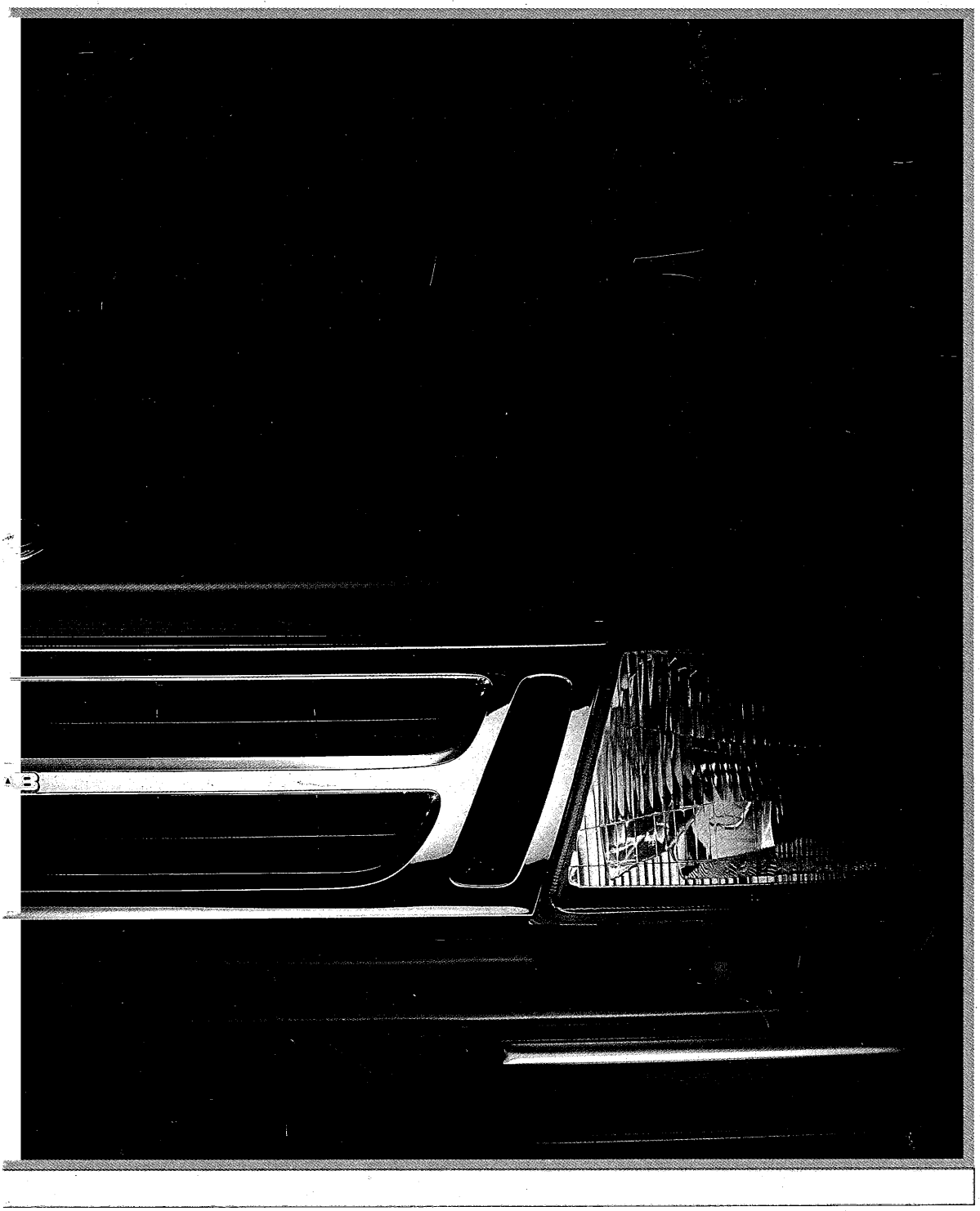
Saab 9000

SERVICE TRAINING



SAAB

Workbook
8:3 ACC II

M 1990

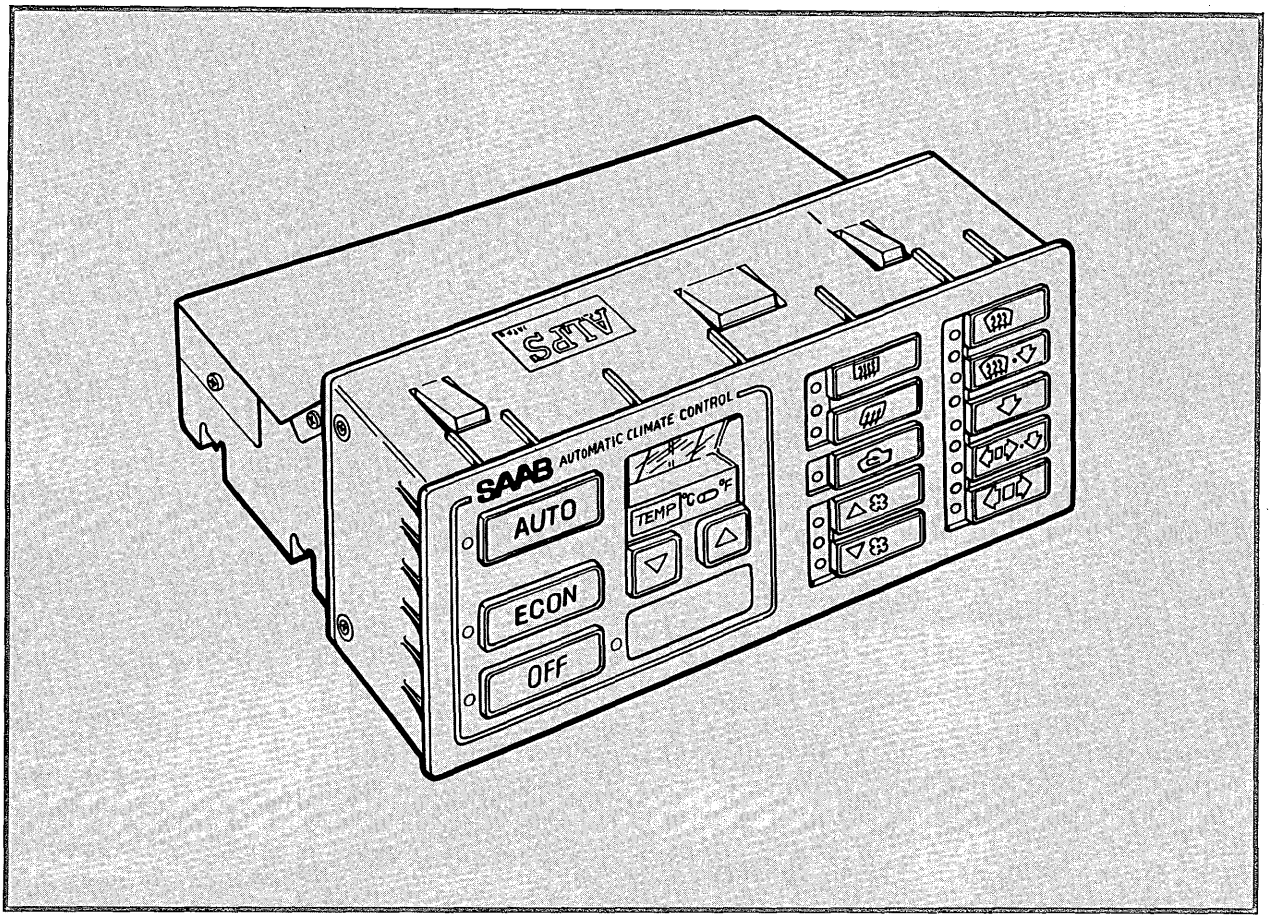
SAAB 9000 – 8:3 ACC (Version 2) Workbook

Contents

Production: Service Training, Saab-Scania, Trollhättan, Sweden

Contents (continued)

1: Introduction to the Saab Automatic Climate Control Unit Version 2 (ACC2)



ACC2 is a further development of ACC1. The new system is equipped with better sensors and more accurate flap control to provide improved standards of comfort and quieter operation.

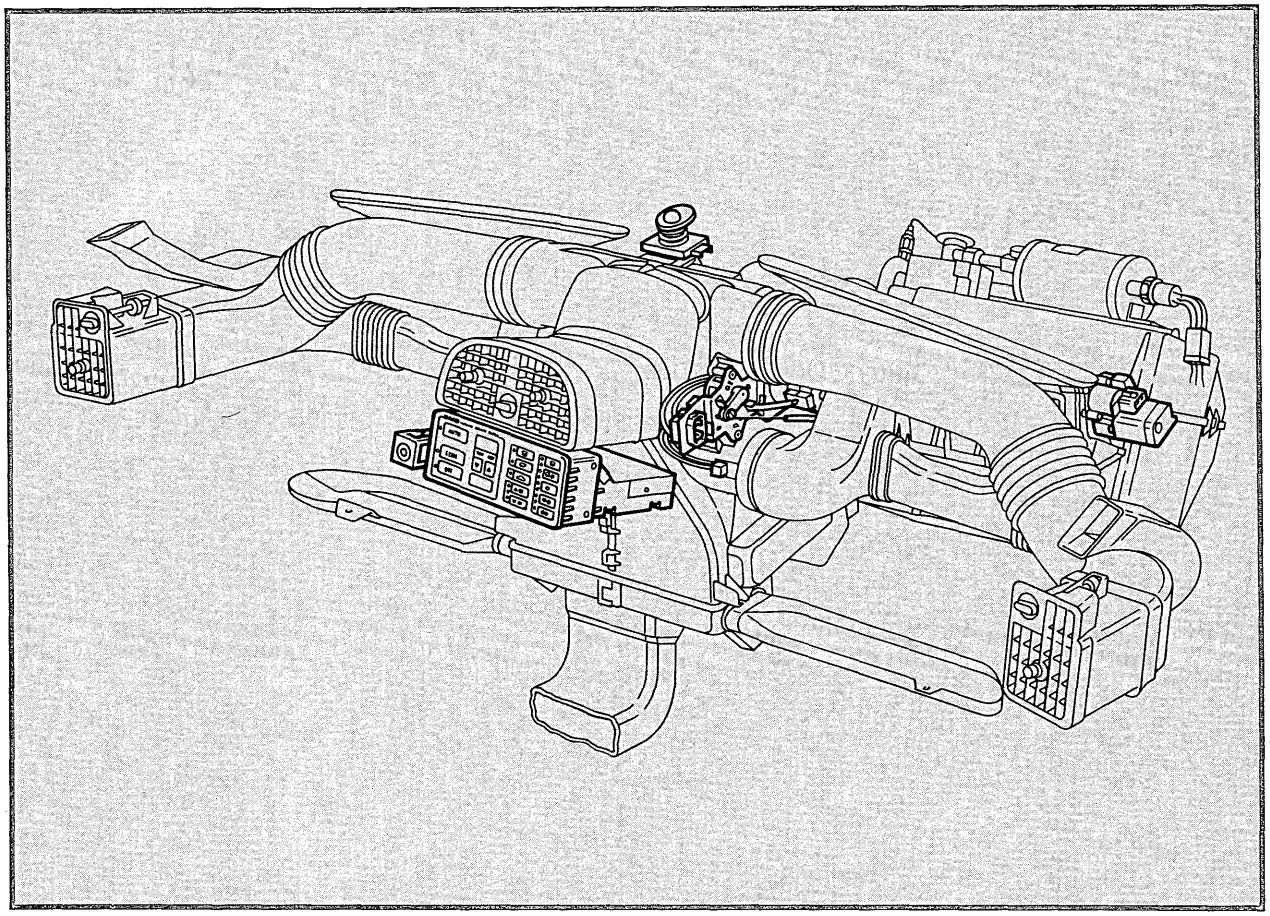
An interesting innovation exclusive to SAAB is the new solar sensor (world patents pending) which is fitted on top of the dashboard. In addition to measuring the infra-red radiation to calculate sun intensity, the new sensor also detects the angle of elevation and bearing of the sun.

The program memory of the microprocessor has been expanded to provide the following:

- More accurate and faster control of the compartment climate.
- New drive motors for the heater and air distribution flaps which are much quieter in operation and permit more accurate control of the positions of the flaps.
- Front panel text changed to symbols for easier reading and a new facility enabling the driver to switch off the unit.

Notes

2: Introduction to the Saab Automatic Climate Control Unit Version 2 (ACC2)

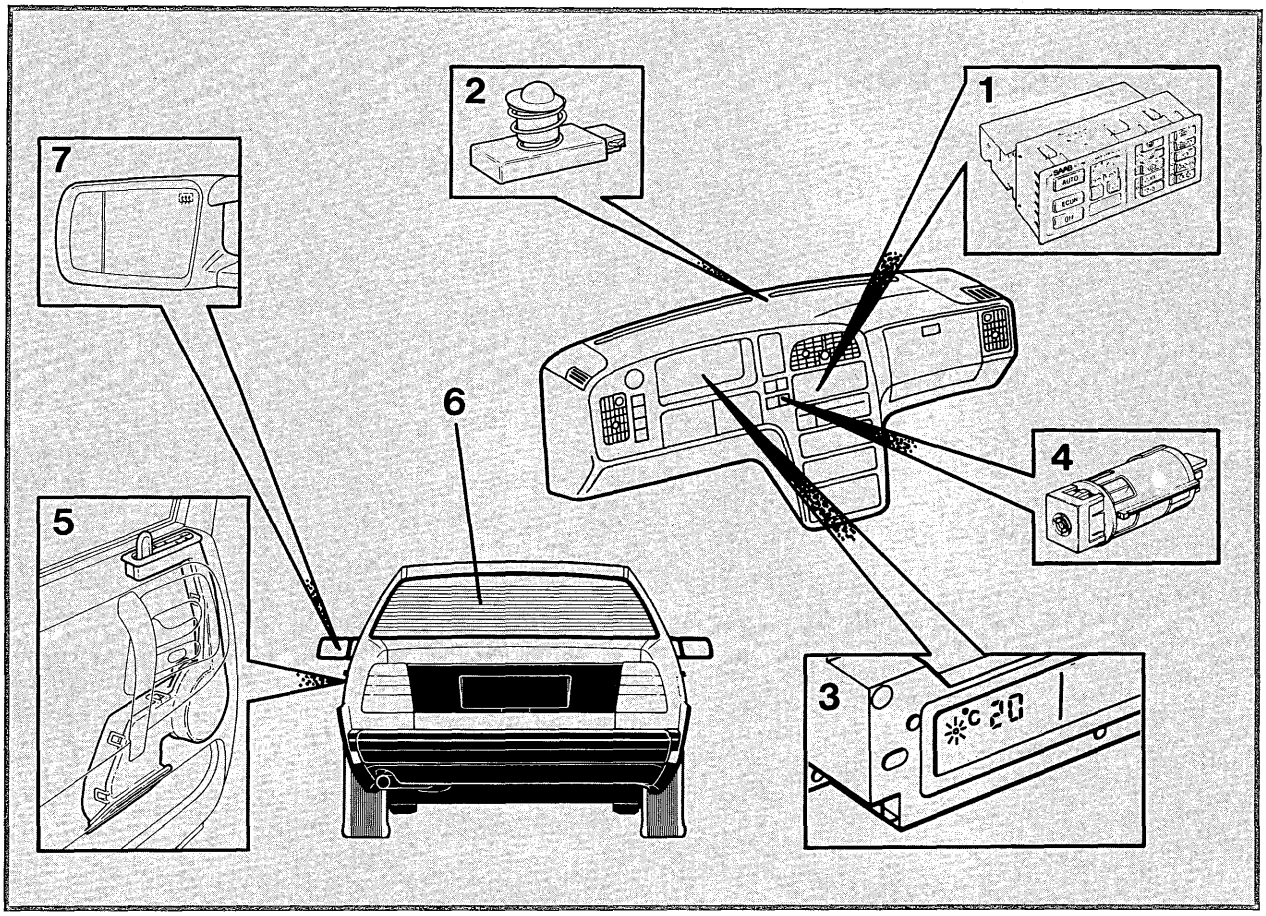


Other improvements include:

- A new mixed air temperature sensor fitted on the right hand side of the heat exchanger.
- User mode programming enabling the driver to choose his own start/drive selections.
- Expanded self test facilities for easier fault finding using ISAT.
- Fitting of more durable door fans. These can be switched on and off at the ACC panel.

Notes

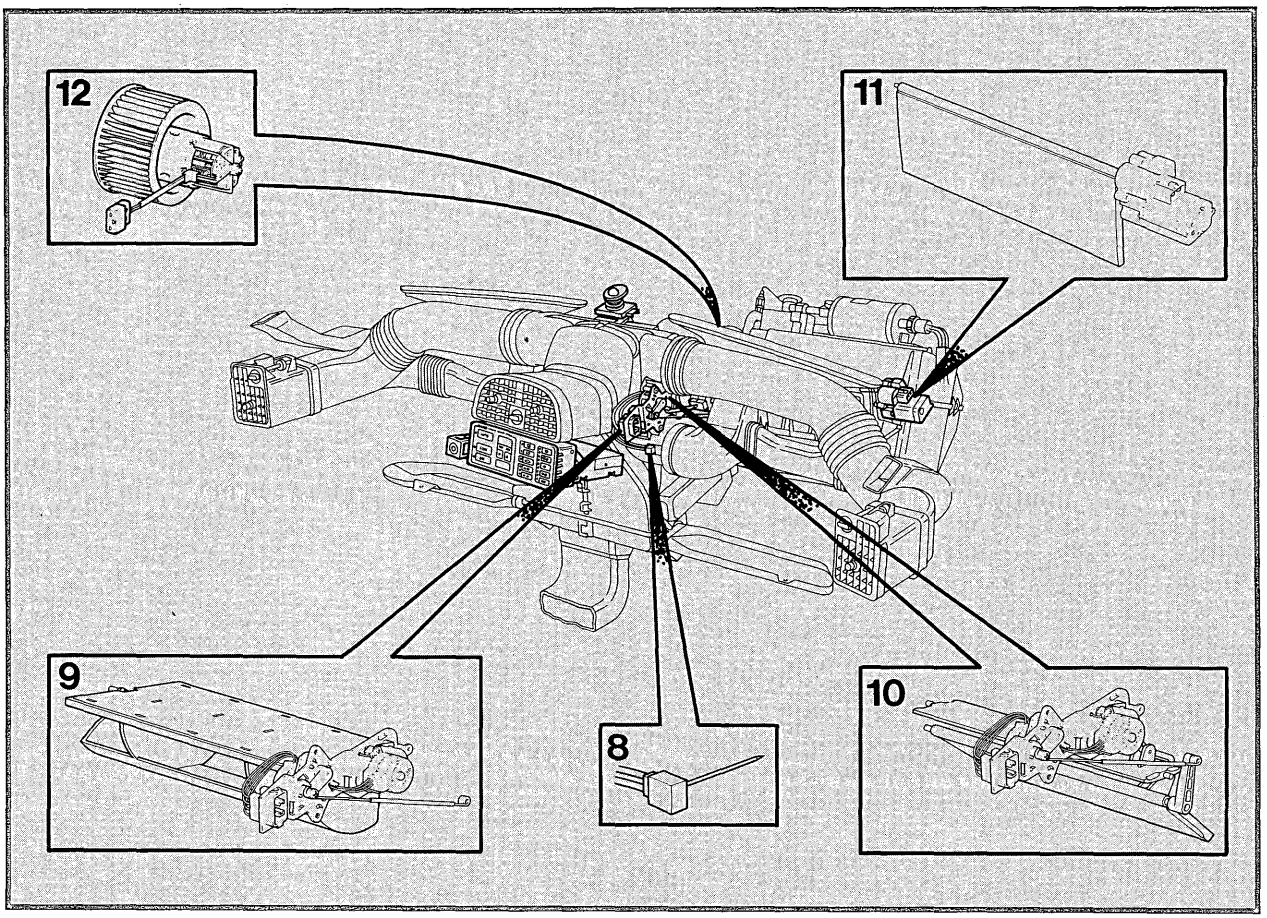
3: ACC unit and associated components



1. Automatic climate control unit
2. Solar sensor (can only be placed in one position).
3. EDU providing outside temperature indication
4. Indoor temperature sensor
5. Rear door fans
6. Rear window heater
7. Outside mirror heaters (only when mirror motors are fitted)

Notes

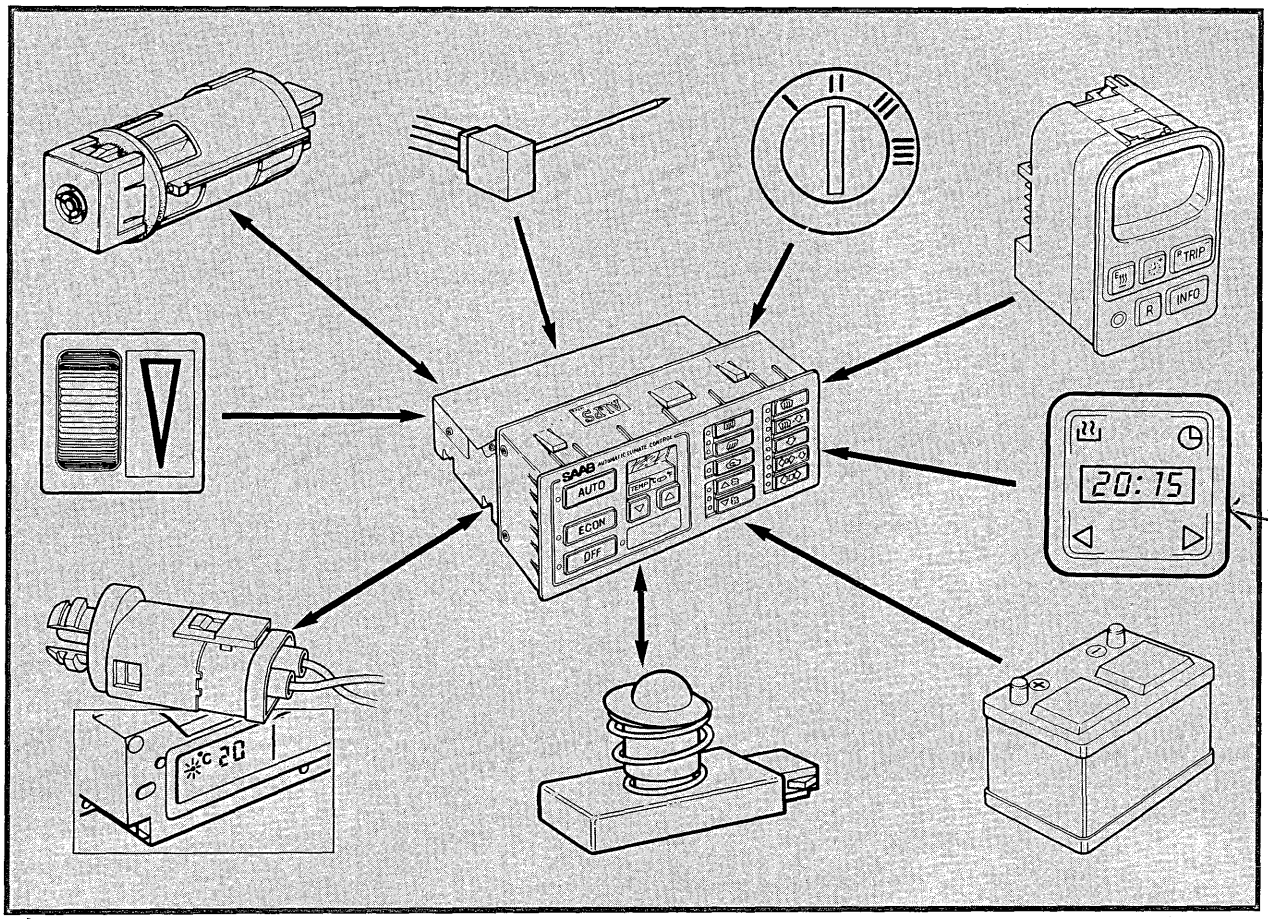
4: ACC unit and associated components



8. Mixed air temperature sensor
9. Air distribution stepping motor
10. Temperature control stepping motor
11. Recirculation DC motor
12. Ventilation fan DC motor

Notes

5: Inputs



The temperature indication signals from the indoor and mixed air temperature sensors are DC signals proportional to temperature. The indoor sensor also receives a supply for the induction fan which sucks air through the sensor.

The solar sensor input is also an output since it is a serial data link providing 2-way communication between the microprocessors used in the solar sensor and ACC unit.

Either the P-timer or the DCC applies a 12V signal to start the parked heating mode and the ACC, in turn, applies a wake-up signal to the EDU to request outside temperature indication.

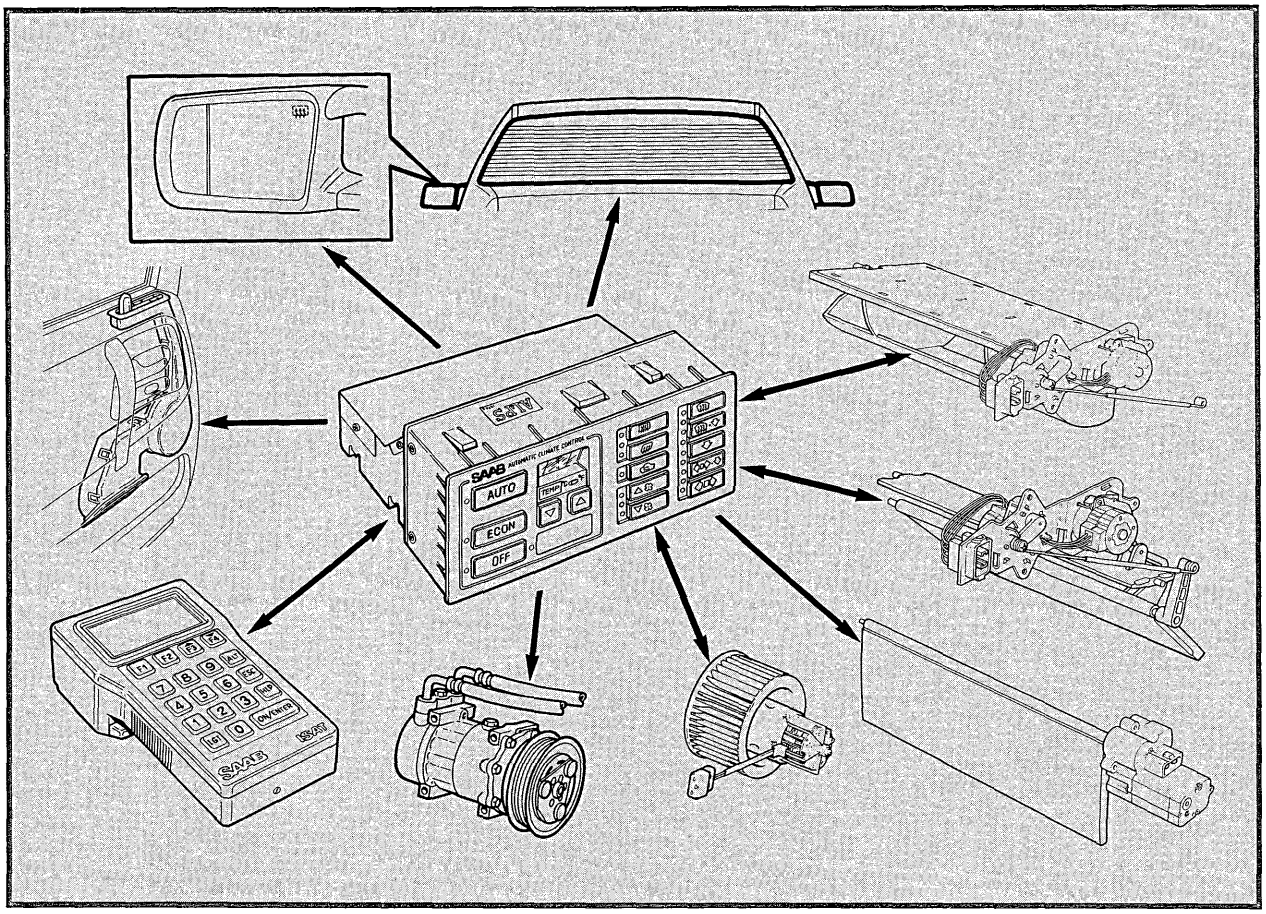
The battery +30 supply provides the main power for the unit and the +54 ignition supply is used to switch on the unit.

The outside temperature signal from the EDU comprises blocks of pulses in which the number of pulses is proportional to temperature. Consecutive blocks are separated by a gap of at least 400mS.

The rheostat supply is used for the pushbutton lamps and during darker conditions also supplies the LED indicators.

Notes

6: Outputs



The AC output and the output to the rear window and mirror heater are 12V signals to operate relays. (On some models the AC output signal goes to the LH control unit.)

The ISAT output and input provides the communication between the ACC and ISAT microprocessors.

The remaining outputs are all motor drives as follows:

Ventilation fan: Variable 0 to 5V DC signal to the fan control unit. The fan feedback signal is a 1 to 12V DC signal proportional to the speed of the fan.

Air recirculation flap: Reversible constant speed DC drive.

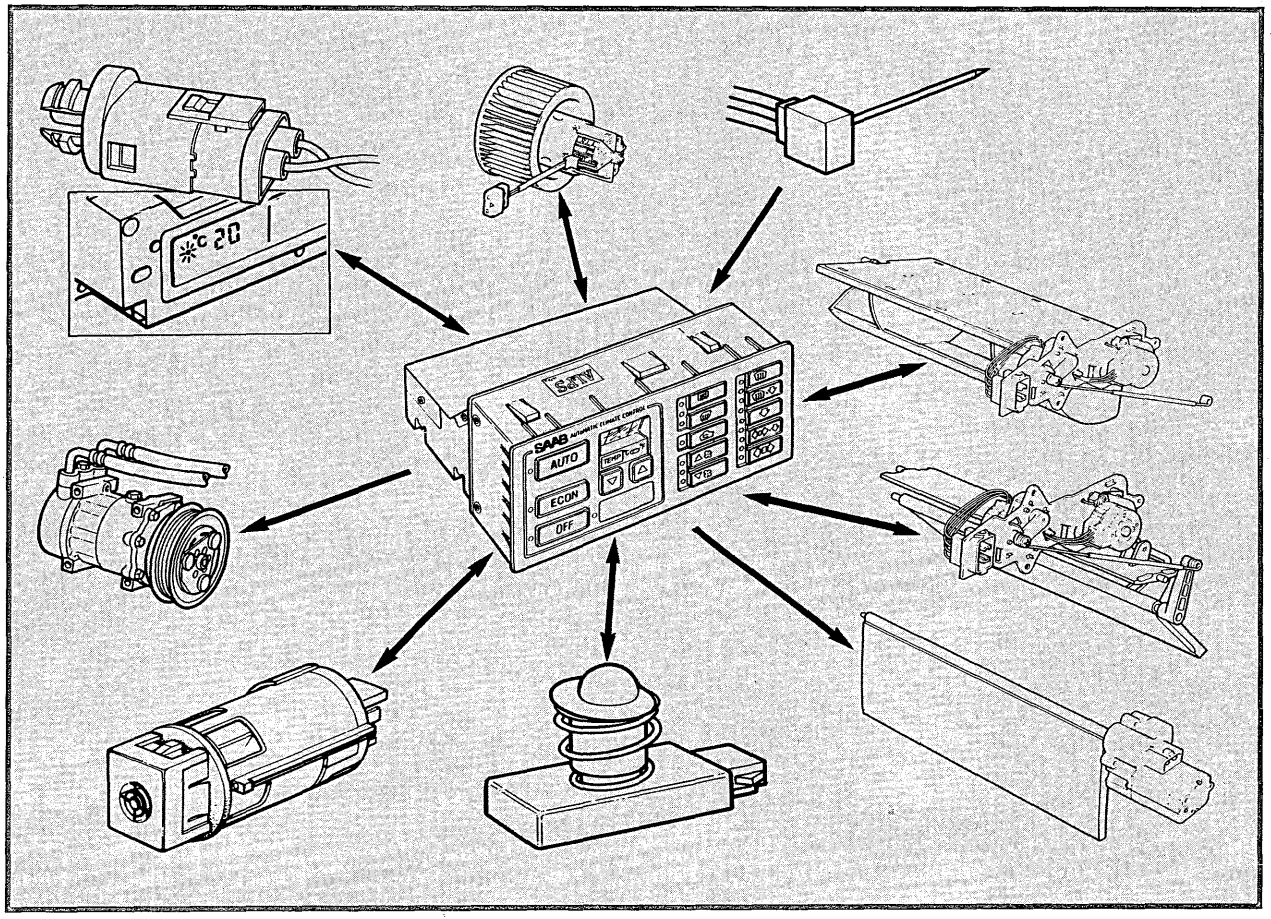
Temperature control flap: Pulses for setting positions of the stepping motor.

