

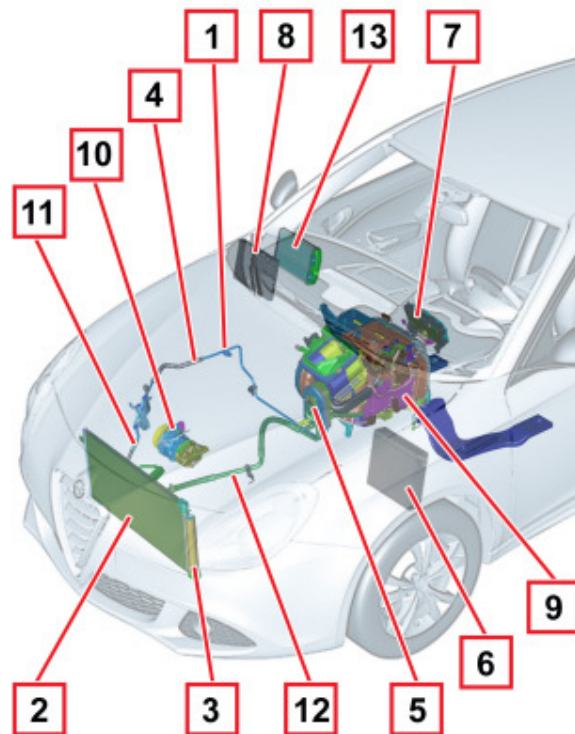
INTRODUCTION

The climate control system fitted on the vehicle is a system that allows the variation of the ambient features of the air introduced into the passenger compartment (temperature and humidity). It allows all glass surfaces to be demisted and prevents the entrance of pollutants, thereby making the environment of the passenger compartment more healthy.

The air conditioning system is a comfort factor that contributes to improving the physiological wellbeing of the vehicle occupants.

Climate control system components

The climate control system components are illustrated in the diagram below.



- 1 - Linear pressure switch
- 2 - Condenser
- 3 - Drier filter built into the condenser
- 4 - Low pressure pipe
- 5 - Expansion valve
- 6 - Evaporator
- 7 - Control panel
- 8 - Pollen filter
- 9 - Duct/distributor unit
- 10 - Compressor
- 11 - High pressure gas pipe
- 12 - High pressure fluid pipe
- 13 - Additional heater

Operating principle

The aim of refrigeration equipment is to absorb heat from an environment. In order to do this an air conditioner has recourse to certain fluids (known as refrigerants) capable of cooling down (lowering their temperature) and changing state (from liquid to gas) when they are subject to a large drop in pressure, thus expanding. They are therefore capable of absorbing heat from their environment. When their temperature increases, causing an increase in pressure as well, they change state yet again (from gas to liquid) on condensing.

The first problem is therefore to liquify this gas, by bringing it to a temperature below the evaporation (or boiling) temperature which, as has already been stated, is -26°C at atmospheric pressure for R134a.

In order for this to be achieved at ambient temperature which, in our case, may be rather high (in the engine compartment), it is necessary to increase the evaporation point of the gas so that it remains liquid until the moment it is made to expand, in order to produce the desired refrigerant effect.

To raise the boiling point of the gas its pressure must be increased, at the same time, decreasing the temperature.

In order for this to take place the system requires a certain amount of power. This power, supplied by the compressor, is subtracted from the power produced by the engine.

The operating principle of the refrigerant cycle phases in the air conditioning system for a motor vehicle can be summed up as follows.

The gaseous R134a refrigerant is drawn in by the compressor at a pressure of between 0.5 and 2 bar and is compressed at a value of between 10 and 17 bar.

Boiling point becomes around 60 °C at these pressures.

This fluid, heated by the compression stage to 80-100°C, still in a gaseous state, in the compressor where, through the effect of the cooling air flow (produced by the vehicle moving forward or through the action of the fan) that passes through it, reaches condensation point, changing at high pressure to a liquid state.

Later on the coolant passes through a filter with three functions: to trap impurities, to absorb the moisture contained in the circuit and to work as a spare reservoir for the coolant itself.

The refrigerant therefore reaches the expansion valve which introduces it into the evaporator where the pressure is around 1.5 atm. (1.52 bar). At this pressure, the liquid-vapour system saturated with coolant fluid is balanced at a temperature of about -7°C. At the same time, the air passing through the evaporator (through the action of a fan), is at a considerably higher temperature than the coolant fluid it contains, causing it to boil and complete evaporation through heat transfer. When it cools down, the air deposits some of the humidity it contains on the evaporator fins in the form of droplets which are collected in a chamber and drained outside the vehicle.

The air, cooled and dehumidified in this way, is sent inside the vehicle. The refrigerant at the evaporator outlet is drawn in again by the compressor giving rise to a new cycle.

The route of the refrigerant fluid can be summarized as follows:

- In the compressor, the fluid coming from the evaporator is gaseous (temperature -5, -7°C, pressure 0.5 - 2 bar). Compression phase: the gaseous fluid is heated (temperature 80 - 100 °C, pressure 10 - 17 bar).

- Condenser - Compression phase: the fluid transmits heat to the outside, cools down and returns to a liquid state (temperature 40 - 60°C, pressure 10 - 17 bar).
- Thermostatic expansion valve - Expansion phase - the fluid loses pressure (0.5 - 2 bar, possibly even 3 bar) becomes a gas + liquid mixture; the temperature is low, typical of air conditioning.
- Evaporator - Evaporation phase: the fluid becomes completely gaseous because the hot air driven by the fan has a higher temperature than the coolant fluid and causes it to boil and evaporate completely giving off heat. The temperature is low, that of air conditioning (pressure 0.5 - 2 bar).

Types of system

This vehicle is available with different climate control systems for the passenger compartment:

- manual climate control
- dual zone automatic climate control.

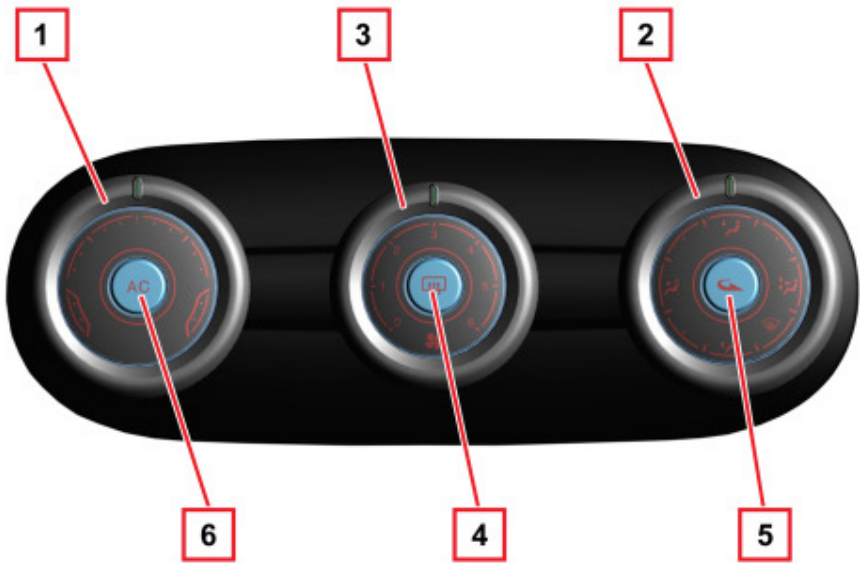
Manual climate control system: the user sets the air temperature, distribution and flow rate and they remain as such until they are altered by the user later on.

Automatic climate control (dual zone): the user can set the parameters and select automatic system management. If they so wish, the user can preseve the facility to manage the system manually.

The automatic climate control system on this vehicle is the dual zone type (driver's zone and front passenger zone) in other words the system has two sets of controls for the driver and the front passenger and the various settings can be managed separately, by altering the air temperature and distribution parameters (the flow rate cannot be different in the two zones) providing a certain degree of independence.

MANUAL CLIMATE CONTROL SYSTEM

The manual climate control system control panel is illustrated in the diagram below.



- 1 - Air temperature adjustment knob (hot/cold air mixing)
- 2 - Passenger compartment air distribution selection knob
- 3 - Fan speed selection knob
- 4 - Heated rear windscreen and exterior rear view mirror defrosting on/off button
- 5 - Interior air recirculation on/off button
- 6 - Climate control compressor on/off button

Operation

The maual air conditioner allows the use to manage the temperature and intake of air into the passenger compartment using the knobs and control buttons.

The following parameters/functions can be altered manually:

- Temperature
- Distribution in 5 positions
- Fan speed
- Engagement of compressor
- Recirculation.

The activation of the air mixing and air distribution controls by the knobs to the climate control casing takes place by means of electric motors.

The recirculation is activated by an electric motor as well.

The compressor can only be activated if a fan speed is set.

AUTOMATIC CLIMATE CONTROL

The automatic climate control is managed by a control unit which is capable, thanks to an extremely sophisticated operating logic, of controlling the temperature within the two passenger compartment zones, either heating or cooling the air to produced the desired comfort level.

