reference mark and is located

84° ahead of TDC of the 1st or 4th cylinder.
The pulse sender is fitted in a bore on the crankcase. The distance is **not** adjustable.

Tools

The following equipment is required for trouble-shooting:

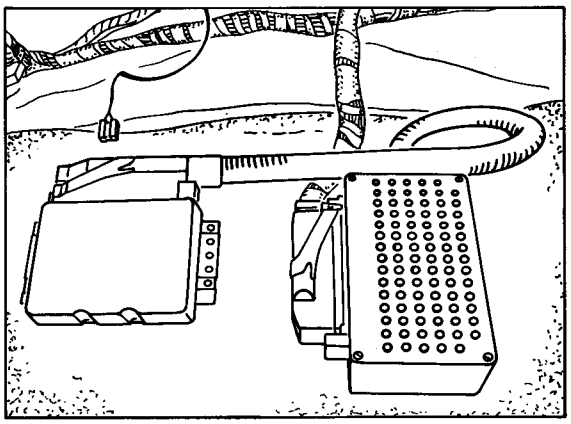
1. Porsche System Tester 2



2. Test adapter 9616

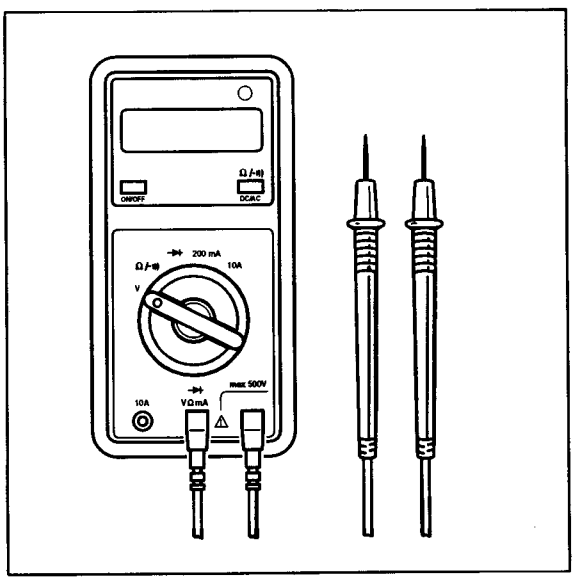
Note

The test adapter is connected between the pulled-off DME control module connector and the DME control module. It protects the contacts of the control module connector and helps the user to find the individual pins.



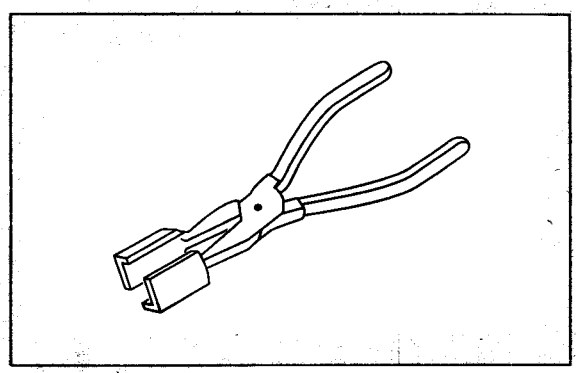
652 - 96

3. Commercially available digital multimeter



2178 - 28

4. Relay extractor 9235



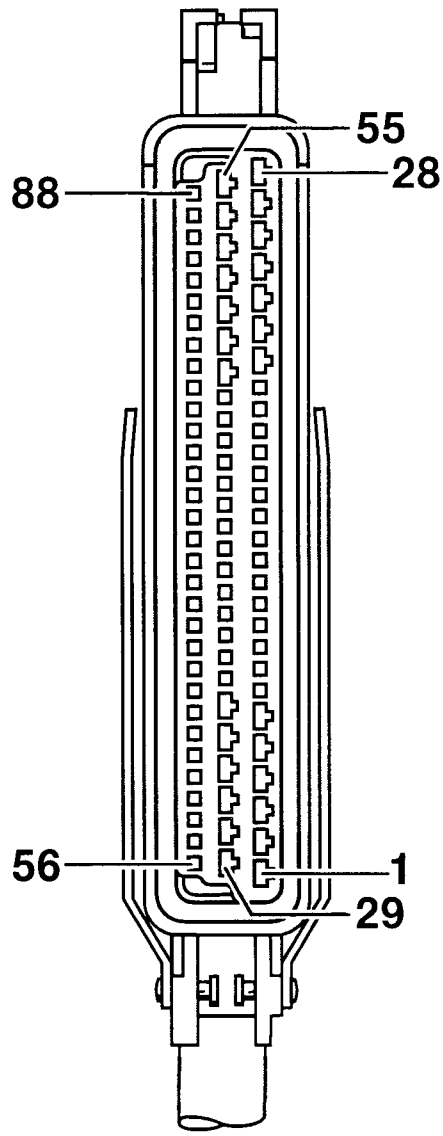
Printed in Germany – 4, 1996 98624D1

DME connector assignment

1 – Oxygen sensor heating behind catalytic converter
2 – IACV make winding
3 – Injector valve, cylinder 1
4 – Injector valve, cylinder 3
5 – Injector valve, cylinder 5
6 – Ground, terminal 31
7 – Carbon canister shutoff valve
8 – Check Engine MIL
9 – EX lamp
10 – Free
11 – Free
12 – Electric fuel pump shutoff
13 – Knock sensor 1
14 – Medium pressure switch (A/C)
15 – Intake temperature in HFM
16 – NTC engine compartment temperature
17 – Hot film mass air flow sensor signal
18 – Signal, oxygen sensor 2 ahead of catalytic converter
19 – Signal, oxygen sensor 1 ahead of catalytic converter
20 – Ground, rpm sender
21 – Signal, Hall-effect sensor
22 – Ignition coil, igniter 4
23 – Ignition coil, igniter 5
24 – Ignition coil, igniter 6
25 – Camshaft adjuster 2
26 – Terminal 30
27 – DME relay
28 – Electronics ground
29 – IACV break winding
30 – Oxygen sensor heating ahead of catalytic converter
31 – Injector valve, cylinder 2
32 – Injector valve, cylinder 4
33 – Injector valve, cylinder 6
34 – Ground, sensors
35 – Radiator fan
36 – Radiator fan
37 – Secondary air pump
38 – Version coding
39 – Indicator light, reserve
40 – Free
41 – Knock sensor 2
42 – Automatic I/M test
43 – Free
44 – Signal, throttle potentiometer
45 – Ground, hot film mass air flow sensor
46 – Ground, oxygen sensors
47 – 5 Volt supply - hot film mass air flow sensor
48 – Spec. engine torque
49 – Ignition coil, igniter 1
50 – Ignition coil, igniter 2
51 – Ignition coil, igniter 3
52 – Camshaft adjuster 1
53 – 5 Volt supply for throttle potentiometer
54 – Voltage output to loads
55 – Ground, ignition
56 – Terminal 15
57 – Diagnosis - tank pump
58 – Actual engine torque
59 – Free

Printed in Germany – 4, 1996 98624D11

60 – Programming voltage
61 – Tank vent (fuel evaporative valve)
62 – Activation, A/C compressor on
63 – Fuel pump relay
64 – Free
65 – Engine compartment purge fan
66 – Activation, start inhibit
67 – Signal, knocking Yes/No
68 – Start enable
69 – A/C request
70 – Free
71 – Ground, knock sensors
72 – Free
73 – Oil temperature
74 – Double NTC thermistor (water temperature)
75 – Free
76 – Signal, oxygen sensor 2 behind catalytic converter
77 – Signal, oxygen sensor 1 behind catalytic converter
78 – Signal, rpm sender
79 – Rpm sensor output, rear
80 – Rpm signal
81 – Free
82 – Fan monitoring
83 – Fuel consumption display
84 – Free
85 – Serial data transfer - LOW
86 – Serial data transfer - HIGH
87 – Free
88 – Diagnosis lead



619 - 96

98624D11

Fault overview

Test point	DTC	Fault effect	Page
General			24 - D 29
1	5, 13		24 - D 31
2	10, 18		24 - D 32
3	15, 16, 21, 22		24 - D 32
4	26, 27, 28		24 - D 33
5	30		24 - D 34
6	32		24 - D 34
7	34, 35, 36		24 - D 35
8	39		24 - D 36
9	50 - 55, 62 - 68 and 75		24 - D 36
10	98		24 - D 36
11	101, 102, 103, 104, 105		24 - D 37
12	107		24 - D 37
13	108		24 - D 38
14	111		24 - D 38
15	112, 113		24 - D 39
16	115		24 - D 39
17	117		24 - D 40
18	120		24 - D 40
19	121		24 - D 41
20	123		24 - D 41
21	124		24 - D 41
22	125		24 - D 42

Printed in Germany – 4, 1996 98624D1

Test point	DTC	Fault effect	Page
23	150 - 155		24 - D 42
24	165		24 - D 43
25	167		24 - D 44
26	168, 169		24 - D 44
27	170		24 - D 45
28	174, 178		24 - D 45
29	210, 211, 212, 213		24 - D 46
30	236		24 - D 47
31	251		24 - D 47
32	253		24 - D 48
33	301		24 - D 48
34	302		24 - D 49
35	322, 325		24 - D 51

98624D1 Printed in Germany – 4, 1996

2470 Programming DME control module

General

When a DME control module is replaced, the new DME control module must be programmed. This sets the new DME control module to the catalytic converter version installed, among other things.

Four catalytic converter versions are available in the Porsche System Tester 2:

1. OBD II control module (W-range)

2. RoW control module (bi-metal catalytic converter)

3. OBD II control module (V-range)

4. OBD II control module (tri-metal catalytic converter, X-range)

Note:

The OBD II control modules (V, W or X-range) are installed in **USA vehicles**.

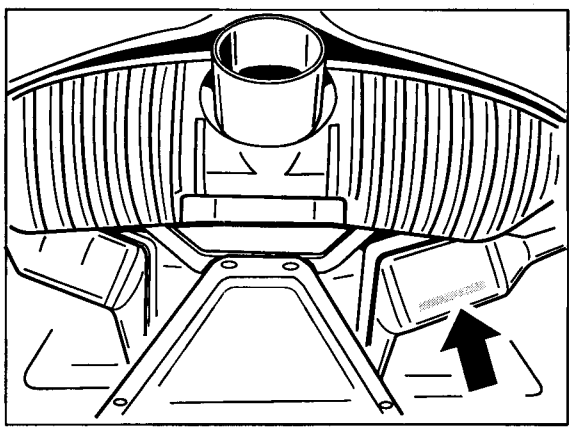
Work preparation

The following vehicle data must be provided before programming of the new DME control module can begin:

- Vehicle Ident. No.
- Catalytic converter Item No. corresponding to the catalytic converter version used
- DME and immobilizer programming codes (from the Porsche IPAS system)

With the information about the *Vehicle Ident. Number* and *catalytic converter item number*, the associated programme can be selected from the allocation table.

Figure 308_98 shows where the catalytic converter item number can be found on the vehicle.



Catalytic converter item number 308_98

Programming

1. Connect and switch on the Porsche System Tester 2 and switch on the ignition.
2. Select **Boxster** in the *Vehicle type* menu.
3. Select **DME** in the *Control unit* menu and press the double arrow key [>>].
4. Select *Program control unit* in the *DME function selection* menu and press the double arrow key [>>].

Printed in Germany - 21, 1998 9862428a

5. Select "Read control units" and press the double arrow key [>>].

6. Install new DME control module.

7. Select **Program control unit** in the *Control unit programming* menu and press the double arrow key [>>].

8. Ensure that all requirements requested on the screen are fulfilled and then press the double arrow key [>>].

9. The following message appears on the screen:
"Input Vehicle Ident. Number".
Use the double arrow key [>>] to accept the number displayed on the screen.

10. The following message appears on the screen:
"Please confirm input"
Confirm input with the [F7] key.

11. The following message appears on the screen:
"Input old DME programming code"
Input DME programming code and press the double arrow key [>>].

12. The following message appears on the screen:
"Please confirm input"
Confirm input with the [F7] key.

13. The following message appears on the screen:
Input new programming code"
Input new DME programming code and press the double arrow key [>>].

14. The following message appears on the screen:
"Please confirm input"
Confirm input with the [F7] key.

15. The following message appears on the screen:
Input new immobilizer code"
Input immobilizer code and press the double arrow key [>>].

16. The following message appears on the screen:
"Please confirm input"
Confirm input with the [F7] key.

17. The following message appears on the screen:
"Select data record "
Select data record according to the allocation table and press the double arrow key [>>].

The control module will now be programmed. Programming will take approx. 5 minutes.

Warning:
> Never interrupt the programming process

18. The following message will appear after the programming time has elapsed:
"Programming was completed successfully"
Press the double arrow key [>>], switch the ignition off and then on again.

This completes programming of the DME control module.

Warning:
Risk of damage if allocation is incorrect!

> Ensure correct allocation of the data record in the control module to the installed catalytic converter (refer to the allocation table).

Catalytic converter version	Vehicle Ident. Number	Catalytic converter item number
OBD II control module (**V**-range)	WP0xx**2**xxx**V**xxxxxxx	996.113.031.06 996.113.032.06
RoW control module (bi-metal catalytic converter)	WP0**ZZZ**xxx**V**xxxxxxx	996.113.021.06 996.113.022.06 996.113.921.01 996.113.922.01
RoW control module (bi-metal catalytic converter)	WP0**ZZZ**xxx**W**xxxxxxx	996.113.021.08 996.113.022.08 996.113.021.09 996.113.022.09 996.113.921.01 996.113.922.01
OBD II control module (**W**-range)	WP0xx**2**xxx**W**xxxxxxx	996.113.021.05 996.113.022.05 996.113.021.06 996.113.022.06 996.113.021.08 996.113.022.08 996.113.021.09 996.113.022.09
RoW control module (tri-metal catalytic converter, **X**-range)	WP0**ZZZ**xxx**X**xxxxxxx	996.113.021.10 996.113.022.10
OBD II control module (tri-metal catalytic converter, **X**-range)	WP0xx**2**xxx**X**xxxxxxx	996.113.021.10 996.113.022.10 996.113.931.00 996.113.932.00

Allocation table

Information:

The DME control module can also be reprogrammed using the Porsche System Tester 2.
In this case, the old data record will be overwritten by a new record.

Program map/data must be selected in Step 7 if reprogramming is necessary.

General test point

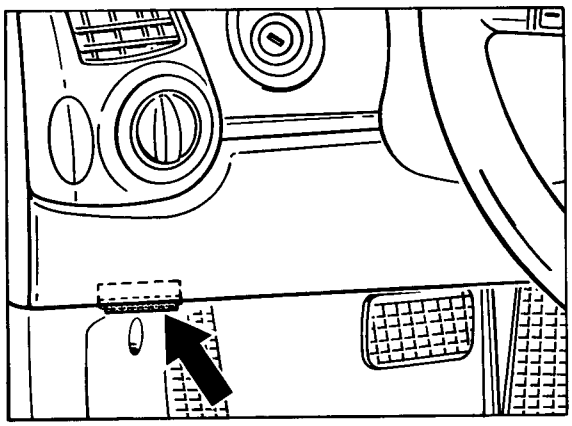
No communication with the Porsche System Tester 2.

Test

1. Test voltage supply at the 16-pole data link connector (on the left in the driver's footwell).

Note

The alarm system must be deactivated.



625 - 96

General test point

Continuous positive voltage (terminal 30)

Connect voltmeter to control module connector or adapter 9616 (test box) pin 6 (ground) and pin 26.

Display: 12.5 V with ignition "OFF"

Connect voltmeter to pin 6 (ground) and pin 54

Display: 12.5 V with ignition "ON" (connected via DME relay)
If there is no display: Check current path according to wiring diagram.

Test point 1

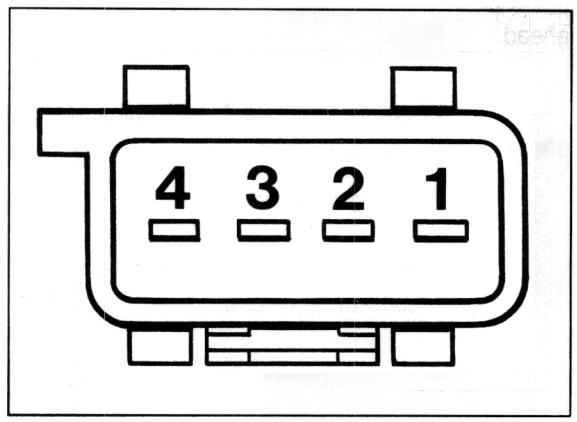
Oxygen sensor heater 2 and oxygen sensor heater 1 **ahead of** cat. converter
DTC 5, 13

1. Pull off relay (ignition/oxygen sensors) from relay support 2 with the special tool "relay extractor 9235".
   Connect ohmmeter to relay base pin 87 and to control module connector pin 30
   Ignition "OFF" (pull off one sensor connector in each case)
   Required measured value: 1 – 15 Ω

Note

Both sensor heaters are connected in parallel.

2. Pull off the sensor connector and connect voltmeter to pin 1 and ground
   Ignition "ON"
   Display: approx. 12 Volt



631 - 96

If there is no display: Check current path according to wiring diagram.

Printed in Germany – 10, 1997 98624D1

General test point

Continuous positive voltage (terminal 30)

Connect voltmeter to control module connector or adapter 9616 (test box) pin 6 (ground) and pin 26.

Display: 12.5 V with ignition "OFF"

Connect voltmeter to pin 6 (ground) and pin 54

Display: 12.5 V with ignition "ON" (connected via DME relay)
If there is no display: Check current path according to wiring diagram.

Test point 1

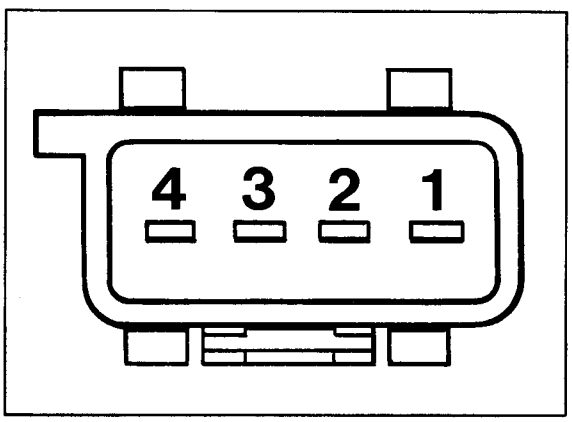
Oxygen sensor heater 2 and oxygen sensor heater 1 **ahead of** cat. converter
DTC 5, 13

1. Pull off relay (ignition/oxygen sensors) from relay support 2 with the special tool "relay extractor 9235".
   Connect ohmmeter to relay base pin 87 and to control module connector pin 30
   Ignition "OFF" (pull off one sensor connector in each case)
   Required measured value: 1 – 15 Ω

Note

Both sensor heaters are connected in parallel.

2. Pull off the sensor connector and connect voltmeter to pin 1 and ground
   Ignition "ON"
   Display: approx. 12 Volt



631 - 96

If there is no display: Check current path according to wiring diagram.

Test point 2

O2 sensor ahead of cat. conv., cylinders 1 - 3
O2 sensor ahead of cat. conv., cylinders 4 - 6
DTC 10, 18

Oxygen sensor of cylinders 1 - 3
Connect voltmeter to control module connector pin 19 (+) and pin 46 (–).
Ignition "ON"
Display: approx. 450 mV

Start engine. With the engine warm, the voltage fluctuates between approx. 0.1 and 0.9 V.

Oxygen sensor of cylinders 4 - 6
Connect voltmeter to control module connector pin 18 (+) and pin 46 (–).
Ignition "ON"
Display: approx. 450 mV

Start engine. With the engine warm, the voltage fluctuates between approx. 0.1 and 0.9 V.

Note

If a fault is stored, there may also be a leak in the intake system. Before replacing the oxygen sensors, check that the oil filler cover and the oil dipstick are seated correctly and check the entire intake system for leaks.

Test point 3

Oxygen sensor ageing ahead of cat. conv., cylinders 1 - 3
Oxygen sensor ageing ahead of cat. conv., cylinders 4 - 6
DTC 15, 16, 21, 22

Note

Check whether additional faults are stored in the memory, and remedy these faults **first**.

1. Erase fault memory.
2. Heat the oxygen sensors (test drive under load, run engine without load at high rpm).
3. Perform test drive.
4. Read out the fault memory and check whether the fault was stored again. If the fault re-appears, the corresponding oxygen sensor must be replaced.

Test point 4

Oxygen sensing
range 2 and range 1,
cylinders 1 - 3
DTC 26, 27, 28

Fault: Lean limit

Mixture is so rich that the control is at its lean limit.

