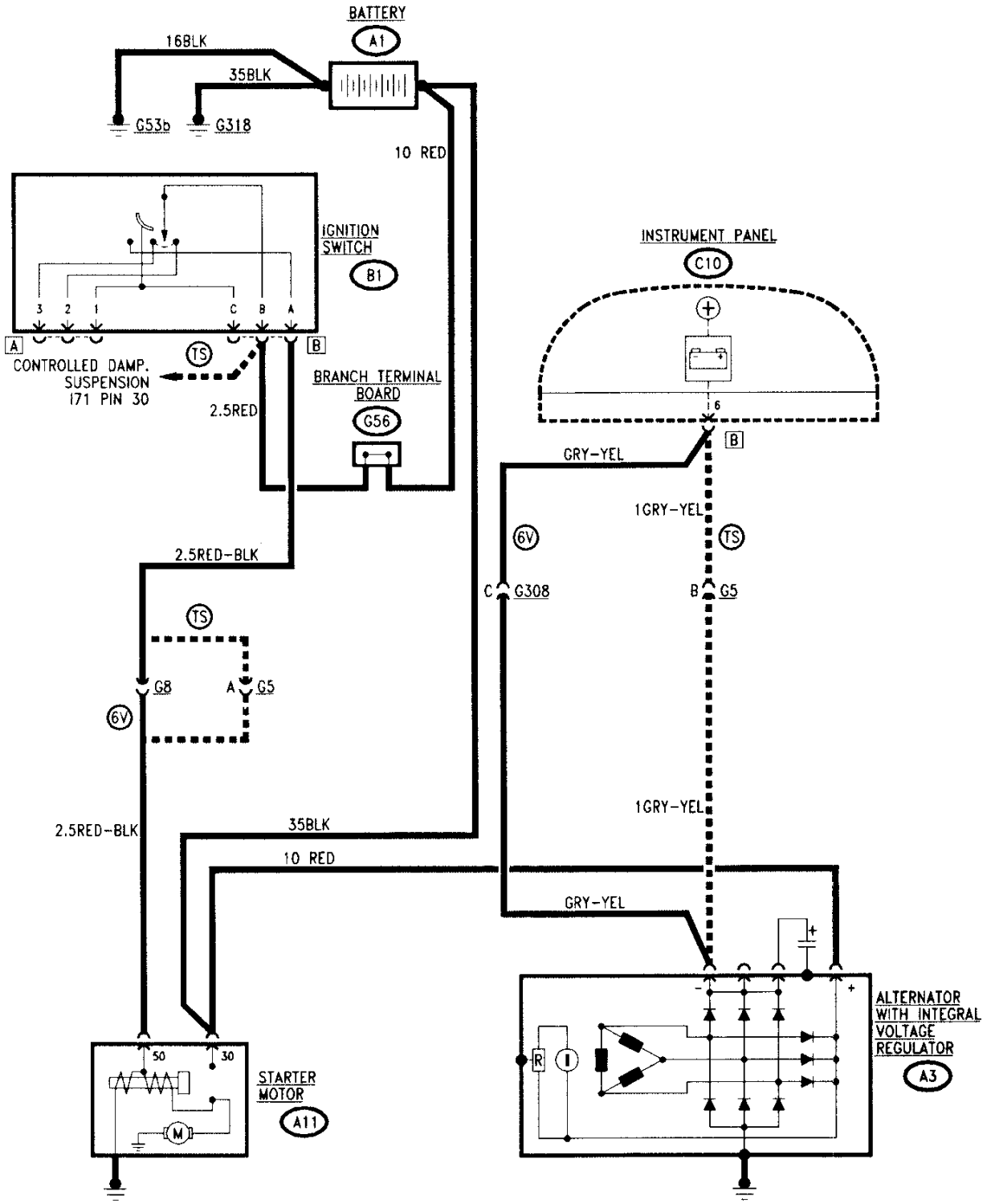
STARTING AND CHARGING

INDEX

WIRING DIAGRAM



GENERAL DESCRIPTION

The starting and charging circuit is composed of the battery, starting motor and the alternator.

The **battery** (12V) is of the sealed type which does not require maintenance.

The **starting motor** consists of a DC motor powered by the battery and a control and engagement solenoid.

By rotating the ignition key, voltage from the battery supplies the windings of the motor, generating the electromagnetic forces which rotate the pinion of the motor itself. At the same time, the solenoid is activated which in turn actuates the mechanism engaging the pinion in the ring gear of the flywheel, in this way rotating the crankshaft.

The **alternator** recharges the battery during the normal rotation of the engine: the shaft of the alternator, rotated by the crankshaft via a drive belt, cuts the magnetic field generated by the statoric windings producing AC current. This is then transformed into DC by a bridge rectifier with diodes and sent to recharge the battery.

A voltage regulator built into the alternator makes it possible to maintain a constant voltage supply (approx. 12 V) for all the variations in the loading and r.p.m. of the engine.

FUNCTIONAL DESCRIPTION

When the ignition key is rotated in the ignition switch **B1** right round to "STARTING", the windings of the starter motor **A11** solenoid are activated (pin 50) and the actual motor is supplied with the voltage from the battery **A1** (pin 30), in this way starting the engine.

The DC supply generated by the alternator **A3** is sent to the battery **A1**, passing the motor **A11**.

The lines toward the various electrical systems of the vehicle also start from here (see "Power Supply")

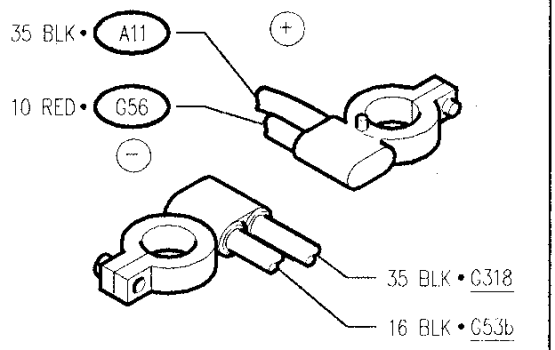
When the alternator is not rotating and therefore the battery is not being recharged, a signal (ground) is sent to the instrument panel **C10** and lights up the relative warning lamp.

TROUBLESHOOTING TABLE

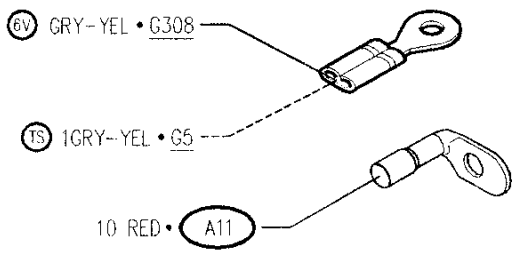
Malfunction	Component					Test
	A11	A1	B1	A3	C10	
Starting engine	•	•	•			A
Recharging engine		•		•		B
Recharging warning lamp				•	•	C

COMPONENTS AND CONNECTORS

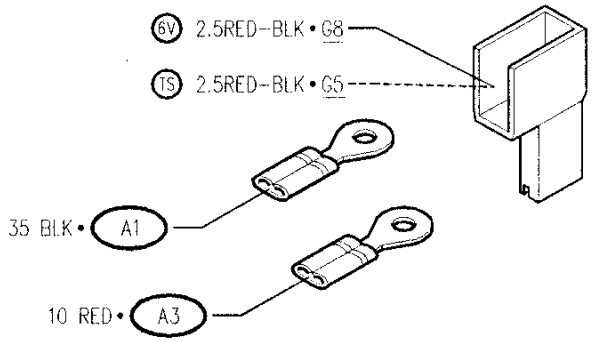
Battery	A1



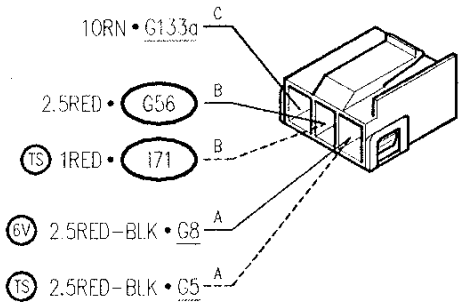
Alternator, with integral voltage regulator	A3



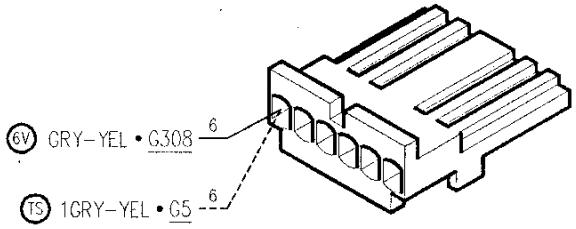
Starter motor	A11



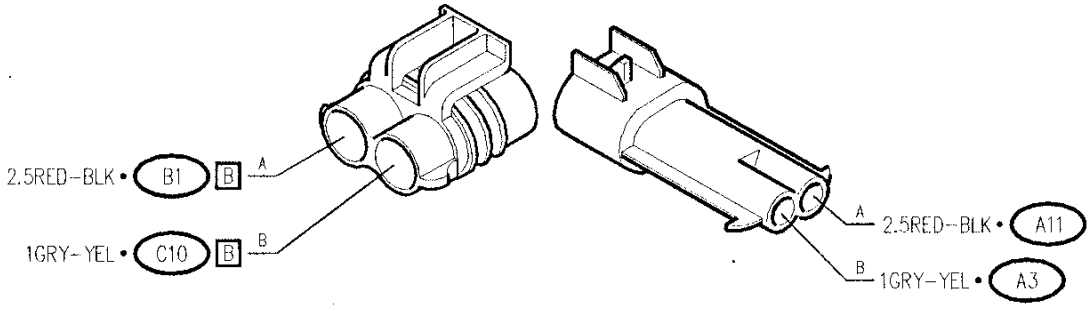
Ignition switch	B1	B



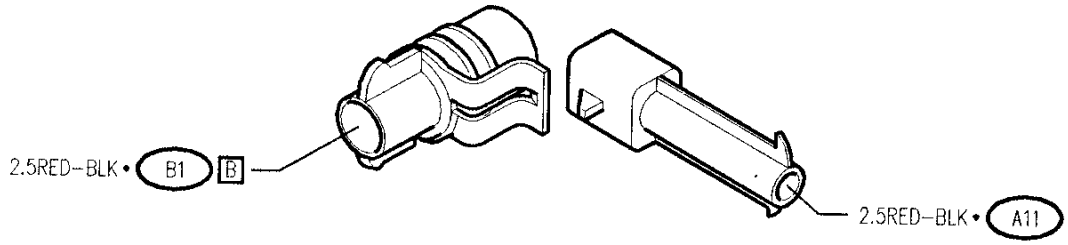
Instrument panel	C10	B



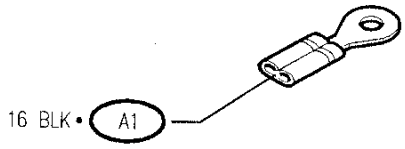
Multiple connector	G5



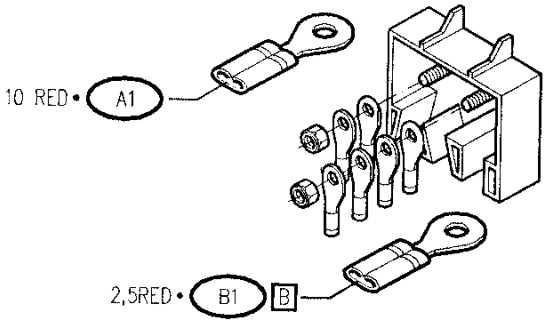
Single connector — G8



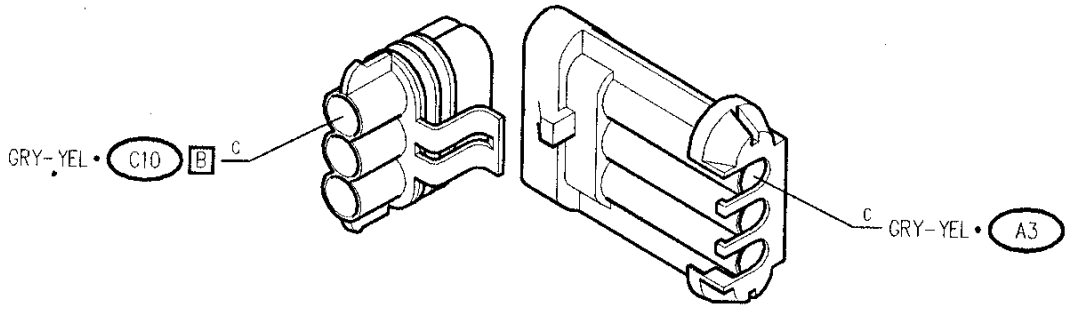
Engine compartment ground-left side — G53b



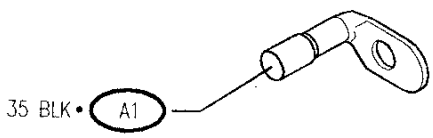
Branch terminal board — G56



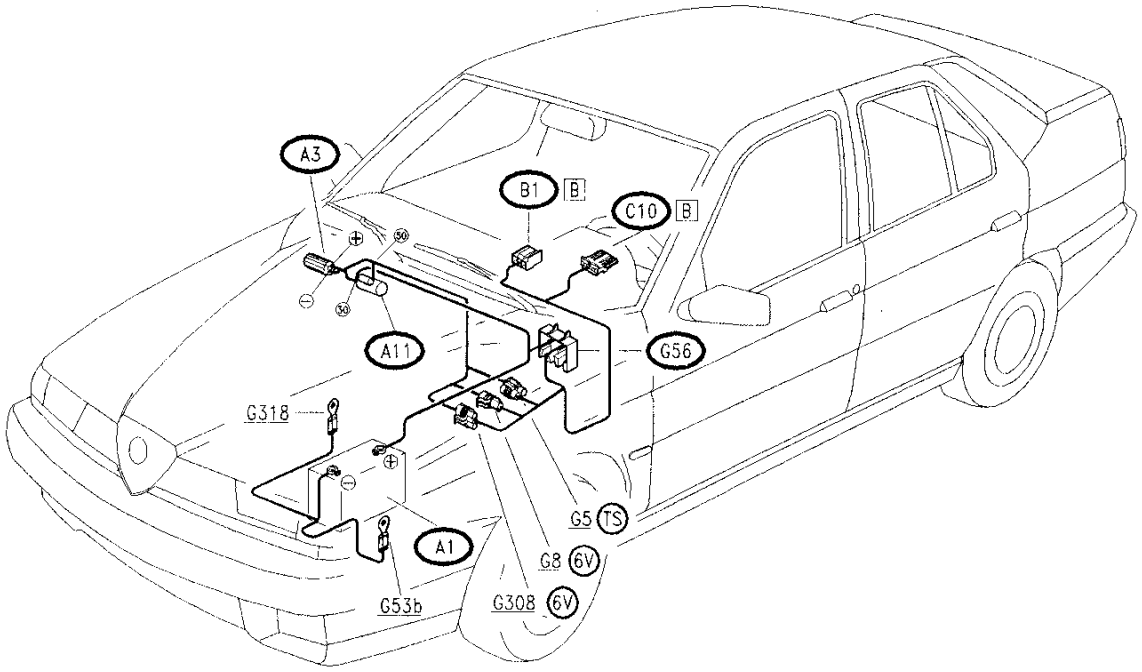
Engine sensors coupling — G308



Ground on gearbox — G318



LOCATION OF COMPONENTS



TROUBLESHOOTING

THE ENGINE DOES NOT START (the starter motor does not turn)	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 CHECK BATTERY – Visually check the battery **A1** for signs of damage; Also check for 12 V between the two terminals	OK ➡	Carry out **step A3**
	~~OK~~ ➡	Carry out **step A2**
A2 CHECK GROUND – Check that the negative pole of the battery (-) **A1** is grounded, both "towards the engine", and "towards the body".	OK ➡	Recharge or replace the battery **A1** **NOTE:** a malfunction of the battery **A1** may be caused by an excessive charge from the alternator **A3.** In this case replace the voltage regulator built into the the alternator itself (see also **Test B**)
	~~OK~~ ➡	Restore wiring between battery **A1** and grounds **G318** and **G53b** (BLK)
A3 CHECK VOLTAGE – Check for 12 V at pin 30 of starter motor **A11**	OK ➡	Carry out **step A4**
	~~OK~~ ➡	Restore wiring between motor **A11** and battery **A1** (BLK)

(continues)

THE ENGINE DOES NOT START (the starter motor does not turn)	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A4 CHECK VOLTAGE – Rotate the ignition key to the "STARTING" position and check for 12 V at pin 50 of motor **A11**	OK ➡	Check that the motor **A11** is correctly connected to ground. If not, check and if necessary replace it. (See also "REPAIR MANUAL - MOTORS" - Group 05)
	OK ➡	Carry out **step A5**
A5 CHECK IGNITION SWITCH – With the ignition key at the "STARTING" position, check for continuity between pins A and B of connector B of **B1**	OK ➡	Restore wiring between: - (TS) pin 50 of **A11** and pin BA, across pin 1 of connector **G5** (RED-BLK) - (6V) pin 50 of **A11** and pin BA, across connector **G8** (RED-BLK)
	OK ➡	Replace the ignition switch **B1**

THE ALTERNATOR DOES NOT RECHARGE THE BATTERY	TEST B

NOTE: before performing this test, check that the alternator drive belt is not damaged (See "REPAIR MANUAL - MOTORS"- Group 05)

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B1 CHECK ALTERNATOR – Check for damage of the alternator **A3**. Ensure that when the engine is running it supplies a constant 12V to pin (+) and that it is correctly connected to ground	OK ➡ ~~OK~~ ➡	Carry out **step B2** Replace the alternator **A3** or one of its component parts (rectifier, voltage regulator, etc..)
B2 CHECK VOLTAGE – With the engine running, check that 12V reaches terminal (+) of battery **A1**	OK ➡ ~~OK~~ ➡	Replace battery **A1** Restore wiring between pin (+) of alternator **A3** and the battery, across the starter motor **A11** (RED)

"BATTERY RECHARGING" WARNING LIGHT ON INSTRUMENT PANEL NOT WORKING	TEST C

Note: The alternator however is recharging the battery. If not carry out previous **test B.**

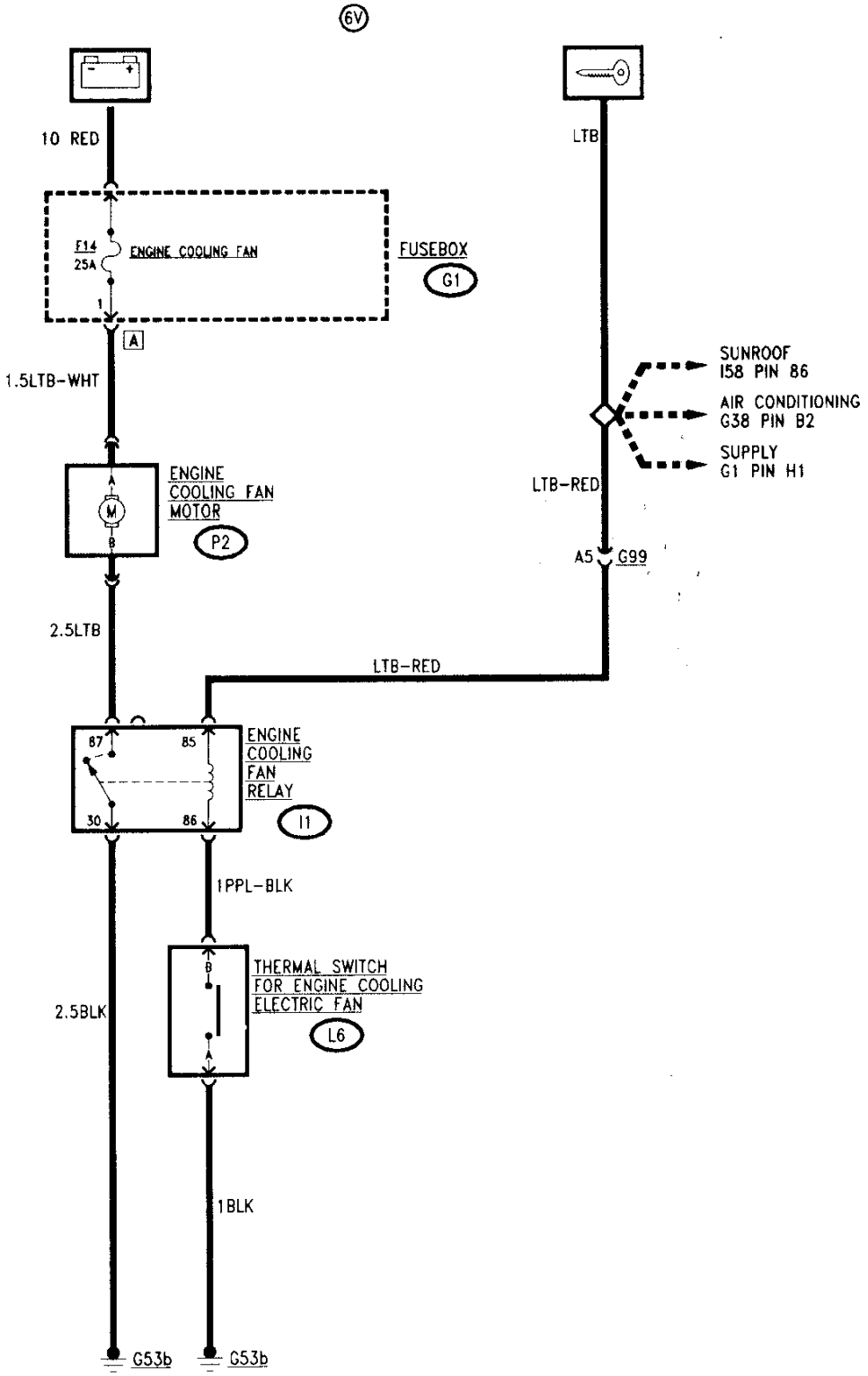
TEST PROCEDURE	RESULT	CORRECTIVE ACTION
C1 CHECK GROUND – With engine running, check for a ground signal (0 V) at pin B6 of instrument panel **C10**	OK ➔	Carry out **step C2**
	~~OK~~ ➔	Carry out **step C3**
C2 CHECK WARNING LAMP – Check for damage of the battery recharging warning lamp, located on the instrument panel **C10**	OK ➔	Check and if necessary replace the instrument panel **C10**
	~~OK~~ ➔	Replace the warning lamp
C3 CHECK GROUND – With the engine running check for and ground signal (0 V) at pin (-) of alternator **A3**	OK ➔	Restore wiring between: - (TS) pin (-) of the alternator and pin B6 of **C10**, across pin 2 of connector **G5** (GRY-YEL) - (6V) pin (-) of the alternator and pin B6 of **C10**, across pin C of connector **G308** (GRY-YEL)
	~~OK~~ ➔	Check and if necessary replace the alternator **A3**

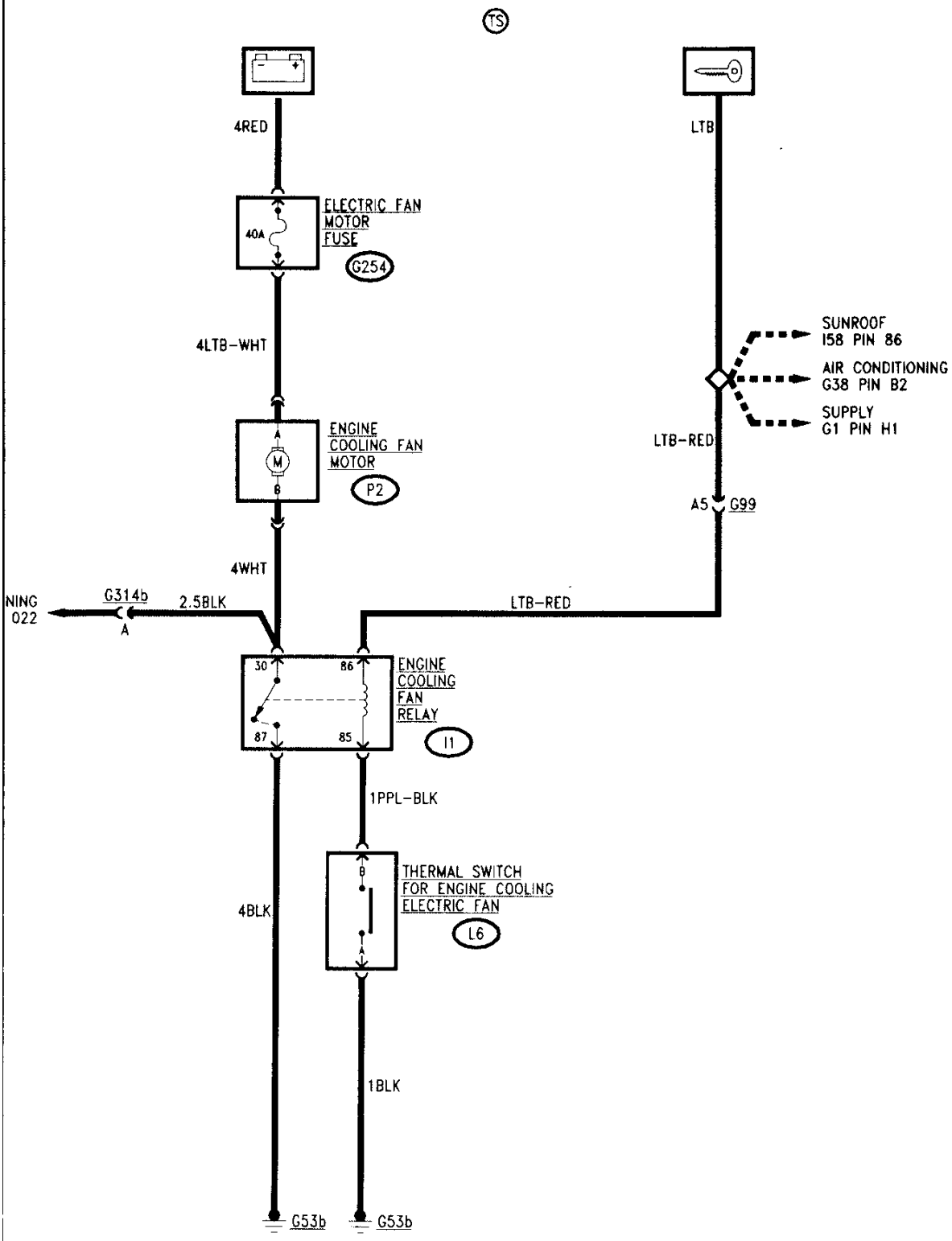
ENGINE COOLING

(models without air conditioning)

IDEX

WIRING DIAGRAM




TS
4RED
LTB
ELECTRIC FAN MOTOR FUSE
40A
G254
4LTB-WHT
SUNROOF
I58 PIN 86
AIR CONDITIONING
G38 PIN B2
SUPPLY
G1 PIN H1
ENGINE COOLING FAN MOTOR
P2
LTB-RED
A5 G99
4WHT
NING
022
G314b
A
2.5BLK
LTB-RED
30
86
87
85
ENGINE COOLING FAN RELAY
I1
1PPL-BLK
THERMAL SWITCH FOR ENGINE COOLING ELECTRIC FAN
L6
4BLK
1BLK
G53b
G53b

GENERAL DESCRIPTION

An electric fan permits an increase in the heat dissipation of the engine coolant from the radiator.
A thermometric switch detects an excessively high engine coolant temperature and switches on an electric fan: the contact closes at 92 ± 2 °C, and opens at 87 ± 2°C.

NOTE: Models with automatic heating/ventilation system with air conditioner are equipped with a two-speed electric fan: the first is actuated when the conditioning fan compressor is engaged when the vehicle is at rest or when the temperature of the engine coolant is at an initial level; the second speed cuts in 10 seconds after the first or at high temperatures.
N.B. The relative electric circuit is illustrated in the section "Air conditioning - Engine electric fan control".

FUNCTIONAL DESCRIPTION

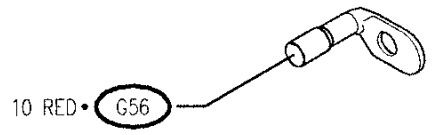
The electric fan **P2** is supplied by battery voltage via fuse **G254** (40A) for the **T.Spark** models, and by fuse **F14** (25A) in fusebox **G1** for the **6V** model.
The relay **I1** which controls the electric fan is turn-key supplied and is excited by an ground signal originating from thermal switch **L6** which closes when the temperature of the engine coolant reaches 92°C: in this way relay **I1** sends an ground to the electric motor which activates the electric fan **P2**.
When the temperature falls below 87°C the contact opens, the relay is deactivated and the electric fan stops.
NOTE: The connections with the heating/ventilation system, which uses a part of this circuit are also indicated in the chart, though it is connected differently as indicated in the section "Air conditioning engine electric fan control".

TROUBLESHOOTING TABLE

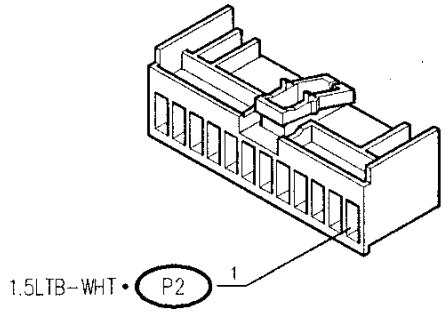
Malfunction	Component					Test
	G254	F14	I1	P2	L6	
Electric fan does not start (T. Spark models)	•		•	•	•	A
Electric fan does not start (6V model)		•	•	•	•	B

COMPONENTS AND CONNECTORS

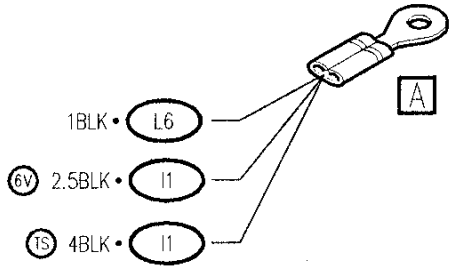
Fusebox	G1



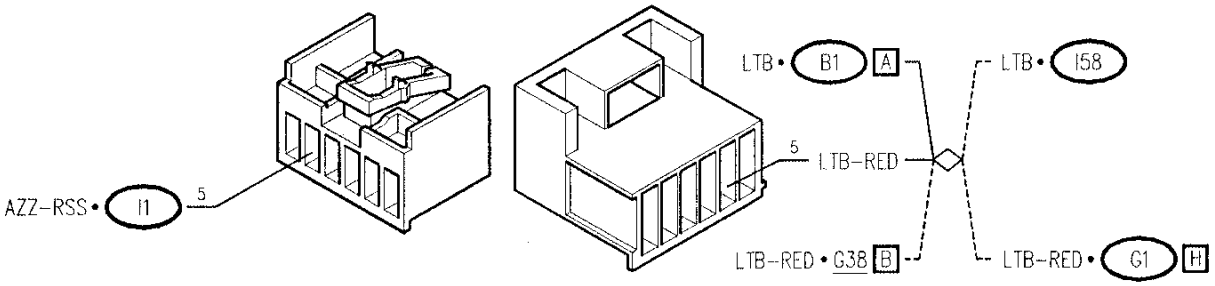
Fusebox	G1 A



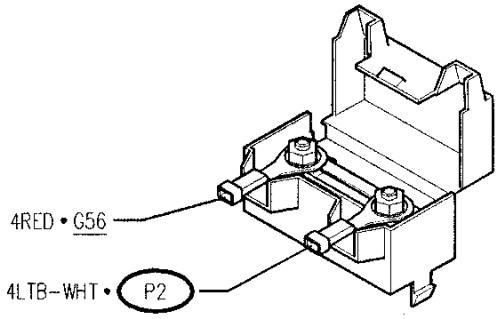
Engine compartment ground-left side	G53b



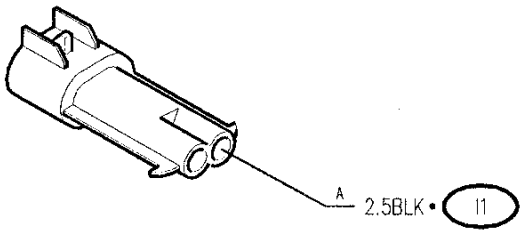
Dashboard/engine connection	G99 A

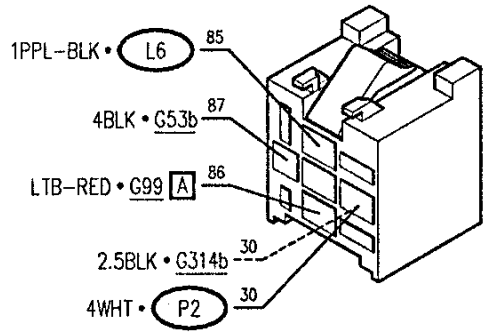
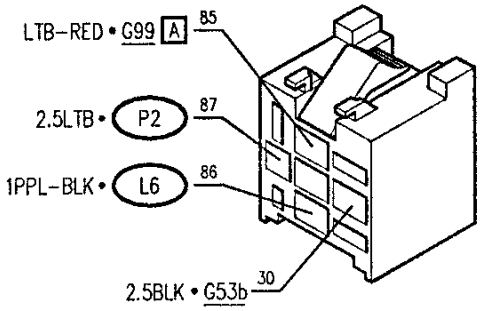
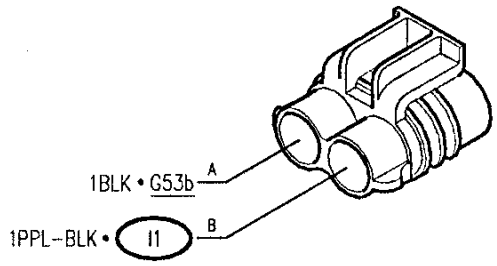
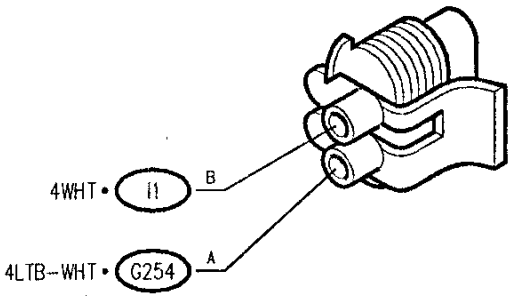
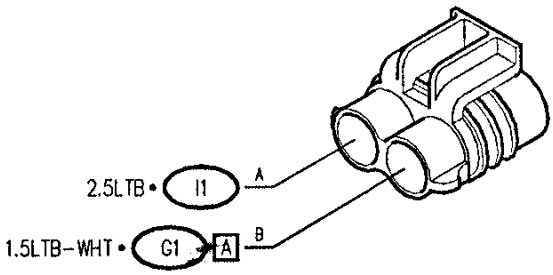


Electric fan motor fuse	G254



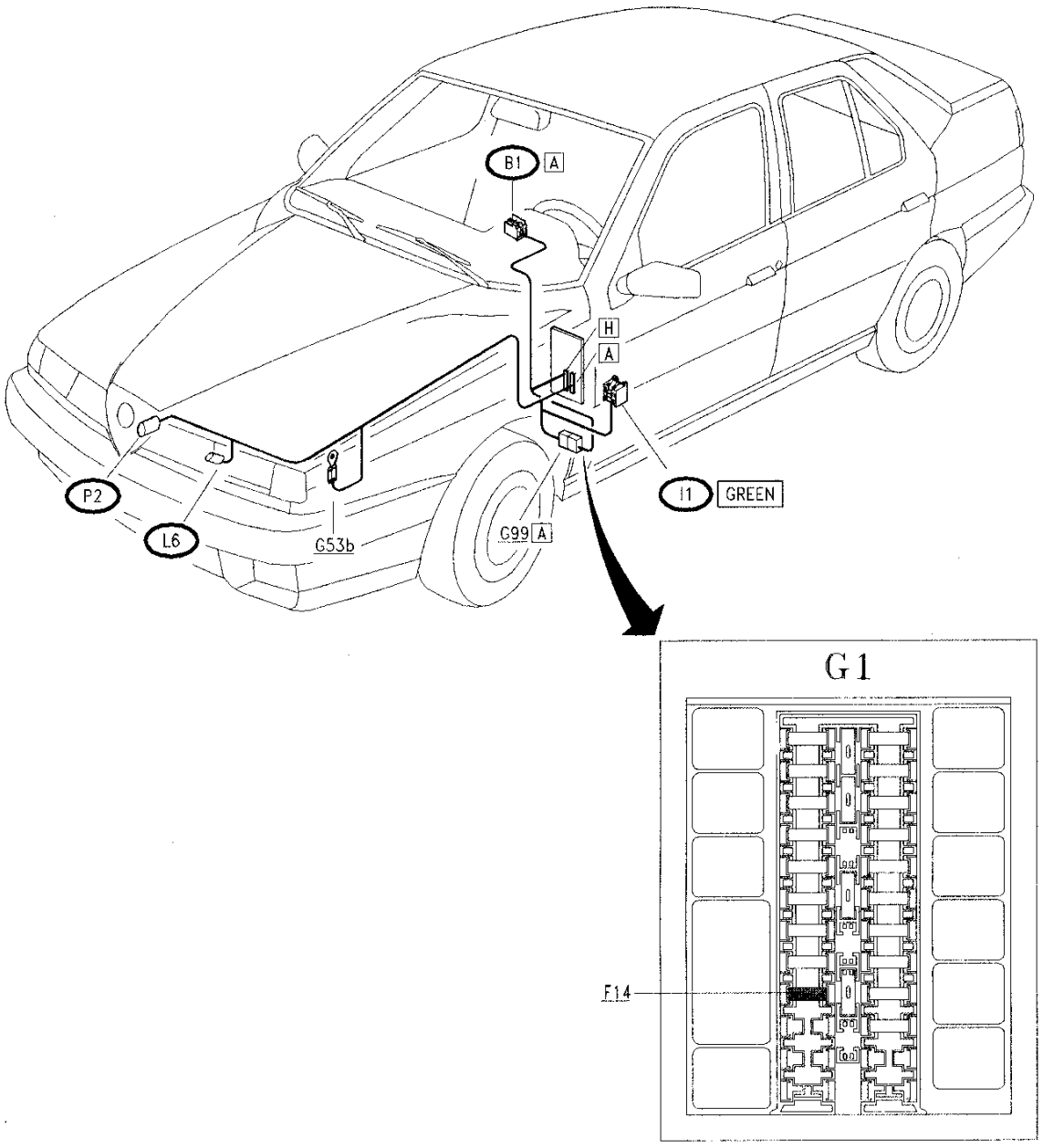
Engine air conditioner wiring B connection	G314b



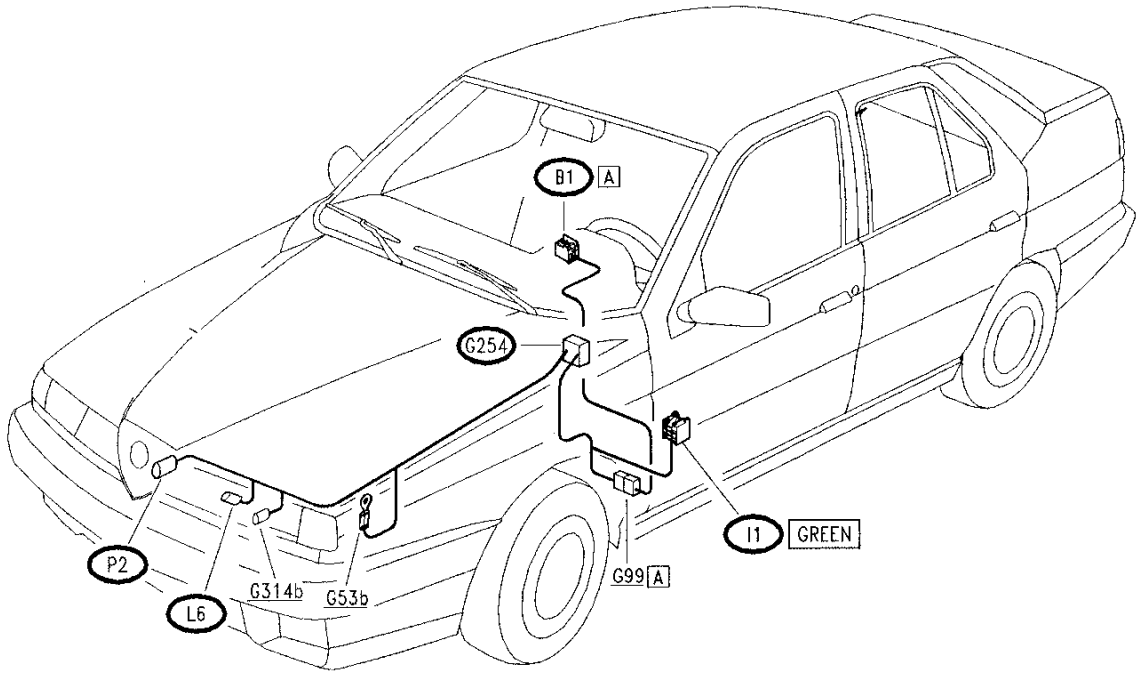
Engine cooling fan relay **TS**	I1	Engine cooling fan relay **6V**	I1
			
Thermal switch for engine cooling electric fan	L6	Engine cooling fan motor **TS**	P2
			
Engine cooling fan motor **6V**	P2		
			

LOCATION OF COMPONENTS

6V



LOCATION OF COMPONENTS
T.S.



