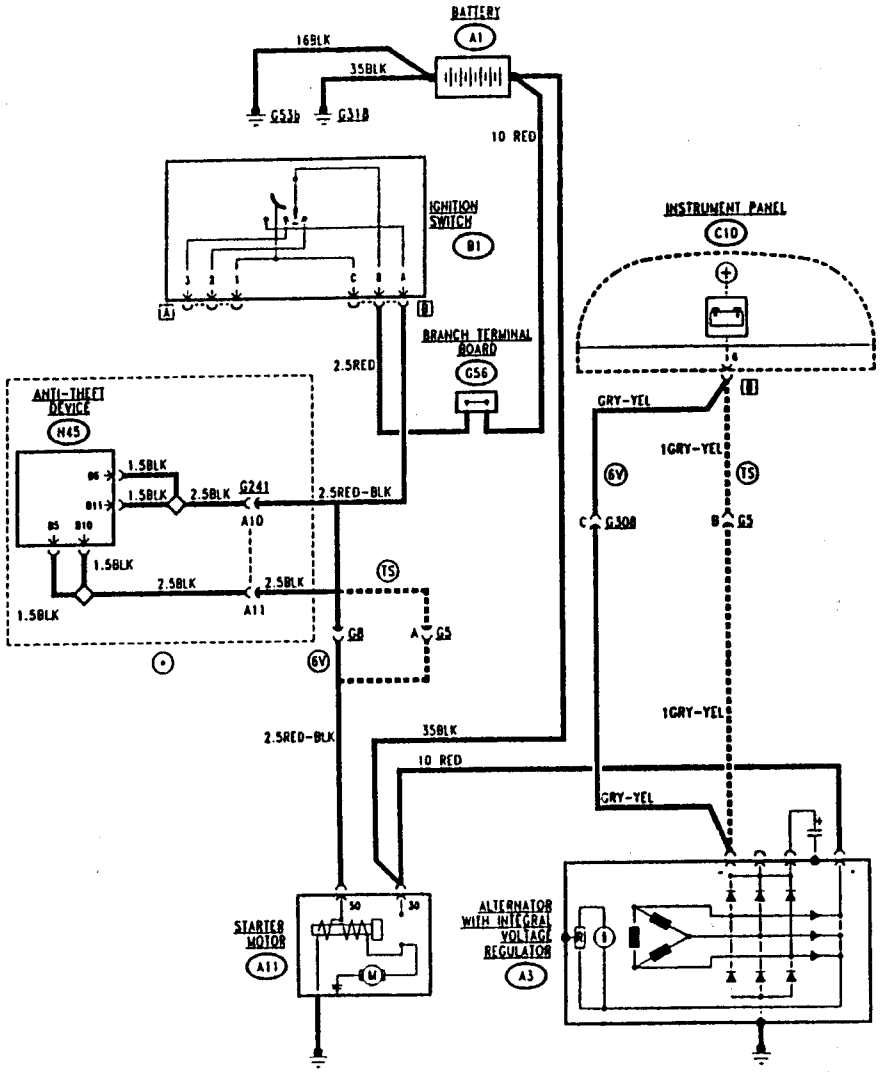
STARTING AND CHARGING

INDEX

WIRING DIAGRAM



GENERAL DESCRIPTION

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

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

The starter motor consists of a motor supplied DC power supply from the battery and command and engagement solenoid.

When the ignition key is rotated the voltage from the battery supplies the coils of the motor generating the electromagnetic forces which rotate the pinion of the motor itself. At the same time the solenoid is activated and works the engagement mechanism which engages the pinion in the crown wheel of the flywheel thus causing the crankshaft to rotate.

The alternator recharges the battery during normal rotation of the engine. The spindle of the alternator (rotor) which is forced to rotate by the crankshaft thorough a belt is supplied with the activation current which generates a magnetic field which induces an alternating current on the stator. This is then transformed into direct current by a bridge rectifier with diodes and sent to recharge the battery.

A voltage regulator incorporated in the alternator makes it possible to maintain a constant delivery of voltage (approx. 12 V) for all the fields of variation in loading and engine r.p.m.

FUNCTIONAL DESCRIPTION

When the ignition key is turned in switch **B1** to the STARTING position, it activates the coils of the solenoid (pin 50) of the starter motor **A11** and with the voltage coming from the battery **A1** (pin 30) supplies the actual starter motor, thus starting the engine.

NOTE: In vehicles equipped with an anti-theft device the power supply to the starter motor (ignition key in the STARTING position) crosses the anti-theft device control unit **N45** which cuts of this power supply in the event of an alarm.

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

All the power supply lines of the various electrical systems on the vehicle start from the branch terminal board **G56** connected to the + terminal of the battery **A1** (see "Power supply").

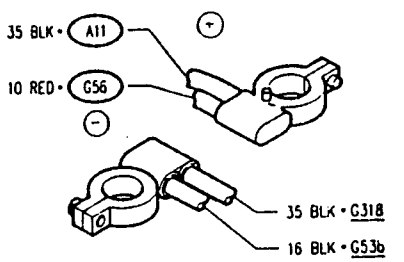
When the alternator does not turn and therefore the battery is not being recharged, an earth signal is sent to the instrument panel **C10** and illuminates the relative warning light. When the engine is started this signal becomes 12V and the warning light goes out.

TROUBLESHOOTING TABLE

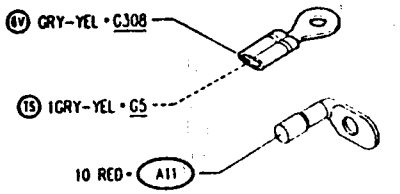
Malfunction	Component					Test
	A11	A1	B1	A3	C10	
Starting engine	•	•	•			A
Recharging engine		•		•		B
Recharging warning lamp				•	•	C

COMPONENTS AND CONNECTORS

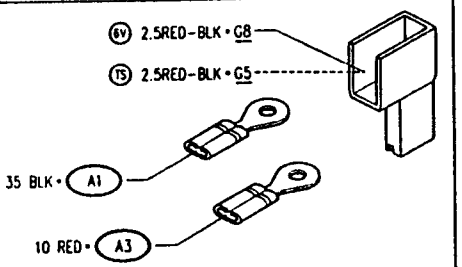
Battery A1



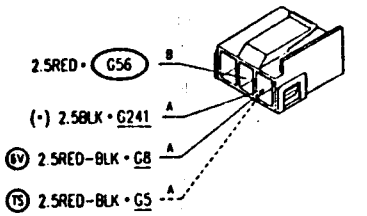
Alternator, with integral voltage regulator A3



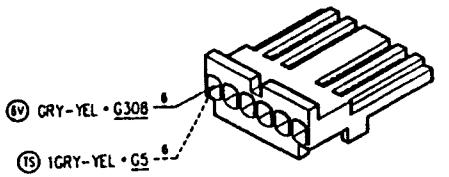
Starter motor A11



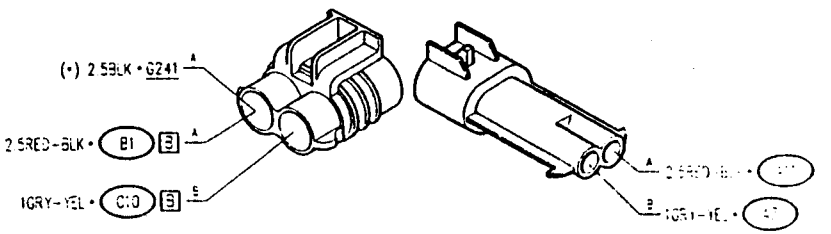
Ignition switch B1 B



Instrument panel C10 B

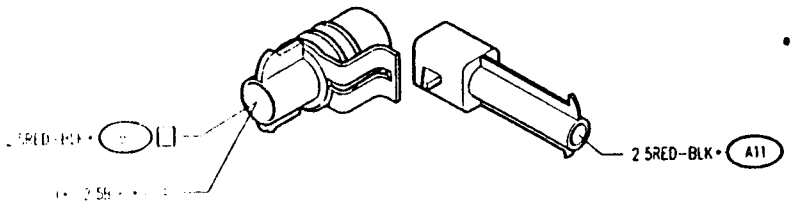


Multiple connector G5

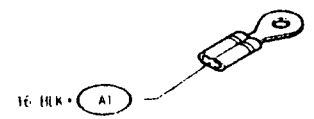


(•) Variation for vehicles with anti-theft device

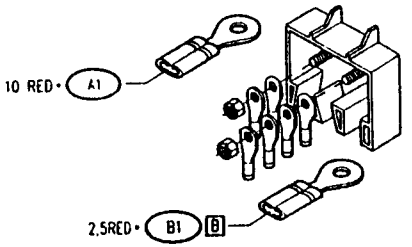
Single connector	G8



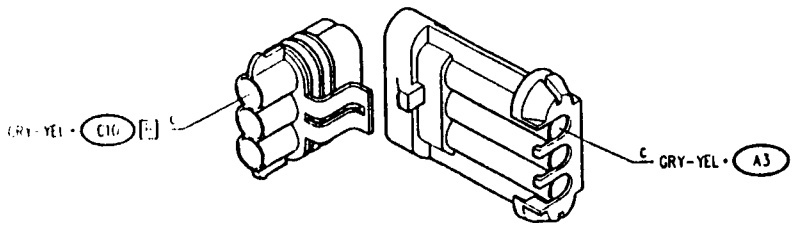
Engine compartment ground-left side	G53b



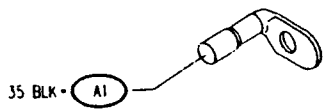
Branch terminal board	G56



Engine sensors coupling	G308

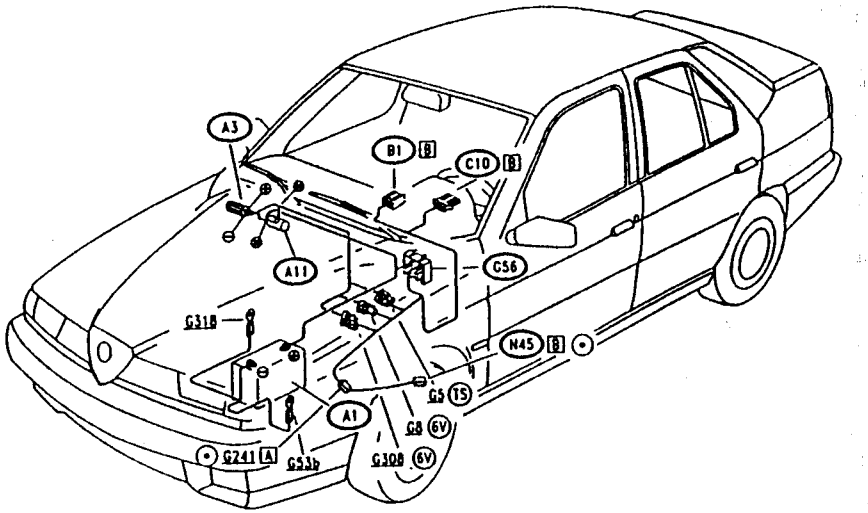


Ground on gearbox	G318



(•) Variation for vehicles with anti-theft device

LOCATION OF COMPONENTS



(•) Variation for vehicles with anti-theft device

TROUBLESHOOTING

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

NOTE: For vehicles with anti-theft device: first check the correct operation of this system (see section "Anti-Theft Device").

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
	NO ▶	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)
	NO ▶	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
	NO ▶	Restore wiring between motor A11 and battery A1 (BLK)
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)
	NO ▶	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) For vehicles with an anti-theft device: check that the connection between anti-theft device N45 and the starter motor A11 is correct
	NO ▶	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 "155 - 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 ▶	Carry out step B2
	NO ▶	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 ▶	Replace battery A1
	NO ▶	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 ignition key engaged but engine not yet running, check for a ground signal (0 V) at pin B6 of instrument panel C10	OK ▶	Carry out step C2
	NO ▶	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
	NO ▶	Replace the warning lamp
C3 CHECK GROUND – With ignition key engaged but engine not yet 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)
	NO ▶	Check and if necessary replace the alternator A3

ENGINE COOLING

(models without air conditioning)

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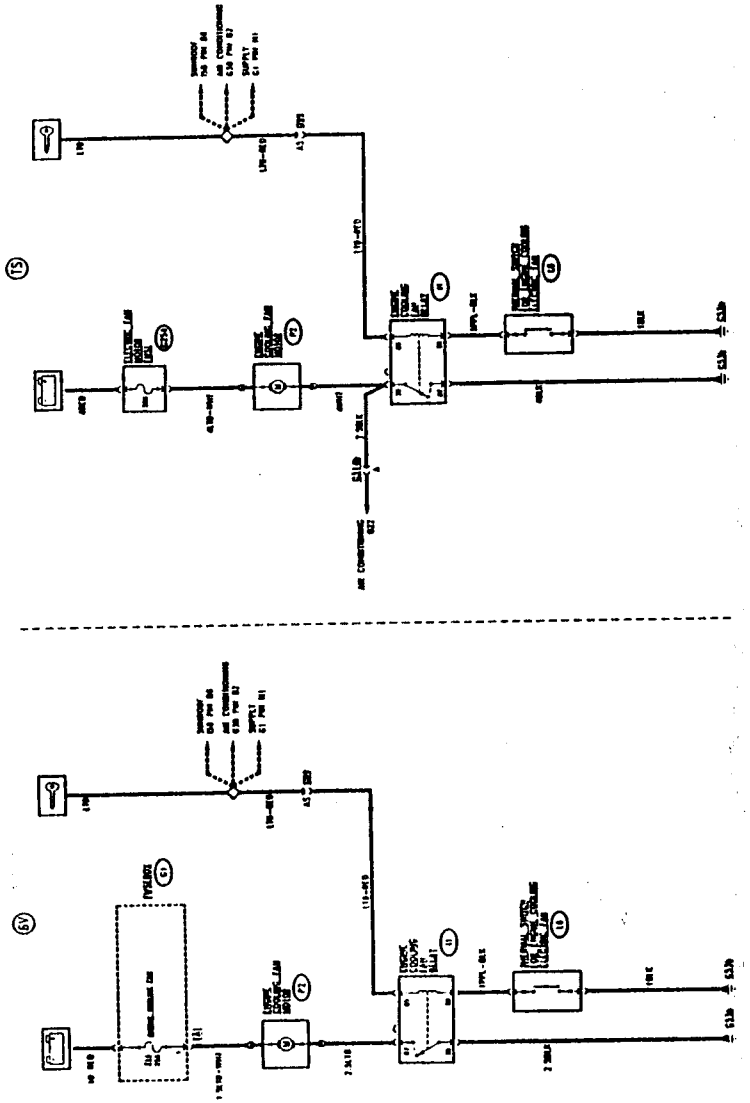
WIRING DIAGRAM



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 (50A) 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.

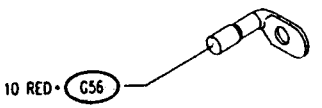
NOTE: The connections with the heating/ventilation system, which uses a part of this circuit are also indicated in the chart, though it is connected differently as indicated in the section "Air conditioning engine electric fan control".

TROUBLESHOOTING TABLE

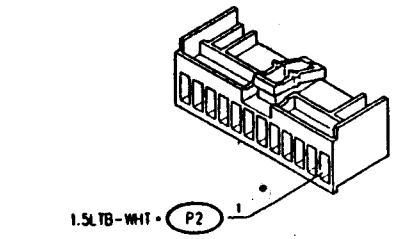
Malfunction	Component					Test
	G254	F14	I1	P2	L6	
Electric fan does not start (T. Spark models)	•		•	•	•	A
Electric fan does not start (6V model)		•	•	•	•	B

COMPONENTS AND CONNECTORS

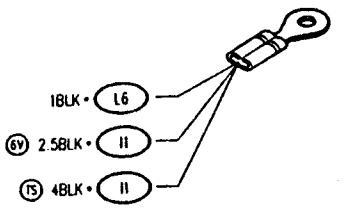
Fusebox G1



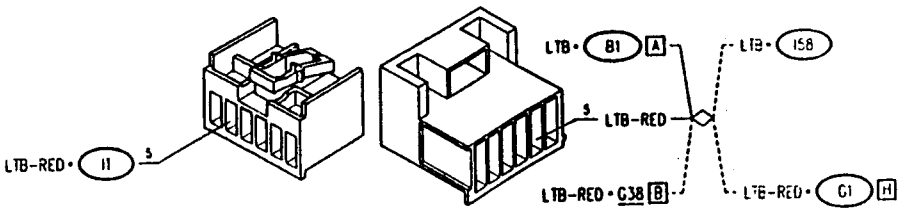
Fusebox G1 A



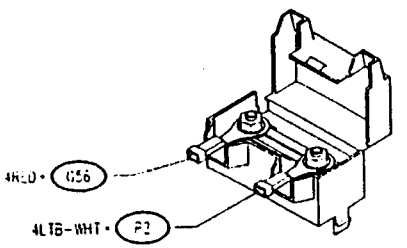
Engine compartment ground-left side G53b



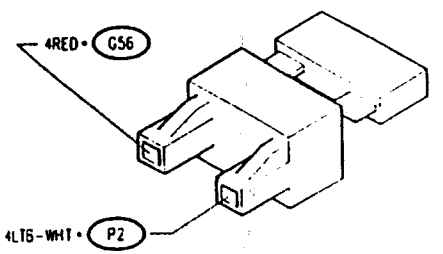
Dashboard/engine connection G99 A



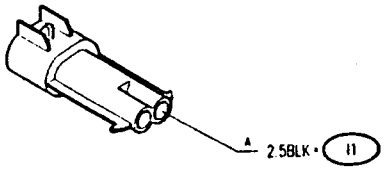
Electric fan motor fuse (up to chassis N.2425) G254



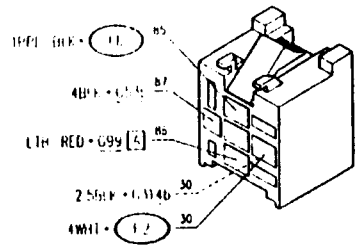
Electric fan motor fuse (from chassis N.2426) G254



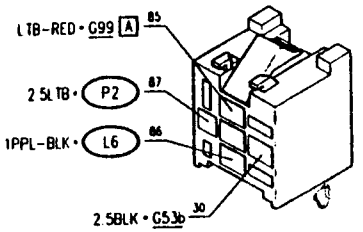
Engine air conditioner wiring B connection	G314b



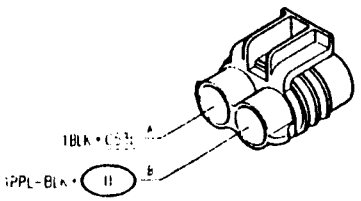
Engine cooling fan relay TS	I1



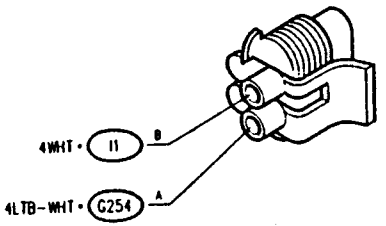
Engine cooling fan relay 6V	I1



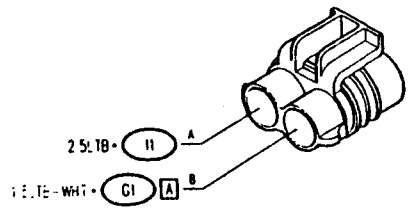
Thermal switch for engine cooling electric fan	L6



Engine cooling fan motor TS	P2

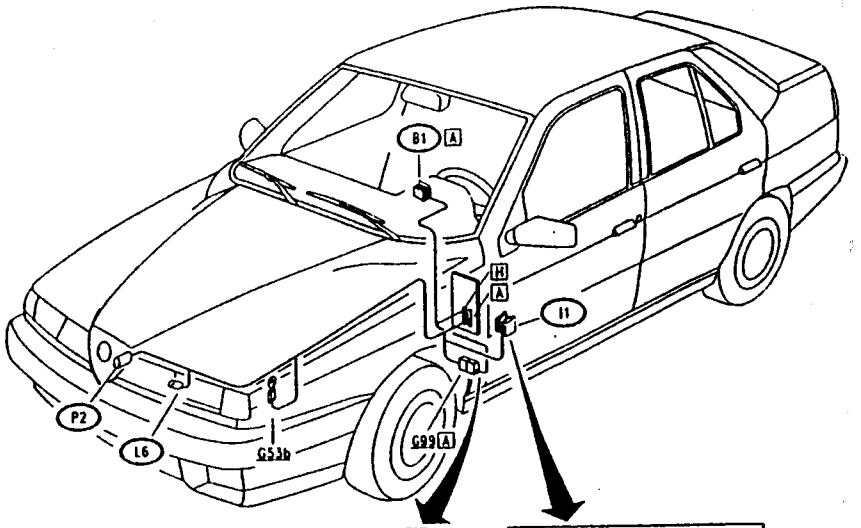


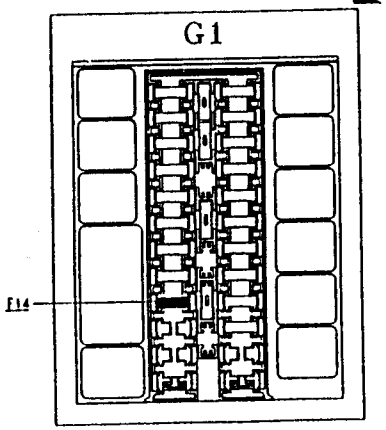
Engine cooling fan motor 6V	P2

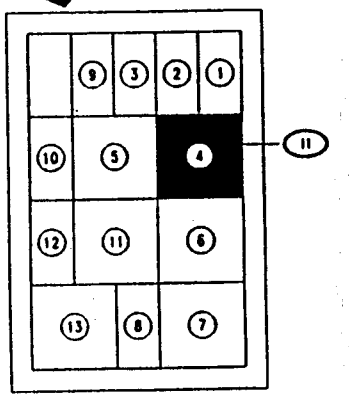


LOCATION OF COMPONENTS

6V





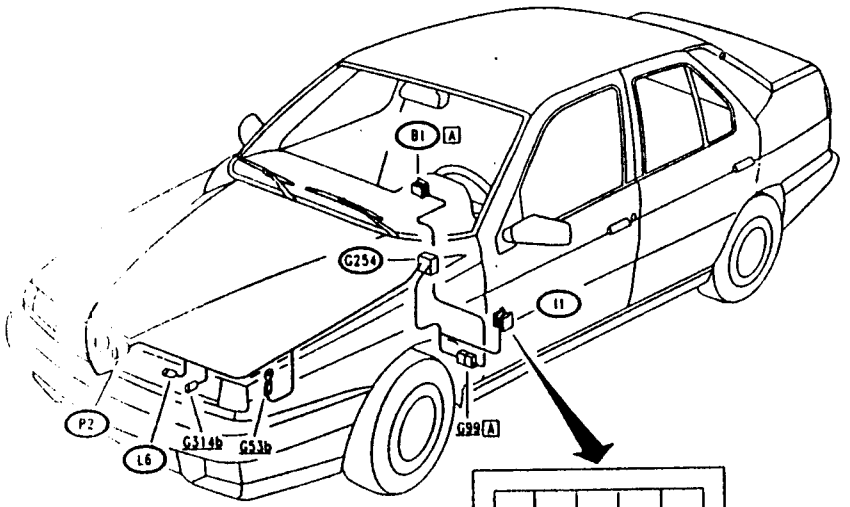


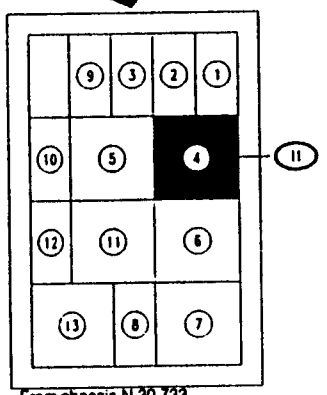
From chassis N.30.733

Up to chassis N.30.732
I1 = GREEN relay holder

LOCATION OF COMPONENTS

T.SPARK





From chassis N.30.733

Up to chassis N.30.732

I1 = GREEN relay holder

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 ▶ NO ▶	Carry out step A2 Replace fuse (50A)
A2 CHECK RELAY – Check for correct functioning of fan relay I1	OK ▶ NO ▶	Carry out step A3 Replace relay I1
A3 CHECK GROUND – Check that pin 87 of relay I1 is grounded (0V)	OK ▶ NO ▶	Carry out step A4 Restore wiring between pin 87 of I1 and ground G53b (BLK)
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 ▶ NO ▶	Carry out step A7 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 ▶ NO ▶	Check operation, and if necessary replace the fan motor P2 Carry out step A6
A6 CHECK VOLTAGE – Verify 12V at pin A of fan P2	OK ▶ NO ▶	Restore wiring between pin B of P2 and pin 30 of relay I1 (WHT) 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
	NO ▶	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)
	NO ▶	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)
	NO ▶	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
	NO ▶	Replace fuse (20A)
B2 CHECK RELAY – Check for correct functioning of fan relay I1	OK ▶	Carry out step B3
	NO ▶	Replace relay I1
B3 CHECK GROUND Check that pin 30 of relay I1 is grounded (0V)	OK ▶	Carry out step B4
	NO ▶	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
	NO ▶	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
	NO ▶	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)
	NO ▶	Restore wiring between pin A1 of G1 and pin A of P2 (LTB-WHT)
B7 CHECK FAN – Connect pin B of thermal switch L6 to ground and check that the fan P2 starts	OK ▶	Carry out step B9
	NO ▶	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)
	NO ▶	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)
	NO ▶	Replace thermal switch L6

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 tolerances) 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 vanes 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 600 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, making 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 acceleration), 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 assistance 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:

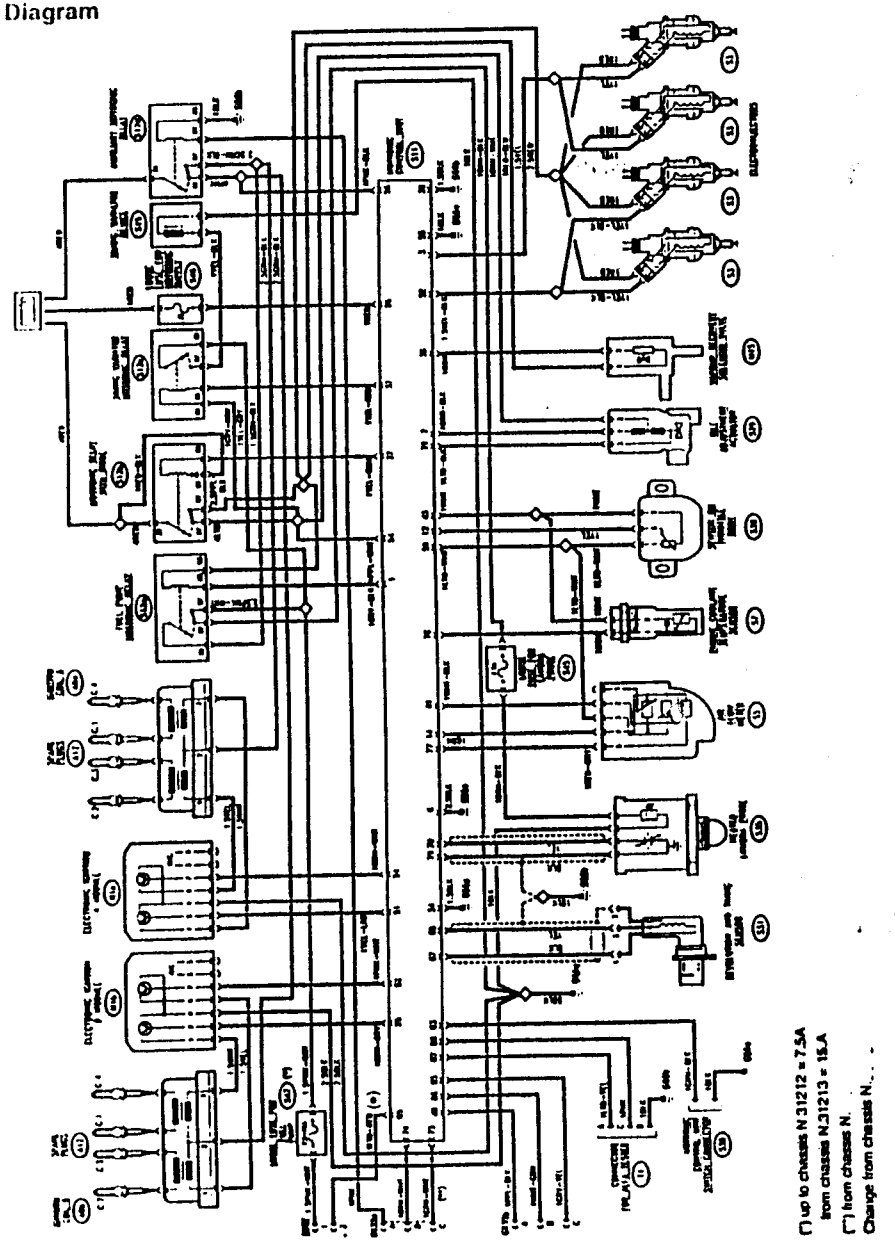
- engine temperature sensor (S7);
- air flow meter (with incorporated air temperature sensor) (S5);
- throttle body sensor (S38);
- R.P.M. and timing sensor (S31);
- oxygen sensor (lambda probe) (S35)

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



(*) up to chassis N.31212 = 7.5A
from chassis N.31213 = 15A
(**) from chassis N.___
Change from chassis N.___

12-1994

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 auxiliary 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 66 and the signal from the Motronic wiring ground G66.