Fault area: Fuel pressure too high or injection valve leaks.

Remedy:
1. Check fuel pressure.
2. Check fuel pressure regulator, vacuum connection and fuel return line.

Fault: Rich limit

Mixture is so lean that the control is at its rich limit.

Fault area:
- Intake system leaks
- Fuel pressure too low
- Injection valves fouled
- Fuel pump delivery too low

Remedy:
1. Check exhaust system for leaks.
2. Check intake system for leaks.
3. Check fuel pressure.
4. Check fuel pump delivery.
5. Clean injection valves in ultrasound cleaning device or replace.

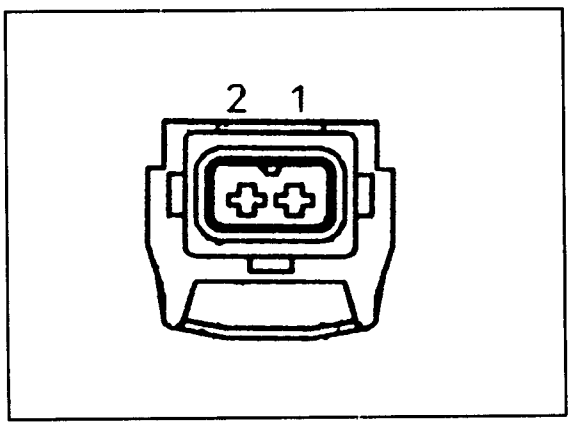
Printed in Germany – 4, 1996 98624D1

Test point 5

Engine compartment temperature sensor
DTC 30

Connect ohmmeter to adapter terminal 16 and terminal 34.
The control module connector must be disconnected from the adapter during the measurement.
Display: 2.4 kΩ

Pull off the temperature sensor connector and connect voltmeter to terminal 1 and terminal 2.
Ignition "ON"
Display: approx. 5 V



Test point 6

Idle control
at stop
DTC 32

Possible faults:

IACV (idle speed positioner) defective

Intake system leaks

Test point 7

Oxygen sensing
range 2 and range 1,
cylinders 4 - 6
DTC 34, 35, 36

Fault: Lean limit

Mixture is so rich that the control is at its lean limit.

Fault area: Fuel pressure too high or injection valve leaks.

Remedy:
1. Check fuel pressure.
2. Check fuel pressure regulator, vacuum connection and fuel return line.

Fault: Rich limit

Mixture is so lean that the control is at its rich limit.

Fault area:
- Intake system leaks
- Fuel pressure too low
- Injection valves fouled
- Fuel pump delivery too low

Remedy:
1. Check exhaust system for leaks.
2. Check intake system for leaks.
3. Check fuel pressure.
4. Check fuel pump delivery.
5. Clean injection valves in ultrasound cleaning device or replace.

Printed in Germany – 4, 1996 98624D1

Test point 8

Anti-drive-off feature
DTC 39

Possible faults:

1. Transponder (wrong key)
2. DME control module was replaced but not yet reprogrammed with the System Tester.
3. Fault in the alarm system; read out fault memory of the alarm system.
4. Check wire from DME control module pin 88 to alarm control module terminal I/23 for continuity, short to B+ and ground (pin 28).

Test point 9

Misfire detection
DTC 50 - 55, 62 - 68 and 75

1. Measure resistance:
   Connect ohmmeter to pin 1 and pin 15 of the ignition coil
   Display: 0.7 Ω
2. Measure voltage:
   Pull off ignition coil connector and measure between pin 2 (–) and pin 3 (+)
   Ignition "ON"
   Display: approx. 12 V
3. Pull spark plug connector off the ignition coil
   Measure resistance at the spark plug connector
   Display: 2.5 kΩ

Test point 10

Fuel evaporative valve
DTC 98

1. Pull off valve connector and connect voltmeter to pin 2 (+) and engine ground
   Ignition "ON"
   Display: approx. 12 V
2. Ignition "OFF"
   Pull off control module connector
   Connect ohmmeter between pin 61 and pin 54
   Display: In temperature range between 18 and 28 °C = 22 - 30 Ω

98624D1 Printed in Germany – 4, 1996

Test point 11

Control module faulty
DTC 101, 102, 103, 104, 105

If DTC 101, 102, 103 or 105 is displayed, replace the DME control module.

If DTC 104 is displayed, erase the fault memory.
Perform a test drive. If DTC 104 is stored again, replace the DME control module.

Test point 12

Supply voltage
DTC 107

Connect voltmeter with control module connector pin 6 and pin 54.
Ignition "ON"
Display: approx. 12.5 V

Printed in Germany – 4, 1996 98624D1

Test point 13

Continuous positive voltage
DTC 108

Test procedure:

Pull off the control module connector and connect voltmeter with pin 6 (–) and pin 26 (+)
Ignition "OFF"
Display: Battery positive voltage

If there is no display, check the current and ground path according to the wiring diagram.

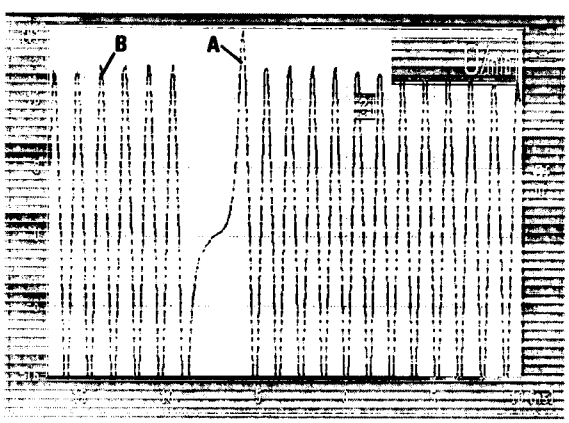
Test point 14

Reference mark sensor (rpm sender)
DTC 111

Perform test with an oscilloscope.

Connect tester lead with control module connector pin 20 (rpm sender ground) and pin 78 (rpm sender signal).

Start engine. A sinusoidal trace must be visible on the screen. A briefly higher amplitude identifies the reference mark signal.

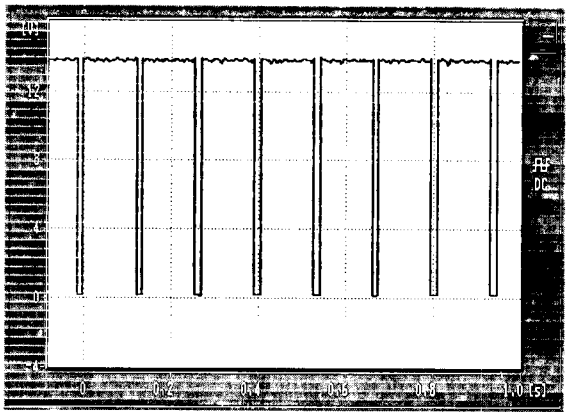


A – Reference mark signal
B – Rpm signal

Test point 15

Hall-effect sensor 1
Hall-effect sensor 2
(only on OBD II vehicles)
DTC 112, 113

1. Connect voltmeter with control module connector pin 53 (+) and pin 34 (–).
   Ignition "ON"
   Display: approx. 5 V
2. Check Hall signal with an oscilloscope.
   Connect oscilloscope with pin 21 for this purpose. Start engine.
   The following signal must be displayed.



Test point 16

Hot film MAF sensor
DTC 115

Connect voltmeter to control module connector or adapter 9616 (test box)
pin 47 (+) and pin 45 (–)
Ignition "ON"
Display: 5 V

Connect voltmeter to control module connector or adapter 9616 (test box)
pin 17 (+) and pin 45 (–)
Ignition "ON"
Display: 1 V

Pull connector off hot film mass air flow sensor
Ignition "ON"
Connect voltmeter to pin 2 (connector side) and engine ground
Display: Battery positive voltage

Printed in Germany – 4, 1996 98624D1

Test point 17

Throttle potentiometer
DTC 117

Connect voltmeter to control module connector pin 53 (+) and pin 34 (–)
Ignition "ON"
Display: 5 V

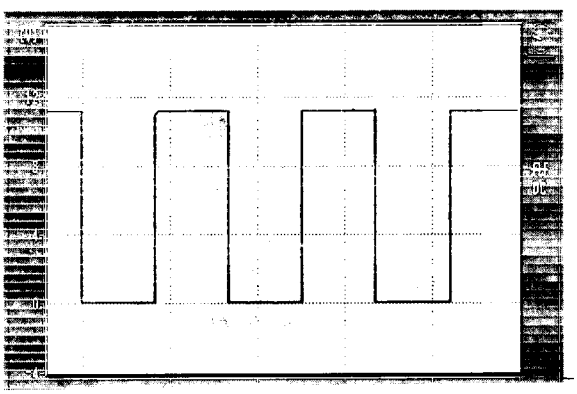
Connect voltmeter to control module connector pin 44 (+) and pin 34 (–)
Ignition "ON"
Display: in idle position approx. 0.55 V
with wide open throttle approx. 4.5 V

Measure resistance
Ignition "OFF"
Pull control module connector off the adapter, as otherwise the measurement result will be falsified.
Connect ohmmeter to pin 44 and pin 34
Display: Idle position
Wide open throttle

Test point 18

Vehicle speed
DTC 120

Test signal with an oscilloscope.
To do this, connect oscilloscope with terminal 79.
Ignition "ON"
Rotate right rear wheel by hand.
This must produce a square-wave signal of variable frequency.



670 - 96

Note
After remedying the fault, erase the ABS/TC fault memory.

Test point 19

Load detection
DTC 121

Possible fault causes:

- Incorrect cruise control adjustment
- Throttle potentiometer defective
- Engine drawing in secondary air

Test point 20

Engine temperature sensor (double NTC thermistor, coolant temperature)
DTC 123

Measure resistance:
Pull control module connector off the adapter, as otherwise the measurement result will be falsified.

Connect ohmmeter to pin 74 and pin 34.
Display: approx. 2395 Ω at 25 °C
at 90 °C: 242.5 ± 13.2 Ω

Test point 21

Intake air temperature
DTC 124

Note

The intake air temperature sensor is integrated in the hot film mass air flow sensor.

Measure resistance:
Pull control module connector off the adapter, as otherwise the measurement result will be falsified.
Connect ohmmeter to pin 15 and pin 45.
Display: 1.5 - 3.5 kΩ at 15 - 30 °

Test point 22

Oil temperature
DTC 125

Measure resistance

Pull control module connector off the adapter, as otherwise the measurement result will be falsified.
Connect ohmmeter to adapter terminal 34 and terminal 73
Display: 15.4 kΩ at an ambient temperature of approx. 25 °C

Measure voltage

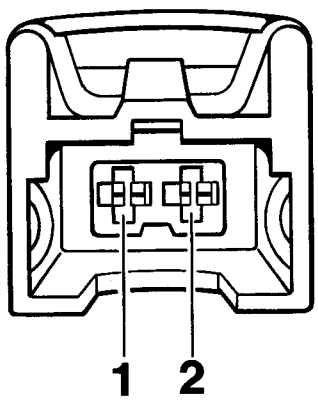
Push control module connector onto the control module.
Pull connector off the oil temperature sender.
Connect voltmeter to pin 1 and pin 2
Display: approx. 5 V

Test point 23

Injector valve,
cylinder 123456
DTC 150 - 155

Check voltage supply

Pull off valve connector
Connect voltmeter to connector pin 1 and ground (engine)
Display: Battery positive voltage



687 - 96

Measure coil resistance

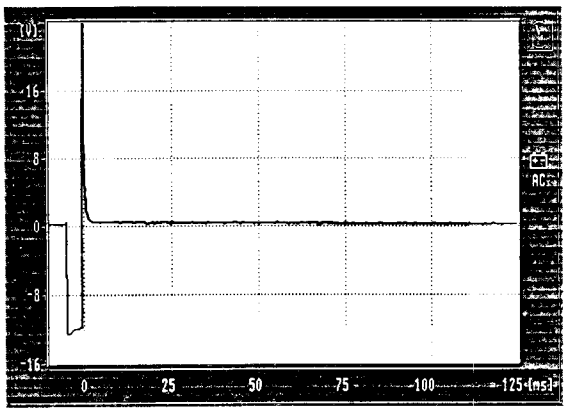
Connect ohmmeter to the contacts of the injection valve
Test value: 12 ± 0.3 Ω

Injection driver

Adjust oscilloscope according to the manufacturer's instructions. Connect auxiliary cable (1 684 463 093) from Messrs. Bosch between the injection valve and connector. Connect oscilloscope with the auxiliary cable according to the manufacturer's instructions.

Important: The Tester cables must not come into contact with ground.

Start engine. The following signal must be visible if the injection driver is functioning properly and the Tester connections are correct:



688 - 96

Test point 24

Check Engine
MIL
DTC 165

Check wire from DME control module connector terminal 8 to instrument cluster terminal III/2 for short to ground, short to B+ and open circuit.

Test point 25

Fuel pump relay
driver
DTC 167

1. Measure voltage
   Connect voltmeter to fuel pump relay terminal 30
   Display: 12 V
   If there is no display, check fuse in row C, No. 4.

2. Connect voltmeter to fuel pump relay terminal 86
   Display: 12 V
   If there is no display, check DME relay.

3. Check wire between fuel pump relay pin 85 and DME control module connector pin 63 for continuity and short circuit.

Test point 26

IACV
break winding
IACV
make winding
DTC 168, 169

1. Connect voltmeter to control module connector terminal 54 (+) and terminal 6 (–)
   Ignition "ON"
   Display: 12 V

2. Measure resistance of windings
   Pull off control module connector
   Connect ohmmeter to break winding terminal 29 and terminal 54
   Display: 15.8 Ω
   Connect ohmmeter to make winding terminal 2 and terminal 54
   Display: 18.4 Ω

Test point 27

A/C compressor control
DTC 170

Connect voltmeter to A/C compressor relay terminal 86 and ground (activated via DME relay)
Ignition "ON"
Display: 12 V

Connect voltmeter to relay terminal 30 and ground
Ignition "ON"
If voltage not present:
Check heater relay No. 18 (in the driver's footwell).
Check wire from relay terminal 85 to DME control module connector pin 62 for continuity.

Check A/C request

Connect voltmeter to control module connector pin 69 and ground
Ignition "ON"
Switch on A/C request
Display approx. 10 V

Test point 28

Camshaft adjustment, bank 1 and bank 2
DTC 174, 178

Measure voltage
Bank 1, cylinders 1 - 3

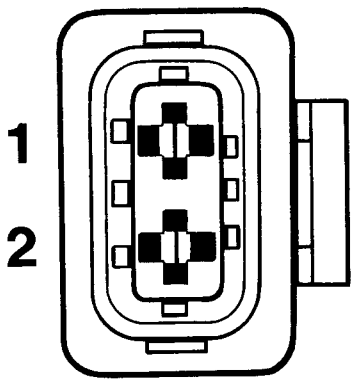
Connect voltmeter to control module connector or adapter pin 52 and pin 54
Ignition "ON"
Display: Battery positive voltage

Measure voltage
Bank 2, cylinders 4 - 6

Connect voltmeter to control module connector or adapter pin 25 and pin 54
Ignition "ON"
Display: Battery positive voltage

Printed in Germany – 4, 1996 98624D1

Pull off valve connector and measure voltage between
pin 1 (+) and ground (engine)
Ignition "ON"
Display: approx. 12 V



Note
Power is supplied via the DME relay

Test point 29

Knock sensors 1 and 2
DTC 210, 211, 212, 213

1. Check fastening of the knock sensors
   (torque and type of hexagon head bolts)
2. Check wiring harness and plug connections according to the wiring diagram
   Allocation:
   Knock sensor 1, pin 13 on the control module connector
   Knock sensor 2, pin 41 on the control module connector
   Ground of knock sensors, pin 71 on the control module connector
3. Loosening and re-tightening the knock sensors may eliminate any excess contact resistance.

Test point 30

CAN timeout
DTC 236

Read out the fault memory of the Tiptronic and remedy the fault if present.

Check wiring for continuity, short to B+ and short to ground.

1. DME control module connector pin 85 to Tiptronic control module connector pin 85.
   Ignition "OFF"

2. DME control module connector pin 86 to Tiptronic control module connector pin 86.
   Ignition "OFF"

Measure resistance

Pull the control module connector off the adapter before measurement, as otherwise the measurement result will be falsified.
Connect ohmmeter to pin 85 and pin 86
Display: approx. 121 Ω

Test point 31

Driver, engine compartment purge fan
DTC 251

1. Connect voltmeter to fan relay (connection point 8 in the rear) terminal 30 and ground.
   Display: approx. 12 V
   If nothing is displayed, check fuse B 4.

2. Connect voltmeter to fan relay terminal 86 and ground.
   Display: approx. 12 V
   If nothing is displayed, check the DME relay.

3. Check the fan relay
   On the relay base, jumper terminal 30 and terminal 87 with a test cable.
   Fan starts: Relay defective

Test point 32

Driver, fans
DTC 253

1. Perform drive link diagnosis with the System Tester.
2. Check fuse C 8 for fan 2
   and fuse C 10 for fan 1.
3. Connect voltmeter to terminal 30 of the individual relays and ground.
   Display: approx. 12 V
4. Connect voltmeter to terminal 86 of the individual relays and ground.
   Ignition "ON"
   Display: approx. 12 V
5. Fan function test:
   On the relay base, jumper terminal 30 and terminal 87 with a test cable.
   The fan must start, otherwise the fan or lead is defective.

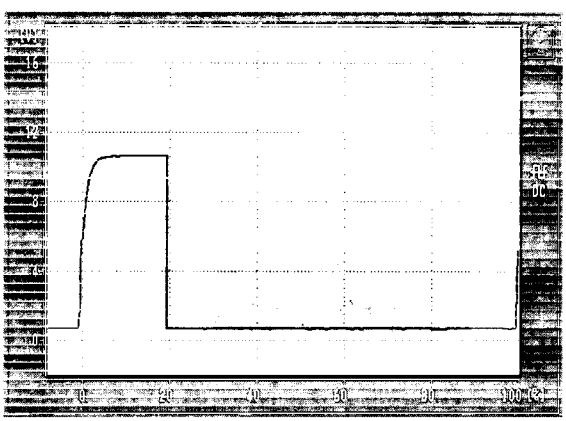
Test point 33

Signal from airbag
DTC 301

In the event of an accident, the DME control module receives the signal "fuel pump off" from the airbag control module.

Test the airbag signal with an oscilloscope. To do this, connect the oscilloscope with pin 12 of the control module connector and ground.

The following signal must be visible.



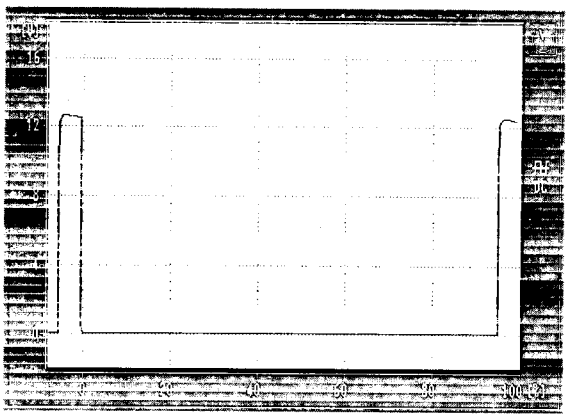
692 - 96

Test point 34

PWM interface,
actual engine torque
DTC 302

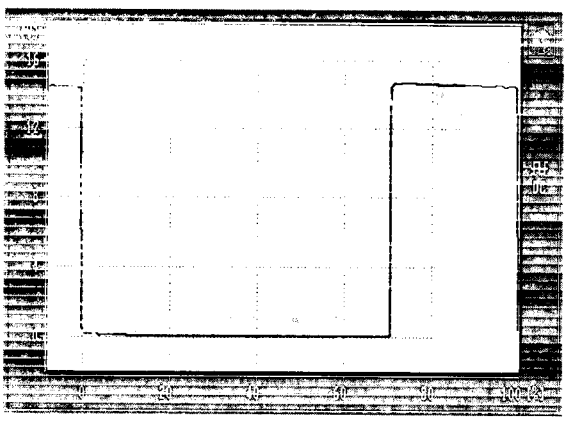
Check actual engine torque

1. Connect oscilloscope. Connect the Tester cable with DME control module connector or adapter terminal 58 and ground. The following signal must be visible with ignition "ON".



