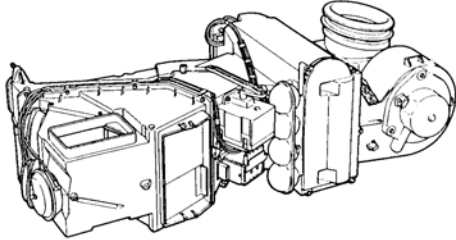


## Electronic Climate Control

**Note!** The unit on the 940 is a further development of the design of previous air conditioning (A/C) units. The function is the same on all variants.

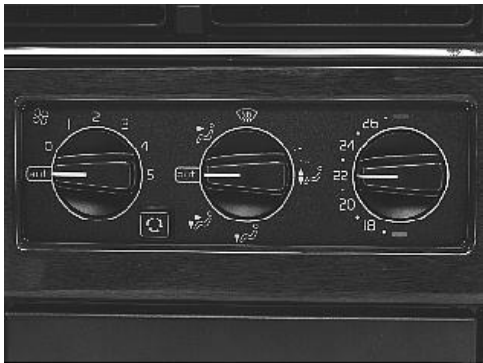


ECC is a further development of the ACC system.

ECC was introduced on the 940/960 from the beginning of 1991.

As before, the unit is of the air-mixing type, which means that cold and heated air are mixed to achieve the desired temperature. The advantage of this is that the interior temperature can be varied rapidly. The system features a new, microprocessor-based control system. The control system and control panel are described on page 28. [Control system](#)

### ECC without A/C function

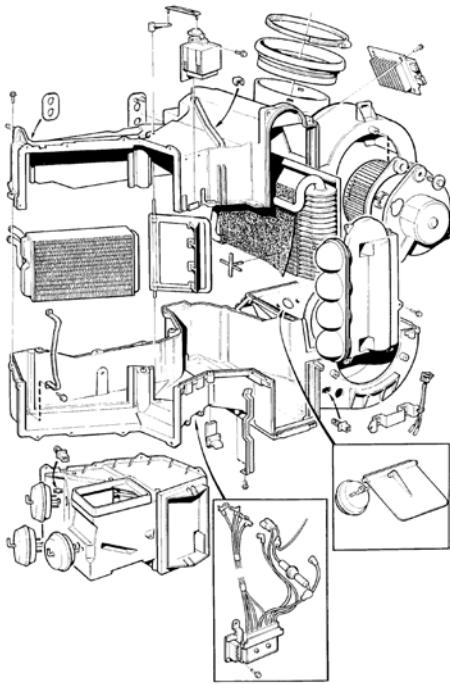


A variant of ECC without an A/C function was introduced on the 1993 960. This means that the unit operates like an automatic standard heater with electronic heating control. In other words, the interior climate cannot be controlled at a value lower than ambient. The illustration shows a control panel for ECC without A/C, the difference being that the A/C button has been eliminated (compare with panel on page 28).

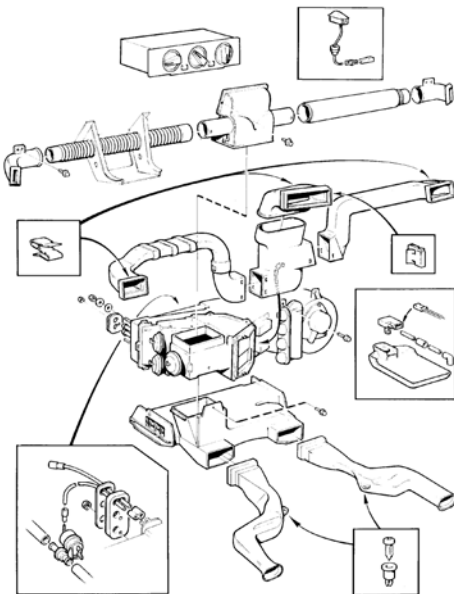
The ECC control module must be removed to request a diagnostic trouble code (DTC). The diagnostic test button and LED for displaying the code are mounted on the module PCB. [Control system](#)

This variant of ECC is described in further detail on page 76.