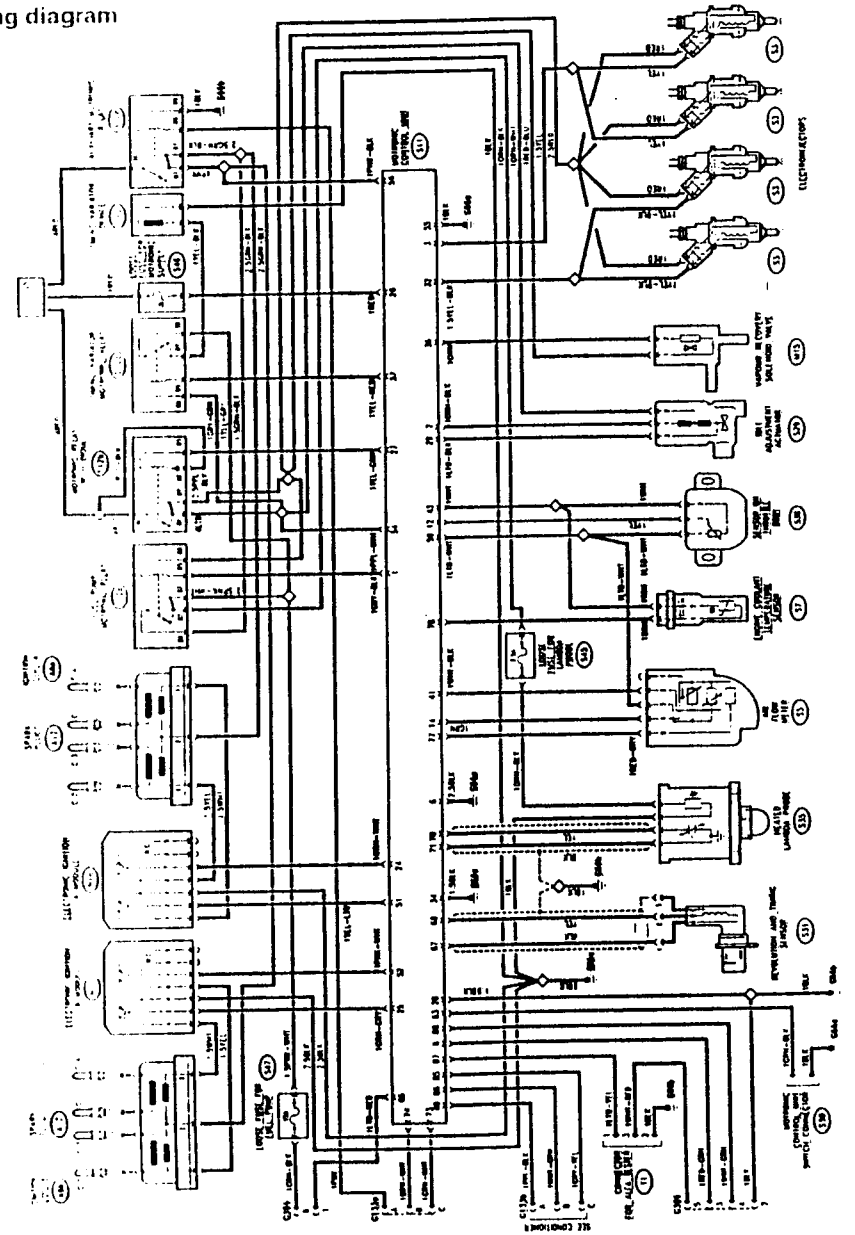
The same control unit is used for engines with different cubic capacity. A special switch S30, connected to the control unit at pin 63 makes it possible, if the control unit is to be replaced, to adapt it to the desired engine:

– 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.

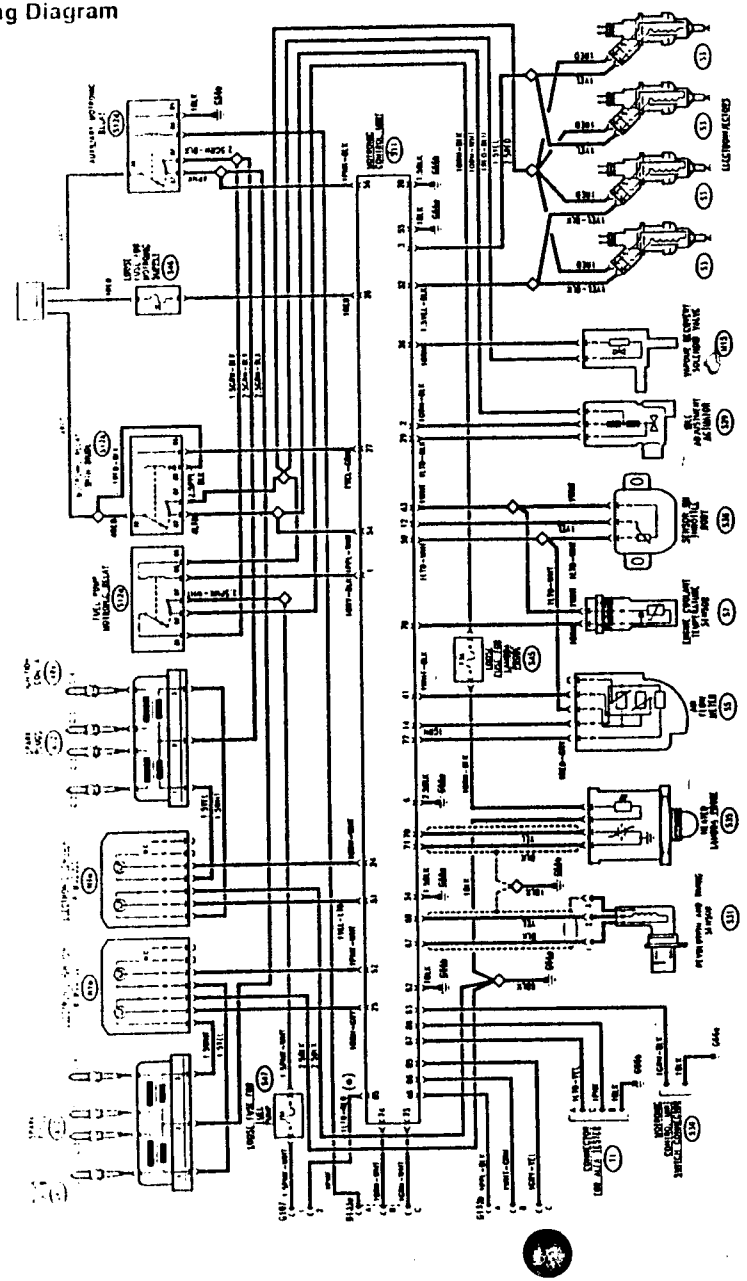
The signal for the "Check Engine" warning light on cluster C10 leads from pin 8.

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.

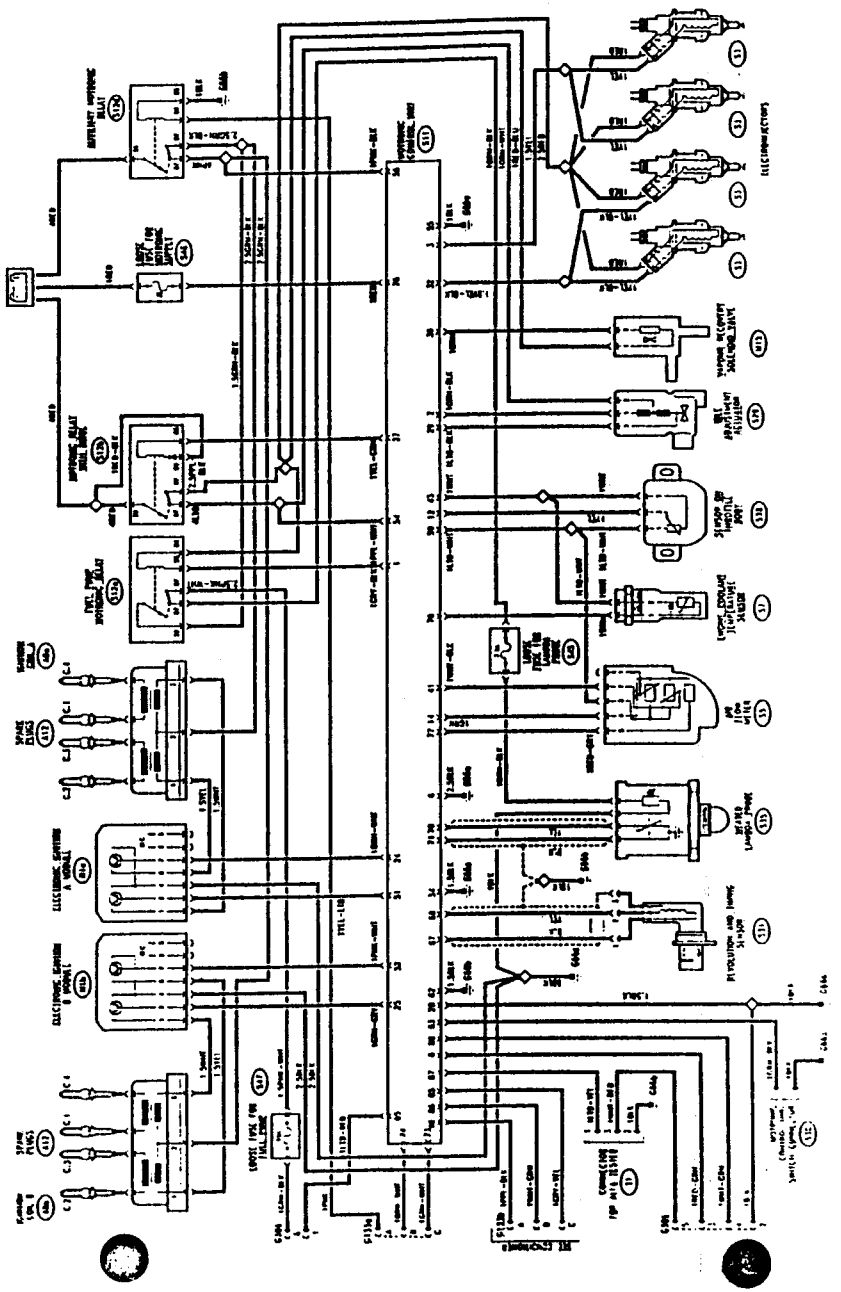
1.7 T.SPARK ENGINE (version without ALFA ROMEO CODE)

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 TSPARK version differs from the preceding versions (1.8 and 2.0 TSPARK) 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

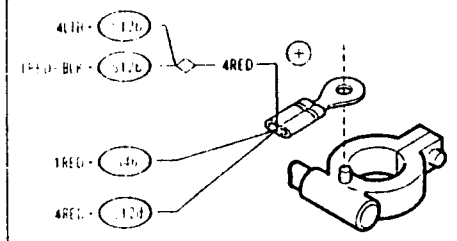
Pin 62 of the MOTRONIC control unit (S11) has been connected to earth: this signal informs the control unit of the absence of the timing variator (S15) and relative relay (S12c): in this way it is subtracted from the control through the signal from pin 37 of the control unit itself.

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

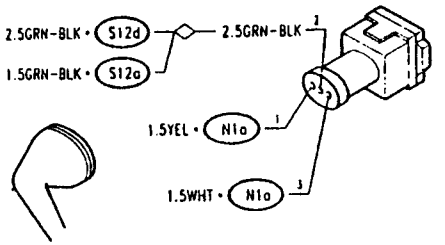
Pin 73 of S11 is connected to the speedometer sensor L17 via connector G133c and solder

Components and Connectors (all T.SPARK engine)

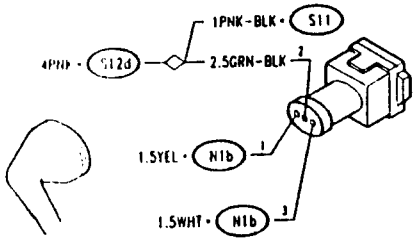
Battery	A1



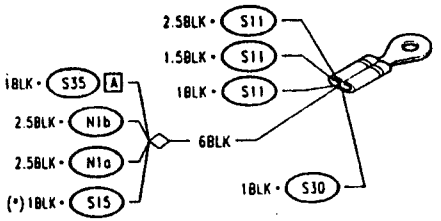
Ignition coil A	A8a



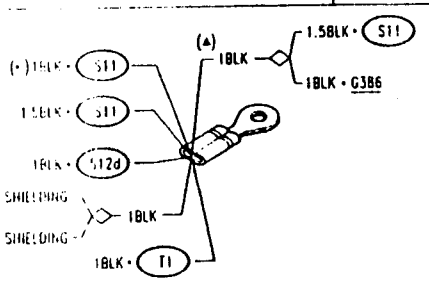
Ignition coil B	A8b



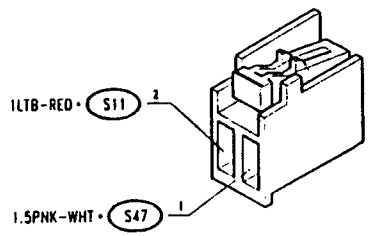
Motronic wiring ground	G66a



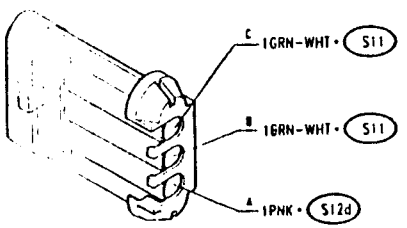
Motronic wiring ground	G66b



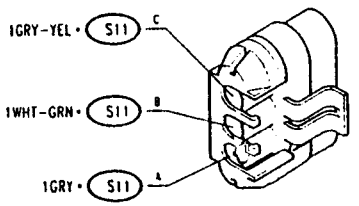
Connector for fuel pump	G107



Electronic ignition-injection wiring A connection	G133a

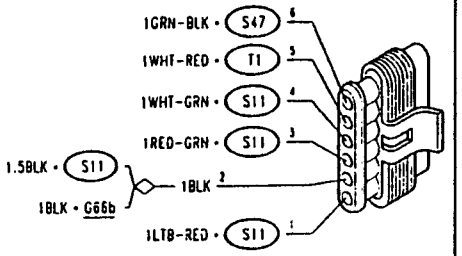


Electronic ignition-injection wiring B connection	G133b

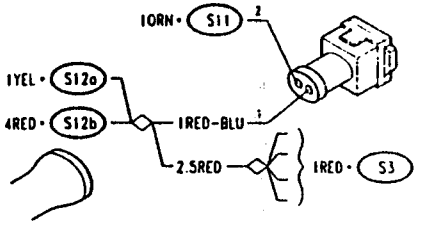


(▲) for versions with ALFA ROMEO CODE only

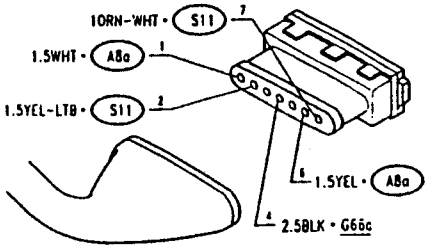
ALFA ROMEO CODE connector (▲)	G386



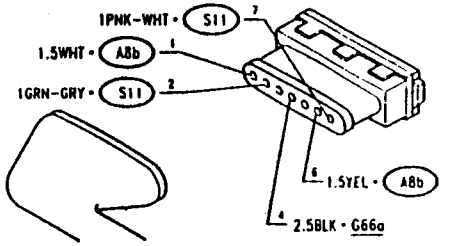
Vapour recovery solenoid valve	M15



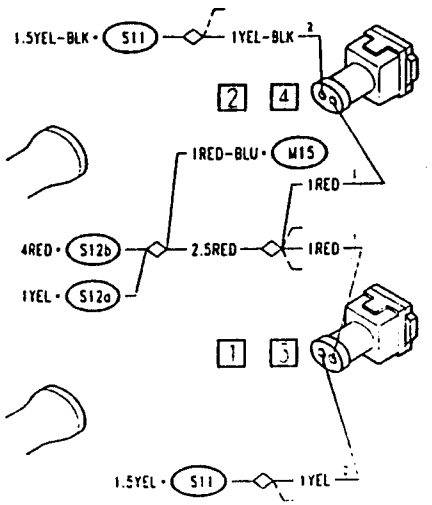
Electronic ignition A module	N1a



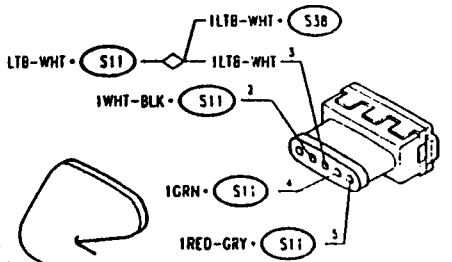
Electronic ignition B module	N1b



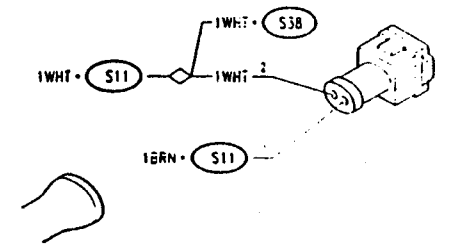
Electroinjectors	S3



Air flow meter	S5

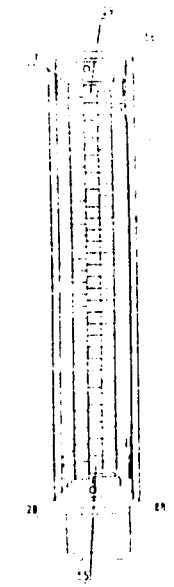


Engine coolant temperature sensor	S7



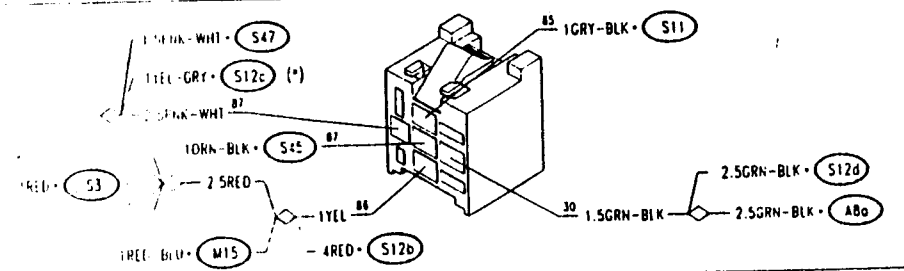
(▲) for versions with ALFA ROMEO CODE only

Motronic control unit (S11)



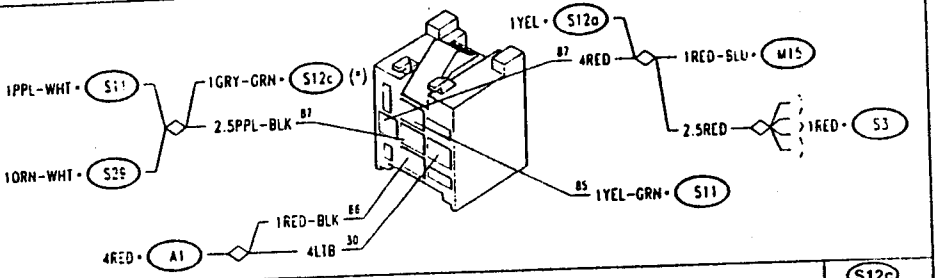
1 1GRY-BLK • S12a
2 1ORN-BLK • S29
3 1.5YEL — 1YEL • S3
6 2.5BLK • G66a
8 1RED-GRN • G386 (A)
12 1YEL • S38
14 1GRN • S5
24 1ORN-WHT • N1a
25 1GRN-GRY • N1b
26 1RED • S46
27 1YEL-GRN • S12b
(A) 28 1.5BLK — 1BLK • G386 / 1BLK • G386
28 1.5BLK • G66b
29 1LTB-BLK • S29
32 1.5YEL-BLK — 1YEL-BLK • S3
34 1.5BLK • 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 (A)
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 (A)

Fuel pump Motronic relay (S12a)

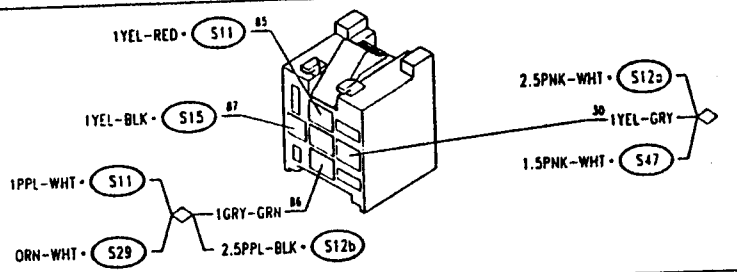


(*) Not present on 1.7 T SPARK
(A) Not present on 1.7 T SPARK with ALFA ROMEO CODE only

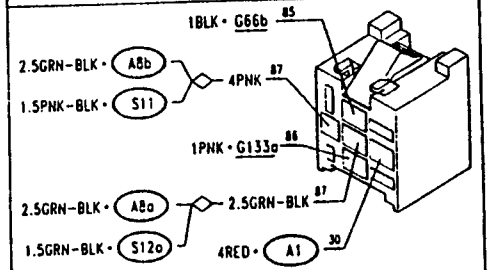
Motronic relay with diode (S12b)



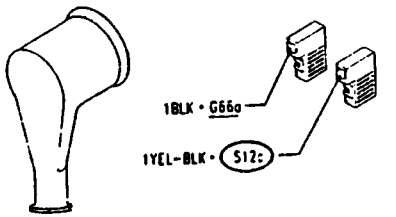
Timing variator Motronic relay (*) (S12c)



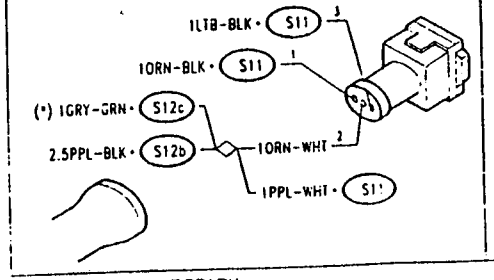
Auxiliary Motronic relay (S12d)



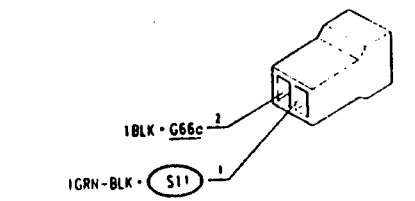
Timing variator device (*) (S15)



Idle adjustment actuator (S29)

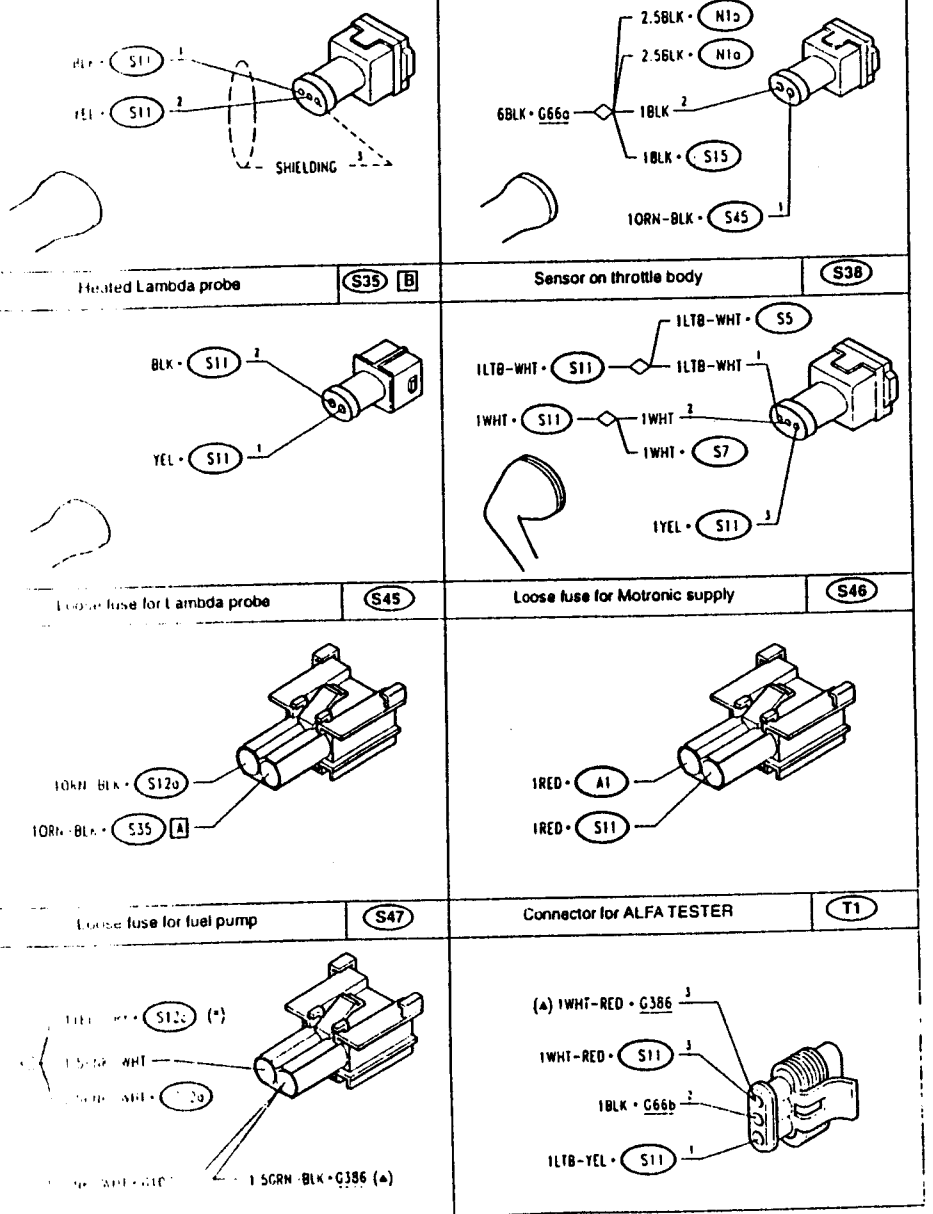


Motronic control unit switch connector (S30)



