TECHNICAL TRAINING

OPERATING PRINCIPLE - BOSCH ME7.4.4 / M7.4.4 AND EOBD

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BROCHURE SUMMARY

OPERATING PRINCIPLE - BOSCH ME7.4.4/M7.4.4 AND EOBD

The aim of this document is to define the composition and operation of the BOSCH ME7.4.4 and M.7.4.4 petrol engine management systems.

These devices consist of a digital ECU which analyses information from the various sensors and then operates the injectors and ignition coils at the right moment. It is also responsible for operating the petrol vapour recycling electrovalve, the gas throttle or idle regulation motor and an air injection to the exhaust pump.

The following subjects will be dealt with in this document:

- General details and presentation of the systems.
- Description and operation of the components.
- Wiring diagrams.
- Diagnostics.

EOBD is dealt with at the end of the document.

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FOREWORD

The ME7.4.4 and M7.4.4 ignition-injection ECUs have been developed to control the following functions:

- engine torque,
- sequential multipoint injection,
- twin static ignition,
- cruise control (optional),
- L4 (EOBD)*/K'/ifL5 depollution standards,
- engine cooling,
- dialogue with the other ECUs on the CAN multiplexed network (automatic gearbox, ESP, BSI etc for ME7.4.4)(automatic gearbox only for M7.4.4).

They both have 3 modular connectors with a total of 112 channels.

They are fitted to the following engines:

- Bosch ME7.4.4: TU5JP4,
- Bosch M7.4.4: TU1JP and TU5JP.

They belong to the new ECUs which can communicate with the vehicle's other ECUs (automatic gearbox, BSI, ESP, etc) using a standard protocol called the CAN (Controller Area Network).

The dialogue with these various ECUs depends on the vehicle type and its equipment level.

The Bosch ME7.4.4 and M7.4.4 ECUs comply with the new standard which came into force on 1st January 2000 regarding the on-board diagnosis of pollutant emissions.

This standard is called EOBD (European On Board Diagnosis).

K' depollution:

- the downstream oxygen sensor is discontinued,
- the upstream oxygen sensor is lead resistant,
- the catalytic converter is not impregnated,
- the EOBD standard does not apply to this depollution level.

ifL5 depollution:

The engine is fitted with an air pump to comply with the L5 depollution standard.
(L5 applicable from 1st January 2005).

By using the information from the various sensors, they perform the following functions:

Calculation of the injection time, phasing and control of the injectors as a function of the following parameters:

- driver's wishes (pedal position sensor for ME7.4.4 and throttle potentiometer for M7.4.4, cruise control, electronic stability program),
- thermal state of the engine (coolant temperature sensor),
- mass of air absorbed (inlet air temperature sensor, inlet air pressure sensor and engine speed sensor),
- engine operating conditions: starting, idling, stabilised engine speed, transitory engine speeds, injection cut-off and power take-up speed (motorised throttle for ME7.4.4 and stepper motor for M7.4.4, engine speed sensor, speed information),
- richness regulation (oxygen sensors)(2 sensors for L4 and ifL5 depollution and 1 sensor for K' depollution),
- canister circuit bleed (canister bleed electrovalve),
- inlet pressure (inlet air pressure sensor),
- battery voltage (battery),
- knock detection (knock sensor),
- cylinder n°1 position (phase detection integrated into the ignition).

Calculation of the advance and control of the ignition as a function of the following parameters:

- engine speed and position (engine speed sensor),
- inlet pressure (inlet manifold pressure sensor),
- knock detection (knock sensor),
- air conditioning compressor status (air conditioning ECU or built-in systems interface or pressurestat information),
- thermal state of the engine (coolant temperature sensor),
- vehicle speed information (vehicle speed sensor or ABS ECU or ESP ECU),
- mass of air absorbed (inlet air temperature sensor, inlet air pressure sensor and engine speed sensor),
- battery voltage.

Management of the following internal functions:

- idle regulation (stepper motor or motorised throttle),
- engine speed stability when idling and when not idling,
- fuel supply (fuel pump),
- supply to the sensors,
- oxygen sensor heating,
- canister bleed (canister bleed electrovalve),
- maximum engine speed limitation by cutting off the injection,
- torque compensation on full steering lock (power steering fluid pressure switch),
- power latch (maintaining the supply to the ECU after the ignition is switched off),
- air injection to the exhaust (air injection to the exhaust pump, specific to ifL5 depollution),
- Autodiagnostic.

Management of the following external functions:

- engine speed information,*
- coolant temperature information,*
- coolant temperature warning information,*
- fuel consumption information,
- diagnostic LED,*
- low fuel information,**
- dialogue with the after-sales diagnostic tools and inspection tools,
- dialogue with the other ECUs (automatic gearbox, built-in systems interface, ABS, etc) (depending on vehicle),
- cruise control (clutch and brake safety switches),
- engine cooling (control of the fan unit(s)),
- engine immobiliser (electronic immobiliser),
- authorisation to engage the air conditioning compressor (internal strategies).

  * To the control panel via the built-in systems interface (depending on vehicle).

  ** Information from the built-in systems interface, specific to EOBD (this information is used to prohibit misfire detection).

ECU operating strategies during specific phases

Cranking phase

When the ignition key is in the cranking position (+CC), the ECU controls the fuel pump via the double relay for 1 - 3 seconds, if no engine rotation appears.

When the engine speed exceeds 20 rpm, the fuel pump is then permanently supplied.

To enable the engine to start, the ECU has to know the exact position of the engine in order to locate the cylinder in the compression phase.

Synchronising on cylinder n°1 is performed using the DEPHIA strategy ("DEtection de PHase Intégrée à l'Allumage" - Phase Detection Incorporated into the Ignition). This strategy is based on the acquisition of a signal from the ignition coil.

Correction during the cranking phase

The ECU controls a constant period flow via the injectors whilst the starter motor is operating.

The amount of petrol injected in asynchronous mode (not phased with TDC) only depends on the following:

- coolant temperature,
- atmospheric pressure.

Once started (the engine is considered to be started when it is rotating above a speed which is defined during calibration), the engine receives an amount of fuel injected in synchronous mode (phased with TDC).

This amount injected varies permanently with:

- the change in engine temperature,
- the pressure in the inlet manifold,
- the engine speed.

The idle speed is then controlled by:

- the stepper motor for M7.4.4 ,
- the motorised throttle for ME7.4.4 .

Operation at transitory engine speeds

At transitory engine speeds (acceleration/deceleration), the calculated injection time is corrected as a function of variations (in speed and amplitude) of the following information:

- engine speed (engine speed sensor),
- driver's wishes (accelerator pedal position sensor for ME7.4.4 or throttle potentiometer for M7.4.4, cruise control),
- throttle position information (motorised throttle housing for ME7.4.4 or throttle potentiometer for M7.4.4),
- inlet pressure (inlet air pressure sensor),
- coolant temperature (coolant temperature sensor),
- inlet air temperature (inlet air sensor).

Cut-off during deceleration

When the engine is decelerating (and from a certain engine speed), when the throttle is closed (no load position), the ECU cuts off injection so as to:

- reduce fuel consumption,
- minimise pollution,
- prevent the catalytic converter from overheating.

Power take-up

The power take-up point corresponds to the point at which injection restarts (after a cut-off during deceleration).

The power take-up engine speed is set at a higher engine speed than the idle speed.

This higher engine speed prevents the engine from stalling due to its inertia when decelerating.

Driving pleasure

The ECU detects and reduces engine hesitation and improves engine speed and idle speed stability by acquiring information from:

- the power steering full lock sensor,
- the vehicle speed sensor,
- the alternator load state,
- the operating status of the air conditioning compressor (line AC/TH),
- the amount of power taken by the fan unit,
- gear changes,
- deceleration or brake pedal pressed,
- the electronic stability program ECU (via the CAN network, depending on vehicle),
- the brake switch (prohibition of cruise control).

The ECU principally adjusts the ignition as well as the position of the motorised throttle (ME7.4.4) or the stepper motor (M7.4.4), to determine the optimum torque required for driving pleasure.

POWER LATCH (maintaining of the ECU power supply after the ignition is switched off)

This function allows the ECU to control the following parameters:

- engine cooling,
- saving of the adaptives and fault memory.

When the ignition is switched off, the ECU maintains the supply to the double multifunction relay for a minimum of 15 seconds.

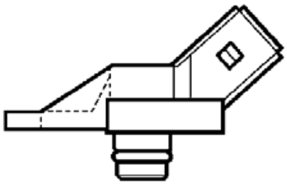
This time can vary depending on coolant temperature.

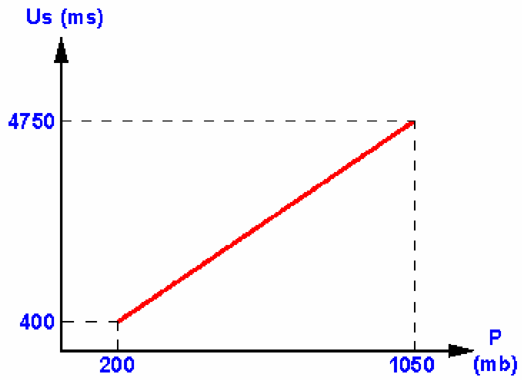
The Power Latch phase allows the new parameters which were programmed since the last time the ignition was switched off to be saved.

At the end of the Power Latch sequence, the ECU is no longer energised.

DESCRIPTION OF THE COMPONENTS

I - INLET AIR PRESSURE SENSOR





The inlet air pressure sensor is a new generation sensor and incorporates the inlet air temperature sensor.

The inlet air pressure sensor permanently measures the pressure in the inlet manifold as well as the temperature of the engine inlet air.

It is supplied with +5V by the ECU when the ignition is switched on.

Inlet air pressure information

The sensor supplies a voltage proportional to the measured pressure and is of piezo-resistive type (resistance varies with pressure).

The ECU uses this information to determine:

- the mass of air absorbed by the engine (with the engine speed and air temperature parameters),
- the flow to be injected at the various engine load states and at the various atmospheric pressures,
- the ignition advance.

An altitude correction is also made to the injection time calculation.

The mass of air absorbed by the engine effectively varies as a function of:

- atmospheric pressure, and therefore altitude,
- air temperature,
- engine speed.

