

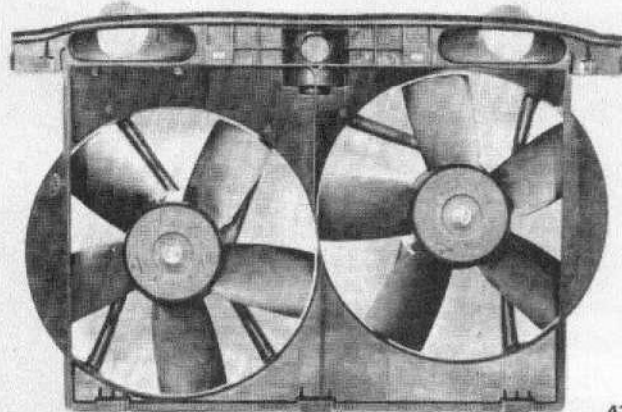
Engine – Cooling Air Regulation

To permit cooling matched with the operating condition of the engine, cooling air regulation is accomplished with a new cooling air flap and radiator fan control. With cooling air flap control the air flow cross section size of engine cooling air is changed with a motor-operated flap mechanism, depending on cooled air requirements. In case of greater cooled air requirements two electric radiator fan motors are activated infinitely through a final stage with the radiator fan control.

928 606 15200

Two electric radiator fans are installed instead of the former visco fan.

Each radiator fan has a power consumption of approx. 200 W/12 V.

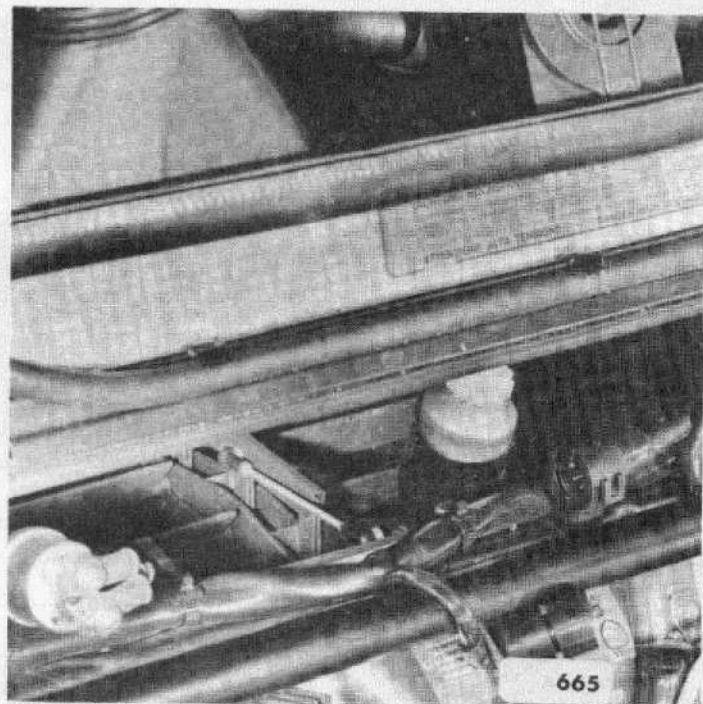


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Cool air coming in through the new front spoiler is regulated by an electric operating motor via cool air regulating flaps in front of the radiator entry. The operating motor can position three flap positions.

- 0 % – flaps closed
- 30 % – flaps opened
- 100 % – flaps wide open

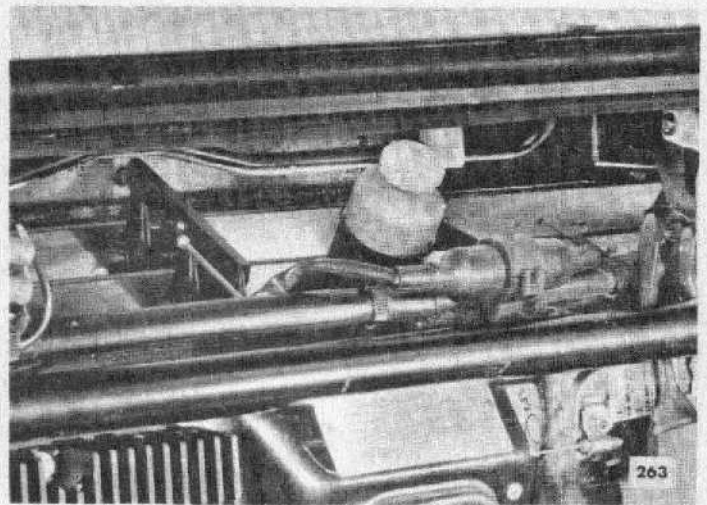
Flap positions are adjusted by a linkage which is connected with the operating motor crank. The crank position corresponding with the flap position is stored mechanically on a control disc integrated in the operating motor. Activation through the control unit takes place via relay XVIII on central electric board, which stops the operating motor after reaching a flap position.



