

VW Baywindow Bus - Double Relay Demystified

by Richard Atwell
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Can you replace that \$65 item with \$8 in parts? As Muir might say, "How works a double relay"?

The double relay or combi relay as it's sometimes called resides on the left side of the firewall in a fuel injected bus. It's also called the fuel pump relay but that's an oversimplification. It's mounted below the series resistors that power the fuel injectors and two plugs connect to the bottom. The plug on the right contains wires from the FI harness and the plug on the left wires from the vehicle's electrical harness. So how does it work?

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Identification:

There two versions: 11-pin and a 13-pin. The 11-pin version is the original that was used in 75-78 (and 79 Federal) busses. The 13-pin version was used in the 79 CA bus and the early aircooled Vanagons. The 2 extra leads of the later style was due to the fact that the 79 CA ECU didn't require the series resistors anymore (it used only the resistance of the harness) and it had to power the electronic ignition model. If you fry the relay purchase the correct one for your bus.

The part numbers in the photo are the original part numbers. These are the part numbers:

071 906 059 1975-78, 1979 Federal (Bosch 0 332 514 120)
- superseded 022 906 059 (Bosch 0 332 514 104)

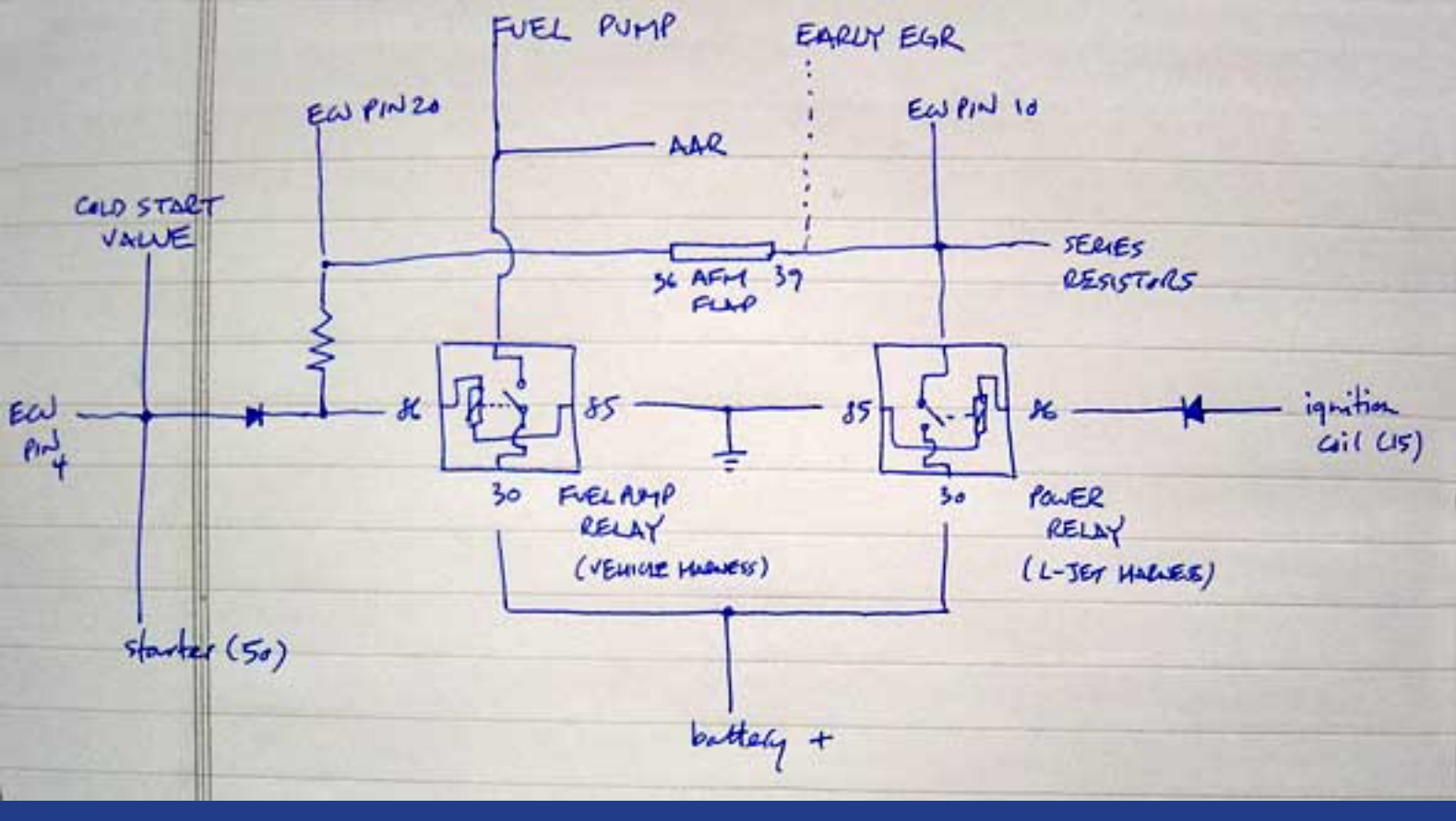
071 906 059A 1979 CA (Bosch 0 332 514 125)



