

Auxiliary Fan Control

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Background

The engine compartment gets very hot, as any XJ-S driver can tell you. It is especially bad after shutdown on a hot day after a bit of hard driving, perhaps in heavy traffic. This "heat soak-back" is theorized to be caused by cooling of very hot metal, such as the exhaust headers and downpipe. But regardless of the cause, the high temperatures tend to cook the soft parts under the bonnet, such as wiring and hoses. Moreover, I for one suspected it as a cause of hot starting problems, perhaps due to vaporization in the fuel rail or injector bodies.

The thought addressed in this note is to run the auxiliary fan after shutdown to combat the heat soak-back problem. Many modern cars do this, notably the small imports. Several schemes for doing it on the XJ-S are described in Kirby Palm's *Experience in a Book*. For example, one often used scheme is to set it up to run on a timer that is "armed" upon engine shutdown. The approach described here, however, is to control it directly off of air temperature, since that is what I was concerned about.

Standard Control

The XJ-S has an auxiliary electric cooling fan in addition to the belt driven fan. In the early cars, this fan is controlled by a relay as shown in Figure 1.

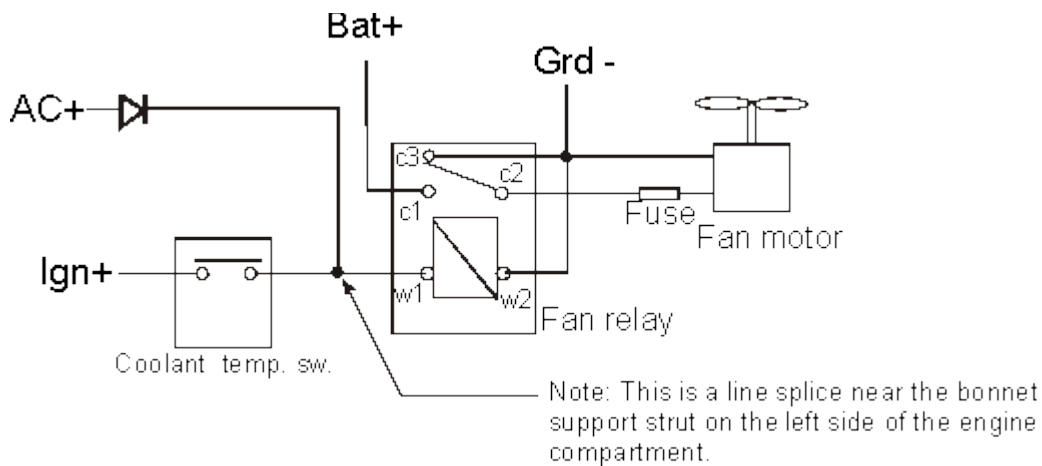


Figure 1 Early XJ-S Auxiliary Fan Control

As can be seen, the relay coil gets energized whenever either (a) the air-conditioning is on, or (b) the ignition is on and the coolant temperature switch closes. The diode is apparently needed to prevent feeding 12 volts to the AC when the coolant temperature is closed but the AC is switched off.

Introducing Air Temperature and AC High-side Pressure Control

One method described in Kirby's Book uses an air temperature thermostat available from Discount Auto Parts, the Imperial Adjustable Thermostat for Electric Cooling Fans, number 226203. Although this thermostat is rated for providing current directly to the fan, this hook-up is probably not a good idea on the XJ-S. The reason can be seen in Figure 1 where we see that in addition to the normally open contact C1 the fan relay has a normally closed port C3, and this one is grounded. Therefore if the Imperial controller output is connected directly to the fan, e.g., by connecting it to C2, there will be a short to ground through the C3 contact if the AC is off and the coolant

temperature switch is open, and the Imperial unit calls for fan operation. For this reason, I decided to instead tie the Imperial unit output to the relay coil.

In addition to post shutdown cooling, I wished to take advantage of a high side pressure switch I had installed when I changed my air conditioning over to R-134a. This switch, called a Trinary (Ranco number 211-176), combines two separate switches, one intended for protection of the compressor by opening on compressor over or under pressure, and one intended for fan control that closes when high side pressure reaches a point where more cooling is indicated. By using this switch, the auxiliary fan can be run only when needed instead of the entire time of AC operation.

The circuit I devised for doing all this is shown in Figure 2. Basically, I have made two changes from the standard early XJ-S circuit in Figure 1. First, there are now three parallel inputs to the fan relay coil instead of two. Second, the AC-on voltage is passed through the second switch in the Ranco high side pressure switch before going to the relay coil. Note that the Imperial thermostat (called Air Temperature Switch in the figure) gets power directly from the battery. This is necessary if we want the fan to run after the ignition is turned off. This fact makes one other detail necessary, namely the diode added to the ignition voltage normally supplied directly to the coolant temperature switch. Without this, if both the air temperature and coolant temperature switches were closed when the ignition was switched off, battery power would feed back to the ignition. I'm not sure of the consequences of this, but perhaps it would prevent engine shutdown. A diode is a cheap and effective fix. I used a 1N4001 general-purpose diode.