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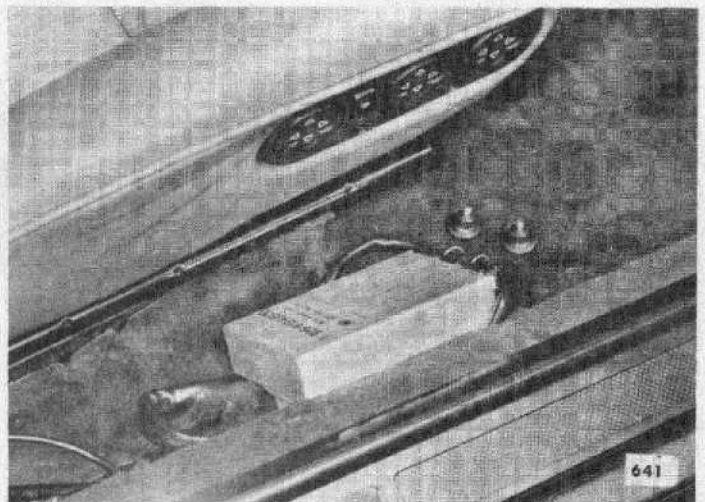
Engine – Cooling Air Regulation

If the operating motor is not activated due to a fault, the rubber protective cap could be pulled off of the operating motor and the flaps opened manually with a knurled nut.



Control Unit

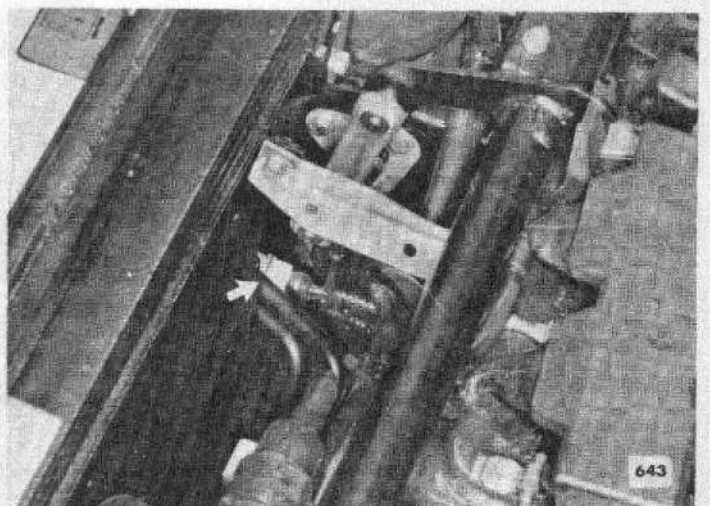
The control unit for flap and radiator fan control is located next to the passenger's seat (in front of the radio booster).



The control unit processes information from various sensors, such as

... coolant temperature by way of coolant temperature sensor in radiator at front left (radiator outlet).

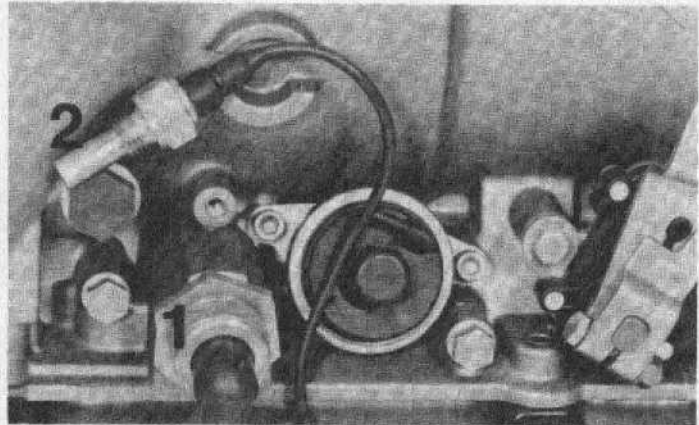
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Engine – Cooling Air Regulation

