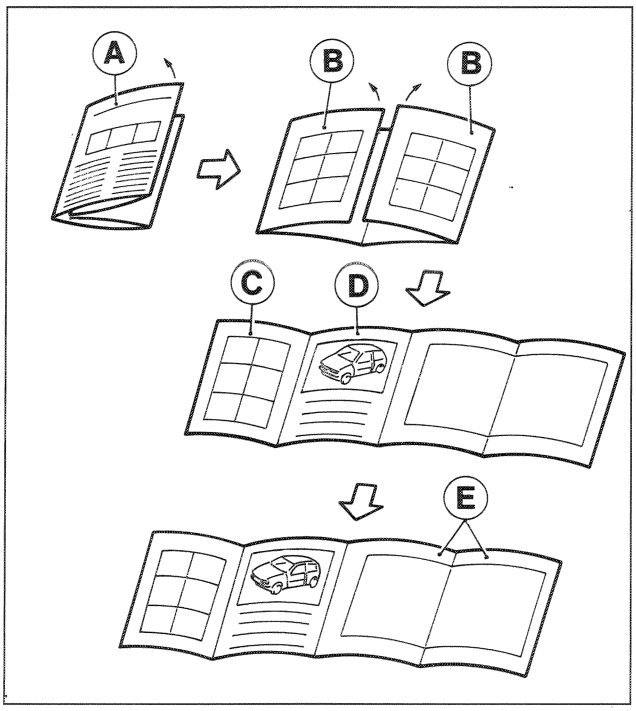
INTRODUCTION

Structure of the publication and how to use it

In this publication the fault diagnosis for the vehicle's electrical equipment is dealt with in functional groups: these groups are listed in the index at the begininning of the publication.

1. The graphic section is made up of several sheets of paper divided into different pages by a series of folds.
2. The diagnostic section for the functional group is composed of several pages bound in one volume.

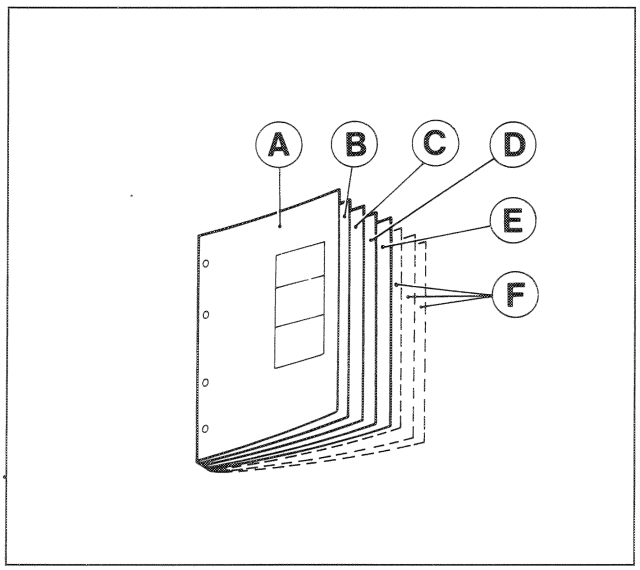
There follows an example of how to interpret the order of the pages correctly by opening the sheets of paper which make up the fault diagnosis for a group and the contents of each of them.



P3M001N01

Graphic section

A. There is the cover made up of symbols and a description both general and functional of the functions examined.
B. The second and sixth pages contain diagrams showing the location of the components.
C. The third page contains diagrams showing the location of the components.
D. The fourth page contains the wiring on the vehicle and the key for the electrical equipment.
E. The fifth page contains the wiring diagram for the system being examined.



P3M001N02

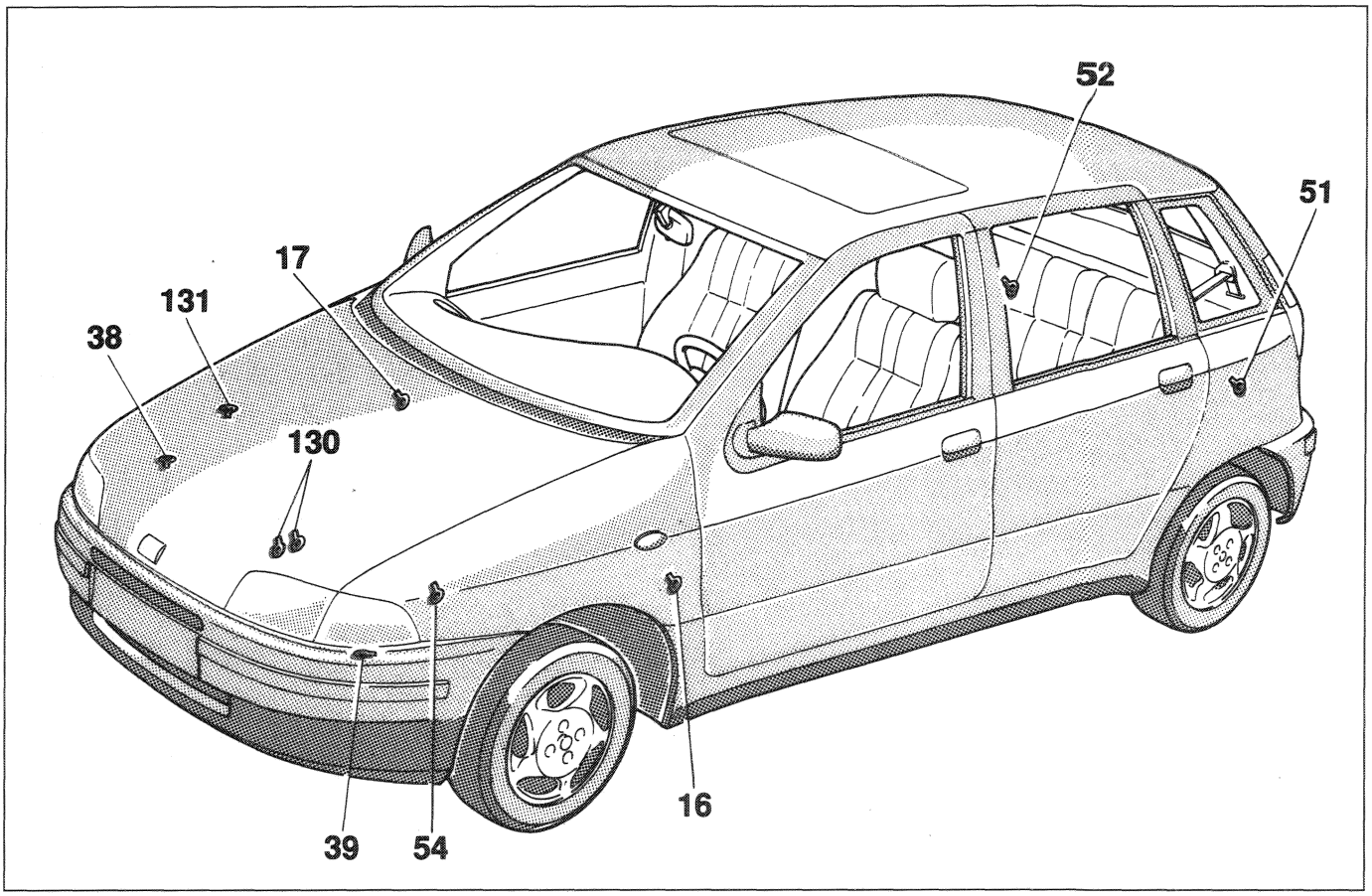
Fault diagnosis for the functional unit with a block diagram

A. Cover
B. First page
C. Second page
D. Third page
E. Fourth page
F. Further pages to follow

GENERAL WARNINGS

Before starting, in order to carry out a correct fault diagnosis, the following operating conditions must be checked and satisfied :

- Battery charge
- The connection between the connector block (36) and connector "A" for the junction unit (7) should be in working order.
- The connection between the negative battery pole, the bodywork and the engine should be in working order.
- All the connections to earth on the vehicle, and in particular the connection points listed below, should be properly tightened, not show signs of oxidation, the terminals should be corrected attached to the cables without distortion and the cables should not be worn.



