



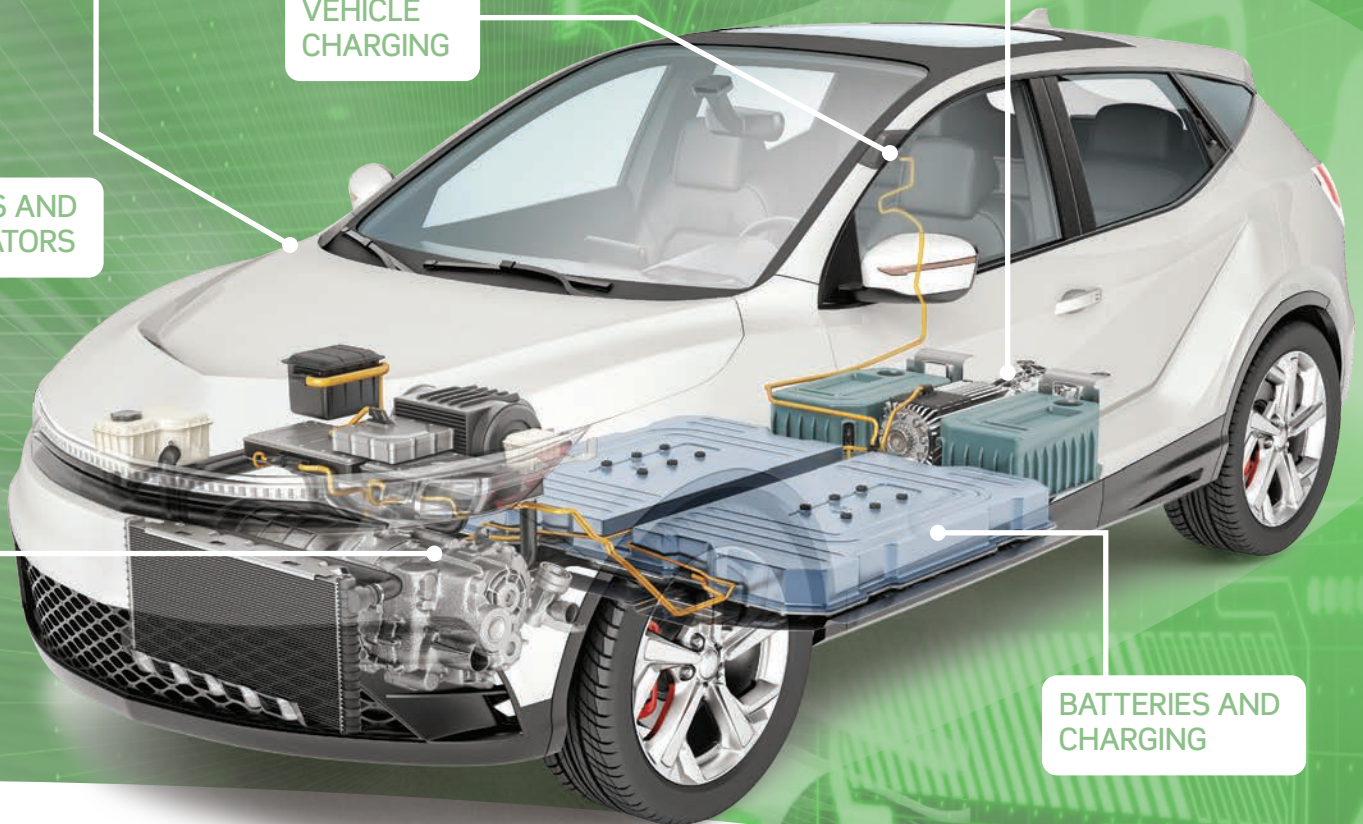
LJCREATE™
Learning for life

COMPLETE
EV SYSTEMS

ELECTRIC VEHICLE
ELECTRONICS

VEHICLE
CHARGING

MOTORS AND
GENERATORS



BATTERIES AND
CHARGING

SKILLING AND UPSKILLING FOR: **EV Technologies**

- ⚡ Comprehensive Range of EV Lessons
- ⚡ EV Desktop Trainers
- ⚡ EV Systems Panel Trainers
- ⚡ CAN System Desktop Trainers
- ⚡ Aligned to Industry-Recognized Certifications

→ Welcome

We're LJ Create, education specialists since 1979



Our latest range of Automotive trainers and associated lessons are designed to provide students with the **skills and knowledge** required to maintain and repair **Electric and Hybrid** vehicles.

WE PROVIDE INSTRUCTION AT THREE LEVELS:

1. Complete Vehicle Systems

These are based on large panel trainers that illustrate the operation of complete EV and Hybrid Vehicle systems.

Students can “operate” each type of vehicle, measure what is going on during the various modes of operation, and troubleshoot common problems.

2. Common EV Sub-Systems

Panel trainers provide each student with underpinning knowledge and troubleshooting experience with the most critical EV sub-systems such as:

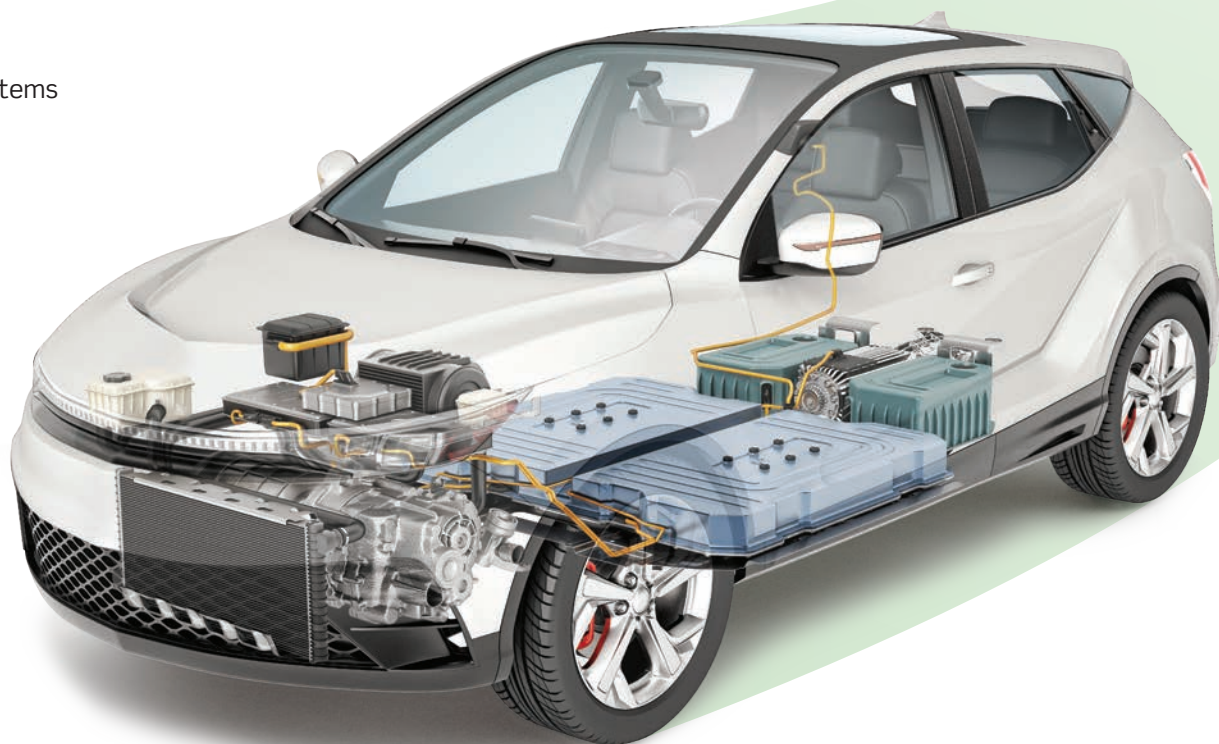
- ⚡ Motors and Drives
- ⚡ Batteries
- ⚡ Charging Systems

