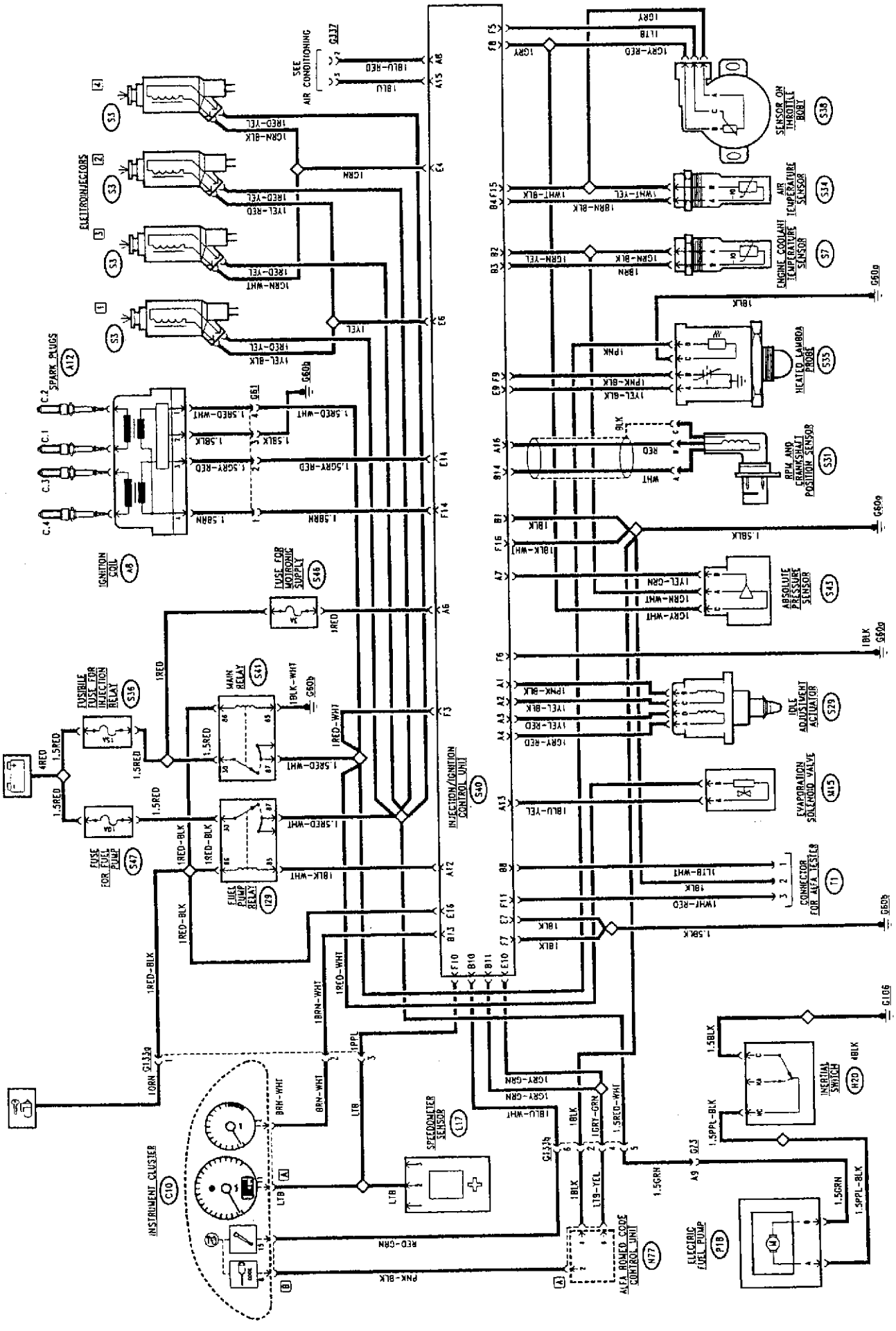
ROCHESTER INJECTION/IGNITION SYSTEM (*)

- Boxer 1.6 engine -

INDICE

(*) from chassis No.___ it replaces the MOTRONIC MP3.1 system (sect. 55-35)

WIRING DIAGRAM



GENERAL DESCRIPTION

The **Rochester injection/ignition management control unit** (ACG Multec XM) belongs to the category of integrated digital electronic ignition systems with lost spark static distribution of the high voltage, and semi-sequential, timed, multipoint injection.

The calculation of the **base injection time** is carried out following the indirect measurement of the engine load by the calculation of the absolute pressure in the intake manifold and the engine rpm (SPEED-DENSITY system).

This value is then corrected, to optimise the stoichiometric ratio, according to the following parameters:

- water temperature;
- air temperature;
- lambda probe signal;
- transient stages.

The **electroinjectors** are connected in pairs (1-2 and3-4) injecting half the fuel dose at each turn of the crankshaft (semi- sequential injection).

The **spark advance** is calculated according to the engine speed and load, through a control unit map defined experimentally.

This value is optimised according to the:

- water temperature;
- air temperature;
- transient stages;
- altitude (calculated by a specific map according to the rpm, absolute pressure and throttle opening);
- idle speed control;
- starting phase.

The **distribution of the high voltage** to the spark plugs takes place through an ignition module comprising two coils and two power modules.

The control unit is **self-adaptive**.

The self-adaptation function allows the system to adjust to ageing of the engine components or to the production tolerances of new engines and components.

The control unit is therefore capable of detecting the changes which take place in the engine (different internal friction at different temperatures, settling of the engine over the course of time, etc.).

Operating logic

The functions of the control unit are the following:

- starting, cold starting;
- engine warming;
- transient stages;
- full load;
- fuel cut-off;
- spark advance control
- idle speed control;
- rpm limiting;
- exhaust gas control;
- fuel vapour recovery;
- conditioner compressor connection;
- connection with the ALFA ROMEO CODE system;
- system self-diagnosis;

Starting, cold starting

During starting the control unit carries out a specific electroinjector command logic, subdivided into two times:

- Prime Pulse;
- Alternating Simultaneous Double Fire Crank.

The Prime Pulse (with opening of all the injectors) takes place as soon as possible to minimise the starting time. The quantity of it depends on the temperature of the coolant fluid.

Subsequently the alternating simultaneous double fire crank takes place twice for every turn of the crankshaft and lasts until the engine speed exceeds 350 rpm.

At this point, normal alternating simultaneous injection is activated.

During cold starts the mixture is boosted by values mapped according to the temperature of the coolant fluid and absolute pressure.

Suitable anti-flooding functions reduce boosting for prolonged starting times.

Engine warming

The warming phase begins when starting has ended and it lasts until the conditions occur for "Closed Loop" operation (operating field of the lambda probe).

During this phase the mixture is richer and it is gradually leaned as the coolant fluid temperature increases.

Transient stages

Enrichment during acceleration and leaning during deceleration are activated in relation to the change of the throttle opening and of the absolute pressure.

Full load

When the engine is operating at full load the mixture is boosted to allow the engine to reach maximum power (outside the stoichiometric ratio): indeed, the reading of the lambda probe is disabled.

Fuel cut-off

When the accelerator pedal is released and depending on the engine rpm, engine load and coolant fluid temperature, the control unit cuts off injection, which will be restored depending on the same conditions.

Spark advance control

The electronic control unit also processes the static electronic firing control logic.

The optimal spark advance is calculated as follows:

- A base advance angle is calculated through a map stored in the memory in which the input parameters are the engine rpm, the absolute pressure detected of the intake manifold and the throttle closed or open condition.
- The values obtained in this way are added to the correction concerning the coolant temperature throughout the cold starting phase.
- The idle speed table value is further corrected if the idle rpm falls abruptly (for example resulting from the engagement of a service).
- In the case of deceleration and the consequent cut-off action, a subtractive correction is carried out.
- The advance angle value is also subjected to correction in the throttle transient stages or return from cut-off to engine idle rpm threshold.
- During starting a specific table is displayed.

Idle speed control

The control unit controls the idle speed in three ways:

- through an idle actuator (stepper motor) which acts on the throttle by pass through a prod;
- by correcting the spark advance;
- by correcting the injection time.

The idle control is activated to compensate the power absorbed by the various services in order to ensure the most constant operating speed possible.