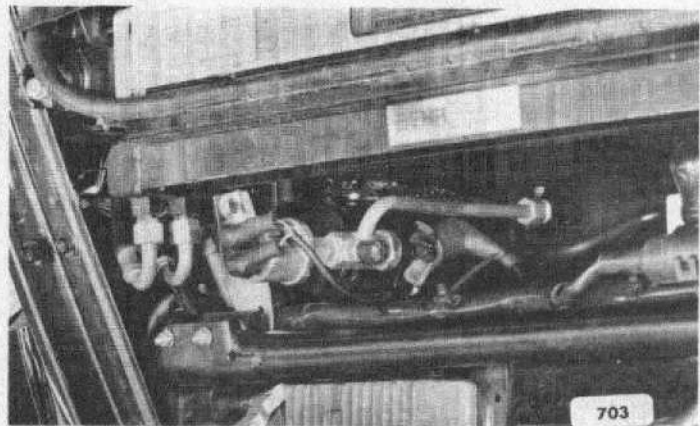
Control Unit

... ATF temperature (only automatic transmission M 249) by way of temperature switch in ATF cooling pipe on transmission; *928 606 15200*

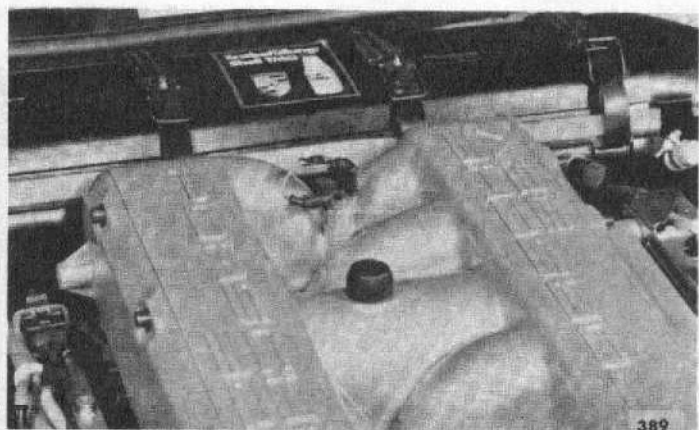


... refrigerant pressure of air conditioner by way of pressure sensor next to drier

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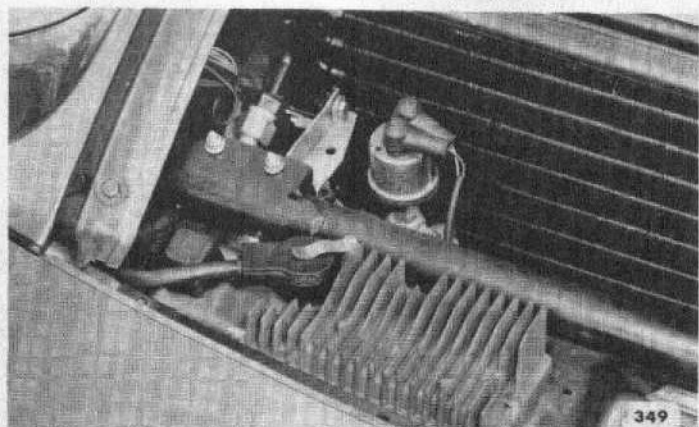
... and intake air temperature by way of temperature switch in intake manifold.



The control unit monitors the coolant temperature sensor and refrigerant pressure sensor for short circuits and breaks, and activates the cool air flaps to 100 % (wide open) in case of fault as well as the radiator fans to max. speed.

Final Stage

A radiator fan final stage is located on the lock cross wall at front right.



Engine – Cooling Air Regulation

Final Stage

The final stage receives a pulse width modulating square signal from the control unit. The final stage consists of two independent, separately fused final stage modules, which each activate a radiator fan.

The following monitoring functions are performed and reported back to the control unit.

Blocking of radiator fan

Short circuit on terminals of radiator fan

Breaks in leads between:

- ... battery + and final stage +,
- ... final stage outlet and radiator fan + connection,
- ... and final stage ground and body ground

If a fault occurs, cooling air flaps will be opened 100 % (wide open) and the still functioning radiator fan operated at max. speed. The faulty radiator fan will even be switched off. The system is checked at intervals of 20 seconds to determine, whether the fault still exists.

