



ELECTRICAL & ELECTRONIC ENGINEERING

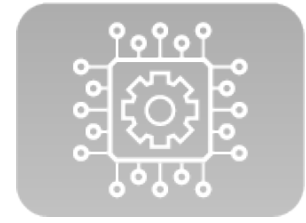


Excellence in education
for over 30 years

www.matrixtsl.com



ELECTRICAL & ELECTRONIC ENGINEERING



Electrical and electronic engineering is an area in which Matrix has always excelled. In recent years, we have developed our range of products further to include a modern electrical machines training system, robotics systems, power and energy electronics, power systems and more. You'll find the whole range outlined in this brochure.



“

“We have used Matrix equipment for several years at Lakes College, ranging from Locktronics to dsPIC systems used with a range of courses / age groups. The kits stand up to day-to-day use and when I have needed support (or spares) I have received accurate timely responses. The kits include workbooks but don't be afraid to take advantage of the versatility and make up your own extension activities. We would recommend the equipment to anyone looking for hands on activities in the classroom to support electrical / electronic engineering.”

Lakes College, United Kingdom




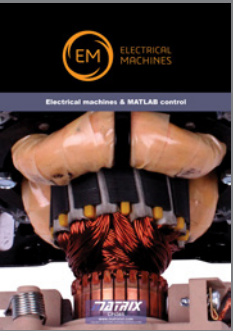

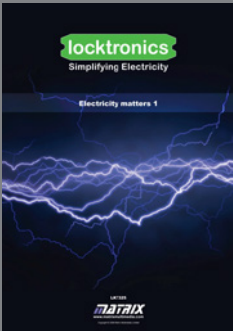
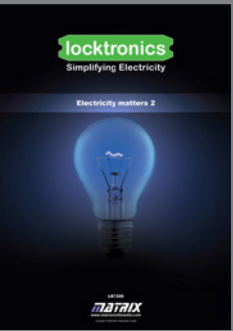



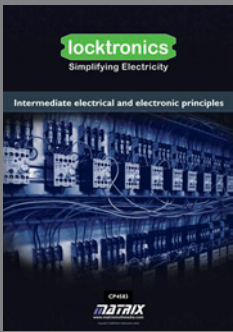
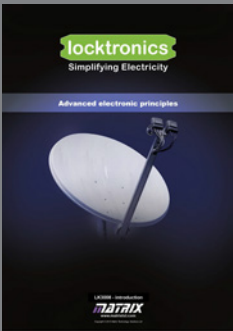
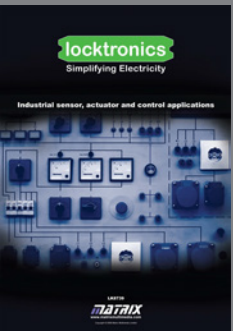
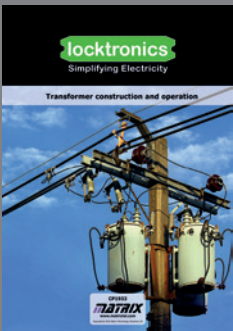
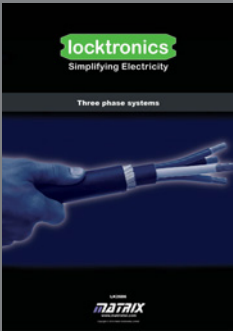
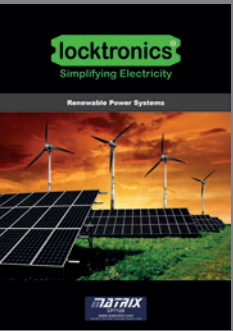
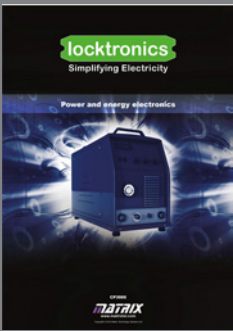
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“In January 2022, Uxbridge College was involved in its first Pearson Unit 6 Microcontroller Systems examinations, with approximately 80 students over a two week period of time. Uxbridge College has had PC examinations before in a dedicated room but this time with so many students given up to two weeks to complete this examination we required 50 x BL0502 E-blocks kits and 12 x rooms spread over the campus, involving around 20 teachers, technicians and admin staff. We required a mix of microcontroller knowledgeable staff and staff with no prior knowledge at all, to keep to requirements. Overall we were very pleased how well the process went.”


















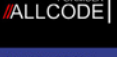





Mr Charles Barlow

Technician – Electrical & Electronic Engineering



 <p>Electrical Machines Systems CP6490</p> <p>Modern Electrical Machines EM6637-2</p>	 <p>Electrical Machines & MATLAB Control CP8385</p> <p>Modern Electrical Machines EM6637-2</p> <p>Locked Rotor Add-on EM2551</p>	 <p>Advanced Electrical Machines CP9989</p> <p>Modern Electrical Machines EM6637-2</p> <p>Locked Rotor Add-on EM2551</p> <p>Transformers Add-on EM4425</p>
 <p>Electricity Matters 1 LK7325</p> <p>Electricity Magnetism and Materials LK9071-2</p>	 <p>Electricity Matters 2 LK7326</p> <p>Electricity Magnetism and Materials LK9071-2</p>	 <p>Sequential Logic CP9945</p> <p>Combinational Logic LK6904</p> <p>Electricity Magnetism and Materials LK9071-2</p>
 <p>Transistor Amplifiers LK8485</p> <p>Transistor Amplifiers LK9435</p> <p>Electricity Magnetism and Materials LK9071-2</p>	 <p>Operational Amplifiers LK3061</p> <p>Sequential Logic LK6905</p> <p>Electricity Magnetism and Materials LK9071-2</p>	 <p>Intermediate Electrical and Electronic Engineering CP4583</p> <p>Intermediate Electrical & Electronic Principles LK9862</p>
 <p>Advanced Electronic Principles Intro LK3008</p> <p>Advanced Electronic Principles LK6804</p>	 <p>Industrial Sense and Control CP7718</p> <p>Industrial Sense and Control V3 LK2101</p> <p>Siemens S7 PLC with HMI AU0205</p> <p>MIAC NXT MI5550</p>	 <p>Transformer Construction and Operation CP1933</p> <p>Transformers LK1989</p>
 <p>Three Phase Systems LK2686</p> <p>Three Phase Systems LK4961</p>	 <p>Renewable Power Systems CP7128</p> <p>Power Systems LK6946</p>	 <p>Power and Energy Electronics CP3666</p> <p>Power and Energy Electronics LK3568</p>

Range Coverage

 <p>Simplifying Electricity</p> <p>Fault finding in electronic circuits</p>  <p>MATRIX</p>	<p>Fault Finding in Electronic Circuits LK9333</p> <p>FLOWCODE</p> <p>Arduino Microsystem Development Centre BL0554</p> <p>PIC Microsystem Development Centre BL0502</p> <p>Fault Finding in Electronic Circuits LK3566</p>	 <p>Introduction to microcontroller programming</p> <p>Suitable for BTEC National in Engineering unit 6: Microcontroller Systems for Engineers</p>  <p>CP4375-3 MATRIX</p>	<p>Introduction to Microcontroller Programming CP4375-3</p> <p>FLOWCODE</p> <p>Arduino Microsystem Development Centre BL0554</p> <p>PIC Microsystem Development Centre BL0502</p>	 <p>Field-Programmable Gate Array (FPGA)</p>  <p>MATRIX</p>	<p>Field-Programmable Gate Array (FPGA) CP3811</p> <p>FLOWCODE</p> <p>FPGA Programming BL0580</p>
 <p>GSM Communications</p>  <p>MATRIX</p>	<p>GSM Communications CP2832</p> <p>FLOWCODE</p> <p>Arduino GSM Technology Training Course BL0521</p> <p>PIC GSM Technology Training Course BL0579</p>	 <p>Bluetooth Communications</p>  <p>MATRIX</p>	<p>Bluetooth Communications CP1795</p> <p>FLOWCODE</p> <p>Arduino Bluetooth Training Course BL0563</p> <p>PIC Bluetooth Training Course BL0506</p>	 <p>Embedded Internet Communications</p>  <p>MATRIX</p>	<p>Embedded Internet Communications CP4895</p> <p>FLOWCODE</p> <p>Arduino Embedded Internet Training Course BL0535</p> <p>PIC Embedded Internet Training Course BL0531</p>
 <p>CAN Bus Communications</p>  <p>MATRIX</p>	<p>CAN Bus Communications CP2793</p> <p>FLOWCODE</p> <p>Arduino CAN Bus Training Course BL0587</p> <p>PIC CAN Bus Training Course BL0589</p>	 <p>ZigBee Communications</p>  <p>MATRIX</p>	<p>ZigBee Communications CP3924</p> <p>FLOWCODE</p> <p>Arduino Zigbee Training Course BL0536</p> <p>PIC Zigbee Training Course BL0516</p>	 <p>RFID systems</p>  <p>MATRIX</p>	<p>RFID Systems CP9329</p> <p>FLOWCODE</p> <p>Arduino RFID Training Course BL0548</p> <p>PIC RFID Training Course BL0510</p>
 <p>Robotics Course - Instructional Guide</p>  <p>MATRIX</p>	<p>Robotics Course - Instructional Guide CP5894</p> <p>Formula AllCode Standard Class Set RB7240</p> <p>Formula AllCode Deluxe Class Set RB7518</p> <p>Formula AllCode Deluxe Set RB7971</p>	 <p>Robot arm Development II</p>  <p>MATRIX</p>	<p>Robot Arm Development 2 CP5390</p> <p>FLOWCODE</p> <p>Robot Arm Production Cell V2 RB1387</p>	<div data-bbox="1070 1377 1219 1494">  </div> <div data-bbox="1230 1377 1481 1494"> <h1>LEARNING CENTRE</h1> </div> <div data-bbox="1070 1525 1251 1697">  </div> <div data-bbox="1289 1512 1492 1615"> <p>Enter the product code on the learning centre to find the curriculum</p> </div> <div data-bbox="1299 1630 1481 1704"> <p>PRODUCT NAME</p> <p>PRODUCT CODE</p> </div>	



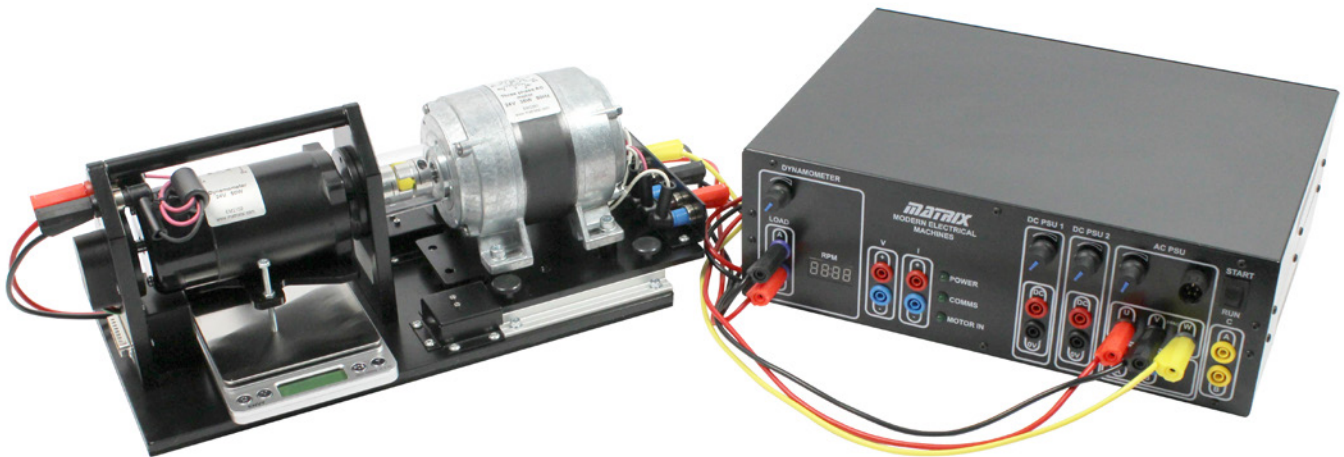
ELECTRICAL MACHINES

Our modern electrical machines training system is a revolutionary way of safely studying the characteristics of different motor types in a learning environment. This solution includes ten different types of machine, integrated power supply, control box and PC-based applications for advanced control of the different machine types. Further to this, we provide four separate curriculum manuals for teaching electrical machines principles using manual control with external meters, using PC control or using MATLAB.



Why choose Electrical Machines:

- Makes learning easier
- Extensive free curriculum
- Rugged and reliable
- Covers range of subject areas
- 10 different machines
- Sturdy storage for solutions
- Minimal assembly required
- MATLAB and LABview control



THIS KIT INCLUDES:

- Safe Operation; all moving parts covered
- Operates on 24V power, AC or DC
- Use manual or full PC Controls for the motors
- Measure voltage, current and power in DC and AC
- All machines are small footprint and low power
- Equipment can be easily stored and packed away

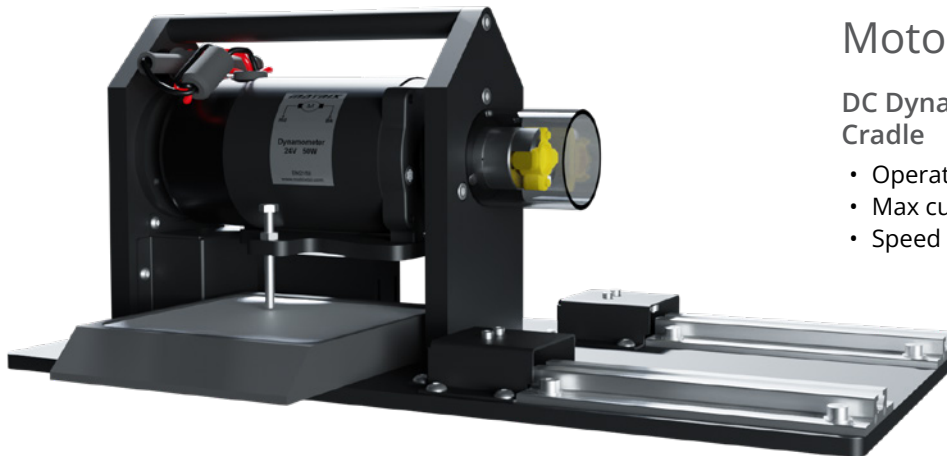
Control Box

At the heart of both manual and PC control of the machines is our control box. The control box houses all of the electronics including motor drivers, to control the modern electrical machines training system.



CONTROL BOX FEATURES

- Select DC, single-phase AC and 3-phase AC outputs
- Integrated voltage and current measurement
- Adjustable dynamometer load
- Switchable start and run capacitor
- 14 different instruments embedded within it
- A unique API, allowing connection to be made to the MATLAB environment
- A small size, around the size of a laptop, making it small enough to sit on a desk along with the rest of the kit and PC



Motors

DC Dynamometer / Motor and Cradle

- Operating voltage – 24V
- Max current - 2A
- Speed - 1500rpm

The aluminium cradle which houses our dynamometer features a rugged and safe sliding mechanism into which each of the other six motors in the range fix into position. The motor coupling meets the dynamometer in a protected housing and allows for safe study of each machine type at 24 volts. When using our system in manual mode, it is likely you will require two (per set) HP1324 Fluke 115 True RMS Digital Multimeter and one HP8067 Tektronix Digital oscilloscope.

Three Phase Induction Motor

Operating voltage – 24V AC
Frequency – 40-80Hz
Max current – 1.4A
Speed – 1400rpm



Shunt Motor

Operating voltage – 24V AC
Max current – 12A
Speed – 1500rpm



Single Phase Induction Motor

Operating voltage – 24V AC
Frequency – 40-80Hz
Max current – 1.4A
Speed – 1400rpm



Universal / Series Motor

Operating voltage – 24V AC
Frequency – 50Hz
Max current – 6A
Speed – 1500rpm



DC Motor/Dynamo

Operating voltage – 24V AC
Frequency – 40-80Hz
Speed – 1500rpm



Brushless DC Motor / 3 Phase Generator

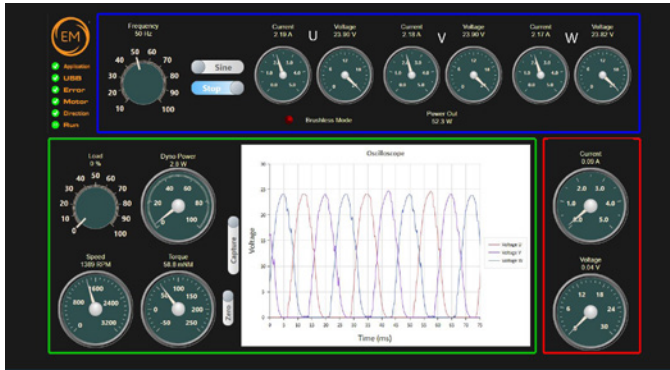
Operating voltage – 24V AC
3 Phase
Max current – 2A
Speed – 1500rpm



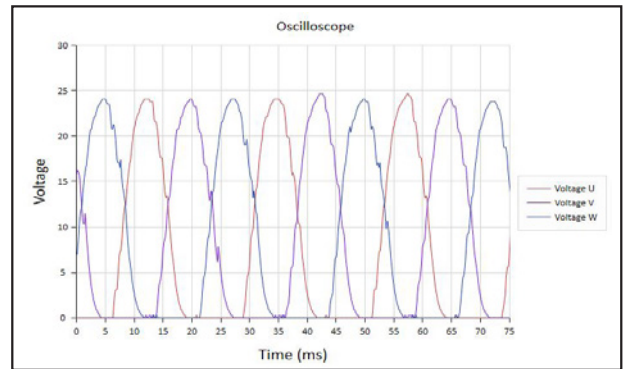
PC Software

The system is designed to be used manually or via connection to a laptop or PC. When utilising the PC control option, the user should download the app from the Resources page on the website. Below are a range of screenshots showcasing the ways the proprietary software can be used to control each type of machine in the range.

