

VOLVO

Service Manual

Design and function

Fault tracing

Repairs and maintenance

Section 2(27)

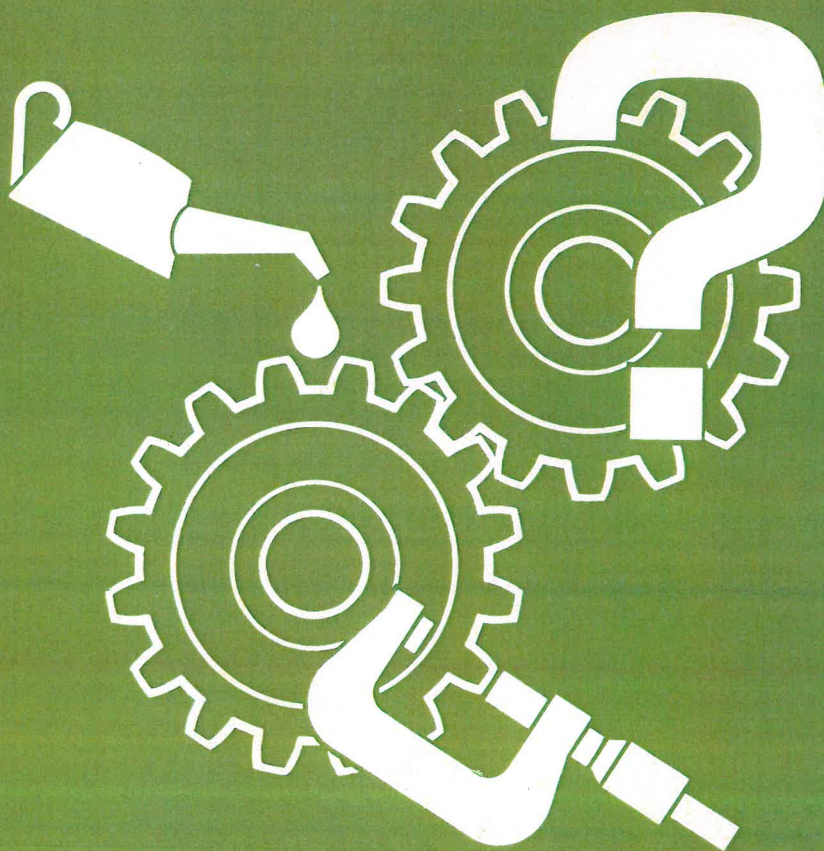
Cruise Control

400

1992 - 19..

February 1992

TP 36024



Volvo Car Corporation

Volvo passenger cars are sold in different variants adapted to the specific requirements of the various countries. This market adaptation is based on such things as legal regulations, tax limitations and specific wishes of the market concerned.

For this reason illustrations and text may appear in this Service manual which are not relevant to the cars in your own country.

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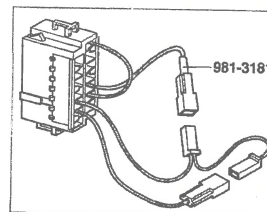
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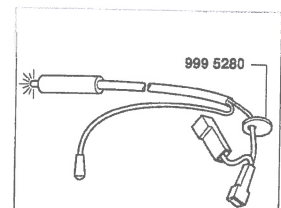
Special tools

999-5280
981-3181

Discription

Test LED
Test connector

981-3181



999-5280

Order number: 36024/1

We reserve the right to make alternations

Group 27. Cruise Control

A1-A8. Design and function

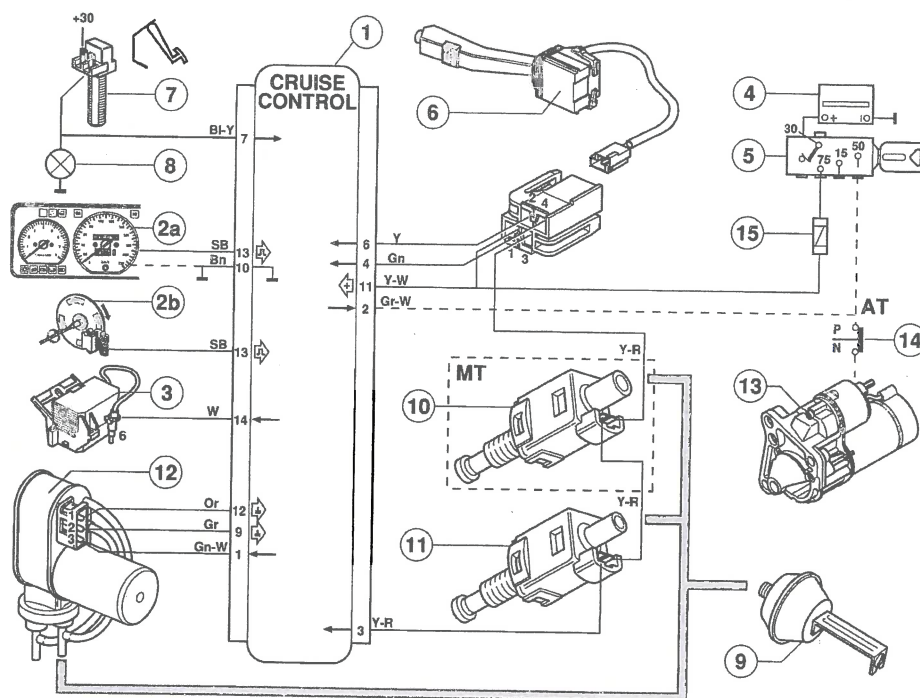
Special tools: 999-5280

General

A1

A Cruise Control system allows the vehicle speed to be kept constant without having to operate the accelerator pedal. The Volvo Cruise Control system is mechanically linked to the throttle valve controls.

The speed can be set by the driver with a multi-function selector switch and a push-button on the direction indicator stalk.



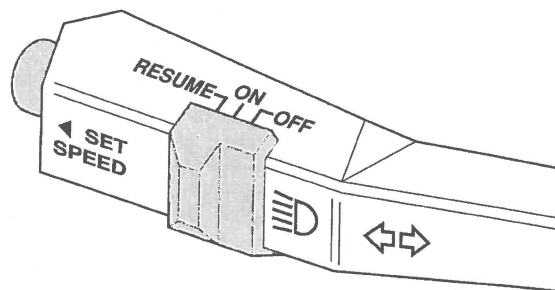
The Volvo Cruise Control system consists of the following components.

