Get charged up for electrical change

Electricity itself may not change but the way it's generated and used in vehicles definitely does. Here, James Dillon explains what this means for the health of batteries, ECUs and more...

THE PROLIFERATION of electronic control systems fitted to the modern motor vehicle has meant the way electricity is generated and distributed has changed radically and permanently.

On the modern motor vehicle the alternator is likely to have its own on-board processor, its own diagnostics and it will be linked to the other ECUs by CAN, LIN or similar vehicle network protocols. What's more, the alternator charge rate is controlled depending on feedback from the battery sensor and the engine ECU.

Key components

The key components of the modern voltage supply system include a battery, a battery sensor, engine control ECU, alternator, data bus, power cables and the vehicle load. In addition to this, the vehicle is likely to have front and rear power distribution centres which service local power requirements such as front lights and rear lights.

The importance of correct capacities

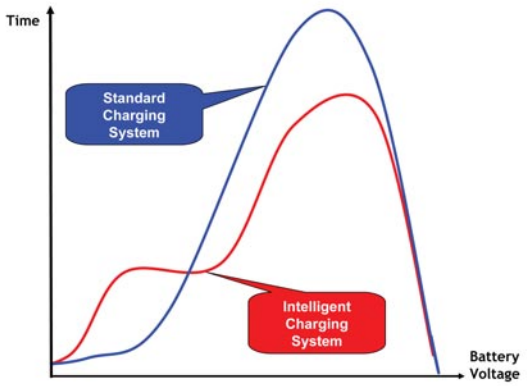
The battery capacity, along with the charge and discharge profile, is coded into the vehicle so the battery sensor is correctly calibrated. This enables the battery to be charged at the optimum level. Should the battery need to be replaced, a unit with the same specifications should be refitted. If a different capacity battery is fitted, the system will not function correctly and the power management system may operate in a limited operation mode, meaning certain peripheral systems will not function (such as heated seats and other comfort systems).

The engine control system communicates with the battery sensor and with the alternator via a serial interface (this is shown in blue in figure 1). The information from the battery sensor is used to calculate the charge and ageing status of the vehicle battery.

Alternator control strategy

The core principle of smart charging, or intelligent alternator control, is that the battery is not fully charged all the time, but charged to a defined level depending on various environmental and ambient conditions (such as outside temperature, battery age and load).

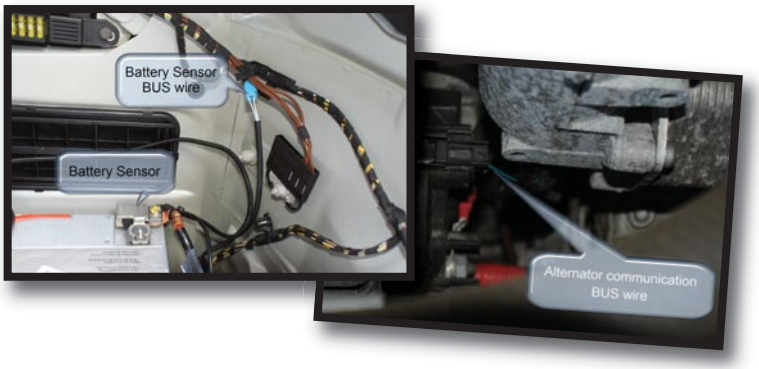
In contrast to conventional charging strategies, the smart charging system recuperates energy during the over-run (coasting) phase of vehicle operation. The alternator excitation is at maximum levels during the over-run. Electrical energy is generated and fed to the vehicle battery using the kinetic energy produced by the vehicle while it's coasting or in over-run. The alternator is not excited during the acceleration phases of the vehicle operation and, therefore, the engine load is reduced and no fuel is used for generating electrical energy.



STAY SMART: Unlike conventional charging systems, smart systems recuperate energy during vehicles' coasting phases.

The charge rate reaches a level of approximately 70 to 80% of the maximum possible charge. The alternator voltage is more often in the lower voltage range in order to achieve more effective charge intake by the vehicle's battery.

t: 01278 671 919
e: sales@techtopics.co.uk
www.techtopics.co.uk



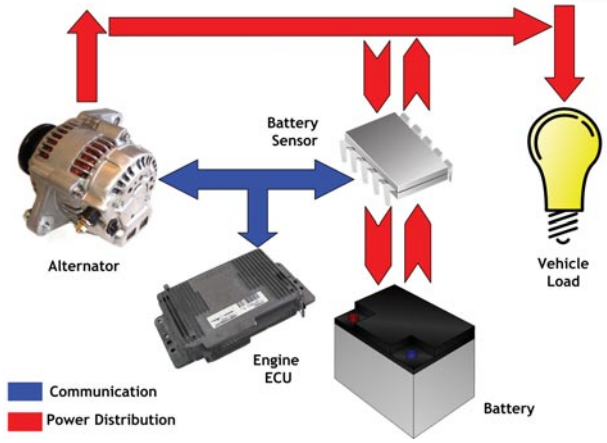


FIGURE 1: How a modern battery supply system works in practise.

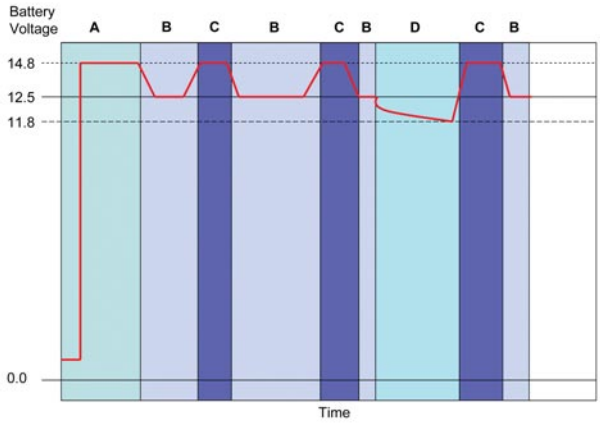


FIGURE 2: A = Battery is charged up by the alternator. B = Battery is fully charged and load is met by alternator. C = Over-run phase when battery charges. D = Vehicle is accelerating and the alternator switches off.

The three charging strategies

In a modern vehicle, depending on the state of charge of the battery, the electrical load and the vehicle operation, the electrical systems of the vehicle may be powered in one of three ways:

- **Directly from the alternator**
  This is a medium-load mode for when the battery is fully charged.
- **Via the battery**
  This is a high-load mode used during acceleration.
- **Via the alternator**
  The alternator may be directed to recharge the battery when in a low-load mode. This is typically used during vehicle over-run.

System testing

Many technicians, when attempting to measure the alternator output, will see a square waveform from the alternator wiring. What is being measured here is the data bus message (from the bus wire) and not the vehicle voltage level. The chart in figure 2 (above) can be referenced as a guide when analysing the alternator charge rate. This provides an indication of the battery voltage level, depending on operating conditions, when measured at the battery terminal.