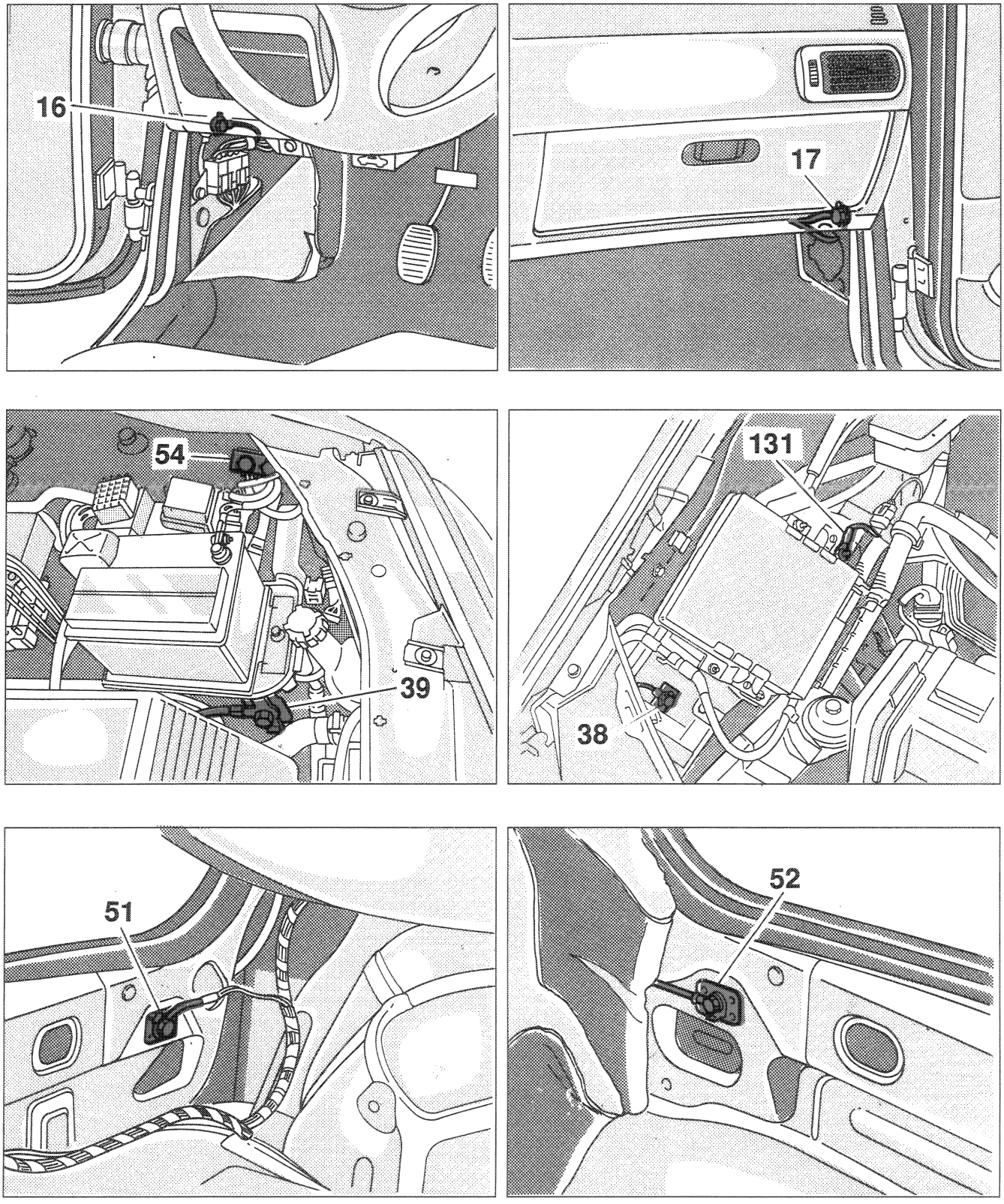
P3M002N02 P3M002N01

Location of earth points on vehicle

Earth code key :

16. Left dashboard earth
17. Right dashboard earth
38. Right front earth
39. Left front earth
51. Left rear earth
52. Right rear earth
54. Battery earth
130. Earths on engin
131. Earth on electronic injection control unit

Detailed location of earth points



P3M003N02 P3M003N01

Key for earth points on vehicle:

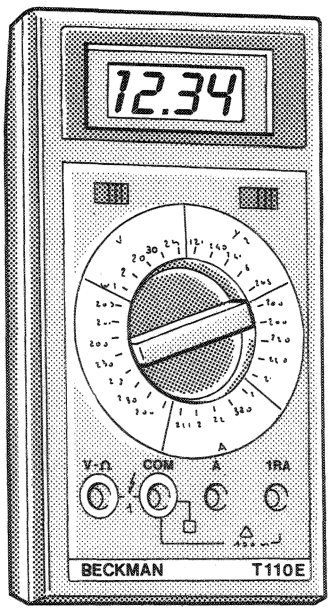
16. Left dashboard earth
17. Right dashboard earth
38. Right front earth
39. Left front earth
51. Left rear earth
52. Right rear earth
54. Battery earth
130. Earths on engine
131. Earth on electronic injection control unit

DIAGNOSTIC INSTRUMENTS

MULTIMETER

In order to measure voltage, current and resistance it is advisable to use a digital multimeter.
This instrument is equipped with a single function switch which allows rapid selection of the function, a liquid crystal display with automatic polarity indication and a decimal point and end of scale which are very clear and easy to read.
The use of high quality materials, protection from overloading and insulation from radio interference make this a reliable and sturdy instrument.
The multimeter is a useful and versatile instrument, capable of carrying out eight different functions over a range of twenty nine measurements. In addition to the conventional measuring functions listed above, this instrument also makes it possible to carry out the diode test and check the continuity with a buzzer.

It should be remembered that measurements made using a multimeter are valid if the electrical contact for the terminals is working properly (i.e. electrical continuity has been established) and the measurement lasts at least 2-3 seconds.



P3M004N01

Using a multimeter as a voltmeter

When voltage is being measured, unless specified otherwise, adjust the multimeter to 20 Volt at the end of the scale, thereby allow voltages in the order of 0.01 Volts to be measured.

Never measure voltage at the ignition coil positive with the power unit switched on, because the measuring instrument may be damaged.

Using a multimeter as an ohmmeter

When a resistance measurement is being carried out and it is not specified otherwise, adjust the multimeter to 200 Volt f.s., thereby allowing decimal resistance values to be read.
Electrical continuity refers to a reading on the instrument close to 0. A value close to the end of scale selected indicates the insulation of or a break in the connection between the terminals of the components being examined.
It is not advisable to rely completely on resistance value measurements close to or less than 0.5Ω because a poor contact at the terminals in question could introduce a contact resistance which is greater than the value being measured.

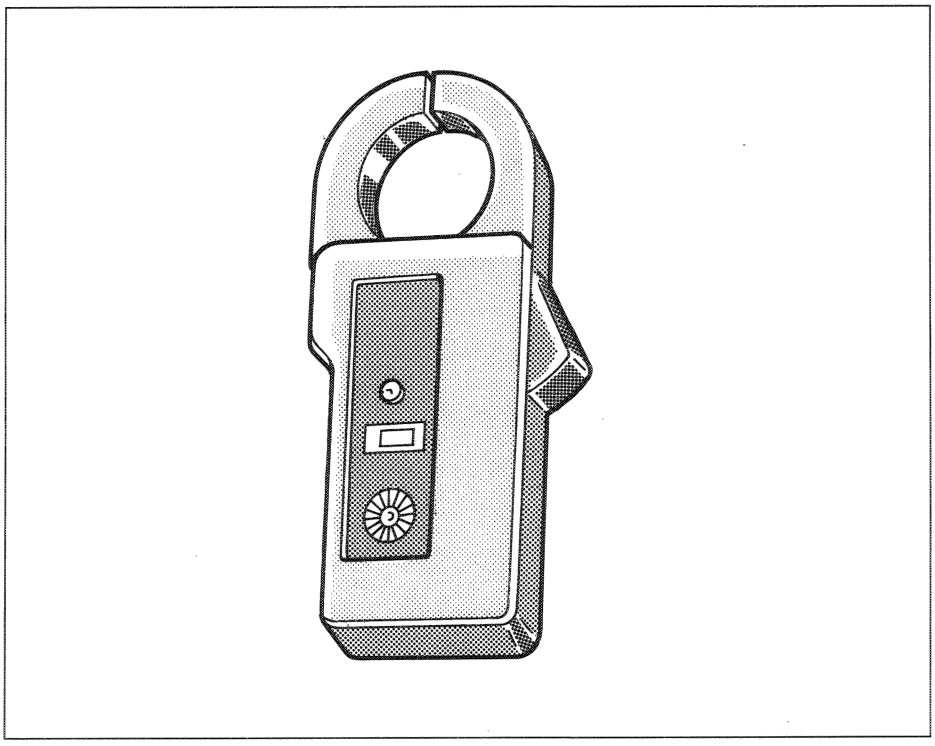
Always disconnect the supply from the component in question.

Using a multimeter as an ammeter

When current is being measured, unless otherwise specified, adjust the multimeter to 10 Ampere at the end of the scale, thereby allowing resistances in the order of 0.01 Ampere to be measured.

For measuring currents in excess of 10 Ampere it is necessary to use ammeter pliers suitable for measuring direct currents.

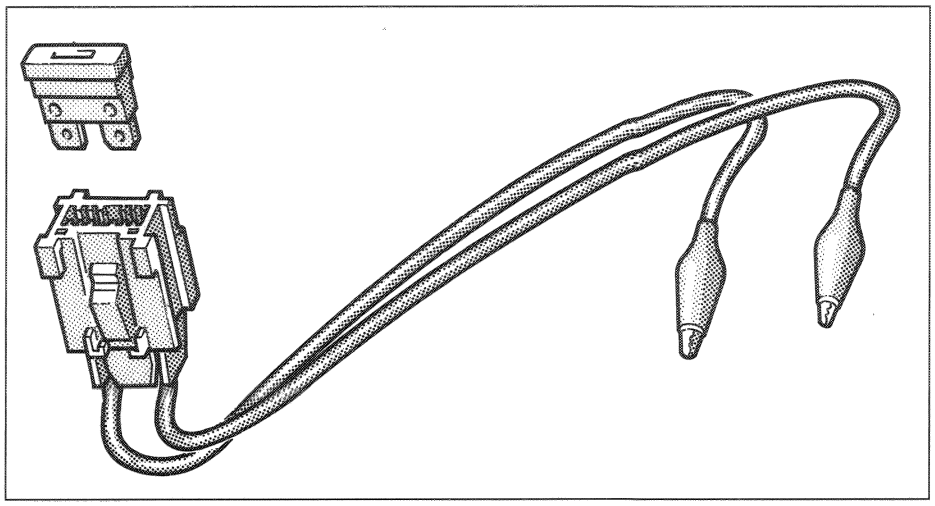
When using the ammeter pliers, refer to the instructions enclosed with the measuring instrument.



P3M005N01

BRIDGE

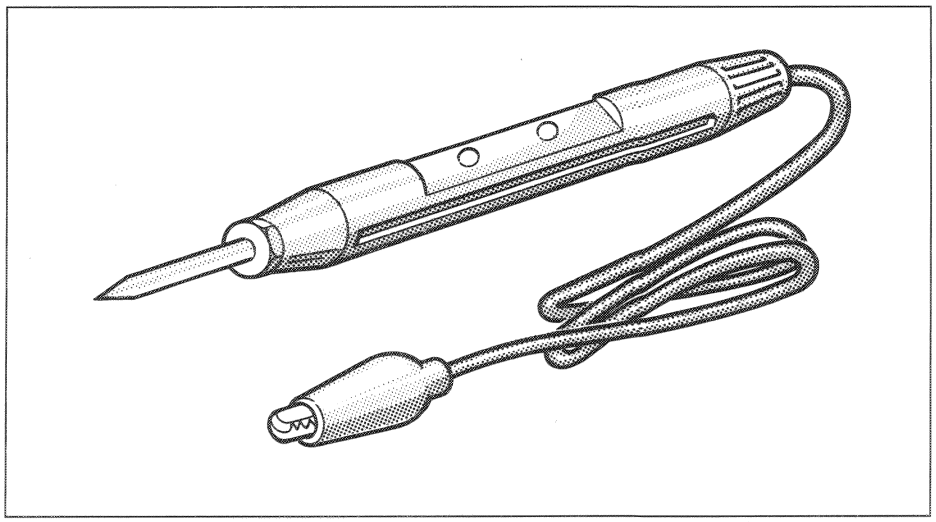
During the diagnostic operations it is sometimes necessary to simulate the closing of a contact or to short circuit a switch.
In these cases a bridge is used: this simple device is made up of a suitable length insulation cable, without insulation at the ends or with terminals; a fuse carrier is fitted about halfway along the cable.
Sometimes a suitable size fuse to protect the circuit which is short circuited is fitted on the fuse carrier.



