Preparing for the workplace

Hardware and Software Resources

- Mechatronics
- Light vehicle repair
- Heavy vehicle repair

LJ CREATE™
Learning for life

Mechatronics and Automotive

Product Guide

Training

Professional development training

We have been providing professional development training since 1979. Our training has two levels of courses available:

- Six-hour program facilitation certification
- Twenty-hour STEM/Career pathways certification

Professional, experienced training staff

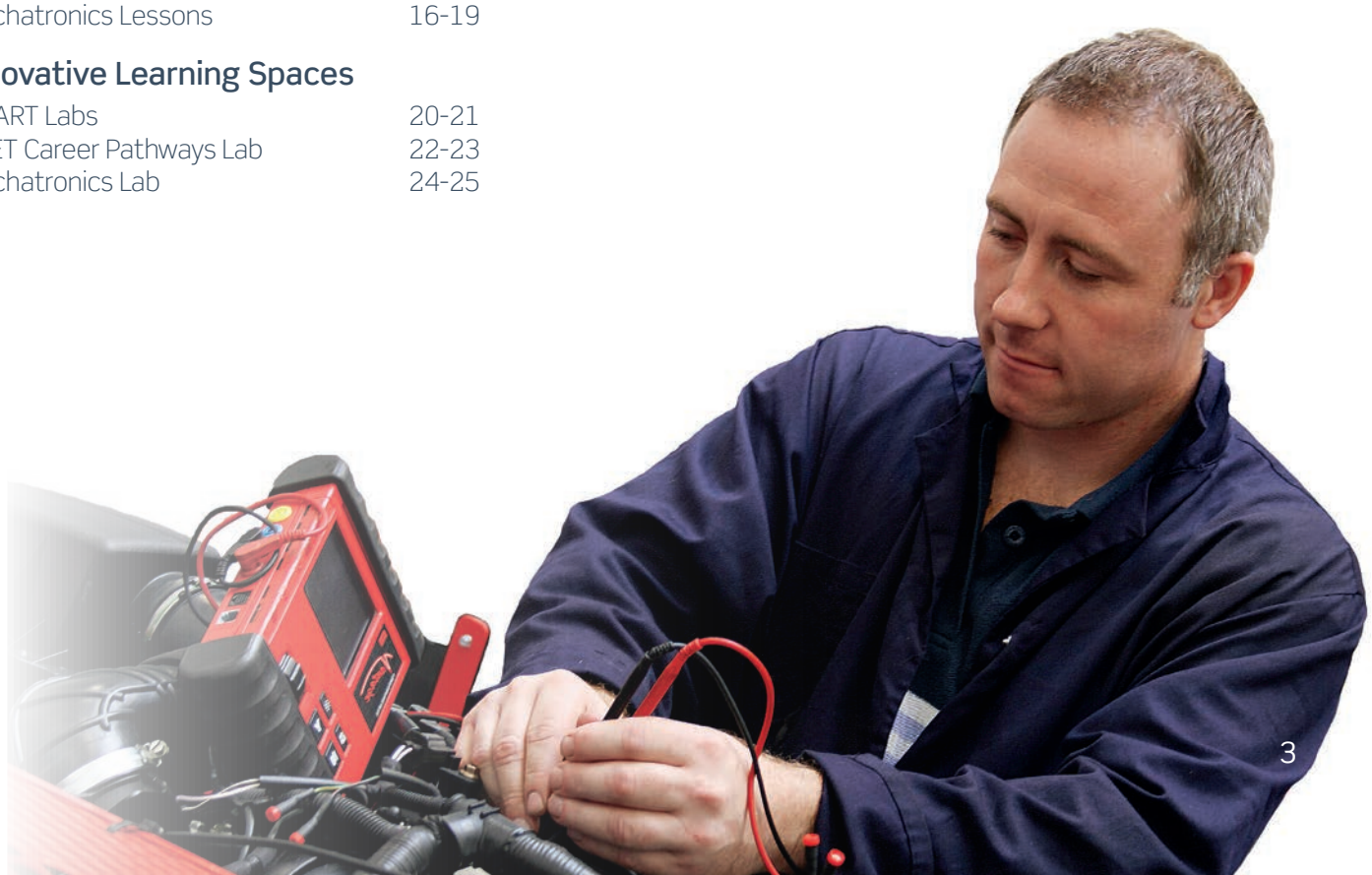
Regular update webinars

Online lessons and post-training support

Contents

MECHATRONICS

AUTOMOTIVE



Control and Instrumentation Hardware

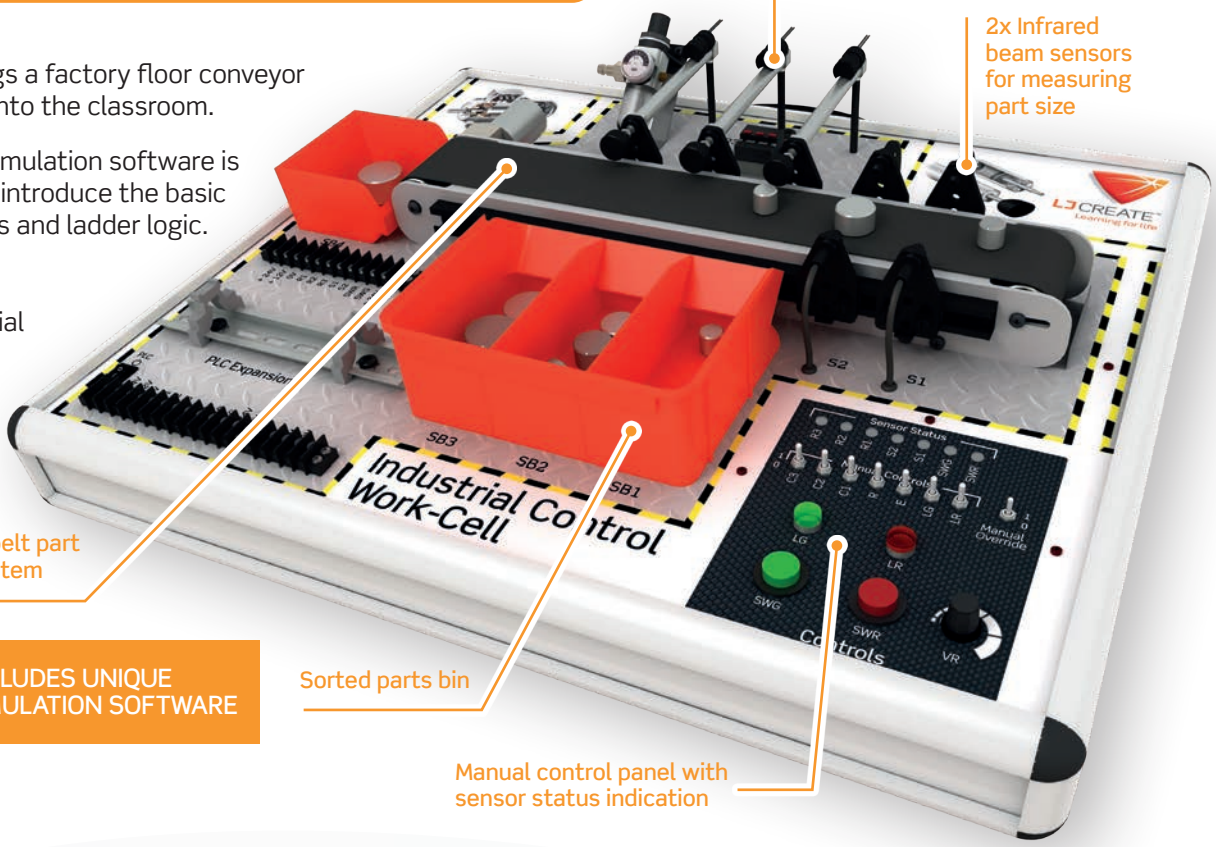
Industrial Control Trainer (290-01)

This trainer 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:

- 290-01 Industrial Control Trainer



INCLUDES UNIQUE SIMULATION SOFTWARE

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

Industrial Control Teaching Set - Allen Bradley (290-00/AB)

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:

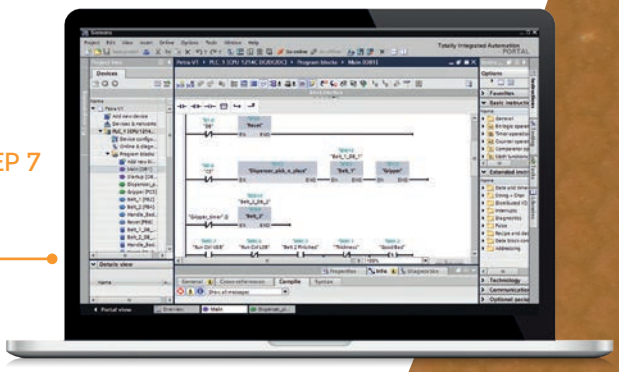
- 292-00 PETRA II Advanced Industrial Control Teaching Set

Teaching set includes:

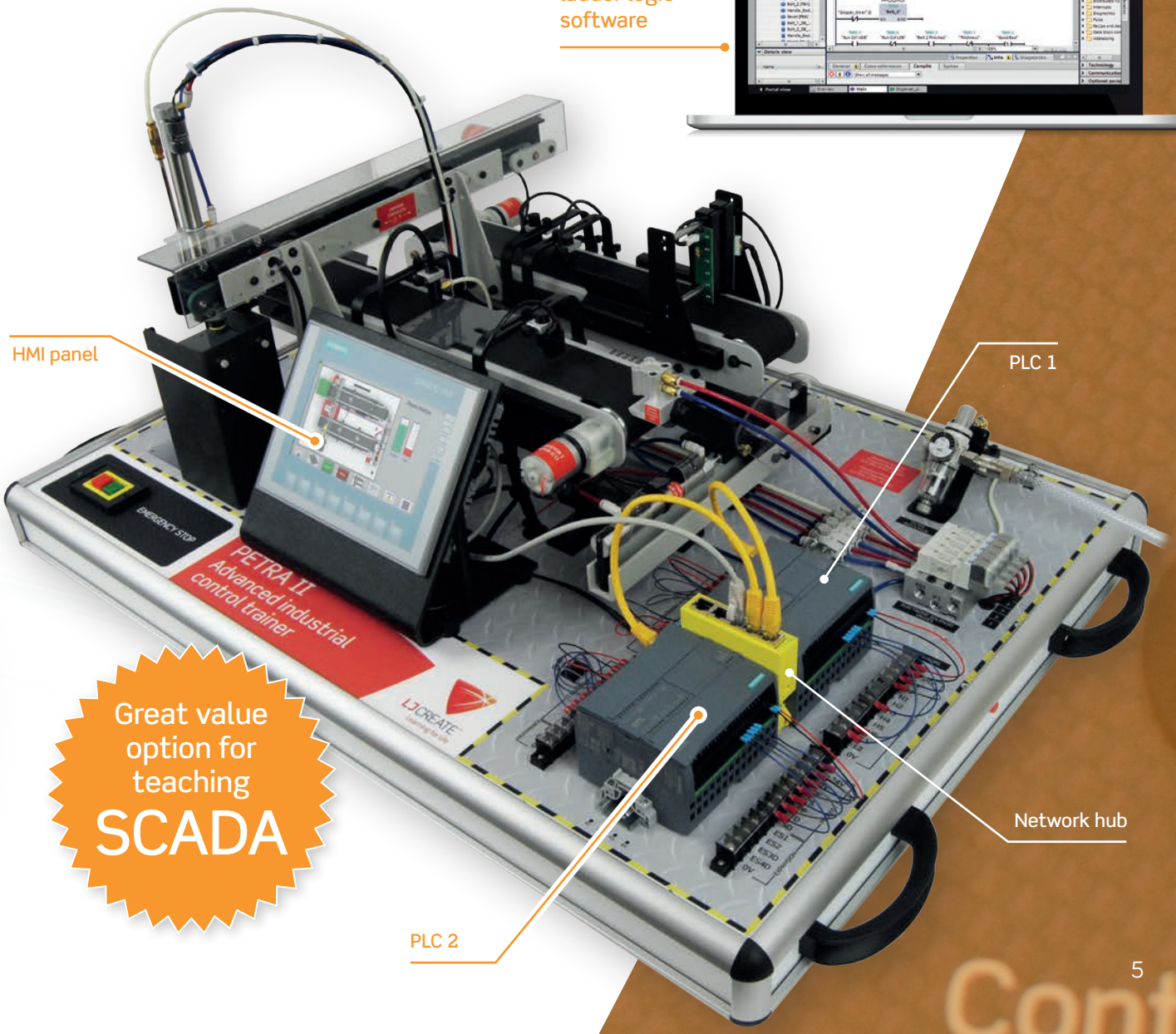
- 292-01 PETRA II Advanced Industrial Control Trainer
- 292-03 Siemens HMI Pack for PETRA II Advanced Industrial Control Trainer (Includes 2x PLCs, STEP 7 Software, HMI Panel)

Also Available:

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



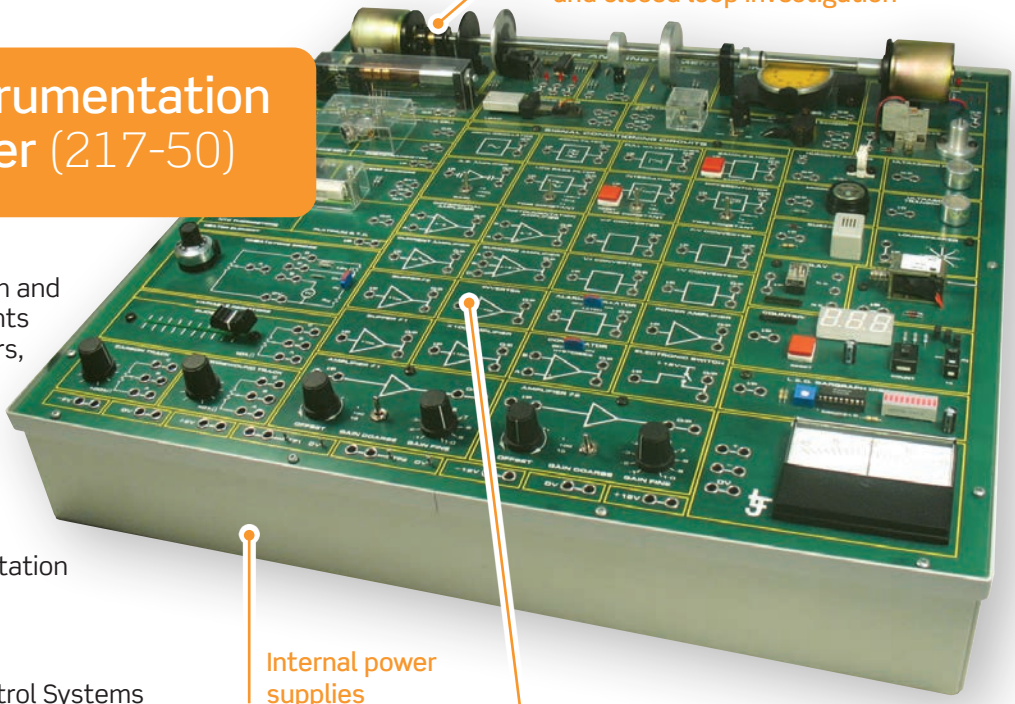
Siemens STEP 7 ladder logic software



Great value option for teaching SCADA

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.

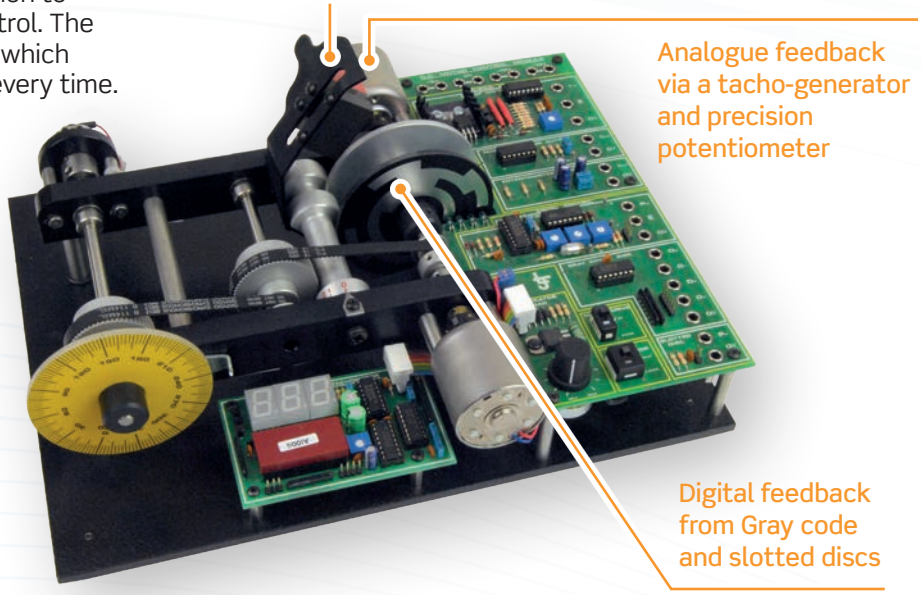
Order as:

- 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:

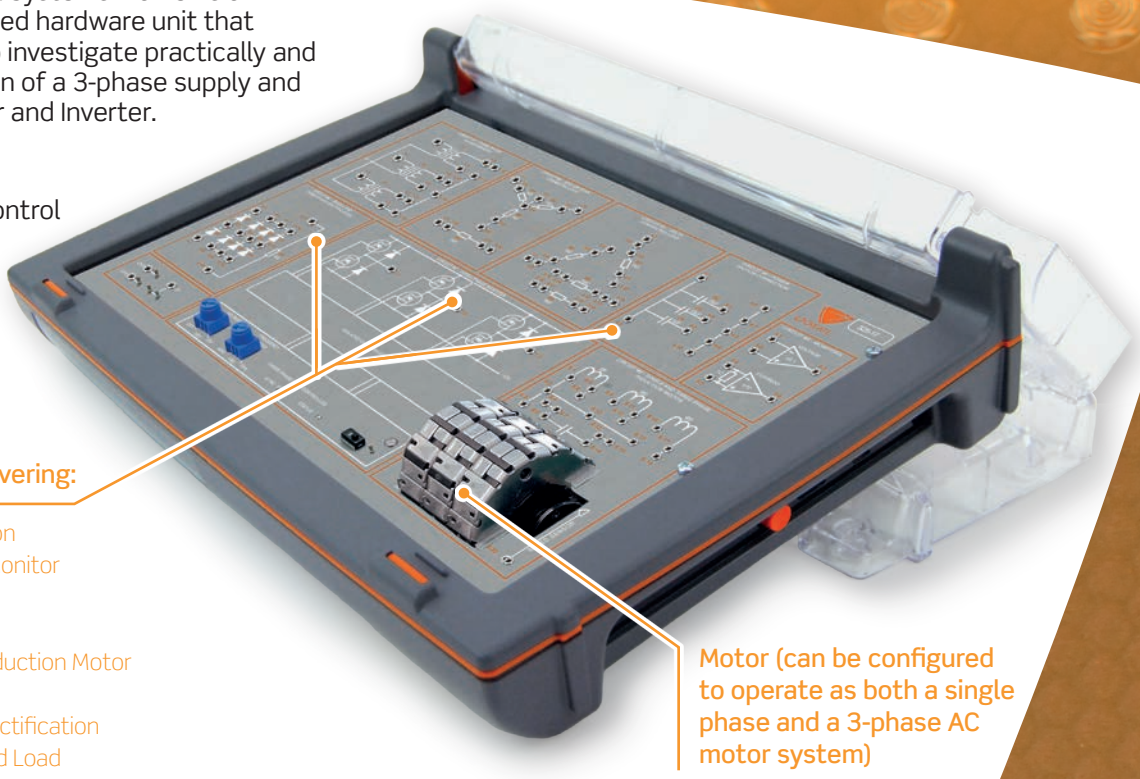
- 207-02 Virtual Control Laboratory
- 207-03 Command Potentiometer
- 207-04 PID Controller Module
- 207-05 4mm Connection Lead Set
- 207-15 D.C. Motor Control Module
- 207-40 Power Supply Unit

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.

