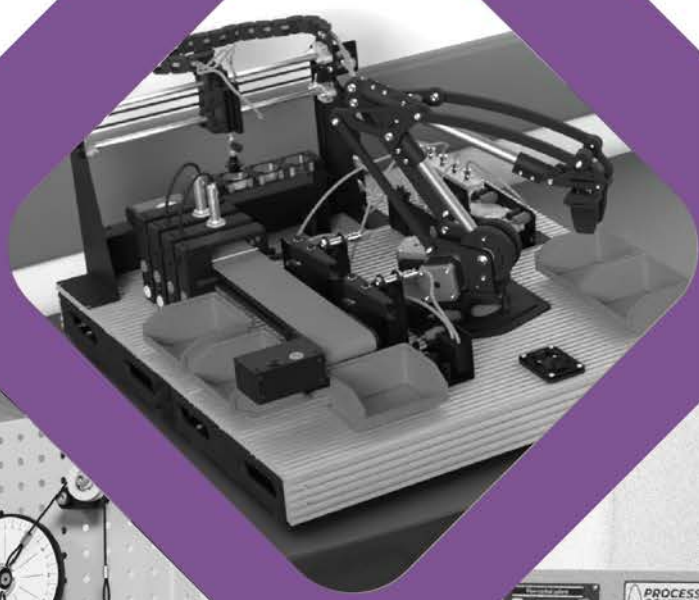
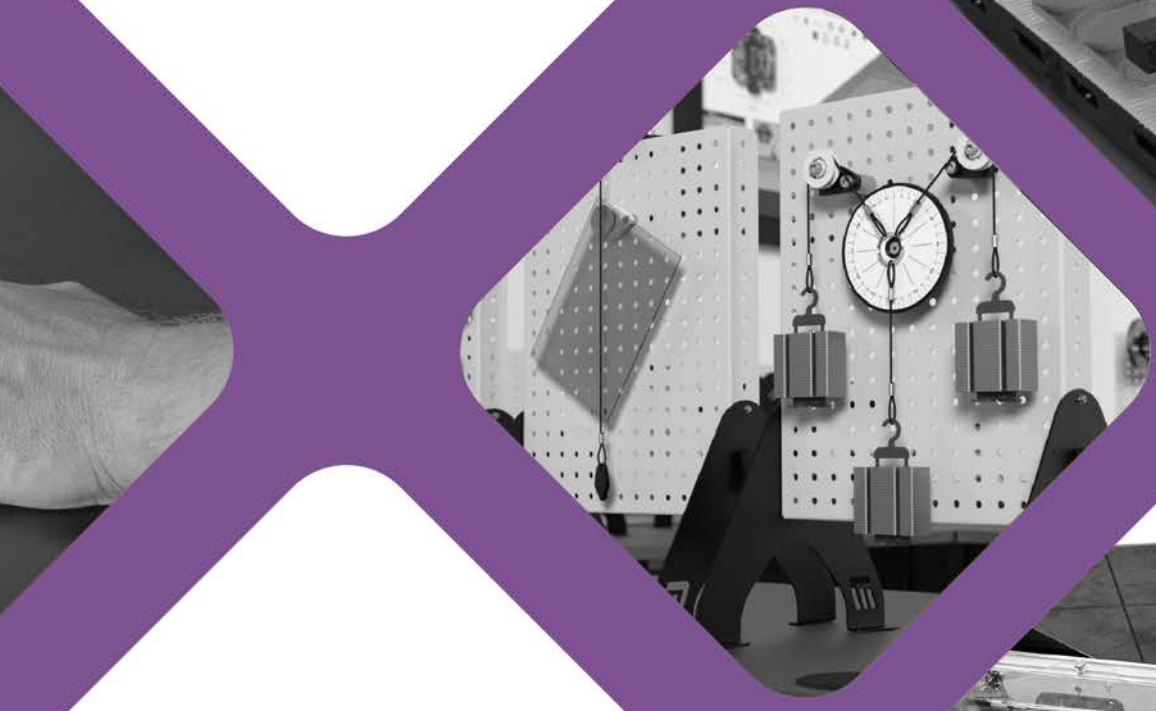
MATRIX

ENGINEERING PRODUCT GUIDE





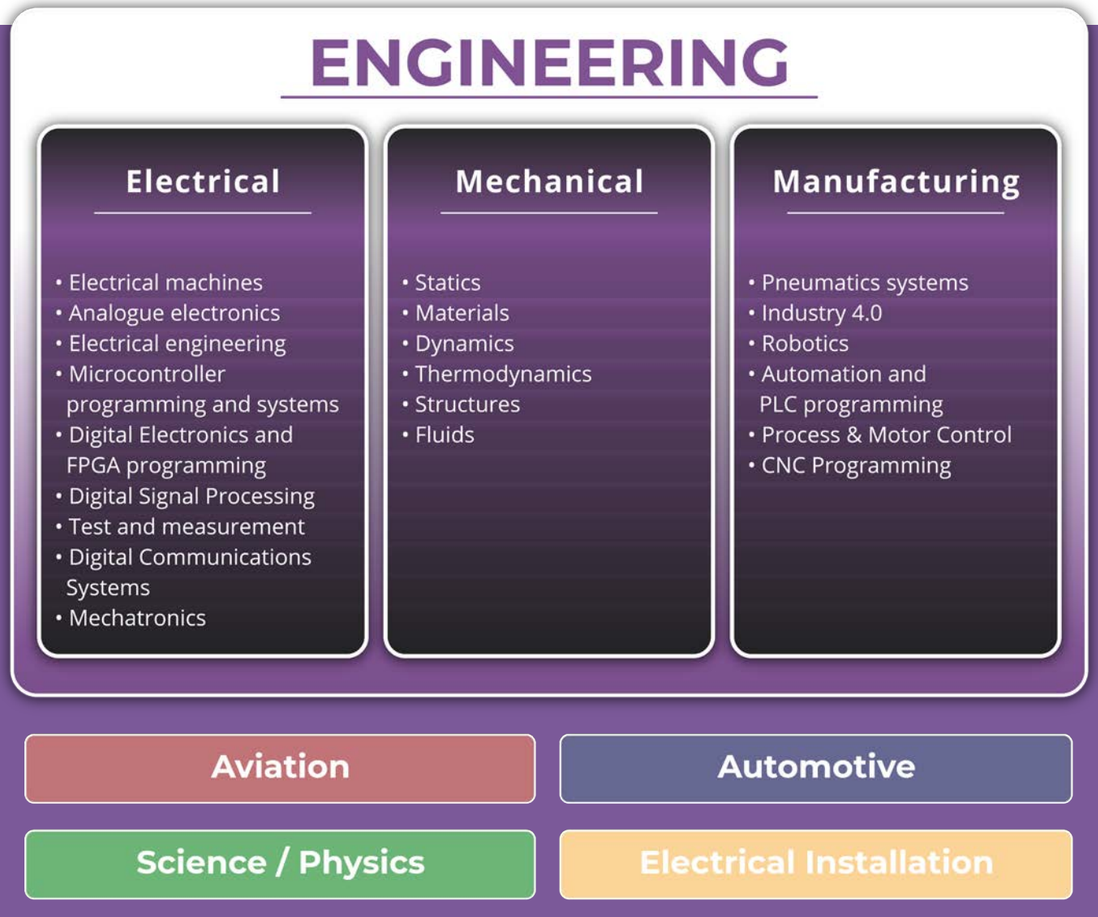
www.matrixtsl.com

Welcome to our new
Engineering Product Guide

Over the last two years, lots has changed at Matrix Technology Solutions. This change has seen us diversify and rapidly continue to grow our product portfolio, as I am sure you will see throughout this guide.

We now operate across engineering sectors, not only in Electrical Engineering but also through Mechanical, Manufacturing and more. In this guide you will find our new solutions for mechanical engineering, fundamental mechanics, and equipment for the teaching of structures. You will also find more in the manufacturing section, including process control and products for the teaching of key Industry 4.0 principles.

I am sure you will find something to suit your teaching requirements. Do not hesitate to get in touch, our contact details are below, or visit us at **www.matrixtsl.com.**



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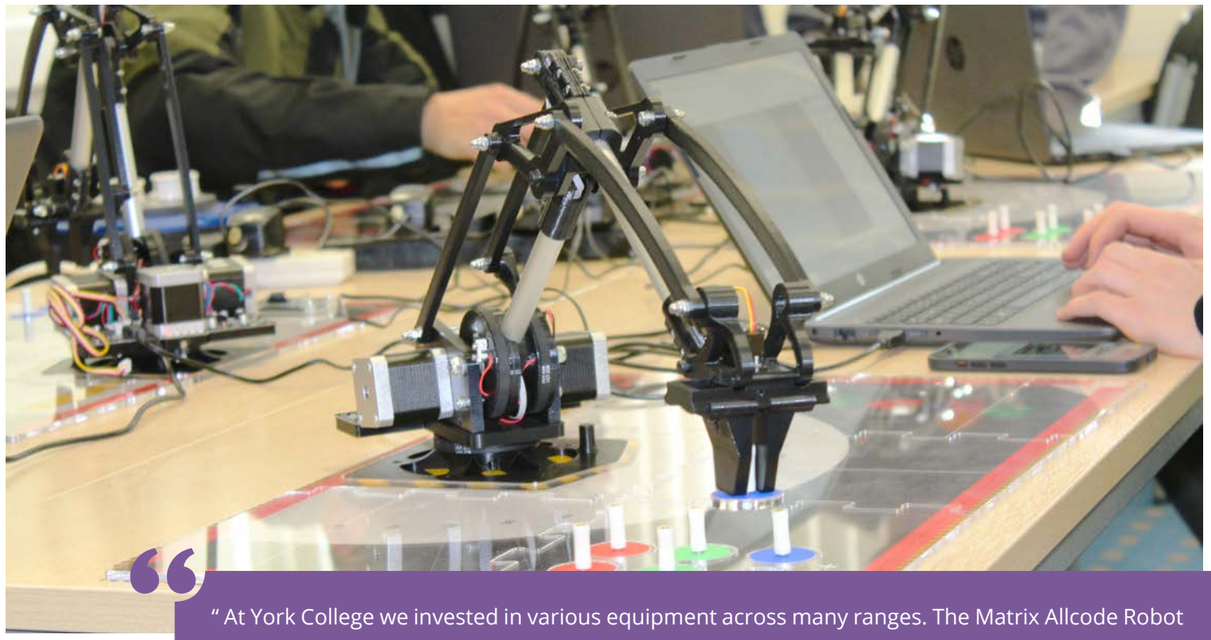
CASE **STUDY**

York College is part of the Yorkshire & Humber Institute of Technology. The Institute of Technology is part of a government initiative for the College to work alongside local employers to understand what the skills needs are and then look at how the curriculum can be tailored to meet those needs. Through the Institute of Technology, employers will have the opportunity to support the content of courses and help ensure that students' skills are up-to-date and relevant for the workplace. In recent years, York College have invested in equipment from Matrix covering Robotics, Mechanical Engineering and Electrical Engineering, including our Electrical Machines kit.



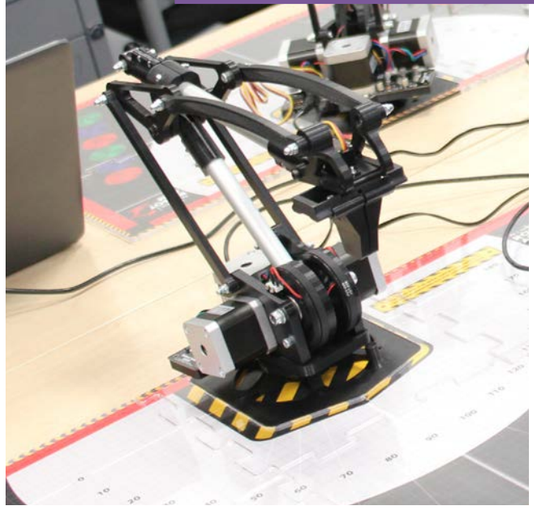
" At York College we invested in various equipment across many ranges. The Matrix Allcode Robot Arm is the perfect tool to compliment our new Institute of Technology Manufacturing Centre. Students obtain first hand experience in controlling the movements and activities of a robot arm similar to those widely used at manufacturing companies across Yorkshire.

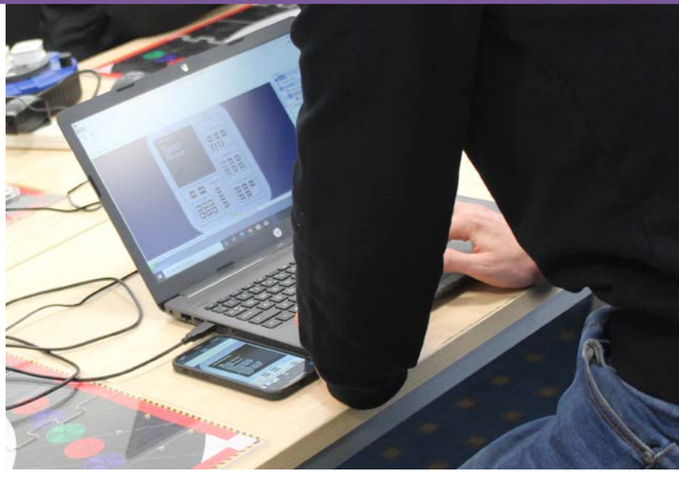
Starting with the simplist method of control using G code and a virtual pendant, each student develops a programming sequence as required in Industrial Robot Technology within the Advanced Manufacturing Engineering qualification.

Our students then take this knowledge and progress on to level 4 / 5 qualifications, and of course, learn more about robotic control using other programming languages, in which they will be attempting to control an industrial robot arm on our new manufacturing line simulation.

The Matrix Allcode Robot Arm provides the perfect solution to understanding robot control within a very enjoyable learning experience whilst in a very safe environment."

Trevor Williams, York College, United Kingdom





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THE MATRIX **PHILOSOPHY**

As our portfolio of products for engineering education has grown significantly over the past few years, we are now in a position whereby we are able to supply an engineering lab with everything required to deliver the core principles of teaching electrical, mechanical and manufacturing engineering.

On page 2, you will find an important diagram outlining the engineering disciplines for which we have developed solutions comprising of rugged, portal hardware, cutting edge software and written curriculum, worksheets and teachers notes.

On these pages, you will find some examples of the types of lab we can support the establishment of – whether in a university, vocational college, Institute of Technology, or school. This is not an exhaustive list, and to discuss this further, we would encourage you to get in touch with us at

sales@matrixtsl.com to find out more.

ELECTRICAL & ELECTRONIC **ENGINEERING**

Flexible classrooms

Comprehensive coverage of engineering disciplines

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MECHANICAL
ENGINEERING

Affordable

Space saving

MANUFACTURING
ENGINEERING

Hands on

Curriculum, worksheets and instructors guides all included

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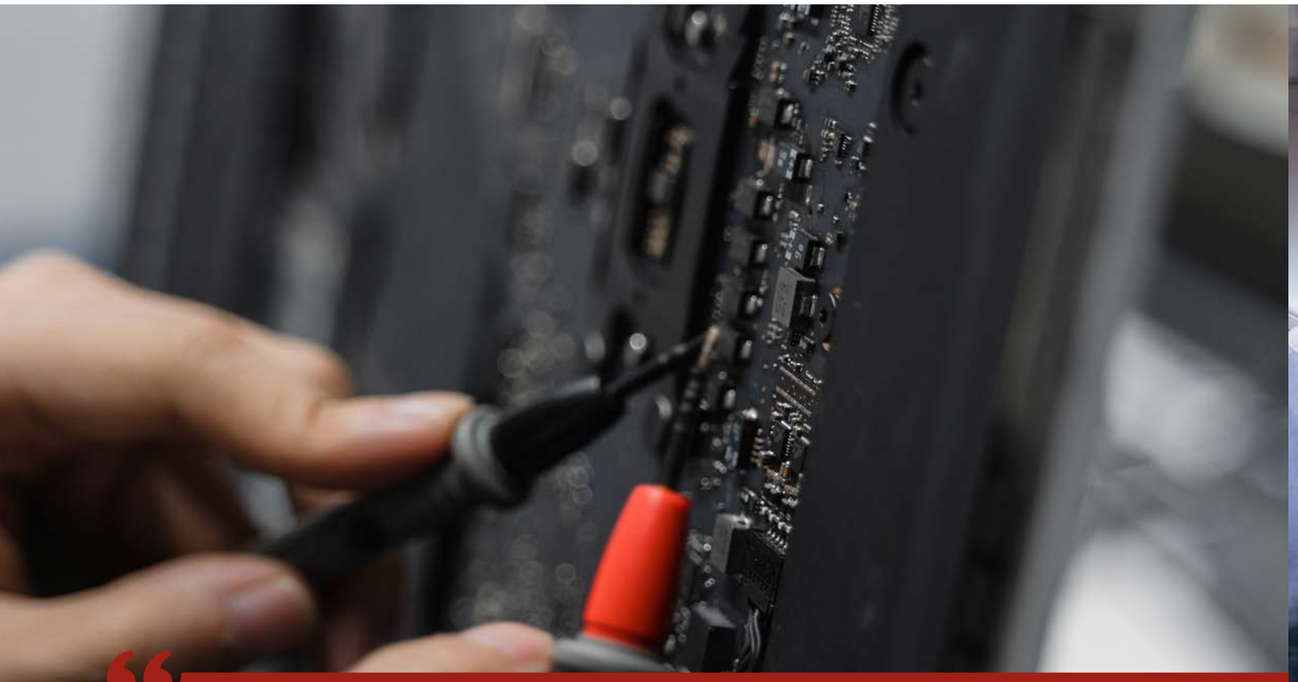
ELECTRICAL & ELECTRONIC **ENGINEERING**

Electrical and electronic engineering is an area in which Matrix have always thrived. In recent years, we have developed beyond electrical circuit and microcontroller based solutions to provide electrical machines, allowing students to learn about machine characteristics, to great success.



“ 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

EM 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 eight different types of machine, integrated power supply and 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
- Vast range of components
- Sturdy storage for solutions
- Minimal assembly required

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Modern Electrical Machines

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

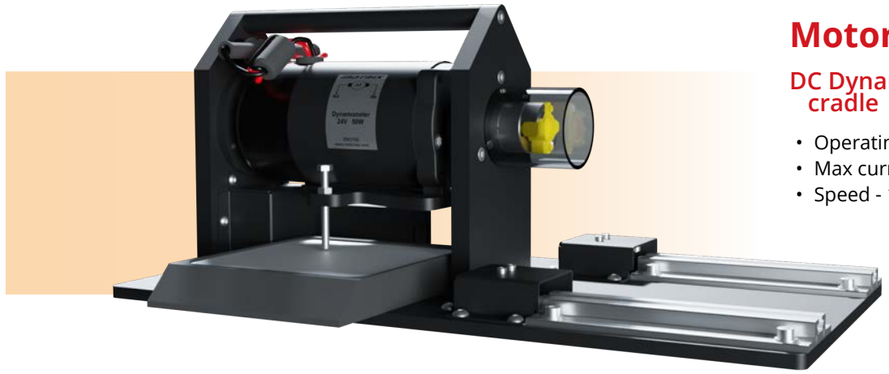
Control Box

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 resistive loads for dynamometer and series winding resistor
- 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

Modern Electrical Machines



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

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

Brushless DC motor / 3 phase generator

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

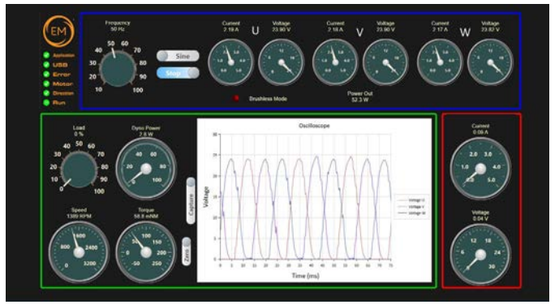
Electrical & Electronic Engineering

Modern Electrical Machines

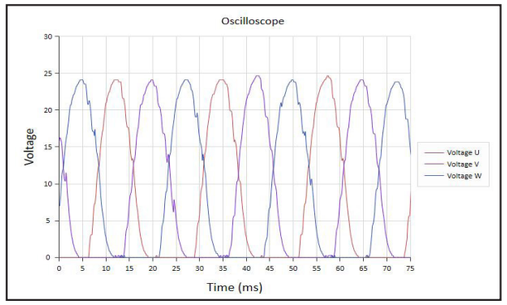
PC Software

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.

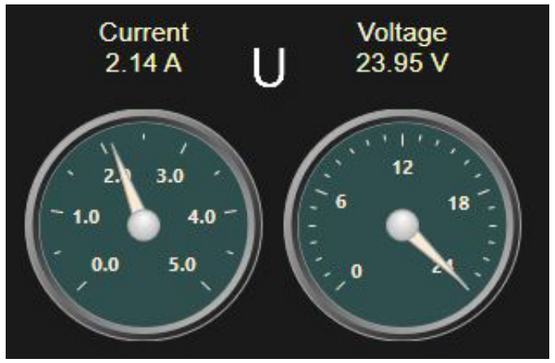
Through experimentation, users can review the results of altering the voltage, load etc of each machine and the subsequent effect this has on each machine's current, torque etc. over time.