Rpm limiting

Injection is cut off upon exceeding 6500 rpm.

Exhaust gas control - Lambda Probe

The control unit ensures a metering of the air-fuel mixture nearing the stoichiometric ratio and keeping it so for the longest time possible, in order to limit the emission of harmful substances, and obtain correct and longlasting operation of the catalytic silencer.

Fuel vapour recovery

The fuel vapours leading from the fuel tank are gathered in an active carbon filter (canister) to be re-admitted to the intake and then burnt.

The amount of vapours taken in is managed by the control unit through a solenoid valve, driven in a Duty Cycle, according to engine rpm, engine load and the injection time.

Air conditioner compressor connection

The control unit is interfaced with the air conditioning system (if fitted).

When it receives the request to turn on the compressor, after checking the engine rpm, coolant temperature and the throttle angle, the control unit commands engagement of the compressor.

It will also intervene appropriately to keep the idle speed constant (compensating the higher load caused by the cutting in and out of the compressor).

Connection with the "ALFA ROMEO CODE" system

The system is connected to the ALFA ROMEO CODE control unit, from which it receives the operating consent signal via a special connection line.

The engine control unit is only enabled when the ALFA ROMEO CODE control unit recognises the code of the key engaged in the ignition lock as correct.

System self-diagnosis

The control unit cyclically checks the input and output signals in addition to its internal circuits, memorising any errors detected, in the event of faults.

The errors are entered on two maps:

- the CURRENT map (or table) associated with a volatile memory (RAM);
- the HISTORY map (or table) associated with a non volatile or permanent memory (STAND-BY RAM).

The moment in which the control unit detects an error this is written in the CURRENT table (RAM).

If the error lasts for a certain length of time (validation time) the error is also written in the HISTORY table (STAND-BY RAM).

When the error ceases it is eliminated from the CURRENT table, but not from the HISTORY table where it remains until one of the following conditions arises which cause it to be cancelled:

- 20 starts (also not consecutive), without the error occurring again
- via command from the ALFA ROMEO TESTER
- after disconnecting the control unit from the wiring.

With regard to the actuators (electroinjectors, coil, etc.), these are tested using the ALFA ROMEO TESTER in "Active Diagnosis" (operating the actuators), because in certain cases they cannot be detected by the control unit as faulty components.

The driver is alerted of a fault on the injection/ignition system by the turning on of a failure warning light on the instrument cluster.

It turns off when the fault has been repaired or if the fault is "intermittent", (fault memorised, but no longer present).

When an error is present the control unit also replaces the lacking parameter with fixed replacement parameters memorised inside the control unit (RECOVERY), thereby allowing the engine to operate in "emergency" conditions, when possible.

Components

The electronic control unit receives the signals leading from the **sensors** which detect the engine operating parameters, processes them according to a logic stored inside it in maps which correlate the different parameters in an optimal manner, and it commands the **actuators** accordingly so that the engine always runs with maximum yield and regularity.

The sensors are the following:

- engine temperature sensor (**S7**)
- air temperature sensor (**S34**)
- sensor on throttle body (**S38**)
- rpm sensor (**S31**)
- heated lambda probe (**S35**)
- absolute pressure sensor (**S43**)

The actuators are the following:

- electroinjectors (**S3**)
- ignition module (**A8**)
- fuel pump (**P18**)
- idle speed adjustment actuator (**S29**)
- vapour recovery solenoid valve (**M15**)

The control unit is also connected with:

- the climate control unit
- the electronic key control unit (**N77**)
- the instrument cluster (**C10**) to which it sends the rev counter signal and the command for turning on the failure warning light
- the tachometric sensor (**L17**) from which it receives the car speed signal.

The system is completed by two relays: the main relay (**S41**) and the fuel pump relay (**I29**). The control unit supply line is protected by wander fuse (**S46**), the two relays are protected respectively by the injection relay wander fuse (**S36**) and the fuel pump wander fuse (**S47**).There is an earth point (**G60a** and **G60b**) on the engine.The connector (**T1**) enables connection with the ALFA ROMEO TESTER.

FUNCTIONAL DESCRIPTION

The control unit **S40** controls and adjusts the entire electronic ignition and injection system.
The control unit receives a positive direct from the battery - pin A6 - protected by fuse **S46** (3A).

Fuse **S47** (10A) protects the fuel pump relay **I29**; Fuse **S36** (15A) protects the main relay **S41**.

The key at MARCIA signal reaches pin E16 of the control unit and supplies the coils of the two relays: **S41** (main relay) and **I29** (fuel pump relay).

The former is energised and supplies the ignition module **A8**, the lambda probe resistance **S35** and the evaporative solenoid valve **M15**.

The control unit sends an earth from pin A12 which energises relay **I29** (supply to the injectors **S3** and to the fuel pump **P18**), only after it has received the engine "rpm signal". Additionally, the earth reaches the pump **P18** via the inertial switch **H20** which interrupts the circuit in the event of an impact, for safety reasons.

The power earth is supplied at pins B1, E7, F7 and F16 of **S40**, the earth at pin F6 disables a specific function).

The control unit **S40** receives numerous signals from the various sensors, thereby keeping all the engine operating parameters under control.

From pin F8 of the control unit a stabilised voltage is sent (+5V) to a number of sensors, while from pins B3 and F15 an electronic earth signal is sent.

The rpm sensor **S31** supplies information about the engine speed and the position of the crankshaft.

This 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 installed on the flywheel; the wheel has 60-2 teeth: the lack of 2 teeth makes it possible to locate the T.D.C. of the two pairs of cylinders (1-2 and 3-4). The sensor is connected to the control unit at pins B14 and A16; the two cables are screened.

The throttle position sensor **S38**, supplied by the control unit **S40** from pins F8 and F15, sends a signal to pin F5 which is proportionate with the degree of opening of the actual throttle. The mobile part of the potentiometer is in fact keyed directly onto the spindle which turns the throttle.

The air temperature sensor **S34** - located on the air intake pipe - is connected to the control unit **S40** at pin F15, and supplies a signal at pin B4 proportionate with the temperature of the air in the intake manifold.

The engine temperature sensor **S7**, connected to the control unit **S40** at pin B2, supplies a signal to pin B3 proportionate with the temperature of the engine coolant, detected next to the thermostat.

The absolute pressure sensor **S43**, supplied by the control unit **S40** from pins F8 and B2, sends a signal to pin A7 which is proportionate with the absolute pressure in the intake box.

The heated lambda probe **S35** supplies the control unit **S40** information about the correct composition of the air - fuel mixture measuring the concentration of oxygen in the exhaust gas; this takes place through the signal sent to pin F9 of the control unit **S40**, while it receives a reference earth from pin E9.
The probe is heated with a resistance, to ensure that it operates correctly.

The resistance is supplied by the main relay **S41**.

On the basis of the signals received from the sensors and the calculations carried out, the control unit **S40** controls the opening of the injectors **S3** through pins E4 and E6. The injectors receive the supply from relay **I29**.
The static ignition is operated directly by the control unit.
The power modules and coils are located in the module **A8**; the control unit **S40** sends the command signal from pins E14 and F14, while the actual module is supplied by relay **S41**.

The idle speed adjustment actuator **S29** (step motor) by-passes the flow of air. It is controlled by the control unit **S40** in two phases (forward/backward) from pins A1, A2, A3 and A4.

The evaporative solenoid valve **M15**, sends the fuel vapours from the canister towards the engine upon a command from the control unit: this signal - of the duty cycle type - is sent from pin A13. The valve is supplied by relay **S41**.

The control unit **S40**, which calculates the engine rpm through sensor **S31**, sends a signal from pin B13 t the rev counter indicator, located on the instrument cluster **C10**.