### Main components, overview



### Air distribution, overview

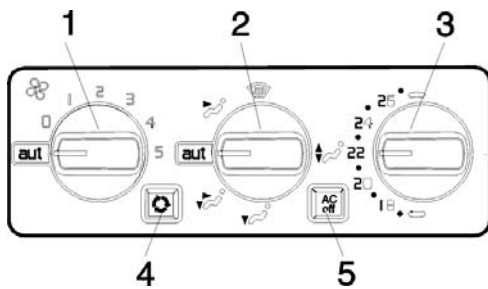


### Control system

The control system consists of the following components:

- ECC control panel
- Power assistance unit
- Solenoid block
- Power unit
- Sensor (x 4)

The ECC control panel is completely new.



1. Blower, automatic or manual
2. Air distribution, automatic or manual
3. Temperature control
4. Recirculation in all positions except defroster
5. A/C on/off + fault indication + 23 DTCs

These afford wide latitude for individual adjustment of the interior climate. In addition to fully automatic operation, all controls can be operated manually.

The A/C unit can be switched off with the A/C button (5).

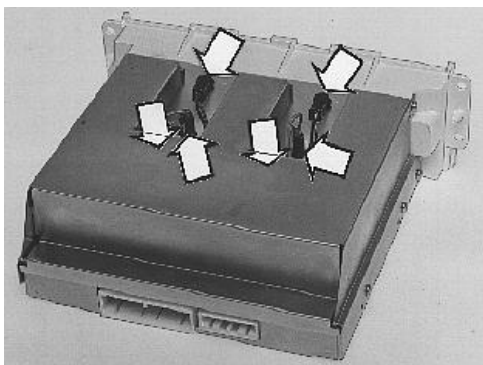
On **1991 cars** the air conditioning (A/C) switch must be **in the out position** ( **snowflake symbol unlit** ). For the **Auto function** the air conditioning (A/C) switch must be pressed in. The compressor is then engaged and disengaged automatically. On **cars from 1991 and onward** the air conditioning (A/C) switch must be **pressed in** ( **air conditioning (A/C) symbol light AC is on continuously** ). For the **Auto function** the air conditioning (A/C) switch must be in the released (out) position (AC ON). The compressor is then engaged and disengaged automatically.

Recirculation can be selected in all positions except defroster. During recirculation, 90% of the air is drawn from the interior and 10% from outside.

#### Inbuilt fault indication

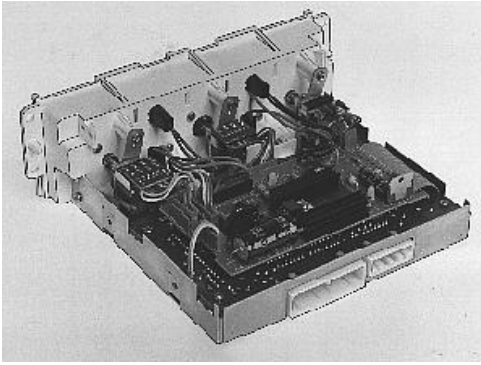
The EEC system has an integral fault indication system which flashes responses using the air conditioning (A/C) switch. Using a three-part code 23 different types of fault can be identified.

## Control module, lamps



#### Lamps

The six lamps on the control module can be replaced without removing the cover.

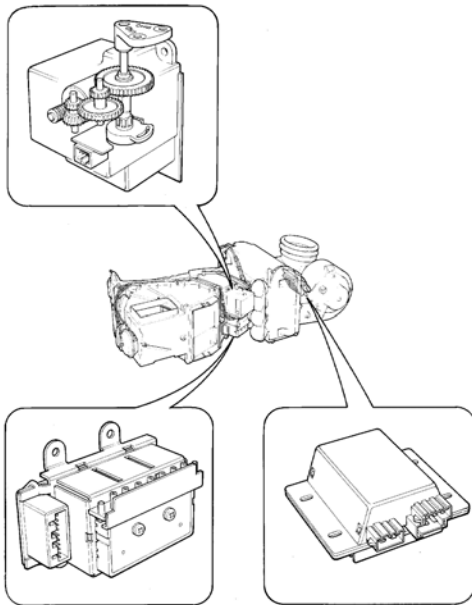


### Control module

The control module is located behind the control panel. Under normal circumstances, the cover need never be removed.