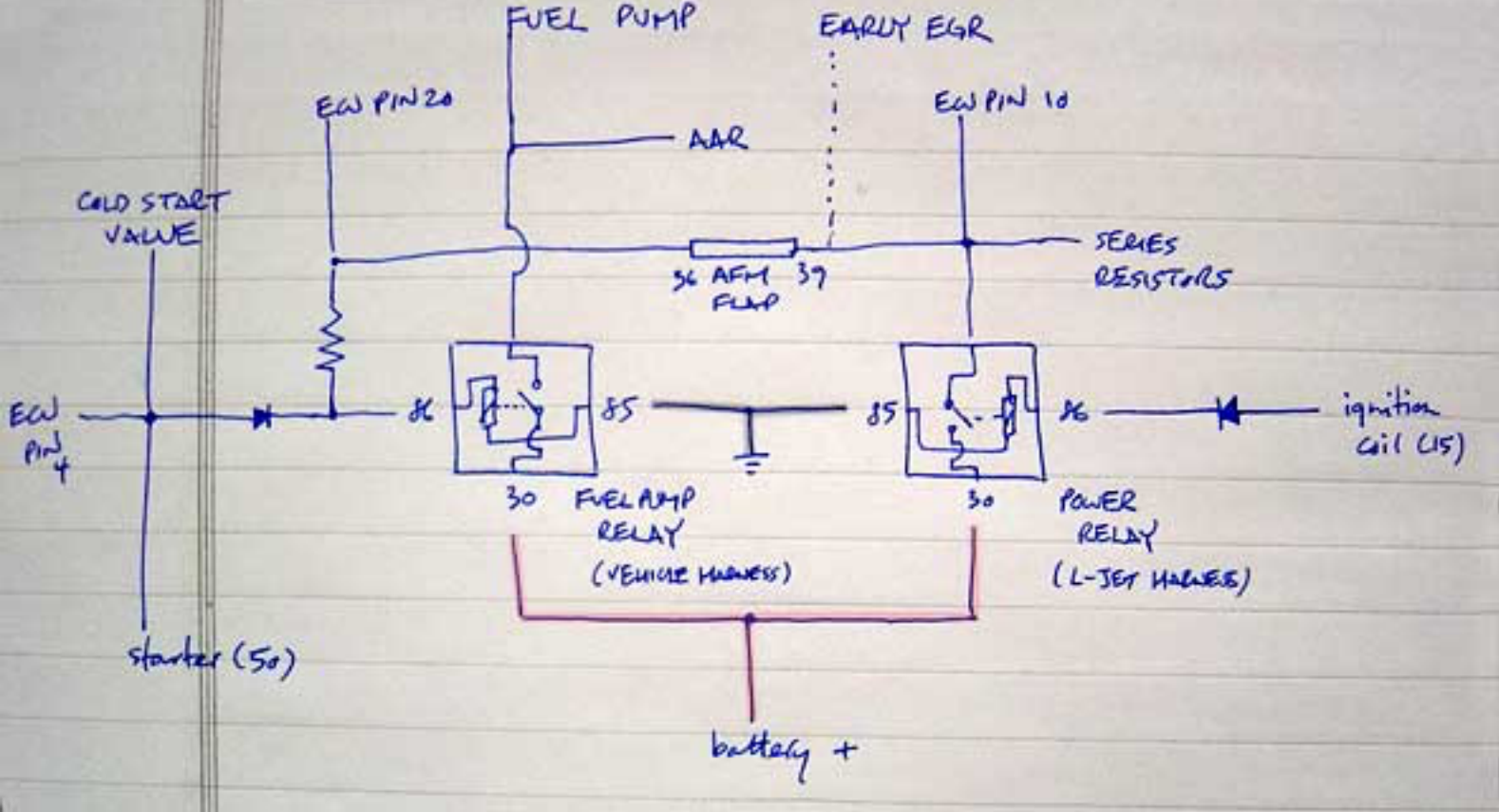
The original relay came in a metal can but has since been replaced by this black plastic version:



How does it work:



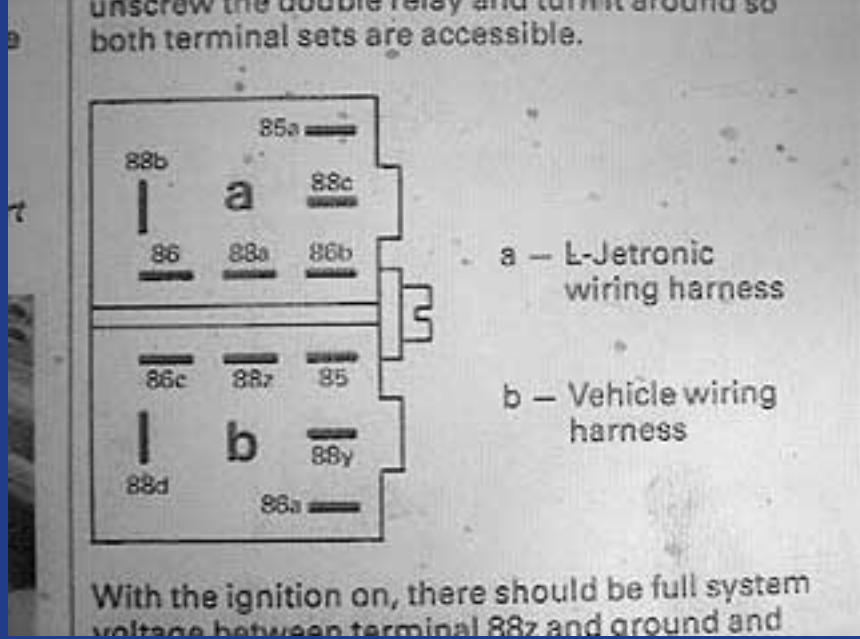
1. The relay is essentially two standard Bosch relays coupled together. Why didn't they just use two? Well, I don't really know but they are Bosch engineers after all and there are some internal components that would have to hang on the outside and since they'd need a bracket for the two relays anyway I guess it made sense to them to customize it since it was going into so many models anyway and hey, they could also charge a lot for it!



