



FIAT DUCATO



DOCUMENTATION MODIFICATIONS / UPDATES

Date	Referent	File name	Description of modification

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1. BRIEFING

1.1 VEHICLE CHARACTERISTICS

Evolution of the Product

Produced by the **Sevel di Val di Sangro** plant 'with a **Joint Venture** between Fiat and PSA, Fiat Ducato has reached its fourth generation, with over 3 million vehicles produced with the three trademarks by the plant in Abruzzo.



Project name: **X2/12**
Produced from 1981 to 1994 (Ducato 10 and 13)
Maxi versions from 1986 to 1994
Restyling in 1990



Project name: **X2/30**
Produced from 1994 to 2002



Project name: **X2/44**
Produced from 2002 to 2006



Project name: **X2/50**
Produced from 2006

The Ducato vocation has always been that of playing a leading role in its Market segment. A vehicle that does not pursue customer needs, but anticipates trends and always provides new opportunities, ever since its birth in 1981, Fiat Ducato has managed to conquer and hold a leading position in its segment in Europe, which is confirmed by its success over these 25 years. Over 1.7 million examples sold in over 80 countries is the most effective proof of the public's great appreciation for this vehicle.



News in brief

Commercial Vehicle customer requirements are continually evolving and, to keep on being a market leader, it is necessary to be able to satisfy and anticipate these needs. For this reason, Fiat Ducato is presented to the public with a completely renewed and grittier styling, with numerous features that will continue to make this vehicle the model of reference in its segment for style, breadth of range, versatility, functionality, performance, driving comfort and quality of life on board.

The product's evolution can be summarized in four macro-areas of operation:

- style renewal
- greater capacity/ease of loading
- greater power/torque of the engines
- greater comfort
- lower running costs

Especially:

- Increased loading capacity with versions having GVW (ground vehicle weight) up to 4 t and capacity up to approximately 2 t.
- Vans with a useful volume of up to 17m³ with an inside length of up to over 4 metres.

Two ranges of mechanics:

"Light" (15" wheels/tyres) with GVW up to 3.5 t

"Maxi" (16" wheels/tyres) with GVW from 3.5t to 4t .

- Height of the loading deck off the ground markedly lower to facilitate loading and unloading goods. 53 cm against 56 cm of the previous range.
- Improvement in safety, protection against theft of the vehicle and of the load, repairability and reduction in running costs.
- Improvement in driving pleasure, comfort, quality of life on board (ergonomics, acoustic, climatic and vibrational comfort).
- Complete renewal in the range of engines, compliance with the Euro4 standard: more powerful, more elastic, more reliable and more economical.

The sales launch is scheduled for June 2006.

Besides the dimensions and load capacity, which are "*basic requirements*", the product features that can make a difference compared to the competition concern the emotional and technological spheres, covering needs that are emerging more and more, also in the commercial vehicle sector, such as:

- style
- comfort
- performance
- on-board telematics
- running costs
- safety

And it is precisely in these areas where the new vehicle presents great innovations and significant improvements over its predecessors.



Engine versions

The New Ducato is equipped from its very sales launch with the 2.2 Multijet 100 bhp, 2.3 Multijet 120 bhp and 2.3 Multijet 130 bhp engines. The gearboxes are the MLGU with 5 and 6 gears. The following table gives the engine-clutch-gearbox combinations for the vehicle:

Engine	Clutch	Gearbox
2.2 (100 bhp)	Luk	MLGU 5/6m
2.3 (120 bhp)	Valeo	MLGU 6m
2.3 (130 bhp)	Valeo	MLGU 6m

At the end of 2006 in addition there is going to be the 3.0 Multijet Sofim engine with M40 gearbox with a power output of 160 bhp and torque of 400 Nm.

Drive

The X2/50 drive, as that of its predecessor, is front wheel, with front transverse engine, MC Pherson front suspensions and rigid rear axle suspensions with leaf springs. This design ensures optimum driving stability, excellent use of the goods compartment and cab room, reduced weight and great versatility. The front-wheel drive is ideal for uses such as the leisure versions: having no bulky rear transmission members allows the designers to make increasing improvements to the living spaces.

The "all ahead" solution makes a significant contribution to passenger comfort, while the manoeuvrability and driving precision of this architecture are unquestionable. On motorways and with mixed driving the all ahead advantages are fully appreciated.

Suspensions

In the mechanics of a commercial vehicle, the suspensions are considered components of primary importance when considering the stresses generated by heavy loads, often distributed unevenly. The suspensions allow the vehicle to negotiate every type of road or route without transmitting the wheel jolts generated by a variety of road surfaces into the passenger compartment, by reducing the body's lateral (rolling) and longitudinal (pitching) oscillations, by absorbing the vertical oscillations and always keeping the maximum road grip to the ground.

Good suspensions therefore mean good safety, comfort, less tyre wear, full use of the maximum load limits, lowering the height of the loading deck and better driveability and road holding on every kind of surface. The suspensions of the New Ducato have been designed to meet all these ends.

Considering the importance of these particular mechanics for safety, handling and comfort, great attention has been paid to the design and experimentation of the new suspensions of the New Ducato.

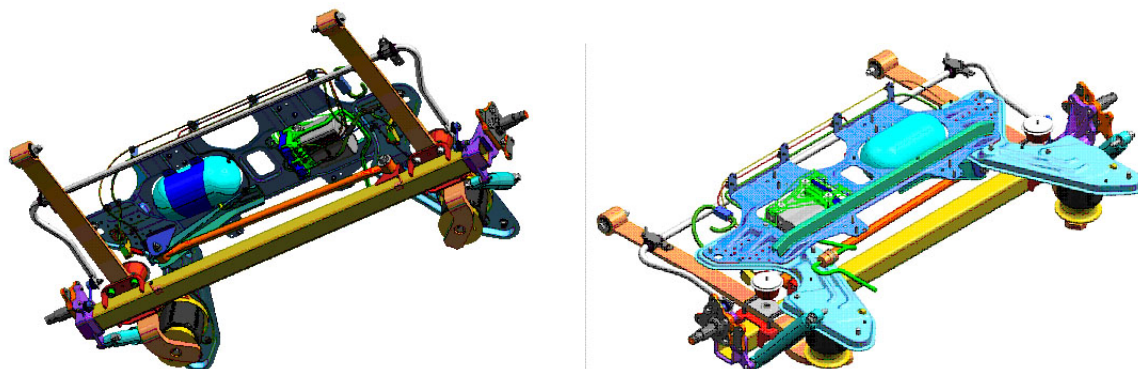
Rear suspension with increased track width

A suspension is available with track width increased to 1980mm (the normal track width is 1790mm). This is mainly combined with the leisure conversion bases (motor homes, box bodies, mobile shops, special conversions).

Self-levelling rear air suspensions

The truly great new feature as regards the suspensions on the new Ducato is the introduction of self-levelling air suspensions that are to be fitted on the vehicle at the end of 2006.

They ensure great comfort and constant driving position in all load conditions (vehicle laden or unladen, goods positioned symmetrically or asymmetrically) and they permit lowering the rear load threshold (down to -70mm) to help loading/unloading goods, or raising the vehicle at the back to improve the ramp angle and/or obstacles passing under the vehicle.



Compared to normal suspensions, the load threshold level is lower and allows the user to lower it further with the push-buttons on the dashboard.

Alongside the steering column, on the side stop plate, there are two buttons with indicator lights that the driver can use, one to raise and one to lower the vehicle. The stability position is adjustable only with the vehicle at a standstill (speed 0 km/h). The buttons are active even with the engine switched off.

It is possible to select 11 positions, 5 for lifting, 5 for lowering and the 0 position that corresponds to the nominal driving level. Each time the button is pressed, a message appears on the display of the instrument panel

Once adjusted, the driving position is kept set up to a speed of 15 km/h. Above this speed the driving position automatically goes back to the nominal driving level. During the adjustment, the indicator light on the push-button corresponding to the direction of the movement blinks; normally, both lights are off. Pressing the buttons simultaneously for 5 sec turns off the system (position 0): the indicator lights on the push-buttons come on steady. In these conditions it is possible to service the vehicle on a lift or change a wheel with the jack provided. Pressing both buttons again for 5 seconds turns the system back on and the indicator lights go out.

The instrument panel has a specific warning light to signal any trouble with the aid suspensions.

Braking system

The braking system fitted on the New Ducato uses the most sophisticated electronic and mechanical systems to be found today on vehicles of the latest generation in higher segments.

The system is the hydraulic servo-assisted type, comprising 2 cross independent circuits (each circuit acts on a front wheel and on the diagonally opposite rear one) to ensure braking and stability even if one circuit fails.

The entire range is equipped as standard with:

- ventilated brake disks on the front wheels and disks on the rear ones
- **ABS**: anti-lock braking system
- **EBD** (Electronic Brake force Distribution): electronic braking divider between front and rear wheels.

From the optionals it is possible to order:

- **ASR**: anti-skid regulation system;
- **ESP** (Electronic Stability Program): electronic vehicle stability control;
- **Hill-holder** (with ESP): a device that allows the driver to park and start the vehicle again along steep roads without using the handbrake;



- **MBA system** (Mechanic Brake Assistance), **HBA** (Hydraulic Brake Assistance, with ESP): electro-hydraulic braking assistance that automatically increases the pressure of the braking circuit during panic braking.

Passive safety

The passive safety of a vehicle is the whole of the technical and product solutions that protect the driver and the passengers in case of front, side and rear crashes.

The safety performance ensured by the New Ducato result from an accurate combination of the structural components, the high number of special devices that make up the occupant protection system and the measures taken in designing the components.

The X250 passenger compartment is a real **survival cell** equipped with:

- reinforced structures;
- energy absorbing zones in the event of a crash (programmed deformation zones that dissipate the energy generated by the collision - to protect the passenger compartment);
- occupant restraint and protection systems.

These elements together permit fully reducing the stresses to which the vehicle's occupants are subjected during a crash. The devices that protect the vehicle's occupants in a crash comprise:

3-point seat belts

All the seats are equipped with belts with three anchoring points, with the sole exception of the four-seat bench of the second row on Double Chassis Cabs whose two middle seats are equipped with lap belts.

Electronic control unit of the restraint system

It constitutes the "core" of the occupant restraint system and is located on the front tunnel. It simultaneously controls all the restraint system actuation and detection devices by processing signals from the various sensors found on the vehicle and from the ones installed inside it and it decides which and how many protection devices to actuate in the event of an accident.

Driver's side front airbag with double actuation stage

It consists of an instantly inflating cushion held in a special compartment located in the middle of the steering wheel (cover). Its capacity is 60 litres.

Passenger side front airbag (opt)

It consists of an instantly inflating cushion held in a special compartment located in the instrument board. The cushion volume is greater than the driver's side cushion so as to protect both occupants if there is a two-seat bench in the cab. Its capacity is 120 litres.

Side bags (opt)

They consist of instantly inflating cushions housed in the seat backs, which are used to protect the occupant's chest in case of medium-to-high seriousness side collision. They are fitted to the seat so as to always ensure the maximum efficiency depending on the seat position.

Window bags (opt)



They consist of two "curtain" cushions housed in the side roof panel coverings and coated with special trimmings. They are used to protect the front occupants' heads in case of side collisions, thanks to the wide deployment surface of the cushions.

Electric power supply and fuel cut-off switch

The vehicle is equipped with a safety switch that trips in the event of a crash, cutting off the supply of fuel and as a result stopping the engine. Besides which there is an additional safety switch that trips in the event of a crash, cutting off the electric power supply. This prevents fuel spillage when the pipes burst and sparks or electric discharges forming after damage to the vehicle's electric components.

Isofix anchorage for child seats

The rear bench seats, as the single rear seats, are equipped with Isofix anchorages for child seats. If the child seat does not have Isofix clips, the length of the safety belts has been sized to install a child seat both on the rear seats and on the front passenger seat.

Video camera system and display for rear vision

The parking video camera system, which will equip the Ducato at the end of 2006, enables the driver to see the scenario behind the vehicle on a display in the cab.

The system is composed of a video camera installed in a plastic casing on the rear tie of the van roof that also includes the third brake light and a display inside a plastic casing and housed on the shelf under the roof panel in the driver's cab.

The display is equipped with digital buttons (On/Off, brightness, backlight); to use it you need to press the release button and move the display into the open position.

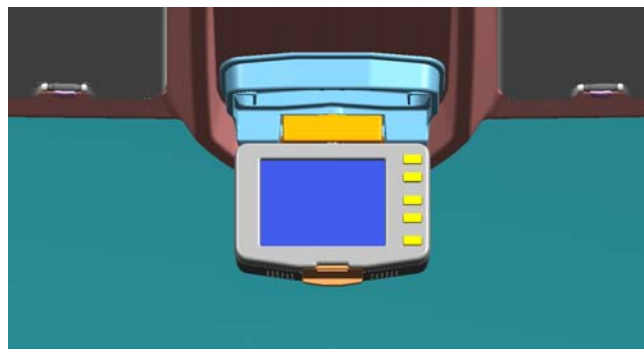
The display can be adjusted with mirror mode for rear vision.

When not used it must be put away in the shelf area.

The system is turned on with the ignition key on at a speed of less than 15km/h by engaging reverse gear or with a specific button and it turns off on exceeding a speed of 18km/h. On leaving reverse gear the image remains on the display for another 5 seconds.



Rear video camera

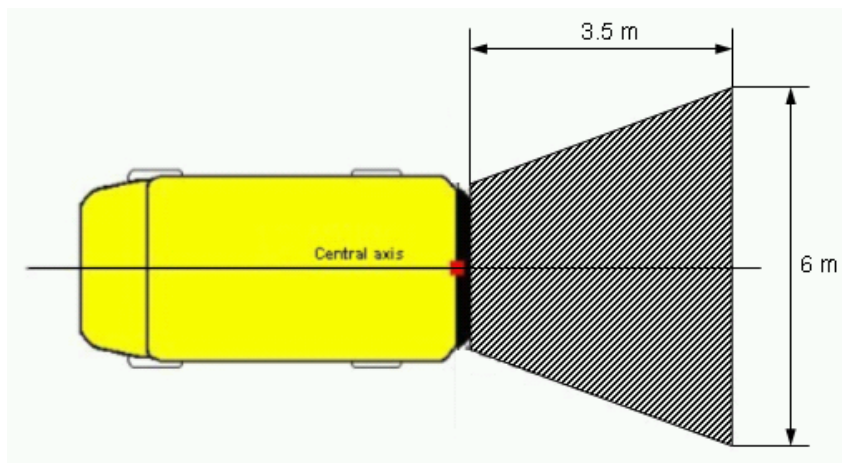


Display

Vision is ensured for all vehicle conditions (including full load), for all vehicle versions and for all weather conditions (fine, rain, snow and fog).

The visibility of the video camera in conditions of darkness is ensured by the reversing light.

The minimum coverage ensured by the video camera is 3.5 m in length and 6 m in width max.



Area of vision

Tachograph

An electronic and digital tachograph will be available at the end of 2006 as **standard or optional** in order to comply with legislation on vehicles assigned to:

- transport of persons with more than nine seats in category **M2**.
- transport of goods with GVW greater than 3.5 t, in category **N2**



Loading space and volume

The parameters declining posture, the position of the driving seat and of the passenger seats, the vehicle's overall liveability and the internal volume have been optimized so as to increase the available space both in the cab and in the goods compartment.

The solutions implemented have made it possible to obtain a vehicle at the vertex of its category as regards useful volume of the loading compartment (which goes from 8 to 17m³ depending on the version) and at the same time excellent liveability of both the cab and the rear passenger zone, for the people carrier versions.

Worthy of note, moreover, is the increase in cab space compared to the previous Ducato, especially for the driver, in terms of length (from the accelerator to the cab-loading compartment partition).

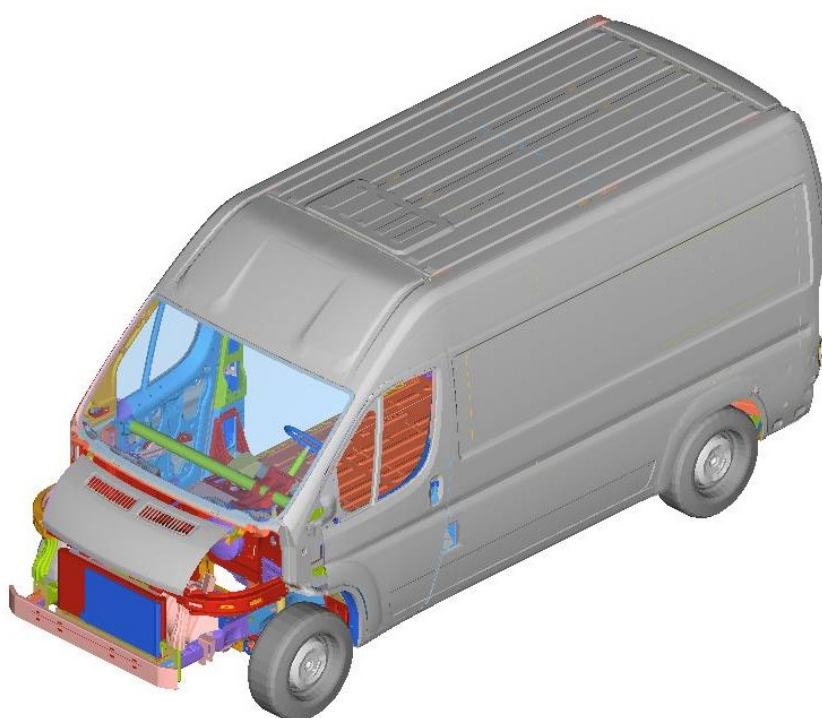


Features of the Bodywork

The body has been designed taking account of using the greatest number of common components, using many sections for the various versions of height and length, suitably breaking down the parts without affecting the vehicle's mechanical characteristics and safety features.

The torsional rigidity of the complete vehicle on the medium wheelbase medium roof version (mh2) has been increased by 30% compared to the current Ducato (passing from **133,800 kgm/rad** to **174,700 kgm/rad**), even though the vehicle is 300 mm longer and the goods compartment 1m³ bigger. This means that the vehicle is stronger, more compact and has less creaking.

The design of the vehicle has taken the weight aspect into great consideration, while the size of the goods compartment has increased by 15%, the vehicle's weight has increased by only 6.5%; the thicknesses and quality of the plate have been optimized to the full advantage of the carrying capacity.



2. TECHNICAL DATA

2.1 ENGINE

Engine type

	2.2 (100 bhp)	2.3 (120 bhp)	2.3 (130 bhp)
Code type	4HV	Sofim F1AE0481ID	Sofim F1AE0481IM
Position	Front Transverse	Front Transverse	Front Transverse
No. of cylinders	4	4	4
Cylinder arrangement	In-line	In-line	In-line
Nr. valves per cylinder	4	4	4



Cycle	Diesel	Diesel	Diesel
Timing system	2ACT	2ACT	2ACT
Fuel supply	Diesel Common Rail	Diesel Common Rail	Diesel Common Rail

Engine data

	2.2 (100 bhp)	2.3 (120 bhp)	2.3 (130 bhp)
Bore (mm)	86	88	88
Stroke (mm)	94,6	94	94
Total displacement (cm³)	2198	2287	2287
Compression ratio	17,5 : 1	19 ± 0.5 : 1	19 ± 0.5 : 1
Maximum power output (kW/bhp)	74 / 100	88 / 120	95,5 / 130
Maximum power speed (rpm)	2900	3600	3600
Peak torque (kgm / Nm)	25,5 / 250	32,6 / 320	32,6 / 320
Peak torque speed (rpm)	1500	2000	2000

Injection

	2.2 (100 bhp)	2.3 (120 bhp)	2.3 (130 bhp)
Type	VISTEON V347/8	Bosch EDC16c39	Bosch EDC16c39
Injection order	1-3-4-2	1-3-4-2	1-3-4-2

2.2 CLUTCH

	2.2 (100 bhp)	2.3 (120 bhp)	2.3 (130 bhp)
Type	Dry single-plate	Dry single-plate	Dry single-plate
Drive	Push-type	Push-type	Push-type
Control	Hydraulic with external piston actuator *	Hydraulic control with coaxial, internal actuator	Hydraulic control with coaxial, internal actuator
Supplier	Luk (Sac)	Valeo	Valeo

* On the six-gear version (opt) the control is coaxial.

2.3 GEARBOX

	2.2 (100 bhp)	2.3 (120 bhp)	2.3 (130 bhp)
Type	MLGU	MLGU 6m	MLGU 6m



There are synchronizers on all the gears

2.4 BRAKES

Braking system

	2.2 (100 bhp)	2.3 (120 bhp)	2.3 (130 bhp)
Type	Hydraulic, servo-assisted	Hydraulic, servo- assisted	Hydraulic, servo-assisted
Servo brake cylinder diameter	11"	11"	11"
Anti-lock system	BOSCH 8.0	BOSCH 8.0	BOSCH 8.0

Front brakes

	PTT 3000 and 3300 – wheels 15"	PTT 3500 L– wheels 15"	PTT 3500 H– wheels 16"	PTT 4000 – wheels 16"
Type of disc	Ventilated	Ventilated	Ventilated	Ventilated
Disc diameter (mm)	280	280	300	300
Rated thickness (mm)	24	28	24	32
Caliper piston diameter (mm)	44 + 48	46 + 52	46 + 52	46 + 52

Rear brakes



	PTT 3000 and 3300 – wheels 15"	PTT 3500 L– wheels 15"	PTT 3500 H– wheels 16"	PTT 4000 – wheels 16"
Type of disc	Non-ventilated	Non-ventilated	Non-ventilated	Non-ventilated
Disc diameter (mm)	280	280	280	280
Rated thickness (mm)	16	16	16	16
Caliper piston diameter (mm)	48	48	48	48

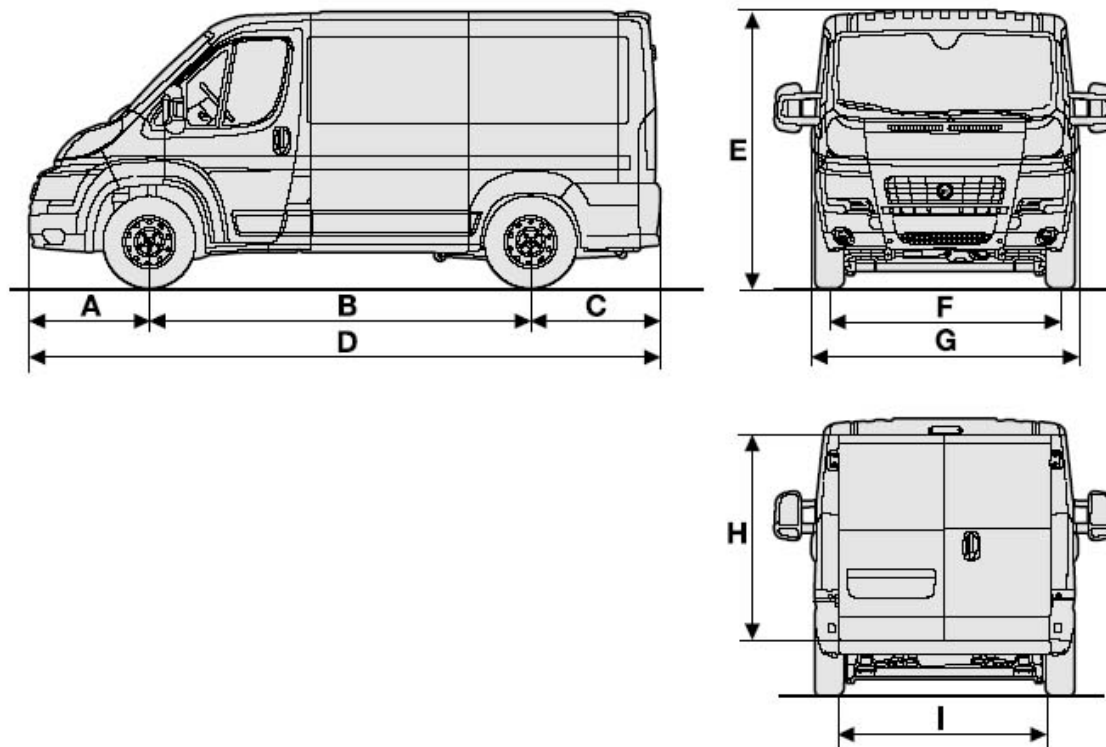


2.5 VEHICLE FEATURES

Dimensions

The following figures summarize the main dimensions of the vehicle given in mm

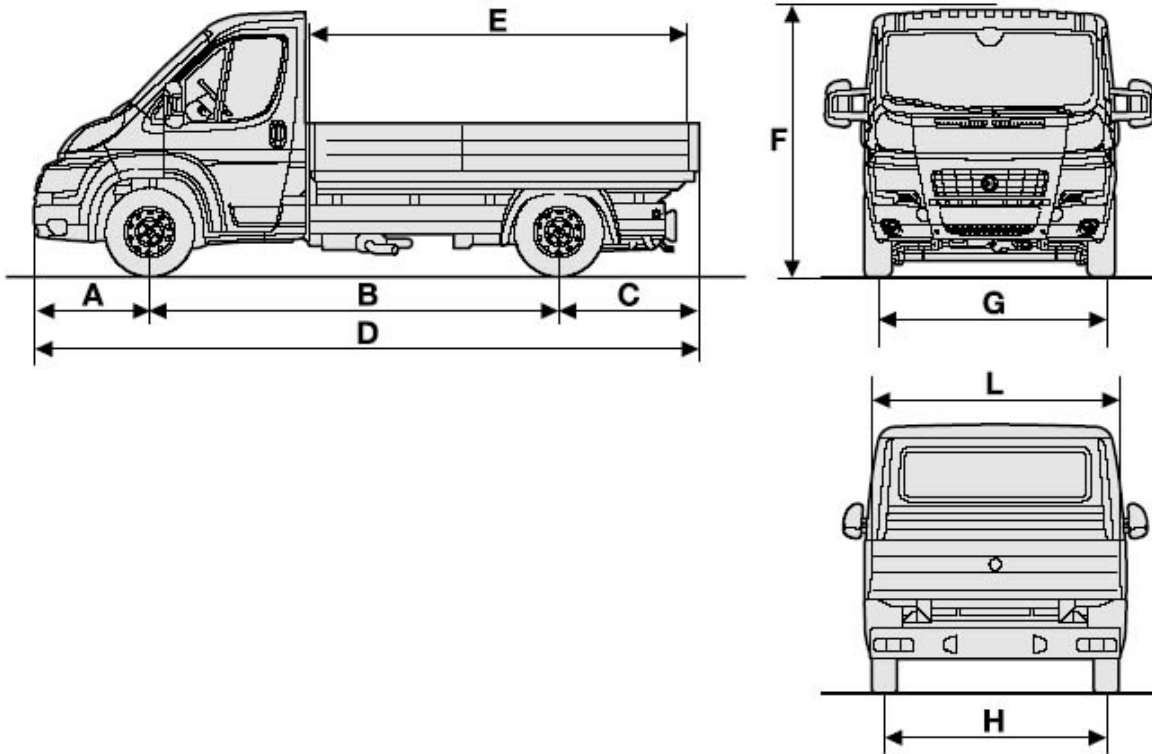
VAN VERSION



VERSIONS	VAN			
	CHI	MHI MH2	LH2 LH3	XLH2 XLH3
A	948	948	948	948
B	3000	3450	4035	4035
C	1015	1015	1015	1380
D	4963	5413	5998	6363
E	2254	2254 / 2524	2524 / 2764	2524 / 2764
F	1810	1810	1810	1810
G	2050	2050	2050	2050
H	-	-	-	-
I	1790	1790	1790	1790



TRUCK VERSION



VERSIONS	BOX-BODY			
	CH1	MH1	LH1	XLH1
A	948	948	948	948
B	3000	3450	4035	4035
C	1345	1345	1345	1710
D	5293	5743	6328	6693
E	2798	3248	3833	4198
F	2254	2254	2254	2254
G	1810	1810	1810	1810
H	1790	1790	1790	1730
L	2100	2100	2100	2100



VERSIONS	CHASSIS CAB			
	CH1	MH1	LH1	XLH1
A	948	948	948	948
B	3000	3450/3800	4035	4035
C	960	960	960	1325
D	4908	5358 / 5708	5943	6308
E	-	-	-	-
F	2254	2254	2254	2254
G	1810	1810	1810	1810
H	1790-1980	1790-1980	1790-1980	1790-1980
L	2050	2050	2050	2050

VERSIONS	CHASSIS COWL			
	CH1	MH1	LH1	XLH1
A	925	925	925	925
B	3000	3450-3800	4035	4035
C	860	860	860	1225
D	4785	5235/5585	5820	6185
E	-	-	-	-
F	-	-	-	-
G	1810	1810	1810	1810
H	1790-1980	1790-1980	1790-1980	1790-1980
L	2050	2050	2050	2050



VERSIONS	SPECIAL CHASSIS CAB			
	CH1	MH1	LH1	XLH1
A	948	948	948	948
B	3000	3450/3800	4035	4035
C	880	880	880	1245
D	4808	5278/5628	5863	6228
E	-	-	-	-
F	2254	2254	2254	2254
G	1810	1810	1810	1810
H	1790-1980	1790-1980	1790-1980	1790-1980
L	2050	2050	2050	2050

VERSIONS	SPECIAL CHASSIS COWL			
	CH1	MH1	LH1	XLH1
A	925	925	925	925
B	3000	3450/3800	4035	4035
C	880	880	880	1245
D	4805	5255/5605	5840	6205
E	-	-	-	-
F	-	-	-	-
G	1810	1810	1810	1810
H	1790-1980	1790-1980	1790-1980	1790-1980
L	2050	2050	2050	2050

CH1_ C: short wheelbase, H1: height1
 MH1_ M: medium wheelbase, H1: height1
 MH2_ M: medium wheelbase, H2: height2
 LH1_ L: long wheelbase, H1: height1
 LH2_ L: long wheelbase, H1: height2
 LH3_ L: long wheelbase, H3: height3
 XLH1_ XL: extra long overhang, H1: height1
 XLH2_ XL: extra long overhang, H2: height2
 XLH3_ XL: extra long overhang, H3: height3



2.6 PREVENTIVE MAINTENANCE**Engine 2.3 (120/130 bhp)**

Description	45	90	135	180	225
Check tyre conditions/wear, and adjust pressure, if necessary.	+	+	+	+	+
Check operation of lighting system (headlamps, indicators, emergency lights, luggage compartment/passenger & driver compartment lights; instrument panel warning lights, etc.).	+	+	+	+	+
Check operation of windscreen wiper & washer; adjust nozzles if necessary.	+	+	+	+	+
Check positioning/wear of windscreen wipers	+	+	+	+	+
Check conditions of wear of brake pads and check the front and rear disk pad wear indicator works properly (if fitted)	+	+	+	+	+
Check conditions of wear of the rear drum brake linings (if fitted)		+		+	
Visually inspect the conditions and soundness of body outside, underbody protection, rigid and flexible pipe lengths (exhaust, fuel feed and brake pipes and hoses), rubber parts (boots, sleeves, bushes, etc.)	+	+	+	+	+
Visually inspect the conditions/tensioning of accessory drive belts (except on engines equipped with automatic tensioners)		+			+
Check the fluid levels (engine cooling, brakes, windscreen washer, battery, etc.) and top up, if necessary	+	+	+	+	+
Check and if necessary adjust the handbrake lever travel	+	+	+	+	+
Visually inspect the conditions of accessory drive belt(s)				+	
Check that the locks are clean and the levers clean/lubricated	+	+	+	+	+
Check exhaust gas emissions/smokiness	+	+	+	+	+
Check the functioning of engine control systems (by means of diagnosis plug)	+	+	+	+	+
Replace the accessory drive belt(s)			+		
Check the timing gear belt		+			
Change the timing system drive belt (*)				+	
Change fuel filter	+	+	+	+	+
Change air filter cartridge	+	+	+	+	+
Change engine oil and engine oil filter	+	+	+	+	+
Change brake fluid (or every 24 months)		+		+	
Change pollen filter (or every 24 months)	+	+	+	+	+

(*): Or every 4 years for harsh use (cold climates, city use, long distances at low speed, use on roads that are particularly dusty or spread with sand and/or salt). Or every 5 years irrespective of the mileage.



Engine 2.2 (100 bhp)

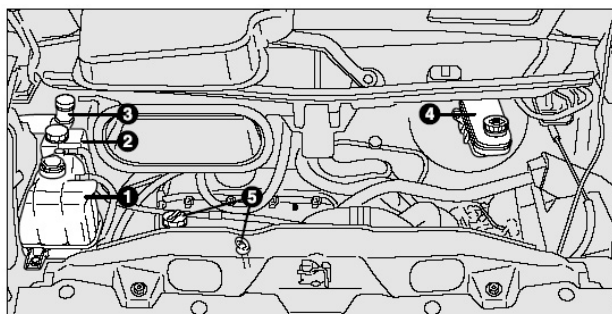
Description	40	80	120	160	200
Check tyre conditions/wear, and adjust pressure, if necessary.	+	+	+	+	+
Check operation of lighting system (headlamps, indicators, emergency lights, luggage compartment/passenger & driver compartment lights; instrument panel warning lights, etc.).	+	+	+	+	+
Check operation of windscreen wiper & washer; adjust nozzles if necessary.	+	+	+	+	+
Check positioning/wear of windscreen wipers	+	+	+	+	+
Check conditions of wear of brake pads and check the front and rear disk pad wear indicator works properly (if fitted)	+	+	+	+	+
Check conditions of wear of the rear drum brake linings (if fitted)		+		+	
Visually inspect the conditions and soundness of body outside, underbody protection, rigid and flexible pipe lengths (exhaust, fuel feed and brake pipes and hoses), rubber parts (boots, sleeves, bushes, etc.)	+	+	+	+	+
Visually inspect the conditions of accessory drive belts		+			+
Check the fluid levels (engine cooling, brakes, windscreen washer, battery, etc.) and top up, if necessary	+	+	+	+	+
Check and if necessary adjust the handbrake lever travel	+	+	+	+	+
Visually inspect the conditions of accessory drive belt(s)		+	+		
Check that the locks are clean and the levers clean/lubricated	+	+	+	+	+
Check exhaust gas emissions/smokiness	+	+	+	+	+
Check the functioning of engine control systems (by means of diagnosis plug)	+	+	+	+	+
Replace the accessory drive belt			+		
Change fuel filter	+	+	+	+	+
Change air filter cartridge	+	+	+	+	+
Change engine oil and engine oil filter	+	+	+	+	+
Change brake fluid (or every 24 months)		+		+	
Change pollen filter (or every 24 months)	+	+	+	+	+

Servicing must be done every 30000 km if the vehicle is chiefly used in any of the following particularly harsh conditions:

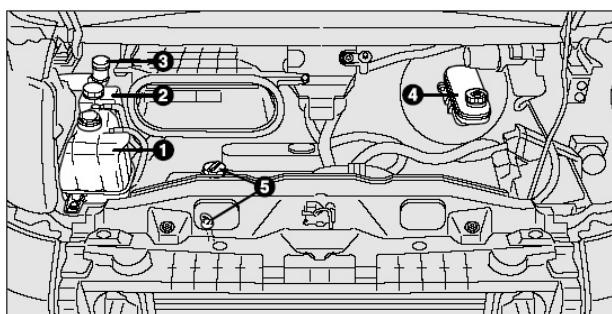
- Towing trailer or caravan;
- Dusty roads;
- Short trips (less than 7-8 km) repeated with outside temperatures below freezing;
- Engine frequently left idling or running long distances at low speed (door-to-door delivery for example), or if not used for a long time;
- City traffic.



2.7 FLUIDS



Engine 2.2 (100 bhp)



Engine 2.3 (120/130 bhp)

1. Engine coolant
2. Power steering fluid
3. Washer fluid
4. Brake fluid
5. Engine oil

Characteristics of Fluids and Lubricants

	2.2 (100 bhp)	2.3 (120 bhp)	2.3 (130 bhp)
Engine oil	Selenia WR	Selenia WR	Selenia WR
Gearbox/differential oil	Tutela Car Experia	Tutela Car Experia	Tutela Car Experia
Brake and clutch control fluid	Tutela Top 4	Tutela Top 4	Tutela Top 4
Power steering fluid	Tutela GI / E	Tutela GI / E	Tutela GI / E
Radiator fluid	Paraflu Up at 50%	Paraflu Up at 50%	Paraflu Up at 50%
Grease for front constant-velocity universal joint, differential side	Tutela MRM Zero	Tutela MRM Zero	Tutela MRM Zero
Grease for front constant-velocity universal joint, wheel side	Tutela STAR 500	Tutela STAR 500	Tutela STAR 500
Windscreen/rear window washer fluid	Tutela Professional SC 35	Tutela Professional SC 35	Tutela Professional SC 35

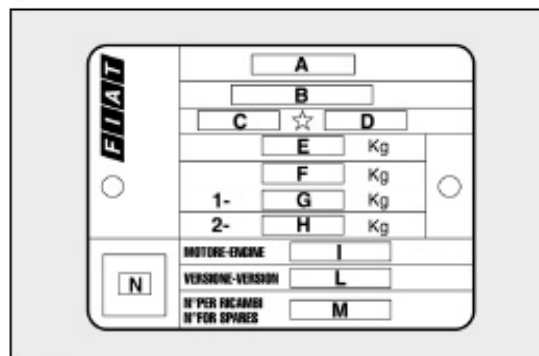


Capacities of Fluids and Lubricants

	2.2 (100 bhp)	2.3 (120 bhp)	2.3 (130 bhp)
Engine oil (sump and filter) (litres)	6,38	6,5	6,5
Gearbox/differential oil (litres)	2,4	2,7	2,7
ABS/(ASR - ESP) brake circuit fluid (litres)	0,6/0,62	0,6/0,62	0,6/0,62
Power steering fluid	1,5	1,5	1,5
Windscreen, rear window washer fluid	5,5	5,5	5,5
Climate control unit system gas/with supplementary air-conditioner (g)	550 ± 40 / 950± 40	550 ± 40 / 950± 40	550 ± 40 / 950± 40

2.8 VEHICLE IDENTIFICATION DATA

Summary identification data plate

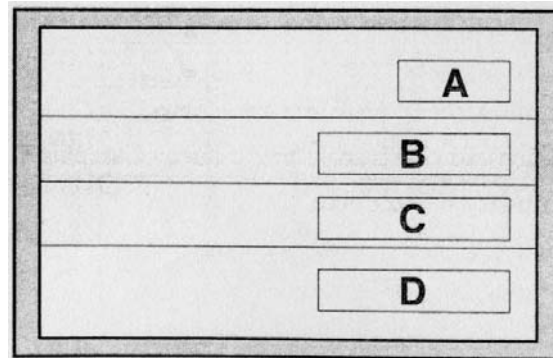


It is fitted on the front tie of the engine compartment and bears the following data:

- A: name of manufacturer
- B: type-approval number
- C: vehicle-type identification code
- D: progressive chassis fabrication number
- E: maximum authorized weight of the vehicle at full load
- F: maximum authorized weight of the vehicle at full load plus trailer
- G: maximum authorized weight on the first axle (front)
- H: maximum authorized weight on the second axle (rear)
- I: engine type
- L: bodywork version code
- M: number for spare parts
- N: correct value of the smoke coefficient (for diesel engines)



Bodywork paint identification plate under bonnet on passenger side



DATA:

A: paint manufacturer

B: name of colour

C: Fiat colour code

D: colour code for retouches or repainting

Chassis marking



Plate at the bottom of the windscreen



Plate on the wheelhouse, inside on passenger side

Data given:

type of vehicle

progressive chassis fabrication number

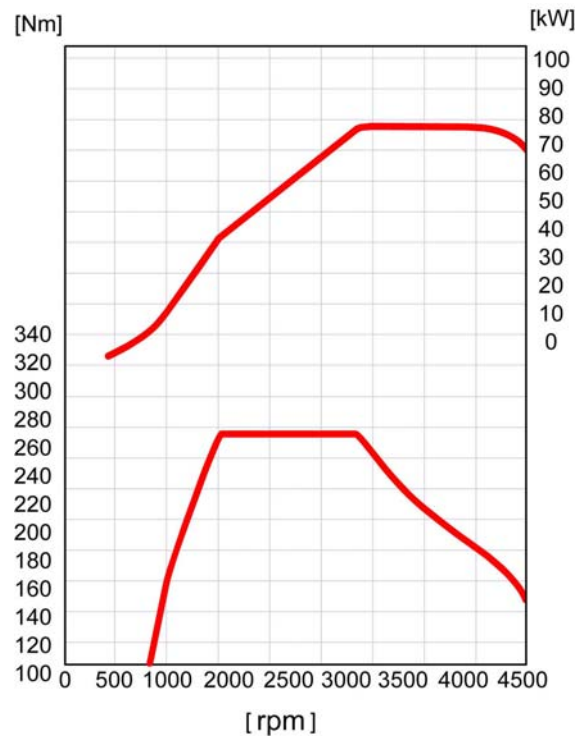
Engine marking

It is stamped on the cylinder block and gives the type and progressive fabrication number.



3. ENGINE

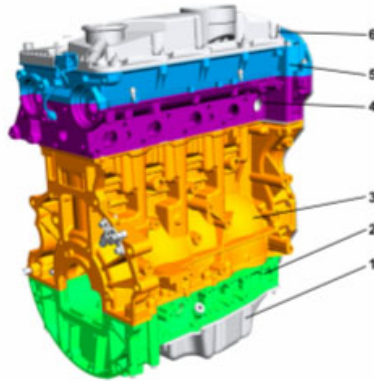
3.1 2.2 ENGINE



The main features of the 2.2 engine are the following:

- turbocharged Diesel engine with fixed geometry turbocharger;
- level of emissions complies with the Euro 4 standard
- power output: 74 kW;
- arrangement with four cylinders in-line;
- displacement 2198 cc;
- bore: 86 mm;
- stroke: 94.6 mm;
- head and overhead made of aluminium alloy;
- timing gear with chain drive;
- twin overhead camshaft with 16-valve timing system;
- rocker arms and hydraulic tappets are fitted on a single cam shaft mounting;
- compression ratio: 17.5:1;
- outside water pump;
- engine control unit: Visteon;
- Denso 1600 bar injection system;
- one-piece block made of nodular cast iron;
- oil sump made of plate.

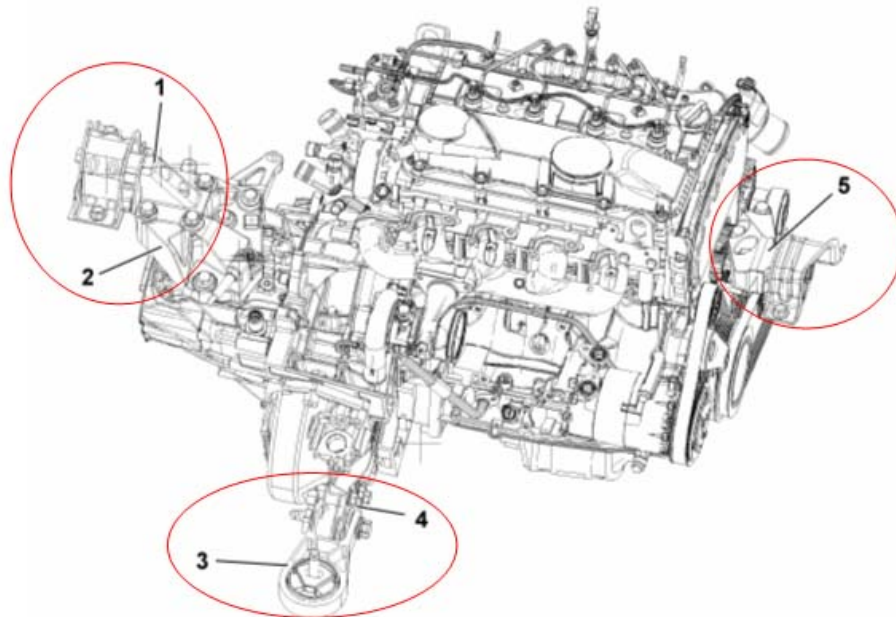




- 1 – Oil sump
- 2 – Crankcase base (lower crankcase)
- 3 – Crankcase
- 4 – Cylinder head
- 5 – Single cam shaft mounting
- 6 – Cylinder head cover

Engine supports

Each support features a metal-rubber dowel used to dampen the vibrations generated by the engine, thus reducing to a significant extent the vibrations transmitted to the body.

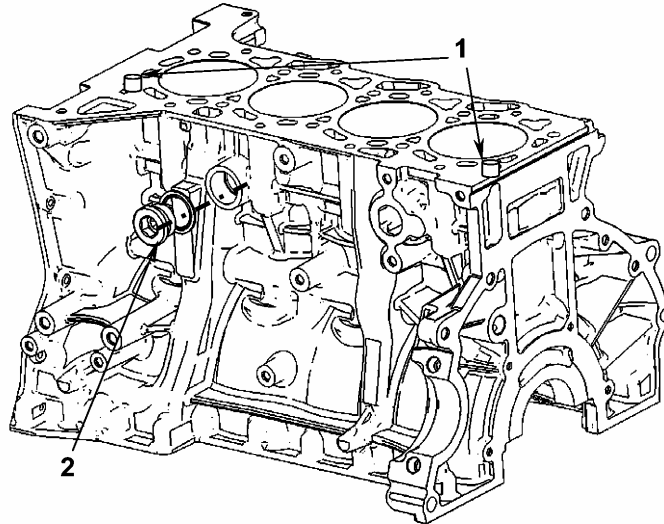


- 1 – Flexible support, gearbox side
- 2 – Supporting bracket, gearbox side
- 3 – Rear screw-stay link rod
- 4 – Rear supporting bracket
- 5 – Flexible support, timing gear side



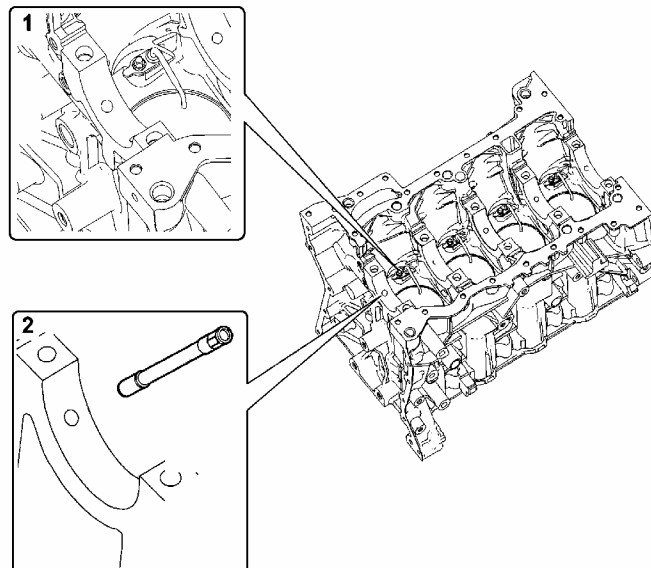
Crankcase

In cast iron with five main bearing housings.



- 1 – Reference pins for positioning the cylinder head correctly
- 2 – Plug

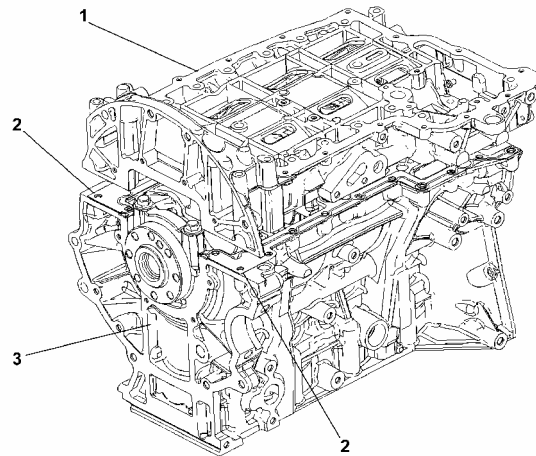
At the bottom of the crankcase there are jets from which engine oil is sprayed to cool the pistons and lubricate the pin.
There is a filter for the lubricating oil by the main bearing housing (timing gear side).



- 1 – Cooling jet
- 2 – Duct with oil filter



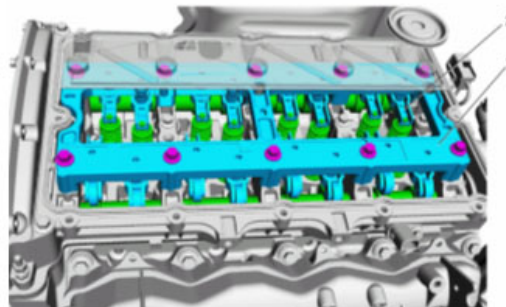
The engine is equipped with a crankcase base made of aluminium alloy. Between the crankcase and the crankcase base there is a gasket (made of two separate pieces, one for the intake side and the other for the exhaust side).



- 1 – Crankcase base
- 2 – Gasket
- 3 – Crankcase

Cylinder head

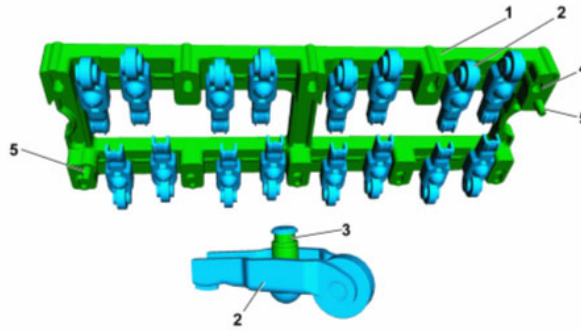
The cylinder head is of the single-structure type and is made from aluminium and silica alloy. Valve opening is controlled by two overhead camshafts, made of nodular cast iron, with a chain drive. The camshaft support is made of aluminium alloy in a single piece. The four valves per cylinder are located in their respective guides and driven by rocker arms actuated by the cams of the camshafts and kept in contact with the valves by means of hydraulic tappets. The rocker arms and hydraulic tappets are fitted on a single support positioned above the camshafts. The gasket between the cylinder head and the crankcase is made of metal; moreover, the cylinder head shall not be retightened during the entire engine life. The single support of the hydraulic tappets and rocker arms is secured above the camshafts.



- 1 – Single support for hydraulic tappets and rocker arms
- 2 – Rocker arm



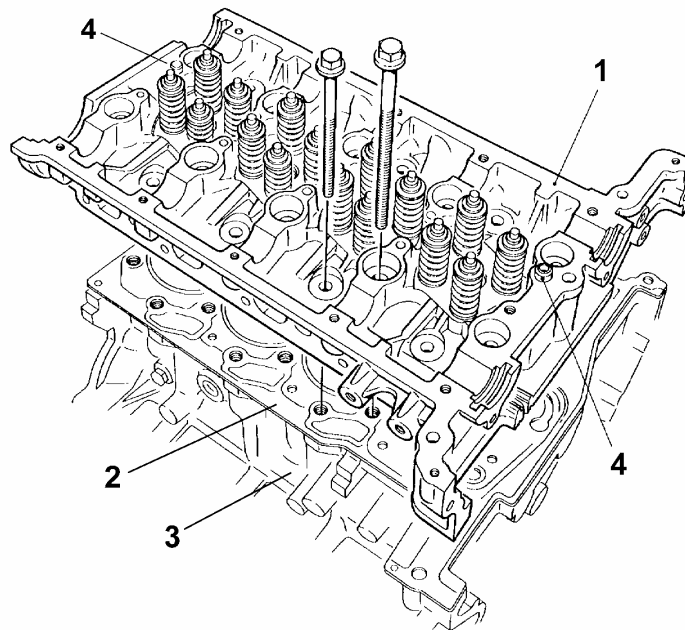
There are two centring pins on the support for correct alignment with the support of the camshafts (5).



- 1 – Single support for hydraulic tappets and rocker arms
- 2 – Rocker arm
- 3 – Hydraulic tappet
- 4 – Oil duct
- 5 – Reference pin

There are holes on the single support of the camshafts for the oil to pass from the cylinder head towards the tappet support.

The head is made of aluminium alloy. There are two centring bushes (4) on the head to position the camshaft support correctly.



- 1 – Cylinder head
- 2 – Gasket
- 3 – Engine block
- 4 – Centring bush

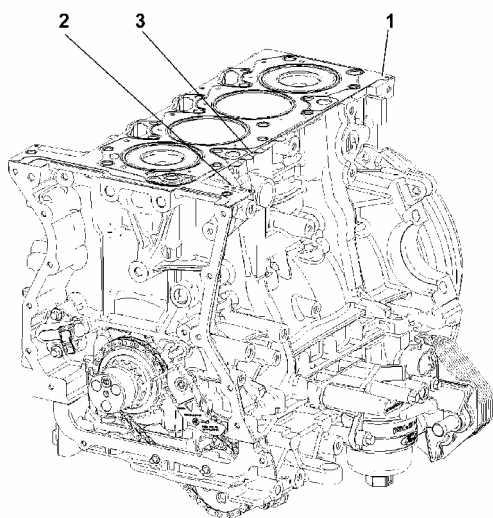


Head gasket

The gasket between the cylinder head and the crankcase is composed of three layers of stainless steel covered with a special heat-resistant rubbery material.

The gasket can be supplied in three different thicknesses, identified by its number of teeth and holes:

- 1 tooth and 1 hole: thickness class 1
- 2 teeth and 2 holes: thickness class 2
- 3 teeth and 3 holes: thickness class 3



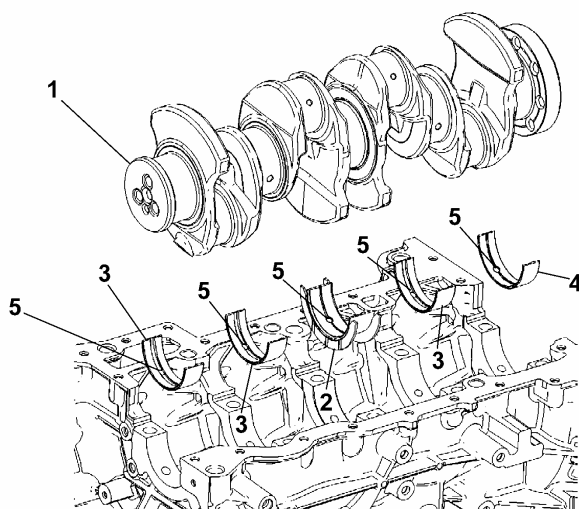
1. Head gasket
2. Thickness identification holes
3. Thickness identification teeth

Crankshaft

The crankshaft is made of carbon steel. It rests on five main bearing houses with half-bearings in between.

The crankshaft end float is adjusted by the half bearing housed at the central main bearing housing. The rear main bearing (flywheel side) is a different size to the others.

Eight counterweights set at 180° give the crankshaft an accurate balance of the rotating masses.

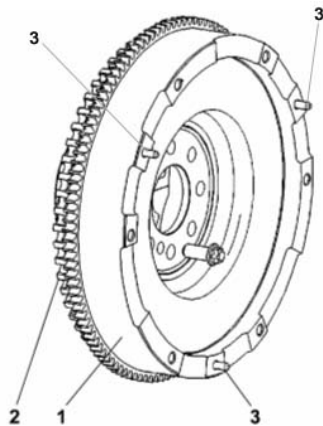


- 1 – Crankshaft
- 2 – Central main bearing (also with the function of registering the end float)
- 3 – Main bearings
- 4 – Rear main bearing
- 5 – Oilway hole



Flywheel

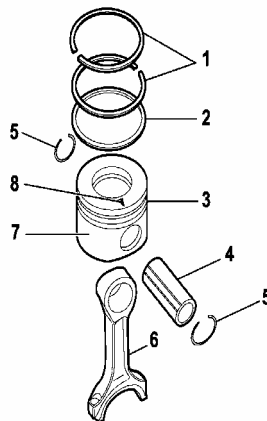
The flywheel supplied by Luk is secured to the crankshaft by 8 screws.
The phonic wheel used by the engine rpm sensor to measure the engine speed is on the flywheel.
The flywheel has 3 centring pins for the clutch mechanism.



- 1 – Flywheel
- 2 – Phonic wheel
- 3 – Clutch centring pins

Pistons

The pistons are obtained from cast aluminium alloy with a molybdenum surface treatment. The connecting rods are made of hardened and tempered steel by hot forming. The con rod caps are made from the connecting rods by fracture. The pistons have a recess for the combustion chamber. The pistons and small ends are joined by floating pins. They are restrained by two circlips fitted in the recesses on the piston hubs. To adjust the piston correctly, turn the reference mark (8) on the piston towards the timing gear side.



- 1 – Seal rings
- 2 – Oil scraper ring
- 3 – Piston
- 4 – Gudgeon pin
- 5 – Piston rings
- 6 – Connecting rod
- 7 – Reference mark on the piston skirt for correct assembly

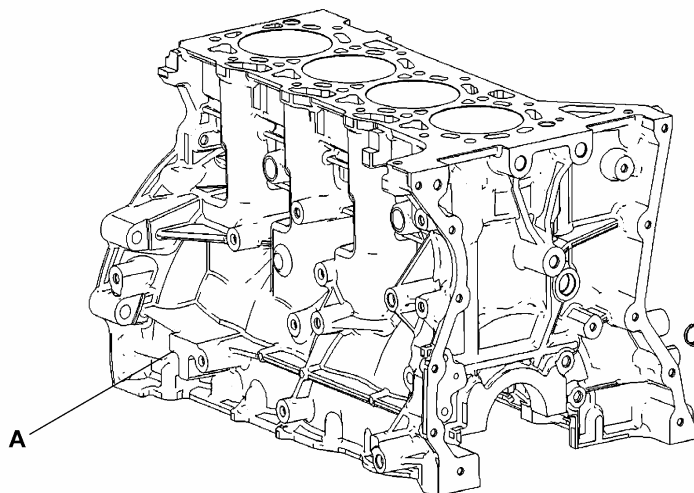


8 – Reference mark on the piston crown for correct assembly

The pistons can be supplied in three different classes: A, B, C.

The piston class from 4 to 1 is stamped on the crankcase from left to right.

The pistons, made of aluminium alloy, are divided into three size classes and have a reference mark stamped on the crown indicating the correct direction of assembly (the reference mark should be turned towards the timing gear side).

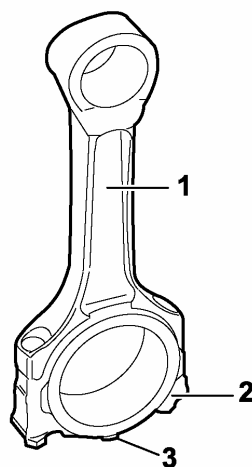


A – Piston class marking

Connecting rods

The connecting rod can be supplied in three different classes of length: K, L, M, the class is stamped on the con rod itself.

There is a reference mark on the con rod caps that should be turned towards the timing gear side.



