

80 – Clutch pedal pressed redundant signal (positive), normally closed.

81 – NC

82 – NC

83 – Can line from NBC – (Can low)

84 – Can line from NBC – (Can High)

85 – NC

86 – Ground for Lambda sensor signal

87 – Lambda sensor reference current

88 – NC

89 – NC

90 – Engine cooling fan speed contactor 1 cut-in command

91 – NC

92 – NC

93 – Glow plug preheating contactor

94 – Engine cooling fan speed contactor 3 cut-in command

M010B Connector

1 – Injector no. 3, supply

2 – Injector no. 2, supply

3 – NC

4 – NC

5 – NC

6 – NC

7 – NC

8 – Fuel pressure sensor (ground)

9 – NC

10 – NC

11 – Timing sensor (power supply)

12 – Rpm sensor (negative input)

13 – Absolute pressure sensor (power supply)

14 – NC

15 – NC

16 – Injector no. 1, supply

17 – Injector no. 4, supply

18 – NC

19 – Fuel flow regulator (power supply)

20 – Timing sensor (negative)

21 – NC

22 – Oil level sensor (ground)

23 – Absolute pressure sensor (negative)

24 – NC

25 – NC

26 – NC

27 – Rpm sensor (positive input)

28 – Rail pressure sensor (positive)

29 – NC

30 – NC

31 – Injector 2 (negative command)

32 – NC

33 – Injector 4 (negative command)

34 – NC

35 – NC

36 – NC

37 – Air temperature sensor (signal) inside air flow meter

38 – NC

39 – NC

40 – Absolute pressure sensor (signal)

41 – Water temperature sensor (ground)

42 – Air mass quantity in flow meter signal

43 – Fuel pressure sensor on rail (signal)

44 – Air flow meter (ground)

45 – NC

46 – Injector 3 (negative command)

47 – Injector 1 (negative command)

48 – NC

49 – Flow regulator control (negative)

50 – Timing sensor (signal)

51 – NC

52 – Oil level sensor (signal)

53 – Air temperature signal of absolute pressure sensor

54 – NC

55 – NC

56 – Signal oil pressure sensor (normally closed)

57 – NC

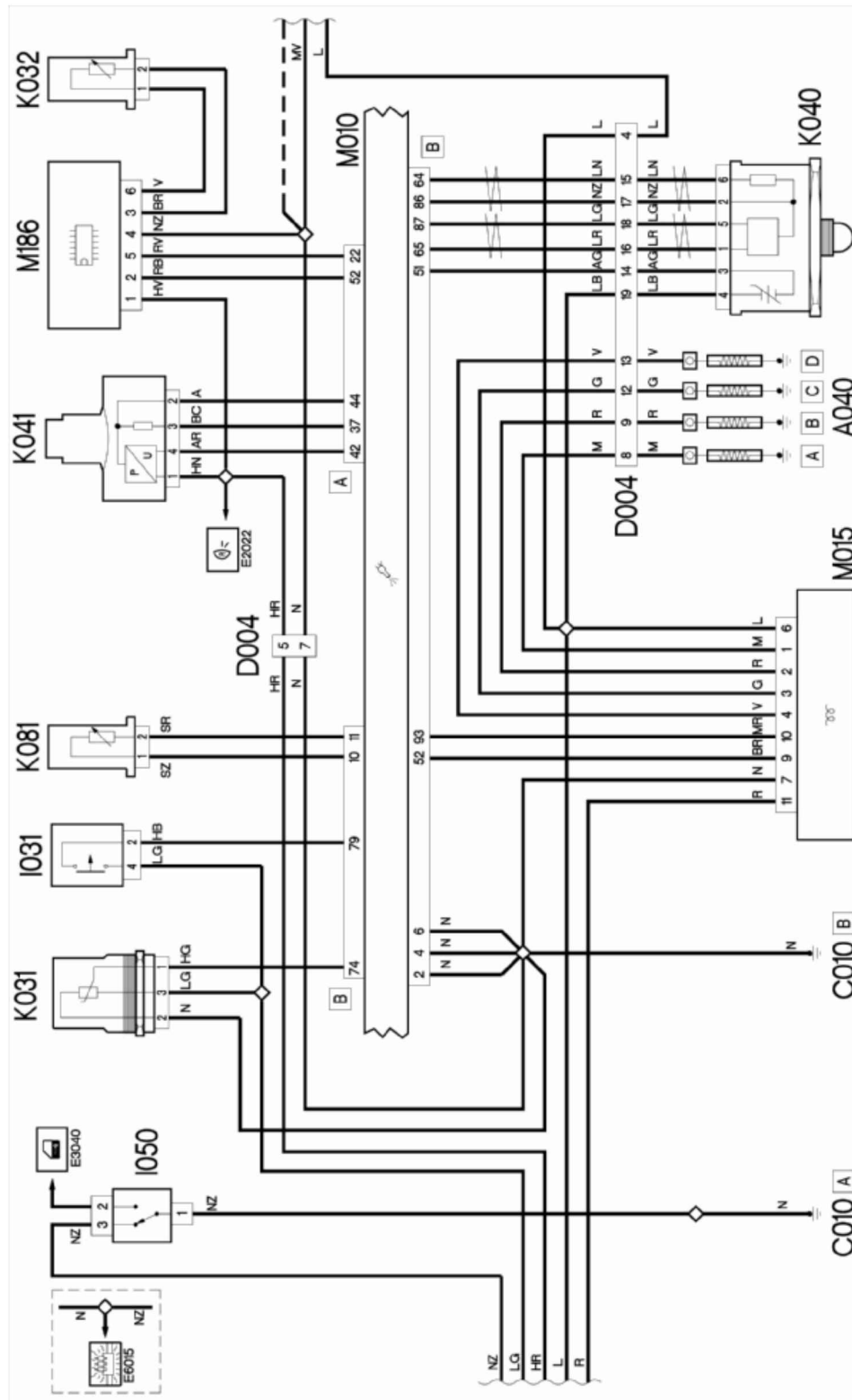
58 – Water temperature sensor (signal)

