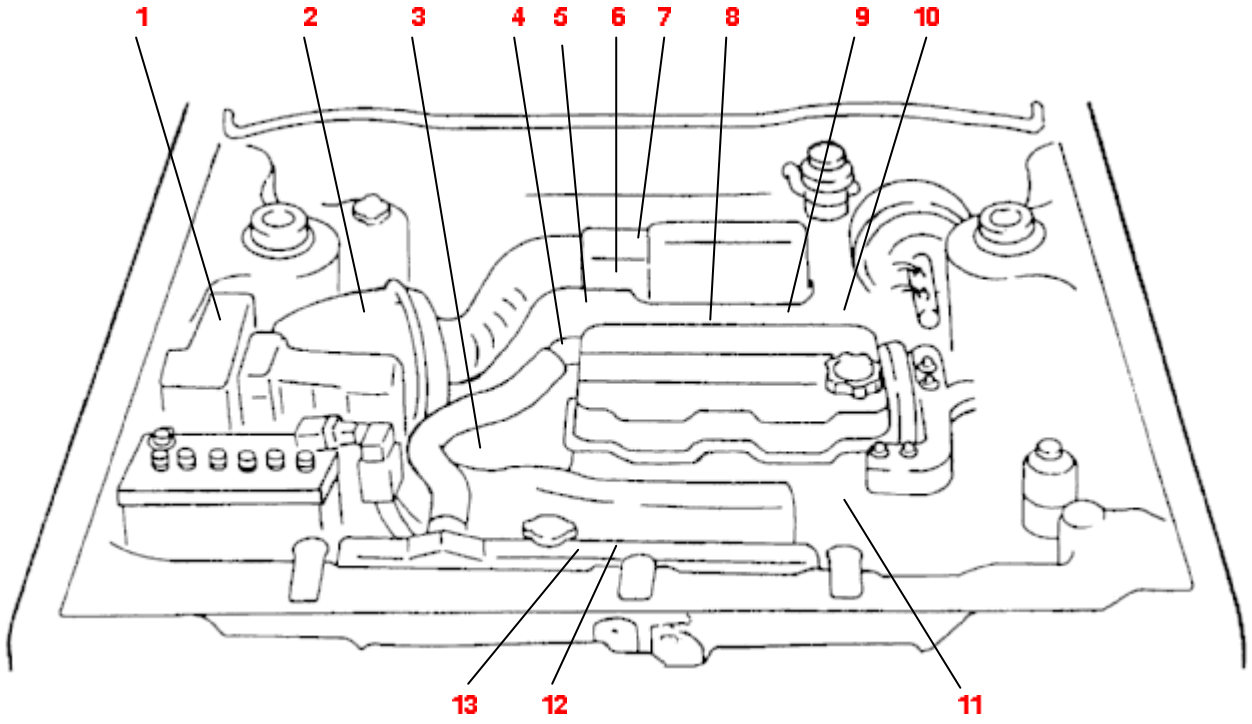
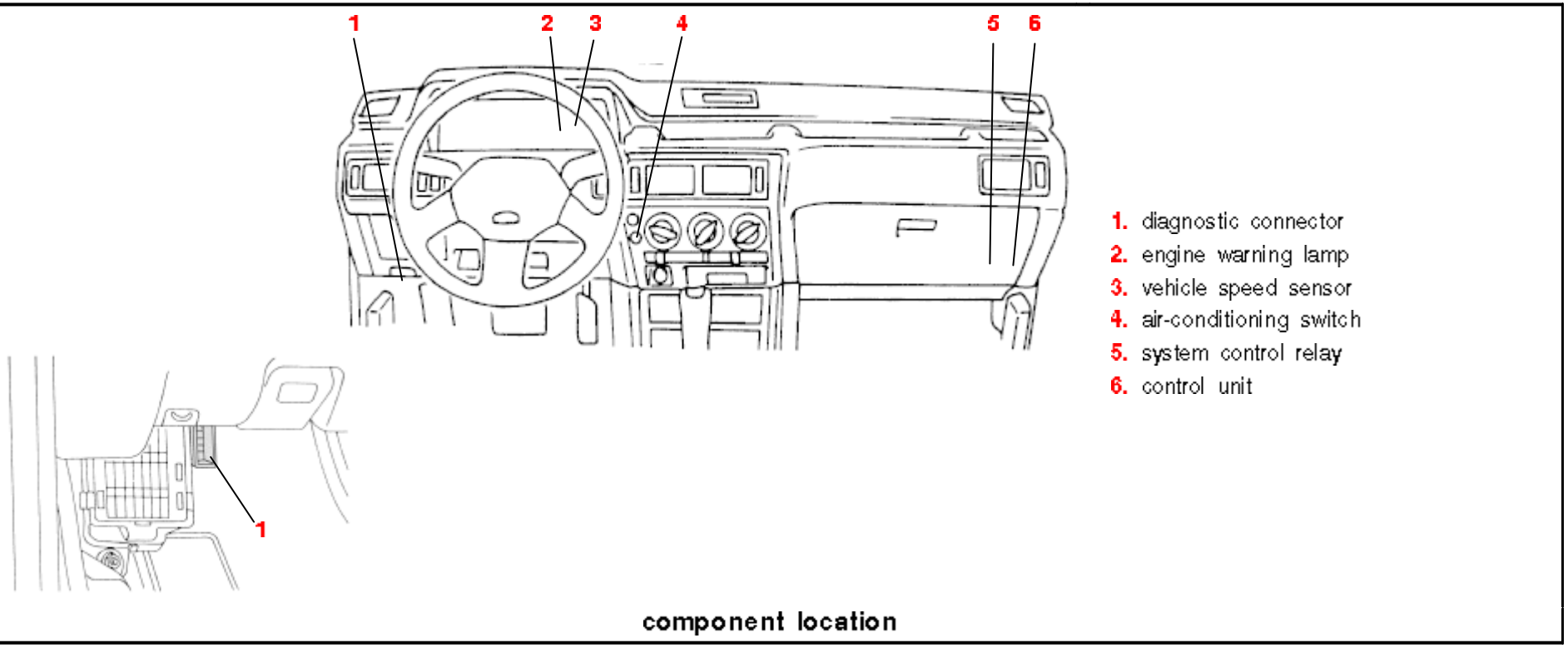
– SOHC engines with engine management

