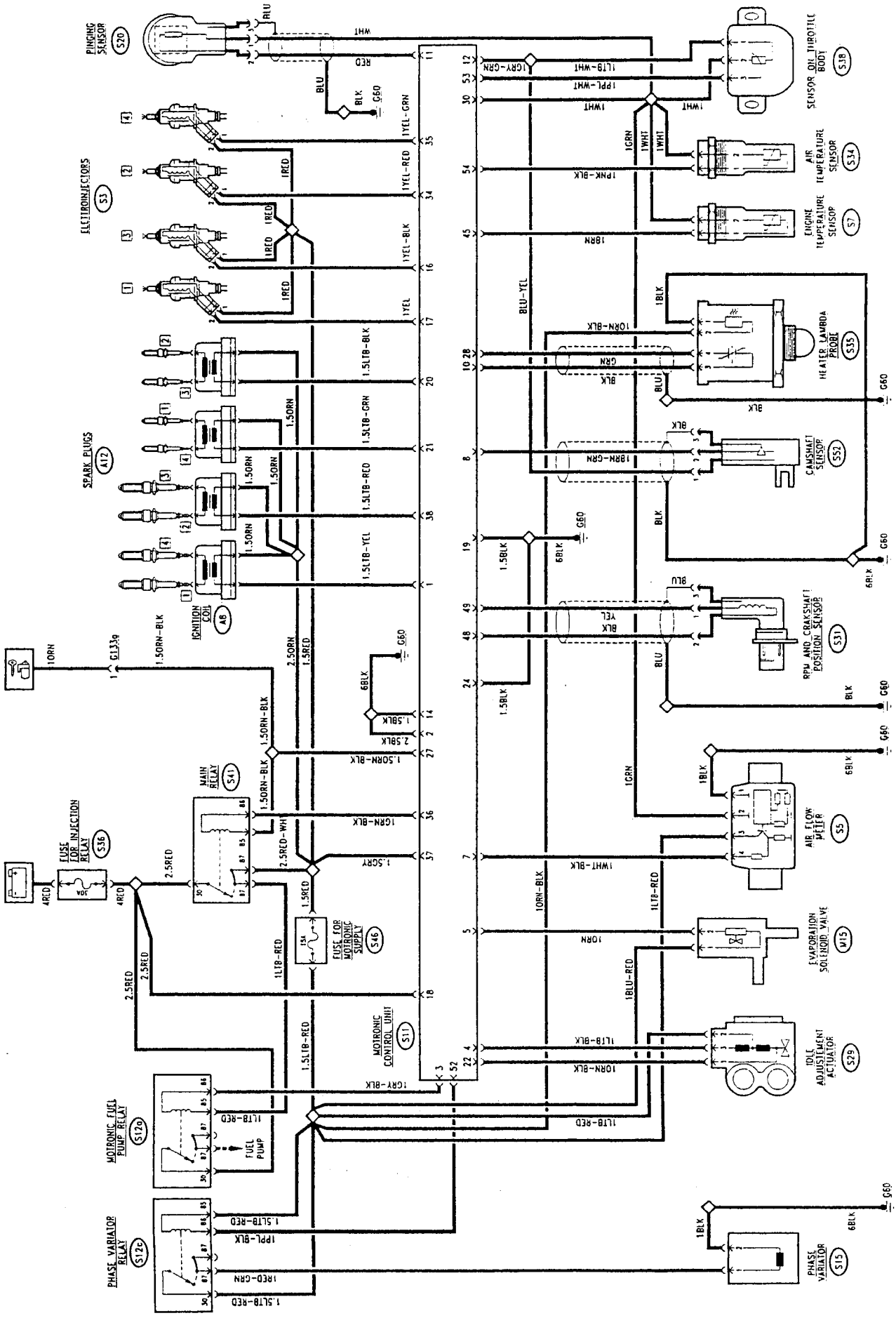
INJECTION/IGNITION SYSTEM MOTRONIC M2.10.4 Engine1.4, 1.6, 1.8 and 2.0 T.SPARK 16v:

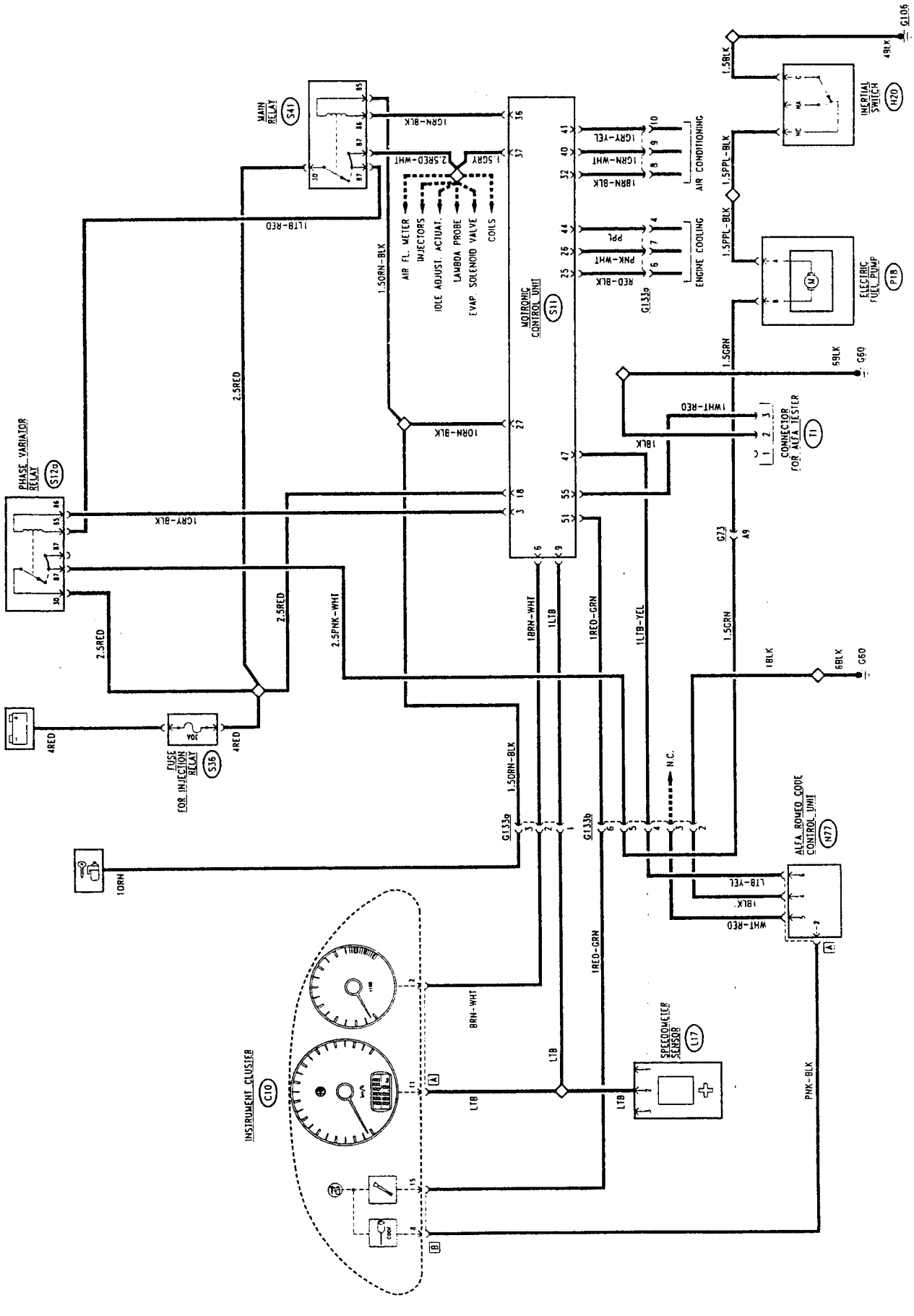
INDEX

WARNING:
for the 2.0 T.SPARK 16v engine, from chassis no. ... it repalces the previous MOTRONIC M2.10.3)