- | | |
|---------------------------------|------------------------------------|
| 1 Electronic Control Unit (ECU) | 9 Vacuum diaphragm unit |
| 2 Speed transmitters | 10 Air valve/switch, clutch |
| 3 Diagnostic tester | 11 Air valve/switch, brake pedal |
| 4 Battery | 12 Electric vacuum pump + governor |
| 5 Ignition switch | 13 Starter motor |
| 6 Switches (in the stalk) | 14 Switch in automatic gearbox |
| 7 Brake light switch | 15 Line fuse (5 A) |
| 8 Brake lights | |

27 006

A2

The driver operated controls on the direction indicator stalk consist of a selector switch and a push-button with the following functions:



- a] OFF System disengaged.
- b] ON System engaged.
- c] RESUME The previous set speed stored in the memory is automatically resumed (after operating the switch once).
- d] SET Releasing the SET SPEED button enters the instantaneous vehicle speed into the memory. Keeping the SET SPEED button pressed in causes the vehicle to accelerate.

27 007

A3

Principle and practice of operation

The ECU (1) responds to signals from the electronic speedometer (2a) or the Hall transmitter mounted on the rear surface of the instrument panel (2b). When the selector switch on the direction indicator stalk (6) is in the ON position and the SET SPEED button is pushed in and then released, the instantaneous vehicle speed is entered into the memory, provided that it is higher than 40 km/h.

The ECU compares the signals from the speed transmitter (2) with the data stored in the memory of the ECU. Depending upon the result of that comparison, the ECU transmits a signal to the vacuum pump (12) which regulates the vacuum prevailing in the vacuum system. The position of the throttle linkage is then adjusted via the vacuum diaphragm unit (9), thus keeping the vehicle speed constant without the driver having to operate the accelerator pedal.

Cruise Control switch-off

The ECU is connected to earth via the brake lights. When the brake pedal is depressed voltage is applied to terminal 7 of the ECU. Depressing the brake or clutch pedal simultaneously interrupts the supply voltage to the ECU (terminal 3) and admits air via the air valve switch(es) into the vacuum system, as a result of which the vacuum diaphragm unit (7) can no longer influence the position of the throttle linkage.

The previous set speed, however, remains stored in the memory of the ECU.

The Cruise Control system is automatically switched off when:

- * the vehicle speed falls below 40 km/h;
- * the vehicle speed deviates more than 25% from the set speed;
- * the deceleration rate during braking is $> 4 \text{ m/s}^2$;
- * on vehicles with automatic transmission the selector lever of the automatic gearbox (14) is in position P or N.

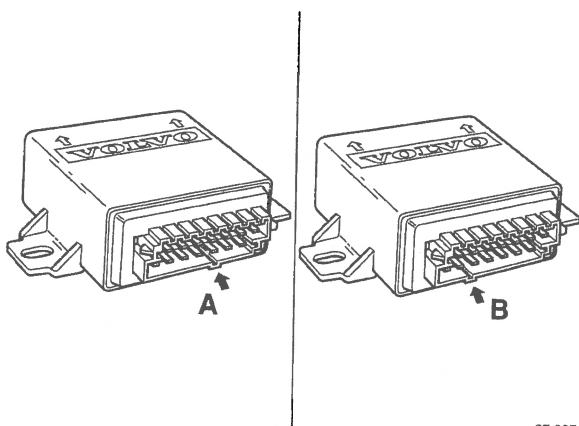
A4

Electronic Control Unit

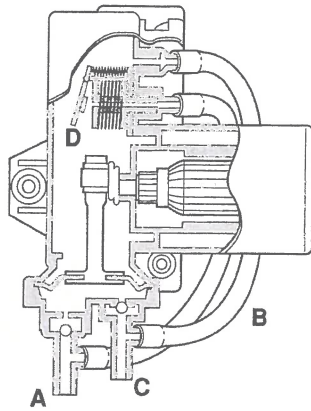
The ECU contains a microprocessor which regulates the vehicle speed depending upon the values stored in its memory. The system also controls acceleration and deceleration. The ECU is located under the dashboard, next to the steering wheel height adjustment mechanism.

Caution! There are two types of ECU, one for electronic speedometers and one for mechanical versions (the connectors have a different shape and colour).

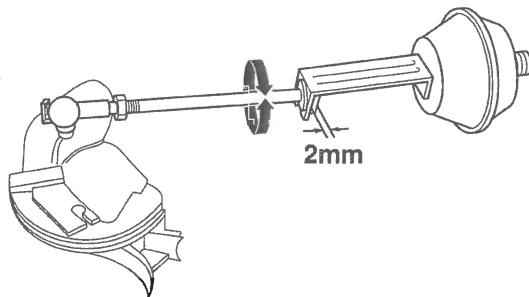
Mechanical (A): black connector.
Electronic (B): grey connector.



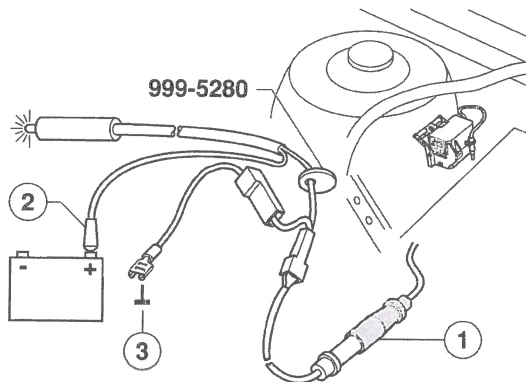
27 027



27 028



27 029



27 008

A5

Vacuum pump and governor

The vacuum pump/governor unit is located under the front right wing. Remove the wheel arch liner. The pump is located on the rear of the bracket.

An electromotor applies vacuum by sucking air out of hose A (black pipe to the vacuum diaphragm unit) to outlet C (white pipe for atmospheric pressure). Two non-return valves are incorporated in the supply and discharge sides.

Atmospheric pressure is always present in the upper section of the pump via hose B. When the engine is throttled down, governor D admits air into the vacuum system.

A6

Vacuum diaphragm unit

The vacuum diaphragm unit is connected to the throttle disc by a control rod with a ball and socket joint. When vacuum is applied by the vacuum diaphragm unit, the diaphragm pulls the throttle valve open. The control rod must be adjusted to obtain a clearance of 2 mm.

A7

Diagnostic system

The diagnostic tester is located on the turret of the left-hand MacPherson strut in the engine compartment. The selector cable must be plugged into position 6.

Some Volvo models only have a diagnostic cable in the wiring harness secured to the turret of the left-hand MacPherson strut. A readout of the codes stored in the memory can be obtained with the help of special tool 999-5280. See the adjacent drawing:

- diagnostic cable (1) connected to the AMP connector;
- + terminal connected to the battery positive pole (2);
- earth connection (3) instead of the push-button.