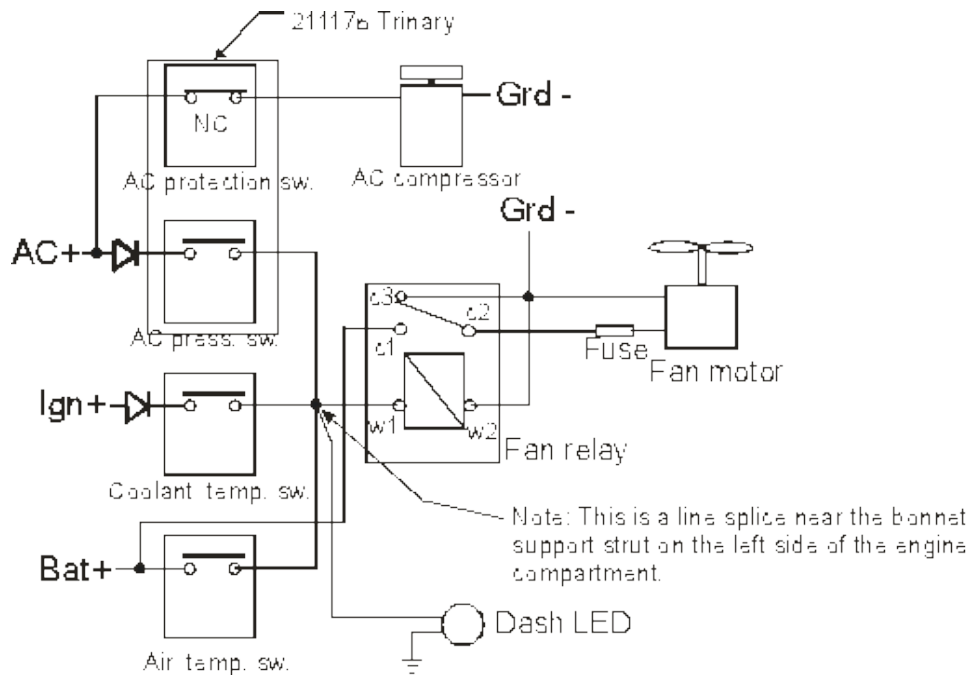


Figure 2 Enhanced Fan Control

An unnecessary but nice feature is an LED pilot light that comes on whenever the relay is energized from any source. I managed to squeeze this into a little hole between the dash proper and the underscuttle cover above the drivers left knee. A process of elimination will reveal why the fan has turned on: if you turn off the AC and it stays on it is either because of air or water temperature. If it stays on after you turn off the ignition, it is because of engine air temperature.

Installation Details

I picked up battery power at the C1 connection of the relay. I wanted to be able to revert to the original control if unhappy with the setup, so made up a splitter with a couple short lengths of wire and some spade connectors, with one leg going to C1 and the other to the input of the air temperature switch. I found that the two original relay inputs were by means of a line splice located near the bonnet strut on the left side of the engine compartment. I just broke into the splice and made my new connections.

The Imperial unit consists of a module about 1 ½" in major dimension. There is a shaft with a screw slot for setting the closing temperature. It is supplied with a mounting bracket, but I enclosed it in a small chassis box from an electronics store. This I mounted on the left fender in the engine compartment. See Figure 3. The bulb is on a lead that is long enough to be placed as far away as the left rear side of the engine. Since I am primarily concerned with fuel rail temperature, I attached it to the fuel rail, near the B5 injector, using rubber gasket material and a clamp.



Figure 3 Imperial Air Temperature controller

Unfortunately, the Imperial unit is not calibrated. As an initial point of reference, I set it to 130 F by immersing the bulb in a pot of water on the stove and using a meat thermometer. This turned out to be too low, causing the fan to run so long that the battery ran down, so I have since adjusted it up to what is probably 150-160 F. I'm thinking about using a heat gun and a meat thermometer to try in situ calibration.

Results

The control works exactly as planned. The only problem, however, is that it tends to run the battery down. When I park the car in a closed garage after driving on a hot day it will cycle on and off for *several hours*. There is a lot of heat in the V-12, and the cooling capacity of the fan working with garage air that is itself in the low 80 F range is limited. So, in the summers I keep an eye on it and if I notice signs of a low battery, such as less than normal cranking vigor, I put the charger on it. Naturally, I'm not totally pleased with this situation, but not yet ready to yank out the control. I may set it up a notch next summer though.