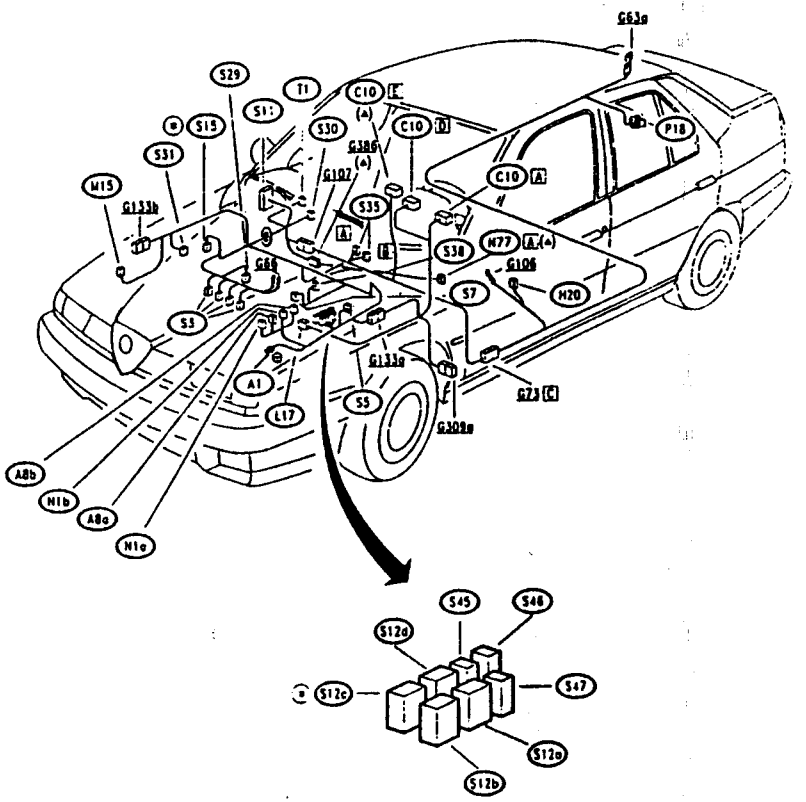
(*) not present on 1.7 T SPARK

Position 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



(*) present on 1.7 T.SPARK
(▲) for versions with ALFA ROMEO CODE only

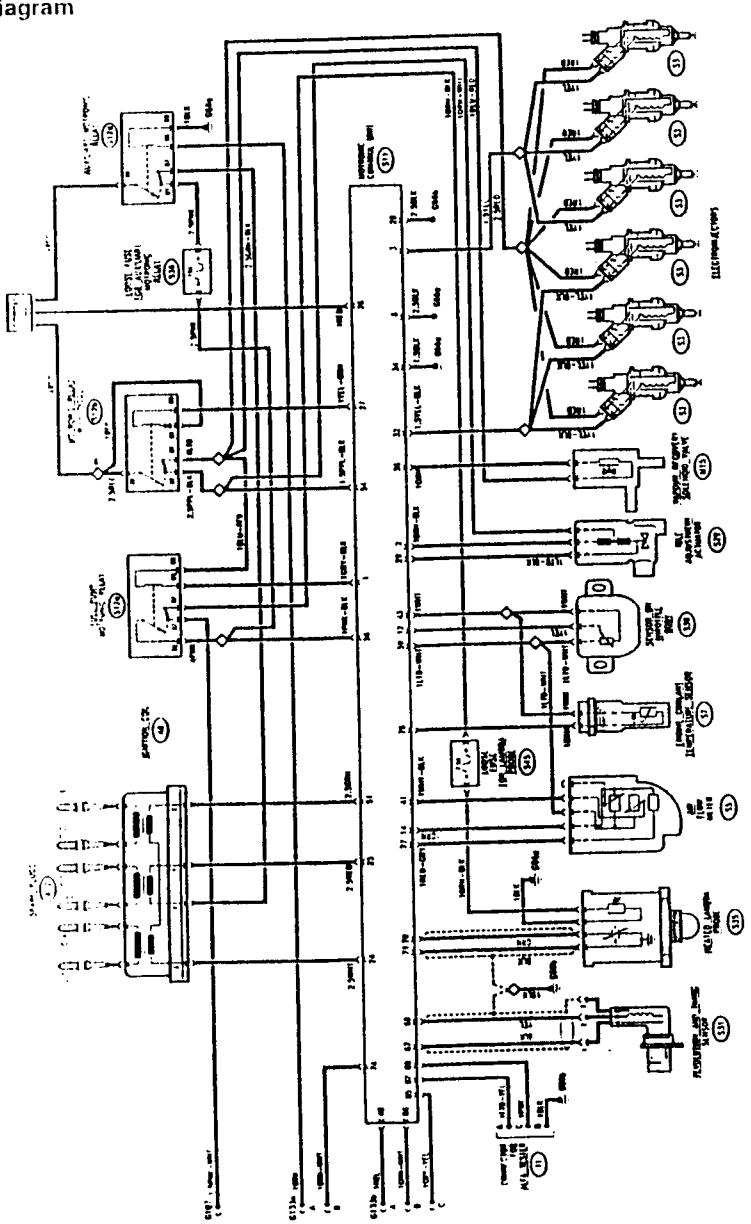
Location of Components



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

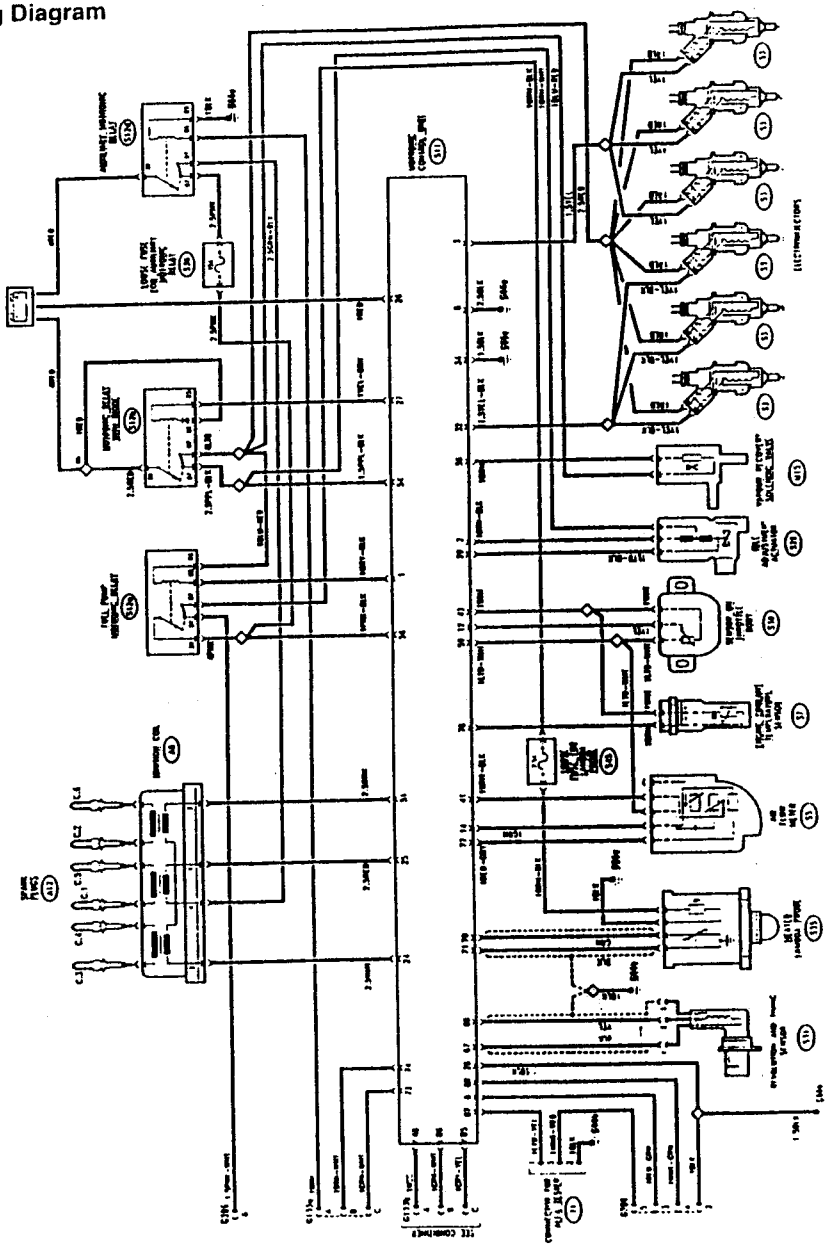
6V ENGINE (versions without ALFA ROMEO CODE)

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 auxiliary 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.

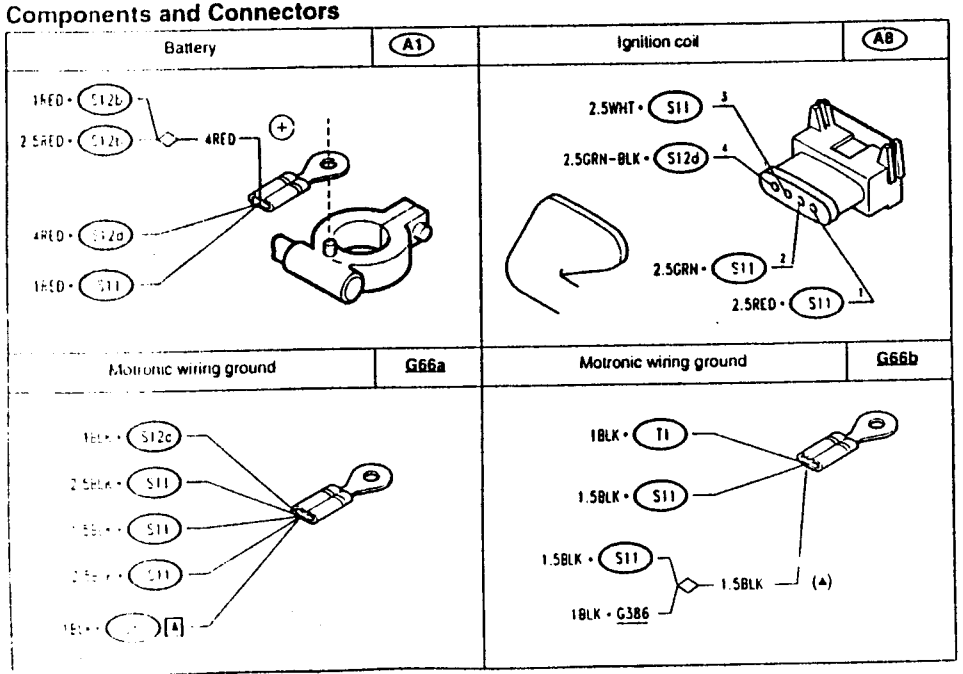
There is no timing variator S15, in the 6 cylinder models; as a result there is also no relay S12c.

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.

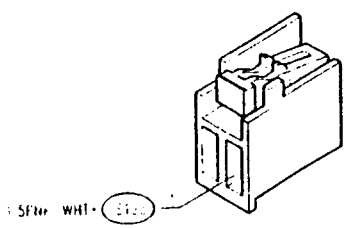
NOTE: also the connection with the **ALFA ROMEO CODE** system is the same as described for the T.SPARK engines.

Components and Connectors

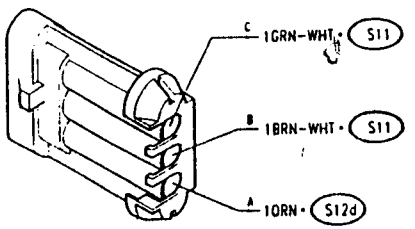


(▲) Versions with ALFA ROMEO CODE only

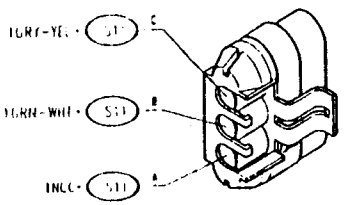
Connection - fuel pump — G107



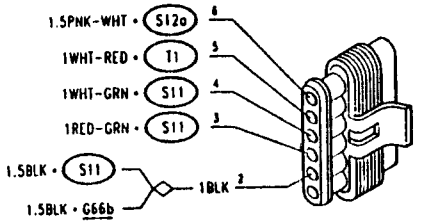
Electronic ignition-injection wiring A connection — G133a



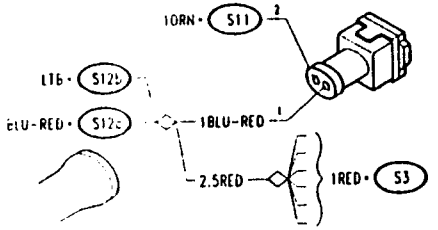
Electronic ignition injection wiring B connection — G133b



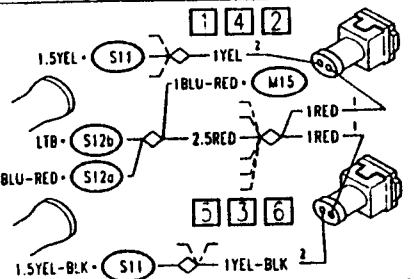
ALFA ROMEO CODE connector — G386



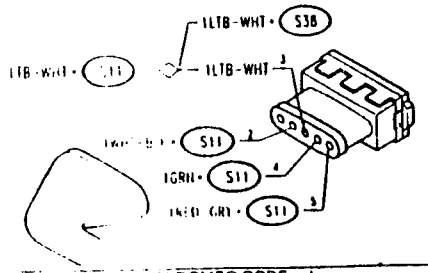
Vapour recovery solenoid valve — M15



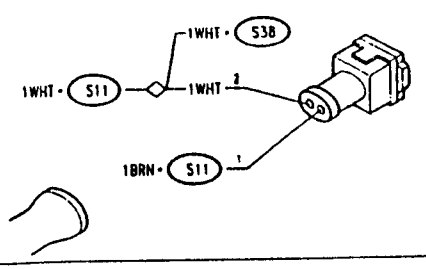
Electroinjectors — S3



Air flow meter — S5

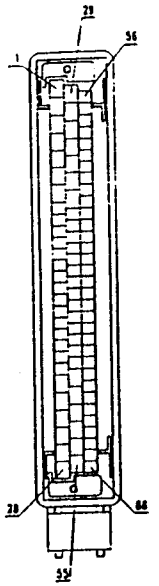


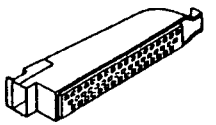
Engine coolant temperature sensor — S7



▲ for versions with ALFA ROMEO CODE only

Motronic control unit — S11



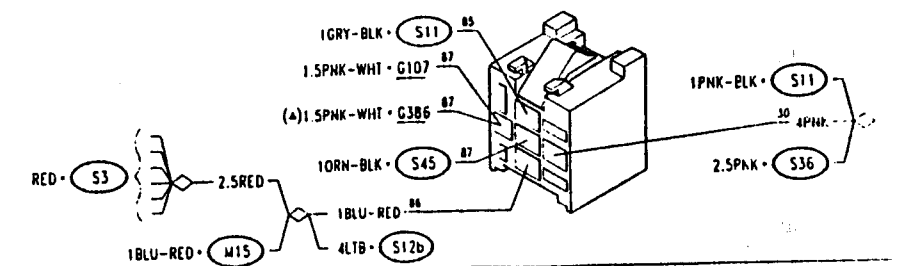


1 1GRY-BLK · S12a
2 1LTB-BLK · S29
3 1.5YEL — 1YEL · S3
6 2.5BLK · G66a
8 1RED-GRN · G386 (▲)
12 1YEL · S38
14 1GRN · S5
24 2.5WHT · A8
25 2.5RED · A8
26 1RED · A1
27 1YEL-GRN · S12b
(▲) 28 1.5BLK — 1.5BLK · G66b / 1.5BLK · G386
28 1.5BLK · G66b
30 1BLK — SHIELDING / SHIELDING
29 1LTB-BLK · S29
32 1.5YEL-BLK — 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

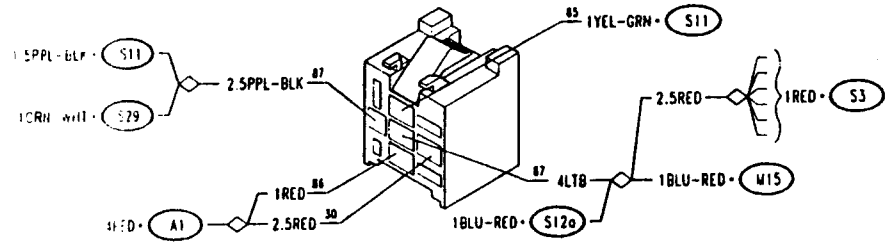
60 YEL · S31
70 GRN · S35 B
71 BLK · S35 B
73 1GRN-WHT · G133a
74 1BRN-WHT · G133a
77 1RED-GRY · S5
78 1BRN · S7
85 1GRY-YEL · G133b
86 1GRN-WHT · G133b
87 1LTB-YEL · T1
88 1WHT-RED · T1
88 1WHT-RED · G386 (▲)

Fuel pump Motronic relay — S12a

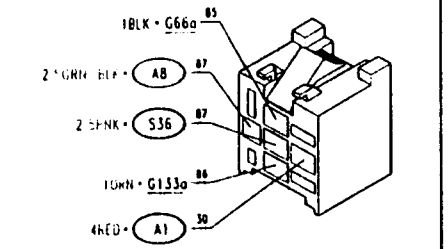


(▲) for versions with ALFA ROMEO CODE only

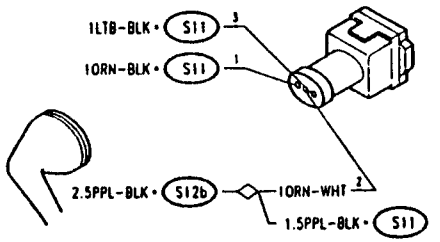
Motronic relay with diode (S12b)



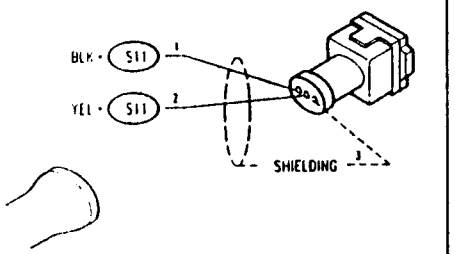
Auxiliary Motronic relay (S12d)



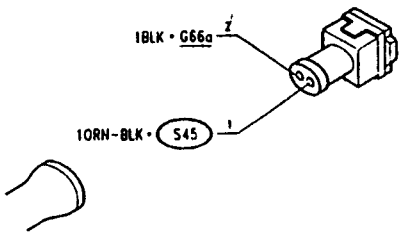
Idle adjustment actuator (S29)



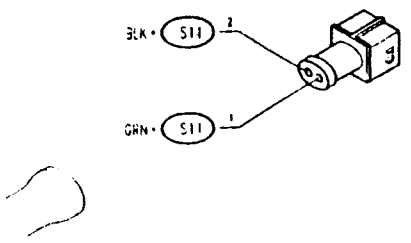
Revolution and timing sensor (S31)



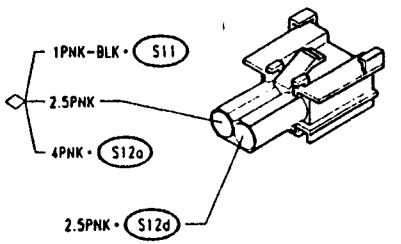
Heated Lambda probe (S35) A



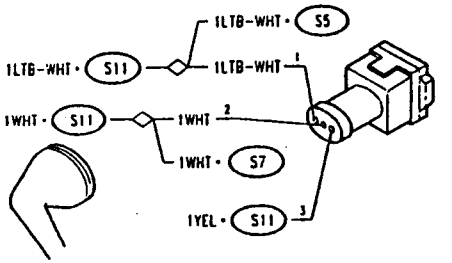
Heated Lambda probe (S35) B



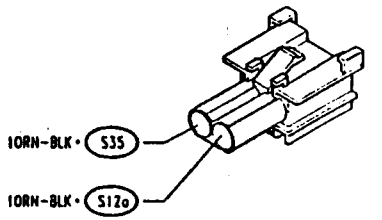
Loose fuse for auxiliary Motronic relay (S36)



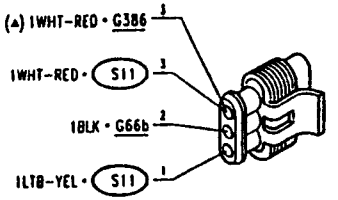
Sensor on throttle body (S38)



Loose fuse for Lambda probe (S45)

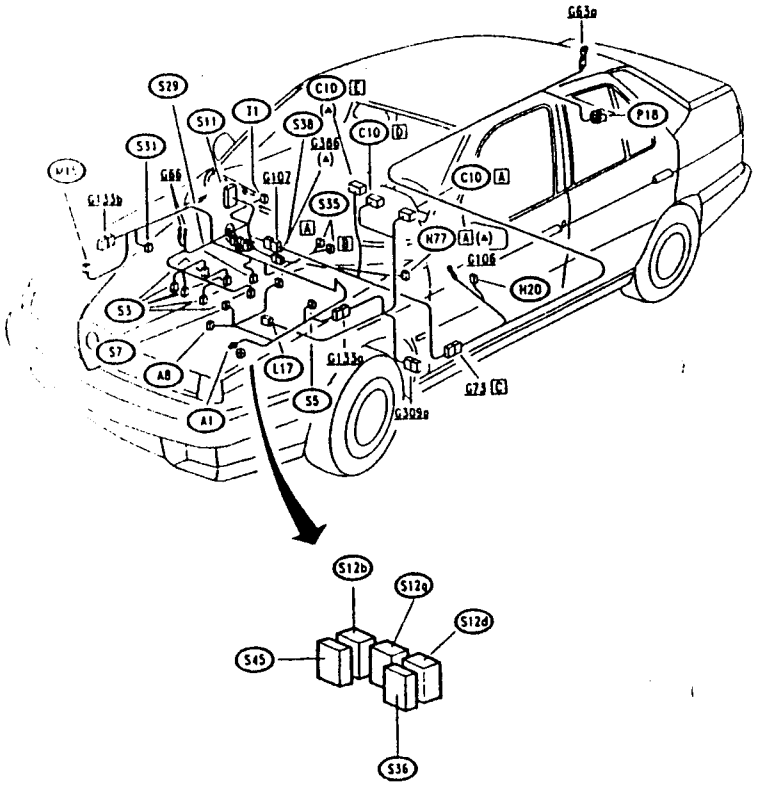


Connector for ALFA TESTER (T1)



(▲) for versions with ALFA ROMEO CODE only

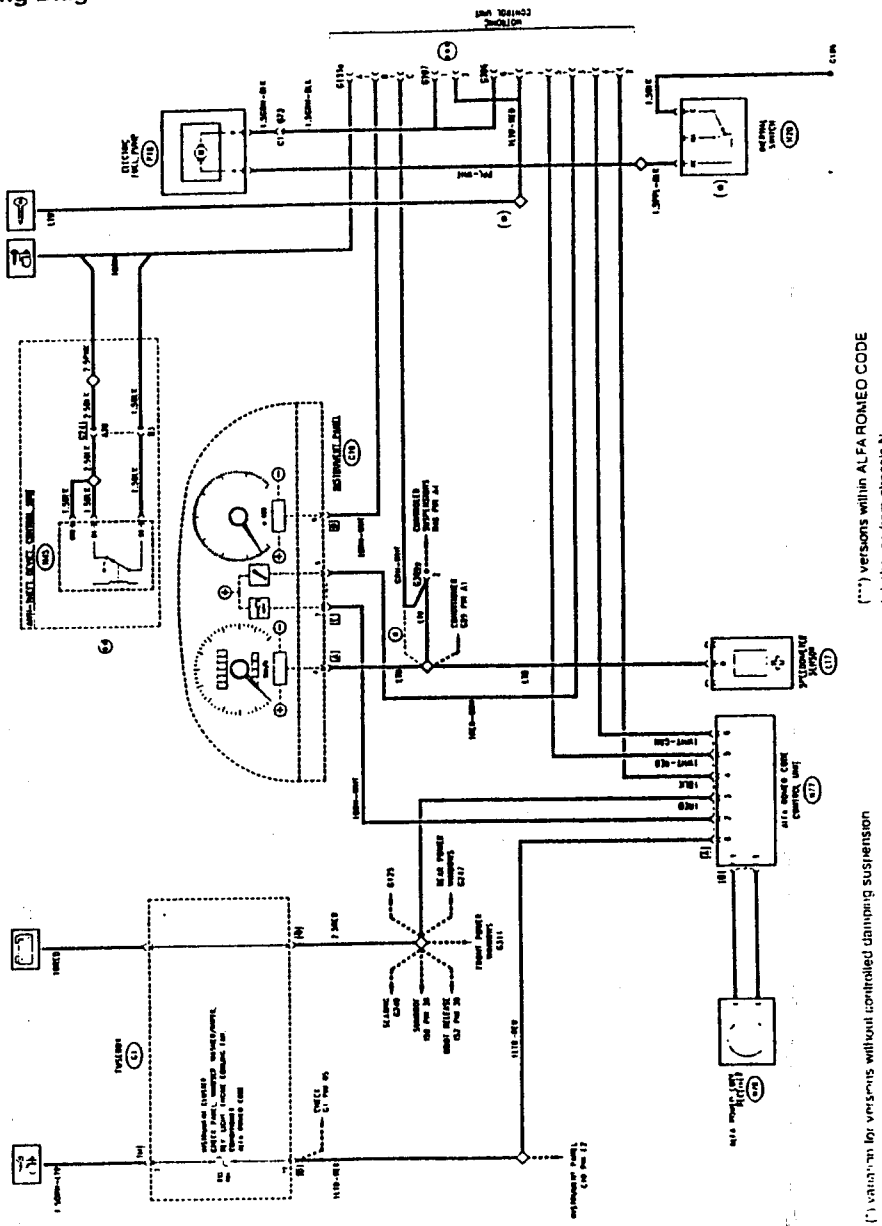
Location of Components



(▲) For versions with ALFA ROMEO CODE only

VEHICLE INTERFACE

Wiring Diagram



(***) versions within ALFA ROMEO CODE
(•) change from chassis N. ....

