Alternators - Time for a rethink

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Vehicles have always needed electrical power to run various systems. In the beginning, manufacturers developed the dynamo to provide the energy required to run the limited systems like lighting, wipers and heating. For the luxury models, even a radio was fitted.

But the limited output from these soon became a problem, as vehicle systems became more power hungry, and the output was limited by the design of the dynamo. The alternator was the next solution for the higher outputs that were required.

Early alternators produced 45 Amps and upwards, depending on manufacturers needs at the time, for more and more electrical circuits in their models. The design allowed for even higher outputs. The internal regulator controlled the voltage to a stable 13.4 volts to 14.8 volts, ideal to cope with the current demands and a healthy battery level.

As demands for even more power to run all the newer systems became the norm, the humble air cooled alternator could no longer cope, so water cooled alternators started to show up on high spec vehicles. Internal voltage regulation remained, and the standard voltage tests of 13.4 volts to 14.8 volts became the normal testing technicians became used to seeing, as normal for a healthy alternator.

But now…

We have had the smart alternator for some time, with the ECM controlling the alternator performance, Ford smart charge is the best known by technicians. And they are getting used to testing the challenge and response signals that manage the charge rate of these components, keeping the current output under control for the demands of the vehicle

Even more recently, we have had to change the way we test the humble alternator.

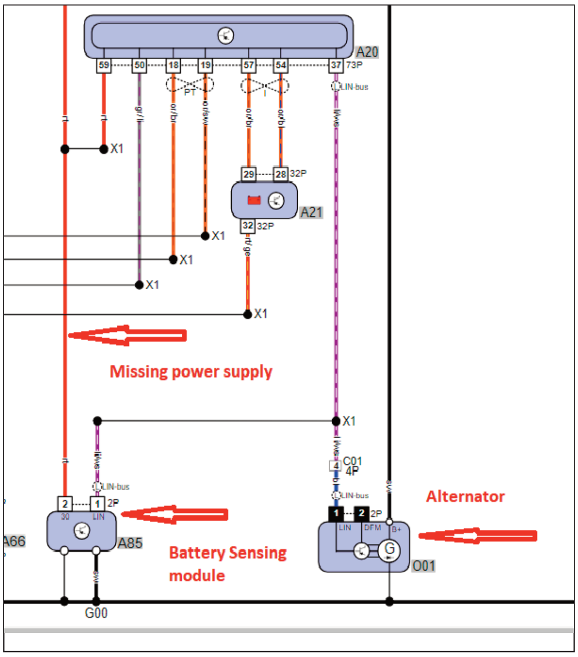
LIN BUS controlled systems now manage the output of the alternator, not only the current, but also the voltage management.

A recent vehicle issue we had was with a 2013 Skoda Fabia II 1.2 TDi CFWA engine, with a fault logged for over-voltage in the central electronics module. On testing the charge rate, the workshop found 14 volts in all modules serial data and at the battery, obviously not over-charging the technician thought. The technician who was very experienced in diagnostics, contacted me for advice on how to approach this issue, as they had not seen it before.

As the vehicle was fitted with Stop Start and a battery monitoring module, we decided to scan all systems and found the central electronics module measuring block 002 was expecting 12.8 volts as the desired output, but was getting 14.0 volts from the alternator.

A LIN check on the battery monitoring module, showed that the module had lost a power supply from a 5 Amp fuse next to the battery. After a little investigation, a broken wire was found, 6 inches from the battery, that was coming from the supply fuse. After repairing the wire and clearing the faults, the charge rate was now 12.8 volts and the data for desired charge rate was the same 12.8 volts.

So, now we need to amend what we have learned, and note some charging systems will only reach a voltage just above the 12.55 volts that of a fully charged battery. But the current output will be controlled by the modules utilizing the LIN network.



A missing power supply to the battery sensing module caused an incorrect voltage supply to the alternator

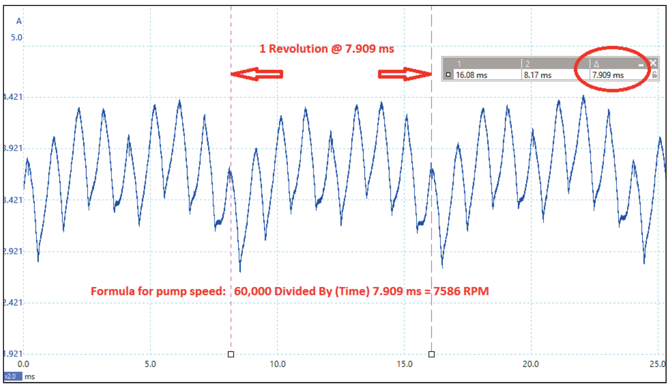
Measurements & Mathematics - A recent case study

A workshop called about a 2003 Nissan Micra that was causing some problems that they had not been able to solve. The Micra was fitted with a CR12DE engine that was having acceleration problems and was not displaying any fault codes.

They had gone through the serial data looking for any issues. They had recently attended a Picoscope training session, and were playing with their newly acquired Pico as they investigated. They scoped the Cam and Crank signals. The MAP sensor output was scoped and checked. Having run out of ideas where to look, they called the helpline for some guidance.

I gave them a test to perform on the Lambda upstream signa,l to check what was the state of the air/fuel mixture on acceleration. It showed a lean condition all the way through the rev range.

On checking the Long Term Fuel Trim (LTFT) data, it was + 10 % continuously, so a fuel flow and pressure test was requested. But the workshop did not have a fuel pressure test kit.



Current draw by the fuel pump was used to calculate it's speed

I gave them some information on how to test the fuel pump performance with the scope, using some time measurements and a mathematics formula. Most electric fuel pumps run at around 5000 rpm when pumping fuel under pressure. Using a formula you can check this. They found that the pump was drawing lower than expected current, and was also running too fast, at around 7500 rpm. This proved that the pump was the problem.

The technician did not realize that with some accurate measurements and math, the scope has such a versatile use in his diagnostic processes.