

The Locktronics automotive range has been designed to meet the Automotive training requirements of both industry and education. The range is split into three levels for basic, intermediate and advanced students. The Locktronics approach is ideal for automotive technicians who gain a good understanding of components, circuits and circuit fault finding through the process of building Locktronics.



Locktronics automotive customers

Locktronics automotive equipment and curriculum is used by colleges, vocational schools, independent automotive training companies and some of the World's leading automotive companies including:



Level 1

At Level 1, the Electricity, magnetism and materials solution allows you to teach students how basic electrical components and circuits work.



Level 2

At Level 2 three solutions on AC principles, motors and generators and digital electronics builds on students' understanding of electricity, electrical circuits and electrical systems.



Level 3

At Level 3 the Sense and Control, the CAN bus systems solution and the Hybrid demonstration system give students experience and understanding of how Electronic Control Unit based systems in modern vehicles operate.





Suitable for IMI and City and Guilds level 1 courses.

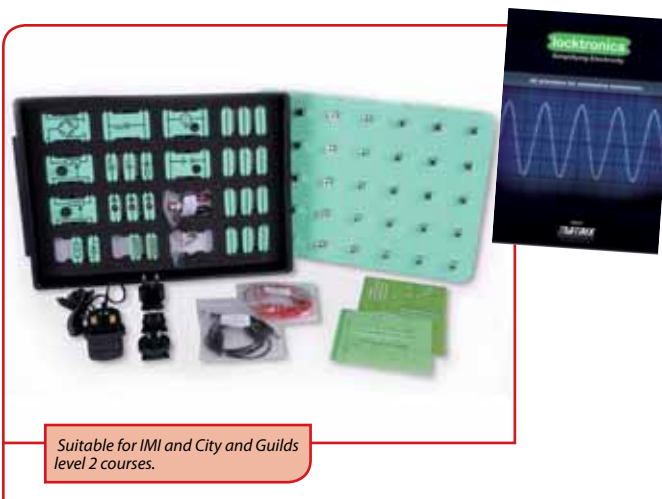
Electricity, magnetism and materials V2

This kit provides a comprehensive range of practical assignments in electricity and magnetism and is ideal for those who are studying science and electricity within a wide variety of academic or vocational courses. The kit is supplied with a comprehensive set of worksheets that cover the electrical properties of materials, and introduce students to electricity.

Learning objectives / experiments

- Electrical properties of materials
- Simple circuits
- Heat and magnetism
- Basic circuit symbols
- Current flow
- Series and parallel circuits
- Patterns of voltage and current
- Electrical sensors
- Relays and electromagnets

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack		
Components included			
1	Switch, push to make, metal strip	1	400 Turn coil carrier
1	Power supply	1	Thermistor, 4.7k, NTC (DIN)
1	Resistor, 12 ohm, 1W, 5% (DIN)	1	LED, red, 12V (SB)
1	Motor, 6V, open frame	1	Voltmeter, 0V to 15V
1	Phototransistor	1	Relay, reed, normally open
2	Resistor, 1k, 1/4W, 5% (DIN)	1	Pair of leads, red and black, 600mm, 4mm to croc clip
1	Resistor, 10k, 1/4W, 5% (DIN)	1	Power supply carrier with battery symbol
1	Potentiometer, 10k (DIN)	1	Fuse/universal component carrier
1	Diode, power, 1A, 50V	1	Buzzer, 12V, 15mA
9	Connecting Link	1	Switch, on/off, metal strip
3	Lampholder, MES	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	7 x 5 metric baseboard with 4mm pillars	1	EMM V2 Accessories pack
1	Ammeter, 0A to 1A	1	Resistor, 50K, 1/4W, 5%
Ordering information		DIN	ANSI
Electricity, magnetism and materials solution with storage, baseboard and power supply.		LK9071-2	LK9071-2A
Corresponding curriculum		LK7325 & LK7326	



Suitable for IMI and City and Guilds level 2 courses.

AC principles for automotive technicians

This course provides an introduction to AC electrical principles that underpin many automotive units. A comprehensive set of curriculum worksheets and supporting documentation deliver experiments to illuminate the theory behind much of the automotive electrical technology.