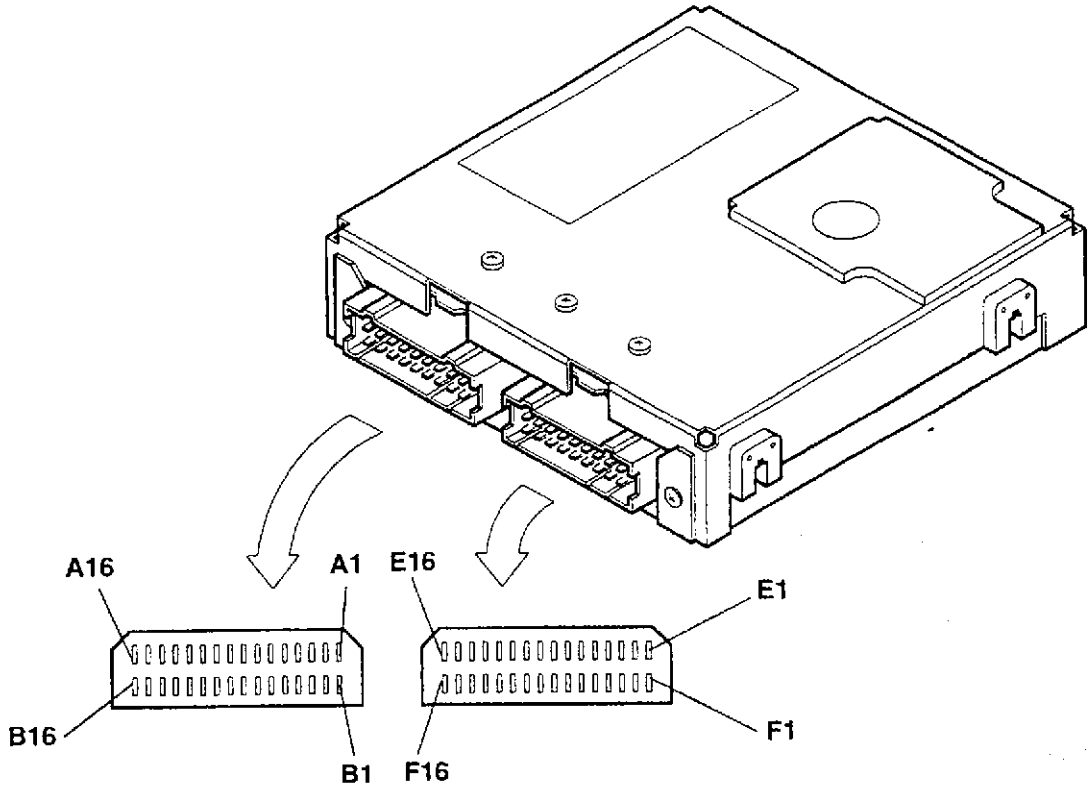
The detection of a fault by the control unit **S40** (see "Self- diagnosis" turns on the corresponding warning light on the instrument cluster via the signal from pin B10.

From the tachometric sensor **L17** the control unit receives at pin F10 the car speed signal, used by the internal logic to optimise certain functions.

The control unit **S40** is connected with the air conditioning system via pins A8 and A15. This makes it possible to adapt the idle speed of the engine to the increased load each time the compressor is engaged, or to disengage it in the event of the need for maximum engine power. For further details, see "Climate control".

The control unit **S40** possesses a self-diagnosis system, with the possibility of dialogue with the ALFA ROMEO Tester (connector **T1**); reached by the diagnosis line K - pin F11 - and line L - pin B8 -.

The connection with the ALFA ROMEO CODE control unit is through the special line of pins B10 and B11 (signal input and output) of **S40**. For further details see "ALFA ROMEO CODE".



CONTROL UNIT PIN-OUTS

A1 Idle actuator output (phase D)
A2 Idle actuator output (phase C)
A3 Idle actuator output (phase A)
A4 Idle actuator output (phase B)
A5 N.C.
A6 Control unit direct supply
A7 Pressure sensor signal
A8 Compressor cut-in request signal
A9 N.C.
A10 N.C.
A11 N.C.
A12 Fuel pump relay command
A13 Evaporative solenoid valve control
A14 N.C.
A15 Compressor cut-in command
A16 Rpm sensor signal

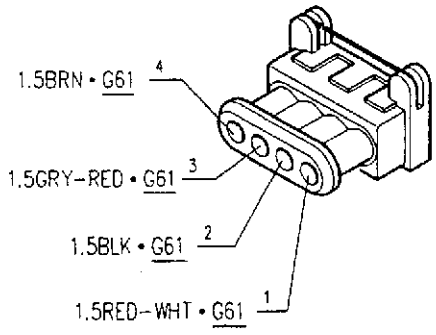
B1 Power earth
B2 Earth for sensors
B3 Water temperature signal
B4 Intake air temperature signal
B5 N.C.
B6 N.C.
B7 N.C.
B8 Diagnosis line L
B9 N.C.
B10 Failure warning light signal
B11 Connection line with ALFA ROMEO CODE
B12 N.C.
B13 Rev counter signal
B14 Rpm sensor signal
B15 N.C.
B16 N.C.

E1 N.C.
E2 N.C.
E3 N.C.
E4 Command to electroinjectors 4/3
E5 N.C.
E6 Command to electroinjectors 1/2
E7 Power earth
E8 N.C.
E9 Lambda probe earth
E10 Connection line with ALFA ROMEO CODE
E11 N.C.
E12 N.C.
E13 N.C.
E14 Ignition control module
E15 N.C.
E16 Key-operated supply

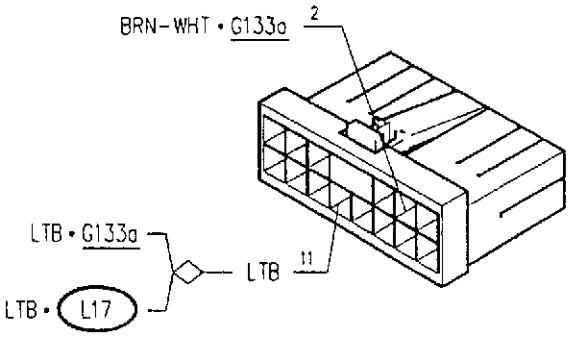
F1 N.C.
F2 N.C.
F3 "Key-operated" supply, ignition module, lambda probe, evaporative solenoid valve
F4 N.C.
F5 Throttle position signal
F6 Earth for provision
F7 Power earth
F8 Sensors supply (5V)
F9 Lambda probe signal
F10 Tachometric signal
F11 Diagnosis line K
F12 N.C.
F13 N.C.
F14 Ignition module command
F15 Earth for sensors
F16 Power earth

