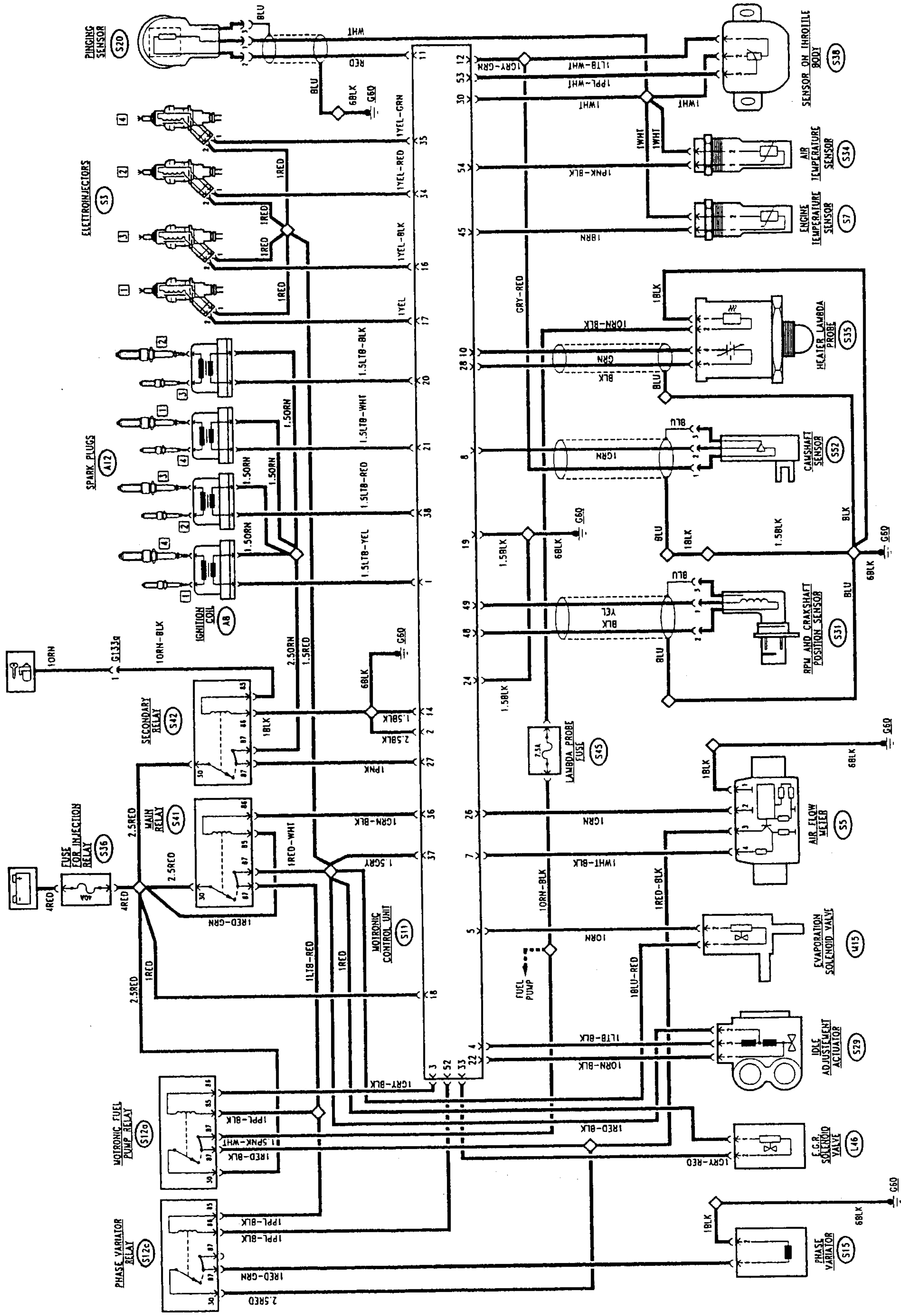
INJECTION/IGNITION SYSTEM
MOTRONIC M2.10.3
- 2.0 T.SPARK 16v Engine -

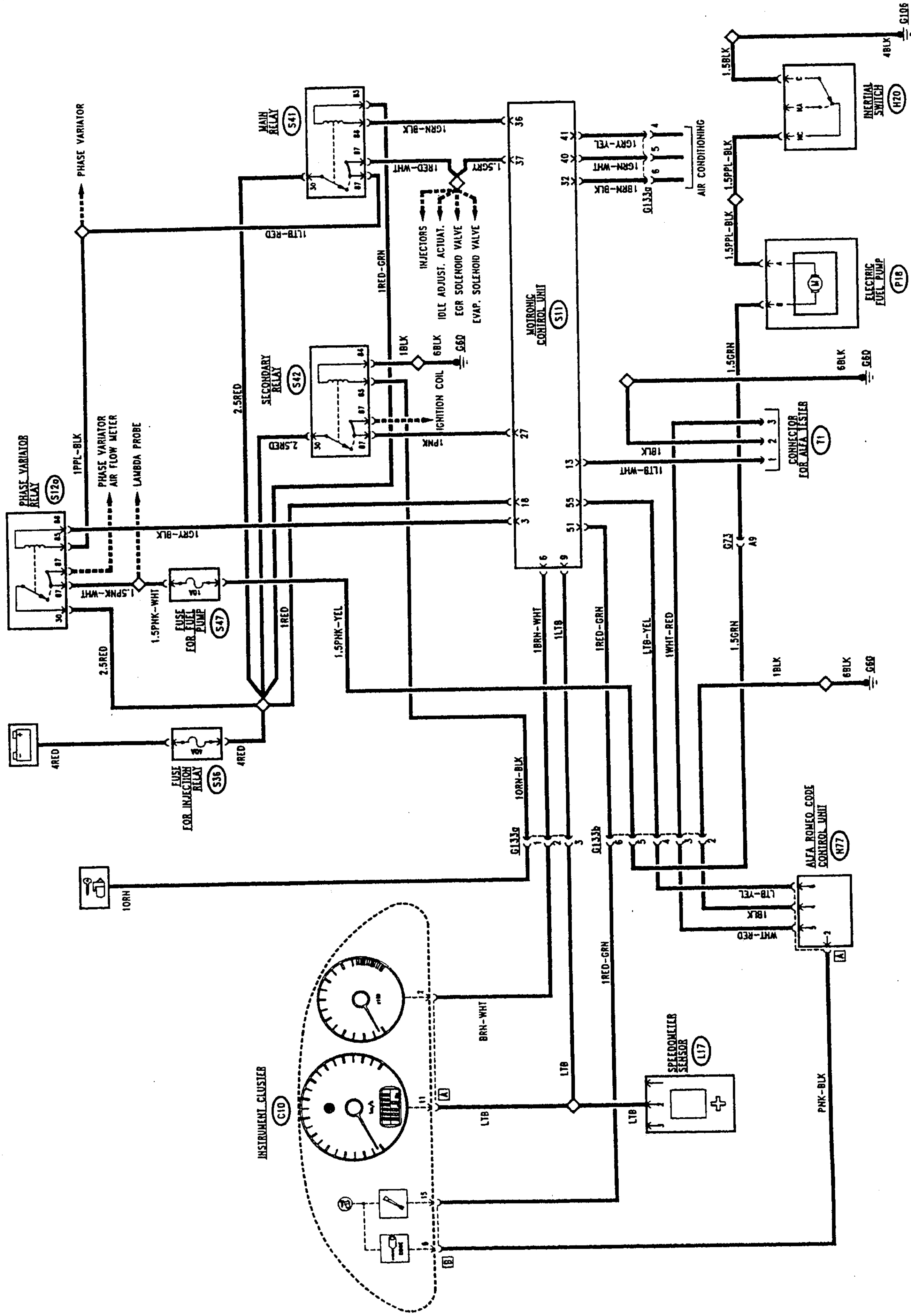
INDEX

WARNING
Only up to chassis no. ...

WIRING DIAGRAM A



WIRING DIAGRAM B



GENERAL DESCRIPTION

An electronic control system supervises and regulates all the parameters of the engine, optimising performance and consumption levels through response in real time to the different operating conditions.

This is the M 2.10.3 version of the proven and reliable BOSCH MOTRONIC system.
Compared with the previous versions this new M 2.10.3 system adopts a control unit - with 55 pins - with advanced design and production technology, it also possesses many possibilities for inserting auxiliary functions.

As a result of the use of new sensors and revision of the control programmes, the system makes it possible to achieve considerable improvements in terms of consumption and emission levels and vehicle handling.

Another feature of this system is self-adaptation, i.e. the capability to recognise the changes that take place in the engine and to compensate them, according to functions which mainly correct:

- the mixture titration;
- the caburetion parameters according to the command of the evaporative solenoid valve;
- an adaptive programme for idle speed control.

FUNCTIONS OF THE SYSTEM

Sequential and timed injection (S.E.F.I.)

With this control unit, fuel injection is sequential and timed for each cylinder: the injection instant (delivery of fuel into the intake manifolds by the opening of the injectors) is not simultaneous for all the cylinders, but takes place for each cylinder in correspondence with the optimum point of injection, calculated by the control unit according to special maps depending on the load, speed and temperature of the engine.
NOTE: the instant considered in the design of the maps is that of the start of injection.

Static ignition

An electronic ignition system has been adopted with "static distribution" (with semi-conductors, without distributor). This solution makes it possible to eliminate rotary components; in addition, it does not produce external sparks thus reducing the risk of interferences; lastly it reduces the number of high voltage cables and connectors.
Static ignition takes place through two coils, according to the so-called "lost spark" logic: this solution exploits the different pressures and environments existi contemporaneously in a pair of cylinders: when one of the cylinders approaches the bursting stroke, with a mixture of air and fuel, the corresponding cylinder is at the end of the exhaust stroke in the presence of exhaust gas.
In a 4-cylinder in line engine, the paired cylinders are 1/4 and 2/3.

The solution adopted for this engine (T.SPARK and 16 valves) has required the adoption of a larger "central" spark plug and a smaller "side" spark plug.
Each of the four coils supplies the small spark plug of the cylinder below and simultaneously the large one of the paired cylinder.

NOTE: This way it is impossible to invert the spark plug cables during servicing operations.

Metering the air flow rate

The newly designed air flow meter adopted is of the "heated film" type; the operating principle is based on a heated plate inserted in the intake manifold.
The film plate is kept at a constant temperature (appr. 120°C) by a heating resistance placed in contact with it.
The mass of air flowing through the manifold tends to withdraw heat from the plate: therefore, to keep its temperature constant, a certain current needs to flow through the heating resistance: this current, suitably measured, is proportionate with the mass of flowing air.