TROUBLESHOOTING

ELECTRIC FAN DOES NOT CUT IN (T. SPARK)	TEST A

NOTE: if the fan cuts in too early (below temperature of engine coolant) or too late (high temperature of engine coolant) check the efficiency and calibration of the thermal switch **L6**, and replace it if necessary

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 CHECK FUSE – Check for damage of wander fuse **G254**, in engine compartment	OK ➡	Carry out **step A2**
	OK ➡	Replace fuse (40A)
A2 CHECK RELAY – Check for correct functioning of fan relay **I1**	OK ➡	Carry out **step A3**
	OK ➡	Replace relay **I1**
A3 CHECK GROUND – Check that pin 87 of relay **I1** is grounded (0V)	OK ➡	Carry out **step A4**
	OK ➡	Restore wiring between pin 87 of **I1** and ground **G53b** (BLK)

(continues)

ELECTRIC FAN DOES NOT CUT IN (T. SPARK)	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A4 CHECK FAN – Connect pin 30 of relay **I1** to ground (e.g. connecting it with pin 87) and check that the fan **P2** starts	OK ➡	Carry out **step A7**
	NOT OK ➡	Carry out **step A5**
A5 CHECK VOLTAGE – Connect pin 30 of relay **I1** to ground (e.g. connecting it with pin 87) and verify 12 V between pin A and B of fan **P2**	OK ➡	Check operation, and if necessary replace the fan motor **P2**
	NOT OK ➡	Carry out **step A6**
A6 CHECK VOLTAGE – Verify 12V at pin A of fan **P2**	OK ➡	Restore wiring between pin B of **P2** and pin 30 of relay **I1** (WHT)
	NOT OK ➡	Restore wiring between branch terminal board and fuse **G254** (RED) and between fuse **G254** and pin A of **P2** (LTB-WHT)

(continues)

ELECTRIC FAN DOES NOT CUT IN (T. SPARK)	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A7 CHECK FAN – Connect pin B of thermal switch **L6** to ground and check that the fan **P2** starts	OK ➡	Carry out **step A9**
	OK ➡	Carry out **step A8**
A8 CHECK VOLTAGE – With ignition key engaged, verify 12V at pin 86 of relay **I1**	OK ➡	Restore wiring between pin 85 of **I1** and pin B of thermal switch **L6** (PPL-BLK)
	OK ➡	Restore wiring between pin 86 of **I1** and ignition switch, across pin A5 of **G99** and the solder (LTB-RED)
A9 CHECK THERMAL SWITCH – Check operation of thermal switch **L6**: • the contact between A and B closes at temperatures exceeding 92°C, and reopens when the temperature falls below 87°C	OK ➡	Restore wiring between pin A of **L6** and ground **G53b** (BLK)
	OK ➡	Replace thermal switch **L6**

ELECTRIC FAN DOES NOT CUT IN (6V)	TEST B

NOTE: if the fan cuts in too early (below temperature of engine coolant) or too late (high temperature of engine coolant) check the efficiency and calibration of the thermal switch **L6**, and replace it if necessary

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
B1	CHECK FUSE		
– Check for damage of fuse **F14** in fusebox **G1**		OK ➡	Carry out **step B2**
		OK ➡	Replace fuse (20A)
B2	CHECK RELAY		
– Check for correct functioning of fan relay **I1**		OK ➡	Carry out **step B3**
		OK ➡	Replace relay **I1**
B3	CHECK GROUND		
– Check that pin 30 of relay **I1** is grounded (0V)		OK ➡	Carry out **step B4**
		OK ➡	Restore wiring between pin 30 of **I1** and ground **G53b** (BLK)

(continues)

ELECTRIC FAN DOES NOT CUT IN (6V)	TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B4 CHECK FAN – Connect pin 87 of relay **I1** to ground (e.g. connecting it with pin 30) and check that the fan **P2** starts	OK →	Carry out **step B7**
	~~OK~~ →	Carry out **step B5**
B5 CHECK VOLTAGE – Connect pin 87 of relay **I1** to ground(e.g. connecting it with pin 30) and verify 12 V between pin A and B of fan **P2**	OK →	Check operation, and if necessary replace the fan motor **P2**
	~~OK~~ →	Carry out **step B6**
B6 CHECK VOLTAGE – Verify 12V at pin A of fan **P2**	OK →	Restore wiring between pin B of **P2** and pin 87 of relay **I1** (LTB)
	~~OK~~ →	Restore wiring between pin A1 of **G1** and pin A of **P2** (LTB-WHT)

(continues)

ELECTRIC FAN DOES NOT CUT IN (6V)	TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B7 CHECK FAN – Connect pin B of thermal switch **L6** to ground and check that the fan **P2** starts	OK ➡	Carry out **step B9**
	~~OK~~ ➡	Carry out **step B8**
B8 CHECK VOLTAGE – With ignition key engaged, verify 12V at pin 85 of relay **I1**	OK ➡	Restore wiring between pin 86 of **I1** and pin B of thermal switch **L6** (PPL-BLK)
	~~OK~~ ➡	Restore wiring between pin 85 of **I1** and ignition switch, across pin A5 of **G99** and the solder (LTB-RED)
B9 CHECK THERMAL SWITCH – Check operation of thermal switch **L6**: • the contact between A and B closes at temperatures in excess of 92°C, and reopens when the temperature falls below 87°C	OK ➡	Restore wiring between pin A of **L6** and ground **G53b** (BLK)
	~~OK~~ ➡	Replace thermal switch **L6**

ALFA ROMEO CODE

Index

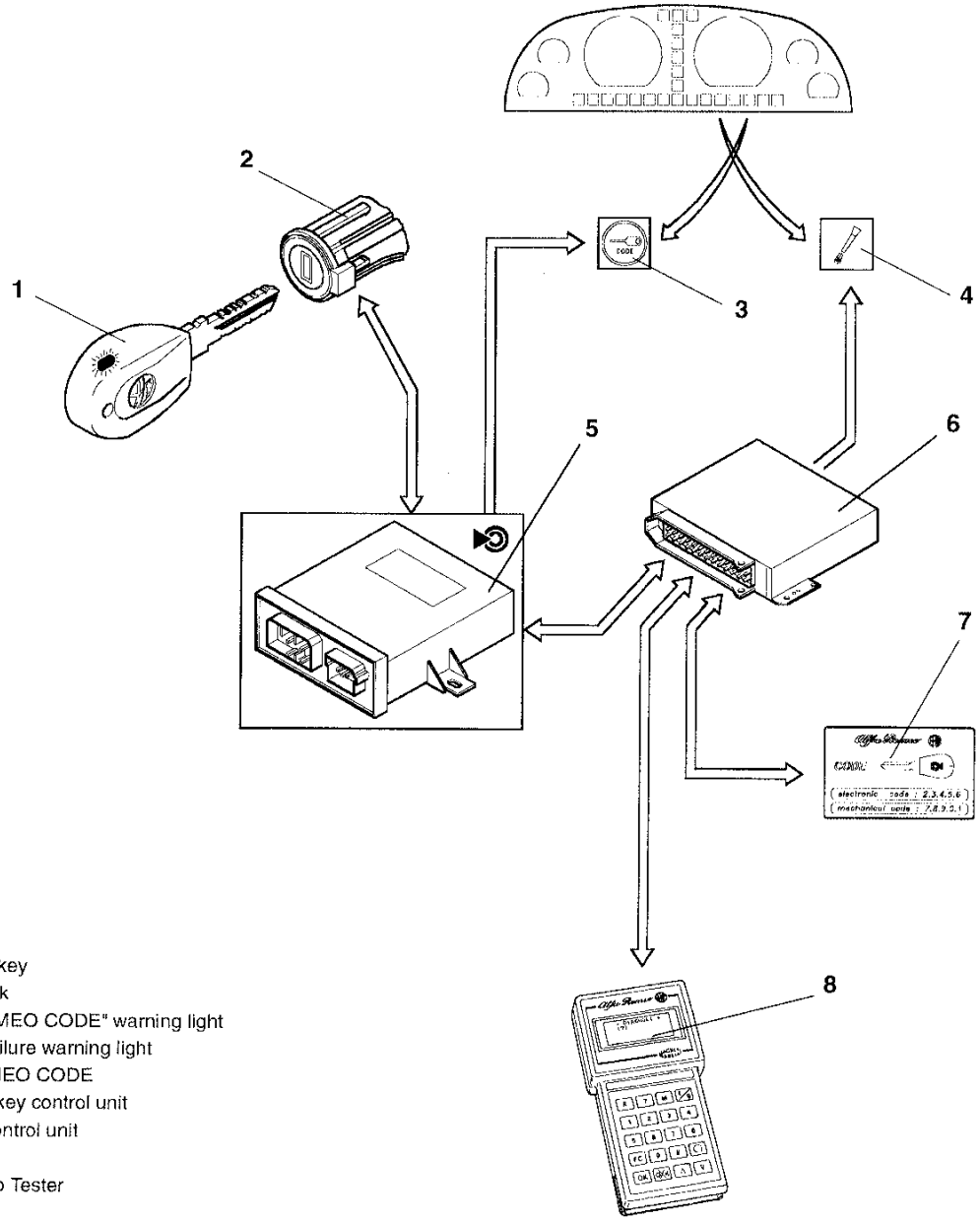
GENERAL DESCRIPTION

The car is fitted with an electronic code system (ALFA ROMEO CODE) which inhibits the control of the engine operated by the ignition keys.

Turning the key to the MARCIA position the Engine Control System Control unit (**C.C.M.**) requests the code from the Control unit of the ALFA ROMEO CODE system - Electronic Key Control Unit (**C.C.E.**). Once it has received the code, it compares it with the code in its memory (**MASTER CODE**).

If the comparison of the code received with the one memorised is positive the C.C.M proceeds with normal electronic engine management (starting, ignition, injection, etc.).
If not, (wrong code, various faults, etc.) the C.C.M. does not carry out engine management and the car will not start.
The C.C.M. offers the possibility to start the car without having received the MASTER CODE by the emergency procedures using the Code Card or the Alfa Tester (see recovery procedures).
The code transmitted to the engine control system control unit (allowing over 4 billion combinations) is computed by an algorithm which makes each transmission between C.C.M. and C.C.E. different from the previous one. (variable, crypted code).

If the code has not been recognised correctly the ALFA ROMEO CODE warning light stays on, together with the injection system failure warning light.



1. Electronic key
2. Ignition lock
3. "ALFA ROMEO CODE" warning light
4. Injection failure warning light
5. ALFA ROMEO CODE
   Electronic key control unit
6. Injection control unit
7. Code Card
8. Alfa Romeo Tester

DESCRIPTION OF COMPONENTS

The system comprises the following components:

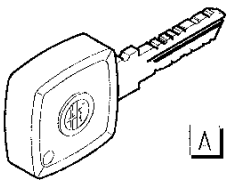
Keys

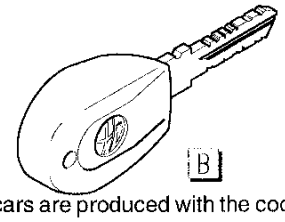
The following are supplied:

– An electronic key ***A:*** **"MASTER" key**

– Two main electronic keys ***B*** **(with Alfa Romeo badge)**

The keys contain an electronic circuit called Transponder, which contains the code which characterises them; this is transmitted to the Electronic key control unit (C.C.E.) when the key is turned to the MARCIA position. Each electronic key possesses its own code, which must be memorised by the system's electronic control unit.





The cars are produced with the codes of the keys supplied with them already memorised, as described below:

– The C.C.E. contains the codes of the two main keys and the MASTER CODE (code of the master key)

– The C.C.M. only contains the MASTER CODE

It is very important to keep the MASTER key most carefully, since its code is memorised, through a special specific procedure (described later), in the electronic injection control unit, therefore the two control units are linked indissolubly.

If the MASTER key goes astray or is damaged, further memorising procedures of new keys will not be possible; without the MASTER key in the event of a failure to the C.C.E. it will be necessary to change the C.C.E. and the C.C.M.

The user is advised to keep the MASTER key in a safe place outside the car. In fact, it serves as an "access key" for memorising further codes (keys). The MASTER key should only be used when needing to memorise new keys.

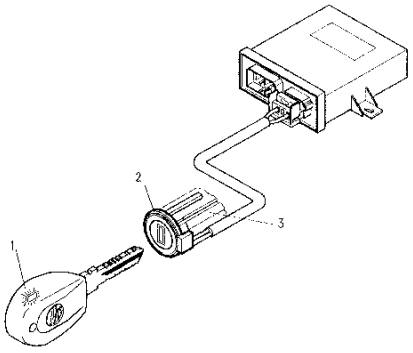
The Transponder inside the key comprises a minute integrated circuit (which contains the code), and a coil (which supplies the integrated circuit and transmits the code).

In the main keys, the Transponder is inserted in an accessible manner, while the MASTER key has the possibility to transfer the component to another MASTER key, if the need arises (for example if the ignition lock needs replacing).

The **MASTER** key is proof of the ownership of the car: it must therefore be present (together with the Code Card), when the car is sold.

Aerial

The aerial is a loop coil which is wound round the ignition lock and is connected to the C.C.E. by a specific connector (see figure) The purpose of the aerial is firstly to supply the transponder so that it can send the code and secondly to receive the Transponder signal.

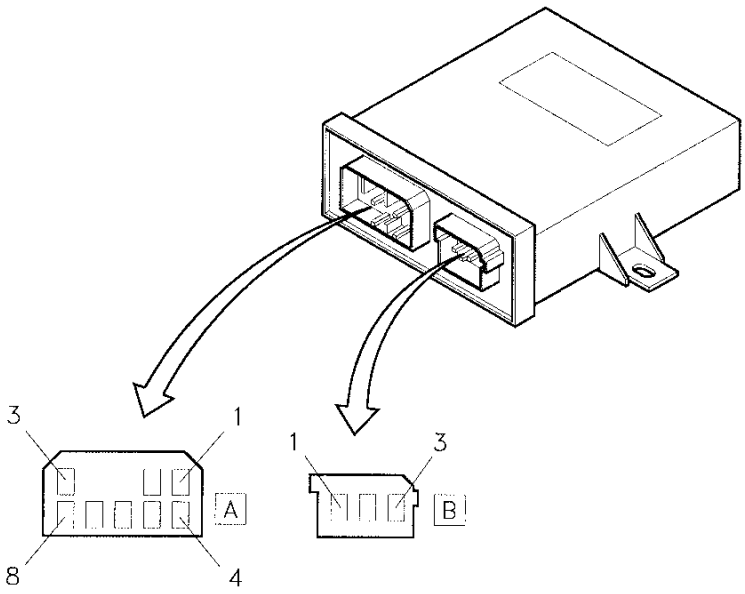


1. Transponder
2. Aaerial
3. Ignition lock

Electronic Key Control unit (C.C.E.)

The C.C.E. is located above the fuse-box; it is interfaced with the car via two connectors: B (3-way) and A (8-way) and it has the following functions:

- It detects rotation of the key in the ignition switch to the MARCIA position
- It emits an electromagnetic field to give power and activate the Transponder of the key
- It receives and computes the secret code sent by the key
- It manages the serial line (one wire) with the Motronic injection control unit
- It manages the special diagnosis warning light on the instrument cluster
- It memorises up to 8 secret codes, one of which is the MASTER CODE
- It recognises connection with the Alfa Tester and allows the use of the serial line for diagnosis



CONNECTOR A
pin 1: N.C.
pin 2: warning light signal
pin 3: direct supply
pin 4: earth
pin 5: diagnosis line K
pin 6: serial line towards the C.C.M.
pin 7: signal for outside relay (N.C.)
pin 8: key-operated supply

CONNECTOR B
pin 1: aerial signal
pin 2: N.C.
pin 3: aerial earth

Engine Control System Control Unit (C.C.M.) with software (programme) for ALFA ROMEO CODE :

Thw engine control system control units adopted on these cars are provided with functions for management of the ALFA ROMEO CODE electronic key: these functions, which are activated when the key is turned, are the following:

- Permanent memorising of the MASTER key code (MASTER CODE) by a specific procedure carried out during production testing or when the C.C.M. is changed.
- Request of the MASTER key code to the C.C.E.
- Recognition of the MASTER CODE and engine control enabling (starting the car)
- Recognition of the message (transmitted by the C.C.E.) warning that an unauthorised key has been inserted (the car will not start).
- Recovery function via the Alfa Romeo Tester (it is necessary to know the ELECTRONIC CODE written on the Code Card)
- Recovery function by entering the ELECTRONIC CODE written on the Code Card using the accelerator pedal.
- Control of the diagnosis warning light (injection failure warning light)

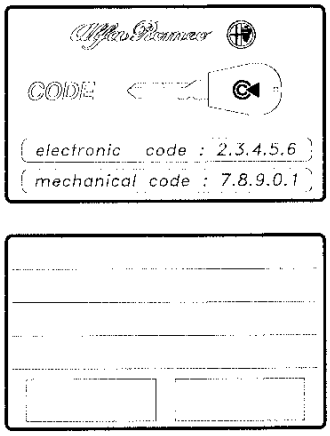
Absolutely never exchange the injection control units between cars to check whether they are working properly.

Therefore, during fault-finding operations, avoid changing the injection control unit, if you are not sure that it is the cause of the problem on the car (firstly check the actuators and sensors and the wiring, etc.) bearing in mind that the installation of a new control unit (never used before) will involve the permanent memorising of the MASTER CODE inside it of the next key that is turned to MARCIA; therefore, from that moment onwards this control unit will only work in combination with the keys and C.C.E. of that car.

Code Card (card with secret code)

This is a memo card the size of a credit card which is supplied with the car. (see illustration).

It contains a five-digit code (**ELECTRONIC CODE**) which makes it possible to start the engine (recovery function) when the electronic keys have been lost or damaged.



Two cards are supplied.

NOTE: Clearly this emergency procedure only takes account of the electronic code associated with the keys, and not the mechanical parts shared with other cars.

The Code Card should not be kept in the car, but it should be kept at hand because through the code, it will be possible to start the car without the ALFA ROMEO CODE (see the specific recovery procedure).

The Code Card, as well as the ELECTRONIC CODE (**"E. CODE"**), contains the mechanical code of the keys (**"M. CODE"**): through this code it is possible to request other keys suited to the ignition switch and to be memorised in the C.C.E.

On the back there are two special spaces for applying the labels of the transmitters supplied with the optional alarm system (V.A.S. alarm).

NB. Also the V.A.S. antitheft/alarm system inhibits the supply of the C.C.M. (see "Alarm).

OPERATION: Anti-theft strategy

Each time the ignition key is turned to MARCIA the following main operations are carried out in sequence: The injection control unit asks the C.C.E. for the MASTER CODE (the one of the MASTER key memorised previously).

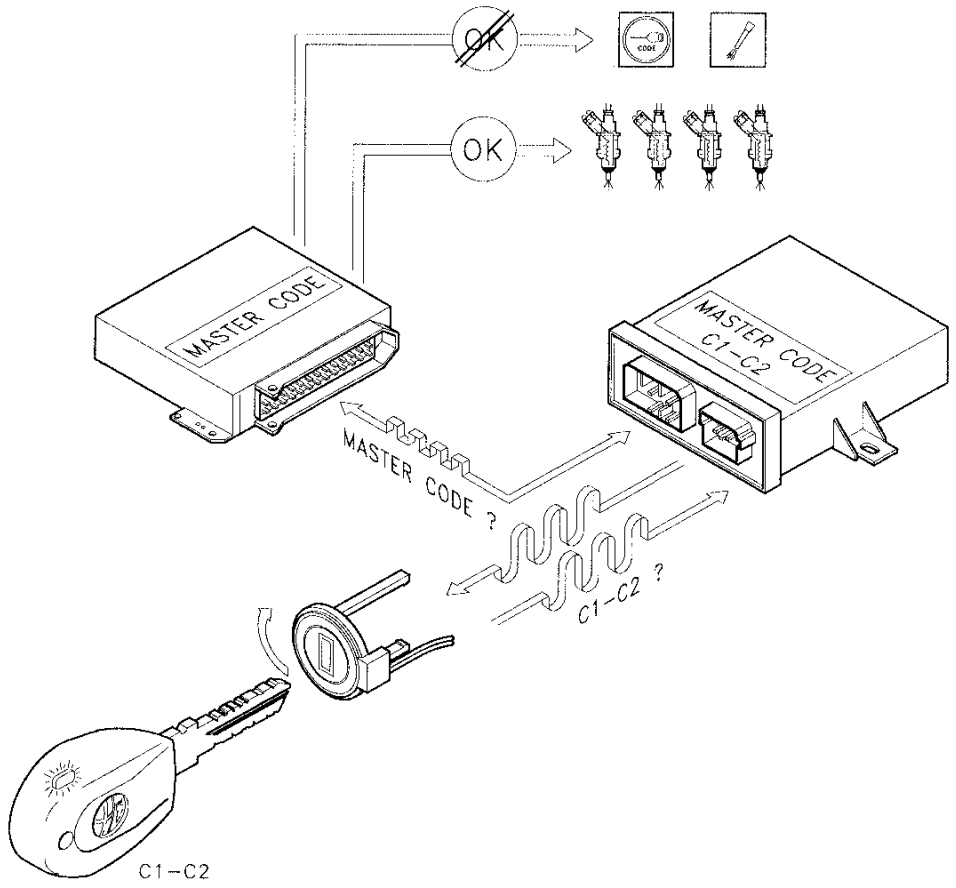
The C.C.E. checks that the code of the key engaged in the ignition lock corresponds to one of the codes contained in its memory.

If the key corresponds to one of the memorised codes:

the C.C.E. sending the MASTER CODE, to the injection control unit, **enables starting** (see illustration).

If the code of the key engaged in the ignition lock does not correspond to one of those memorised:

The C.C.E. informs the injection control unit that an extraneous key has been engaged and **starting will not be enabled** (see illustration) this situation will be indicated by the turning on of the electronic injection system failure warning light and the ALFA ROMEO CODE warning light.



C1, C2 = key codes

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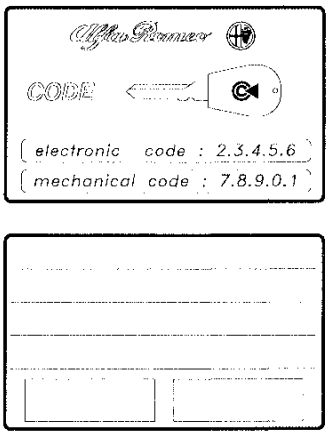

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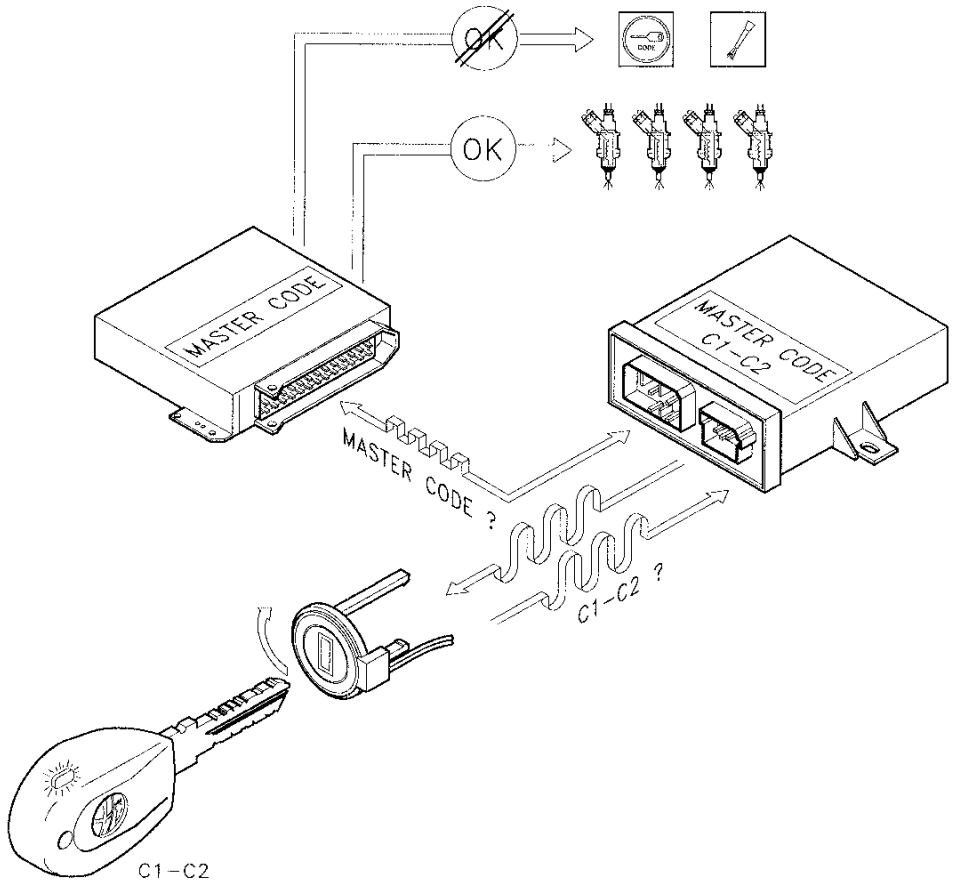


C1, C2 = key codes

Interaction between key and C.C.E.

When the C.C.E. detects the engagement of the key it sends a signal to the ends of the aerial thereby generating an electromagnetic field.

This way the Transponder coil is inductively connected and it receives the energy to supply the integrated circuit to which it is connected.

At this point the integrated circuit transmits the code.

Sharing of the serial line of the diagnosis functions and the ALFA ROMEO CODE system

Inside the C.C.E. there is a shunt relay which has the purpose of enabling dialogue between the C.C.M. and the Alfa Tester or the C.C.E. itself. Pin A6 is usually dedicated to dialogue between the C.C.E. and the C.C.M (see illustration).

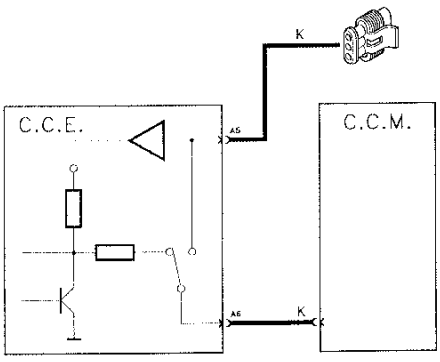
Line K of the diagnosis socket is connected to the C.C.E. at pin A5.

The shunt relay is normally in such a position as to allow dialogue between the C.C.E. and the C.C.M (default position). When diagnosis begins connecting with the Alfa Tester (turning the ignition key to MARCIA) the C.C.E., after ending dialogue with the C.C.M. recognises the request for diagnosis and pilots the relay to connect pin A5 and A6 to one another, thereby enabling dialogue between the tester and the C.C.M. The C.C.E enables connection with the Alfa Tester only when the following conditions occur contemporaneously:

- There is not activity on the serial line between the C.C.E. and the C.C.M.
- A low level (of voltage) is present on pin A5 for a time of between 500ms and 5s (a low level for over 5s is considered as a short circuit towards earth)

The relay returns to the default position when there is no activity on pin A5 for over 30s.

When the control unit detects that the Alfa Tester has been engaged, it turns on the ALFA ROMEO CODE warning light to indicate correct switching of the relay.



Dialogue between C.C.E. and C.C.M.

As mentioned previously, the C.C.E. and C.C.M. "dialogue" via a serial line formed of a single cable. The serial line is two-way, this means that the information travels sequentially from the C.C.M. to the C.C.E. and vice- versa. The information exchanged between the two control units may concern the following operating conditions:

A) Checking the code C.C.E. memorised C.C.M. memorised:

Each time the key is turned to MARCIA (also during starting) the C.C.M., before starting engine management, asks the C.C.E. for the MASTER CODE. The C.C.E. can answer in one of the following three ways:

1. It sends the MASTER CODE (crypted), enabling the C.C.M. to start the car

2. It sends a code which inhibits starting the engine (if the key engaged has not been memorised, or it is a key without Transponder, aerial failure, etc.)

3. It does not answer (C.C.E. failure)

The function is governed by a programme which takes account of all the variables that might be present in the system.

B) Memorising the codes

These operations concern the system when at least one control unit (C.C.E. or C.C.M) is brand new.
The following instances may arise:

C.C.E brand new and C.C.M. brand new:

When both the control units are brand new (C.C.E. and C.C.M.) the C.C.E. answers the request of the injection control unit sending a universal code crypted by an algorithm. This condition is indicated by a characteristic flash.(1.6 Hz) of the warning light: this only takes place if the C.C.E. has detected the presence of a Transponder. Conversely, if the aerial is broken or disconnected or there is no Transponder in the key, the C.C.E. will not answer).
In this situation the system is not protected yet, and it is ready to start the key memorising procedure.

C.C.E. memorised and C.C.M. brand new:

When the ignition key has been turned to MARCIA the C.C.M. will ask the C.C.E. for the MASTER CODE to memorise it; the C.C.E. sends the MASTER CODE only if it has recognised a key among those memorised in the ignition lock: from this moment the MASTER CODE is memorised in the C.C.M. which is thus indissolubly linked with the car.

C.C.E. brand new and C.C.M. with MASTER CODE memorised:

When the ignition key has been turned to MARCIA the C.C.M. asks for the MASTER CODE to be enabled for start-

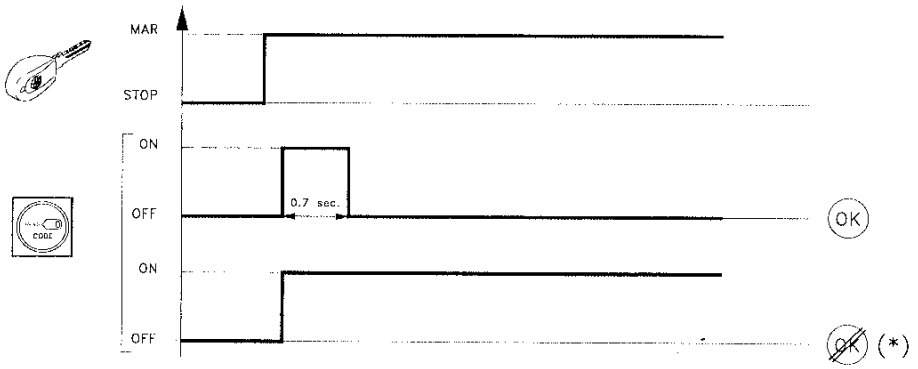
ing. As the C.C.E. is brand new, it answers sending the universal code, only if it reads a code correctly in the Transponder. (It might be a key without Transponder or with a key with the Tramsponder not working or the aerial might be disconnected or damaged, etc.).

The C.C.M. prevents the engine from being started as it does not recognise the universal code: it is necessary to memorise the keys in the C.C.E., MAKING SURE THAT THE MASTER KEY IS THE ONE WHICH OPENS AND CLOSES THE PROCEDURE (see programming).