## Servomotor, solenoid valves and power stage

### Servomotor



An electric motor is used to operate the air mixing shutter. A potentiometer mounted adjacent to the motor detects the shutter position. A worm gear is used to reduce the motor speed and stroke.

Although the climate unit is installed in mirror-image configuration in LHD and RHD cars, the same servomotor is used. Different holes are provided for attaching the shutter arm.

### Solenoid valves

The solenoid valves open and close the vacuum lines from the vacuum bells used to control the shutters, in response to electrical signals from the microprocessor.

The few vacuum hoses which are installed are securely clamped, eliminating the risks of interchanging and pinching the hoses.

**Note! The vacuum hoses cannot be removed individually.**

The vacuum functions are shown in the diagram on page 32. [Blower housing, evaporator and vacuum tank](#)

### Power stage

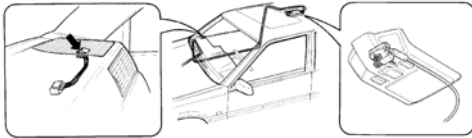
The power stage amplifies the control signals to operate the blower motor and control compressor operation.

The blower speed is controlled by a power transistor. A relay is connected into the circuit at the highest speed reduce the load on the transistor, while a second relay controls the operation of the compressor through the low-pressure pressostat on the air receiver/dryer. On the 960 from 1995 on, this relay has been relocated in the fusebox' in the engine compartment.

The power stage is mounted on the evaporator housing to ensure that it receives cooling. The unit is provided with cooling fins facing inwards towards the evaporator and is cooled by the air flow from the blower.

## Sensors (four)

### Sun sensor



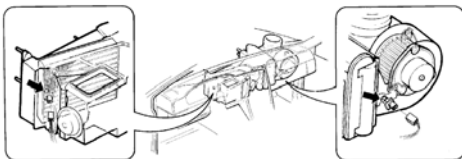
The solar sensor, which is located in the right-hand loudspeaker grille on the dashboard, measures the incident sunlight.

The device can compensate the interior temperature by a maximum of 3°C (5°F).

### In-car temperature sensor

The interior temperature sensor, which is located in the roof light, measures the temperature in the passenger compartment at head level. The device is ventilated by means of a tube from the intake manifold, through which air is drawn through the sensor.

### Engine coolant temperature (ECT) sensor



The water temperature sensor at the heater actually measures the air temperature immediately adjacent to the unit. This prevents the blower from starting at the highest speed in the automatic mode before the coolant has begun to heat up. The blower speed increases gradually with coolant temperature.

### Operates even if the sensor is faulty

To avoid the entire system failing should just one sensor become defective it is programmed to operate in a reduced function mode. The unit will however respond more slowly and temperature regulation will be less precise.

The A/C button will flash to indicate the

presence of a fault (not, however, a solar sensor fault).

### Outer temperature sensor

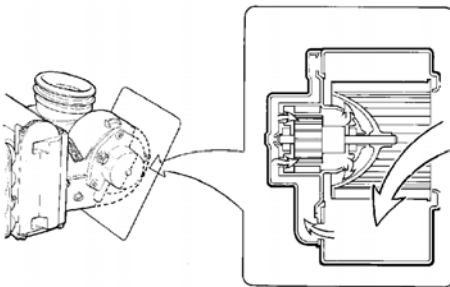
The ambient temperature sensor, which is mounted on top of the blower housing, measures the temperature of the inlet air. Thus, during recirculation, the sensor measures the temperature of the air drawn from the interior of the car.

### NTC resistance and photo reactive diode

NTC resistor and photocell. The ambient, interior and water temperature sensors are resistors of the NTC (negative temperature coefficient) type, the resistance of which falls with rising temperature. The resistance is 9.9 k $\Omega$  at 25°C (77°F).

The solar sensor is a photocell.