3. EV Electrical and Electronics Fundamentals

A desktop training system provides very specific instruction and practice in the basic skills that are going to be required by students as they complete their studies.

Topics covered include:

- ⚡ Cables and Cabling
- ⚡ Circuit Protection
- ⚡ Conductors, Insulators, and Earth Return
- ⚡ Voltage, Current, Resistance, and Power Calculations
- ⚡ DC and AC Signals
- ⚡ Relays and Relay Control
- ⚡ Passive and Active Component Operation
- ⚡ Electromagnetic Device Operation
- ⚡ Transducer Operation
- ⚡ Structure of a 3-Phase Signal
- ⚡ Pulse Width Modulation



Electric and Hybrid Vehicle Lesson Pack

Electric Vehicles

- Introduction to Hybrid and Electric Vehicles
- Definition of Electric Vehicles
- Example: The Nissan Leaf
- Features of Electric Vehicles
- Electric Motors
- Fuel Cells
- The Principle of the Fuel Cell
- Using Hydrogen as a Fuel
- Proton Exchange Membrane Fuel Cell
- Plug-in Electric Vehicles
- Range Extenders
- Principle of Regenerative Braking
- Choosing an Electric Vehicle
- Running an Electric Vehicle

High-Voltage Systems

- High-Voltage Vehicles
- Safety in High-Voltage Vehicles
- First Responders Safety
- Danger of Electric Current for Humans
- Safeguards Against Electric Shock
- Effect of Current on the Human Body
- Dealing with the Victim of an Electric Shock
- Qualifications for Working on High-Voltage Vehicles
- High-Voltage Wiring and Connectors
- Disabling Hybrid Vehicle Systems
- Disabling the High-Voltage System
- Legal Regulations
- Reasons for the Development of High-Voltage Vehicles

Batteries for BEV, HEV, and PHEV

- Introduction to Electrical Storage Devices
- Lithium-ion Batteries
- NiMH Batteries
- Lead Acid Batteries
- Nickel Metal Hydride Batteries
- Principles of Lithium-ion Batteries
- Principles of NiMH Batteries
- Safety with Batteries
- Battery Packs
- Battery Disconnection System
- Battery Lifetime vs Charging Rate
- Structure and Function of a Battery Pack
- Battery Modules
- Battery Cell Technology
- Effect of Temperature on Batteries
- Battery Thermal Management
- Battery Module Sensing Systems
- Battery Management System (BMS)
- Troubleshooting HV Battery Systems
- Advanced Battery Technology

Electric Vehicle Systems

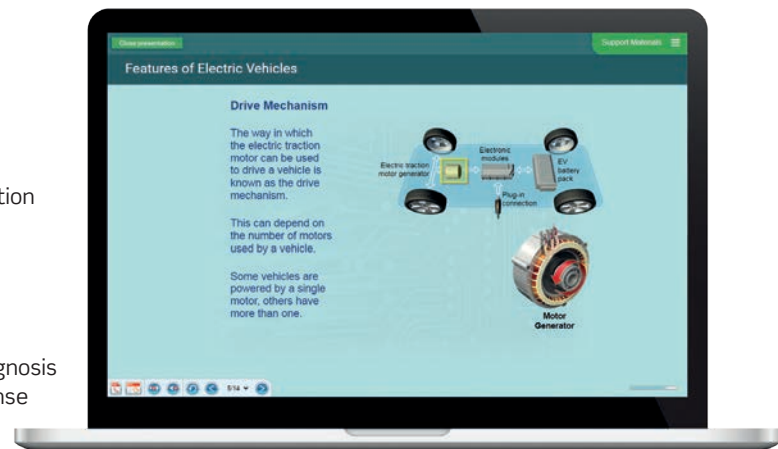
- Introduction to EV Systems
- Electric Vehicle - Driver Display Panel
- EV Systems - Modes of Operation
- Operating an Electric Vehicle
- Troubleshooting EV Control Systems
- Cables and Connectors
- Cables, Connectors, and Protection Devices
- Electronic Circuits and Modules
- Contactors
- Construction of a Contactor
- Controlling Contactors
- Current Flow in Latching Circuits
- Selection of Contactors
- Single-Phase AC Voltage
- Three-Phase AC Voltage
- Three-Phase AC
- Generation of Three-Phase AC
- Representation of Three-Phase AC
- Voltage Converters
- The Inverter Principle
- DC to DC Converter
- Bridge Rectifiers
- Operation of a Bidirectional Inverter
- Pulse Width Modulation
- Troubleshooting a Frequency Motor Control Circuit
- In-Car Charging Circuits
- Troubleshooting the Charging Circuit
- Heating and Air Conditioning Fundamentals
- Air Conditioning Principles
- Air Conditioning Systems
- Refrigerant Leak Detection
- Refrigeration Cycle
- A/C Electrical System Fault Investigation
- Air Distribution Control System Investigation
- Blower Motor Fault Investigation
- Climate Control System Operation
- Compressor Fault Investigation
- Compressors
- Condensers
- HVAC Electrical Controls Investigation
- Lines and Hoses
- Networked Systems Data
- CAN Bus Data Processing
- CAN Bus Fault Diagnosis
- CAN Signal Response

EV Traction Motors

- AC Motors and Generators
- DC Motors
- Efficiency Formulas for Electric Motors
- Synchronous & Asynchronous Motors
- Frequency Motor Control
- Function of Frequency Converters
- EMC
- Frequency Converter Parameters
- Frequency Filters
- Motor Protection
- Interlock Systems
- Motor Installations and Safety
- Motor Protection
- Brake Systems
- Plug-in Hybrid Vehicles
- Motor Feedback & Sensors
- Position and Speed Feedback - Encoders
- Diagnose Equipotential Faults
- Diagnose Insulation Measurement Faults

Vehicle Charging Systems

- Electrical Installation in Buildings
- Components of an Electrical Installation
- Earthing Systems
- Circuit Breakers
- Consumer Units
- Re-Testing to Electrical Standards
- Production, Transmission, and Distribution of Electrical Energy
- Energy Distribution Calculations
- Line Surge Protection
- Introduction to Charging Systems
- Voltage, Current, and Power Calculations
- Charge Rate Measurement & Calculation
- Fast Rate Charging
- Ultra-Fast Charging
- SMART Charging Systems
- EV Charging Management Software



Electric Vehicle Systems Desktop Trainers

Electric Vehicle Electronics Trainer (730-10)

This hands-on resource allows students to build a variety of introductory EV electronic circuits using a range of on-board and carrier-mounted components.