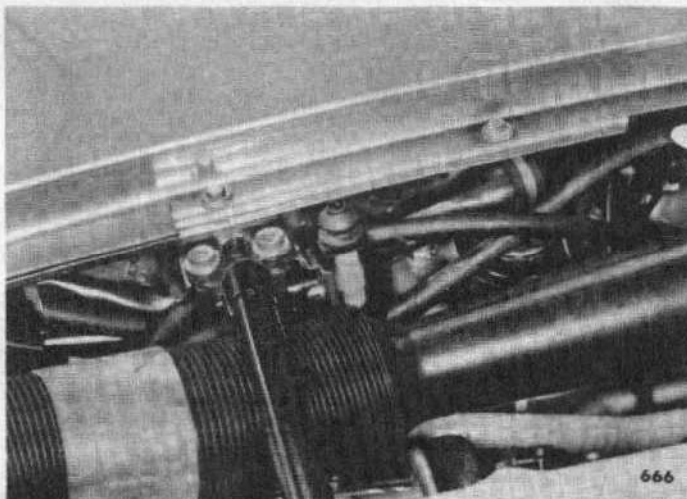
The final stage regulates the radiator fan speed by changing the voltage on the fan motors between 6.5 and 12 volts analog control signals from the control unit.

Engine Hood Switch

The alarm switch of the burglar alarm is located on the right side of the engine compartment. This switch is now standard and also used as a safety switch for after-running of the fans.

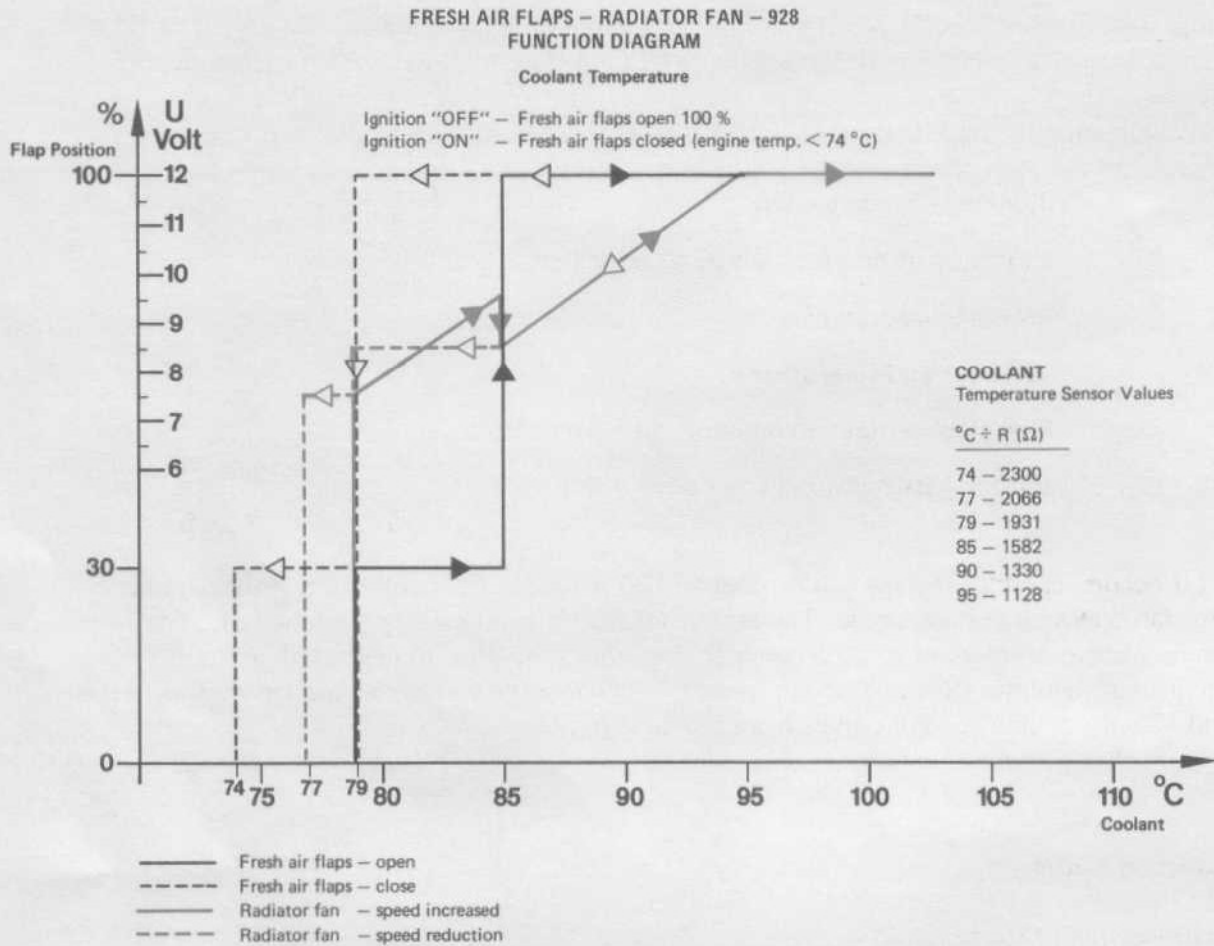
It only has influence in ignition "OFF" or with the ignition key removed.