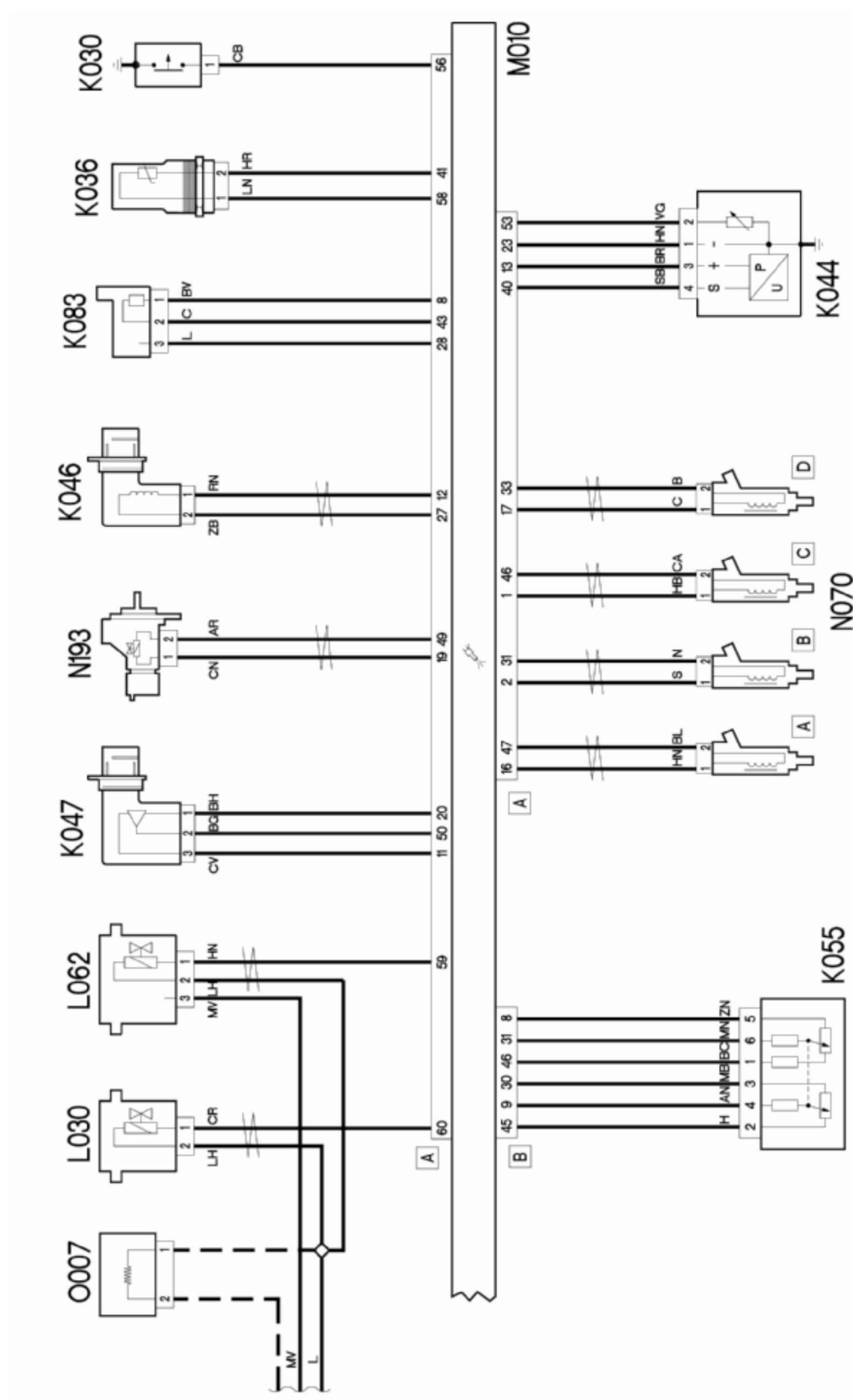
59 – Powered throttle actuator command

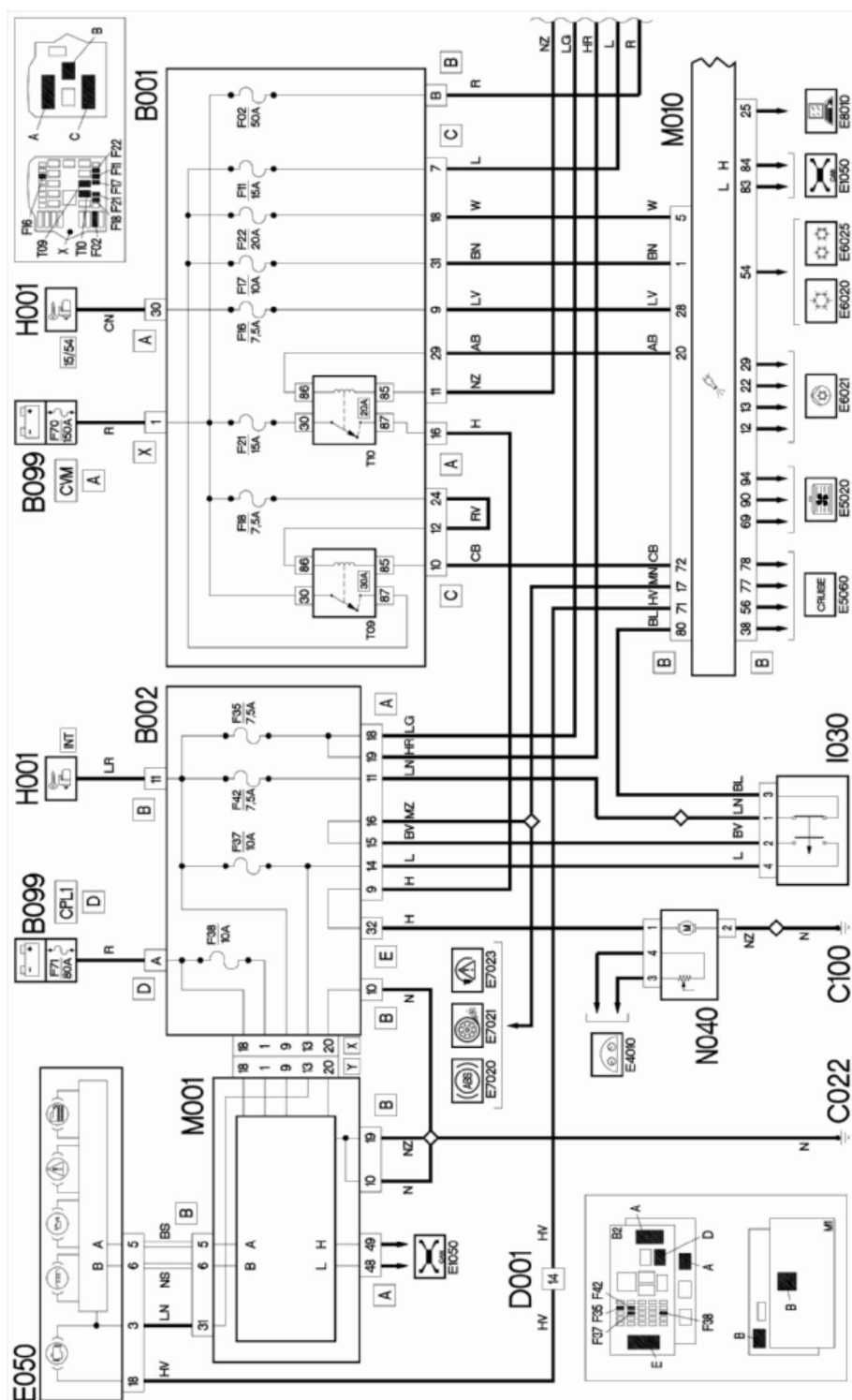
60 – EGR negative command



3.2.3 Engine management wiring diagram







Key to engine management wiring diagram components

A040. Preheating glow plugs
B001. Engine compartment connector box
B002. Connector box under dashboard
B099. Pmaxi-fuse box on battery
C010. Front left ground
C022. Central dashboard ground
C100. Cab ground
D001. Dashboard/front junction
D004. Engine/front junction
E050. Instrument panel
H001. Ignition switch
I030. Brake pedal switch
I031. Clutch pedal switch
I050. Inertia switch
K030. Engine oil pressure sensor
K031. Water in diesel filter sensor
K032. Engine oil level sensor
K036. Engine water temperature sensor
K040. Lambda sensor
K041. Air flow meter
K044. Intake air pressure and temperature sensor
K046. Rpm sensor
K047. Timing sensor
K055. Accelerator pedal potentiometer
K081. Fuel temperature sensor