COMPONENTS AND CONNECTORS

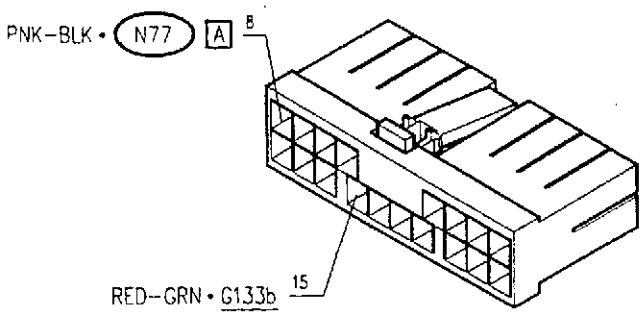
Ignition coil	A8



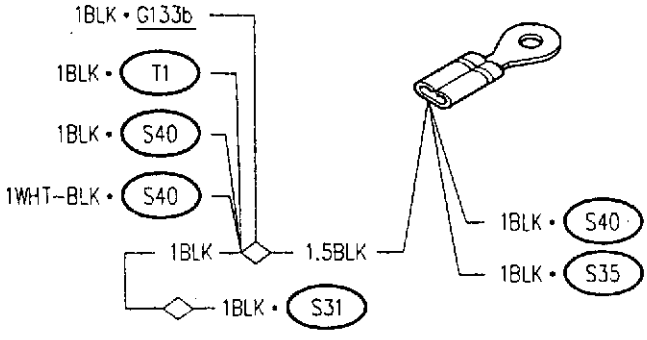
Instrument cluster	C10 A



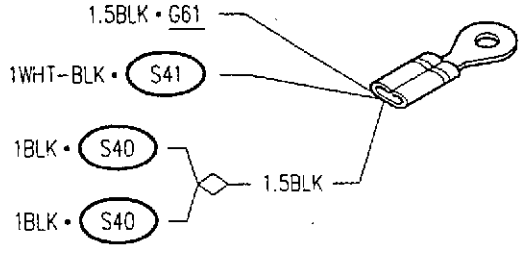
Instrument cluster	C10 B



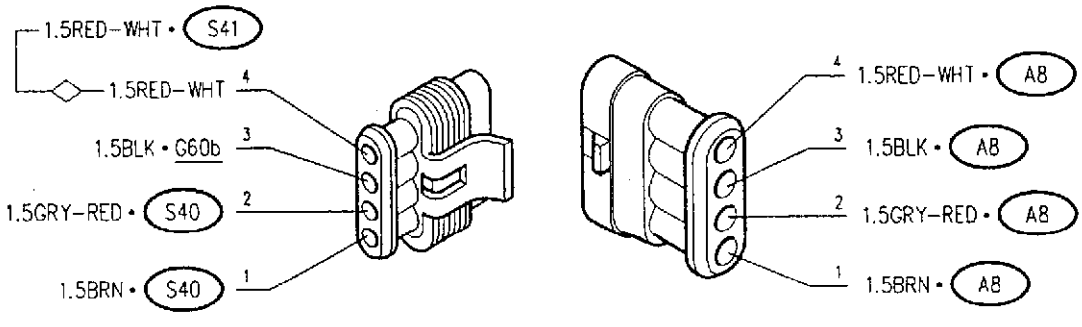
Injection wiring earth	G60a



Injection wiring earth	G60b

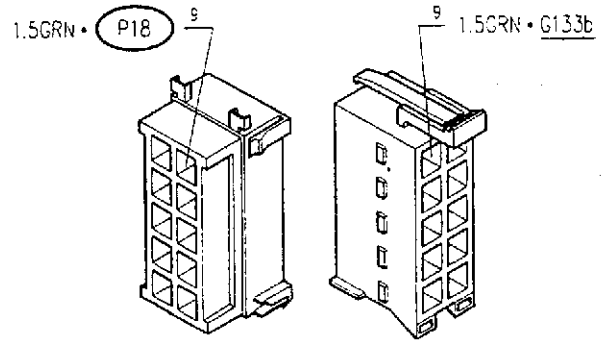


Connector for ignition coil	G61

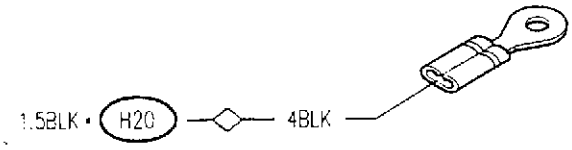


COMPONENTS AND CONNECTORS (cont.d)

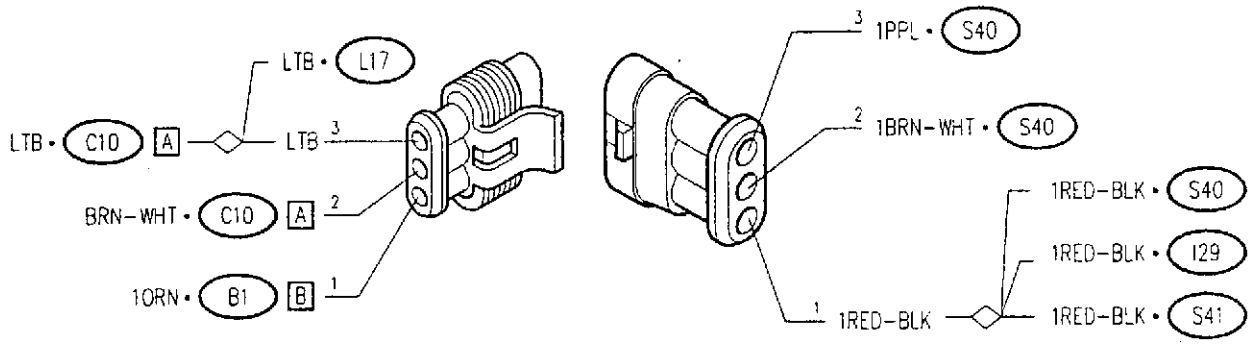
Rear services connector	G73 A



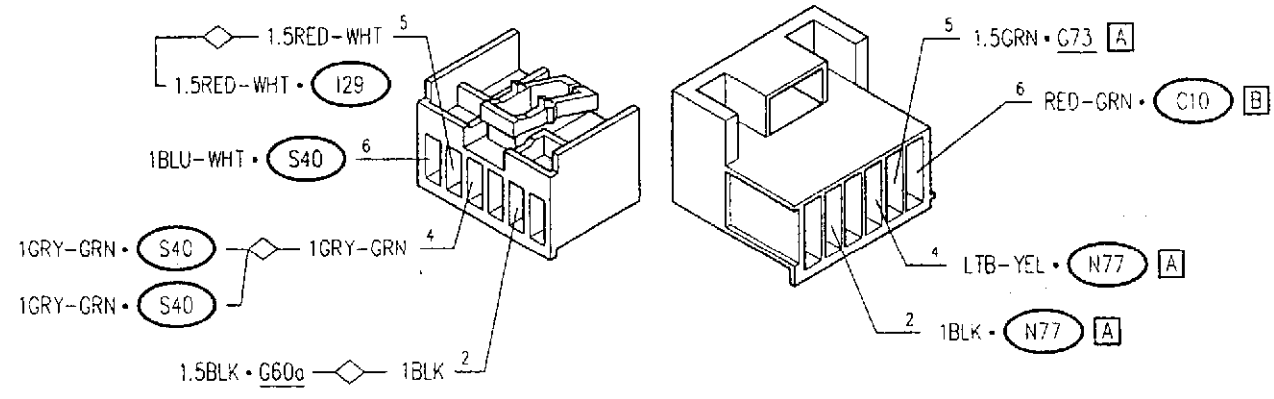
Seat crossrail earth	G106



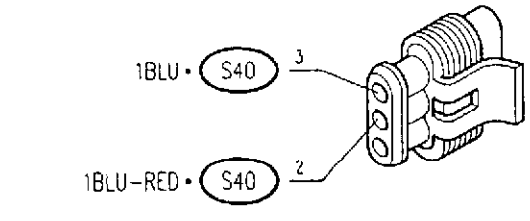
Injection wiring connector A	G133a



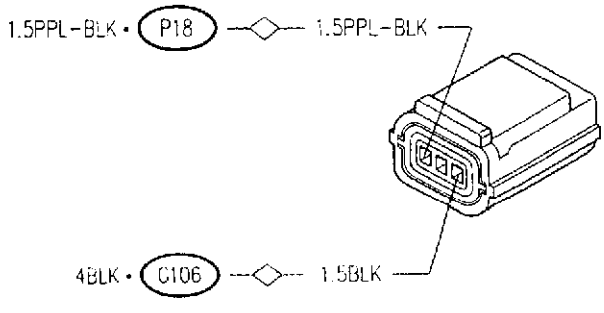
Injection wiring connector B	G133b



Conditioner system/injection system connector	G337

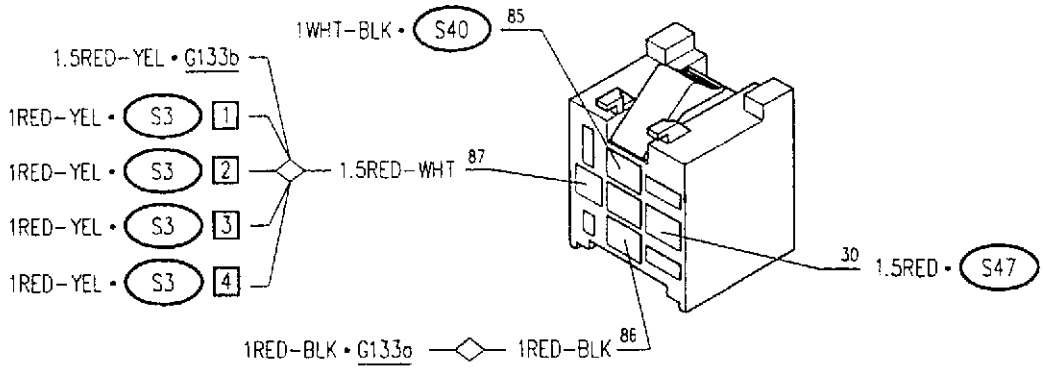


Inertial switch	H20

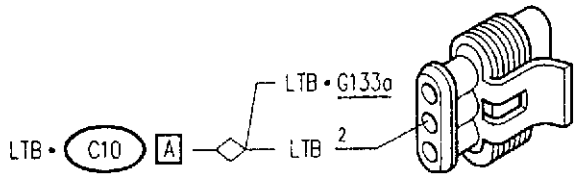


COMPONENTS AND CONNECTORS (cont.d)

