

The Porsche 964/993 Heating & Ventilating System

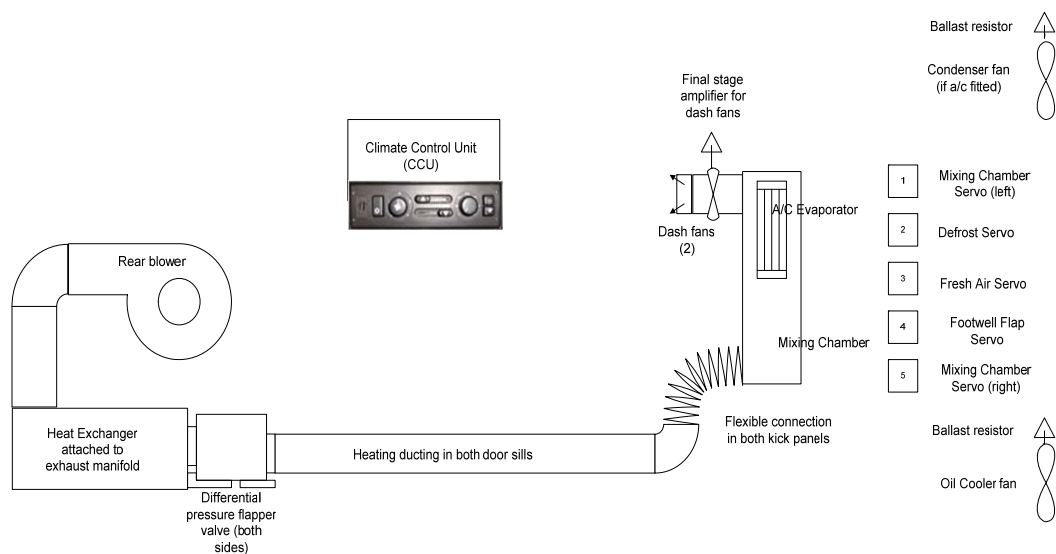
Compared to previous incarnations of the 911, the 964 of 1989 introduced a level of complexity previously unheard of – particularly in the area of heating and ventilating.

The system is often at the root of problems on older cars and can be readily misunderstood with fault diagnosis being difficult. Problems such as fans not running, no heat – or heat in the wrong place, hot when it should be cold, cold when it should be hot etc. etc. can all be difficult to identify, often because of the inter-dependence of some parts of the system on other functions. The considerable amount of electronics employed makes diagnosis complex and often leads to conclusions being wrong.

The hub of the whole system lies in the Climate Control Unit (CCU) which sits in the DIN slot in the dash. There are no less than 8 variations of the CCU (for LHD/RHD, a/c or non-a/c, up to 1990 or beyond) – none of which are currently available as new parts from Porsche. Replacements are 993 parts which require some small modifications to function properly in a 964.

The CCU relies on a number of sensors in the car in order to control a selection of fans and servo motors to result in the driver's required environment.

The diagram below shows the major components of the system and the following description will attempt to outline the way it works.



Firstly, the systems for heating, air conditioning and oil cooling are largely separated although all controlled by the CCU.

Oil Cooling

The engine oil, used for cooling the engine, is circulated through a mechanical thermostat (behind the RH sharkfin) and once oil temperature reaches a nominated level the thermostat routes the circulating oil to the oil cooler in the right front wing. Here a temperature sensor relays information back to the CCU which will, in turn, control the cooling fan to run at either slow or fast speed or stop completely. The ballast resistor provides the electrical resistance to reduce the fan speed when slow speed is selected by the CCU. There are some specifics on diagnosing fan operation on John Miles' web site at <http://www.porsche964.co.uk/technical/cooling.htm>.

Air Conditioning

The air conditioning system (if fitted) is fairly rudimentary, consisting of a compressor, condenser, receiver/dryer, expansion valve and evaporator. When the air conditioning is switched on from the snowflake button on the CCU the compressor engagement clutch is activated by the CCU. You should note that if there is insufficient refrigerant pressure in the system a fail safe pressure sensor prevents the compressor clutch from activating in order to avoid damage being done to the system. In addition, the compressor clutch will not activate if the selected fan speed is on "0".