Air distribution flap: Pulses for setting positions of the stepping motor.

Rear door fans: Variable speed 7 to 11V DC drive.

Notes

7: Automatic climate control



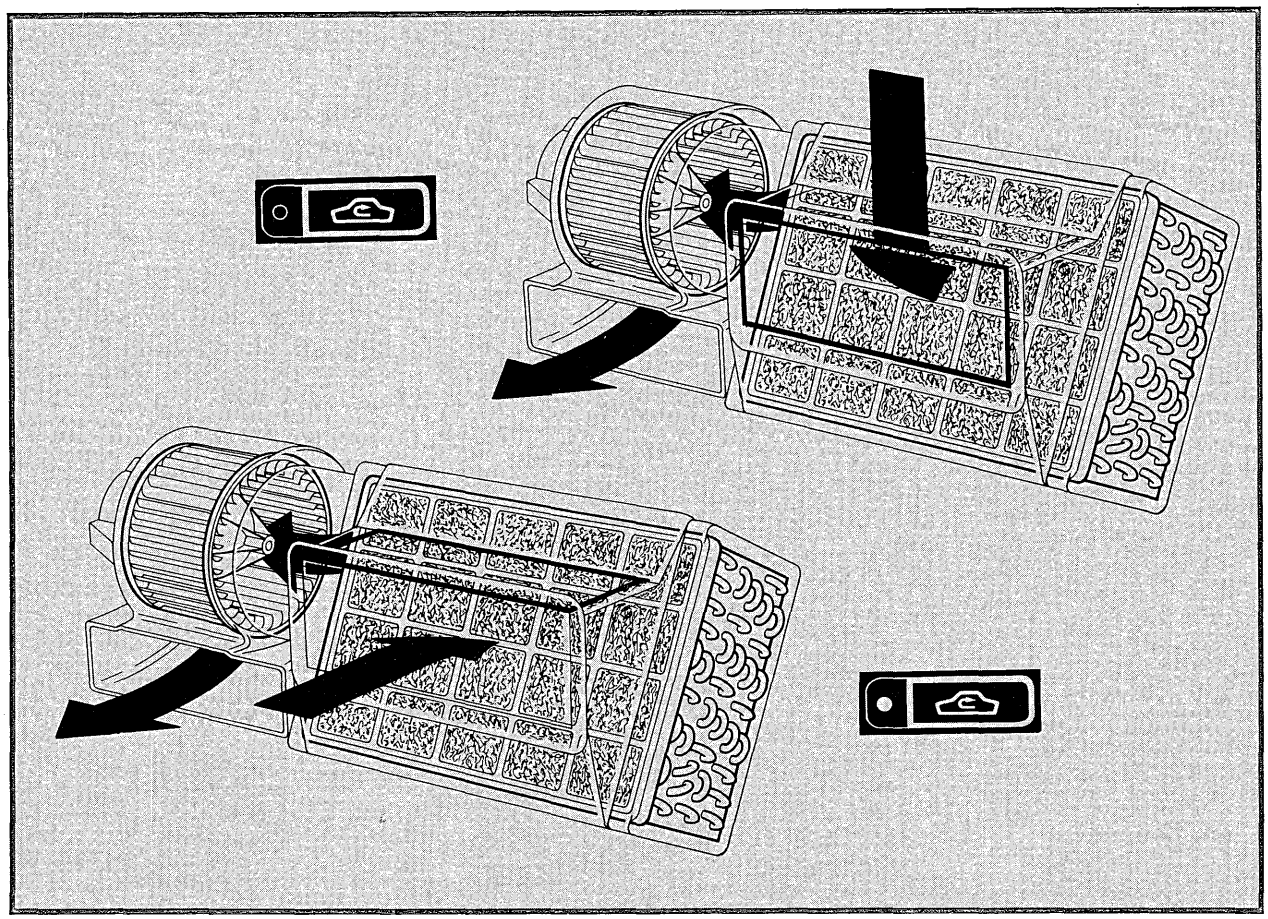
The ACC unit monitors the temperature signals and the signals from the solar sensor and controls the positions of the various flaps and the speed of the ventilation fans to maintain the selected conditions in the car.

All sensors and control mechanisms are used by the ACC unit to maintain the quality of comfort by:

- Establishing safe and comfortable conditions as quickly as possible when the car is first started.
- Predicting impending changes due to varying conditions and making the necessary adjustments as quickly and quietly as possible.

Notes

8: Recirculation flap and AC unit



Depending on the position of the recirculation flap, ventilation air from the passenger compartment is either recirculated or fresh air is drawn in from outside, providing outside conditions permit.

After the recirculation flap the air passes through the evaporator in the ventilation system to the ventilation fan.

Auto mode

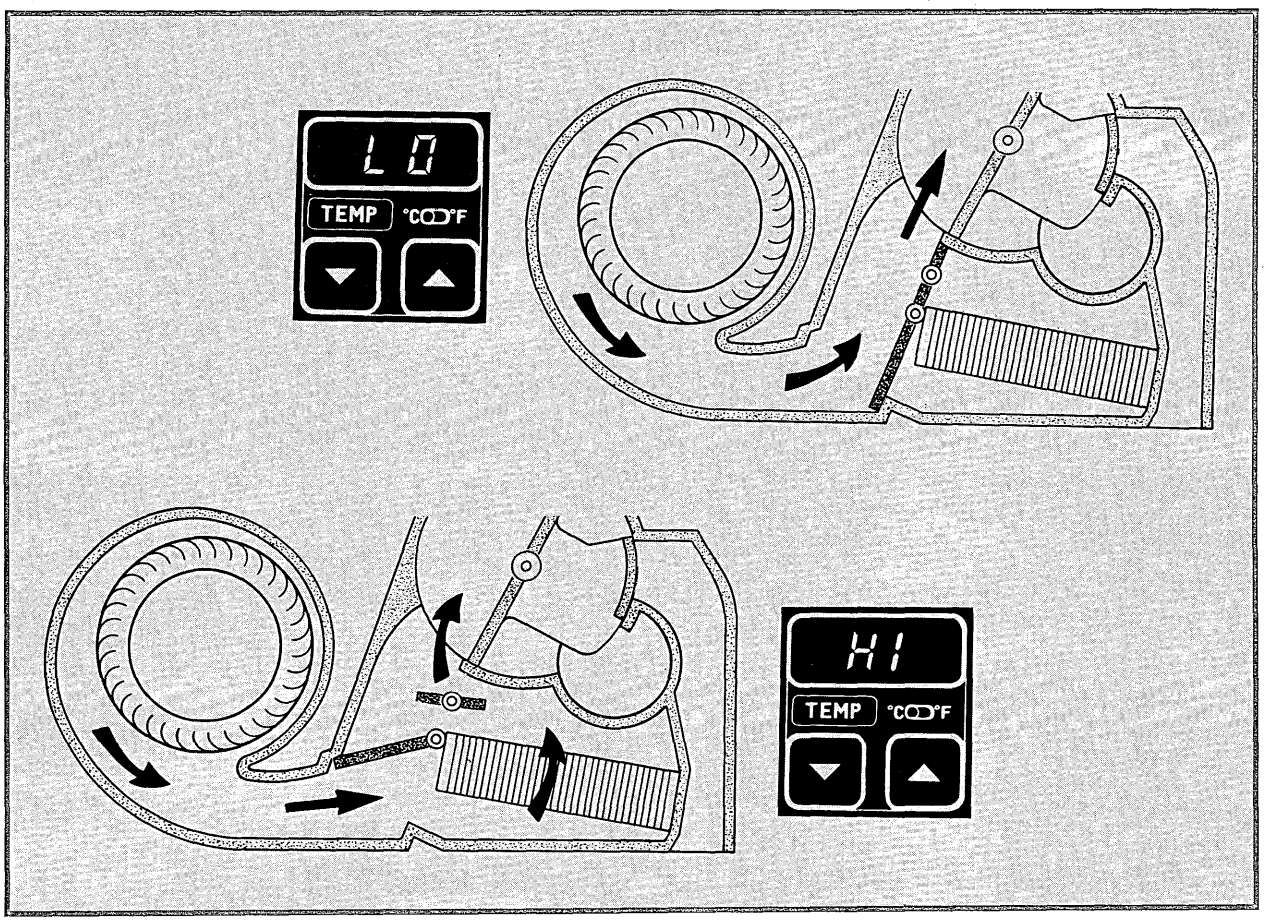
The first 60 seconds after staring, the recirculation flap remains in the fresh air position.

1. With an outside temperature of 27°C or more the flap is in the recirculation position.
   With an outside temperature of 26°C or less the flap is in the fresh air position.

2. If distribution is in bi-level, vent, or between bi-level and vent, and outdoor temperature is greater than 10°C the flap moves to the recirculation position.

Notes

9: Ventilation fan, temperature control and air distribution flaps



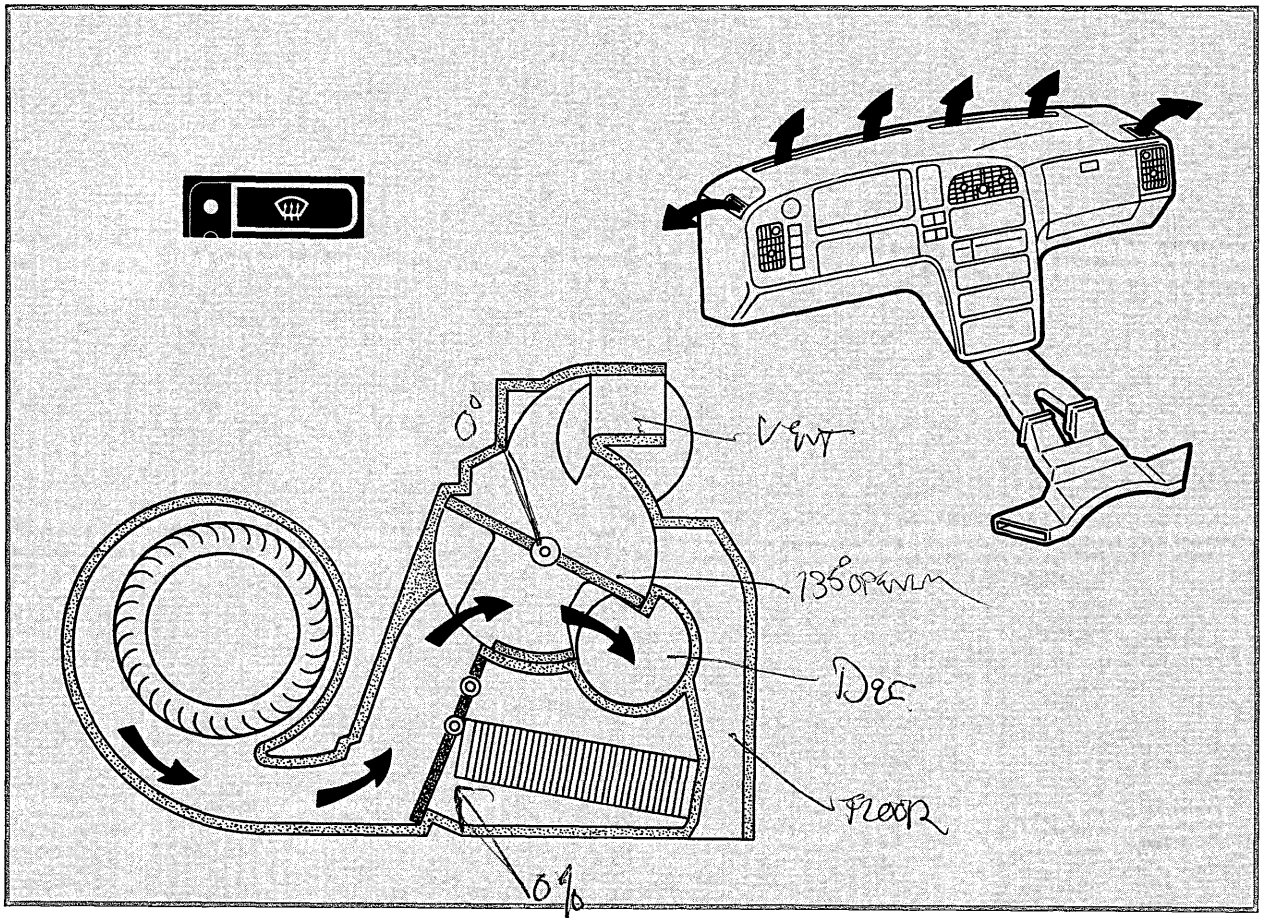
The fan is situated after the evaporator and blows the air to the temperature control flap which determines the amount of air that passes over the heater; in the 0% flap position no air flows over the heater and in the 100% position all the air is heated.

The following pages illustrate the air flow distribution for each flap.

The air distribution flap is at the end of the air flow path and routes the air to the required areas of the car. The positions of this flap can be selected either manually or automatically.

Notes

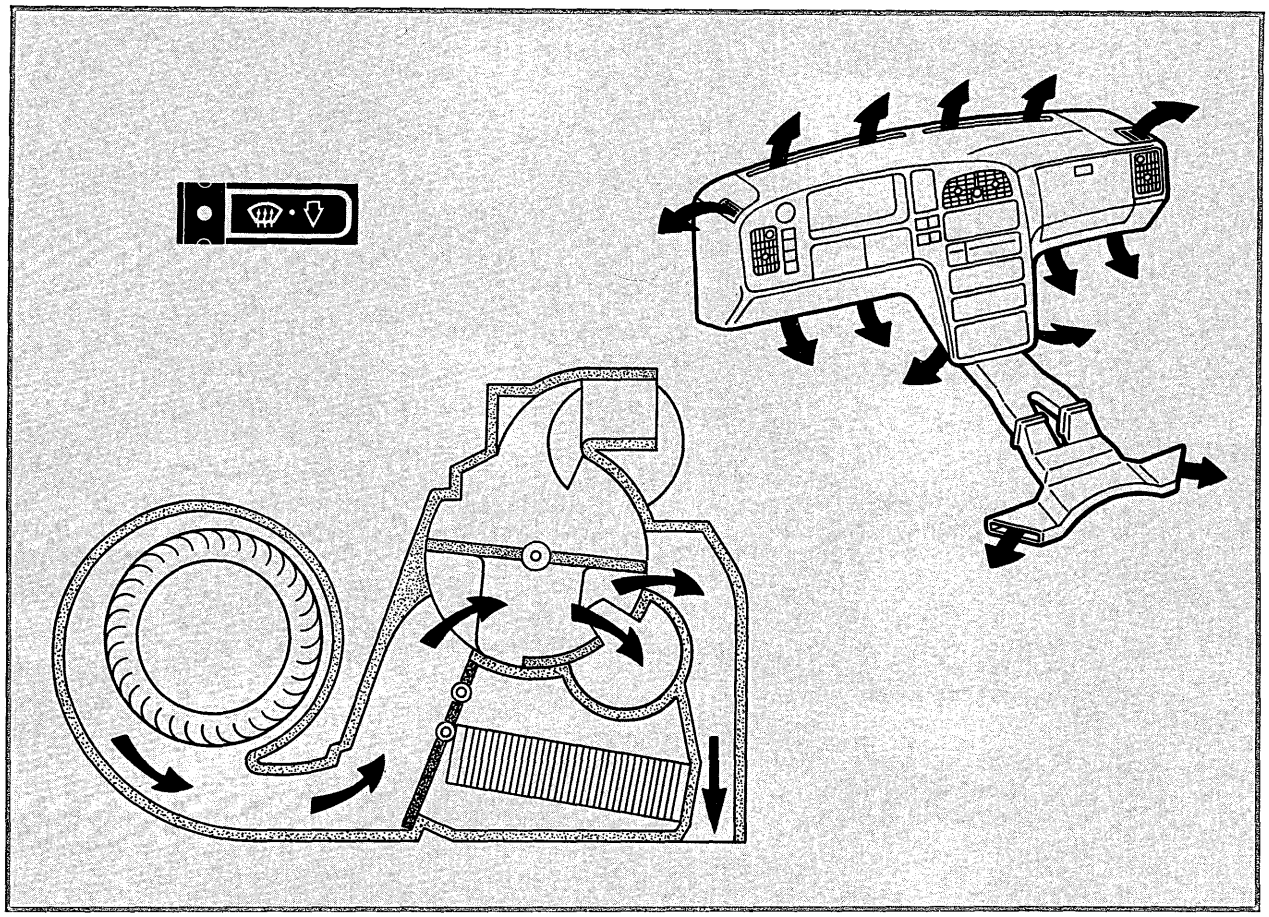
10: Air distribution flap: Defrost position



Flap angle 135 degrees in both the automatic and manual modes.

Notes

11: Air distribution flap: Heat position

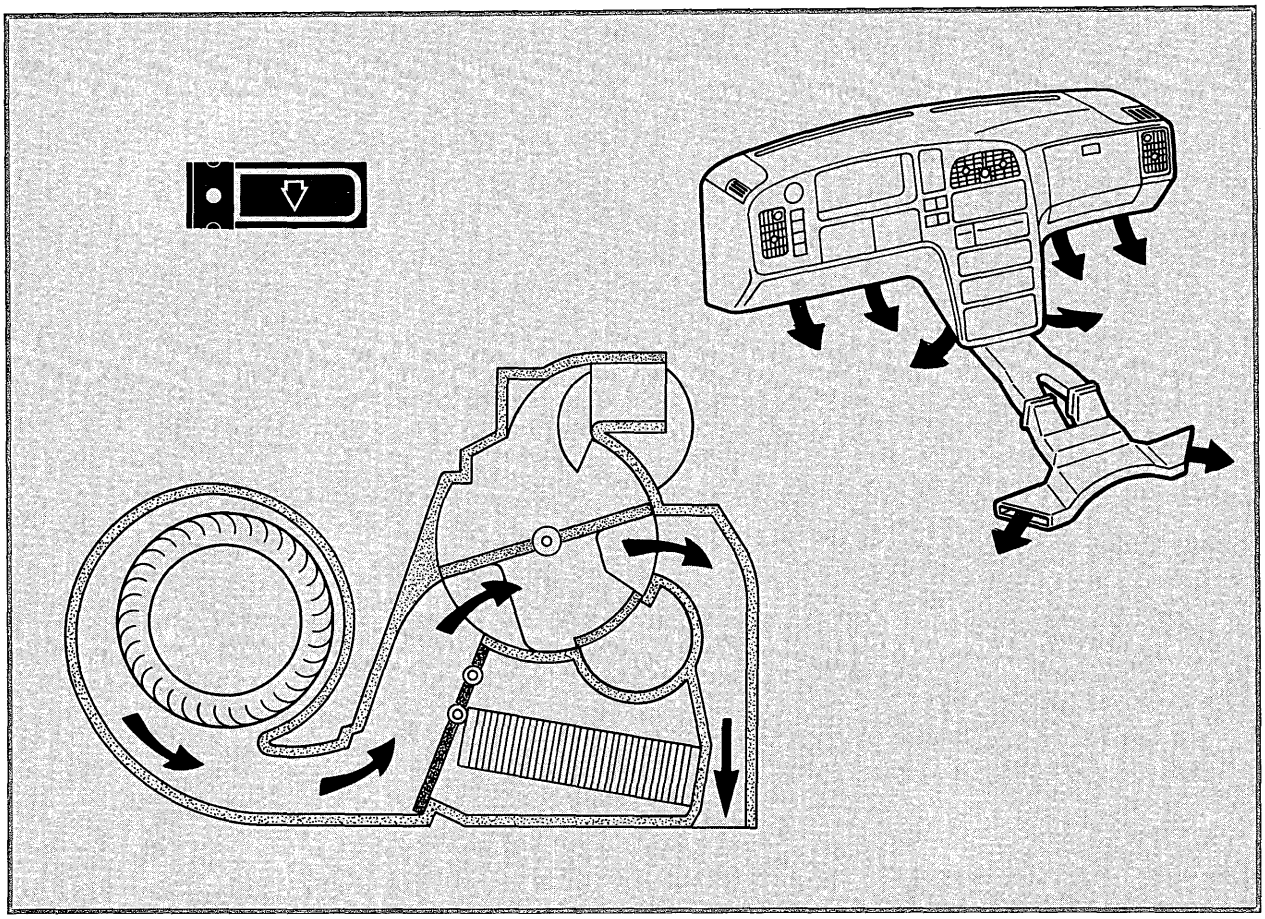


Flap angle 112.5 degrees in manual and 112.5 to 135 degrees in the automatic mode.-

112.5° TO 135° IN AUTO

Notes

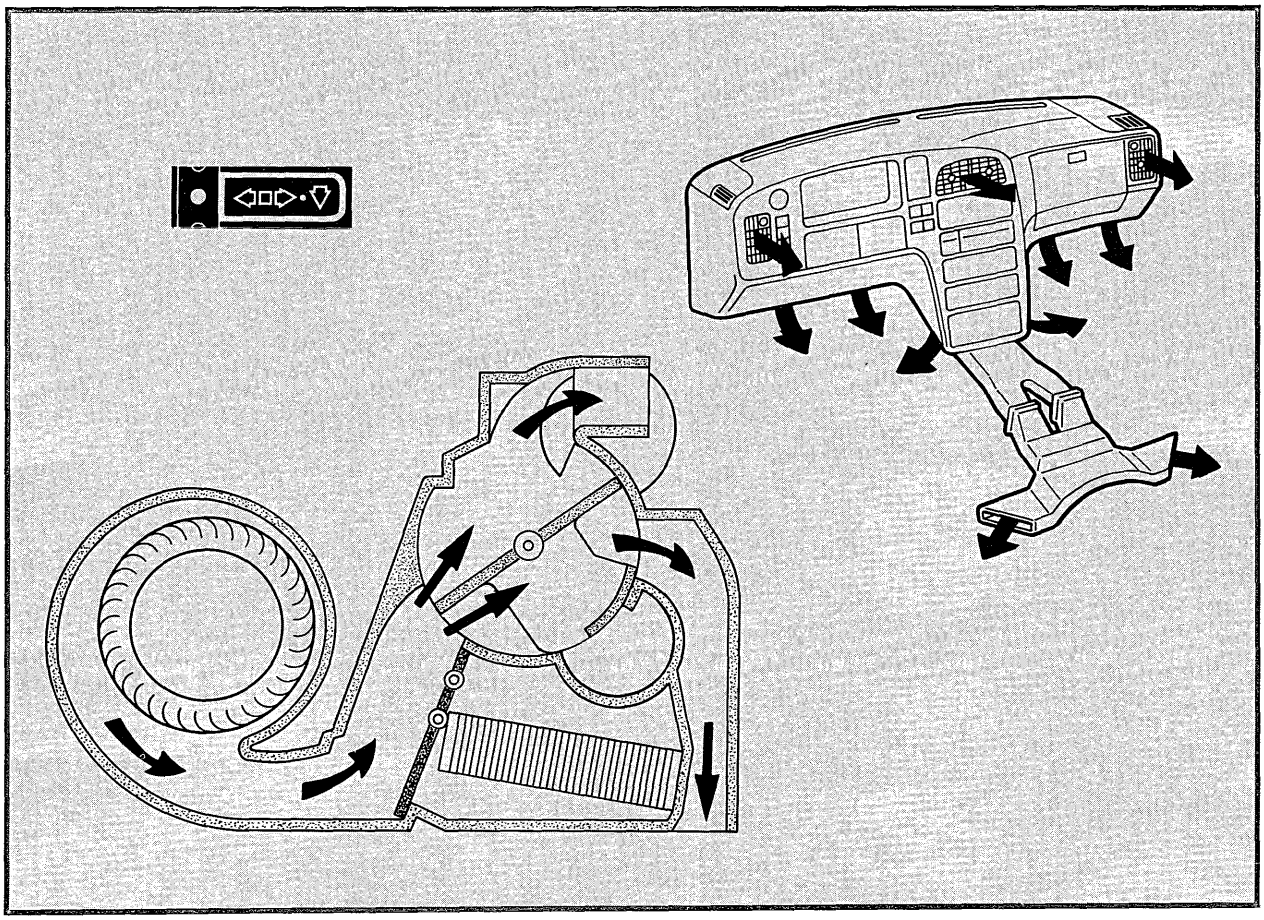
12: Air distribution flap: Floor position



Flap angle 90 degrees in manual. This position is not used in the automatic mode.

Notes

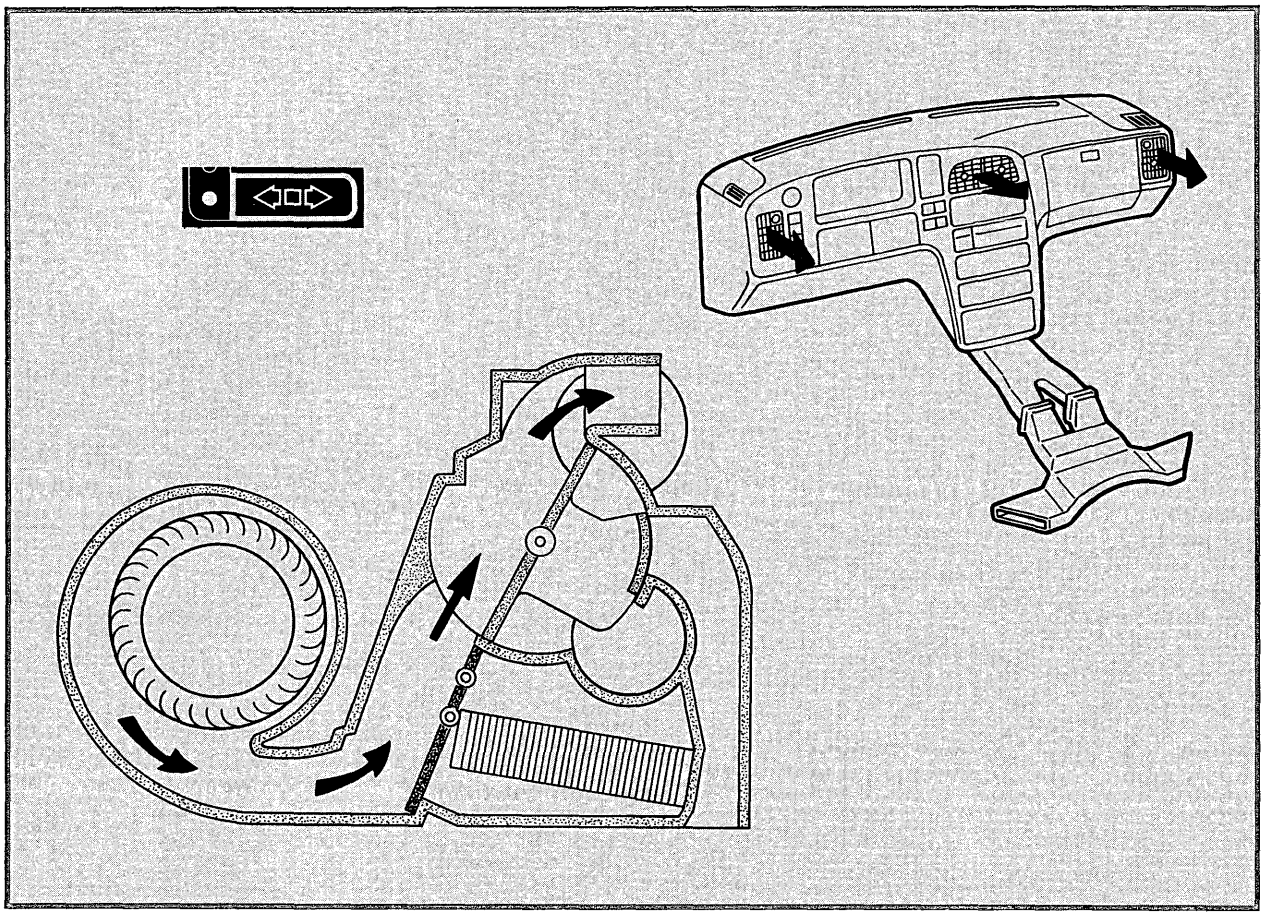
13: Air distribution flap: Bi-level position



Flap angle 72 degrees in manual and 57 to 72 degrees in the automatic mode.

Notes

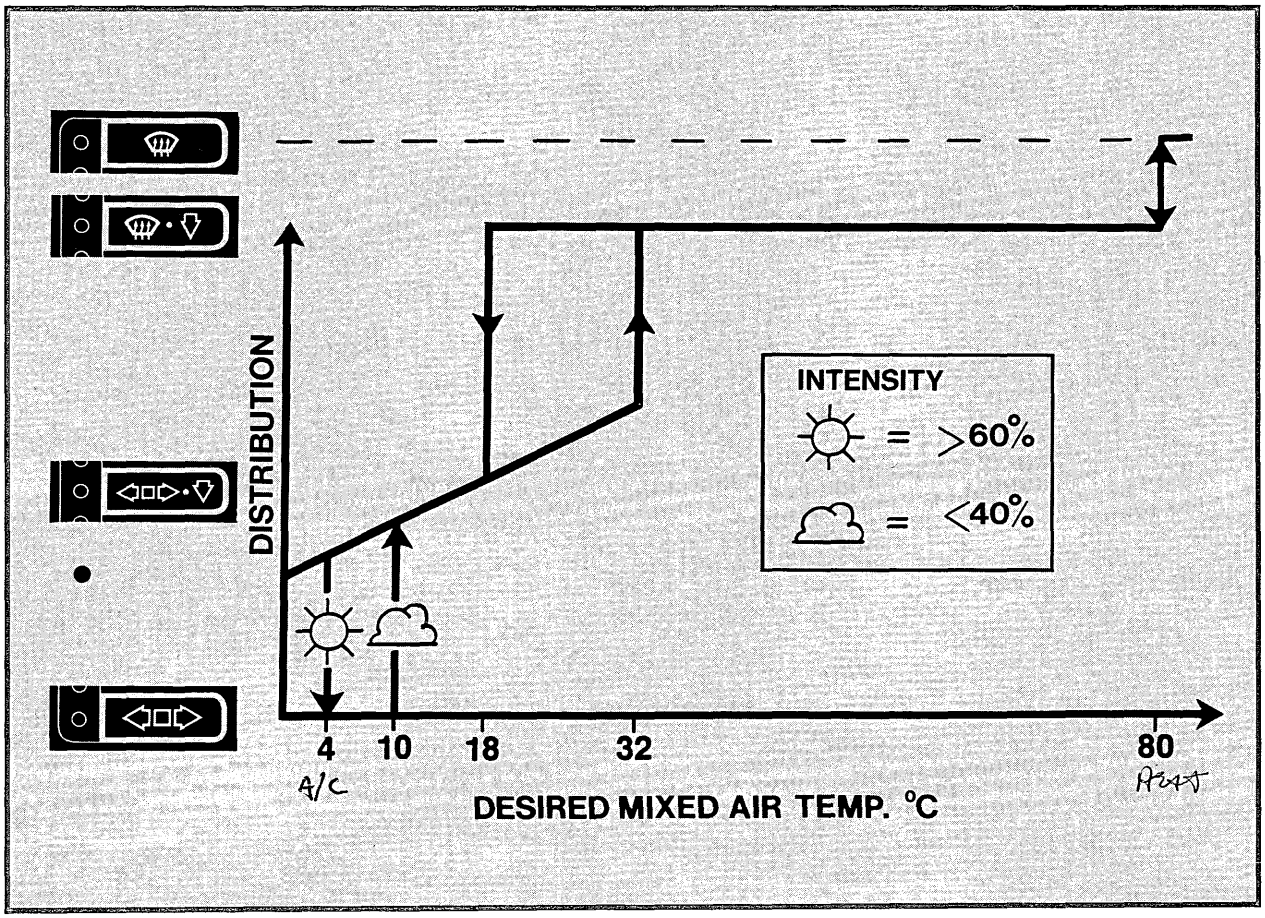
14: Air distribution flap: Vent position



Flap angle 45 degrees in manual and automatic mode.