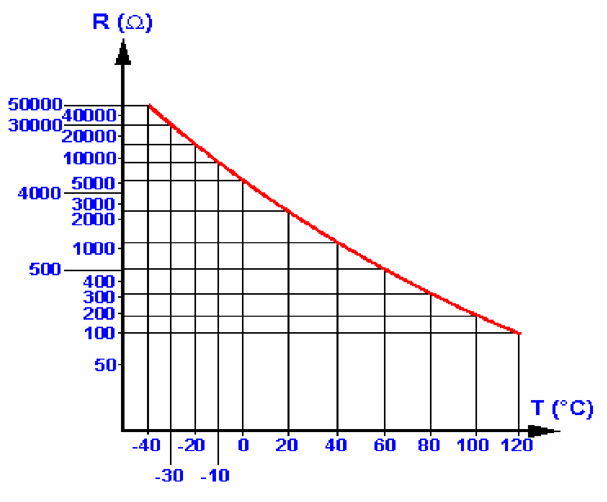
Pressure measurements are taken:

- every time the ignition is switched on,
- at very high loads and low engine speeds (when driving up a hill, and therefore change in altitude and pressure).

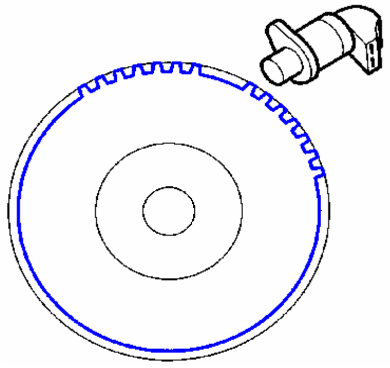
Inlet air temperature information

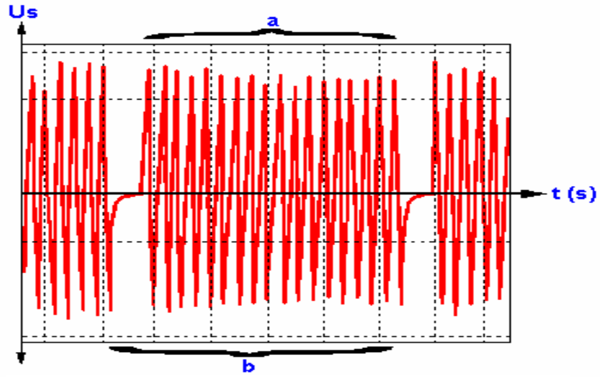
The resistance of the inlet air temperature sensor is of NTC type (Negative Temperature Coefficient), and therefore its resistance decreases as temperature increases.

The ECU uses this information to calculate the mass of air absorbed by the engine.



II - ENGINE SPEED SENSOR





Us: induced voltage
t(s): time
a: 58 periods
b: 1 engine revolution

The engine speed sensor consists of a magnetic core and a winding.

It is positioned opposite a ring with 60 teeth, 2 of which have been removed in order to determine the TDC (top dead centre) position.

When the teeth of the flywheel pass in front of the sensor, a variation in magnetic field is created.

This variation induces an alternating voltage (sinusoidal wave) in the winding.

The frequency and amplitude of this signal are proportional to the rotational speed of the engine.

Sensor specifications:

- resistance: x Ohms,
- air gap: 1 mm ± 0.5 (not adjustable).

Ring specifications:

- 60-2 = 58 teeth (one tooth corresponds to 6° crankshaft).

The voltage of the engine speed sensor is transmitted to the injection ECU and is used to ascertain:

- the engine speed,
- sudden variations in engine speed (specific to L4 depollution).

These variations in engine speed can be positive or negative, caused by an acceleration or a deceleration.

Using this information, the ECU can deduce a poor road condition in order to prohibit the misfire detection function.

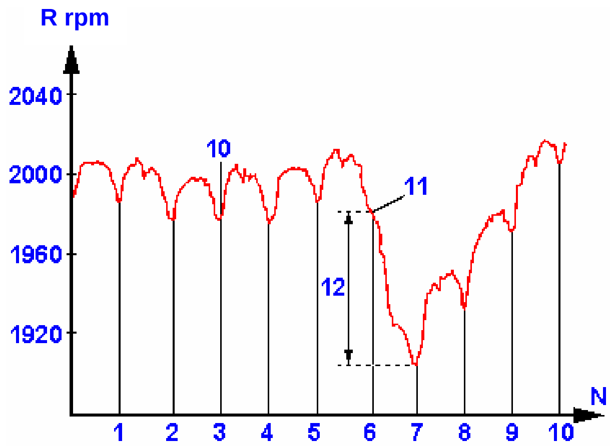
This information allows the ECU to control the various engine operating states (engine off, engine running) and modes (acceleration, cut-off, power take-up, etc).

The ECU detects any misfires by analysing the variations in engine speed between successive combustions.

During normal operation, for one crankshaft revolution, the flywheel must be subject to 2 accelerations corresponding to the 2 combustions during this revolution.

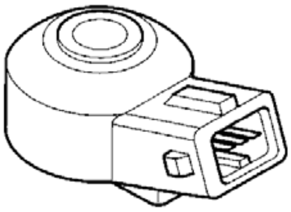
If an acceleration is not detected, a misfire is detected.

The diagnostic LED flashes if misfires which may damage the catalytic converter occur. If it involves misfires which lead to the regulatory limits being exceeded, the LED remains illuminated.



(R): engine speed (rpm)
(N): ignition number
(10): combustion without misfire
(11): misfire
(12): variation in engine speed due to misfires

III - KNOCK SENSOR



The piezo-electric type knock sensor is mounted on the engine block.

This sensor is used to detect knock (vibrations caused by the mixture detonating in the combustion chamber).

This phenomenon, if repeated, can destroy mechanical parts due to an abnormal rise in temperature of the cylinder walls.

This sensor supplies a voltage corresponding to the engine vibrations.

After receiving this information, the ECU retards the ignition advance of the cylinder or cylinders affected by 3° with a maximum decrease of 12° for M7.4.4 and 15° for ME7.4.4.

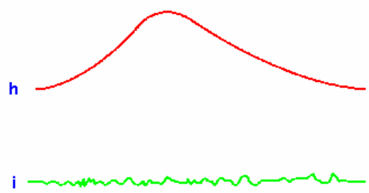
It is increased back to the original level progressively.

At the same time as retarding the advance, the ECU increases the richness of the air/fuel mixture to prevent the temperature of the exhaust gases rising too much.

Operation without knock:

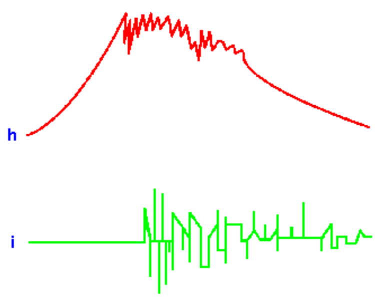
The curve (h) shows the change in pressure in a cylinder.

The knock sensor emits a signal (i) corresponding to the curve (h).

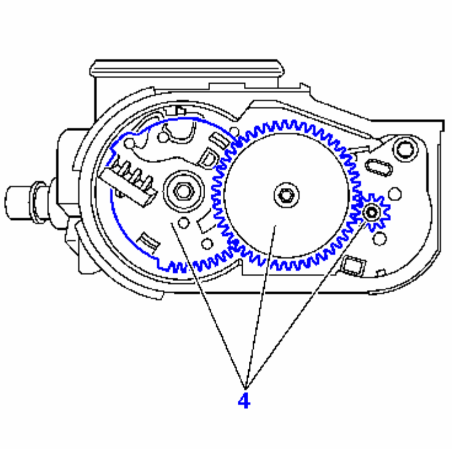


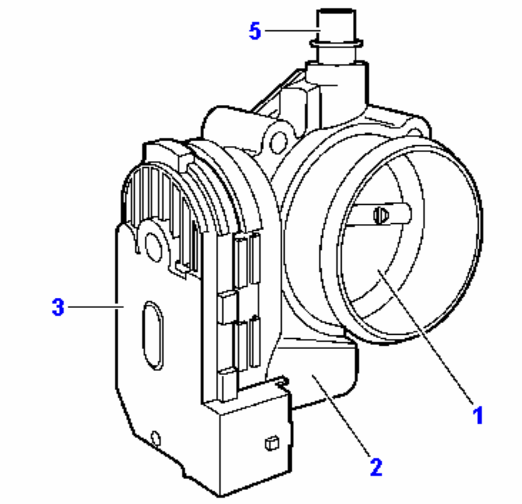
Operation with knock:

The intensity and frequency of the signal (i) from the sensor are greater.



IV - MOTORISED THROTTLE HOUSING (ME7.4.4)





1 – Throttle

2 – Motor

3 – Double track throttle potentiometer

4 – Drive pinions

5 – Oil and fuel vapour recycling

The request to open the throttle is no longer controlled directly by a cable connected to the accelerator pedal.

An accelerator pedal position sensor effectively converts the torque request from the driver into a voltage.

This voltage allows the ECU to adjust to the driver's wishes (acceleration, deceleration) in the same way as it would to a request from another ECU or function such as:

- air conditioning,
- automatic gearbox,
- electronic stability program,
- cruise control,
- engine cooling,
- etc.

This new engine load management system provides optimum engine torque control.

The throttle position is determined by the action of the motor which is itself controlled by the ECU.

As the idle speed is also controlled by this motor, the idle regulation electrovalve no longer exists.

The various engine modes are therefore controlled by the operation of the motor which is used to:

- supply an additional air flow (cold starting),
- regulate an idle speed, depending on the engine temperature, the engine load, engine age and consumers,
- improve idle returns (dash-pot or follower effect).

A double track potentiometer positioned on the throttle pin allows the ECU to ascertain its precise position.

This potentiometer cannot be adjusted.

This information is used to recognise the No Load and Full Load positions.

Electrical diagnostics and emergency modes have been designed to promote maximum driver safety.

In effect, should electrical problems occur on the motor control, it would no longer be possible to set the throttle opening required by the ECU.

Various operating faults have been studied and emergency modes have been included.

A - THE MOTOR IS NO LONGER CONTROLLED (OPEN CIRCUIT OR SHORT CIRCUIT)

The ECU receives 2 items of incoherent electrical information:

- driver's wishes (pedal sensor),
- throttle position (throttle potentiometer).

The throttle is in its idle position.

This idle position is not the same as the position adopted by the throttle when the engine is idling.

In effect, contrary to other systems which do not have a motorised throttle housing, when idling, the throttle is not in an idle position but is open by approximately 2 degrees.

However, when the throttle is no longer supplied, the opening is determined by springs. The throttle does not rest on a mechanical stop.

If a fault occurs in this position, due to the shape of the throttle housing body (LIMPHOME), a sufficient air flow will allow the driver to reach a repair garage without being immobilised at the side of the road.

In this case, the ECU will control the flow to the injectors and the ignition advance depending on the driver's wishes to increase the engine speed and allow the vehicle to move.

