OBD (II)

INTRODUCTION

General

This manual is intended for trained automotive workshop personnel who have successfully completed Porsche training seminars on the respective systems and who possess the necesssary theoretical and practical knowledge to perform work on complex systems.

The basic prerequisite for all work on the DME is the acknowledgement and observance of safety regulations and warnings; these are contained in the chapter "Notes" on the following pages.

Note!

The following diagnosis and troubleshooting procedures are oriented toward and described for left-hand drive vehicles. Plugs and jacks specified may have different pin assignments for right-hand drive vehicles, which could lead to both misinterpretation during troubleshooting and to unpredictable accidents. Therefore, work should not be performed on right-hand drive vehicles without the correct circuit diagram or diagnosis and troubleshooting descriptions for right-hand drive vehicles.

This OBDII manual DME 7.1.1 covers the following vehicles:

- Cayenne with V8 turbo engine, as of model year 2003
- Cayenne with V8 naturally-aspirated engine, as of model year 2003
- Cayenne with V6 naturally-aspirated engine, as of model year 2004

This manual describes the diagnosis and troubleshooting procedures for the engine control module DME 7.1.1. It is based on the OBD II versions (USA version, OBD = On-Board Diagnosis). This includes the EOBD (European OBD) and RoW (Rest of the World) versions that were adapted to the respective national laws or regulations regarding diagnosis.

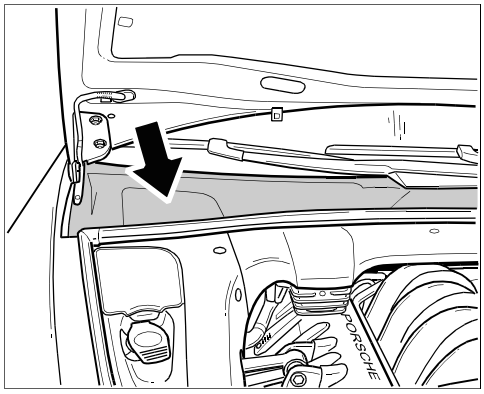
The main differences between the OBD II and EOBD versions include the fuel tank leakage test required by law in the USA and the criteria for storing faults and activating the CHECK ENGINE light (abbreviated CE below), which is also referred to as the MIL (Malfunction Indicator Light).

The following functions are assured by the OBD II system:

- Detection of combustion misfiring
- Monitoring the Efficiency of the Catalytic Converter
- Monitoring the fuel tank ventilation system
- Monitoring the fuel tank system for leaks
- Monitoring secondary air injection.
- Monitoring the adaptation limits (e.g. of oxygen sensing, boost pressure control)
- Monitoring the oxygen sensors
- Monitoring the thermostat and water temperature sensor
- Monitoring positive crankcase ventilation (via lambda adaption).
- Monitoring the transmission (Tiptronic control module)
- Monitoring emission-relevant sensors and actuators associated with the DME (previous scope of OBD 1)
- Triggering the Check Engine light and storing faults in the memory
- Indication of monitoring readiness (Ready codes, see "Ready status" section in chapter entitled "Definition of terms")
- Output of existing diagnostic trouble codes (DTCs)
- Storage of defined operating parameters in the event of a fault (including freeze frame)
- Functional checks of the OBD system (warm-up cycle, driving cycle)
- Communication with standardised control-module tester (scan tool) in the prescribed modes
- Standardised read-out of operating data such as rpm, temperature, etc.

Digital engine control module DME 7.1.1

Location of DME control module ►



DME 7.1.1 is a proven, highly reliable engine control module, which was specially adapted to suit Porsche requirements. It is located under a cover in the right-hand part of the plenum chamber (engine compartment) and is protected against penetrating moisture.

Unlike with the DME control modules Porsche used previously, the fault memory is retained even after the battery is disconnected. It is especially important to bear this fact in mind when installing control modules as a test and then returning them to storage or installing

them somewhere else. In cases such as this, the fault memory must be erased again before removing the control module.