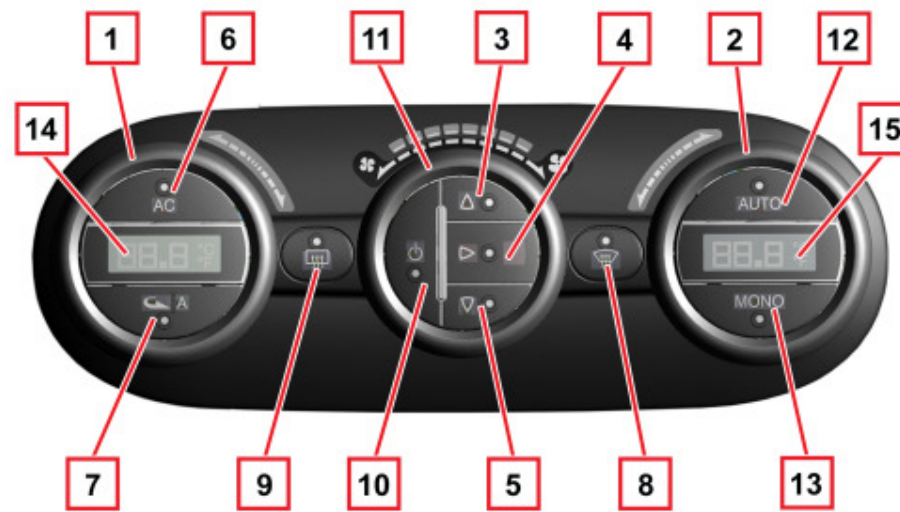
The climate control system automatically regulates the following parameters/ functions:

- Air temperature at the driver's/passenger side vents
- Fan speed
- Air distribution
- Engagement of compressor
- Recirculation.

Commands

All the non adjustment buttons are dual (ON/OFF) including the recirculation.

The control panel for the climate control system control unit is illustrated in the diagram below.



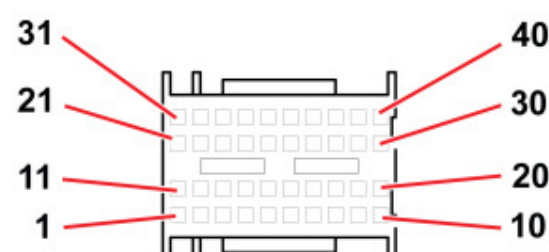
- 1 - Driver's temperature adjustment knob
- 2 - Passenger side temperature adjustment knob
- 3,4,5 - Air distribution buttons
- 6 - Compressor on button
- 7- Recirculation button
- 8 - Defrost button
- 9 - Heated rear windscreen button
- 10 - Control unit ON/OFF button
- 11 - Fan speed adjustment knob
- 12 - AUTO button
- 13 - MONO button
- 14 - Driver side temperature display
- 15 - Passenger side temperature display

Climate control system control unit

The climate control system is managed automatically by an electronic unit known as the "Climate Control Node "(NCL), which maintains the set air climate control conditions desired by the user (or users).

The NCL is connected to the vehicle electrical system B-CAN.

The NCL is incorporated in the climate control system control panel fitted in the dashboard in the middle. Views of the control unit are given with the connection to the electrical system highlighted and the connector pin out is given below.



Control unit pin out

PIN	FUNCTION
01	5 V power supply to LH mixer motor
02	5 V power supply for distribution motor
03	Ignition-operated + power supply
04	Power earth
05	Direct power supply
06	Compressor relay feed
07	Right mixer control
08	Left mixer control
09	Timing drive belt
10	Recirculation control (-)
11	5 V power supply to RH mixer motor
12	Frost sensor earth
13	Distribution earth
14	LH mixing earth
15	RH mixing earth
16	LH FLOOR treated temperature earth
17	RH VENT treated temperature earth
18	RH floor treated temperature earth
19	LH VENT treated temperature earth
20	Distribution shared
21	Fan feedback
22	Distribution feedback
23	Frost sensor signal
24	Right floor treated temperature sensor
25	Right VENT treated air temperature sensor
26	Left VENT treated air temperature sensor
27	Left FLOOR treated air temperature sensor
28	Recirculation control (+)
29	Left mixer shared
30	Right mixer shared
31	Left mixer feedback
32	Right mixer feedback

33	Demisting sensor
34	Solar sensor
35	Pollution sensor
36	Fan control
37	CAN L line
38	CAN H line
39	PTC 1 relay feed
40	PTC 2 relay feed

Operating logic

The control unit that manages the automatic climate control is capable of producing and maintaining the desired comfort within the two areas of the passenger compartment by controlling the following parameters and functions:

- Air temperature at the driver's/passenger side vents;
- Fan speed (continuous variation);
- Air distribution;
- Engagement of compressor;
- Recirculation.

The climate control system control system is managed in such a way as to regulate the "equivalent temperature", i.e. the temperature correlated to the thermal sensation and defined by a series of parameters such as humidity, passenger compartment air flow rate, average temperature, etc.

Therefore the user sets an equivalent temperature and the system acts on all the variables in its control to ensure the thermal sensation requested; for this reason the temperature in degrees centigrate measured in the passenger compartment may not coincide with the temperature shown on the display.

The following parameters/functions can be altered manually:

- Driver's/passenger side temperatures
- Fan speed
- Distribution in 7 positions
- Compressor
- Defrosting/demisting function
- Recirculation.

Manual selections always take priority over automatic ones and are memorised until the user restores the automatic mode.

The manual setting of a function does not adversely affect the control of the other automatic functions, in particular the temperature control is always automatic when the system is operating.

Each time it is switched on, the system restores the conditions memorized when it was turned off, except for:

- the MAX DEF function which is reset;
- the recirculation which, with the compressor OFF, is forced open;
- fan speed (continuous variation).

Temperature setting knob

By turning the knob for the required zone (driver's knob 1 or passenger's knob 2) the temperature is increased (clockwise) or decreased (anticlockwise) and is shown on the relevant display (14 or 15).

The temperature settings are memorized at the key off and then restored at the next key on.

The knob works in steps of 0.5 °C and one complete revolution of the knob produces 34 steps.

The temperature range that can be set is from 16 °C to 32 °C. Below 16 °C the setting is LOW, whilst above 32 °C it is HI.



High condition (hi)

The HI condition or maximum heating (shown on the display 14 and 15) is reached by setting an equivalent T requested by the user greater than 32°C. The request by the user (driver's knob 1 or passenger's knob 2) for the "HI" condition or maximum heating switches off the AUTO button (12) and forces the MONO condition (13) regulating the following parameters:

- The status of the recirculation and the compressor remains unaltered;
- The mixer flaps are in the maximum heating position;
- Distribution flap in FLOOR position and LED on;
- Air flow rate at preset value and dependent on the engine coolant temperature.

All the manual settings are allowed in the HI condition in accordance with the planned logics.

The Auto command is accepted, the HI function and the 32 °C temperature setting for both zones are reset.

If the driver turns the temperature setting the passenger setting moves outside the HI range to the required value.

If the passenger turns the temperature setting this also moves the driver's setting out of HI (to 32°C), then the passenger can change only their own settings, having set the system to Dual Zone mode.



Low condition (lo)

When the LO condition or maximum cooling is set (shown on displays 14 and 15), the AUTO button is switched off and the MONO mode is forced, entailing the following actions:

- Enabling of the compressor (AC LED on);
- Mixer flaps in maximum cold position;
- Distribution flap in VENT position and LED on;
- Air flow rate at preset value;
- Recirculation remains unchanged as requested by user.

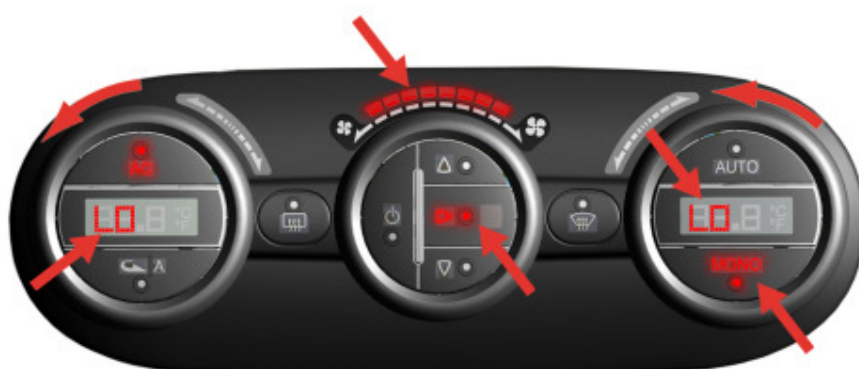
All the manual settings are allowed in the LO condition in accordance with the planned logics.

The Auto command is accepted, the LO function and the 16 °C temperature setting for both zones are reset.

If the driver adjusts the temperature setting this moves the passenger setting out of LO to 16°C.

If the passenger changes the temperature setting this also moves the driver's setting out of LO (to 16 °C), then the passenger can change their own setting setting the system to Dual Zone mode.

If the compressor is switched off (AC LED off), the system may not be capable of controlling/maintaining one or both of the temperatures set. The digits indicating the temperature will flash in these conditions.



Auto mode button

Pressing this button (12) makes the AUTO button LED switch on and the system switches to automatic management which controls:

- Air distribution;
- Fan speed;
- Compressor;
- Recirculation.

The AUTO LED switches off when at least one manual distribution, flow rate, recirculation or compressor control is carried out. At this point the system only returns to AUTO mode if the AUTO button is pressed again.

If the compressor is switched off (AC LED off), the system may no longer be capable of controlling/maintaining one or both of the temperatures set. The digits indicating the temperature will flash in these conditions.



Air distribution buttons

There are seven positions for air distribution.