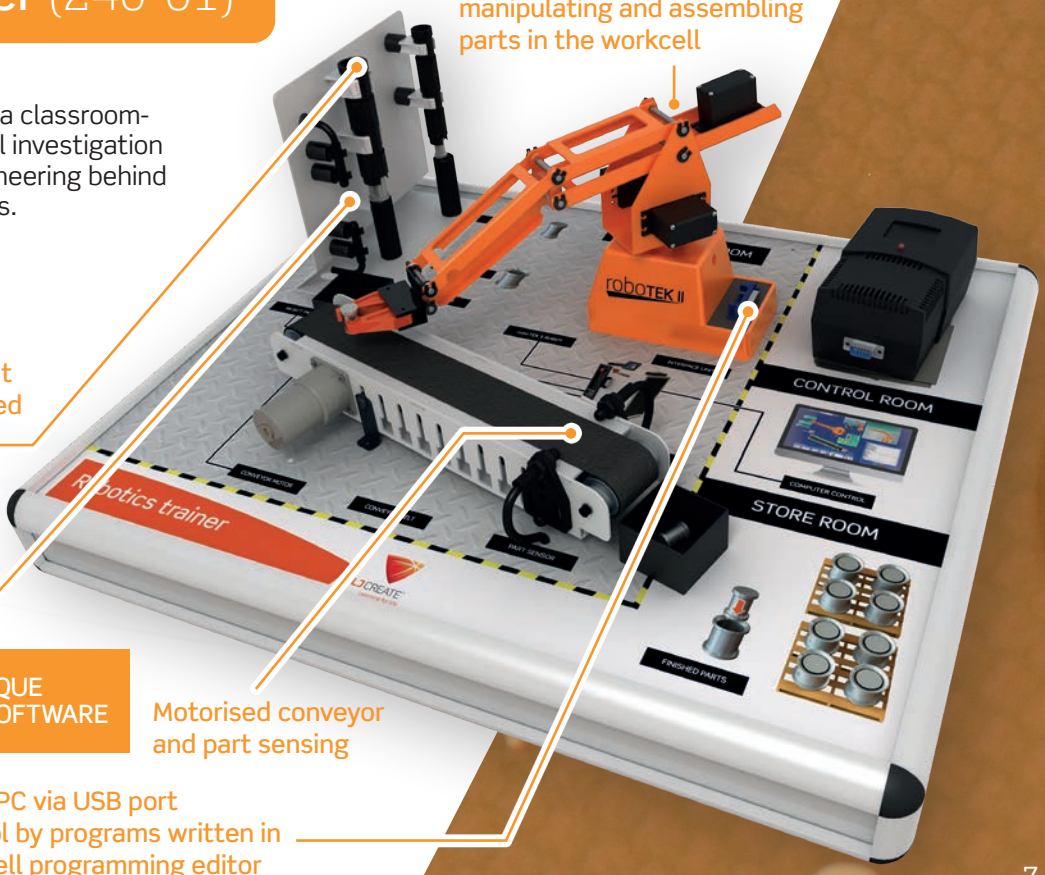
Order as:

- 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



INCLUDES UNIQUE SIMULATION SOFTWARE

Motorised conveyor and part sensing

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

Core Electronics
Hardware

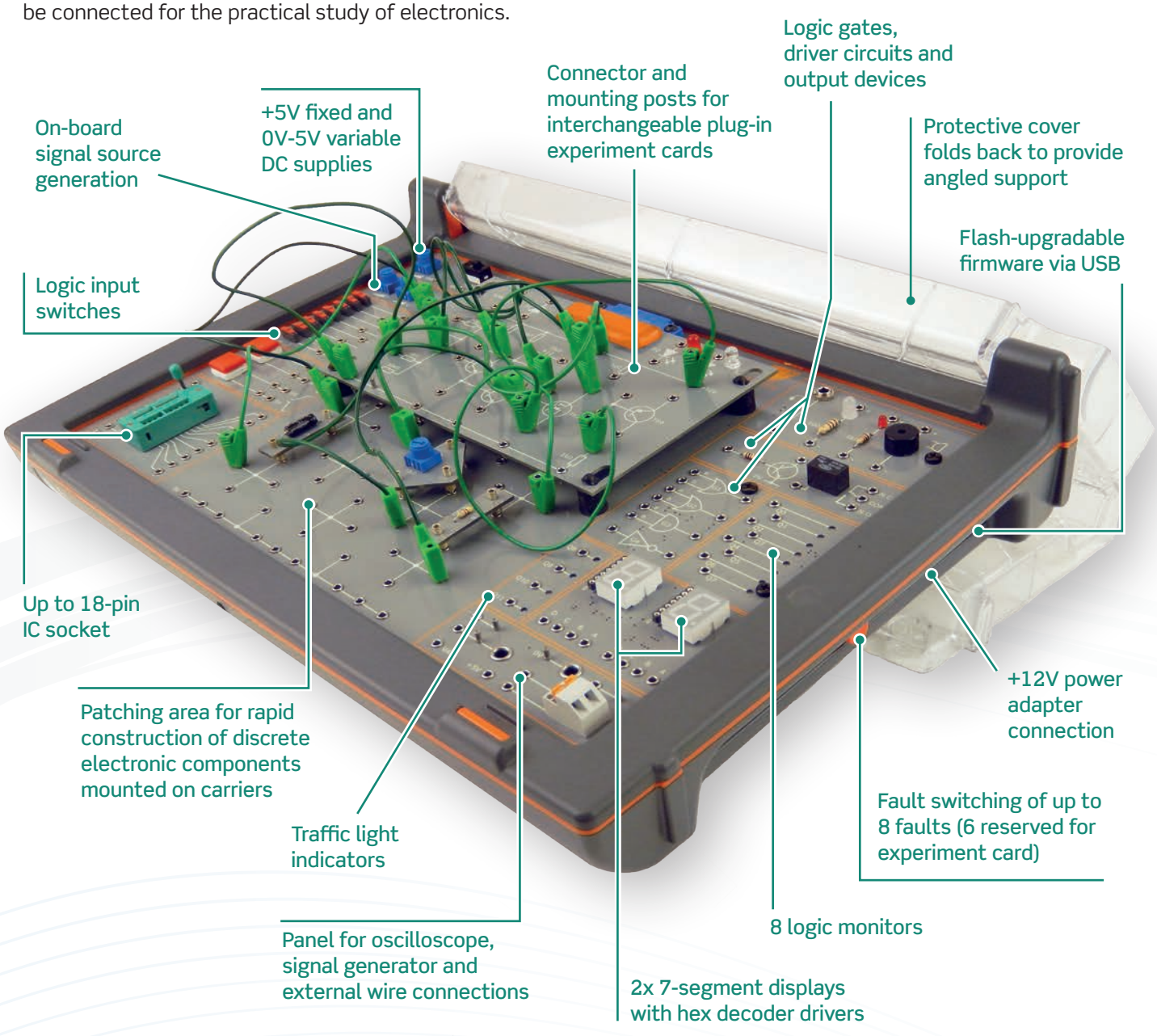
Electronics Study Trainer (320-00)

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)

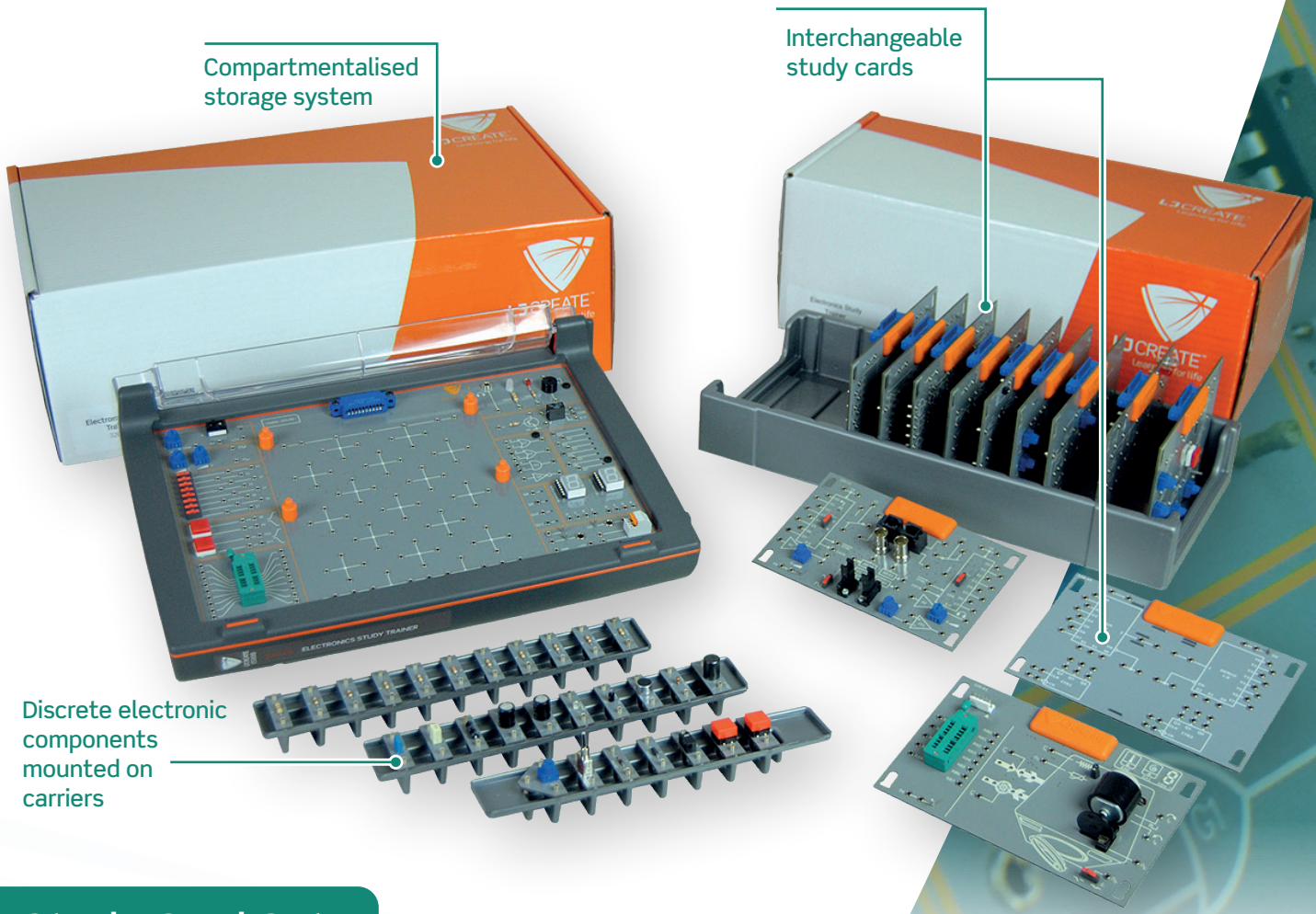
The core electronics series allows the practical study of a wide range of electronics subjects, including DC and AC circuits, semiconductors, analogue and digital systems, telecommunications and microcontrollers.

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)



Study Card Set

- 320-01 Electronic Systems Card
- 320-14 Electromagnetism Card
- 320-21 Diodes and Transistors Card
- 320-22 Transistor Amplifiers Card
- 320-31 Operational Amplifiers Card
- 320-32 Analogue Integrated Circuits Card
- 320-41 Combinational Logic Card
- 320-42 Sequential Logic Card
- 320-43 A/D-D/A Digital Systems Card
- 320-44 Encoder/Decoder Digital Systems Card
- 320-45 Multiplexer/Demultiplexer Digital Systems Card
- 320-51 Electronic Communications Card
- 320-61 PIC Programmer and Applications Card

Advanced Electronics Hardware

Advanced Electronics Experiment Platform (300-01)

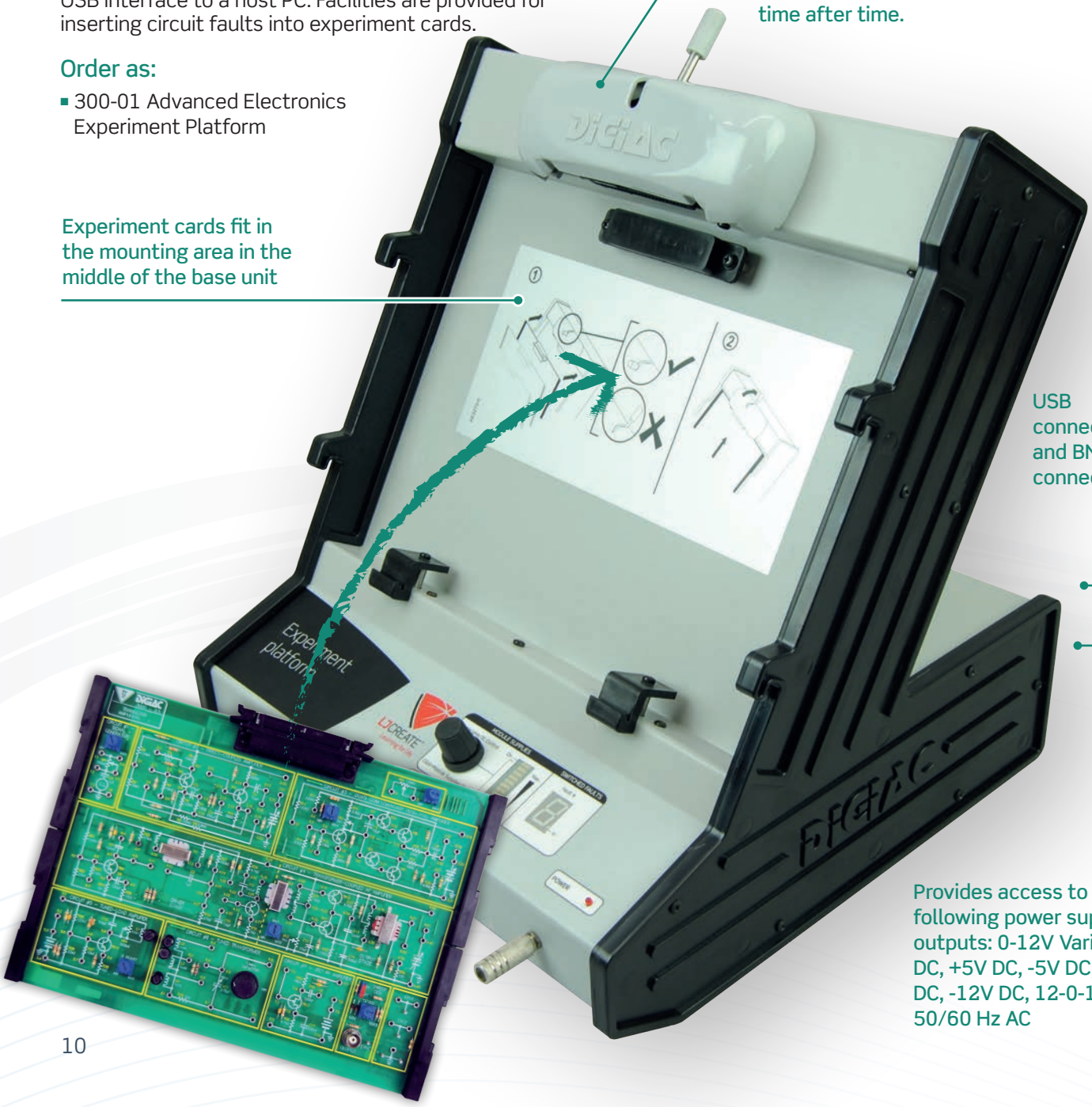
This unit provides power supplies and connection facilities for the complete range of advanced electronics experiment cards modules (see opposite). It can operate either in standalone mode, or via a USB interface to a host PC. Facilities are provided for inserting circuit faults into experiment cards.

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



USB connection and BNC connectors

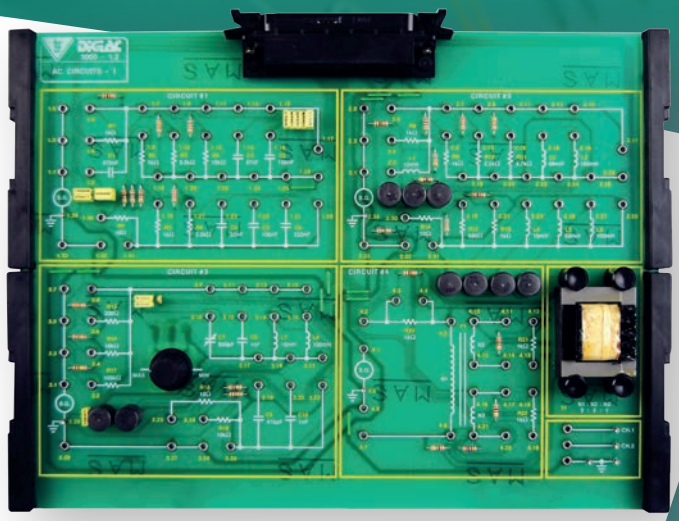
Provides access to the following power supply outputs: 0-12V Variable DC, +5V DC, -5V DC, 12V DC, -12V DC, 12-0-12V 50/60 Hz AC

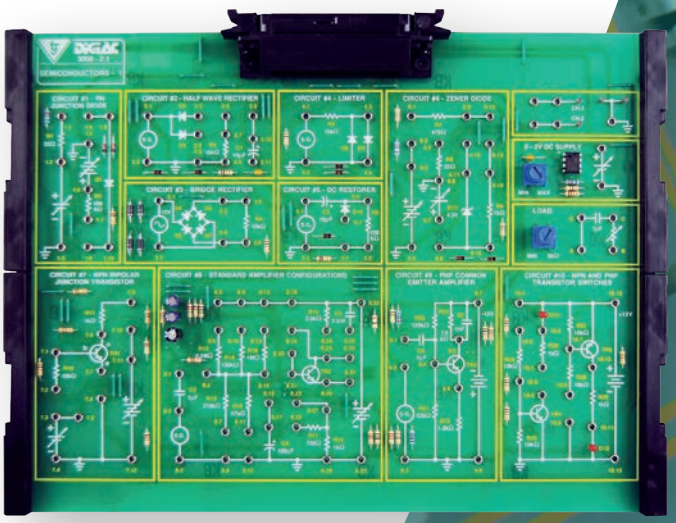
Experiment Cards

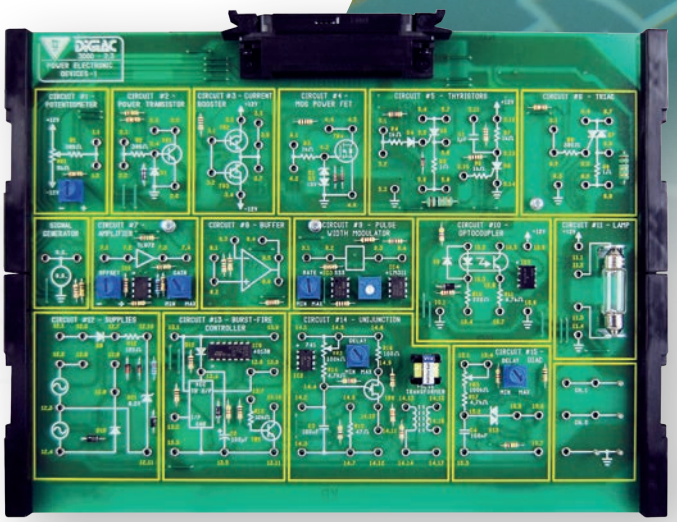
An extensive library of experiment cards is available for use with the Advanced Electronics Experiment Platform (see opposite) to teach specific elements of electronic circuits and systems.

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







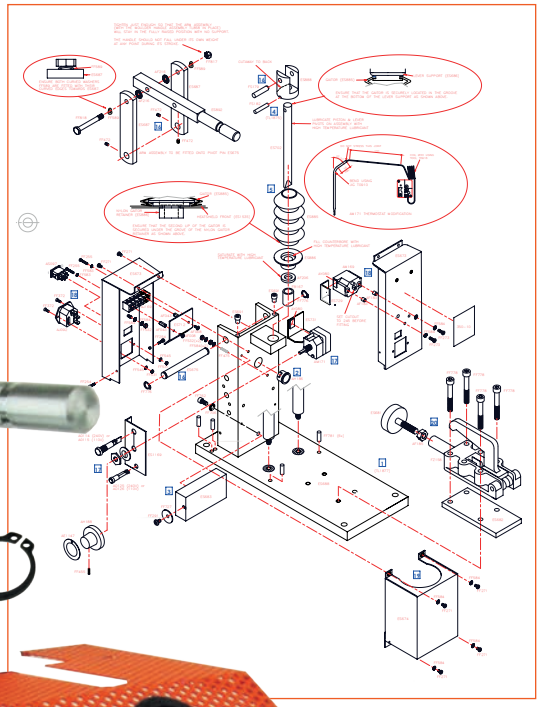
Mechanical and Fluid Power
Hardware

Injection Moulder Assembly Kit (350-10)

The Injection Moulder Assembly Kit contains a set of parts and associated instructions - to provide students with an opportunity to learn and practice the hand skills required for maintenance of mechanical and electrical equipment.