Piloting times of the ALFA ROMEO CODE warning light

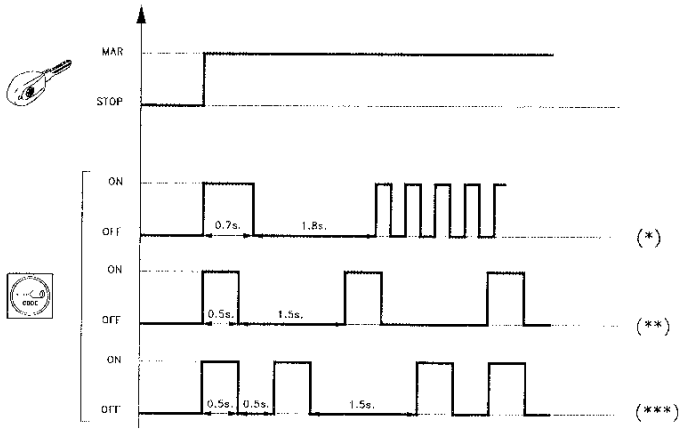
The diagnosis warning light on the instrument panel is controlled by the C.C.E. to inform the user and workshops of the system status. There are two types of characteristic flashing:

1. **When the keys have already been memorised** (see illustration) it indicates the correct operation of the system or a problem:
2. **When the system is still brand** new the flash (1.6 Hz after 2.5 seconds) means that the system is intact and working, the car is not protected until a key memorising procedure has been carried out, other faults detected are also indicated (see illustration)



(1)

(*)- Transponder not recognised/absent/faulty
- lack of connection between C.C.E. and C.C.M
- aerial faulty/disconnected
- C.C.E. faulty
- re-memorising not carried out correctly



(2)

(*) system intact, working but brand new, car not protected
(**) lack of connection between CCE and CCM
(***) -Transponder not recognised/absent/faulty
- aerial faulty/disconnected

WARNING! If the ALFA ROMEO CODE warning light turns on momentaneously or permanently while travelling or starting the car, this does not necessarily mean a system failure, but, in certain cases, it means a condition that can be interpreted as an attempt to manipulate the vehicle by a thief.
Should this occur, to correctly check the car, turn the engine off and move the key to STOP; then turn the key back to MARCIA: the warning light should turn on and off in less than one second.
If it stays on after this procedure, repeat the operation, leaving the key at STOP for more than 30 seconds. If the warning light still stays on when the key is in the MARCIA Position, carry out diagnosis on the ALFA ROMEO CODE system.

PROGRAMMING THE KEYS

The system is capable of memorising up to 7 keys plus the MASTER KEY. Correct memorising needs two keys plus the MASTER key.

During production testing the keys were memorised and the system is tested and working. If the need arises, for servicing reasons, to replace faulty components or there is the need for more keys than those supplied, the key memorising procedure must be carried out. There are two types of ways to memorise the keys :

- **Memorising** procedure, with a brand new system (C.C.E. and C.C.M. new).
- **Re-memorising** procedure, which is carried out under the following circumstances:
  - the addition of other keys besides those already memorised in the C.C.E.
  - if it is absolutely necessary to change the ignition lock. In this circumstance, in fact, it is possible to keep the only the Transponder of the MASTER key of the old set of keys, which, once inserted in the new key (see specific procedure) makes it possible to memorise the other keys provided with the new ignition lock.
  - changing the C.C.E.

MEMORISING

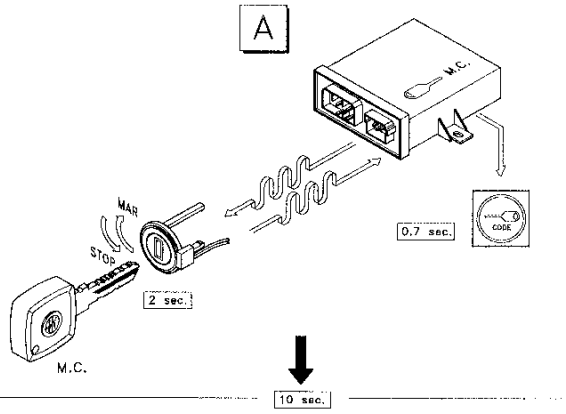
Before starting to programme the keys, it is necessary to check whether the system is brand new or if any keys have been memorised; this can be done by displaying the indications of the diagnosis warning light or connecting to the Alfa Tester. **The use of a faulty or already memorised C.C.E. would in fact involve the irreversible memorising of an incorrect code in the C.C.M. which it will no longer be possible to use in future on other cars.**

The memorising procedure is divided into two strictly consecutive phases:

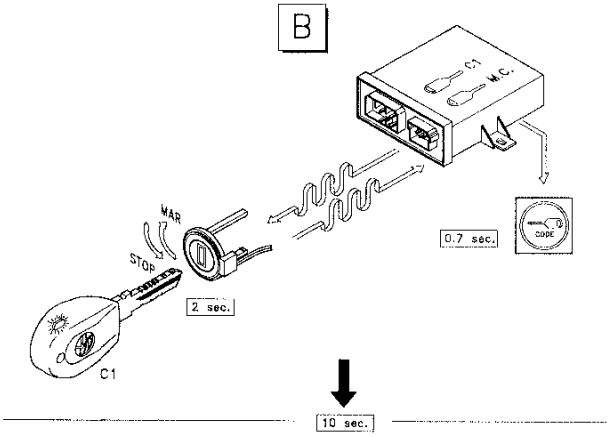
1. Memorising the keys inside the C.C.E.
2. Memorising the MASTER CODE in the engine control system control unit (if brand new)
   This is carried out only when the first one has been carried out with a positive result, turning the key to MARCIA.

MEMORISING PROCEDURE WITH BRAND NEW SYSTEM

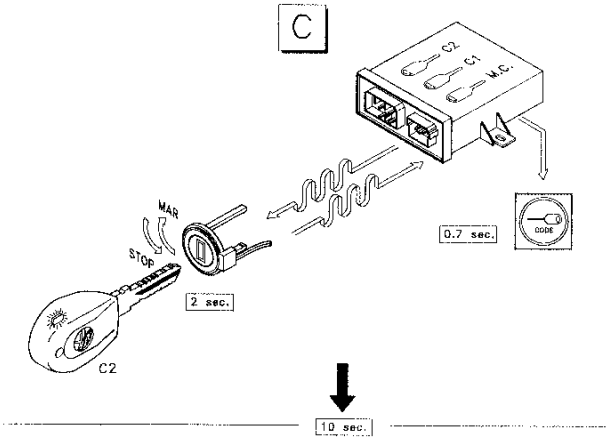
A Insert the **MASTER key** in the ignition lock
Turn the MASTER key to MARCIA and move it back to STOP as soon as the ALFA ROMEO CODE warning light goes off.



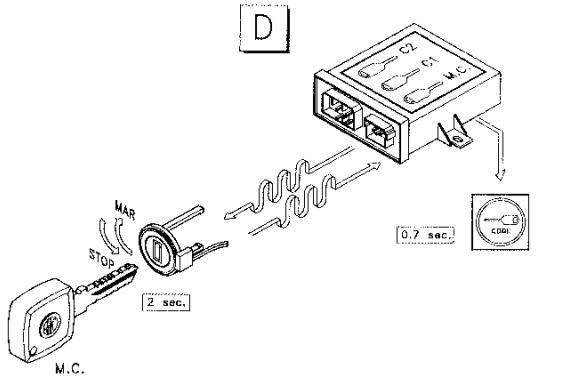
B Within 10 seconds:
Remove the MASTER key from the ignition lock, insert **a main key** in the lock
Turn the key to MARCIA. As soon as the ALFA ROMEO CODE warning light goes out, turn the key to the STOP position.



C Within 10 seconds:
Remove the key from the ignition lock, insert **a second main** key in the lock.
Turn the key to MARCIA. As soon as the ALFA ROMEO CODE warning light goes out, turn the key to the STOP position.



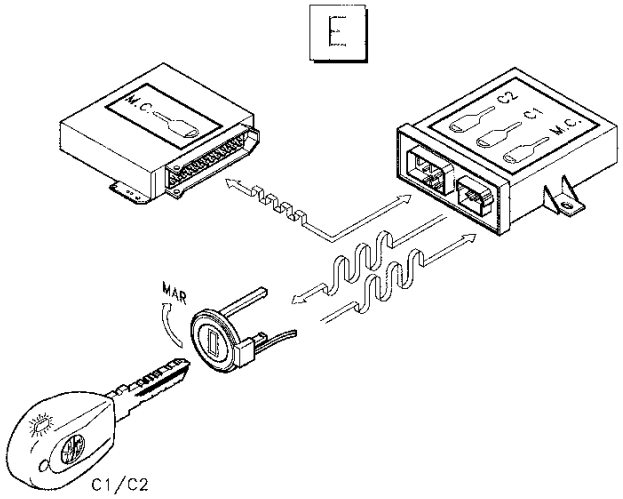
D Within 10 secondsi:
Remove the key from the ignition lock, insert **the MASTER key** in the ignition lock **again**
Turn the key to MARCIA. As soon as the ALFA ROMEO CODE warning light goes out, move it back to the STOP position.



M.C. = MASTER CODE C1, C2 = key codes

At this point the keys are memorised in the C.C.E.

E **Insert** any one of the memorised keys **and turn it to MARCIA**: the ALFA ROMEO CODE warning light will turn off and go out after 0.7 seconds.
Wait for 2 seconds: if the ALFA ROMEO CODE warning light stays off, that means that the key memorising procedure has been carried out correctly, and the MASTER key code has been memorised in the injection control unit.
Conversely, if the warning light flashes again (1.6 Hz), it means that the memorising procedure has not been carried out correctly.



M.C. = MASTER CODE C1, C2 = key codes

If, for any reason and in any moment, you think you have mistaken the procedure:

- **Move the key to MARCIA for more than 2 seconds or move the key to STOP for more than 10 seconds.**
- **Repeat the procedure from the start inserting all the keys.**

As may be deduced, during the procedure the key should never be kept at MARCIA for over 2 seconds, while it should never be kept at STOP for over 10 seconds.

Each time the key is turned to MARCIA, the warning light turns on (0.7 s), indicating the correct sequence of the procedure.

The above-mentioned procedure includes three keys: the MASTER key and two main keys.
Up to seven main keys may be inserted, using more keys between two insertions of the MASTER key.The MASTER key must always be inserted for the first and last time during programming.

The procedure is interrupted if the following situations occur:

- The same key is inserted twice consecutively
- The same key is inserted twice or more times between two insertions of the MASTER key
- A key stays at MARCIA for more than 2 seconds
- A key is kept at STOP (during the procedure) for more than 10 seconds

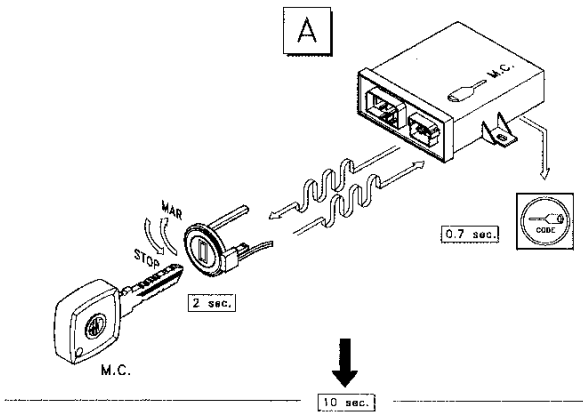
KEY RE-MEMORISING PROCEDURE

This procedure is similar to the previous one, and consists in inserting the main keys between two insertions of the MASTER Key.

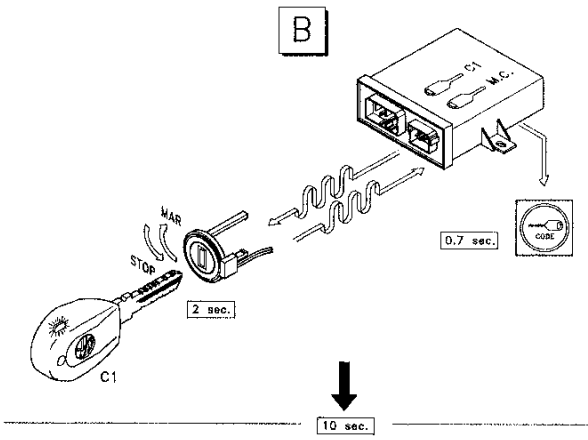
During the sequence the new main keys and the old ones are inserted.

If the main keys memorised previously are not inserted, their code will be erased from the memory of the control unit.

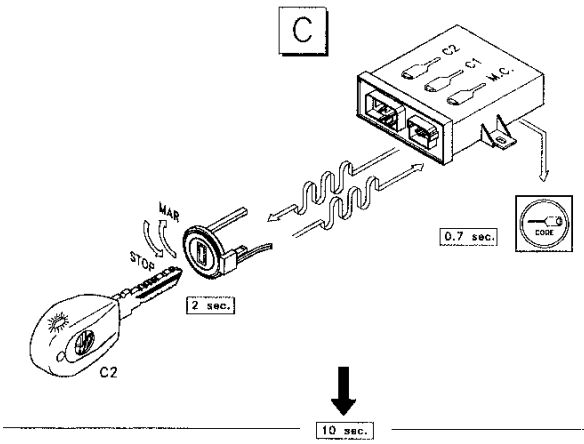
A Insert the **MASTER key** in the ignition lock
Turn the MASTER key to MARCIA and move it back to STOP as soon as the ALFA ROMEO CODE warning light goes out.



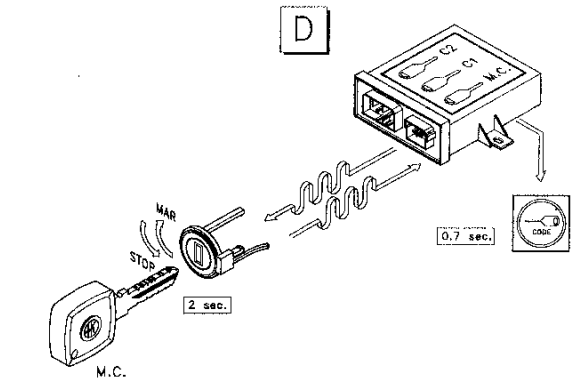
B Within 10 seconds:
Remove the MASTER key from the ignition lock, insert **a main key (known or new)** in the lock. Turn the key to MARCIA : when the ALFA ROMEO CODE warning light goes out, turn the key to the STOP position.



C Within 10 seconds:
Insert **a second main key (known or new)** in the ignition lock
Turn the key to MARCIA : when the ALFA ROMEO CODE warning light goes out, turn the key to the STOP position.



D Within 10 seconds:
Remove the key from the ignition lock, insert **the MASTER** key in the lock **again**
Turn the key to MARCIA and when the ALFA ROMEO CODE warning light goes out, move it back to the STOP position.



M.C. = MASTER CODE C1, C2 = key codes

If, for any reason and in any moment, you think you have mistaken the procedure:

- **Move the key to MARCIA for more than 2 seconds or move the key to STOP for more than 10 seconds.**
- **Repeat the procedure from the start inserting all the keys..**

As may be deduced, during the procedure the key should never be kept at MARCIA for over 2 seconds, while it should never be kept at STOP for over 10 seconds.

Each time the key is turned to MARCIA, the warning light turns on (0.7 s), indicating the correct sequence of the procedure.

The above-mentioned procedure includes three keys: the MASTER key and two main keys.
Up to seven main keys may be inserted, using more keys between two insertions of the MASTER key.The MASTER key must always be inserted for the first and last time during programming.

The procedure is interrupted if the following situations occur:

- The same key is inserted twice consecutively
- The same key is inserted twice or more times between two insertions of the MASTER key
- A key stays at MARCIA for more than 2 seconds
- A key is kept at STOP (during the procedure) for more than 10 seconds

Memorising the MASTER CODE in the C.C.M. (if the latter is changed:

This operation takes place turning the key to MARCIA after having memorised all the keys in the C.C.E.

Warning:

- **Once the codes have been programmed, the C.C.E. is capable of transferring the MASTER CODE to the injection control unit (which stores it permanently), each time the key is turned to MARCIA.**
- **Do not use brand new C.C.M.s to check that the system is working properly.**
- **Do not swop C.C.M.s among cars.**

Memorising with brand new C.C.E. and memorised C.C.M.:

This function is carried out following the normal memorising procedure, as if the whole system were brand new; the MASTER Key must be the same with which the injection control unit was memorised previously.

WARNINGS:

- **Before starting the procedure make sure that the C.C.E. is truly brand new. The use of a faulty or already memorised C.C.E. will cause the irreversible memorisation of a wrong code in the C.C.M., which will no longer be able to be used in future on other cars.**
- **WARNING:**
  If the ALFA ROMEO CODE warning light stays on during re- memorisation, it means that the procedure has not been carried out correctly and it has been interrupted.
  Repeat the re-memorising procedure from the start.
- **If the ALFA ROMEO CODE warning light stays on when the MASTER key has been inserted twice consecutively, this does not mean a malfunctioning, but that the re-memorising procedure has been opened (key at MARCIA) and interrupted (second key at MARCIA). To resume the correct operation of the warning light, move the key to STOP.**

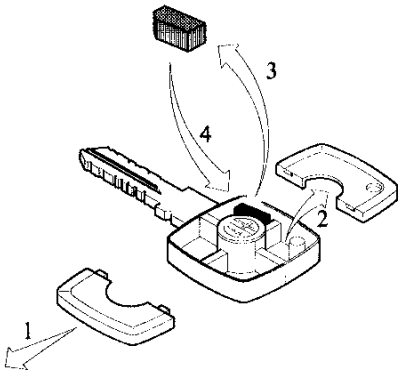
TRANSPONDER TRANSFER PROCEDURE

When needing to change the ignition lock or a door lock, for example, it is possible to transfer the Transponder from MASTER key to another: this way the memory of the Electronic Key Control Unit (C.C.E.) can be "re-opened" to memorise the new main keys (with new locks). Otherwise it would be necessary to change both the C.C.E. and the Master Key Control Unit (C.C.M.) as it would be impossible to re-open the memory of the latter using another Transponder.

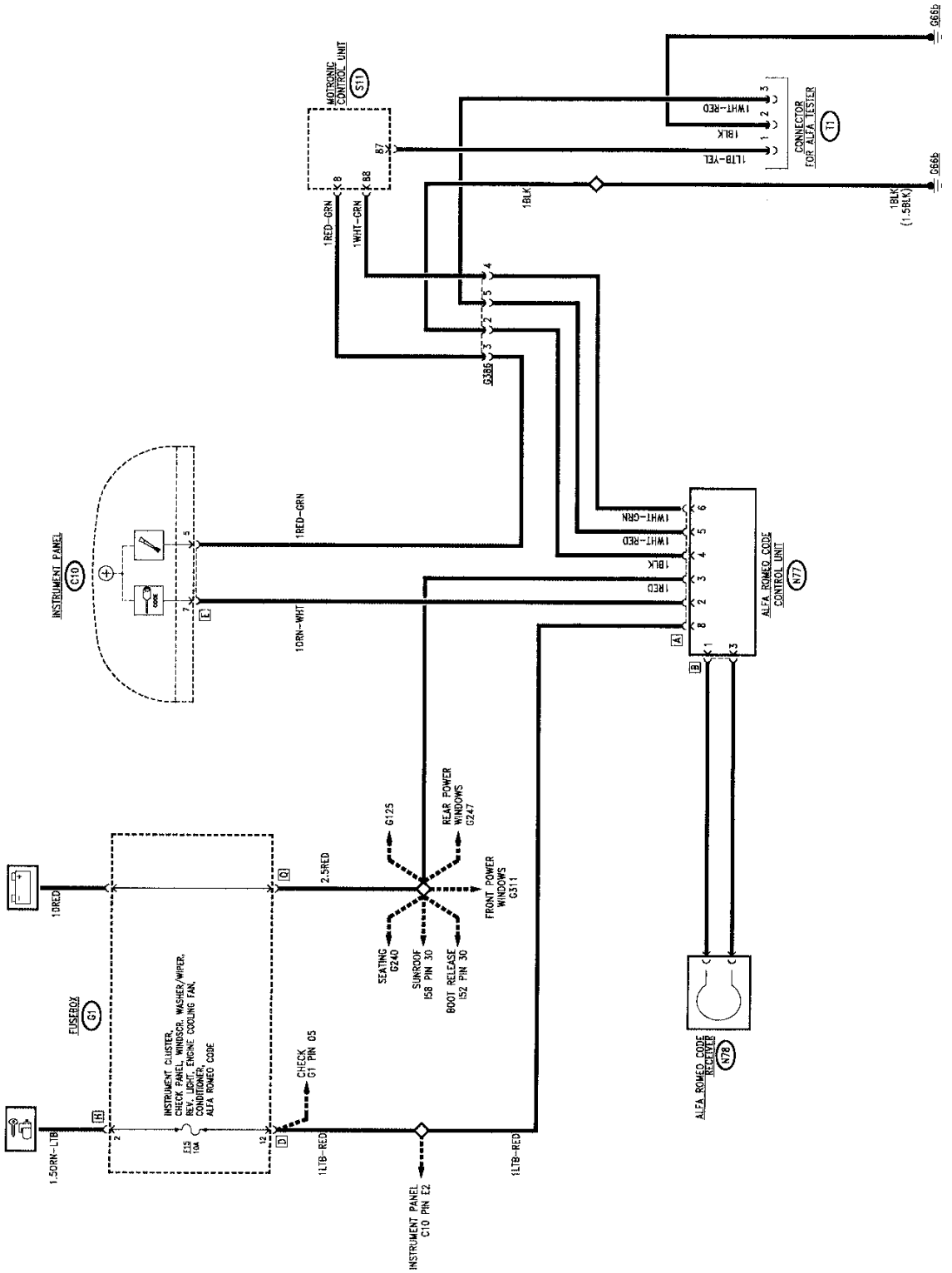
To transfer a Transponder, proceed as follows:

1. Open the MASTER key sliding the mobile section.
2. Raise the remaining part, levering on the two fastening notches. Open carefully to avoid damaging the actual key.
3. Remove the Transponder taking care not to damage it.
4. Insert the Transponder in another MASTER key.

N.B.: The Transponder is not restrained in its housing in the key, it is simply rested.



WIRING DIAGRAM



FUNCTIONAL DESCRIPTION

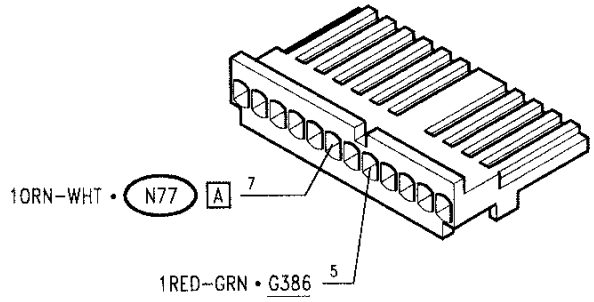
The ALFA ROMEO CODE control unit **N77**, to be found next to the fusebox **G1**, is connected via connector B to a special pair of cables to the receiver **N78**, consisting in a coaxial aerial with the ignition switch. Through connector A it is connected to the Motronic control unit **S11** and to the other systems: at pin 8 it receives the "key- operated" supply and through the line of fuse **F15** (10A), while at pin 3 it receives the direct supplyvia connector Q of **G1**, and pin 4 is earthed.

The connection line with the ALFA ROMEO CODE warning light on the instrument panel leaves from pin 2.

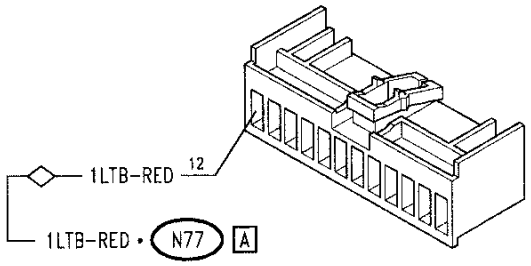
Pins 5 and 6 manage communication between the ALFA ROMEO CODE control unit **N77** and the Motronic control unit **S11**: this communication takes place "cutting off" the diagnosis line K which leads from **S11** to the diagnosis connector **T1**.

COMPONENTS AND CONNECTORS

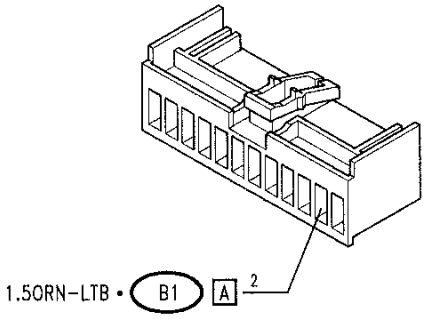
Instrument cluster	C10 E



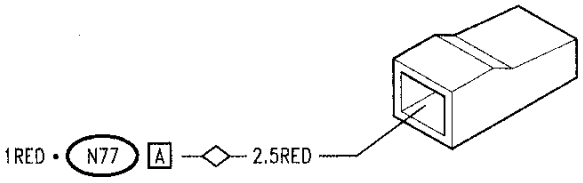
Fusebox	G1 D



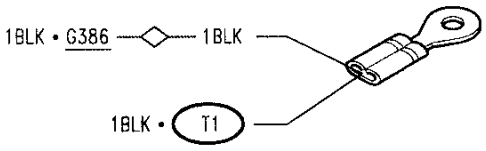
Fusebox	G1 H



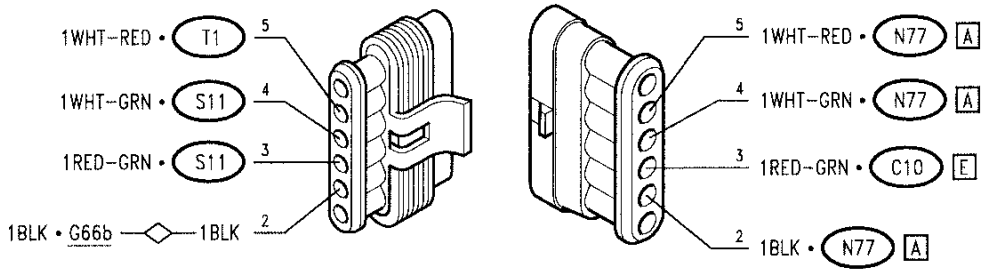
Fusebox	G1 Q



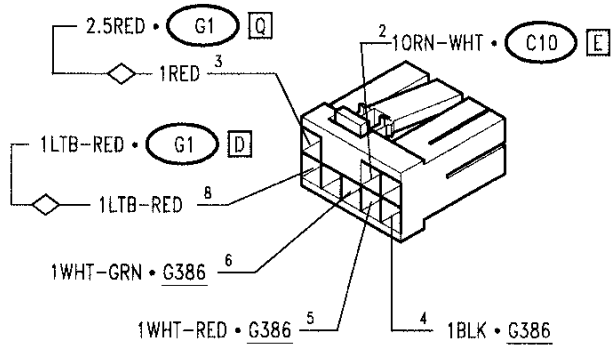
Motronic wiring ground	G66b



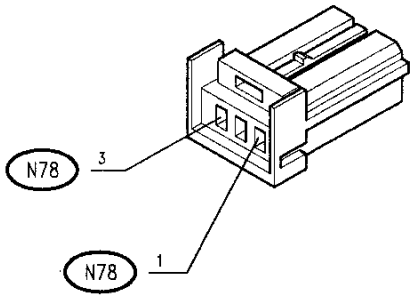
ALFA ROMEO CODE connector	G386



ALFA ROMEO CODE control unit	N77 A



ALFA ROMEO CODE control unit	N77 B

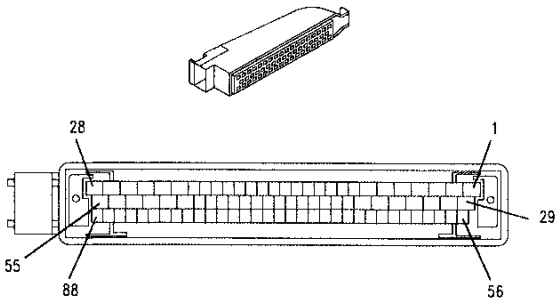


Motronic control uni	S11

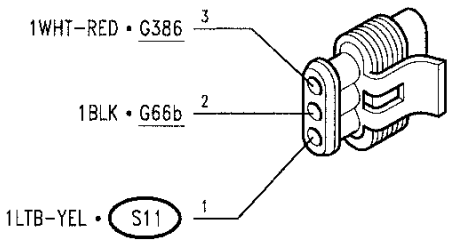
8 1RED-GRN • G386

87 1LTB-YEL • T1

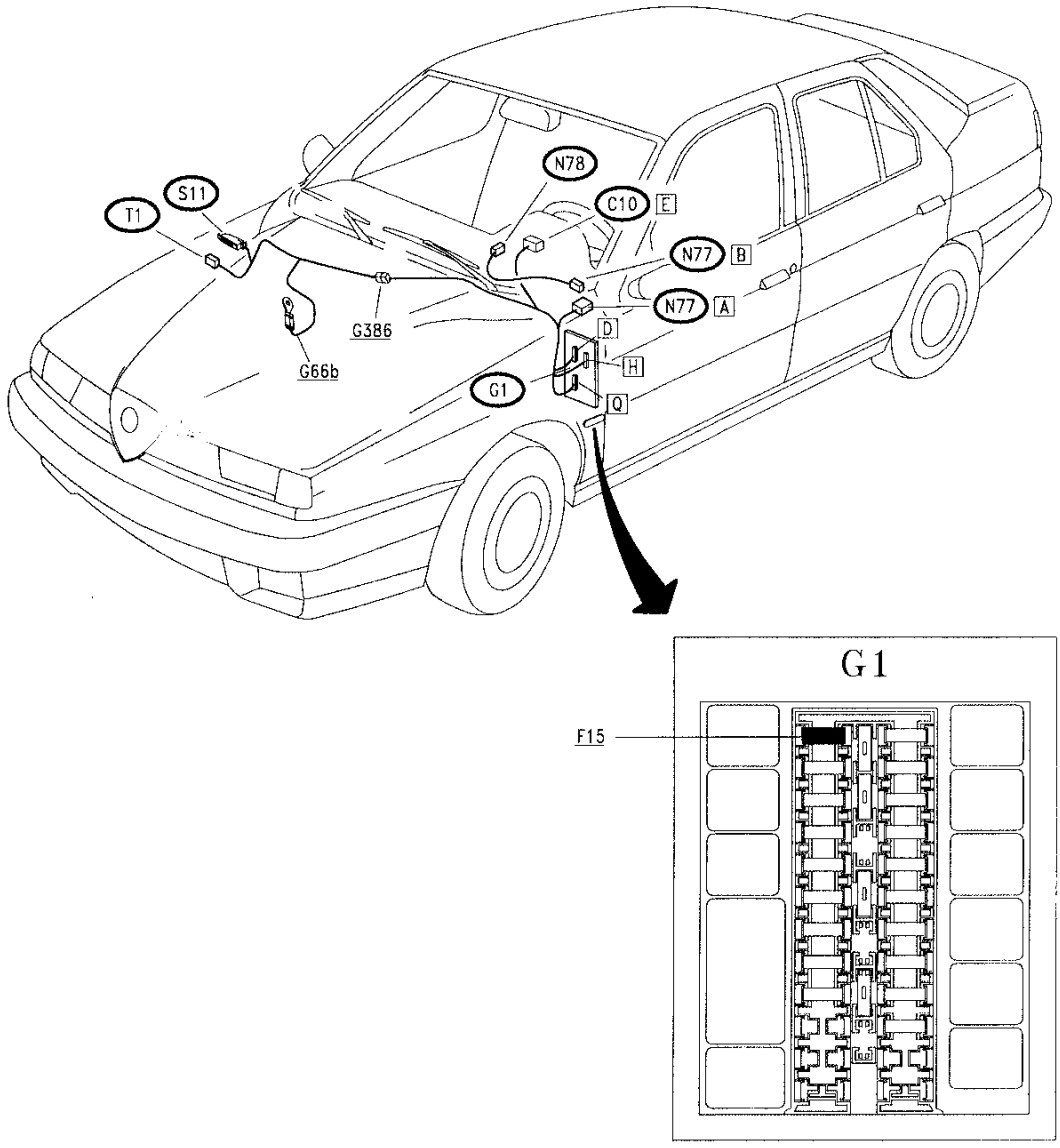
88 1WHT-GRN • G386



Connector for ALFA TESTER	T1



LOCATION OF COMPONENTS



DIAGNOSIS

The C.C.E. cannot be tested directly via the Alfa Tester.

To the injection control unit, which already possesses a sophisticated self-diagnosis, the possibility has been added to test and display the more important functions of the ALFA ROMEO CODE.

Dialogue between the C.C.M. and the Alfa Tester begins when the key has been turned to MARCIA and when communication between the C.C.M. and the C.C.E. has ended.

The information, concerning the ALFA ROMEO CODE, supplied to the Alfa Tester, may belong to two different environments:

Errors:
generally displayed by the tester with priority depending on the importance.

There is a counter inside the control unit, which is activated when an error is stored and it decreases each time the error is no longer present; when the counter reaches zero, the control unit erases the error from the memory.

Therefore, the error memorised can be distinguished as PRESENT or not PRESENT.

The errors memorised are:

- Serial line not active, code not received or time-out:
  this error indicates that the control units (C.C.E. and C.C.M.) have not succeeded in communicating and the probable causes can be line interrupted or short circuited or some problem on the actual control units (or - with brand new system - faulty or disconnected aerial or faulty or lacking Transponder).

- Received incorrect code:
  the injection control unit has received from the C.C.E. a code that does not correspond to its memorised MASTER CODE; the probable cause can be an exchange of the injection control unit or the use of another main key during re-memorisation.

- Incorrect code in the C.C.E.:
  this means that a key unknown to the control unit has been inserted and starting of the car has not been allowed.

Parameters:

This is the environment of the Tester after connection with the C.C.M. (if no errors are present).

This environment is used to display the engineering parameters which define the status of a system.

The parameters are the following:

- brand new C.C.M.

- Starting inhibition procedure; (an unmemorised key has been inserted, the C.C.M. has not been enabled to start by the C.C.E.)

- brand new C.C.E. connected correctly

RECOVERY PROCEDURES

***The emergency procedures* should be carried out, when it is not possible to start the engine with the keys available.**

This procedure requires the possession of the Code Card; with the corresponding ELECTRONIC CODE (5-figure code written on the card. The procedure, (carried out either with the Alfa Tester or with *the accelerator pedal) consists in enter*ing the ELECTRONIC CODE directly in the inection control unit.

This procedure makes it possible to start the engine only once; the procedure must be repeated to start the engine again (or a "known" key must be inserted, i.e. already memorised in the control unit).

Emergency starting procedure (using the accelerator pedal)

This procedure should be carried out using the accelerator pedal and carefully watching the indications of the injection control unit warning light.

– Turn the key to MARCIA

– Press the accelerator pedal and keep it pressed until the warning light goes out.

– When the warning light goes out release the accelerator pedal.

– At this point the warning light begins to flash; after the number of flashes corresponding to the first number of the code on the Code Card (ELECTRONIC CODE) depress the accelerator pedal completely.

– The warning light turns on and stays on for 4 seconds then it goes out.

– When the warning light goes out, release the accelerator pedal

– The warning light starts to flash again; after the number of flashes corresponding to the second number of the ELECTRONIC CODE, press the accelerator fully home again.

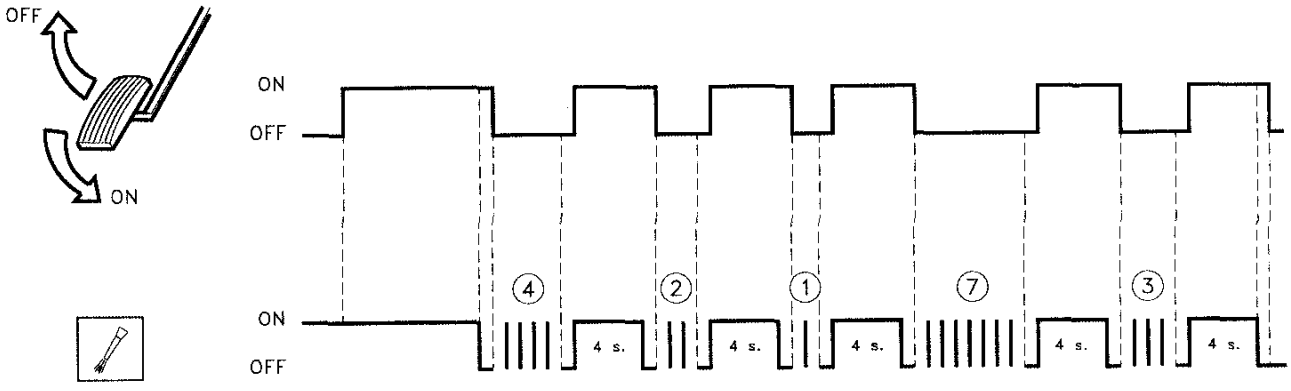
– Proceed in the same way for the other numbers of the ELECTRONIC CODE.