B - THE MOTOR IS PERMANENTLY CONTROLLED (SHORT CIRCUIT)

The ECU receives 2 items of incoherent electrical information:

- driver's wishes (pedal sensor),
- throttle position (throttle potentiometer).

In this case, the ECU continues to use the driver's wishes information to control the flow to the injectors and the ignition advance but will limit the engine speed to 1100 rpm.

C - THE MOTOR IS NO LONGER CONTROLLED AS A FUNCTION OF THE DRIVER'S WISHES

The ECU permanently checks the information from the accelerator pedal position sensor and the information from the inlet air pressure sensor.

This check allows the ECU to check the coherence between the throttle position and the rotational speed of the engine.

If an incoherence is detected, the ECU adopts a downgraded mode which involves reducing the engine's performance.

As far as the driver is concerned, this downgraded mode leads to the diagnostic LED illuminating on the control panel.

D - ONE OF THE 2 TRACKS OF THE THROTTLE POSITION SENSOR IS FAULTY (SHORT CIRCUIT OR OPEN CIRCUIT)

The ECU uses the information from the track deemed to be correct.

The ECU then implements a downgraded mode which involves reducing the engine's performance.

As far as the driver is concerned, this downgraded mode leads to the diagnostic LED illuminating on the control panel.

Programming the motorised throttle housing

For this system to operate correctly, it must be programmed.

The programming procedure consists of programming the closed and fully open positions of the throttle.

The throttle position programming procedure should be performed after:

- replacing the ECU,
- replacing the motorised throttle housing,
- repairing the motorised throttle housing after a fault is detected,
- downloading the ECU,
- telecoding the ECU.

Motorised throttle housing programming procedure

- reconnect the wiring harnesses,
- switch on the ignition,
- leave the ignition on for at least 10 seconds (do not switch off the ignition during these 10 seconds and do not press the accelerator pedal),
- switch off the ignition and leave it off for 15 seconds (the ECU records the motorised throttle programming parameters in the EEPROM - this is the POWER LATCH phase),

Warning: Do not switch the ignition on during these 15 seconds.

Important: If the values are not programmed:

- the system will not control the engine torque correctly as a function of throttle opening,

The ECU will effectively not be able to precisely recognise:

- the closed and fully open positions of the throttle.

This operating fault will last until the ignition is switched off and until the POWER LATCH sequence has finished (minimum duration = 15 seconds).

The throttle position is also programmed automatically during the engine's life to counteract wear in the throttle's minimum end stop.

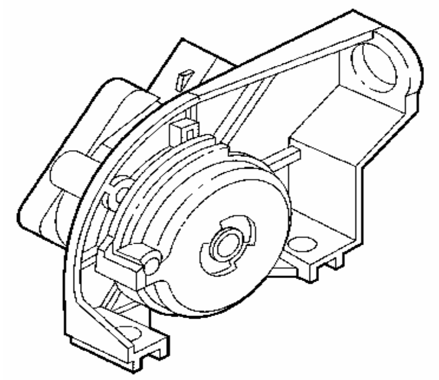
In effect, the ECU systematically compares the memorised "Limphome" position (non controlled throttle position) with the position when the ignition is switched on.

If this value is not equal to 300 mV, the ECU will perform the programming procedure.

Therefore from time to time, after the end of the POWER LATCH sequence, a clicking noise from the throttle can be heard as it comes into contact with its end stops.

This is not an operating fault.

V - ACCELERATOR PEDAL POSITION SENSOR (ME7.4.4)



The pedal sensor is located either in the engine compartment or on the accelerator pedal (depending on vehicle).

When it is located in the engine compartment, it is connected by a cable to the accelerator pedal.

It is a sensor with a contactless double potentiometer.

Supplied with 5 Volts by the ECU, the sensor transmits 2 variable voltages to the ECU reflecting the pressing of the accelerator pedal. One of the voltages is twice the value of the other.

The information is controlled by the ECU in the same way as a request from another ECU or function such as:

- air conditioning,
- automatic gearbox,
- electronic stability program,
- cruise control,
- engine cooling.

Depending on these different "consumers", the ECU implements the following strategies:

- idling,
- acceleration,
- deceleration,
- injection cut-off,
- transitory engine speeds.

When the engine is started, the throttle opening is preset to a certain position in case the driver requests a position which is less than this level.

Programming the pedal position sensor

For this system to operate correctly, it must be programmed.

The programming procedure consists of programming:

- The idle position of the pedal sensor in order to recognise the idle position of the accelerator pedal,
- The maximum position of the pedal sensor in order to recognise the full load position of the accelerator pedal.

The accelerator pedal position sensor programming procedure should be performed after:

- replacing the ECU,
- replacing the accelerator pedal position sensor,
- repairing the accelerator pedal position sensor after a fault is detected,
- downloading the ECU,
- telecoding the ECU.

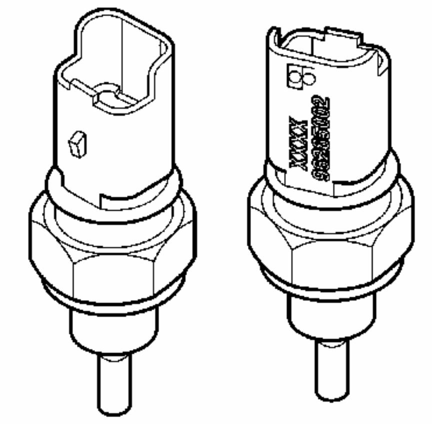
Pedal position sensor programming procedure

- accelerator pedal at rest,
- switch on the ignition,
- press the accelerator pedal down fully,
- release the accelerator pedal,
- start the engine without accelerating.

Important: If this programming procedure is not performed, the ECU will not be able to precisely recognise:

- the idle position of the pedal sensor in relation to the idle position of the accelerator pedal,
- the full load position of the pedal sensor, where this information is required to control torque requests from the driver.

VI - COOLANT TEMPERATURE SENSOR



The coolant temperature sensor has two functions:

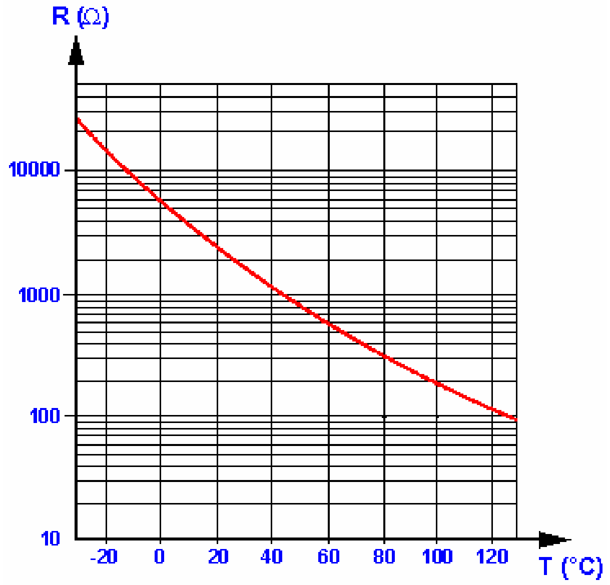
- it informs the ECU of the coolant temperature in the cooling circuit and therefore the temperature of the engine,
- it transmits the coolant temperature information to the temperature gauge on the control panel for non multiplexed vehicles.

The ECU uses the coolant temperature information:

- to calculate the advance,
- to calculate the injection time,
- for idle regulation,
- for engine cooling,
- for controlling the air pump (ifL5 depollution)

Located on the coolant outlet housing, the coolant temperature sensor is supplied with +5 V by the ECU.

The electrical resistors of these sensors are of NTC type (Negative Temperature Coefficient), whereby the resistance decreases as the temperature increases.



Wiring of the Beige 3-way connector:

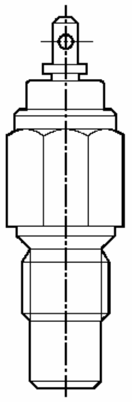
Channel 1: Coolant temperature signal (+5V supply)

Channel 2: ECU earth

Channel 3: Temperature gauge signal

Note: For multiplexed vehicles, the coolant temperature information is transmitted by the ECU on the CAN network and in this case, channel 3 of the coolant temperature sensor is not connected.

VII - COOLANT TEMPERATURE THERMOCONTACT



The ECU is responsible for controlling the "coolant temperature warning" LED when the temperature reaches a critical level (risk of damaging the engine).

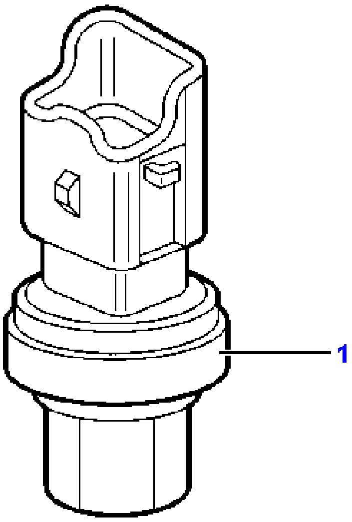
To perform this function, a coolant temperature thermocontact is used. This is mounted directly into the engine block as it can be more reactive in the event of loss of coolant.

The thermocontact is wired in parallel to the coolant temperature sensor. It therefore does not disturb the signal when it is open and forces the signal to earth when it is active simulating the presence of an excessive temperature at the ECU terminals.

Contact closing temperature: 118 ° ± 2.

Note: This information is transmitted on the CAN network for multiplexed vehicles.

VIII - PRESSURESTAT



Depending on the vehicle, the pressurestat used is either linear or has 3 levels.

3 level pressurestat

This informs the ECU using +12V when there is an excess pressure (P=17 bars) in the vehicle air conditioning circuit.

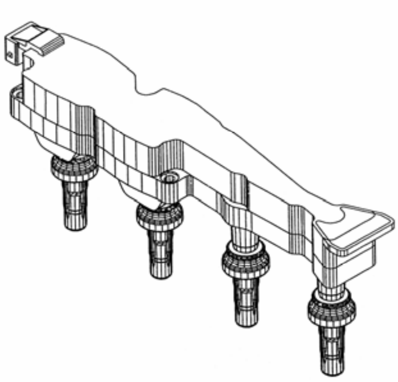
When the ECU receives this information, it controls the fan unit at high speed.

Linear pressurestat

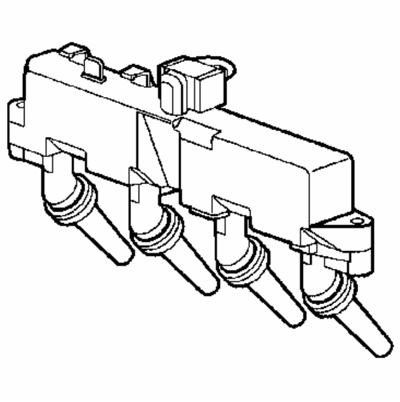
The linear pressurestat transmits a voltage proportional to the fluid pressure to the ECU.

