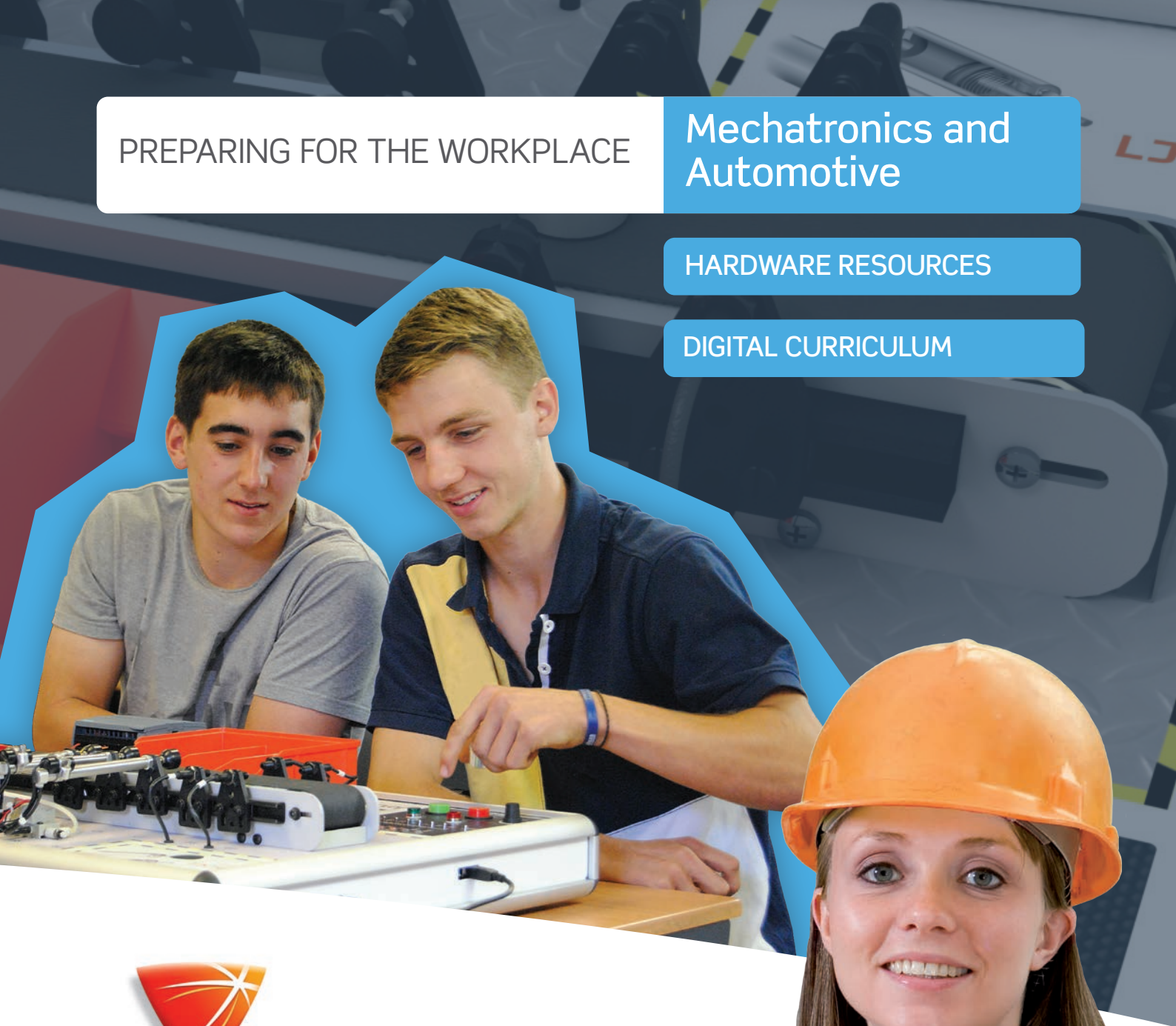
PREPARING FOR THE WORKPLACE

Mechatronics and Automotive

HARDWARE RESOURCES

DIGITAL CURRICULUM



LJ CREATE™
Learning for life

Mechatronics and Automotive

Product Guide

Contents

MECHATRONICS

AUTOMOTIVE

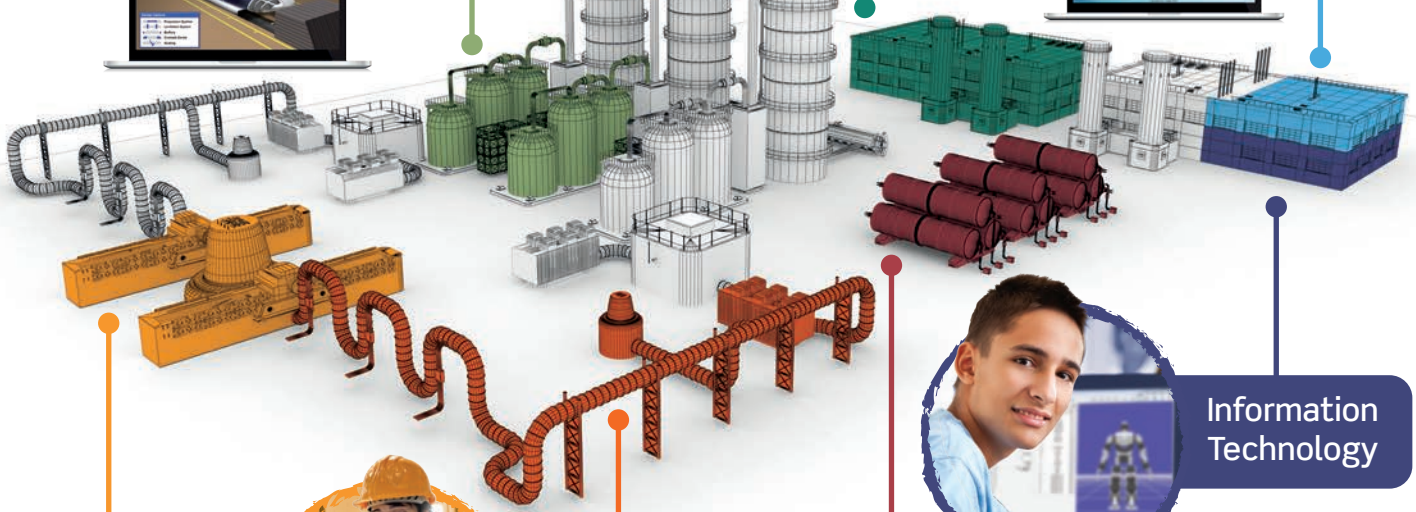
Preparing engineers for the workplace

At LJ Create, we recognise that a successful learning environment has to fulfil the challenging demands of a range of industries. To close the skills gap, engineers must be **multi-disciplined**, adaptable and **confident problem solvers**. Using our educational resources, you can bring modern industry into the classroom for future engineers and technicians to practice these essential professional skills.

Electronics

Research, Design and Technology

Engineering Management



Information Technology

Industrial and Process Control

Transportation, Distribution and Logistics

Mechanical and Fluid Power

Programmable Control Hardware

Industrial Control Teaching Set - Siemens (290-00/SI)

This teaching set brings a factory floor conveyor sorting system into the classroom.

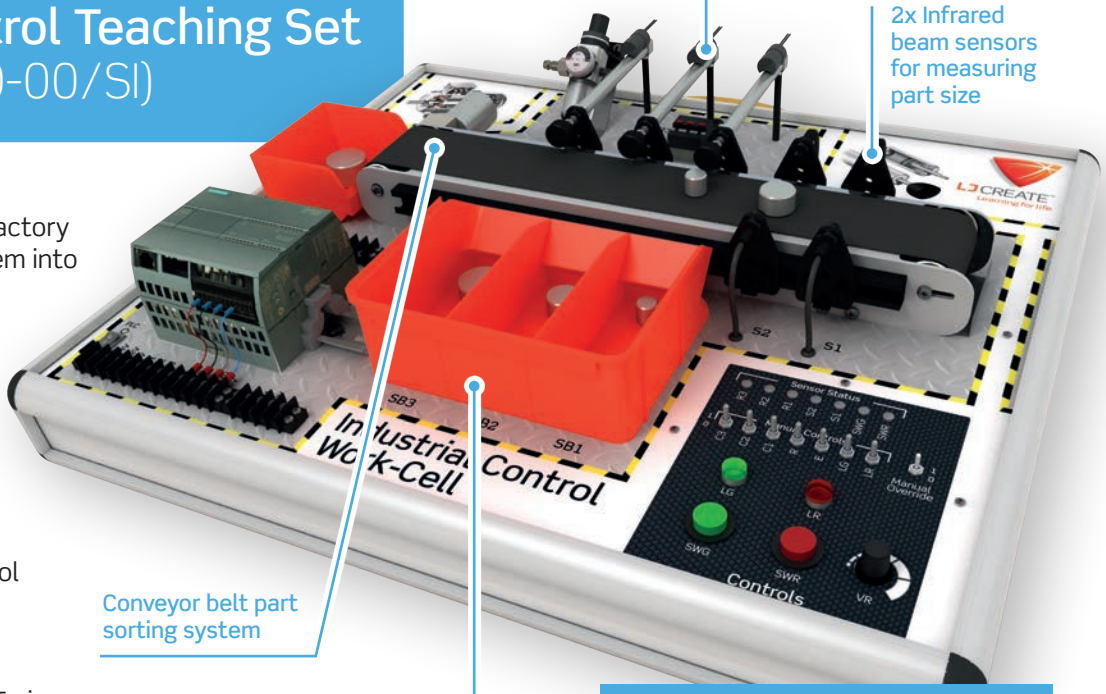
Our innovative simulation software is included to help introduce the basic concepts of PLCs and ladder logic.

Order as:

- 290-00/SI Industrial Control Teaching Set - Siemens

Also available:

- 290-01 Industrial Control Trainer
- 290-00/AB Industrial Control Teaching Set - Allen Bradley



INCLUDES UNIQUE SIMULATION SOFTWARE

PLCs Trainer Teaching Set - Siemens (291-00/SI)

This PLCs Trainer Teaching Set offers a rotating disc sorting application to help teach the fundamentals of PLC control.

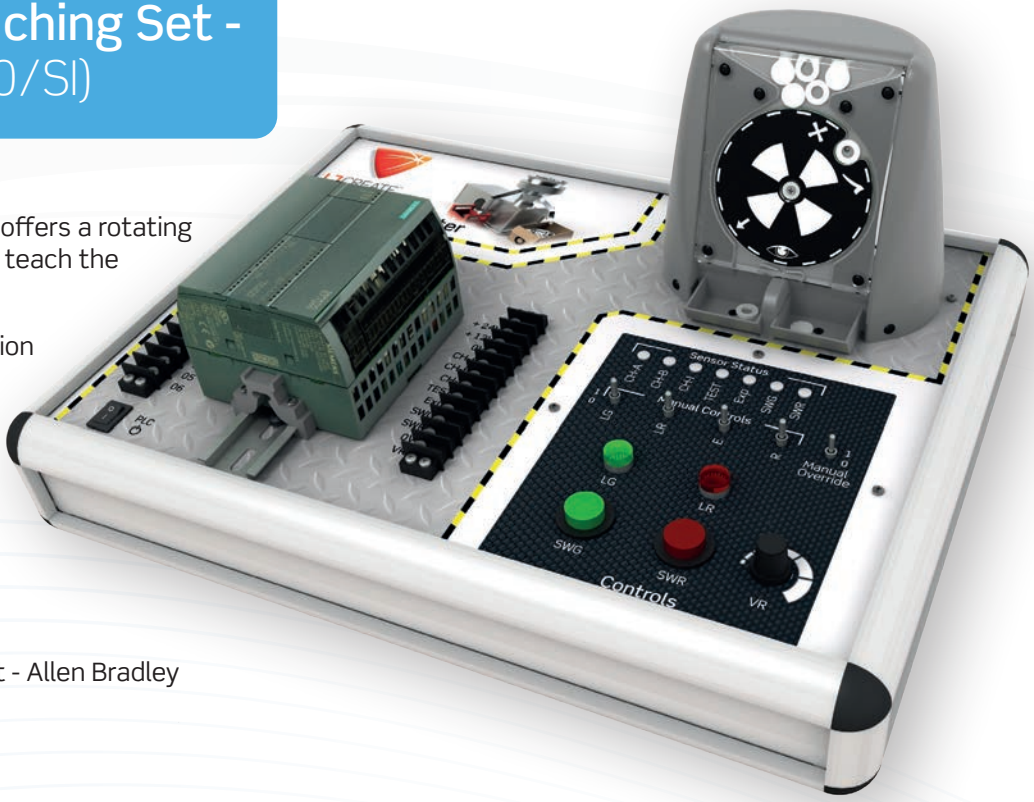
Students program the application using an industrial-standard Siemens PLC.

Order as:

- 291-00/SI PLCs Trainer Teaching Set - Siemens

Also available:

- 291-01 PLCs Trainer
- 291-00/AB PLCs Teaching Set - Allen Bradley



PETRA II Advanced Industrial Control Teaching Set (292-00)

Once students have learned to program and troubleshoot a single controller and plant, the next step is to link multiple units together and monitor the performance and operation of a more complex system. This is the role of our PETRA II Teaching Set.

The teaching set achieves this with a simulated industrial plant containing two distinct processes each controlled by its own PLC. An HMI (human-machine-interface) touch panel unit supervises the two PLCs, monitoring and displaying key information from sensors around the plant.

Using an industry-standard PLC programming software suite, each PLC must be programmed to control its own set of processes. The HMI panel must be programmed to supervise the two PLCs and display relevant plant information.

Students will also explore the functionality of SCADA (Supervisory Control and Data Acquisition).

Order as:

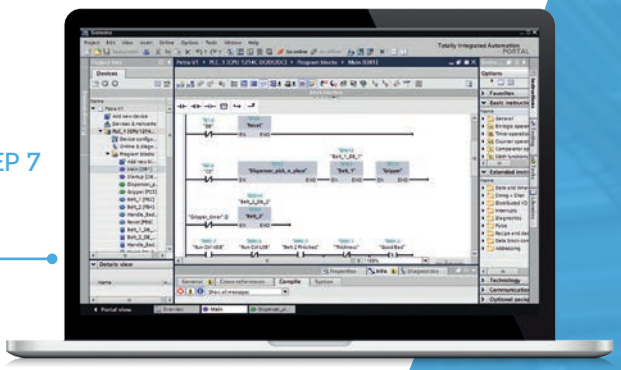
- 292-00 PETRA II Advanced Industrial Control Teaching Set

Teaching set includes:

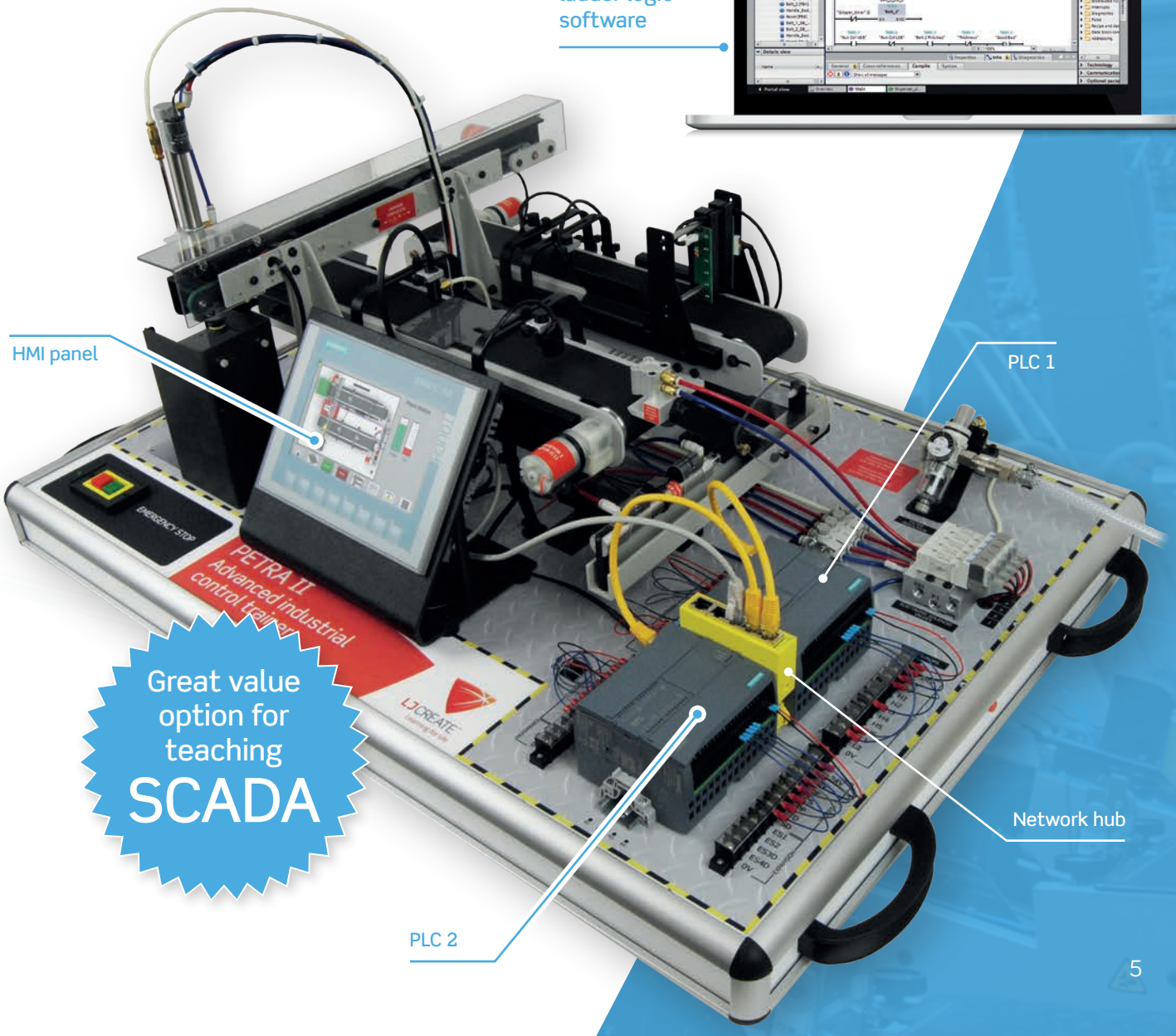
- 292-01 PETRA II Advanced Industrial Control Trainer
- 292-03 Siemens HMI Pack for PETRA II Advanced Industrial Control Trainer (Includes 2x PLCs, STEP 7 Software, HMI Panel)

Also Available:

- 290-02/SI Siemens S71200 + Step 7 + Lessons PLC Pack
- 290-02/AB Allen Bradley Micro820 + Software Pack



Siemens STEP 7 ladder logic software



Great value option for teaching SCADA

Electronics
Core Electronics Hardware

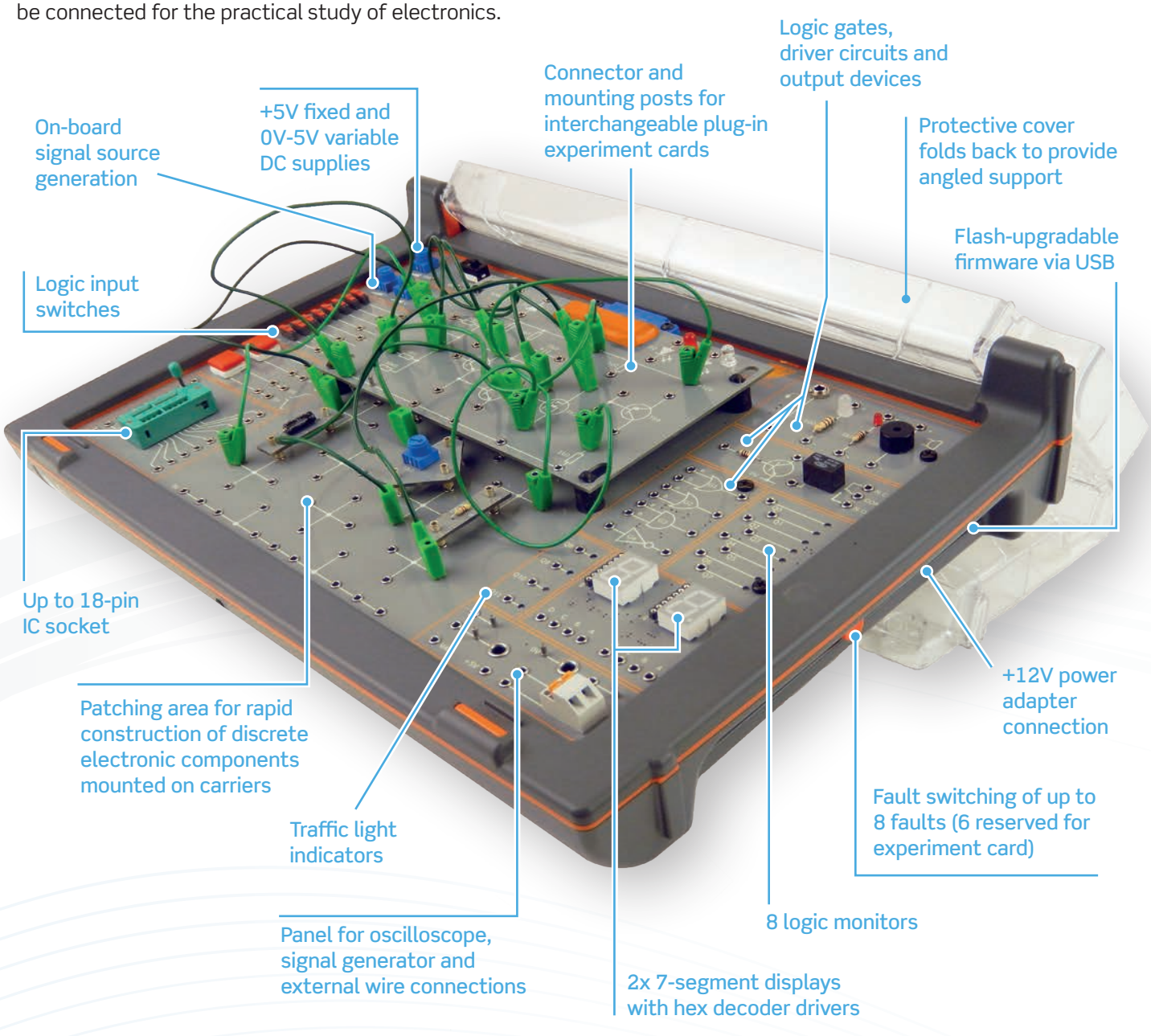
Electronics Study Trainer (320-00)

The Electronics Study Trainer provides the basis for a practical resource that introduces students to core electronics and electronic systems through a wide range of practical activities.

The study trainer allows a range of experiment cards to be connected for the practical study of electronics.

Order as:

- 320-00 Electronics Study Trainer



Complete Electronics Workstation (320-10)

Our core electronics series is a perfect blend of component-based and systems training for intermediate (Level 1, 2 and 3) electronics students.

- Patch discrete components quickly and easily
- Add an interchangeable study card for more complex circuits
- Or combine the two for even more flexibility!
- Controlled troubleshooting faults that really test circuit understanding

The Complete Electronics Workstation allows the practical study of a wide range of electronics subjects, including DC and AC circuits, semiconductors, analogue and digital systems, telecommunications and microcontrollers.

The series comprises an electronics study trainer and component set, and a range of plug-in experiment cards. The unique design of the trainer includes a heavy duty casing with transparent protective cover.