### Blower housing, evaporator and vacuum tank

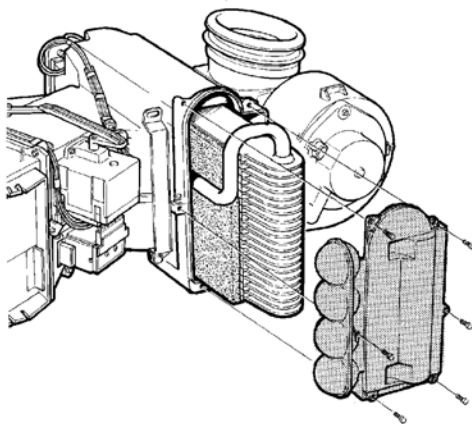


#### Note! The fan shroud turned (960 only)

The blower is now installed horizontally in the heater, affording more room for the feet. The blower motor is fully supported on rubber mountings and, as a result, runs more smoothly than before. The blower cools itself by drawing an air supply through the motor from a duct.

The blower motor is also of a higher capacity than before although the current consumption is lower.

### Evaporator opening



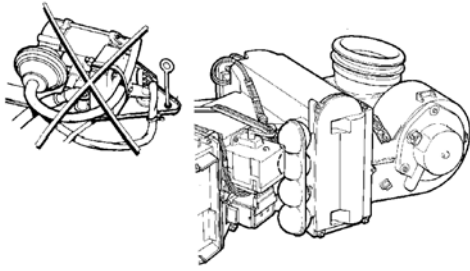
The evaporator is easily accessed through a special opening at the rear of the unit. The vacuum tank is also mounted on the cover (as illustrated below).

The evaporator is also provided with a filter to prevent water droplets formed on the unit from being blown into the system.

(the 940 has the old shrouds and therefore does not have the new cover for the evaporator).

### Integral vacuum tank

The vacuum tank is mounted on the heater



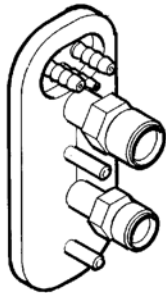
housing, between the servomotor and evaporator.

The electrical vacuum pump previously installed in the engine compartment has been discontinued.

Ordinary engine vacuum is now sufficient since the system is electronically controlled and vacuum is only needed in the four vacuum bells used to operate the shutters.

The solenoid valves open and close to control the vacuum in the vacuum bells.

### Fewer penetrations to engine compartment



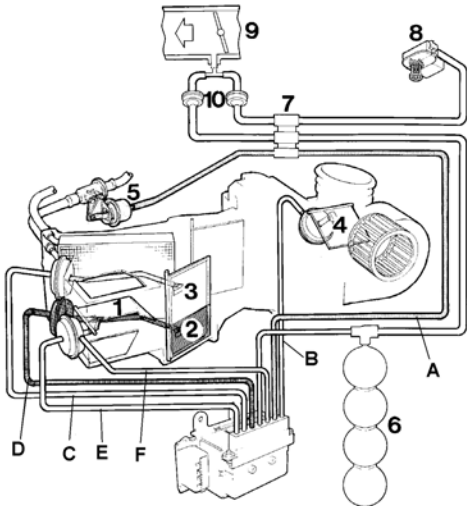
**Note!** The illustration is of a 960. The 940 is the same as before.

Only three vacuum lines pass through the firewall into the engine compartment:

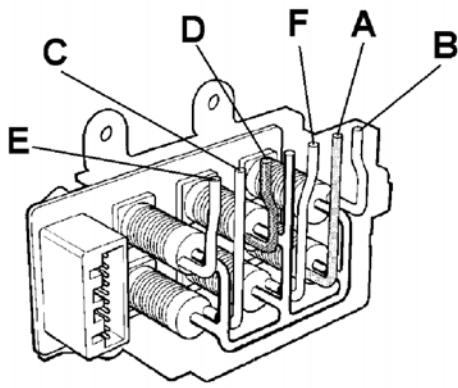
- between the engine compartment and vacuum tank;
- between the engine compartment and the interior temperature sensor in the roof light;
- between the solenoid valves and the vacuum-controlled water valve.

No electrical wiring passes into the engine compartment.