One of the 7 possible positions can be selected manually (by operating buttons 3, 4, 5) using the combination logic described below.

MAIN DISTRIBUTIONS:

- DEF (hot/cold or mixed air for defrosting) (button 3)
- VENT (hot/cold or mixed ventilated air at the front) (button 4)
- FLOOR (hot/cold or mixed air at the floor) (button 5)

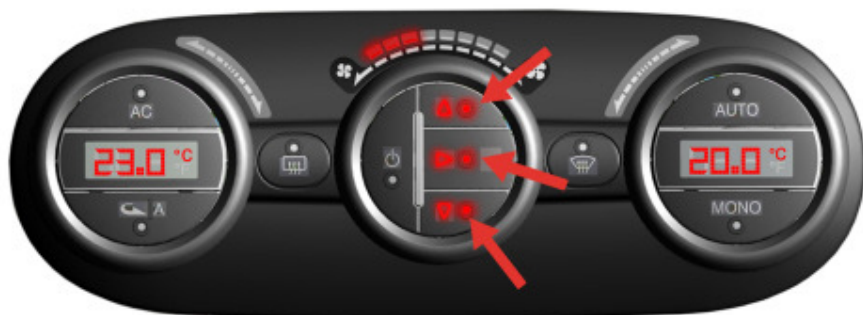
COMBINED DISTRIBUTIONS THAT CAN BE IMPLEMENTED:

- BILEVEL (VENT-FLOOR) (buttons 4 and 5)
- HEAT (DEF-FLOOR) (buttons 3 and 5)
- HI LEVEL (DEF-VENT) (buttons 3 and 4)
- TRI LEVEL (DEF-VENT-FLOOR) (buttons 3, 4 and 5)

AUTOMATIC DISTRIBUTION

In automatic operation the control of the distribution is managed by means of an algorithm that governs the switches according to the outside temperature and objective temperature conditions at the vents; in winter the FLOOR distribution is favoured and in summer the VENT distribution.

If there is a humidity sensor, at the onset of misting conditions, the algorithm directs the air towards the windscreen to ensure good visibility conditions.



Recirculation

The recirculation button and the LED operate according to ROLLING logic.

By pressing this button repeatedly, the 3 possible types of operation are recalled:

- Recirculation forced closed (passenger compartment air)
- Recirculation forced open (outside air).
- Automatic recirculation (management transferred to the control unit).

RECIRCULATION FORCED CLOSED

This type of operation is signalled by the recirculation LED being on (button 7).



RECIRCULATION FORCED OPEN

This type of operation is signalled by the AUTO LED being off and the recirculation LED being off.



AUTOMATIC RECIRCULATION

The AQS function (Air Quality System), automatically activates internal air recirculation when the outside air is polluted (e.g. in traffic queues and tunnels). With the AQS function active, after a preset time interval of the internal air recirculation system functioning, the climate control system enables the intake of outside air for approximately one minute to change the air in the passenger compartment. This takes place regardless of the pollution level of the outside air. In automatic operation inside air recirculation will be controlled automatically by the system according to outside environmental conditions.



Air flow rate variation control (fan)

The air flow rate can be adjusted manually (using knob 11) to eight levels displayed on the LED above the knob itself. To increase the air flow in the compartment, just turn the knob clockwise and to decrease it turn it anticlockwise. In automatic operation the speed is continuously controlled by the control unit and displayed on the LEDs. If the ventilation control is operated manually, the AUTO condition is exited. At KEY ON the air flow rate is at the first bar (minimum flow rate) until the engine is started.



Compressor enablement

The LED in the compressor button (6) indicates the setting desired by the user: if the LED is on, the user wishes the compressor to be activated.

With the LED on, pressing the button switches off the LED and deactivates the compressor. This selection remains memorised indefinitely even after the car has stopped, the same as for the other manual controls. The button has a dual function and therefore pressing it again re-activates the compressor and switches on the LED.

Pressing the compressor button (6) activates the compressor and switches on the LED.

From this moment, if the requirements relating to the outside temperature are met, the system produces the necessary cold for controlling the climate control system inside the passenger compartment with the dehumidification effect of the evaporator.

This functional state is maintained even after the next Key Off/On.

When the user deactivates the compressor the following takes place:

- the LED in the compressor button switches off.
- The AUTO LED switches off.

The check verifies whether, with the current outside temperature, the system is capable of reaching/maintaining the requested temperature:

- If the answer is YES, then the system works normally and is capable of meeting the requirements even without the compressor switched on.
- If the answer is NO, then the system is not capable of meeting the user's requirements and signals this by making the temperature setting values flash.



Switching off control unit (off)

Pressing the control unit OFF button (10) results in:

- memorizing of the current status;
- switching on of the OFF button LED;
- fan excluded;
- compressor excluded;

In OFF status, the heated rear window (9) button is managed normally without activating the climate control system.

In OFF status the recirculation button has a dual function (ON/OFF) opening (LED off) and closing (LED on) the flap.

Pressing any button afterwards (except recirculation and heated rear window) switches the system back on, activates the function requested, if it was not previously (otherwise it confirms it) and restores all previous operating conditions, recirculation excluded.



Mono control

Pressing the MONO button (13) causes the following actions:

- the temperature set on the passenger side is made the same as that set by the driver;
- the MONO button LED (13) comes on.

 From that moment the system behaves like a SINGLE ZONE system.

The return to DUAL ZONE operation, with the LED in the MONO button switching off, is managed by the system by pressing the mono button again or by changing the passenger side temperature.

These functional states are maintained even after subsequent KEYS OFF/ON.



Maximum defrosting button

The MAX DEF function manages the air flow rate and distribution to demist the windows in the shortest possible time (the flow rate is minimal with the engine switched off).

The activation of the function lasts for three minutes starting from when the temperature of the cooling water exceeds a preset level.

When the MAX DEF button (8) is pressed, the system carries out the following operations:

- Switching on of the MAX DEF LED (8);
- Memorizing of the functional status and previous displays of MAX DEF control;
- Switching off of the AUTO and RECIRCULATION function LEDs;
- Switching on of the DEF distribution, compressor enablement, MONO, recirculation open and heated rear windscreen LEDs;
- Display of the max hot temperature (HI) on both temperature displays (14 and 15);
- Displaying of the air flow on the LED.

The following controls are also activated:

- Air flow rate at preset value;
- Distribution flap in DEF position;
- Mixture flaps in MAX HOT position;
- Air intake flap forced open;
- Compressor function enabled;
- Rear windscreen defrost function.

The air flow rate can be varied (up/down), during the operation of the MAX-DEF, at will and the heated rear windscreen deactivated.

It is not possible to:

- Alter the temperature setting (driver/passenger).
- Alter the distribution setting.
- Alter the recirculation setting.

The MAX-DEF function can be interrupted by activating any of the climate control buttons (recirculation, compressor enabling, Auto, Mono, MAX-DEF, OFF, temperature and distribution) implementing the return to the condition prior to MAX DEF plus the implementation of the control for the button pressed.

The management of the MAX-DEF procedure takes priority over the management of the following procedures:

- LO (max cold).
- HI (max hot).

If in progress, the execution is interrupted if the MAX DEF procedure is activated.



Heated rear window

The rear defrosting is implemented both with the appropriate button pressed and through the Max-Def procedure.

The operating status is displayed by the relevant led switching on or off. The function requesting the activation of the heated rear windscreen is only subject to the presence of the key-on.

The HEATED REAR WINDSCREEN function is not memorized at the key-off.



Switching on after the vehicle has stopped

On switching on the various parameters are controlled manually or automatically depending on the selections made by the user before switching off.

Therefore all manual interventions carried out before the car stops are memorised and maintained at the next starting except for those relating to safety (e.g. misting).

 If at the previous key off, the control was MAX-DEF, at the next key on the system will assume the position memorised before MAX-DEF.

Self-learning procedure

After the control unit or one of the actuators (excluding the recirculation one) has been replaced, it is necessary to proceed as follows.

CONTROL UNIT REPLACEMENT

Some of the CAN nodes (including the climate control system control unit) are programmed with default settings which the customer will discover on acquiring the vehicle. If the control unit is being replaced, the Parts Dept. will send a blank component: once fitted, the data memorized in the Body Computer must be transferred to it.

- Connect the Examiner.
- Select "Active Diagnosis".
- Launch the "Autotest" procedure.
- Select the "Flap Actuator Learning" test.

ACTUATOR REPLACEMENT

The self-learning procedure must be carried out using the Examiner selecting the "Flap Actuator Learning" test (automatic procedure) or following the instructions given below (manual procedure).

Entering self-diagnosis mode - manual climate control system

- Switch the ECU on (Key-on);
- Turn the Adjustment knob (1), to the low end of the scale;
- press the rear window button (3) once;
- turn the Temperature Adjustment Knob (1) clockwise by one notch;
- press the rear window button (3) once;
- turn the Temperature Adjustment Knob (1) clockwise by one notch;
- press the rear window button (3) once;
- turn the Temperature Adjustment Knob (1) clockwise by one notch;
- press the rear window button (3) once.

 The activation of the "Self-diagnosis" mode is signalled by the switching off of the ECU backlighting LEDs.