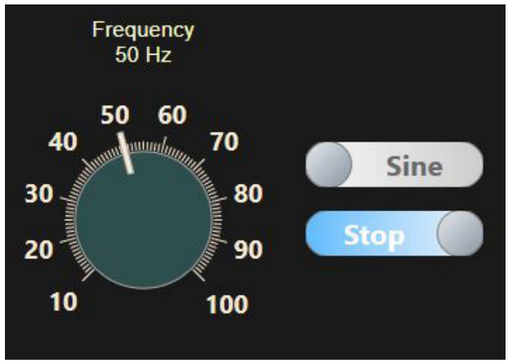
Three phase control software with integrated oscilloscope.



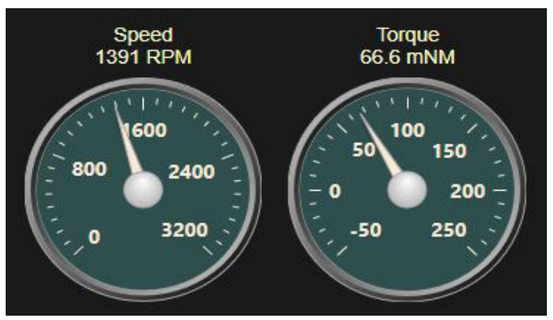
Close up of oscilloscope plot – users can select from one of 14 on-board instruments.



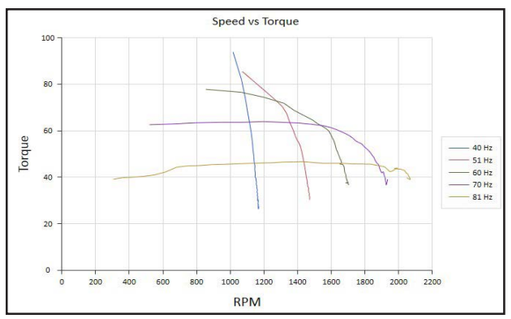
Gauges show key values such as current and voltage.



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.

Electrical & Electronic Engineering

Modern Electrical Machines

Optional Add Ons

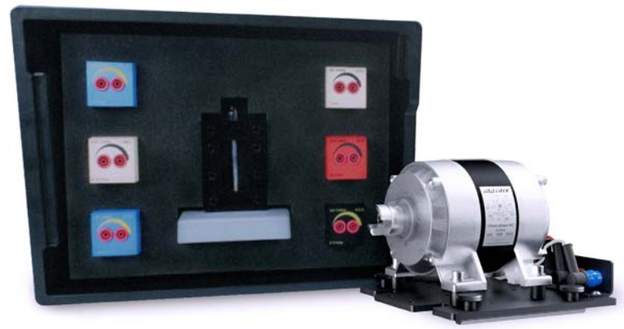
The system is designed to be used manually or via connection to a laptop or PC. When utilising the PC control option, the user should download the app from the Resources page on the website. Above are a range of screenshots showcasing the ways the proprietary software can be used to control each type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

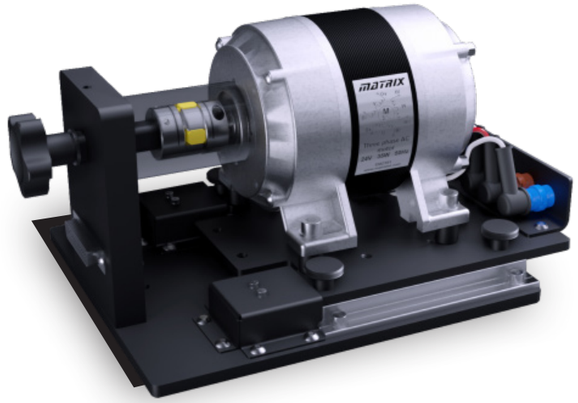
Through experimentation, users can review the results of altering the voltage, load etc of each machine and the subsequent effect this has on each machine's current, torque etc. over time.

Transformer Add On

This add-on allows users to add transformer construction study to the electrical machines system from Matrix. With this kit, students can study:

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





Locked Rotor Add On

This add-on allows users at add advanced level to study the electrical machines system from Matrix. With this kit, students can study:

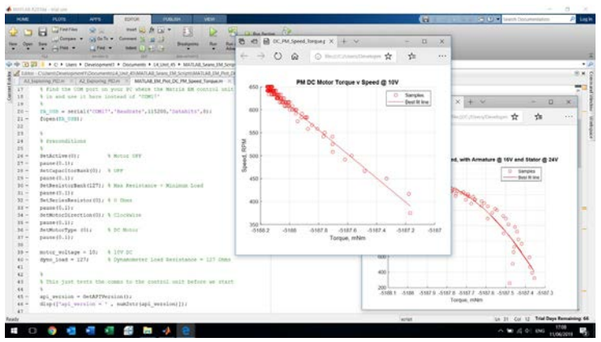
- Open and short circuit characteristics of induction motors
- Circuit modelling of induction motors using MATLAB or LabVIEW

Modern Electrical Machines

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.



Curriculum

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 teachers 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.

As with all Matrix solutions, our electrical machines kit is provided with storage trays, to ensure minimal lab space is taken up.

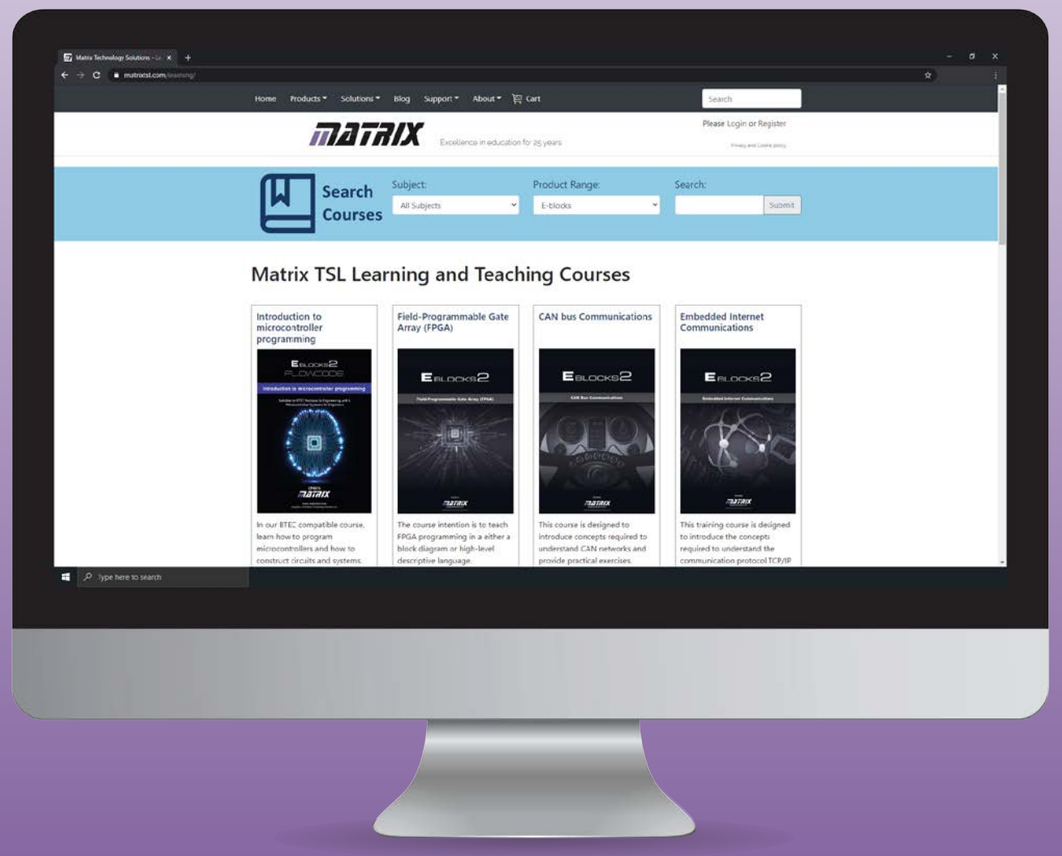
SCAN TO VISIT PRODUCT PAGE

Ordering information	
Modern electrical machines	EM6637-2
Corresponding curriculum	CP6490, CP4160, CP8385, CP9989
You will also need	
Fluke 115 True RMS Digital Multimeter	HP1324
Tektronix Digital Oscilloscope	HP8067
ADD ONS	
Electrical machines transformer add-on	EM4425
Electrical machines locked-rotor add-on	EM2551

Electrical & Electronic Engineering

LEARNING **CENTRE**

The Matrix Learning Centre is our easy to navigate, freely available library of product curriculum and training materials, containing workbooks, lesson plans and teachers notes to aid efficient study.

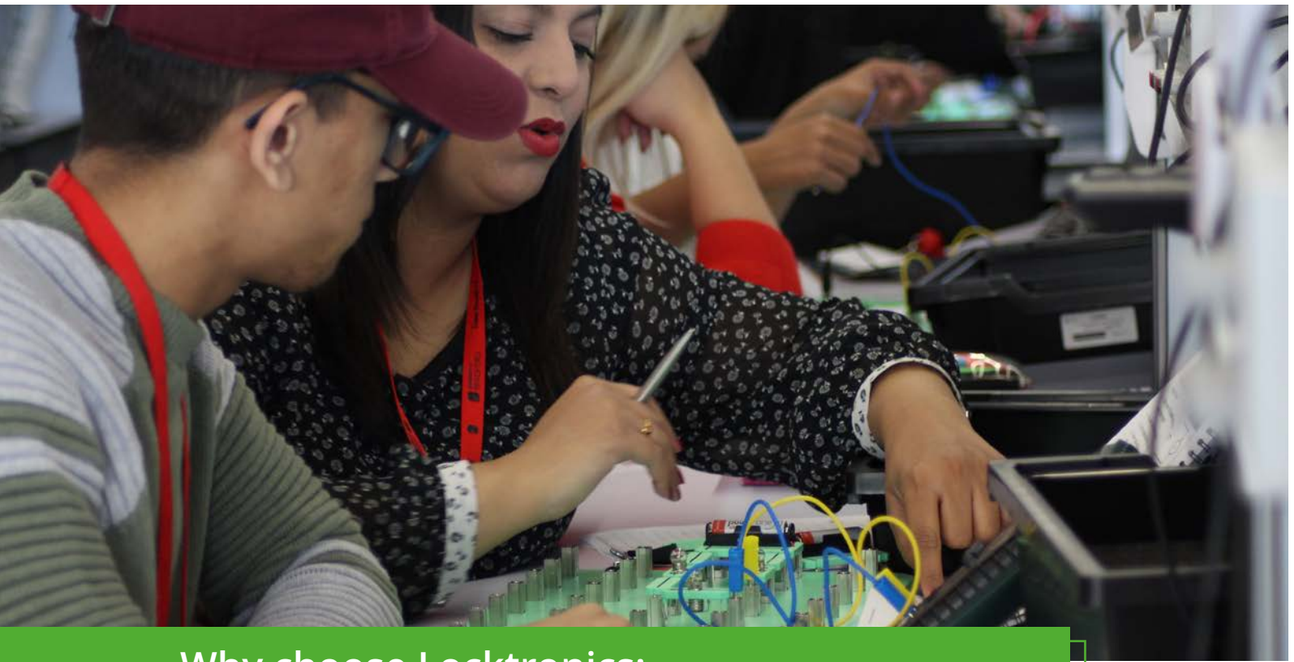


www.matrixtsl.com/**learning**

locktronics™

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

Locktronics for Engineering **Explained**

Level 1: Electricity and Magnetism (LK9071-2)

- Sequential Logic add-on pack (LK6905)
- Combinational Logic add-on pack (LK6904)
- Transistor Amplifiers add-on pack (LK9435)
- Operational Amplifiers add-on pack (LK6906)

Level 2: Intermediate Electrical and Electronic Principles (LK9862)

Level 3: Advanced Electronic Principles (LK6804)

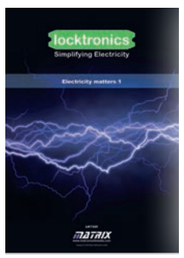
- Industrial Sensors, Actuator and Control Application (LK5783-2)
- Transformer Construction and Operation (LK1989)
- Three Phase Systems (LK4961)
- Power Systems (LK6946)
- Power and Energy Electronics (LK3568)
- Fault Finding in Electronic Circuits (LK3566)
- Internet of Things Solution (MI0899)

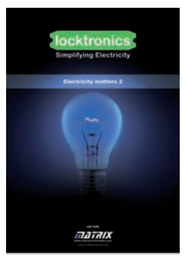
Electricity, Magnetism and Materials

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.

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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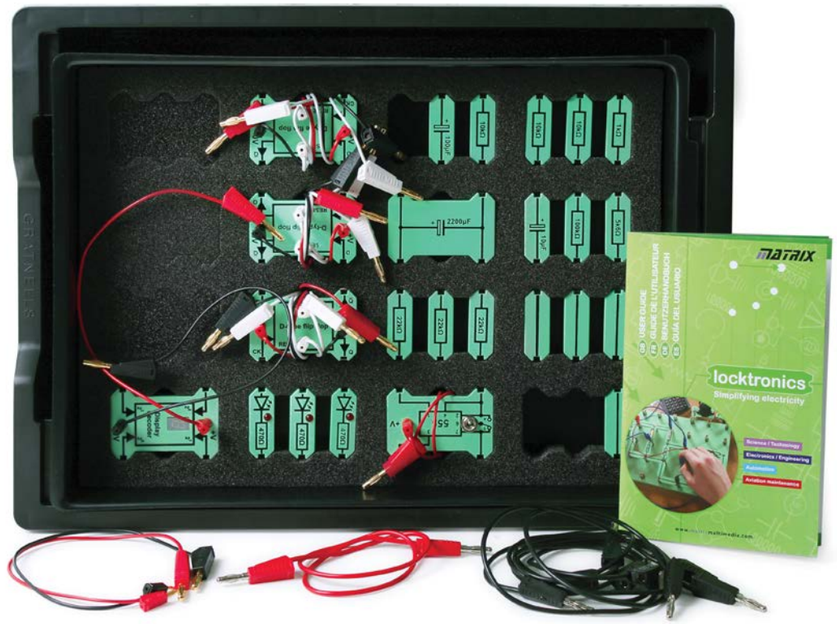
Ordering information	DIN	ANSI
Electricity, magnetism and materials solution with storage, baseboard and power supply	LK9071-2	LK9071-2A
Corresponding curriculum	LK7325 & LK7326	
You will also need		
Multimeter pack	LK1110	

Electrical & Electronic Engineering

Sequential Logic add-on pack

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.



Learning objectives / experiments:

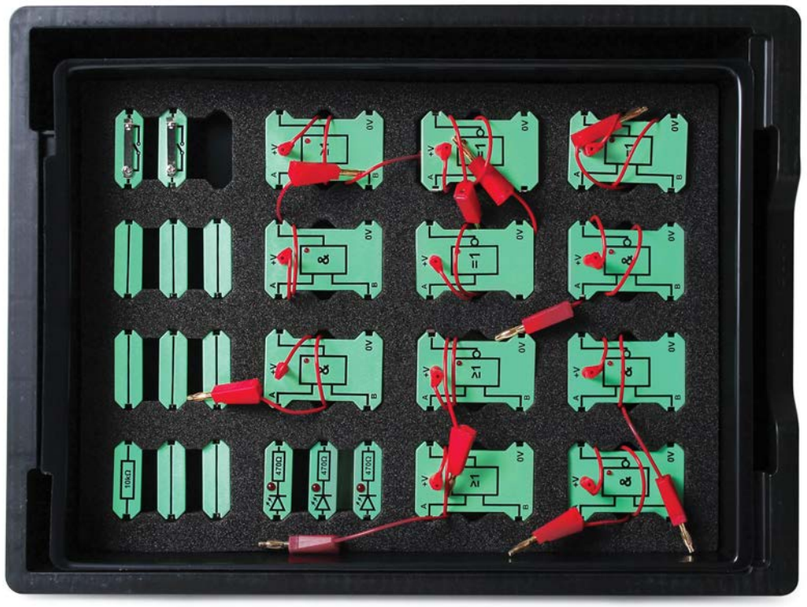
- JK Bistable
- D-type flip flop
- Monostables and bistables
- Synchronous and asynchronous circuits
- Debounce circuits
- Latches
- 3 stage counter
- BCD counter
- 7-segment displays
- 3 stage shift register – PISO and PIPO
- R2R ladder DAC

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Sequential logic add-on pack	LK6905
Corresponding curriculum	LK9945

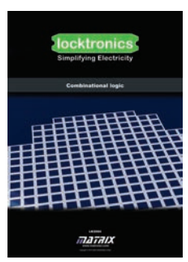
Combinational Logic add-on pack

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.



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

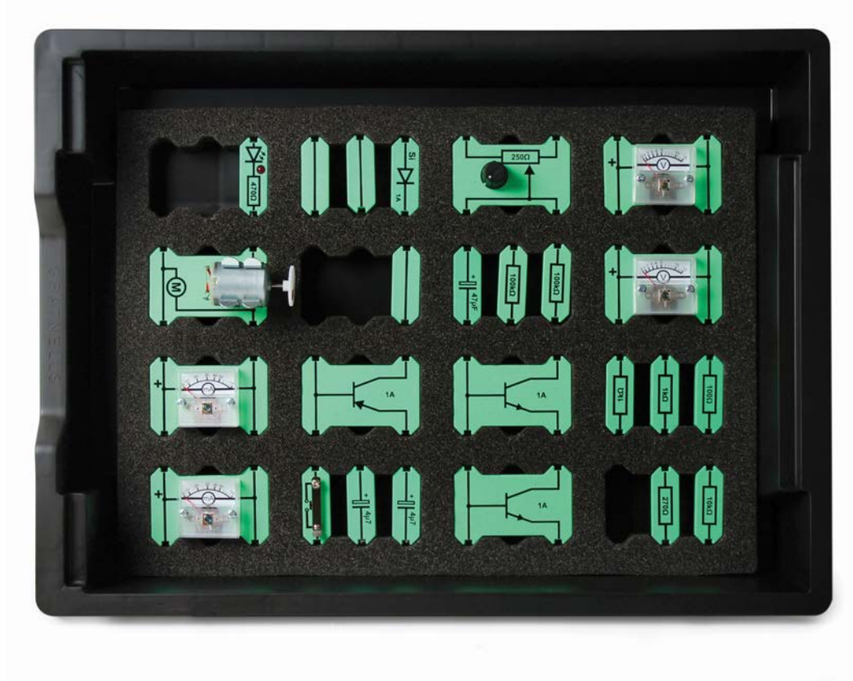


SCAN TO VISIT PRODUCT PAGE

Ordering information	
Combinational logic add-on pack	LK6904
Corresponding curriculum	LK2094

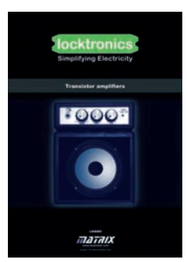
Transistor Amplifiers add-on pack

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.



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

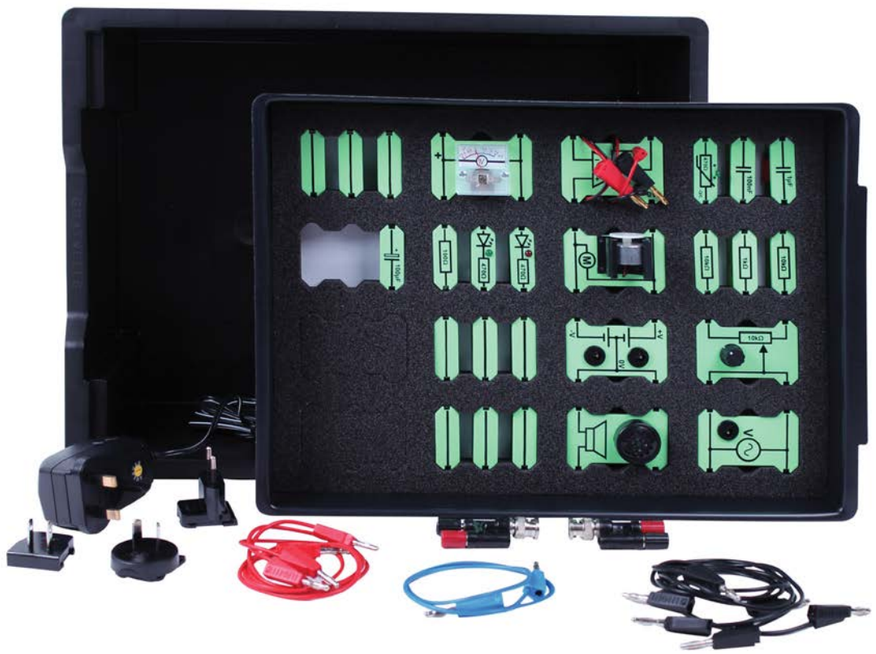


SCAN TO VISIT PRODUCT PAGE

Ordering information	
Transistor amplifiers add-on pack	LK9435
Corresponding curriculum	LK4403

Operational Amplifiers add-on pack

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.



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

SCAN TO VISIT PRODUCT PAGE

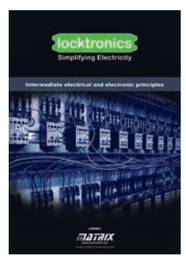
Ordering information	DIN	ANSI
Operational amplifiers add-on-kit	LK6906	LK6906A
Corresponding curriculum	LK3061	
You will also need		
Source - DC PSU, AC PSU and signal generator	LK6999/LK2975	

Intermediate Electrical and Electronic Principles

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.