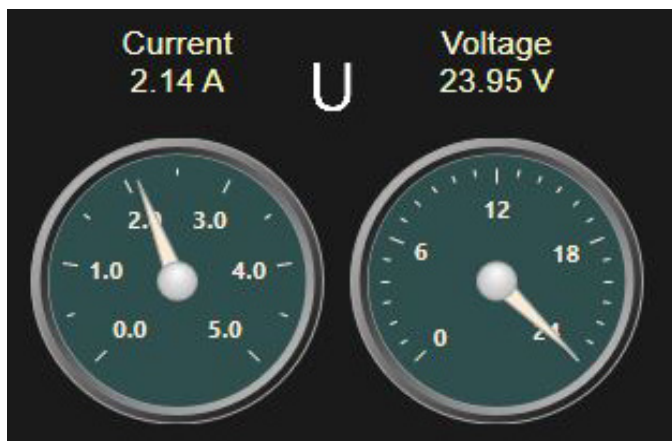
Through experimentation, users can review the results of altering the voltage, load etc of each machine and the subsequent effect this has on each machine's current, torque etc. over time.



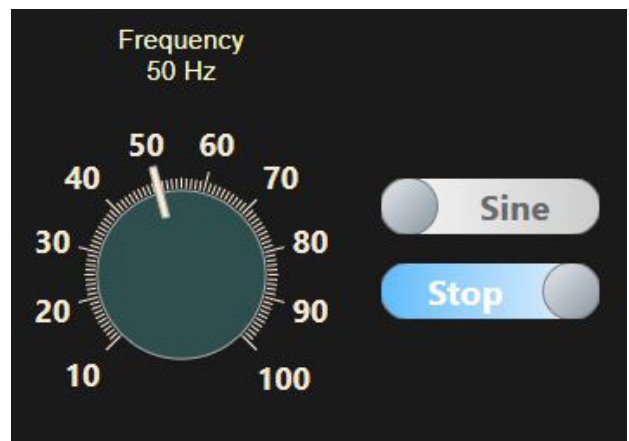
Three phase control software with integrated oscilloscope.



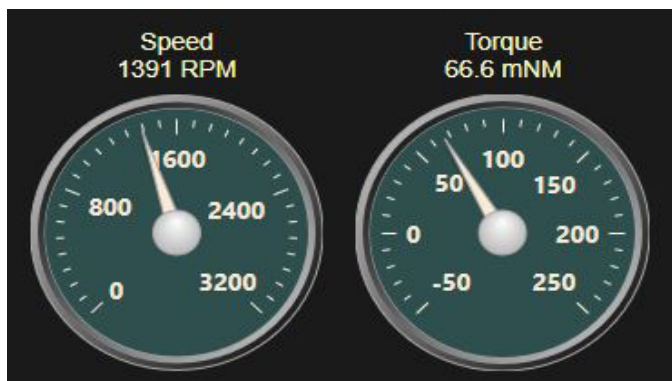
Close up of oscilloscope plot – users can select from one of 14 on-board instruments.



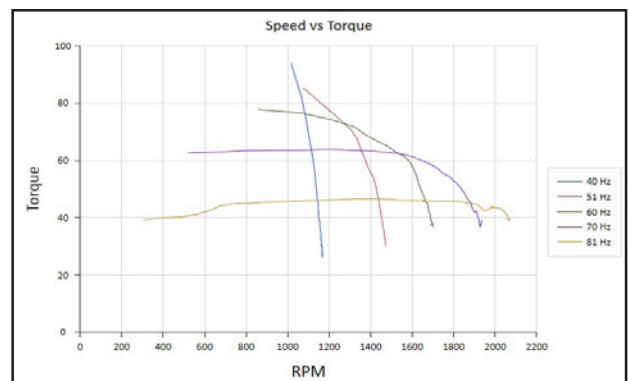
Gauges show key values such as current and voltage.



Set output frequency and waveform type – in this case digital or pseudo-sine.



Software allows you to monitor RPM and torque in real time.



Automatic speed torque graph for any of the machines can be generated by the software.

Optional Add Ons

Transformer Add On

EM4425

This add-on allows users to add transformer construction study to the electrical machines system from Matrix. This add-on is used with the Advanced Electrical machines curriculum and with this kit, students can study:

- Open and short circuit characteristics of transformers
- Circuit modelling of transformers using MATLAB or LabVIEW



LEARNING OBJECTIVES & EXPERIMENTS:

- Transformer open circuit test
- Transformer short circuit test

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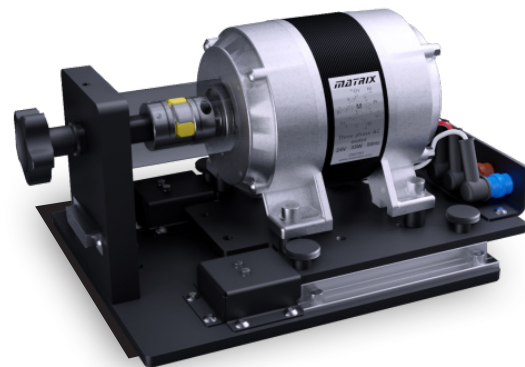


Locked Rotor Add On

EM2551

This locked rotor add-on allows higher level students to ascertain the equivalent circuit of an electrical machine through the locked rotor and free running rotor tests, students can study:

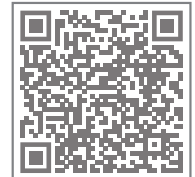
- Open and short circuit characteristics of induction motors
- Circuit modelling of transformers using MATLAB or LabVIEW



LEARNING OBJECTIVES & EXPERIMENTS:

- Induction machine locked rotor test
- Induction motor free running test

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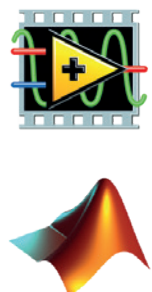
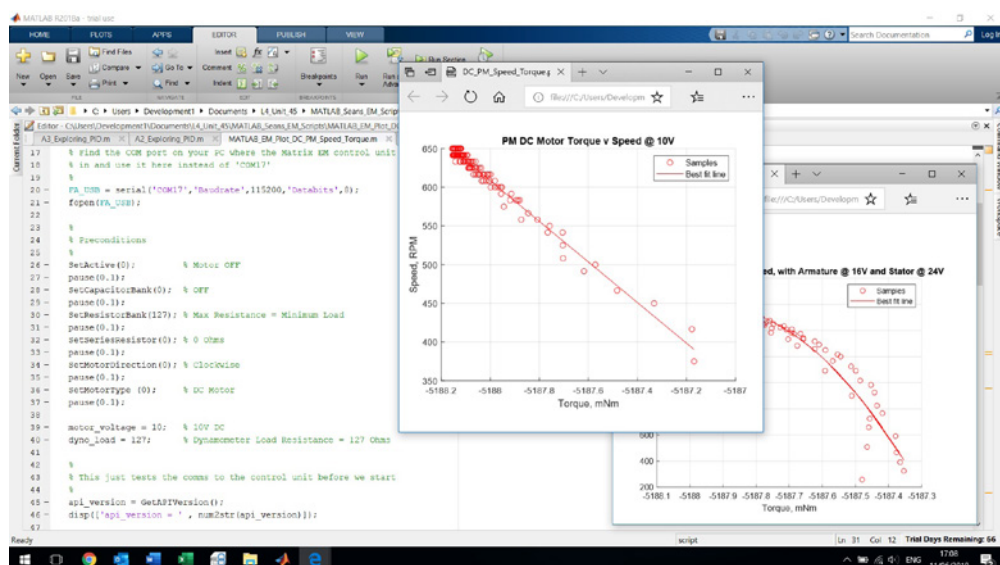
The electrical machines system is supplied with internet-based control as standard. This means the system can be used remotely by students, for distance or blended learning purposes.

Featuring Internet Control

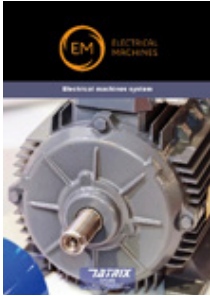


MATLAB and LABVIEW

A suite of API calls are provided which allows the system to be used with both MATLAB and LabVIEW software. This allows students to understand the characterisation of electromechanical systems using mathematical formulae and to compare simulated results with real world values.



We have created 4 curriculum packs to go with our range of modern electrical machines. They follow the learning required within different courses and come complete with learning instructions, worksheets and a teacher's section. They come equipped with all the learning required for the course, along with the software required.



Electrical Machines System

Teaches students the basics of electrical machine operation, their speed / torque characteristics, relevant mathematical relationships including torque, power, and slip, and details of the circuits and power supplies needed to drive them.

Electrical Machines, Electrical Installation & HVAC

Teaches Electrical Installation students the basics of electrical machine operation, their speed / torque characteristics and the circuits and power supplies needed to drive them.



MATLAB and Electrical Machines

Teaches students how to use MATLAB to measure the characteristics of electrical machines, how to define the characteristics using a mathematical model and to verify that model using test results.



Advanced Electrical Machines

Introduces students to more advanced concepts and models of electrical machines and focuses particularly on building equivalent circuits of machines.



Easily packed away and stored solution



"The electrical machines kit from Matrix is provided with storage trays. The kit is easily disassembled and packed in trays which can be stacked and stored away, leaving space for a multi use classroom"

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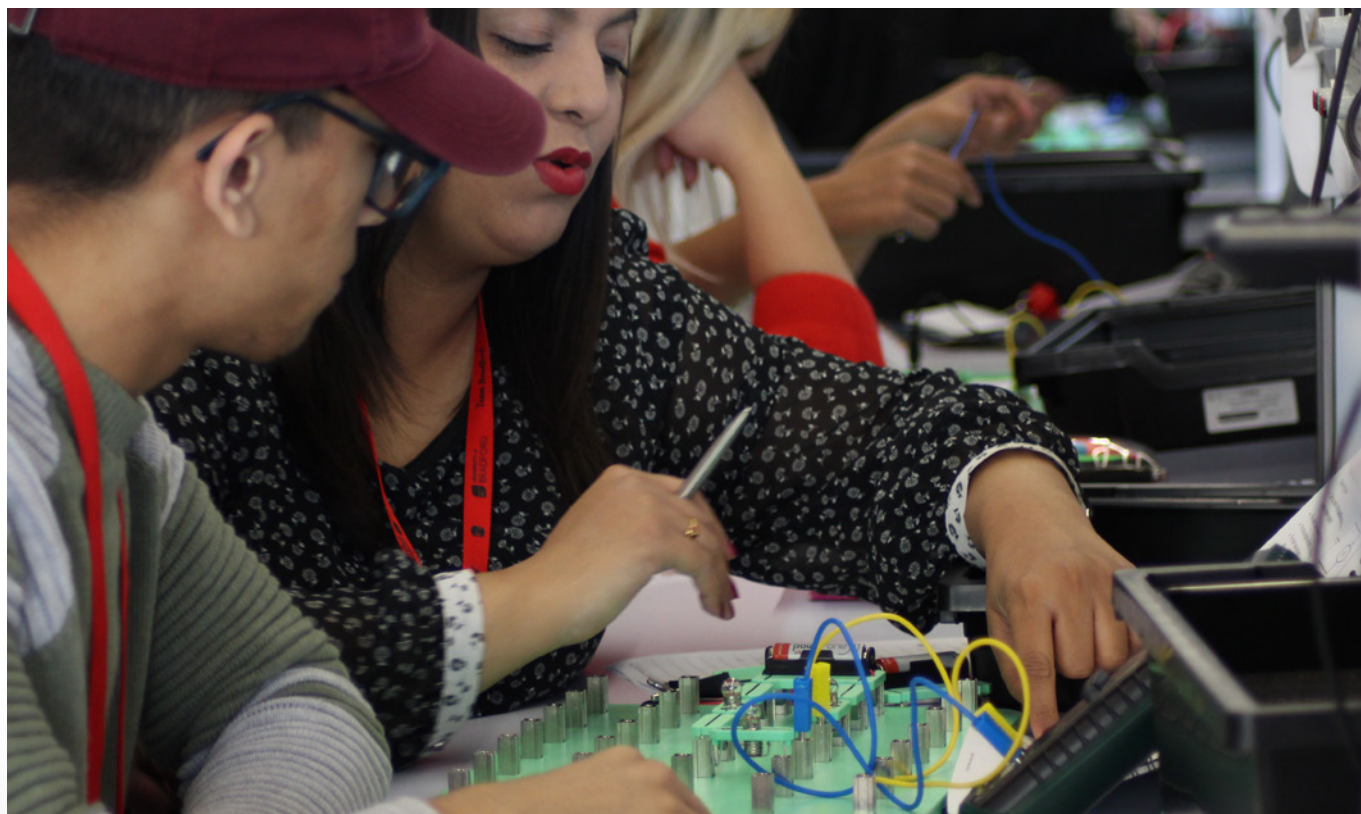






Simplifying Electricity

Locktronics is a range of products that simplifies the process of learning and teaching electricity and electronics from a basic through to a more advanced level. The core range consists of more than 200 electronic components (ANSI and DIN), which are assembled into topical kits for engineering, electrical installation, automotive, aviation and more. These components are mounted on rugged plastic carriers which are printed with the corresponding circuit symbol. Students use the carriers, in conjunction with a baseboard with interconnecting metal pillars to build up a working circuit, then use the worksheets provided to carry out experiments. All solutions are provided in sturdy storage solutions and with up-to-date curriculum always available online. Solutions are designed to be used 1 kit between 2 students.



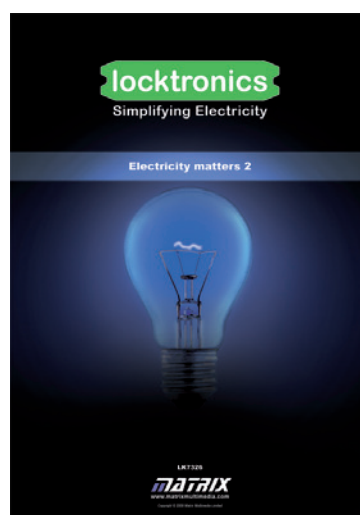
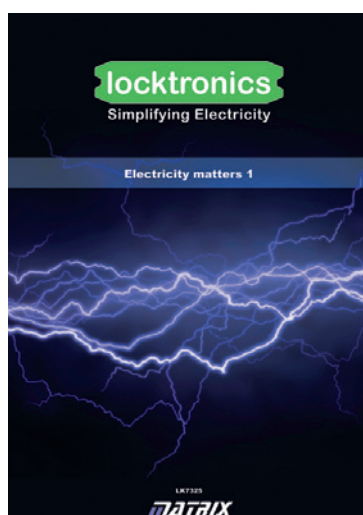
Why choose Locktronics:

- Makes learning easier
- Extensive free curriculum
- Rugged and reliable
- Covers range of subject areas
- Vast range of components
- Sturdy storage for solutions
- Minimal assembly required

The Electricity, magnetism and materials solution 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.



ANSI version also available **LK9071-2A**



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

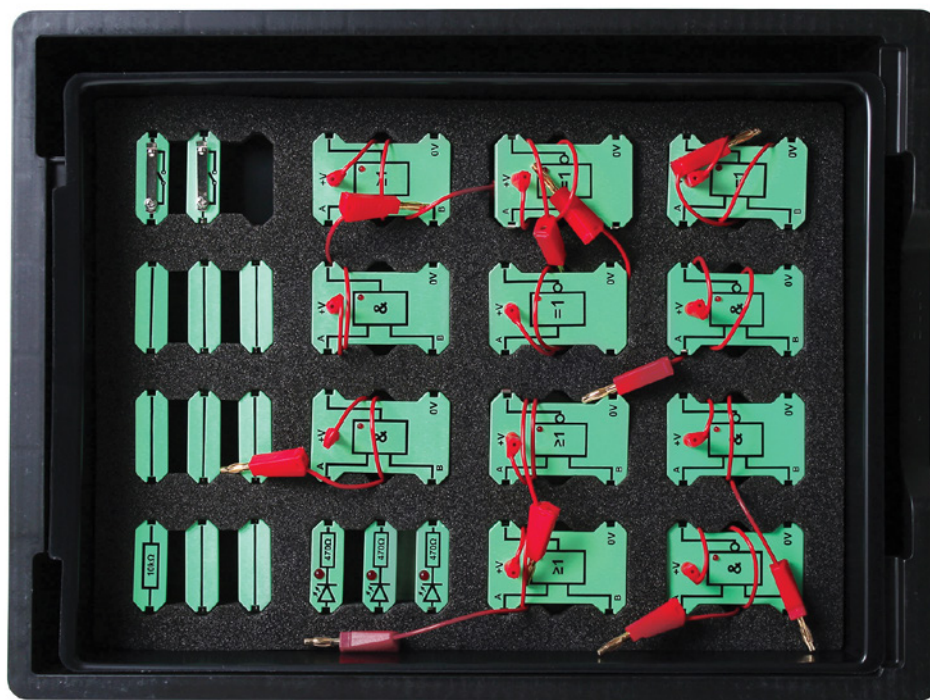
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Combinational Logic add-on pack

LK6904

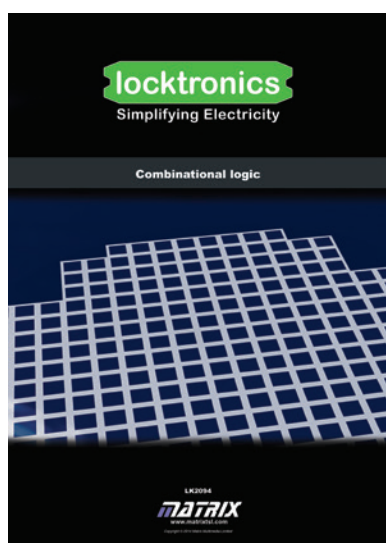
This kit is designed to be added to one of our basic kits to allow extended work in understanding logic gates and combinational logic systems. The pack starts by allowing students to understand basic logic gate operation and builds up to circuits and systems with up to four logic gates. A full set of worksheets and teacher's notes are provided.