Notes

15: Air distribution: Normal control mode



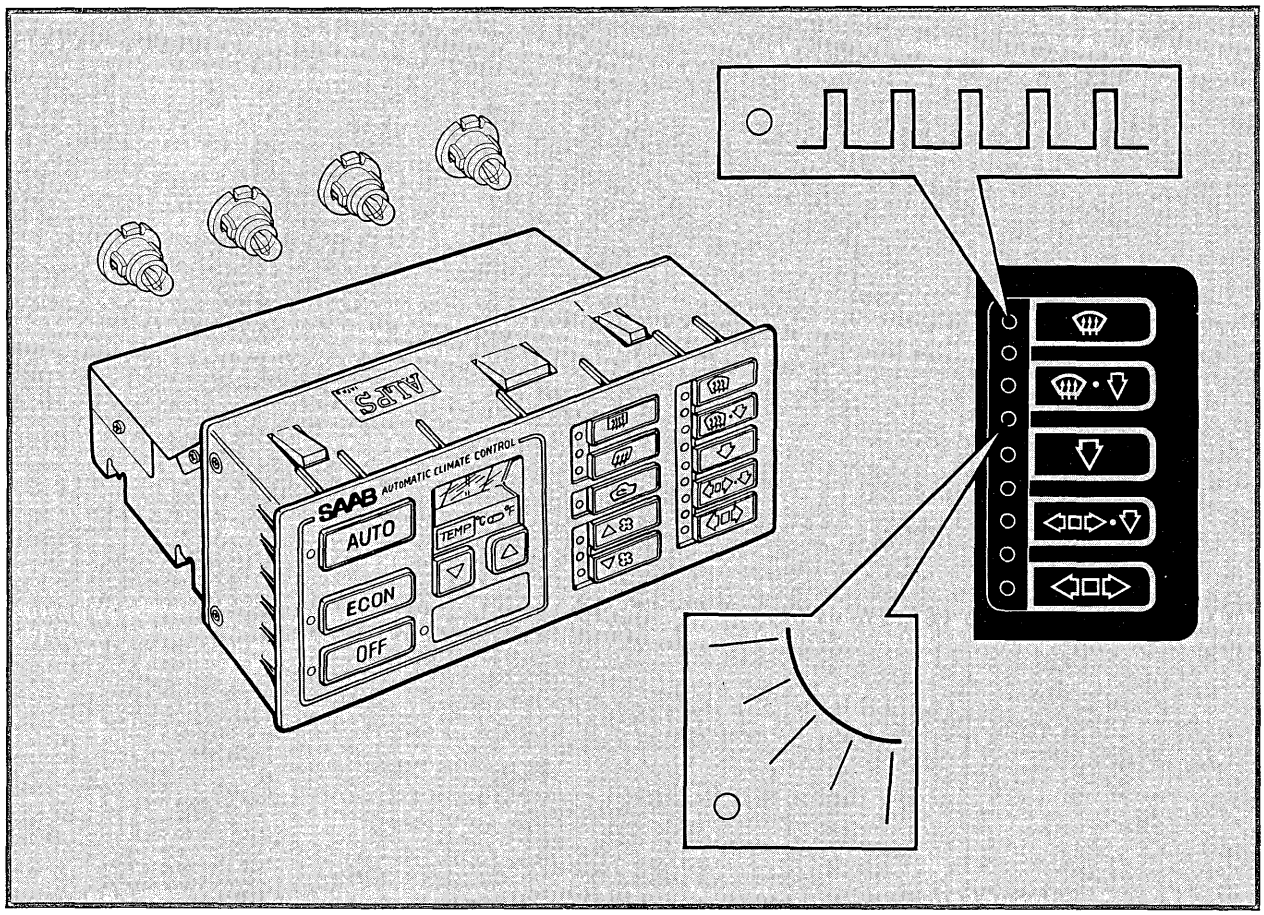
Distribution is dependent on the desired mixed air temperature (controlled by the ACC unit) and the sun's intensity.

If the sun's intensity is higher than 60%, and the desired mixed air temperature is 4°C or less, the distribution flap is moved to the vent position.

If the sun's intensity is less than 40%, and the desired mixed air temperature is 10°C or more, the distribution flap is moved to the the bi-level position.

Notes

16: ACC unit and power supplies



The unit is powered from the +54 and +30 supply lines.

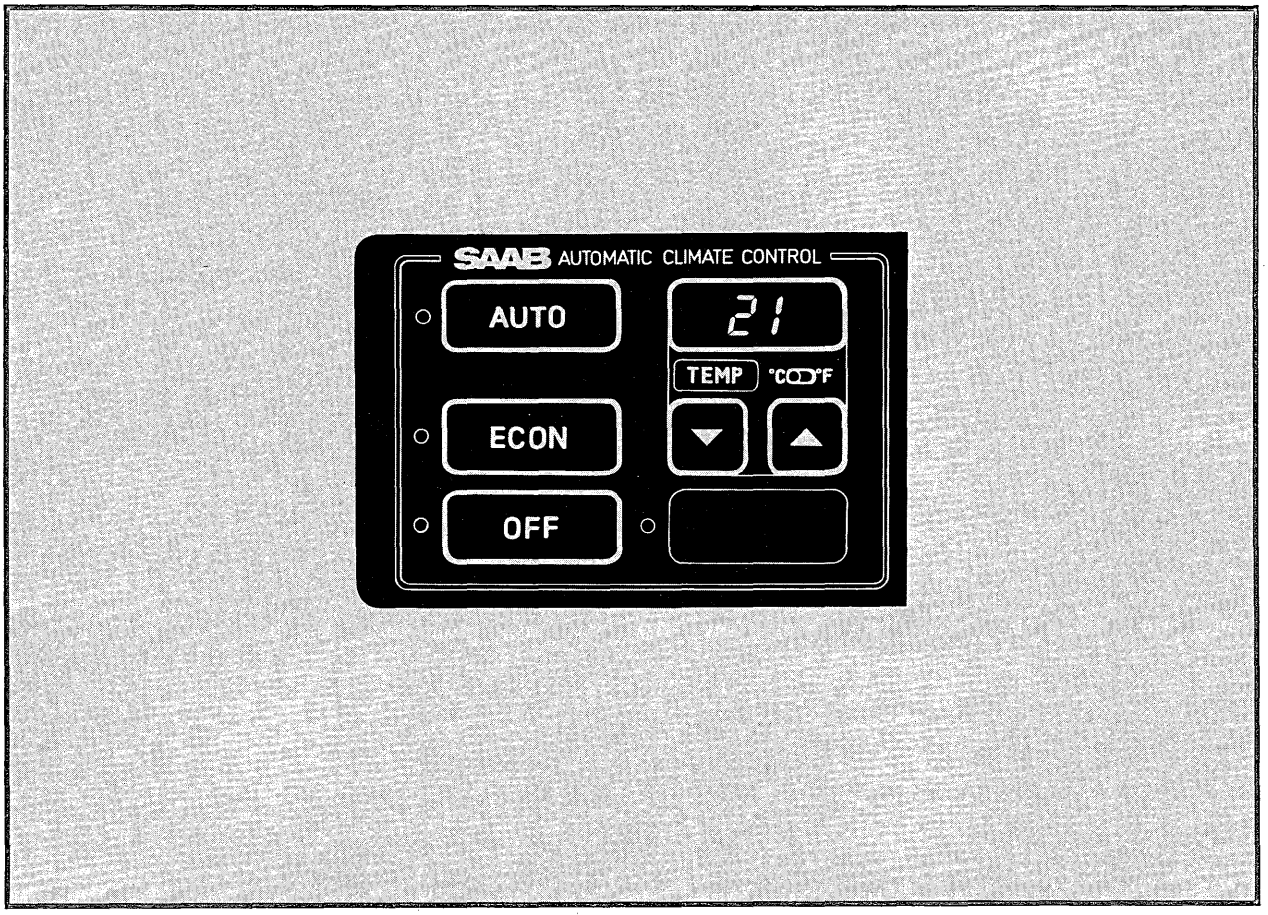
Indicators on the unit consist of a 2-digit display of the selected temperature and LEDs to indicate AUTO and/or the current manual selections. The 2-digit display is also used to indicate the number of faults, if any, which may be detected by the self test program. The fault indication occurs for a short period when the ignition is first switched on and when the auto button is pressed with the ACC unit in the off mode.

The LEDs and display are powered by a pulsed supply. In dark conditions the illumination level is controlled by the rheostat and in bright conditions by the ACC unit. The illumination is measured by a photo-transistor on the ACC panel.

Backlighting for the pushbuttons is from four filament lamps powered by the rheostat supply. To gain access to the lamps, remove the front cover.

Notes

17: Left hand side panel manual controls



Selects automatic mode in which the unit maintains the temperature in the car constant at the desired level.

The indicator is lit with AUTO selected and remains lit if the rear window heater or the door fans are switched on or off manually. All other manual selections cause the indicator to extinguish. The ACC will always start in auto mode if nothing else has been programmed.

Prevents operation of the AC system, and recirculation (Automatic Control without AC).

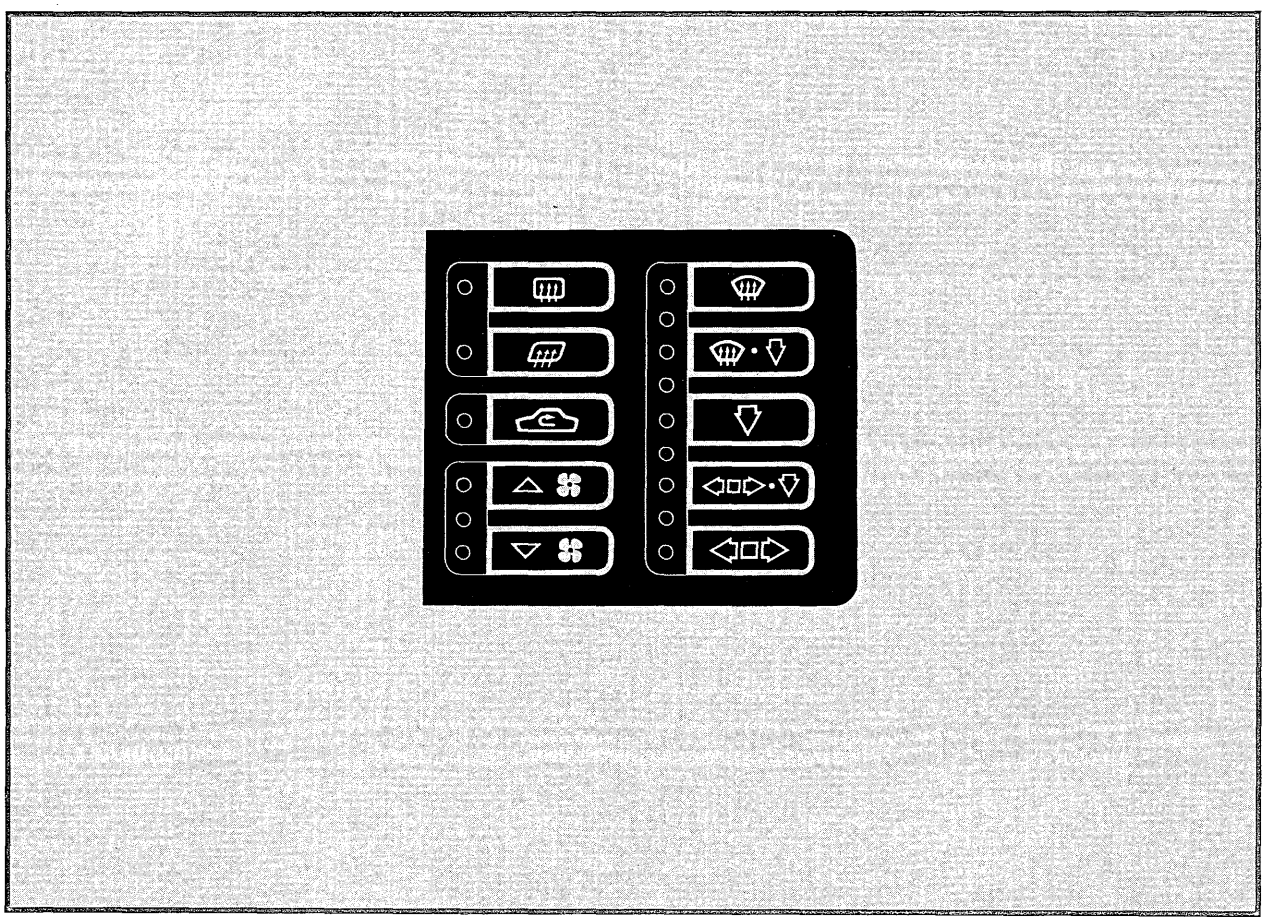
Selects off if the unit is operating or the previously selected manual conditions if the unit is already off. With off selected, the ACC still continues to monitor the conditions in the car.

Selected temperature indication in °C or °F, depending on the position of the switch below the display. Above 27°C the indicator displays HI and below 17°C it displays LO.

Temperature increase and decrease pushbuttons.

Notes

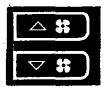
18: Right hand side panel manual controls



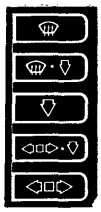
Switches the rear window heater relay and the heaters for the external mirrors on and off. The indicator lights for ten minutes when 'on' is selected manually or in the AUTO mode.

Switches the door fans on and off. The indicator lights when 'on' is selected. In both the manual and auto speed control modes, the speed of the door fans varies in step with the ventilation fan.

Selects recirculation or fresh air. The indicator lights in the recirculation position.



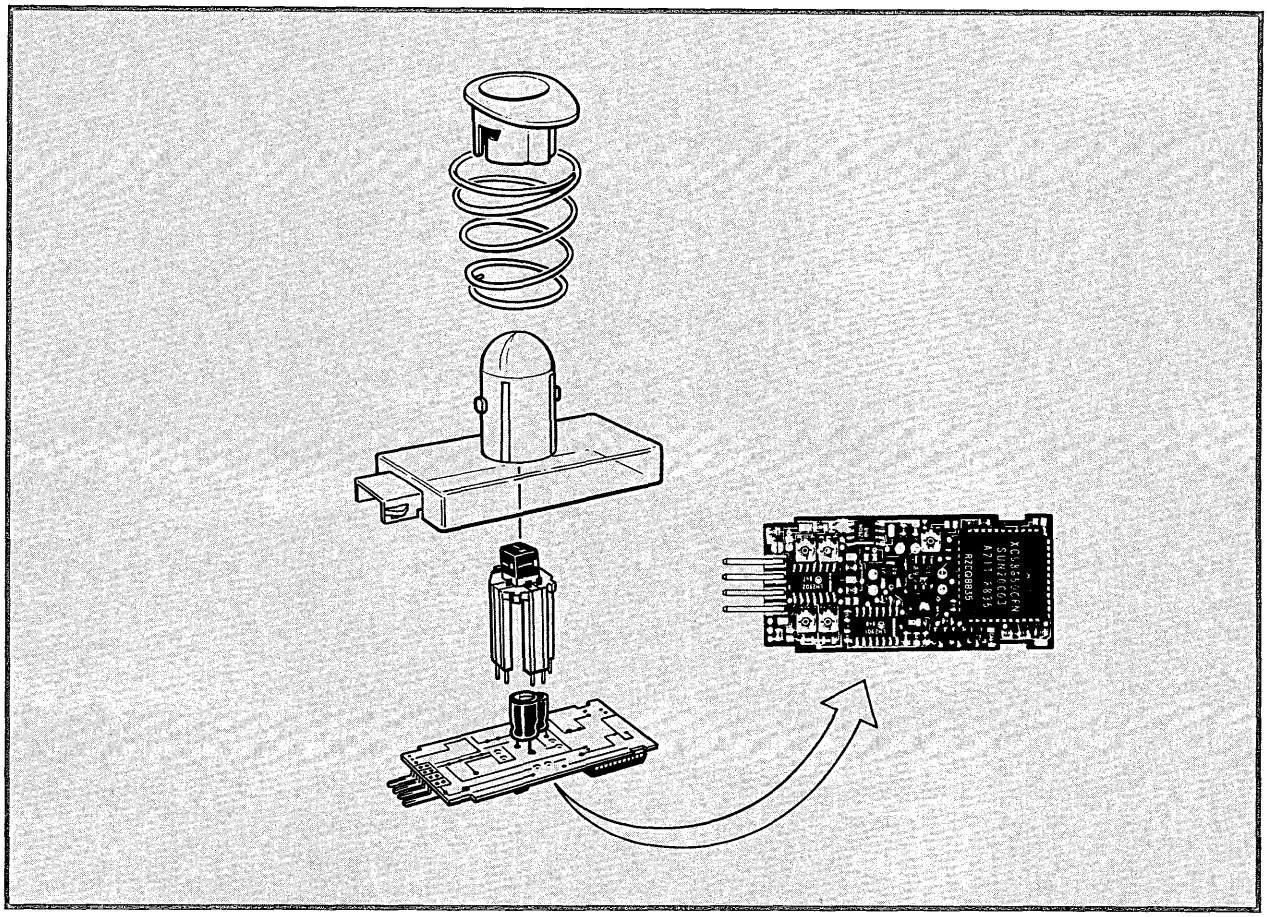
Increases or decreases the speed of the ventilation fan. The top and bottom indicators light for speeds above and below the AUTO selection. The middle indicator lights when the speed is being controlled automatically.



Selects the air distribution indicated. For all flap positions an indicator lights when the manual flap position angle is selected in either manual or automatic mode. When a flap is positioned between these angles in the automatic mode, an intermediate indicator lights.

Notes

19: Solar sensor



The Solar sensor is a microprocessor based unit fitted on the top of the dash to sense the solar energy through the windscreen. It comprises five solar cells and a microprocessor. The microprocessor transmits digital signals to indicate the intensity, angle of elevation and bearing of the sun.

The sensor is enclosed in a scratch-proof cover constructed of extremely tough epoxy-coated plastic. The top of the cover also acts as a filter, allowing only infra-red radiation to penetrate. The sensor is soldered into the unit PCB which in turn is fitted in a plastic box and filled with silicone.

The signal representing the intensity of the sun covers the range zero to 1200 watts per square metre at ground level, i.e. the approximate maximum level of solar radiation recorded.

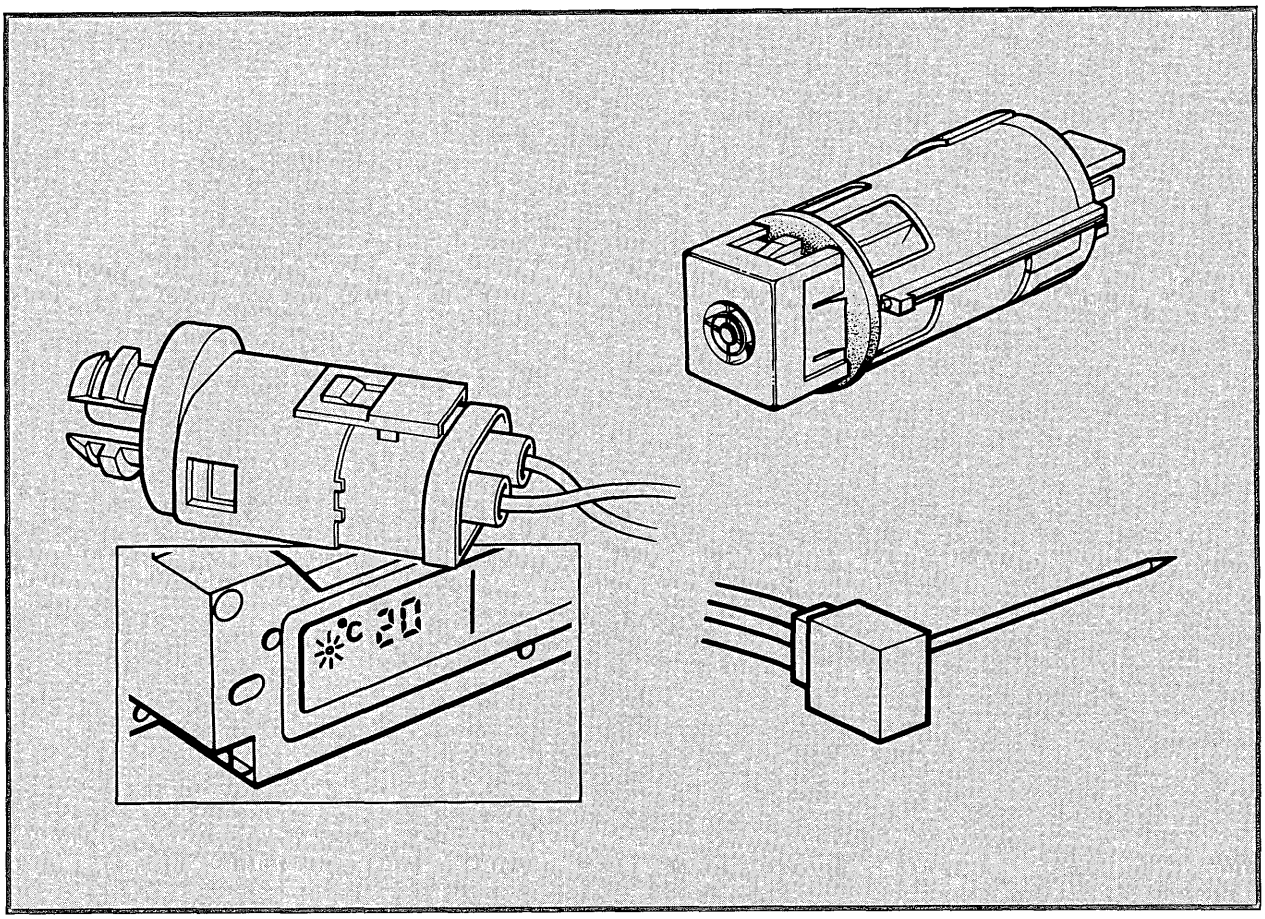
The range of elevation measurement is 0 (horizontal) to 90 degrees (vertical). The complete 360 degrees of bearing is indicated with 0 straight ahead and 90 degrees to the right of the car.

The message indicating the three measurements is transmitted to the ACC unit in serial form at 1-second intervals.

Note: Connection of the sensor in the car is from the RH side of the car.

Notes

20: Temperature sensors



The three temperature measurements used by the ACC unit are supplied by the following NTC resistors (thermistors);

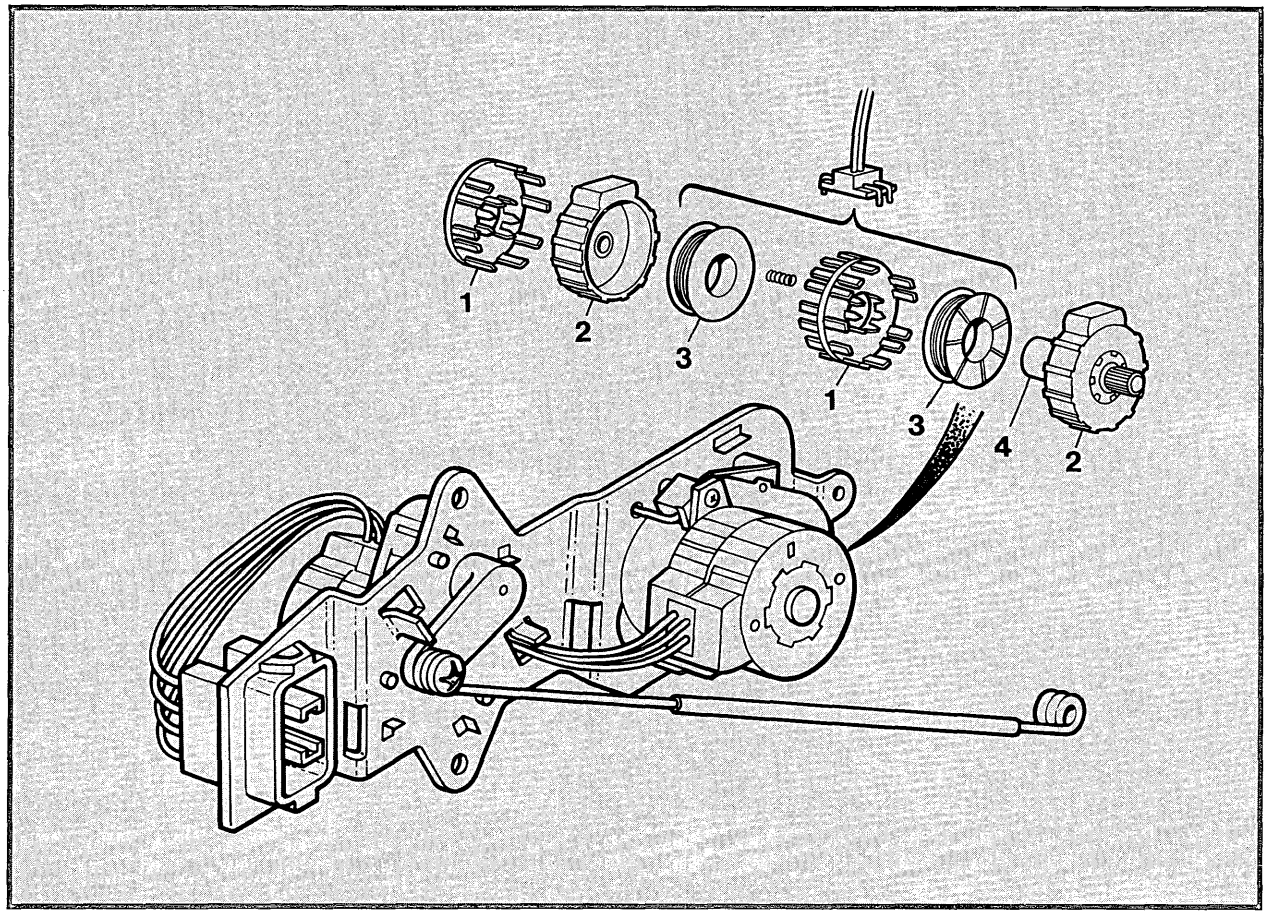
- Inside temperature sensor comprising a fan which sucks air across the thermistor. When the ignition is switched off the fan continues to operate for 20 - 50 seconds. The sensor is fitted on the dashboard close to the ACC unit.

- To improve measurement sensitivity, the mixed air temperature sensor is now located in the mixed air outlet on the right of the climate housing.

- The outside temperature sensor is fitted below the front bumper. The signal from this sensor is fed via the EDU which converts the DC signal to sequential blocks of pulses. The number of pulses within each block is proportional to the outside temperature and consecutive blocks are separated by a gap of 400ms (minimum).

Notes

21: Stepping motors



The temperature control and air distribution flaps are controlled by stepping motors which are positioned to an accuracy of 0.1% approximately under control of pulses from the ACC unit. The direction of rotation of the motors is determined by the relative phase of the pulses.

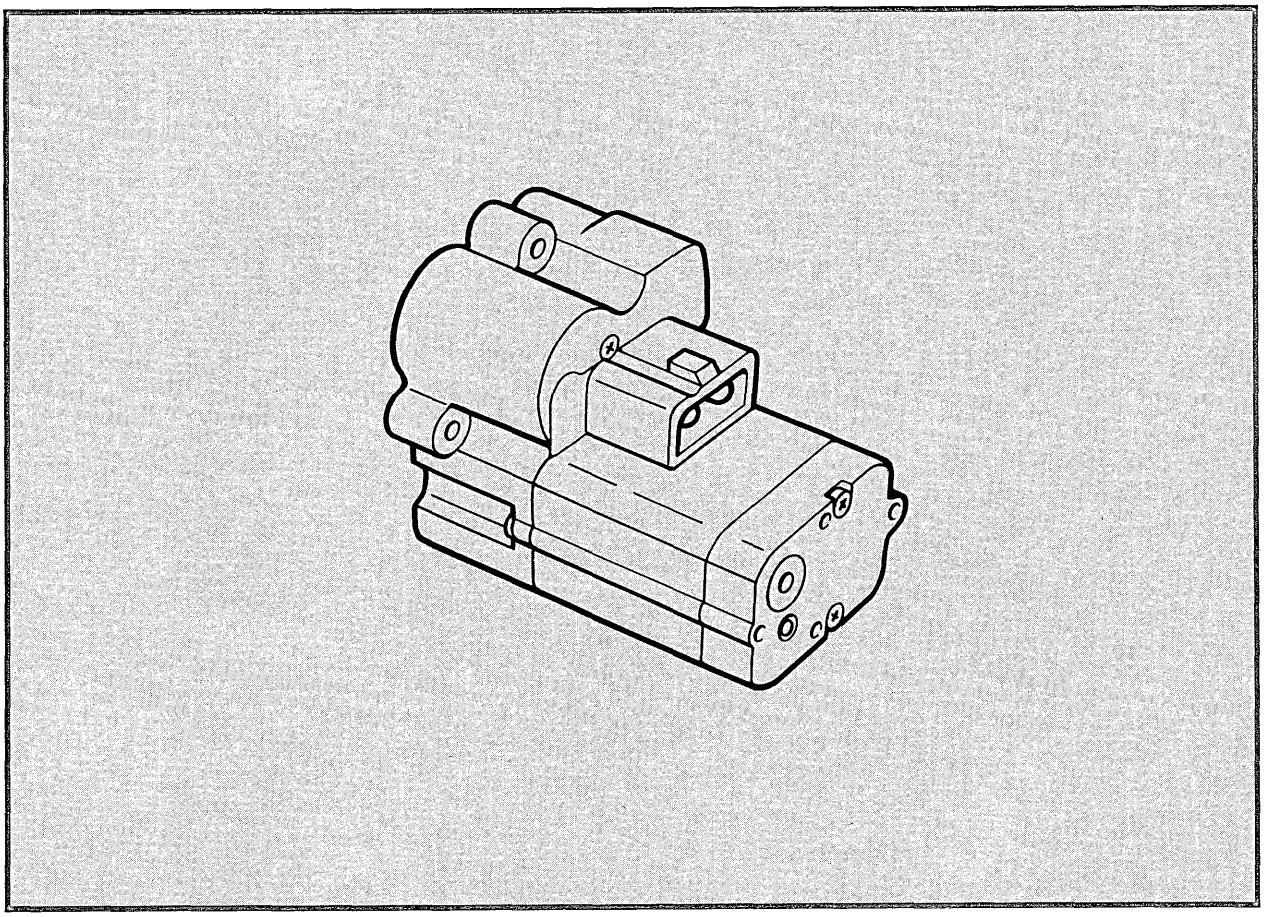
The stepping motor consists of stators (1), sliprings with bearing and flange (2), coils (3) and a rotor (4) containing permanent magnets. The rotor steps one pole position each time the coils are energised.

When a stepping motor is removed or a new one fitted, the end position and step angle must be calibrated. This is achieved by fitting the motors with the flaps in the delivery positions and pressing AUTO & VENT or by using ISAT (code 900). The calibration positions are LO for the temperature control flap and DEF for the air distribution flap.

Calibration must also be carried out when the ACC unit is removed and refitted, when a new ACC unit is fitted or if the battery has been discharged whilst starting or disconnected before the 30-second switch off period has elapsed. To obtain the correct voltage (11 to 14V), calibration should be carried out with the engine running.

Notes

22: Recirculation flap motor

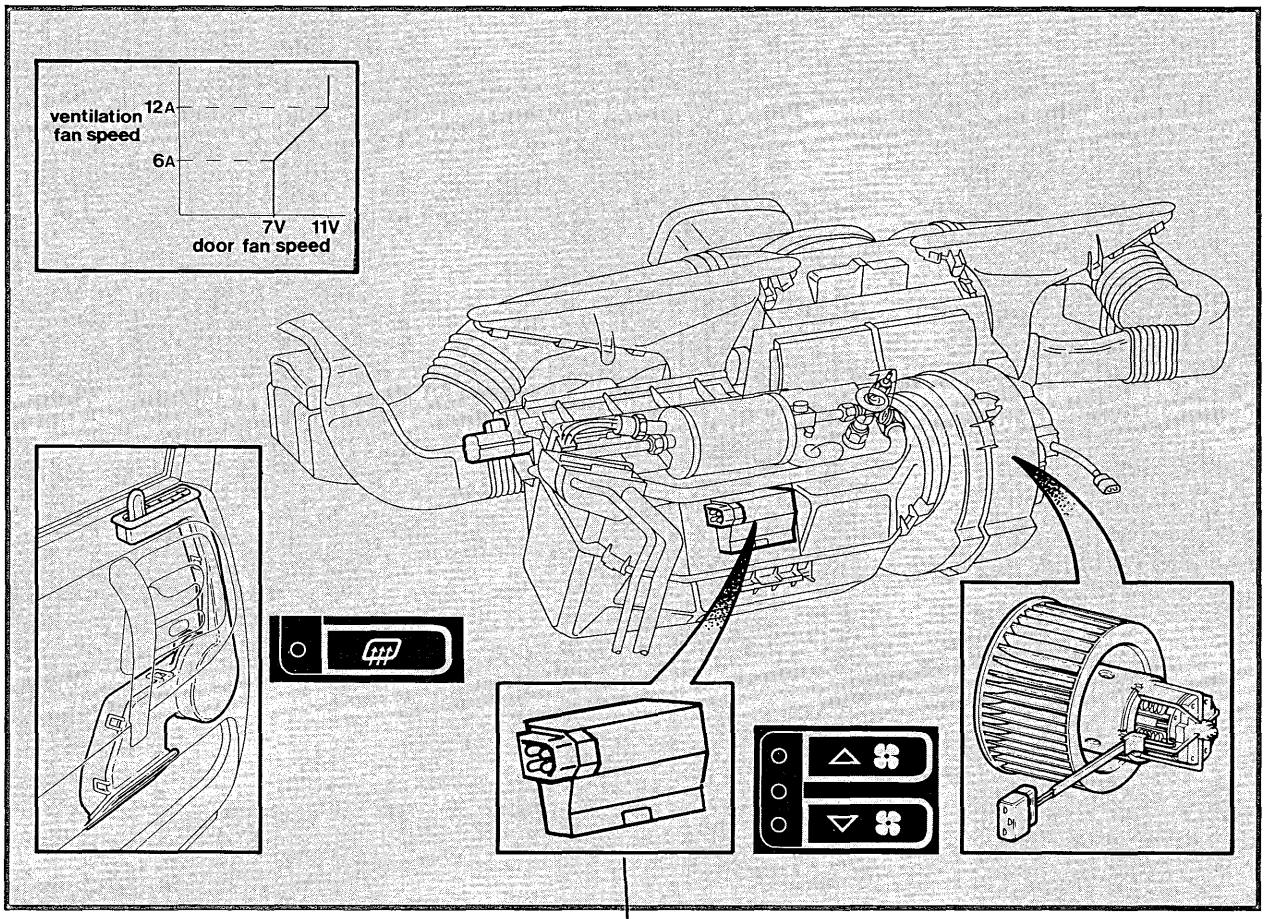


This is a fixed speed DC motor which runs in forward or reverse to move the flap between the fresh air and recirculation positions under control of the ACC unit. After approximately 15 seconds, the motor will switch off automatically.