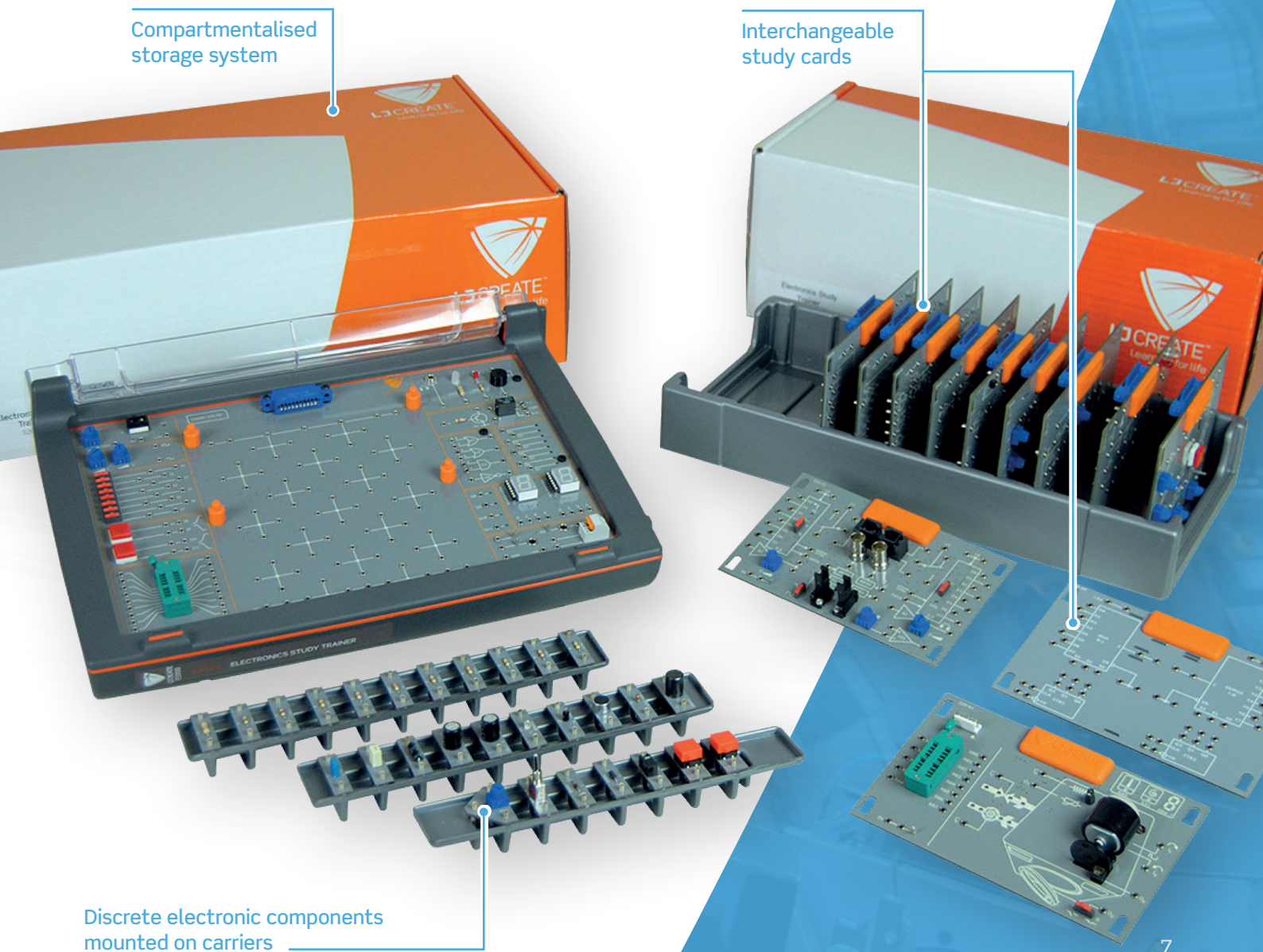
When in use, the cover folds back to provide an angled support for the unit. With the cover closed, trainers become stackable for easy storage.

Order as:

- 320-10 Complete Electronics Workstation (includes 320-00 to 320-61)

Also Available:

- 320-11 Core Electronics Workstation (includes 320-00 to 320-45)

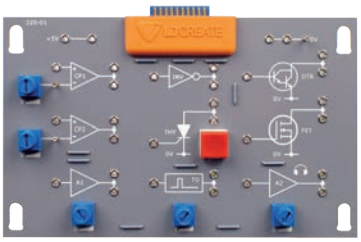


Electronics
Core Electronics Study Cards*

Electronic Systems Card (320-01)

Typical practical tasks and topics include:

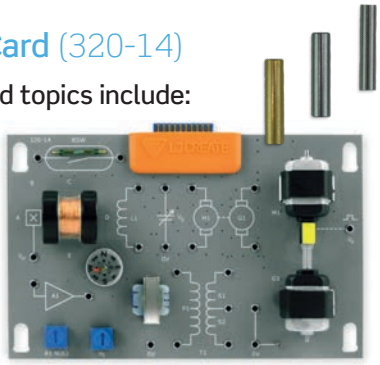
- Darlington pair and FET investigation
- Thyristor investigation
- Automatic lighting project
- Baby alarm project



Electromagnetism Card (320-14)

Typical practical tasks and topics include:

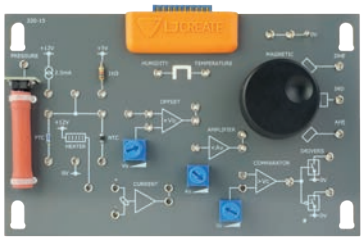
- Reed switch operation
- Hall effect investigation
- Transformer power and efficiency
- DC motor-generator investigation



Input Transducers Card (320-15)

Typical practical tasks and topics include:

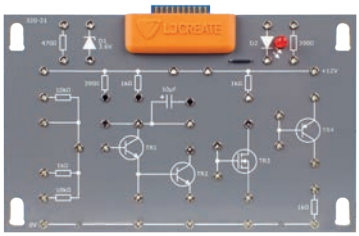
- Photo sensors - auto headlamp circuit
- Operation of a current sensor
- Low pass filter application



Diodes and Transistors Card (320-21)

Typical practical tasks and topics include:

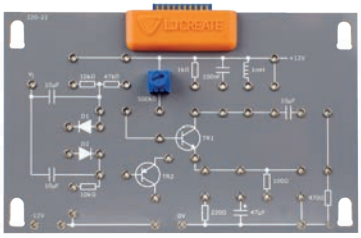
- Voltage stabilisation using a zener diode
- NPN transistor as a voltage amplifier
- FET operation
- Testing diode and transistor circuits



Transistor Amplifiers Card (320-22)

Typical practical tasks and topics include:

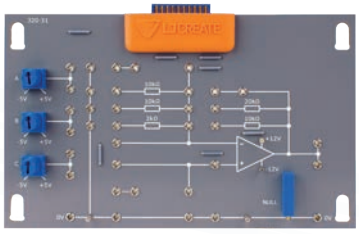
- Build and test Class A, B, AB and C transistor amplifiers
- Crossover distortion
- Effects of feedback in a transistor amplifier circuit



Operational Amplifiers Card (320-31)

Typical practical tasks and topics include:

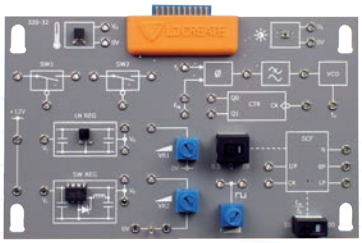
- Voltage comparator circuits
- Building and testing inverting amplifiers
- High frequency performance of an op. amp.



Analogue Integrated Circuits Card (320-32)

Typical practical tasks and topics include:

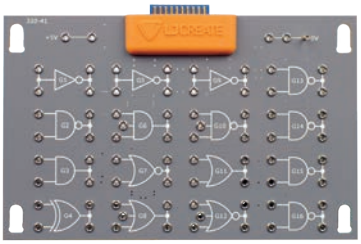
- Comparing linear and switch mode voltage regulators
- Testing a switched capacitor filter
- Investigating the operation of a phase locked loop



Combinational Logic Card (320-41)

Typical practical tasks and topics include:

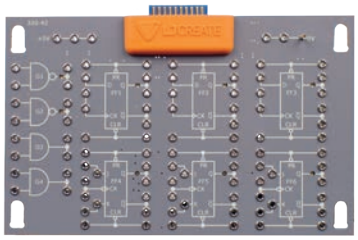
- Investigating logic gates
- Constructing truth tables
- Building EXOR gates from other gates
- Equivalent logic circuits



Sequential Logic Card (320-42)

Typical practical tasks and topics include:

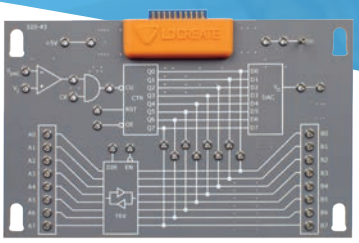
- Investigating a D-type flip-flop
- Binary counter operation
- Frequency division
- Shift register operation



A/D-D/A Digital Systems Card (320-43)

Typical practical tasks and topics include:

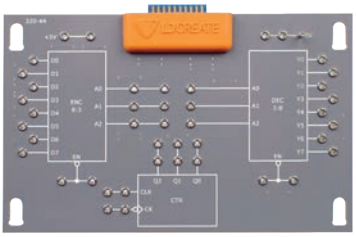
- Investigating a D/A converter
- Building and testing an A/D converter
- Tri-state devices
- Testing and fault-finding A/D and D/A systems



Encoder/Decoder Digital Systems Card (320-44)

Typical practical tasks and topics include:

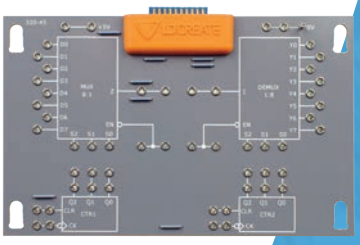
- Decoding the output from a binary counter
- Building and testing an encoder-decoder system



Multiplexer/Demultiplexer Digital Systems Card (320-45)

Typical practical tasks and topics include:

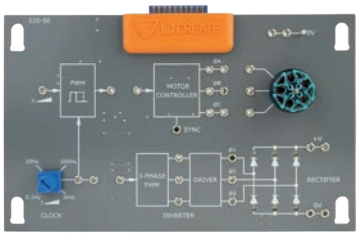
- Scanning multiplexer inputs using a binary counter
- Clocking and Synchronization



Pulse Width Modulation Signals Card (320-50)

Typical practical tasks and topics include:

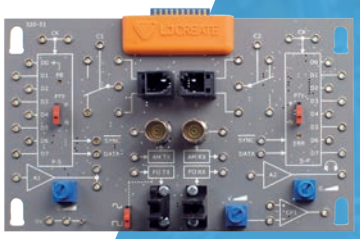
- PWM signal driving an LED
- Investigation of a 3-phase waveform
- PWM motor speed control circuit



Electronic Communications Systems Card (320-51)

Typical practical tasks and topics include:

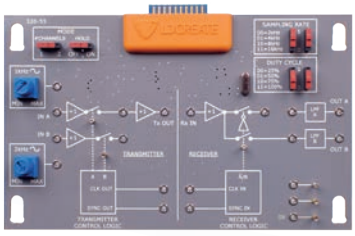
- AM & Optical transmission
- Digital data transmission
- Transmission protocols



PAM/TDM Communications Card (320-55)

Typical practical tasks and topics include:

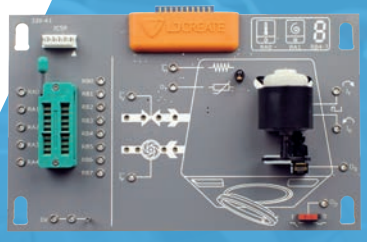
- Introduction to Pulse Amplitude Modulation
- Sample Rate and PAM Frequency Content
- Time Division Multiplexing of PAM Signals



PIC Programmer and Applications Card (320-61)

Typical practical tasks and topics include:

- Sensors and actuators
- Controlling I/O port lines
- Performing arithmetic and logical operations
- Using sub-routines



***Please note:** these circuit cards are used in conjunction with 320-00 Electronics Study Trainer featured on page 6)

Electronics
Advanced Electronics Hardware

Advanced Electronics Experiment Platform (300-01)

This unit provides power supplies and connection facilities for the complete range of advanced electronics experiment cards (see opposite). Facilities are provided for inserting circuit faults into experiment cards.

Order as:

- 300-01 Advanced Electronics Experiment Platform

A special lever-operated 'load and eject' system protects the connector from any stress and ensures reliable connection time after time.

Experiment cards fit in the mounting area in the middle of the base unit

BNC connectors

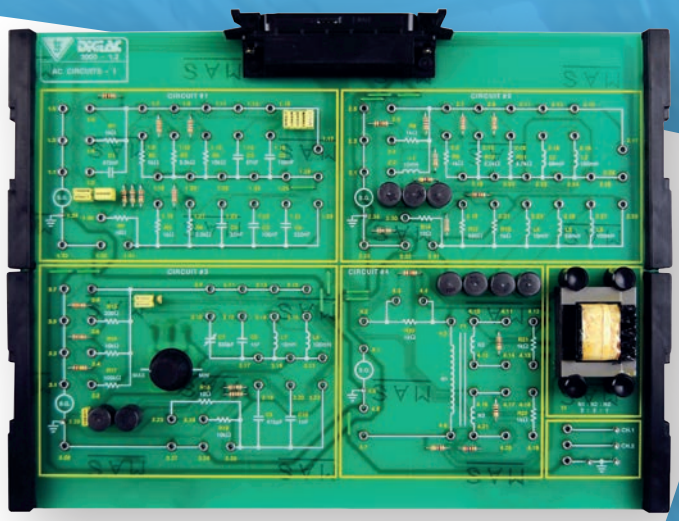
Provides access to the following power supply outputs: 0-12V Variable DC, +5V DC, -5V DC, 12V DC, -12V DC, 12-0-12V 50/60 Hz AC

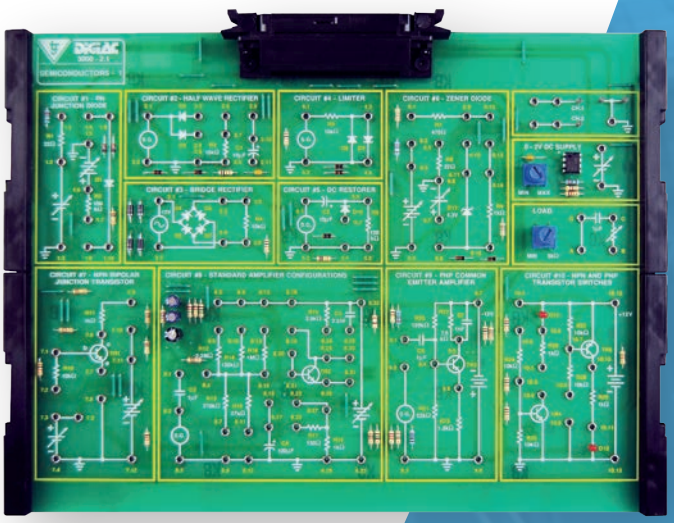
Experiment Cards

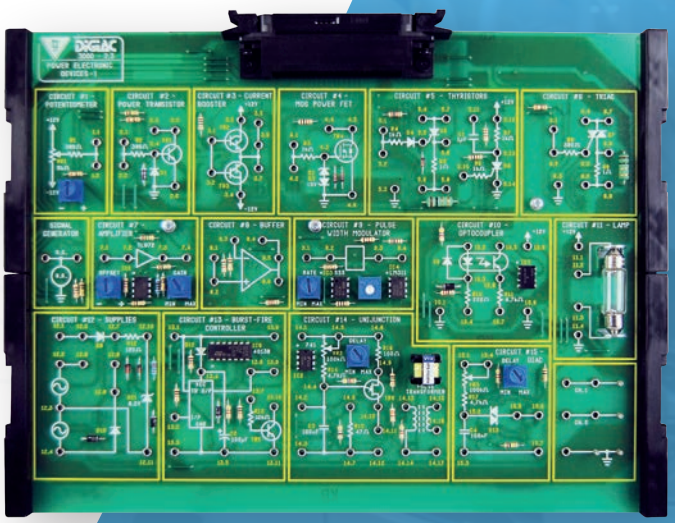
An extensive library of experiment cards is available for use with the Advanced Electronics Experiment Platform (see opposite) to teach specific elements of electronic circuits and systems.

Experiment Cards Include:

- 301-01 Basic Electricity Study Module
- 301-11 DC Circuits Study Module
- 301-12 AC Circuits Study Module
- 301-13 Electrical Networks Study Module
- 301-14 Electromagnetic Devices Study Module
- 302-21 Semiconductors 1 Study Module
- 302-22 Semiconductors 2 Study Module
- 302-31 Operational Amplifiers Study Module
- 303-24 Optoelectronic Devices Study Module
- 303-25 Transistor Amplifiers Study Module
- 303-32 Filter Circuits Study Module
- 303-33 Oscillators Study Module
- 303-34 Power Supplies Study Module
- 304-41 Fundamentals of Digital Logic Study Module
- 304-42 Combinational Logic Study Module
- 304-43 Sequential Logic Study Module
- 304-44 Digital Systems Study Module
- 305-17 AC Power Study Module
- 305-23 Power Electronics 1 Study Module
- 305-26 Power Electronics 2 Study Module
- 316-01 PIC 3000 Microcontroller Study Module
- 316-02 PIC 32 Extension Kit
- 316-35 Microcontroller Applications Board







Mechanical and Fluid Power
Hardware

Injection Moulder Trainer (350-01)

This trainer offers a classroom-based resource for investigating the techniques used to create thermo-plastic products.

Students will see how a good grasp of materials science is needed to select appropriate materials and methods for production.

INCLUDES UNIQUE SIMULATION SOFTWARE

Typical practical tasks and topics include:

- Investigate the moulding process
- Investigate the causes of mould flash and shrinkage
- Research tools and fabrication processes used in manufacturing
- Compare costs of differently designed moulded parts
- Design, prototype, test and evaluate a door knob

Order as:

- 350-01 Injection Moulding Trainer

Also Available:

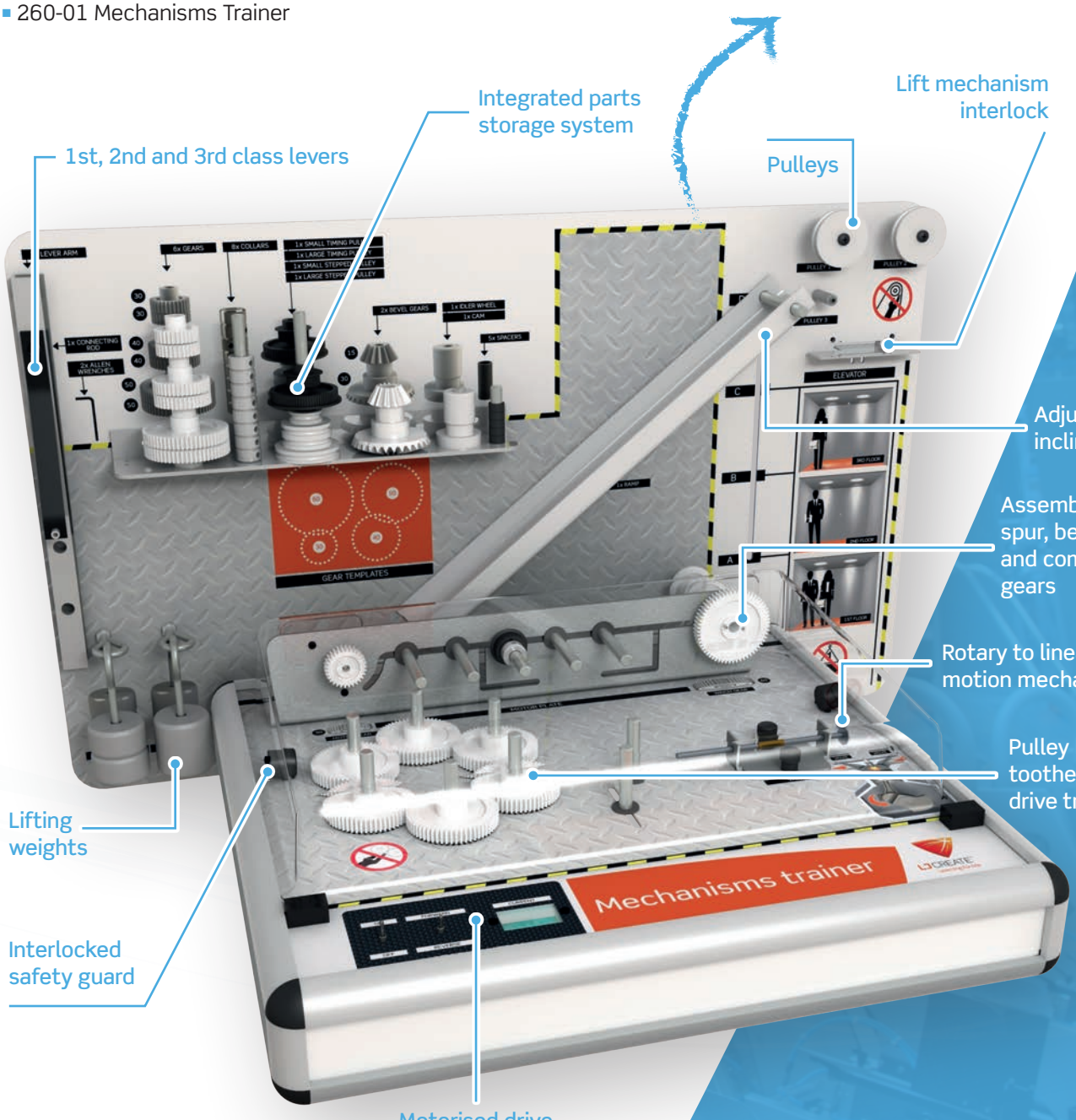
- 350-10 Injection Moulder Assembly Kit

Mechanisms Trainer (260-01)

The Mechanisms Trainer offers a classroom-based resource for practical investigation of a variety of fundamental mechanical systems. The trainer allows users to investigate gears, pulleys, levers, cams, belt drives, and inclined planes.

Order as:

- 260-01 Mechanisms Trainer



Mechanical and Fluid Power Hardware

Hydraulics Trainer (280-01)

The Hydraulics Trainer offers a portable classroom-based resource for practical investigation of hydraulic components and systems. The trainer uses quick-release hydraulic hoses to allow rapid circuit connection and setup.

A Fluid Power Resource Pack is ideal for a whole-class introduction to fluid control using syringes and hoses.