A8

Test functions

General faults are stored in test function 1. Five fault codes are possible; see Operation B1. The fault codes must be read out of the memory **immediately** after the test drive. Keep the engine running or turn the ignition key back to the +75 position.

Input signals are tested in test function 2. Codes are indicated by operating the relevant switch or component; see Operation G2.

Codes related to system switch-off for safety critical reasons are stored in test function 5. Five fault codes are possible; see Operation H1.

B1-B2. Test function 1. Diagnostic system, self-test

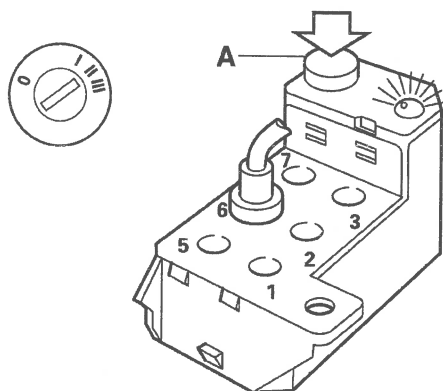
B1

General

The fault codes in test function 1 must be read out of the memory **immediately** after the test drive. Keep the engine running or turn the ignition key back to the +75 position. The codes are erased from the memory when the ignition is switched off.

To allow any faults to be entered and subsequently read out of the memory, the vehicle speed **during** the test drive must be higher than 40 km/h and the system must be switched on. At speeds below 40 km/h fault code 1-2-2 will always be indicated.

Code	Cause of fault	Operation
1-1-1	No faults. Speed was higher than 40 km/h.	-
1-1-2	Forbidden speed signal.	C1
1-2-2	Speed was not higher than 40 km/h or there was no speed signal.	D1- D3
2-1-1	Fault in supply voltage or ECU.	E1
2-1-2	Fault in vacuum pump or governor, circuit or influence of a magnetic field.	F1



27 009

Test function 1

Leave the ignition switched on.
Plug the selector cable into position 6. Activate test function 1 by pressing the button (A) once for 0.5 to 1 second.

Make a note of the code.
(If the LED fails to light up or does not flash, check the diagnostic tester; see Operations J1-J3.)

Repeat the operation and make a note of all the codes.

B2

C1. Code 1-1-2. Forbidden speed signal

C1

General

Code 1-1-2 is stored in the memory in the event of system switch-off for safety critical reasons or in the case of an abnormal speed signal.

System switch-off for safety critical reasons

System switch-off for safety critical reasons does not necessarily mean there is a fault, but may also be caused by abnormal changes in speed; see Operation H1. Examples of such speed changes are rapid acceleration (wheelspin), wheel lock, or an instantaneous speed which is 25% lower than the set speed (for example, on steep gradients).

Abnormal speed signal

If code 1-1-2 appears during the test drive readout, this indicates that faults have occurred in the interface between the speedometer and the ECU. Possible causes: accessories or systems which use the same speed signal or the same earth connection.

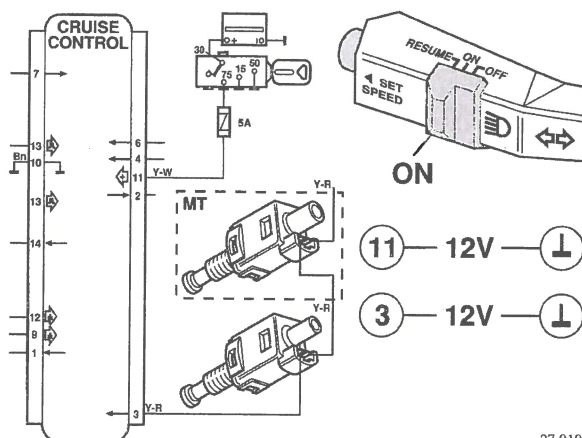
Faults may also occur if the ECU and the speedometer do not share the same earth connection.

D1-D3. Code 1-2-2. Speed signal not higher than 40 km/h

D1

General

Code 1-2-2 is entered into the memory when the ignition is switched on and remains stored until the vehicle speed has exceeded 40 km/h for at least 15 seconds. If the code is still present after the test drive, this indicates that the ECU is not receiving a speed signal.



27 010

Test the supply voltage and earth connection

Switch on the ignition.

Measure the voltage at terminal 11: this should be 12 V.

- no voltage: check the wiring between the line fuse (5 A) (near the fuse box) and the ECU; see the wiring diagram on page 15.

Cruise Control selector switch in the ON position.

Measure the voltage at terminal 3 of the ECU.

- 12 V: see Operations G5-G7.
- no voltage: check the clutch and brake pedal switches. Test the Cruise Control selector switch; see Operation G11.

Check the wiring between terminal 10 of the ECU and the earth connection on the left-hand A-pillar.

D3

Test the speed signal**Mechanical speedometer.**

Switch on the ignition. Raise one front wheel clear of the ground.

Connect a voltmeter between terminal 13 of the ECU and the earth connection (terminal 9).

Rotate the wheel slowly. The voltmeter reading should fluctuate between 9 V and 1 V (approximate values).

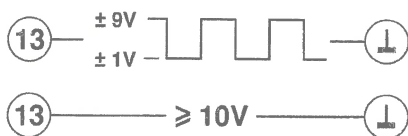
No voltage fluctuation: check the wiring to the instrument panel; see the wiring diagram on page 15.

Electronic speedometer.

The signal cannot be tested!

Check the speedometer. Switch on the ignition. Measure the voltage at terminal 13 of the ECU.

Voltage > 10 V: wiring in order.



27 011

E1. Code 2-1-1. Fault in supply voltage or ECU

E1

General

Code 2-1-1 is stored in the memory when there are faults in the supply voltage and/or earth connection. The voltage should be > 10.5 V. Excessively high voltage levels may also cause faults. See Operation D2.

F1. Code 2-1-2. Fault in vacuum pump and governor circuit

F1

General

Code 2-1-2 is stored in the memory when the vacuum pump and governor circuit is earthed or connected to battery voltage. There may also be a fault in the ECU, for example due to a magnetic field in the vicinity of the ECU and/or wiring.

Start with Operations K1-K4. Check the vacuum system!

G1-G11. Test function 2. Testing components

G1

General

Important: adjust the clutch as specified in the relevant Service literature.

Test function 2 can be used to test the various components, wiring and switches. When the components are activated, the ECU responds with an answer code.

Answer codes can occur both when switching on and switching off.

Code 3-1-1 usually occurs when there is a short circuit between wires or in the switch.