If recirculation has been chosen by ACC or manual it will always go back to fresh air after the ignition is switched off.

Notes

23: Ventilation and rear door fans



The ventilation fan is driven by a variable speed DC motor. The speed is selected automatically in the AUTO mode and under control of the fan speed pushbuttons in the manual mode. To control the speed the ACC unit applies a control signal to a fan control unit which in turn varies the motor current. The rate of change of current is 1 A per second in the AUTO mode and 2 A per second in the manual mode. The current at maximum speed is approximately 16 A .

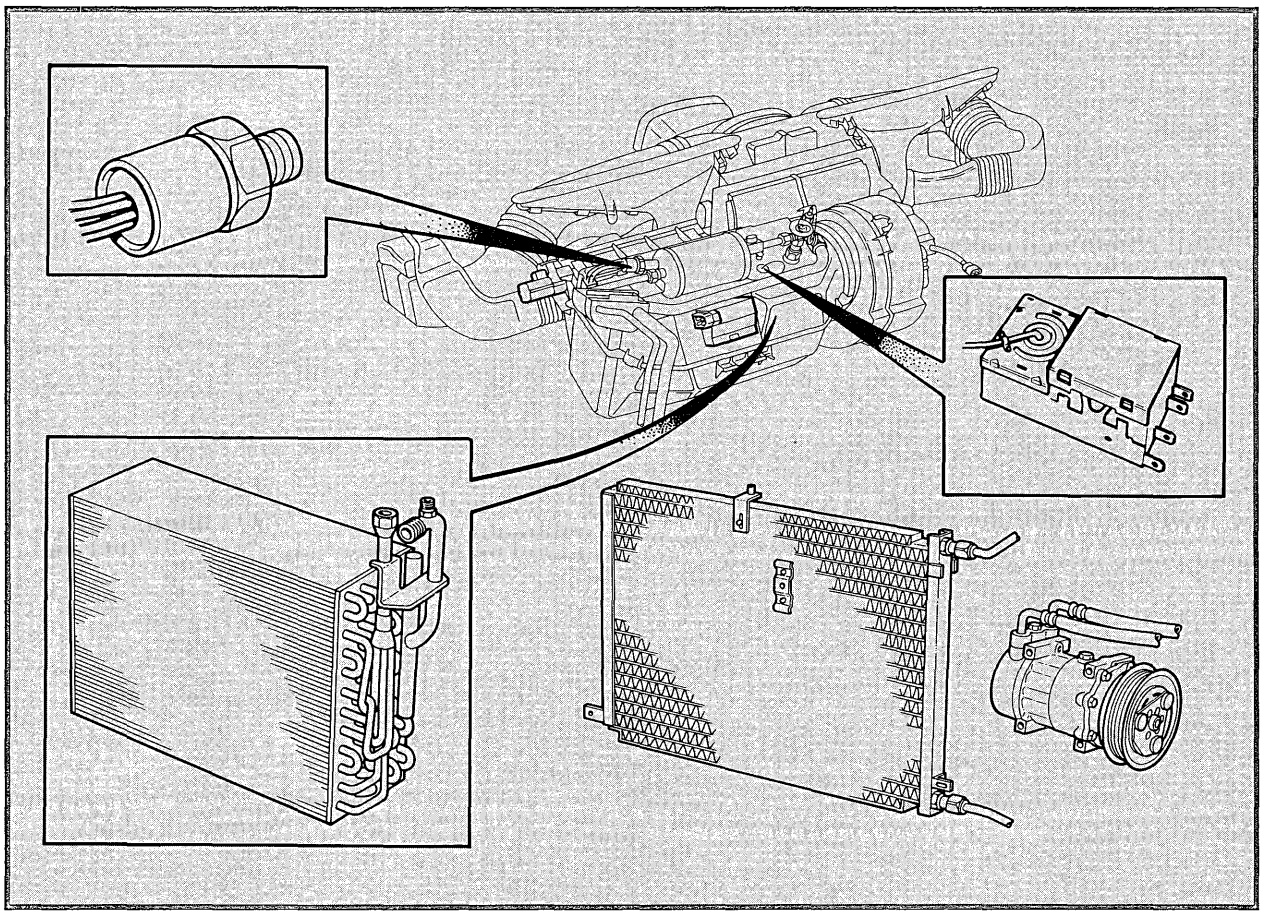
When HI or LO is selected on the temperature indicator the motor runs at maximum speed continuously.

A feed back signal, derived from the motor armature, enables the ACC unit to monitor the speed and the amount of the ventilation fan motor.

The rear door fans are also driven by variable speed DC motors. They have a preset minimum speed, increase in step with the ventilation fan in the middle of the range, and run at maximum speed at the top of the range. When the rear window heater is switched on, the door fans run at maximum speed.

Notes

24: Air conditioning unit



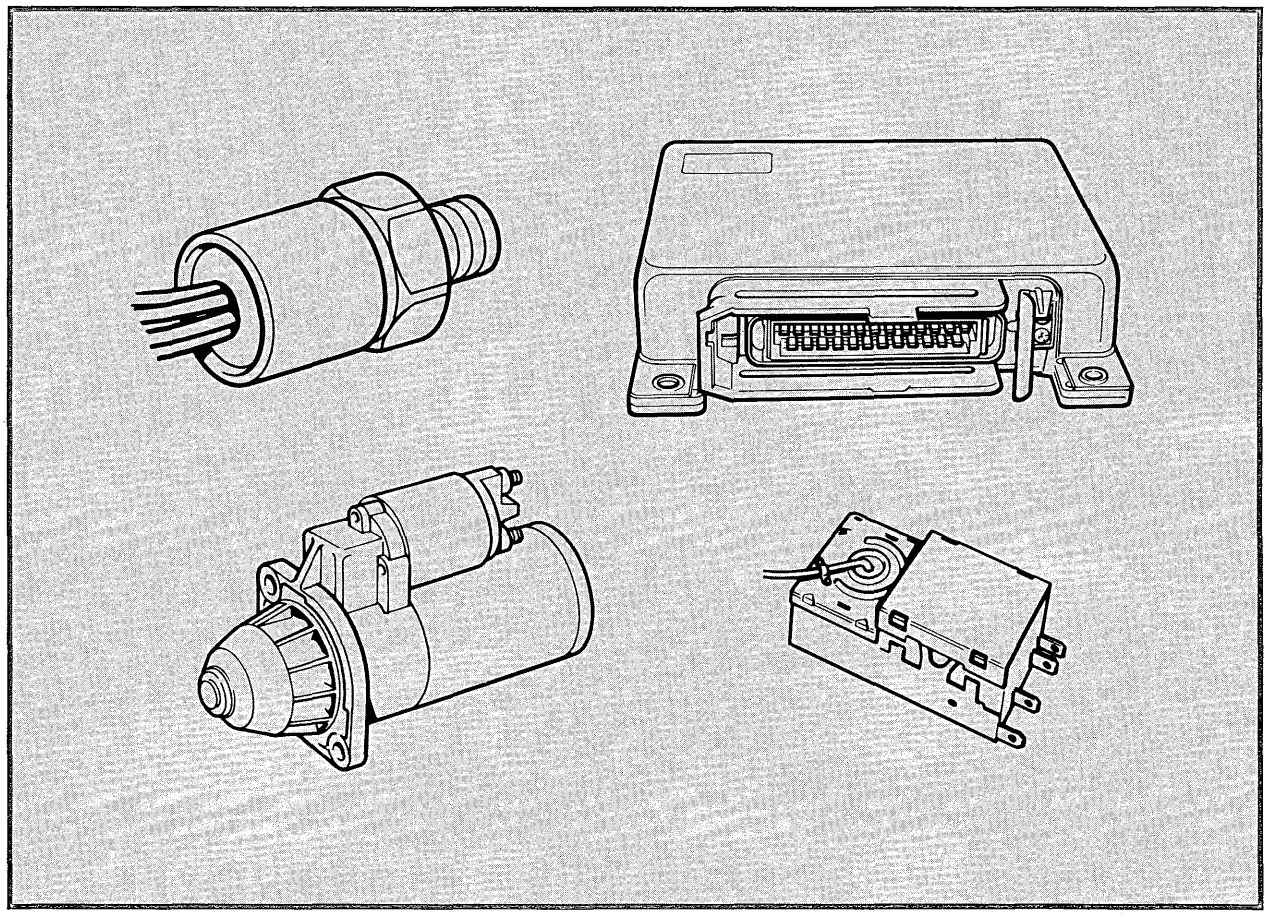
The air conditioning unit is identical to the unit used for Version 1 of the Automatic Climate Control system.

The unit comprises a compressor, evaporator and condenser. An anti-freeze protection device is fitted on the evaporator and high and low pressure protection devices are fitted on the Freon filter which is mounted on top of the evaporator.

Temperature control is achieved by reheating the cooled air to the required level under control of the temperature control flap in a similar manner to that when recirculated or fresh air is being used.

Notes

25: Air conditioning unit control



To prevent the AC operating when ECON is selected the 12V control signal at pin 31 of the ACC unit is removed.

Other conditions which must be satisfied for the AC unit to operate are:

- When the contacts of both the high and low pressure switches, located on the Freon filter, are closed.
- The anti-frost thermostat fitted to the evaporator is in the closed position.
- The starter motor is not running.
- The engine has been running for at least 10 seconds after start, or 18 seconds (cars with catalytic converters).
- The engine is not running at full throttle.

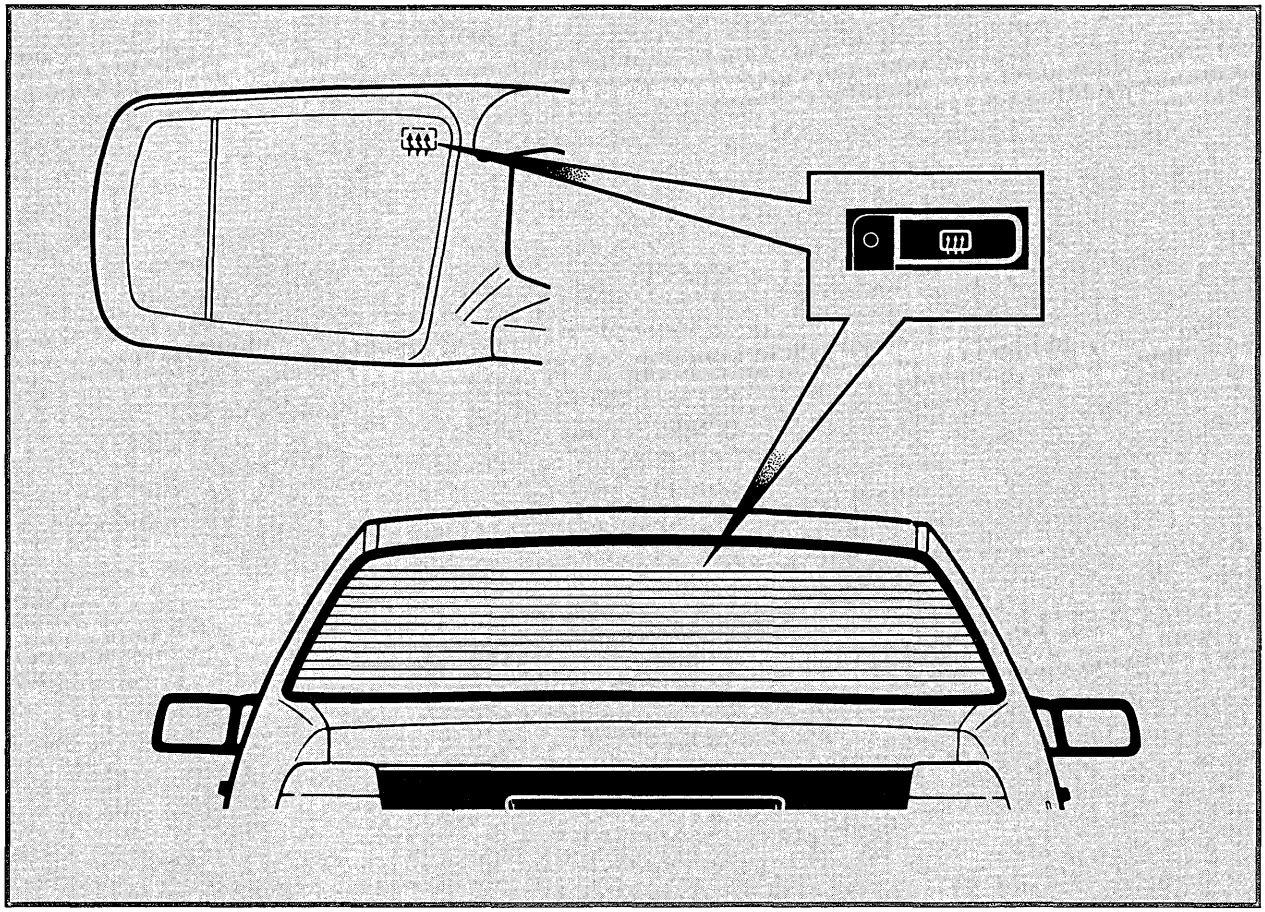
To achieve the 10/18 seconds delay on earlier models, a timing relay is used. On some later models, all interlocks, dependent on the fuel injection system, are incorporated in the control unit for that system and an ordinary on/off relay is used.

During idling, the AC system cuts in and out as necessary under control of the anti-frost thermostat. On later models, the system is switched on and off for set periods under control of the LH (2.4.1) unit, and the anti-frost thermostat signal is overidden.

To increase condenser cooling if the pressure of the refrigeration gas starts to rise, a pressure switch applies a signal to start the radiator fan.

Notes

26: Rear window and external mirror heaters

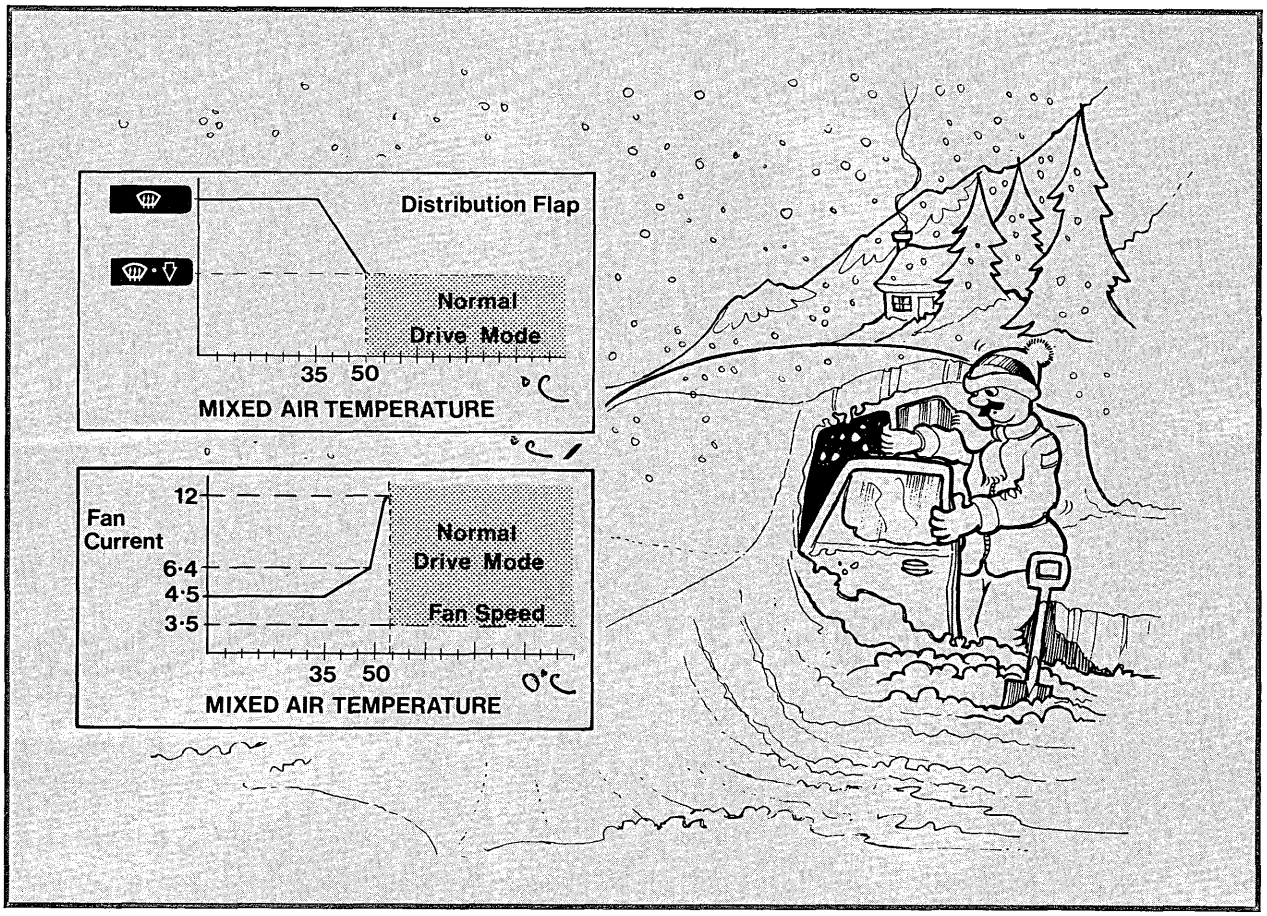


The +30 supply to the rear window heater and the external mirror heaters is switched on via a relay controlled by the ACC unit thereby enabling these functions to be controlled automatically when required.

When the indoor temperature is less than +10°C at ignition on, the supply is switched on automatically for approximately 10 minutes but can be manually switched off before this period has expired. Switch off after 10 minutes also occurs when the heater is switched on manually.

Notes

27: Cold start mode



Cold start occurs when the outside temperature is below the selected temperature by 5°C or more and the mixed air temperature being demanded is 80°C or more. The position of the air distribution flap and the speed of the ventilation fan depend upon the actual mixed air temperature as follows:

Air distribution flap cold start positions

Mixed air temperature	Flap
below +35°C	DEFrost position
+35°C to +50°C	From DEFrost to HEAT position
above +50°C	Normal drive mode

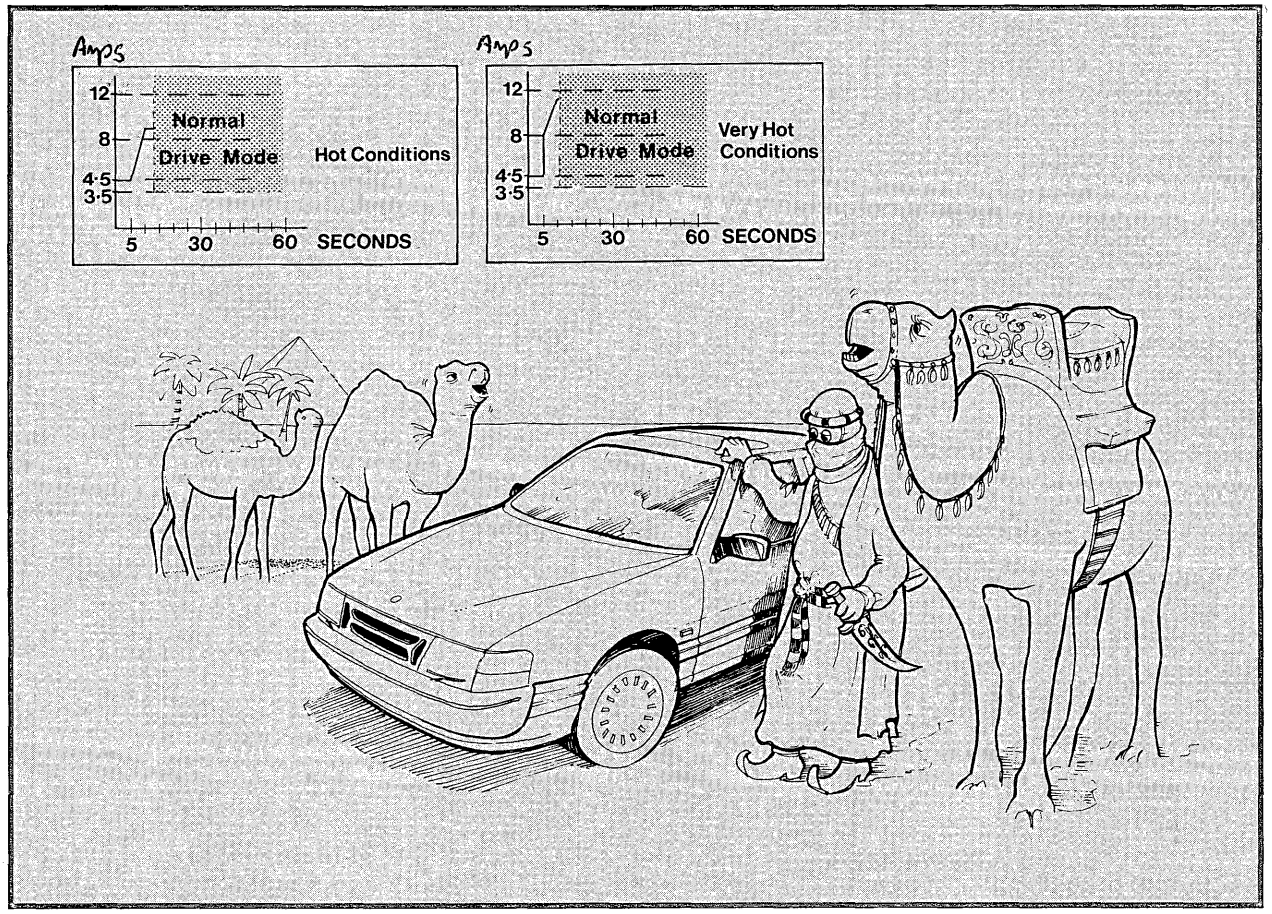
Ventilation fan cold start speeds

Mixed air temperature	
below +35°C	Current approximately 4.5A
+35°C to +50°C	Current approximately 4.5 to 6.4A
+50°C to +55°C	Current approximately 6.4 to 12A

When the ACC's calculated value for mixed air temperature drops below +80°C, but not earlier than 1 minute after start, the unit changes to the normal drive mode for both air distribution and fan speed.

Notes

28: Warm start mode



Warm start occurs when the outside temperature exceeds the selected temperature by more than 5°C or the calculated value for the mixed air temperature is less than +80°C.

Two levels of warm start can occur, depending on the result of temperature calculations carried out by the ACC unit to establish conditions. For the purposes of this explanation these are simplified to hot and very hot conditions. The special start up selections are as follows:

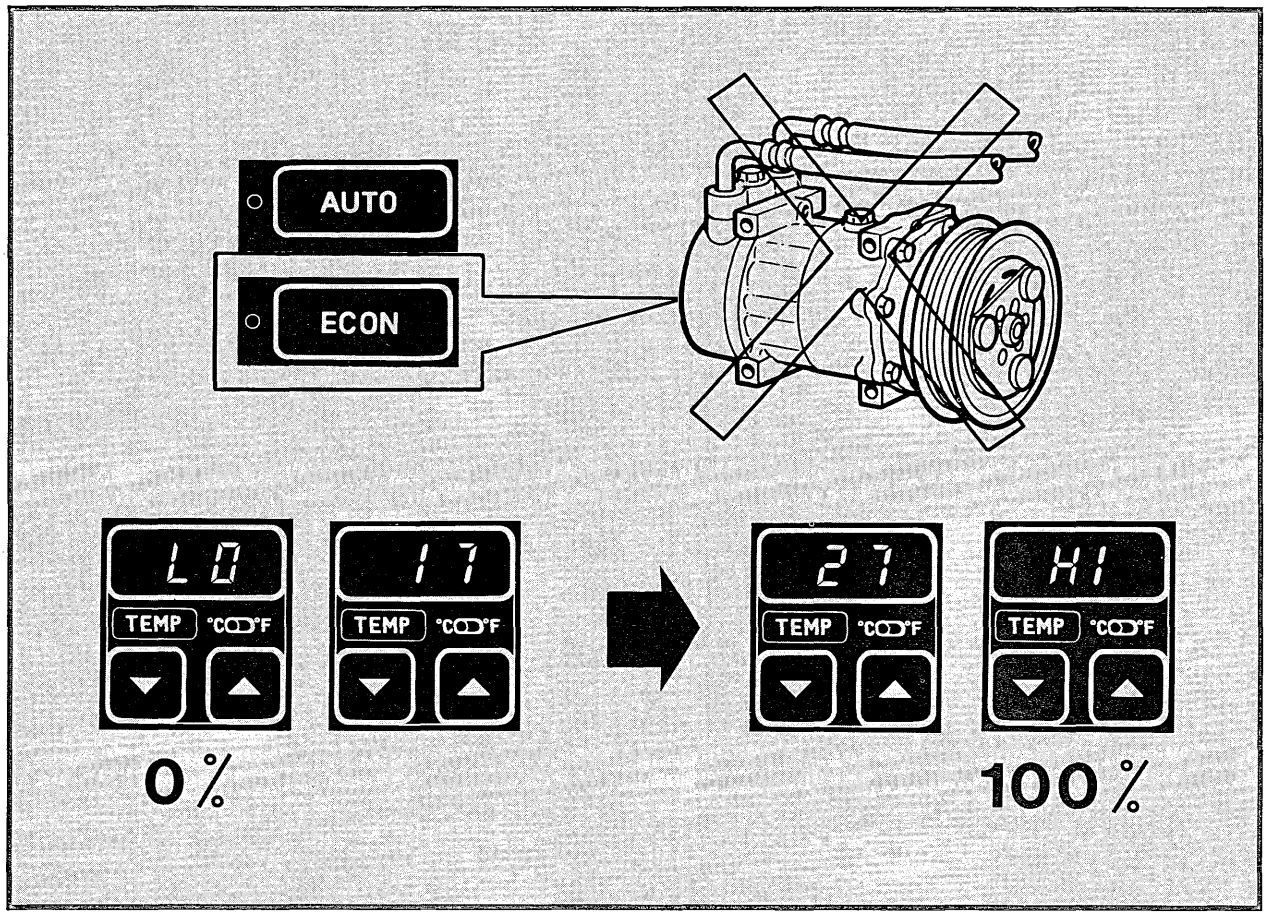
Hot conditions – Ventilation fan motor current increases from 4.5A during the initialisation period, up to the required speed at 1A per second. The distribution flap starts in the normal position and when the fan has reached its operating speed, the programme continues in normal drive mode.

Very hot conditions – Ventilation fan motor current increases from 4.5A during initialisation to 8A, then in steps of 1A per second up to the required speed. Distribution flap goes to VENT for 60 seconds.

After 1 minute the unit switches to the normal drive mode.

Notes

29: Automatic and economy modes



In the AUTO and ECON modes the temperature is maintained at the selected value by controlling the positions of the various air flaps and the speed of the ventilation fan. The temperature selection range is 17 to 27°C (63 to 81°F).

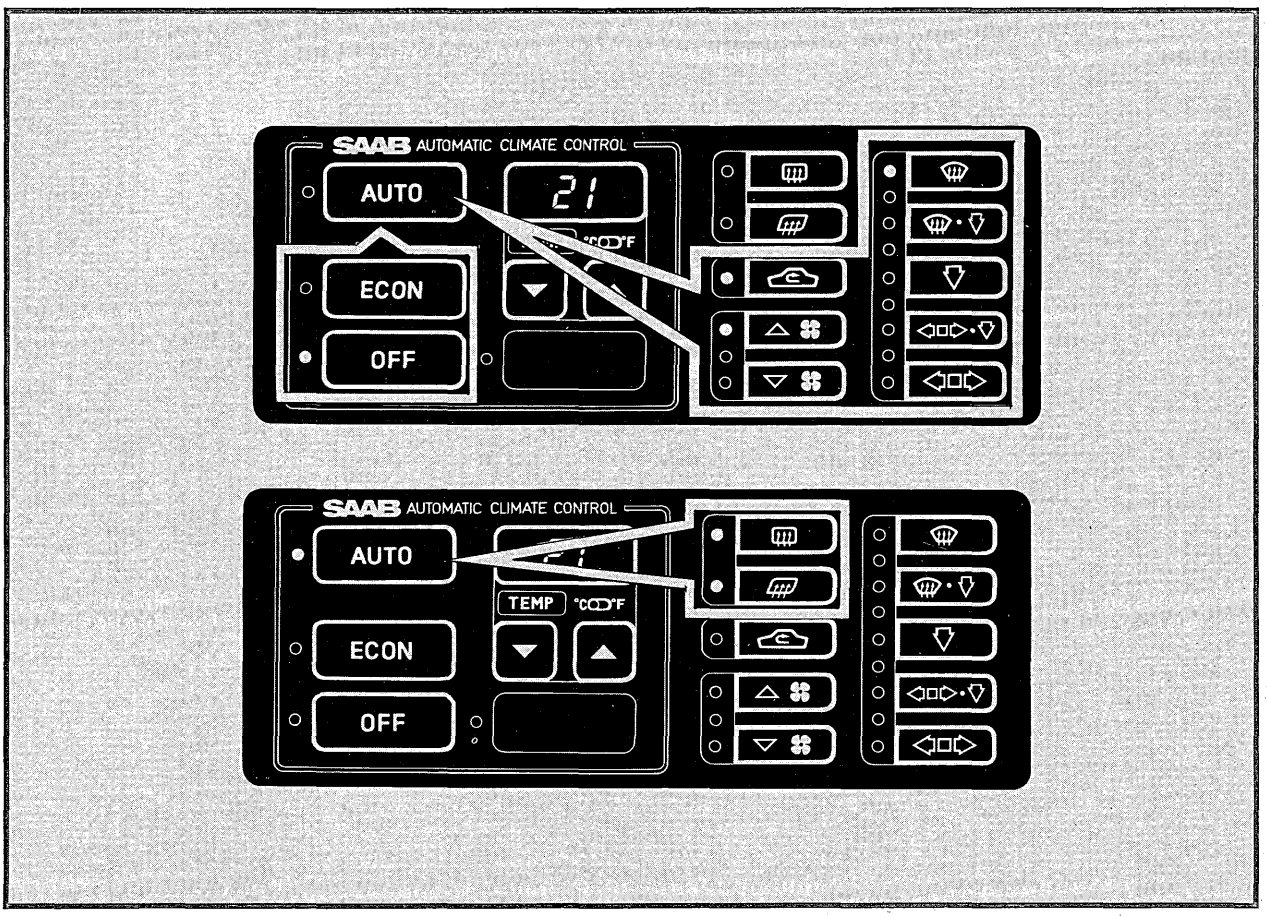
With LO selected the temperature control flap is set to the 0% (bypass heater) position and the air distribution flap is set to VENT (flap angle 45 degrees). No temperature control occurs and the ventilation fan runs at maximum speed.

With HI selected, the temperature control flap is set to the 100% position (maximum heating) and the air distribution flap is in the (DEF) to (HEAT) position. No temperature control occurs and the ventilation fan runs at maximum speed.