ACTIVATION OF THE SELF-LEARNING ROUTINE

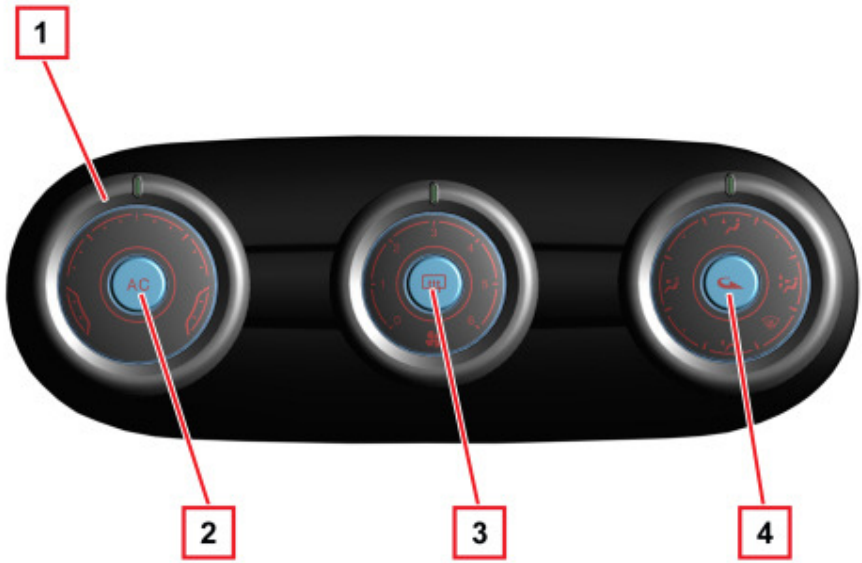
Once in the Self-Learning channel, the LEDs of the buttons (2, 3, 4) report the status of the last Self-Learning procedure carried out, with the following codification:

SELF-LEARNING STATUS	VALUE DISPLAYED
Self-Learning RUNNING	Backlight Blinking and function buttons LEDs OFF
Self-Learning completed successfully	Backlight OFF and Function buttons LEDs ON
Self-Learning NOT completed successfully	Backlight OFF and Function buttons LEDS OFF

To start a new Self-learning procedure, just press the AC button (2); for the entire duration of the routine, the LEDs of the function buttons will be OFF and the backlight LEDs will flash (RUN).

A positive outcome will be shown at the end of the procedure: the backlight LEDs will be off and the function buttons LEDs will be on.

A negative outcome will be shown at the end of the procedure: the backlight LEDs and the function buttons LEDs will be off.



To leave the "Self-Diagnosis" mode, press the LUN and REC buttons simultaneously (3 and 4), or switch the ECU off and on again (key off followed by key on).

Entering to self-diagnosis mode - automatic climate control system

- Switch the ECU on (key-on);
- turning the Driver Temperature Adjustment knob (1), set the temperature to 20°C;
- press the rear window button (2) once;
- turning the Driver Temperature Adjustment knob (1) clockwise, set the temperature to 22°C;
- press the rear window button (2) once;
- turning the Driver Temperature Adjustment knob (1) clockwise, set the temperature to 24°C;
- press the rear window button (2) once;
- turning the Driver Temperature Adjustment knob (1) clockwise, set the temperature to 26°C;
- press the rear window button (2) once.

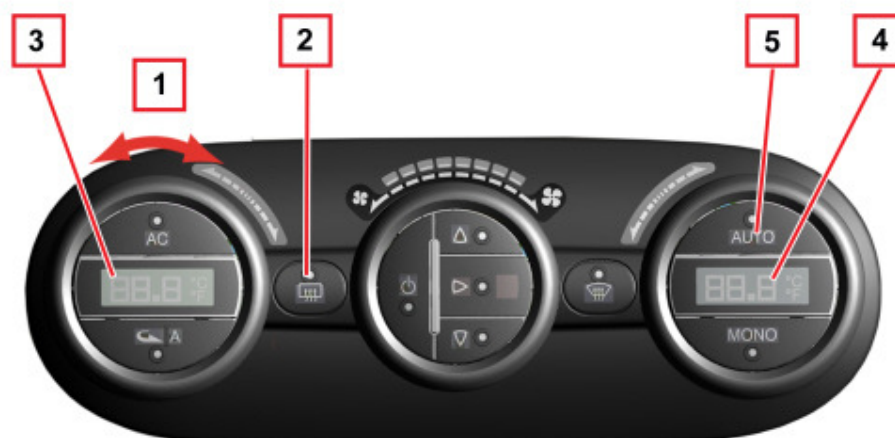
 The activation of "Self-diagnosis" mode is signalled by the change of the displayed value on both control unit displays (3 and 4).

ACTIVATION OF THE SELF-LEARNING ROUTINE

Once in the Self-Learning channel, the Passenger Temperature Display (4) reports the status of the last Self-Learning procedure carried out, with the following codification:

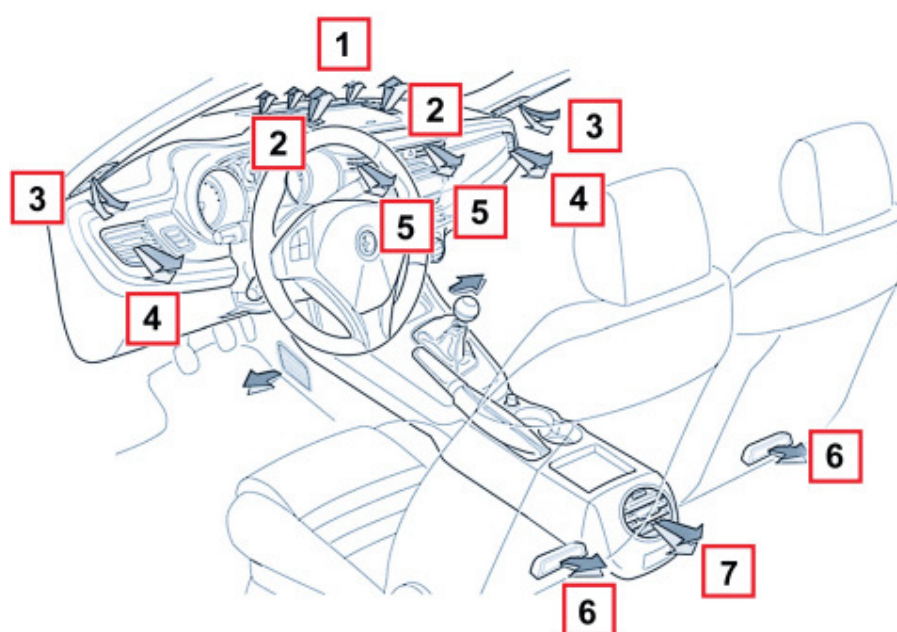
SELF-LEARNING STATUS	VALUE DISPLAYED
Self-Learning RUNNING	0
Self-Learning completed successfully	1
Self-Learning NOT completed successfully	2

To start a new a Self-learning procedure, simply press the AUTO button (5); for the entire duration of the routine the Passenger Temperature Display (4) signals 0 (RUN) and shows the positive outcome at the end (value displayed = 1) or negative outcome (value displayed = 2).



To leave the "Self-Diagnosis" mode, press the OFF button, or switch the ECU off and on again (key off followed by key on).

AIR FLOW DIAGRAM



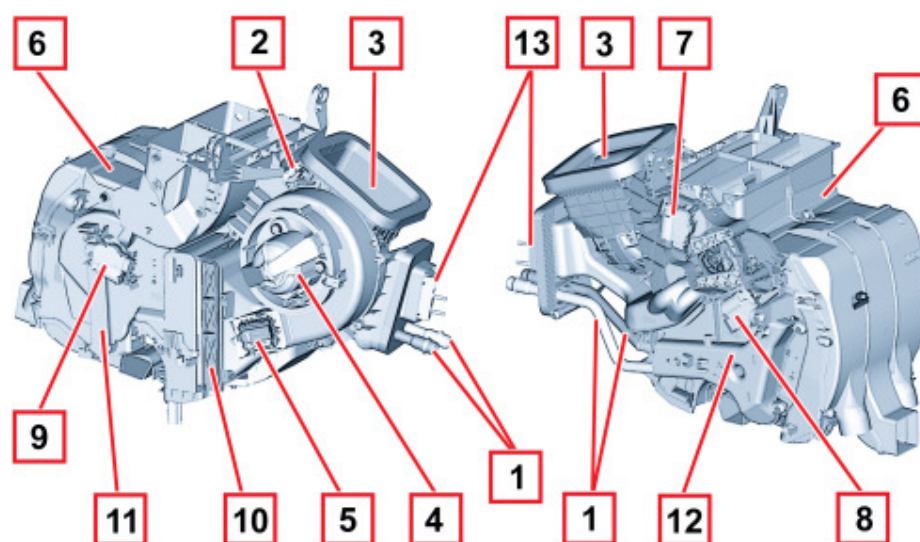
- 1 - Fixed upper vent
- 2 - Fixed upper vents
- 3 - Fixed side vents
- 4 - Adjustable side vents
- 5 - Adjustable central vents
- 6 - Lower vents for rear seats
- 7 - Adjustable vent for rear seats

