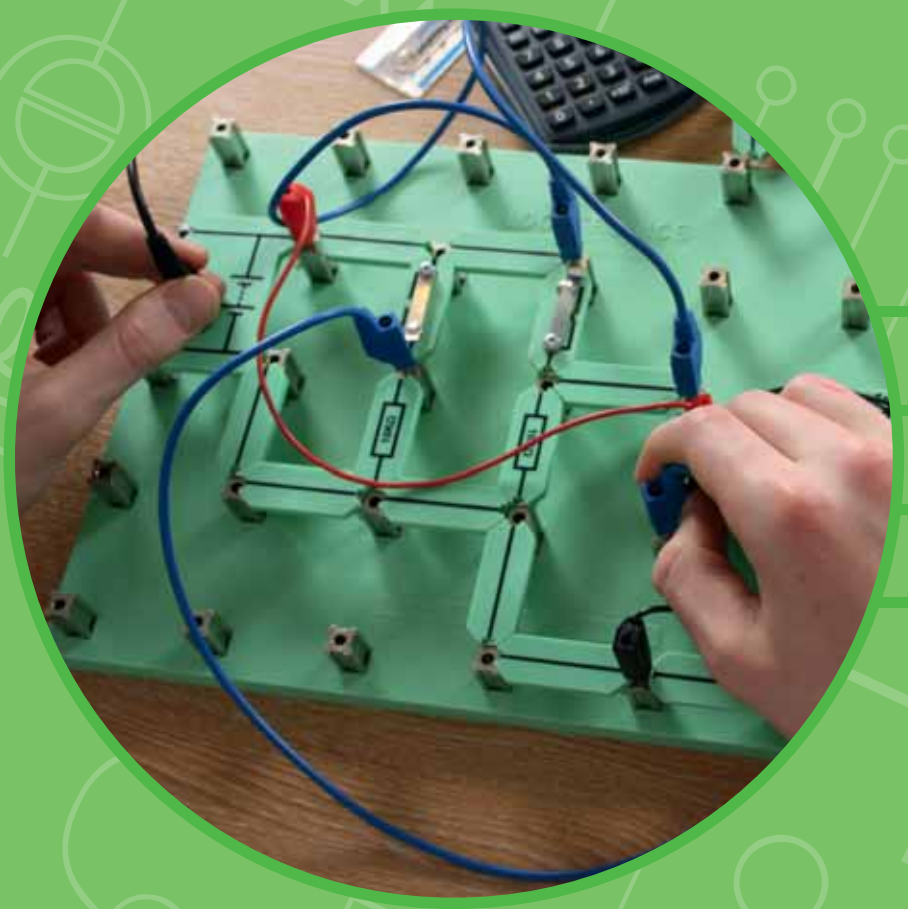
MATRIX

locktronics

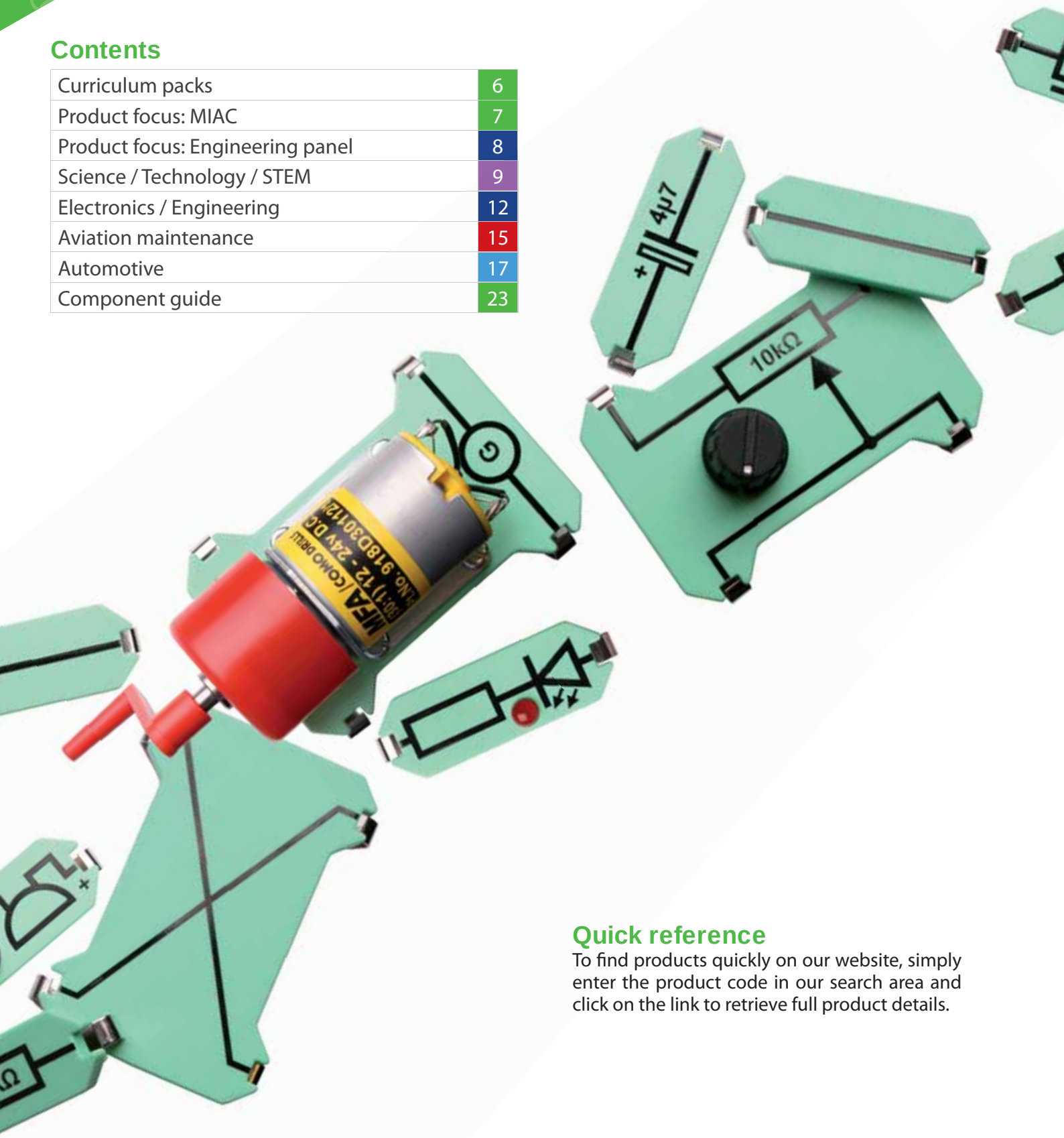
Simplifying electricity



- Science / Technology
- Electronics / Engineering
- Automotive
- Aviation maintenance

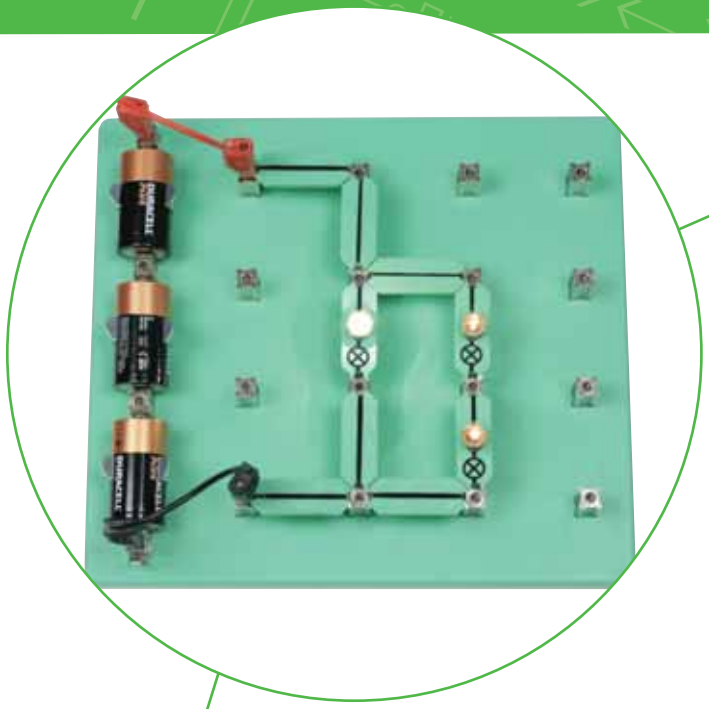
www.matrixmultimedia.com

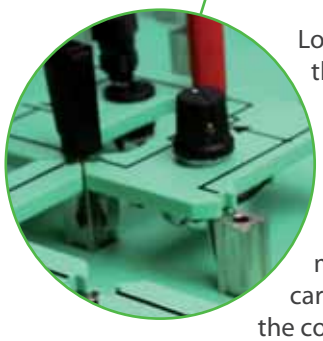
Contents



Quick reference

To find products quickly on our website, simply enter the product code in our search area and click on the link to retrieve full product details.





Locktronics is a range of products that simplifies the process of learning and teaching electricity and electronics.

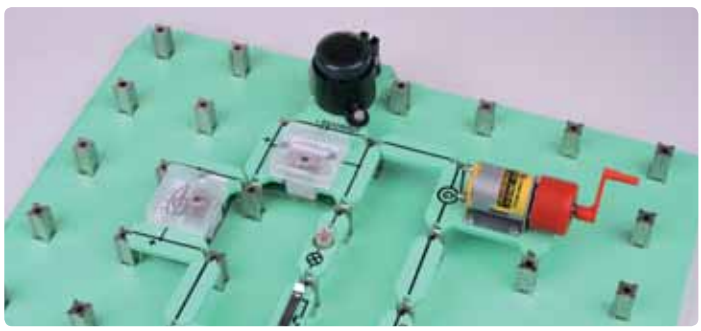
The core range consists of more than 200 electronic components mounted on rugged plastic carriers which are printed with the corresponding circuit symbol. Students use these carriers, in conjunction with a baseboard with interconnecting metal pillars, to build up a working circuit. They then use the curriculum provided to carry out experiments in electricity and electronics.

The key benefit of Locktronics is that as students construct the working circuit, they can also see the corresponding circuit diagram. This helps students link theory to practice and simplifies the process of learning electricity and electronics.

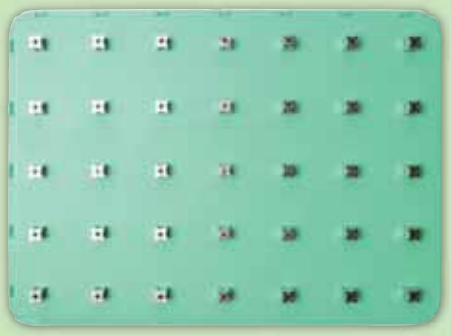
Locktronics can be used in a wide range of subject areas.

Disciplines include:

- Science and technology
- Electronics
- Engineering
- Automotive
- Aviation maintenance



The Locktronics range includes:



Baseboards
To which students add...

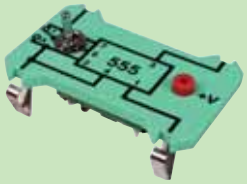
Capacitors

Resistors

Inductors

Semiconductors

Logic gates



System blocks

Electromechanical

Lamps and LEDs

Curriculum packs

Power supplies

Why choose Locktronics?