(*) variation for versions without controlled damping suspension
(**) variation for vehicles with anti-theft device

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, 65 and 66 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.

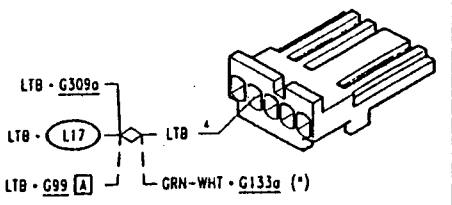
N.B. In cars fitted with an alarm system, the "key-operated" consent supply "crosses" the control unit **N45** which cuts off this supply - thus preventing any attempt to start the engine - in the case of an alarm (for further details see section "Alarm System").

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

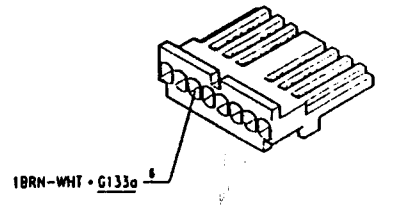
There is also the connection with the instrument cluster **C10** for the "Check Engine" warning light signal.

Components and Connectors

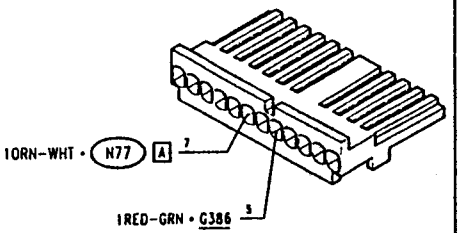
Instrument panel	C10 A



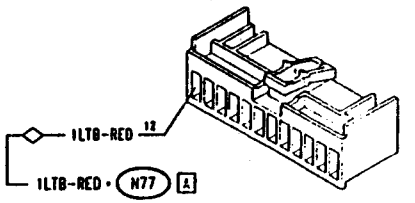
Instrument panel	C10 D



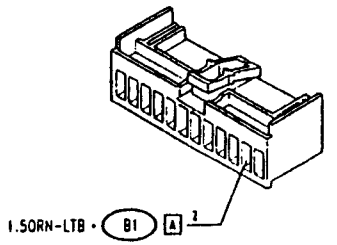
Instrument panel	C10 E



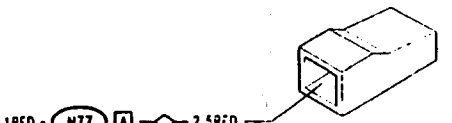
Fusebox	G1 D



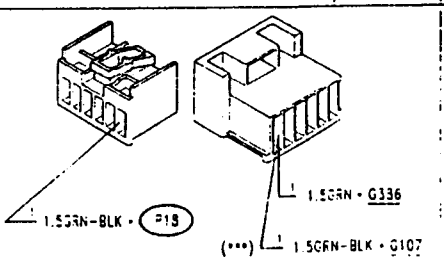
Fusebox	G1 H



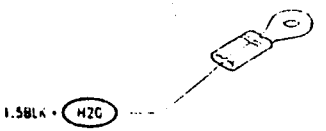
Fusebox	G1 O



Connector for rear services	G73 C



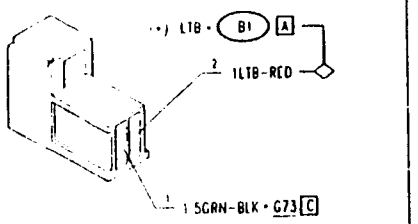
Seat cross rail earth (•)	G106



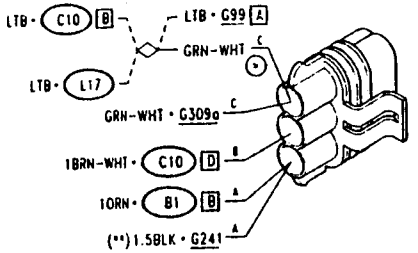
(*) variation for vers... without controlled damping suspension
(***) versions with... ROMEO CODE

(•) change from chassis N ...

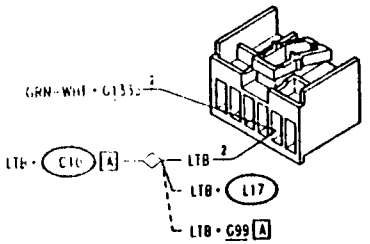
Connector for fuel pump (***)	G107



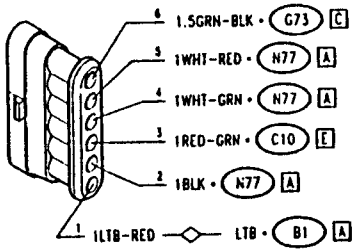
Electronic ignition-injection wiring A connection	G133a



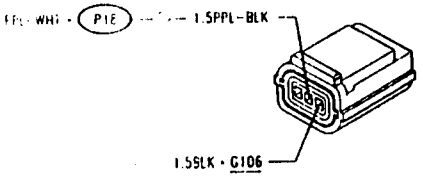
Controlled damping suspension A connection	G309a



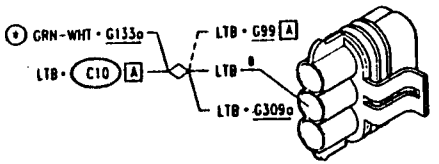
ALFA ROMEO CODE connector	G386



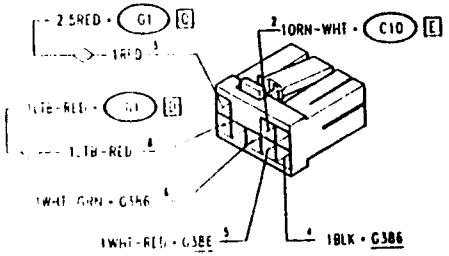
Inertial switch (•)	H20



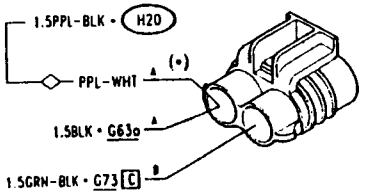
Speedometer sensor	L17



ALFA ROMEO CODE control unit	N77 A



Electric fuel pump	P18



(*) Connection for versions without controlled damping suspension
(**) Connection for versions with anti theft device

(***) versions within ALFA ROMEO CODE
(•) change from chassis N ____

12-1994

FAULT DIAGNOSIS

The self-diagnosis function of the MOTRONIC M1.7 ignition and injection control unit **S11** makes it possible to "read" the anomalies memorized during operation of the vehicle in two ways:

- using the ALFA ROMEO TESTER (see appropriate publications) by hooking up to the special connector T1
- identification of the component affected by the anomaly using the FLASHING CODE and successive verification of the component itself.

The tests which check the electrical operation of the individual components (from TEST C to TEST M) are illustrated below

Only TEST K (rpm and timing sensor S31 check) does not derive from signalling by flashing code as this sensor is NOT controlled by the system's self-diagnosis.

TEST A (TS) and **TEST B (6V)** are particular cases which search the whole system for the cause of an interruption in power supply

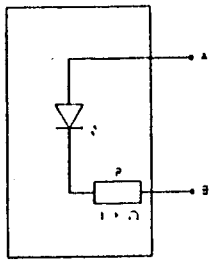
The final tests - **TEST N (TS)** and **TEST O (6V)** make it possible to identify a malfunction affecting the components of the ignition system (coils, spark plugs, power modules) which are not controlled by the system's self-diagnosis starting from a malfunction pointed out by the user.

For a complete fault-diagnosis starting from any other malfunction which may have been pointed out by the user, refer to "155 - REPAIR MANUAL - ENGINES" Group 04

For problems affecting the connection between the air conditioning system and the MOTRONIC system refer to the fault diagnosis relative to the air conditioning system (see section "Heating and ventilation").

USE OF THE FLASHING CODE

To activate the flashing code the display device shown in the diagram must first be available.



A key operated supply
B connection to pin 8 of the control unit **S11**

Note: in place of the led and resistance a normal 12V (max. 1.2 W) bulb may be used.

The flashing of the led (or bulb) on the display device makes it possible to "read" the errors memorized in the control unit **S11**.

Each error code is formed of four blocks each of which is composed of brief flashes which last approximately 0.5 seconds at intervals of 0.5 seconds.
The various blocks are separated by a pause lasting approximately 2.5 seconds.

Counting and noting down the number of flashes from each of the four blocks will result in four numbers which form the anomaly code.

Entering the following table with this code it is possible to find the affected component and to operate as shown or to continue with the diagnosis by carrying out one of the tests given below.

PROCEDURE TO ACTIVATE THE FLASHING CODE

- connect pin A of the display device to the key-operated supply and pin B to pin 8 of control unit **S11**.
- Turn the ignition key to the MARCIA position and work the accelerator pedal **5 times in less than 5 seconds** pressing it fully and then releasing it.
- check that the warning light flashes and note down the number of digits of the anomaly code.
- repeat the above operation if necessary to read other anomalies which have been memorized. **N.B.:** when the same code appears twice, no other anomalies have been memorized.

NOTE: a special code (4-4-4-4) indicates that NO anomaly has been memorized!

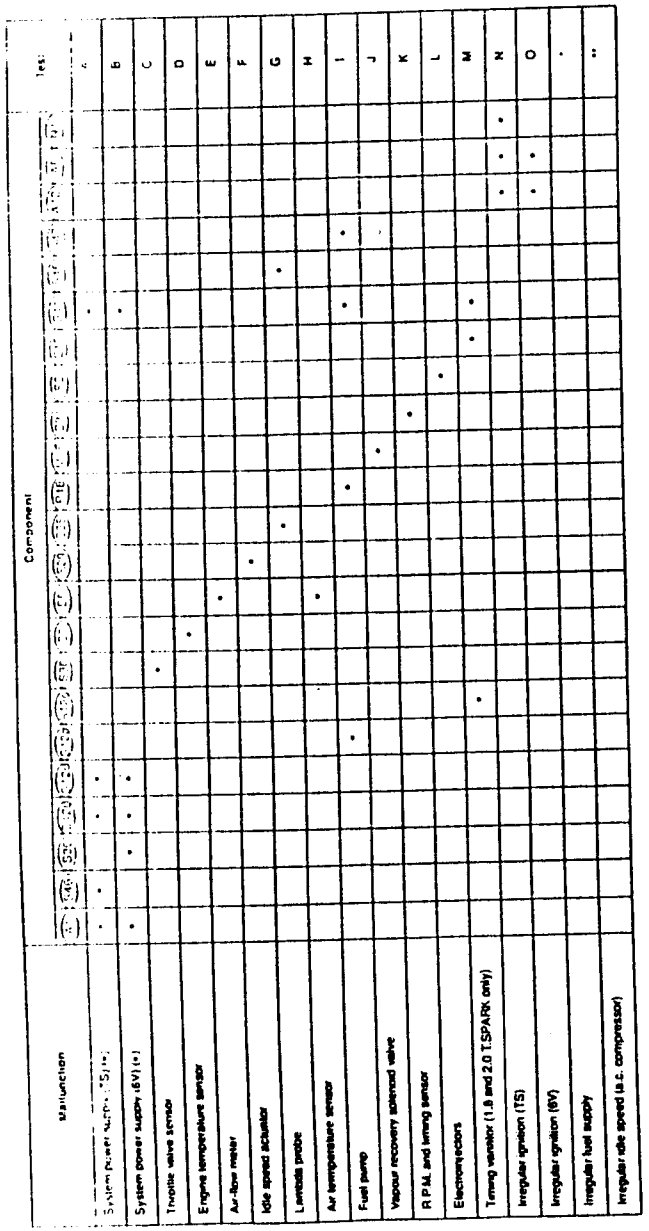
N.B.: If the warning light does not flash:

- check the connections of the device
- check battery voltage and key-operated supply
- check power supply to the control unit **S11** - see successive **Test A (TS)** or **B (6V)**.
- check connections and operation of the throttle valve sensor **S38** (see also successive **test C**).

TABLE OF ANOMALY CODES

CODE	MALFUNCTION	SEE TEST
4-4-4-4	no errors	N (TS) o O (6V) in case of irregular starting
1-2-1-1	anomalous battery voltage	A
1-2-1-4	engine temperature sensor	D
1-2-1-6	throttle valve sensor	C
1-2-2-1	air flow meter	E
1-2-2-2	idle actuator (opening)	F
1-2-2-3	regulation of lambda probe	replace control unit **S11**
1-2-2-4	heated lambda probe	G
1-2-2-5	air temperature sensor	H
1-2-2-6	electroinjectors (group 1) power circuit (inside control unit)	replace control unit **S11**
1-2-3-1	electroinjectors (group 2)	L
1-2-3-2	idle actuator (closure)	L
1-2-3-3	compressor inlets	F
1-2-3-5	compressor command	see "heating-ventilation" section"
1-2-3-6	fuel pump relay	see "heating-ventilation" section"
1-2-4-3	vapour recovery solenoid valve	I
1-2-4-4	timing variator relay (only 1.8 and 2.0 T.SPARK)	J
1-2-4-5	control unit EPROM	M
1-2-5-1	throttle valve sensor (signal)	replace control unit **S11**
1-2-5-4		C

THOUBLESHOOTING TABLE



(*) 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.

* See test I, of "REPAIR MANUAL - MOTORS", Group 04.
** See test F, of the section "Heating, ventilation and air conditioning"

NO POWER SUPPLY TO SYSTEM (T.SPARK models) — TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 CHECK BATTERY VOLTAGE – Check that the battery voltage is 12V	OK ▶ OK ▶	Carry out step A2 Restore the correct voltage by recharging or replacing the battery A1 **NOTE:** If the battery voltage falls below 12 V, even if only slightly, not only this but also the electronic systems could be negatively affected
A2 CHECK FUSE – Check for damage of wander fuse S46	OK ▶ OK ▶	Carry out step A3 Replace fuse (3A)
A3 CHECK RELAYS – Check for correct functioning of relays S12b and S12d	OK ▶ OK ▶	Carry out step A4 Replace faulty relays
A4 CHECK GROUND – Check that pins 6, 28, 34 and 55 of control unit S11 are grounded (0V) (only for 1.7 T.SPARK: check that pin 82 of S11 us grounded)	OK ▶ OK ▶	Carry out step A5 Restore wiring between pins in question and grounds G66a and G66b (BLK)
A5 CHECK VOLTAGE – Check for 12 V at pin 26 of control unit S11	OK ▶ OK ▶	Carry out step A6 Restore wiring between pin 26 of S11 and the battery A1, across wander fuse S46 (RED)
A6 CHECK VOLTAGE – With engine running, verify 12 V at pin 54 of control unit S11	OK ▶ OK ▶	Carry out step A12 Carry out step A7
A7 CHECK VOLTAGE – With engine running, verify 12 V at pin 87 of relay S12b	OK ▶ OK ▶	Restore wiring between pin 54 of S11 and pin 87 of S12b, across the solder (PPL-WHT and PPL-BLK) Carry out step A8
A8 CHECK VOLTAGE – Check for 12 V at pin 30 of relay S12b	OK ▶ OK ▶	Carry out step A9 Restore wiring between the battery A1 and pin 30 of S12b, across the solder (RED and LTB)

(continues)

NO POWER SUPPLY TO SYSTEM (T.SPARK models) — TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A9 CHECK VOLTAGE – Check for 12 V at pin 86 of relay S12b	OK ▶	Carry out step A10
	NO ▶	Restore wiring between pin 86 and pin 30 of S12b (RED-BLK)
A10 CHECK GROUND – With engine running, check for a ground (0V) at pin 85 of S12b	OK ▶	Carry out step A12
	NO ▶	Carry out step A11
A11 CHECK GROUND – With engine running, check for a ground signal (0V) at pin 27 of S11	OK ▶	Restore wiring between pin 27 of S11 and pin 85 of S12b (YEL-GRN)
	NO ▶	Replace control unit S11
A12 CHECK VOLTAGE – With key in ignition, verify 12 V at pin 56 of control unit S11	OK ▶	The system is correctly powered. If the anomaly continues, replace the control unit S11
	NO ▶	Carry out step A13
A13 CHECK VOLTAGE – With key in ignition, verify 12 V at pin 87 of relay S12d	OK ▶	Carry out step A14
	NO ▶	Restore wiring between pin 87 of S12d and pin 56 of S11, across the solder (PNK and PNK-BLK)
A14 CHECK VOLTAGE – Check for 12 V at pin 30 of relay S12d	OK ▶	Carry out step A15
	NO ▶	Restore wiring between the battery A1 and pin 30 of S12d (RED)
A15 CHECK VOLTAGE – With ignition key engaged, verify 12 V at pin 86 of relay S12d	OK ▶	Restore wiring between pin 85 of S12d and ground G66b (BLK)
	NO ▶	Restore wiring between pin 86 of S12d and ignition switch B1, across pin A of connector G133a (PNK and ORN) For vehicles with anti-theft device: check for a correct connection between the anti-theft device control unit N45 and the connector G133a (see section "Anti-theft Device")

NO POWER SUPPLY TO SYSTEM (6V model) — TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B1 CHECK BATTERY VOLTAGE – Check that battery voltage is 12V	OK ▶	Carry out step B2
	NO ▶	Restore the correct voltage by recharging or replacing the battery A1 NOTE: if the battery voltage falls below 12 V, even if only slightly, not only this but also the electronic systems could be negatively affected
B2 CHECK FUSE – Check for damage of wander fuse S36	OK ▶	Carry out step B3
	NO ▶	Replace fuse (15A)
B3 CHECK RELAYS – Check for correct functioning of relays S12b and S12d	OK ▶	Carry out step B4
	NO ▶	Replace faulty relays
B4 CHECK GROUND – Check that pins 6, 28, 34 and 55 of control unit S11 are grounded (0V)	OK ▶	Carry out step B5
	NO ▶	Restore wiring between pins in question and grounds G66a and G66b (BLK)
B5 CHECK VOLTAGE – Check for 12 V at pin 26 of control unit S11	OK ▶	Carry out step B6
	NO ▶	Restore wiring between pin 26 of S11 and the battery A1 (RED)
B6 CHECK VOLTAGE – With engine running, verify 12 V at pin 54 of control unit S11	OK ▶	Carry out step B12
	NO ▶	Carry out step B7
B7 CHECK VOLTAGE – With engine running, verify 12 V at pin 87 of relay S12b	OK ▶	Restore wiring between pin 54 of S11 and pin 87 of S12b, across the solder (PPL-BLK)
	NO ▶	Carry out step B8

(continues)

NO POWER SUPPLY TO SYSTEM (6V model) — TEST B

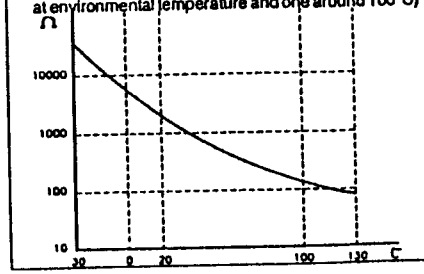
TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B8 CHECK VOLTAGE – Check for 12 V at pin 30 of relay S12b	OK ▶	Carry out step B9
	NO ▶	Restore wiring between the battery A1 and pin 30 of S12b, across the solder (RED)
B9 CHECK VOLTAGE – Check for 12 V at pin 86 of relay S12b	OK ▶	Carry out step B10
	NO ▶	Restore wiring between pin 86 and pin 30 of S12b (RED)
B10 CHECK GROUND – With engine running, check for a ground (0V) at pin 85 of S12b	OK ▶	Carry out step B12
	NO ▶	Carry out step B11
B11 CHECK GROUND With engine running, check for a ground signal (0V) at pin 27 of S11	OK ▶	Restore wiring between pin 27 of S11 and pin 85 of S12b (YEL-GRN)
	NO ▶	Replace the control unit S11
B12 CHECK VOLTAGE – With key in ignition, verify 12 V at pin 56 of control unit S11	OK ▶	The system is correctly powered. If the anomaly persists, replace the control unit S11
	NO ▶	Carry out step B13
B13 CHECK VOLTAGE – With key in ignition, verify 12 V at pin 87 of relay S12d	OK ▶	Carry out step B14
	NO ▶	Restore wiring between pin 87 of S12d and pin 56 of S11, across wander fuse S36 and the solder (PNK)
B14 CHECK VOLTAGE – Check for 12 V at pin 30 of relay S12d	OK ▶	Carry out step B15
	NO ▶	Restore wiring between the battery A1 and pin 30 of S12d (RED)
B15 CHECK VOLTAGE With ignition key engaged, verify 12 V at pin 86 of relay S12d	OK ▶	Restore wiring between pin 85 of S12d and ground G66a (BLK)
	NO ▶	Restore wiring between pin 86 of S12d and ignition switch B1, across pin A of connector G133a (ORN) For vechicles with anti-theft device: check for a correct connection between the anti-theft device control unit N45 and the connector G133a (see section "Anti-theft Device")

CHECK THROTTLE VALVE SENSOR — TEST C

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
C1 CHECK SENSOR – Check that the resistance value between pins 2 and 3 of S38 varies in relation to the degree of opening of the throttle valve: between approximately 1 kΩ with valve closed and 2.7 kΩ with valve completely open	OK ▶	Carry out step C2
	NO ▶	Replace the throttle valve sensor S38
C2 CHECK CONTINUITY – Check for continuity between pin 2 of S38 and pin 43 of control unit S11	OK ▶	Carry out step C3
	NO ▶	Restore wiring between pin 2 of S38 and pin 43 of control unit S11, across the solder (WHT)
C3 CHECK CONTINUITY – Check for continuity between pin 1 of S38 and pin 59 of control unit S11	OK ▶	Carry out step C4
	NO ▶	Restore wiring between pin 1 of S38 and pin 59 of control unit S11, across the solder (LTB-WHT)
C4 CHECK CONTINUITY – Check for continuity between pin 3 of S38 and pin 12 of control unit S11	OK ▶	the sensor in question functions correctly: check the control unit S11 or other components
	NO ▶	Restore wiring between pin 3 of S38 and pin 12 of control unit S11 (YEL)

CHECK ENGINE TEMPERATURE SENSOR — TEST D

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
D1 CHECK SENSOR – Check that the resistance value measured at the ends of S7 varies with the changes in temperature in accordance with the relevant table (e.g. carry out a test at environmental temperature and one around 100°C)	OK ▶	Carry out step D2
	NO ▶	Replace engine temperature sensor S7



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CHECK ENGINE TEMPERATURE SENSOR — TEST D

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
D2 CHECK CONTINUITY – Check for continuity between pin 1 of S7 and pin 78 of control unit S11	OK ▶	Carry out step D3
	NO ▶	Restore wiring between pin 1 of S7 and pin 78 of control unit S11 (BRN)
D3 CHECK CONTINUITY – Check for continuity between pin 2 of S7 and pin 43 of control unit S11	OK ▶	The sensor in question functions correctly: check the control unit S11 or other components
	NO ▶	Restore wiring between pin 2 of S7 and pin 43 of control unit S11, across the solder (WHT)

CHECK AIR-FLOW METER — TEST E

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
E1 CHECK METER – Check operation of air-flow meter S5 and carry out the following tests: - check for a resistance value between pins 4 and 3 of S5 of approximately 300÷500Ω with the shutter closed - check for a resistance value between pins 2 and 4 of S5 of approximately 10Ω with shutter closed; manually operate the shutter and check that the value increases smoothly, without abrupt changes, up to 200 Ω. Also check the correct mechanical operation of the meter	OK ▶	Carry out step E2
	NO ▶	Replace air-flow meter S5
E2 CHECK CONTINUITY – Check for continuity between pin 4 of S5 and pin 14 of control unit S11	OK ▶	Carry out step E3
	NO ▶	Restore wiring between pin 4 of S5 and pin 14 of control unit S11 (GRN)
E3 CHECK CONTINUITY – Check for continuity between pin 3 of S5 and pin 59 of control unit S11	OK ▶	Carry out step E4
	NO ▶	Restore wiring between pin 3 of S5 and pin 59 of control unit S11, across the solder (LTB-WHT)
E4 CHECK CONTINUITY – Check for continuity between pin 2 of S5 and pin 41 of control unit S11	OK ▶	The air-flow meter in question functions correctly: check the control unit S11 or other components
	NO ▶	Restore wiring between pin 2 of S5 and pin 41 of control unit S11 (WHT-BLK)

CHECK IDLE SPEED ADJUSTMENT ACTUATOR — TEST F

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
F1 CHECK ACTUATOR – Check impedance value: • of approximately 13 Ω between pins 2 and 3 of S29 • of approximately 26 Ω between pins 1 and 3 of S29 Also check the correct mechanical operation of the actuator	OK ▶	Carry out step F2
	NO ▶	Replace idle speed adjustment actuator S29
F2 CHECK VOLTAGE – With engine running, verify 12 V at pin 2 of S29	OK ▶	Carry out step F3
	NO ▶	Restore wiring between pin 2 of S29 and pin 87 of relay S12b, across the solder (ORN-WHT and PPL-BLK)
F3 CHECK CONTINUITY – Check for continuity between pin 3 of S29 and pin 29 of control unit S11	OK ▶	Carry out step F4
	NO ▶	Restore wiring between pin 3 of S29 and pin 29 of control unit S11 (LTB-BLK)
F4 CHECK CONTINUITY – Check for continuity between pin 1 of S29 and pin 2 of control unit S11	OK ▶	Idle actuator in question functions correctly: check the control unit S11 or other components
	NO ▶	Restore wiring between pin 1 of S29 and pin 2 of control unit S11 (ORN-BLK)

CHECK LAMBDA PROBE — TEST G

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
G1 CHECK AIR SUPPLY – Check for damage of air intake duct of air cleaner	OK ▶	Carry out step G2
	NO ▶	Clean or replace the affected parts
G2 CHECK SPARK PLUGS AND INJECTORS – Check for damage of spark plugs A12 and injectors S3 (see also test L)	OK ▶	Carry out step G3
	NO ▶	Clean or replace affected parts

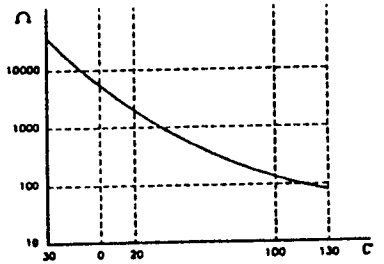
(continues)