– Also after the last number, keep the accelerator pressed until the warning light goes out (appr. 4 seconds)

– Release the accelerator pedal.

If the warning light flashes quickly, it means that the operation has been carried out correctly, thus the car can be started: if the warning light stays on, the code has not been entered correctly, move the key to STOP and back to MARCIA again, and repeat the procedure.

EXAMPLE: ELECTRONIC CODE = "42173"



NOTE : If this procedure is not activated correctly, check the throttle potentiometer and the corresponding wiring, and also the throttle itself (throttle stroke without obstacles or sticking); also check the supply to the C.C.M..

SERVICE

DIREZIONE POST-VENDITA
SERVIZI ASSISTENZIALI
Viale Alfa Romeo 20020 Arese (MI)
Fiat Auto S.p.A.

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BOSCH MOTRONIC M 1.7 IGNITION AND INJECTION SYSTEM

INDEX

GENERAL DESCRIPTION

An electronic control system defines and controls all the parameters of the engine, optimizing performance and consumption through a real time response to the differing operating conditions.
A single control unit governs both ignition and injection: the point at which the engine catches is identified via special sensors and as a consequence, the actuators carrying out the following functions are operated:

- regulation of injection times;
- regulation of ignition;
- control of cold starting;
- control of enrichment during acceleration;
- fuel cut-off during deceleration;
- constant idle speed control;
- limitation of maximum r.p.m.;
- timing variator control (T.SPARK only);
- combustion control -Lambda probe
- fuel vapour recovery;
- connection with the air conditioner compressor (where applicable);
- connection with the alarm system and with the ALFA ROMEO CODE (where applicable).

The system is also equipped with a self-diagnosis function which memorizes any anomalies and facilitates their identification and correction.

MOTRONIC M 1.7

In comparison to previous models this new 1.7 system employs a control unit of a more technologically up-to-date design and is therefore more reliable. It is also includes various possibilities of operating particular functions.
A "static distribution" electronic ignition has also been adopted (semiconductors without distributor).
The set-up greatly increases reliability as it makes it possible to eliminate rotating components and as a result, reduces noise. In addition sparks are not produced externally, which reduces the risk of interference; it also reduces the number of high voltage cables and connections.
The sensor controlling the throttle valve is also of a new design: the two microswitches signalling the minimum (throttle valve closed) and maximum (throttle valve open) have been replaced by a potentiometer which sends a signal proportional to the throttle valve angle.
The idle speed regulation device is also slightly different and increases the speed of regulation.
The characteristic and innovative feature of this system is the **autoadaptation**": it is in fact able to recognize the changes which occur in the engine (internal attrition, settling of the engine with time etc.) so that adjustments can be made as a consequence.
This autoadaptation function makes it possible to compensate for the inevitable differences (due to production tollerances) of any replaced components. This permits and optimal results on all vehicles without necessitating particular adjustment and controls.

N.B. Because of this it is important that after any type of intervention the engine is left to run for a few minutes so that the control unit can "memorize" any changes which have taken place and adapt itself to them.

PRINCIPLES OF OPERATION

- **Identification of the catch point:** the point at which the engine catches is identified by two sensors: the r.p.m amd timing sensor supplies the control unit with the speed and angular position of the crankshaft; the air flow meter supplies the instantaneous volumetric output of the engine (relation between actual volume of air entering the cylinders and the volume of the cylinders themselves).
- **Regulation of injection times (fuel quantity):** The control unit controls the injectors at great speed and with great precision, calculating the opening times on the basis of engine loading (r.p.m. and air delivery) also taking battery voltage and engine temperature into account.
Injection is simultaneous; all the injectors are opened at the same time during each revolution permitting the cylinders to be supplied with the correct ammount of fuel and improving operation during the transient states.
- **Regulation of ignition (calculation of advances)**: a mapping system within the control unit calculates the advance on the basis of engine loading (r.p.m. and air delivery); the value is also corrected on the basis of the intake air temperature and engine temperature.
Ignition is of the static type employing double coils; the set-up which has been adopted exploits the differing pressures and environmental conditions existing at the same time in a pair of cylinders; when one of the cylinders is nearing the firing stage in the presence of air-fuel mixture, the corresponding cylinder is at the end of the exhaust phase in the presence of exhaust gas.
Examining the voltage necessary to strike the arch between the electrodes of the spark plugs it can be noted that in a cylinder during the firing phase this tension is elevated (around 10 kV) while the voltage during the exhaust phase is greatly reduced (around 500 V).
At the moment in which the Motronic control unit removes the control from one of the power phases, the flow of electricity in the main circuit of the relevant coil is interrupted generating, by induction, an increase in voltage on the secondary circuit (up to 30 kV empty).
During the increase in high voltage, one side of the secondary circuit of the coil is closed towards ground by the lost spark which, with a charge of approximately 500 V, strikes the spark plug located in the cylinder during the exhaust phase.

This permits a voltage increases on the spark plug connected to the other side of the secondary circuit which is in contact with the mixture present in the cylinder, and provokes combustion.

- **Control of cold starting:** During the cold starting phase the control unit uses the advance and injection time values.
  The control unit also controls the injection at each ignition impulse and not at each revolution of the crankshaft as happens under normal operation. When a certain temperature/engine r.p.m. ratio is reached, the control unit returns the system to normal operation.

- **Control of enrichment during acceleration:** when accelerating, the control unit increases injection in order to reach the required loading as quickly as possible.
  This function is carried out by the potentiometer located on the throttle valve which instantaneously alerts the control unit that maximum power has been requested, anticipating the signal coming from the air flow meter which shows a great increase in air flow, in this way an immediate response is obtained.

- **Fuel cut-off during deceleration:** with the throttle valve closed and the number of revolutions exceeding a threshold value (approx. 1.200 revs), the control unit interrupts fuel inection; in this way the number of revolutions decreases rapidly towards idle speed and fuel consumption, controlled to a greater degree, is as a consequence greatly decreased. The threshold value of the cut varies in relation to the temperature of the engine.

- **Idle speed control:** The regulation of idle speed is carried out through an actuator which acts on the by-pass of the throttle valve.
  This acts as an additional air chamber and as a regulator for the operation of the various functions (e.g. air conditioning compressor): with the throttle valve at the stop limit the actuator regulates the by-pass clearance compensating for the power requested by the functions in order to guarantee and idle speed which is as far as possile constant around 800 r.p.m.
  The actuator employed in this version guarantees high speed regulation as the opening and closing of the by-pass are both controlled by magnetic windings.
  Idle speed adjustment, for small variations is carried out by the ignition advance after which it is regulated by the by-pass.
  N.B. The automatic adaptation function of the system makes it possible to avoid regulating the idle r.p.m which recognizes the "throttle valve in the stop limit position" by way of the throttle valve sensor, makimg it possible to "follow" any wear which over a period of time may influence the closed position of the throttle valve.

- **Limitation of maximum r.p.m.:** once a certain threshold has been exceeded (around 6,400 r.p.m.) the control unit automatically interrupts the fuel injection in order to avoid overloading the engine and to protect it when revs are excessively high.

- **Timing variator control:** 4 cylinder engines are equipped with a electromechanical-hydraulic timing variator which, connected to the camshaft, controls and regulates intake timing on the basis of engine loading and r.p.m. This mechanism is activated by the control unit at high r.p.m. (in excess of 1,600 revs and with a loading greater than 30%).

- **Combustion control -Lambda probe-:** the oxygen probe (or "Lambda" probe) informs the control unit of the quantity of oxygen present during exhaust and therefore of the correct air-fuel metering.
  The optimal mixture is obtained by the lambda coefficient = 1 (intake air = theoretical quantity of air required for combustion). The electrical signal that the probe sends to the control unit undergoes an abrupt variation when the composition of the mixture deviates from lambda = 1. When the mixture is "lean", the control unit increases the quantity of fuel, when the mixture is "rich" the fuel is decreased: in this way the engine functions as near as possible to the ideal lambda value.
  The signal from the lambda probe is processed inside the control unit by an integrator which prevents abrupt swings.
  The probe is heated by an electrical resistance in order to be able to reach the correct operating temperature (approx. 300°C) as quickly as possible.
  This probe therefore, makes it possible to regulate the supply of fuel to the engine both retroactively and with precision.
  It also permits operation within the limits dictated by the laws regarding vehicle emissions.
  In addition, this mechanism makes a compensation for altitude possible, as the variations in air density, via the lambda probe, adjust the delivery by the injectors separate from the air flow meter which detects variations more slowly.

- **Fuel vapour recovery**: the petrol vapours, collected from various points in the fuel delivery system into a special tank, are directed to the engine where they are then burned: this occurs through a solenoid valve opened by the control unit, only when petrol vapours are in fact present in the tank and engine and only when loading conditions are such that correct combustion is ensured without affecting the engine: the control unit compensates for this extra quantity of petrol with a reduction in the fuel supplied to the injectors.

- **Connection to air conditioning compressor:** the control unit is connected to the air conditioning system so that the idle r.p.m can be adjusted to the increase power which occurs each time the compressor cuts-in.
  As this is a device requiring a large power input, when increased engine

performance is requested (high accelaration), the control unit momentarily interrupts (7-10 seconds) the supply to the compressor.

- **Connection with the ALFA ROMEO CODE:** as soon as the Motronic control unit receives the signal that the key has been switched to "MARCIA", it "asks" the ALFA ROMEO CODE system consent to start the engine; this consent is only given if the ALFA ROMEO CODE control unit recognises the code of the key engaged in the ignition switch as correct. The dialogue betwen the two control unit takes place on diagnosis line K already used for the Alfa Romeo Tester.

NOTE:
Starting from chassis no. ... the version of the electronic ignition/injection control unit with updated software is adopted. This control unit is distinguished by a yellow dot, it possesses new, more efficient maps which are the result of ever increasing experience owing to the use on this vehicle.

- It also has - for T.SPARK versions only - a special connection with the ignition switch for detecting STARTING: signal at pin 65 of the control unit; this makes it possible to avoid possible inconveniences to the engine when it is started, suitably optimising the parameters controlled by the system.

SELF-DIAGNOSIS

The control unit is equipped with a self-diagnosis system which continually checks the signals coming from the various sensors and compares them with the permitted limits. If these limits are exceeded, the system recognizes a malfunction and replaces the anomalous values with suitable average values so that the vehicle is able to proceed safely, though not under optimum conditions, to a point where Network asistance can be gained: this method has been termed the "limp home" capability.
The parameters which can be "substituted" by the control unit in the event of a malfunction are: air-flow meter, idle adjustment actuator, engine temperature sensor, throttle valve sensor and vapour recovery solenoid valve.
If a malfunction occurs in the control unit, or to the r.p.m. and timing sensor or injectors, the system will not identify the fault and the vehicle will come to a halt.
The self-diagnosis system also enables an efficient and rapid identification of the anomalies to be made when connected to the ALFA ROMEO Tester (refer to specific publications)
Troubleshooting is however possible even without the aid of this instrument by following the instructions given below in this section (see "Troubleshooting".)

COMPONENTS

The electronic control unit (**S11**) receives the signals from **sensors** which "read" the functioning of the engine. It then processes these signals on the basis of a logic system stored in "maps" which make an optimum correlation between the various parameters and operates the **actuators** so that the engine operates with the highest degree of performance and regularity.

The control sensors are the following:

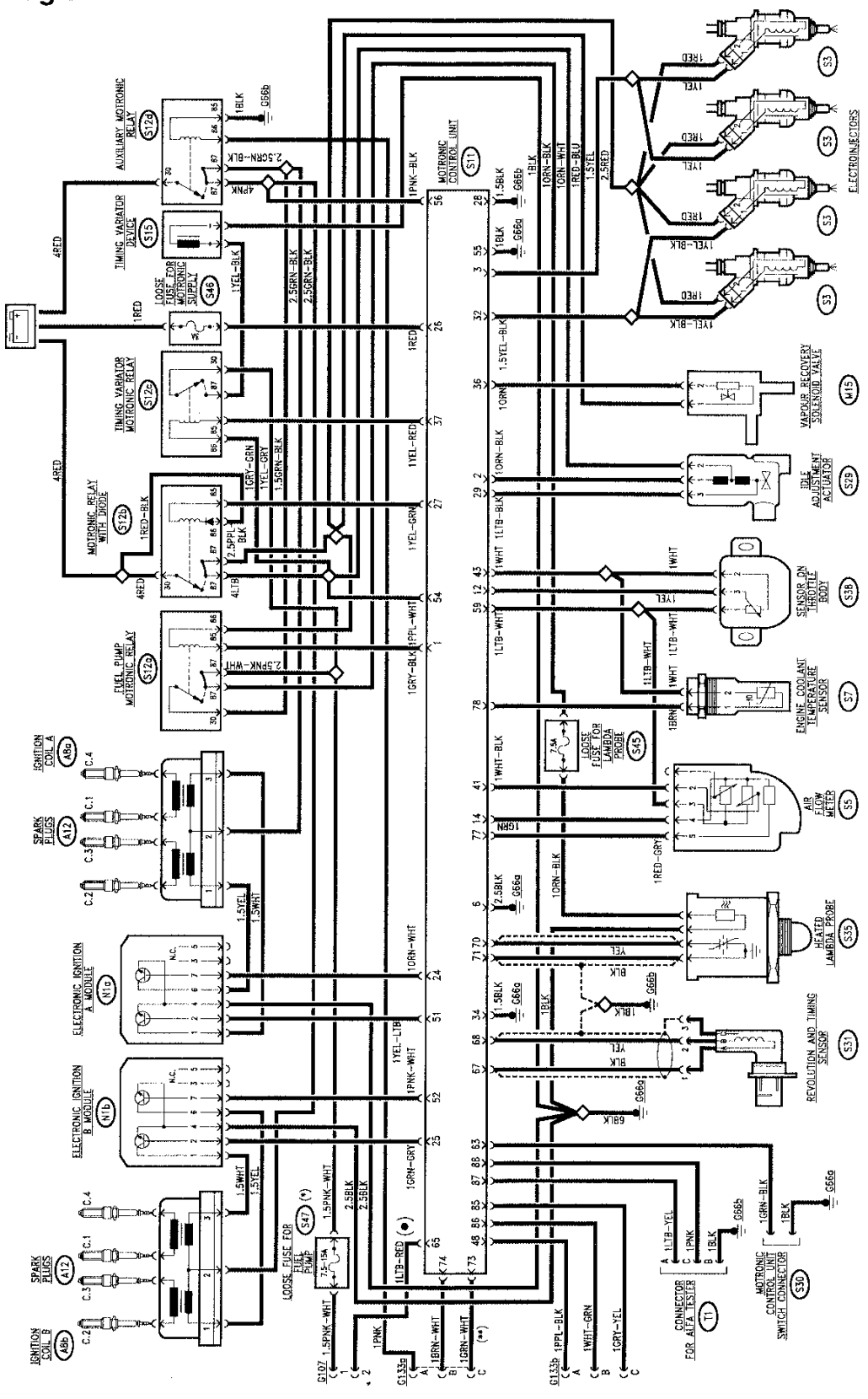
- engine temperature sensor (**S7**);
- air flow meter (with incorporated air temperature sensor) (**S5**);
- throttle body sensor (**S38**);
- R.P.M. and timing sensor (**S31**);
- oxygen sensor (lambda probe) (**S35**)

The actuators controlling the system are:

- electroinjectors (**S3**);
- ignition coil (**A8**)
- double coil (**A8a**; **A8b**) with power module (**N1a**; **N1b**) in the T. SPARK 1.8 and 2.0 models;
- fuel pump (**P18**);
- idle adustment actuator (**S29**);
- timing variator (**S15**) -only for T. SPARK models;
- vapour recovery solenoid valve (**M15**).

1.8 T. SPARK AND 2.0 T.SPARK ENGINES (versions without ALFA ROMEO CODE)

Wiring Diagram



Functional Description

The Motronic control unit **S11** controls and regulates the entire electronic ignition and injection system.
The control unit is supplied by the battery at pin 26 via fuse **S46** (3A).
The auxillary Motronic relay **S12d**, excited by the signal resulting from the ignition key being in the "marcia" position, delivers power supply to the control unit, pin 56, and supplies the fuel pump relay **S12c**, and the main windings of coils **A8a** and **A8b**.
The Motronic relay with diode **S12b**, excited by a negative signal from the control unit from pin 27, sends a return signal to the control unit itself, pin 54, supplies the fuel pump relay **S12c** and gives a permit signal to the vapour recovery solenoid valve **M15**, the idle speed actuator **S29** and to the injectors **S3**.
The electric fuel pump **P18** is controlled by the relative relay **S12c**, which is excited by the control unit with a negative signal from pin 1. The power supply to the pump is protected by fuse **S47** (15A).
The control unit **S11** receives numerous signals from the various sensors and is therefore able to keep all the parameters regarding the operation of the engine under control.
The r.p.m. and timing sensor **S31** supplies information regarding the engine r.p.m. and timing through the signals sent to pins 67 and 68 from the control unit. These two signals are of low intensity and are suitably shielded. The sensor is of the induction type and detects the number of revolutions of the engine through the variation in the magnetic field produced by the passage of the teeth on a phonic wheel installed on the crankshaft pulley; the wheel has 60 teeth, two of which are missing which makes it possible to determine the timing.
The throttle body sensor **S38**, supplied by the control unit from pins 43 and 59, generates a signal, through a potentiometer, which is sent to pin 12 and which is proportional to the angle to which the throttle valve opens.
The engine temperature sensor **S7**, supplied by the control unit from pin 43, supplies a signal at pin 78 which is proportional to the temperature of the engine coolant, measured by a NTC material (resistance which diminishes when the temperature falls).

The air-flow meter **S5**, supplied by the control unit from pins 14 and 59 sends it two signals: the first, to pin 41, is proportional to the flow of air and is generated by a potentiometer connected to the rotation of a mobile vent; the second, at pin 77, comes from a sensor (NTC) which generates a signal which is proportional to the temperature of the intake air.
The heated lambda probe **S35** supplies the control unit with information regarding the correct composition of the air-fuel mixture, measuring the concentration of oxygen in the exhaust gas; this is carried out through the signals sent to pins 70 and 71 of the control unit. These two signals are of low intensity and are therefore adequately shielded. The probe is heated by a resistance in order to ensure a correct functioning even when cold; the resistance is supplied by the fuel pump relay **S12d** and is protected by a specific fuse **S45** (7.5A).
The control unit **S11** controls then opening of the injectors **S3** via pins 3 and 32, on the basis of the signals received from the sensors and the calculations made. The injectors receive the permit to open from relay **S12b**.
The static type ignition is directly controlled by the control unit which automatically regulates the advance. A negative signal is sent by the control unit, from pins 24,25,51 and 52 to the power modules **N1a** and **N1b** which generate the high voltage impulses sent to the coils **A8a** and **A8b** and from these to the spark plugs **A12**.
There are four double output coils grouped in twos in groups **A8a** and **A8b**, each connected to two spark plugs of two different cylinders: the main windings are supplied by modules **N1**, the secondary winding send the impulse to the spark plugs **A12**.
The timing variator **S15** mechanically controls the timing advance during intake. It is controlled by the relative relay **S12c** which, supplied by relays **S12b** and **S12d**, is excited through a negative signal from the control unit, pin 37, and supplies the timing variator **S15**. This signal operates the actuator which controls the flow of oil to the hydraulic group of the device regulating camshaft rotation.
The idle adjustment actuator **S29** makes up an air flow by-pass line and is composed by two windings: one operates the opening and the other the closure of a box regulating the gap in the by-pass section. A safety spring fixes an average opening value in the event of a malfunction in the device. The actuator is controlled by the control unit through the signals of pins 2 and 29.
The vapour recover solenoid valve **M15** permits the passage of the fuel vapours towards the engine where they are added to the mixture which enters in the combustion chamber. A signal from pin 36 is opened by the control unit when the engine is under loading conditions.
From chassis N.___ the connection to pin 73 of the control unit which supplies the speedometer coming from the appropriate sensor (**L17**) has been introduced. This makes it possible to improve control over the "handling" of the vehicle.
Additionally, from chassis N. ____ the "detection" signal at pin 65 is foreseen.
The control unit is equipped with a self-diagnosis system which can be used when it is connected to connector **T1** of the ALFA ROMEO Tester; malfunction signals reach the connector from the control unit, pins 87 and 88 and the signal from the Motronic wiring ground **G66**.

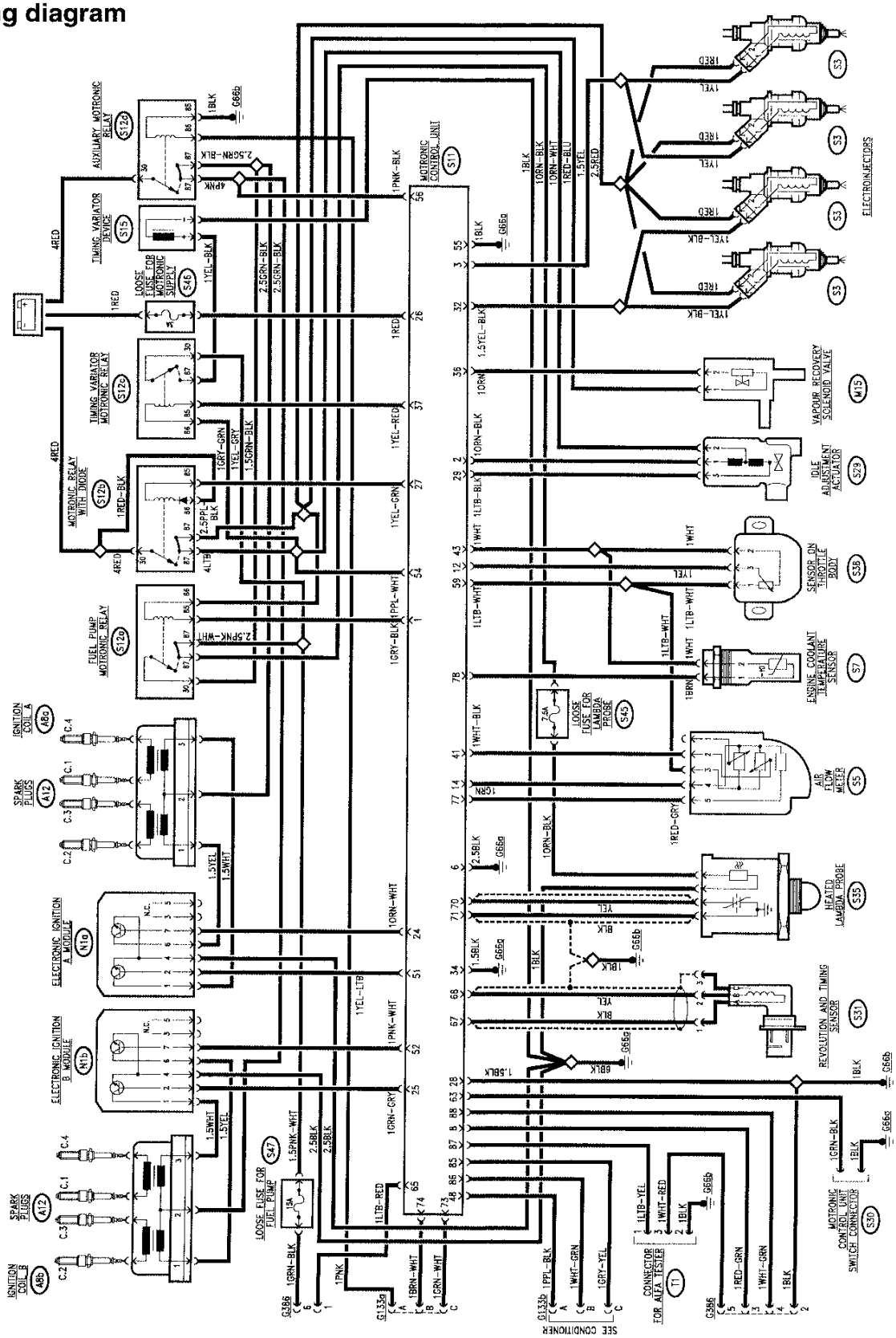
The same control unit is used for engines with different cubic capacity; a special switch **S30**, connected to the control unit at pin 63 makes it possible, if the control unit is to be replaced, to adapt it to the desired engine.

– contact closed = 1800 cc engine.

– contact open = 2000 cc engine.

1.8 T. SPARK ENGINE (version with ALFA ROMEO CODE)

Wiring diagram



Functional Description

N.B. Here, a description is given only of the differences with respect to the version without ALFA ROMEO CODE.

The control unit S11 is connected by pin 88 with the ALFA ROMEO CODE control unit N77 via diagnosis line K; this way, if the ALFA ROMEO CODE does not receive a correct "key code" it will not allow the Motronic control unit to start the engine.

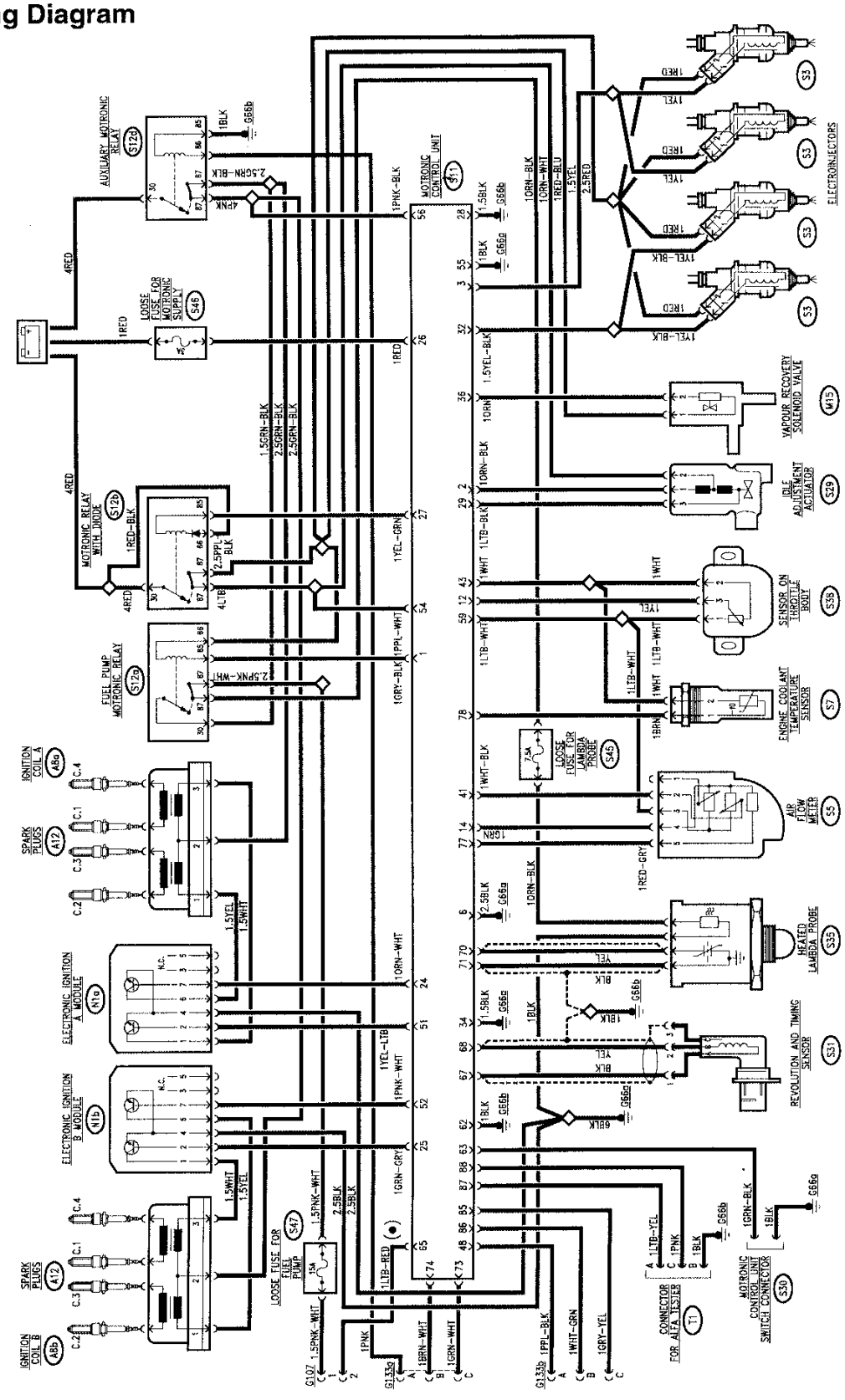
The signal for the "Check Engine" warning light on cluster C10 leads from pin 8.

The control unit possesses a self-diagnosis system which may be used by connecting with the ALFA ROMEO Tester at connector T1; it receives the control unit fault signals via diagnosis lines L - pin 87 - and K - pin 88-, while the earth leads from G66b. (Line K is also used by the ALFA ROMEO CODE control unit).

N.B.:
the adoption of the ALFA ROMEO CODE is not foreseen for the 2.0 T.SPARK ENGINE.

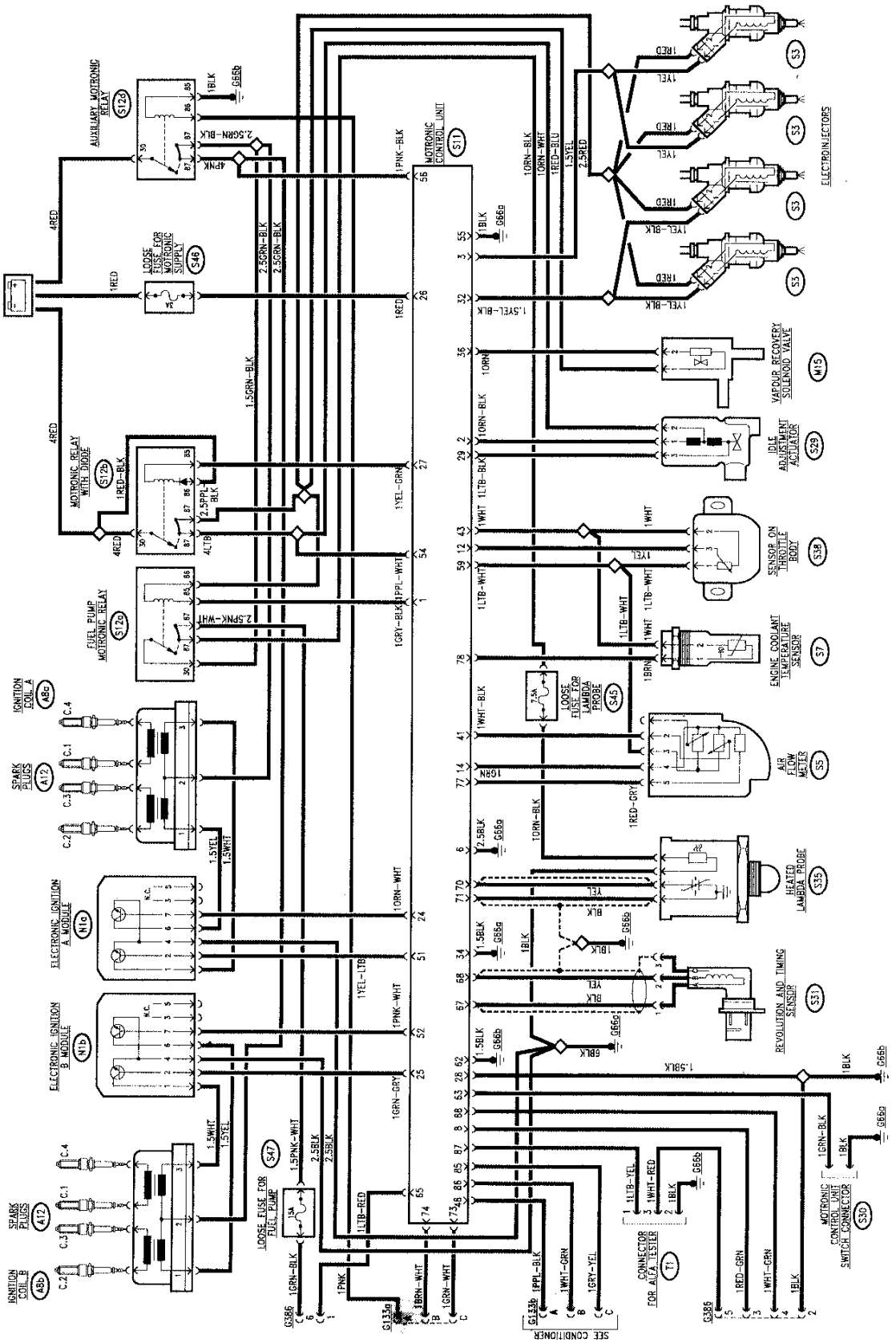
1.7 T.SPARK ENGINE (version without ALFA ROMEO CODE)

Wiring Diagram



Change from chassis N.____

1.7 T.SPARK ENGINE (version with ALFA ROMEO CODE)



Functional Description

N.B. Only the variations in relation to the other versions are described below.

The **1.7 T.SPARK** version differs from the preceding versions (1.8 and 2.0 T.SPARK), integrated electronic ignition-injection system, only for the absence of the timing variator and relative command relay. In addition it has undergone variation and modification as described below.

ABSENCE OF TIMING VARIATOR

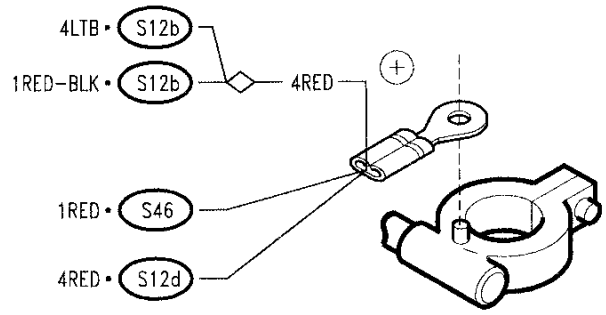
Pin 62 of the MOTRONIC control unit (**S11**) has been connected to earth: this signal informs the control unit of the absence of the timing variator (**S15**) and relative relay (**S12c**): in this way it is subtracted from the control through the signal from pin 37 of the control unit itself.

Pin 62 of the control unit **S11** is connected to earth **G66b**.

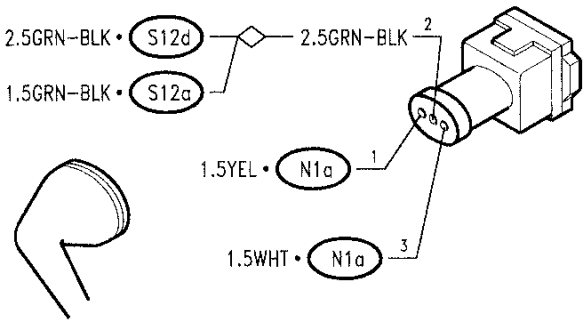
Pin 73 of **S11** is connected to the speedometer sensor **L17** via connector **G133c** and solder.