Locktronics is used in more than 10,000 schools worldwide. Teachers and students like to use Locktronics for a number of reasons:

Makes learning easier

- Students can see the circuit diagram and the real circuit
- Circuits are fast to build and easy to work with
- Support materials guide students step-by-step

Saves preparation time

- Locktronics is reliable and works year after year
- Curriculum and worksheets are provided

It lasts and lasts

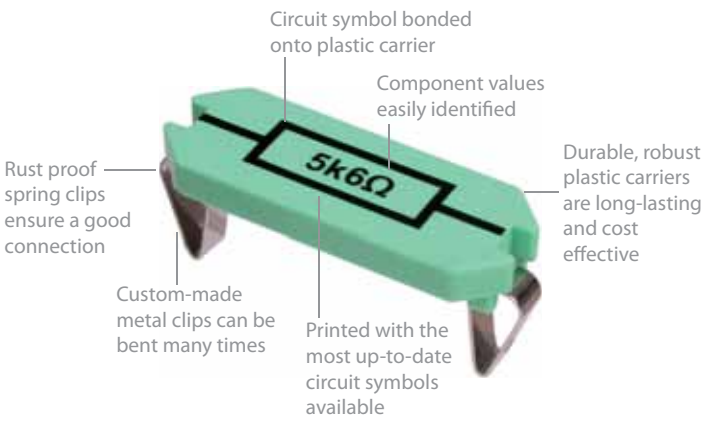
- Components mounted on rugged plastic carriers
- Simple, effective, strong baseboards
- Component legend bonded to plastic carriers

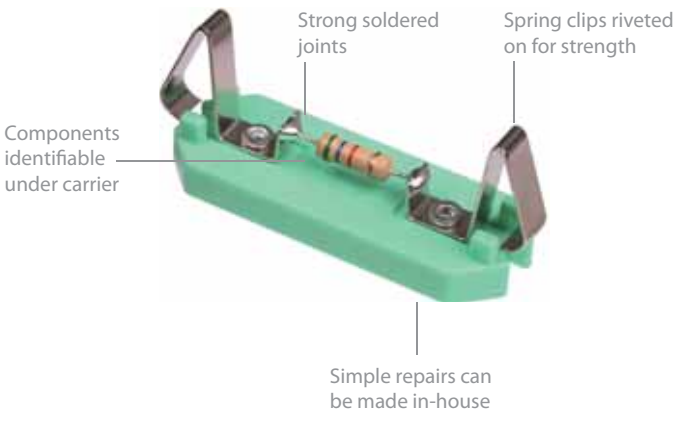
Versatility

- Can be used in many subject areas, at many levels
- Vast range of components
- Ideal for demonstrations, practicals and projects

Support

- Components and curriculum now updated
- 12 month guarantee on all items
- Unlimited telephone support on all products

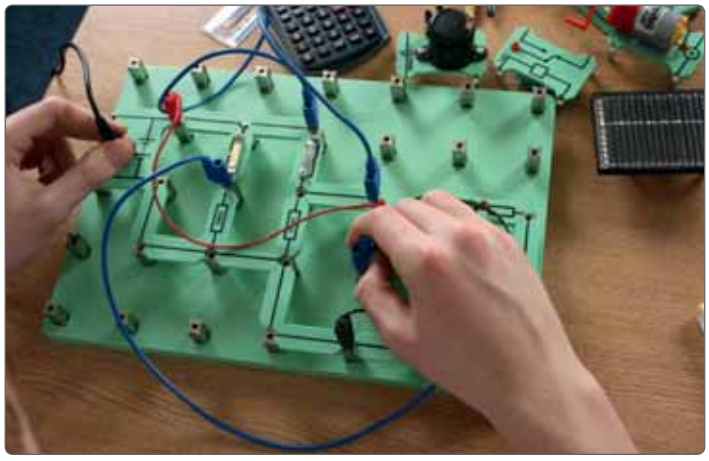




Theory

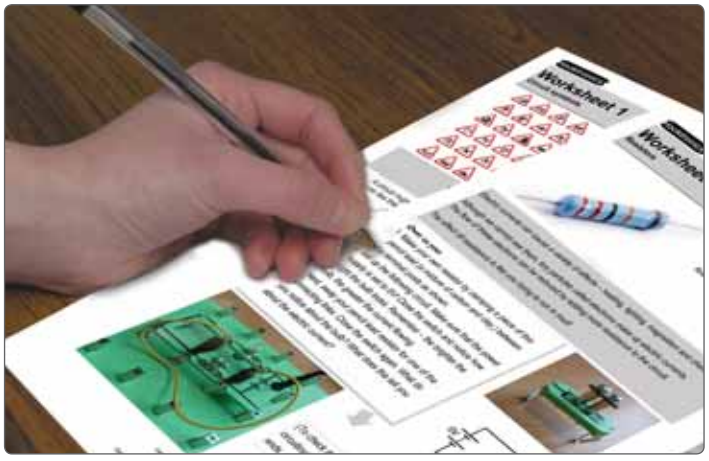
Teach students electrical theory in the classroom using text books, CD ROMs, or other means...

Application



...students apply theory to practice using Locktronics kits...

Understanding



...understanding comes from completing assignments in curriculum packs.

Choosing your Locktronics package

In this catalogue, you can choose from our extensive range of kits tailored to syllabuses in primary education, secondary education and further education, in engineering, science, technology and automotive.

Choosing the right solution

Take a look at our range of over 25 curriculum packs that you can see on page 6. View them on our website and make sure the experiments are right for you.

Choosing accessories and extras

Bills of material showing the complete contents of each kit are available online. Make sure you have the test equipment you need for teaching your course. Most courses require the use of one or two multimeters. Some require signal generators and oscilloscopes.

Component and kit variations

Make sure you choose the correct version of your solution - components are available with ANSI (USA) and DIN (European) circuit symbols.

Making up your own kit

If the kits we have don't suit you then you can make up your own kit from our vast library of parts - see page 23.

Choosing additional manuals and parts

If you already have some Locktronics parts, then you can download free updated manuals from our website and can buy additional components which will allow you to deliver new courses.

Take a look at our curriculum packs online...

...choose one of our solutions...

...with ANSI (North American) symbols...

...or DIN/SB (European) symbols...

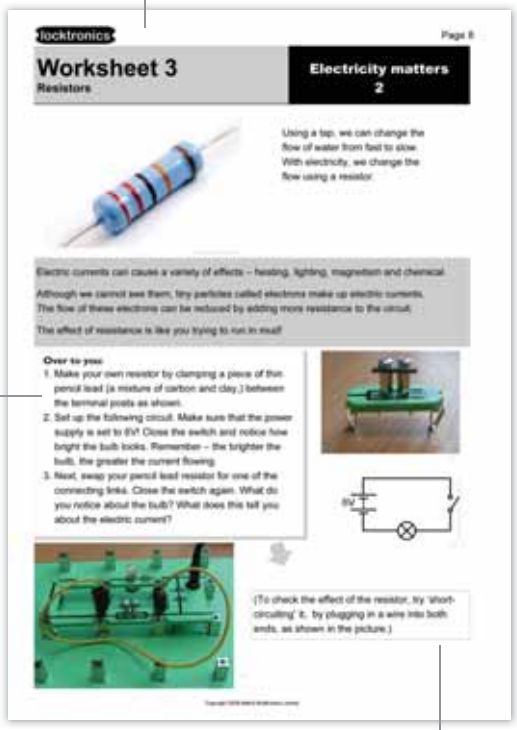
...with accessories like our current probe...

...and our active MIAC control unit.

Curriculum packs

Description	Part No.	Language
Fundamentals of electricity (primary)	LK6816	
Introduction to the transistor	LK4556	
Basic and extended logic workbook	LK6920	
Operational amplifiers	LK3061	
Transistor linear applications	LK7003	
Electricity matters 1	LK7325	
Electricity matters 2	LK7326	
Electricity matters 3	LK7664	
Electricity matters 4	LK7773	
Advanced electrical principles DC	LK8473	
Advanced electrical principles AC	LK8749	
Intermediate electronic engineering	LK8293	
Automotive sense and control	LK8849	
CAN bus systems and operation	LK9893	
PICmicro microcontroller systems	LK7209	
Industrial sensor, actuator and control	LK8739	
Energy and the environment	LK7122	
AC principles for automotive technicians	LK8392	
An introduction to motors, generators and hybrid	LK8821	
An introduction to digital electronics	LK9392	
Operational amplifiers	LK3061	
EASA electrical fundamentals 1	LK7378	
EASA electrical fundamentals 2	LK7381	
EASA electrical fundamentals 3	LK7393	
EASA electrical fundamentals 4	LK7415	
EASA electronic fundamentals 1	LK7419	
EASA electronic fundamentals 2	LK7422	
EASA electronic fundamentals 3	LK7426	
EASA electronic fundamentals 4	LK7430	
Hybrid vehicle systems	LK4483	
Further electrical and electronic engineering	LK4583	
PICmicro getting started guide	LK8741	

Most worksheets follow the same format. Illustrated introduction to topic area and components supports student learning.



'Over to you' allows students to experiment based on what they have learnt and allows teachers to assess their understanding through a series of exercises.

Additional information to support the outcomes of the exercises for students to read or copy, often leading them into the next worksheet.

There are over 25 different curriculum packs available for the Locktronics range covering a wide spectrum of topics: from simple electricity for wiring technicians, through to advanced transistor characteristics for undergraduate electronic engineers. The table on the left shows the complete list of products available.

Most curriculum packs are provided free of charge with relevant solutions. Curriculum packs are supplied in PDF format on CD ROM.

MIAC - Matrix Industrial Automotive Controller

Code: MI0245

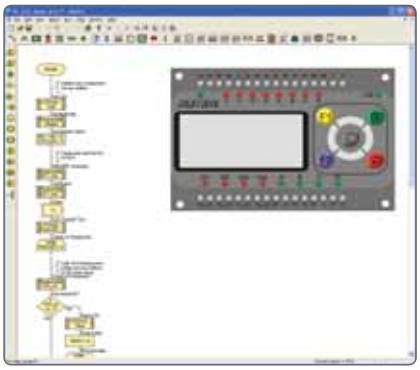
Features

- The world's only educational Electronic Control Unit
- A flexible resource with many uses in many areas of engineering
- Physically and electrically rugged
- Compatible with Flowcode, C, Assembly, LabView and Visual Basic
- 8 digital or analogue inputs, 4 relay outputs, 4 motor outputs with speed control, 4 line LCD display and control keys and CAN bus
- Compatible with a wide range of industrial sensors
- Fast CAN bus for networking

The MIAC is a fully specified industrial grade Programmable Logic Controller (PLC). It has 8 analogue or digital inputs, 4 high current relay outputs, 4 motor outputs and an integrated Controller Area Network (CAN) bus which allows many units to be networked together.

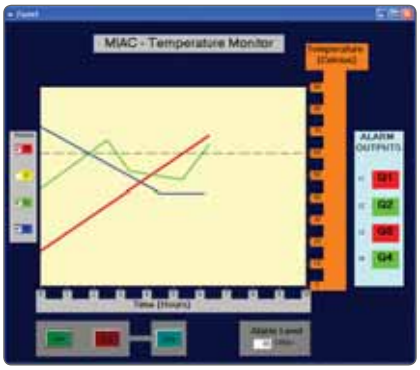
The MIAC is available in a rugged plastic case with all connections made available using 4mm shrouded 'banana' sockets. The status of all I/O lines is indicated with an individual LED. A keypad and 4 line 16 character display facilitate user interactions.

The unit is programmed directly from a PC's USB port using Matrix's own Flowcode graphical programming language, C code or Assembly code. The unit can also be controlled via the LabView and Visual Basic development environments.



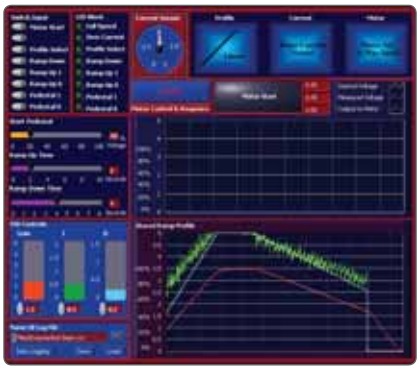
Use with Flowcode...

Flowcode is an easy-to-use graphical programming language based on flow charts. Drag and click on icons and components to create a program, simulate on screen and then download to the MIAC.



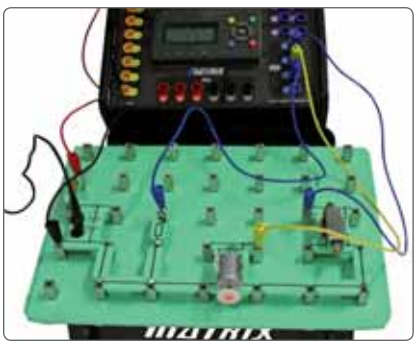
...Visual Basic®...

A free program can be downloaded to the MIAC which makes it function as a VB or LabView interface. A DLL with function calls is supplied which allows a wide variety of PC based control systems to be developed.