The information is used to authorise or prohibit the engaging of the air conditioning compressor and to control the rotational speed of the fan unit.

IX - IGNITION COIL



TU5JP4



TU1JP-TU5JP

The ignition is of twin static type: BBC2.2 (Compact Coil Unit and no HT leads).

The compact coil unit consists of 2 coils with 2 HT outputs. It is located directly above the spark plugs.

Each coil consists of a primary winding linked to a secondary winding.

Each secondary output is connected to a spark plug. This technology improves ignition quality.

The ECU has two power stages and controls each coil primary winding alternately.

The engine speed and position information allows the ECU to control the two primary windings at the correct moment and in the correct order.

DEPHIA ("Détection de Phase Intégrée à l'Allumage" - Phase Detection Integrated into the Ignition)

To control the injectors separately, the ECU must ascertain the position of cylinder N°1.

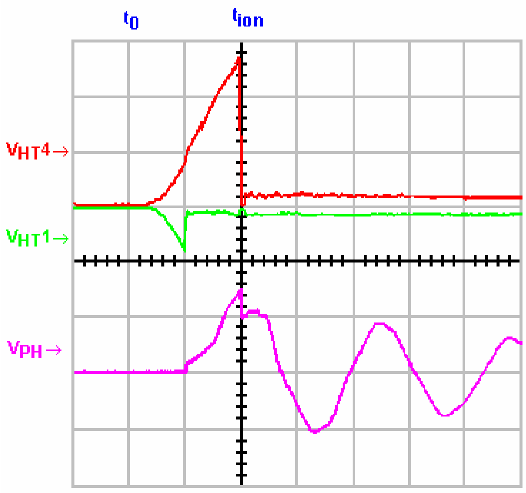
To do this, the DEPHIA strategy is used which is based on acquiring a signal from the ignition coil.

The signal used is a logic signal which is called PHASE and is defined from the voltages of the outputs of the ignition coil common to cylinders 1 and 4.

During ignition, one of the two cylinders is in the compression phase and the other is therefore in the exhaust phase. The pressures in the combustion chambers are therefore different. The voltage required to create the arc between the spark plug electrodes is thus much higher for the cylinder in compression.

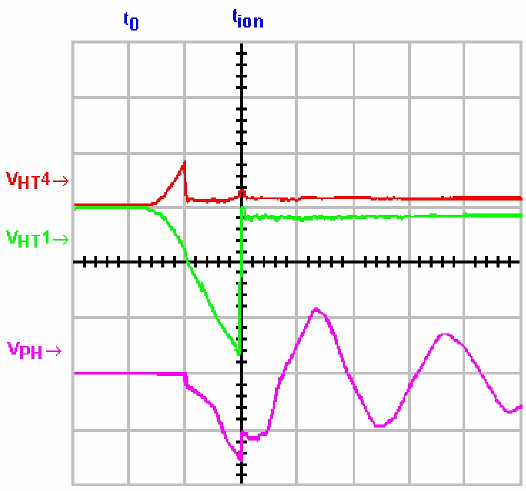
Cylinder 4 in the compression phase and cylinder 1 in the exhaust phase

From the instant t_0 when the ignition control is caused by the ECU, the secondary voltages $V_{HT}4$ and $V_{HT}1$ increase simultaneously but with opposite signs. Voltage V_{PH} remains close to 0 V until the spark plug of cylinder 1 conducts; the voltage at the terminals of this spark plug drops suddenly and voltage V_{PH} takes a non zero value with the sign of voltage $V_{HT}4$. Voltage V_{PH} continues to increase for as long as voltage $V_{HT}4$ rises up to the ionisation instant t_{ion} of spark plug 4. After the arc has been set up, voltage V_{PH} oscillates and is damped.



Cylinder 1 in the compression phase and cylinder 4 in the exhaust phase

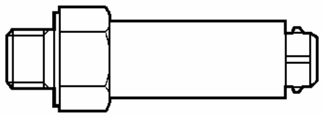
When cylinder 1 is in the compression phase, voltage V_{PH} takes the sign of $V_{HT}1$ between t_0 and t_{ion}. The sign of V_{PH} therefore shows which cylinder is in the compression phase.



Depending on voltage V_{PH}, the ECU defines a logic state called PHASE:

- a logic state of "1" if voltage V_{PH} is negative, therefore cylinder 1 is in the compression phase,
- a logic state of "0" if voltage V_{PH} is positive, therefore cylinder 4 is in the compression phase.

X - POWER STEERING OIL PRESSURE SWITCH *



The pressure switch is located on the power steering circuit after the pump.

This pressure switch informs the ECU when the driver turns the steering wheel to the full lock position.

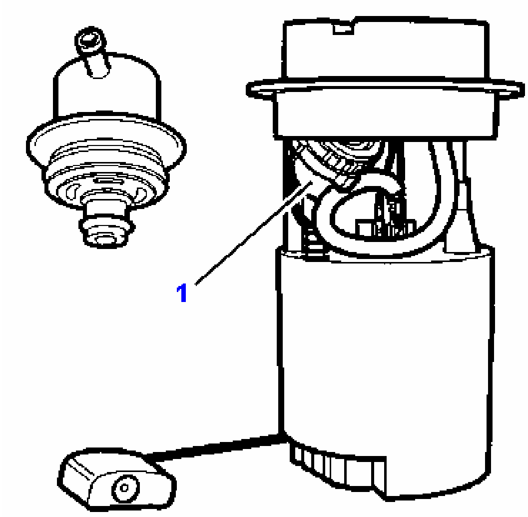
It opens when the pressure in the circuit exceeds 35 bars.

This information allows the ECU to increase its idle speed in order to compensate for the additional torque (essentially during slow speed manoeuvres).

If the driver keeps the steering wheel on full lock, the pump increases the pressure in the circuit thus creating an additional load on the engine.

* Depending on vehicle.

XI - FUEL PRESSURE REGULATOR



Depending on the vehicle, it is located:

- either close to the fuel pump (on the tank),
- or on the fuel pump.

This new location allows a non return injection rail to be fitted. In this type of assembly, the regulator is no longer dependent on the vacuum from the engine.

The regulator used to be dependent on the engine vacuum so as to maintain a constant pressure difference between the upstream and downstream areas of the injector and so as to always have the same flow for a given injection time.

This link has been replaced by a different calculation of the injection time, taking into account the information from the inlet pressure sensor.

The role of this regulator is to maintain:

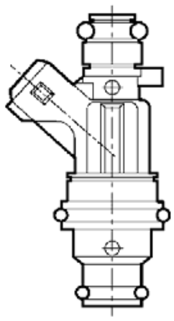
- a supply pressure during engine operation,
- a residual pressure, when the engine is off (for a certain time).

Maintaining a residual pressure makes it easier to restart the engine from warm by preventing the formation of a VAPOUR LOCK.

In effect, at a certain temperature, there is a risk of bubbles forming in the fuel circuit giving rise to poor fuel atomisation.

This residual pressure is 3.5 bars.

XII - INJECTORS



The injectors are of twin jet type.

They are supplied with +12 V via the double multifunction relay.

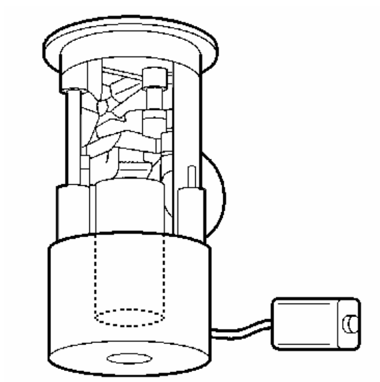
The ECU controls the injectors separately by earthing them in the order 1-3-4-2 when the inlet valves are closed.

The amount of fuel injected depends on the injector opening time (called the injection time).

Pulses from the injection ECU cause a magnetic field in the winding of the electromagnet, the core is attracted and the injector plate rises up from its seat.

Winding resistance = 14.5 Ohms at 20°C.

XIII - FUEL PUMP



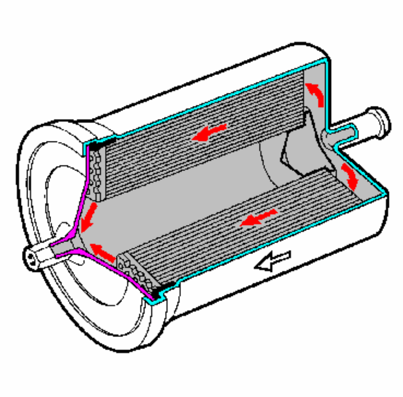
The fuel pump is submerged in the fuel tank and provides a flow of approximately 110 l/h.

The flow from the pump is greater than engine requirements so as not to create a drop in fuel pressure when the engine requirements change suddenly (acceleration).

A non return valve is incorporated into this pump on the delivery circuit; its aim is to maintain a residual pressure for the same reasons as the pressure regulator.

The residual pressure is 3.5 bars.

XIV - FUEL FILTER



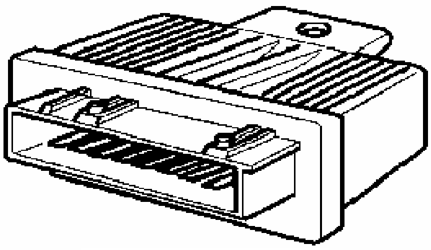
The fuel filter is located between the fuel tank and the injection rail.

This filter houses a paper element which has a filtration level of 8 - 10 microns.

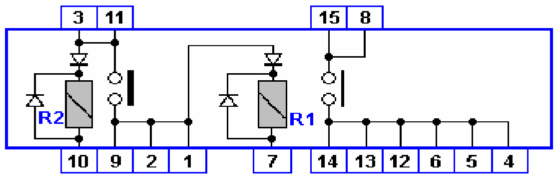
The surface area of the filter represents approximately 2000 cm²; its aim is to filter any impurities from the fuel.

Important:	Ensure the filter is fitted in the correct direction of fuel flow as shown by an arrow on the filter body.

XIV - DOUBLE MULTIFUNCTION RELAY



Internal diagram



R1: Power relay
R2: Supply relay

The main supply to the system is by means of a double relay, which provides 4 operating states:

- ignition off:
  - the power to some system components such as:
    - . the injectors,
    - . the ignition coil,
    - . the fuel pump,
    - . the canister bleed electrovalve,
    - . the oxygen sensor heating resistors,
    - . the air pump relay (specific to ifL5 depollution),
    - . the ECU,

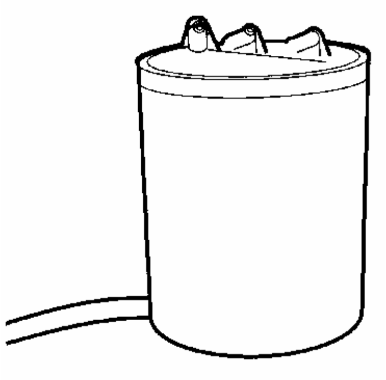
is maintained for 2 - 3 seconds and is then cut off as the engine is no longer running (no engine speed signal).