Learning objectives / experiments

- Batteries and their properties
- AC signal fundamentals
- DC equivalent, peak and RMS values
- Reactance, inductance and suppression
- Diode and zener diode behaviour
- Half and full wave rectifiers
- Battery charging systems

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack	HP8279	Picoscope
HP7894	Signal generator		
Components included			
12	Connecting Link	1	7 x 5 metric baseboard with 4mm pillars
1	Resistor, 1k, 1/4W, 5% (DIN)	2	Switch, on/off, metal strip
1	Potentiometer, 10k (DIN)	1	AC voltage source carrier
1	Potentiometer, 250 ohm (DIN)	1	Power supply carrier with battery symbol
1	Capacitor, 100uF, Electrolytic, 25V	1	Power supply
1	Capacitor, 2,200 uF, Electrolytic, 25V	2	Lead, red, 500mm, 4mm to 4mm stackable
1	Capacitor, 1 uF, Polyester	2	Lead, black, 500mm, 4mm to 4mm stackable
1	Choke, 47mH	1	Locktronics User Guide
3	MES bulb, 6V, 0.04A	1	BNC male to dual 4mm binding post
3	Lampholder, MES	1	Bridge rectifier
1	Diode, power, 1A, 50V		
Ordering information		DIN	ANSI
AC principles for automotive technicians solution including storage trays, baseboard and power supply.		LK8222	LK8222A
Corresponding curriculum		LK8392	



Suitable for IMI and City and Guilds level 2 courses.

An introduction to motors, generators and hybrid

This course investigates the electrical principles behind motors and generators and is designed to support the teaching of a range of automotive units. It is accompanied by a comprehensive set of curriculum worksheets and supporting documentation to facilitate the learning of this core topic in automotive electrical technology.

Learning objectives / experiments

- Magnetic fields, field strength and flux density
- Electromagnets
- The force on a conductor in a magnetic field (Fleming's left-hand motor rule)
- DC motor principles
- The induced current when a conductor moves inside a magnetic field (Fleming's right-hand dynamo rule)
- Investigate the factors that determine the magnitude of the induced current
- AC generator principles
- Transformer construction and operation
- Electrical energy storage

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack	HP8279	Picoscope
HP7894	Signal generator		
Components included			
1	Resistor, 1k, 1/4W, 5% (DIN)	1	Capacitor, 2,200 uF, Electrolytic, 25V
1	Power supply	1	Faraday's law kit
1	Zener diode, 4.7V	1	BNC male to dual 4mm binding post
1	Switch, push to make, metal strip	1	Pair of leads, red and black, 600mm, 4mm to croc clip
1	Bridge rectifier	1	Lead, black, 500mm, 4mm to 4mm stackable
1	Diode, power, 1A, 50V	1	Lead, red, 500mm, 4mm to 4mm stackable
1	7 x 5 metric baseboard with 4mm pillars	1	AC voltage source carrier
1	Potentiometer, 250 ohm (DIN)	1	Power supply carrier with battery symbol
1	Resistor, 270 ohm, 1/2W, 5% (DIN)	1	Lenz's law kit
1	Transformer, 2:1 turns ratio	1	Alnico Rod Magnet
1	Motor 3 to 12V DC, 0.7A	1	1:1 transformer with retractable ferrite core
1	Ammeter, 0A to 1A	1	Locktronics User Guide
1	Ammeter, 0mA to 100mA	1	400 Turn coil carrier
5	Connecting Link	1	Fleming's motor rule apparatus
Ordering information		DIN	ANSI
An introduction to motors, generators and hybrid		LK7444	LK7444A
Corresponding curriculum		LK8822	



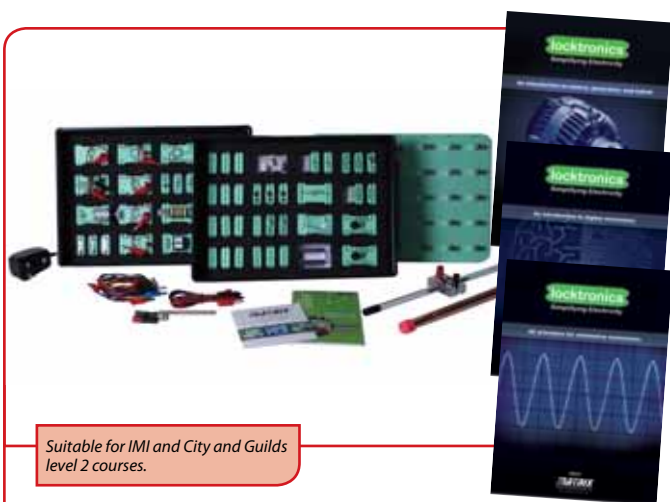
An introduction to digital electronics

This course covers the basics of digital electronics, a core topic in modern automotive electrical technology. In doing so, it supports the delivery of a range of automotive units. It focuses on the use of logic functions and shows how these can be delivered through conventional discrete gates and through programmable logic systems. It is accompanied by a comprehensive set of curriculum worksheets and supporting documentation.

