A Failed Diagnosis or Multiple Faults?

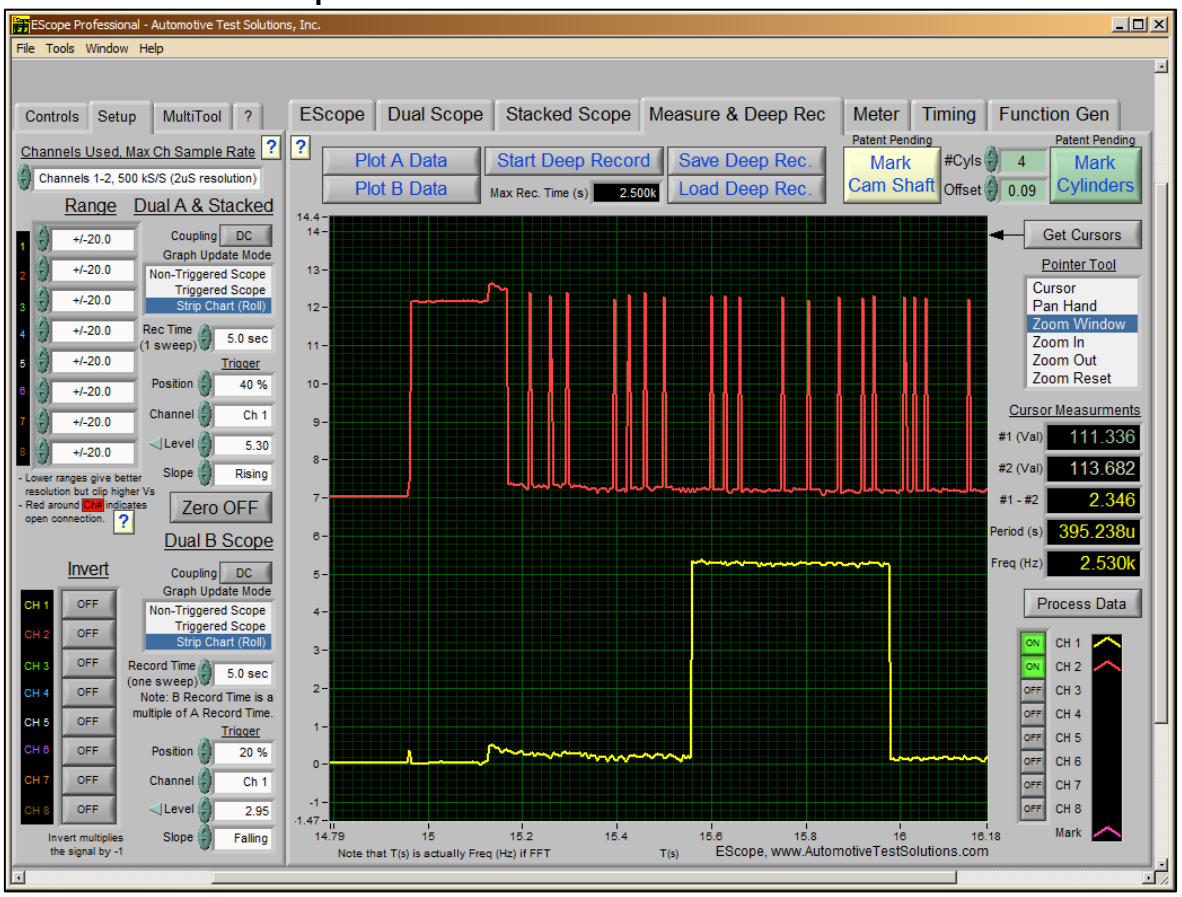
A customer bought a used 1998 Jeep Grand Cherokee, and almost immediately began having stalling problems. The seller ‘disappeared’, so no history was available. The vehicle was towed to a shop, where for weeks the technician replaced parts like the CMP sensor, the CKP sensor, and the PCM. Nothing seemed to help, so they put all the original parts back on and ‘shipped it.’

The Jeep came to us, and we noticed that it didn’t stall very often, and no amount of hot/cold, wiggling, tapping, or other manipulation could make it occur. We understand that most shops don’t use Lab Scopes, but in a case like this you need to be able to monitor multiple signals to see the root cause of the stalling.

Lab Scope ‘Fishing Expedition’

The capture below was obtained after a stall, and shows the CMP (bottom trace) and CKP (top trace) signals while cranking in an attempt to restart. The CKP sensor on this application should switch high 12 times per engine revolution, in 3 groups of 4 pulses. It’s easy to see in this example that the CKP pulses are totally erratic – and that’s all it takes to stall this engine (and prevent a restart). The test was run again while also measuring the reference voltage and sensor ground circuits (not shown), and those circuits were fine, proving that the CKP sensor itself was faulty. These 4.0L engines have crankshaft end play and flex plate issues, but 10 minutes of inspection ruled out end play, and the CMP/CKP relationship was correct and consistent when not acting up, ruling out flex plate breakage.