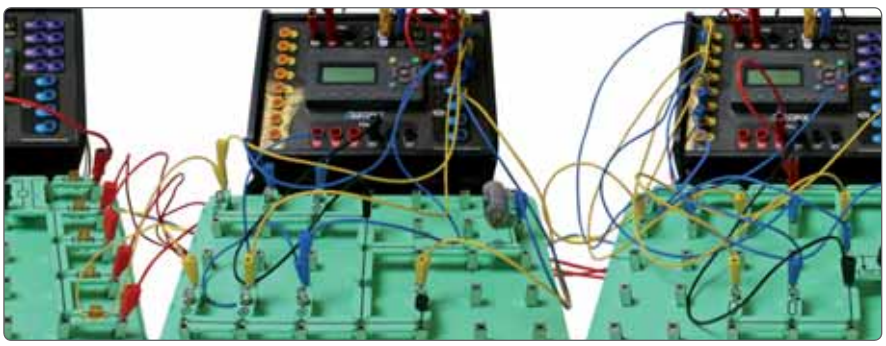


...or LabView®

- PC based data capture and control
- LabView and VB via USB
- Ideal for advanced engineering concepts such as PID
- A flexible lab interface

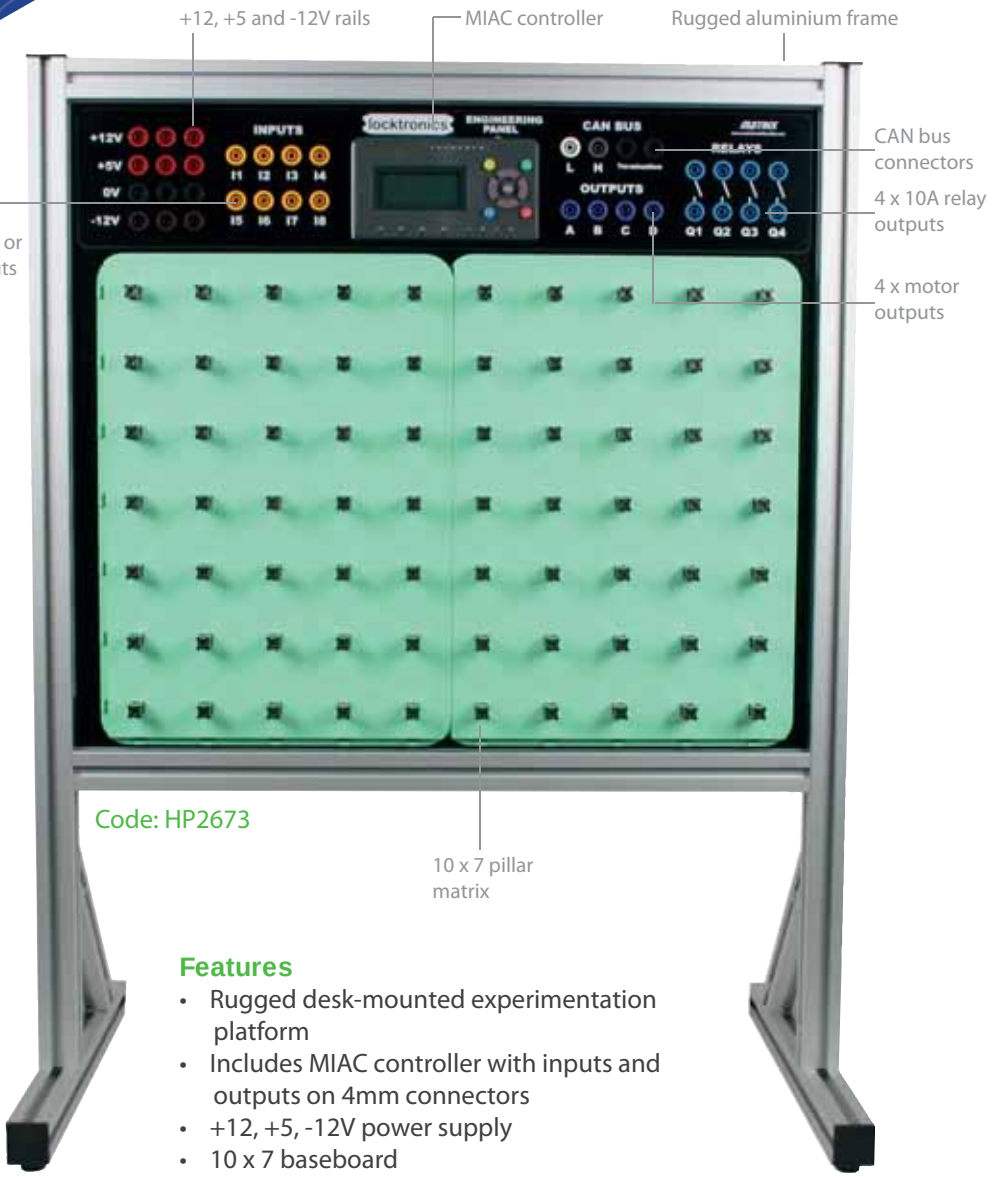


MIAC used to demonstrate sense and control in an industrial context.



MIAC and Locktronics used to study the role of ECUs in an automotive system.

Engineering panel



Code: HP2673

Features

- Rugged desk-mounted experimentation platform
- Includes MIAC controller with inputs and outputs on 4mm connectors
- +12, +5, -12V power supply
- 10 x 7 baseboard

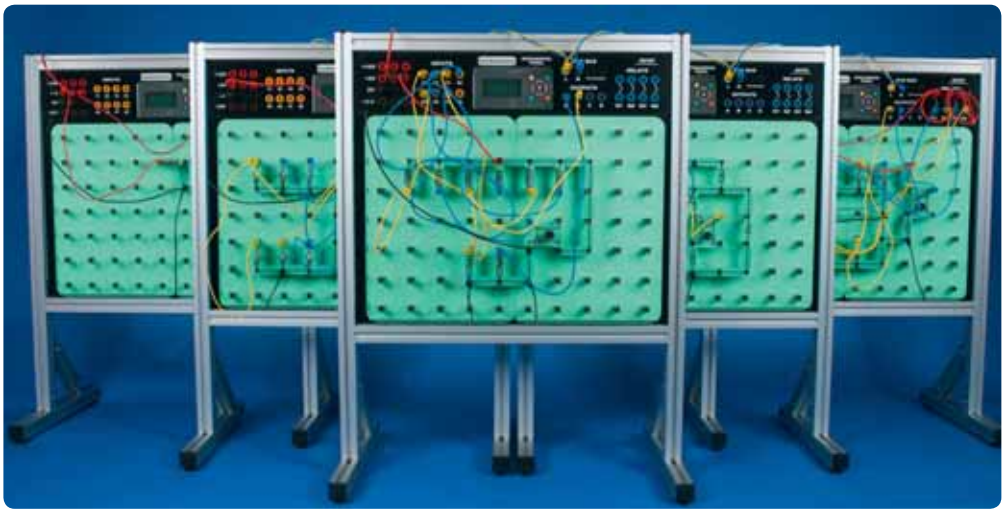
The Locktronics engineering panel is ideal for use in labs where a more permanent setup is required. The panel is constructed from rugged extruded aluminium and sits on a lab desk to allow easy access for students, who can carry out experiments and tests using the Locktronics hardware. The panel includes a MIAC controller, a +12, +5, -12 volt power supply, and a large 10 x 7 grid of pillars which allows larger circuits to be built.

Use in engineering

Use the MIAC and Locktronics carriers to create a flexible lab for many engineering disciplines including for use with LabView and Visual Basic.

Use in automotive

The engineering panel is fitted with a MIAC to provide a rugged platform for carrying out experiments in automotive education.



Use with CAN bus system

You can use five engineering panels to create a superb CAN bus demonstration and experimentation platform for your automotive lab.

Fundamentals of electricity

This kit provides an introduction to the fundamentals of electricity. It is ideal for those who are completely new to the subject, and is suitable for use from ages 8+. The kit is supplied with 30 pages of notes and worksheets. (In the UK suitable for KS1 and KS2 Science units 2F, 4F, 6G).

Learning objectives / experiments

- What is electricity?
- Simple electrical components
- The simplest circuit
- Conductors and insulators
- Switches
- Two way switches
- Series circuits
- Parallel circuits
- Buzzers
- Motors

Components included			
1	Curriculum CD ROM	3	MES bulb, 6.5V, 0.3A
9	Connecting Link	1	Power supply carrier with battery symbol
3	Lampholder, MES	1	Power supply
1	Switch, push to make, metal strip	1	Pair of leads, red and black, 600mm, 4mm to croc clip
1	Switch, on/off, metal strip	1	Small bar magnet
1	Buzzer, 6V, 15mA	1	Locktronics User Guide
1	Motor 3 to 12V DC, 0.7A	1	Switch, reed, normally open
1	4 x 4 baseboard with 4mm pillars and battery holder	1	Lead, red. 500mm, 4mm to 4mm stackable
2	MES bulb, 2.5V, 0.2A	1	Lead, black, 500mm, 4mm to 4mm stackable

Ordering information	DIN	ANSI
Fundamentals of electricity with baseboard, storage tray and DC power supply.	LK6444	LK6444A
Corresponding curriculum	LK6816	

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. Suitable for pupils from age 11 upwards. (In the UK suitable for KS3 and KS4).

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	Light dependent resistor	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	Curriculum CD ROM
9	Connecting Link	1	Buzzer, 12V, 15mA
3	Lampholder, MES	1	Switch, on/off, metal strip
1	7 x 5 metric baseboard with 4mm pillars	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	Ammeter, 0A to 1A	1	EMM V2 Accessories pack

Ordering information	DIN	ANSI
Electricity, magnetism and materials solution with storage, baseboard and power supply.	LK9071	LK9071A
Corresponding curriculum	LK7325 & LK7326	

Energy and the environment

This course provides an introduction to renewable energy generation and energy saving measures through intelligent building control. As such, it addresses the aims of a number of courses in Science and Technology. A comprehensive set of curriculum worksheets and supporting documentation deliver experiments to illuminate the issues raised.

Learning objectives

- Advantages / disadvantages of renewable energy sources: photovoltaic, wind, wave, hydroelectric
- Solar cells and their operation
- Electricity generators
- Solar heating and energy storage
- Voltage regulation
- Efficiency of a filament lamp and LED lamp
- Insulation and double glazing
- Energy efficient building design using microcontrollers

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack		
Components included			
1	Power supply carrier with battery symbol	1	Lead, yellow, 500mm, 4mm to 4mm stackable
1	USB reprogrammable PIC carrier with power lead	2	Lead, black, 500mm, 4mm to 4mm stackable
2	Thermistor, 470 ohm, NTC (DIN)	2	Lead, red. 500mm, 4mm to 4mm stackable
1	Light dependent resistor	1	Lampholder, MES, for automotive LEDs
2	Lampholder, MES	2	Switch, push to make, metal strip
12	Connecting Link	1	Locktronics User Guide
1	Solar cell	1	MES bulb, 6.5V, 0.3A
1	Hand cranked generator	1	Potentiometer, 10k (DIN)
1	MES bulb, 6V, 0.04A	1	Resistor, 1k, 1/4W, 5% (DIN)
1	Slotted opto sensor with 2mm to 4mm lead	1	7 x 5 metric baseboard with 4mm pillars
2	Power supply	1	Energy Meter
1	Capacitor, 22,000uF, Electrolytic 16V	1	Resistor, 270 ohm, 1/2W, 5% (DIN)
1	LED, red, 5V (SB)	1	Curriculum CD ROM
1	MES bulb, 12V, LED, white		

Ordering information	DIN	ANSI
Energy and environment solution including storage, power supply and energy meter.	LK7345	LK7345A
Corresponding curriculum	LK7122	

Electrical and electronic principles

The kit provides a comprehensive range of practical assignments for electricity and magnetism and is ideal for those who are studying science and electricity for science students. The kit is supplied with a comprehensive set of worksheets that cover the electrical and electronic principles. Suitable for students of Physics aged 16 to 18.

Note

To add PICmicro investigation to this kit see page 11.
To add Operational amplifier investigation to this kit see page 14.