Learning objectives / experiments

- Analogue and digital signals
- Binary and hexadecimal number systems
- A simple logic probe
- Truth tables for AND, OR, NOT, NAND, NOR
- NAND gates and circuits
- Microcontroller circuits and logic systems

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack		
Components included			
1	Power supply	2	LED, red, 5V (SB)
1	Locktronics User Guide	1	AND Gate with 2mm to 4mm lead - ANSI
1	USB reprogrammable PIC carrier with power lead	1	OR Gate with 2mm to 4mm lead - ANSI
1	Light dependent resistor	1	NOT Gate with 2mm to 4mm lead - ANSI
2	Resistor, 10k, 1/4W, 5% (DIN)	1	NAND Gate with 2mm to 4mm lead - ANSI
16	Connecting Link	1	NOR Gate with 2mm to 4mm lead - ANSI
1	Lead, yellow, 500mm, 4mm to 4mm stackable	1	Power supply carrier with battery symbol
1	Lead, blue, 500mm, 4mm to 4mm stackable	1	7 x 5 metric baseboard with 4mm pillars
2	Switch, on/off, metal strip		
Ordering information		DIN	ANSI
An Introduction to digital electronics.		LK4221	LK4221A
Corresponding curriculum		LK9392	



Suitable for IMI and City and Guilds level 2 courses.

Combined level 2 Automotive pack

This kit provides a comprehensive set of experiments for learning AC principles, motors, generators Hybrid basics, and an introduction to digital electronics. With a single base board, a number of trays of components and three separate workbooks with teacher's notes, this kit represents great value for money learning opportunities for level 2 automotive students.

Learning objectives / experiments

- Batteries and their properties
- AC signal fundamentals
- DC equivalent, peak and RMS values
- Reactance, inductance and suppression
- Diode, zener diodes and rectifiers
- Battery charging systems
- Magnetic fields, field strength and flux density
- Electromagnets, induction and Fleming's rule
- Motor and generator principles
- Transformer construction and operation
- Electrical energy storage
- Analogue and digital signals
- Binary and hexadecimal number systems
- AND, OR, NOT, NOR and NAND gates and circuits
- Microcontroller circuits and logic systems

Components included

The LK4500CUS includes the components necessary for delivery of learning objectives from the LK8222, LK7444 and LK4221 kits.

Instruments

To deliver this course you will also need:

LK1110	Multimeter pack	HP8279	Picoscope
HP7894	Signal generator		

Ordering information

Combined level 2 automotive pack	LK4500CUS
Corresponding curriculum	LK8822, LK9392, LK8392



Suitable for IMI and City and Guilds level 3 courses.

Sensors and control in automotive applications

This kit provides an introduction to the role of an Electric Control Unit. Students use a number of pre-written programs for the MIAC Electronic Control Unit (ECU) to enable them to construct a wide variety of Input - Process - Output circuits using sensors and actuators typically found in vehicles. A full curriculum pack is provided.

Learning objectives / experiments

- DC motors with speed control
- Stepper motors
- Temperature sensor
- Light sensor
- Potential dividers and their use
- Transistors as switches
- Use of relays
- ECU action and function
- Automotive control systems
- Sensor and actuator waveforms and signals
- Sensors and motor faults

Components included

1	Microswitch	1	Motor 3 to 12V DC, 0.7A
1	Thermistor, 4.7k, NTC (DIN)	1	USB2 high speed A to mini B lead
1	Resistor, 10 ohm, 1W 5% (DIN)	1	Locktronics User Guide
2	Resistor, 1k, 1/4W, 5% (DIN)	1	Hall effect switch
1	Capacitor, 4,700 uF, Electrolytic, 16V	1	Buzzer, 12V, 15mA
1	Potentiometer, 10k (DIN)	1	Phototransistor
1	Relay, 12V coil, 10A, normally open	1	7 x 5 metric baseboard with 4mm pillars
1	Solenoid	6	Lead, yellow, 500mm, 4mm to 4mm stackable
1	Stepper Motor	6	Lead, blue, 500mm, 4mm to 4mm stackable
1	LED, red, 12V (SB)	1	Lead, black, 500mm, 4mm to 4mm stackable
1	Transistor RHF, NPN	1	Lead, red, 500mm, 4mm to 4mm stackable
1	Automotive fuse carrier	1	Cased MIAC with Shrouded 4mm Connectors
2	Switch, on/off, metal strip	1	Small bar magnet
4	Switch, push to make, metal strip	16	Connecting Link
1	Power supply	1	MES bulb, 14V, 0.06A
1	Power supply carrier with battery symbol	1	MIAC Getting Started Guide
1	Resistor, 10k, 1/4W, 5% (DIN)	1	MES bulb, 12V, LED, white
1	Lampholder, MES	1	Resistor, 47k, 1/4W, 5%
1	Lampholder, MES, for automotive LEDs		