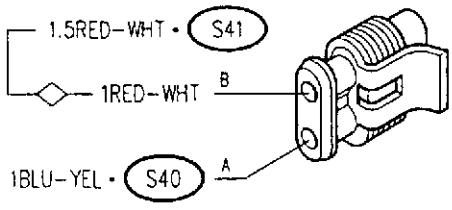
Fuel pump relay — I29



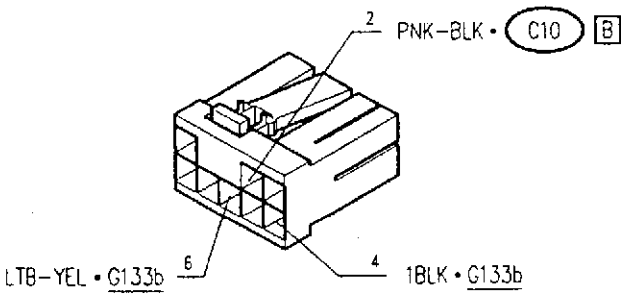
Tachometric sensor — L17



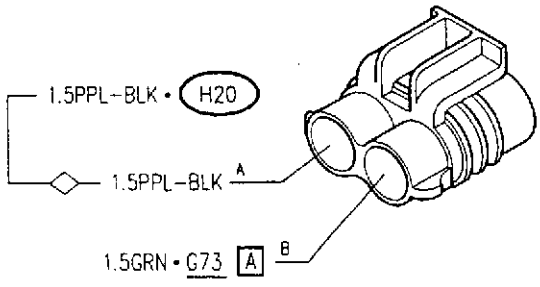
Evaporative solenoid valve — M15



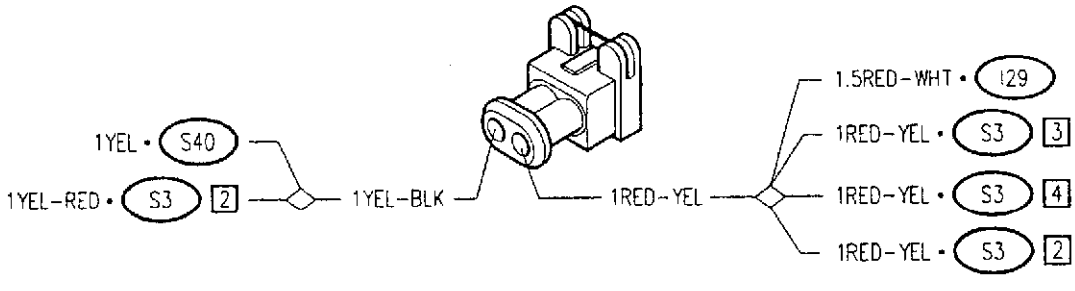
ALFA ROMEO CODE control unit — N77 A



Electric fuel pump — P18

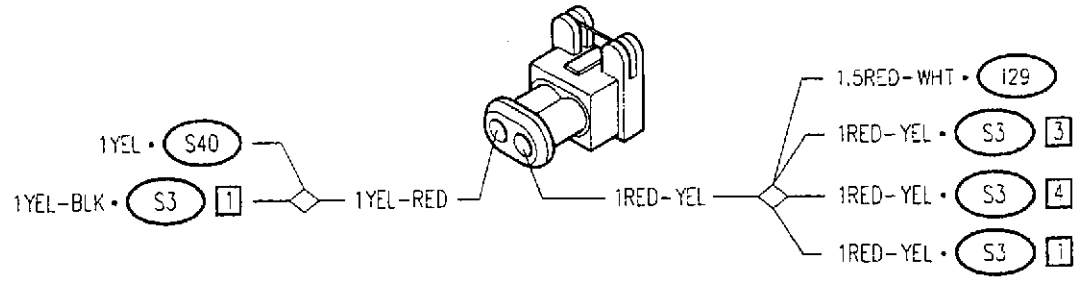


Electroinjector — S3 1

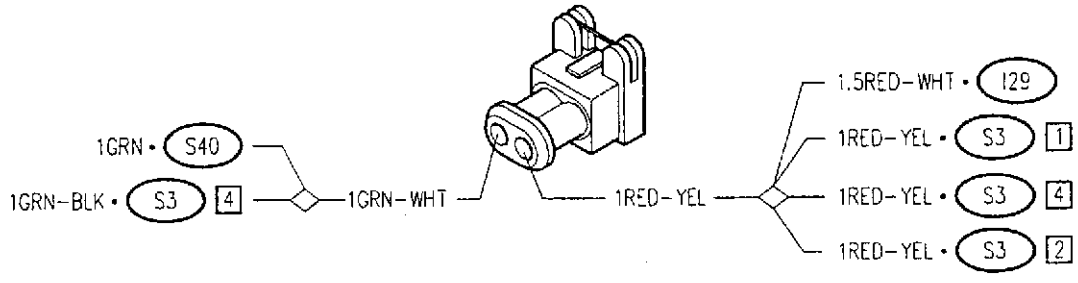


COMPONENTS AND CONNECTORS (cont.d)