Component or switch

Code

Operation

ON and OFF switch, brake and/or clutch air valve/switch

1-1-3

G2-G7

RESUME switch

1-2-3

G8

SET SPEED switch

1-3-1

G9

Brake light switch

1-3-2

G3

Start interlock (AT only)

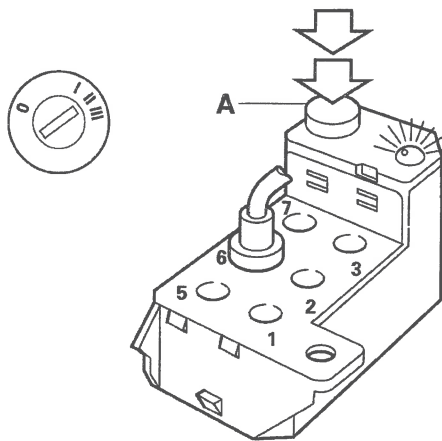
2-2-3

G10

Several signals together

3-1-1

-



27 012

G2

Test function 2

Plug the selector cable into position 6. Switch on the ignition.

Cruise Control selector switch in the OFF position.

Vehicles with automatic transmission: move the gearbox selector lever to position D. **Apply the handbrake!**

Activate test function 2 by pressing the button twice for 0.5 to 1 second each time. The LED should now start to flash rapidly.

Make a note of the code.

(If the LED fails to light up or does not flash, check the diagnostic tester; see Operations J1-J3.

G3

Brake lights

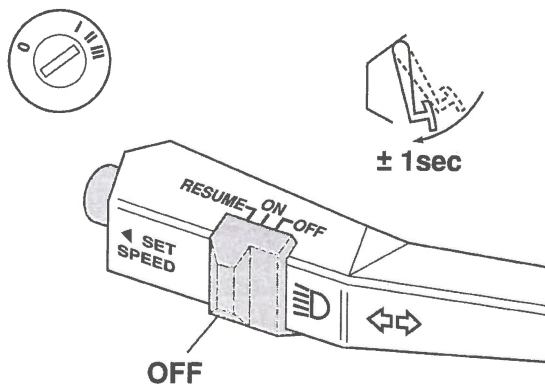
Ignition on. Cruise Control selector switch in the OFF position.

Depress the brake pedal for approximately 1 second.

No code: check the wiring; see the wiring diagram on page 15. Test the voltage at terminal 7.

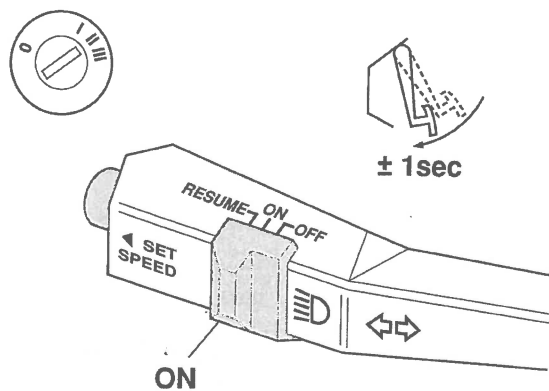
Code 1-3-2: brake light circuit in order.

Continue from Operation G4.



27 013

G4



27 014

ON position of Cruise Control selector switch

Move the Cruise Control selector switch to the ON position. A code should then appear.

No code: check the clutch and brake air valve/switches; see Operations G5-G7.

Code 1-1-3: depress the brake pedal for 1 second and the clutch pedal for 1 second.

No code: check the clutch and brake air valve/switches; see Operations G5-G7.

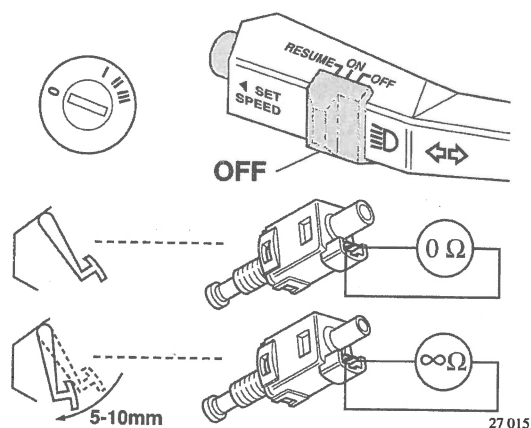
Code 1-1-3: ON and OFF selector switch and air valve/switches in order.

G5

Clutch and brake air valve/switches

When the Cruise Control selector switch is moved from ON to OFF, or when the brake or clutch pedal is depressed while the switch is in the ON position, code 1-1-3 should appear.

If the code does not appear, then the voltage at terminal 3 is constant (either 12 V or 0 V).



27 015

G6

Check the clutch and brake air valve/switches

Ignition off. Cruise Control selector switch in the OFF position.

Unplug the connector from the valves. Measure the resistance.

Pedal in raised position: resistance should be 0 ohms.

Pedal depressed 5-10 mm: resistance should be ∞ ohms.

Note: on vehicles equipped with ABS a clip is mounted on the pedal.

Important: adjust the clutch as specified in the relevant Service literature.

G7

Test the supply voltage

Ignition on. Cruise Control selector switch in the ON position.

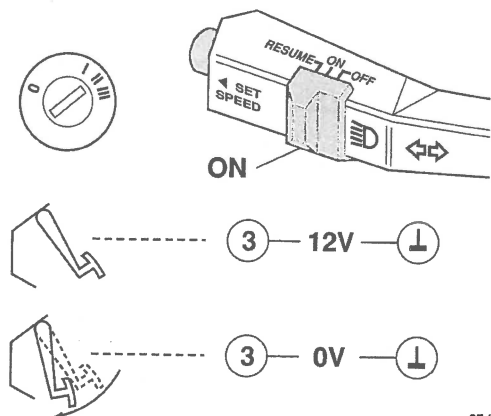
Measure the voltage at terminal 3.

Pedals not depressed: 12 V.

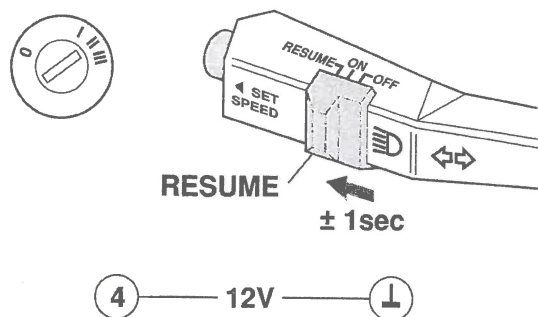
Pedals depressed: 0 V.

Cruise Control selector switch to the OFF position: 0 V.