Ordering information

	DIN	ANSI
Sensors and control solution with baseboard, storage trays, power supply and leads.	LK9834	LK9834A
Corresponding curriculum	LK8849	



Sensors and control with Engineering panel

The LK6491 sensors and control solution includes an Engineering panel that allows you to set up a more permanent lab for automotive electrical training.

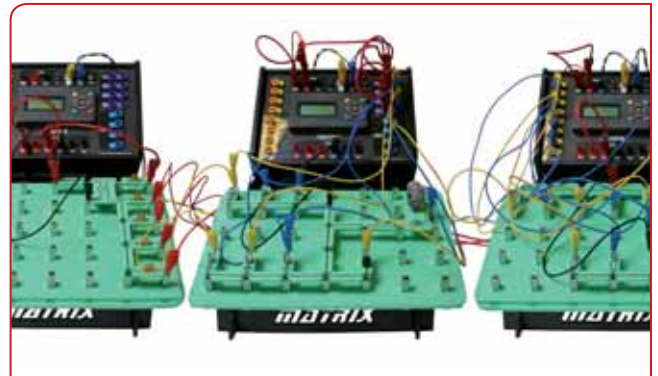
Ordering information	DIN	ANSI
Sensors and control solution on Engineering panel	LK6491	LK6491A



Suitable for IMI and City and Guilds level 3 courses

CAN bus systems and operation

This kit allows a fully functioning CAN bus system, mimicking vehicle operation, to be set up using 5 MIAC Electronic Control Units representing Instrument Panel, Front ECU, Powertrain control, Rear ECU and system diagnosis. Students can set up a fully working CAN bus system, insert faults and use scan tools to understand fault diagnosis procedures and practice. Supplied with a full curriculum pack.



Components included	
1 MIAC Getting Started Guide	1 Locktronics User Guide
5 Cased MIAC with Shrouded 4mm Connectors	53 Connecting Link
1 OBD2 to 4mm Lead	1 Lead, D-type to yellow and blue 4mm for CAN analyser
9 Lead, black, 500mm, 4mm to 4mm stackable	1 USB2 high speed A to mini B lead
19 Lead, red, 500mm, 4mm to 4mm stackable	1 USB CAN sniffer
4 Lead, red, 2000mm, 4mm to 4mm plug	6 Switch, on/off, metal strip
24 Lead, yellow, 500mm, 4mm to 4mm stackable	4 MES bulb, 12V, LED, red
24 Lead, blue, 500mm, 4mm to 4mm stackable	5 MES bulb, 12V, LED, white
13 Lampholder, MES, for automotive LEDs	4 MES bulb, 12V, LED, yellow
3 Switch, push to make, metal strip	1 Motor 3 to 12V DC, 0.7A
6 Resistor, 1k, 1/4W, 5% (DIN)	4 Potentiometer, 10k (DIN)
1 Relay, 12V coil, 10A, normally open	4 Power supply
1 Buzzer, 12V, 15mA	1 Resistor, 560 ohm, 1/4W, 5% (DIN)
5 Automotive fuse carrier	1 Zener diode, 8.2V
2 Resistor, 68 ohm 1/2W, 5% (DIN)	2 LED, red, 12V (SB)
5 7 x 5 metric baseboard with 4mm pillars	

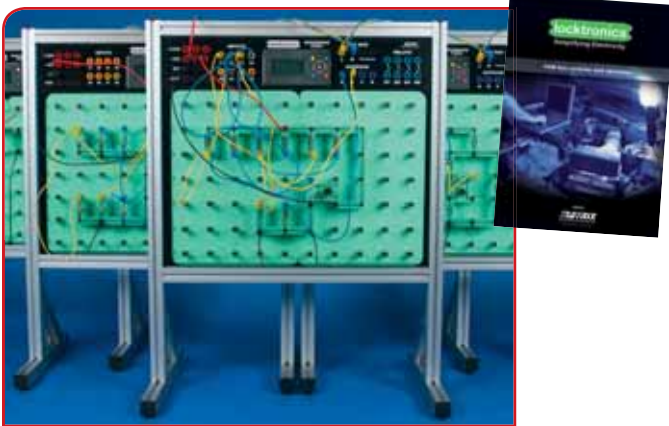
Ordering information	DIN	ANSI
CAN bus systems and operation solution with storage trays, power supply, leads and Kvaser analyser.	LK7629	LK7629A
CAN bus systems and operations solution with storage trays, power supply, leads and PICOscope 4000.	LK8391	LK8391A
Corresponding curriculum	LK9893	



CAN bus make-up kit

The LK9813 CAN bus make-up kit allows you to transform 5 sensors and control in automotive solutions into a CAN bus systems and operations solution.