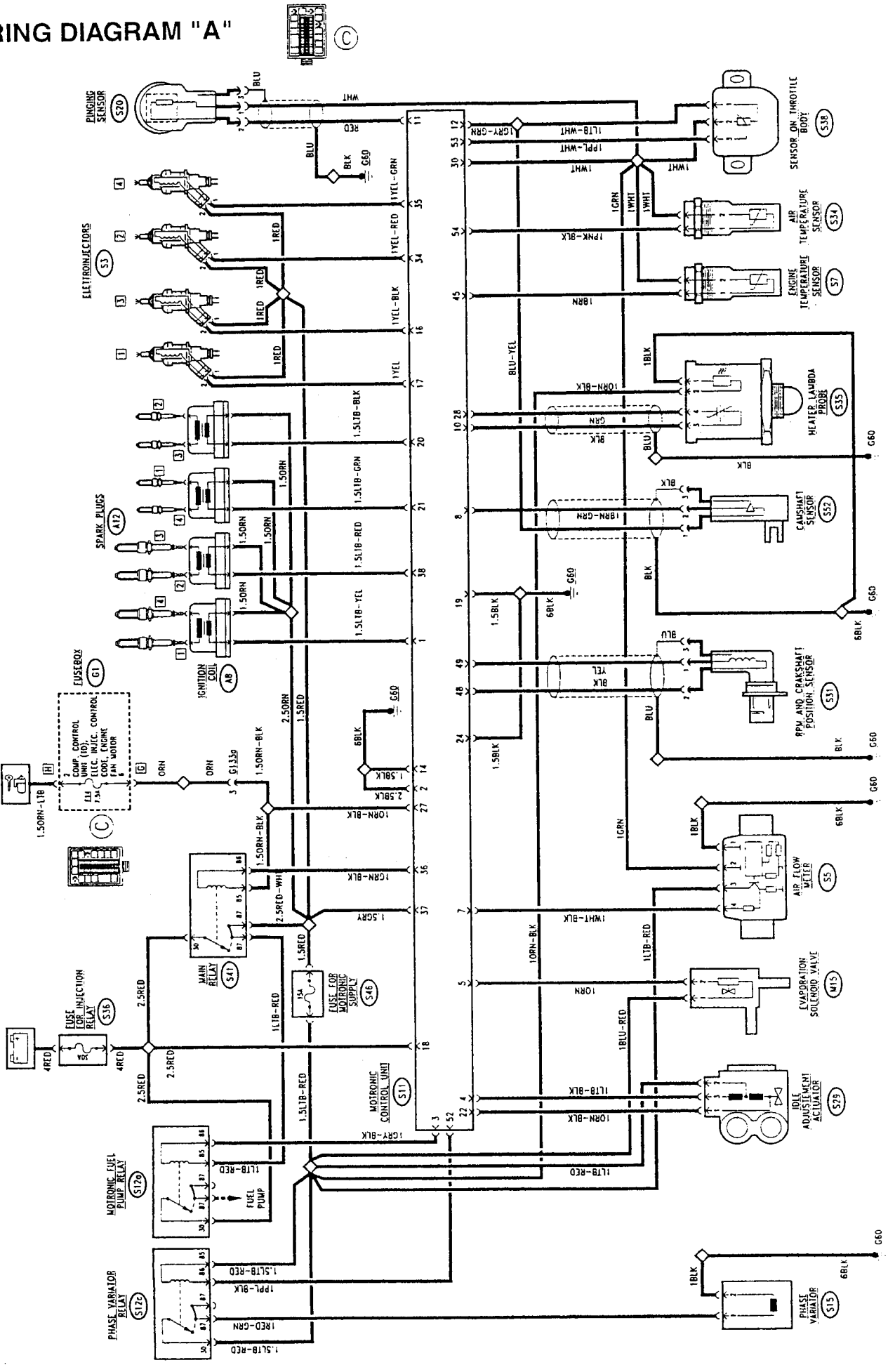
WIRING DIAGRAM "A"



WIRING DIAGRAM "B"



WIRING DIAGRAM "A"



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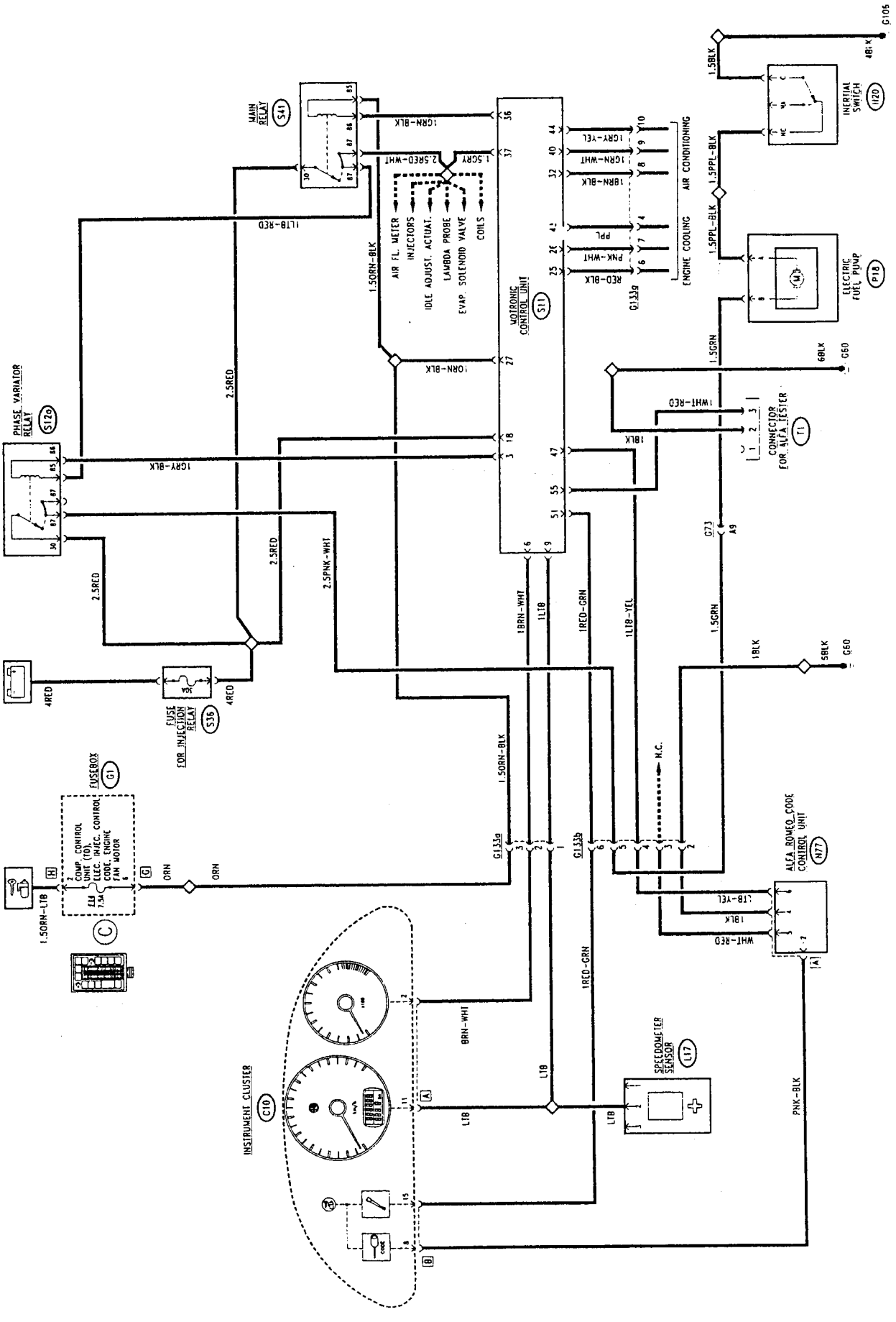


GENERAL DESCRIPTION

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 sophisticated latest generation system consists of a single control unit which controls both ignition (static with lost spark) and injection (timed).

This is the M 2.10.4 version of the proven and reliable BOSCH MOTRONIC system.

Compared with the previous versions this new M 2.10.4 system adopts a control unit - with 55 pins - with advanced design and production technology, it also possesses many possibilities for inserting auxiliary functions (engine cooling fan).

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, 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 optimal point of injection, calculated by the control unit according to special maps depending on the load, speed and temperature of the engine.

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.

Static ignition takes place through four coils, according to the so-called "lost spark" logic: this solution exploits the different pressures and environments existing 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 c 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.

Two of the four coils supply the small spark plug of the cylinder below and simultaneously the other two supply the large ones.

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

Metering the air flow rate

The air flow meter adopted is of a more modern design known as the "hot film" type.

Outside, the air-flow meter looks like a part of duct between the intake manifold and the air cleaner.

Inside the air-flow meter there is an electronic circuit and a plate that is crossed by the air which passes into the duct. The film plate is kept at a constant temperature (appr. 120°C over the temperature of the incoming air) 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.)

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.

Conversely, the rpm sensor sends a reference signal for each turn of the engine and each subsequent tooth of the phonic wheel informs the control unit of an increase of the angular position of the crankshaft, so that injection is sent correctly to the suitable cylinder and the spark to the corresponding pair of cylinder

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 electromechanical-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.

OPERATING LOGIC

– Identification of the "operating point":

the "point of operation of the engine" is located 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 extremely 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. .

– 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 fitted directly on the throttle body which acts on the throttle by-pass: in fact, when the throttle is closed, this valve adjusts the by-pass gap 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 sensor-:

the oxygen sensor (or "lambda" sensor) 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 sensor 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 sensor is processed inside the control unit by a special integrator which prevents sudden "oscillations".

The sensor is heated by an electrical resistance so that it quickly reaches the correct operating temperature (appr. 300 °C).

Through this sensor 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%).

– Pinging control:

Through a knock sensor the control unit is informed if any pinging or "pinging" 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 pinging 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 conditioner system and it cuts in the compressor in relation to operation of the engine.

For further details see section "32A - Air Conditioner"

– Connection with the radiator cooling fan

in this version the thermal contact for controlling the cooling fan on the radiator has been eliminated. The command for the first and second speed of the fan is in fact supplied by the injection control unit in relati to the temperature measured by the coolant fl temperature sensor.

– Connection with 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 to start the engine: this consent is given only if the ALFRA 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 the special serial line which connects them.

– Self-diagnosis:

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 corresp ding warning light on the instrument cluster.

The warning light turns on when the engine is started to indicate the initial test of the entire system (appr. 4 seconds), it then turns off if no errors have been memorised: otherwise it stays on.

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 (see "Fault-finding"), through which all the errors memorised can be "read". It is also possible to check the operating parameters recorded by control unit and operate the single actuators to check whether they are working properly.