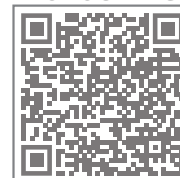
ANSI version also available **LK6904A**

LEARNING OBJECTIVES & EXPERIMENTS:

- Logic gates NOT, AND, NAND, OR, NOR, XOR
- Three input gates
- Equivalent gates
- Boolean expressions
- Combinational logic circuits: adder, encoder, multiplexer
- RS bistables



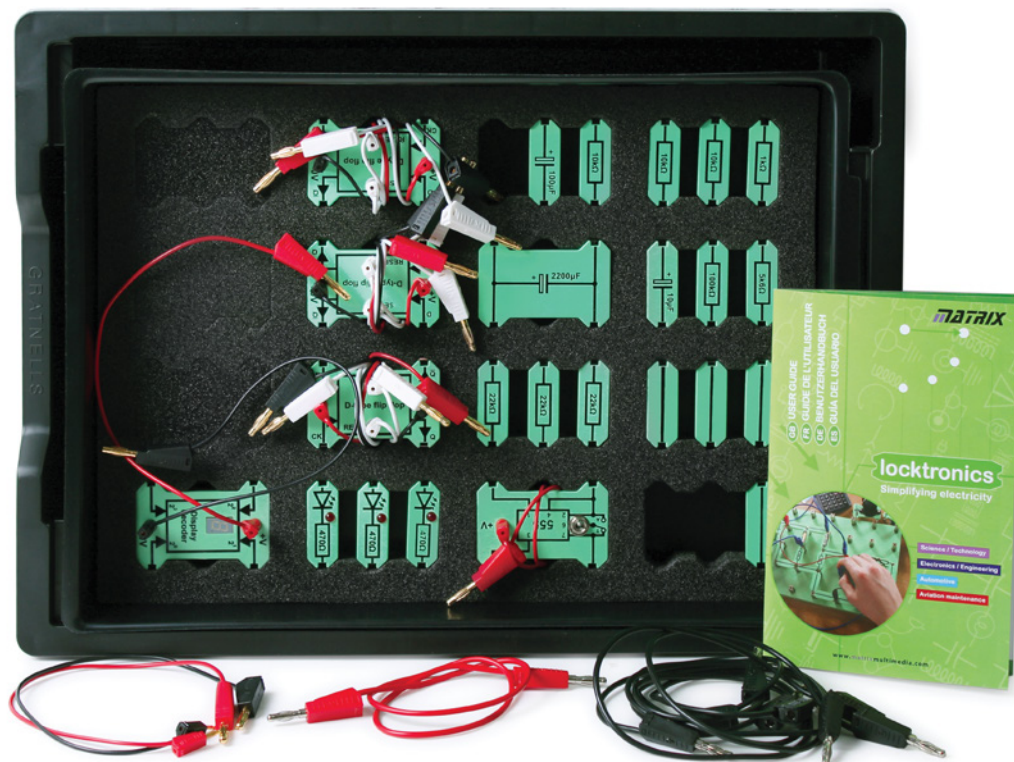
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Sequential Logic add-on pack

LK6905

The worksheets used with this kit assume a customer has bought one of our basic kits, like LK9071-2, as well as the Combinational logic add-on pack, LK6904. Together these kits allow students to do extended work in understanding sequential logic circuits and systems. The pack starts by allowing students to understand basic flip flop operation and builds up to the design of circuits and systems with three flip flops. A full colour workbook with teacher's notes is included.



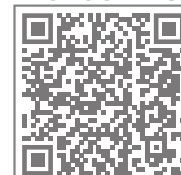
ANSI version also available **LK6905A**



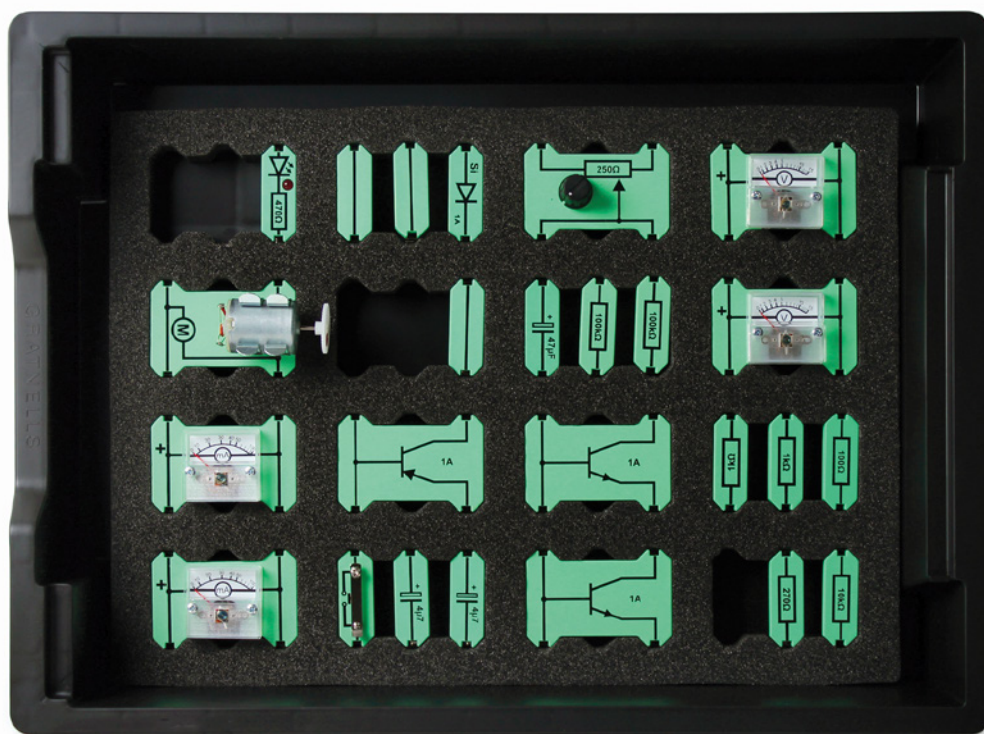
LEARNING OBJECTIVES & EXPERIMENTS:

- JK Bistable
- D-type flip flop
- Monostables and bistables
- Synchronous and asynchronous circuits
- Debounce circuits
- Latches
- 3 stage counter
- BCD counter
- 7-segment displays
- 3 stage shift register – PISO and PIPO
- R2R ladder DAC

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This add-on pack can be added to one of our basic kits to allow students to understand the use of transistors in amplifier circuits. Students construct a number of different types and classes of transistor amplifiers including classes A, B and AB, and analyse their behaviour. A full colour workbook, supplied in PDF format, contains all the experiments, worksheets and teacher's notes.

ANSI version also available **LK9435A**

LEARNING OBJECTIVES & EXPERIMENTS:

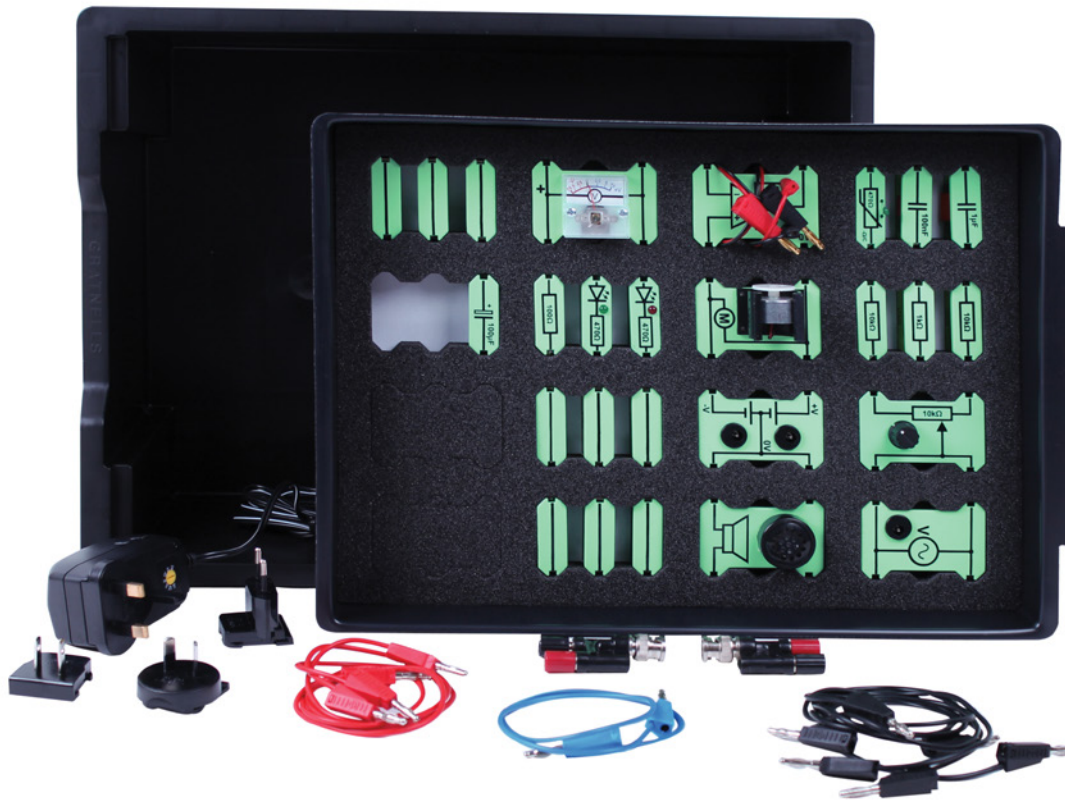
- Testing transistors
- BJT transistor characteristics
- Transistor as a switch
- Transistor as an amplifier
- Transformer coupled amplifier
- Stabilised common-emitter amplifier
- Two-stage amplifier
- Push - pull amplifier



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This add-on pack can be added to one of our basic kits to 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 student instructions and teacher's notes.



ANSI version also available **LK6906A**

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



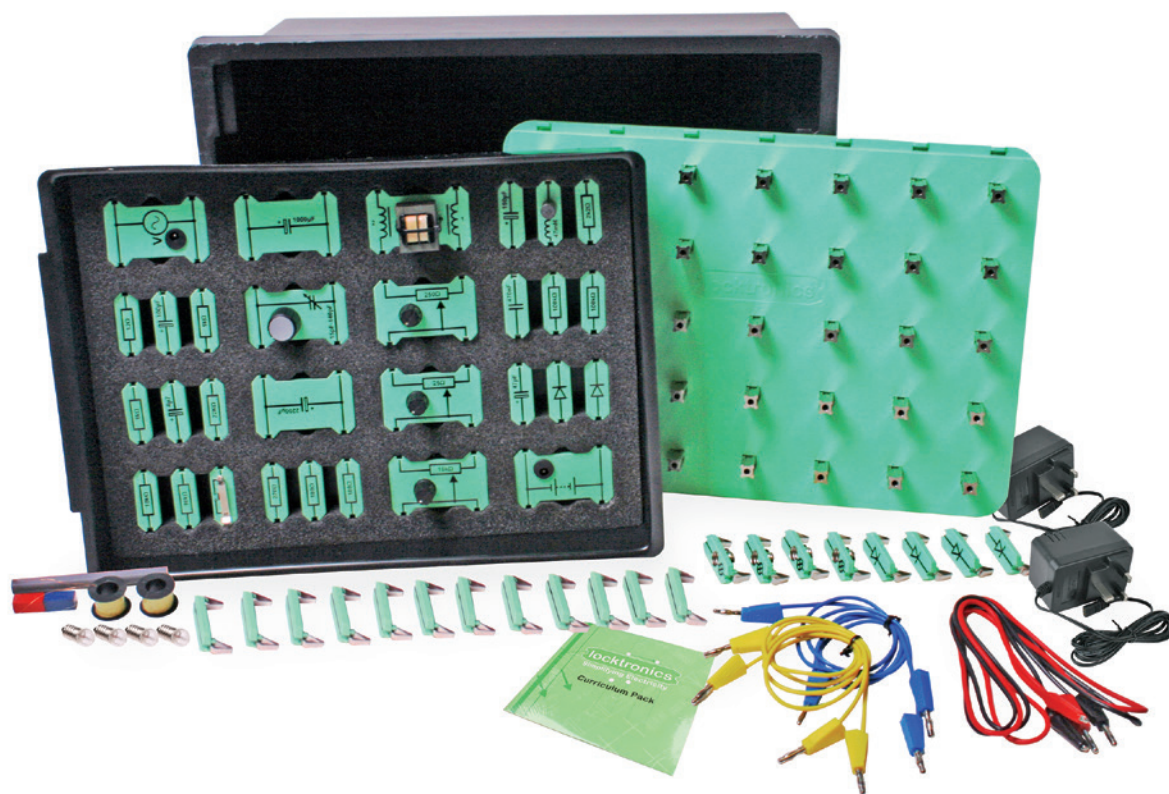
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Intermediate Electrical and Electronic Principles

LK9862

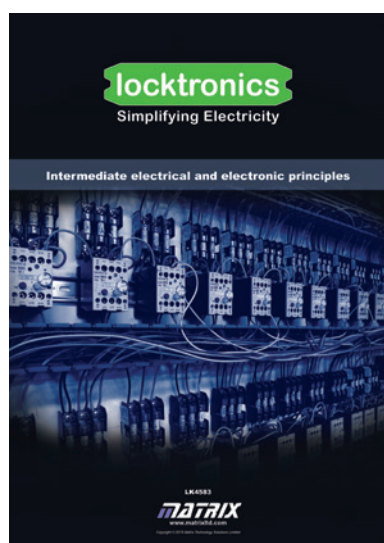
This kit, with its accompanying workbook, is intended to reinforce the learning that takes place in the classroom or lecture room for students at an intermediate level, studying electrical and/or electronic engineering. The 70-page workbook provides a series of practical activities and investigations that are designed to complement learning in the classroom and a comprehensive set of teacher's notes is included.



ANSI version also available **LK9862A**

LEARNING OBJECTIVES & EXPERIMENTS:

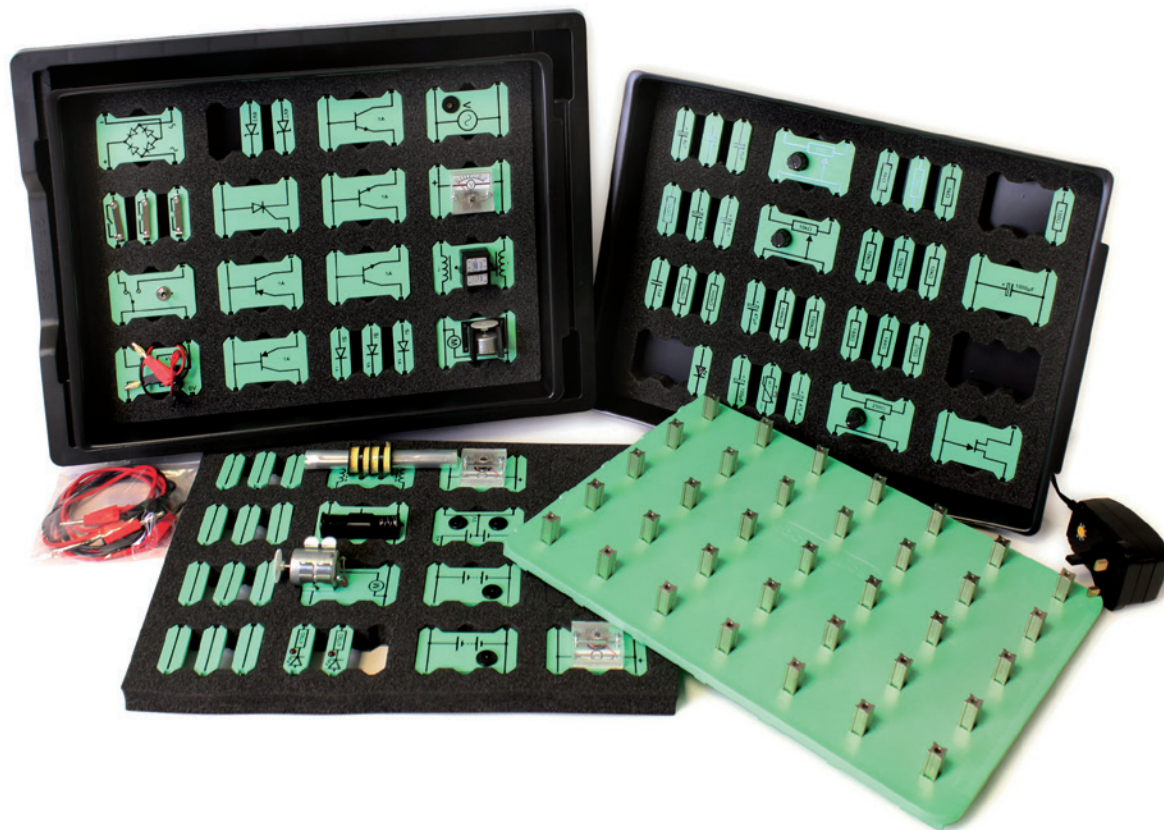
- Current and voltage measurement
- Current and voltage dividers
- Kirchoff's laws
- Power in DC circuits
- Electrostatics and capacitors
- AC measurements
- L-R, C-R and L-C-R circuits
- Transformers
- Diode characteristics
- Half and full wave bridge rectifiers



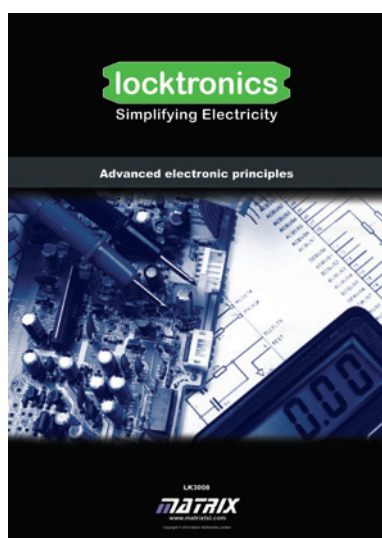
SCAN TO VISIT
PRODUCT PAGE



The experiments in this pack are designed for the more advanced students of electronics who need to understand the theory and practice of a wide range of electronic components and circuits: from basic diode circuits through to feedback and oscillator design. The 42 experiments are guided by a 100 page book and full instructor notes are included.