Failed CKP Sensor Capture

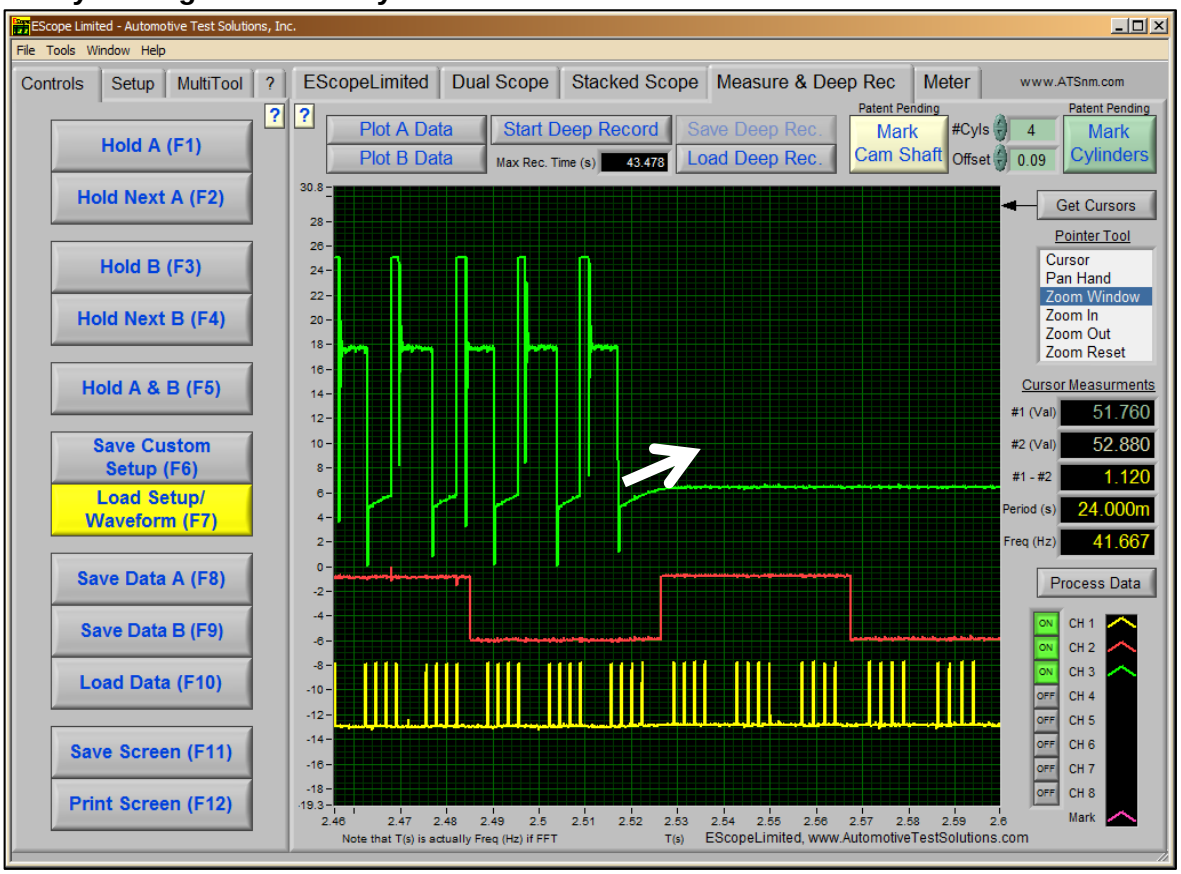


The Fix?

A new CKP sensor was installed and the clearance set properly. The engine was started….and it stalled! A failed diagnosis? Impossible, the Lab Scope capture caught a CKP sensor failure red-handed. The Lab Scope was connected to the position sensor circuits, ignition primary, and injection driver circuits. The next time and the engine stalled it was clear that the CMP and CKP sensors were working properly, and that the injectors were firing steadily. The coil primary circuit, however, was acting erratically.

The capture below shows one of the 'funky' coil events (top trace). The CMP and CKP waveforms are perfect, and an injector driver (not shown in this capture) was also normal. The primary simply stopped switching. Loss of power? Loss of ground? Those don't even need to be tested because the voltage slopes up after the last drop (arrow). This is called counter-electromotive force,' and is caused by current ramping up in the coil windings. This proves that current really is flowing through the coils. This is a clear case of a PCM driver sticking closed, and requires a PCM replacement to repair.

Sticky PCM Ignition Primary Driver



The Complete Fix

Remember, the previous shop tried a CKP sensor *and* a PCM. And they were correct, but they never had a new CKP and a new PCM installed at the same time. Without the Lab Scope evidence, they weren't confident enough to stick with either repair. Having this kind of backup captured really changes the confidence with which we can approach the customer. This is especially true on an application like this Jeep, where it's not uncommon to get multiple bad PCMs – even from the dealer. Another PCM did fix this Jeep, and in a gesture of respect for a job *almost* well done, we made sure that the original shop was informed they had been correct about the CKP and the PCM.