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



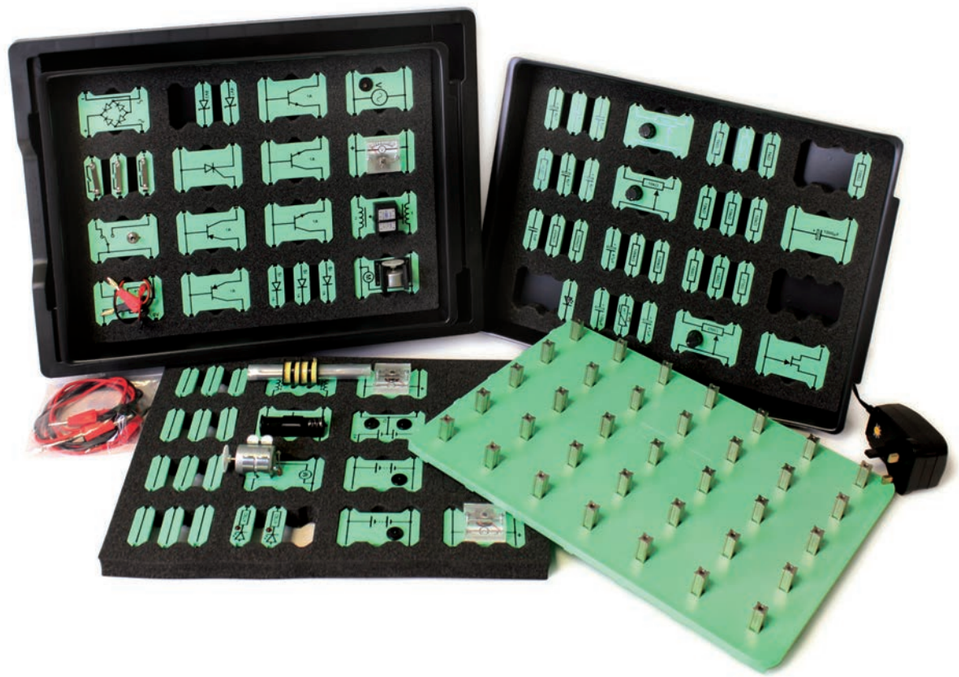
SCAN TO VISIT PRODUCT PAGE

Ordering information	DIN	ANSI
Intermediate electronic engineering solution	LK9862	LK9862A
Corresponding curriculum	CP4583	
You will also need		
Multimeter pack	LK1110	

Electrical & Electronic Engineering

Advanced Electronic Principles

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.



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

SCAN TO VISIT PRODUCT PAGE

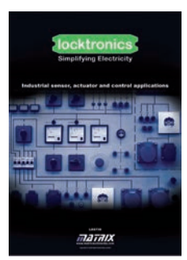
Ordering information	DIN	ANSI
Advanced electronic principles	LK6804	LK6804A
Corresponding curriculum	LK3008	
You will also need		
Source - DC PSU, AC PSU and signal generator	LK6999/LK2975	

Industrial Sensors, Actuator and Control Application

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 LabViewTM and Visual BasicTM. 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



SCAN TO VISIT PRODUCT PAGE

Ordering information	DIN	ANSI
Industrial sensor, actuator and control solution	LK8856	LK8856A
Corresponding curriculum	LK8739	
You will also need		
Multimeter pack	LK1110	

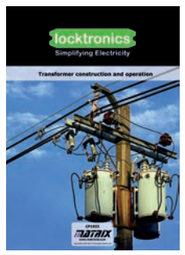
Electrical & Electronic Engineering

Transformer Construction and Operation

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.

Learning objectives / experiments:

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

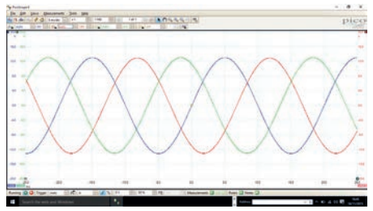


SCAN TO VISIT PRODUCT PAGE

Ordering information	
Transformer construction and operation pack	LK1989
Corresponding curriculum	CP1933
You will also need	
Source - DC PSU, AC PSU and signal generator	LK6999/LK2975

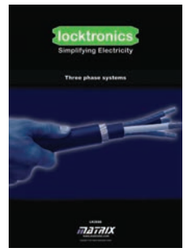
Three Phase Systems

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 not included in the pack. Picoscope is optional. Current clamp is needed for some experiments.



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



SCAN TO VISIT PRODUCT PAGE

Ordering information	
Three phase systems	LK4961
Corresponding curriculum	LK2686
Recommended	
Pico 4 phase oscilloscope	HP5834
AC/DC current clamp	HP5561

Electrical & Electronic Engineering

Power Systems

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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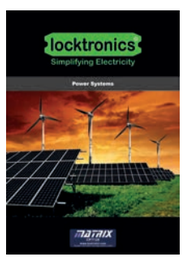
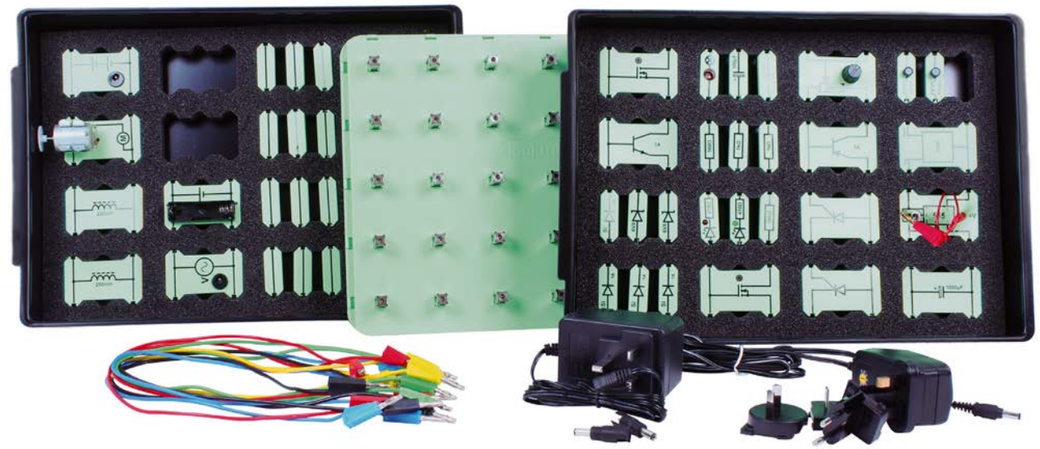


Ordering information	
Power Systems	LK6946
Corresponding curriculum	LK7128

Power and Energy Electronics

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.



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

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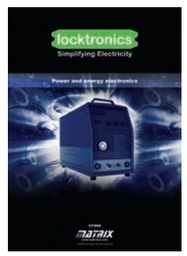
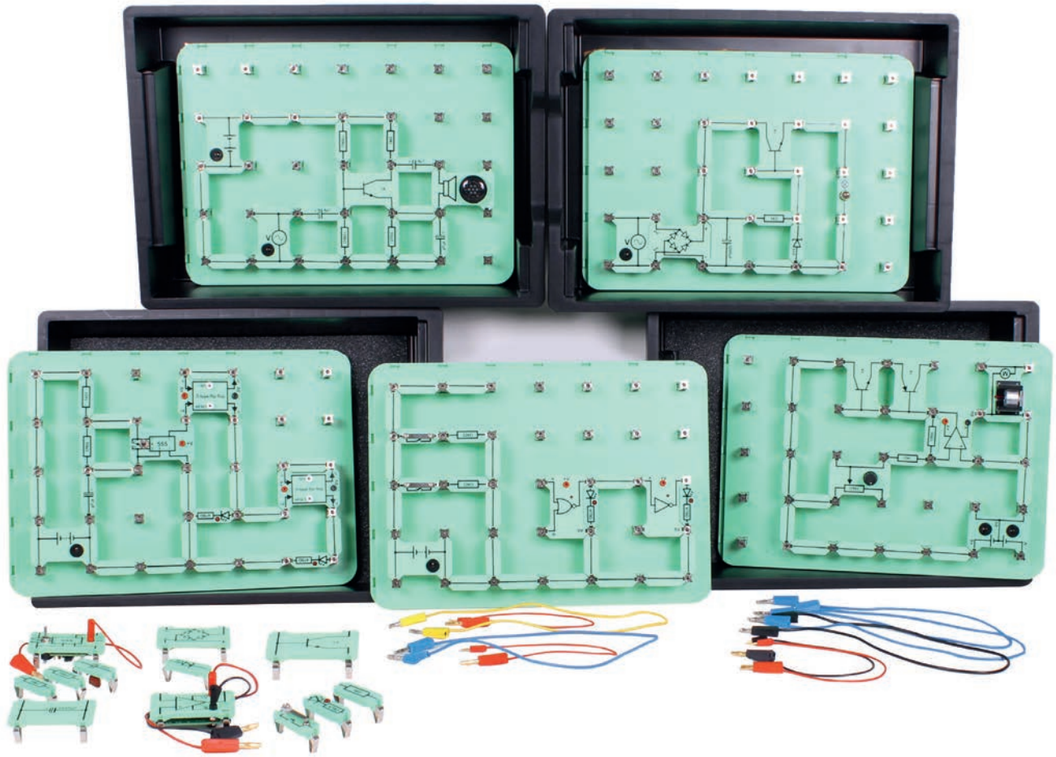


Ordering information	
Power and energy electronics	LK3568
Corresponding curriculum	CP3666
You will also need	
Source - DC PSU, AC PSU and signal generator	LK6999/LK2975

Fault Finding in Electronic Circuits

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.

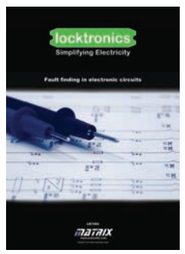


Learning objectives / experiments:

- Safety in fault finding
- Using multimeters
- PC based oscilloscopes
- Testing diodes and transistors

Fault finding circuits:

- 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

Ordering information	
Fault finding in electronic circuits	LK3566
Corresponding curriculum	LK9333
You will also need	
Multimeter pack	LK1110
Picoscope	HP8279

Internet of Things Solution

This Internet of Things solution is designed to allow students to give consideration to current trends in technology, including the future of industrial systems (with Industry 4.0 in mind), the impact of digital developments, the increase of wireless and remote control and the Internet of Things.

Our IoT kit comes with a basic guide, to using our Raspberry Pi based MIAC(s) with Node-RED - a flow-based IDE for visual programming for wiring together hardware devices, APIs and online services as part of the Internet of Things. Users of this kit send and receive data remotely via Wi-Fi using pre-built internet communication services.

The IoT solution also includes a small selection of Locktronics parts for example work, the pre-written guide is available through the resources in our online learning centre.

Learning objectives / experiments:

- Development of Raspberry Pi based IoT applications
- Development of cloud-based IoT applications
- Exchanging data between IoT devices and cloud-based applications
- Utilising Node-RED as an IoT platform for learning and development
- Security implications for IoT
- Remote datalogging, sensing and control

SCAN TO VISIT PRODUCT PAGE

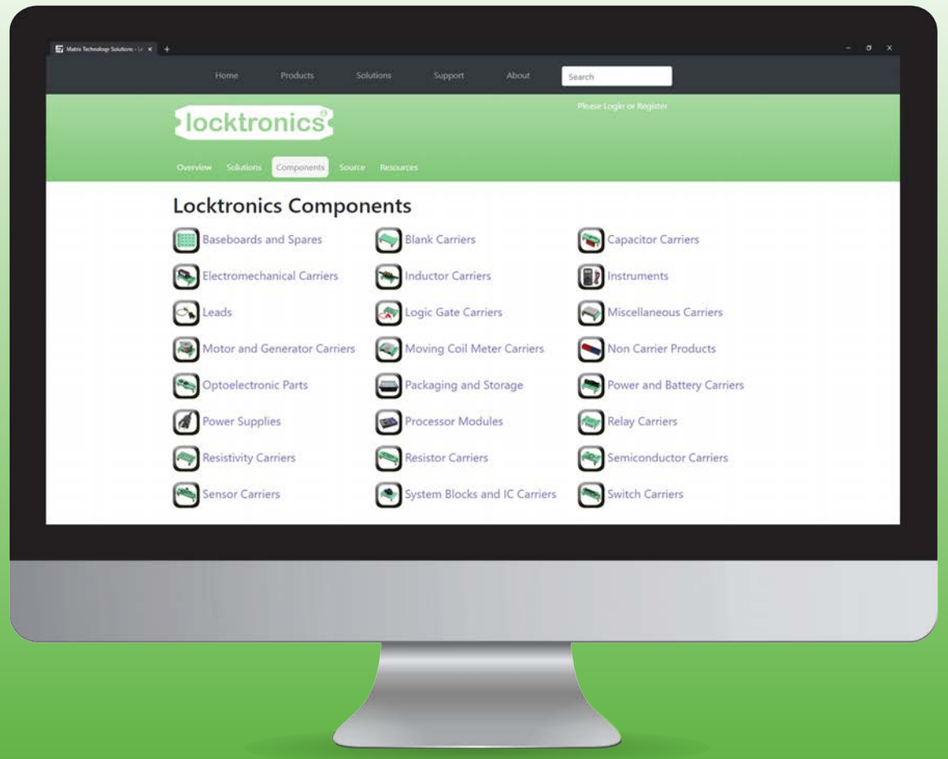
Ordering information	
Internet of Things Solution	MI0899

Electrical & Electronic Engineering

locktronics™

Components

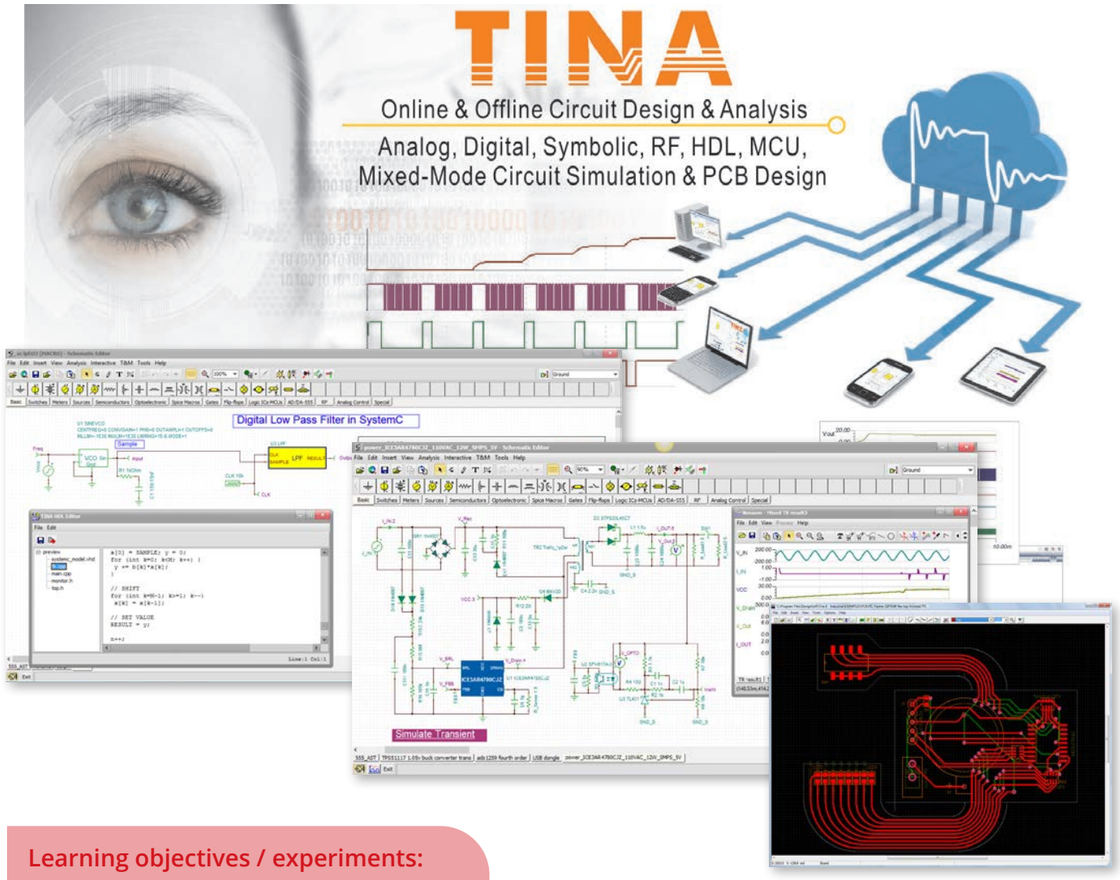
Each Locktronics kit is supplied with a comprehensive list of components to ensure any required replacements or spares can be sourced from our online store. Extra components can also be purchased to increase kit functionality.



www.matrixtsl.com/locktronics/**components**

TINA

TINA is a powerful yet affordable circuit simulation and PCB design software package for analysing, designing, and real time testing of analogue, digital, VHDL, microcontroller, and mixed electronic circuits and their PCB layouts. You can also analyse Switched Mode Power supplies, RF, communication, and optoelectronic circuits; and test microcontroller applications in a mixed circuit environment. 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

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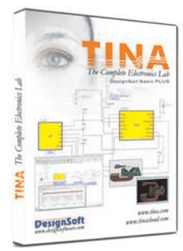


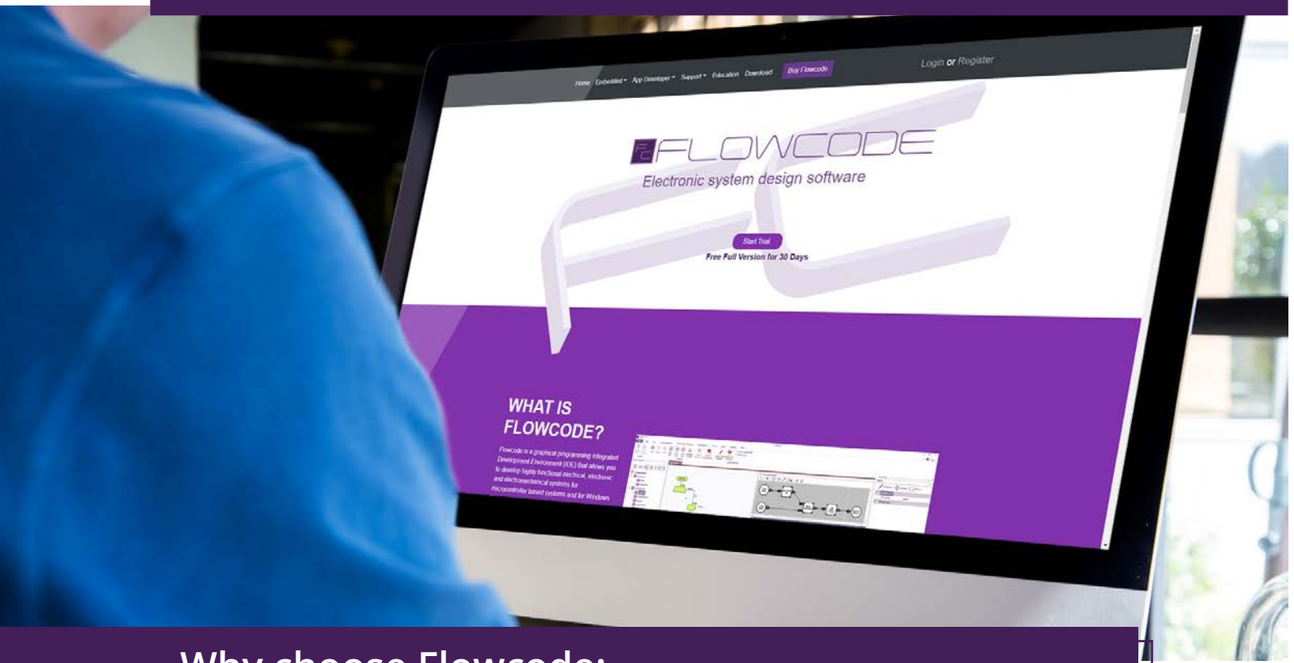
Ordering information	
TINA	TINA

FLOWCODE

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*



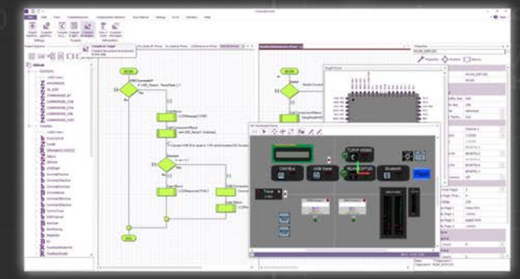
Why choose Flowcode:

- Graphical programming & C code
- Support for 34 families including Arduino
- Integrated E-blocks2 hardware
- 3D simulation of designs
- Test & debugging features
- Free student licences for home use