The indoor temperature corresponds to the desired temperature and is adjusted according to airflow, humidity and radiation heat.

Notes

30: Manual mode



Manual selection of any of the following conditions causes the AUTO indicator to extinguish.

- Air recirculation
- Ventilation fan speed
- Air distribution
- Off mode
- Economy mode

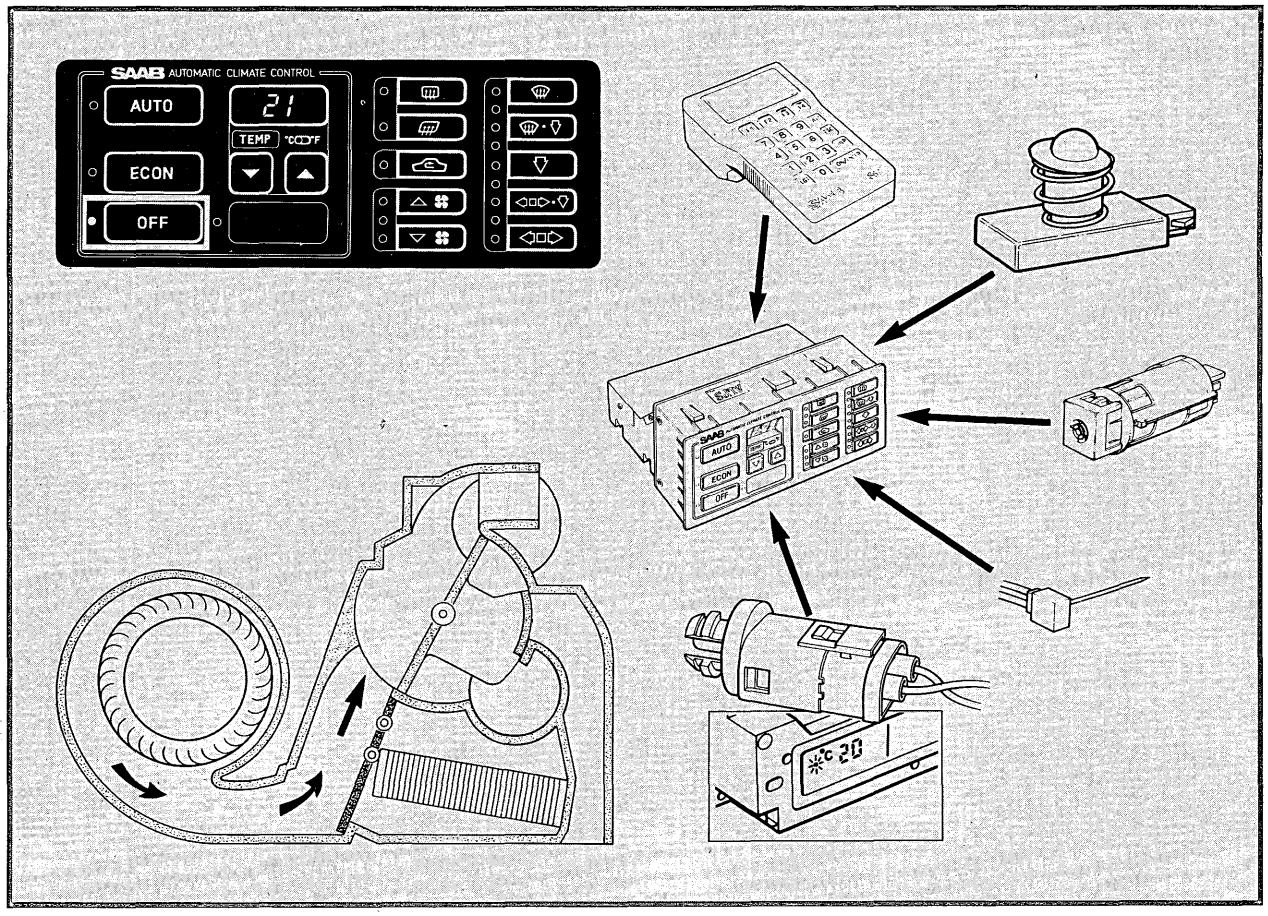
If for example an air distribution button is pressed for a second time, air distribution begins to operate automatically although air recirculation and ventilation fan speed continue to function manually. The same applies to air recirculation. Auto selection reverts everything to auto mode.

When rear window heater 'on' or 'off' is selected manually, the corresponding indicator lights or extinguishes but the AUTO indicator remains lit. Similarly, manual selection of rear door fans 'off' causes the indicator to extinguish but does not affect the AUTO indicator.

When the position of any of the control mechanisms is selected manually, the others continue to operate in the automatic mode to maintain a constant temperature.

Notes

31: Off mode



The off mode selections are as follows:

Temperature control flap - 0% (heating off)

Air distribution flap - as selected

Recirculation flap - fresh air

Sun sensor communications - on

ISAT communications - on

Ventilation fan
Rear window & outside mirror heaters
Rear door fans
Air conditioning
} - off

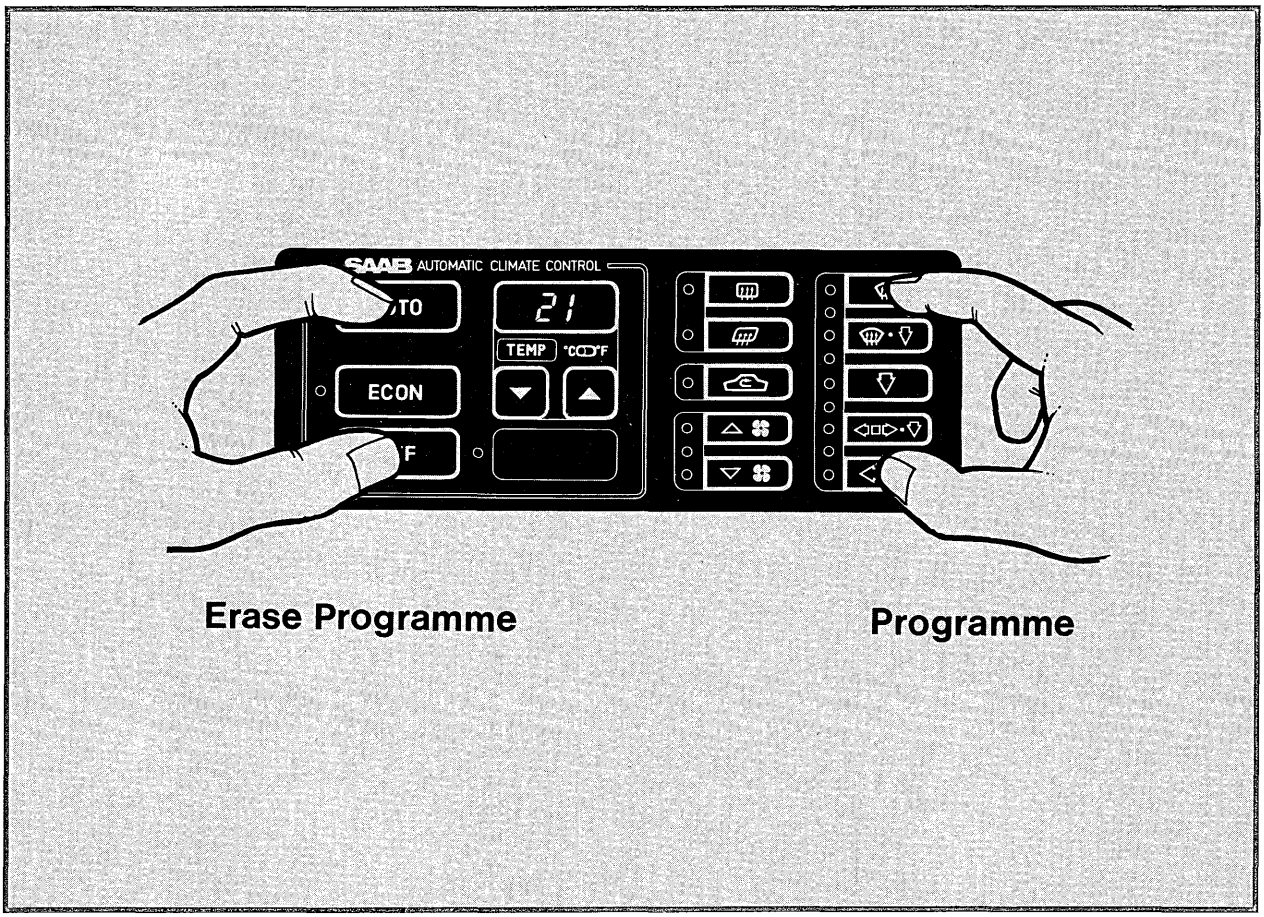
OFF indicator - on

Other indicators - off

In the OFF mode the system continues to monitor all sensor inputs so that it is ready to make the necessary selections immediately the system is restarted. Restart is accomplished by selecting AUTO to return to the automatic mode or OFF to return to the previously selected manual conditions.

Notes

32: User programmed mode



The ACC unit can be programmed to start with preset manual selections active as follows:

- Make the required selections using the manual controls.
- Operate the DEF & VENT pushbuttons at the same time for at least 20 mS.

The temperature display extinguishes for a short period confirming selection.

Control continues with chosen selections active and the selections are automatically implemented when the ignition is switched on, provided the ignition has been switched off for more than 30 seconds.

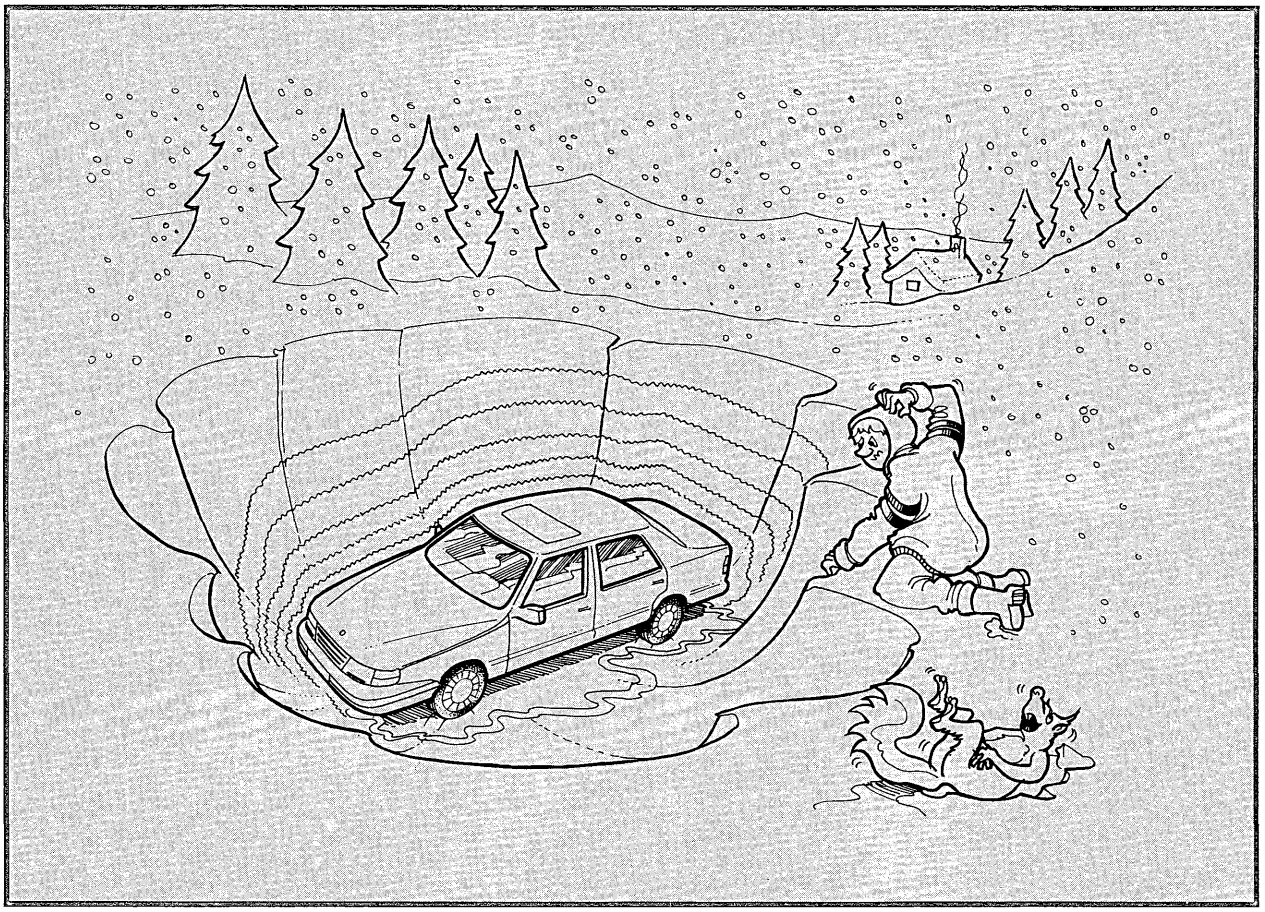
Following start, the selections remain active until cancelled by the AUTO, ECON or OFF pushbuttons or different manual selections are chosen using the other manual controls.

The programmed selections are cancelled by pressing the AUTO & OFF pushbuttons for a further 20 mS.

The selections can be changed at any time by repeating the programming procedure.

Notes

33: Parking heater mode



The parking heater mode is selected by a timer or the DCC applying a parked heating mode select signal to the ACC unit. This results in the following selections provided the ignition is off:

Temperature control flap - normal automatic control

Air distribution flap - DEFrost and HEAT (flap angle 135 to 112.5 degrees)

Recirculation flap - Recirculation when outside temperature below -10°C (fresh air when outside temperature is above -8°C)

Ventilation fan - 5.5 A approximately

Rear window heater and outside mirror heaters - off

Rear door fans - off

Air conditioning - off

Temperature display - latest temperature selection (LO = +16°C)

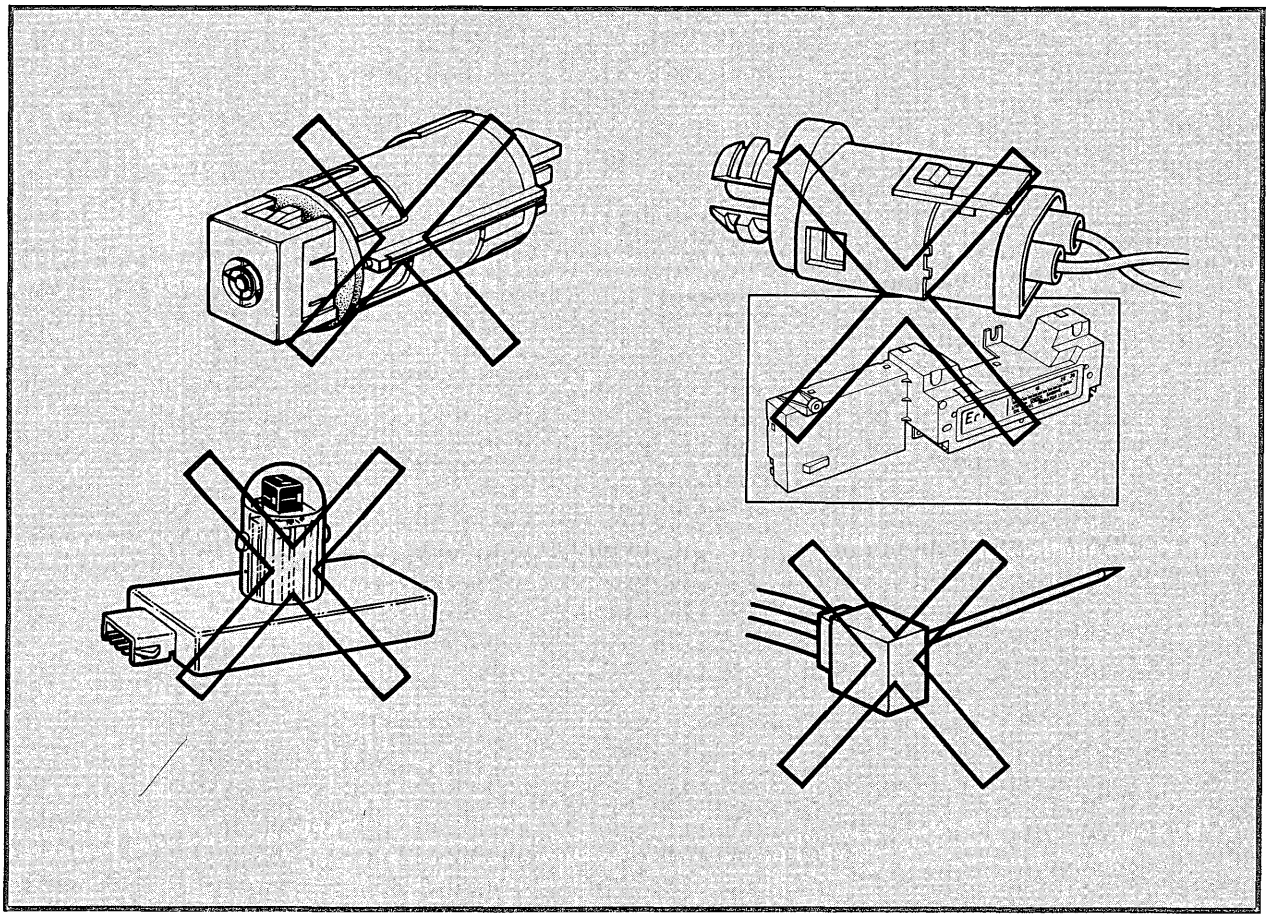
Indicators - Normal

Manual controls - all selections except OFF are possible

Note: No OFF control is available with the parking heater mode signal active (consequently the selection can only be cancelled by changing the selection at the DCC or P-timer or switching the ignition on).

Notes

34: Limp home mode



When a fault is detected by the ACC unit self test program the limp home mode is selected. If a short circuited output is detected, the corresponding control mechanism is switched off. If a sensor fails the following assumed values are used:

Inside temperature - level set to +18°C

Outside temperature - previous value or –44°C if the failure existing at start.

Mixed air temperature level is set to +50°C (Version 2.00).

Mixed air temperature - calculated set value by ACC (Version 2.01).

Sun sensor - intensity, angle of elevation and bearing all set to zero

If the battery voltage drops below 9V or rises above 16V the ACC unit switches off but switches on again when the voltage returns to normal.

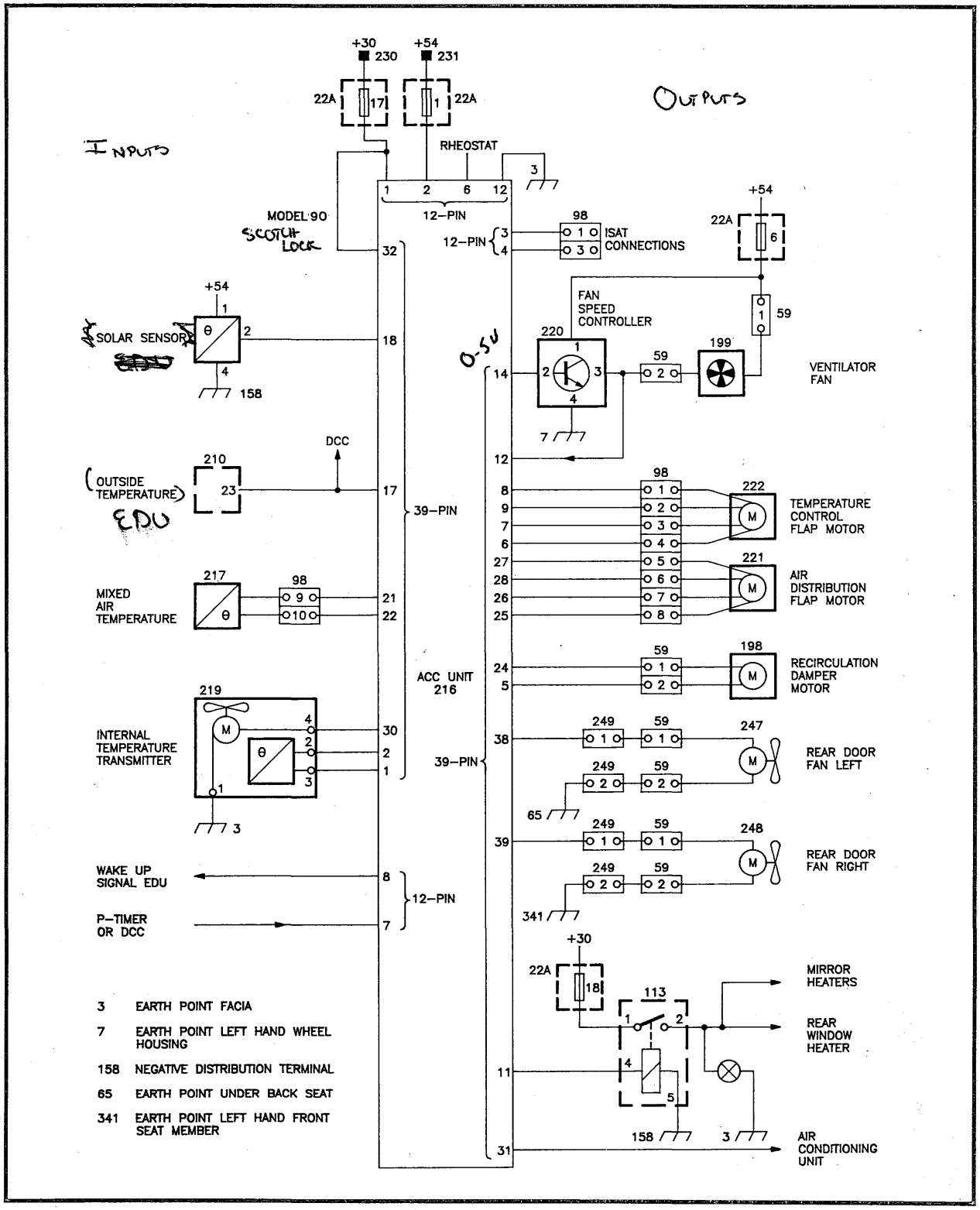
If the battery voltage in the ACC unit drops below 10.5V, control of the stepping motors ceases but the system continues operating with the temperature control and air distribution flaps in their last positions which were selected when the failure occurred.

If the internal EPROM in the CPU is faulty, The ACC does not switch off when the ignition is switched off.

Note: The self-test of mixed air and indoor temperature sensors is only possible if the outside temperature is greater than 0°C.

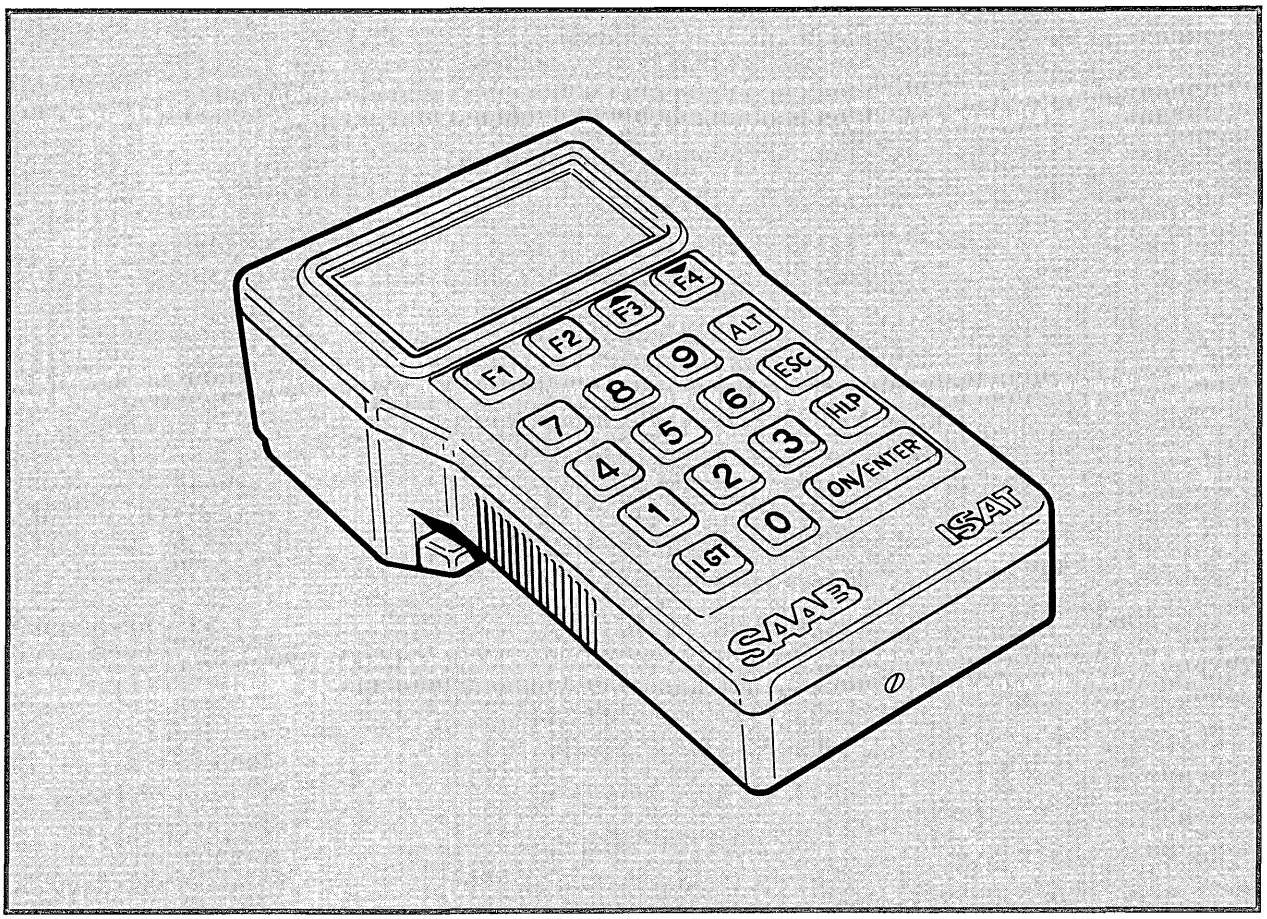
Notes

35: Wiring Diagram



Notes

36: Fault finding



ACC System number 2 (Use ISAT first to record all faults)

A self test program is integrated with the ACC program and carries out checks whilst the unit is operating. The program also runs during initialisation (when the ignition is first switched on), either when selected by pressing the AUTO & VENT pushbuttons or under control of ISAT. For a complete self test and calibration the program must run for 35 seconds.

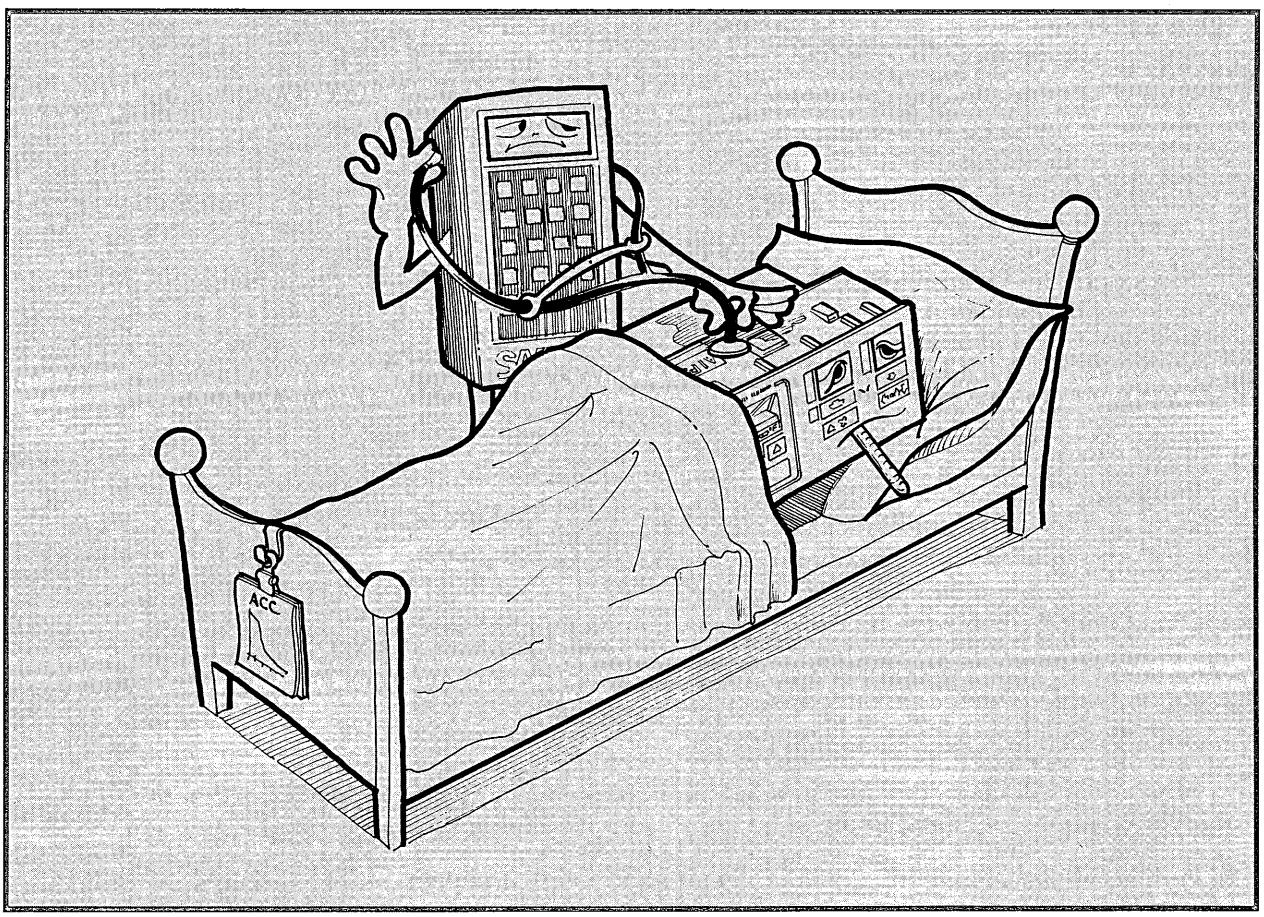
Any faults detected by the self test program are allocated a fault code indicating the type of fault. When the ignition is first switched on the number of faults detected is displayed while the initialisation program is running. It is also possible to see faults displayed when OFF is pressed, followed by AUTO.

The fault codes recorded are read from the memory using ISAT. They are erased using ISAT (command code 900) or by operating the AUTO and VENT pushbuttons.

NOTE: If the temperature is below 0°C tests of indoor and mixed air temperature sensors cannot be carried out.

Notes

37: Fault finding



Points to note:

When fault finding on microprocessor systems the memory may become corrupted causing unusual symptoms. To clear any strange symptoms switch the ignition off for at least 35 seconds.

Read and record fault codes before disconnecting the battery or ACC control unit.

When fault finding on car electronics, it is always good practice to first check that the earth connection to the unit is sound and the power supplies are correct.

ALWAYS CHECK THE CONNECTIONS AT PLUGS AND SOCKETS BEFORE FAULT FINDING IN OTHER AREAS. DISCONNECT THE PLUGS AND INSPECT THE PINS FOR DAMAGE. REFIT THE PLUGS, CLEAR ALL FAULT CODES THEN RUN THE SYSTEM AND CHECK IF THE FAULT IS STILL PRESENT.

When first detected all fault codes are permanent. The code changes to intermittent when the fault disappears. Fault codes can be erased either by ISAT/command code 900 or by pressing the AUTO & VENT pushbuttons.

The voltage levels given in the signal level tables are all measured using a Digital multimeter.

All signals around the 12V level are proportional to battery voltage, consequently the values quoted should be treated as guidance only.

The 0V signals are earth level but may register slightly above zero on a sensitive digital multimeter.

Note: All measurements must be carried out from behind the plugs or sockets. Voltage measurement of inputs or outputs must be made with ignition on or engine running.

Notes

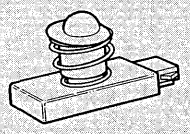
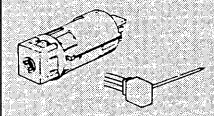
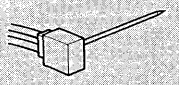
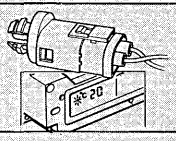
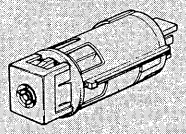
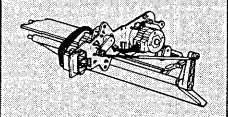
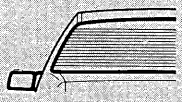
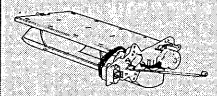
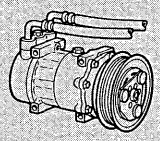
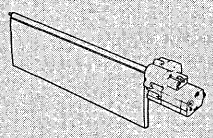
38: Fault Codes

On ISAT display it is possible to identify which version of the ACC unit is connected to the car

VERSION 2.00 . . . . . Rom I **VERSION 2.01 . . . . . Rom III**

If no version is stated: both 2.00 and 2.01 is applicable.