Engine management



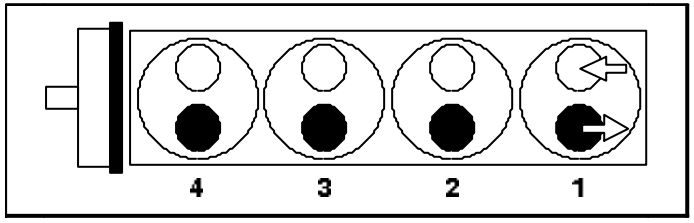
component location

1. air-conditioning compressor relay
2. air flow meter
3. start/inhibitor switch
4. coolant temperature sensor
5. CO potentiometer
6. throttle valve potentiometer
7. throttle valve servo motor
8. injectors
9. Ignition coil
10. crankshaft position sensor and engine speed sensor
11. power steering pressure switch
12. knock sensor
13. oxygen sensor



1. diagnostic connector
2. engine warning lamp
3. vehicle speed sensor
4. air-conditioning switch
5. system control relay
6. control unit

component location



firing order	1 - 3 - 4 - 2

This is a multipoint fuel and ignition system. An ECU controls both systems using several sensors and actuators. The most important sensors are:

- air flow meter
- air intake temperature sensor
- atmospheric pressure sensor; built into the air flow meter
- coolant temperature sensor
- throttle valve potentiometer
- idle speed switch; switches the control unit wire to earth when the throttle valve closes
- potentiometer of throttle valve servo motor; is built into the throttle valve servo motor

- crankshaft position sensor; is built into the distributor
- engine speed sensor
- vehicle speed sensor; is built into the speedometer in the dashboard
- knock sensor
- oxygen sensor; a rich mixture gives an oxygen sensor voltage of approx. 1 V; a weak mixture approx. 100 mV. During normal oxygen sensor control of the running engine, the voltage sent will vary between these two values.
- CO potentiometer; on versions without catalytic converter, the CO-percentage is adjusted by the CO potentiometer.

The control unit controls the following components.

- fuel pump; electric pump in the tank. There is a fuel pump connection on the firewall that can be used to connect a 12 V source to check the pump operation.
- injectors
- throttle valve servo motor
- fuel vapour cut-off valve
- ignition module

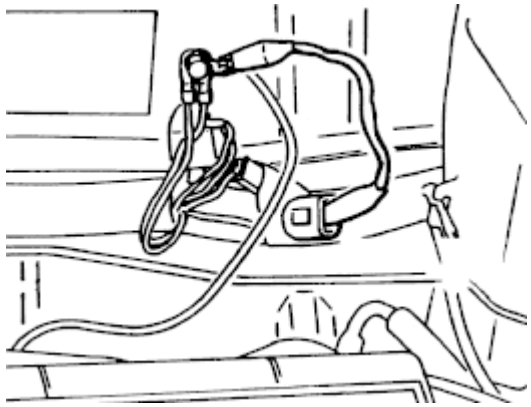
Note: Versions from 06/1990 onwards: the ignition coil is built into the distributor.

technical specifications	
coil resistance, primary; conventional ignition system	0,72 - 0,88 Ω
coil resistance, primary; engines with distributorless ignition system	0,9 - 1,2 Ω
coil resistance, secondary; conventional ignition system	10290 - 13920 Ω
coil resistance, secondary; engines with distributorless ignition system	20000 - 29000 Ω
HT-leads resistance	6000 - 10000 Ω; depends upon the length of the leads

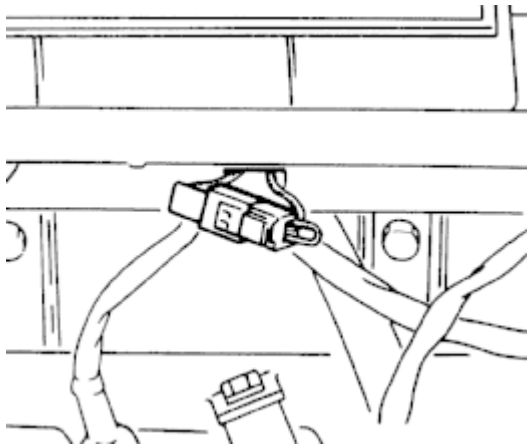
system pressure; pressure regulator vacuum hose connected	approx. 2,7 bar; at idle speed
system pressure; pressure regulator vacuum hose disconnected and blanked off	3,3 - 3,5 bar; at idle speed
throttle valve potentiometer; resistance	3500 - 6500 Ω
CO potentiometer; resistance	4000 - 6000 Ω
injector; resistance	13 - 16 Ω

Adjustments

Ignition timing



service connector earth terminal



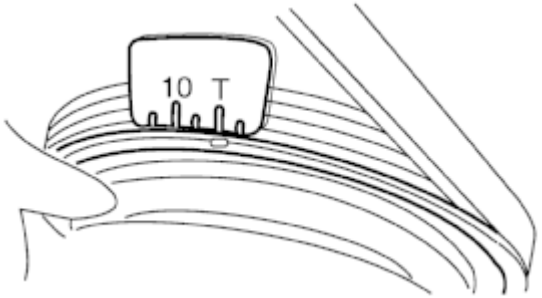
connect engine speed signal connector

basic setting at 700 - 900/min	5° ± 2°BTDC

Run the engine to operating temperature. Switch off all electrical consumers. Place automatic transmission in "N" or "P". On versions with power steering: turn the wheels straight ahead. Connect the service connector to earth. The engine management system will come into the service set mode. Check the ignition timing with a rev. counter and a timing light. Set the ignition timing by turning the distributor. With ignition switched off, undo the earth connection. Re-check the ignition timing.