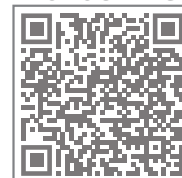
ANSI version also available **LK6804A**



LEARNING OBJECTIVES & EXPERIMENTS:

- Semiconductor devices: diodes, zener diodes, transistors, photodiodes, thyristor, voltage regulator, operational amplifiers.
- Semiconductor circuits: Full and half wave rectifiers, transistors as switches and amplifiers
- Amplifiers: characteristics, power amplifiers (A, B, AB), inverting, non-inverting, tuned, integrator, differentiator, comparator, Schmitt, filters (high pass, low pass, band pass, notch)
- Amplifiers with feedback
- Oscillators: Wien bridge, twin T, RC ladder, LC coupled, crystal

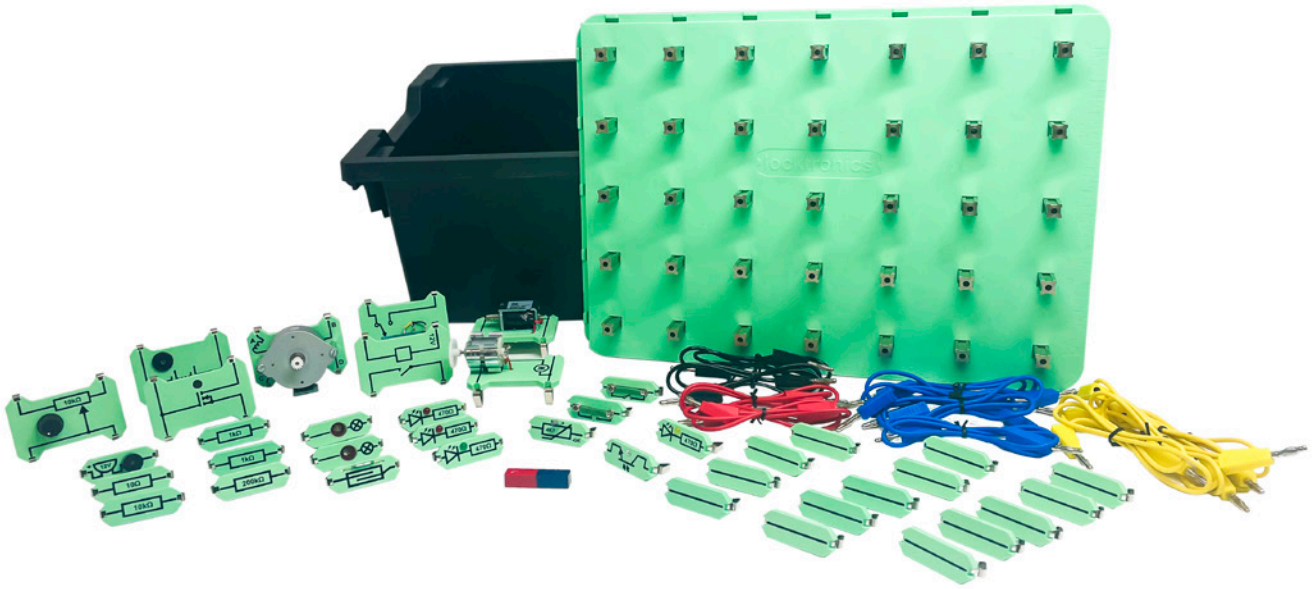
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Industrial Sense and Control V3

LK2101

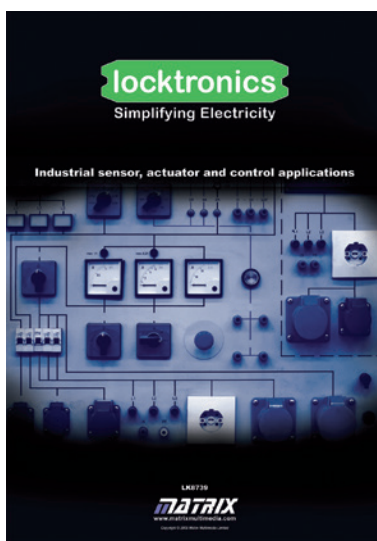
This solution provides an introduction to the role of industrial controllers in engineering. It can be carried out with our own MIAC NXT controller (MI5550), a Siemens S7 PLC with HMI (AU0205), or any other PLC using 24V inputs and outputs. The system consists of a controller, a Locktronics base board and a number of Locktronics switches, sensors, motors and indicators that students use to build a range of simple control circuits. Students progress through the worksheets building circuits and programming the controller to form a variety of functioning electronic systems.



ANSI version also available **LK2101A**

LEARNING OBJECTIVES & EXPERIMENTS:

- Basic output systems
- Sequenced output systems
- DC motor control with Pulse Width Modulation
- Basic inputs
- Traffic lights with crossing
- Stepper motor control
- Analogue sensing
- Detecting faults
- Open loop control
- Closed loop control



SCAN TO VISIT
PRODUCT PAGE



Siemens S7 PLC with HMI and 4mm Connectors

AU0205

The Siemens S7 PLC with HMI unit provides a 4mm connected interface between the S7 and your PC in a rugged plastic case. The S7 is fitted with a S7-1214C PLC which provides 10 inputs and 10 transistor outputs and a Siemens KTP 400 Series Touch Screen HMI - 4.3 in, TFT Display, 480 x 272pixels. The S7 is programmed from your PC using either a CAT 5 cable (provided) or Wi-Fi. A Telonika RUT950 high-performance industrial 4G LTE Wi-Fi router is included in the box – this allows you to program the unit by Wi-Fi and interface to other IP connected systems as part of Industry 4.0.

KEY FEATURES

- Siemens S7 PLC
- Wi-Fi router
- 4mm connector inputs outputs
- 24V power supply included



MIAC NXT

MI5550

The MIAC NXT is an educational Electronic Control Unit designed specifically for use in teaching automotive students how ECUs are used to control the electronic systems in vehicles. The MIAC NXT includes 8 analogue or digital inputs, 2 relays, 6 transistor outputs, 3 CAN buses, a LIN bus and connections for USB, Bluetooth, Wi-Fi and LAN. The MIAC NXT is provided with an accompanying operating system, or API, which allows it to be controlled by any third party programming system and is compatible with Flowcode Embedded and Flowcode App Developer. The MIAC NXT is built with real automotive technology and provides the same functionality as an automotive ECU. J1939 and OBDII connection are supported through software libraries within Flowcode software which are user accessible and allow users to create their own automotive system.

KEY FEATURES

- World's only educational ECU
- 8 inputs
- 2 relays
- 6 transistor outputs
- USB, Bluetooth, Wi-Fi and LAN
- Full API provided



Transformer Construction and Operation

LK1989

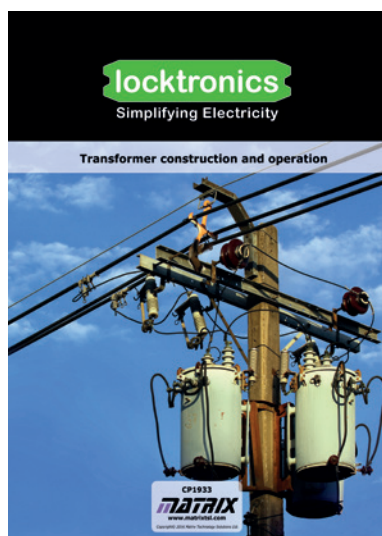
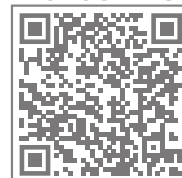
The Transformer construction and operation pack allows students to study not only how transformers work, but also study several different properties of induced magnetism. This kit consists of a plastic base, a laminated iron core, mounting fixtures, and six coils protected in a heat resistant film. Topics covered include Lenz' Law, Faraday's Law, how iron cores increase magnetic field strength, and electromagnetic induction itself. This versatile piece of equipment can also be used to teach about how transformers used by power companies carry electrical energy. Extensive instructions on how to use the apparatus as a demonstration as well as inquiry based lessons surrounding electromagnetic induction and transformers are included.



ANSI version also available LK1989A

LEARNING OBJECTIVES & EXPERIMENTS:

- Power and energy in DC systems
- Power in AC systems, power factor, losses
- Transformer construction
- Reactive loads

SCAN TO VISIT
PRODUCT PAGE



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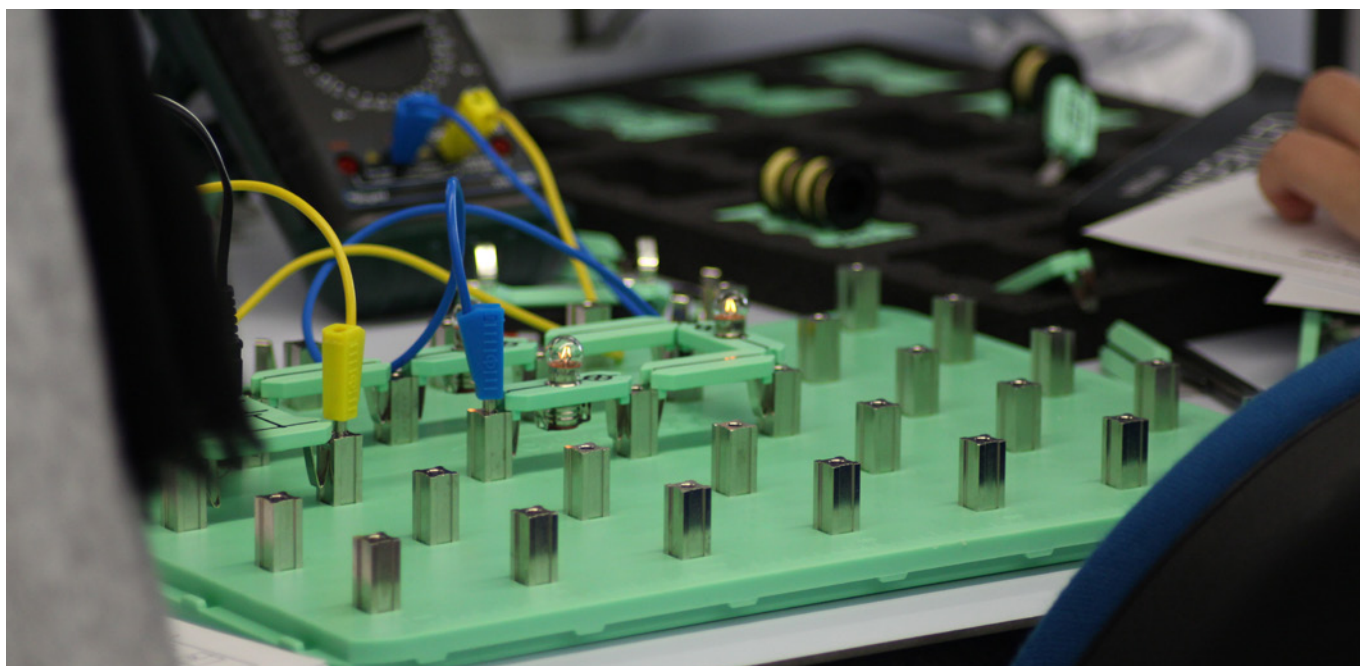
“We use the Matrix Locktronics Trainer in three different Automotive Service Technician courses offered at NAIT. There are many great features and benefits of these trainers.

The ease at which the students can build circuits with a wide variety of components and perform tests. The students can easily identify different components by the symbols on them and can visualize what is happening in the circuit. All the instructors like how compact and portable the units are which make it very easy to move from classroom to classroom.

The last thing I will mention is the reliability of the components is exceptional. After using them for over 5 years the only components we have had to replace are definitely because of user abuse not poor quality. ”

Calvin Feist

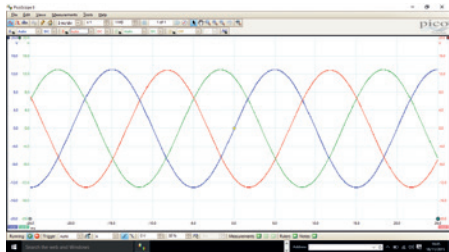
Program Chair for NAIT



Three Phase Systems

LK4961

This pack includes a suite of practical investigations into three phase systems and it includes a low voltage three phase generator and a low voltage three phase motor. The pack includes the parts needed to set up three phase systems based on star and delta topologies with balanced and unbalanced loads. Students work through the 33 page full colour workbook understanding three phase concepts as they progress. A 4 input Picoscope and current clamp is recommended. Current clamp is needed for some experiments.

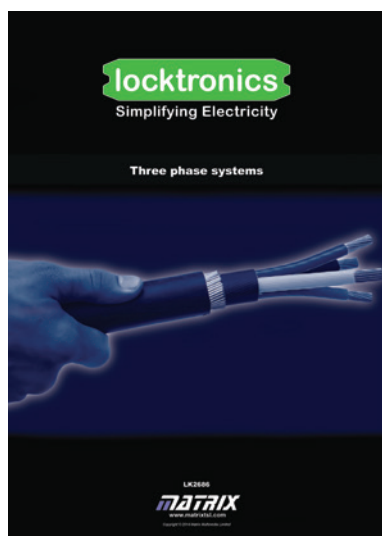


ANSI version also available **LK4961A**

LEARNING OBJECTIVES & EXPERIMENTS:

- Three phase circuits – star and delta
- Balanced and unbalanced loads
- Phase relationships in three phase systems
- Phase vectors
- Using a capacitor to create a phase shift for motors
- Three phase rectification – half and full
- Real, reactive and apparent power
- Three phase inductance and reactance
- Power in three phase systems
- Motors in three phase systems
- Using current clamps and PC oscilloscopes
- Power factor correction

Optional add-ons **HP5834 (Picoscope)**
HP5561 (Current Clamp)



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PRODUCT PAGE

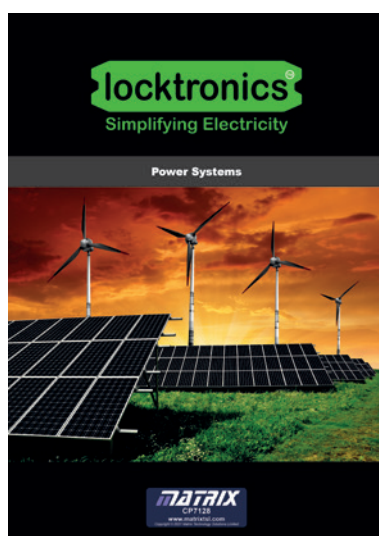


This kit combines our Locktronics learning system with a solar panel rig and a miniature wind turbine rig that can be used for experiments in Power and Energy electronics. The solar panel rig includes a full-sized solar panel - rated at 120 watts - that generates a reasonable amount of power under classroom/laboratory lighting. The kit also contains a variable speed DC motor coupled to a three-phase generator which produces up to 20 watts of power, replicating an industrial wind turbine. Together the solar panel rig and wind turbine rig can be used to provide varying amounts of energy, with varying voltage and current, in the lab. Students use these accessories with the Locktronics Power and Energy Electronics kit and 3.7V Lithium-ion batteries to conduct a range of experiments in domestic energy systems.



LEARNING OBJECTIVES & EXPERIMENTS:

- Sources of power and energy
- Wind turbine operation and output
- Solar panel operation and output
- Energy conversion – upconverters and downconverters
- Energy efficiency
- Batteries and series parallel configurations
- Lead Acid and Li-ion battery charge and discharge characteristics
- Powerwall technology
- Wind turbines
- Wind turbine power dumping
- Three phase rectification
- Voltage inversion – DC to AC



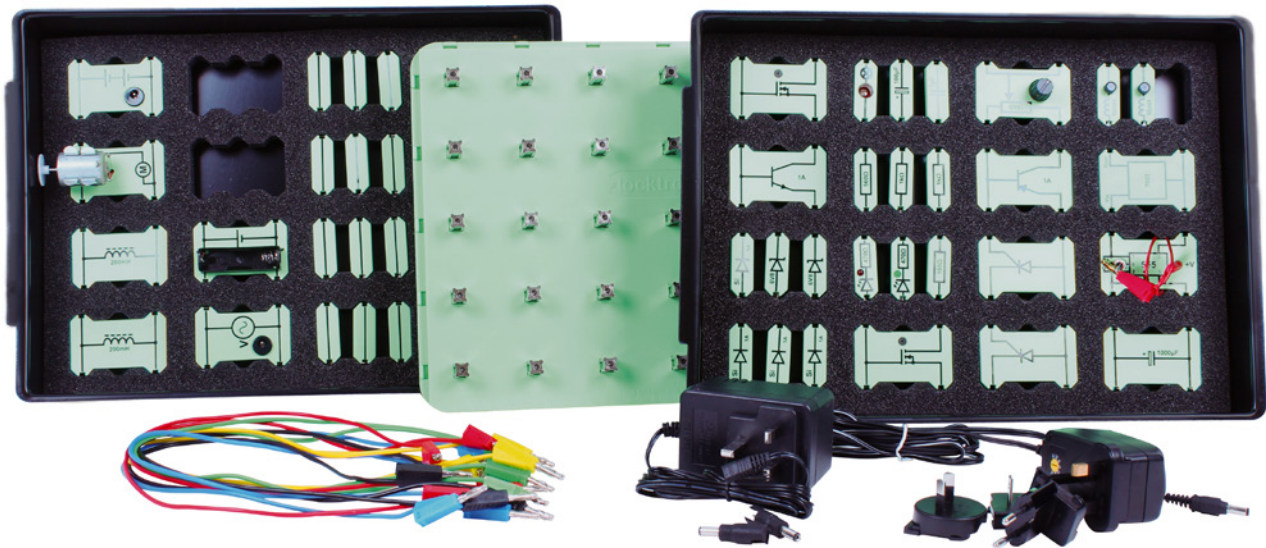
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Power and Energy Electronics

LK3568

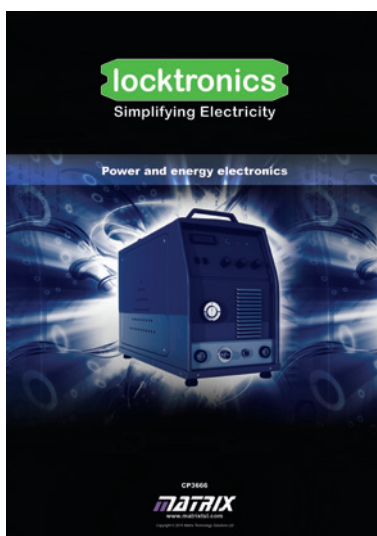
This kit is suitable for teaching students the technology behind modern power electronics systems which are used to convert one form of electrical energy into another in vehicles, domestic energy systems and a new wave of electronics devices. The kit first explores power components including diodes, BJT, MOSFET, IGBT, SCR, thyristors and triacs and then moves on to showing how these are used in power circuits including rectifiers, converters and inverters. A full suite of worksheets is supplied which guides students through the learning activities.