CHECK LAMBDA PROBE — TEST G

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
G3 CHECK FUSE Check for damage of wander fuse **S45**	OK ▶ NO ▶	Carry out **step G4** Replace fuse (7.5 A)
G4 CHECK PROBE RESISTANCE Check that between ends of the resistance of probe S35 (pin A1 and A2) there is a resistance of approximately 3 Ω	OK ▶ NO ▶	Carry out **step G5** Replace probe **S35**
G5 CHECK VOLTAGE With engine running, verify 12 V at pin A1 of probe S35	OK ▶ NO ▶	Carry out **step G6** Restore wiring between pin A1 of **S45** and pin 87 of relay **S12a**, across fuse **S45** (ORN-BLK)
G6 CHECK GROUND Check that pin A2 of probe **S35** is grounded (0V)	OK ▶ NO ▶	Carry out **step G7** Restore wiring between pin A2 of **S35** and ground **G68a**, across the solder (BLK)
G7 CHECK SIGNAL - Start the engine and wait until it is idling. Check for a difference in voltage between pins B1 and B2 of S35 of between 0.1 and 1 V (with correct composition of the exhaust gas the value is approx. 0.7V). Check for a resistance of about 0.3 Ω at the ends of the probe (this value increases with time up to 0.5 Ω). When cold the resistance rises to 1÷1.5 Ω	OK ▶ NO ▶	Carry out **step G8** Replace probe **S35**
G8 CHECK SIGNAL Operating as for the previous step, check the signal at pins 70 and 71 of control unit **S11**	OK ▶ NO ▶	The lambda probe in question functions correctly: check the control unit **S11** or other components Restore wiring between: • pin 71 of **S11** and pin B2 of **S35** (BLK) • pin 70 of **S11** and pin B1 of **S35** (TS:YEL - 6V:GRN) Check also the shielding plait, which must be grounded

CHECK AIR TEMPERATURE SENSOR — TEST H

NOTE: the air temperature sensor is incorporated in the air-flow meter **S5**

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
H1 CHECK SENSOR – Check that the resistance value between pins 5 and 4 of air-flow meter **S5** (with a built-in air temperature sensor) varies with the temperature in accordance with the relative table (e.g. carry out a test at environmental temperature and one around 100 °C) 	OK ▶ NO ▶	Carry out **step H2** Replace air-flow meter **S5**
H2 CHECK CONTINUITY – Check for continuity between pin 5 of **S5** and pin 77 of control unit **S11**	OK ▶ NO ▶	Carry out **step H3** Restore wiring between pin 5 of **S5** and pin 77 of control unit **S11**, across the solder (RED-GRY)
H3 CHECK CONTINUITY – Check for continuity between pin 4 of **S5** and pin 14 of control unit **S11**	OK ▶ NO ▶	The air temperature sensor (located in the air-flow meter) in question functions correctly: check the control unit **S11** or other components Restore wiring between pin 4 of **S5** and pin 14 of control unit **S11** (GRN)

CHECK FUEL PUMP — TEST I

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
I1 CHECK FUSE – Check for damage of wander fuse: - (TS) S47 - (6V) S36	OK ▶ NO ▶	Carry out **step I2** Replace fuse (15A)
I2 CHECK RELAY – Check for correct functioning of fuel pump relay **S12a**	OK ▶ NO ▶	Carry out **step I3** Replace faulty relay
I3 CHECK VOLTAGE – With key in ignition, verify 12 V at pin 30 of relay **S12a**	OK ▶ NO ▶	Carry out **step I4** Restore wiring between: - (TS) pin 30 of **S12a** and pin 87 of **S12d** (GRN-BLK) - (6V) pin 30 of **S12a** and pin 87 of **S12d**, across the solder and fuse **S36** (PNK)
I4 CHECK VOLTAGE – With key in ignition, verify 12 V at pin 86 of relay **S12a**	OK ▶ NO ▶	Carry out **step I5** Restore wiring between: - (TS) pin 86 of **S12a** and pin 87 of **S12b**, across the solder (YEL and RED) - (6V) pin 86 of **S12a** and pin 87 of **S12b**, across the solder (BLU-RED and LTB)
I5 CHECK GROUND SIGNAL – With engine running check for a ground signal (0V) at pin 85 of S12a	OK ▶ NO ▶	Carry out **step I7** Carry out **step I6**
I6 CHECK GROUND SIGNAL – With engine running check for a ground signal (0V) at pin 1 of control unit **S11**	OK ▶ NO ▶	Restore wiring between pin 1 of **S11** and pin 85 of **S12a** (GRY- BLK) Check and if necessary replace the control unit **S11**

(continues)

CHECK FUEL PUMP — TEST I

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
I7 CHECK VOLTAGE – With engine running, verify 12 V at pin B of fuel pump **P18**	OK ▶ NO ▶	Carry out **step I8** Restore wiring between: - (TS) pin B of **P18** and pin 87 of **S12a**, across pin C1 of connector **G73**, pin 1 of connector **G107**, wander fuse **S47** and the solder (GRN-BLK and PNK-WHT) - (6V) pin B of **P18** and pin 87 of **S12a**, across pin C1 of connector **G73** and pin 1 of connector **G107** (GRN-BLK and PNK-WHT)
I8 CHECK VOLTAGE – Check that pin A of **P18** is grounded (0V)	OK ▶ NO ▶	Replace pump **P18** Restore wiring between pin A of **P18** and ground **G63a** (BLK)

CHECK VAPOUR RECOVERY SOLENOID VALVE — TEST J

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
J1 CHECK SOLENOID VALVE – Check for a resistance (when cold) of about 45Ω between the two terminals of the valve. Also, when the engine warm, accelerate revving slightly and check for 0V at pin 2 of solenoid valve **M15**	OK ▶ NO ▶	Carry out **step J2** Carry out **step J3**
J2 CHECK VOLTAGE – With engine running, verify 12 V at pin 1 of **M15**	OK ▶ NO ▶	Replace solenoid valve **M15** Restore wiring between pin 1 of **M15** and pin 87 of **S12b**, across the solder (TS: RED-BLU and RED 6V:RED-BLU and LTB)
J3 CHECK CONTINUITY – Check for continuity between pin 2 of **M15** and pin 36 of control unit **S11**	OK ▶ NO ▶	The vapour recovery solenoid valve in question functions correctly: check the control unit **S11** or other components Restore wiring between pin 2 of **M15** and pin 36 of control unit **S11** (ORN)

CHECK R.P.M. AND TIMING SENSOR — TEST K

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
K1 CHECK AIR GAP – Check for correct air gap value between the sensor and the crankshaft pulley (see "REPAIR MANUAL-MOTORS", Group 04)	OK ▶	Carry out step K2
	NO ▶	Restore correct air gap value
K2 CHECK SENSOR – When cold check for a resistance at the terminals of the sensor of about 540Ω. Also, when the engine running, check for a signal that varies in frequency between pins 1 and 2 of r.p.m. and timing sensor S31. This signal varies with the engine r.p.m.	OK ▶	Carry out step K3
	NO ▶	Replace sensor S31
K3 CHECK CONTINUITY – Check for continuity between: • pin 2 of S31 and pin 68 of control unit S11 • pin 1 of S31 and pin 67 of control unit S11	OK ▶	The r.p.m. and timing sensor in question functions correctly: check the control unit S11 or other components
	NO ▶	Restore wiring between: • pin 2 of S31 and pin 68 of control unit S11 (YEL) • pin 1 of S31 and pin 67 of control unit S11 (BLK) Check also the shielding plait, which must be grounded.

CHECK ELECTROINJECTORS — TEST L

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
L1 CHECK ELECTROINJECTORS – Check for damage and correct mechanical functioning of the electroinjectors S3 (see "REPAIR MANUAL-MOTORS", Group 04) Check also that the resistance value at the tips of an injector S3 is approximately 16 Ω	OK ▶	Carry out step L2
	NO ▶	Replace faulty injectors
L2 CHECK VOLTAGE – With engine running, verify 12 V at pins 2 of electroinjectors S3	OK ▶	Carry out step L3
	NO ▶	Restore wiring between pin 2 of injectors and pin 87 of S12b, across the solders (TS: RED; 6V: RED and LTB)

CHECK ELECTROINJECTORS — TEST L

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
L3 CHECK CONTINUITY – Check for continuity between: • (*) pin 1 of injectors S3 and pin 32 of control unit S11 • (**) pin 1 of injectors S3 and pin 3 of control unit S11	OK ▶	The injectors in question function correctly: check the control unit S11 or other components
	NO ▶	Restore wiring between: • (*) pin 1 of injectors S3 and pin 32 of control unit S11, across the solder (YEL-BLK) • (**) pin 1 of injectors S3 and pin 3 of control unit S11, across the solder (YEL)

(*) TS: cylinders 2 and 4 - 6V: cylinders 3, 5 and 6
(**) TS: cylinders 1 and 3 - 6V: cylinders 1, 2 and 4

CHECK TIMING VARIATOR — TEST M

NOTE: the timing variator S15, and relative relay S12c, are only fitted to the engines of the 1.8 and 2.0 T.SPARK models

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
M1 CHECK RELAY – Check for correct functioning of timing variator relay S12c	OK ▶	Carry out step M2
	NO ▶	Replace faulty relay
M2 CHECK VOLTAGE – With engine running, verify 12 V at pin 30 of relay S12c	OK ▶	Carry out step M3
	NO ▶	Restore wiring between pin 30 of S12c and pin 87 of S12a, across the solder (YEL-GRY and PNK-WHT)
M3 CHECK VOLTAGE – With key in ignition, verify 12 V at pin 86 of relay S12c	OK ▶	Carry out step M4
	NO ▶	Restore wiring between pin 86 of S12c and pin 87 of S12b, across the solder (GRY-GRN and PPL-BLK)
M4 CHECK GROUND SIGNAL – With engine running check for a ground signal (0V) at pin 85 of S12c	OK ▶	Carry out step M6
	NO ▶	Carry out step M5

(continues)

CHECK TIMING VARIATOR — TEST M

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
M5 CHECK GROUND SIGNAL – With engine running check for a ground signal (0V) at pin 37 of control unit S11	OK ▶	Restore wiring between pin 37 of S11 and pin 85 of S12c (YEL-RED)
	NO ▶	Check and if necessary replace the control unit S11
M6 CHECK TIMING VARIATOR – Check for damage and correct mechanical operation of timing variator S15 (see "REPAIR MANUAL-MOTORS", Group 04) Check also that the resistance value at the tips of S15 is approximately 10 Ω	OK ▶	Carry out step M7
	NO ▶	Replace timing variator S15
M7 CHECK GROUND – Check for 0V at pin with BLK wire of timing variator S15	OK ▶	Carry out step M8
	NO ▶	Restore wiring between M15 and ground G66a across the solder (BLK)
M8 CHECK CONTINUITY – Check for continuity between pin with wire (YEL-BLK) of S15 and pin 87 of relay S12c	OK ▶	The timing variator in question functions correctly: check the control unit S11 or other components
	NO ▶	Restore wiring between S15 and pin 87 of relay S12c (YEL-BLK)

IRREGULAR IGNITION (T.SPARK models) — TEST N

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
N1 CHECK SPARK PLUGS (*) – Visually check the condition of the spark plugs.	OK ▶	Carry out step N2
	NO ▶	Replace faulty spark plugs A12
N2 CHECK CABLES (*) • Check that the cables connecting the coils and spark plugs are not damaged. • Check for a total resistance between coils and spark plugs including the supressors of approximately 6 kΩ	OK ▶	Carry out step N3
	NO ▶	Replace the faulty cables or supressor

(continues)

(*) The presence of burnt petrol will irreparably damage the catalytic exhaust: do not therefore remove the spark plug cables when the engine is running

IRREGULAR IGNITION (T.SPARK models) — TEST N

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
N3 CHECK COILS – Check the toatal resistances of the circuits of coils A8a and A8b: • main (pin 2-1 and pin 2-3) approximately 0.5 Ω • secondary approximately 13.3 kΩ	OK ▶	Carry out step N4
	NO ▶	Replace faulty coil/s A8a or A8b
N4 CHECK VOLTAGE – Check for 12 V at pins 2 of coils A8a and A8b	OK ▶	Carry out step N6
	NO ▶	Carry out step N5
N5 CHECK VOLTAGE – Check for 12 V at pin 87 of relay S12d	OK ▶	Restore wiring between pin 2 of A8a and A8b and pin 87 of S12d, across the solder (GRN-BLK)
	NO ▶	Carry out test A
N6 CHECK CONTINUITY – Check for continuity between: • pin 3 of A8a and pin 1 of N1a • pin 3 of A8b and pin 1 of N1b • pin 1 of A8a and pin 6 of N1a • pin 1 of A8b and pin 6 of N1b	OK ▶	Carry out step N7
	NO ▶	Restore wiring between: • pin 3 of A8a and pin 1 of N1a (WHT) • pin 3 of A8b and pin 1 of N1b (YEL) • pin 1 of A8a and pin 6 of N1a (WHT) • pin 1 of A8b and pin 6 of N1b (YEL)
N7 CHECK CONTINUITY – Check for continuity between modules N1a and N1b and the control unit S11, and precisely between: • pin 7 of N1a and pin 24 of S11 • pin 2 of N1a and pin 51 of S11 • pin 7 of N1b and pin 52 of S11 • pin 2 of N1b and pin 25 of S11	OK ▶	Replace the electronic module N1a or N1b
	NO ▶	Restore wiring between: • pin 7 of N1a and pin 24 of S11 (ORN-WHT) • pin 2 of N1a and pin 51 of S11 (YEL-LTB) • pin 7 of N1b and pin 52 of S11 (PNK-WHT) • pin 2 of N1b and pin 25 of S11 (GRN-GRY)

IRREGULAR IGNITION (6V model) — TEST O

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
O1 CHECK SPARK PLUGS (*) - Visually check the condition of the spark plugs.	OK ▶	Carry out **step O2**
	OK ▶	Replace faulty spark plugs **A12**
O2 CHECK CABLES (*) - Check that the cables connecting the coils and spark plugs are not damaged. - Check for a total resistance between coils and spark plugs, including the supressors of approximately 2.5 kΩ	OK ▶	Carry out **step O3**
	OK ▶	Replace the faulty cables or supressor
O3 CHECK COIL Check total resistances of circuits of coil **A8**: - main (pin 1-4, 2-4 and 3-4) approximately 0.5 Ω - secondary approximately 13.3 kΩ	OK ▶	Carry out **step O4**
	OK ▶	Replace coil **A8**
O4 CHECK VOLTAGE Check for 12 V at pin 4 of coil **A8**	OK ▶	Carry out **step O6**
	OK ▶	Carry out **step O5**
O5 CHECK VOLTAGE - Check for 12 V at pin 87 of relay **S12d**	OK ▶	Restore wiring between pin 4 of **A8** and pin 87 of **S12d** (GRN-BLK)
	OK ▶	Carry out **test B**
O6 CHECK CONTINUITY - Check for continuity between coil **A8** and the control unit **S11**, and precisely between: • pin 3 of **A8** and pin 24 of **S11** • pin 2 of **A8** and pin 51 of **S11** • pin 1 of **A8** and pin 25 of **S11**	OK ▶	Replace coil **A8**
	OK ▶	Restore wiring between: • pin 3 of **A8** and pin 24 of **S11** (WHT) • pin 2 of **A8** and pin 51 of **S11** (GRN) • pin 1 of **A8** and pin 25 of **S11** (RED)

(*) The presence of burnt petrol will irreparably damage the catalytic exhaust: do not therefore remove the spark plug cables when the engine is running

ALFA ROMEO CODE

Index

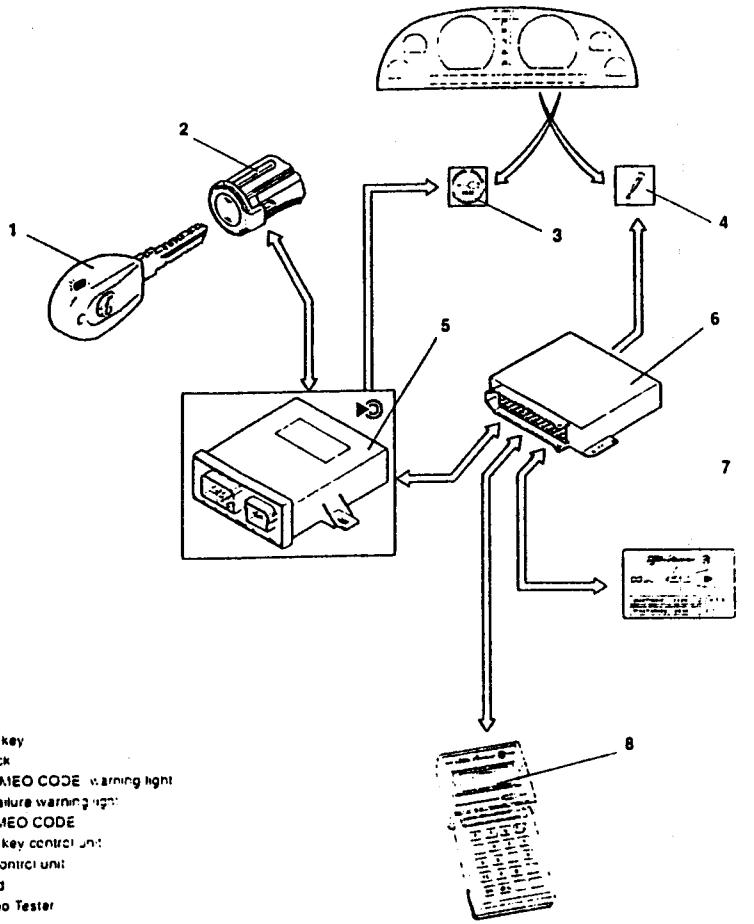
GENERAL DESCRIPTION

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

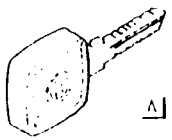
The system comprises the following components

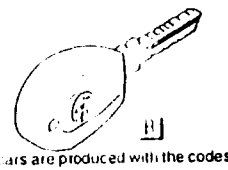
Keys

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.

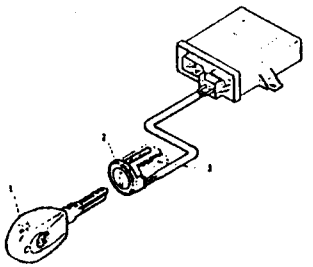
The Transponder inside the key comprises a minute integrated circuit (which contains the code), and a coil (which supplies the integrated circuit and transmits the code).

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 transpondar so that it can send the code and secondly to receive the Transponder signal.

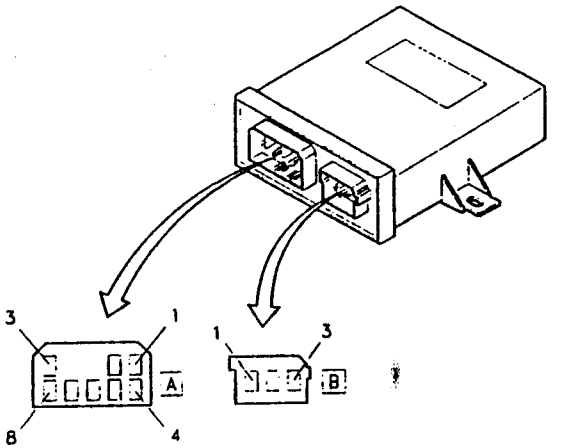


1. Transponder
2. Aaenal
3. Ignition lock

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

The C.C.E. is located above the fusebox; 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 :

The 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)

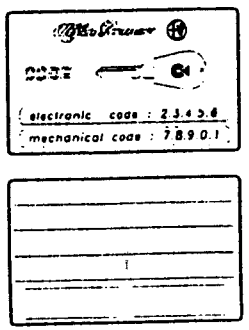
Absolutely never exchange the injection control units between cars to check whether they are working properly.

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).

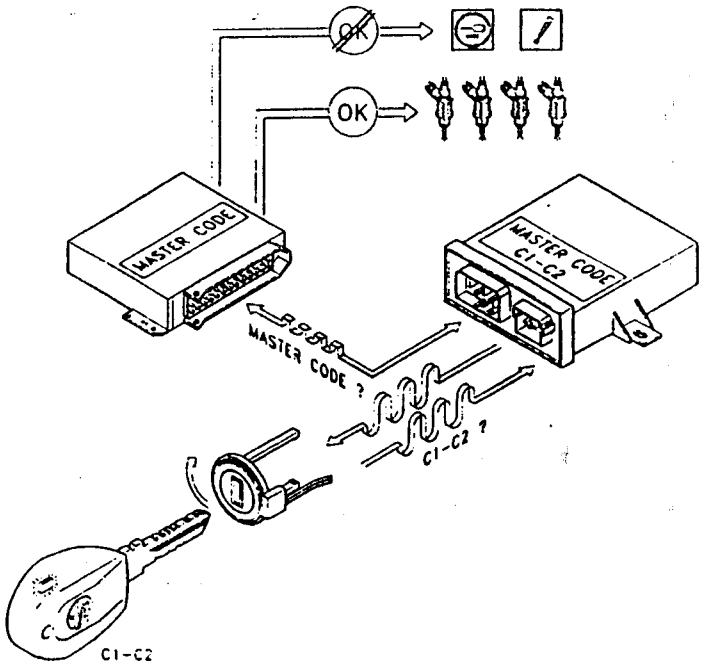
The C.C.E. checks that the code of the key engaged in the ignition lock corresponds to one of the codes contained in its memory.

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

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).

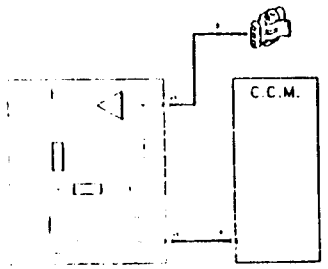
Line K of the diagnosis socket is connected to the C.C.E. at pin A5.

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:

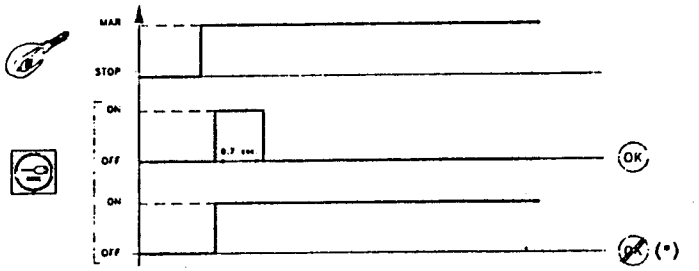
When the ignition key has been turned to MARCIA the C.C.M. asks for the MASTER CODE to be enabled for starting. As the C.C.E. is brand new, it answers sending the universal code, only if it reads a code correctly in the Transponder. (It might be a key without Transponder or with a key with the Transponder 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

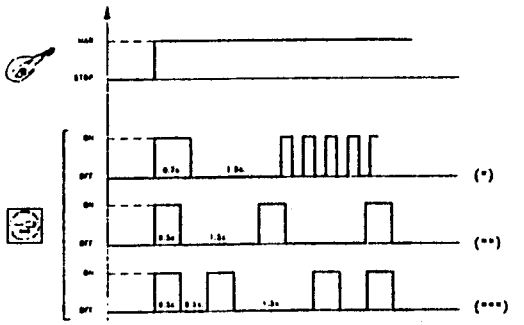
The diagnosis warning light on the instrument panel is controlled by the C.C.E. to inform the user and workshops of the system status. There are two types of characteristic flashing:

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 anses, 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.

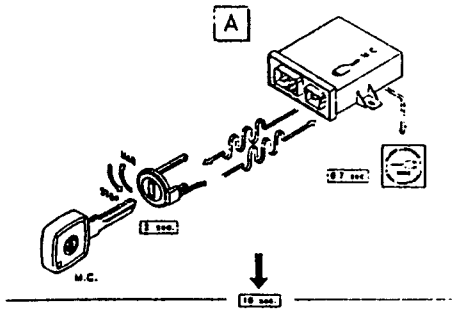
MEMORISING

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.**

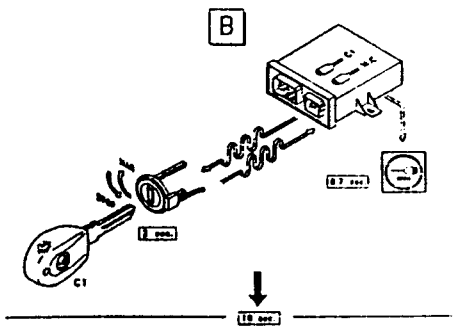
The memorising procedure is divided into two strictly consecutive phases:

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.

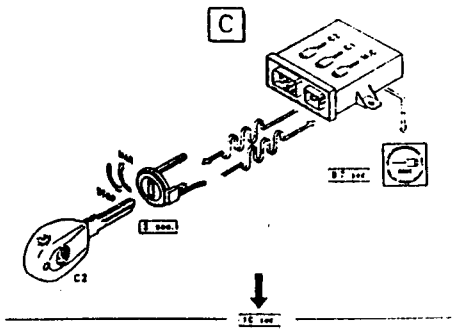
MEMORISING PROCEDURE WITH BRAND NEW SYSTEM



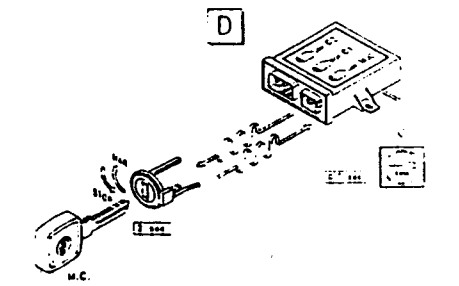
A Insert the MASTER key in the ignition lock
Turn the MASTER key to MARCIA and move it back to STOP as soon as the ALFA ROMEO CODE warning light goes off.



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.

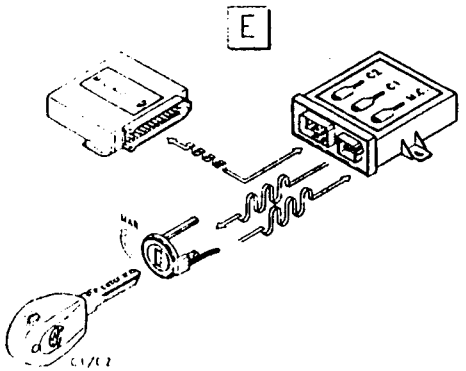


D Within 10 seconds:
Remove the key from the ignition lock, insert the MASTER key in the ignition lock again
Turn the key to MARCIA. As soon as the ALFA ROMEO CODE warning light goes out, move it back to the STOP position.

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.

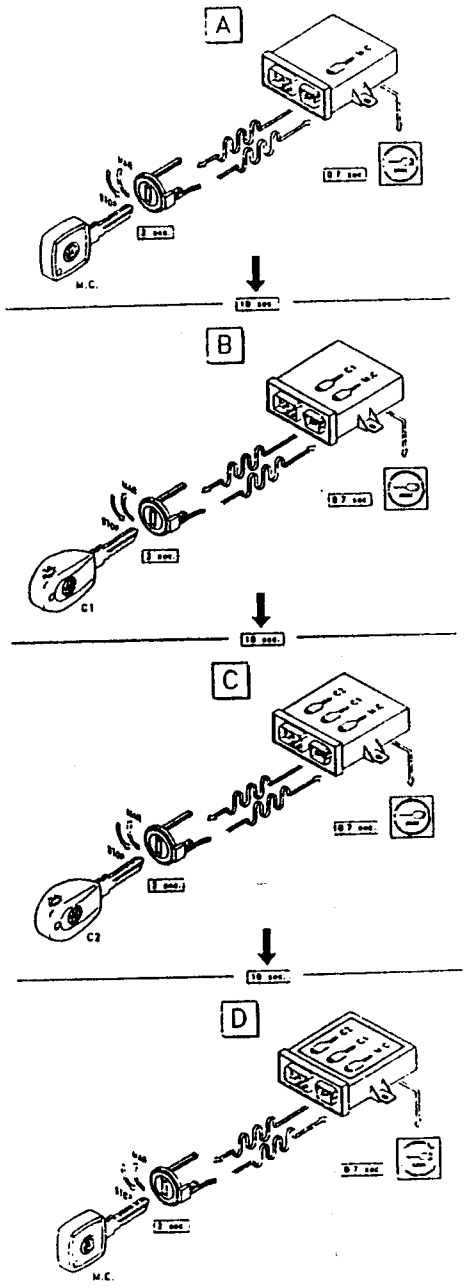
If the main keys memorised previously are not inserted, their code will be erased from the memory of the control unit.