P = Permanent I = Intermittent

Version	P	I	Component	Version	P	I	Component
	66891				42521	22521	
	E6891	D6891			46322	26322	
	46391	26391			46323	26323	
	53624	33624		2.01	53672	33672	
2.01	53674	33674		2.01	53221	33221	
	53623	33623		2.01	53271	33271	
2.01	53673	33673		2.01	53222	33222	
2.01	53621	33621		2.01	53272	33272	
2.01	53671	33671					

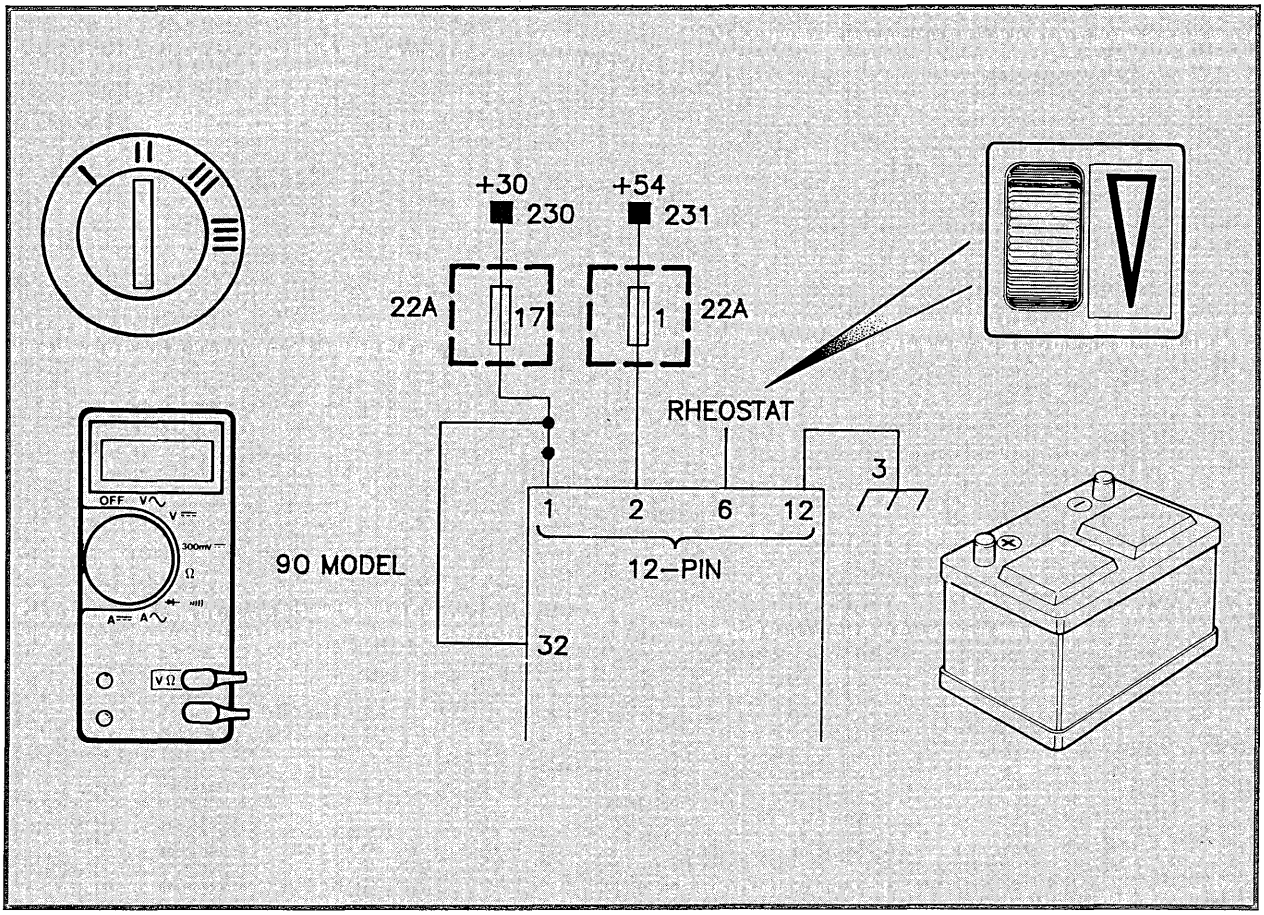
Notes

39: ISAT Command Codes

ISAT Command Codes	Description
27A Display Shows	Desired position of temperature flap motor. 0% (LO) - 100% (HI)
27B Display Shows	Desired position of distribution flap motor 45° (vent) - 135° (DEF)
279 Display Shows	Desired position of recirculation flap motor. Fresh air or recirculation.
380 Display Shows	Type of solar sensor. Standard or Australian.
229 Display Shows	Battery voltage ACC unit. Voltage range 0 - 26.5 V.
22A Display Shows	Ventilation fan control signal. 0 - 5 V.
270 Display Shows	Illumination level control of LED's by photo-transistor. 0% (dark) - 100% (bright)
251 Display Shows	Outside temperature by EDU. –44°C - +50°C.
252 Display Shows	Mixed air temperature. 0°C - +80°C.
250 Display Shows	Indoor temperature. +10°C - +40°C.
100	Send all stored fault codes.
800 /TERMINATE	End of communication.
900	Clear all stored fault codes. Starting self test on the ACC-system, and calibration of flap motors. All earlier stored faults will be erased.
NOTE! Command codes 27A, 27B and 279 are desired positions of the motor. This means that you will never know if the motor really moved to the required positions. The only way to be sure is to carry out a visual check.	

Notes

40: Power supply check



ISAT Command Codes	Display Shows
229	The battery voltage in the ACC unit. Voltage range 0 - 26.5 V (the voltage in the ACC unit is always 1V below the battery voltage).
270	Illumination level control of LED's by photo-transistor. 0% (dark) - 100% (bright)
Use a finger and place it on the photo transistor. Display shows percentage close to zero and the LED is dim. Use a torch and shine it on the photo-transistor. Display shows a higher percentage and the LED's are brighter.	

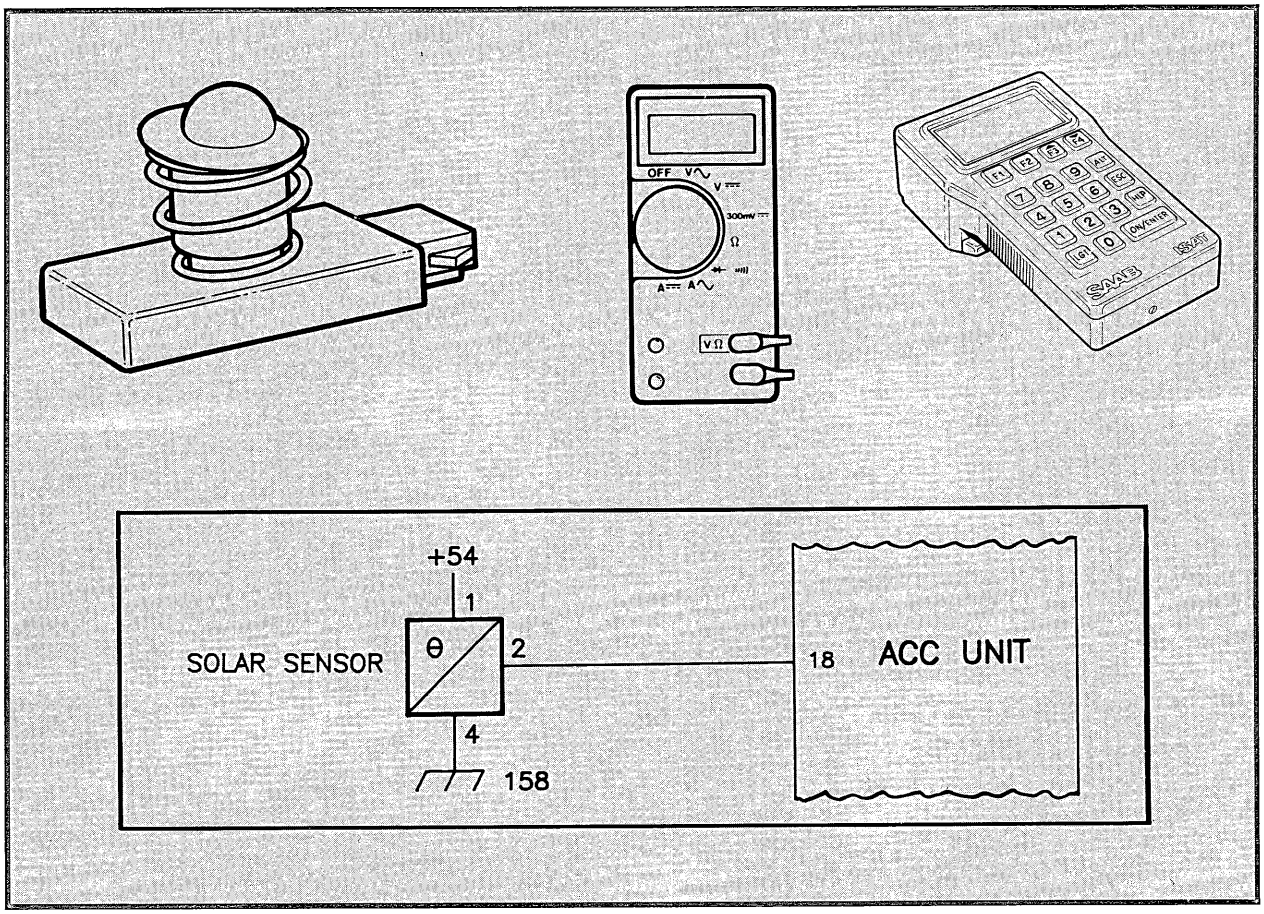
1. Disconnect the 12-pin plug (58) and check for earth continuity at pin 12.
2. Check the +30 supply across pins 1 and 12 of the 12-pin plug (58).
3. Check the +54 supply across pins 2 and 12 of the 12-pin plug (58).

Signal levels

Signal Measured	ACC Pins	Condition	Voltage
+30	1 & 12 (58)	Normal	B-voltage
+54	2 & 12 (58)	Normal battery voltage	(9 to 16V)
Rheostat	6 & 12 (58)	Normal	0 to 12V

Note: If the supply voltage goes outside the limits 9 to 16V, the OFF LED lights and the display goes blank.

41: Solar sensor check



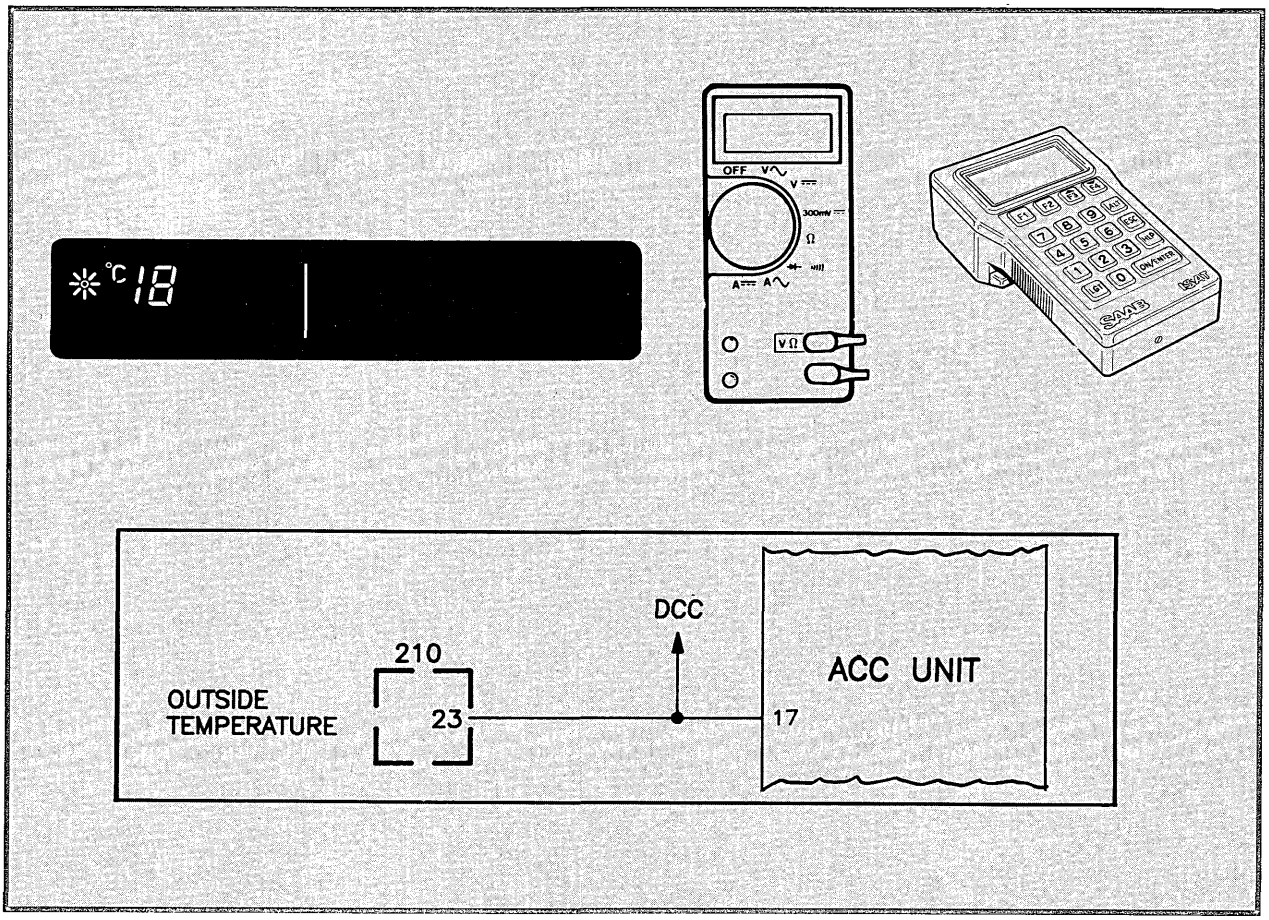
Fault Codes		Fault
Permanent	Intermittent	
66891 E6891	D6891	Solar sensor hardware fault. Solar sensor communication fault. The fault may be open circuit, short circuit to earth, or short circuit to 12V (pin 18).

ISAT Command Codes	Display Shows
380	Type of solar sensor. Standard or Australian.

1. Disconnect the solar sensor plug and check the earth at pin 4 and the +54 supply at pin 1. If incorrect check the wiring. If correct refit the plug, clear any fault codes and run the system.
2. If a fault is still present, disconnect the solar sensor and the 39-pin ACC unit plugs. Check the continuity between pin 2 of the sensor plug and pin 18 of the ACC unit plug. If normal, refit the plugs, clear any fault codes and run the system.
3. If a fault is still present, try a new solar sensor and run the system.
4. If a fault is still present, refit the old sensor and try a new ACC unit.

Notes

42: Outside temperature sensing check



Fault Codes		Fault
Permanent	Intermittent	
46391	26391	No outside temperature pulses from the EDU.

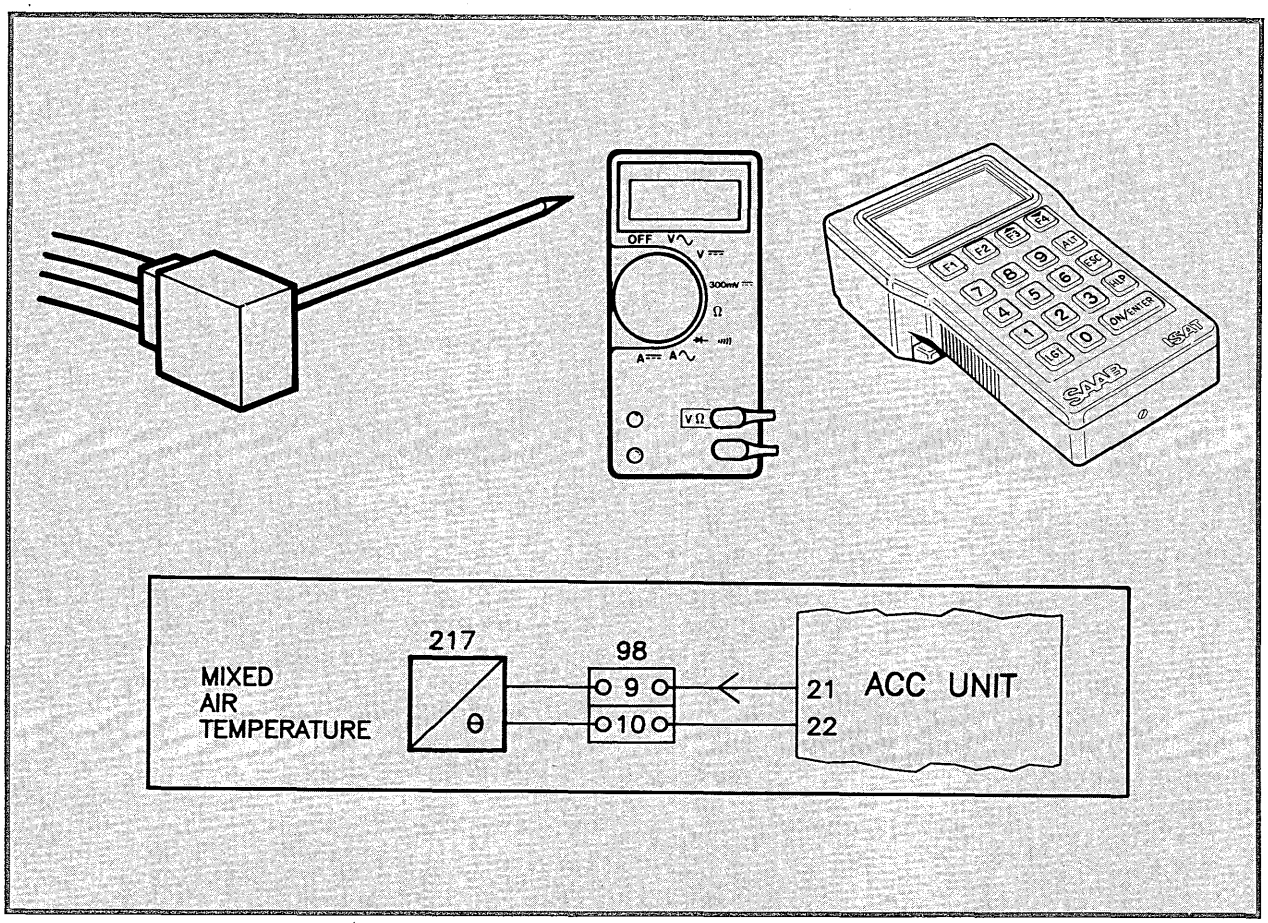
ISAT Command Codes	Display Shows
251	Outside temperature by EDU. –44°C - +50°C.

If Display Shows	Possible Fault
Set latest value during driving. Compare with EDU.	: Open circuit or battery voltage on pin 17.
–44°C.	: Open circuit or battery voltage on pin 17 when starting the engine. : Earth on pin 17. : Fault in the EDU or ACC.

BEFORE CARRYING OUT THIS CHECK ENSURE OUTSIDE TEMPERATURE SENSING BY THE EDU IS OPERATING NORMALLY. CHECK ALSO (IF DCC FITTED) FOR FAULT CODE F2.

1. Disconnect the EDU and ACC unit plugs and check for continuity between pin 23 of the EDU and pin 17 of the ACC unit 39-pin connector. If normal, refit the plugs, clear any fault codes and run the system.
2. If a fault is still present, try a new EDU.
3. If this fails to clear the fault, refit the old EDU and try a new ACC.

43: Mixed air temperature sensor check



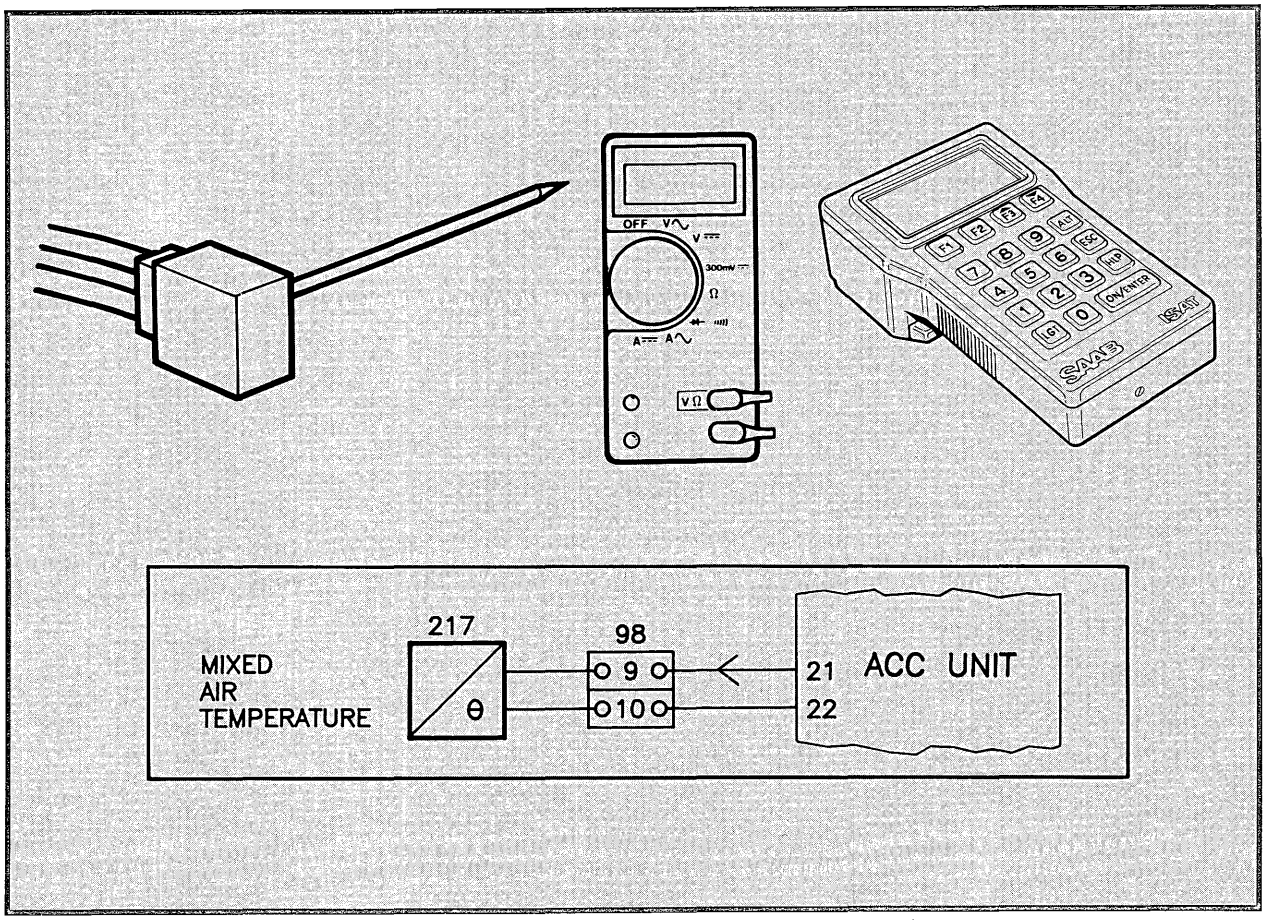
Fault Codes		Fault
Permanent	Intermittent	
46322	26322	Mixed air temperature sensor open circuit or pin 21 at 12V or a fault in ACC unit monitoring circuit.

ISAT Command Codes	Display Shows
252	Mixed air temperature. 0°C - +80°C.

If Display Shows	Possible Fault	
Set temperature of +50°C (version 2.00), calculated set value by ACC (version 2.02).	: Open circuit pin 21 or 22. : LED's dim – – – battery voltage pin 22 (see page 48).	
+50°C (version 2.00) calculated set value by ACC (version 2.01).	: Battery voltage on pin 21.	
+80°C (version 2.00 and version 2.01).	: Bridge betwen pin 21 and 22. : Pin 21 at earth.	No fault code.

Notes

43: Mixed air temperature sensor check



1. Disconnect the ACC unit 39-pin plug and check the resistance value across pins 21 and 22. The value varies between 1 and 240 kohms over the range +90 to –40°C. Values at particular temperatures are:

	Minimum (kohms)	Maximum (kohms)
0°C	25.5	30.5
+10°C	16.6	19.6
+20°C	11.2	13.0
+30°C	7.7	8.8
+40°C	5.4	6.1

2. If the value is incorrect, disconnect the temperature sensor plug and repeat the resistance check across pins 9 and 10 of the plug. If the value is still incorrect, fit a new temperature sensor.

3. If the value measured across the temperature sensor plug is correct, check for continuity between plug 98 and ACC unit (pins 9 and 21, pins 10 and 22). If the wiring is normal, refit the plugs, clear any fault codes and run the system to determine if a fault is still present.

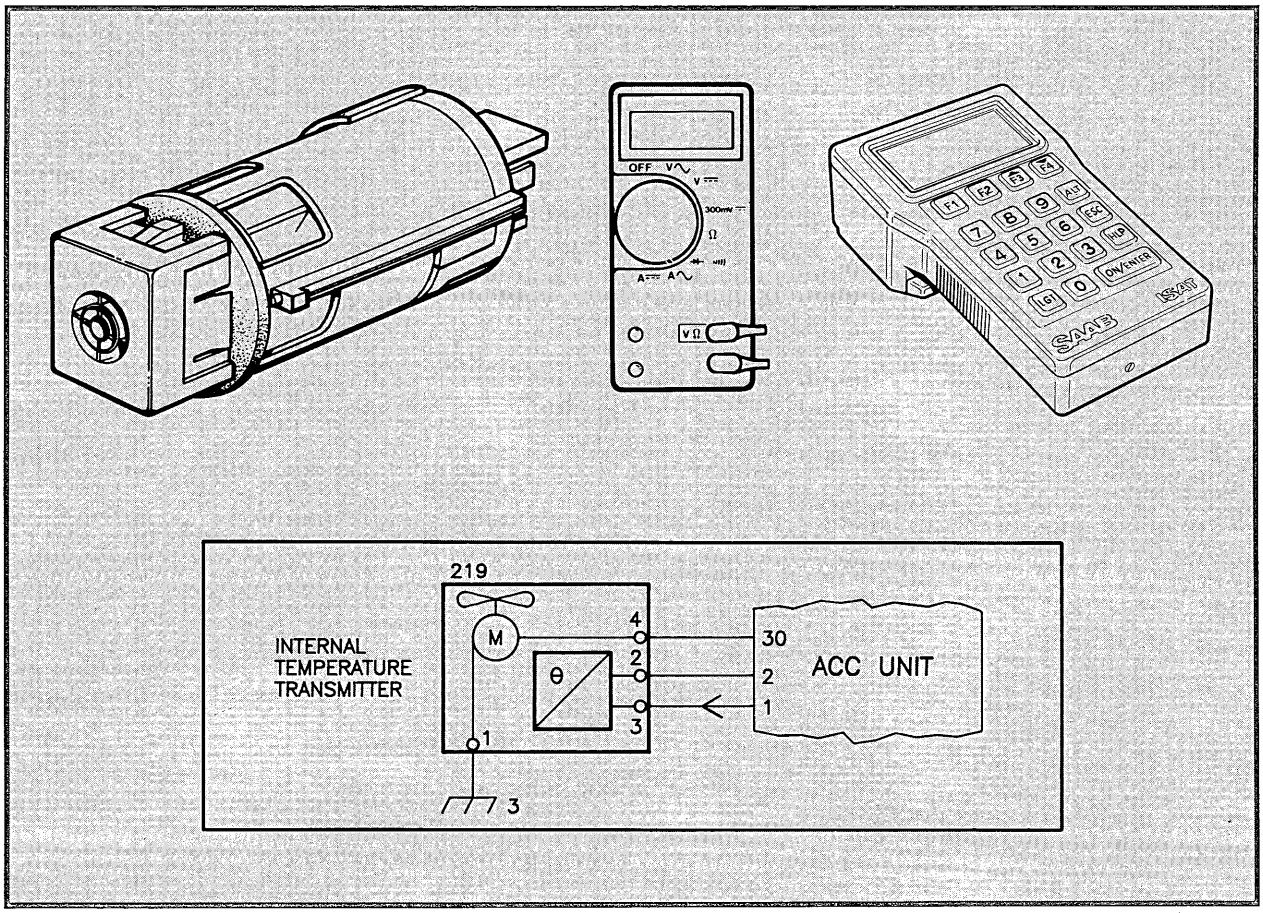
4. If a fault is still present, measure the voltage at pin 21 of the ACC unit. This will vary depending on the sensor resistance value and the battery voltage according to the following formula: (Measure with the ACC plugged in and ignition ON).

$$\frac{\text{(B-volts} - 1.5) \times \text{R-sensor}}{\text{R-sensor} + 10 \text{ kohms}}$$

5. If the voltage is incorrect, try a new ACC unit.

Notes

44: Inside air temperature sensor check



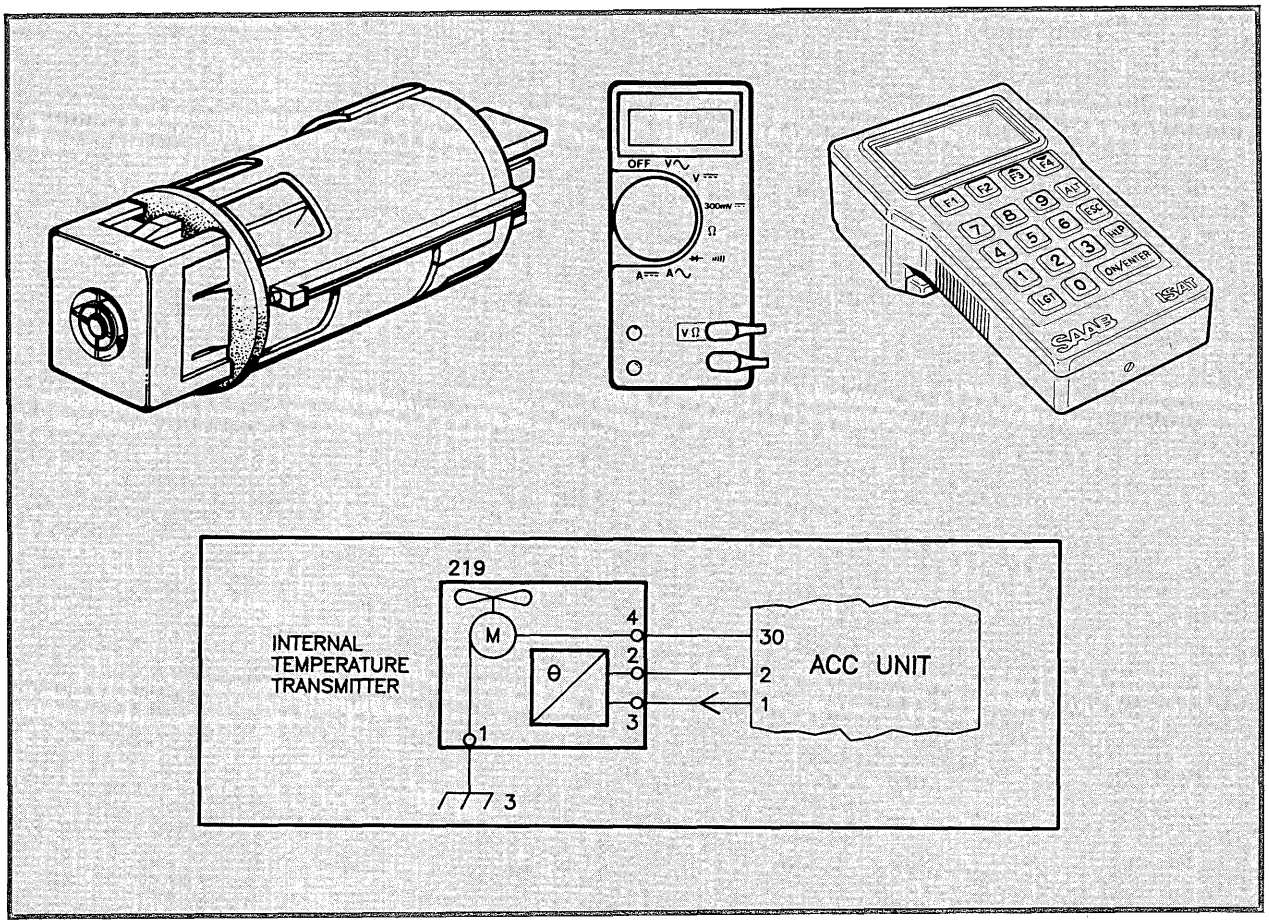
Fault Codes		Fault
Permanent	Intermittent	
46323	26323	Inside air temperature sensor open circuit or 12V at pin 1 of the ACC unit or a fault in the ACC unit fault monitoring circuit.