COMPONENTS

The electronic control unit receives the signals leading from the **sensors** which measure the engine operating parameters. It processes them according to a logic stored inside in "maps" which correlate the different parameters in the best way possible and it operates the **actuators** accordingly so that the engine always works with the highest level of regularity and yield.

The sensors are the following:

- 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 the following:

- injectors (**S3**);
- ignition coils (**A8**);
- fuel pump (**P18**);
- idle adjustment actuator (**S29**);
- vapour recovery solenoid valve (**M15**) ;
- timing variator (**S15**).

The control unit is also connected with:

- the climate control unit and engine cooling system;
- the ALFA ROMEO CODE control unit (**N77**);
- the instrument cluster (**C10**) to which it supplies the signal for turning on the diagnosis warning light and for the rev counter,
- the tachometric sensor (**L17**) from which it receives the car speed signal.

The system is completed by three relays: the first two - the main relay (**S41**) and the fuel pump relay **S12a** operate the fuel pump, the injectors, the coils and the other components of the system, while the third - the timing variator relay (**S12c**) supplies the corresponding component.

The supply line for the entire system is protected by fuse **S36**, while the control unit is protected by wander fuse (**S46**).
Lastly, there is an earth point (**G60**) on the engine.
Connector **T1** enables connection with the ALFA ROMEO Tester: this is located inside the car next to the control unit.

FUNCTIONAL DESCRIPTION

The Motronic control unit **S11** controls and adjusts the entire electronic ignition and injection system; all the system supply lines are protected by fuse **S36** (30A).

The control unit is supplied at pin 18 directly from the battery via the above-mentioned fuse **S36**. At pin 37 it receives the supply from the main relay **S41**, while at pin 27 it receives the "key-operated" supply.
For box "C" the line is protected by fuse **F14** in fusebox **G1**.
Pins 2, 14, 19 and 24 are earthed and they serve as reference respectively for the ignition, injectors, electronic screening and for the final power stages.

The main relay **S41** controls the entire system; it is energised by a command 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**, the injectors **S3**, coils **A8**, the EGR solenoid valve **L46** (if present), to the air flow meter **S5**, the sensor **S36**; in addition - via fuse **S46** (15A) - to the timing variator relay **S12c**, the vapour recovery solenoid valve **M15**, and to the idle speed actuator **S29**.

The fuel pump relay **S12a**, supplied by the main relay **S41**, is energised by a command signal - earth - leading from pin 3 of the control unit **S11**. Consequently, the relay supplies the fuel pump **P18**. The earth at the pump **P18** leads through the inertial switch **H20** which cuts off the circuit in the event of a crash.

The control unit **S11** receives numerous signals from the various sensors, thereby keeping all the engine parameters under control.
The rpm sensor **S31** sends information about engine speed through a frequency signal sent to pins 48 and 49 of the control unit; these two signals are very low in intensity and are therefore suitably screened.

The sensor is inductive and detects the engine rpm through the changing of the magnetic field produced by the passage of the teeth of a "phonic" wheel (60-2 teeth) fitted on the crankshaft.

The cam angle sensor **S52** (timing sensor), is supplied at 5 V from pin 12 of the control unit and sends a frequency signal corresponding to the phase at pin 8 of the control unit; these two signals are very low in intensity and are therefore suitably screened.

The sensor comprises a Hall effect device by which the voltage signal that is sent to the control unit "lowers" sharply when the hollow machined on the camshaft passes in front of the sensor itself.

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; the above two signals are very low in intensity and are therefore suitably screened.

The sensor is heated with a resistance to make sure that it operates correctly even when the engine is cold; the resistance is supplied by the main relay **S41** and protected by a specific fuse **S46** (15A).

The throttle body sensor **S38**, supplied by the control unit from pins 12 and 30, relays a signal through a potentiometer to pin 53 which is proportionate with the degree of opening of the actual throttle.
The engine temperature sensor **S7**, connected to the electronic earth at pin 30, supplies a signal to pin 45 which is proportionate with the temperature of the engine coolant fluid, detected with an NTC material (resistance which lowers with the temperature).

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

The pinging sensor **S20** supplies information about pinging conditions through a frequency signal sent to pin 11 of the control unit, 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, the purpose of which is to detect the vibrations produced by the engine 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 air flow meter **S5** is supplied by relay **S41**; it receives the reference earth from pin 30 of the control unit, while it sends to pin 7 a signal proportionate with the air flow rate.
The air flow meter is of the "heated film" type; a diaphragm is placed 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 withdraws heat from the diaphragm, therefore, in order to keep it at a constant temperature, a certain current must flow through the resistance; this current, suitably measured, is proportionate with the mass of air that flows.

Depending on the signals received from the sensors and 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) when the main relay **S41** opens.

The static ignition is managed directly by the control unit which adjusts the advance automatically.
N.B. The power modules which generate the high voltage pulses are located inside the control unit itself.
The command 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 plug **A12**: from pin 1 and 21 for cylinders 1-4 and from pin 28 and 30 for cylinders 2-3.

The primary windings of the coils **A8** are supplied with "key-operated" 12V from relay **S42**.
The power modules inside the control unit are connected to earth via pin 2.
The idle adjustment speed actuator **S29** forms a by-pass line of the flow of air; it comprises two windings: one opens and the other closes a valve which adjusts the gap of the by-pass section; it is controlled by the control unit through the duty-cycle signals of pin 22 (closing) and 4 (opening).

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

The timing variator **S15** mechanically controls timing advance at the intake; it is controlled by the corresponding relay **S12c**; this is supplied by relay **S41** and is energised through a negative signal from the control unit, pin 52, thus it supplies the timing variator **S16**:

this signal operates the actuator which controls the flow of oil in the hydraulic unit of the device which adjusts the rotation of the camshaft.

The tachometric signal (car speed) reaches the control unit at pin 9 through sensor **L17**: while the control unit sends a "pulse" signal from pin 6 to the cluster proportionate with engine rpm; the signal for the "injection failure" warning light on the cluster **C10** leads from pin 51.

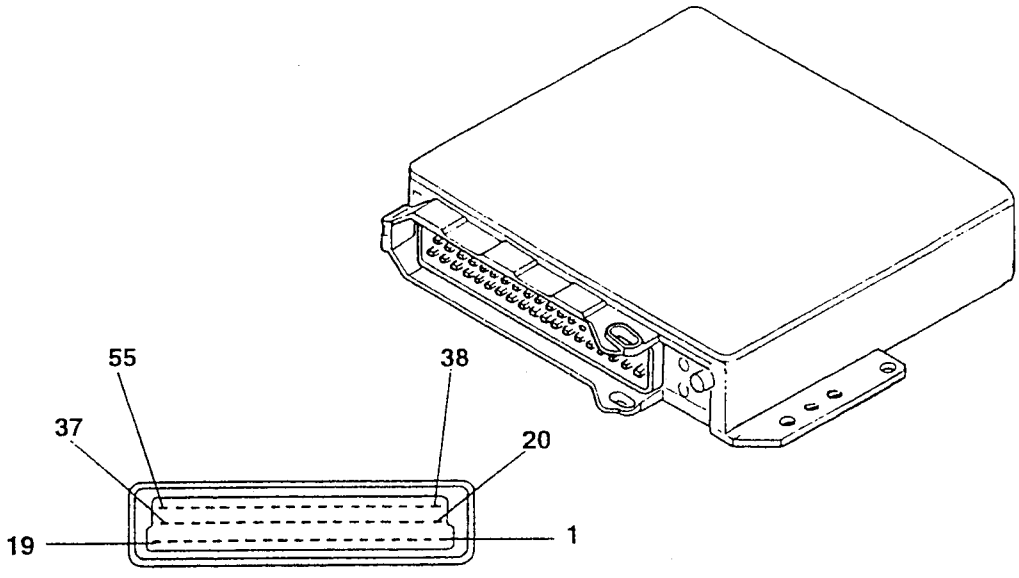
The control unit **S11** is connected with the air conditioning system via pins 32, 40, 43 and 44.

This makes it possible to adapt the engine idle speed to the increased load each time the compressor is engaged or to cut it out in the event of high speed or high engine loads.

The control unit **S11** controls and adjusts the engine water cooling fan/s **P2** operating system.
Pins 26 and 25 respectively give the command for engaging first and second speed of the fan.

The control unit **S11** is connected with the ALFA ROMEO CODE control unit **N77** through the special serial line from pin 47. This way, if the ALFA ROMEO CODE does not detect a correct "key code" it will not allow the Motronic control unit to start the engine.

The control unit is fitted with a self-diagnosis system, which can be used connecting with the ALFA ROMEO Tester at connector **T1**; it receives the fault signals from the control unit through the diagnosis line K - p 55 -, while the earth leads from **G60**.

