

## A Whitepaper Discussion: Introduction to Autotronics

Automotive technology has developed rapidly as new and emerging technology have been introduced in the 21st Century. This development has been accelerated by the presence of the Fourth Industrial Revolution marked by extraordinary enhancements in terms of artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing.

Everywhere, people can easily encounter mobile technologies, super-computing, intelligent robots, self-driving cars, neuro-technologic brain enhancements, and genetic editing. Evidence of these dramatic changes is all around, and they're being churned out with exponential speed. And just as phones got smart, so now are cars; and while they don't quite "think," they will respond and remind. Cars on the road are being equipped with danger-warning applications, traffic information services, and a host of infotainment features and increased safety features.

The automotive industry continues to experience rapid development as it moves from manufacturing cars with conventional systems that are mechanical in nature to those dominated by analog and digital electronic systems. Since the discovery of semiconductor materials in the 60s, and the outgrowth of information technology — better known as the "digital era," or the "era of computerization" — electronic control systems in all fields have been growing rapidly.

The increasing desire and demand of humans for safety, comfort, and ease of driving go hand-in-hand with the more developed electronic systems that are increasingly being installed in motor vehicles. In the not-too-distant future, we may have cars that are intelligent enough to be able to automatically configure themselves with the driver. In addition, the modification of electronic systems in motor vehicles also initiates the first step in the automotive industry to move towards automobiles running fully automatic operations, and hybrid and electric vehicles.

Some enhancements in the automotive field, especially autotronics, undoubtedly have consequences for the automotive service industry to always be able to serve the needs of consumers as they deal with new and varied problems, and ongoing maintenance of these autotronic systems. To perform these tasks, naturally employees are expected to upgrade their competencies to catch up with the robust development of autotronic technology, as well as try to be ready for future systems. In the context of workforce preparation, technical education — especially technical colleges and CTE schools — will play a strategic role in preparing entry- and middle-level workforce candidates in the automotive field. Employers expect graduates to have competencies according to their employment needs, and to be able to adapt to various characteristics of current changes. Students in automotive programs will need to acquire knowledge and skills on automotive electronic problem-solving techniques using state-of-the-art testing and diagnostic equipment so they will be able to maintain, troubleshoot, and repair electrical and mechanical systems.

The LJ Create Autotronics program and resources were designed to help students achieve these goals. To learn more about what LJ Create has to offer, visit us online:

[LJ Create Automotive Technology Complete Lab Solutions](#)

## The LJ Create Autotronics Troubleshooting Program

Our 3,080 online software lessons for light vehicle repair cover every aspect of the vehicle – bumper to bumper. We provide background content and direct job sheets for every ASE task across MLR, AST and MAST certification.

However, our one major area of focus is on autotronics troubleshooting. It's our background, plus one of the areas of most need for young auto technician trainees. Our emphasis is to train students to go beyond the initial code reading and take enough measurements on the vehicle to determine the exact fault.

To do this we practice using a three or four step process until the troubleshooting sequence becomes easy and second nature:

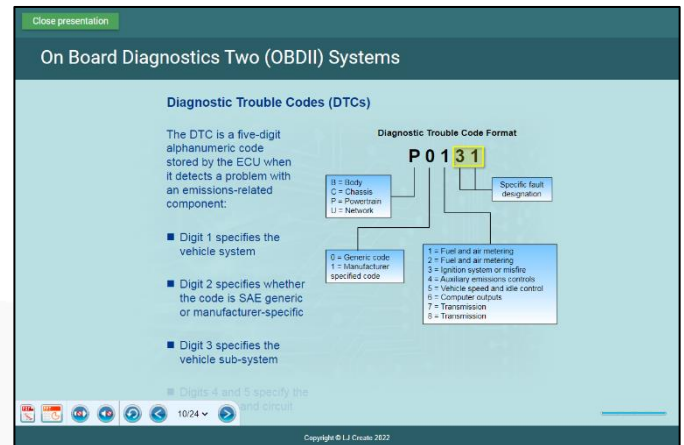
1. Students troubleshoot on-screen using software simulation
2. Students follow the same process using workshop measuring tools on system simulation panels/boards
  - a. **Engine Management**
  - b. **ABS Braking**
  - c. **Ignition Systems**
  - d. **Air Conditioning**
  - e. **Modern Starting/Charging (CAN)**
  - f. **Modern Lighting (CAN)**
  - g. **Modern Auxiliary Systems (CAN)**
  - h. **Hybrid Systems**
3. Students take the same measurements and remove components on practice rigs
  - a. **Air Conditioning**
  - b. **Ignition Systems**
  - c. **Engine Trainer**
4. Students complete the ASE job sheets out in the workshop.



## The typical topic sequence for an autotronics course is listed below.

This shows the depth and scope of our lessons.

