APPLIES TO VERSIONS WITH: Allarme

SPECIFCATIONS

GENERAL CHARACTERISTICS

The Bosch Motronic ME73H4 system (microhybrid control unit) with a motorized throttle belongs to the category of ignition systems integrated with sequential timed electronic injection system.
The fuel system is returnless.
The control unit electronically controls the air flow rate (flow meter) at the rotation speed set through the electronic butterfly, it regulates the fuel injection so that the (air/fuel) ratio is always within the optimum values, calculating the moment of ignition, in order to allow the smooth operation of the engine as the environmental parameters and loads applied vary.

APPLIES TO VERSIONS WITH: Allarme

The ignition system is the static advance type with one coil with four outlets. The power modules are located inside the control unit.

APPLIES TO VERSIONS WITH: Allarme

The engine control system, which is the auto-adjusting type, is capable of recognizing the changes which take place in the engine and compensates for them according to auto-adjustment functions which correct the carburation and air flow rate plans stored in the control unit.
There are also two auto-adjustment functions for the carburation according to the anti-evaporation solenoid valve (see appropriate paragraph) and an idle adjustment plan: the latter is capable of effectively compensating for any air seepage.
The continuous auto-adjustment of the carburation makes it possible to have the correct quantity of fuel in all temperature and altitude conditions.
As a result of this, after each operation it is necessary to drive the vehicle for at least 15 minutes in the various operating conditions, in order to ensure that the control unit memorizes any changes which have taken place in the system and end the adjustment.

The main operating principles of the system are basically as follows:

- regulation of injection times;
- adjustment of ignition advance values;
- control of cold starting;
- control of enrichment during acceleration;
- fuel cut-off during deceleration;
- management of the idle speed (also according to the battery voltage);
- limiting the maximum engine speed;
- control of combustion using the Lambda sensor;
- fuel vapour recovery;
- control of the electric fans;
- connection to the automatic transmission control unit;
- attachment/detachment of the climate control system;
- autodiagnosis.

There is also a special function that manages the connection with the body computer through a two-way signal for the Can line which includes:

- engine temperature for instrument panel (output);
- battery voltage (output);
- engine rpm (output) for instrument panel;
- max engine temperature warning light for instrument panel (output)
- engine oil pressure warning light for control panel (output);
- City button signal (input), only for 6m/e automatic transmission versions;
- car speed (input) + mileometer (input);
- Fiat code anti-theft device (input/output);
- key status;
- fuel consumption meter signal (output) for trip computer
- fuel level gauge signal (input);

FUEL INJECTION SYSTEM

The essential conditions that must always be met in the preparation of the air-fuel mixture for the correct operation of controlled-ignition engines are mainly:

- the 'metering' (air/fuel ratio) must constantly be kept as close as possible to the stoichiometric ratio, so as to ensure the necessary rapidity of combustion, avoiding unnecessary fuel consumption
- the 'homogeneity' of the mixture, consisting of petrol vapours, diffused as finely and evenly as possible in the air.

The injection/ignition system uses an indirect measuring system known as the 'SPEED DENSITY LAMBDA' type.
In other words the angular rotation speed, density of the intake air and control of the mixture strength (retroactive control).
In practice the system uses data on the ENGINE SPEED (rpm) and AIR DENSITY (pressure and temperature) to measure the quantity of air drawn in by the engine.
The quantity of air drawn in by each cylinder, for each engine cycle depends not only on the density of the intake air, but also on the unit displacement and the volumetric efficiency.
The density of the air refers to that of the air drawn in by the engine and calculated according to the absolute pressure and the temperature, both detected in the inlet manifold.
Volumetric efficiency refers to the parameter relating to the coefficient for filling the cylinders measured on the basis of experimental tests carried out on the engine throughout the entire operating range and then stored in the electronic control unit memory.
Having established the quantity of intake air, the system has to provide the quantity of fuel according to the desired mixture strength.
The end of injection pulse or supply timing is contained in a map stored in the control unit memory and varies according to the engine speed and the pressure in the inlet manifold.
In practice, it involves processing which the electronic control unit carries out to command the sequential, phased opening of the four injectors, one per cylinder, for the length of time strictly necessary to form the air/petrol mixture which is closest to the stoichiometric ratio.
The fuel is injected directly into the manifold near the inlet valve at a pressure of around 3 bar.
The speed (number of revs per minute) and the density of the air (pressure and temperature) are used to measure the quantity of intake air which, when established, enables the quantity of fuel to be metered according to the desired mixture strength.
The other system sensors (coolant temperature, throttle valve position, battery voltage, etc.) allow the control unit to correct the basic strategy for all particular engine operating conditions.
It is vital for the air/fuel ratio to be around the stoichiometric value for the correct and prolonged operation of the catalytic silencer and for the reduction of pollutant emissions.

IGNITION SYSTEM

The ignition is of the inductive discharge type, breakerless with power modules located in the electronic injection/ignition control unit.

APPLIES TO VERSIONS WITH: Allarme

The primary winding for the coil is connected to the power relay (thereby receiving the battery voltage) and to the pins for the electronic control unit for connection to earth.

APPLIES TO VERSIONS WITH: Allarme

After the starting stage, the electronic unit manages the basic advance taken from a special map according to the:

- engine rpm
- absolute pressure value (mmHg) measured in the inlet manifold.

This advance value is corrected according to the temperature of the engine coolant and the intake air.

APPLIES TO VERSIONS WITH: Allarme

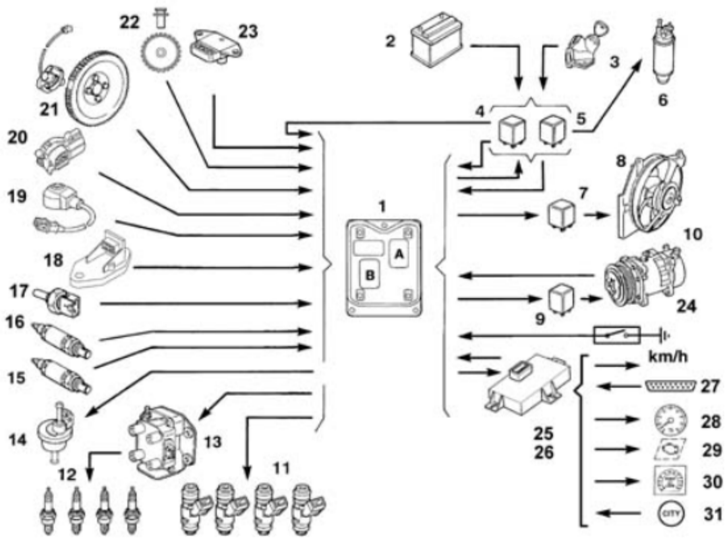
The spark plugs for cylinder 1-4 and 2-3 are connected directly by means of high tension leads to the terminals of the coil secondary winding and their connection is in series because the cylinder head joins them.
This solution is also known as the 'lost spark' becuse the energy accumulated by the coil is almost exclusively discharged at the electrodes for the spark plug of the cylinder under compression allowing the ignition of the mixture.
The other spark is obviously not used, as no mixture is found in the cylinder to ignite, only exhaust gas.