setting; at 700 - 900/min	4G37: 10°BTDC 4G63: 5°BTDC

A deviation is normal. The ignition timing is advanced at greater heights.



crankshaft pulley marking

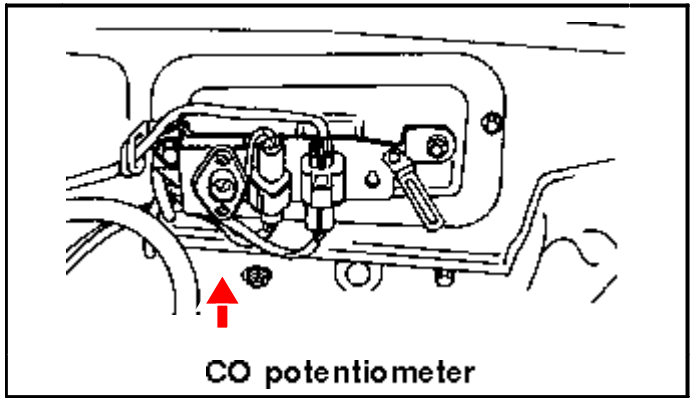
Idle speed

idle speed	800 ± 50/min

Run the engine to operating temperature. Switch off all electrical consumers. Place automatic transmission in "P". On versions with power steering place the wheels straight ahead. The ignition timing must be correctly set. Check that the idle speed is correct. The idle speed is non-adjustable. With any deviation: check the engine management system.

CO-percentage

CO-percentage	
versions with catalytic converter	max. 0,5 %
versions without catalytic converter	1,5 ± 0,5%



CO potentiometer

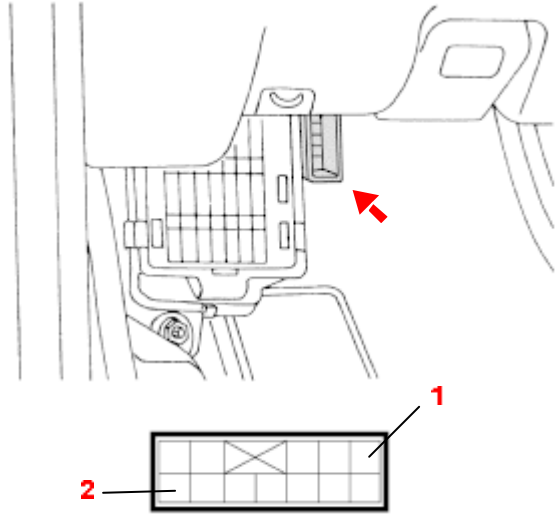
On versions with catalytic converter: the CO-percentage is not adjustable. On versions without catalytic converter: the CO-percentage is set with the CO potentiometer. Run the engine for a short time at: 2000 - 3000/min. Check the CO-percentage at idle speed. If necessary: adjust.

Fault finding

Fault codes

The self diagnostic system has an engine warning lamp that lights when a fault occurs in the engine management system. The lamp also lights for 5 seconds:

- after switching on the ignition
- when the ignition adjustment connector is switched to earth during adjustment



1. fault code signal
2. earth

diagnostic connector

The fault code read out can be done with an LED tester. Connect the LED tester to the fault code signal pin and earth pin of the diagnostic connector. The diagnostic connector is located under the dashboard. As soon as the ignition is switched on, the fault codes appear. The long pulses are tens; the short the units.

The fault memory can be erased by disconnecting the battery terminals or control unit multiplug for a short time.

fault codes list

code	*fault finding*	*fault*
no code	control unit	control unit faulty
11	oxygen sensor	oxygen sensor: fuel pressure; injectors; air leaks; wiring
12	air flow meter	air flow meter; wiring
13	intake air temperature sensor	intake air temperature sensor; wiring
14	throttle valve potentiometer	throttle valve potentiometer; idle switch; wiring
15	potentiometer of throttle valve servo motor	potentiometer of throttle valve servo motor; throttle valve potentiometer; wiring
21	coolant temperature sensor	coolant temperature sensor; wiring
22	engine speed sensor	engine speed sensor; wiring

23	crankshaft position sensor	crankshaft position sensor; wiring
24	vehicle speed sensor	vehicle speed sensor; wiring
25	atmospheric pressure sensor	atmospheric pressure sensor; wiring
31	knock sensor	knock sensor; wiring
36	ignition timing setting	wiring
41	injectors	injectors; wiring
42	fuel pump	relay; wiring
even pulses	normal operation	—

Components signal simulation

Oxygen sensor signal simulation

See: **General - Electronic Control Systems**, under **Sensors/Actuators**, under **oxygen sensor**.

Engine speed simulation

Disconnect the TDC/engine speed sensor. Connect a wire to the connector (control unit terminal 2). Pulse with this wire to earth.

Check that the injectors and fuel pump are activated.

Ignition module simulation

Connect a test spark plug to the ignition coil lead. Connect a wire to terminal 4 of the disconnected ignition module connector. Pulse the ignition module terminal 1 wire to earth. The test spark plug must spark if the ignition module is in good condition.

Throttle valve servo motor

The throttle valve servo motor can be tested as follows: Disconnect the control motor connector; supply 12 V to the control motor. Depending upon the polarization, the motor will turn anti-clockwise or clockwise. This can be identified by the adjustment plunger movement.

Test measurements

Note: **connector** = connector from the relevant sensor/switch/valve; unless otherwise indicated

Note: **pin** = connectors of the ECU multiplug; unless otherwise indicated.