K083. Fuel pressure sensor
L030. EGR solenoid valve
L062. Throttle body
M001. Body computer
M010. Engine control unit
M015. Glow plug preheating control unit
M186. Engine oil level control unit
N040. Electric fuel pump and fuel level meter
N070. Electro-injectors
N193. Fuel flow regulator
O007. Oil vapour heating resistor



3.2.4 Injection/ignition system components

ENGINE CONTROL UNIT

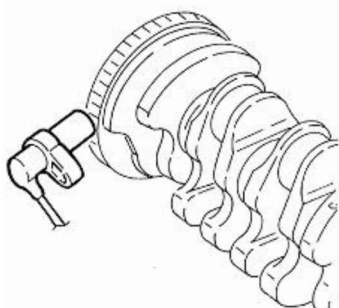
It is fitted in the engine compartment on the right-hand side panel. The control unit is of the "flash e.p.r.o.m." type, i.e. it can be reprogrammed from outside without removing the hardware.

The injection control unit incorporates the absolute pressure sensor.

The figure below shows the control unit.

RPM SENSOR

Features



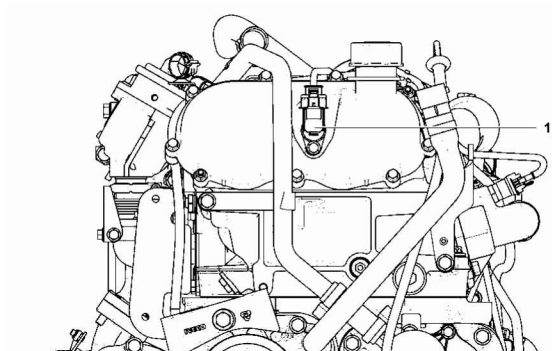