Typical practical tasks and topics include:

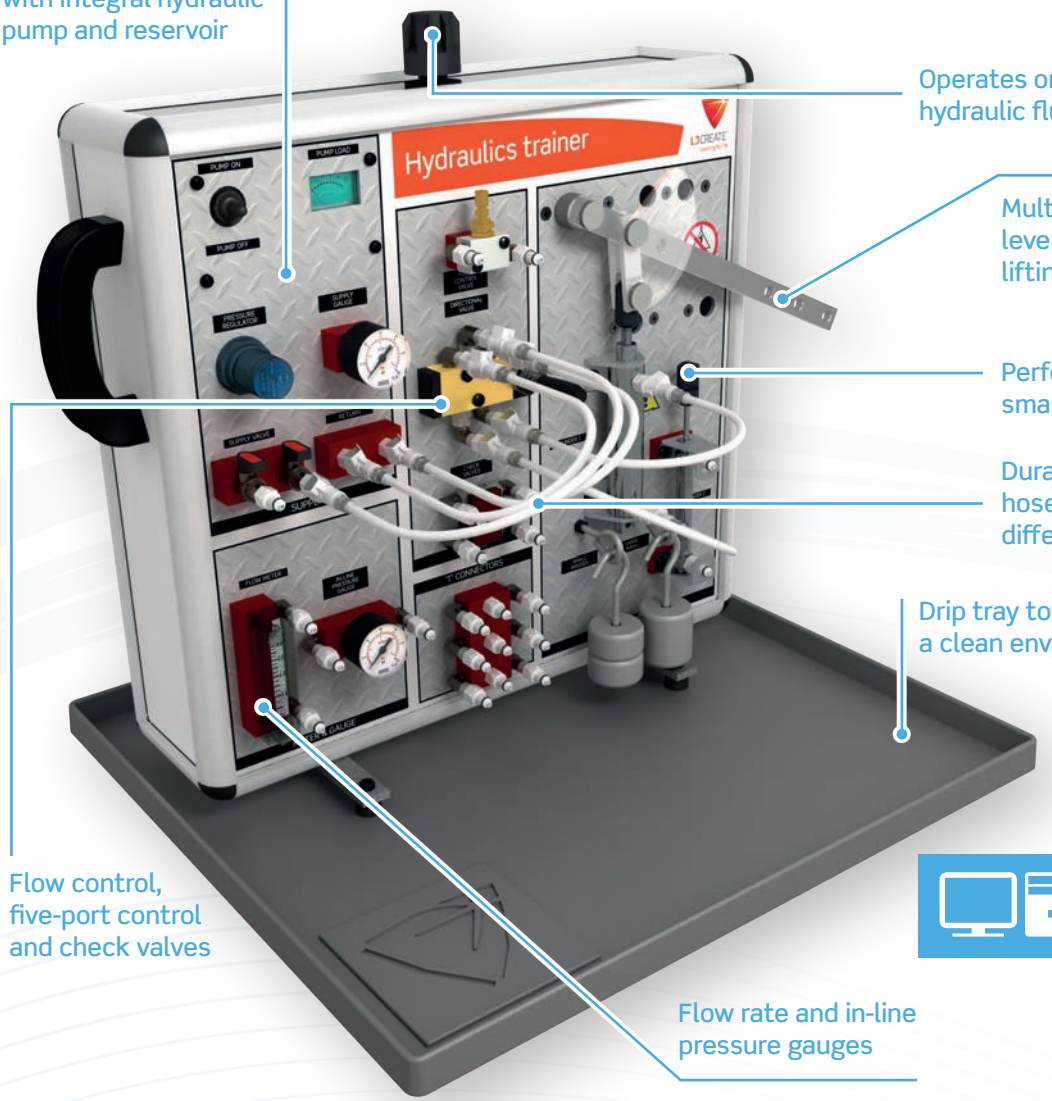
- Principles of hydraulics
- Valves and flow control
- Creating pressure with pumps
- Cylinder design

Order as:

- 280-01 Hydraulics Trainer

Also available:

- 278-01 Fluid Power Student Resource Pack



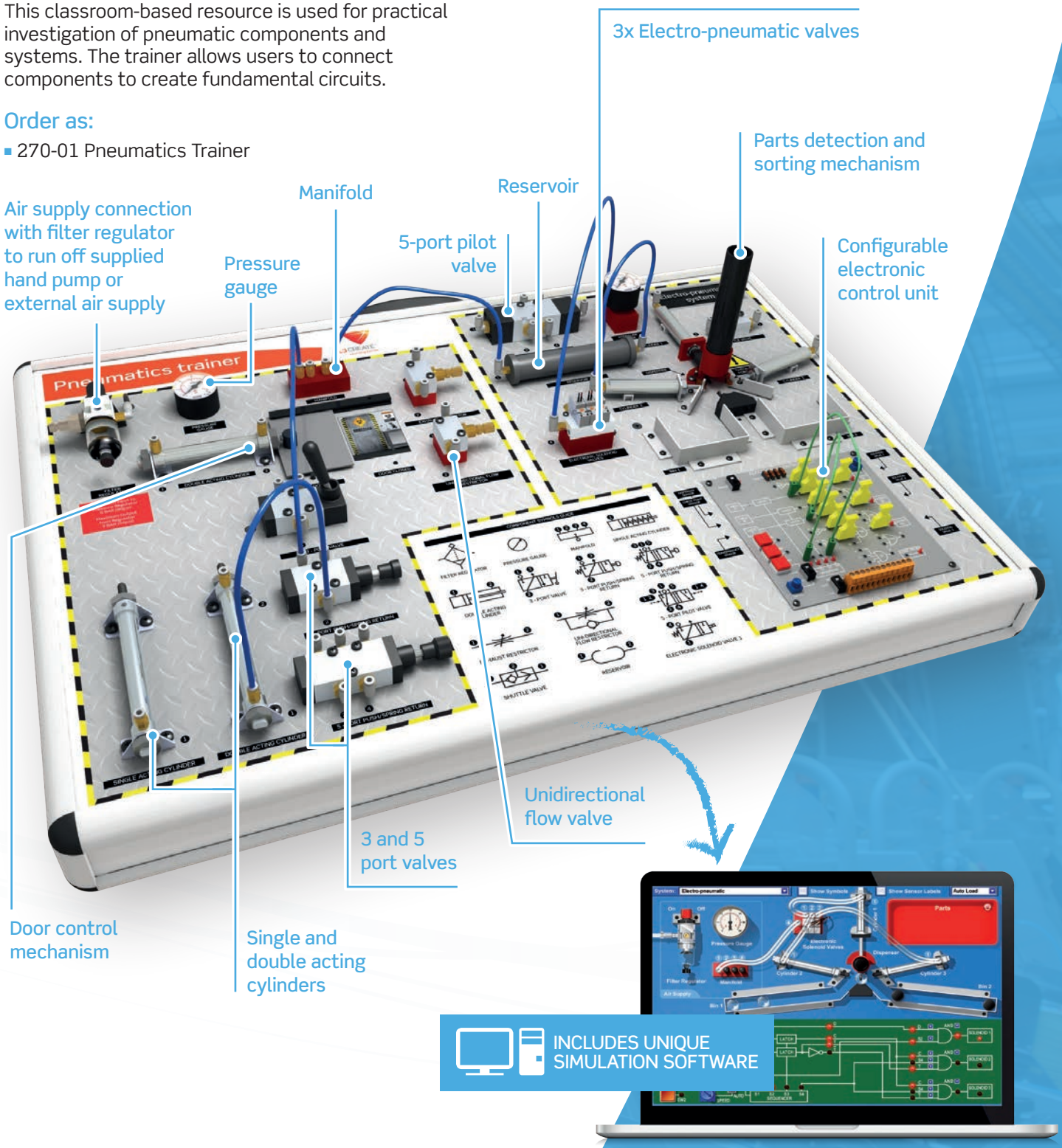
INCLUDES UNIQUE SIMULATION SOFTWARE

Pneumatics Trainer (270-01)

This classroom-based resource is used for practical investigation of pneumatic components and systems. The trainer allows users to connect components to create fundamental circuits.

Order as:

- 270-01 Pneumatics Trainer



Design and Technology
Hardware

Green Energy in Buildings Trainer (122-01)

The Green Energy in Buildings package offers a resource that puts a model home into the classroom.

Typical practical tasks and topics include:

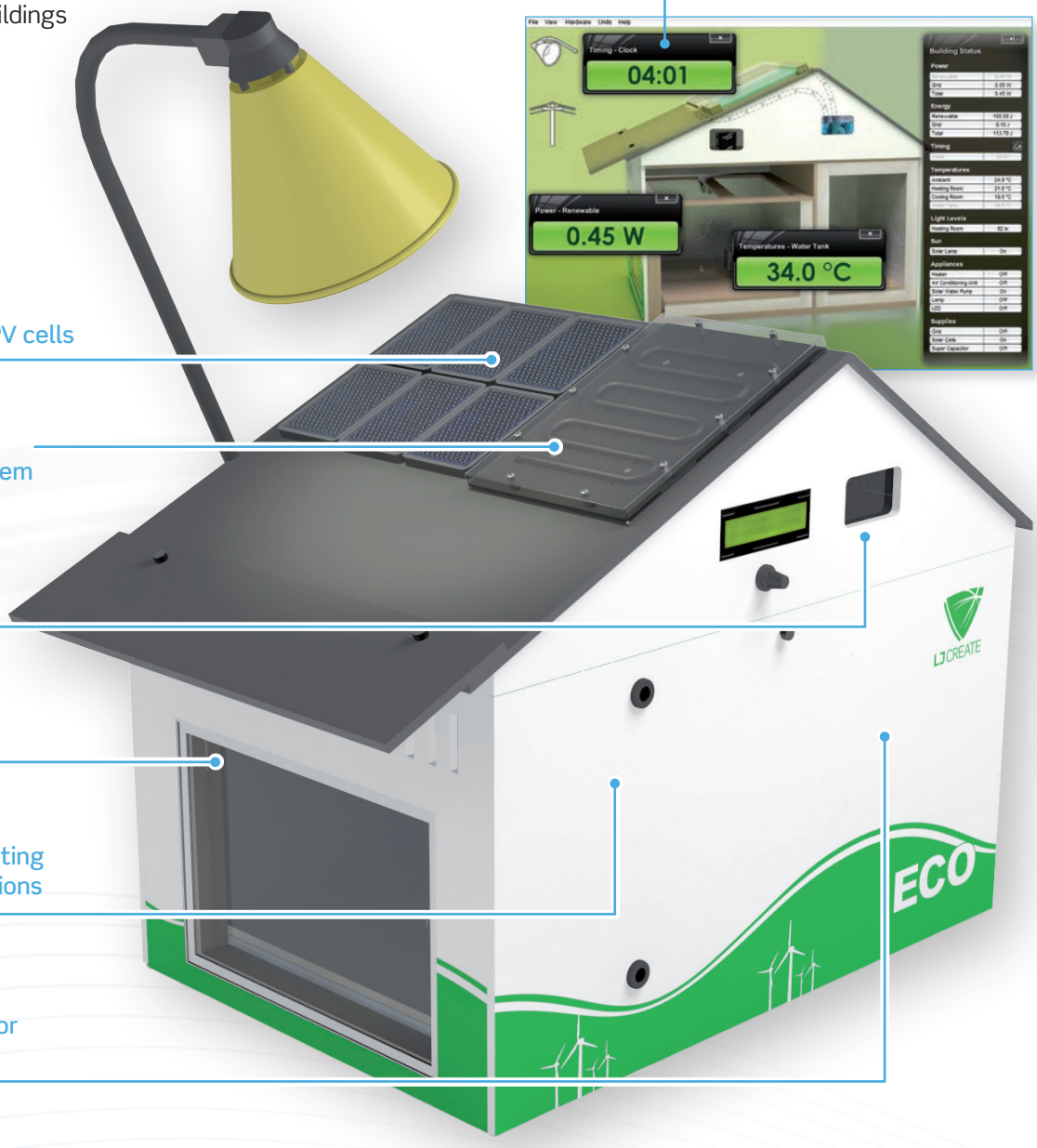
- Investigating energy use in buildings
- Home wind turbines
- Solar electric systems
- Energy for heating buildings
- Solar water heating
- Insulation and glazing performance
- Heat pump principles

Order as:

- 122-01 Green Energy in Buildings Trainer

Digital content

Onscreen interface



PV cells

Solar water heating system

Water heating pump

Glazing units

Insulated room for heating and lighting investigations

Air conditioned room for cooling investigations

Sustainable Energy Teaching Set (100-00)

The equipment included will turn any classroom into an exciting alternative energy lab. This resource includes access to digital curriculum materials including theory and practical learning tasks.

Order as:

- 100-00 Sustainable Energy Teaching Set

Teaching set includes:

- 100-01 Sustainable Energy Production Trainer
- 100-02 Sustainable Energy Production Student Resource Pack x12

INCLUDES UNIQUE SIMULATION SOFTWARE

Structures and Materials Teaching Set (121-00)

The Structures and Materials package offers student activities to investigate the science and technology behind the built environment.

Explore beam designs and perform destructive testing on them to analyse their materials and design. Includes digital curriculum materials featuring theory and practical lesson content.

Order as:

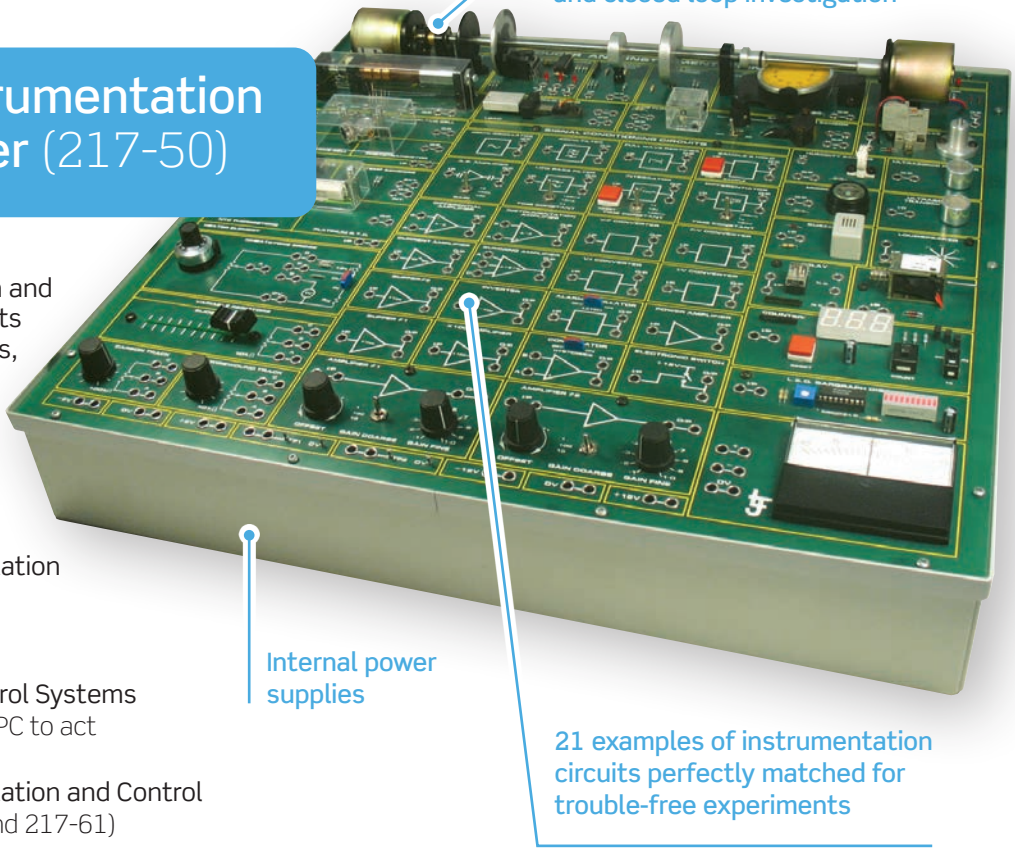
- 121-00 Structures and Materials Teaching Set

Teaching set includes:

- 121-01 Structures and Materials Student Resource Packs (x12)
- 121-02 Structures and Materials Class Consumables Pack (x1)

Control and Instrumentation Hardware

Transducers, Instrumentation and Control Trainer (217-50)



The Transducers, Instrumentation and Control Trainer introduces students to input sensors, output actuators, signal conditioning circuits and display devices through a wide range of hands-on practical activities.

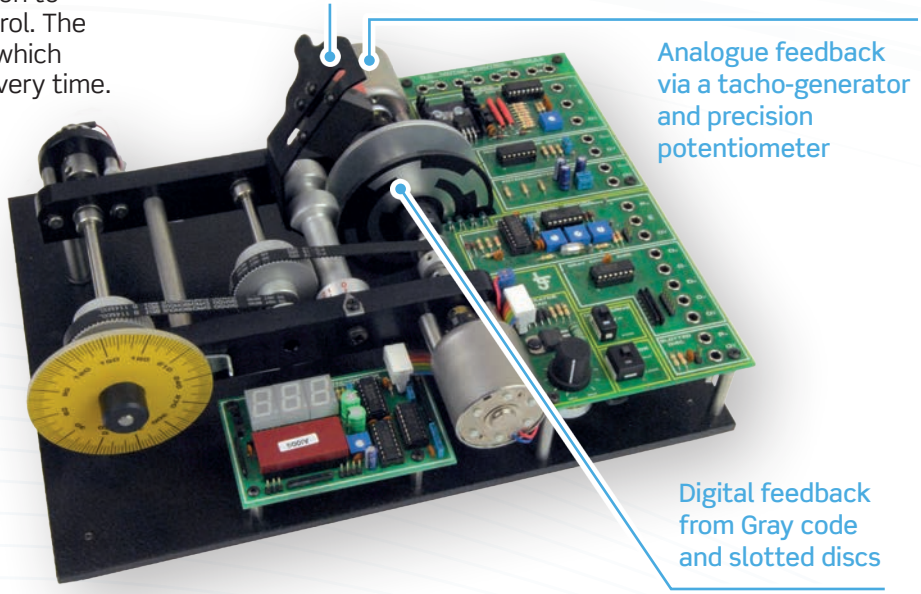
Order as:

- 217-50 Transducers, Instrumentation and Control Trainer

Also available:

- 217-61 Data Acquisition of Control Systems (An instrument unit that allows a PC to act as a set of test instruments).
- 217-00 Transducers, Instrumentation and Control Teaching Set (Includes 217-50 and 217-61)

Analogue and Digital Motor Control Teaching Set (207-00)



This system provides the complete solution to teaching analogue and digital motor control. The heart of the system is a mechanical unit which produces repeatable, text-book results every time.

Order as:

- 207-00 Analogue and Digital Motor Control Teaching Set

Teaching set includes:

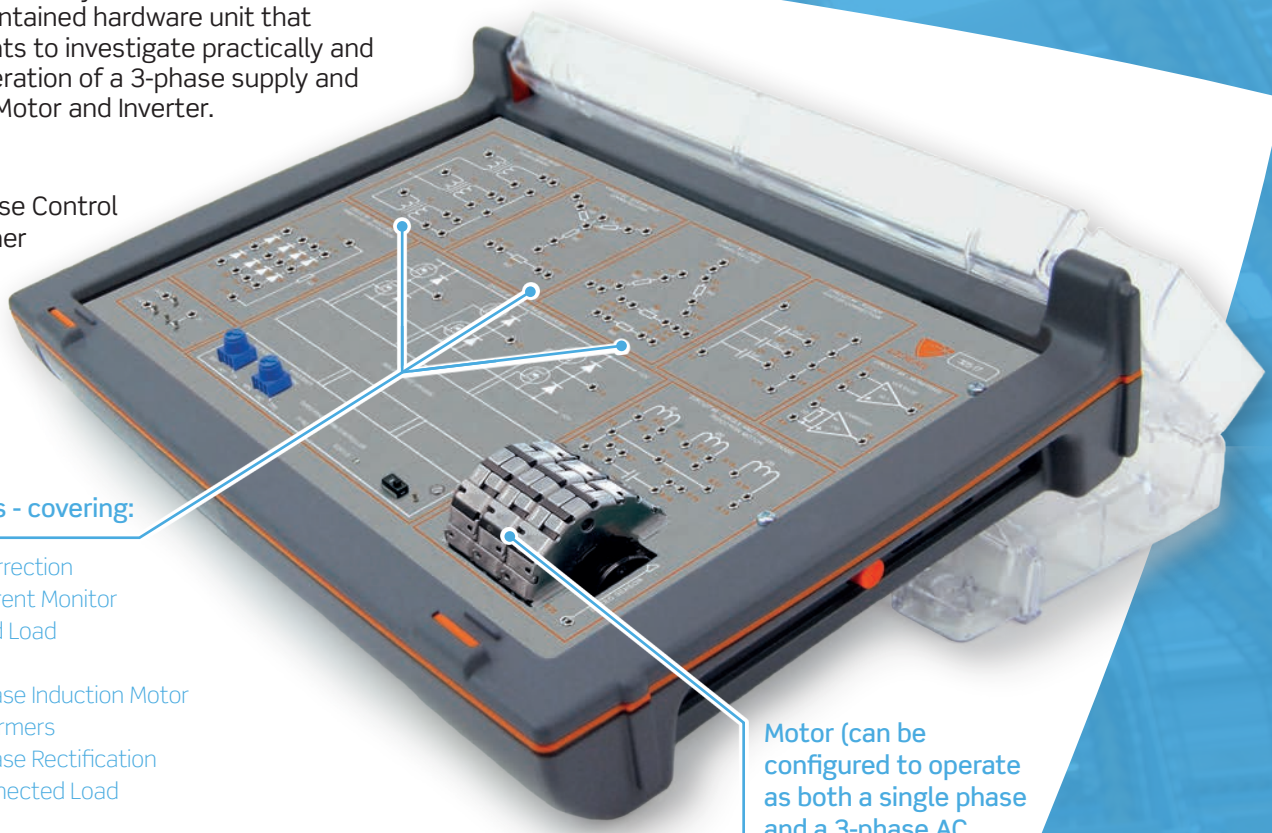
- 207-02 Virtual Control Laboratory
- 207-03 Command Potentiometer
- 207-04 PID Controller Module
- 207-05 4mm Connection Lead Set
- 207-15 D.C. Motor Control Module
- 207-40 Power Supply Unit

3-Phase Control Systems Trainer (325-17)

The 3-Phase Control Systems Trainer is a rugged, self-contained hardware unit that enables students to investigate practically and safely the generation of a 3-phase supply and operation of a Motor and Inverter.

Order as:

- 325-17 3-Phase Control Systems Trainer



8x circuit zones - covering:

- Power Factor Correction
- Voltage and Current Monitor
- Delta Connected Load
- 3-Phase Inverter
- Single and 3-Phase Induction Motor
- 3-Phase Transformers
- Single and 3-Phase Rectification
- Wye or Star Connected Load

Motor (can be configured to operate as both a single phase and a 3-phase AC motor system)

Robotics Trainer (240-01)

The Robotics Trainer offers a classroom-based resource for practical investigation of the technology and engineering behind modern automated systems.