694 - 96

2. Start engine. The following signal must be visible.

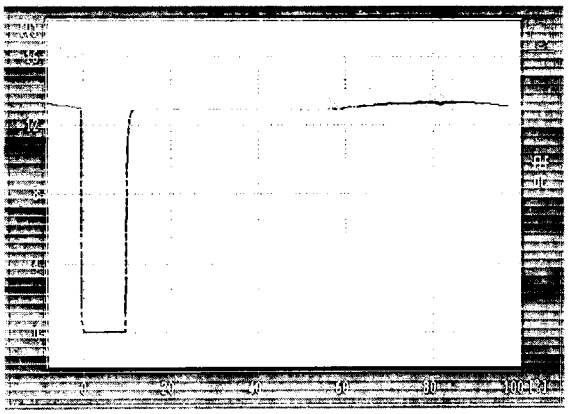


695 - 96

3. If signal is not visible, check wire between DME control module connector pin 58 and ABS control module connector pin 27 for continuity and short circuit.

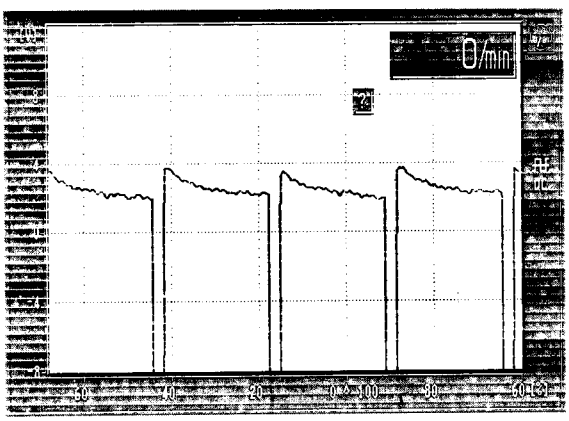
Check actual engine torque

1. Connect oscilloscope. Connect Tester with DME control module connector or adapter pin 48 and ground. The following signal must be visible with ignition "ON".



696 - 96

2. Start engine. The following signal must be visible.



697 - 96

3. If signal is not visible, check wire between DME control module connector pin 48 and ABS control module connector pin 13 for continuity and short circuit.

Test point 35

Timing chain out of position, bank 1 and bank 2
DTC 322, 325

Possible fault cause:

Allocation of exhaust camshaft and inlet camshaft does not agree.

24 01 DME setpoints

Boundary conditions

- Ambient temperature approx. 20° C
- Engine temperature 90 - 105° C
- All loads switched off
- Engine idling

Nominal values

	Value	Unit	Deviation
Idle speed	740	rpm	±40
Load signal	1.0	ms	±0.25
Mass air flow	15	kg/h	±1.25
Hot air mass air flow sensor	1.4	V	±0.1
Voltage	13.6	V	±0.5
Engine temperature	90	°C	±5.0
Throttle plate angle	0.0	%	±0.5
Ignition timing	5.3	°crk	±0.5
Spec. air mass	15.5	kg/h	±0.25
Spec. air adaption	1.5	kg/h	±0.05
Injection time	2.2	ms	±0.1
Exhaust gas temperature behind catalytic converter	270	°C	±50
Oil temperature	90.0	°C	±5

	Value	Unit	Deviation
Oxygen sensing, cylinder 1 - 3	1.0	-	±0.05
Oxygen sensing, cylinder 4 - 6	1.0	-	±0.05
Range 2, cylinder 1 - 3 (FRA)	0.96	-	±0.03
Range 2, cylinder 4 - 6 (FRA 2)	0.96	-	±0.03
Range 1, cylinder 1 - 3 (TRA)	0.00	-	±0.06
Range 1, cylinder 4 - 6 (TRA 2)	0.00	-	±0.06
O2 sensor voltage ahead of cat. conv.	$0.07 \leq U_L \leq 0.79$	V	-
O2 sensor voltage 2 ahead of cat. conv.	$0.07 \leq U_{L2} \leq 0.79$	V	-
* O2 sensor voltage behind cat. conv.	$0.64 \leq U_L \leq 0.79$	V	-
* O2 sensor voltage 2 behind cat. conv.	$0.64 \leq U_{L2} \leq 0.79$	V	-
Camshaft position 1 deviation	0.0	°crk	±4
* Camshaft position 2 deviation	0.0	°crk	±4
Rough-running threshold	6.3	$1/s^2$	±1.5
Rough running	0.0	$1/s^2$	±1.5
Segment (A)	0.01	-	-
Segment (B)	1.0	-	-
Learning progress, sensor wheel adaptation	0.000	-	-
Misfire detection	0.0	-	-

	Value	Unit	Deviation
Engine compartment temperature	63.0	°C	±8.0
Oxygen sensor heat resistance ahead of cat. conv.	3.1	Ω	±0.3
* Oxygen sensor heat resistance behind cat. conv.	3.1	Ω	±0.3

* **Only for OBDII vehicles**

Note:

The stated values are the result of measurements of vehicles with different mileages and in perfect condition. Different values can result from diagnosis in the workshop because of mileage and environmental influence. For DME diagnosis, it is important to look at several values simultaneously and in a collective group during troubleshooting.

Example:

An important collective group is formed by the following values:

Group	Values in normal state	Change caused by secondary air (oil filler cap)
Range 2 cylinder 1 - 3 (FRA)	0.96	0.96
Range 2 cylinder 4 - 6 (FRA 2)	0.96	0.96
Range 1 cylinder 1 - 3 (TRA)	0.00	0.2
Range 1 cylinder 4 - 6 (TRA 2)	0.00	0.2
Ignition timing	5.3 °crk	3.8 °crk
Mass air flow	15 kg/h	12.25 kg/h

37 01

Diagnosis/troubleshooting

Tiptronic

System G 40

Printed in Germany – 3, 1996 98637D1

Contents overview

98637D1 Printed in Germany – 3, 1996

Notes on on-board diagnostic

An on-board diagnostic system with fault memory is integrated in the Tiptronic control module. It can detect and store certain faults on the electronic transmission control system (see fault overview on Page 37 - D 17).

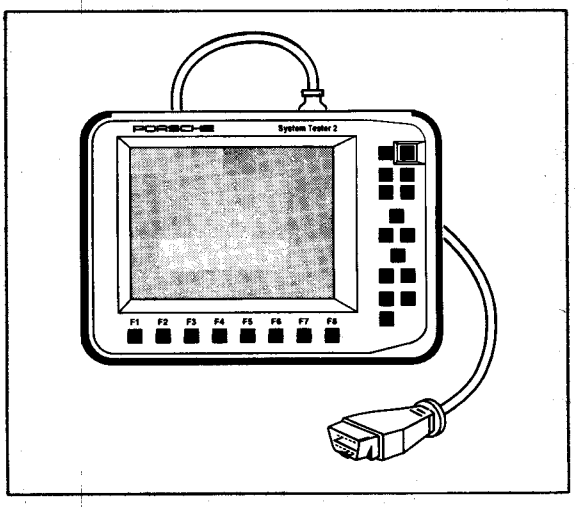
If a fault is present, it is first stored as a **static** fault. If the fault no longer exists, it first becomes a **sporadic** fault and "Fault not present" appears in the display of the Tester. The counter is set to 40 in this case.

Sporadic faults are deleted automatically after 40 cold starts of the engine (followed by transmission warm-up).

Printed in Germany – 3, 1996 98637D1

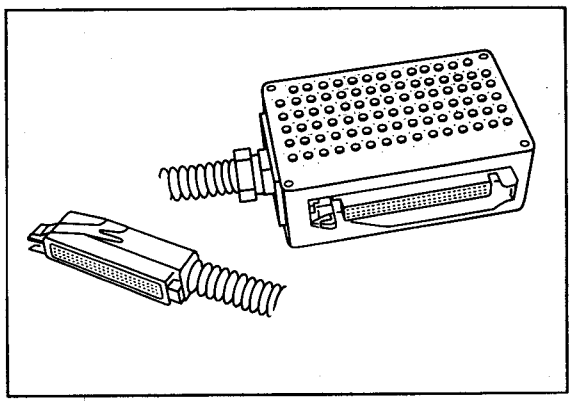
Tools

Porsche System Tester 2



547 - 96

Test adapter 9616



615 - 96

Note

The test adapter must be used for all tests on electrical leads (e.g. transmission control module - connector/sensors).
It does not damage the plug-in contacts and facilitates location of the individual pins.

Function selection with the Porsche System Tester 2 (software G 40)

The following menus can be called up with the Tester:

- Identification
- Fault memory
- Erase fault memory
- Drive links
- Input signals
- Actual values
- Coding

Identification

The diagnosis software number and the control module - part - number are displayed here.

Fault memory

All faults detected by the control module are stored in the fault memory according to the respective fault code.

Erase fault memory

The fault memory can be erased with this menu.

Drive links

Drive links can be controlled with this menu. Functions of the drive links can be determined very quickly in this way.

Note

Drive link diagnosis can be performed only if the selector lever is in position "P", the engine is not running and the vehicle is stationary.

The following drive links can be controlled:

- Solenoid valve 1
- Solenoid valve 2
- Solenoid valve 3
- Coolant shutoff valve

Input signals

Input signals can be checked and read out with this menu:

- Selector lever position
- Selected gear
- Multi-function switch
- Kick-down switch
- Downshift switch
- Upshift switch
- Manual program switch
- Stop light switch
- Traction Control

Actual values

The following actual values can be read out with this menu:

- Rpm
- Transmission input speed
- Speed, front right
- Speed, front left
- Speed signal, transmission
- Throttle plate angle
- Transverse acceleration
- Transmission temperature
- Supply voltage

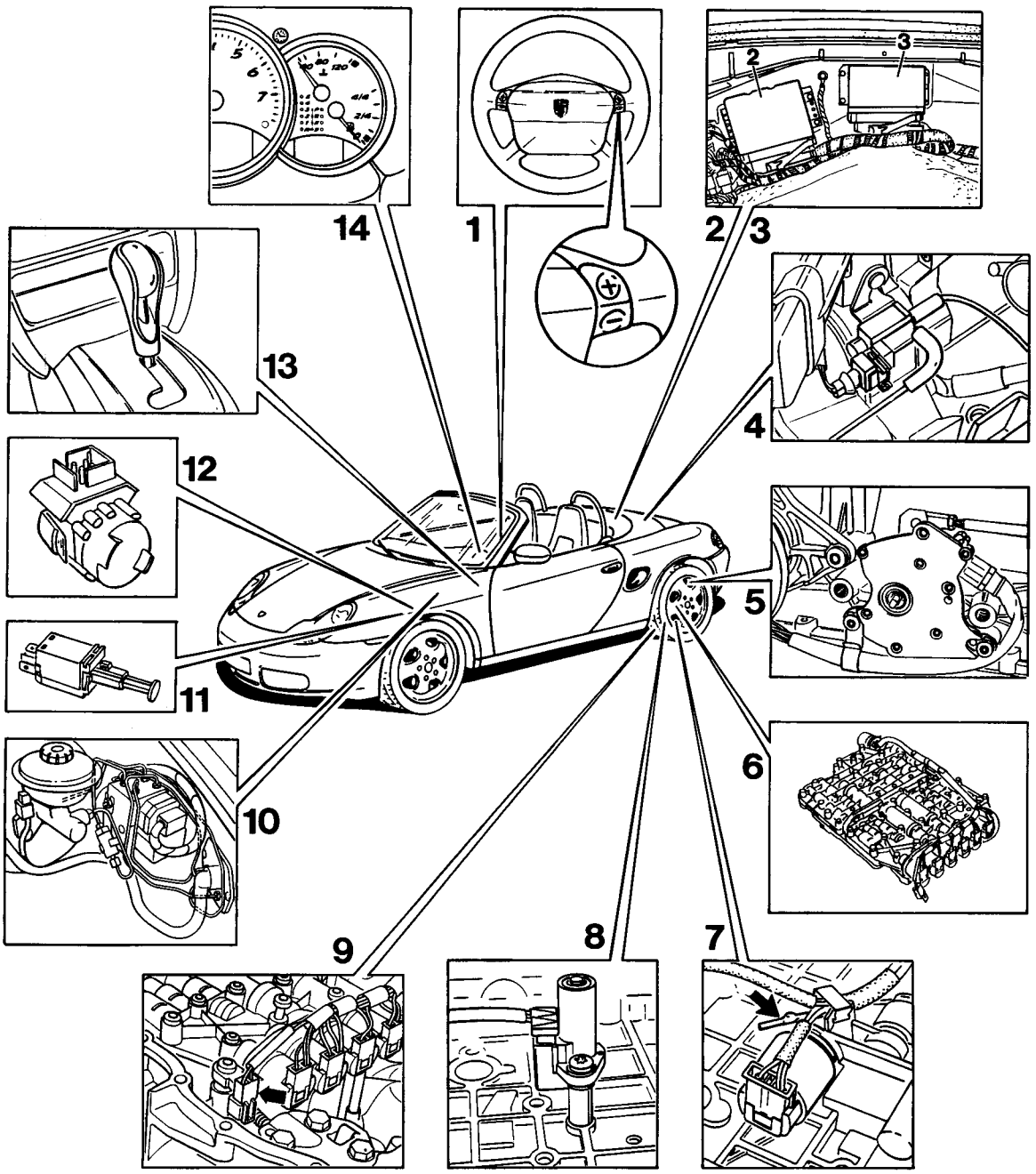
Coding

Control modules can be coded to the prescribed country version with this menu.

Three country versions are available:

- RoW/USA
- Taiwan
- Korea

Component arrangement



Printed in Germany – 3, 1996 98637D1

Function of individual components

1. Upshift and downshift switches

Installation position: In the steering wheel.

In the manual gate, they connect ground to the Tiptronic control module, which initiates upshifting or downshifting, depending on the speed.

2. DME control module

Installation position: On the rear wall in the rear luggage compartment.

The DME control module is connected with the Tiptronic control module. It transmits the following information via a control line (CAN bus):

Rpm,

torque,

throttle position,

engine temperature.

3. Tiptronic control module

Installation position: On the rear wall in the rear luggage compartment.

The Tiptronic control module is the information and command centre of the entire system. From a large volume of incoming information (measured variables), which are compared with stored driving and shifting programs, the Tiptronic control module selects the characteristic suitable for the type of driving and sends commands to the transmission to shift or not to shift.

4. Coolant changeover valve

Installation position: On the engine (transport eye).

Depending on the ATF and coolant temperature, the changeover valve is activated by the Tiptronic control module and routes vacuum to the shutoff valve, which opens or closes the transmission coolant circuit.

5. Multi-function switch

Installation position: On the transmission.

The multi-function switch is actuated directly by the selector lever via a cable and transfers the selector lever position to the transmission control module. It controls the reversing lights and disables the starter when a transmission range is selected.
The "reduced driving program" is activated if this signal is faulty.

6. Solenoid valves (SV)

Installation position: On the hydraulic control unit in the transmission.

The electronic transmission controls the transmission functions via the SVs. SVs 1, 2 and 3 are On-Off valves. Their task is to switch over valves in the hydraulic system.

The SVs (pressure regulators 1 ... 4) are electronic pressure-control valves. They convert an electric current into a proportional hydraulic pressure, and actuate the valves of the shifting elements.

7. Sender for ATF temperature

Installation position: The sender is integrated in the transmission wiring harness. If it is damaged, the entire wiring harness must be replaced.

The sender controls the modulation pressure of the transmission in accordance with the ATF temperature. This keeps shifting operations very comfortable across the entire temperature range.

It the ATF temperature is too high, the control module selects a map with the least power loss possible and closes the torque converter clutch. In addition, downshifting takes place at higher engine speed values. This reduces converter slip, and the ATF can cool down.

The sender is regarded as defective if the signal voltage exceeds or falls below the prescribed signal voltage range. Shifting then takes place with a substitute value of 80 °C.

8. Sender for transmission input speed

Installation position: On the hydraulic control unit in the transmission.

The sender (inductive pickup) transfers the transmission input speed to the transmission control module.

9. Sender for transmission speed

Installation position: Beside the hydraulic control unit in the transmission.

The sender (inductive pickup) transfers the transmission speed (output speed) to the transmission control module.

10. ABS control module

Installation position: In the front luggage compartment.

The ABS control module is connected with the Tiptronic control module. It transfers the front wheel speeds, which are required for slip monitoring and for calculation of the transverse acceleration.
Furthermore, on vehicles with traction control (TC), the Tiptronic control module is signalled whether TC is active. The Tiptronic control module goes to a special map when this information is received.

11. Stop light switch

Installation position: In front of the brake pedal.

The transmission control module requires the stop light switch signal in order to initiate downshifting before curves and for activation of the shiftlock lift solenoid.

12. Kick-down switch

Installation position: In the accelerator pedal box in front of the accelerator.

Note

As the accelerator pedal box must not be opened, the complete accelerator pedal box must be replaced if the kick-down switch is defective.

The kick-down switch detects when the accelerator pedal is floored past the full-throttle position. It connects ground to the Tiptronic control module, which shifts the shifting times for faster acceleration. The transmission shifts down immediately, depending on the engine speed, and shifts

Printed in Germany – 3, 1996 98637D1

up again only when the highest permissible engine speed is reached.
Kick-down is not performed if the switch is defective.

13. Selector lever with manual switch

The selector lever transmits the selector lever positions to the transmission and the multi-function switch via a cable.

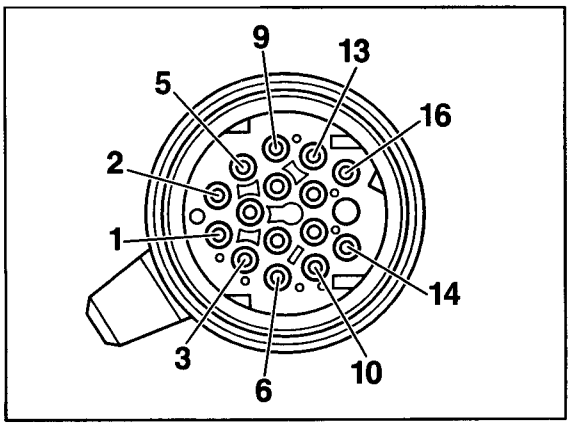
In the manual gate, the manual switch connects ground to the Tiptronic control module, which enables manual tip shifting.

14. Instrument cluster

The respective selector lever position and the engaged gear are displayed in the instrument cluster.
In the "Reduced driving program", the position display flashes alternately with the 4th gear.

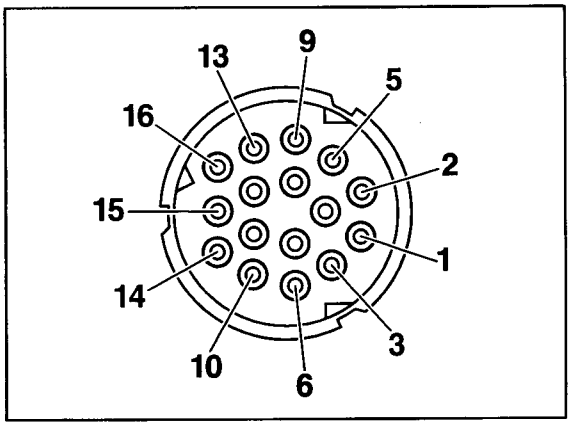
Connector diagrams and ground points

Transmission plug



561 - 96

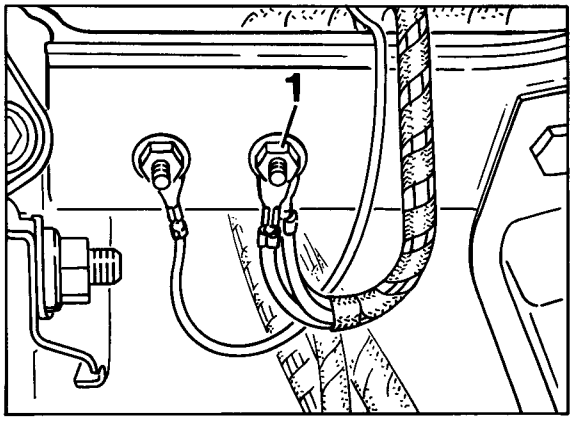
Transmission socket



562 - 96

Ground point 4

Ground point 4 is located in front of the instrument cluster on the dashboard support frame.

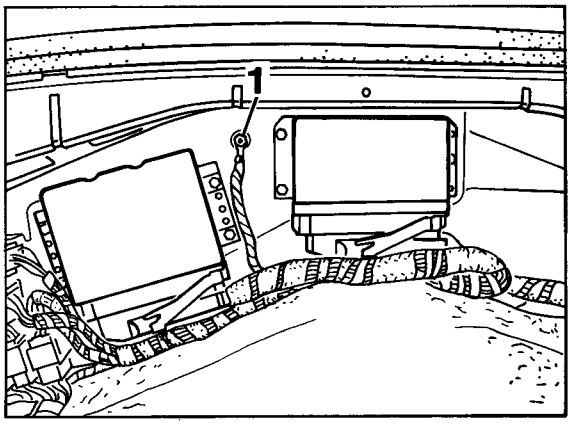


1 = Ground point 4

599 - 96

Ground point 9

Ground point 9 is located on the rear wall in the rear luggage compartment, between the DME control module and Tiptronic control module.