### Vacuum functions

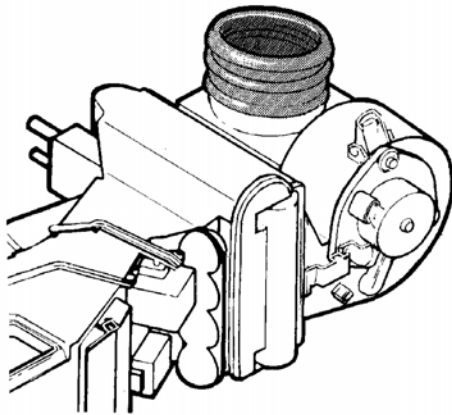


1. Floor/defroster shutter
2. Bi-level shutter
3. Ventilation shutter
4. Recirculation shutter
5. Water valve
6. Vacuum tank
7. Firewall penetration
8. Interior temperature sensor
9. Intake manifold
10. Check valves



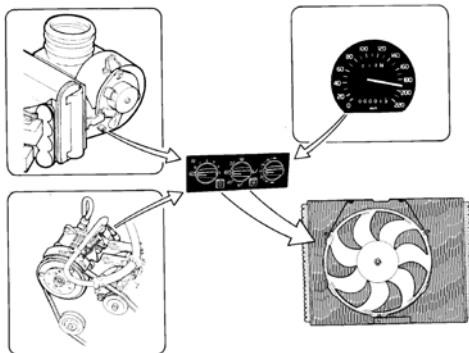
Component	Vacuum hose	Vacuum on	Vacuum off
5. Water valve	A. Grey	Closed (cold)	Open (hot)
4. Recirculation shutter	B. Orange	Recirculation	Ambient air
3. Ventilation shutter	C. Red	Open, also operates bi-level shutter mechanically	Closed
2. Bi-level shutter	D. Transparent/Beige	Open	Closed
1. Defroster shutter	E. Blue	Shutter in lower position	Mid-position
1. Floor shutter	F. Yellow	Shutter in upper position	Mid-position

### Rubber bellows at air intake



The air intake is fitted with a rubber bellows which greatly facilitates installation of the climate unit.

### Engine cooling fan control



The engine cooling fan (FC) is switched in as normal by closure of the thermostat in the radiator.

The engine cooling fan (FC) can however be engaged via the ECC control module. The engine cooling fan is then controlled by speed, ambient temperature and by whether or not the compressor is engaged.

When A/C is engaged, the FC is also controlled by two pressure switches, one for low speed and the other for high speed (see page 8 for operating settings). **Pressure**



### switches

On and off operation is subject to **hysteresis** (the overlap between switch-on and switch-off). (Compare the case of an automatic transmission shifting up at 70 km/h/44 mph and down at 65 km/h/40 mph.) Conditions a, b and c below must be met for switch-on.

**a.** Ambient temperature 28°C (82°F): Switch-on if b and c are also fulfilled (Ambient temperature 24°C (75°F): Switch-off operation in all cases)

**b.** Vehicle speed 50 km/h (31 mph): Switch-off (in all cases) Vehicle speed 15 km/h (9.4 mph): Switch-on if a and c are also fulfilled.

**c.** Compressor running

(On 960s from 1995 on, the FC is controlled by the engine control module (ECM) instead of the ECC control module.)