1 – Connecting rod

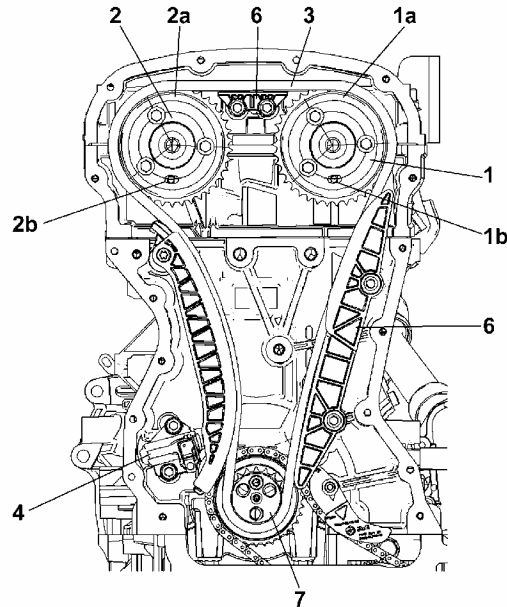
2 – Con rod cap

3 – Reference mark for correct assembly of the con rod cap



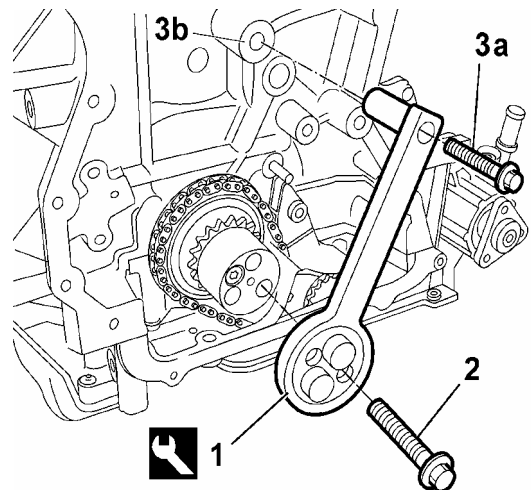
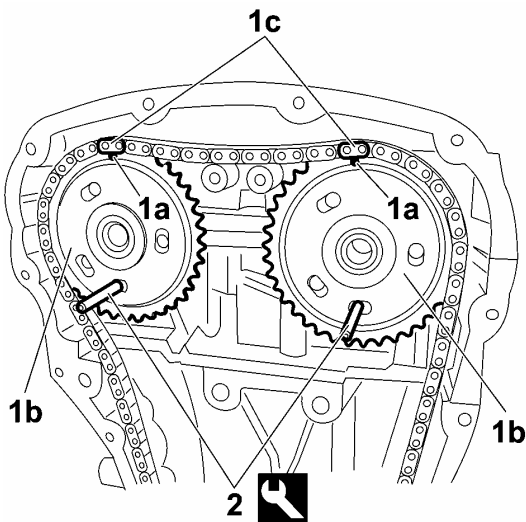
Camshaft drive

The camshaft drive is direct, via a single chain governing both camshafts.



- | | |
|---|------------------------------------|
| 1 – Intake shaft drive gear | 2b – Hole for exhaust shaft timing |
| 1a – Reference mark on the intake shaft drive gear | 3 – Timing chain |
| 1b – Hole for intake shaft timing | 4 – Tensioner |
| 2 – Exhaust shaft drive gear | 5 – Chain tightener sliding shoe |
| 2a – Reference mark on the exhaust shaft drive gear | 6 – Chain guide |
| | 7 – Gear secured on the crankshaft |

Timing

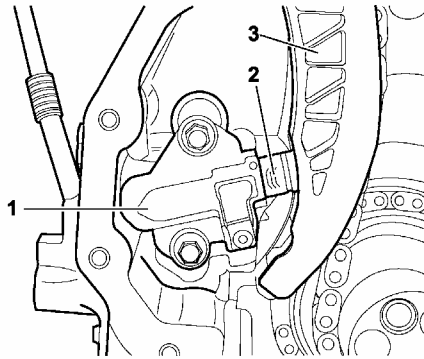


Insert the pins (2) and lock the camshafts, make the coloured links of the chain (1c) coincide with the reference marks on the gears (1a) and lock them with the screws. Position the crankshaft so it is possible to insert the paddle (1), secure it and in this position insert the chain, sliding shoes and hydraulic tensioner.



Hydraulic tensioner

The tensioning of the timing belt is accomplished with an automatic mechanical/hydraulic tensioner that avoids maintenance operations to check the tensioning.



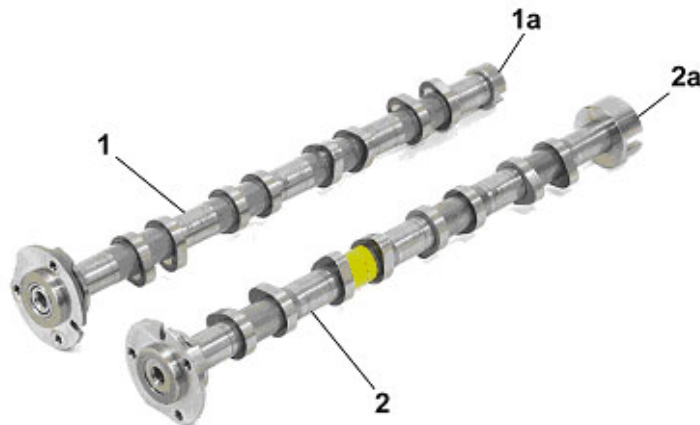
- 1 – Tensioner body
- 2 – Piston
- 3 – Chain tightener sliding shoe

Camshafts

The camshafts are made of cast iron with induction hardening on the cams and they are driven directly by a chain.

On the intake valve camshaft there is a coupling to transmit drive to the high pressure pump.

On the exhaust valve camshaft there is a coupling to transmit drive to the vacuum pump.



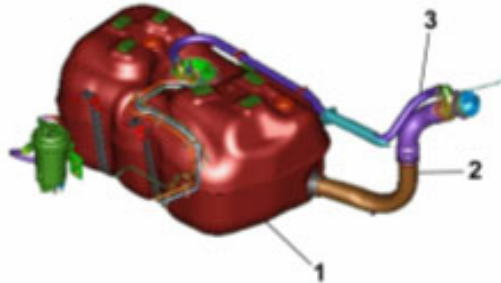
- 1 – Exhaust valve camshaft
- 1a – Coupling to transmit drive to the vacuum pump
- 2 – Intake valve camshaft
- 2a – Coupling to transmit drive to the high pressure pump

Note: It is not possible to swap over the camshafts because the distance between the pairs of cams is different on the two shafts.



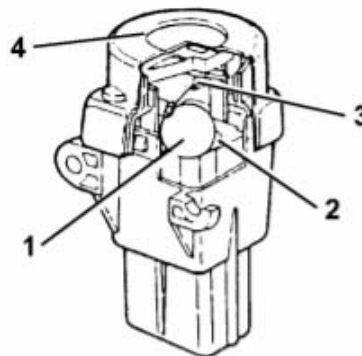
Fuel tank

The fuel tank, with a capacity of approximately 90 litres, is made of plastic; it is equipped with a flexible connector and includes the seat for fitting the fuel pump and the level gauge.



- 1 – Fuel tank
- 2 – Fuel filling pipe
- 3 – Breather pipe

Inertia switch



- 1. Round shutter
- 2. Tapered seat
- 3. Quick-coupling mechanism
- 4. Flexible cover

The inertia switch is located under the dashboard on the passenger side.

It contains a ferromagnetic ball held in its tapered seat by a permanent magnet.

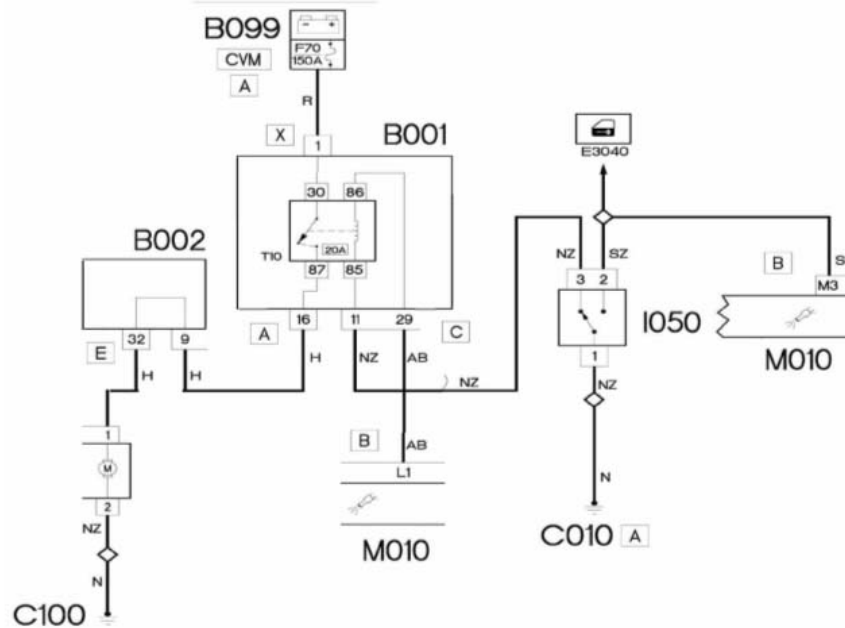
When vehicle deceleration exceeds a certain threshold due to impact, the ball disengages from its seat and hits a switch, turning the fuel pump relay ground towards the body computer.

This cuts off the pump supply, releases the locks and turns on the interior lighting.

The switch can be reset with the flexible cover.



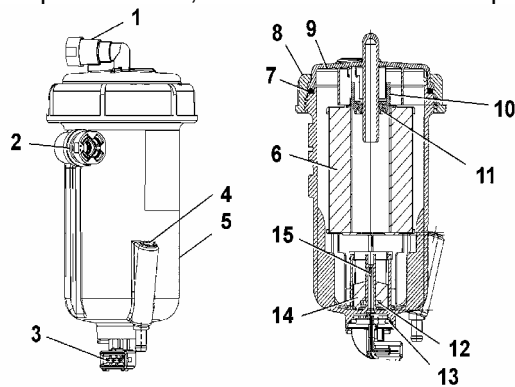
Inertia switch electrical connection diagram



- I050 Inertia switch
- M010 Engine management control unit
- B001 Engine compartment shunt control unit
- B002 Shunt control unit on the body computer

Fuel filter

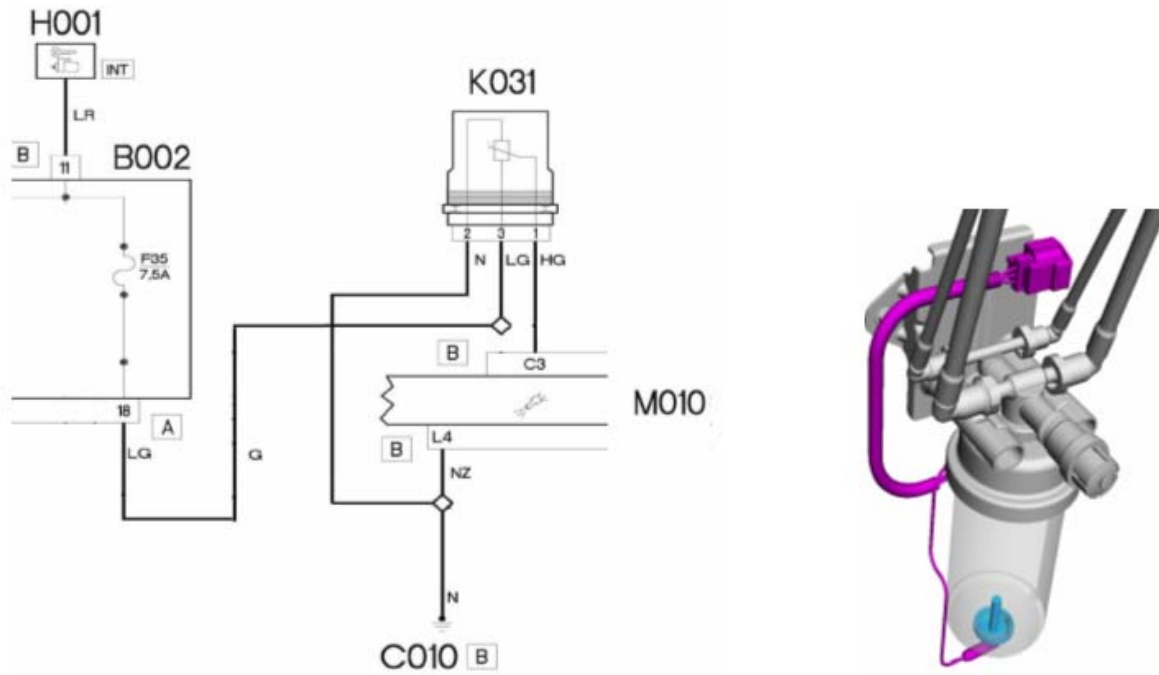
The fuel filter is fitted in the engine compartment near the fireproof bulkhead. The filter is made of a plastic shell that contains a depth partition cartridge made of synthetic material, which is highly efficient in terms of performance, service life and water separation.



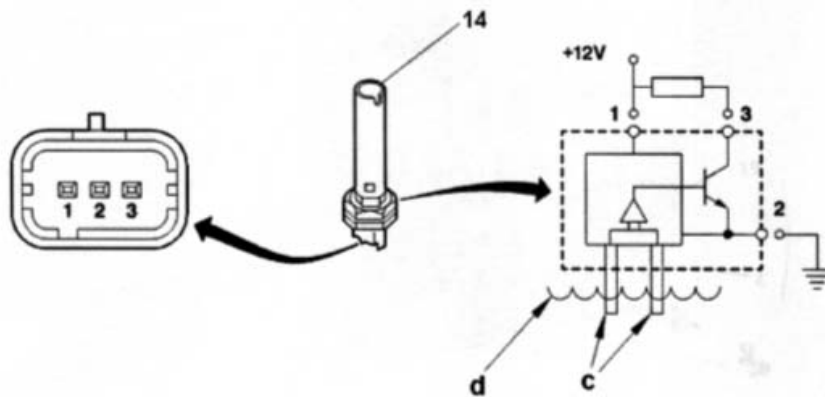
- 1 – Fuel inlet
- 2 – Fuel outlet
- 3 – Water presence sensor electric connection
- 4 – Water drain actuating screw
- 5 – Filter body
- 6 – Filtering cartridge (sealing O-ring supplied)
- 7 – Cover gasket
- 8 – Cover fixing ring nut
- 9 – Cover
- 10 – Spacer
- 11 – Rubber pad
- 12 – Ferromagnetic ring
- 13 – Gasket
- 14 – Float
- 15 – Water sensor

Water sensor electrical connection diagram





H001 Ignition switch, **B002** Shunt control unit, **K031** Water in diesel filter sensor, **M010** Engine control unit.



14 - sensor
c - electrodes
d - water level

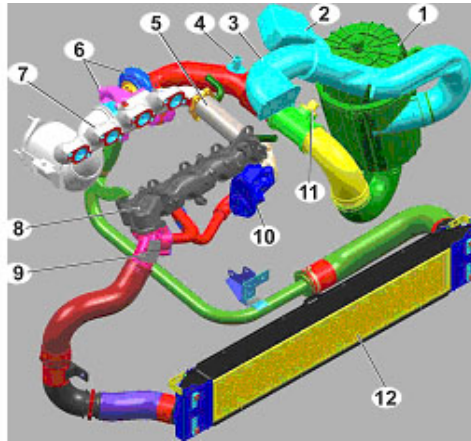
Sensor pin	Engine control unit pin	Connector	function
1	C3	B	signal
2			ground
3			Power supply +12V



Air supply circuit diagram

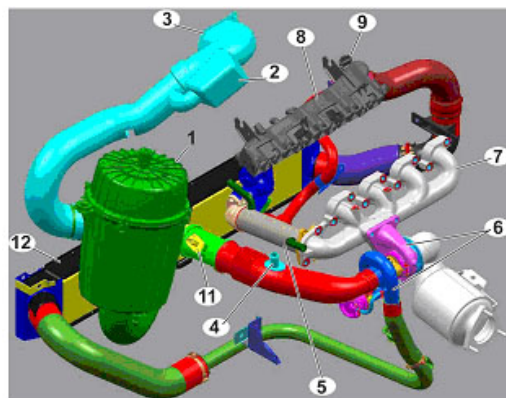
The intake air is filtered and conveyed to the exhaust gas turbocharger; before reaching the engine, the compressed air is cooled in the air-air heat exchanger (Intercooler).

The following figure schematically illustrates the main elements comprising the air supply circuit.
Air supply circuit seen from the front of the engine



- 1 – Air filter
- 2 – Resonator
- 3 – Air intake connector
- 4 – Union to retrieve oil vapours from the head cover
- 5 – EGR gas heat exchanger
- 6 – Turbocharger
- 7 – Exhaust manifold
- 8 – Intake manifold
- 9 – Integrated air temperature and absolute pressure sensor
- 10 – EGR solenoid valve
- 11 – Hot film intake air flow sensor
- 12 – Intercooler heat exchanger

Air supply circuit seen from the rear of the engine

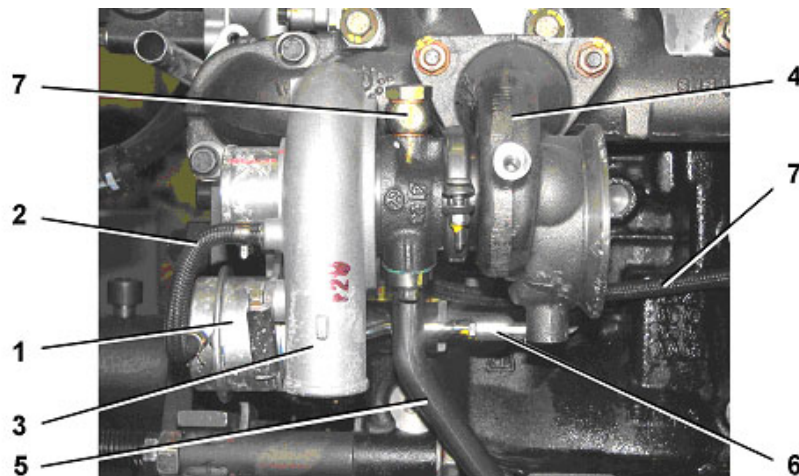


- 1 – Air filter
- 2 – Resonator
- 3 – Air intake connector



- 4 – Union to retrieve oil vapours from the head cover
- 5 – EGR gas heat exchanger
- 6 – Turbocharger
- 7 – Exhaust manifold
- 8 – Intake manifold
- 9 – Integrated air temperature and absolute pressure sensor
- 10 – EGR solenoid valve
- 11 – Hot film intake air flow sensor
- 12 – Intercooler heat exchanger

Turbocharger



- 1 – Exhaust gas bypass control air actuator
- 2 – Pressure pipe to control the WASTE - GATE valve
- 3 – Compressor
- 4 – Turbine
- 5 – Piping retrieving lubricating – cooling fluid from the turbocharger
- 6 – Control rod of the wastegate valve
- 7 – Piping sending lubricating – cooling fluid to the turbocharger

Turbine data:

- Maximum speed of rotation: 205,000 rpm
- Maximum working temperature: 760°C
- Mechanical wastegate: diameter 22 mm, operating stroke: 1 mm at a pressure of 153.5 kPa (**1.535 bar**), 5 mm at a pressure of 184 kPa (**1.84 bar**).

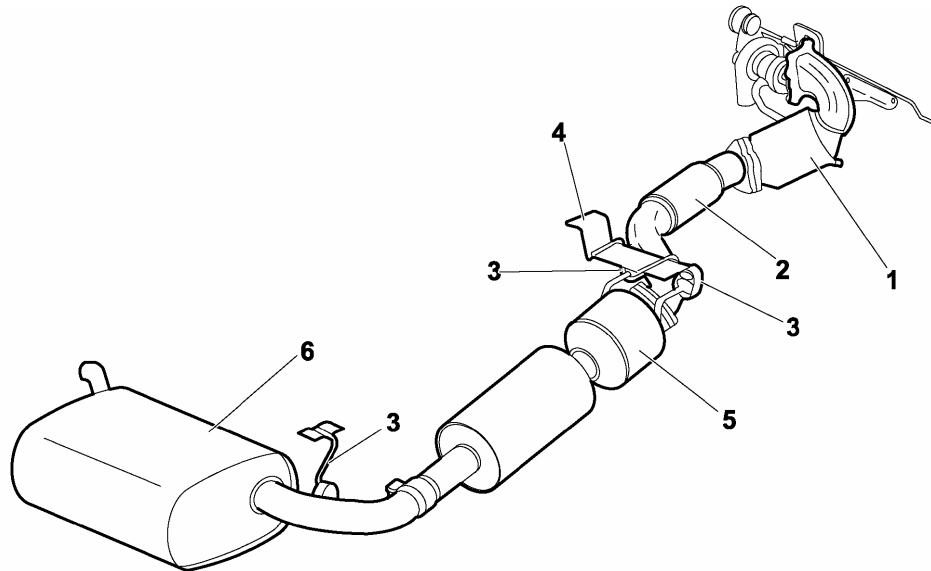


Exhaust system

The engine exhaust gases flow through the manifold (2) to the three-way catalytic converter (17). The silencer (14) is secured to the rear section (10) of the exhaust piping with the clamp (11).

A special guard (9) limits heat radiation toward the body.

The various components are supported by means of snap rings (8 and 13) secured to the underbody.

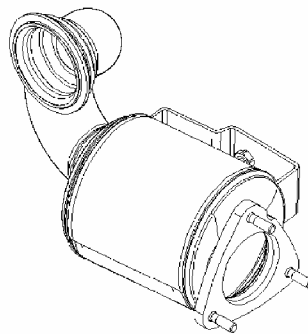


- 1 – Pre-catalyst
- 2 – Exhaust pipe middle section
- 3 – Flexible supports
- 4 – Supporting bracket
- 5 – Catalyst
- 6 – Rear exhaust piping

Catalytic converter

The three-way catalytic converter reduces the three polluting gases present in exhaust gases simultaneously:

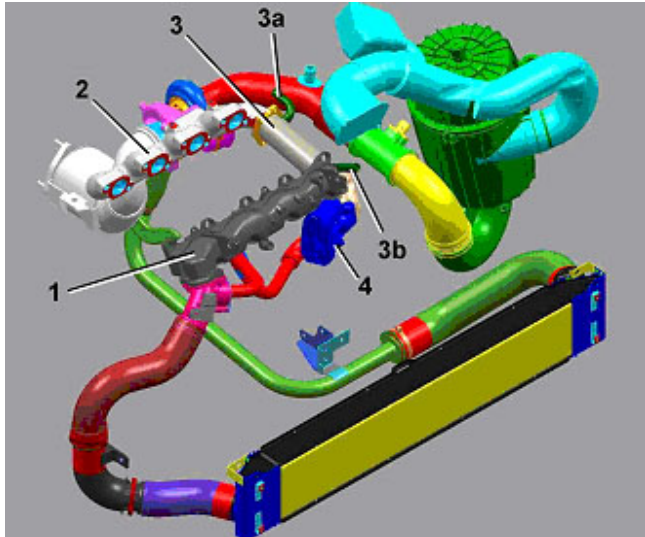
- unburnt hydrocarbons (HC);
- carbon monoxide (CO);
- nitrogen oxides (NOx).



EGR System

This system makes it possible, under certain operating conditions, to convey a portion (5 - 15%) of the exhaust gas to the intake.

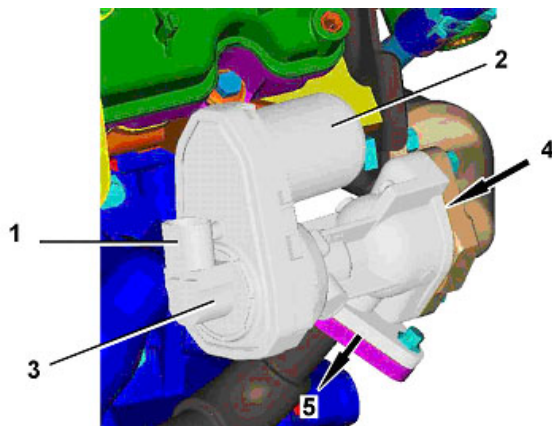
Thus, the temperature peak is lowered in the combustion chamber, thus reducing the formation of nitrogen oxides (NOx). The engine control unit performs the function of putting some of the exhaust gases taken from the exhaust manifold back into the engine intake.



- 1 – Air intake manifold
- 2 – Exhaust manifold
- 3 – E.G.R. gas cooling heat exchanger
- 3a – Heat exchanger water outlet union
- 3b – Heat exchanger water inlet union
- 4 – E.G.R. solenoid valve

The E.G.R. solenoid valve is composed of:

- an electric motor powered with direct current and controlled with a PWM signal,
- a position sensor,
- a set of gears to transmit the motor drive to the valve shutter,
- a shutter.



- 1 – Electric connector
- 2 – Solenoid valve actuating motor
- 3 – Position sensor
- 4 – Exhaust gas inlet
- 5 – Exhaust gas outlet



The solenoid valve is normally closed.

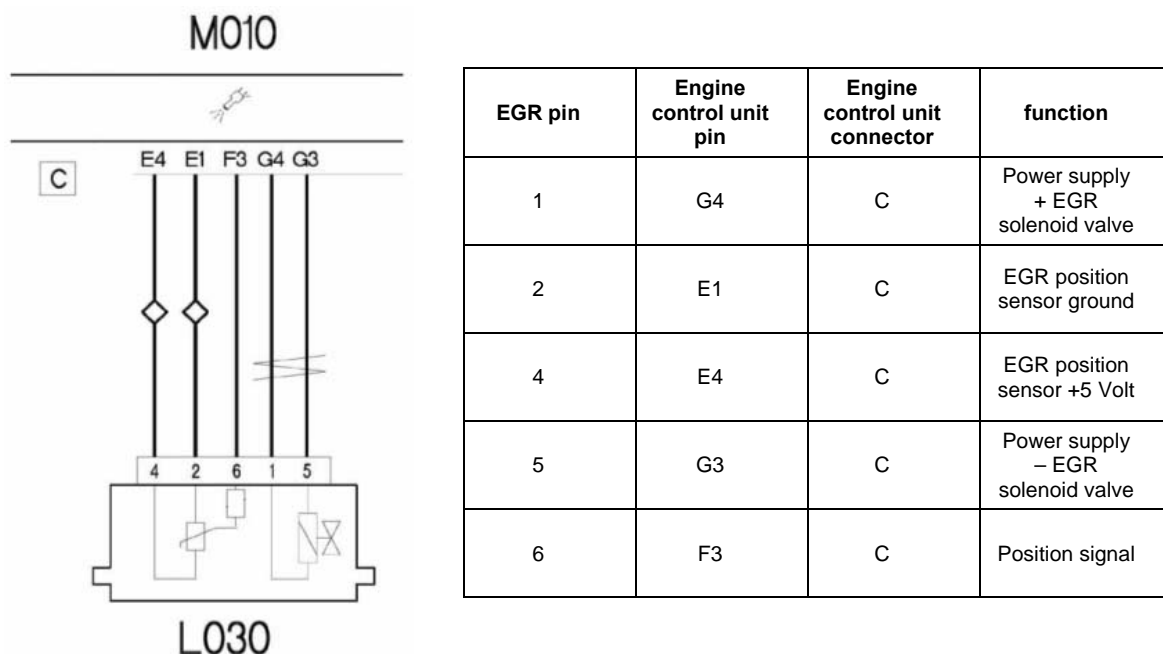
The change in PWM signal allows the E.G.R. motor to move a shutter, thereby adjusting the flow of exhaust gases from the exhaust manifold to the intake manifold; this produces two results:

- less air is let in;
- the combustion temperature is lowered (due to the presence of inert gas), thus reducing the formation of NOx (nitrogen oxides).

The engine management control unit is constantly informed of the quantity of recirculated gas by the information from the flow sensor and intake air temperature: if for a certain speed there is the intake of a certain quantity of air (Qam) and the value sent by the intake air temperature and flow sensor (Qar) is less, the difference (Qgr) is the value of the quantity of recirculated gas.

The atmospheric pressure signal is used when driving the E.G.R. solenoid valve to recognize the high-altitude driving condition, so as to reduce the amount of recirculated gas and avoid engine smokiness.

Electric connection diagram of the EGR valve and related position sensor



Resistance of the EGR solenoid valve measured between pins 1 and 5 = 5 ohm

Resistance of the potentiometer (EGR position sensor) measured with EGR closed:

between pin 4 and 2 = 1887 ohm

between pin 4 and 6 = 2998 ohm

between pin 2 and 6 = 1930 ohm

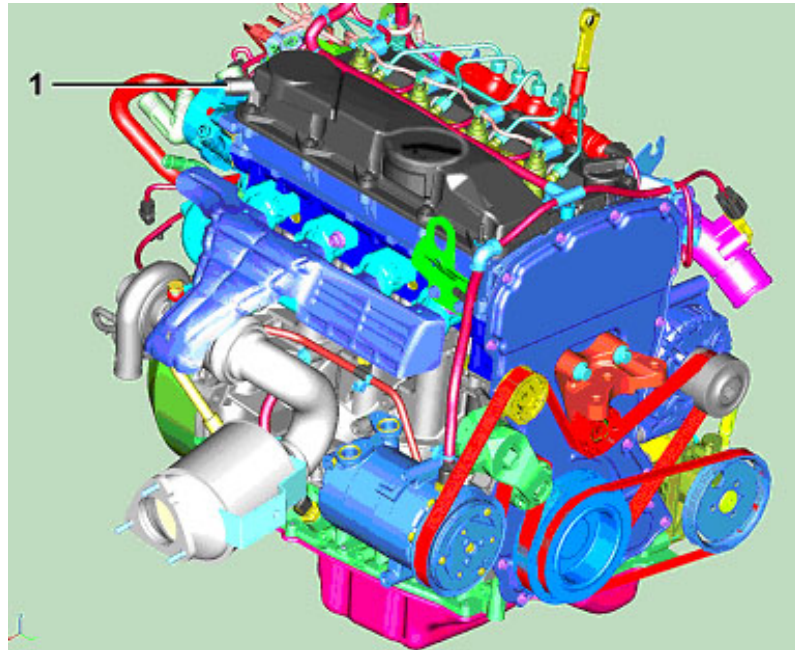


Crankcase oil vapour recovery system

The system controls the emission from the crankcase of the breather gases, composed of mixtures of air, fuel vapours and exhaust gases that blow by the piston rings and lubricating oil vapours, taking them back into the engine for combustion.

The breather gases from the crankcase climb up to the cylinder head and are conveyed into the tappet cover.

The condensed vapours return to the head, whereas the non-condensed ones are sent through a pipe (1) to the turbocharger air intake sleeve.



1 – Tappet cover oil vapour recovery pipe

On the tappet cover there is a control valve with a spring that under normal conditions acts on a diaphragm, keeping it open, thereby allowing the oil vapours from the oil separator to pass through.

When the vacuum in the pipe (1) exceeds the spring setting it shifts the diaphragm thereby closing the duct from the oil separator preventing intake of oil from the head.



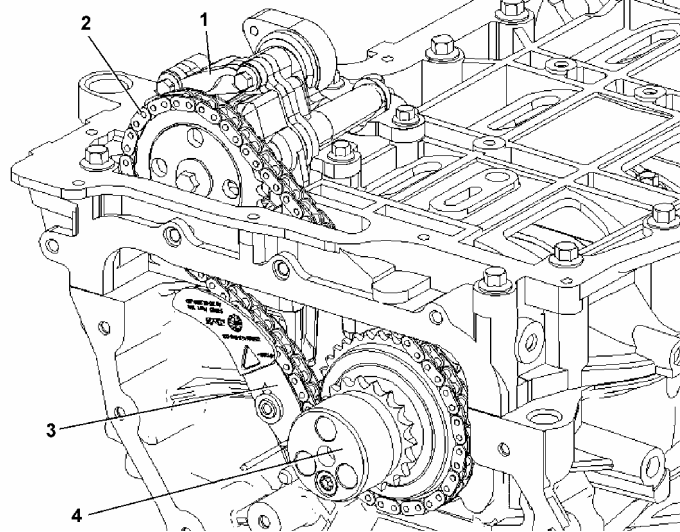
1 – Control valve

2 – Tappet cover oil vapour recovery pipe



Engine lubrication system

The oil pump, secured to the crankcase base, is trochoid and is driven by the crankshaft via a chain. The engine oil is drawn from the sump by the vacuum created by the rotation of the gears, filtered through the filtering screen on the suction tube and sent from the pump to the filter – heat exchanger assembly.



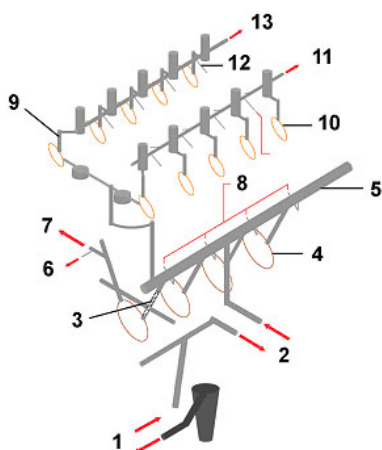
- 1 – Oil pump
- 2 – Oil pump driving chain
- 3 – Tensioner
- 4 – Oil pump chain driving gear secured onto the crankshaft

The filtered oil flows in a duct in the engine block, from here it reaches the crankshaft supports and, via intersecting oilways in the crankshaft, reaches the connecting rod supports and then comes out of the big end to lubricate the pistons, rings and cylinder walls.

From a branch of the main duct, the oil reaches the cylinder head and lubricates the valves, camshafts, etc..

On the oil pump there is a safety valve that triggers when the oil pressure exceeds a specific value (**from 5 to 7 bar**); inside the oil duct at main bearing housing 1 there is an oil filter.

Below is a diagram of the engine lubricating oil ducts.

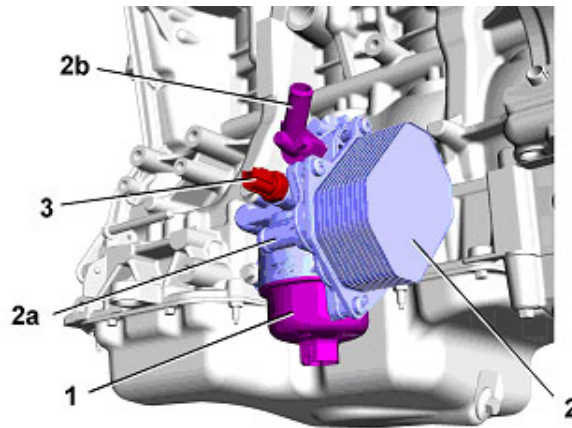


- 1 – Towards the oil pump
- 2 – Towards the filter and heat exchanger
- 3 – Oil filter in the crankcase
- 4 – Crankshaft support lubrication
- 5 – Main longitudinal duct
- 6 – Towards the timing gear chain tensioner
- 7 – Towards the turbocharger
- 8 – Piston lubricating – cooling nozzles
- 9 – Towards the rocker arm and tappet support
- 10 – Camshaft support lubrication
- 11 – Towards the high pressure pump
- 12 – Towards the hydraulic tappets
- 13 – Towards the vacuum pump



Oil filter and heat exchanger

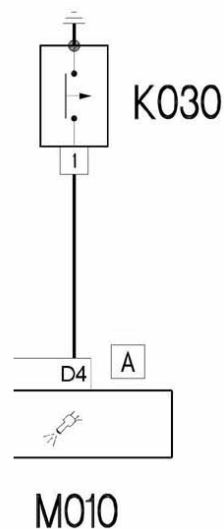
The oil filter/water-oil heat exchanger assembly is secured to the crankcase base on the intake side. The oil pressure sensor is fitted on the assembly.



- 1 – Oil filter
- 2 – Heat exchanger
- 2a – Engine coolant inlet (from the pump)
- 2b – Engine coolant outlet
- 3 – Engine oil pressure sensor
(normally closed when there is no pressure)

The switch turns off at a pressure of between 0.4 and 0.5 Bar

Engine oil pressure switch electrical connection diagram



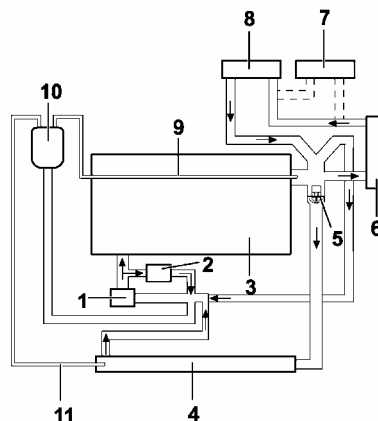
K030 engine oil pressure switch
M010 engine management control unit



Engine cooling circuit

The following figure illustrates the engine coolant flow diagram.

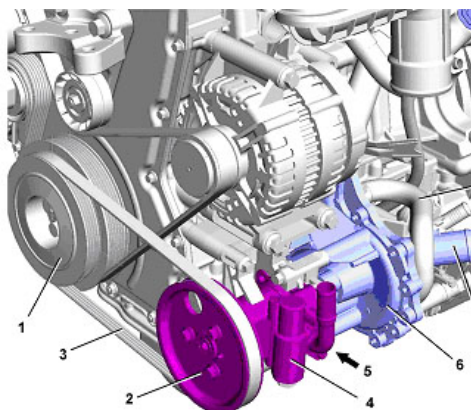
At temperatures under 88°C the thermostat is closed and the fluid does not flow through the radiator. The thermostat is contained in the outlet manifold of the engine coolant from the head.



- | | |
|--------------------------------|--|
| 1 – Water pump | 7 – Webasto heater (where applicable) |
| 2 – Water – oil heat exchanger | 8 – Heater unit |
| 3 – Engine | 9 – Cooling circuit breather pipe on engine |
| 4 – Radiator | 10 – Expansion tank |
| 5 – Thermostat | 11 – Cooling circuit breather pipe on radiator |
| 6 – E.G.R. heat exchanger | |

Water pump

The water pump is a centrifugal vane pump, secured externally to the crankcase and it is connected directly to the power steering pump via a tripod coupling. The power steering pump is driven by the crankshaft via a belt.



- | | |
|------------------------------------|--|
| 1 – Crankshaft pulley | 6a - pump water inlet union |
| 2 – Power steering pump pulley | 6b – water delivery union to the pump |
| 3 – Power steering pump drive belt | 7 – Pipe joining water pump with exchanger |
| 4 – Power steering pump | 8 – Water – oil heat exchanger |
| 5 – Coupling | 8a - exchanger outlet union |
| 6 – Water pump | |

Thermostat



The thermostat is contained in the engine coolant outlet manifold from the head, gearbox side, with the function of keeping the engine at the optimum temperature:

- at a temperature of $< 88^{\circ}\text{C}$ the thermostatic valve (closed) diverts the fluid directly toward the pump,
- at a temperature of $> 88^{\circ}\text{C}$ the thermostatic valve (open) conveys the coolant toward the radiator.

Fuel supply circuit

The fuel feed system is divided into a low pressure circuit and a high pressure circuit.

The low pressure circuit is composed of:

- submerged auxiliary motor pump;
- diesel filter;
- return manifold.

The high pressure circuit is composed of:

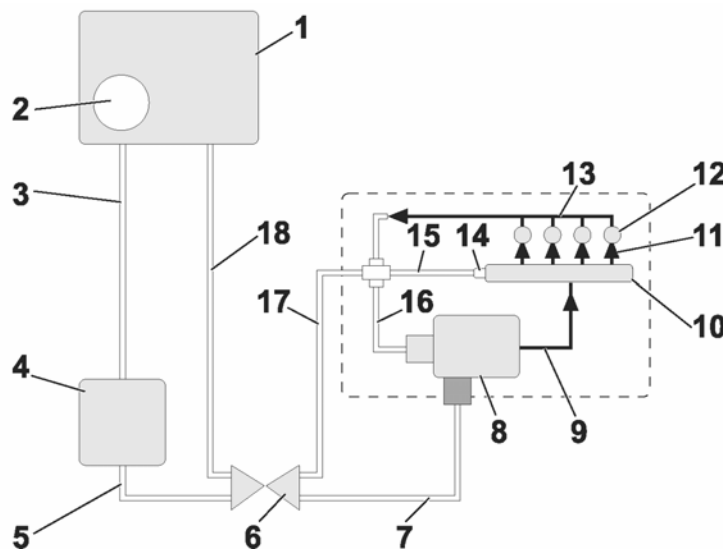
- pressure pump;
- distribution manifold.

The diesel is drawn from the tank by a pre-feed motor pump, operating at 12 V, whose purpose is to supply an adequate flow rate to ensure the Radialjet gets lubricated and cooled too.

The diesel filter is fitted between the motor pump and the Radialjet pump.

The hydraulic, high-pressure connections are made by means of steel pipes with inner diameter of 2 mm and outer diameter of 6 mm.

The recirculation of the pump and injectors and the return from the rail overpressure valve, after being collected in a single pipe, are sent to the tank.

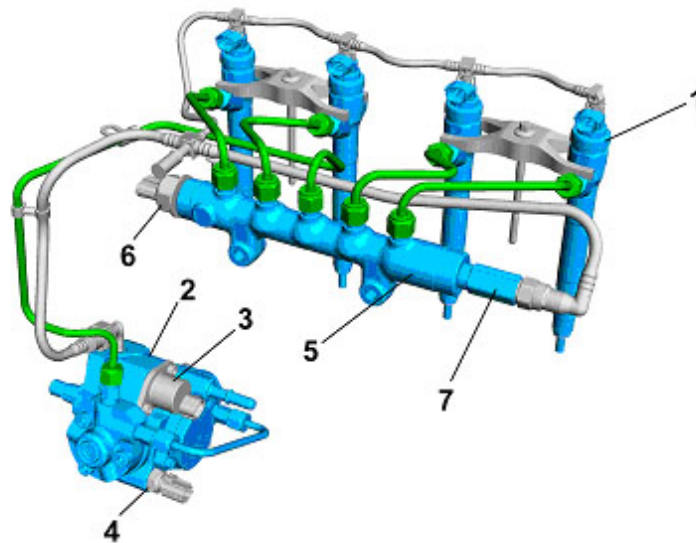


- 1 – Fuel tank
- 2 – Submerged pump assembly
- 3 – Pipe connecting tank with fuel filter
- 4 - Fuel filter
- 5 – Pipe connecting fuel filter with fuel pressure control valve
- 6 – Fuel pressure control valve
- 7 – Pipe connecting fuel pressure control valve with high-pressure pump
- 8 – High-pressure pump
- 9 – Pipe connecting high-pressure pump with fuel manifold (Rail)
- 10 – Fuel manifold (Rail)



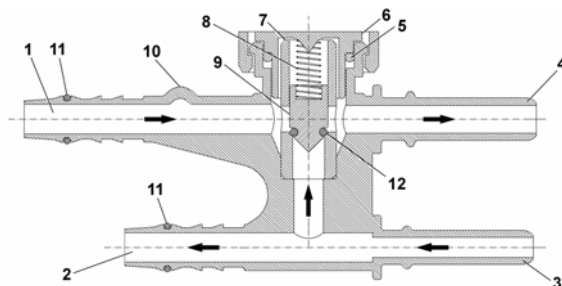
- 11 – Pipe connecting fuel manifold (Rail) with electro-injectors
- 12 - Electro-injectors
- 13 – Return pipe from electro-injectors
- 14 – Overpressure valve on rail
- 15 – Return pipe from overpressure valve on rail
- 16 – Return pipe from high-pressure pump
- 17 – Single fuel return pipe towards fuel pressure control valve
- 18 – Single fuel return pipe towards tank

The following figure illustrates the high pressure circuit



- 1 - Electro-injector
- 2 – Pressure pump
- 3 – Flow regulator
- 4 – Fuel temperature sensor
- 5 – Distribution manifold (rail)
- 8 – Fuel pressure sensor
- 9 – Fuel overpressure valve

On the fuel supply pipes, downstream from the diesel filter, there is a pressure reducer. Its function is to ensure a constant pressure at a value of approximately **0.4 bar**.



- 1 – Return from the engine
- 2 – Delivery to the high pressure pump
- 3 – Inlet from the fuel filter
- 4 – Return to the tank
- 5 – Plug seal
- 6 – Plug
- 7 – Metal insert
- 8 – Spring
- 9 – Metal piston
- 10 – Pressure reducer body
- 11 – Seals
- 12 – Metal piston seal

The Denso Common Rail is a high-pressure electronic injection system for fast direct-injection diesel engines.

Its main features comprise:

- high injection pressures available (**1600 bar**);
- high-pressure pump driven directly by the intake camshaft;
- high-pressure pump with two pumping elements;
- electro-injectors governed by solenoids;
- injection control accuracy (advance and injection duration);
- less consumption;
- lower emission levels.

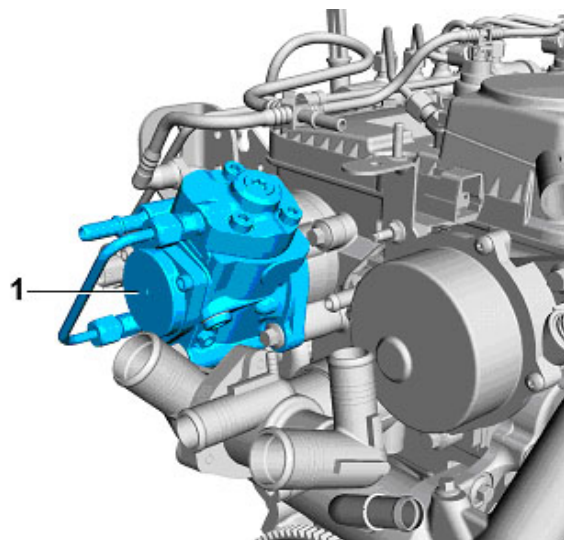
During every single turn of the engine the control unit recognizes which cylinder is in the power stroke and controls the injection sequence to the proper cylinder.

The fuel pump of the Common Rail system is called the Radialjet because the pumping action is accomplished by two pumping elements (pistons) arranged radially in relation to the axis of rotation of the pump shaft.

The pump is installed on the engine, gearbox side, and is driven directly by the intake camshaft with a ratio of **1:2** in relation to the crankshaft rpm.

The high-pressure pump contains a trochoid transfer pump that ensures the fuel flows correctly to the pumping pistons.

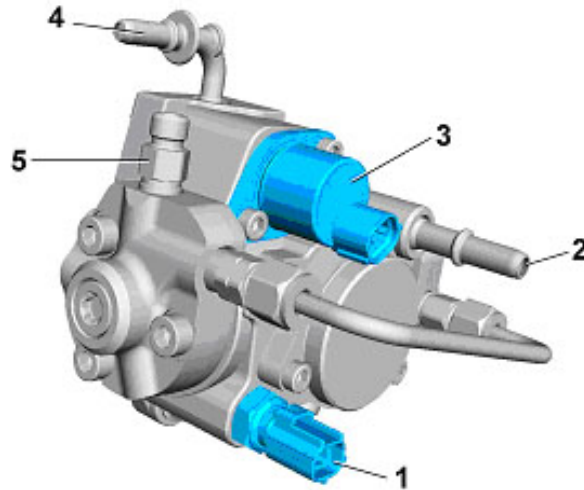
The quantity of fuel sent to the two pumping pistons is controlled by a pressure regulator governed by the engine management control unit.



1 – High-pressure pump

The pump comprises:

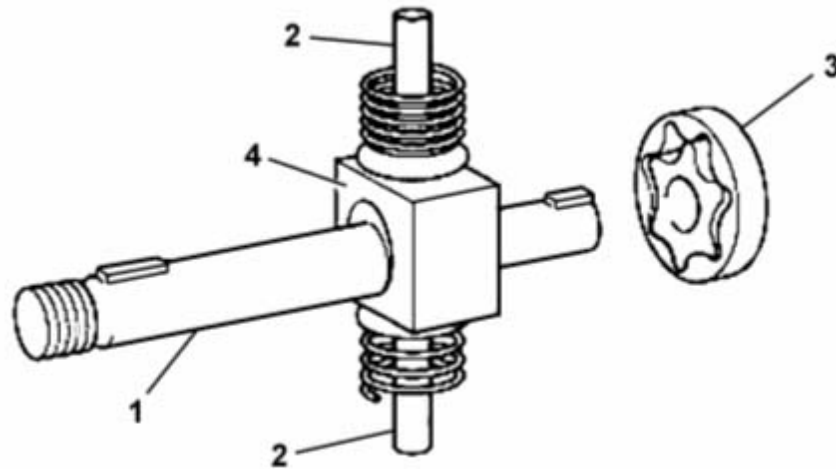
- low pressure side: flow regulator, transfer pump, fuel temperature sensor;
- high pressure side: shaft with cam, cam driving the pistons, two pumping pistons set diametrically opposite each other in relation to the camshaft.



- 1 – Fuel temperature sensor
- 2 – Pump fuel inlet pipe
- 3 – Flow regulator
- 4 – Excess fuel return pipe to the tank
- 5 – Fuel delivery union to the rail



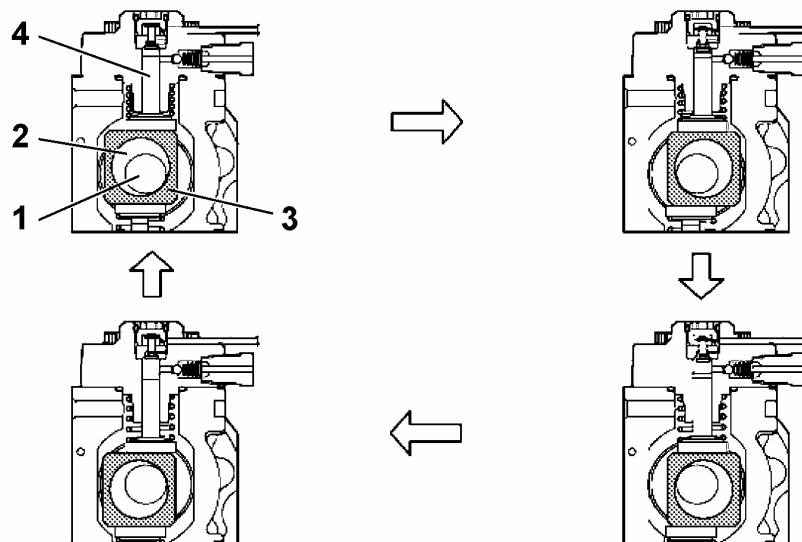
The following figure illustrates the shaft driving the pumping element and the transfer pump.



- 1 – Shaft with cam
- 2 – Pumping pistons
- 3 – Transfer pump
- 4 – Piston driving cam

Operation

The pump is driven directly by the intake camshaft. The rotation of the shaft with the cam generates the vertical movement of the cam driving the pistons.



- 1 - Pump shaft
- 2 - Cam on the shaft
- 3 - Cam driving the pistons
- 4 - Pumping piston



In this injection system the timing and duration of injection are tasks deferred to the electronic control system. This pump performs the sole purpose of keeping the fuel contained in the manifold permanently at the required level of pressure.

Each pumping unit is equipped with an intake valve and a ball delivery valve. Both deliveries of the pumping elements are externally joined with the pump and send fuel to the common manifold via a single duct.

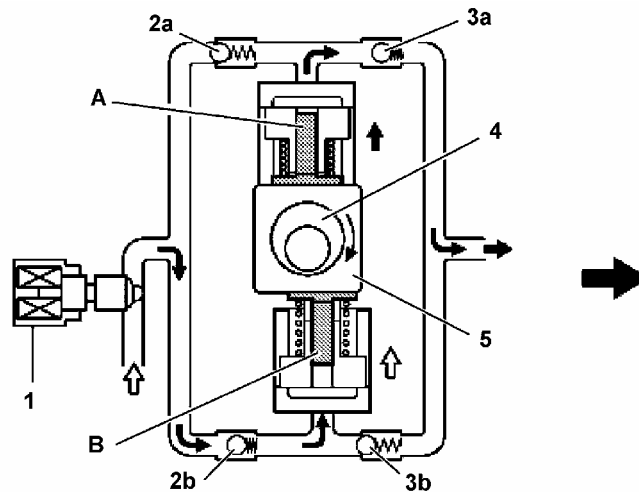
This pump has the peculiarity of being lubricated and cooled simultaneously by the same diesel circulating inside it via suitable orifices.

To adjust the delivery flow rate there is a flow regulator on the pump inlet so that the pump compresses only the diesel needed to reach the pressure mapped in the control unit.

Piston motion is determined by the rotation of a cam integral with the pump shaft. This cam causes the two pistons to move in succession by the movement of a mechanical interface (piston driving cam) between the cam and the foot of the piston. The contact between the cam driving the pistons and the foot of the pistons is ensured by a spring.

The rotation of the cam generates the upward movement of piston A that compresses the fuel.

The force of the spring pushes piston B that draws in the fuel.

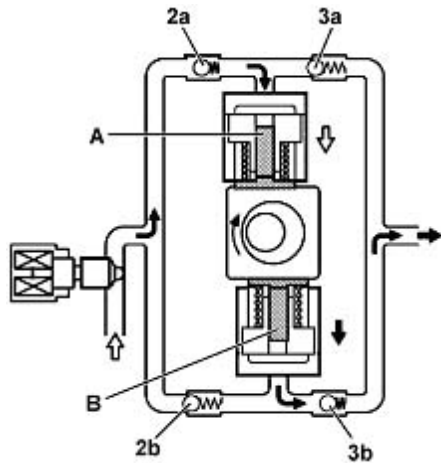


- 1 – Flow regulator
- 2a – Inlet valve for piston A
- 2b – Inlet valve for piston B
- 3a – Delivery valve for piston A
- 3b – Delivery valve for piston B
- 4 – Shaft cam
- 5 – Piston driving cam
- A – Pumping piston
- B – Pumping piston

Piston A: compression stroke completed
Valve 2a: fully closed
Valve 3a: fully open

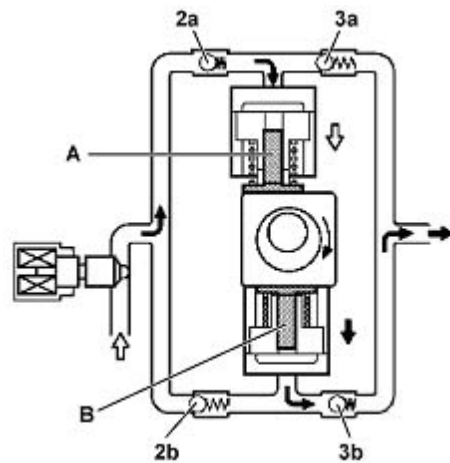
Piston B: intake stroke completed
Valve 2b: fully open
Valve 3b: fully closed





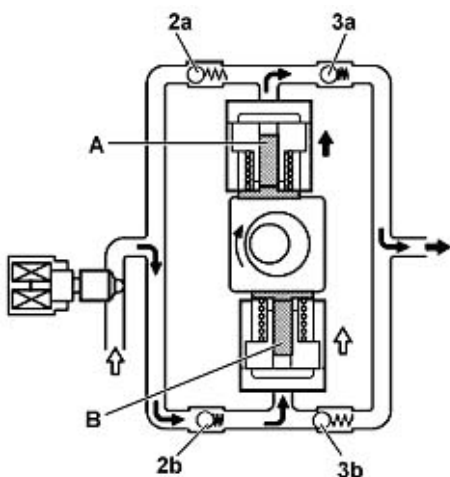
Piston A: start of intake stroke
Valve 2a: start of opening
Valve 3a: closing completed

Piston B: start of compression stroke
Valve 2b: closing completed
Valve 3b: start of opening



Piston A: intake stroke completed
Valve 2a: fully open
Valve 3a: fully closed

Piston B: compression stroke completed
Valve 2b: fully closed
Valve 3b: fully open



Piston A: start of compression stroke
Valve 2a: closing completed
Valve 3a: start of opening

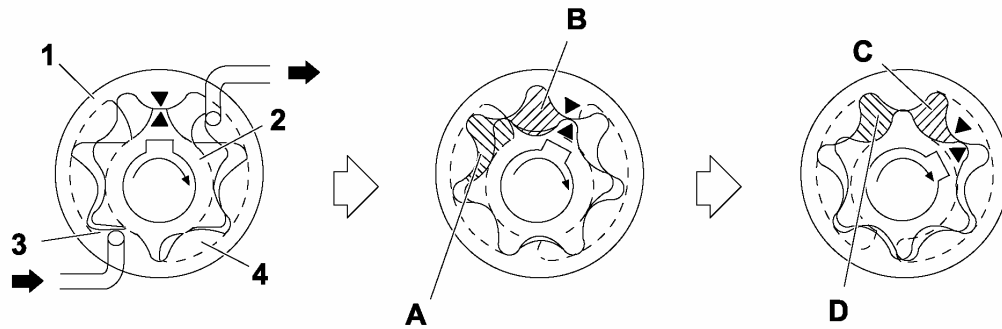
Piston B: start of intake stroke
Valve 2b: start of opening
Valve 3b: closing completed

Low-pressure pump



The low-pressure transfer pump is the trochoid type and is integrated in the injection pump; the low-pressure pump is force fitted onto the same shaft transmitting motion to the high-pressure pump. The rotation of the internal impeller generates the vacuum that permits drawing in the fuel from the inlet duct and sending it through the outlet duct.

The pumping action is accomplished by the change in volume of the chambers marked off by the internal and external impeller.



- 1 – External impeller
- 2 – Internal impeller
- 3 – Inlet duct
- 4 – Delivery duct

- A – The chamber volume is increasing
- D – The chamber volume is decreasing
- C – Fuel outlet
- D – Fuel intake

Flow regulator

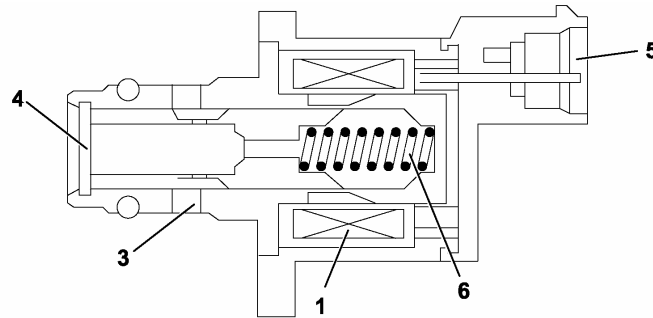
The fuel flow regulator is fitted on the low-pressure circuit of the pump. The regulator modulates the quantity of fuel sent to the high-pressure circuit according to the commands received directly from the engine management control unit. The regulator chiefly comprises the following components:

- connector,
- body,
- solenoid,
- pre-loading spring,
- shutter cylinder.

If there is no signal the flow regulator is normally open, so the pump is in the condition of maximum delivery.

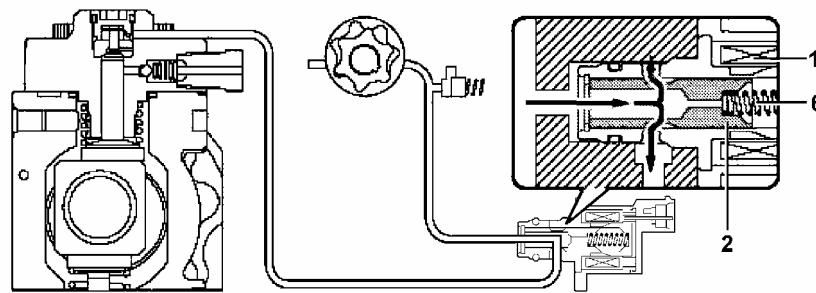
The engine management control unit, via a PWM (Pulse Width Modulation) signal, modulates the change in fuel delivery in the high-pressure circuit by partially closing or opening the fuel line sections in the low-pressure circuit.



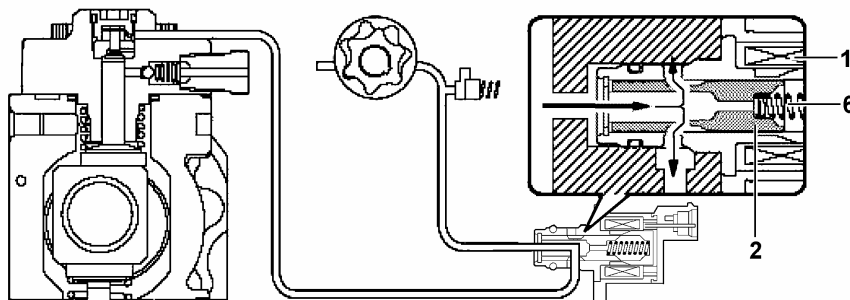


- 1 – Solenoid
- 2 – Shutter cylinder
- 3 – Fuel outlet
- 4 – Fuel inlet
- 5 – Electric connector
- 6 – Pre-loading spring

When the solenoid (1) is not energized, the shutter cylinder (2) is pushed into the rest position by the pre-loading spring (6). In this condition the shutter cylinder is in such a position as to provide the fuel with the greatest cross-section of flow.