1 = Ground point 9

576 - 96

Tiptronic connector assignment

1 - Pressure regulator 2

2 - Shiftlock solenoid

3 - Free

4 - Pressure regulator 4

5 - Pressure regulator 1

6 - Power ground

7 - Free

8 - Multi-function switch, line 2

9 - Multi-function switch, line 4

10 - Brake light

11 - Free

12 - Pin code 1

13 - Manual program switch

14 - Output shaft speed (-)

15 - Shield, output shaft speed

16 - Turbine speed (+)

17 - Free

18 - Kick-down

19 - TC active

20 - Free

21 - Sensor ground

22 - ATF temperature

23 - Shield, turbine speed

24 - Free

25 - Display, manual mode

26 - Terminal 30

27 - Cruise control

28 - Electronics ground

29 - Pressure regulator 3

30 - Solenoid valve 1

31 - Free

32 - Solenoid valve 3

33 - Solenoid valve 2

34 - Power ground

35 - Free

36 - Multi-function switch, line 1

37 - Multi-function switch, line 3

38 - Front-wheel speed, left

39 - Front-wheel speed, right

40 - Free

41 - Free

42 - Output shaft speed (+)

Printed in Germany – 3, 1996

43 - Free

44 - Ground, turbine speed

45 - Free

46 - Upshift

47 - Downshift

48 - Pin code 2

49 - Free

50 - Free

51 - Coolant shutoff valve

52 - Plus - pressure regulator, solenoid valves

53 - Plus - pressure regulator, solenoid valves, shiftlock

54 - Terminal 15

55 - Terminal 15

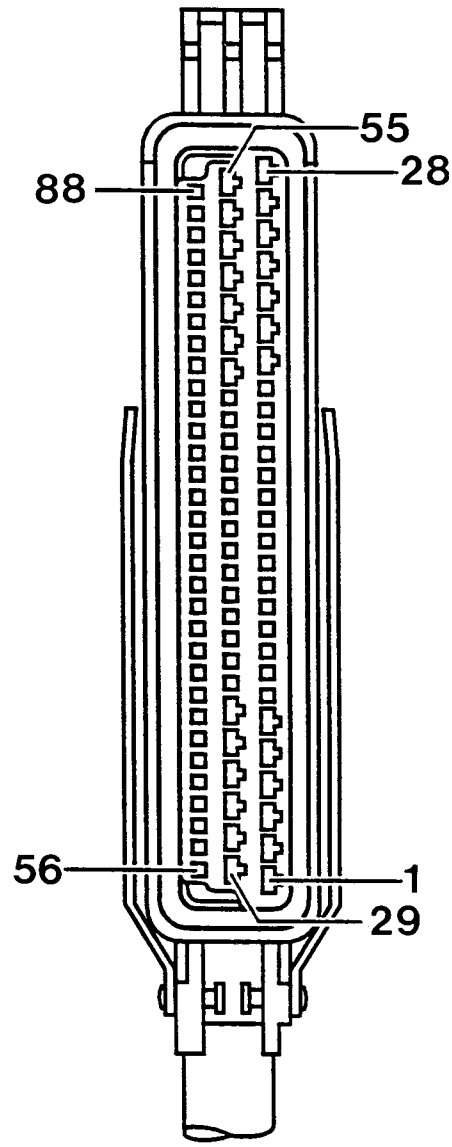
56 ... 84 - Free

85 - CAN - low

86 - CAN - high

87 - Free

88 - K-line



543 - 96

Fault overview

Test point	DTC Porsche	DTC OBD II	Fault text	Page
1	43	P1746	Control module faulty (relay)	37 - D 21
2	44	P0602	Control module faulty (watchdog)	37 - D 21
3	49	P0603	Control module faulty (EEPROM)	37 - D 22
4	42	P0605	Control module faulty (checksum)	37 - D 22
5	31	P0753	Solenoid valve 1	37 - D 22
	32	P0758	Solenoid valve 2	
	33	P0743	Solenoid valve 3	
6	63	P1762	Shiftlock P/N lock	37 - D 23
7	80	P1813	Pressure regulator 1	37 - D 24
	81	P1818	Pressure regulator 2	
	82	P1823	Pressure regulator 3	
	83	P1828	Pressure regulator 4	
8	55	P1710	Speed signal	37 - D 25
	62	P1715	front right/front left	
9	93	P1656	Coolant shutoff valve	37 - D 26
10	35	P0706	Multi-function switch	37 - D 26
11	21	P0727	Rpm signal from DME control module	37 - D 28
12	46	P0725	Governor	37 - D 29
13	36	P0722	Speed sensor	37 - D 29

Printed in Germany – 3, 1996 98637D1

Test point	DTC Porsche	DTC OBD II	Fault text	Page
14	90	P0722	Gear sel. monitor, output drive	37 - D 30
15	91	P0717	Stall speed, transmission input	37 - D 31
16	92	P0717	Gear sel. monitor, transmission input speed	37 - D 33
17	72 73 74 75	P0732 P0733 P0734 P0735	Gear sel. monitor, 2nd, 3rd, 4th and 5th gear	37 - D 34
18	22	P1770	Load signal from DME control module	37 - D 35
19	23	P1765	Throttle information fault	37 - D 35
20	53	P1704	Kick-down switch	37 - D 36
21	56	P1790	Instrument cluster activation	37 - D 36
22	11	P1750	Voltage to control module	37 - D 38
23	12	P1602	Terminal 30, open circuit	37 - D 38
24	51	P1744	Manual program switch	37 - D 39
25	37	P0710	Transmission temperature sensor	37 - D 39
26	70	P0740	Solenoid valve, torque converter clutch	37 - D 41
27	100	P0600	CAN timeout	37 - D 42
28	101	P0600	CAN bus fault	37 - D 42

Test point	DTC Porsche	DTC OBD II	Fault text	Page
29	61	P1749	Version coding	37 - D 43

Printed in Germany – 3, 1996 98637D1

Fault overview

General information

- **Never** pull off or push on the control module connector with the ignition switched on.
- Stored faults can be erased only with the Porsche System Tester 2.
- Faults may be stored under certain circumstances if, for troubleshooting purposes, electrical connections are loosened or disconnected with the ignition switched on.
- If terminal 15 (pin 54/55) fails, the "Reduced driving program" will be activated. It is not possible to start diagnosis in this case.
- Erase the fault memory with the Porsche System Tester 2 and perform a test drive each time after performing troubleshooting or repairs. During the test drive, drive the vehicle under different loads and at different speeds so that all shift operations (manual and automatic programs) take place at least once.
- After the test drive, read out the fault memory with the Porsche System Tester 2.

Fault, DTC	Possible causes, elimination, notes
Test point 1	
Control module faulty (relay) **DTC 43**	Fault effect: Reduced driving program. Replace control module.
Test point 2	
Control module faulty (watchdog) **DTC 44**	Fault effect: Reduced driving program. Replace control module.

Printed in Germany – 3, 1996 98637D21

Fault, DTC	Possible causes, elimination, notes

Test point 3

Control module faulty (EEPROM)
DTC 49

Fault effect:

Reduced driving program.

Replace control module.

Test point 4

Control module faulty (checksum)
DTC 42

Fault effect:

Reduced driving program.

Replace control module.

Test point 5

Solenoid valves 1, 2, 3
Open circuit/short to ground,
short to B+
DTCs 31, 32, 33

Fault effect:

Reduced driving program.

Note

The functions of the solenoid valves (SVs) can be checked with the Porsche System Tester 2 (Drive links/ Solenoid valves 1, 2, 3). The activation pulses of the valves can be heard as a clicking sound near the transmission.

1. Check function of the SVs with the Tester.

2. Check SV with wiring. To do this, connect ohmmeter to the control module connector and measure the resistance:

   SV1 = Pin 52 and pin 30
   SV2 = Pin 52 and pin 33
   SV3 = Pin 52 and pin 32

   Nominal value: 24 ... 36 Ω

Fault, DTC	Possible causes, elimination, notes
	3. Check wiring from the control module connector pins 30, 32 and 33 to the 16-pole transmission connector pins 8, 4 and 9 for continuity, short to ground and short to B+. 4. Check SV. To do this, remove the ATF pan, disconnect plug connection on the SV and measure the resistance. Nominal value: 24 ... 36 Ω
Test point 6 Shiftlock P/N lock Open circuit/short to ground, short to B+ **DTC 63**	Fault effect: Fault is only entered in the fault memory. **Note** When the ignition is on, a transmission range can be selected from the selector lever position P or N only if the foot brake is pressed in addition. 1. Check lifting solenoid with wiring. To do this, connect an ohmmeter to control module connector pins 2 and 53 and measure the resistance. Nominal value: 60 ... 90 Ω 2. Check wire from control module connector pin 2 to the lifting solenoid connector pin 5 for continuity, short to ground and short to B+. **Note** The lifting solenoid connector is accessible only if the centre console is removed.

Printed in Germany – 3, 1996 98637D21

Fault, DTC	Possible causes, elimination, notes

Test point 7

Pressure regulators
1, 2, 3, 4
Open circuit/short to ground, short to B+
DTCs 80, 81, 82, 83

Fault effect:

Reduced driving program.

If there is a short to B+ on pressure regulator 4, the torque converter clutch will always stay open.

Note

The pressure regulators (DRs) are pressure-control solenoid valves. They convert an electrical current to a proportional hydraulic pressure.

1. Check pressure regulator with wiring. To do this, connect an ohmmeter to the control module connector and measure the resistance:

   DR1 = Pin 52 and pin 5
   DR2 = Pin 52 and pin 1
   DR3 = Pin 52 and pin 29
   DR4 = Pin 52 and pin 4

   Nominal value: 5 ... 10 Ω

2. Check wiring from the control module connector pins 1, 4, 5 and 29 to the 16-pole transmission connector pins 3, 11, 2 and 7 for continuity, short to ground and short to B+.

3. Check the pressure regulator. To do this, remove the ATF pan, pull off plug connection on the pressure regulator and measure the resistance.

   Nominal value: 5 ... 10 Ω

   Note

   The hydraulic control unit must be removed before the DR4 (modulation pressure) can be tested.

Fault, DTC	Possible causes, elimination, notes

Test point 8

Speed signal
front right/left
Signal implausible
DTCs 55, 62

Fault effect:

No manual program.
Upshifting is not prevented during braking.
No downshifting during braking.
Substitute value for transverse acceleration.

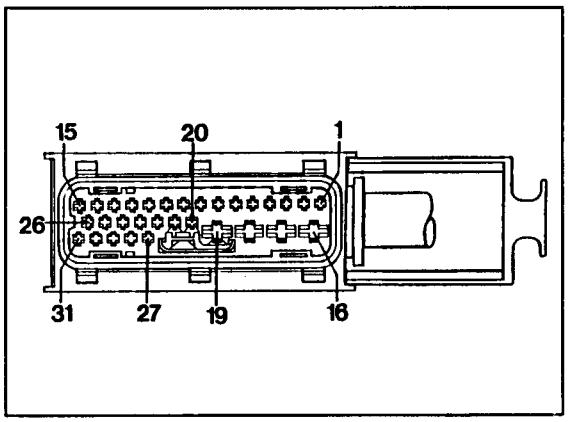
Note

The wheel speeds can be checked with Porsche System Tester 2 (Actual values/Speed signal (FR)/(FL)).
To do this, raise the vehicle and spin the right or left front wheel by hand.

1. Check wheel speed with the Tester.

2. Read out fault memory of the ABS/TC control module and remedy the fault according to the ABS test plan.

3. Check wiring from the Tiptronic control module connector pin 38 (or 39) to the ABS/TC control module connector pin 25 (or 26) for open circuit, short to ground and short to B+.



ABS/TC control module connector 540 - 96

Fault, DTC	Possible causes, elimination, notes

Test point 9

Coolant shutoff valve
Open circuit/short to ground, short to B+
DTC 93

Fault effect:

The reduced driving program is activated if there is an open circuit/short to ground.
The fault is only entered in the fault memory in the event of a short circuit to plus.

Note

The function of the coolant shutoff valve can be tested with the Porsche System Tester 2 (Drive links/Coolant shutoff valve).

1. Test valve with the Tester.

2. Check internal resistance of the valve. To do this, pull off plug connection on the valve and connect ohmmeter to pin 1 and pin 2.

   Nominal value: 25 ... 35 Ω

3. Check wire from the Tiptronic control module connector pin 51 to the coolant shutoff valve connector pin 1 for open circuit, short to ground and short to B+.

Test point 10

Multi-function switch
Signal implausible
DTC 35

Fault effect:

Reduced driving program.

Note

The multi-function switch (MFS) can be tested with the Porsche System Tester 2 (Input signals/Multi-function switch).

1. Test the MFS with the Tester. To do this, shift through all selector lever positions in steps and check whether the position display in the instrument cluster and the display on the Tester agree.

Fault, DTC **Possible causes, elimination, notes**

Note

As the Tester display appears after a delay due to the functional principle of the unit, do not shift through the positions too quickly.

2. Check MFS with wiring.
   To do this, pull off the Tiptronic control module connector and test the MFS for continuity according to the Table.

	Pin 8	Pin 9	Pin 36	Pin 37
P	–	–	O	–
R	O	–	–	–
N	O	–	O	O
D	–	O	O	O

ohmmeter display:
– = Open circuit
O = Continuity

3. Check MFS without wiring.
   To do this, disconnect the MFS connector and test the MFS for continuity according to the Table.

	Pin E - A	Pin E - B	Pin E - C	Pin E - D
P	O	–	–	–
R	–	O	–	–
N	O	O	O	–
D	O	–	O	O

ohmmeter display:
– = Open circuit
O = Continuity

Printed in Germany – 3, 1996 98637D21

Fault, DTC	Possible causes, elimination, notes

4. Check wiring from the Tiptronic control module connector pin 8, 9, 36 or 37 to the MFS connector pin B, D, A or C for continuity, short to ground and short to B+.

5. Check the selector lever cable adjustment (refer to Volume 3, Page 34 - A 9).

Test point 11

Speed signal
DME control module
Signal implausible
DTC 21

Fault effect:

Reduced driving program.

Notes

- The DME control module signals a fault directly to the Tiptronic control module via a data line (CAN bus).
- The rpm signal can be checked with the Porsche System Tester 2 (Actual values/Rpm).

1. Check rpm signal with the Tester.

2. Read out fault memory of the DME control module and remedy the fault according to the DME test plan.

3. Check wiring from the Tiptronic control module connector pin 86 (or 85) to the DME control module connector pin 86 (or 85) for open circuit, short to ground and short to B+.

Fault, DTC	Possible causes, elimination, notes

Test point 12

Governor
Signal implausible
DTC 46

Fault effect:

Reduced driving program.

Note

The "Governor" function is activated to prevent overrevving of the engine in the event of false rpm signals.

Possible faults:

Wrong transmission speed signals.
Stuck spool valves in the transmission.

Test point 13

Speed sensor
Signal implausible
DTC 36

Fault effect:

Reduced driving program.

Note

The ratio of transmission output speed/engine speed is monitored.

1. Check sender for transmission speed on Tiptronic control module connector pin 14 and pin 42 with an ohmmeter.

   Nominal value: 0.80 ... 1.2 kΩ

2. Check wiring from the control module connector pin 42 (or 14) to the
   16-pole transmission connector pin 10 (or 1) for open circuit, short circuit to ground and short to B+.

3. Check shield on control module connector pin 15.

Printed in Germany – 3, 1996 98637D21

Fault, DTC	Possible causes, elimination, notes

4. Check sender on transmission socket pin 10 and pin 1 with an ohmmeter.

   Nominal value: 0.80 ... 1.2 kΩ

   Note

   The ATF pan must be removed before the sender can be replaced.

5. If items 1 ... 4 are OK and no other faults are stored, there is a mechanical/hydraulic fault in the transmission (e.g. ATF level not OK, defective converter, slipping clutches or brakes).

Test point 14

Gear sel. monitor, output drive
Signal implausible
DTC 90

Fault effect:

Reduced driving program.

The ratio of transmission input speed/transmission output speed is monitored.

1. Test sender for the transmission speed on Tiptronic control module connector pin 14 and pin 42 with an ohmmeter.

   Nominal value: 0.80 ... 1.2 kΩ

2. Check wiring from control module pin 42 (or 14) to the 16-pole transmission connector pin 10 (or 1) for open circuit, short to ground and short to B+.

3. Check shield on control module connector pin 15.

Fault, DTC	Possible causes, elimination, notes

4. Test sender on transmission socket pin 10 and pin 1 with an ohmmeter.

   Nominal value: 0.80 ... 1.2 kΩ

   Note

   The ATF pan must be removed before the sender can be replaced.

5. If items 1 ... 4 are OK and no other faults are stored, there is a mechanical/hydraulic fault in the transmission (e.g. ATF level not OK, slipping clutches or brakes).

Test point 15

Stall speed, transmission input
Signal implausible
DTC 91

Fault effect:

Reduced driving program.

Note

The ratio of transmission input speed/engine speed is monitored.

1. Test sender for the transmission input speed on Tiptronic control module connector pin 16 and pin 44 with an ohmmeter.

   Nominal value: 230 ... 300 Ω

2. Check wiring from control module pin 16 (or 44) to the 16-pole transmission connector pin 5 (or 6) for open circuit, short to ground and short to B+.

Fault, DTC	Possible causes, elimination, notes

3. Check shield on control module connector pin 23.

4. Check sender on transmission socket pin 5 and pin 6 with an ohmmeter.

   Nominal value: 230 ... 300 Ω

   Note

   The hydraulic control unit must be removed before the sender can be replaced.

5. If items 1 ... 4 are OK and no other faults are stored, there is a mechanical/hydraulic fault in the transmission (e.g. ATF level not OK, defective converter, slipping clutches or brakes.)

Fault, DTC	Possible causes, elimination, notes

Test point 16

Gear sel. monitor, transmission input speed
Signal implausible
DTC 92

Fault effect:

Reduced driving program.

Note

The ratio of transmission input speed/transmission output speed is monitored.

1. Test sender for transmission input speed on Tiptronic control module connector pin 16 and pin 44 with an ohmmeter.

   Display: 230 ... 300 Ω

2. Check wiring from control module pin 16 (or 44) to the 16-pole transmission connector pin 5 (or 6) for open circuit, short to ground and short to B+.

3. Check shield on control module connector pin 23.

4. Test sender on transmission socket pin 5 and pin 6 with an ohmmeter.

   Display: 230 ... 300 Ω

   Note

   The hydraulic control unit must be removed before the sender can be replaced.

5. If items 1 ... 4 are OK and no other faults are stored, there is a mechanical/hydraulic fault in the transmission (e.g. ATF level not OK, slipping clutches or brakes).

Printed in Germany – 3, 1996 98637D21

Fault, DTC	Possible causes, elimination, notes

Test point 17

Gear sel. monitor,
2nd, 3rd, 4th, and 5th gear
Signal implausible
DTCs 72, 73, 74, 75

Fault effect:

Reduced driving program.

Note

The gear selection monitor for 2nd to 5th gears monitors the ratio of engine speed/output drive speed. In the case of deviations from nominal values, the Tiptronic control module detects whether shifting was performed mechanically or hydraulically.

If no other faults are stored, there is a mechanical/hydraulic fault in the transmission.

The following procedure can be used to check whether the transmission actually shifted to the correct gear in each case:

ATF temperature between 40 °C and 95 °C.

Hold gears 2 5 in the manual gate.

– Drive at a constant vehicle speed on level ground (not on the roller test stand) and read off the engine speed.

The following values must be achieved during this test:

	Speed		Engine rpm
	Speedom. indication	Tester display	Nmin ... Nmax
2nd gear	50 km/h	45 km/h	3300 ... 3700
3rd gear	60 km/h	55 km/h	2800 ... 3200
4th gear	70 km/h	65 km/h	2300 ... 2700
5th gear	80 km/h	74 km/h	1900 ... 2200

Fault, DTC	Possible causes, elimination, notes

Test point 18

Load signal from DME control module
DTC 22

Fault effect:

Fixed map.

Note

The DME control module signals a fault directly to the Tiptronic control module via a data lead (CAN bus).

1. Read out the fault memory of the DME control module and remedy the fault according to the DME test plan.

2. Check wiring from Tiptronic control module connector pin 85 (or 86) to the DME control module connector pin 85 (or 86) for open circuit, short to ground and short to B+.