- engine running:
  - the components listed above are supplied.
- after the ignition is switched off:
  - the power supply to the ECU is maintained for at least 15 seconds for the ME7.4.4 and at least 5 seconds for the M7.4.4.

This function allows the ECU to manage the following parameters (Power Latch phase):

- engine cooling,
- saving of the adaptives and fault memory.

XVI - CANISTER RESERVOIR



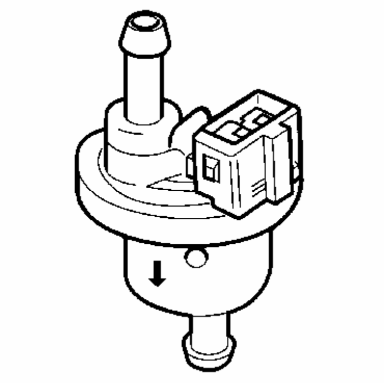
The canister contains an active carbon filter. It is located between the fuel tank and the canister bleed electrovalve.

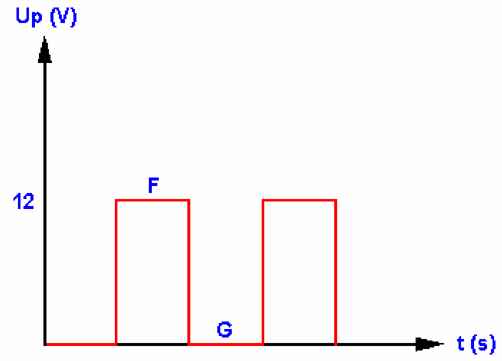
The fuel vapours in the fuel tank are absorbed by the active carbon.

This aim of this function is to prevent:

- the pressure rising in the fuel tank,
- vapours being released into the atmosphere (by recycling them to the engine).

XVII - CANISTER BLEED ELECTROVALVE





F/(F+G): Open Cycle Ratio

The canister bleed electrovalve is located between the canister and the throttle housing.

It is supplied with +12 V by the double multifunction relay.

Controlled by the ECU, the canister bleed electrovalve is used to recycle the fuel vapours contained in the canister reservoir depending on the engine operating conditions:

- at full load, the canister is bled (except M7.4.4),
- when decelerating, the canister is not bled in order to limit emissions of unburned hydrocarbons and to avoid damaging the catalytic converter.

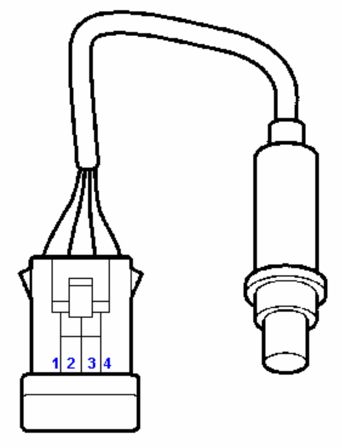
The ECU authorises bleeding of the canister from 60°C for the M7.4.4 system and 70°C for the ME7.4.4 system.

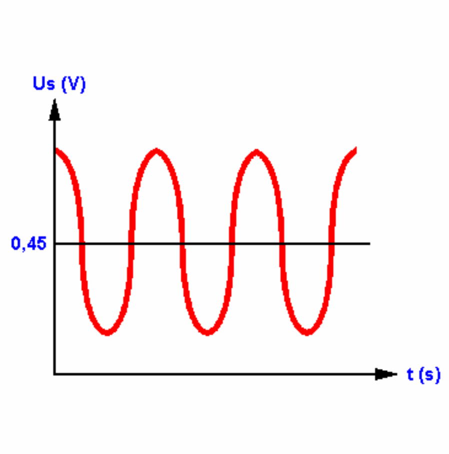
This is a normally closed electrovalve which means that it is closed when it is not energised.

This type of electrovalve complies with the SHED environmental standard which aims to limit emissions of fuel vapours into the atmosphere when the vehicle is stationary.

The fuel vapours contained in the canister are recycled downstream of the throttle and the electrovalve control is of OCR type (open cycle ratio).

XVIII - UPSTREAM OXYGEN SENSOR





This sensor is mounted on the exhaust manifold, at the inlet to the catalytic converter and permanently supplies a voltage to the ECU representing the oxygen content of the exhaust gases.

This voltage, which is analysed by the ECU, is used to correct the injection time.

Rich mixture:

- sensor voltage: 0.6 V - 0.9 V.

Lean mixture:

- sensor voltage: 0.1 V - 0.3 V.

An internal heating device allows it to reach its operating temperature quickly, in this case more than 350°C. This operating temperature is reached within 15 seconds.

The heating resistor is controlled by the ECU using square signals with the aim of controlling the temperature of the oxygen sensor.

When the exhaust gas temperature is above 800°C, the oxygen sensor is no longer controlled.

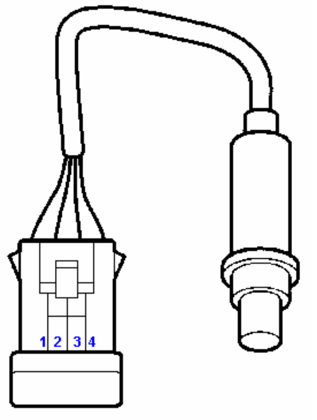
During certain engine operating phases, the system operates in an open loop. This means that the ECU ignores the signal supplied by the sensor.

These phases occur:

- when the engine is cold (temperature less than 20°C),
- at high engine load.

Note: For K' depollution, the upstream oxygen sensor is specific and is lead petrol resistant.
The ECU controls the oxygen sensor heating resistor via a mini relay.

XIX - DOWNSTREAM OXYGEN SENSOR



The downstream oxygen sensor is used to comply with the EOBD regulations (European On Board Diagnosis).

It is located after the catalytic converter and it is used to check the efficiency of the catalytic converter.

The specifications and heating device of the downstream oxygen sensor are the same as for the upstream oxygen sensor.

The ECU is responsible for analysing the voltage supplied by the downstream oxygen sensor. This voltage represents the oxygen content of the exhaust gases at the outlet of the catalytic converter.

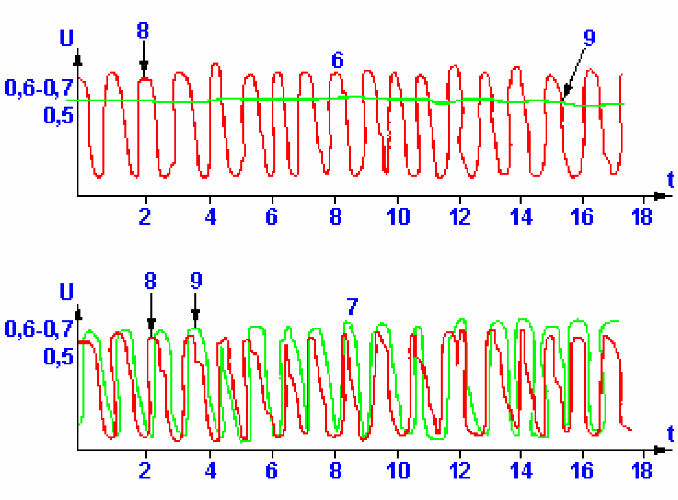
The voltage supplied by the downstream oxygen sensor is offset in relation to the upstream oxygen sensor as the exhaust gases have to pass through the catalytic converter before reaching the downstream oxygen sensor.

In a new catalytic converter, chemical reactions are theoretically complete. As all of the oxygen is used for the chemical combinations, the low oxygen content at the output of the catalytic converter results in a voltage between 0.5 and 0.7 Volts at the terminals of the downstream oxygen sensor when the engine is warm.

In reality, the signal does however show a slight undulation despite the fact that the catalytic converter is in good condition. It then deteriorates over time as the performances of the catalytic converter fall.

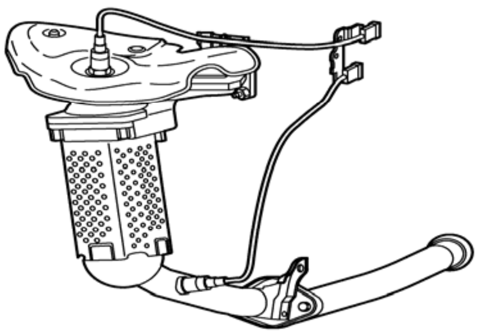
As a function of this voltage, the ECU analyses the efficiency of the catalytic converter and the combustion quality and from this decides whether richness regulation should be modified or not.

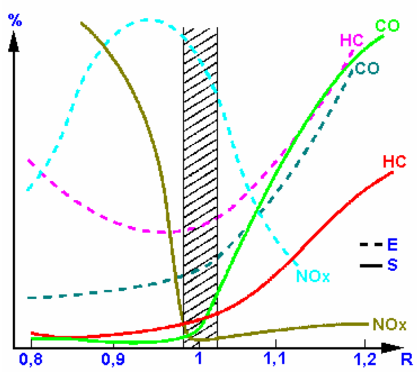
Note: For K' depollution, the downstream oxygen sensor is not fitted.



(t): time
(U): voltage (continuous and "alternating")
(6): catalytic converter in good condition
(7): damaged catalytic converter
(8): upstream sensor signal
(9): downstream sensor signal

XX - CATALYTIC CONVERTER





E: Emissions at the inlet to the catalytic converter
S: Emissions from the outlet of the catalytic converter

The catalytic converter is designed to reduce, by catalysis, unburned pollutant gases at the exhaust:

- CO: carbon monoxide
- HC: hydrocarbons
- NOx: nitrogen oxide

Catalysis is a phenomenon which, by using a catalyst, encourages chemical reactions without the catalyst itself being involved in the chemical reaction.

As it deals with three main pollutants, the catalytic converter is called tri-functional or 3-way.

Composition of a catalytic converter:

- a stainless steel casing,
- a thermal insulator,
- a honeycomb monolith.

The monolith is impregnated with precious materials such as:

- rhodium,
- palladium,
- platinum.

To operate correctly, the catalytic converter must rise in temperature very quickly.