The trainer is an ideal resource for a basic automotive/ EV electronics program and includes access to digital curriculum materials, including theory and practical learning tasks. With this trainer these lessons start with a basic introduction to electricity using switches and lamps.

The trainer includes authentic automotive input, safety, process, and output devices - all designed to be most familiar to auto technicians.

The trainer allows for an **optional range of experiment cards** to be connected for the practical study of more advanced Electric Vehicle circuits.

Order as:

- 730-10 Electric Vehicle Electronics Trainer

INPUT

A range of typical vehicle input components, including:

- Normally Open and Normally Closed Switches
- Variable Resistor
- Momentary Switches

PROCESS

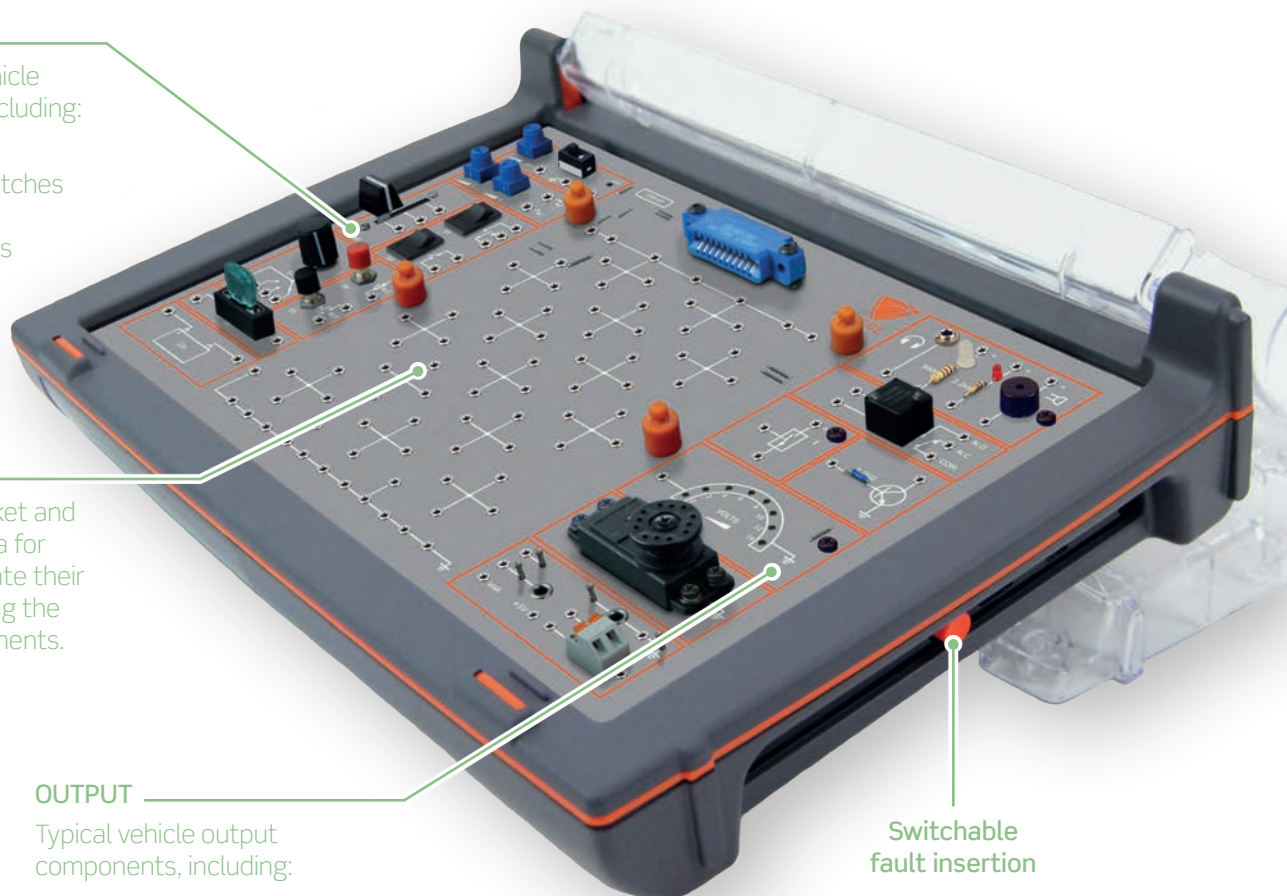
Plug in card socket and patch board area for students to create their own circuits using the supplied components.

OUTPUT

Typical vehicle output components, including:

- High and Low Intensity LEDs
- Relay
- Buzzer
- Servo Motor

Switchable
fault insertion



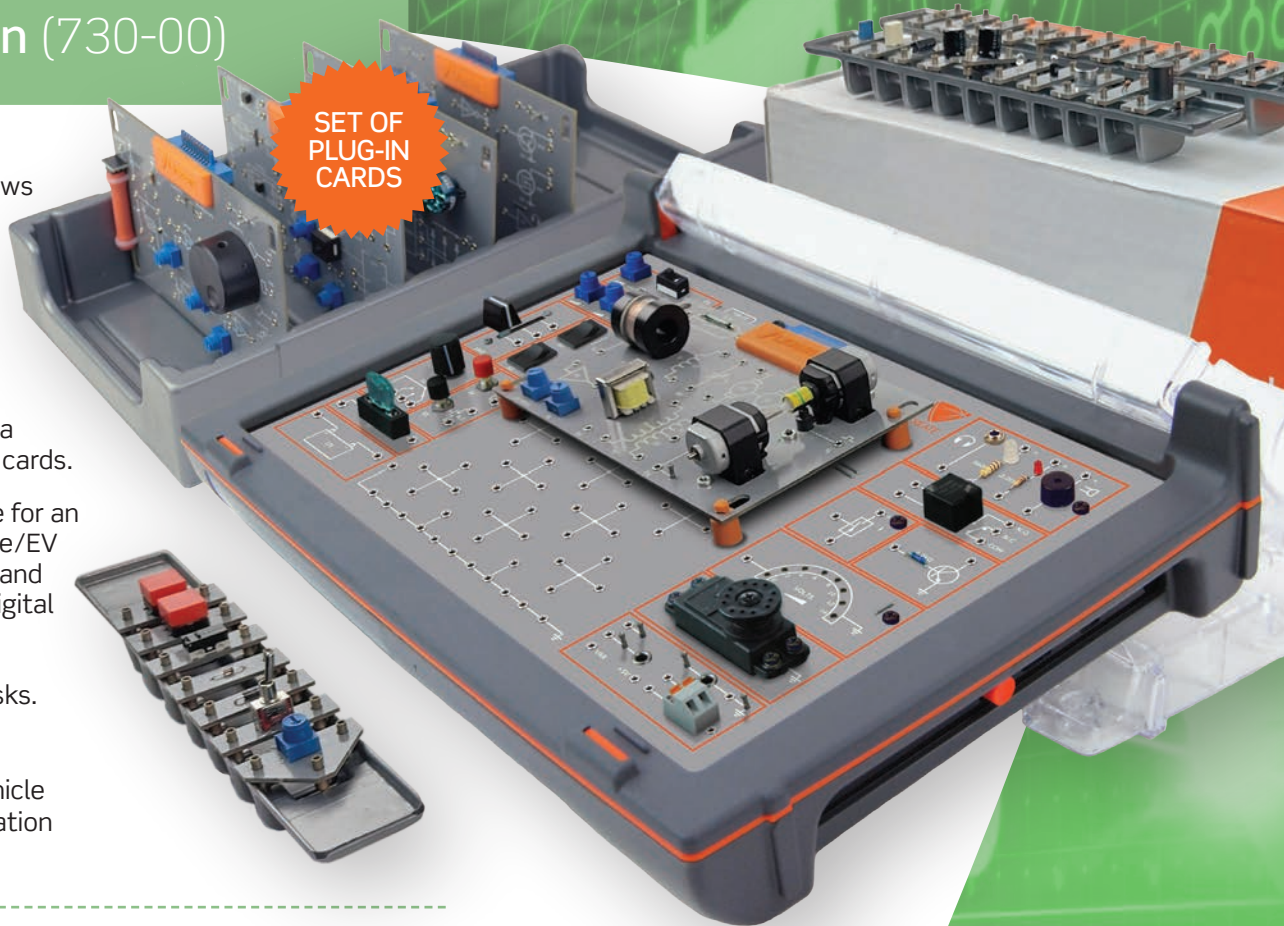
Electric Vehicle Electronics Workstation (730-00)

