

9. ELECTRICAL SYSTEM

9.1 OVERVIEW OF THE ELECTRICAL SYSTEM

9.1.1 The Mini F.L.Ore.N.C.E architecture

The electrical system implements the now well-known Mini F.L.Ore.N.C.E architecture, which has been in use for some time on other Fiat Group models. The innovations that characterise this model and application are illustrated below.

Innovations, changes and implementations

LIN Bus

The LIN (Local Interconnect Network) is a serial line used for exchanging information between systems which do not require particularly fast data transmission speeds. The LIN protocol allows the use of relative simple hardware and low costs. The LIN is used for communications between the NCL and the climate control actuators and between the NQS and the central instrument unit.

Logistic mode

Purpose of the power mode - called logistic mode - is to reduce unnecessary load current draw while vehicles are stored during the time elapsing from end of production to deliver to end customers and therefore preserve the battery charge. Logistic mode is activated by the factory only and ensures that the car can be accessed and driven safely, although riding comfort is decreased within an acceptable range. Logistic mode must be deactivated before the car is delivered to the end customer.

SMART KEY (TRW)

The smart key is an electronic device that replaces the traditional ignition switch and mechanical key. It is used to:

- remotely control locking and unlocking of doors and boot
- releasing the steering
- starting the engine.

Instrument panel (MARELLI- VDO)

The instrument panel features indicators for the new implemented functions, including, for example: graphic obstacle indicator display, TEG indications and special warning lights.

On-board computer (BOSCH)

The NIT may implement an optional system called Convergence. Convergence is an electronic module for interfacing the computer with a *Bluetooth* cellular phone within the operating range of the system (approximately 5 metres).

TPMS Tyre Pressure Monitoring System (TRW)

The TPMS Tyre Pressure Monitoring System checks tyre inflation pressure and informs the driver if the pressure or temperature of one or more tyres is out of range. Tyre state information is shown to the driver by means of visual signals on the panel. Acoustic warnings are associated to the panel signals for the most critical cases (e.g. badly deflated tyre).

Parking Assistance (VALEO)

The Parking Assistance system provides information on distance between obstacles in front of and behind the car while parking. It consists of four rear sensors and four front sensors. The driver is informed on the presence and distance of the car from the obstacle by means of acoustic signals whose frequency depends on the distance and on the display by means of visual indications.

Knee airbag (TRW)

This is a dual stage airbag with ECS sensor. Two airbags for protecting the knees on driver and passenger side have been added to the classical configuration. The front seat belt pretensioners are electrical-pyrotechnical and fastened to buckle.

Bi-xenon headlights (Automotive Lighting)

The car also fits xenon dipped-beam headlights. The innovation consists of a ballast system integrated in the bulb. The trim regulation system and the operating principle is used on other models of the make.



9.1.3 System electrical component classification

The Mini F.L.Ore.N.C.E. components are classified according their implemented technology. The table below shows the classes to which the various components belong.

ID	TECHNOLOGICAL CLASS	EXAMPLES
B	Electrical power generators	Battery, alternator
C	Distribution components	Interconnection units, wiring harnesses, clock wire
D	Manual controls	Stop switches, reverse switches, control panel
E	Nodes/ECUs	Body computer, airbag ECU
I	Lighting devices	Headlights, ceiling lights
K	Combined manual and electronic controls	Steering column stalk module
L	Inductances	Compressor, solenoid valve, relay, speakers
M	Motors	Window winders, door locks, fuel pump
P	Protections	Fuses, diodes, polyswitches
R	Resistors	Heated rear window, cigar lights, heaters
S	Sensors	Engine speed sensor, antenna, heat contact, pressure contact
W	Motors with electronics	ABS, electrical power steering
Z	Sensors with electronics	Speedometer sensor, mass air flow meter

9.1.4 Ground points

CODE	DESCRIPTION	WIRING HARDNESS
G01	Front LH engine compartment ground	Front
G02	Powerplant ground for battery	Battery ground
G03	Front RH engine compartment ground	Front
B01	Ground on battery negative terminal	Front, Radiator
G05	Chassis ground for ABS	Front
G06	Engine ground for injection system	Engine Pre-Wiring
G07	Engine ground for ignition coils	Engine Pre-Wiring
G08	Chassis ground for injection system	Engine Pre-Wiring
G12	Chassis ground for battery	
G21	LH side dashboard area ground	Dashboard, Rear
G22	RH side dashboard area ground	Rear
G23	Central dashboard area ground	Front
G24	Airbag system ground	Dashboard
G24	Airbag system ground	Rear
G29	Climate control system ground	Climate Control Pre-Wiring
G41	Rear LH light cluster ground	Rear
G42	Rear RH light cluster ground	Rear



9.1.5 Electronic components

The following table shows the most complete configuration on design level.
Some nodes or ECUs may not be installed for the moment in this model.

CODE	ID	Description
E	CDC	CD-Changer (opt)
E	CSA	Antitheft siren ECU
E	CST	Auxiliary instrument ECU
E	DSP	BOSE hi-fi audio amplifier (opt)
E	NBC	Body Computer node
E	NBS	Steering lock node
E	NCV	Convergence node (opt)
E	NIT	Computerised info node (opt)
E	NPG	Driver's door node
E	NPP	Passenger's door node
E	NPA	Front door node (single)
E	NQS	Instrument panel node
E	NRR	Radio receiver node
E	NSP	Parking sensor node (opt)
E	NVB	Boot node
E	NTR	Smart Key (TEG) reader node
E	RNV	Radio navigator (opt)
K	NVO	Steering wheel node
Z	NAS	Steering angle sensor node (ABS + VDC)

CODE	ID	Description
E	CPP	Tyre pressure monitoring system ECU (opt)
E	CPR	Glow plug preheat ECU
E	NAB	Airbag node
E	CPD	Right headlight ECU
E	CPS	Left headlight ECU (w/ discharge headlights)
E	NCA	Automatic transmission node (opt)
E	NCR	Robotised transmission node (opt)
E	NCL	Climate control node
E	NCM	Engine control node
K	NAG	Driver trim node (opt)
K	NAP	Passenger trim node (opt)
K	NSC	Transmission selector node (opt, with automatic transmission)
W	CTA	Sunroof ECU (opt)
W	NFR	Braking system node (VDC)
W	NFR	Braking system node (ABS and ABS+ VDC) (opt)
Z	NYL	Lateral Yaw sensor node (opt with VDC)



9.1.6 User control modules

The user control modules are components which comprise devices for acquiring controls from the user or from sensors.

The modules are listed with the other controls in the following table.

CODE	ID	Description
D	CAP	Window winder control on rear doors
D	CEM	Hazard lights switch
D	CLA	Brake lights control
D	PCS	Controls board left
D	IFR	Clutch mounted switch
D	PAV	Ignition button
D	PCP	Control panel on driver's door
D	PCT	Control panel on tunnel
D	PAC	Central front ceiling light
D	CCP	Control ECU on passenger's side
K	DEV	Steering column stalk control module
Z	CSP	Rain sensor/dusk sensor ECU

9.1.7 Fuse and relay box

CODE	ID	Description
C	CBA	Battery fusebox
C	CPL	Dashboard fusebox
C	CVB	Boot fusebox
C	CVM	Engine compartment fusebox
C	CFO	Optional fusebox

9.1.8 Networks and serial lines

NAME	DESCRIPTION
B-CAN	Low speed CAN line (50 Kbit)
C-CAN	High speed CAN line (500 Kbit)
K	ISO 5 diagnostic serial line
W	ISO 5 immobiliser recovery serial line
A-bus	ISO 5 alarm serial line; wiper, light, tyre pressure functions
LIN	Bus LIN for auxiliary instruments, climate control system
F-BUS	Vehicle speed sensor serial line

9.1.9 The LIN concept

Features

LIN (Local Interconnect Network) is a serial, one-line protocol implementing SCI (UART) byte-word common interface. LIN access is governed by a master node; no management of arbitrage or slave node collision is required. Worst case waiting times for signal transmission are therefore ensured.

A particular characteristic of the LIN system is the synchronisation mechanism which allows clock resetting via slave nodes without the use of quartz or ceramic resonator. The specifications of the driver and the line receiver comply with ISO 9141 concerning single wires, with some improvements. The maximum transmission speed is kbit/s which results from electromagnetic compatibility requirements and clock synchronisation.

The LIN nodes do not use system configuration data except for master node denomination. Nodes can be added to the LIN without requiring changes on hardware and software level in the other slave nodes. A LIN can typically contain less than 12 nodes (although this limitation is not binding) due to the limited number of identifiers (64) and the



relative slow transmission speed. The main factors that make the LIN a cost-effective solution are clock synchronisation, the simplicity of UART communication and the one-wire configuration.

UART

Pronounced 'you-art' stands for *Universal Asynchronous Receiver-Transmitter*. The UART is a computer component that governs asynchronous serial communications. UARTs are found in all computers for managing serial ports and in some internal modems.

Serial asynchronous transmission

Asynchronous transmission is to used transmit data without forcing the transmitter to send a clock signal to the receiver. On the contrary, these two entities must establish the synchronisation parameters beforehand. Furthermore, special bits are added to each word for synchronising the transmission and reception units.

9.1.10 Fuses

By the way of example, the following tables show the list of fuses and relays fitted in the electrical system.

Boot fusebox

CODE	COMPONENT	In[A]
F-54	+30 HI-FI AMPLIFIER FUSE	25
F-55	HOUSING FOR FUSE CONNECTED TO T21 (available)	-
F-56	DRIVER'S SEAT ADJUSTER FUSE	30
F-57	DRIVER'S SEAT HEATER FUSE	10
F-58	+30 NVB FUSE	20
F-59	TRAILER SETUP FUSE	15
F-60	PASSENGER'S FRONT SEAT ADJUSTER FUSE	30
F-61	REAR LH SEAT HEATER FUSE	10
F-62	+30 WEBASTO HEATER FUSE	15
F-63	+30 NPE FUSE	10
F-64	+30 NVB FUSE (REAR WINDOW WIPER/REAR WINDOW WASHER)	15
F-65	REAR RH SEAT HEATER FUSE	10
F-67	PASSENGER'S FRONT SEAT HEATER FUSE	10
F-80	LH REAR SEAT ADJUSTER FUSE	30
F-81	RH REAR SEAT ADJUSTER FUSE	30
F-83	HOUSING FOR FUSE CONNECTED TO +30 (SETUP)	-
F-84	HOUSING FOR FUSE CONNECTED TO +30 (SETUP)	-
T21	SEAT ADJUSTER/HEATER RELAY	50
T23	RELAY HOUSING (AVAILABLE)	
T24	DEVIATOR RELAY FOR WEBASTO METERING PUMP TO NA FIS (*)	10/ 20

Battery fusebox (CBA)

The battery fusebox is a power distribution unit positioned on the battery positive terminal. It contains power fuses and integrates the automatic battery cut-off device in series with the battery terminal capable of cutting off power to the ignition/recharging engine wire when the FIS is working.

The CBA is connected to the front wiring harness, to the CVM engine pre-wired harness and to the battery positive for the ignition/recharging circuit.

The CBA is provided with a connection terminal for powering the fuses connected to the wiring harness. The fusebox is connected to the terminal. The fusebox pinout is shown on the following page.

CODE	COMPONENT	In[A]
SB	AUTOMATIC BATTERY CUT-OFF	150
F-70	CVM FUSE	150
F-71	CPL 1 FUSE	70
F-72	CVB – CPL 2 FUSE	70
F-73	PRE-HEATER ECU FUSE	60



CFO fusebox (optional fusebox)

This component is wired to the front wiring harness and connected to the CBA.

CODE	COMPONENT	In[A]
F-74	PTC1 SUPPLEMENTARY HEATER FUSE (JTD versions)	40
F-75	PTC2 SUPPLEMENTARY HEATER FUSE (JTD versions)	40
F-76	PTC3 SUPPLEMENTARY HEATER FUSE (JTD versions)	40

Dashboard fusebox (CPL)

The dashboard fusebox is located under the dashboard on the left-hand side.

CODE	APPLICATION	In[A]
FUSES		
F-12	RH DIPPED-BEAM HEADLIGHT FUSE	15
F-13	LH DIPPED-BEAM HEADLIGHT/HEADLIGHT TRIM CORRECTOR FUSE	15
F-31	INT/A COIL RELAY CPL/ CVM, NBC	7,5
F-32	+30 NPG, NPP, NTR FUSE	15
F-33	NVB 1 POWER FUSE	20
F-34	NVB 2 POWER FUSE	20
F-35	+15 FUSE FOR PCT, REVERSING LIGHTS, CRUISE CONTROL, CLA (NC), AQS SENSOR, WATER IN FUEL FILTER SENSOR, C.R. CONTROL LEVEL LIGHTING	7,5
F-36	+30 NVB FUSE (NPA alternative to NPG, NPP, NVB)	20
F-37	+15 FUSE FOR CLA (NA), THIRD BRAKE LIGHT, NQS, CPS, CPD	10
F-38	BOOT OPENING FUSE	15
F-39	+30 FUSE FOR NCL, EOBD DIAGNOSTIC SOCKET, CAV, PAC, REAR CEILING LIGHT, CSA, EEMS, CPP, NRR, NCV C1/C3, CELL PHONE SETUP	10
F-40	REAR WINDOW HEATER FUSE	30
F-41	WINDSCREEN/REAR WINDOW WASHER NOZZLE DEFROSTER, HEATER WINDSCREEN RELAY COIL (EXTERNAL MIRROR DEFROSTER WITH NPA ONLY)	7,5
F-42	+15 FUSE FOR NFR, NAS, NYL	7,5
F-43	WINDSCREEN WIPER/WASHER FUSE	30
F-44	CIGAR LIGHTER, BOOT CURRENT SOCKET (max. 120W)	20
F-45	CTA 2 FUSE	20
F-46	CTA 1 FUSE	20
F-47	NPG POWER FUSE	20
F-48	NPP POWER FUSE	20
F-49	+15 FUSE FOR NVO, NIT, NSP, CTA, CAV, PAC, PCS, FRONT SEAT CONTROL LIGHTS, WINDSCREEN SERVICES; CELL PHONE SETUP, CEM, NCV C1/C3	7,5
F-50	AIRBAG SYSTEM FUSE	7,5
F-51	+15 FUSE FOR NRC, CPP (radio setup)	7,5
F-52	REAR WINDOW WIPER, CURRENT SOCKET ON TUNNEL FUSE (max. 120W)	15
F-53	+30 FUSE FOR DIRECTION INDICATORS/HAZARD LIGHTS, NQS	10

RELAYS

T01	DIPPED-BEAM HEADLIGHT RELAY	30
T11	HEATER REAR WINDOW RELAY	30
T12	UTILITY RELAY 1 (FROM INT/A IGNITION)	30
T13	UTILITY 2 RELAY (DEPENDENT ON BC)	50



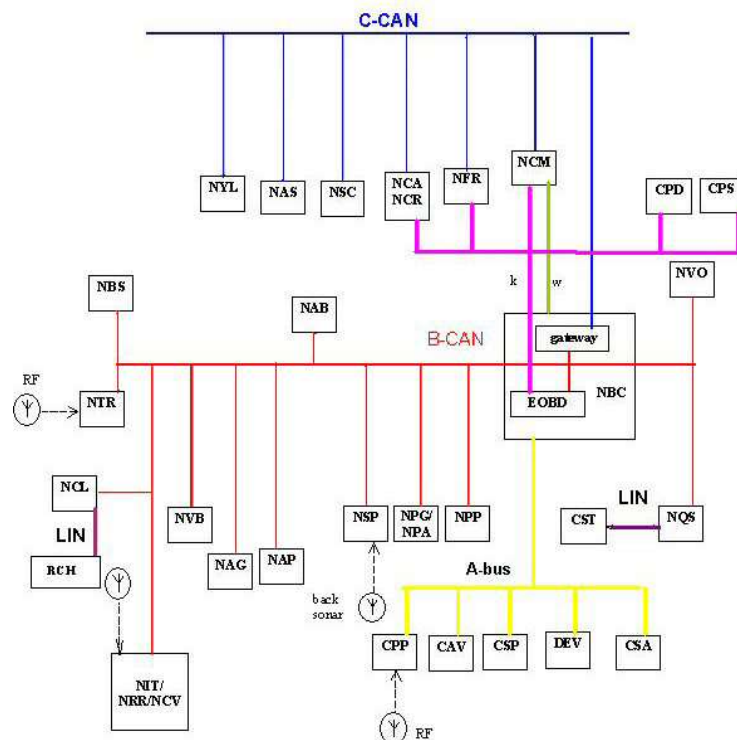
Engine compartment fusebox (CVM)

CODE	APPLICATION	In[A] mod.
	FUSES	
F-1	+30 CPL2, CVB FUSE	70
F-2	+30 CLIMATE CONTROL SYSTEM FAN FUSE	40
F-3	NBS FUSE	20
F-4	NFR1 FUSE	40
F-5	NFR2 FUSE	30
F-6	ENGINE COOLING FAN LOW SPEED (one/two-fan configurations), HIGH SPEED MOTOR 1 (two-fan configurations) FUSE	40
F-7	ENGINE COOLING FAN HIGH SPEED (one/two-fan configurations), HIGH SPEED MOTOR 2 (two-fan configurations) FUSE	50
F-8	MTA PUMP FUSE	30
F-9	HEADLIGHT WASHER FUSE	20
F-10	HORN FUSE	15
F-11	IGNITION SECONDARY VARIOUS SERVICES FUSE	15
F-14	RH MAIN-BEAM HEADLIGHT FUSE	10
F-15	LH MAIN-BEAM HEADLIGHT FUSE	10
F-16	INJECTION SYSTEM INT1 FUSE	7,5
F-17	INJECTION PRIMARY SERVICES FUSE	10
F-18	+30 NCM, NCR or NCA + NSC FUSE	15
F-19	COMPRESSOR FUSE	7,5
F-20	spare	-
F-21	FUEL PUMP POWER FUSE	15
F-22	INJECTION PRIMARY SERVICES FUSE (PETROL)	15
F-22	INJECTION PRIMARY SERVICES FUSE (JTD)	20
F-23	+30 NIT/NRR FUSE	15
F-24	15/54 NCA/ NSC or NCR FUSE	15
F-30	FOG LIGHT FUSE	15

	RELAYS	
T02	MAIN BEAM RELAY	20
T03	HORN RELAY	20
T05	COMPRESSOR RELAY	20
T06	ENGINE COOLING FAN LOW SPEED RELAY	30
T07	ENGINE COOLING FAN HIGH SPEED RELAY	50
T08	MICRO RELAY 30-87 JUMPER	30
T09	INJECTION SYSTEM MAIN RELAY	30
T10	FUEL PUMP RELAY	20
T14	FOG LIGHT RELAY	20
T17	HEADLIGHT WASHER RELAY	20
T19	AVAILABLE	-
T20	REVERSE LIGHT RELAY (AISIN TRANSMISSION)	20



9.1.11 'Mini F.L.Ore.N.C.E.' architecture diagram

**Notes on functions of nodes, ECUs, fuseboxes and components****Engine compartment fusebox (CVM)**

The CVM is a fusebox installed next to the battery. It contains fuses and relays and interconnects the front wiring harness, the engine pre-wired harness and the radiator pre-wired harness.

Battery fusebox

The battery fusebox is located on the positive battery terminal and contains the general protection maxi fuses and the safety battery cut-off relay. The latter is connected to the FIS and cuts battery positive off from the wire from the alternator wire in the event of a collision to prevent fires.

Dashboard fusebox (CPL)

The CPL is a fusebox installed on the dashboard on driver's side. It contains fuses and relays and interconnects the front, dashboard and rear wiring harnesses. Furthermore, it is connected to the body computer node (with which it is supplied) by means of a connector on the back. The **CPL + NBC** set is called dashboard node (**NPL**).

Body computer node (NBC)

The NBC is an electronic component connected to the vehicle's serial networks for managing the basis Mini F.L.Ore.N.C.E. architecture functions. It hosts the gateway between the B-CAN and the C-CAN. The NBC also interconnects the dashboard, front and rear wiring harnesses. It is connected to the dashboard fusebox (with which it is supplied) via a connector arranged on the front. An EOBD connector is arranged on the front part for connecting the diagnostic tool.

Instrument panel node (NQS)

The NQS is an electronic component connected to the B-CAN and the dashboard wiring. Three versions of the panel are available: HIGH, MEDIUM and BASIC.

Auxiliary instrument ECU (CST)

The CST is arranged in the middle of the dashboard and includes the fuel level gauge, the engine temperature gauge and the engine oil temperature gauge. It interfaces with the NQS via a LIN serial line.



Steering column stalk (DEV)

The DEV integrates the electronics for controlling the windscreen/rear window wiper and the external lights, windscreen/rear window wiper/washer, cruise control, trip computer functions, rain/dusk sensor and light dimmer. It is connected to the dashboard and front wiring harnesses and transmits controls to the NBC via the A-BUS serial line.

Radio receiver node (NRR)

The NRR BLAUPUNKT is connected to the B-CAN and the dashboard wiring. The connectors are used to interface with an external audio amplifier.

External audio amplifier (DSP) Opt.

The BOSE DSP (Digital Sound Processor) is an electronic component connected to the audio wiring harness. The DSP receives the signal from the NRR audio output. From the NRR it receives enabling for activation and is capable of outputting an acknowledgement signal to the NRR. It is usually located in the boot.

Radio navigator (RNV) Opt.

The RNV pictogram navigator (Magneti Marelli) is an alternative to the NRR.

Computerised info node (NIT)

The NIT (Bosch) is connected to the B-CAN, the I-CAN and the dashboard wiring. Connectors are provided with connection for external microphone and handset. The NIT can interact with the Convergence node.

Convergence node (NCV) Opt.

The NCV is a device connected to the B-CAN capable of interacting with the NIT via a Bluetooth cell phone. It interfaces with the controls on the rearview mirror and with the free-hands microphone on the front, central ceiling light.

Front door node (NPA)

The NPA is connected to the B-CAN and to the respective front door wiring. It manages the electrical functions of the front doors, the electrical/heated mirrors, the puddle lights and the rear ceiling lights. The NPA is present when the rear doors are not fitted with electrical window winders and it manages the electrical functions of both rear doors. The NPA also makes the external temperature reading acquired by the sensor built into the mirror available.