- Electrical Test Equipment
- Using a Multimeter
- Introduction to Fault Finding
- Finding a Simple Fault (Board)
- Introduction to Wiring Diagrams
- Finding a Fault using Wiring Diagrams (Board)
- Reading Wiring Diagrams
- Symbols, Device Markings and Terminal Block Designations
- Lighting Circuits (Board)
- Continuity and Circuit Faults



## Transducer Circuit Troubleshooting

- ECT (Software simulation, Panel, Engine Rig, then Workshop)
- Mass Airflow Sensor (Software simulation, Panel, then Workshop)
- Throttle Position Sensor (Software simulation, Panel, Engine Rig, then Workshop)
- Intake Air Temperature (Software simulation, Panel, then Workshop)
- Oxygen Sensor (Software simulation, Panel, Engine Rig, then Workshop)
- Crankshaft Position Sensor (Software simulation, Panel, Engine Rig, then Workshop)
- Vehicle Speed Sensor (Panel)
- Additional Engine Management Troubleshooting (Panel)

**Transducer Fault 1 (panel)**

**Lab Work – Transducer Fault 1**

Engine transducers have to work under stressful conditions in terms of heat, cold, and vibration. It is, therefore, not surprising that they sometimes fail, resulting in incorrect data being sent to the ECM and abnormal operation of the engine.

Use the Engine Management systems panel trainer to perform a fault finding task, using a multimeter to diagnose which transducer is faulty, and make a suggestion to rectify the fault.

[Engine Management Systems Information Sheet](#)

[Engine Management Systems Typical Measurements](#)

**Recommended Equipment**

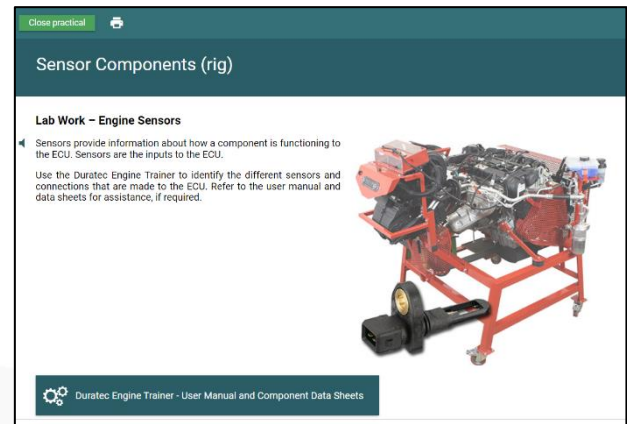
- [Engine Management Trainer](#)
- Digital multimeter

## ABS Systems

- Troubleshooting ABS Control Systems (Panel)
- Troubleshooting ABS (Workshop)

## Heating and AC

- Troubleshooting FOTCC System (Panel)
- Air Distribution Control System Troubleshooting (Panel)
- AC Components Fault Finding (AC Rig)
- AC Components Fault Finding (Workshop)



## SRS, EBS and Hybrid High Voltage Systems

- Hybrid and Electric Vehicle Systems
- Troubleshooting Hybrid Electric Motors (Panel)
- Troubleshooting Hybrid Control System (Panel)
- Hybrid and Electric Vehicle Safety (Workshop)

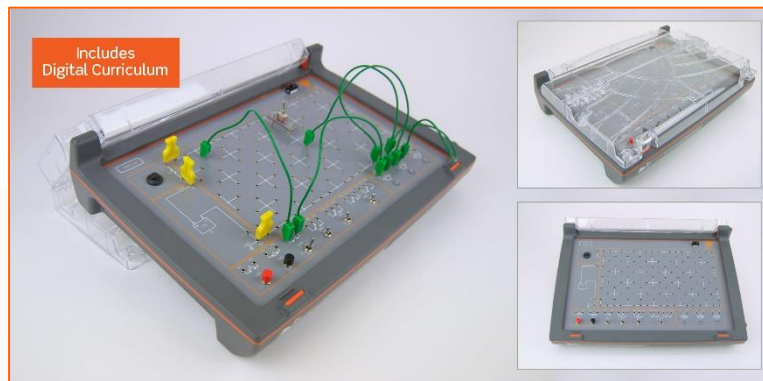
## Auto Networked Systems

- CAN
- LIN
- MOST
- CAN Bus troubleshooting – Starting and Charging System (Board)
- CAN Bus troubleshooting – Lighting System (Board)
- CAN Auxiliary Bus troubleshooting (Board)

The equipment we recommend for use with these lessons can be found online at:  
<http://www.ljcreate.com/us/programs/automotive/automotive-hardware>

Equipment that can be used in the autotronics program:

### **700-10 Basic Auto Electronics Trainer**



### **701-02 Modern Automotive Lighting Circuits Trainer**



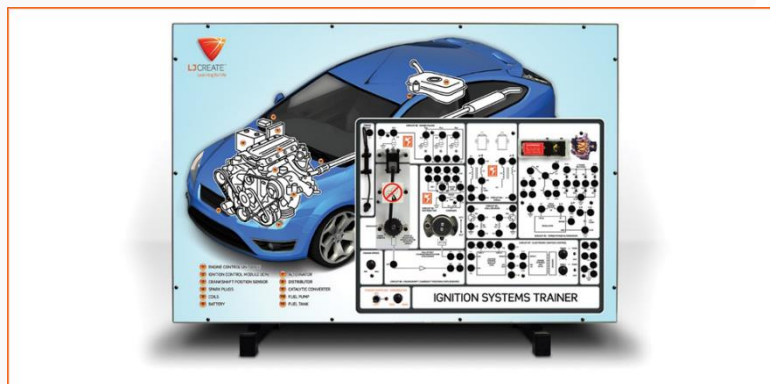
### **720-02 Modern Starting and Charging Systems Trainer**



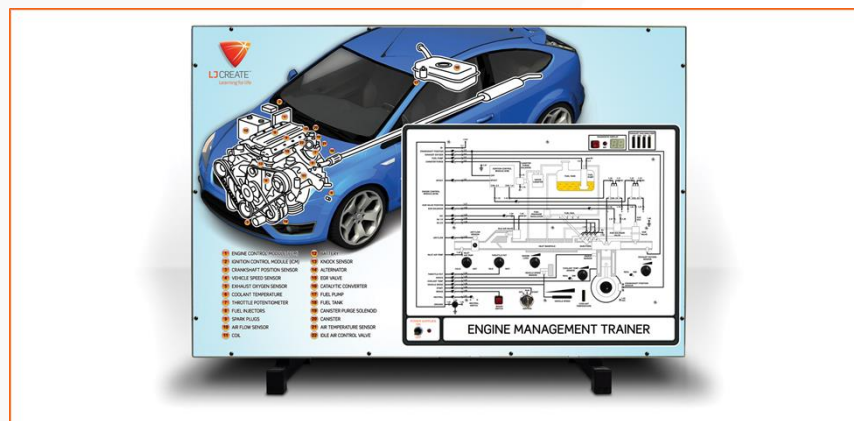
## 721-01 Modern Auxiliary Systems Trainer



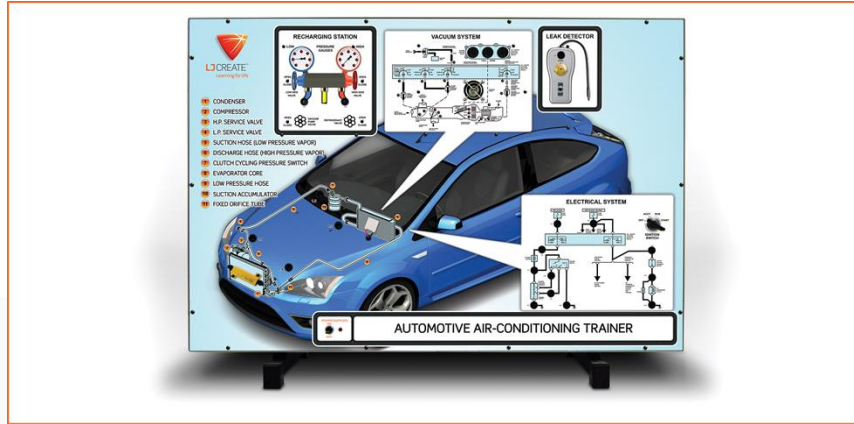
## 750-01 Ignition and Charging Systems Panel Trainer



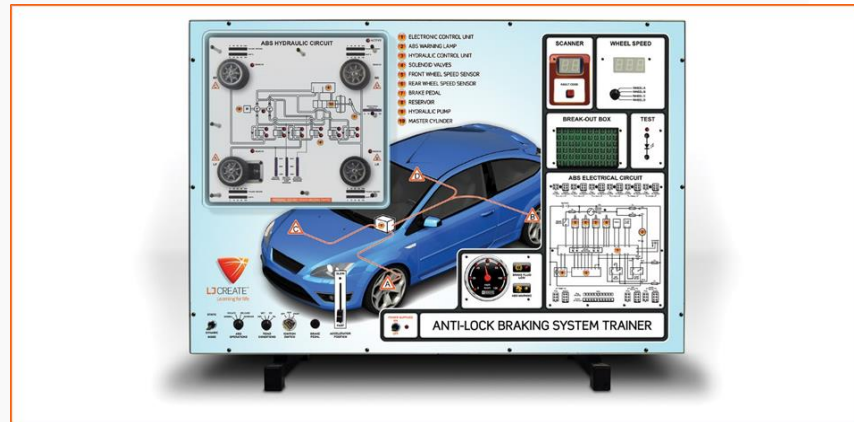
## 751-01 Engine Management Systems Panel Trainer



## 754-01 Air Conditioning Systems Panel Trainer



## 755-01 Anti-Lock Braking Systems Panel Trainer



## 756-01 Hybrid Vehicle Systems Panel Trainer



## **760-02 Engine (CAN and Climate Control) Trainer Includes Fault Insertion**



## **765-01 Distributerless Ignition System Trainer Includes Fault Insertion**



## 766-01 Air-Conditioning System Trainer