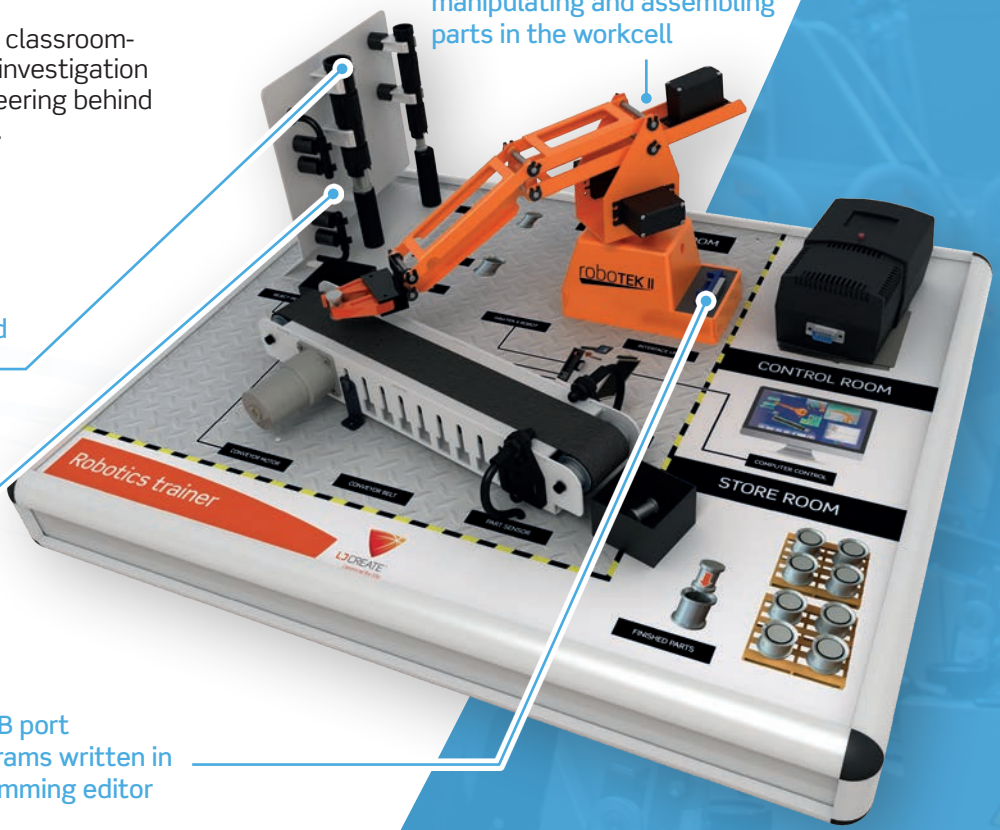
Order as:

- 240-01 Robotics Trainer

Articulated robot for manipulating and assembling parts in the workcell

Parts from the 2-component parts dispenser are collected by the robot arm

Part sensing to check for a hole in the container part



Robot connects to PC via USB port interface for control by programs written in our bespoke workcell programming editor

Mechatronics Lessons

Topics from our online library of over 3,800 learning units

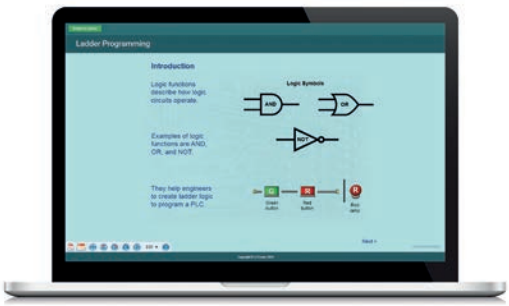
Our online library is a comprehensive resource of engineering lessons. Students can access the presentations, investigations and assessments in our library through an online portal; no specialist software or downloads are needed.

Using our LMS, teachers can quickly select and assign lessons to student groups where student progress can be tracked and reported. Ready-made courses for the more popular qualifications are also available.

CONTROL AND INSTRUMENTATION

Industrial Control (159 learning units)

- Feedback Control Systems
- Programmable Logic Control
- Construction and Function of a PLC
- Connecting a PLC
- Digital and Analogue Inputs and Outputs
- Sequence Control System
- PLC Programming
- GRAFCET Sequence Control Systems
- Ladder Programming
- PLC Latches, Counters, Timers and Memory Stores
- Rotary Encoder
- Conveyor Application Control
- Parts Sorter Application Control
- Step 7 Programming
- Fieldbus, AS Interface, and Profibus DP



Transducers, Instrumentation and Control (189 learning units)

- Basic Control Systems Equipment & Terms
- Positional Resistance Transducers
- Wheatstone Bridge Measurements
- Environmental Measurement
- Temperature, Sound and Light Sensing
- Linear Position and Force Applications
- Linear and Rotational Motion
- Rotational Speed and Position Measurement
- Display Devices
- Signal Conditioning
- Comparators, Oscillators and Filters
- Mathematical Operations
- Position and Speed Control Systems

Analogue and Digital Motor Control (158 learning units)

- Transient and Steady State Response
- Proportional Speed and Position Control
- Second Order Response Parameters
- Velocity and Transient Velocity Feedback
- Controller Characteristics
- Proportional Plus Integral Speed Control
- Proportional Plus Integral Plus Derivative Position Control
- Stability and Instability
- Three-Term, PID Control
- Time Response
- Frequency Response
- Computer Control
- Analogue and Digital Interfacing
- Digital Interfacing

Data Acquisition of Control Systems (37 learning units)

- Thermal and Light Controlled Systems
- Temperature Transducer Response
- Proportional, Integral and Derivative Control
- Velocity Feedback

Avionics (66 learning units)

- Single Engine Aircraft Electrical and Power Systems
- Troubleshooting
- Single Engine Power Supply and Distribution Systems
- Landing Gear Control and Indication Systems
- Flap Control Systems
- Stall Warning Systems
- Take Off Warning Systems
- Temperature Systems
- Fuel Quantity and Fuel Flow Measurement

ELECTRONICS

Electronic Systems (71 learning units)

- Systems and Sub-Systems
- Alarm Systems
- Inputs, Outputs and Processes
- Analogue Signal Processing
- Digital Signal Processing
- Electronic Components
- Closed Loop Control
- Energy and Power
- Fault Finding Electronic Systems

DC Circuits (134 learning units)

- Voltage and Current
- Resistance
- Electrical Energy and Power
- Capacitor Circuits
- Inductor Circuits

Electrical Networks (125 learning units)

- Voltage, Current and Resistance
- Series and Parallel Circuits
- Voltage Divider Principle
- Internal Resistance
- Kirchhoff's Laws
- Thevenin's Theorem
- Superposition Principle
- Measuring Instruments

AC Circuits (129 learning units)

- Effective Values of Alternating Voltages and Currents
- Measuring with an Oscilloscope
- Period and Frequency
- Peak, Peak-to-Peak and RMS Values
- Capacitor Circuits
- Inductor Circuits
- Capacitive and Inductive Reactance
- Graphical Representations and Equations of RLC Circuits
- Phase Difference and Power
- LC Oscillator Circuit and Resonant Frequency

Magnetism and Electromagnetism (39 learning units)

- Magnetic Principles
- Electromagnetism
- Self-Inductance of Inductors
- Magnetic Flux and Flux Density
- Transformers
- The DC Motor
- Fault Finding Electromagnetic Devices

Electrical Engineering (75 learning units)

- Electrical Installation in Residential Buildings
- Components of an Electrical Installation
- Lighting Systems
- Heating and Cooling Technology in the Home
- Technical Building Management System
- Safeguards Against Electric Shock
- Earthing Systems
- Cables and Wires
- Circuit Breakers
- Testing to Electrical Standards
- Ingress Protection and IP Codes
- Production, Transmission and Distribution of Electrical Energy

Linear Electronics (57 learning units)

- Analogue Circuits
- Inverting and Non-inverting Operational Amplifier Circuits
- Filter Circuits
- Oscillator Circuits
- IC Sensors
- The 555 Timer
- Analogue Switches
- Power Supplies
- Fault Finding Linear Electronic Circuits

Semiconductors (155 learning units)

- Diodes
- Bridge Rectifiers
- BJT and FET Transistors
- Transistor Amplifiers
- SCRs
- Optoelectronic and Display Devices
- Fault Finding Semiconductor Circuits

Power Electronics (137 learning units)

- Three-phase AC
- Star and Delta Connections
- Single-Phase and Three-Phase AC Motors
- The Induction Motor
- Three-Phase Rectifiers and Inverters
- Motor Starting and Speed Control
- Motor Drive Connection Components
- Efficiency of Electric Motors
- Construction, Selection and Controlling Contactors
- Motor Protection and Interlock Systems
- Frequency Converters
- EMC

Digital Electronics (291 learning units)

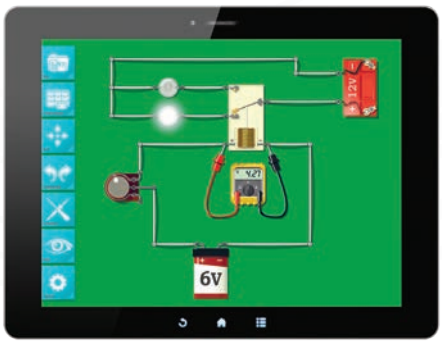
- Number Systems
- Logic Gates
- Logic Families
- Boolean Algebra
- Combinational Logic
- Karnaugh Maps
- Integrated Circuit Memory
- S-R Latch
- D-Type and J-K Flip-Flops
- Synchronous Counters and Shift Registers
- Half and Full Adders
- Monostable and Astable IC Circuits
- Magnitude Comparator
- Encoders and Decoders
- Multiplexers and Demultiplexers
- D-A and A-D Conversion
- Bi-directional Driver & Tri-State Interface
- Analogue Switch
- Fault Finding Digital Circuits

Telecommunications (31 learning units)

- Electronic Communication Systems
- AM Transmission
- Optical Transmission
- Simplex and Duplex Transmission
- Phase Locked Loops
- Digital Data Transmission
- Antennas
- Fault Finding Telecommunication Circuits

Circuit Construction and Testing (129 learning units)

- Safety and Accident Prevention
- Plan, Build & Test on Breadboard
- Plan, Build & Test on Stripboard
- Plan, Build & Test on Printed Circuit Board
- Applications of Electronics Project



MECHANICAL AND FLUID POWER

Engineering Drawing (42 learning units)

- Drawing Standards
- Basic Geometric Construction
- Types of View
- Co-ordinate Systems
- Dimensions
- Roughness
- Sectional Views
- Drawing Analysis
- Screws and Threaded Components
- Machine Elements
- Tolerances and Fits
- Drilling and Finishes
- Fluid Power Diagrams
- Permanent Connections

Inspection, Maintenance and Quality Management (60 learning units)

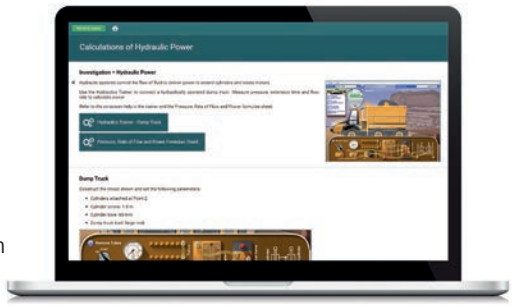
- Working with Powers and Standard Form
- Accuracy
- Measuring Lengths and Pythagoras' Theorem
- Measuring and Calculating Angles
- Measurement Tolerances and Calculations
- Clearances and Fits
- Quality Management
- Statistical Analysis
- Maintenance Principles and Accident Prevention
- Maintenance Inspection and Documentation
- Diagnostics and Troubleshooting
- Mechanical Breakdown
- Fault Repair

Machine and Instrument Engineering (72 learning units)

- Mechanical Units
- Mass and Volume Flow Rate
- Energy, Work, Power and Efficiency
- Transferring Mechanical Energy
- Torque and Power
- Stress-Strain Analysis
- Stress Calculations in Joints
- Manufacturing Facilities
- Material Conversion
- Plain and Rolling-Element Bearings
- Seals and Gaskets
- Joining Hubs to Shafts
- Simple and Compound Gears and Drives
- Gear Calculations and Design Factors
- Clutches, Traction Drives and Adjustable Speed Transmission

Mechanical Systems (62 learning units)

- Machines
- Machine Design
- Friction
- Lubricants, Bushes and Bearings
- Inclined Planes
- Levers
- Gears and Simple Gear Trains
- Compound Gear Trains and Special Gears
- Pulleys
- Cams and Cranks



Fluid Power (150 learning units)

- Principles of Pneumatics
- Pneumatic Components, Symbols and Circuits
- Pneumatic Cylinders and Valves
- Pneumatic Logic
- Pneumatic Applications and Problem Solving
- Sequential and Automatic Control Circuits
- Pneumatic Circuit Time Delays
- Electro-pneumatics
- Levers and Movement
- Principles of Hydraulics
- Hydraulic Components, Symbols and Circuits
- Hydraulic Applications
- Hydraulic Cylinders
- Hydraulic Valves and Flow Control
- Hydraulic Actuators
- Creating Pressure with Pumps
- Fluid Power

Materials Engineering (51 learning units)

- Classification of Materials
- Iron and Steel
- Non-Ferrous Metals
- Ceramic and Sintered Materials
- Composite Materials
- Corrosion
- Polymers
- Lubrication
- Properties of Materials
- Structure of Metals
- Solutions and Phases
- Microstructure of Metals

Manufacturing Engineering (155 learning units)

- Manufacturing Processes
- Safety and Protective Measures
- Machine Tools and Terminology
- Primary Metal Shaping Processes
- Turning and Milling
- Grinding
- Drilling
- Bending
- Forming Procedures and Calculations
- Forging
- Erosive Manufacturing Processes
- Finishing Processes
- Environmental Protection
- Joining Processes
- Welding Processes
- CNC Programming
- Planning and Organising Work Processes
- Measurement

WORKPLACE SKILLS

Business Skills (199 learning units)

- Business Organisational Structure
- Corporate Mission and Goals
- Quality and Environmental Management
- Business Process Optimisation
- Procurement
- Stock Control and the Production Process
- Purchasing Calculations and Monitoring
- Material Requirements Planning (MRP)
- International Commercial Terms and Contracts
- Warehousing
- Production Management and Planning
- Analytical Techniques
- Production Process Control
- Financial Accounting and Bookkeeping
- Balance Sheet Accounting
- Profit and Loss Accounts
- Inventory Accounting Methods
- Marketing Planning
- Product, Advertising, Distribution and the Marketing Mix
- Pricing Strategies
- Sales and Marketing Measures
- Contracts and Legal Framework
- Economic Factors and Measures
- Investing, Leasing and Financing

Person Skills (24 learning units)

- Punctuality
- Dress Code
- Personal Space
- Attending a Meeting
- Handle Collective Property
- Common Courtesy
- Handling a Telephone Call
- How to Introduce Yourself
- Listening and Understanding
- Engage in a Two-Way Conversation

Workplace Problem Solving (108 learning units)

- Developing Solutions to Production Scenarios
- Developing Solutions to Construction Scenarios
- Developing Solutions to Sales and Marketing Scenarios
- Developing Solutions to Finance Scenarios
- Developing Solutions to Customer Service Scenarios
- Developing Solutions to Human Resources Scenarios

Engineering Mathematics (122 learning units)

- Units of Measure
- Approximation
- Arithmetic
- Fractions
- Percentages
- Length, Area and Volume
- Graphs and Charts
- Equations
- Algebra
- Factorisation
- Indices
- Trigonometry
- Phasors

English Language Skills (47 learning units)

- Citing Evidence to Support Analysis
- Identifying and Analysing Ideas in a Text
- Understanding the Role of Structure
- Determining a Writer's Perspective
- Considering Whether Arguments are Credible and Accurate
- Understanding Multiple Sources of Information
- Evaluating Arguments and Specific Claims Made in a Text
- Planning, Writing, Presenting and Evaluating
- Discussing Different Perspectives
- Justifying Decisions with Reasoning
- Engaging in Group Discussions
- Presenting a Perspective to an Audience
- Speaking on the Telephone
- Arguing a Perspective
- Presenting a Persuasive Perspective
- Formal Letters with a Perspective
- Creating an Informative Text
- Informing an Audience
- Understanding and Using Perspective in a Narrative

Warehouse Management (39 learning units)

- Basics of Storage
- Storage of Goods
- Picking Stock
- Packaged Goods
- Efficiency and Optimisation of the Warehouse

Freight Logistics (66 learning units)

- Loading Goods
- Internal Transport and Loading
- Human Resources
- Route Planning
- Stowage Planning
- Event Driven Process Chains
- Information Processing

COMPUTER PROGRAMMING

Information Technology (135 learning units)

- Accessing the Internet
- Using MS Windows
- Word Processing
- Spreadsheets

Computer Science (34 learning units)

- Algorithms and Problem Solving
- Program Inputs and Outputs
- Program Data, Constants and Variables
- Program Operators and Control Structures
- Program Documentation and Testing
- Program Design Projects
- Computer Systems

Microprocessors (35 learning units)

- Microprocessor Architecture and Operation
- Number Systems
- Instruction Groups
- Subroutines and the Stack
- Microprocessor System Applications
- Designing and Entering Programs
- Running and Debugging Programs
- Actuator Control
- Using Feedback
- Embedded Computers and Memory

Innovative learning spaces for:
Mechatronics

Students study Mechanical Systems, Control Systems, Fluid Power, and Electronics. Computer and device programming is included in many different forms for a diverse and rounded engineering experience.

Qualifications addressed are Level 3 and 4 engineering units as well as appropriate skills for apprenticeships.

This typical Mechatronics Lab configuration includes the following resources:

- Electronics Study Trainer (x4)
- Circuit Card Set (x2)
- Hydraulics Trainer (x2)
- Mechanisms Trainer (x2)
- Pneumatics Trainer (x2)
- Industrial Controls Trainer (x2)
- PLC Trainer (x2)
- Transducers, Instrumentation and Control Trainer (x2)
- Injection Moulding Trainer
- Data Acquisition of Control Systems Trainer

IN FOCUS: INDUSTRIAL CONTROL TEACHING SET - SIEMENS (290-00/SI)

The Industrial Control Teaching Set offers a classroom based resource for practical investigation of automated control systems. Users can select from a range of prepared demonstration programs to explore how step-based ladder logic programs are used in automated systems.

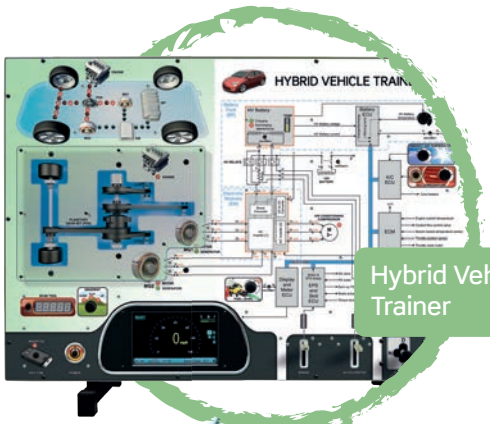
Alternatively students can create their own programs and see them in action on the trainer using the included simulation package. This teaching set includes digital curriculum materials containing theory and practical learning tasks, as well as tutor support materials.


Investigate hydraulic systems and components in a practical way using an all-in-one desktop trainer
Students perform practical investigations of a variety of fundamental mechanical systems
Investigate the techniques used to create thermo-plastic products
Mechatronics Lab
CREATE
SWR
LR
Manual Override

Auto Skills Training

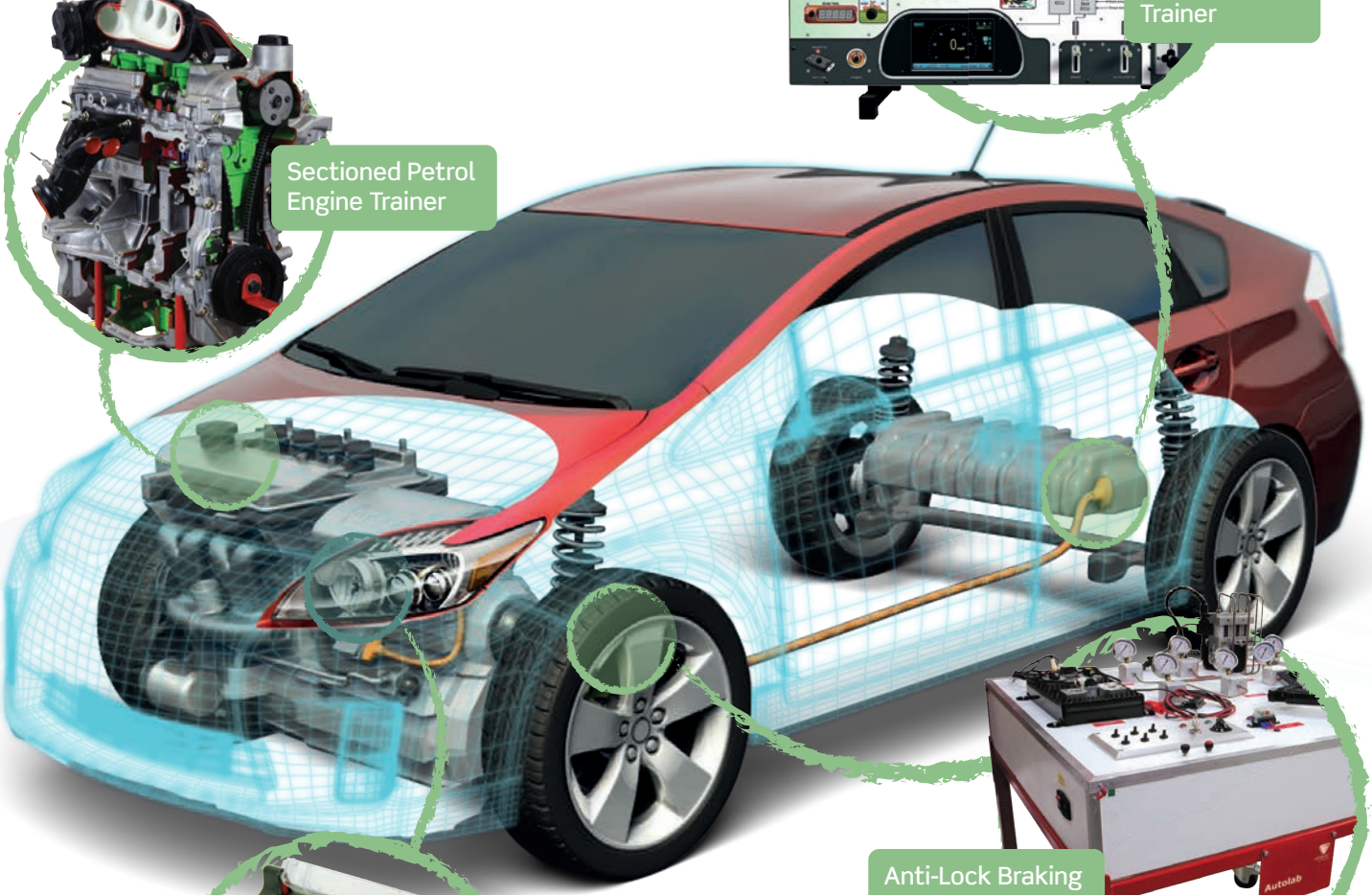
Guide your students from the classroom to the workshop

Our training equipment ranges from cut-away sectioned trainers that allow students to see what is happening inside working components, to desktop troubleshooting trainer boards and electronic panel trainers that simulate complex automotive systems, through to fully-functioning operational auto rigs and vehicle trainers.