Driver's door node (NPG)

The NPG is connected to the B-CAN and to the respective front door wiring. It manages the electrical functions of the respective door, the external mirror on driver's side and the rear ceiling light. It is connected to the door control panel (PCP). As the NPA, the NPG also makes the external temperature signal available to the network.

Passenger's door node (NPP)

The NPP is connected to the B-CAN and to the respective front door wiring. It manages the electrical functions of the respective door, the rear ceiling light and the external mirror. It is connected to the door control panel (PCS) and houses a connector for directly connecting the wiring provided with the respective external mirror.

Boot node (NVB)

The NVB is an electronic component connected to the B-CAN and to the rear wiring harness. It manages the electrical functions of the rear doors, particularly when these are equipped with electrical window winders.

Passenger control ECU (CCP)

The CCP is a component connected to the respective front door. It manages the electrical window winder power and signal.

Control panel on driver's door (PCP)

The PCP module integrates the controls on driver's door and is connected to the NPG via the front door wire on driver's side. The PCP receives dimmed power for lighting the ideograms and houses the following controls:

- External mirror movement/folding
- Front window winders
- Rear window winders
- Rear window winder cut-out with respective indicator LED.



Steering column stalk (DEV)

The DEV integrates the electronics for controlling the windscreen/rear window wiper and the external lights, windscreen/rear window wiper/washer, cruise control, trip computer functions, rain/dusk sensor and light dimmer. It is connected to the dashboard and front wiring harnesses and transmits controls to the NBC via the A-BUS serial line.

Radio receiver node (NRR)

The NRR BLAUPUNKT is connected to the B-CAN and the dashboard wiring. The connectors are used to interface with an external audio amplifier.

External audio amplifier (DSP) Opt.

The BOSE DSP (Digital Sound Processor) is an electronic component connected to the audio wiring harness. The DSP receives the signal from the NRR audio output. From the NRR it receives enabling for activation and is capable of outputting an acknowledgement signal to the NRR. It is usually located in the boot.

Radio navigator (RNV) Opt.

The RNV pictogram navigator (Magneti Marelli) is an alternative to the NRR.

Computerised info node (NIT)

The NIT (Bosch) is connected to the B-CAN, the I-CAN and the dashboard wiring. Connectors are provided with connection for external microphone and handset. The NIT can interact with the Convergence node.

Convergence node (NCV) Opt.

The NCV is a device connected to the B-CAN capable of interacting with the NIT via a Bluetooth cell phone. It interfaces with the controls on the rearview mirror and with the free-hands microphone on the front, central ceiling light.

Front door node (NPA)

The NPA is connected to the B-CAN and to the respective front door wiring. It manages the electrical functions of the front doors, the electrical/heated mirrors, the puddle lights and the rear ceiling lights. The NPA is present when the rear doors are not fitted with electrical window winders and it manages the electrical functions of both rear doors. The NPA also makes the external temperature reading acquired by the sensor built into the mirror available.

Driver's door node (NPG)

The NPG is connected to the B-CAN and to the respective front door wiring. It manages the electrical functions of the respective door, the external mirror on driver's side and the rear ceiling light. It is connected to the door control panel (PCP). As the NPA, the NPG also makes the external temperature signal available to the network.

Passenger's door node (NPP)

The NPP is connected to the B-CAN and to the respective front door wiring. It manages the electrical functions of the respective door, the rear ceiling light and the external mirror. It is connected to the door control panel (PCS) and houses a connector for directly connecting the wiring provided with the respective external mirror.

Boot node (NVB)

The NVB is an electronic component connected to the B-CAN and to the rear wiring harness. It manages the electrical functions of the rear doors, particularly when these are equipped with electrical window winders.

Passenger control ECU (CCP)

The CCP is a component connected to the respective front door. It manages the electrical window winder power and signal.

Control panel on driver's door (PCP)

The PCP module integrates the controls on driver's door and is connected to the NPG via the front door wire on driver's side. The PCP receives dimmed power for lighting the ideograms and houses the following controls:

- External mirror movement/folding
- Front window winders
- Rear window winders
- Rear window winder cut-out with respective indicator LED.



Window winder controls on passenger's side front door and rear doors (CAP)

The CAP modules are connected to the NPP and to the NVB via wiring harnesses on the passenger's side front door and rear doors to control the respective window winder motor. The receive power for lighting the ideograms.

Parking sensor node (NSP) Opt.

The NSP is an electronic component connected to the B-CAN and to the rear and front wiring harnesses. It is a driving assistance tool that informs of the presence of obstacles in front of and behind the car. The NSP is connected to the front/rear bumper sensors and trailer ECU. A button and respective LED is provided to cut out the front sensors. The NSP is arranged in the boot on the right-hand side.

Steering angle sensor node (NAS) Opt.

The NAS is an electrical component provided with the steering wheel stalk unit. It is connected to the C-CAN and to the dashboard wiring and transmits the steering wheel angle to the NFR for the VDC function.

Antitheft siren ECU (CSA)

The TRW CSA is connected to the front wiring harness to the NBC and communicates with the A-bus serial line. It is located under the front left wheel harness.

Clock wire (CVS)

The CVS is an interconnection component supplied with the steering column stalk unit. It ensures the connection between the dashboard wire, the steering wheel controls (NVO) and the airbag module on driver's side.

Ignition button (PAV)

The PAV directly connects to the NBS from which it receives protected power and the command to light up the ideograms on the button. It is located on the dashboard, next to the NTR.

Steering lock node (NBS)

The NBS interfaces directly with the ignition button (PAV) and the NTR and NBC via the B-CAN. It manages the steering lock/release and power distribution to various on-board services. It emulates the functions of the traditional key switch to all effects. It is fastened by means of a metallic collar to the steering column.

TEG reader node (NTR)

The NTR (Entry and Go remote control reader) manages the door locking Code and RF functions. The Entry and Go remote control (TEG) is inserted in the NTR. It is located on the dashboard, next to the PAV. It provides the TEG in and TEG blocked signals to the NBS which powers it.

Brake lights control (CLA)

The CLA is the typical two-contact (NO/NC) brake light switch on the brake pedal. It controls the brake lights and provides pedal status to the ECU that require it.

Clutch pedal switch (IFR)

The IFR is a two-contact switch (NO/NC) on the clutch pedal. It is similar to the CLA brake light. It provides the status to the NCM and NBS.

Control panel on tunnel (PCT)

The PCT is located on the central part of the tunnel behind the gearlever. It is connected to the front wiring harness. The PCT has buttons for the following controls:

- ASR/VDC deactivation
- Door lock/unlock
- Hazard lights switch

Left control board left (PCS)

The PCS is a panel for controlling the external lights and headlight trim corrector. It is connected to the dashboard harness. It is located on the dashboard to the left of the steering column (on left-hand drive cars). The PCS houses the following controls:

- Taillights/parking lights
- Headlights correct up/down
- Fog lights
- Rear fog lights



Tyre pressure ECU (CPP) Opt.

The tyre pressure monitoring ECU is an electronic device with RF receiver capable of receiving the low tyre pressure signal from a transmitter arranged on the valve. It is located under the dashboard on the right-hand in left-hand drive models and on the other side in right-hand drive models.

Lateral yaw sensor node (NYL) Opt.

The NYL is an auxiliary node of the NFR used to implement the VDC (Vehicle Dynamic Control) function. It transmits vehicle trim conditions when cornering to the NFR. It is only present in vehicles with braking system equipped with VDC. It interfaces with the vehicle via the C-CAN. It is located on the central tunnel between the two front seats.

FPS or FIS

The FPS (Fire Prevention System), also called inertia switch, cuts off the fuel pump and disconnects the positive battery terminal from the alternator in the event of a collision to prevent fires. It is located under the front left seat near the tunnel.

9.1.12 Diagnostic architecture

The diagnostic architecture for ECUs (nodes) with and without CAN interface is summarised in the following table. The nodes requiring proxy alignment if replaced are shown in bold print:

System/node	Bus	Diagnostic function?	Physical means	Proxy?
Volumetric alarms ECU	A-BUS	NO	/	NO
Steering column stalk unit	A-BUS	NO	/	NO
Antitheft siren ECU	A-BUS	NO	/	NO
Rain sensor ECU	A-BUS	NO	/	NO
Headlight ECU	/	YES	K line	NO
Airbag ECU	/	YES	B CAN	NO
Body Computer node	B-C CAN	YES	B CAN	YES
Computerised info node	B CAN	YES	B CAN	NO
Instrument panel node	B CAN	YES	B CAN	YES
Radio receiver node	B CAN	NO	/	NO
Climate control node	B CAN	YES	B CAN	YES
Driver trim node	B CAN	YES	B CAN	NO
Passenger trim node	B CAN	YES	B CAN	NO
Driver's door node	B CAN	YES	B CAN	NO
Passenger door node	B CAN	YES	B CAN	NO
Boot node	B CAN	YES	B CAN	NO
Parking sensor node	B CAN	YES	B CAN	YES
Steering wheel node	B CAN	NO	/	NO
Steering lock node	B CAN	YES	B CAN	NO
Engine control node	C-CAN	YES	K line	NO
Steering angle node	C-CAN	NO	/	NO
Robotised transmission node	C-CAN	YES	K line	NO
Braking node	C-CAN	YES	K line	NO
Cruise Control node	C-CAN	YES	K line	NO
Electrical power steering node	C-CAN	YES	K line	NO



9.1.13 Logistic mode function

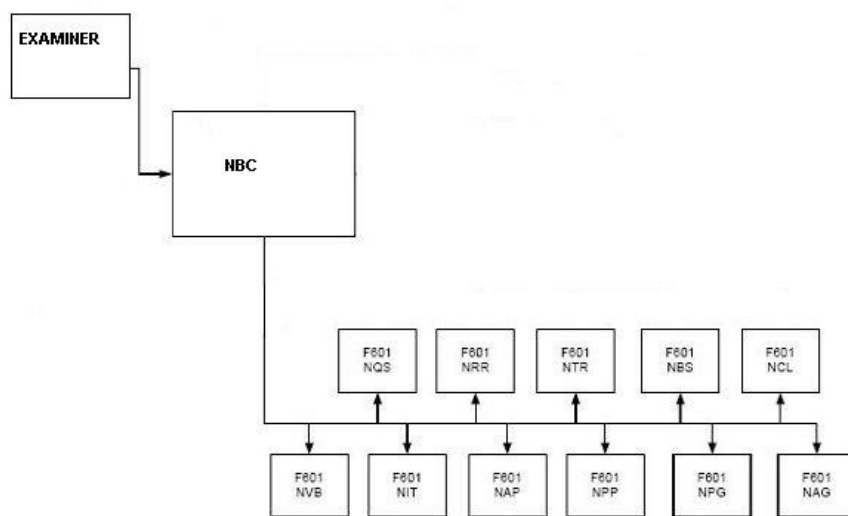
The special power mode - called 'logistic mode' - is needed to reduce current draw caused by unnecessary loads while cars are stored during the time elapsing from the end of the assembly line to delivery to customers and therefore preserve the battery charge.

Logistic mode must ensure the possibility of accessing and driving the car without compromising safety within an acceptable range of reduced comfort. The function is activated after release from the plant and must be deactivated (by the dealer) before delivery to the end customer.

The basic requirements of logistic mode implementation are:

- Considerable reduction of on-board electrical/electronic component performance and consumption during storage to preserve the battery charge and increase its life cycle.
- To ensure that the car can always be safely driven also during storage.
- An activation and deactivation procedure which is cost-effective in terms of time requirements and operations.
- No revolution in basic architecture of the car where the system is applied is needed.

The nodes involved in the logistic mode function are:



Activation at the factory

Logistic mode is activated at the factory at the end of the line. The NBC is the ECU set up to receive the service.

When the NBC receives the activation signal, it switches to 'low consumption' mode, deactivates some loads and sends the logistic mode command to the CAN (B-CAN, C-CAN and LIN). All concerned ECUs and nodes will implement their own low consumption strategy.

During logistic mode activation, the ECUs may be requested not to read some signals and/or not to actuate certain actuators. In these cases, the diagnostic procedures referred to these components must not store false errors. The ECUs must therefore deactivate the diagnostic procedures which would not be efficient while logistic mode is up.

All network wake-up events at key-off will be deactivated except for those concerning driveability and safety. The following wake-up events must always be present:

- CAN interface
- key-on
- hazard.

Performance after activation

Vehicle performance is split into the following macro areas:

- **Vehicle accessibility**
- **Entertainment**
- **Comfort**
- **Visibility**
- **System**



Vehicle accessibility

During logistic mode activation, accessibility to the vehicle must always be guaranteed. The following functions are deactivated:

- Centralised locking system
- Anti-theft protection (dead lock, alarm, etc.), except for the Code system
- Remote controls (TEG)
- Electrical window winders (it must be possible to operate the driver's window at least while travelling).

Entertainment

All entertainment components are deactivated, including:

- Radio
- Navigator
- DSP

Comfort

The following functions are deactivated:

- Power sockets/cigar lighters
- Clock
- Heater/climate control system
- Supplementary heater
- Power sunroof
- Heated seats

Visibility

The following functions are deactivated:

- Ceiling lights
- Boot/bonnet lights
- Windscreen/rear window defroster
- Puddle lights
- Parking lights
- Fog lights
- Dipped-beam headlights (when car is not travelling)
- Main-beam headlights (when car is not travelling)

System

All events generating CAN wake-up at key-off are deactivated, except for those which are necessary to ensure driveability and safety, such as for example:

- The door locking/unlocking command (door/boot locking/unlocking from the lock which forwarded the command is possible)
- Robotised transmission pump activation
- The following wake-up events must always be present:
 - CAN interface
 - key-on
 - Hazard lights

Deactivation before delivery to customer

The logistic mode function must obviously be deactivated before the vehicle is delivered to the customer.

The NBC receives the deactivation command from Examiner. In addition to quitting low consumption mode, it sends the logistic mode deactivation command to the CAN lines.

All the involved ECUs when the command is received, will restore their full functionality and send a confirmation message to the NBC. The logistic mode function, once it is deactivated, cannot be reactivated.



9.2 TRW SMART KEY SYSTEM

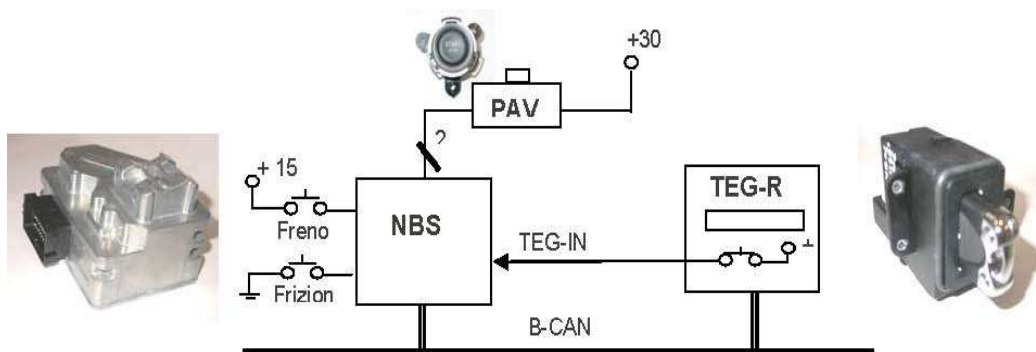
The smart key is an electronic system that replaces the traditional ignition switch and mechanical key. It is used to:

- remotely control locking and unlocking of doors and boot
- release the steering
- start the engine.

9.2.1 Functions

Functions of the Smart Key system include:

- Accessing the vehicle by RF (radio-frequency) recognition of the remote control (TEG).
- Starting the engine by Code recognition.
- Power distribution aboard the vehicle (+15, INT/A, +50) via the steering wheel lock node (NBS).
- Releasing and locking the steering wheel.



9.2.2 Structure

The system consists of the following parts:

- **TEG (Entry and Go remote)**
The TEG is a device that integrates the door and boot lock remote control and transponder for Code functions. Up to eight enabled TEGs can be programmed.
- **NTR (TEG reader node)**
Task of the NTR node is to reach the transponder codes housed in the TEGs and to interface with the NBC. The NTR is located on the instrument panel.
- **NBS (steering lock node)**
The NBS locks and releases the steering wheel whenever a valid TEG is inserted in the NTR. It is fastened to the steering wheel column.
- **PAV (ignition button)**
The PAV is used to start the engine. It is located on the dashboard near the NTR.



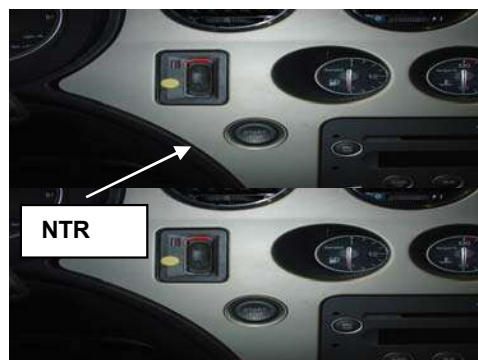
9.2.3 Operative procedures

Accessing the vehicle

The TEG is the only control device. A radio-frequency signal is transmitted whenever a TEG button is pressed. The signal is picked up by the TEG reader (NTR). The NTR interprets the signal and sends commands out to the various vehicle access system devices. The commands are sent to the various vehicle access functions (door locking system, alarm, blinker, ceiling lights).



TEG



Command mapping

The following table summarises the actions which occur after a TEG button is pressed:

Key	Type of action	Function
Unlock all button	Press once	Unlock driver's door (*)
		Unlock boot (*)
		Eliminate dead lock
		Switch on ceiling lights
		Switch off door LED and blinker
		Disarm alarm
	Press twice	Unlock all doors (*)
Hold pressed	Open sunroof and windows	
Release	Stop opening sunroof and windows	
Lock all button	Press once	Lock doors
		Lock boot
		Switch on door LED and blinker
		Arm alarm
	Press twice	Apply dead lock
		Start blinking door LED and blinker
	Hold pressed	Close sunroof and windows (*)
Release	Stop closing sunroof and windows	
Unlock boot button	Press once	-
	Hold pressed	Unlock boot
		Start blinker
		Start blinking door LED and blinker

(*) Feature not present in NPA+CCP versions

Dead lock management

The dead lock is applied only when all the doors and the boot are correctly closed.

Automatic re-lock after unlocking doors

The locks will be automatically locked again if the user does not take possession of the vehicle (opening a boot or the boot, turning the key-on) within 150 seconds from when the doors are unlocked. The automatic locking function does not generate signals.



Multiple command and/or overlapping inhibition

The NBC inhibits all door locking and unlocking commands for 2 seconds to prevent interference caused by connecting the +30 battery power from accidentally locking the doors.

Key-on

The steering wheel is released by the NBS when a TEG stored in the NTR (TEG reader) is inserted; +15 power is activated as described in detail below.

Steering wheel lock management

The steering wheel is unlocked when a valid TEG is inserted in the reader. Insertion is recognised by a switch in the node, called TEG IN; validity of the TEG is established by reading the transponder according to the Code operating logic.

A warning message is sent to the NQS to inform the user if the steering cannot be unlocked (invalid/unrecognised TEG).

The steering is **locked** when the TEG is extracted from the reader. The TEG can only be extracted at key-off, except for using the emergency TEG procedure described in the specific paragraph below.

There are no recovery strategies for the steering lock. As a consequence, the device cannot be released and the engine cannot be started in the event of a fault to the system.

+15 signal activation

To switch from key-off to key-on:

- insert a valid TEG in the TEG reader or
- press the PAV button if the TEG is already inserted in the reader (both insertion of the TEG and pressure of the PAV will wake the CAN up).

At this point, the NBS will ask the NBC for permission to give +15 and after checking validity of the code via the NTR will unlock the steering and send a power enable to the electrical system. The NBS provides + 15/54, INT and INT/A when it is enabled by the NBC.

NOTE: On versions with automatic transmission, the NBS will also ask the NTR to lock the TEG if the gearlever is in a position other than 'Park'.

If the code is not recognised, the NBS will not be enabled by the NBC and the steering will not be unlocked. When the TEG is inserted in the reader, the NBS will ask the instrument panel (NQS) to show a message illustrating the ignition procedure. The message will appear for 10 seconds when the TEG is inserted. The message will disappear as soon as an attempt is made to ignite the engine or extract the TEG from the NTR. A message will appear on the instrument panel if a problem that prevents the NBS from activating the +15 occurs.

PAV button light

The start/stop button light is governed by the NBS according to state of the B-CAN as follows:

- at key-on: the button is always lit
- at key-off: the button is lit until the B-CAN is active. The button LED is switched off when the system goes to sleep.

TEG reader light

The TEG slot lights up when a TEG is inserted according to the following logic:

- **Key-on:** the slot light will go out when the TEG is locked in the reader (TEG unlocked: slot light on; TEG locked: slot light off).
- **Key-off:** the slot is lit according to B-CAN state. The slot light is on when the B-CAN is active and goes out when the B-CAN goes to sleep.

+15 deactivation or engine off

With key-on, the NBS will deactivate the +15/54, INT and INT/A loads and will unlock the TEG from the NTR when the start/stop button (PAV) is pressed for at least two seconds. In vehicles with automatic transmission, the TEG is only unlocked if the gearlever is in 'Park' position. The NBS will not lock the steering if the TEG is extracted from the NTR when loads are deactivated by pressing PAV and the vehicle speed is higher than 4 km/h or not valid. In this case, the following warning message will appear on the NQS: *'Steering will not be locked'*.

Timed key-off

After key-on (+15), the NBS will automatically deactivate the +15, INT and INT/A loads if at least one of the following events occurs within **20 minutes**:



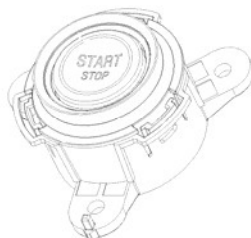
- ignition (pressing PAV with brake/clutch pedal pressed)
- vehicle speed > 10 km/h
- vehicle speed error
- engine running
- state change to key-off

This strategy is needed to prevent the following cases:

- key-off/on while travelling
- vehicle towing with key-on
- key-on while engine is running
- vehicle towed and raised (vehicle speed error)
- dynamometer test with engine running or not

Start/stop button (PAV) management

The PAV (ignition button) is located on the dashboard panel. It consists of a dual circuit button with double output signal. Both signals are acquired by the NBS. The user's intention is determined by the transition of one of the two signals.