If the radiator fans would run on, they would be stopped when raising the engine hood.



Important: This protective measure is only fully guaranteed when the ignition key is removed.

Function – (Coolant Temperature Sensor)



Flaps are always opened 100 % with the ignition turned off.

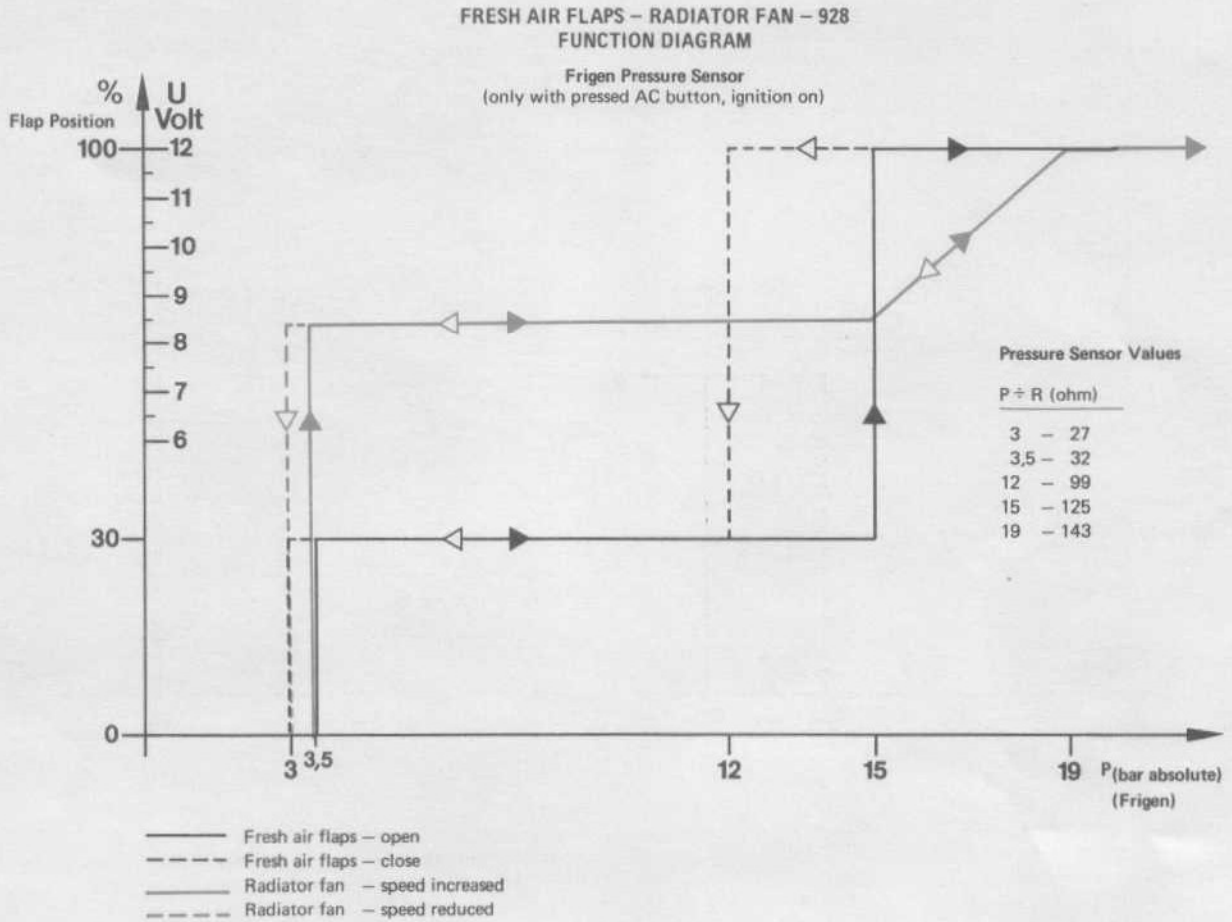
If the ignition is turned on and the engine is cold (< 74 °C), the cooling air flaps will be closed.

In accordance with the diagram above, the cooling air flaps will be opened 30 % by the coolant temperature sensor when reaching a coolant temperature of 79 °C. Both radiator fans will also be operated at approximately half speed (7.5 V). The speed of both radiator fans will be increased (9.5 V) as the coolant temperature rises.