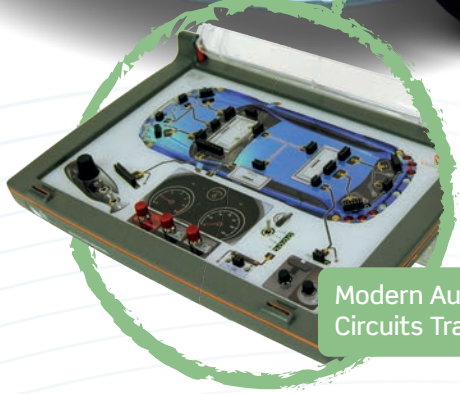


Hybrid Vehicle Trainer

Sectioned Petrol Engine Trainer



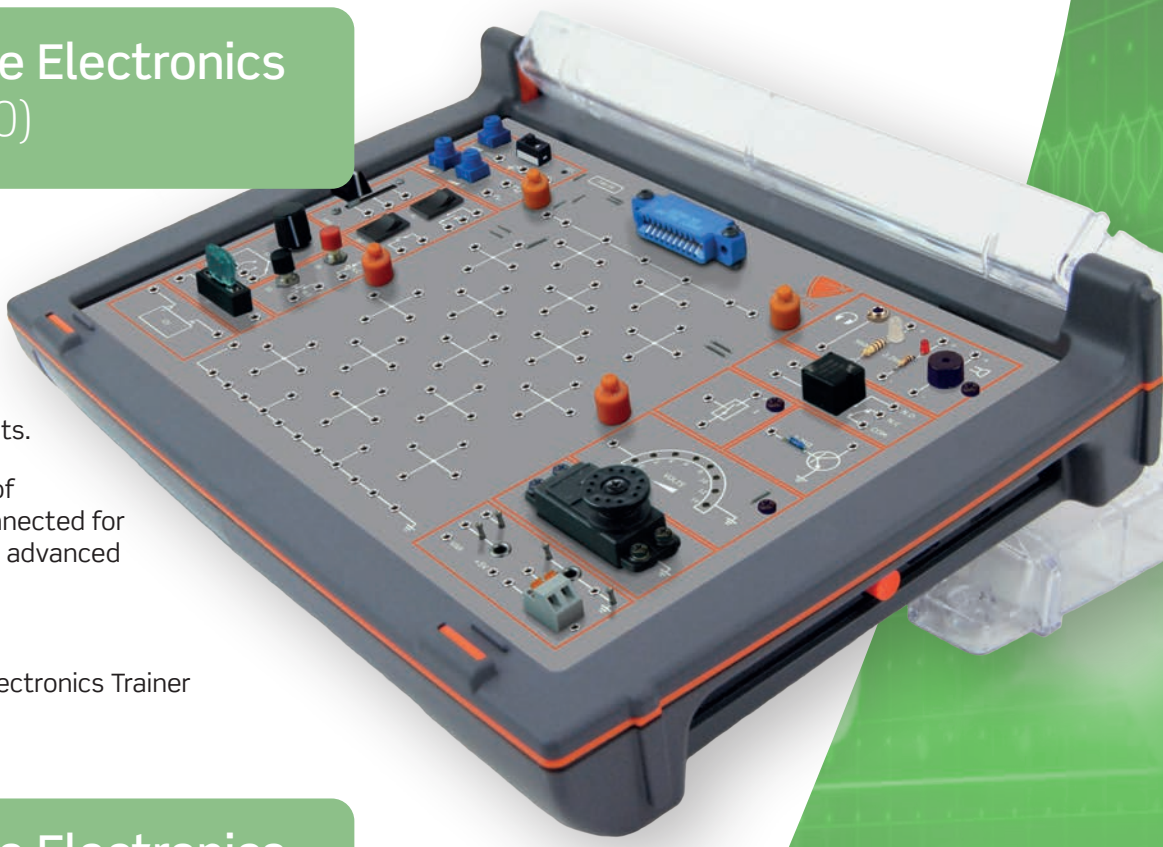
Anti-Lock Braking System Trainer



Modern Auto Lighting Circuits Trainer

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 allows a 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

Electric Vehicle Electronics Workstation (730-00)

This system allows the practical study of a range of advanced Electric Vehicle circuits and concepts. It includes a desktop trainer, component set, and a range of experiment cards.

Order as:

- 730-00 Electric Vehicle Electronics Workstation

Includes the Following Experiment Cards:

- 320-01 Electronic Systems Card
- 320-14 Electromagnetism Card
- 320-15 Input Transducers Card
- 320-32 Analogue Integrated Circuits Card
- 320-50 Pulse Width Modulation Signals Card

Electric Vehicle Systems
Panel Trainers

Electric Vehicle Systems Panel Trainer (740-01)

This brand-new trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of the electrical system of a typical Electric Vehicle.

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

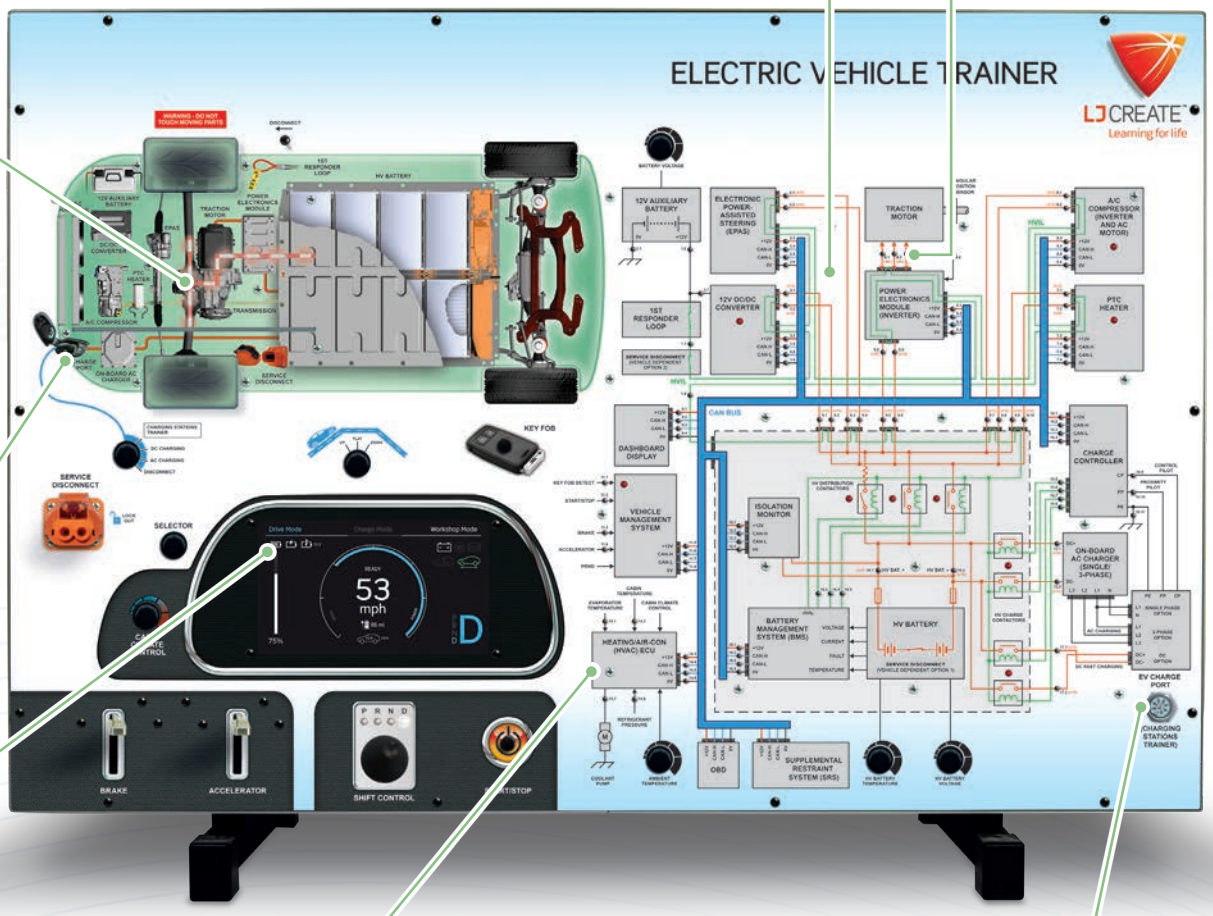
Order as:

- 740-01 Electric Vehicle Systems Panel Trainer

Test points for signal monitoring and fault-finding

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

Schematic showing 12V and HV systems - with CAN integration throughout the vehicle



Simulated AC and DC charging

Touchscreen display for Drive, Charge, and Workshop modes

HVAC system for cabin and battery cooling

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

EV Motors and Generators Panel Trainer (742-01)

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

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:

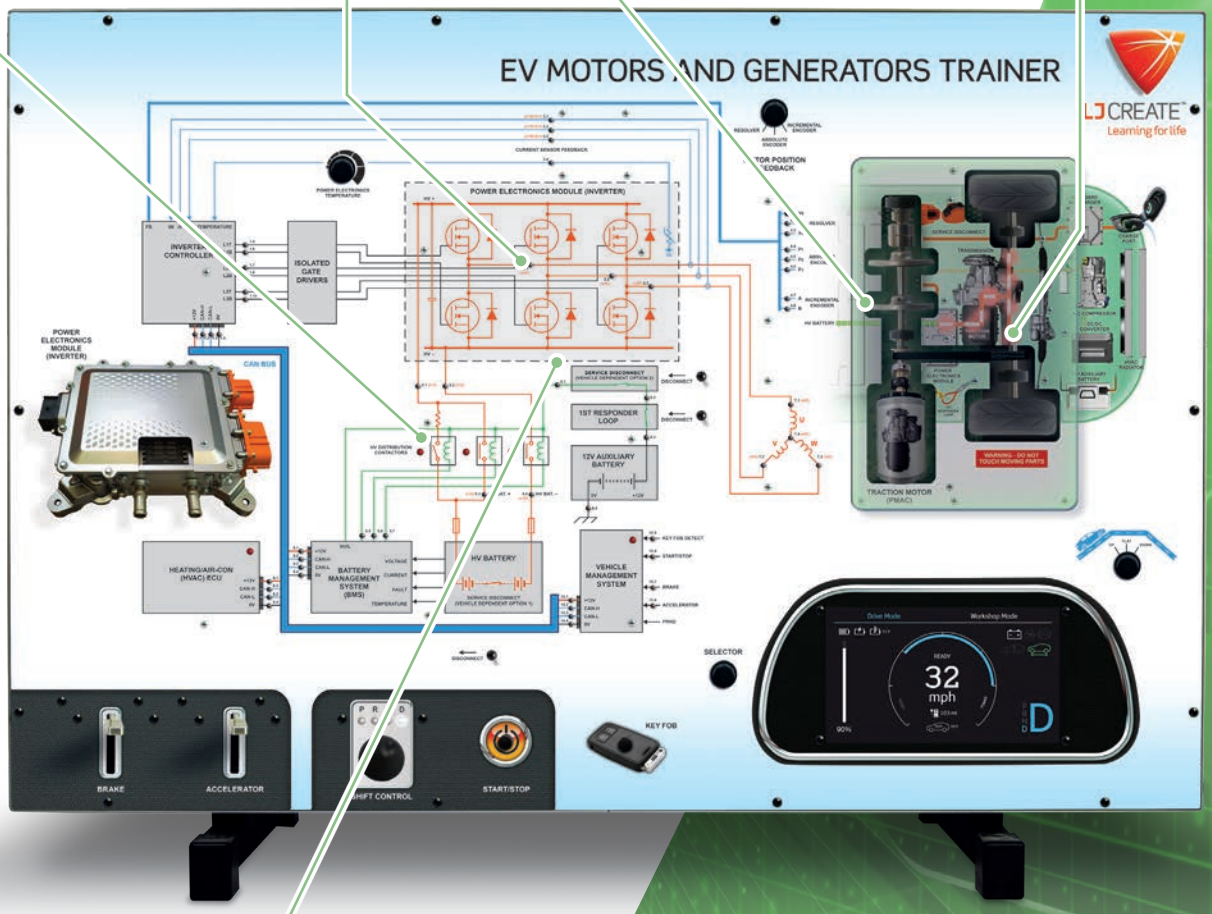
- 742-01 EV Motors and Generators Panel Trainer

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

Battery management system controlling activation of HV relays

Schematic of EV circuits with test points for signal monitoring and fault-finding

Absolute & incremental encoders, and resolver - to feedback motor position and speed



Inverter rectifier circuit for safe measurement of motor inputs

Electric Vehicle Systems Panel Trainers

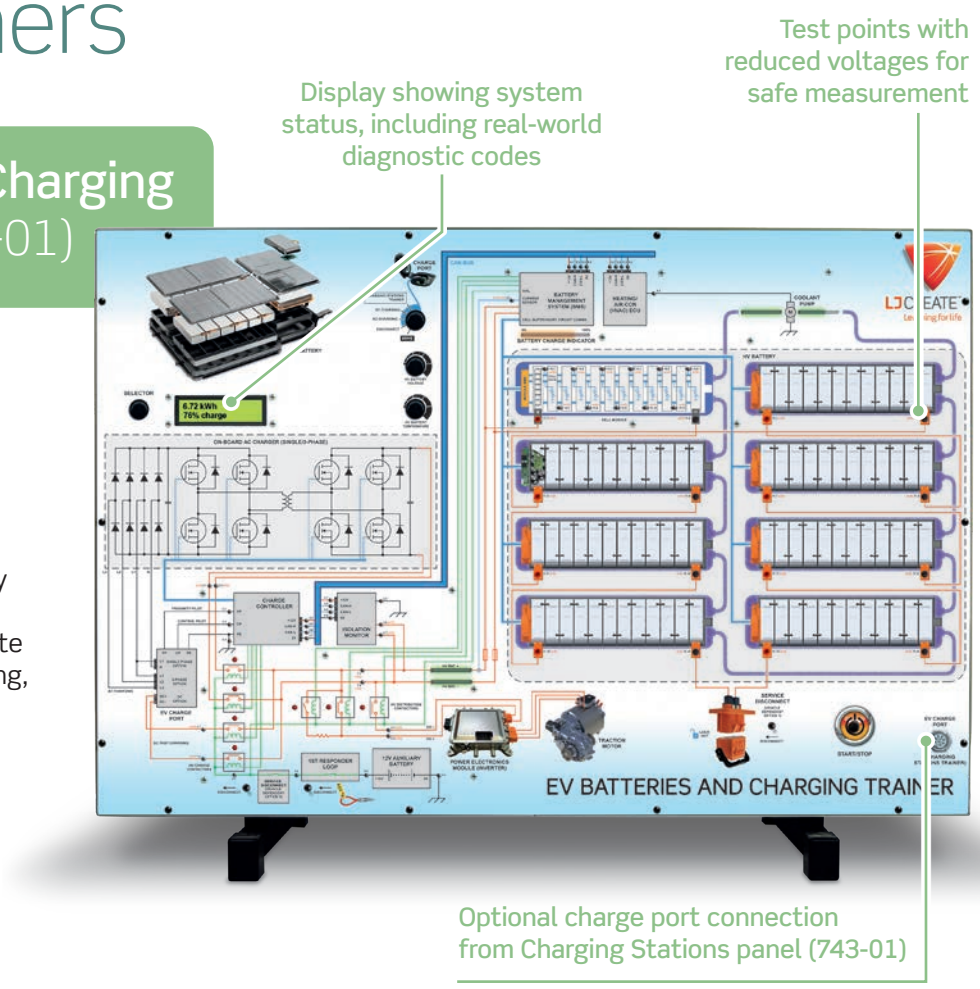
EV Batteries and Charging Panel Trainer (741-01)

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

Students will investigate how battery temperature and efficiency is effected at differing levels of charge. Instructors can demonstrate regenerative charging, cell balancing, and more with this on-vehicle charging systems panel trainer.

Order as:

- 741-01 EV Batteries and Charging Panel Trainer



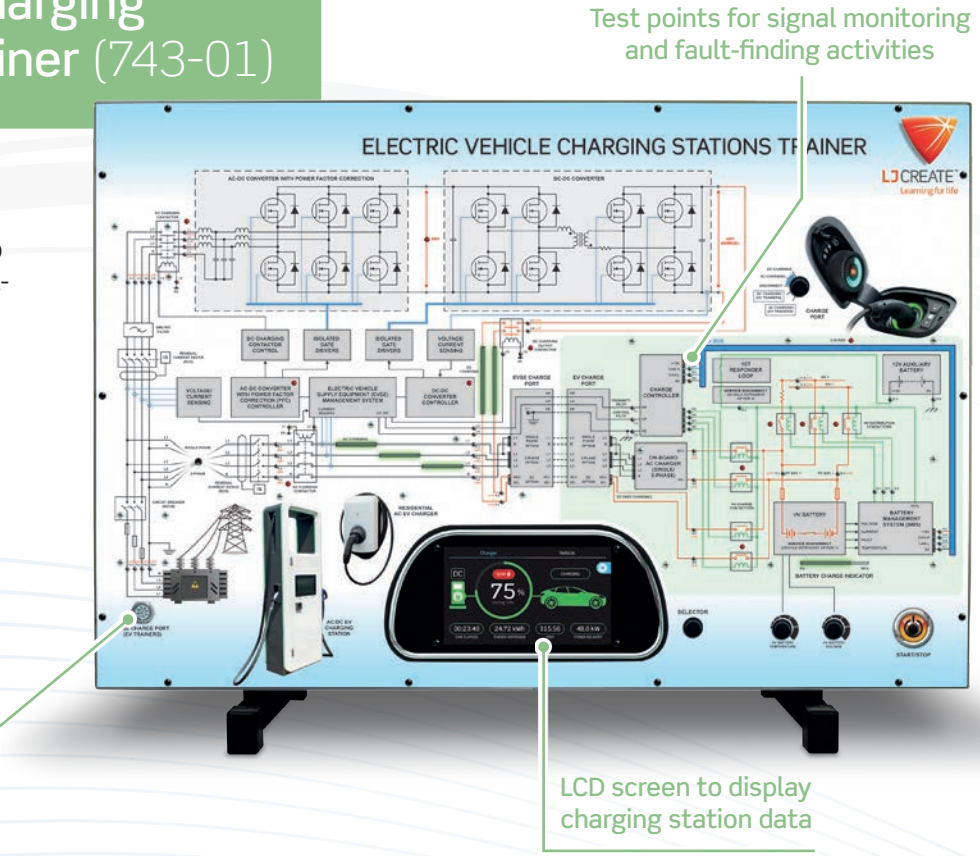
Electric Vehicle Charging Stations Panel Trainer (743-01)

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

Charging principles such as fast charge, trickle charge, and intelligent charging are covered on this brand-new panel trainer.

Order as:

- 743-01 Electric Vehicle Charging Stations Panel Trainer



Hybrid Vehicle Systems
Panel Trainers

Hybrid Vehicle Systems Panel Trainer (756-01)

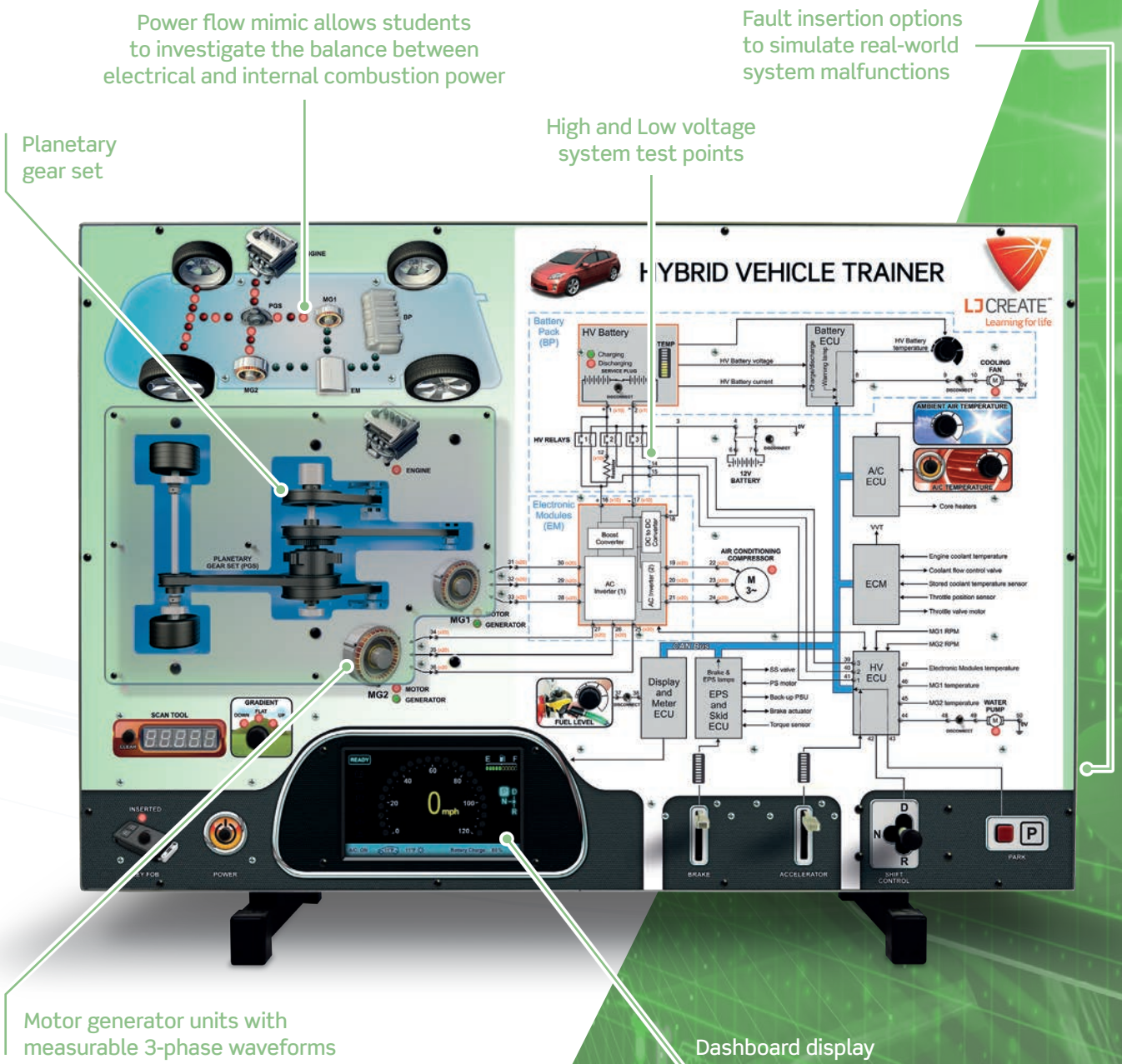
This trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find a simulation of a hybrid vehicle electrical system.

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.

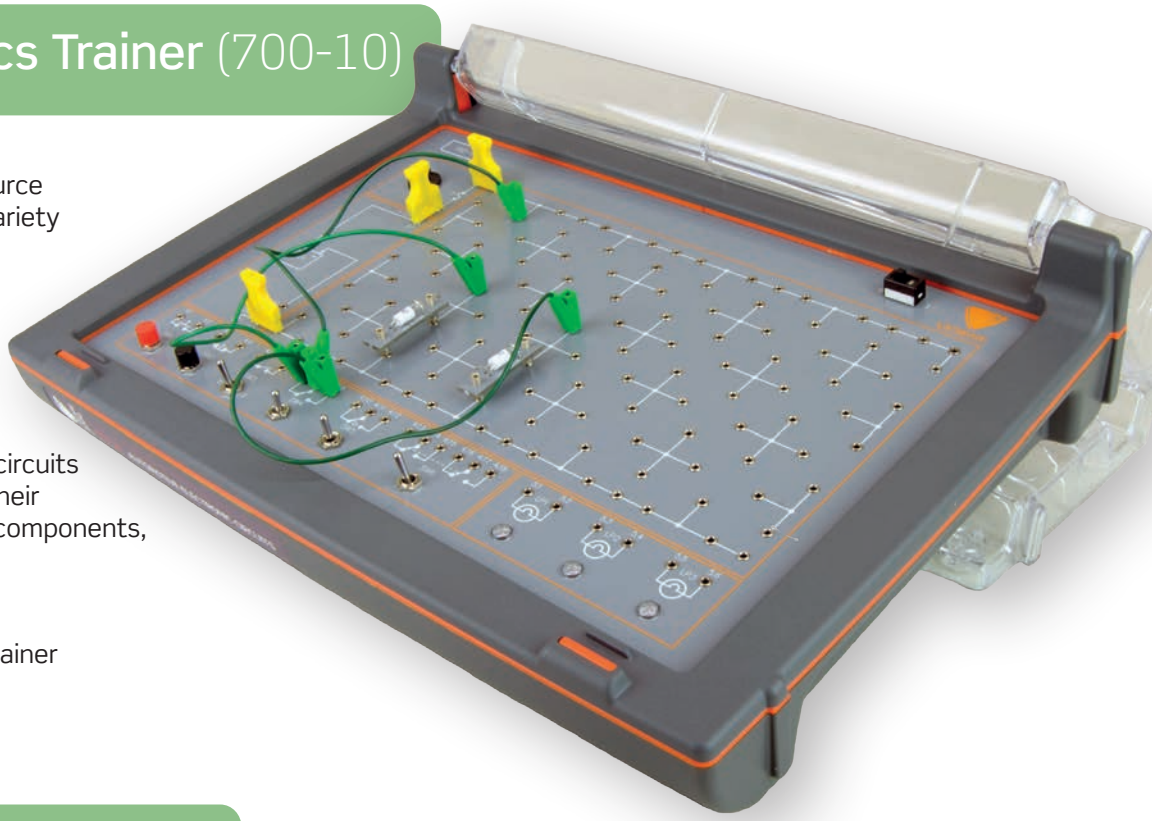
Order as:

- 756-01 Hybrid Vehicle Systems Panel Trainer



Auto Diagnostics Systems
Desktop Trainers

Auto Electronics Trainer (700-10)



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

Students are set tasks that encourage them to explore circuits practically to help develop their understanding of electrical components, circuits, and systems.