PAV (ignition button)

The system will behave as follows in the event of start/stop button failure.

Start/stop button failure: always off

In the event of discrepancy between two signals, the NBS simply needs to acknowledge pressing of the button, by means of one of the two PAV signals, to start/stop the engine.

In this case, an error which can be read in diagnostic mode, will be stored. Acknowledgement is only possible with the CAN active in the event of a failure PAV signal. The network is woken up simply by opening a door of the vehicle.

Start/stop button failure: always on

To prevent undesired start-ups, the signal will be ignored if one or both the NBS inputs detect PAV pressure for 30 consecutive seconds until state change is detected. In both cases, steering is blocked when TEG is extracted and a warning message is sent to the instrument panel.

From ignition to drive

The engine is started by pressing the start/stop button when the clutch or brake pedal is pressed (versions with mechanical transmission) or when the brake pedal is pressed (versions with automatic/robotised transmission). The loads will be switched off (key-off) if the start/stop button is pressed and the brake or clutch pedal is not pressed. The NBS checks the following conditions before driving the starter motor when the start command is acknowledged:

- Clutch/brake pedal pressed during +15 activation
- +15 present confirmation signal also on B-CAN
- Gearlever in park/neutral (automatic transmission versions)
- Ignition enabled by NBC (Code checked).

The starter motor will be turned (+50) until the either the clutch/brake pedal or the start/stop button is released or for a maximum time of 10 seconds. If ignition is correct, the NBS will check the engine speed signal on the network and will mechanically lock the TEG in the TEG reader.

If the TEG lock is not successful, the engine can be started but the NBS will not switch loads off (key-off) when the TEG is extracted from the reader. The PAV must be pressed to obtain key-off.

For versions with automatic/robotised gearbox, the gearlever must be in 'park/neutral' position to start the engine. The procedure must be repeated, if it fails, with the gearlever in the correct position.



NOTE: The vehicle cannot be moved using the starter motor with the gear engaged if the engine does not start because either the clutch or brake pedal must always be pressed.

From ignition to key-off

If no operation is performed within 20 minutes after inserting the TEG in the reader (that is after +15 key-on), the NBS automatically deactivates the +15, INT and INT/A loads (key-off).

In this case, when the start/stop button is pressed, the clutch or brake pedal is pressed and a valid TEG is inserted in the reader, the NBS will activate loads (key-on) and start the engine as described if the button is held pressed.

The start button must be released and pressed again to start the engine if the NBS is clear after key-on.

Clutch and brake pedal validation

The engine can be started if brake pedal is pressed, also if the clutch pedal is not. To prevent accidental ignition, the clutch pedal will be ignored by the NBS if it is held pressed for longer than 5 minutes. The clutch pedal must be released and pressed again.

Stopping the engine and extracting the key

Pressing of the start/stop button while the engine is running, regardless of the state of the brake or clutch pedal, is interpreted as the user's intention to stop the engine.

The NBS will switch off the +15/54, INT and INT/A loads and will unlock the TEG from the TEG reader.

In vehicles with automatic transmission, the TEG is only unlocked if the gearlever is in 'Park' position.

The NBS will not lock the steering when the TEG is extracted if the vehicle speed is faster than 4 km/h or not valid at key-off.

Smart key system signals

The Smart Key system controls various indicators on the instrument panel for the following functions:

- Accessing vehicle and/or alarm
- Steering lock/unlock
- Starting and stopping the engine.

In particular:

- Locking the doors
- Locking the boot
- Applying the dead lock
- Unlocking the doors
- Unlocking the boot
- Arming the alarm system
- Disarming the alarm system
- Electrical steering lock failure
- No TEG recognition
- Start/stop button failure
- Steering not locked
- Smart Key reader failure
- TEG in reader when driver's door is opened after key-off
- TEG inserted.

Emergency extraction

The TEG can be released in all conditions, also while travelling, by means of an emergency mechanical insert. This operation will be detected by the NBS which will send a signal to the instrument panel for indicating the steering will not be locked.

9.2.4 Overview of fundamental operations

Key-on

The steering is released by the NBS when a valid TEG is inserted in the TEG reader; +15 is consequently activated.

If no operation is performed within 20 minutes after inserting the TEG in the reader, the NBS automatically deactivates the +15, INT and INT/A loads (key-off). In this case, when the start/stop button is pressed, the clutch or brake pedal is pressed and a valid TEG is inserted in the reader, the NBS will activate loads (key-on) and start the engine if the button is held pressed.



Cranking

The engine is cranked (+50) when the clutch or brake pedal is pressed and the start/stop button is pressed. The engine will be cranked until either the clutch/brake pedal or the start/stop button is released. The operation is accepted for up to 10 seconds, after which the procedure must be repeated.

Stopping the engine and extracting the TEG

The engine will stop if the start/stop button is pressed (regardless of the position of the brake or clutch pedal) when the engine is running. In vehicles with automatic transmission, the TEG is only unlocked if the gearlever is in 'Park' position. The NBS will not lock the steering when the TEG is extracted if the vehicle speed is faster than 4 km/h or not valid at key-off.

Emergency TEG extraction

The TEG can be released and extracted in all conditions, also while travelling, by means of an emergency mechanical insert. The TEG can be removed in an emergency by extracting the mechanical insert and inserting it in the specific hole on the reader.

9.2.5 Code system programming and component management

Code system spare parts management database

Orders for all Code system components are managed by Fiat Ricambi's centralised database (in common for all markets). The production plant will transfer all the necessary data to the database when the vehicle is manufactured. Fiat Ricambi will access the database to handle orders for components to be replaced in service.

The database contains a variety of information, including:

- vehicle chassis number
- secret code
- electronic key (TEG) codes
- emergency key mechanical code
- programming date.

Proceed as follows to replace and consequently order Code system components:

Loss of electronic key (TEG)

- Ask the customer for all the electronic keys (TEGs) in their hands.
The customer must also be asked to demonstrate that the car is actually theirs by presenting the car's log book and a valid form of identification.
- Cancel all electronic key (TEG) codes from the NTR memory as follows:
 1. Connect Examiner to the car's diagnostic socket.
 2. Open the NTR programming menu and follow the instructions.
 3. Enter the electronic keys (TEGs) still owned by the customer in the electronic key (TEG) reader when prompted by the instrument.
 4. Shut the programming procedure down.

The electronic keys (TEGs) not presented during this step will not be deleted and cannot be stored again at a later time.

At the end of the procedure, it is advisable to print out a table showing the identification codes which are still enabled. If no printer is available, copy the codes from the screen into the specific Fiat Ricambi system form.

Transmit the codes to Fiat Ricambi to update the database only if the electronic key reader (NTR) already contains 8 electronic keys (TEGs).

Requesting new electronic keys (TEGs)

Connect to Fiat Ricambi using the personal computer provided. Enter the chassis number, the model code and use a depannage order to request a new electronic key (TEG) (by entering the part number). Specify the number required. Note that the electronic key reader (NTR) was designed to store no more than eight electronic keys (TEGs). Orders for more than eight electronic keys (TEGs), summing up the newly ordered keys and those already in the customer's hands, will be rejected. Check the form that shows this situation when ordering new electronic keys (TEGs).



Programming TEGs in the NTR memory

After receiving the new electronic keys (TEGs) from Fiat Ricambi, make sure you have all the customer's old electronic keys (TEGs).

Connect the instrument to the car's diagnostic socket and proceed as follows.

1. Connect the instrument to the car's diagnostic socket.
2. Set the electronic key reader (NTR) to 'Programming' mode.
3. Insert all the electronic keys (TEGs) in sequence in the electronic key reader (NTR).
4. Shut down 'Programming' mode.
All electronic keys (TEGs) not presented during this step will not be deleted and cannot be stored again at a later time.
5. Check that the system is working properly before delivery to the customer by using all the electronic keys (TEGs) to start the engine and lock/unlock the doors with the remote control.

NOTE: Only use spare parts to deal with functional anomalies. Never exchange remote control electronics between electronic key (TEG) systems: this may compromise future servicing of the car.

9.2.6 Procedures for replacing components**Replacing the electronic key reader (NTR)**

Ask the customer for all the electronic keys (TEGs) in their hands.

The customer must also be asked to demonstrate that the car is actually theirs by presenting the car's logbook and a valid form of identification.

Connect to Fiat Ricambi using the personal computer provided. Enter the chassis number, the model code and use a depannage order to request a new NTR (by entering the part number to identify the version). Specify the number required.

Proceed as follows after receiving the new NTR from Fiat Ricambi:

1. Check that the serial number printed on the label applied to the order coupon corresponds to that on the NTR.
2. Check that the chassis number printed on the label applied to the order coupon corresponds to car's.
3. Install the NTR if all codes correspond.
4. Store all TEGs owned by the customer in the NTR.
5. All TEGs which are not included in the procedure will be eliminated from the NTR and cannot be stored again.
6. Check that the system is working properly before delivery to the customer by using all the TEGs to start the engine and lock/unlock the doors with the remote control.

Replacing the engine control ECU

Install a new engine control ECU and insert a TEG in the NTR to start the self-programming procedure.

Press the start/stop button with the brake/clutch pedal pressed to start the engine. Check that the engine is running properly.

Replacing the electrical steering lock (NBS)

Install a new NBS and insert a TEG in the NTR to start the self-programming procedure.

Remove the TEG from the NTR after 10 seconds and wait for the mechanical steering lock to be applied (after approximately 5 seconds).

Check that the steering wheel is locked.

Replacing the body computer (NBC)

Install a new body computer and insert a TEG in the NTR to start the code alignment procedure.

Press the start/stop button with the brake/clutch pedal pressed to start the engine. Check that the electrical system is running properly.

Replacing lock barrels and/or emergency mechanical key

Connect to Fiat Ricambi using the personal computer provided. Enter the chassis number, the model code and use a depannage order to request a new electronic key and barrel kit (by entering the part number) according to vehicle type and outfit.

NOTE: One only barrel cannot be ordered by providing the mechanical code only.

IMPORTANT: The mechanical code of the emergency key and the electronic code of the electronic key (TEG) are matched when the vehicle is programmed for the first time at the end of the line and must not be separated for any reason.



9.2.7 NTR diagnostic procedures

Foreword

This function is used to run diagnostic procedures on system parts.

The NTR must be capable of identifying and storing the following faults:

- Transponder:
 - faulty, missing or wrong secret code
 - cancelled/deactivated
 - unknown/not stored
- Transponder antenna:
 - faulty battery connection (open circuit, short-circuit to ground or to battery).

The following parameters/data can be read using Examiner:

Code system state:

- clear (whenever a TEG is inserted)
- programmed at end of line (whenever a TEG is inserted)
- spare part (whenever a TEG is inserted)

Number of programmed TEGs; the following data is available for each TEG inserted in the NTR

- TEG ID
- position in the table
- whether the transponder is valid
- whether the TEG is stored
- whether the secret code is valid

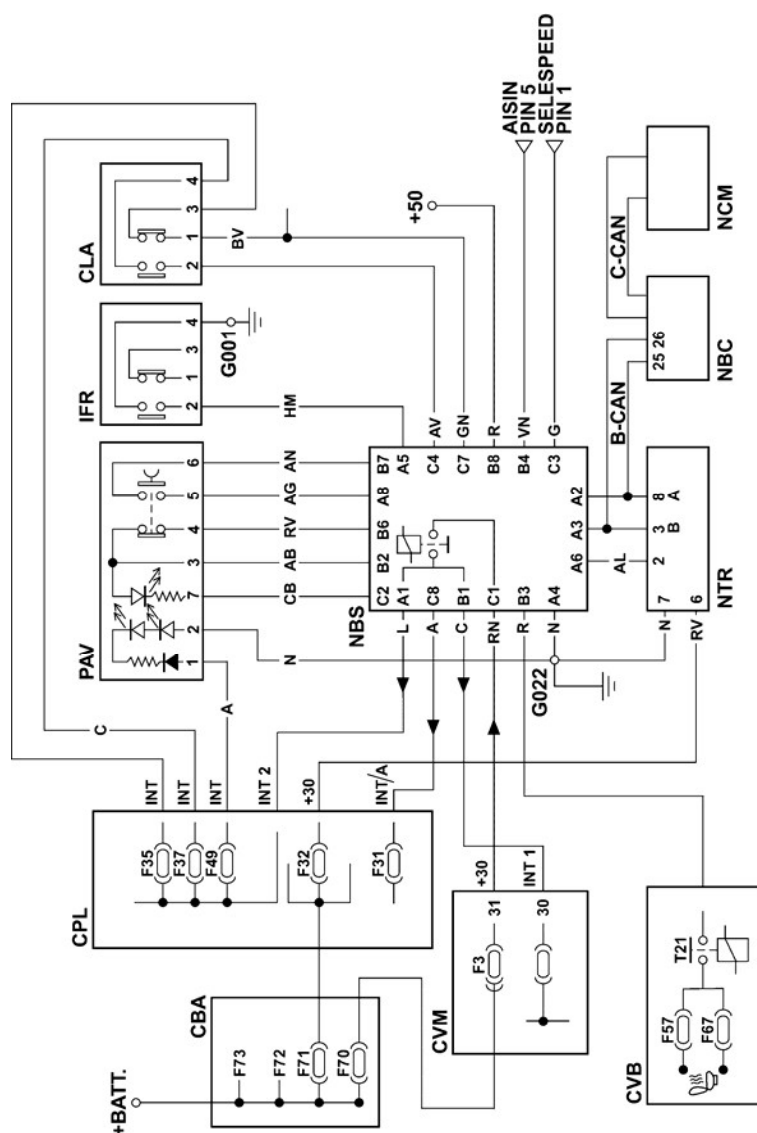
Other functions include:

Querying number and ID of last TEG used.

- Querying reading of all enabled keys.
- Querying number of enabled and deactivated keys.
- Manual key storing procedures by means of later acquisitions (quality of the transponder must be checked after each acquisition).
- Acknowledging presence of a transponder in the antenna and establishing whether it is valid or not.
- Querying the current system state to establish whether:
 - the last TEG used is enabled and recognised
 - the immobiliser is clear
 - the ID of the last TEG used is present in the enabled key table
 - the ID of the last TEG used is present in the deactivated key table.



Wiring diagram

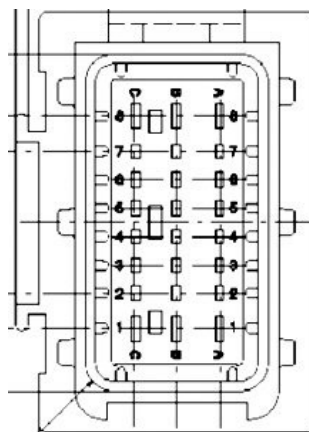


Legend

Component	Location/destination
CBA Battery fusebox	On battery
CVM Engine compartment ECU	Engine compartment, next to battery
CVB Boot ECU	Boot on left-hand side
CPL Dashboard fusebox	Dashboard, left-hand side, combined with NBC
PAV Engine start/stop button	Dashboard, central area
NBS Steering lock node	Steering column, lower part
NTR TEG reader node	Dashboard, central area
IFR Clutch switch	Pedal board, clutch pedal
CLA Brake lights control	Pedal board, brake pedal
NBC Body Computer node	Dashboard, left-hand side
NCM Engine control node	Engine compartment
+50 Starter motor control signal	To starter motor
AISIN pin 5	To Aisin NCA, cranking enable
SELESPEED Pin 1	To Selespeed NCA, cranking enable
G001 Ground	Engine compartment, front left-hand side
G022 Ground	Dashboard, right-hand side



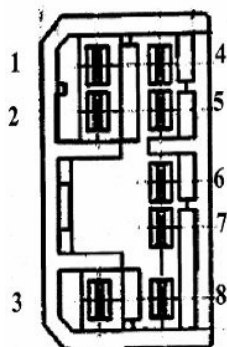
NBS pinout



#	Pin		FUNCTION
A	1	OUT	INT 2 to CPL
A	2	BUS	B CAN A
A	3	BUS	B CAN B
A	4		GROUND
A	5	IN	CLUTCH SWITCH (NO)
A	6	IN	TEG PRESENT
A	7	IN	NPE ENABLE (not connected)
A	8	OUT	+30 PROTECTED 2 FOR PAV POWER (PIN 5)
B	1	OUT	INT 1 to CVM
B	2	OUT	+30 PROTECTED 1 FOR PAV POWER (PIN 3)
B	3	OUT	CVB T21 (front seat heater)
B	4	IN	CRANKING ENABLE FROM NCA (Aisin)
B	5	IN	TRR KEY-ON (not connected)
B	6	IN	START/STOP 1
B	7	IN	START/STOP 2
B	8	OUT	+50 to starter motor
C	1	IN	+30 NBS POWER
C	2	OUT	PAV BUTTON LED
C	3	OUT	CRANKING REQUEST FROM NCR (Selespeed)
C	4	IN	BRAKE SWITCH 1 (NO)
C	5	IN	TRR CRANK 1 (not connected)
C	6	IN	TRR CRANK 2 (not connected)
C	7	IN	BRAKE SWITCH 2 (NC)
C	8	OUT	INT/A

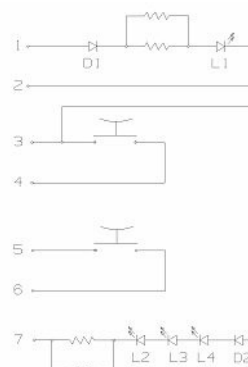
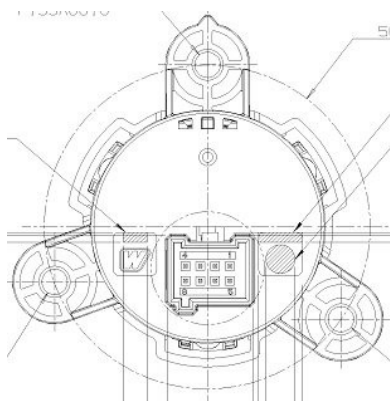


NTR pinout



PIN	FUNCTION	8 pin connector p/n AMP C_174955_E
1	NC	
2	OUT	TEG inserted position output (12V=TEG inserted)
3	BUS	CAN-B
4	NC	
5	NC	
6	IN	Vbatt (+30) Power positive
7		GROUND Power negative
8	BUS	CAN-A
9		

PAV pinout



1	+ 15 start/stop symbol light
2	Light ground
3	Ignition/cranking control protected power
4	Positive signal (AVV) from ignition/cranking to NBS
5	Ignition/cranking control protected power
6	Positive signal (AVV) from ignition/cranking to NBS
7	Negative signal for ignition/cranking control ring LEDs
8	Not connected



9.3 ON-BOARD INSTRUMENTS

Three versions of the panel are available:

- HIGH
- MEDIUM
- BASIC

A auxiliary instrument panel is inserted in the middle of the dashboard. Four auxiliary instrument panels are available:

- Petrol instrument panel (HIGH panel version)
- Petrol instrument panel (MEDIUM panel version)
- Diesel instrument panel (HIGH panel version)
- Diesel instrument panel (MEDIUM panel version)

9.3.1 HIGH and MEDIUM instrument panels

- Two analogue dials (speedometer and rev counter) in instrument body.
- Three analogue indicators in the auxiliary instrument panel.
- 15 warning lights + 5 spare warning light positions (diesel versions) or 13 warning lights + 7 spare warning light positions (petrol versions).
- One buzzer.
- One light sensor for automatically adjusting instrument brightness (day/night mode).
- Interface with 7 external buttons fitted on steering wheel stalks and left-hand panel: 'MODE', 'MODE +', 'MODE -', 'TRIP', 'TRIP up', 'TRIP down' and 'km'.
- One monochromatic reconfigurable matrix LCD with two-colour (red/amber) area.
- Additional heater (versions with automatic/robotised transmission only).



Outfit-specific HIGH and MEDIUM panel variants

- Petrol and Diesel (differences concern rev counter scale).
- Left-hand drive and right-hand drive (differences concern speedometer scale: in kilometres for left-hand drive versions and in miles for right-hand drive versions).
- Automatic/robotised transmission and manual transmission (differences concern presence of additional heater on display).

Speedometer (HIGH, MEDIUM and BASIC versions)

The system calculates the real vehicle speed on the basis of values provided by sensors on the drive wheels and according to the real circumference of the wheels provided by the on-board computer. The electronic architecture implements a microprocessor.

The speedometer dial is operated by a stepper motor. The scale is appropriate for left-hand and right-hand drive versions with a clockwise angle of 270°.

The instrument panel slightly increases the real speed for safety reasons without exceeding the maximum tolerance allowed in countries where the car is marketed. The speed value ranges are uniform.

The real speed value is provided also in the event of failures to one or both drive wheel sensors.

The indicator will point to home range in the event of a failure to the vehicle speed sensor. The maximum full scale value is 260 km/h for kilometre panels and 160 mph for mile panels.



Rev counter (HIGH, MEDIUM and BASIC versions)

The electronic architecture implements a microprocessor. The gauge is operated by a stepper motor ensuring precision, continuity and reading across the entire scale within the operating range. The scale presents a clockwise indication angle of 270°.

The diesel and petrol version rev counters differ for the maximum scale (6000 rpm for diesel and 8000 rpm for petrol) and for the start of the red sector (4500 rpm for diesel and 6800 rpm for petrol).

Buzzer

The buzzer can provide signals of different intensity for the following functions:

- Doors open while car is travelling
- Handbrake applied while car is travelling
- Parking sensors
- Speed limit exceeded
- Acoustic feedback for functions activated by means of buttons
- Acoustic feedback for stored seat and mirror positions
- Reverse and automatic/robotised transmission safety position
- Driver's door open with TEG inserted
- Feedback for warnings/alarms shown on display

Light sensor (HIGH and MEDIUM versions)

The sensor, positioned on the speedometer dial, measures environmental light conditions and sends this information (day and night) to the body computer which compares this information with the taillight state and selects the appropriate lighting configuration inside the vehicle (day/night mode).

Auxiliary instrument panel (HIGH, MEDIUM and BASIC versions)

The central instrument panel presents three analogue instruments managed by an integrated electronic ECU. The instruments are directly controlled by the main instrument panel via a LIN.

Central instrument dashboard configurations and variants

The following variants are available:

- Petrol (with engine oil temperature indicator) or diesel (with turbo charger pressure indicator).
- Red graphics (MEDIUM or BASIC panel versions) or white graphics (HIGH panel versions).
- Right-hand drive or left-hand drive versions present different orientation of indicators, direction of rotation of dials and fastening point on tunnel.