Note: In case test values are out of limit; see the *Follow-on checks*. See: **General - Electronic Control Systems**, under the relevant **Sensors/Actuators**.

air flow meter		
location: in the air filter		
feed; connector disconnected; ignition on		
connection	*to pin*	*test value*
red; V+	relay	10,0 - 13,0 V
green/black; V-	14/24	
green/red; V+ atmospheric pressure sensor	13/23	4,8 - 5,2 V
earth; V-	—	
green/blue; V+	10	4,8 - 5,2 V
earth; V-	—	
signal; connector connected		
connection	*to pin*	*test value*
green/blue; V+	10	ignition on: 0,9 - 1,2 V idle speed: 2,9 - 3,1 V 3000/min: 2,8 - 3,0 V
earth; V-	—	

throttle valve potentiometer		
location: on the throttle body		
feed; connector disconnected; ignition on		
connection	*to pin*	*test value*
green/red; V+	13/23	4,8 - 5,2 V
green/black; V-	14/24	
signal; connector connected; ignition on		
connection	*to pin*	*test value*
green/white; V+	19	throttle closed: 0,4 - 0,6 V (dependent upon throttle valve servo motor) throttle open: up to 4,8 - 5,2 V
earth; V-	—	

coolant temperature sensor		
location: near thermostat		
feed; connector disconnected; ignition on		
connection	*to pin*	*test value*
yellow/green; V+	20	4,8 - 5,2 V
green/black; V-	14/24	

signal; connector connected; ignition on		
connection	*to pin*	*test value*
yellow/green; V+	20	+20 °C: 2,4 - 2,8 V
earth; V-	—	+90 °C: 0,4 - 0,6 V
resistance; connector disconnected		
connection	*test value*	
measure on the sensor	+20 °C: 2000 - 3500 Ω	
	+80 °C: 180 - 300 Ω	

engine speed/position sensor		
location: in the distributor		
feed; connector disconnected; ignition on		
connection	*to pin*	*test value*
black/white; V+	ignition	10,0 - 13,0 V
black; V-	106	
brown/yellow; V+ engine speed sensor	21	4,8 - 5,2 V
earth; V-	—	
black/blue; V+ crankshaft position sensor	22	4,8 - 5,2 V
earth; V-	—	

signal; connector connected; start engine		
connection	*to pin*	*test value*
brown/yellow; V+ engine speed sensor	21	1,5 - 2,5 V
earth; V-	—	
black/blue; V+ crankshaft position sensor	22	0,5 - 1,5 V
earth; V-	—	

intake air temperature sensor		
location: in air flow meter		
feed; connector disconnected; ignition on		
connection	*to pin*	*test value*
green/orange; V+	8	4,8 - 5,2 V
green/black; V-	14/24	

signal; connector connected; ignition on; engine cold		
connection	*to pin*	*test value*
green/orange; V+	8	2,5 - 2,9 V
earth; V-	—	
resistance; connector disconnected		
connection	*test value*	
measure on the sensor	+20 °C: 2000 - 3500 Ω	

oxygen sensor; without heating		
location: exhaust manifold		
signal; connector connected; run engine at approx. 2000/min; connect lambda signal tester		
connection	*to pin*	*test value*
white	4	signal must alternate between rich and weak
earth	—	

injectors		
location: in inlet manifold		
feed; connector disconnected; ignition on		
connection	*to pin*	*test value*
yellow/white; V+	relay	10,0 - 13,0 V
earth; V-	—	
signal; connector connected; connect LED tester; start engine		
connection	*to pin*	*test value*
battery positive	—	LED flashes
yellow/blue	51	
yellow/black	52	
light green	60	
light green/white	61	
resistance; connector disconnected		
connection	*test value*	
measure on injector	13 - 18 Ω	

ignition module		
location: near ignition coil		
feed; connector disconnected; ignition on		
connection	*to pin*	*test value*
green/yellow; V+	54	10,0 - 13,0 V
black; V-	—	
signal; connector disconnected; start engine		
connection	*to pin*	*test value*
green/yellow; V+	54	9,0 - 10,0 V
earth; V-		

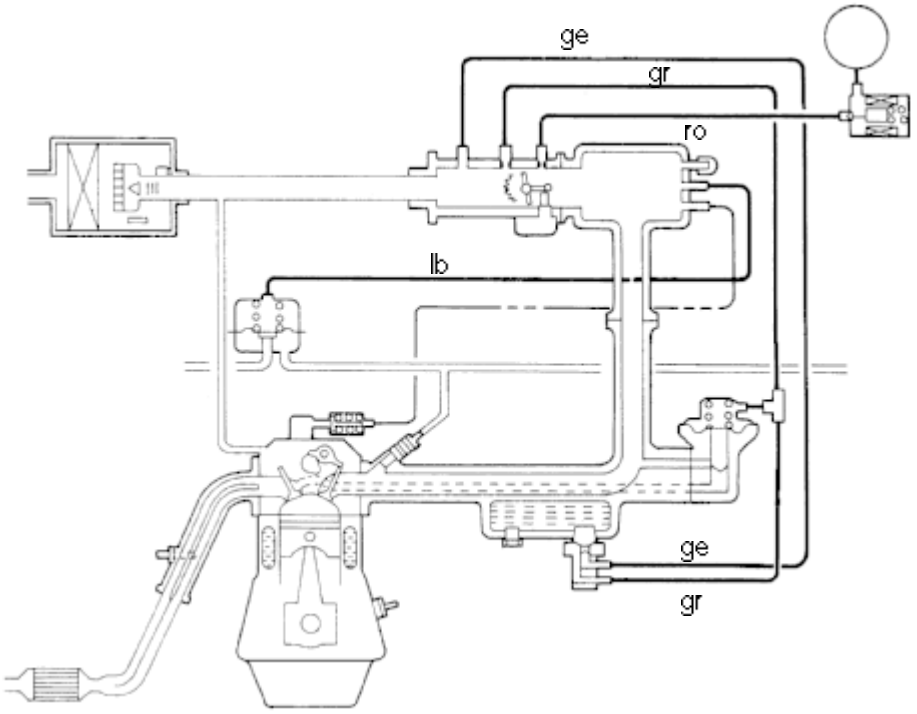
throttle valve servo motor and potentiometer		
location: on the throttle body potentiometer of throttle valve servo motor: to 1989: 4- or 5-pin connector; from 1990 onwards: 6 pin connector (with zero load switch) throttle valve servo motor; to 1989: 4-pin connector (with zero load switch); from 1990 onwards: 2-pin connector		
feed; connector disconnected; ignition on		
connection	*to pin*	*test value*
green/red; V+	13/23	4,8 - 5,2 V
green/black; V-	14/24	