The radiator fan speed will be taken back (approx. 8.5 V) and the cooling air flaps opened wide (100 %) after reaching a coolant temperature of 85 °C. A further increase in coolant temperature will cause the radiator fan speed to also increase up to the maximum speed (12 V/95 °C).

If the coolant temperature drops to < 95 °C, the radiator fan speed will be taken back (~ 85 °C/ ~ 8.5 V) and remains at a constant speed equal to 8.5 volts up to a coolant temperature of approx. 79 °C, is reduced to 7.5 V and the radiator fans will be switched off when reaching a coolant temperature of approx. 77 °C. The cooling air flaps are adjusted to a 30 % opening at a coolant temperature of 79 °C and closed as from approximately 74 °C.

Function – (Refrigerant Pressure Sensor)



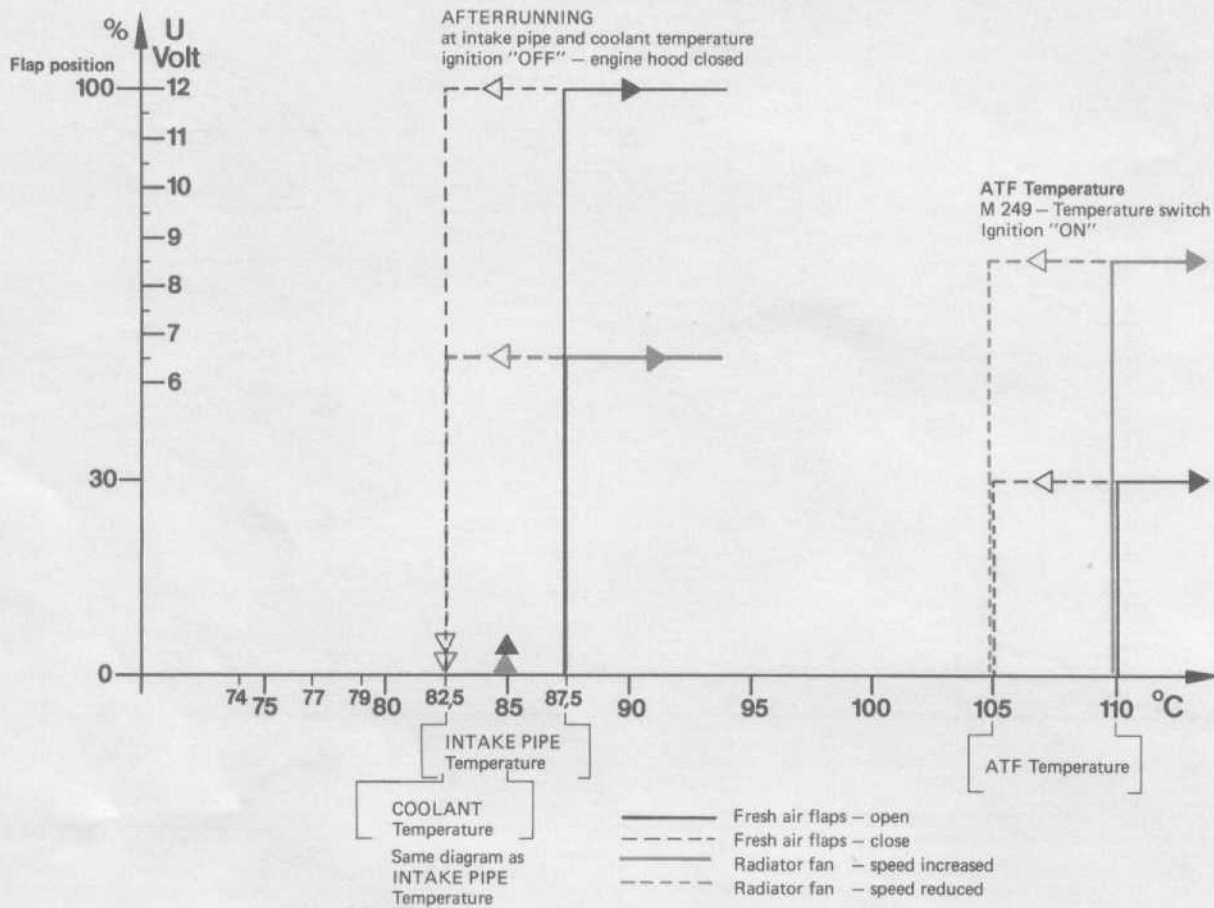
With the air conditioner switched on the cooling air flaps will be adjusted and the radiator fan motors switched on, depending on the refrigerant pressure in the high pressure line of the air conditioner, but independent of the coolant temperature.