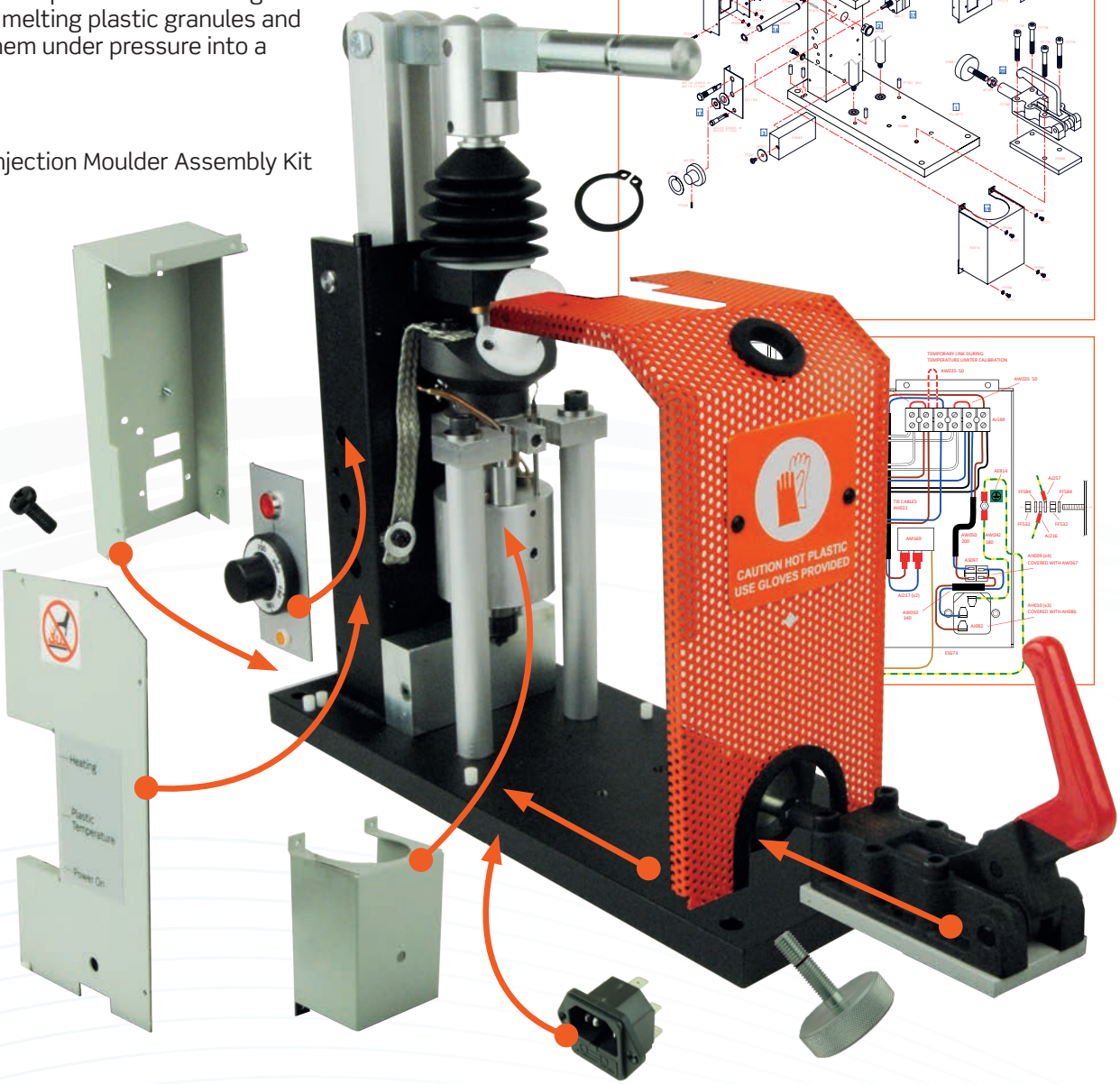
Students are led, via comprehensive instructions, through the process of assembling and testing a working plastics injection moulder. The kit contains all the parts necessary to complete the task, together with spare items where required. The kit contains over 120 separate components.

The completed product is a working moulder capable of melting plastic granules and injecting them under pressure into a mould.



Order as:

- 350-10 Injection Moulder Assembly Kit

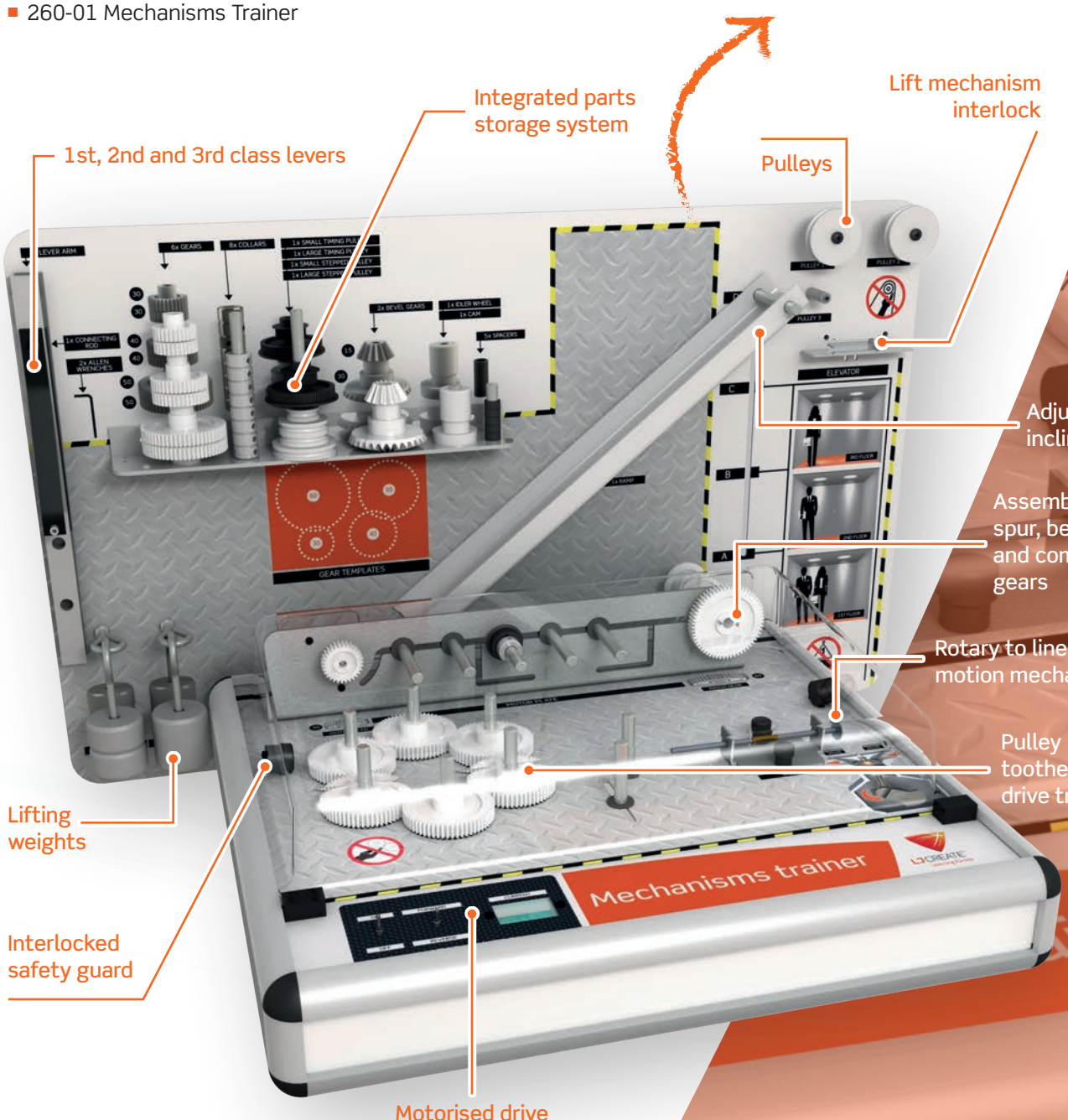


Mechanisms Trainer (260-01)

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:

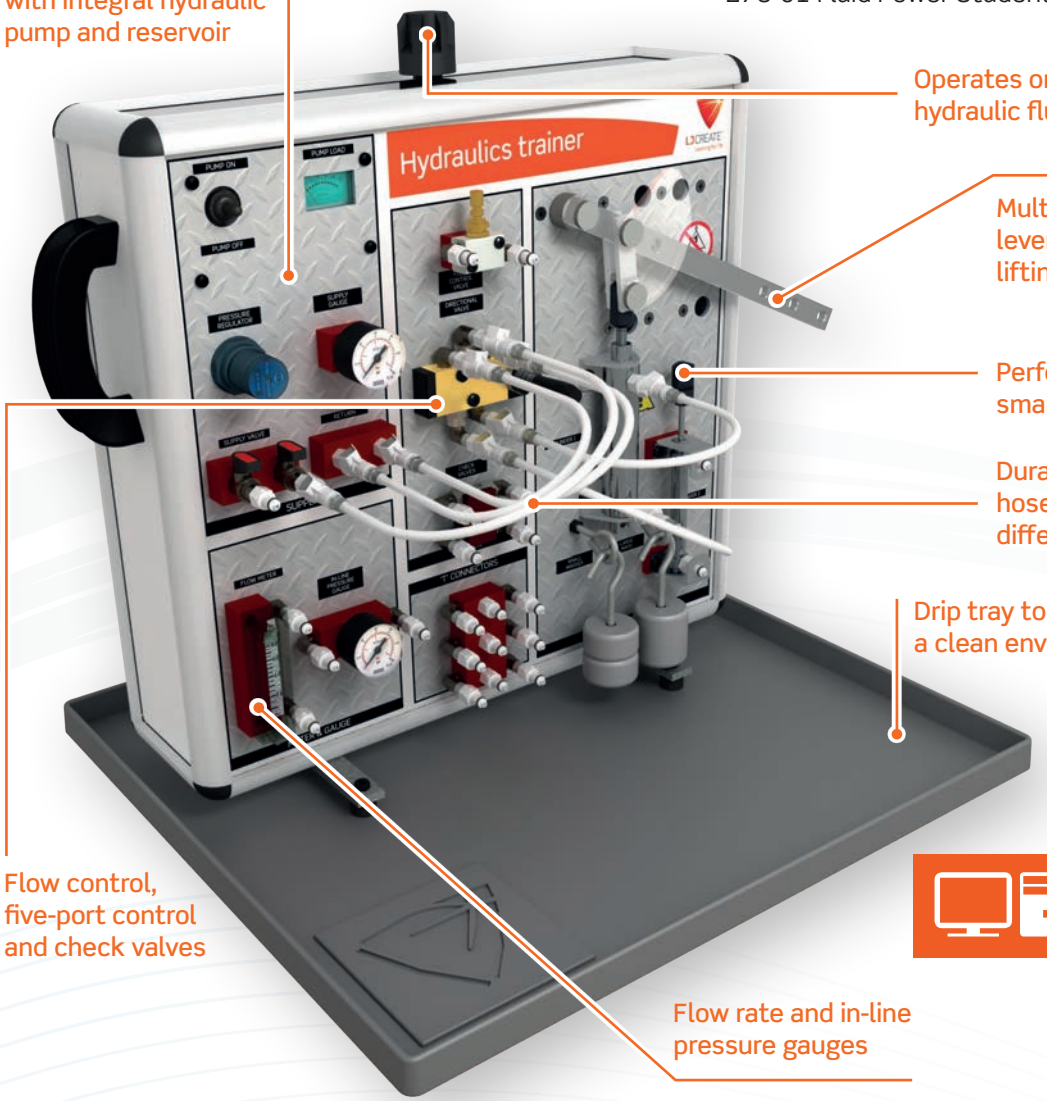
- Principles of hydraulics
- Valves and flow control
- Creating pressure with pumps
- Cylinder design

Order as:

- 280-01 Hydraulics Trainer

Also available:

- 278-01 Fluid Power Student Resource Pack



Fluid supply controls with integral hydraulic pump and reservoir

Operates on safe erifon-based hydraulic fluid

Multi-order configurable lever arm mechanism for lifting weights

Performance comparison of small and large cylinders

Durable, quick-release hoses for configuring lots of different hydraulic circuits

Drip tray to maintain a clean environment

Flow control, five-port control and check valves

Flow rate and in-line pressure gauges

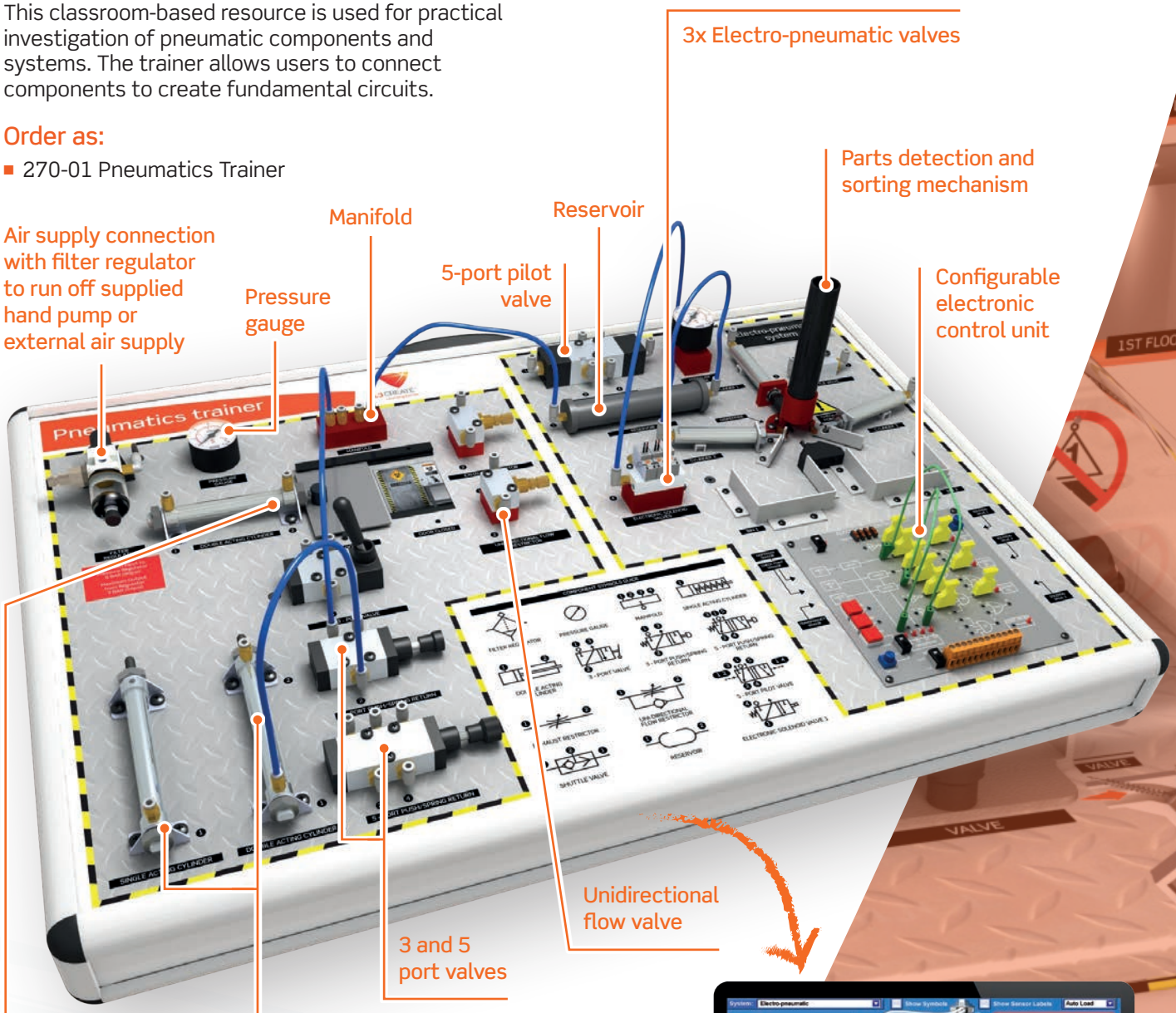
INCLUDES UNIQUE SIMULATION SOFTWARE

Pneumatics Trainer (270-01)

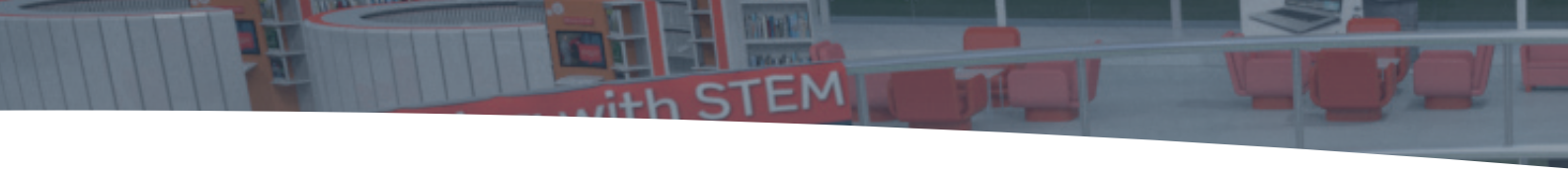
This classroom-based resource is used for practical investigation of pneumatic components and systems. The trainer allows users to connect components to create fundamental circuits.

Order as:

- 270-01 Pneumatics Trainer



INCLUDES UNIQUE SIMULATION SOFTWARE



Mechatronics Lessons

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

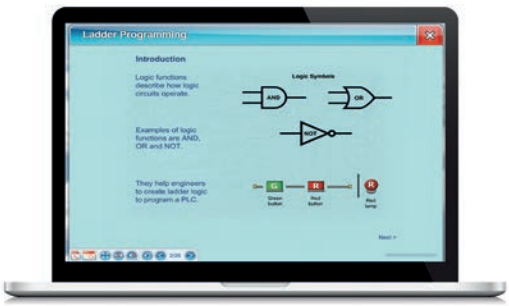
Our online library is a comprehensive resource of engineering lessons. Students can access the presentations, investigations and assessments in our library through an online portal; no specialist software or downloads are needed.

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)

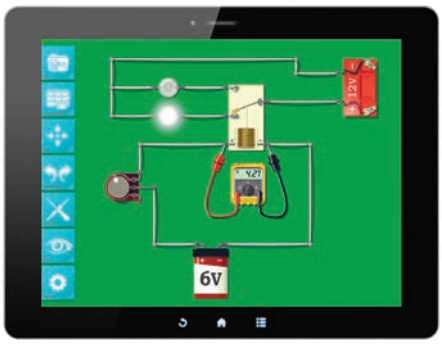
- Number Systems
- Logic Gates
- Logic Families
- Boolean Algebra
- Combinational Logic
- Karnaugh Maps
- Integrated Circuit Memory
- S-R Latch
- D-Type and J-K Flip-Flops
- Synchronous Counters and Shift Registers
- Half and Full Adders
- Monostable and Astable IC Circuits
- Magnitude Comparator
- Encoders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

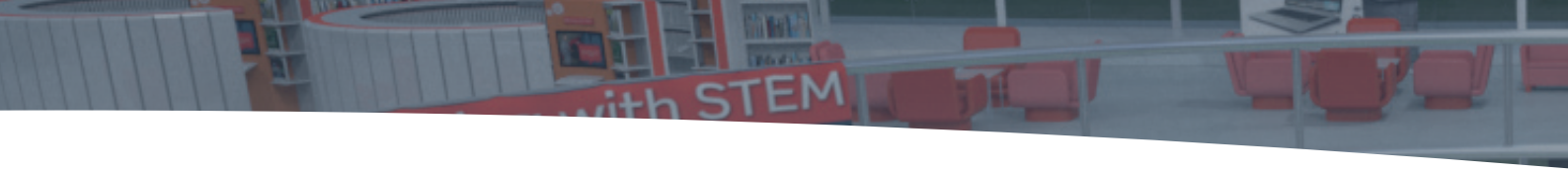
Telecommunications (31 learning units)

- 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

Smart Labs

At LJ Create we pride ourselves on the innovative learning spaces we produce for a wide range of STEM education and occupational disciplines. We call these Smart Labs. This brochure illustrates a few examples of these labs. We combine and customise these spaces to meet every customer's specific needs.