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack	HP8279	Picoscope
HP7894	Signal generator		
Components included			
1	Resistor, 10 ohm, 1W 5% (DIN)	1	Resistor, 5.6k, 1/4W, 5% (DIN)
1	1:1 transformer with retractable ferrite core	1	Transformer, 2:1 turns ratio
1	Capacitor, 22,000uF, Electrolytic 16V	1	Resistor, 3.9 ohm, 3W, 5% (DIN)
1	Light dependent resistor	1	Potentiometer, 250 ohm (DIN)
1	Thermistor, 4.7k, NTC (DIN)	1	Curriculum CD ROM
1	Resistor, 22k, 1/4W, 5% (DIN)	1	Resistor, 2.2k, 1/4W, 5% (DIN)
1	Resistor, 1k, 1/4W, 5% (DIN)	1	Capacitor, 2,200 uF, Electrolytic, 25V
1	Resistor, 100 ohm, 1W, 5% (DIN)	1	Constantan Wire Carrier, 0.075 x 500mm
1	LED, red, 12V (SB)	1	Nichrome Wire Carrier, 0.21 x 500mm
1	Resistor, 47 ohm, 1/2W, 5% (DIN)	1	Nichrome Wire Carrier, 0.075 x 250mm
1	Choke, 47mH	1	Nichrome Wire Carrier, 0.075 x 500mm
1	Switch, on/off, metal strip	1	Capacitor, 1,000 uF, Electrolytic 30V
1	Power supply	1	Small bar magnet
1	7 x 5 metric baseboard with 4mm pillars	1	Power supply carrier with battery symbol
1	Resistor, 68 ohm 1/2W, 5% (DIN)	12	Connecting Link
1	Locktronics User Guide	3	AA battery holder carrier
1	Resistor, 270 ohm, 1/2W, 5% (DIN)	3	MES bulb, 6V, 0.04A
1	Resistor, 10k, 1/4W, 5% (DIN)	1	400 turn induction coil
1	Capacitor, 1 uF, Polyester	3	Lampholder, MES

Ordering information	DIN	ANSI
Electrical and electronic principles solution with storage, baseboard and power supplies.	LK9329	LK9329A
Corresponding curriculum	LK7664 & LK7773	

Class pool kit

This 'one per class' kit is designed to give you a flexible suite of parts that can be added to the Electrical and electronic principles pack to allow a much wider range of experiments and demonstration in Electronics from our Operational Amplifiers, PICmicro, Logic and Energy and environment solutions. The pack also includes useful equipment for teaching Lenz's law, Faraday's law and motor principles.

Learning objectives / experiments

- Batteries in series and parallel
- Internal resistance of batteries
- Power dissipation and efficiency
- Potential dividers
- Resistivity
- Kirchoff's laws
- AC circuits
- Capacitors
- Flemings laws
- Inductors
- Faraday's and Lenz's laws
- Transformers

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack	HP8279	Picoscope
HP7894	Signal generator		

Components included			
2	Resistor, 10k, 1/4W, 5% (DIN)	1	NOT Gate with 2mm to 4mm lead - ANSI
2	MES bulb, 6.5V, 0.3A	2	Lead, red, 300mm, 4mm to 2mm stackable
2	Capacitor, 10 uF, Electrolytic, 25V	2	Lead, blue, 500mm, 4mm to 4mm stackable
1	Capacitor. 4.7uF, electrolytic, 25V	2	Lead, yellow, 500mm, 4mm to 4mm stackable
1	Capacitor, 1 uF, Polyester	1	Lead, black, 500mm, 4mm to 4mm stackable
1	Capacitor, 0.1 uF, Polyester	4	Connecting Link
1	Thermistor, 4.7k, NTC (DIN)	1	Low power solar motor
1	Thermistor, 470 ohm, NTC (DIN)	1	Speaker
1	Potentiometer, 10k (DIN)	1	Energy Meter
1	Resistor, variable, 250 ohm	1	Solar cell
1	Potentiometer, 25 ohm (DIN)	1	Slotted opto sensor with 2mm to 4mm lead
1	Resistor, 270k, 1/4W, 5% (DIN)	1	NOR Gate with 2mm to 4mm lead - ANSI
1	Diode, power, 1A, 50V	1	Capacitor, 100uF, Electrolytic, 25V
1	Resistor, 22k, 1/4W, 5% (DIN)	1	OR Gate with 2mm to 4mm lead - ANSI
1	Bridge rectifier	2	Lead, black, 300mm, 4mm to 2mm stackable
1	Resistor, 180 ohm, 1/2W, 5% (DIN)	1	AND Gate with 2mm to 4mm lead - ANSI
1	Resistor, 120 ohm, 1/2W, 5% (DIN)	1	USB reprogrammable PIC carrier with power lead
1	Resistor, 47 ohm, 1/2W, 5% (DIN)	1	Op Amp module (TL081)
1	Resistor, 10 ohm, 1W 5% (DIN)	1	Hand cranked generator
1	Switch, on/off, metal strip	2	400 turn induction coil
1	Switch, push to make, metal strip	1	Faraday's law kit
1	LED, yellow, 12V (SB)	1	Lenz's law kit
1	LED, green, 12V (SB)	1	Motor 3 to 12V DC, 0.7A
2	LED, red, 12V (SB)	1	Fleming's motor rule apparatus
1	Lampholder, MES, for automotive LEDs	1	Choke, 200mH
1	MES bulb, 12V, LED, white	1	Choke, 10mH
1	Resistor, 100k, 1/4W, 5% (DIN)	1	NAND Gate with 2mm to 4mm lead- ANSI

Ordering information	DIN	ANSI
Electrical and electronics principles class pool kit.	LK6802	LK6802A
Corresponding curriculum	LK7664 & LK7773	

PICmicro microcontroller systems investigation

This new kit allows students to investigate circuits and systems based on the popular PICmicro microcontroller. The kit focuses on system construction with a pre-programmed PIC carrier which includes 8 programs, selectable by hardware switches. The work can be extended to include programming of PICmicro® microcontrollers using flowcharts with our Flowcode software. A full curriculum pack is included.

Learning objectives / experiments

- Switch inputs
- Sensors and sensor circuits
- Digital comparators
- Driving transducers
- Output transducers
- DC motor speed control
- Open and closed loop control

Components included			
1	Power supply	1	LED, yellow, 5V (SB)
1	USB reprogrammable PIC carrier with power lead	1	MES bulb, 6.5V, 0.3A
1	Light dependent resistor		Locktronics User Guide
2	Resistor, 10k, 1/4W, 5% (DIN)	1	USB2 high speed A to mini B lead
16	Connecting Link	2	Lead, yellow, 500mm, 4mm to 4mm stackable
1	Lampholder, MES	1	Thermistor, 4.7k, NTC (DIN)
2	Switch, push to make, metal strip	1	Transistor RHF, NPN
2	Switch, on/off, metal strip	1	Motor 3 to 12V DC, 0.7A
1	Buzzer, 6V, 15mA	1	Resistor, 2.2k, 1/4W, 5% (DIN)
1	Curriculum CD ROM	1	7 x 5 metric baseboard with 4mm pillars
1	Potentiometer, 10k (DIN)	1	Power supply carrier with battery symbol
2	LED, red, 5V (SB)	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	LED, green, 5V (SB)	1	Resistor, 1k, 1/4W, 5% (DIN)

Ordering information	DIN	ANSI
PICmicro systems solution with storage tray, baseboard and power supply	LK8922	LK8922A

The PICmicro microcontroller add-on kit can be added to the Electrical and Electronic principles pack:

PICmicro microcontroller add-on-kit			
1	Resistor, 10k, 1/4W, 5% (DIN)	1	Locktronics User Guide
1	Buzzer, 6V, 15mA	1	Thermistor, 4.7k, NTC (DIN)
2	LED, red, 5V (SB)	2	Lead, yellow, 500mm, 4mm to 4mm stackable
1	LED, yellow, 5V (SB)	1	Resistor, 2.2k, 1/4W, 5% (DIN)
1	LED, green, 5V (SB)	1	Curriculum CD ROM
1	Motor 3 to 12V DC, 0.7A	1	Transistor RHF, NPN
1	Switch, push to make, metal strip	7	Connecting Link
1	USB reprogrammable PIC carrier with power lead	2	Switch, on/off, metal strip
1	Resistor, 100 ohm, 1W, 5% (DIN)		

Ordering information	DIN	ANSI
PICmicro microcontroller add-on kit	LK5822	LK5822A
Corresponding curriculum	LK7209	

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	Light dependent resistor	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	Curriculum CD ROM
9	Connecting Link	1	Buzzer, 12V, 15mA
3	Lampholder, MES	1	Switch, on/off, metal strip
1	7 x 5 metric baseboard with 4mm pillars	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	Ammeter, 0A to 1A	1	EMM V2 Accessories pack

Ordering information	DIN	ANSI
Electricity, magnetism and materials solution with storage, baseboard and power supply.	LK9071	LK9071A
Corresponding curriculum	LK7325 & LK7326	

Intermediate electronic engineering

This solution provides a broad-based introduction to electronics and provides substantial syllabus coverage of the relevant BTEC First Award (Unit 7). It provides a series of practical investigations that allow students to unify theoretical work with practical skills - from bulbs in series to radio circuits. The kit is supplied with a comprehensive 60 page manual which includes experiments and notes for teachers.

Learning objectives / experiments

- LDRs and thermistors
- Diodes and their function
- Combinational logic
- Transistors as a switch/amplifier
- Operational amplifiers
- Timers
- Simple radio circuits

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack		
Components included			
1	Systems block, 555 timer, with 4mm to 2mm lead	2	Switch, on/off, metal strip
1	7 x 5 metric baseboard with 4mm pillars	2	Resistor, 100k, 1/4W, 5% (DIN)
2	Transistor RHF, NPN	2	Resistor, 10k, 1/4W, 5% (DIN)
1	Transistor RHF, PNP	2	LED, red, 5V (SB)
1	1:1 transformer with retractable ferrite core	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	Voltmeter, +/- 7.5V	18	Connecting Link
1	Op Amp Carrier (TL081) with 2mm to 4mm Lead	1	Power supply carrier with battery symbol
1	Speaker	2	Resistor, 1k, 1/4W, 5% (DIN)
1	Motor 3 to 12V DC, 0.7A	1	Potentiometer, 10k (DIN)
2	Power supply	2	Capacitor, 0.47 uF, Polyester
2	Lead, blue, 500mm, 4mm to 4mm stackable	1	Thermistor, 4.7k, NTC (DIN)
1	Voltmeter, 0V to 15V	1	Capacitor, 47uF, Electrolytic, 25V
1	Curriculum CD ROM	1	Diode, germanium
1	Locktronics User Guide	1	Diode, power, 1A, 50V
1	NOT Gate with 2mm to 4mm lead - ANSI	1	Capacitor, 4n7, Ceramic
1	NOR Gate with 2mm to 4mm lead - ANSI	3	Lampholder, MES
2	Lead, yellow, 500mm, 4mm to 4mm stackable	3	MES bulb, 12V, 0.1A
1	OR Gate with 2mm to 4mm lead - ANSI	1	Capacitor, 100pF, Ceramic
1	NAND Gate with 2mm to 4mm lead - ANSI	1	Choke, 10mH
1	AND Gate with 2mm to 4mm lead - ANSI	1	Dual rail power supply carrier
1	Ammeter, 0mA to 100mA	1	Buzzer, 6V, 15mA
1	Light dependent resistor	2	Capacitor. 4.7uF, electrolytic, 25V
1	Switch, push to make, metal strip		

Ordering information	DIN	ANSI
Intermediate electronic engineering solution with storage, baseboard and power supply.	LK3889	LK3889A
Corresponding curriculum	LK8293	

Further electrical and electronic engineering

This kit, with its accompanying workbook, is intended to reinforce the learning that takes place in the classroom or lecture room for intermediate level courses such as the BTEC National (QCF Level 3) unit in Electrical and electronic principles (J/600/0255). The 70 page workbook provides a series of practical activities and investigations that are designed to complement the BTEC syllabus and a comprehensive set of teacher's notes is included.