Auxiliary instrument panel for left-hand drive petrol versions:Auxiliary instrument panel for left-hand drive diesel versions:

The auxiliary instrument panel comprises three indicators (according to the version) including:

- Fuel gauge with reserve warning light
- Coolant temperature indicator with overheating warning light
- Engine oil temperature indicator with overheating warning lights (petrol versions only)
- Turbo charger pressure indicator (diesel version only).

9.3.2 BASIC instrument panels

Features of the BASIC on-board panel

- Two analogue dials (speedometer and rev counter) in instrument body.
- Three analogue indicators in the auxiliary instrument panel.
- 31 warning lights + 1 spare warning light position (diesel versions).
- 29 warning lights + 3 spare warning light positions (petrol versions).
- One buzzer.
- One light sensor for automatically adjusting instrument brightness (day/night mode).
- Interface with 7 external buttons fitted on steering wheel stalks and left-hand panel: 'MODE', 'MODE +', 'MODE -', 'TRIP', 'TRIP up', 'TRIP down' and 'km'.
- One negative contrast alphanumeric LCD.



Speedometer, rev counter and auxiliary instruments: Like the HIGH and MEDIUM panel versions.

Buzzer (BASIC version)

The buzzer can provide signals of different intensity for the following functions:

- Doors open while car is travelling
- Handbrake applied while car is travelling
- Speed limit exceeded
- Acoustic feedback for functions activated by means of buttons
- Acoustic feedback for stored seat and mirror positions
- Feedback for warnings/alarms shown on display

Light sensor (BASIC version)

The sensor, positioned on the speedometer dial, measures environmental light conditions and sends this information (day and night) to the body computer which compares this information with the taillight state and selects the appropriate lighting configuration inside the vehicle (day/night mode).

The instrument performs as follows after receiving the data:

- In day mode, the display and dials are fully lit and graphics are off.
- In night mode, the display, graphics and dials can be set to eight levels. The setting is transmitted to the components which consequently adjust their brightness (climate control system display, radio display).



Buttons (BASIC version)

The following buttons are fitted on the left-hand steering stalk:

- 'MENU'
- 'MENU +'
- 'MENU -'

for the following functions: setup menu, dimming and night panel.

The trip meter button is located on the left-hand panel. Press to show and hide the trip meter. Hold pressed to reset it.

Alphanumeric LCD (BASIC version)

The visible area of the two-line negative transreflective BASIC on-board panel is 61 millimetres wide and 28 millimetres high.

The top row consists of nine 14-segment characters for displaying:

- Clock
- External temperature and first decimal in degrees centigrade
- Setup menu

The second row (bottom) consists of:

- Wrench symbol indicating service deadlines
- Six 7-segment characters with decimal point for odometer and trip meter and 'TOT' symbol to identify type of odometer shown
- Snow symbol for indicating ice hazard
- Unit of measure for odometer distances



Basic on-board panel display (single version for right-hand and left-hand drive).

Type of information which can be displayed on the BASIC on-board panel.

9.3.3 Notions on the Service function**Scheduled service information**

The 'Service' message followed by the number of kilometres or miles (according to the unit of measure programmed in the setup menu) or days before the deadline will appear on the display as the service schedule deadline approaches automatically (automatic Service function) at key-on (after the initial check procedure).

The service schedule information may also be displayed by the user by selecting a specific setup menu item. In this case, the information can be seen regardless of the deadlines. The service schedule includes **nine** 'service coupons'.

- The initial kilometrage programmed by the on-board instrument panel must be equal to **20,000 km** (or 12,000 miles).
The initial setting of 20,000 kilometres must be appropriately converted into miles by the on-board panel to ensure acknowledgement of thresholds at which the information will be shown on the display (as defined in the next paragraph).
- The initial days must be equal to a **365** (one year) and must be set automatically by the on-board panel when the total odometer reading is equal to 201 kilometres (125 miles).

On-board display logic in automatic Service mode:

- The first message must be shown once only at key-on whenever one of the following conditions occur:



- a. the kilometres or miles (according to the programmed unit) before the programmed deadline are either equal to or less than the threshold (2000 kilometres or 1240 miles)
 - b. there are thirty or fewer days before the deadline.
- The message must be shown once only at key-on whenever the value is either equal to or less than the following partial thresholds:
- a. 1800, 1600, 1400, 1200, 1000, 800, 600, 400, 200, 100, 50 km.
 - b. 27, 24, 21, 18, 15, 12, 9, 6, 3 days.

The message will not be shown at key-on until the next partial threshold is reached.

The message shown at key-on must show the kilometres/miles or real days before the programmed deadlines once one of the thresholds is exceeded. Consequently, this value must be equal to or less than the respective threshold value considered.

Panel display logic after all nine coupons:

No message must be appear in 'Automatic Service' mode.

No setup menu item can be selected in 'On-demand' mode (the function must not be active).

Counter resetting by service network

Servicing personnel at each scheduled service deadline must:

- Reset the kilometre (or mile) counter and the day counter to initial values (20,000 kilometres/12,000 miles and 365 days) using the diagnostic instrument. Data must remain readable and writable using the diagnostic instrument.
- Store performed scheduled service data. Trace of the last service coupon must remain through:
 - coupon date
 - number of the coupon
 - total distance driven.

Data must remain readable and writable using the diagnostic instrument. The coupon number must be decreased at each Service-Info-Reset starting from 9 (decreasing from 9 to 0).

Instrument panel configuration after replacement

When replacing the on-board panel, service network personnel must:

- Restore the total odometer reading (kilometres/miles).
- Read the number of coupons done and store the value in the new instrument panel.
- Read the kilometre/mile and day counters before the next scheduled service deadline and program the values on the new on-board panel.

Stored data must be maintained by the on-board panel if the battery is disconnected.

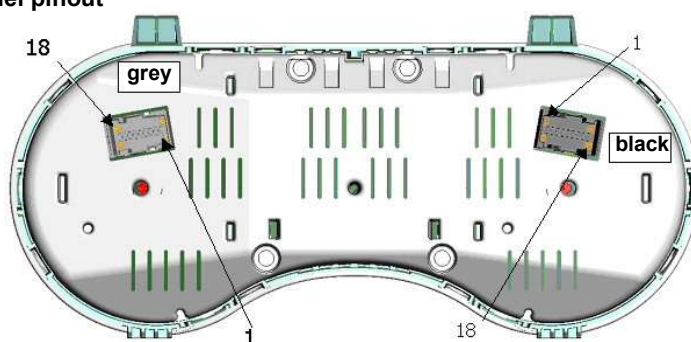
N.B.: Use the Fiat part number shown on the label if the failure is such to prevent reading of the damaged unit.

The parameters read from the panel to be replaced and stored in the new instrument panel are:

- Odometer
- Distance in kilometres since the last coupon
- Service coupon number
- Service day counter information



Main instrument panel pinout



BLACK connector

PIN	PIN FUNCTION
1	INT from F-37
2	+30 from F-53
3	B - CAN L
4	B - CAN H
5	Analogue signal on LH stalk: 'Mode, -, +'
6	Analogue signal on RH stalk: 'Trip, up, down'
7	NQS ground
8	Not connected
9	Not connected
10	Injection/EOBD warning light negative signal from NCM
11	Not connected
12	Dimmed positive for button panel LEDs
13	EHB warning light (electrohydraulic brake)
14	NPB failure warning light
15	Safety buzzer negative from NCR
16	Brake pedal switch positive signal setup for EHB (electrohydraulic brake)
17	Engine oil level sensor power
18	Engine oil level sensor signal

GREY connector

PIN	Function	Opt.
1	LIN bus	X
2	Central instrument ground	X
3	Central instrument protected power	X
4	Not connected	-
5	Dimmed light	X
6	Not connected	-
7	Trim meter reset button	X
8	Not connected	-
9	Not connected	-
10	Supercharger pressure signal (PWM)	X
11	Not connected	-
12	Windscreen/rear window liquid level signal	X
13	Engine coolant level signal	P2
14	Not connected	-
15	Serial line setup for EHB (electrohydraulic brake)	P1
16	Engine oil pressure signal (analogue signal)	P2
17	Engine oil level/pressure sensor ground	X
18	Engine oil temperature signal (analogue signal)	X



Auxiliary instrument panel pinout

PIN	PIN FUNCTION
1	Serial line with NQS
2	Ground (connection to NQS)
3	INT from F-37 (connection to NQS)
4 - 5 - 6	Not connected

9.4 COMPUTERISED SYSTEMS

Various levels are available to suit all needs:

- Traditional telephone setup
- Bluetooth telephone connection (Convergence)
- Map radio navigator (RN)
- Map radio navigator with integrated free-hands telephone (RNT)
- Connect Nav+ (radio navigator and telephone with information and rescue services)

Connect Nav+ and Convergence are described in detail below. The map radio navigator (with and without telephone) derive from Connect Nav+ and have the same navigation and audio features. They differ for the absence of computerised services and for the absence of the integrated telephone and hands-free kit (the latter for RN).



9.4.1 Connect NAV+

Connect Nav+ provides information such as for example local traffic, weather, services, and timetables coordinated with the GPS.

The device includes:

- radio module
- CD-ROM drive
- GPS module
- dual band GSM telephone module
- self-standing map navigation module
- TFT 6.5" colour display
- external Blaupunkt CD changer management (if present)
- voice recognition integrated module
- WAP protocol management software
- MP3 file software
- interface with controls on steering wheel
- three-button panel on ceiling light (NAV, Connect, SOS)



Radio module

General features:

- music audio power: 4 x 35W
- five band graphic equaliser
- easy-to-manage menu for adjusting radio settings and external interfaces (CD changer)
- remote control on steering wheel
- possibility of interfacing with external Blaupunkt 10-disc CD changer
- volume control according to speed
- possibility of operating some controls using the voice recognition module

CD-ROM drive

Connect is equipped with a CD-ROM drive and are therefore capable of reading, playing and managing:

- normal audio CDs
- CD-ROMs containing MP3 files
- official Magneti Marelli CD-ROMs containing updated copies of management software and map database needed for navigation.

GSM module

Connect is equipped with a dual band telephone module and a small SIM card (the SIM card can be inserted by the user). It also fits an external microphone (for hands-free kit and voice recognition system) and is ready for connecting a telephone handset.

Security

Connect remains automatically locked if there is no CAN connection. In this case, enter the master code to authenticate the body computer and start operation.

Available language

The test strings (menu items) and navigation voice messages are available in the following languages:

- French
- English
- German
- Italian
- Spanish
- Dutch
- European Portuguese

A specific CD (setup CD) must be inserted whenever the voice recognition language is changed.

Navigation

Connect can be used for vehicle localisation and route guidance services.

The vehicle is positioned by:

- GPS satellite positioning
- Dead reckoning
- Map matching

GPS positioning:

Positioning is based on the reception of GPS signals. At least three satellites must be received by the antenna located on the roof of the car. GPS positioning is precise within a 20 meter range (in normal working conditions).



Dead reckoning:

This method determines vehicle position by integrating the vehicle direction, speed and direction signals (provided by sensors fitted aboard the vehicle). It is used to ensure positioning if no GPS signals are picked up (tunnels, covered places, etc.).

Map matching:

This method compares the vehicle's course and the topographic characteristics of the terrain. The actual position of the vehicle is pinpointed in this way and connected to the roads.

The navigation module receives positioning, advancement and direction change data from the on-vehicle sensors. These data are gathered and processed by a specific algorithm which also considering the current position of the GPS satellites calculates the estimate position of the car (*car positioning*).

Setup

The device is used to operate on the Connect and vehicle setup. Variations selected by the user are proposed on the on-board panel.

The menu offers three main function groups:

- Language & Date & Temperature: for selecting type, format and unit of measure of the information shown
- Vehicle: for configuring the functions of same on-board devices (if the specific outfit does not include the feature, the corresponding menu item cannot be selected)
- Panel buzzer volume
- Panel button volume
- Door lock while travelling
- Separate driver's door release
- Separate boot release
- Auto close
- Dusk sensor sensibility

Connect: For configuring some device operating parameters:

- Brightness
- Contrast
- Display light
- Connect power-off mode

Trip

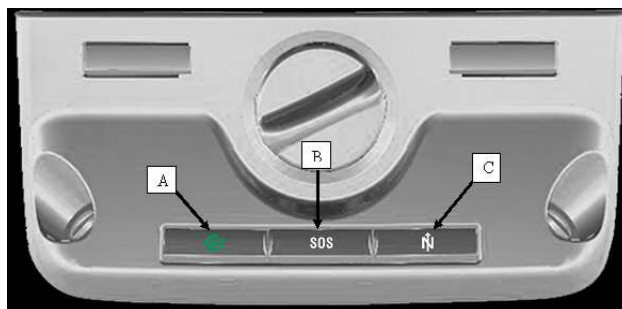
The device is used to show (and possibly configure) trip parameters. The following functions are available:

- General trip (data display)
- Trip B (data display)
- Speed (current speed limit and alarm)
- Setup (trip parameter units of measure)
- Info (vehicle/personal organiser)
- General trip reset
- Trip B reset

Ceiling light computerised buttons

The first button simply repeats the functions of the NAV button on the front of the Connect unit. The other two are used to access the **Infomobility Targa services as shown below:**





9.4.2 CONNECT button (A)

A variety of external driving assistance services (e.g. traffic information, information on shops and stores, etc.) can be accessed by subscribing to the service.

Press the 'CONNECT' button to open a menu for selecting/showing previously stored Infomobility messages. If the services are currently active, press 'CONNECT' again to start information request to the TargaSys Service Provider over the telephone. If the services are enabled, the service provider will call the user back to answer the question.

The answer may be provided over the telephone and completed by sending a text message containing the relevant information.

Information received in text messages (when containing geographic coordinates and telephone number) can be stored and used directly by the user (using Connect) to make a telephone call and/or start navigating towards the destination.

SOS button (B)

The following functions can be activated manually to automatically call the service provider:

- medical help (subscription needed)
- road rescue (subscription needed)
- personal number
- emergency number
- settings

Operation of the SOS button:

- The 'Assistance' screen appears on the Connect display with the 'Medical help' function highlighted.
- The user can program the system so that if the default selection (by pressing a button on the front panel) is not changed within 25 seconds the 'Medical help' call is automatically forwarded to the service provider.
- The user can select 'Road rescue' (in this case a 'Road rescue' call will be forwarded to the service provider) or quit the Assistance page (and cancel the call).
- If the user is not subscribed, the only functions that can be activated are the emergency call function, call to a personal number and access to the settings menu.

NAV button (C)

This repeats the function of the NAV button on the Connect front panel.

Convergence C1

The vehicle is setup to connect to the optional Convergence system. Convergence C1 is an innovative electronic module for interfacing the computer with a Bluetooth cellular phone within the operating range of the system (approximately 5 metres).

The interaction method of the system consists of the following devices:

- Microphone in ceiling light
- Controls on steering wheel connected via CAN
- Monochromatic display on on-board panel connected via CAN.

The system provides effective and intuitive access to the following functions:



- Hands-free cellular phone use without needing to operate the telephone itself (i.e. the telephone needs to be inside the car but not necessarily reachable).
- Voice recognition call (in 'Speaker dependent' and 'Speaker independent' modes).
- Copying of personal numbers from telephone to on-board module and reading on on-board panel.
- Display interaction for called numbers, incoming calls and incoming text messages.
- Access to normal telephone functions (answer, reject calls, recall back number, etc.) using buttons on the steering wheel.

9.5 TYRE PRESSURE DETECTION SYSTEM

9.5.1 Overview

The TPMS (Tyre Pressure Monitoring System) checks tyre inflation pressure and informs the driver if the pressure or temperature of one or more tyres is out of range. Tyre state information is shown to the driver by means of visual signals on the panel. Acoustic warnings are associated to the panel signals for the most critical cases (e.g. badly deflated tyre).

The anomalies concerning one or more tyres detected by the system are:

- deflated tyre
- very deflated or punctured tyre
- excessively inflated tyre

9.5.2 Structure

The tyres pressure monitoring system consists of:

- One RF management and reception unit (CPP) located under the dashboard
- Four RF pressure sensors located inside the tyre on wheel rims
- Four LF (low frequency) initiators (antennas) located in each wheelhouse.

The system also uses the on-board panel to provide acoustic and visual information to the user:

- One indicating icon combined with the display indicating:

Tyre pressure in the event of deflated or excessively inflated tyre(s)

Low tyre pressure in the event of punctures or very deflated tyres and acoustic warning buzzer

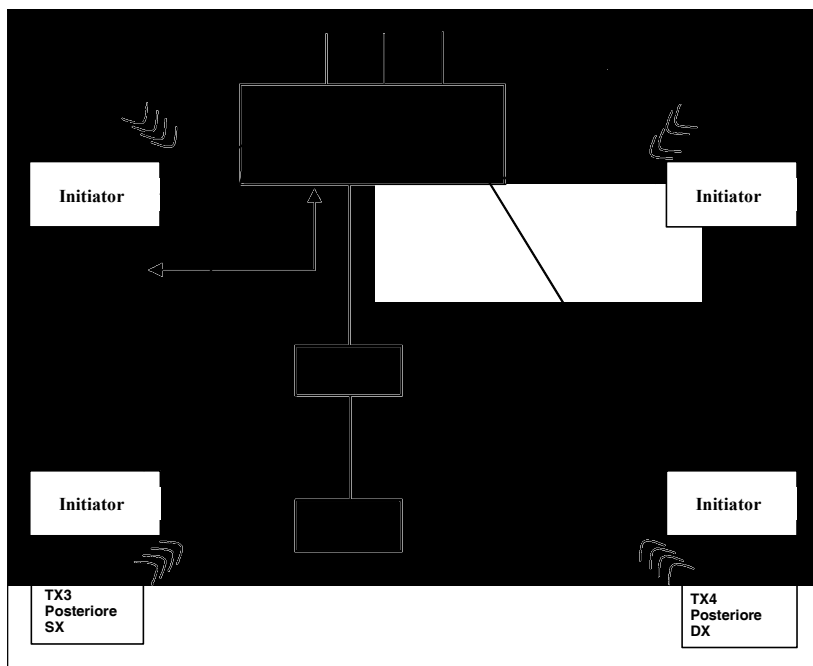
Tyre pressure monitoring function not available in the event of system failures with acoustic warning buzzer

Each warning is associated with an indication of the wheel that caused the anomaly: front left, rear left, etc. as shown in the diagram below:



The system structure is shown in the following figure:



**Legend:**

NQS	Instrument panel node
NBC	Body Computer node
A-BUS	Serial line carrying data from CPP to NBC
B-CAN	Serial line carrying data from NBC to NQS
TXn	Transmitter sensor inside wheel rim
CPP	Tyre pressure ECU
K-LINE	Serial line for ECU and system programming and diagnostics.

9.5.3 Operation

The system monitors the pressure of the four tyres fitted and not that of the spare wheel in vehicles equipped with a space-saver spare. The monitoring system will not work when a spare wheel is fitted until a normal size wheel equipped with pressure sensor is fitted back.

On the other hand, in vehicles equipped with a normal size spare wheel, the system monitors the pressure of the four tyres fitted and not that of the spare wheel while this is stowed in the boot. When the spare is fitted, the system will be cut out for a few minutes to give time for the sensor inside the wheel to be recognised by the system. The conditions of the four fitted tyres will be monitored by the system.

Similarly, if one or more wheels without sensor are fitted, the system will not be available and the respective message will appear on the display until the four wheels with sensors are fitted again.

The TPMS cannot indicate sudden loss of tyre pressure (e.g. caused by puncturing). In this case, the car must be stopped by applying the brakes and steering carefully.

The valves are specific. For this reason, Fiat approved sealants only must be used to repair the tyres: use of other fluids may prevent normal system operation.

Particular precautions are needed to fit and remove tyres and/or rims. Tyres and/or rims must be replaced by specialised personnel only to prevent damage and incorrect fitting of the sensors.

9.5.4 TPMS deactivation

The system can be deactivated by Examiner. The unit can be deactivated if the user decides to change the type of tyres using tyres without a sensor (e.g. snow tyres in the winter). In this case, it is advisable to program the TPMS as if it were not transmitting rather than having failure messages appear on the NQS. The NQS must consider the TPMS as deactivated.



9.5.5 Tyre pressure monitoring system

The sensor is fitted on the wheel rim according to the various configurations (pressed steel or die-cast alloy). The sensor is capable of measuring pressure and temperature via specific transducers and to transmit to the ECU via RF (433.92 MHz for the European market, 315 MHz for other markets). Communication with the energiser is performed at 125kHz.

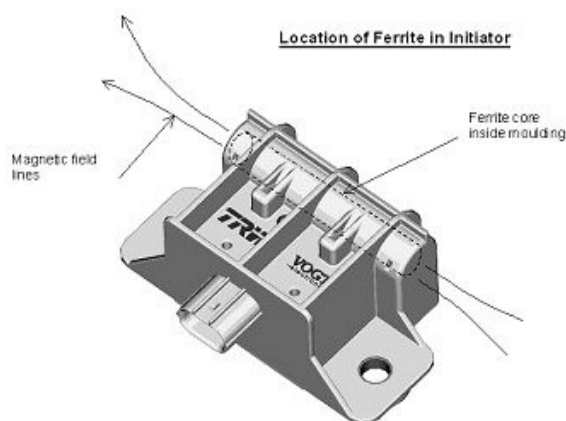


9.5.6 Initiator

The initiator is a ferrite based antenna located near the wheelhouse.

It has a three-wire interface (power, ground and 125KHz modulated signal).

The 125KHz signal must be appropriately amplified to ensure correct operation of the system in all working conditions (environmental range, power voltage range, perturbed field). The typical operative range is one metre.



9.5.7 Control unit

The microprocessor control unit manages RF transmission and reception.

Control software is present in the ECU.

The ECU is provided with A-Bus and diagnostic K line interface. It must be provided with an auto location system capable of provided tyre pressure indications immediately at key-on.

The ECU must ensure at least the following functions:

1. Querying each sensor and providing information to the user in 10 to 15 seconds identifying each wheel.
2. Managing tyre changes without need to reprogram the ECU externally.
3. Self-learning of wheel sensor identification codes at end of line.

