So Why Is My Battery Dead Again?

Alexander Cook CTO / V.P. Engineering Vanner Inc.

My battery is dead, so what is wrong with my electrical system?

A question no one likes to face. Modern electrical systems are becoming more and more sophisticated. It used to be that a voltmeter was all you needed to trouble shoot when your battery was dead. Now it seems like you need a degree in communications theory and $50,000 worth of equipment.

As electrical loads are added to the system, particularly “parasitic” loads (those not required to move the vehicle), dead batteries are more and more of an issue. At the same time, expectations for reliability are rising: and everyone is looking for “solutions” to the problem.

The good news is there is a light at the end of the tunnel. But first, let’s review where we are currently with battery power.

Batteries alone cannot provide all the power needed for today’s vehicle electrical systems. Batteries are expected to provide energy for accessory loads. This requires storage with a good cycle life, a high energy density and they must supply plenty of cranking power.

The batteries must provide this power while managing the battery conditions to avoid overcharging, over- discharging, or undercharging--any of which can dramatically shorten battery life.

There are a number of technologies available to aid the battery and increase electrical system reliability, including:

- Ultra-Capacitors for short bursts of energy
- Battery Monitoring and Analysis Capability
- Communications Capability
- Power Electronics Technology to control power flow

Each of these stand-alone technologies can help, but combining these technologies results in the most reliable starting system available. An integrated system solution incorporating all of these technologies will:

- Provide energy for accessory loads
- Supply plenty of cranking power
- Manage battery conditions to extend battery life
- Communicate battery state of charge to the alternator
- Communicate battery state of charge to the power management system

Communicating the battery state of charge to the alternator guarantees accurate re-charging of the battery and eliminates either over-charge or under-charge. Communicating the battery state-of-charge to the power management system also prevent over-discharge of the battery.

This management of the battery-state-of-charge extends the battery life dramatically, and if we add an ultra-capacitor to supply the high surge current for engine cranking, we can use a deep cycle battery and achieve a high cycle life.

We need to get the battery life closer to its potential 10-year life. Achieving this requires some intelligence in the system and a certain degree of control. But, this only helps if there is information for the system intelligence to analyze.

This is where CAN (Controller Area Network) is effective. SAE has done some sterling work (based on work by others such as Bosch) in establishing industry standards. These performance standards allow different devices on the vehicle to communicate with each other. CAN has become the enabler of sophisticated electrical systems by replacing what would otherwise be costly (in terms of price and weight) systems, as well as horrendous wiring challenges.

Vanner has been supplying vehicle monitors for decades. One of our products, the EM70, is a simple device that provides warnings of major bus electrical problems, such as an alternator failure, before the vehicle electrical system degrades to the point that it is immobilized.

The EM70 has three wires that attach to a display identifying three different faults. A CAN interface also requires three wires (two if you're feeling lucky), but because it is a serial communications system, somewhat like the network connection on your computer, it can handle large volumes of data or messages without major changes to the vehicle wiring.

These "CAN enabled" products, such as the Vanner Vann-Guard 70 and 80 Series Equalizers and Vanner Vann-BUS Sensors, have a similar number of wires as the older products, but are capable of doing much more without additional wiring. Some examples of CAN enabled capabilities include:

- Sense bad connections or blown fuses
- Collect data on system temperatures, currents and voltages for use by ESC (Electrical System Controller) in diagnosing system problems and controlling system power flow Evaluate Battery State of charge and state of health
- Compensate for wiring voltage drops to improve battery life.
- Provide specific electrical system diagnosis and prognostics to alert the vehicle operator of problems before they occur.

The Vanner 90-60CAN, our "Converter-Isolator", allows the use of two dissimilar batteries or separate battery banks to be used on the same vehicle. As it is a converter, the batteries can have

different charge regimes. This optimizes battery life. The Converter-Isolator controls the current, so we can choose how much of the alternator power is routed to the secondary battery bank.

With this degree of control, we can prioritize charging of the primary (cranking) battery. Using the battery algorithms in the Converter-Isolator and the 80-Series CAN Equalizer, the ESC knows the state of charge of both batteries and can control the power flow. If necessary, the ESC can disconnect non-essential loads to prevent battery damage or it can allow a percentage of both batteries to be discharged.

Batteries produce a voltage that is dependent on load, temperature, state of health, and the particular type of the battery. A typical voltage-controlled disconnect is inaccurate because of the chemical nature of the battery.

The Vanner virtual-cell battery monitor, that is integrated into the 80-Series CAN Equalizer and the Converter-Isolator, model the battery and compensate for the variables and provide the ESC with accurate data. The ESC then knows the actual state of charge of the battery so it can use the appropriate amount of charge from the battery and effectively avoid premature disconnects and avoiding over-stress of the battery.

Another benefit of CAN is that the communication wires are shared between multiple devices so the same three wires that are used by the Equalizer for communication are also used, for example, by a module that controls the lighting or door switch sensors.

The power distribution can now share multiple loads due to the power line being switched on and off, near the load, by a multiplex module. Although all loads do not share the same power lines for reliability reasons (we don't want a short in the taillight to take out all the vehicle lighting) there are still separate, grouped, distribution wires for load power. However, with CAN we don't need one wire for each switched load or sensor coming from the ESC or display panel.

Vanner's Vann-Guard and Vann-BUS products are designed to the SAE J-1939 standard. They can communicate with other compatible devices (Clever Devices, Vansco Electronics, I/O Controls, to name a few) and create a unique communications network that gives the fleet operator a wealth of critical information and control that is not available in conventional electrical systems.

Current electrical systems can not provide the information necessary for proper preventative maintenance on batteries. Consequently, batteries fail prematurely. The new CAN technologies now give accurate information which will allow for significant electrical system dependability and vehicle uptime.

Vanner Vann-BUS and Vann-Guard products are available now for specification on new OEM electrical systems. Some Vanner CAN technology is currently available for retrofit; this allows

the fleet operator to upgrade older “less intelligent” systems and enables the immediate benefit of increased system intelligence and electrical system reliability.