Our SMART Labs are designed to create:

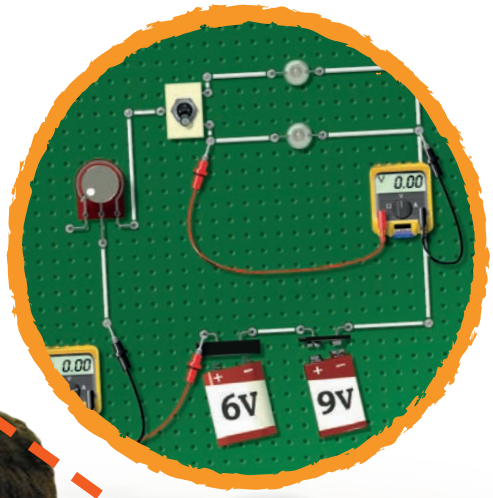
SKILLS – in students: academic, occupational and learning skills

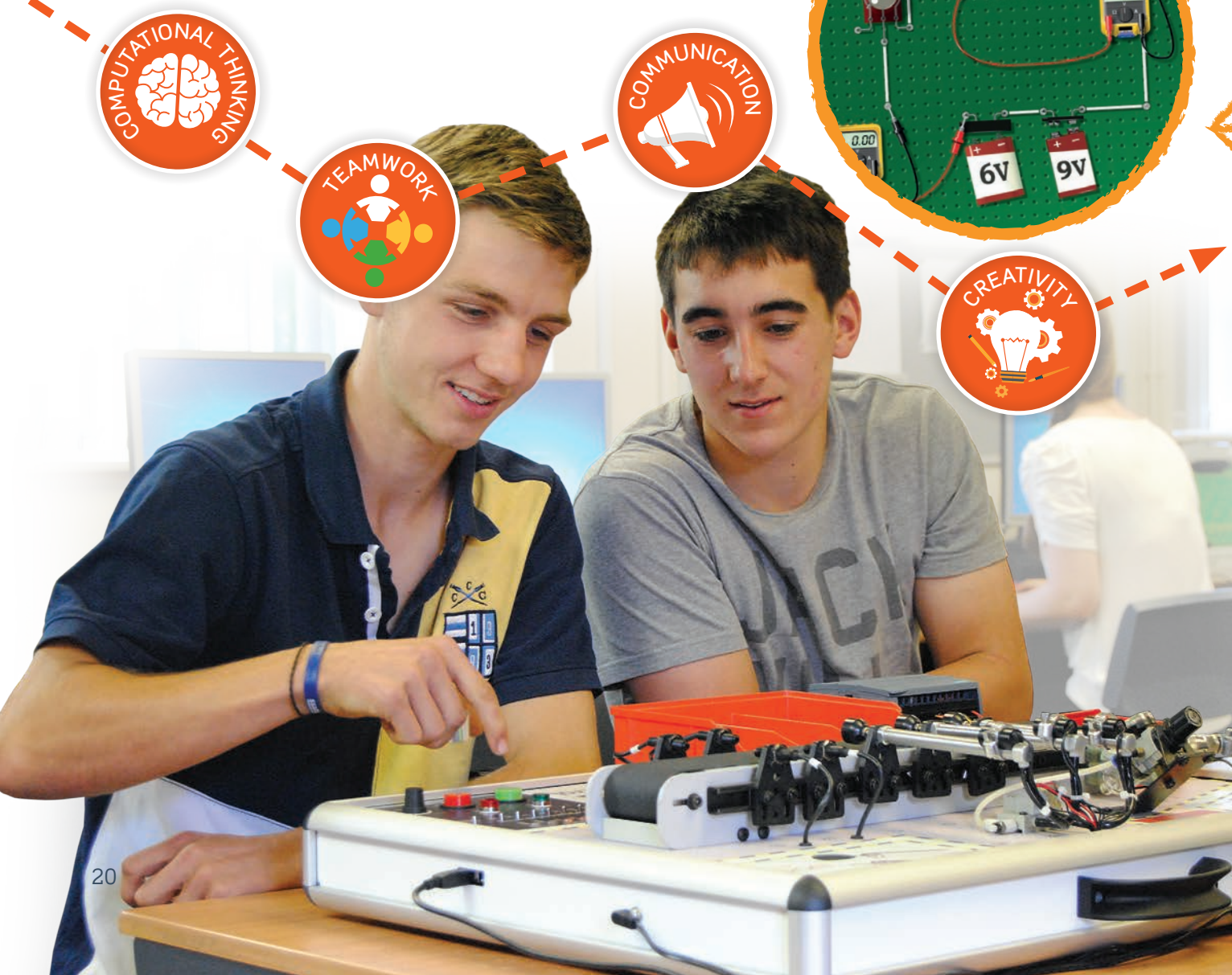
MOTIVATION – for students, staff and stakeholders who take pride in a 'showpiece'

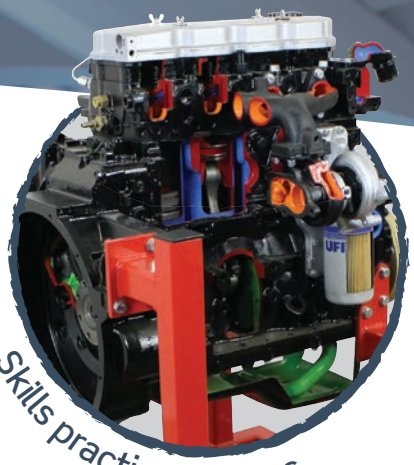
ADAPTABILITY – for different staff and student groups

RESULTS – for the institution and individuals

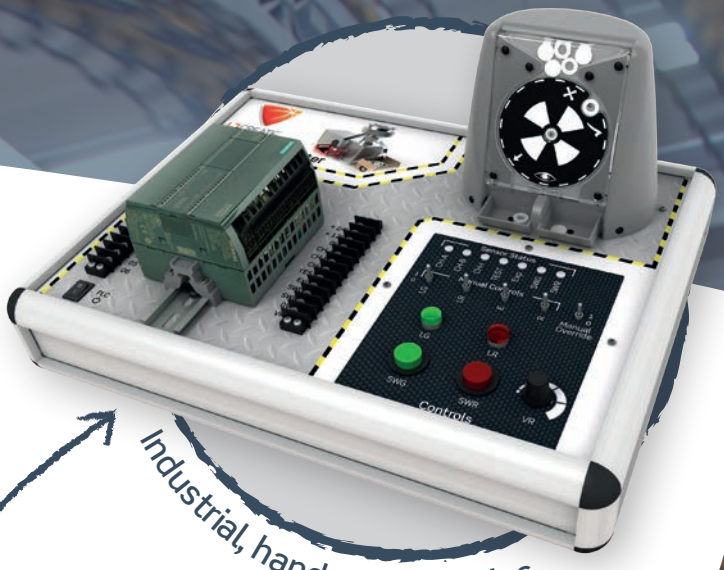
TIME – for instructional staff to spend on the best parts of their jobs







Skills practice trainers



Industrial, hands-on activities

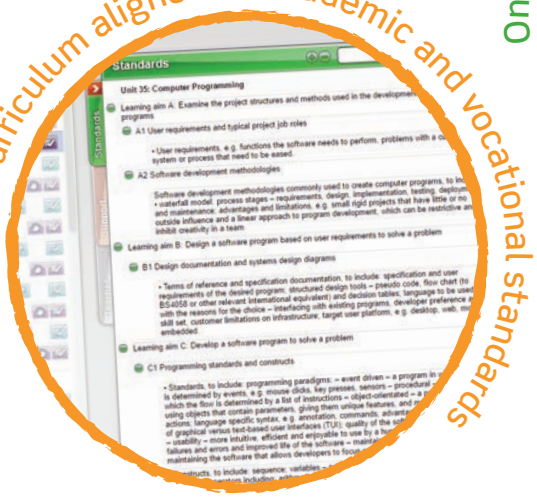
EVERY LJ CREATE LAB INCLUDES:

INNOVATIVE HARDWARE

ONLINE LMS AND LESSON LIBRARIES

CONTINUING PROFESSIONAL DEVELOPMENT (CPD)

Desktop fault-finding trainers



Curriculum aligned to academic and vocational standards

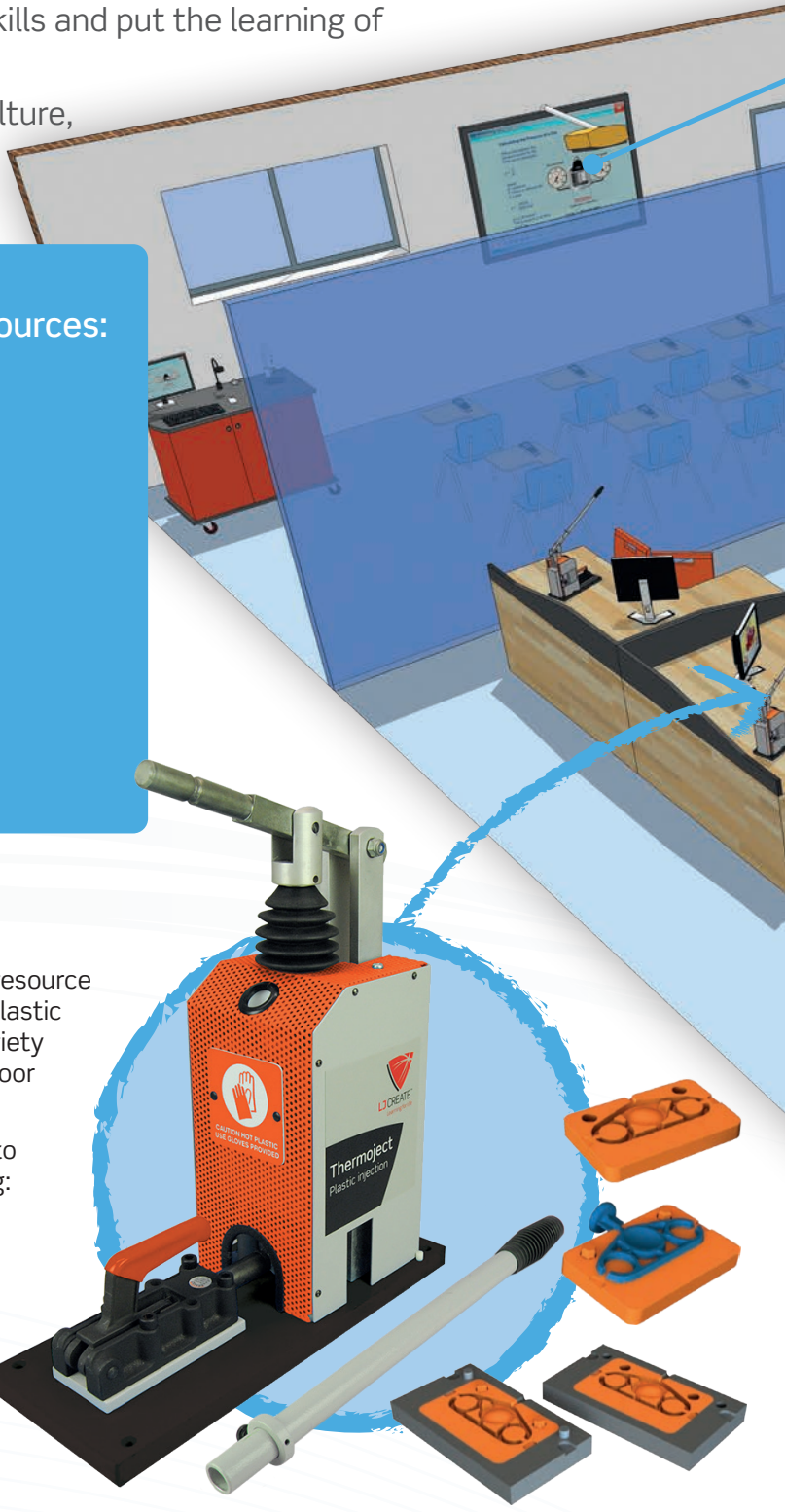
Ongoing support from our instructors

Training and professional development

Innovative learning spaces for:
TVET Career Pathways

This broad-based careers lab will provide students with the underpinning skills and knowledge for a wide range of careers. Interactive software and hands-on activities provide general job skills and put the learning of academic skills in an occupational context.

Pathway options in this space include: Agriculture, Construction, Business, Health Sciences, Manufacturing and Transportation.



This typical Career Pathways Lab configuration includes the following resources:

- Mechanisms Trainer
- Electronic Circuits Teaching Set (x2)
- Industrial Control Trainer
- Electronic Communications Trainer
- Sustainable Energy Production Trainer
- Robotics Trainer
- Engineering Construction Kit (x2)
- Injection Moulding Trainer (x2)
- Rapid Prototyping Machine
- Biology Experiment Kit (x2)
- Data Logging Kit

IN FOCUS:
INJECTION MOULDING TRAINER (350-01)

The Injection Moulding Trainer offers a classroom-based resource for investigating the techniques used to create thermo-plastic products. Students initially use the trainer to mould a variety of items, including a model car and different designs of door handles.

Using the trainer alongside a 3D printer allows students to follow rapid prototyping and tooling techniques, including:

- 3D printing, evaluation and improvement of prototypes
- 3D printing of injection mould tools
- Injection moulding of the final product

Teacher presentation area for up to 12 students

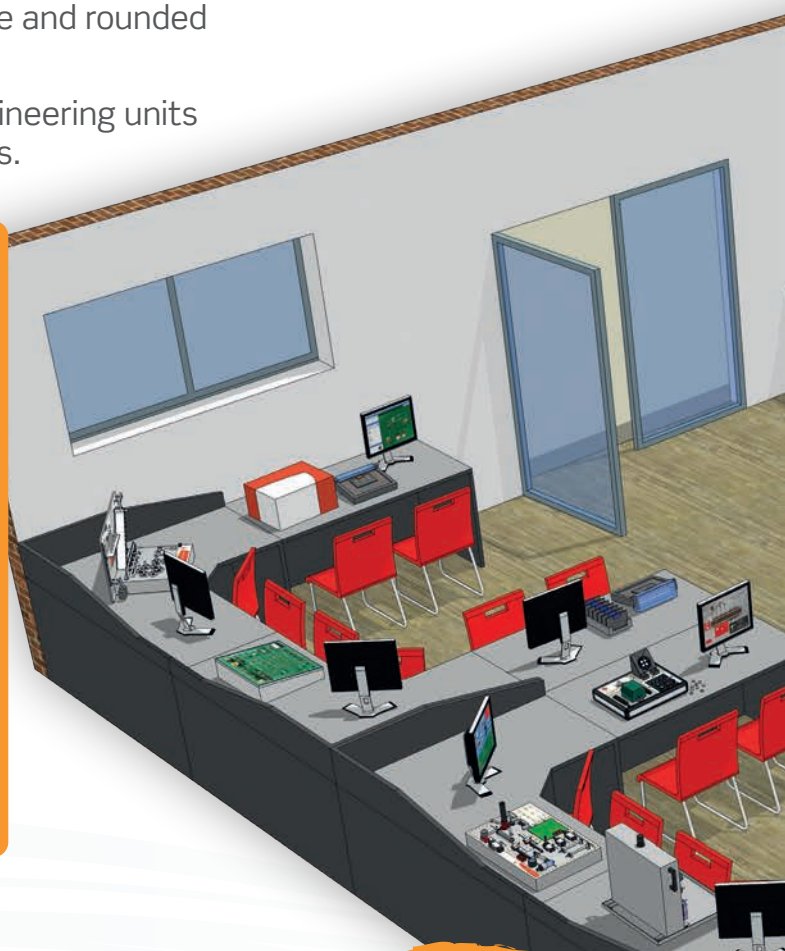
The Robotics Trainer offers a classroom-based resource for practical investigation of the technology and engineering behind modern automated systems

Complete project-based tasks with the Engineering Construction Kit; students build electro-mechanical models based around real-world STEM themes

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)
- Educational Robotics Invention Kits (x2)
- Hydraulics Trainer (x2)
- Mechanisms Trainer (x2)
- Pneumatics Trainer (x2)
- Industrial Controls Trainer (x2)
- PLC Trainer (x2)
- Transducers, Instrumentation and Control Trainer (x2)
- Data Acquisition of Control Systems Trainer

IN FOCUS:
INDUSTRIAL CONTROL TRAINER (290-01)

The Industrial Control Trainer 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 trainer includes a curriculum CD 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

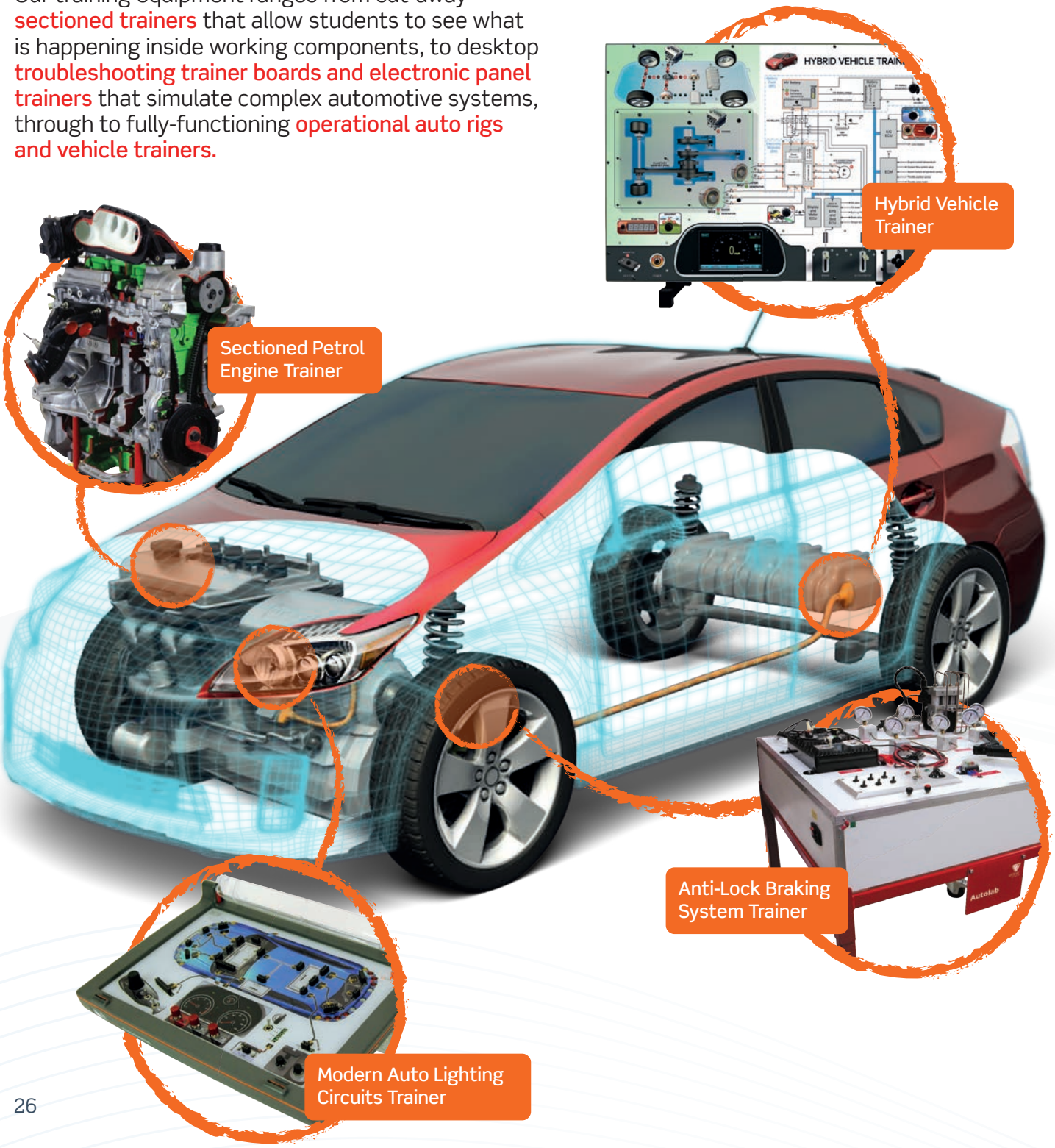
Students perform practical investigations of a variety of fundamental mechanical systems

Combine code and creativity with our Educational Robotics Invention Kits

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.



Auto Diagnostics Systems
Hardware

Auto Electronics Trainer (700-10)

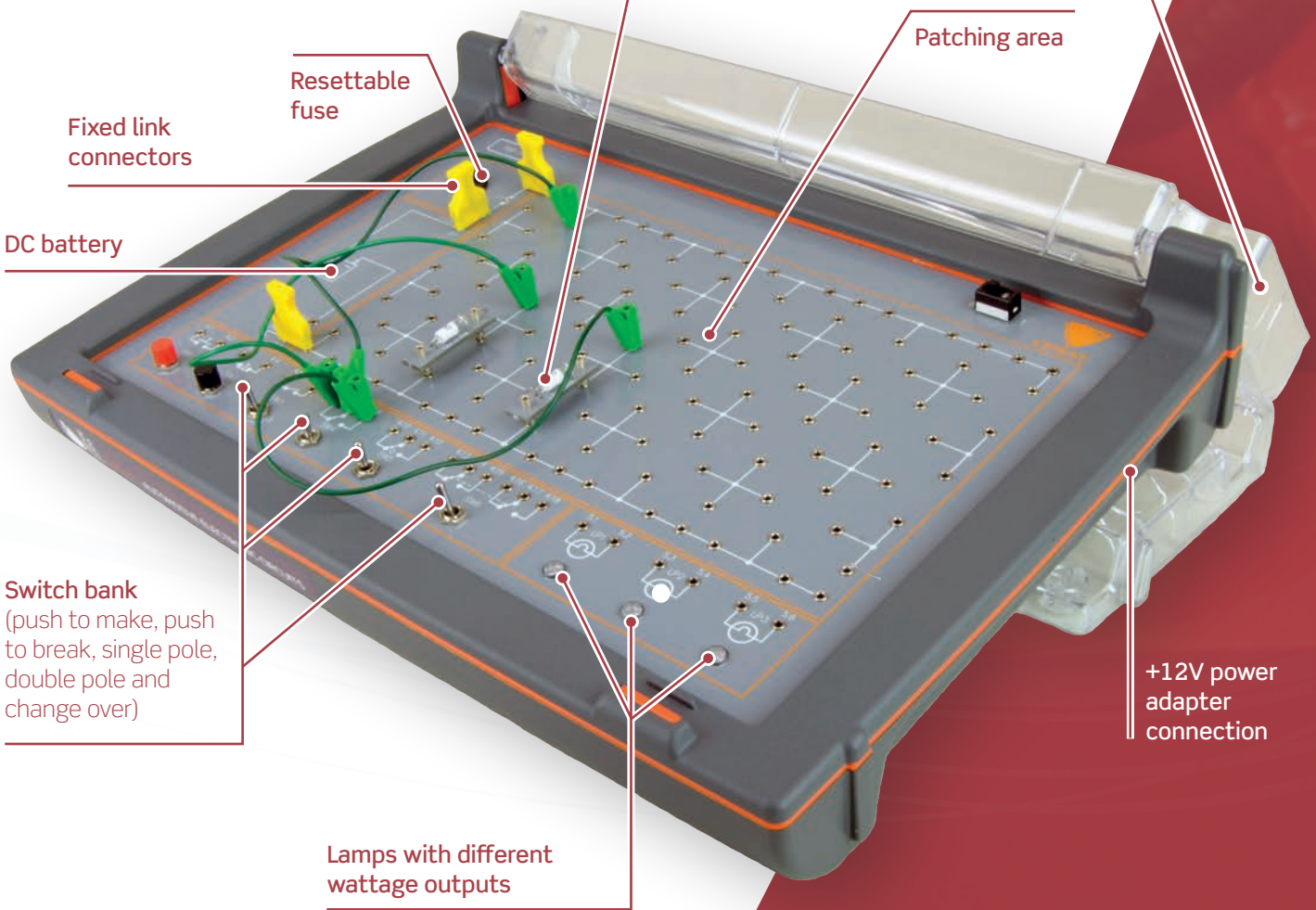
This hands-on learning resource allows students to build a variety of introductory automotive electronic circuits using a range of on-board and carrier-mounted components. Students are set tasks that encourage them to explore circuits practically to help develop their understanding of electrical components, circuits, and systems.