9.5.8 Operating details

The tyre pressure ECU (CPP) acquires information on the state of the four tyres via radio-frequency. A sensor is queried at key-on by being energised by the respective initiator. One initiator is provided for each of the four wheels. The CPP communicates on the A-Bus serial line with the NBC.

The NBC transmits the following signals on the B-Can line:



- ECU programmed/not programmed
- ECU OK/not OK
- Wheel indication with spare wheel management
- Tyre pressure: advanced information (axle imbalance, rapid or slow loss of pressure)
- Advanced tyre state indications (axle imbalance, rapid or slow loss of pressure)
- TPMS on/off
- Run-flat tyre management (indication of remaining distance)

The four wheel pressure/temperature information (information on the spare wheel is optional) must be available on the network within 10 sensors from key-on. After this start-up phase, the information above will be managed on a 15 second basis with regular/on-event messages.

The NQS acquires these signals and manages the respective indications.

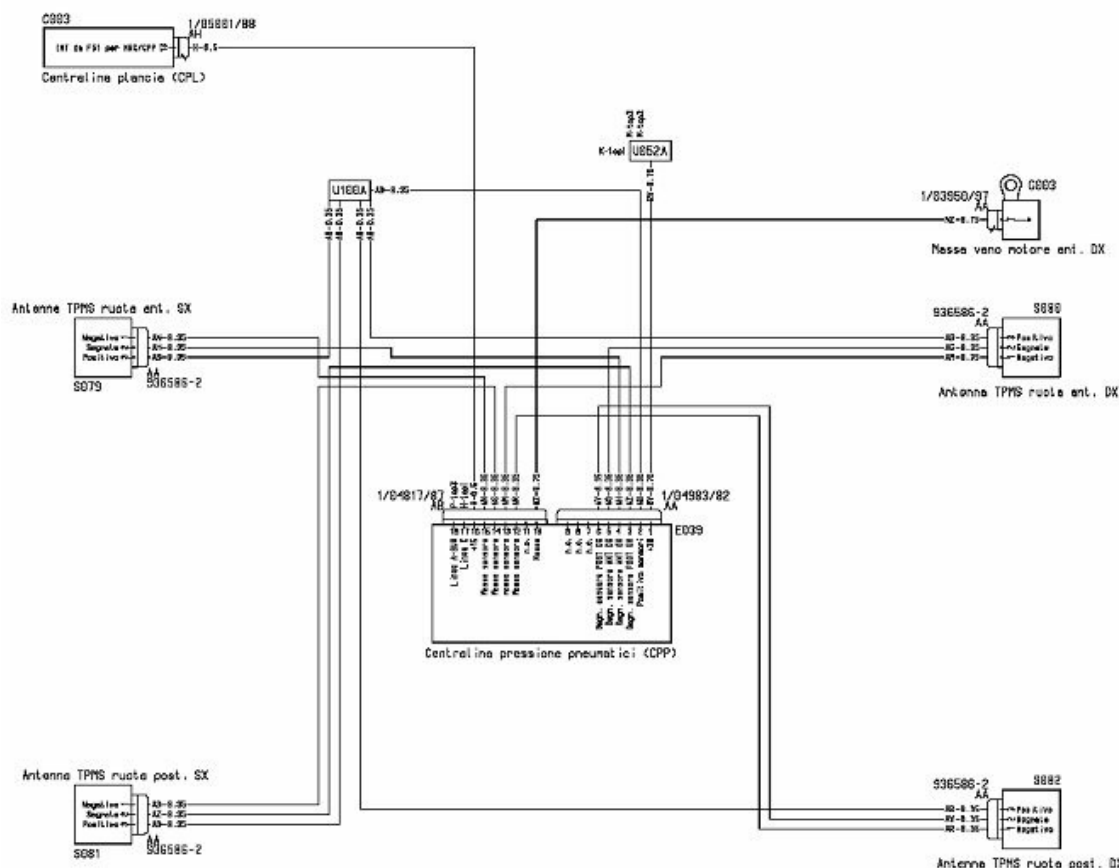
The message is transmitted regularly via the A-Bus from the CPP every 15 seconds. A CPP anomaly signal is sent and displayed by the NQS if the body computer does not receive a message for one minute.

9.5.9 Key-on/key-off strategies

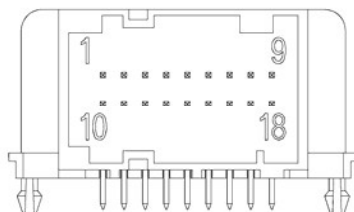
If an anomaly is reported during key-on (ECU failure, low pressure), the information will be represented at the next key-off/key-on cycle only if the anomaly occurs again. Specifically, in the case of run-flat tyres, the CPP ECU is capable of correctly managing residual distance (run-flat management).

If loss of pressure from one or more tyres occurs during key-off, the respective message will appear on NQS (within 10 seconds) at the following key-on as shown in the finalised tyre pressure monitoring system ECU specifications.

Wiring diagram



Tyre pressure ECU



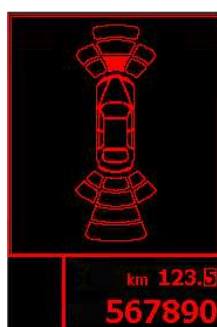
Pin N.	Description
1	+30
2	LF_Supply
3	TPM_Request_RL_Output
4	TPM_Request_FL_Output
5	TPM_Request_FR_Output
6	TPM_Request_RR_Output
7	Not_Used
8	Not_Used
9	Not_Used
10	GND
11	Not_Used
12	LF_Ground
13	LF_Ground
14	LF_Ground
15	LF_Ground
16	+15
17	K_Line
18	A_Bus

9.6 PARKING ASSISTANCE

The parking assistance system provides information on distance between obstacles in front of and behind the car while parking. The system helps the driver by identifying obstacles outside the driver's view.

The driver is informed on the presence and distance of the car from the obstacle by means of acoustic signals whose frequency depends on the distance and on the display by means of visual indications.

The driver can avoid collisions by integrating direct visual information with the acoustic warning generated by the system.



9.6.1 Notions for calculating distance from obstacles

The ECU generates a sequence of ultrasound pulses which are reflected by the obstacle through sensors built into the bumpers. The reflected pulses are captured by the sensors which amplify and convert them into a digital signal.



The ECU compares these signals with those previously transmitted and is capable of measuring the delay and consequent distance from the obstacle.

9.6.2 Structure

The parking assistance system consists of the following components:

- One ECU located underneath the rear seat
- Eight ultrasound sensors (four in the front grill and four on the rear panel)
- Two dedicated buzzers: (one in the back of the passenger compartment and one in the front of the dashboard)

9.6.3 Electronic control unit

The ECU controls the following functions:

- Activate the sensors
- Process the signals received from the sensors
- Check functionality of sensors
- Operate buzzer
- Manage diagnostics and test functions.

The ECU is equipped with a diagnostic B-CAN interface.

9.6.4 Ultrasound sensors

The sensor is an ultrasound transducer for smart transmitting and receiving ultrasound pulse packets. Both the pulse frequency and voltage are generated in the transducer. The output pulses are reflected by obstacles.

The transducer thus receives an echo that is amplified and converted into a digital signal, sent to the ECU via the same line used to request transmission.

Each sensor can also be operated as a receiver only to triangulate the two sensors. This technique allows better reception of smaller obstacles in situations characterised by critical reflections. The sensors all have the same electrical and mechanical properties. The maximum detection distance of each sensor can be adapted by software according to its position on the bumper.

9.6.5 Buzzers

The front buzzer informs the driver on the distance from the obstacle located in front of the vehicle by means of beeps. Similarly, the rear buzzer (whose tone is different from that of the front buzzer) informs the driver on the distance from an obstacle behind the car.

The beeps inform the driver that the car is approaching an obstacle. The warning tone consists of beeps whose duration is constant (75 ms). The pauses between beeps is directly proportional to the distance from the obstacle: beeps in rapid sequence indicate the presence of a very close object. An continuous signal indicates that the distance is less than 30 centimetres.

The closest approaching obstacle is signalled if there are several obstacles.

The beeps cease immediately if the distance from the obstacle increases. The sound cycle remains constant if the distance measured by the central sensors remains unchanged. The signal on the other hand is interrupted after three seconds if this situation occurs for side sensors (to avoid warnings when for example manoeuvring along a wall parallel to the car).

No rear obstacles are detected if a trailer is fitted.

9.6.6 Switching the system on and off

A self-diagnostic test is run on all peripherals when the ECU is switched on (at key-on). The system is ready for use in less than 0.5 seconds. The distance measuring system only runs when the system is active. Only the ECU microcontroller runs when the system is not working.

The system is beeps at increasing frequency when the system is active in the presence of obstacles. The system is switched off when the speed exceeds 18 km/h or when the on/off button A is pressed.





9.6.7 Coverage area

The system covers the rear middle and side areas of the car.

Obstacles in the rear middle area are detected at a distance of approximately 1.40 m (maximum value). Obstacles in the rear side area are detected at a distance of approximately 0.6 m.

Obstacles in the front middle area (eight sensor systems only) are detected at a distance of approximately 0.9 m (maximum value). Obstacles in the front side area are detected at a distance of approximately 0.6 m.

9.6.8 Diagnostics

The ECU runs an auto-diagnostic test on system and sensors at key-on.

The sensors are continuously monitored while the system is running. The failure of also only one sensor will inhibit the operation of the entire system: in this case, the system will automatically cut out and send a failure message.

Faults and errors are immediately reported on the on-board panel.



Rear sensor deactivation with trailer

The rear sensors must be deactivated in the presence of a trailer. Connect connector A pin 5 to ground in this case.

9.6.9 Component characteristics

Parking sensor ECU (CPA)

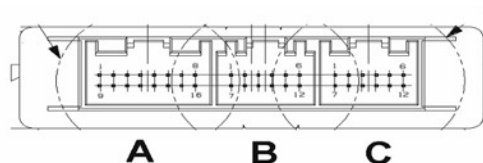
The ECU is an electronic component connected to the rear wiring harness that provides assistance to the driver by performing the following functions:

- receiving from the CAN and directly from the respective button the activation/deactivation signals
- controlling the operating LED
- controlling the sensors
- processing the signals received from the sensors
- checking the functionality of sensors
- operating the buzzers
- managing diagnostics and test functions.

The ECU is provided with a protection device against voltage surges and short circuits.



9.6.10 ECU pinout



8-channel configuration

Connector A

Pin	Signal
1	Key-on (+15)
2	Rear buzzer signal (-)
3	Not connected
4	Parking system on/off button
5	Negative signal from trailer ECU (where fitted)
6	Not connected
7	B-CAN A
8	Ground
9	Not connected
10	Rear buzzer (+)
11	Not connected
12	Not connected
13	Parking system on/off LED
14	B-CAN B
15	Not connected
16	Not connected

Connector B

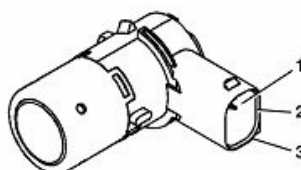
Pin	Signal
1	Front sensor ground
2	Front sensor power
3	Front buzzer signal (-)
4	Front buzzer signal (+)
5	Left outer front sensor signal
6	Left inner front sensor signal
7	Right inner front sensor signal
8	Right outer front sensor signal
9	Not connected
10	Not connected
11	Not connected
12	Not connected

Connector C

Pin	Signal
1	Right inner rear sensor ground
2	Right inner rear sensor signal
3	Left inner rear sensor signal
4	Right outer rear sensor signal
5	Left outer rear sensor signal
6	Right inner rear sensor power
7	Left inner rear sensor ground
8	Right outer rear sensor ground
9	Left outer rear sensor ground
10	Left inner rear sensor power
11	Right outer rear sensor power
12	Left outer rear sensor power



9.6.11 Ultrasound sensor

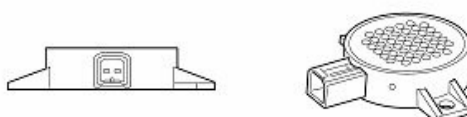


Sensor pinout

Pin	Signal
1	Sensor power supply
2	Sensor signal
3	Sensor ground

Buzzers

The two buzzers (one front and one rear) inform the driver on the distance and indicate system failures. The frequency and volume of the warnings are controlled by the ECU.

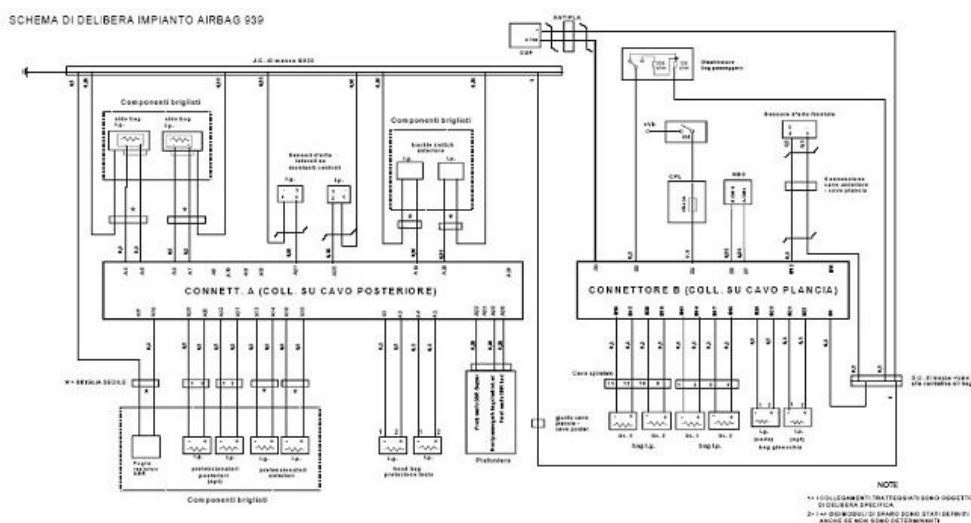


9.7 AIRBAGS

9.6.1 Overview

The car is equipped with driver and passenger knee airbags. The knee airbags integrate the front airbags and the seat belts. They reduce risk of injuries to the occupants' knees and even prevent contact with the surface of the dashboard. They contribute to reaching the highest safety standards. The driver's knee airbag is standard; the passenger's is optional.

9.7.2 Airbag system diagram



Supplementary Early Crash Sensor (ECS)

The supplementary Early Crash Sensor (ECS) located near the bonnet lock helps the ECU to anticipate airbag deployment with respect to a traditional system and avoids the risk of minor injuries caused by airbag deployment by inflating the airbags before the occupant starts advancing towards the steering wheel or dashboard. It also decreases sensitivity in the case of collisions under the body for which airbag deployment is not necessary because they do not cause risks to occupants.

Manual airbag deactivation switch

The switch, located on the right-hand side of the dashboard (left-hand side on right-hand drive models), can be used to deactivate the passenger's airbag to safely install a back-facing child seat. A LED will light up on the instrument panel when the airbag is deactivated. Deactivation is only possible when the car is stationary.

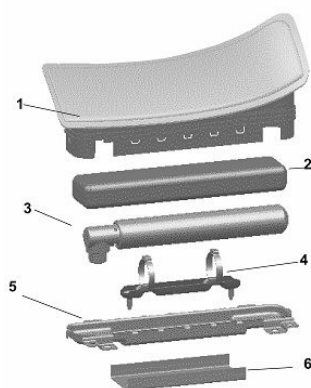
9.7.3 Knee airbag modules**Features**

Two airbag modules are fitted in the lower part of the dashboard in front of the passenger's knees and under the steering wheel. These modules protect the lower limbs and increase protection for the driver and front passenger, especially by preventing forward slipping that can cause chest injuries.

Construction

The knee airbag module consists of a metallic casing housing a gas generator and a nylon bag.

The container is fastened to a supporting plate and a safety anchoring that fastens it rigidly to the lower part of the dashboard.



1. External cover
2. Bag
3. Gas generator
4. Generator support
5. Support plate
6. Safety plate

Seat belts with pretensioner on buckle

The same system of sensors that controls the airbags also activates the seat belt pretensioners. The pretensioners recover belt slackness and hold the occupant against the vehicle from the first instants of the collision to reduce movements inside the passenger compartment. Furthermore, the pretensioner on the buckle allows to control hip movement limiting forward movements and loads on thighbones in the event of collisions.

The belts are also equipped with progressive load limited which decrease the force to two decreasing thresholds for releasing the belt.

This along with the protection offered by the airbags integrates the occupant's safety more gradually and efficacy.

The load limiter force levels considerably reduces the risk of fractures to shoulder bones and ribs also for the most delicate bones (e.g. the elderly). Four position height adjuster are fitted on the front seats to ensure maximum comfort and optimal safety.



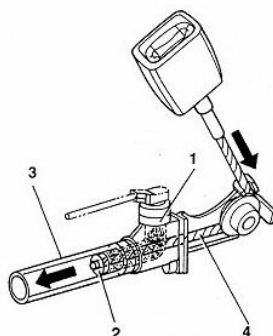
9.7.4 Front seat belt pretensioners

Features

The pretensioners fitted on the front seat belt buckles are pyrotechnic devices, electrically activated by a signal from the ECU. The same logic that controls the airbags also activates the seat belt pretensioners. The pretensioners recover belt slackness and hold the occupant against the backrest from the first instants of the collision to reduce movements inside the passenger compartment.

The belts are also equipped with two-threshold progressive load limiters to decrease the force transmitter to the occupant's chest: the load limiter force levels considerably reduces the risk of fractures to shoulder bones and ribs also for the most delicate bones (e.g. the elderly).

The pretensioner mechanism is shown in the following figure.



1. Gas generator
2. Piston
3. Cylinder
4. Metallic wire

Operation

When a sufficiently high deceleration is detected by the system accelerometers, the electronic sensor in the ECU sends a signal to fire the pyrotechnic charges of the gas generators. The combustion of the propellant develops a chemical reaction and forms inert gas whose pressure generates a force that pushes a piston. The piston is connected to the metallic wire which via a rotation pin pulls the buckle downwards.

NOTE: After deploying the pretensioners, the belts remain blocked and must be replaced.

9.7.5 Front seat belt reminder sensors

When the seat belts are not worn, the risk of injury for occupants is higher than that of seat belt wearers also in very less severe crashes. Specific signals from the seat belt reminder sensors in the front seat belt buckles and from a pressure sensor embedded in the seat cushion foam are used by the ECU to deploy the airbags but not the pretensioners if a passenger is sitting in the seat. The pretensioners are not deployed in this case which would only determine additional cost for repairing the vehicle.

9.7.6 Airbag system warning lights



1. Airbag system failure warning light on instrument panel
2. Passenger airbag deactivate warning light on front ceiling light
3. Seat belt reminder warning light on front ceiling light



9.7.7 Airbag system failure warning light

With TEG inserted, the airbag system failure warning light (red) will light up for approximately four seconds (initial self-diagnostic procedure) and then goes out. The corresponding failure code is stored if the ECU detects a failure. If no failures are detected at key-on and no failure events are stored, the warning light will go out after the four-second diagnostic procedure. Otherwise, it will stay on.

The warning light will stay on or light up while the vehicle is running when:

- the ECU detects an airbag system failure
- the ECU detects a collision and the system is deployed
- an failure in the warning light connection circuit occurs.

The warning light will stay on until the operative conditions of the system are restored (i.e. the concerned component is replaced and the ECU is reset using Examiner) following a collision that deployed only the pretensioners or side airbags. If the collision deployed the front airbag modules, the warning light will remain on permanently. The ECU cannot be reset (it must be replaced). The warning light will come on fixed if during the ECU's life internal errors that cannot be reset using Examiner occur.

9.7.8 Passenger airbag deactivated warning light

With TEG inserted, the passenger airbag deactivated warning light (amber) will light up for approximately four seconds (initial self-diagnostic procedure) and then blink for the next four seconds. If the ECU detects a warning light failure, it will store the failure code, switch the failure warning light on and deactivate the passenger side airbag. Proceed with Examiner as for the failure warning light to restore system operation.

NOTE: The TEG MUST NOT BE INSERTED IN THE TEG READER to deactivate the passenger airbag module: this would store an error in the ECU.

9.7.9 Seat belt reminder

First warning cycle : warning light

The seat belt warning light comes on to indicate that a seat belt (driver, front passenger, rear passengers) has not been fastened as follows:

- steady light at key on if the seat belt is not fastened
- steady light if seat belt is unfastened after key-on (unless blinking conditions subsist, see below)
- off if the seat belt was fastened before key-on
- off if the seat belt is fastened during key-on
- always off at key-off.

NOTE: The steady light indication cannot be switched off.

Warning cycle: warning light and buzzer

The warning cycle is activated for 90 seconds if with seat belt unfastened at key-on, at least of the following events occurs:

- over 30 seconds have elapsed and vehicle speed is higher than 4 km/h
- vehicle speed higher than 25 km/h
- distance exceeding 500 m.

During the warning cycle, the warning light will blink (frequency 2Hz D.C. 50%) in combination with a buzzer tone.

Operation during the 90 second cycle

- The warning cycle will stop immediately (the warning light will go out and the buzzer will be muted) if the seat belt is fastened. The system will set up for the next warning.
- The cycle will continue for the entire 90 seconds if one of the three events which caused the warning cycle come less.



- If another warning event occurs, the new event will appear on the instrument panel and the warning cycle in progress will be interrupted (the buzzer will be muted and the seat belts warning light will switch from blinking to steady). Warning of the last event will resume.

Naturally, the warning cycle will be interrupted if the seat belt is fastened during the new warning cycle.

- The warning cycle will stop immediately at key-off.

Operation after 90 seconds

If the seat belt remains unfastened:

- The buzzer is muted.
- The warning light will stop blinking and light up steady.

The warning cycle will be run once only if the aforesaid conditions subsist: this means that the warning cycle is not repeated after the 90 seconds also if the belt remains unfastened.

New warnings

The warning cycle will only be repeated if the unfastened seat belt condition is detected again (transition from fastened to unfastened) in one of the said conditions.

Warning cycle cut-out (warning light/buzzer)

The user can deactivate the warning cycle **temporarily** by means of the following procedure:

Within one minute from key-on:

- Fasten the driver and passenger seat belts. The seat belt can be fastened before key-on to make the procedure easier.
- Keep seat belts fastened (at the same time) for at least 20 seconds (with TEG inserted).
- Unfasten at least one seat belt.