APPLIES TO VERSIONS WITH: Allarme

OPERATION

DIAGRAM OF INPUT/OUTPUT INFO TO/FROM CONTROL UNIT

The diagram below shows the information entering/leaving the control unit.



1, Engine control unit
2, Battery
3, Ignition
4, Engine control system relay
5, Fuel pump relay
6, Fuel pump
7, Radiator fan relay/s
8, Radiator fan
9, Compressor activation relay
10, Compressor
11, Injectors
12, Spark plugs
13, Ignition coil
14, Carbon filter flushing solenoid
15, Lambda sensor (pre-catalyzer)
16, Lambda sensor (post-catalyzer)
17, Coolant temperature sensor
18, Bodyshell accelerometer
19, Detonation sensor
20, Throttle and throttle position sensor actuator
21, Engine rpm and TDC sensor
22, Injection timing sensor
23, Air pressure and absolute temperature sensor
24, Oil pressure switch
25, Body computer:
26, CODE control unit (via CAN line)
27, Tester connection (via CAN line)
28, Rev counter (via CAN line)
29, System failure bulb (via CAN line)
30, Speedometer (via CAN line)
31, City button for power-assisted steering (via CAN line)

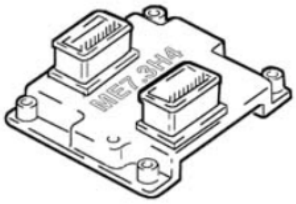
APPLIES TO VERSIONS WITH: Allarme

SELF-LEARNING

The control unit implements the self-learning mode in the following conditions:

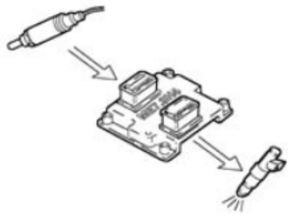
- removing-refitting or replacement of the injection control unit
- removing-refitting or replacement of the throttle body

The values memorized by the control unit are preserved if the battery is disconnected.



SELF-ADAPTATION OF THE SYSTEM

The control unit has a self-adaption function which recognizes changes in the engine which occur as a result of bedding-in and ageing processes of both components and the engine itself.
These changes are stored in the form of modifications to the basic mapping, and their purpose is to adapt the operation of the system to the gradual alterations in the engine and components compared with their characteristics when new.
This self-adaptation function also makes it possible to even out inevitable differences (due to production tolerances) in any replaced components.
From the exhaust gas analysis, the control unit changes the basic mapping in relation to the original characteristics of the new engine.
The self-adaptation parameters are not cancelled if the battery is disconnected.



AUTODIANOSIS AND RECOVERY

The control unit autodiagnostic system controls the correct operation of the system and signals any faults by means of an (MIL) warning light in the instrument panel which has a standardized European colour and ideogram.
This warning light signals both engine management faults and problems detected by the EOBD strategies.
The (MIL) warning light operating logic is as follows:
With the ignition key in the ON position, the warning light comes on and remains on until the engine has been started up. The control unit's self-test system checks the signals coming from the sensors, comparing them with the permitted limits:

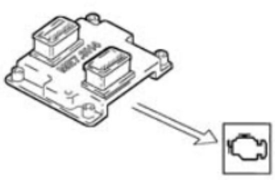
Signalling of faults during engine starting:

- the failure of the warning light to go out once the engine has been started up means that there is an error memorized in the control unit.

Fault indication during operation

- the warning light flashing indicates possible damage to the catalyzer due to misfire.
- the warning light on constantly indicates the presence of engine management errors or EOBD errors.

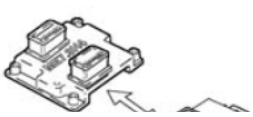
From time to time, the control unit defines the type of recovery according to the components which are faulty.
The recovery parameters are managed by those components which are not faulty.

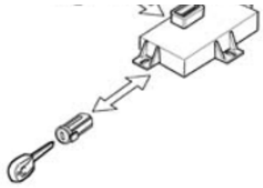


SYSTEM CHECKS AND MANAGEMENT

Recognition of fiat code

When the control unit receives the ignition 'ON' signal, it communicates with the body computer to obtain starting enablement.
Communication takes place via a two-way CAN line which connects the two control units.





Control of cold starting

The following occurs during cold starting:

- a natural weakening of the mixture because of poor turbulence of the fuel particles at low temperatures
- reduced fuel evaporation
- condensation of the fuel on the inner walls of the inlet manifold
- increased viscosity of the lubricant oil.

The electronic control unit recognizes this condition and corrects the fuel injection time in accordance with:

- coolant temperature
- intake air temperature
- battery voltage
- engine rpm.

The ignition advance depends solely on the engine rpm and the coolant temperature.
The rpm is made to decrease in proportion to the increase in temperature of the engine until the optimum value with the engine up to temperature is obtained.

APPLIES TO VERSIONS WITH: Allarme

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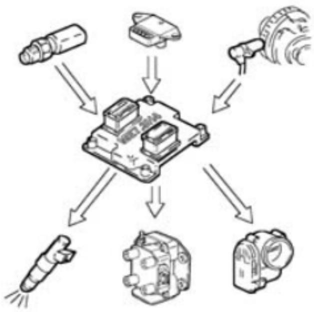
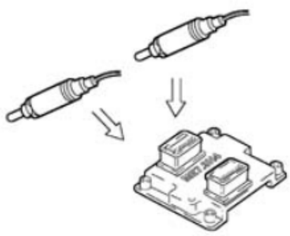


APPLIES TO VERSIONS WITH: Allarme

Control of combustion - lambda sensors

In EOBD systems the Lambda sensors, which are all the same type, are located upstream of the catalyzer and downstream of the catalyzer.
The pre-catalyzer sensor carries out the check on the mixture strength called 1st loop (closed loop of the upstream sensor).
The post-catalyzer sensor is used for the catalyzer diagnosis and for finely modulating the 1st loop control parameters.
With this in mind, the adjustment of the second loop is designed to recover both production differences and those in the response of the pre-catalyzer sensors which may occur as a result of ageing and pollution.
This control is known as the 2nd loop (post-catalyzer sensor closed loop).