Typical practical tasks and topics include:

- Measure and construct simple circuits
- Investigate the operation of battery, fuse, switch and lamp components
- Ohm's Law and resistance
- Switches in series and parallel

Order as:

- 700-10 Auto Electronics Trainer



Auto Diagnostics Systems
Hardware

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.

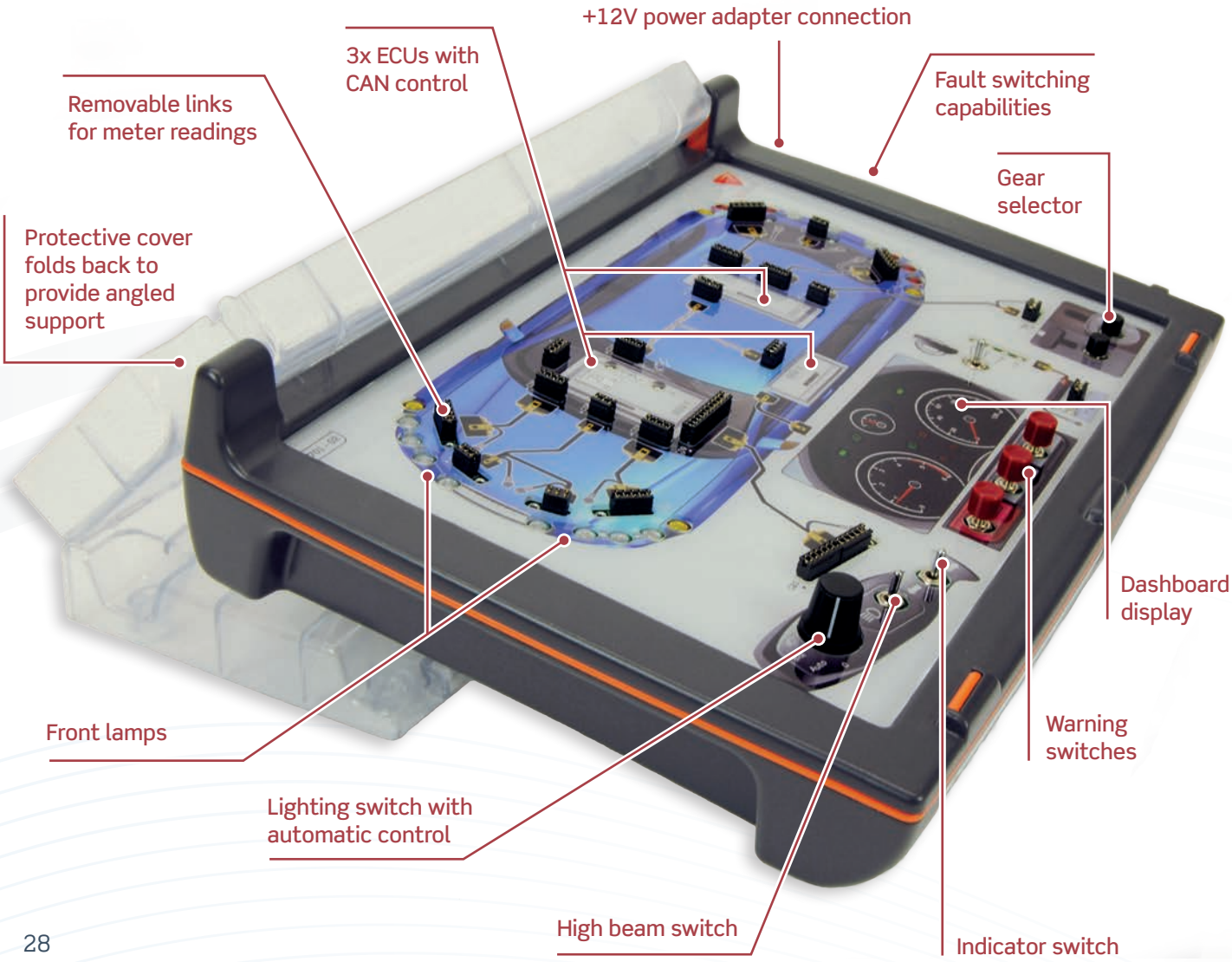
Students are set tasks that encourage them to explore CAN controlled lighting circuits practically and improve their knowledge of electrical components, circuits, signals and systems.

Typical practical tasks and topics include:

- CAN Bus lighting systems and CAN signals
- CAN control of lighting circuits: headlamp, brake, reverse, dipped beams, hazard warning lights, direction indicators, automatic lighting
- Finding and diagnosing CAN lighting faults

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.

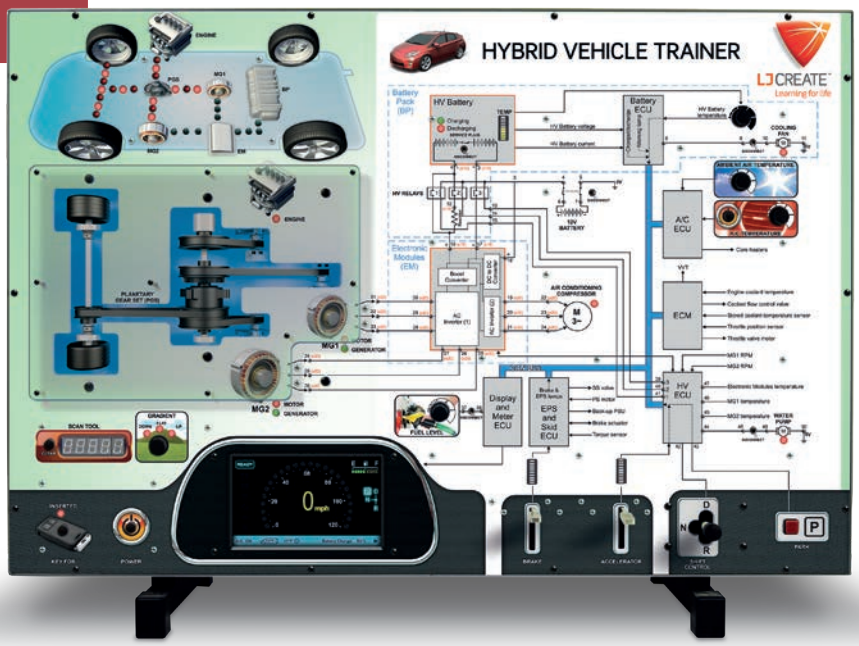
Students will also be directed to work through a number of fault-finding activities (8 in all), encouraging fault-diagnosis skills.

Order as:

- 720-02 Modern Starting and Charging Systems Trainer

Light Vehicle Repair Trainers
Hardware

Hybrid Vehicle Systems Panel Trainer (756-01)



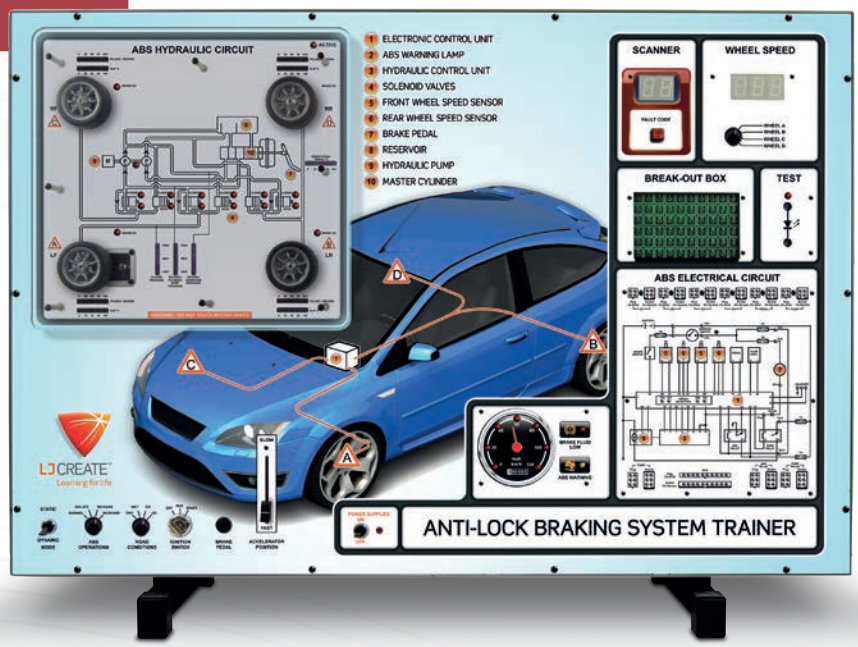
This trainer provides students and instructors with the opportunity to demonstrate, investigate and fault-find a simulation of a hybrid vehicle electrical system.

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.

Order as:

- 756-01 Hybrid Vehicle Systems Panel Trainer

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



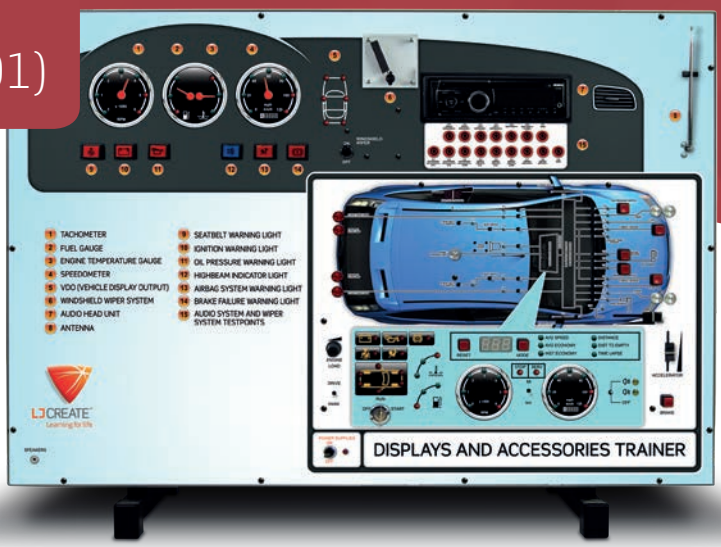
This trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of a typical 4-wheel anti-lock braking system.

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

Displays and Accessories Systems Panel Trainer (752-01)



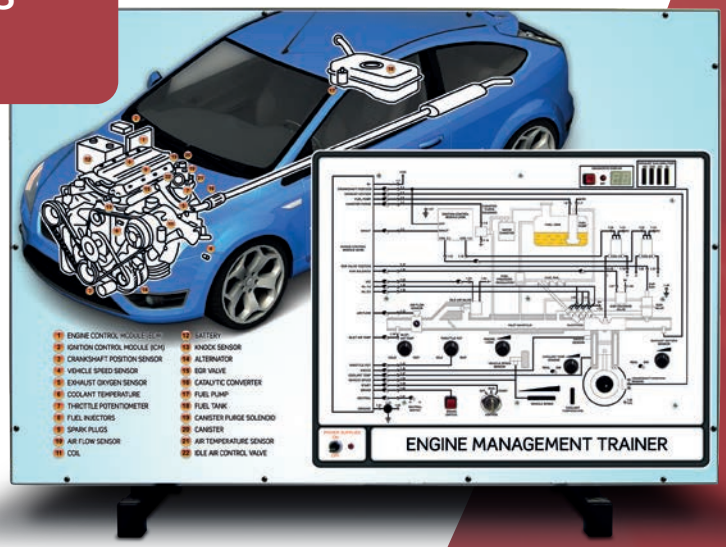
This trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of typical automotive display systems.

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

Engine Management Systems Panel Trainer (751-01)



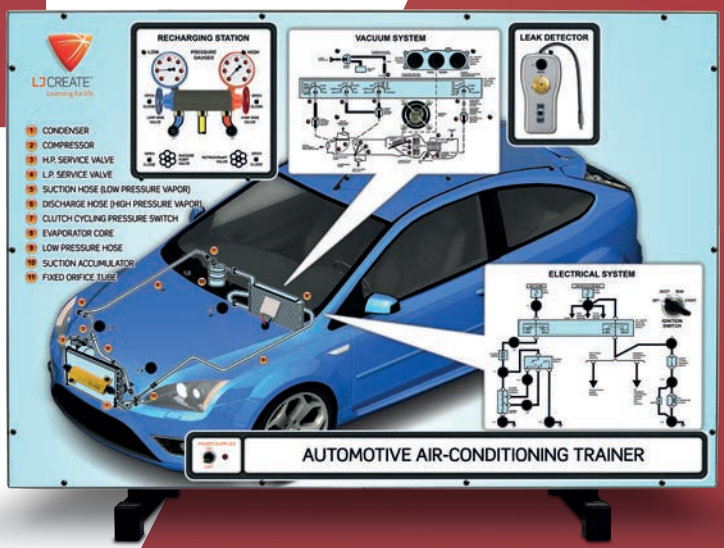
This trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of a typical automotive engine management system.

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.

Order as:

- 751-01 Engine Management Systems 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

Light Vehicle Repair Trainers
Hardware

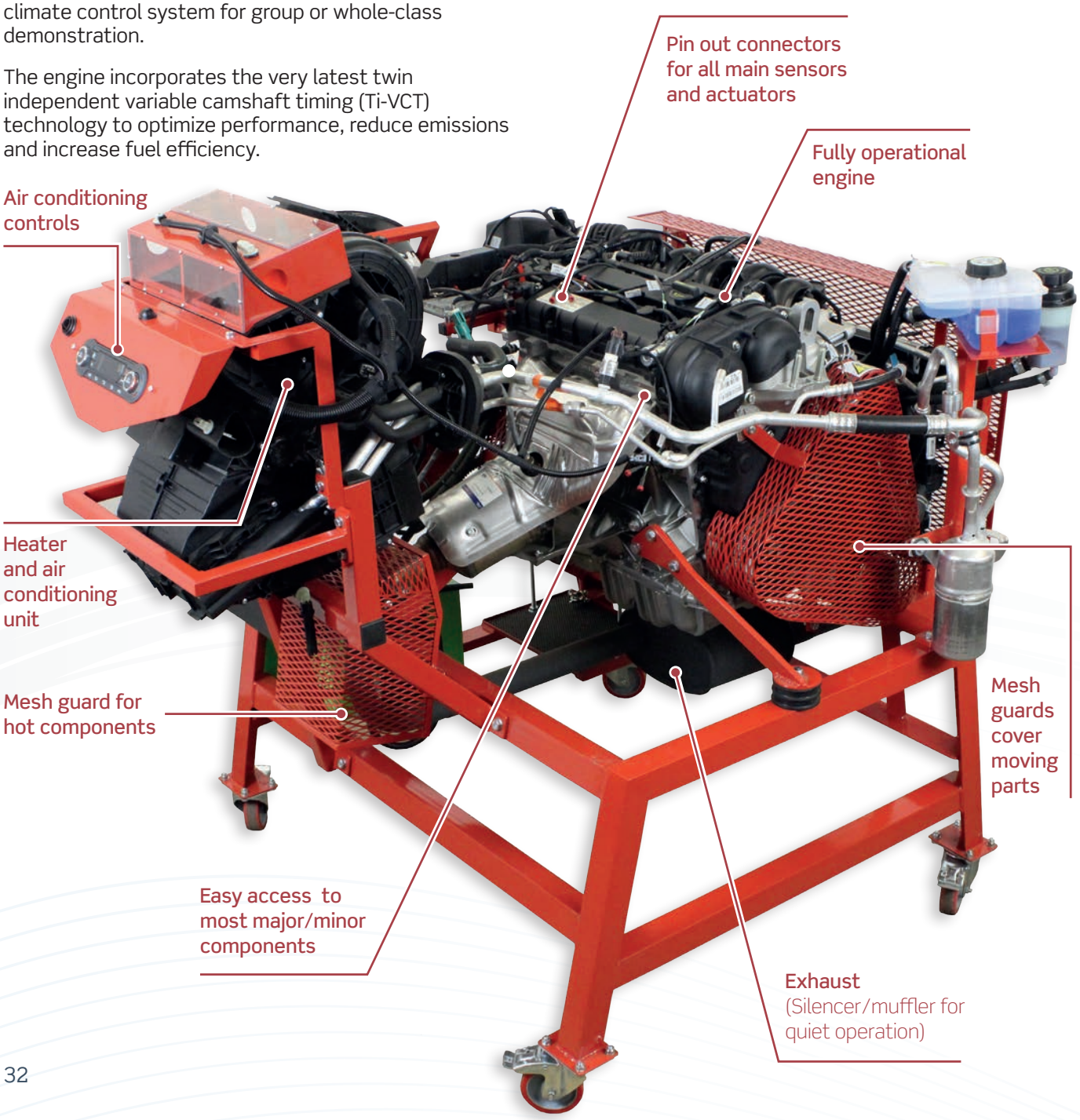
Petrol Engine (CAN and Climate Control) Trainer (760-02)

This trainer provides a complete working engine with an engine management system incorporating CAN bus control technology. It also includes a fully-functional climate control system for group or whole-class demonstration.

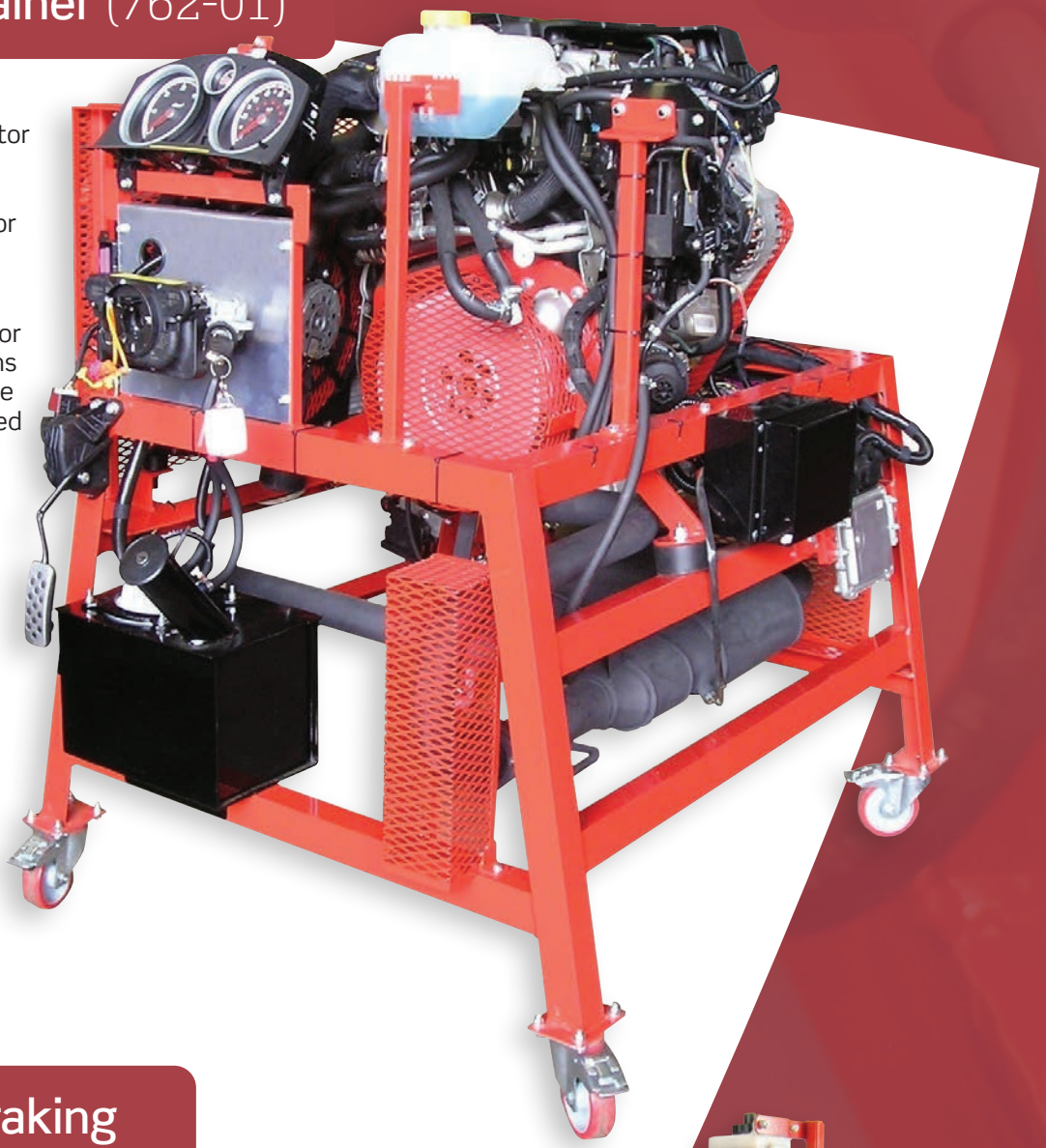
The engine incorporates the very latest twin independent variable camshaft timing (Ti-VCT) technology to optimize performance, reduce emissions and increase fuel efficiency.