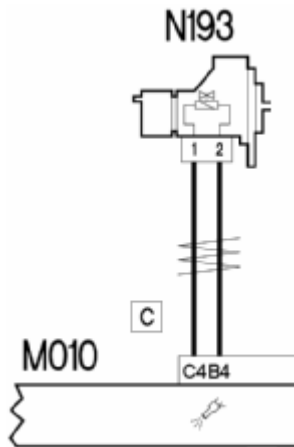
When the engine control unit governs the flow regulator (via PWM signal), the solenoid (1) is energized that, in its turn, generates the movement of the shutter cylinder (2), partially choking the flow of fuel.



Note: In the event of failure of the flow regulator, the MIL warning light will come on

Flow regulator electrical connection diagram





Actuator pin	Engine management control unit pin	Engine management control unit connector	Function
1	C4	C	Supply
2	B4	C	Regulator control

N193 Flow regulator, M10 Engine control unit, Regulator resistance = 2.4 ohm

Single fuel manifold pipe

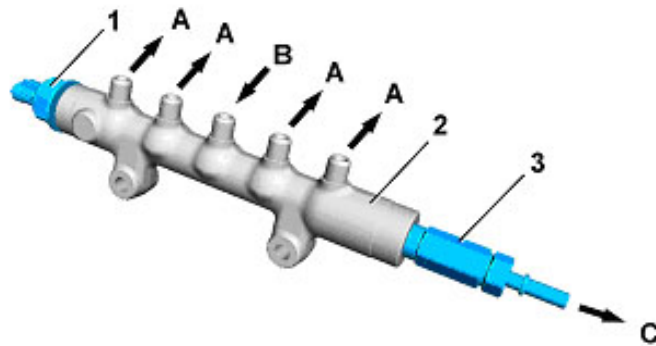
The single fuel manifold pipe (rail) is fitted on the cylinder head, intake side.

With its volume of approximately 33 cm³ it dampens the fuel pressure oscillations due to:

- the pressure pump operation
- the opening of the electro-injectors.

The fuel pressure sensor and the overpressure valve are fitted on the rail.

The hydraulic, high-pressure connections between the pump-manifold and the electric injectors-manifold are made by means of steel pipes with inner diameter of 2 mm and outer diameter of 6 mm.

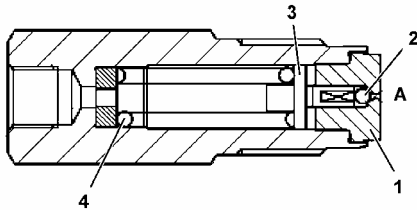


- 1 – Fuel pressure sensor
- 2 – Rail
- 3 – Overpressure valve
- A – Toward the injectors
- B – From the high-pressure pump
- C – Toward the tank

Pressure relief valve



When the pressure inside the rail increases abnormally, the pressure relief valve discharges some of the fuel (toward the tank) until the correct pressure is restored.
The valve is set to trip when the pressure in the rail exceeds 200±9 MPa.



- 1 – Valve body
- 2 – Valve
- 3 – Valve guide
- 4 – Spring
- A – Rail side

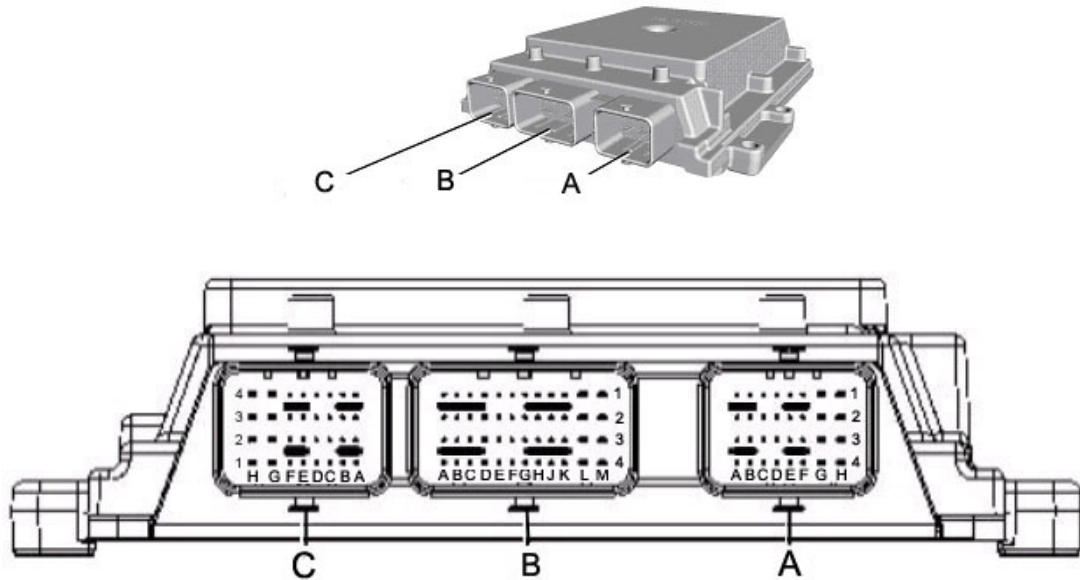
List of 2.2 Engine Equipment

Code	Application	Description
1870718000	2.2 Engine	Blade for cutting sealant
1860470000	2.2 Engine	Cylinder head support
1860644000	2.2 Engine	Valve extraction lever
1870890000	2.2 Engine	Valve cage
1870894000	2.2 Engine	Valve oil seal pliers
1860183000	2.2 Engine	Piston ring pliers
1860700000	2.2 Engine	Piston ring tightening tape
2000016500	2.2 Engine	Timing pins
2000016600	2.2 Engine	Valve guide fitting
2000016700	2.2 Engine	Template for oil pump centring
2000016800	2.2 Engine	Crankcase base centring pins
2000016900	2.2 Engine	Extractor for oil seal on crankshaft
2000017000	2.2 Engine	Timing system cover centring
2000017100	2.2 Engine	Timing pin on flywheel
2000017200	2.2 Engine	Injector extractor
2000018400	2.2 Engine	Reaction key on crankshaft pulley
2000018700	2.2 Engine	Timing template on crankshaft
	New Tools	
	Existing Tools	

Engine control unit VISTEON V347/ 8



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 re-programmed from outside without acting on the hardware. The injection control unit incorporates the absolute pressure sensor. The following figure illustrates the control unit.



Connector A

- A1 – N.C.
- A2 – Intake air temperature sensor signal on intake manifold
- A3 – Fuel pressure sensor signal (on rail)
- A4 – Fuel pressure sensor +5V power supply (on rail)
- B1 – Absolute pressure sensor signal on intake manifold
- B2 – Crankshaft rpm sensor ground
- B3 – Crankshaft rpm sensor signal
- B4 – Rail sensor cable shielding
- C1 – Fuel pressure sensor ground (on rail)
- C2 – N.C.
- C3 – Engine temperature sensor signal
- C4 – Engine temperature sensor ground
- D1 – Oil level sensor signal
- D2 – N.C.
- D3 – N.C.
- D4 – Engine oil pressure sensor signal
- E1 – N.C.
- E2 – N.C.
- E3 – N.C.
- E4 – Oil level sensor ground
- F1 – N.C.
- F2 – N.C.
- F3 – N.C.
- F4 – N.C.
- G1 – Ground
- G2 – Command + injector cylinder 2 and 3
- G3 – Command - injector cylinder 4
- G4 – Command - injector cylinder 1
- H1 – Power supply from main relay
- H2 – Command + injector cylinder 1 and 4



H3 – Command - injector cylinder 3

H4 – Command - injector cylinder 2

Connector B

A1 – Accelerator pedal potentiometer 1 power supply +5V

A2 – Linear sensor power supply +5V

A3 – N.C.

A4 – Can H network

B1 – Engine cooling electric fan relay command (speed 2)

B2 – Compressor cut-in relay command

B3 – N.C.

B4 – Can L network

C1 – Glow plug pre-heating control unit command

C2 – Engine cooling electric fan relay command (speed 1)

C3 – Water in fuel filter sensor signal

C4 - Accelerator pedal potentiometer 1 ground

D1 – Accelerator pedal potentiometer 1 signal

D2 – Accelerator pedal potentiometer 2 signal

D3 – Accelerator pedal potentiometer 2 power supply +5V

D4 – Engine cooling electric fan control unit control

E1 – N.C.

E2 – N.C.

E3 – Brake pedal switch main signal

E4 – N.C.

F1 – Linear sensor signal

F2 – Air-conditioner compressor cut-in request signal

F3 – Brake pedal switch secondary signal

F4 – N.C.

G1 – Main relay control ground

G2 – Battery positive from main switch

G3 – Clutch pedal switch signal

G4 – N.C.

H1 – Cruise control: Set +

H2 – Cruise control: Set -

H3 – Cruise control: Resume

H4 – Cruise control: On

J1 – N.C.

J2 – Line K

J3 – N.C.

J4 – Linear sensor ground

K1 – N.C.

K2 – MIL indicator light on control on instrument panel

K3 – N.C.

K4 – N.C.

L1 – Fuel motor pump relay control

L2 – N.C.

L3 – Glow plug pre-heating control unit diagnosis signal

L4 – Ground

M1 – Accelerator pedal potentiometer 2 ground

M2 – N.C.

M3 – Inertia switch signal

M4 – N.C.

Connector C

A1 – N.C.

A2 – N.C.

A3 – N.C.



A4 – N.C.
B1 – Air flow sensor (debimeter) ground
B2 – Air flow sensor (debimeter) signal
B3 – N.C.
B4 – Fuel flow regulator control (on high-pressure pump)
C1 – N.C.
C2 – N.C.
C3 – Intake air temperature sensor (debimeter) signal
C4 – Fuel flow regulator (on high-pressure pump) power supply +12V
D1 – N.C.
D2 – Timing sensor power supply +5V
D3 – Timing sensor signal
D4 – Timing sensor ground
E1 – Fuel temperature sensor (on high-pressure pump) and EGR solenoid valve potentiometer ground
E2 – Connection with alternator
E3 – N.C.
E4 – Power supply +5V: absolute pressure and intake air temperature sensor on intake manifold and EGR actuator
F1 – Ground: absolute pressure and intake air temperature sensor on intake manifold
F2 – Fuel temperature sensor signal (on high-pressure pump)
F3 – EGR solenoid valve potentiometer position signal
F4 – N.C.
G1 – N.C.
G2 – N.C.
G3 – Power supply - EGR solenoid valve actuator
G4 – Power supply + EGR solenoid valve actuator
H1 – Ground
H2 – Power supply from main relay
H3 – N.C.
H4 – N.C.

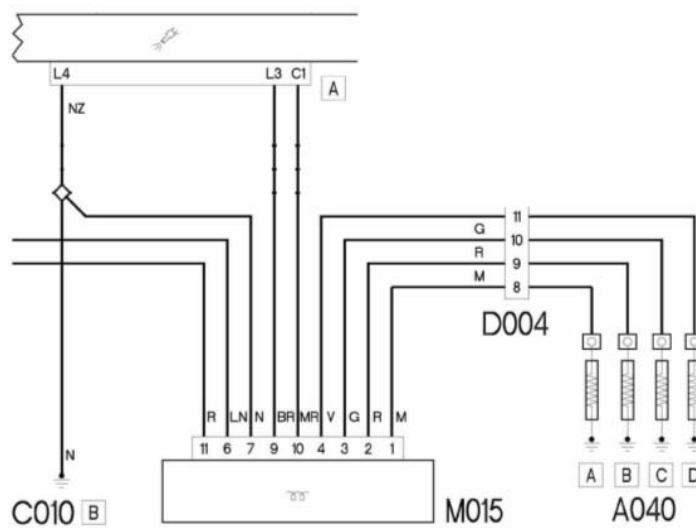
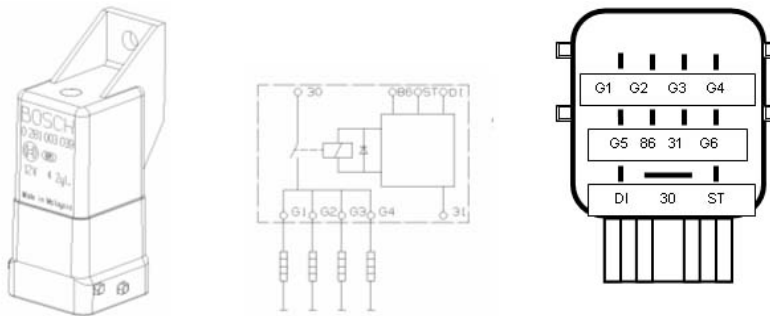
Description of electric components

Glow plug pre-heating system

The glow plugs are powered by the pre-heating control unit under the direct control of the engine management control unit that sets the pre-heating time according to the engine temperature.



Inside the pre-heating control unit there is a contactor combined with an electronic circuit that informs the engine control unit about any faults with the pre-heating system.

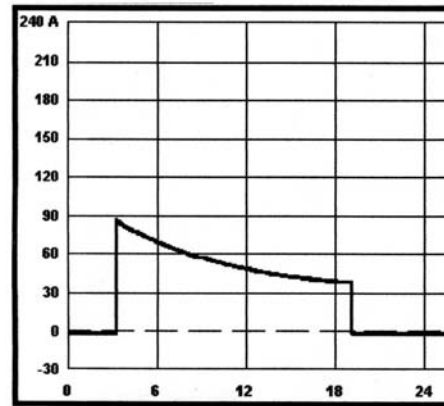
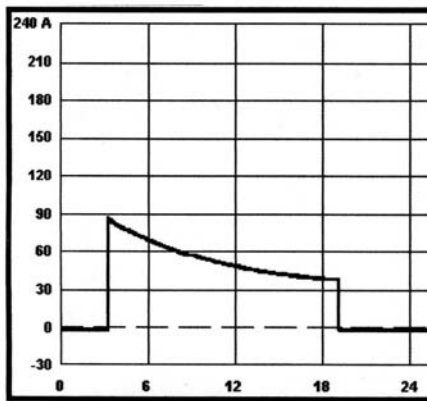


Pre-heating control unit pin	Connector pin Pre-heating control unit	Engine control unit pin	Function
86	6		Positive from main relay controlled by the engine management control unit
31	7		Ground
ST	10	C1 connector B	Command signal from the engine control unit
DI	9	L3 connector B	Engine control unit diagnosis signal
30	11		Battery positive
G1,2,3,4,	1,2,3,4		Pre-heating glow plug power supply output

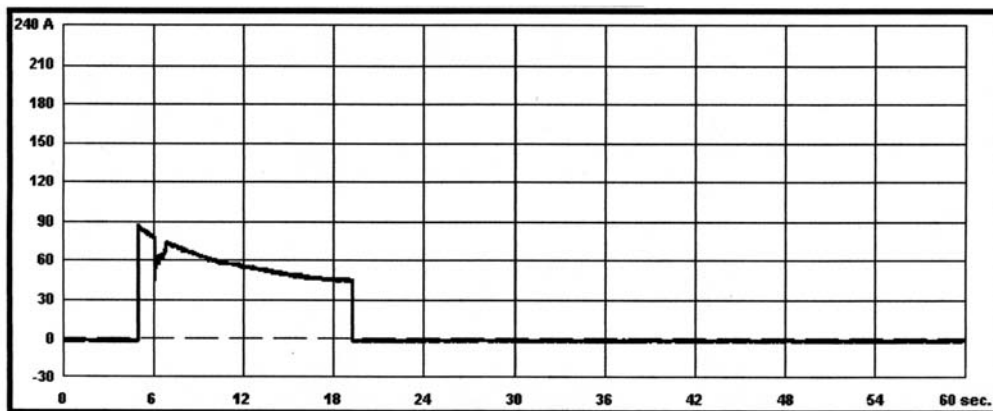
Glow plug input test performed with engine cold without starting the engine

Glow plug input test performed with engine warm without starting the engine

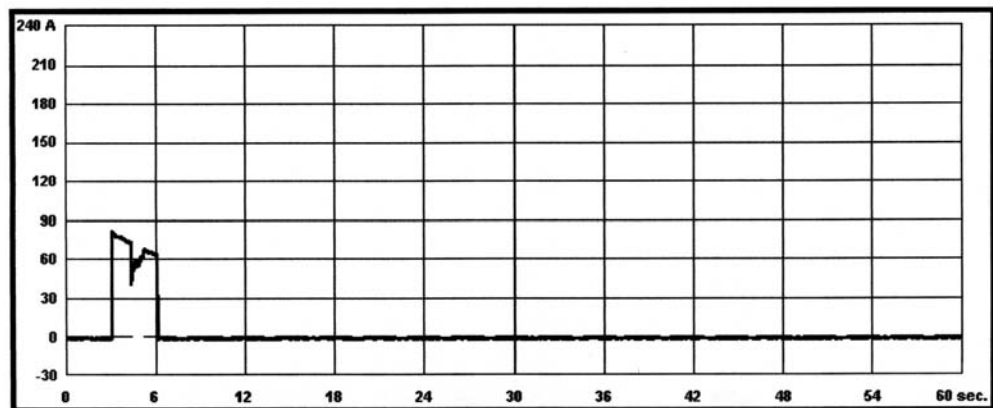




Glow plug input test starting the engine cold



Glow plug input test starting the engine warm



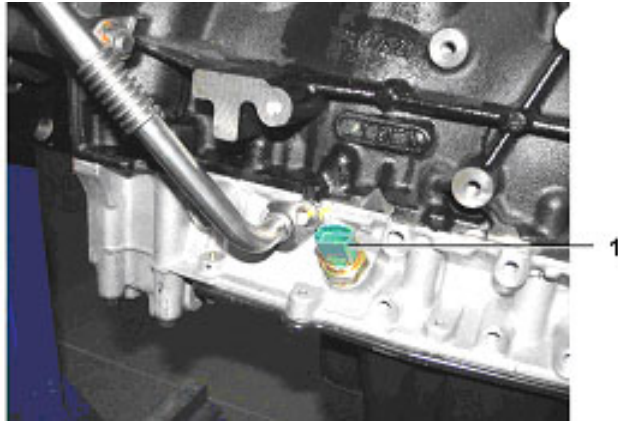
From the above graphs it can be seen that the glow plug heating time is irrespective of the engine temperature if starting is not performed.

On the contrary, if the engine is started, the glow plugs will keep on being powered for a time that will always be shorter as the engine temperature rises.

Engine oil level sensor

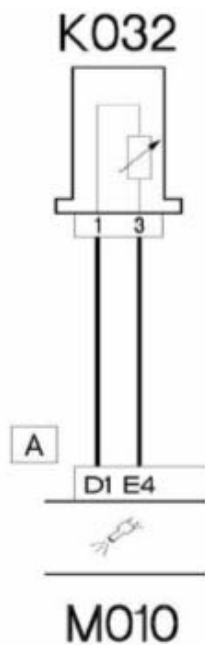
The engine oil level sensor is located on the crankcase base, exhaust side.





1 – Oil level sensor

Oil level sensor electrical connection diagram



Sensor pin	Engine management control unit pin	Engine management control unit connector	Function
1	D1	A	Signal
2	E4	A	Ground

K032 Engine oil level sensor

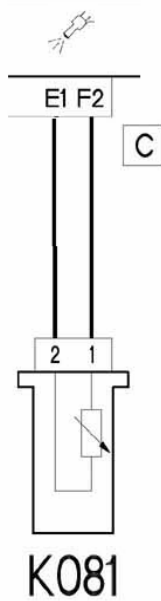
M010 Engine management control unit

Fuel temperature sensor

The fuel temperature sensor is used to control the pressure in the rail and the injected quantity. It uses the characteristics of an electrical resistance that varies according to the temperature.



M010



1 - Resistance

The following table gives the resistance in relation to the temperature.

Temperature (°C)	Resistance (kOhm)
-30	25.4
-20	15.04 (+1.29 -1.20)
-10	9.16
0	5.74
10	3.70
20	2.45 (+0.14 -0.13)
30	1.66
40	1.15
50	0.811
60	0.584
70	0.428
80	0.318 (+-0.008)
90	0.240
100	0.1836
110	0.1417 (+-0.0018)
120	0.1108

Electro-injectors

The electric injectors are fitted onto the cylinder head and controlled by the injection control unit.



The electric injector can be divided into two parts:

- actuator/nozzle composed of pressure rod (1), pin (2) and nozzle (3);
- governing solenoid valve composed of coil (4) and pilot valve (5).

The electric injector operation can be divided into three phases.

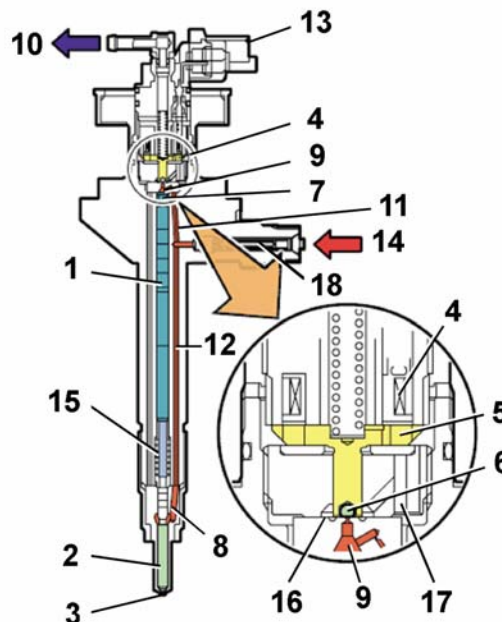
REST POSITION: coil (4) is de-energized, and shutter (6) is in the closing position and does not allow fuel to be let into cylinder $F_c > F_a$, where:

- F_c : is the force due to the line pressure that acts on control area 7 of rod 1;
- F_a : is the force due to the line pressure that acts on feed volume 8.

START OF INJECTION: coil (4) is energized and causes shutter (6) to be raised.

The control volume fuel (9) flows out toward return manifold (10), thus causing a pressure drop on control area (7). At the same time, the line pressure through feed duct (12) exerts a force $F_a > F_c$ in feed volume (8), thus causing pin (2) to be lifted, with resulting fuel flow into the cylinders.

END OF INJECTION: coil (4) is de-energized and causes shutter (6) to go back to its closing position, which gives rise to such a force balance that pin (2) is made to go back to its closing position, and injection is terminated, accordingly.



- 1 - Pressure rod
- 2 - Pin
- 3 - Nozzle
- 4 - Coil
- 5 - Pilot valve
- 6 - Ball shutter
- 7 - Control area
- 8 - Feed volume
- 9 - Control volume

- 10 - Fuel return - low pressure
- 11 - Control duct
- 12 - Feed duct
- 13 - Electrical connection
- 14 - Fuel inlet union - high pressure
- 15 - Spring
- 16 - Seal ring
- 17 - Outlet duct
- 18 - Filter

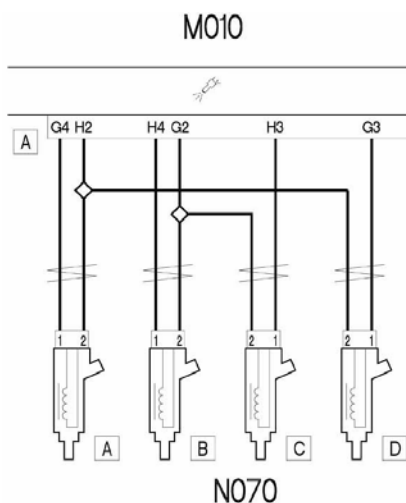
IMA classification

At the time of testing the injectors are checked by testing their characteristics under different conditions of pressure/delivery. All the injectors that fail to come within a certain standard are discarded; the remainder are classified with an alphanumeric code of sixteen characters, the IMA code, written by laser onto the top of the electric connector.



When fitting on the vehicle the control unit must save the single code and if replacing one or more injectors during servicing it is necessary to enter the change in code with the instrument diagnosis.

Electro-injector electrical connection diagram



The coil resistance of the single injector is 0.7 Ohm.

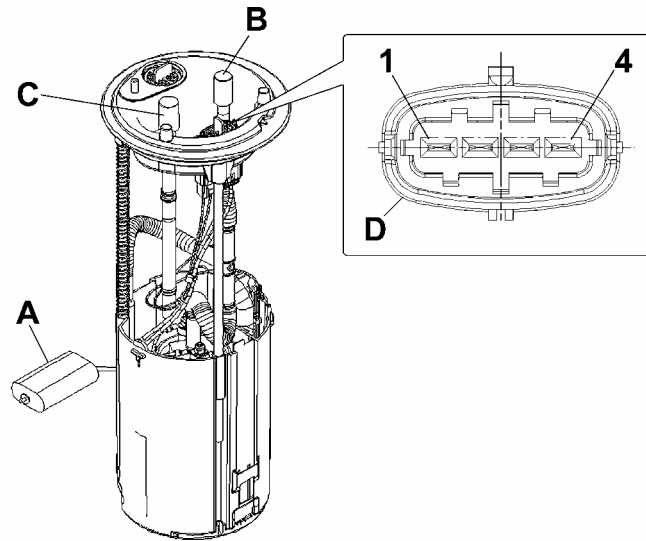
Actuator pin	Engine control unit pin	Engine control unit connector	Function
1 injector (A)	G4	A	Cylinder 1 injector control
2 injector (A and D)	H2	A	Command + injector cylinder 1 and 4
1 injector (B)	H4	A	Cylinder 2 injector control
2 injector (B and C)	G2	A	Command + injector cylinder 2 and 3
1 injector (C)	H3	A	Command – injector cylinder 3
1 injector (D)	G3	A	Cylinder 4 injector control

Submerged pump assembly complete with level gauge control

It is chiefly composed of:

- a fuel motor pump
- a fuel filter
- a level gauge of the type with a float
- a diaphragm pressure regulator
- a screen prefilter





- A – Level sensor with float
- B – Delivery union
- C – Return union
- D – Electrical connection

Pinout connector:

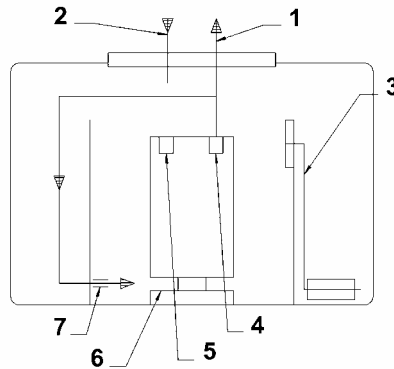
- 1 – Fuel level sensor power supply
- 2 – Fuel level sensor ground
- 3 – Motor pump ground
- 4 – Motor pump power supply

Characteristic data of the pump:

- safety valve setting: **600 - 800 KPa, (6-8 bar)**
- pump nominal delivery: 135 l/h (23°C),
- power supply: 12.5V.



The following figure illustrates the outline diagram of the pump assembly.

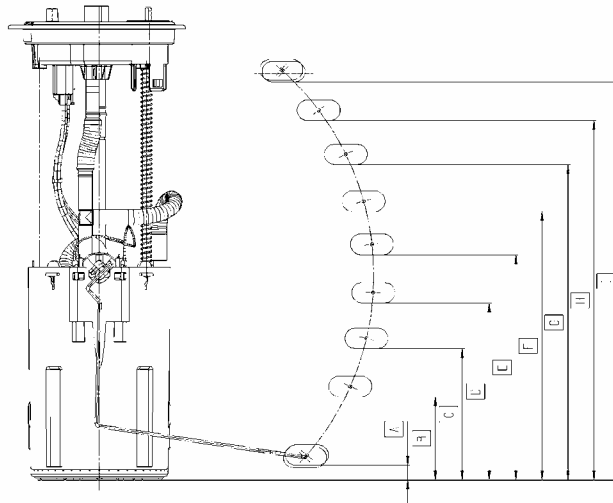


- 1 – Fuel delivery
- 2 – Fuel return
- 3 – Fuel level sensor
- 4 – Check valve
- 5 – Overpressure valve
- 6 – Filter
- 7 – Fuel return from the pump

The following table gives the fuel level sensor settings.

Check points	Tank empty stop	A	B	C	D	E	F	G	H	I	Tank full stop
Height measurement (mm)	9.5	11.2±2	59.6±2	96.3±2	133.0±2	169.7±2	202.5±2	238.2±2	271.8±2	303.3±2	304.8
Resistance (Ohm)	300 ±3	300±3	250±2.8	216±2.5	181±2.5	146.5±2.3	115.5±2	82±1.9	50±1.7	20±1.5	20±1.5
Fuel level (mm)		19	68	105	142	179	212	248	282	314	

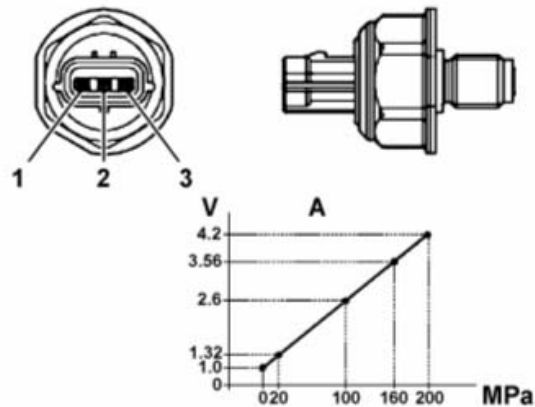




Fuel pressure sensor

The sensor measures the pressure of the fuel in the rail and sends an analog signal to the engine control unit. The control unit in its turn governs the flow regulator (on the high-pressure pump) to keep the pressure in the rail within the mapped values.

The sensor is the piezo-resistive type with a semiconductor, the internal resistance varies according to the pressure applied on a metal diaphragm.



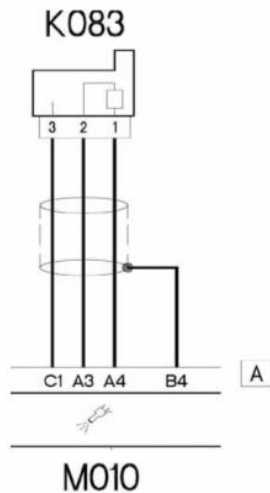
Pinout sensor:

- 1 – Supply voltage (5V)
- 2 – Sensor signal (V)
- 3 – Sensor ground

Graph A represents the signal in relation to the pressure.

Fuel pressure sensor electrical connection diagram





Sensor pin	Engine management control unit pin	Engine management control unit connector	Function
1	A4	A	Power supply +5V
2	A3	A	Signal
3	C1	A	Sensor ground

K083 Fuel pressure sensor
M010 Engine management control unit

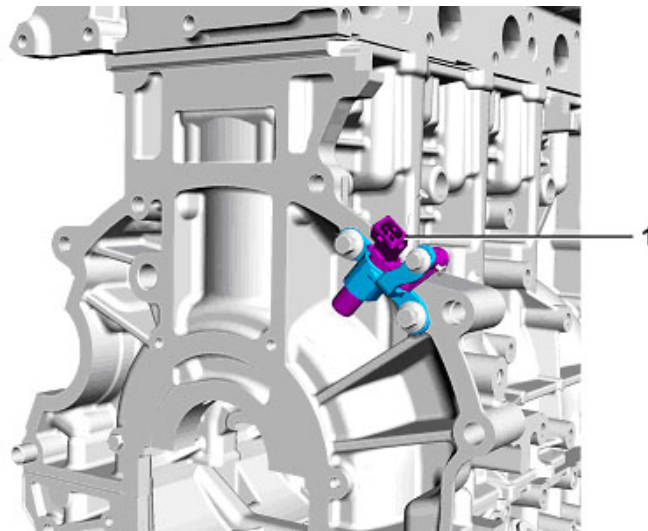
Revs sensor

The rpm sensor is fitted on the crankcase and “faces” the phonic wheel on the engine flywheel. It is inductive, that is it works by means of the change in magnetic field generated by the passage of the teeth of the phonic wheel (60 - 2 teeth).

The sensor generates a sinusoidal voltage varying between 0.33 V and 100V.

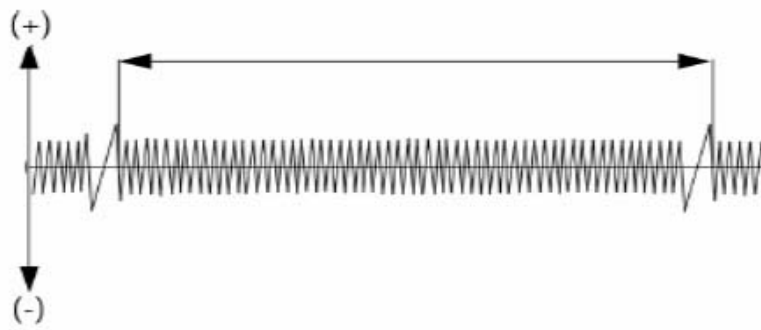
The injection control unit uses the revs sensor signal to:

- determine the rotation speed;
- synchronize with the timing sensor
- determine the angular position of the crankshaft.

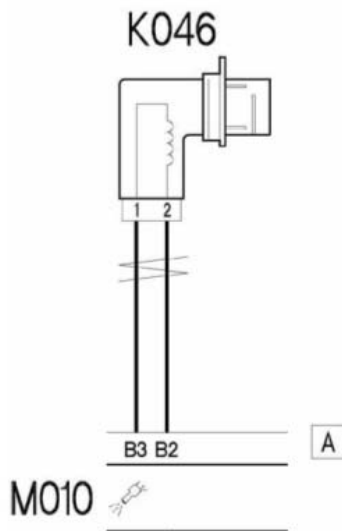


1 – Engine speed sensor





Rpm sensor electrical connection diagram



Sensor pin	Engine management control unit pin	Engine management control unit connector	Function
1	B3	A	Ground
2	B2	A	Signal

The sensor resistance is approximately 400 ohm

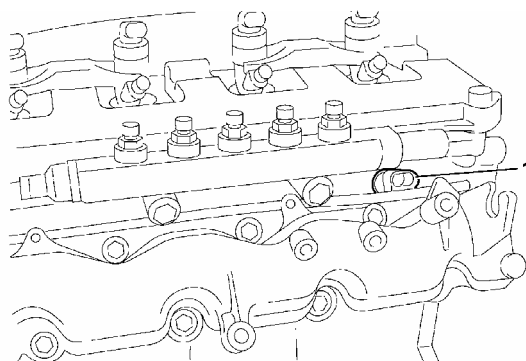
K046 Rpm sensor

M010 Engine management control unit

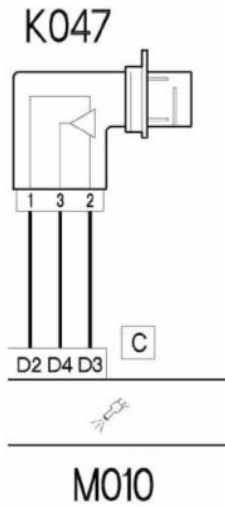
Timing sensor

The timing sensor is the “Hall” effect type. It is fitted on the cylinder head and “faces” the intake camshaft of which it recognizes the position of the second cam starting from the gearbox side.

The injection control unit uses the signal of the timing sensor to know the T.D.C. of the end of compression.



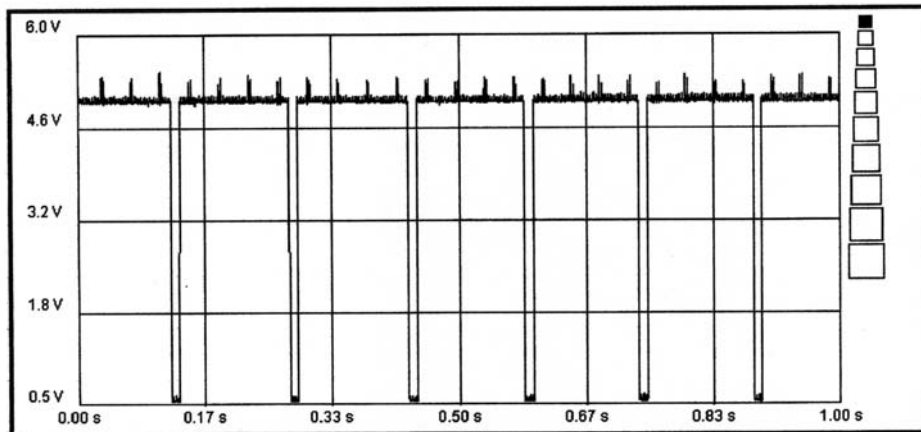
Timing sensor electrical connection diagram



Sensor pin	Engine management control unit pin	Engine management control unit connector	Function
1	D2	C	Power supply + 5 v
2	D3	C	Timing signal
3	D4	C	Timing sensor ground

K047 Timing sensor
M010 Engine management control unit

Timing sensor signal



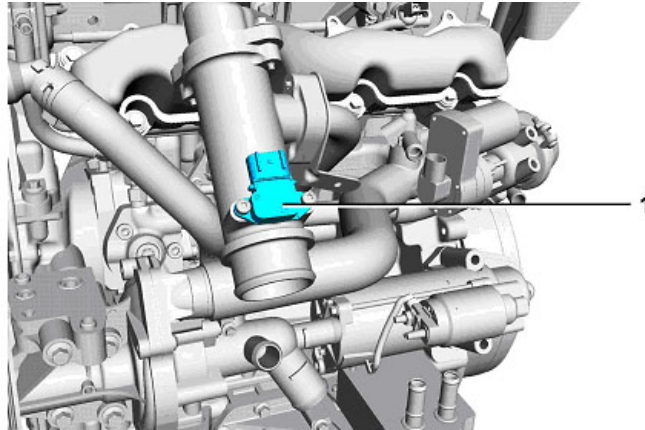
Intake air temperature and overpressure sensor



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

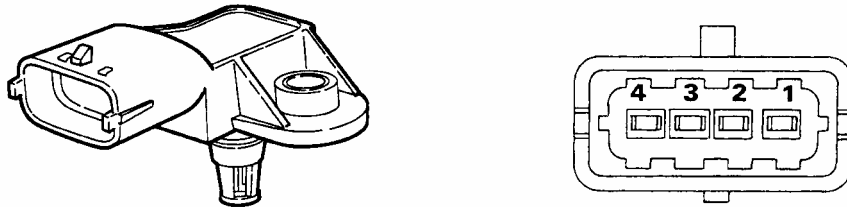
The sensor is fitted on the intake manifold. The signal sent to the engine control unit makes it possible to:

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



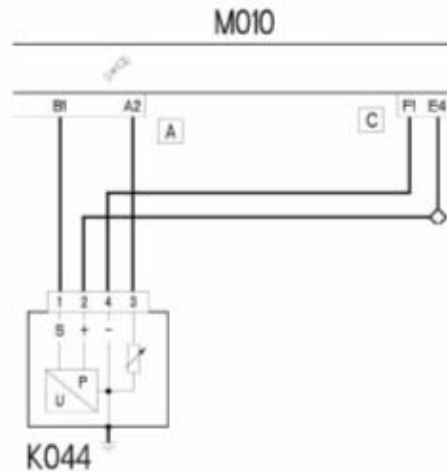
1 – Intake air temperature and overpressure sensor

The following figure illustrates the sensor pinout



Turbocharging pressure sensor electrical connection diagram

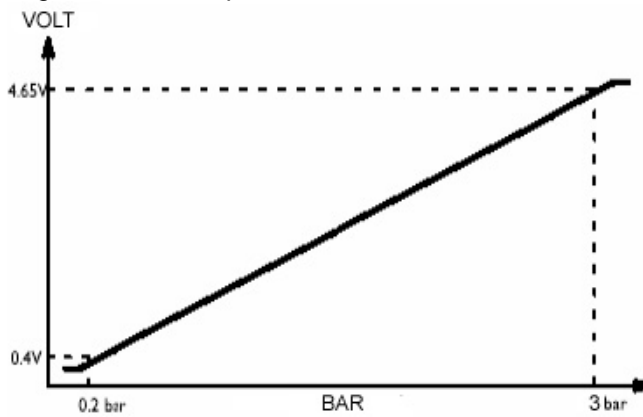




K044 Air temperature and pressure sensor
M010 Engine management control unit

Sensor pin	Engine management control unit pin	Engine management control unit connector	Function
1	B1	A	Pressure signal
2	E4	C	Power supply 5 V
3	A2	A	Air temperature signal
4	F1	C	Ground

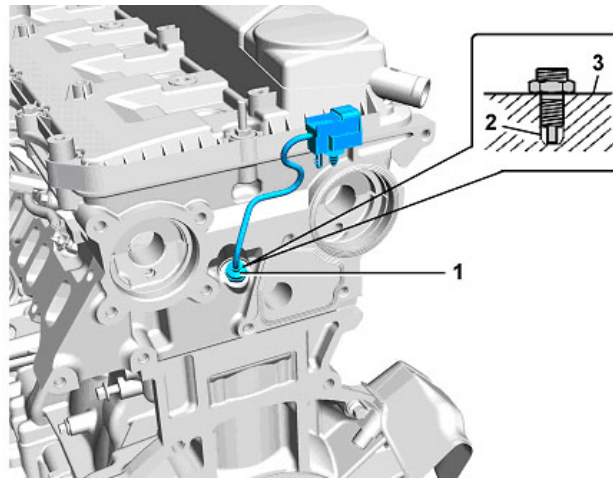
Graph of voltage in relation to pressure



Engine temperature sensor



The engine temperature sensor is fitted on the head, gearbox side, and measures the temperature with an NTC thermistor with a negative resistance coefficient.

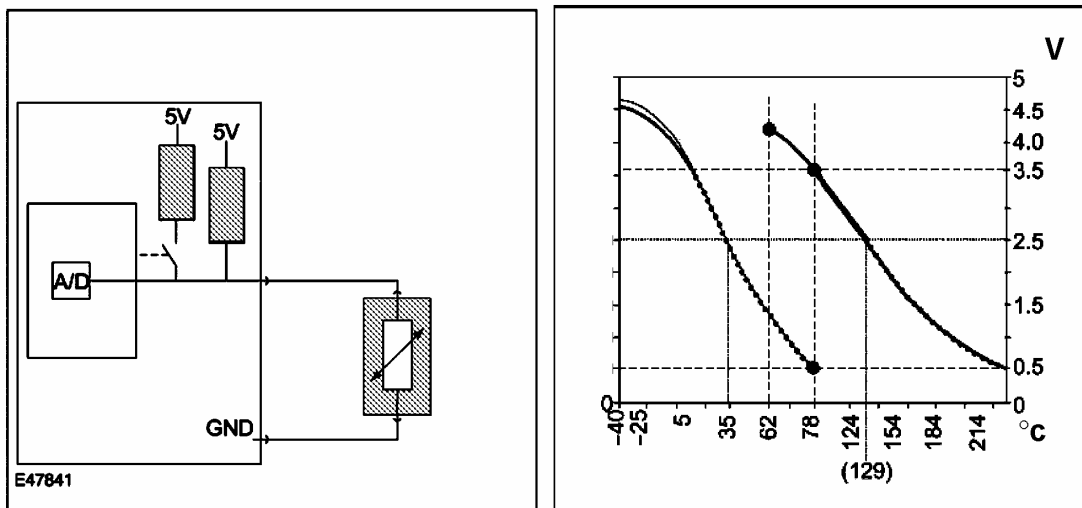


- 1 – Engine temperature sensor
- 2 – Sensitive element
- 3 – Cylinder head

The change in resistance, not being linear, for the same temperature increase, is greater for the lower temperatures than for the higher ones.

Inside the control unit there are two resistors, the second one is powered only on exceeding 62°C.

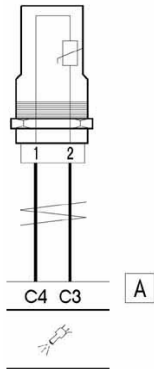
The following graph illustrates the change in signal in relation to temperature.



Engine temperature sensor electrical connection diagram



K036

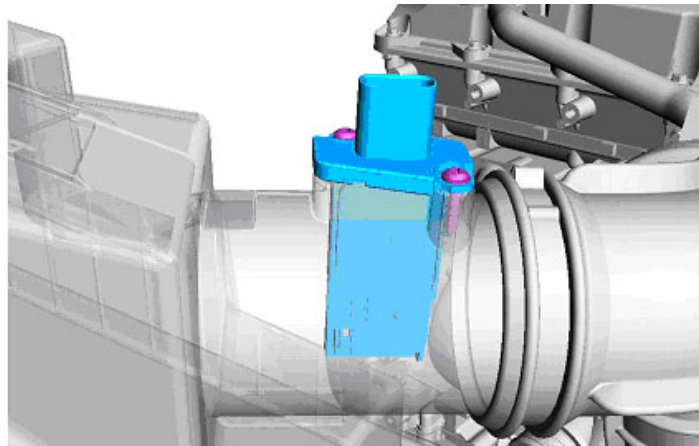


M010

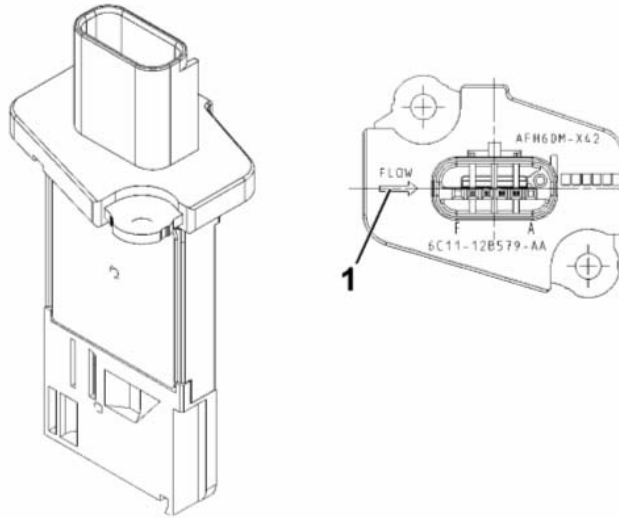
Sensor pin	Engine management control unit pin	Engine management control unit connector	Function
1	C4	A	Engine temperature sensor signal
2	C3	A	Ground engine temperature sensor

K036 Engine temperature sensor**M010** Engine management control unit**Air flow meter (debimeter) with built-in air temperature sensor**

The air flow meter is on the air intake sleeve and is the “heated film” type.



The following figure illustrates the air flow meter.



1 – Indication for correct debimeter positioning

Pinout

- A – N.C.
- B – Air flow rate sensor signal
- C – Ground
- D – Air flow sensor power supply
- E – Air temperature sensor signal
- F – N.C.

CAUTION: It is not possible to break down the air flow meter

The following table gives the frequency values of the signal in relation to the measured air flow.

Output signal frequency (Hz)	Air flow (kg/h)
9,989	700
9,773	650
9,527	600
9,268	550
8,991	500
8,690	450
8,369	400
8,020	350
7,631	300
7,195	250
6,714	200
6,120	150
5,340	100
5,153	90
4,725	70
4,180	50
3,692	35
3,503	30
2,197	20
1,965	7

The following table gives the tolerance of the signal in relation to the air flow.



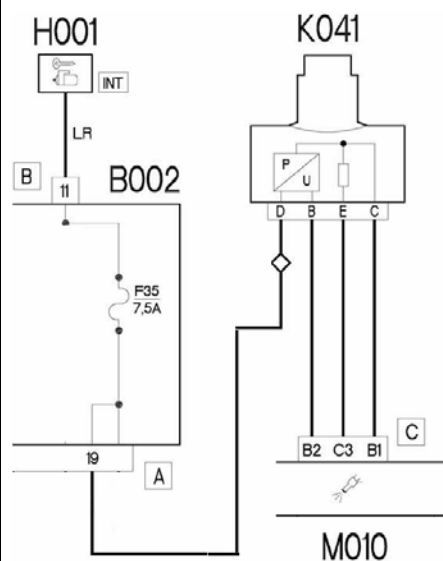
Tolerance (%)	Air flow (kg/h)
3	7 – 18
2	18 – 300
3	300 – 700

The following table gives the temperature sensor output resistance and voltage in relation to the intake air temperature.

Temperature (°C)	Output voltage (V)	Nominal resistance (Ohm)
- 40	4,537	925,021
- 30	4,7999	496,051
- 20	4,3675	276,959
- 10	4,1931	160,313
0	3,9404	95,851
10	3,6013	58,987
20	3,1848	37,340
25	2,9556	30,000
30	2,7188	24,253
40	2,2440	16,113
50	1,7995	10,926
60	1,4119	7,548
70	1,0921	5,335
80	0,8384	3,837
90	0,6422	2,804
100	0,4925	2,080
110	0,3795	1,564
120	0,2942	1,191

NOTE: The debimeter measures the mass (not the volume) of air directly, thereby eliminating problems of temperature, altitude, pressure, etc.

Debimeter electrical connection diagram



Sensor pin	Engine management control unit pin	Engine management control unit connector	Function
B	B2	C	Air flow rate sensor signal
C	B1	C	Ground
D			Air flow sensor power supply
E	C3	C	Air temperature sensor signal

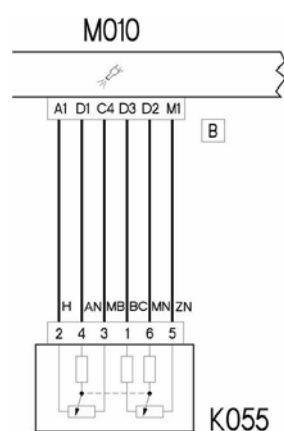


Accelerator pedal potentiometer

The sensor is composed of a casing secured to the accelerator pedal inside which, in an axial position, there is a shaft connected to the two potentiometers: the ratio between the signals of the two potentiometers is 2:1 (one potentiometer has twice the resistance of the other). These two signals (in volts) are detected by the control unit that processes them together with the information on the rpm to obtain the injection times and associated pressure.

A helical spring on the shaft ensures the right pressure resistance, while a second spring ensures it returns on release.

Accelerator pedal sensor electrical connection diagram



K055 Accelerator pedal sensor M010 Engine management control unit

Values of the electrical resistance of potentiometer 1

Between pins 3 and 4 with pedal released with pedal pressed	1.2 KΩ 2.1 KΩ
Between pins 2 and 4 with pedal released with pedal pressed	2.1 KΩ 1.3 KΩ
Between pins 2 and 3	1.2 KΩ

Values of the electrical resistance of potentiometer 2

Between pins 1 and 5	1.8 KΩ
Between pins 5 and 6 with pedal released with pedal pressed	1.2 KΩ 1.9 KΩ
Between pins 1 and 6 with pedal released with pedal pressed	2.8 KΩ 2.2 KΩ

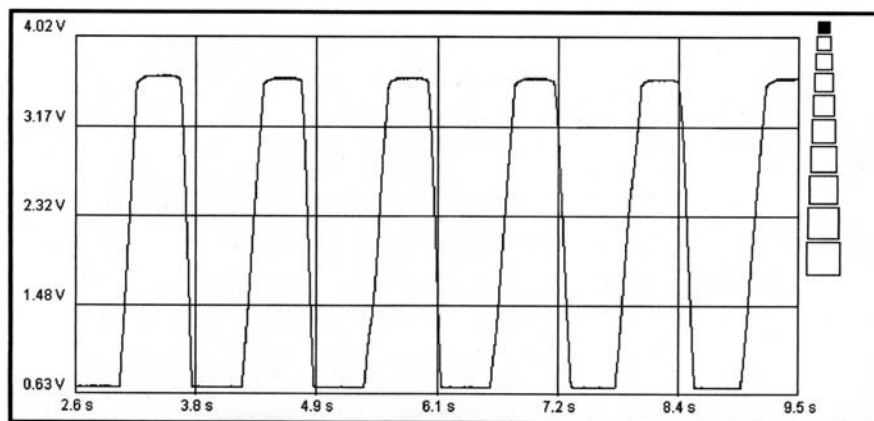


Pin out of the sensor



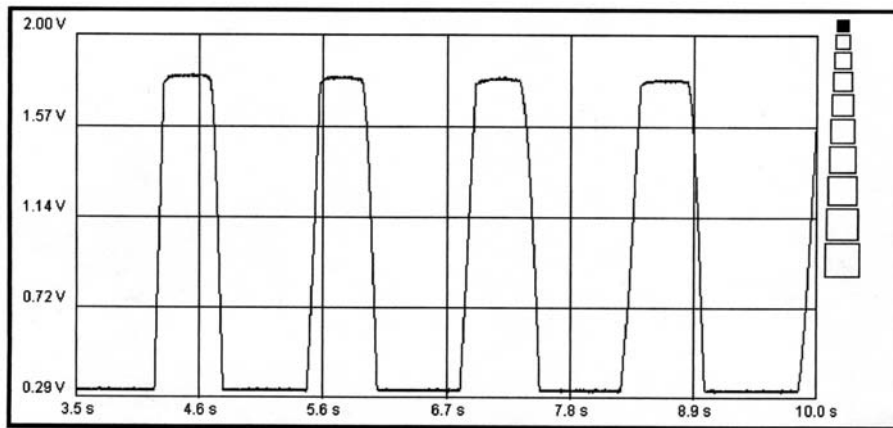
Sensor pin	Engine management control unit pin	Engine management control unit connector	Function
1	D3	B	Power supply +5V Potentiometer 2
2	A1	B	Power supply +5V Potentiometer 1
3	C4	B	Ground Potentiometer 1
4	D1	B	Signal Potentiometer 1
5	M1	B	Ground Potentiometer 2
6	D2	B	Signal Potentiometer 2

Track 1 potentiometer signal graph (repeated acceleration)



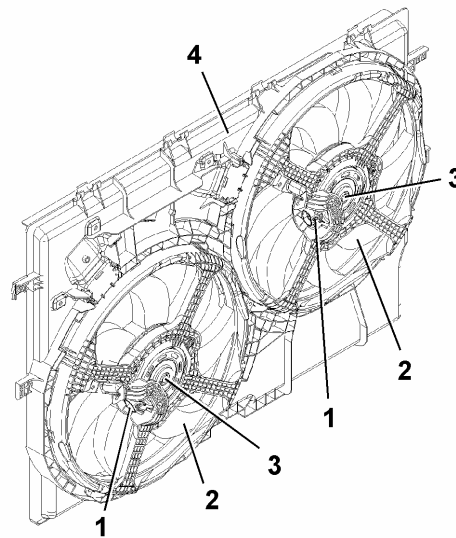
Track 2 potentiometer graph (repeated acceleration)





Electric fan

The electric cooling fans, of the type with two speeds, permit increasing the capacity of the radiator and/or condenser of the air-conditioning system to disperse heat. They are controlled directly by the engine control unit according to a specific operating logic.



- 1 – Motor power supply connector
- 2 – Fan
- 3 – Fan motor
- 4 – Air duct

Radiator cooling fan relay management

The Engine Management Control Unit manages the relay for switching on the radiator cooling fan according to the signals received from:

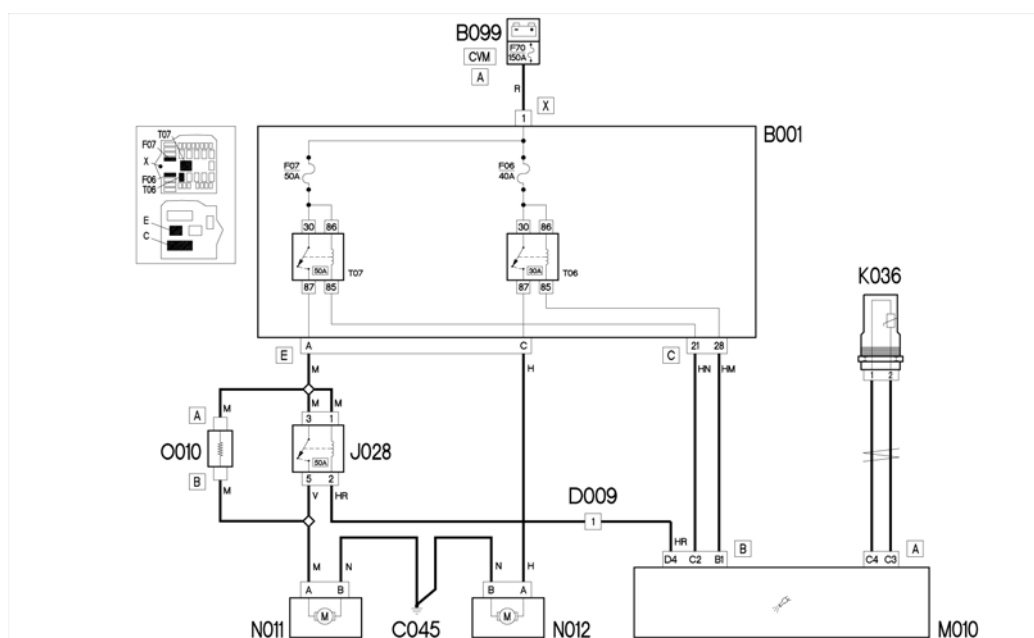


- engine coolant temperature sensor,
- linear sensor.