Test point 19

Throttle information fault
DTC 23

Fault effect:

Throttle plate substitute value (approx. 15 %).
Fixed shift map.
No manual program.

Notes

- The DME control module signals a fault directly to the Tiptronic control module via a data lead (CAN bus).

- The throttle plate angle can be tested with the Porsche System Tester 2 (Actual values/Throttle plate angle).

1. Read out the fault memory of the DME control module and remedy the fault according to the DME test plan.

2. Check wiring from Tiptronic control module connector pin 85 (or 86) to DME control module connector pin 85 (or 86) for open circuit, short to ground and short to B+.

Printed in Germany – 3, 1996 98637D21

Fault, DTC	Possible causes, elimination, notes

Test point 20

Kick-down switch
Short to ground
DTC 53

Fault effect:

No kick-down.

Note

The function of the kick-down switch can be tested with the Porsche System Tester 2 (Input signals/Kick-down).

1. Test function of the switch with the Tester.

   Note

   As the accelerator pedal box must not be opened, the complete box must be replaced if the kick-down switch is defective.

2. Check wire from control module connector pin 18 to the kick-down switch for short to ground.

   Nominal value:
   Accelerator pedal in idle position (kick-down switch open) = ∞ Ω

   Accelerator pedal to the stop (kick-down) = **0 ... 5** Ω

Test point 21

Instrument cluster activation
No signal change
DTC 56

Fault effect:

Reduced driving program.

Note

The Tiptronic control module (pin 25) is connected with instrument cluster (pin II/17) via a serial data lead.

Specification:
Signal type = PWM
Frequency = 50 Hz
Level = 0 ... 12 V

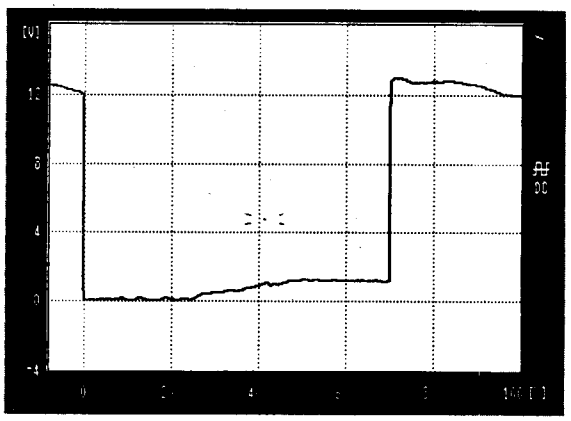
Fault, DTC **Possible causes, elimination, notes**

Signal coding:

Actual gear	1	2	3	4	5
Pulse width					
in "D"	10 %	20 %	30 %	40 %	50 %
in "M"	15 %	25 %	35 %	45 %	55 %

Note

There is no fault if the pulse width is 70 % with the engine running and with the selector lever in position "P".



592 - 96

1. Test the PWM signal with an oscilloscope.

2. Check wire from Tiptronic control module connector pin 25 to the instrument cluster connector II (white) pin 17 for open circuit, short to ground and short to B+.

Fault, DTC	Possible causes, elimination, notes

Test point 22

Voltage to control module
Open circuit/
short to ground
DTC 11

Fault effect:

Reduced driving program.

Note

One side of the solenoid valve (SV) coils is supplied directly with positive voltage, and the other side is connected to ground via a driver.

1. Check supply leads of the solenoid valves (pins 52 and 53) for open circuit and short to ground.

2. If the test described in 1 is not OK, check wiring from control module connector pin 52 (or 53) to the 16-pole transmission connector pin 12 (or 16) for open circuit and short to ground.

3. Check the transmission wiring harness at transmission socket pin 16 and pin 12 for open circuit and short to ground.

Test point 23

Terminal 30, open circuit
Open circuit/short
circuit to ground
DTC 12

Fault effect:

Fault is only entered in the fault memory.

Note

The Tiptronic control module is continuously supplied with battery voltage via pin 26 (+ 30).

1. Test voltage at control module connector pin 26.
   If no battery positive voltage is displayed, check fuses B1 and F6 and check wire from the battery to the control module.

Fault, DTC	Possible causes, elimination, notes

Test point 24

Manual program switch
Short to ground
DTC 51

Fault effect:

No manual program.

Note

The manual program switch can be tested with the Porsche System Tester 2 (Input signals/Manual program switch).

1. Test switch with the Tester.

2. Check whether ground is connected to control module connector pin 13.

   Nominal value:
   In the automatic gate = ∞ Ω
   In the manual gate = **0 ... 5** Ω

   If display is OK = Control module faulty.

3. Check wire from control module connector pin 13 to the manual switch for short to ground.

Test point 25

Transmission temperature sensor
Open circuit/short to plus
DTC 37

Fault effect:

Reduced driving program.
Substitute value of 80 °C for ATF temperature.
No activation of the coolant switchover valve (transmission always cooled).

Notes

- The ATF temperature can be tested with the Porsche System Tester 2 (Actual values/Transmission temp.).

- A fault is stored if an ATF temperature outside the limit range below – 50 °C or above + 180 °C is detected.

Printed in Germany – 3, 1996 98637D21

Fault, DTC	Possible causes, elimination, notes

1. Check ATF level (refer to Page 37 - A 12).

2. Check sender for ATF temperature with wiring To do this, connect an ohmmeter to control module connector pins 21 and 22.

   Nominal value:
   At 20 °C = approx. 1.00 kΩ
   At 40 °C = approx. 1.15 kΩ
   At 60 °C = approx. 1.30 kΩ

3. Check wiring from control module connector pin 21 (or 22) to the 16-pole transmission connector pin 14 (or 13) for continuity, short circuit to ground and short to B+.

4. Test sender for ATF temperature with transmission wiring harness. To do this, connect an ohmmeter to transmission socket pin 13 and pin 14.

   Nominal value:
   At 20 °C = approx. 1.00 kΩ
   At 40 °C = approx. 1.15 kΩ
   At 60 °C = approx. 1.30 kΩ

   If the nominal value is not OK = the transmission wiring harness or sender for the ATF temperature is defective.

   Note

   As the sender for the ATF temperature is integrated in the transmission wiring harness, the transmission wiring harness must be replaced if the sender is damaged.

Fault, DTC	Possible causes, elimination, notes

Test point 26

Solenoid valve, torque converter clutch
Open circuit/short to ground
DTC 70

Fault effect:

Torque converter clutch always open.

1. Check ATF level (refer to Page 37 - A 12) and erase the fault memory.

2. Perform a test drive and read out the fault memory.

   Note

   Diagnosis conditions for fault detection:

   - Torque converter clutch activated.
   - No engine speed fault, spider shaft speed fault, transmission ratio fault or pressure regulator 4 fault entered as present.
   - Gear or 4 or 5.
   - No shifting operation taking place.

3. If the fault recurs after the test drive and no other faults are stored, the following fault possibilities can be present:

   - Electrical activation of pressure regulator 4 not OK (diagnostic trouble codes 83 and 55 present?).
   - Mechanical defect in pressure regulator 4.
   - ATF supply to the torque converter clutch not OK.
   - Converter defective.

Printed in Germany – 3, 1996 98637D21

Fault, DTC	Possible causes, elimination, notes

Test point 27

CAN timeout
DTC 100

Fault effect:

Reduced driving program.

Notes

- The Tiptronic control module is connected with the DME control module via a data lead (CAN bus).
- Never pull off or push on the control module connector with the ignition switched on.
  If the DME control module connector, for example, is pulled off with the ignition switched on, the on-board diagnostic system may detect a "CAN timeout" fault under certain circumstances.

1. Read out the DME fault memory. If the fault "CAN timeout" is stored here as well, check the wiring from the Tiptronic control module to the DME control module.
2. Check wiring from Tiptronic control module pin 85 (or 86) to the DME control module pin 85 (or 86) for continuity, short to ground and short to B+.

Note

If the wiring is OK and the fault is stored in one control module only, the fault can lie in another control module.

Test point 28

CAN bus fault
DTC 101

Fault effect:

Reduced driving program.

Note

The Tiptronic control module is connected with the DME control module via a data lead (CAN bus).

Fault, DTC	Possible causes, elimination, notes

Never pull off or push on the control module connector with the ignition switched on.
If the DME control module connector is pulled off with the ignition switched on, for example, the on-board diagnostic system can detect a "CAN : bus or DPRAM" fault under certain circumstances.

1. Read out the DME fault memory. If the fault "CAN : bus or DPRAM fault" is stored, check the wiring from the Tiptronic control module to the DME control module

2. Check the wiring from Tiptronic control module pin 85 (or 86) to DME control module pin 85 (or 86) for continuity, short to ground and short to B+.

Note

If the wiring is OK and fault is stored in one control module only, the fault can lie in another control module.

Test point 29

Version coding
Signal implausible
DTC 61

Fault effect:

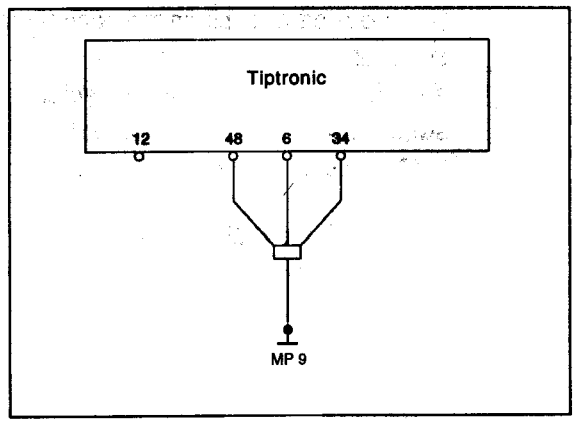
Reduced driving program.

Note

As transmission damage can result if the control modules are confused, there is a code in the vehicle wiring harness that must agree with the code programmed in the Tiptronic control module.

Pin code 2 Pin code 1	ground open circ.	open circ. ground	ground ground	open circ. open circ.
Reaction	Function	Reduced driving programme		

Fault, DTC	Possible causes, elimination, notes



591 - 96

6 = Power ground
34 = Power ground
48 = Pin code 2
12 = Pin code 1

1. Use the Porsche System Tester 2 (Control modules/Identification) to check whether the prescribed control module is installed. (Refer to the Spare Parts Catalogue for details of the allocation.)

2. Check whether ground is connected to control module connector pin 48. If this is the case, the control module is faulty.

3. Check wire from control module connector pin 48 to ground point 9 for open circuit.

Note

Ground point 9 (MP 9) is located in the rear luggage compartment between the DME control module and Tiptronic control module.

45 02

Diagnosis/troubleshooting

Anti-lock brake system

System ABS 5.3 and system ABS/TC 5.3

Printed in Germany – 3, 1996 986D451

Contents overview

986D451 Printed in Germany – 3, 1996

Contents overview

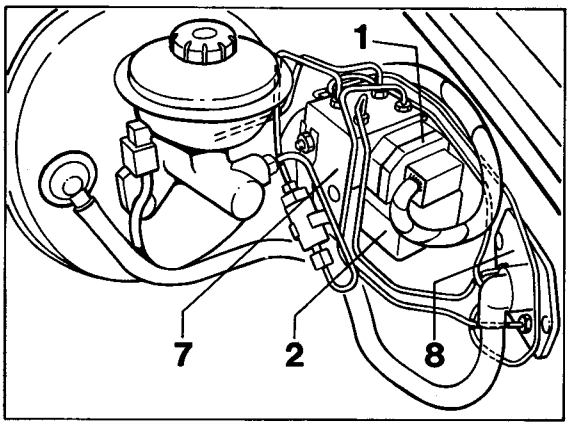
Printed in Germany – 3, 1996 986D451

Important information about ABS 5.3 and ABS/TC 5.3

General

The Porsche Boxster is fitted **as standard** with an anti-lock brake system (ABS 5.3).
"Traction Control (TC)" can be obtained on **special request** on the basis of ABS 5.3.
Traction Control (TC) is a combination of anti-slip control (ASR) and Automatic Brake Differential (ABD).
TC is a further system for increasing driving safety.

ABS 5.3 is optimised with regard to installed volume and weight **compared with** the **ABS 5** (ABS 5 in the 993). Control module (No. 1), hydraulic unit (No. 7), pump motor relay and valve relay (No. 2) of ABS 5.3 and ABS/TC 5.3 **are a unit** that is positioned next to the master brake cylinder.



Diagnosis and system checks on both systems are carried out with the **Porsche System Tester 2**.

Differences between ABS 5.3 and ABS/TC 5.3

ABS 5.3 = **3**-channel system
(diagram: see Page 45 - D 7).

ABS/TC 5.3 = **4**-channel system
(diagram: see Page 45 - D 9).

The essential **distinguishing features** between ABS and ABS/TC **are:**

- Number of brake lines at intermediate piece (No. 8 / Figure 181 - 96):
  ABS 5.3 = 3 brake lines
  ABS/TC 5.3 = 4 brake lines

- TC OFF switch for switching driving stability control on and off is not available on vehicles with Solo ABS (ABS 5.3).

- **TC (ASR/ABD) MIL** and
  TC (ASR/ABD) function light
  (information light) in vehicles **with ABS/TC.**
  These lights are lit when the ignition is switched on (lamp check).
  In vehicles **with ABS 5.3** (Solo ABS) these lamps are **not fitted** in the instrument cluster.
  A figure showing the warning (MIL) and function lights is on Page 45 - D 10.

Printed in Germany – 3, 1996 986D451

ABS 5.3 (3-channel system) system description

ABS operation

The ABS control module receives a signal from the stop-light switch and the AC voltage signals from the four speed sensors. These signals are converted into digital wheel-speed signals independently of each other by two microprocessors. The wheel slip (approximately proportional to the computed vehicle reference speed) is formed from these wheel-speed signals.

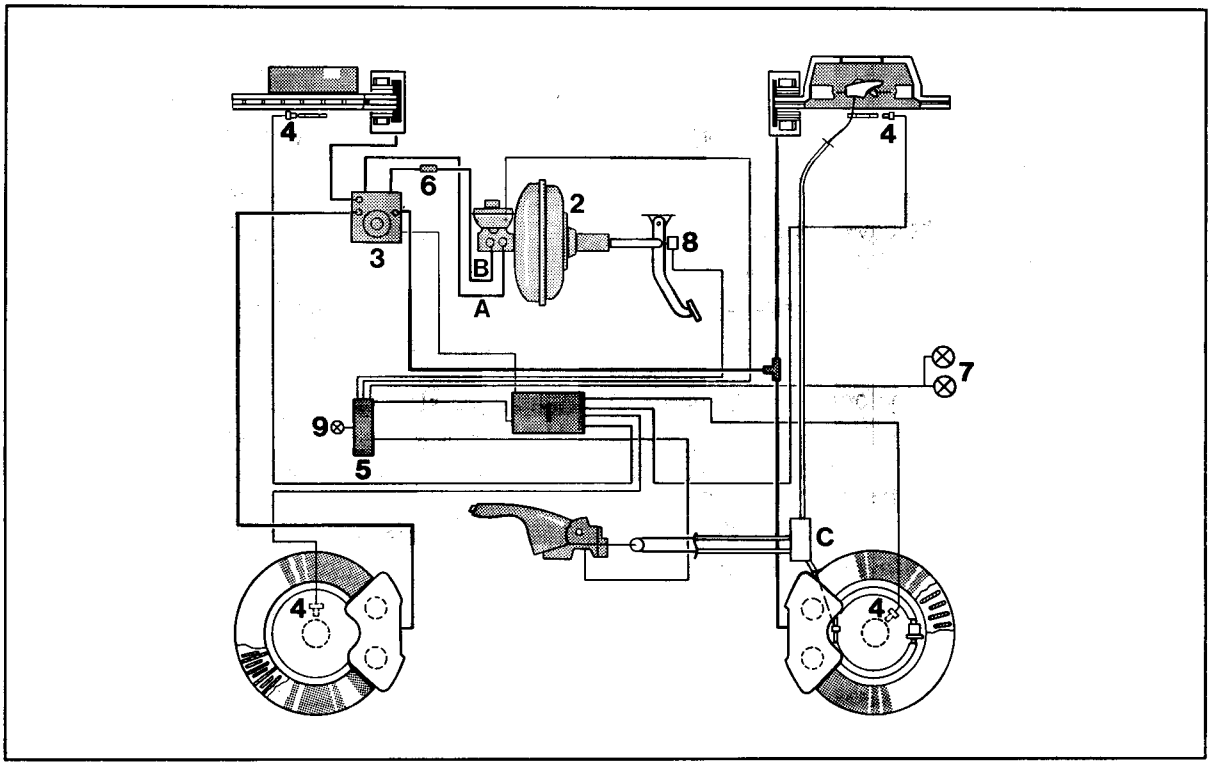
If vehicle deceleration and excess slip are detected at a wheel, the pressure-holding phase is initiated as the first step, i.e. the inlet valve for the relevant wheel is closed to prevent a further increase in pressure. If in spite of the pressure being held constant the wheel tends to continue to locking up, the pressure in the brake cylinder reduced. For this purpose, the outlet valve is opened and the brake fluid is pumped back to the brake master cylinder via the return pump (pressure-reduction phase), until the wheel turns again. Then, depending on the control cycle, further appropriate cycles are initiated.

This function or the input signals are continuously monitored. If a fault is detected, the control module switches the ABS function off, switches on the ABS MIL and stores the fault in a non-volatile memory in the control module.

In addition, whenever a trip is begun and a speed of 6 km/h is exceeded, a test program is started. The solenoid valves and the pump motor are electrically actuated and checked. If a fault is detected, the control module switches the ABS function off, the ABS MIL is switched on and the fault is stored.

Function of the individual components on Page 45 - D 11

Diagram: ABS 5.3 (3-channel system)



178 - 96

1 – ABS control module *

2 – Brake unit (brake booster with tandem master brake cylinder)

3 – ABS hydraulic unit * (**3** hydraulic outputs)

4 – ABS speed sensors

5 – Central Information System

6 – Brake proportioning valve **(1x)**

7 – Brake light

8 – Stop-light switch

9 – ABS MIL (yellow)

A = Front-axle braking circuit

B = Rear-axle braking circuit

C = Parking brake cable deflection box

* Control module, hydraulic unit, pump motor relay and valve relay **form a unit**, which is located next to the master brake cylinder.

Printed in Germany – 3, 1996 986D451

ABS/TC 5.3 (4-channel system) system description

Note

Traction Control (TC) represents an extension of the ABS system and is a combination of anti-slip control (ASR) and Automatic Brake Differential (ABD).

TC prevents spinning of the drive wheels when moving off and accelerating. Driving stability and traction are improved over the entire speed range.

Traction Control (TC) is ready for operation whenever the engine is started.

The TC information lamp in the instrument panel is lit during a control process **and warns that the driving style must be matched to road conditions.**

Function

Driving stability control:
If Traction Control (TC) detects that a certain speed difference between the wheels has been exceeded (wheelspin), engine power is automatically reduced.

Brake control:
In addition to reducing the engine power (driving stability control), the TC (via the ABD) brakes the drive wheel that is spinning.
Since this control requires the drive wheels to be individually controlled, the **ABS/TC system is a 4-channel system.**

Switching off driving stability control *

Press the "TC OFF" logo of the rocker switch.
Driving stability control cannot be switched off during a TC control process (information light on).

One-sided wheel speed on the drive axle is further prevented by brake control up to a speed of 100 km/h.
Driving stability is not monitored, since the drive wheels can start to spin at the same speed (slip).

With driving stability control switched off, the TC MIL in the instrument panel and the indicator light in the rocker switch are lit.

It can be advantageous to switch off driving stability control:
– on a loose surface and in deep snow
– when "rocking" the vehicle free
– when using snow chains.