Once activated, the refrigerant gas – initially R12, but likely changed to R134a - is compressed, generating heat as it goes. (try holding your finger over the end of a bicycle pump while pumping and see how much heat is generated!!) The compressed (and hot) gas is pumped through the piping (which passes through the left hand sill) to the condenser in the left front wing where it passes through what is effectively a radiator and gets cooled. As the gas cools it condenses back into a liquid although still pressurised and it now passes through the receiver/dryer which removes any moisture from the liquid. Now comes the clever bit!! The pressurised liquid now passes through the expansion valve which substantially reduces the pressure – and the nature of the refrigerant gas means that the reduction in pressure gives rise to a significant drop in temperature. The now cold liquid passes through the evaporator – which is similar in construction to a radiator – positioned in the air flow to the cabin. The ambient air gives up much of its heat to the evaporator - hence cooling the air and heating the refrigerant. The refrigerant, in absorbing the heat, becomes gaseous again and starts its journey again back to the compressor.

Heating and Ventilating

The heating system in the 964 is very effective – much more so than most modern water cooled cars – since it derives heat from the exhaust. Whilst the engine is running the exhaust gets very hot and the heat exchangers which surround the manifold transfer much of that heat to the air within the exchangers. If the cabin doesn't require that heat there are a pair of differential pressure flapper valves which cleverly divert unwanted hot air to vents by the rear wheels.

If the heat control on the CCU is turned towards the red dot the CCU commands the rear blower fan to start (initially on slow speed) which creates additional air pressure within the heat exchangers and the dash mounted fans cause a reduction in pressure in the output of the flapper valves, hence routing the hot air towards the cabin. The two slider controls on the CCU control the attitudes of 3 of the 5 servo motors mounted at the rear of the luggage compartment just ahead of the windscreen. These servo motors control the mixing of fresh and heated air (according to the heat selection on the CCU dial) and the routing of the air to the face level and footwell vents. The remaining 2 servos control the defrost (full heat and air conditioned air routed to the windscreen only) and recirculation (fresh air input cut off) functions.

It should be noted that the two mixing chamber servos are mounted inside the footwell trim on 993 cars.

Diagnosing problems

Because of the complexity of the system, diagnosing problems can often be difficult and the interdependence of some functions on other parts of the system can lead to erroneous conclusions.

Where there are problems with fans not operating as expected it is often beneficial to check the operating relays before assuming a more complex cause. The rear blower, oil cooler blower and air conditioning condenser all use an identical relay for operation and they can be swapped for the purposes of testing. The part number (an old VW part) is 811.951.253 and there are identical relays used in the main electrical panel in the luggage compartment to control the oil cooler fan (R4) and, if fitted, the air conditioning condenser fan (R14).

One very common problem is heat dissipating in one or either of the footwells regardless of the CCU settings. This is invariably caused by the disintegration of one of the flexible pipes joining the sill tube to the mixing chamber. There is one on each side, under the kick panel, and they are prone to crumble with age. They are very cheap (£8 each or so) but are a little awkward to replace due to the limitation of available space.

The servo motors mentioned above can also have problems. They are controlled by the CCU and provide feedback to the CCU via small electrical "wipers" inside the unit. These wipers can often develop bad connections through sheer wear and tear and can often fail to operate correctly. They can be dismantled and sometimes repaired at very small cost although replacements are available through Porsche.

One issue regarding the rear blower is that early 1989 cars will have a sticker in the rear fuse box identifying the fuse as a 25 amp part. This was re-specified by Porsche in 1990 to a 30 amp part with no other changes. The 25 amp fuse will blow quite regularly whereas the 30 amp fuse will hold throughout normal usage.

Failure of the compressor clutch to operate is most often because of a lack of gas pressure in the system (or the fan selector on "0"). With the absence of gas pressure it is recommended to take the car to an a/c specialist who can pressure test the system and, if sound, can re-gas the system as required. If there is concern about leakage it's advisable to insert some ultra-violet sensitive dye into the system to aid in leak detection.

Another common fault with air conditioning particularly is where the condenser fan constantly runs for a few seconds and then turns off, only to repeat again within seconds. This fault is caused by the failure of the ballast resistor which is, unfortunately, positioned in such a place to render it in the front line for corrosion attack. It's a relatively cheap part but a little awkward to get to right above the condenser in the front left wing.

The dash fans can also fail – either through bearing wear or electrical failure. Both fans are driven through a final stage amplifier rather than a relay. This solid state amplifier is attached to an aluminium heat sink mounted under the main electrical fuse/relay panel at the rear of the luggage compartment.

Of course, the ultimate failure can be with the CCU itself. There have been many instances of faults cause by bad solder connections inside the CCU and of failed transistors. There have been some reported successes of owners resoldering connections and there are places in the UK, Italy and the US who can repair the CCU. Replacement CCUs are VERY expensive and, because of the updated design, are not always a simple installation.