N.B. This air flow meter measures directly the mass of air (and not the volume as in the previous versions with "floating port", thereby eliminating problems of temperature, altitude, pressure, etc.)
This air flow meter does not have a built-in intake air temperature sensor. This sensor is separate and to be found just downstream of the air-flow meter itself.

Cylinder detection

Following the sequential and timed injection system, a timing sensor has been introduced (cam angle sensor): this makes it possible to detect which cylinder is in the bursting stroke when the engine is started, in order to be able to start the correct injection sequence.
The sensor is formed of a Hall-effect device by which the voltage signal sent to the control unit "lowers" suddenly when the tooth machined on the camshaft pulley passes in front of the actual sensor; therefore a signal is sent every two turns of the crankshaft.

Fuel pump

The complex control logic of the fuel pump carried out by the control unit (mainly based on the rpm signal) immediately cuts off the supply to the pump as soon as the engine stops.
Moreover, the pump will not operate with the key engaged and the engine not running.

In this car, this logic is integrated - in order to further higher the standards of safety - by the **inertial switch** device: this is an electromechanical switch which, in the event of heavy shocks, opens to cut off the circuit that takes the earth to the fuel pump, which stops instantaneously. This device is particularly important as an integration of the safety guaranteed by the logic of the control unit, especially if the car is hit from behind or in the case of other accidents in which the engine does not stop immediately.

Timing variator

This T.SPARK 16 valve engine is fitted with an electro-mechanical-hydraulic timing variator which is connected to the camshaft and controls and adjusts intake timing (advance) in such a way that a larger amount of air is taken in. This device is activated by the control unit only after exceeding a determinate rpm and engine load to avoid adversely affecting correct operation of the engine at low speeds.

Percentage of exhaust gas recirculation

Nox (nitric oxide) is developed at high temperatures in the combustion chambers.
To reduce these emissions an E.G.R. (Exhaust Gas Recirculation) system is adopted which by recirculating part of the exhaust gases, lowers the temperature, thus the Nox produced, in the combustion chambers. In fact, part of the exhaust gas is withdrawn through the special E.G.R. Valve and re-admitted to the intake box where it is mixed with the intaken air and burnt again in the engine. The E.G.R. valve is modulated by a solenoid valve controlled by the injection control unit and, as a result of the type of control, in addition to reducing the amount of Nox, consumption levels are also reduced.

The percentage of exhaust gas to be returned to the engine is established by the control unit taking account of a specific characteristic curve which depends on the load, speed and temperature of the engine.

OPERATING LOGIC

– Identification of the "operating point":

the "point of operation of the engine" is located mainly through two sensors: the rpm sensor informs the control unit of the speed of rotation of the engine; the air flow meter supplies the value of the mass of air actually entering the cylinders, defining the instantaneous volumetric yield of the engine.

– Adjustment of injection times (quantity of fuel): the control unit controls the injectors very quickly and precisely, calculating the opening time on the basis of engine load (rpm and air flow), also taking into account the battery voltage and the temperature of the engine. Injection is "sequential", i.e. the injectors are opened in correspondence of the exhaust stroke of the cylinder concemed.

– Ignition adjustment (calculation of advances):

the control unit calculates the advance on the basis of the engine load (rpm and air flow); the value is also corrected according to the temperature of the intaken air and that of the engine: ignition is "static" as described previously.

– Cold starting control:

during cold starts the control unit uses special advance values and injection times.

When a determinate temperature/rpm ratio is reached, the control unit resumes normal operating conditions.

– Control of enrichment during acceleration:

upon the need for acceleration, the control unit increases injection in order to reach the required load as quickly as possible.
This function takes place through the potentiometer located on the throttle which instantaneously informs the control unit of the need to accelerate.

– Fuel cut-off during deceleration:

with the throttle closed and an engine speed above a certain threshold, the control unit de-activates fuel injection; this way the rpms decrease rapidly towards idle speed reducing the speed and fuel consumption. The cut-off threshold value varies according to the temperature of the engine and the speed of the car.

– Control of idle speed:

the adjustment of the engine idle speed is carried out through the special actuator which acts on the throttle by- pass. This also acts as a regulator for engaging the different services (eg. air conditioner compressor): in fact, when the throttle is closed, the actuator adjusts the by-pass compensating the load required by the services in order to ensure that idle speed is as constant as possible.

– Maximum Rpm limiting:

above a certain threshold the control unit automatically stops the injection of fuel preventing the engine from "over-revving".

– Combustion control -lambda probe-:

the oxygen sensor (or "lambda" probe) informs the control unit of the amount of oxygen at the exhaust, and therefore the correct air-fuel metering.

The optimum mixture is obtained when the lambda coefficient = 1 (optimum stoichiometric mixture). The electric signal sent by the probe to the control unit changes abruptly when the composition of the mixture departs from lambda = 1. When the mixture is "lean" the control unit increases the amount of fuel, reducing it when the mixture is "rich": this way the engine operates as far as possible around the ideal lambda rating.
The signal from the lambda probe is processed inside the control unit by a special integrator which prevents sudden "oscillations".
The probe is heated by an electrical resistance so that it quickly reaches the correct operating temperature (appr. 300 °C).
Through this probe it is therefore possible to adjust engine carburetion precisely. Among other items, this makes it possible to meet emission limit regulations.

- **Timing variator control:**

The electro-mechanical-hydraulic timing variator, connected to the camshaft, controls and adjusts the intake timing according to the load and rpm of the engine. This device is activated by the control unit at higher engine operating speeds (above 1,600 rpm and with load above 30%).

- **E.G.R. valve control**

The percentage of exhaust gas to be returned to the engine is determined by the control unit taking account of a specific characteristic curve which depends on the engine load and speed: recirculation is only activated when the engine speed is between 2500 and 4000 rpm., also in relation to the temperature of the engine (higher recirculation percentage with high temperatures).

- **Knocking control:**

Through a knock sensor the control unit is informed if any pinging or "knocking" occurs and it corrects the spark advance "delaying" it accordingly; a further correction also takes account of the air temperature, in fact, when the temperature of the intake air is high, pinging is more accentuated.
N.B. The intaken air temperature sensor to be found just downstream of the air-flow meter, is not used to calculate the engine load but to control the knocking parameters.

- **Fuel vapour recovery:**

the fuel vapours collected from the various points of the supply circuit in a special active carbon canister are ducted to the engine where they are burnt: this takes place through a solenoid valve which is opened by the control unit only when the engine is in a condition that allows correct combustion without adversely affecting the operation of the engine: in fact the control unit compensates this amount of fuel by reducing delivery to the injectors.

- **Connection with the air conditioner compressor:**

the control unit is connected with the air condition compressor and it cuts in the compressor in relation to operation of the engine. As this service absorbs a considerable amount of power, the control unit:

- adapts the engine idle speed each time the compressor cuts in; if the engine speed falls below 700 rpm, the compressor is turned off;
- when there is the need for high power (high speed - over 6000 rpm - or full load - max. throttle opening), it momentaneously cuts out the compressor
- when the engine is being started the compressor is disabled until normal operating conditions have been reached.

- **Connection with ALFA ROMEO CODE system:**

on cars fitted with the ALFA ROMEO CODE system, as soon as the Motronic control unit receives the signal that the key has been turned to MARCIA, it "asks" the above-mentioned system for consent start the engine: this consent is given only if the ALFA ROMEO CODE control unit recognizes the code of the key engaged in the ignition switch as correct. This dialogue between the two control units takes place on diagnosis line K already used for the Alfa Romeo Tester.

COMPONENTS

The control unit receives the signals leading from the sensors which "read" the operating conditions of the engine according to a logic stored inside the control unit in "maps" which correlate the various parameters, operating the actuators accordingly to keep the engine at maximum yield and regularity.

The sensors are:

- engine temperature sensor (**S7**);
- air temperature sensor (**S34**);
- sensor on throttle body (**S38**);
- rpm sensor (**S31**);
- cam angle sensor (**S52**);
- heated lambda sensor (**S35**)
- air-flow meter (**S5**);
- pinging sensor (**S20**);

The actuators are:

- injectors (**S3**);
- ignition coils (**A8**);
- fuel pump (**P18**);
- idle speed adjustment actuator (**S29**);
- vapour recovery solenoid valve (**M15**) ;
- E.G.R. solenoid valve (**L46**);

– timing variator (**S15**)

The control unit is also connected with:

– the climate control system,

– ALFA ROMEO CODE control unit (**N77**)

– the instrument cluster (**C10**) to which it supplies the signal for the rev counter and for turning on the warning light,

– sensor **L17** from which it receives the car speed signal.

The system is completed by four relays: the first three - main relay (**S41**), secondary relay **S42** and fuel pump relay **S12a** operate the fuel pump, the injectors, coils and the other components of the system, while the fourth - the timing variator relay - **S12c** - supplies the timing variator.
The entire system is supplied by the line of fuse **S36**, while special fuses protect the pump (**S47**), and the resistance of the lambda sensor (**S45**).
Lastly, there is an earth point (**G60**) on the engine.
Connector **T1** enables connection with the ALFA ROMEO Tester: this is located in an easily accessible position in the engine compartment.

FUNCTIONAL DESCRIPTION

The Motronic control unit **S11** controls and adjusts the entire electronic ignition and injection system;
all the system supplies are protected by fuse **S36** (40A).

The control unit is supplied at pin 18 directly by the battery through fuse **S36**. At pin 37 it receives the supply from the main relay **S41**, while at pin 27 it receives the "key- operated" supply from the secondary relay **S42**.

Pins 2, 14, 19 and 24 are earthed and serve as reference respectively for the ignition, the injectors, electronic screening and the final power stages.

Two relays control the entire system:

The main relay **S41**, acts as supply relay for the whole system; it is energized by a control signal - earth - leading from pin 36 of the control unit and consequently sends the supply (12V) to pin 37 of the control unit itself, to the fuel pump relay **S12a**, to the timing variator relay **S12c**, to the vapour recovery solenoid valve **M15**, to the idle speed actuator **S29**, to the EGR solenoid valve **L46** and lastly to the injectors **S3**.

The secondary relay **S42**, energized by the "key-operated" supply, supplies the control unit at pin 27 and the primary windings of the coils **A8**.