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



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

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

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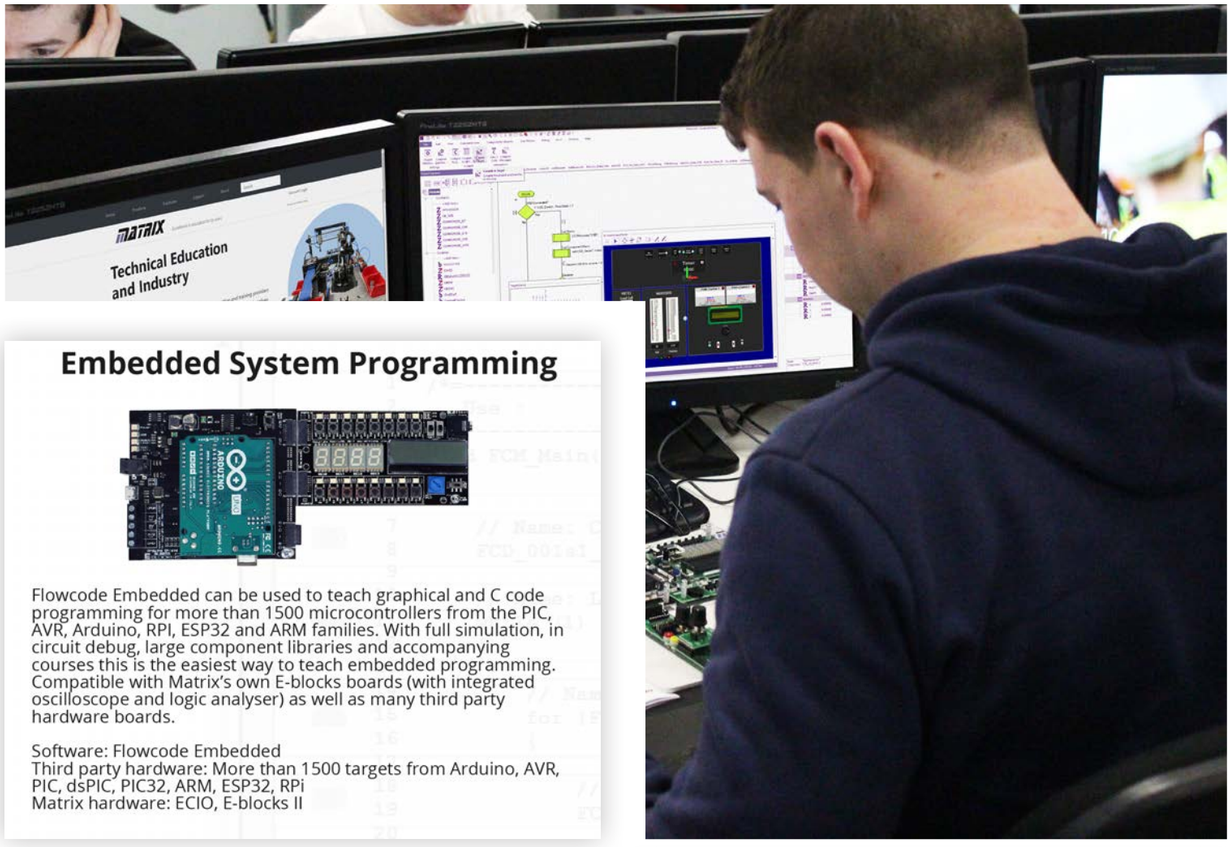
FLOWCODE in Education

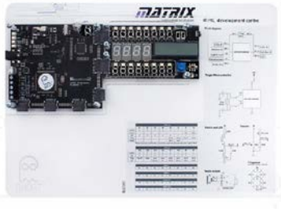


Embedded System Programming

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



The Data Flow/ DSP tools in Flowcode allow drag and drop, point and click construction of DSP systems on screen using a wide range of components including oscillators, sum, maths, filter, and FFT. Resulting designs can be simulated and compiled to a range of microcontrollers with DSP functions for the study of DSP with Fourier transforms and other digital mathematical constructs.

Software: Flowcode Embedded
Third party hardware: Many third party hardware development boards based on ARM, PIC32, dsPIC
Matrix hardware: E-blocks II

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.

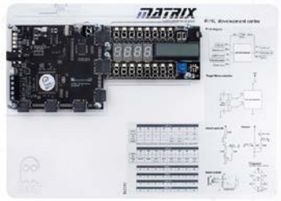
Software: Flowcode Embedded
Matrix hardware: E-blocks II solutions

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.

Music Technology and Music Engineering



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.

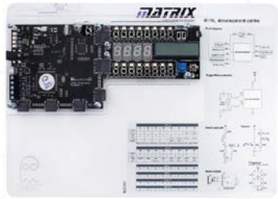
Software: Flowcode Embedded
Third party hardware: Fast microcontrollers based on PIC32, ARM, dsPIC
Matrix Hardware: E-blocks II

Automotive Engineering

Flowcode App Developer and Flowcode Embedded combined allow students to build advanced Automotive engineering platforms with multiple CAN bus and LIN bus communications.

Software: Flowcode App Developer
Matrix hardware: MIAC NXT

Communications



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 Embedded
Third party hardware: Fast microcontrollers based on PIC32, ARM, dsPIC
Matrix hardware: E-blocks II, Sysblocks

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 Flowcodes'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

Test and Measurement

Flowcode App Developer allows students to build advanced human 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.

Software: Flowcode App Developer
Third party hardware: Low cost microcontroller boards based on Arduino Uno, PIC ECIO, ESP32, RPi, with the free API supplied.
Matrix hardware: E-blocks II, MIAC NXT

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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

Electrical & Electronic Engineering

Programming Arduino Microcontrollers

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 can also be purchased separately with a "combo" board 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

Ghost & Flowcode provide:

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

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Arduino microcontroller system development kit (modular)	BL0554
Arduino development centre and printed panel	BL0599
Arduino programmer and combo board	BL0544
Flowcode	

Programming PIC Microcontrollers

TThis 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 Gratnell's tray with all necessary boards included. The programmer board can also be purchased separately with a "combo" board either with or without the printed panel.

Approved hardware and software for BTEC National unit 6: Microcontroller systems for engineers

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

Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

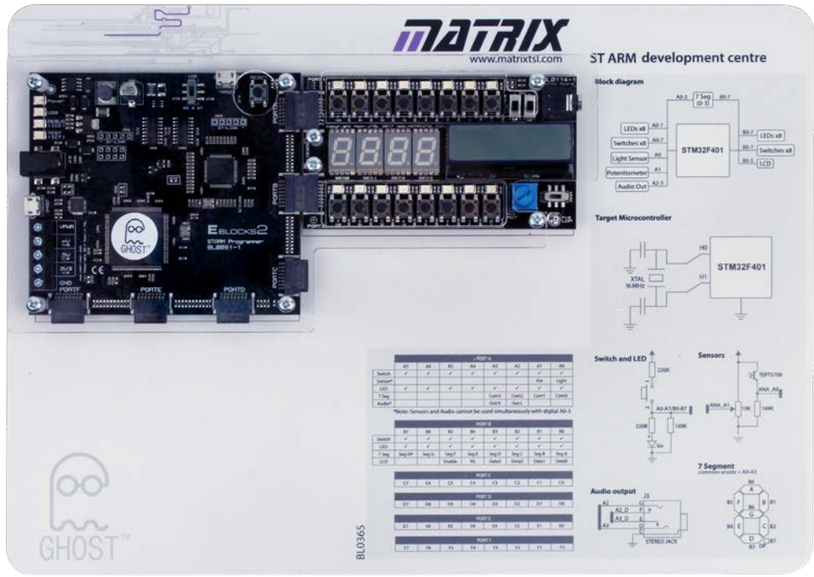
Ordering information	
PIC microcontroller system development kit (modular)	BL0502
PIC development centre and printed panel	BL0562
PIC programmer and combo board	BL0505
Flowcode	
C for PIC microcontrollers	
Assembly for PIC microcontrollers	

SCAN TO VISIT PRODUCT PAGE

Programming ARM Microcontrollers

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.



Learning objectives / experiments:

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

Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

SCAN TO VISIT PRODUCT PAGE

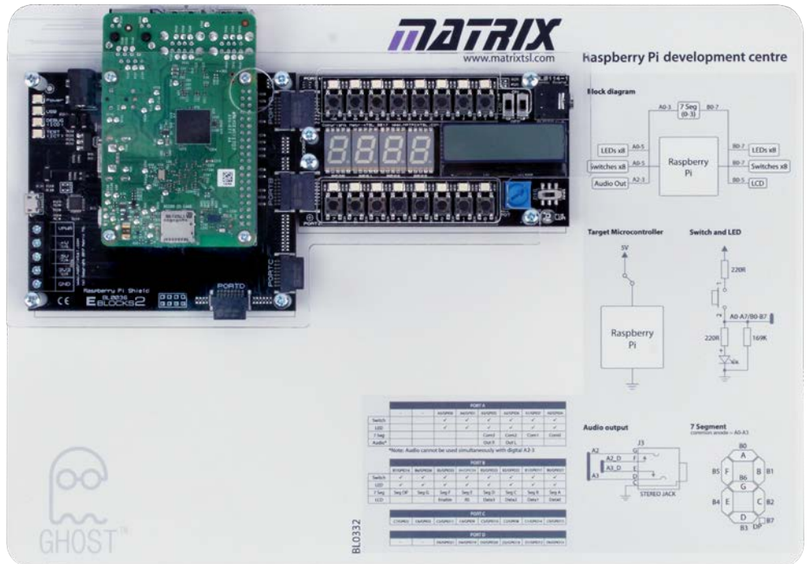
Ordering information	
ARM microcontroller system development kit	BL0546
ARM development centre and printed panel	BL0593
ARM programmer and combo board	BL0596
Flowcode	

Electrical & Electronic Engineering

Raspberry Pi Development Kit

This solution guides students through the process of developing 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.



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

Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

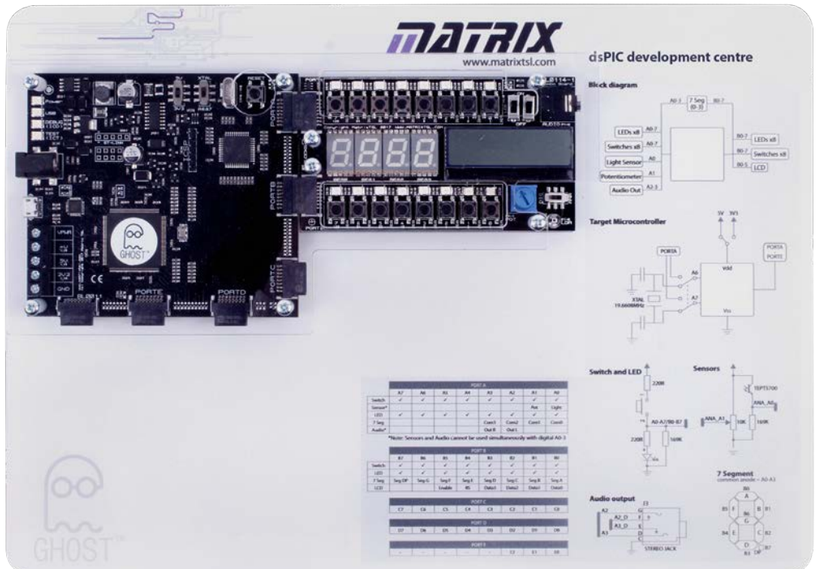
SCAN TO VISIT PRODUCT PAGE

Ordering information	
Raspberry Pi system development kit	BL0575
Raspberry Pi development centre and printed panel	BL0557
Raspberry Pi programmer and combo board	BL0560
Flowcode	

Programming dsPIC Microcontrollers

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.



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

Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

SCAN TO VISIT PRODUCT PAGE

Ordering information	
dsPIC microcontroller system development kit	BL0503
dsPIC development centre and printed panel	BL0514
dsPIC programmer and combo board	BL0564
Flowcode	

Electrical & Electronic Engineering

Programming AVR Microcontrollers

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 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 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

Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

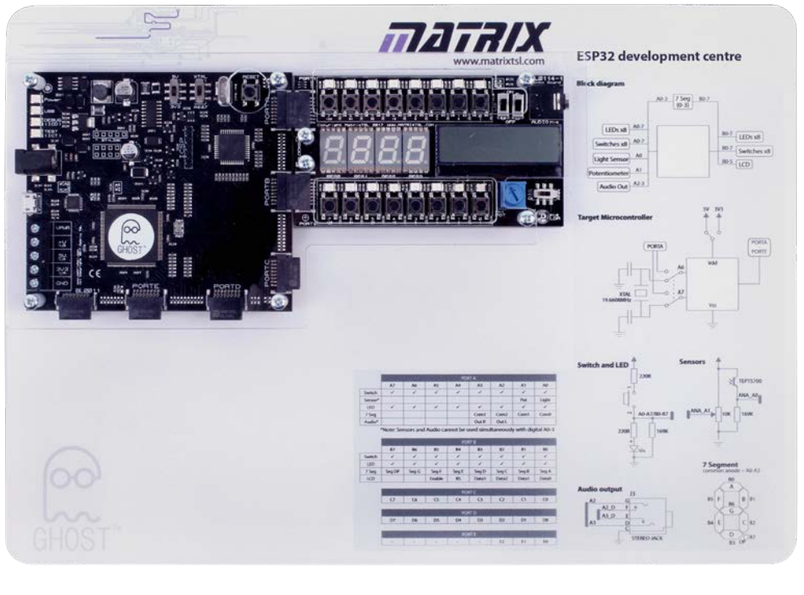
SCAN TO VISIT PRODUCT PAGE

Ordering information	
AVR microcontroller system development kit	BL0591
AVR development centre and printed panel	BL0518
AVR programmer and combo board	BL0570
Flowcode	

Programming ESP32 Microcontrollers

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 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 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

Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

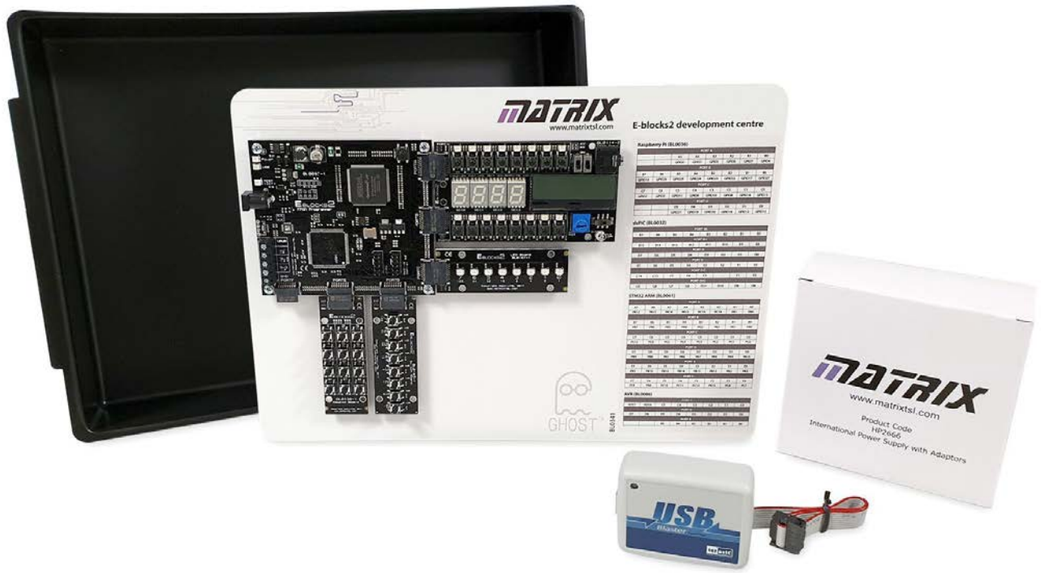
SCAN TO VISIT PRODUCT PAGE

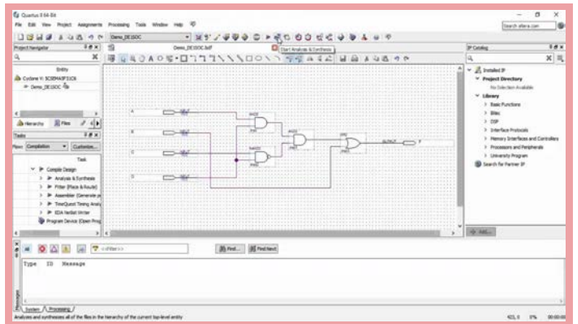
Ordering information	
ESP32 microcontroller system development kit	BL0541
ESP32 development centre and printed panel	BL0545
ESP32 programmer and combo board	BL0568
Flowcode	

Electrical & Electronic Engineering

FPGA Training Course

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

Ordering information	
FPGA training course	BL0580

SCAN TO VISIT PRODUCT PAGE

Arduino GSM Training Course

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.

Learning objectives / experiments:

Programming:

- 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

Communications:

- 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

Ghost & Flowcode provide:

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

Ordering information	
Arduino GSM training course	BL0521
PIC GSM training course	BL0579
Requires Flowcode, which must be ordered separately	

SCAN TO VISIT PRODUCT PAGE

Electrical & Electronic Engineering

Arduino Bluetooth Training Course

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.

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

Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Arduino Bluetooth training course	BL0563
PIC Bluetooth training course	BL0506
Requires Flowcode, which must be ordered separately	

Arduino Embedded Internet Training Course

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.

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

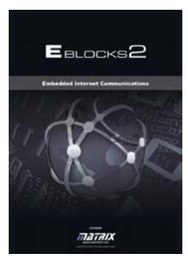
Learning objectives / experiments:

- ARP scanning
- Ping
- Time and date messages using UDP
- Sending HTML using HTTP protocol
- Receiving HTML
- Sending an email using SMTP protocol

Advanced tasks include:

- Custom messaging using UDP
- A firewall application

Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer



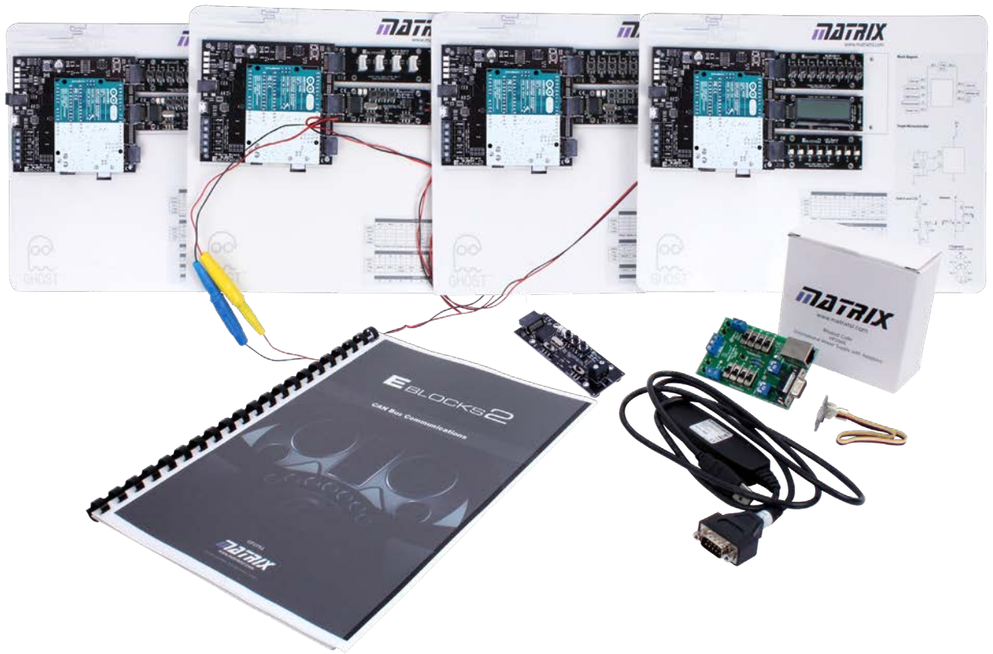
SCAN TO VISIT PRODUCT PAGE

Ordering information	
Arduino embedded internet training course	BL0535
PIC embedded internet training course	BL0531
Requires Flowcode, which must be ordered separately	

Electrical & Electronic Engineering

Arduino CAN Bus Training Course

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.



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

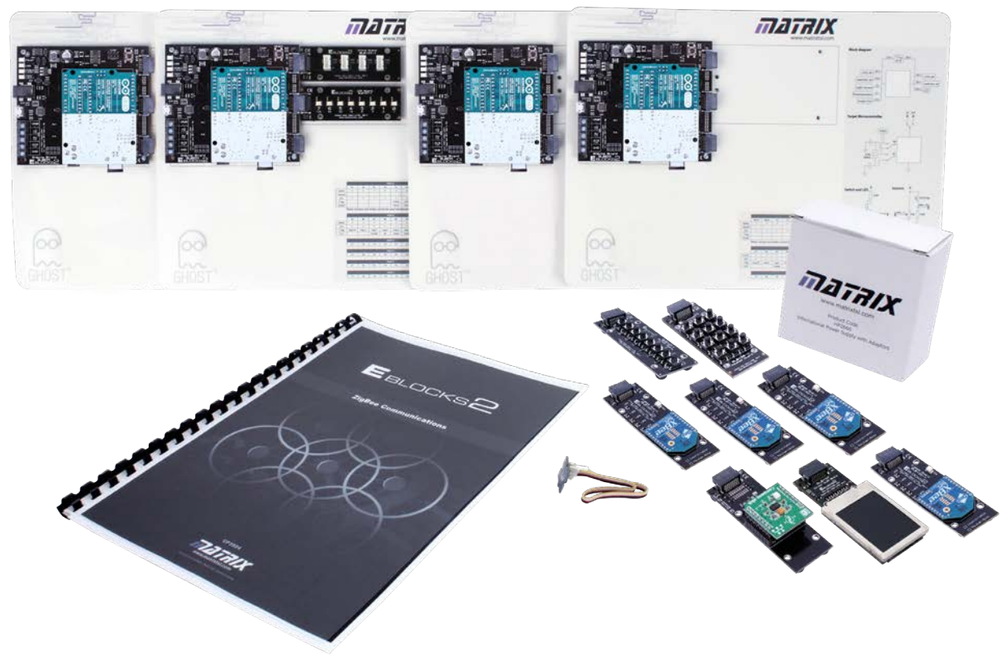
GHOST™
Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Arduino CAN bus training course	BL0587
PIC CAN bus training course	BL0589
Requires Flowcode, which must be ordered separately	

Arduino ZigBee Training Course

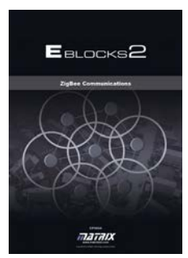
This training solution provides a complete 20 hour course in developing wireless area networks based on the ZigBee standard. It gives students who are familiar with microcontrollers an understanding of the programming techniques involved in developing ZigBee wireless communications systems. A ZigBee 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.