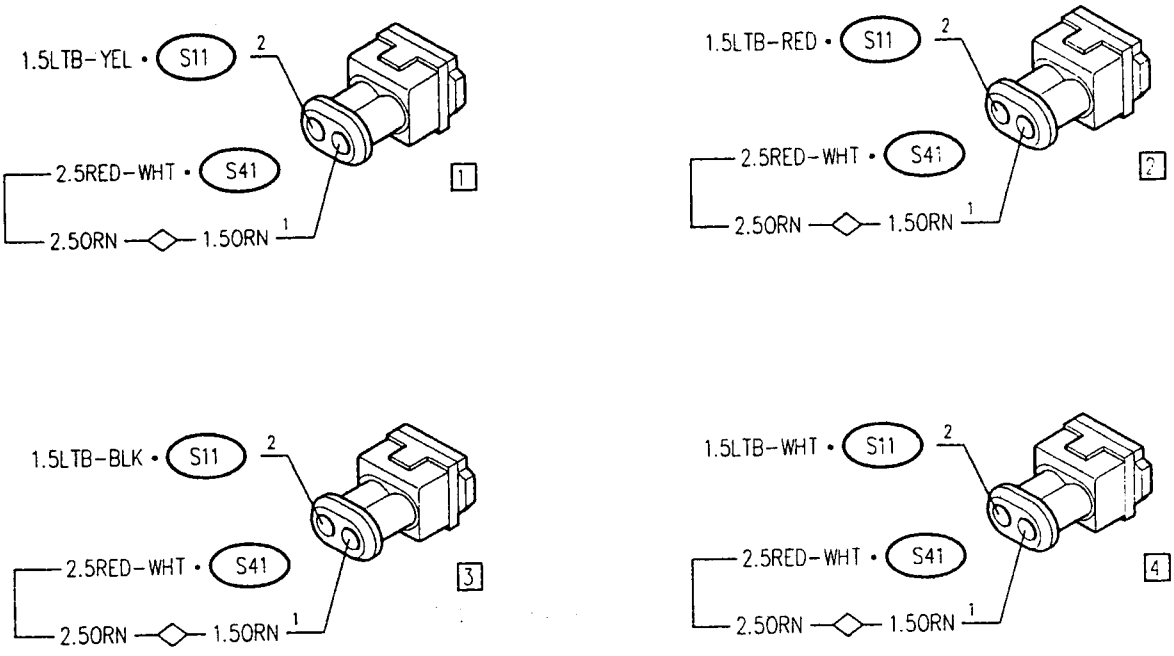


CONTROL UNIT PIN-OUT

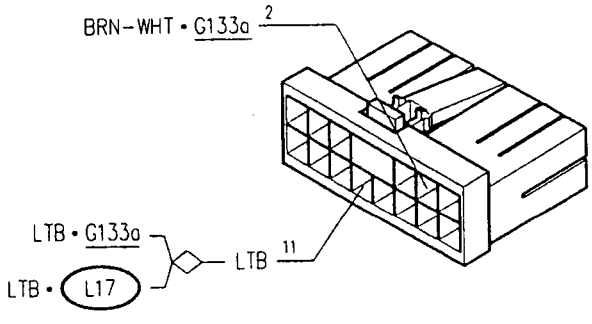
1. Ignition coil control - cyl. 1 and 4 -
2. Earth for ignition
3. Fuel pump relay control
4. Idle actuator control - opening
5. Evaporative solenoid valve control
6. Rev counter signal
7. Air flow meter signal
8. Timing signal
9. Car speed signal
10. Lambda sensor signal
11. Pinging sensor signal
12. Stabilized voltage (5V) for sensors
13. N.C.
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. Fan 2nd speed command
26. Fan 1st speed command
27. "Key-operated" supply
28. Lambda sensor earth
29. N.C.
30. Electronic earth for sensors
31. N.C.
32. Conditioner compressor relay control
33. N.C.
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. N.C.
42. N.C.
43. Fand second speed engagement request
44. Fan first speed engagement request
45. Engine temperature signal
46. N.C.
47. Connection line with ALFA ROMEO CODE
48. Signal for rpm sensor
49. Rpm sensor signal
50. N.C.
51. "Check Engine" warning light
52. Timing variator control
53. Throttle position signal
54. Intaken air temperature signal
55. Diagnosis line K

COMPONENTS AND CONNECTORS

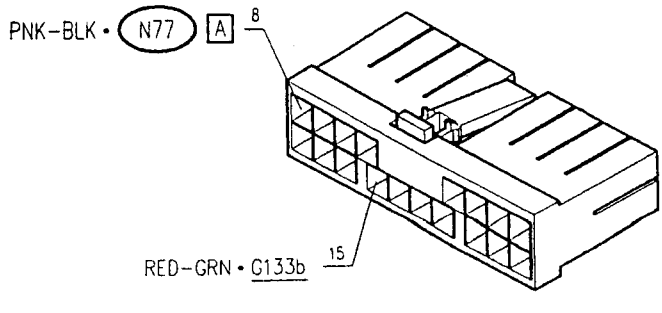
Ignition coil — A8



Instrument cluster — C10 A

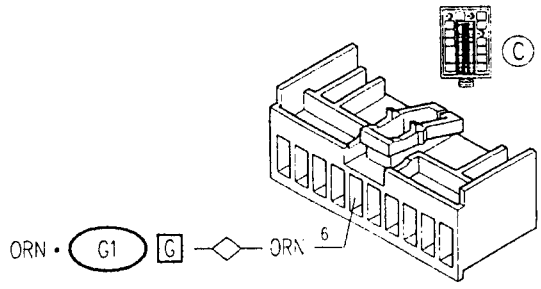


Instrument cluster — C10 B

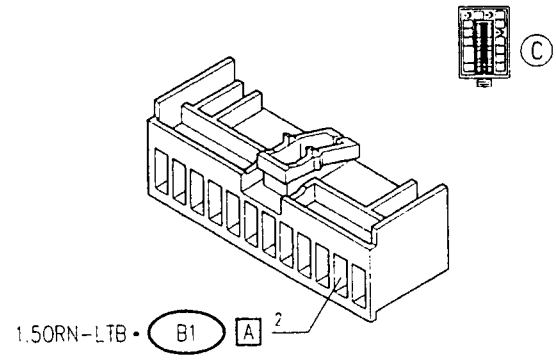


COMPONENTS AND CONNECTORS (contd.)

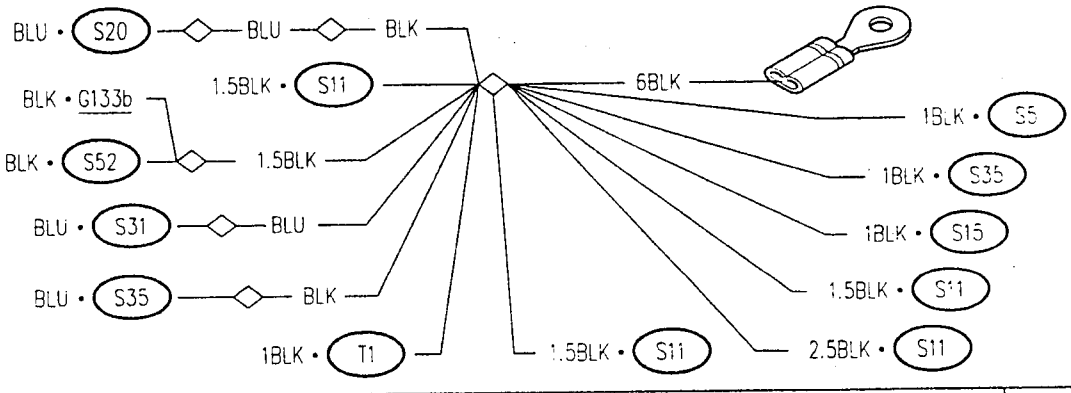
Fusebox	G1 G



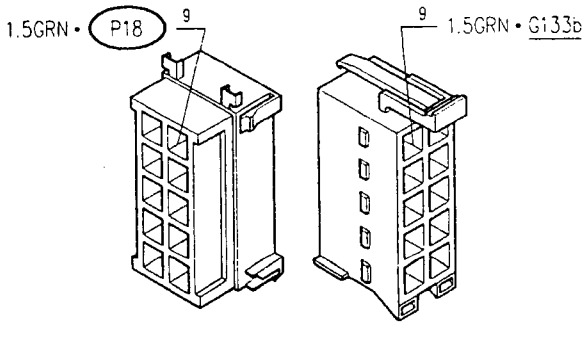
Fusebox	G1 H



Injection wiring earth	G60

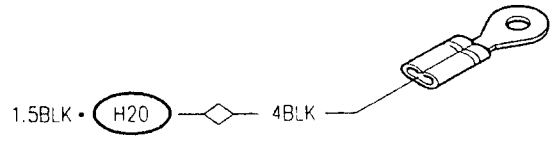


Rear services connector	G73 A

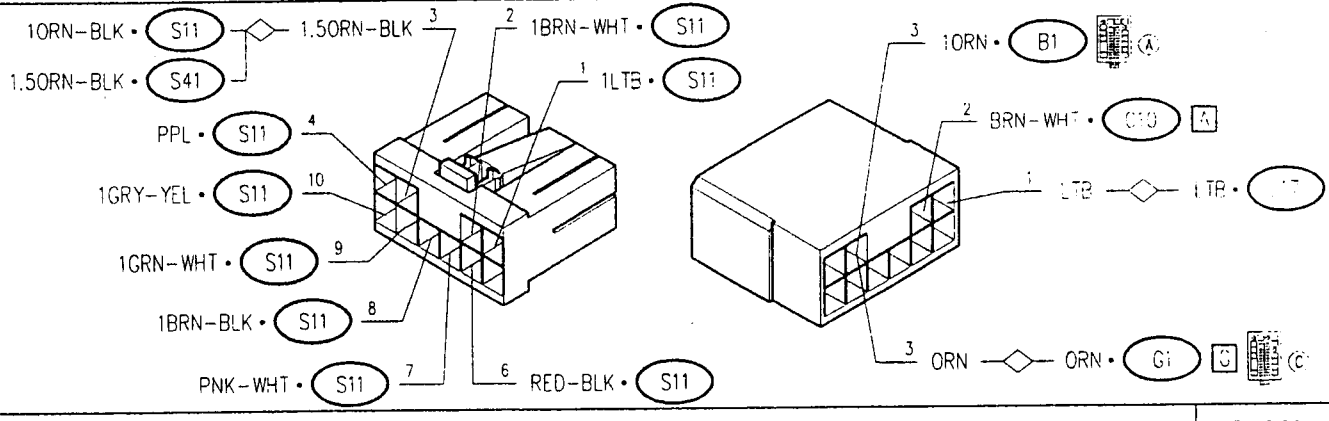


COMPONENTS AND CONNECTORS (contd.)