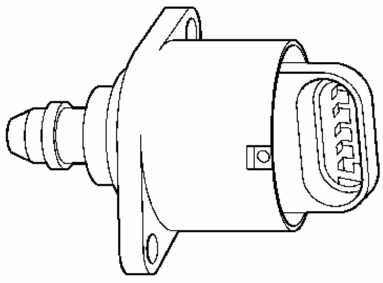
In effect, when the temperature is below 350°C, the catalytic converter cannot process the pollutants. To ensure a rapid temperature rise, the catalytic converter is located under the exhaust manifold.

The ideal temperature for efficient purification is between 600 and 800°C, however, too high a temperature, above 1000°C, may destroy the catalytic converter.

This temperature is determined by the mixture richness and the ignition advance, requiring very precise regulation of the richness and advance point to avoid damaging the catalytic converter.

Note: For K' depollution, the catalytic converter is not impregnated.

XXI - STEPPER MOTOR (M7.4.4)

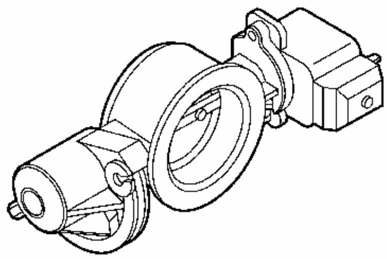


The idle regulation stepper motor is mounted on the end of the inlet manifold or on the throttle housing; it is controlled electrically by the ECU.

This stepper motor controls an air flow taken in parallel to the throttle with the aim of:

- providing an additional air flow (cold starting),
- regulating an idle speed as a function of engine temperature, engine load, engine age and consumers,
- improving idle returns (dash-pot or folllower effect) by increasing the number of steps when not idling to ensure the engine returns to idle speed smoothly.

XXII - THROTTLE HOUSING (M7.4.4)



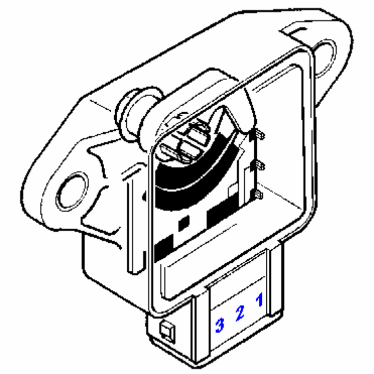
The main aim of the throttle housing is to control the air flow required by the engine.

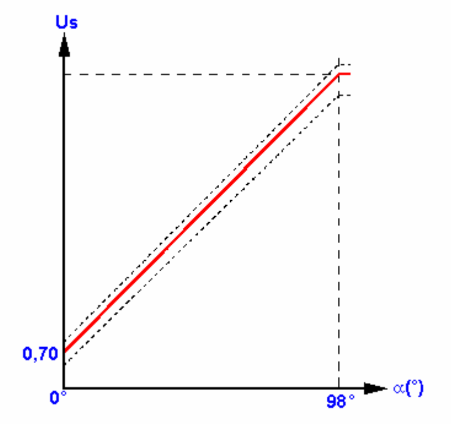
This air flow contains two components:

- the main air flow which depends on the position of the throttle and is therefore linked to the driver's wishes,
- the secondary air flow which is provided by the stepper motor located on the throttle housing or on the inlet manifold.

The housing body is made from plastic which prevents the throttle housing from icing up and does away with the need for a heating resistor.

XXIII - THROTTLE POTENTIOMETER (M7.4.4)





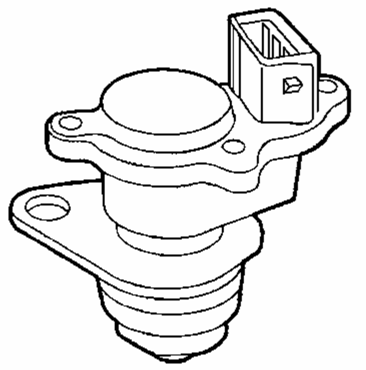
The throttle potentiometer is located on the throttle housing.

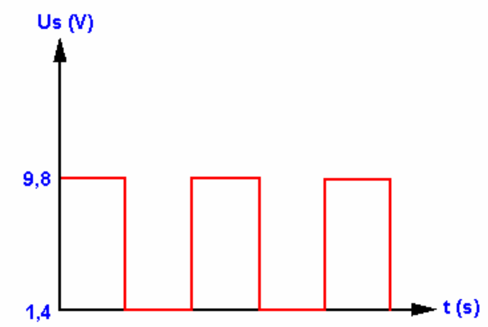
Supplied with +5 V by the ECU, this potentiometer transmits a variable voltage to the ECU which is a function of the position of the throttle (driver's wishes).

This information is used for recognising no load and full load positions and transitories for acceleration, injection cut-off and power take-up strategies.

This potentiometer also implements an emergency operating mode if a fault occurs on the inlet pressure sensor.

XXIV - VEHICLE SPEED SENSOR





This sensor is of Hall effect type and is located on the gearbox output. It is supplied with +12 V.

This sensor transmits information which, along with the engine speed, is used to determine the gear engaged.

This information is used to:

- improve driving pleasure (engine hesitation),
- inform the driver of the gear engaged (depending on vehicle).

XXV - CRUISE CONTROL BRAKE SAFETY SWITCH (ME7.4.4)

This switch is located on the brake pedal. It informs the ECU using +12 V, when the driver presses the brake pedal.

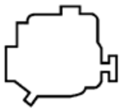
The ECU uses this information to deactivate the cruise control function.

XXVI - CRUISE CONTROL CLUTCH SAFETY SWITCH (ME7.4.4)

This switch is located on the clutch pedal. It informs the ECU using +12 V, when the driver presses the clutch pedal.

The ECU uses this information to deactivate the cruise control function and to adjust the engine torque to the gear change.

XXVII - ENGINE DIAGNOSTIC LED



The LED located on the control panel is controlled by the ECU. On a multiplexed vehicle, this information is broadcast on the CAN network.

For L4 and ifL5 depollution, the engine diagnostic LED is used to inform the driver that the regulatory pollutant emissions level has been exceeded.

Operating mode of the LED for L4 and ifL5 depollution:

- ignition off:
  - the LED is extinguished.
- ignition on, engine off:
  - the LED is illuminated.
- engine running:
  - no fault:
    - . the LED extinguishes.

Presence of a major permanent fault with LED permanently illuminated:

- the LED will remain illuminated to warn the driver that the regulatory emissions level has been exceeded,
- it will extinguish when this fault successfully passes 3 diagnostic sequences.

Presence of a major permanent fault with LED flashing:

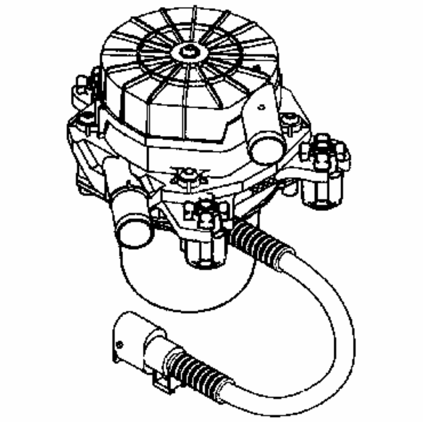
- the LED will flash after misfires to warn the driver (risk of damaging the catalytic converter),
- the LED will stop flashing when the misfires have disappeared.

Note: For the ME7.4.4 injection system, all faults affecting the motorised throttle or the pedal sensor cause the diagnostic LED to illuminate immediately.

For K' depollution, the diagnostic LED is used when there is a risk of damaging the engine.

The LED illuminates when the fault appears and extinguishes when the fault switches to temporary.

XXVIII - AIR PUMP



The air pump is only used to comply with the ifL5 depollution standard.

The air pump is located in the engine compartment and is controlled by the ECU via a relay. It has a flow rate of 20 kg/hr.

The aim of the air pump is to blow fresh air into the cylinder head downstream of the exhaust valves.

Adding air allows a post-combustion to be performed in the exhaust pipe thus increasing the temperature of the exhaust gases.

This rise in temperature leads to:

- a faster rise in temperature in the catalytic converter,
- much earlier richness regulation.

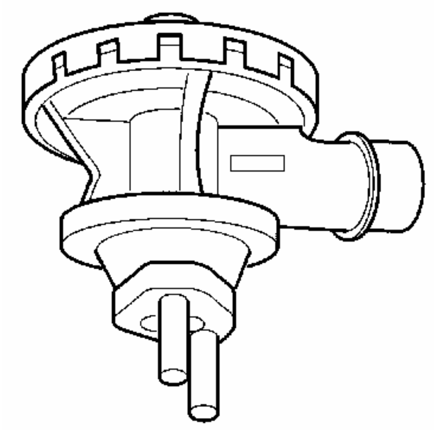
The operating time of the air pump varies depending on engine temperature:

- approximately 10 seconds for a temperature below –7° C, to prevent the pump and the valve seizing,
- approximately 30 seconds for a temperature between –7° C and 15°C, to prevent the pump and the valve seizing,
- approximately 80 seconds for a temperature between 15°C and 20°C, with an increase in mixture richness of approximately 20%.

These commands are performed as soon as the engine is started and when idling.

Pump operation is suspended when the engine speed exceeds 2500 rpm.

XXIX - VALVE



The valve is positioned on the air injection circuit between the air pump and the engine.

This valve is controlled by the pressure of the air blown in by the air pump.

The aim of this valve is to isolate the air injection circuit from the exhaust circuit, when the air pump is no longer controlled in order to:

- prevent exhaust gases exiting via the air injection circuit,
- stop the air flow immediately.

DIAGNOSTIC ASSISTANCE

Diagnostic functions offered by the BOSCH M7.4.4 and ME7.4.4 ECUs:

- IDENTIFICATION,
- HISTORY,
- READ FAULTS,
- ERASE FAULTS,
- PARAMETER MEASUREMENT,
- TEST ACTUATORS,
- INITIALISE AUTOADAPTIVES,
- TELECODING,
- DOWNLOADING.

This diagnostic functions assist the repair technician when a fault occurs on the injection system.

I - IDENTIFICATION

The menu displays:

- the PSA reference of the ECU,
- the PSA reference of the software,
- the development index.

This information is available when the ignition is on, engine running or engine stationary.

II - HISTORY

The "history" menu is used to keep a trace of the operations performed on the ECU.

This information is saved in the after-sales zones, of which there are 50.

Each after-sales zone is entered when a request is made to erase faults.

The following information is available in the after-sales zone:

- the operation date,
- the vehicle mileage,
- the tool used:
  - SCANTOOL regulatory tool,
  - constructor's diagnostic tool (SCANTOOL type erasing),
  - constructor's diagnostic tool.
- the operation site (corresponds to the dealer code for the Peugeot network).

III - READ FAULTS

This function is used to display all the faults detected by the ECU.