The fuel pump relay **S12a**, supplied by the main relay **S41**, is energized by a control signal - earth - leading from pin 3 of the control unit **S11**. Consequently, the relay supplies the resistance of the lambda probe **S35**, the relay of the timing variator **S12c** and of course the fuel pump **P18**; this supply line is protected by a special fuse **S47** (10A).

The earth reaches the pump **P18** via the inertial switch **H20** which cuts off the circuit in the event of impact.

The control unit **S11** receives numerous signals from the different sensors, thereby keeping all the engine operating parameters under control.

Through a frequency signal sent to pins 48 and 49 of the control unit, the rpm sensor **S31** supplies information about the engine rpm; the two above-mentioned signals are very low in intensity and are therefore suitably screened.

The sensor is inductive and detects the number of revolutions of the engine through the change in a magnetic field produced by the passage of the teeth of a "phonic" wheel (60-2 teeth) fitted on the fluwheel.

The cam angle sensor **S52** (timing sensor), supplied at 12 V at pin 1, and connected to earth at pin 3, sends a signal in frequency from pin 2 corresponding to the phase to pin 8 of the control unit itself

The sensor comprises a Hall effect device due to which the voltage signal sent to the control unit "lowers" abruptly when the hollow machined on the camshaft passes in front of the sensor.

The heated lambda sensor **S35** supplies the control unit information about the correct composition of the air-fuel mixture detecting the concentration of oxygen in the exhaust gas; this takes place through the signal sent to pin 28 of the control unit, while pin 10 supplies the reference earth; these two signals are very low in intensity and are therefore suitably screened.
The sensor is heated by a resistance to make sure that it operates correctly also when the engine is cold; the resistance is supplied by the fuel pump relay **S12a** and it is protected by a specific fuse **S45** (7.5A).

The throttle body sensor **S38**, is supplied by the control unit from pins 12 and 30 and through a potentiometer it sends a signal to pin 53 which is proportionate with the degree of opening of the throttle itself.

The engine temperature sensor **S7**, connected to the electronic earth at pin 30, supplies a signal to pin 45 proportionate with the temperature of the engine coolant, detected with an NTC material (resistance that lowers with the temperature).

The knock sensor **S20**, through a frequency signal sent to pin 11 of the control unit, supplies information about the knocking conditions, while an electronic earth leads from pin 30; these two signals are very low in intensity and are therefore suitably screened.

The sensor comprises a piezoelectric plate which detects the vibrations produced when the engine is running, exploiting a particular characteristic of piezoelectric materials which generate an output voltage when subjected to mechanical stresses; this voltage is filtered and analysed by the control unit which corrects the ignition parameters accordingly.

The intake air temperature sensor **S34**, connected to the electronic earth at pin 30, supplies a signal to pin 54 which is proportionate with the temperature of the air entering the intake box, detected by an NTC material (resistanmce that lowers with the temperature).

The air flow meter **S5**, is supplied by relay **S12e**: from pin 26 of the control unit it receives the reference earth, while it sends a signal proportionate with the air flow to pin 7.
The air flow meter is of the "heated film" type: a diaphragm is interposed in a measurement channel, through which the intake air flows: this diaphragm is kept at a constant temperature by a heating resistance; the mass of air that crosses the measurement channel tends to withdraw heat from the diaphragm, therefore, in order to maintain its temperature constant, a certain amount of current must flow through the resistance: this current, appropriately measured, is proportionate with the mass of air flowing in the channel.
On the basis of the signals received from the sensors and of the calculations carried out, the control unit **S11** controls the opening of the single injectors **S3** through special signals - of the duty-cycle type - pins 17 (cyl. 1), 34 (cyl. 2), 16 (cyl. 3) and 35 (cyl. 4). The injectors receive consent (12V) to open from the main relay **S41**.

The static ignition system is controlled by the control unit directly which automatically adjusts the advance. N.B. the power modules which generate the high voltage pulses are located inside the control unit. The control signals (earth) for the primary windings of the coils **A8** lead from the control unit, while the secondary winding sends the pulse to the spark plugs **A12**: from pins 1 and 21 for cylinders 1- 4 and from pins 18 and 30 for cylinders 2-3.
The primary windings of the coils **A8** are supplied at 12 V ("key-operated") by relay **S42**.

The power modules inside the control unit are connected to earth via pin 2.

The idle speed adjustment actuator **S29** forms a by-pass line for the flow of air; this comprises two windings: one opens and the other closes a valve that adjusts the gap of the by- pass section; a safety spring establishes a mean opening value in the event of a fault to the device; the actuator is supplied by the main relay **S41**, and controlled by the control unit through the duty-cycle signals of pins 22 (closing) and 4 (opening).

The vapour recovery solenoid valve **M15** allows the passage of the fuel vapours towards the engine intake where they are added to the mixture entering the combustion chamber; this valve, supplied by the main relay **S41**, is opened by the control unit when the engine is under load through a duty cycle signal from pin 5.

The E.G.R. solenoid valve **L46**, controlled by the control unit, operates the actual E.G.R. valve modulating its opening: the latter is a vacuum-operated diaphragm valve: the electropneumatic valve works by changing this vacuum which is withdrawn from the same "takeoff" used for the servobrake. The solenoid valve is controlled from pin 33 of the control unit while it is supplied at 12 V by main relay **S41**.

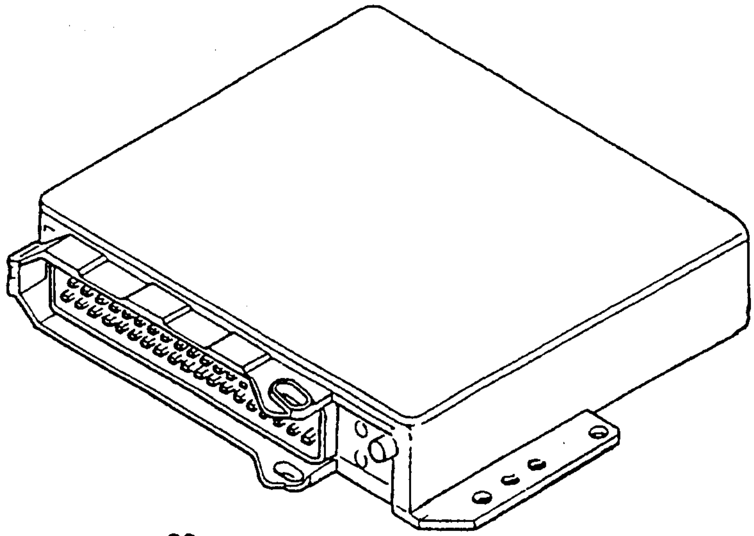
The timing variator **S15** mechanically controls timing advance at the intake; it is operated by the corresponding relay **S12c**: this relay is supplied by relays **S12a** and **S41** and it is energized via a negative signal from the control unit, pin 52, thus supplying the timing variator **S15**: this signal operates the actuator which controls the flow of oil in the hydraulic unit of the device that adjusts camshaft rotation.

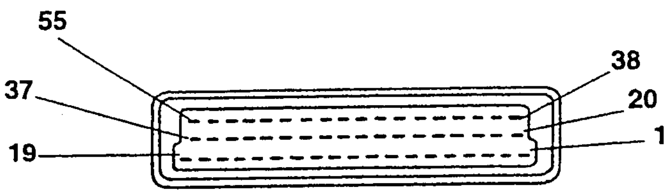
The tachometric signal (car speed) reaches the control unit at pin 9 via sensor **L17**; while from pin 6 the control unit sends a "pulse" signal to the cluster which is proportionate with the number of revolutions of the engine; the signal for the warning light on the cluster **C10** leads from pin 51.

The control unit **S11** is connected with the air conditioning system through pins 32, 40 and 41.
This makes it possible to adapt the engine idle speed to the increased power each time the compressor cuts in, or to cut it out in the case of high speed or engine loads. For further details see the "Climate control" section.

The control unit **S11** is connected by pin 55 with the ALFA ROMEO CODE control unit **N77** via the diagnosis line K; if the ALFA ROMEO CODE system does not recognise a correct "key code" it will not enable the Motronic control unit to start the engine (for further details see the section "ALFA ROMEO CODE).

The control unit possesses a self-diagnosis system which can be used through connection to the ALFA ROMEO Tester at connector **T1**; the tester receives the fault signals from the control unit through the diagnosis lines L - pin 13 -and K - pin 55 -, while the earth leads from **G60** (line K is also used by the ALFA ROMEO CODE control unit).