The rpm sensor is fitted on the crankcase with its sensing surface facing the phonic wheel on the engine flywheel. It is an inductive sensor that changes its output as it senses the changes in the magnetic field caused by the phonic wheel teeth (60 - 2 teeth) passing across it.

The injection control unit uses the rpm sensor signal to:

- determine the rotation speed;
- determine the angular position of the crankshaft.

TIMING SENSOR

Features



The timing sensor is a Hall sensor fitted on engine oil filler cover on the upper cylinder head section.

It determines engine timing by sensing the position of intake camshaft drive gear. The injection control unit uses the signal of the timing sensor to determine T.D.C. at the end of the compression stroke.

1 –Timing sensor



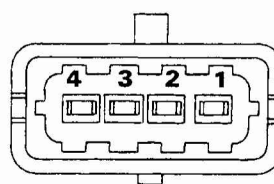
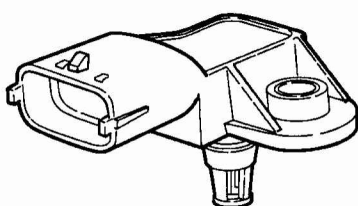
INTAKE AIR TEMPERATURE AND OVERPRESSURE SENSOR

Features

The intake air overpressure and temperature sensor is an integrated component used to measure the pressure and temperature of the air inside the intake manifold.