A pressure sensor located on the drier sends pertinent switching data to the control unit. If the pressure sensor is bridged (short circuit) or a lead has a break, the radiator fans will run at max. speed and cooling air flaps will be wide open (100 %). The safety function, however, is only active when the AC button is pressed.

Function – ATF Temperature Switch and Fan Afterrunning

FRESH AIR FLAPS – RADIATOR FAN – 928
FUNCTION DIAGRAM

Afterrunning and ATF Temperature Control



ATF Temperature

A temperature switch, which also sends switching signals for adjustment of cooling air flaps and operation of radiator fans to the control unit, is located in the ATF cooling line near the transmission of cars with an automatic transmission (M 249). Cooling air flaps are opened 30 % and radiator fans operated with approx. 8.5 V when reaching an ATF temperature of approx. 110 °C, regardless of the engine operating temperature. Radiator fans are switched off and cooling air flaps closed (0 %) at approx. 105 °C.

Fan Afterrunning

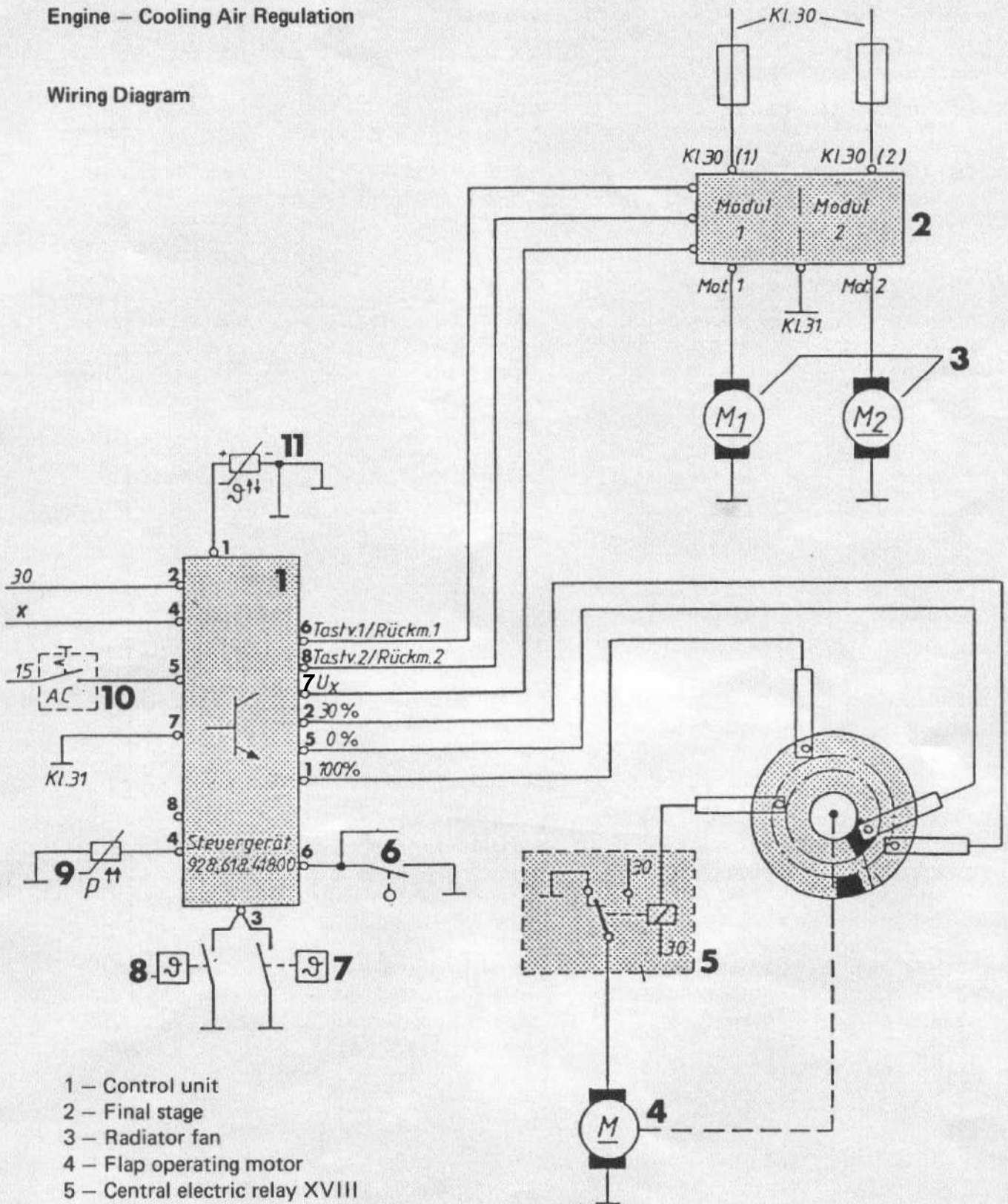
Radiator fans can only run on when the engine hood is closed (engine hood safety switch), ignition is turned off and the intake pipe temperature rises above 87.5 °C or the coolant temperature is above 85 °C. Radiator fans run at about half speed (~ 6.5 V) and cooling air flaps are wide open (100 %) for both conditions.