This workstation allows the practical study of a range of advanced Electric Vehicle circuits and concepts. It includes the Electric Vehicle Electronics Trainer, component set, and a range of experiment cards.

It is an ideal resource for an advanced automotive/EV electronics program and includes access to digital curriculum materials including theory and practical learning tasks.

Order as:

- 730-00 Electric Vehicle Electronics Workstation



The following Experiment Cards are included with the workstation:

Electronic Systems Card (320-01)

Practical tasks include the following:

- Investigation of sub-systems
- Intruder alarm system project
- Testing and fault-finding

Electromagnetism Card (320-14)

Practical tasks include the following:

- Reed switch operation
- Hall effect sensor investigation
- DC motor-generator investigation

Input Transducers Card (320-15)

Practical tasks include the following:

- Operation of a humidity and temperature sensor
- PTC temperature sensor operation
- Closed loop temperature control circuit

Analog Integrated Circuits Card (320-32)

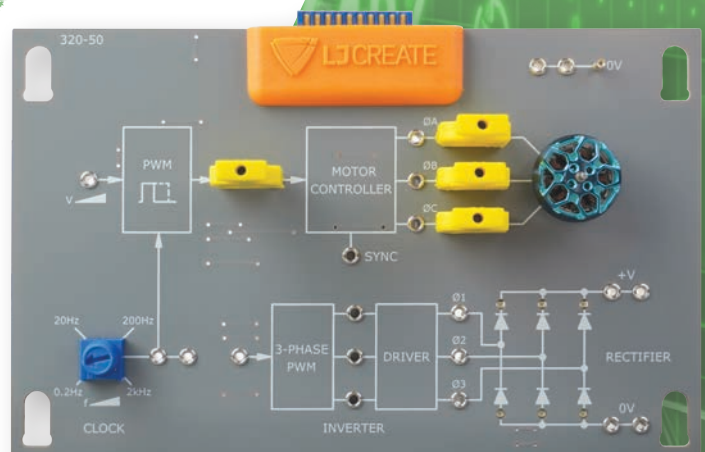
Practical tasks include the following:

- Investigating IC sensors
- Testing a switched capacitor filter
- Investigating the operation of a phase locked loop

Pulse Width Modulation Signals Card (320-50)

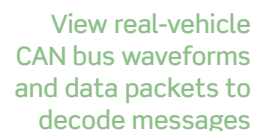
Practical tasks include the following:

- Investigation of a 3-phase waveform
- Rectifier with DC smoothing capacitor
- Fault-finding signal conditioning circuits



Electric Vehicle Systems Panel Trainer (740-01)

■ 740-01 Electric Vehicle Systems Panel Trainer



Test points for signal monitoring and fault-finding



EV Batteries and Charging Panel Trainer (741-01)

The focus of this trainer is on the operation, safety, and limitations of Electric Vehicle batteries.

Students will operate the panel to explore charging/discharging of the HV battery, and will also investigate battery temperature, voltage, and efficiency.

Instructors can demonstrate regenerative charging, cell balancing, and more with this on-vehicle charging systems panel trainer.

To facilitate the development of techniques in diagnostics and fault-finding skills, the panel includes a range of fault-insertion options to simulate typical real-world system malfunctions.

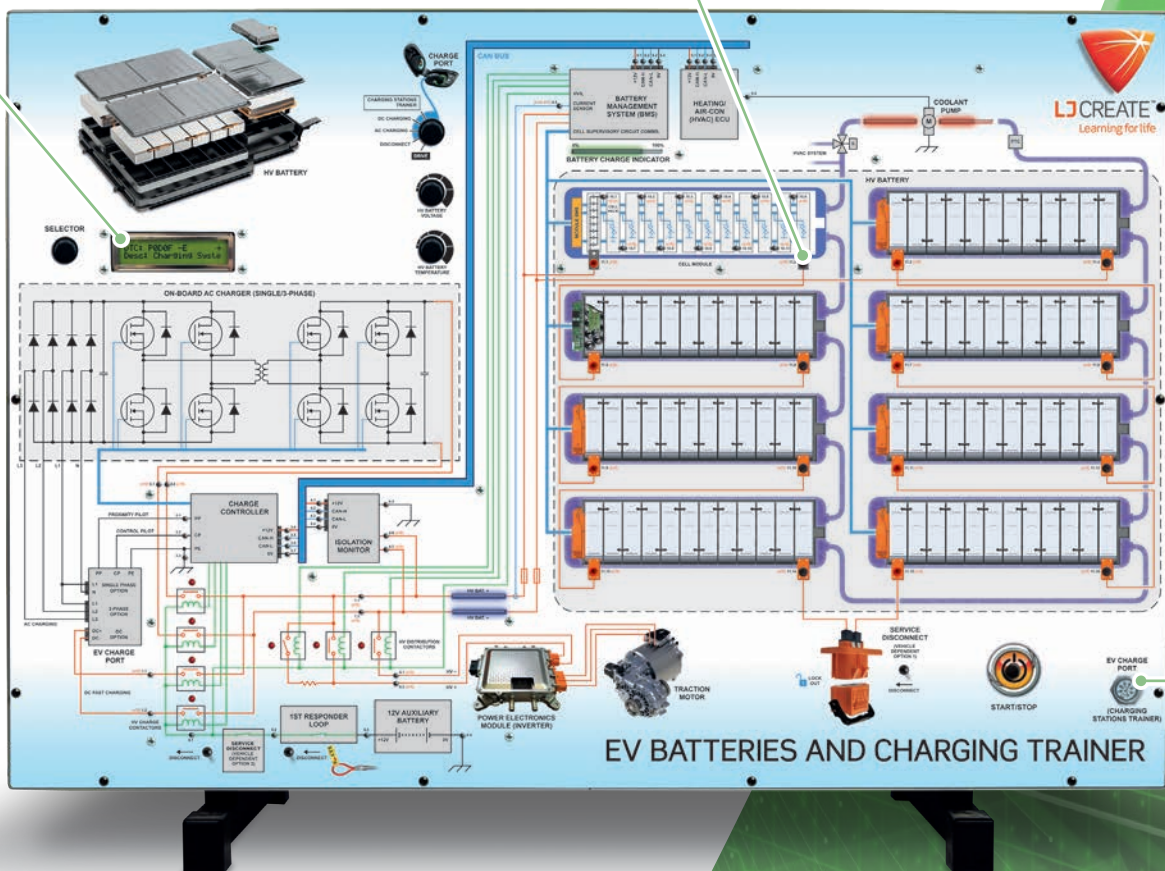
Order as:

- 741-01 EV Batteries and Charging Panel Trainer

Display showing system status and fault insertion information

Test points with scaled voltages for safe measurement

Optional charge port connection from Charging Stations panel (743-01)



Electric Vehicle Systems

Panel Trainers

EV Motors and Generators Panel Trainer (742-01)

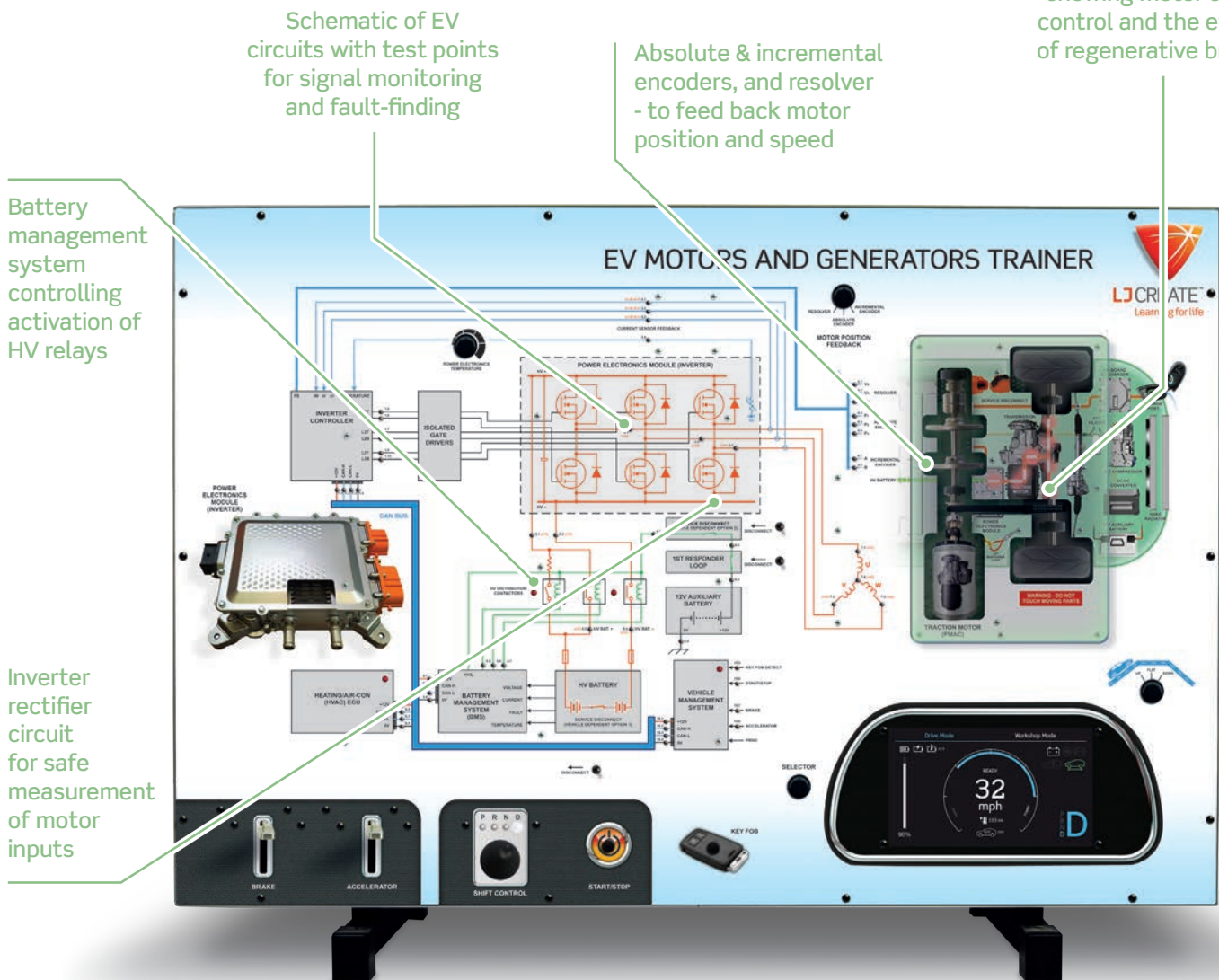
This trainer is focused on motor speed control, and uses a variety of sensors to feed back motor position and speed. Electrical circuit operation is illustrated under different conditions: Throttle, Brake, and Direction of Travel.

The trainer includes a variety of test points for vehicle electrical components including the facility to test each phase of a 3-phase motor.

Order as:

- 742-01 EV Motors and Generators Panel Trainer

Simulated drive train showing motor speed control and the effects of regenerative braking



Electric Vehicle Charging Stations Panel Trainer (743-01)

This trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find the circuitry and operation of off-vehicle charging systems.

Charging principles such as single-phase, 3-phase, and DC charging are covered on this panel trainer. The trainer operates at scaled voltages that are completely safe for users and uses conveniently scaled timeframes for battery charging.