Order as:

- 760-02 Petrol Engine (CAN and Climate Control) Trainer



Common Rail Diesel Engine (CAN Control) Trainer (762-01)



This trainer provides the instructor with a complete common rail diesel engine with an engine management system for group or whole-class demonstration.

The system comprises all the elements that control the injector timing and the exhaust emissions together with the ECU and all the sensors and actuators associated with the control system.

Order as:

- 762-01 Common Rail Diesel Engine (CAN Control) Trainer

Disc and Drum Braking System Trainer (763-01)

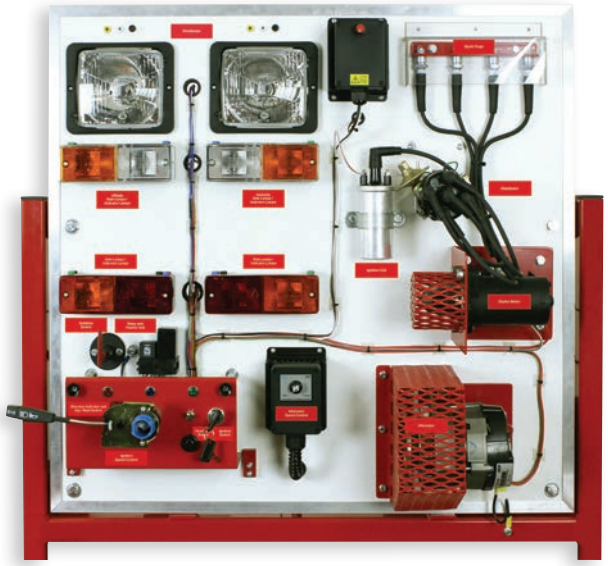
This real component-based trainer provides students and instructors with the opportunity to demonstrate and investigate the operation of a typical automotive braking system.

The trainer is designed to allow access to both disc and drum brake components, as well as providing the opportunity to understand the operation of the hydraulic circuit.

Order as:

- 763-01 Disc and Drum Braking System Trainer

Vehicle Electrical System Trainer (770-01)



This real component trainer offers a fully operational automotive electrical system designed for teaching basic electrical principles.

Full operation of headlights, side lights, brake lights, indicators, and alternator via a speed controller can be observed.

Order as:

- 770-01 Vehicle Electrical System Trainer

Supplemental Restraint System Trainer (784-01)

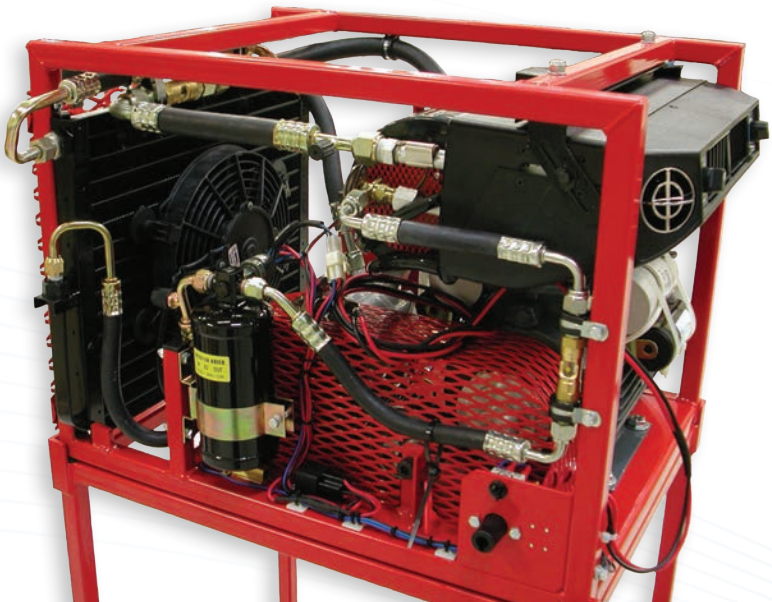
This trainer comprises real vehicle components that have been made safe for a classroom or workshop environment, using charges that have either been pre-deployed or replaced with safe replica charges.

The components have been carefully sectioned and dismantled to show students the various elements that make up the system.

Order as:

- 784-01 Supplemental Restraint System Trainer

Air Conditioning System Trainer (766-01)



This real component-based trainer provides students and instructors with the opportunity to demonstrate and investigate the operation of a functional automotive air conditioning system.

The trainer is designed to allow access to the vacuum system and electrical system, as well as provide the opportunity to understand the processes involved with system evacuation and charging.

Order as:

- 766-01 Air Conditioning System Trainer

Electronic Fuel Injection System (Wet) Trainer (767-02)

This real component trainer provides the instructor with a working multi-point fuel injection system for group or whole-class demonstration.

Order as:

- 767-02 Electronic Fuel Injection System (Wet) Trainer

Also available:

- 767-01 Electronic Fuel Injection System (Dry) Trainer

HDI Common Rail Fuel Injection System Trainer (771-01)

This real component trainer provides the instructor with a working HDI common rail fuel injection system for group or whole-class demonstration.

The system comprises all the elements that control the air-fuel ratio, the injectors, the ECU, and all the sensors associated with the control system.

Order as:

- 771-01 HDI Common Rail Fuel Injection System Trainer

Anti-Lock Braking System (Bosch) Trainer (769-01)

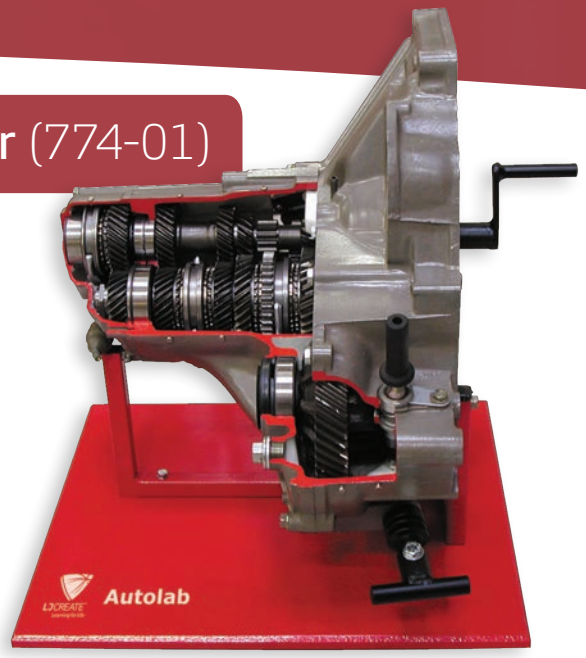
This trainer will provide the instructor with a simulated anti-lock braking system for group or whole-class demonstration, using components from a commercial ABS.

The system will demonstrate the basic principles of ABS, including wheel speed sensing, signal processing, fluid pressure and modulation, together with brake pressure measurement.

Order as:

- 769-01 Anti-Lock Braking System (Bosch) Trainer

Sectioned Manual Gearbox Trainer (774-01)



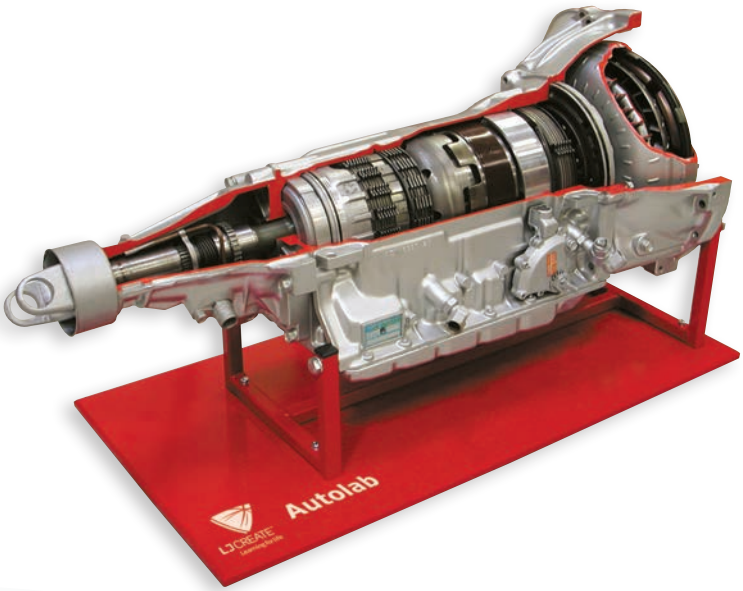
This trainer provides the instructor with a complete manual gearbox for group or whole-class demonstration, mounted on a steel plate for use on a workshop bench or classroom desk.

The gearbox is operated by hand and is sectioned so that all moving components can be seen and the way they interact can be observed.

Order as:

- 774-01 Sectioned Manual Gearbox Trainer

Sectioned Automatic Gearbox Trainer (775-01)



This trainer provides the instructor with a complete automatic gearbox for group or whole-class demonstration, mounted on a steel plate for use on a workshop bench or classroom desk. The gearbox is operated by hand and is sectioned so that all moving components can be seen and the way they interact can be observed.

Order as:

- 775-01 Sectioned Automatic Gearbox Trainer

Distributorless Ignition System Trainer (765-01)

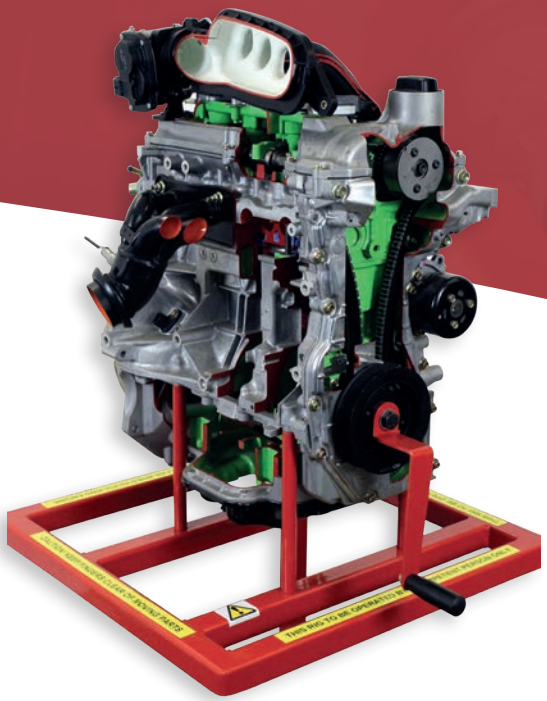
This real component trainer provides the instructor with a working distributorless ignition system for group or whole-class demonstration.

This includes all the individual components of the system presented on a steel turret so that each component can be clearly identified.

Order as:

- 765-01 Distributorless Ignition System Trainer

Sectioned 4-Cylinder Petrol Engine Trainer (772-01)



This trainer provides the instructor with a complete 4-cylinder petrol engine for group or whole-class demonstration. Mounted on a movable, heavy-duty steel frame.

The engine is operated by hand and is sectioned so that all moving parts can be seen, and the way they interact can be observed.

Order as:

- 772-01 Sectioned 4-Cylinder Petrol Engine Trainer

Sectioned Diesel Engine (Common Rail) Trainer (773-01)

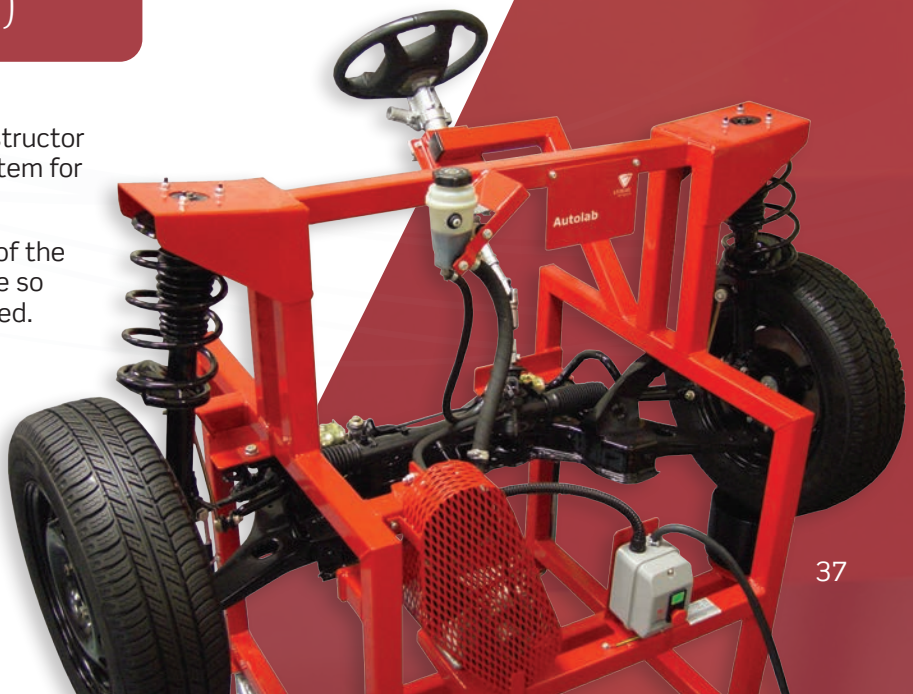
This trainer provides the instructor with a complete 4-cylinder diesel engine for group or whole-class demonstration, mounted on a movable, heavy-duty steel frame.

The engine is operated by hand and is sectioned so that all moving parts can be seen and the way they interact can be observed.

Order as:

- 773-01 Sectioned Diesel Engine (Common Rail) Trainer

Steering and Suspension System Trainer (764-01)



This real component trainer provides the instructor with a working steering and suspension system for group or whole-class demonstration.

This includes all the individual components of the system presented on a movable, steel frame so that each component can be clearly identified.

Order as:

- 764-01 Steering and Suspension System Trainer

Heavy Vehicle Repair Trainers
Hardware

4-Cylinder HGV Diesel Engine (Common Rail) Trainer (776-01)

This trainer provides the instructor with a complete working 4-cylinder HGV diesel engine with a Bosch EDC engine management system and high-pressure common rail fuel injection system. The trainer is mounted on a moveable, heavy-duty steel frame.

Trainer enables demonstration of the following:

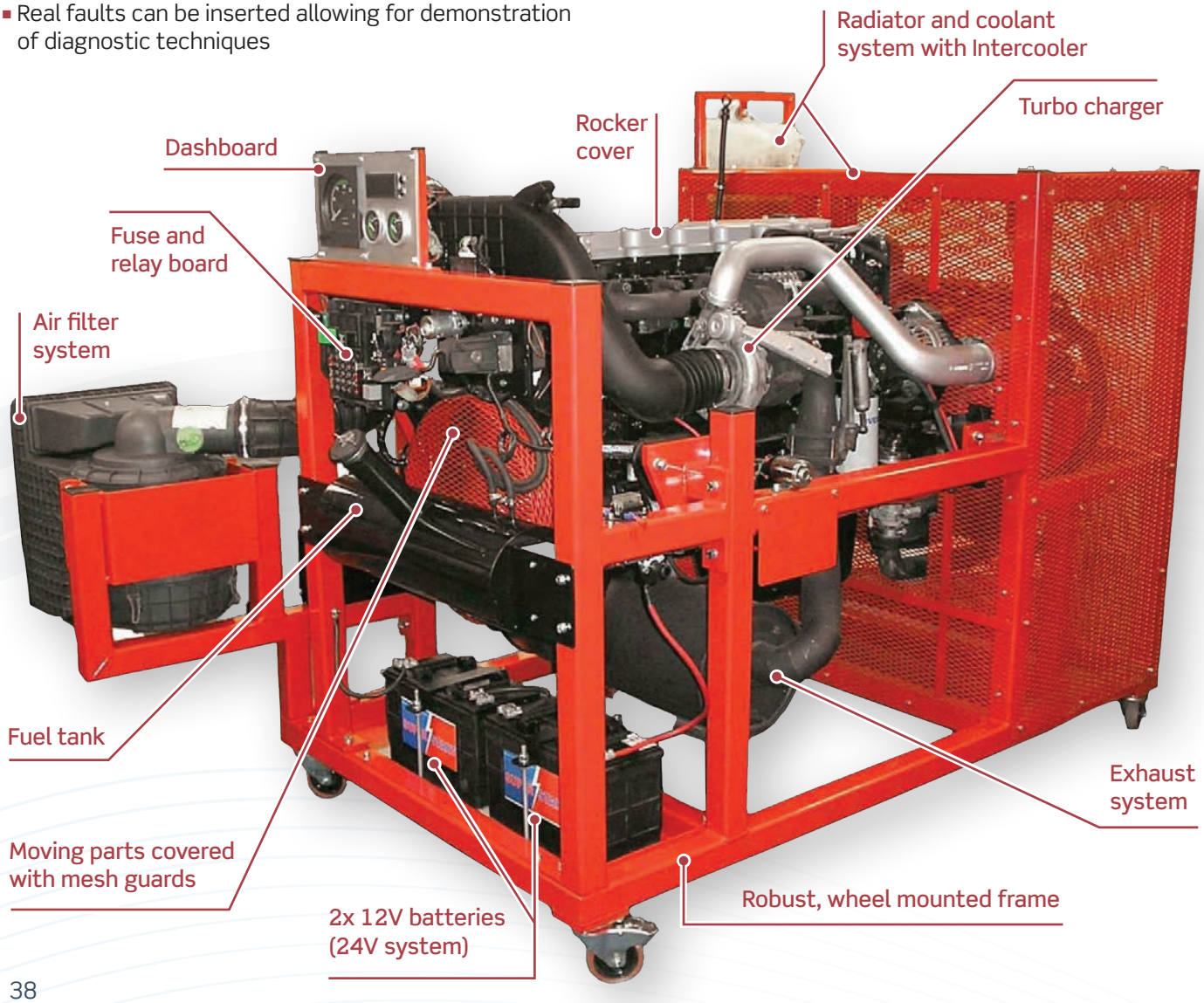
- The position and mounting of all engine components
- Engine management system fundamentals
- Sensor and actuator components
- Real faults can be inserted allowing for demonstration of diagnostic techniques

Order as:

- 776-01 4-Cylinder HGV Diesel Engine (Common Rail) Trainer

Also available:

- 776-01/6C 6-Cylinder HGV Diesel Engine (Common Rail) Trainer



Sectioned HGV Diesel Engine (4-Cylinder) Trainer (779-01)

This trainer provides the instructor with a fully sectioned 4-cylinder truck diesel engine for group or whole-class demonstration. The trainer is mounted on a self-contained steel frame and base plate, complete with castors.