The sensor is fitted on the intake manifold and its output is used by the engine control unit:

- to adjust turbocharger pressure
- to protect the engine from overheating
- to diagnose air flow meter operation



Sensor pinout:

- 1 – Ground
- 2 – Air temperature signal

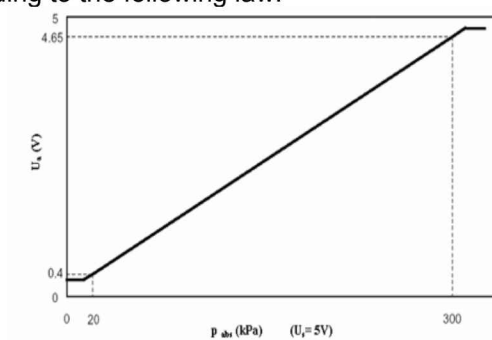
- 3 – 5 V power supply (from engine control unit)
- 4 – Turbocharging pressure output signal

Sensor output voltage changes with absolute pressure according to the following law:

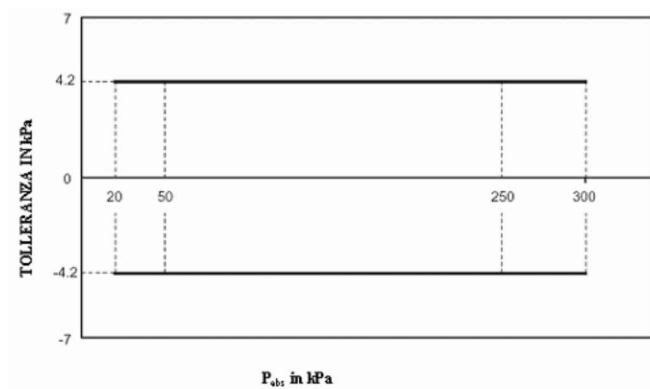
$$U_a = (c_1 \cdot p_{abs} + c_0) \cdot U_s$$

where:

- U_a = signal output voltage in V
- U_s = power supply voltage in V
- p_{abs} = absolute pressure in kPa
- $c_0 = 5.4/280$
- $c_1 = 0.85/280 \text{ kPa}^{-1}$



The graph below shows output signal tolerance in relation to pressure.

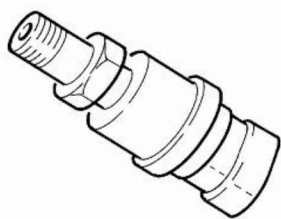


The following table lists temperature sensor resistance values in relation to air temperature

Temperature (°C)	Resistance in Ohm		
	Minimum	Rated	Maximum
-40	45301	48153	51006
-35	33703	35763	37823
-30	25350	26854	28359
-25	19265	20376	21487
-20	14785	15614	16443
-15	11453	12078	12702
-10	8951	9426	9901
-5	7055	7419	7783
0	5605	5887	6168
5	4487	4707	4926
10	3618.7	3791.1	3693.5
15	2938.5	3074.9	3211.3
20	2401.9	2510.6	2619.3
25	1975.8	2062.9	2150.1
30	1644.7	1715.4	1786.2
35	1374.2	1431.8	1489.5
40	1152.4	1199.6	1246.7
45	969.9	1008.6	1047.4
50	819.1	851.1	883.0
55	694.2	720.7	747.1
60	590.3	612.3	634.2
65	503.6	521.9	540.2
70	431.0	446.3	461.6
75	370.1	382.89	395.7
80	318.68	329.48	340.27
85	275.25	284.37	293.48
90	238.43	246.15	253.86
95	207.12	213.67	220.23
100	180.42	186.00	191.58
105	157.37	162.35	167.32
110	137.63	142.08	146.52
115	120.68	124.66	128.63
120	106.09	109.65	113.21
125	93.48	96.68	99.88
130	82.58	85.45	88.32



ENGINE COOLANT TEMPERATURE SENSOR



The engine coolant temperature sensor is mounted on a thermostatic plate and detects coolant temperature by means of a double NTC (negative temperature coefficient) thermistor.

One NTC thermistor sends a signal to the injection control unit, while the other sends a signal to temperature indicator and light on the instrument panel.