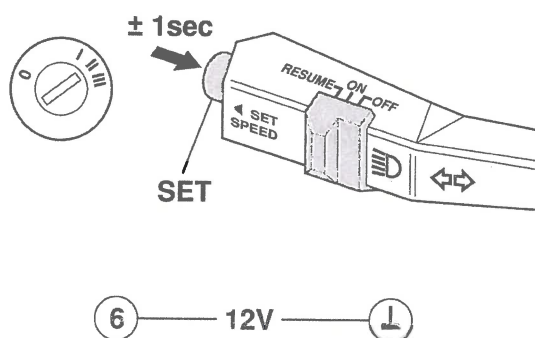
No voltage: Test the wiring and the switch; see Operation G11.



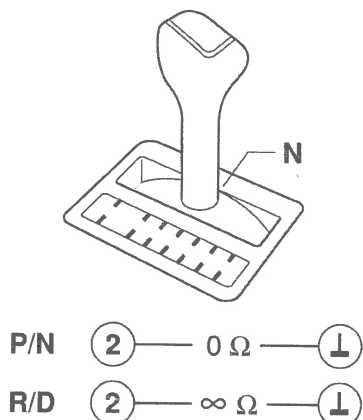
27 016



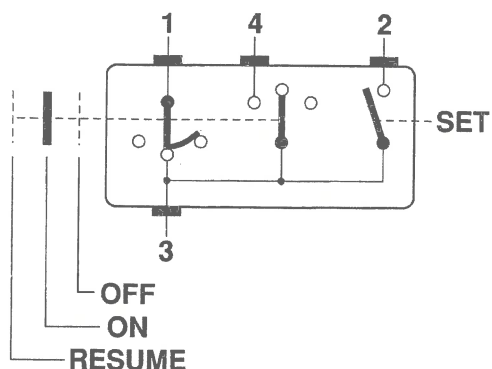
27 017



27 018



27 019



27 020

G8

Test the RESUME switch

Cruise Control selector switch in the ON position. Press the RESUME switch (spring-loaded contact) for approximately 1 second.

Code 1-2-3: the RESUME function is in order.

No code: ignition on. Cruise Control selector switch in the ON position.

Measure the voltage at terminal 4.

With the RESUME switch on: value should be 12 V.

Other positions: 0 V.

No voltage: test the switch; see Operation G11.

G9

Test the SET SPEED button

Cruise Control selector switch in the ON position. Press the SET SPEED button for approximately 1 second.

Code 1-3-1: the SET SPEED function is in order.

No code: ignition on. Cruise Control selector switch in the ON position.

Measure the voltage at terminal 6.

With the SET SPEED button on: value should be 12 V.

Other positions: 0 V.

No voltage: test the switch; see Operation G11.

G10

Test the automatic transmission start interlock

Ignition on. Move the gearbox selector lever to the N position.

Code 2-2-3: start interlock function is in order.

No code: measure the resistance across terminal 2 and earth.

Selector lever	Resistance
Position "P"	0 ohm
Position "R"	∞ ohm
Position "N"	0 ohm
Position "D"	∞ ohm
Other positions	∞ ohm

For a description of the repair methods, see the Automatic Transmission Service Manual.

G11

Test the switch

The switch can be tested for continuity with an ohmmeter. Check each contact for play and wear by switching on and off a number of times.

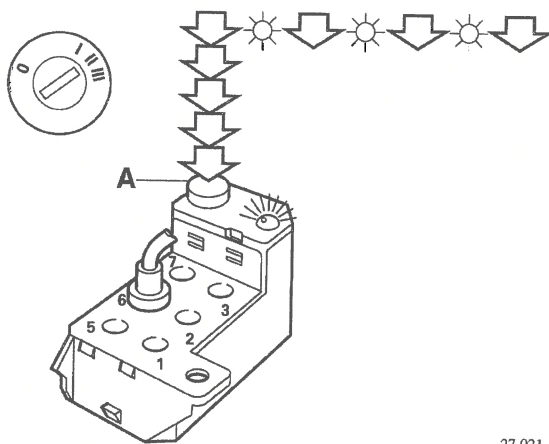
H1-H7. Test function 5. Causes of system switch-off

General

H1

The last fault that caused the system to switch itself off is stored in the memory. If the system switches itself off during a test drive without this being initiated by the driver, then the switch-off code will be stored in the memory until the ignition is switched off.

Code	Switch-off cause	Operation
1-1-4	Safety critical switch-off	H3
1-4-1	Start interlock switch-off	H4
4-1-1	switch-off of selector switch and brake or clutch pedal switch	H5
1-2-4	Brake light circuit switch-off	H6
2-1-4	Supply voltage switch-off	H7



Test function 5

H2

Leave the ignition switched on.
Plug the selector cable into position 6.
Activate test function 5 by pressing the button (A) five times for 0.5 to 1 second. If the LED lights up, enter code 1-1-1 (wait for the LED to light up again before pressing the button).

Make a note of the code.
(If the LED fails to light up or does not flash, check the diagnostic tester; see Operations J1-J3.)

27 021

Code 1-1-4. Safety critical switch-off

H3

System switch-off for safety critical reasons does not necessarily mean there is a fault, but may be caused by abnormal changes in speed. Examples of such speed changes are rapid acceleration (wheelspin), wheel lock, or an instantaneous speed which is 25% lower than the set speed (for example, on steep gradients).

H4

Code 1-4-1. Start interlock switch-off

Moving the selector lever into position P or N causes code 1-4-1 to be stored in the memory.

If the selector lever was **not** operated during the test drive, this indicates that terminal 2 has been earthed. See Operation G10.

H5

Code 4-1-1. Switch-off of selector switch and brake or clutch pedal switch

Operating the Cruise Control selector switch and the brake or clutch pedal causes code 4-1-1 to be stored in the memory.

If code 4-1-1 is stored in the memory during the test drive **without** operation of the selector switch or the pedals, this indicates that the voltage at terminal 3 has been interrupted.

Causes: play in the switch, loose wires/terminals or an incorrectly adjusted air valve/switch of the brake and/or clutch. See Operations G5-G7.

Important: adjust the clutch as specified in the relevant Service literature.

H6

Code 1-2-4. Brake light circuit switch-off

Operating the brake pedal causes code 1-2-4 to be stored in the memory.

If code 1-2-4 is stored in the memory during the test drive **without** operation of the brake switch, this indicates that terminal 7 was not earthed at the instant of switch-off.

Causes: loose wires/terminals or an incorrectly adjusted brake light switch.