Order as:

- 700-10 Auto Electronics Trainer

Modern Auto Lighting Circuits Trainer (701-02)

Our range of Autotronics boards are designed to provide a practical approach to theoretical learning, as well as developing technical skills for electronic system fault finding.

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

Order as:

- 701-02 Modern Auto Lighting Circuits 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.

Students will also be directed to work through a number of fault-finding activities (7 in all), encouraging fault-diagnosis skills.

Order as:

- 721-01 Modern Auxiliary Systems 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 and also improve their knowledge of components, circuits, signals and systems.

Students will also be directed to work through a number of fault-finding activities (8 in all), encouraging fault-diagnosis skills.

Order as:

- 720-02 Modern Starting and Charging Systems Trainer

Light Vehicle Repair
Panel Trainers

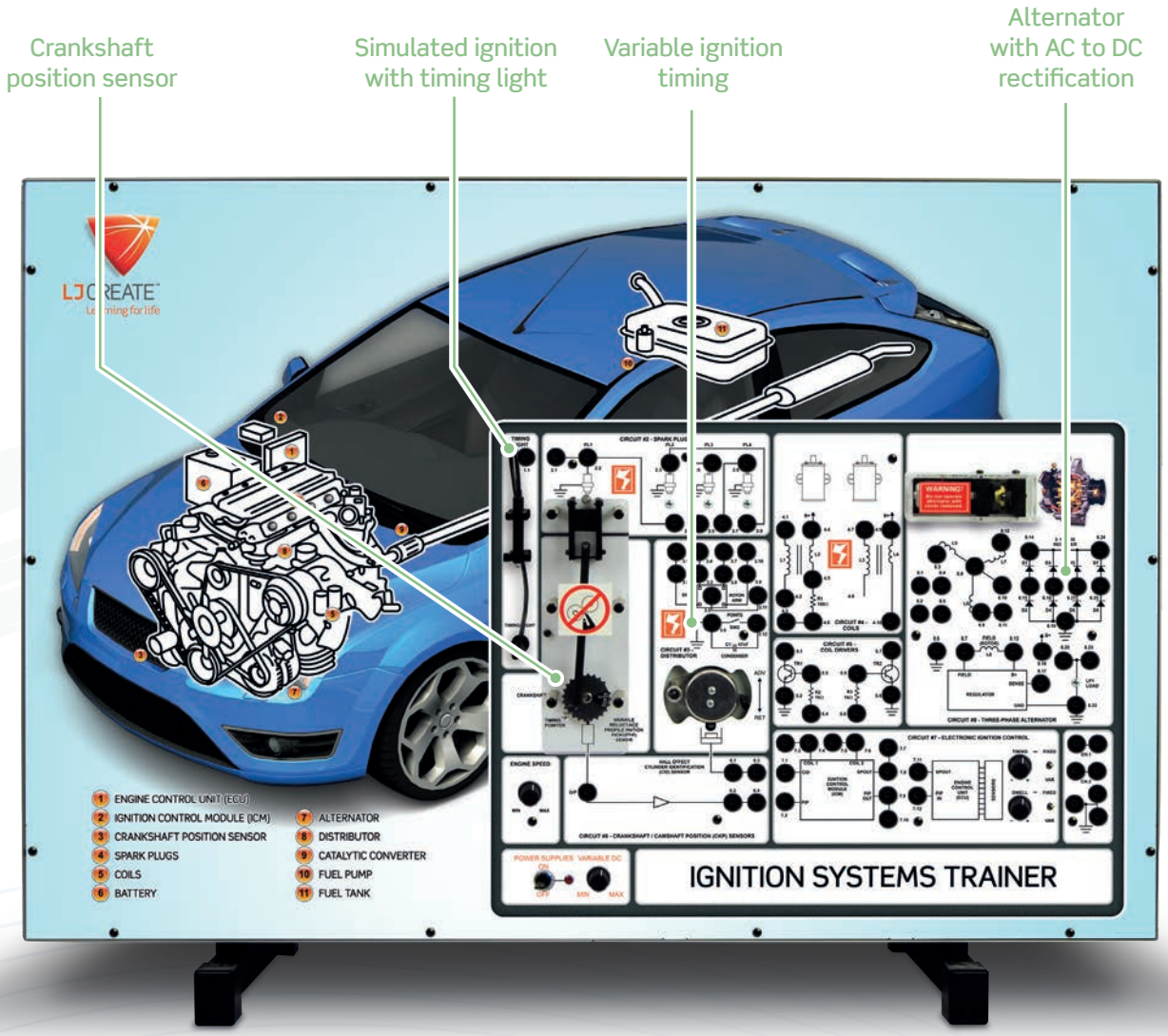
Ignition and Charging Systems Panel Trainer (750-01)

This trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find a simulation of a typical automotive ignition and charging system.

The trainer is designed to allow access to a variety of ignition systems and a charging system, as well as provide an understanding of the overall system layout and configuration

Order as:

- 750-01 Ignition and Charging Systems Panel Trainer



Engine Management Systems Panel Trainer (751-01)

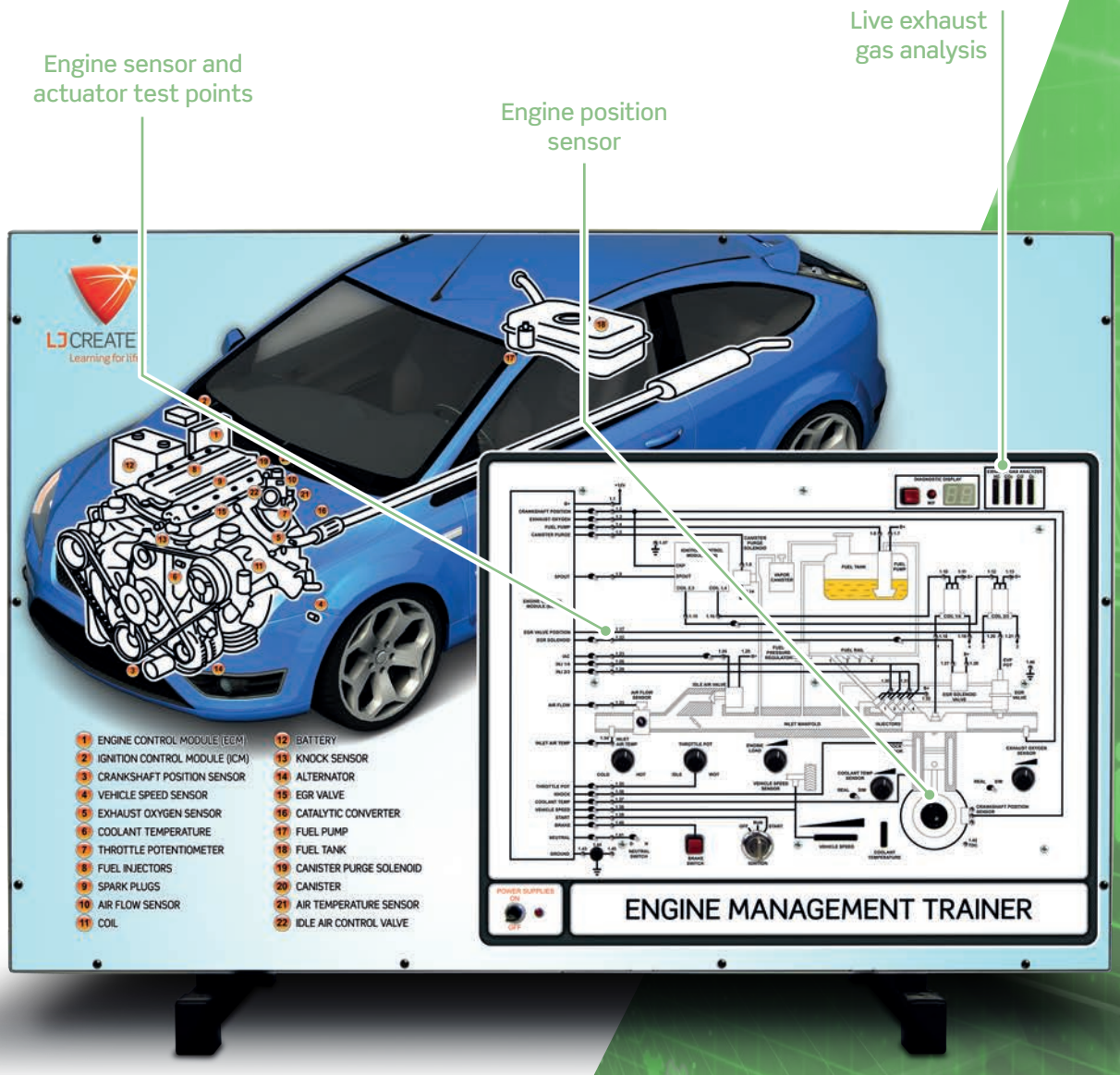
This trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of a typical automotive engine management system.

The trainer is designed to allow access to a variety of test points for engine components and the ECU system, as well as provide an understanding of the overall system layout and configuration.

The panel also includes test points to allow students to test engine sensors and actuators.

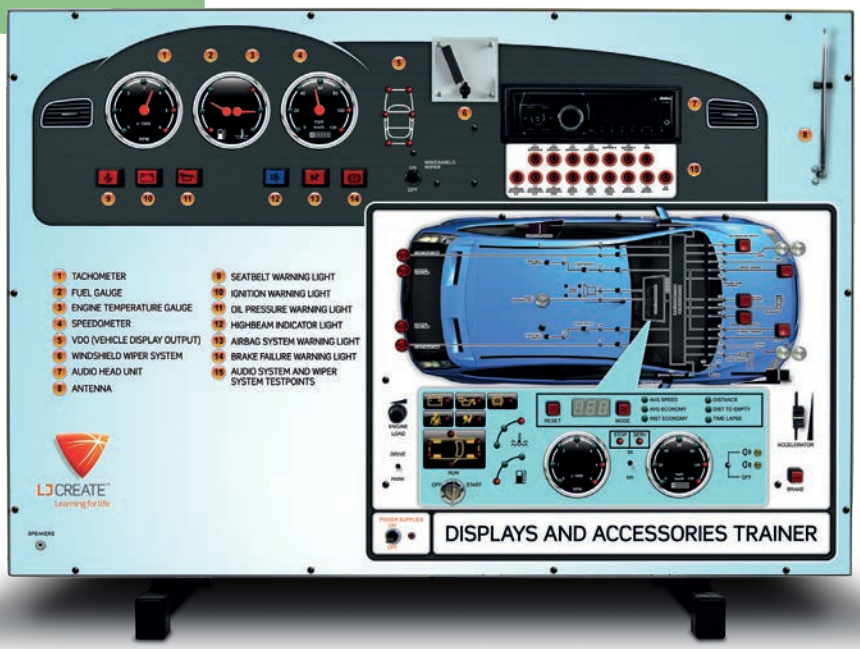
Order as:

- 751-01 Engine Management Systems Panel Trainer



Light Vehicle Repair
Panel Trainers

Displays and Accessories Systems Panel Trainer (752-01)



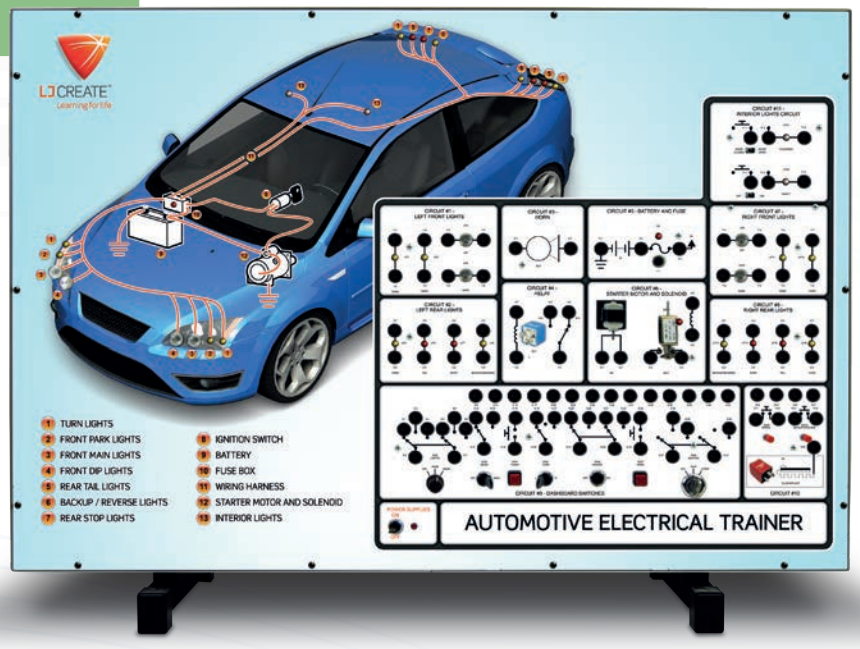
This trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of typical automotive display systems.

The trainer is designed to allow access to a variety of test points for vehicle electrical components and explore how they relate to dashboard displays and warning lights.

Order as:

- 752-01 Displays and Accessories Systems Panel Trainer

Automotive Electrics Panel Trainer (753-01)



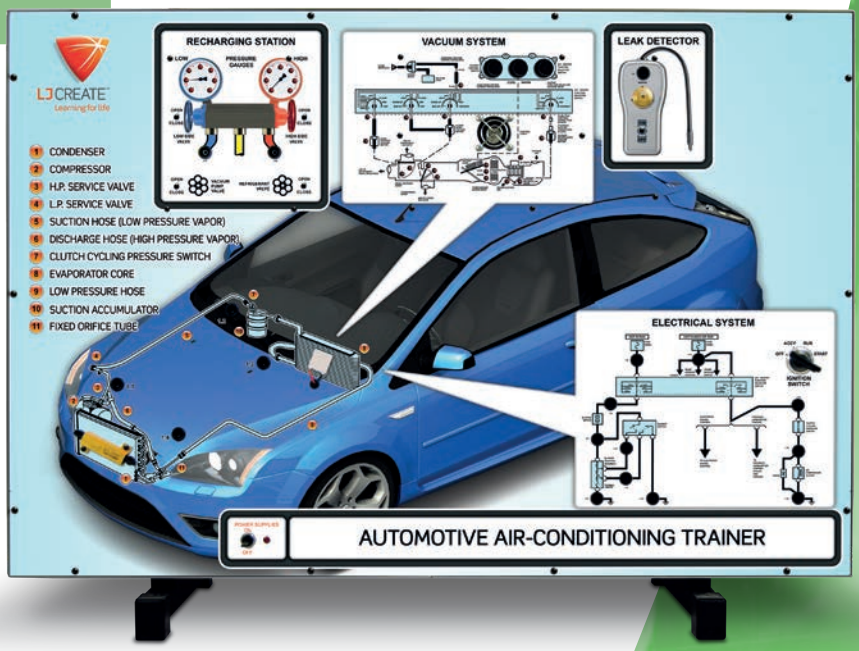
This trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find a simulation of typical automotive electrical systems.

The trainer is designed to allow access to a variety of test points for vehicle electrical components, as well as provide an understanding of the overall system layout and configuration.

Order as:

- 753-01 Automotive Electrics Panel Trainer

Air Conditioning Systems Panel Trainer (754-01)



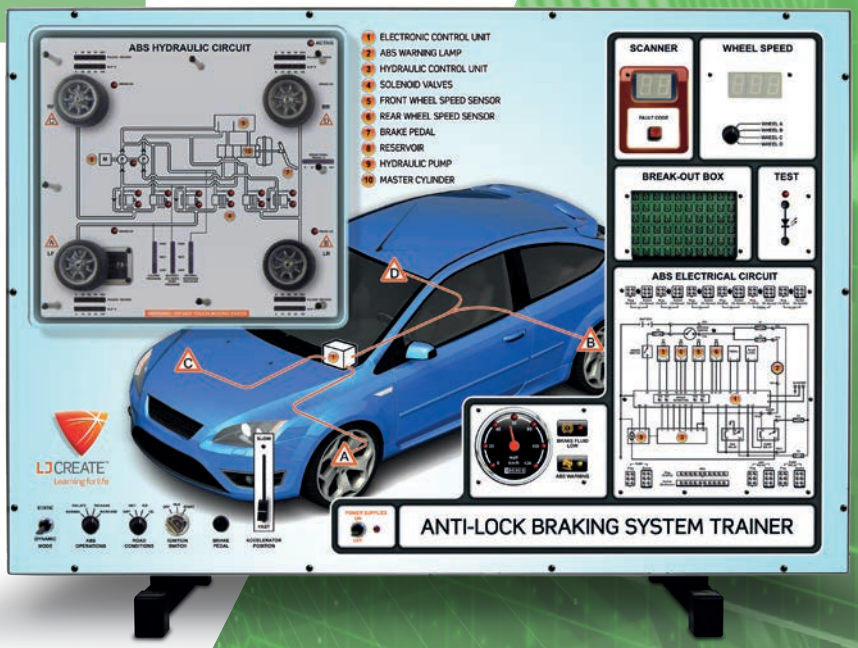
This trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of a typical automotive air conditioning system.

The trainer is designed to allow access to controls for the vacuum system, electrical system and recharging station, as well as provide an understanding of the overall system layout and configuration.

Order as:

- 754-01 Air Conditioning Systems Panel Trainer

Anti-Lock Braking Systems Panel Trainer (755-01)



This trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of a typical 4-wheel anti-lock braking system.

The trainer is designed to demonstrate ABS hydraulic and electrical system operation, as well as provide the ability to simulate changes in road conditions that impact ABS operation.

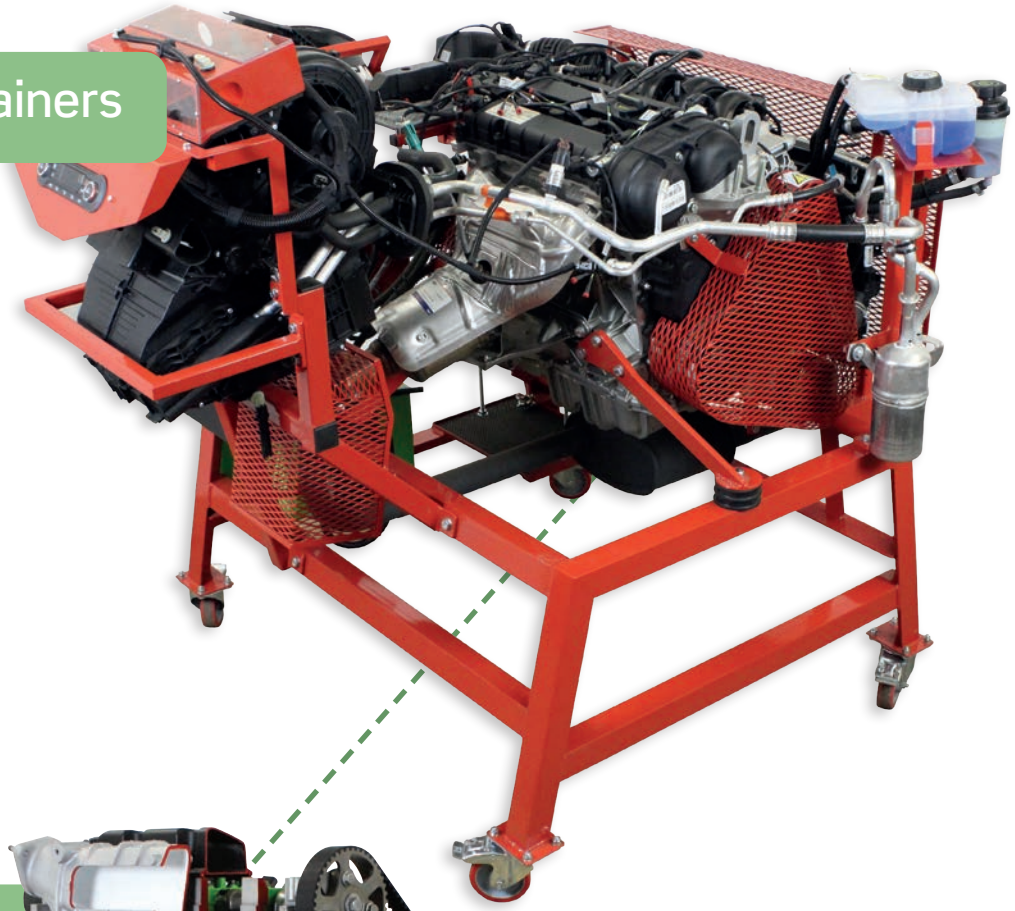
Order as:

- 755-01 Anti-Lock Braking Systems Panel Trainer

Light Vehicle Repair
System and Component Rigs

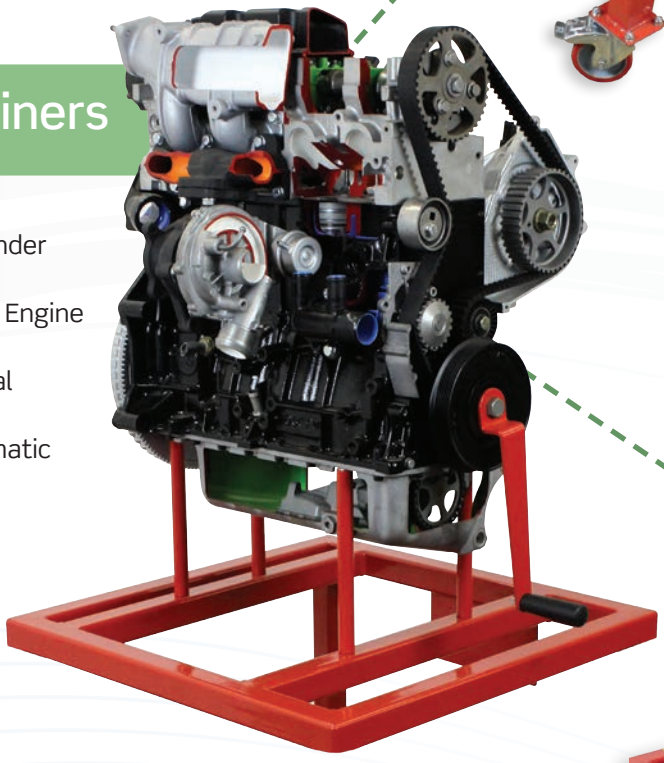
Working Engine Trainers

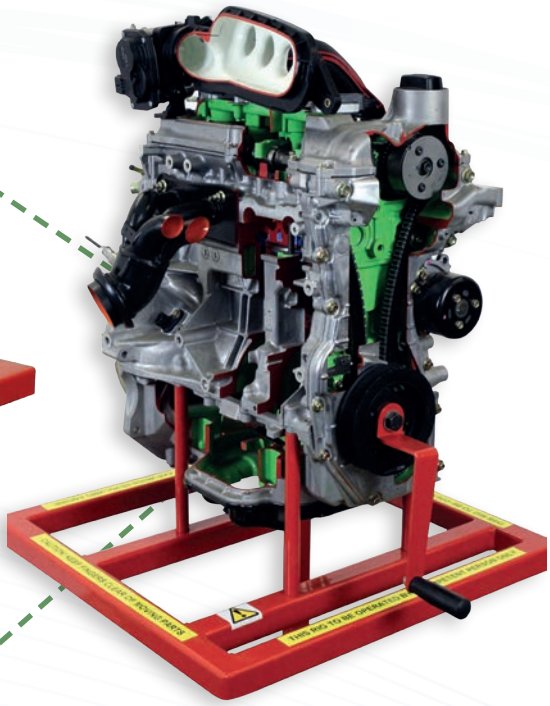
- 760-02 Engine (CAN and Climate Control) Trainer
- 762-01 Common Rail Diesel Engine (CAN Control) Trainer



Sectioned Trainers

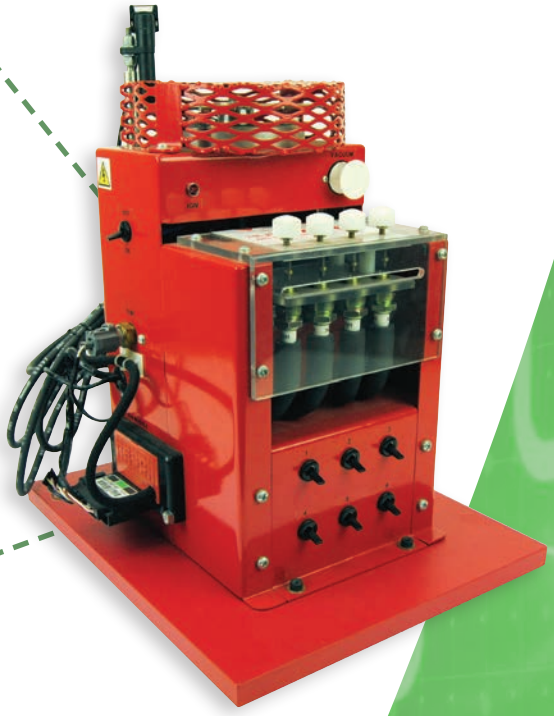
- 772-01 Sectioned 4-Cylinder Gasoline Engine Trainer
- 773-01 Sectioned Diesel Engine (Common Rail) Trainer
- 774-01 Sectioned Manual Gearbox Trainer
- 775-01 Sectioned Automatic Gearbox Trainer





Automotive System Trainers

- 763-01 Disc and Drum Braking System Trainer
- 764-01 Steering and Suspension System Trainer
- 764-02 Steering and Suspension System Trainer (Electric)
- 764-03 Electric Power Steering Trainer
- 765-01 Distributerless Ignition System Trainer
- 766-01 Air-Conditioning System Trainer
- 767-01 Electronic Fuel Injection System (Dry) Trainer
- 767-02 Electronic Fuel Injection System (Wet) Trainer
- 769-01 Anti-lock Braking System (Bosch) Trainer
- 770-01 Vehicle Electrical System Trainer
- 771-01 HDI Common Rail Fuel Injection System Trainer
- 784-01 Supplemental Restraint System Trainer



Heavy Vehicle Repair
Panel Trainers

Heavy Vehicle Electrical Systems Panel Trainer (757-01)

This trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find a simulation of typical diesel electrical systems.