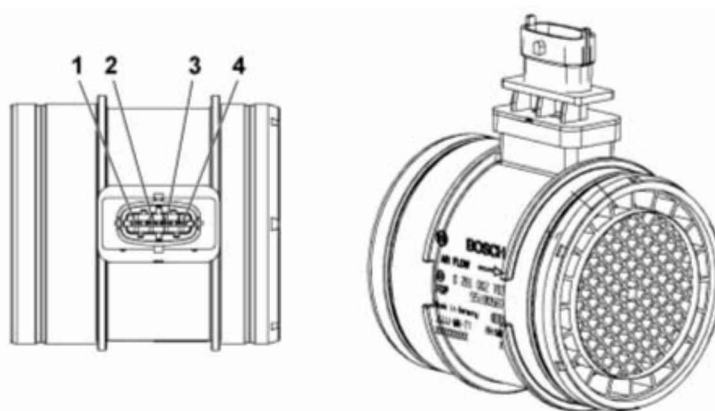
The sensor uses semiconductor technology; as sensor temperature increases with coolant temperature, sensor resistance drops.

The change in resistance is not linear; temperature increase being equal, resistance will drop faster in the low temperature range than at higher temperatures.

AIR FLOW METER WITH INCORPORATED AIR TEMPERATURE SENSOR

Features

The hot-film air flow meter is located on the air intake sleeve. It incorporates the intake air temperature sensor.



Air flow meter pinout:

- 1 – Power supply
- 2 – Ground
- 3 – Air temperature sensor signal
- 4 – Air mass quantity signal

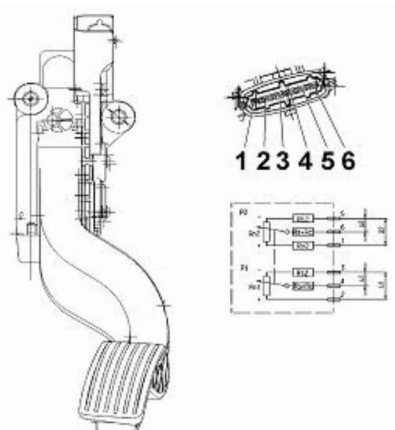


ACCELERATOR PEDAL POTENTIOMETER

Features

The sensor casing is secured to the accelerator pedal and accommodates two (main and safety) potentiometers connected by an axial shaft.

The shaft is fitted with two springs: a coil spring provides the correct resistance when pressure is applied to the pedal, the second is the return spring for when the pedal is released.



- | | | | |
|---|---|---------------------------------|---|
| 1 | – | Accelerator pedal potentiometer | 2 |
| | | power supply | |
| 2 | – | Accelerator pedal potentiometer | 1 |
| | | power supply | |
| 3 | – | Accelerator pedal potentiometer | 1 |
| | | ground | |
| 4 | – | Accelerator pedal potentiometer | 1 |
| | | signal | |
| 5 | – | Accelerator pedal potentiometer | 2 |
| | | ground | |
| 6 | – | Accelerator pedal potentiometer | 2 |
| | | signal | |

Sensor output voltage changes with accelerator pedal position and is sent to the injection control unit. The accelerator pedal position signal is processed together with the rpm input to calculate injection times and pressure.

MOTOR-DRIVEN THROTTLE BODY

Double potentiometer = factor 2

Power supply voltage (U_1, U_2) = $5\text{ V} \pm 0.3\text{ V}$

Series and contact resistance ($R_s + R_c$) = $1\text{ k}\Omega \pm 0.4\text{ k}\Omega$

Maximum load on sliding contact = 0.5 micro Ampere

Potentiometer resistance R_{n1} = $1.2\text{ k}\Omega \pm 0.5\text{ k}\Omega$

Potentiometer resistance $R_{n2} + R_{v2}$ = $1.7\text{ k}\Omega \pm 0.8\text{ k}\Omega$

Linearity = $\pm 0.02\text{ u/U}$

P1/P2 synchronisation = $\text{absolute value}(u_1/(U_1/2) - u_2/U_2) \leq 0.014\text{ u}$

The (normally open) throttle valve assembly fitted on the intake manifold controls the flow rate of intercooler air to be mixed with the exhaust gases recirculated by the E.G.R. valve, according to a programmed percentage.

Recirculated exhaust gas is mixed with intercooler air in a duct inside the cylinder head.