ISAT Command Codes	Display Shows
250	Indoor temperature. +10°C - +40°C.

If Display Shows	Possible Fault
+18°C	: Open circuit pin 1 or 2. : Battery voltage pin 1. : LED's dim – – – battery voltage pin 2 (see page 48).
+40°C (Cold air)	: Bridged pin 1 and 2. : Pin 1 at earth. } No fault code.

Notes

44: Inside air temperature sensor check



1. Disconnect the ACC unit 39-pin plug and check the resistance value across pins 1 and 2. The value varies between 5 and 35 kohms over the range 0 to +40°C. Values at particular temperatures are:

	Maximum (kohms)	Minimum (kohms)
0°C	30.0	34.8
+10°C	18.5	21.1
+20°C	11.7	13.1
+25°C	9.5	10.5
+30°C	7.6	8.5
+40°C	4.9	5.6

2. If the value is incorrect, disconnect the temperature sensor plug and repeat the resistance check across pins 2 and 3 of the plug. If the value is still incorrect, fit a new temperature sensor.

3. If the value is correct across the temperature sensor plug, check for continuity between the sensor plug and ACC unit 39-pin plug (pins 2 and 2, pins 3 and 1). If the wiring is normal, refit the plugs, clear any fault codes and run the system to determine if a fault is still present.

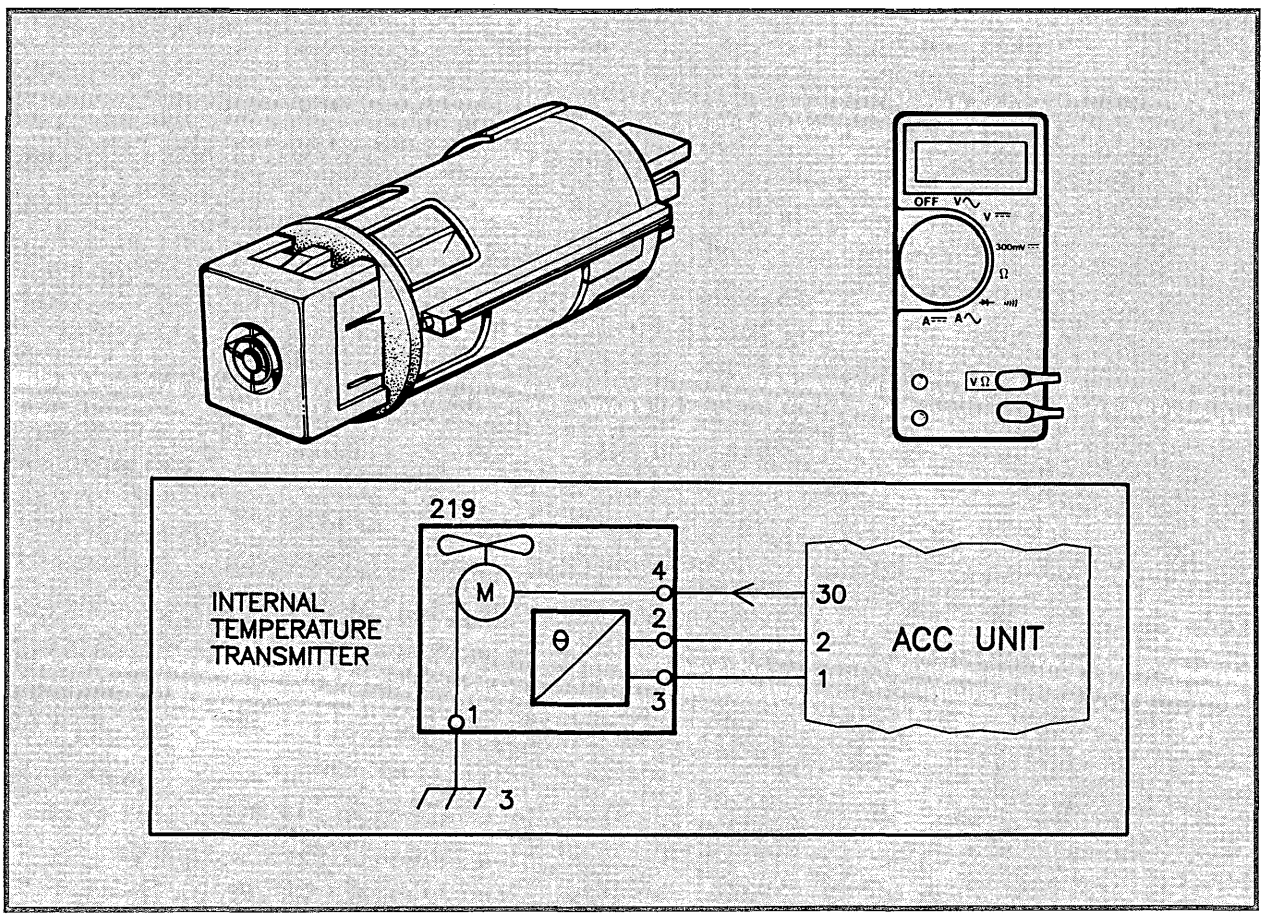
4. If a fault is still present, measure the voltage at the ACC unit 39-pin plug pin 1. This will vary depending on the sensor resistance value and the battery voltage according to the following formula: (Measure with the ACC plugged in and ignition ON).

$$\frac{\text{(B-volts - 1.5) x R-sensor}}{\text{R-sensor + 10 kohms}}$$

5. If the voltage is incorrect, try a new ACC unit.

Notes

45: Fan inside temperature sensor check



Fault Codes		Fault
Permanent	**Intermittent**	
53672	33672	Short circuit to earth pin 30 (version 2.01).

1. Disconnect the sensor and check the voltage across pins 4 and 1 of the plug. The reading should be 11 to 12V.

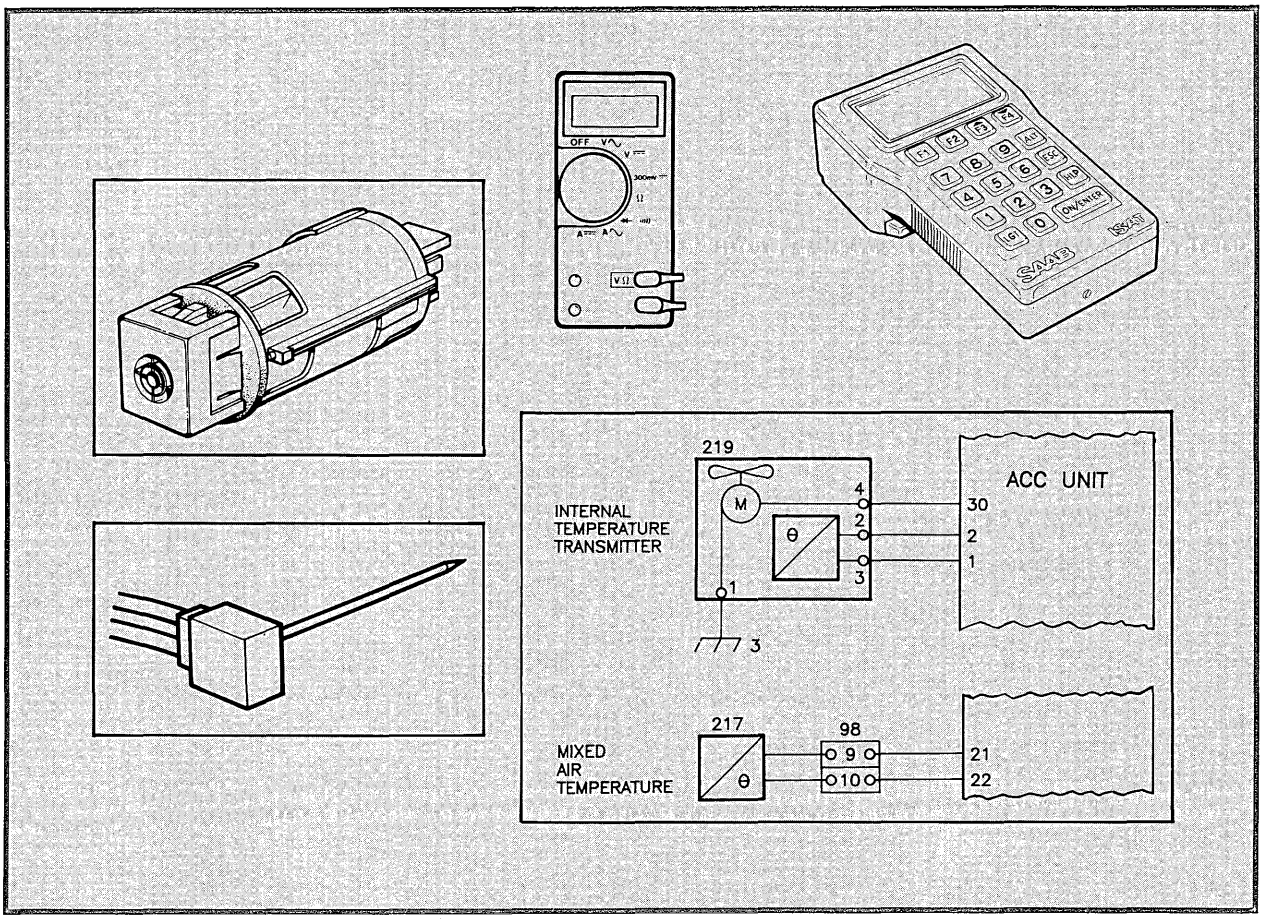
2. If a correct voltage is obtained, refit the plug and check the motor is still stopped before trying a new sensor. Note that the resistance of the fan motor across pins 4 and 1 of the sensor should be approximately 230 ohms.

3. If no voltage is obtained during Step 1, disconnect the 39-pin ACC unit plug and check for continuity between pin 4 of the sensor plug and pin 30 of the ACC unit 39-pin plug. Check also for earth continuity at pin 1 of the sensor plug and that pin 4 of the sensor plug is NOT shorted to earth.

4. If the wiring is normal, refit the plugs and check whether the fan is still stopped before trying a new ACC unit.

Notes

46: Common sensor ground fault



Fault Codes		Fault
Permanent	Intermittent	
42521	22521	This fault code is recorded when self-test program detects 12V on common 0V line for mixed air, pin 22, and internal temperature sensors, pin 2, together with fault codes 46322 and 46323. Less than 12V recorded. Only one fault code (42521 - 22521).

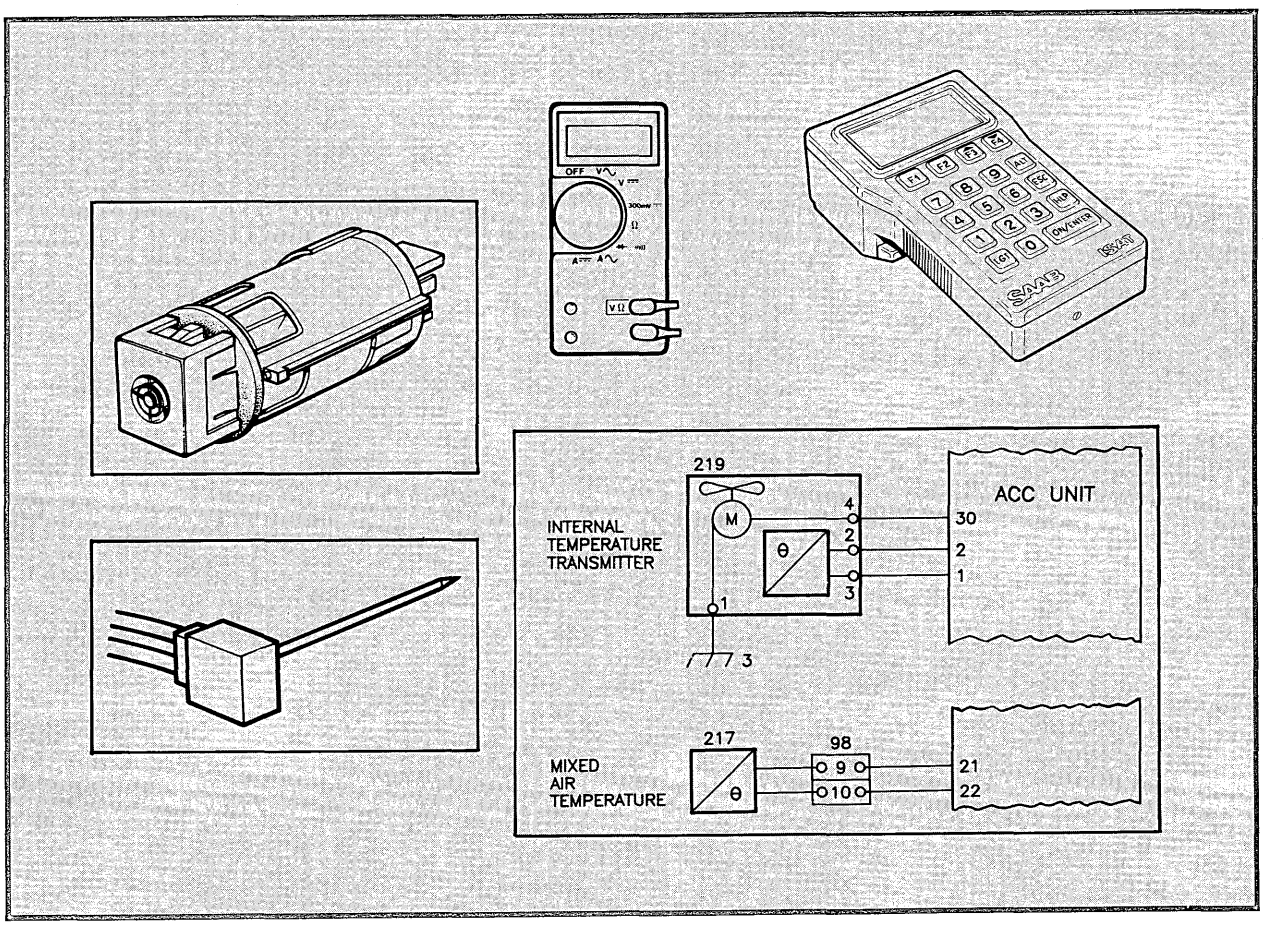
ISAT Command Codes	Display Shows
250	Indoor temperature = +10°C - +40°C.

If Display Shows	Possible Fault
Set temperature on +18°C	: Battery voltage pin 2. : LED's are dim.

ISAT Command Codes	Display Shows
252	Mixed air temperature = 0°C - +80°C.

If Display Shows	Possible Fault
Set temperature of 50°C (version 2.00) or calculated set value by ACC (version 2.01)	: Battery voltage at pin 22. : LED'S are dim.

46: Common sensor ground fault



This fault code is recorded when the self test program detects 12V or less on the common 0V line, pin 22 mixed air temperature sensor, and pin 2 inside temperature sensor.

1. With the ignition on measure the voltage of pin 2 or pin 22, and earth, from behind the ACC unit with a 39-pin plug connected.

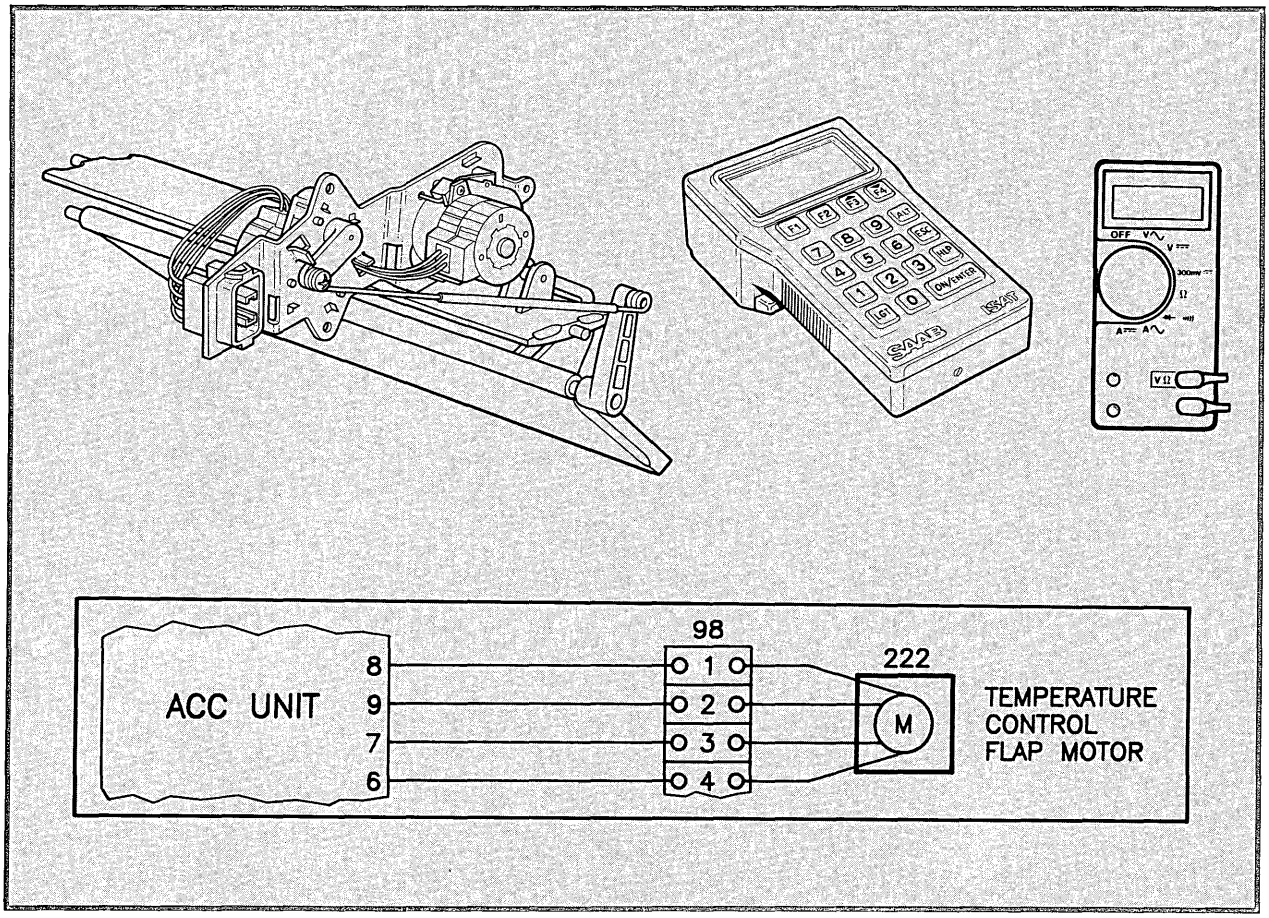
2. If a voltage is detected switch off the ignition, wait 35 seconds, and disconnect the 39-pin connector from the ACC unit.

3. Switch the ignition on. If a voltage is still detected check the wire to the sensor and the sensor itself.

4. If no voltage is detected refit all the plugs and clear the fault codes. Rerun the system to check that the fault is still present before trying a new ACC unit.

Notes

47: Temperature control flap motor check

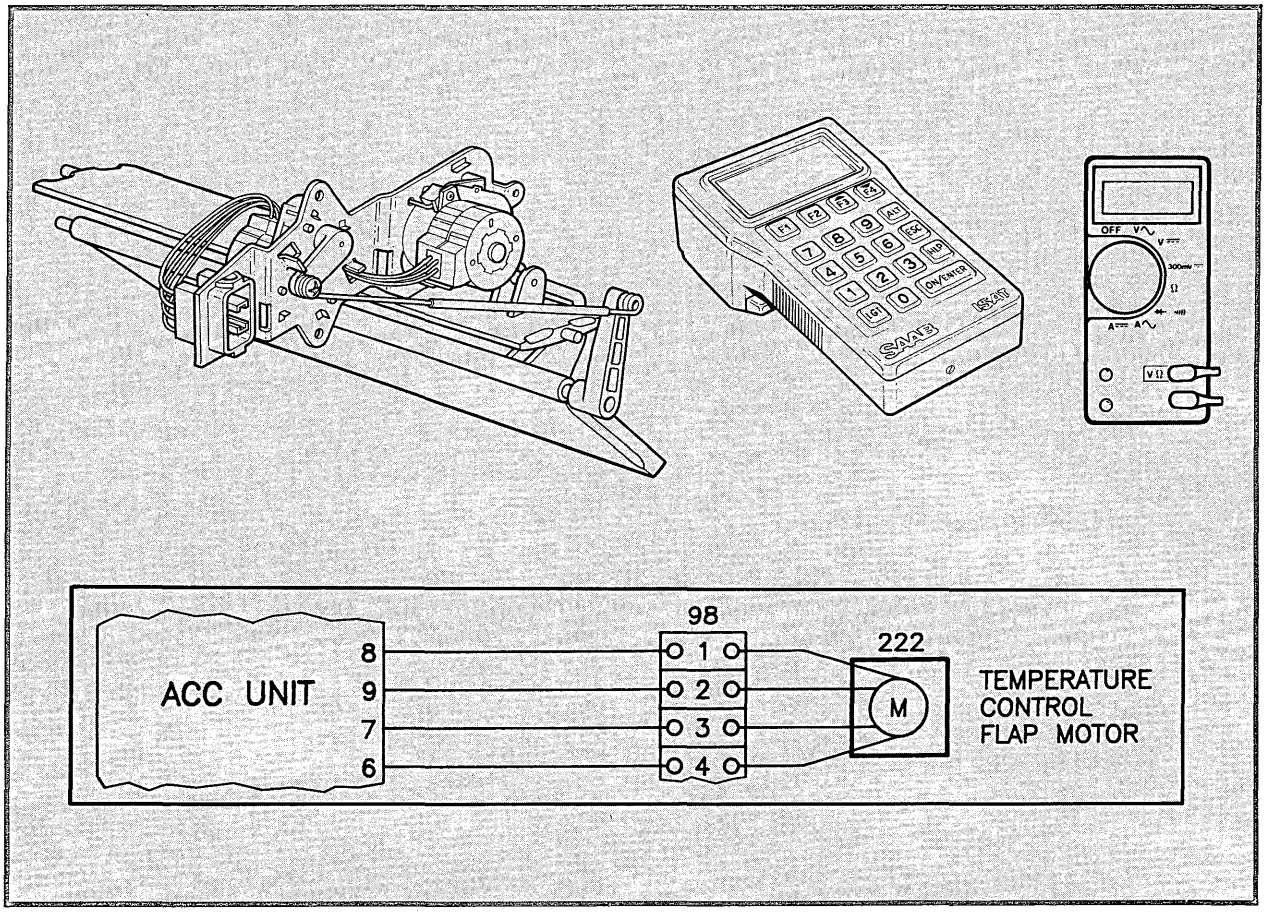


Fault Codes		Fault
Permanent	Intermittent	
53624	33624	Temperature control flap motor overload, open circuit, bridge circuit or internal short circuit in the ACC unit (fault code 53624 - 33624 on version 2.01 is together with 53674 - 33674).
53674	33674	Temperature control flap motor short circuit to earth (version 2.01).

ISAT Command Codes	Display Shows
27A	Desired position of temperature flap motor. 0% (LO) - 100% (HI).
IMPORTANT! Desired position of temperature flap motor does not mean that the motor is moving to different positions. It is a request from the ACC unit.	

Notes

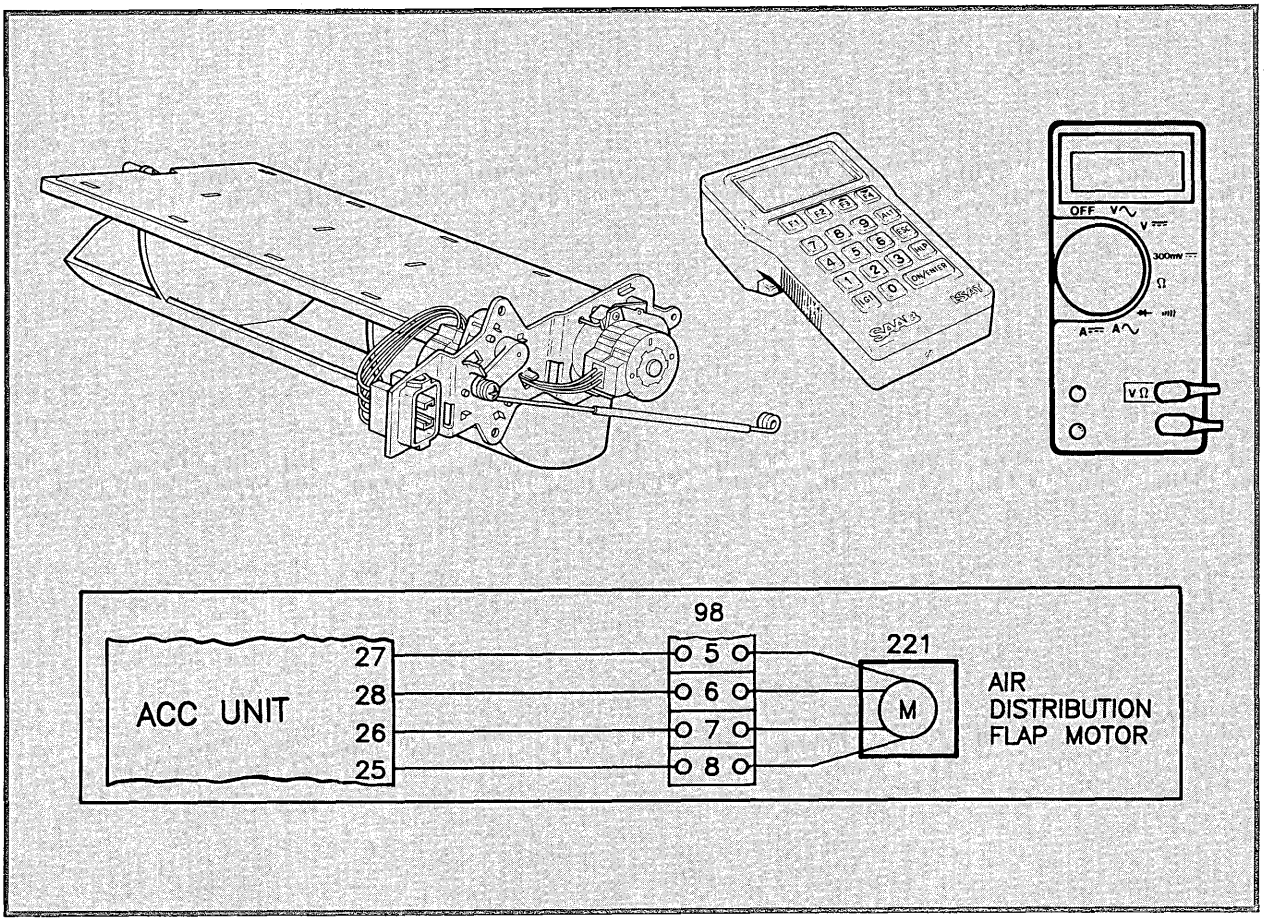
47: Temperature control flap motor check



1. Visually check that the motor is moving the temperature control flap, using the temperature select pushbuttons to alternately select HI and LO.
2. If the flap is not operating, disconnect the ACC unit 39-pin plug and check the resistance of the stepping motor windings across pins 6 & 7 and 8 & 9. The value should be approximately 100 ohms at 20°C.
3. If the resistance is incorrect, disconnect the stepping motor plug and check the resistance values directly across the motor windings. If these are incorrect try a new stepping motor.
4. If the stepping motor winding resistances are correct, check for continuity between the ACC unit plug and the stepping motor plug, 98. Check also for short circuits between the wires and to earth.
5. If all electrical measurements are normal, refit the plugs. Clear the fault codes and run the system to check that the fault is still present before trying a new stepping motor.
6. If fitting a new stepping motor fails to clear the fault, refit the old stepping motor unit and try a new ACC unit.

Notes

48: Distribution flap motor check

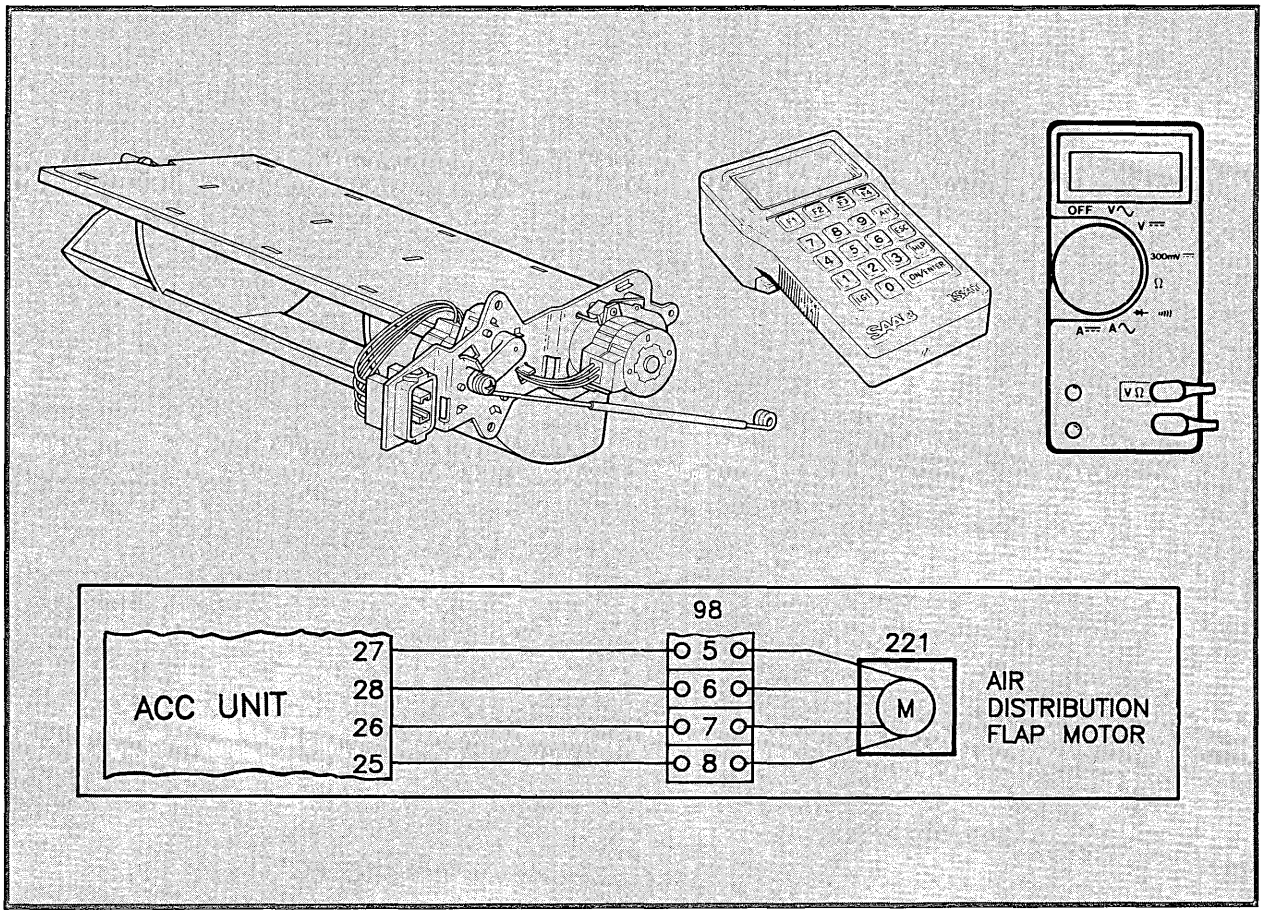


Fault Codes		Fault
Permanent	Intermittent	
53623	33623	Air distribution flap motor overload, open circuit, bridge circuit or internal short circuit in the ACC unit (fault code 53623 - 33623 on version 2.01 together with 53673 - 33673).
53673	33673	Air distribution flap motor, short circuit to earth (version 2.01).

ISAT Command Codes	Display Shows
27B	Desired position of distribution flap motor. 45°C (vent) - 135°C (def).
IMPORTANT! Desired position of distribution flap motor does not mean that the motor is moving to different positions. It is a request from the ACC unit.	