Components and Connectors (all T.SPARK engine)

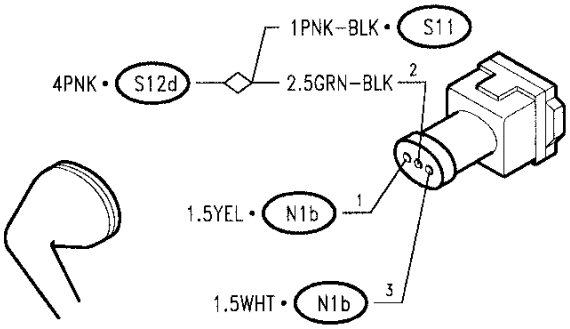
Battery	A1



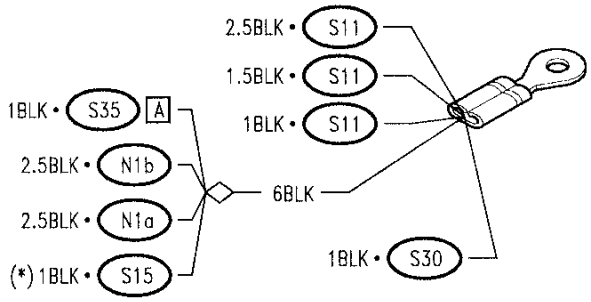
Ignition coil A	A8a



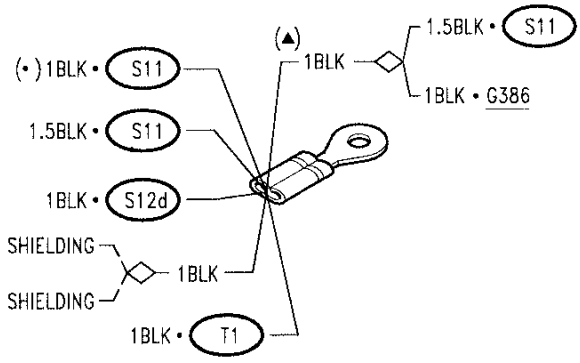
Ignition coil B	A8b



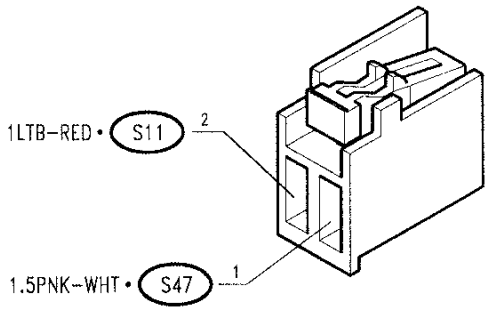
Motronic wiring ground	G66a



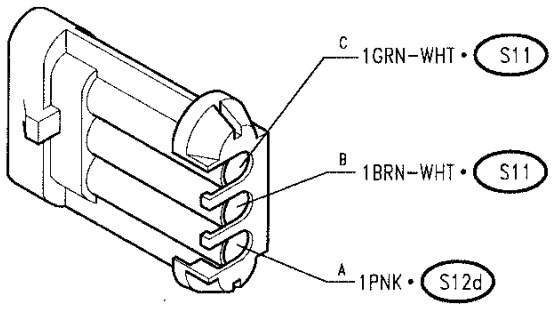
Motronic wiring ground	G66b



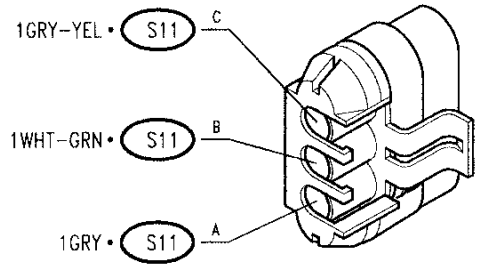
Connector for fuel pump	G107



Electronic ignition-injection wiring A connection	G133a

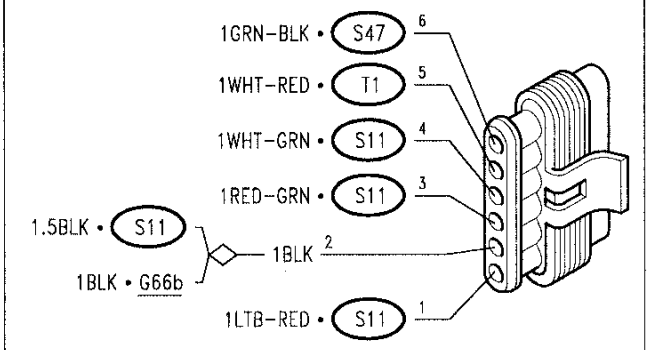


Electronic ignition-injection wiring B connection	G133b

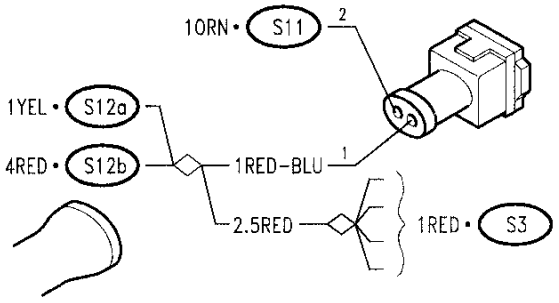


(*) not present on 1.7 T.SPARK
(•) only 1.7 T.SPARK
(▲) for versions with ALFA ROMEO CODE only

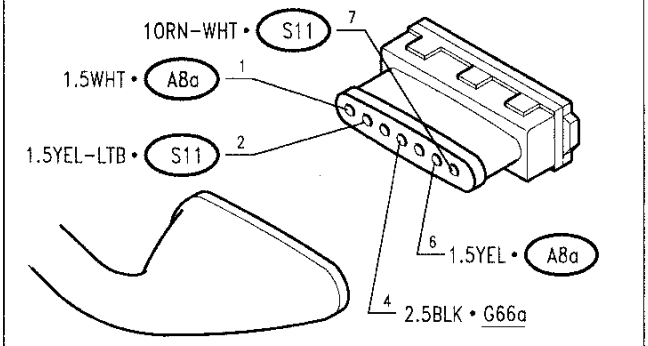
ALFA ROMEO CODE connector (▲) G386



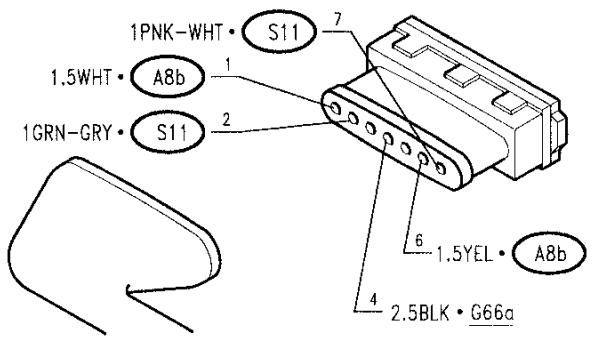
Vapour recovery solenoid valve M15



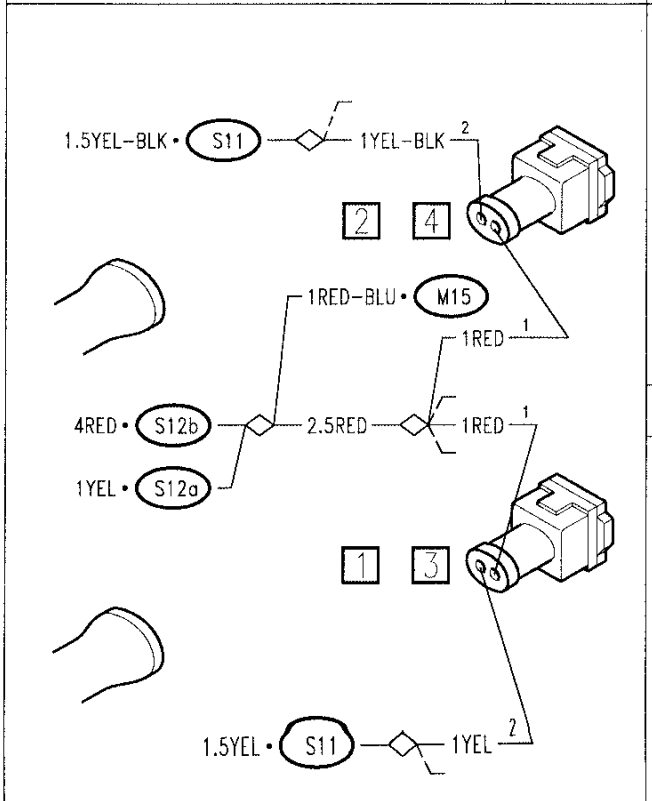
Electronic ignition A module N1a



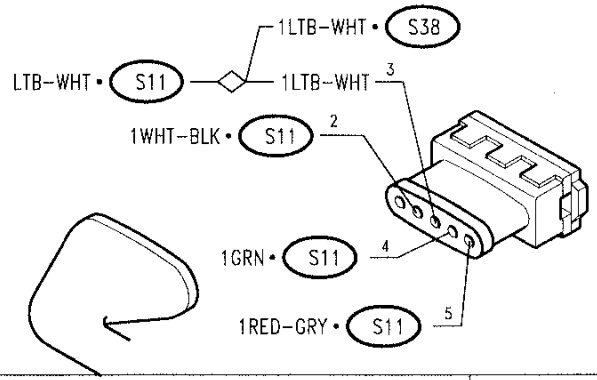
Electronic ignition B module N1b



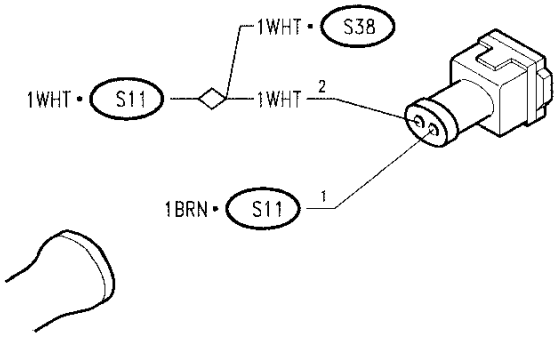
Electroinjectors S3



Air flow meter S5



Engine coolant temperature sensor S7



(▲) for versions with ALFA ROMEO CODE only

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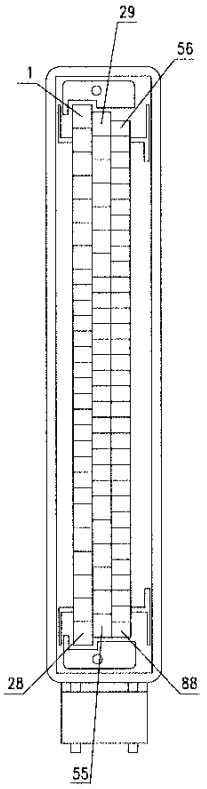
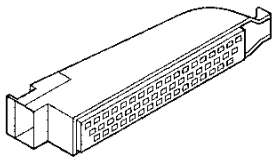
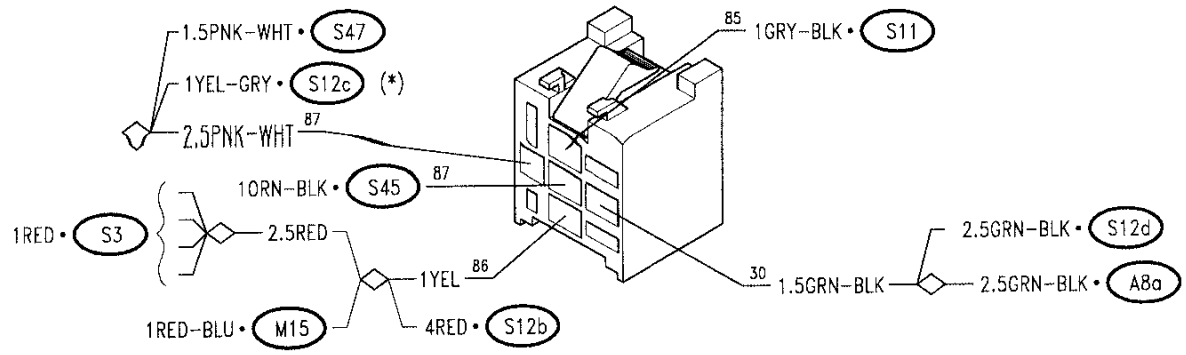
Motronic control unit — S11





1 1GRY-BLK • S12a
2 1ORN-BLK • S29
3 1.5YEL — 1YEL • S3
6 2.5BLK • G66a
8 1RED-GRN • G386 (▲)
12 1YEL • S38
14 1GRN • S5
24 1ORN-WHT • N1a
25 1GRN-GRY • N1b
26 1RED • S46
27 1YEL-GRN • S12b
(▲) 28 1.5BLK — 1BLK • G386 / 1BLK • G386
28 1.5BLK • G66b
29 1LTB-BLK • S29
32 1.5YEL-BLK — 1YEL-BLK • S3
34 1.5BLK • G66a
36 1ORN • M15
37 1YEL-RED • S12c (*)
41 1WHT-BLK • S5
43 1WHT — 1WHT • S7 / 1WHT • S38
48 1GRY • G133b
51 1.5YEL-LTB • N1a
52 1PNK-WHT • N1b
54 1ORN-WHT • S29 / 1PPL-WHT — 1GRY-GRN • S12c (*) / 2.5PPL-BLK • S12b
55 1BLK • G66a
56 2.5GRN-BLK • A8b / 1.5PNK-BLK — 4PNK • S12d
59 1LTB-WHT — 1LTB-WHT • S5 / 1LTB-WHT • S38
63 1GRN-BLK • S30
65 1LTB-RED • G107
65 1LTB-RED • G386 (▲)
67 BLK • S31
68 YEL • S31
70 YEL • S35 B
71 BLK • S35 B
73 1GRN-WHT • G133c
74 1BRN-WHT • G133a
77 1RED-GRY • S5
78 1BRN • S7
85 1GRY-YEL • G133b
86 1WHT-GRN • G133b
87 1LTB-YEL • T1
88 1WHT-RED • T1
88 1WHT-RED • G386 (▲)

Fuel pump Motronic relay — S12a



(*) not present on 1.7 T.SPARK
(▲) for versions with ALFA ROMEO CODE only

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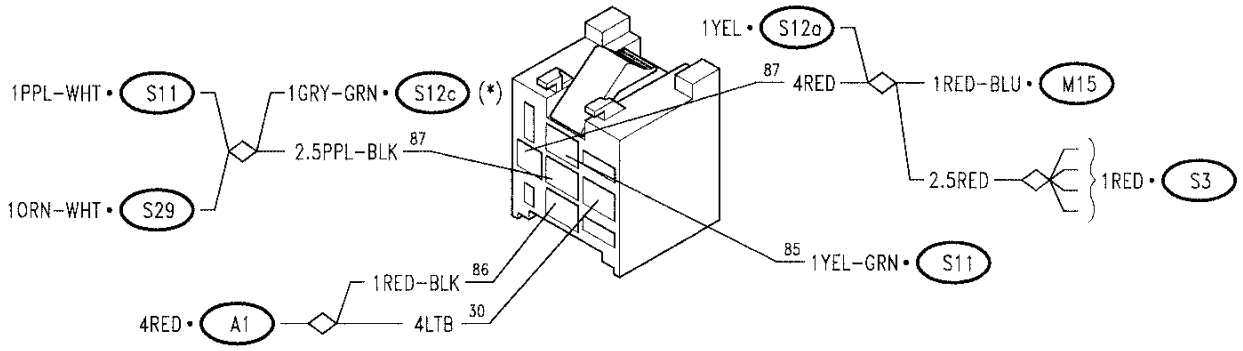
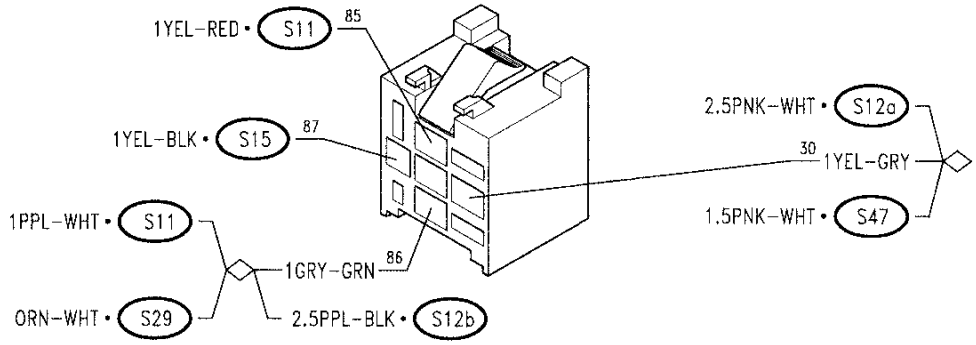
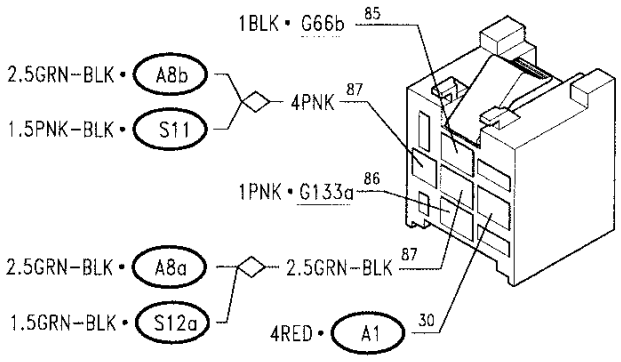
Motronic relay with diode (S12b)



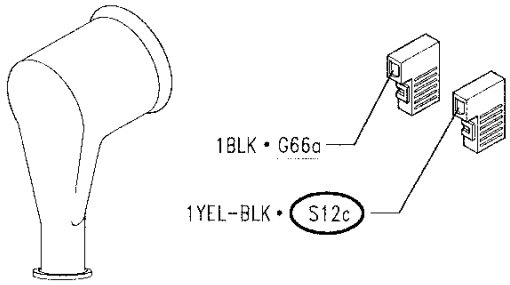
Timing variator Motronic relay (*) (S12c)



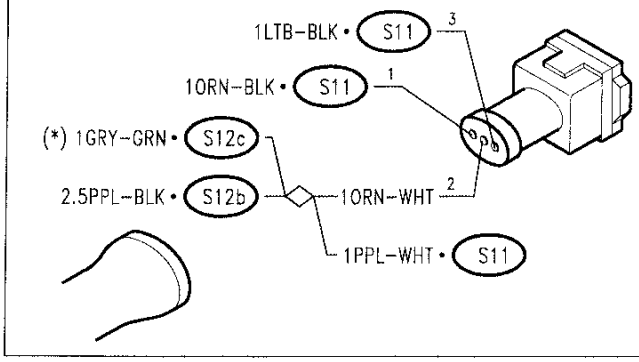
Auxiliary Motronic relay (S12d)



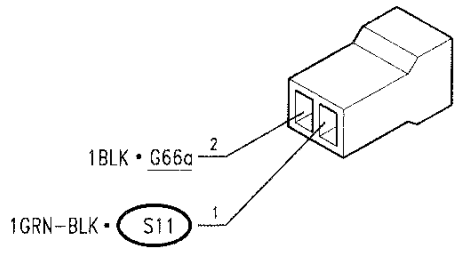
Timing variator device (*) (S15)



Idle adjustment actuator (S29)

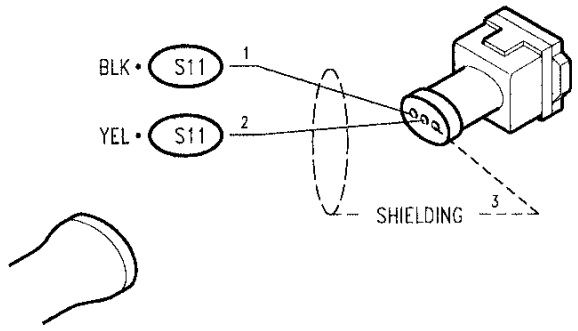


Motronic control unit switch connector (S30)

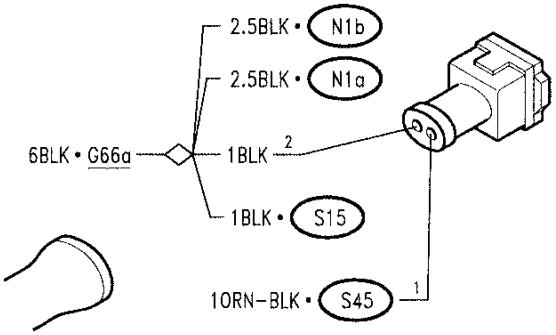


(*) not present on 1.7 T.SPARK

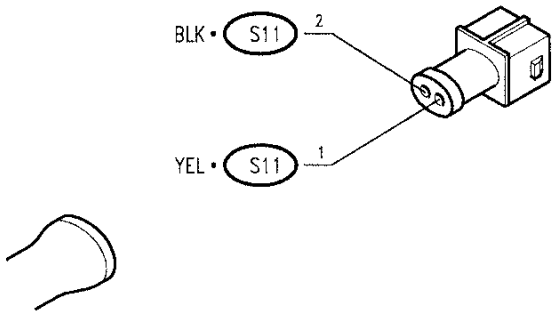
Revolution and timing sensor	S31



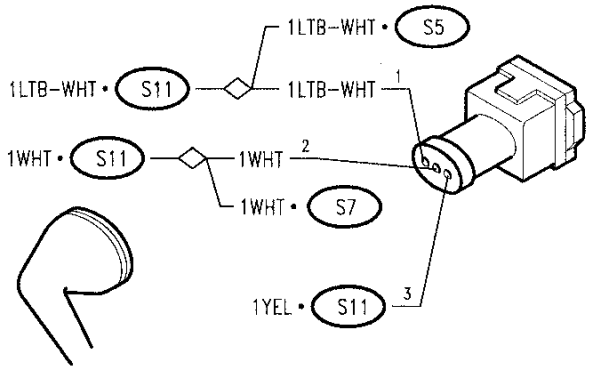
Heated Lambda probe	S35 A



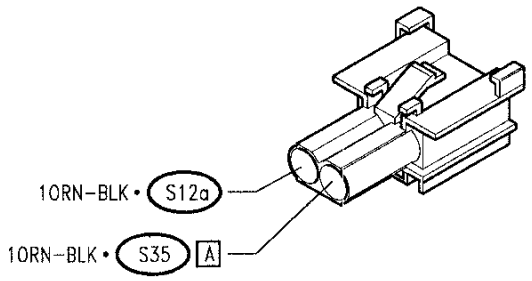
Heated Lambda probe	S35 B



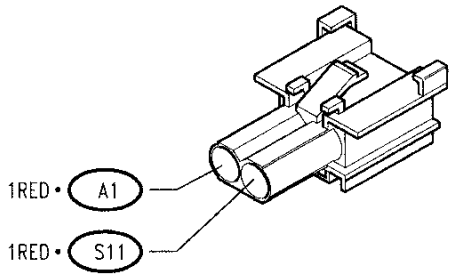
Sensor on throttle body	S38



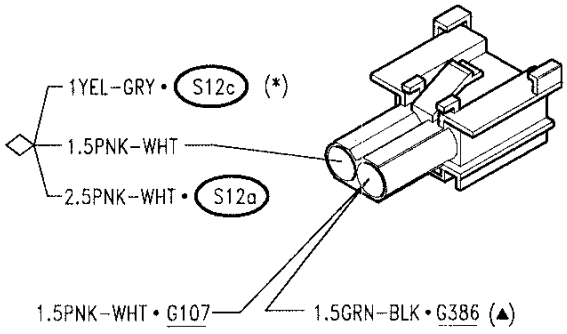
Loose fuse for Lambda probe	S45



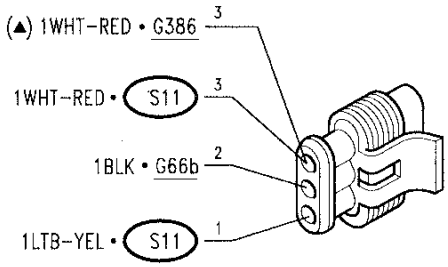
Loose fuse for Motronic supply	S46



Loose fuse for fuel pump	S47



Connector for ALFA TESTER	T1



(*) not present jon 1.7 T.SPARK
(▲) for versions with ALFA ROMEO CODE only

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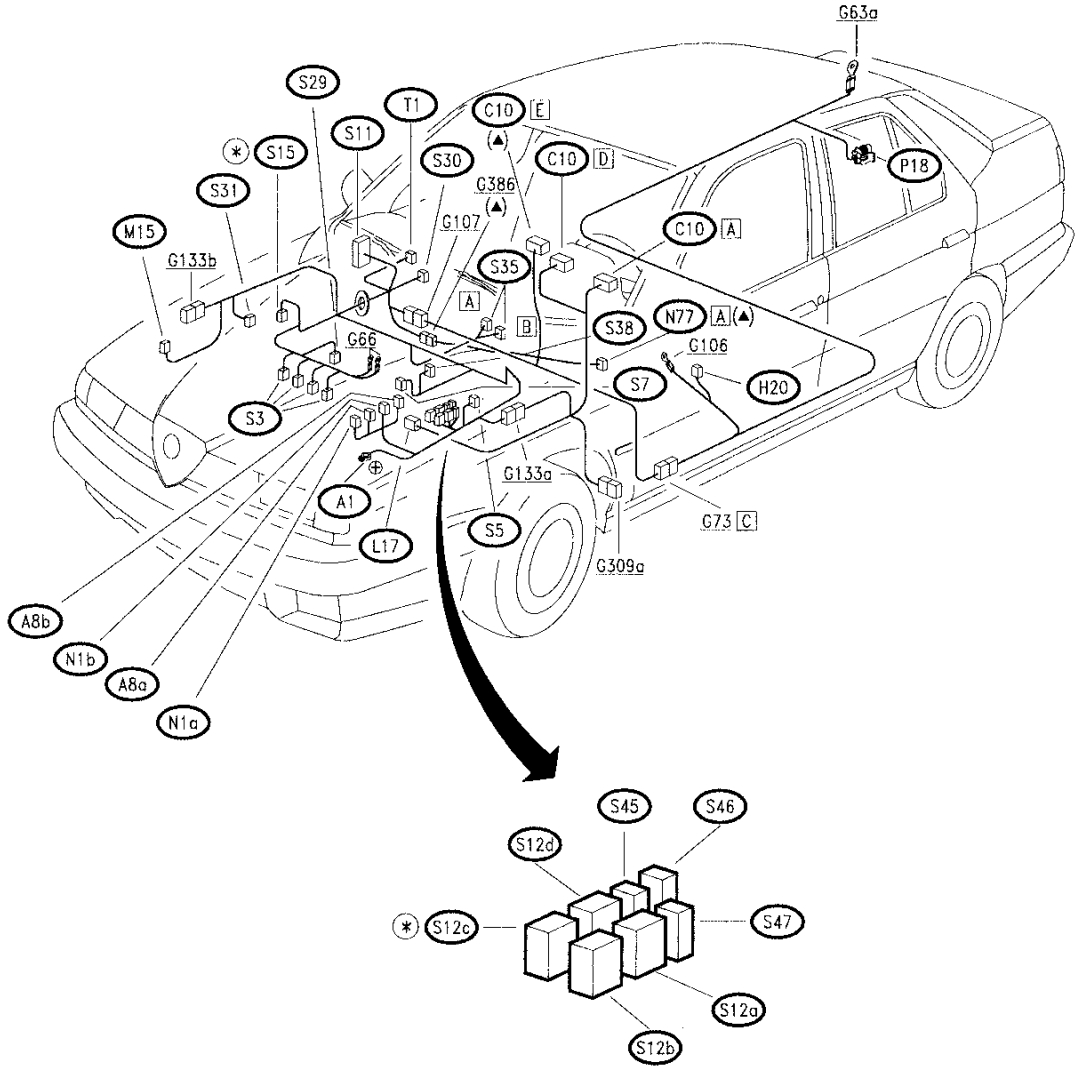
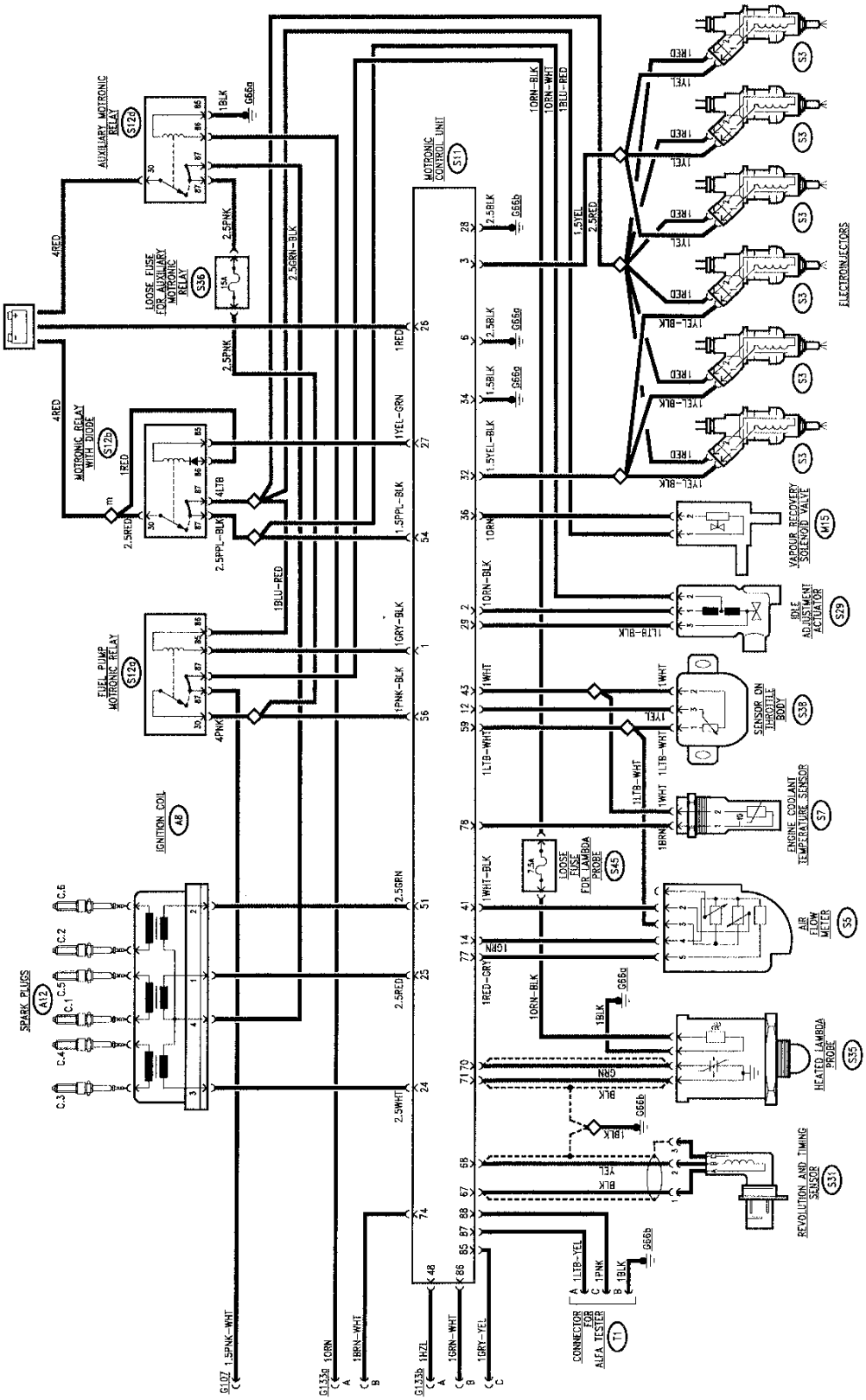
Location of Components



(*) not present on 1.7 T.SPARK
(▲) for versions with ALFA ROMEO CODE only

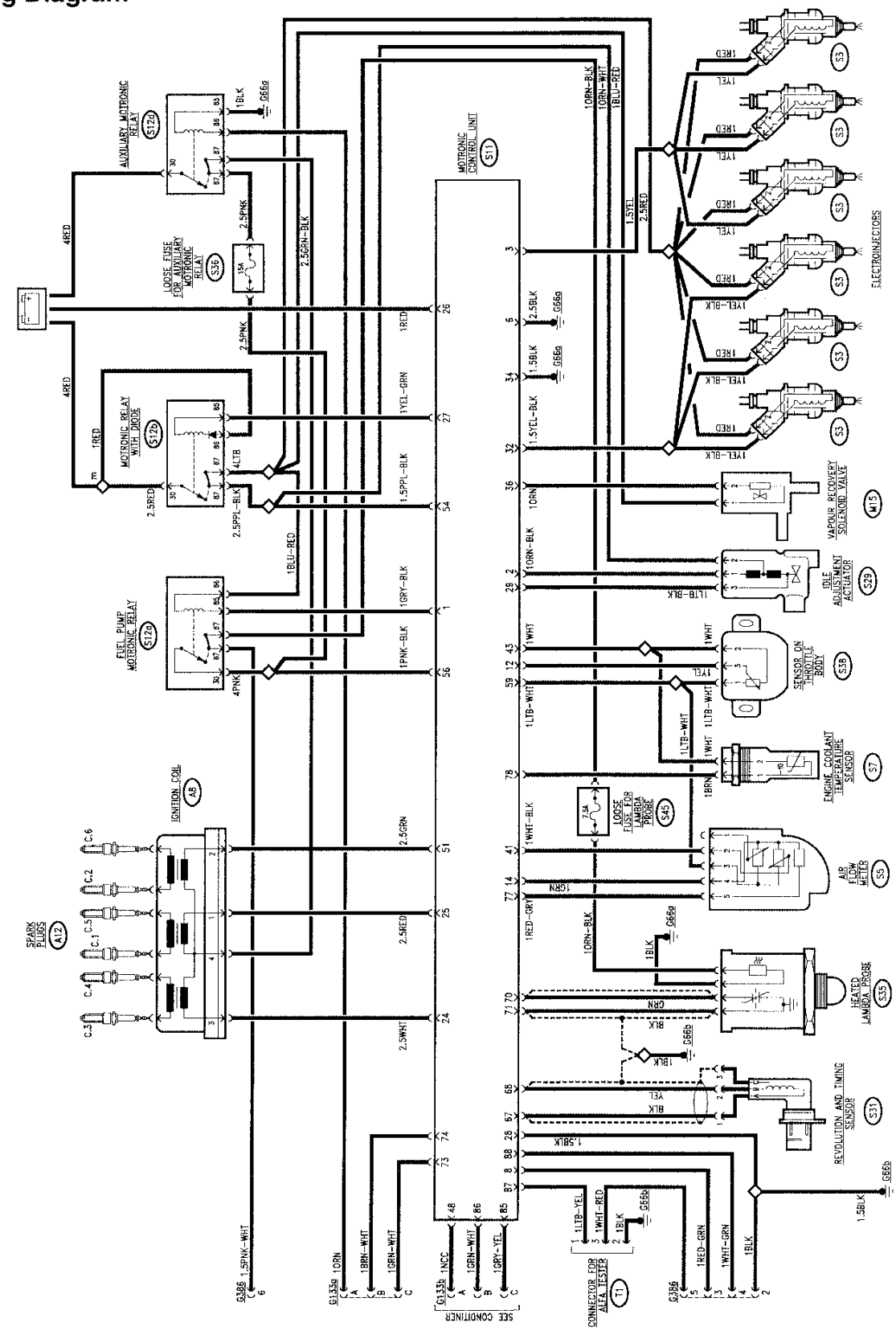
6V ENGINE (versions without ALFA ROMEO CODE)

Wiring Diagram



6V ENGINE (versions with ALFA ROMEO CODE)

Wiring Diagram



Functional Description

The model for the 6 cylinder engine differs from that of the T.SPARK engine only in the aspects described below.

For the all else, refer to the previous functional description.

The control unit is supplied at pin 26 directly from the battery with no intervening fuse.

The auxillary Motronic relay **S12d**, sends supply from the control unit, pin 56 and the fuse **S36** (15A) is inserted on this line.

The electric fuel pump **P18** is controlled by the relative relay **S12c**, but the power supply is not protected by a fuse.

Ignition is of the static type and is regulated by a signal sent from the control unit, from pins 24, 25 and 51, directly to group **A8** (three double coils) equipped with six outputs, transmitting the impulse to the spark plugs. A power module is alo incorporated in the group and this generates the high voltage impulses which are sent to the spark plugs **A12**.