Cooling air flaps close and radiator fans are switched off when reaching an intake pipe or coolant temperature of < 83 °C.

Fans can only run on within approx. 45 minutes after turning off the ignition.

Engine – Cooling Air Regulation

Wiring Diagram



- 1 – Control unit
- 2 – Final stage
- 3 – Radiator fan
- 4 – Flap operating motor
- 5 – Central electric relay XVIII
- 6 – Engine hood contact
- 7 – Intake pipe temp. switch
- 8 – ATF temperature switch
- 9 – Refrigerant pressure sensor
- 10 – AC switch
- 11 – Coolant temperature sensor

Troubleshooting Cooling Air Flap and Fan Control System

Signal/Component	Fault	Condition	Noticed On
1. NTC Coolant	<ul style="list-style-type: none"> — Break in lead — Short circuit in lead or faulty switch 	With ignition ON, fan maximum speed, flaps 100 %	Extremely loud fan noise
2. Intake pipe switch (afterrunning)	<ul style="list-style-type: none"> — Break in lead or switch does not close any more — Lead has short circuit or switch "seized" 	<p>Afterrunning not possible, possibly hot starting problems at high outside temperature</p> <p>45 minutes of after-running generally after stopping engine</p>	<p>No afterrunning</p> <p>Is sometimes not noticed. Regular inspection by Service</p>
3. ATF temperature switch (only automatics)	<ul style="list-style-type: none"> — Lead has break, switch does not close — Lead always has short circuit, switch "seized" 	<p>No cooling from ATF temperature, foaming over is possible</p> <p>Generally fans 8.5 V/flaps 30 % with ignition "ON"</p>	Problems with automatic transmission with very high transmission loads and low coolant temperature
4. Refrigerant pressure sensor	<ul style="list-style-type: none"> — Lead has break or short circuit 	Monitoring through control unit, see NTC: point 1	Same as point 1, but only with AC button pressed
5. Hood contact switch	<ul style="list-style-type: none"> — Switch faulty or lead has short circuit/break 	No afterrunning or with afterrunning fans are not stopped when raising engine hood	Is not noticed, must be checked by Service

Troubleshooting Cooling Air Flap and Fan Control System

Signal/Component	Fault	Condition	Noticed On
6. Fans	<ul style="list-style-type: none"> – Plug disconnected on one fan – One fan seized – Short circuit in terminals of one fan 	Second fan runs at max. speed, flaps 100 %	Extremely loud noise as soon as ignition is "ON". With high engine loads or at high outside temperature with AC: temperature warning lamp comes on.
7. Operating motor	<ul style="list-style-type: none"> – Plug disconnected – Motor seized or not turning 	Effect on cooling depending on previous flap position. If closed, overheating of engine = red warning lamp = stop car, "open" flaps with knurled nut operation of motor = see owner's manual.	Check flap position, if warning lamp comes on. Open them, if closed.
8. Final stage	<ul style="list-style-type: none"> – Plug fallen off (not very likely) – Transistor faulty 	Fans do not run, no cooling for stationary car.	Warning lamp comes on (drive slower).
9. Signals: Term. 30 Term. 15 Term. 31 AC U _B	<ul style="list-style-type: none"> – Signal missing (lead has break, no signal from AC button/term. 15 ignition lock) Lead contr. unit final stage 	Fans run at max. speed, even with ignition "OFF"	No function of fans or flaps
10. Relay for operating motor	<ul style="list-style-type: none"> – Faulty 	Motor is not activated (see 8.)	– Coolant temperature warning lamp (open flaps, drive slower)
			See point 8. Warning lamp comes on (drive slower)