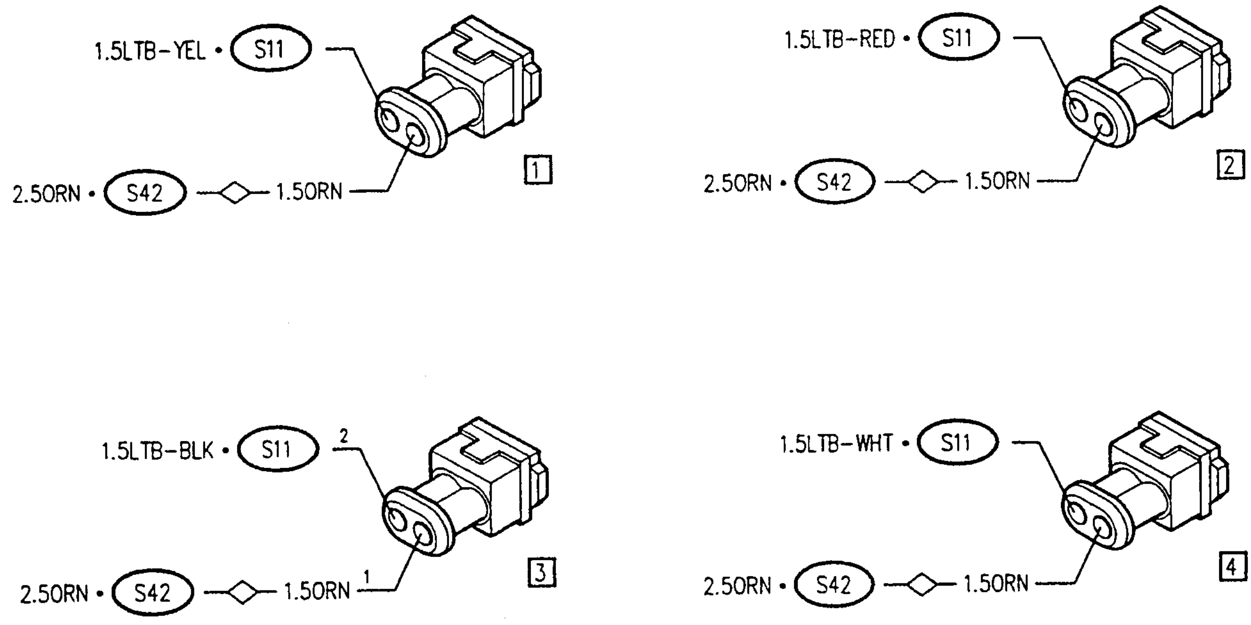


CONTROL UNIT PIN-OUTS

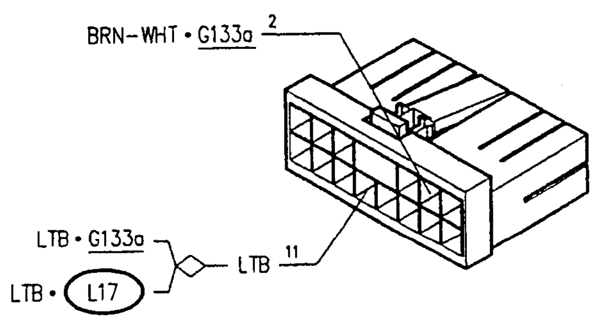
1. Ignition coil control - cyl. 1 and 4 -
2. Earth for ignition
3. Fuel pump relay control
4. Idle actuator control - opening
5. Evaporative solenoid valve control
6. Rev counter signal
7. Air flow meter signal
8. Timing signal
9. Car speed signal
10.Lambda probe signal
11.Knock sensor signal
12.Stabilized voltage (5V) for sensors
13.Diagnosis line L
14.Earth for injectors
15.N.C.
16.Cyl. 3 injector
17.Cyl. 1 injector
18.Direct supply
19.Electronic screening earth
20.Ignition coil control - cyl. 3 and 2
21.Ignition coil control - cyl. 4 and 1
22.Idle speed actuator control - closing
23.N.C.
24.Earth for final stages
25.N.C.
26. Air-flow meter earth
27."Key-operated" supply, from secondary relay
28.Lambda probe earth
29.N.C.
30.Electronic earth for sensors
31.N.C.
32.Conditioner compressor relay control
33.E.G.R. solenoid valve control
34.Injector cyl. 2
35.Injector cyl. 4
36.Main relay control
37.Supply from main relay
38.Cyl. 2 and 3 ignition coil control
39.N.C.
40.Compressor engagement request
41.Conditioning system engagement request
42.N.C.
43.N.C.
44.N.C.
45.Engine temperature signal
46.N.C.
47.N.C.
48.Rpm sensor signal
49.Rpm sensor signal
50.N.C.
51.Signal for warning light on instrument cluster
52.Timing variator control
53.Throttle position signal
54.Intaken air temperature signal
55.Diagnosis line K (via ALFA ROMEO CODE control unit)

COMPONENTS AND CONNECTORS

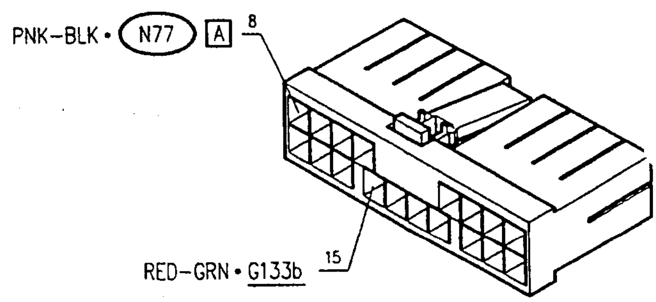
Ignition coil (A8)



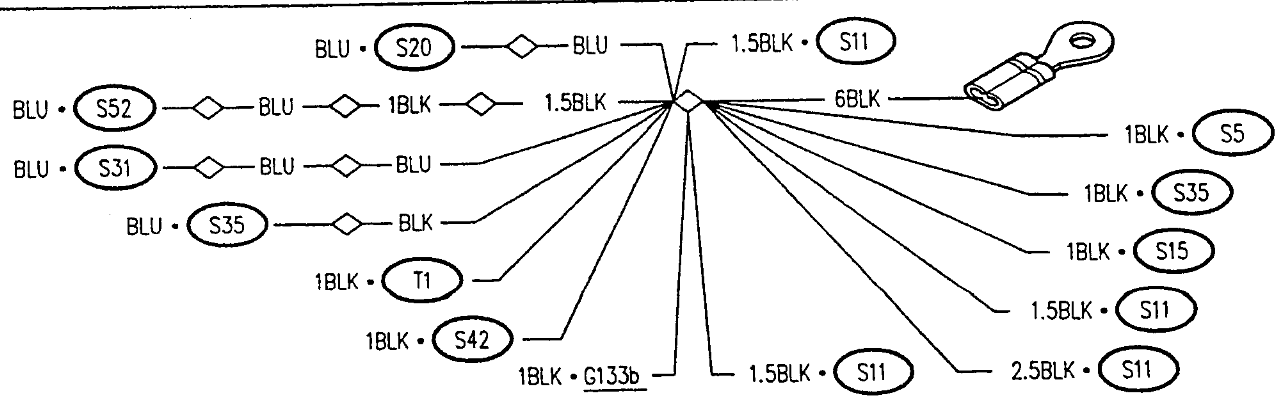
Instrument cluster (C10) A



Instrument cluster (C10) B

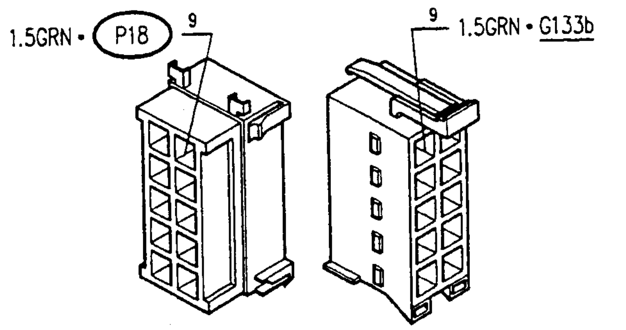


Injection wiring earth G60

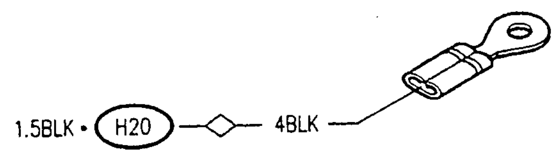


COMPONENTS AND CONNECTORS (contd.)

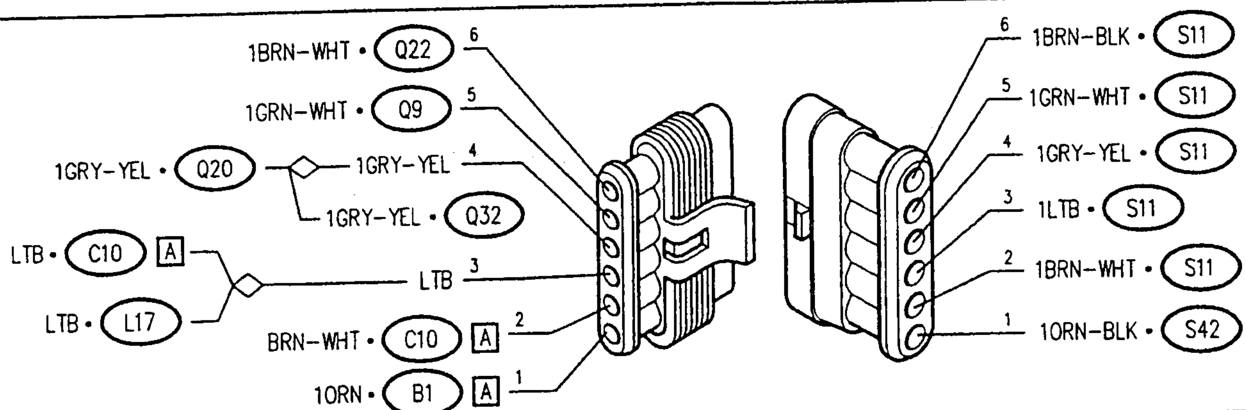
Rear services connector — G73 [A]



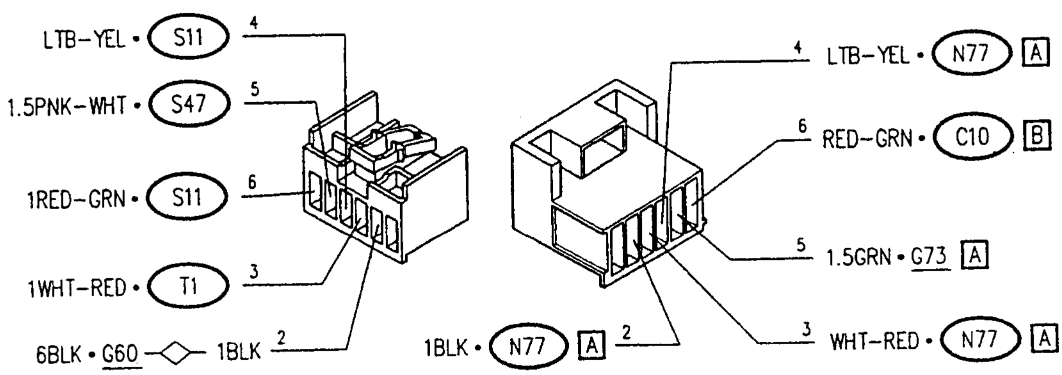
Seat crossmember earth — G106



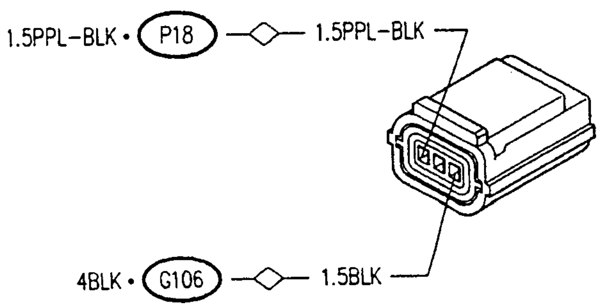
Electr. injection wiring connector A — G113a