The trainer is designed to allow access to a variety of test points for vehicle electrical components, as well as provide an understanding of the overall system layout and configuration.

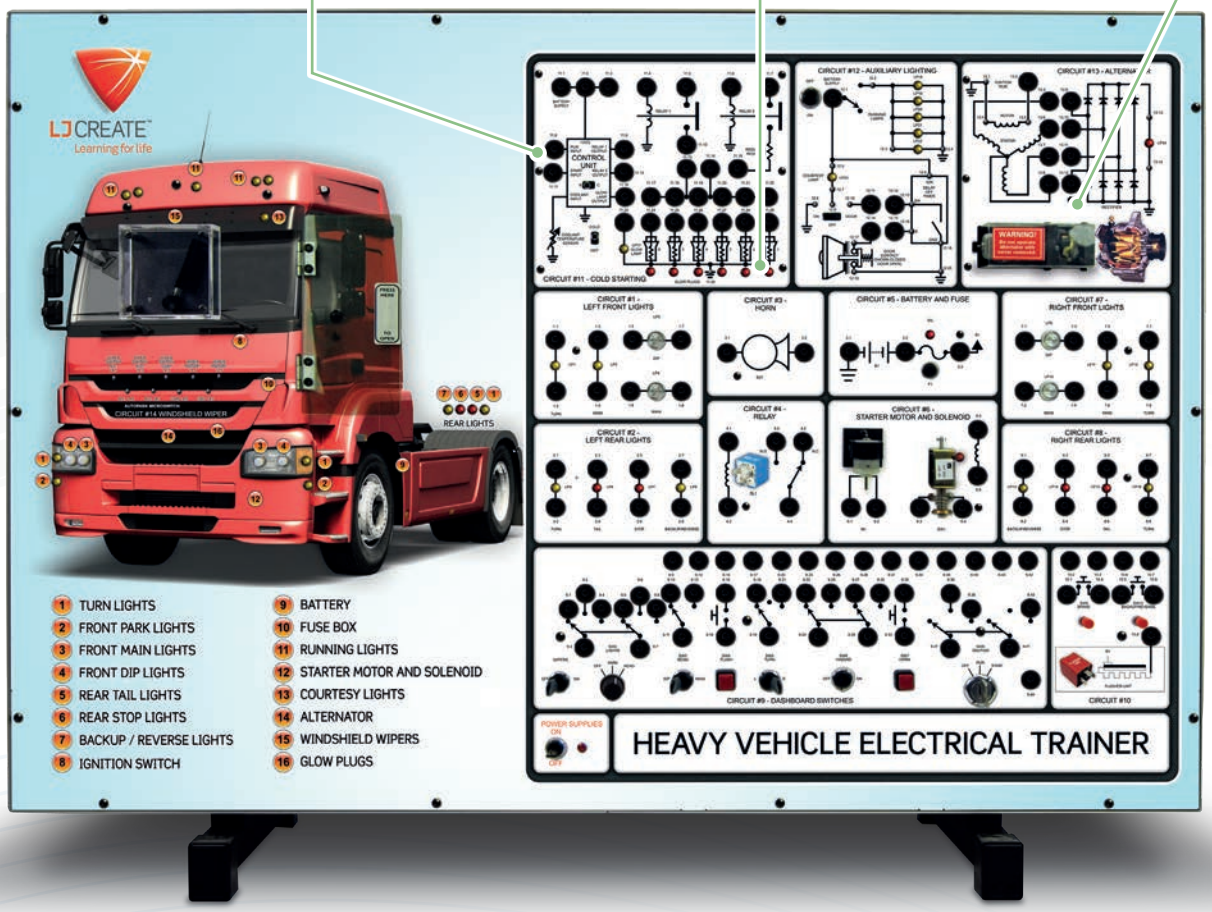
Order as:

- 757-01 Heavy Vehicle Electrical Systems Panel Trainer

Input switches representing real vehicle controls

Glow plugs showing cold starting procedures

Alternator with AC to DC rectification



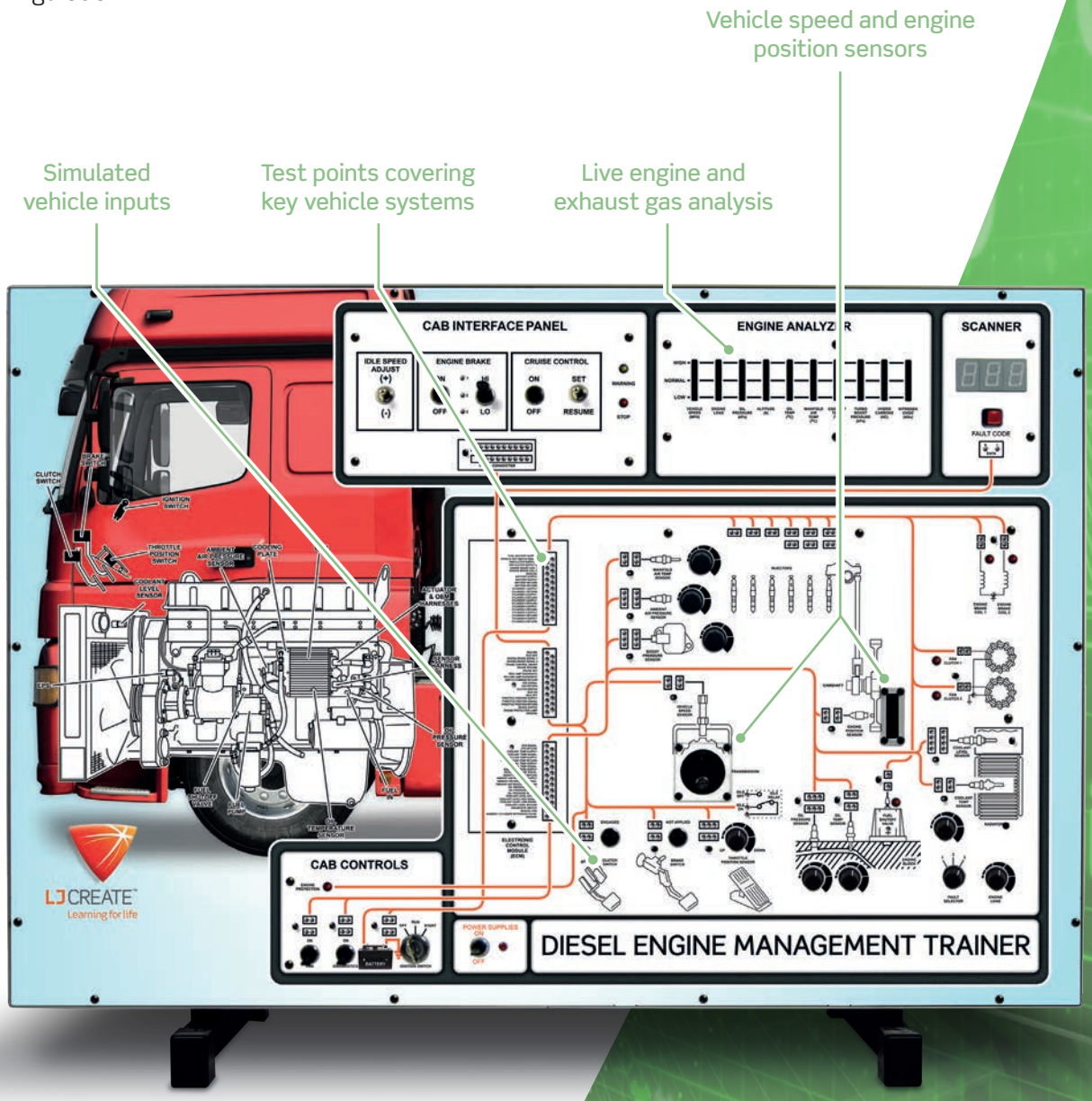
Diesel Engine Management Systems Panel Trainer (758-01)

This trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find a simulation of typical diesel engine management systems.

The trainer is designed to allow access to a variety of test points for vehicle electrical components, as well as provide an understanding of the overall system layout and configuration.

Order as:

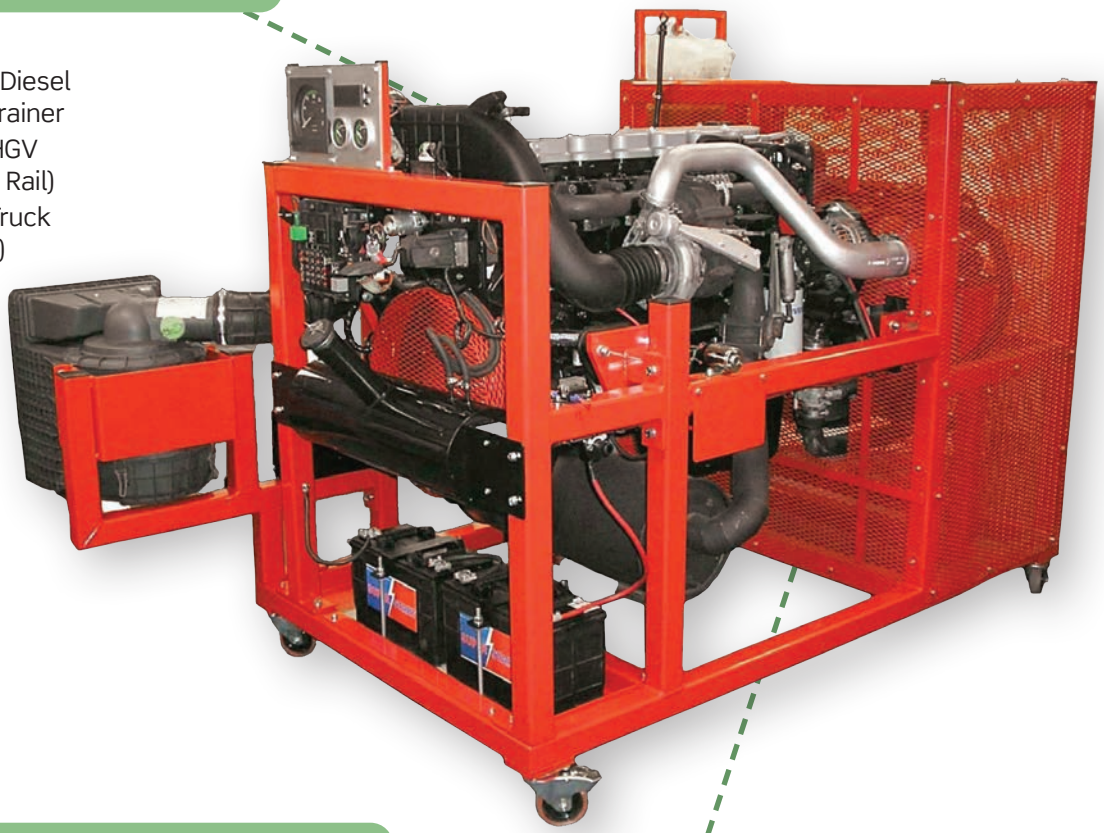
- 758-01 Diesel Engine Management Systems Panel Trainer



Heavy Vehicle Repair
System and Component Rigs

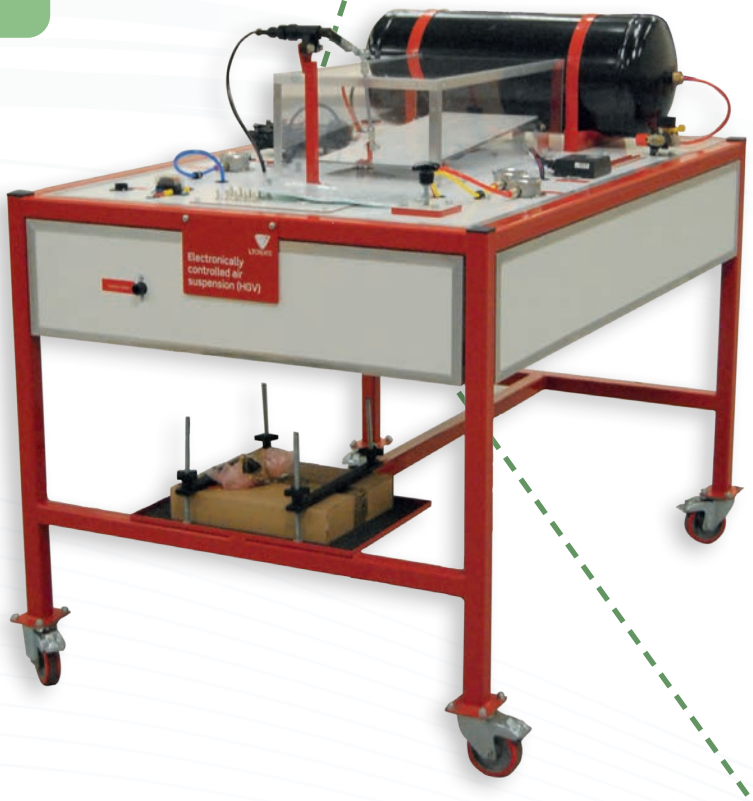
Working Engine Trainers

- 776-01 4-Cylinder HGV Diesel Engine (Common Rail) Trainer
- 776-01/6C 6-Cylinder HGV Diesel Engine (Common Rail)
- 776-04/6C 6-Cylinder Truck Diesel Engine (with ERS)



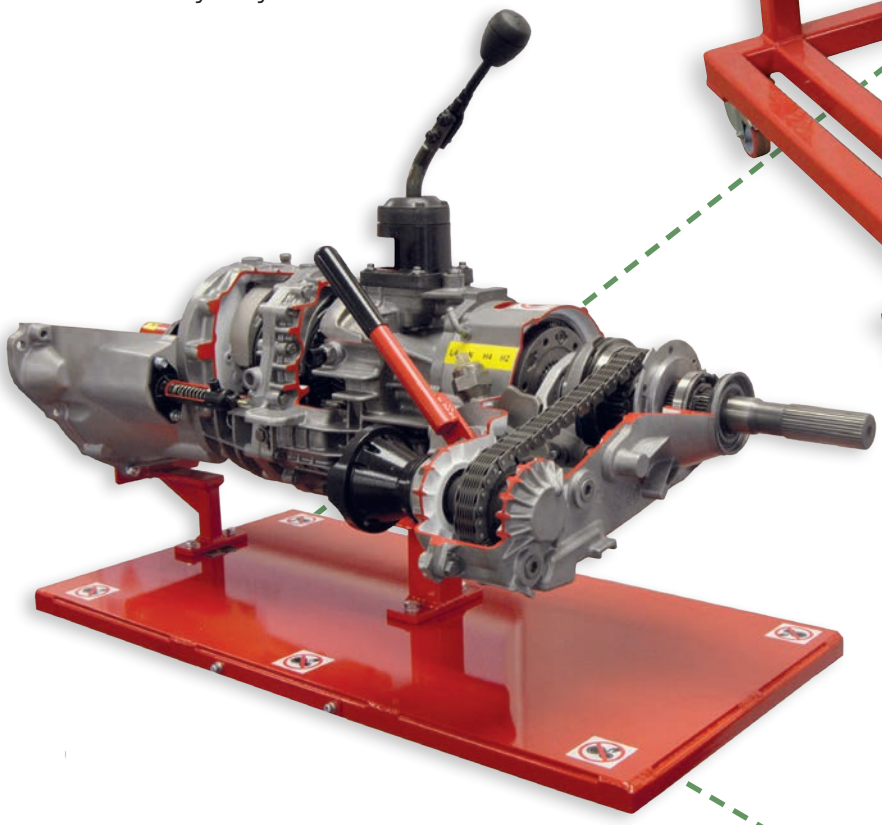
Automotive System Trainers

- 777-01 Electronic Controlled Air Suspension Trainer
- 778-01 Air Brake Tractor/Trailer System Trainer
- 785-01 Live Front Axle with Air Disc Brake Assembly
- 778-04 Disc Air Brake Trainer
- 770-02 24 Volt Electrical System Trainer



Sectioned Trainers

- 779-01 Sectioned HGV Diesel Engine (4-Cylinder) Trainer
- 779-01/6C Sectioned HGV Diesel Engine (6-Cylinder) Trainer
- 780-01 Sectioned HGV Gearbox Trainer
- 781-01 Sectioned HGV Rear Axle (with Reduction Hubs) Trainer
- 786-01 Four Wheel Drive Sectioned Gearbox
- 786-02 Four Wheel Drive Sectioned Drivetrain
- 787-01 Heavy Duty Sectioned Clutch



Automotive Lessons

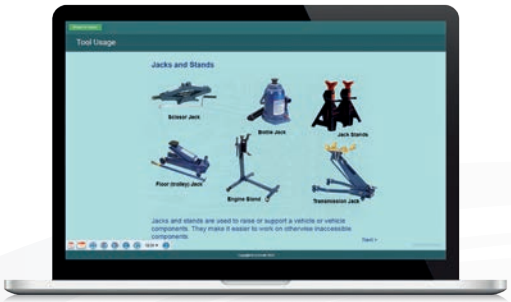
Over 2,000 learning units of online guided instruction

Auto Shop (85 learning units)

Shop and Personal Safety
- Rules and Procedures
- Ventilation Procedures
- Fire Safety Equipment
- Material Safety Data Sheets

Tools and Equipment
- Tools and Test Equipment
- Tool Usage
- Standard and Metric Designation
- Tool Cleaning, Storage, and Maintenance (Workshop)

Preparing Vehicle for Service and Return
- Repair Orders
- Vehicle Service History
- Logical Fault Diagnosis
- Vehicle Preparation



Engine Repair (132 learning units)

Engine Fundamentals
- Introduction to Engine Systems
- Four Stroke Cycle (Auto Rig)
- Position and Mounting of Engine Components (Rig)
- Common Rail Diesel Engine Component Identification (Auto Rig)

Cylinder Head and Valve Trains
- Components of the Top End
- Top End Component Identification (Auto Rig)
- Engine Cycles, Valve and Ignition Timing

Engine Block
- Components of the Bottom End
- Bottom End Component Identification (Auto Rig)
- CI Engine Size (Rig)
- Crankshaft and Piston Operation (Rig)

Engine Servicing
- Basic Engine Service Procedures (Workshop)
- Inspect and Repair Threads (Workshop)
- Engine Removal and Replacement (Workshop)
- Cooling System Inspection, Test and Repair (Workshop)

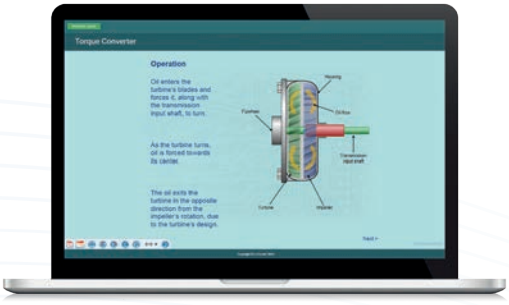
Lubrication and Cooling Systems
- Lubrication Systems
- Engine Oil Pressure
- Engine Oil Pressure (Panel)
- Adjusting Drive Belt Tension (Workshop)

Automatic Transmission and Transaxle (40 learning units)

Transmission System Fundamentals
- Introduction to Automatic Transmissions
- Automatic Transmission Components
- Torque Converter (Auto Rig)
- Electrical and Electronic Controls

Final Drives
- Drivetrain and Driveline
- Locating Driveline Components (Workshop)

Automatic Transmission Servicing
- Automatic Transmission Diagnostic Checks (Workshop)



Manual Drivetrain and Axles (63 learning units)

Manual Transmission System Fundamentals
- Manual Transmissions
- Clutch and Manual Transmission Systems
- Gears and Gear Ratios (Auto Rig)

Manual Transmission Components and Operation
- Manual Transmission Construction (Rig)
- Clutch Construction and Operation
- Selector Lever and Selector Forks (Rig)
- Rear Wheel Drive Shafts

Manual Transmission and Driveline Servicing
- Clutch Removal, Inspection, and Refitting
- Inspecting FWD Shafts & Joints (Workshop)
- Inspecting the Complete Transmission System of a Vehicle (Workshop)

Suspension (59 learning units)

Suspension System Fundamentals
- Suspension Systems 1
- Geometry Fundamentals

Suspension Components and Operation
- Control Arms
- Springs and Shock Absorbers
- Leaf and Rubber Springs