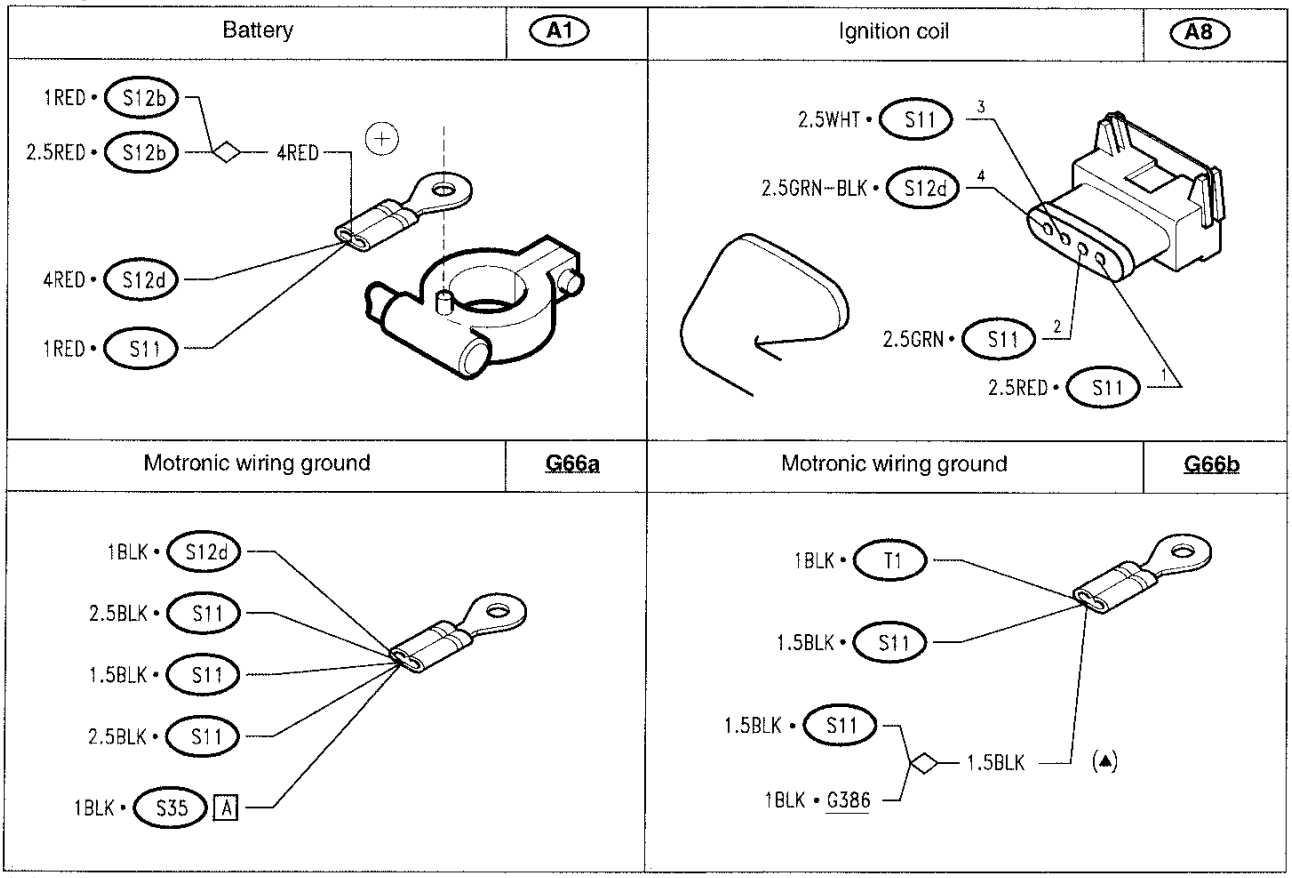
There is no timing variator **S15**, in the 6 cylinder models; as a result there is also no relay **S12c**.

This control unit is not used for engines of differing cubic capacity and therefore the relative switch **S30** is also not present.

Nor is the starting detection signal - pin 65 foreseen.

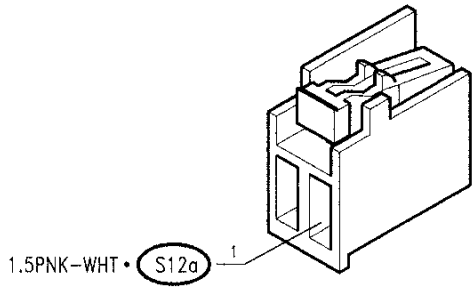
NOTE: also the connection with the **ALFA ROMEO CODE system** is the same as described for the T.SPARK engines.

Components and Connectors

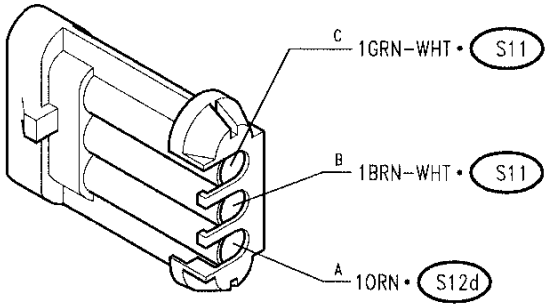


(▲) for versions with ALFA ROMEO CODE only

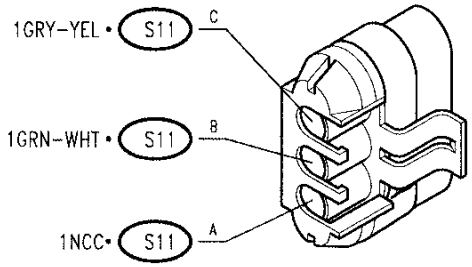
Connector for fuel pump	G107



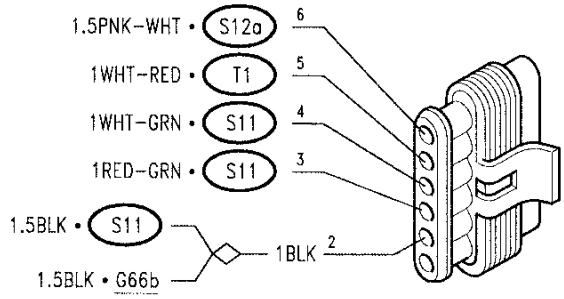
Electronic ignition-injection wiring A connection	G133a



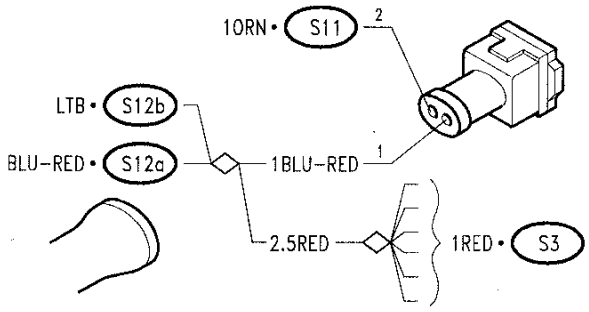
Electronic ignition-injection wiring B connection	G133b



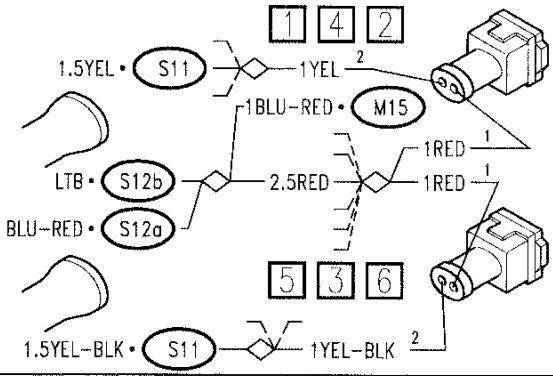
ALFA ROMEO CODE connector	G386



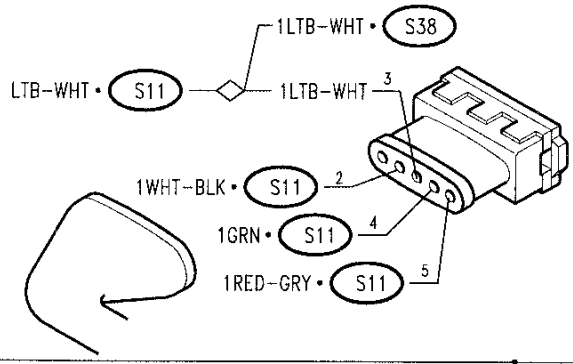
Vapour recovery solenoid valve	M15



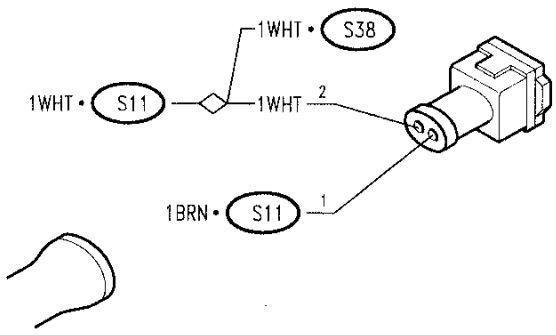
Electroinjectors	S3



Air flow meter	S5

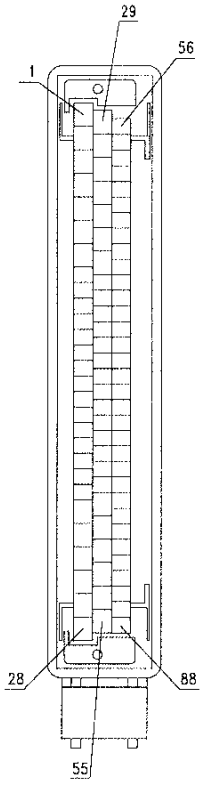


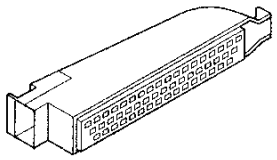
Engine coolant temperature sensor	S7



(▲) for versions with ALFA ROMEO CODE only

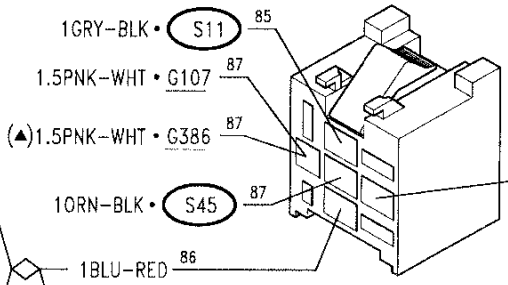
Motronic control unit — S11





1 1GRY-BLK • S12a
2 1LTB-BLK • S29
3 1.5YEL — 1YEL • S3
6 2.5BLK • G66a
8 1RED-GRN • G386 (▲)
12 1YEL • S38
14 1GRN • S5
24 2.5WHT • A8
25 2.5RED • A8
26 1RED • A1
27 1YEL-GRN • S12b
(▲) 28 1.5BLK — 1.5BLK • G66b / 1.5BLK • G386
28 1.5BLK • G66b
28 1BLK — SHIELDING / SHIELDING
29 1LTB-BLK • S29
32 1.5YEL-BLK — 1YEL-BLK • S3
34 1.5BLK • G66a
36 1ORN • M15
41 1WHT-BLK • S5
43 1WHT — 1WHT • S7 / 1WHT • S38
48 1NCC • G133b
51 2.5GRN • A8
1ORN-WHT • S29
54 1.5PPL-BLK — 2.5PPL-BLK • S12b
55 2.5BLK • G66a
4PNK • S12a
56 1PNK-BLK
2.5PNK • S36
59 1LTB-WHT — 1LTB-WHT • S5 / 1LTB-WHT • S38
67 BLK • S31
68 YEL • S31
70 GRN • S35 B
71 BLK • S35 B
73 1GRN-WHT • G133a
74 1BRN-WHT • G133a
77 1RED-GRY • S5
78 1BRN • S7
85 1GRY-YEL • G133b
86 1GRN-WHT • G133b
87 1LTB-YEL • T1
88 1WHT-RED • T1
88 1WHT-RED • G386 (▲)

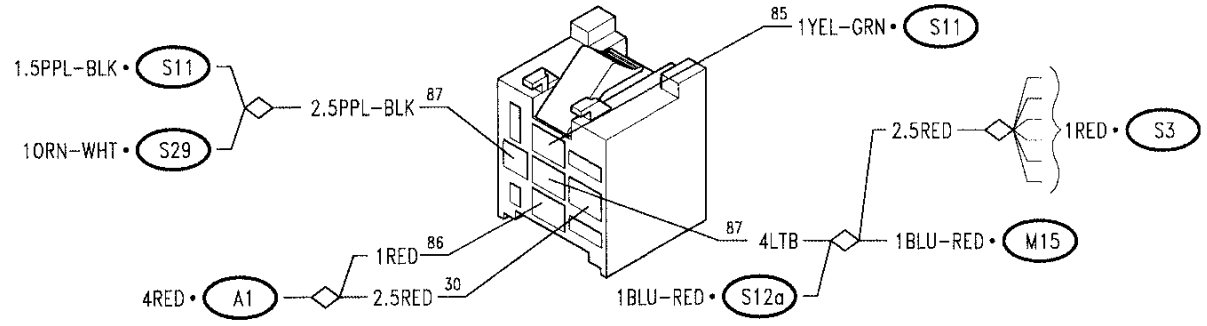
Fuel pump Motronic relay — S12a



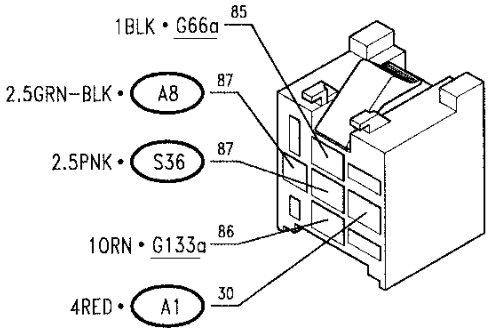
1GRY-BLK • S11
1.5PNK-WHT • G107
(▲)1.5PNK-WHT • G386
1ORN-BLK • S45
1BLU-RED
1PNK-BLK • S11
4PNK
2.5PNK • S36
RED • S3
2.5RED
1BLU-RED • M15
4LTB • S12b

(▲) for versions with ALFA ROMEO CODE only

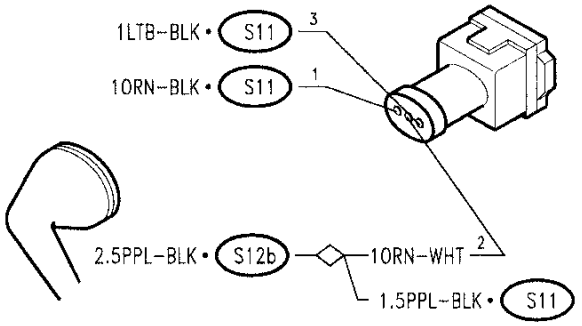
Motronic relay with diode — S12b



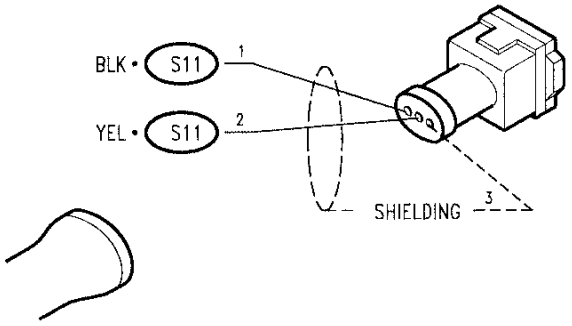
Auxiliary Motronic relay — S12d



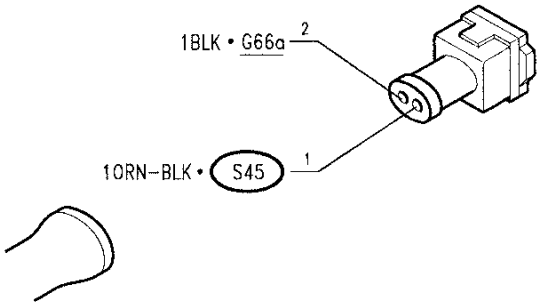
Idle adjustment actuator — S29



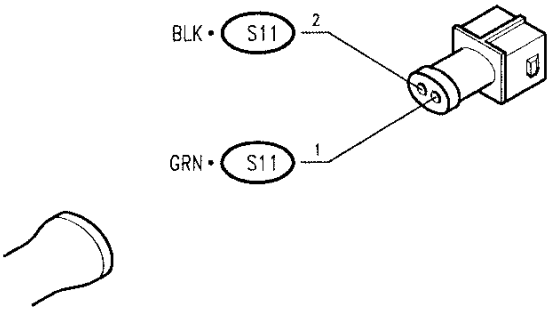
Revolution and timing sensor — S31



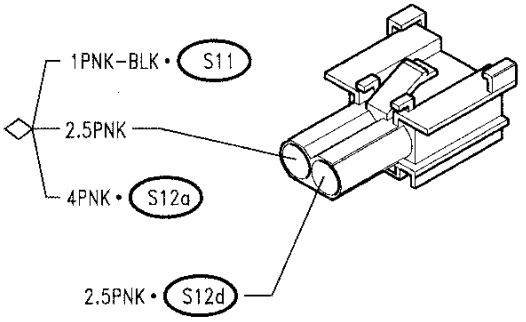
Heated Lambda probe — S35 A



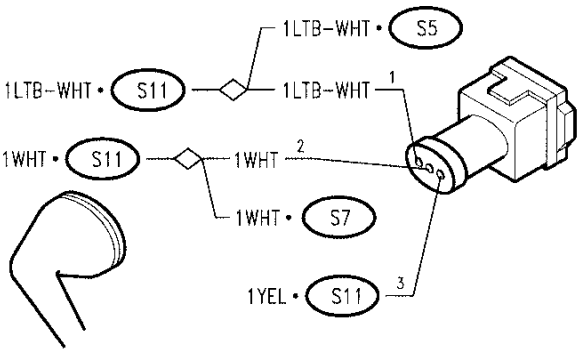
Heated Lambda probe — S35 B

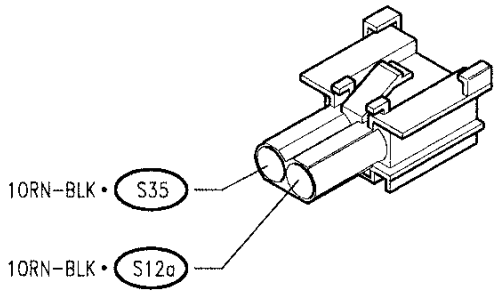


Loose fuse for auxiliary Motronic relay — S36

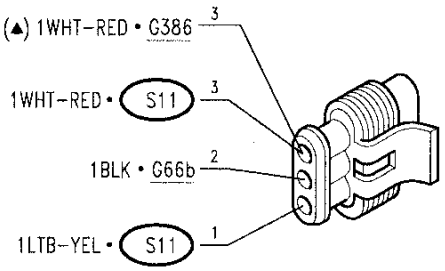


Sensor on throttle body	S38	Loose fuse for Lambda probe	S45



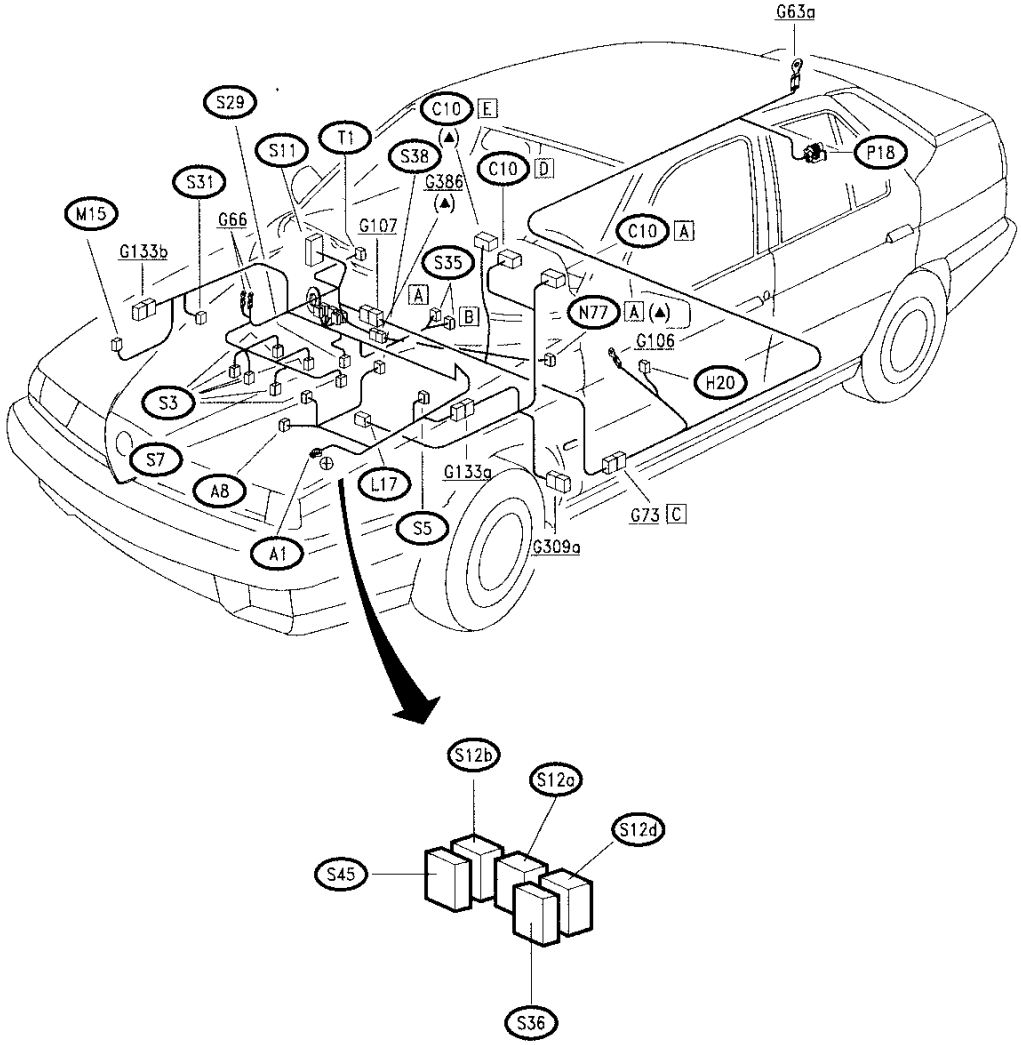


Connector for ALFA TESTER	T1



(▲) for versions with ALFA ROMEO CODE only

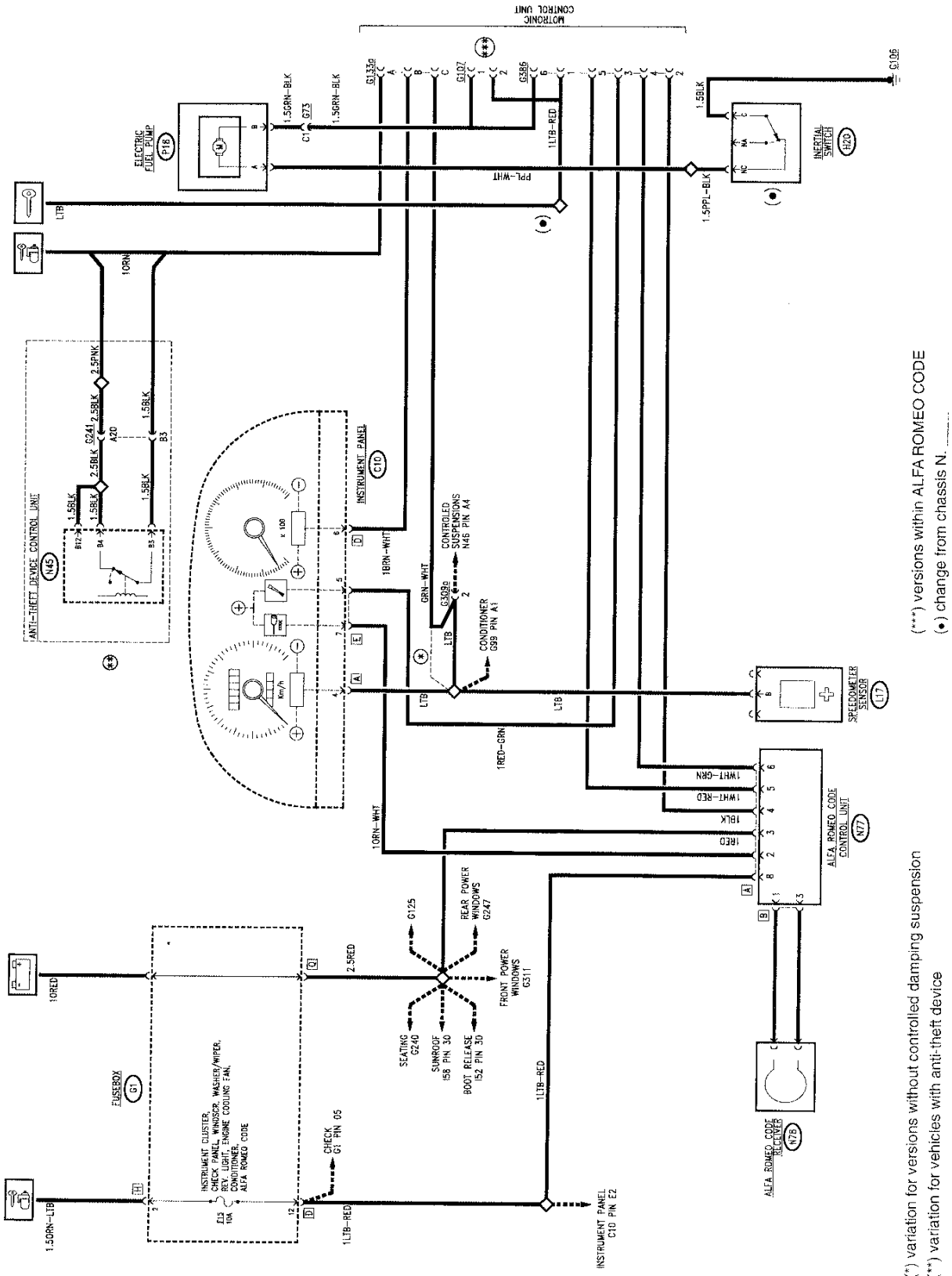
Location of Components



(▲) for versions with ALFA ROMEO CODE only

VEHICLE INTERFACE

Wiring Diagram



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Functional Description

Through connectors **G133a**, **G133b** and **G107** or **G386**, the Motronic wiring loom is connected with the others of the vehicle.
Through the rpm and timing sensor **S31** the control unit is constantly informed of the engine speed: this information is sent to the rev counter, located on the instrument cluster **C10**, through the signal of pin 74 and connector **G133a**.

Through sensor **L17** it receives the car speed signal at pin 73 of **S11**.

The control unit **S11** is connected at pins 48, 85 and 86 with the air conditioning system via connector **G133b**.

This makes it possible to adapt the engine idle speed to the increased power each time the compressor cuts in.
In addition, in the event of the need of high power by the engine (heavy accelerating), the control unit sends a signal which momentaneously cuts off the compressor supply (for further details, see "Climate control: compressor control").
The fuel pump **P18** is connected through connector **G107**.

The inertial switch **H20** is to be found on the line that supplies the earth to the fuel pump **P18**. The opening of the switch **H20** instantly shuts off the earth signal thereby stopping the fuel pump.

Only for T.SPARK engines:
Also the "starting" detection signal leads from the ignition switch to the control unit **S11** (pin 65) via connector **G107**.
Lastly, through connector **G133a** (pin A) the control unit receives the "key-operated" consent from the ignition switch.

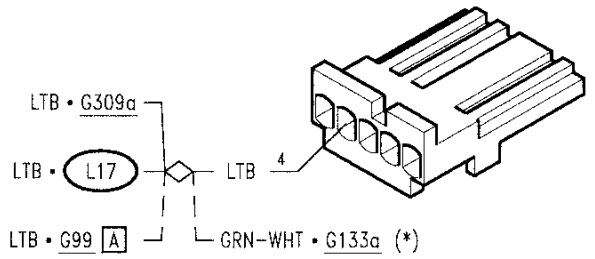
N.B. In cars fitted with an alarm system, the "key-operated" consent supply "crosses" the control unit **N45** which cuts off this supply - thus preventing any attempt to start the engine - in the case of an alarm (for further details see section "Alarm System").

Through connector **G386** (which also replaces **G107**) the control unit is connected to the ALFA ROMEO CODE system, as described previously.

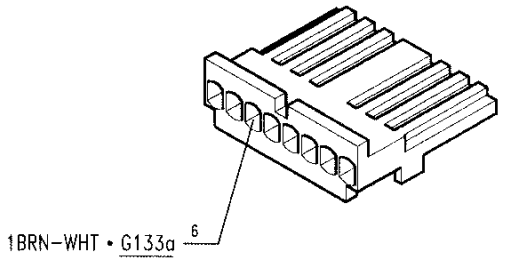
There is also the connection with the instrument cluster **C10** for the "Check Engine" warning light signal.

Components and Connectors

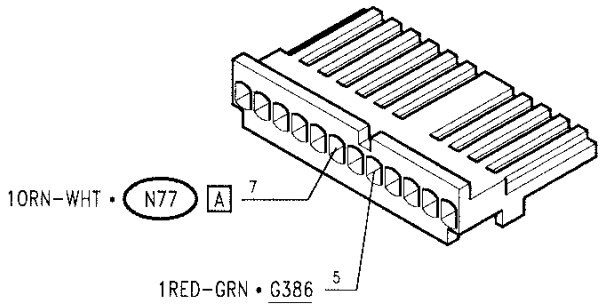
Instrument panel	C10 A



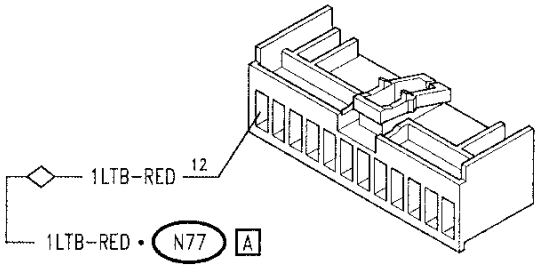
Instrument panel	C10 D



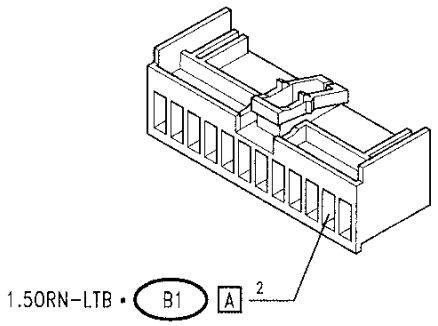
Instrument panel	C10 E



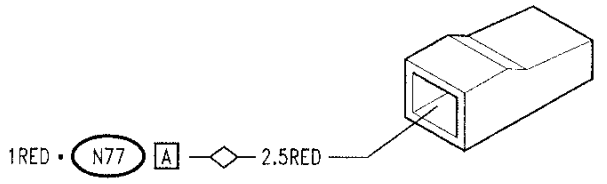
Fusebox	G1 D



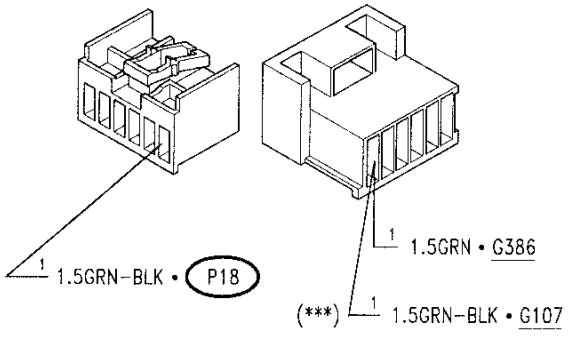
Fusebox	G1 H



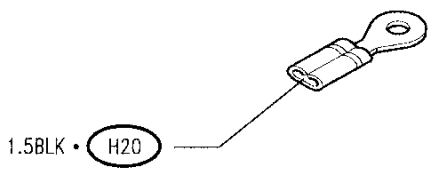
Fusebox	G1 Q



Connector for rear services	G73 C

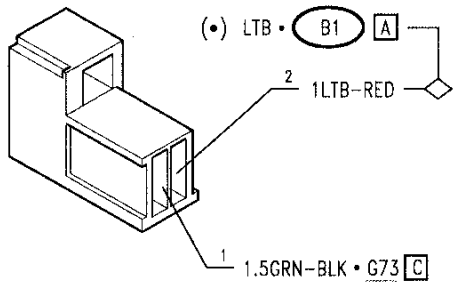


Seat cross rail earth (•)	G106

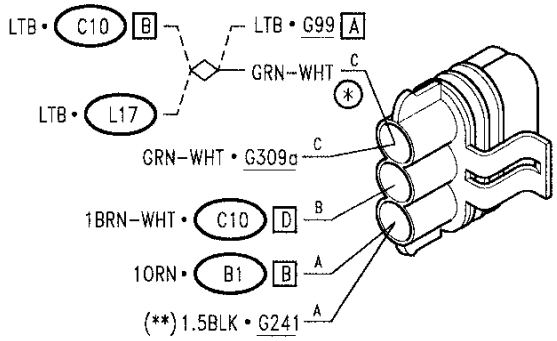


(*) variation for versions without controlled damping suspension
(***) versions within ALFA ROMEO CODE
(•) change from chassis N. ____

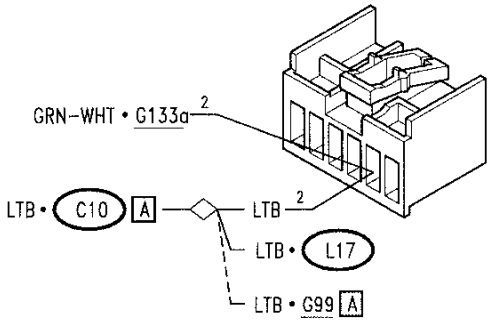
Connector for fuel pump (***)	G107



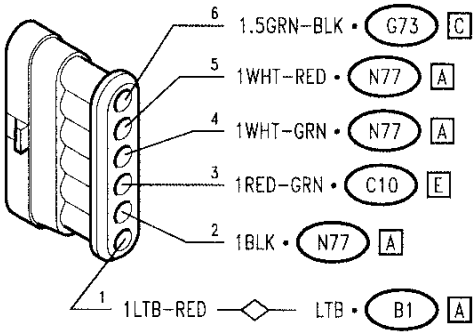
Electronic ignition-injection wiring A connection	G133a



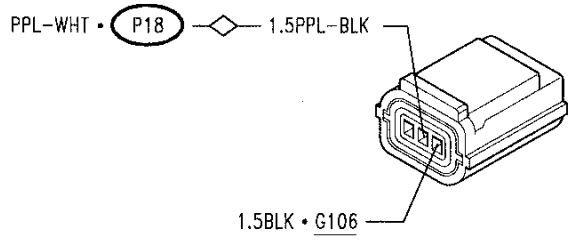
Controlled damping suspension A connection	G309a



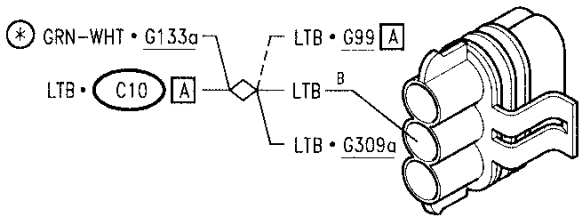
ALFA ROMEO CODE connector	G386



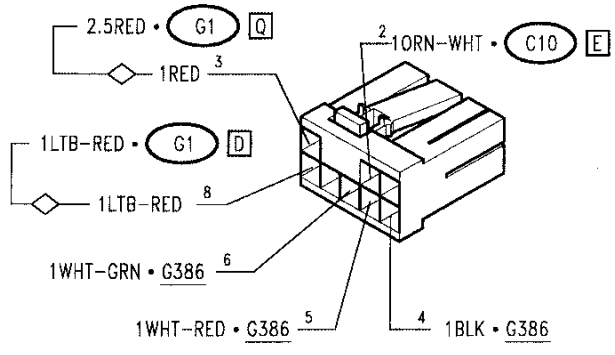
Inertial switch (•)	H20



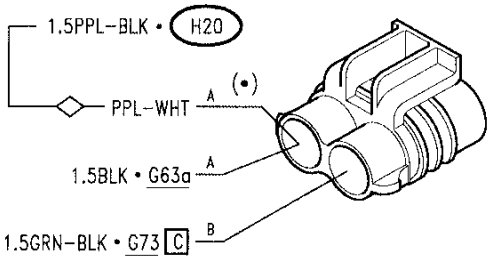
Speedometer sensor	L17



ALFA ROMEO CODE control unit	N77 A



Electric fuel pump	P18



(*) variation for versions without controlled damping suspension
(**) variation for vehicles with anti-theft device
(***) versions within ALFA ROMEO CODE
(•) change from chassis N. ____

BOSCH MOTRONIC M 1.7 IGNITION AND INJECTION SYSTEM

INDEX

GENERAL DESCRIPTION

An electronic control system defines and controls all the parameters of the engine, optimizing performance and consumption through a real time response to the differing operating conditions.
A single control unit governs both ignition and injection: the point at which the engine catches is identified via special sensors and as a consequence, the actuators carrying out the following functions are operated:

- regulation of injection times;
- regulation of ignition;
- control of cold starting;
- control of enrichment during acceleration;
- fuel cut-off during deceleration;
- constant idle speed control;
- limitation of maximum r.p.m.;
- timing variator control (T.SPARK only);
- combustion control -Lambda probe
- fuel vapour recovery;
- connection to air conditioning compressor (only for models with automatic heating-ventilation with air conditioner).

The system is also equipped with a self-diagnosis function which memorizes any anomalies and facilitates their identification and correction.