COMPONENTS

Air conditioning unit

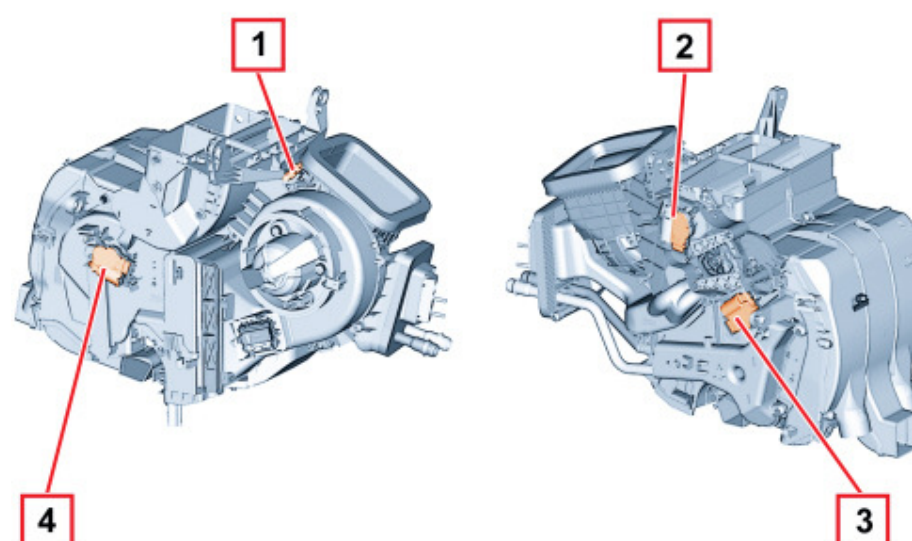
The unit is particularly compact and houses:

- the fan;
- the evaporator;
- the heater radiator;
- the temperature sensors, the air flow control flaps and the flap actuators;
- the additional heater (if present).



- 1 - Coolant fluid pipe unit
- 2 - Recirculation actuator
- 3 - Outside air intake unit
- 4 - Electric fan
- 5 - Electric fan regulator
- 6 - Climate control system unit
- 7 - Distribution actuator
- 8 - Left mixing actuator
- 9 - Right mixing actuator (automatic climate control system only)
- 10 - Pollen filter cover
- 11 - Additional heater (PTC)
- 12 - Heater
- 13 - Expansion valve

Actuators



- 1 - Recirculation actuator
- 2 - Distribution actuator
- 3 - Left mixing actuator
- 4 - Right mixing actuator (automatic climate control system only)

Air mixing actuator

The adjustment of the temperature of the treated air is managed via the temperature setting knobs.

The actuators activate the rotation of the mixture flaps depending on the signal from the control unit. A motor with a 12 Volt supply controls the rotary movement of a drive pin which acts directly on the mixture flaps.

A potentiometer detects the actual position and provides feedback to the control unit.

Air distribution actuator

The distribution actuator activates the rotation of the air distribution flap.

It receives a 12 volt power supply and, by reversing the polarity, it can be made to rotate either clockwise or anti-clockwise. A potentiometer detects the actual position and acts as feedback for the control unit, checking complete travel between the extreme positions.

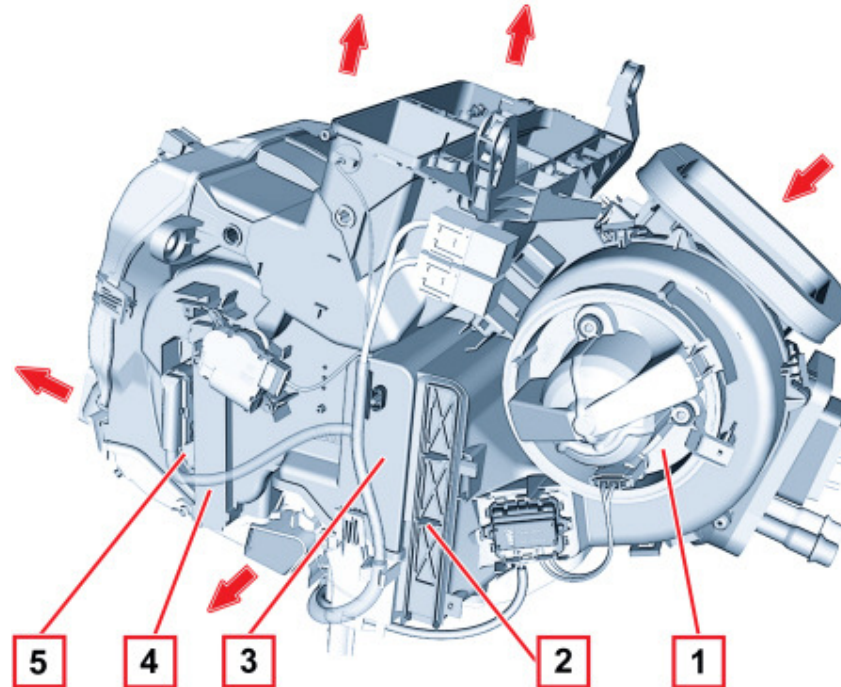
Recirculation actuator

The actuator manages the rotation of the flap in two dynamic air and recirculation extreme positions without intermediate positions.

It receives a 12 volt power supply and, by reversing the polarity, it can be made to rotate either clockwise or anti-clockwise.

Automatic system operation

The air is drawn in by the fan through the outside air intake or through the inside air intake and reaches the mixing zone. The temperature of the air to be sent to the diffusers is determined by the position of the mixture flap which limits the flow of air coming from the outside directly to the distribution zone or at the heat exchanger.



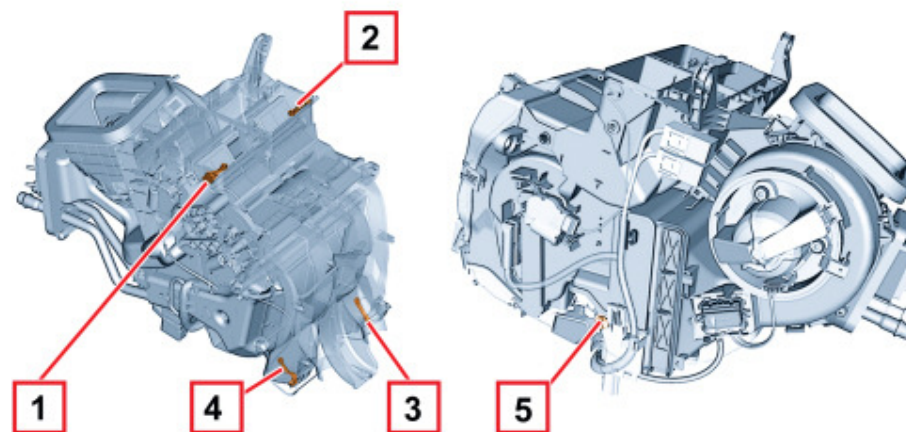
- 1 - Electric fan
- 2 - Filter
- 3 - Evaporator
- 4 - Heater
- 5 - Additional heater PTC

Climate control sensors

Temperature sensors

There are four temperature sensors on the duct/distributor assembly - for automatic climate control system - which provide the climate control system control unit with a signal relating to the temperature of the air coming out of the vents on both the left and right sides. Two of the sensors are located by the FLOOR vents, the other two are inside the middle dashboard vents.

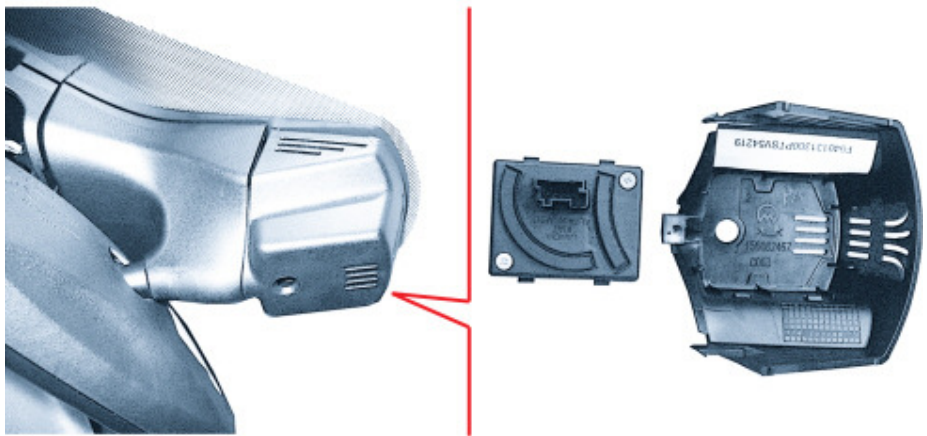
The frost sensor is located next to the evaporator.



- 1 - Left side treated air sensor
- 2 - Right side treated air sensor
- 3 - Right floor treated air sensor
- 4 - Left floor treated air sensor
- 5 - Frost sensor

Tmr sensor (only available for automatic climate control system)

The TMR is a new sensor that replaces the standard passenger compartment temperature sensor and the solar sensor used in standard automatic systems. The new sensor measures the mean radiant temperature in the compartment and gives an optimised signal regarding the current temperature conditions inside the car, to obtain a more rapid automatic adjustment response and improved comfort for passengers.



Passenger compartment moisture sensor (only available for automatic climate control system)

The moisture sensor allows the automatic system to intervene to prevent the windscreen and the front side windows from misting up, which happens in certain outside climate conditions, and ensure optimum visibility.
This sensor is incorporated in the TMR sensor.