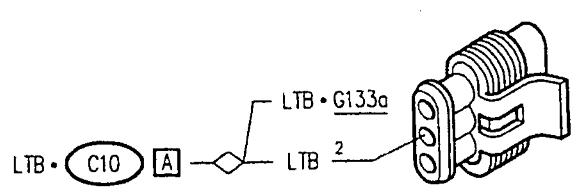
Electr. injection wiring connector B — G133b



Inertial switch — H20

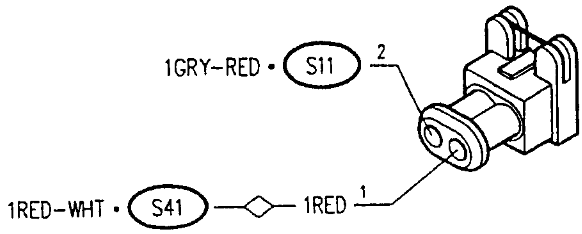


Tachometric sensor — L17

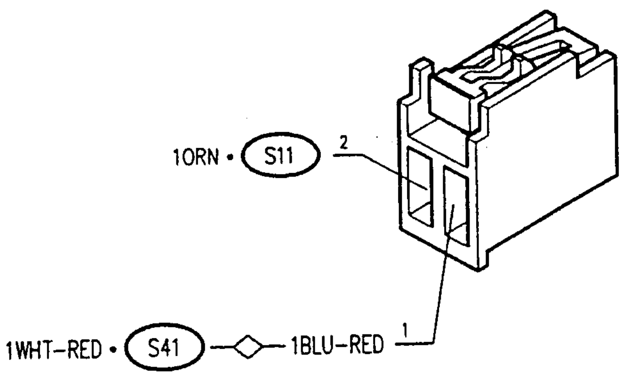


COMPONENTS AND CONNECTORS (contd.)

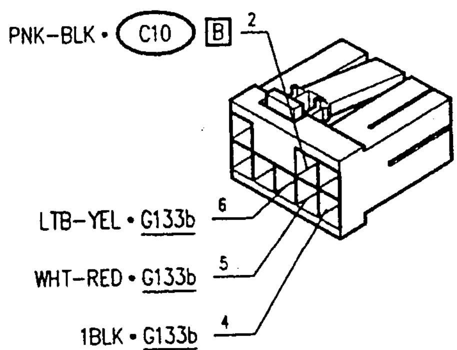
E.G.R. control solenoid valve — L46



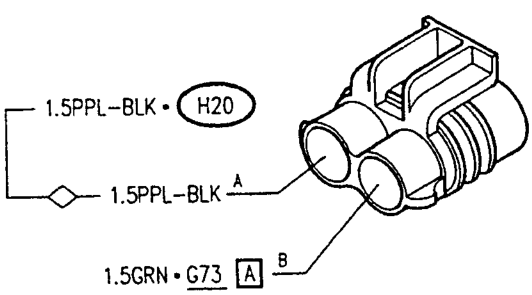
Evaporative solenoid valve — M15



ALFA ROMEO CODE control unit — N77 A

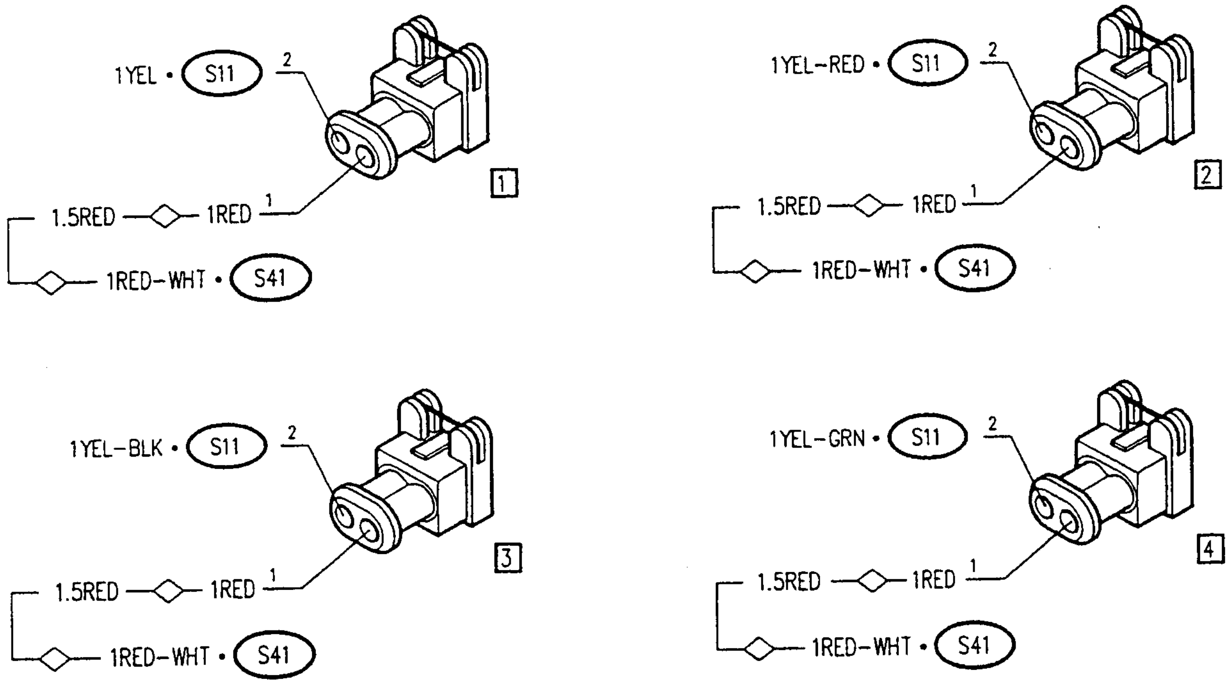


Electric fuel pump — P18

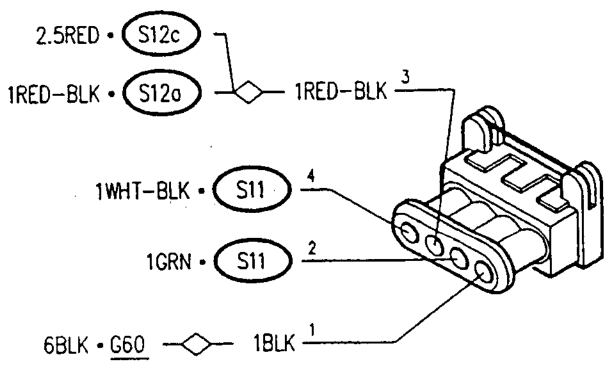


COMPONENTS AND CONNECTORS (contd.)

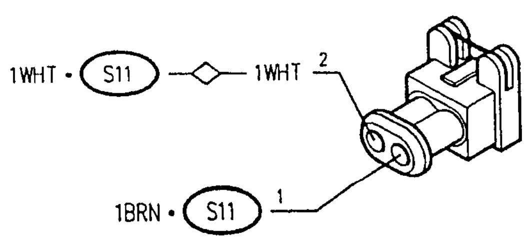
Injector (S3)



Air-flow meter (S5)



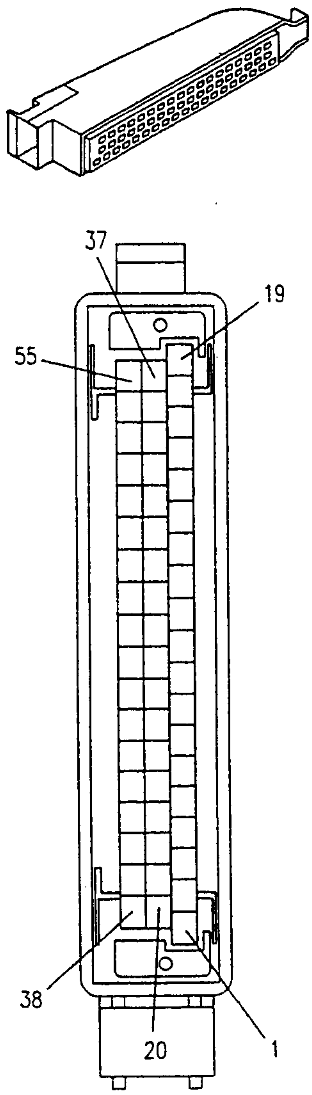
Engine temperature sensor (S7)



COMPONENTS AND CONNECTORS (contd.)

Motronic control unit	(S11)

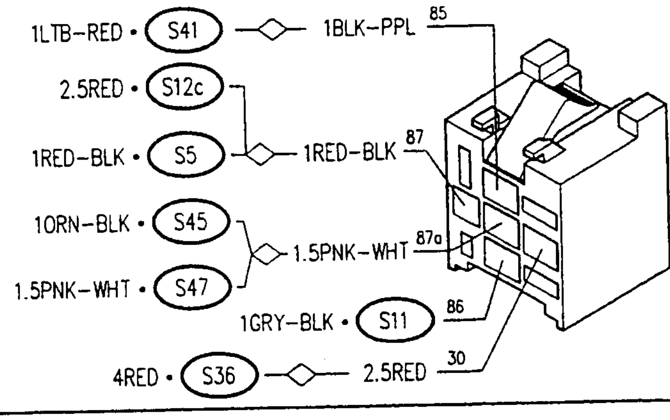
1 1.5LTB-YEL • (A8) [1]
2 2.5BLK —◇— 6BLK • G60
3 1GRY-BLK • (S12a)
4 1LTB-BLK • (S29)
5 1ORN • (M15)
6 1BRN-WHT • G133a
7 1WHT-BLK • (S5)
8 1GRN • (S52)
9 1LTB • G133a
10 GRN • (S35)
11 RED • (S20)
12 1GRY-GRN —◇— 1LTB-WHT • (S38) / GRY-RED • (S52)
13 1LTB-WHT • (T1)
14 1.5BLK —◇— 6BLK • G60
16 1YEL-BLK • (S3) [3]
17 1YEL • (S3) [1]
18 1RED —◇— 4RED • (S36)
19 1.5BLK —◇— 6BLK • G60
20 1.5LTB-BLK • (A8) [3]
21 1.5LTB-WHT • (A8) [4]
22 1ORN-BLK • (S29)
24 1.5BLK —◇— 6BLK • G60
26 1GRN • (S5)
27 1PNK • (S42)
28 BLK • (S35)
30 1WHT —◇— 1WHT • (S34) / 1WHT • (S38) / 1WHT • (S7) / WHT • (S20)



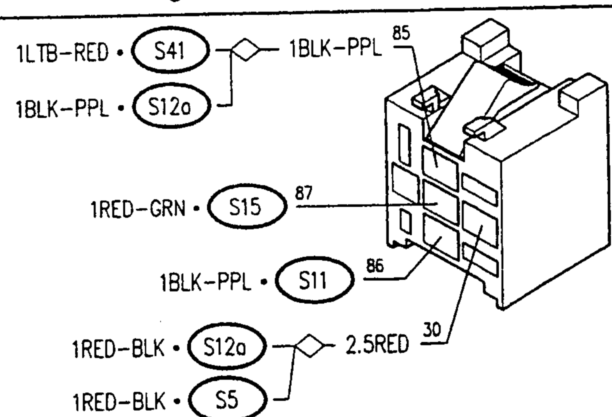
32 1BRN-BLK • G133a
33 1GRY-RED • (L46)
34 1YEL-RED • (S3) [2]
35 1YEL-GRN • (S3) [4]
36 1GRN-BLK • (S41)
37 1.5GRY —◇— 1RED-WHT • (S41)
38 1.5LTB-RED • (A8) [2]
40 1GRN-WHT • G133a
41 1GRY-YEL • G133a
45 1BRN • (S7)
48 BLK • (S31)
49 YEL • (S31)
51 1RED-GRN • G133b
52 1BLK-PPL • (S12c)
53 1PPL-WHT • (S38)
54 1PNK-BLK • (S34)
55 1WHT-GRN • G133b

COMPONENTS AND CONNECTORS (contd.)