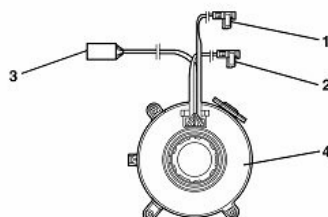
The warning cycle is activated automatically again at the next key-on.

The warning cycle can be deactivated **permanently** only by Technical Assistance.

The deactivation procedure is run from the on-board panel using the diagnostic tool (Examiner).

NOTE: No-one can deactivate the instrument panel warning light which will always remain on (steady light) when the seat belt is unfastened.

9.7.10 Clock contact pinout

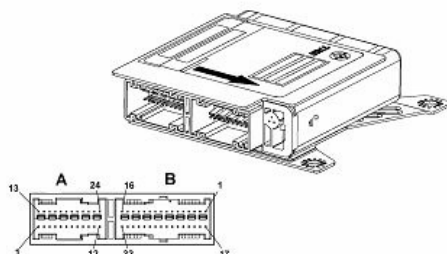


PIN	SIGNAL
1	Horn button negative signal
2	Not connected
3	B-CAN B
4	B-CAN A
5	Key-on power
6	Ground
7	Selespeed control ground
8	Selespeed control signal
9	Airbag 2nd level (+)
10	Airbag 2nd level (-)



11	Airbag 1st level (-)
12	Airbag 1st level (+)

ECU pinout

**A - Front connector** (dashboard wiring harness, blue)

PIN	SIGNAL
1	Ground
2	Key-on power
3	(Not connected)
4	(Not connected)
5	Front collision sensor ground
6	(Not connected)
7	B-CAN A line
8	B-CAN B line
9	Passenger airbag deactivation key (+)
10	Passenger airbag deactivation key (-)
11	(Not connected)
12	Front collision sensor signal
13	Passenger airbag - first stage (-)
14	Passenger airbag - first stage (+)
15	Driver airbag - first stage (+)
16	Driver airbag - first stage (-)
17	Passenger airbag - second stage (-)
18	Passenger airbag - second stage (+)
19	Driver airbag - second stage (+)
20	Driver airbag - second stage (-)
21	Passenger knee airbag (-)
22	Passenger knee airbag (+)
23	Driver knee airbag (+)
24	Driver knee airbag (-)



B - Rear connector (rear wiring harness, black)

PIN	SIGNAL
1	Driver window airbag (-)
2	Driver window airbag (+)
3	Passenger window airbag (+)
4	Passenger window airbag (-)
5	Driver side airbag (-)
6	Driver side airbag (+)
7	Passenger side airbag (+)
8	Passenger side airbag (-)
9	(Not connected)
10	(Not connected)
11	(Not connected)
12	(Not connected)
13	Driver belt pretensioner (-)
14	Driver belt pretensioner (+)
15	Passenger belt pretensioner (+)
16	Passenger belt pretensioner (-)
17	(Not connected)
18	Passenger presence sensor signal
19	Driver seat belt reminder switch signal
20	Passenger seat belt reminder switch signal
21	Driver side collision sensor ground
22	Seat belt reminder buzzer signal
23	Passenger side collision sensor ground
24	(Not connected)
25	Passenger airbag deactivated warning light
26	Seat belt reminder warning light
27	Driver side collision sensor power
28	Passenger side collision sensor power
29	(Not connected)
30	(Not connected)
31	(Not connected)
32	(Not connected)

9.8 FRONT LIGHT CLUSTER (xenon gas discharge version)

The need to improve the performance of current halogen lamp systems in terms of light energy output, spectrum distribution and bulb life led to the development of gas discharge headlights and respective devices for operating on the vehicle.

The advantages deriving from the development of this technology are essentially three:

- higher light efficiency for decreasing electrical power draw;
- high light flow reduces the dimensions of the light flow (particularly height) and more freedom in front-end design;
- the life-span is in average double that of a halogen bulb.

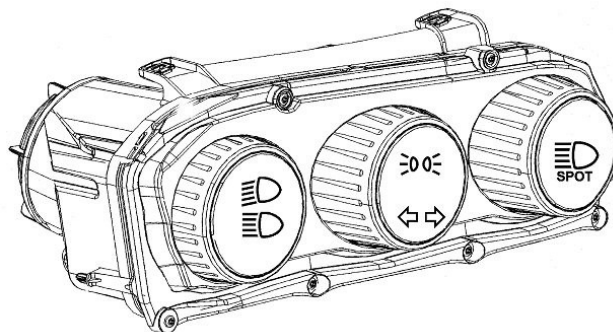
The gas discharge headlight technology has led to the development of a number of devices which briefly include:



- xenon bulb
- headlight reflecting surface
- controlling electronic (ballast)
- automatic beam height correction.

Each light cluster integrates the components needed for operating the discharge bulb (bulb, reactor, ECU and control motor). It also comprises traditional components (side lights, direction indicators, dipped-beam headlight).

The cluster appears as follows:



1. Spot main-beam headlight
2. Concealed side light
3. Main-beam/dipped-beam headlight
4. Direction indicators

NOTE: The spot main-beam headlight is used alone to flash the headlights when the headlights are off and in combination with the xenon bulb when switching from dipped to main beam.

An appropriately shaped metallic shield is lowered to switch the xenon bulb from dipped-beam to main-beam.

The following bulbs are present:

- **Xenon D1S bulb** for dipped-beam/main-beam headlights
- **W5W all glass blue bulb** for side lights - 12V-5W
- **PY21W all glass silver bulb** for direction indicators - 12V-21W
- **H1 halogen bulb** for spot main-beam headlights 12V-55W

The left cluster is the master. The sensors for controlling vehicle trim are connected to this cluster. The right cluster is the slave and is connected to the master via a specific serial line.

9.8.1 Xenon bulb

Construction and operation

Construction

The xenon bulb consists of a ampoule containing two electrodes arranged at a distance of a few millimetres and filled with low pressure xenon gas. Light emission is sparks an arc between the two electrodes which is maintained during the operation of the bulb. This process is similar to that of neon lights for residential purposes. Unlike neon lights, however, it is not possible to wait for a few minutes for the process to stabilise. The light cluster is equipped with an ECU that ensures warm-up time equivalent to that of a traditional headlight.

Operation

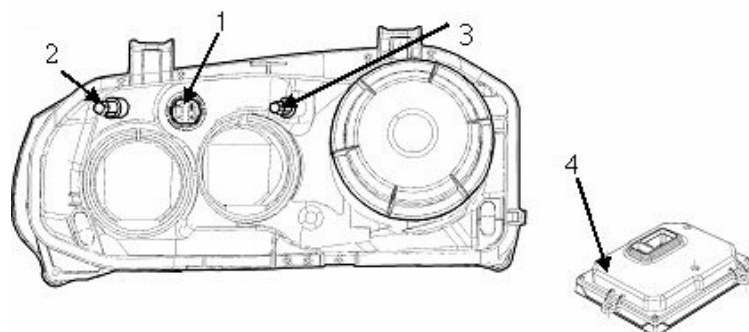
The operation of a xenon bulb consists of four phases:

- **Ignition:** During this phase, the ballast generates a voltage capable of sparking a specific device located in the igniter. A voltage elevator circuit transfers the appropriate amplified overvoltage to the bulb and causes the discharge between the electrodes.
- **Arc take-over:** During this phase (that lasts for a few seconds), the bulb is super powered to cause the rapid evaporation of metallic halides contained in the bulb and ensure that running brightness is reached rapidly. In these conditions, the bulb flashes with light whose intensity is double the normal value for approximately 100 microseconds.



- **Warm-up** The ballast adjusts brightness for approximately two minutes detecting the physical state of the bulb and its impedance (closed loop).
- **Steady state**: The light beam is continuously controlled in a closed loop also during steady state conditions.

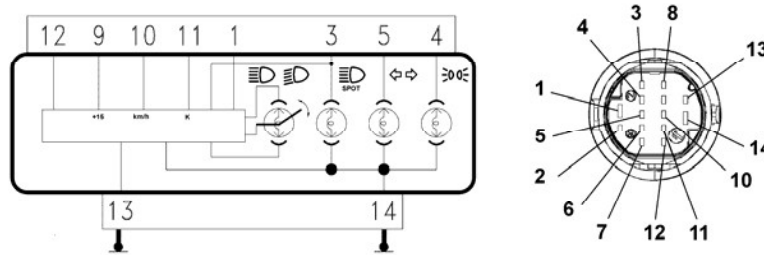
9.8.2 Rear headlight view



1. Headlight power 14-pin connector
2. Headlight horizontal axis adjustment screw
3. Headlight vertical axis adjustment screw
4. ECU

9.8.3 Wiring diagram and optical cluster connector pinout

Headlight power 14-pin connector



PINOUT:

1. Dipped-beam headlight control
2. Main-beam headlight control
3. Side light control
4. Direction indicator control
9. ECU key-on power
10. Speedometer signal (to master only)
11. K diagnostic line
12. Serial line
13. ECU ground connection
14. Bulb ground connection

9.8.4 Automatic headlight position corrector

Due to the high brightness output by the bulb, the vehicle is fitted with an automatic headlight trim corrector to prevent dazzling oncoming vehicle drivers when the trim changes. The device works in the following conditions:

- static for load distribution
- dynamic for acceleration and deceleration.



The automatic corrector also improves driving comfort because the illuminated area is stabilised and the driver's eye does not need to constantly adapt to changes of lighting.

The device consists of:

- a stepper actuator for each headlight
- two load sensors connected to the front and rear suspensions on the right-hand side.

Correction function

Correction is made by means of the load sensor signal which, connected to the suspensions, provides an indication of vehicle load.

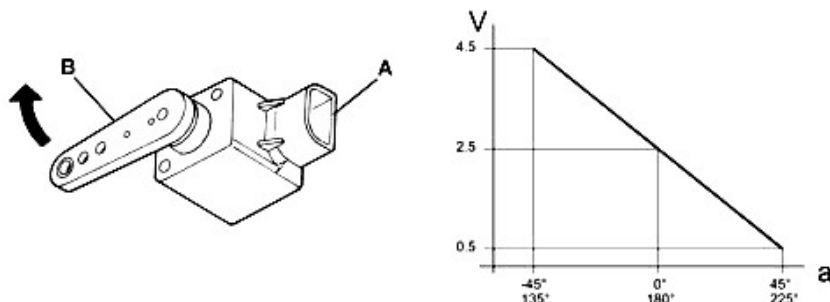
The ECU is activated at key-on and resets the headlights to the exact position calculated according to vehicle load after moving them to end of stroke position and back.

The load sensor signals are regularly acquired and appropriate mediated to readjust the position of the headlight if necessary (e.g. fuel consumption while travelling). This readjustment is not immediate. It is filtered in time to avoid undesired corrections (e.g. potholes, rough roads, etc.).

This correction is also performed when the lights are off so that the beam is correctly positioned the instant the headlights come on.

Load sensors

The load sensors are fastened to the vehicle chassis. An appropriately shaped lever follows the movement of the suspension. The sensor is powered by the headlight ECU and provides a linear output signal which is proportional to the position of the suspension with respect to the body.

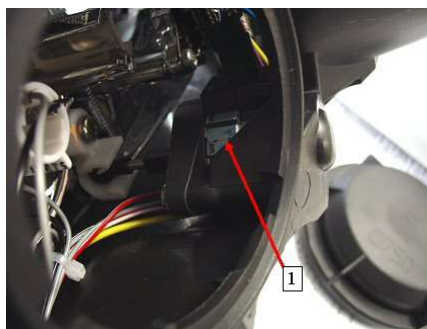


- A. Connector
- B. Control lever
- a. Lever camber
- V. Sensor output signal voltage

9.8.5 Adjustment actuator

A stepper actuator inside the light cluster makes the adjustment. It consists of an electrical stepper motor and a worm screw reducer which transforms the rotary movement into linear motion of a pin hinged via a ball joint to the reflecting surface.

1. Stepper motor



9.8.6 Self-diagnostics

The electronic system is provided with a self-diagnostic function which constantly monitors functionality. The ECU continuously self-diagnoses system operation. Specifically, it detects and stores failures. The failure stored in the ECU can be analysed using Examiner or other diagnostic tools.

9.8.7 Recovery

The self-diagnostic management logic is also provided with a recovery function. The system stops working correctly when errors are detected. This could cause dangerous dazzling of oncoming vehicles. The light beam is therefore positioned down to prevent dazzling in all cases but to ensure sufficiently lighting to safely reach a garage.

9.8.8 Resetting

When replacing a system component (headlight, sensor, etc.), a self-learning procedure must be run using a diagnostic tool for automatically resetting the system. The system must acknowledge the correctly aligned headlight position (zero position) from where to control the various settings.



10. CLIMATE CONTROL SYSTEM

The vehicle may be equipped with one of three types of climate control system configurations:

- One-zone manual
- Two-zone automatic
- Three-zone automatic

10.1 CLIMATE CONTROL SYSTEM OVERVIEW

The climate control system implements a variable displacement Zexel-Valeo compressor and a block expansion valve. The effective capacity of regulating gas quantities in the evaporator achieved by these two elements has eliminated the need to use a frost sensor. The system contains 550 40 grams of R134 gas. 150 cm³ (+15/-30 cm³) of ZXL100PG oil is used.

A pollen filter accessible through the flap (2) shown in the figure on page 3 is fitted in all versions. Specifically, a traditional filter is fitted in one-zone versions while a two-layer paper filter containing a chemical substance capable of withholding also finest dust and particulate is fitted in two and three-zone versions.

10.2 MANUAL CLIMATE CONTROL SYSTEM

The manual climate control system is a one-zone device. The classical control panel that integrates the NCL ECU is shown in the figure below:



10.2.1 Structure

The air mixing (17), air distribution (18) and air recirculation (16) controls are transmitted by stepper motors controlled directly by the ECU (see figure on page 3 and wiring diagram on page 5). The climate control fan speed is controlled by a classic resistive splitter (20) fitted in the air manifold.

10.2.2 Operation

The manual climate control system can be used to adjust the temperature and air flows let into the passenger compartment using buttons and knobs. The following parameters/functions can be adjustment manually:

- Temperature
- Air distribution (five positions)
- Fan speed
- Compressor enabling
- Recirculation
- Defrosting/demisting

10.3 SUPPLEMENTARY HEATER

Diesel versions fit a supplementary heater for warming up the passenger compartment faster while the engine is warming up. The device consists of a plate (9) split into two sections, each of which integrates a PTC that heats up when powered. The plate is positioned inside a specific compartment (5) in the body of the heater unit and is invested by the air let in from the outside.

10.3.1 Operation

The PTCs are powered by two relays in the unit (24) and are controlled directly by the NCL ECU when:

- The engine temperature is cooler than 65°C

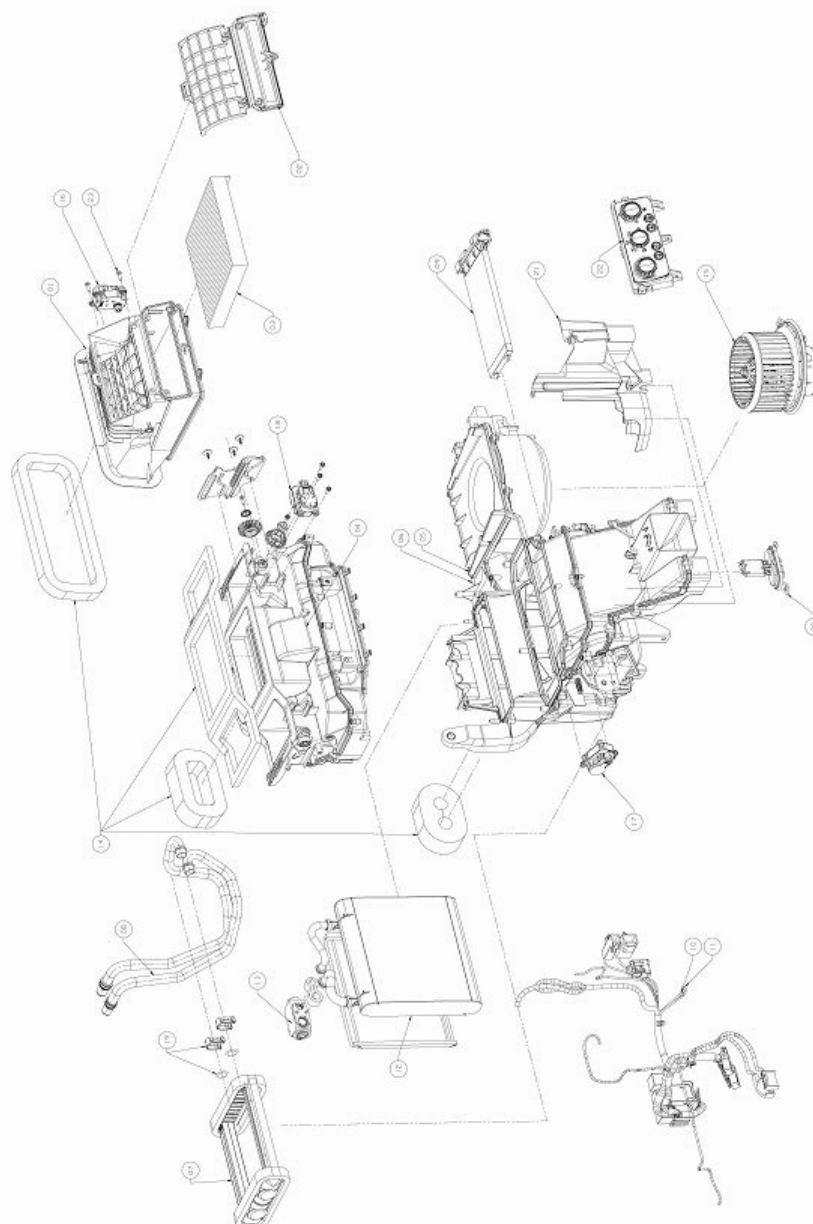


- The outside temperature is cooler than 20°C

Two and three-zone versions only: when the temperature set by the user is higher than that inside the passenger compartment. The two sections are operate according to battery voltage, as follows:

- no section is operated if the battery voltage is under 12.2 V
- one section is operated if the battery voltage is included in the range from 12.2 V to 12.6 V
- both sections are operated if the battery voltage is over 12.6 V.

10.4 ONE-ZONE CLIMATE CONTROL SYSTEM



One-zone climate control system legend:

1. Air intake unit
2. Pollen filter compartment flap
3. Pollen filter
4. Upper distribution unit



- | | |
|--------|----------------------------|
| CVM | Engine compartment fusebox |
| NCL | Climate control node |
| NVM | Engine control node |
| PTC1/2 | Supplementary heaters |



10.5 TWO AND THREE-ZONE AUTOMATIC CLIMATE CONTROL SYSTEM

10.5.1 Two-zone system

The automatic two-zone climate control system can differ the distribution and temperature of the air let into the passenger compartment two different levels for the driver/rear seat and the front seat passenger. The system is managed by an ECU that monitors the temperature outside the passenger compartment and either warms or cools the air to reach the required level of comfort.

The climate control system automatically adjusts the following parameter/functions:

- Air temperature at air vents on driver/passenger side
- Fan speed (continuous variation)
- Air distribution on driver/passenger side
- Compression operation
- Recirculation
- Defrosting/demisting of windscreen and rear window.

The automatic two-zone climate control panel integrates the ECU and is shown in the following figure.

10.5.2 Front two/three-zone controls



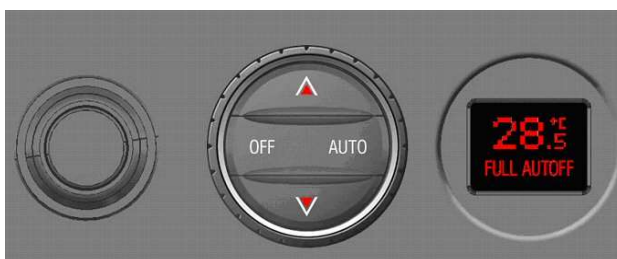
10.5.3 Three-zone system

Overview

The automatic three-zone system offers the possibility of adjusting the air distribution and temperature in different ways for the driver, front passenger and rear seats.

From a structural point of view, it differs from the two-zone system due to a different climate control unit and for the presence of a supplementary ECU with respective controls for adjusting air mixing and distribution for the rear seats. The front ECU is the same as that of the two-zone version.

10.5.4 Rear three-zone controls



Construction

In particular, the system consists of the following parts (see figure on page 9 and wiring diagram on page 11):

- NCL (climate control node) forming the governing unit
- Rear seat adjustment interface
- Three air mixing actuators (left front, right front, rear)
- Three air distribution actuators (left front, right front, rear)
- One air recirculation actuator



- One climate control system fan electronic speed regulator
- One temperature sensor downstream of the evaporator
- One internal temperature sensor integrated in the NCL
- One external temperature sensor located in the left external mirror
- This sensor does not belong to the climate control system but contributes to its operation by means of a signal transmitted via NQS and B-CAN
- One sun sensor located on the dashboard panel
- The system may be fitted with an optional AQS sensor located near the external air intake vent and a fog sensor located near the rain sensor.

An optional supplementary heater may be fitted aboard two/three-zone systems in diesel versions. This unit consists of a PTC resistor unit located downstream of the heater radiator.

Operation

These functions are controlled by seven electrical actuators (18, 19, 20, 21, 22, 23, 24) consisting of stepper motors each integrated in an electronic control unit. Each actuator is independent from the others and is a data acquisition unit. The NCL communicates with the control units via a serial bus (LIN) to pin 8 and are connected in series. The signal of the temperature sensor downstream of the evaporator is used by the ECU for calculating the temperature of the air to be let into the passenger compartment and is not a frost sensor. It also contributes to the vehicle speed signal and the engine speed.

IMPORTANT: The actuators cannot be switched because each once is equipped with dedicated software for their specific function. For replacements, order the new spare part by quoting the correct spare part number.

- The system will adapt automatically after disconnecting and reconnecting power or replacing parts. No alignment or resetting is therefore needed.
- A proxy alignment procedure must be run to replace the NCL.

10.5.5 Notes on sensor operation

AQS (Air Quality Sensor)

The AQS is used to detect the presence of pollutants in the air let into the passenger compartment. This sensor generates a PWM signal with 12V amplitude, whose duty cycle may vary in the range from 20% to 60% respectively, in the absence or presence of pollutants and is used by the NCL to close the recirculation flap. It is connected to pin 19 of the NCL.