When the voltage supply is interrupted, the following control module values will be deleted:

- All adaption values
- Learned values of the throttle adjusting unit
- Ready statuses of the individual diagnosis routines (see following chapter)
- Freeze frames (ambient conditions; see following chapter) stored with the faults

Bear in mind that programming the DME (e.g. loading a new data record) will also delete the values mentioned above.

Note on adaption

The DME control module must perform a learning and adaptation routine for the throttle valve adjuster if:

- the power supply to the DME control module was interrupted,
- the DME control module connectors were unplugged,
- a new DME control module was installed,
- the throttle valve adjuster was replaced,
- the DME was programmed.

To initiate adaption:

1. Switch on the ignition without starting the engine
2. Perform a "throttle adaptation" under the "System adaptation" column using the 9588 Porsche System Tester II.

The following conditions must be met, otherwise adaptation is not possible:

- Do not press the accelerator (make sure there is no carpet pressing on the accelerator, for example)
- Stationary vehicle
- Battery positive voltage between 10 V and 16 V
- Engine temperature between 5 °C and 100 °C
- Intake air temperature > 10°C

Standardised fault codes according to ISO 15031

Diagnostic trouble codes that can be issued by the control module are standardised according to ISO 15031. This ISO standard is based on SAE J 2012.

The fault code or DTC is always a 5-character alphanumeric value, e.g. "P0100".

The first character (letter) of the code identifies the system which has set the code. A total of four system types are covered:

- P for powertrain (this is the first character of all OBD II fault codes)
- C for chassis
- B for body
- U for future systems

The P codes are classified in 2 main categories according to ISO 15031:

- Uniformly standardised codes: P0XXX and P2XXX; these codes are identical for all manufacturers
- Manufacturer codes: P1XXX and P3XXX: only the first 3 characters are standardised here (example: P13XX for ignition-system diagnosis or misfire detection); the last two characters are freely selectable by the manufacturer.

Only the P codes are required for OBD II.

The standardised codes are subdivided as follows:

P0001 to P0299	Fuel and air metering
P03xx	Ignition system and misfire detection
P04xx	Additional emission control systems
P05xx	Speed and idle air control
P06xx	Computer and output signals
P0700 to P0999	Transmission

P2000 to P2299	Fuel and air metering
P23XX	Ignition system and misfire detection
P24XX	Additional emission control systems
P25XX	Additional input signals
P26XX	Computer and output signals
P27XX	Transmission
P28XX	Reserved
P29XX	Fuel and air metering

Definition of terms

Warm-up cycle

The warm-up cycle is the time which the engine requires to reach operating temperature. To fulfil the 'warm-up cycle' condition, the engine temperature on start-up must not be higher than a specified value (currently 44°C). The engine operating phase has to be long enough to produce a certain temperature increase (currently 21°K, but the temperature reached must be at least 54°C). The warm-up cycle condition is needed to decrement (count down) the fault erasing counter in the event of faults that have been recognised as "healed" (see section entitled 'Fault healing').

Driving cycle

A driving cycle consists of starting the engine, possibly a test drive (with a share of idling, partial load, constant driving, and overrunning phase) and the time between stopping the engine and starting again. For the purpose of shedding/healing faults, the driving cycle must sometimes include performing the relevant diagnosis.

Ready status

The "Ready Status" menu item inidicates whether the OBD system has performed the required fault checks since the last time the 'fault memory was erased' or 'reset'. If a check proves to be OK, the one-off check is sufficient for a Ready status; if the system is faulty, the Ready status is achieved after a second check.

This is important, for example, for Inspection and Maintenance; this is where it is possible to detect whether the fault memory of a faulty vehicle was erased before the examination, without the cause(s) of the fault having been remedied.

The ready status is displayed for the following sub-systems:

- Oxygen sensor heater
- Oxygen sensor
- Secondary-air system
- Fuel tank ventilation system
- Cat. conv. efficiency

Once the Ready status has been reached for a sub-system, this is stored until the next time the ' fault memory is erased'.

Note!