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.**

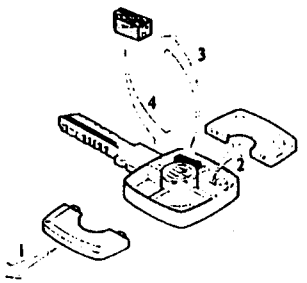
TRANSPONDER TRANSFER PROCEDURE

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.

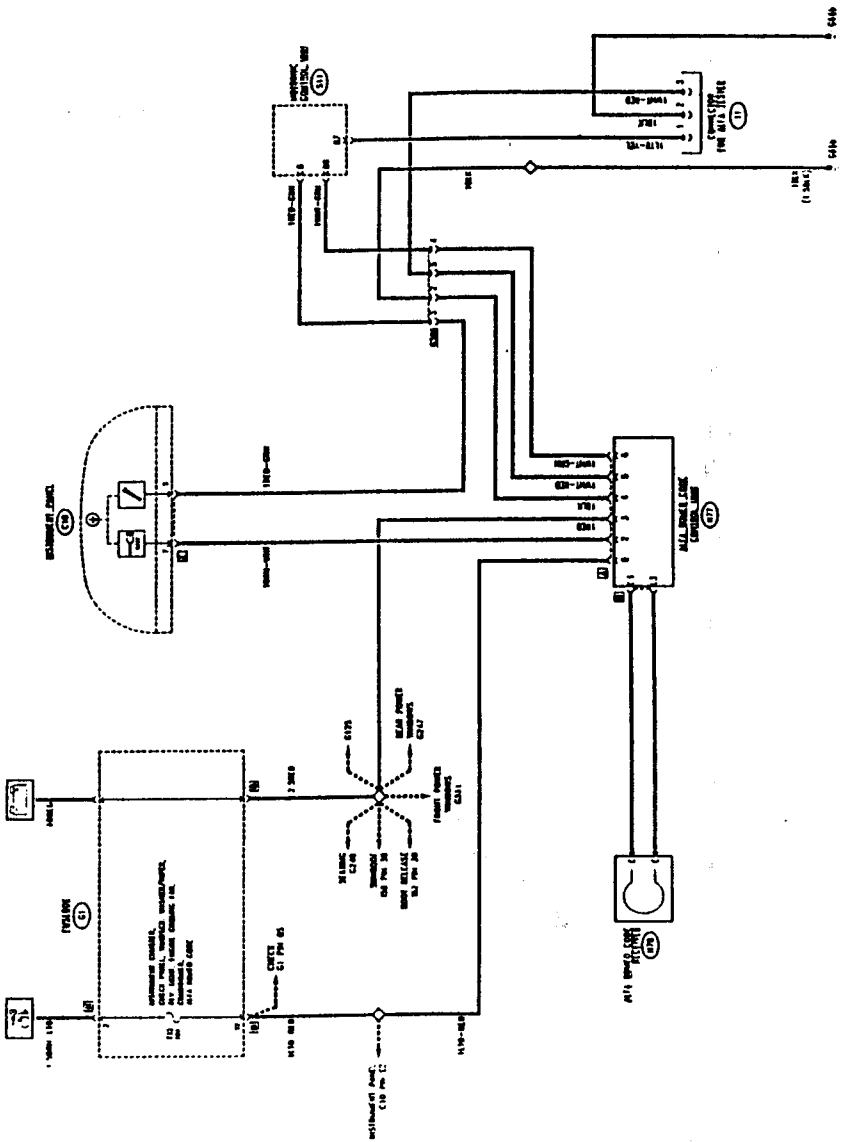
To transfer a Transponder, proceed as follows:

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

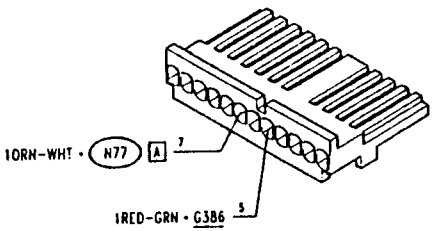
The ALFA ROMEO CODE control unit N77 is to be found next to the fusebox G1, is connected via connector B to a special pair of cables to the receiver N78, consisting in a coaxial aerial with the ignition switch. Through connector A it is connected to the Motronic control unit S11 and to the other systems: 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.

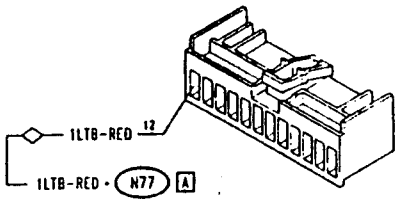
Pins 5 and 6 manage communication between the ALFA ROMEO CODE control unit N77 and the Motronic control unit S11: this communication takes place "cutting off" the diagnosis line K which leads from S11 to the diagnosis connector T1.

COMPONENTS AND CONNECTORS

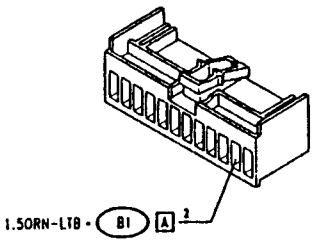
Instrument cluster C10 E



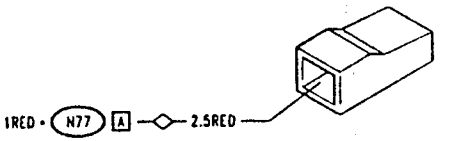
Fusebox G1 D



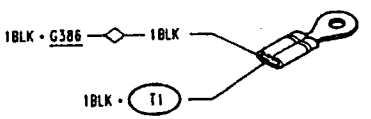
Fusebox G1 H



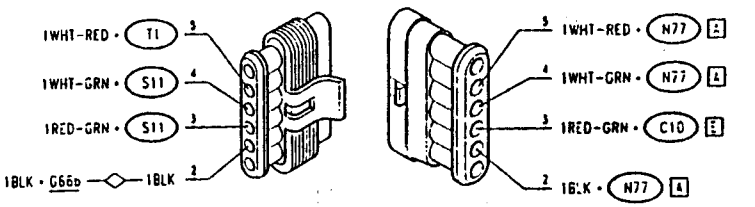
Fusebox G1 Q



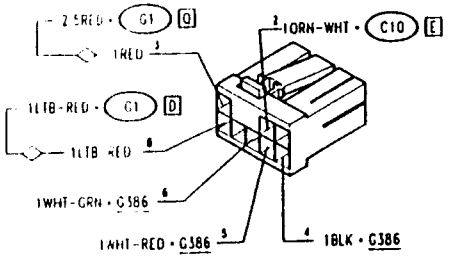
Motronic wiring ground G66b



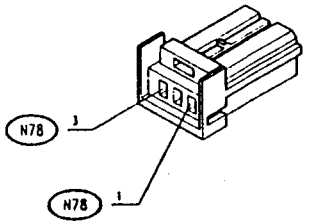
ALFA ROMEO CODE connector G386



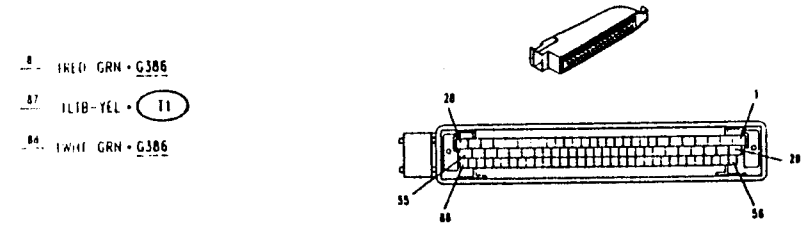
ALFA ROMEO CODE control unit (N77) [A]



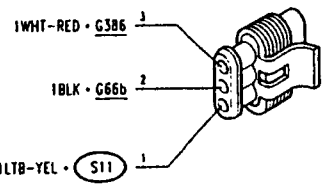
ALFA ROMEO CODE control unit (N77) [B]



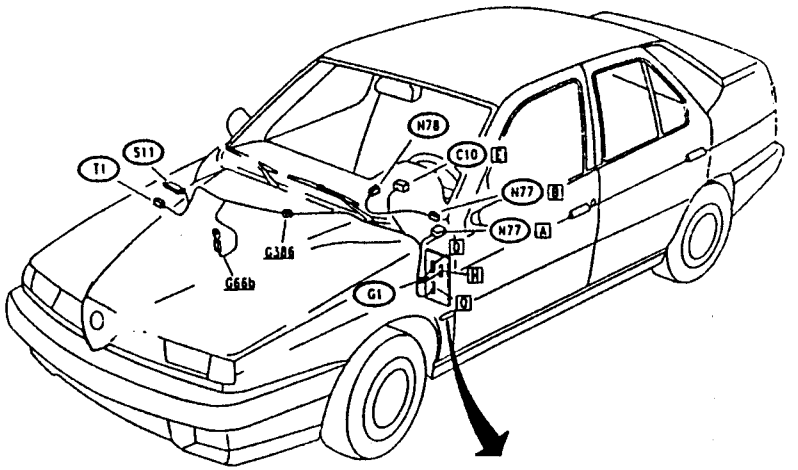
Motronic control uni (S11)

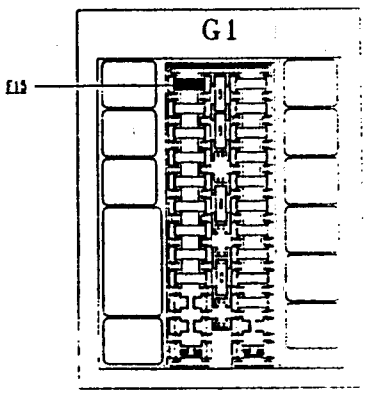


Connector for ALFA TESTER (T1)



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 entering the ELECTRONIC CODE directly in the inection control unit.

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

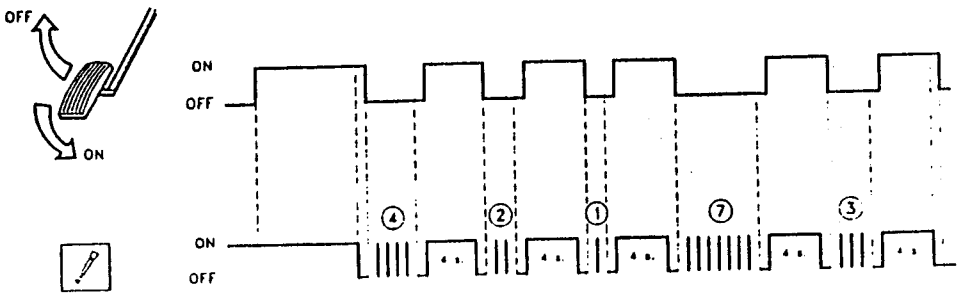
Emergency starting procedure (using the accelerator pedal)

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"

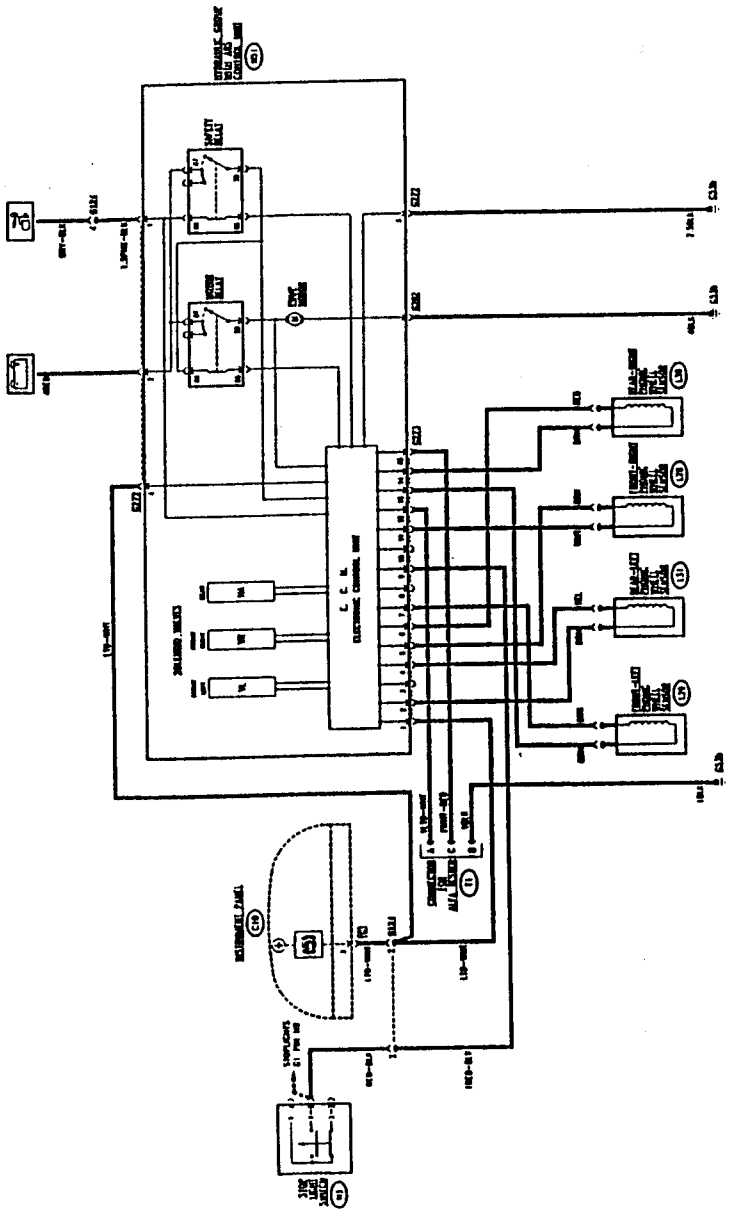


NOTE : If this procedure is not activated correctly, check the throttle potentiometer and the corresponding wiring, and also the throttle itself (throttle stroke without obstacles or sticking); also check the supply to the C.C.M..

ABS SYSTEM

INDEX

WIRING DIAGRAM



GENERAL DESCRIPTION

The vehicle is equipped with an electronic system to prevent the wheels of the vehicle from locking (ABS).
This system regulates the braking pressure transmitted to the wheels, preventing loss of road holding under all tyre and road conditions.
The system has been designed to integrate, and not substitute, the normal mechanical braking system, guaranteeing a high degree of safety in the event of a braking anomaly. The intervention is carried out on the same brake fluid found in traditional mechanical circuits.
Four sensors located on the four wheels communicate the speed of the wheels to the control unit, showing up locking situations affecting the wheels, skidding and loss of road holding.
In these situations, the control unit actuates solenoid valves which regulate the pressure in the hydraulic circuit, eliminating wheel locking and restoring road-holding which means that braking distance is reduced to a minimum without loss of steering control.
There are only three solenoid regulating valves in this version of the system: one for each of the two front wheels and one common to both the rear wheels which are regulated in parallel by a sequential control valve.

The system if composed of:

- four magnetic induction sensors which measure wheel speed **L28, L29, L30, L31**.
- an integrated hydraulic/electronic control unit **N51**, where the following components are located:
  - electronic control module
  - three solenoid valves
  - brake fluid pump
  - safety relay
  - pump control relay
- self-diagnosis connector **T1**
- brake switch **H3** (the same switch which also lights up the stop lights) which signals the braking state to the system.

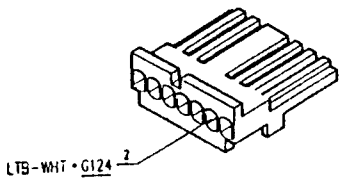
The ABS system includes a self-diagnosis system which continually monitors all the components and the operating parameters of the system. In the event of a malfunction or fault the system automatically cuts itself out leaving the traditional servo-assisted braking system operational: this is communicated to the driver by way of the warning lamp located on the instrument panel.
Connecting up to the diagnosis connector (**T1**) located near the control unit, it is possible to use the signals of the flashig code to rapidly identify the faulty component (see Troubleshooting).
The connector **T1** can also be used to connect the ALFA ROMEO Tester system.
The "ABS malfunction" warning lamp also comes on when the vehicle is started and will go out after a few seconds, thus signalling to the driver that the initial system testing has been carried out and no anomaly found.

FUNCTIONAL DESCRIPTION

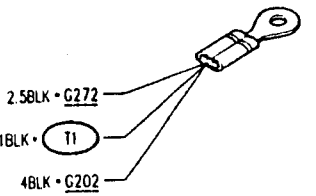
The key-operated supply powers the coil of the safety relay via pin 1 of connector **G272**. The safety relay is located inside control unit **N51**, which supplies the electronic module and the engine relay coil with battery voltage, coming from pin 2 of **G272**. Following a command from the electronic module, this actuates the pump motor.
The electronic module and the relays are connected to ground via pin 3 of connector **G272**, while the pump is grounded through connector **G202**.
Inside the control unit, the module is connected to the three regulating solenoid valves while externally it is connected via connector **G273**, to the four sensors **L28 - L29 - L30 - L31** which signal the speed of the individual wheels, and to the brake switch **H3**. The consensus signal from the brake switch prevents the system from intervening when the brake pedal is not depressed.
When the control unit detects a problem via the self- diagnosis function, it sends a signal to the instrument panel **C10** which then lights up the "ABS malfunction" warning lamp; this signal is dependant upon the malfunctioning of the electronic module -pin 1 of connector **G273**- or of the hydraulic control - pin 4 of **G272**.
The diagnosis connector **T1**, can be used to connect the control unit to the ALFA ROMEO Tester or to permit "reading" of the flashing code (see Troubleshooting).

COMPONENTS AND CONNECTORS

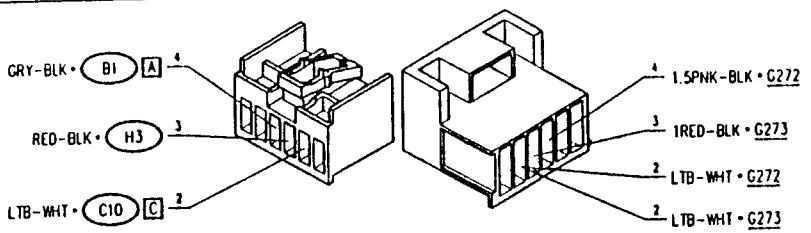
Instrument panel — C10 C



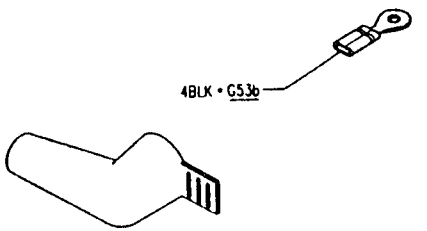
Branch terminal board — G56



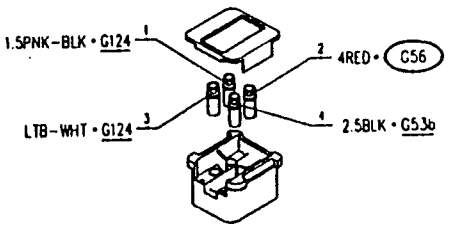
Connector for ABS system — G124



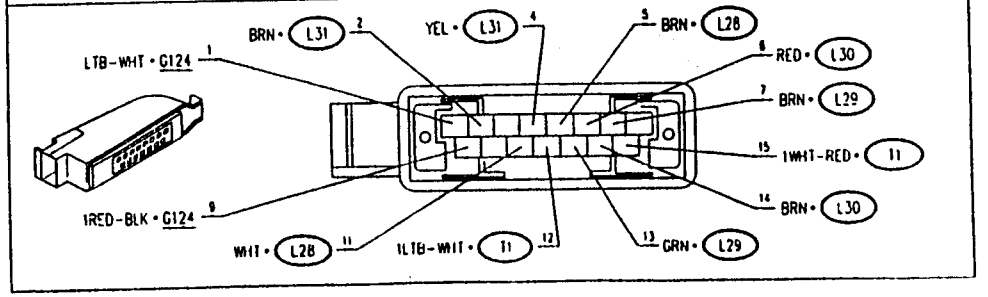
ABS system ground connector — G202



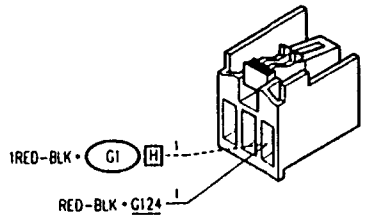
Connector for ABS hydraulic group — G272



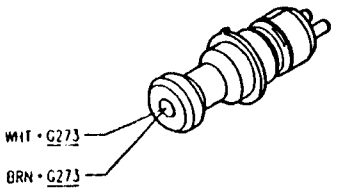
Connector for ABS control unit — G273

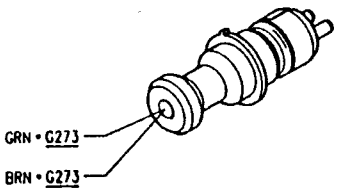


Stop light switch	H3

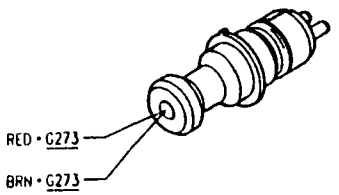


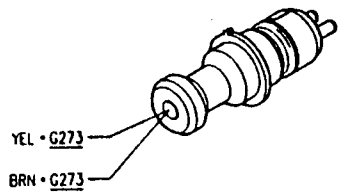
Front-right phonic wheel sensor	L28	Front-left phonic wheel sensor	L29



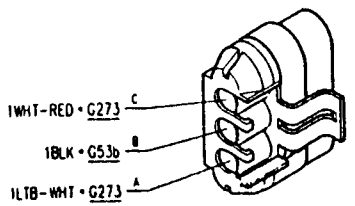


Rear-right phonic wheel sensor	L30	Rear-left phonic wheel sensor	L31

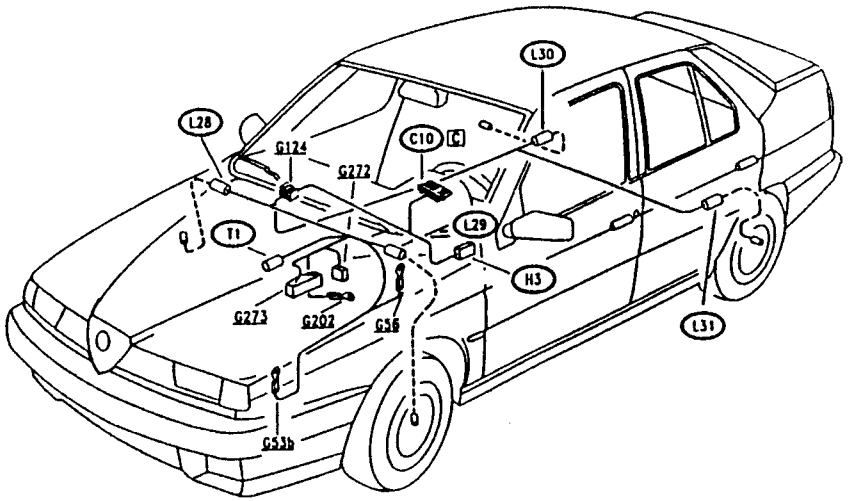




Connector for ALFA TESTER	T1



LOCATION OF COMPONENTS



TROUBLESHOOTING USING THE SELF-DIAGNOSIS FUNCTION

The self-diagnosis function with which this system is equipped makes a rapid identification of the faulty components possible by following the indications given by a FLASHING CODE which is actuated in the following way:

- connect the line of pin A, connector T1 to ground (LTB- WHT)
- provide power to the ABS control unit N51 (key-operated supply)
- read the sequence of impulses which appear on the "ABS malfunction" warning light located on the instrument panel C10:
  - code "12" will appear three times to indicate correct operation: if this does not occur, carry out test A
  - the codes of the stored errors will appear (each repeated three times): carry out the test indicated in the following table
  - code "12" will appear another three times to indicate the end of the sequence

NOTE: To reset the stored codes, disconnect the line of pin A, connector T1 and actuate the ignition switch 20 times (or use the ALFA ROMEO Tester)

TROUBLESHOOTING TABLE

CODE	MALFUNCTION	SEE TEST
12	Beginning and end of diagnosis	-
No code	Control unit anomaly and self-diagnosis	A
16	Faulty front left solenoid valve (VL)	Check solenoid valve impedence (1.5+2.5 Ω) and the connections between control unit and solenoid valve; if necessary replace the solenoid valve
17	Faulty front right solenoid valve (VR)	Check solenoid valve impedence (1.5+2.5 Ω) and the connections between control unit and solenoid valve; if necessary replace the solenoid valve
18	Faulty rear (HA) solenoid valve	Check solenoid valve impedence (1.5+2.5 Ω) and the connections between control unit and solenoid valve; if necessary replace the solenoid valve
19	Faulty safety relay	B
25	Incorrect number of teeth on phonic wheel	Replace the affected phonic wheel (see "REPAIR MANUAL-MECHANICAL UNITS" - Group 22)
35	Faulty pump motor	C
37	Faulty brake switch (H3)	D
39	Faulty front left sensor (L29)	Check sensor impedence (approximately 1 KΩ); replace it if necessary. Carry out successive test E.
41	Front left sensor (L29) not connected	E
42	Faulty front right sensor (L28)	Check sensor impedence (approximately 1 KΩ); replace it if necessary. Carry out successive test F.
43	Front right sensor (L28) not connected	F
44	Faulty rear left sensor (L31)	Check sensor impedence (approximately 1 KΩ); replace it if necessary. Carry out successive test G.
45	Rear left sensor (L31) not connected	G
46	Faulty rear right sensor (L30)	Check sensor impedence (approximately 1 KΩ); replace it if necessary. Carry out successive test H.
47	Rear right sensor (L30) not connected	H
48	Insufficient voltage	I
55	Faulty electronic control unit	Replace the control unit, located in N51

AUTOMATIC CHECKING UPON IGNITION:
when the vehicle is started the "ABS malfunction" warning lamp located on the instrument panel will come on for approximately 2 secs., and will then go out indicating that the system is operating correctly.
If the lamp stays on, carry out diagnosis using the flashing code as shown above.
If the warning lamp does not come on, carry out test A.