Control of detonation

The control unit detects the presence of knocking by processing the signal coming from the relevant sensor.
The control unit continuously compares the signals coming from the sensor with a threshold value, which, in turn, is continuously updated to take account of background noise and ageing of the engine.
The control unit is therefore capable of detecting the presence of detonation (or the onset of detonation) in each individual cylinder and reduces the ignition advance for the cylinder concerned (in steps of 3 degrees up to a maximum of 6 degrees) until the phenomenon disappears. The advance is then gradually restored to the basic value (in steps of 0.8 degrees).
Under acceleration conditions, a higher threshold is used to take account of the increased engine noise under such conditions.
The knock control strategy also has a self-adaptation function, which memorizes the reductions in advance that may be repeated continuously, so as to adjust the mapping to the different conditions now affecting the engine.

APPLIES TO VERSIONS WITH: Allarme

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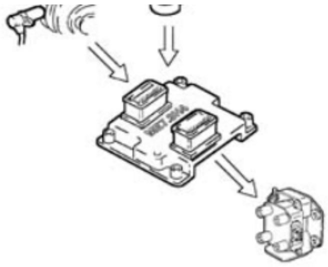


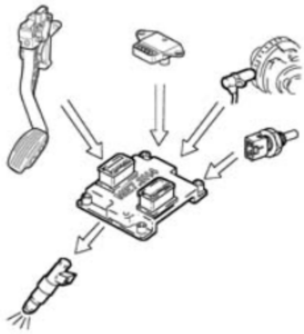
APPLIES TO VERSIONS WITH: Allarme

Control of enrichment during acceleration

During this stage, the control unit increases the quantity of fuel requested by the engine as appropriate (to achieve maximum torque) according to the signals coming from the following components:

- accelerator pedal potentiometer and throttle position
- Rpm and TDC sensor

The 'basic' injection time is multiplied by a coefficient which depends on the temperature of the engine coolant, the opening speed of the accelerator butterfly and the increase in pressure in the inlet manifold.
If the sharp variation in the injection time is calculated when the injector is already closed, the control unit reopens the injector (extra pulse) in order to compensate the mixture strength extremely quickly; the subsequent injections are already increased on the basis of the coefficients mentioned previously.



Controlling fuel supply - fuel pump

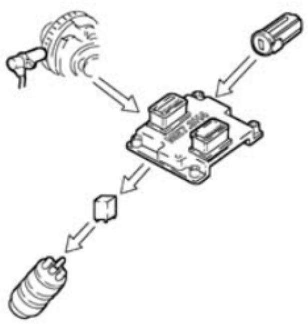
The control unit supplies the electric pump:

- when the ignition is ON for 0.8 s
- with the ignition in the START position and the engine speed > 22.8 rpm

The control unit cuts off the supply to the electric pump:

- with ignition in OFF position
- with engine speed < 22.8 rpm.

The returnless fuel supply system ensures a constant petrol pressure of 3.5 bar.



APPLIES TO VERSIONS WITH: Allarme

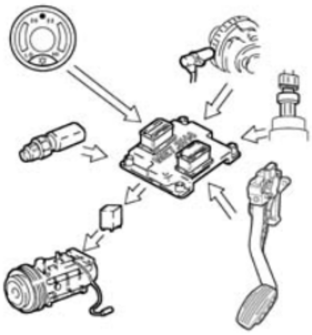
Connection with the climate control system

When the compressor turns on and power is required, the control unit drives the motorized throttle to increase the air flow.

The control unit momentarily interrupts the supply to the compressor:

- during starting
- by switching it off over 6200 rpm

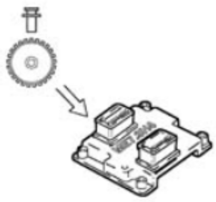
- by switching it off if the engine temperature > 112° C.
- during pick-up with accelerator fully depressed.



APPLIES TO VERSIONS WITH: Allarme

Recognition of cylinder position

The engine timing signal, together with the engine rpm and top dead centre (TDC) signal, allows the control unit to recognize the succession of cylinders to implement phased injection.
This signal is generated by a Hall-effect sensor, positioned on the cylinder head near the phonic wheel on the inlet camshaft.



APPLIES TO VERSIONS WITH: Allarme

Fuel cut-off during overrunning

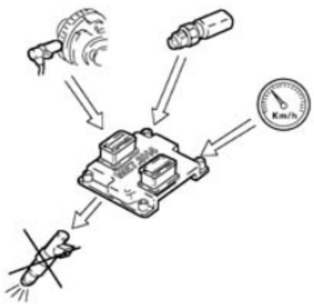
During release of the accelerator pedal, and beyond a pre-established threshold, the control unit:

- cuts off the supply to the fuel injectors
- reactivates the supply to the fuel injectors at 1300-1500 rpm.

As there is no fuel supply, the rpm decreases more or less rapidly depending on the vehicle's driving conditions.
Before idle speed is reached, the trend of the fall in rpm is checked.
If it exceeds a certain value, the fuel supply is partially reactivated so that the engine can 'gently accompany' the drop towards idle speed.

The thresholds for reactivation of the fuel supply and for fuel cut-off vary depending on:

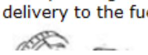
- engine coolant temperature
- vehicle speed
- engine rpm

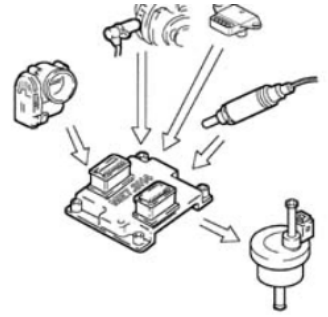


APPLIES TO VERSIONS WITH: Allarme

Fuel vapour recovery

The (polluting) fuel vapours, collected in an activated-charcoal filter (canister), are sent to the inlet ducts to be burnt.
This takes place via a solenoid controlled by the control unit only when the engine's operating conditions so permit.
The control unit compensates for the additional quantity of fuel by reducing the delivery to the fuel injectors.