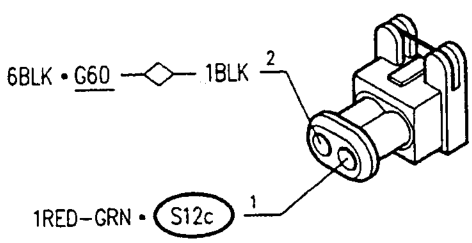
Fuel pump Motronic relay (S12a)



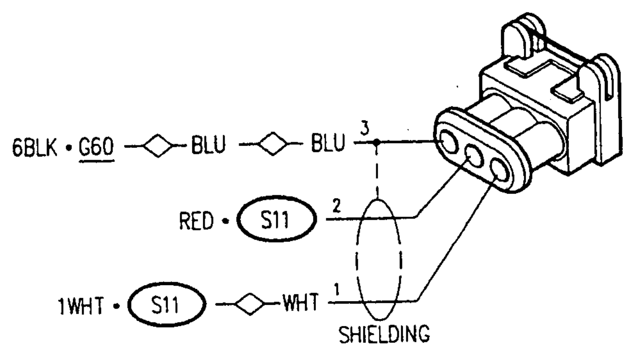
Timing variator relay (S12c)



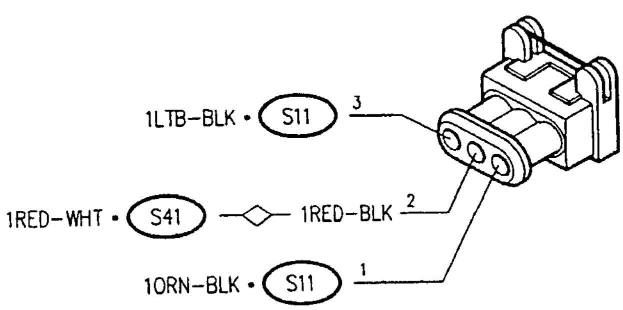
Timing variator (S15)



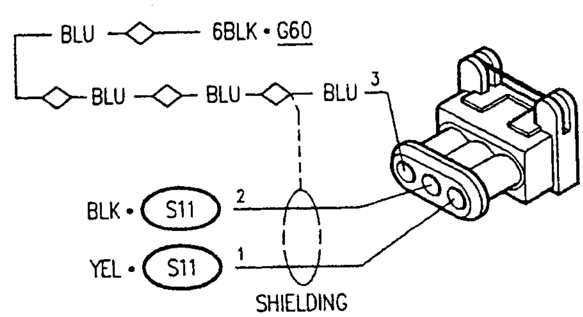
Knocking sensor (S20)



Idle adjustment actuator (S29)

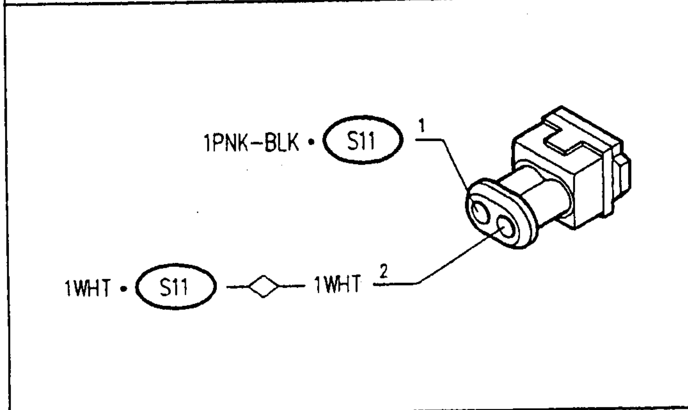


Rpm and crankshaft position sensor (S31)

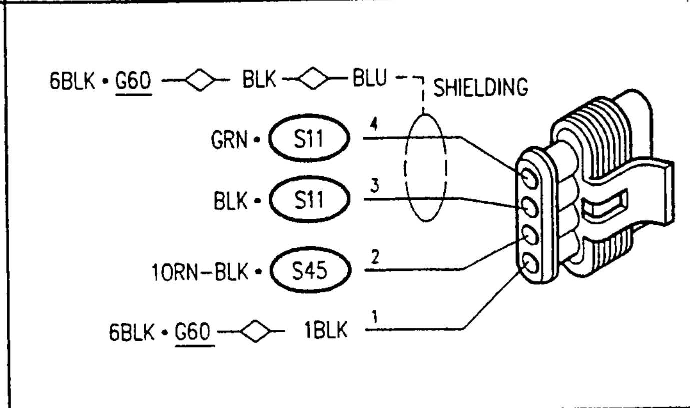


COMPONENTS AND CONNECTORS (contd.)

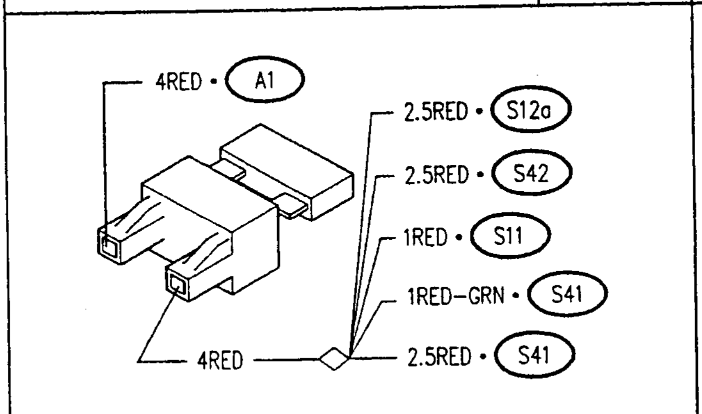
Air temperature sensor (S34)



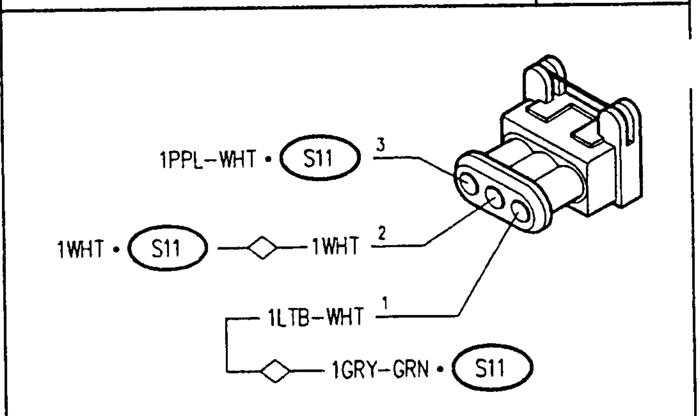
Heated lambda probe (S35)



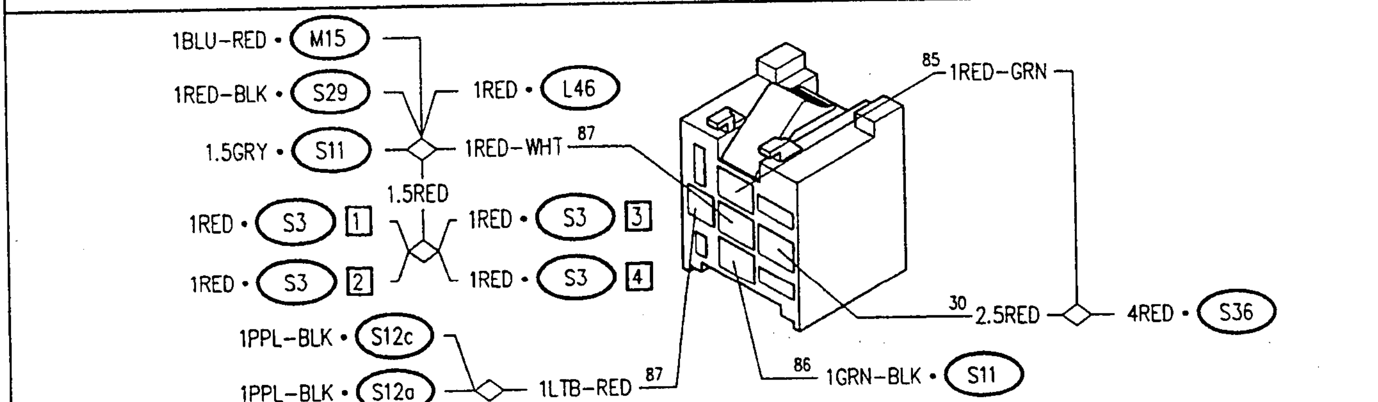
Injection wander fuse (S36)



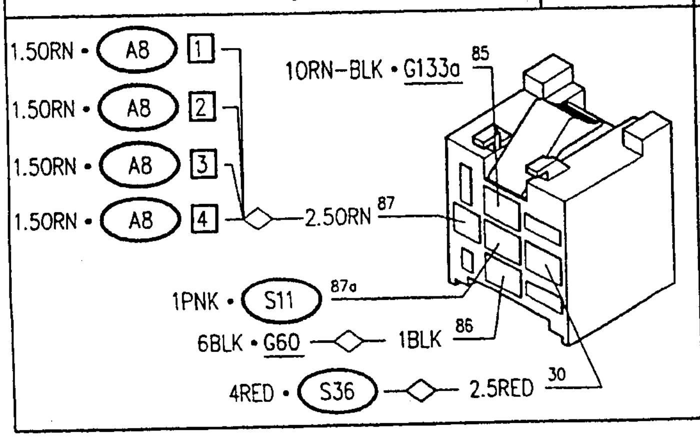
Sensor on throttle body (S38)