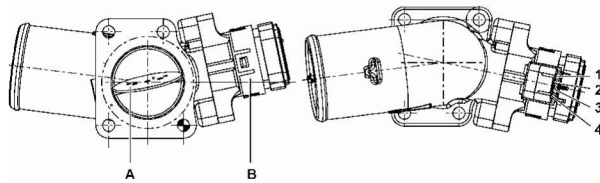
The throttle valve is operated by an electric actuator controlled by a PWM signal from the EDC 16 control unit.

If the throttle valve jams, the control unit will reduce engine performance to prevent engine damage.



The motor-driven throttle body performs two functions:

- shut-off management
- it controls exhaust gas temperature by restricting the cross-section area of the intake duct.



Connector pinout

- 1 – PWM (Pulse Width Modulate) command
- 2 – Power supply
- 3 – Ground
- 4 – Position signal

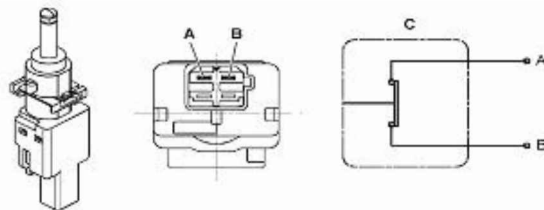
A– Throttle valve

B – Electrical actuator

CLUTCH PEDAL POSITION SWITCH

The clutch pedal position switch is mounted on the pedal assembly and generates a positive signal for the electronic control unit when the clutch is engaged (pedal released).

Whenever the clutch is disengaged to shift gears, the control unit senses that the switch signal is missing and disables the Cruise Control (where fitted).



A – Power supply positive

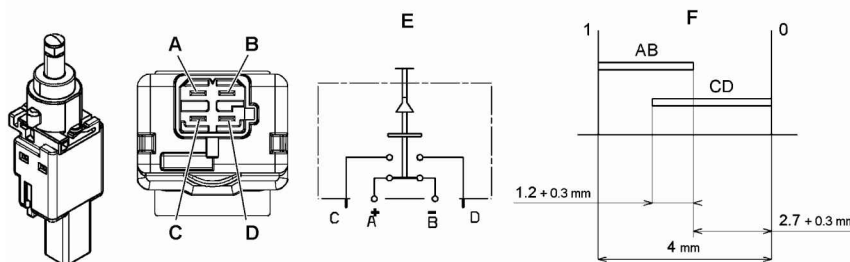
B – Electrical load

C – Wiring diagram (pedal depressed)

BRAKE PEDAL POSITION SWITCH

The brake pedal position switch is mounted on the pedal assembly. When the brake pedal is released, the switch generates a positive signal. The control unit uses this signal to determine when the brake is operated so as to disable the Cruise Control (where fitted) and cut off fuel.

The switch also operates the brake lights.



A – Power supply positive

B – Electrical load

C – Not connected

D – Not connected

E – Wiring diagram (pedal depressed)

F – Diagram showing operation

0 – Brake pedal released

1 – Brake pedal depressed



3.3 DIAGNOSIS

3.3.1 Parameter section

Exhaustive system information can be viewed in the parameter screen, starting with typical engine operation parameters (rpm, water temperature, etc.).

The system is derived from the EDC16C39 SYSTEM developed for Fiat Croma and Alfa 159, so the following parameters should be noted:

SPEED LIM FUNCTION: Possible states are: LEARNT: After proxi alignment, when the vehicle did not exceed the speed limit set in the ECU

SPEED LIMITATION: Displays vehicle speed limitation set in the ECU

WARNING: The following OPTIONAL parameters:

- AC cut-in request
- AC control relay
- Air conditioner pressure
- Cruise control switch
- Request from Cruise control lever
- Irrev. Cruise control error state

will be labelled 'Not available' unless the teach-in procedure for that function has been performed

Parameter description can be viewed by pressing the HELP button in the PARAMETER SELECTION screen