The following table gives the characteristic data of the electric fan motors

	Motor 200W fan with 9 blades	Motor 300W fan with 7 blades
Clear air rotation speed	2370 rpm	2623 rpm
Rotation speed on cooling module	2295 rpm	2623 rpm
Maximum input in clear air	18A	22A
Maximum input on cooling module	20A	22A
Pick-up input on cooling module	87.6A	107.4A
Pick-up torque	3 Nm	3.8 Nm

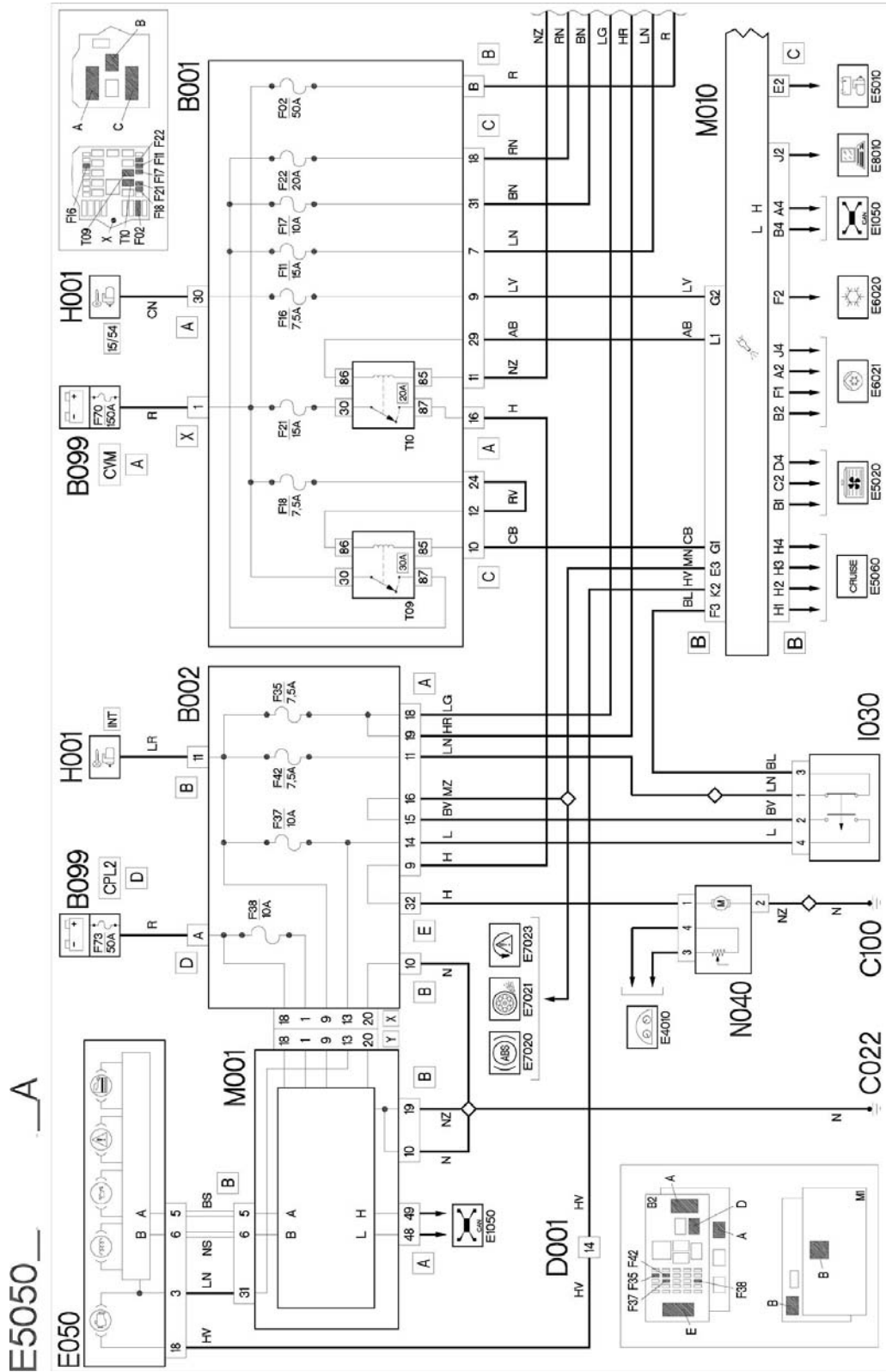
Electric fan management wiring diagram



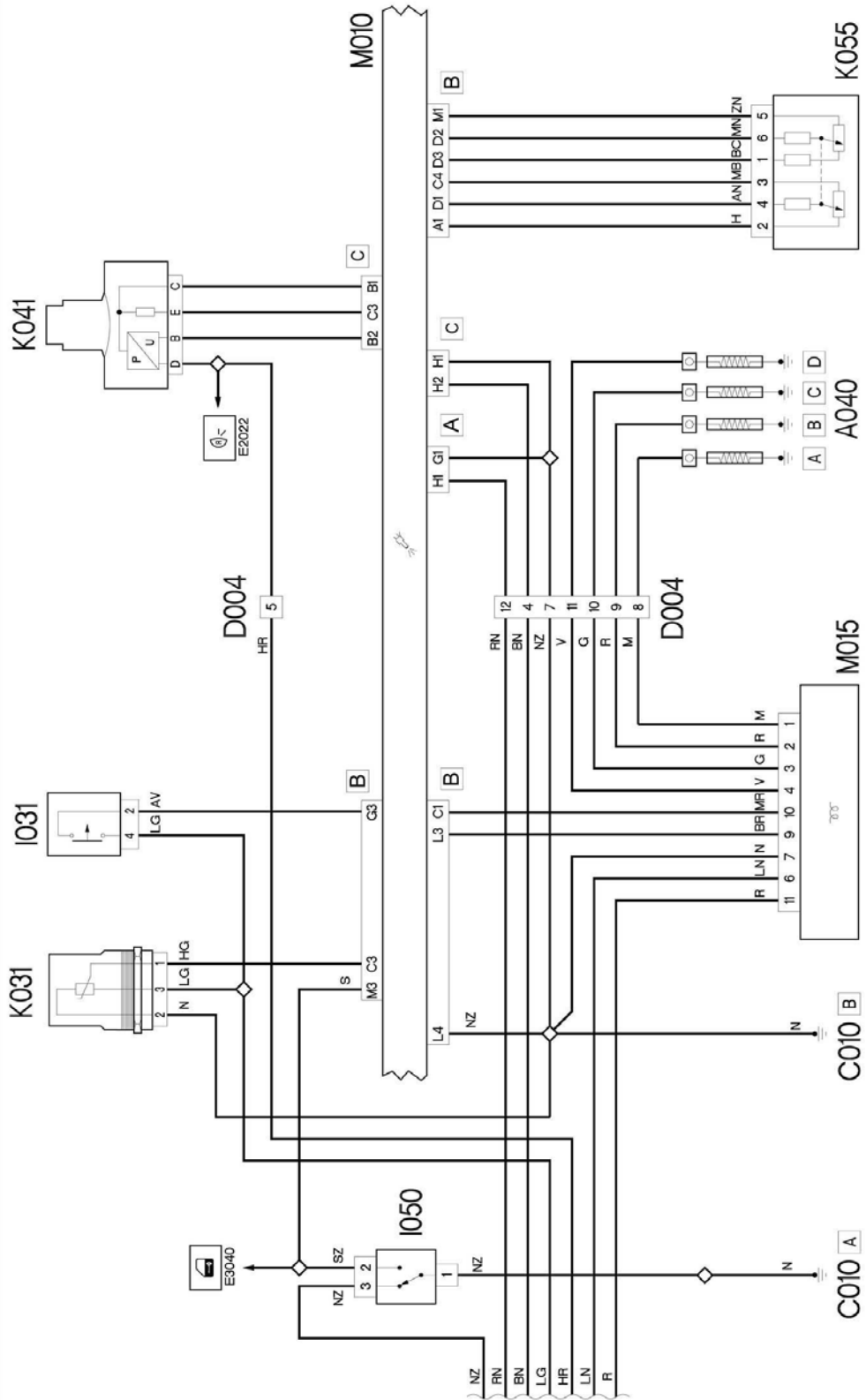
B099: battery control unit CBA. **B001:** engine compartment control unit CVM. **T07:** fan cut-in contactor N011. **T06:** fan cut-in contactor N012. **O010:** condenser and engine coolant cooling fan low-speed resistor. **J028:** fan high-speed contactor N011 located on fan frame. **N011:** condenser and engine coolant cooling fan. **N012:** condenser and engine coolant cooling fans. **C045:** engine compartment ground. **M010:** engine management control unit. **K036:** engine coolant temperature sensor. **D009:** connection.

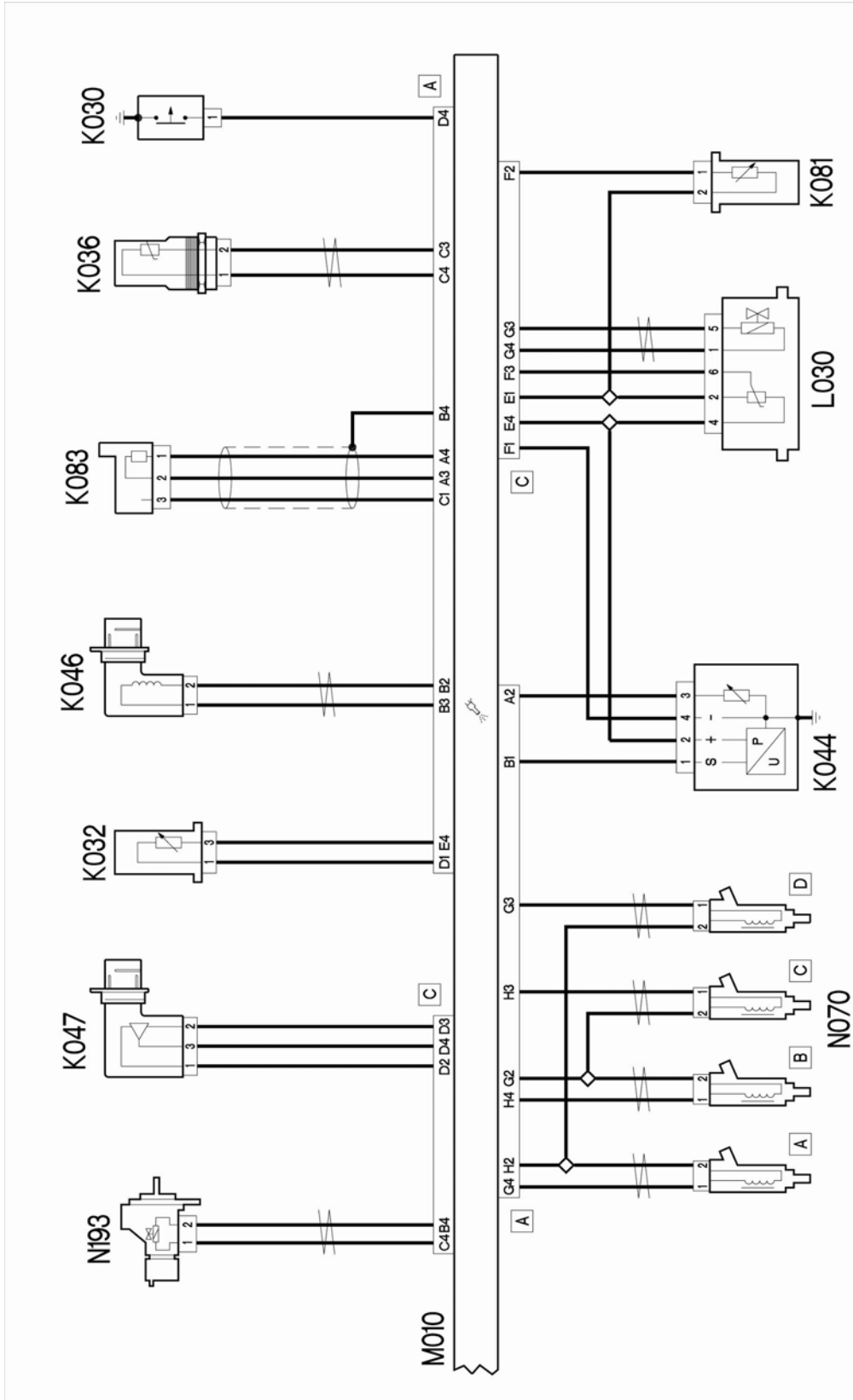


Engine management wiring diagram VISTEON V347/8



E5050 __ _B





Key to components

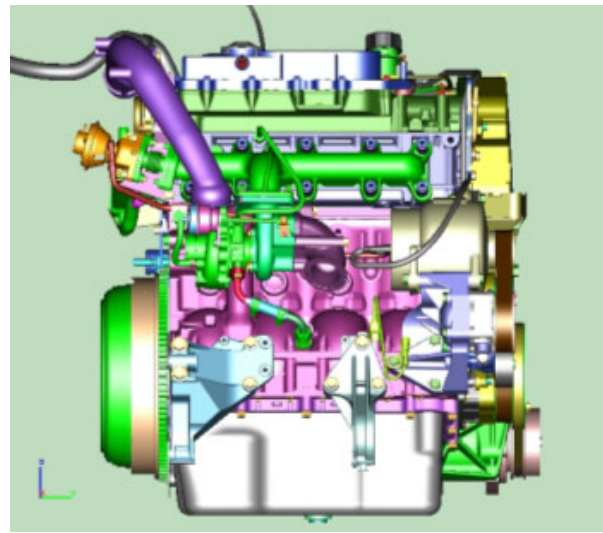
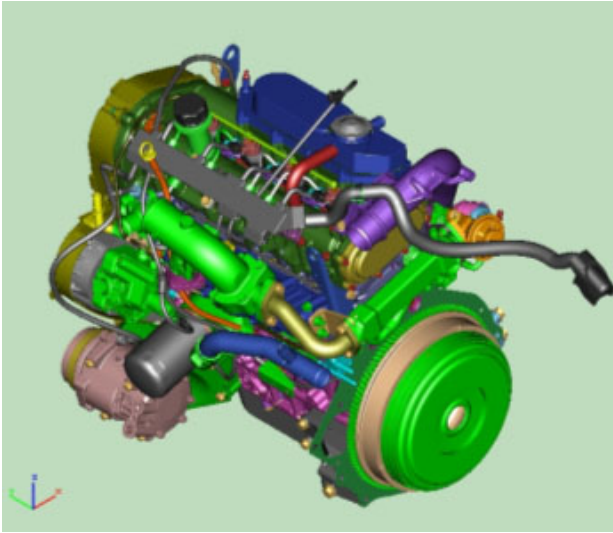


A040. Pre-heating glow plugs
B001. Engine compartment shunt control unit
B002. Shunt control unit under dashboard
B099. Pmaxi-fuse box on battery
C010. Front left ground
C022. Central dashboard ground
C100. Cab ground
D001. Dashboard/front joint
D004. Engine/front joint
E050. Instrument panel
H001. Ignition 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
K041. Air flow meter
K046. Revs sensor
K047. Timing sensor
K055. Accelerator pedal potentiometer
K081. Fuel temperature sensor
K083. Fuel pressure sensor
L030. EGR solenoid valve
M001. Body computer
M010. Engine management control unit
M015. Glow plug pre-heating control unit
N040. Fuel motor pump and fuel level meter
N070. Electro-injectors
N193. Fuel flow regulator

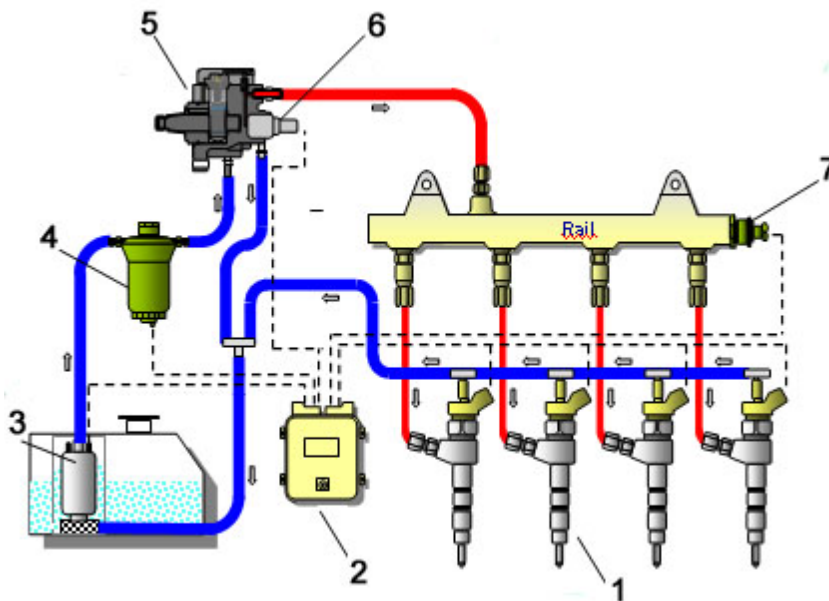


3.2 2.3 ENGINE

The significant differences with respect to the configuration already known are given below

**Fuel Architecture**

The following is the fuel architecture diagram for the 2.3 engine with the Bosch EDC16c39 engine control unit; the high pressure system is the 1600 bar type with CPIH pump.

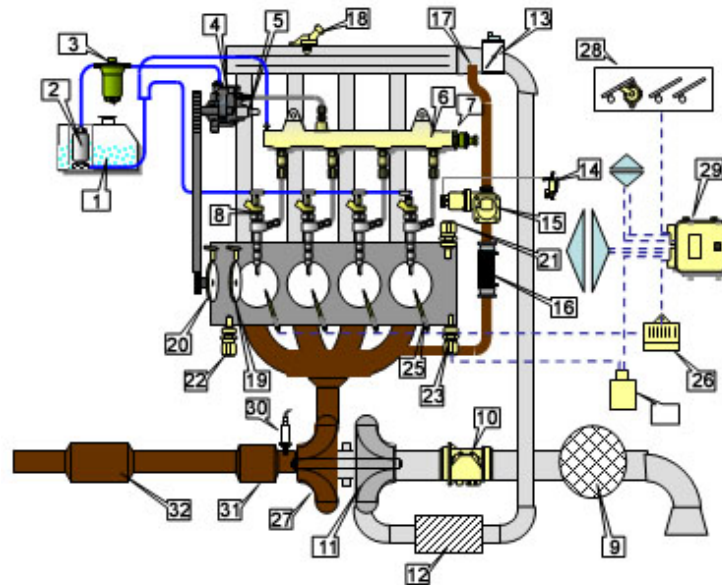


1. Injectors
2. Engine management control unit
3. Fuel pump
4. Fuel filter
5. High-pressure pump
6. Flow regulator
7. Fuel pressure sensor



Supply system diagram

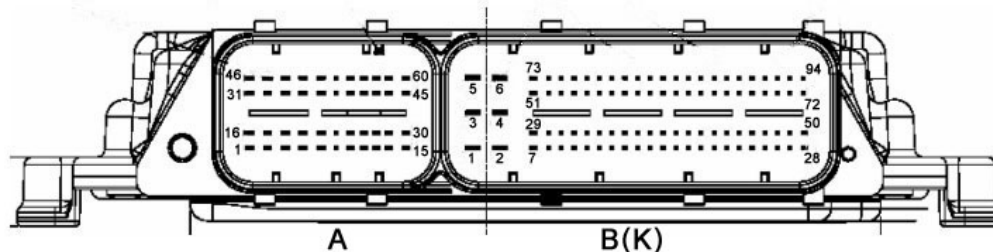
The following diagram represents the fuel air supply system used for the 2.3 engine; the engine control is Bosch EDC16c39 with lambda sensor.



1. Tank
2. Fuel pump
3. Fuel filter
4. High-pressure pump
5. Flow regulator
6. Rail
7. Fuel pressure sensor
8. Injectors
9. Air filter
10. Decimeter (with intake air temperature sensor)
11. Compressor
12. Intercooler
13. Powered throttle
14. EGR solenoid valve
15. EGR pneumatic valve
16. EGR cooling
17. Gas inlet from EGR
18. Intake air pressure and temperature sensor
19. Revs sensor
20. Timing sensor
21. Water temperature sensor
22. Minimum oil pressure sensor
23. Oil level sensor
24. Oil level control unit
25. Glow plugs
26. Glow plug control unit
27. Fixed geometry turbine Waste Gate
28. Accelerator pedal
29. Engine management control unit
30. Lambda sensor
31. Pre-catalyst
32. Catalyst



Bosch EDC16c39 engine control unit



Bosch EDC16C39 engine control pinout

CONN. A	Description	CONN. B (K)	Description
1	Injector no. 3 supply	1	Key-controlled power supply from main contactor
2	Injector no. 2 supply	2	Ground 1 control unit
3	NC	3	NC
4	NC	4	Ground 2 control unit
5	NC	5	Key-controlled power supply from main contactor
6	NC	6	Ground 3 control unit
7	NC	7	NC
8	Fuel pressure sensor (ground)	8	Accelerator pedal potentiometer 2 ground
9	NC	9	Accelerator pedal potentiometer 1 signal
10	NC	10	Fuel temperature signal (ground)
11	Timing sensor (power supply)	11	Fuel temperature sensor (signal)
12	Revs sensor (negative input)	12	Climate control unit pressure linear sensor (ground)
13	Absolute pressure sensor (power supply)	13	Climate control unit pressure linear sensor (signal)
14	NC	14	NC
15	NC	15	NC
16	Injector no. 1 supply	16	NC
17	Injector no. 4 supply	17	Brake pedal switch (signal)
18	NC	18	NC
19	Fuel flow regulator (power supply)	19	NC
20	Timing sensor (negative)	20	Fuel pump contactor power supply (positive)
21	NC	21	NC
22	Oil level sensor (ground)	22	Climate control unit pressure linear sensor (power supply)
23	Absolute pressure sensor (negative)	23	NC
24	NC	24	NC
25	NC	25	Line K for diagnosis

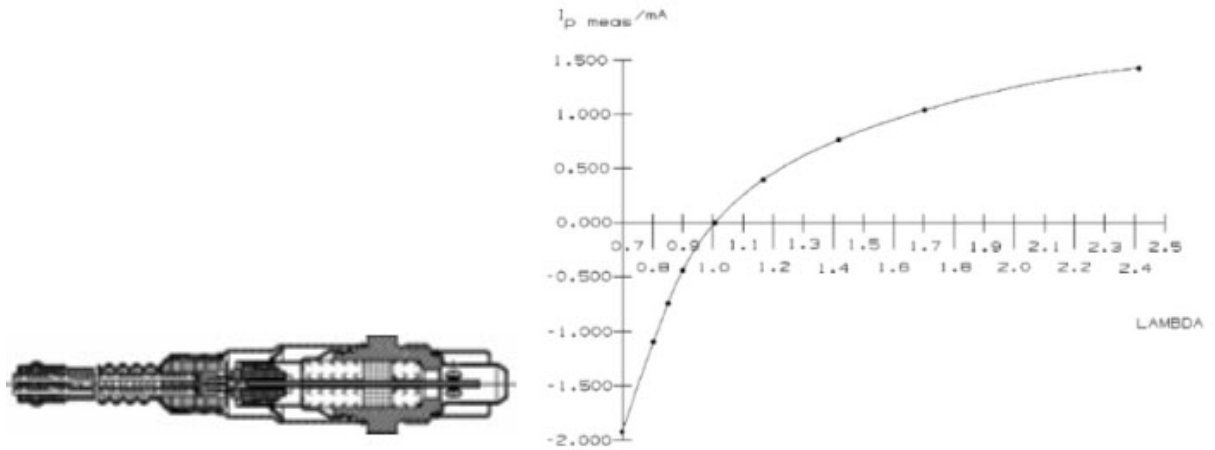


CONN. A	Description	CONN. B (K)	Description
26	NC	26	NC
27	Rpm sensor (positive input)	27	NC
28	Rail pressure sensor (positive)	28	Direct power supply from switch +15
29	NC	29	Compressor cut-in contactor command
30	NC	30	Accelerator pedal potentiometer 1 ground
31	Injector 2 (negative command)	31	Accelerator pedal potentiometer 2 signal
32	NC	32	DPF exhaust gas temperature signal
33	Injector 4, low side	33	DPF exhaust gas temperature ground
34	NC	34	Exhaust gas temperature sensor 1 signal
35	NC	35	Exhaust gas temperature sensor 1 ground
36	NC	36	Particulate filter differential sensor signal
37	Air temperature sensor (signal) inside the debimeter	37	Particulate filter differential sensor negative power supply
38	NC	38	Resume from cruise control command
39	NC	39	NC
40	Absolute pressure sensor (signal)	40	NC
41	Water temperature sensor (ground)	41	NC
42	Air mass quantity in the Debimeter signal	42	NC
43	Fuel pressure sensor on rail (signal)	43	NC
44	Debimeter (ground)	44	Particulate filter differential sensor power supply
45	NC	45	Accelerator pedal potentiometer 1 power supply
46	Injector 3 (negative command)	46	Accelerator pedal potentiometer 2 power supply
47	Injector 1 (negative command)	47	NC
48	NC	48	NC
49	Flow regulator control (negative)	49	NC
50	Timing sensor (signal)	50	NC
51	NC	51	Lambda sensor heating (negative)
52	Oil level sensor (signal)	52	Feedback input of the glow plug pre-heating time/fault detection
53	Air temperature signal of the absolute pressure sensor	53	NC
54	NC	54	Compressor cut-in request from push-button positive signal
55	NC	55	NC
56	Signal oil pressure sensor (normally closed)	56	Cruise control for "set / acc."
57	NC	57	NC
58	Water temperature sensor (signal)	58	NC
59	Powered throttle actuator	59	NC

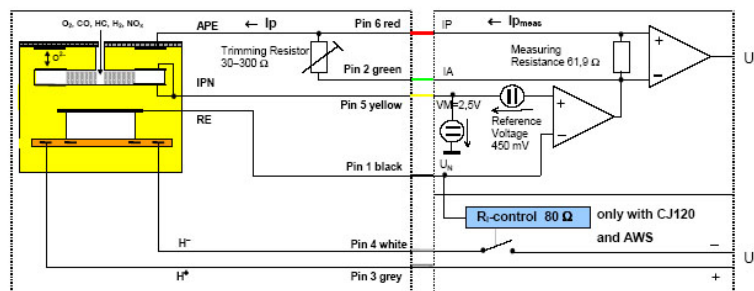


CONN. A	Description	CONN. B (K)	Description
	command		
60	EGR negative command	60	NC
		61	NC
		62	NC
		63	NC
		64	Lambda sensor Nerst cell reference voltage signal
		65	Lambda sensor pumping current
		66	NC
		67	NC
		68	Diesel filter heater contactor command (prearrangement)
		69	Engine cooling fan speed contactor 2 cut-in command
		70	NC
		71	Fault warning light (EOBD/MIL)
		72	Direct power supply from the battery
		73	NC
		74	Water in fuel sensor (signal)
		75	NC
		76	NC
		77	Cruise control on/off control lever positive
		78	Cruise control "set/dec." command positive
		79	Clutch pedal pressed positive signal (NC switch)
		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 pre-heating contactor
		94	Engine cooling fan speed contactor 3 cut-in command

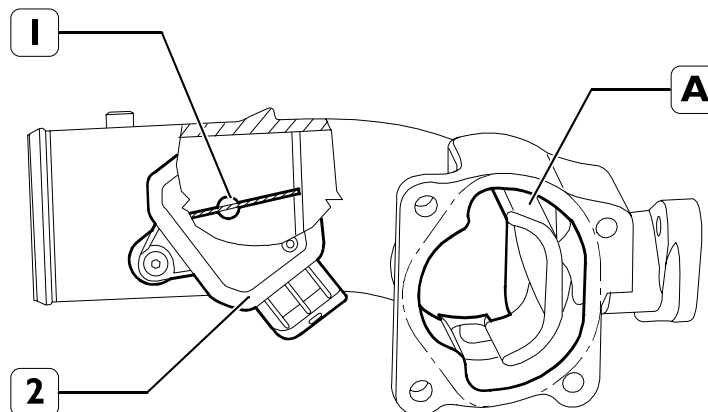
Lambda sensor



CHARACTERISTICS: The sensor is the broadband linear type LSU4.9 with incorporated heater. It can work in a range from $\lambda = 0.65$ in the air. For the sensor to work it must be coupled with a module integrated in the control unit as shown in the following figure.



Powered throttle



- 1 - Throttle valve
- 2 - Electric actuator
- A - Exhaust gas/air mixing chamber



The throttle valve assembly (normally open) supplied by Wahler, fitted on the intake manifold, has the function of regulating the flow rate of the air, from the intercooler, to mix with the exhaust gases recirculated by the E.G.R. valve, according to a programmed percentage. The air/exhaust gas mixing takes place with the turbulence generated in the chamber (A) shown in the figure.

The throttle valve is operated by an electric actuator controlled by a PWM signal between 5% and 95%; if the throttle valve locks the control unit reduces the engine performance to prevent it from possibly getting damaged.

The throttle is used also in the phase of switching off the engine to reduce the jolting in this condition.



Engine oil level measuring

The system is composed of an electronic control unit and a hot wire sensor.

The engine oil level is controlled only with the engine switched off when the key is turned onto drive position in the ignition switch.

The system utilizes the capacity of the oil to dissipate heat.

The current passing through the hot wire causes its temperature and its resistance to rise causing a drop in voltage.

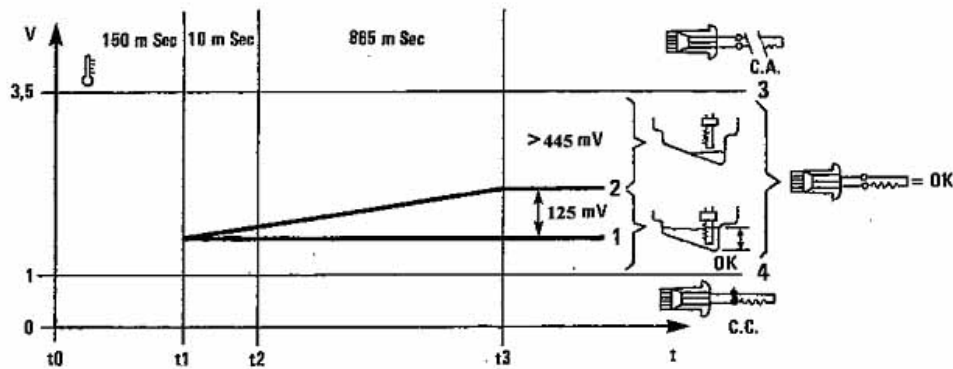
If the hot wire is submerged in oil, some of the heat will be absorbed by the oil; then the temperature, resistance and drop in voltage will have lower values.

With the key in the drive position the control unit sends a current of 210.5mA on the hot wire of the sensor. After a period for the power supply to settle ($t_0 - t_1 = 150 \text{ mSec}$) the control unit makes an initial measurement of the voltage ($t_1 - t_2 = 10 \text{ mSec}$).

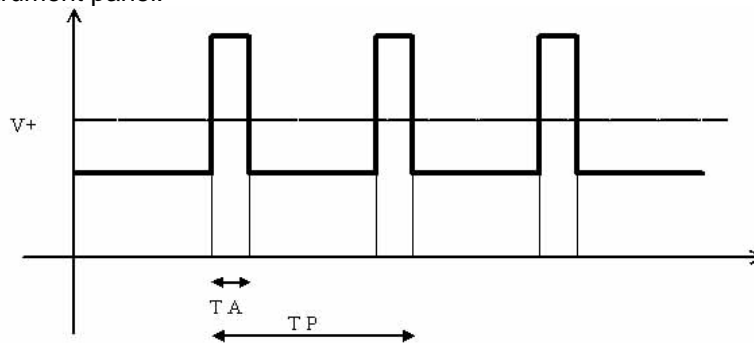
After a second period of time ($t_2 - t_3 = 865 \text{ mSec}$) the control unit makes a second measurement that is compared with the first one.

There may be the following conditions:

1. if the difference between the two measurements is less than 125mV, the oil level is as prescribed
2. if it is more than 445mV, the oil level is at the minimum
3. if the voltage of the second measurement is greater than 3.5V, the sensor is broken
4. if the voltage is less than 1V the sensor is short circuited.



The measurement made is converted into a PWM signal by the oil level control unit that sends it to the engine management control unit. The latter puts the parameter in the C-CAN network for the due signalling on the instrument panel.



Frequency PWM : $125 \pm 10 \text{ Hz}$
Tolerance at ambient temperature PWM $\pm 3.5\%$

PWM signal for the oil level information represented by duty cycle TA / TP.

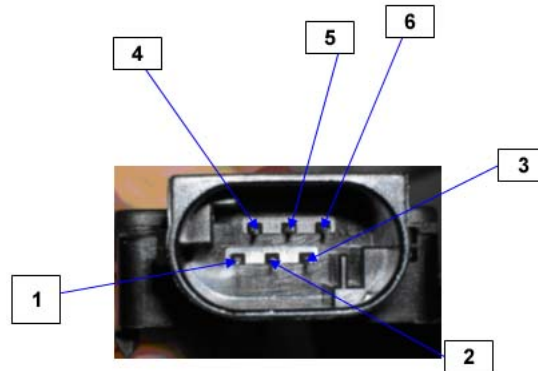
At the minimum level the PWM will be at 30% (440mV) whereas at the max level it will be 90% (125mV).

Between 10% and 15% the module is in the phase of acquisition.

Between 3% and 7% it means that a measurement error has been made.



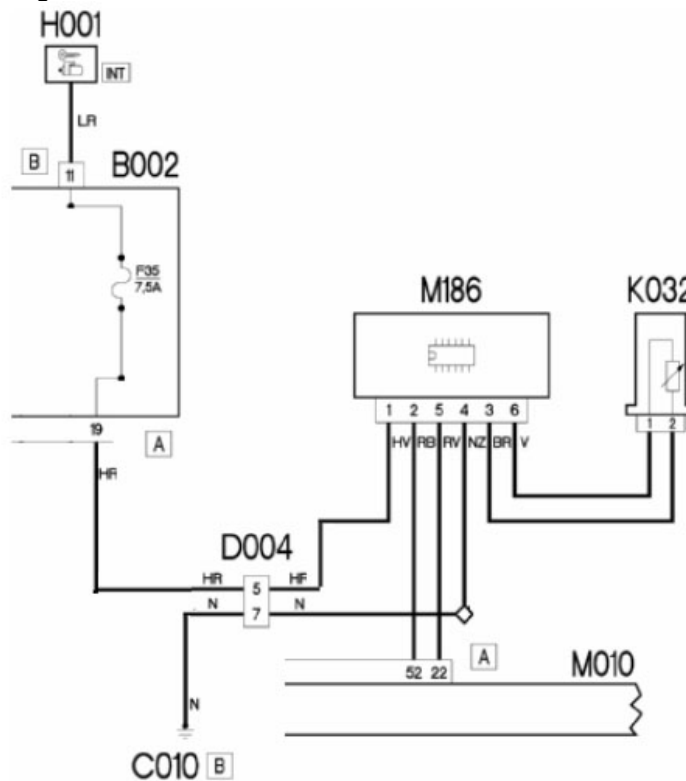
Control unit pin-out



PIN

- 1 +12 Volt
- 2 Output signal level
- 3 + Oil level sensor
- 4 Ground
- 5 Signal ground
- 6 Oil level sensor ground

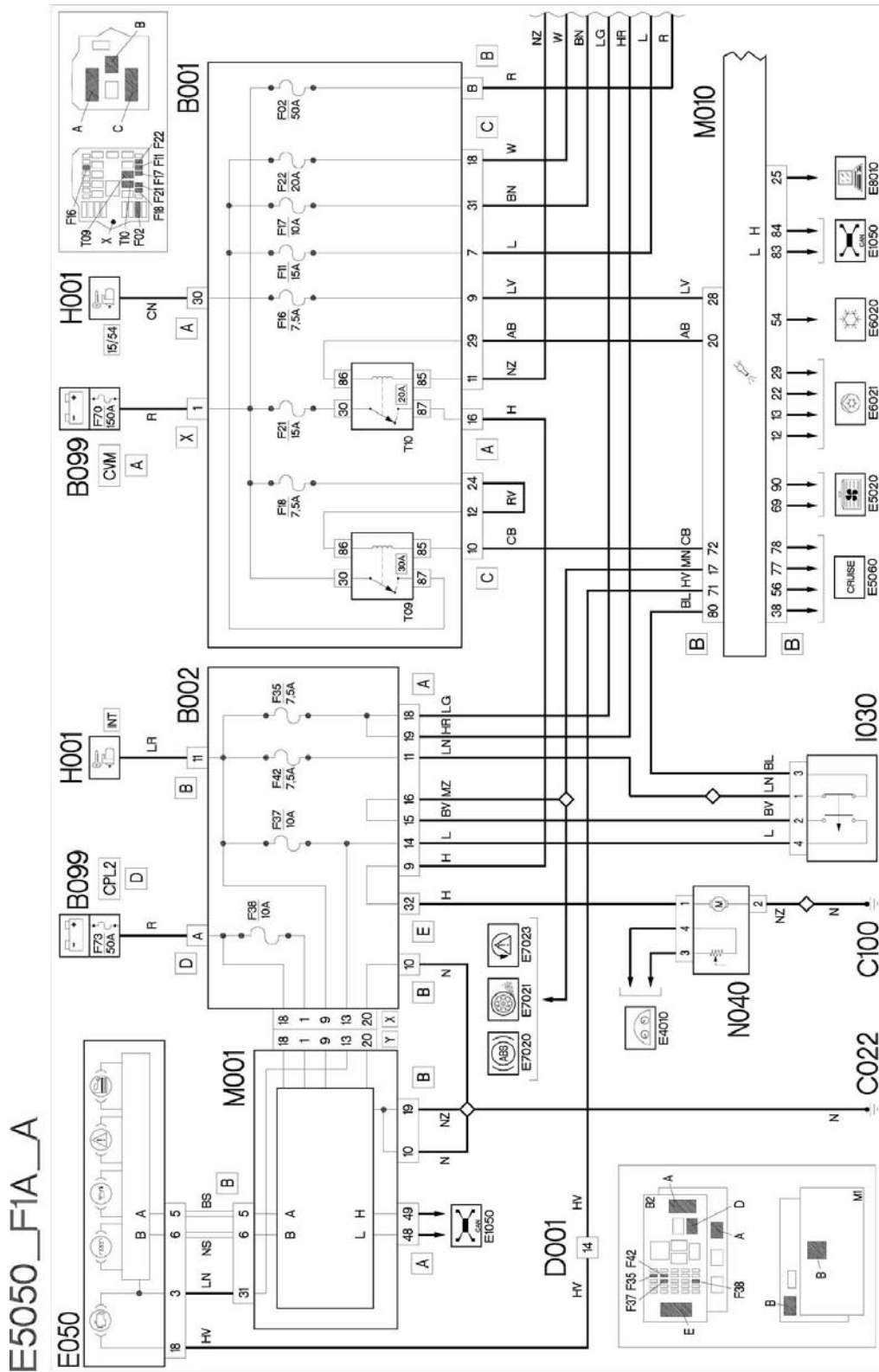
Electrical connection diagram

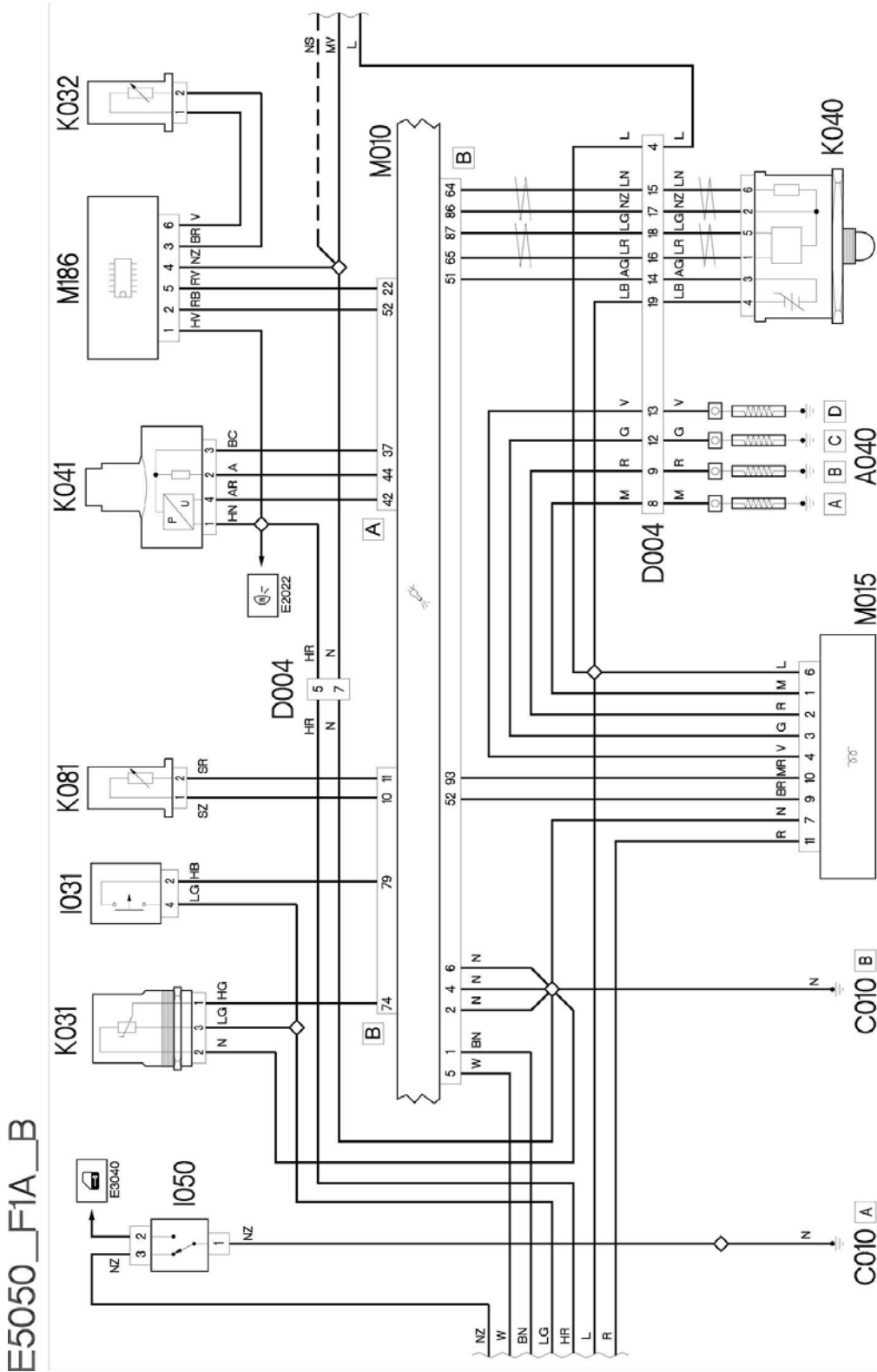


- B002 Shunt control unit under the dashboard
- C010 Front left ground
- D004 Front / engine junction
- M010 Engine management control unit
- M186 Engine oil sensor signal control unit
- K032 Engine oil level sensor

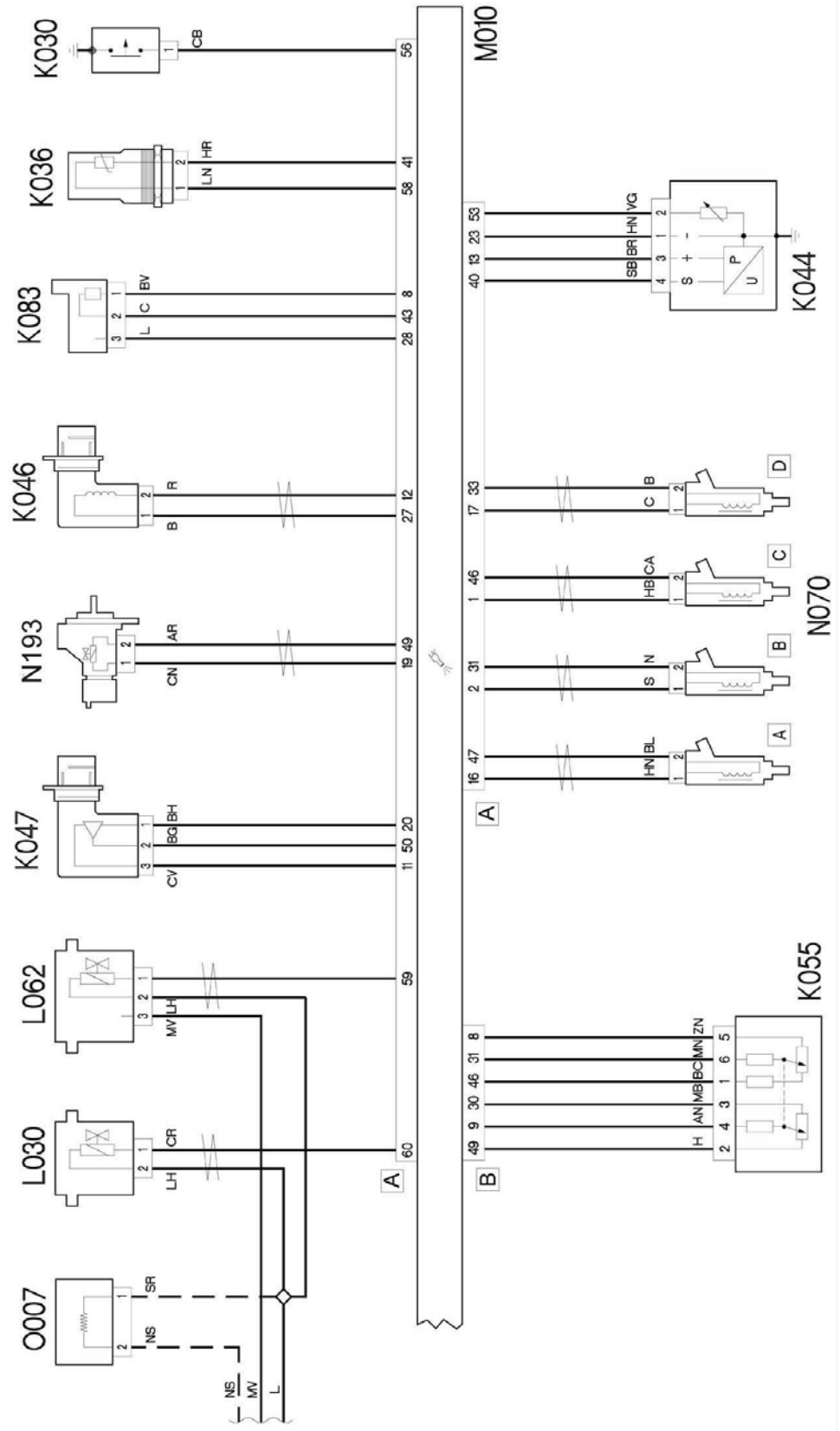


Engine management wiring diagram EDC16c39





E5050_F1A_C



Key to components

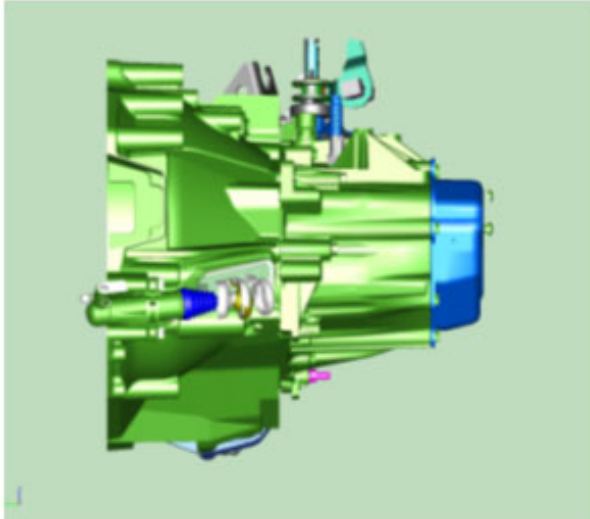
A040. Pre-heating glow plugs
B001. Engine compartment shunt control unit
B002. Shunt control unit under dashboard
B099. Pmaxi-fuse box on battery
C010. Front left ground
C022. Central dashboard ground
C100. Cab ground
D001. Dashboard/front joint
D004. Engine/front joint
E050. Instrument panel
H001. Ignition 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 temperature and pressure sensor
K046. Revs sensor
K047. Timing sensor
K055. Accelerator pedal potentiometer
K081. Fuel temperature sensor
K083. Fuel pressure sensor
L030. EGR solenoid valve
L062. Throttled body
M001. Body computer
M010. Engine management control unit
M015. Glow plug pre-heating control unit
M186. Engine oil level control unit
N040. Fuel motor pump and fuel level meter
N070. Electro-injectors
N193. Fuel flow regulator
O007. Oil vapour heating resistor



4. GEARBOX

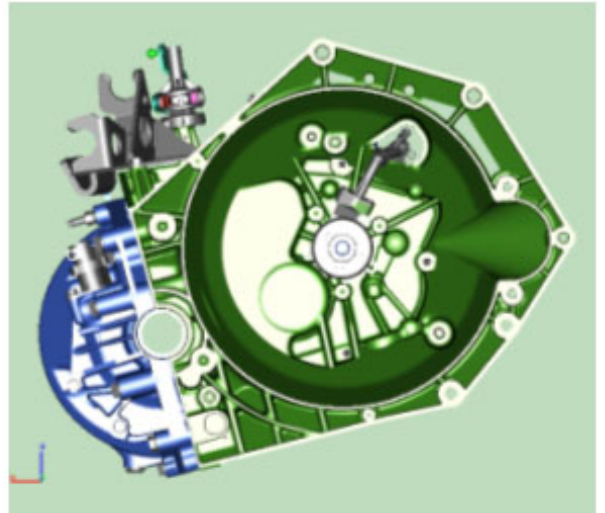
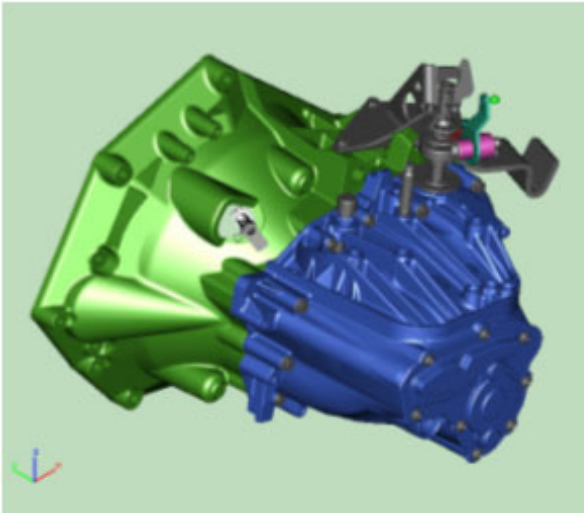
Features

MLGU 5 gears



The gearbox used for the 2.2 100 bhp engine is the 5-gear MLGU with hydraulic clutch control with external piston.

MLGU 6 gears



The gearbox used for the F1A 120/130 bhp engines is the 6-gear MLGU with clutch control coaxial with the gearbox main shaft (this gearbox is also an Opt for the 2.2 engine).

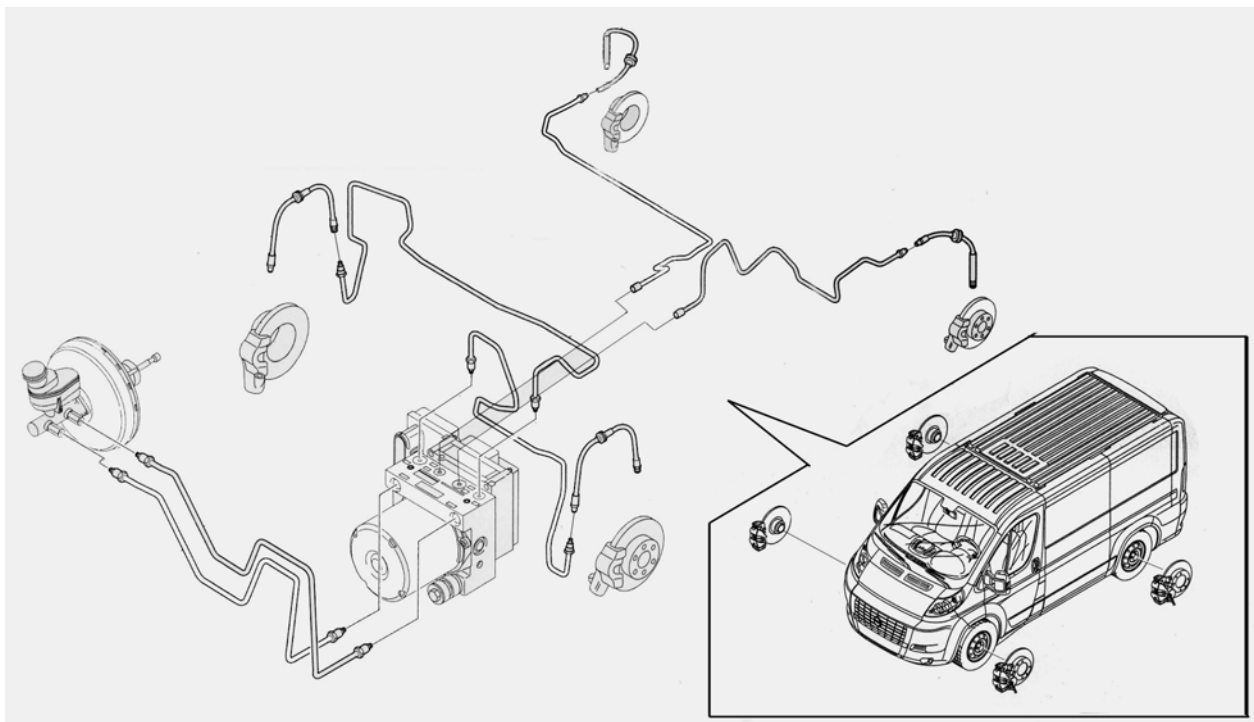


5. BRAKING SYSTEM

The system is the servo-assisted hydraulic type, composed of 2 independent crossed circuits (each circuit acts on a front wheel and on the diagonally opposite rear one) to ensure braking and stability also in case of one circuit failing; large diameter Bosch servo brakes (11") are used with an aluminium pump and extended travel to ensure a good reserve of pedal travel even under harsh conditions of overheating due to intense use.

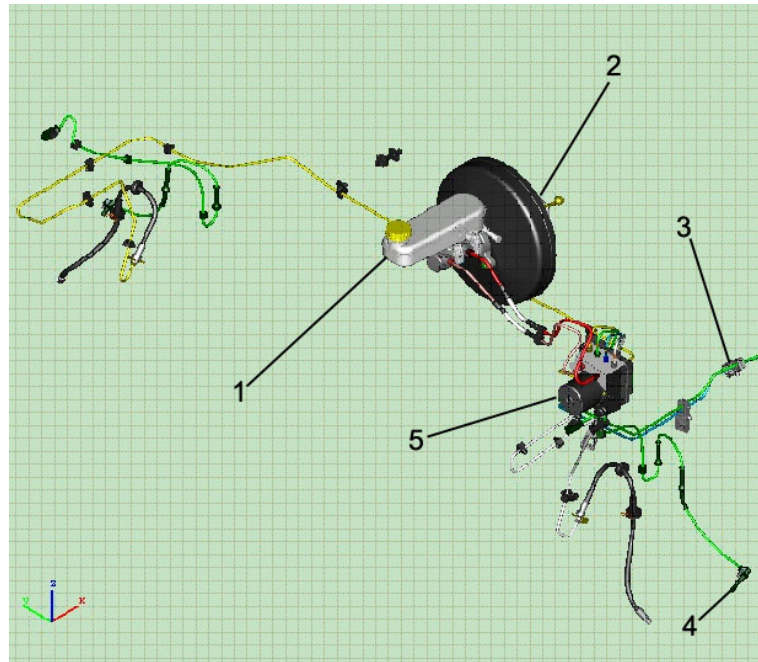
The Bosch 8.0 ABS system has a hydraulic power pack with 8 solenoid valves (12 for ESP versions), 4 sensors on and 4 channels with brake load sensing valve (or divider) (EBD).

System diagram



As on the preceding Ducato, the handbrake lever is positioned on the left-hand side of the driver in order to keep the central area of the passenger compartment clear. With the braking system with rear disc brakes, the parking brake is obtained inside the disc brakes, with a system called "Drum in Hat" that consists of a drum brake obtained inside the brake disc.





- 1-Oil tank
- 2-Servo brake
- 3-Rear pipes
- 4-Sensor for ABS
- 5-ABS control unit

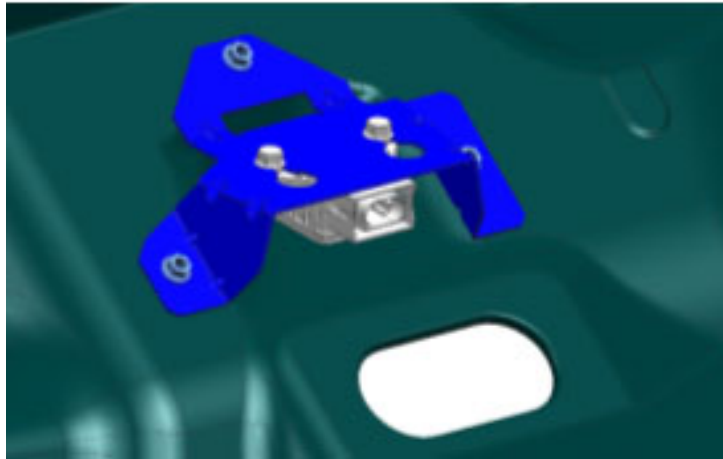
In addition to the above-mentioned sensors (and, of course, the control unit), the system is interfaced with the items below:

- high-speed CAN line (ABS dialogue with engine control unit / automatic transmission control unit);
- power assembly (specific brake pump);
- electronic throttle (dialogue with ASR);
- instrument panel (warning lights of the active type);
- steering angle sensor fitted to the steering column;
- yaw sensor located on the central floor in the central unit (to measure side acceleration and vehicle camber);
- special control unit fitted to the engine compartment.

Hill-holder function

The "Hill-holder" function is supplied combined with the ESP system. The yaw/side acceleration and longitudinal acceleration sensors are incorporated in a single sensor.





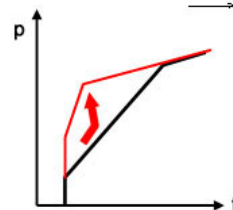
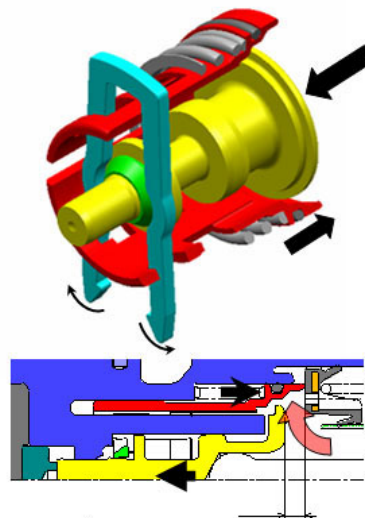
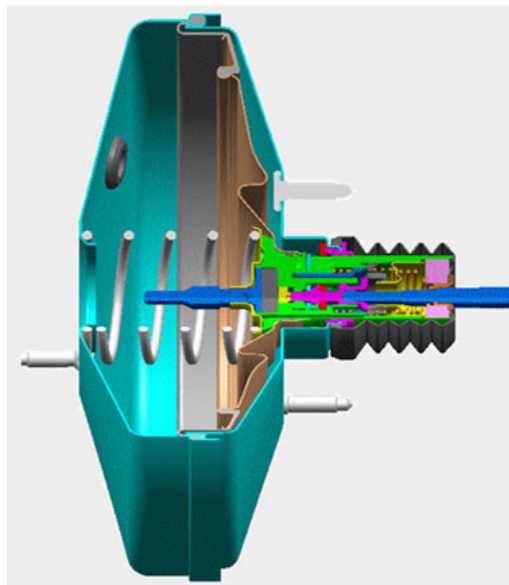
Yaw/side acceleration and longitudinal acceleration sensor

HBA function (Hydraulic Brake assistant, with ESP)

Electro-hydraulic braking assistant that automatically increases the pressure of the braking circuit during panic braking.

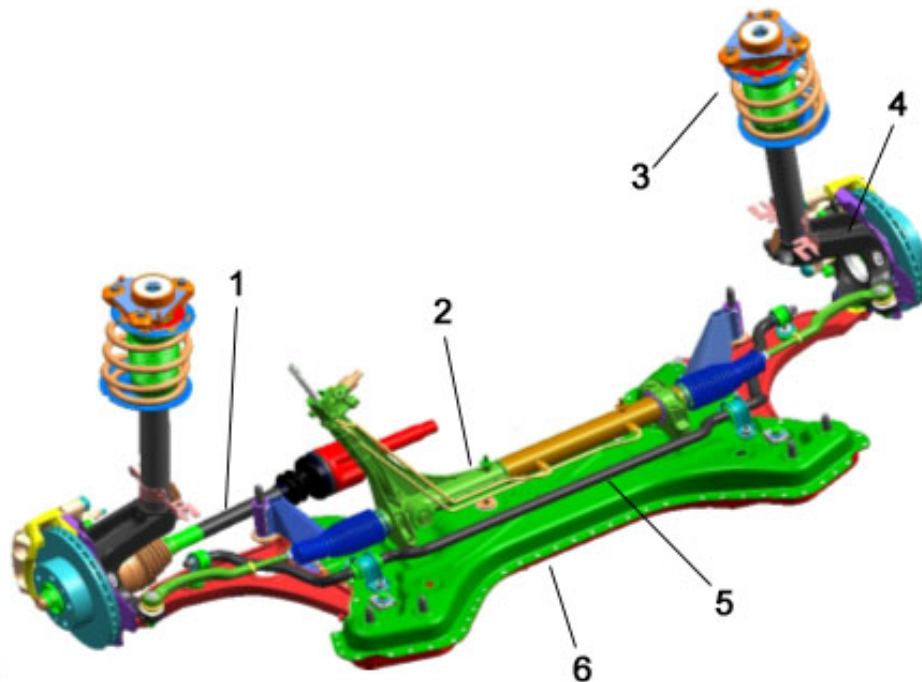
MBA system (Mechanical Brake Assistance, without ESP)

It automatically increases the braking circuit pressure during panic braking, thanks to a mechanical device, whose detail is shown in the figure, housed in the servo brake; during panic braking the device can increase the cross-section of the external air faster at atmospheric pressure acting on the diaphragm of the servo brake increasing its braking force.