FAULT DIAGNOSIS

GENERAL SYSTEM MALFUNCTION	TEST A

TEST STEP	RESULT	CORRECTIVE ACTION
A1 CHECK RELAY – Check the safety relay (in group N51)	OK ▶ NO ▶	Carry out step A2 Replace the relay if faulty
A2 CHECK VOLTAGE – Check for 12 V at pin 2 of G272	OK ▶ NO ▶	Carry out step A3 Restore wiring between pin 2 of G272 and terminal board G56 (RED)
A3 CHECK VOLTAGE – Engage the ignition key and check for 12 V at pin 1 of G272	OK ▶ NO ▶	carry out step A4 Restore wiring between pin 1 of G272 and ignition block B1, across pin 4 of G124 (PNK-BLK and GRY-BLK)
A4 CHECK GROUND – Check that G202 is grounded	OK ▶ NO ▶	carry out step A5 Restore wiring between G202 and ground G53b (BLK)
A5 CHECK GROUND – Check that pin 3 of G272 is grounded	OK ▶ NO ▶	carry out step A6 Restore wiring between pin 3 of G272 and ground G53b (BLK)
A6 CHECK CONTINUITY – Check continuity between pin 12 of G273 and pin A of connector T1	OK ▶ NO ▶	carry out step A7 Restore wiring between pin 12 of G273 and pin A of connector T1 (LTB-WHT)

(continues)

GENERAL SYSTEM MALFUNCTION — TEST A

TEST STEP	RESULT	CORRECTIVE ACTION
A7 CHECK GROUND SIGNAL - Engage the ignition key and check, for a few seconds 0V at pin C2 of instrument panel **C10**	OK ▶	Replace the "ABS malfunction" warning light on instrument panel **C10**
	OK ▶	Carry out step **A8**
A8 CHECK GROUND SIGNAL - Engage the ignition key and check, for a few seconds 0V at pin 1 of **G273**	OK ▶	Restore wiring between pin 1 of **G273** and pin C2 of **C10**, across pin 2 of **G124** (LTB-WHT). Also check the wiring between pin 4 of **G272** and pin 2 of **G124** (LTB- WHT).
	OK ▶	Replace the electronic control unit contained in **N51**

FAULTY SAFETY RELAY — TEST B

TEST STEP	RESULT	CORRECTIVE ACTION
B1 CHECK RELAY - Check for correct operation of safety relay, (in group N51)	OK ▶	carry out step **B2**
	OK ▶	Replace the relay
B2 CHECK VOLTAGE - Check for 12 V at pin 87 of safety relay	OK ▶	carry out step **B3**
	OK ▶	In this case there are probably some interruptions in the connection between pin 2 of **G272** and pin 87 of the safety relay. Replace the group **N51**
B3 CHECK VOLTAGE - Engage the ignition key and check for 12 V at pin 86 of safety relay	OK ▶	carry out step **B4**
	OK ▶	In this case there are probably interruptions between pin 1 of **G272** and pin 86 of safety relay. Replace group **N51**
B4 CHECK VOLTAGE - Engage the ignition key and check for 12V at pin 86 of engine relay	OK ▶	Replace the engine relay (see also test C)
	OK ▶	Replace group **N51**

FAULTY ENGINE PUMP — TEST C

TEST STEP	RESULT	CORRECTIVE ACTION
C1 CHECK RELAY – Check for correct operation of the engine relay (in group N51)	OK ▶	carry out step **C2**
	OK ▶	Replace the relay, contained in **N51**
C2 CHECK VOLTAGE – Check for 12 V at pin 87 of engine relay	OK ▶	carry out step **C3**
	OK ▶	In this case there are probably interruptions between pin 2 of **G272** and pin 87 of engine relay. Replace group **N51**
C3 CHECK VOLTAGE – Engage the ignition key and check for 12 V at pin 86 of engine relay	OK ▶	carry out step **C4**
	OK ▶	Check safety relay (see test B). Otherwise there are probably interruptions in the connection between pin 30 of safety relay and pin 86 of engine relay. Replace group **N51**
C4 CHECK GROUND – Check that the eye G202 is grounded	OK ▶	carry out step **C5**
	OK ▶	Restore wiring between **G202** and ground G53b (BLK)
C5 CHECK GROUND – Check for 0 V at pin (-) of engine pump	OK ▶	carry out step **C6**
	OK ▶	In this case there are probably interruptions between pin (-) of engine pump and **G202**. Replace group **N51**
C6 CHECK PUMP – Bridge pins 30 and 87 of engine relay. Check that the engine pump functions normally	OK ▶	If necessary check the hydraulic brake circuit. (see "155 -REPAIR MANUAL" - MECHANICAL GROUPS" - Group 22)
	OK ▶	Replace group **N51**, together with engine pups

FAULTY BRAKE SWITCH — TEST D

TEST STEP	RESULT	CORRECTIVE ACTION
D1 CHECK BRAKE LIGHTS – Check for correct operation of the brake lights	OK ▶	carry out **step D2**
	NO ▶	Replace the stop light switch **H3**, or follow the indications given in the section "Stop lights".
D2 CHECK VOLTAGE – With pedal pressed, check for 12V at pin **9** of **G273**	OK ▶	Check and if necessary replace the electronic control unit contained in **N51**
	NO ▶	Restore wiring between pin **9** of **G273** and pin **1** of **H3**, across pin **3** of **G124** (RED-BLK)

FRONT LEFT-HAND SENSOR NOT CONNECTED — TEST E

TEST STEP	RESULT	CORRECTIVE ACTION
E1 CHECK FOR OPEN CIRCUIT – Engage the ignition key and check for open circuit between pins **7** and **13** of **G273**	OK ▶	carry out **step E2**
	NO ▶	carry out **step E3**
E2 CHECK CONTINUITY – Disconnect sensor **L29** and check continuity between sensor and pin **7** of **G273** , and between sensor and pin **13** of **G273**	OK ▶	Check and if necessary replace the sensor **L29**.
	NO ▶	Restore wiring between: • sensor **L29** and pin **7** of **G273** (BRN) • sensor **L29** and pin **13** of **G273** (GRN)
E3 CHECK CIRCUIT OPEN – Disconnect sensor **L29** and check for circuit open between pins **7** and **13** of **G273** (wiring side)	OK ▶	Check and if necessary replace sensor **L29**.
	NO ▶	Restore the wiring eliminating the short-circuit between the BRN and GRN cables connecting **L29** with **G273**

FRONT RIGHT-HAND SENSOR NOT CONNECTED — TEST F

TEST STEP	RESULT	CORRECTIVE ACTION
F1 CHECK CIRCUIT OPEN – Engage the ignition key and check for ciurcuit open between pins **5** and **11** of **G273**	OK ▶	carry out **step F2**
	NO ▶	carry out **step F3**
F2 CHECK CONTINUITY – Disconnect the sensor **L28** and check for continuity between the sensor and pin **5** of **G273**, and between sensor and pin **11** of **G273**	OK ▶	Check and if necessary replace sensor **L28**.
	NO ▶	Restore wiring between: • sensor **L28** and pin **5** of **G273** (BRN) • sensor **L28** and pin **11** of **G273** (WHT)
F3 CHECK FOR CIRCUIT OPEN – Disconnect the sensor **L28** and check for circuit open between pins **5** and **11** of **G273** (wiring side)	OK ▶	Check and if necessary replace sensor **L28**.
	NO ▶	Restore the wiring eliminating the short circuit between the BRN WHT cables connecting **L28** with **G273**

REAR LEFT-HAND SENSOR NOT CONNECTED — TEST G

TEST STEP	RESULT	CORRECTIVE ACTION
G1 CHECK CIRCUIT OPEN – Engage the ignition key and check for circuit open between pins **4** and **2** of **G273**	OK ▶	carry out **step G2**
	NO ▶	carry out **step G3**
G2 CHECK CONTINUITY – Disconnect the sensor **L31** and check continuity between the sensor and pin **4** of **G273**, and between the sensor and pin **2** of **G273**	OK ▶	Check and if necessary replace sensor **L31**.
	NO ▶	Restore wiring between: • sensor **L31** and pin **4** of **G273** (YEL) • sensor **L31** and pin **2** of **G273** (BRN)
G3 CHECK CIRCUIT OPEN – Disconnect the sensor **L31** and check for circuit open between pins **4** and **2** of **G273** (wiring side)	OK ▶	Check and if necessary replace sensor **L31**.
	NO ▶	Restore the wiring eliminating the short-circuit between the BRN and YEL cables connecting **L31** con **G273**

REAR RIGHT-HAND SENSOR NOT CONNECTED — TEST H

TEST STEP	RESULT	CORRECTIVE ACTION
H1 CHECK CIRCUIT OPEN – Engage the ignition key and check for circuit open between pins 6 and 14 of **G273**	OK ▶	carry out **step H2**
	OK ▶	carry out **step H3**
H2 CHECK CONTINUITY – Disconnect the sensor **L30** and check continuity between the sensor and pin **6** of **G273**, and between the sensor and pin 14 of **G273**	OK ▶	Check and if necessary replace sensor **L30**.
	OK ▶	Restore wiring between: • sensor **L30** and pin 6 of **G273** (RED) • sensor **L30** and pin 14 of **G273** (BRN)
H3 CHECK CIRCUIT OPEN – Disconnect the sensor **L28** and check for circuit open between pins 6 and 14 of **G273** (wiring side)	OK ▶	Check and if necessary replace sensor **L30**.
	OK ▶	Restore the wiring eliminating the short-circuit between the BRN and RED cables connecting **L30** con **G273**

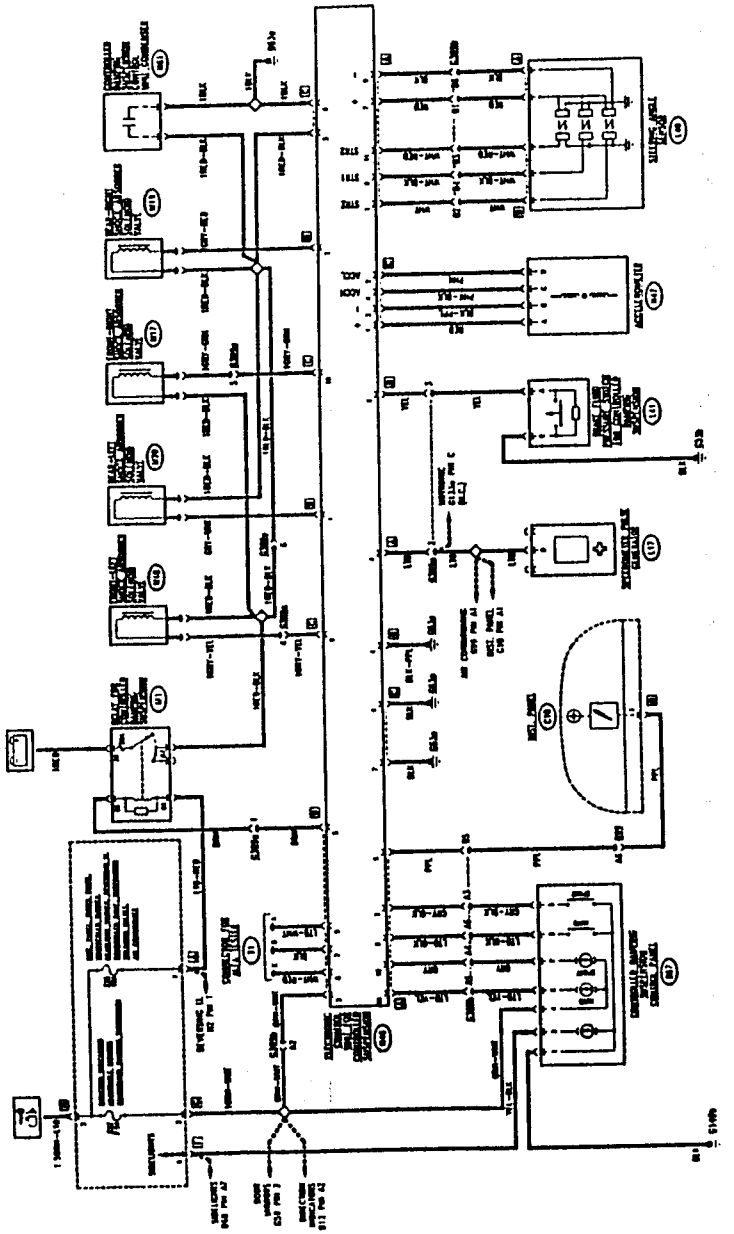
INSUFFICIENT POWER SUPPLY VOLTAGE — TEST I

TEST STEP	RESULT	CORRECTIVE ACTION
I1 CHECK VOLTAGE – Check that the battery voltage is **12V**	OK ▶	carry out **step I2**
	OK ▶	Restore the correct voltage recharging or replacing the battery **A1** **NOTE:** If the voltage in the battery falls, below 12 V, even if only slightly this and other electronic systems could be negatively affected
I2 CHECK VOLTAGE – Check for a voltage of **12 V** at pin **2** of **G272**	OK ▶	carry out **step I3**
	OK ▶	Restore wiring between pin 2 of **G272** and battery **A1** (RED)
I3 CHECK VOLTAGE – With ignition key engaged, check for a voltage of 12 V at pin 1 of **G272**	OK ▶	Check the state of the connector. Check and if necessary replace the electronic control unit contained in **N51**
	OK ▶	Restore wiring between pin 1 of **G272** and the ignition switch **B1** (PNK-BLK and GRY-BLK)

CONTROLLED DAMPING SUSPENSION

INDEX

WIRING DIAGRAM



GENERAL DESCRIPTION

The electronic system controlling the suspension varies the setting of the four shock absorbers, in real time, on the basis of the variations in driving and road conditions detected by the relevant sensors. This means that road holding and comfort are greatly increased.

Depending on the choice of the driver, the system operates with two different intervention procedures:

- "AUTO" which entrusts the control of the shock absorbers to the electronic system under all driving conditions;
- "SPORT" which locks the setting to "rigid" permitting high performance sports driving.

The choice between the two possibilities is made by acting on one of two buttons located on the relative control panel B67 equipped with leds which signal the selected option.

PRINCIPLES OF OPERATION:

The electronic control unit N46 varies the setting of the suspension by acting on solenoid valves M17-M18-M19-M20 which adjust the flow of oil within the shock absorbers.
The rigidity varies in relation to the speed of the vehicle, detected by the speedometer sensor L17.
At extremely low speed (below approximately 5 km/h) the setting remains rigid, thus avoiding excessive springiness during manoeuvring or when driving on rough roads. For speeds up to approximately 30 km/h the soft setting of the steering is employed ensuring ease of driving and greater comfort, while a rigid setting controls accelerating and braking.
At higher speeds the system changes the rigidity when one of the sensors signals particular road or driving conditions, for example:

- sudden changes in direction or tight bends, through the steering angle sensor L40, which measures angles and speed of rotation of the steering wheel;
- bumps or roughness through the accelerometer N47 which detects relevant vertical accelerations;
- sudden braking detected by the brake fluid pressure switch L41, which intervenes when the pressure of the brake fluid is higher than 20 bars;
- increasing speed, detected by the speedometer sensor L17, increases the rigidity of the system (above 150 km/h, for example. It is rigid under all conditions).

SELF-DIAGNOSIS:

The system automatically and continuously controls its own operation (self-diagnosis): any anomalies which are picked up, are signalled by the control unit via the relative warning lamp located on the instrument panel and, at the same time, the system is set to the "rigid" position whatever the option selected. The warning light will stay on, as long as the key is in the ignition, until the fault has been rectified.

It will therefore be necessary to carry out the troubleshooting as indicated below. An electronic diagnosis is also possible by connecting connector T1 to the ALFA ROMEO Tester.

During starting the warning light comes on for 2 - 3 seconds, then, if no malfunctions have been detected, it goes out. This makes it possible to easily check the correct operation of the system.

FUNCTIONAL DESCRIPTION

The system is controlled by the control unit N46, located under the rear seat.
The supply to the control unit is key-operated via fuse F17 (7.5 A) in fusebox G1.
The same line also supplies the control panel B67, which is in addition connected to the sidelights circuit so that the control panel is lit.
This is connected via four signals to the control unit: an ground signal (from pin 2 for the "AUTO" logic, from pin 5 for the "SPORT" logic) is sent to the control unit when the switch of the chosen option is pressed, which informs the control unit. A "feed- back" signal (at pin 6 or 7) lights up the relative warning lamp.
A specific line connects the control unit to the instrument panel C10 (pin 3 of connector D) to which the processed malfunction signal is sent by the self-diagnosis function.
The control unit is also connected with three signals at the connector for the system diagnosis T1.
The control unit receives signals from the sensors to which it is directly connected;

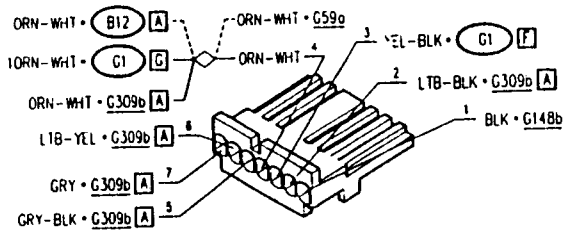
- three signals from the steering angle sensor L40:
  three leds and three photoconductive diodes measure the steering angles and transform them into impulses; the first signal (STR-Z), from pin 1B, indicates rectilinear direction and the others (STR1 and STR2), from pins 2B and 3B, send an impulse approximately every 18° of steering angle spread so that the control unit is signalled each 9°). Power supply and ground reach pins 2A and 1A respectively of the sensor.

- two signals from the accelerometer N47:
  the vertical acceleration of the vehicle cause impulses to be sent to the control unit. These impulses correspond to two acceleration values: the first (ACCL) signals low acceleration (0.08g), pin D; the second (ACCH) high acceleration (0.16g), pin C. Pins B and A receive ground and supply respectively.
- a speed signal from the speedometer L17
- a braking signal from the brake fluid pressure switch L41

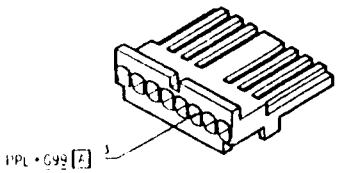
Processing of these signals by the stored logic of the control unit prepares the signals which are then sent to the solenoid valve controlling the shock absorbers (M17 front right; M18 front left; M19 rear right and M20 rear left).
In addition to the control signal coming from the control unit, each solenoid valve receives current from a relative relay with incorporated 30A fuse f71, of which the coil, under key operated supply via fuse F15 (20 A) in fusebox G1, is grounded by the control unit itself in this way powering the solenoid valve with voltage from the battery. A 0.22 µF) condenser N61 has been installed to avoid radio interference on the wiring.

COMPONENTS AND CONNECTORS

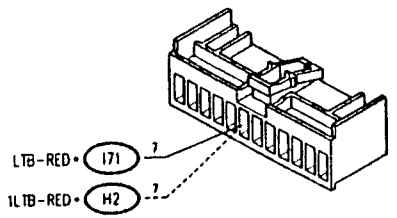
Controlled damping suspension control panel — B67



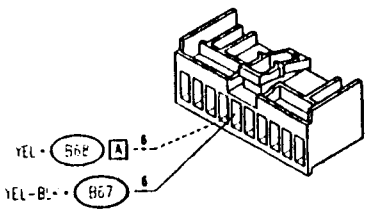
Instrument panel — C10 D



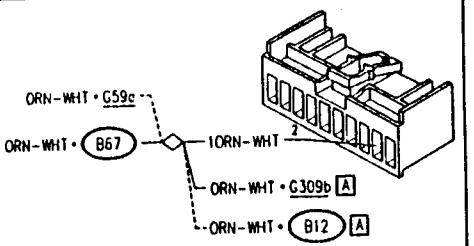
Fusebox — G1 A



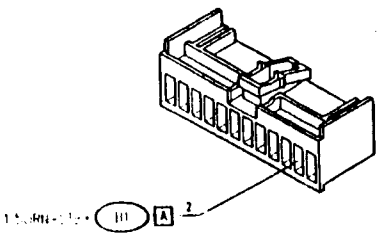
Fusebox — G1 F



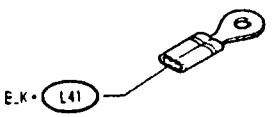
Fusebox — G1 G



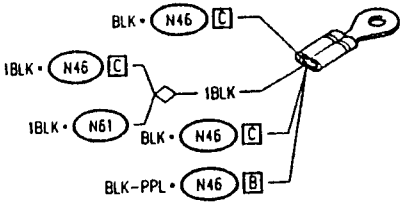
Fusebox — G1 H



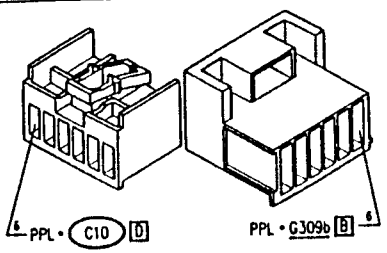
Engine compartment ground-left side — G53b



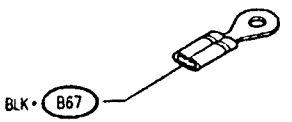
Rear right ground — G63a



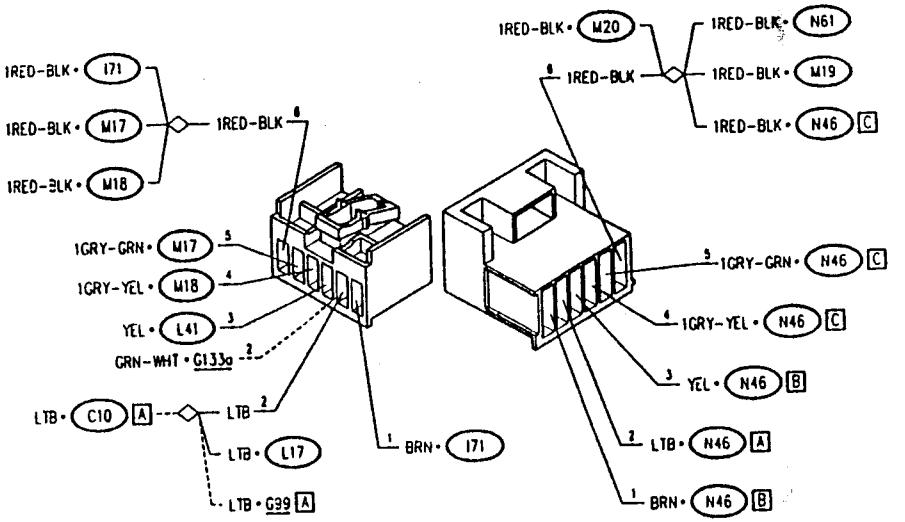
Dashboard/engine connection — G99 A



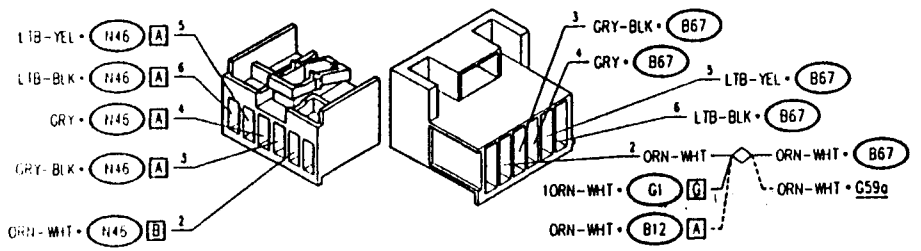
Under-dashboard ground-left side — G148b



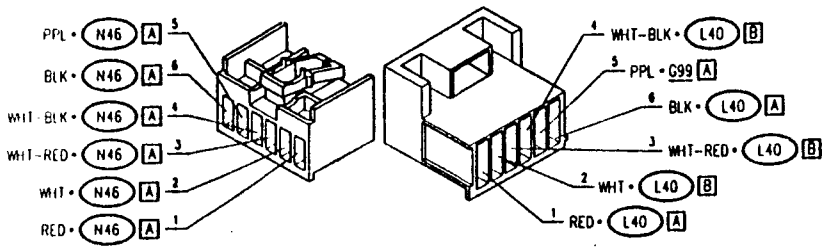
Controlled damping suspension A connection — G309a



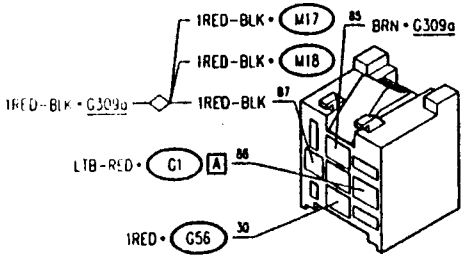
Controlled damping suspension B connection — G309b A



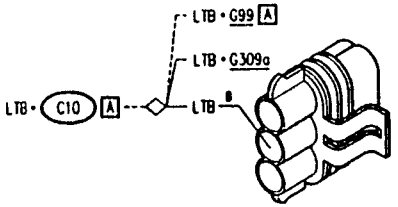
Controlled damping suspension B connection — G309b B



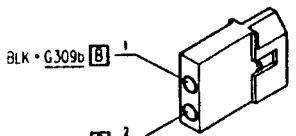
Relay for controlled damping suspension — I71



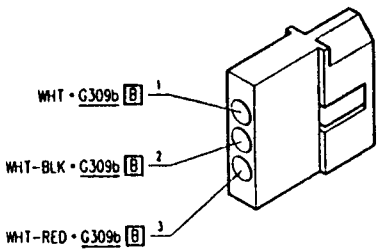
Speedometer pulse generator — L17



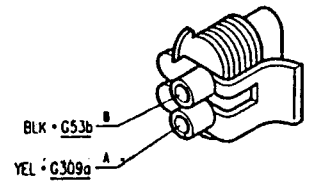
Steering angle sensor — L40 A



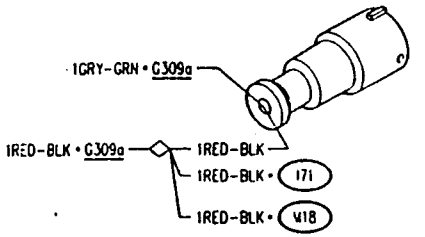
Steering angle sensor — L40 B



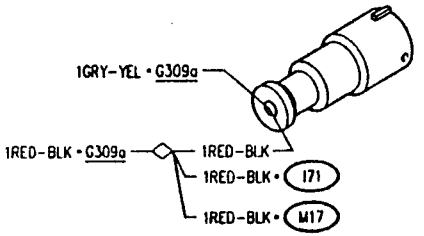
Brake fluid pressure switch for controlled damping suspension — L41



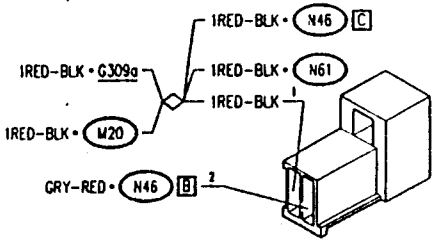
Front-right shock absorber solenoid valve — M17



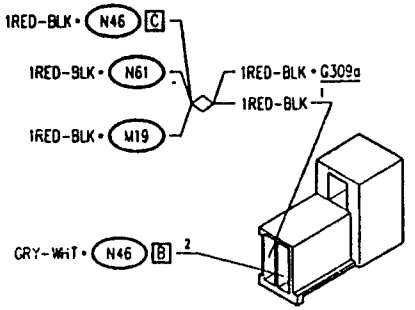
Front-left shock absorber solenoid valve — M18



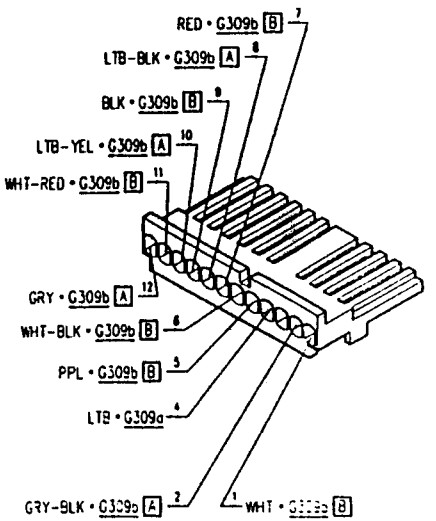
Rear-right shock absorber solenoid valve — M19