P3M006N01

POLARITY DETECTOR

In order to detect fast variations in voltage, for example the operating voltage at the central locking geared motor terminals, a polarity detector has to be used.
The polarity detector indicates whether there is a difference in power between the probe and the terminal, irrespective of the reading and the polarity.
This takes place by a green coloured warning light coming on if the terminal is connected to earth and the probe to a positive, whilst a red warning light comes on if the terminal is connected to the positive and the probe to earth. If there is no power between the terminal and the probe neither light comes on.



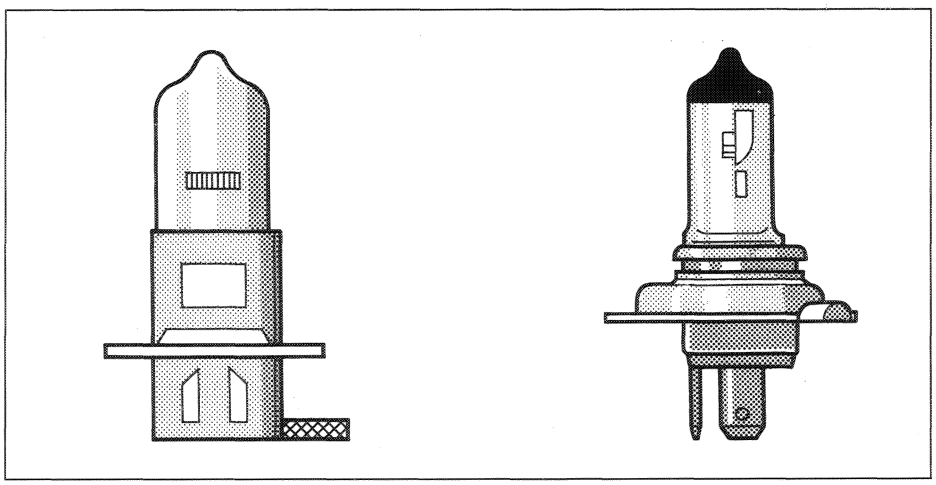
P3M006N02

MAIN SYSTEM COMPONENTS

BULBS

Different types of bulbs are used on the vehicle depending on the usage and type of lighting required. These bulbs may be either halogen or incandescent; the former are used in active safety devices (exterior lighting), the latter in passive safety devices (interior lighting, side light, and direction indicators). The bulbs are characterized by the operating voltage and their power; as the power of a bulb increases it internal resistance decreases: a bulb for a fog lamp therefore has a lesser internal resistance than a bulb for a direction indicator.

The condition of the bulb can be tested by proceeding as follows: switch a multimeter to "Ω x1" then connect the probes to the terminals on the bulb body: if the reading is infinite, the filament is broken, whilst if the reading is close to 0 Ω. then the bulb is intact. On halogen lamps the bulb may turn black (due to ageing or air penetration) or silvery (this fault is a sign of the poor operation of the recharging system or a slack connection which is causing excess voltage); in both cases the bulbs should be replaced. The measurement should be taken with no supply to the bulb.



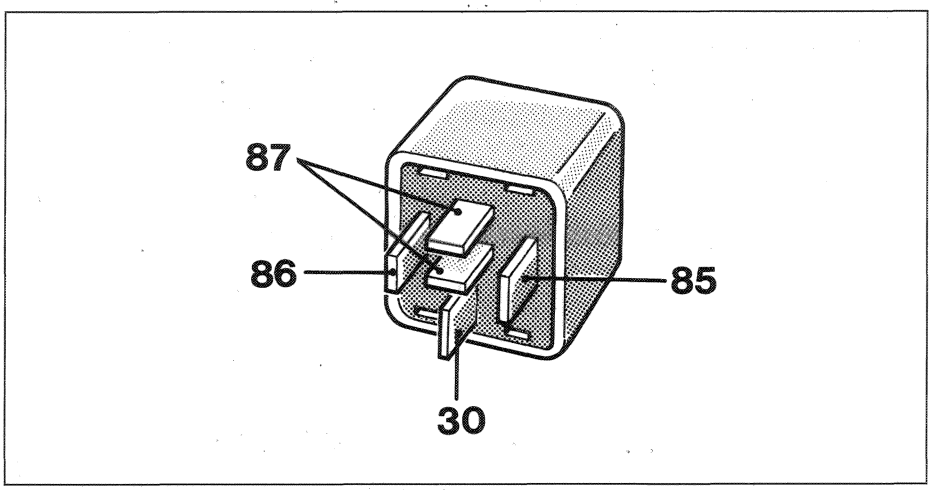
P3M007N01

On the halogen headlamps the bulbs are made from quartz and not glass: on account of the high operating temperature, any grease on the surface of the bulb causes the "devitrificaton" of the quartz with the consequent deterioration of the luminous qualities of the bulb.

Halogen lamps should be handled by the metal collar, avoiding touching the actual bulb with one's fingers; if this does take place, thoroughly clean the bulb with heptane or an equivalent de-greasing product.

RELAYS AND REMOTE CONTROL SWITCHES

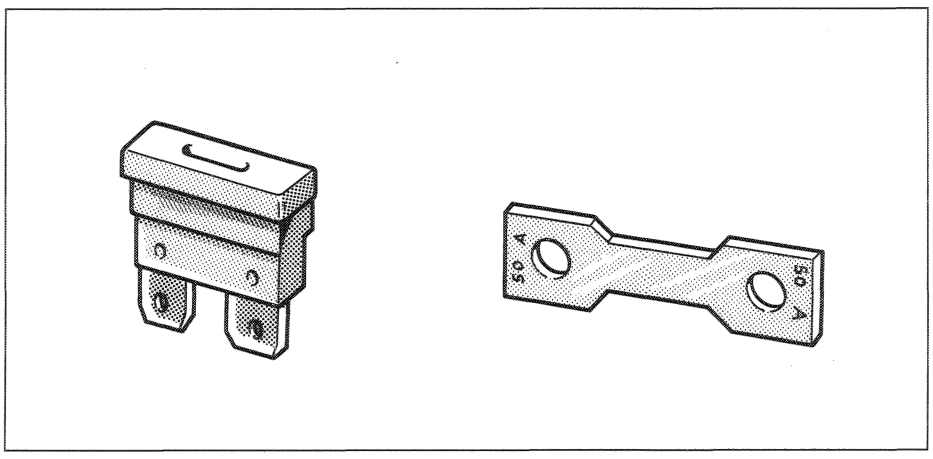
These components are normally used in the field of electro-technics/-electronics for their notable current switching properties.
By passing a control current between terminals 85 and 86 it is possible to create a far greater current at terminals 30 and 87.
They take advantage of certain electro-magnetism properties on account of which a solenoid on a magnetic through which a current passes through creates a magnetic field capable of attracting conducting materials; in effect, when a current is applied to terminals 85 and 86, the electro-magnet creates an electro-magnetic force which attracts one terminal of the conducting material on the circuit between terminals 30 and 87.
The switching persists until the control current is interrupted.



P3M008N01

FUSES

The fuses are basically used to protect the electric circuits from current overloads.
These components are made up of a conductor which cuts out if the current exceeds the value for which the fuse is designed.

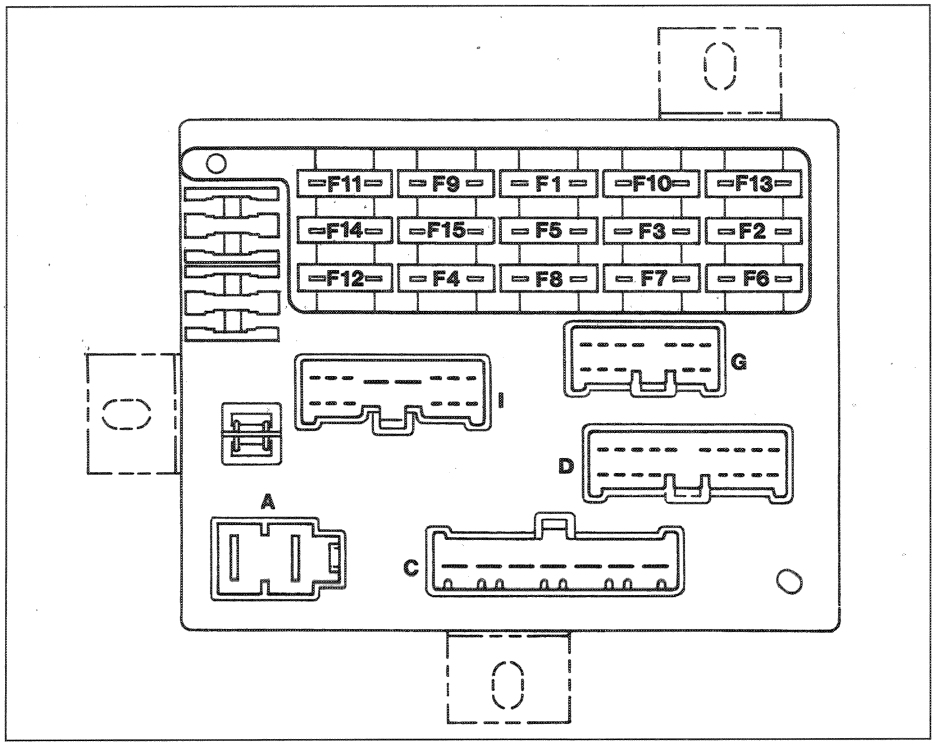


P3M008N02

Before replacing a fuse the cause of it blowing must be determined. If the fuse supplies more than one circuit then the problem may be caused by a fault in a different circuit from the one suspected.

