



BEYOND OPEN & SHORT: THE POWER OF ADVANCED SENSOR & ACTUATOR SIMULATION

More learning. Deeper understanding. Better prepared technicians.

OPEN CIRCUIT / SHORT TO GROUND

Traditional Fault Simulation

VOLTAGE VARIATION & PWM

Advanced Sensor & Actuator Simulation



HOW THE STUDENT FINDS IT

- Symptoms are usually obvious
- Scan tool typically shows a missing signal or “not detected”
- Quick continuity or voltage test reveals the fault
- Straightforward to isolate the **problem to a wire or component**

- Symptoms can be subtle or intermittent
- Scan tool shows a signal that is present but **implausible**, out of range or inconsistent
- Requires analysis of live data, measurements, **specifications and system behaviour**
- Students must think critically to identify the **root cause**



WHAT THE ECU TELLS THEM

- Sets DTCs related to open circuit, short to ground or no signal
- Often illuminates MIL immediately
- May store pending or current faults with clear circuit descriptions
- ECU usually enters a **default or limp-home mode**

- Sets DTCs related to signal range, rationality, performance or correlation
- May not illuminate MIL immediately
- May store intermittent, history or performance codes
- ECU may use substitute values, adapt strategies or limit **system performance**



WHAT IT TEACHES – SECONDARY (K-12 / CTE)

- How circuits work
- How to use a multimeter
- How to read wiring diagrams
- How to find open or shorted circuits
- Basic electrical fault-finding

- How **sensors influence vehicle behaviour**
- What different **sensor values** mean
- How the **vehicle reacts** when signals change
- Introduction to **electronic control** concepts
- Strengthens connection between sensor, ECU and real-world symptoms



WHAT IT TEACHES – POST-SECONDARY (COLLEGE)

- Circuit testing and verification
- Component failure vs. proper operation
- DTC retrieval and basic diagnostics
- Fault isolation and repair validation

- Signal interpretation and **data analysis**
- ECU **decision-making** and control strategies
- **Actuator command** vs. actual performance
- **Intermittent, degraded** and performance diagnostics
- Comparing manufacturer strategies and **system behaviour** across vehicles
- Real-world **diagnostic thinking** and workflow



OPEN / SHORT FAULTS TEACH WHETHER **THE CIRCUIT WORKS.**

They build essential electrical skills and teach students how to test, measure and verify circuits.



ADVANCED SENSOR & ACTUATOR SIMULATION TEACHES HOW MODERN VEHICLE SYSTEMS **THINK AND ACT.**

It develops the diagnostic reasoning, systems understanding and problem-solving skills today's technicians need.



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