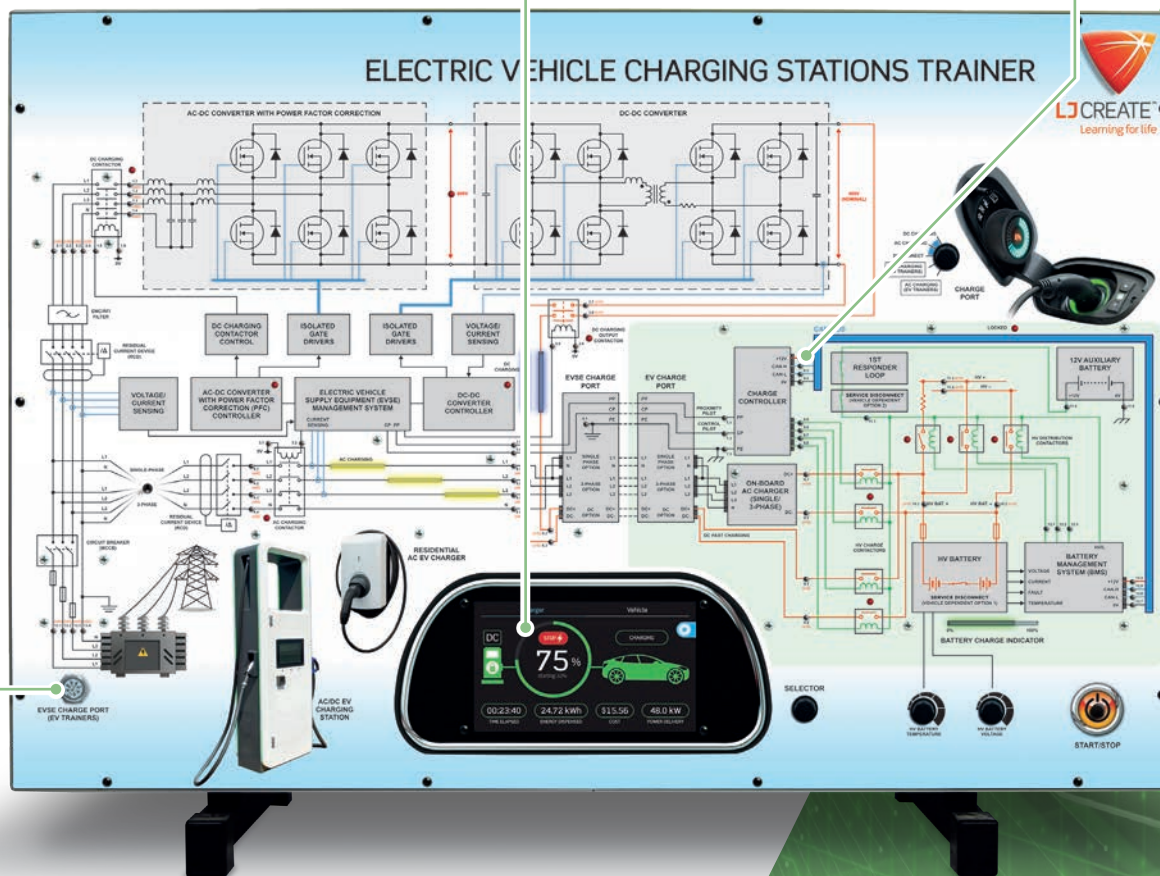
Order as:

- 743-01 Electric Vehicle Charging Stations Panel Trainer

Optional charge port connection to 740-01/741-01 panels

LCD screen to display charging station data

Test points for signal monitoring and fault-finding activities



Heavy Vehicle Systems Panel Trainers

Electric Bus Panel Trainer (745-01)

This brand-new panel is the latest addition to our Electric and Hybrid Vehicle product range. Designed to complement the existing line-up, it provides students with the skills and knowledge to maintain and repair Electric Buses.

A power flow mimic allows students to investigate the effects of regenerative braking, and on-board diagnostics can be explored via the intelligent display.

To facilitate the development of techniques in diagnostics and fault-finding skills, the panel includes a range of fault-insertion options to simulate typical real-world system malfunctions.

Order as:

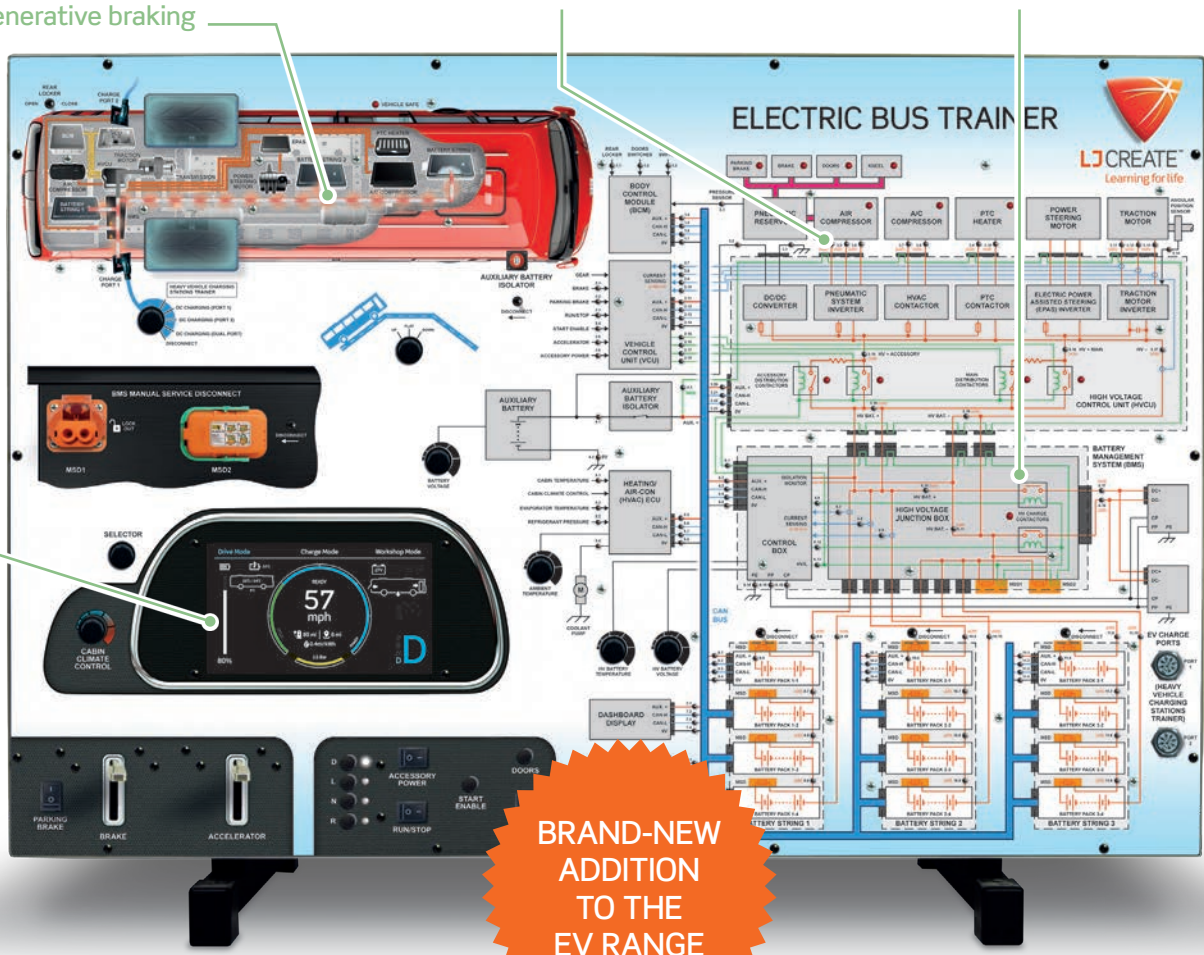
- 745-01 Electric Bus Panel Trainer

Power flow mimic allows students to investigate the flow of energy to and from the 3x HV battery strings, and the effects of regenerative braking

Test points with scaled voltages for safe measurement

Schematic diagram provides a detailed visual representation of the systems and circuits found within a typical electric bus

Touchscreen display for Drive, Charge, and Workshop modes



Bus and Truck Charging Stations Panel Trainer (746-01)

This brand-new trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find the circuitry and operation of heavy vehicle charging systems.