Fog Sensor

The fog sensor detects the fogging up of the windscreen and makes the NCL automatically select defrost air distribution. The fog sensor provides a PWM signal with 12V amplitude whose duty cycle is established according to the degree of humidity inside the windscreen. It is connected to pin 20 of the NCL.

Sun sensor

The sun sensor is only used by the NCL to correct the air temperature let into the passenger compartment considering the degree of thermal radiation due to the presence or absence of sun. The device consists of two photodiodes arranged behind a screen which allows the crossing of particular light radiations. The sensor generates a linear analogue signal (0 5VDC) proportional to the detected radiation.

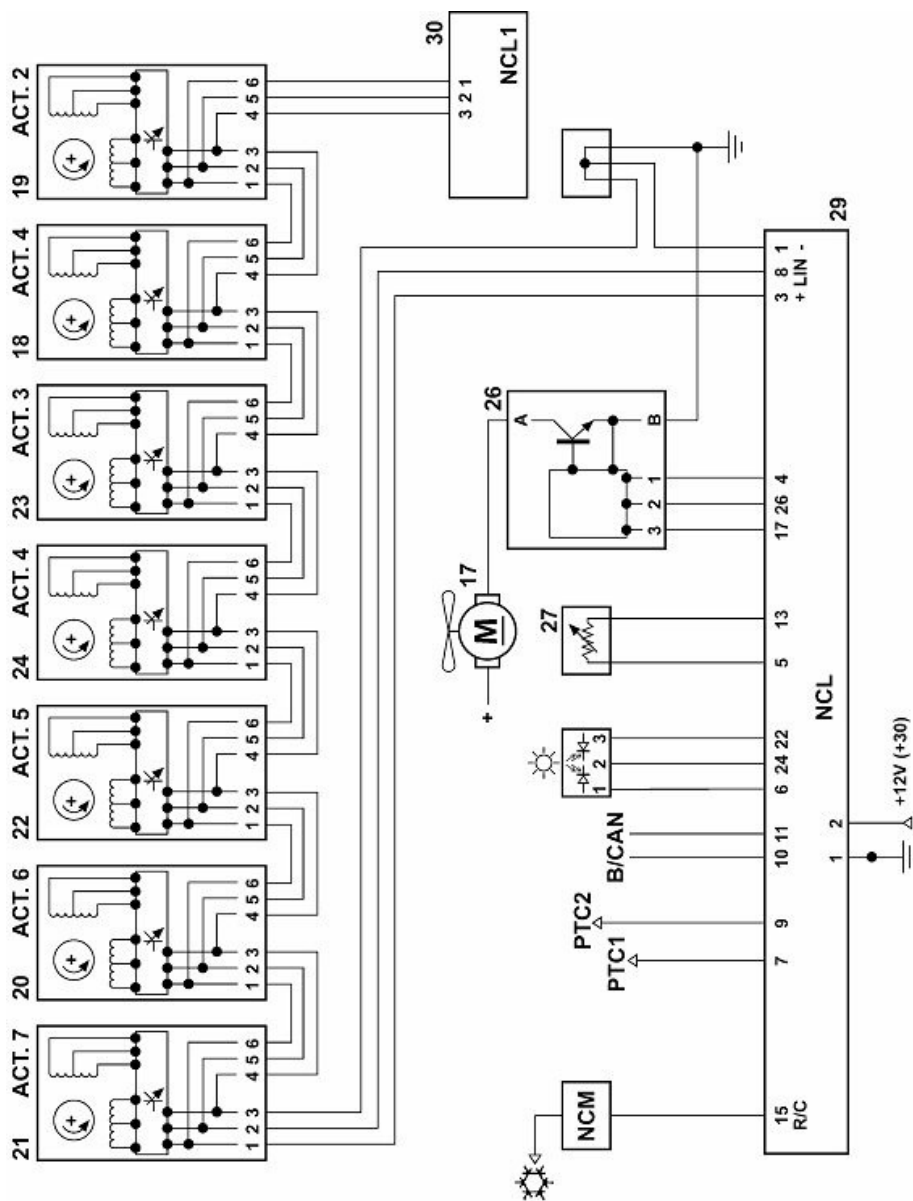


10. 11.12.13. Climate control system wiring connectors with dashboard wiring harness
14. Evaporator
15. Expansion valve
16. Weather strips
17. Climate control fan
18. Rear mixer actuator
19. Left front mixer actuator
20. Right front mixer actuator
21. Recirculation actuator
22. Rear distribution actuator
23. Left front distribution actuator
24. Right front distribution actuator
25. Heater piping seals
26. Fan speed electronic regulator
27. Evaporator temperature sensor (30 Kohm/20°C)
28. Cover
29. Climate control ECU (NCL)
30. Rear climate control system ECU
31. Mixing controls (two-zone system)
32. Actuator fastening screws
33. Supplementary heater PTC power (diesel) and fan power (one-zone system) relays
34. Sun sensor

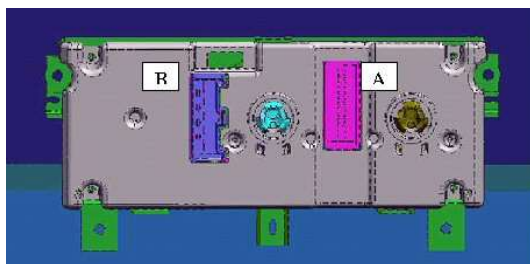
NOTE: The AQS and fog sensor are not shown in the technical drawing or the wiring diagram.



10.5.7 Two/three-zone climate control system wiring diagram



One-zone ECU pinout



Connector A

Pin	Signal description	Colour	Pin	Signal description	Colour
1	Ground (Gnd)	Black	14	A2 coil Recirculation	Brown/blue
2	+30 battery voltage (Vbatt)	Red/green	15	B2 coil Recirculation	Grey/brown
3	Not used	---	16	B1 coil Recirculation	White/black
4	PTC 1 relay	Red/green	17	A1 coil Recirculation	White/green
5	PTC 2 relay	Red/yellow	18	Not used	---
6	INT/A Blower relay	Red/grey	19	B2 coil Mode	Blue/green
7	Not used	---	20	A2 coil Mode	Brown/red
8	Not used	---	21	A1 coil Mode	Black/green
9	Not used	---	22	B1 coil Mode	Orange
10	Not used	---	23	B2 coil Mix	Green/mauve
11	Compressor (A/C Request)	Purple/black	24	A1 coil Mix	Brown/black
12	B-CAN	Pink/white	25	A2 coil Mix	Brown/yellow
13	B-CAN	Pink/black	26	B1 coil Mix	Blue/yellow

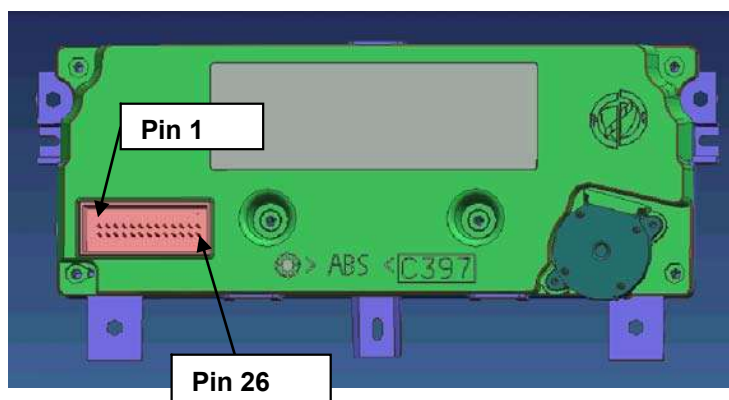
Connector B

Pin	Signal	Colour	Sec. (mm2)
1	Fan power relay ground	Red/black	4.0
2	Fan speed 1	Green/brown	2.5
3	Fan speed 2	Red/yellow	2.5
4	Fan speed 3	Grey/blue	2.5
5	Fan speed 4	Pink	4.0



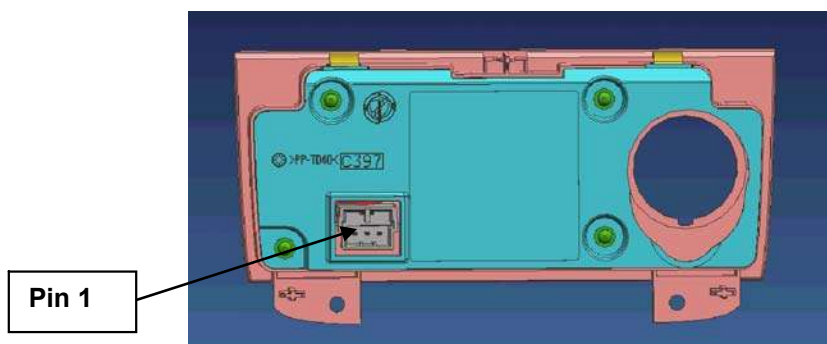
Two/three-zone ECU pinout

Front control head connector pinout: (NCL)



Pin	Signal	Wire colour	Pin	Signal	Wire colour
1	Ground (Gnd)	Black	14	Not used	---
2	+30 battery voltage (Vbatt)	Red/green	15	A/C Compressor (A/C Request)	Purple/black
3	+30 for Lin Bus (V.batt Lin Bus)	Orange	16	Not used	---
4	+30 Power Module (Vbatt PM)	Orange	17	Fan speed regulator PWM signal	White/black
5	Ground (Agnd)	Black/green	18	Not used	---
6	Sun sensor power	Blue/yellow	19	Air Quality Sensor (AQS) PWM Signal	Brown/black
7	PTC 1 relay	Grey/brown	20	Fog sensor PWM signal	Brown/yellow
8	Lin Bus	Green	21	Not used	---
9	PTC 2 relay	Blue/white	22	LH sun sensor (driver)	Green/mauve
10	B-CAN	Pink/white	23	Not used	---
11	B-CAN	Pink/black	24	RH sun sensor (passenger)	Brown/red
12	Not used	---	25	Not used	---
13	Evaporator sensor	White/green	26	Fan speed regulator feedback signal	Grey/blue

10.5.8 Head control rear connector pinout



Pin	Signal	Wire colour
1	+30 for Lin Bus (Vbatt Lin Bus)	Orange
2	Lin Bus	Green
3	Ground (Gnd)	Black



11. BODYWORK

11.1 SUNROOF

The sunroof is a mobile glass panel which tilts vertically and slides away horizontally. The glazing lets external light into the passenger compartment when closed offering an outside view. The full span on the glazing can be opened. The mobile panel slides in a specific seat between roof panels.

The sunroof consists of a tempered glass sliding element, electrically operated by an electrical motor and adjustable by means of a nine position selector knob (three spoiler positions and six foldaway positions) in addition to the closed position.

A weather strip in line with the profile of the roof is arranged along the edges of the sliding roof.

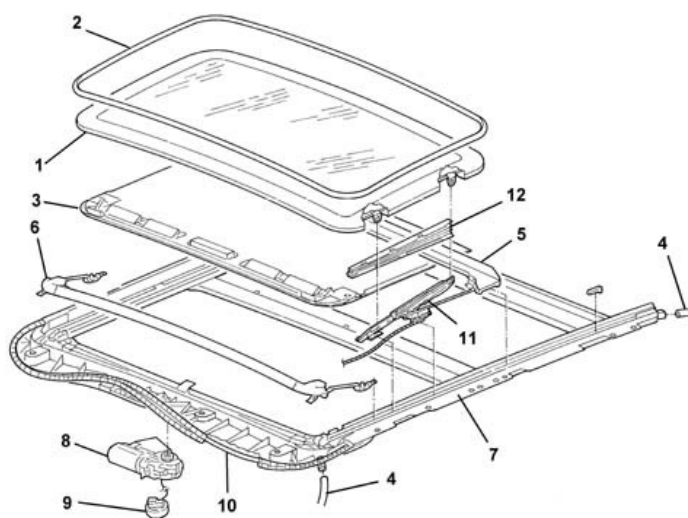
The sliding roof is also equipped with a manually operated rigid blind for shielding from the sun.

The knob is located on the ceiling light between the two ultrasound sensors. It controls the operation of the electrical motor via an ECU. Movement is obtained by means of two fixed racks onto which the sunroof carriage guides are anchored.

A safety function is activate when the sunroof is closing (sliding or tilting movements) to prevent the risk of crushing for passengers and objects caused by the moving panel.

Drain channels are present on the front and rear sides of the frame. These drain water through pipes provided with one-way valves to prevent water from leaking through the weather strips if the sunroof is not perfectly closed or badly aligned.

11.1.1 Sunroof components

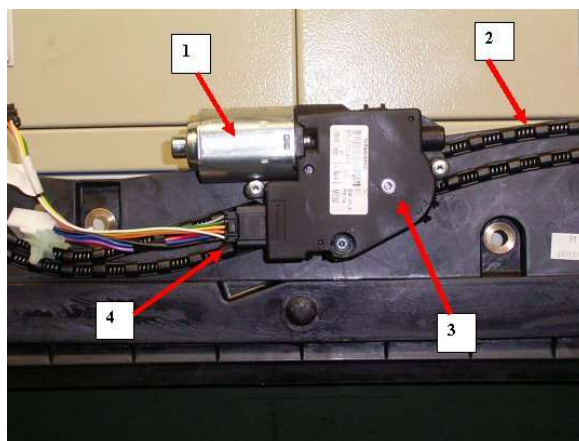


1. Tempered glass
2. Weather strip
3. Sun blind
4. Drain pipe
5. Drain channel
6. Tilting mechanism
7. Mechanism guide
8. Motor
9. Potentiometer
10. Flexible racks
11. Supporting tilting mechanism
12. Mechanism guard



The sunroof consists of the following parts:

- A frame consisting of two aluminium guides in which the mechanisms and the two crosspieces slide (front crosspiece made of plastic and rear crosspiece made of metal and joined to side guides).
- A right and left system of mechanisms inserted in aluminium guides for moving the glass panel operated by an electrical motor via a metallic spiral wire.
- A manually moveable sun blind with handle and slots for letting air through.
- A tempered glass panel, 4 millimetre thick, low energy (<17%) and light (>35%) transmission.
- A direct current motor and geared reducer, a magnetic wheel fitted on drive shaft, one or more Hall effect sensors and a 6-pin interface connected to the vehicle wiring harness.
- An electronic control unit.
- A knob for selecting the various opening and closing positions with additional cut-out position.



1. Electrical motor
2. Racks
3. Emergency screw
4. Electrical connector

11.1.2 Operation of the sunroof

The sunroof is moved along the sliding guides on the frame by an electrical motor which can be controlled manually by means of the selector knob or remotely (where fitted) via a control sent by the body computer to the ECU.

The motor moves the flexible drive racks housed in the specific housings in the frame onto which the sunroof supporting tilting mechanisms are anchored to the required point or position.

The sunroof is equipped with a manual blind and handle to shield from the sun.

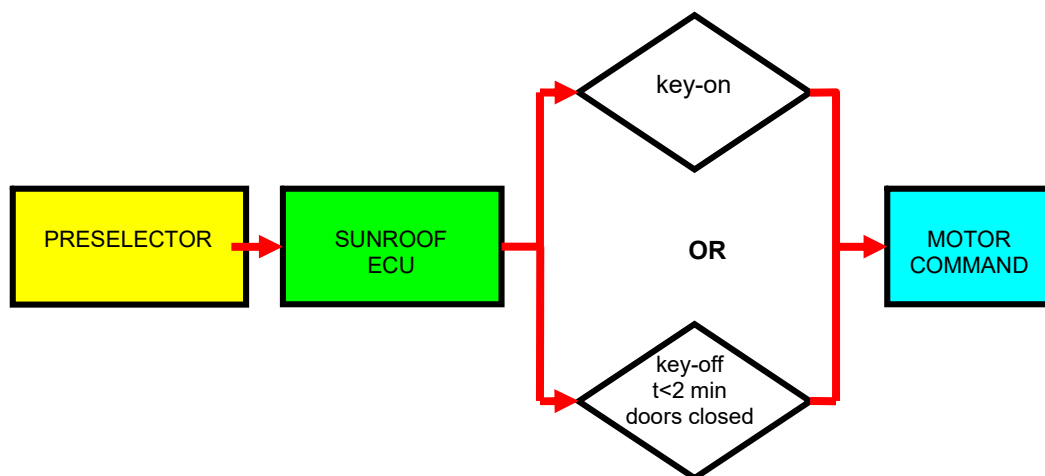
The blind is folded away with the sunroof inside the roof panel. When closing the sunroof, the blind will partially project to make the handle accessible.

The sunroof is operated by means of the opening/closing pre-selector on the front central ceiling light.

11.1.3 Operating logic

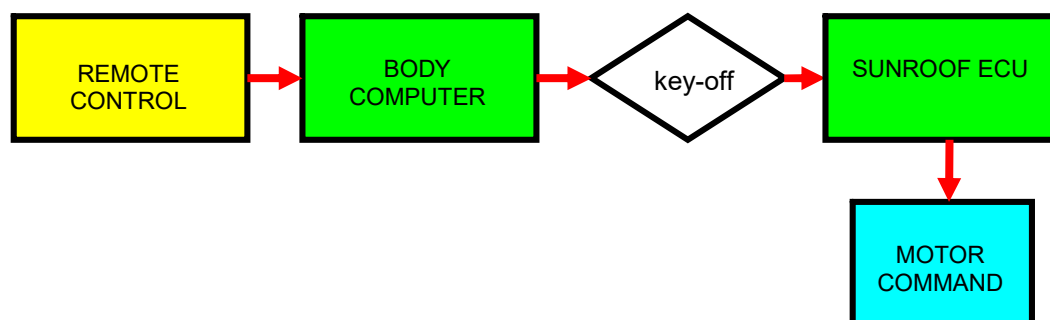
The operating logic is described below. The electrical motor is controlled by an ECU.



Manual control via pre-selector

The sunroof can be moved to one of the programmed positions by turning the selector knob in the following cases:

- at key-on
- during the first two minutes after key-off or until one of the doors is opened.

Remote control

Opening/closing from remote control (at key-off): the CTA receives the signal for operating the sunroof from the body computer.

Notes

The pinch force safety protection function is active for the entire stroke (except for the last 4 mm) during closing operations (horizontal and/or vertical). Specifically, the pinch force safety function is always active during operations controlled by the remote control. The inhibit position can be selected for local operations using the manual selector knob by pressing the switch to close the sunroof without the safety protection.

The movement will be completed if service relay 2 switches from on to off (two minutes after key-off or when a door is opened) while the sunroof is moving following a manual control.

If an automatic control is received at key-off while a manual control is in progress, the manual control is completed. A new remote control must be sent to move the sunroof automatically after this.

Remote movements can be stopped by the user either by changing the position of the manual selector knob or by pressing the inhibit button.



The sunroof will ignore the remote control and reach the newly set position on the selector.

Pinch force safety function

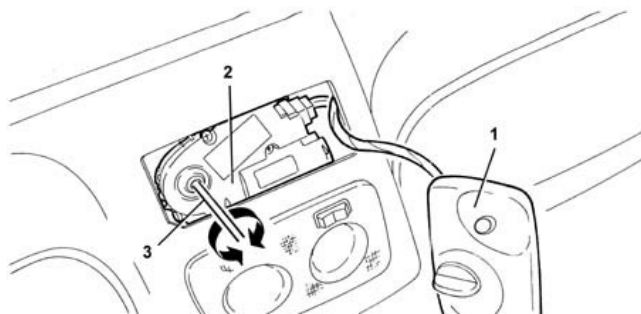
The pinch force safety function managed by the ECU protects occupants from movement controlled from inside the vehicle in compliance with Directive 2000/4/EC. It is active during horizontal closing (front edge) and vertical closing (rear edge) and trips when an obstacle (e.g. finger, hand) is encountered. The possibility of pinching between the sides of the sunroof is prevented by adopting side guards which prevent access to dangerous areas.

Movement of the panel is automatically stopped when an obstacle obstructing the movement of the panel is detected. The panel may stall for no longer than 20-30 milliseconds (to prevent an unpleasant pinching feeling) and the movement is reversed to return to the programmed position.

- The function is active for the entire horizontal stroke (if the sunroof is opened by more than 4 millimetres) and trips if an obstacle is encountered on the front side of the glass panel. Motion is reversed for 100 millimetre from the point of encounter.
- The function is active for the entire vertical stroke (if open for more than 4 millimetres from the edge of the weather strip) and trips if an obstacle is encountered on the rear end of the glass panel. Motion is reversed to reach max tilting position.

The inversion load is <100 N as requested by Directive 2000/4/EC in both cases.

11.1.4 Emergency operation



1. Volumetric sensor support
2. Control electric motor
3. Operating key

In the event of an emergency or servicing without power, the front motor can be operated manually to open/close the front glass panel as follows:

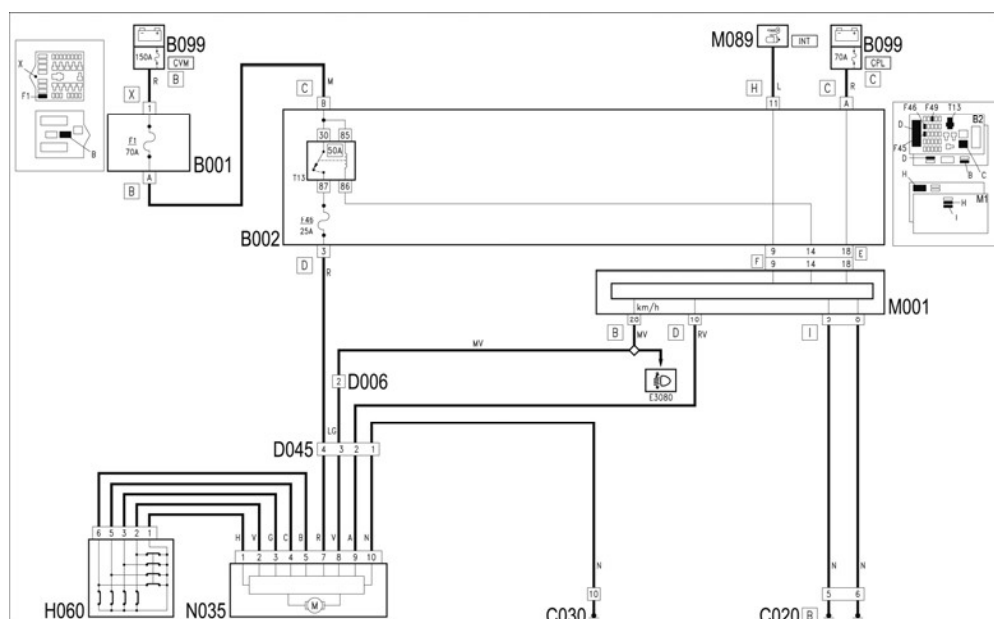
- Remove front central ceiling light.
- Insert an emergency key in the motor.
- Turn the key to close or open the panel (turn accordingly).

