

## ABS Diagnosis

Correctly indicating ABS warning light system: When you first go to start your car, it should light up (amber color) with key in the ignition at "on" position, stays lit through cranking, and it goes off as the engine fires and you let your key to "run" position (there may be a very short delay in this light going off at this point, that's ok)

Symptoms: (as with any electrical systems, make sure your grounding points are nice and clean first!) 1) ABS warning light bulb NEVER lights under any circumstance whatsoever and obviously you can lock up your brakes (no ABS engagement)... check the bulb for a burned out filament. When this bulb burns out, it acts as a fuse, and deactivates the system. You need to pull the instrument cluster to access the bulb. 2) ABS warning light comes on at key in "on" position, stays lit as you start your engine and return the key to "run" position (never goes out after this). Quite likely your ABS relays are stuck. Scroll down to bottom for a pertinent information. 3) ABS light goes through the correct sequence of events at startup, but it comes back on as you first move your car and reach about 5~7mph. The ABS brain (computer) is registering discrepancy in wheel speed readings coming from 4 corners of the car. The wheel hub assembly on all 4 wheels contain what are referred to as "ABS pulse wheels", a series of metallic teeth which the magnetic coil sensor ("ABS pulse generator") picks up via induction, creating AC voltage in the millivolt range as the wheels spin. The AC voltage increases as a function of wheel speed... So the task is to determine whether the sensors are getting bad or the pulse wheel teeth are corroding away. Read on below: 4) ABS functions fine at normal city speeds, but the light comes on at higher speeds (60~80mph). I've heard this can happen when only a few of those hub teeth are missing. This results in relatively stable (within tolerance) wheel speed readings at low speeds, but as the rpms get higher, the chances of reading wrong signals also increase or something along that line.

Front sensors: There should be whitish/yellow connectors on either side of the car in the engine compartment, right in the upper strut mount area, right against the firewall, probably ziplock tied to the firewall. These connectors are about, oh, 2 inches in length by 1/2 inch diameter, you can disconnect them one at a time and read the resistance across the sensors. At rest, they should read about 1.03Kohms +/-0.05, at least that's what a brand new sensor wires read at rest with my DMM. If they read infinite resistance (wires broken) or 0 resistance (shorted), you need to get a new sensor. They are about \$100 from discount parts

## ABS Diagnosis

source. If the resistance reads fine, then you should spin the wheel one at a time by hand (jack up car) and read the AC voltage across the sensor. Left and right sides should read consistently, I got a range of about 0.3~0.5V AC (or 300~500mV AC, but in any case, they were relatively stable and consistent, increases as rpm increases; essentially zero voltage at rest). If you get erratic reading, that's indicative of one of few things (or all). 1) your pulse generating teeth on the wheel hub may be corroded to the point of losing a few teeth, thereby giving you an erratic reading, 2) the teeth are fine but your sensors are shot, 3) sensor and wheel teeth are not properly aligned (ABS sensor is bolted into place with M6 5mm hex head allen wrench, so this automatically sets the alignment correct... unless like you are missing this bolt or the wheel bearing's creating such a lateral play that it's throwing the alignment off... point is that they have to be well aligned), or 4) your magnetic sensor tips and/or ABS teeth are collecting so much brake dust and other general crap that it's obstructing proper function... clean them. To determine, remove the caliper and remove the front brake rotor. You should be able to look at the pulse generator teeth on the hub itself, behind the flange area where your rotor hat gets put on. If they look fine, then you have a bad sensor. If they look like they are falling apart, you need a new hub (front wheel hub for ABS cars, can be had for like \$100 a piece). Or, alternatively, you can get the sensor from the side that's reading correctly, put it onto the side that's not reading right and then see if that reads ok there or not... if not, you have bad pulse wheel teeth on your hub.

Rear sensors: The basic troubleshooting steps are identical to the front sensors, the rear sensors can be accessed from under the rear seat. You can remove the rear seats by unscrewing them at the bottom side and then popping them out of the retainers at the top. There should be a black rubber plug on either side of the car, lower down, with a black wire going into it. Pop out the rubber plug and pull out the wire until you see, again, those white connectors. Or, you can access from under the car, jack up the tail end, support securely on jackstands at the subframe, then there should be a rubber plug with wire going through it on either sides of the car. Pop out the rubber plugs (there are even pull tabs on those plugs), the connector should be sort of implanted in that rubber plug. May be easier actually to access from under the car since that's the way it is supposed to go in when you R&R those sensors anyway. Do the same analysis as for the front sensors with one exception: the rear wheel pulse wheel teeth can be visually inspected without having to

## ABS Diagnosis

pull the rear brake rotors. There should be a small opening at the bottom side of where the halfshaft/CV joint connects onto the rear wheel hub. Look through there with a pen-light, you should be able to see the state of those teeth immediately. Those hub flanges can be had for about \$60. The rear sensor can be removed from the hub area by removing the rear brake caliper, it obstructs it unless you remove them off (undo those two big (19mm?) bolts securing the caliper carrier to the trailing arm), do not let the caliper hang by the rubber brake line!!, use a bungee cord or something to secure.

By going through the above exercise, you should be able to pin point the trouble spots.

ABS relays: ABS pump housing in the engine compartment contains two relays, one blue 4 prong Bosch relay (\$10) and a big black 4 prong Bosch relay (\$70). You can go tap on them and clean the contacts if you want too, it can't hurt. You must unscrew a little retaining screw to remove the black plastic covering to get at those relays.

System wire harness: Electrical Troubleshooting Manual for E24 lists the pin designation info for ABS harness. You can go at it with your DMM to check for continuity if you suspect that deteriorating wires are the culprit... Cleaning the grounding contacts probably fits into this category. I had put some dielectric grease on those connections to ensure a good sealing and anti oxidation etc.

If after all the above, still no cure....: The next and the final step is the ABS computer. They are usually bullet proof, though may develop hairline cracks on the solder joints. The computer is located next to the intensive washer fluid reservoir on the passenger side of the car, right in that little area next to the black metallic center strip that covers your blower fan. You pop off the black plastic protective cover and then unscrew the thing off the car, remove the harness. They usually do not fry themselves unless someone took a welder at the car and was careless about correct grounding, or there was a voltage spike/surge due to improper jumping or whatever... but if that had happened, your main Motoronic computer would probably have been fried too. If it is bad, they can be had for about \$100, used. A new unit will cost you over \$2000 from the dealer parts.

## ABS Diagnosis

A note on intermittent problems: I had an intermittent symptom #3 after changing out rear wheel hubs and rear sensors. ABS would work absolutely fine on most days but on colder/wetter days, it would trigger a fault via the scenario #3 above... It turned out to be an intermittently failing left front sensor. I found this out by pulling over immediately when that light came on and went at the front sensors with my DMM. Sure enough, left front was registering open circuit in cold temperature. Got a new sensor, no problems ever since