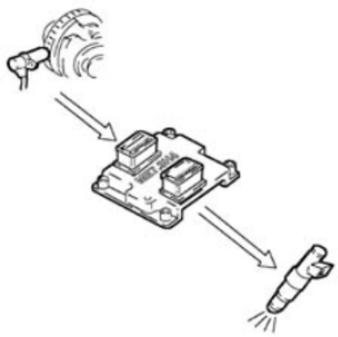


APPLIES TO VERSIONS WITH: Allarme

Controlling maximum rpm

Depending on the rpm reached by the engine, the control unit:

- over 7000 rpm cuts off the supply to the fuel injectors
- below 7000 rpm it restores the operation of the injectors.



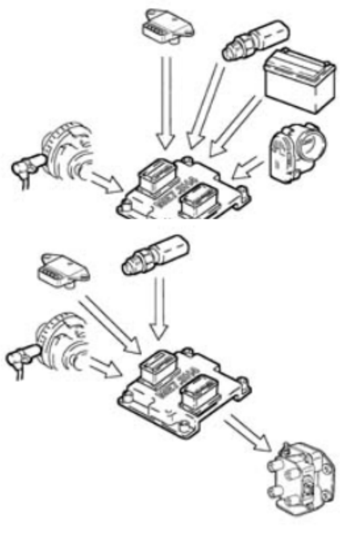
APPLIES TO VERSIONS WITH: Allarme

Adjusting injection times

The control unit calculates the injector opening times and controls them extremely quickly and precisely on the basis of:

- engine load (rpm and air flow)
- battery voltage
- engine coolant temperature;

Fuel injection is sequential and phased for each cylinder, and takes place at the optimum 'start-of-injection' point, while the 'end-of-injection' point remains fixed.



APPLIES TO VERSIONS WITH: Allarme

Control of the idle speed

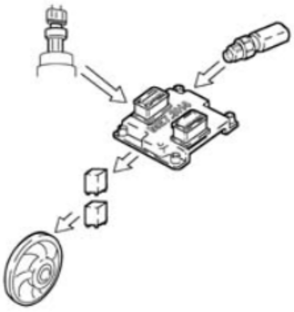
The control unit recognizes the idle condition from the accelerator pedal being in the 'released' position.
According to the consumers switched on and the brake/clutch pedal signals, the control unit controls the position of the motorized butterfly.
The idle speed when warm is 750 ± 50 rpm (for the version with automatic transmission it is 800 ± 50 rpm). .

Controlling radiator cooling fan

The control unit controls the switching on of the electric fan in accordance with the coolant temperature:

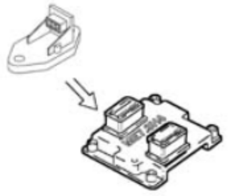
- temperature for switching on 1st speed 97° C
- temperature for switching on 2nd speed 102° C

There is a further check (4 stage pressure switch signal) which engages the 1st or 2nd fan speed, according to the pressure of the refrigerant gas, with the air conditioning system switched on.
In the absence of the coolant temperature signal, the control unit activates the recovery function and switches on the fan 2nd speed until the error disappears.



Accelerometer sensor

The accelerometric sensor measures an acceleration value by means of an internal piezoelectric element and generates an output voltage proportional to the intensity of the parameter.
It is used to measure ground roughness and must therefore be fitted very rigidly to the vehicle body in a very specific area: the suspension dome.
We need to measure roughness because we need to discriminate, for the purposes of engine control, between drive torque changes due to road surface roughness and changes due to combustion chamber misfiring.

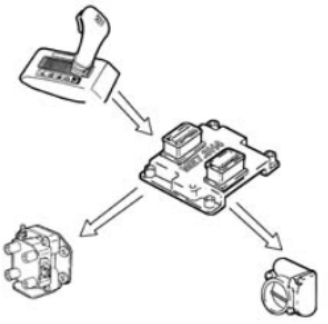


Connection to the transmission control unit

Communcation between the engine control unit and the automatic transnmission control unit takes place via dedicated lines.

In the case of a gear shift (indicated by the transmission control unit), the injection control unit reduces drive torque by:

- a reduction in the ignition advances.
- reducing the throttle opening angle.

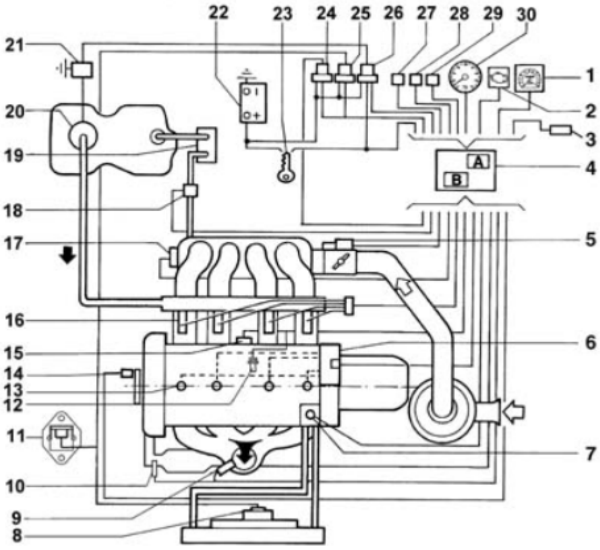


APPLIES TO VERSIONS WITH: Allarme

COMPOSITION

VIEW OF ASSEMBLY

The diagram below shows the main components of the system.