Air quality sensor (aq5)

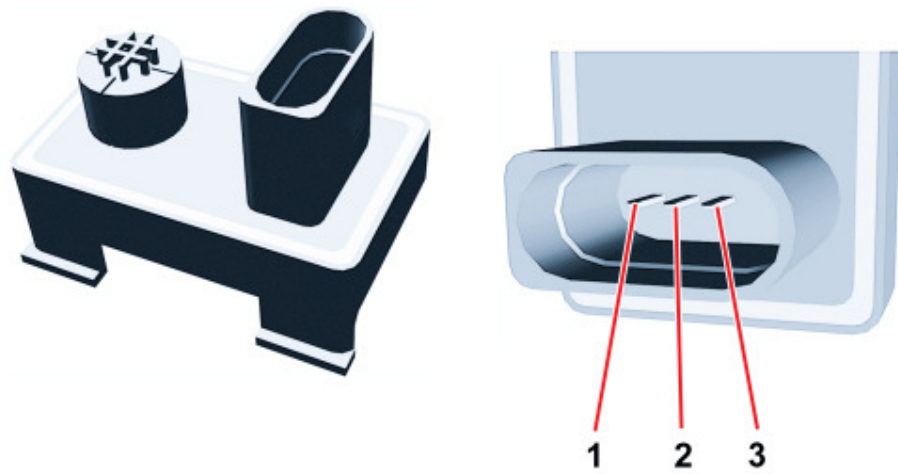
The AQS is an electronic device which sends a control signal for opening/closing the recirculation flap for the distributor unit when the air pollution index exceeds pre-set pollution levels to prevent the introduction of polluted air into the passenger compartment; it is fitted on the distributor unit outside air intake. Through the use of a special sensitive element, the presence of oxidising pollutant particles (e.g. CO) or reducing agents (e.g. NOx) in the air surrounding the vehicle can be detected.
The sensitivity of the system is optimised according to the potential danger of the pollutant gases according to the M.A.K. index (maximal concentration of harmful substances at work at an exposure of over 8 hours).
The sensitive element is regulated and heated to a constant temperature of 300°C to give a consistent performance in an ambient temperature operating range of -25°C to -85°C. It is not affected by the speed or the temperature of the air passing through.
The sensor produces a PWM signal within around 40 secs from when it is first supplied.

PWM signal (time base:100mSec)	Meaning
0%	short circuit to earth of the signal line
20%	non polluted air circulation
40%	level 1 pollution
50%	level 2 pollution
60%	level 3 pollution
80%	Sensor in error
100%	short circuit to +12V of the signal line

If the sensor has not been used for a long period its response time varies as illustrated below:

Time out of use	Response time
< 24h	max 1 sec
24 h < t < 76 h	max 30 sec
76 h < t < 480 h	max 180 sec
> 480 sec	max 300 sec

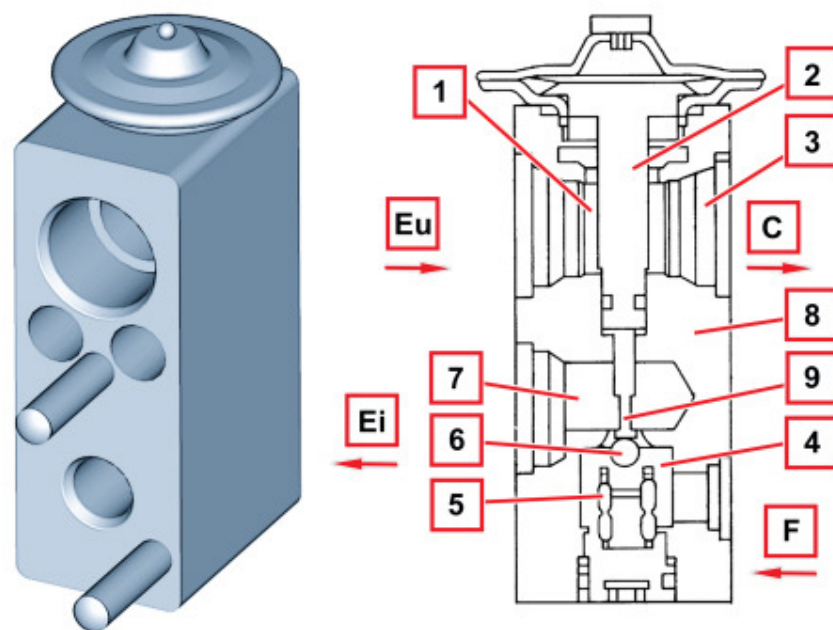
- In order to check the sensor:
- Turn the key on.
 - Wait 36 secs for the sensor to warm up.
 - Within 120 secs, inject pollutant gas into the sensor using the canister (part. n° 71715571).
 - Check that the result of the test is positive using the diagnosis equipment.



- 1 - Ignition-operated power supply
- 2 - Earth
- 3 - Signal

Expansion valve

The section of the expansion valve and the main parts are illustrated in the diagram below.



- 1 - Fluid outlet duct from the evaporator
- 2 - Heat sensitive element
- 3 - To the compressor intake connector
- 4 - Pressurized fluid
- 5 - Counter spring
- 6 - Ball and calibrated port
- 7 - Expanded fluid (at the evaporator inlet connector)
- 8 - Valve body
- 9 - Rod
- C - To the compressor
- F - To the drier filter
- Ei - Evaporator inlet
- Eu - Evaporator outlet

The tasks of this valve are to:

- Separate the high pressure circuit from the low pressure circuit;
- Expand the refrigerant (change in state from liquid to gas);
- Regulate the evaporation process (flow rate);
- Regulate the evaporation temperature;
- Protect the compressor from refrigerant fluid.

The thermostatic expansion valve, fitted on the evaporator inlet/outlet ducts, has the task of regulating the flow and expansion (drop in pressure) of the R134a refrigerant before entering the evaporator.

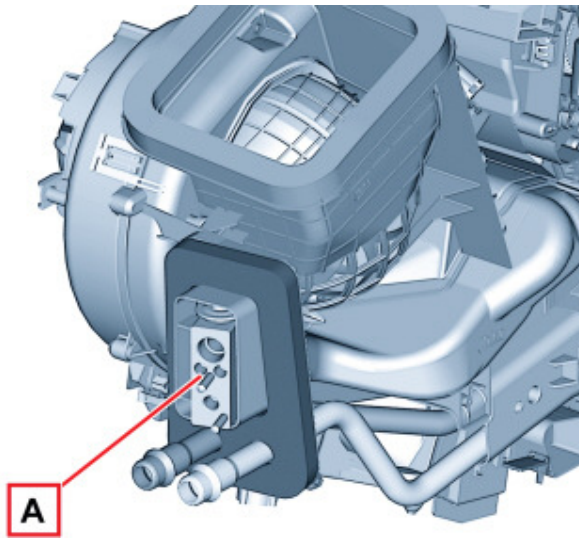
The automatic regulation of the size of the passage for the gas inside the expansion valve is produced by a sensitive bulb which measures the temperature of the refrigerant fluid and depending on this suitably adjusts the size of the opening that the gas passes through by means of a special spring that moves a shutter determining the extent of the expansion.

The increase in temperature at the evaporator outlet, detected by the sensitive bulb, opens the valve with a consequent increase in the flow rate of the refrigerant in the evaporator.

Conversely, low temperatures involve a reduction in the size of the gas port, determining a decrease in the flow of gas.

 The valve regulation screw is calibrated during production and should NOT be tampered with, in order to avoid adversely affecting the efficiency of the air conditioning system.

The expansion valve is directly accessible from the engine compartment; see the diagram below:



A - Expansion valve

This type of expansion valve has two different refrigerant fluid flows:

- Lower flow, from point (4), gas coming from the drier filter, to point (7), gas outlet towards the evaporator, containing the overheating spring (5) and the modulating element which, in this case, is the ball (6) housed in the calibrated duct.
- Upper flow, from pint (1), gas coming from the evaporator, to pin (3), gas outlet towards the compressor, containing the thermostatic sensor (2) which is connected to the upper part of the diaphragm and to the ball (6).

The flow rate control function is exerted through the movement of the ball (6) connected, via the rod (9), to the thermostat sensor (2).

The action of the ball (6) is opposed by the spring (5) which is suitably calibrated and ensures that the refrigerant in the evaporator is in a gaseous state without the presence of any fluid which, if drawn in by the compressor, could damage it.

The position of the ball (6) depends on the difference in pressure acting on the diaphragm inside the sensor (2); this, in turn, depends on the temperature of the refrigerant leaving the evaporator (upper flow of the valve).

High evaporator (1) gas outlet temperatures, corresponding to conditions where heat dissipation is high, increase the pressure inside the thermostatic sensor (2); this involves the movement of the rod (9) and the ball (6) connected to it, which increases the area of the flow and, as a result, the refrigerant (7) flow rate.

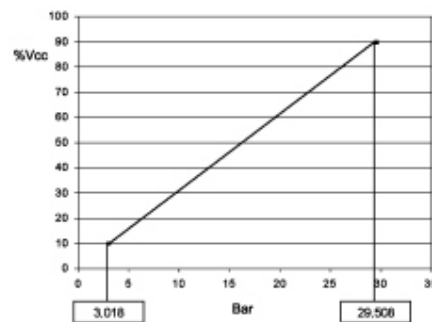
The opposite takes place when the temperature of the gas coming out of the evaporator (1) is low.

Linear pressure switch

The linear pressure switch controls the correct operation of the system replacing the function performed by the quadrinary pressure switch. The sensor works by continuously analyzing the pressure of the climate control system circuit providing the engine management control unit, in real time, with the variations in pressure making the management of the activation thresholds more flexible.