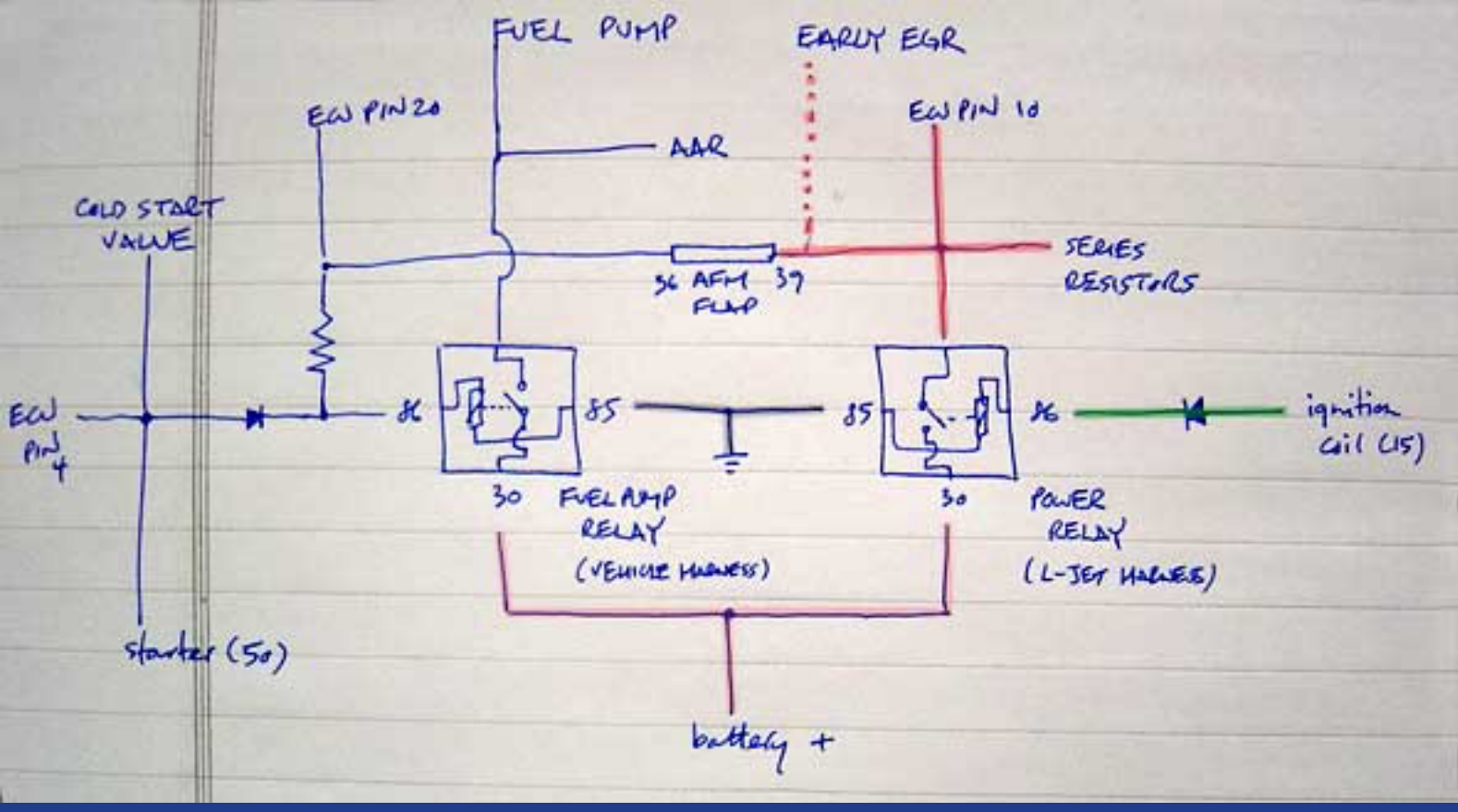
2. With the battery connected and key in the off position the relays are simply idle holding back the current from the battery by a broken circuit (infinite resistance). In the Bosch world of terminal designation the numbers mean:

- 30 - Input from + battery terminal, direct
- 87 - Output
- 86 - Start of winding
- 85 - Output, actuator (end of winding to ground or negative)