JUNCTION UNIT (fuse side)

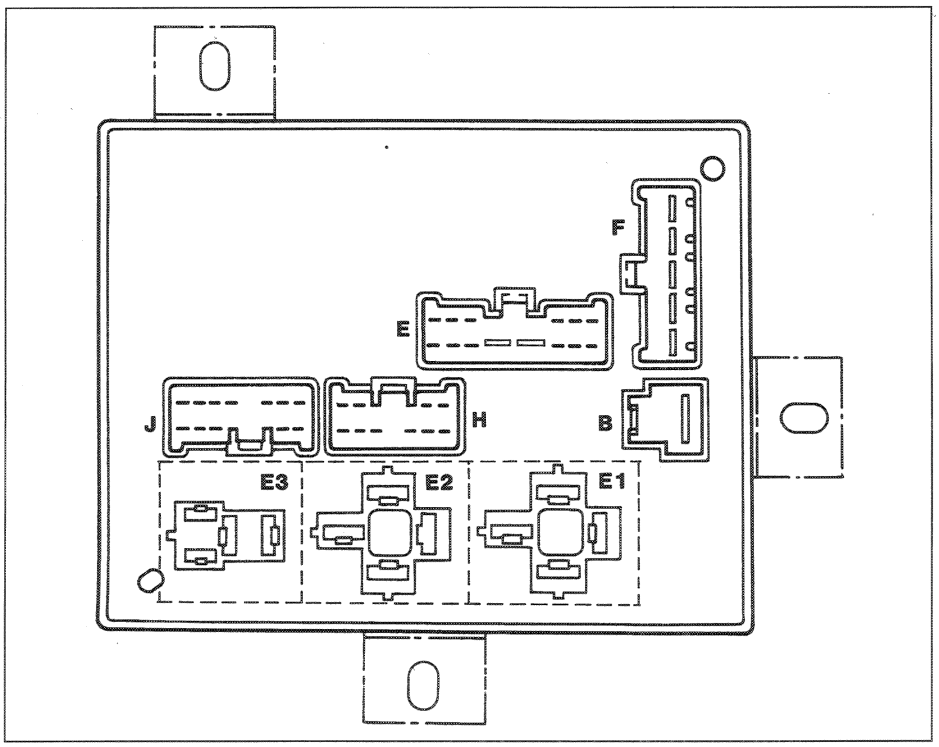
The junction unit, fuse side is made up of 15 fuses which are different colours according to the amperage:



P3M009N01

JUNCTION UNIT (relay side)

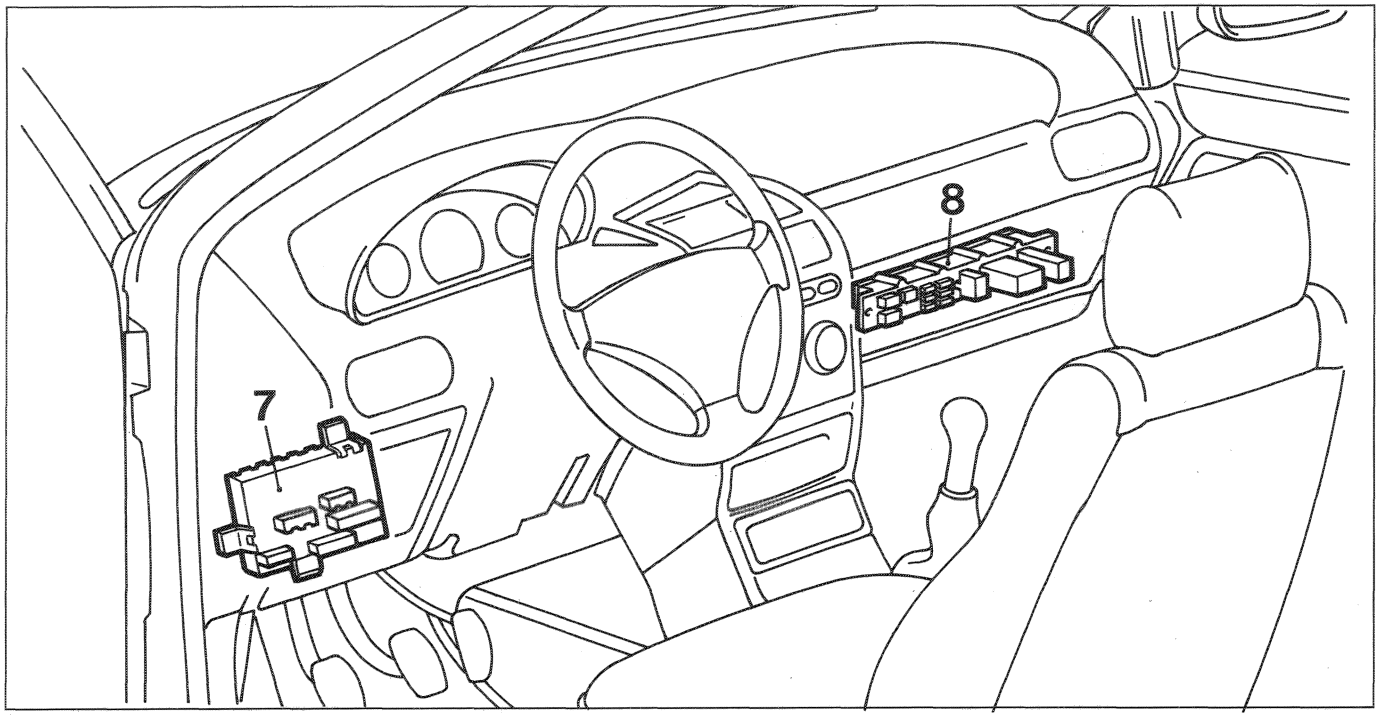
The junction unit, relay side is made up of:
E1 Ignition discharge relay
E2 Electric horns relay feed
E3 Heated rear windscreen relay feed
The diagram shows the layout for the above mentioned components.



P3M009N02

Location of the junction unit and control unit for optional equipment

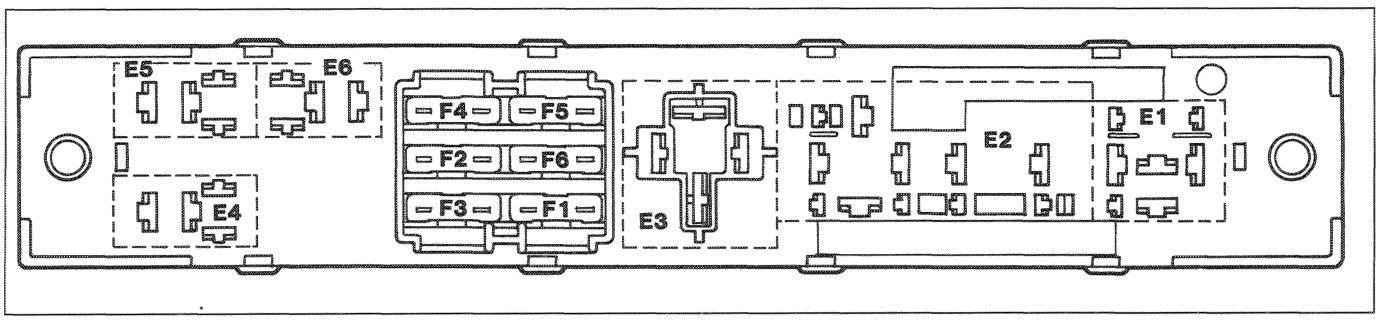
The junction unit (7) is located under the dashboard, on the left hand side and is fixed by three self-threaded botls, whilst the control unit for the optional equipment (8) is located in the oddments compartment on the right hand side and is fixed under the dashboard by two self-threaded bolts.