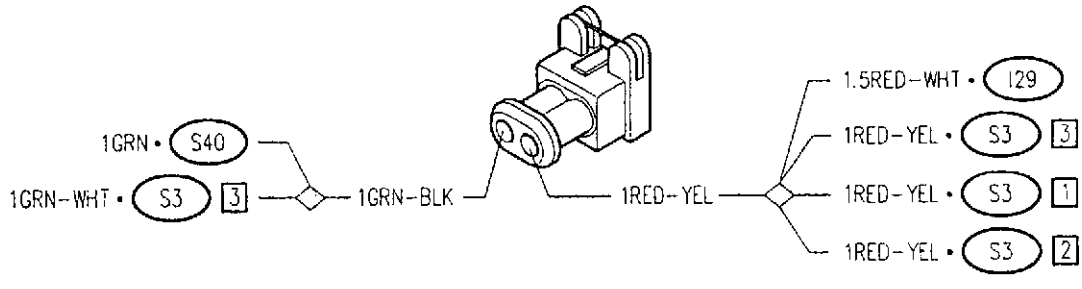
Electroinjector — S3 2



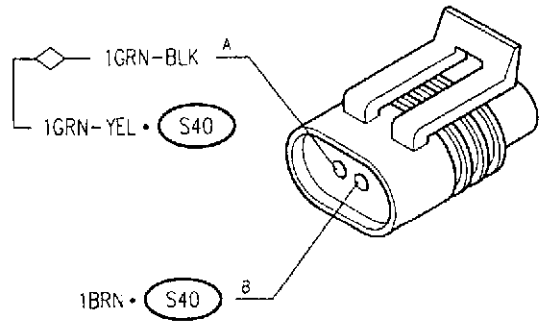
Electroinjector — S3 3



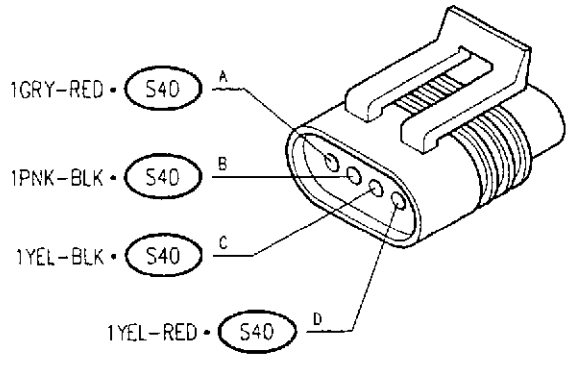
Electroinjector — S3 4



Engine temperature sensor — S7

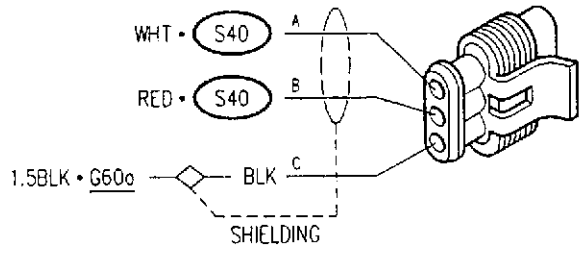


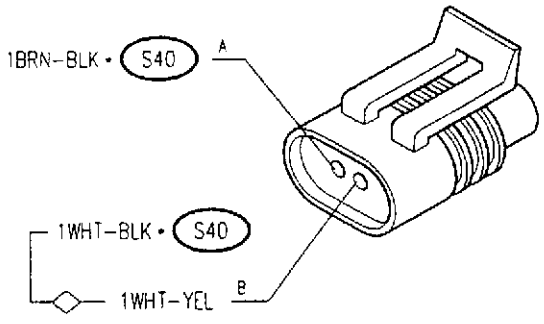
Idle speed adjustment actuator — S29



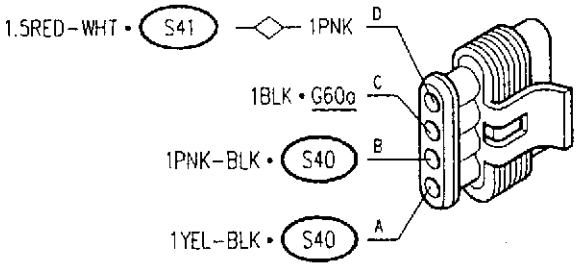
COMPONENTS AND CONNECTORS (cont.d)

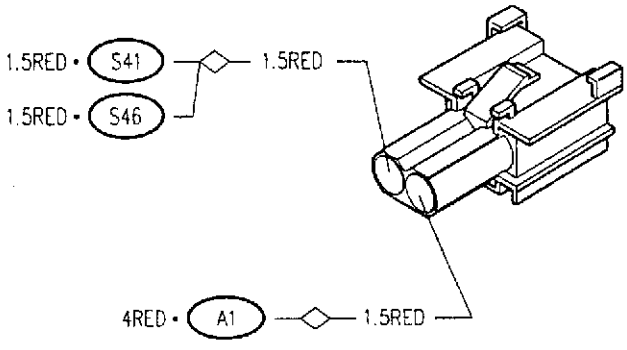
Rpm and crankshaft position sensor	S31	Air temperature sensor	S34



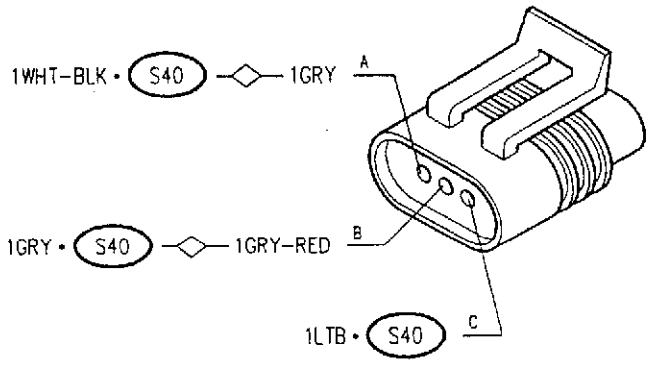


Heated lambda probe	S35	Injection relay wander fuse	S36



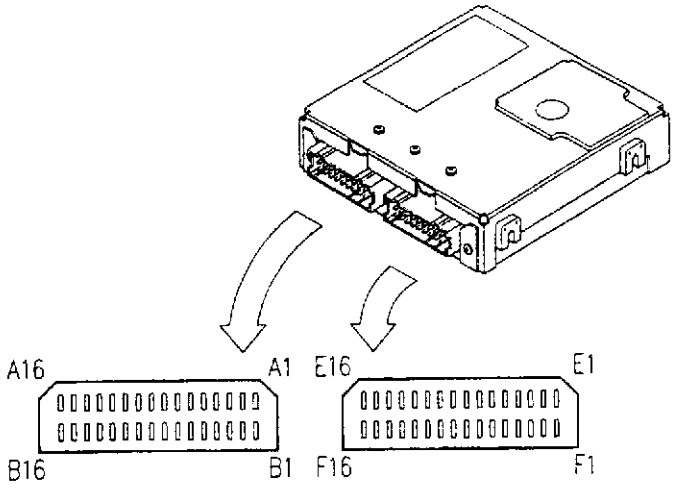


Sensor on throttle body	S38



COMPONENTS AND CONNECTORS (cont.d)

Injection/ignition control unit — S40



A1 1PNK-BLK • S29
A2 1YEL-BLK • S29
A3 1YEL-RED • S29
A4 1GRY-RED • S29
A6 1RED • S46
A7 1YEL-GRN • S43
A8 1BLU-RED • G337
A12 1WHT-BLK • I29
A13 1BLU-YEL • M15
A15 1BLU • G337
A16 RED • S31

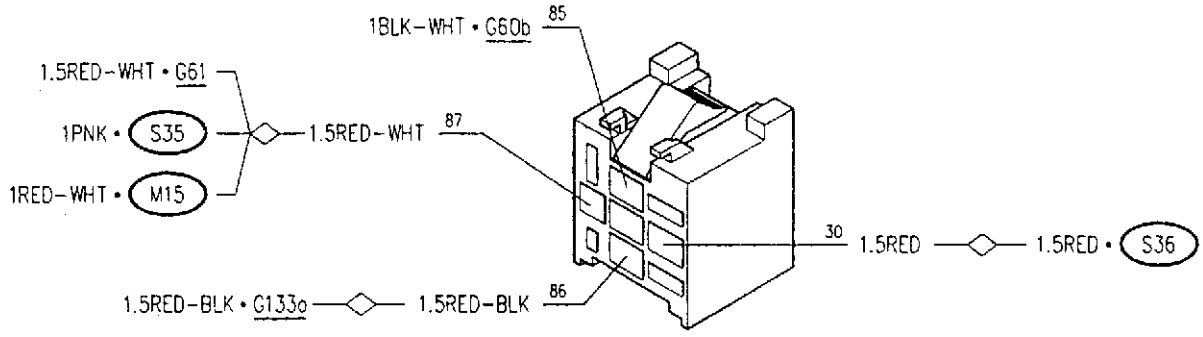
B1 1BLK — 1.5BLK • G60a
B2 1GRN-YEL — 1GRN-BLK • S7
1GRN-WHT • S43
B3 1BRN • S7
B4 1BRN-BLK • S34
B8 1LTB-WHT • T1
B10 1BLU-WHT • G133b
B11 1GRY-GRN — 1GRY-GRN • G133b
B13 1BRN-WHT • G133a
B14 WHT • S31

E4 1GRN — 1GRN-BLK • S3 [4]
1GRN-WHT • S3 [3]
E6 1YEL — 1YEL-BLK • S3 [1]
1YEL-RED • S3 [2]
E7 1BLK — 1.5BLK • G60b
E9 1YEL-BLK • S35
E10 1GRY-GRN — 1GRY-GRN • G133b
E14 1.5GRY-RED • G61
E16 1RED-BLK — 1RED-BLK • G133a

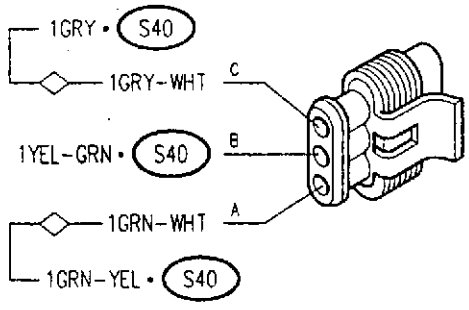
F3 1RED-WHT — 1.5RED-WHT • S41
F5 1LTB • S38
F6 1BLK • G60a
F7 1BLK — 1BLK • G60b
F8 1GRY — 1GRY-RED • S38
1GRY-WHT • S43
F9 1PNK-BLK • S35
F10 1PPL • G133a
F11 1WHT-RED • T1
F14 1.5BRN • G61
F15 1WHT-BLK — 1WHT-YEL • S34
1GRY • S38
F16 1BLK-WHT — 1.5BLK • G60a