6. SUSPENSION SYSTEM

Front suspensions



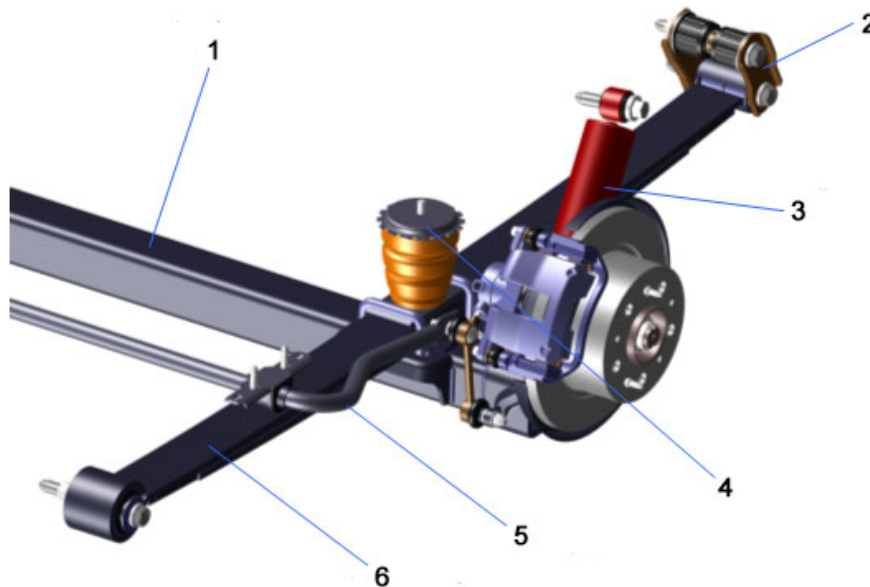
- 1 - Driving axle
- 2 - Steering box
- 3 - Spring and shock absorber assembly
- 4 - Wheel pillar
- 5 - Antiroll bar
- 6 - Crossbar

The front suspension is the MC Pherson type with independent wheels with:

- Telescopic shock absorbers secured to the bodywork with silentblocks and dust guards fitted on the pads.
- Helical springs offset from the shock absorber axis to decrease the transverse forces that would cause friction, that is resistance, to the free movement of the shock absorber rod in the body of the shock absorber.
- Buffer pads coaxial with the spring secured under the dome head.
- Lower arm with triangular pin with ball head secured to the wheel pillar and anchored with flexible bushes to the chassis mechanic cross bar.
- Wheel pillar designed to obtain the ideal geometry for the suspension.
- Completely new cross bar mechanics compared to the preceding vehicle to permit reaching the new goals of total ground weight of 4000kg. It is secured to the bodywork and supports all the elements of the front suspension: pin arms, steering box, antiroll bar.

Rear suspensions





1. Axle
2. Link
3. Shock absorber
4. Pad
5. Antirolling bar
6. Leaf spring

The rear suspension is the rigid axle type with leaf springs (H plan). The elements composing it are:

- Tubular axle with a square cross-section.
- Longitudinal leaf spring with link.
- Telescopic shock absorbers, anchored at the bottom on the axle flange and at the top to the bodywork, under the floor line.
- Bumper pad secured to the structural member.
- Antirolling bar (on some versions)

The tubular axle with a square cross-section permits reducing bending under load. In addition it has been sized to reach the goal of total ground weight up to 4000kg.

The pads are designed to withstand the stresses and strain due to the higher load targets. The leaf spring supporting brackets have been discarded and the fixing systems optimized (the leaf springs are secured straight onto the bodywork), while reducing the weight.

The characteristics of the rear suspensions are:

- Reduction in the height of the loading deck in order to be among the best in its category
- Increase in the rear track width of 50 mm compared to the preceding vehicle (it was 1740mm, on the new one it becomes 1790mm)
- Increase in the vehicle capacity and therefore increase in the total ground weight, on the previous one the maximum was 3500kg, on the new one it is 4000kg.
- Versions available with a track width increased up to 1980 mm for the leisure conversion bases.

Twin-blade leaf spring



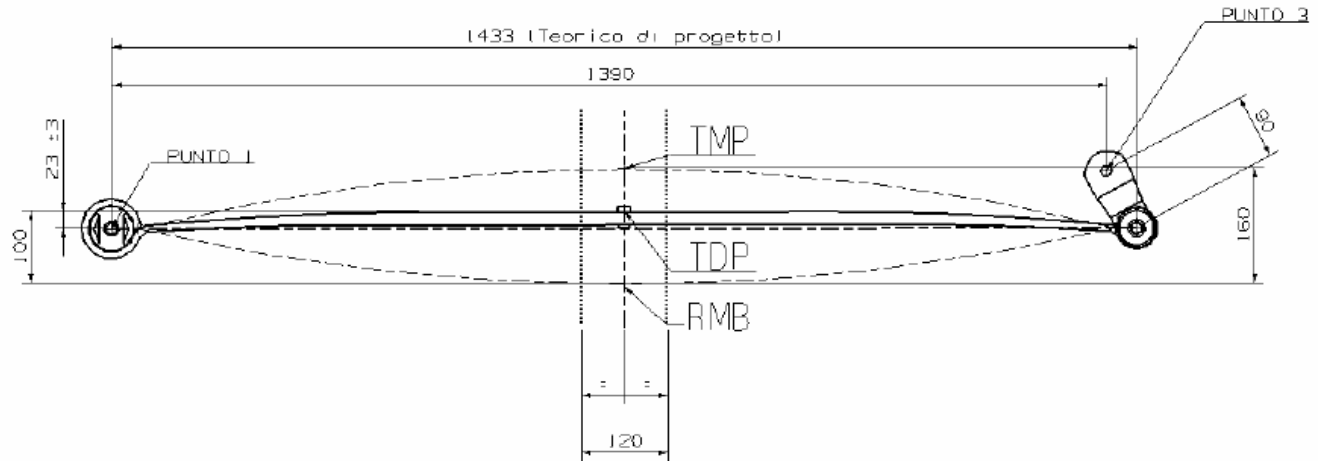
The range of rear suspensions offered is very broad and allows meeting all the needs of transport, driving position and comfort

The Panorama versions use leaf springs of the COMFORT type with variable flexibility with sliding bushes, capable of ensuring excellent driving conditions.

Three types of leaf spring are available for the Heavy versions: 1 single blade and 2 twin blade, whereas for the Light versions there are 4 different types of leaf spring, 3 twin blade and 1 single blade.

The twin-blade leaf springs feature reduced flexibility and are particularly useful in cases of harsh use or heavy conversions on chassis cab and chassis cowl versions, whereas the single-blade leaf springs are mainly fitted on vans.

All these leaf springs are combined with dedicated shock absorbers, designed specifically.

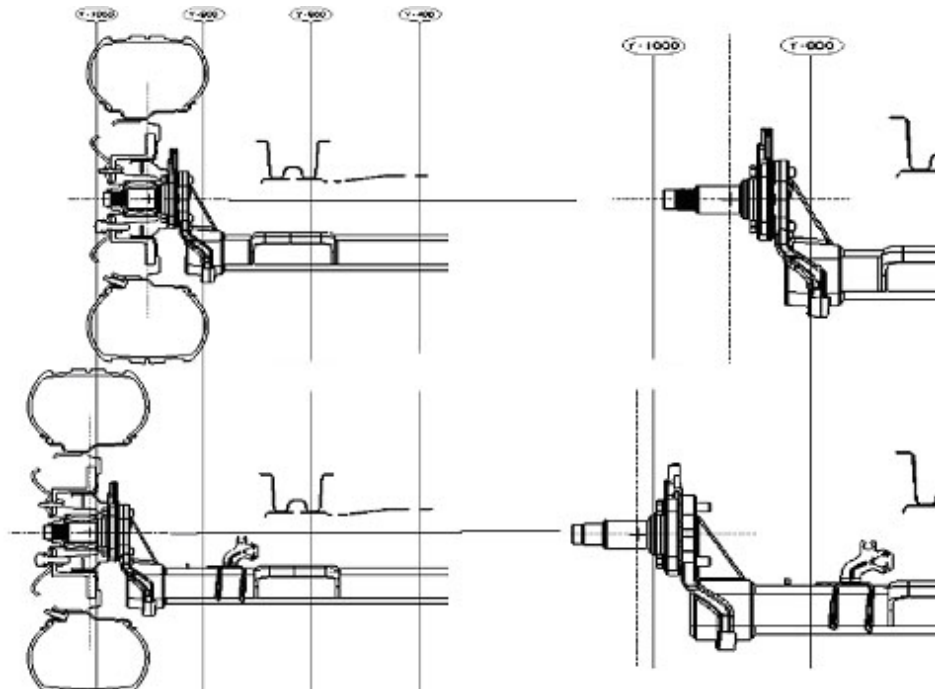


Weight	Type	Track width	Leaf Spring code	Deflection (TDP)	Leaf Spring features
Comfort	Panorama	1790	PC	-23	Single-blade leaf spring with sliding bush (comfort)
Light	Van	1790	PL2	-23	Light single-blade leaf spring for vans
Light	Van	1790	PLF2	-33	Light twin-blade leaf spring for vans
Light	Box bodies	1790	PLF2CA	+12	Light twin-blade leaf spring for box bodies
Light	Camping Car	1790	PLF2CC+25	+25	Light twin-blade leaf spring for camping cars (leisure)
Heavy	Vans/Box bodies	1790	PHF2+12	+12	Heavy twin-blade leaf spring for vans and box bodies
Heavy	Camping Car	1790	PHF2CC+42	+42	Heavy twin-blade leaf spring for camping cars (leisure)

Rear suspension with increased track width



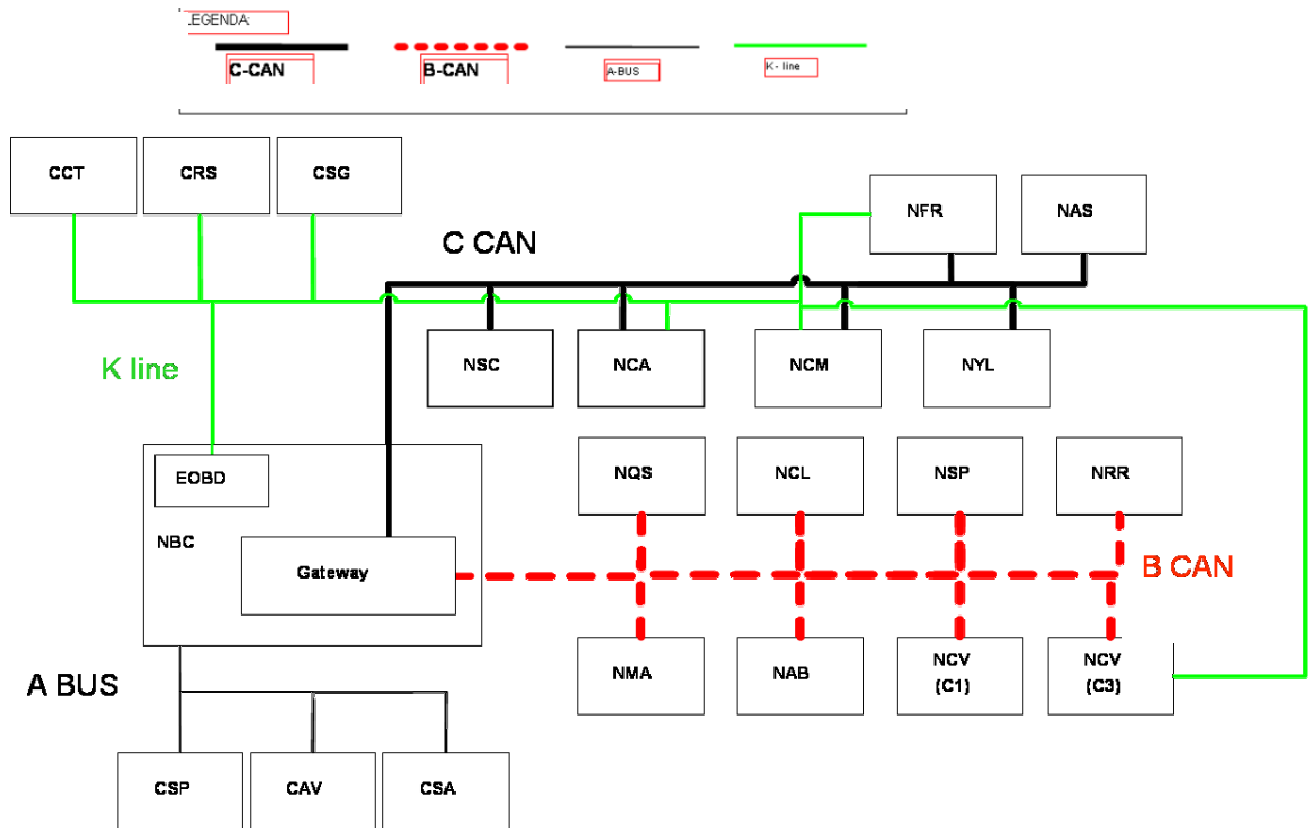
A suspension is available with track width increased to 1980 mm (the normal track width is 1790mm). This is mainly combined with the leisure conversion bases (motor homes, box bodies, mobile shops, special conversions).



7. ELECTRIC SYSTEM

7.1 GENERAL

The vehicle's electric system is made with architecture called NANO-FLORENCE. that is a variant of the known F.L.O.Re.N Ce. that for years has equipped some models of our product. NANO-FLORENCE features a lighter structure while keeping the main functions and the same protocol (B – C - CAN). and it adds some nodes that are specific for this type of vehicle. The figure shows the block diagram of the architecture.



Legend

NODES CONNECTED TO B-CAN

NBC : Node Body Computer, **NQS**: Node Instrument Panel, **NRR**: Node Radio Receiver, **NCV**: Node Convergence (C1) Node Convergence (C3), **NCL**: Node Climate Control Unit, **NSP**: Node Parking Sensor, **NAB**: Node Airbag, **NMA**: Node Air Springs

NODES CONNECTED TO C-CAN

NBC: Node Body Computer, **NCM**: Node Engine Control, **NFR**: Node Braking (ABS, ASR, ESP), **NCA**: Node Automatic Transmission, **NAS**: Node Steering Angle, **NYL**: Node Yaw Rate Sensor, **NSC**: Node Gearbox Selector

CONTROL UNITS CONNECTED WITH A-BUS

CSP: Control Unit Rain Sensor / Photocell, **CAV**: Control Unit Volumetric and/or tilting alarm, **CSA**: Control Unit Anti-Theft System Siren



NOTE: The tilting control unit does not feature volumetric sensors for this vehicle

INDEPENDENT CONTROL UNITS

CSG: Control Unit Power Steering, **CRS:** Control Unit Supplementary Heater, **CCT:** Control Unit Tachograph, **VideoParkingSystem:** Control Unit Parking Video Camera (VPAS - Video Parking Aiding System)

USER INTERFACES

DSHS: Driver Seat Heating System, **PSHS:** Passenger Seat Heating System, **CGP:** Control Unit Door Management, **CVM:** Control Unit Engine Compartment, **CPL:** Control Unit Dashboard, **DEV:** Steering column stalk, **CSS:** Central Stack Switch, **LSS:** Left Stack Switch, **DDC:** Driver Door Command, **CDC:** Codriver Door Command

Bus and serial lines

For each node / control unit the following table gives:

- 1: The acronym of the node to Fiat standard.
- 2: The description of the acronym related to the node.
- 3: The bus by which the communication is made.
- 4: The type of node (whether master, slave, on which bus it is connected, etc.).
- 5: Whether it is equipped with a diagnosis program.
- 6: The bus by which the diagnosis is made.
- 7: Whether the node needs a proxy alignment in the event of replacement.

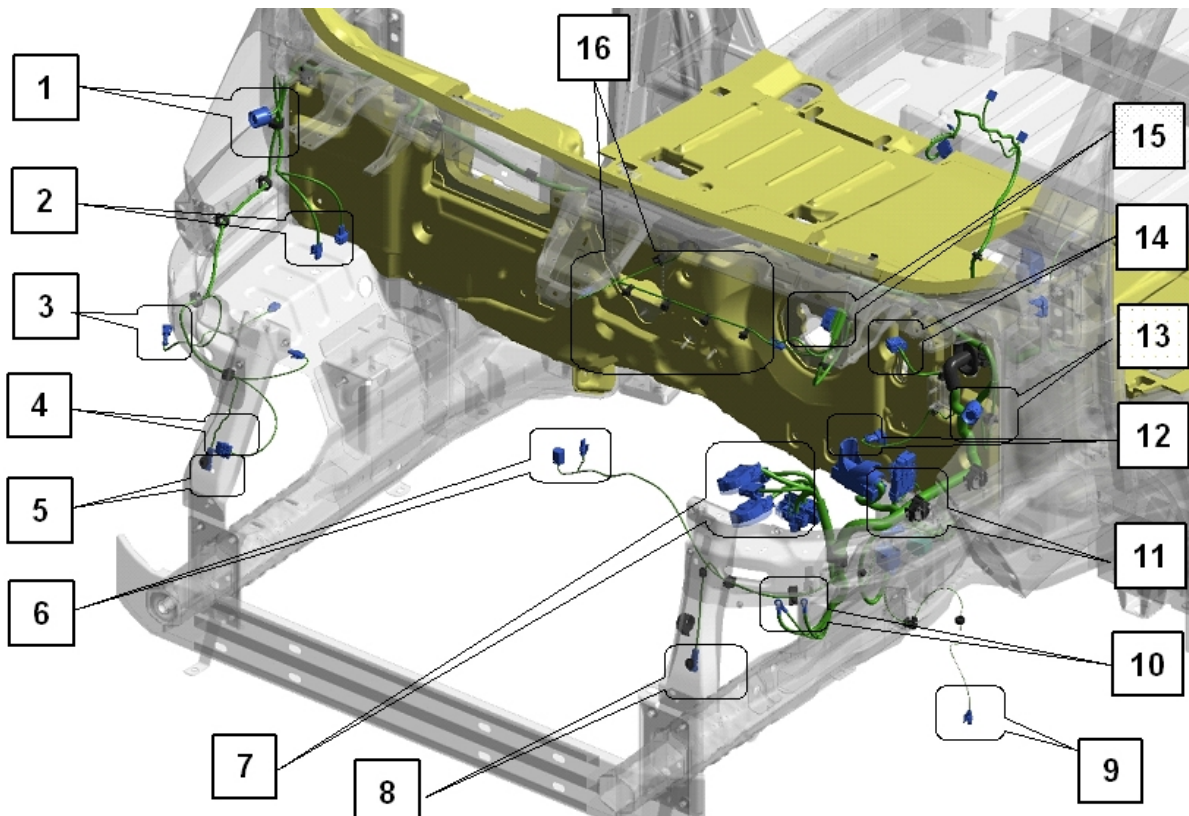
Node (1)	Description (2)	Data bus (3)	Type of Node (4)	Diagnosis (5)	Diagnosis Bus (6)	Proxy (7)
NBC	Body Computer node	B CAN C CAN	B: +30 master C: node ABUS: node	YES	B CAN	YES
NCM	Engine control node	C CAN	C: +15 node	YES	K line	-
NQS	Instrument board node	B CAN	B: +30 slave	YES	B CAN	YES
NRR	Radio receiver node	B CAN	B: +30 slave	NO	-	-
NFR	Braking node (ABS, ASR, VDC)	C CAN	C: +15 node	YES	K line	-
NCV	Convergence node	B CAN	B: +30 slave	YES	B CAN	YES
NCL	Air conditioner node	B CAN	B: +15 slave	YES	B CAN	YES
NCA	Automatic transmission node	C CAN	C: +15 node	YES	K line	-
NAS	Steering angle node	C CAN	C: +15 node	NO	-	-
NYL	Yaw sensor node	C CAN	C: +15 node	NO	-	-
NSC	Gearbox selector node	C-CAN	C: +15 node	NO	-	-
NSP	Parking sensor node	B CAN	B: +15 slave	YES	B CAN	-
NAB	Airbag node	B CAN	B: +15 slave	YES	B CAN	YES
NMA	Air springs node	B CAN	B: +30 slave	YES	B CAN	-
CSA	Anti-theft siren control unit	A-BUS	ABUS: node	NO	-	-
CAV	Tilting alarm control unit	A-BUS	ABUS: node	NO	-	-
CSP	Rain sensor / photocell control unit	A-BUS	ABUS: node	NO	-	-
CSG	Power steering control unit	-	-	YES	K line	-
CRS	Supplementary heater control unit	-	-	YES	K line	-
CCT	Tachograph control unit	-	-	YES	K line	-



VPAS	Parking video camera control unit	-	-	NO	-	-
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Layout of components and wirings

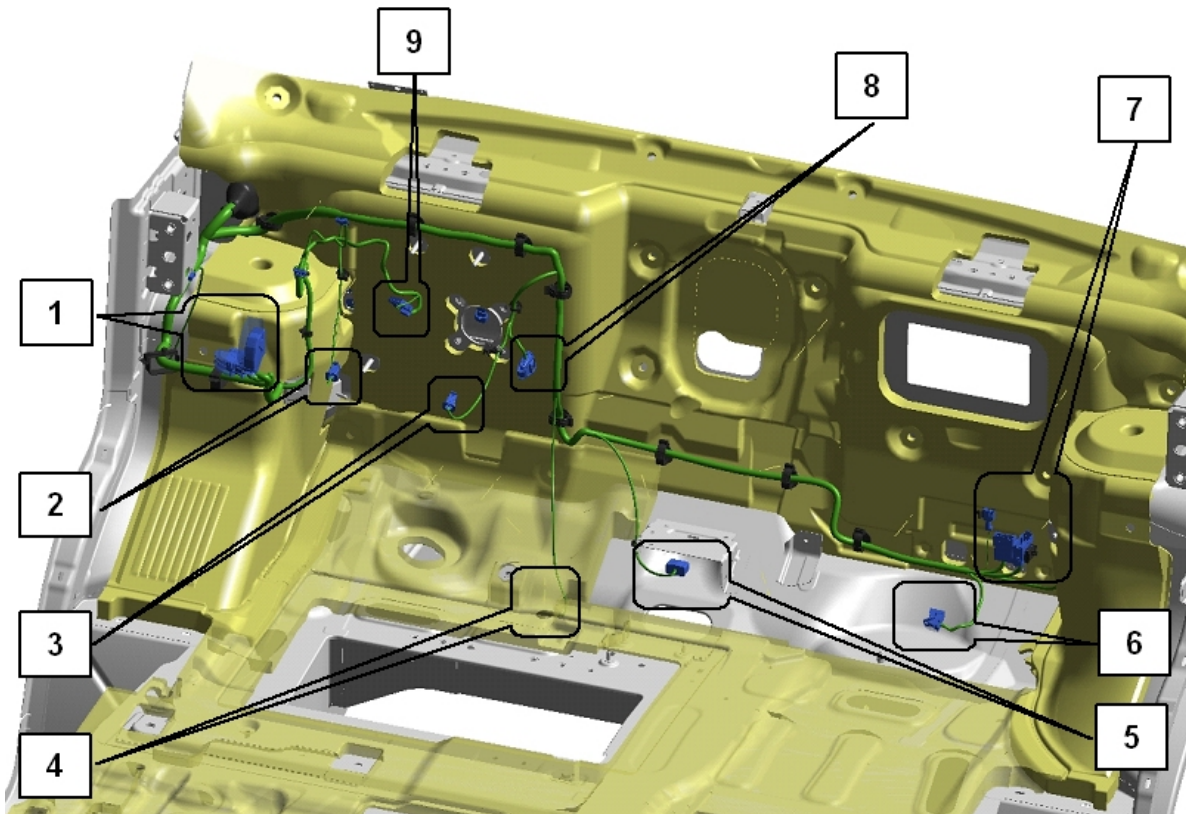
Engine compartment wiring



Legend:

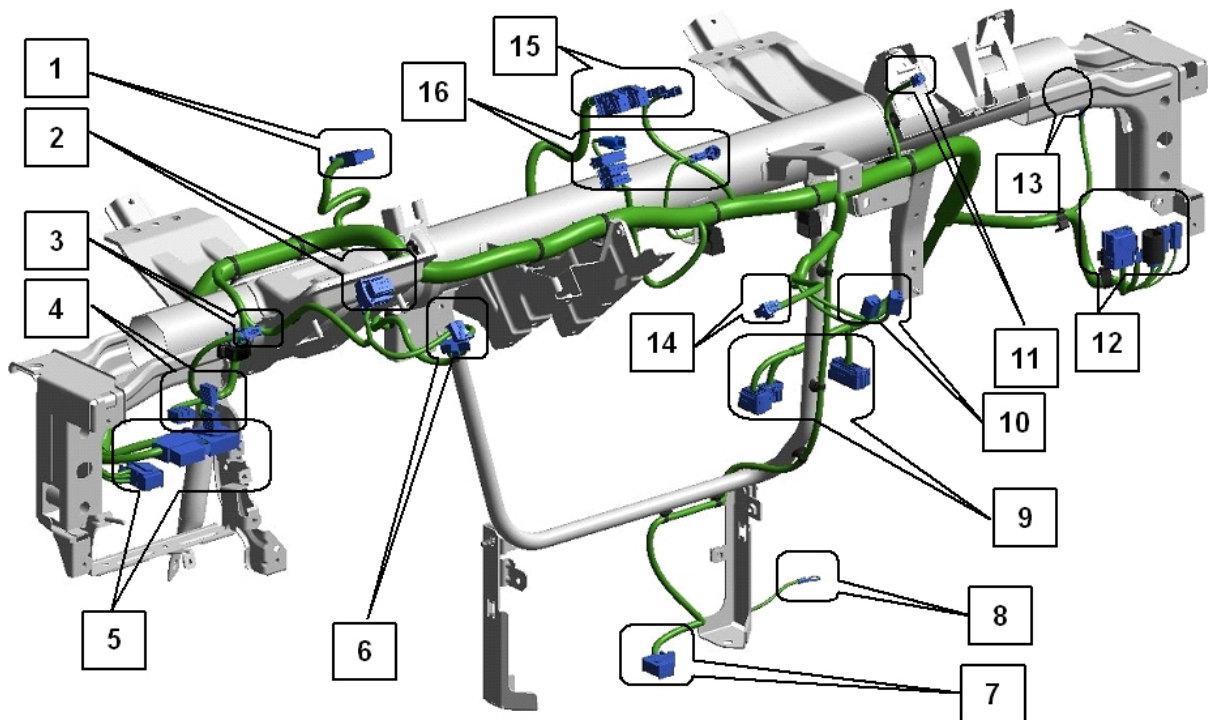
- 1 - Right headlight connection.
- 2 - Windscreen washer pump.
- 3 - Horn.
- 4 - CSA alarm siren.
- 5 - Right fog lamp prearrangement.
- 6 - Crash sensor (ECS) and bonnet lock switch.
- 7 - CVM engine compartment control unit.
- 8 - Left fog lamp prearrangement.
- 9 - Break wear sensor.
- 10 - Front masses.
- 11 - Pre-heating control unit and prearrangements for additional heater (Webasto)
- 12 - NFR Brake node.
- 13 - Left headlight connection.
- 14 - Windscreen wiper.
- 15 - Diesel filter (heating and water detection).
- 16 - Radio frequency antenna (secured on plate under windshield).



Passenger compartment wiring**Legend**

- 1 - Connectors for NPL (NBC: node body computer + CPL: control unit dashboard).
- 2 - Clutch switch.
- 3 - Brake switch
- 4 - Servotronic valve cable passage.
- 5 - NYL Yaw sensor.
- 6 - CSG servotronic control unit.
- 7 - Isolating connectors with dashboard wiring and F.I.S. connection
- 8 - Accelerator pedal potentiometer.
- 9 - Ignition switch.

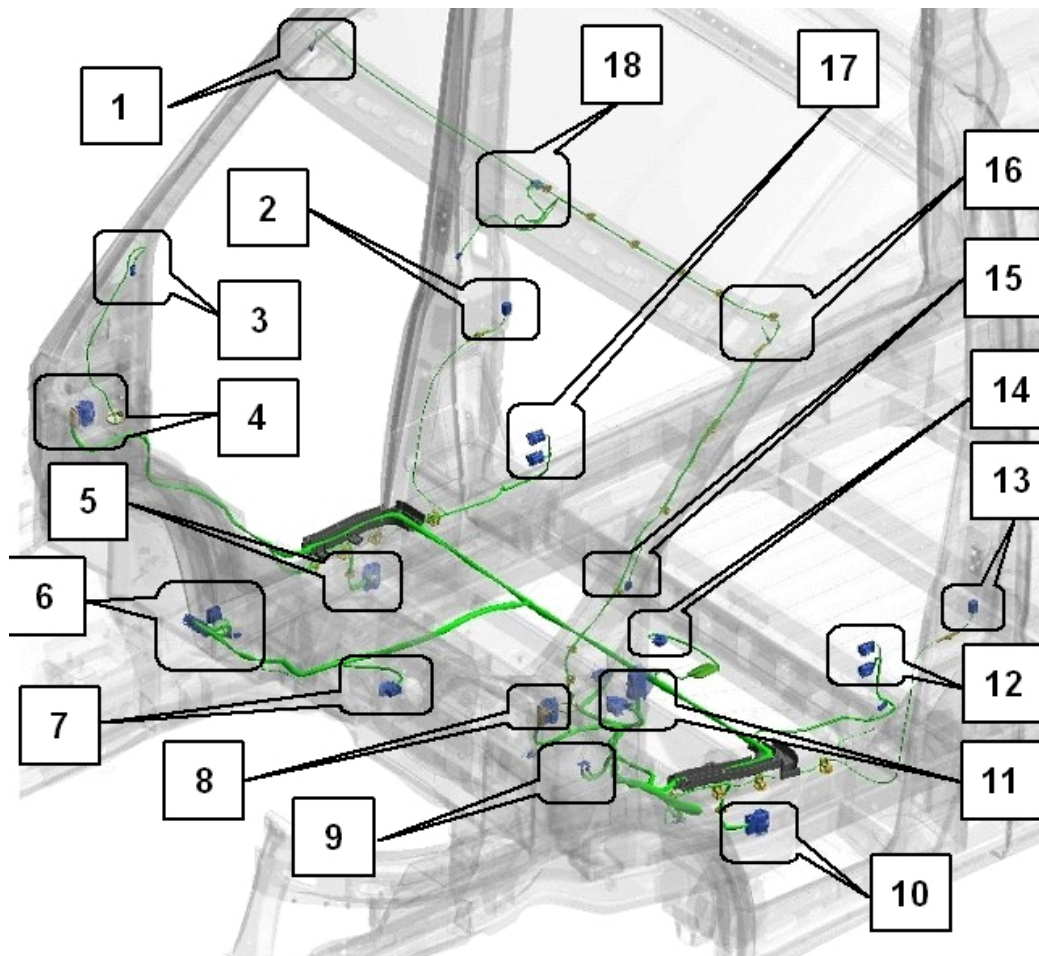


Dashboard wiring**Legend:**

- 1 - NQS Instrument panel node.
- 2 - Steering column stalk.
- 3 - PCS Left control board.
- 4 - PCA Auxiliary control board.
- 5 - NPL (Connections, rear side).
- 6 - Steering column stalk and ignition switch.
- 7 - NAB Airbag node.
- 8 - Airbag ground.
- 9 - Isolating connectors with passenger compartment wiring and door management control unit connection (CGP)
- 10 - Cigar lighter and power socket.
- 11 - Passenger airbag.
- 12 - Antenna connectors.
- 13 - Dashboard ground
- 14 - PCC central control board.
- 15 - NCV Convergence node (OPT)
- 16 - NRR Radio receiver – CD node.



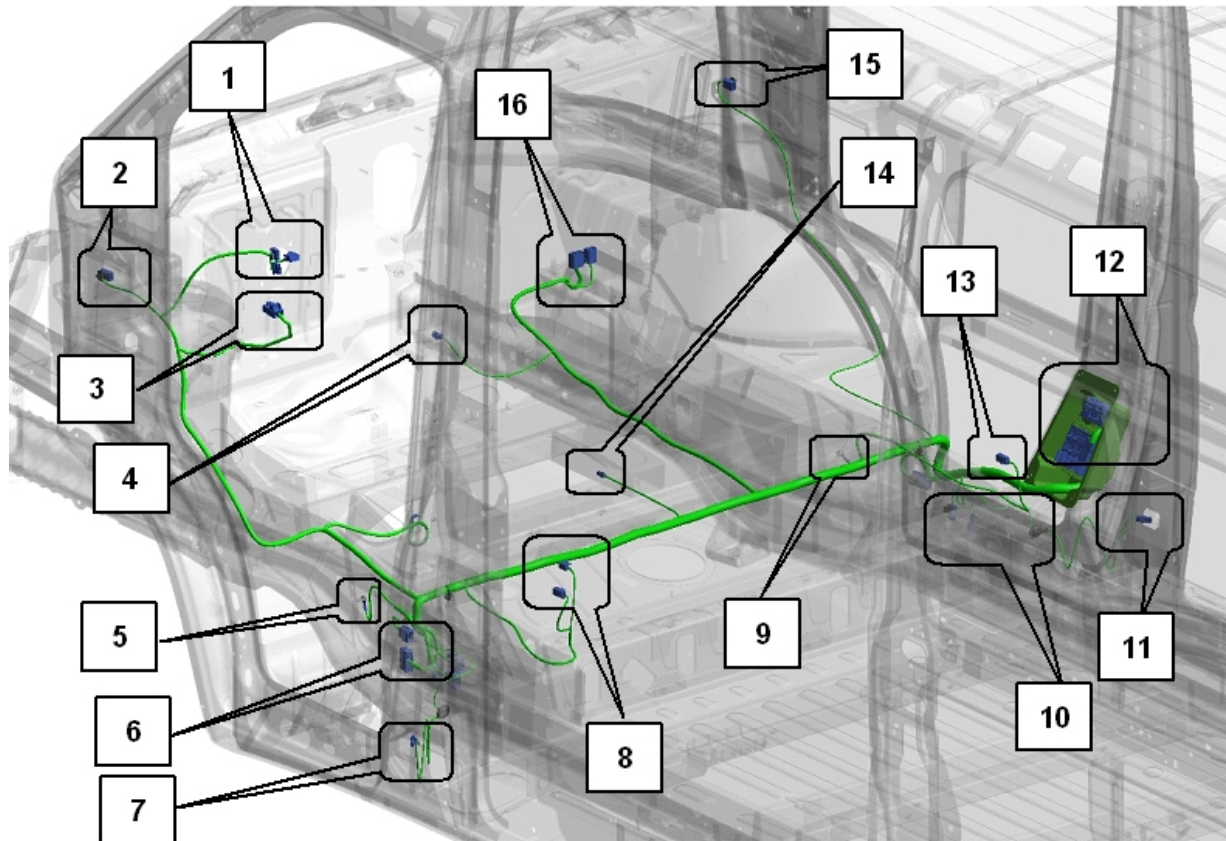
Cab wiring



Legend.

- 1 - Head bag (window bag), right.
- 2 - Side collision sensor, right.
- 3 - Tweeter speaker, right.
- 4 - Isolating connectors with front right door.
- 5 - Isolating connectors in the right board.
- 6 - Isolating connectors (on connector-carrier bracket).
- 7 - NAB Airbag node.
- 8 - Isolating connectors with left door.
- 9 - Ground.
- 10 - Isolating connectors in the left board.
- 11 - Connection with NPL.
- 12 - Connections to the driver's seat.
- 13 - Side collision sensor, left.
- 14 - Fuel level gauge control.
- 15 - Tweeter speaker, left.
- 16 - Head bag (window bag), left.
- 17 - Connections to the passenger seat.
- 18 - Ceiling light.

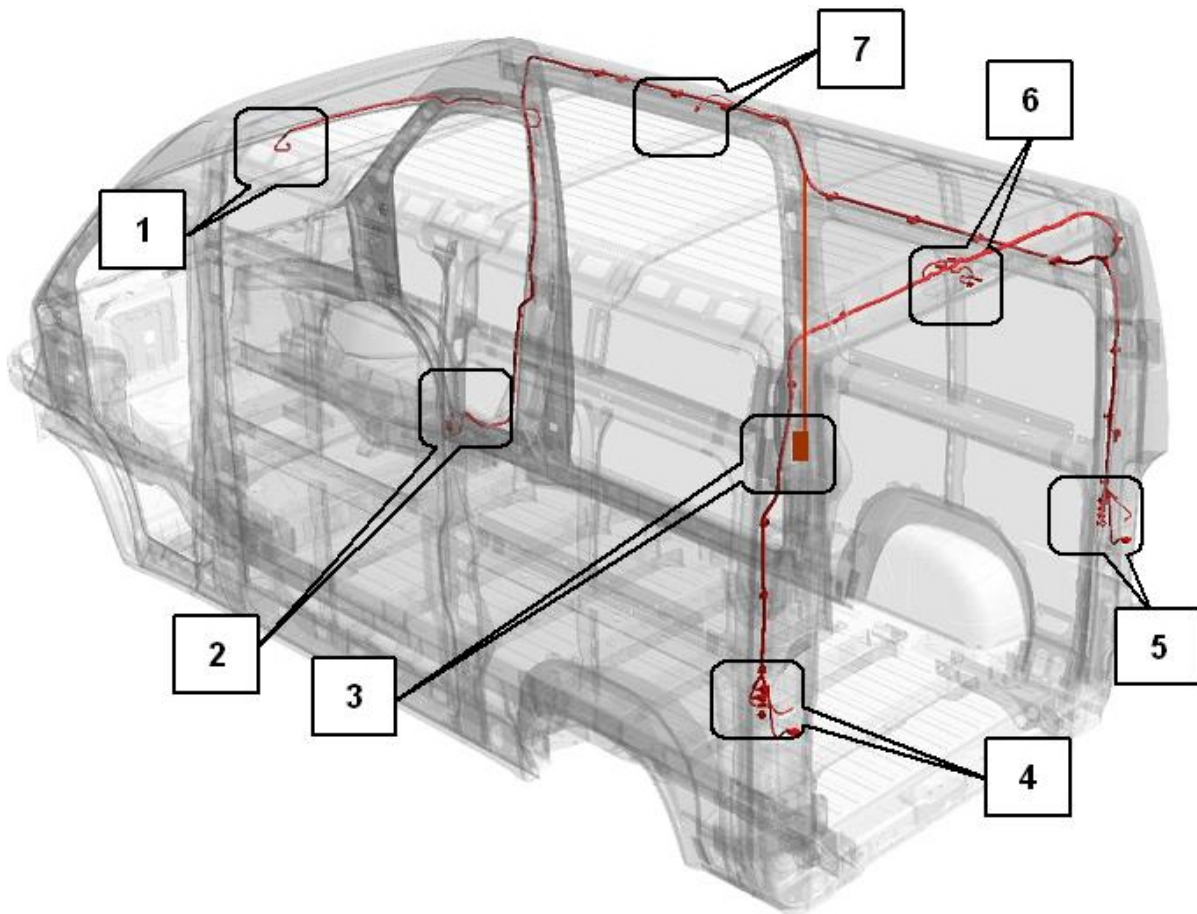


Cab wiring for optionals**Legend:**

- 1 - PCO: Optional control board.
- 2 - Isolating connectors with front left door.
- 3 - Connector for NPL power supply.
- 4 - Isolating connector for heater valve under seat.
- 5 - Ground.
- 6 - Isolating connectors in the left board.
- 7 - Side marker.
- 8 - Connectors for left seat.
- 9 - Ground.
- 10 - Isolating connectors in the left board.
- 11 - Side marker.
- 12 - CFO: Optionals fuse control unit.
- 13 - Connectors for right seat.
- 14 - Connection for refrigerator.
- 15 - Isolating connectors with front right door.
- 16 - Isolating connectors with cab cables (on connector-carrier bracket).



Rear right wiring



Legend:

- 1 - Connectors for front ceiling light and rear video camera viewer (opt).
- 2 - Rear wiring isolating connectors.
- 3 - Connector for left side sliding door lock.
- 4 - Connectors for rear left light cluster.
- 5 - Connectors for rear right light cluster and prearrangement.....
- 6 - Connectors for rear ceiling light, third brake light and rear video camera (opt).
- 7 - Connector for side ceiling light.



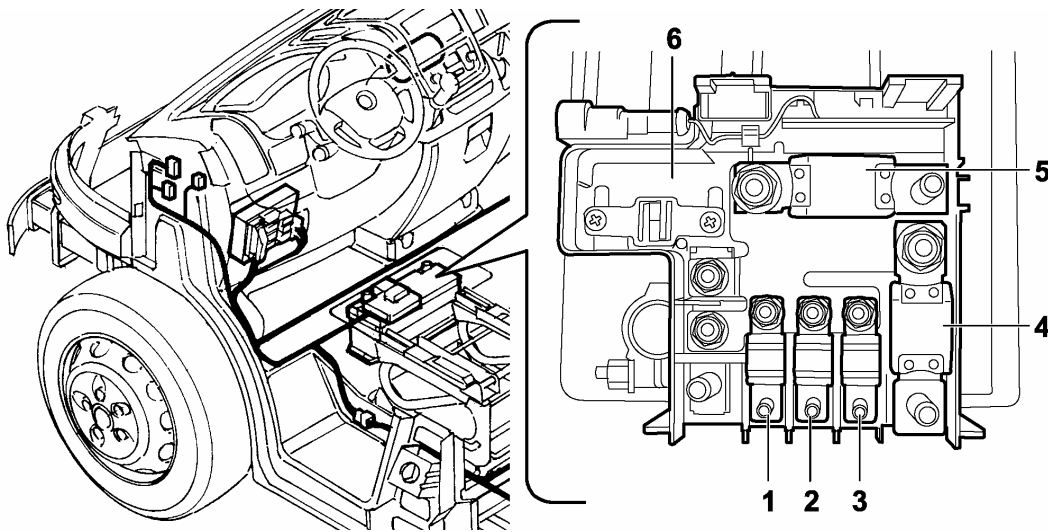
Fuse box on battery and engine compartment control unit

Fuse box on battery

On the vehicle's standard battery there is an interconnecting unit on which there is also a power tap for a supplementary battery.

The connection for the body-makers is the fuse (3) of 50A.

The interconnected cable is comprehensive of the two-way connector located in the compartment at the bottom of the right-hand pillar

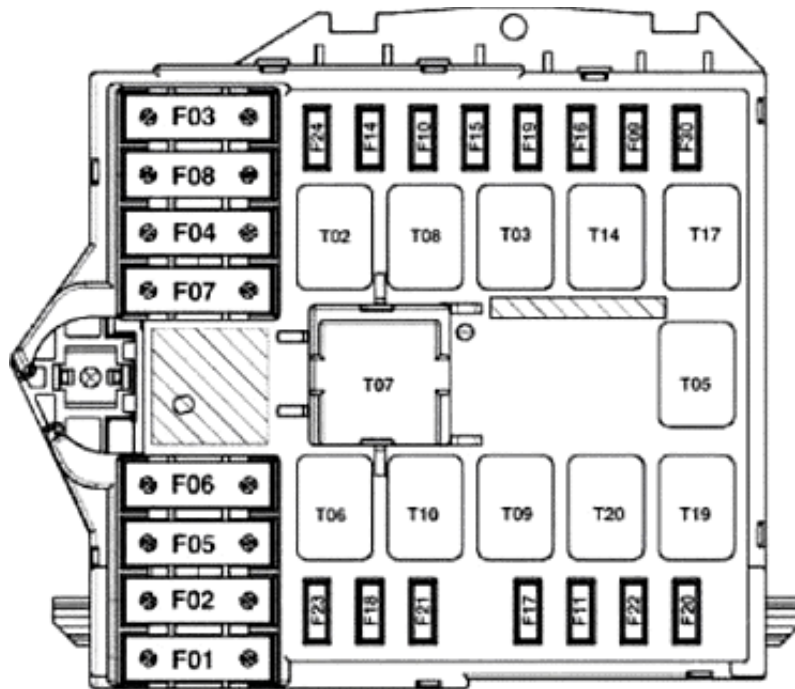


Legend and description of connections:

- 1 - main power supply for fuse control unit and relay under dashboard CPL (80 A)
- 2 - secondary power supply for fuse control unit and relay under dashboard CPL (70 A)
- 3 - power supply for a supplementary battery (50 A) via 2-way connector
- 4 - power supply for fuse control unit and relay in the engine compartment CVM (150 A)
- 5 - power supply for starter motor and alternator
- 6 - interconnecting box on battery.



Engine compartment control unit (CVM)



	FUSES	A
F01	NFR1 (PUMP)	40
F02	Glow plug pre-heating	50
F03	Ignition switch	30
F04	Webasto control unit (CRS)	20
F05	+30 passenger compartment fan with Webasto	20
F06	Engine cooling electric fan (high speed)	40/60
F07	Engine cooling electric fan (low speed)	40/50
F08	Climate control unit	40
F09	Windscreen washer pump	20
F10	Horns	15
F11	E.I. secondary miscellaneous services	15
F14	Right high-beam headlamp	7,5
F15	Left high-beam headlamp	7,5
F16	E.I. system 15/54	7,5
F17	E.I. primary services	10
F18	+30 NCM	7,5
F19	Compressor	7,5
F20	Headlamp washing pump	30
F21	Fuel pump	15
F22	E.I. primary services	20
F23	+30 NFR (SOLENOID VALVES)	30
F24	NCA Automatic transmission node 15/54	15
F30	Fog lamps	15



	RELAY	A
T02	Main beam headlamps	20
T03	Horns	20
T05	Compressor	20
T06	Engine cooling electric fan (high speed)	30
T07	Engine cooling electric fan (low speed)	50
T08	Climate control unit	30
T09	Injection system (main)	30
T10	Fuel pump	20
T14	Fog lamps	20
T17	Windscreen washer pump	20
T19	Headlamp washing pump	30
T20	Spare	-

NOTE:

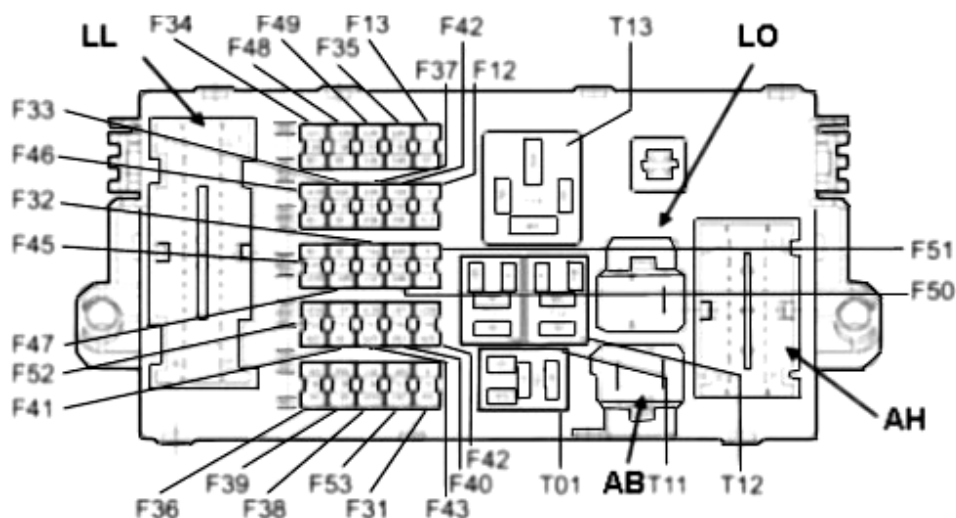
In this publication, the identification codes of the various connectors of the control units and body computer, in some diagrams, are the original ones.

Other wiring diagrams used for training purposes are the ones that will be used in the assistance manual and available at the time of drawing up this publication, in which the identification codes of the various connectors have been changed, using the ones standardized by FIAT. The following table provides a comparison of the two coding systems to help understand the diagrams.

Original	Corresponding
Body computer NBC	M001
AB (2 pins)	D
CY/CX (20 pins)	Y - X
AV 52 (pins)	A
KK 16 (pins)	EOBD
LN (52 pins)	C
PG/PD/PF (36 pins)	B
CPL Dashboard control unit	B002
AB (2pins)	C
LO (2 pins)	D
AH (20 pins)	A
LL (32 pins)	E
PM (20 pins)	B
PQ/PR (9+9 pins)	G



Fuse box and relay under dashboard



FRONT VIEW

	FUSES	A
F12	RH low-beam headlamp	10
F13	LH low-beam headlamp/headlight alignment corrector	10
F31	+ Key for control unit relay coils engine compartment CVM, body computer node NBC	7,5
F32	Minibus internal lights (emergency)	10
F33	Rear power socket	15
F34	Not present	-
F35	Cruise Control, reversing lights, sensor. H ₂ O diesel	7,5
F36	+30 control unit for door locking/unlocking CGP door management control unit	20
F37	Brake lights control CLA (N.O.), THIRD BRAKE LIGHT, NQS instrument panel node	10
F38	+30 for internal relays NBC	10
F39	NRR, diagnosis socket EOBD, CSA, CAV, CCT, A/C control, Webasto timer	10
F40	LH rear heated window, mirror defroster on driver's side	15
F41	RH rear heated window, mirror defroster on passenger side	15
F42	+Key for NFR, NAS, NYL, CLA (N.C.)	7,5
F43	Windscreen wiper	30
F44	Cigar lighter, front power socket	20
F45	Controls on DDC driver's door, controls on CDC passenger door	7,5
F46	Not present	-
F47	Power windows, driver's side	20
F48	Power windows, passenger side	20
F49	+ Key for NSP, CSP, CSS, LSS, CAV, car radio, NCV, LIGHT. HEAT. controls SEATS, driver's side power window, aux board, parking video camera	7,5
F50	+Key NAB	7,5
F51	+Key CSG, CCT, NBC	7,5
F52	+Key for CCO optional wired control unit relay coil	7,5
F53	NQS, rear fog lamp	7,5



	CONTACTORS	A
T01	Low-beam headlamps	30
T11	Rear heated window	30
T12	Services 1	30
T13	Services 2	50

AB 2-WAY CONNECTOR

Pin	Pin function
A	+30 from F-71 CBA
B	+30 from F-72 CBA (CF0)

LO - 2-WAY CONNECTOR

Pin	Pin function
A	Not Available
B	+30 from F-72 CBA for CFO

AH - 20-WAY CONNECTOR

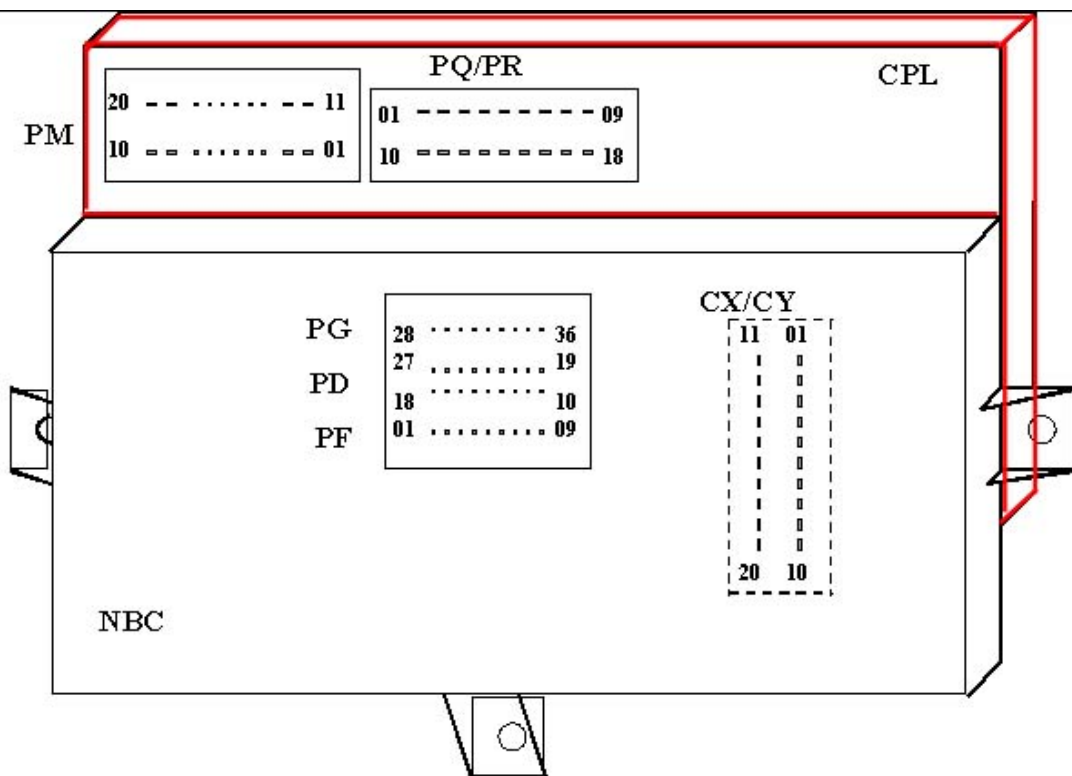
Pin	Pin function
1	RH/LH headlight alignment corrector actuator command signal (conn. with PR18)
2	RH/LH headlight alignment corrector actuator power supply from F-13
3	LH low-beam headlamp power supply from F-13
4	+ lights for climate control unit (passing track conn. with PR1)
5	CSG fault warning light command (passing track conn. with PM16)
6	Signal from FIS for BDS (passing track conn. with PM15)
7	INT/A ign.sw. from F-31 for CVM
8	Reverse light power supply from switch on gearbox (conn. w/ LL7, LL8)
9	Fuel pump power supply from relay (conn. with LL32)
10	Front power socket power supply from F-43
11	INT from F-42 for NFR, NAS, NYL, CLA (NC)
12	RH low-beam power supply from F-12
13	INT from F-51 for Power Steering Control Unit
14	INT from F-37 for brake lights N.O. (to switch on pedal unit)
15	Brake lights power supply from switch N.O. on pedal unit (conn. with CX2, LL5, LL6, AH16)
16	Brake lights signal (N.O.) for NCM/ NFR/ NCR (conn. with AH15)
17	INT from F-35 for cruise control command
18	INT from F-35 for water in diesel filter sensor
19	INT from F-35 for reverse lights
20	CPL ground track (prearrangement, conn. with PM10)

LL 32-WAY CONNECTOR

Pin	Pin function
1	Power supply from F-33 for low-low relay CRS (Webasto)
2	Power supply for headlamp washer relay from F-34
3	Power from F-46 for CRS (webasto)
4	Power from F-45 for NCA, NSC
5	Supplementary brake light power (conn. with AH15)
6	Connection with AH15 (prearrangement)



7	LH reverse light power from switch on gearbox (conn. with AH8)
8	RH reverse light power from switch on gearbox (conn. with AH8)
9	Signal from FIS for BDS (passing track conn. with PR15)
10	J.C. B-CAN A on rear cable (NSP)
11	+30 from F-32 (prearrangement)
12	Relay coil power T66 CFO from F-52 (conn. with PR17)
13	+30 from F-36 for CGP
14	Rear power socket power supply from F-44 (conn. with PM9)
15	Power from F-40 for LH heated rear window and RH rear window relay coil
16	Relay neg command BL/SBL front doors (conn. with CX10)
17	Passenger power window motor power from F-48
18	Enable comfort (conn. with CX11)
19	INT from F-49 for NSP, CSP, CAV
20	Connection with PR11 (prearrangement)
21	INT from F-49 for NCL, heated seat controls lighting
22	Passing track conn. with PR5 (prearrangement)
23	INT from F-49 (prearrangement)
24	INT from F-49 (prearrangement)
25	INT from F-51 (prearrangement)
26	INT from F-51 (prearrangement)
27	INT from F-51 (prearrangement)
28	J.C. B-CAN B on rear cable (NSP)
29	Not Available
30	Power window motor power supply LG from F-47
31	Mirror defroster power from F-41
32	Tank fuel pump power (conn. with AH9)



REAR VIEW



PM 20-WAY CONNECTOR

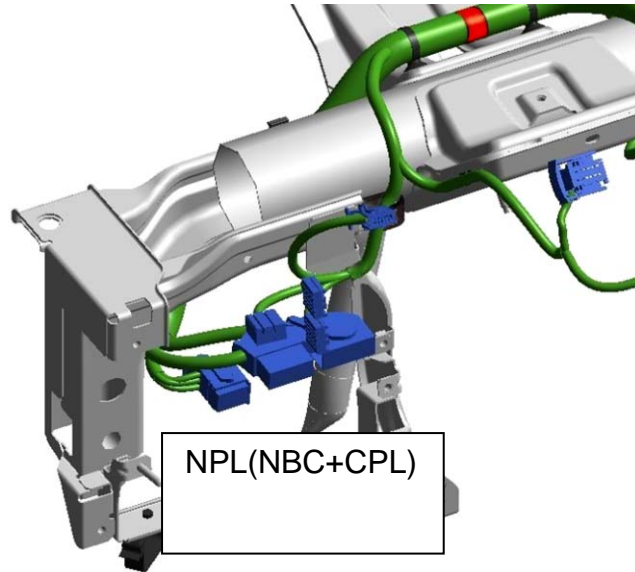
Pin	Pin function
1	INT/A from ignition switch
2	Pos. sig. from Ign. Sw. for park lights (conn. with CX12)
3	INT from F-49 for LH board lighting
4	INT from F-49 for NRR
5	B-CAN B for NRR
6	INT from F-50 for NAB
7	+30 from F-39 for NRR
8	+30 from F-39 (prearrangement)
9	Power from F-44 prearrangement (conn. with LL14)
10	CPL power ground (conn. with CX20, PR10, AH20)
11	INT from Ign. Switch
12	INT from F-51 for Tachograph
13	INT from F-51 (prearrangement)
14	INT/A from F-31 for NBC
15	Signal from FIS for BDS (conn. with AH6)
16	CSG power steering control unit fault warning light command (conn. with AH5)
17	B-CAN A for NRR radio receiver node
18	Not Available
19	Power from F-48 (prearrangement)
20	Power from F-47 (prearrangement)

PQ/PR 9+9-way connector

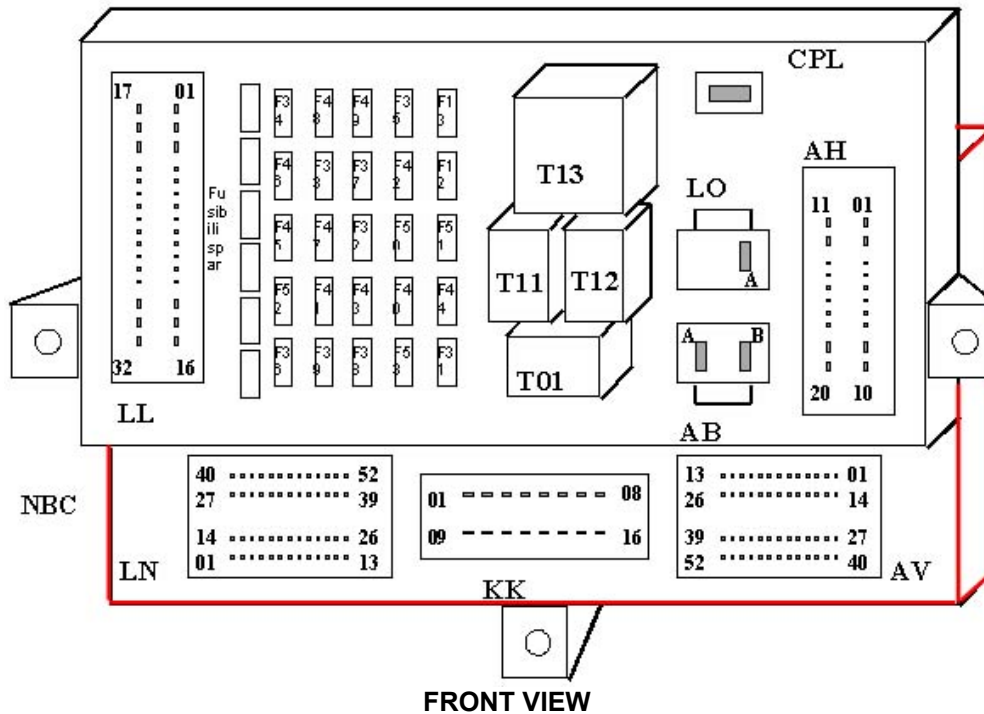
Pin	Pin function
1	+ Lights for climate control unit (connected with AH4)
2	INT from F-37 (prearrangement)
3	Not Available
4	Not Available
5	Connected with LL22 (prearrangement)
6	Not Available
7	Not Available
8	INT from F-51 (prearrangement)
9	INT from F-51 (prearrangement)
10	Ground track conn. with PM10 (prearrangement)
11	Connection with LL20 (prearrangement)
12	INT from F-49 for central board lighting
13	External power for F-51 (prearrangement)
14	Power from F-13 for headlamp alignment corrector on NQS
15	Signal from FIS for BDS (passing track conn. with LL9)
16	+30 from F-32 (prearrangement)
17	Cigar lighter power from F-52
18	Signal from headlamp alignment corrector command on NQS (conn. with AH1)