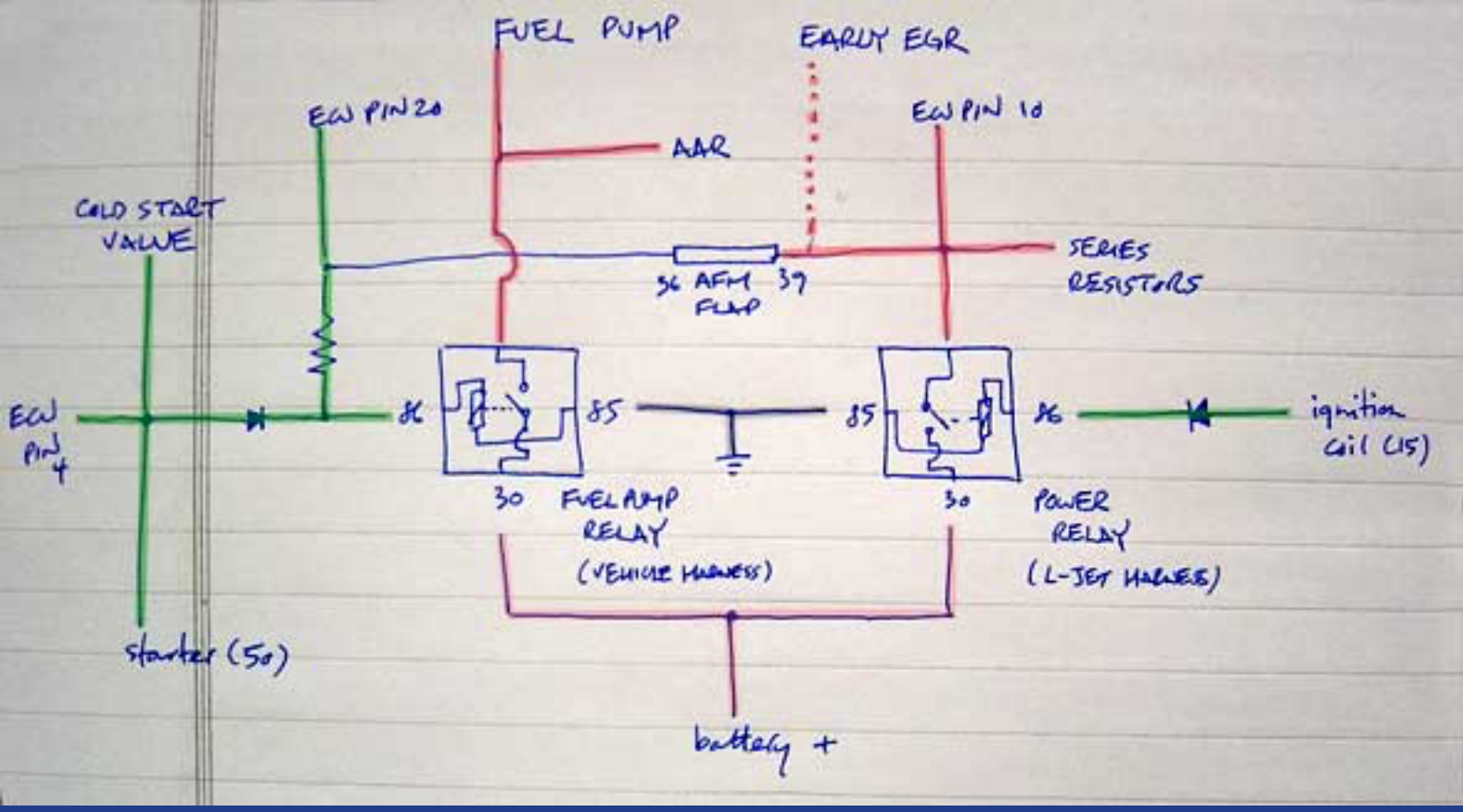
The double relay uses many Bosch terminal numbers but I've mapped them to a standard automotive relay for illustrative purposes. Here are the actual terminal numbers and the components they are wired to:



- 85 - Ground
- 86 - Thermo time switch and ECU pin 4
- 86a - Starter
- 86b - AFM harness connector #36
- 86c - Terminal 15 of ignition coil (+12v)
- 88a - AFM harness connector #39
- 88b - Series resistors and ECU pin 10
- 88c - Aux air regulator
- 88d - Fuel Pump
- 88y - Battery +12v
- 88z - Battery +12v