COMPONENTS AND CONNECTORS (cont.d)

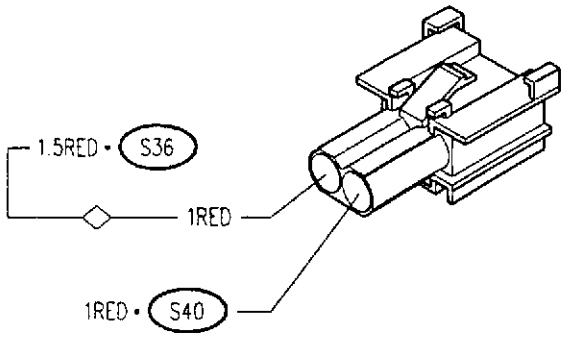
Main relay — S41



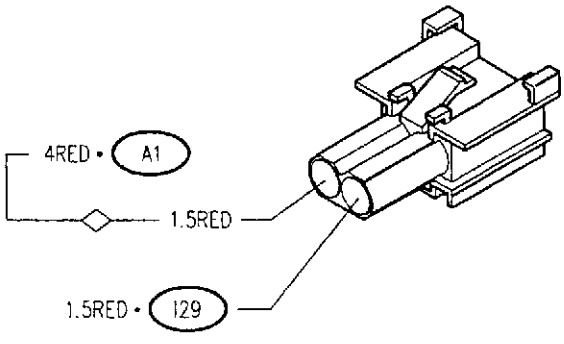
Absolute pressure sensor — S43



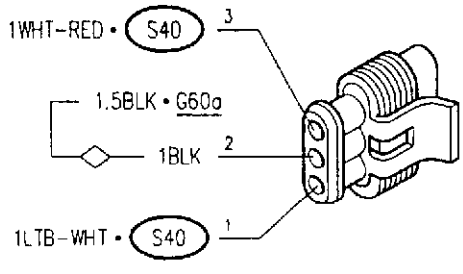
Motronic supply wander fuse — S46



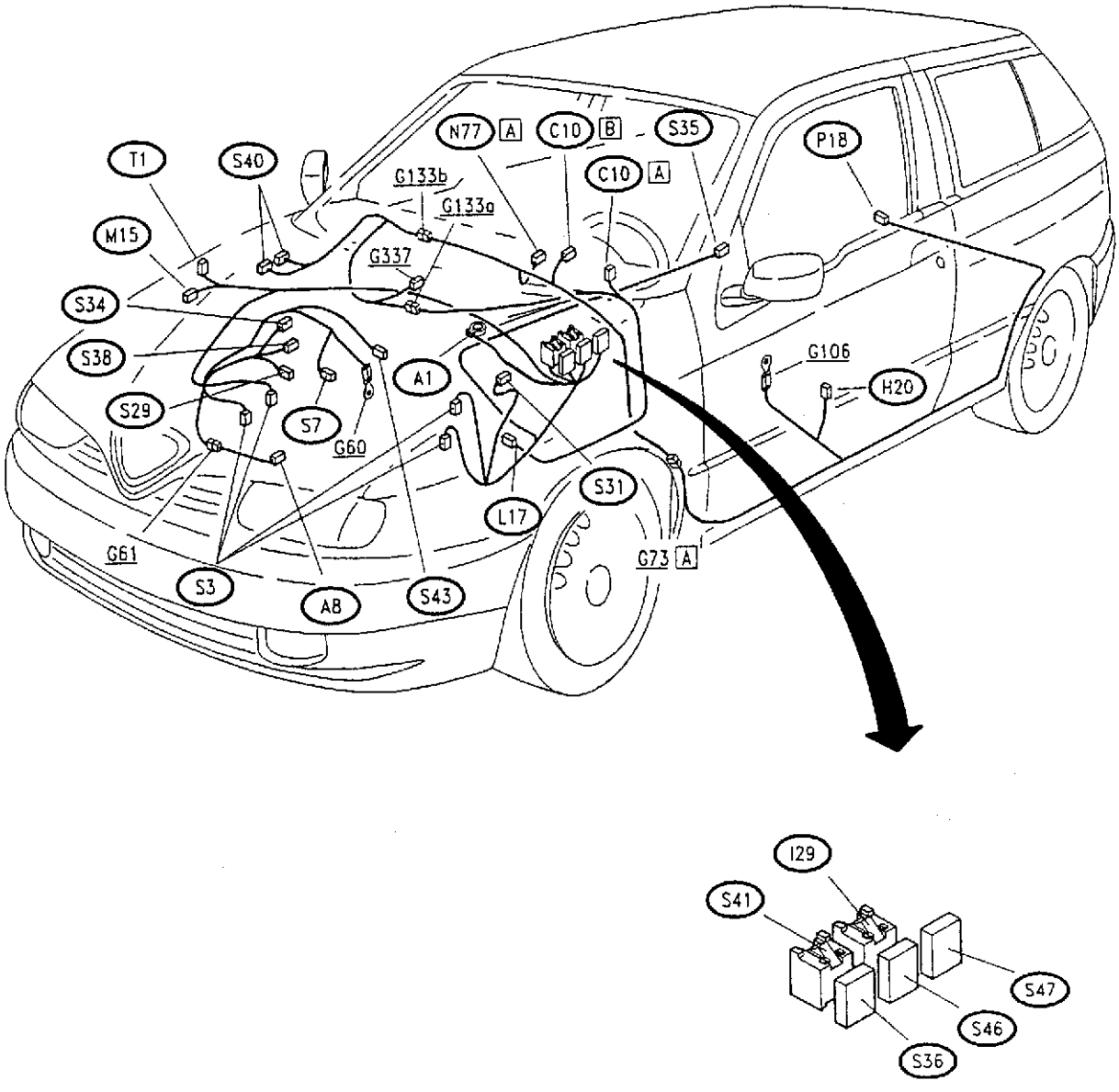
Fuel pump wander fuse — S47



Connector for ALFA TESTER — T1



LOCATION OF COMPONENTS



TROUBLESHOOTING

The control unit possesses a self-diagnosis system which cyclically checks the input and output circuits and its internal circuits, memorising the errors detected in the event of faults.

The errors are entered on two maps:

- the CURRENT map (or table) associated with a volatile memory (RAM);
- the HISTORY map (or table) associated with a non volatile or permanent memory (STAND-BY RAM).

The moment in which the control unit detects an error this is written in the CURRENT table (RAM).

If the error lasts for a certain length of time (validation time) the error is also written in the HISTORY table (STAND-BY RAM).

The driver is alerted of a fault on the injection/ignition system by the turning on of a failure warning light on the instrument cluster.

It turns off when the fault has been repaired or if the fault is "intermittent", (fault memorised, but no longer present).

When an error is present the control unit also replaces the lacking parameter with fixed replacement parameters memorised inside the control unit (RECOVERY), thereby allowing the engine to operate in "emergency" conditions, when possible.

Error cancelling

When the error ceases it is eliminated from the CURRENT table, but not from the HISTORY table where it remains until one of the following conditions arises which cause it to be cancelled:

- 20 starts (also not consecutive), without the error occurring again;
- via command from the ALFA ROMEO TESTER;
- disconnecting the control unit from the wiring.

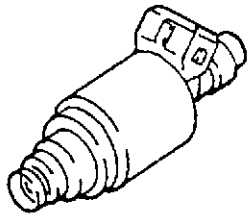
With regard to the actuators (electroinjectors, coil, etc.), these are tested using the ALFA ROMEO TESTER in "Active Diagnosis" (operating the actuators), because in certain cases they cannot be detected by the control unit as faulty components.