Ordering information	DIN	ANSI
CAN bus make-up kit	LK9813	LK9813A



CAN bus systems and operation solution with engineering panel

The LK2839 CAN has the same learning objectives and components as the LK7629 but is based on our engineering panel which makes it more suitable for a dedicated automotive electrical training lab.

Learning objectives / experiments

- ECU action and function
- Automotive control systems
- Wiring in CAN bus systems
- CAN bus faults
- Faults in sensors and actuators

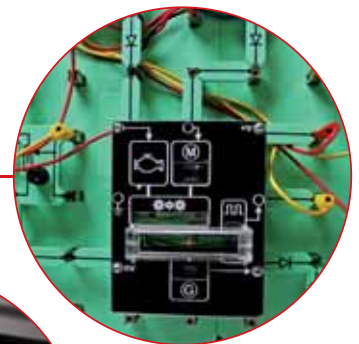


Hybrid vehicle demonstration system

This Locktronics based hybrid demonstration system uses MIAC technology to demonstrate the energy pathways in hybrid systems and shows how the engine management system makes decisions on energy usage based on the State Of Charge (SOC) of the vehicle battery.

Learning objectives / experiments

- Power modes in a series-parallel hybrid vehicle
- Regenerative braking
- Advantages of regenerative braking
- Factors affecting the acceleration of a vehicle
- Battery voltage, internal resistance, battery capacity, state of charge
- The role of the ECU in controlling the changes between power modes



Components included

1 Resistor, 1k, 1/4W, 5% (DIN)	7 Lead, red, 500mm, 4mm to 4mm stackable
1 Locktronics engineering panel	4 Lead, yellow, 500mm, 4mm to 4mm stackable
4 Diode, power, 1A, 50V	6 Lead, blue, 500mm, 4mm to 4mm stackable
1 Hybrid principles inlay (DIN)	1 Hybrid Car Motor Unit
1 Power MOSFET transistor	1 Hybrid Car Battery Unit
18 Connecting Link	1 Hybrid Car Power Output Meter
1 Potentiometer, 10k (DIN)	2 Hybrid Car Input Power Meter
4 Lead, black, 500mm, 4mm to 4mm stackable	1 Switch, push to make, metal strip

Ordering information	DIN	ANSI
Hybrid automotive principles on engineering panel	LK6483	LK6483A
Corresponding curriculum	LK4483	

Ordering information	DIN	ANSI
CAN bus systems and operation solution with the Engineering panel	LK2839	LK2839A

NEW



Suitable for unit 6 of the BTEC National:
Microcontroller systems for engineers

Microcontrollers for Automotive engineers

This solution provides a suite of equipment suitable for studying microcontroller system development in an automotive context. The solution consists of two development centres with either PICmicro or Arduino microcontroller boards. To these students can add one of our power boards, a relay board and a CAN bus board to form a basic Automotive network. Two fully functioning vehicle light clusters are included for experiments.

Learning objectives / experiments

- Microcontroller programming and circuits, clocks, pins, inputs, outputs, ports, memory and memory types, current limits
- Programming using flowcharts, Arduino or MPLAB: input, system, output, loops, decision, subroutine, go to, calculations, delays, variables, strings, A/D conversion, interrupts, hardware macros, software macros, arrays
- Techniques: Binary, Hexadecimal, ASCII, calculations Components: clocking devices, switches, LEDs, LED arrays, sensors, LCD, 7-segment displays, quad 7-segment displays, power supply, EEPROM
- Techniques: switch debounce, Schmitt trigger, prototyping with E-blocks strip board
- Automotive control using CAN bus



Our new Locktronics demonstration panels are great for classroom use



For an explanation of icons please see page 6



Ordering information	QTY	
Either: Arduino development centre with printed base plate	2	HP9769
Or: PIC development centre with printed base plate	2	HP4988
E-blocks CAN bus board	2	EB018
E-blocks relay board	2	EB038
Power supply	1	HP2666
Rear light cluster - Aspock Minipoint square 4-F. lamp, non plug-in	2	HP7478
USB lead	1	HPUSB