H7

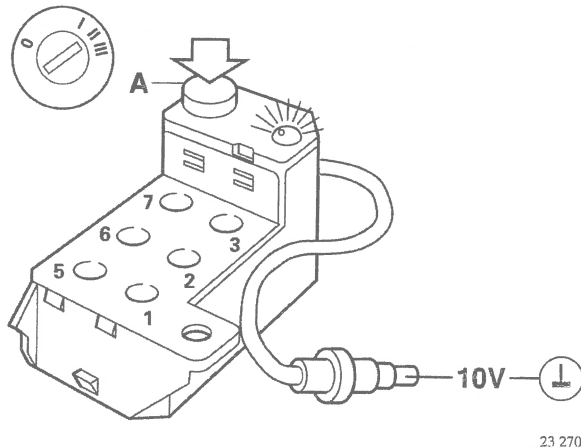
Code 2-1-4. Supply voltage switch-off

When switching on the ignition, code 2-1-4 is stored in the memory **until** the Cruise Control has been switched on once **and** switched off once with the SET SPEED button.

If code 2-1-4 is stored in the memory after the test drive without switching off the engine, this indicates that the voltage has dropped to an inadequate level.

Check the wiring and the terminals.

J1-J3. Functional test of the diagnostic tester



J1

Check the diagnostic tester

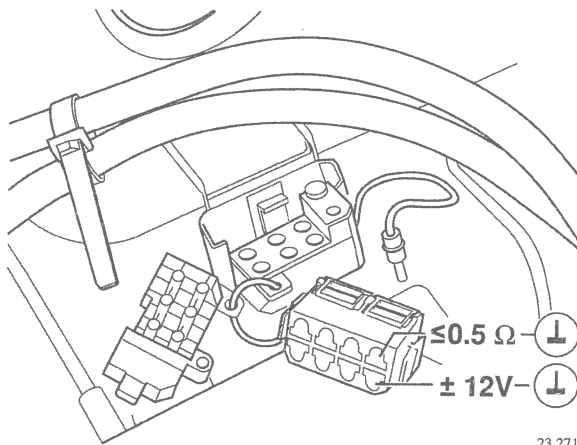
Switch on the ignition.

Press the button (A): the LED should light up.

Measure the voltage across the cable and earth: this should be approximately 10 V.

Both tests correct: go to Operation J3.

One of the tests not correct: check the supply voltage and the earth connection; see Operation J2.



J2

Check the supply voltage and earth connection of the diagnostic tester

Unplug the connector from the diagnostic tester.

Switch on the ignition.

Measure the voltage across terminal 4 and earth: this should be 12 V.

No voltage: check (the wiring to) the fuse.

Measure the resistance across the brown cable of the connector and earth: this should be not more than 0.5 ohms.

Resistance higher: check the wiring to the earth connection behind the battery.

Supply voltage and earth connection in order: fit a new diagnostic tester.

J3

Check the wiring between the ECU and the diagnostic tester

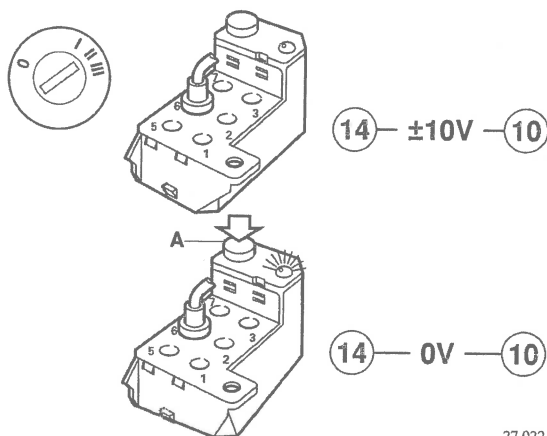
Plug the selector cable into position 6.

Switch on the ignition.

Measure the voltage across terminals 14 and 10: this should be approximately 10 V.

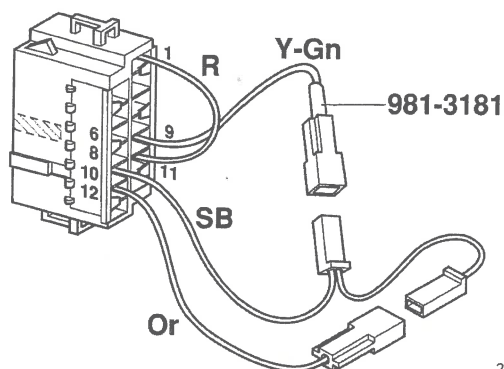
Press the button (A): voltage should decrease to 0 V.

No voltage: check the wiring.



K1-K4. Functional test of the vacuum system

Special tools: 981-3181



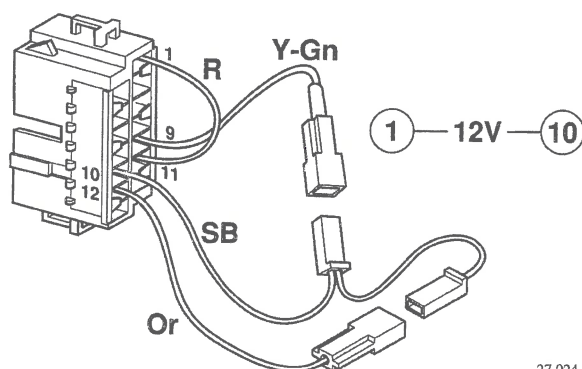
K1

Modify the tool

Special tool **981-3181** is for electronic speedometers. For use on mechanical speedometers (Hall transmitter) the tool has to be modified by making a slot between terminals 6 and 8. See the adjacent drawing.

\$W

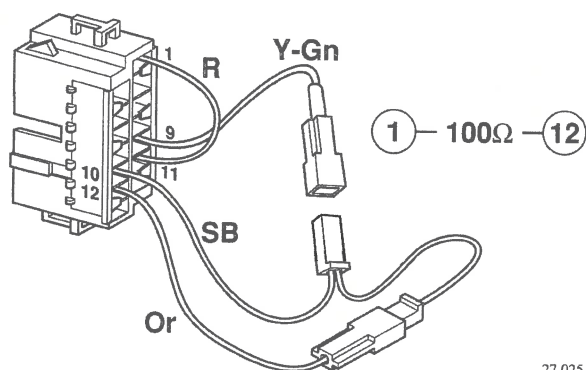
After this modification the special tool is still suitable for electronic speedometers.



K2

Test the supply voltage

Connect up special tool **981-3181**. Switch on the ignition. Measure the voltage across terminals 10 and 1 of the connector: this should be 12 V.