- *in some countries (currently: USA, Canada), it is necessary to restore the Ready status following manipulation of the DME before the vehicle is supplied to the customer.*
- *To do this, you must perform the short test available in the 9588 Porsche System Tester II or a test drive to achieve the relevant diagnostic conditions (these are listed for each system at the beginning of the test instructions for P codes in this manual).*
- *If you have any questions, please contact your nearest importer.*

Freeze frames (officially prescribed 'frozen fault boundary conditions')

Freeze Frame data is standardised and records the operating conditions in the (first) event of a fault. Freeze frames have different priorities. This can be significant when output to a scan tool since it may only be possible to display one freeze frame here although several faults are stored (misfire or fuel supply faults overwrite the freeze frames of other faults).

Freeze frames can be examined in the "extended fault memory" of the 9588 Porsche System Tester II.

The control module must be able to output the following freeze frame data to a standardised diagnostic device (scan tool):

- DTC that caused this freeze frame to be stored
- Engine load
- Engine speed
- Coolant temperature
- Oxygen sensor status (control or sensing)
- Mixture adaptation values
- Fuel pressure (when available, not for DME 7.1.1 at present)
- Intake manifold pressure (when available, only for turbo vehicles at present in the case of DME 7.1.1)
- Vehicle Speed

With DME 7.1.1, a freeze frame is stored whenever a fault occurs for the first time. This freeze frame contains all the actual values listed above. See also next section.

Other ambient conditions

Each time a fault occurs, two other operating conditions (actual values at the time the fault occurred), as well as the operating time and even the total number of kilometres/miles, are stored in DME 7.1.1.

This includes one memory entry for the first occurrence of the fault (the entry is stored) and a further entry for the last occurrence of the same fault (the entry is updated each time the fault recurs). This data can provide troubleshooting clues for difficult diagnoses, and can only be examined in the "extended fault memory" of the 9588 Porsche System Tester II. The list of possible ambient conditions overlaps at present with the freeze frames in order to store important ambient conditions even after the first occurrence of the fault.

Fault shedding (confirmation of a suspected fault)

When a fault occurs for the first time during a diagnostic routine, it is stored as a suspected fault. At the same time, a fault shedding counter is started that contains a certain value (e.g. 2). During additional diagnostic procedures, the shedding counter will be decremented by 1 if the fault is recognised in the same area window. When the shedding counter has reached the value 0, the fault is considered as shedded and is thus entered. If the fault class provides for this, the CE light is now activated as well.

Fault healing (CE light off)

When a fault occurs for the first time during a diagnostic routine, it is stored as a suspected fault. This suspicion is either confirmed (the fault occurs again) or refuted (the fault does not occur again, no display on a scan tool) in the subsequent driving cycle. If the fault activates the CE light, a fault healing counter that contains a certain value (e.g. 5) is started at the same time. During additional diagnostic routines, the fault healing counter will be decremented by 1 if the fault is not recognised in the same area window. When the fault healing counter has reached the value 0, the fault is considered to be healed. If the fault has triggered the Check Engine light, then the latter is switched off as long as this is not prevented by any other faults. The fault remains in the fault memory for the time being; it is not deleted again until a certain number of warm-up cycles (defined in the fault erasing counter) are completed successfully (as workshop help, e.g. if the tank cap is not screwed on tightly for a short time).

Fault erasing counter

For each recognised fault, an individual fault erasing counter is kept. It contains the defined number of required OK tests until the respective fault is erased in the fault memory.

The first time a fault is recognised, the fault erasing counter is set to 80, for example (suspected fault).

If an unshedded fault is recognised as healed, the fault erasing counter is set to 10 (only visible for the PST2). (Workshop help for very sporadic faults)

Each time a shedded fault is recognised (= CE light on), the fault erasing counter is set to 40, for example. It retains this value until fault healing is recognised.

The fault erasing counter is decreased by 1 after each warm-up cycle if the fault in question is recognised as unshedded or healed. When the fault erasing counter reaches the value 0, the fault is erased from the memory. Faults that are confirmed but not recognised as healed are not decremented in the fault erasing counter.

