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Electrics for mechanics



Many truck and trailer systems now have electronic controllers. 21st century trucks are likely to have electronic controllers on the engine, transmission, brakes and air suspension. But how can the workshop cope with all this electrical complexity? The old answer was to get an auto electrician to find faults. This is no longer practical as the first response because of the shortage of auto electricians and the likely costs. In 2012 ARTSA will run a specialist electrical course for workshop managers and mechanics with the hope of making this a bi-annual event. This article describes some of the principles that will be taught by ARTSA and offers some suggestions about the technology that is needed in the 21st century workshop.

Current generation heavy vehicles have a complex electrical system with the following features:

- A 12V or 24V electrical system with an alternator, starter and battery.
- An electronic controller for each major system (engine, ESC, instrumentation, etc.)
- A CAN bus that transfers digital signals between each controller and some smart sensors.
- Multi-volt (LED) lights and controllers

- Some combination vehicles have voltage converters that change the voltage from 12V to 24V or vice-versa.
- Some hybrid vehicles may have an integrated starter-generator and a 48V battery pack.

When a vehicle comes into the workshop with an electric fault, a standard approach needs to be followed. Here are the steps:

1. Is there damage to any electrical component including burning on wiring, battery buckled, chaffed insulation, singed relays or connectors or driver reports of a burning smell? If so, disconnect the battery lead when the vehicle is unattended.

2. If something has stopped working, first check the fuses and circuit breakers. Follow this up by checking that the supply voltage is reaching the device using a multi-meter. Note that a voltage converter will only produce a sensible voltage when a load is connected. There is no excuse for not finding the blown fuse!

3. If a system is working abnormally when a switch is operated, check the earth points on the circuits. Sometimes a back-feed occurs when the earthing is bad.

4. A schematic of the electrical system is a must have. The connector pin out information is also essential. Insist that the OEM manufacturer provides this.

5. Draw a diagram of the inputs and outputs of the system controller. What signals does it get and what outputs does it generate? What are the average voltages in and out?

6. Check that the output voltages are sensible. Use a multi-meter. Does the

output change when it should? Note that the multi-meter can give confusing results if the circuit has a time varying (AC) voltage waveform.

7. Check that the input voltages are sensible. Measure the input voltages using a multi-meter. If the input is a time-varying signal, look at it with a screen multi-meter.

8. Many inputs will come via the data-bus. The signals can usually be read using a data-bus reader. This provides invaluable information about the health of the sensors.

9. Modern tools will be able to capture the readings in a form that allows them to be emailed to a specialist. This will promote the use of expert advice off site.

10. Electronic systems on heavy trucks are robust and not easily damaged. However, one way to damage them is to use a test light directly onto 5V electronic circuits. A multi-meter set to a volt range will not damage the circuit. The 21st century mechanic will need to be familiar with basic electric fault finding. They will also need access to schematic, next-generation diagnostic tools and OEM specialists who can guide the diagnosis remotely. Email will be an important communication method.

Mechanics can gain competence with systematic electrical fault finding if they are properly trained. This is an essential responsibility for the 21st century workshop manager.

Those interested in attending the electrical course for workshop managers and mechanics, to be held by ARTSA, can register their interest by emailing exec@artsa.com.au.

By Peter Hart
Chairman, ARTSA



Workshop electrical meters for the 21st century. A conventional multimeter (left) and specialist screen multimeter (right).



A data bus reader that is used on North-American trucks.