11.1.5 Initialisation procedure

- Turn key on.
- (Note: Wait for three seconds after key-on to replace a geared motor. Turn key off and wait for three seconds. Turn the key on again and proceed as follows.)
- Turn the knob all to the left (anticlockwise).
- Press the knob and hold pressed until the sunroof is mechanically locked (clearly visible).
- Release the knob.
- Within 5 seconds, press the selector again and hold it pressed.
- The sunroof will start an automatic cycle after a few seconds. Hold the selector pressed.
- Release the selector when the sunroof initialisation ends.
- The sunroof will be in the 0 position. Turn the selector knob and take the sunroof to the required position.



11.1.6 Wiring diagram



Component code	Description
B001	Engine compartment fusebox
B002	Fusebox under dashboard
B099	Maxi fusebox on battery
C020	Dashboard ground on driver's side
C030	Ground on central tunnel
D045	Sunroof connector
H60	Sunroof switch
M1	Body computer
M089	Ignition switch
N35	Sunroof motor

11.2 SEATS

11.2.1 Features of the seats

Front seats

The front part of the front seats is optimised to prevent anti-submarining, i.e. to prevent the occupant's body from slipping forward underneath the seatbelts in the event of a violent front collision. This considerably contributes to limiting injuries for the abdomen and thighs by reducing forward acceleration of the body. The main features of the front seats are:

- The seats are provided with an efficient spring system in the ischiococcygeal area made of thin plastic coated steel wires anchored with springs to the external frame to favour vibrational comfort and particularly to dampen vibrations induced by road roughness (e.g. tram lines, etc.).





- A modern lumbar support system is provided. The system is specifically dimensioned to more completely adapt to the occupant's back and support it in a relaxing way by being very wide and functional.



- The driver's seat can be adjusted in height and has a vertical stroke of approximately 50 millimetres.

The seat's height can be adjusted with the knob. Operation is very light and easy. Longitudinal sliding guides are provided.

They are fitted at a 4.5° slant which pulls the seat slightly upwards as it moves forward.

The driving position can be optimised for a very wide range of drivers by adjusting the height of the seat and the axial position of the steering wheel.

The backrest slant adjustment is continuous and regulated by means of a knob located in the area of the backrest facing the inside of the passenger compartment.

The lumbar support can be adjusted in some versions on both the driver's and the passenger's seat using a knob on the outer side of the seat which controls a mechanism that varies the push in the lumbar area of the backrest.

The front seat foam is comfortable thanks to variable lift (this parameter measures the capacity of the padding to give under the weight of the body).

FRONT SEAT FEATURES:

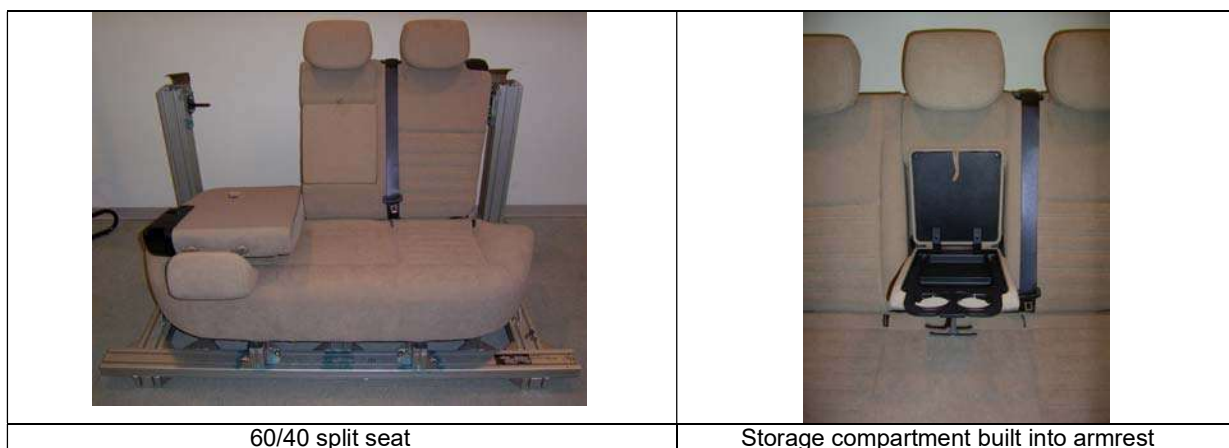
- Distance between guides 446 mm; stroke 242 mm
- Continuous backrest adjustment with two-sided joint
- Headrest adjustable on the Z axis by approximately 40 mm
- Semi-parallel standard seat height adjustment system on driver's and passenger's side



- Optional tilt function for both front seats
- Side bag installed inside seat upholstery
- Adjustable lumbar support

Rear seats

The standard rear seat is split (40/60) and the cushion can be tipped.
The rear seat cushions have optimal design to prevent anti-submarining.
The rear seat foam is comfortable thanks to variable lift (this parameter measures the capacity of the padding to give under the weight of the body) in different areas of the seat (cushion, backrest, sides of cushion and backrest).

**REAR SEAT FEATURES:**

- Number of seats: 3
- 40/60% split backrest
- Height adjustable headrests
- Padded central armrest
- Central armrest with built-in storage compartment.

Three-point seat belt for middle passenger integrated in backrest when this is tipped.
Three-point Isofix fasteners (two on cushion and on one backrest).



11.2.2 Front seat structure

	
Right front seat with height adjustment and tilting system	Left front seat with height adjustment and tilting system

Anti-whiplash system

The front seat backrests are provided with an anti-whiplash system which tilts in a rear end collision. The headrest is moved towards the occupant's head to reduce bouncing of the head which can cause whiplash.

The system does not need to be operated because the backrest advances by effect of the energy of the collision itself. It is held in normal position by a spring that automatically restores the original backrest position.

The mechanism therefore does not need to be adjusted nor restored after a rear end collision.

The figure below shows the two positions of the backrest, in normal position and when the anti-whiplash system is in action.



1. Axis of backrest in normal position
2. Axis of backrest with anti-whiplash spring in action

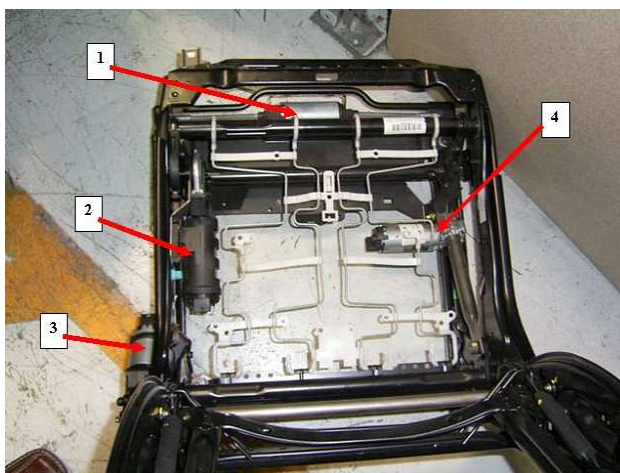
Detail of the anti-whiplash spring

11.2.3 Electrically adjustable seats

Electrically adjustable front seats are available on demand. The driver's side seat is provided with three pre-settings for storing the various configurations.



Electrically-adjustable front seat structure

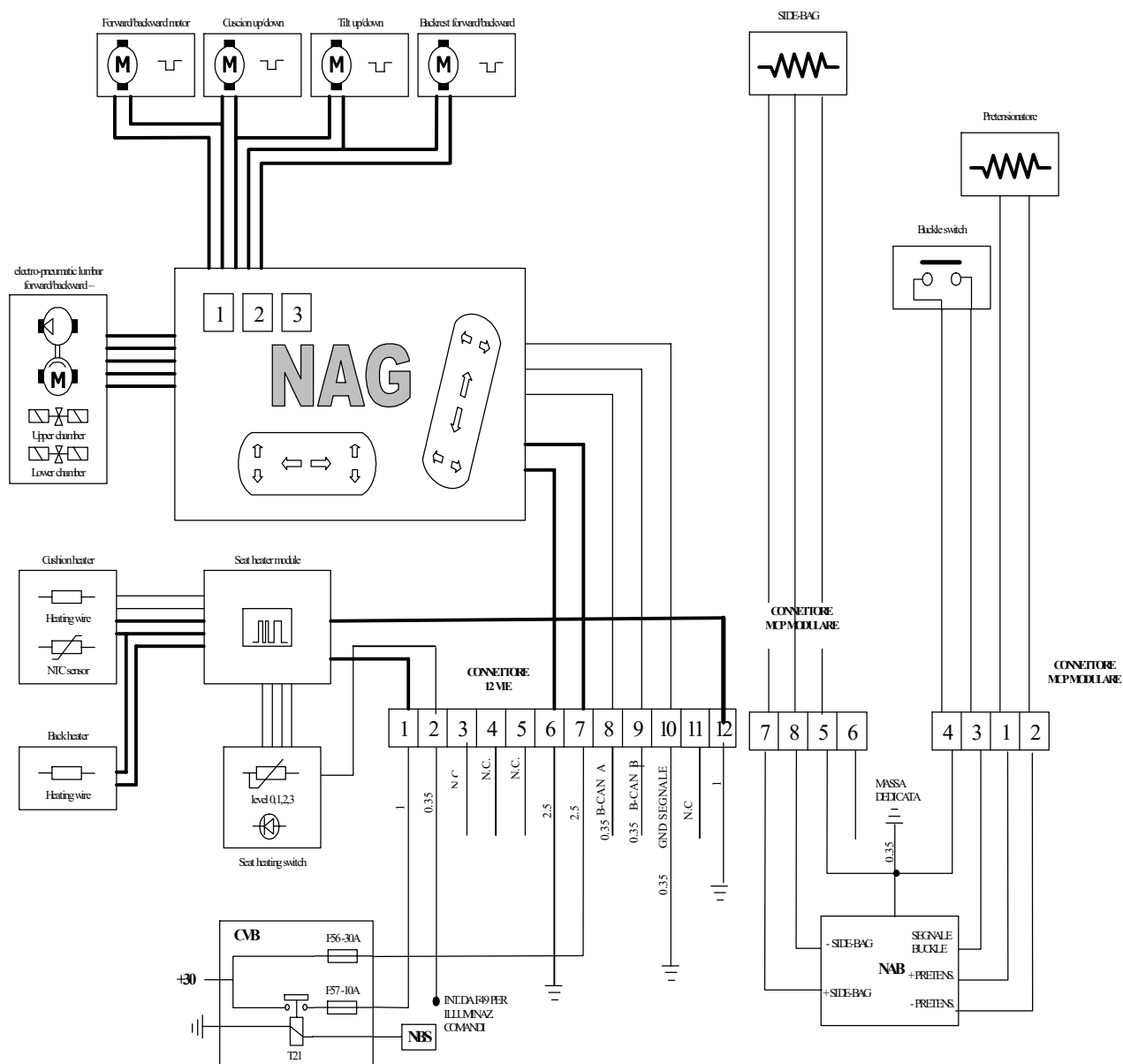


1. Longitudinal seat adjustment
2. Seat tilt
3. Backrest tilt
4. Seat height adjustment

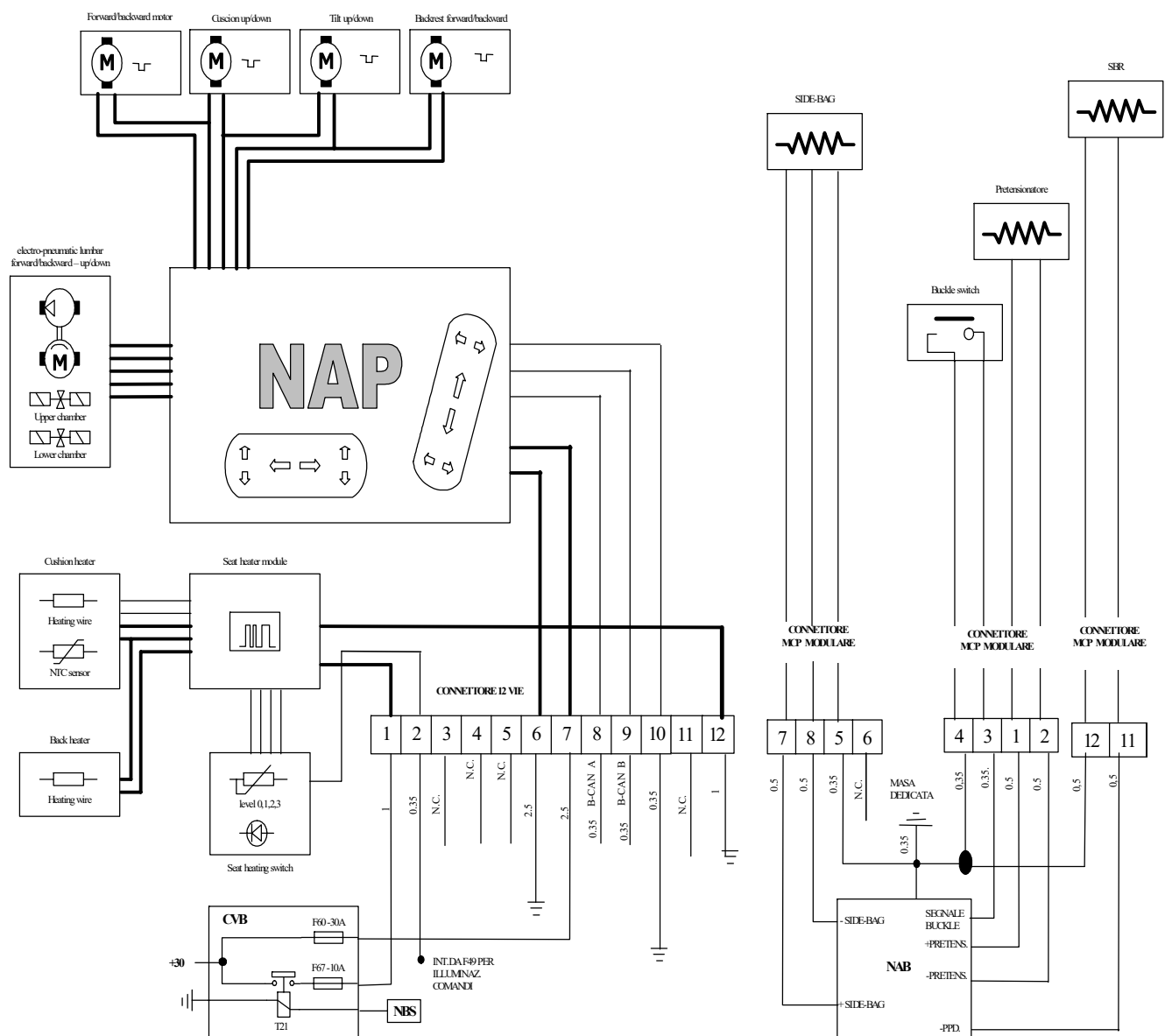


Electrical seat diagrams

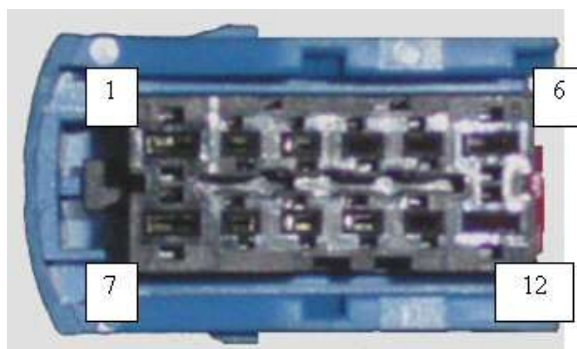
Wiring diagram of driver's seat



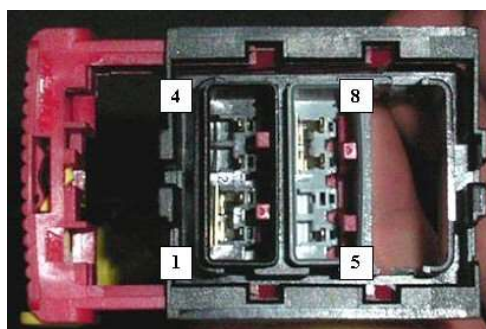
Wiring diagram of passenger's seat



Front seat interface pinout



DRIVER'S SIDE	
PIN	FUNCTION
1	Heater power
2	Heater control light
3	(Not connected)
4	Not connected
5	Not connected
6	NAG/NAP power ground
7	+30 NAG/NAP
8	B-CAN A
9	B-CAN B
10	NAG/NAP signal ground
11	Not connected
12	(seat heater ground)

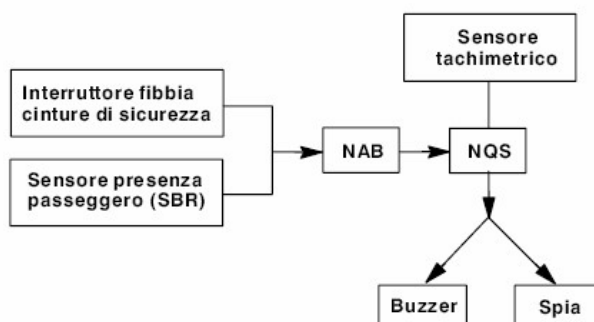


PIN	FUNCTION	
1	Pretensioner positive	
2	Pretensioner negative	
3	Buckle switch signal	
4	Buckle switch ground	
5	Side bag ground	
6	Not connected	
7	Side bag positive signal	
8	Side bag negative signal	
1	Not connected	For passenger side interface only
2	Not connected	
3	SBR signal	
4	SBR negative	

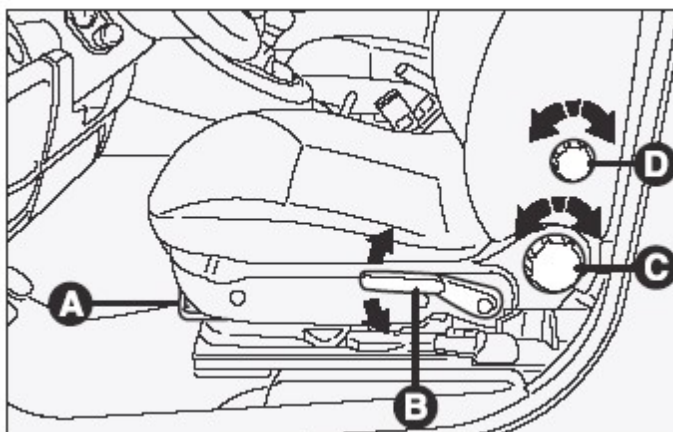


Passenger presence sensor (SBR)

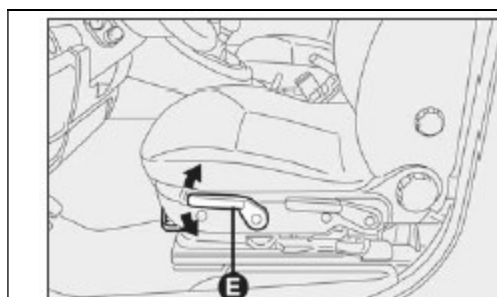
The SBR is installed under the cover of the passenger seat cushion. Along with the airbag ECU (NAB) and the instrument panel node, the sensor informs the driver and the passenger that the seat belts are not fastened by means of acoustic and visual reminders.

**Seat operation**

Manually adjustable front seats (replace pictures with those of the Alfa 159)

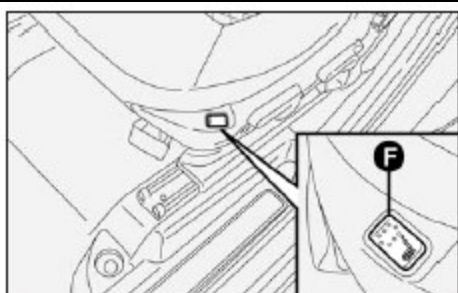


To adjust in the longitudinal direction, simply lift the lever (A) and move the seat. To adjust in height, operate lever (B). Knob (C) is used to adjust the seat tilt and knob (D) is used to adjust the lumbar setting. The other possible settings are shown in the following table:

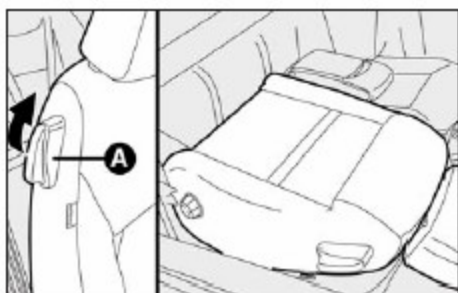


Tilting (where fitted)



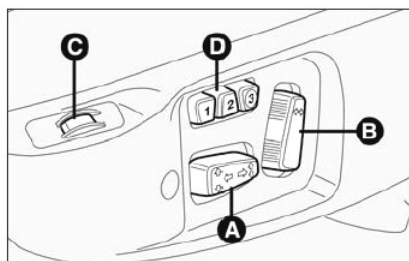


Heating: press the button at key-on only. A LED in the button will light up to indicate that the system is working. The button is replaced with a four-position knob in electrically adjustable seats.



Front backrest folding to form a table.

Electrically adjustable front seats



Adjustment is possible at key-on or for one minute after key-off or extraction of the key or for three minutes after opening the doors.

- Longitudinal adjustment: (A).
- Height adjustment: turn the knob (A) anticlockwise to lift the rear end of the cushion; turn clockwise to lift the front end.
- Backrest slant: control (B).
- Heater (C).

Storing driver's seat positions

Three different positions of the driver's seat and external rearview mirrors can be stored and recalled. Press one of the buttons (1), (2), (3) for three seconds until a confirmation tone is heard to store the current seat and mirror position. A new position will be stored if the same button is held pressed again. The preset seat positions do not comprise lumbar adjustment and heating.

The car speed must be less than 10 km/h to recall a preset position.

Pressing of any button while a preset position is being recalled will stop the function ('anti-panic' mode).