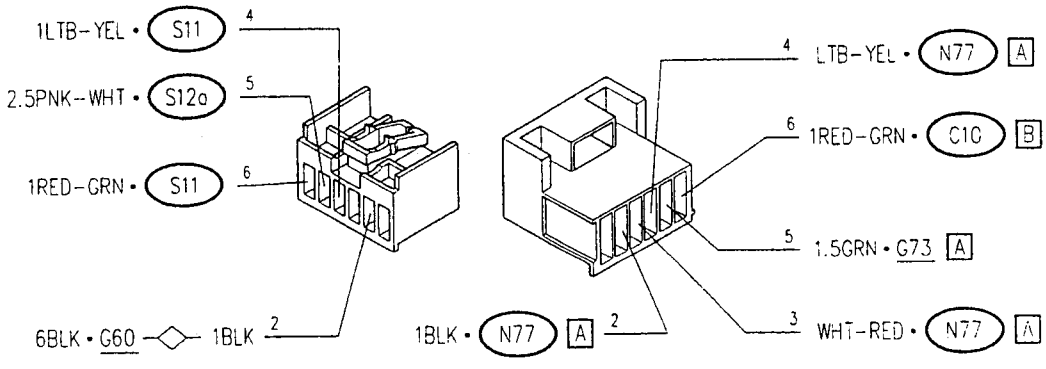
Seat crossmember earth	G106



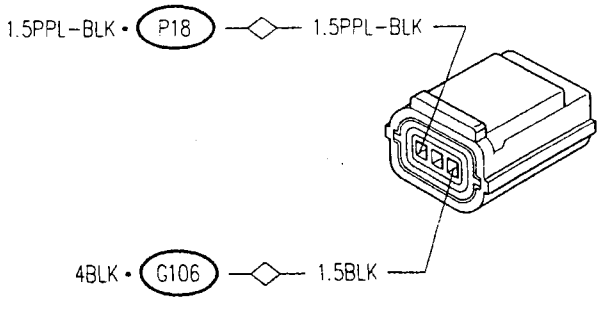
Electr. injection wiring connector A	G133a



Electr. injection wiring connector B	G133b

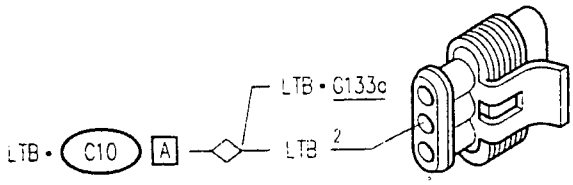


Inertial switch	H20

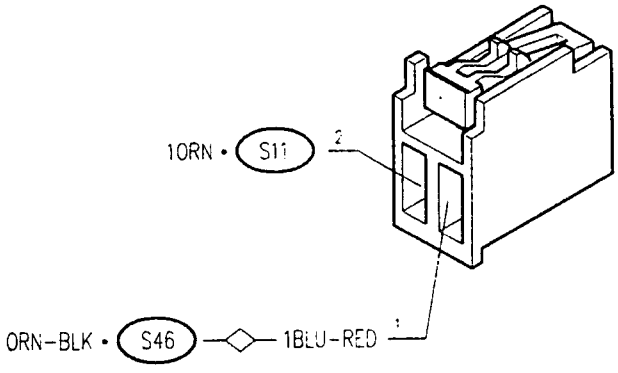


COMPONENTS AND CONNECTORS (contd.)

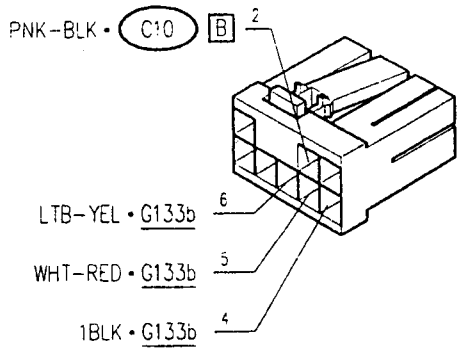
Tachometric sensor	L17



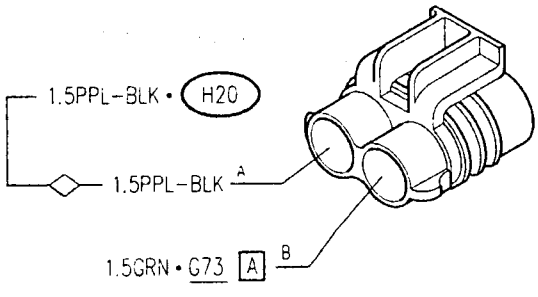
Evaporative solenoid valve	M15



ALFA ROMEO CODE control unit	N77 A

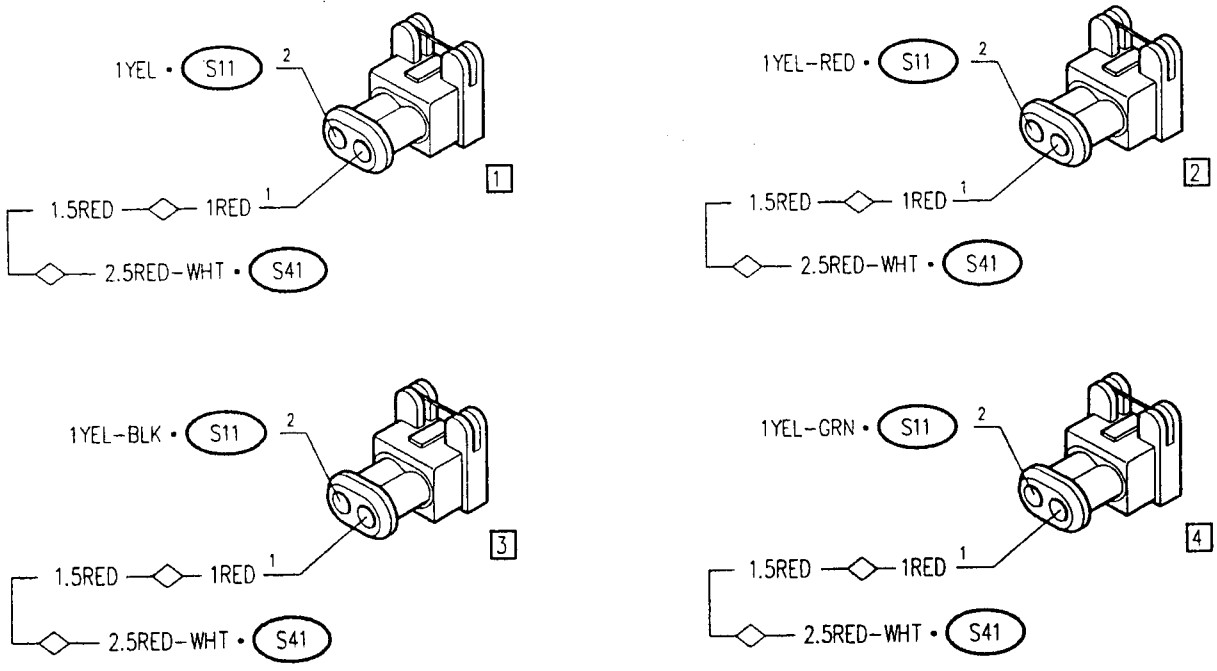


Electric fuel pump	P18

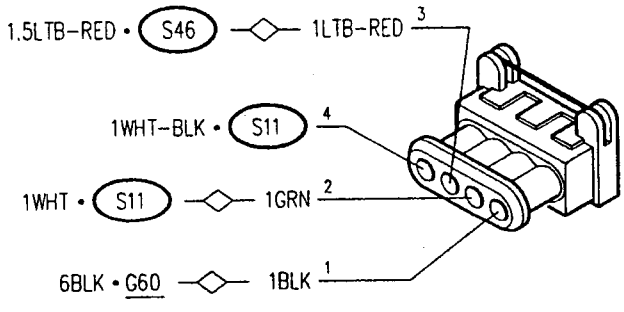


COMPONENTS AND CONNECTORS (contd.)