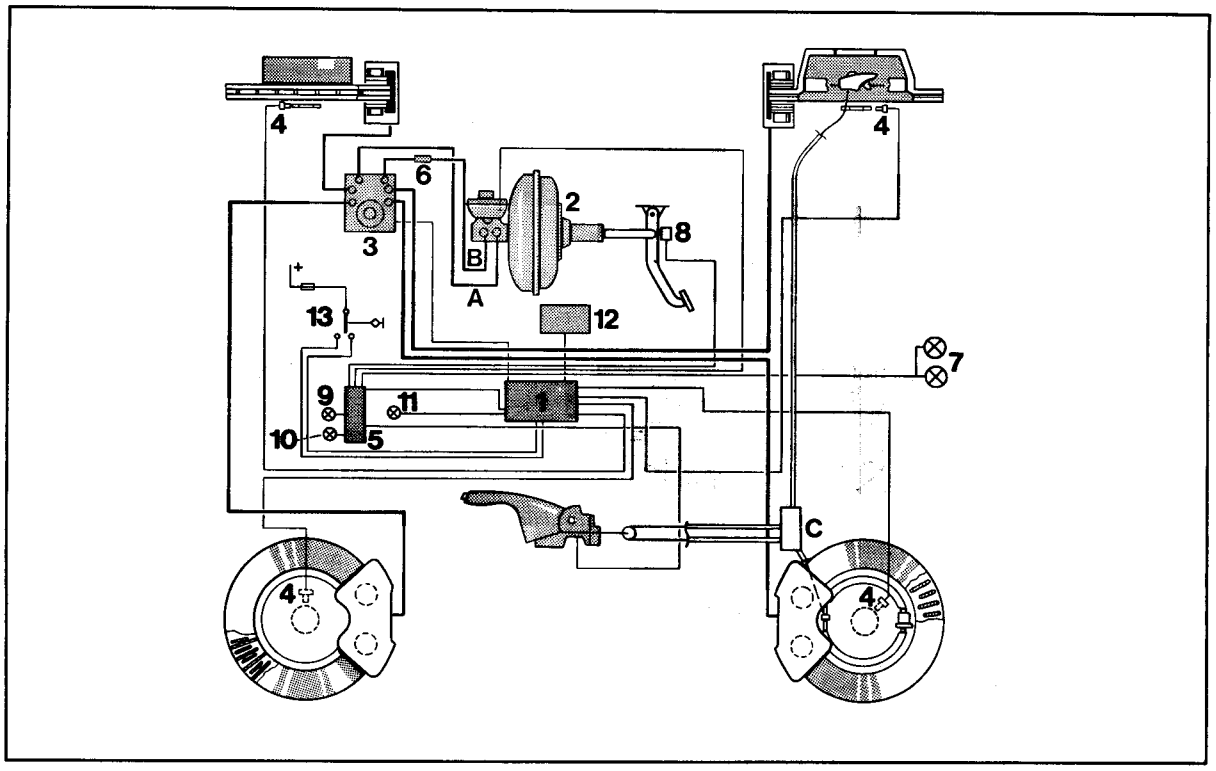
Switching driving stability control back on *

Press the indicator light in the rocker switch.

Driving stability control cannot be switched on again during a TC control process (information light on).

* Press the switch for at least 0.1 second. Then a further 0.3 seconds will pass until the routine is complete. Only then is driving stability control switched off or on.

Diagram: ABS/TC 5.3 (4-channel system)



1 – **ABS/TC** control module *

2 – Brake unit (brake booster with tandem master brake cylinder)

3 – **ABS/TC** hydraulic unit * (**4** hydraulic outputs)

4 – ABS speed sensors

5 – Central Information System

6 – Brake proportioning valve **(1x)**

7 – Brake light

8 – Stop-light switch

9 – **ABS MIL** (yellow)

10 – **TC MIL** (TC/yellow)

11 – **TC function light** (green)

12 – **DME control module**

13 – TC rocker switch (see Page 45 - D 10)

A = Front-axle braking circuit

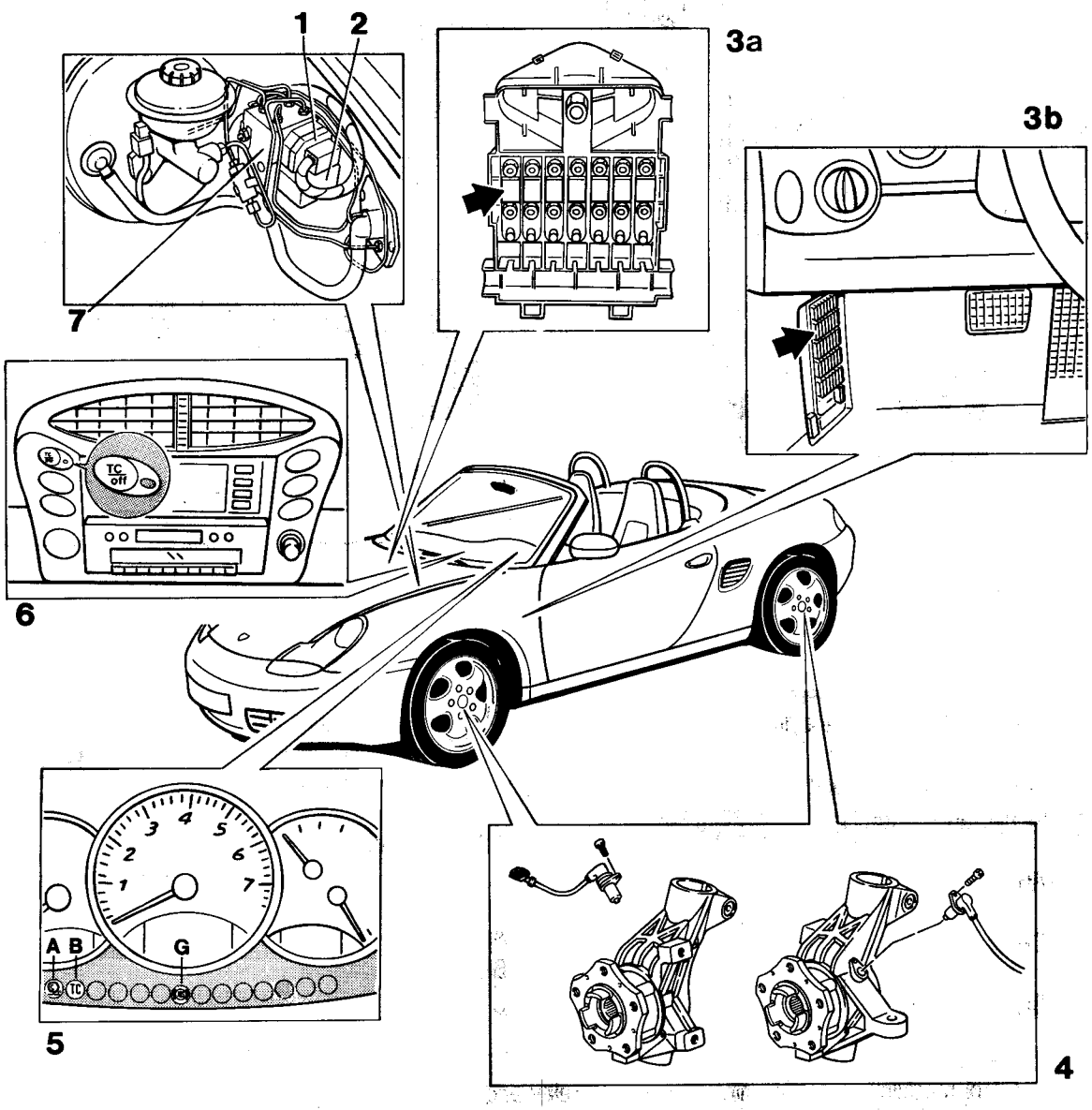
B = Rear-axle braking circuit

C = Parking brake cable deflection box

* Control module, hydraulic unit, pump-motor relay and valve relay form a unit, which is located beside the master brake cylinder.

Printed in Germany – 3, 1996 986D451

Component arrangement (ABS 5.3 and ABS/TC 5.3)



Function of individual components

1. Control module (ABS 5.3 and ABS/TC 5.3)

This module processes incoming signals and actuates the solenoid valves or/and the return pump in the hydraulic unit when wheel slip is excessive (see also System description). If the ABS or ABS/TC switches off when a system fault is detected, it activates the MIL and stores the fault in a non-volatile memory.

Note

The control module and relay are not supplied individually. In the event of replacement, the complete hydraulic unit must be replaced.

2. Relay

The solenoid valve relay is actuated by the control module (closes) as soon as the control module receives voltage from the generator (D+ / terminal 61).
As soon as the relay has closed (picked up), battery positive voltage (terminal 30) is present at the valve coils of all solenoid valves in the hydraulic unit.

If the ABS or the TC (ABD) begins to control, the control module applies negative voltage to the appropriate valve coil of the valve to be controlled at the appropriate wheel.

The return pump relay is actuated (with a negative voltage) by the control module if required, and closes.
As soon as the relay has closed / picked up, battery positive voltage (terminal 30) is applied to the return pump, which then runs.

Note

The relays cannot be exchanged.
When replacement is necessary, the complete hydraulic unit must be replaced.

3. Fuses

3a. A 50-A fuse **in the current distributor** (F1/arrow) protects the return pump and the solenoid valves.
The current distributor is located under the instrument panel. The fastening points are accessible from the luggage-compartment side.

3b. The 15-A fuse F 2/9 (field 2, No. 9) on the **central electrical board** protects the control module's electrical supply (ABS and ABS/TC). The arrow points to field 2.

On vehicles with Traction Control (TC), the 15-A fuse F 2/1 (field 2, No. 1) on the central electrical board protects the supply to the "TC OFF" rocker switch (switch for switching driving stability control on and off).

4. Speed sensors

The speed sensors provide wheel speed information (speed information for each wheel) to the control module. These speed sensors operate according to the inductive principle, in which sinusoidal alternating voltages are generated in accordance with the number of teeth on a pulse wheel and at a frequency that is a measure of the wheel speed.

Printed in Germany – 3, 1996 986D451

5. MILs and information lights

Note

A = TC information light (see Page 45 - D 10)
B = TC MIL (see Page 45 - D 10)
G = ABS MIL (see Page 45 - D 10)

Information light for TC (A)

- Lights for a lamp check when the ignition is switched on
- Indicates a control process (even when driving stability control is switched off).

MIL for TC (B)

- Lights in combination with the indicator light in the rocker switch (TC OFF) for a lamp check when the ignition is switched on.
- In combination with the indicator light in the rocker switch, indicates that driving stability control is off.
- Indicates defect: TC is out of order
- Lights together with the ABS MIL if there is an **ABS fault**.

MIL for ABS (G)

- Lights up for a lamp check when ignition is switched on.
- If the ABS MIL lights up **with the engine running**, the ABS has switched off due to a fault.

6. TC (OFF) rocker switch with light

For switching driving stability control on and off.
The rocker switch has one contact for switching off and another for switching on.

To switch off, press the "TC OFF" logo on the rocker switch. This applies a positive voltage to the control module while the switch is pressed. This switches off driving stability control.
Driving stability control cannot be switched off during a TC control process (information light on).

When driving stability control is off, the TC MIL in the instrument panel and the indicator light in the rocker switch are lit.

To switch on driving stability control, press the indicator light in the rocker switch. This applies a positive voltage to the control module while the switch is pressed. This switches on driving stability control.
Driving stability control cannot be switched back on during a TC control process (information light on).

Driving stability control is ready for operation, i.e. is switched on automatically, whenever the engine is started.

System description on Page 45 - D 8.

7. Hydraulic unit

The hydraulic unit essentially consists of fast-switching electromagnetic valves and a return pump. Regardless of the pressure in the master brake cylinder, the hydraulic unit can change the fluid pressure to the wheel brake cylinders (holding or reducing pressure). Increasing the pressure above that of the master brake cylinder is not possible, however.

The ABS 5.3 hydraulic unit has three hydraulic outputs (3-channel system) and six electromagnetic valves (three inlet and three outlet valves).

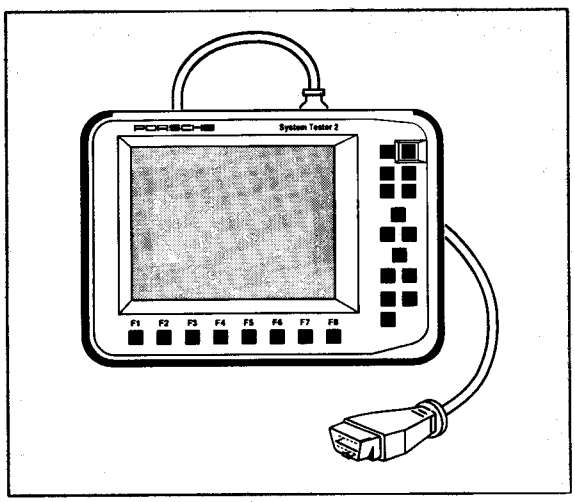
The ABS / TC 5.3 hydraulic unit has four hydraulic outputs (4-channel system) and ten electromagnetic valves (four inlet valves / four outlet valves, one switch-over valve and one intake valve).
The intake and the switch-over valves are required so that the return pump can perform **two tasks**:

I. Return flow to the master brake cylinder (pressure reduction) during ABS control.
II. Supply (pressure increase) to the right or left rear-wheel brake cylinder during **TC control (ABD control).**

In the case of **ABS control** at the rear axle, the solenoid valves for both rear wheels are actuated in parallel (joint control as in Solo ABS control (3-channel system)).

Tools

1. Porsche System Tester 2 with integrated digital multimeter.



547-68

2. When performing measurements on the control module connector with a multimeter, use measuring leads (e.g. commercially available leads from Messrs. Bosch or shop-made leads) in order to avoid damaging the contacts in the control module connector.

   Normal pins:
   1 to 2 measuring leads with 2.5 mm flat connectors.

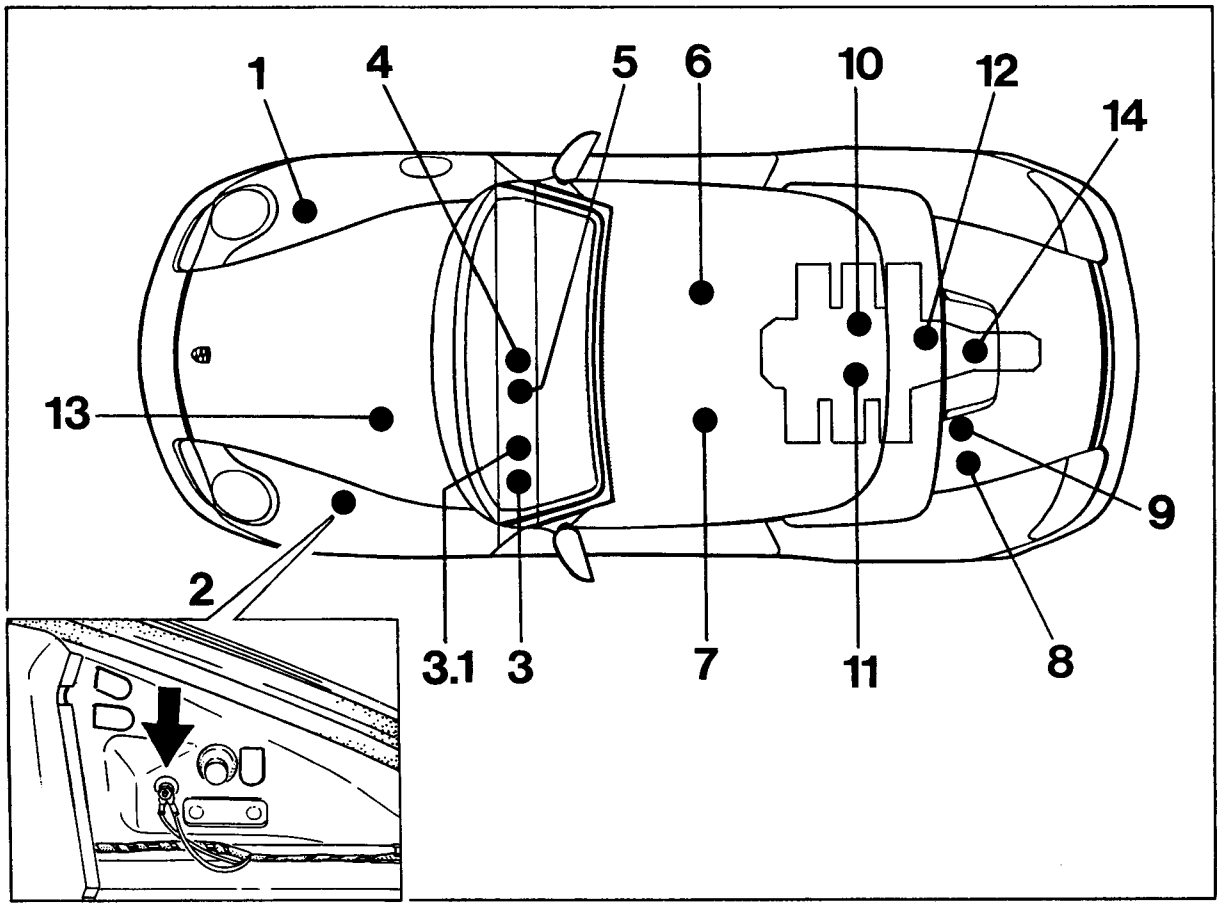
   Mini pins:
   1 to 2 measuring leads with 1.6 mm flat connectors.

Ground points

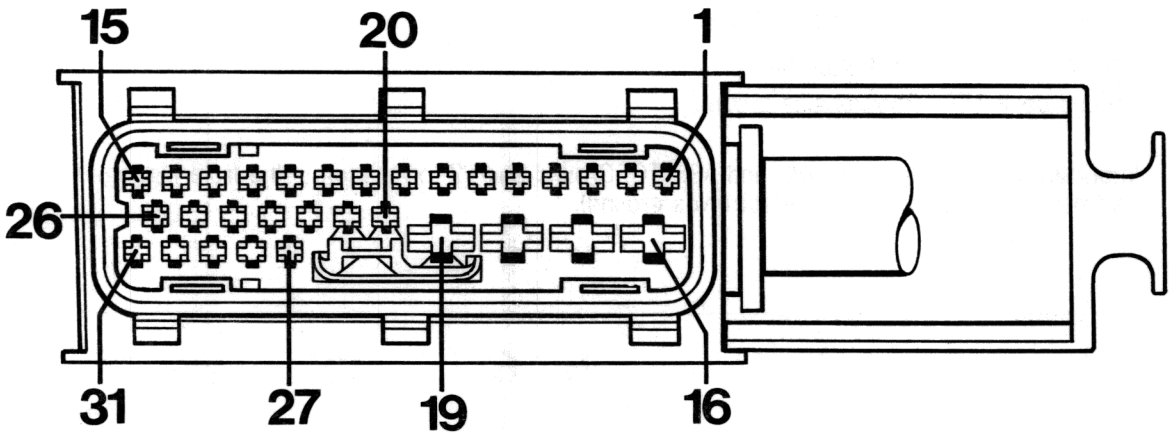
Notes

- Ground point 5 = Electronics ground.
- Ground point 13 = Battery ground.
- Ground point 14 = Body/engine ground.

- Important ground points for ABS and ABS/TC: Ground point 2 (on the left in the front luggage compartment) and ground point 5 (electronics ground).



Connector assignment, control module (ABS and ABS/TC)



540 - 96

- Ground from speed sensor, rear right

2 - Signal from speed sensor, rear right

3 - Free

4 - Ground from speed sensor, front right

5 - Signal from speed sensor, front right

6 - Ground from speed sensor, front left

7 - Signal from speed sensor, front left

8 - Ground from speed sensor, rear left

9 - Signal from speed sensor, rear left

10 - D +, terminal 61

11 - K-line from diagnosis

12 - TC OFF from rocker switch (activation with positive voltage)

13 - Signal to the DME control module (setpoint engine torque / MMR)

14 - Stop-light switch signal (vehicle voltage when brake actuated)

15 Control module power supply (terminal 15 / from fuse F2/9)

16 - Ground

17/18 - Voltage for return pump relay and valve relay

19 - Ground

20 - Activation of TC MIL (ground)

21 - Activation of ABS MIL (ground)

22 - TC switch indicator lamp (activation by ground)

23 - Output signal (speed sensor, rear left) to the instrument cluster (speedometer signal) and to the DME

24 - Activation of TC information lamp (ground)

25 - On Tiptronic vehicles = output signal (speed sensor, front left) **to** the Tiptronic control module

26 - On Tiptronic vehicles = Output signal (speed sensor, front right) **to** the Tiptronic control module

27* - Signal from the DME control module (actual engine torque / MMI)

28* - Signal **to** the Tiptronic-control module during TC control, for activation of a specific Tiptronic map

29 - Free

30* - Signal from the DME control module (engine speed)

31* - TC ON from the rocker switch (activation with positive voltage)

* Only on vehicles with Traction Control (TC)

Printed in Germany – 3, 1996 986D451

Function selection (menu selection), ABS 5.3 and ABS/TC 5.3

Overviews of available menus

- Identification
- Fault memory
- Erase fault memory
- Drive links
- Actual values
- Input signals
- Static test
- Bleed*
- Extract coding*
- Modify coding*

Identification:	Display of the diagnosis software number and the control module part number.
Fault memory:	see Page 45 - D 19
Drive links:	see Page 45 - D 36
Actual values:	see Page 45 - D 39
Input signals:	see Page 45 - D 41
Static test:	see Page 45 - D 42
Bleed:	see Page 45 - D 43
Extract coding/ Modify coding	see Page 45 - D 45

* In the case of ABS 5.3 (Solo ABS), the menus are not necessary and are therefore not present.