Fault frequency counter

This indicates how often a fault has recurred after its first occurrence. If the value is "1", the fault has occurred only once. Thus, it can now be "present" or "not present". The number in the fault frequency counter is increased by 1 whenever the fault status changes from "not present" to "present". A large value in the fault frequency counter thus might indicate a loose contact. It is important to remember that the ambient conditions stored in the "extended fault memory" relate only to the first and last occurrence of the fault.

Warnings

Warnings

Danger!

- ***Danger of accident if test and diagnostic equipment (PST2, scan tool, etc.) is operated while driving!***
- ***Always get a second person to operate the test and diagnostic equipment while driving***
- ***Some tests or system checks can affect vehicle handling so make sure to carry out these tests in a cordoned-off area!***

Danger!

- ***Gasoline is toxic!***
- ***Inhaling vapours can lead to irritation of the mucous membranes and eyes***

- ***It represents a serious risk to health when inhaled, touched or swallowed over extended periods***
- ***Wear a breathing mask with active charcoal filter; do not breathe in any fuel vapours***
- ***Wear protective gloves that are fuel-resistant***
- ***Perform work on the fuel system only in well-ventilated rooms***
- ***Relieve the fuel pressure before opening the fuel lines or fuel hoses***
- ***Collect escaping fuel; absorb it if necessary with a suitable binding material and dispose of properly (special-category waste!)***
- ***Pay attention to cleanliness when working on the fuel system***

Danger!

- ***Working with gasoline involves a danger of fire and explosion***
- ***Keep away from sources of ignition***
- ***Do not smoke***
- ***Danger of fire due to naked flames and sparks, e.g. during welding or grinding work***
- ***Danger of fire due to escaping fuel, e.g. on hot engine components and/or due to electrostatic charging***
- ***Secure the vehicle, e.g. with a warning sign***
- ***Change any clothing soaked with fuel immediately***
- ***In case of fire, use a CO_2 or dry powder fire extinguisher***

Warning!

- ***Danger of injury by hot and/or rotating parts!***
- ***Do not perform any work on the engine and/or exhaust system when the engine is running and/or hot!***
- ***Danger of injury due to fan start-up! Fans can start up unexpectedly when the ignition is switched on, when control module connector B is disconnected, when the air-conditioning system is switched on or when the engine is***

warm. Make sure to wear safe, correctly fitting clothes and any necessary personal safety gear (hair net). Do not work in this area when the engine is running.

Caution!

Risk of property damage if batteries and plug connectors of the control modules are handled incorrectly!

- ***Never disconnect the battery terminals with the engine running.***
- ***Never start the engine without the battery terminals properly connected.***
- ***Never connect or disconnect the plug connections of the control modules or other electronic components with the ignition switched on.***
- ***Please observe warnings in the Body Manual if you intend to do welding work on vehicles.***

Notes on troubleshooting

Working on oxygen sensors

Note!

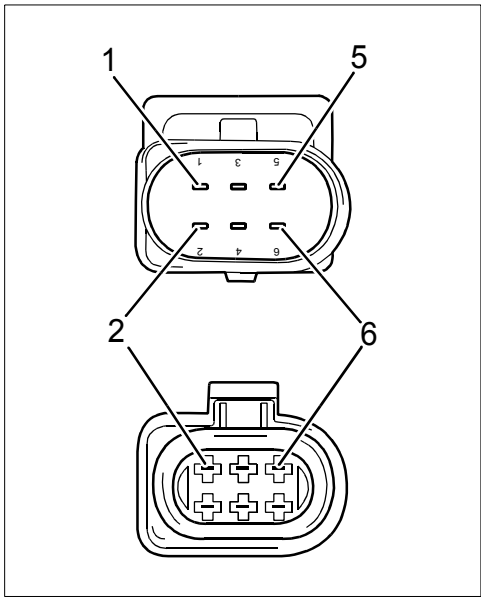
Oxygen sensors used for DME 7.1.1

Component		**Application**	
Oxygen sensor	Number of pins	Ahead of catalytic converter	Behind catalytic converter
LSU broadband sensor	6	All models	/
LSF Narrow-band oxygen sensor	4	/	All models