Order as:

- 779-01 Sectioned HGV Diesel Engine (4-Cylinder) Trainer

Also available:

- 779-01/6C Sectioned HGV Diesel Engine (6-Cylinder) Trainer

Sectioned HGV Gearbox Trainer (780-01)

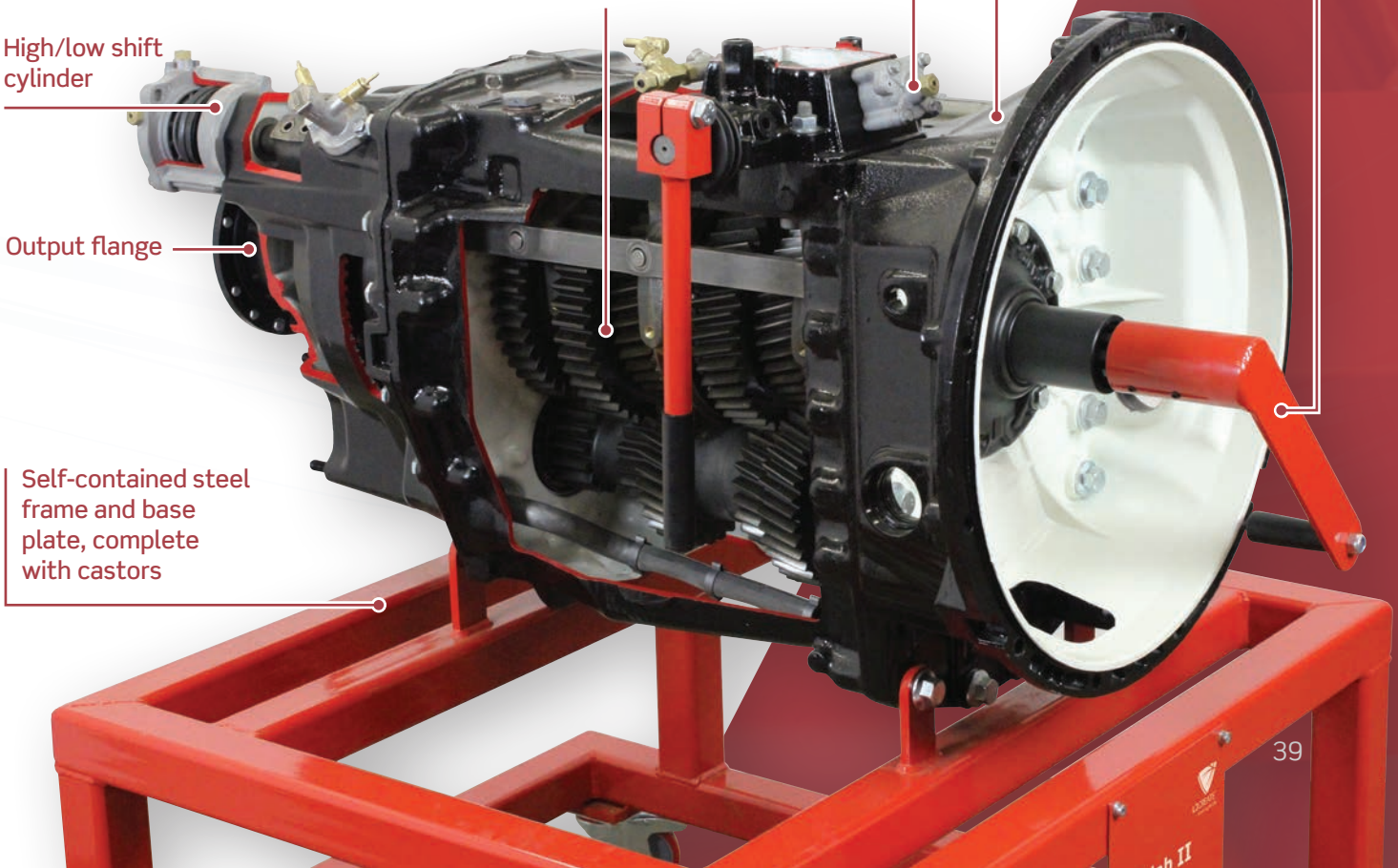
This trainer provides the instructor with a fully sectioned truck gearbox for group or whole-class demonstration. The trainer is mounted on a self-contained steel frame and base plate, complete with castors.

Order as:

- 780-01 Sectioned HGV Gearbox Trainer

Typical practical tasks and topics include:

- Identification of main gearbox mechanical components
- Operation of gearbox and reduction components
- Identification of crawler range components
- Identification of synchro hubs



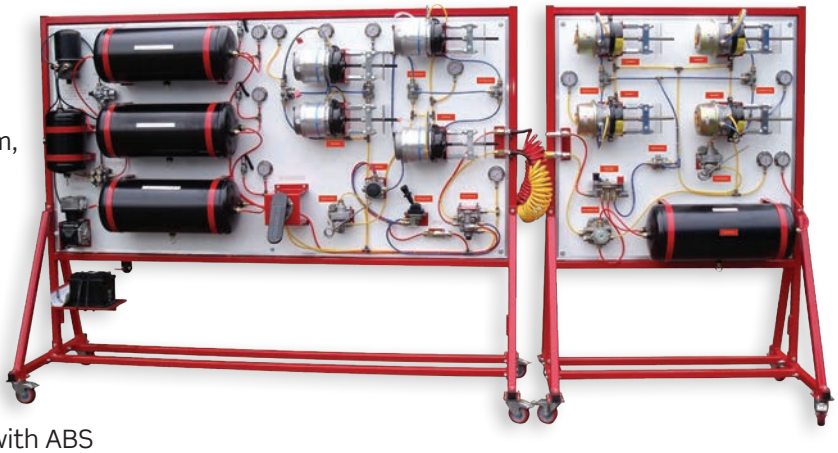
Electronic Controlled Air Suspension Trainer (777-01)

This trainer provides the instructor with a fully operational Electronically Controlled Air Suspension (ECAS) trainer, manufactured using original components. It is based on a DAF ECAS III 4x2 truck. The trainer is mounted on a self-contained steel frame and base plate, complete with castors.

Order as:

- 777-01 Electronic Controlled Air Suspension Trainer

Air Brake Tractor/Trailer System Trainer (778-01)



This comprehensive, panel-mounted system provides a fully operational 2-line air brake system, as fitted to a typical heavy vehicle tractor and trailer unit. The trainer features quick-fit connectors over the whole board.

Order as:

- 778-01 Air Brake Tractor/Trailer System Trainer

Also available:

- 778-02 Air Brake Tractor/Trailer System Trainer with ABS
- 778-03 Air Brake Tractor/Trailer System Trainer with EBS

Sectioned HGV Rear Axle (with Reduction Hubs) Trainer (781-01)

This trainer provides the instructor with a fully sectioned truck rear axle, for group or whole-class demonstration.

The trainer is mounted on a self-contained steel frame and base plate, complete with castors.

Order as:

- 781-01 Sectioned HGV Rear Axle (with Reduction Hubs) Trainer

Four Wheel Drive Sectioned Gearbox (786-01)

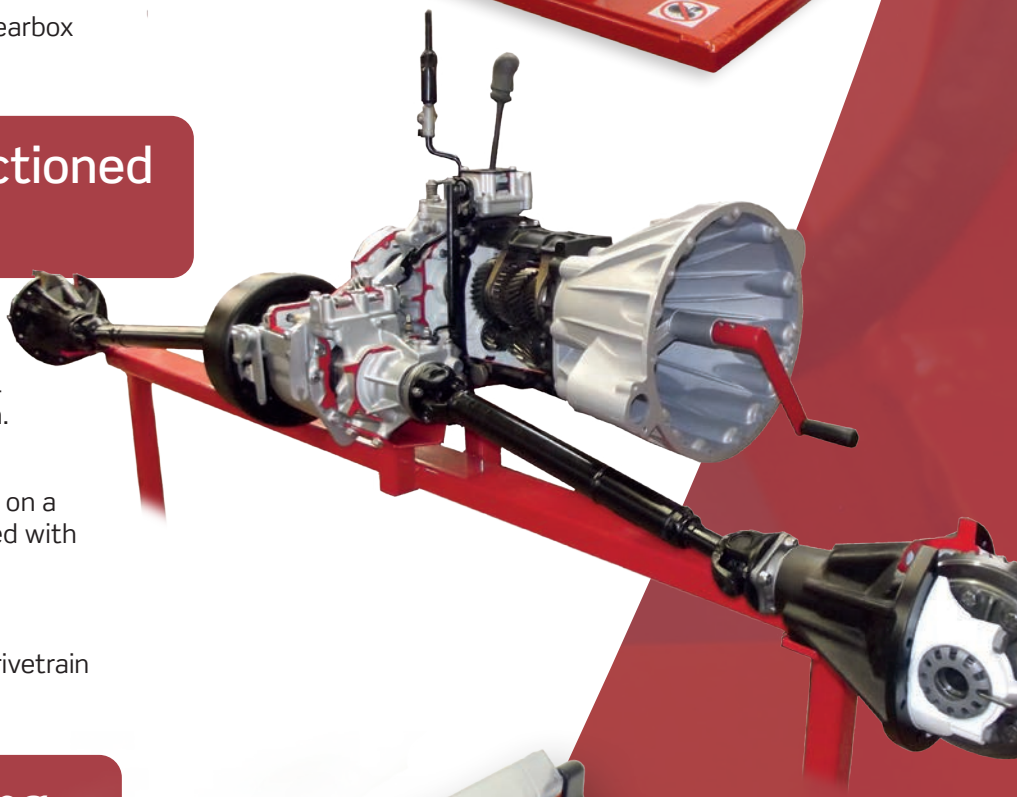
This fully sectioned trainer allows the instructor to demonstrate the internal operation of a complete 4x4 gearbox.

Designed for group or whole-class demonstration, the trainer is mounted on a self-contained steel frame that is fitted with castors for ease of movement.

Order as:

- 786-01 Four Wheel Drive Sectioned Gearbox

Four Wheel Drive Sectioned Drivetrain (786-02)



This fully sectioned trainer allows the instructor to demonstrate the internal operation of a complete 4x4 drivetrain.

Designed for group or whole-class demonstration, the trainer is mounted on a self-contained steel frame that is fitted with castors for ease of movement.

Order as:

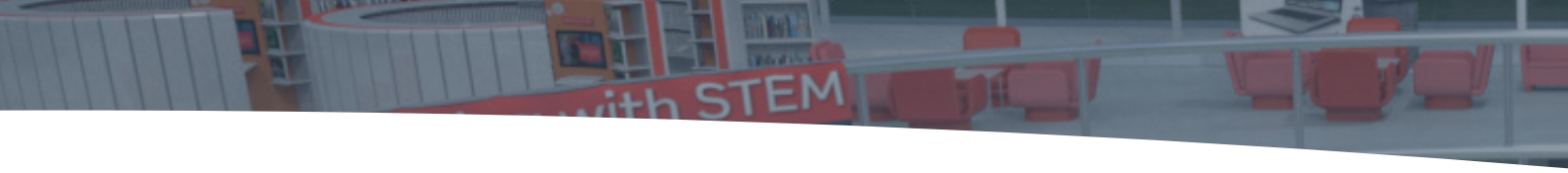
- 786-02 Four Wheel Drive Sectioned Drivetrain

Heavy Vehicle Lighting Circuits Trainer (701-03)

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:

- 701-03 Heavy Vehicle Lighting Circuits Trainer



Automotive Lessons

Over 2,000 learning units of online guided instruction

Auto Shop
(30 hours – approx.)

Shop and Personal Safety
(39 learning units)

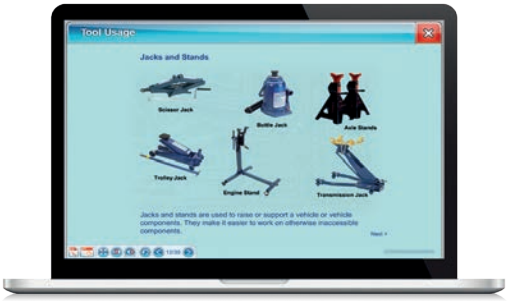
- Rules and Procedures
- Ventilation Procedures
- Fire Safety Equipment
- Fire Fighting
- First Aid
- Personal Protective Equipment
- SRS, EBS, and Hybrid High Voltage Systems
- High Voltage Circuits
- Material Safety Data Sheets

Tools and Equipment
(24 learning units)

- Tools and Test Equipment
- Tool Usage
- Standard and Metric Designation
- Handling Tools and Equipment (Workshop)
- Lifting Equipment
- Measuring with a Calliper, Micrometer, or Dial Gauge (Workshop)
- Tool Cleaning, Storage, and Maintenance (Workshop)

Preparing Vehicle for Service and Return
(22 learning units)

- Repair Orders
- The Three Cs (Concern, Cause, and Correction) (Workshop)
- Vehicle Service History
- Logical Fault Diagnosis
- Vehicle Preparation



Engine Repair
(50 hours – approx.)

Engine Fundamentals
(36 learning units)

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

Cylinder Head and Valve Trains
(15 learning units)

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

Engine Block (24 learning units)

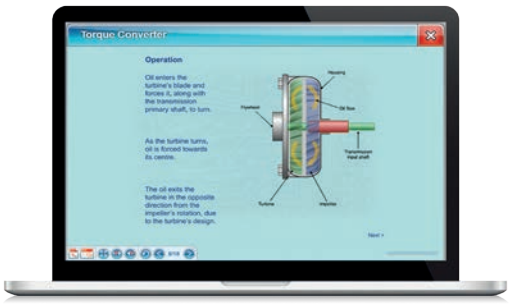
- Components of the Bottom End
- Bottom End Component Identification (Auto Rig)
- CI Engine Size (Rig)
- Crankshaft and Piston Operation (Rig)

Engine Servicing (33 learning units)

- 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
(24 learning units)

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



Automatic Transmission and Transaxle (15 hours – approx.)

Transmission System Fundamentals
(25 learning units)

- Introduction to Automatic Transmissions
- Automatic Transmission Operation (Auto Rig)
- Automatic Transmission Components
- Torque Converter (Auto Rig)
- Planetary Gears, Clutches, and Bands
- Electrical and Electronic Controls

Final Drives (12 learning units)

- Drivetrain and Driveline
- Locating Driveline Components (Workshop)

Automatic Transmission Servicing
(3 learning units)

- Automatic Transmission Diagnostic Checks (Workshop)

Manual Drivetrain and Axles
(30 hours – approx.)

Manual Transmission System Fundamentals
(12 learning units)

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

Manual Transmission Components and Operation (36 learning units)

- Manual Transmission Construction (Auto Rig)
- Transmission Operation (Auto Rig)
- Clutch Construction and Operation
- Gears and Speed

- Manual Transaxles
- Differential (Rig)
- Front Wheel Drive Shafts
- Selector Lever and Selector Forks (Rig)
- Rear Wheel Drive Shafts

Manual Transmission and Driveline Servicing (15 learning units)

- Clutch Removal, Inspection, and Refitting
- Drive Shaft Servicing Procedures (Workshop)
- Inspecting FWD Shafts and Joints (Workshop)
- Inspecting the Complete Transmission System of a Vehicle (Workshop)

Suspension (30 hours – approx.)

Suspension System Fundamentals (9 learning units)

- Suspension Systems 1
- Geometry Fundamentals

Suspension Components and Operation (18 learning units)

- Control Arms
- Springs and Shock Absorbers
- Coil Springs, Torsion Bars, and MacPherson Struts
- Leaf and Rubber Springs

Inspection and Repair (32 learning units)

- Geometry Adjustments
- Remove, Inspect and Install Ball Joints on Suspension Systems (Workshop)
- Removal, Inspection and Installation of Coils Springs and Insulators (Workshop)
- How to Check Shock Absorbers for Leaks (Auto Rig)
- MacPherson Strut Removal, Inspection, and Re-installation Procedures (Workshop)
- Remove, Inspect, Install and Adjust Torsion Bars (Workshop)

Steering (45 hours – approx.)

Steering System Components and Operation (26 learning units)

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

Inspection and Repair (25 learning units)

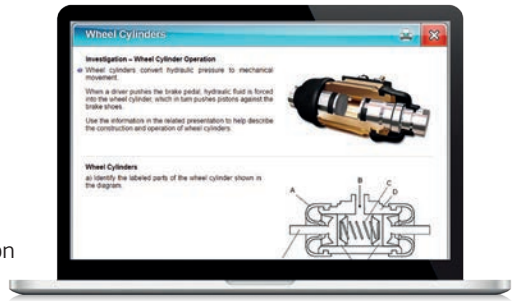
- Adjusting Wheel Height (Auto Rig)
- Steering Column Inspection (Auto Rig)
- Steering Column Inspection (Workshop)
- Flushing and Bleeding the Power Steering System (Auto Rig)
- Remove and Inspect Conventional Steering Components (Workshop)
- Steering Knuckle Removal and Inspection (Auto Rig)

Wheels and Tires (32 learning units)

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

Wheel and Tire Servicing (42 learning units)

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



Braking Systems (35 hours – approx.)

Brake System Fundamentals (9 learning units)

- Brake Systems
- Friction

Hydraulic Control (18 learning units)

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

Anti-Lock Braking Systems (62 learning units)

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

Advanced Brake Systems (12 learning units)

- Stability Control Systems
- Diagnosing Faults in ESP Systems

Brake System Components (20 hours – approx.)

Brake System Fundamentals (3 learning units)

- Introduction to Brake Systems

Drum Brakes (12 learning units)

- Brake Drums and Shoes
- Wheel Cylinders

Power Assistance (6 learning units)

- Vacuum Brake Boosters
- Hydraulic Brake Boosters

Disc Brakes (12 learning units)

- Brake Rotors and Callipers
- Integral Calliper Parking Brake

Hydraulic Control (18 learning units)

- Hydraulics
- The Master Cylinder
- Brake Lines and Hoses
- Brake Fluid

Brake servicing (35 hours – approx.)

Brake System Fundamentals (6 learning units)

- Braking Forces
- Braking Calculations

Drum Brake System Servicing (14 learning units)

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

Disc Brake System Servicing (19 learning units)

- Brake Calliper Inspection (Auto Rig)
- Brake Pad and Rotor Replacement (Auto Rig)
- Measuring Brake Rotors (Auto Rig)
- Brake Pad Wear Indicator Inspection
- Machining a Rotor (Workshop)

Brake Line Servicing (6 learning units)

- Fabricating Brake Lines (Workshop)

Brake System Servicing (39 learning units)

- Brake Pedal Height
- Bleed Brake System (Manual Bleed) (Workshop)
- Parking Brake Cable Replacement (Auto Rig)
- Master Cylinder Inspection (Workshop)
- Vacuum Leak Testing Procedure (Workshop)
- Vacuum Supply Testing Procedure (Workshop)
- Testing the Anti-lock Braking System (Workshop)
- Troubleshooting a Braking System (Workshop)
- Testing the Brake Lamp Switch Circuit (Workshop)
- Test Brake Light Switch (Workshop)

Automotive Electrical Fundamentals (35 hours - approx.)

Electrical Fundamentals (72 learning units)

- Controlling and Protecting Simple Circuits
- Simple Battery, Lamp, Switch and Fuse Circuit (Board)
- Common Ground Circuits and Wiring Diagrams
- DC and AC Current
- Current Flow in a Simple Circuit (Board)
- Continuity and Circuit Faults
- Two-Position Changeover Switches (Board)
- Resistance and Ohm's Law
- Ohm's Law (Board)
- Electrical Circuits
- Electromagnetic Principles
- Electrical Safety and Circuit Checks
- Introduction to Wiring Diagrams
- Transistors
- Relays
- Signal Processing
- Sensors

Electrical Supply (15 learning units)

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

Electrical Measurement (26 learning units)

- Electrical Test Equipment
- Reading Wiring Diagrams
- Calculating and Adjusting Permitted Voltage Drop
- Electrical Circuit Testing (workshop)
- Symbols, Device Markings and Terminal Block Designations

Starting and Charging (25 hours - approx.)

Charging System Fundamentals (15 learning units)

- Charging Principles
- Charging Systems
- Alternator Construction

Charging System Inspection and Test (24 learning units)

- Alternator Output Tests
- Alternator Output Tests (Workshop)
- Alternator Output Waveforms (Board)
- Charging System Fault Diagnosis
- Alternator Fault Investigation (Board)
- Alternator Service Procedure (Workshop)
- Replacing an Alternator and Drive Belt (Workshop)

Starting System Fundamentals (10 learning units)

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

Starting System Inspection and Test (19 learning units)

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

Automotive Lighting (50 hours - approx.)

Lighting Circuit Fundamentals (29 learning units)

- Types of Light Sources
- Lighting Systems
- Lighting Systems (Panel)
- Series Lamp Circuits
- Non-Identical Lamps in Series (Board)
- Parallel Lamp Circuits
- Identical Lamps in Parallel (Board)
- Power in a Simple Lamp Circuit (Board)

Headlight Circuits (28 learning units)

- Headlamps
- Headlights (Panel)
- Low and High Beam Circuits (Board)
- Headlamp Flash Circuit
- Four-Pin Relay Headlamp Circuit (Board)
- Relay and Spot Lamp Circuit (Board)
- Automatic Lighting

Park and Tail Light Circuits (15 learning units)

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

Stop and Backup Light Circuits (9 learning units)

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

Turn Signal Circuits (10 learning units)

- Turn Signal Systems
- Turn Signal Circuit (Board)

Hazard Warning Lighting Circuit (5 learning units)

- Hazard Warning Lamps

Internal Lighting Circuits (7 learning units)

- Internal Lighting
- Internal Lamp Circuit Investigation (Panel)

Lighting Circuit Fault Diagnosis (64 learning units)

- Introduction to Fault-Finding
- Lighting Fault Diagnosis
- Fault-Finding Example (Board)
- Lighting Circuit Fault Investigation (Board)
- Lighting Circuit Fault Investigation (Panel)
- Headlamp Lighting Faults (Board)
- Three Pin Relay Headlamp Circuit Fault (Board)
- Four Pin Relay Headlamp Circuit Problem Solving (Board)
- Park, Tail, and Headlamp Circuit Problem Solving (Board)
- Backup Lamp Circuit Fault (Board)
- Hazard Warning Circuit Fault (Board)
- Interior Lamp Circuit Fault (Board)

Automotive Transducers
(15 hours – approx.)