Diagnosis with the ALFA TESTER

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

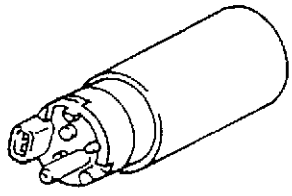
CHECKING COMPONENTS

Electroinjectors (S3)



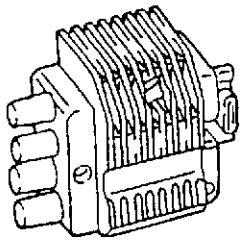
SPECIFICATIONS	
Winding resistance	12 ± 0.4 Ω
Operating pressure	300 ± 0.2% kPa

Fuel pump (P18)



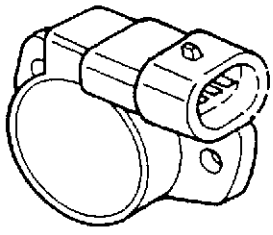
SPECIFICATIONS	
Nominal flow rate	~ 90 l/h
Max. absorption (at 13.5V and 350 kPa)	7.75A
Maximum pressure (with nil flow - pipes clogged) (safety valve setting)	450 kPa

Ignition coil (A8)

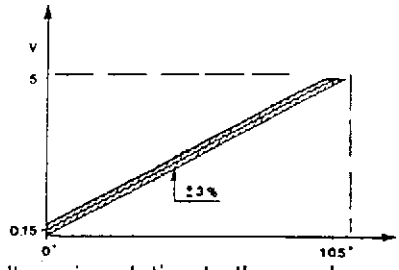


SPECIFICATIONS	
Secondary resistance	6 kΩ

Throttle position sensor (S38)

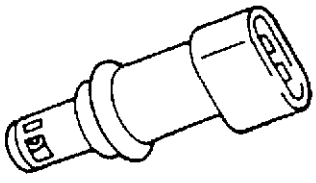


SPECIFICATIONS	
Useful electric angle	105 ± 2°
Mechanical angle	110 ± 4°
Resistance of track	1200 Ω ± 20%
Temperature operating field	-30°C ÷ +125°C



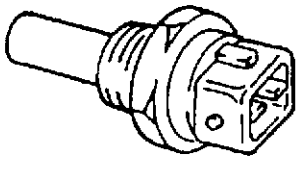
Output voltage in relation to the angle

Air temperature sensor (S34)



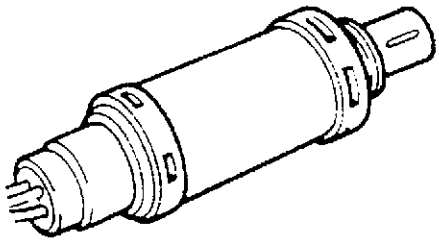
SPECIFICATIONS	
Temperature (°C)	Resistance (Ω)
+ 100	181.10 ± 7.5
+ 128	82.13 ± 3.17

Engine temperature sensor (S7)



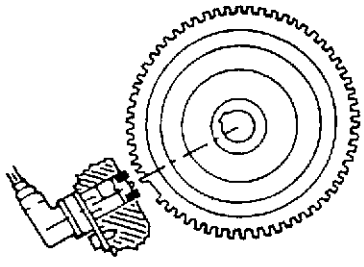
SPECIFICATIONS	
Temperature (°C)	Resistance (kΩ)
- 40	100.707
- 20	28.677
0	9.423
+ 20	3.515
+ 40	1.459
+ 60	0.667
+ 80	0.332

Lambda probe (S35)



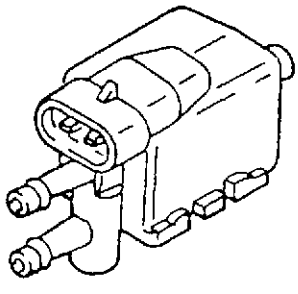
SPECIFICATIONS	
Heating resistance	3 Ω
Response time (from lean to rich & vice-versa at 260°C)	100 msec
Output voltage at 260°C for rich mixture for lean mixture	 800 mVmin 20 mV max

Rpm sensor (S31)



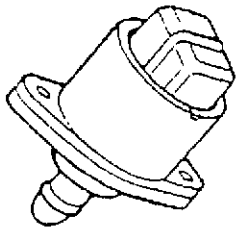
SPECIFICATIONS	
Sensor winding resistance at 25 ± 5°C	540 ± 10%Ω
Sensor winding inductance at 25 ± 5°C	240 mH ± 15% at 1 kHz
Electric signal	600 mV at 60 RPM
Distance (gap) between sensor and flywheel ring gear	1 ± 0.7 mm

Evaporative solenoid valve (M15)



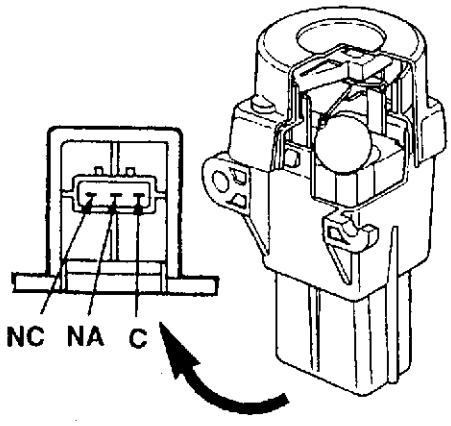
SPECIFICATIONS	
Air flow rate open 100% open 70% open 30%	50 ÷ 58 l/min 33 ÷ 46 l/min 11 ÷ 20 l/min
Duty-cycle signal	16 Hz
Ohmic resistance of winding (at 20°C)	33 Ω
When not energised the solenoid valve is normally closed	

Idle adjustment actuator (S29)



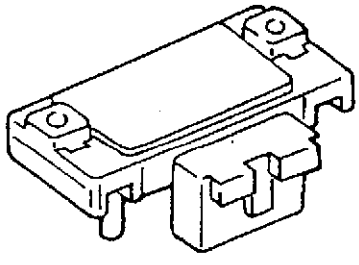
SPECIFICATIONS	
Resistance of windings	53Ω ± 10% at 20°C
Operating temperature	-40°C ÷ +85°C

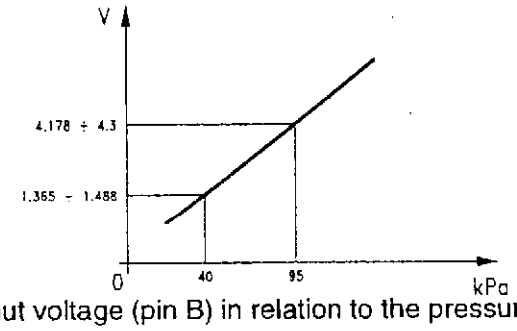
Inertial switch (H20)



SPECIFICATIONS
Check continuity between pins NC and C: this continuity is cut off in the event of impact; the contact is closed again operating the special pushbutton.

Absolute pressure sensor (S43)



SPECIFICATIONS

Output voltage (pin B) in relation to the pressure on the diaphragm

ROCHESTER SYSTEM PRELIMINARY CHECK — 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 "ALFA ROMEO CODE" section) or, if the ALFA ROMEO CODE is not installed check the connection with the anti-theft system.

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 CHECK FUSE – Check that fuses **S36** and **S47** are intact	OK ▶	Carry out step A2
	~~OK~~ ▶	**Change fuse** S36 **(15A) or** S47 **(10A)**
A2 CHECK VOLTAGE – Check for 12 V at pin 30 of relay **I29** and at pins 30 and 86 of relay **S41**	OK ▶	Carry out step A3
	~~OK~~ ▶	**Restore the wiring between the battery** A1, **fuses** S36 **and** S47 **and relays** S41 **and** I29
A3 CHECK VOLTAGE – With the key turned, check for 12 V at pin 86 of relays **I29** and **S41**	OK ▶	Carry out **step A4**
	~~OK~~ ▶	Restore the wiring between the ignition switch **B1** and relays **I29** and **S41**
A4 CHECK RELAYS – Check that relays **I29** and **S41** are working properly	OK ▶	Carry out **step A5**
	~~OK~~ ▶	Change any faulty relays
A5 CHECK CONTROL UNIT SUPPLY – With the key turned, check for 12 V at pin E16 of the control unit **S40**	OK ▶	Carry out **step A6**
	~~OK~~ ▶	Restore the wiring between the control unit **S40** and the ignition switch **B1**
A6 CHECK EARTH – Check for an earth at pins B1, E7, F6, F7 and F16 of **S40**	OK ▶	**CONTINUE DIAGNOSIS USING THE ALFA TESTER**
	~~OK~~ ▶	Restore the wiring between **S40** and earth **G60a**, or **G60b**