

# SPARK OF INSIGHT

**Y**ou've got to work in a methodical way and have the right information." That's fault-finding in a nutshell, according to Alistair Baldwin, an irtec master technician at Scania dealer TruckEast in Norwich. Baldwin is one of Scania's escalation technicians, with more than 30 years' experience. For a start, "It's important to have the correct wiring diagram. You've got to know what you're looking at."

Also emphasising the need for a methodical approach is Paul Bodycot, product quality engineer at Volvo's UK HQ in Warwick, who spends much of his time helping dealers with their stickiest technical problems. He points out that factory diagnostics can help: "We have a guided diagnostic tool for Volvo. The technician puts the error code in, and the

*The Kvaser Memorator Pro 2xHS v2 is a CAN-Bus interface which will interface with a PC via USB, and acts as a stand-alone datalogger*

**Even now, some technicians treat electrical fault-finding as a black art. But as expert technicians tell Toby Clark, taking the right approach and using the right tools makes the topic less mystifying**

system says these are the potential issues. Have you checked the basics – plug connections, terminals, things like that? Then you go through a series of resistance tests." The system includes acceptable values for resistance in specific components and connections. "That can get basic mechanics up to a really good skill level because they've got all the information they need."

While hybrid trucks are still very rare, hybrid buses have become commonplace – but electrical troubleshooting on their 600V drive systems is very different, according to Jamie Parnham, a workshop supervisor based at Volvo Truck and Bus Enfield. He points out that high-voltage components can retain a lot of energy if they are not shut down correctly.

"The fundamental aspect of fault tracing on a hybrid system is the decommissioning

process and then recommissioning the system. You must assume you have live [equipment]," says Parnham, but adds that he has never seen such a situation in more than a decade of working on hybrids. (The irtec technician qualification's new EV module covers this; see [www.is.gd/qecaga](http://www.is.gd/qecaga) for details).

## **NOT COMPLICATED**

But for more ordinary applications, test equipment does not have to be particularly sophisticated or expensive – sometimes even a basic multimeter is too much. "You need to know when to use a bulb and when to use a multimeter," says Alistair Baldwin. "You can use a bulb to make sure you've got enough current, where a multimeter won't work".

Essentially, a bulb (it can be a test lamp or even an ordinary 21W indicator bulb) acts as a 'consumer' – it provides a resistance, and hence a load, where a multimeter provides almost none. A digital



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multimeter's input impedance (that is, resistance) is typically 1M $\Omega$  or 10M $\Omega$ , whereas an incandescent test light has a resistance of a few Ohms. If you test a connection for continuity or positive voltage, a multimeter may show that all is well, because it will detect a tiny current.

Paul Bodycot points out that even a heavily corroded terminal may transmit enough current to show a voltage: "But a conventional bulb will not light unless an appreciable current can flow, so they can pick up a resistive failure on the circuit such as corrosion.

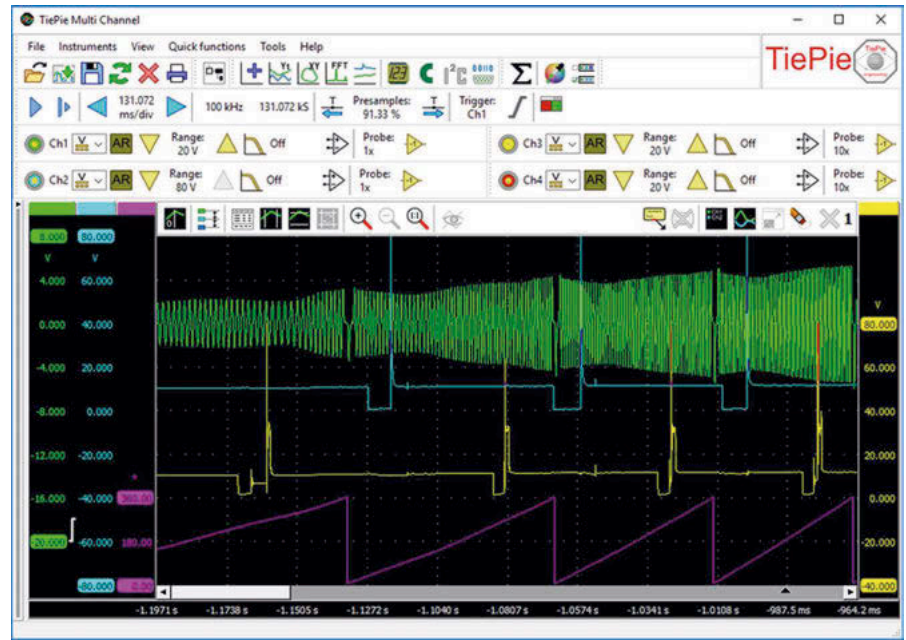
"Some of the guys use power probes; you can use one of these to load cables, and it has really good functions, so it will give you a voltage, resistance and current measurement." But experience helps in interpreting results. Bodycot points out that if a connection is specified at 120 Ohms, some people might be unnecessarily worried if the measured resistance is 130 Ohms.

Intermittent problems are really tricky, and Baldwin reckons asking the right questions is key: "Sometimes drivers can tell you something they might not think is relevant, but it's vital."

"It's like all fault tracing," adds Jamie Parnham; "If the information is not there or the symptom is not described accurately, you can go off on a tangent."

"You can load a wire and still get a resistive failure that's only there when the truck is moving," says Bodycot. "But you can use an oscilloscope to measure what the truck sees in its environment. It is a bit tricky to set up if you're not familiar, [so] most technicians prefer to use a multimeter. But it does get easier! With a four-channel oscilloscope you can test multiple wires at one time."

The oscilloscope can be used as a datalogger to record the behaviour of components. Paul Bodycot says one of the most common problems is a short to ground, "which is easy to measure if it's there all the time - but a short to



A PC-connected oscilloscope such as the Handyscope can act as a datalogger for multiple inputs

ground can happen in a millisecond". The oscilloscope "allows us to look at a voltage for a period of 90 seconds on the laptop. But even measuring with the scope doesn't fix the problem - it just guides you to what it is."

**DOWN TO EARTH**

"People check the power circuits, but you've got to have a good earth," says Alistair Baldwin. "And your earth should have no Volts showing with a voltmeter. If you've got any voltage on the earth, it's faulty."

"With modern vehicles having the correct diagnostic equipment is essential," says Jamie Parnham. "Experience is good, but now especially with Euro VI there have come so many more error codes."

Parnham adds that if a sensor is giving an extreme reading - even if it is within its nominal range - this may cause other components to behave in an unexpected way.

The electrical

*An automotive test probe (such as this Power Probe Hook) combines some of the functions of a multimeter with the ability to provide an instant power source for testing components*



modifications and additions that bodybuilders make can cause issues, and Bodycot points out that any parameter changes that a dealer or bodybuilder makes must be properly documented: "That's another side of fault tracing which is not necessarily electrical."

On that front, Alistair Baldwin adds: "Components can be controlled by other components. Unless you know how the system's been configured you can go round in a circle". An example is the bus-stop brake linked to the passenger doors: "You've got to know which systems are interlocked."

"When things get trickier you need to go above and beyond," says Bodycot. "The worst problems are inactive codes - the driver may have reported a fault on the truck, but when we download the codes there may only be a timestamp of a problem." If intermittent faults are detected by the CAN-Bus system, a specialist datalogging unit such as a Memorator [pictured, facing page] is useful.

Ideally, says Bodycot, "You need a good diagnostic tool, a good voltmeter, a good oscilloscope and someone who is willing to be able to trace diagnostic issues and understand them." **TE**