signal; connector connected; run warm engine at idle speed		
connection	*to pin*	*test value*
brown; V+	17	0,8 - 1,2 V
earth; V-	—	
signal; connector connected; run warm engine at idle speed; clamp off idle speed air hose or switch on electrical consumers		
connection	*to pin*	*test value*
brown; V+	17	0,8 - 1,2 V
earth; V-	—	voltage increasing
throttle valve servo motor resistance; connector disconnected		
connection	*test value*	
measure on throttle valve servo motor	5 - 9 Ω	

combination relay		
location: in the console		
system control relay; relay disconnected; ignition on		
connection	*to pin*	*test value*
4; black/red; V+	battery	10,0 - 13,0 V
6; black; V-	earth	
8; black/white; V+	ignition	10,0 - 13,0 V
earth; V-	—	
system control relay; relay fitted; ignition on		
connection	*to pin*	*test value*
3; red; V+	107	10,0 - 13,0 V
earth; V-	—	
fuel pump relay; relay disconnected; ignition on		
connection	*to pin*	*test value*
4; black/red; V+	battery	10,0 - 13,0 V
6; black; V-	earth	

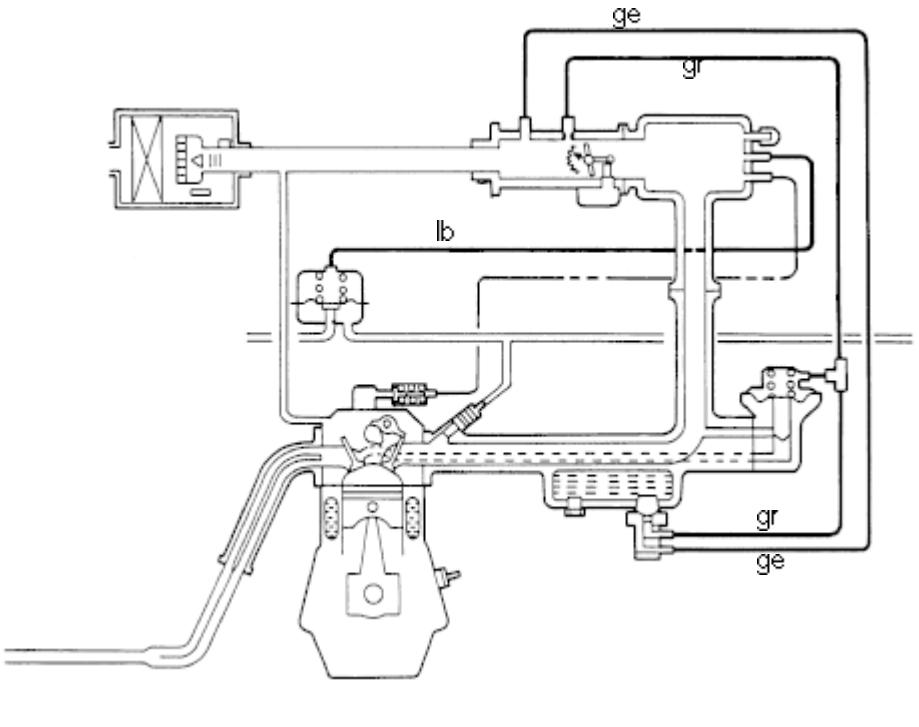
fuel pump relay; relay fitted; start engine		
connection	*to pin*	*test value*
battery positive; V+	—	10,0 - 13,0 V
5; white/red; V-	56	
1; black/white; V+	109 and fuel pump	10,0 - 13,0 V
earth; V-	—	
function test; connector connected; ignition on		
connection	*to pin*	*test value*
connect black/red with black/white	—	fuel pump must run; pump pressure 2,8 - 3,2 bar