Fault memory

Overview of possible faults with ABS 5.3 and ABS / TC 5.3

- Control module faulty

- Rear left speed sensor, signal implausible
- Front right speed sensor, signal implausible
- Rear right speed sensor, signal implausible
- Front left speed sensor, signal implausible

- Rear left speed sensor wire, open circuit/short to ground/short to B+
- Front right speed sensor wire, open circuit/short to ground/short to B+
- Rear right speed sensor wire, open circuit/short to ground/short to B+
- Front left speed sensor wire, open circuit/short to ground/short to B+

- Valve supply voltage
- Return pump
- Stop-light switch
- Incorrect gear wheel
- Undervoltage

- Intake valve
- Switch-over valve
- Version coding

- Electrical connection between TC and Tiptronic
- Engine rpm information missing
- Electrical connection between TC and DME (MMI)
- Electrical connection between TC and DME (MMR)
- Fault stored in DME control module

Printed in Germany – 3, 1996 986D451

Fault overview / troubleshooting (diagnosis / test plan)

Test point	DTC	Fault display (brief fault text)	Page
1	4607	Control module faulty	45 - D 23
2	4206	Front left speed sensor, signal implausible	45 - D 24
3	4201	Front right speed sensor, signal implausible	45 - D 25
4	4211	Rear right speed sensor, signal implausible	45 - D 25
5	4216	Rear left speed sensor, signal implausible	45 - D 25
6	4205	Front left speed sensor wire *	45 - D 26
7	4200	Front right speed sensor wire *	45 - D 27
8	4210	Rear right speed sensor wire *	45 - D 27
9	4215	Rear left speed sensor wire *	45 - D 27
10	4256	Control module faulty **	45 - D 28
10	4261	Control module faulty **	45 - D 28
10	4226	Control module faulty **	45 - D 28
10	4231	Control module faulty **	45 - D 28
10	4246	Control module faulty **	45 - D 28
10	4251	Control module faulty **	45 - D 28
10	4236	Control module faulty **	45 - D 28
10	4241	Control module faulty **	45 - D 28
11	4276	Valve supply voltage	45 - D 29
12	4266	Return pump fault	45 - D 30
13	4340	Stop-light switch	45 - D 31
14	4225	Wrong gear wheel	45 - D 31
15	4802	Undervoltage	45 - D 32

* Open circuit / short to ground / short to B+

** ABS solenoid valve fault. As only the complete hydraulic unit with control module can be replaced, a solenoid valve fault is interpreted as a control module fault.

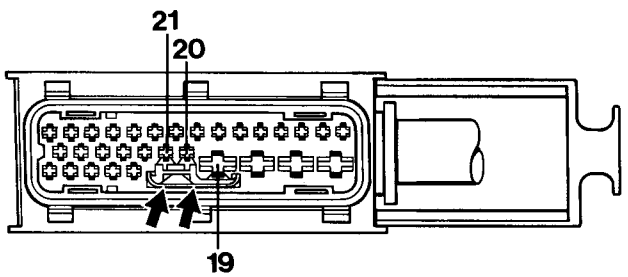
Test point	DTC	Fault display (short fault text)	Page
16	5260	Intake valve	45 - D 32
17	5265	Switch-over valve	45 - D 32
18	5281	Version coding	45 - D 33
19	5282	Electrical connection between ABS/TC and Tiptronic	45 - D 34
20	5283	Engine rpm information missing	45 - D 34
21	5284	Electrical connection between TC and DME (MMI)	45 - D 34
22	5285	Electrical connection between TC and DME (MMR)	45 - D 35
23	5286	Fault stored in DME control module	45 - D 35

Printed in Germany – 3, 1996 986D451

Notes on fault memory / troubleshooting

The ABS MIL or TC MIL can light up although no fault is stored in the fault memory. The following faults are possible in this case:

- Mechanical switching contacts (arrows) in the control module connector bent. As a consequence, these contacts are permanently connected to ground (ground of PIN 19 connected to PIN 20 and PIN 21).
  Explanation: Normally, these contacts are grounded only when the connector is pulled off. This causes the ABS MIL or the TC MIL to be activated when the engine is running.



540/1-96

- When the engine is running, the "terminal 61" signal is missing at the control module. This can be checked with the Porsche System Tester 2 via the **Input signals** menu (see P. 45 - D 41).

Work after fault elimination

The fault memory must be erased after a fault occurs in the anti-lock brake system and is eliminated. Then perform a short **test drive and perform a TC control operation, taking the road conditions into consideration. Then read out the fault memory again.**

Fill/bleed the system after the hydraulic unit has been replaced or removed and reinstalled.
Then perform a system test.

Fault, DTC	Possible causes, elimination, notes

Test point 1

Control module faulty
DTC 4607

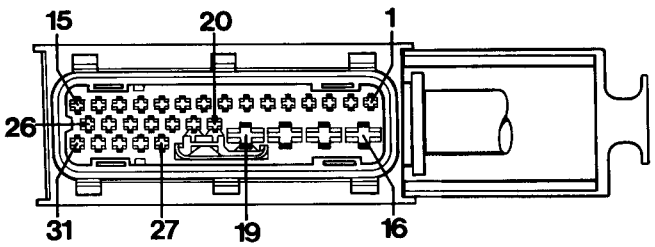
If "Control module faulty" is displayed in combination with DTC 4226, 4231, 4236, 4241, 4246, 4251, 4256, or 4261, test point 10 (Page 45 - D 28) is relevant.

- If the control module is damaged, the complete hydraulic unit with integrated control module must be replaced.
  Important: Before replacing the hydraulic unit, check whether:

- there are voltage differences due to contact resistance (missing or poor ground connections).
  Important:
  Poor ground connections can be present not only on the affected parts, but also at other important ground points.

- ground is connected to control module connector PIN 16 (from ground point 2) and PIN 19 (from electronics ground). The locations of the ground points are shown on the wiring diagram Ground points.

- positive voltage (vehicle voltage) is connected to control module connector PIN 17 and PIN 18.



540 - 96

Fault, DTC	Possible causes, elimination, notes

Test point 2

Front left speed sensor, signal implausible
DTC 4206

Control module receives a false / unrealistic speed sensor signal.

Procedure

Check the speed sensor signal with the System Tester 2 via the "Actual values" menu. To do this, call up the front left wheel speed.
Two tests are possible here.
Test **1** with raised vehicle.
(Swap of speed sensors and test of the speed sensor signal quality).
Test **2** with vehicle driving straight at approx. 2-4 km/h.
(Comparison of wheel speed signal qualities with each other).
Test 2 is a better measure of the signal quality than is test 1.

Further to test 1

To perform the test, manually rotate the left front wheel at a speed of approx. 2 - 3 km/h (observe display in the Tester screen).
Slowly increase the speed and simultaneously observe the speed increase (display).

Nominal values/required display
Speed steps of approx. 0.06 km/h. First display at 1.81 km/h.
This means: From the value measured last, the next value must be 0.06 km/h higher or, if the wheel is rotating slower, must be 0.06 km/h lower.
The Tester rounds the value down to 0.05 km/h or up to 0.07 km/h in some cases.

Example

First measured value	= 1.81 km/h
Second nominal value	= 1.87 km/h
Third nominal value	= 1.93 km/h
etc.	

Fault, DTC	Possible causes, elimination, notes
	Further to test 2 Display all four wheels in the Tester display. Drive straight ahead at a uniform speed of approx. 2-4 km/h and have a second person observe the Tester display. Required display: Deviation between the wheel speeds of the four wheels **max. 1 km/h**. Further details about tests 1 and 2 are given under "Actual values menu" on P. 45 - D 38. **Possible faults (cause in the event of deviation)** – Air gap between speed sensor and gear wheel (pulse wheel) too large or, due to wear (chip formation), too small (check installation). – Pulse wheel defective or corroded. – Wheel bearing damage (wheel bearing not adjustable). – Plug connection in wiring from the speed sensor to the control module or PIN on the control module connector not OK.
Test point 3 Front right speed sensor, signal implausible **DTC 4201**	General procedure as for test point 2/diagnostic trouble code 4206 (check speed sensor signal with the Porsche System Tester 2). – Speed sensor signal: Go to the Actual values menu. There, select the front right wheel speed.
Test point 4 Rear right speed signal, signal implausible **DTC 4211**	General procedure as for test point 2/diagnostic trouble code 4206 (check speed sensor signal with the Porsche System Tester 2). – Speed sensor signal: Go to the Actual values menu. There, select the rear right wheel speed.
Test point 5 Rear left speed signal, signal implausible **DTC 4216**	General procedure as for test point 2/diagnostic trouble code 4206 (check speed sensor with the Porsche System Tester 2). – Speed sensor signal: Go to the Actual values menu. There, select the rear left wheel speed.

Printed in Germany – 3, 1996 986D451

Fault, DTC	Possible causes, elimination, notes

Test point 6

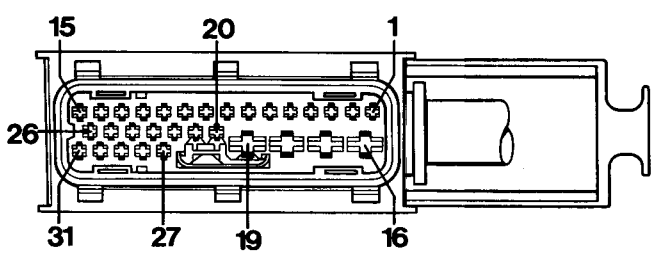
Front left speed sensor, open circuit/ short to ground/ short to B+
DTC 4205

Wire/plug connection between control module and speed sensor not OK (open circuit, short to B+ or short to ground) or the speed sensor itself is damaged.

– Check the speed sensor wire and plug connection in the wheel area for damage (visual inspection).

– Check the speed sensor signal with the Porsche System Tester 2 via the Actual values menu (see test point 2/diagnostic trouble code 4206). If no speed is displayed when the left front wheel is turned, check the wiring from the control module connector to the speed sensor (following test step).

– Pull off control module connector. Measure internal resistance/continuity between PIN 6 and PIN 7 on the connector (see connector assignment on Page 45 - D 16/17).
Nominal value 1600...1800 Ω.
If the nominal value is not achieved, check wires and plug connection in the wiring from the front left speed sensor.
If the nominal value (1600...1800 Ω) is not achieved although the wiring / plug connection is OK, replace the speed sensor.



– Check PIN 6 and PIN 7 of the control module connector (visual inspection for deformation).

Fault, DTC	Possible causes, elimination, notes
Test point 7 Front right speed sensor, open circuit/ short to ground/ short to B+ **DTC 4200**	General procedure as for test point 6/diagnostic trouble code 4205. – Speed sensor signal: Check with the Porsche System Tester 2 via the Actual values menu (call up front right wheel speed). – Internal resistance/continuity between PIN 4 and PIN 5 on the control module connector.
Test point 8 Rear right speed sensor, open circuit/ short to ground/ short to B+ **DTC 4210**	General procedure as for test point 6/diagnostic trouble code 4205. – Speed sensor signal: Check with the Porsche System Tester 2 via the Actual values menu (call up rear right wheel speed). – Internal resistance/continuity between PIN 1 and PIN 2 on the control module connector.
Test point 9 Rear left speed sensor, open circuit / short to ground / short to B+ **DTC 4215**	General procedure as for test point 6/diagnostic trouble code 4205. – Speed sensor signal: Check with the Porsche System Tester 2 via the Actual values menu (call up rear left wheel speed). – Internal resistance/continuity between PIN 8 and PIN 9 on the control module connector.

Printed in Germany – 3, 1996 986D451

Fault, DTC	Possible causes, elimination, notes

Test point 10

Control module faulty:
DTCs 4226, 4231, 4236, 4241, 4246, 4251, 4256, 4261

Actual fault: ABS solenoid valve faulty.

The System Tester 2 can be used to check the function of the ABS solenoid valves via the Drive links menu, sub-menu **Maintain pressure and Reduce pressure**.

If the control module or ABS solenoid valves are damaged, the complete hydraulic unit with integrated control module must be replaced.
Important: Before replacing the hydraulic unit, check whether:

- ground is connected to control module connector PIN 16 (from ground point 2) and PIN 19 (from electronics ground). The locations of the ground points are shown on the wiring diagram Ground points.

- plus (vehicle voltage) is connected to control module connector PIN 17 and PIN 18.

- Use the System Tester 2 to test the function of the ABS solenoid valves via the Drive links menu (reaction at the front left, front right, rear left and rear right wheels).
  If the reaction is not OK, check the hydraulic allocation (text below).
  Allocation test using example of left front wheel:
  In the Drive links menu, sub-menu **Reduce pressure, front left**, the left front wheel must alternately lock up and then rotate freely (also see P. 45 - D 35/36).
  The allocation is wrong if the activated wheel does **not** alternately lock up and rotate freely again, but a **different wheel** does this instead.

- The hydraulic unit must be replaced if the aforementioned drive link test is not OK but the hydraulic lines are **not** not swapped.

Fault, DTC	Possible causes, elimination, notes

Test point 11

Valve supply voltage
DTC 4276

The System Tester 2 can be used to determine whether the valve relay has picked up or dropped out. Select "Valve relay" in the Input signals menu. "Valve relay picked up" or "Valve relay dropped out" then appears in the Tester display.
Required display: Valve relay picked up.

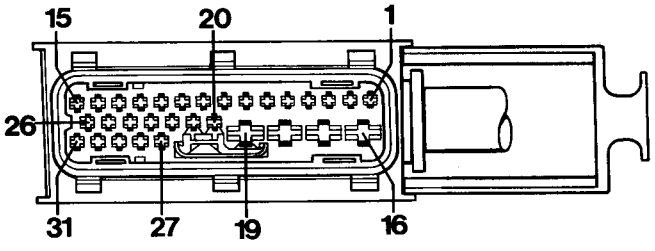
If the control module connector was pulled off, first switch off the ignition before the test and then switch it on again, as the valve relay will otherwise not pick up.

The valve relay also can be in the dropped-out state if there is another system fault. (ABS valve fault.)

The complete hydraulic unit with integrated valve relay must be replaced if the valve relay is damaged.
Important: Before replacing the hydraulic unit, check whether:

- ground is connected to control module connector PIN 16 (from ground point 2) and PIN 19 (from electronics ground). The locations of the ground points are shown on the wiring diagram Ground points.

- plus (vehicle voltage) is connected to control module connector PIN 17 and PIN 18.



540-96

- If all test steps are OK, replace the hydraulic unit.

Fault, DTC	Possible causes, elimination, notes

Test point 12

Return pump fault
DTC 4266

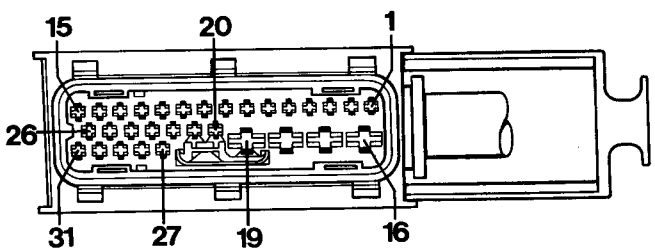
No feedback signal (return-pump monitoring) to the control module.

The Porsche System Tester 2 can be used to test the function of the return pump via the Drive links menu.
To do this, call up the return pump in the Drive links menu and activate the pump (required function: return pump runs).

The complete hydraulic unit must be replaced if the return pump is damaged.
Important: Before replacing the hydraulic unit, check whether:

- ground is connected to control module connector PIN 16 (from ground point 2). The locations of the ground points are shown on the wiring diagram Ground points.

- plus (vehicle voltage) is connected to control module connector PIN 17 and PIN 18.



540-96

- the plug connection on the return pump is OK.

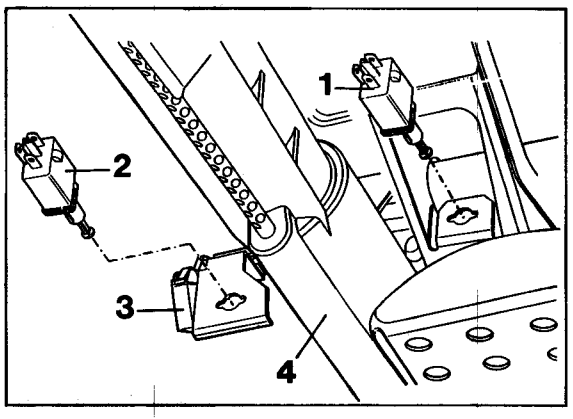
Fault, DTC	Possible causes, elimination, notes

Test point 13

Stop light switch
DTC 4340

– Check with the System Tester 2 via the **„Input signals"** menu. Press the brake pedal after selection of the stop-light switch. Required display: Display in screen changes from "not actuated" to "actuated".

– Pull off wires on the stop-light switch (No. 1). Test the stop-light switch with a multimeter (remove switch for the test if necessary).



620/1-96

– Check stop-light switch adjustment (operating point) (see Volume 4, Running gear, repair group 46).

– Check wiring according to the wiring diagram.

Test point 14

Wrong gear wheel
DTC 4225

The ABS gear wheels possess 48 teeth. Not all 48 teeth are detected during a revolution of the wheel.

– Check ABS gear wheels (clamping pins on the front axle / pulse strip on the rear axle) for dirt or damage. Replace damaged parts.

– Check wheels and tyres (extreme tyre differences or impermissible wheel/tyre combination).

Fault, DTC	Possible causes, elimination, notes

Test point 15

Undervoltage
DTC 4802

Control module supply voltage too low (less than 9.5 V).
Normally, this fault occurs only when the engine is started in combination with a discharged battery.

- Pull off the control module connector and measure the voltage between PIN 15 (plus) and PIN 19 (ground).
  Nominal value: Vehicle voltage.

- Check wiring and ground point in combination with the wiring diagram.

Test point 16

Intake valve
DTC 5260

The complete hydraulic unit must be replaced if the intake valve is damaged.

In the intake valve test with the Porsche System Tester 2, select Intake valve in the Drive links menu.
Perform the test according to the Tester instructions. If the functions specified in the Tester display: Rear axle locked up / Rear axle still locked / Release (rear axle free) are not achieved, the following faults are possible:

- Test sequence not observed.
- Inadequate bleeding of ABD secondary circuit, see Page 45 - D 43.
- Function of the intake valve not OK.
- Return pump operation not OK.
  Check pump operation. To do this, select return pump in the Drive links menu (pump must then run).
- Intake or switch-over valve leaks.

Fault, DTC	Possible causes, elimination, notes

Test point 17

Switch-over valve
DTC 5265

The complete hydraulic unit must be replaced if the switch-over valve is damaged.

In the switch-over valve test with the Porsche System Tester 2, select switch-over valve in the Drive links menu and perform the test according to the Tester instructions.
If the functions specified in the Tester display:
Rear axle locked up / Rear axle free are not achieved, the following faults are possible:

- Brake not actuated at the start of the test
- Test sequence not observed
- Function of the switch-over valve not OK.

Test point 18

Version coding
DTC 5281

Wrong version coding in the control module. Change coding.

The active transmission version (Tiptronic or manual transmission) can be read out under menu item "Extract coding".

The ABS/TC control module can be adapted to the transmission version under menu item "Modify coding".

Printed in Germany – 3, 1996 986D451

Fault, DTC	Possible causes, elimination, notes

Test point 19

Electrical connection between ABS/TC and Tiptronic
DTC 5282

Tiptronic control module (No. 3) does not receive a signal from the ABS/TC control module.

– Check wire for open circuit, short to B+ and to ground (PIN 28 on the ABS/TC control module and PIN 19 on the Tiptronic control module).

Test point 20

Engine rpm information missing
DTC 5283

The ABS/TC control module does not receive any speed information (rpm signal) from the DME control module (No. 2). The rpm signal is checked with the Porsche System Tester 2 via the Actual values menu.

– Check the rpm signal (indication of the current engine speed) via the Actual values menu with the engine running.
Then select the DME system and also check the rpm signal there via the Actual values menu. If the signal is present in the DME system but not in the ABS/TC system, the fault lies in the wiring between the ABS/TC control module and the DME control module.