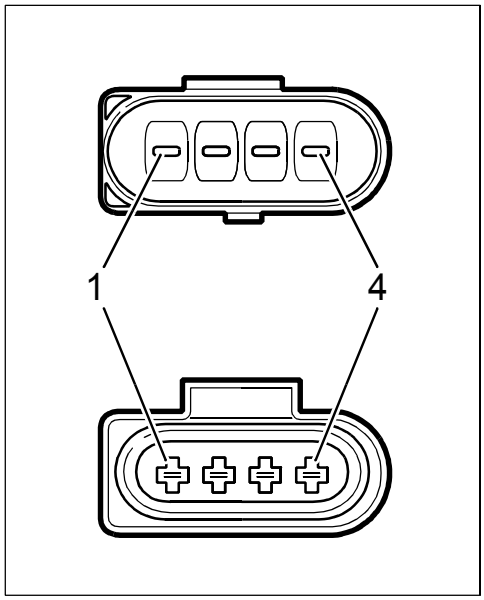
The LSU (universal oxygen sensor) can determine the oxygen value in a wide range.

The LSF (flat oxygen sensor) can only determine oxygen values greater or less than 1 (the rich-lean jump).

Oxygen sensor ahead of catalytic converter (LSU) has a 6-pole connector ►



Oxygen sensor after catalytic converter (LSF) has a 4-pole connector ►



Note!

Do not confuse oxygen sensor ahead of catalytic converter and oxygen sensor after catalytic converter as this will cause implausible fault entries. This note refers to the possibility of mistakenly installing a sensor intended for installation in front of the catalytic converter at the installation position for the sensor behind the catalytic converter in the exhaust system. The plugs themselves are coded and cannot be swapped.

Note!

Do not use contact spray on the oxygen sensor plug connections as this may cause irreparable damage to the wiring (contamination of the oxygen sensor via the reference air channel).

Troubleshooting procedure

Troubleshooting is possible only if the fault is actually present. This means: targeted troubleshooting according to instructions (diagnosis/troubleshooting for the individual DTCs) is only possible if the entry has the status 'present' in the fault memory.

If the fault is 'not present' at the moment, it is necessary to check the following:

- Has the fault healing counter and possibly the fault erasing counter been decremented? This would indicate that the fault has been corrected
- Did the fault occur a long time ago? Read out the extended fault memory (operating time and mileage for last fault entry)
- Are the diagnostic conditions fulfilled? Carry out a short test or test drive, if necessary
- Are all the plug connections and ground points of the current path in question OK?
- By pulling and shaking, put all wiring harnesses of the current path in question in a state corresponding to that of driving operation (loose contact).
- Condition/leak tightness of the catalytic converter
- For tank system: Condition/leak tightness of hoses and possibly the tank cap

Diagnosis conditions

Note!

Important! Switch off all unneeded loads before starting diagnosis. When working with the ignition switched on, connect a suitable battery charger to the vehicle battery or to the jump lead starting terminals intended for this purpose.

Note!

Only if the preconditions listed under 'Diagnostic conditions' have been met is/was it possible for the control module to recognise the fault. For this reason, it is necessary to comply with the specified procedure after remedying a fault:

1. Erase fault memory once you have printed or stored it
2. Meet the prerequisites listed under 'Diagnostic conditions' or carry out a short test with the 9588 Porsche System Tester II. It is important to remember here that faults can only be detected with the DME control module based on reset adaptation values (particularly for fuel supply and misfire detection) after driving the vehicle for a long time. It may be possible to observe the relevant adaptation values ("actual values") during a subsequent road test in order to pinpoint a particular tendency.
3. Read out the fault memory again.

Possible fault causes

Note!