1, Speedometer (via CAN network)
2, System failure bulb (via CAN network)
3, CITY button (via CAN network)
4, Engine management control unit
5, Throttle control actuator and throttle position sensor
6, Ignition coil
7, Coolant temperature sensor
8, Radiator fan
9, Lambda sensor (upstream)
10, Lambda sensor (downstream)
11, Bodyshell accelerometer
12, Injection timing sensor
13, Spark plugs
14, Engine speed and TDC sensor
15, Detonation sensor
16, Injectors
17, Absolute pressure and air temperature sensors
18, Charcoal filter solenoid valve
19, Active charcoal filter
20, Holder (including pump, pressure regulator, filter, level sensor)
21, Inertia switch
22, Battery
23, Ignition switch
24, Engine control system relay
25, Fuel pump relay
26, Radiator fan relay/s
27, Climate control connection
28, CODE connection (via CAN network)
29, Tester connection (via CAN line)
30, Rev counter (via CAN line)

APPLIES TO VERSIONS WITH: Allarme

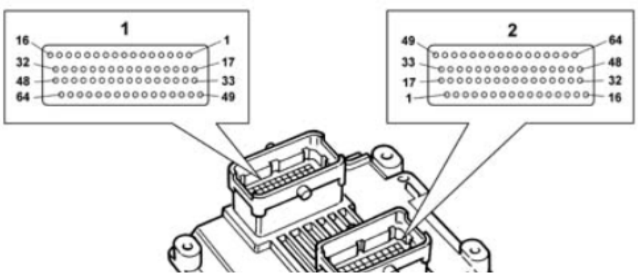
ME 7.3 H4 INJECTION/IGNITION CONTROL UNIT

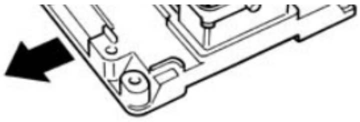
Specifications

The control unit is mounted in the engine bay over the throttle body and withstands high temperatures.
The control unit memory is the 'flash EPROM' type, i.e. reprogrammable from the outside without intervening on the hardware.
The replacement of the injection control unit or the throttle body means that the self-learning procedure has to be carried out.

Control unit pin-out

The diagram below shows





ENGINE SIDE connector (1)
1, Not connected
2, Cylinder 3 injector control
3, Not connected
4, Not connected
5, Not connected
6, Pressure sensor
7, + 5 V sensors
28, Pre-catalyzer Lambda sensor signal (+)
9, Engine timing sensor earth
10, Engine rpm sensor
11, Throttle valve actuator earth
12, Not connected
13, Not connected
14, Not connected
15, Not connected
16, Not connected
17, Post-catalyzer Lambda sensor signal (+)
18, Cylinder 2 injector control
19, Not connected
20, Not connected
21, Knock sensor signal
22, Not connected
23, Throttle 1 potentiometer signal input
24, Not connected
25, Pre-catalyzer Lambda sensor earth
26, Air temperature and pressure sensor earth
27, Not connected
28, Throttle valve actuator (positive)
29, Not connected
30, Not connected
31, Cylinders 2 and 3 coil control
32, Cylinders 1 and 4 coil control
33, Canister solenoid control
34, Cylinder 4 injector control
35, Not connected
36, Engine timing sensor signal
37, Knock sensor earth
38, Engine temperature sensor signal
39, Throttle 2 potentiometer signal input
40, Not connected
41, Post-catalyzer Lambda sensor earth
42, Engine rpm sensor
43, Throttle valve actuator earth
44, Not connected
45, Not connected
46, Not connected
47, Not connected
48, Not connected
49, Pre-catalyzer Lambda sensor heater
50, Not connected
51, Cylinder 1 injector control
52, Not connected
53, Not connected
54, Not connected
55, Air temperature sensor
56, Throttle potentiometers 1 and 2 supply (+5V)
57, Post-catalyzer Lambda sensor signal
58, Throttle 1 and 2 potentiometers earth
59, Not connected
60, Throttle valve actuator positive
61, Not connected
62, Not connected
63, Not connected
64, Not connected
VEHICLE SIDE connector (2)
1, Not connected
2, Line k
3, Engine temperature (versions with automatic transmission only)
4, Accelerator pedal 2 potentiometer supply (+5V)
5, Accelerator pedal 2 potentiometer earth
6, Not connected
7, Clutch switch signal
8, Neutral position signal (versions with automatic transmission only)
9, Not connected
10, Failure signal (versions with automatic transmission only)
11, CAN network (HIGH)
12, Not connected
13, Not connected
14, 1st fan speed relay control
15, Not connected
16, Not connected
17, Supply from main relay
18, Direct supply (+30)
19, Main relay control
20, Rev counter signal
21, Accelerator pedal 1 potentiometer supply (+5V)
22, Accelerator pedal 1 potentiometer earth

23, Not connected
24, 2nd fan speed switch engagement (quadrinary)
25, Brake pedal switch signal
26, Engine idle request (versions with automatic transmission only)
27, Not connected
28, Not connected
29, Engine torque signal (versions with automatic transmission only)
30, 2nd fan speed relay control
31, Failure warning light on signal
32, Not connected
33, Supply for main relay
34, Not connected
35, Throttle position signal (versions with automatic transmission only)
36, Not connected
37, Accelerator 2 potentiometer signal input
38, Failure warning light on request
39, Signal from accelerometer on bodyshell
40, Air conditioning engagement request
41, Not connected
42, Oil pressure signal
43, CAN network (LOW)
44, Not connected
45, Not connected
46, Air conditioning cmopressor engagement relay control
47, Not connected
48, Not connected
49, Direct supply from main relay
50, Not connected
51, Signal from ignition switch (15/54)
52, Not connected
53, Not connected
54, Accelerator 1 potentiometer signal input
55, Fuel tank level sensor signal
56, 1st fan speed switch operation (quadrinary)
57, Not connected
58, Not connected
59, Not connected
60, Not connected
61, Not connected
62, Petrol pump relay control
63, Not connected
64, Not connected

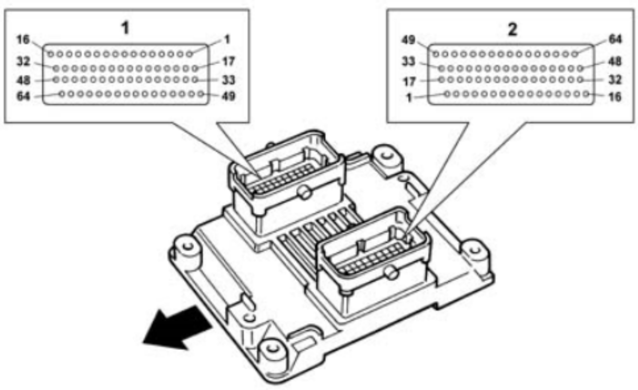
INJECTION-IGNITION CONTROL UNIT ME 7.3 H4

Specifications

The control unit is mounted in the engine bay over the throttle body and withstands high temperatures.
The control unit memory is the 'flash EPROM' type, i.e. reprogrammable from the outside without intervening on the hardware.
The replacement of the injection control unit or the throttle body means that the self-learning procedure has to be carried out.