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

GHOST™
Ghost & Flowcode provide:
- In-Circuit-Test
- In-Circut-Debug
- Software oscilloscope
- Packet decoder
- Logic Analyzer



SCAN TO VISIT PRODUCT PAGE

Ordering information	
Arduino ZigBee training course	BL0536
PIC ZigBee training course	BL0516
Requires Flowcode, which must be ordered separately	

Electrical & Electronic Engineering

Arduino RFID Training Course

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.

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

GHOST™

Ghost & Flowcode provide:

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

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Arduino RFID training course	BL0548
PIC RFID training course	BL0510
Requires Flowcode, which must be ordered separately	

MATRIX
MATRIX

MECHANICAL ENGINEERING

We are pleased to present a new range of mechanical engineering solutions, designed to meet the needs of students who need to learn key principles of various common subjects.
Our fundamental mechanics solutions comprise of equipment suitable for the learning of Statics, Materials, Dynamics, Linear and Rotational Dynamics with data-logging and Thermodynamics. These affordable kits can be easily packed away and stored and cover the key topics studied by students in an engineering course at school, college or in the foundation years of university.

We have also introduced equipment for the study of seven Structures related topics in mechanical engineering. These kits are rugged, portable and storable, with built-in data acquisition via USB meaning students' can output data directly into excel for further experimental analysis and simulation. We are also pleased to present another new range with equipment for the study of Fluids fundamental and additional principles.
All of the new mechanical engineering kits we have introduced come with full curriculum, with worksheets accessible free of charge in the Learning Centre.

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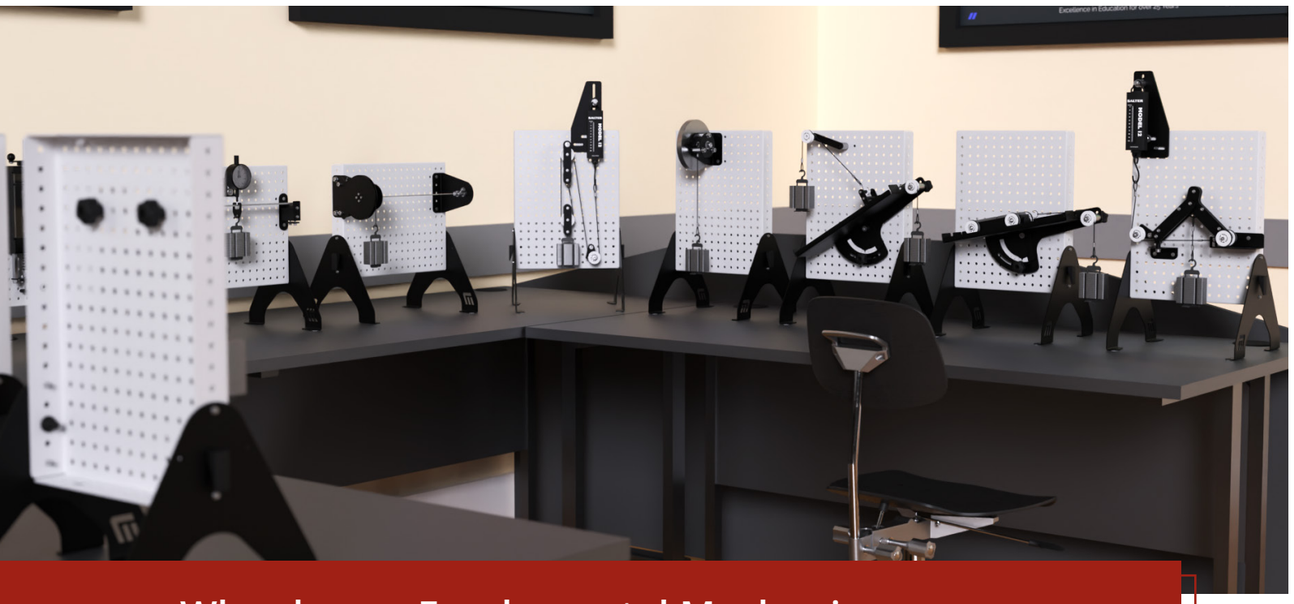
Fundamental MECHANICS

The fundamental mechanics range of equipment that allows students to study the principles of mechanical engineering required in many engineering related courses. Three kits are available in the main fundamentals range, covering Statics, Materials and Dynamics fundamentals, meaning students can study a total of 14 experiments. A complete set combines all three in to one easy to use, robust and storable education system. These kits comprise of a rugged metal work panel, with removable legs, all of which store in the provided trays. The experimental components are hard-wearing and high quality, meaning they stand up to the rigours of an educational lab.
Further to this, we are also able to provide experimentation kits for the study of Linear and Rotational Dynamics with data-logging and Thermodynamics principles.
All kits in this range come in storable trays, meaning portability and storability are taken care of for the user.

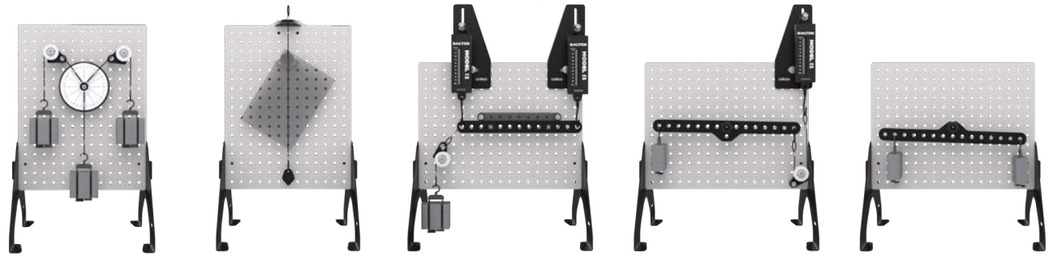


Why choose Fundamental Mechanics:

- Flexibility through modular design
- Small and compact solution
- Rugged and long lasting
- Covers range of subject areas
- Minimal assembly required
- Extensive free curriculum

Statics Fundamentals

This set of equipment covers the needs of students studying forces, moments, beams and more. Students use the storable work panel (included) to construct a range of experiments, which allow you to study a full course in static engineering systems. A full 10-hour workbook is included free of charge in the Learning Centre for this kit.



Learning objectives / experiments:

- Forces (mass, force, weight, combining, parallelogram, triangle and polygon
- Centre of gravity
- Units of weight and mass
- Free body diagrams
- Force vectors
- Coplanar forces
- Bow's notation
- Principles of moments and moment of forces
- Distinguishing between moments and torque
- Equilibrium of forces
- Levers and the term mechanical advantage
- Simply supported beams
- Concentrated and uniform distributed loads
- Different types of pinned supports

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Statics Fundamentals	FM1883

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Mechanical Engineering

Materials Fundamentals

This set of equipment covers the needs of students studying torsion, stress and strain, elastic constants, Young's Modulus and more. Students use the storable work panel (included) to construct a range of experiments, which allow you to study a full course in material principles. A full 10-hour workbook is included free of charge in the Learning Centre for this kit.

Learning objectives / experiments:

- Torsion of rods
- What effect has Polar second moment of area on torque and modulus of rigidity
- What effect has torque, shape, length and material on rod deflection
- Tensile test using plastic, aluminium and mild steels
- Understand the terms stress and strain
- Introduction to Youngs modulus for different materials
- Terms elastic deformation and plastic deformation
- Terms yield strength and ductility
- Shear force tests
- Shear stress and shear strain
- What effect has second moment of area on beam deflection
- What effect has load, shape, length and material on beam deflection
- Different types of supports for beams

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Ordering information	
Materials Fundamentals	FM1292

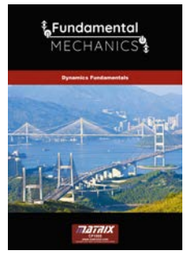
Mechanical Engineering

Dynamics Fundamentals

This set of equipment covers the needs of students studying pulleys, static and sliding friction, mechanisms and energy conversion. Students use the storable work panel (included) to construct a range of experiments, which allow you to study a full course in dynamic engineering systems. A full 10 hour workbook is included free of charge in the Learning Centre for this kit.

Learning objectives / experiments:

- Kinetic and gravitational energy parameters and principles
- Dynamic parameters and principles
- Newton's Law of Motion
- Mechanical efficiency and advantage
- Flywheel experimentation
- Toggle mechanisms
- Single and compound Pulley experimentation
- Static and sliding friction on inclined planes (with frictional surfaces and rollers)



SCAN TO VISIT PRODUCT PAGE

Ordering information	
Dynamics Fundamentals	FM3935

Complete Fundamentals

This full set of equipment allows students to understand the principles of fundamental statics, materials and dynamics engineering systems in one portal set of equipment.

Included in this equipment are the full contents of the following kits:

Statics fundamentals
Materials fundamentals
Dynamics fundamentals

The user receives everything in neat, Gratnell's trays and each solution includes a work panel (3 in total). Three, 10- hour workbooks are included free of charge in the Learning Centre for this kit.

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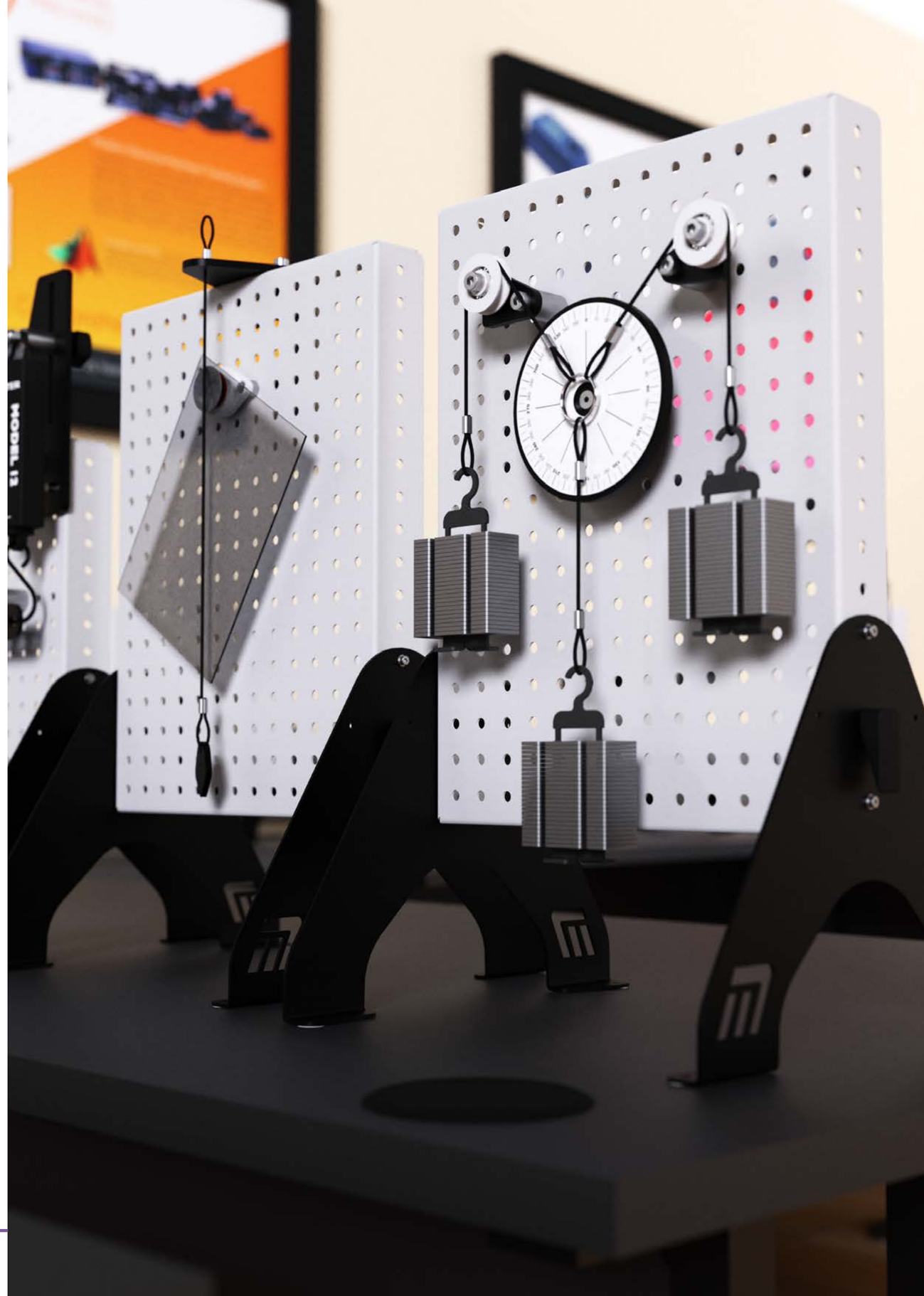
Ordering information	
Complete Fundamental Mechanics Kit	FM9458



Linear and Rotational Dynamics

This kit includes a dynamics track, handheld datalogger with LCD screen, and a range of sensors and accessories that allow students and teachers to carry out a range of experiments in dynamics. The datalogger can be used independently of a PC for many experiments with data automatically passed to Excel for further analysis. The datalogger has a VGA output which makes the equipment perfect for classroom demonstrations. The equipment is supplied with a suite of worksheets and teacher support material.

The datalogger included is fully self-contained and has a VGA output for connection to a projector for class demonstrations.

Learning objectives / experiments:

- Parameters of kinetics: displacement, velocity, acceleration
- Equations of motion
- Parameters of dynamics: inertia, acceleration, force, momentum, mechanical work and power
- Newton's laws of motion, conservation of momentum and energy
- Linear and angular motion
- Rotational dynamics
- Simple harmonic motion

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Linear and rotational dynamics	HP5099

Thermodynamics Kit

This kit allows engineering students to carry out a wide range of practical experiments in Thermodynamics to help them understand the temperature related behaviour of mechanical systems. The kit includes experimental apparatus including metal blocks with heating elements, linear rods with heaters, Leslie cube and Jolly bulb. The kit also includes measuring instruments such as digital thermometers, energy meter, and infrared thermometer. A downloadable manual covers all experiments and includes teacher's notes. A unique feature of the kit is that all the experiments can be completed just with electricity as the heat source – no Bunsen burner is required.

Learning objectives / experiments:

- Heat capacity of liquids
- Heat capacity of solids
- Linear expansion of heat
- Heat absorption
- Heat radiation
- Expansion of gases – Charles' law
- Boyle's law

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Ordering information	
Thermodynamics kit	HP4159
Corresponding curriculum	CP4261
You will also need	
Source - DC PSU, AC PSU and signal generator	LK6999/LK2975

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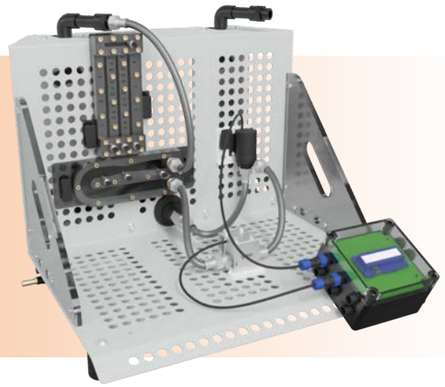
Fundamental FLUIDS

Our new Fundamental Fluids range allows students to gain a hands-on understanding of the key principles of Fluid mechanics. The equipment is centred around a base-station, which provides flow control and sensor feedback to the user via a display. Users have the capability to log system results via USB or network connection or produce results from experimentation using manually taken readings.
For each experiment, a series of modules are mounted to the perforated work panel, each module is secured using quick release latches. The range of modules include a centrifugal pump, calibrated flow sensor, differential pressure sensor, Venturi tube, a manometer, viscosity apparatus, losses in bends/transitions etc in order to study the learning outcomes of seven separate experiments using the one system. Some of these experiments are displayed below and on the next page.
Additional modules will allow students to explore the principles of extracting energy from fluid flow and how different turbine types and their speed/torque characteristics change in response to changes in pressure and flow rate. This equipment is provided with a full course in Fluids.



Bernoulli's Theorem & Venturi Tube Flow Meter

Demonstrates Bernoulli's theorem in a practical and visual way. Water is circulated through the Venturi tube module and a calibrated flow sensor module in a closed loop setup.

Pressure is measured at the Venturi inlet and at the throat section. Pressure readings can be taken manually using the manometer module or digital readings can be taken using the differential pressure sensor module (not shown)

This allows comparison of theoretical and measured readings. The discharge coefficient of the Venturi tube can be calculated from the results.

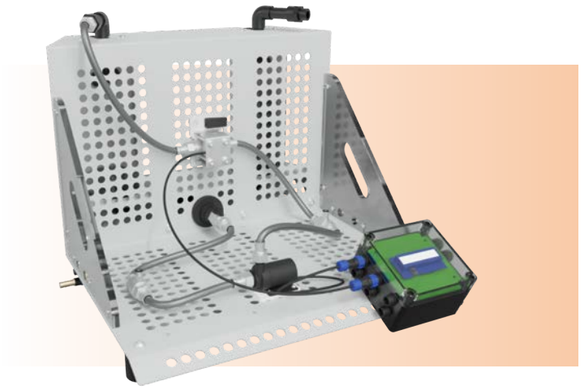
Centrifugal Pump Characteristics

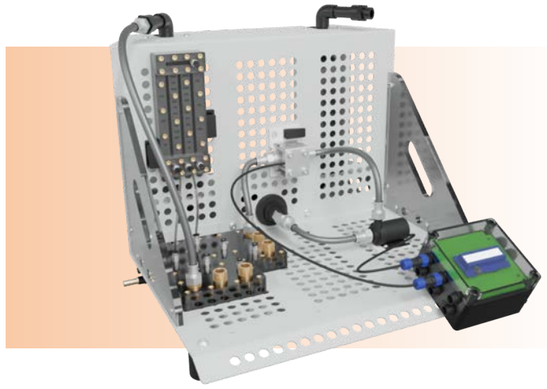
The characteristics of a centrifugal pump are investigated using the pump, flow sensor and pressure measurement modules in a closed loop setup.

The pump inlet and outlet pressure is measured at a given speed and increase the flow resistance using an inline control valve.

The pressure gain and flow rate are plotted to give the characteristic curve of the pump.

The test can be repeated at different pump speeds.





Losses in Bends

Water is circulated through the bend component module in a closed loop setup.

The static pressure is measured before and after the bend, using the manometer module or pressure sensor module.

The test is repeated for each of the bend geometries.

The pressure drop of the bend components can be directly compared to one another.

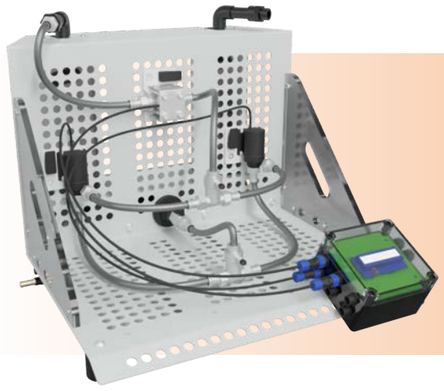
Series & Parallel Pump Characteristics

The pressure and flow rate of different pump configurations can be investigated.

The flow rate is measured using a calibrated flow sensor, the static pressure before and after the pumps is measured using a differential pressure sensor.

Students demonstrate how adding pumps in the different configurations affects the system pressure and flow rate.

Shown is the parallel pump setup. The pumps are re-arranged for series configuration

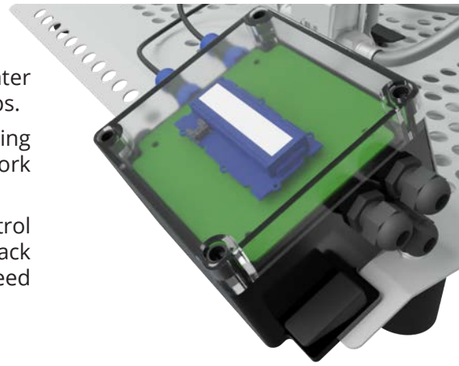


Fluids Features

Featuring dual 1.5 litre clear water tanks, each with 30l/min pumps.