Control systems



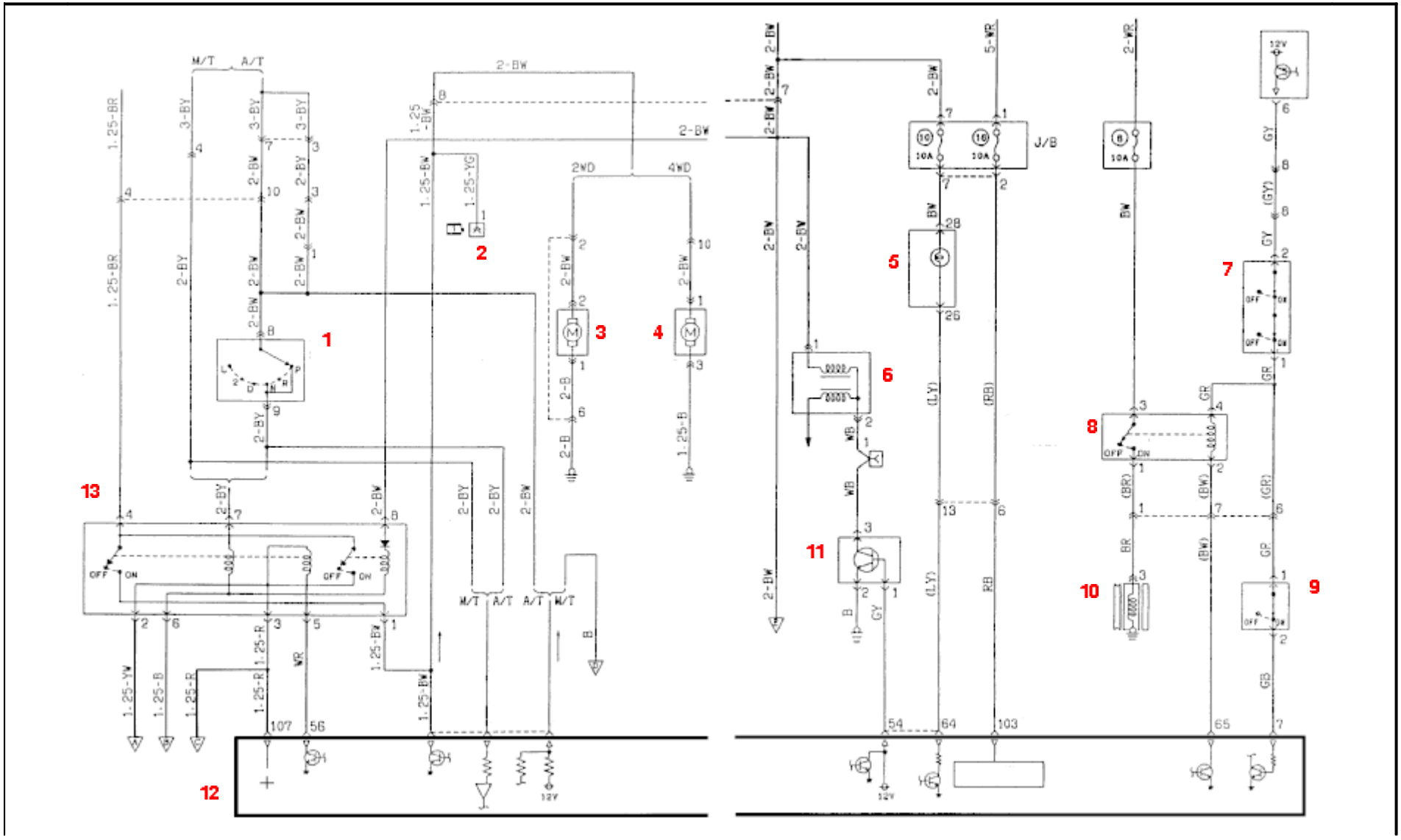
ge = yellow; gr = green; ro = red; zw = black; lb = light blue

vacuum diagram: versions with catalytic converter



ge = yellow; gr = green; ro = red; zw = black; lb = light blue

vacuum diagram: versions without catalytic converter


M/T
A/T
2-BW
2WD
4WD
J/B
OFF
ON
12V
1
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5
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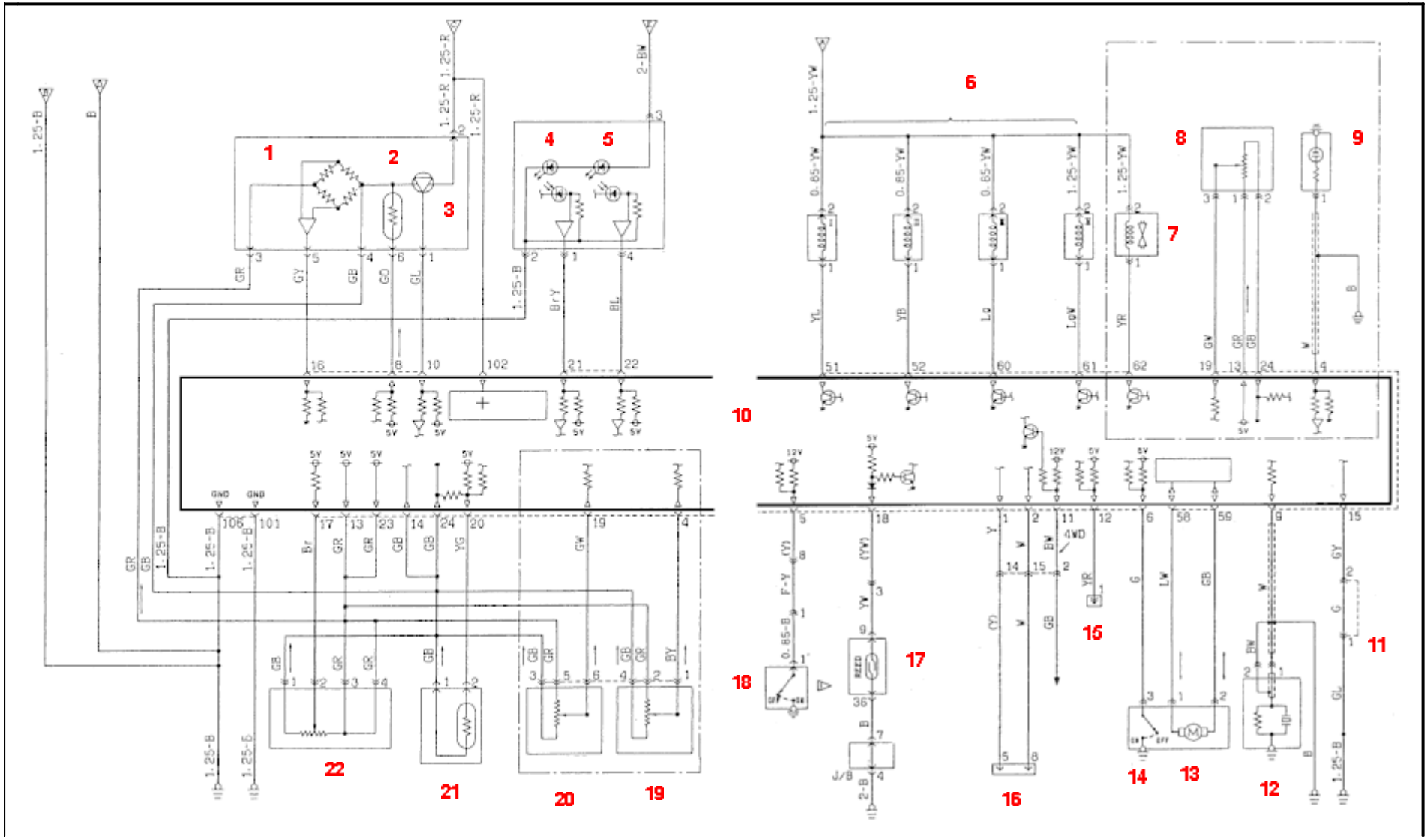
7
8
9
10
11
12
13