P3M010N01

CONTROL UNIT FOR OPTIONAL EQUIPMENT

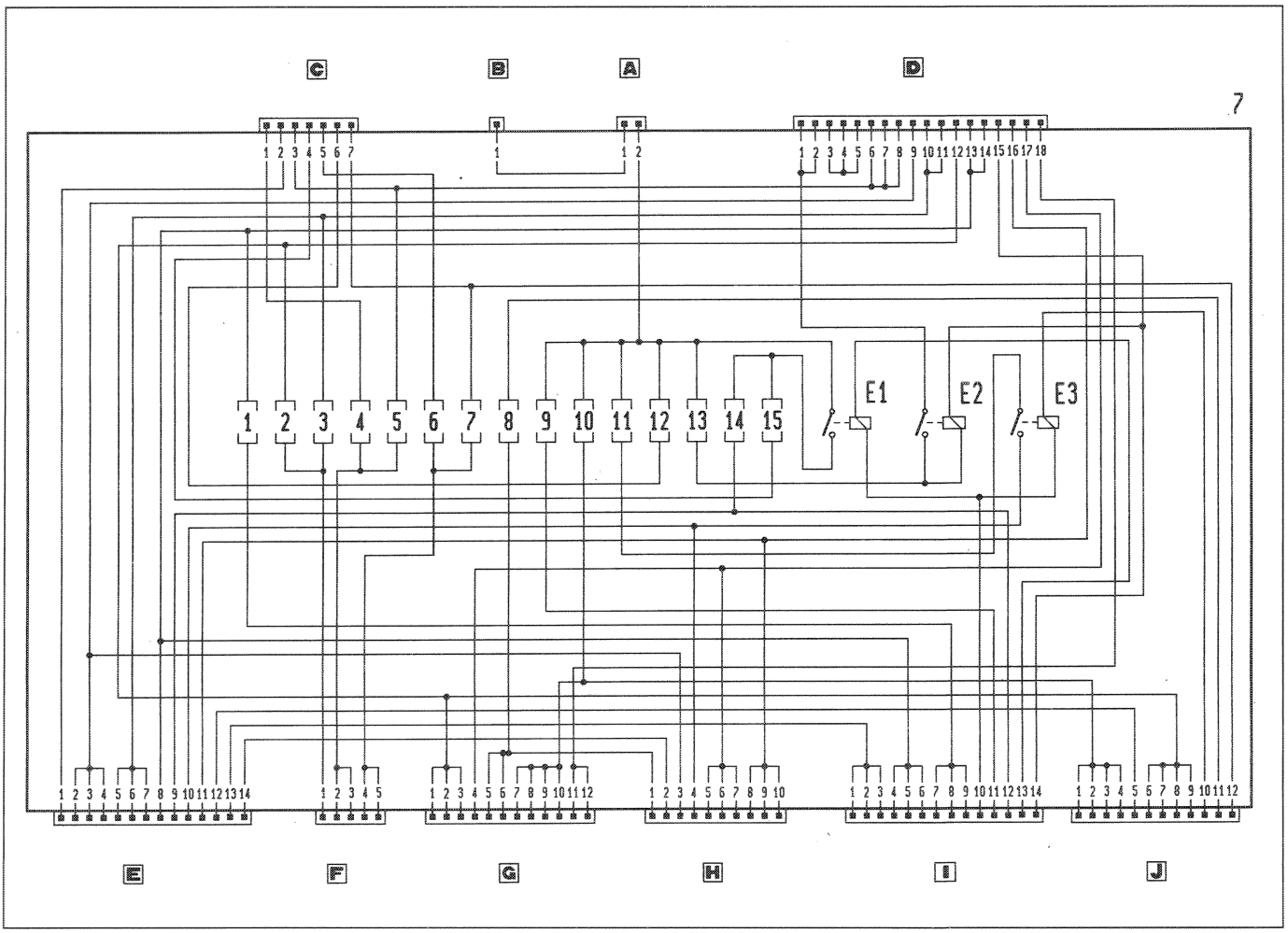
The control unit for the optional equipment is made up of 6 fuses which are different colours according to the amperage and of relays:
E1 Central locking control unit
E2 Electric front windows control unit
E3 Power relay (sun roof)
E4 Dipped beam headlamps/headlamp alignment correct control unit
E5 Fog lights relay
E6 Rear fog lamps relay with fog lamps on
The diagram shows the layout for the above mentioned components.



P3M010N02

JUNCTION UNIT

This table illustrates the entire electrical equipment for the junction unit, which contains the relays and the fuses.
The letters identify the various connectors in the junction unit



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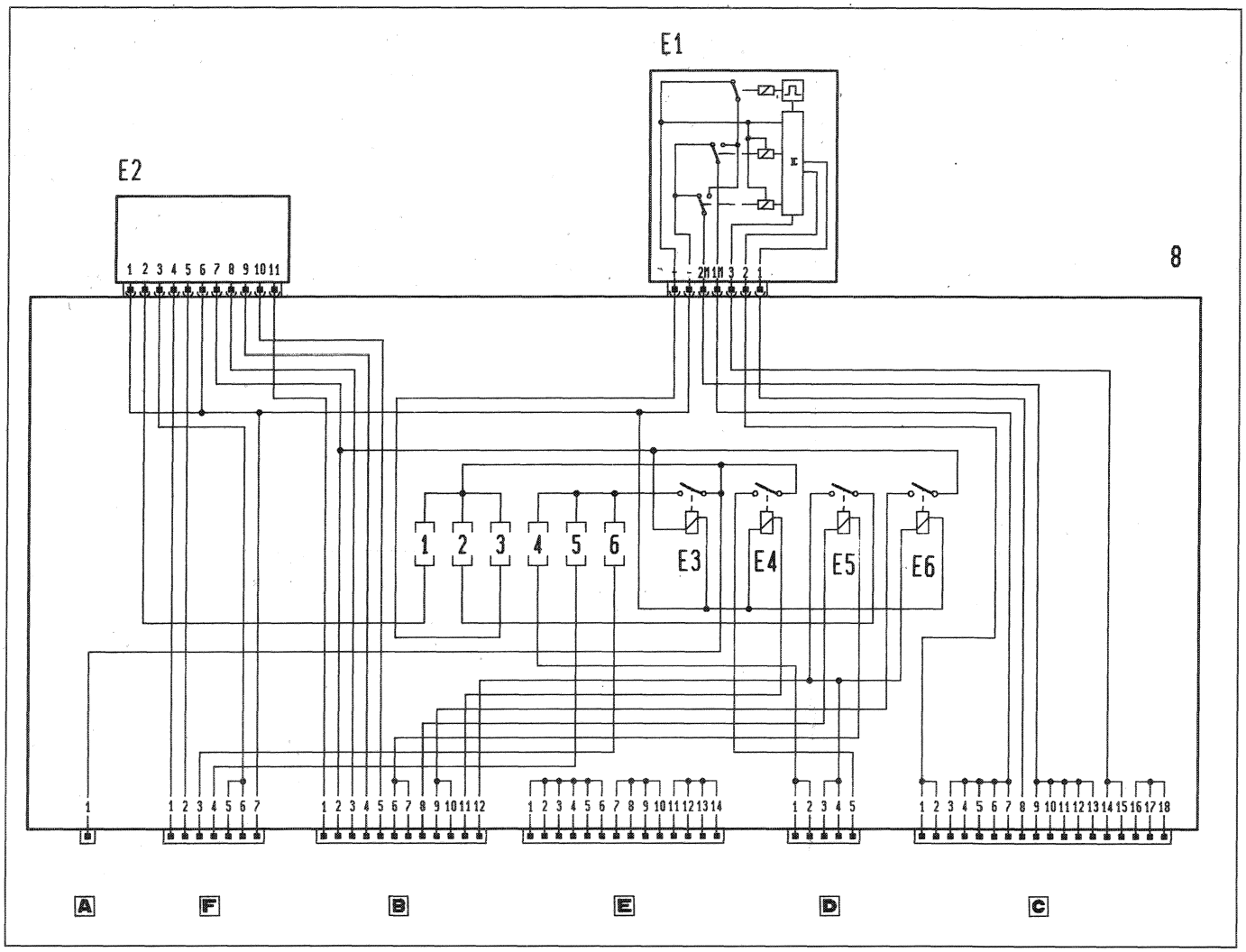
55D.

CONTROL UNIT FOR THE OPTIONAL EQUIPMENT

This table illustrates the entire electrical equipment for the control unit for the optional equipment which contains the relays and the fuses. The letters identify the various connectors in the control unit for the optional equipment.



P3M012N01

JUNCTION UNIT

Fuse symbol	Fuse number	Fuse amperage	Fuse colour	Protected circuits
SERVIZI SERVICES	1	15 A	Blue	Hazard warning lights, brake lights, additional brake lights (if fitted), impulse generator for the electric speedometer (if fitted), digital clock display (if fitted), direction indicators flasher unit, instrument supply, check panel supply (if fitted), electric mirrors operation (if fitted)
	2	10 A	Red	Right front side light, left rear side light, right no. plate light, instrument light and side lights warning light, cigar lighter light, dashboard switches light, headlamp alignment correction light (if fitted, electric mirror control light (if fitted), heated seat control light (if fitted)
	3	10 A	Red	Left front side light, heater/air conditioner controls light, right rear side light, left no. plate light, digital clock display dimmer (if fitted)
	4	10 A	Red	Right dipped headlamp
	5	10 A	Red	Left dipped headlamp, headlamp alignment corrector (if fitted)
	6	10 A	Red	Right main beam headlamp
	7	10 A	Red	Left main beam headlamp, main beam headlamps warning light
	8	10 A	Red	Rear fog lamps
	9	10 A	Red	Hazard warning lights flasher unit
	10	15 A	Blue	Courtesy light, map reading light (if fitted), luggage compartment light (if fitted), clock supply, central locking remote control supply (if fitted), radio supply, cigar lighter supply, anti-theft device blinker (if fitted)

Fuse symbol	Fuse number	Fuse amperage	Fuse colour	Protected circuits
	11	20 A	Yellow	Heated rear windscreen,heated rear windscreen warning light, mirrors de-frosting (if fitted)
	12	30 A	Green	Engine cooling fan
	13	20 A	Yellow	Electric horns
	14	20 A	Yellow	Windscreen wiper, rearscreen wash/wipe, electric windscreen washer pump / rearscreen washer
	15	20 A	Yellow	Car interior ventilation fan

Relay key:

E 1 Ignition discharge relay
E 2 Electric horn relay feed
E 3 Heated rear windscreen relay feed

CONTROL UNIT FOR OPTIONAL EQUIPMENT

Fuse symbol	Fuse number	Fuse amperage	Fuse colour	Protected circuits
	1	30 A	Green	Electric front windows
	2	20 A	Yellow	Fog lamps device
	3	20 A	Yellow	Central locking
	4	20 A	Yellow	Electric sun roof
	5	30 A	Green	Spare
	6	30 A	Green	Spare

Relay key:

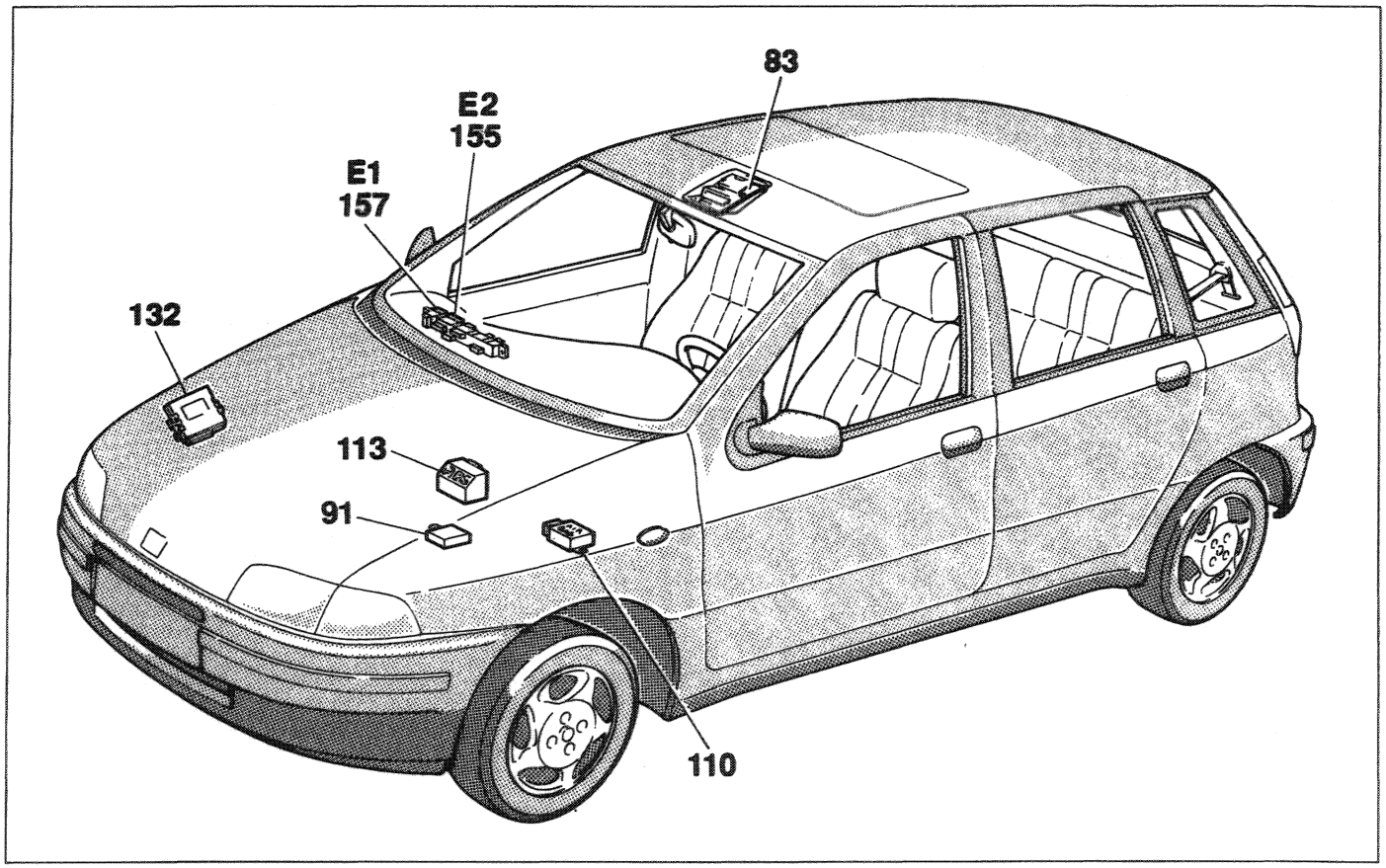
E 1 Central locking control unit
E 2 Electric front windows control unit
E 3 Power relay (sun roof)
E 4 Dipped beam headlamps/headlamp alignment correcter relay feed
E 5 Fog lights relay
E 6 Rear fog lamps relay with fog lamps switched on

ELECTRONIC CONTROL UNITS

Over recent years, electronic control units have become the most important components on vehicles. For this very reason control units are virtually 100% reliable, in actual fact there are various protected circuits upstream.

On account of their complexity, electronic control units require special instruments for their fault diagnosis as the use of a multimeter is neither sufficient nor advisable.

Generally, control units are equipped with a special socket for fault diagnosis (as for example with injection/ignition control units) or special instruments with connecting cables to replace the wiring to carry out the fault diganosis (as for the A.B.S. control unit)



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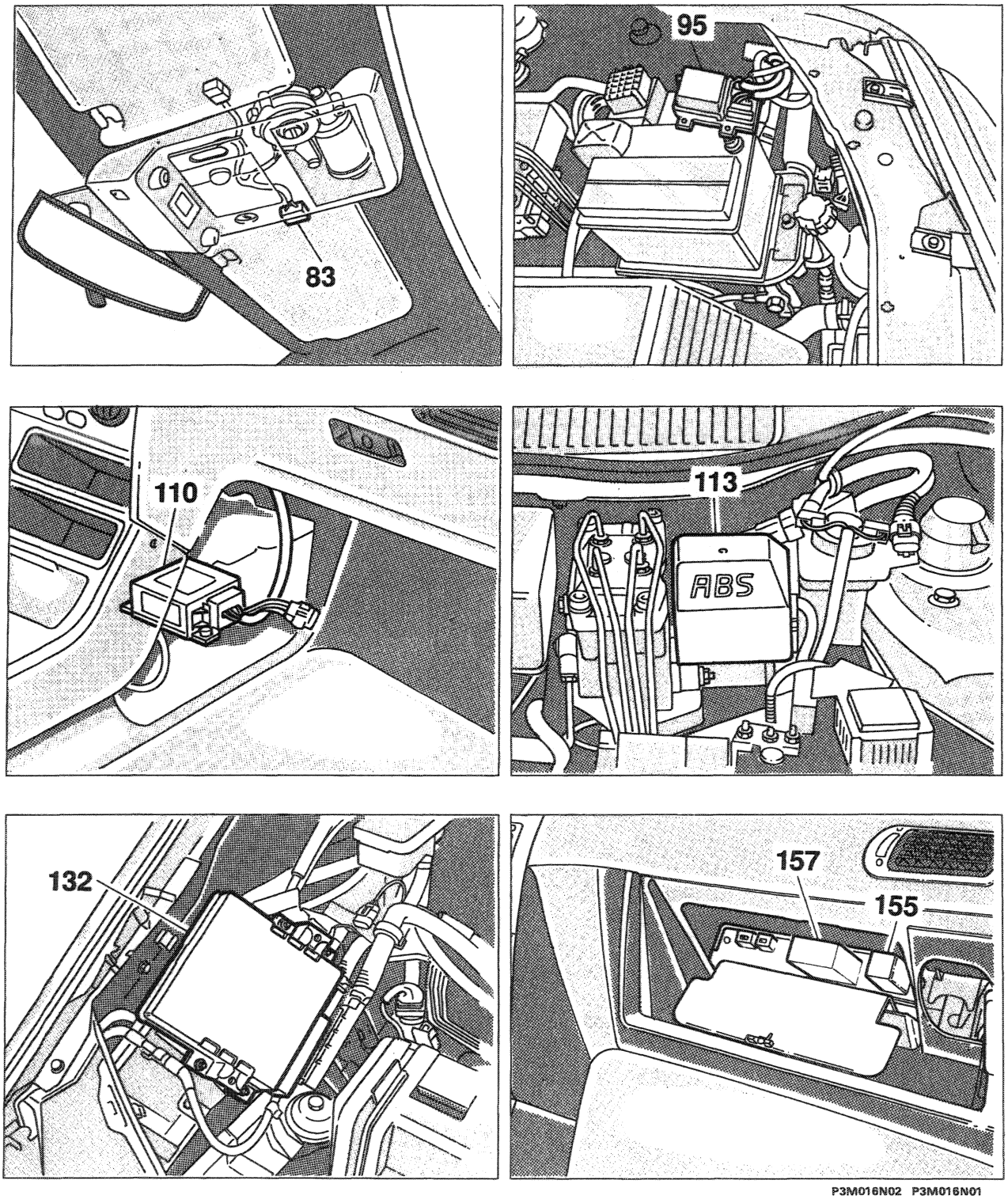
Location of electronic control units on vehicle

Electronic control units key:

83. Electrically operated sun roof electronic control unit
91. Fuse and relay control box for air conditioning
110. Air bag electronic control unit
113. Anti-lock brakes (A.B.S.) electronic control unit
132. I.A.W. electronic ignition and injection control unit
155. Electric front windows control unit
157. Central locking control unit

Detailed location of electronic control units

On account of their complexity, electronic control units require special instruments for their fault diagnosis on account of which a multimeter is not sufficient and its use is not advisable for electronic measurements



P3M016N02 P3M016N01

Electronic control units key:

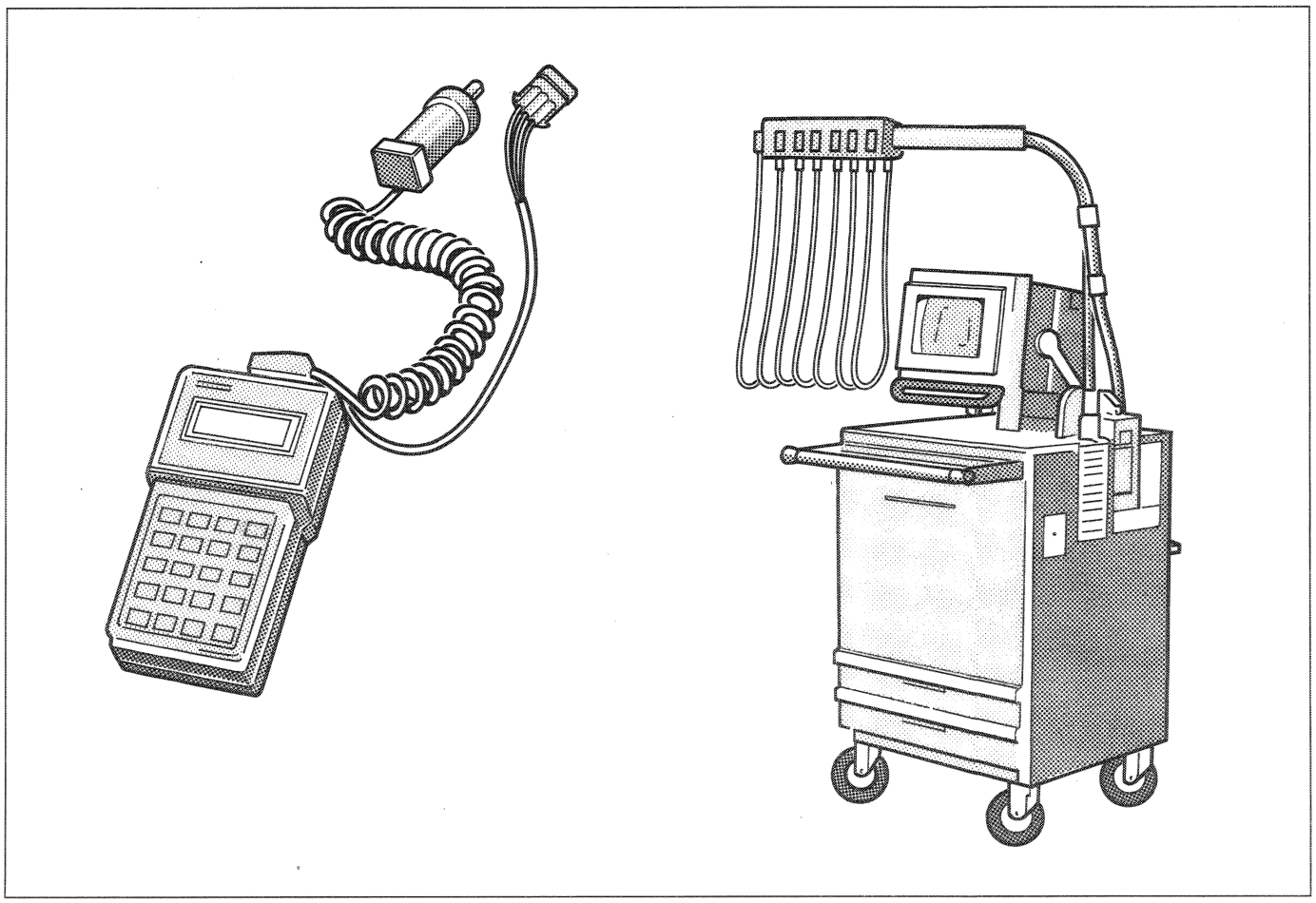
83. Sun roof electronic control unit
95. Fuse and relay control box for air conditioning
[illegible]. Air-bag electronic control unit
113. Anti-lock brakes (A.B.S.) electronic control unit
132. I.A.W. electronic ignition and injection control unit
155. Electric front windows electronic control unit
157. Central locking electronic control unit