Inspection and Repair
- Geometry Adjustments
- Remove, Inspect and Install Ball Joints on Suspension Systems (Workshop)
- Removal, Inspection and Installation of Coils Springs and Insulators (Workshop)

Steering (217 learning units)

Steering System Components and Operation

- Steering Systems
- Tie Rods
- Electronic Steering Systems
- Using the Power Steering on the Steering and Suspension Trainer (Auto Rig)

Inspection and Repair

- Adjusting Wheel Height (Auto Rig)
- Steering Column Inspection (Auto Rig)
- Steering Column Inspection (Workshop)
- Steering Knuckle Removal and Inspection (Auto Rig)

Wheels and Tires

- Wheel and Tire Fundamentals
- Road Wheels
- Tire Changing and Wheel Balancing
- Wheel Alignment
- Wheel Bearings

Wheel and Tire Servicing

- Tire Inspection and Inflation (Workshop)
- Wheel Bearing Maintenance (Workshop)
- Wheel Bearing Replacement Procedure (Workshop)
- Sealed Wheel Bearing Replacement Procedure (Workshop)

Braking Systems (59 learning units)

Brake System Fundamentals

- Brake Systems
- Friction

Hydraulic Control

- Fluid Power Concepts
- Brake Warning Systems
- Brake Fluid Warning System
- Brake Fluid Warning System (Panel)

Anti-Lock Braking Systems

- Anti-Lock Brake Systems
- ABS Braking Cycle (Panel)
- Wheel Speed Sensors
- Hall Effect Sensor Investigation (Panel)
- Troubleshooting ABS Input Devices (Panel)

Advanced Brake Systems

- Stability Control Systems
- Diagnosing Faults in ESP Systems

Brake System Components (51 learning units)

Brake System Fundamentals

- Introduction to Brake Systems

Drum Brakes

- Brake Drums and Shoes
- Wheel Cylinders

Power Assistance

- Vacuum Brake Boosters
- Hydraulic Brake Boosters

Disc Brakes

- Brake Rotors and Callipers
- Integral Calliper Parking Brake

Hydraulic Control

- Hydraulics
- The Master Cylinder
- Brake Fluid

Brake Servicing (51 learning units)

Brake System Fundamentals

- Braking Forces
- Braking Calculations

Drum Brake System Servicing

- Drum Brake Removal and Inspection (Rig)
- Brake Shoe Replacement (Auto Rig)
- Machining a Drum (Workshop)

Disc Brake System Servicing

- Brake Calliper Inspection (Auto Rig)
- Machining a Rotor (Workshop)

Brake Line Servicing

- Fabricating Brake Lines (Workshop)

Brake System Servicing

- Brake Pedal Height
- Test Brake Light Switch (Workshop)

Automotive Electrical Fundamentals (113 learning units)

Electrical Fundamentals

- Controlling and Protecting Simple Circuits
- DC and AC Current
- Current Flow in a Simple Circuit (Board)
- Sensors

Electrical Supply

- Battery and Fuse Investigation (Panel)
- Battery and Fuse Circuit Fault Investigation

Electrical Measurement

- Electrical Test Equipment
- Electrical Circuit Testing (Workshop)
- Symbols, Device Markings and Terminal Block Designations

Starting and Charging (68 learning units)

Charging System Fundamentals

- Charging Principles
- Charging Systems
- Alternator Construction

Charging System Inspection and Test

- Alternator Output Tests
- Alternator Output Tests (Workshop)
- Alternator Output Waveforms (Board)
- Charging System Fault Diagnosis

Starting System Fundamentals

- Starting Systems
- Starting and Charging
- Starting and Charging (Board)

Starting System Inspection and Test

- Starter Motor and Solenoid Measurements (Panel)
- Starter Control Circuit Service (Workshop)
- Starting System Fault Diagnosis
- Wire Repair (Workshop)

Automotive Lighting (167 learning units)

Lighting Circuit Fundamentals
- Types of Light Sources
- Lighting Systems
- Lighting Systems (Panel)
- Power in a Simple Lamp Circuit (Board)

Headlight Circuits
- Headlamps
- Headlights (Panel)
- Automatic Lighting

Park and Tail Light Circuits
- Park and Tail Lighting
- Park and Tail Lamp Circuits (Board)
- Park, Tail, and Headlamp Circuits

Stop and Backup Light Circuits
- Stop and Backup Lamps
- Stop and Backup Lamp Circuits (Board)

Turn Signal Circuits
- Turn Signal Systems
- Turn Signal Circuit (Board)

Hazard Warning Lighting Circuit
- Hazard Warning Lamps

Internal Lighting Circuits
- Internal Lighting
- Internal Lamp Circuit Investigation (Panel)

Lighting Circuit Fault Diagnosis
- Introduction to Fault-Finding
- Lighting Fault Diagnosis
- Lighting Circuit Fault Investigation (Panel)
- Interior Lamp Circuit Fault (Board)

Automotive Transducers (45 learning units)

Transducer Circuits and Components
- Engine Coolant Temperature Sensor
- Mass Airflow Sensor
- Air Flow Sensor (Board)
- Performing a Gauge Circuit Test (Workshop)

Transducer Fault Diagnosis
- Fault Investigations (Board)
- Transducer Faults (Panel)

Ignition Systems (68 learning units)

Ignition System Fundamentals
- Introduction to Ignition Systems
- Transistor Assisted Ignition Systems (Panel)
- Ignition Coil Investigation (Board)
- Spark Plugs

Distributor Electronic Ignition Systems
- Inductive Reluctance Electronic Ignition Systems (Panel)
- Hall Effect Electronic Ignition Systems (Board)

Distributorless Electronic Ignition Systems
- Distributorless Ignition Systems
- DIS Trainer Waveforms (Auto Rig)
- DIS Trainer Temperature Sensor (Auto Rig)
- DIS Trainer Crankshaft Sensor (Auto Rig)

Ignition System Servicing
- Ignition Secondary Circuit Inspection (Workshop)
- Distributor Testing (Workshop)
- Ignition Timing Check and Adjustment (Workshop)

Ignition System Diagnosis
- Lack of Power Problem (Auto Rig)
- Extremely Rough Idle Problems (Auto Rig)
- No Start Problems (Auto Rig)
- Troubleshooting Distributorless Ignition Systems (Panel)

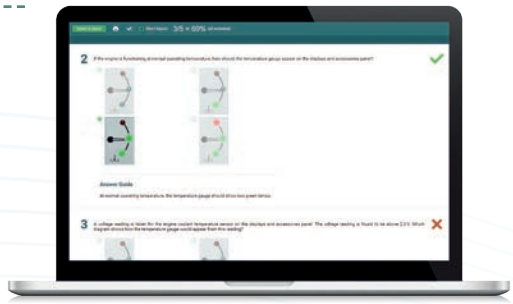
Engine Management Systems (111 learning units)

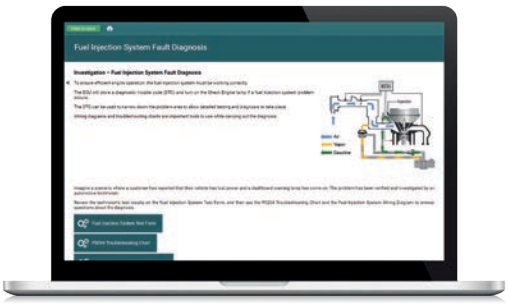
Engine Management System Fundamentals
- Decision Making Processes (Board)
- Fuel Injection System Decisions (Panel)
- Air Management in a Diesel Engine

Sensors and Actuators
- Sensors and Actuators
- Sensor Components (Rig)
- Engine Coolant Temperature (Panel)
- Actuator Components (Rig)

Engine Inspection
- Thermostatic Air Cleaner Inspection and Test (Workshop)
- The Digital EGR Valve (Workshop)
- Thermostat Servicing (Workshop)

Engine Management Fault Investigation
- Engine Management System Fault Diagnosis
- Diesel Engine Fault Diagnosis
- Fault Investigations (Panel)
- Engine Fault Diagnosis (Rig)





Fuel and Emissions (144 learning units)

Fuel Components and Operation
- Fuel Injector Pulse Timing (Board)
- Electric Fuel Pump (Panel)
- EFI Fuel Injector Pulse Timing (Rig)
- EFI Pressurized Fuel Systems (Rig)

Air Induction Components and Operation
- Air Management
- Sensor Circuits and Components (Rig)

Emission Control Systems
- Catalytic Converter
- Exhaust Emission Control Components (Rig)
- The Electronic Control Unit (ECU) (Rig)

Fuel and Emissions System Servicing
- Fuel System Inspection (Workshop)
- Inspecting and Draining a Fuel System (Workshop)
- Exhaust Gas Analyser (Workshop)
- EFI Demonstrator Fault Diagnosis (Rig)

Diesel Engine Management
- Common Rail Diesel Engine
- Fuel in a Diesel Engine
- Fuel Injection Management in a Diesel Engine
- Exhaust Management System

Electric and Hybrid Vehicle Technology (123 learning units)

Electric Vehicles
- Definition of Electric Vehicles
- Fuel Cells
- Electric Motors
- Range Extenders

High Voltage Electric Vehicles
- Principles of NiMH Batteries
- Lithium-ion Batteries
- High Voltage Wiring and Connectors
- Classification of Hybrid Vehicles

Hybrid and Electric Vehicle Systems
- Fuel and Emissions
- Plug-in Electric Vehicles
- Plug-in Hybrid Vehicles
- Disabling the High Voltage System

Automotive Network Systems (30 learning units)

Networked Systems Structure
- CAN, LIN and MOST Data Buses

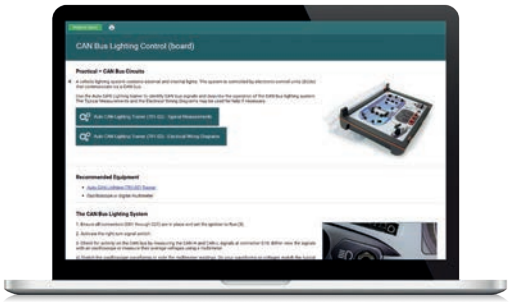
Networked Systems Data
- CAN Bus Data Processing
- CAN Signal Response
- CAN Bus Fault Diagnosis

Troubleshooting Electrical Systems (123 learning units)

Lighting Systems Operation
- CAN Bus Lighting Systems (Board)
- CAN Bus Park, Tail, and Headlight Systems
- CAN Bus Stop and Backup Light Systems

Lighting Systems Measurement
- CAN Bus Lighting Systems Measurement
- CAN Bus Park and Tail Light System Measurement (Board)
- CAN Data Bus Measurement (Board)

Lighting Systems Diagnosis
- CAN Bus Lighting Faults
- CAN Bus Lighting Control Faults (Board)



Auxiliary Systems Operation
- Auxiliary CAN Bus Systems
- Auxiliary CAN Bus Safety Systems
- Auxiliary CAN Bus Security Systems

Auxiliary Systems Measurement
- CAN Data Bus Measurement (Board)
- CAN Bus Window, Mirror, and Seat Systems Measurement
- CAN Bus Power Door Locking System Measurement

Auxiliary Systems Diagnosis
- Auxiliary CAN Bus Fault Tolerance
- Faults in Auxiliary CAN Bus Systems
- CAN Bus Auxiliary Faults

Starting and Charging Systems Operation
- The Starting and Charging Systems' CAN Bus (Board)
- CAN Bus Advanced Starting and Charging System (Board)

Starting and Charging Systems Measurement
- CAN Data Bus Measurement
- CAN Bus Starting and Charging Systems Measurement
- CAN Bus Power Consumers Measurement (Board)

Starting and Charging Systems Diagnosis
- CAN Bus Starting and Charging Faults

Automotive Heating and Air Conditioning (95 learning units)

Heating and Air Conditioning Fundamentals
- Air Conditioning Systems
- Air Conditioning Trainer Operation (Rig)
- Refrigerant Leak Detection (Panel)

HVAC Components and Operation
- Lines and Hoses
- Condensers and Compressors
- Climate Control System Operation (Rig)

HVAC Servicing
- A/C System Troubleshooting (Panel)
- Removal (Workshop)
- FOTCC System Troubleshooting (Panel)

Passenger Safety Systems (25 learning units)

SRS Components and Operation
- Airbag Safety
- Introduction to SRS (Rig)
- Seat Belts (Rig)

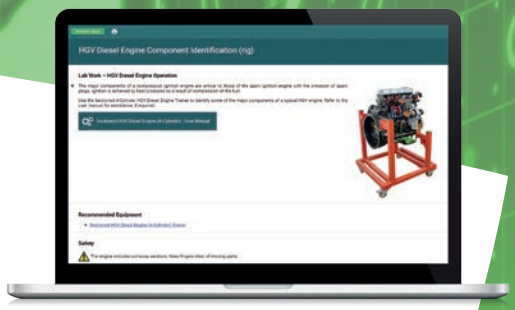
SRS Inspection and Diagnosis
- Disabling and Enabling the Air Bag System (Workshop)
- SRS Faults (Rig)

Heavy Vehicle Systems (196 learning units)

CI Engine Components
- HGV Diesel Engine Component Identification (Rig)
- HGV Diesel Engine Cylinder Head and Valves (Rig)

Engine Management System Fundamentals
- Electronic Control Module
- Cruise Control

Gearbox Components and Operation
- Transmission Construction (Rig)
- HGV Gears and Gear Ratios (Rig)
- Selector Lever, Rail, and Synchronizers (Rig)



Electronic Controlled Air Suspension
- Electro-pneumatics (Rig)
- Air Suspension Fault Diagnosis (Rig)

Lighting Systems
- Park, Tail, and Headlamp Circuits 1
- HGV Brake and Backup Lights
- HGV Auxiliary Lighting

Auxiliary Electrical Systems
- Battery and Fuses
- HGV Windshield Wiper System

Starting and Charging
- Starting Management and Regulation
- HGV Alternator Charging Systems
- HGV Cold Starting Systems

Sensors
- Engine Protection
- Engine Management Actuators

Diesel Engine Management
- Fuel Injection
- Injector Timing
- Engine Exhaust Emissions

Complete Vehicle Systems – Land Cruiser (44 learning units)

Land Cruiser Systems
- Land Cruiser Driveline Investigation (Rig)
- Winch Systems

Land Cruiser Fuel Injection
- Land Cruiser Fuel Injector Pulse Timing (Rig)

Land Cruiser Faults
- Land Cruiser Fault Diagnosis (Rig)

Engine Dynamometers (44 learning units)

Engine Dynamometer Measurements
- Introduction to Dynamometers
- Measuring Torque with Variable RPM (Rig)

Dynamometer Software Analysis
- Introduction to Dynamometer Software
- Analysing Air Flow with Variable RPM

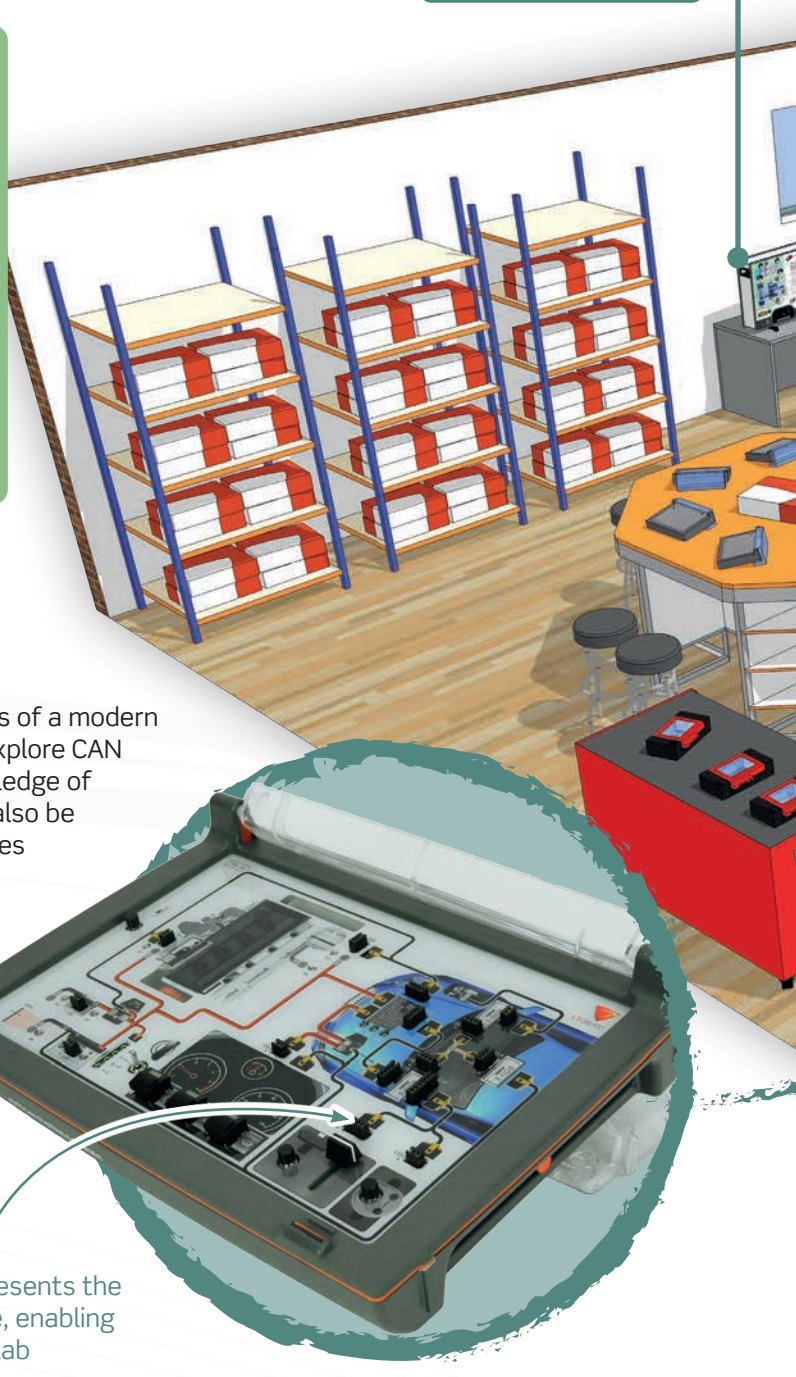
Innovative learning spaces for:
Automotive Diagnostics

Modern vehicle systems are linked together by a series of computers, which run everything at high speed.

The use of diagnosis tools and subsequent troubleshooting is the most required skill in the current automotive industry.

This typical Automotive Diagnostics Lab configuration includes the following:

- Auto Electronics Trainer (x16)
- Modern Starting and Charging Systems Trainer (x4)
- Modern Auto Lighting Circuits Trainer (x4)
- Modern Auxiliary Systems Trainer (x4)
- Engine Trainer with Fault Insertion
- Distributorless Ignition System Trainer
- Hybrid Systems Panel Trainer



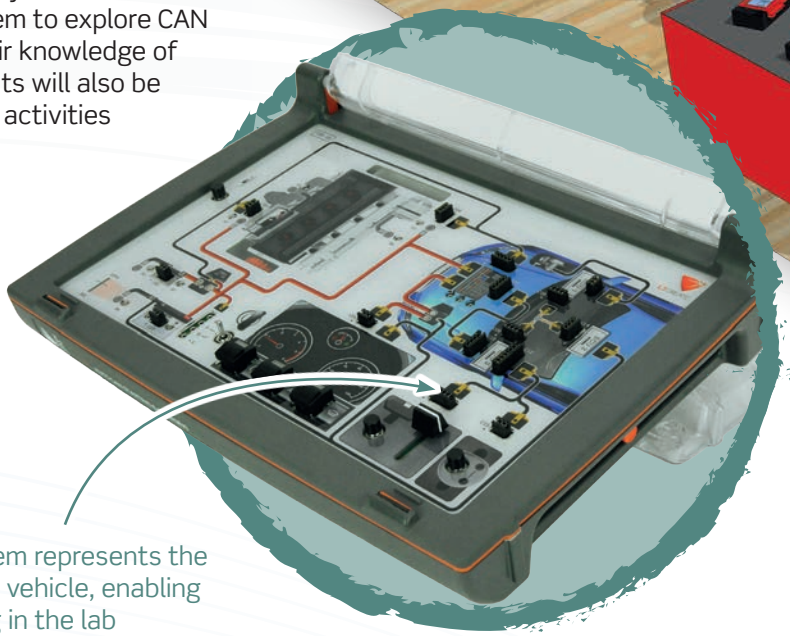
Learn real-world fault-finding skills in a classroom environment

IN FOCUS:
MODERN STARTING AND CHARGING SYSTEMS TRAINER (720-02)

The board 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 and also improve their knowledge of components, circuits, signals and systems. Students will also be directed to work through a number of fault-finding activities (8 in all), encouraging fault-diagnosis skills.

Typical Activities Include:

- Investigate high speed CAN Data Bus
- Perform CAN Bus conventional and advanced starting and charging system measurements
- Perform CAN Bus consumers measurements
- Diagnose 8 different CAN Bus starting and charging faults



Unique connection system represents the connectors on an actual vehicle, enabling realistic troubleshooting in the lab


Practice service and diagnosis techniques for ignition systems
Investigate CAN Bus technologies with our innovative virtual vehicle simulators
Working engine trainer rig with fault insertion
Automotive Diagnostics Lab

Innovative learning spaces for:
EV Technologies

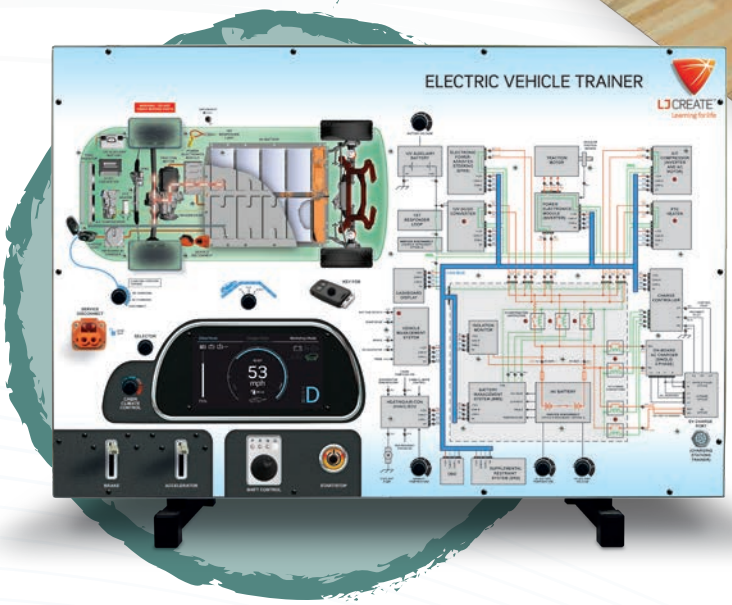
Students learn the necessary skills and knowledge required to repair and maintain Electric and Hybrid Vehicles in this lab. A combination of hands-on trainers and comprehensive EV lessons combine to create a diverse learning experience.

This typical Electric Vehicle Systems 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 (x2)
- Electric Vehicle Charging Stations Panel Trainer (x2)
- Modern Auto Lighting Circuits Trainer (x2)
- Modern Starting and Charging Systems Trainer (x1)
- Modern Auxiliary Systems Trainer (x1)

IN FOCUS:
ELECTRIC VEHICLE SYSTEMS PANEL TRAINER (740-01)

This brand-new trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of the electrical system of a typical Electric Vehicle.




EV Batteries and Charging Panel Trainer
Electric Vehicle Charging Stations Panel Trainer
EV Motors and Generators Panel Trainer
Electric Vehicle Electronics Workstation
Hybrid Vehicle Systems Panel Trainer
Modern Starting and Charging Systems Trainer

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