1. start/inhibitor switch
2. fuel pump test connector
3. fuel pump: 2WD
4. fuel pump: 4WD
5. engine warning lamp
6. ignition coil
7. power steering pressure switch
8. air-conditioning compressor relay
9. temperature switch
10. magnetic clutch
11. ignition module
12. control unit
13. system control relay

B = black; Br = brown; G = green; Gr = grey; L = blue; Sb = silver; Lg = light green; Ll = light blue; O = orange; P = pink; R = red; Y = yellow; W = white

SOHC engines to model year 1990; diagram 1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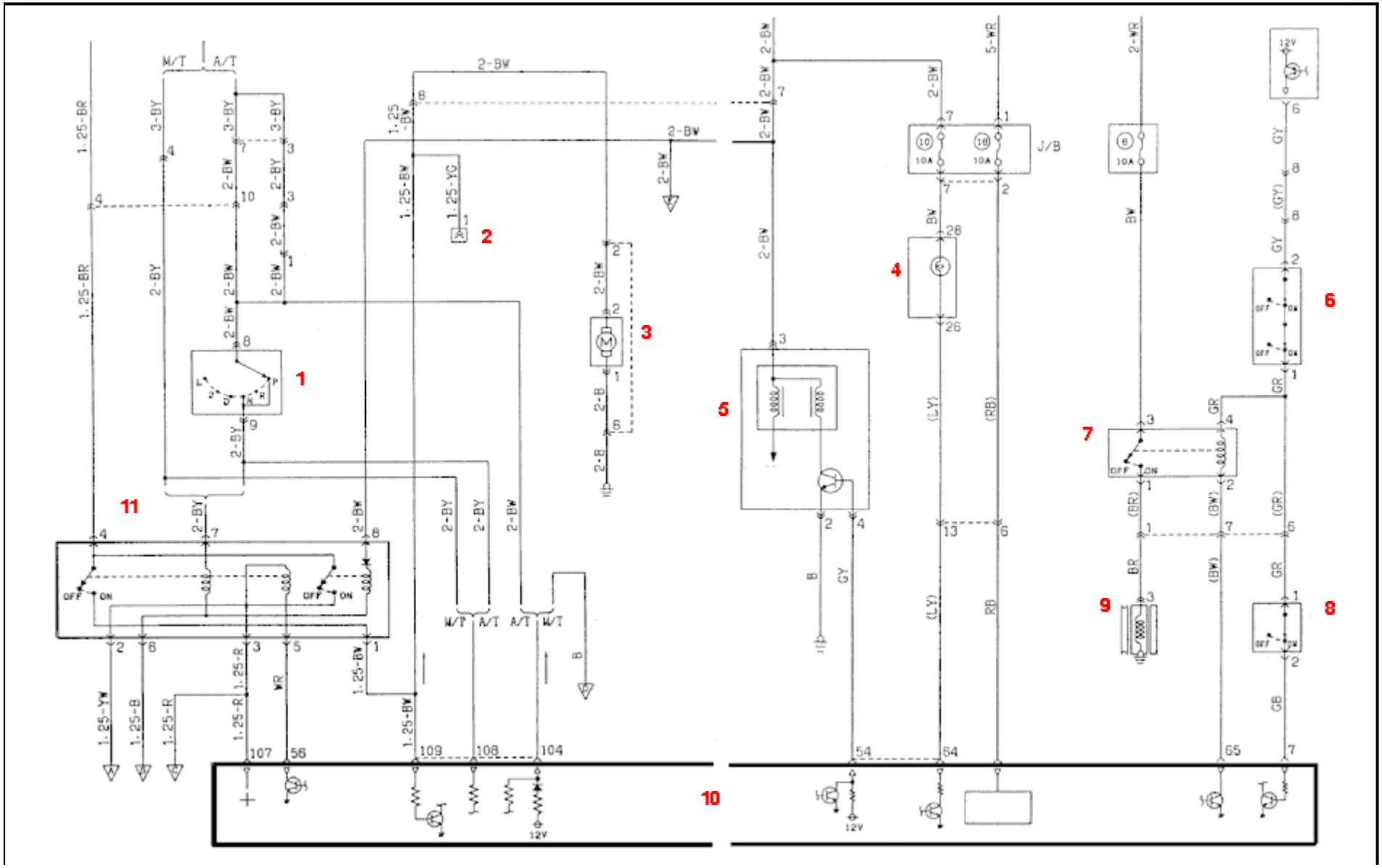
1. atmospheric pressure sensor
2. air intake temperature sensor
3. air flow meter
4. engine speed sensor
5. crankshaft position sensor
6. injectors
7. fuel vapour cut-off valve; with catalytic convertor
8. throttle valve potentiometer; with catalytic convertor
9. oxygen sensor; with catalytic convertor
10. control unit
11. octane adjust connector
12. knock sensor
13. throttle valve servo motor
14. idle switch
15. adjustment connector
16. diagnostic connector
17. vehicle speed sensor
18. power steering pressure switch
19. CO potentiometer; without catalytic convertor
20. throttle valve potentiometer; without catalytic convertor
21. coolant temperature sensor
22. potentiometer of throttle valve servo motor