Learning objectives / experiments

- Current and voltage measurement
- Current and voltage dividers
- Kirchoff's laws
- Power in DC circuits
- Electrostatics and capacitors
- AC measurements
- L-R, C-R and L-C-R circuits
- Transformers
- Diode characteristics
- Half and full wave bridge rectifiers

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack		

Components included			
1	Potentiometer, 250 ohm (DIN)	2	Lead, yellow, 500mm, 4mm to 4mm stackable
3	MES bulb, 12V, 0.1A	1	Voltmeter, 0V to 15V
1	AC voltage source carrier	3	AA battery holder carrier
1	Power supply	1	Choke, 47mH
12	Connecting Link	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	Resistor, 180 ohm, 1/2W, 5% (DIN)	1	400 Turn coil carrier
1	Resistor, 270 ohm, 1/2W, 5% (DIN)	1	Capacitor, 1 uF, Polyester
1	Resistor, 1k, 1/4W, 5% (DIN)	1	1:1 transformer with retractable ferrite core
2	Resistor, 10k, 1/4W, 5% (DIN)	1	Ammeter, 0mA to 100mA
1	Locktronics User Guide	1	Switch, push to make, metal strip
1	Capacitor, 47uF, Electrolytic, 25V	1	Power supply carrier with battery symbol
1	Capacitor, 1,000 uF, Electrolytic 30V	1	Resistor, 22k, 1/4W, 5% (DIN)
1	Transformer, 2:1 turns ratio	1	Capacitor, 2,200 uF, Electrolytic, 25V
1	Curriculum CD ROM	3	Lampholder, MES
2	Pair of leads, red and black, 600mm, 4mm to croc clips	1	Capacitor, 150 uF, Electrolytic, 25V
2	Lead, blue, 500mm, 4mm to 4mm stackable	1	Capacitor, 100uF, Electrolytic, 25V
1	Diode, germanium	1	Resistor, 2.2k, 1/4W, 5% (DIN)
1	7 x 5 metric baseboard with 4mm pillars	1	Small bar magnet
1	Diode, power, 1A, 50V	1	Bridge rectifier

Ordering information	DIN	ANSI
Further electrical and electronic engineering solution.	LK9862	LK9862A
Corresponding curriculum	LK4583	

Advanced electrical principles

The kit provides practical experiments that tie into electrical principles at an advanced level and allows students to marry theoretical work in AC and DC theory with practical measurements and understanding. It is suitable for those studying electrical or electronic engineering at college or university level and is modelled on the UK BTEC High National syllabus.

Learning objectives / experiments

- Resistors in series and parallel
- Kirchoff's laws
- Superposition theorem
- Thevenin's theorem
- Max power transfer theorem
- Inductive and capacitive reactance
- RLC circuits
- Series and parallel resonance
- Q factor and bandwidth

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack	HP8279	Picoscope
HP7894	Signal generator		

Components included			
2	Power supply	1	Resistor, 2.2k, 1/4W, 5% (DIN)
3	Resistor, 10k, 1/4W, 5% (DIN)	1	Resistor, 1k, 1/4W, 5% (DIN)
1	Resistor, 270 ohm, 1/2W, 5% (DIN)	2	Power supply carrier with voltage source symbol
1	Resistor, 5.6k, 1/4W, 5% (DIN)	1	Locktronics current probe
12	Connecting Link	1	Curriculum CD ROM
1	Resistor, 330k, 1/4W, 5% (DIN)	1	General puprpose lead set (LK5603 x 2, LK5604 x 2)
2	Capacitor, 1 uF, Polyester	1	Locktronics User Guide
1	Resistor, 22k, 1/4W, 5% (DIN)	1	Resistor, 10 ohm, 1W 5% (DIN)
1	Resistor, 15k, 1/4W, 5% (DIN)	1	Resistor, 47 ohm, 1/2W, 5% (DIN)
1	Choke, 47mH	1	7 x 5 metric baseboard with 4mm pillars

Ordering information	DIN	ANSI
Advanced electrical principles solution.	LK9043	LK9043A
Corresponding curriculum	LK8473 DC & LK8749 AC	

Industrial sensors, actuator and control applications

This kit provides an introduction to the role of industrial controllers - under control of conventional controller software, as well as with third party applications like LabView™ and Visual Basic™. Students are given several industrial applications that they need to construct and develop programs for, and sample applications in Flowcode, Visual Basic and LabView are provided.

Learning objectives / experiments

- DC motors with speed control
- Stepper motors
- Relays and solenoids
- Temperature and light sensors
- Potential dividers and their use
- Transistors as switches
- Electric controllers and their function
- Open and closed loop feedback
- Control system operation and function
- Control of systems using Flowcode, Visual Basic and LabView

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack		

Components included			
1	Relay, 12V coil, 10A, normally open	1	Microswitch
4	Switch, on/off, metal strip	1	LED, green, 12V (SB)
4	Switch, push to make, metal strip	1	Buzzer, 12V, 15mA
6	Lead, yellow, 500mm, 4mm to 4mm stackable	1	Solenoid
1	Lead, red. 500mm, 4mm to 4mm stackable	1	Motor 3 to 12V DC, 0.7A
1	Switch, reed, normally open	1	Power supply carrier with battery symbol
2	LED, red, 12V (SB)	1	Potentiometer, 10k (DIN)
1	Lampholder, MES	1	Cased MIAC with Shrouded 4mm Connectors
6	Lead, blue, 500mm, 4mm to 4mm stackable	1	Power supply
1	Diode, power, 1A, 50V	1	USB2 high speed A to mini B lead
1	Resistor, 10k, 1/4W, 5% (DIN)	1	Small bar magnet
2	Resistor, 1k, 1/4W, 5% (DIN)	1	MES bulb, 12V, LED, white
1	Light dependent resistor	1	Transistor LHF, NPN
1	Stepper Motor	14	Connecting Link
1	Potentiometer, 1k (DIN)	1	Locktronics User Guide
1	Resistor, 10 ohm, 1W 5% (DIN)	1	Curriculum CD ROM
1	Thermistor, 4.7k, NTC (DIN)	1	MIAC Getting Started Guide
1	LED, yellow, 12V (SB)	1	7 x 5 metric baseboard with 4mm pillars
1	Lead, black, 500mm, 4mm to 4mm stackable	1	MES bulb, 14V, 0.06A

Ordering information	DIN	ANSI
Industrial sensor, actuator and control applications solution with storage trays, power supply and leads.	LK5783	LK5783A

Ordering information	DIN	ANSI
Industrial sensor, actuator and control applications with storage trays, PSU, leads and engineering panel	LK6499	LK6499A
Corresponding curriculum	LK8739	

Operational amplifiers

This solution contains experiments that allow students to investigate the properties and function of operational amplifiers. It is suitable for students studying engineering or applied science aged 16+. The solution includes a 33 page workbook with students instructions and teacher's notes.

Learning objectives / experiments

- Operational amplifier properties
- Comparator and Schmitt trigger
- Non-inverting and inverting amplifier
- Voltage follower
- Summing and different amplifier
- Active filter
- Relaxation oscillator

Components included			
1	7 x 5 metric baseboard with 4mm pillars	1	Voltmeter, +/- 7.5V
3	Resistor, 1k, 1/4W, 5% (DIN)	2	Power supply
1	LED, green, 12V (SB)	1	Locktronics User Guide
1	LED, red, 12V (SB)	1	Curriculum CD ROM
2	Lead, red. 500mm, 4mm to 4mm stackable	1	Op Amp Carrier (TL081) with 2mm to 4mm Lead
3	Lead, black, 500mm, 4mm to 4mm stackable	2	Potentiometer, 10k (DIN)
1	Lead, blue, 500mm, 4mm to 4mm stackable	1	Low power solar motor
1	Dual rail power supply carrier	1	Capacitor, 0.1 uF, Polyester
1	Thermistor, 470 ohm, NTC (DIN)	2	BNC male to dual 4mm binding post
3	Resistor, 10k, 1/4W, 5% (DIN)	1	Capacitor, 1 uF, Polyester
1	Speaker	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	AC voltage source carrier	1	Light dependent resistor
1	Capacitor, 100uF, Electrolytic, 25V	18	Connecting Link

Ordering information	DIN	ANSI
Operational amplifiers solution, including storage, baseboard and DC power supply.	LK7148	LK7148A

The Operational amplifiers add-on kit can be added to the Electrical and Electronic principles pack:

Operational amplifiers add-on-kit			
1	Capacitor, 100uF, Electrolytic, 25V	1	Power supply
2	BNC male to dual 4mm binding post	3	Lead, black, 500mm, 4mm to 4mm stackable
1	AC voltage source carrier	1	Capacitor, 1 uF, Polyester
1	Resistor, 100 ohm, 1W, 5% (DIN)	1	LED, red, 12V (SB)
1	Low power solar motor	1	LED, green, 12V (SB)
1	Resistor, 1k, 1/4W, 5% (DIN)	1	Op Amp Carrier (TL081) with 2mm to 4mm Lead
2	Resistor, 10k, 1/4W, 5% (DIN)	1	Dual rail power supply carrier
1	Potentiometer, 10k (DIN)	1	Speaker
1	Capacitor, 0.1 uF, Polyester	1	Voltmeter, +/- 7.5V
9	Connecting Link	1	Lead, blue, 500mm, 4mm to 4mm stackable
1	Thermistor, 470 ohm, NTC (DIN)	2	Lead, red. 500mm, 4mm to 4mm stackable

Ordering information	DIN	ANSI
Operational amplifiers add-on-kit	LK6906	LK6906A
Corresponding curriculum	LK3061	

EASA electrical fundamentals (module 3)

This comprehensive solution is designed to fulfil the learning requirements of the European Safety Agency (EASA) module 3 - electrical fundamentals - for aircraft maintenance engineers. The solution contains all the Locktronics parts needed as well as 4 separate workbooks covering each of the sub-modules in the EASA specification.

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack	HP8279	Picoscope
HP7894	Signal generator		

Components included			
1	Resistor, 10 ohm, 1W 5% (DIN)	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	Resistor, 5.6k, 1/4W, 5% (DIN)	1	Resistor, variable, 10k (DIN)
1	Resistor, 12 ohm, 1W, 5% (DIN)	1	Faraday's law kit
1	Switch, on/off, metal strip	1	Lenz's law kit
1	Diode, germanium	1	Resistor, 2.2k, 1/4W, 5% (DIN)
1	1:1 transformer with retractable ferrite core	3	Resistor, 10k, 1/4W, 5% (DIN)
2	Lead, yellow, 500mm, 4mm to 4mm stackable	1	Capacitor, 1 uF, Polyester
1	Transformer, 2:1 turns ratio	1	Resistor, 15k, 1/4W, 5% (DIN)
1	Resistor, 270 ohm, 1/2W, 5% (DIN)	3	MES bulb, 6V, 0.04A
1	Fleming's motor rule apparatus	1	Potentiometer, 250 ohm (DIN)
1	Resistor, 22k, 1/4W, 5% (DIN)	1	7 x 5 metric baseboard with 4mm pillars
1	Resistor, 47 ohm, 1/2W, 5% (DIN)	3	MES bulb, 6.5V, 0.3A
1	Switch, push to make, metal strip	2	Lead, blue, 500mm, 4mm to 4mm stackable
1	Choke, 47mH	2	Power supply
3	Choke, 10mH	14	Connecting Link
1	Choke, 5mH	1	AC voltage source carrier
3	Capacitor, 10 uF, Electrolytic, 25V	2	Power supply carrier with battery symbol
2	Capacitor. 4.7uF, electrolytic, 25V	1	Ammeter, 0mA to 100mA
2	Capacitor, 2.2 uF, Polyester	1	Motor, 6V, open frame
1	Resistor, 1k, 1/4W, 5% (DIN)	1	Fuse/universal component carrier
1	Alnico Rod Magnet	3	AA battery holder carrier
1	AC power supply, 12VAC, 1.5A, UK	1	Solar cell
1	Locktronics User Guide	1	Thermocouple and carrier
1	Curriculum CD ROM	3	Lampholder, MES

Ordering information	DIN	ANSI
EASA electrical fundamentals solution including storage trays, baseboard, DC (multinational) and AC (UK) power supplies.	LK9339	LK9339
Corresponding curriculum	LK7378, LK7381, LK7393 & LK7415	

EASA Electrical fundamentals 1

- Series and parallel circuits
- Measuring voltage and current
- Cells and batteries
- Thermocouples
- Photocells
- Ohm's law

EASA Electrical fundamentals 2

- Resistors in series and in parallel
- Series/parallel networks
- Voltage and current dividers
- Kirchoff's laws
- Power in DC circuits
- Power transfer

EASA Electrical fundamentals 3

- Capacitors and electrostatics
- Inductors and inductance
- DC motors
- Generator principles
- Transformers and their construction
- Transformer losses

EASA Electrical fundamentals 4

- AC measurements
- Inductance and capacitance
- LR and CR series AC circuits
- LCR series AC circuits
- LR and CR parallel AC circuits
- LCR parallel AC circuits
- Q factor and bandwidth
- Low pass and high pass filters
- Band pass and band stop filters

Note: These packs are delivered with an international DC power supply and a UK style (3 square pin) 220V AC power supply. If you are ordering outside the UK please let us know which kind of mains plug you require on the AC supply.