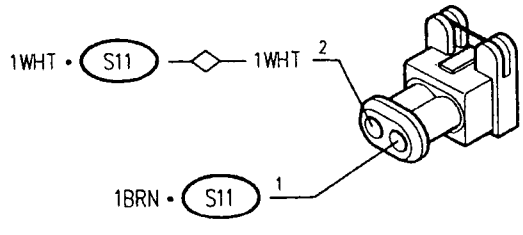
Injector — S3



Air-flow meter — S5

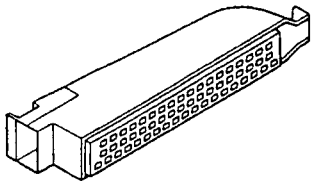


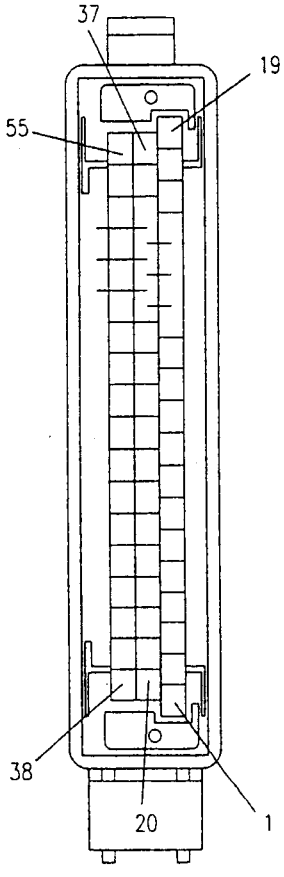
Engine temperature sensor — S7



COMPONENTS AND CONNECTORS (contd.)

Motronic control unit — S11



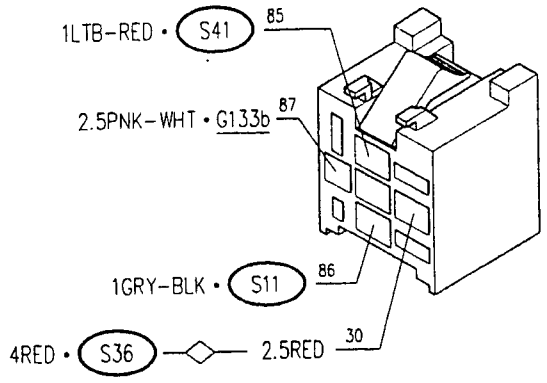


1 — 1.5LTB-YEL • A8 [1]
2 — 2.5BLK — 6BLK • G60
3 — 1GRY-BLK • S12a
4 — 1LTB-BLK • S29
5 — 1ORN • M15
6 — 1BRN-WHT • G133a
7 — 1WHT-BLK • S5
8 — 1BRN-GRN • S52
9 — 1LTB • G133a
10 — BLK • S35
11 — RED • S20
12 — 1GRY-GRN — 1LTB-WHT • S38; BLU-YEL • S52
14 — 1.5BLK
16 — 1YEL-BLK • S3 [3]
17 — 1YEL • S3 [1]
18 — 2.5RED — 4RED • S36
19 — 1.5BLK
20 — 1.5LTB-BLK • A8 [3]
21 — 1.5LTB-GRN • A8 [4]
22 — 1ORN-BLK • S29
24 — 1.5BLK — 6BLK • G60
25 — RED-GRN • G133a
26 — PNK-WHT • G133a
27 — 1ORN-BLK — 1ORN-BLK • G133a; 1ORN • S41
28 — GRN • S35
30 — 1WHT — 1WHT • S34; 1WHT • S38; 1WHT • S7; 1GRN • S5; 1WHT • S20

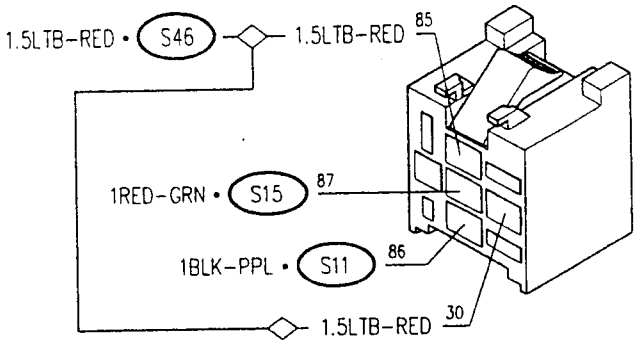
32 — 1BRN-BLK • G133a
34 — 1YEL-RED • S3 [2]
35 — 1YEL-GRN • S3 [4]
36 — 1GRN-BLK • S41
37 — 1.5GRY — 2.5RED-WHT • S41
38 — 1.5LTB-RED • A8 [2]
40 — 1GRN-WHT • G133a
43 — PPL • G133a
44 — 1GRY-YEL • G133a
45 — 1BRN • S7
47 — 1LTB-YEL • G133b
48 — BLK • S31
49 — YEL • S31
51 — RED-GRN • G133b
52 — 1PPL-BLK • S12c
53 — 1PPL-WHT • S38
54 — 1PNK-BLK • S34
55 — 1WHT-RED • T1

COMPONENTS AND CONNECTORS (contd.)

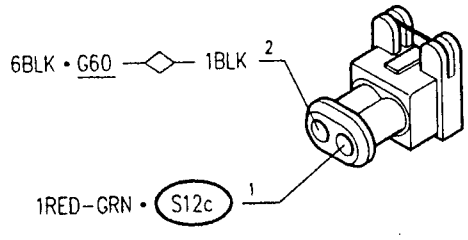
Fuel pump Motronic relay — S12a



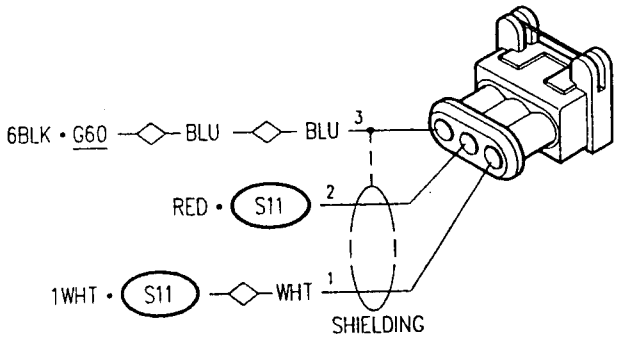
Timing variator relay — S12c



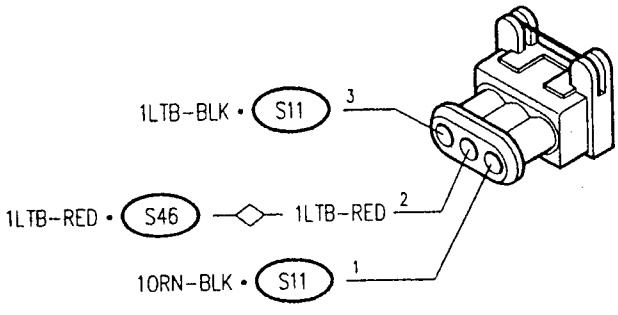
Timing variator — S15



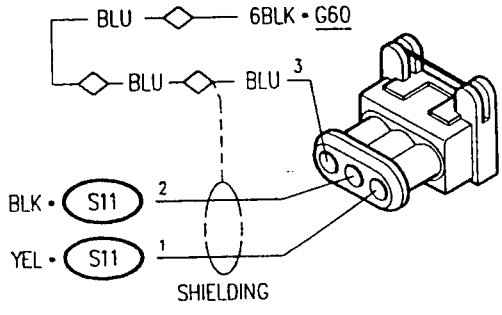
Knocking sensor — S20



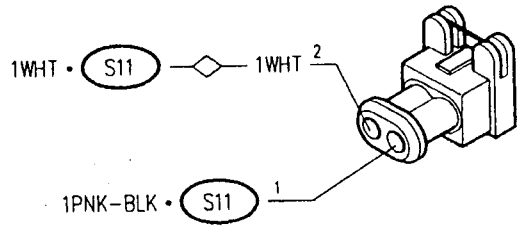
Idle adjustment actuator — S29



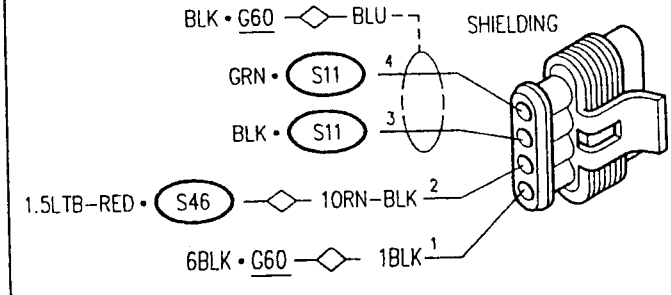
Rpm and crankshaft position sensor — S31



Air temperature sensor — S34

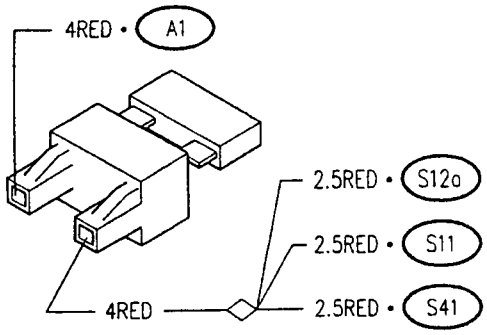


Heated lambda probe — S35

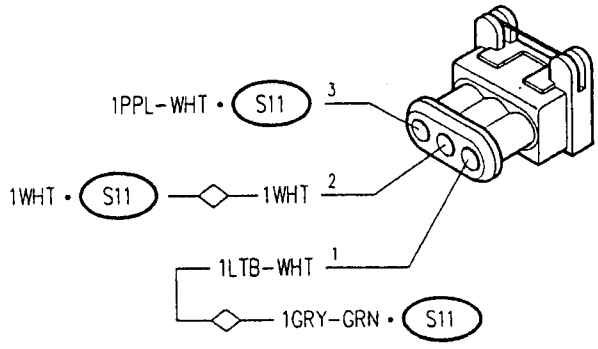


COMPONENTS AND CONNECTORS (contd.)