Control unit pin-out

The diagram below shows



ENGINE SIDE connector (1) _ 1, Not connected
2, Cylinder 3 injector control
3, Not connected
4, Not connected
5, Not connected
6, Air pressure sensor signal
7, + 5 V air pressure sensors/timing sensor
8, Lambda sensor signal (+) upstream of catalyzer
9, Engine timing/engine coolant temperature sensors earth
10, Engine rpm sensor
11, Throttle valve actuator earth
12, Not connected
13, Not connected
14, Not connected
15, Cylinder 4 coil operation
16, Cylinder 2 coil operation
17, Heated Lambda sensor signal (-) downstream of catalyzer
18, Cylinder 2 injector control
19, Not connected
20, Not connected
21, Knock sensor signal
22, Not connected

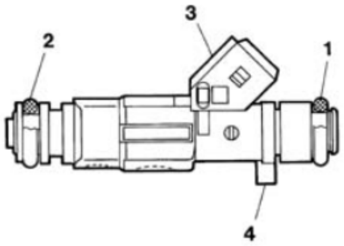
22, Not connected
23, Throttle 1 potentiometer signal input
24, Not connected
25, Lambda sensor earth upstream of catalyzer
26, Air temperature and pressure sensor earth
27, Not connected
28, Throttle valve actuator (positive)
29, Not connected
30, Not connected
31, Cylinder 3 coil operation
32, Cylinder 1 coil operation
33, Canister scavenging solenoid valve operation
34, Cylinder 4 injector control
35, Not connected
36, Engine timing sensor signal
37, Knock sensor earth
38, Engine coolant temperature sensor signal
39, Throttle 2 potentiometer signal input
40, Not connected
41, Lambda sensor signal (-) downstream of catalyzer
42, Engine rpm sensor
43, Throttle valve actuator earth
44, Not connected
45, Not connected
46, Not connected
47, Not connected
48, Not connected
49, Heated Lambda sensor negative signal (-) upstream of catalyer
50, Not connected
51, Cylinder 1 injector control
52, Not connected
53, Not connected
54, Air conditioning linear sensor signal
55, Air temperature sensor signal
56, Throttle potentiometers 1 and 2 supply (+5V)
57, Lambda sensor signal downstream of catalyzer
58, Throttle 1 and 2 potentiometers earth
59, Not connected
60, Throttle valve actuator positive
61, Not connected
62, Not connected
63, Not connected
64, Not connected
VEHICLE SIDE connector (2)
1, Not connected
2, Body computer line k
3, Not connected
4, Accelerator pedal 2 potentiometer supply (+5V)
5, Accelerator pedal 2 potentiometer earth
6, Not connected
7, Clutch switch signal
8, Cruise Control deceleration signal
9, Cruise Control acceleration signal
10, Not connected
11, CAN network (HIGH)
12, Not connected
13, Not connected
14, 1st fan speed relay feed
15, Not connected
16, Not connected
17, Power supply from main relay
18, Direct supply (+30)
19, Main relay feed
20, Rev counter signal
21, Accelerator pedal 1 potentiometer supply (+5V)
22, Accelerator pedal 1 potentiometer earth
23, Not connected
24, Not connected
25, Signal from brake pedal switch N.A. contact
26, Not connected
27, Not connected
28, CAN network (LOW)
29, Not connected
30, 2nd fan speed relay feed
31, MIL warning light on signal
32, Not connected
33, Main relay power supply
34, Not connected
35, Not connected
36, Not connected
37, Accelerator 2 potentiometer signal input
38, Not connected
39, Not connected
40, Air conditioning engagement request
41, Cruise Control resume
42, Engine oil pressure signal
43, CAN network (LOW)
44, Not connected
45, Not connected
46, Air conditioning cmopressor engagement relay control
47, Not connected
48, Not connected
49, Direct supply from main relay
50, Not connected
51, Signal from ignition switch (15/54)
52, W line from body computer
53, Accelerator 1 potentiometer signal input

53, Accelerator 1 potentiometer signal input
54, Accelerator 1 potentiometer signal input
55, Not connected
56, Not connected
57, Signal from brake switch N.C. contact
58, Cruise Control on control
59, Not connected
60, CAN network (HIGH)
61, Not connected
62, Petrol pump relay feed
63, Not connected
64, Not connected

INJECTORS

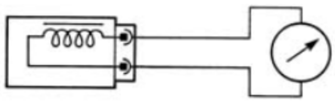
Specifications

The twin jet injectors (with the spray at an angle in relation to the injector axis) are specifically designed for engines with 4 valves per cylinder, making it possible to direct the jets towards the two inlet valves.
The injector is top-feed, i.e. fuel is fed in from the upper part of the body, which houses the electrical winding connected to the terminals of connector (3).
When the current passes through the winding, the magnetic field which is produced attracts the shutter, opening the injector and the flow of fuel.
Two rings ensure a seal on the fuel manifold side (1) and intake manifold side (2).
Notch (4) determines angular injector position and directs the jets correctlly in relation to the intake valves.



Electrical characteristics

Injector resistance may be measured by disconnecting the connector and connecting an ohmmeter as shown in the figure.
Resistance value: 14.5 ± 5% ohm.

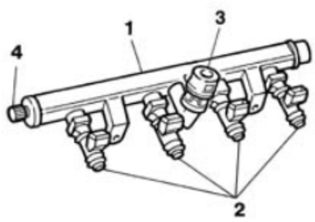


Operation

The jets of fuel, at a differential pressure of 3 bar, come out of the injector and are instantly atomized forming two cones.
The control logic for the injectors is the sequential, phased type, in other words the four injectors are operated according to the engine cylinder inlet sequence, whilst the supply for each cylinder can already start during the expansion stroke and continue until the inlet stroke has already started.

FUEL MANIFOLD

The function of the fuel manifold is to distribute fuel to the injectors. It incorporates seats for the injectors and air bleed valve.
The fuel intake is secured by a quick-release fitting.
No recirculation pipe is present because the system is returnless.