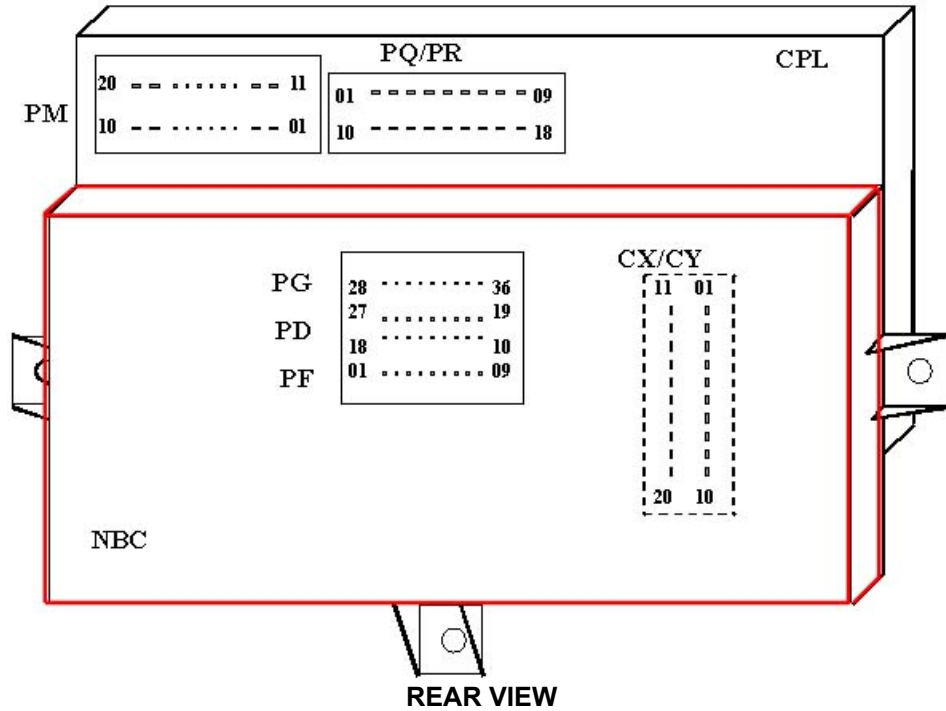


Connection wiring



7.2 BODY COMPUTER





NBC connectors pin out 250

AB 2-WAY CONNECTOR

Pin	Pin function
A	+30 from F-71 CBA
B	+30 from F-72 CBA (CF0)

CY/CX CONNECTOR (20 POLES AMP Multilock)

Pin	Pin function
01	30 from F-38 for relays inside NBC
02	LH/RH brake lights positive digital signal from CPL
03	Reverse lights positive digital signal from CPL
04	Not connected
05	B-CAN B
06	Heated rear window relay coil negative command (T11)
07	B-CAN A
08	Low beam relay coil negative command (T01)
09	INT (positive) from ignition switch
10	Repetition external relay coil negative command D+
11	Relay contact output for SBMT function (minimum voltage battery cut-out)
12	Parking lights positive signal from switch
13	INT from F-37
14	Services 2 relay coil negative command (T13)
15	INT for F-51
16	Not connected



17	30 from F-39
18	30 for NBC (Direction/hazard lights, immo, CAN, positions, stop, SBMT, command +lights)
19	30 from F-53 (7.5 A) for NQS, rear fog lamps
20	Ground for relays inside NBC

AV CONNECTOR (52 PINS AMP Multilock)

Pin	Pin function
01	Low active analog input (not used)
02	Low active analog input (not used)
03	Windscreen Washer Pump external relay coil negative command
04	LIN serial line (not used)
05	LH front direction light actuation
06	CSG fault low active analog signal
07	Immobilizer antenna
08	Immobilizer antenna
09	Engine coolant level switch negative signal (N.O.)
10	VSO signal from NFR
11	Fog lamps relay coil negative command
12	High beam relay coil negative command
13	INT from F-37
14	LH wheel TPMS signal (not used)
15	RH wheel TPMS signal (not used)
16	Rear Window Washer Pump external relay coil negative command
17	30 from F-39 for NCL
18	Horn external relay coil negative command
19	Windscreen wiper cam negative signal
20	Headlamp washer relay coil negative command
21	Driver's side door open signal repetition
22	K line for NFR
23	FIS signal negative input
24	Negative analogical signal from brake fluid level switch (N.O.)
25	Alternator D+ positive signal
26	K line for NCM diagnosis
27	Ground reference for TPMS sensors (not used)
28	RH front direction light actuation
29	Windscreen Wiper Speed 2 relay coil negative command
30	Ground reference for RF antenna
31	DRL Lights Control
32	Negative signal from LH front brake pad wear sensor
33	Negative signal from bonnet open signalling switch (NC)
34	A-bus serial line on front cable for CSA
35	B-CAN A
36	B-CAN B
37	Tachometer 1 (VSO) signal repetition for CSG



38	LIN serial line (not used)
39	RH front side light actuation
40	Windscreen Wiper ON Speed 1 relay coil negative command
41	Rear Window Wiper relay coil negative command
42	LED Positive Command
43	Antenna for RF receiver
44	C-CAN L for NAS
45	C-CAN H for NAS
46	30 from F-39 for CSA
47	K line for CSG - CRS - NCA
48	C-CAN L
49	C-CAN H
50	LH front direction light actuation
51	RH front direction light actuation
52	LH front side light actuation

KK CONNECTOR (16 PINS AMP Multilock)

Pin	Pin function
01	K line for NFR
02	C-CAN H for diagnosis (only until the preseries)
03	K line, connection available
04	Ground reference for diagnosis equipment
05	Ground reference for diagnosis equipment
06	B-CAN B for diagnosis
07	K line for NCM diagnosis
08	N.C. (Immobilizer K line)
09	Dashboard K line connection available
10	C-CAN L for diagnosis (only until the preseries)
11	N.C.
12	K line for CSG, CRS, NCA
13	K line for rear devices
14	B-CAN A for diagnosis
15	N.C.
16	+30 from F-39 for EOBD diagnosis socket

LN CONNECTOR (52 PINS AMP Multilock)

Pin	Pin function
01	Side Marker Lights relay coil negative command
02	High external temperature input
03	Low external temperature input
04	Door lock/dead lock common external relay coil negative command
05	LH side direction light actuation / Opt Dead Angle Control Unit (not used)



06	RH rear direction light actuation
07	Fuel level signal from tank (positive)
08	LH rear side light actuation
09	RH rear side light actuation
10	A-bus serial line on rear cable for CAV (anti-lifting).-CSP
11	Negative signal from switch N.O. on driver's side front door (door open signal)
12	LH/RH number plate light actuation
13	Power windows super-closing negative command (not used)
14	Ceiling light relay coil negative command (PCA)
15	Goods compartment door status LED positive command
16	Passenger side lock pawl analog input
17	Tachometer 2 (VSO) signal repetition for CSS central control board
18	LH rear direction light actuation
19	RH side direction light actuation (RH side direction light relay command for extra long vehicles)
20	Negative signal from handbrake ON indicator switch (N.O.)
21	Fuel level signal from tank (negative)
22	Negative signal from switch N.O. on left side door (door open signal)
23	Low active analog input (not used) (prearrangement)
24	K line connection available
25	Low active analog input (not used) (prearrangement)
26	RH rear fog light actuation
27	High active analog input
28	Driver side lock pawl analog input
29	Central rear ceiling light timed/dimmered negative command
30	Front ceiling light timed/dimmered negative command
31	RH brake light actuation
32	30 SBMT 1 for front ceiling light
33	Negative signal from switch N.O. on rear hinged door (door open signal)
34	Negative signal from switch N.O. on passenger side front door (door open signal)
35	Negative signal from switch N.O. on side doors (door open signal)
36	Front door lock/unlock relay coil negative command
37	High active analog input (prearrangement) network activation from switching on ceiling light
38	High active digital input (prearrangement)
39	Step light timed/dimmered negative command
40	High active analog input (prearrangement)
41	Goods compartment door lock/unlock relay coil negative command
42	Door dead lock relay coil negative command
43	LH rear fog light actuation
44	LH brake light actuation
45	30 SBMT 2 Connection to rear ceiling lights, step light and removable on fixed lamp
46	Low active analog input
47	Low active digital input
48	Low active digital input



49	Rear ceiling light timed negative command
50	Goods compartment lock/unlock negative analog input from board on driver's door
51	30 from F-39 for CAV
52	Lights control depending on side lights

PG/PD/PF CONNECTOR (36 PINS AMP Multilock)

Pin	Pin function
01	Windscreen wiper intermittence negative analog signal
02	Lights selector negative analog signal from DEV
03	30 from F-53 for NQS
04	High beam / Flash negative analog signal from DEV
05	B-CAN A for NQS
06	B-CAN B from NQS
07	Direction indicators negative analog signal from DEV
08	Ground reference for left-hand board
09	Ground reference for DEV steering column stalk
10	NBC power ground
11	Tachograph K line
12	K line connection available
13	Goods compartment door status LED positive command
14	Deterrence and vehicle door status LED positive command
15	Vehicle speed from tachograph input
16	30 SBMT 2
17	Low active analog input - Minibus Emergency Button
18	Lights control depending on side lights
19	NBC power ground
20	Vehicle lock/unlock negative analog signal from push-button on dashboard
21	Heated rear window ON LED positive command
22	Low active analog input for network activation from internal lighting
23	Tachometer 2 (VSO) signal repetition
24	B-CAN B for NCL
25	B-CAN A for NCL
26	30 from F-39
27	INT/A from F-31 CPL
28	Windscreen wiper selector negative analog signal from DEV
29	Hazard lights ON LED positive command
30	Windscreen washer negative analog signal from DEV
31	INT from F-37 for NQS
32	Negative signal from heated rear window button
33	Rear window wiper negative analog signal from DEV
34	Hazard lights switch negative signal
35	Rear / front fog lamp negative analog signal
36	Ground reference for NQS



Summary of main functions for NBC

Logistic mode

NBC is in "logistic mode" prior to delivery to the customer. This condition is signalled by the "charging" indicator light on the instrument panel. The function must be turned off with examiner before delivering the vehicle to the customer. The operation is not reversible.

Off key load command

This command receives the information of turning on the following loads:

Drawer light;
Boot light;
RH and LH visor light;

If you forget one of the off key loads on and if for at least 5 minutes a drop in battery voltage is detected below a value determined by software, a function triggers to cut off these loads that is also called **SBMT (battery cut-out for minimum voltage)**.

The central ceiling light and the RH and LH front spot lights are not powered by the SBMT driver. If these loads are unintentionally left on with the key off, they are switched off by software when a drop in battery voltage is detected below a set threshold.

F.I.S. signal reception (Inertia switch)

The F.I.S. is located under the dashboard, on the far right side.

The signal from the F.I.S. is acquired by the body computer that switches on the passenger compartment lights and unlocks the doors.

Fuel level signal

The NBC receives the signal in volts from the sensor fitted in the tank. It must therefore know the characteristics and capacity of the tank (programmed in ROM) and process the signal from the sensor so as to ensure filtering/damping towards the indicator on the instrument panel.

The information is sent over the CAN line and is expressed in % points of the tank capacity.

The interface with the fuel level sensor is a variable resistor from 5 to 300 ohm.

It is possible to diagnose an open circuit and short circuit of the sensor, short circuit to ground or Vbat of each pin of the sensor.

Signal Alternator

The NBC measures the level of voltage on the D+ circuit and compares it with the battery voltage. In the event of trouble with the alternator, the fault is signalled with the specific symbol lighting up. This measurement is only made with the key on.



Speedometer signal/ VSO (vehicle speed output)

The speedometer signal is generated by the NFR with the two sensors on the rear wheels reading the speed. The signal is made available over the C- CAN network. The NBC codes it on B- CAN by means of which it reaches NQS to govern the speedometer and the odometer.

The NBC also uses another speedometer signal, called VSO, generated by the NFR. This signal does not involve the network, but is sent straight to the NBC to be used by control units that are not connected to the network but which use a vehicle speed signal for their operation, such as for instance the power steering control unit, tachograph and the rear video camera (where applicable)

RF Remote Control

Transmitter

The transmitter is the device that transmits the code to the receiver.

It is equipped with one or more buttons and a LED: the button activates the command, the function of the LED is to visually check that the transmitter is sending the code and to signal a low battery charge.

The transmitter is equipped with a radiofrequency stage at 433.92 MHz incorporated in the key grip. The range is approximately 10 m.

Receiver

The receiver, housed under the vehicle dashboard, works at a frequency of 433.92 MHz. It is super heterodyne and has the following functions:

- receive and decode the signals from the transmitter;
- manage the storage of a maximum number of 8 transmitters;
- generate the door unlocking and locking command;
- turn an alarm system on and off;
- generate the timed courtesy light switch command.

Alarm

Composition and Functions

The alarm system detects and signals attempts made to break into the vehicle. It comprises the following components:

- remote control system (transmitter + receiver included in the NBC);
- self-powered siren (Metasystem type)
- sensors (door switch, anti-tilting).

The alarm system performs perimeter surveillance, monitoring vehicle tilting, power cable cutting and surveillance on the ignition key block. If an attempted break-in is detected, it generates visual (direction indicators flashing) and audible (siren sounding) alarms in compliance with the provisions of Dir. 95/56/EC and the current regulations in the importing country.

Turning on the alarm system is indicated by the direction indicators coming on with a steady light and the siren beeping in synch with the direction indicators coming on; the doors are locked too.

Turning off the alarm system makes the direction indicators flash twice and the siren beep twice in synch with the direction indicators coming on; the doors are unlocked too.



After an attempted break-in, a blink code emitted by the deterrence warning light indicates which sensor detected it: this warning light moreover signals the charge status of the transmitter battery (normally in the key head)

The alarm system is also turned off by inserting an enabled key recognized by the immobilizer.

Alarm Activation

During the phase of surveillance the alarm can be triggered by the perimeter protection but also by the external modules (anti-tilting...) or by the siren (for cable cutting).

On receiving one of the alarm activation commands, the NBC immediately passes into alarm status, triggering the cycles contemplated for the type of alarm received.

Power Supply and Operation with Key-Off

The NBC receives fuse-protected power supplies for the power circuitry.

The contemplated power supplies are:

- | | |
|--------------------------------------|--|
| +30 (protected by maxi-fuse) | powers basic functions, positions, parking rear fog lamp immobilizer, RF receiver, anti-theft car radio, stop, SBMT, internal lights |
| +30 (protected by mini-fuse F53 10A) | powers direction indicators functions, hazard lights |
| +INT (protected by fuse F37 of 10A) | powers the third brake light and brake lights control. |
| +30 (protected by mini-fuse F38 20A) | powers boot unlocking function. |

The controls that turn on the NBC are:

- +key;
- emergency;
- parking

Each time one of these controls is turned off the NBC stays on with its own power for approximately 1 minute.

If there are no load actuation commands, it goes onto stand-by in order to save power. The maximum consumption is 3 mA excluding the alarm function.

The NBC is moreover triggered by special commands:

- door locking/unlocking operations;
- doors open, hatch open;
- remote control operations;
- lifting sensor;
- turning on/off via CAN line;
- turning on/off via fault diagnosis line.

Following these commands the control unit remains powered for the necessary time to perform the function.

Limp Home Functions (recovery)



Limp-home functions are contemplated with the key on for the following functions:

brake lights	The lights are controlled directly by the switch. It is possible to check the function that is sent to the microprocessor. The integrity of the brake lights fuse is diagnosed.
low-beam headlights	The low-beam headlights command governs the relay driver directly, without passing via the microprocessor. The low-beam headlights relay driver can be controlled by the microprocessor during the phase of diagnosis.
parking lights	Following low-beam headlights limp-home, the parking lights are turned on via hardware too. The parking lights are turned on by the microcontroller during the phase of diagnosis.

Main functional specifications of the NBC

Nominal voltage:	13.5 V
Operating voltage:	6 - 16 Volt
Parameter operating voltage:	10 - 16 Volt
Operating limit voltage:	18V for 1 hour 24V for 1 min.

The input on stand-by (with V = 13.5 Volt) is: <= 6 mA

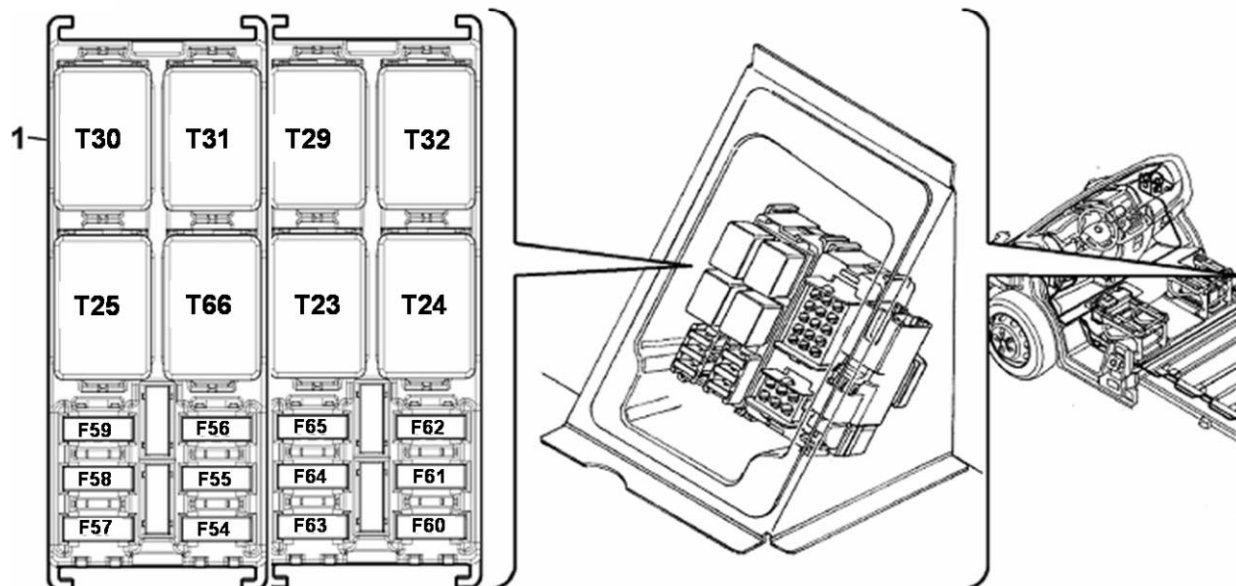
The input on stand-by with the alarm function (with V = 13.5 Volt) is: <= 10 mA

The input on run (with V = 13.5 Volt) with no loads on is: <= 160 mA



CCO optional wired control unit

The CCO control unit (1) can be present in one or two modules, depending on the opt on the vehicle. One of the two modules can be replaced by the opt. socket for body-makers, as described in the following 0.2sections.



Code	Use on module 1	I [A]	Code	Use on module 2	I [A]
	FUSES				
F54	Not present	15	F60	Spare	
F55	Heated seats	15	F61	Spare	
F56	People carrier rear socket 12V	15	F62	Spare	
F57	Supplementary heater under seat	10	F63	+30 rear supplementary heater protection	30
F58	Not present	-	F64	Spare	
F59	+30 NMA (NO. air springs)	20	F65	Supplementary heater fan	30
	CONTACTORS				
T25	Minibus internal lights	30	T23	INT/A supplementary heater fan	
T30	Not present	-	T29	Supplementary climate control unit enable	
T31	Supplementary heater under seat	30	T32	Spare	
T66	+Key for heated seats	30	T24	switch discharge (refrigerator, heated seats, climate control fan speed 1)	



Prearrangement for body-makers**Alternators and supplementary batteries**

The installation of electrical appliances with a high input (e.g., electric motors used frequently or motors used less frequently but for long periods and without using the vehicle's engine, such as tail lifts for town use) or a large number of supplementary electrical appliances can require power outputs that the vehicle's normal system is not able to deliver. In these cases it is necessary to use supplementary batteries of suitable capacity and an uprated alternator.

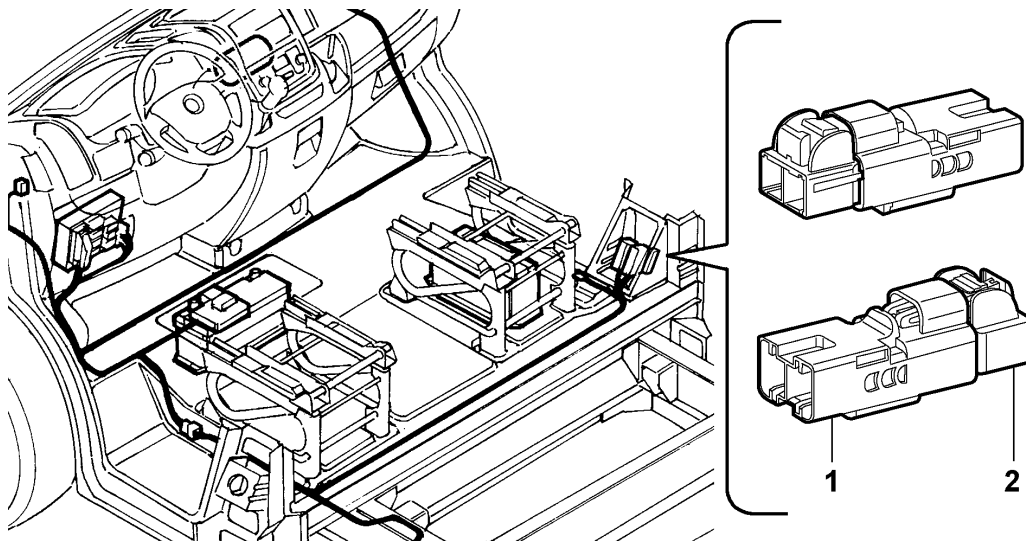
The application of supplementary appliances must include suitable protection and must not overload the vehicle's system.

If it is necessary to use batteries with a greater capacity, because of additional loads, check that the vehicle is equipped with an uprated alternator.

In any case it is recommended not to exaggerate in increasing the battery capacity by over 20-30% of the maximum values supplied as optionals so as not to damage any components in the system.

Supplementary Alternator

The use of an uprated alternator is contemplated with the following characteristics:

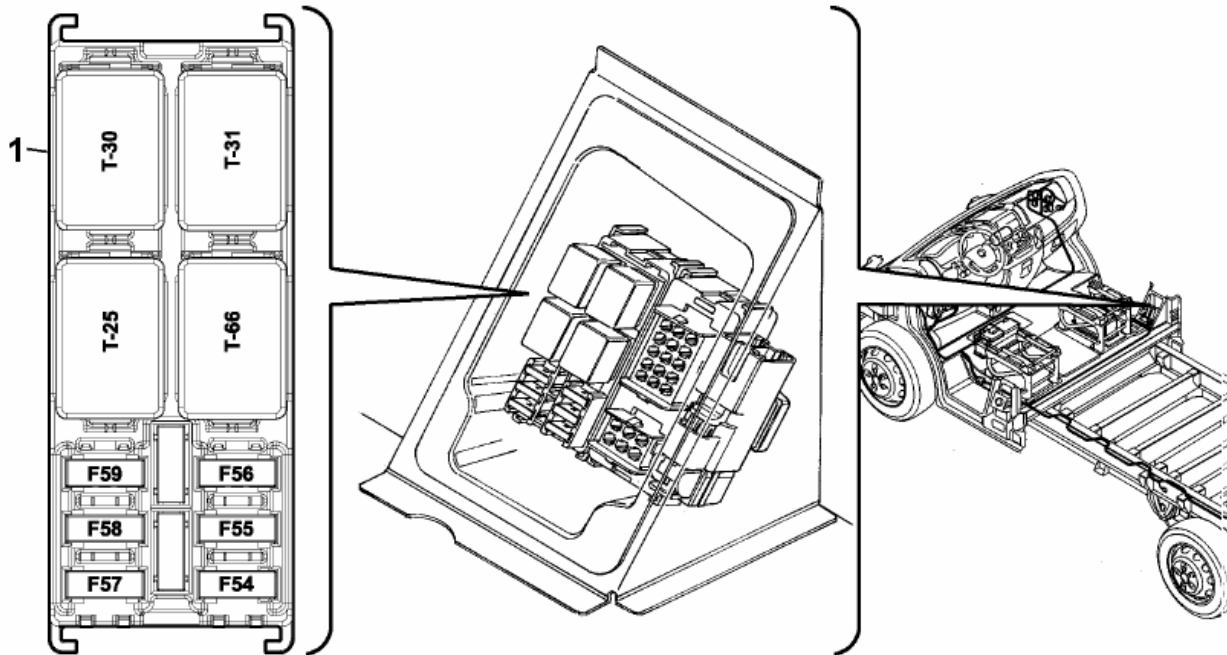
Auxiliary battery**85A – 160A 14V**

Pin	Function/Part number Connector	Minimum cable cross-section [mm ²]	cable colour	Notes
	MTA 2-way connector p/n 45.40300 Counterpart: MTA p/n 45.40400			Reference on diagram C036-L1C
1	Power supply +30	10	R	Nominal current fuse 50A
2	Power ground	10	N	Max continuous current 53A



Fuse and contactor box for optionals on right-hand pillar (CCO)

The opt prearrangement is installed in place of the right-hand module of the optional wired control unit, as shown in the figure. If the two modules of the optional wired control unit are both used, depending on the contemplated versions, the opt socket for body-makers is located in the area above the two modules. The contactors and fuses of the CCO are the same ones shown above.

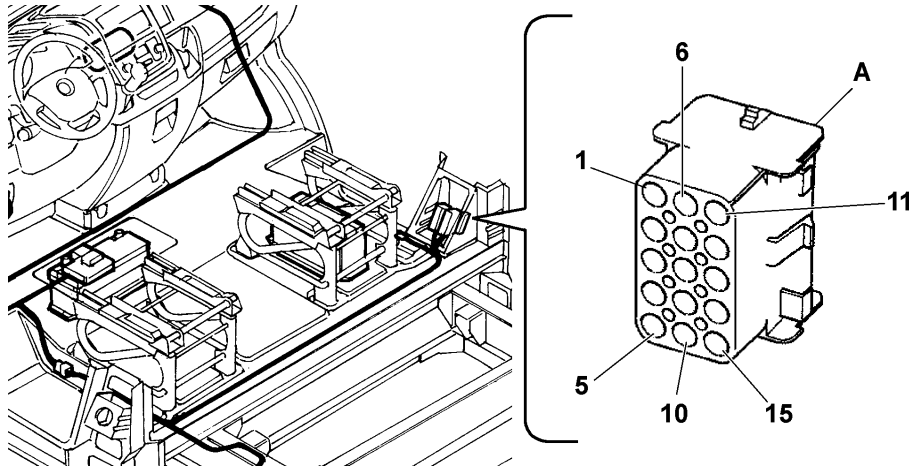


For the pinout, see module 1 in the CCO optional wired control unit section.



Opt socket for body-makers (Opt 081)

This prearrangement allows body-makers to connect accessories and specific devices for the vehicle's electrical system without altering operation.

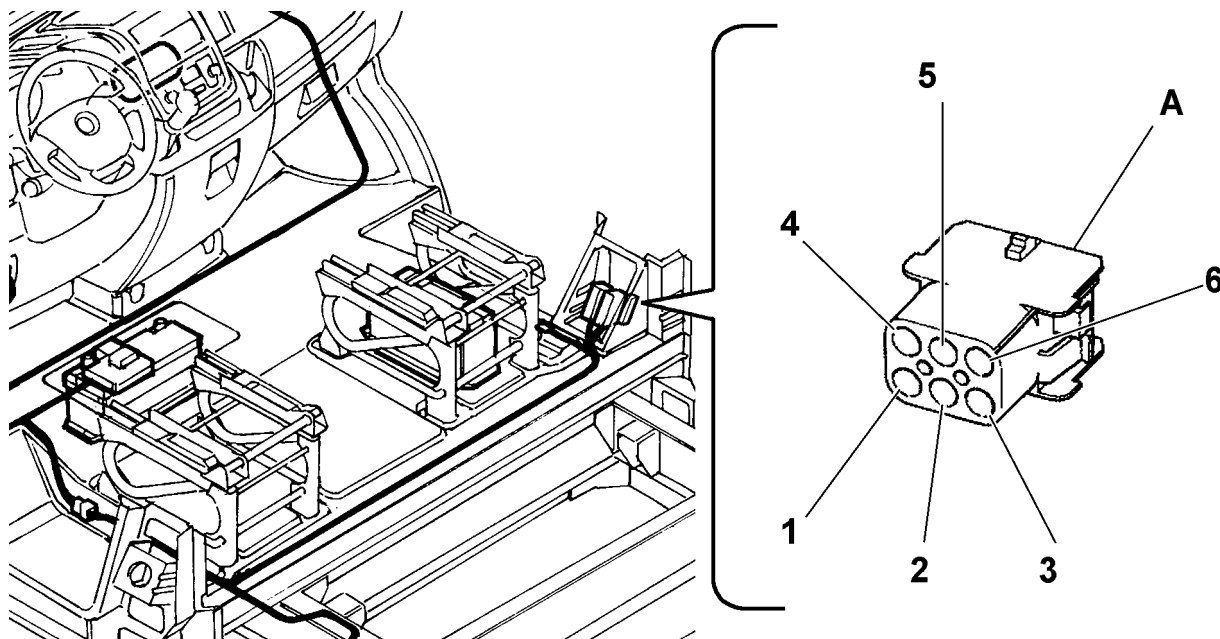


Pin	Function/Part number Connector	m cable cross-section	cable colour	Notes
	Tyco 15-way connector p/n 0-926647-1 Counterpart: Tyco p/n 1-480710-0 (by the body-maker)			Reference on diagram C036-L1A
1	Supplementary brake light	0,5	B	$P_{MAX}= 21W$ at 12V (to use as an alternative to the one on Y203L4A)
2	D+ (active to ground)	0,5	MB	$I_{MAX}= 300mA$ (1 relay coil FIAT Auto standard)
3	Vehicle speed repetition (VSO)	0,5	GR	$I_{MAX}= 5mA$ (see Figure 27)
4	Lock command	1,5	RN	$I_{MAX}= 12A$ (For the actuation times see Table 1)
5	Unlock command	1,5	NR	$I_{MAX}= 12A$ (For the actuation times see Table 1)
6	Lateral and rear door status signal	0,5	NZ	Use a normally open (N.O.) switch to ground (minimum clean contact current 10 mA)
7	Driver 20W SBMT timed power supply for ceiling lights	0,5	RV	Ceiling light timed power supply (+) for 15 min. with key off ($P_{MAX}= 20W$ at 12V)
8	Ceiling light negative command (dimmered)	0,5	BV	Ceiling light command (-) $P_{MAX}= 20W$ at 12V
9	B-CAN Low	0,35	BS	Prearrangement for FIAT Auto accessories line anti-theft ⁽¹⁾
10	B-CAN High	0,35	NS	Prearrangement for FIAT Auto accessories line anti-theft ⁽¹⁾
11	Relay negative command for side parking lights (sidemarker)	0,5	Z	$I_{MAX}= 300 mA$ (1 relay coil FIAT Auto standard)
12	A/C request	0,5	GV	Air-conditioning cut-in positive signal $I_{MAX}= 300 mA$ (1 relay coil FIAT Auto standard)



13	Power supply with key on (+KEY)	0,5	L	I _{max} =600 mA (2 relay coils FIAT Auto standard)
14	Supplementary heater command.	-	-	I _{MAX} = 300 mA (1 relay coil FIAT Auto standard)
15	Not connected	-	-	-

Prearrangement for rear speakers



Pin	Function/Part number Connector	cable cross-section	cable colour	Notes
	Tyco 6-way connector p/n 1-480705-0 Counterpart: Tyco p/n 1-480704-0 (by the body-maker)			Reference on diagram C036-L1B
1	Permanent 12V power supply (+30) for car radio	1,5	RG	Auxiliary battery permanent power supply to car radio only present from C036-L1A to Y028L1A ⁽¹⁾
2	Rear speaker LH +	1	V	
3	Rear speaker LH -	1	VN	
4	Rear speaker RH +	1	HN	
5	Rear speaker RH -	1	H	
6	Not connected	-		



7.3 INSTRUMENT PANEL

The contemplated versions are MODAL AND COMFORT.



Modal



Comfort

The instrument panel, both MODAL and COMFORT version, mirrors the standard operating logic of the latest generation panels that equip the brand vehicles.



NOTES:

- The instrument panel (NQS) is a node to which the proxy alignment procedure must be performed as required on the diagnosis program of the examiner whenever it is replaced with a new one. Failed proxy alignment of the panel will cause the warning lights to blink.
- The total odometer can be reset once if the displayed mileage is less than 200 km. If it has not yet been reset, the displayed kilometres is preceded by a symbol similar to an H. Resetting is done by pressing and holding down the setup + / - buttons on the control board.
- If replacing the instrument panel, it is necessary to save the data again for the total odometer and the service date. Perform the proxy alignment again.

The table briefly summarizes the information provided by the instrument panel, according to the two versions.

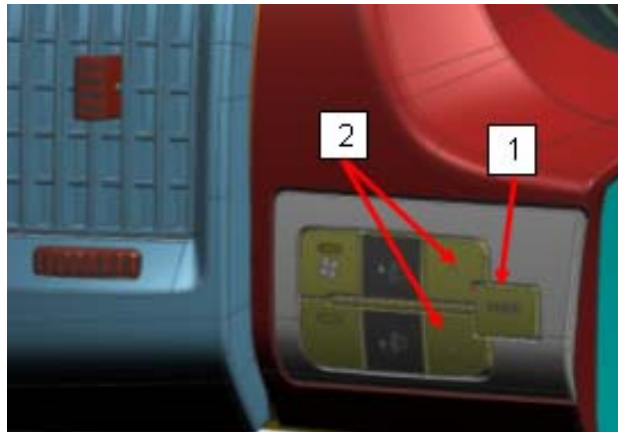
Content	MODAL	COMFORT
Tachometer	X	X
Revs counter	X	X
Fuel level gauge	X	X
Engine coolant temperature gauge	X	X
Headlight alignment corrector	X	X
Odometer	X	X
External temperature and ice danger	-	X
Rheostat lighting	-	X
Reduced setup menu	X	-
Complete setup menu	-	X
Time	X	-
Time and Date	-	X
Trip Computer	X	X
Scheduled maintenance and engine oil change warnings	X	X
Automatic transmission information	-	X
Audio information repetition	-	X
Information repetition for Convergence C1	-	X
Information repetition for Convergence C3	-	X
Logistic Mode	X	X
Buzzer (faults, parking sensor, SBR, button operation confirmation beep)	X	X
Diesel Particulate Filter + Oil life	X	X
Alternator failure	X	X
Minimum engine oil pressure	X	X
Minimum oil level	X	X
EOBD/MIL indicator	X	X
Glow plug pre-heating / sensor failure	X	X
Water in diesel filter	X	X
Cruise Control	X	X
Front and rear fog lights	X	X
Direction indicators, parking, number plate and check lights	X	X
High-beam headlights	X	X
Photocell sensor failure	-	X
Rain sensor failure	-	X
Airbags	X	X
Deactivating passenger airbag from menu	X	X



Seat Belt Reminder	X	X
ABS indicator	X	X
ESP indicator	X	X
Handbrake engaged with audible alarm with the vehicle running	X	X
Minimum brake fluid level	X	X
Brake pad wear	X	X
Servo-assisted steering	X	X
Immobilizer indicator	X	X
Fire Prevention Switch	X	X
Exceeding speed limit	X	X
Doors / goods compartment open	X	X
Parking sensor signals	X	X
Self-levelling suspensions alignment and failure display	-	X
Oil level display	X	X

SET-UP MENU

The setup menu can be activated with the key on DRIVE (MARCIA) and pressing the MODE button (located on the left-hand side control board) twice consecutively.



The functions of the set-up menu that can be selected with the “MODE” / “+” / “-” buttons must be able to be activated solely with the vehicle at a standstill except for the function: “Speed limit” (speed limit on/off selection and speed limit threshold).

These functions moreover cannot be activated during the fault message display cycles.

Operation must be of the sequential type as follows:

a) “MODE” button (1)

1 short pulse :

- with the vehicle running: activation of the “reduced” set-up menu;
- selection of the functions in the set-up menu.

1 long pulse:

- saves the changes confirmed with the short pulse and returns to the standard screen (or screen active before pressing the “MODE” button).

b) “+” / “-” buttons (2)

- setting / adjusting the functions in the set-up menu



*Main functions of the SET-UP menu***1) Clock setting:**

- **"Hour"** written in place of the odometer
- fixed clock indicator, setting with the "+" and "-" buttons

2) Buzzer setting:

- **"buzz"** written in place of the odometer
- **"0", "1", "2", "3", "4", "5", "6", "7"** written in place of the clock, can be set with the "+" and "-" buttons and indicating the levels of buzzer loudness
- by default: **4**

Level 0 = buzzer "mute" for signals that can be turned off (e.g., roger beep), at the minimum level for the others

Level 7 = max. buzzer level

The "Buzzer setting" is a single setting that takes effect over all the adjustable audible signals emitted by the NQS buzzer.

3) Speed limit setting:

- **"SPEED"** written in place of the odometer (with lowercase "d")
- **"km/h"** (or **"mph"**) according to the unit of measurement set previously
- **"OFF"** (speed limit off) or speed limits (e.g. **"130"**) written in place of the clock, can be selected with the "+" and "-" buttons (range between 30 and 250 km/h and step equal to 5 km/h; range between 20 and 155 mph and step equal to 5 mph as on the "Comfort" panel).

➤ by default: **OFF**; default value for ON: **130 km/h** or equivalent value in mph.

4) Setting unit of measurement in "km" or "miles":

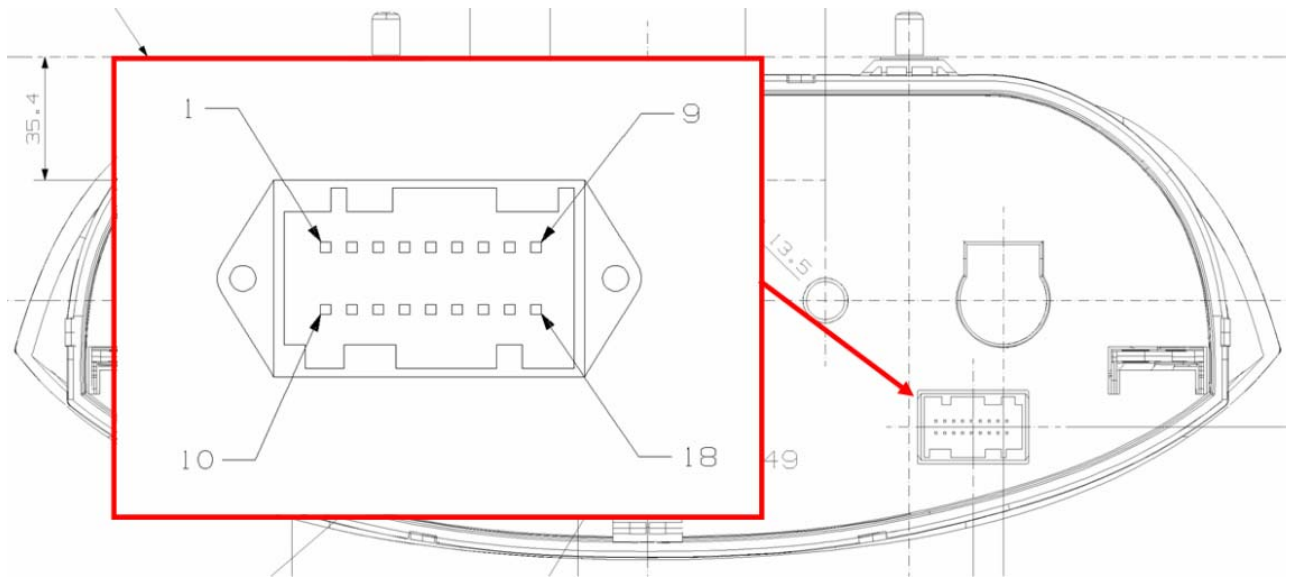
- **"Unit"** written in place of the odometer
- fixed icon **"km"** or **"mi"**, setting with "+" and "-" buttons
- the clock is not displayed

5) Request to turn passenger airbag on/off:

- main menu item: **"BAG P"** written in place of the odometer
- request to turn passenger airbag on/off: **"BAG P"** written in place of the odometer and blinking settings **"OFF"** (passenger airbag turned off) or **"On"** written in place of the clock. Confirmation request: **"Conf"** written in place of the odometer and blinking settings **"YES"** or **"no"** written in place of the clock (**default: always "no" even after previously selecting "YES"**).
- feedback message lasting 3 seconds: **"BAG P"** written in place of the odometer and **"OFF"** or **"On"** written in place of the clock.



Instrument panel pinout



PIN	18-way connector p/n 1/08060/07 Tab.91353	1	2	3
1	Ground	0,5	N	X
2	+30 from F-53	0,5	RV	X
3	INT from F-37	0,5	LN	X
4	Not connected	-	-	-
5	B – CAN A	0,35	BS	X
6	B – CAN B	0,35	NS	X
7	Signal reference for headlight corrector actuators	0,35	AR	X
8	+low-beam from F-13 for headlight corrector command	0,75	CR	X
9	Negative signal from trip computer button on steering column stalk	0,35	AB	X
10	Not Applicable	-	-	-
11	Not connected	-	-	-
12	Not connected	-	-	-
13	Signal from commands on PCS: "Mode", "Mode +"	0,35	AV	X
14	Signal from PCS "up headlight alignment corrector", "down headlight alignment corrector",	0,35	BL	X
15	Not connected	-	-	-
16	Signal from commands on PCS: "Mode –"	0,35	AN	X
17	CSG fault warning light negative signal	0,5	BN	X
18	e.i./EOBD fault warning light negative signal from NCM	0,5	HV	X

1 cable cross-section.

2 cable colour.

3 x = for all versions.



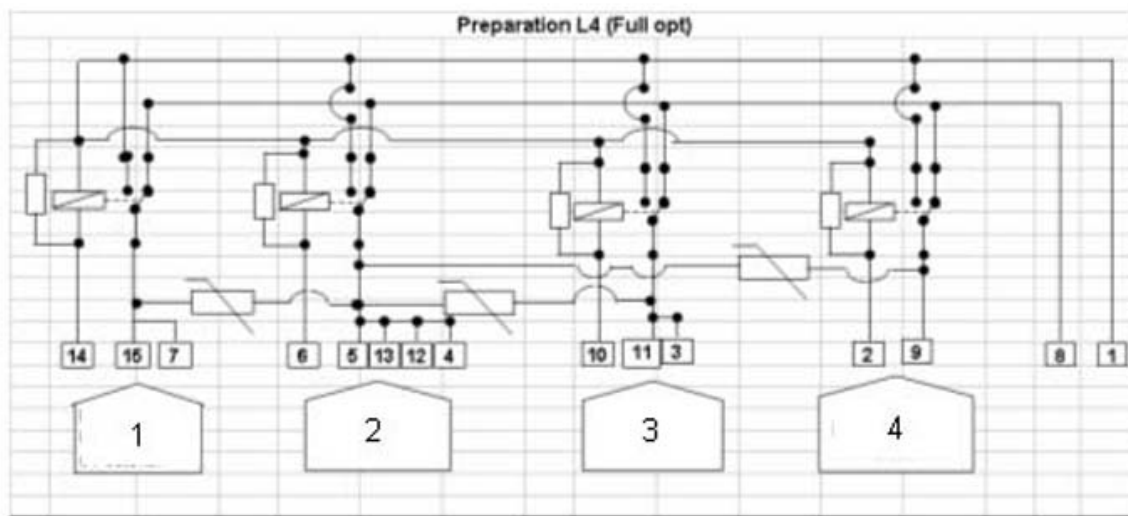
7.4 DOOR MANAGEMENT CONTROL UNIT

The Nano florence electrical system does not contemplate using the door and rear nodes. Door central locking management is governed by a specific control unit that acts in synergy with the NBC; it is located under the dashboard, right-hand side.

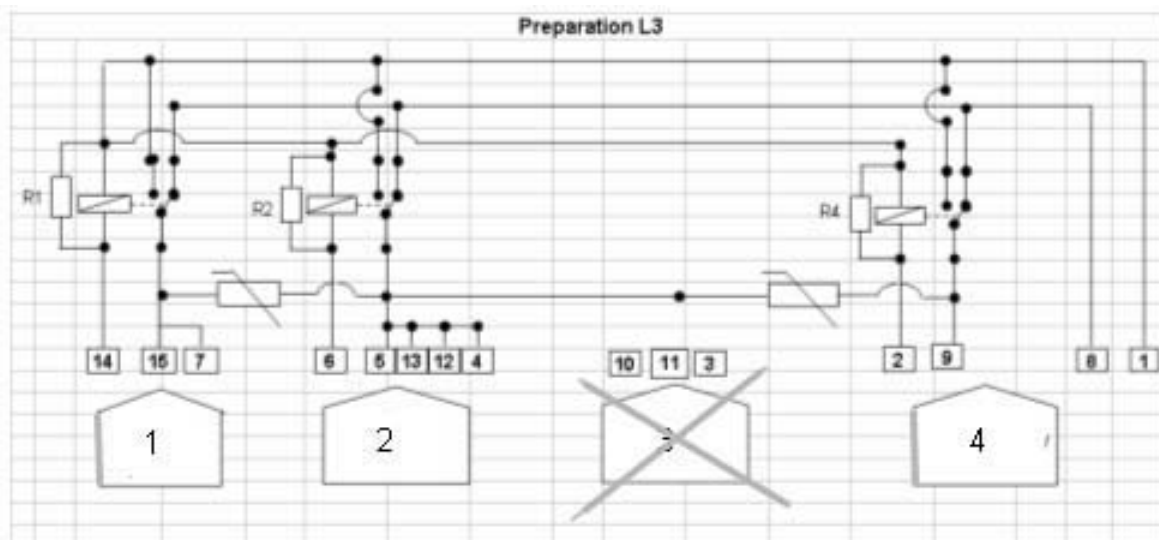
Door lock

The door management control unit (CGP) can have four different configurations depending on the vehicle version.

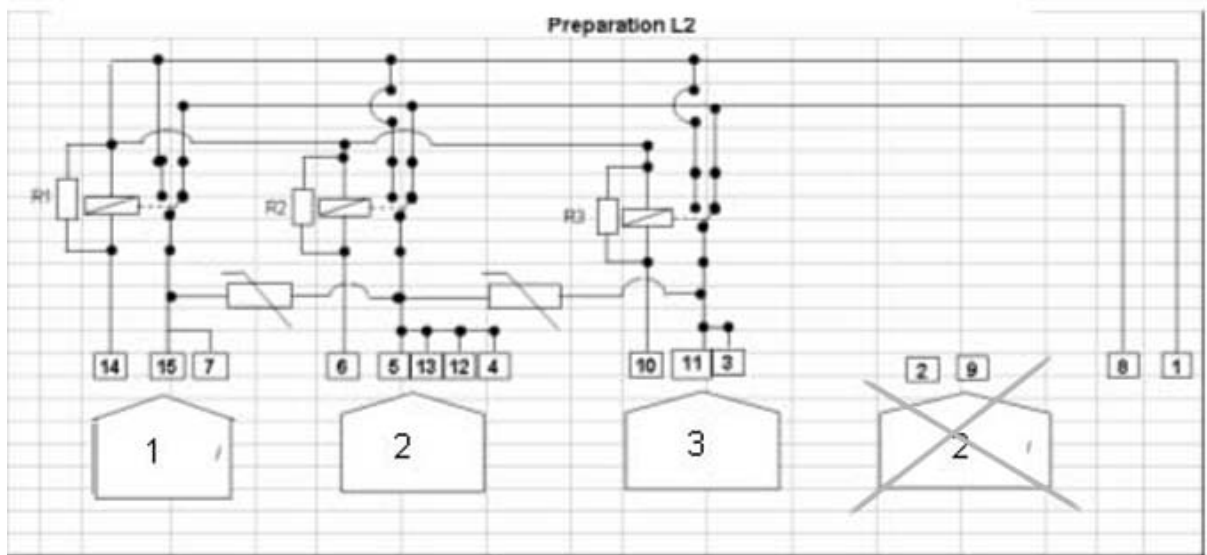
L4: (Full opt) with front doors, rear doors and dead lock.



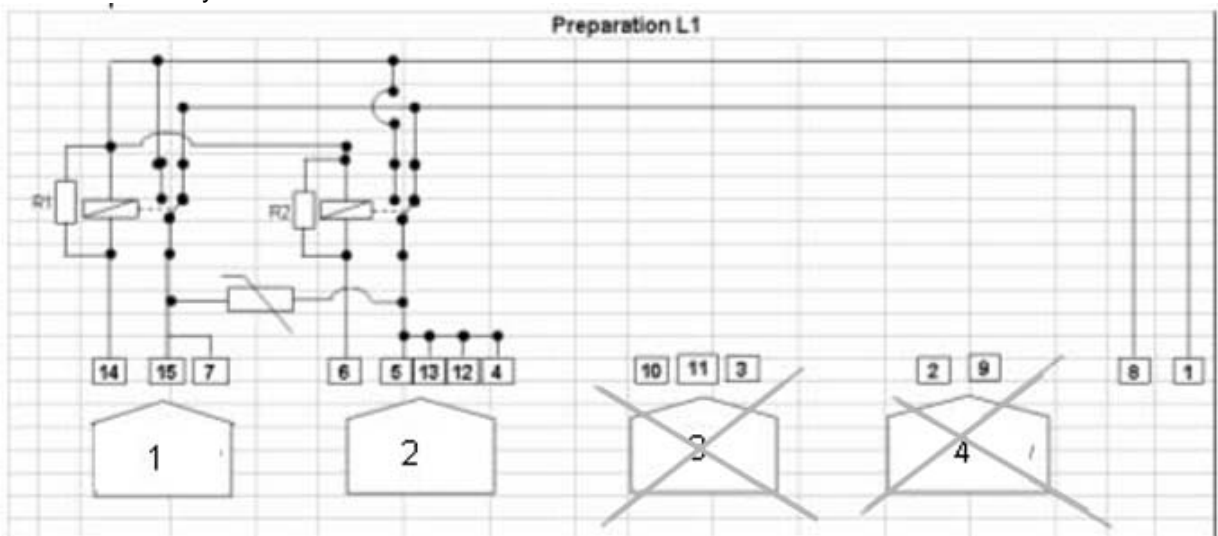
L3: with front and rear doors (without dead lock)



L2: with front doors and dead lock (without rear doors)



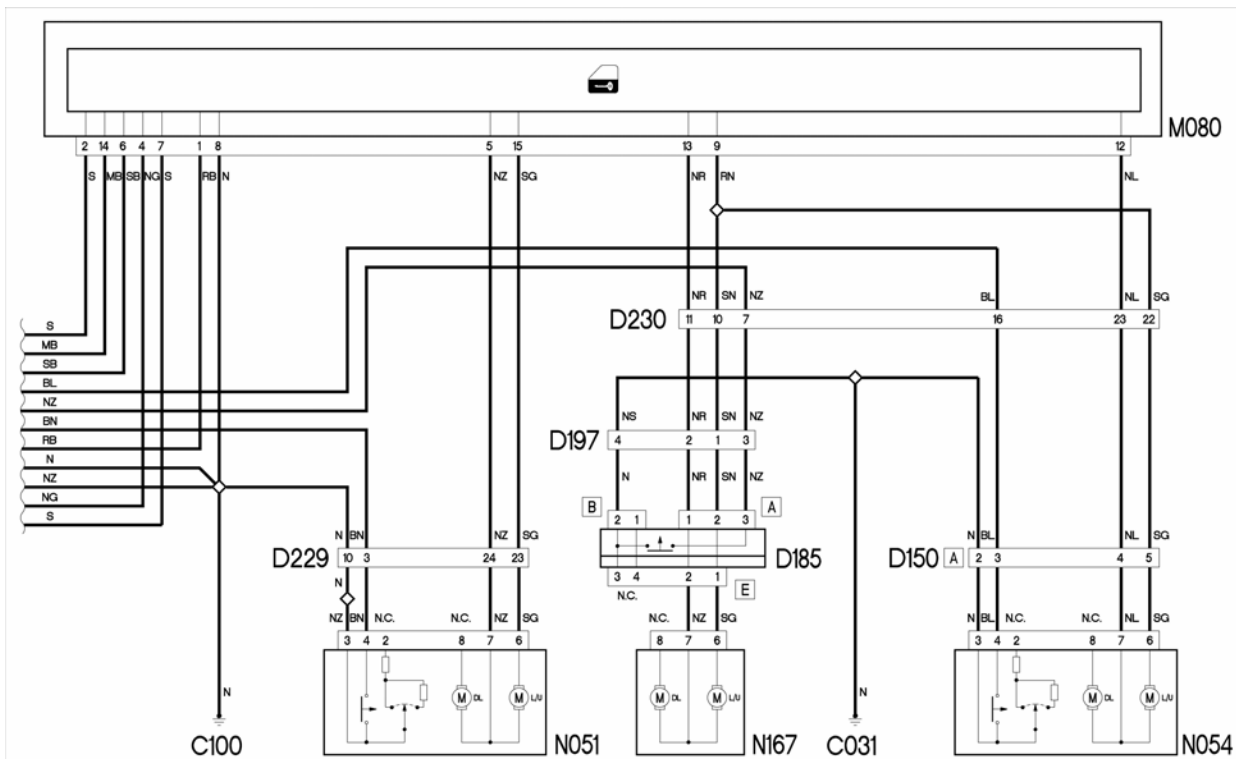
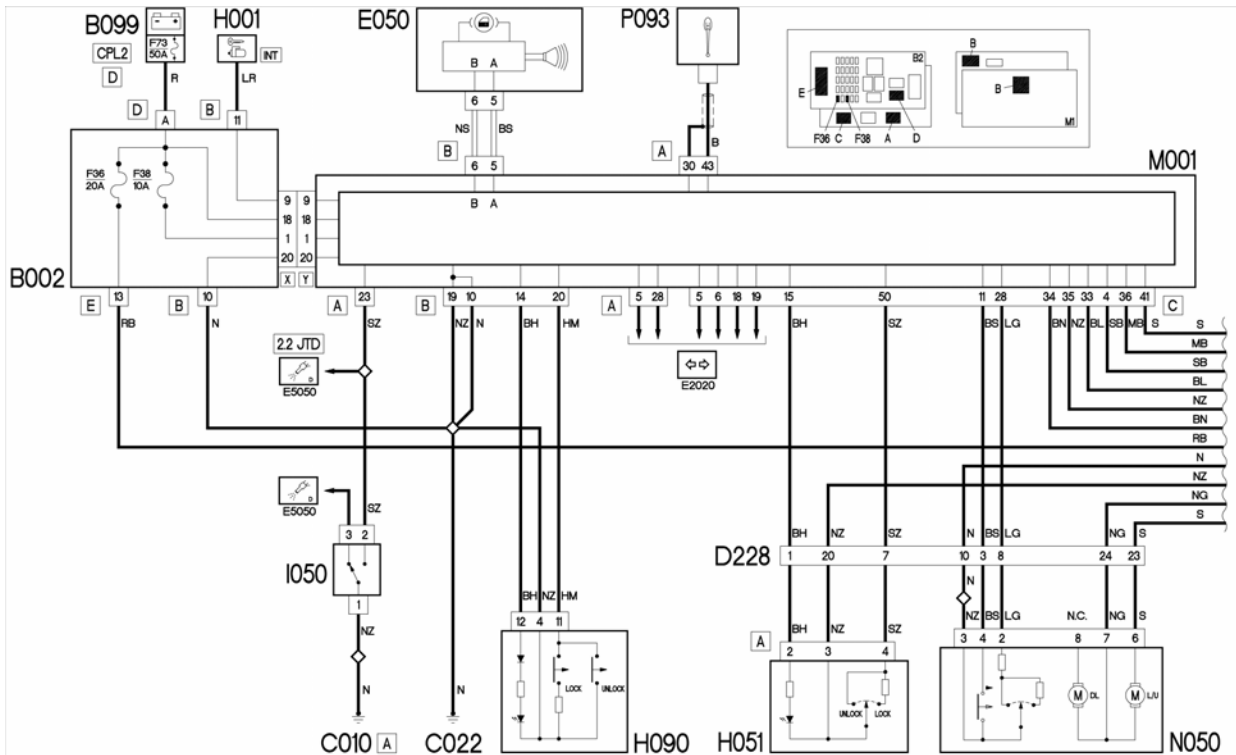
L1: front doors only.



- 1: Front door lock/unlock contactor.
- 2: Common contactor.
- 3: Dead lock contactor.
- 4: Rear door lock/unlock contactor.



Door lock wiring diagram



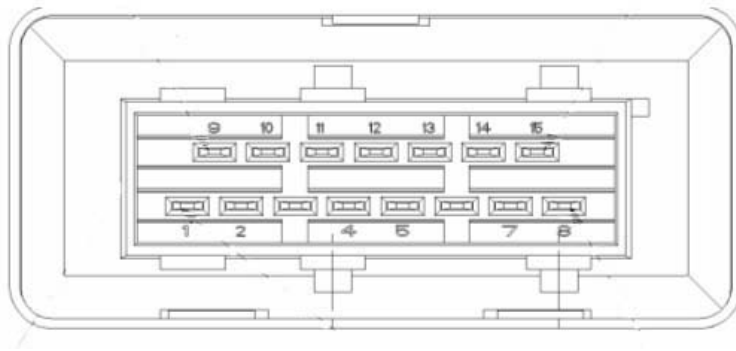
Legend

B099 Control unit battery CBA. **H001** Key switch. **P093** R.F. antenna for door lock receiver. **B001** Node body computer NBC. **B002** Control unit dashboard CPL. **E050** Node instrument panel NQS.

I050 Inertia switch. **H090** Central control board. Main lock/unlock controls.

H051 Driver door control board. Goods compartment door lock/unlock controls. **N050** Driver side door lock.