ANSI version also available **LK3568A**

LEARNING OBJECTIVES & EXPERIMENTS:

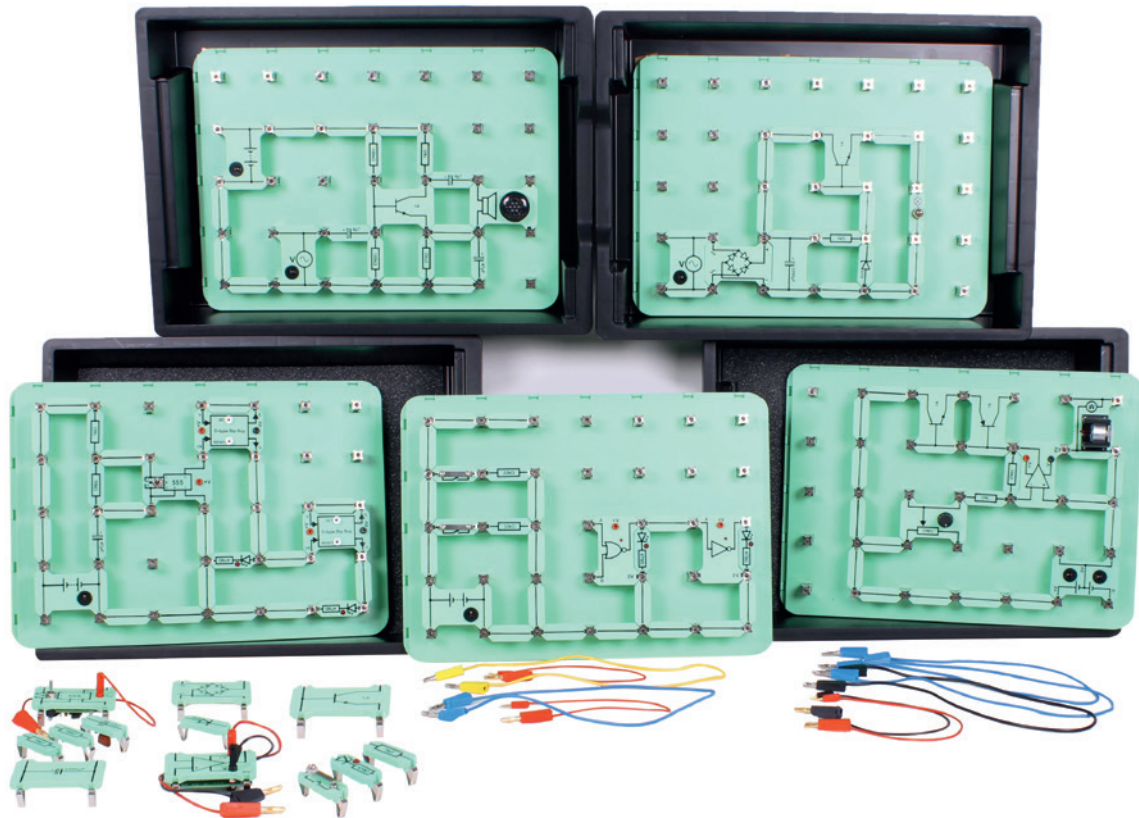
- Diodes, BJT, MOSFET, IGBT, SCR, thyristors and triac components
- Speed control of DC motors
- Half and full wave rectifiers
- Fixed voltage regulators
- Buck and boost converters
- Modern power electronics topologies
- Sources of renewable energy



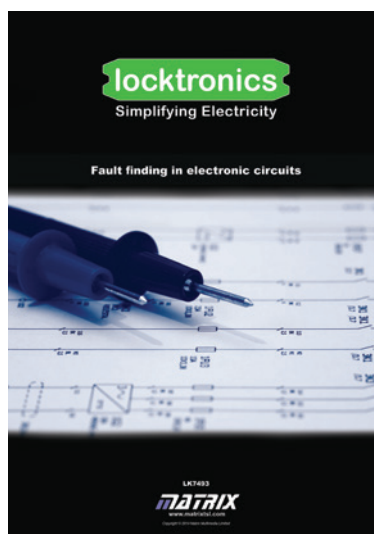
SCAN TO VISIT
PRODUCT PAGE



This solution allows students to gain experience of fault finding on several analogue and digital systems. Students first learn how to use test equipment and test the major groups of active and passive components. Then students are given a fully working circuit so that they can understand the circuit's function. Supervisors then insert one of a number of faults on each circuit and the student must deduce the fault through the use of the appropriate instruments. Faulty components are clearly marked underneath the carrier. Five fully tested and assembled circuits supplied.



ANSI version also available **LK3566A**



LEARNING OBJECTIVES & EXPERIMENTS:

- Safety in fault finding
- Using multimeters
- PC based oscilloscopes
- Testing diodes and transistors
- Combinational logic circuit
- Counter circuit
- Motor control circuit
- Regulated AC power supply circuit
- Astable multivibrator
- Class C transistor amplifier circuit

SCAN TO VISIT
PRODUCT PAGE



E BLOCKS2

E-blocks2 is the latest generation of microcontroller boards from Matrix. With over 30 boards available, the E-blocks2 range includes upstream and downstream boards, as well as cost saving bundles, all of which allow you to build a complete system in a matter of minutes.

Although boasting industry standard features, E-blocks2 is in fact designed primarily for learners and educators. Our kits, supplied alongside free curriculum, are perfect for delivery of microcontroller system teaching across various platforms including those delivering PIC and Arduino system development and the design and manufacture of our boards allows them to last longer in the demands of educational labs. Further to this, integration with our own Flowcode IDE makes the development of electronic systems faster, more intuitive and easier.



Why choose Eblocks:

- Flexibility through modular design
- Small and compact solution
- Rugged and long lasting
- Seeed® Grove module compatible
- In-Circuit Test & Debugging
- Integration with Flowcode IDE
- Integration with Arduino
- Power routed through connectors

This pack guides students through the process of developing microcontroller- based electronic products using Arduino microcontrollers and is based on our new E-blocks2 range. The pack includes a range of downstream E-blocks2 boards, such as switches, LEDs, LCD and sensors and an Arduino shield complete with Arduino Uno board which features Ghost Technology (when used with Flowcode) – providing In-Circuit-Test, In-Circuit-Debug, software oscilloscope, logic analyser and packet decoder along with Auto-ID for your hardware. Circuit connections are provided using one of our printed panels and students are guided through the process using a free course, provided online. The course is written to specific curriculum specifications from level 3 to level 5 and includes up to 50 hours of student-centered learning.

This product is available as a development kit in Gratnell's tray with all necessary boards included. The programmer board and combo board can also be purchased separately either with or without the printed panel.



LEARNING OBJECTIVES & EXPERIMENTS:

- Programming microcontrollers with flowcharts, or C (using Arduino IDE)
- Control hardware and specifications for Arduino microcontrollers
- Input and output devices
- Assembling and operating a microcontroller system
- Programming/coding constructs and techniques
- Flowchart programming
- Full simulation capabilities
- Full C code editor
- Ghost technology

SCAN TO VISIT
PRODUCT PAGE



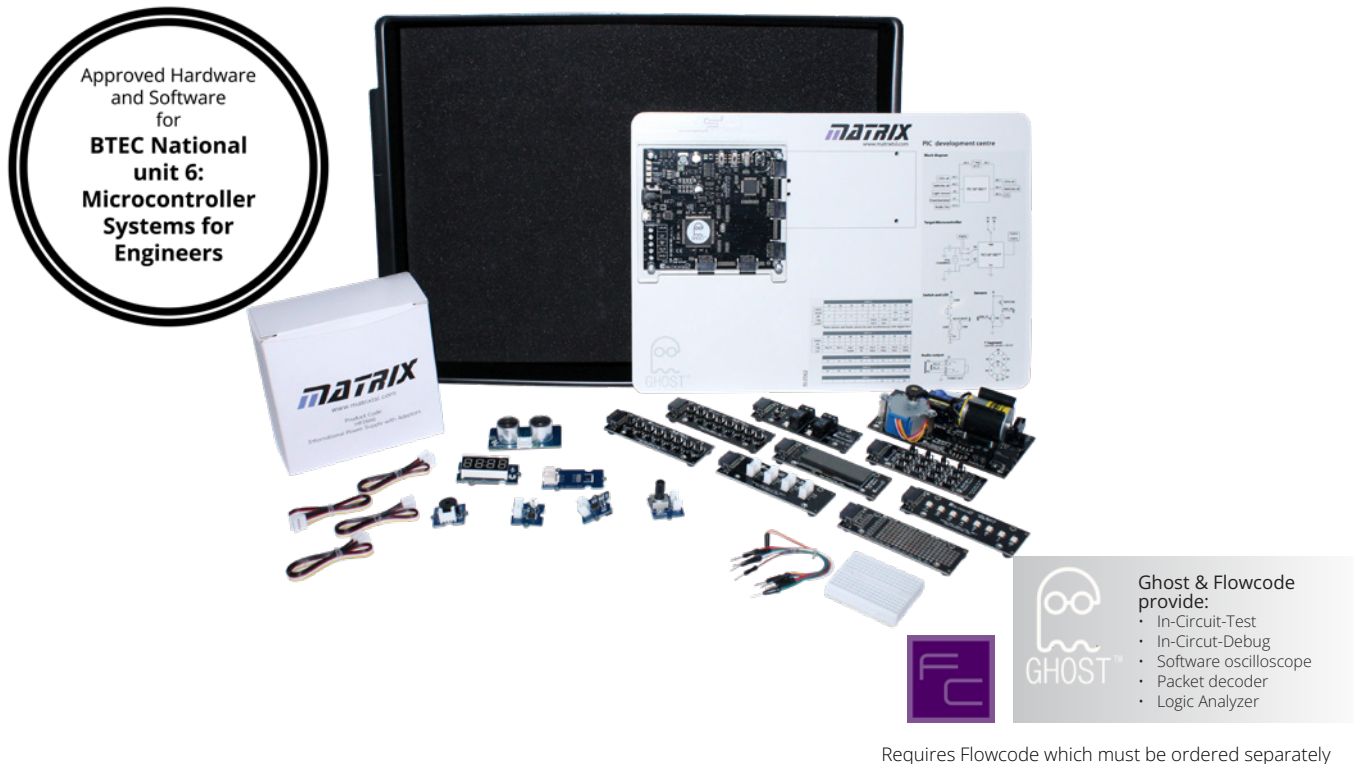
Programming PIC Microcontrollers

BL0502

This pack guides students through the process of developing microcontroller-based electronic products using PIC microcontrollers and is based on our new E-blocks2 range. The pack includes a range of downstream E-blocks2 boards, such as switches, LEDs, LCD and sensors and an 8-bit PIC programmer board which features Ghost Technology (when used with Flowcode) – providing In-Circuit-Test, In-Circuit-Debug, software oscilloscope, logic analyser and packet decoder along with Auto-ID for your hardware.

Circuit connections are provided using one of our printed panels and students are guided through the process using a free course, provided online. The course is written to specific curriculum specifications from level 3 to level 5 and includes up to 50 hours of student-centered learning.

This product is available as a development kit in Grattell's tray with all necessary boards included. The programmer board and combo board can also be purchased separately either with or without the printed panel.



Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- Programming microcontrollers with flowcharts, C or assembler
- Control hardware and specifications for PIC microcontrollers
- Input and output devices
- Assembling and operating a microcontroller system
- Programming/coding constructs and techniques
- Assembler code programming
- 40 hours of learning
- Full assembler included
- C code programming
- 40 hours of learning
- Full C compiler

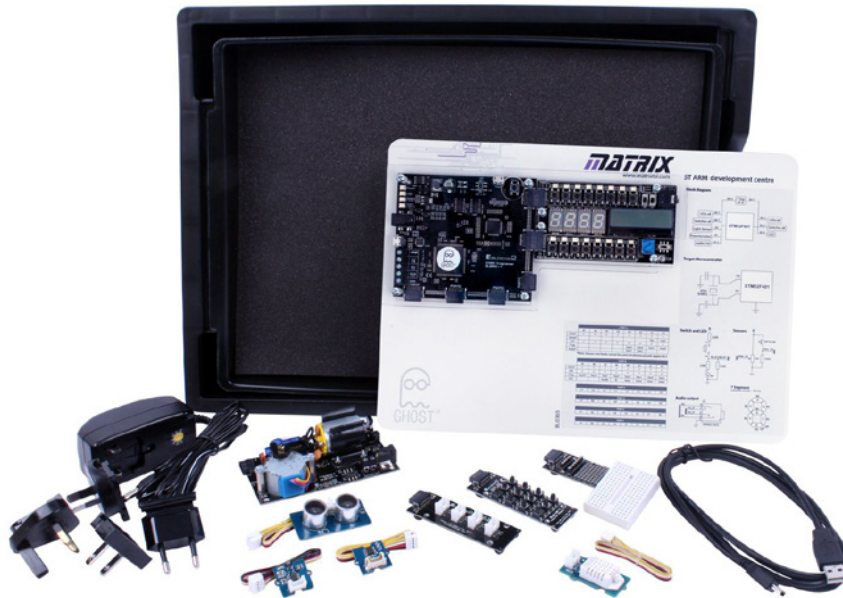


SCAN TO VISIT
PRODUCT PAGE



This pack allows students to develop microcontroller-based electronic products using ARM microcontrollers and is based on our new E-blocks2 range. The pack includes a downstream “combo” board with switches, LEDs, LCD and sensors and an ARM programmer board which features Ghost Technology (when used with Flowcode) – providing In-Circuit-Test, In-Circuit-Debug, software oscilloscope, logic analyser and packet decoder along with Auto-ID for your hardware. Circuit connections are provided using one of our printed panels.

This product is available as a development kit in Gratnell's tray with all necessary boards included. The programmer board and combo board can also be purchased separately either with or without the printed panel.



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- Programming ARM microcontrollers and techniques
- Control hardware and specifications for ARM microcontrollers
- Input and output devices
- Assembling and operating a microcontroller system
- Programming/coding constructs
- Flowchart programming
- Simulation capabilities
- Ghost technology



SCAN TO VISIT
PRODUCT PAGE



Raspberry Pi Development Kit

BL0575

This solution allows students to develop systems to control a Raspberry Pi and connected development boards. The pack includes a downstream "combo" board with switches, LEDs, LCD and sensors and a Raspberry Pi programmer board which features Ghost Technology (when used with Flowcode) – providing In-Circuit-Test, In-Circuit- Debug, software oscilloscope, logic analyser and packet decoder. Circuit connections are provided using one of our printed panels.

This product is available as a development kit in Gratnell's tray with all necessary boards included. The programmer board and combo board can also be purchased separately either with or without the printed panel.



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- Working with Raspberry Pi architecture
- Control hardware and specifications for Raspberry Pi
- Human-computer-interfacing
- Input and output devices
- Assembling and operating a microprocessor system
- Programming/coding constructs and techniques
- Flowchart programming
- Simulation capabilities
- Ghost technology



SCAN TO VISIT
PRODUCT PAGE



This pack allows students to develop microcontroller-based electronic products using dsPIC microcontrollers and is based on our new E-blocks2 range. The pack includes a downstream “combo” board with switches, LEDs, LCD and sensors and a 16-bit dsPIC programmer board which features Ghost Technology (when used with Flowcode) – providing In-Circuit-Test, In-Circuit-Debug, software oscilloscope, logic analyser and packet decoder along with Auto-ID for your hardware. Circuit connections are provided using one of our printed panels.

This product is available as a development kit in Gratnell's tray with all necessary boards included. The programmer board and combo board can also be purchased separately either with or without the printed panel.



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- Programming dsPIC microcontrollers
- Control hardware and specifications for dsPIC microcontrollers
- Input and output devices
- Assembling and operating a microcontroller system
- Programming/coding constructs and techniques
- Flowchart programming
- Simulation capabilities
- Ghost technology



SCAN TO VISIT
PRODUCT PAGE



Programming AVR Microcontrollers

BL0591

This pack allows students to develop microcontroller-based electronic products using AVR microcontrollers and is based on our new E-blocks2 range. The pack includes a downstream "combo" board with switches, LEDs, LCD and sensors and an AVR programmer board which features Ghost Technology (when used with Flowcode) – providing In-Circuit-Test, In-Circuit-Debug, software oscilloscope, logic analyser and packet decoder along with Auto-ID for your hardware. Circuit connections are provided using one of our printed panels.

This product is available as a development kit in Grotnell's tray with all necessary boards included. The programmer board and combo board can also be purchased separately either with or without the printed panel.



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- Programming AVR microcontrollers
- Control hardware and specifications for AVR microcontrollers
- Input and output devices
- Assembling and operating a microcontroller system
- Programming/coding constructs and techniques
- Flowchart programming
- Simulation capabilities
- Ghost technology



SCAN TO VISIT
PRODUCT PAGE



This pack allows students to develop microcontroller-based electronic products using ESP32 microcontrollers and is based on our E-blocks2 range. The pack includes a downstream "combo" board with switches, LEDs, LCD and sensors and an ESP32 programmer board which features Ghost Technology (when used with Flowcode) – providing In-Circuit-Test, In-Circuit-Debug, software oscilloscope, logic analyser and packet decoder along with Auto-ID for your hardware. Circuit connections are provided using one of our printed panels.

This product is available as a development kit in Grotnell's tray with all necessary boards included. The programmer board and combo board can also be purchased separately either with or without the printed panel.