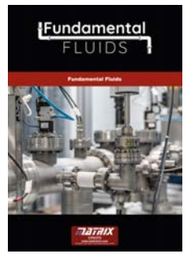
Drip tray with drain tapping provides a safe and clean work area

Enclosed, low voltage control module provides sensor feedback and manual control of the speed of the pump(s)



Learning objectives / experiments:

- Bernoulli's equation and using Venturi flow meter
- Using manometers
- Pressure losses in bends & pipes
- Series and parallel pumps
- Centrifugal pump characteristics
- Cavitation in Venturi tube



Ordering information	
Fundamental Fluids	FM1000
Corresponding curriculum	CP0370

STRUCTURES

These new kits for the study of structures cover seven commonly taught principles of structures across college and universities worldwide, in the subject area of mechanical engineering.
Each of the seven kits in this range feature a robust, metal work panel which is fitted with removeable legs (which can attach to the reverse of the panel for storage purposes). A carry handle and plastic moulded cover is also supplied to protect the system from any damage when not in use.
The experimental components are rugged and designed to stand up to the challenges of an educational lab. Connection to a PC is through a simple USB, meaning users can export data from their experiments to excel for analysis and simulation. Power is provided through the PC connection or through connection to a simple wall plug.
Each of the work panels are also supplied with built in LCD's which are connected to the on-board controller, in order to provide the user with a manual method of collating results from their experiments.

Why choose Structures:

- Portable solution that can be packed away
- Rugged design
- Free curriculum worksheets for each kit
- Power routed through PC connection
- USB connection to PC for data export
- Coverage of key structures principles in mechanical engineering

Bending Moments

This kit allows students to apply loads to hangers suspended along a beam, held between two supports. One support allows rotational movement, acting as a pinned support, whilst the other allows translational movement, acting as roller support. A load cell measures the bending moment due to the load applied by the student and students' can then create positive and negative bending moments.

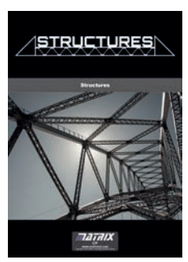
Point loads and uniformly distributed loads can be applied across the beam in order for students to gain experience of various different situations for their experimentation.

An integrated load cell measures the force applied across the cut and is displayed on the built in LCD display. The display has a push button zero feature for experimental setup.

The experiment is powered by a USB cable to PC or wall plug. If the USB is connected via a PC port, data acquisition can be output directly into excel or further experimental analysis and simulation.

Learning objectives / experiments:

- Bending moment at the cut due to a varying single point load
- Bending moment at the cut due to a moving single point load
- Bending moment at the cut due to a uniformly distributed load
- Bending moment at the cut due to a point load and uniformly distributed load in superposition



Ordering information	
Bending Moments	ST8801
Corresponding curriculum	CP1843

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Shear Force

This kit allows students to apply loads to hangers suspended along a beam, held between two supports. One support allows rotational movement, acting as a pinned support, whilst the other allows translational movement, acting as roller support. A load cell measures the bending moment due to the load applied by the student and students' can then create positive and negative shear force.

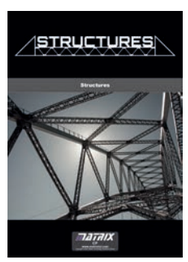
Point loads and uniformly distributed loads can be applied across the beam in order for students to gain experience of various different situations for their experimentation.

An integrated load cell measures the force applied across the cut and is displayed on the bult in LCD display. The display has a push button zero feature for experimental setup.

The experiment is powered by a USB cable to PC or wall plug. If the USB is connected via a PC port, data acquisition can be output directly into excel or further experimental analysis and simulation.

Learning objectives / experiments:

- Shear force at the cut due to a varying single point load
- Shear force at the cut due to a moving single point load
- Shear force at the cut due to a uniformly distributed load
- Shear force at the cut due to a point load and uniformly distributed load in superposition



Ordering information	
Shear Force	ST4484
Corresponding curriculum	CP4708

Reactions of a Simply Supported Beam

This product allows student to explore the behaviour of reaction forces on beam with supports. Two 'simply supported' supports are attached to load cells so that a precise measure of reactional force can be measure for a loading parameter.

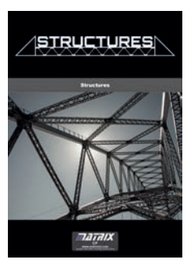
The load cell output in connected to the LCD displays and the USB interference for data acquisition, for further experimental analysis.

The beam has a measure indicator for accurate distance measured between supports, while both support blocks can slide along the rail for exploring the behaviour of varying length.

The beam has incremental pins for hanging weights on at different places to create different point loads and can balance the weights on top to create uniformly distributed loads. Overhanging point loads can be achieved too to create negative reaction forces to show direction of forces. This allows student to explore reactional forces that are positive and negative and the principle of superposition.

Learning objectives / experiments:

- Reactions due to point loads
- Reactions due to UDL's
- Reactions due to overhangs
- Reactional force change due to varying distance between supports.



Ordering information	
Reactions of a Simply Supported Beam	ST0454
Corresponding curriculum	CP3604

Bending Stress

The bending stress structures product provides students with a beam with 4 strain gauges attached to it. These strain gauges are then connected into the back panel allowing simple 4mm banana plug socket connections to conduct the experiment.

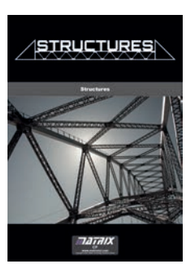
The experiment explores the bending stress in a beam with applied loads. Using equations for bending deflection and stress, the theoretical value can be compared to the output of the experiment. The strain gauges can be connected up using the 4mm banana cables into 3 different Wheatstone bridge configurations. Student can then explore the behaviour of a quarter bridge, half bridge and full bridge configuration. High precision resistors are used to make up the Wheatstone bridge in the absence of a strain gauge.

The LCD display shows the millivolt change of the output from the Wheatstone bridge. With a zero button to reset the experiment.

The experiment is powered by a USB cable to PC or wall plug. If the USB is connected via a PC port, data acquisition can be output directly into excel or further experimental analysis and simulation.

Learning objectives / experiments:

- Stress and strain relationship
- Strain gauges as instruments
- Finding the neutral axis by experiment and calculation
- Quarter, half and full Wheatstone bridge applications, with advantages and disadvantages



Ordering information	
Bending Stress	ST5671
Corresponding curriculum	CP1877

Deflection of Beams

This kit allows students to utilised a range of beams in order to understand the elastic properties of beams and cantilevers.

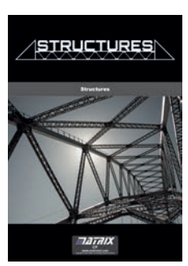
Beams can be fitted to one support to form a cantilever, or between two supports with different fixing methods, forming simply supported and fixed or ‘encastre’ beams.

Students apply loads and measure the deflection. This product includes a set of ‘specimens’ of different metals for comparison of the elastic properties. It also allows the student to vary the length of the beam to see how this affects the magnitude of deflection for a given load.

The Digital Mitutoyo dial has its own display, but it is connected to the USB interface so data acquisition can occur across the USB cable

Learning objectives / experiments:

- Beam bending formula
- Deflection due to point loads and UDLs (uniformly distributed loads)
- How beam fixings affect deflection of: Simply supported beams, Fixed or ‘encastre’ beams, Cantilever beams, Propped cantilever
- Shape of a deflected beam
- Beam length and deflection
- Beam material and deflection — the elastic (Young’s) modulus
- Beam cross-section and deflection — the Second Moment of Area (‘I’ value) – and material stiffness



Ordering information	
Deflection of Beams	ST9544
Corresponding curriculum	CP1879

Torsion of Rods

This kit allows students to understand the torsional elastic properties of rods. Students choose from a selection of test rods and fit them to the experimental work panel. They can adjust the distance between the chucks for tests on varying rod length. Each chuck includes pointers that work with the scale on the platform for accurate positioning.

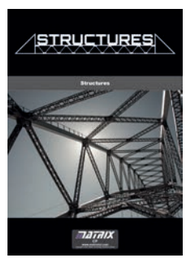
Students apply angular deflection to the specimen using a chuck which includes a precision potentiometer to measure the angular deflection, which is then displayed on the LCD display. The other chuck connects to a load cell to measure the resulting torque, which is displayed on the other LCD display. Students use textbook beam equations to predict the deflection and torque relationship and compare the calculated results with the measured results. This helps confirm the reliability of the textbook equations and the accuracy of the experiment results.

This product includes a set of rods of different metals for comparison of the elastic properties, dimensions and polar second moment of area ('J' value). It also allows the student to vary the effective length of the rods to see how this affects the magnitude of deflection for a given torque.

The angle and load cell output is connected to the USB interference and can have the data acquisition through the USB cable.

Learning objectives / experiments:

- Torsion formula
- Rod length and angle of twist relationship
- Rod material and angular deflection—the elastic (shear) modulus (G)
- Rod cross-sectional dimensions and torsion—the polar second moment of area (J)



Ordering information	
Torsion of Rods	ST0386
Corresponding curriculum	CP8231

Pin Jointed Frameworks

This kit allows students to apply loads in different places on the pin joint framework to explore the tension and compression forces within each structure member. 6 load cells on each of the 6 structure members is connected directly to an LCD display for the output and to the USB inference for data acquisition.

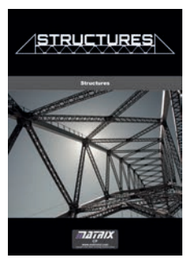
Zero buttons next to the LCD display allows for student to zero the load cell output and setup the experiment each time.

Two hanging positions allow for students to explore the idea of redundancy in frameworks and how load is transmitted though the system. A magnetic pulley allows for students to applied angles loads as well.

Students will learn to analysis the structure members using method of joints and method of sections, while using bow's notation.

Learning objectives / experiments:

- Method of joints
- Method of sections
- Bow notation's
- Principle of superposition for multiple loads redundancy



Ordering information	
Pin Jointed Framework	ST6365
Corresponding curriculum	CP8026

MANUFACTURING ENGINEERING

The third core area of engineering for Matrix is Manufacturing. This range of products cover key principles of manufacturing in a learning and industrial environment. From automation and pneumatics to CNC machining through our revolutionary MicroCNC product range. We have low voltage solutions to teach key principles, or more advanced learning outcomes for your students. Furthermore, you will also find our Industry 4.0 Smart Factory and Robotics products in this section of the catalogue, which help students to develop critical thinking for real-world engineering scenarios using intuitive products.

"We have used the MicroCNC equipment, primarily for level 2 Engineering (Technical Diploma) in a unit that focuses on the introduction and basics of CNC. Most of the students have no prior experience or knowledge of the subject and we were hesitant to invest in more expensive (and thus fewer) kits.

As expected, the materials that can be machined are limited to softer types, and within smaller dimensional constraints, but this is sufficient at this level to show the progression from idea through computer aided drafting to machined product. It also means that there is more inherent safety due to the types of materials and speeds of machining. The packaged software (CamBam and Deskproto) come with tutorials which allow beginners to follow step by step.

Our students have enjoyed working with the kits, and some ventured into the more advanced coding, while others were happy with the basic competencies gained in following the tutorials and ending up with machined products."

Ghulam Solker,

Suffolk One Sixth Form College, United Kingdom.

Manufacturing Engineering

PID PROCESS CONTROL

The **Modern Process Control** system from Matrix, allows students to investigate the principles of industrial process control, using independent Temperature, Pressure, Flow and Level based systems.
With a common controller for all applications, the advanced 16 bit dsPIC processer with operating system, comes equipped with USB, WiFi Bluetooth and LAN communications. Once set up the system can run independently and does not require a PC connection. Data can be viewed on the internal graph or saved to a file for later analysis and comes ready to plug in for 110 – 240V operation.
Full documentation is supplied with the units, including a manual for the equipment and a curriculum workbook, which guides students through the use of Process control systems and the Control function. Transfer functions can be studied using MATLAB or equivalent software.
These sets of equipment are suitable for delivery of various qualifications at level 3 and above across many disciplines of engineering. In the UK, This includes the BTEC Higher National unit 45 Industrial Systems and other higher education courses.

Why choose Process Control:

- Portable solution with carry handles
- Integrated digital electronics
- MATLAB / LabVIEW compatibility
- Internet control integrated
- Safe, low voltage
- Free curriculum worksheets and instructor guide

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Process Control

Featuring Internet Control

All units come with a full curriculum with hours of learning, including teachers notes and a user manual. Both of which are available in our learning centre at www.matrixtsl.com/learning

Learning objectives

- Servo control systems
- Inverting pendulums
- Drive systems and their scaling factors
- Sensor characteristics, scaling factors, calibration
- On/off control systems, oscillation, hysteresis
- System time constants
- P control systems and offset error
- PI control systems
- PID control systems
- Control functions and block diagrams
- Pseudocode implementations of P, PI and PID systems
- Recognition of problems in PID systems
- Integral wind up issues and overcoming them
- Derivative filtering
- Ziegler Nichols algorithm
- Manual tuning of PID systems
- Transfer Functions for digitally samples systems

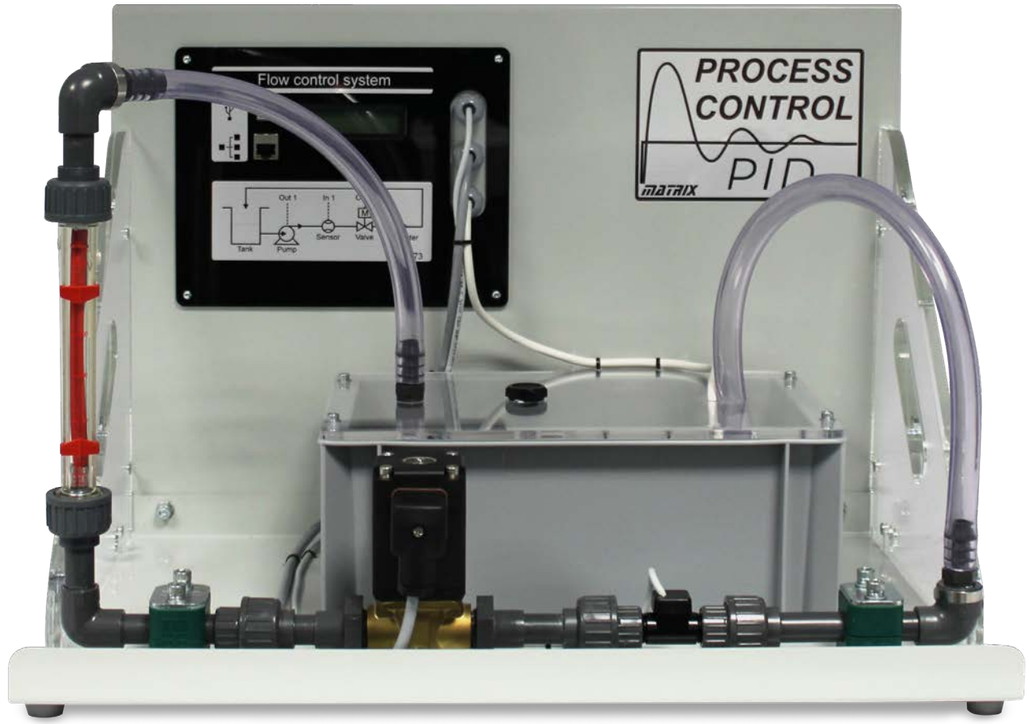
These learning objectives are covered in the worksheets with the software provided.

Worksheets and Curriculum:

- Understanding the drive
- Understanding the sensors
- On/Off control systems
- System time constant
- P controller
- PI controller
- PID controller
- Zeigler Nichols algorithm
- Integral wind up
- Derivative filter
- Manual tuning
- Interfacing with MATLAB/LabVIEW
- Servo pendulum - angle control

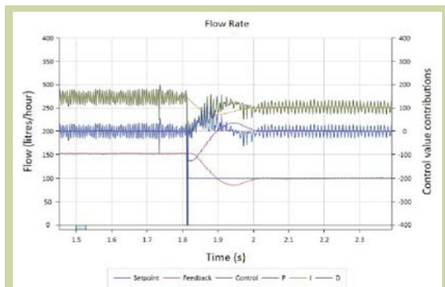
Flow Control

The Flow system consists of a water tank, variable speed pump, a turbine type flow sensor, an electrically operated proportional valve and a variable area flow meter (rotameter). This allows students to adjust the flow rate via the pump speed and the valve opening to develop a PID based control system.



Kit Includes:

- 4mm x 1.5mm Wall clear PVC tube (300mm)
- UK head for 24V PSU
- 24V PSU 60w 2.5a
- Flow process control assembly
- Barley pot for process control
- Usb lead



Zeigler Nichols PID Classic Setting

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Flow Control	CT0673

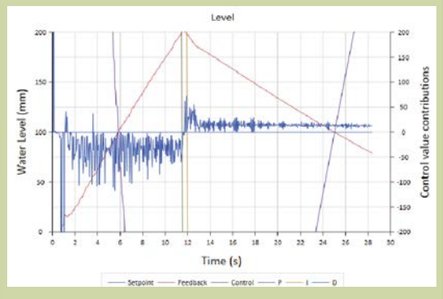
Manufacturing Engineering

Level Control

The Level system consists of a reservoir water tank, a variable speed pump, a pressure-based level sensor, and clear process vessel with a scale. A proportional valve provides the process vessel drain. An overflow pipe in the process vessel prevents it being overfilled and the system allows students to adjust the pump speed and valve opening.

Kit Includes:

- 4mm x 1.5mm Wall clear PVC tube (300mm)
- UK head for 24V PSU
- 24V PSU 60w 2.5a
- Level process control system assembly
- Barley pit for process control
- Usb lead



Zeigler Nichols PID Classic Setting

SCAN TO VISIT PRODUCT PAGE

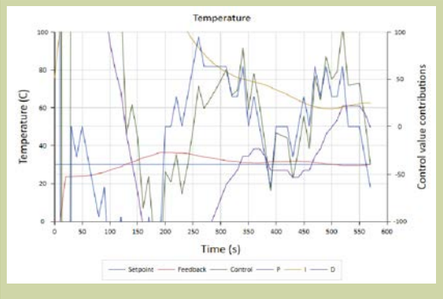
Ordering information	
Level Control	CT5971

Temperature Control

The temperature process control system includes a heated plate within a duct and a thermocouple. A fan at one end of the duct blows ambient air over the block, to change the control conditions and provide a disturbance to the system. The system allows students to adjust the heater power and the air flow rate to develop a PID based control system then adjust these parameters to achieve the required time/temperature change profile for the system in response to step changes in system requirements.

Kit Includes:

- UK head for 24V PSU
- 24V PSU 60w 2.5a
- Temperature process control assembly
- Usb lead



Zeigler Nichols PID Classic Setting

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Temperature Control	CT1491

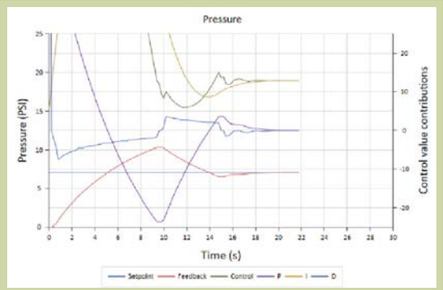
Manufacturing Engineering

Pressure Control

The Pressure system consists of a variable speed reciprocating air pump (compressor), the speed of which can be adjusted by students, a pressure vessel and an outflow system. The outflow system allows the air to escape via either a manually operated needle valve - providing an ongoing outflow, or via a solenoid valve and second needle valve - providing a step change in outflow. The vessel pressure is measured by a Bourdon type mechanical gauge along with a pressure sensor. The Bourdon gauge provides a visual indication of the pressure in the vessel and a means for students to check and calibrate the controller input from the pressure sensor.

Kit Includes:

- UK head for 24V PSU
- 24V PSU 60w 2.5a
- Pressure process control assembly
- Usb lead



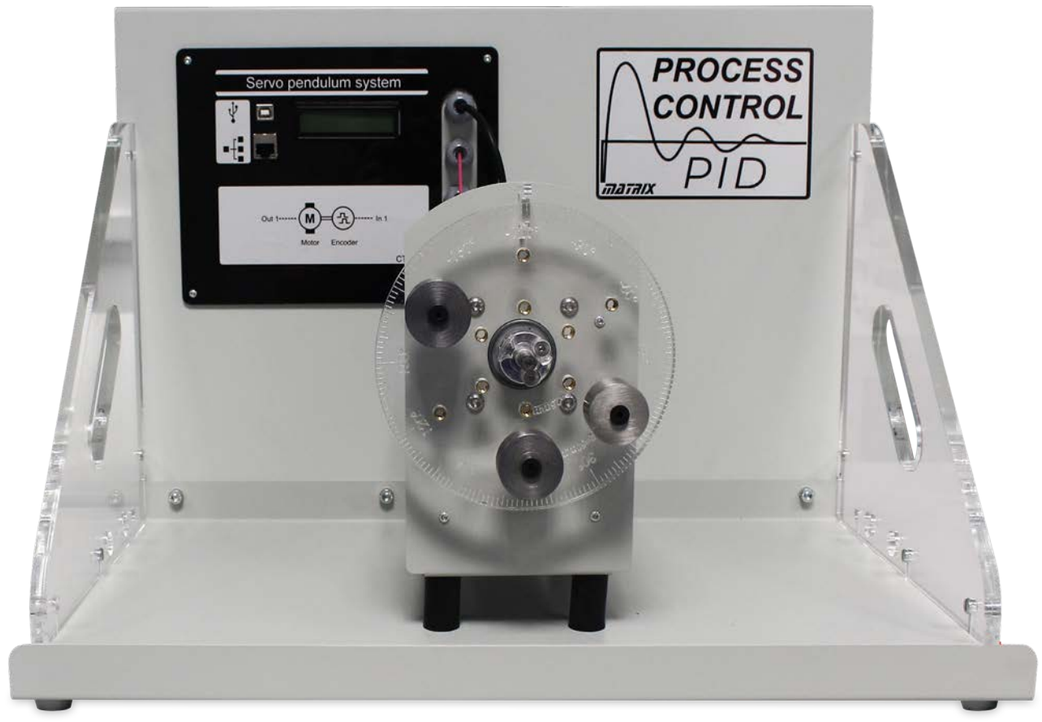
Zeigler Nichols PID Classic Setting

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Pressure Control	CT1733

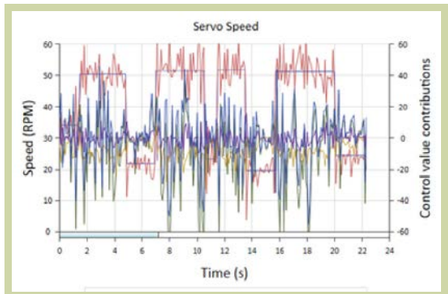
Motor Control

The system consists of a powerful DC motor mounted on a rugged frame. A disc with captive nuts is attached to the DC motor and students are able to screw in 100-gram weights to different parts of the disc to alter the characteristics of the system. A single weight at 0 degrees forms an inverting pendulum.