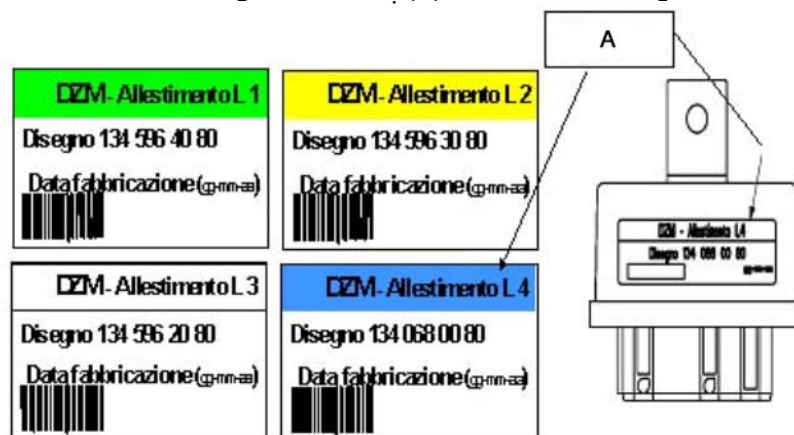
N051 Passenger side door lock. **N054** Rear door lock. **N167** Side door lock. **D185** Contact panel on side sliding door with side door open indicator switch. **M080** control unit door management CGP. **D228** Connector dashboard – driver door. **D229** Connector dashboard – passenger door.

Door management control unit pinout.

No. pin	Function	Connection
1	+ 12V battery protected from F36 of the CPL	CPL
2	Rear door lock/unlock contactor command	NBC - pin LN41
3 -11	Actuator command for dead lock function	
4 – 12 – 13 – 5	Front and rear door lock/unlock actuator command	
6	Common lock / unlock contactor command	NBC – pin LN4
7 – 15	Front and rear door lock/unlock actuator command	
8	General ground	
9	Rear door lock/unlock actuator command	
10	Dead lock contactor command	NBC – pin LN42
14	Front and rear door lock/unlock contactor command	NBC – pin LN36

Control unit identification:

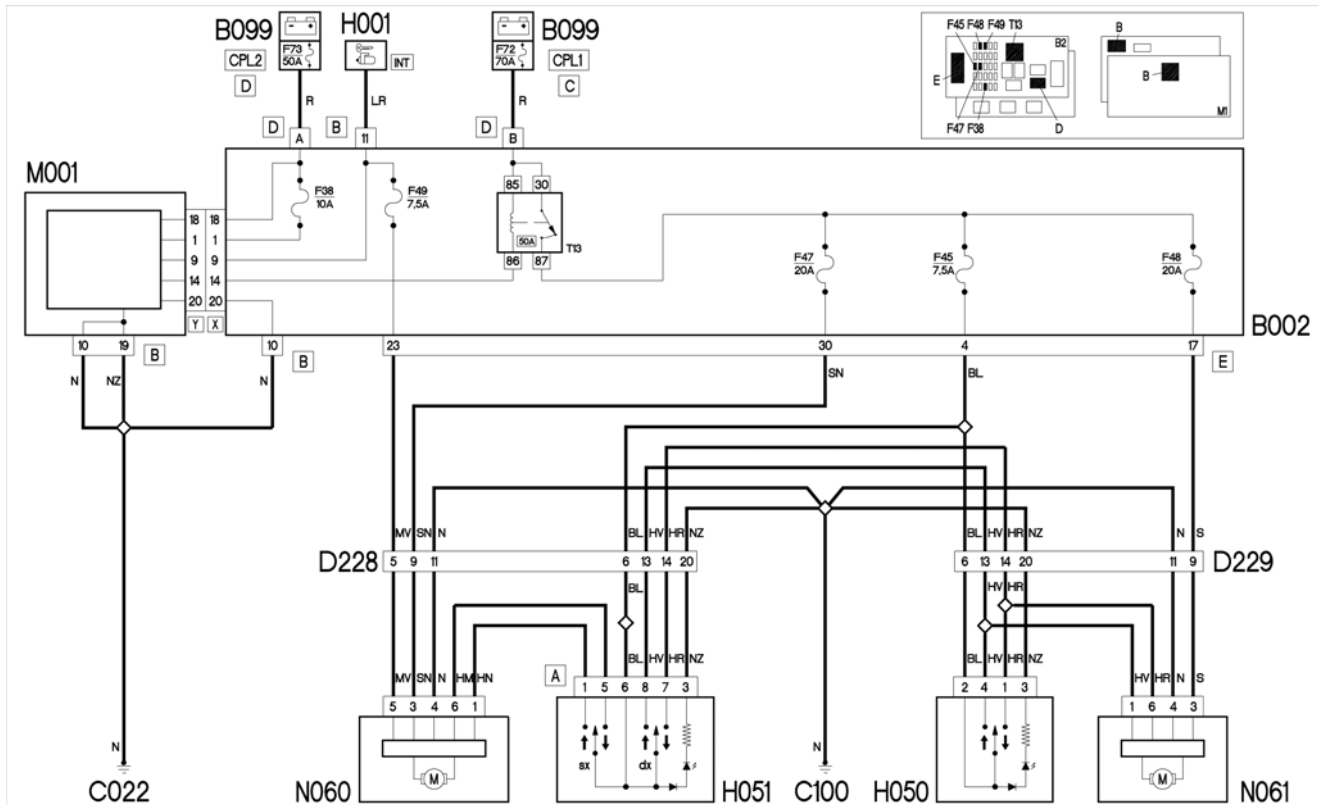
The control unit identification data are given on label (A) as shown in the figure.



7.5 POWER WINDOWS AND MIRRORS

Power Windows

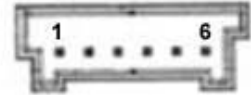
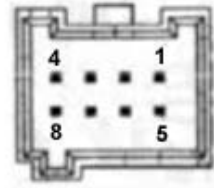
The power window motors are powered by an electronic unit integrated with the motors themselves. The function of this control unit is to move the window up/down manually and automatically. The command signals are sent directly from the push-buttons on the control boards of the front doors on the armrests.



Legend

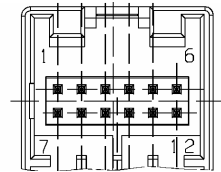
- B099 CBA battery control unit
- H001 + int from ignition switch
- M001 NBC body computer node
- B002 CPL dashboard control unit
- N60 left power window actuator
- H051 power window control panel on left door
- H050 power window control panel on left door
- H061 right power window actuator
- D228 – D229 dashboard-door connectors





Side door lock/unlock and power window section connector pinout.

- Pin 1 = Left window Up command.
- Pin 2 = Side door LOCK indicator light positive.
- Pin 3 = Ground.
- Pin 4 = Side door LOCK/UNLOCK signal.
- Pin 5 = Left window Down command.
- Pin 6 = Positive 12V.
- Pin 7 = Right window Down command.86



- Pin 8 = Right window Up command.

Power mirror reversing section connector pinout.

- Pin 1 = Ground.
- Pin 2 = RH mirror reverser opening.
- Pin 3 = RH mirror reverser closing.
- Pin 4 = LH mirror reverser opening.
- Pin 5 = LH mirror reverser closing.
- Pin 6 = Positive + 15.

Power mirror adjusting section connector pinout

- Pin 1 = Ground
- Pin 2 = Up/down - right main mirror.
- Pin 3 = LH/RH - left wideangle mirror.
- Pin 4 = LH/RH - left main mirror.
- Pin 5 = Positive 12 V. lighting.
- Pin 6 = Up/down - left wideangle mirror.
- Pin 7 = Power supply + 12 V .
- Pin 8 = Mirror motor common;
- Pin 9 = Up/down - left main mirror.
- Pin 10 = LH/RH - right wideangle mirror.
- Pin 11 = Up/down - right wideangle mirror.
- Pin 12 = LH/RH - right main mirror.



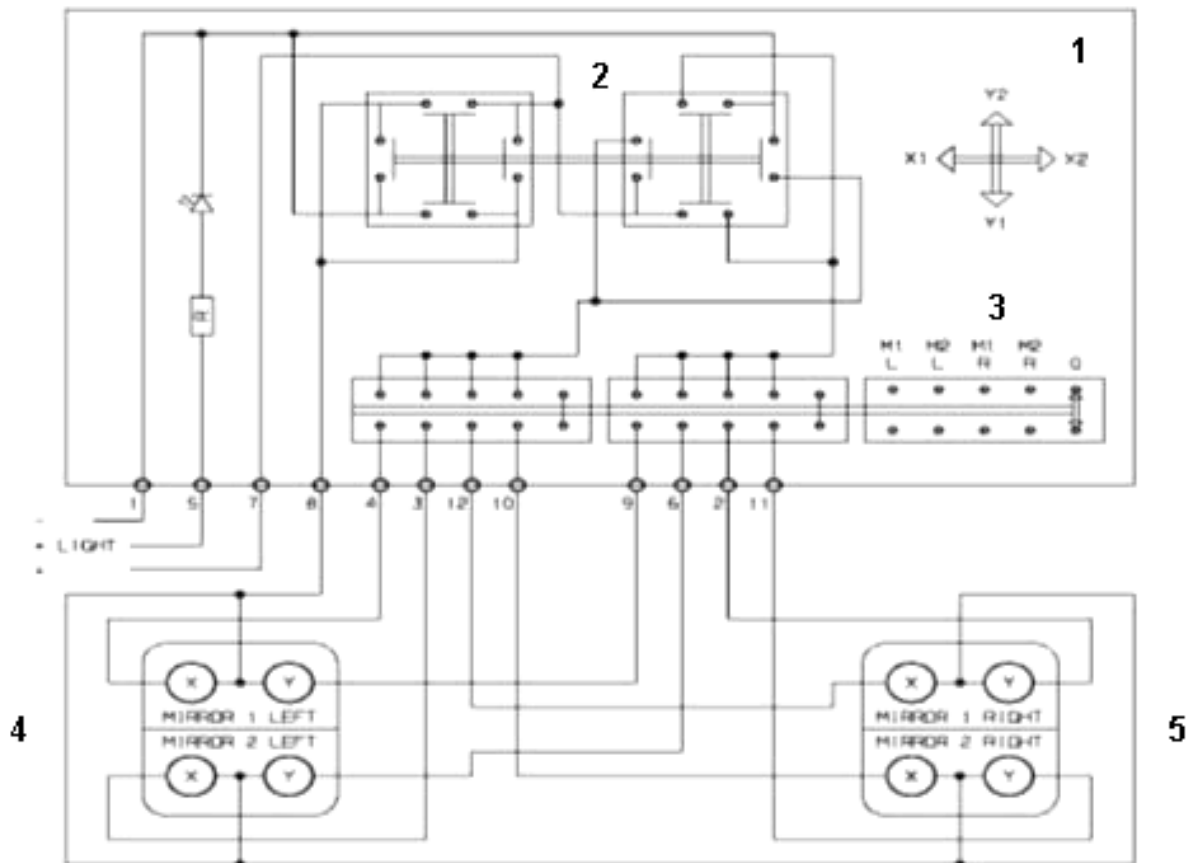
Power Mirrors

The power mirrors are the classic type and are adjustable from the specific board, located on the left door.

There are three versions of power window, depending on the contemplated type of radio.

With radio +CD (MP3) the radio antenna is on the roof: the mirror is the standard type; then there is the optional version of the rearview mirror with integrated radio antenna and the full version, with radio antenna, integrated GPS and GSM.

Wiring diagram



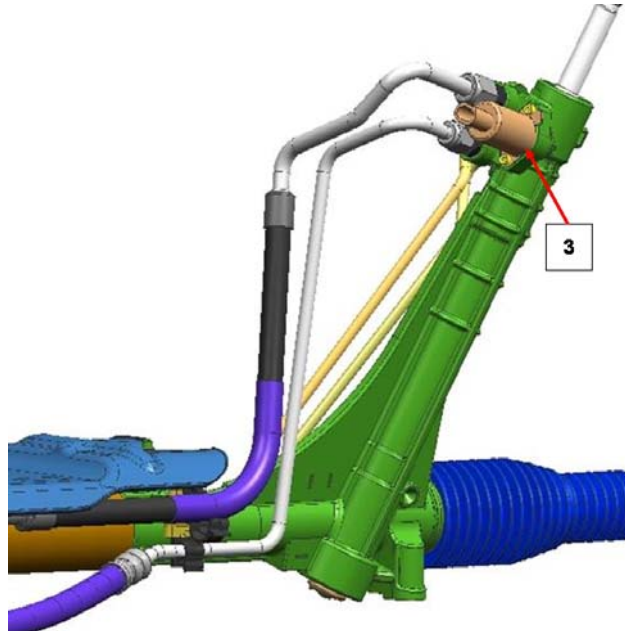
Legend.

- 1 - power window control board.
- 2 - motor unit control switch joystick.
- 3 - mirror movement selector.
- 5 - left mirror adjustment motor unit.
- 6 - right mirror adjustment motor unit.



7.6 POWER STEERING WITH VARIABLE INTERLOCK

The steering system is servo assisted by a TRW system that acts on the oil outlet from the hydraulic interlocking device of the steering box via the control of a solenoid valve (3) governed by an electronic control unit.



Operation

The degree of steering interlock is obtained by the solenoid valve (3) that adjusts the flow of oil in the reaction chamber (6).

The solenoid valve (3) is governed by a PWM signal, generated by the servotronic control unit, according to the vehicle speed.

The vehicle speed is established by a digital signal with variable frequency (VSO) generated by the NBC (see AV connector pin 37), by processing the vehicle speed information generated by the NFR and made available on C-CAN.

The solenoid valve is normally open (zero current = vehicle speed approximately 70 km/h).

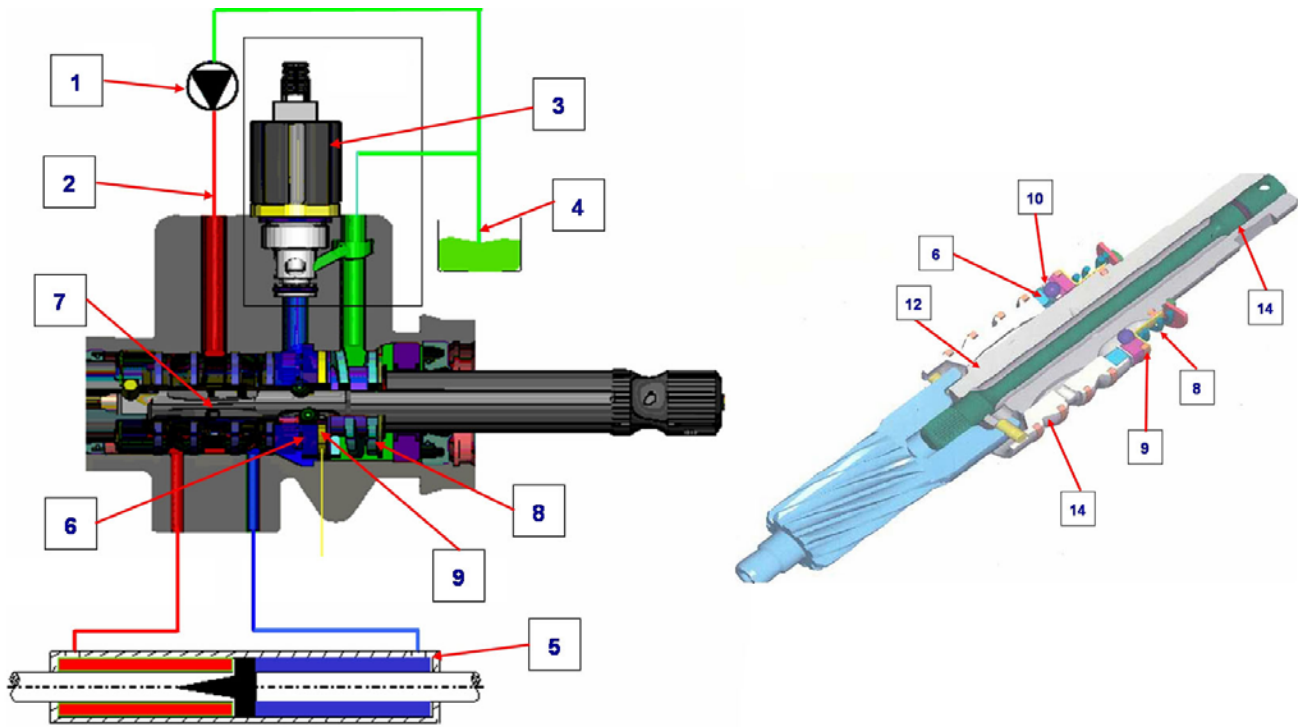
Low speed operation:

When steering at a standstill, the position taken by the control valve (7) permits sending oil under pressure into one chamber of the steering actuator (5) and discharging the other one. On the outlet there is the valve (3) that in this case is energized with the maximum current (approximately 650 mA) and closes. Under these conditions the plunger limits the discharge of oil towards the tank (4). The increase in pressure in the reaction chamber (6) shifts the plate (9) to the right that overcomes the load of the spring (8) and discharges the thrust on the balls (10) reducing/cancelling the resisting torque that they exert on the shaft (11). The pressure difference between the steering actuator chambers is reduced. The torque to apply on the steering wheel is thereby reduced.

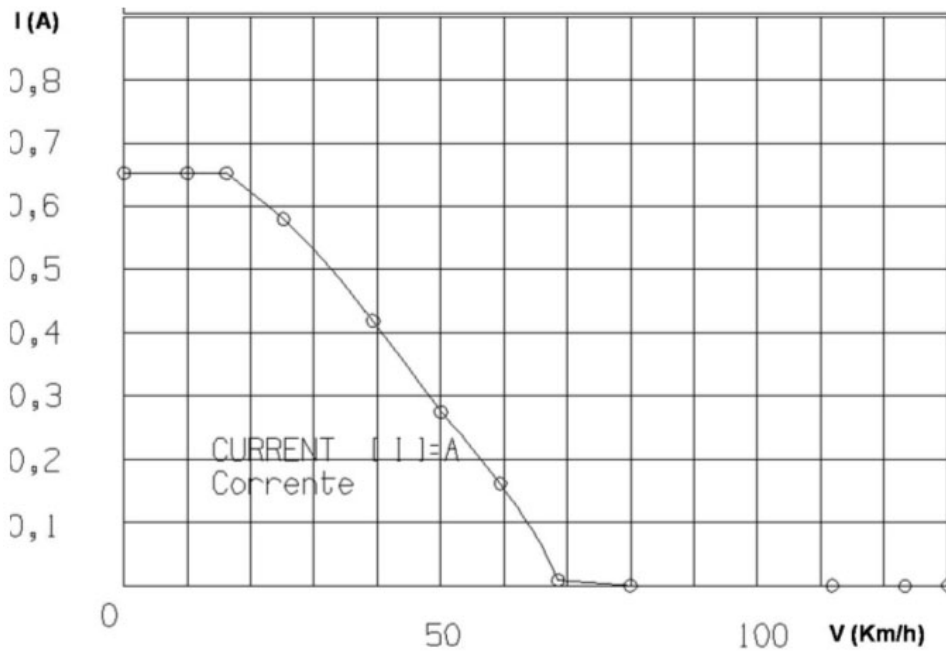
High speed operation:

During the phase of steering, as the vehicle speed increases, the current on the solenoid valve decreases: in this way the plunger tends to open the oilway to the tank completely. The reaction chamber (6) is thus discharged. The spring (8) takes the plate (9) into the position where the balls (10) exert the maximum resistance on the shaft (11). The torque to apply on the steering wheel increases.





Graph of current applied to the solenoid valve according to the vehicle speed.

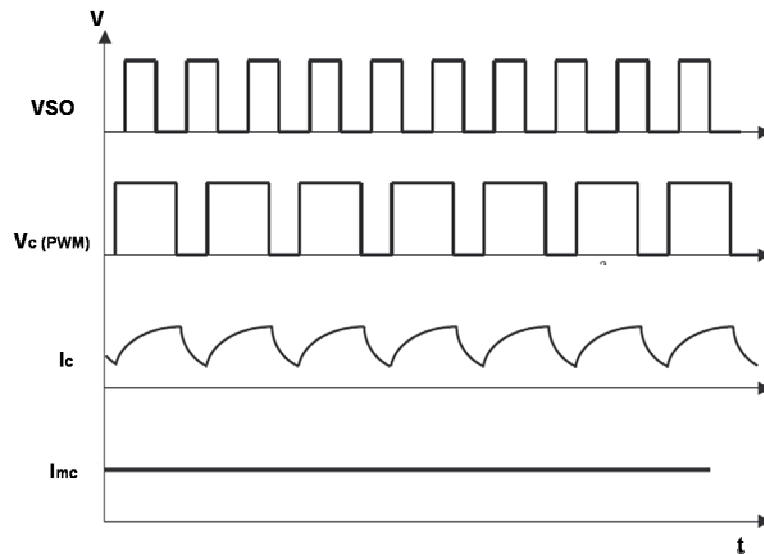


Legend:

I (mA) solenoid valve current.

V (Km/h) vehicle speed.



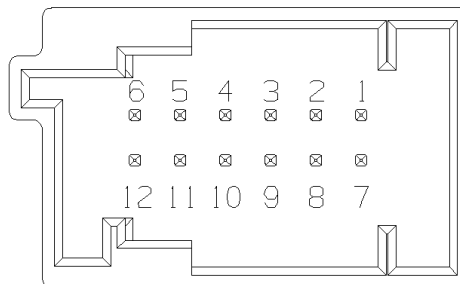
Signals applied to the solenoid valve**Legend:**

VSO Vehicle speed signal, from NBC (AV connector, pin 37) 12 V. 7 pulses=1.93m.

Vc PWM signal at 300 Hz – 10 V. governing solenoid valve.

Ic Graph of solenoid valve input current.

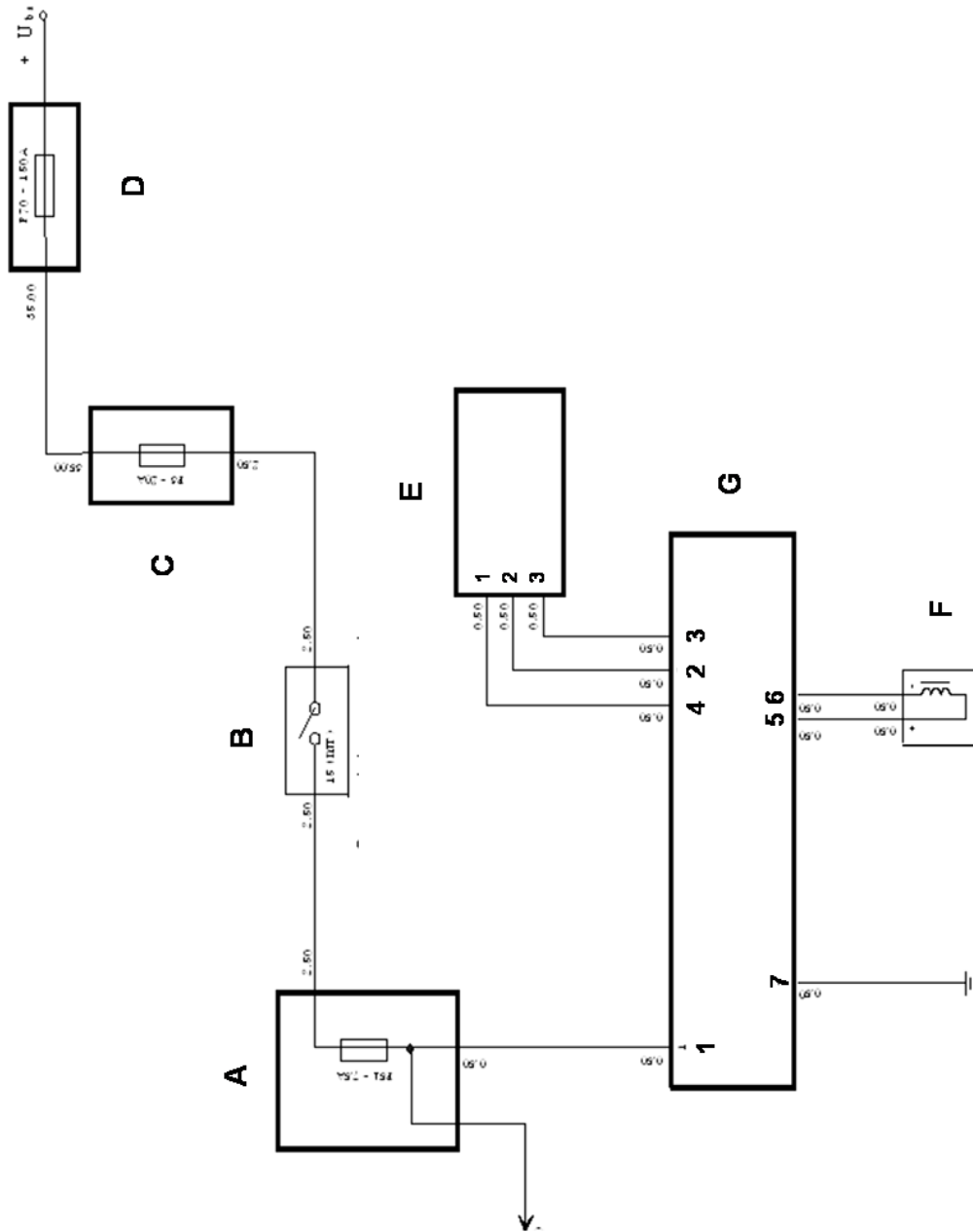
Imc Average solenoid valve input current.

Control unit pin-out

No.pin	Signal name	Type of signal
1	+ 15 power supply	
2	Vehicle speed	Digital 12 V.
3	Fault lamp	Digital (low =indicator light on)
4	K line	Digital (ISO 9141)
5	Solenoid valve positive	Digital PWM 10 V.
6	Solenoid valve negative	Digital PWM
7	Ground	
8	Ground	
9	Ground	
10	Ground	
11	Ground	
12	Ground	



Wiring diagram



Legend

- A - CPL dashboard control unit
- B - key switch
- C - CVM engine compartment control unit
- D - CBA battery control unit
- E - NBC body computer node
- F - servo valve
- G - power steering control unit



System diagnosis

Power supply

With the key on the system must turn on the fault warning light for a time of $T = 4 \pm 0.1$ s.

Low voltage fault

If the supply voltage falls under 10 V, the control unit must illuminate the warning light as follows:

- If the voltage falls under 10 V and stays there for longer than 10 seconds (T1), the fault warning light must come on.
- If the voltage rises above 10 V for longer than 4 seconds (T2) the lamp must be off.

The fault remains in memory as proof of a malfunction with the vehicle's electrical system.

Vehicle speed signal fault

If the vehicle speed signal undergoes a sudden change due to a break in the cable, short circuit to ground or V.batt. the system must actuate the following recovery strategy:

- Fault lamp ON
- Proportional assistance at 60 km/h (can be calibrated)

Fault lamp signal

The control unit must save the following faults:

- sc to ground
- sc V batt.
- open circuit

If the signal is automatically restored the control unit must keep the fault in memory as proof of a fault with the vehicle's electrical system.

System features

Solenoid valve:

Normally open.

Resistance value: approximately 5 – 7 Ohm at 20 C° (15 mH at 1 Hz)

Maximum permissible current: approximately 1 A.

Maximum interlock current: approximately 800 mA.

VSO:

Amplitude 1.5 V

7 pulses=1930 mm.

7.7 AIR BAG

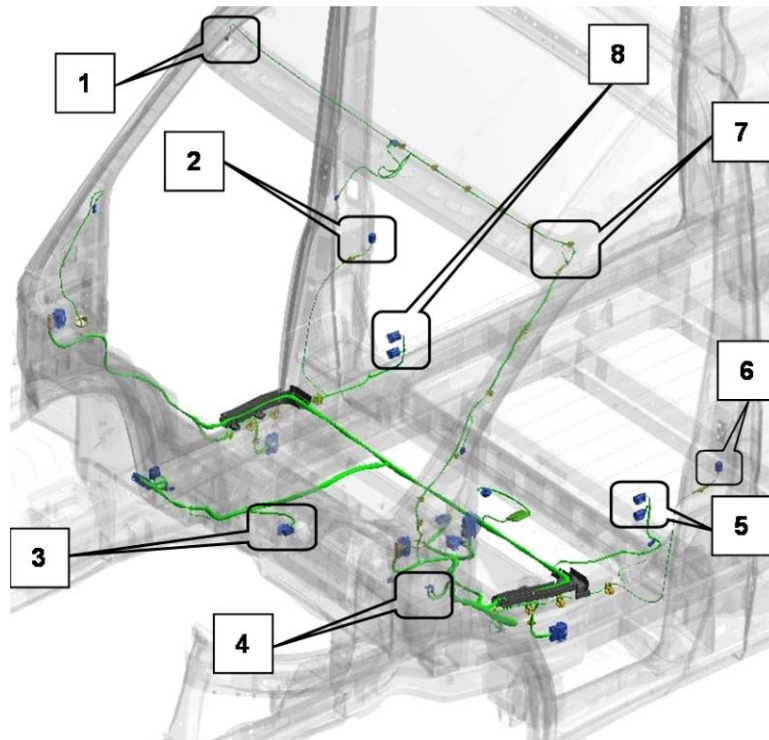
The vehicle is equipped with a TRW airbag of the classic type with electric drive that has six bags and three pre-tensioners.



Seat belts

- All the seats are equipped with belts with three anchoring points, with the sole exception of the four-seat bench of the second row on Double Chassis Cabs whose two middle seats are equipped with lap belts.
- In the case of revolving seats the seat belts are incorporated in the seat, while the pivoting seats with a revolving plate have a normal seat belt with three anchoring points.
- The front seat belts are equipped with a pre-tensioner that acts on the buckle of the belt.

Component layout:



- 1 - Window bag, right side
- 2 - Side collision sensor, right
- 3 - Airbag node
- 4 - Ground
- 5 - Connections for left seat (Side bag and pre-tensioner)
- 6 - Side collision sensor, left
- 7 - Window bag, left side
- 8 - Connections for right seat (Side bag and pre-tensioner)

NOTE:

Passenger Air-Bag disable

The vehicle panel set-up menu allows you to deactivate the passenger's bag, so that a child seat facing against the direction of running can be fitted with no risk at all. Airbag deactivation is signalled by the lighting of the respective warning light on the instrument panel.

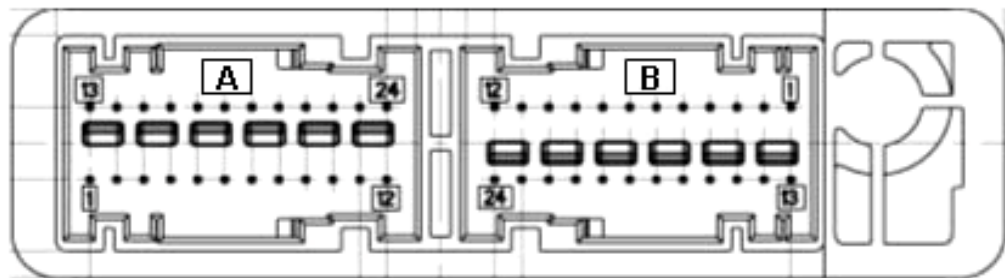


Driver's seat belt not on warning light and audible warning (Seat Belt Reminder)

If the driver's seat belt is not fastened and you are in one of the following conditions:

- 30 seconds after starting the vehicle with a driving speed above 4 km/h,
- driven at least 500 m
- exceeded the speed of 25km/h,

the unfastened seat belt warning light comes on together with a repeating audible warning signal. The warning light and the buzzer cut out when the seat belt is fastened. In any case, after 90 seconds the buzzer stops but the warning light on the instrument panel stays on.

Pinout**Connector A:**

1. Ground
2. Power supply + 15
- 3 – 4 – 5 – 11 – 17 – 18 - 21 – 22- 23 -24. N.C.
6. ECS (pre-crash sensor)
7. B CAN – A
8. B CAN – B
9. Prearrangement for passenger air bag inhibition switch
10. Prearrangement for passenger air bag inhibition switch
12. ECS (pre-crash sensor)
13. Driver airbag stage 2 squib negative
14. Driver airbag stage 2 squib positive
15. Driver airbag stage 1 squib positive
16. Driver airbag stage 1 squib negative
19. Passenger airbag squib positive
20. Passenger airbag squib negative

Connector B:

1. Side collision sensor, right
2. Side collision sensor, left
3. Side collision sensor, right
4. Side collision sensor, left
5. Driver side belt buckle switch
6. – 7 – 8 – 9 – 11 – 12 N.C.
10. Driver side belt buckle switch
13. Passenger side bag squib negative
14. Passenger side bag squib positive
15. Driver side bag squib positive
16. Driver side bag squib negative
17. Passenger belt pre-tensioner squib negative
18. Passenger belt pre-tensioner squib positive
19. Driver belt pre-tensioner squib positive
20. Driver belt pre-tensioner squib negative
21. Passenger window bag squib negative
22. Passenger window bag squib positive
23. Driver window bag squib positive
24. Driver window bag squib negative

7.8 CLIMATE CONTROL**General Information**

The climate control of the new Ducato features a considerable range of variants, mainly associated with the specific version and user requests.

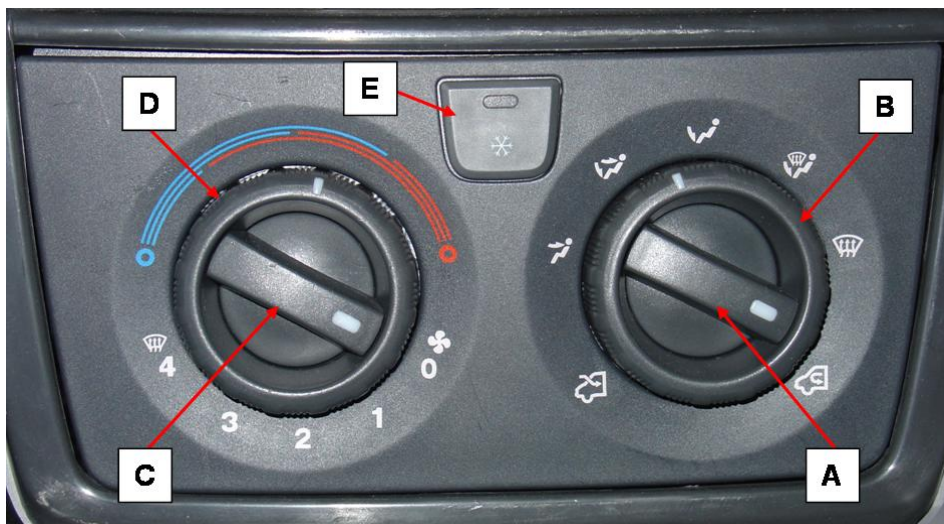
On the New Ducato there are therefore the following configurations:

- Heater with manual controls.
- Heater with manual controls and Webasto additional heater.
- Heater with single-zone manual controls and Webasto additional heater.
- Single-zone automatic climate control unit.
- Single-zone automatic climate control unit and Webasto additional heater.
- Additional rear heater.
- Additional rear air conditioner.

In addition the vehicle can be fitted for the body-maker to install a heater or air conditioner, extending the engine coolant and gas pipes, at the rear.

Heater with manual controls

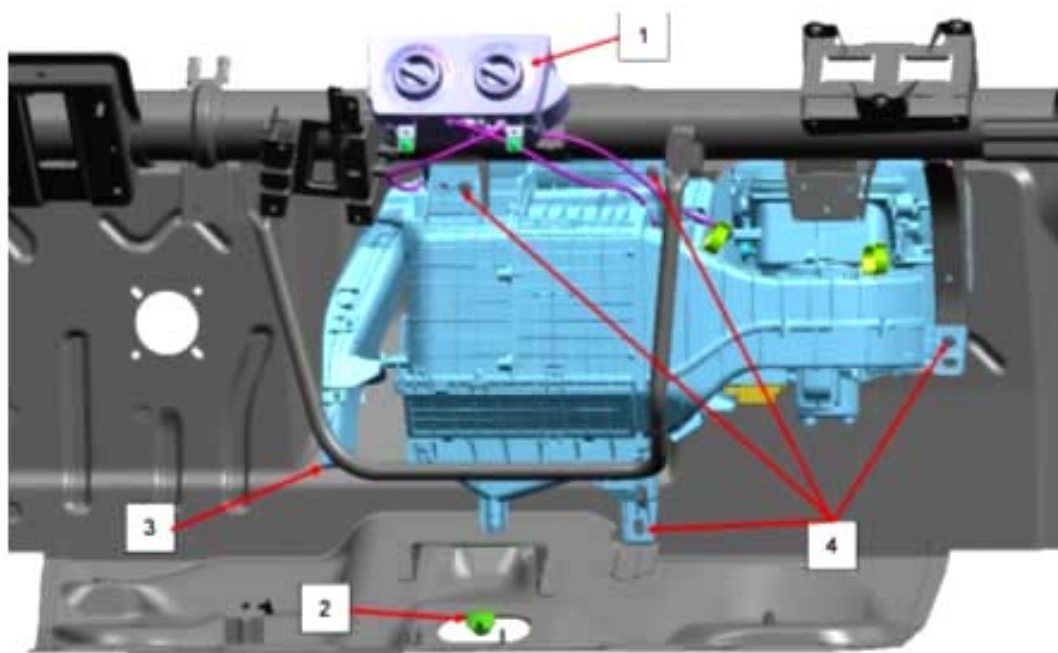
It is the classic type, with controls for distribution, mixing and recirculation made with bowdens. The heater fan control is accomplished with a 5-position switch and resistance divider.



Legend:

- A - recirculation control.
- B - distribution control.
- C - fan speed control.
- D - mixing control.
- E - compressor cut-in control.

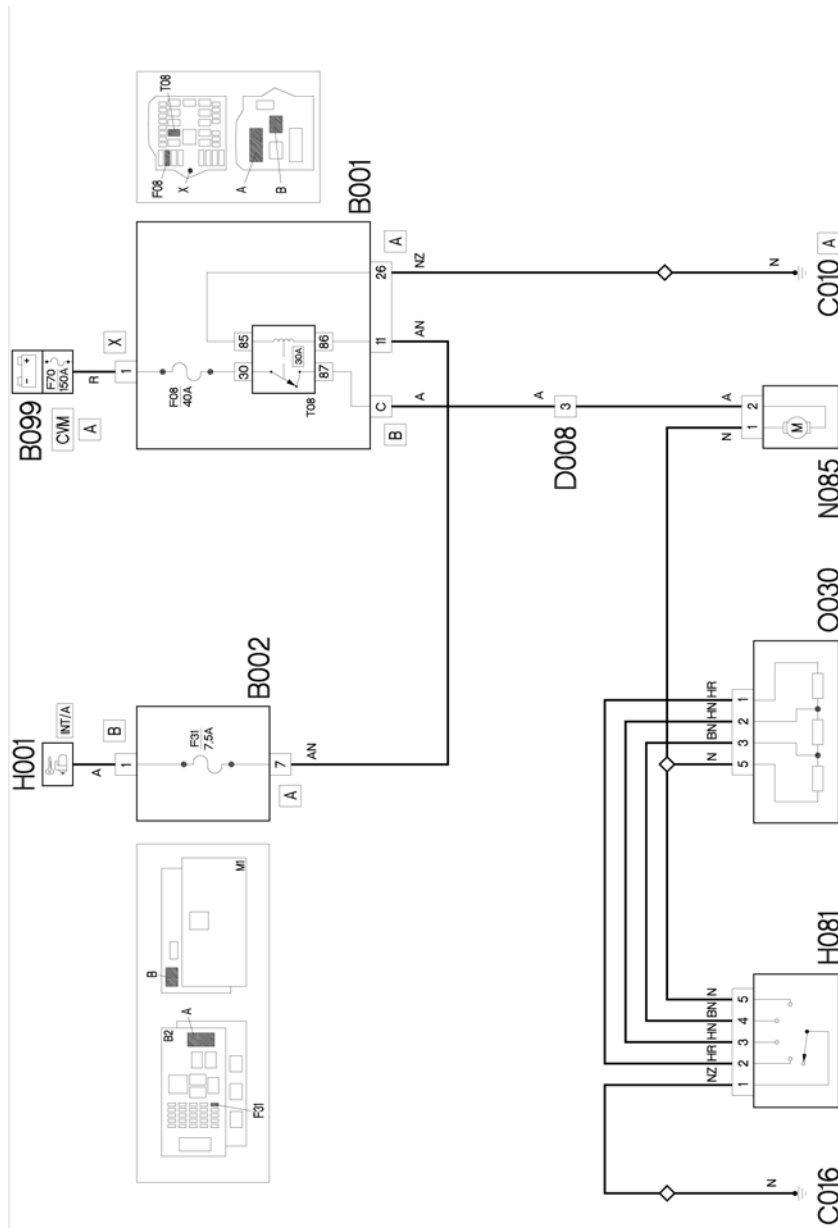


Standard heater unit**Legend:**

- 1 - manual heater control board;
- 2 - drain pipe;
- 3 - heater unit;
- 4 - unit fastening points.



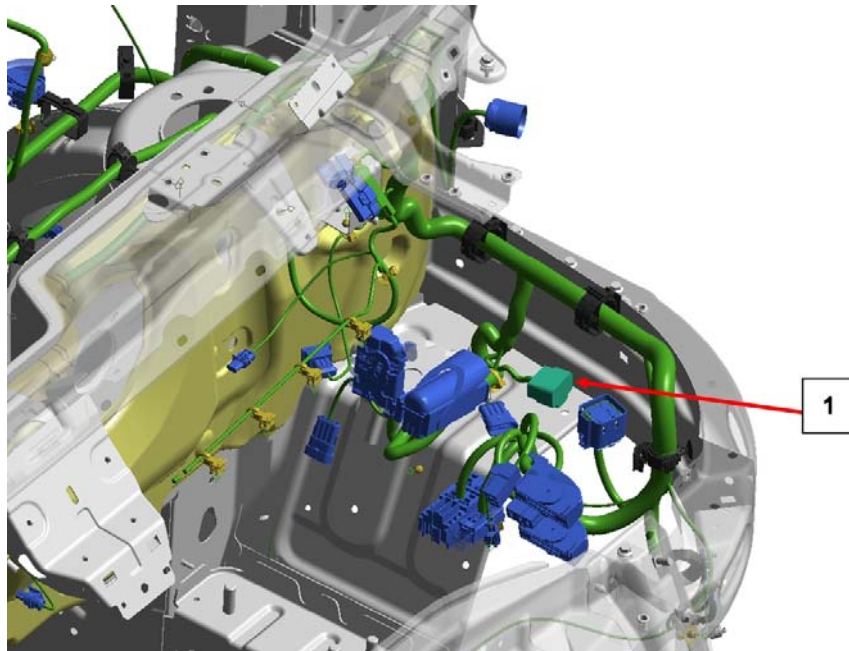
Wiring diagram of the heater with manual controls



Legend

- H001 ignition switch
- H081 climate control fan speed switch.
- B002 dashboard control unit (CPL)
- B001 engine compartment control unit (CVM)
- B099 battery control unit (CBA)
- N085 climate control unit fan
- N030 resistance divider for climate control fan speed.
- C010 engine compartment ground
- C016 dashboard ground



Heater with manual controls with Webasto additional heater (opt. 205)

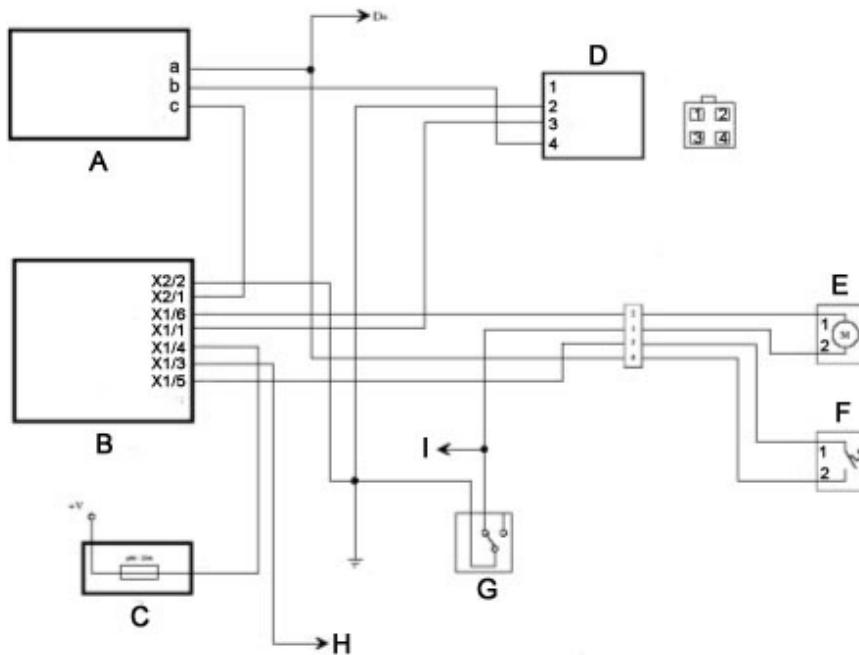
On request, the heater can be combined with the Webasto additional heater. This type of version features the installation of the following parts:

- Webasto unit, installed in the engine compartment on the left.
- Timer (on request) on the left board of the instrument panel.

The figures highlight the prearrangement connector (1) for connecting the Webasto unit and the timer (2).



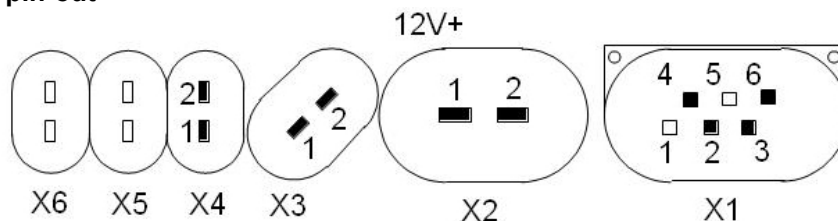
Wiring diagram of Webasto additional heater



Legend:

- A - Body computer. a: alternator D+ signal, b: +batt. From F 39, c: diagnosis K line.
- B - Webasto control unit.
- C - CVM engine compartment control unit
- D - Webasto Timer. 1: not connected, 2: ground, 3: Webasto cut-in signal, 4: +batt from F39 of the NBC.
- E - Webasto fuel pump
- F - Temperature sensor. F1: signal, F2: signal from D+ alternator. The heater turns off when the engine coolant temperature reaches 70 °C.
- G - Inertia switch
- H - To the climate control unit. Climate control fan contactor cut-in signal.
- I - Fuel pump contactor energizing.

Webasto control unit pin-out

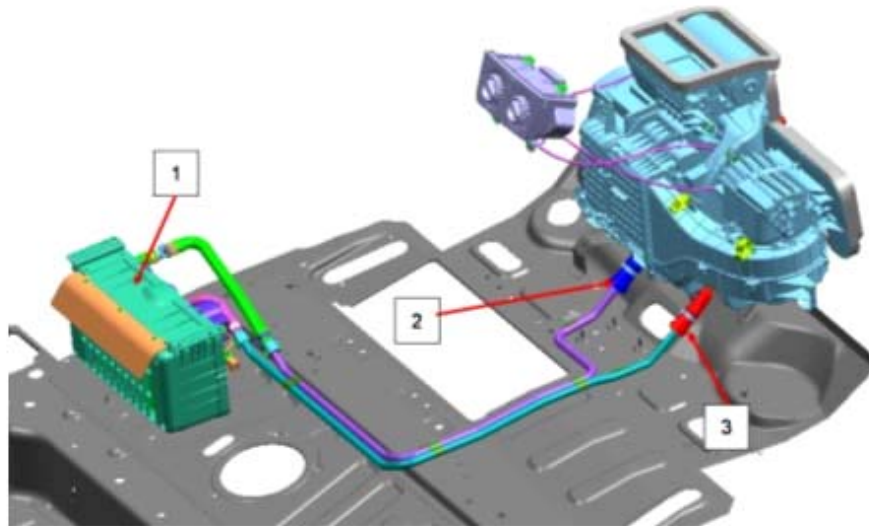


- X1 / 1 heater cut-in signal from timer (low: cut-in)
- X1 / 2 K diagnosis line
- X1 / 3 heater control via thermostat (from D+ alternator)
- X1 / 4 passenger compartment fan contactor cut-in
- X1 / 5 not connected
- X1 / 6 fuel pump command for heater
- X2 / 1 Power supply +30 from F04 of the CVM
- X2 / 2 control unit ground
- X3: ignition glow plug, X4: air inlet motor, X5: water pump, X6: not used.

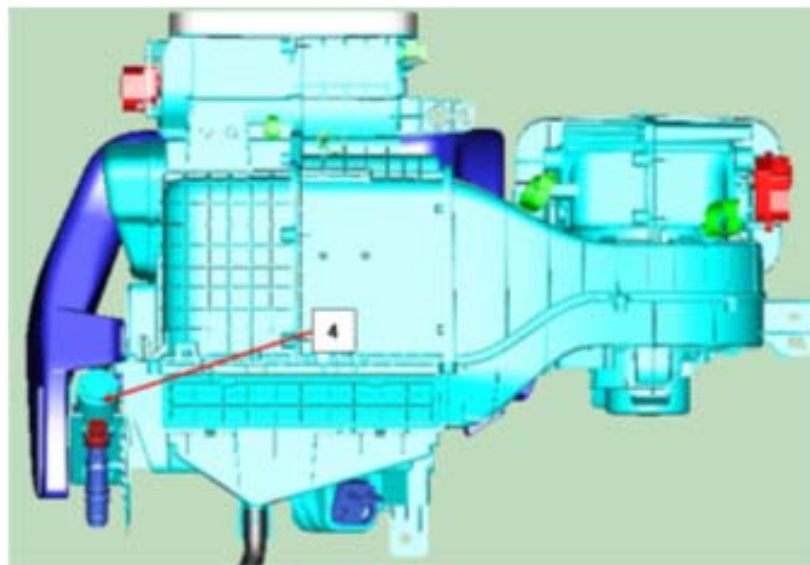


Supplementary heater under the front seat (opt 200)

The supplementary heater is a unit composed of a heat exchanger and a fan. It is located under the driver's seat. The supply of the exchanger is made with two pipes connected to two unions located on the main assembly. The main assembly is composed of a solenoid valve that opens or closes the flow of heating fluid towards the heat exchanger.

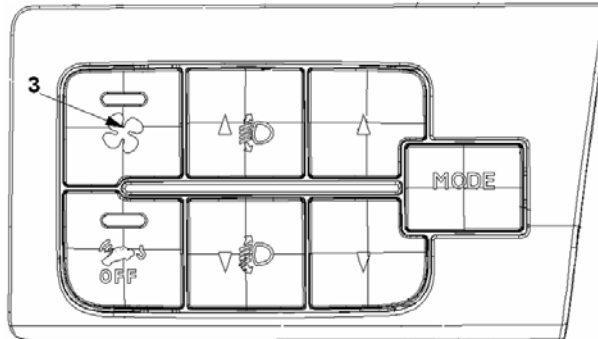
**Legend:**

- 1 - Supplementary heater unit (heat exchanger + fan)
- 2 - Engine coolant return pipe
- 3 - Engine coolant delivery pipe
- 4 - Heating fluid solenoid valve (normally open)

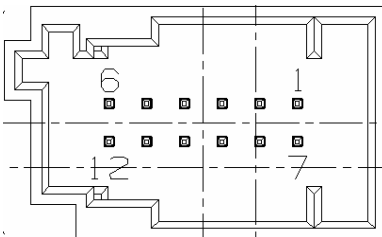


Switching on the heater

The supplementary heater is switched on by pressing the REAR A/C button (3) on the left control board, as shown in the figure.



The fan and the heating fluid solenoid valve are connected in parallel and are supplied by the contactor T31 on the optionals control unit that is energized by pressing the REAR button (3), on the left side board. The REAR button is a monostable button equipped with an electronic circuit that keeps the last setting made by the user in memory, under the condition of the key on stop.

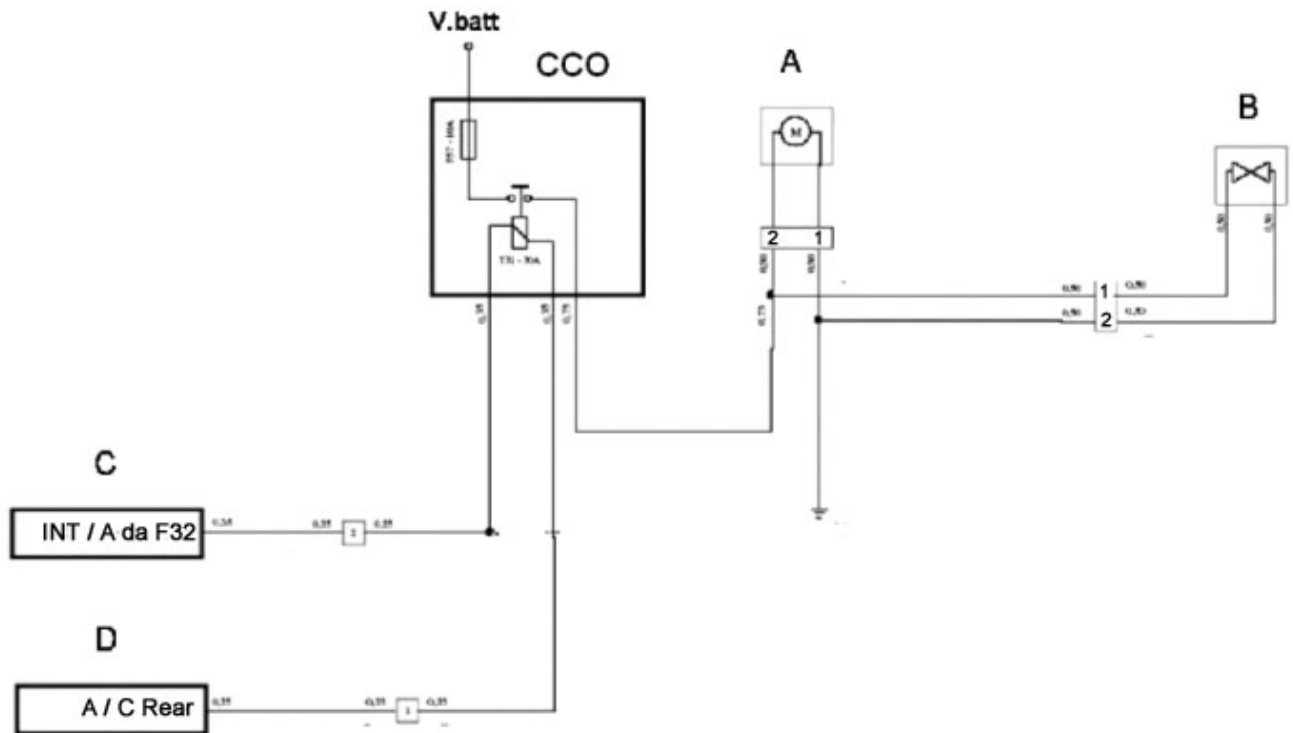


pinout

- 1: + lighting
- 2: ground
- 3: n.c.
- 4: headlight alignment corrector signal
- 5: MODE + signal
- 6: MODE – signal
- 7: n.c.
- 8: anti-lifting cut-out warning light control signal (ground = on)
- 9: REAR function cut-in signal
- 10: supplementary climate control unit cut-in signal (ground = on)
- 11: n.c.
- 12: n.c.



Wiring diagram of the supplementary heater under the seat

**Legend**

A: supplementary heater fan, B: heating liquid solenoid valve (normally open), C: CPL dashboard control unit, D: control board on dashboard – REAR button (pin 9 = ground when REAR button pressed), CCO: control unit for fuses and contactors for optionals.