MOTRONIC M 1.7

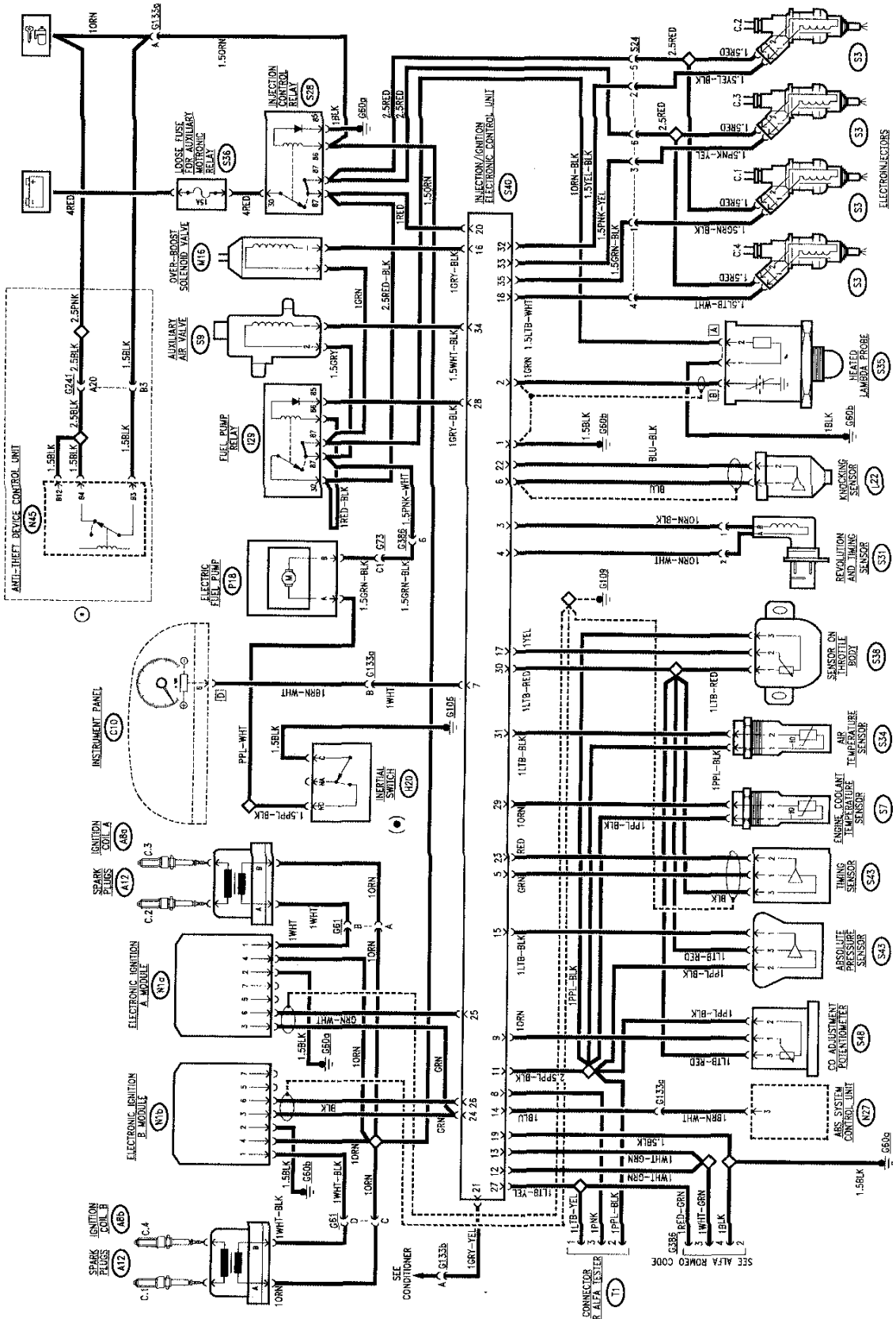
In comparison to previous models this new 1.7 system employs a control unit of a more technologically up-to-date design and is therefore more reliable. It is also includes various possibilities of operating particular functions.
A "static distribution" electronic ignition has also been adopted (semiconductors without distributor).
The set-up greatly increases reliability as it makes it possible to eliminate rotating components and as a result, reduces noise. In addition sparks are not produced externally, which reduces the risk of interference; it also reduces the number of high voltage cables and connections.
The sensor controlling the throttle valve is also of a new design: the two microswitches signalling the minimum (throttle valve closed) and maximum (throttle valve open) have been replaced by a potentiometer which sends a signal proportional to the throttle valve angle.
The idle speed regulation device is also slightly different and increases the speed of regulation.
The characteristic and innovative feature of this system is the **autoadaptation**": it is in fact able to recognize the changes which occur in the engine (internal attrition, settling of the engine with time etc.) so that adjustments can be made as a consequence.
This autoadaptation function makes it possible to compensate for the inevitable differences (due to production tollerances) of any replaced components. This permits and optimal results on all vehicles without necessitating particular adjustment and controls.

N.B. Because of this it is important that after any type of intervention the engine is left to run for a few minutes so that the control unit can "memorize" any changes which have taken place and adapt itself to them.

PRINCIPLES OF OPERATION

- **Identification of the catch point:** the point at which the engine catches is identified by two sensors: the r.p.m amd timing sensor supplies the control unit with the speed and angular position of the crankshaft; the air flow meter supplies the instantaneous volumetric output of the engine (relation between actual volume of air entering the cylinders and the volume of the cylinders themselves).
- **Regulation of injection times (fuel quantity):** The control unit controls the injectors at great speed and with great precision, calculating the opening times on the basis of engine loading (r.p.m. and air delivery) also taking battery voltage and engine temperature into account.
  Injection is simultaneous; all the injectors are opened at the same time during each revolution permitting the cylinders to be supplied with the correct ammount of fuel and improving operation during the transient states.
- **Regulation of ignition (calculation of advances):** a mapping system within the control unit calculates

WIRING DIAGRAM (versions with alarm system and/or ALFA ROMEO CODE)



(*) variant for versions with alarm system

(•) from chassis no. ...

PA4736E14x4001

12-1994

the advance on the basis of engine loading (r.p.m. and air delivery); the value is also corrected on the basis of the intake air temperature and engine temperature.

Ignition is of the static type employing double coils; the set-up which has been adopted exploits the differing pressures and environmental conditions existing at the same time in a pair of cylinders; when one of the cylinders is nearing the firing stage in the presence of air-fuel mixture, the corresponding cylinder is at the end of the exhaust phase in the presence of exhaust gas.

Examining the voltage necessary to strike the arch between the electrodes of the spark plugs it can be noted that in a cylinder during the firing phase this tension is elevated (around 10 kV) while the voltage during the exhaust phase is greatly reduced (around 500 V).

At the moment in which the Motronic control unit removes the control from one of the power phases, the flow of electricity in the main circuit of the relevant coil is interrupted generating, by induction, an increase in voltage on the secondary circuit (up to 30 kV empty).

During the increase in high voltage, one side of the secondary circuit of the coil is closed towards ground by the lost spark which, with a charge of approximately 500 V, strikes the spark plug located in the cylinder during the exhaust phase.

This permits a voltage increases on the spark plug connected to the other side of the secondary circuit which is in contact with the mixture present in the cylinder, and provokes combustion.

- **Control of cold starting:** During the cold starting phase the control unit uses the advance and injection time values.

  The control unit also controls the injection at each ignition impulse and not at each revolution of the crankshaft as happens under normal operation. When a certain temperature/engine r.p.m. ratio is reached, the control unit returns the system to normal operation.

- **Control of enrichment during acceleration:** when accelerating, the control unit increases injection in order to reach the required loading as quickly as possible.

  This function is carried out by the potentiometer located on the throttle valve which instantaneously alerts the control unit that maximum power has been requested, anticipating the signal coming from the air flow meter which shows a great increase in air flow, in this way an immediate response is obtained.

- **Fuel cut-off during deceleration:** with the throttle valve closed and the number of revolutions exceeding a threshold value (approx. 1.200 revs), the control unit interrupts fuel inection; in this way the number of revolutions decreases rapidly towards idle speed and fuel consumption, controlled to a greater degree, is as a consequence greatly decreased. The threshold value of the cut varies in relation to the temperature of the engine.

- **Idle speed control:** The regulation of idle speed is carried out through an actuator which acts on the by-pass of the throttle valve.

  This acts as an additional air chamber and as a regulator for the operation of the various functions (e.g. air conditioning compressor): with the throttle valve at the stop limit the actuator regulates the by-pass clearance compensating for the power requested by the functions in order to guarantee and idle speed which is as far as possile constant around 800 r.p.m.

  The actuator employed in this version guarantees high speed regulation as the opening and closing of the by-pass are both controlled by magnetic windings.

  Idle speed adjustment, for small variations is carried out by the ignition advance after which it is regulated by the by-pass.

  N.B. The automatic adaptation function of the system makes it possible to avoid regulating the idle r.p.m which recognizes the "throttle valve in the stop limit position" by way of the throttle valve sensor, makimg it possible to "follow" any wear which over a period of time may influence the closed position of the throttle valve.

- **Limitation of maximum r.p.m.:** once a certain threshold has been exceeded (around 6,400 r.p.m.) the control unit automatically interrupts the fuel injection in order to avoid overloading the engine and to protect it when revs are excessively high.

- **Timing variator control:** 4 cylinder engines are equipped with a electromechanical-hydraulic timing variator which, connected to the camshaft, controls and regulates intake timing on the basis of engine loading and r.p.m. This mechanism is activated by the control unit at high r.p.m. (in excess of 1,600 revs and with a loading greater than 30%).

- **Combustion control -Lambda probe-:** the oxygen probe (or "Lambda" probe) informs the control unit of the quantity of oxygen present during exhaust and therefore of the correct air-fuel metering.
  The optimal mixture is obtained by the lambda coefficient = 1 (intake air = theoretical quantity of air required for combustion). The electrical signal that the probe sends to the control unit undergoes an abrupt variation when the composition of the mixture deviates from lambda = 1. When the mixture is "lean", the control unit increases the quantity of fuel, when the mixture is "rich" the fuel is decreased: in this way the engine functions as near as possible to the ideal lambda value.
  The signal from the lambda probe is processed inside the control unit by an integrator which prevents abrupt swings.
  The probe is heated by an electrical resistance in order to be able to reach the correct operating temperature (approx. 300°C) as quickly as possible. This probe therefore, makes it possible to regulate the supply of fuel to the engine both retroactively and with precision.
  It also permits operation within the limits dictated by the laws regarding vehicle emissions.
  In addition, this mechanism makes a compensation for altitude possible, as the variations in air density, via the lambda probe, adjust the delivery by the injectors separate from the air flow meter which detects variations more slowly.

- **Fuel vapour recovery**: the petrol vapours, collected from various points in the fuel delivery system into a special tank, are directed to the engine where they are then burned: this occurs through a solenoid valve opened by the control unit, only when petrol vapours are in fact present in the tank and engine and only when loading conditions are such that correct combustion is ensured without affecting the engine: the control unit compensates for this extra quantity of petrol with a reduction in the fuel supplied to the injectors.

- **Connection to air conditioning compressor:** the control unit is connected to the air conditioning system so that the idle r.p.m can be adjusted to the increase power which occurs each time the compressor cuts-in.
  As this is a device requiring a large power input, when increased engine performance is requested (high accelaration), the control unit momentarily interrupts (7-10 seconds) the supply to the compressor.

SELF-DIAGNOSIS

The control unit is equipped with a self-diagnosis system which continually checks the signals coming from the various sensors and compares them with the permitted limits. If these limits are exceeded, the system recognizes a malfunction and replaces the anomalous values with suitable average values so that the vehicle is able to proceed safely, though not under optimum conditions, to a point where Network asistance can be gained: this method has been termed the "limp home" capability.
The parameters which can be "substituted" by the control unit in the event of a malfunction are: air-flow meter, idle adjustment actuator, engine temperature sensor, throttle valve sensor and vapour recovery solenoid valve.
If a malfunction occurs in the control unit, or to the r.p.m. and timing sensor or injectors, the system will not identify the fault and the vehicle will come to a halt.
The self-diagnosis system also enables an efficient and rapid identification of the anomalies to be made when connected to the ALFA ROMEO Tester (refer to specific publications)
Troubleshooting is however possible even without the aid of this instrument by following the instructions given below in this section (see "Troubleshooting".)

ure on the waste-gate valve, when max. power is requested.

The latter valve does not act with a continuous command, but with a "duty-type" signal (12V impulses with a 15Hz frequency), which allows the boost pressure to be "softly" modulated, in order to obtain a progressive and regular supply of power.
For safety reasons the control unit will interrupt injection if the boost pressure exceeds 1.5 bar.

In addition to the above points the system also controls the following functions:

Fuel pump control: the control unit drives the electric fuel pump according to a very precise logic which guarantees maximum safety:

- during start-up, the pump's supply is interrupted after a given time (variable between 0.5 and 10 secs in function with the engine temperature) if the engine has not already started to rotate regularly.
- the pump is continuously supplied as long as a signal provides the r.p.m.; if this signal stops for any reason (if there is an accident and the engine cuts out) the pump is immediately disactivated.

In addition, from chassis no. .... the inertial switch is present which cuts off the earth line to the pump in the event of a significant crash.

Control of cold starting: during the cold starting phase the control unit uses the advance and injection time values so as to obtain the "automatic starter" function.

In addition, in this situation the idle speed control logic also varies (see).

Control of enrichment during acceleration: when accelerating the control unit increases the injection in order to reach the required torque/power ratio as quickly as possible.

This function can be recognised by the rapid variation in both the intaken air density, and the signal of the potentiometer positioned on the throttle which immediately signals to the control unit that "maximum power" has been requested.
An enrichment of the amount of fuel injected is achieved during acceleration starting with the throttle angle above 30° (max. speed).

Fuel cut-off during deceleration: with the throttle closed and the r.p.m. above the threshold value (approx. 1.100 revs plus 200 hysterisis revs), the control unit disenables the fuel injection; in this way the number of revs decreases rapidly towards the idle speed and above all there is a considerable saving in fuel, and a considerable consumption control.

Limitation of r.p.m.: the control unit automatically reduces the fuel injection when the engine speed reaches a high value, close to the maximum threshold, and protects the engine from operating in these critical conditions.

Control of knocking: as already seen, the knock sensor hears the knocking in the combustion chamber. In this condition it reduces the amount of fuel to eliminate this phenomenom as quickly as possible.

Connection with the air conditioning compressor: the control unit is connected to the air conditioning system so that it can adapt the engine idle speed to the increase in load every time that the compressor is activated.

Connection with the alarm system: (from chassis no. ... and where applicable): the electronic control unit is supplied through the control of the alarm system electronic control unit which prevents it from receiving the "key-operated" supply thereby disabling starting of the engine.

Connection with the ALFA ROMEO CODE system (from chassis no. ...): as soon as the IAW control unit receives the signal that the key is at "MARCIA", it "asks" the ALFA ROMEO CODE system for consent to start the engine: this consent is only given if the ALFA ROMEO CODE control unit recognises the code of the key engaged in the ignition switch as correct. This conversation between the two control units takes place on the special serial line.

Fuel vapour recovery: N.B.: in this system the electronic control unit does not control the fuel vapour recovery, it is controlled pneumatically (see "155 Q4 - REPAIR MANUAL - ENGINES", Group 04)

SELF DIAGNOSIS

The control unit is equipped with a self diagnosis system, which continually verifies the signals originating from the various sensors and compares them with the maximum allowed limits, memorizing any faults.
These faults can be easily identified by connecting to the ALFA ROMEO Tester (see suitable publications).

COMPONENTS:

The electronic control unit (**S40**) receives signals from the sensors which "read" the functioning of the engine, it processes them according to a logic memorized internally in "maps" which are correlate, in the best way, the various parameters, which in turn activate the actuators so that the engine always functions with the highest degree of performance and regularity.
The "maps" are the result of long bench and on-road tests to determine the optimal values and are stored in a permanent "read only" ROM memory programmed during control unit assembly and that can not be modified.
The parameters are calculated for every engine revolution, which allows a "real time" response to the systems's operating conditions.
The control unit is also able to adapt the signal sent to the actuators in function with the supply voltage, because varying this voltage would cause the actuators to respond differently.

The control sensors are:

- revolution and TDC sensor (**S31**);
- timing sensor (**S13**)
- engine coolant temperature sensor (**S7**);
- air temperature sensor (**S34**);
- absolute pressure sensor (**S43**);
- sensor on throttle body (**S38**)
- heated lambda probe (**S35**)
- knock sensor (**L22**)

The actuators controlled by the system are:

- electroinjectors (**S3**);
- ignition coil (**A8a**; **A8b**) with ignition modules (**N1a**; **N1b**);
- fuel motor pump (**P18**);
- air supplement solenoid valve (idle) (**S9**);
- "overboost" solenoid valve (waste-gate control) (**M16**)

The control unit is also connected to:

- the heater/ventilation system, which signals when the compressor has been activated to adapt the engine idle speed
- the ABS control unit **N27** which signals when the idle fast is to be activated
- instrument panel **C10** to which the rev counter signal is provided.
- alarm system control unit **N45** and the ALFA ROMEO CODE control unit **N77**.

The control unit **S40** is also connected to the CO control trimmer (**S48**).

The system is completed by two relays which activate the engine fuel pump (fuel pump relay **I29**) and the injectors (injection control relay **S28**), by a loose protection fuse (**S36**) and three ground points (**G60a**, **G60b** and **G109**).

Finally it is connected to the ALFA ROMEO tester through connector **T1**.

FUNCTIONAL DESCRIPTION

The control unit **S40** controls and regulates the entire electronic ignition and injection system, as well as the boosting.

The control unit **S40** is supplied to pin 20 of the injection control relay **S28**. This supply is protected by fuse **S36** (15A).

Relay **S28**, excited with the key in "run" position signal, supplies the control unit to pin 20 and the fuel pump relay **I29**; it also provides a consensus signal to the injectors **S3**.

The petrol pump relay **I29**, excited by a negative signal from the control unit **S40** from pin 28, supplies the fuel

electric pump **P18**, and provides a consensus signal to the over boost solenoid valve **M16**, to the air supplement solenoid valve **S9** and the lambda probe **S35**.

The inertial switch **H20** is located on the line that supplies the earth to the fuel pump **P18**. The opening of switch **H20** instantaneously cuts out the earth signal, thereby stopping the fuel pump.

For safety reasons, the control unit **S40** controls the supply to the fuel pump: this takes place through the consensus signal to relay **I29**, to pin 28, according to the logic described above.

The control unit **S40** receives signals from the various sensors, and keeps all the engine's operating parameters under control.

From pin 30 of the control unit a "filtered and controlled" supply signal is sent to the numerous sensors, whilst a "filtered" ground signal is sent from pin 11 to a series of other sensors.

The revolution and T.D.C. sensor **S31** and the timing sensor **S13** supply information regarding engine speed and timing.

Sensor **S31** is of the inductive type and measures the engine r.p.m. by varying a magnetic field produced by the passing of the teeth of the "phonic" wheel assembled on the crankshaft pulley; the wheel has four teeth, dephased by 90° which allows the speed to be identified and the passage to T.D.C to be recognised: it receives a control unit ground from pin 3, and sends out a signal to pin 4.

The timing sensor **S13** reconstructs the timing value through a Hall effect device fitted to the cam shaft, exhaust side: it receives a control unit ground at pin 5, a supply at pin 30 and sends out a signal to the pin 23 of the control unit; all three cables are protected.
The control unit **S40** compares this signal with the rev and T.D.C. sensor **S31** and identifies the operating time for each cylinder and consequently pilots the injection sequence.

The sensor on throttle body **S38**, controlled by the control unit **S40** from pin 30 and 11, generates a signal through a potentiometer which is sent to pin 17 which is proportional to the degree of opening of the throttle itself.

The mobile part of the potentiometer is fitted directly on the shaft which makes the throttle rotate.

The air temperature sensor - in the intake manifold - **S34**, controlled by the control unit **S40** from pin 11, supplies a signal to pin 31 which is proportional to the temperature in the intake manifold, measured by the NTC type thermistor (resistance which decreases with the temperature.)

The engine temperature sensor **S7**, controlled by the control unit **S40** from pin 11, supplies a signal to pin 29 in proportion with the engine coolant temperature measured, close to the thermostat, with an NTC thermistor (resistance which decreases with the temperature).

The absolute pressure sensor **S43**, controlled by the control unit **S40** from pins 30 and 11, generates a signal sent to pin 15 which is proportional to the incoming air absolute pressure.
This signal is of the piezoresistive type: an internal electronic device within the sensor itself amplifies the deformations of a membrane which "hears" on one side the absolute vacuum and on the other the vacuum in the intake manifold.

The knock sensor **L22**, controlled by a ground from the control unit **S40** to pin 6, supplies a signal, to pin 22 - protected - proportional to the vibrations of the hammering phenomenom (knocking) in the combustion chamber. A piezoelectric material generates a voltage proportional to the vibrations detected.

The heated lambda probe **S35** supplies information to the control unit **S40** regarding the correct air-fuel mixture composition by measuring the concentration of oxygen in the exhaust gases; this takes place through a signal sent to pin 2 of the control unit **S40**; the above mentioned signal is of a very low intensity and is therefore protected.
The probe is heated with a resistance, in order to ensure a correct functioning even with the engine cold; the resistance is supplied by the fuel pump relay **I29**.

On the basis of the signals received from the sensors and the calculations performed, the control unit **S40** controls the opening of the injectors **S3** through the pins 18, 35, 33 and 32. The injectors receive the consensus for opening from relay **S28**.

The ignition is the static type and is controlled directly by the control unit which consequently regulates automatically the advance.

The ignition modules **N1a** and **N1b** are supplied by relay **S28** to pin 4; pin 2 is grounded, whilst pin 3 receives the consensus through a ground from the control unit **S40**, pin 24.
The control signal is sent from pins 25 and 26 of the control unit **S40** to pin 6 of **N1a** and **N1b**: these signals are of a very low intensity and are therefore protected.
The modules **N1a** and **N1b** generate the impulses sent, from pin 1 to the coils **A8a** and **A8b** and from the spark plug **A12**.

The air supplement solenoid valve **S9** realizes an air flow by-pass around the throttle; it is composed of an electromagnetic winding which moves the piston to vary the section of the gap, modulating the quantity of air in the by-pass. The control signal originates from pin 34 of the control unit **S40**, and the supply fron relay **I29**.

The overboost solenoid valve **M16**, is activated to regulate the waste- gate valve by the control unit **S40** through the signal to pin 16, whilst the supply originates from relay **I29**. It is a three way valve where, with the winding excited, it will close the gap towards the waste-gate valve, and release the pressure supplied by the turbocharger into the intake channel,; this allows an increase in the boosting pressure ("boost-drive" logic).

The CO control trimmer **S48**, controlled by the control unit **S40** from pin 11 and 30, is connected to pin 9 to which it sends a signal proportional to the rotaion of the CO adjusting screws.

The control unit **S40**, through sensor **S31**, is continually aware of the r.p.m: this information is sent to the revs counter indicator, situated on the instrument panel **C10**, through the signal from pin 7.

The control unit **S40** is connected with the air conditioning system through pin 21.
This allows the idle speed to be adjusted to the power increases every time the compressor is activated.

Pin 14 is connected to the ABS control unit **N27**, which signals when the "idle fast" is enabled or excluded.

The alarm system control unit **N45** - where applicable - cuts off the system supply at pin 86 of **S28**, thereby preventing, if necessary, the engine from starting.

The control unit **S40** is connected from pins 12 and 13 with the ALFA ROMEO CODE control unit **N77** through the special serial line. This way if the ALFA ROMEO CODE does not detect a correct "key code", it does send a consent signal and the engine will not start.

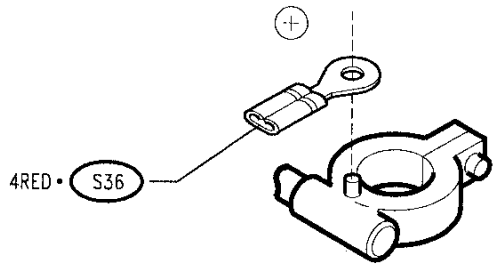
The signal for the "Check Engine" warning light on the cluster **C10** leads from pin 27.

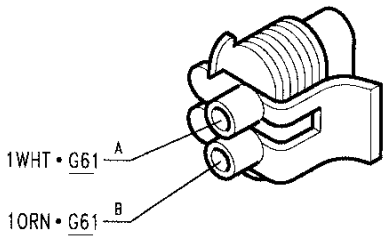
The control unit **S40** is equipped with a self diagnosis system, which can be used by connecting it to connector **T1** of the ALFA ROMEO tester; the fault signals for at least one of the system's components are sent here from the control unit, pin 27, whilst pin 8 provides the reference supply and pin 11 the controlled ground.

Finally pins 1 and 19 of the control unit **S40** are grounded (**G60b** and **G60a** respectively).

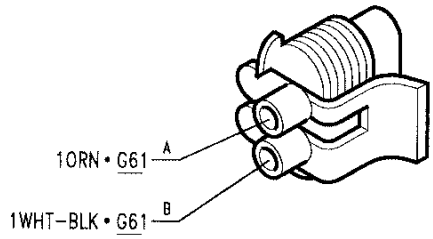
COMPONENTS AND CONNECTORS

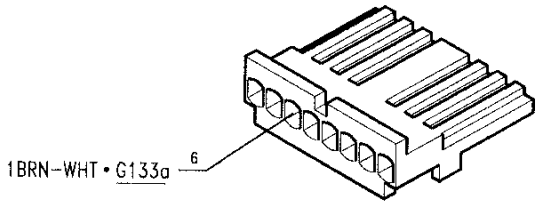
Battery	A1	Ignition coil A	A8a



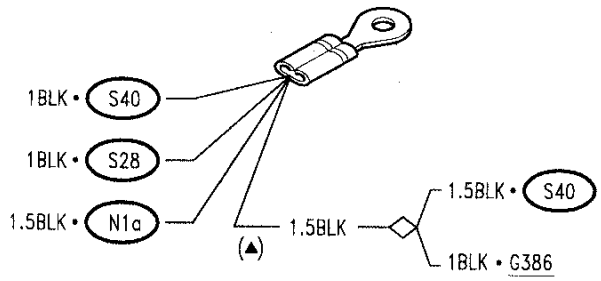


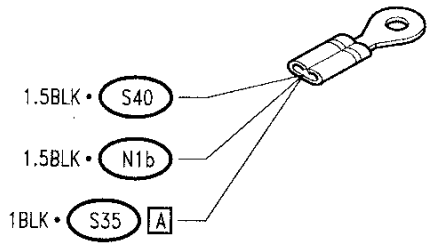
Ignition coil B	A8b	Instrument panel	C10 D



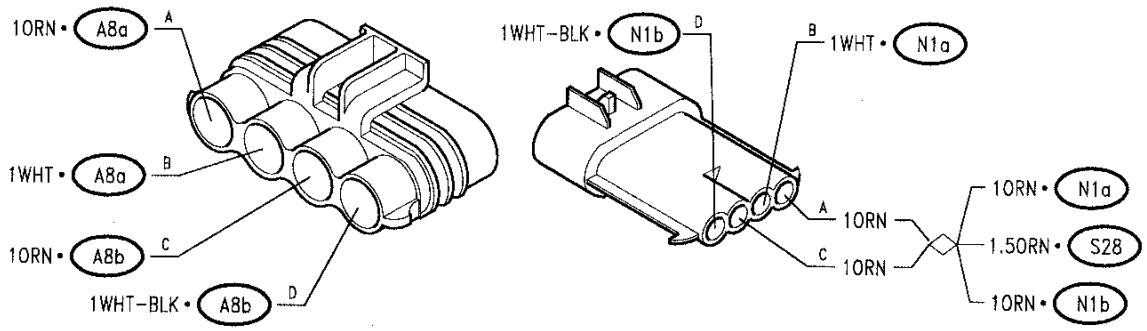


Injection wiring ground	G60a	Injection wiring ground	G60b



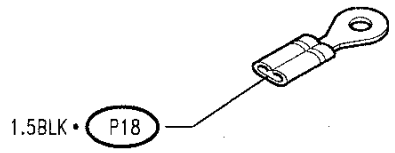


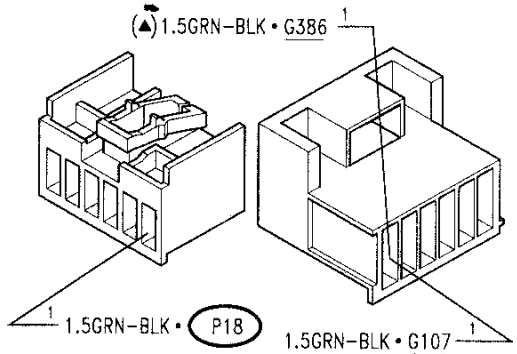
Injection coil connection	G61



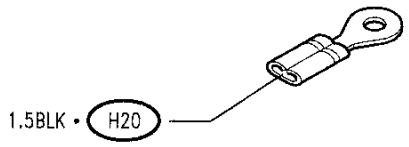
(▲) for versions with ALFA ROMEO CODE only

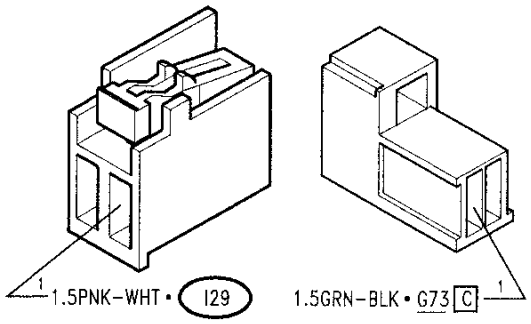
Rear right ground	G63a	Connector for rear services	G73 C



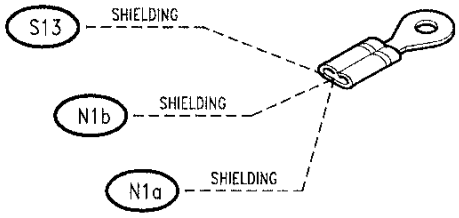


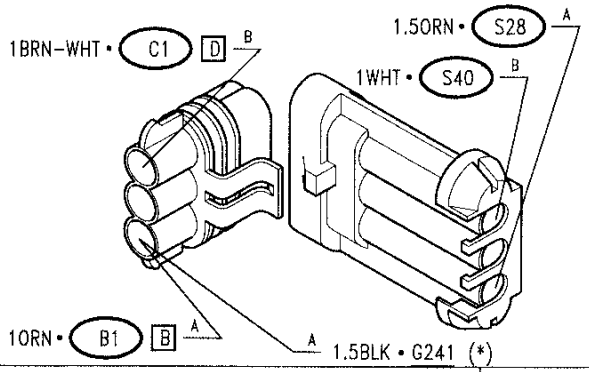
Seat cross rail earth(•)	G106	Connector for fuel pump	G107



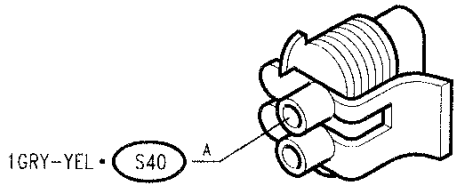


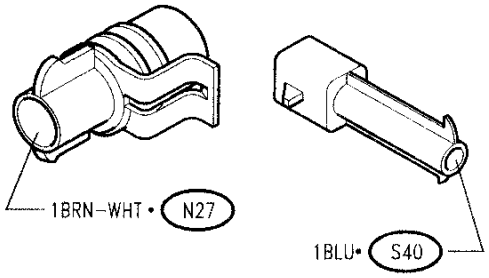
Injection wiring ground	G109	Electronic ignition/injection wiring connection A	G133a





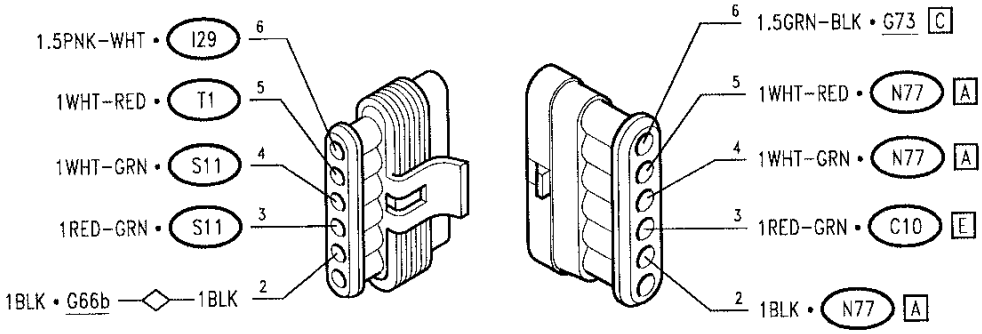
Electronic ignition/injection wiring connection B	G133b	Electronic igntion/injection wiring connection C	G133c



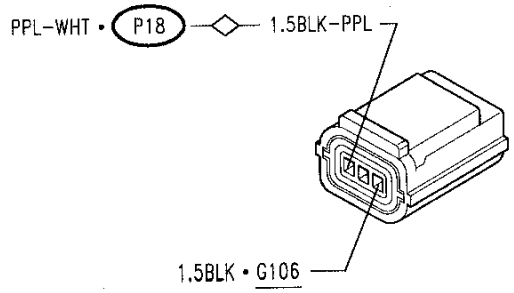


(▲) for version with ALFA ROMEO CODE only
(*) variation for vehicles with anti-theft device
(•) change from chassis N. _____