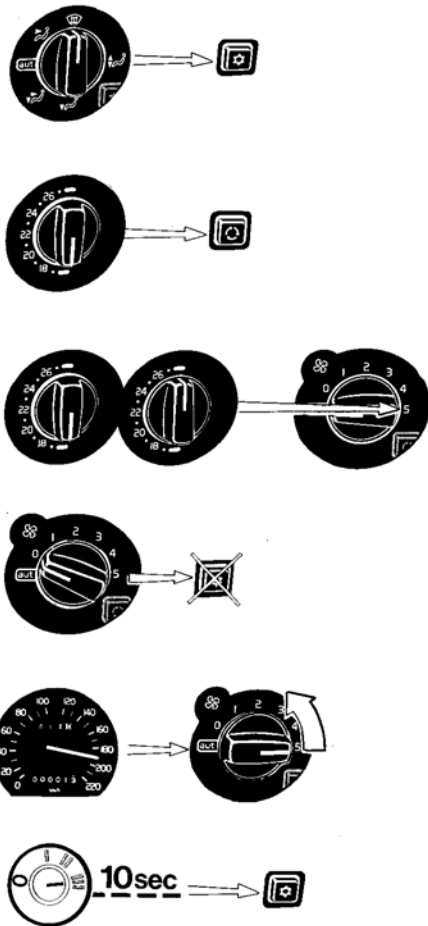
#### **Example:**

The engine cooling fan (FC) will **start** when the temperature measured by the sensor on the blower housing is at least 28°C and the vehicle speed is less than 15 km/h and the compressor is engaged. (However, the FC will not stop unless the temperature falls below 24°C or the vehicle speed exceeds 50 km/h if the compressor is still engaged.)

The FC **will not start**, even if the temperature exceeds 28°C (82°F) and the vehicle speed is less than 15 km/h (9.4 mph), if the compressor is not running.

### **Override control in certain cases**

- if the defroster setting is selected, A/C will be engaged in all cases (if the ambient temperature is at least +5°C/41.0°F) and recirculation is deselected.
- If max. cooling is selected (and A/C is engaged), recirculation will be engaged in all cases, except when the defroster setting is selected.
- If max. cooling or max. heating is selected, the blower will run at max. speed in all cases if the blower selector is set to auto.
- If the 0 blower speed setting is selected, the A/C compressor will be switched out to prevent icing of the evaporator.
- At high vehicle speeds, the control module reduces the blower speed to provide a constant air flow inside the car. (Under



these conditions, air is forced into the car by the ram action' of the air in front of it.) This applies to all blower settings, but not at max. cooling, max. heating or recirculation.

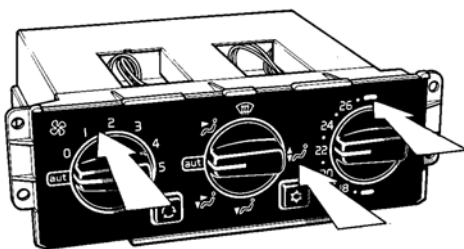
- Compressor switch-in is delayed for 10 seconds when the engine is started. This is to prevent stalling of the engine before the speed has stabilised. (However, the A/C button will be illuminated after 2 seconds.)

### Special functions

The control module will substitute a preprogrammed value for a missing or incorrect parameter.

The control module will restart the program if it should crash'. (This may be caused by the effects of external interference on the electronics).

### Parking heater input



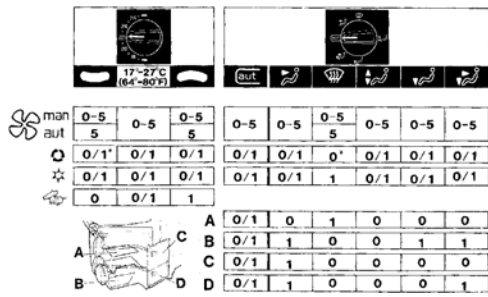
The control module is provided with a special input for use when a parking heater is installed. When the parking heater is started, the climate unit is automatically set as follows:

- blower between settings 1 and 2
- floor/defroster
- max. heat

### Function diagram

#### How to read the chart:

Select the symbol corresponding to the particular setting at the top of the table. The



column directly underneath shows the actual or possible settings of the various components shown at the left of the chart.

"0-5" indicates the blower settings (the setting is steplessly variable in the automatic position). "1" indicates "Open"/"On".

"0" indicates "Closed"/"Off".

"0/1" indicates either 0 or 1, depending on other selected settings or whether the blower is on automatic.

\* If max. cooling is selected, recirculation will be engaged to achieve faster cooling (although never in the defroster position).

### Control module response to faults

If a fault is detected, the control module will ignore the incorrect signal and will select a preset value which will **"make the best"** of the situation. If, for example, the servomotor potentiometer is faulty, the air mixing shutter will assume the position corresponding to the temperature selector. If the servomotor does not operate due, for example, to seizure of the arm or loss of the motor supply, the motor will be switched out after 10 seconds and will be prevented from restarting until the ignition is next switched on. If the blower motor or servomotor is connected to the incorrect supply voltage, the unit in question will be switched out immediately. In the event of a blower motor fault, starting of both the blower and compressor will be inhibited.