G = green; Gr = grey; L = blue; Sb = silver; Lg = light green; Ll = light blue; O = orange; P = pink

SOHC engines to model year 1990; diagram 2


M/T
A/T
1.25-BR
3-BY
2-BW
2-BY
1.25-BW
1.25-YC
2-B
1.25-YW
1.25-B
1.25-R
WR
5-WR
2-WR
BW
GY
(GY)
GR
(BR)
(BW)
BR
(LY)
(RB)
RB
GB
B
J/B
10A
OFF
ON
12V
1
2
3
4
5
6
7
8
9
10
11

1. start/inhibitor switch
2. fuel pump test connector
3. fuel pump
4. engine warning lamp
5. ignition coil
6. power steering pressure switch
7. air-conditioning compressor relay
8. temperature switch
9. magnetic clutch
10. control unit
11. system control relay

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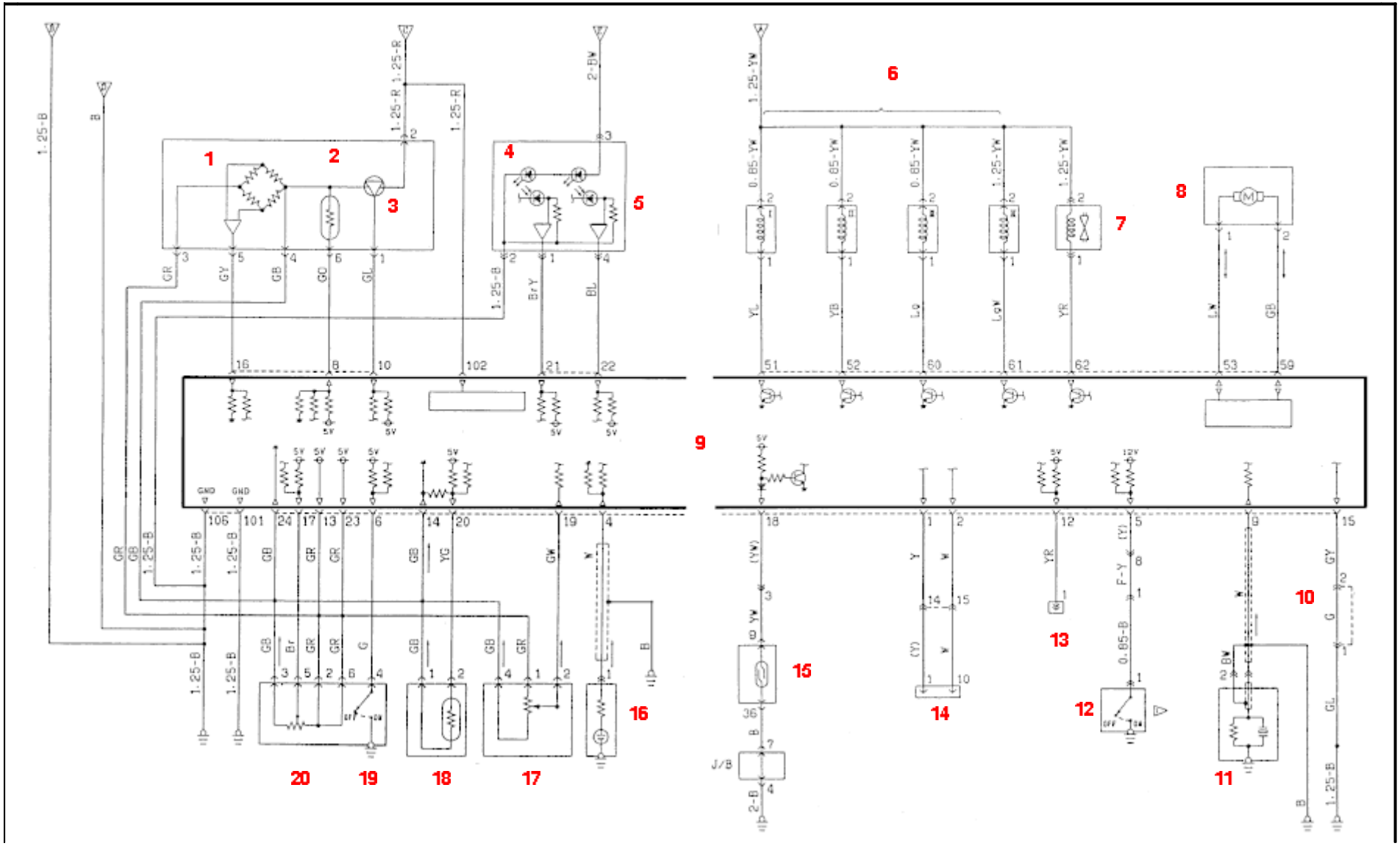
SOHC engines from model year 1991 onwards; diagram 1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1.25-R
2-BW
1.25-YW
0.85-YW
1.25-B
GR
GY
GB
GO
GL
BrY
BL
YG
YB
LG
LgW
YR
LW
GW
W
B
Br
G
(YW)
(Y)
F-Y
J/B
GND
5V

1. atmospheric pressure sensor
2. air intake temperature sensor
3. air flow meter
4. engine speed sensor
5. crankshaft position sensor
6. injectors
7. fuel vapour cut-off valve
8. throttle valve servo motor
9. control unit
10. octane adjust connector
11. knock sensor
12. power steering pressure switch
13. adjustment connector
14. diagnostic connector
15. vehicle speed sensor
16. oxygen sensor
17. throttle valve potentiometer
18. coolant temperature sensor
19. idle switch
20. potentiometer of throttle valve servo motor

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SOHC engines from model year 1991; diagram 2