For each variation in pressure there is a corresponding voltage signal used by the engine management control unit to activate the fan speed and turn the compressor off if the pressure goes above or below the permitted limits (safety function).

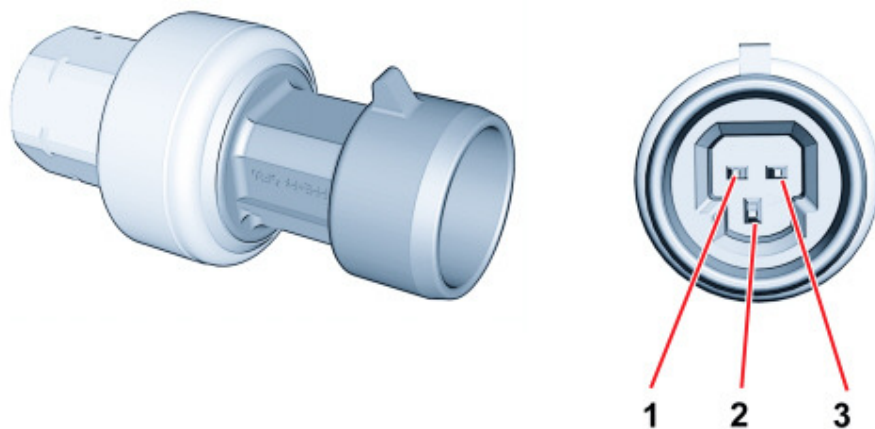
The operating range of the linear sensor goes from 3.018 bar up to 29.508 bar according to the following pressure (bar) / output voltage percentage (%Vdc) curve.



The go ahead for the activation of the compressor and the adjustment of the fan speed, depending on the variation in pressure, takes place in this pressure range; the compressor is deactivated above and below these values for safety reasons to prevent damage to the system.

The pin out for the sensor is illustrated in the diagram below.

 The supply voltage can vary +/- 10% and the operating temperature of the sensor is between 5°C and 80°C



1- Earth

2 - Supply voltage

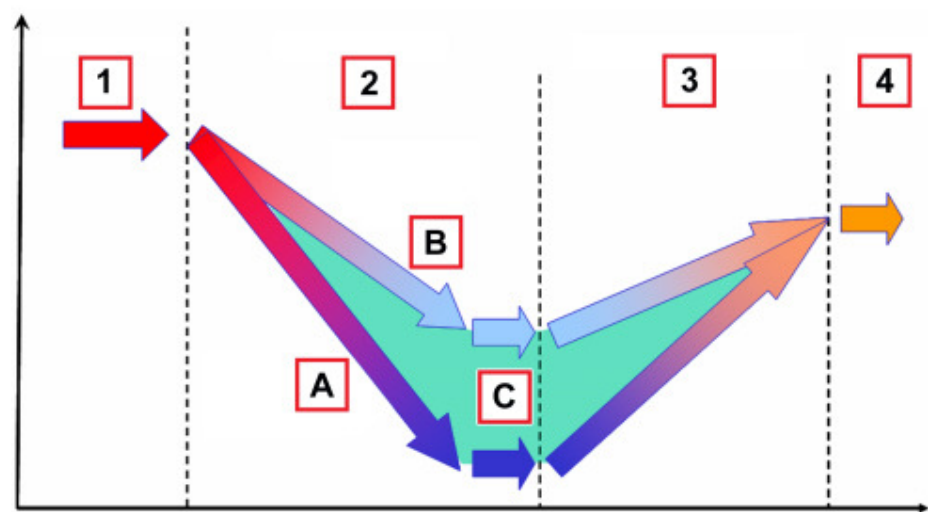
3 - Output signal

Externally controlled compressor

The externally controlled compressor is fitted on both the manual and automatic climate control system. This component, which has a special adjustment component, makes it possible to alter the temperature downstream of the evaporator and, if the thermal conditions allow, to reduce the post-heating.

As a matter of fact, in conventional systems, when an intermediate air temperature is requested, the air cooled by the climate control unit must be heated, wasting a part of the energy used for cooling.

The compressor external control changes the temperature downstream of the evaporator, thereby reducing post-heating. This allows fairly good energy saving when an intermediate temperature is required at the vents.



- 1 - Outside air
- 2 - Cooling
- 3 - Post-heating
- 4 - Outlet to the vents
- A - Conventional system
- B - External control
- C - Energy saving

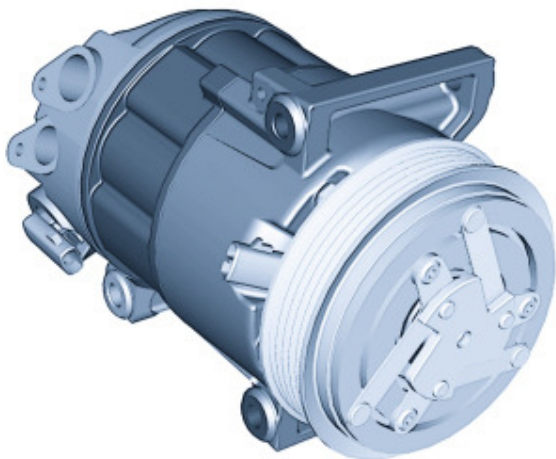
Using the mechanical energy from the engine via the electromagnetic clutch and pulley, this machine allows the circulation of the refrigerant in the circuit varying the pressure level.

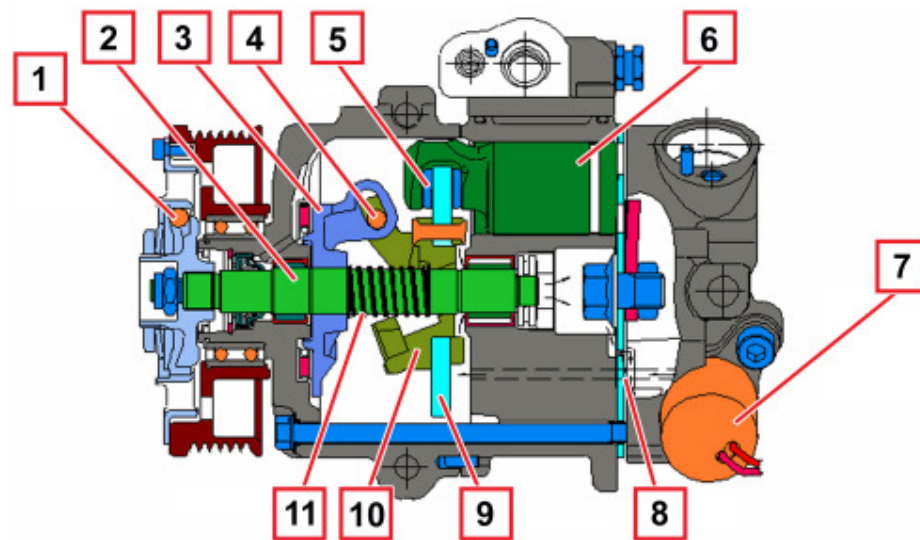
Variable capacity compressor specifications

The car comes with a DELPHI 5CVC compressor.

Maximum capacity	120 cc/rev
Minimum capacity	6 cc/rev
Number of cylinders	5
Number of maximum continuous revs	8000 rpm
Number of maximum non continuous revs	9200 rpm
Minimum speed	600 rpm
oil type and quantity	RL-897-150 ml

The capacity of these types of compressors may increase or decrease depending on variations in load requested by the system, changing exterior conditions such as temperature and/or humidity and sharp variations in engine load conditions.





- 1 - Mechanical torque limiter
- 2 - Main shaft
- 3 - Rotor
- 4 - Pin
- 5 - Thrust bearing
- 6 - Piston
- 7 - External control actuator
- 8 - Orifice
- 9 - Connecting rod carrier plate
- 10 - Cam
- 11 - Spring

Condenser with built-in drier filter

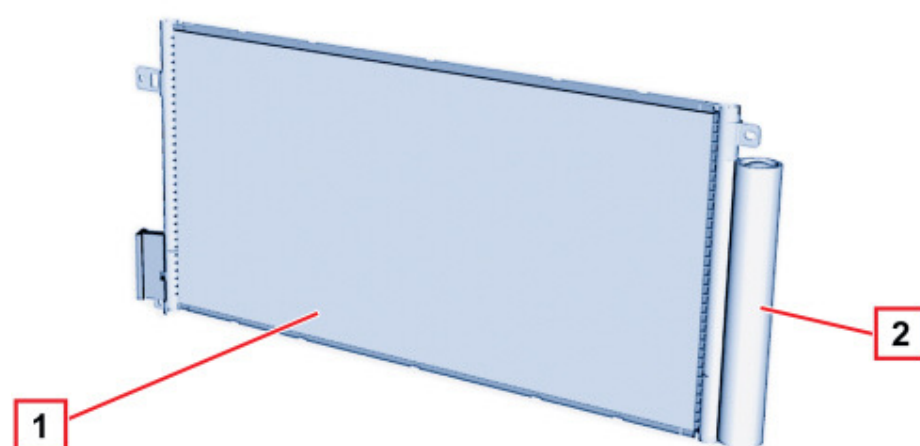
The condenser is a heat exchanger located in front of the engine coolant radiator.

The refrigerant fluid in a gaseous state passes through the condenser pipes and liquefies, on average, at a temperature of 60°C.