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

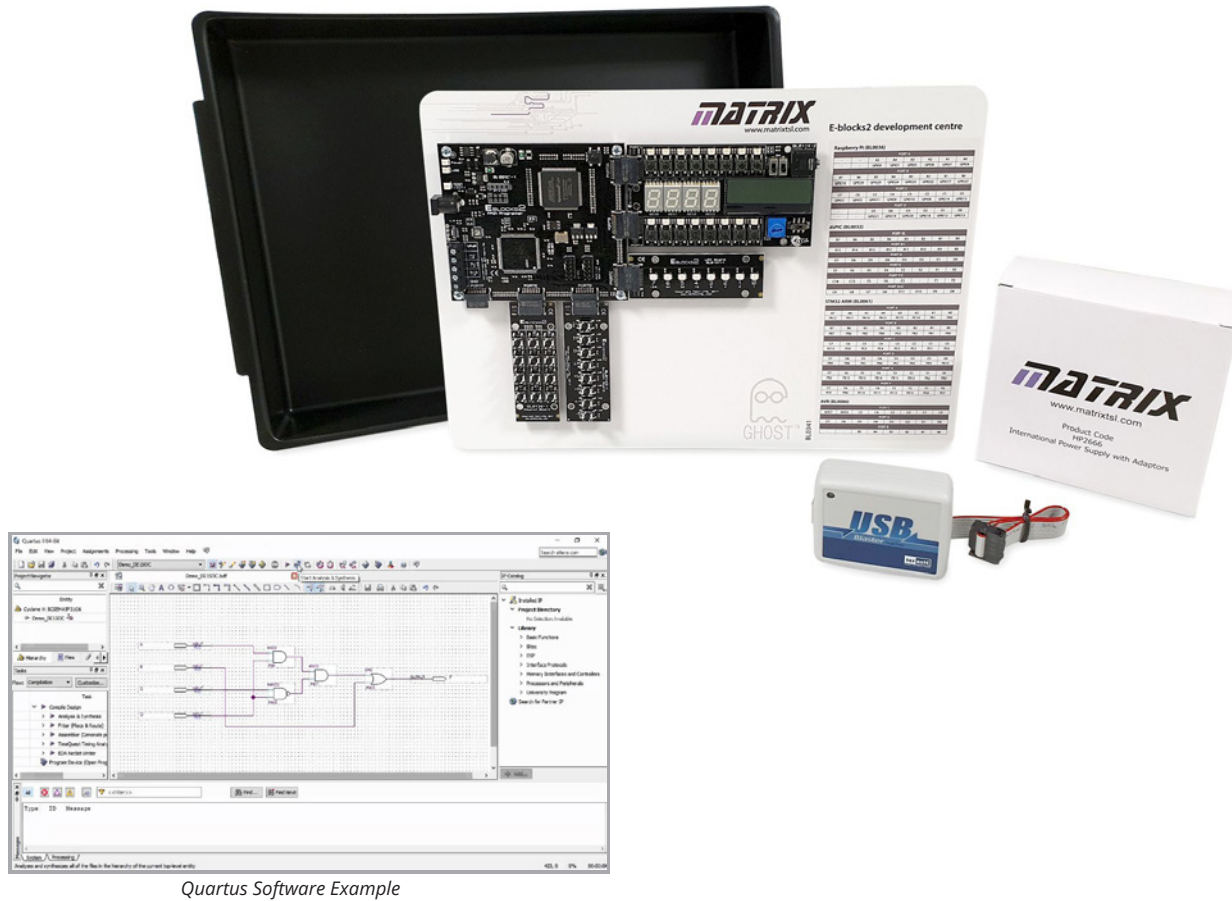
- Programming ESP32 microcontrollers
- Control hardware and specifications for ESP32 microcontrollers
- Input and output devices
- Assembling and operating a microcontroller system
- Programming/coding constructs and techniques
- Flowchart programming
- Simulation capabilities
- Ghost technology



SCAN TO VISIT
PRODUCT PAGE



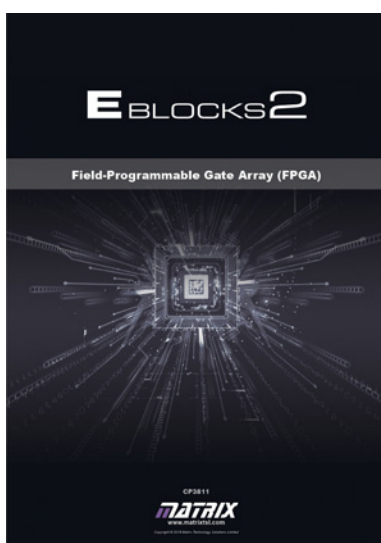
This training solution provides a complete 40 hour course in the techniques of developing projects based on FPGAs using either Verilog or VHDL using an Altera FPGA and the free version of the Quartus design software, which requires registration with Altera. The equipment is ideal for learning and for project work and students can go on to develop more advanced projects which might even include embedding NIOS processors. A full instructors' manual is available to download from our website.



Quartus Software Example

LEARNING OBJECTIVES & EXPERIMENTS:

- FPGA design techniques
- Quartus development environment: top down and bottom up projects
- VHDL design language
- Verilog design language
- Combinational logic circuits: simple circuits, encoders, decoders, parity checkers, adders, subtractors, multipliers
- Sequential logic circuits: SR, D, JK flip flops, asynchronous up, down and BCD counters, synchronous binary up and down counters, state machines
- Project work



SCAN TO VISIT
PRODUCT PAGE



This training solution provides a complete course in developing communication systems. In completing the 20 hour course, students will learn about communications systems, the AT command protocol, communications strategies and many aspects of project development and management. The solution includes a fully working mobile phone based on E-blocks. A 50 page teacher's manual contains a range of exercises and is available to download from our website.



Also available with PIC **BL0579**



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- General programming of systems including LCD, Keypad etc
- RS232 protocol and programming
- String construction and deconstruction in communications
- The use of state machines in controlling electronic systems
- RS232 communications and handshaking protocols
- ASCII representation of characters in messages
- AT command structure and command protocols used in telecommunications
- Sending and receiving text messages in mobile phone systems
- Modem control and messaging



SCAN TO VISIT
PRODUCT PAGE



Arduino Bluetooth Training Course

BL0563

This 20 hour training solution allows students to carry out investigations into the Bluetooth standard using high level macros written in Flowcode. Students use the hardware, software (available separately) and curriculum (available to download from our website) to investigate various Bluetooth protocols and functions including the serial protocol (SPP). An 80 page teacher's manual covers system set-up, Bluetooth theory and a range of exercises for students to work through.



Also available with PIC **BL0506**



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

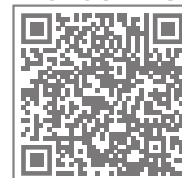
Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- Data communication between microcontroller and Bluetooth modules
- Bluetooth visibility
- Device discovery, pass keys and addresses
- Responses - sequence flow and error checking
- Connecting and pairing
- Data communication
- Using Bluetooth for control applications



SCAN TO VISIT
PRODUCT PAGE



This 40 hour training solution gives students a full understanding of modern digital communications protocols and the development of embedded internet-based products. An 80 page teacher's manual is available to download from our website and covers system set-up, digital communications theory and contains a range of exercises for students to work through.



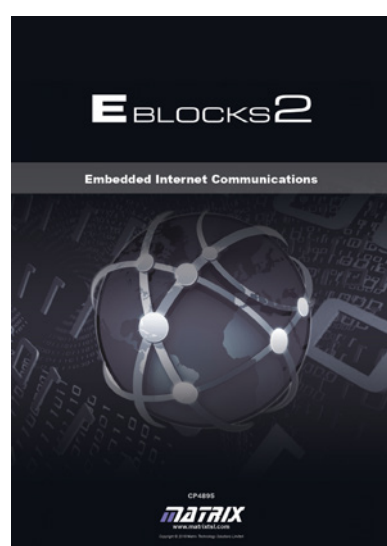
Also available with PIC **BL0531**



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

Requires Flowcode which must be ordered separately



LEARNING OBJECTIVES & EXPERIMENTS:

- OSI model and layers
- Ethernet, DLC, MAC, ARP, TCP, IP, UDP, ICMP, HTTP and POP3 protocols
- MAC packet structure and message creation using microcontrollers
- Communication strategy and information flow
- Packet injectors and debuggers
- ARP scanning
- Ping
- Time and date messages using UDP
- Sending HTML using HTTP protocol
- Receiving HTML
- Sending an email using SMTP protocol
- Custom messaging using UDP
- A firewall application

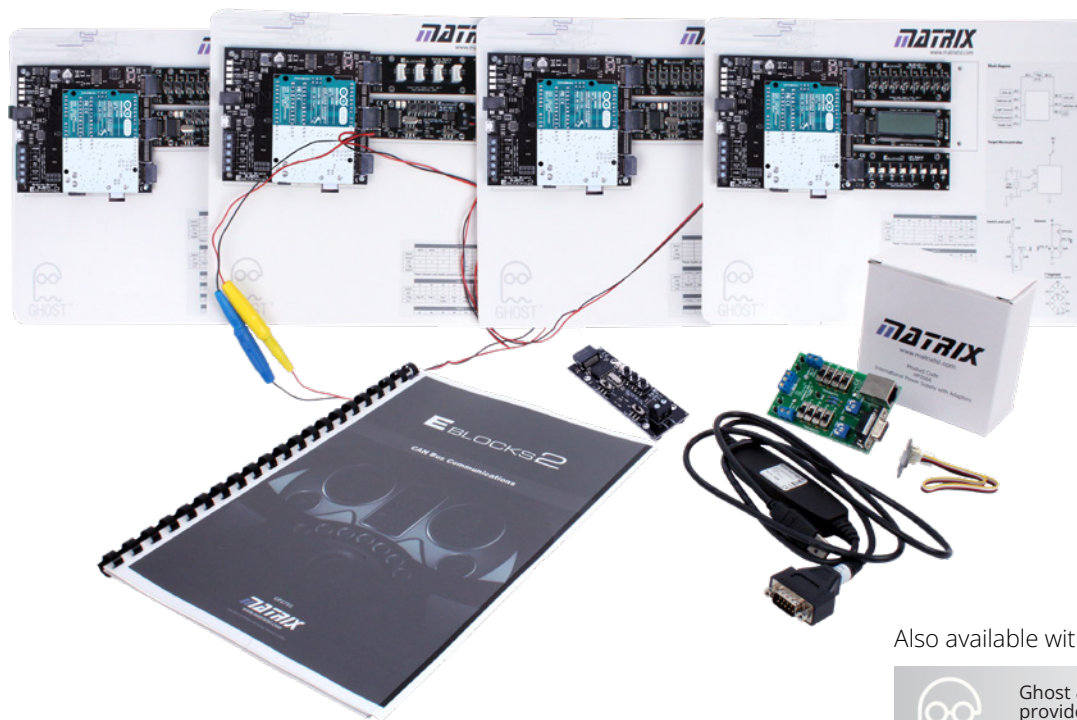
SCAN TO VISIT
PRODUCT PAGE



Arduino CAN Bus Training Course

BL0587

This 20 hour training solution is designed to facilitate the development and investigation of systems that use the CAN bus protocol. The solution is suitable for both automotive students and for electronics undergraduates. Four fully programmable CAN nodes are included in the solution, along with circuit boards which mimic the functions of indicator lamps, switches and sensors. A CAN bus analyser and message generator are also included. An 80 page teacher's manual contains a range of exercises for automotive technicians upwards and is available to download from our website.



Also available with PIC **BL0589**



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

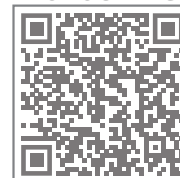
Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- CAN technology, wiring, topology and networks
- CAN message structure and physical layer transmission
- Understanding CAN bus protocols
- Using buffers in CAN systems
- Using CAN transmit and receive messages
- Errors in CAN systems
- Programming techniques in CAN systems
- Masks and filters in CAN systems
- Higher level protocols
- Development of complete CAN systems based on microcontrollers



SCAN TO VISIT
PRODUCT PAGE



This training solution provides a complete 20 hour course in developing wireless area networks based on the ZigBee standard. It gives students who are familiar with microcontrollers an understanding of the programming techniques involved in developing ZigBee wireless communications systems. A ZigBee packet analyser is included in the solution, along with four fully working ZigBee nodes based on E-blocks. A 50 page teacher's manual contains a range of exercises and is available to download from our website.



Also available with PIC **BL0516**



Ghost & Flowcode provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

Requires Flowcode which must be ordered separately



LEARNING OBJECTIVES & EXPERIMENTS:

- Zigbee protocols, message transmission and reception, and networks
- Zigbee principles, topologies and components
- Development of microcontroller based systems using Zigbee technology
- Moulding the network
- Adding nodes
- Expanding the network
- Reducing power consumption
- Dynamic networks
- Message routing
- Data logging gateways
- A complete modular fire and burglar alarm
- Improving network security

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PRODUCT PAGE



This training solution provides a complete 20 hour course in developing RFID systems. It gives students who are familiar with microcontrollers an understanding of the programming involved in developing RFID systems. An E-blocks RFID board and four RFID tags embedded into credit cards are included. This hardware allows students to learn about reading and writing transponder data in both I-code and Mifare mode. A 50 page teacher's manual contains a range of exercises and is available to download from our website.



Also available with PIC **BL0510**



Ghost & Flowcode

provide:

- In-Circuit-Test
- In-Circuit-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

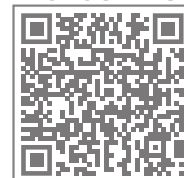
Requires Flowcode which must be ordered separately

LEARNING OBJECTIVES & EXPERIMENTS:

- RFID systems and applications
- Configuring RFID readers
- Commands and syntax used in reading and writing data to and from RFID cards
- Communication with both Mifare and I-code systems
- Development of microcontroller based systems using RFID technology



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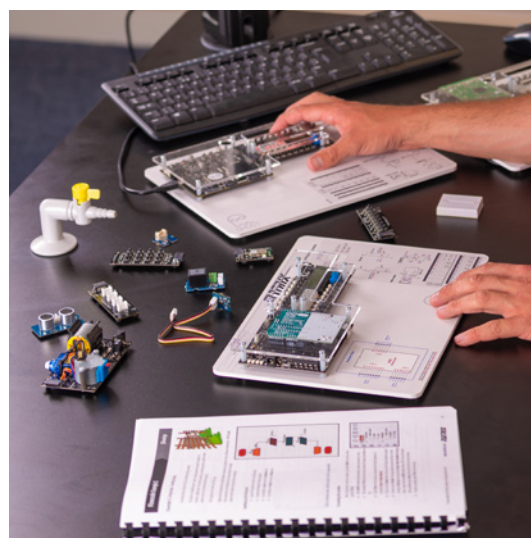
“

“At Redcar and Cleveland College we are investing heavily in our engineering facilities and equipment. The region is seeing a growth in green energy and low carbon initiatives which we are preparing the next generation of engineers for.

Matrix were selected to supply the college with equipment to help our students understand the curriculum content needed for a successful future career in these sectors. Students have been enjoying using the Flowcode and E-blocks2 / AllCode circuits and software to develop understanding of automation and its place in a variety of industrial applications. Students will also be taking their hands-on practical workshop skills to the next level using the Matrix MicroCNC suite we have installed alongside the Electrical Machines equipment. We have been particularly impressed with the ready-made educational training packages that support the use of the equipment just as much as the kit itself.”

Mike Reid BSc (Hons) QTS

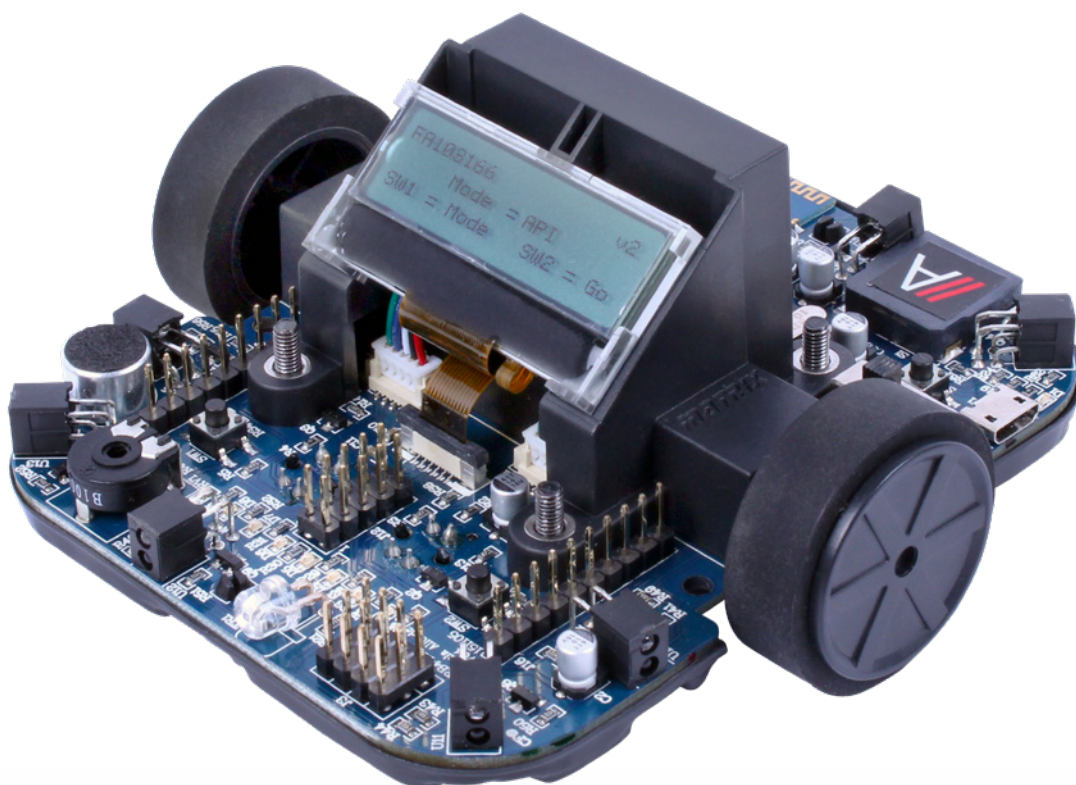
Subject Lead for Engineering at RCC.



ALLCODE

AllCode is a new concept in programming. All our AllCode products are host independent, run on a powerful 16bit dsPIC microcontroller and can be used with just about any programming language, including Flowcode, MATLAB, LabVIEW, Python, App Inventor, Visual Basic/C#/C++ and more.