Climate control system features

The air conditioner meets the characteristics given in the following table:

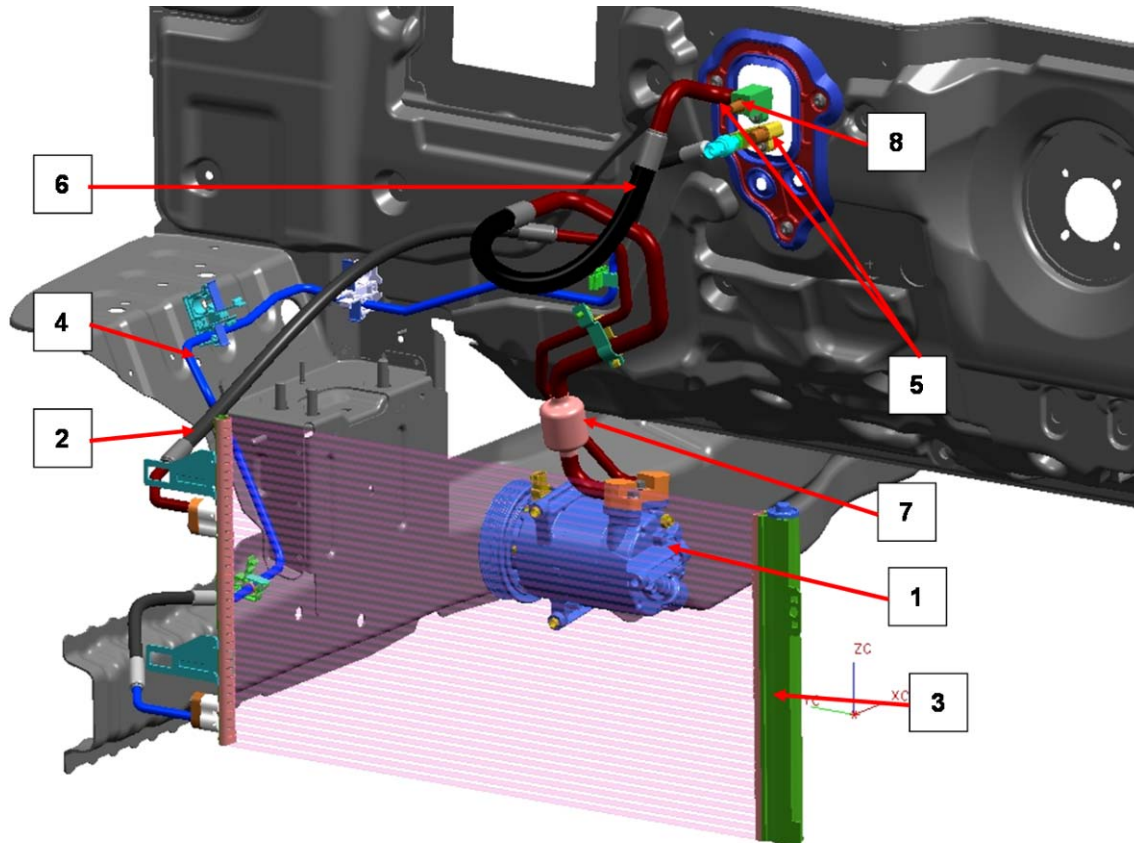
MODEL	ENGINE	COMPRESSOR	OIL TYPE	GAS QUANTITY (g)
Air conditioned with Opt 025 / 140	2.2	VISTEON 160 CC VDC	MSH- MIC231-B (for topping up it is permissible to use SP10 oil)	550 +/- 40
	2.3	SD7 V16	SP10	550 +/- 40
Transport of persons air conditioned with Opt. 204	2.2	VISTEON 160 CC VDC	MSH- MIC231-B (for topping up it is permissible to use SP10 oil)	950 +/- 40
	2.3	SD7 V16	SP10	950 +/- 40



Notes:

Opt. 025 Air conditioner with manual controls; Opt. 140: automatic air conditioner; Opt. 204: rear supplementary air conditioner

Layout of air-conditioner components for 2.2 engine

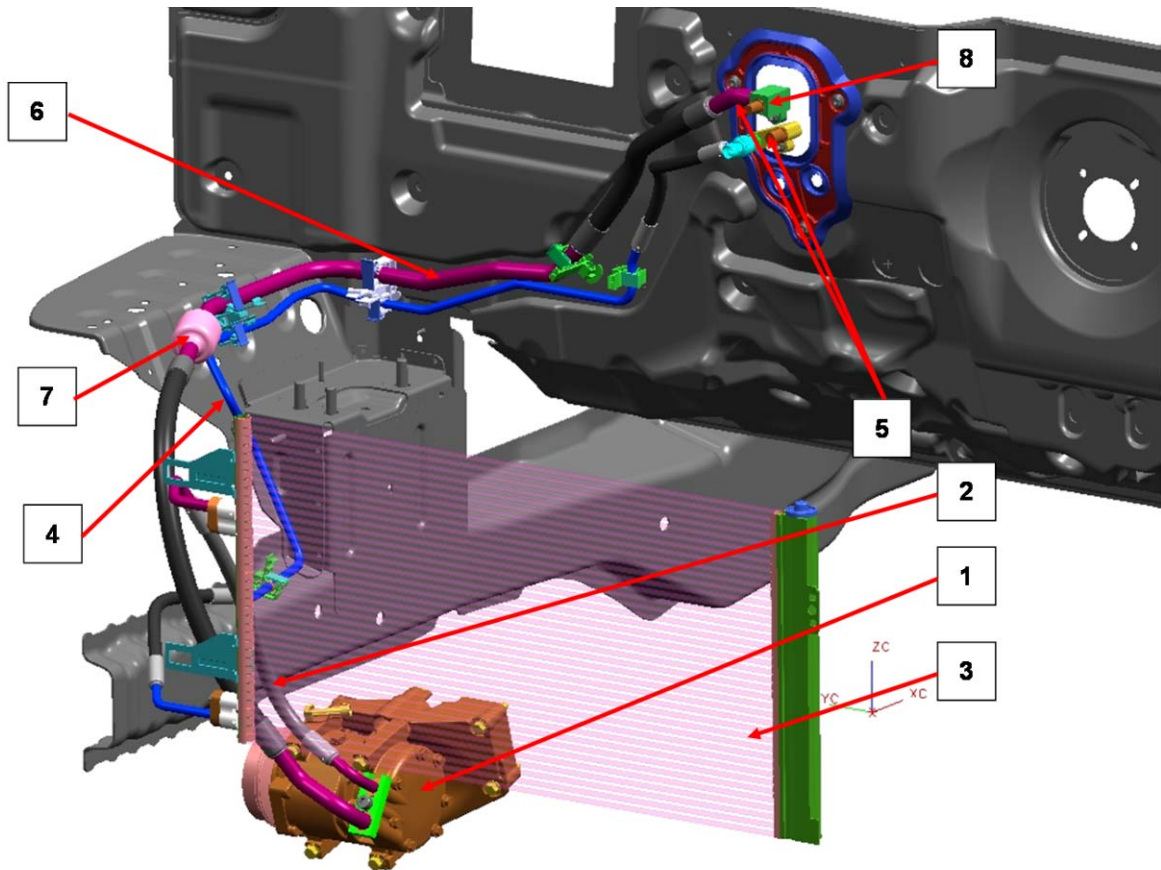


Legend

- 1 - Variable capacity compressor type VISTEON 6C11
- 2 - Compressor – condenser high-pressure line
- 3 - Condenser
- 4 - Condenser – evaporator high-pressure line
- 5 - High and low pressure charging unions
- 6 - Evaporator – compressor low-pressure line
- 7 - Shock absorber
- 8 - Pressure switch (linear R 47 Kohm – Supply voltage 5Vdc from NCM)



Layout of air-conditioner components for 2.3 engine

**Legend**

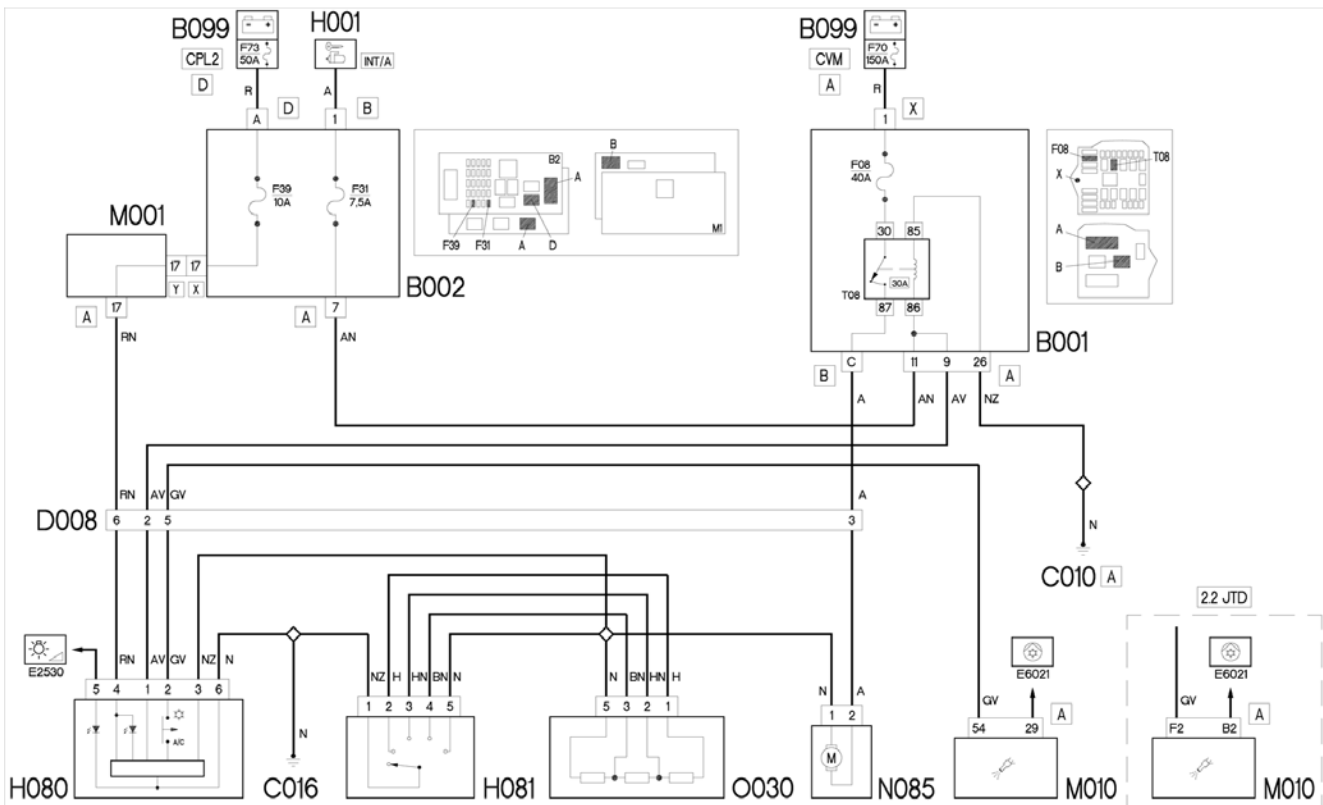
- 1 - Variable capacity compressor type SANDEN SD7 V16.
- 2 - Compressor – condenser high-pressure line
- 3 - Condenser
- 4 - Condenser – evaporator high-pressure line
- 5 - High and low pressure charging unions
- 6 - Evaporator – compressor low-pressure line
- 7 - Shock absorber
- 8 - Pressure switch (linear R 47 Kohm – Supply voltage 5Vdc from NCM)



Climate control unit with manual controls (opt 025)

The vehicle can be equipped with a manual climate control unit. In this case the climate control unit, which basically remains similar to the one for the manual heater, will have an evaporator with its associated expansion valve.

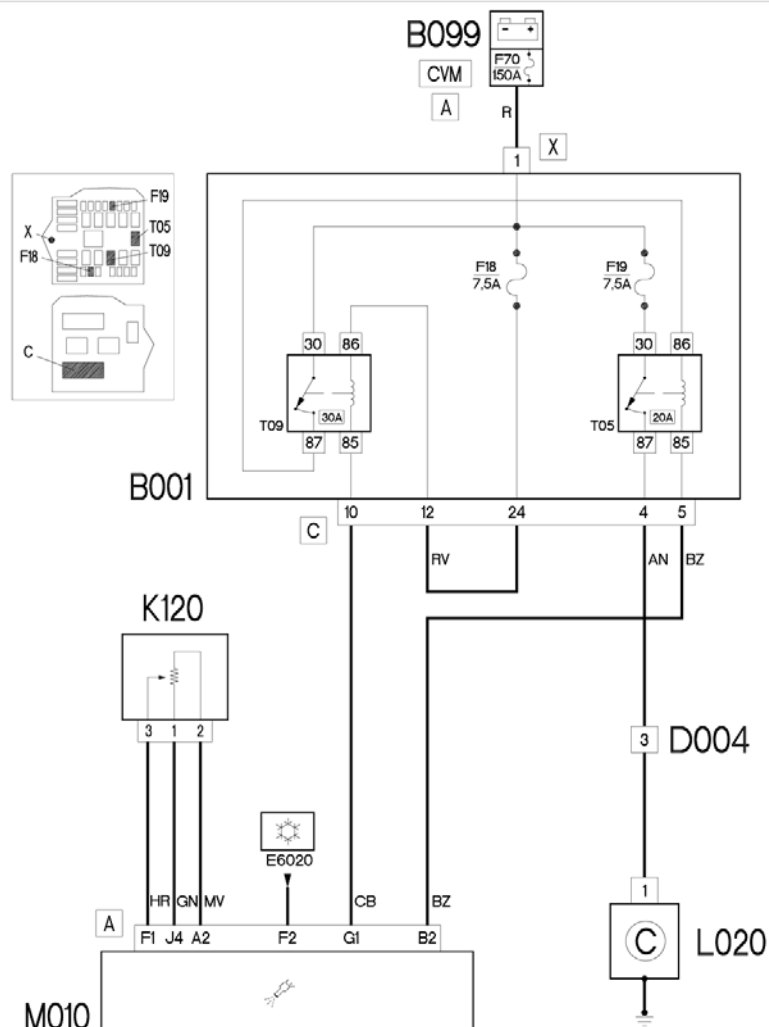
The manual climate control unit also implements a supplementary heater and/or air conditioner under the driver's seat.

Wiring diagram of the climate control unit with manual controls section E6020 fan control and air conditioner cut-in.**Legend:**

- H080 Air conditioner control board
- H081 Climate control fan speed switch
- O030 Resistance divider for climate control fan speed
- N085 Climate control fan
- M010 engine control node NCM 2.3/2.2
- H001 Ignition switch
- B099 CBA battery control unit
- B002 CPL dashboard control unit
- B001 CVM engine compartment control unit
- M001 NBC body computer node



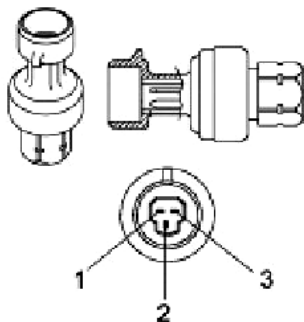
Wiring diagram of the climate control unit with manual controls section E6021 compressor cut-in.



Legend:

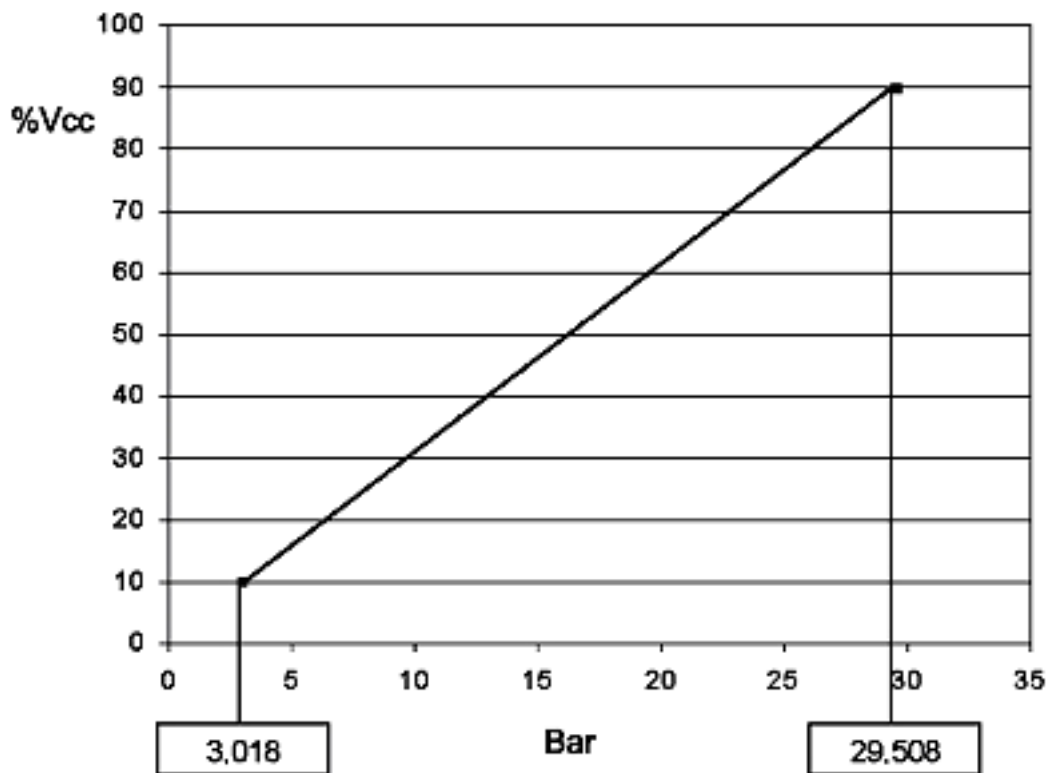
- B099 CBA battery control unit
- B001 CVM engine compartment control unit
- K120 Linear pressure switch – R: 47 Kohm, nominal supply voltage: 5Vdc
- M010 NCM engine control node (in the figure: node for 2.2 engine)
- L020 Compressor electromagnetic coupling.
- D004 Connection



Linear pressure switch**Pin-out**

PIN	FUNCTION
1	General ground from the NCM
2	Power supply form the NCM
3	Linear pressure signal value

The linear sensor trips according to the following characteristic curve.



Where:

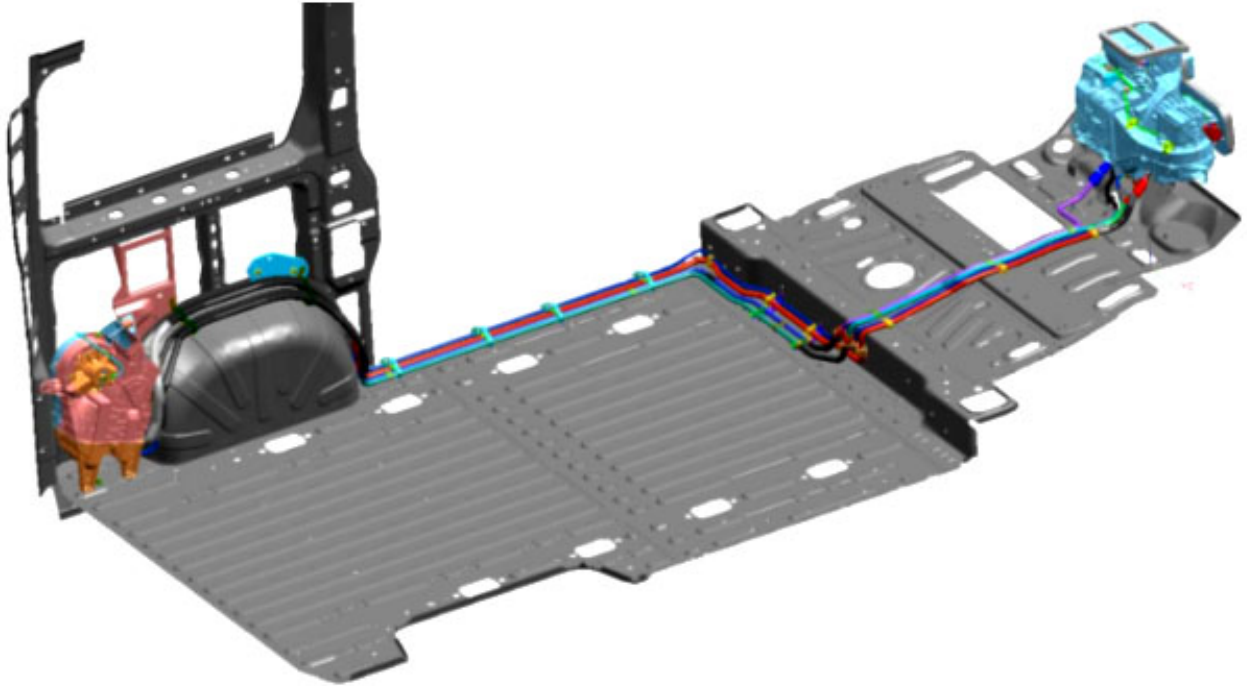
%Vdc: expresses the percentage of output V from the sensor with respect to the power supply V.

Bar: expresses the gas pressure value measured by the sensor.



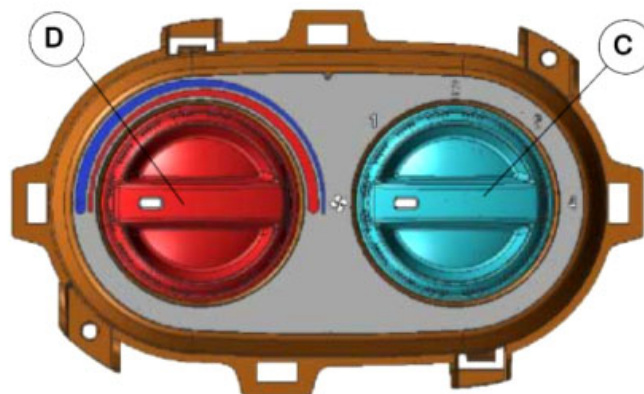
Climate control unit with manual controls and supplementary air conditioner (opt. 204)

The manual climate control unit can be combined with a supplementary climate control unit, installed at the rear of the vehicle, as shown in the figure.



The circulation of gas in the evaporator of the rear unit is permanent, in the sense that switching on the front climate control unit sends gas to the rear evaporator too, whereas the circulation of the heating fluid is established by the specific solenoid valve on the main climate control unit, as already described in the section on the supplementary heater.

The unit is equipped with a centrifugal fan with speed control via a rotary switch and resistance divider and an electric control system for mixing and distributing the air.



The figure shows the control dashboard on the upper deck that has a knob to control the mixing and distribution and one to adjust the fan speed.

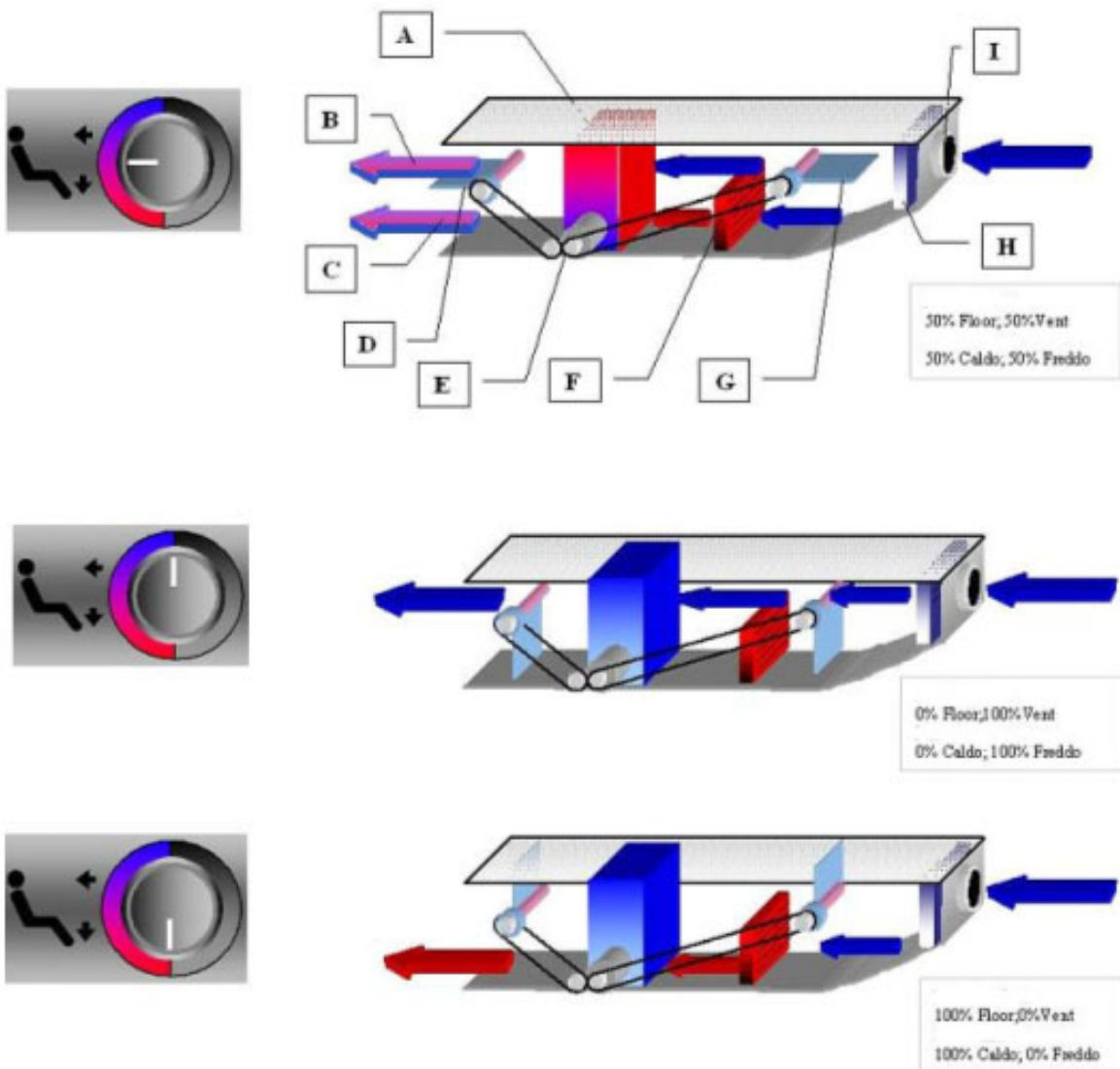


Operation

The mixing and distribution of the supplementary unit is controlled by an electric actuator with resistive position transducer.

With the control knob it is possible to move the mixing hatch G and the distribution hatch E synchronously at the same time, passing from an All Hot and Floor distribution mode to an All Cold and Vent distribution mode, with the possibility of having linear intermediate mixing and distribution.

The hatches are moved only with the Key - On and only if the REAR button is pressed at the same time. The figures represent the hatch movement logic according to the position of the mixing and distribution control knob.

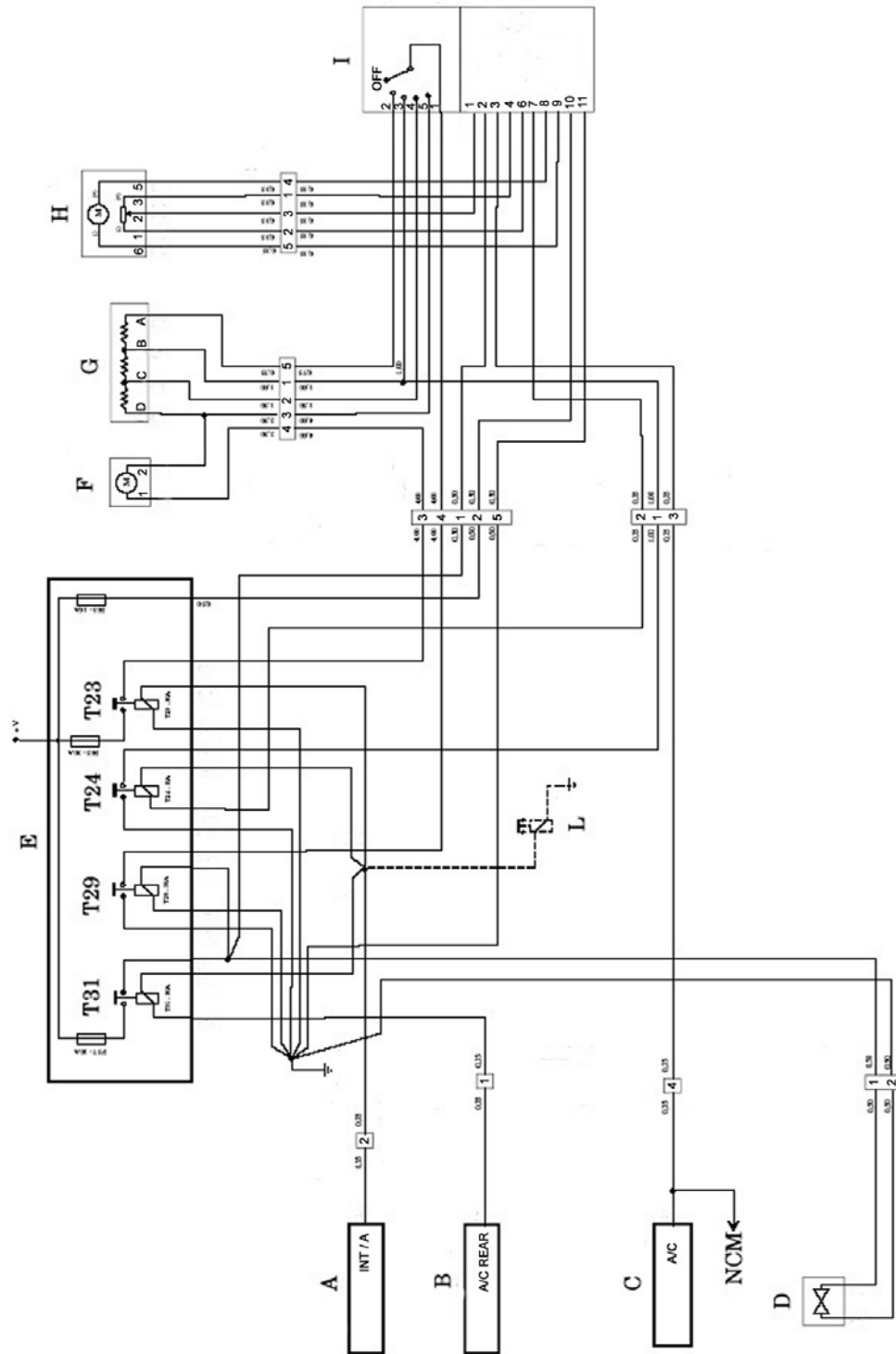


Legend:

A mixing chamber; B VENT distribution; C FLOOR distribution; D distribution hatch; E actuator; F heat exchanger; G mixing hatch; H evaporator; I fan.

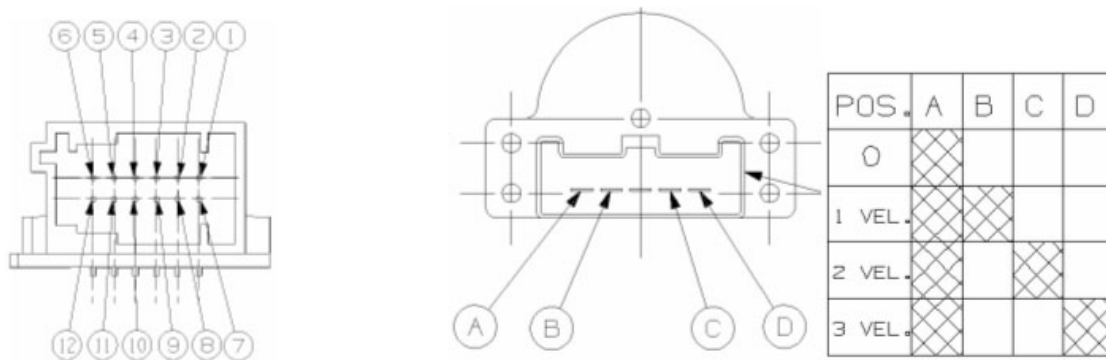


Wiring diagram of manual climate control unit and supplementary air conditioner



Legend:

- A - CPL dashboard control unit
- B - Left control board – REAR A/C button
- C - Air conditioner cut-in control (from manual climate control board or NCL automatic climate control unit)
- D - Heater fluid solenoid valve on climate control unit.
- E - CCO optional fuses and contactors wired control unit
- T31 - Supplementary heater supply contactor
- T29 - Contactor for connection to ground of the supplementary climate control unit fan speed control switch
- T24 - Climate control fan speed 1 cut-in contactor.
- T23 - Climate control fan supply contactor
- F - Supplementary climate control unit fan
- G - Climate control fan speed resistance divider.
- H - Supplementary climate control unit mixing actuator (12 V D.C. motor) with potentiometric position transducer.
- I - Supplementary climate control board incorporating:
 - Rotary 4-position switch for supplementary climate control fan speed adjustment (F)
 - Climate control unit.
- L - Contactor for any optional services tied to the supplementary climate control unit, made by the body-maker.

Supplementary air conditioner control panel control unit pin-out:**12-way connector:**

- 1 - mixing actuator feedback.
- 2 - supplementary heater cut-in control signal input (from REAR button).
- 3 - supplementary climate control cut-in control signal input (from manual climate control board or from NCL automatic climate control unit).
- 4 - power supply + 5 V mixing actuator position transducer.
- 5 - mixing actuator position transducer ground.
- 6 - not connected.
- 7 - T24 contactor control to turn on climate control fan speed 1.
- 8 - actuator motor power supply.
- 9 - actuator motor power supply.
- 10 - power supply +30 supplementary climate control unit.
- 11 - ground.

5-way connector: the combination of the internal contacts is given on the table next to the switch pin-out.



Automatic air conditioner

The automatic air conditioner is the single-zone type. The control unit is incorporated as always in the control panel.



Main characteristics of the automatic climate control unit

Settable temperature: LOW - 16 °C - 32 °C. – HIGH

Air distribution: DEF – VENT – FLOOR –BI_LEVEL (Vent and Floor) - HEAT (Floor and Def) - HI-LEVEL (Vent and Def) - TRILEVEL (Floor, Vent and Def).

Distribution, mixing and recirculation actuators: stepper motors.

Climate control unit fan control: via PWM 2KHz.

Temperature control: via internal temperature sensor, treated temperature sensors 1 and 2.

External temperature sensor: on the external side mirror. Value acquired from NBC via B- CAN network.

Single-zone solar sensor: refractive phototransistor type, on instrument panel.

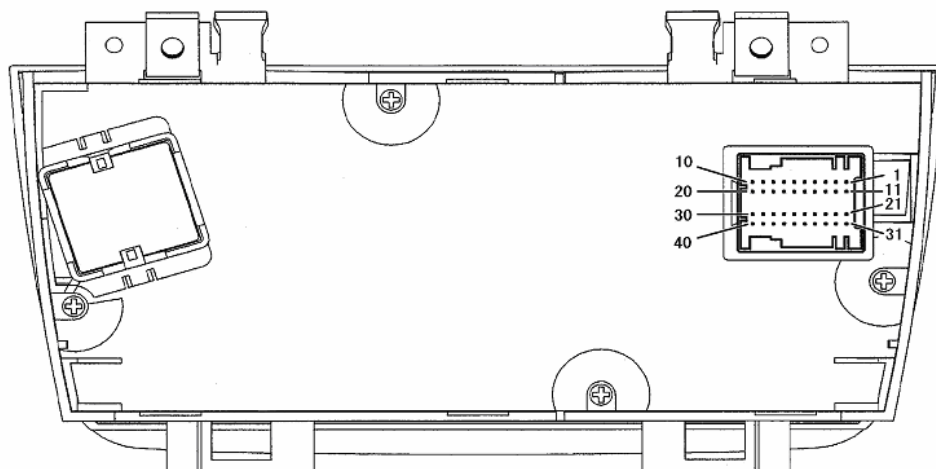
Evaporator temperature sensor: absent.

NOTE:

The outside temperature sensor is connected directly to the NBC on the LN connector (C on Fiat diagrams), pins 2 and 3.



NCL automatic climate control node pin-out



PIN	Function	All versions
	40-way connector p/n Tyco 284229-1	
1	B-CAN Low (A)	O
2	B-CAN High (B)	O
3	Not connected	-
4	Not connected	-
5	Fan speed control PWM signal.	O
6	Not connected	-
7	Solar sensor power supply (+ 5 VDC)	O
8	Not connected	-
9	Upper treated air sensor (TT1 - Vent)	O
10	Solar sensor (signal)	O
11	Analog ground	O
12	Not connected	-
13	Not connected	-
14	Not connected	-
15	Not connected	-
16	Not connected	-
17	Not connected	-
18	Not connected	-
19	Not connected	O
20	Lower treated air sensor (TT2 - Feet)	O
21	REC1 (recirculation actuator – stepper channel 1)	O
22	REC3 (recirculation actuator – stepper channel 3)	O
23	DIST1 (distribution actuator – stepper channel 1)	O
24	DIST3 (distribution actuator – stepper channel 3)	O
25	MIX1 (distribution actuator – stepper channel 1)	O
26	MIX3 (distribution actuator – stepper channel 3)	O

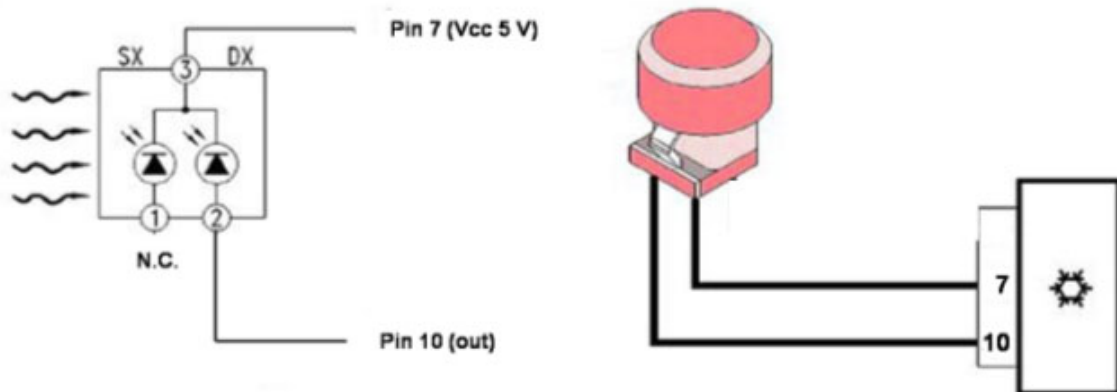


27	Not connected	-
28	Webasto input	O
29	Feedback signal from the electric fan.	O
30	NCL power supply +B (30)	O
31	REC4 (recirculation actuator channel 4)	O
32	REC6 (recirculation actuator channel 6)	O
33	DIST4 (distribution actuator – stepper channel 4)	O
34	DIST6 (distribution actuator – stepper channel 6)	O
35	MIX4 (distribution actuator – stepper channel 4)	O
36	MIX6 (distribution actuator – stepper channel 6)	O
37	A/C cut-in request signal	O
38	Actuator power supply	O
39	NCL power supply (INT/A)	O
40	NCL ground	O

General information on the solar sensors

The solar radiation sensor is used to make corrections to the air mixing and distribution according to the brightness of the sunlight, so as to keep the temperature constant in both shade and sunshine.

The sensor is usually composed of one (single-zone) or two (two-zone) photodiodes incorporated in a container in the middle of the instrument panel and powered by a voltage of + 5V. The generated signal is proportional to the brightness of the light hitting the sensor.



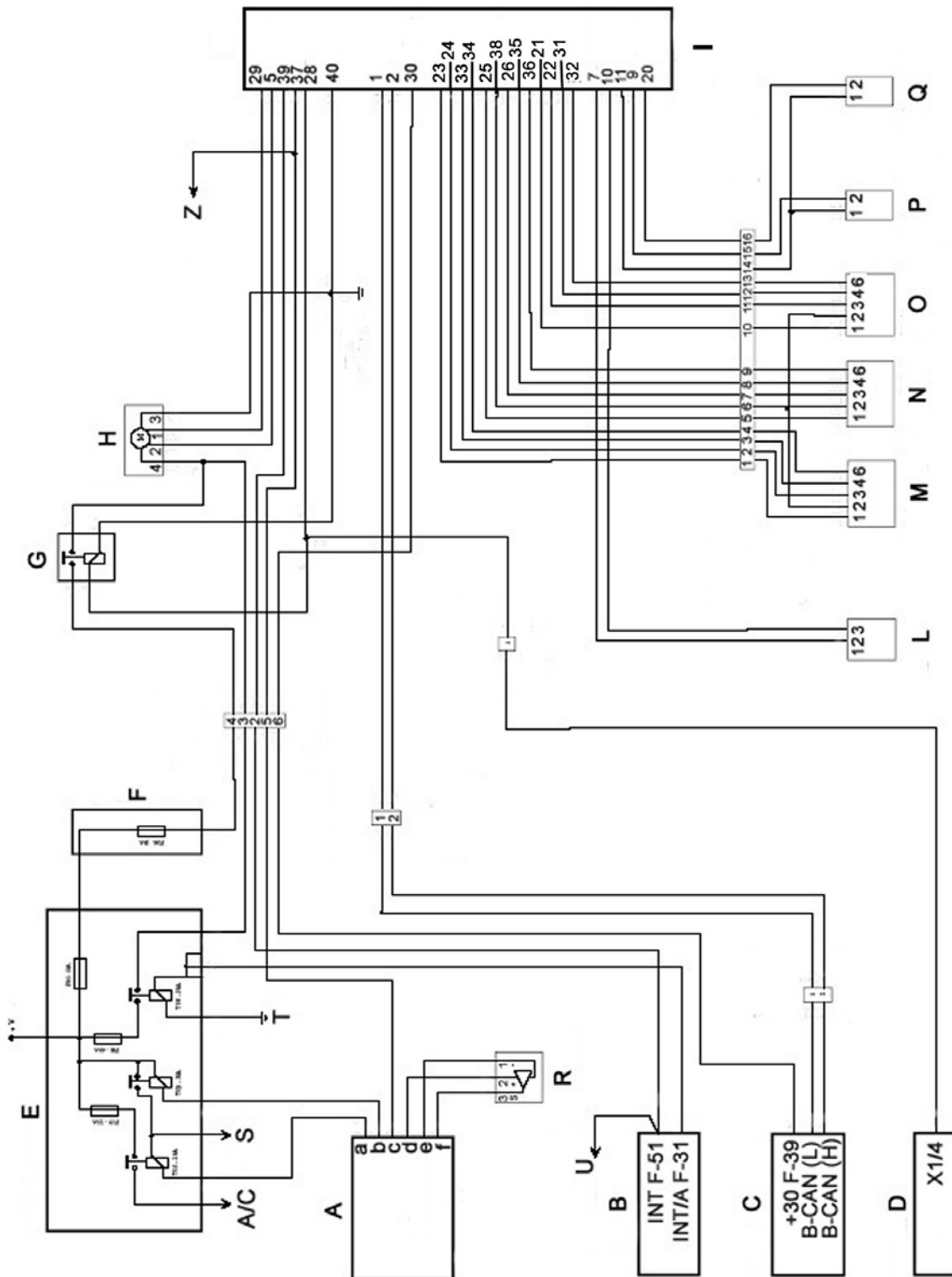
The sensor can be two-zone or single-zone. The two-zone one is able to check the solar radiation in both the left and right areas of the passenger compartment.

Whereas the single-zone one is equipped with a single photodiode and checks the solar radiation in the vehicle in general.

In this specific case, a single-zone sensor is used.



Wiring diagram of automatic climate control unit with Webasto additional heater



Legend:

A - engine control unit

a: compressor cut-in; b: main power supply contactor; c: compressor cut-in request; d: + 5V pressure switch power supply; e: pressure switch negative; f: pressure switch signal

B - CPL dashboard control unit

C - body computer node

D - webasto additional heater control unit

E - CVM engine compartment fuse control unit

T05 - compressor cut-in contactor; T09 - main power supply contactor; T08 - climate control fan power supply contactor (H); A/C to the compressor coupling.

F - CCO optional fuses wired control unit

G - climate control fan power supply contactor (energized when the webasto additional heater is on) Located on the climate control unit, under the control board.

H - climate control fan

I - NCL automatic climate control node

L - single-zone solar sensor with photodiode

M - distribution actuator

N - mixing actuator

O - recirculation actuator

P - treated air temperature sensor TT1 (upper) 10 Kohm at 25 °C

Q - treated air temperature sensor TT2 (lower) 10 Kohm at 25 °C

R - linear pressure sensor (R: 47 Kohm

S - injection system miscellaneous user power supply output.

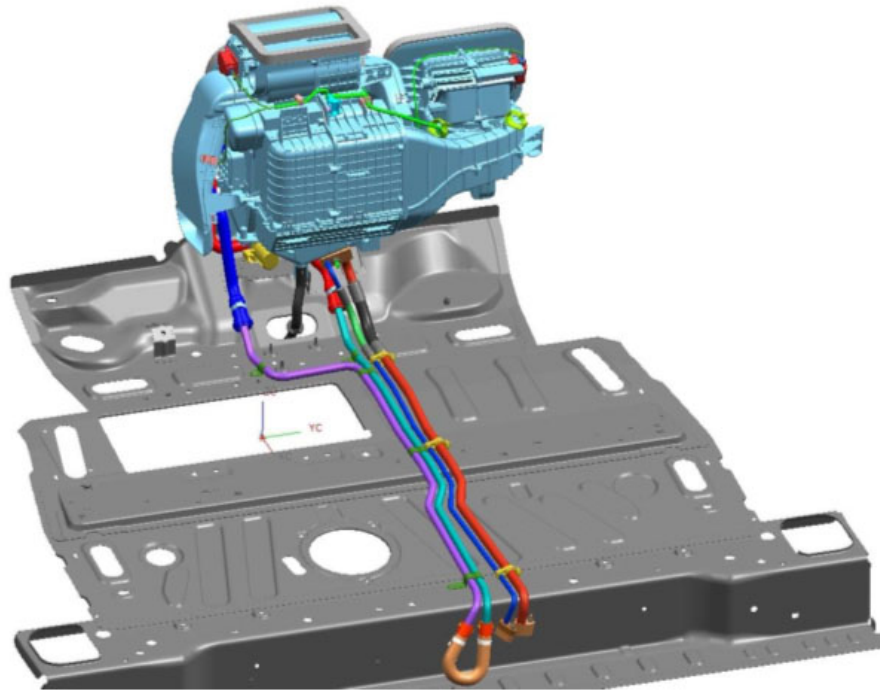
T - ground

U - power supply + INT for Cruise control

Z - supplementary climate control cut-in request

Prearrangements for body-makers

The figure shows the prearrangement for installing the supplementary climate control.



7.9 ALARM

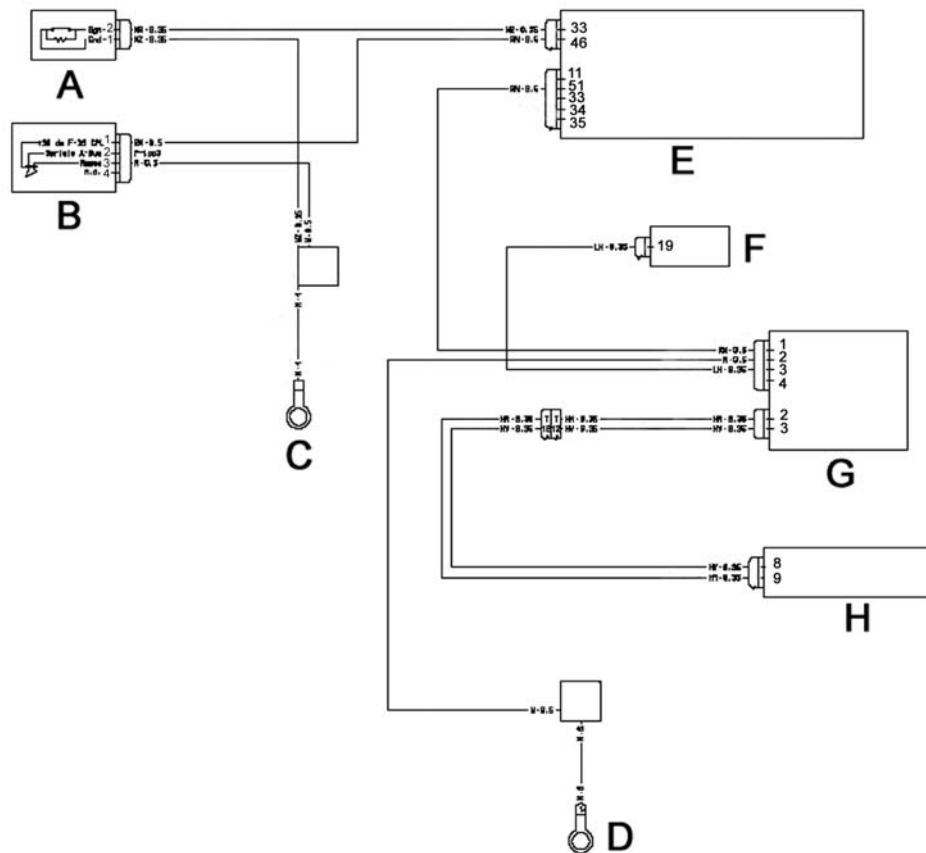
The alarm system (Opt. 213) features the installation of a CSA alarm siren control unit and, on request, the system can be implemented with an anti-lifting control unit.

The alarm siren control unit is installed under the left front wheelhouse, the anti-lifting control unit, under the dashboard on the passenger side.

Both are connected to the NBC via the A-BUS serial line of 9600 Kbits/sec. as already known.

The alarm system can also be installed after market by connecting the siren control unit and the anti-lifting control unit via the specific wiring, included in the Metasystem kit.

Wiring diagram



Legend:

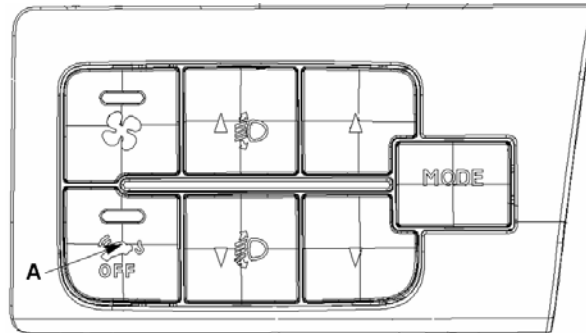
- A - open bonnet signal switch.
- B - anti-theft siren control unit. Pin 2: connection to NBC A- BUS line.
- C - left front engine compartment ground.
- D - dashboard control unit cab ground.
- E - NBC body computer node.
- AV connector pin 46: +30 from F39; pin 33: open bonnet signal.
- LN connector pin 51: + 30 from F39.
- F - CPL dashboard fuse control unit. + key from F49.
- G - anti-lifting control unit (tilt sensor) see pinout.
- H - left control board. Pin 8: anti-lifting cut-out LED.
pin 9: signal from anti-lifting cut-out button.(ground = cut out)



Tilt sensor

The purpose of the tilt sensor is to detect and signal a change in vehicle tilt to the NBC in order to signal attempted theft by removing the vehicle. The control unit dialogues with the NBC and with the other components of the alarm system via A-BUS serial line. The sensor is able to perform self-diagnosis and give the result to the NBC.

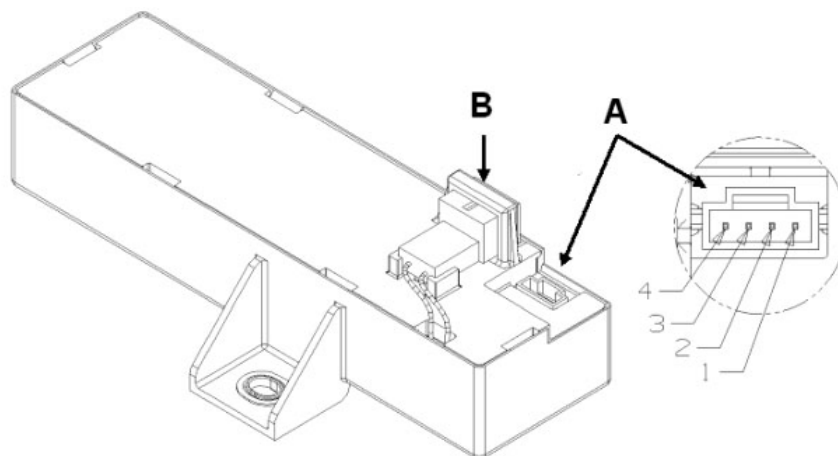
The operation of the device is based on a bi-axial sensor that generates an analog signal in proportion to the tilt of the module.



The system can be cut out by a specific push-button (A), located on the left board.

NOTE: For the pin-out of the board, refer to the one already given in the supplementary air conditioner section.

Tilt control unit pin-out



Connector A:

- 1 + 30 from battery, from F39 of the NBC
- 2 ground in cab
- 3 + 15 key from F49 CPL dashboard control unit.
- 4 A- BUS serial line.

Connector B:

- 1 anti-lifting cut-out push-button signal, from left control board.
- 2 anti-lifting cut-out signal LED, from left control board.



7.10 RAIN SENSOR AND PHOTOCELL

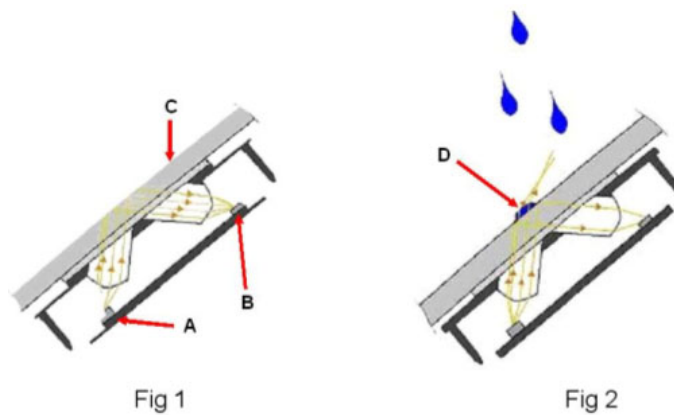
Operating principle of the rain sensor

The operating principle is based on the difference in refraction of the light hitting the windscreen, caused by whether there is any water that changes the refractive properties of the surface.

The sensor generates a signal that is proportional to the gradient of refraction of the glass surface on which it faces.

Figure 1 represents the condition in which the light, generated by a LED (A), refracts completely on the glass (C) and hits the photodiode (B) that is the real sensor.

Figure 2 represents the condition in which the glass is wet: some of the light is diverted by the drops of water (D) on the outside so the photodiode (B) is hit by less intense light. Therefore the signal generated by the sensor varies in proportion.



Operating principle of the photocell sensor

The operating principle is based on measuring the angles of incidence of the light on the windscreen and the brightness of the light.

The sensor is equipped with two photodiodes (A) and (B). Photodiode (A) measures the ambient light where the vehicle is to be found. Photodiode (B) detects the light hitting the windscreen directly in front of the vehicle. The condensers (C) and (D) direct the light onto the sensors suitably, according to the desired characteristic.

Fig. 1 represents the condition in which the light has a wide and diffused angle of incidence, typical of the condition of ambient light.

Fig. 2 represents the condition in which the light is direct and concentrated on the windscreen.

With an intelligent algorithm of evaluation, which considers other additional information too, such as: vehicle speed, conditions of shade, night, day, etc., the device communicates the necessary information via A- BUS to the body computer, which can decide whether to switch on the vehicle lights.



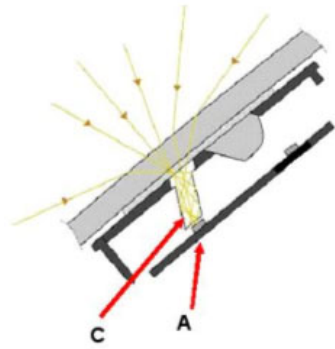


Fig 1

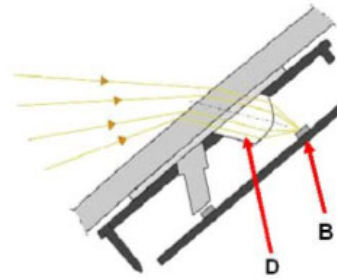
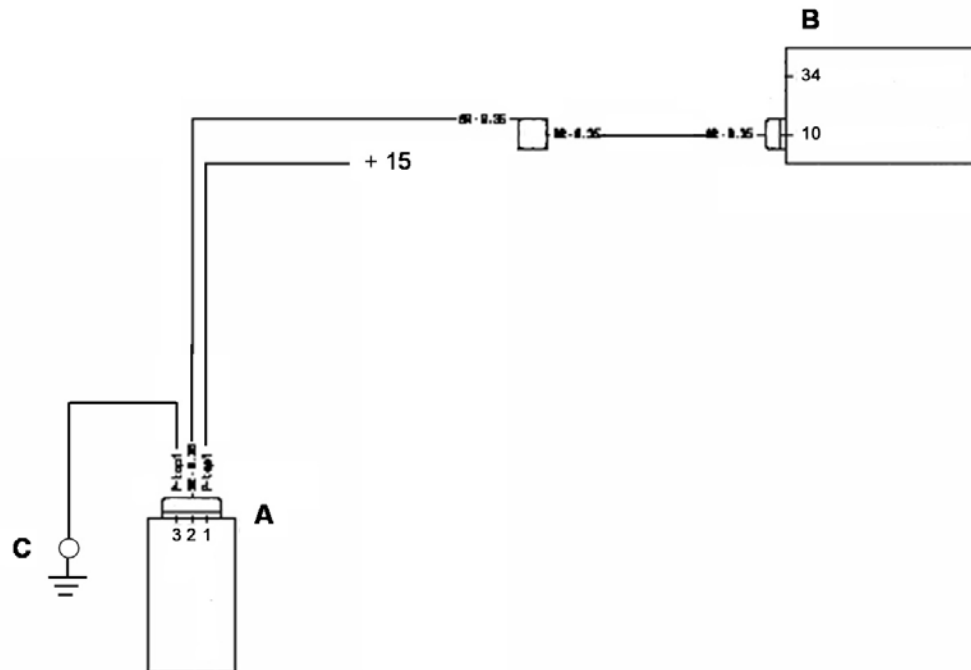


Fig 2

Wiring diagram



Legend

- A - Rain sensor and photocell
- B - NBC body computer node. Pin 10 input A- BUS
- C - Dashboard ground

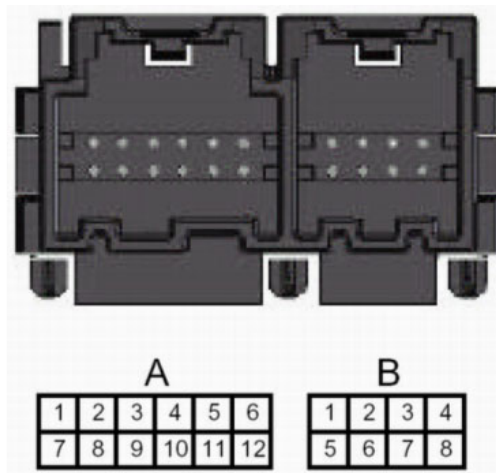


7.11 PARKING SENSORS

The parking aid system is composed of a control unit, located in the right rear pillar, and four parking sensors, installed on the rear bumper.

If a tow hook is installed, the two central sensors can be cut out by the diagnosis instrument to prevent the hook from being recognized as an obstacle.

When the trailer is hooked on and consequently connected to the electrical system, pin B6 of the parking sensor control unit is automatically connected to ground, which automatically cuts out operation.



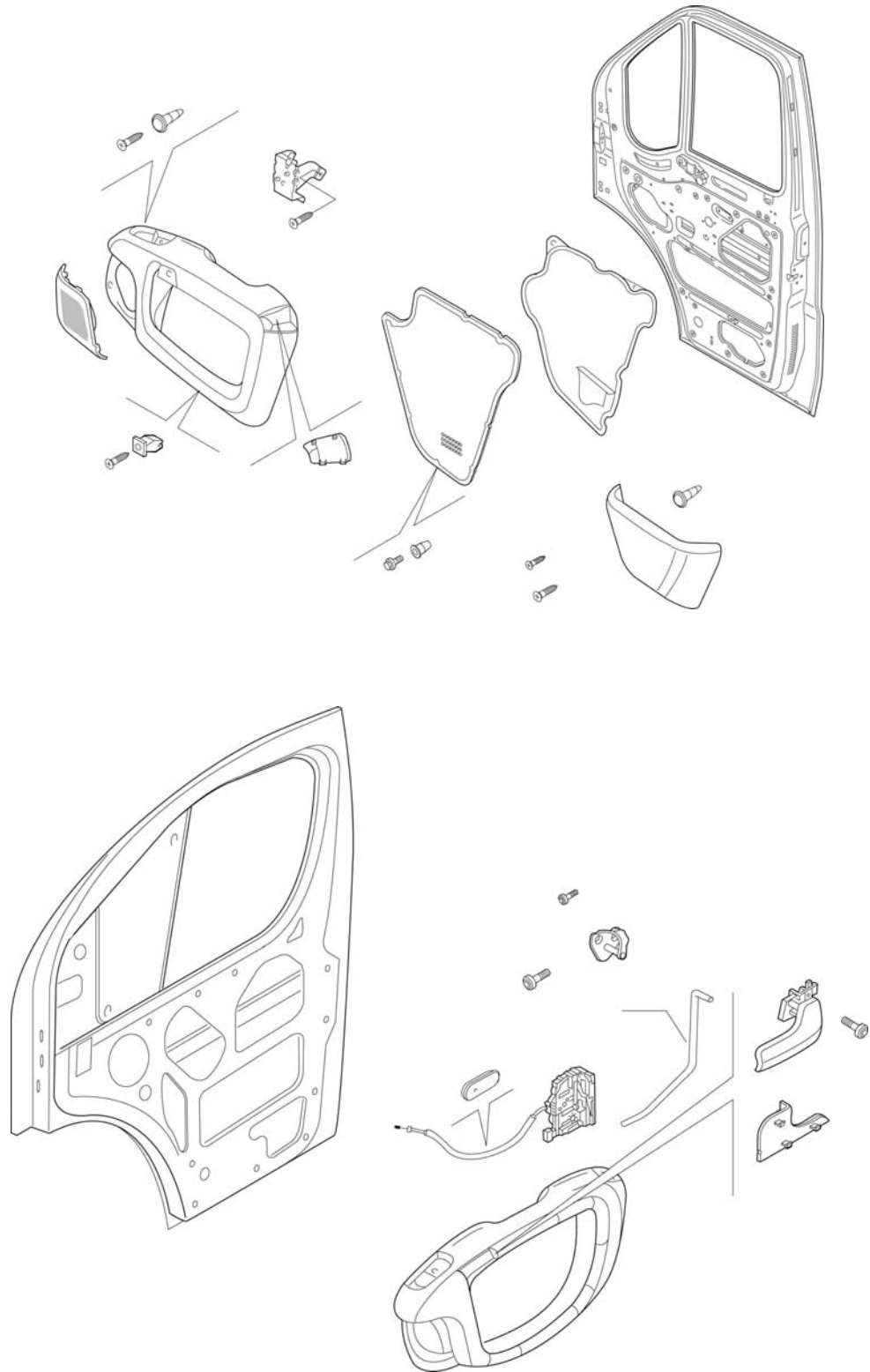
Parking sensor control unit pin-out

Connector A		Connector B	
1	+ 15 key	1	Right outer sensor
2	n.c.	2	Right inner sensor
3	n.c.	3	Left inner sensor
4	n.c.	4	Sensor supply
5	n.c.	5	Left outer sensor
6	B – CAN H	6	Sensor cut-out with trailer
7	Ground	7	n.c.
8	n.c.	8	Sensor RTN rear
9	n.c.		
10	n.c.		
11	n.c.		
12	B – CAN L		



8. BODYWORK

8.1 DOOR PANEL



8.2 DASHBOARD