Notes

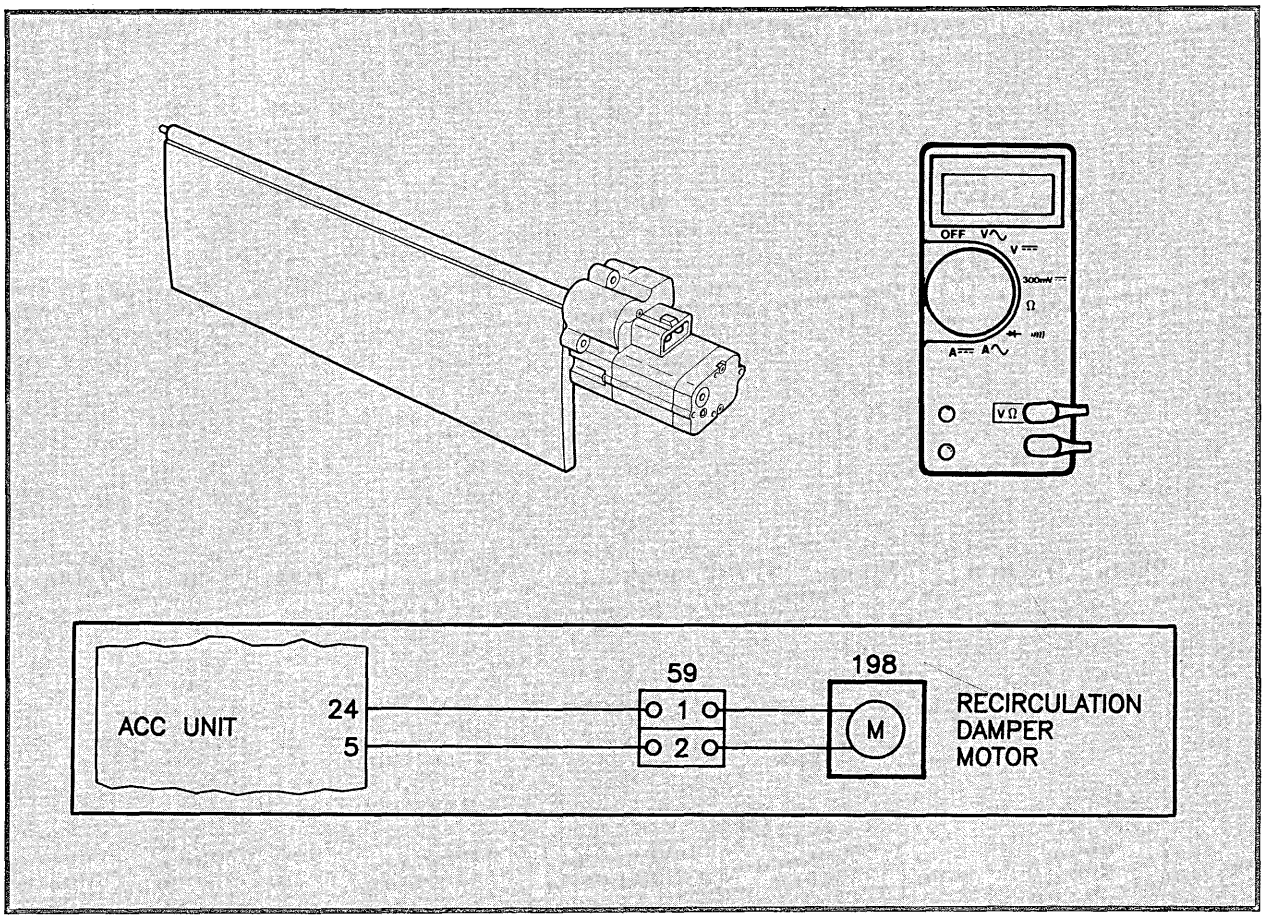
48: Distribution flap motor check



1. Visually check that the air distribution flap is working by selecting DEF and VENT to move the flap over the complete range of movement.
2. If the flap is not operating, disconnect the ACC unit 39-pin plug and check the resistance of the motor windings across pins 25 & 26 and 27 & 28. The value should be approximately 100 ohms at 20°C.
3. If the resistance is incorrect, disconnect the stepping motor plug, 98, and check the resistance values directly across the motor windings. If these are incorrect try a new stepping motor.
4. If the stepping motor winding resistances are correct, check for continuity between the ACC unit plug and the stepping motor plug. Check also for short circuits between the wires and to earth.
5. If all electrical measurements are normal refit the plugs. Clear the fault codes and run the system to check that the fault is still present before trying a new stepping motor.
6. If fitting a new stepping motor fails to clear the fault, refit the old stepping motor unit and try a new ACC unit.

Notes

49: Recirculation flap motor check

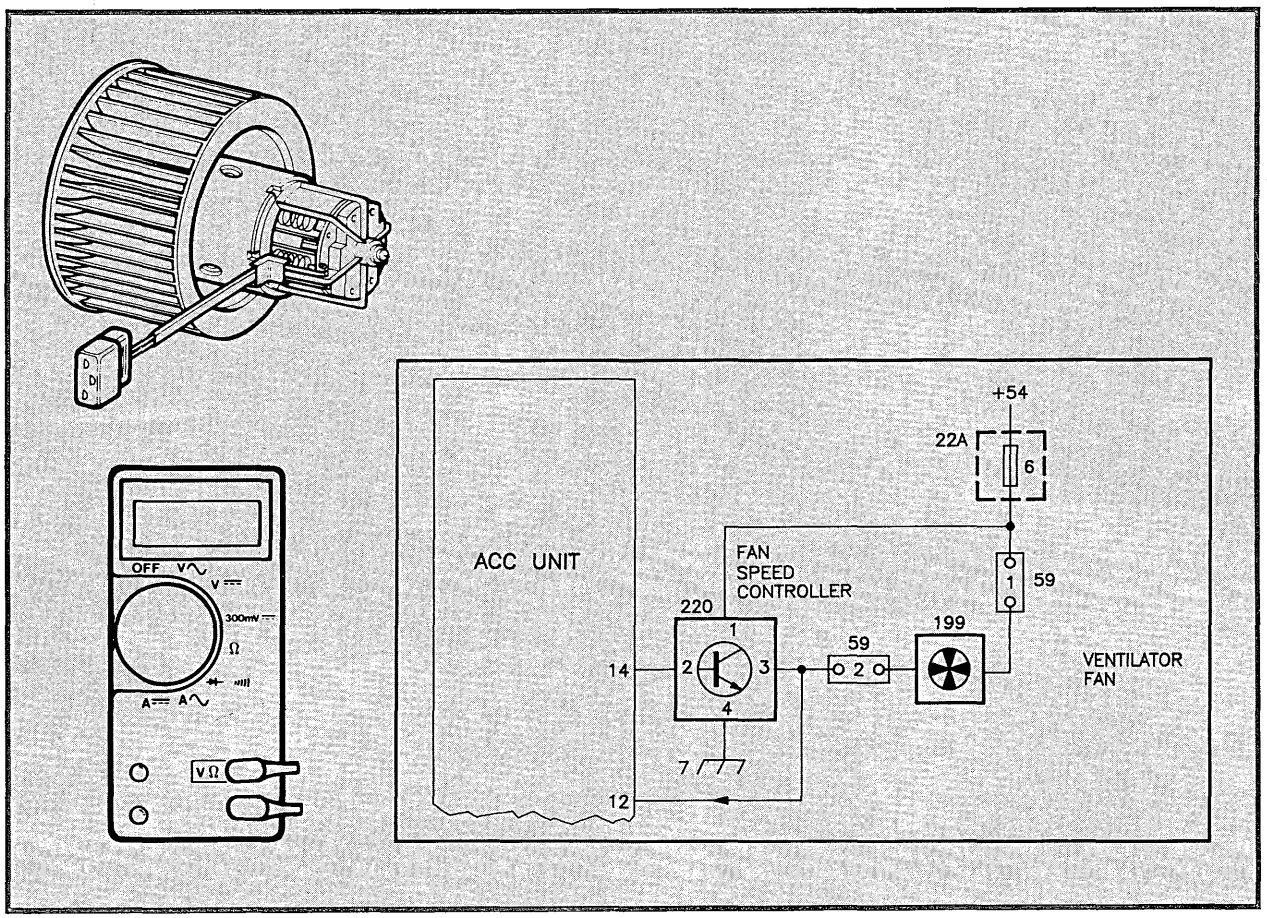


Fault Codes		Fault
Permanent	Intermittent	
53621	33621	Recriculation flap motor short circuit +12V. (Version 2.01)
53671	33671	Short circuit to earth.

ISAT Command Codes	Display Shows
279	Desired position of recirculation flap motor. Fresh air or recirculation.
IMPORTANT! Desired position of recirculation motor does not mean that the motor is moving to a different position. This is a Request from the ACC unit.	

1. Visually check if the flap is moving between the recirculation and fresh air positions when the flap is controlled manually.
2. Disconnect the ACC unit 39-pin plug and check the resistance of the motor windings across the plug pins 5 & 24. The value should be approximately 50 ohms.
3. If the resistance is incorrect, disconnect the motor plug and check the resistance value directly across the motor windings. If this is incorrect try a new motor.
4. If the motor winding resistance is correct, check for continuity between the ACC unit plug and the motor plug. Check also for short circuits between the wires and to earth.
5. If all electrical measurements are normal connect the 39 pin plug on the ACC and measure the voltage on plug 59, pins 1 and 2. Connect the Red cable from the multimeter on pin 1, and the Black cable on pin 2. The reading should be taken when the flap is moving to re-circulation (+10/12V) and the LED is illuminated or is moving to fresh air (–10/12V) and the LED is extinguished. If you get a correct reading try a new motor.
6. If not, try a new ACC unit.

50: Ventilation fan check



ISAT Command Codes	Display Shows
22A	Ventilation fan control signal, 0 - 5V.

CAUTION: THE FAN SPEED CONTROLLER HEAT SINK IS LIVE (1.5 TO 12V DEPENDING ON THE SPEED OF THE MOTOR), DO NOT CONNECT THE HEAT SINK TO EARTH.

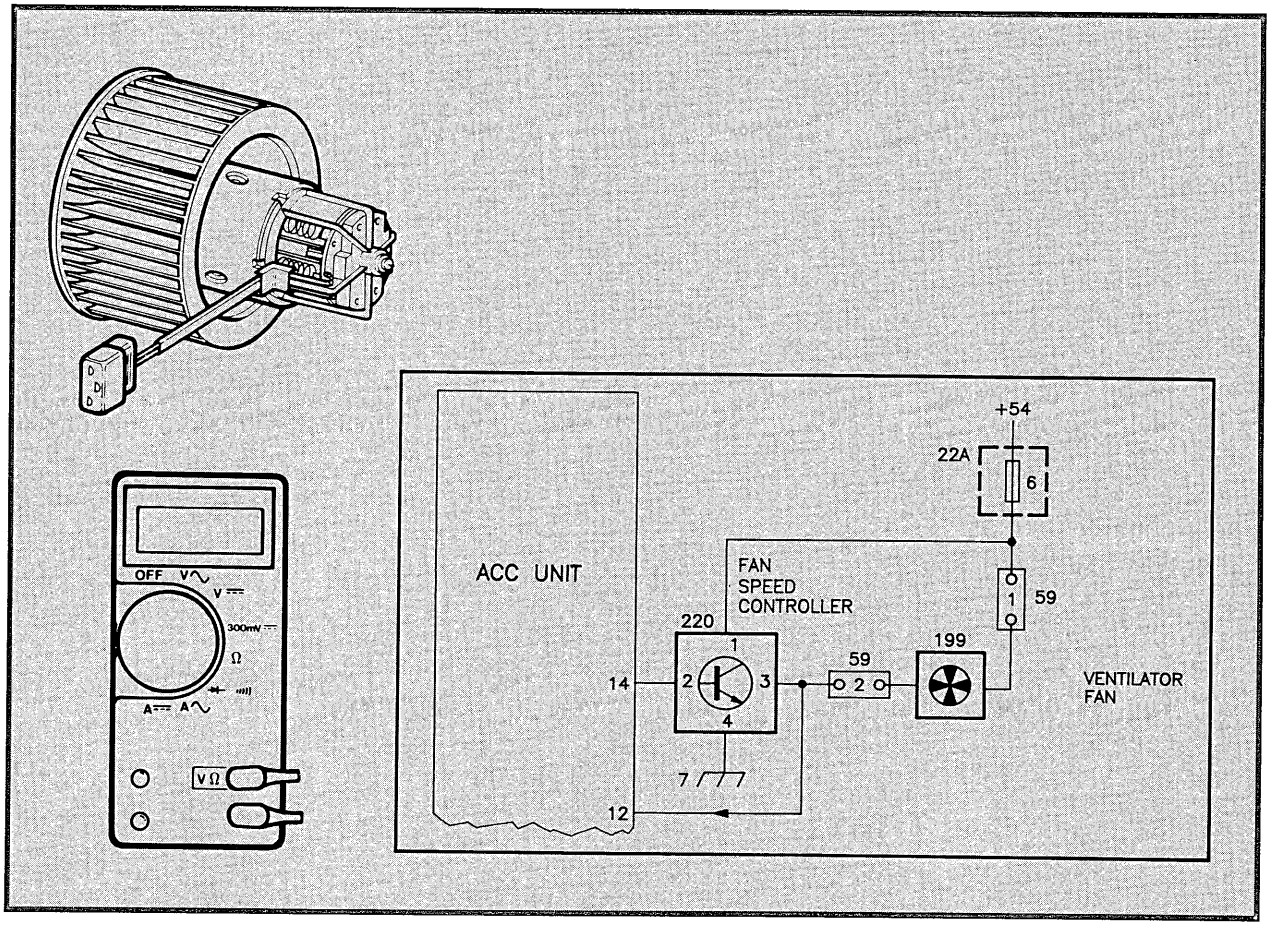
If the ventilation fan does not work, or the ACC cannot control the speed, carry out the following:

1. Check the ventilation fan fuse.
2. Check the ventilation fan control signal at the ACC unit (pin 14 and earth). Vary the speed using the manual fan buttons to change the level of the signal.
3. If control voltage measurement is incorrect, try a new ACC unit.
4. If the fan speed control signal is normal, disconnect the ACC unit 39-pin plug and check for continuity between pin 14 of the plug and pin 2 of the speed controller.
5. If the connection between the ACC unit and the fan speed controller is normal, check the supply voltage to pin 1 of the fan speed controller and the earth connection pin 4.

Signal levels

Signal Measured	ACC Pins	Connection	Voltage
Ventilation fan control	14 & earth	Min to max speed	0 to 5V
Speed check	12 & earth	Min to max speed	12 to 1V

50: Ventilation fan check



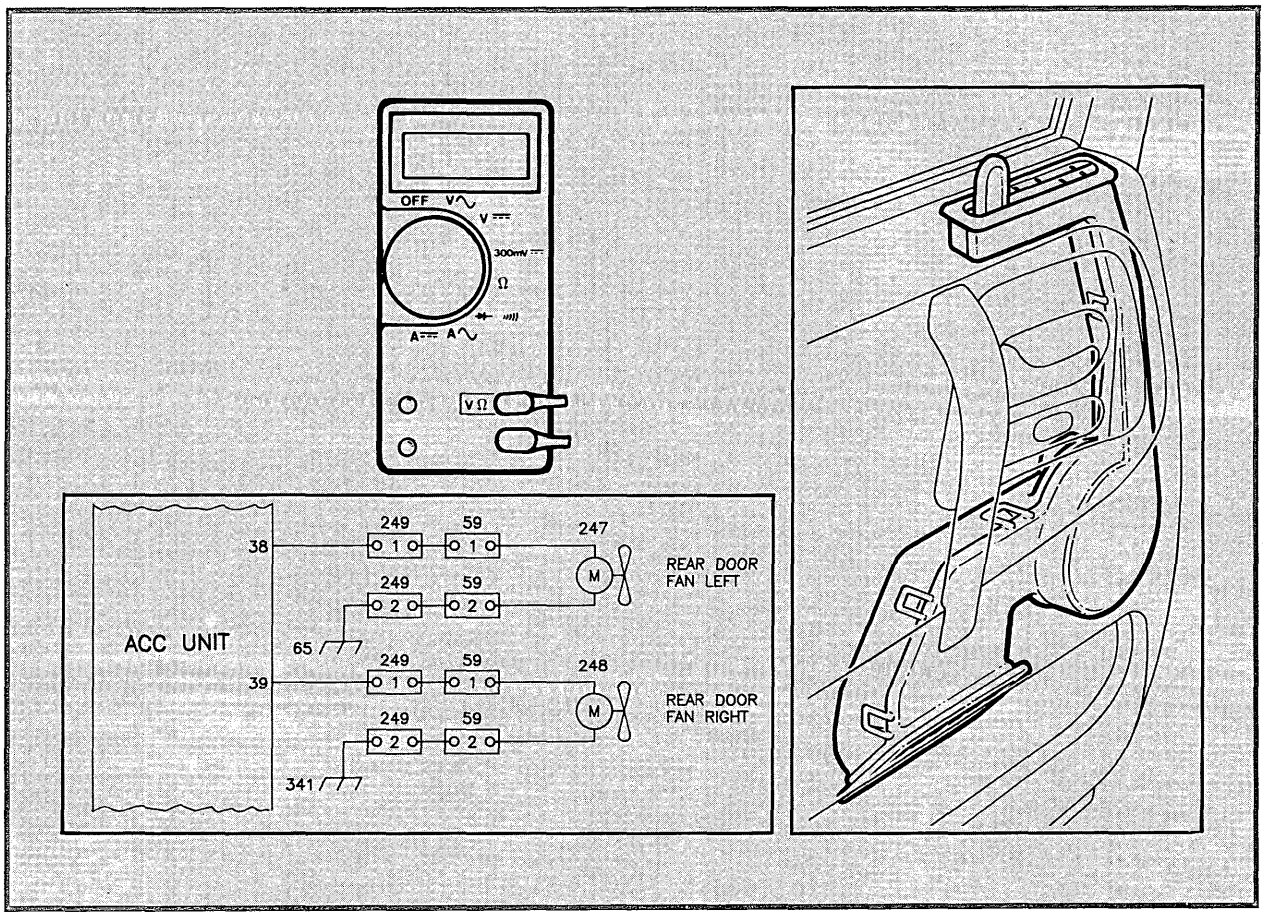
6. If the supply and earth connections are normal, short circuit pins 3 and 4 of the speed control unit plug with the unit disconnected. If the motor now runs the fault may be in the fan speed controller. However, refit all plugs and run the system to check if the fault is still present before trying a new fan speed controller.

7. If the motor fails to run with the fan speed control unit shorted out. Switch the ignition off and wait for 35 seconds. Disconnect the ACC unit 39-pin plug and the fan speed controller plug. Disconnect plug 59 and bridge pins 1 and 2. Determine whether it is open or short circuit to earth by measuring the resistance on the wires to plug 59 across pin 12 of the ACC unit plug and on the fuse box with fuse 6 removed.

8. If the value to plug 59 is correct, the fault may be in the motor. However, refit all plugs and run the system to check if the fault is still present before trying a new motor.

Notes

51: Rear door fans check



1. Check the fan output signal at pin 38 or 39 on the ACC unit, varying the speed manually by using the ventilation fan speed controls.

2. If the output signal is correct, disconnect the ACC unit 39-pin plug and check the resistance of the door fan windings. The value should be <80 ohms. If the resistance is correct, refit the plugs and run the system to check if the fault is still present.

3. If the motor resistance is incorrect, check the wiring between the motor and ACC unit 39-pin plugs, and if this is normal try a new motor.

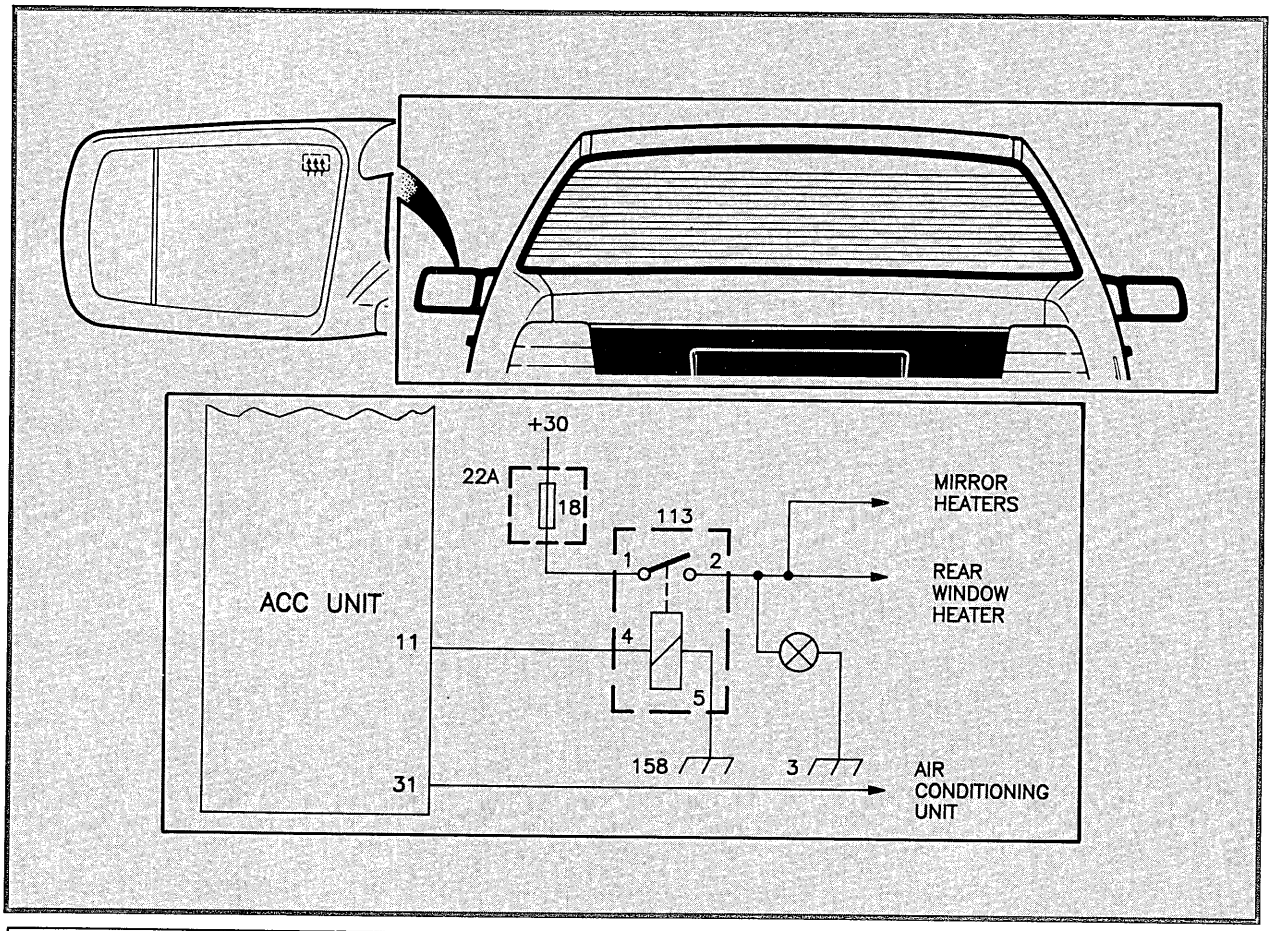
4. If the fan output signal is incorrect thoroughly check the 39-pin plug connections before trying a new ACC unit.

Signal levels

Signal Measured	ACC Pins	Condition	Voltage
Rear door fan left	38 & earth	Min to max speed Stopped	7 to 11V 0V
Rear door fan right	39 & earth	Min to max speed Stopped	7 to 11V 0V

Notes

52: Rear window and outside mirror heaters check



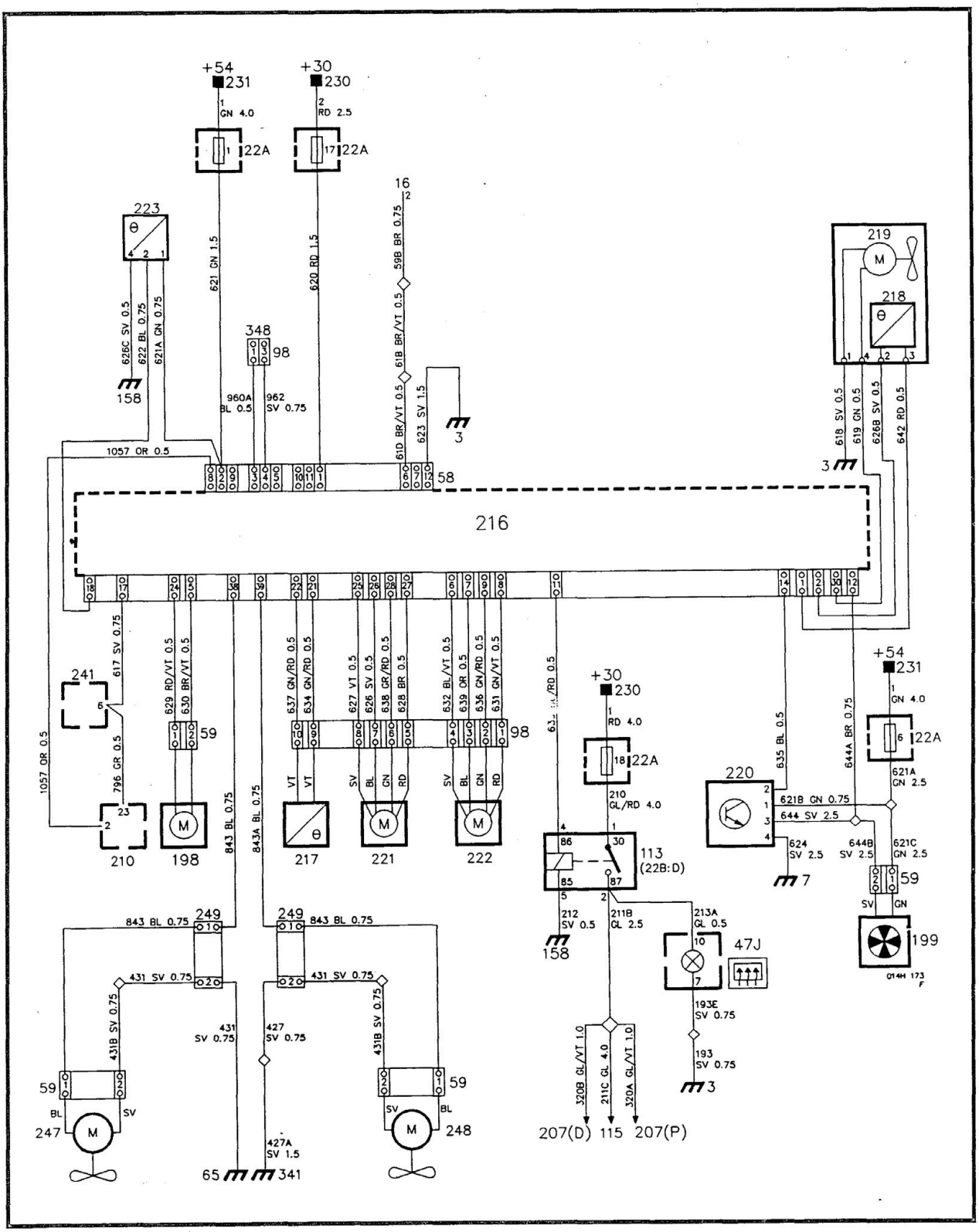
Fault Codes		Fault	
Permanent	**Intermittent**		
		Control signal rear demister relay	
53221	33221	Open circuit or short circuit to 12V (pin 11) with the rear demister off.	Version 2.01
53271	33271	Short circuit to earth (pin 11) with the rear demister on.	Version 2.01
		Control signal to AC relay or fuel injection control unit	
53222	33222	Open circuit or short circuit to 12V (pin 31) only with ECON on.	Version 2.01
53272	33272	Short circuit to earth (pin 31) only with AUTO on.	Version 2.01

1. Check the supply fuse (to the rear demister).
2. Check if a supply is obtained at the window heater when the supply is switched on manually.
3. If no supply is being obtained at the heater, check the rear heater signal at the ACC unit.
4. If the signal is correct the fault is in the relay unit or the associated wiring.
5. If the control signal from the ACC unit is incorrect, thoroughly check the ACC unit plug connections before trying a new ACC unit.

Signal levels

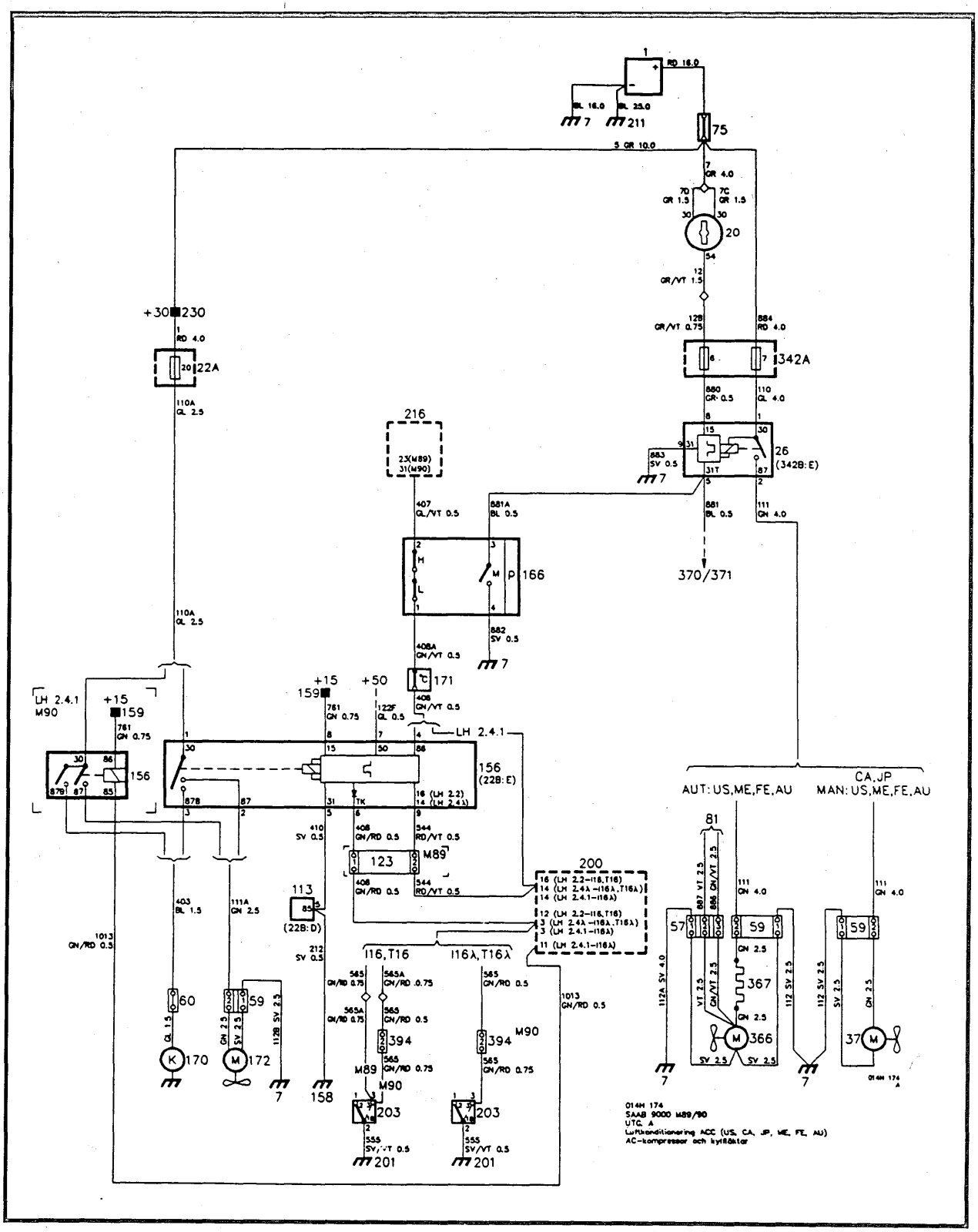
Signal Measured	ACC Pins	Condition	Voltage
Rear heater etc.	11 & Earth	On Off	12V 0V
AC	31 & Earth	Auto On	12V
AC	31 & Earth	ECON	0V

53: ACC Unit Wiring Diagram



Notes

54: Air Conditioning Unit Wiring Diagram



Notes

(GB) Art nr **304592**. English edition. Printed in Sweden.

Saab-Scania
Saab Car Division
Nyköping, Sweden