The trainer is designed to illustrate the operation of commercial and on-board charging systems as well as provide a mimic of the electrical power flow.

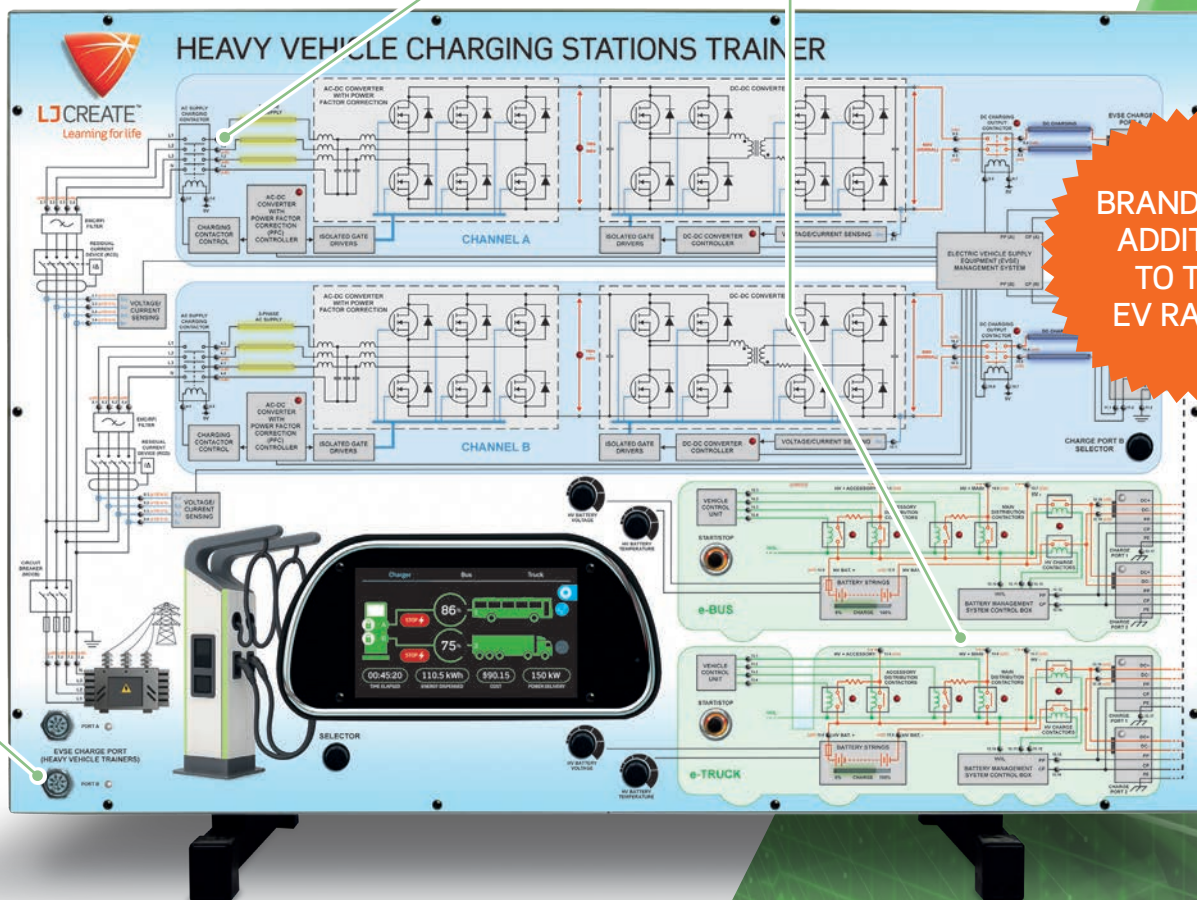
Order as:

- 746-01 Bus and Truck Charging Stations Panel Trainer

Test points for
signal monitoring
and fault-finding

Optional charge port connection to Electric Bus Trainer

Investigate charging principles for both Electric Buses and Electric Trucks



**BRAND-NEW
ADDITION
TO THE
EV RANGE**

Hybrid Vehicle Systems Panel Trainers

Hybrid Vehicle Systems Panel Trainer (756-01)

This trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find a simulation of a hybrid vehicle electrical system.

The trainer is designed to allow access to a simulation of the mechanical operation as well as provide a mimic of the electrical power flow.

The panel also includes test points at a safe voltage level to allow for investigation of electrical circuits.

Order as:

- 756-01 Hybrid Vehicle Systems Panel Trainer

Power flow mimic allows students to investigate the balance between electrical and internal combustion power