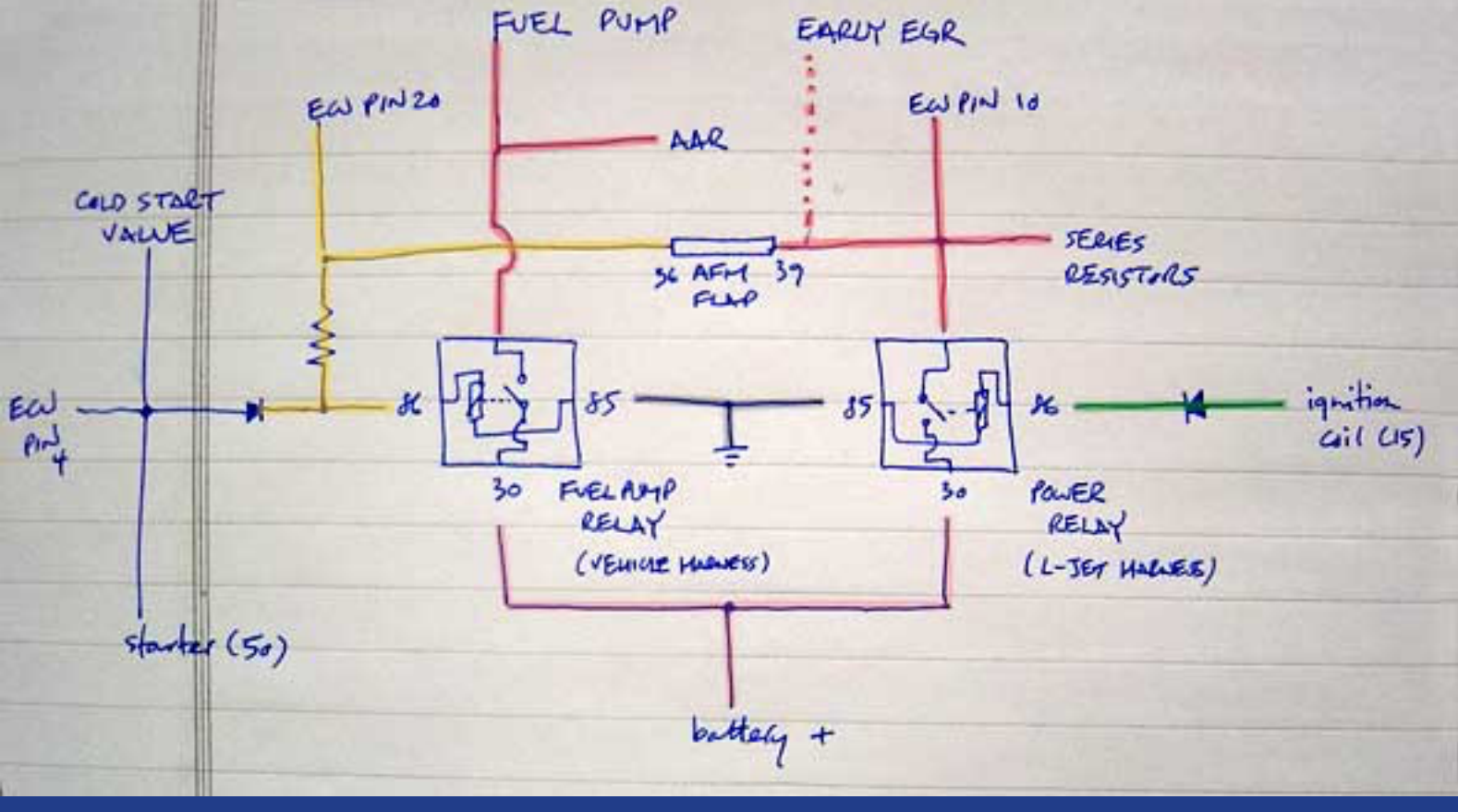


3. When you turn the key to on, the ignition coil is powered and the power relay within the double relay energizes. This provides power to the series resistors and the ECU (fuel injection "brain") so the fuel injectors can fire (they are grounded by the ECU logic). On the early 75 - 76 1/2 models the electro-vacuum style EGR also gets power indirectly via the microswitch under the throttle body.



4. When the key is turned to start, the starter motor energizes and engages the flywheel; the Cold Start Valve (CSV) is powered along with two other pins on the ECU and the power relay energizes. The relay powers the fuel pump and the Aux Air Regulator (AAR) while the engine is starting.

The AAR has a coil inside that heats and closes an opening that provides extra air to the engine to raise the idle during warmup. The CSV is powered similarly but it is switched by the Thermo Time Switch (TTS) that heats and breaks the circuit to the CSV so the engine only gets fuel enrichment when it's stone cold. This prevents flooding.



5. After the engine has started and the key is moved from the start position back to the on position power is removed from the starter solenoid and the fuel pump relay loses power. About the same time, a switch in the AFM closes which is attached to the flap that is inside. The flap deflects when air is passing through and this serves to let the electricity from the power relay reach the fuel pump relay to keep the fuel pump and AAR powered while the engine is running.

This mechanism also serves as a failsafe system: if the engine dies for whatever reason, the AFM flap will open the switch and cut power to the fuel pump.

That's all there is to it. It's a clever system and it appears you could replace this costly unit with \$8 of parts and some rewiring: 2 automotive relays and connectors, 2 diodes and a resistor. The two diodes exists to keep the current flowing in the correct direction during the relay state transitions and there is a resistor to limit the current going through the switch in the AFM.

Anybody want to try? :-)

When it's not working correctly it's the cause of several symptoms due to components now lacking power: the cold start valve (hard start), fuel pump (no fuel), aux air regulator (high idle), and series resistors (no juice).

References:

- [How Bosch Relays Work](#) (BCAE1.com)

History:

02/15/04 - Created
06/09/04 - Added double relay pin terminal numbering explanation
09/06/11 - Fixed broken photos, added translate button, updated footer
07/15/19 - Google update: new adsense code, removed defunct translate button

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