DIAGNOSTIC INSTRUMENTS FOR ELECTRONIC CONTROL UNITS

On account of their complexity electronic control unit require special instruments for fault diagnosis which means that using a multimeter is neither satisfactory nor advisable.
These instruments have to be specially made and they send special signals and analyze the control unit responses. The electronic control units in their turn, are often supplied with a diagnostic socket to which these instruments should be connected in order to carry out the diagnostic operations.
Fiat can supply the following instruments to the Service Network for fault diagnosis of vehicles:

A- the Fiat-Lancia Tester (for electronic control units with special diagnostic sockets)

B- the Computerized Diagnosis Station (SDC) which is capable of carry out the fault diagnosis for different devices and control units, simulating instruments and carrying out checks and road tests.



P3M017N01

ULTRASONIC WELDING

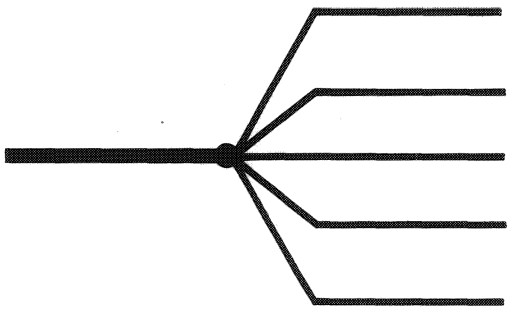
Ultrasonic welding is extensively used and is a very important feature.

Ultrasonic welding has been introduced because it involves a series of important improvements.

The advantages of ultrasonic welding

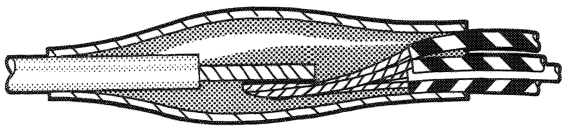
The main advantages of this type of welding are :
- A considerable increase in resistance to electro-magnetic interference outside the vehicle (High Tension lines; Radio-TV transmitters; unprotected electric motors... etc).
- Almost 100% reliability, thanks to the elimination of the majority of earth and supply bridges, with less possibility of malfunctions
- A reduction in the size of the connecting cables, because each cable only carries the current for the consumer connected.

Diagram



P3M018N01

Wiring



P3M018N02

General warnings

The welds are located inside the wiring and are insulated from the rest of the cables by suitable dielectric materials.

Given their position inside the wiring and consequent inaccessibility, if there is a problem (which is, however, as explained earlier, extremely unlikely) they cannot be repaired directly.

During the fault diagnosis ultrasonic welding is not considered as a source of malfunctions or problems. On the contrary, a lack of earth or positive voltage is considered.

It is as if the connection to earth or to a possible, achieved through ultrasonic welding, is acting on the diagnostic procedure and is considered as a connection without a physical break (a single wire).

They are not shown graphically in the section on connections because of their inaccessibility; they are taped in the wiring on account of which if the connections have to be examined, it is necessary to refer to the wiring diagram.

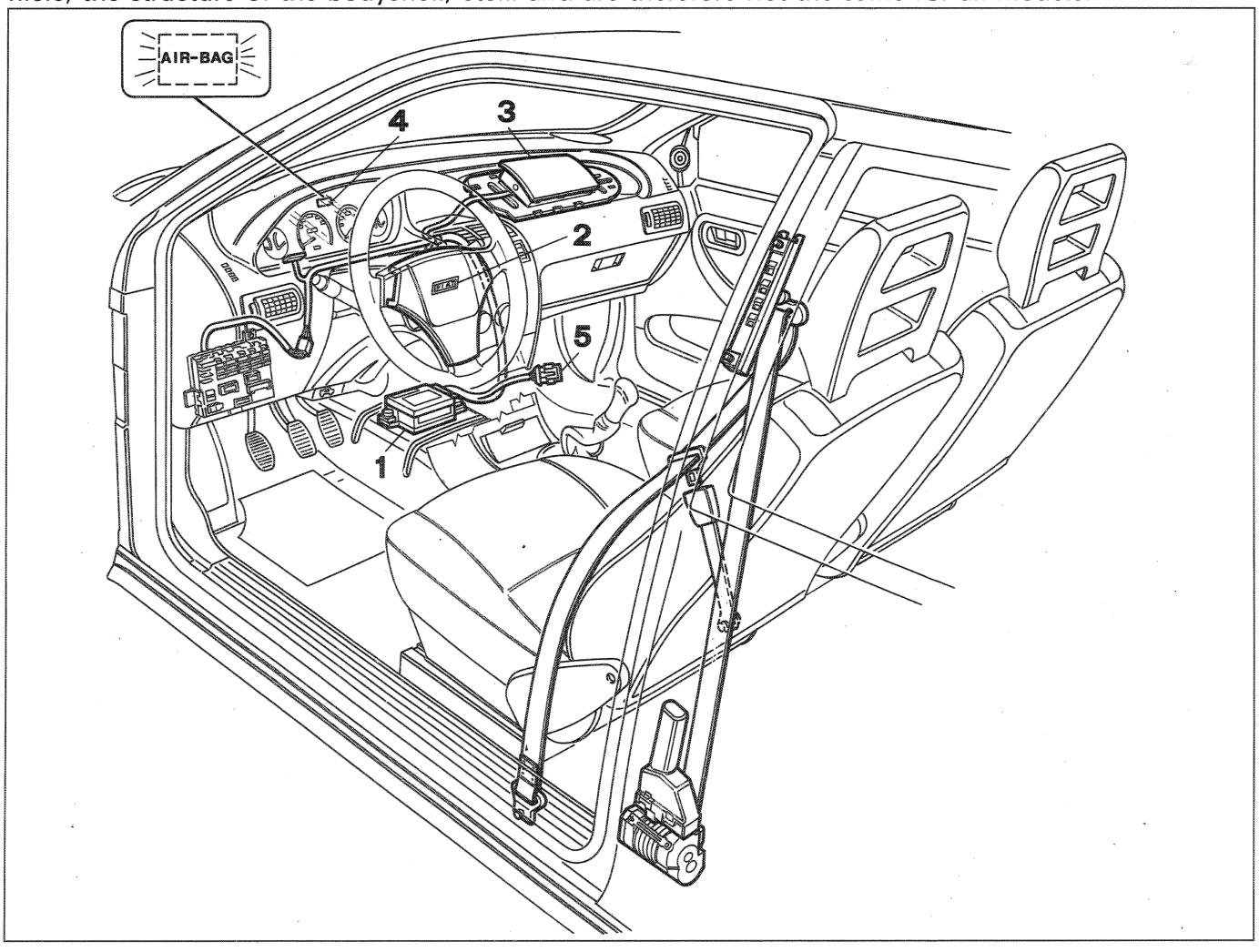
AIR-BAG

Introduction

The AIR BAG is a passive safety device made up of one or two cushions which, in the case of a frontal impact, automatically inflate and are positioned between the bodies of the occupants of the front seats and the front part of the passenger compartment.
The AIR BAG system is made up of the following components:

1. Electronic control unit:
   - it contains an electronic circuit inside with two deceleration sensors;
   - having assessed the impact situation, it implements the operating strategies, checking and memorizing any problems
2. AIR BAG module, driver's side
3. AIR BAG module, passenger side
4. Red warning light in the instrument panel signalling system problems and diagnostic codes.
5. Socket for connecting FIAT/LANCIA TESTER

An electronic control unit equipped with suitably calibrated deceleration sensors, assesses the impact condition and sets off a chemical reaction which produces nitrogen by means of two electrical detonators.
The gas inflates the two synthetic fibre cushions contained inside the centre of the steering wheel and in a housing in the dasboard in front of the front passenger, respectively.
The system comes into operation when the deceleration of the vehicle corresponds to that for a frontal impact at a speed of around 20 - 25 kph against a fixed barrier.
These figures are given purely as a guide and depend on different factors including the weight of the vehicle, the structure of the bodyshell, etc... and are therefore not the same for all models.



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FAULT DIAGNOSIS

The entire time the vehicle is driving the electronic control unit carries out a diagnostic cycle every 100 msecs checking the AIR-BAG system and memorizing any possible momentary or persistent failures in the FAULT-MEMORY. The moment a fault is detected it is memorized and the AIR-BAG warning light (4) comes on signalling to the driver that the AIR-BAG system may not come into operation. The driver should therefore go soon to the closest Dealership in the area or Service Centre to have the system checked using a FIAT/LANCIA TESTER.