1, Fuel manifold
2, Injector
3, Fuel inlet connection
4, Bleed valve

ENGINE COOLANT TEMPERATURE SENSOR

Specifications

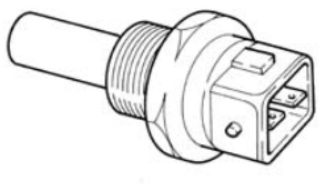
It is fitted on the thermostatic cup and measures the temperature of the coolant by means of an NTC thermistor which has a negative resistance coefficient.
The table shows the variation in the resistance value according to the temperature

° C	O
-20	15971
-10	9620
0	5975

10	3816
20	2502
25	2044
30	1679
40	1152
50	807
60	576
70	418
80	309
90	231
100	176

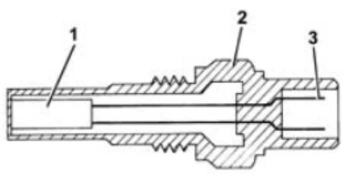
Operation

The reference voltage for the NTC element for the injection system is 5 Volt; As the input circuit into the control unit is designed as a voltage divider, this voltage is divided between a resistor located in the control unit and the sensor's NTC resistor.
The control unit is thus able to assess the changes in the sensor's resistance via the changes in voltage, and thus obtain the temperature information.



Components

The diagram illustrates the composition of the sensor

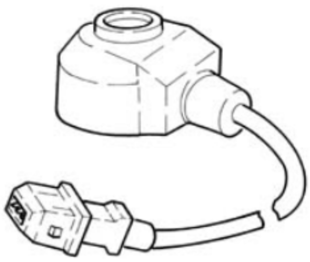


1, NTC resistor
2, Sensor body
3, Electrical connector

KNOCK SENSOR

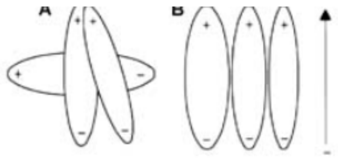
Specifications

The piezoelectric type detonation sensor is fitted on the cylinder block/crankcase and detects the intensity of the vibrations caused by the detonation in the combustion chambers.
This phenomenon produces a mechanical repercussion on a piezoelectric crystal which sends a signal to the control unit; on the basis of this signal, the control unit reduces the ignition advance until the phenomenon has disappeared. The advance is then gradually restored to the basic value.
Electrical specifications: resistance 4.9 MO20%.



Operation

The molecules of a quartz crystal feature electrical polarization.
In rest conditions (A) the molecules do not have a particular direction.
When the crystal is subjected to pressure or an impact (B), they are directed - the higher the pressure to which the crystal is subjected, the more marked their direction.
This direction produces a voltage at the ends of the crystal.



A. Rest position
B. Under pressure position

RPM SENSOR

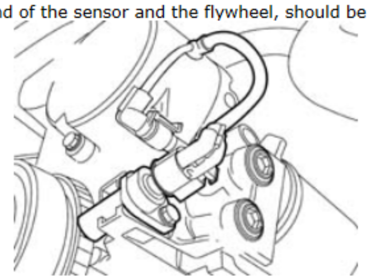
Specifications

It is mounted on the engine block and 'faces' the phonic wheel located on the crankshaft.
It is of the inductive type, i.e. it functions by means of the variation in the magnetic field generated by the passage of the teeth of the flywheel (60-2 teeth).

The fuel injection control unit uses the rpm sensor to:

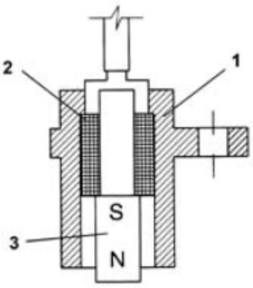
- determine the speed of rotation
- determine the angle of the crankshaft.

Electrical specifications: resistance:1134-1386 ohm at 20° C.
The distance (gap) for obtaining correct signals, between the end of the sensor and the flywheel, should be between 0.5 and 1.5 mm.



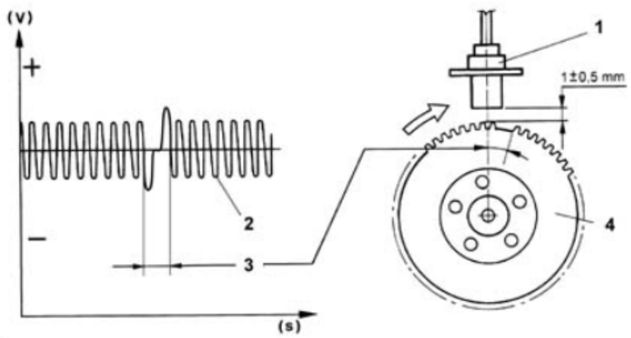
Components

The sensor consits of a tubular casing (1) which contains a permanent magnet (3) and an electrical winding (2).



Operation

As the flywheel teeth go past, the magnetic flow produced by the magnet (3) undergoes fluctuations due to the change in the gap.
These fluctuations induce an electromotive force in the winding (2), at the ends of which there is a voltage which alternates between positive (tooth opposite sensor) and negative (gap opposite sensor).



1, Sensor
2, Output signal
3, Signal corresponding to the two missing teeth
4, Crankshaft pulley with flywheel

The peak value of the output voltage from the sensor, provided other factors remain the same, depends on the distance between the sensor and tooth (gap).

BUTTERFLY CASING

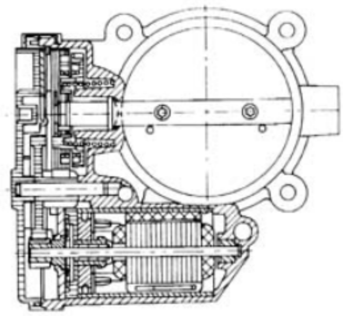
Specifcations

It is fitted on the inlet chamber and regulates the quantity of air drawn in by the engine.
According to the signal coming from the accelerator pedal potentioemter, the injection control unit controls the opening of the throttle by means of a direct current motor integrated in the throttle casing.
The throttle opening takes place between 0° and 80° therefore including the idle adjustment.
The throttle body actuator is equipped with two potentiometers integrated so that one controls the other and viceversa.

If both the potentiometers fail or there is no supply, depending on the position of the accelerator pedal, the control unit reduces the drive torque:

- fully depressed, it cuts off the supply to one or more pistons, until a maximum speed of 2500 rpm is reached
- in intermediate positions, it cuts off the supply to one or more pistons, until a speed below 1200 rpm is reached.

If the throttle body or the injection control unit or the air chamber is replaced then the self-learning procedure must be carried out.



Operating

The throttle opening is managed by an electronic motor.