EASA electronic fundamentals (module 4)

This solution is designed to fulfil the learning requirements of the European Safety Agency (EASA) module 4 - electronic fundamentals - for aircraft maintenance engineers. The solution contains all the Locktronics parts needed including 4 separate workbooks covering each of the sub-modules in the EASA specification.

Instruments			
To deliver this course you will also need:			
LK1110	Multimeter pack	HP8279	Picoscope
HP7894	Signal generator		

Components included			
1	Resistor, 100 ohm, 1W, 5% (DIN)	1	Transistor LHF, NPN
1	Potentiometer, 250 ohm (DIN)	1	Transistor RHF, NPN
1	Capacitor, 1,000 uF, Electrolytic 30V	1	Thyristor
2	Capacitor, 47uF, Electrolytic, 25V	3	Dode, power, 1A, 50V
4	Capacitor. 4.7uF, electrolytic, 25V	2	Switch, push to make, metal strip
3	Capacitor, 0.47 uF, Polyester	1	Transformer, 2:1 turns ratio
2	Resistor, 100k, 1/4W, 5% (DIN)	1	Zener diode, 8.2V
3	Resistor, 10k, 1/4W, 5% (DIN)	1	Transistor RHF, PNP
3	Resistor, 1k, 1/4W, 5% (DIN)	2	Power supply carrier with battery symbol
2	Resistor, 180 ohm, 1/2W, 5% (DIN)	1	Dual rail power supply carrier
1	Resistor, 500k, 1/4W, 5% (DIN)	12	Connecting Link
2	7 x 5 metric baseboard with 4mm pillars	1	Diode, germanium
2	Power supply	1	AA battery holder carrier
2	Lead, blue, 500mm, 4mm to 4mm stackable	2	LED, red, 5V (SB)
2	Lead, yellow, 500mm, 4mm to 4mm stackable	1	Switch, on/off, metal strip
2	Lead, black, 500mm, 4mm to 4mm stackable	2	Ammeter, 0mA to 100mA
2	Lead, red. 500mm, 4mm to 4mm stackable	1	Voltmeter, 0V to 15V
1	Resistor, 270 ohm, 1/2W, 5% (DIN)	1	OR gate carrier (ANSI)
1	AC power supply, 12VAC, 1.5A, UK	1	Zener diode, 4.7V
1	Resistor, 200k, 1/4W, 5% (DIN)	2	NOT gate carrier (ANSI)
1	Capacitor, 1nF, Polyester	1	Transistor LHF, PNP
1	Capacitor, variable, 15-140pF	1	Op Amp Carrier (TL081) with 2mm to 4mm Lead
1	Thermistor, 4.7k, NTC (DIN)	1	1:1 transformer with retractable ferrite core
2	Potentiometer, 10k (DIN)	1	Switch, changeover, toggle
1	Capacitor, 100uF, Electrolytic, 25V	1	Low power solar motor
1	Resistor, 2.2k, 1/4W, 5% (DIN)	1	AC voltage source carrier
1	Capacitor, 1 uF, Polyester	1	Bridge rectifier
1	Locktronics User Guide	1	Motor 3 to 12V DC, 0.7A
1	Curriculum CD ROM	1	AND gate carrier (ANSI)

Ordering information	DIN	ANSI
EASA electronic fundamentals solution including storage trays, baseboard, DC (multinational) and AC (UK) power supplies.	LK9282	LK9282
Corresponding curriculum	LK7419, LK7422, LK7426 & LK7430	

Ordering information	DIN	ANSI
EASA electrical and electronic fundamentals combined solution including storage, baseboard, DC (multinational) and AC (UK) power supplies.	LK9672	LK9672A

EASA Electronic fundamentals 1

- Diodes and diode types
- Full and half wave rectifiers
- Rectifier efficiency
- Reservoir capacitors
- Voltage multipliers
- Thyristor and SCR circuits
- Zener diodes and circuits
- LEDs in AC and DC circuits

EASA Electronic fundamentals 2

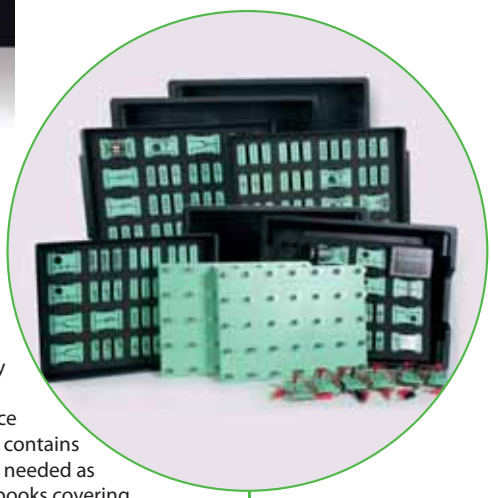
- NPN and PNP transistors
- Transistor characteristics
- Transistor bias and decoupling
- Common base, common emitter and common collector circuits
- Class A, B and C amplifiers
- Other transistor circuits

EASA Electronic fundamentals 3

- AND, OR, NAND, NOR and NOT gates
- Simple logic circuits
- Operational amplifiers
- Inverting and non-inverting amplifiers
- Integrator, differentiator, comparator
- Positive and negative feedback in amplifiers

EASA Electronic fundamentals 4

- Open and closed loop systems
- Analogue transducers
- Damping in feedback systems



This comprehensive solution is designed to fulfil the learning requirements of the European Safety Agency (EASA) modules 3 and 4 for aircraft maintenance engineers. The solution contains all the Locktronics parts needed as well as 8 separate workbooks covering each of the sub-modules in the EASA module 3 and 4 specification.

For a complete list of parts in this solution please see our website.

The Locktronics automotive range has been designed to meet the training requirements of both industry and education. The range is split into three levels for basic, intermediate and advanced students. For each level Locktronics hardware solutions and curriculum packs are provided.

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 circuits and carrying out the associated experiments.

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.

Level 1

Level 2

Level 3

MIAC Controller

Unique programmable ECU technology

Our more advanced sensors and control and CAN bus modules are based on the Matrix MIAC controller: the World's only Electronic Control Unit designed for automotive training.

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:

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	Light dependent resistor	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	Curriculum CD ROM
9	Connecting Link	1	Buzzer, 12V, 15mA
3	Lampholder, MES	1	Switch, on/off, metal strip
1	7 x 5 metric baseboard with 4mm pillars	1	Resistor, 100 ohm, 1W, 5% (DIN)
1	Ammeter, 0A to 1A	1	EMM V2 Accessories pack

Ordering information	DIN	ANSI
Electricity, magnetism and materials solution with storage, baseboard and power supply.	LK9071	LK9071A
Corresponding curriculum	LK7325 & LK7326	

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	Curriculum CD ROM
1	Diode, power, 1A, 50V	1	Bridge rectifier

Ordering information	DIN	ANSI
AC principles for automotive technicians solution including storage trays, baseboard and power supply.	LK8222	LK8222
Corresponding curriculum	LK8392	

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 conductors 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	Faraday's law kit
1	Power supply	1	Curriculum CD ROM
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
1	Capacitor, 2,200 uF, Electrolytic, 25V		

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	1	Curriculum CD ROM
1	Locktronics User Guide	2	LED, red, 5V (SB)
1	USB reprogrammable PIC carrier with power lead	1	AND Gate with 2mm to 4mm lead - ANSI
1	Light dependent reisistor	1	OR Gate with 2mm to 4mm lead - ANSI
2	Resistor, 10k, 1/4W, 5% (DIN)	1	NOT Gate with 2mm to 4mm lead - ANSI
16	Connecting Link	1	NAND Gate with 2mm to 4mm lead - ANSI
1	Lead, yellow, 500mm, 4mm to 4mm stackable	1	NOR Gate with 2mm to 4mm lead - ANSI
1	Lead, blue, 500mm, 4mm to 4mm stackable	1	Power supply carrier with battery symbol
2	Switch, on/off, metal strip	1	7 x 5 metric baseboard with 4mm pillars

Ordering information	DIN	ANSI
An Introduction to digital electronics.	LK4221	LK4221A
Corresponding curriculum	LK9392	

If you would like a combined kit that allows you to deliver all level 2 automotive courses (AC principles, Motors and generators, and Digital electronics) then please ask us about our LK4500 combined solution.

Sensors and control in automotive applications

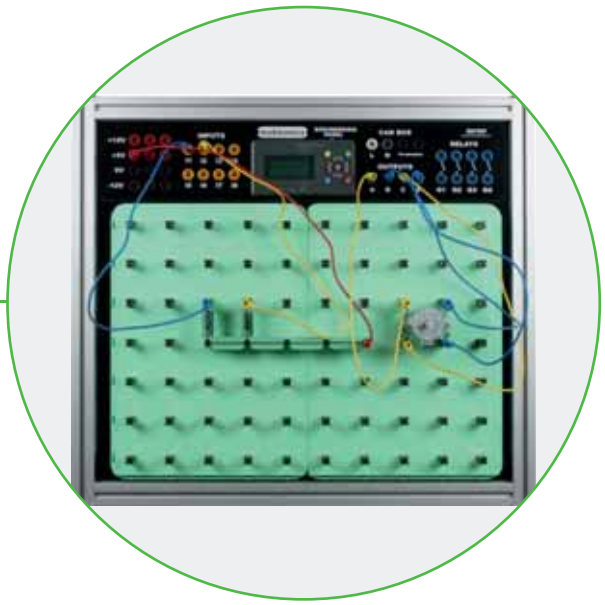
This kit provides an introduction to the role of an Electric Control Unit. Students use a number of pre-written programs for the MIAC Electronic Control Unit (ECU) to enable them to construct a wide variety of Input - Process - Output circuits using sensors and actuators typically found in vehicles. 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	Curriculum CD ROM
2	Resistor, 1k, 1/4W, 5% (DIN)	1	Locktronics User Guide
1	Capacitor, 4,700 uF, Electrolytic, 16V	1	Hall effect switch
1	Potentiometer, 10k (DIN)	1	Buzzer, 12V, 15mA
1	Relay, 12V coil, 10A, normally open	1	Light dependent resistor
1	Solenoid	1	7 x 5 metric baseboard with 4mm pillars
1	Stepper Motor	6	Lead, yellow, 500mm, 4mm to 4mm stackable
1	LED, red, 12V (SB)	6	Lead, blue, 500mm, 4mm to 4mm stackable
1	Transistor RHF, NPN	1	Lead, black, 500mm, 4mm to 4mm stackable
1	Automotive fuse carrier	1	Lead, red. 500mm, 4mm to 4mm stackable
2	Switch, on/off, metal strip	1	Cased MIAC with Shrouded 4mm Connectors
4	Switch, push to make, metal strip	1	Small bar magnet
1	Power supply	16	Connecting Link
1	Power supply carrier with battery symbol	1	MES bulb, 14V, 0.06A
1	Resistor, 10k, 1/4W, 5% (DIN)	1	MIAC Getting Started Guide
1	Lampholder, MES	1	MES bulb, 12V, LED, white
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

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

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

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	

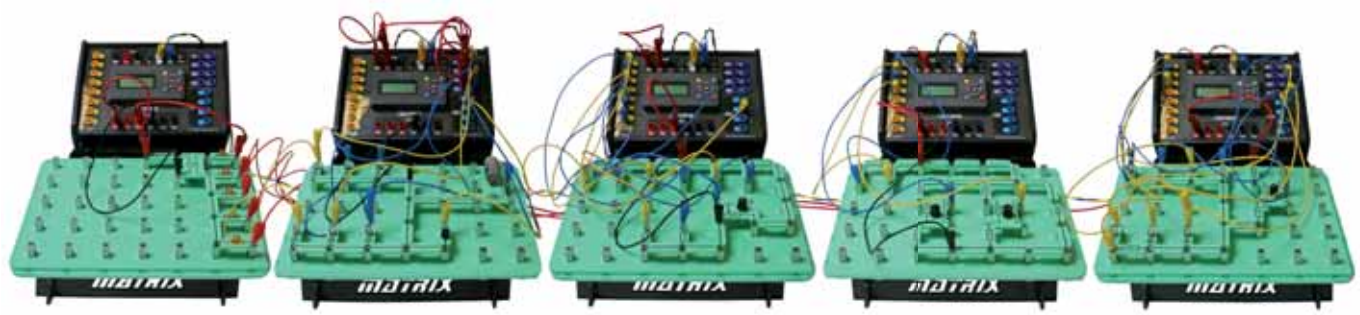
CAN bus systems and operation solution with engineering panel