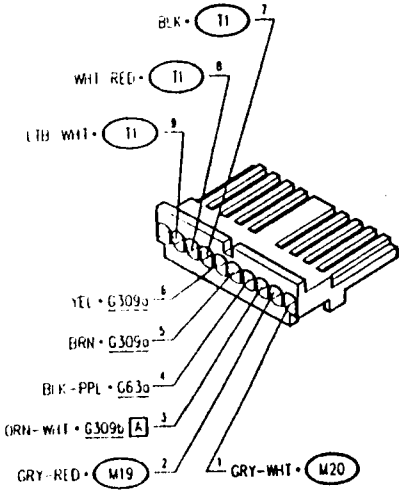
Rear-left shock absorber solenoid valve — M20



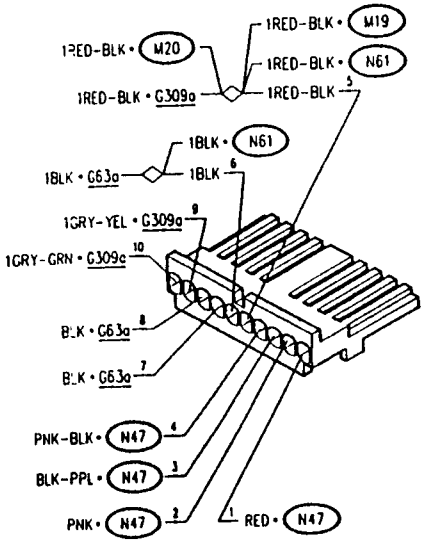
Electronic control unit for controlled damping suspension — N46 A



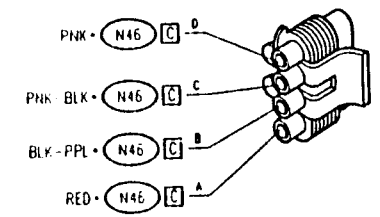
Electronic control unit for controlled damping suspension (N46 B)



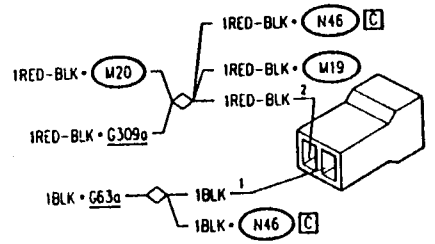
Electronic control unit for controlled damping suspension (N46 C)



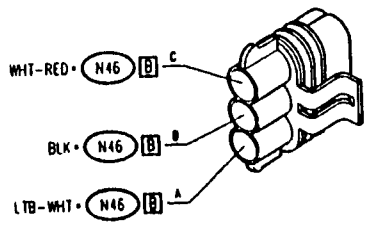
Accelerometer (N47)



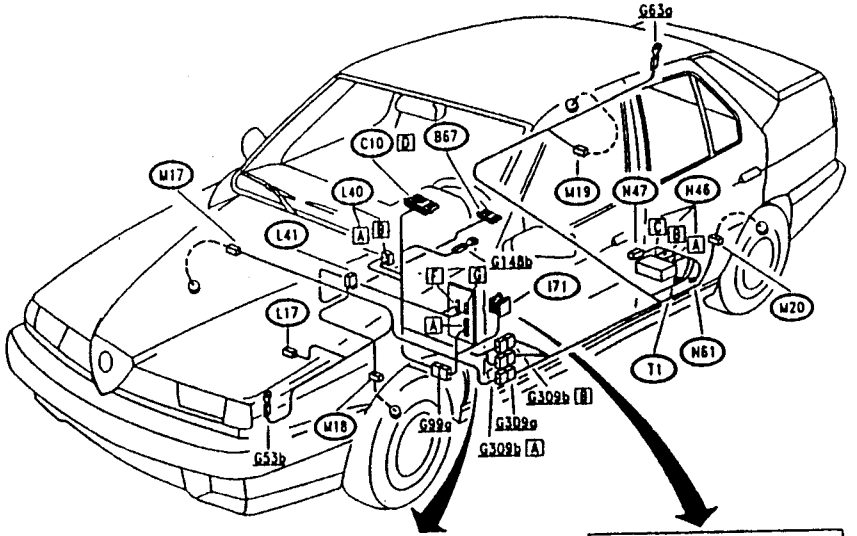
Controlled damping suspension control unit condenser (N61)

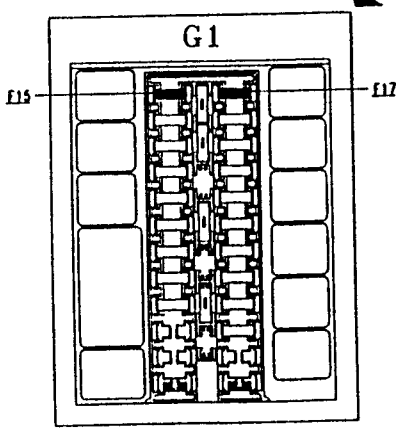


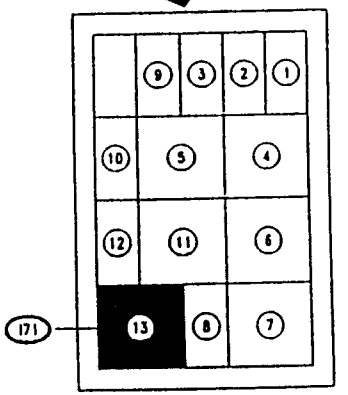
Connector for ALFA TESTER (T1)



LOCATION OF COMPONENTS







From chassis N.30.733

Up to chassis N.30.732

I71 = BROWN relay holder

CHECK ACCELEROMETER — TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B1 CHECK "ACCH" SIGNAL – Separate the accelerometer **N47** from the control unit **N46**; place it on the bottom of the vehicle and, leaving it connected, rotate the ignition key: • check that when subjecting it to a light knock (e.g. letting a ball-bearing fall on the accelerometer), a variation in voltage is detected (from 1 to 5 V) at pin C4 of control unit **N46**	OK ▶ ~~OK~~ ▶	Carry out **step B2** Carry out **step B3**
B2 CHECK "ACCL" SIGNAL – Proceeding as for the previous step, check for a variation in voltage at pin C2 of control unit **N46**	OK ▶ ~~OK~~ ▶	Carry out **test C** Carry out **step B3**
B3 CHECK VOLTAGE – Engage the ignition key and check for a difference in voltage of at least 5 V between pins A and B of accelerometer **N47**	OK ▶ ~~OK~~ ▶	Carry out **step B5** Carry out **step B4**
B4 CHECK VOLTAGE – Engage the ignition key and check for a difference in voltage of at least 5 V between pins C1 and C3 of control unit **N46**	OK ▶ ~~OK~~ ▶	Restore wiring between: • pin C1 of **N46** and pin A of **N47** (RED) • pin C3 of **N46** and pin B of **N47** (BLK-PPL) Check and if necessary replace electronic control unit **N46**
B5 CHECK CONTINUITY – Check continuity between: • pin C4 of **N46** and pin C of **N47** • pin C2 of **N46** and pin D of **N47**	OK ▶ ~~OK~~ ▶	Replace accelerometer **N47** Restore wiring between: • pin C4 of **N46** and pin C of **N47** (PNK-BLK) • pin C2 of **N46** and pin D of **N47** (PNK)

CHECK SHOCK ABSORBER SOLENOID VALVES — TEST C

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
C1 CHECK SOLENOID VALVES – Check for an impedance of approximately 3÷3.3 Ω at the terminals of the solenoid valves **M17, M18, M19, M20**	OK ▶ ~~OK~~ ▶	Carry out **step C2** Replace the faulty solenoid valve(s)
C2 CHECK CONTINUITY – Check continuity between pin 87 of relay **I71** and pin C5 of control unit **N46**	OK ▶ ~~OK~~ ▶	Carry out **step C3** Restore wiring between pin 87 of **I71** and pin C5 of control unit **N46**, across pin 6 of connector **G309a** and the solders (RED-BLK)
C3 CHECK CONTINUITY – Check continuity between pin 87 of relay **I71** and solenoid valves (terminal with RED-BLK wire)	OK ▶ ~~OK~~ ▶	Carry out **step C4** Restore wiring between: • pin 87 of **I71** and solenoid valve **M18**, across the solder (RED-BLK) • pin 87 of **I71** and solenoid valve **M17**, across the solder (RED-BLK) • pin 87 of **I71** and solenoid valve **M20**, across pin 6 of connector **G309a** and the solders (RED-BLK) • pin 87 of **I71** and solenoid valve **M19**, across pin 6 of connector **G309a** and the solders (RED-BLK)
C4 CHECK CONTINUITY – Check continuity between pin C9 of control unit **N46** and solenoid valve **M18**	OK ▶ ~~OK~~ ▶	Carry out **step C5** Restore wiring between pin C9 of control unit **N46** and solenoid valve **M18**, across pin 4 of connector **G309a** (GRY- YEL)
C5 CHECK CONTINUITY – Check continuity between pin C10 of control unit **N46** and solenoid valve **M17**	OK ▶ ~~OK~~ ▶	Carry out **step C6** Restore wiring between pin C10 of control unit **N46** and solenoid valve **M17**, across pin 5 of connector **G309a** (GRY- GRN)
C6 CHECK CONTINUITY – Check continuity between pin B1 of control unit **N46** and solenoid valve **M20**	OK ▶ ~~OK~~ ▶	Carry out **step C7** Restore wiring between pin B1 of control unit **N46** and solenoid valve **M20** (GRY-WHT)
C7 CHECK CONTINUITY – Check continuity between pin B2 of control unit **N46** and solenoid valve **M19**	OK ▶ ~~OK~~ ▶	Carry out **test D** Restore wiring between pin B2 of control unit **N46** and solenoid valve **M19** (GRY-RED)

CHECK BRAKING SENSOR — TEST D

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
D1 CHECK SENSOR – Check for a resistance of approximately 2200 Ω between pin A and B of sensor L41	OK ▶ NO ▶	Carry out step D2 Replace sensor L41
D2 CHECK SENSOR – Fully depress the brake pedal and check for a short circuit between pins A and B of sensor L41	OK ▶ NO ▶	Carry out step D3 Replace sensor L41
D3 CHECK GROUND – Check that pin B of L41 is grounded	OK ▶ NO ▶	Carry out step D4 Restore wiring between pin B of L41 and ground G53b (BLK)
D4 CHECK CONTINUITY – Check continuity between pin A of L41 and pin B6 of N46	OK ▶ NO ▶	Carry out test E Restore wiring between pin A of L41 and pin B6 of N46, across pin 3 of connector G309a (YEL)

CHECK SPEEDOMETER SIGNAL — TEST E

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
E1 CHECK SPEEDOMETER – Check for correct functioning of the speedometer on the instrument panel C10	OK ▶ NO ▶	Carry out step E2 Refer to the fault diagnosis relative to the speedometer in the section "Instrument Panel"
E2 CHECK SIGNAL – Check for a speedometer signal by proceeding as follows: • connect pins C and A of sensor L17 respectively to 12V and ground • insert the shaft of an electric motor in the sensor • check that, varying the speed of the electric motor, the signal reaching pin A4 of control unit N46 varies in frequency between 1 and 7.5 V	OK ▶ NO ▶	Carry out test F Restore wiring between pin B of L17 and pin A4 of N46, across pin 2 of connector G309a and the solder (LTB)

CHECK STEERING SENSOR — TEST F

NOTE: Check that the steering is aligned correctly before carrying out this test (see "REPAIR MANUAL - MECHANICAL UNITS", Group 21)

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
F1 CHECK "STRZ" SIGNAL – With the wheels perfectly aligned, engage the ignition key and check for 0V at pin A1 of control unit N46. Check for a variation in voltage when rotating the steering wheel.	OK ▶ NO ▶	Carry out step F2 Carry out step F4
F2 CHECK "STR1" SIGNAL – With the wheels perfectly aligned, engage the ignition key and check for voltage of 3-5 V at pin A6 of control unit N46. Rotating the steering wheel check that the voltage decreases to 0 V every 18° and viceversa.	OK ▶ NO ▶	Carry out step F3 Carry out step F8
F3 CHECK "STR2" SIGNAL – With the wheels perfectly aligned, engage the ignition key and check for a voltage of 0 V at pin A11 of control unit N46. Rotating the steering wheel check that the voltage increases to 3-5 V every 18° and vice-versa.	OK ▶ NO ▶	Carry out test H Carry out step F9
F4 CHECK VOLTAGE – Engage the ignition key and check for a difference in voltage of at least 5 V between pins A1 and A2 of sensor L40	OK ▶ NO ▶	Carry out step F7 Carry out step F5
F5 CHECK VOLTAGE – Engage the ignition key and check for a difference in voltage of at least 5 V between pins A7 and A9 of control unit N46	OK ▶ NO ▶	Restore wiring between: • pin A7 of N46 and pin A2 of N47, across pin B1 of connector G309b (RED) • pin A9 of N46 and pin A1 of N47, across pin B6 of connector G309b (BLK) Carry out step F6
F6 CHECK SENSOR – Engage the ignition key and, disconnecting sensor L40, check for a difference in voltage lower than 5 V between pins A1 and A2 of sensor L40	OK ▶ NO ▶	Check and if necessary replace electronic control unit N46 Replace sensor L40

(continues)

CHECK STEERING SENSOR — TEST F

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
F7 CHECK CONTINUITY – Check continuity between pin A1 of **N46** and pin B1 of L40	OK ▶	Replace sensor **L40**
	NOT OK ▶	Restore wiring between pin A1 of **N46** and pin B1 of L40, across pin B2 of connector G309b (WHT)
F8 CHECK CONTINUITY – Check continuity between pin A6 of **N46** and pin B2 of L40	OK ▶	Replace sensor **L40**
	NOT OK ▶	Restore wiring between pin A6 of N46 and pin B2 of L40, across pin B4 of connector G309b (WHT-BLK)
F9 CHECK CONTINUITY – Check continuity between pin A11 of **N46** and pin B3 of L40	OK ▶	Replace sensor **L40**
	NOT OK ▶	Restore wiring between pin A11 of N46 and pin B3 of L40, across pin B3 of connector G309b (WHT-RED)

CHECK CONTROL PANEL — TEST G

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
G1 CHECK FUSE – Check for damage of fuse **F17** in fusebox **G1**	OK ▶	Carry out **step G2**
	NOT OK ▶	Replace fuse (7.5A)
G2 CHECK VOLTAGE – Check for 12 V at pin 4 of panel **B67**	OK ▶	Carry out **step G3**
	NOT OK ▶	Restore wiring between pin 4 of B67 and pin G2 of G1, across the solder (ORN-WHT)
G3 CHECK GROUND – Check for 0 V at pin 1 of panel **B67**	OK ▶	Carry out **step G4**
	NOT OK ▶	Restore wiring between pin 1 of B67 and ground G148b (BLK)

(continues)

CHECK CONTROL PANEL — TEST G

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
G4 CHECK LIGHTING – Check that, with sidelights on, the panel lights up	OK ▶	Carry out **step G6**
	NOT OK ▶	Carry out **step G5**
G5 CHECK VOLTAGE – With sidelights on, check for 12 V at pin 3 of B67	OK ▶	Replace panel B67
	NOT OK ▶	Restore wiring between pin 3 of B67 and pin F6 of G1 (YEL-BLK)
G6 CHECK SIGNAL – Pressing the "AUTO" button, check for a ground signal (0V) at pin A8 of control unit N46	OK ▶	Carry out **step G7**
	NOT OK ▶	Carry out **step G8**
G7 CHECK SIGNAL – Pressing the "SPORT" button, check for a ground signal (0V) at pin A2 of control unit N46	OK ▶	Carry out **step G10**
	NOT OK ▶	Carry out **step G9**
G8 CHECK SIGNAL – After pressing the "AUTO" button, check for a ground signal (0V) at pin 2 of panel **B67**	OK ▶	Restore wiring between pin A8 of N46 and pin 2 of B67, across pin A8 of connector G309b (LTB-BLK)
	NOT OK ▶	Replace the panel B67
G9 CHECK SIGNAL – After pressing the "SPORT" button, check for a ground signal (0V) at pin 5 of panel **B67**	OK ▶	Restore wiring between pin A2 of N46 and pin 5 of B67, across pin A3 of connector G309b (GRY-BLK)
	NOT OK ▶	Replace panel B67

(continues)

CHECK CONTROL PANEL — TEST G

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
G10 CHECK LED WARNING LAMPS – Check that, pressing the "AUTO" or "SPORT" buttons, the relative led lights up	OK ▶	Carry out test H
	NO ▶	Carry out step G11
G11 CHECK SIGNAL – Pressing the "AUTO" button, check for 0 V at pin 6 of panel B67 Pressing the "SPORT" button, check for 0 V at pin 7 of panel B67	OK ▶	Replace panel B67
	NO ▶	Carry out step G12
G12 CHECK SIGNAL – Pressing the "AUTO" button, check for 0 V at pin A10 of control unit N46 Pressing the "SPORT" button, check for 0 V at pin A12 of control unit N46	OK ▶	Restore wiring between pin 6 of B67 and pin A10 of N46, across pin A5 of connector G309b (LTB-YEL) Restore wiring between pin 7 of B67 and pin A17 of N46, across pin A4 of connector G309b (GRY)
	NO ▶	Check and if necessary replace control unit N46

CHECKING POWER SUPPLY TO CONTROL UNIT — TEST H

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
H1 CHECK FUSE – Check for damage of fuse F17 in fusebox G1	OK ▶	Carry out step H2
	NO ▶	Replace fuse (7.5A)
H2 CHECK VOLTAGE – Check for 12 V at pin B3 of control unit N46	OK ▶	Carry out step H3
	NO ▶	Restore wiring between pin B3 of N46 and pin G2 of G1, across pin A2 of connector G309b and the solder (ORN-WHT)
H3 CHECK GROUND – Check that pins B4, C6, C7, and C8 of control unit N46 are grounded (0 V)	OK ▶	If all the preceeding tests have been carried out, check and if necessary replace the control unit N46
	NO ▶	Restore wiring between: • pin B4 of N46 and ground G63a (BLK-PPL) • pin C6 of N46 and ground G63a, across the solder (BLK) • pin C7 of N46 and ground G63a (BLK) • pin C8 of N46 and ground G63a (BLK)

SUSPENSION SYSTEM MALFUNCTION WARNING LIGHT NOT WORKING — TEST I

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
I1 CHECK WARNING LAMP – Engage the ignition key and check that "suspension system malfunction" warning lamp comes on on the instrument panel C10: the warning lamps stays on	OK ▶	Carry out all the tests from TEST A to TEST F. If no malfunction is detected, replace the control unit N46
	NO ▶	Carry out step I2
I2 CHECK GROUND SIGNAL – Engage the ignition key and for a few seconds, check for a signal of 0 V at pin D3 of instrument panel C10	OK ▶	Replace the relative warning lamp on the instrument panel C10
	NO ▶	Carry out step I3
I3 CHECK CONTINUITY – Check continuity between pin D3 of C10 and pin A5 of N46	OK ▶	Check and if necessary replace control unit N46
	NO ▶	Restore wiring between pin D3 of C10 and pin A5 of N46, across pin A6 of connector G99 and pin B5 of connector G309b (PPL)

COMPONENTS

(*) This key refers to alfa 155 models and versions

COMPONENTS

H44 Anti-theft device switch in engine bay
H51 Sunroof stop limit switch
H54 Full load switch

I RELAYS
I1 Engine cooling fan relay
I1a Engine cooling fan relay
I1b Engine cooling fan relay
I2 Heated rear window relay
I3 Horn relay
I13 Rear power window relay
I17 Fog-light relay
I25 Rear fog light relay
I28 Relay for hazard warning lights
I29 Fuel pump relay
I35 Key-operated supply relay
I44 Fuel pre-heating device relay
I49 Dipped beam headlight relay
I50 Main beam headlight relay
I52 Boot lid opening relay
I57 ABS system electronic relay
I58 Sunroof relay
I64 Sidelights relay
I65 Fog-light consensus relay
I67 Day-light exclusion relay
I68 Supplementary engine cooling fan relay
I71 Relay for controlled damping suspension
I87 Left seat warming pad relay
I88 Right seat warming pad relay
I91 DIM-DIP engagement relay

L SENDERS
L2 Engine oil minimum pressure switch
L5 Engine coolant max. temperature warning lamp thermal switch
L6 Thermal switch for engine cooling electric fan
L7 Engine coolant temperature sender
L8 Oil pressure gauge sender
L9 Fuel level gauge sender
L10 Sender for engine coolant temperature gauge and max temperature warning lamp contact
L12 Engine oil level sensor
L13 Windscreen washer liquid level sensor
L14 Engine coolant level sensor
L16 Rev counter sensor
L17 Speedometer pulse generator
L22 Knock sensor
L28 Front-right phonic wheel sensor
L29 Front-left phonic wheel sensor
L30 Rear-right phonic wheel sensor
L31 Rear-left phonic wheel sensor
L33 Two-stage thermocontact
L36 Max. turbo pressure sensor
L40 Steering angle sensor
L41 Brake fluid pressure switch for controlled damping suspension
L44 Motor oil temperature sender
L45 K.S.B. water temperature sensor
L46 E.G.R. solenoid valve
L49 Sensor on accelerator pedal
L58a Volumetric sensor for right-hand anti-theft device
L58b Volumetric sensor for left-hand anti-theft device
L50 Fuel filter water sensor

M SOLENOIDS - SOLENOID VALVES
M5 Engine stop electromagnet
M12 Boot lid opening actuator solenoid
M15 Vapour recovery solenoid valve
M16 Over-boost solenoid valve
M17 Front-right shock absorber solenoid valve
M18 Front-left shock absorber solenoid valve
M19 Rear-right shock absorber solenoid valve
M20 Rear-left shock absorber solenoid valve

N ELECTRONIC DEVICES- INTERMITTENCES - TIMERS
N1 Electronic ignition module
N1a Electronic ignition A module
N1b Electronic ignition B module
N6 Glow plug warming timer
N10 Courtesy light timer
N11 Door locking control unit
N12 Headlight washer timer
N13 Hazard warning lights and direction indicators intermittence
N14 Electronic windscreen wiper intermittence
N27 ABS system electronic control unit
N28 ABS system brake fluid pump device
N31 Fuel pre-heating device
N38 Power window control unit
N45 Anti-theft device control unit
N46 Electronic control unit for controlled damping suspension
N47 Accelerometer
N49 Aerial control unit - Heated rear window
N51 Hydraulic group with ABS control unit
N53 Luggage compartment light radio anti-interference condenser
N58 Seat adjustment control unit

N59 Check Panel control unit
N60 Sunroof control unit
N61 Controlled damping suspension control unit condenser
N62 ABS longitudinal accelerometer
N63 ABS transversal accelerometer
N66 Stop light radio anti-interference condenser
N67 Remote control signal receiver

O ANCILLARY EQUIPMENT
O1 Heated rear window
O2 Horn
O3 Antenna
O4 Radio
O5 Loud-speaker
O5a Front RH loud-speaker
O5b Front LH loud-speaker
O5c Rear RH loud-speaker
O5d Rear LH loud-speaker
O6 Cigar lighter
O14 Front-left seat warming pad
O17 Front-right seat warming pad
O18 Right door mirror defroster
O19 Left door mirror defroster
O22 Additional engine cooling fan resistance
O22a Additional engine cooling fan resistance
O22b Additional engine cooling fan resistance
O27 K.S.B. device
O28 DIM-DIP resistance

P ELECTRIC MOTORS
P1 Windscreen wiper motor
P2 Engine motor cooling fan
P2a Engine cooling fan motor
P2b Engine cooling fan motor
P5 Front-left seat adjustment motor
P6 Front-right backrest adjustment motor
P7 Front-left backrest adjustment motor
P8 Motor for electric door mirror - left side
P9 Motor for electric door mirror - right side
P10 Front-right door locking motor
P11 Front-left door locking motor
P12 Rear-right door locking motor
P13 Rear-left door locking motor
P14 Front-right power window motor
P15 Front-left power window motor
P16 Rear-right power window motor
P17 Rear-left power window motor
P18 Fuel motor pump
P19 Windscreen washer pump
P20 Headlight washer pump
P24 Sunroof motor
P28 Front-right seat longitudinal adjusting motor
P29 Front-left seat longitudinal adjusting motor
P30 Front-right seat adjustment motor
P35a Right headlight alignment adjustment motor
P35b Left headlight alignment adjustment motor

Q HEATER/VENTILATION - AIR CONDITIONING
Q1 Heating/ventilation electric fan
Q4 Heating/ventilation electric fan control knob
Q5 Heater fan speed rheostat
Q9 Minimum pressure switch
Q11 Compressor electromagnetic coupling
Q12 Compressor electromagnetic joint cut-off thermal contact
Q14 Supplementary conditioner fan relay
Q15 Heating-ventilation electric fan relay
Q20 Min. and max. pressure switch (Trinary)
Q21a Automatic control check unit
Q22 Electromagnetic coupling control relay
Q24 Outside air temperature sensor
Q25a Upper mixed air temperature sensor
Q25b Lower mixed air temperature sensor
Q27 Air recirculation vent control motor
Q30a Air distribution motor
Q30b Warm/cold air mixing motor
Q31 Conditioning unit fan speed adjuster
Q32 Heater/ventilation auxiliary relay
Q33 Passenger compartment temperature sensor with motor
Q35 Loose fuse for air-conditioning system - 40 A
Q36 Air conditioning system ground
Q39a Loose fuse for air-conditioning system - 30 A
Q39b Loose fuse for air-conditioning system - 30 A
Q40 Loose fuse for air-conditioning system - 15 A
Q41 Air conditioning relay and fuses assembly
Q42 Air conditioning fan delaying device
Q43 Loose fuse for conditioning system - 50 A
Q65 Loose fuse for air-conditioning system - 7.5A
Q66 Loose fuse for air-conditioning system - 3A
Q67 Compressor disengagement control unit
Q68 Compressor-air recirculation engagement switches
Q69 Heating-ventilation electric fan 1st speed relay

R SAFETY DEVICES
R9 Switch on seat belts

S	**ELECTRONIC INJECTION**
S1	Injection control unit
S3	Electroinjectors
S5	Air flow meter
S7	Engine coolant temperature sensor
S9	Air supplement solenoid valve (idle)
S11	Motronic control unit
S12a	Fuel pump Motronic relay
S12b	Motronic relay with diode
S12c	Timing variator Motronic relay
S12d	Auxiliary Motronic relay
S13	Timing sensor
S15	Timing variator device
S24	Connection for electroinjectors
S28	Injection control relay
S29	Idle adjustment actuator
S30	Motronic control unit switch connector
S31	Revolution and T.D.C. sensor
S34	Air temperature sensor
S35	Heated lambda probe
S36	Loose fuse for ignition relay
S38	Sensor on throttle body
S40	Ignition/injection control unit
S43	Absolute pressure sensor
S45	Loose fuse for Lambda probe
S46	Loose fuse for Motronic supply
S47	Loose fuse for fuel pump
S48	CO control trimmer
S50	Equipped injector
S51	Diesel fuel injection pump
T	**DIAGNOSIS**
T1	Connector for ALFA TESTER

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