K3

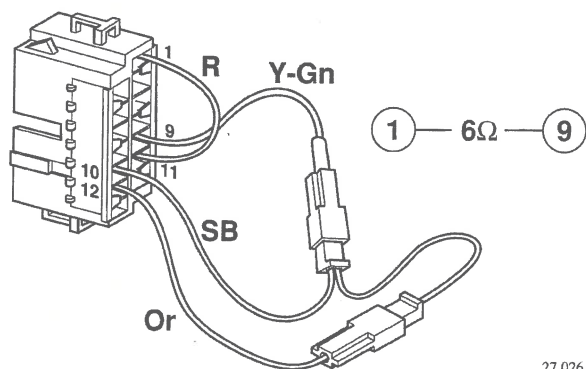
Test the governor

Connect the orange cable to the black cable (terminals 12 and 10).

The governor (on the pump unit) should make a clicking noise.

No click: switch off the ignition. Check the wiring and measure the resistance across terminals 1 and 12: this should be approximately 100 ohms.

Audible click: proceed with Operation K4.



K4

Test the vacuum pump

Connect the yellow-green cable to the black cable (terminals 9 and 10).

The vacuum pump should start to operate and the vacuum diaphragm unit should pull in completely.

Pump fails to operate: check the wiring and measure the resistance across terminals 1 and 9: this should be approximately 6 ohms.

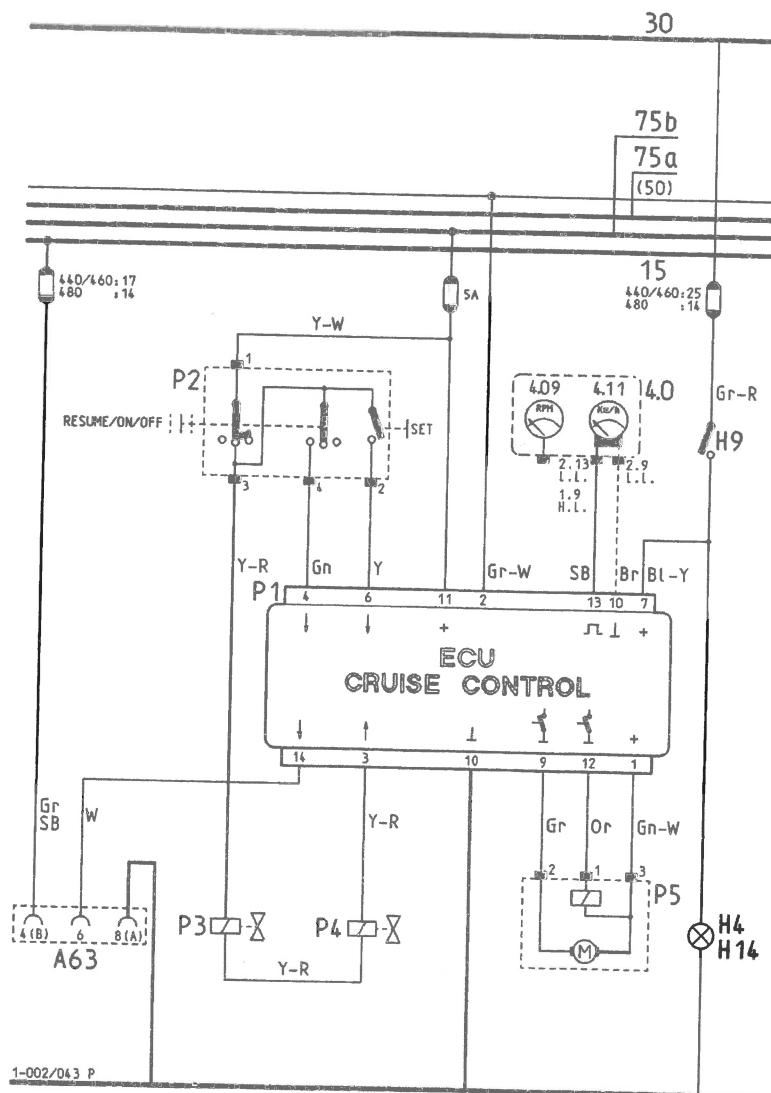
Pump operates but vacuum diaphragm unit does not pull in: check the hoses to the vacuum pump and the vacuum diaphragm unit.

Pump and vacuum diaphragm unit operate correctly: disconnect the yellow-green cable (terminal 9). Wait 30 seconds.

There must be no perceptible return motion of the vacuum diaphragm unit.

Disconnect the orange cable (terminal 12). The governor should click and the throttle valve should gradually return to its initial position.

Cruise Control wiring diagram



- | | |
|-----|--------------------------------|
| 4.0 | Instrument panel |
| A63 | Diagnostic tester |
| H4 | Brake light, left |
| H9 | Switch, brake lights |
| H14 | Brake light, right |
| P1 | ECU, Cruise Control |
| P2 | Cruise Control selector switch |
| P3 | Air valve/switch, clutch |
| P4 | Air valve/switch, brake |
| P5 | Vacuum pump/governor |

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Field report form

To:

Volvo Car Corporation
Afd. Service Technical Support
P.O. Box 1015
5700 MC Helmond
The Netherlands

From:

Concerns publication:

Section: Page TP no.

Suggestions/reasoning:

Date

Do you have any useful comment or other ideas concerning this manual?
If so, make a copy of this page and send them to us at the above address.

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Netherlands

Drukkerij Jémé B.V. Eindhoven / De Wit Binders B.V. Eindhoven

VOLVO

Manual de Servicio

**Diagnóstico de averías
Reparación y mantenimiento**

Sección 3(39)