The maximum number of faults which can be memorised by the ECU is:

- 8 for K' depollution,
- 20 for L4 and ifL5 depollution (12 EOBD codes and 8 constructor codes).

List of functions on which diagnostic operations can be performed:

	A	B	C	D
Inlet manifold pressure sensor	•	•		
Inlet air thermistor	•	•		
Coolant thermistor	•	•		
Accelerator pedal sensor 1		•	•	•
Accelerator pedal sensor 2		•	•	•
Throttle potentiometer	•			
Motorised throttle		•	•	•
Idle regulation stepper motor	•			
Engine speed sensor	•	•		
Vehicle speed information	•	•		
Upstream oxygen sensor	•	•	•	
Downstream oxygen sensor	•	•	•	
Upstream oxygen sensor heating control	•	•	•	
Downstream oxygen sensor heating control	•	•		
Richness regulation autoadaptation	•	•	•	•
Injector 1-2-3-4 control	•	•	•	•
Double multifunction relay control	•	•		
Misfires	•	•	•*	•**
Misfires cylinder 1-2-3-4	•	•	•	
Ignition coils	•	•		
Ignition coil control 1/4 and 2/3	•	•		
Phase detection integrated into the ignition	•	•		
Knock sensor	•	•		
Knock regulation	•	•		
Knock regulation cylinder 1-2-3-4	•	•		
Catalytic converter ageing	•	•	•	
Canister bleed electrovalve control	•	•	•	•
Battery voltage	•	•		
Alternator load information	•	•		
Fan unit control at high speed	•	•		
Fan unit control at low speed	•	•		
Fan unit function	•	•		
Air conditioning pressure information	•	•		
Air conditioning control	•	•		
Coolant temperature warning control	•	•		
Diagnostic LED control	•	•		
Air pump relay control function		•	•	
Air injection to the exhaust		•	•	

	A	B	C	D
Low fuel information		•		
Stop lamps information		•		
Telecoding	•	•	•	•
Engine ECU	•	•	•	•
Memorising of the engine immobiliser code	•	•		
No communications with the BSI		•	•	•
No communications with the automatic gearbox ECU	•	•	•	•
No communications with the ESP ECU		•	•	•
No communications between the engine ECU and the other ECUs of the CAN network		•	•	•

A: M7.4.4

B: ME7.4.4

C: Illumination of the diagnostic LED - L4 and ifL5 depollution

D: Illumination of the diagnostic LED - K' depollution

•*: Flashing (risk of destroying the catalytic converter), permanent (pollution: regulatory limits exceeded).

•**: Flashing

Access to the EOBD fault codes

Memorised fault codes can be accessed by all professional repair technicians with a standardised diagnostic tool called SCANTOOL.

Access to the diagnostic modes is as follows:

- mode 01: Reading of the number of fault codes and the engine speed (dynamic),
- mode 02: Reading of associated contexts,
- mode 03: Reading of fault codes,
- mode 04: Erasing of fault codes.

IV - ASSOCIATED VARIABLES

This function is used to memorise certain parameters when a fault appears.

This information is used to ascertain the conditions under which the fault appeared.

List of associated variables:

- engine speed,
- coolant temperature,
- vehicle speed,
- manifold pressure,
- richness regulation state.

There are 5 possible states for the richness regulation state:

- open loop 1: Open loop, the conditions for switching to closed loop have not yet been satisfied,
- closed loop 1: Closed loop operation,
- open loop 2: Open loop due to the driving conditions (increase in richness at full load, decrease in richness when decelerating),
- closed loop 2: Closed loop, fault on an oxygen sensor,
- open loop 3: Open loop due to a system fault.

V - ERASE FAULTS

This function is used to erase all temporary faults memorised by the ECU.

Before erasing the faults, an after-sales zone must be entered.

This signature is of the same type as the one stored in the ECU identification zone when performing a download.

This information can be viewed using a diagnostic tool in the "History" section.

There are 50 after-sales zones and when they have all be used, faults can still be erased.

Faults can be erased without using a diagnostic tool. The ECU can automatically erase a temporary fault from its memory if it does not reappear within 40 warming up cycles.

A "warming up cycle" is a vehicle operating period which is sufficient to allow the engine temperature to increase by at least 22°C from when the engine was started and reach a minimum temperature of 70°C.

VI - PARAMETER MEASUREMENT

The ME7.4.4 and M7.4.4 systems provide a certain number of parameters.

These parameters are used to analyse engine operation and provide additional assistance to refine the fault finding process.

The parameters are available in the following menus:

- injection,
- ignition,
- richness,
- sensors,
- driving,
- ECU state *.

* Specific to ME7.4.4 (depending on vehicle).

Note: Some parameters are only available when the engine is running.

Contents of the Menus

INJECTION	IGNITION	RICHNESS
Engine speed	Engine speed	Engine speed
Battery voltage	Battery voltage	Battery voltage
Engine torque	Engine torque	Coolant temperature
Injection time	Injection time	Injection time
Injection cut-off	Injection cut-off	Injection cut-off
Throttle state	Throttle state	Throttle state
Throttle angle	Ignition advance	Canister bleed electrovalve state
Throttle voltage	Charging time: Ignition coil cyl 1/4	Canister bleed electrovalve open cycle ratio
Coolant temperature	Charging time: Ignition coil cyl 2/3	Upstream oxygen sensor state
Air temperature	Coolant temperature	Downstream oxygen sensor state
Manifold pressure	Air temperature	Catalytic converter upstream richness regulation state
Stepper motor (M7.4.4)		Catalytic converter downstream richness regulation state
Canister bleed electrovalve state		
Double relay control		

SENSORS	DRIVING	ECU STATE
Engine speed	Engine speed	ECU state
Battery voltage	Battery voltage	Engine immobiliser programming state
Engine torque	Ignition advance	
Throttle state	Engine torque	
Throttle angle	Injection time	
Throttle voltage	Injection cut-off	
Coolant temperature	Throttle state	
Air temperature	Coolant temperature	
Manifold pressure	Air temperature	
Stepper motor (M7.4.4)	Manifold pressure	
Canister bleed electrovalve state	Canister bleed electrovalve state	
Canister bleed electrovalve cycle open ratio	Air conditioning authorisation	
Air conditioning authorisation	Air conditioning request input	
Air conditioning request input	Fan unit control at low speed	
Fan unit control at low speed	Fan unit control at low speed	
Fan unit control at low speed	Fan unit control (chopper)	
Fan unit control (chopper)	Vehicle speed	
Gear ratio	Gear ratio	

VII - ACTUATOR TESTS

The ECU can activate certain components in accordance with a well defined mode.

These tests can only be performed under the following conditions:

- ignition on,
- ECU unlocked,
- engine off,
- vehicle stationary.

Activating the actuators is used:

- to check the electrical and mechanical operation of the components,
- to locate the components,
- for training purposes.

After an actuator has been activated, the ECU returns the component to its initial position.

If the operator asks for an actuator to be activated whilst another actuator is being activated, the ECU will perform the following operations:

- it will stop activating the current actuator,
- it will reposition the component,
- it will activate the new actuator.

An electrical diagnostic of the components is performed by the ECU during activation.

This diagnostic operation will be passed on to the diagnostic tool at the end of activation if the activation runs its full course (not deliberately interrupted by the operator).

Activation table

COMPONENT	ACTIVATION	DURATION
Coils 1/4 and 2/3	Every second (I max charge time)	10 s
Injectors 1 - 4	Every second for 1 ms	10 s
Double relay (fuel pump relay)	Permanent supply	10 s
Air pump relay	Permanent supply	10 s *
Air conditioning control	Every second for 5 ms	10 s ***
Rev counter	3000 rpm for 1 s and 0 rpm for 1 s	20 s ***
Stepper motor (M7.4.4)	Every 2 s, min and max setting	10 s
Fan unit at low speed	Permanent supply	20 s
Fan unit at high speed	Low speed for 5 s and high speed for 20 s	25 s
Fan unit - chopper	Speed increasing from 0 to max speed (25 s) and max speed (10 s)	35 s **
Canister bleed electrovalve	Frequency 15 Hz	10 s
Diagnostic LED	Frequency 0.5 Hz	20 s ***
Coolant temperature warning LED	Frequency 0.5 Hz	20 s ***

* Specific to IfL5 depollution

** Depending on vehicle

*** Not available with multiplexed BSI

VIII - INITIALISING AUTOADAPTIVES

The aim of the auto-adaptives is to maintain a perfectly adjusted injection system throughout the vehicle's life.

These values are saved in the ECU's permanent EEPROM.

These values are therefore stored even in the following cases:

- when faults are erased,
- when the ECU is disconnected,
- when the battery is disconnected.

The auto-adaptives only have to be initialised if repairs have been made to the fuel supply circuit:

- injectors,
- fuel pump.

Note: After initialising the auto-adaptives, the motorised throttle housing and the accelerator pedal sensor have to be programmed (ME7.4.4).

IX - TELECODING

Telecoding allows the same engine ECU (one hardware reference) to be used on different vehicles which do not have the same equipment (automatic gearbox, air conditioning, etc).

The ECU has just one software program in its memory (one software reference) but has several sets of calibrations which can be selected using the telecoding operation.

The overall aim is to significantly reduce the number of different ECUs.

The telecoding operation consists of making the ECU operational by configuring it as a function of the equipment fitted to the vehicle.

If telecoding is not performed, the vehicle will operate in downgraded mode:

- the vehicle can drive,
- the engine speed is limited to 3000 rpm,
- an associated fault code shows that the operation has not been performed,
- the diagnostic LED illuminates.

Note: When downloading a new software program, the ECU does not under any circumstances have to be telecoded again. The downloading operation does not erase the previously performed configuration.

Only the telecoding operation erases the fault code and extinguishes the diagnostic LED.

Even if the ECU has not been telecoded, the following diagnostic operations are still possible:

- ECU identification,
- reading and erasing of faults (except the telecoding fault),
- parameter measurements,
- actuator tests.

Note: After telecoding, it is essential to program the end stops of the motorised throttle housing and the accelerator pedal sensor (specific to ME7.4.4).

X - DOWNLOADING

Flash EPROM technology, which is now a common feature of modern ECUs, is used to update the ECU's program from the after-sales tool using a downloading procedure.