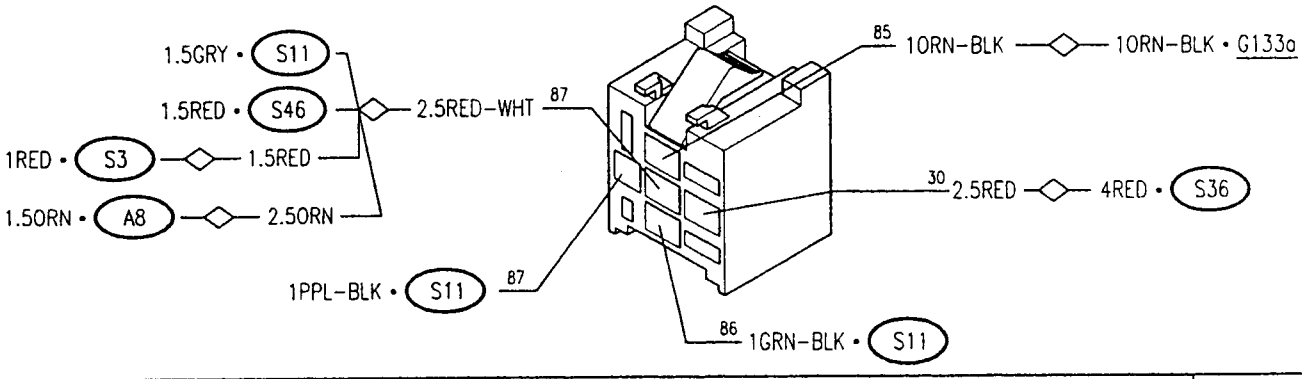
Injection wander fuse — S36



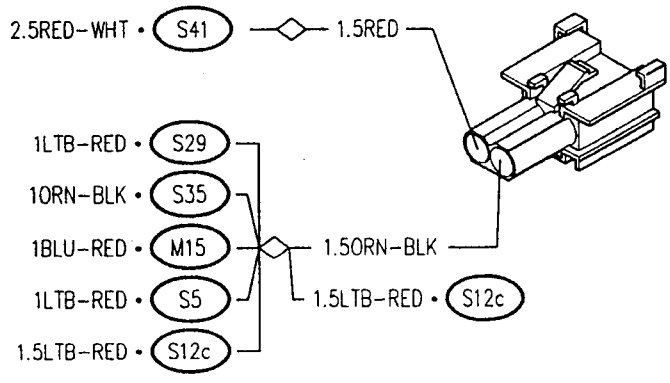
Sensor on throttle body — S38



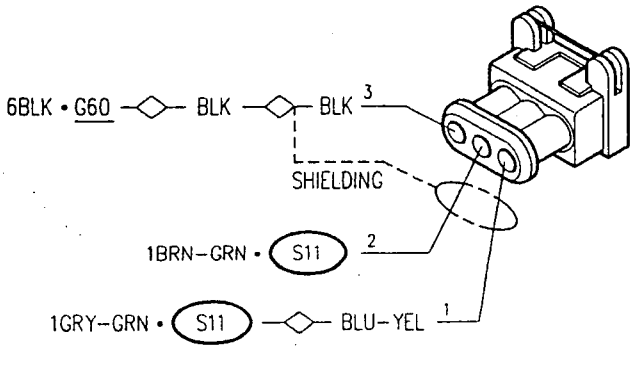
Main relay — S41



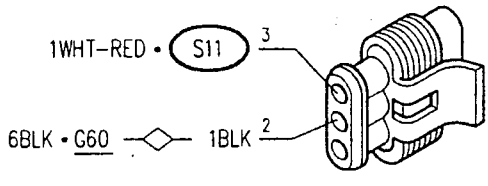
Fuse for Motronic supply — S46



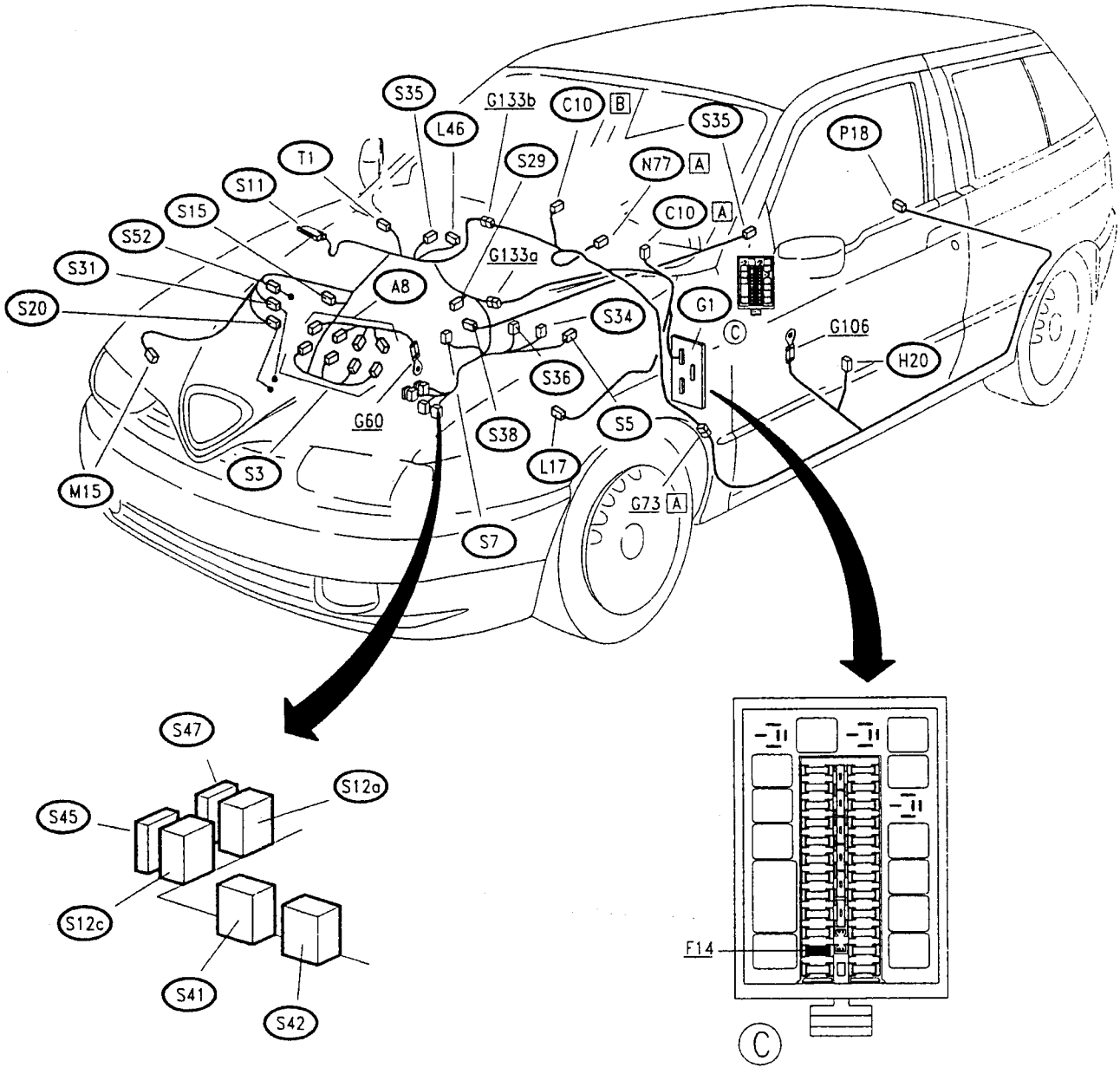
Cam angle sensor — S52



Connector for ALFA TESTER (Motronic) — T1

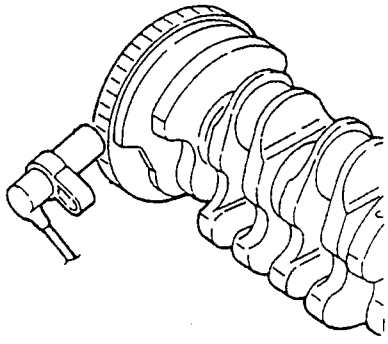


LOCATION OF COMPONENTS



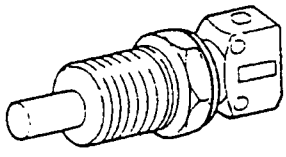
CHECKING COMPONENTS

Rpm sensor (S31)



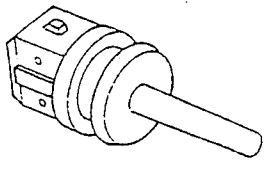
SPECIFICATIONS	
Sensor winding resistance (20 °C)	486 ÷ 594 Ω
Distance (gap) between sensor and phonic wheel	0.5 ÷ 1.5 mm

Engine temperature sensor (S7)