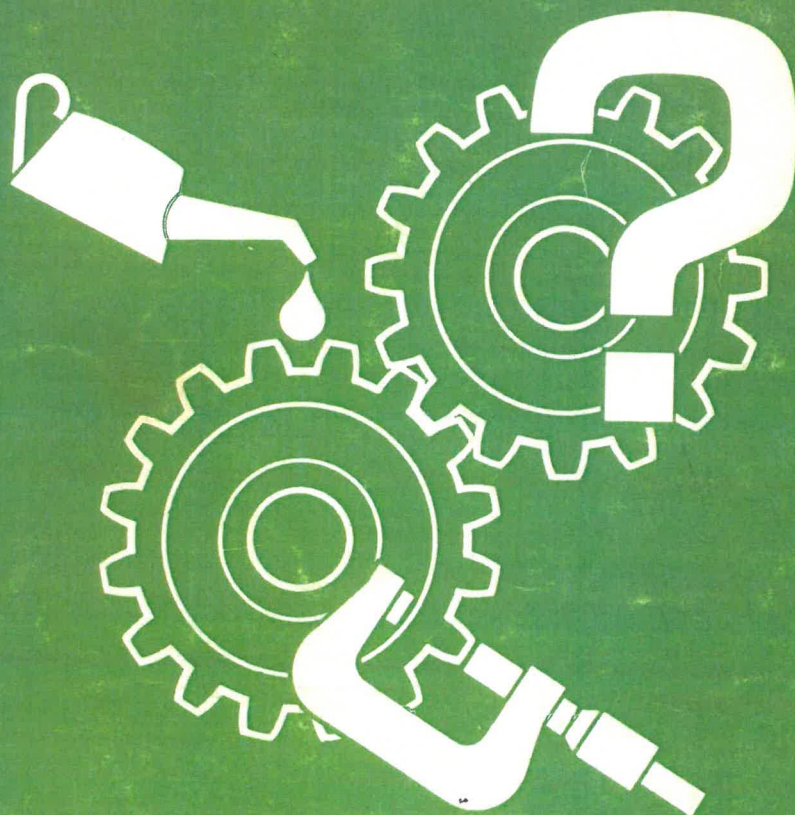
**Esquemas eléctricos
Suplemento**

480

1992-1994

agosto 1993

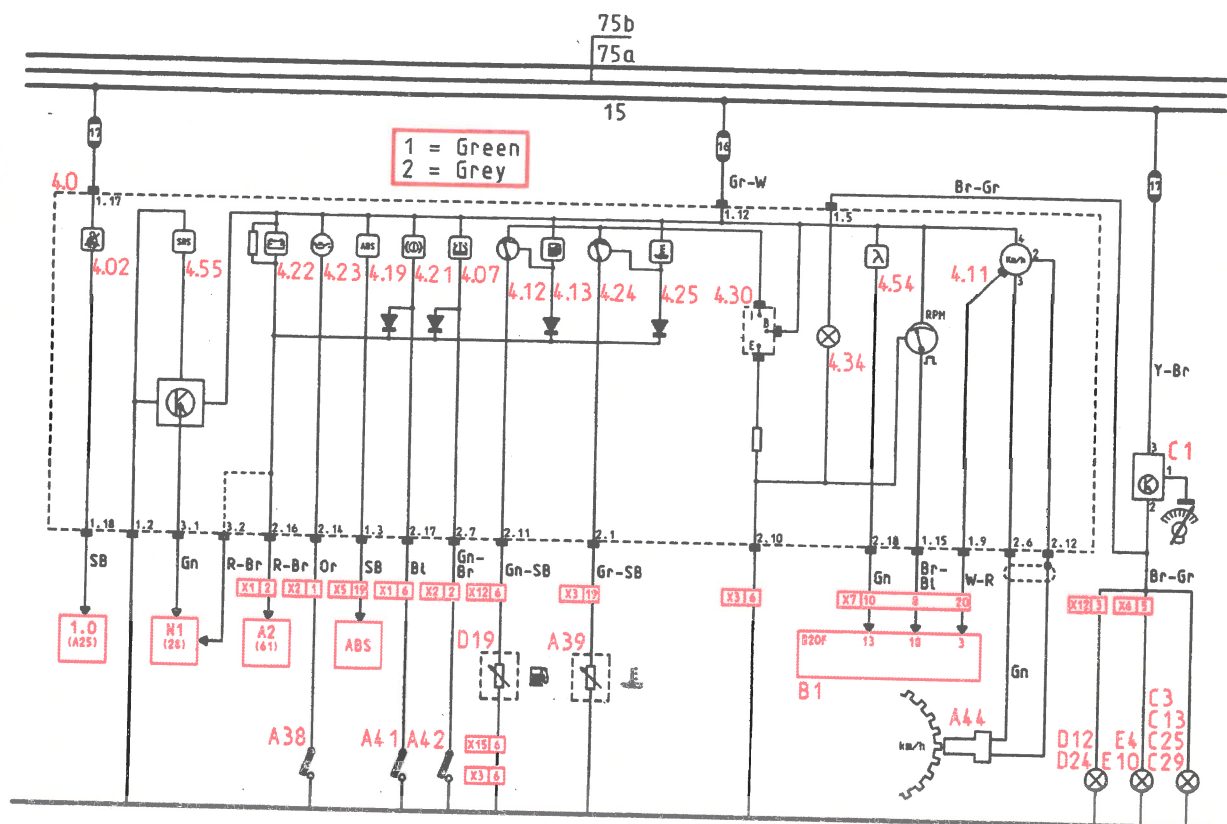
TP 3906061



Volvo Car Corporation

A partir del chasis no. 581.112, en los vehículos 480-S se ha cambiado el centro de información por un indicador de temperatura y de nivel de combustible. Los conectores siguen siendo los mismos (2x 18 polos).

30



Observación:

Se ha incorporado el testigo de identificación de fallos (MIL) (señal λ) para controlar los valores de emisión.

Conexiones c21 Gn (verde)

Nº	Colores de cables	Componente
1	Bl-Gn	Fusible 31
2	Br	Masa
3	SB	ABS
4	Y	Transmisor nivel aceite
5	Br-Gr	Alumbrado reóstato
6	Y-SB	Puerta abierta
7	Br	Masa
8	Y-W	Calefacción luneta trasera
9	W-R	Generador Hall - ECU
10	Br-Bl	Fusible 28
11	Gn-R	Intermitente dirección l.
12	Gr-W	Fusible 16
13	Bl-Gr	Luz antiniebla trasera
14	Bl-Y	Faros antiniebla
15	Br-Bl	Señal cuentarrevoluciones - ECU
16	Gn-SB	Intermitentes de aviso
17	GR-W	Cinturón de seguridad
18	SB	Cinturón de seguridad-CEM

Conexiones c20 Gr (gris)

Nº	Colores de cables	Componente
1	SB	Transmisor temperatura del refrigerante
2	Gr	Transmisor nivel del aceite
3	Gr-R	Fusible 21
4	W-Bl	Transmisor temperatura exterior
5	Gn	Señal de inyección - ECU
6	W	Velocímetro
7	Gn-Br	Flotador líquido lavalunetas
8	-	-
9	W	Transmisor temperatura del aceite
10	Br-Bl	Sensores de masa
11	Gn-SB	Flotador depósito de combustible
12	-	Masa transmisor velocidad
13	Bl	Detector bombillas fundidas
14	Or	Interruptor presión del aceite
15	Gn-Y	Intermitente dirección D.
16	R-Br	Alternador
17	Bl	Flotador líquido de frenos/freno de mano
18	SB	MIL (control de emisión)

Conexiones c75Gr

1	Gn	SRS
2	R-Br	Salida señal alternador