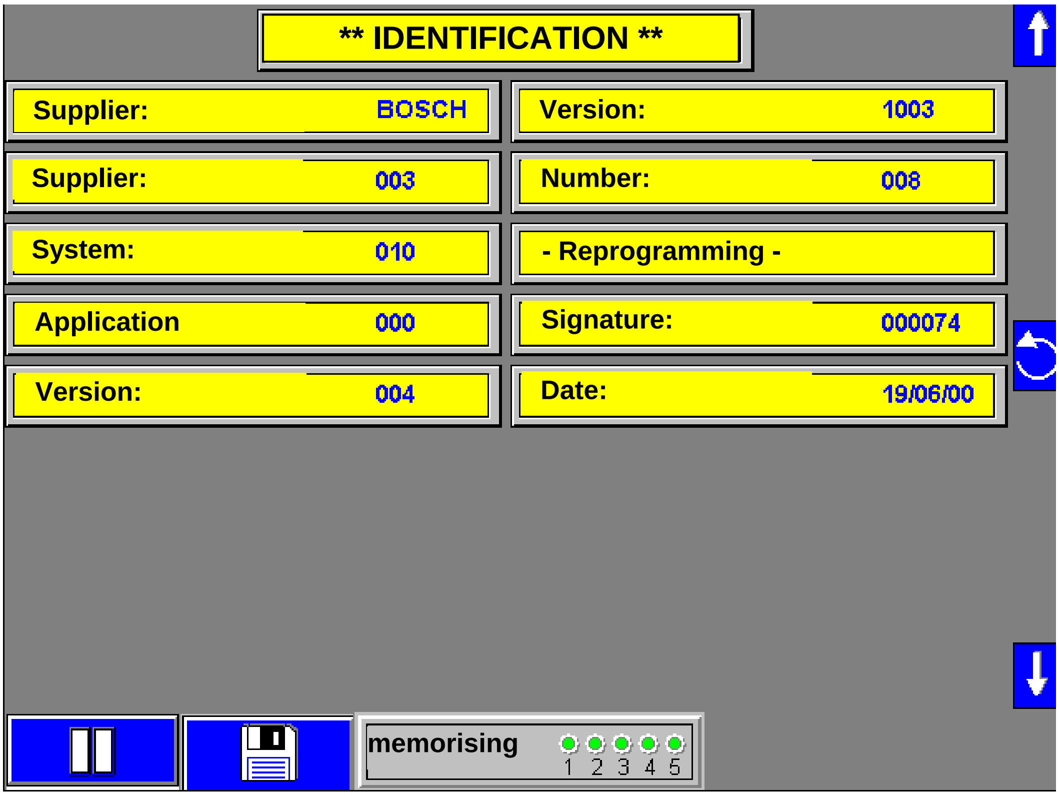
This operation is performed to solve driving pleasure problems linked to the ECU calibration.

The operation consists of downloading the new program into the ECU's memory using a suitable after-sales tool via the diagnostic socket.

This operation must be performed to ensure the system components operate correctly (no faults).

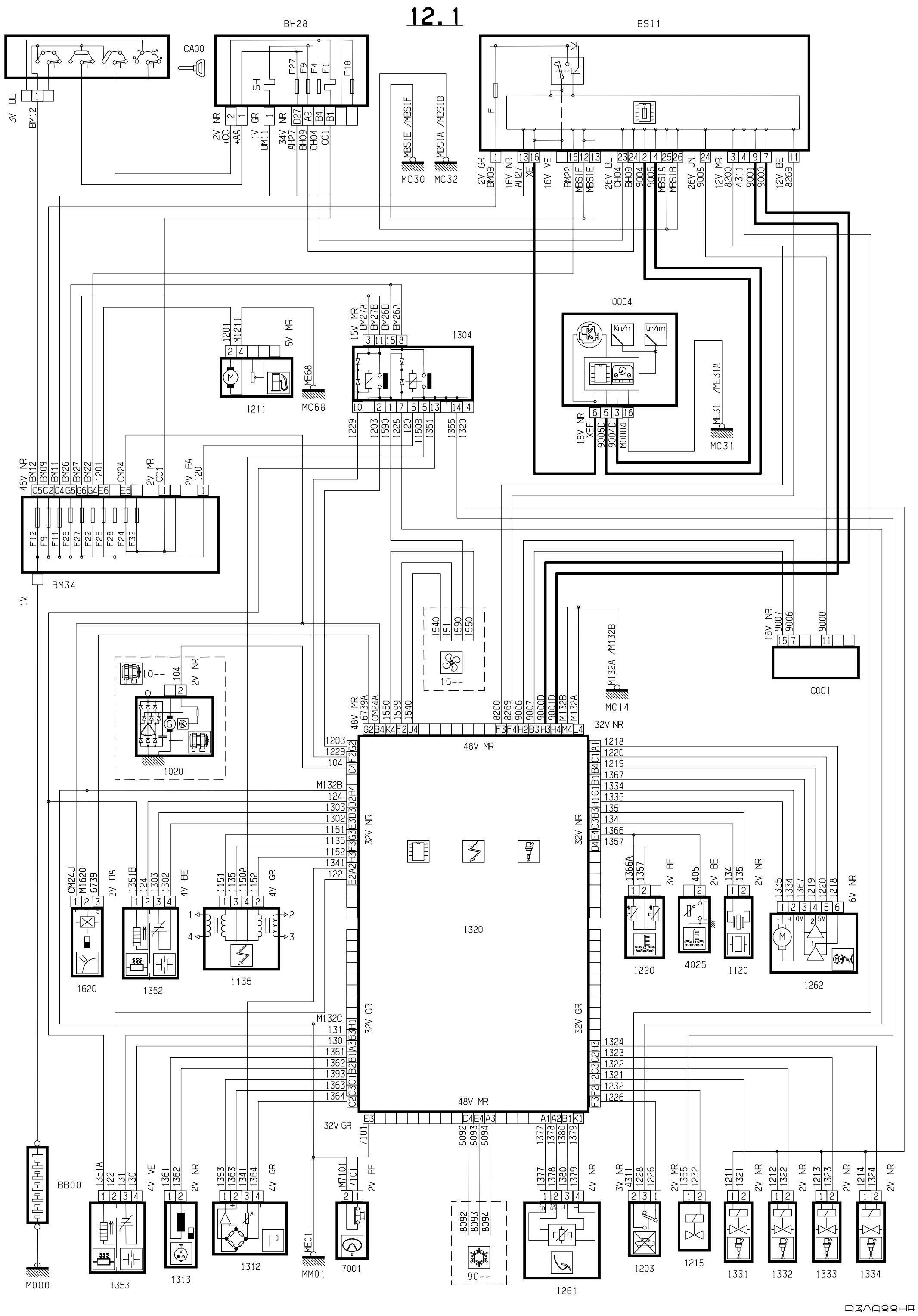
Note: After downloading, it is essential to program the end stops of the motorised throttle housing and the accelerator pedal sensor (specific to ME7.4.4).

The after-sales tool provides the option of viewing the ECU identification zone before and after downloading.



WIRING DIAGRAM

I - LAYOUT DIAGRAM



OPERATING PRINCIPLE - BOSCH ME7.4.4/M7.4.4 AND EOBD

II - PARTS LIST

BB00 - Battery
BM34 - 34 fuse engine relay unit
BSI1 - Built-in systems interface
BH28 - Passenger compartment 28 fuse box
CA00 - Ignition switch
C001 - Diagnostic connector
M000 - Earth
MM01 - Earth
MC14 - Earth
MC30 - Earth
MC31 - Earth
MC32 - Earth
MC68 - Earth
0004 - Control panel
1020 - Alternator
1120 - Knock sensor
1135 - Ignition coil
1203 - Inertia switch
1211 - Fuel pump sender
1215 - Canister bleed electrovalve
1220 - Coolant temperature sensor
1261 - Accelerator pedal position sensor
1262 - Motorised throttle
1304 - Engine management double multifunction relay
1312 - Inlet air pressure sensor
1313 - Engine speed sensor
1320 - Engine management ECU
1331 - Injector cylinder 1
1332 - Injector cylinder 2
1333 - Injector cylinder 3
1334 - Injector cylinder 4
1352 - Front downstream oxygen sensor
1353 - Front upstream oxygen sensor
1620 - Vehicle speed sensor
1630 - Automatic gearbox ECU
4025 - Coolant thermocontact - temperature sensor (gauge)
7001 - Power steering fluid pressure switch
10 - - - Starting - current generation
15 - - - Engine cooling
80 - - - Air conditioning

EOBD - GENERAL DETAILS

EOBD = European On Board Diagnostic

EOBD, which appeared with the "Euro 3" standard (L4 at PCA), consists of detecting all faults which may lead to a decline in vehicle depollution and of informing the driver of these by illuminating the "MIL" diagnostic LED of the engine management device.

MIL = Malfunction Indicator Lamp

(C0 > 3.2 g/km; HC > 0.4 g/Km; NOx > 0.6 g/Km).

In practice, faults linked to EOBD detected by the ECU can be read with an after-sales tool (PROXIA, LEXIA) within the scope of a fault reading procedure.

To perform an EOBD fault finding procedure, the engine management device uses additional sensors: one (or two) downstream oxygen sensor(s) for the catalytic converter(s).

Warning: EOBD faults are normally all faults which can be viewed using the "SCANTOOL" regulatory tool for use by the authorities only.

These faults can be divided into "EOBD electrical continuity faults" and "EOBD operating faults".

The EOBD operating faults are linked to a decline in depollution.

Note: EOBD operating faults may have different names in the regulatory tool and the after-sales tool. In addition, they are shown cylinder by cylinder on the after-sales tool.

OPERATING FAULTS DETECTED

- Misfires
  - → Analysis of the variations in engine speed, between several successive combustions. Sensors used = Engine speed / position sensor opposite the 60 - 2 teeth ring.
- Catalytic converter efficiency
  - → Analysis of its conversion capacity. A signal which becomes more and more "undulated" from the downstream sensor and therefore which looks more and more like the signal from the upstream sensor is the sign that the catalytic converter is ageing.
- Poor operation of or a fault in the fuel regulation system.
  - → An oscillation period of the upstream oxygen sensor which becomes bigger and bigger shows that the upstream sensor is ageing. The sensor becomes "slower" from a signal frequency point of view.
- Poor operation of or a fault in the fuel injection system.
  - → A richness regulation factor which exceeds a low calibrated value or a high calibrated value also shows that the upstream sensor is ageing.
- Poor operation of or a fault in the EGR system.
  - → Analysis of the level of the absolute pressure in the manifold during repeated operation of the EGR valve.
- Poor operation of or a fault in the secondary air injection system.
  - → When the air injection to the exhaust function is active, the mixture is theoretically "lean".
- Poor operation of or an operating fault in the canister bleed system.
  - → This fault is not covered by the fault finding procedures in current Citroën applications.
- Poor operation of the automatic gearbox.
  - → The automatic gearbox ECU asks the engine management ECU to illuminate the MIL when "3rd hydraulic" downgraded mode is implemented.