Transducer Circuits and Components
(29 learning units)

- Engine Coolant Temperature Sensor
- Mass Airflow Sensor
- Air Flow Sensor (Board)
- Intake Air Temperature Sensor
- Throttle Position Sensor
- Oxygen Sensor (Panel)
- Crankshaft Position Sensor
- Vehicle Speed Sensor (Panel)
- Performing a Gauge Circuit Test (Workshop)

Transducer Fault Diagnosis
(16 learning units)

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

Ignition Systems
(35 hours – approx.)

Ignition System Fundamentals
(18 learning units)

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

Distributor Electronic Ignition Systems
(8 learning units)

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

Distributorless Electronic Ignition Systems
(18 learning units)

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

Ignition System Servicing (27 learning units)

- Ignition Secondary Circuit Inspection (Workshop)
- Inspection and Testing of an Ignition Coil (Workshop)
- Distributor Testing (Workshop)
- The Magnetic Pulse Generating Pickup (Workshop)
- The Ignition Control Module (ICM) (Workshop)
- Ignition Timing Check and Adjustment (Workshop)

Ignition System Diagnosis (24 learning units)

- 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
(35 hours – approx.)

Engine Management System Fundamentals
(29 learning units)

- Engine Management System Fundamentals (Rig)
- Electronic Control Unit
- Decision Making Processes (Board)
- Fuel Injection System Decisions (Panel)
- Ignition System Decisions (Panel)
- On Board Diagnostics Two (OBDII) Systems
- Starting Management, Control, and Regulation
- Air Management in a Diesel Engine

Sensors and Actuators (20 learning units)

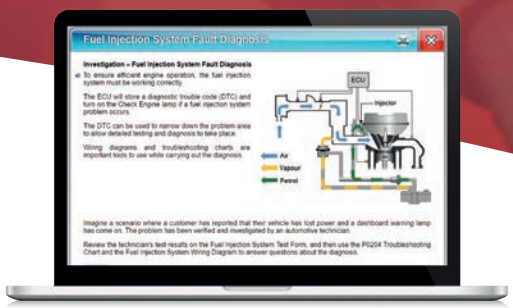
- Sensors and Actuators
- Sensor Components (Rig)
- Engine Sensor Fault Diagnosis
- Engine Coolant Temperature (Panel)
- Actuator Components (Rig)

Engine Inspection (28 learning units)

- Thermostatic Air Cleaner Inspection and Test (Workshop)
- Retrieval and Clearing of OBD Trouble Codes (Workshop)
- The Engine Coolant Temperature (ECT) Sensor (Workshop)
- The Throttle Position Sensor (TPS) (Workshop)
- The Digital EGR Valve (Workshop)
- Thermostat Servicing (Workshop)

Engine Management Fault Investigation
(34 learning units)

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



Fuel and Emissions
(60 hours – approx.)

Fuel Components and Operation
(48 learning units)

- Electronic Multipoint Fuel Injection Systems
- Fuel Injector Pulse Timing (Board)
- Electric Fuel Pump (Panel)
- Pressurized Fuel Systems (Rig)
- Fuel Injector Pulse Width (Rig)
- EFI Fuel Injector Pulse Timing (Rig)
- EFI Pressurized Fuel Systems (Rig)

Air Induction Components and Operation
(9 learning units)

- Air Management
- Sensor Circuits and Components (Rig)

Emission Control Systems
(13 learning units)

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

Fuel and Emissions System Servicing
(62 learning units)

- Fuel System Inspection (Workshop)
- Idle Speed and Fuel Mixture Adjustment (Workshop)
- Inspecting and Draining a Fuel System (Workshop)
- Fuel Filter Inspection (Workshop)
- Fuel Pump Inspection & Pressure Testing (Workshop)
- Throttle Body Servicing (Workshop)
- Turbocharger System - Inspection and Testing (Workshop)
- Fuel Trim and Exhaust Emissions Monitoring (Workshop)
- Exhaust Gas Analyser (Workshop)
- EFI Demonstrator Fault Diagnosis (Rig)

Diesel Engine Management
(12 learning units)

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

Electric and Hybrid Vehicle Technology (40 hours – approx.)

Electric Vehicles (21 learning units)

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

High Voltage Electric Vehicles (40 learning units)

- Principles of NiMH Batteries
- Lithium-ion Batteries
- Safety with Batteries
- High Voltage Wiring and Connectors
- Voltage Converters
- The Rotating Magnetic Field
- Safety in High Voltage Vehicles
- Legal Regulations
- Special Equipment for High Voltage Testing and Repair
- Classification of Hybrid Vehicles

Hybrid and Electric Vehicle Systems (62 learning units)

- Fuel and Emissions
- Series Parallel Systems and Components
- Practical Series Parallel Hybrid Systems
- Plug-in Electric Vehicles
- Plug-in Hybrid Vehicles
- The High Voltage System
- The Low Voltage System
- Hybrid Electric Motors
- Hybrid Engines
- Electronic Circuits and Modules
- Cables, Connectors and Protection Devices
- Introduction to Electrical Storage Devices
- Battery Packs
- Disabling the High Voltage System

Automotive Network Systems (10 hours – approx.)

Networked Systems Structure (9 learning units)

- CAN, LIN and MOST Data Buses

Networked Systems Data (21 learning units)

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

Troubleshooting Electrical Systems (70 hours – approx.)

Lighting Systems Operation (37 learning units)

- CAN Bus Lighting Systems (Board)
- CAN Bus Park, Tail, and Headlight Systems
- CAN Bus Turn Signal and Hazard Warning Systems (Board)
- CAN Bus Stop and Backup Light Systems
- The Lighting Systems' CAN Bus (Board)

Lighting Systems Measurement (17 learning units)

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

Lighting Systems Diagnosis (23 learning units)

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

Auxiliary Systems Operation (30 learning units)

- Auxiliary CAN Bus Systems
- CAN Bus Window, Mirror, and Seat Systems (Board)
- CAN Bus Power Door Locking System
- Auxiliary CAN Bus Door Mirror Control Systems
- Auxiliary CAN Bus Safety Systems
- Auxiliary CAN Bus Security Systems

Auxiliary Systems Measurement (24 learning units)

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

Auxiliary Systems Diagnosis (26 learning units)

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

Starting and Charging Systems Operation (16 learning units)

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

Starting and Charging Systems Measurement (18 learning units)

- CAN Data Bus Measurement
- CAN Bus Starting and Charging Systems Measurement
- Automatic Stop-Start System Measurement (Board)
- CAN Bus Power Consumers Measurement (Board)

Starting and Charging Systems Diagnosis (19 learning units)

- CAN Bus Starting and Charging Faults

Automotive Heating and Air Conditioning (30 hours – approx.)

Heating and Air Conditioning Fundamentals (14 learning units)

- Air Conditioning Systems
- Air Conditioning Trainer Operation (Auto Rig)
- Refrigerant Leak Detection (Panel)

HVAC Components and Operation (31 learning units)

- Lines and Hoses
- Condensers and Compressors
- Air Distribution Control System Investigation (Panel)
- Air Distribution Control System Troubleshooting (Panel)
- A/C Electrical System Fault Investigation (Panel)
- Blower Motor Fault Investigation (Panel)
- Compressor Fault Investigation (Panel)
- Climate Control System Operation (Rig)

HVAC Servicing (50 learning units)

- Discharging and Recharging an A/C System (Panel)
- A/C System Troubleshooting (Panel)
- Air Conditioning System Performance Test (Auto Rig)
- Inspection and Testing of Airflow Components (Workshop)
- Cooling System Inspection (Workshop)
- Control Head and Component Servicing (Workshop)
- Removing and Replacing the A/C Compressor (Workshop)
- Servicing the FOT and TXV (Workshop)
- A/C Compressor Clutch Removal (Workshop)
- FOTCC System Troubleshooting (Panel)

Passenger Safety Systems
(10 hours – approx.)

SRS Components and Operation
(9 learning units)

- Airbag Safety
- Introduction to SRS (Rig)
- Seat Belts (Rig)

SRS Inspection and Diagnosis
(16 learning units)

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

Heavy Vehicle Systems
(60 hours – approx.)

CI Engine Components (10 learning units)

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

Engine Management System Fundamentals
(10 learning units)

- Electronic Control Module
- Cruise Control

Gearbox Components and Operation
(8 learning units)

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

Electronic Controlled Air Suspension
(30 learning units)

- Electronically Controlled Air Suspension (Rig)
- Electro-pneumatics (Rig)
- Solenoid Valve Unit (Rig)
- Height Sensor (Rig)
- Remote Control Unit (Rig)
- Electronic Controlled Air Suspension Fault Diagnosis (Rig)

Lighting Systems (24 learning units)

- Park, Tail, and Headlamp Circuits 1
- Turn Signal Systems
- Stop and Backup Lamps
- HGV Turn Signal and Hazard Warning Lights
- HGV Brake and Backup Lights
- HGV Auxiliary Lighting

Auxiliary Electrical Systems
(16 learning units)

- Battery and Fuses
- Horn and Relays
- HGV Windshield Wiper System

Starting and Charging (19 learning units)

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

Sensors (62 learning units)

- Engine Protection
- Manifold Air Temperature Sensor
- Oil Pressure Sensor
- Turbo Boost Pressure Sensor
- Engine Management Active Sensors
- Engine Management Digital Sensors and Switches
- Engine Management Active Sensors
- Engine Management Actuators

Diesel Engine Management
(17 learning units)

- Fuel Injection
- Injector Timing
- Engine Exhaust Emissions

Complete Vehicle Systems – Land Cruiser (25 hours – approx.)

Land Cruiser Systems (18 learning units)

- Land Cruiser Driveline Investigation (Rig)
- Brake System Inspection (Rig)
- Ride Height Measurement (Rig)
- Winch Systems

Land Cruiser Fuel Injection (6 learning units)

- Land Cruiser Fuel Injector Pulse Timing (Rig)

Land Cruiser Faults (20 learning units)

- Land Cruiser Fault Diagnosis (Rig)

Engine Dynamometers
(50 hours – approx.)

Engine Dynamometer Measurements
(31 learning units)

- Introduction to Dynamometers
- Measuring Air Flow with Variable RPM (Rig)
- Measuring Cylinder Pressure with Variable RPM (Rig)
- Measuring Fuel Use with Variable RPM (Rig)
- Measuring Oil Pressure with Variable RPM (Rig)
- Measuring the Effect of Load on Torque (Rig)
- Measuring Torque with Variable RPM (Rig)
- Calculating Power with Variable RPM (CI Engine) (Rig)
- Calculating Power with Variable RPM (SI Engine) (Rig)

Dynamometer Software Analysis
(15 learning units)

- Introduction to Dynamometer Software
- Analysing Air Flow with Variable RPM
- Analysing Torque with Variable RPM
- Analysing Power with Variable RPM

Innovative learning spaces for:

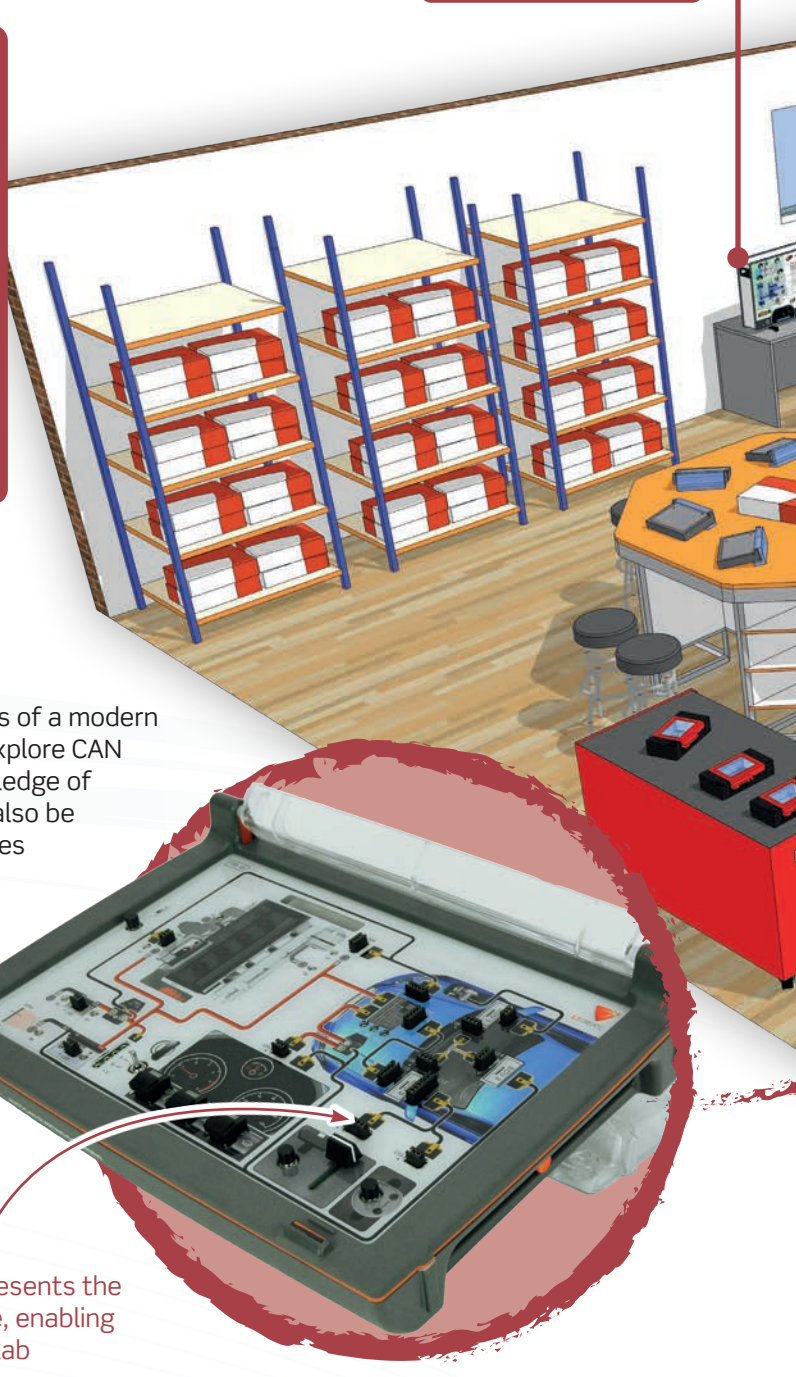
Automotive Diagnostics

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



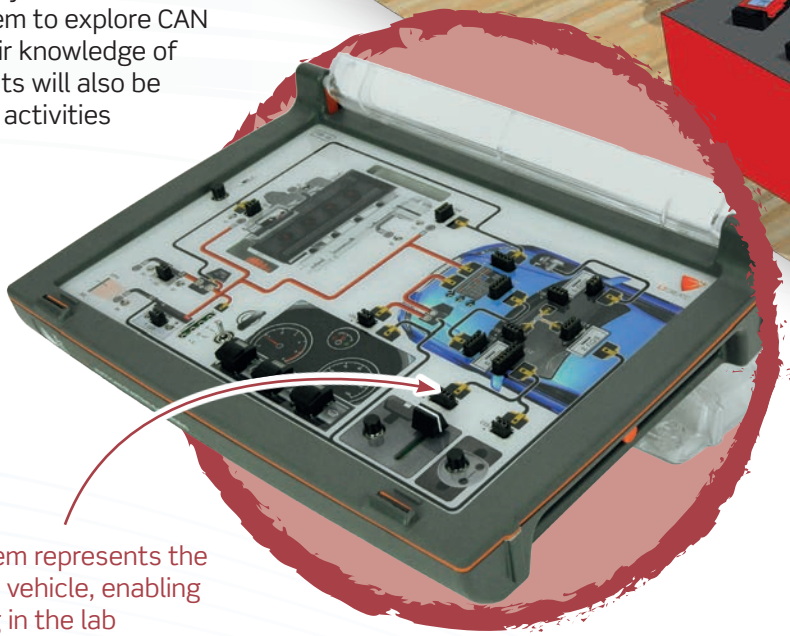
Learn real-world fault-finding skills in a classroom environment

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:

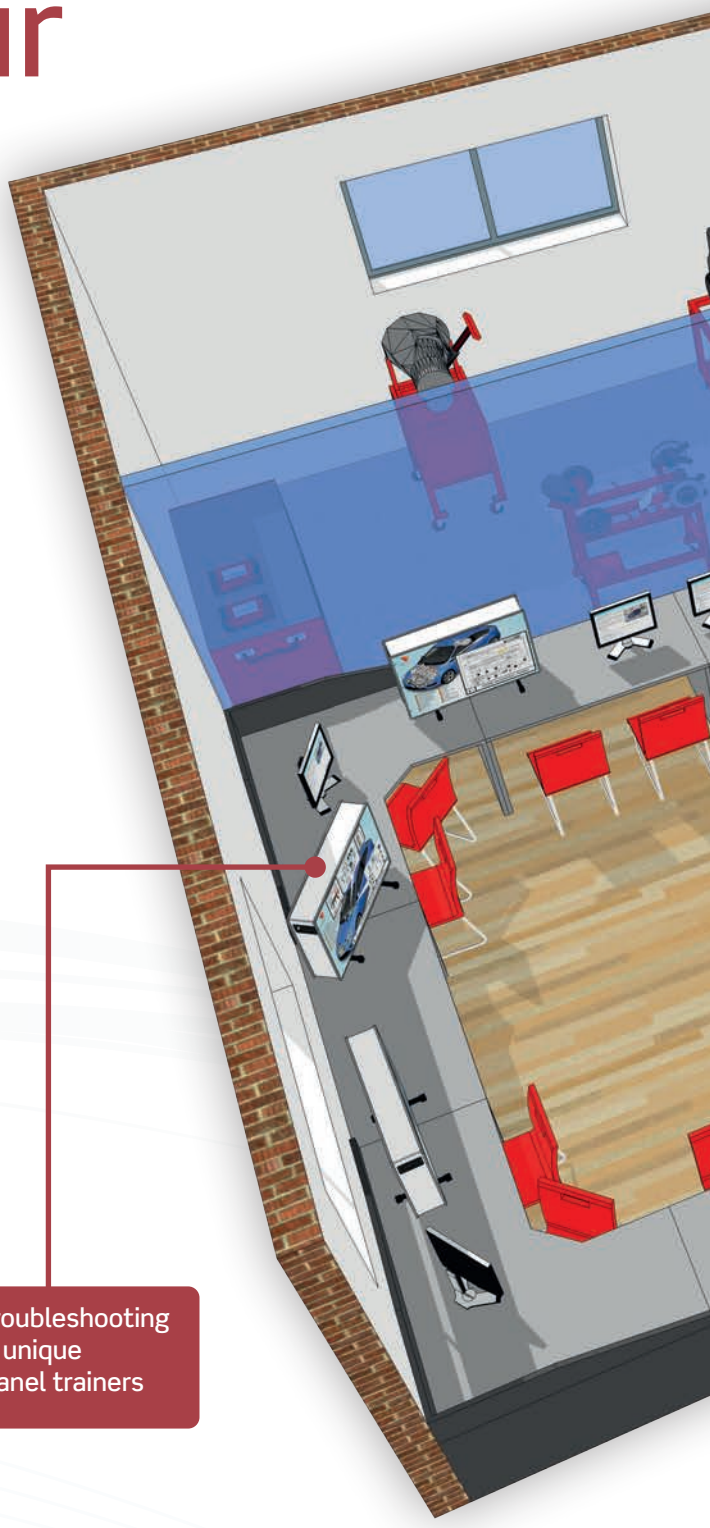
Light or Heavy Duty Vehicle Repair

The modern automobile is a complex collection of electronic and mechanical systems.

This laboratory is designed to limit the amount of text-based learning that future automotive technicians complete and replaces it with interactive experiences and skills practice across all the vehicle systems including engines, braking, steering and suspension, air conditioning and transmission systems.

This typical Light or Heavy Duty Vehicle Repair Lab configuration includes the following:

- Ignition and Charging Systems Panel
- Distributorless Ignition System Trainer
- Displays and Accessories Panel
- Engine Management Panel
- Sectioned Petrol Engine
- Sectioned Diesel Engine
- Sectioned Manual Gearbox
- Air Conditioning Panel
- Air Conditioning Trainer
- ABS Braking Panel
- Braking Systems Trainer
- Steering and Suspension Trainer



Practice troubleshooting skills with unique desktop panel trainers

Work on real vehicle system trainer rigs in the workshop area

IN FOCUS:
ABS 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.

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

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