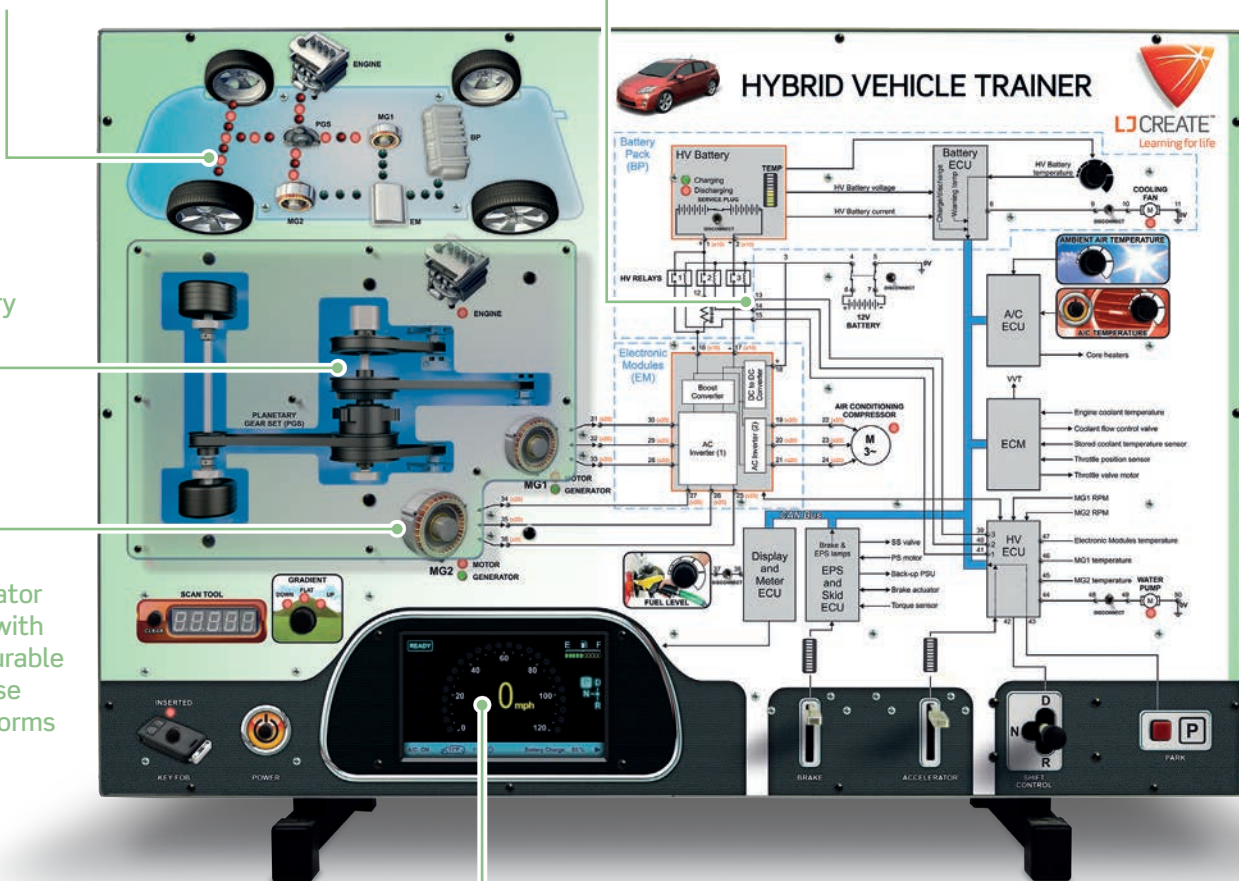
High and Low voltage system test points

Fault insertion options to simulate real-world system malfunctions

Planetary gear set

Motor generator units with measurable 3-phase waveforms

Dashboard display



→ CAN Systems Desktop Trainers

Modern Auto Lighting Circuits Trainer (701-02)

Students are set tasks that encourage them to explore CAN-controlled lighting circuits practically, and tasks that improve their knowledge of electrical components, circuits, signals, and systems.

Order as:

- 701-02 Modern Auto Lighting Circuits Trainer



Modern Starting and Charging Systems Trainer (720-02)

This trainer is focused on the starting and charging systems of a modern vehicle. Students are set tasks that encourage them to explore CAN Data Bus systems practically.

Order as:

- 720-02 Modern Starting and Charging Systems Trainer



Modern Auxiliary Systems Trainer (721-01)

Students are set tasks that encourage them to explore CAN Bus electric window, door mirror, seat, and central locking circuits practically and improve their knowledge of these systems.

Order as:

- 721-01 Modern Auxiliary Systems Trainer



Electric Vehicle Systems Innovative Learning Space

Students learn the necessary skills and knowledge required to repair and maintain Electric and Hybrid Vehicles in this lab. A combination of hands-on trainers and comprehensive EV lessons combine to create a diverse learning experience.

Electric Vehicle
Systems Panel
Trainer

This typical EV Technologies Lab configuration includes the following:

- Electric Vehicle Electronics Workstation (x12)
- Hybrid Vehicle Systems Panel Trainer (x2)
- Electric Vehicle Systems Panel Trainer (x2)
- EV Batteries and Charging Panel Trainer (x2)
- EV Motors and Generators Panel Trainer (x1)
- Electric Vehicle Charging Stations Panel Trainer (x1)
- Electric Bus Panel Trainer (x1)
- Bus and Truck Charging Stations Panel Trainer (x1)
- Modern Auto Lighting Circuits Trainer (x2)
- Modern Starting and Charging Systems Trainer (x1)
- Modern Auxiliary Systems Trainer (x1)

IN FOCUS:

ELECTRIC AND HYBRID VEHICLE LESSON PACK

This comprehensive lesson pack includes hundreds of learning units in the following format:

PRESENTATIONS

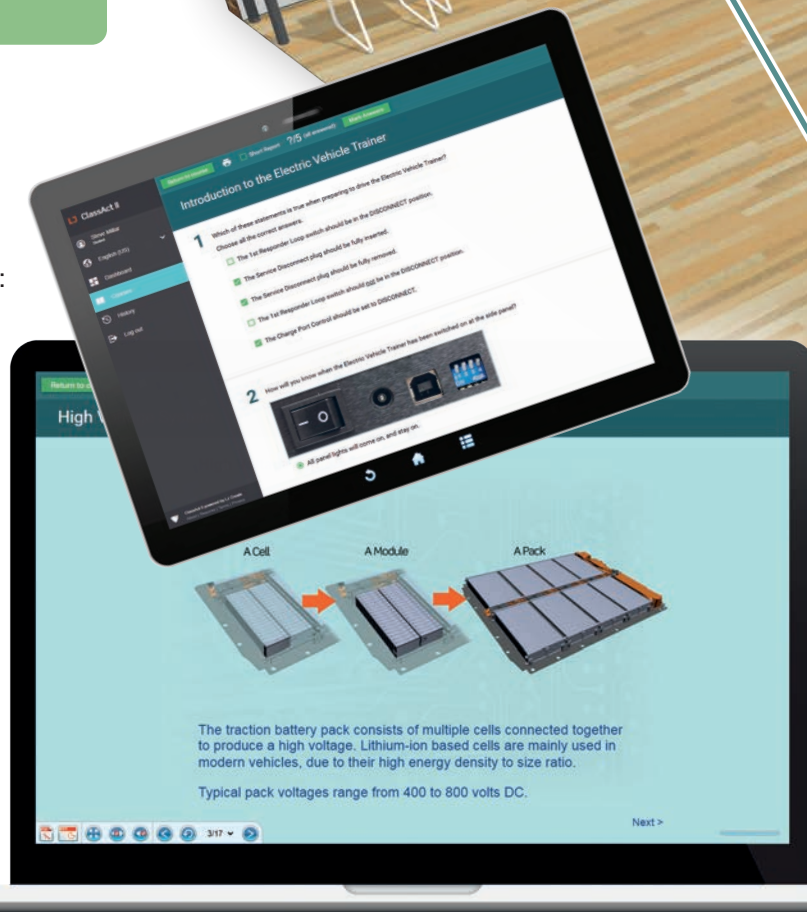
Provide students with the underpinning knowledge they need to grasp the key technical EV Technology concepts.

INVESTIGATIONS

Provide an opportunity for students to apply what they have learned. These digital activities provide an introduction to real-world applications of knowledge and skills.

ASSESSMENTS

Each lesson includes a short assessment to test knowledge development. Assessments can be marked, tracked, and managed by our online LMS.





EV Batteries
and Charging
Panel Trainer

Bus and Truck
Charging Stations
Panel Trainer

Electric Bus
Panel Trainer

Electric Vehicle
Charging Stations
Panel Trainer

EV Motors and
Generators
Panel Trainer

EV Technologies Lab

Electric Vehicle
Electronics Workstation

Hybrid Vehicle
Systems Panel
Trainer

Modern Starting
and Charging
Systems Trainer



For more information on our range of learning resources, please contact:

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