Kit Includes:

- UK head for 24V PSU
- 24V PSU 60v 2.5a
- Servo pendulum process control assembly
- Usb lead



Zeigler Nichols PID Classic Setting

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Motor Control	CT9513

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MICRO CNC

Our MicroCNC range of machines are low voltage, easy to store and cost-effective allowing students to work in small groups to prototype their designs and learn key machining concepts. The robust range is a great introduction to manufacturing engineering principles. The MicroCNC system controller and base plate allows the user to control our machines using a variety of software packages. After creating designs using CAD software including Solidworks, the user converts their design into G code. The machine components are secured to the base plate quickly and easily, to provide a solid and tidy machine which can easily be put away for storage.
The complete MicroCNC set enables users to easily create any one of the three machines in our range, meaning teaching of manufacturing engineering technologies is made easier than ever.

Why choose MicroCNC:

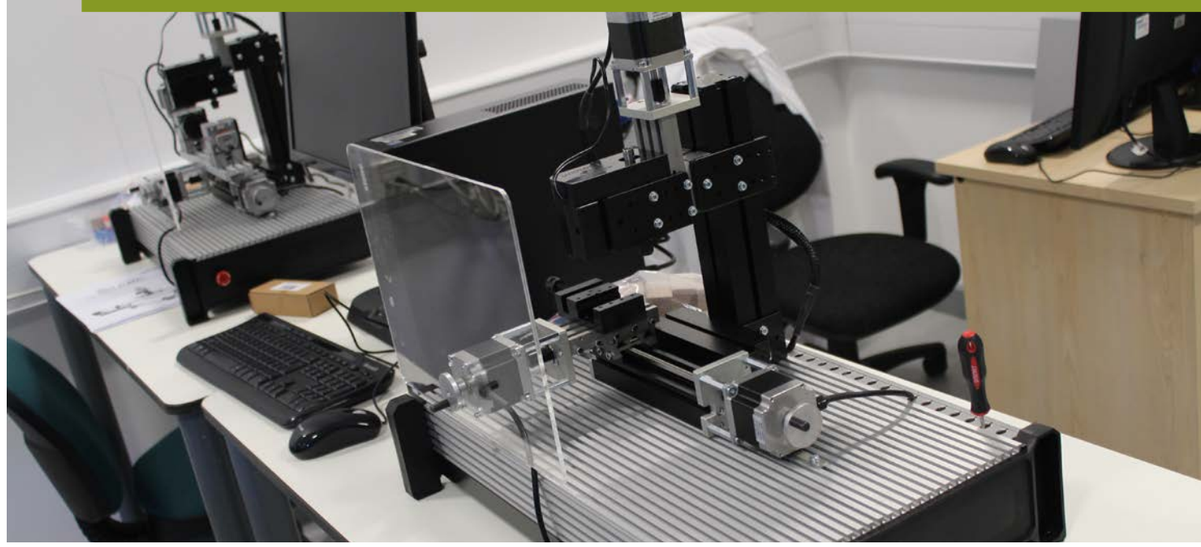
- Compact and easily stored
- Designed for students to work in small groups
- Learn key principles of CNC machining and prototype easily
- 2-axis lathe and 3 and 4-axis milling machines
- Construction of a range of CNC machines
- Includes software to easily convert your CAD designs

“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.



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MicroCNC System Controller and Base Plate

The MicroCNC system controller and base plate allows you to control our MicroCNC machines using a variety of software packages. The CNC system controller is compatible with our range of multi axis CNC machines. The base plate includes all power supplies and an industrial standard computer with stepper motor driver circuitry and a USB port for connection to your PC. The unit is fitted with a single IEC mains connector and includes a number of output sockets for the stepper motors of the CNC machines.

The individual machine components are easily fastened to the base plate, providing a solid and tidy machine which can easily be put away for storage. Windows compatible.

MicroCNC lab at Redcar and Cleveland College

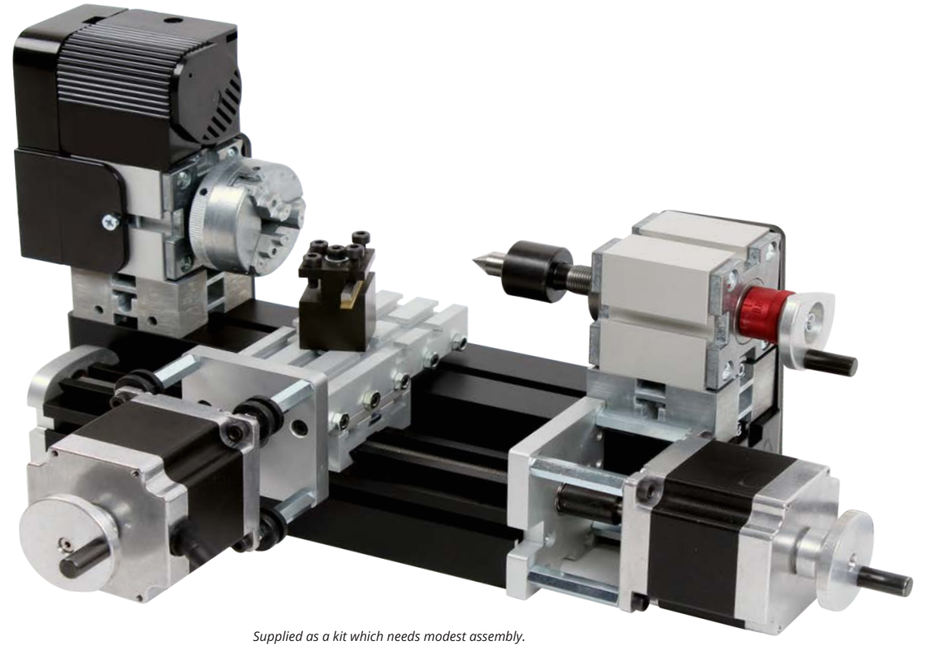
SCAN TO VISIT PRODUCT PAGE

Ordering information	
MicroCNC system controller and base plate	CN4079-V2

2-axis MicroCNC Lathe

The 2-axis MicroCNC lathe allows students to understand how G codes are used to control a CNC lathe. The two stepper motors and DC motor connect to our CNC system controller hardware to allow full control of the lathe using the G code file host software. Students can use the hardware and lathe to see how each G code command affects the lathe operation and they can create complex work pieces from wax cylinders.

This kit is stored in our standard plastic storage tray and can be assembled in minutes.



Supplied as a kit which needs modest assembly.
You will also need: MicroCNC system controller and base plate

Learning objectives / experiments:

- Lathe construction and operation
- Simple G and M code protocol
- CNC machine operation using G codes
- Creation of milled parts using CNC technology

SCAN TO VISIT PRODUCT PAGE

Ordering information	
2-axis MicroCNC lathe	CN2668
MicroCNC system controller and base plate	CN4079-V2
Corresponding curriculum	CP7449
You will also need	
CamBam software	CN8332/CN2171

Manufacturing Engineering

3-axis MicroCNC Milling Machine

The 3-axis MicroCNC milling machine allows students to understand how G codes are used to control a CNC operated milling machine. The three stepper motors and DC motor connect to our CNC system controller hardware to allow full control of the miller using the G code file host software. Students can use the hardware and software to see how each G code command affects the machine operation and create complex work pieces from polyurethane blocks or acrylic pieces.

Learning objectives / experiments:

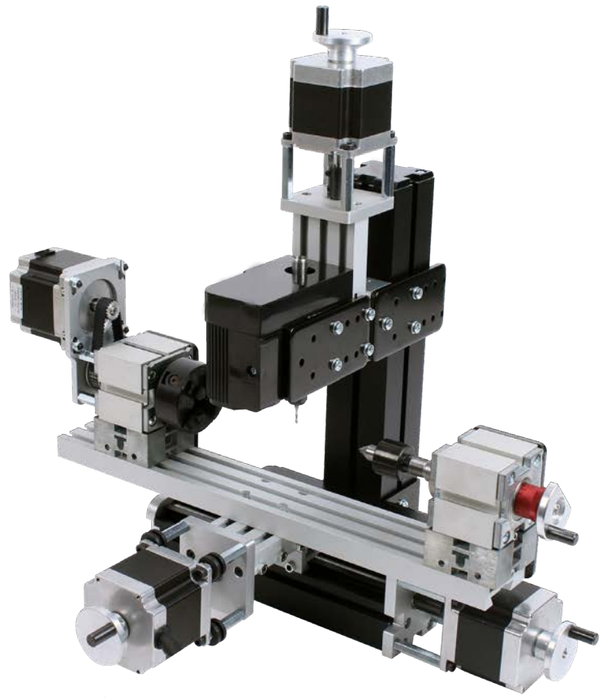
- 3-axis CNC machine construction
- Simple G and M code protocol
- CNC machine operation using G codes
- Creation of milled parts using CNC technology

SCAN TO VISIT PRODUCT PAGE

Ordering information	
3-axis MicroCNC milling machine	CN4234
MicroCNC system controller and base plate	CN4079-V2
Corresponding curriculum	CP7449
You will also need	
Deskproto CAM software	CN2498/CN3075

4-axis MicroCNC Milling Machine

The 4-axis MicroCNC milling machine allows students to understand how G codes are used to control a CNC operated milling machine. The four stepper motors and DC motor connect to our CNC system controller hardware to allow full control of the miller using the G code file host software. Students can use the hardware and software to see how each G code command affects the machine operation and create complex work pieces from polyurethane blocks or acrylic pieces.



Supplied as a kit which needs modest assembly.
You will also need: MicroCNC system controller and base plate.

Learning objectives / experiments:

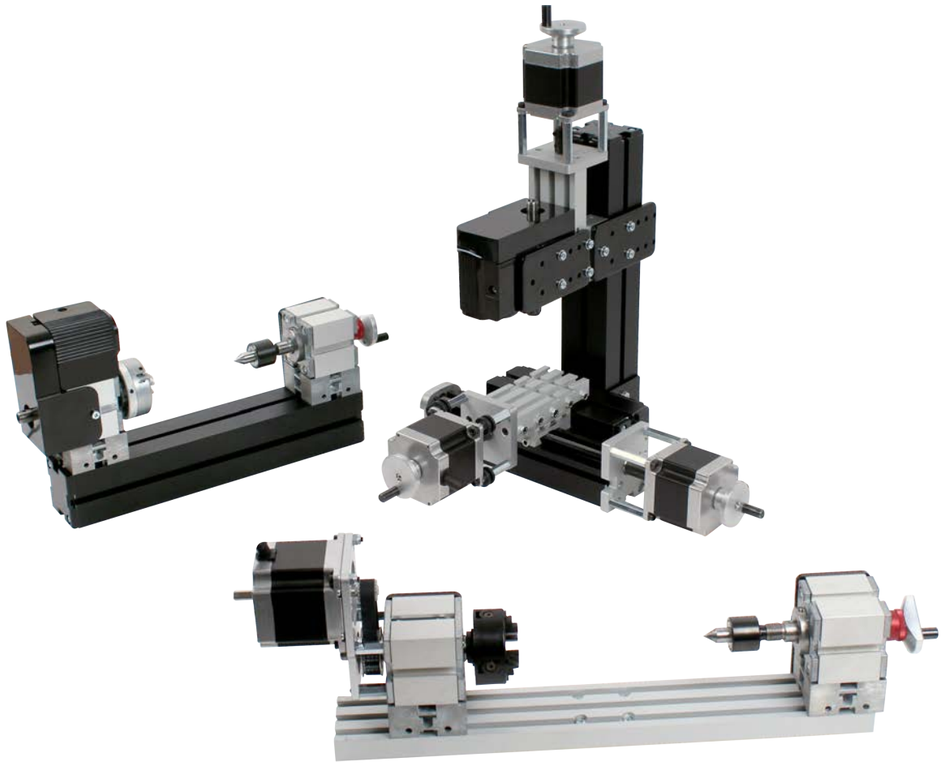
- 4-axis CNC machine construction
- Simple G and M code protocol
- CNC machine operation using G codes
- Creation of milled parts using CNC technology

SCAN TO VISIT PRODUCT PAGE

Ordering information	
4-axis MicroCNC milling machine	CN8285
MicroCNC system controller and base plate	CN4079-V2
Corresponding curriculum	CP7449
You will also need	
Deskproto CAM software	CN2498/CN3075

Complete MicroCNC Set

This kit of parts allows students to assembly all four of our MicroCNC machines (only one at any one time). The kit is supplied with all necessary parts and is shipped with a full manual describing how each machine can be assembled. When combined with our system controller and base plate, students can then program each machine to manufacture parts in wax, acrylic and polyurethane blocks using G code editor supplier.



Learning objectives / experiments:

- Construction of a range of CNC machines
- G and M code commands and CNC programming
- Manufacturing a part using a G code editor
- Design of parts using a 3D package
- Manufacture of parts using a CAD CAM tool chain

Ordering information	
Complete MicroCNC set	CN3885
MicroCNC system controller and base plate	CN4079-V2
Corresponding curriculum	CP7449
You will also need	
Deskproto CAM software	CN2498/CN3075
CamBam software	CN8332/CN2171

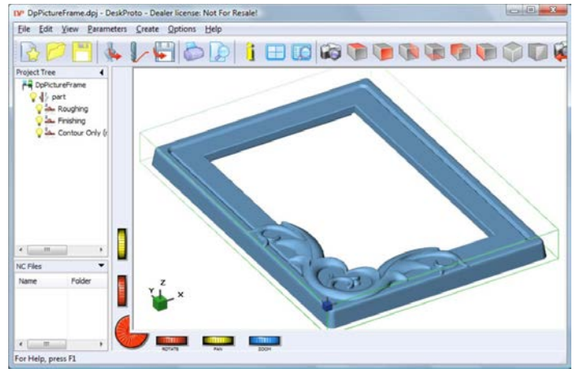
SCAN TO VISIT PRODUCT PAGE

Deskproto CAM Software

Whilst our CAD/CAM simulation software can produce G code files from very simple shapes, the Deskproto software takes this function to the next level. Deskproto can import STL files from any 3D CAD program, calculate CNC toolpaths and then write a G code program file for any brand of CNC milling machine - 3-axis, 4-axis or 5-axis. Deskproto is used by a wide variety of industrial companies as well as educational institutions.

This software is compatible with Solidworks, AutoCAD and other CAD packages.

Compatible with 3-axis milling machine, 4-axis milling machine and the complete MicroCNC set



SCAN TO VISIT PRODUCT PAGE

Ordering information	
Deskproto single license	CN3075
Deskproto site license	CN2498

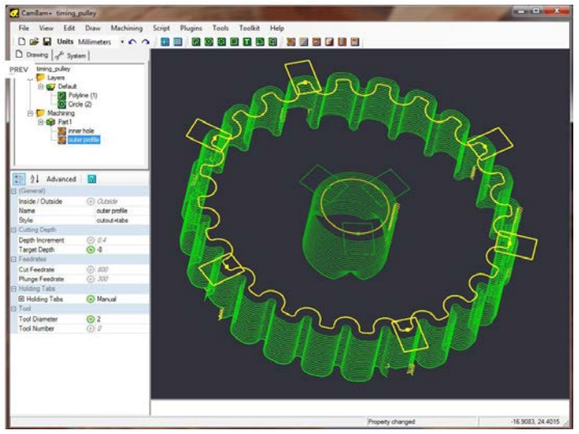
CamBam Software

CamBam is an application to create CAM files, G code, from CAD source files or its own internal geometry editor and has many users worldwide from CNC hobbyists to professional machinists and engineers.

CamBam currently supports:

- Reading from and writing to 2D DXF files
- 2.5D profiling machine operations with auto-tab support
- 2.5D pocketing operations with auto island detection
- Drilling (Normal, Peck, Spiral Milling and Custom Scripts)
- Engraving
- True Type Font (TTF) text manipulation and outline (glyph) extraction
- Conversion of bitmaps to heightmaps
- 3D geometry import from STL, 3DS and RAW files
- 3D surfacing operations
- Extendable through user written plugins and scripts

Compatible with 2-axis lathe and the complete MicroCNC



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Ordering information	
CamBam single license	CN8332
CamBam site license	CN2171

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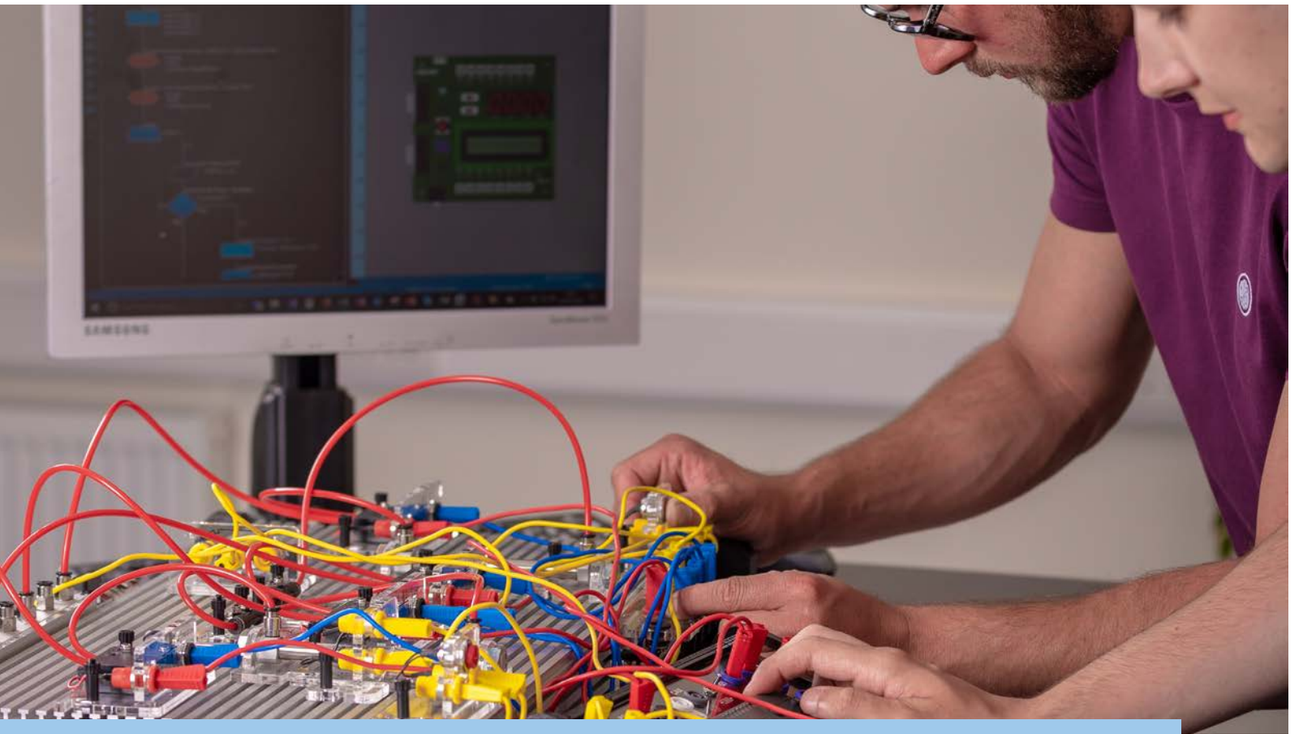
AUTOMATICS

Automatics is a range of products that simplifies the process of teaching and learning about pneumatic and automation systems. The Automatics range has been designed to suit the classroom environment. The pneumatic components are identical to those used by real engineers, but have been cleverly adapted so that students can construct automation systems speedily and without tools. There are around 30 separate rugged components in the range, each one mounted on a clear acrylic carrier which is marked with the appropriate pneumatic or electrical symbol. Students mount the components on to the stable aluminium platform using plastic 'tee' bolts and connect the components together with nylon tubing to build working pneumatic circuits.



