Eure!Car Tech Blog Revision
checking a power supply

Here is a recent post from the Eure!Tech Blog that will take you back to basics, to help you improve your diagnosing skills.

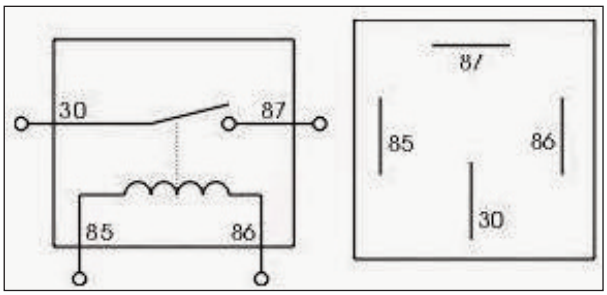
Nothing wrong with this fuse, or is there?

We are going to do a bit of revision, and what better example than a common occurrence: A vehicle comes into your garage that does not start, or does so with difficulty. After you verify that it does not start, the first thing to do is check for existing or stored DTCs using your diagnostic scanner.

You see that there is an injection relay error stored in memory. Due to the ease of testing with another relay, you replace this relay to see if it is indeed malfunctioning. The relay is a common 20 amp relay, and there are bound to be some around your garage, so you fit the replacement relay and test it. The car continues to have the fault and does not start. There is no other option but to start a more thorough diagnosis.

For this, we use the vehicle's wiring diagram and first check the power supplies and grounds. How do you proceed in the case of a relay failure? This common 4-pin relay is configured as follows:

Pin 85 – Relay coil power supply (+)
Pin 86 – Relay coil ground (-)
Pin 30 – Power supply (+30)
Pin 87 – Positive output to component



A typical 4-pin relay wiring diagram

To speed up the diagnosis, and to not have to look in the relay box or at the wiring diagram to see which wire corresponds to each of the relay pins, what is usually done is to remove the relay from its base, clamp a multimeter on the three pins (85, 86 and 30) to verify that the power supply or the ground is connected that corresponds to each one of them. In other words, you check to see if indeed there is battery voltage at 85 and 30, and ground at 86.

You have just made a possible mistake by checking the relay like this. With this diagnosing, you can only verify if there is or is not battery voltage or ground being supplied to the relay, without being able to check the power supply current value at this point.

If you are checking for problems with a power supply or ground, testing must be done while the circuit is under load. If you are testing an un-loaded circuit, you are not really testing the component or the circuit thoroughly, and may overlook the true cause of a fault.

After fitting the relay back onto its base, you realise that the ground and positive power supplies are arriving at the relay in the ignition phase and the relay operates correctly. In the starting phase, the relay ceases to function.

This leads you to the conclusion that although the test was carried out with the relay fitted and with the ignition on, one final check of the voltages and ground must be carried out while the engine is cranking. During cranking, the circuit will have a drop in voltage due to the consumption of the starter motor itself, plus a normal operating consumption of the engine control unit of about 10 amps.

Testing voltage supplied to the relay, and the ground, during cranking showed that the power supplied to the relay coil dropped below an acceptable level for activating this coil. As a result, the relay's internal electromagnet was not actuated, the relay did not switch to the closed position, and the engine control unit does not have any power supplied to it by the relay.

The actual cause of this specific fault that resulted in this car coming to the workshop was a defective fuse. A poor quality 30A fuse generated a resistance when under load that caused a drop in current in the positive supply to the relay (pin 85 of the relay), preventing proper operation of the relay. A simple look at the fuse in question did not reveal a problem, and the cause of the defect was the material of which the fuse was made. A multimeter will show the voltage drop across a defective fuse. Once the fuse was replaced, the relay functioned properly and the engine would start.

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