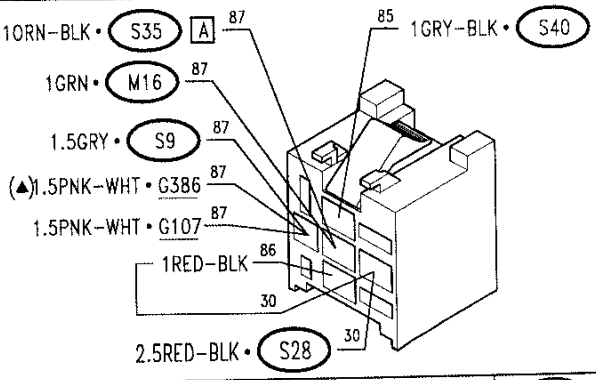
ALFA ROMEO CODE connector — G386



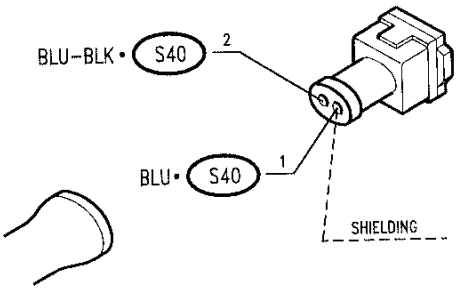
Inertial switch (•) — H20



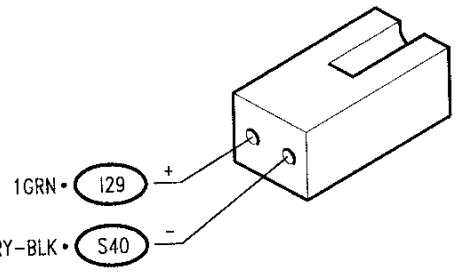
Fuel pump relay — I29



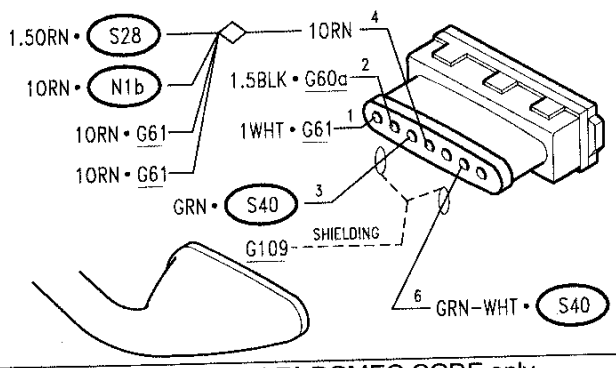
Knock sensor — L22



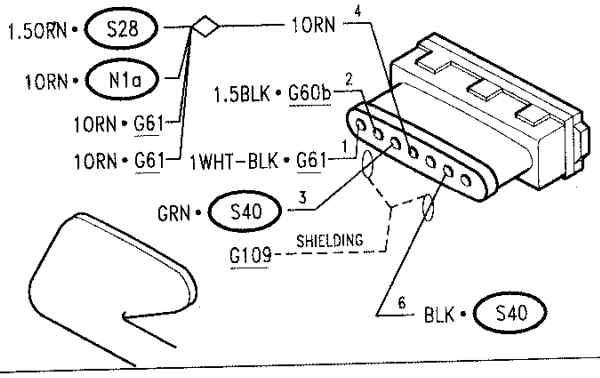
Over-boost solenoid valve — M16



Electronic ignition module A — N1a



Electronic ignition module B — N1b

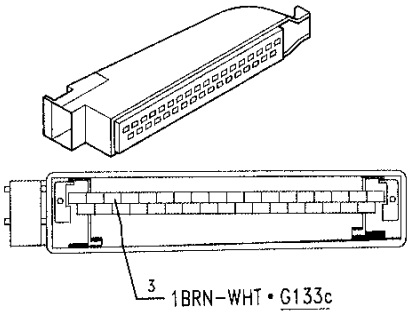


(▲) from versions with ALFA ROMEO CODE only
(•) change from chassis N. ____

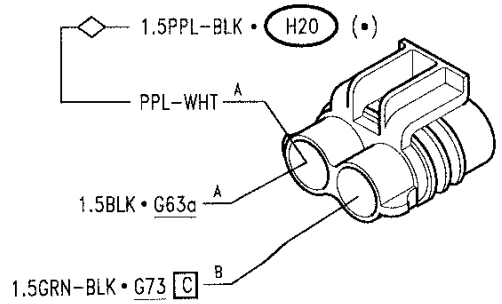
12-1994

PA4736E14x4001

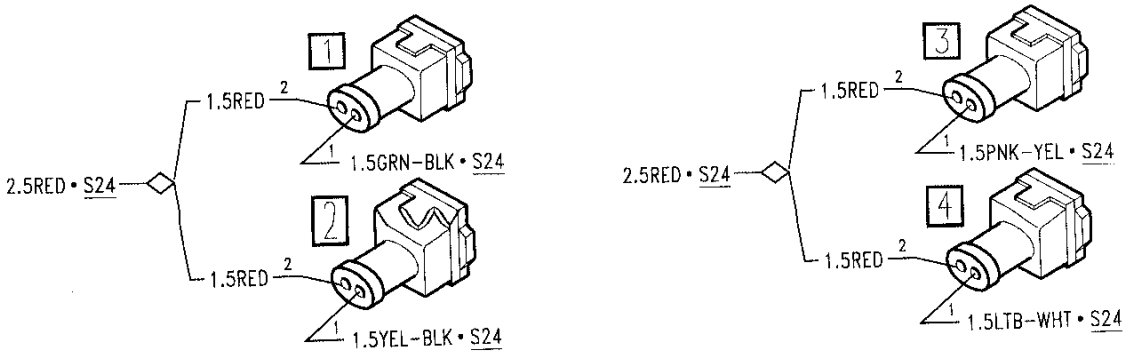
ABS system electronic control unit (N27)



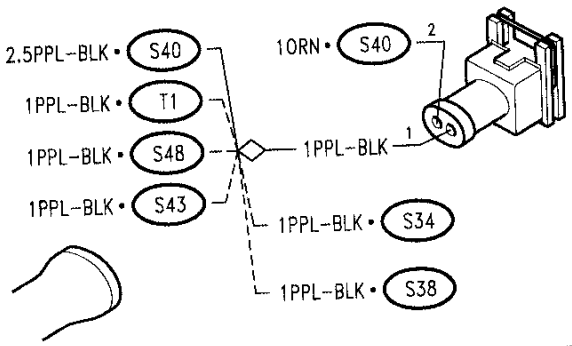
Fuel motor pump (P18)



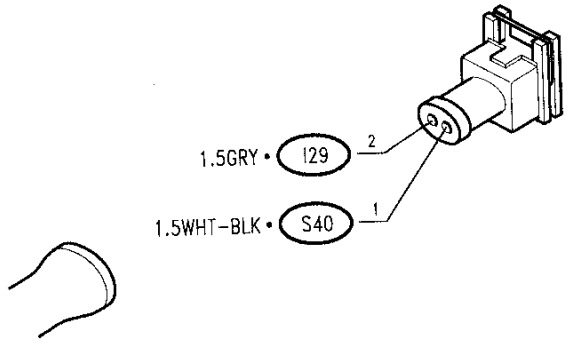
Electroinjectors (S3)



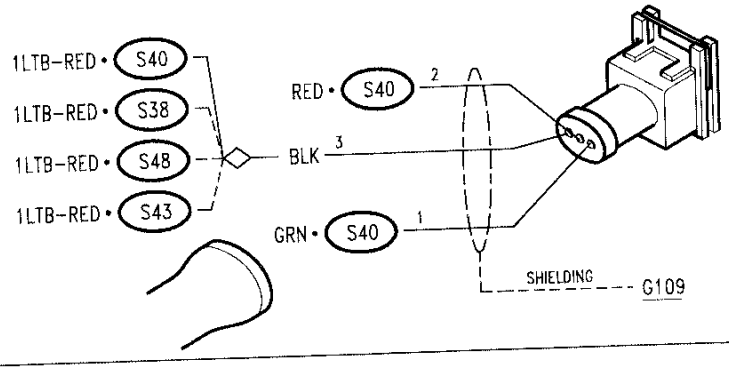
Engine coolant temperature sensor (S7)



Air supplement solenoid valve (idle) (S9)



Timing sensor (S13)



(•) change from chassis N. ____

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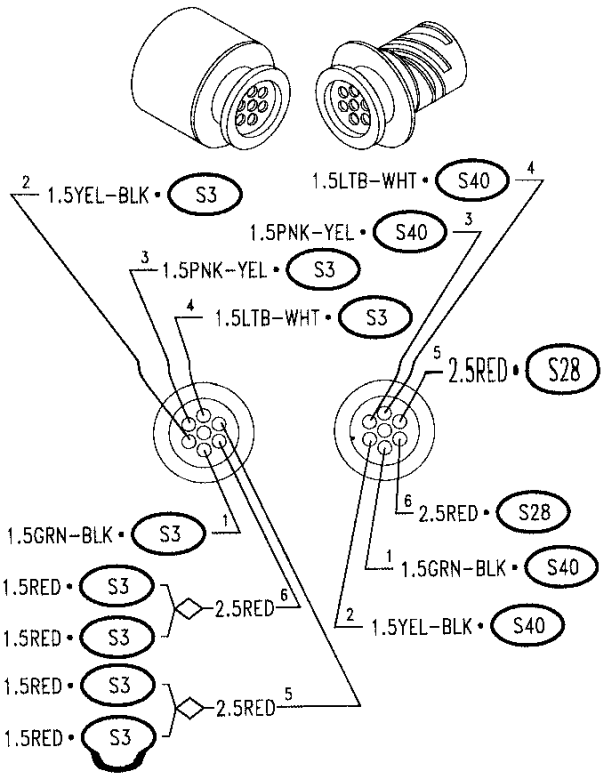
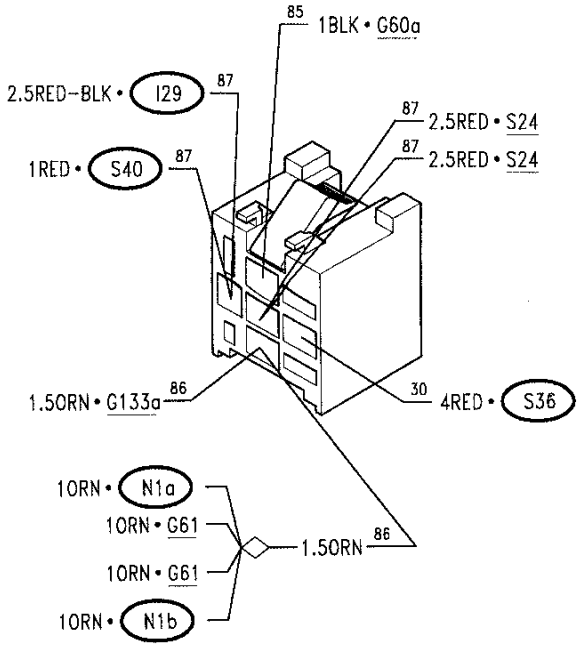
PA4736E14x4001

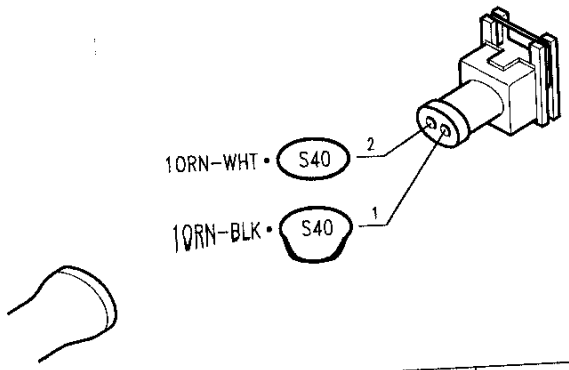
Connector for electroinjectors	S24



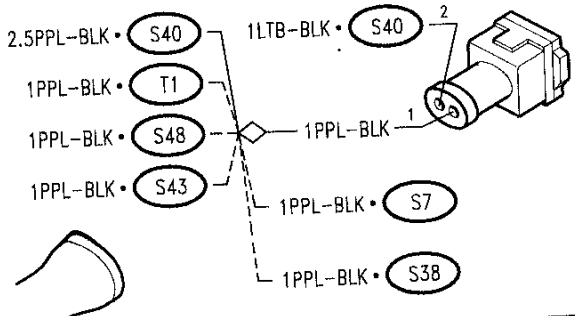
Injection control relay	S28



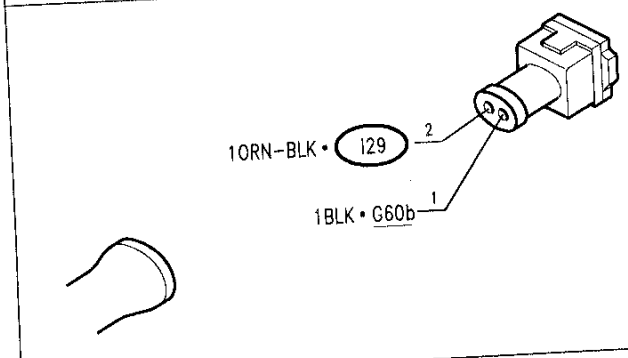
Revolution and T.D.C. sensor	S31



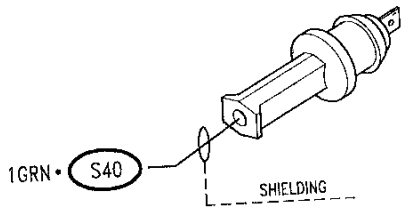
Air temperature sensor	S34



Heated lambda probe	S35 A



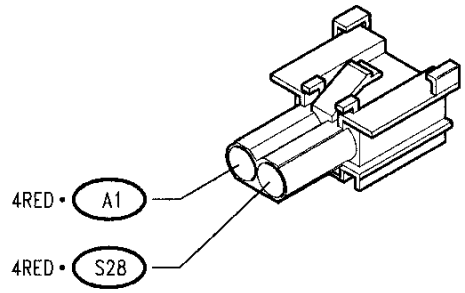
Heated lambda probe	S35 B



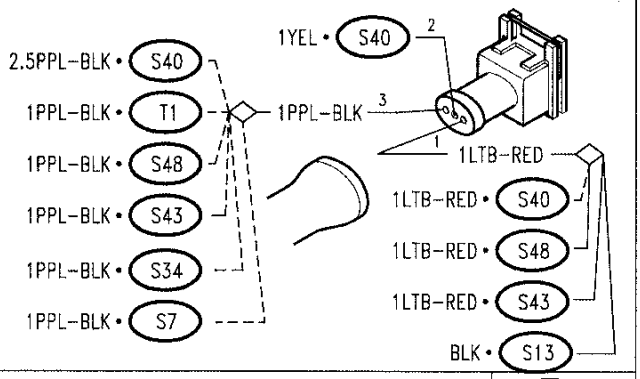
12-1994

PA4736E14x4001

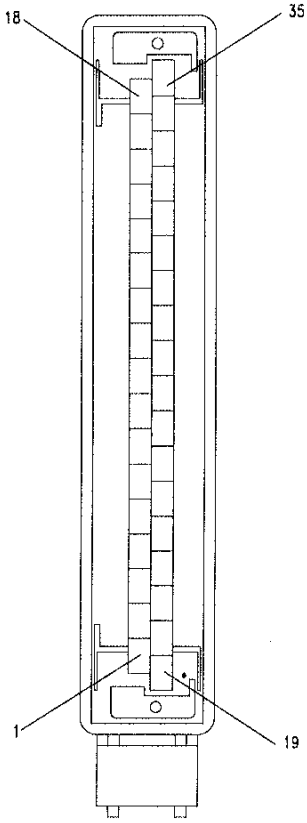
Loose fuse for ignition relay — S36

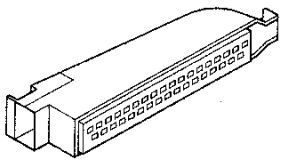


Sensor on throttle body — S38



Ignition/injection control unit — S40

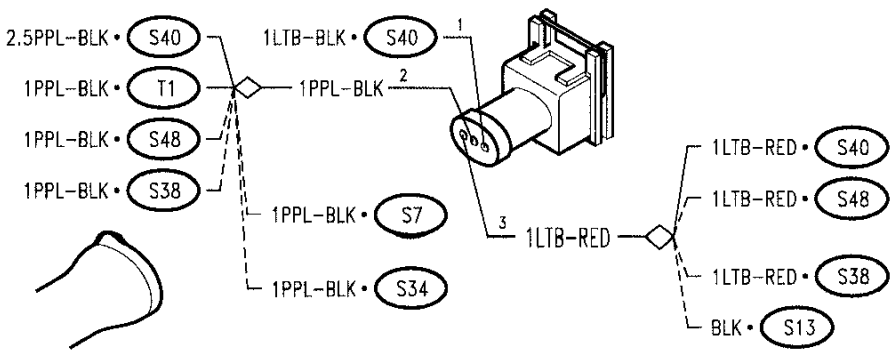




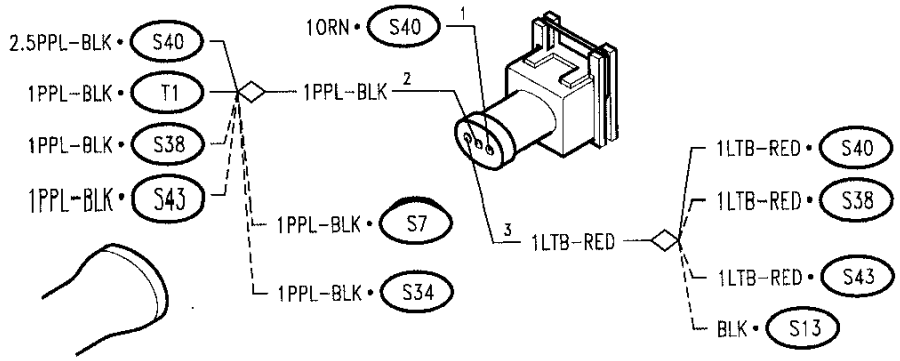
1 1.5BLK • G60b — SHIELDING
2 1GRN • S35 [B]
3 1ORN-BLK • S31
4 1ORN-WHT • S31
5 GRN • S13
6 BLU • L22 — SHIELDING
7 1WHT • G133a
8 1PNK • T1
9 1ORN • S48
11 2.5PPL-BLK
(▲) 12 1WHT-GRN — 1WHT-GRN • G386
(▲) 13 1WHT-GRN
14 1BLU • G133c
15 1LTB-BLK • S43
16 1GRY-BLK • M16
17 1YEL • S38
18 1.5LTB-WHT • S24
19 1BLK • G60a
(▲) 19 1.5BLK — 1.5BLK • G60a / 1BLK • G386
20 1RED • S28
21 1GRY-YEL • G133b
22 BLU-BLK • L22
23 RED • S13
24 GRN • N1a / GRN • N1b
25 GRN-WHT • N1a
26 BLK • N1b
27 1LTB-YEL • T1
(▲) 27 1LTB-YEL — 1LTB-YEL • T1 / 1RED-GRN • G386
28 1GRY-BLK • I29
1PPL-BLK • S43
1PPL-BLK • T1
1PPL-BLK • S48
1PPL-BLK • S34
1PPL-BLK • S7
1PPL-BLK • S38
29 1ORN • S7
29 1ORN • S7
30 1LTB-RED — 1LTB-RED • S38 / BLK • S13 / 1LTB-RED • S43 / 1LTB-RED • S48
31 1LTB-BLK • S34
32 1.5YEL-BLK • S24
33 1.5PNK-YEL • S24
34 1.5WHT-BLK • S9
35 1.5GRN-BLK • S24

(▲) for versions with ALFA ROMEO CODE only

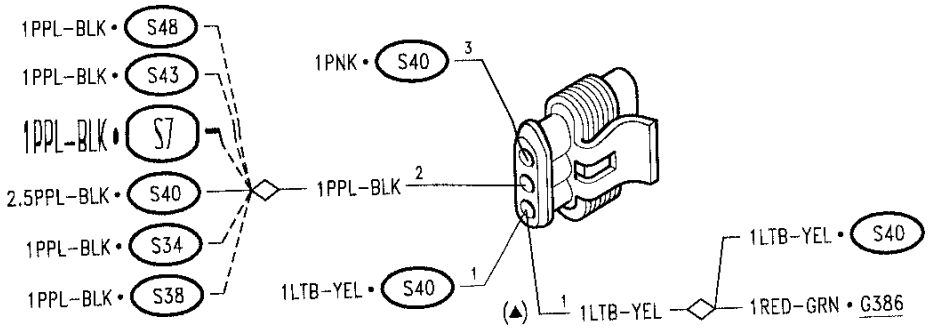
Absolute pressure sensor — S43



CO control trimmer — S48

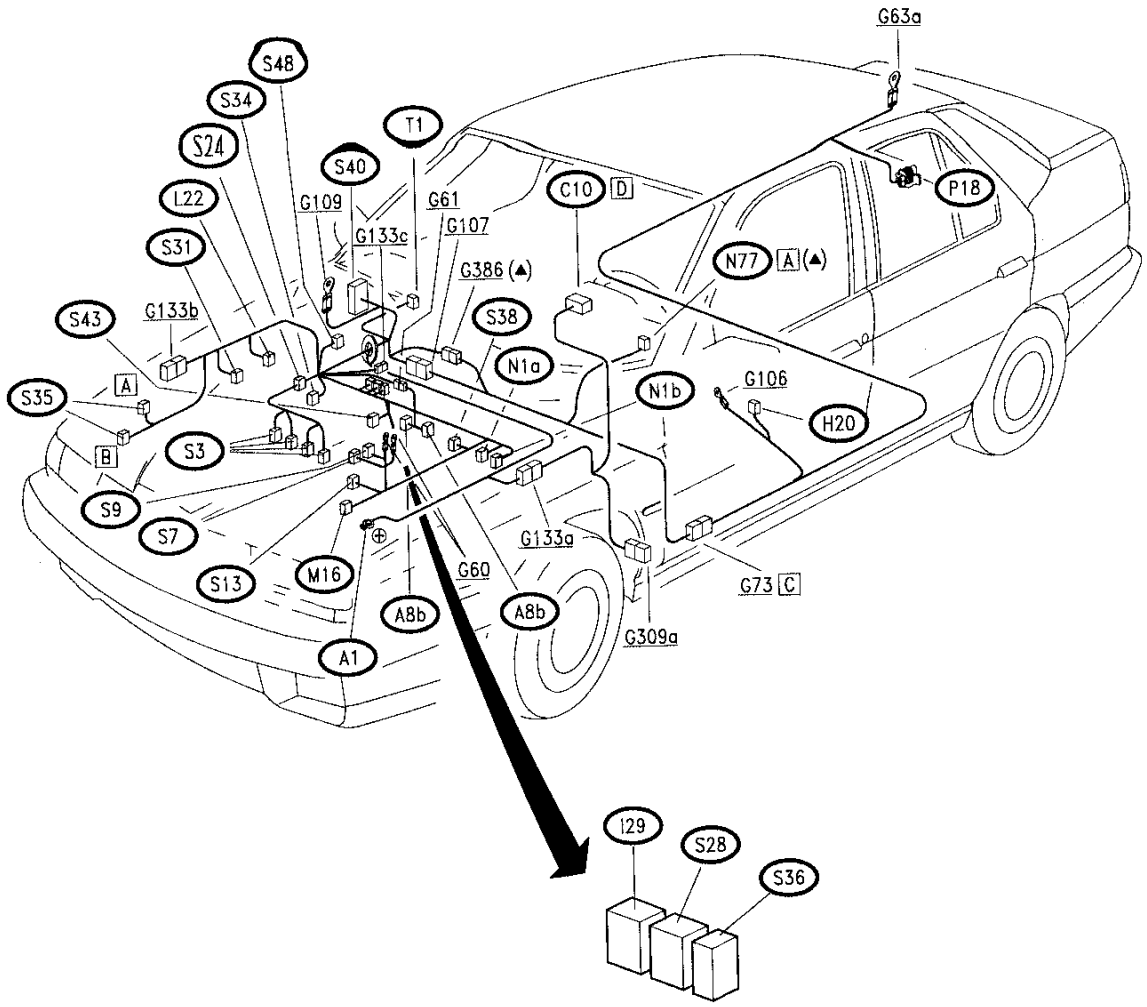


Connector for ALFA TESTER — T1



(▲) for versions with ALFA ROMEO CODE only

LOCATION OF COMPONENTS



(▲) for versions with ALFA ROMEO CODE only

TROUBLESHOOTING TABLE

Malfunction	Component																				Test
	A1	S28	S36	I29	S38	S7	S34	S13	S31	S43	L22	S35	S9	M16	S48	S3	P18	S40	A12	A8	N1	
System power supply	•	•	•															•				A
Throttle sensor					•													•				B
Engine temperature sensor						•												•				C
Air temperature sensor							•											•				D
Timing sensor								•										•				E
Rev. and T.D.C. sensor									•									•				F
Absolute pressure sensor										•								•				G
Knock sensor											•							•				H
Lambda probe				•								•						•				I
Air supplement valve (idle)				•									•					•				J
"Over-boost" valve				•										•				•				K
CO Potentiometer															•			•				L
Electroinjectors		•														•		•				M
Fuel pump		•		•													•	•				N
Irregular ignition																		•	•	•	•	O
Irregular injection																						*
Irregular idle speed (compressor activation)																						**
Irregular "fast idle" (connection with ABS)																						***

* See **tests M and N**, or "155 Q4 - REPAIR MANUAL - ENGINES" Group 04.

** See **test J**, or section "Air Conditioning"

(•) For cars with alarm system, firstly check that this system is working properly (see section "Alarm system"). For cars with ALFA ROMEO CODE, make sure that this system has not inhibited the operation of the system.

ALFA ROMEO CODE

Index

GENERAL DESCRIPTION

From chassis no. ___, the car is fitted with an electronic code system (ALFA ROMEO CODE) which inhibits the control of the engine operated by the ignition keys.

Turning the key to the MARCIA position the IAW Engine Control System Control unit (**C.C.M.**) requests the code from the Control unit of the ALFA ROMEO CODE system - Electronic Key Control Unit (**C.C.E.**). Once it has received the code, it compares it with the code in its memory (**MASTER CODE**).

If the comparison of the code received with the one memorised is positive the C.C.M proceeds with normal electronic engine management (starting, ignition, injection, etc.).

N.B.:
The ALFA ROMEO CODE is the same as the one installed on the T.SPARK and V6 versions, described in "155 - "REPAIR INSTRUCTIONS" - ELECTRICAL AND ELECTRONIC DIAGNOSIS - PA4653E1000000.

This section only describes the specific differences for the Q4 version.

Reference should be made to the above-mentioned publication concerning the following:

- DESCRIPTION OF THE SYSTEM;
- DESCRIPTION OF COMPONENTS;
- OPERATION;
- PROGRAMMING THE KEYS;
- TRNSPONDER TRANSFER PROCEDURE;
- DIAGNOSIS;
- RECOVERY PROCEDURES.

OPERATION:

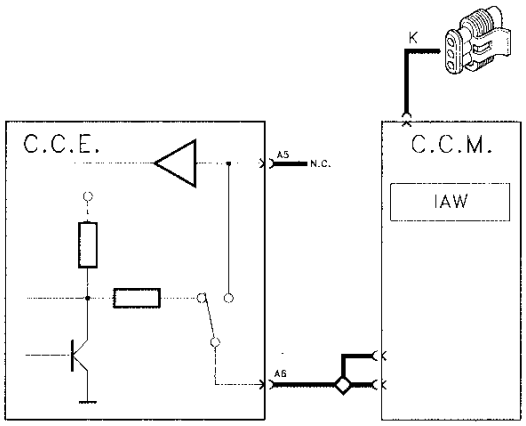
Sharing of the serial line between the diagnosis functions and the ALFA ROMEO CODE system

Inside the C.C.E. there is a switching relay, the purpose of which is to enable dialogue between the C.C.M. and the Alfa Tester or the C.C.E. itself.

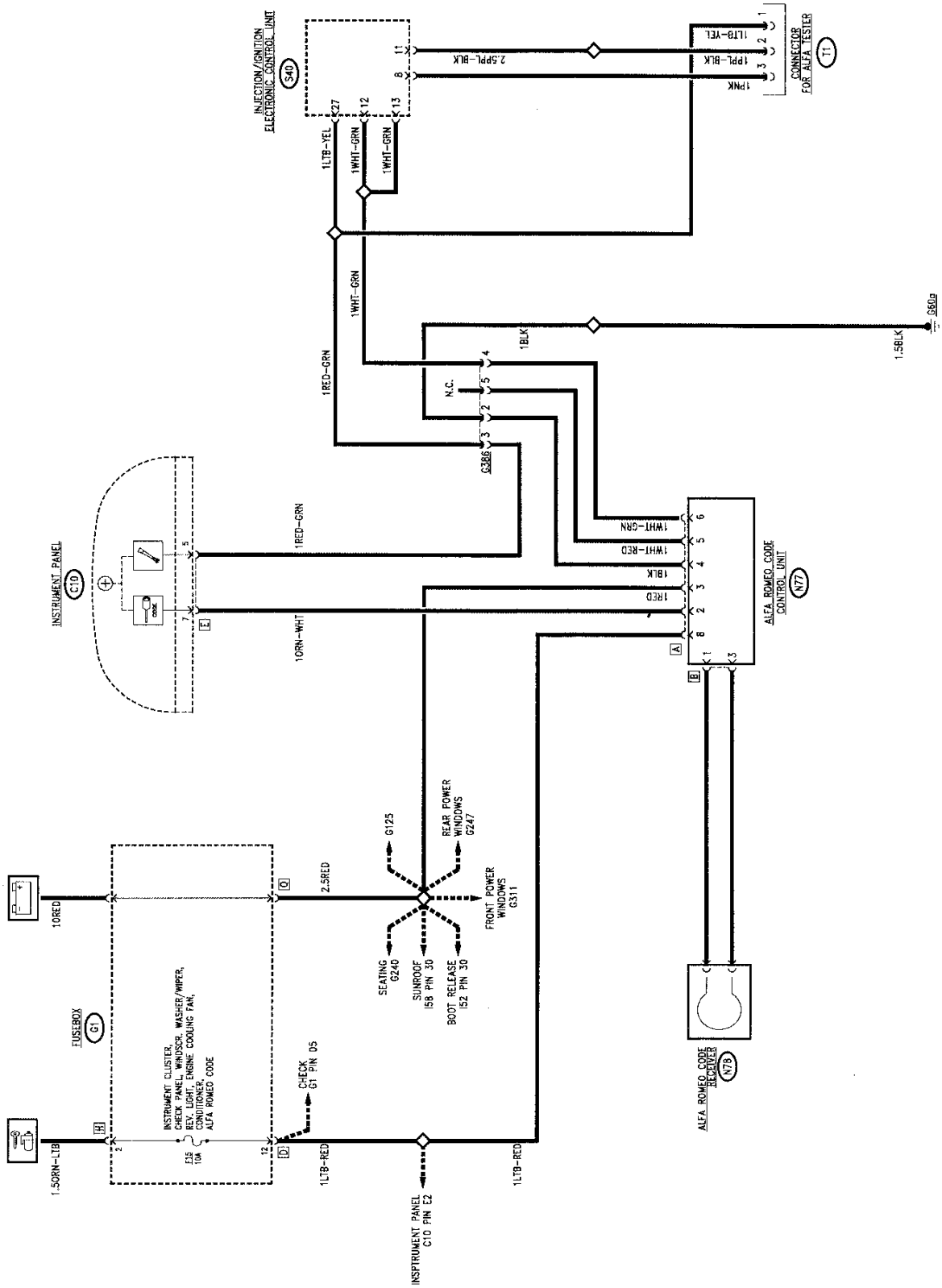
Some injection control unts including the IAW, have a special provision with a serial line for dialogue between the C.C.M. and the C.C.E., using pin A6 of the C.C.E. (see diagram).

Line K of the diagnosis socket is NOT connected to the C.C.E. at pin A5, but leads driectly from the C.C.M. - to the Tester.

Diagnosis line K is still enabled by the C.C.M. only at the end of the dialogue between the C.C.M. and the C.C.E..



WIRING DIAGRAM



FUNCTIONAL DESCRIPTION

The ALFA ROMEO CODE control unit **N77**, located next to the fusebox **G1**, is connected through connector B to a special pair of cables at receiver **N78**, consisting of an aerial coaxial with the ignition switch.

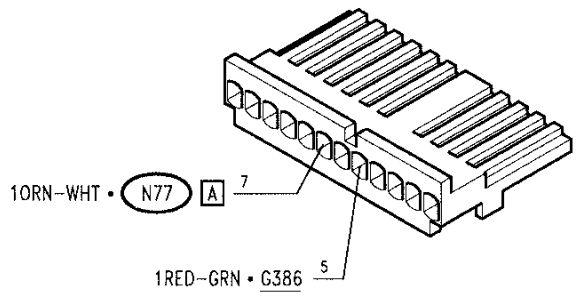
Through connector A it is connected to the control unit **S40** and to the other systems: at pin 8 it receives the "key- operated" supply via the line of fuse F15 **(10A)** of **G1**, while at pin 3 it receives the direct supply through connector Q of **G1**, and pin 4 is earthed.

The connection line with the ALFA ROMEO CODE warning light on the instrument cluster **C10** leads from pin 2.

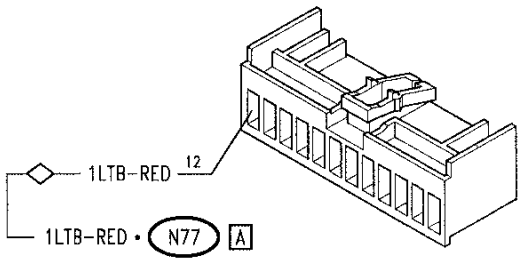
Pin 6 operates communication between the ALFA ROMEO CODE control unit **N77** and the injection control unit **S40** via the special serial connection line (pins 12 and 13 of **S40**: in this case one pin serves for the input of the signal in the control unit and the other for the output).

COMPONENTS AND CONNECTORS

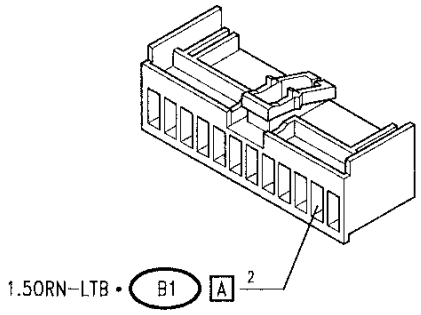
Instrument cluster	C10 E



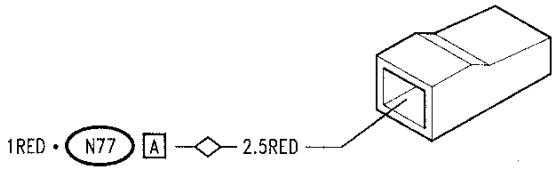
Fusebox	G1 D



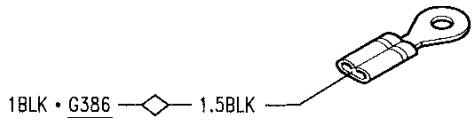
Fusebox	G1 H



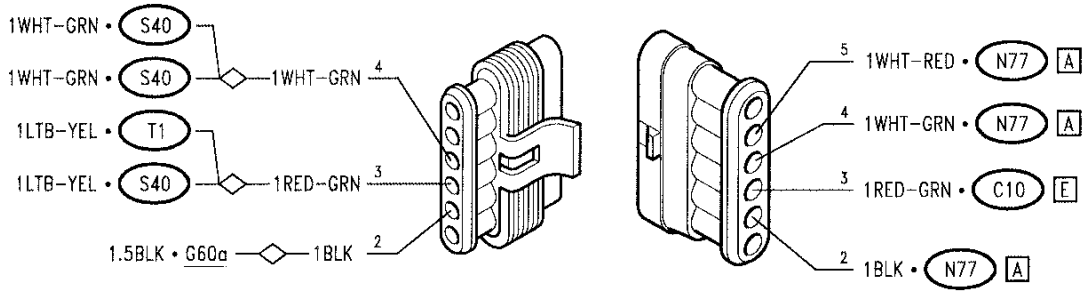
Fusebox	G1 Q



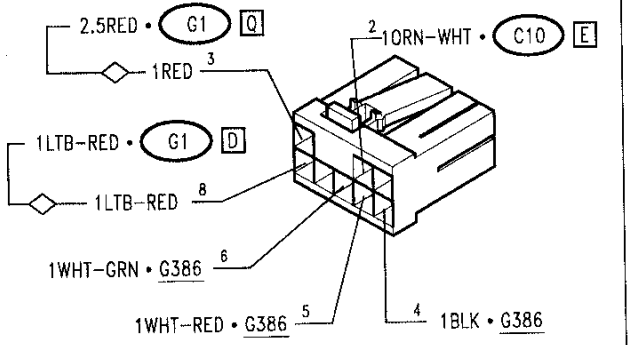
Injection wiring earth	G60a



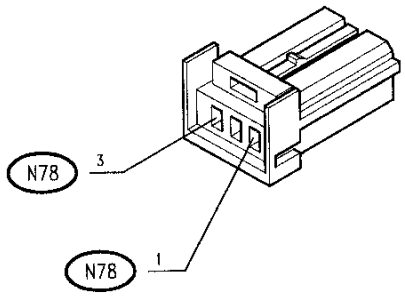
ALFA ROMEO CODE system connector	G386



ALFA ROMEO CODE Control unit (N77 A)



ALFA ROMEO CODE Control unit (N77 B)



Injection/ignition control unit (S40)

8 1PNK • T1

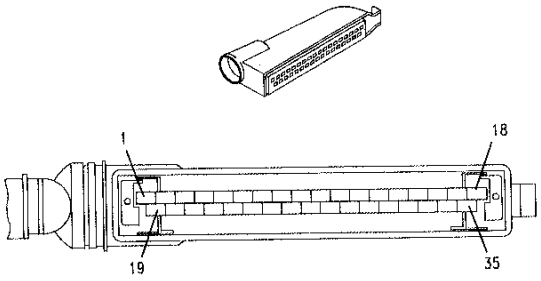
11 2.5PPL-BLK — 1PPL-BLK • T1

12 1WHT-GRN — 1WHT-GRN • G386

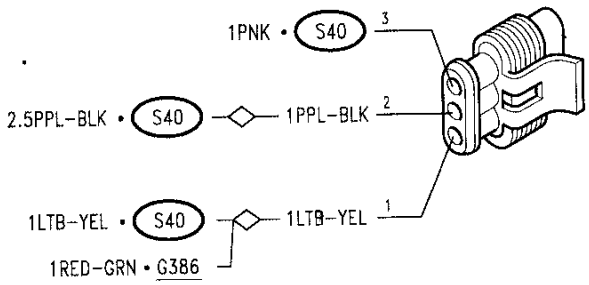
13 1WHT-GRN

27 1LTB-YEL — 1LTB-YEL • T1

1RED-GRN • G386



ALFA TESTER connector (T1)



LOCATION OF COMPONENTS