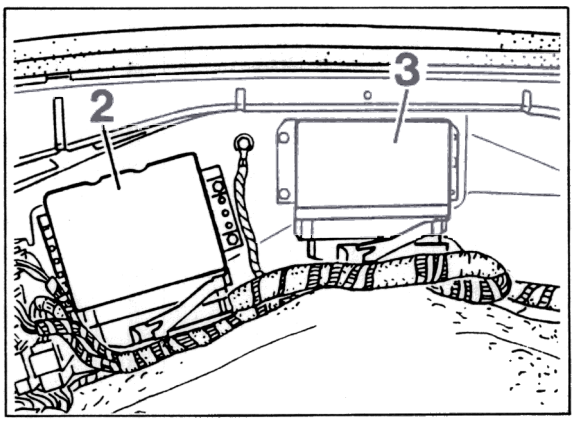
– Check the wiring (wire, connectors on the control modules) (PIN 30 on the ABS/TC control module and PIN 80 on the DME control module).

Test point 21

Electrical connection between TC and DME (MMI)
DTC 5284

The ABS/TC control module does not receive any signal from the DME control module (No. 2) (actual engine torque).

– Check wire for open circuit, short to B+ and to ground (PIN 27 on the ABS/TC control module and PIN 58 on the DME control module).



Fault, DTC	Possible causes, elimination, notes
Test point 22	
Electrical connection between TC and DME (MMR) **DTC 5285**	DME control module does not receive any signal from the ABS/TC control module (setpoint engine torque). Check wire for open circuit, short to B+ and short to ground (PIN 13 on the ABS/TC control module connector and PIN 48 on the DME control module connector).
Test point 23	
Fault stored in the DME control module **DTC 5286**	Read out fault memory in the DME control module and remedy the fault according to the DME test plan (DME troubleshooting).

Printed in Germany – 3, 1996 986D451

Drive links (ABS and ABS/TC)

The following drive links can be activated with the System Tester 2 via the Drive links menu:

Drive links with Solo ABS

- ABS MIL
- Return pump
- Front left ABS solenoid valves via:
  Maintain pressure, front left
  Reduce pressure, front left
- Front right ABS solenoid valves via:
  Maintain pressure, front right
  Reduce pressure, front right
- Rear ABS solenoid valves via:
  Maintain pressure, rear (rear axle)
  Reduce pressure, rear (rear axle)

Drive links with ABS/TC

- ABS MIL
- TC MIL
- TC information light
- TC switch indicator light
- Return pump
- Intake valve
- Switch-over valve
- Front left ABS solenoid valves via:
  Maintain pressure, front left
  Reduce pressure, front left
- Front right ABS solenoid valves via:
  Maintain pressure, front right
  Reduce pressure, front right
- Rear left ABS solenoid valves via:
  Maintain pressure, rear left
  Reduce pressure, rear left
- Rear right ABS solenoid valves via:
  Maintain pressure, rear right
  Reduce pressure, rear right

Important note

Drive links must be activated only when the vehicle is stationary.

In the solenoid valve test, it is possible to check both the function and the allocation (test to determine whether electrical or hydraulic lines are swapped).

If the selected drive link does not function or does not function correctly (reaction) after activation with the Porsche System Tester 2, perform troubleshooting according to the test plan (troubleshooting list) in the following text.

Diagnosis / test plan (troubleshooting) for drive links

Further to MILs and information light

The corresponding MIL or information light (depending on selection) does not flash.

- Check bulb.
- Check wiring from the instrument cluster to the control module according to the wiring diagram.

Further to the return pump

Return pump does not run after activation.

- Perform troubleshooting analogous to test point 12 (diagnostic trouble code 4266) on Page 45 - D 30.

Further to front and rear ABS solenoid valves (Maintain pressure and Reduce pressure)

The function of the solenoid valves or the return pump is not OK. If a solenoid valve has a mechanical fault, the fault is **not** stored in the fault memory.
Hydraulic or electrical lines could be swapped.

If a fault is stored in the fault memory, first eliminate this fault.

Test step "Maintain pressure" not OK:

- Brake pedal not pressed or not pressed at the right time.
- Electrical or hydraulic lines swapped if the activated wheel locks up (precondition: corresponding inlet valve activated with the F8 key).
- Inlet valve faulty.

Test step "Reduce pressure" not OK:

- Brake pedal not actuated.
- If the activated wheel does **not** alternately lock up and then rotate freely again but another wheel (precondition: the parking brake is not engaged and the selector lever of Tiptronic vehicles is in position "N"), the hydraulic lines are swapped.
- Outlet valve faulty.

Further to the intake and switch-over valves (solenoid valves for ABD)

Solenoid valves not OK (function or leakage).

Note

A correct test on the ABD solenoid valves is possible only if there is no fault on an ABS inlet valve or ABS outlet valve.
Therefore, read out the fault memory beforehand and remedy this fault first if necessary.

Test step "Intake valve" not OK

- Test sequence not observed.
- Function of the intake valves not OK.
- Return pump operation not OK.
  Check pump operation. To do this, select return pump in the Drive links menu (pump must then run).
- ABD secondary circuit poorly bled.
  Bleeding, see Page 45 - D 43.
- Intake or switch-over valve leaks.

Test step "Switch-over valve" not OK

- Test sequence not observed.
- Function of the switch-over valve not OK.

Actual values (ABS and ABS/TC)

The following actual values can be checked with this menu (with this function):

- Speed (wheel speed / test possible up to 18 km/h)

  Speed, front left
  Speed, front right
  Speed, rear left
  Speed, rear right

- Engine rpm (not present with Solo ABS)

Further to speed:

Select, activate and call up the desired wheel using the arrow keys.
The wheel speed is displayed according to the wheel rpm.
All four wheels are displayed if all speeds are activated and called up.

Example (front left wheel)

Speed, front left	15.00 km/h

Example (all wheels)

Speed, front left	15.00 km/h
Speed, front right	15.00 km/h
Speed, rear left	15.00 km/h
Speed, rear right	15.00 km/h

Procedure

Two tests are possible to determine the speed-sensor signal.

Test 1 with the vehicle raised.
(Swapping the speed sensors and checking the quality of the speed sensor signal.)

Test 2 when driving straight ahead at approx. 2 - 4 km/h.
(signal qualities of the individual wheels are compared with each other). Test 2 is a better measure of the signal quality than is test 1.

Further to test 1

In order to perform the test, manually turn the left front wheel at a uniform speed of approx. 2 - 3 km/h (observe display in the Tester screen). Slowly increase the speed while simultaneously observing the speed increase (display).

Nominal values/required display
Speed steps of approx. 0.06 km/h.
First display at 1.81 km/h. This means: From the value measured last, the next value must be 0.06 km/h higher or, if rotating slower, must be 0.06 km/h lower. The Tester rounds the value down to 0.05 km/h or up to 0.07 km/h in some cases.

Example

First measured value	= 1.81 km/h
Second nominal value	= 1.87 km/h
Third nominal value	= 1.93 km/h
etc.	

Note

When performing the test on the rear axle, lock up (hold) the opposite wheel.

Further to test 2

Display all four wheels in the Tester display.

Drive straight ahead at a uniform speed of approx. 2-4 km/h, and have a second person observe the Tester display.

Required display: Deviation between the four wheel speeds **max. 1 km/h**.

Further to engine speed:

Precondition: engine running.
Display of the current engine speed.

Input signals (ABS and ABS/TC)

The following input signals can be checked with this menu (with this function):

- Stop-light switch
- Valve relay
- Return pump
- Signal, terminal 61
- TC switch

Further to the stop-light switch:

Press the brake pedal.

Required display: Change from "not actuated" to "actuated".

Further to the valve relay:

The following appears in the display panel if the ignition is switched on or the engine is running and if the system is intact: "Valve relay picked up".

Further to the return pump:

Display: Return pump not running
(Display if the pump were running:
Return pump running).

Further to signal terminal 61:

Required display:
with engine running - not present
with engine running - present.

Further to the TC switch:

Required display without actuation:
TC switch not actuated.

Required display, depending on actuation:
(Switching Traction Control off or on):
TC switch ON actuated or
TC switch OFF actuated.

Static test (ABS and ABS/TC)

Electrical test of the system (advance check), e.g. after replacement of the hydraulic unit or if connectors were pulled off.

Important: This **is not** a substitute for the system test, as **no check for swapped electrical and hydraulic lines** is performed. Furthermore, the **mechanical** function of the solenoid valves is **not** tested.

If a fault is displayed, perform troubleshooting with the diagnosis/test plan on P. 45 - D 20/21 ff.

Menu: Bleed (ABS/TC 5.3)

Bleeding

Important notes

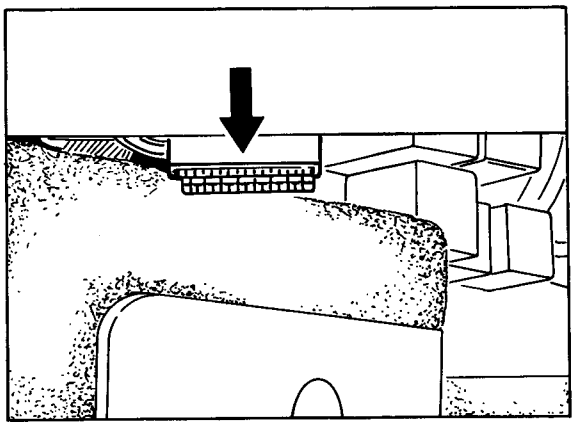
The Bleed menu is not available with the Solo ABS (it is not required).
On vehicles with Traction Control, this menu can be used to bleed the ABD secondary circuit in the hydraulic unit.
This additional bleeding is necessary **only** after **conventional** bleeding has been performed and only if the hydraulic unit is replacaed or was removed. The secondary circuit also can be bled in the event that the brake pedal travel is too large if the system was properly bled by the conventional method beforehand.

Bleeding the ABD circuit

– Preparatory work: Bleed brakes by conventional method
(repair group 47, Volume 4, Running gear).

– The bleeding unit remains connected (switched on) when the ABD circuit is being bled.
Bleed pressure. 1.5...2.0 bar.

– Connect the **Porsche System Tester 2** to the diagnostic socket.
The diagnostic socket is located in the driver's footwell (left-hand drive vehicles) or passenger's footwell (right-hand drive vehicles) near the fuse box.
Switch on the ignition. Select the "Bleed" menu in the ABS/TC system.



12-96

– Open the rear right bleeder valve (use collection bottle).

– Press the Start key on the System Tester.
This initiates certain functions in the hydraulic unit (the return pump, outlet solenoid valve and the switch-over solenoid valve are activated).
Bleed the system until the brake fluid emerges without bubbles.
In addition (during the entire bleeding process), fully depress the brake pedal to the stop (pump) at least ten times.
Important: Double the number of pumping cycles for vehicles with extremely high mileage or for very old vehicles, and use only half of the master brake cylinder stroke (damage could be caused to the master brake cylinder / primary boots).

– Close the right rear bleeder valve.
Then immediately press the Stop key on the System Tester.

– Switch off the ignition and disconnect the System Tester.

– Switch off and disconnect the bleeding unit.
Correct the brake fluid level if necessary.

Extract coding / Modify coding (ABS/TC 5.3)

Extract coding

The transmission version (manual transmission or Tiptronic) activated in the ABS/TC control module can be read out under menu item "Extract coding".

Modify coding

The ABS/TC control module can be adapted to the transmission version under menu item "Modify coding".

The coding must be adapted to the transmission version when the hydraulic unit is replaced.

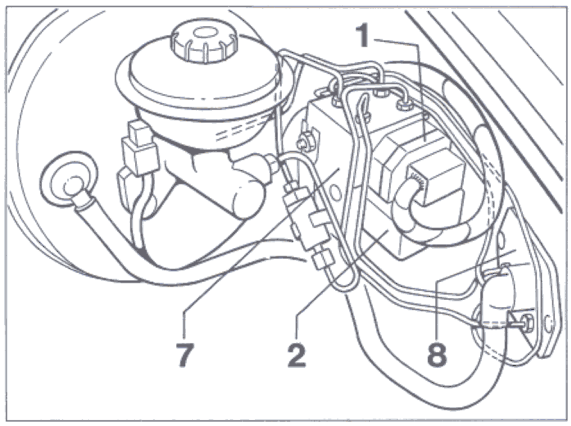
Printed in Germany - 3, 1996 986D451

System test (ABS and ABS/TC)

Important notes

1. A **system test (function test)** must be performed if work is performed on the hydraulic unit No. 7, the speed sensors and the wiring harness or if the hydraulic unit is exchanged. This is the case after accident repairs, for example. This prevents electrical and hydraulic lines from being swapped and ensures **flawless operation of the system.**

2. **A system test also has to be performed** if certain brake lines are replaced, e.g. on the intermediate piece No. 8. Unintentional bending of the brake lines could lead to **incorrect hydraulic allocation**, despite the different thread sizes used (M12 x 1 and M 10 x 1).



3. The system test is **not** menu-prompted (program-guided).
   The system test consists of several test steps and is performed via different menus. Observe the specified sequence when performing the system test.
   The static test must be performed at the start of the system test.
   Remedy any detected fault before proceeding with the system test.
   On vehicles with TC, the version coding must be checked or corrected **before the static test is performed.**

4. As fewer test steps are required on vehicles with Solo ABS (without TC) (several components are not installed), the TC-specific test steps are not displayed in the corresponding menu during the Solo ABS system test.

   Test step No. 1, Nos. 6...10, Nos. 18...19 and No. 24 are therefore not necessary (not possible) with the Solo ABS.

5. After the system test, take the vehicle on a test drive and make sure that a controlled braking operation (ABS control operation) is performed.

System test overview (ABS and ABS/TC)

Note

The static test must be performed at the start of the system test.
Locate and remedy any detected fault. Proceed with the system test only after the static test has been completed successfully.

Necessary test steps with ABS/TC 5.3 (4-channel system):

Test step	
1	Version coding (start of the test/possible only on vehicles with TC)
2	Static test
3...4	Stop-light switch and terminal 61 signal
5...8	MIL and information lights
9	Intake valve
10	Switch-over valve
11	Return pump operation
12...19	ABS solenoid valves (8 ea./function and incorrect allocation)
20...23	Speed sensors (function and incorrect allocation)
24	Engine speed information to ABS/TC control module

Necessary test steps with ABS 5.3 (3-channel system):

Note

On vehicles with **Solo ABS**, the test begins with the static test (test step 2).
The test steps in brackets are not necessary (possible only with a 4-channel system).

Test step	
(1)	_____
2	**Static test (start of test)**
3...4	Stop-light switch and terminal 61 signal
5	ABS MIL
(6...10)	_____
11	Return pump operation
12...17	ABS solenoid valves (6 ea. / function and incorrect allocation)
(18...19)	_____
20...23	Speed sensors (function and incorrect allocation)
(24)	_____

Printed in Germany – 3, 1996 986D451

Test of required display / required function	Test step not OK Possible causes, elimination, notes

System test

ABS and ABS/TC

Test step 1

Select and call up the version coding.
Display according to transmission version (Tiptronic or manual transmission).

Present only for vehicles with Traction Control.
If necessary, select the Modify coding menu to change the coding.

Test step 2

Select and perform the static test.
Required display: 0 faults.

This test checks whether all parts of the system are present or whether all electrical components are connected. If necessary, remedy any existing fault before proceeding with the system test.

Test step 3

Call up the Input signals menu and select the stop-light switch.
Briefly actuate the brake.
The stop light switch status (open or closed) is checked.
Required display: Change from "not actuated" to "actuated".

Perform troubleshooting analogous to test point 13 (stop-light switch / DTC 4340) on Page 45 - D 31.

Test of required display / required function	Test step not OK Possible causes, elimination, notes

Test step 4

Call up Input signals menu and select terminal 61 signal. Start the engine.
Required display: Signal present (engine not running: not present).

For troubleshooting, the status of terminal 61 (present or not present) also can be checked in the system "Alarm system" via the Input signals menu.

- If "not present" appears in the Tester display with the engine running, call up the **system "Alarm system"** and also check the status of terminal 61 there in the Input signals menu.
  If the signal is present **there**, the fault lies in the wire between the ABS control module and the other control module. For troubleshooting, consult the wiring diagram.
  If the terminal 61 signal is also **not present** with the system "Alarm system", continue with the next point.
- Bulb of Generator (MIL) in the instrument cluster faulty.
  Perform a lamp test (lamp must light up when the ignition is switched on).
- Check the generator.

Test step 5

Call up the Drive links menu and activate the ABS MIL.
The display must flash.
With the ABS/TC, the TC-MIL is activated as well

- Check bulb
- Check wiring between the instrument cluster and control module according to the wiring diagram.

Test step 6

Activate the TC-MIL in the Drive links menu.
The display must flash

Only on vehicles with TC. For vehicles with Solo-ABS, continue with test step 11

- Troubleshooting analogous to test step 5

Printed in Germany – 3, 1996 986D451

Test of required display / required function	Test step not OK Possible causes, elimination, notes

Test step 7

Activate the TC information light in the Drive links menu.
Display must flash.

Only on vehicles with TC. On vehicles with Solo ABS, continue with test step 11

– Troubleshooting analogous to test step 5

Test step 8

Activate the TC switch information light in the Drive links menu.
Display must flash.

Only on vehicles with TC. On vehicles with Solo ABS, continue with test step 11

– Troubleshooting analogous to test step 5

Test step 9

In the Drive links menu, test function of the **intake valve** in the hydraulic unit.

Only on vehicles with TC. On vehicles with Solo ABS, continue with test step 11.

– Perform troubleshooting analogous to test point 16 (diagnostic trouble code 5260) on Page 45 - D 32.

Test step 10

In the Drive links menu, test function of the **switch-over valve** in the hydraulic unit.

Only on vehicles with TC. On vehicles with Solo ABS, continue with test step 11.

– Perform troubleshooting analogous to test point 17 (diagnostic trouble code 5265) on Page 45 - D 33.

Test step 11

In the Drive links menu, activate the return pump.
Return pump runs audibly.

– Perform troubleshooting analogous to test point 12 (return pump fault / DTC 4266) on Page 45 - D 30.
If necessary, open the front lid in order to hear the pump run.

Test of required display / required function	Test step not OK Possible causes, elimination, notes

Test steps 12 - 19

In the Drive links menu, check the inlet and outlet ABS solenoid valves in the hydraulic unit **for function and incorrect allocation.** Rotate all four wheels individually (one after the other according to the test-step sequence). When doing this, carefully follow the instructions in the Tester Display.

On the Solo ABS, the test of the rear-axle valves (test steps 16...17) can be performed on the right or left wheel.

Test step 12: Maintain pressure, front left
Test step 13: Reduce pressure, front left

Test step 14: Maintain pressure, front right
Test step 15: Reduce pressure, front right

Test step 16: Maintain pressure, rear left (or rear with Solo ABS)
Test step 17: Reduce pressure, rear left (or rear with Solo ABS)

Test step 18: Maintain pressure, rear right
Test step 19: Reduce pressure, rear right
(Test steps 18 and 19 only on vehicles with TC)

Test step "Maintain pressure" not OK:

- Hydraulic lines incorrectly allocated if the activated wheel locks up (precondition: Inlet valve activated with the F8 key). Incorrect allocation of electrical wires is another possibility if impermissible repairs were made on the wiring harness after accident repairs.
- Inlet valve faulty.

Test step "Reduce pressure" not OK:

- If the activated wheel **does not** alternately lock up and then rotate freely again but another wheel does this (precondition: the parking brake is not engaged and the selector lever of Tiptronic vehicles is in position "N"), the hydraulic lines are swapped.
- Outlet valve defective.

Troubleshooting

Perform troubleshooting analogous to test point 10 on P. 45 - D 28.

Test of required display / required function	Test step not OK Possible causes, elimination, notes

Test steps 20 - 23

Check speed sensors for function and incorrect allocation.
To do this, go to the **Actual values** menu and select the wheel speeds there.
Rotate all four wheels **individually**. When each wheel is rotated, the speed allocated to the wheel must be displayed.
The non-tested wheel must be held when the test is performed on the driven axle.

Test step No.:
20 = Front left wheel
21 = Front right wheel
22 = Rear left wheel
23 = Rear right wheel

– Rotate the wheel on which the test step is not OK.
The non-tested wheel must be held when the test is performed on the driven axle.
If an indication for a **different** wheel now appears in the Tester display, the electrical wires are swapped (incorrect allocation of the speed sensors). This is normally not possible, but could occur if an impermissible repair was performed on the wiring harness after an accident repair.

– Perform troubleshooting analogous to test points 2 to 9 (depending on the wheel in question) on Page 45 - D 24 ff.

Test step 24

Check the engine speed in the Actual values menu.
The current engine speed is displayed if the engine is running.

– Perform troubleshooting analogous to test point 20 (Engine rpm information missing / DTC 5283) on Page 45 - D 34.