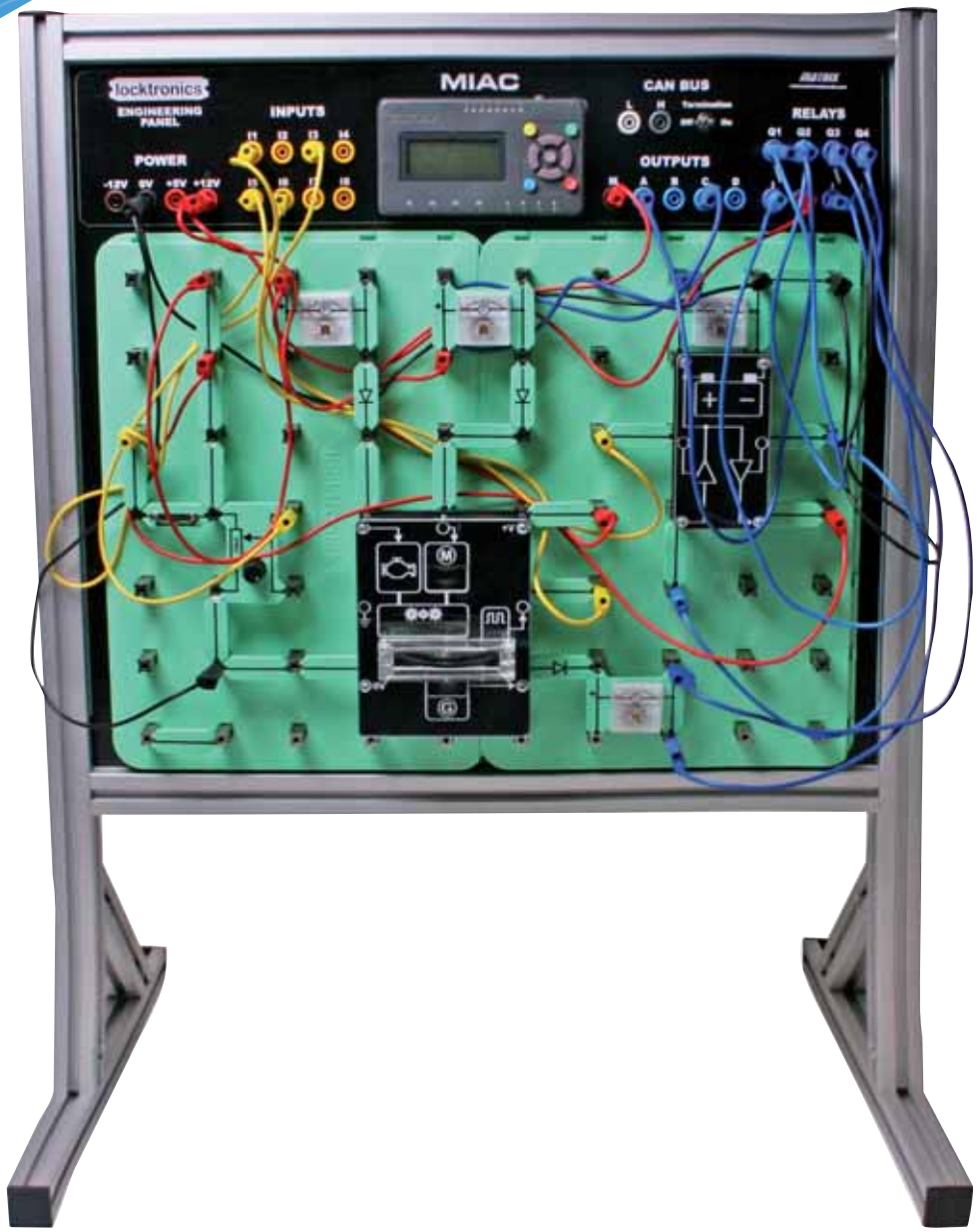
The LK2839 CAN has the same learning objectives and components as the LK7629 but is based on our engineering panel which make it more suitable for a dedicated automotive electrical training lab.

Learning objectives / experiments

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

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



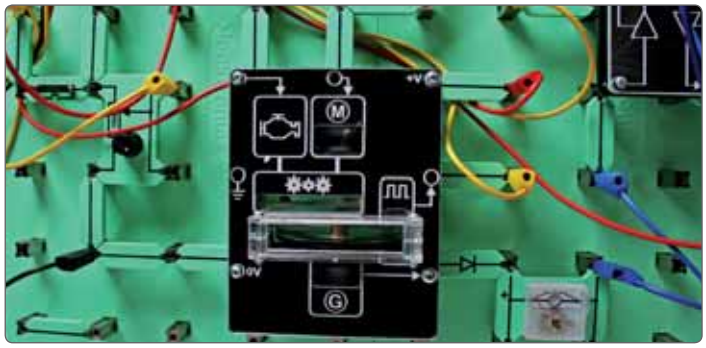


Hybrid vehicle demonstration system

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	

Baseboards and spares

Description	Part number
7 x 5 baseboard with 4mm pillars	LK8900
4 x 4 baseboard with 4mm pillars and battery holders	LK3000
Spare 4mm pillar and bolt	LK3293
Battery contact spring	LK3288
Battery retaining clip	LK8615
7 x 5 baseboard with 2mm pillars	LK7302
4 x 4 baseboard with 2mm pillars and battery holders	LK5940
Spare 2mm pillar and bolt	LK5939

Instruments

Description	Part number
Multimeter	LK1110
Energy meter	LK8591
25MHz Pico 2205 oscilloscope with free lead set	HP8279
3MHz TTI signal generator with free lead set	HP7894
Picoscope 4223 automotive oscilloscope	HP3829

Leads

Description	2mm option	Standard part
Lead, black, 320mm, 4mm stackable to croc clip	LK5297E	LK5297
Lead, red, 300mm, 4mm to 2mm stackable	LK5555E	LK5555
Pair of 4mm to croc clip leads		LK5570
Lead, red, 320mm, 4mm to croc clip	LK5298E	LK5298
Lead red, 500mm, 4mm to 4mm stackable		LK5603
4mm to 4mm lead, black		LK5604
4mm to 4mm lead, yellow		LK5607
4mm to 4mm lead, blue		LK5609
General purpose lead set (LK5603 x 2, LK5604 x 2)		LK8022
Lead, D-type to yellow and blue 4mm for Kvaser analyser		LK5695
Lead, red, 2000mm, 4mm to 4mm stackable		LK5674
Lead, black, 300mm, 4mm to 2mm stackable	LK5556E	LK5556
General purpose lead set (LK5603 x 2, LK5604 x 2)		LK8022
Lead, white, 300mm, 4mm to 2mm stackable	LK5557E	LK5557
Lead, red, 2000mm, 4mm to 4mm plug		LK6574

Need more information?

Our website includes photographs and descriptions of every product in the Locktronics range. Data sheets on many products are also available.

Miscellaneous carriers

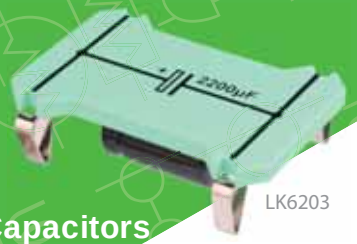
Description	Part number
Connecting link	LK5250
Crossover link	LK5251
Fuse/universal component carrier	LK7936
Sampler	LK5290
Automotive fuse carrier	LK4786
Fuse	LK8623
Protoboard	LK4893

Non-carrier products

Description	Part number
MES bulb, 2.5V, 0.2A	LK2341
MES bulb, 6V, 0.04A	LK2347
MES bulb, 6.5V, 0.3A	LK2350
MES bulb, 14V, 0.06A	LK2363
MES bulb, 12V, 0.1A	LK2346
Locktronics current probe	LK5100
MES bulb, 12V, LED, red	LK6749
MES bulb, 12V, LED, yellow	LK6822
MES bulb, 12V, LED, white	LK6841
Earphone/microphone with leads	LK5270
400 turn induction coil	LK5299
Ferrite rod	LK3290
Curriculum CD ROM	LK6492
Terminal post	LK5294
Small bar magnet	LK0123
Small compass	LK0124
Locktronics user guide	LK4000
Lenz's law kit	LK7487
Faraday's law kit	LK7489
Fleming's motor rule apparatus	LK6482
Locktronics mini protoype board	LK4839
Circuit breaker	LK8623
OBDII lead	LK5697

Packaging and storage

Description	Part number
Deep tray	HP5540
Tray lid	HP4039
62mm daughter tray	HP9564
Daughter tray foam insert	HP7750
18 tray trolley	HP3025N
12 tray trolley	HP2025Q



LK6203

LK6205
LK6206

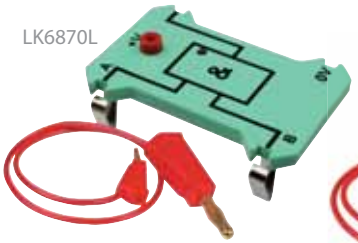
Capacitors

Description	Part number
Capacitor, 100pF, Ceramic	LK6283
Capacitor, 0.1µF, Polyester	LK5222
Capacitor, 0.47µF	LK6216
Capacitor, 1µF, Polyester	LK6205
Capacitor, 2.2µF, Polyester	LK6217
Capacitor, 4.7µF, 25V	LK6206
Capacitor, 4.7µF, Ceramic	LK6239
Capacitor, 100µF, 25V	LK6202
Capacitor, 150µF, 25V	LK6223
Capacitor, 1000µF, Electrolytic, 30V	LK4003
Capacitor, 2200µF, 25V	LK6203
Capacitor, 4700µF, Electrolytic, 16V	LK6653
Capacitor, 22000µF, Electrolytic, 16V	LK3662
Capacitor, 10uF, Electrolytic, 25V	LK5221
Capacitor, 47uF, Electrolytic, 25V	LK5224
Capacitor, Variable, 15-140PF	LK6214
Capacitor, 1nF, Polyester	LK6239

LK6214R3
LK4021
LK4123

Inductors

Description	Part number
Choke, 5mH	LK6214R3
Choke, 10mH	LK6214R1
Choke, 47mH	LK6214R2
Choke, 68mH	LK6215
Choke, 200mH	LK9877
Transformer, 2:1 turns ratio	LK4123
Ferrite rod carrier	LK4021
2:1 transformer	LK7483
Dual 400 turn coil	LK9998


LK6870L


LK6860L

Logic gates - CMOS

Gates are available with either American National Standards Institute (ANSI) symbols or with Systems Block (SB) symbols. All sub-systems and logic gates are fitted with 2mm power connector sockets. Gates are delivered with 2mm to 4mm power leads as standard - 'L' Gates are also available with 2mm to 2mm leads for use in labs where only 2mm connectors are allowed - 'LE'.

Description	Part no. SB 2mm to 2mm	Part no. ANSI 2mm to 2mm	Part no. SB 2mm to 4mm	Part no. ANSI 2mm to 4mm
AND gate with lead	LK6870LE	LK6860LE	LK6870L	LK6860L
NAND gate with lead	LK6873LE	LK6863LE	LK6873L	LK6863L
NOR gate with lead	LK6874LE	LK6864LE	LK6874L	LK6864L
NOT gate with lead	LK6872LE	LK6862LE	LK6872L	LK6862L
OR gate with lead	LK6871LE	LK6861LE	LK6871L	LK6861L
XOR gate with lead	LK6875LE	LK6865LE	LK6875L	LK6865L

LK5214A

LK5202

Resistors

Here is our range of resistors. If you do not see the value you need, then you can make your own with our pre-printed blank carrier resistors.

