GM Electrical Power Management



An alternator can produce more voltage than needed and we must regulate the output. Too much voltage will damage system components. Many vehicles use a voltage regulator to turn off the alternator when voltage exceeds a limit. In 2005 General Motors began using Electrical Power Management or EPM on many SUV and truck models.

Instead of only off and on, with EPM the alternator output is variable from five to 95%. Charge rate and system voltage varies depending on system need. EPM uses several components to estimate battery condition and decide which charging strategy to use. Six different charge modes are available and the vehicle switches between them, depending on the conditions.

Startup mode

After starting the engine, the body control module attempts to charge at 14.5 volts for 30 seconds. This quickly replaces power used by starting. It can also confuse drivers. When startup mode ends, the system voltage will change, depending on the next mode selected by the body control module. This may cause a drop on the voltmeter, which some drivers mistake as a problem.

Charge mode

When we use the HVAC system, we need additional current. The LAN reports this to the body control module which decides if the vehicle needs the charge mode.

Running the inside fan on high, switching the rear window defroster on or cooling fans running, causes charge mode to start. In charge mode, output is between 13.9 and 15.5 volts, depending on the state of charge and temperature of the battery.

- Other things that cause charge mode include:
- The battery temperature is at or below freezing.
- The state of battery charge is below 80%.
- We turn the windshield wipers on for three seconds or more.
- A problem causes voltage to drop below 12.56 volts.
- Driving more than 90 MPH or 140 km/h.



• Headlamp mode

If we turn the headlamps to either high or low beam, the BCM switches to headlamp mode. In headlamp mode they regulate voltage between 13.9 and 14.5 volts.

Voltage reduction mode



To increase battery life, the BCM will reduce system voltage under certain conditions. This alarms many drivers that think the alternator has a problem. The target output will only be 12.9 volts in voltage reduction mode. They use this mode when the ambient temperature is above freezing. The system measures current flow and reduces system voltage under certain conditions. The current draw must be less than seven amps, the charge-rate less than one amp and the alternator duty cycle less than 99%. Voltage reduction will continue until any of these conditions change.

Fuel economy mode

When the system draw is less than eight amps and alternator output is less than 15 amps, battery condition is considered. A calculated state of charge of 80% or more and ambient temperature above freezing sets fuel economy mode. The voltmeter will read as open battery voltage in this mode. A reading of 12.5 to 13.1 volts is normal in fuel economy mode.

Fuel-economy mode remains selected until the conditions change or the BCM calls another mode as described above.

Battery sulfation mode

When a battery discharges, sulfur can cling to the plates. We call this sulfation, and it drastically shortens the life of the battery. When we get a battery voltage below 13.2 volts for 45 minutes, the BCM switches to sulfation mode. The BCM enters charge mode for 2-3 minutes and then retests the system. Depending on the battery state, the BCM decides the next mode to use.

System problems

With all the complexity of the EPM system, they have not extended battery life. Failure at three years is common, as with other less complex systems. Diagnosis can be very involved and bidirectional communication with the BCM, and power control module is necessary to diagnose problems. The system stores codes, much like a check-engine light, and these provide a starting point for diagnosis.



Warning messages, such as BATTERY NOT CHARGING SERVICE CHARGING SYSTEM, also alert the driver of possible problems. These messages will remain on, until the condition causing them is corrected.

A common example may be allowing the vehicle to warm up in cold weather, by idling. With the blower on high, headlamps on and rear the defroster on, the alternator may not keep up. High load at low engine speed may cause a warning light. If the light goes out after driving, the system is likely okay. A light that continues to come on or that lights under normal conditions, means a problem.