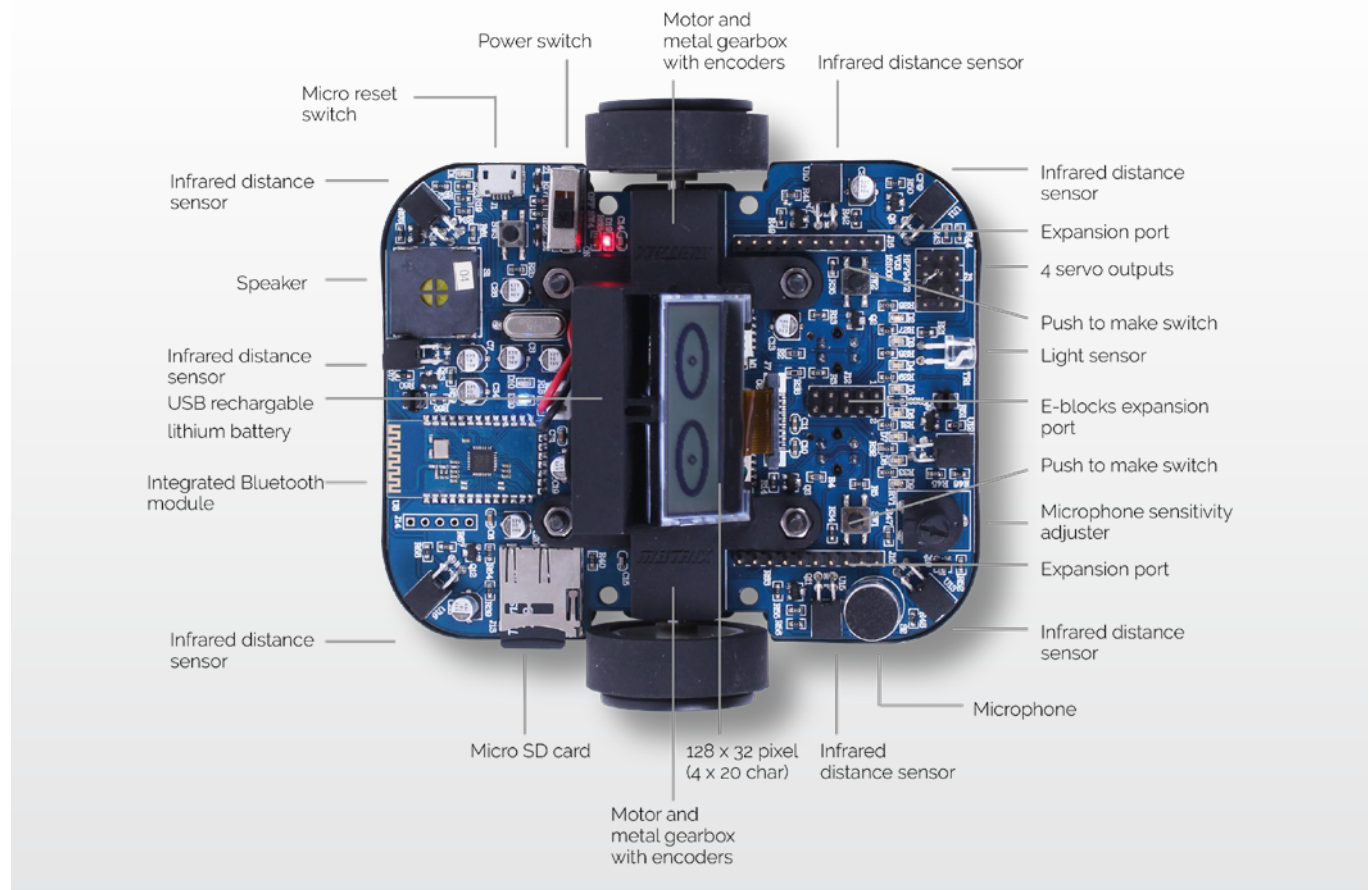
Both Formula AllCode and the Robot Arm production cell are provided with free curriculum, helping you to get the most out of your new robotics solution. These courses include a range of activities with varied levels of difficulty: from simple line following to maze solving with the Formula AllCode robot buggy, and API control to automatic pick and place with the AllCode Robot Arm production cell.



Why choose Allcode:

- Compatible with many programming languages
- Quick and easy setup
- Rugged design
- A range of activities with varied levels of difficulty
- Powerful 16bit microcontroller
- Portable storage solution

This training solution provides a course in robotics with a sequence of staged exercises including line following and maze solving. The course makes use of the high specification Formula AllCode robot which can be programmed with a number of languages on various operating systems including Flowcode, App Inventor, Python and LabView. This is great for introducing students to programming and robotics in a fun and motivating way with huge scope for further work and competitions. The deluxe kit and class sets are supplied with a large double-sided task mat and a set of maze walls.



LEARNING OBJECTIVES & EXPERIMENTS:

- Microcontroller programming and robotics
- Programming concepts: input, system, output, loops, decision, subroutine, go to, calculations, delays, simple variables, A/D conversion
- Robotic components: switches, LEDs, light sensors, distance sensors, infrared sensors, audio level sensors, speaker, motor drivers, motors and gearboxes
- Robotic tactics including logo-like commands, power control, motion control and steering, motor characterisation, obstacle avoidance
- Progressive exercises include: light following, line following, song and dance, time trials, races, simple maze solving, creating custom mechanics



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Formula AllCode Standard Class Set

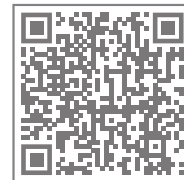
RB7240

The Formula AllCode standard class set gives you five Formula AllCode robots at a fantastic, discounted price. For study within a class environment, the buggies are contained in an easy to store Graternells tray and provide you with a set of maze walls and 2x maze mats for your class based activities.



KEY FEATURES:

- 5x host independent robots, 1x maze walls, 2x maze mats
- Compatible with Raspberry Pi, Android, MATLAB & more
- Rechargeable batteries and 2 micro USB leads included
- Bluetooth enabled
- Free complete course included

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Formula AllCode Deluxe Class Set

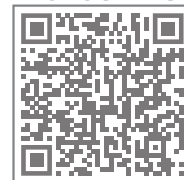
RB7518

The Formula AllCode deluxe class set gives you ten Formula AllCode robots at a fantastic, discounted price. For study within a class environment, the buggies are contained in an easy to store Graternells tray and provide you with a set of maze walls and 5x maze mats for your class based activities.



KEY FEATURES:

- 10x host independent robots, 1x maze walls, 5x maze mats
- Compatible with Raspberry Pi, Android, MATLAB & more
- Rechargeable batteries and 4 micro USB leads included
- Bluetooth enabled
- Free complete course included

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Formula AllCode Deluxe Kit

RB7971

The Formula AllCode deluxe kit gives you the perfect solution for containing your Formula AllCode in a neat, easy to store and easy to transport carry case. You also receive a complete set of desktop maze walls for problem solving and a double-sided maze mat to complete a range of line following and other activities.



KEY FEATURES:

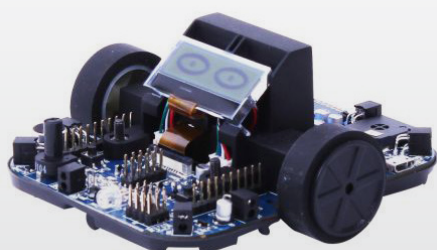
- 1x Host independent robot, 1x maze walls, 1x maze mat and 1x smart case
- Compatible with Raspberry Pi, Android, MATLAB & more
- Rechargeable batteries and micro USB leads included
- Bluetooth enabled
- Free complete course included

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Formula AllCode Robot Buggy RB4191

The AllCode buggy is available to purchase individually, which allows flexibility in increasing class sets.



Maze Mat RB8975

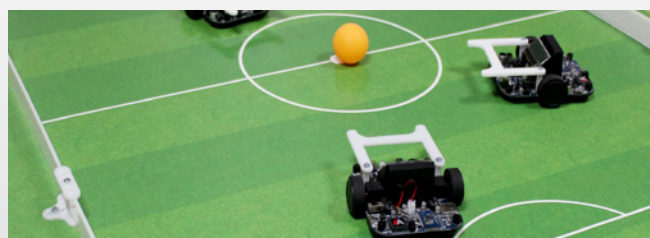
This double-sided activity mat includes line following challenges, grid challenges as well as basic technical information on the AllCode buggy.



- Activity mat on one side
- Race track on the other side
- Challenges for beginners and advanced user

Football Mat RB4938

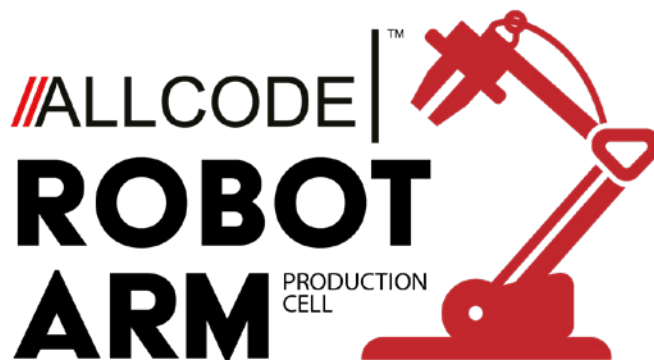
The football pitch consists of a 119cm x 84cm printed mat, extra connectors included that will supplement your maze walls to form the goals and pitch area as well as two ping pong "foot" balls.



Maze Walls RB8962

The Formula AllCode desk mounted maze walls can make an X by Y cell maze for problem solving competitions. They are precision cut acrylic walls to allow you to construct and complete a series of bespoke mazes for your Formula AllCode.



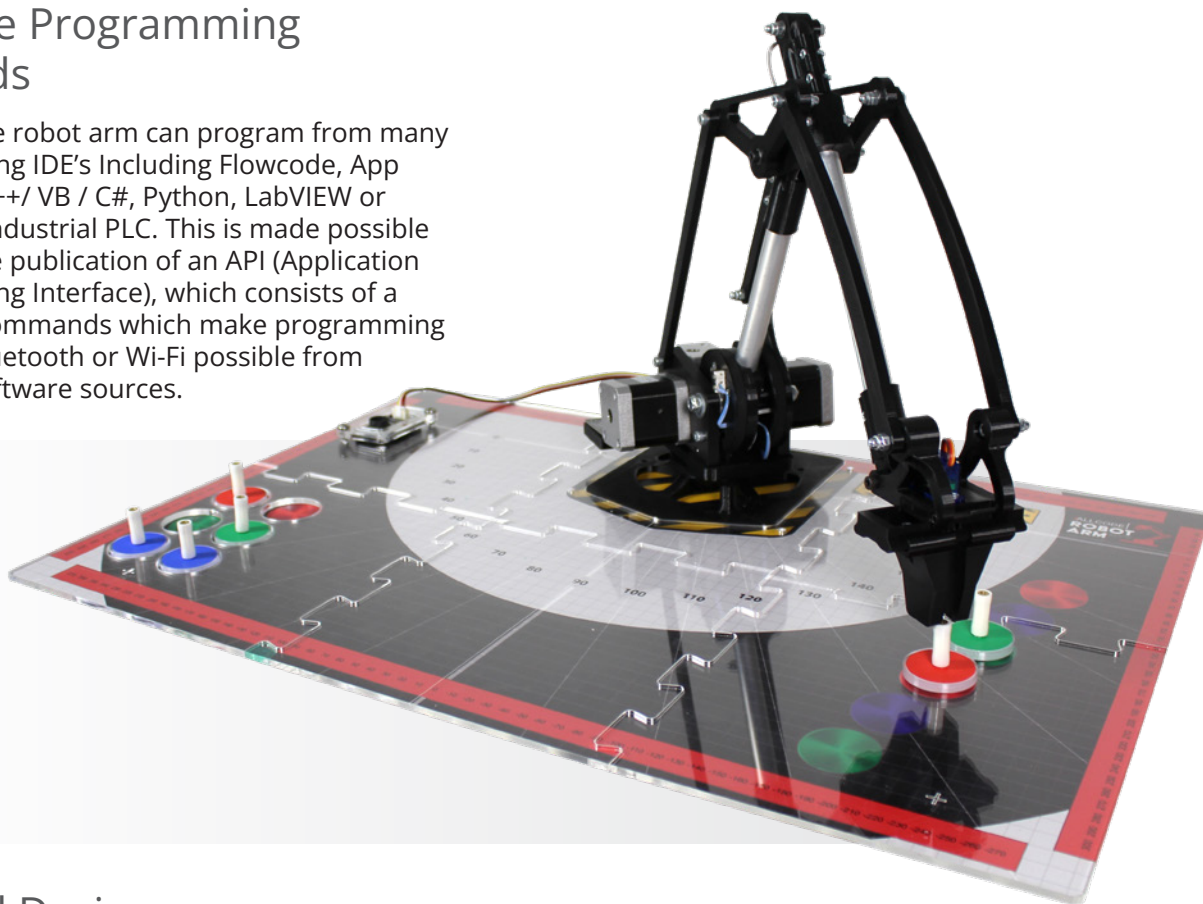


Robot Arm

The robot arm production cell consists of a rugged stepper motor controlled 3 degrees of freedom arm bolted to a base plate and supplied with activity mat that provides a range of exercises to replicate an industrial robot arm. The free instructional guide includes worksheets in pendant, G code, API and microcontroller programming, sensors and actuators, kinematics and more. The user can connect the robot arm production cell to their hardware platform – Windows PC, Android mobile, Raspberry Pi/Linux device using USB, Bluetooth or Wi-Fi technology.

Multiple Programming Methods

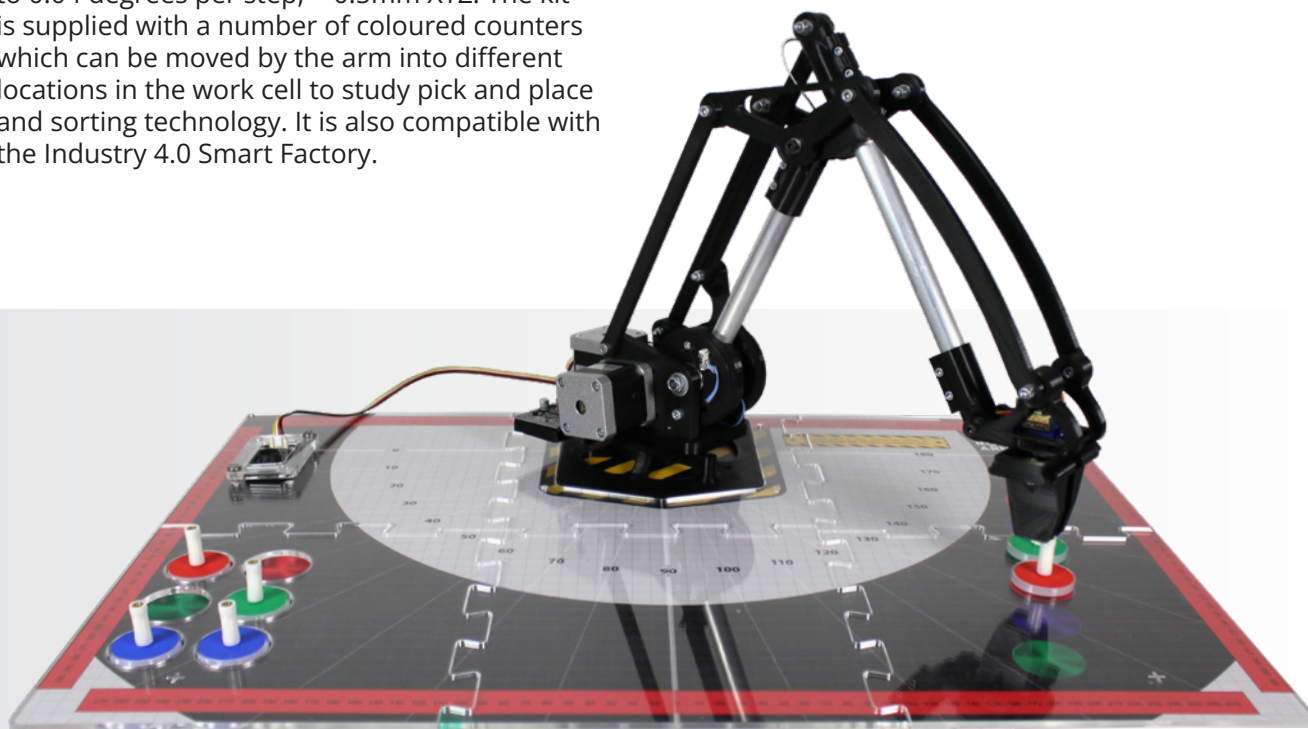
Users of the robot arm can program from many programming IDE's Including Flowcode, App Inventor, C++/ VB / C#, Python, LabVIEW or their own industrial PLC. This is made possible through the publication of an API (Application Programming Interface), which consists of a library of commands which make programming via USB, Bluetooth or Wi-Fi possible from multiple software sources.



Refined Design

The mechanics of the arm are designed to maximise the payload (the amount the arm can lift). This is achieved by placing the heavy motors on the base platform and by using a system of levers and cogs to allow the arm to move with great precision within its range of motion.

With base, shoulder and elbow rotation and functional gripper, the arm itself delivers fast, accurate and repeatable movement. The stepper motor driven arm delivers an accuracy to 0.04 degrees per step, < 0.5mm XYZ. The kit is supplied with a number of coloured counters which can be moved by the arm into different locations in the work cell to study pick and place and sorting technology. It is also compatible with the Industry 4.0 Smart Factory.



LEARNING OBJECTIVES & EXPERIMENTS:

- Robot cell design and programming
- Microcontroller programming
- Sensors and actuators in robotics
- Kinematics: 3D movement in robotic systems
- Web based control
- Programming in many languages



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PRODUCT PAGE





www.flowcode.co.uk

Flowcode is a graphical programming Integrated Development Environment (IDE) that allows you to develop highly functional electrical, electronic and electromechanical systems for microcontroller based systems and for Windows PCs and tablets.

“

“I used Flowcode for the students in a module called “Embedded Systems Engineering” (MSc and MEng module). Some students have never used microcontrollers before and they were able to use Flowcode easily for basic microcontroller based embedded system design on a ping pong game.

The students moved on to use Flowcode for a project on Zigbee based wireless network system for environment monitoring. The project was very successful.”