Description	Part no. DIN	Part No. ANSI
Resistor, 3.9Ω, 3W, 5%	LK5211	
Resistor, 10Ω, 1W, 5%	LK4025	LK4025A
Resistor, 12Ω, 1W, 5%	LK4100	LK4100A
Resistor, 47Ω, 0.5W, 5%	LK4065	LK4065A
Resistor, 68Ω, 0.5W, 5%	LK5217	LK5217A
Resistor, 100Ω, 1W, 5%	LK4002	LK4002A
Resistor, 120Ω, 0.5W, 5%	LK5206	LK5206A
Resistor, 180Ω, 0.5W, 5%	LK5207	LK5207A
Resistor, 220Ω, 0.5W, 5%	LK5215	LK5215A
Resistor, 270Ω, 0.5W, 5%	LK5205	LK5205A
Resistor, 500Ω, 0.5W, 5%	LK6237	
Resistor, 560Ω, 0.25W, 5%	LK6219	LK6219A
Resistor, 1KΩ, 0.25W, 5%	LK5202	LK5202A
Resistor, 2.2KΩ, 0.25W, 5%	LK6218	LK6218A
Resistor, 5KΩ, 0.25W, 5%	LK6230	
Resistor, 5.6KΩ, 0.25W, 5%	LK5209	LK5209A
Resistor, 10KΩ, 0.25W, 5%	LK5203	LK5203A
Resistor, 15KΩ, 0.25W, 5%	LK6213	LK6213A
Resistor, 22KΩ, 0.25W, 5%	LK6211	LK6211A
Resistor, 33KΩ, 0.25W, 5%	LK5201	LK5201A
Resistor, 50KΩ, 0.25W, 5%	LK6231	
Resistor, 100KΩ, 0.25W, 5%	LK5218	LK5218A
Resistor, 150KΩ, 0.25W, 5%	LK6212	
Resistor, 200KΩ, 0.25W, 5%	LK6238	LK6238A
Resistor, 270KΩ, 0.25W, 5%	LK5204	LK5204A
Resistor, 330KΩ, 0.25W, 5%	LK6201	LK6201A
Resistor, 500KΩ, 0.25W, 5%	LK6232	LK6232A
Resistor, 1MΩ, 0.25W, 5%	LK6200	LK6200A
Resistor, 1.5MΩ, 0.25W, 5%	LK5210	
Resistor, 10MΩ, 0.25W, 5%	LK6233	
Resistor, Rx	LK5252	LK5252A
Potentiometer, 25Ω	LK5212	
Potentiometer, 250Ω	LK5208	LK5208A
Potentiometer, 1KΩ	LK4034	LK4034A
Potentiometer, 10KΩ	LK5214	LK5214A
Potentiometer, 100KΩ	LK5219	
Potentiometer, 1MΩ	LK5213	
Resistor, variable, 250Ω	LK3893	
Resistor, variable, 10KΩ	LK6630	
Resistor, variable, 100KΩ	LK6631	
Resistor, 50ohm, 1/4w, 2%	LK8980	

System blocks and other ICs

All sub-system and logic gates are fitted with 2mm power connector sockets. Gates are delivered with 2mm to 4mm power leads as standard - 'L'. Gates are also available with 2mm to 2mm leads for use in labs where only 2mm connectors are allowed - 'LE'.

Description	Part number	
Systems block transistor switch		LK6831L
Systems block transducer driver		LK6832L
Description	**2mm to 2mm**	**2mm to 4mm**
555 timer	LK6300LE	LK6300L
Op Amp module (TL081)	LK6234LE	LK6234L
Voltage regulator (7805)	LK7208LE	LK7208L
Flip-flop, horizontal carrier	LK6500LE	LK6500L
Flip-flop, vertical carrier	LK6501LE	LK6501L

Semiconductors

Description	Part number
Diode, germanium	LK5242
Diode, power, 1A, 50V	LK5243
Diode, silicon	LK5249
Zener diode, 4.7V	LK5247
Zener diode, 6.8V	LK5253
Zener diode, 8.2V	LK5254
Zener diode, 12V	LK5258
Schottky diode	LK8000
Bridge rectifier	LK5266
Transistor LHF, NPN	LK5241
Transistor LHF, PNP	LK5256
Transistor RHF, NPN	LK5240
Transistor RHF	LK5255
Transistor, unijunction	LK5246
Power transistor, NPN, 1.5A	LK6705
Power transistor, NPN, 10A	LK7203
Transistor, JGFET	LK5146
Transistor, FET	LK7219
Power MOSFET transistor	LK8011
Thyristor	LK5248

Electromechanical

Description	Part number
Solenoid	LK6838
Buzzer, 6V, 15mA	LK6423
Buzzer, 12V, 15mA	LK3246
Speaker	LK8932

Dimensions
W: 60cm x H: 78cm

Engineering panel

Description	Part number
Engineering panel with built in MIAC controller, with UK power supply	HP2673

Power / battery carriers

Description	Part number
Power supply carrier	LK8275
Power supply carrier with voltage source symbol	LK7461
Dual voltage rail power supply carrier	LK8492
AC voltage source carrier	LK2340
AA battery holder carrier	LK7409

Relays

Description	Part number
Relay, 12V coil, 10A normally open	LK5280
Relay, 6V coil, 10A normally open	LK5403
Relay, 6V coil, 10A changeover with 2mm to 4mm lead	LK7889
Relay, reed, changeover	LK4103
Relay, reed, normally open	LK5405
Relay, 12V coil, 10A changeover with 2mm to 4mm lead	LK7049

Power supplies

Description	Part number
Adjustable DC power supply, 3V to 13.5V, 1.6A, no carrier	HP2666
AC power supply, 12VAC, 1A, UK	HP3728
AC power supply, 12VAC, 1A Europe	HP4429
AC power supply, 12VAC, 1A, USA	HP4688
+/-12VDC power supply, 5 pin DIN, inc UK mains lead	HP8405
IEC mains connector lead, for +/-12 VDC PSU, Europe	HP3702
IEC mains connector lead, for +/-12 VDC PSU, USA	HP3703
DC power supply, 15VDC, 25A, UK	HP0056

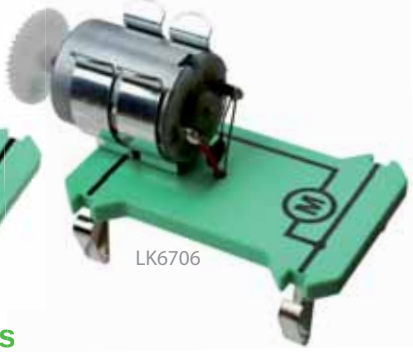

LK7746


LK6430

Optoelectric and lights / lamps

Description	Part no. SB	Part no. ANSI
Lampholder, MES, for automotive LEDs	LK5287	
Lampholder, MES	LK5291	
LED, red	LK6635	LK6635A
LED, green	LK6636	LK6636A
LED, yellow	LK6637	LK6637A
Solar cell	LK7746	


LK4663


LK6706

Motors / generators

Description	Part number
Motor, 3V to 12VDC, 0.7A	LK6706
Motor, 6V, open frame	LK4102
Stepper motor	LK4322
Low power solar motor	LK4663
Hand cranked generator	LK4893
Hand cranked generator spare handle	LK4894
Motor with reluctor	LK8113

LK5144

LK5401

LK4121

Sensors

Description	Part no. DIN	Part no. ANSI
Hall effect switch	LK6734	
Light dependent resistor	LK5144	LK5144A
Photodiode	LK7361	
Thermistor, 470Ω, NTC	LK5401	LK5401A
Thermistor, 4.7KΩ, NTC	LK5402	LK5402A
Thermistor and moisture sensor PCB	LK6850	
Thermocouple carrier	LK8988	
Voltage dependent resistor	LK4121	
Slotted opto sensor with 2mm to 4mm lead	LK6707	
Magnetic pickup	LK8743	

LK6207

LK6632

LK6633

Switches

Description	Part number
Switch, on/off, toggle	LK6633
Switch, push to make, metal strip	LK6207
Switch, normally open, reed	LK5404
Switch, reversing, toggle	LK6632
Switch, changeover, toggle	LK6224
Switch, changeover	LK6208
Microswitch	LK6634
Switch, on/off, metal strip	LK6209


LK5800

LK7215

LK5900

LK7215A

Blank carriers

Description	Part no. SB	Part no. ANSI
Blank carrier, large, pack of 10	LK5900	
Blank carrier, small, pack of 20	LK5800	
Blank resistor carrier	LK7215	LK7215A
Blank capacitor carrier	LK7216	
Blank electrolytic carrier	LK7217	
Blank diode carrier	LK8013	
Blank transistor carrier	LK7218	


LK3982

Moving coil meters

Description	Part number
Voltmeter, 0V to 15V	LK3982
Voltmeter, +/-7.5V	LK9438
Ammeter, 0mA to 100mA	LK9381
Ammeter, 0A to 1A	LK8397


LK8150


LK8154

Resistivity carriers

Description	Part number
Nichrome 0.075mm² x 500mm	LK8150
Nichrome 0.075mm² x 250mm	LK8152
Nichrome 0.21mm² x 500mm	LK8154
Constantan 0.075mm² x 500mm	LK8156

Lenz's law apparatus

The Lenz's law apparatus allows students to easily see that, "An induced current is always in such a direction to oppose the motion or change causing it". The apparatus consists of a copper tube, with one side removed, and two identical cylinders only one of which is magnetised. Lenz's law is demonstrated by the fact that when the metal cylinders are dropped through the copper tube, the magnetised cylinder falls at a much slower rate because of induced eddy currents in the copper tube wall. Students will be intrigued by this highly visual experiment which forms an ideal part of a course on motors and generators.

Description	Part number
Lenz's law apparatus	LK7487

Energy meter

This simple meter is ideal for giving students a quantitative and qualitative feel for the unit of energy - the Joule - and power - the Watt. The meter measures voltage, current, power consumption and shows energy used over time. For simplicity, the instrument automatically adjusts the display to show suitable units and an appropriate number of decimal places so that it can deal with a very wide range of values (e.g. for energy, from 0.01 millijoules up to 300 kilojoules). The function button has four settings to select the desired quantities to be measured (energy and time, power, average power, voltage and current). The meter includes a 9V mains adaptor (UK only).

Description	Part number
Energy meter	LK8591

Faraday's law apparatus

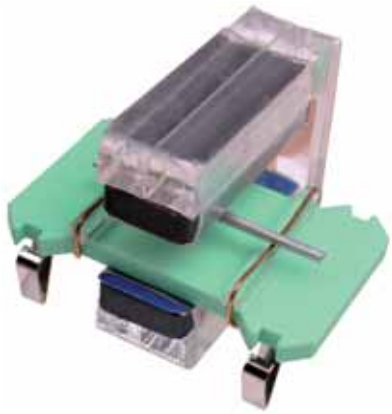
This apparatus is ideal for demonstrating Faraday's law of electromagnetic induction. It consists of a clear plastic tube containing a powerful magnet, with a 400 turn coil bonded onto the surface of the tube. When the tube is inverted the magnet passes through the coil, inducing a voltage on the coil terminals. Students are able to use an oscilloscope or datalogger to easily see the induced voltage. This is an ideal precursor to understanding generator theory.

Description	Part number
Faraday's law apparatus	LK7489

Locktronics PICmicro microcontroller

This carrier includes a reprogrammable PICmicro microcontroller with four general purpose input output pins. When used as inputs the pins can be configured to be analogue or digital. The carrier includes three slide switches which can be used for selecting one of 8 internal programs in the PIC. The device can also be reprogrammed from the USB port. Power can be derived from the on-board 2mm connectors or from the USB port. This product is compatible with the free (2K code limit) version of Flowcode.

Description	Part number
USB reprogrammable PICmicro MCU with 2mm to 4mm lead	LK4690L
Replacement chip for Locktronics PIC	LK8372
USB2 high speed A to mini B lead	HPUAB



Fleming's motor rule apparatus

This apparatus is used to demonstrate the fact that a force is exerted on a current-carrying conductor when it is placed in a magnetic field. The apparatus consists of three parts - a large Locktronics carrier with two parallel wires, a powerful magnetic yoke with North and South poles clearly visible, and a thin metal tube as the conductor. The tube 'kicks' off the carrier when a current is passed through it. This highly visual apparatus provides an opportunity of demonstrating Fleming's left hand motor rule.

Description	Part number
Fleming's motor rule apparatus	LK6482

MIAC

MIAC is a powerful controller which has applications in Science, Technology, Electronics, Mechanical engineering, Automotive engineering and Chemical engineering. This version of the MIAC is supplied with 4mm shrouded sockets which are internally connected to all of the input outputs of the MIAC. The 4mm connectors mean that connection to Locktronics baseboards is extremely easy. Power supply and USB lead are not included.

Description	Part number
MIAC with 4mm shrouded sockets	MI0245
Power supply for MIAC (international)	HP2666
USB2 high speed A to B mini lead	HPUAB

Also available: E-blocks & Automatics catalogues

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