Fault diagnosis with the FIAT/LANCIA TESTER

In order to prevent the accidental explosion of AIR BAGS during diagnosis, the wiring has to be disconnected and a 2 Ω simulating resistance, which is supplied with the FIAT/LANCIA TESTEr memory, connected to the connectors.
When the FIAT/LANCIA TESTER is connected to the diagnostic socket the first screen displays:
- AUTOMATICC
- WRITE ISO CODE
- SKIP ISO CODE

By pressing button ↑ ↓ the function which is confirmed by pressing the E/S button is selected. The subsequent information appears:
A. Software code, year of production, date of production, , serial number and the indication that the CRASH MEMORY contains information.
B. ERRORS
- fault in the warning light circuit (open circuit - short circuit)
- positive signal fault in the ignition circuit
- negative signal fault in the ignition circuit
- fault in the primary circuit
- signal that the battery voltage is $< 9.5V$ for $T > 10$ seconds
- control unit fault.

NOTE *When the ignition is switched OFF the time and the type of fault or the error code is maintained in the FAULT-MEMORY. Once the fault is repaired it will be cancelled by the FIAT/LANCIA TESTER. Intermittent type faults remain in the FAULT- MEMORY for 48 hours, counted from the moment they occur. The time is only counted with the ignition switch in the ON position.*

System diagnosis with code flashing

As an alternative to the FIAT/LANCIA TESTER it is possible to carry out the diagnosis of the system by seeing the number of times the "AIR BAG" warning light in the instrument panel flashes.
In order to implement the diagnosis, with the ignition switched on, connect terminal no. 3 for the electronic control unit to earth for between 1 and 5 seconds. (The AIR BAG system failure warning light is connected to terminal no. 3 for the control unit)
The table on the page overleaf, contains the problems which may be encountered and the appropriate remedies, according to the number of times the warning light flashes.
When the fault is repaired, the test has to be repeated to make sure that there are no other problems.
Bear in mind that the control unit communicates the faults one at a time, in decreasing order, until the system is completely repaired. When the repairs are completed the FAULT-MEMORY has to be cancelled by connecting terminal no. 3 of the control unit for between 5 and 10 seconds. All the errors stored in the memory are cancelled one by one, repeating the procedure each time, until the FAULT--MEMORY is completely cancelled.

Lamp code table

LAMP NO.	POSSIBLE FAULT	REMEDIES
1	System OK	
2	Control unit faulty	Replace the control unit
3	Wiring for module engagement circuits in contact with +12V	Check the wiring
4	Wiring for module engagement circuits in contact with earth	Check the wiring
5	Dirver's side module engagement device resistance outside of the tolerance	Check the wiring or replace the driver's side module
6	Passenger side module engagement device outside of the tolerance	Check the wiring or replace the passenger side module
7	Supply voltage below 9.5V	Recharge or replace the battery
8	Warning light circuit faulty	Replacing the warning light - Check the wiring

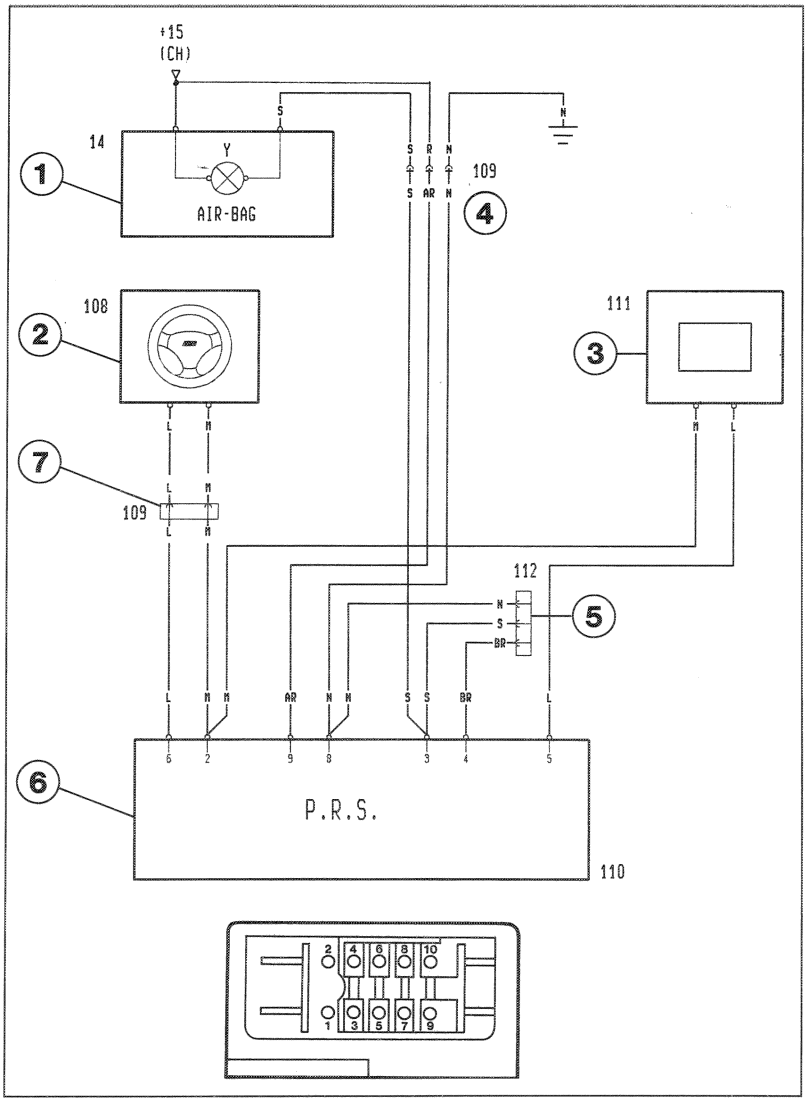

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Diagram showing Air Bag

1. Instrument panel with AIR BAG failulre warning light
2. AIR BAG module, driver's side
3. AIR BAG module, passenger side
4. Connector connecting AIR BAG system to cable loom under the dashboard on the left hand side of the heater unit
5. Diagnostic socket for the Fiat/Lancia Tester
6. AIR BAG electronic control unit
7. Connector for the CLOCK SPRING device

55D.

SAFETY MEASURES

It should be remembered that the AIR BAG is a device which is regulated by the legislation for explosives, classified in the 5th grade of group A of the Public Safety Laws; it is therefore important that the persons who fit or remove the device from the vehicle adhere strictly to the safety procedures listed below.

During the repair:

- Only suitably trained personnel should work with these devices.
- When removing and replacing AIR BAGS after they have come into operation, gloves and protective goggles must be worn.
  At the end of the operation, hands should be thoroughly washed with neutral soap and if any powder residues from the device comes into contact with the eyes, then they should be rinsed with plenty of cold water.
- On all versions fitted with AIR BAGS it is prohibited to work from the front seats without having first renedered the system inoperative by disconnecting the two cables from the battery and waiting 10 minutes.
- As soon as it comes into operation the metal components of the AIR BAG become very hot.
  Avoiding touching these components for several minutes after the AIR BAG has come into operation.
- Any spare parts which are stored should be kept in their original packaging (if this involves temporarily storing an AIR BAG module which has not come into operation, it should be kept with the polyurethane cover upwards).
- These devices should always be kept in a suitable metal container, under lock and key (an impact resistant metal container with grilles to allow ventilation).
  The container should have special notices on it saying (DANGER - EXPLOSIVES - NO NAKED FLAMES - TO BE OPENED BY AUTHORIZED PERSONNEL ONLY).
- Damaged or defective individual components should not be repaired or tampered with in any way, but should be replaced.
  In the case of:
- Repairs to the bodywork
- Welding
- Removing/refitting any AIR BAG system component
- Repairs to the electrical equipment, fitting an anti-theft device or radio, it is necessary to disconnect both the battery terminals (+) and (-) from the poles and insulate them thoroughly.
- In the case of removing the cushion inflation devices, in addition to disconnecting the battery, the following procedure must be rigorously adhered to:
- Wait for at least 10 minutes after having disconnected the battery before starting to remove the module.
- Undo the fixing bolts.
- Remove the connector for the cushion inflation devices (modules).
- After an accident where the AIR BAGS have not come into operation, the components which are visibly distorted or damaged or show up as being faulty when checked with the FIAT/LANCIA TESTER should be replaced.
- Do not use naked flames near AIR BAG modules and system components.
- As with other electronic control units, those for the AIR BAG system must always be removed if the temperature may exceed 85 degrees centigrade.

- If the control unit should accidentally fall to the ground, then it should be checked using the FIAT/LANCIA TESTER, cancelling the error messages. The electronic control units for AIR BAGS should automatically be replaced if they fall from a height of more than 75 cm, as set out in the Service Manual.
- AIR BAG modules which have not come into operation should be placed immediately into the suitably marked special container once they have been removed and kept under lock and key.
- Never scrap a vehicle with the inflation devices still intact or any devices on their own which have not come into operation.
- Spent AIR BAG modules should be placed in a sealed plastic bag and disposed of (see laws concerning refuse disposal).
  The chemical residues may cause irritation.

To sum up, in addition to strictly following the above insructions, persons handling AIR BAG systems should be fully aware of the potential dangers involved in accidentally setting off a device.

LEGAL REGULATIONS

NOTE *The explosives equipment is subject to legal checks. Ensure that local laws are observed as far as the storing and handling of pyrotechnic equipment such as AIR BAGS and seat belt pre-tensioners is concerned.*

Explosives are governed by the Public Safety Regulations.

We wish to advise you that the first informal indications received from the Ministry of the Interior concerning the type of explosives into which category AIR BAGS fall, states the following:

- it is necessary to have a licence for explosives (suitable for the category of explosives stored);
- or it is possible to ask the local high police official for authorization as an alternative to this licence;
- the Proprietor of the workshop must also ask the local high police official for authorization to carry out work (removing and refitting) with explosive material (category V group A;
- the personnel who will handle the AIR BAGS should possess a "Suitability Certificate" for handling explosives which can be obtained from the local Prefecture.