TECH TIPS

THE NEW GENERATION OF WHEEL SPEED SENSORS

Wheel speed sensors [WSS] were usually of the same design regardless of where the car was manufactured. For decades they were all some variation of a PM Gen, or permanent magnet generator style of sensor. Also known as variable reluctance [VR] sensors, these two-wire devices were fairly simple to diagnose. Active sensors are not new by design, you may know them as Hall-effect sensors. Hall-effect sensors provide information to the PCM such as: crank speed, cam position, driveshaft speed, and vehicle speed. Hall devices require a power supply and have three wires. Active WSS's are relatively new devices that also require a power supply to function, but they only have two wires. This is extremely important, because if you don't know that the vehicle uses active sensors, then your diagnostics can mislead you into replacing a sensor that is perfectly functional.

Active WSS's use something called an ASIC. An ASIC is a small integrated circuit that was designed from the ground up to serve one specific purpose. The name ASIC means Application Specific Integrated Circuit, and these devices have become more popular in the automotive world in recent years. These differ from other integrated circuits that can be used in many different applications such as a 555 timer or a 741 amplifier. ASICs are found in many devices, but we will be looking at just one application: the active wheel speed sensor. Active WSS's use "magneto-resistive" technology that is far more accurate than the older VR or Hall devices. This enables ABS controllers to precisely detect wheel speeds right down to zero mph.

While we do not need to know exactly how they work internally, we do need to know how to tell if it's really bad. Vehicles with active sensors will initially look the same, but there is more that is different than the internal parts of this sensor. VR sensors must be mounted directly over a toothed ring or 'tone wheel', easily visible when the sensor is removed. When you remove an active sensor you may not see any teeth, because the ring has now been incorporated into the hub or wheel bearing, the surface will be perfectly smooth. VR sensors require no power supply, but if you probe the harness connector for an active sensor while the key is on you should find close to 12v on one circuit. Since it's electronic, or solid state, measuring resistance will not determine anything. If you do, you should see something over 10k ohms, if not, the device may be shorted internally. The sensor ground is at the mounting point so if you remove it, you can't check it without providing a ground.

The signal produced by an active sensor is different, as is the way it's produced. VR sensors generate an AC voltage pattern. Hall sensors will toggle a supplied reference voltage, usually 5v, to ground and then releases this ground to create the familiar 5v square wave. An active WSS signal for wheel speed has two states: low and high. Toggling between these two states is what indicates the rotational speed of the wheel. In the low state the sensor produces 0.9v and 7mA of current as an input to the ABS controller. In the high state the signal voltage leaps all the way to 1.65v and 14mA. This translates to a square wave of 1.65 volts minus 0.9 =0.75v. This is easy to see with a voltmeter, but you will have to turn the wheel slowly. An oscilloscope is the best way to verify that the tiny 0.75v square wave signal is present and clean. The controller checks up on each WSS every 7 milliseconds to verify the connection-that's about 143 times every second.

The first hint that the vehicle has active sensors will be the reading on your scanner. Older VR sensors didn't produce a signal the controller could use until the vehicle reached about 3 mph. This is why you may see speed values displayed with the vehicle in park and the engine off. An ABS, traction control or vehicle stability system with active sensors should display zero mph under the same conditions.

The Teves Mark 20 e system used in Mercedes Benz vehicles from 1999 is one example of a system that uses active sensors. Ford's 2000 Focus has them along with tone rings that are actually part of the wheel bearing assembly. This is important to know since many vehicles can be purchased without ABS. In the case of the Focus there are two different wheel bearing assemblies. The one for a non-ABS vehicle has a RED bearing grease seal on both sides. An ABS equipped Focus needs a bearing with one RED and one BLACK seal. Just make sure that you do not install it backwards. This type of sensor is becoming more popular as time progresses, so there is a good chance that if you work on ABS systems, you will eventually see one.

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