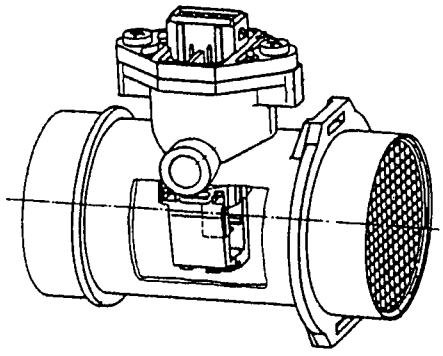
SPECIFICATIONS	
Temperature (°C)	Resistance (Ω)
- 10°C	8100 ÷ 10770 Ω
+ 20°C	2280 ÷ 2720 Ω
+ 80°C	292 ÷ 362 Ω

Intake air temperature sensor (S34)

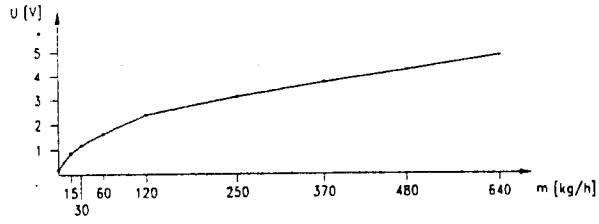


SPECIFICATIONS	
Temperature (°C)	Resistance (Ω)
- 10°C	8100 ÷ 10770 Ω
+ 20°C	2280 ÷ 2720 Ω
+ 80°C	292 ÷ 362 Ω

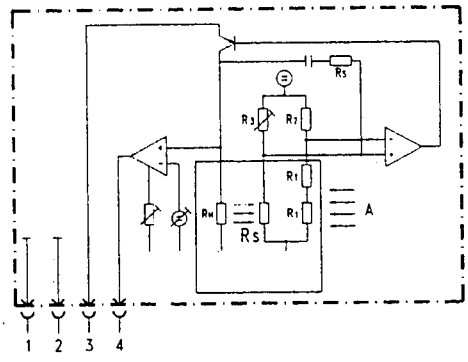
Air flow meter (S5)



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

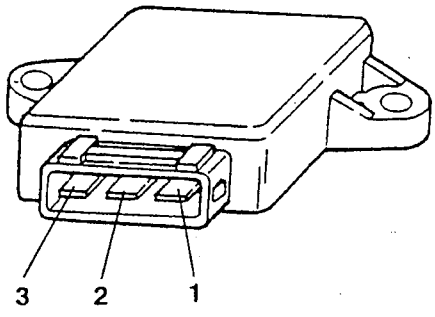


Sensor characteristic curve
m = capacity
U = voltage between pin 4 and 2



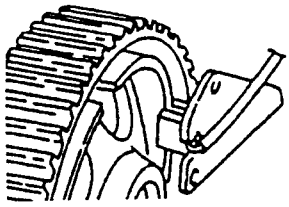
pin 1 - Earth
pin 2 - Reference earth
pin 3 - 12 V supply
pin 4 - Measurement signal
A = air
Rs = hot film sensor

Throttle position sensor (S38)

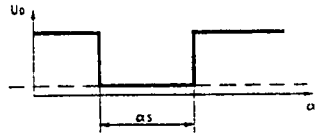


SPECIFICATIONS	
Resistance between terminals:	
1 - 2 (fixed)	≃ 2 kΩ
1 - 3 (throttle closed)	≃ 1 kΩ
1 - 3 (throttle completely open)	≃ 2.7 kΩ

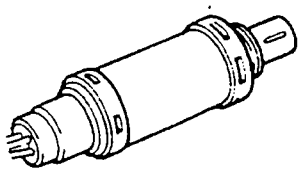
Cam angle sensor (S52)



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

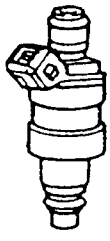


Lambda sensor (S35)



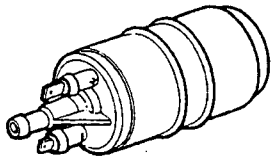
SPECIFICATIONS	
Heating resistance	3 Ω

Injectors (S3)



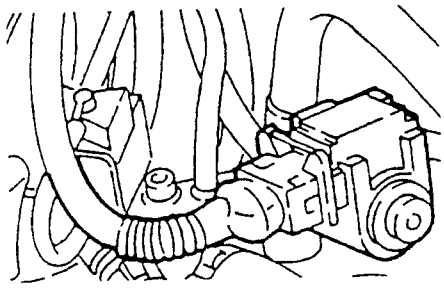
SPECIFICATIONS	
Winding resistance	15.9 ± 0.35 Ω

Fuel pump (P18)



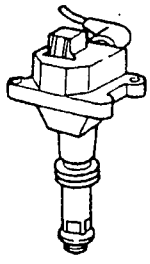
SPECIFICATIONS	
Capacity	≥120 l/h
Pressure	4 bar
Nominal voltage	12V

Idle speed adjustment actuator (S29)



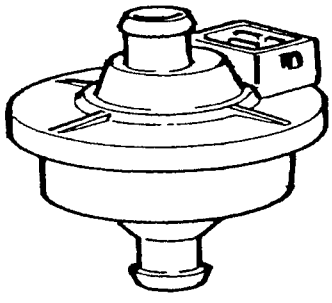
SPECIFICATIONS	
Resistance between terminals:	
1 - 3	~ 33 Ω
1 - 2	~ 17.5 Ω
2 - 3	~ 15.5 Ω

Ignition coils (A8)



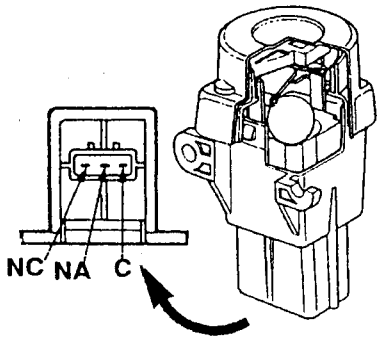
SPECIFICATIONS	
Primary resistance	0.3 Ω ± 12%
Secondary resistance	7 kΩ ± 12%

Evaporative solenoid valve (M15)



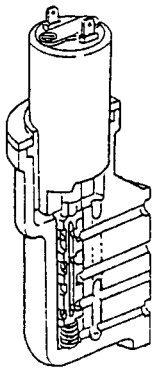
SPECIFICATIONS	
Duty-cycle signal	12 V; 10 Hz
Winding ohmic resistance ohmica	26 ± 4 Ω
When not energised the solenoid valve is normally closed	

Inertial switch (H20)



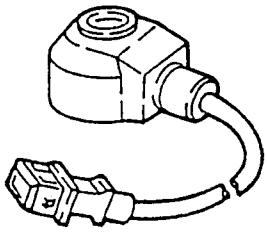
SPECIFICATIONS
Check continuity between pin NC and C: this continuity is cut off in case of a crash: the contact is closed again pressing the special push-button

Timing variator (S15)



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

Pinging sensor (S20)



SPECIFICATIONS		
Resonance frequency		> 20 kHz
Impedence		⊥ 1 MΩ
Allowed vibration	for long times	≤ 80 g
	for short times	≤ 400 g

FAULT-FINDING

The control unit possesses a self-diagnosis function which continuously checks the signals from the various sensors for plausibility and comparing them with the permissible limits: if these limits are exceeded, the system detects a fault and memorises it. It also turns on the special warning light on the instrument cluster,

For certain parameters the control unit replaces the abnormal values with appropriate mean values so that the car can "limp" to a point of the Service Network.
These values, known as "recovery" depend on the other correct signals and 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 the errors memorised may be "read". It is also possible to check the operating parameters recorded by the control unit and engage 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 test described below (**TEST A**).

The Tester and electronic control unit should be connected as follows:

1. Power the Tester either through the cigar lighter socket or connecting it directly to the battery using the special cable.
2. Connect the socket of the Tester to the one for the control unit (to be found next to the control unit).

The information the instrument can provide is:

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

Error clearing

Before ending diagnosis the contents of the "permanent" memory are cancelled through the Tester in Active Diagnosis.

Otherwise, reconnecting the Tester errors already examined would be signalled.

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

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

N. B.:
Disconnecting the control unit for at least 30 seconds the contents of the "permanent" memory are cleared

PRELIMINARY TEST OF BOSCH M2.10.4 SYSTEM — TEST A

NOTE: Beforehand check that the ALFA ROMEO CODE system is working correctly as it may have cut off the supply to the system!

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 CHECK FUSE – Check the intactness of fuses **S36** and **S46**	OK ▶	Carry out **step A2**
	OK ▶	Change fuses **S36**: 30A **S46**: 15A
A2 CHECK VOLTAGE – Check for 12 V at pin 30 of relays **S41** and **S12a**	OK ▶	Carry out **step A3**
	OK ▶	Restore the wiring between the battery **A1** and relays **41** and **S12a** through fuse **S36**
A3 CHECK VOLTAGE – With the key turned, check for 12 V at pin 85 of relay **S41**	OK ▶	Carry out **step A4**
	OK ▶	Restore the wiring between the ignition switch **B1** and relay **S41**
A4 CHECK RELAYS – Check that relays **S41** and **S12a** are working properly	OK ▶	Carry out **step A5**
	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 for appr. 0 V (very low voltage) at pin 3 and 36 of **S11**	OK ▶	Carry out **step A6**
	OK ▶	Restore the wiring between the control unit **S11** and relays **S41** and **S12a**
A6 CHECK EARTH – Check for an earth at pins 2, 14, 19 and 24 of **S11**	OK ▶	**CONTINUE DIAGNOSIS USING THE ALFA ROMEO TESTER**
	OK ▶	Restore the wiring between **S11** and earth **G60**