This is where the 'Possible fault causes' leading to the fault are listed. Please bear in mind that additional faults may be stored in the memory after troubleshooting under certain circumstances (e.g. if plug connections are disconnected). After repairing the vehicle, read out the fault memories of all control modules and erase all faults that were added during troubleshooting or repairs.

Faulty DME

Note!

- *Faulty control modules are extremely rare! Although almost every fault can theoretically also be caused by a faulty control module, past experience has shown that, for DME control modules in particular, even control modules sent in for inspection turned out to be OK.*
- *We would again like to stress the necessity of thoroughly examining all other possible fault causes before replacing a DME control module (this is the last logical step at the end of a fruitless troubleshooting procedure). If necessary, the fault entry must be deleted and a test drive or short test must be performed.*
- *If further faults have been recorded, these are to be remedied first according to instructions (example: a fault in the inlet camshaft can, under certain circumstances, cause an oxygen sensor fault to be issued).*
- *CAN timeout fault entries are critical faults which, when they occur alone, are not necessarily caused by a malfunction. Instead, these CAN timeout faults are intended to provide additional information when other faults (even 'non-CAN faults') are recorded or when functions are impaired.*
- *Fault entries that are connected only with troubleshooting, repairs or the programming of control modules (e.g. CAN timeout errors) must be erased.*

Diagnosis/troubleshooting

Note!

It is possible to access the 'extended fault memory' with the aid of the fault memory info key F8 on the 9588 Porsche System Tester II. In addition to the freeze frames and ambient conditions, the extended fault memory also contains information about the type of fault.

Fault type

The following fault types are possible for DME:

- Signal implausible (fault type 1, Plaus)
- No signal/communication (fault type 2, Sig)
- Below lower limit (fault type 3, Min)
- Above upper limit (fault type 4, Max)

Several faults can also be stored at the same time.

Fault status

The following status types are possible:

- Present
- Not present

This information should be saved and printed with the Save key F4.

Note!

- *Faults not present: If faults are entered but not present at the moment, it is necessary, depending on the system, to check the parts of the wiring connected to moving parts on and in the vehicle once the diagnostic conditions have been met or set. Various switching states that can cause a fault to occur must be simulated using the circuit diagram. Bear in mind that the 9588 Porsche System Tester II can show the current fault status only to a certain extent. Here, the fault frequency counter shows the operating time and mileage for the last occurrence of the fault.*
- *In difficult cases involving faults that are not currently present, it is a good idea to erase the fault memory (after printing it out) and check whether the fault is recorded again when a loose contact is simulated.*

Note!

- *Visual inspection of plug connections: As part of troubleshooting, it is important to ensure that the pins in the affected plug connections are neither damaged nor corroded, both on the component side and on the wiring-harness side. Furthermore, the wiring and the connectors must be checked for signs of external damage (cracks, etc.) and proper contact (pins not bent, spread apart or pressed into the housing). Repair damaged or corroded pins if possible, otherwise replace them. Repair or replace damage wiring. If wiring on the oxygen sensors is damaged, always replace the entire oxygen sensor.*
- *Visual inspection of components: As part of troubleshooting, it is important to ensure that the affected components or wiring harnesses show no visible signs of damage (e.g. cracks, deformation or chafing marks). This is particularly important for components that cannot be tested with a multimeter, e.g. the ignition bar modules, or components that can cause sporadic faults due to penetrating moisture.*

Note!

Battery positive voltage and signals: The general precondition for diagnosis/troubleshooting is a battery positive voltage in the range from 11.4 V to 14.5 V. This must be checked and ensured if necessary using a suitable battery charging device.

Note!

Unless stated differently, specified resistance values refer to an ambient temperature of 20 °C.

End of troubleshooting (→ End)

→ End identifies the end of the diagnosis/troubleshooting procedure described in the troublshooting tables. The procedure for the repair is contained in the respective repair instructions for the corresponding repair group. Once the repair has been completed, erase the DME control module fault memory, adapt the throttle adjusting unit if necessary and subsequently perform a short test or test drive to achieve the diagnostic conditions for the relevant fault. Then read out the fault memory again. The Ready statuses must be produced, depending on the country.