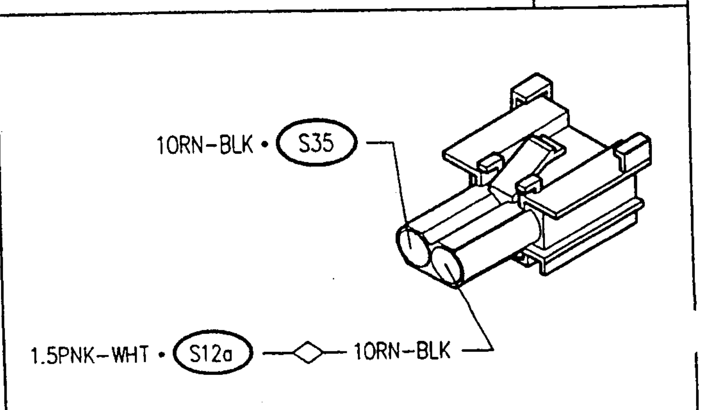
Main relay (S41)



Secondary relay (S42)

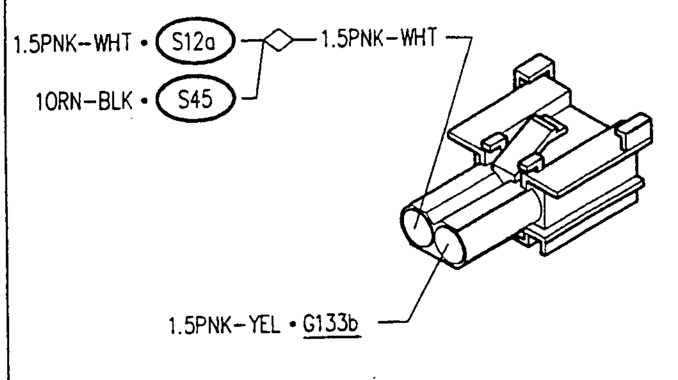


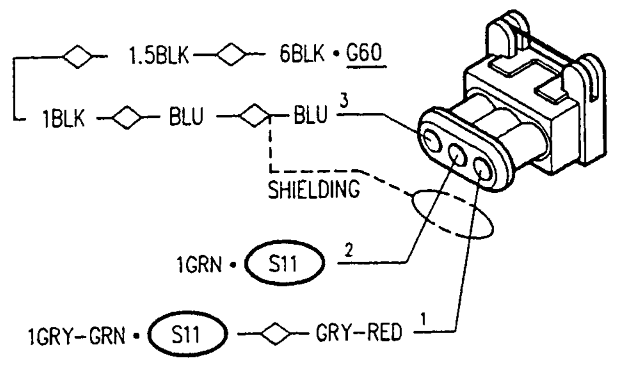
Lambda sensor wander fuse (S45)



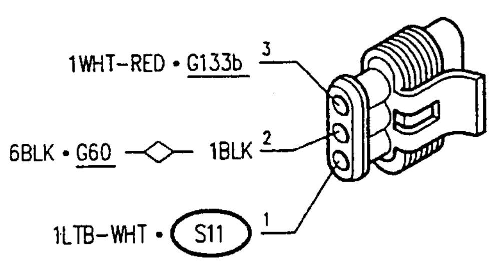
COMPONENTS AND CONNECTORS (contd.)

Fuel pump wander fuse	S47	Cam angle sensor	S52

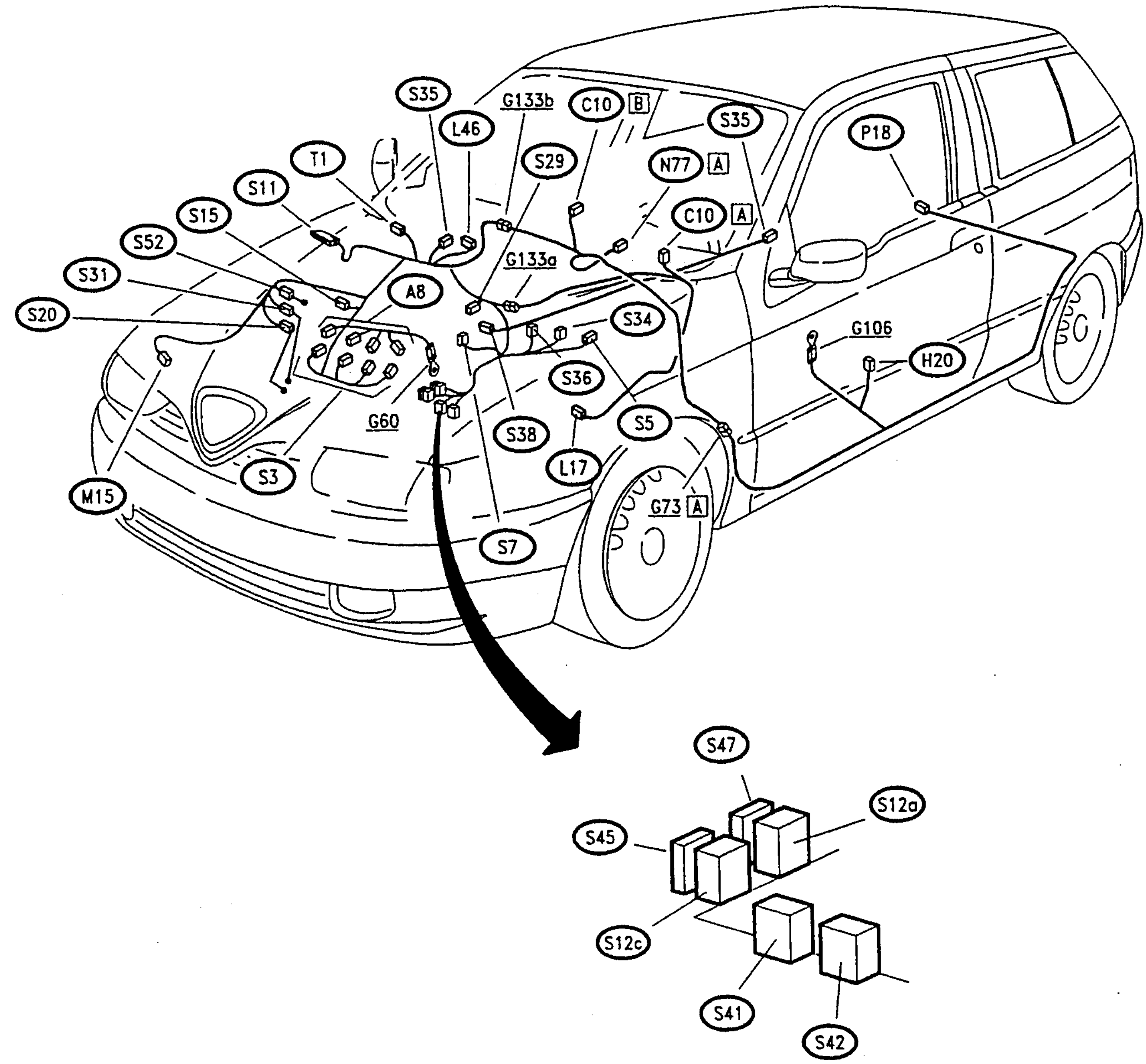




Connector for ALFA TESTER (Motronic)	T1



LOCATION OF COMPONENTS



FAULT-FINDING

the control unit possesses a **self-diagnosis system,** which continuously monitors the plausibility of the signals from the various sensors and compares them with the limits allowed: if these limits are exceeded, the system detects a fault and turns on the corresponding warning light on the instrument cluster.

The warning light turns on when the ignition key is at MARCIA and stays on until the engine is started, it then turns off. If it stays on, this means that a fault has been memorised.

For certain parameters, the control unit replaces the abnormal values with suitable ones so that the car can "limp" to a point of the Service Network.

These "recovery" values depend on the other correct signals and they are defined individually by the control unit operating logic.

The self-diagnosis system also enables quick and effective location of faults connecting with the ALFA ROMEO Tester, through which all the errors memorised can be displayed. It is also possible to check the operating parameters recorded by the control unit and operate the single actuators to check whether they are working properly.

Diagnosis using the ALFA TESTER

N.B. Before carrying out diagnosis with the Tester, carry out the preliminary check described below (**TEST A**).

The connection between the Tester and the electronic control unit must be carried out as follows:

1. Power the Tester either through the cigar lighter socket or connecting it directly to the battery using the cable provided.
2. Connect the Tester socket to that of the control unit (the socket is to be found near the control unit itself).

The information the instrument can give comprises:

- display of the parameters;
- display of errors;
- active diagnosis.

Error clearing

Before ending diagnosis the contents of the "permanent" memory should be cleared by the Tester in the "Active Diagnosis" function.

In the failure to do so, the next time the Tester is connected, errors that have already been examined will be signalled.

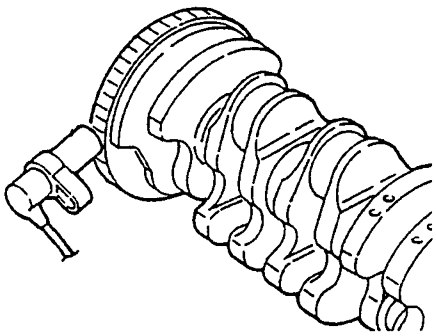
The contents of the "permanent" memory can be cleared as follows:

- using the Tester in Active Diagnosis
- if the cause that determined the error is no longer present and the engine has been started 10 times (operating for no less than 20 minutes) with at least 2 minutes between one start and the next.

N.B.:
Disconnecting the control unit from the system the contents of the "permanent" memory are erased.