The outside air produced by the vehicle moving forwards comes into contact with the condenser. When the vehicle is stationary or driving in traffic, the flow of air is produced by the engine radiator fan.

An insufficient thermal exchange in the condenser causes an increase in the pressure in the system and the incomplete condensation of the fluid thereby reducing the efficiency of the system.

There is a housing on the left side of the condenser for the built-in drier filter. This allows the layout of the system to be improved.

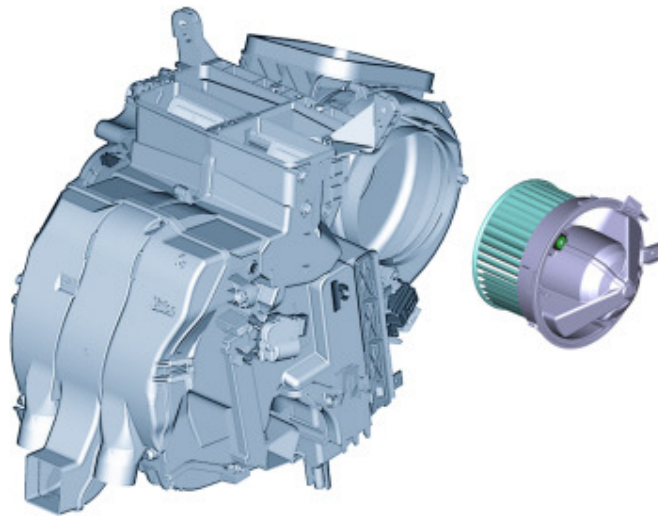


- 1 - Condenser
- 2 - Built-in drier filter

Fan

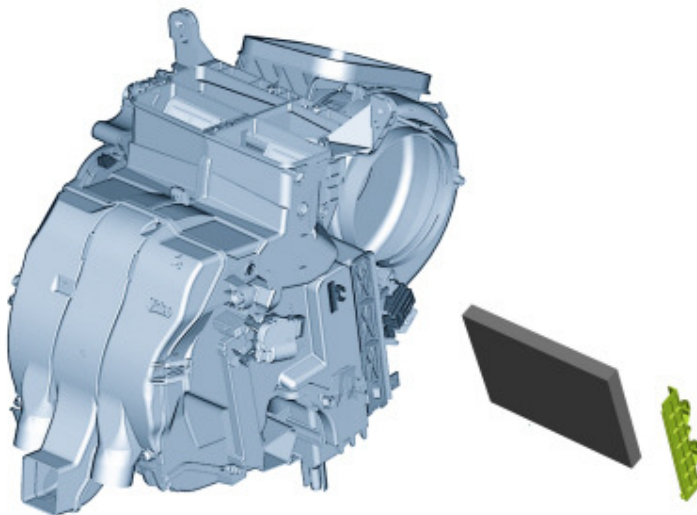
On the manual system, the fan is activated by the passenger compartment air speed selector which sends the signal to a resistive divider which produces the different speeds. The resistive divider is fitted in the duct between the dynamic air intake and the unit to cool it.

In the automatic system the fan is operated by dedicated buttons in the control panel which send the signal to the Climate Control Node which produces different voltage values for the different speeds.



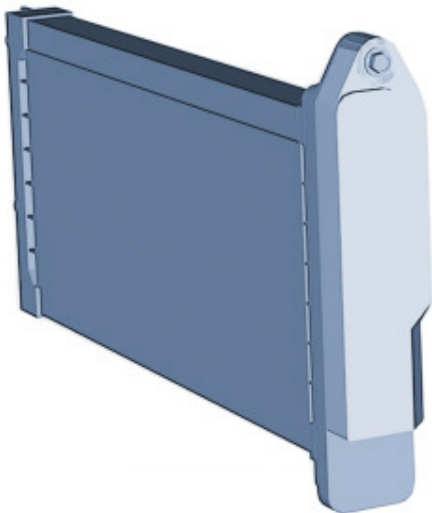
Pollen filter

The pollen filter is designed to filter the outside air entering the passenger compartment.
It is located inside the air conditioner casing.
The filter is fitted on both the manual version and the automatic version of the climate control system.



Additional heater (ptc)

The car may be fitted with an additional PTC heater which is designed to heat the passenger compartment more quickly with the vehicle moving when the outside weather conditions are unfavourable (for example in a particularly cold climate).
It is a resistance located near the radiant mass with a maximum power of 750W.



Operating logic

The additional heater (PTC) is managed by an electronic control unit located at the edge of the climate control unit which activates the ignition relays for at least three seconds consecutively if the following conditions prevail:

- Request for PTC activation from the CAN by the climate control unit (on versions with automatic climate control system) OR fan activation signal and maximum hot request (on versions with manual climate control)
- Outside temperature (< 20 °C)
- Engine speed > 700 rpm
- Engine coolant < 70 °C
- Battery voltage > 12.6 V

The two relays are activated in three steps within 5 seconds:

Step	PTC command	Time
250 W	PTC1 = ON - PTC2= OFF	0s
500 W	PTC1 = OFF - PTC2= ON	2.5s

750 W	PTC1 = ON - PTC2= ON	5s
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The PTC is deactivated if at least one of the following conditions persists for at least 3 seconds.

- Request for PTC deactivation from the CAN by the climate control unit (on versions with automatic climate control system) or fan deactivation signal and NOT maximum hot request (on versions with manual climate control)
- Outside temperature (> 20 °C)
- Engine speed < 600 rpm
- Engine coolant > 70 °C
- Battery voltage < 11.2 V

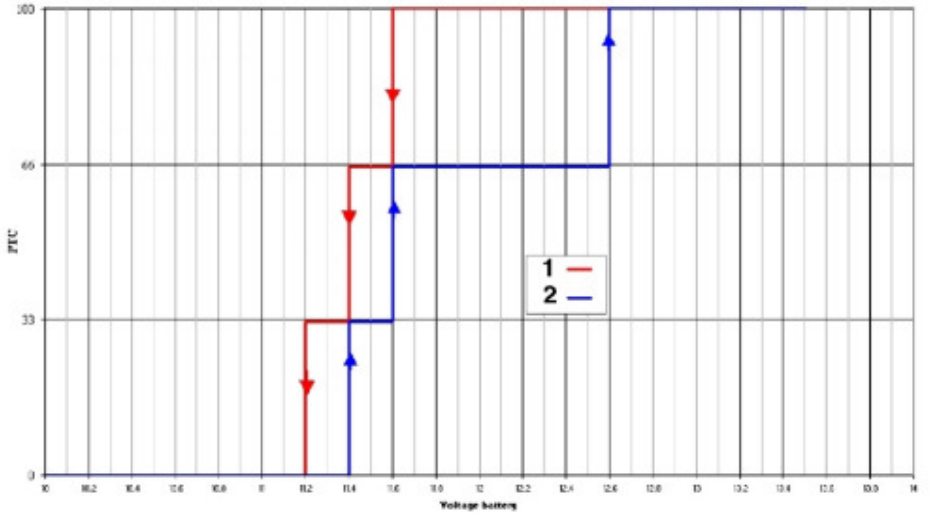
Thermal balance

The PTC is disabled in successive steps according to the engine coolant temperature, as shown in the following table:

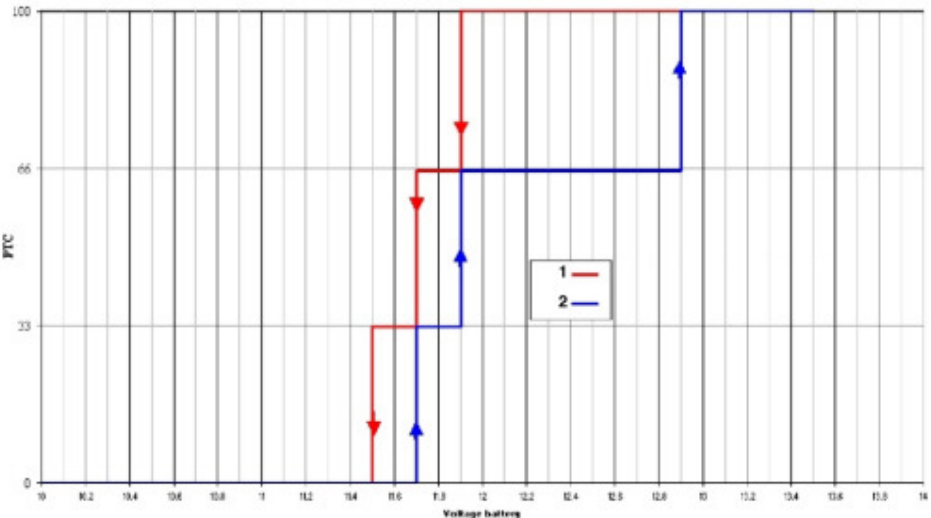
Engine water temperature	% PTC
> 70 °C	0
> 65 °C and < 70 °C	33
> 60 °C and < 65 °C	66
< 60 °C	100

Electrical balance

The PTC is disabled in steps also depending on the battery voltage as set out in the table below:
 Graph for the first 120 seconds from switching on (in which the alternator is still not working at full speed):



1. PTC operation with decreasing battery voltage
 2. PTC operation with increasing battery voltage
- Graph after 120 seconds from switching on (in which the alternator is recharging the battery):



1. PTC operation with decreasing battery voltage
2. PTC operation with increasing battery voltage