DESCRIPTION	HELP
Engine rpm	ENGINE RPM: Shows engine rotation speed
Accelerator pedal	
Accelerator pos. 1 AD/C	ACCELERATOR POSITION 1 AD/C: Voltage reading of accelerator potentiometer channel 1
Accelerator pos. 2 AD/C	ACCELERATOR POSITION 2 AD/C: Voltage reading of accelerator potentiometer channel 2.
Fuel COR CYL 1	FUEL CORRECTION CYL 1/2/3/4: Amount of fuel added/subtracted for each injector to obtain the same performance from all cylinders and correct possible engine malfunctions.
Fuel COR CYL 2	FUEL CORRECTION CYL 1/2/3/4: Amount of fuel added/subtracted for each injector to obtain the same performance from all cylinders and correct possible engine malfunctions.
Fuel COR CYL 3	FUEL CORRECTION CYL 1/2/3/4: Amount of fuel added/subtracted for each injector to obtain the same performance from all cylinders and correct possible engine malfunctions.
Fuel COR CYL 4	FUEL CORRECTION CYL 1/2/3/4: Amount of fuel added/subtracted for each injector to obtain the same performance from all cylinders and correct possible engine malfunctions.
TOTAL FUEL QTY	TOTAL FUEL QTY: Total overall quantity of Diesel fuel injected
Target fuel PRESS	TARGET FUEL PRESSURE: This is the pressure calculated by the control unit and estimated to occur in the high pressure fuel circuit.
Measured fuel PRESS	MEASURED FUEL PRESSURE: This is the pressure reading taken in the high pressure fuel circuit.
Fuel pressure AD/C	FUEL PRESSURE AD/C: Voltage reading at sensor output.
Press reg opng (MPROP)	PRESS REG OPNG (MPROP): Opening rate of pressure regulator fitted on the high pressure pump at the low pressure circuit end
Meas TURBO PRESS	MEASURED TURBOCHARGING PRESSURE: This is the pressure reading taken in the turbocharging circuit.
Turbo PRESS	TURBOCHARGING PRESSURE AD/C: Voltage reading at sensor



AD/C	output.
Engine oil pressure	
Target air mass	TARGET AIR MASS: Air quantity calculated by control unit according to sensor inputs.
Measured air mass	MEASURED AIR MASS: Quantity of air measured by air flow meter.
EGR control	
EGR valve opening	EGR VALVE OPENING: EGR valve opening rate dictated by ECU signal
Atmospheric pressure	ATMOSPHERIC PRESSURE: Pressure reading taken by sensor housed inside control unit
Air Temp (air flow meter)	AIR TEMP (AIR FLOW METER): Air temperature measurement taken by digital air flow meter
Air Temp (Turbo)	AIR TEMPERATURE (TURBO): Air temperature reading taken inside turbo sensor.
Air Temp AD/C (Turbo)	AIR TEMPERATURE AD/C: Voltage reading at air temperature sensor output.
Water temperature	WATER TEMPERATURE: Engine coolant temperature
Water Temp AD/C	WATER TEMPERATURE AD/C: Voltage reading at water temperature sensor output
Fuel temperature	FUEL TEMPERATURE: Fuel temperature inside Diesel fuel pump.
Fuel temperature AD/C	FUEL TEMPERATURE AD/C: Voltage reading at Diesel fuel temperature sensor output
Battery voltage	BATTERY VOLTAGE: Power supply voltage fed to control unit
Lambda sensor voltage	LAMBDA SENSOR VOLTAGE: Voltage at sensor expressed in millivolts.
Lambda oxygen conc	LAMBDA OXYGEN CONC: Concentration rate . . . of Lambda sensor, range is 0% to 21%.
Vehicle speed	VEHICLE SPEED: Vehicle speed.
Preheat ECU Diag	PREHEATING CONTROL UNIT DIAG: 'ON' means that the glow plug preheating control unit has cut in
Fuel pump relay command	FUEL PUMP RELAY COMMAND: State of Diesel fuel low pressure pump relay command
Fan speed	
Throttle SV opening	THROTTLE SV OPENING: Opening rate of throttle in intake duct (5% = throttle wide open, 95% = throttle closed)
Throttle state	
AC cut-in request	AC CUT-IN REQUEST: Request to switch on air condition compressor
AC relay command	AC RELAY COMMAND: State of air conditioner relay command from control unit.
AC PRESS	
Brake pedal state	BRAKE PEDAL STATE: Indicates whether brake pedal is 'Pressed or 'Released'.
Brake contact 2	BRAKE CONTACT 2: Brake pedal position detected by secondary contact of brake pedal.
Clutch pedal	CLUTCH PEDAL: Clutch pedal position.
Water in diesel filter	
Cruise control switch	CRUISE SWITCH: Possible states are 'On' and 'Off'; when set to 'On', it automatically maintains the cruising speed set by the driver.
Request from Cruise lever	REQUEST FROM CRUISE LEVER: Request triggered by cruise lever (None, Cruise Resume Button (RCL), Set Cruise deceler (-), Set Cruise