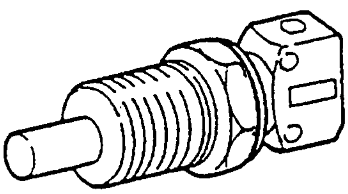
CHECKING COMPONENTS

Rpm sensor (S31)



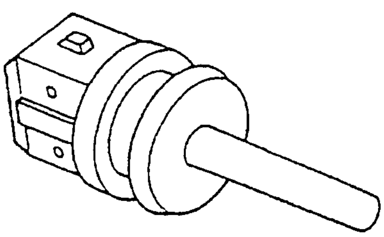
SPECIFICATIONS	
Sensor winding resistance 20 °C	486 ÷ 594 Ω
Gap between sensor and phonic wheel	0.5 ± 1.5 mm

Engine temperature sensor (S7)



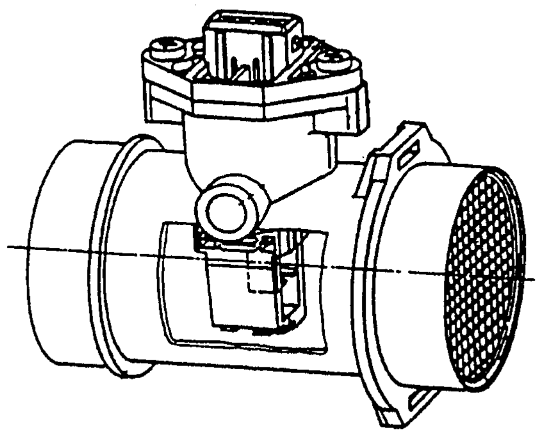
SPECIFICATIONS	
Temperature	Resistance
- 10°C	8100 ÷ 10770 Ω
+ 20°C	2280 ÷ 2720 Ω
+ 80°C	292 ÷ 362 Ω

Intake air temperature sensor (S34)

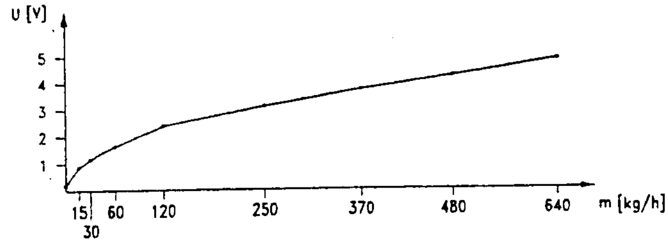


SPECIFICATIONS	
Temperature	Resistance
- 10°C	8100 ÷ 10770 Ω
+ 20°C	2280 ÷ 2720 Ω
+ 80°C	292 ÷ 362 Ω

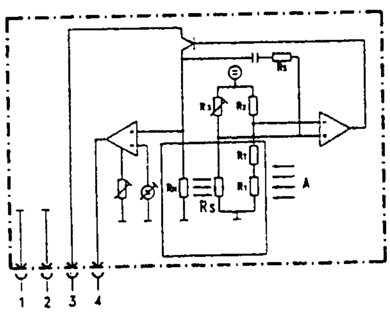
Air-flow meter (S5)



SPECIFICATIONS	
Current that crosses the diaphragm	
flow rate (kg/h)	current (A)
0 640	≤ 0.25 ≤ 0.80

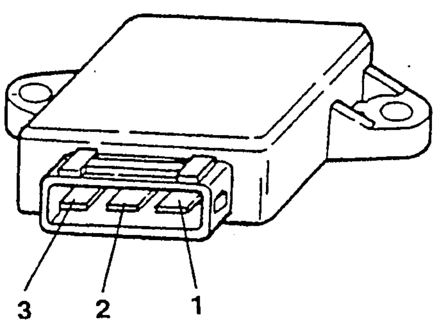


Characteristic curve of sensor
m = flow rate
U = voltage between pins 4 and 2



pin 1 - Earth
pin 2 - Reference earth
pin 3 - 12 V supply
pin 4 - Measurement signal
A = air
Rs = hot film sensor

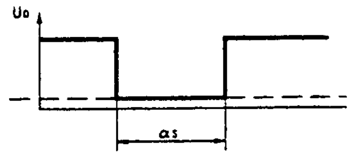
Throttle position sensor (S38)



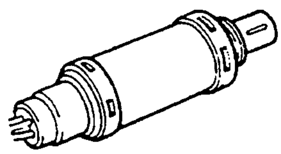
SPECIFICATIONS	
Resistance between terminals:	
1 - 2 (fixed)	≃ 2 kΩ
1 - 3 (throttle closed)	≃ 1 kΩ
1 - 3 (throttle completely open)	≃ 2.7 kΩ

Cam angle sensor (S52)

SPECIFICATIONS
The voltage signal "lowers" abruptly when the tooth machined on the camshaft passes in front of the sensor itself:



Lambda sensor (S35)

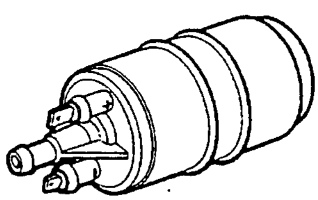


SPECIFICATIONS	
Heating resistance	3 Ω

Injectors (S3)

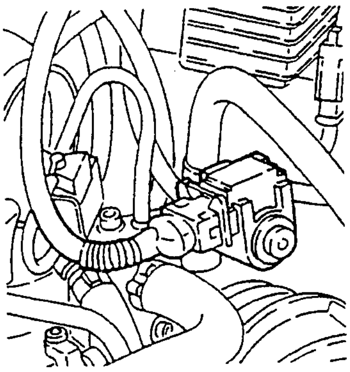
SPECIFICATIONS	
Winding resistance	15.9 ± 0.35 Ω

Fuel pump (P18)



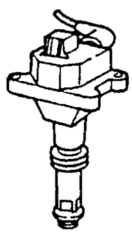
SPECIFICATIONS	
Flow rate	≥120 l/h
Pressure	4 bar
Nominal voltage	12V

Idle adjustment actuator (S29)



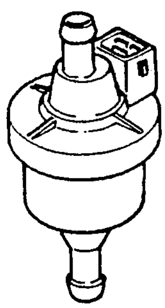
SPECIFICATIONS	
Resistance between terminals:	
1 - 3	~ 33 Ω
1 - 2	~ 17.5 Ω
2 - 3	~ 15.5 Ω

Ignition coil (A8)



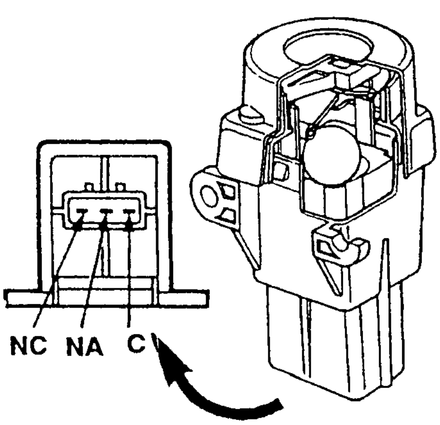
SPECIFICATIONS	
Primary resistance	0.3 Ω ± 12%
Secondary resistance	7 kΩ ± 12%

Evaporative solenoid valve (M15)



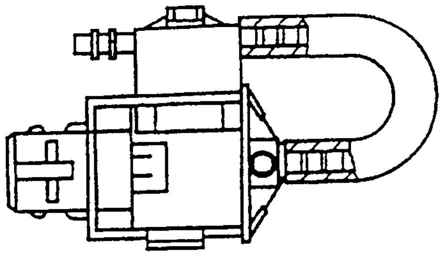
SPECIFICATIONS	
Duty-cycle signal	12 V; 10 Hz
Ohmic resistance of winding	26 ± 4 Ω
When not energised the solenoid valve is normally closed	

Inertial switch (H20)



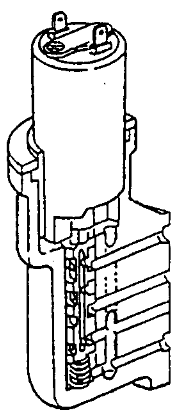
SPECIFICATIONS
Check continuity between pins NC and C: this continuity is cut off in the event of a crash; the contact is closed again pressing the special button

E.G.R solenoid valve (L46)



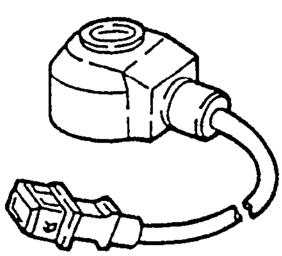
SPECIFICATIONS	
Duty-Cycle signal	12V; 15.3 Hz
Ohmic resistance of winding (20°C)	26.6 ÷ 1.4 Ω

Timing variator (S15)



SPECIFICATIONS	
Resistance between two terminals	~ 10 Ω
Max. absorption at 13.5V	1.34 A

Knock sensor (S20)



SPECIFICATIONS		
Resonance frequency		>20 kHz
Impedence		$\geq 1\Omega$
Vibration allowed	for long times	≤ 80 g
	for short times	≤ 400 g

PRELIMINARY TEST OF BOSCH M2.10 SYSTEM — TEST A

NOTE: Beforehand check that the ALFA ROMEO CODE system is working properly as it may have cut off the supply to the system! (see section "ALFA ROMEO CODE")

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
A1	CHECK FUSE		
– Check the intactness of fuses **S36** and **S47**		OK	Carry out **step A2**
		NOT OK	Replace the fuses **S36**: 40A **S47**: 10A
A2	CHECK VOLTAGE		
– Check for 12 V at pin 30 of relays **S41, S42** and **S12a** and also at pin 85 of **S41**		OK	Carry out **step A3**
		NOT OK	Restore the wiring between the battery **A1** and relays **S41, S42** and **S12a**
A3	CHECK VOLTAGE		
– With the ignition key turned, check for 12 V at pin 85 of relay **S42**		OK	Carry out step A4
		NOT OK	Restore the wiring between the ignition switch **B1** and relay **S42**
A4	CHECK RELAYS		
– Check the correct operation of relays **S41**, **S42** and **S12a**		OK	Carry out **step A5**
		NOT OK	Replace any faulty relays
A5	CHECK CONTROL UNIT SUPPLY		
– Check for 12 V at pin 18 of the control unit **S11**; with the key turned 12 V also at pins 27 and 37 of **S11** and appr. 0 V (very low voltage) at pin 3 and 36 of **S11**		OK	Carry out **step A6**
		NOT OK	Restore the wiring between the control unit **S11** and the relays and between the control unit and fuse **S36**
A6	CHECK EARTH		
– Check for an earth at pins 19 and 24. Also check for an earth at pin 86 of **S42**		OK	CONTINUE DIAGNOSIS USING THE ALFA ROMEO TESTER
		NOT OK	Restore the wiring between **S11** and the relay and earth **G60**