Hongying Meng,

Brunel University, United Kingdom



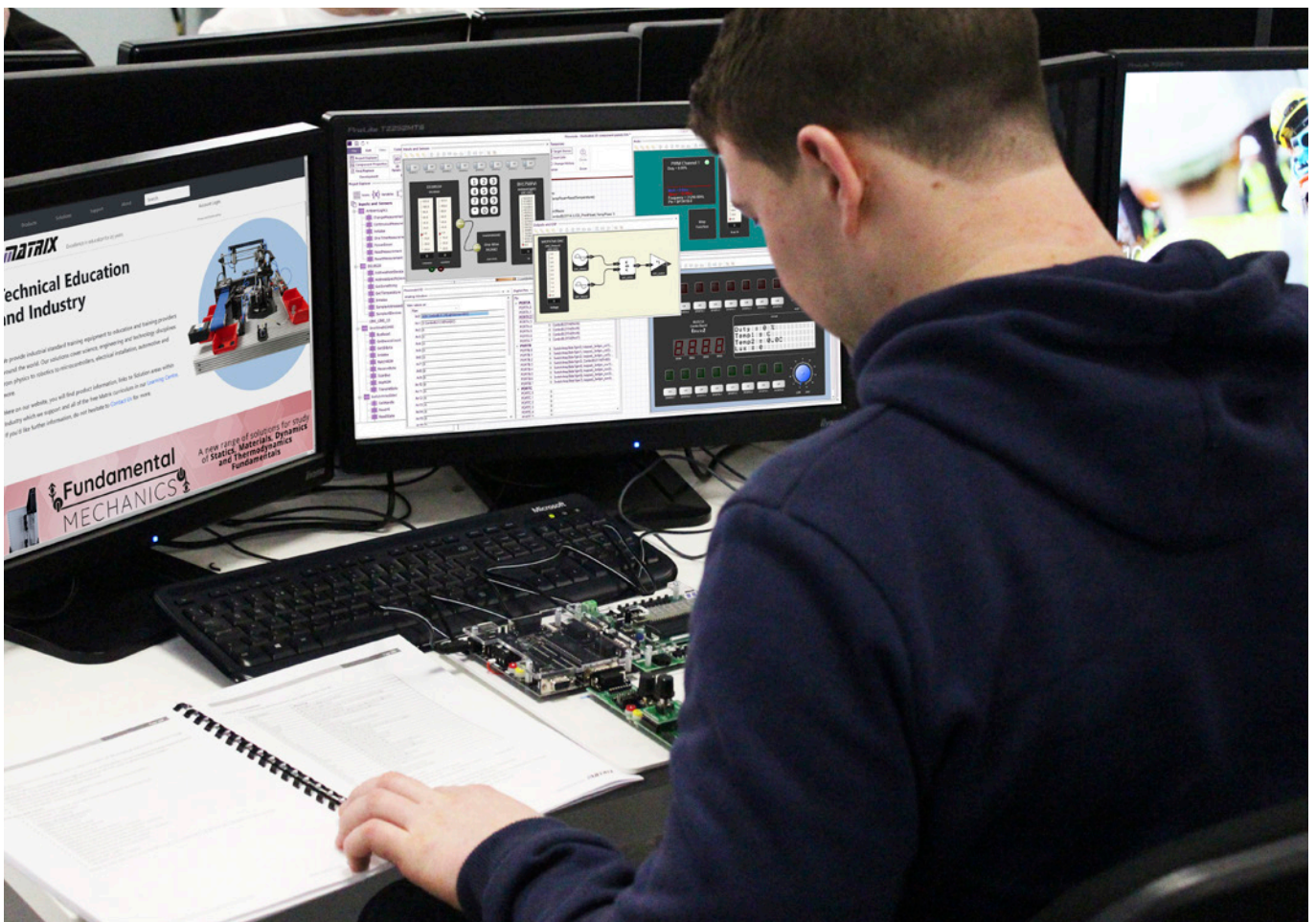
Why choose Flowcode:

- Academic licenses include all chip packs
- Free student licenses for home use
- Dedicated 2D component panel
- Free curriculum with over 120 hours of guided learning
- Plot variables on graph, scope and data recorder
- Open source components



FLOWCODE in Education

Educational institutions use Flowcode because it is accessible for all engineering students including electrical, mechanical, aerospace, and automotive. All engineers need to understand programming, sensors, actuators, feedback and control systems. Flowcode allows junior engineers to be successful system designers - whatever their major discipline.



Did you know? Student licences are available for all educational Flowcode sites. That means if your school, college or university are using Flowcode, then you can licence your students to use the software at home, free of charge.

FLOWCODE SUPPORTS MULTIPLE LANGUAGES



FLOWCODE APP DEVELOPER



Flowcode App Developer allows students to easily develop highly functional projects for Windows computers and tablets using low cost hardware interfaces.

- Create great Windows Human Machine interfaces for control and data gathering using Rpi, Arduino, PIC, ESP
- Graphical programming: use flowcharts, state diagrams and data flow techniques
- Comprehensive library of dials, switches, indicators, graphs and other components

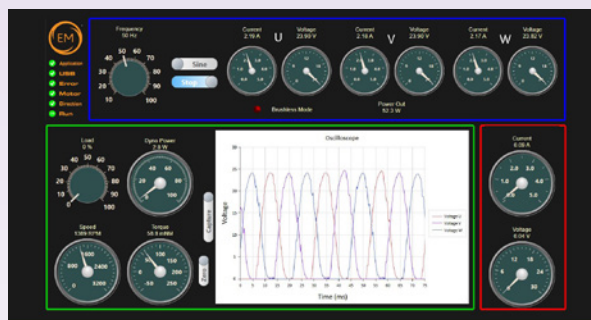


General input output interface for Arduino

Design

Design your electronic system on screen:

- Choose the Input Output device(s) that has the characteristics your application needs from four types of device
- Choose from one of our own low cost hardware interfaces or use any third party hardware
- Add other instruments and systems that have Application Programming Interfaces you can work with like signal generators, environmental chambers etc
- Drag local (USB/Bluetooth) and remote (Wi-fi/LAN/Internet) hardware components onto the 2D panel
- Add components from the library to create a distributed electronic system
- Design a program using flow chart, Blocks, Pseudo-code, or state machine diagrams



Control system with USB, LAN, Wi-fi and Bluetooth connection

Test

Test your design to make sure it functions like you want it to:

- Link your design to low cost local or remote hardware interfaces
- 'Play' the program or step through the program one command at a time to make sure it works
- Use the on-screen instruments to see the variables in your system
- Use the Data Recorder and Console to monitor your program and see how it is working
- Use the Graph plotter to document the performance of your system in real time



Process Control software built with App Developer

FLOWCODE EMBEDDED



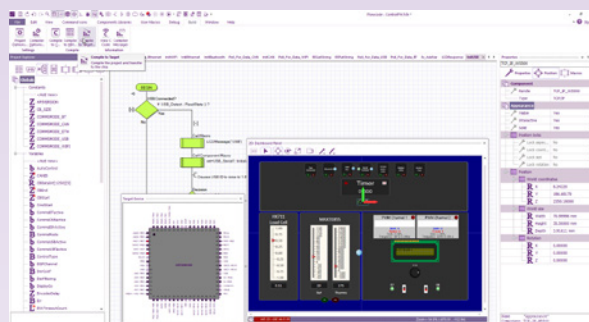
Flowcode Embedded helps students learn to develop complex embedded systems. It allows students to progress faster and go further than other programming languages.

- Create highly functional microcontroller projects using Rpi, Arduino, PIC, ESP, ARM and AVR processors
- Graphical programming: use flowcharts, state diagrams and data flow techniques
- Full simulation – electrical and mechanical
- Huge library of parts and subroutines

Design

Design your electronic system on screen:

- Choose a microcontroller that has the characteristics your application needs.
- Develop a model of the electronic system using the 2D or 3D panels.
- Add components from the library or create your own. Link to a mechanical model exported from Solidworks.
- Design a program using flow chart, Blocks, Pseudo-code, C code or state machine diagrams.
- Develop a Human Machine Interface to provide a good visual test bed.

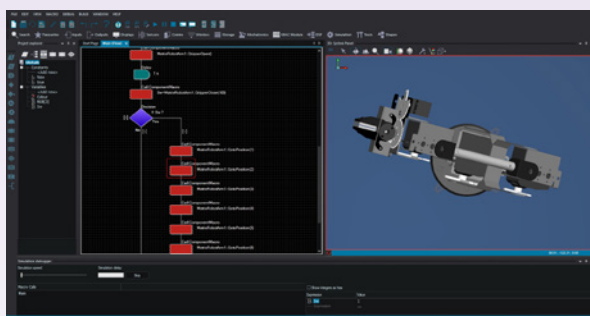


Flowcode design example

Simulate

Simulate your design to see how it functions:

- Use on-board digital switches and analogue sliders to change real world parameters and see how your system copes.
- Use the Meters, Oscilloscope, Data Recorder, Console or Graph to verify your system's performance.
- Use test signal injectors to send streams of comms data in any protocol to see how your system responds.
- Link to Solidworks to see your 3D hardware model move on screen under control of your program.

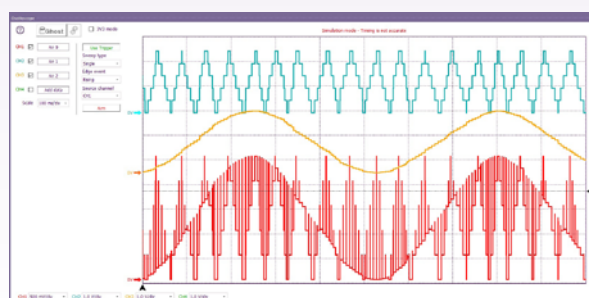


Simulation with a robot arm

Test

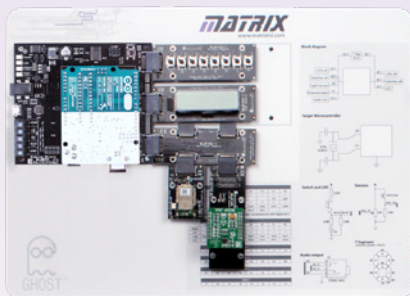
Test your design to make sure it functions like you want it to:

- Compile your design to hex for a microcontroller.
- Using Matrix In-Circuit-Debug hardware step through the program in the chip one icon at a time or let the program run.
- Use Matrix Ghost to view pin and variable status on the Oscilloscope.
- Use the Data Recorder and Console to decode comms serial buses and check message integrity.
- Verify your design's performance using Flowcode App developer via USB, Bluetooth or the internet.



Flowcode scope for testing

Advanced Digital Communications

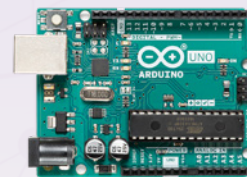


Students can study a wide variety of modern digital communications systems including SPI, I2C, CAN bus, Bluetooth, USB, Internet communications, Zigbee, RDIF.

Software: Flowcode Embedded

Matrix hardware: E-blocks II solutions

Windows Programming with Low Cost Hardware Targets



Flowcode App Developer allows students to build advanced human machine interfaces for Windows systems based on low cost hardware interfaces using PIC, Arduino, RPi and ESP32 target hardware. With a wide range of on-screen switches, dials, indicators, graphs and other controls this allows control and data gathering using USB, Bluetooth, Wi-Fi and LAN. Compatible with Matrix's MIAC controller, E-blocks, ECIO and many third party hardware boards.

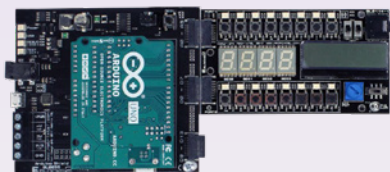
Software: Flowcode App Developer

Third party hardware: Arduino Uno, PIC ECIO, ESP32, RPi, with appropriate free API. A huge variety of third party hardware with an API supplied.



FLOW

Embedded System Programming



Flowcode Embedded can be used to teach graphical and C code programming for more than 1500 microcontrollers from the PIC, AVR, Arduino, RPi, ESP32 and ARM families. With full simulation, in circuit debug, large component libraries and accompanying courses this is the easiest way to teach embedded programming. Compatible with Matrix's own E-blocks boards (with integrated oscilloscope and logic analyser) as well as many third party hardware boards.

Software: Flowcode Embedded

Third party hardware: More than 1500 targets from Arduino, AVR, PIC, dsPIC, PIC32, ARM, ESP32, RPi

Matrix hardware: ECIO, E-blocks II

Digital Signal Processing



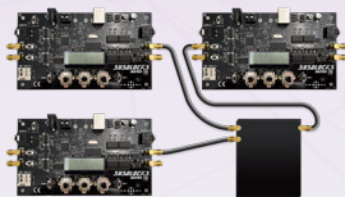
COMING SOON

A Sysblock is a powerful Digital Signal Processing capable microcontroller fitted with external fast A/D and D/A blocks that facilitates a number of investigations in signal processing. Flowcode Embedded now includes an array of DSP components that allow signal processing systems to easily be constructed on screen and compiled to the Sysblock. Flowcode and Sysblocks provides the ideal environment for studying DSP systems.

Software: Flowcode 10

Matrix Hardware: Sysblocks

Communications



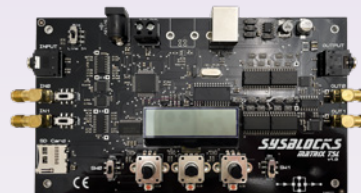
COMING SOON

Sysblocks and Flowcode allow a number of communications systems to be studied. Data flow graphical programming allows students to construct communications systems on screen, simulate their performance using internal oscilloscope and then download them to a fast microcontroller. Students can easily construct modulator/demodulator and encoder/decoder systems including AM, FM, PM, QAM, SSB, ASK, APSK, CPM, FSK, MFSK, OOK, PPM, PSK, QAM, ASFDMA and spread spectrum techniques.

Software: Flowcode 10

Matrix Hardware: Sysblocks

Music Technology and Music Engineering



COMING SOON

Flowcode is the perfect tool for teaching how modern audio technology systems manipulate audio in a digital format to create audio effects, condition delays in stadiums, and manage music in a variety of situations. Flowcode also includes components for MIDI, DMX and other control standards.

Software: Flowcode 10

Matrix Hardware: Sysblocks

FLOWCODE in Education

Robotics



Flowcode is the perfect accompaniment for Robotics courses. Flowcode interfaces with Solidworks to allow students to design electromechanical systems and simulate them electrically and mechanically in Flowcode's 3D interface. Flowcode can also be used in an embedded and PC based context to control robotic systems locally and remotely.

Software: Flowcode Embedded

Third party hardware: Third party robotic systems based on Arduino, PIC etc.

Matrix hardware: Formula Allcode, Matrix Robot Arm

Automotive and Industrial Engineering



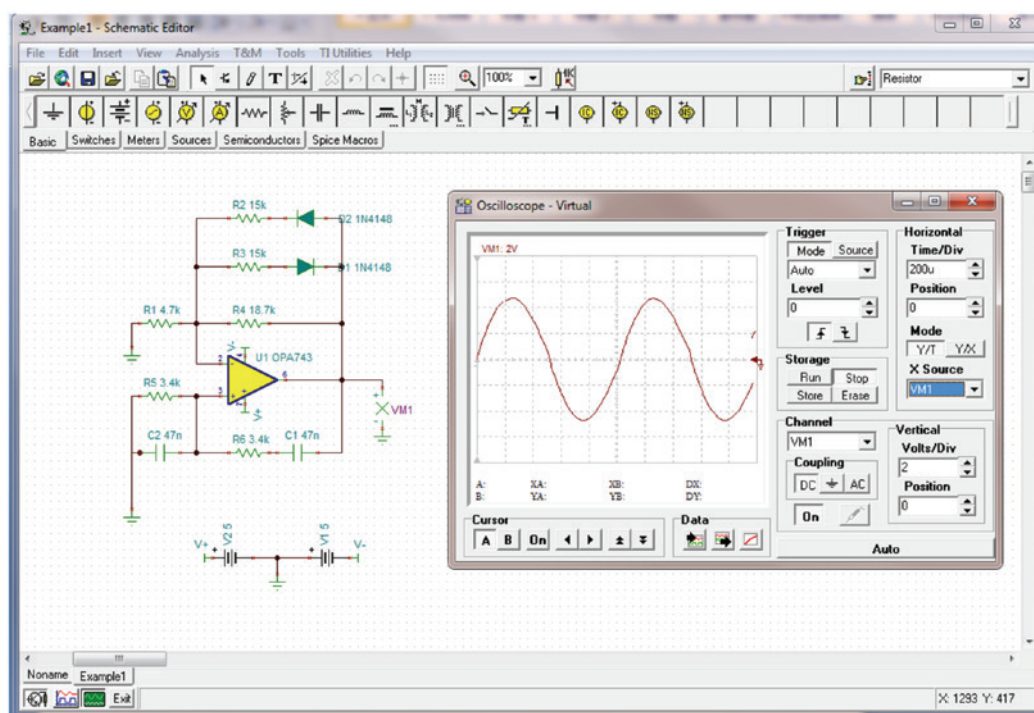
MIAC NXT is a rugged controller interface for industrial and automotive applications. MIAC NXT is based on a powerful dsPIC microcontroller and is directly programmable from Flowcode Embedded. An API is available which allows direct communication with Flowcode App Developer to allow students to create feature rich PC-based apps. Software: Flowcode App Developer

Matrix hardware: MIAC NXT

TINA

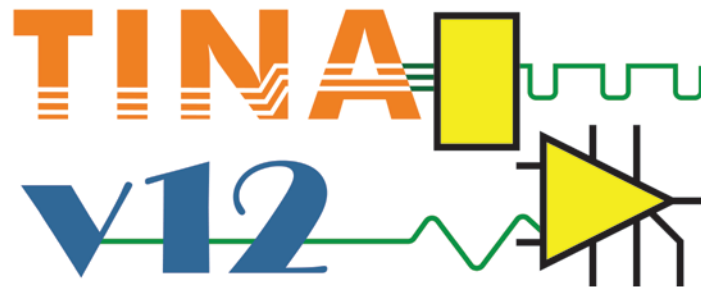
TINA is a powerful electronics CAD system for electronic product development including full schematic capture, many simulation tools, and a full circuit board layout package. TINA is used by thousands of professional designers across the world - including Texas Instruments who recommend TINA for simulating their analogue devices.

Electrical engineers will find TINA an easy to use, high performance tool, while educators will welcome its unique features for the training environment.



LEARNING OBJECTIVES & EXPERIMENTS:

- Schematic entry with more than 20,000 component models
- Mixed signal circuit simulation
- Full simulation suite with virtual instruments
- PCB design with full data output for PCB manufacture and 3D visualisation
- Microcontroller circuit simulator for PIC, AVR and ARM with test and debug facilities from Assembler or C with external C compiler
- VHDL and Verilog design suite with simulation



Offline circuit simulation with TINA

TINA Design Suite is a powerful yet affordable circuit simulator, circuit designer and PCB design software package for analyzing, designing, and real time testing of analog, digital, IBIS, HDL, MCU, and mixed electronic circuits and their PCB layouts. You can also analyze SMPS, RF, communication and optoelectronic circuits; generate and debug MCU code using the integrated flowchart tool; and test microcontroller applications in a mixed circuit environment. Off-line licenses of TINA include free private on-line licenses for one year.

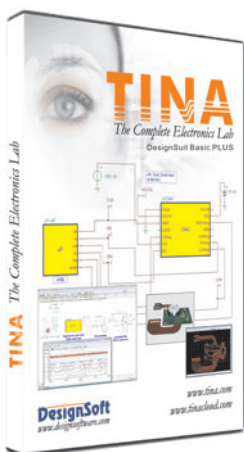
You can analyze your circuit through more than 20 different analysis modes or with 10 high tech virtual instruments. Present your results in TINA's sophisticated diagram windows, on virtual instruments, or in the live interactive mode where you can even edit your circuit during operation, develop, run, debug and test HDL & MCU applications. Electrical engineers will find TINA an easy to use, high performance tool, while educators will welcome its unique features for the training environment.



Online circuit simulation with TINACloud

With the TINACloud on-line circuit simulator, in addition to the installable versions, now you can also edit and run your schematic designs and their PCB layouts online on PCs, Macs, thin clients, tablets, smart phones, smart TVs and e-book readers without any installation. You can use TINACloud in the office, classroom, at home and while travelling, anywhere in the world that has internet access.

The TINA Library includes over 30,000 components which can be user modified



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ELECTRICAL & ELECTRONIC ENGINEERING



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