APPLIES TO VERSIONS WITH: Allarme

The ME73H4 system operates the motorized throttle according to the accelerator pedal request; a potentiometer is connected to it which sends a voltage signal to the control unit where it is processed and the more or less accentuated opening laws are produced.
In six-speed versions and automatic transmission versions; the system is able to govern throttle movement in accordance with two modes: one more sporty and the other more comfortable.
The driver can modify the response of the engine to the action of the accelerator pedal via a switch in the console near the gear lever.

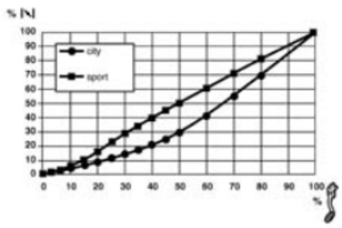
In particular:

- with the 'CITY' function switched on, the response of the throttle movement is smoother.
- with the 'CITY' function switched off, the throttle movement response is faster.

Activation mode:

- press the CITY button;
- release the accelerator pedal.

The control unit activates the management.
The graph illustrates the throttle opening law.

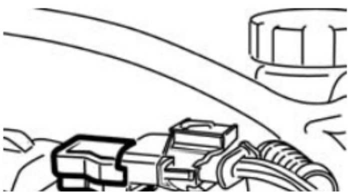


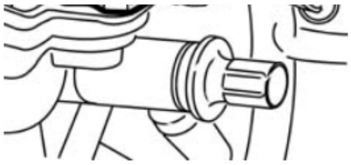
APPLIES TO VERSIONS WITH: Allarme

INTAKE AIR TEMPERATURE AND PRESSURE SENSOR

Specifications

The intake air temperature and pressure sensor is a component which is designed to measure the pressure and the temperature of the air inside the inlet manifold.
Both pieces of information are used by the injection control unit to define the quantity of air drawn in by the engine; this information is then used to calculate the injection time and the point of ignition.
The sensor is fitted on the inlet manifold.





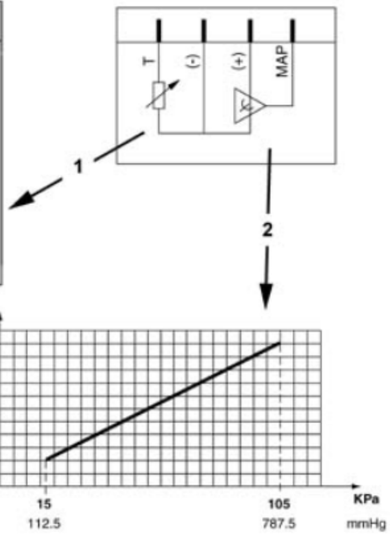
Composition

The air temperature sensor consists of an NTC thermistor (Negative Temperature Coefficient). The resistance of the sensor decreases as the temperature increases.
The control unit input circuit divides the 5 Volt reference voltage between the sensor resistance and a fixed reference value, obtaining a voltage which is proportional to the resistance and therefore to the temperature.
The sensitive element of the pressure sensor consits of a Wheatstone bridge on a cermamic diaphragm. On one side of the diaphragm is the absolute reference vacuum, whilst on the other side there is the vacuum from the inlet manifold.
The (piezoresistive) signal from the distortion suffered by the diaphragm, before being sent to the engine control unit, is amplified by an electronic circuit in the support which also houses the ceramic diaphragm.
When the engine is off, the diaphragm bends in accordance with the atmospheric pressure; the altitude information is thus obtained.
When the engine is running, the effect of the vacuum produces a mechanical action on the sensor diaphgram, which bends, altering the resistance value.
Since the supply is kept rigorously constant (5V) by the control unit, altering the resistance alters the voltage output value.

Electrical characteristics

The diagram below illustrates the electrical specifications of the sensor.

T °C	Ω	T °C	Ω
-40°	49.933	+60	0.578
-30	26.628	+70	0.419
-20	15.701	+80	0.309
-10	9.539	+85	0.263
0	5.959	+90	0.231
+10°	3.820	+100	0.176
+20	2.509	+110	0.135
+25	2.051	+120	0.105
+30	1.686	+125	0.092
+40	1.157	+130	0.083
+50	0.810		



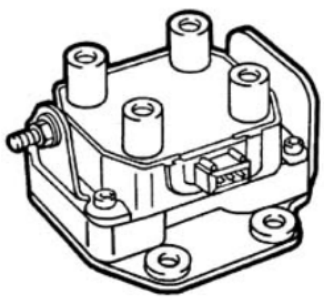
1, Air temperature sensor
2, Intake air pressure sensor

APPLIES TO VERSIONS WITH: Allarme

IGNITION COILS

Specifcations

The coils are fixed, by a bracket, to the camshaft covers and are the closed magnetic circuit type with a core made from silicon steel with a thin gap containing both windings.



The windings are covered by a pressed plastic container and are insulated through immersion in an epoxide resin and quartz compound which gives hem exceptional dielectric, mechanical and thermal properties enabling them to withstand high temperatures.
The proximity of the primary winding to the magnetic core reduces the magnetic flow losses optimizing the coupling with the secondary winding.

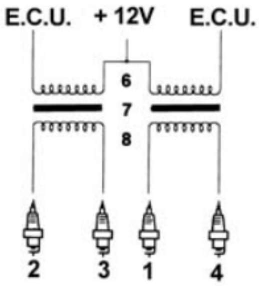
Electrical characteristics

Primary circuit resistance: 0.52-0.62 ohm at 23° C
Secondary circuit resistance: 6830 - 7830 ohm at 23C

APPLIES TO VERSIONS WITH: Allarme

Composition

The diagram below illustrates the composition of the coils.



1, H.T. socket for spark plug for cylinder 1
2, H.T. socket for spark plug for cylinder 2
3, H.T. socket for spark plug for cylinder 3
4, H.T. socket for spark plug for cylinder 4
5, L.T. socket for control unit connection
6, Primary circuit
7, Gap
8, Secondary circuit

APPLIES TO VERSIONS WITH: Allarme

VEHICLE SPEED SENSOR

Specifcations

This sensor is located at the differential output, by the left driveshaft joint and transmits the vehicle speed to the body computer, which forwards it to the control unit: the signal is also used for the operation of the speedometer.
The Hall effect sensor transmits 16 impulses/rev; according to the frequency of the impulses it is possible to ascertain the speed of the vehicle.

on versions with ABS, the vehicle speed signal is generated by the ABS control unit.