Why choose Automatics:

- Makes learning easier
- Rugged and reliable
- Integrate Pneumatics & Control
- Covers a range of subject areas
- Extensive free curriculum
- Range of individual components
- Sturdy storage for solutions
- Minimal assembly required

Automatics Essentials Solution

This kit provides a complete introduction to pneumatic circuit design and construction. The curriculum pack includes a comprehensive set of worksheets that allow students to progress from first principles through to circuits of moderate complexity; including reciprocating circuits and generating sequences of movements.

The solution is intended for students in their early teens and older who are learning technology and engineering subjects. Tasks are designed to be suitable for pairs of students sharing a single kit.

Everything you will need to teach the course is included in the solution pack, with the exception of an air compressor.

Learning objectives / experiments:

- Understanding the different varieties of valves and where each is appropriate in a system
- Understanding the basic types of cylinder, controlling speed and the factors that influence power output
- Combining valves to produce logic functions
- Semi-automatic and automatic reciprocation
- Creating sequences of movements
- Using reservoirs to create time delays
- Air bleed and pilot operated circuits
- Component symbols and circuit diagrams
- Staying safe when using air at high pressure

SCAN TO VISIT PRODUCT PAGE

Ordering information	
Automatics essentials solution	AU9020
Corresponding curriculum	AW2080
You will also need	
Compressor	AU1050

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Manufacturing Engineering

Electro-pneumatics add-on kit

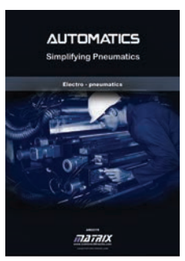
This kit supplements the Automatics essentials solution by adding a selection of electrically operated valves and a range of sensors. By following the curriculum, students will learn how to use these new components to create systems in which pneumatics and electrical circuits are combined into complete systems.

The electrical components are connected together quickly and reliably using 4mm connectors, for which all of the necessary leads and accessories are provided. Electrical components are robustly mounted to the Automatics platform using the same 'tee' bolt system used for the pneumatic parts and are printed with standard circuit symbols.

Working two to a kit, students follow the detailed worksheets to gain a comprehensive understanding of electro-pneumatics. By the end of the course, students will be able to create reciprocating and sequential circuits, and will have an understanding of how these are used to solve real world engineering problems.

Learning objectives / experiments:

- Understand the operation of electrically controlled pneumatic valves
- Use of electrical switching to control circuit operation
- Using microswitches to sense cylinder position
- Sensing position without physical contact using reed switches
- Expressing electrical circuits using ladder diagrams
- Electrically operated reciprocal circuits
- Sequential control circuits
- Analysing real world problems and formulating solutions



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Ordering information	
Electro-pneumatics add-on kit	AU9015
Corresponding curriculum	AW2079

Pneumatics Control add-on kit

This kit extends your Automatics pneumatics solution by adding a powerful programmable microcontroller unit, the MIAC, together with the pneumatic components necessary to put it through its paces.

By following the included curriculum, students will learn how the combination of a controller and custom software can create powerful and flexible pneumatic systems.

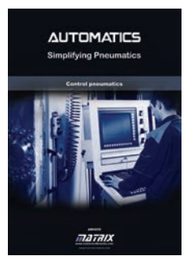
Students will learn how to establish the state of a pneumatic machine using sensors, the use of logic to process that data and the issuing of commands to the included solenoid valves.

Two versions of the curriculum are supplied. In the first, students use pre-programmed control systems supplied in the MIAC's built in memory. A more advanced course, Control plus, teaches students how to write their own programs for the controller.

This kit can also be supplied without the MIAC PLC, for those who wish to integrate their own industrial PLC into our system. Please see ordering information below, the product at the bottom of the page, or contact us for more information.

Learning objectives / experiments:

- Reading sensors and switches
- Issuing commands to the pneumatic circuits
- Learning the difference between digital and analogue signals
- Using flowcharts to visualise programs
- Program flow and decision making
- Programming sequences
- Using feedback to enhance reliability and improve safety



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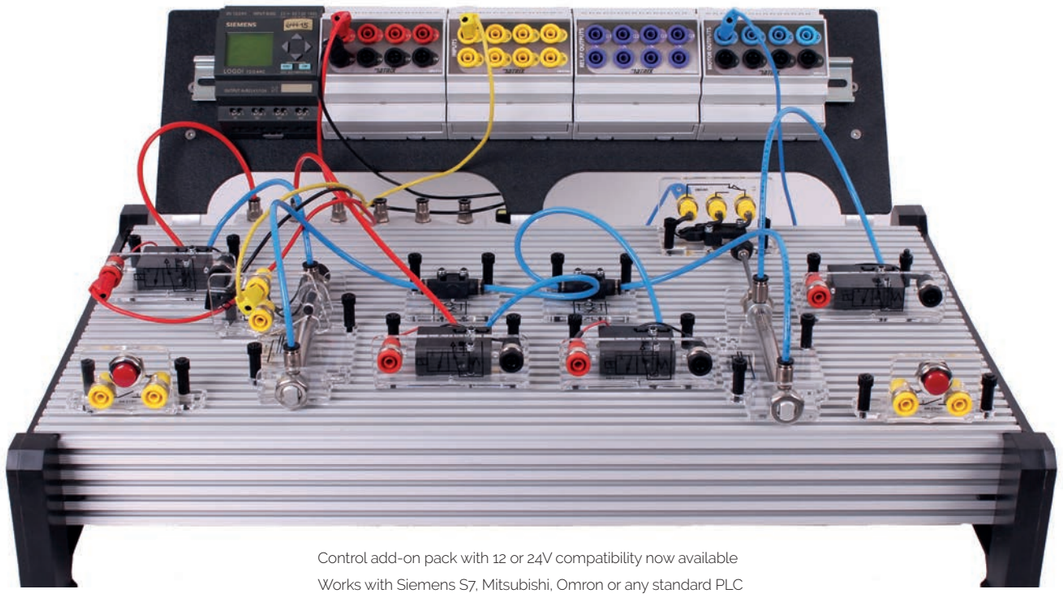
Ordering information	
Automatics control add-on kit (12V) with MIAC	AU6781
Automatics control add-on kit (24V) no MIAC	AU9025
Corresponding curriculum	AW4956 / AW4957
You will also need	
Automatics essentials solution	AU9020
Flowcode	

Pneumatics with your own PLC

We are now able to supply pneumatics training equipment which can be used with any PLC with the Automatics PLC adaptor rail. The Adaptor rail allows students to connect to relay and motor outputs using standard 4mm connectors which connect directly to other Automatics components. This pack combines standard pneumatics components with Control pneumatics components to provide a complete learning platform for pneumatics and PLC programming in one package. A PLC is not included. Any programming language - including ladder logic - can be used. Worksheets are based on flow charts. PLC adaptor modules included: power distribution, inputs (8), motor outputs (8), relays (4).



Control add-on pack with 12 or 24V compatibility now available

Works with Siemens S7, Mitsubishi, Omron or any standard PLC which fits onto a 50 mm DIN rail

Learning objectives / experiments:

- Pneumatic components, circuits and circuit diagrams
- Sensors and switches in pneumatic systems
- Digital and analogue signals
- PLC programming with ladder logic or block diagrams
- PLC inputs and outputs
- Logic functions

Ordering information	
PLC Adaptor - input module	HP6700
PLC Adaptor - power module	HP6711
PLC Adaptor - motor module	HP6723
PLC Adaptor - relay module	HP6752
PLC adaptor - mounting bracket	HP6785
You will also need	
Automatics essential solution	AU9020
Automatics control add-on kit (24V) no MIAC	AU9030

SCAN TO VISIT PRODUCT PAGE

Pneumatics Control with S7-1200 Siemens PLC add-on

This kit can be added to the Automatics essentials solution to produce learning outcomes for those wishing to study about rugged, industrial PLCs. By following the provided curriculum, students will learn how the combination of a rugged Siemens industrial controller and related software can create powerful and flexible pneumatic systems. Students will learn how to establish the state of a pneumatic machine using sensors, the use of logic to process that data and the issuing of commands to the included solenoid valves.

Two versions of the curriculum are supplied. In the first, students use pre-programmed control systems supplied in the Siemens S7-1200's built in memory. A more advanced course, Control plus, teaches students how to write their own programs for the PLC.

Learning objectives / experiments:

- Reading sensors and switches
- Issuing commands to the pneumatic circuits
- Learning the difference between digital and analogue signals
- Using flowcharts to visualise programs
- Program flow and decision making
- Programming sequences
- Programming industrially rugged programmable logic controllers PLC
- Using feedback to enhance reliability and improve safety

SCAN TO VISIT PRODUCT PAGE

SIEMENS

Ordering information	
Pneumatics control with S7-1200 Siemens PLC add-on	AU9077

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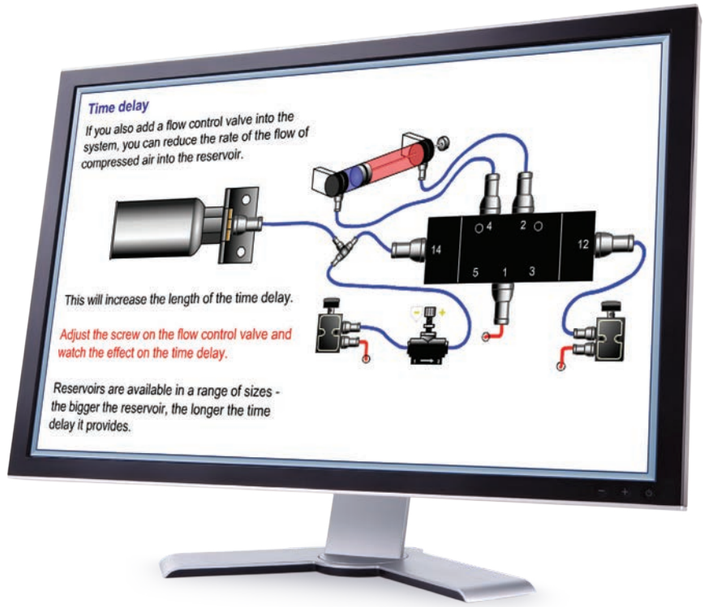
Automatics Interactive Courseware

The Automatics interactive courseware is a complete pneumatics and automation curriculum in the form of an interactive PC application. Students are guided through the construction of systems using onscreen simulations of the physical Automatics components and a simple drag and drop interface. The courseware is a complete curriculum, covering everything from basic component identification and learning circuit symbols, through to the construction of complete automated systems. The similarity between the graphical representation and real components then make it very simple for students to apply what they have learned when they are constructing real systems using the Automatics hardware solutions. Automatics interactive courseware is compatible with all versions of Windows and has very modest PC requirements. It is available with an educational site licence.



Learning objectives / experiments:

- Single and double acting cylinders
- Three port valves, valve actuators, flow control valves, five port valves, pilot-operated five port valves
- Piston speed control with flow control valves
- Semi-automatic return circuits, automatic return circuits and applications
- Reservoirs, time delays and applications, diaphragm valves, pressure decay sensing
- AND and OR functions
- Sequential circuits and applications, cascade method
- Electrical control of pneumatics with solenoid valves, switches, toggle switches, microswitches, reed switches, and computer control
- Circuit diagrams and circuit symbols
- Force exerted by a cylinder and calculations
- Instroke and outstroke forces and calculations
- Construction of pneumatic and electropneumatic systems

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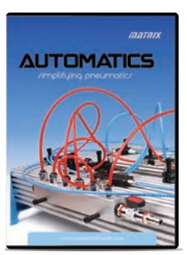

Ordering information	
Automatics interactive courseware site licence	AW20780

Mechatronic Systems

This pack contains products from three of our ranges of equipment: Locktronics, E-blocks and Automatics. The pack includes a wide variety of resources suitable for studying mechatronics using three types of control system: a PIC microcontroller, a micro PLC, and a PC. Students can learn the basics of control using flow charts before progressing to other languages like C++ or LabView software (C++ and LabView not included). A wide range of curriculum is included in the packs covering Industrial sense and control, flow chart programming of microcontrollers, Industrial sense and control with C++ or LabView programming, and design of pneumatic control systems. Further curriculum options for programming in C or Assembly are available.

Learning objectives / experiments:

- PIC and controller programming using flow charts
- Programming options: Flowcode, Embedded C, Assembly, C++ or LabView
- Mathematical models of sensors
- PID control of DC motors with speed and position (2nd order)
- Sensors: thermistor, light, thermocouple, rotary, Gyroscope, Hall effect, PIR, Cap touch, Magnetometer, Ultrasonic, Colour
- Actuators: relays, stepper motors, DC motors with feedback, servo motors

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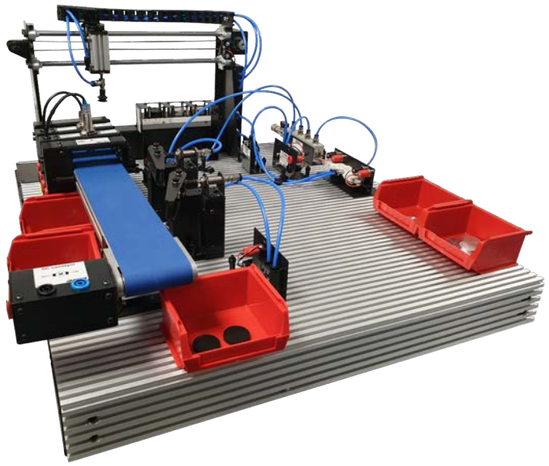
Ordering information	
Mechatronic systems	HP4550-2
Corresponding curriculum	LK8739, CP4375, AW4956, AW2080

Automatics Smart Factory

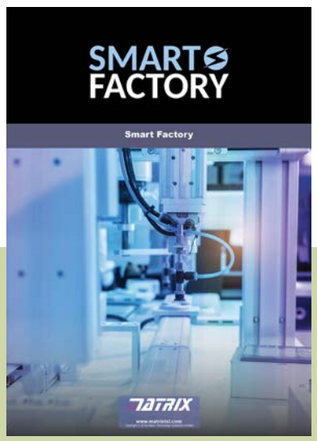
The Automatics Smart Factory allows students to get experience of a number of processes and technologies that are commonly used in manufacturing and modern-day Industry 4.0 principles. This includes conveyor systems, sensing systems, pneumatic pick and place technology, DC motor drives, and stepper motor drives. The factory includes a number of coloured discs made from plastic and other materials. A conveyor belt moves these pieces into the factory, where user programmed sensors sort the discs into multiple rejection bins. Some are picked off the conveyor by a suction device and a stepper motor-controlled gantry sorts the discs into appropriately coloured containers. The smart factory is completely self-contained and can be stored away in one of our standard trays. The smart factory can be used with Siemens (or other brand) 12V or 24V) PLC and is also compatible with our dsPIC MIAC .



SIEMENS

Smart Software

The Smart Factory is controlled in one of two ways. Users can either opt to control using two of our dsPIC driven MIAC controllers, which are educational PLC's and perfect for younger students to understand the capabilities and possibilities of industrial smart factories. Alternatively our Siemens add-on for the smart Factory, gives students the ability to program the system using an industrial grade S7-1200 PLC. This is provided on a DIN rail bracket with adaptor modules. As a Siemens education partner, we can also provide you with software to control these upon request.



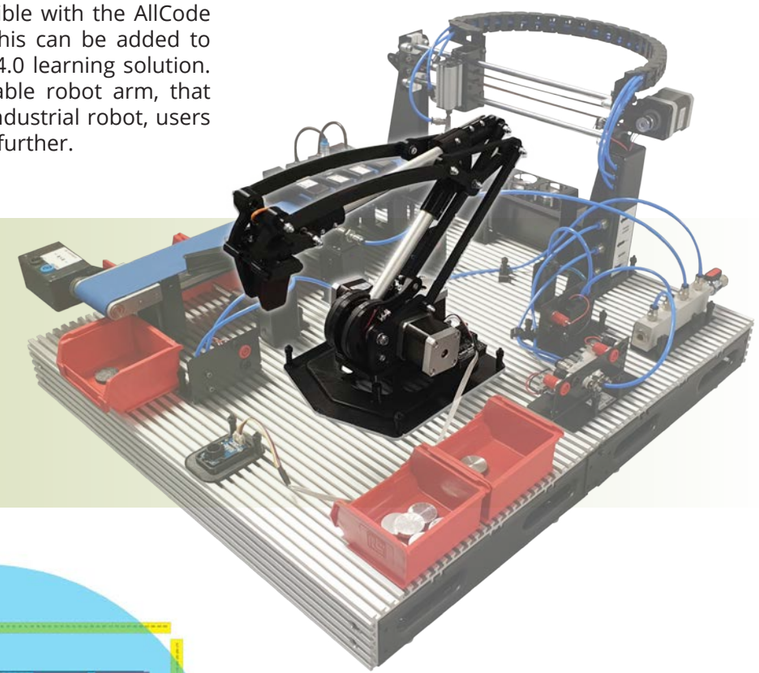
Learning objectives / experiments:

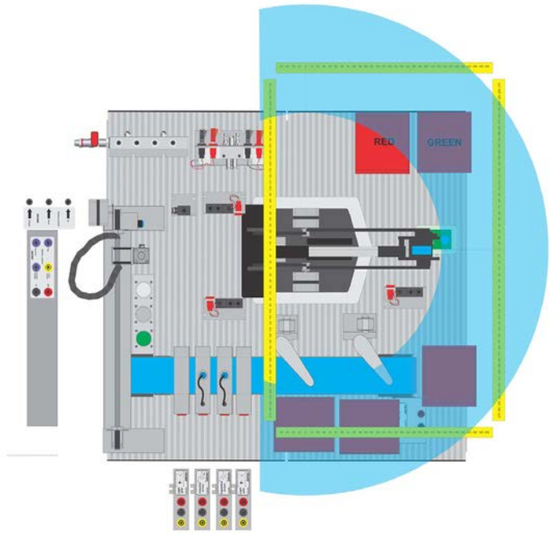
- Factory control and automation systems
- Software design for automation
- DC motor and stepper drives
- Conveyor and gantry systems
- Vacuum pick and place systems
- Component sensing and sorting
- System design with more than one controller (some systems)

Automatics Smart Factory

Robot Arm Integration

The Smart Factory is compatible with the AllCode robot arm production cell. This can be added to provide a powerful Industry 4.0 learning solution. By introducing a programmable robot arm, that acts in the same way as an industrial robot, users can take their learning a step further.





Students create a counter sorting program in which the Robot Arm will collect plastic counters and using the colour sensor, they are sorted into appropriate collection bins. The system can be operated manually or using internet communications, students can implement a handshaking system to automate the process.

INDUSTRY 4.0

Featuring Internet Control

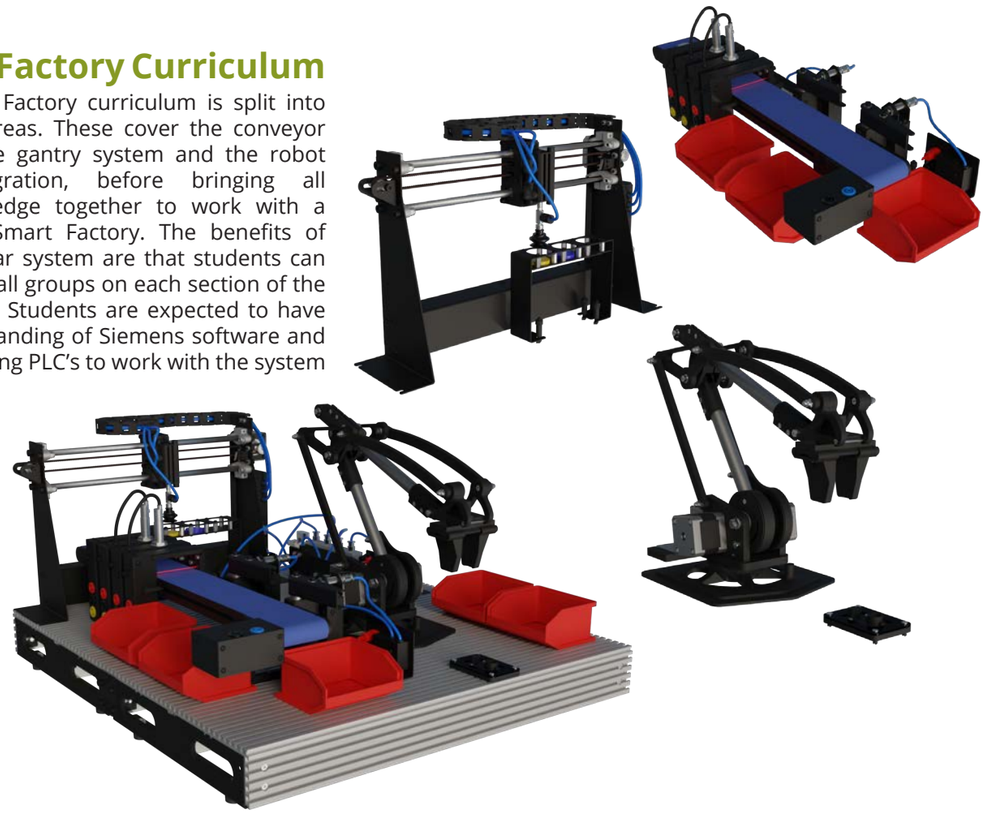
Using API (Application Programming Interface) functionality, which is provided pre-programmed on the Robot Arm Production Cell, users can control the system using any software application, including Flowcode, MATLAB, LabVIEW and many other IDE's. This gives users a powerful remote, automated environment through which to control an industrial system.

Manufacturing Engineering

Automatics Smart Factory

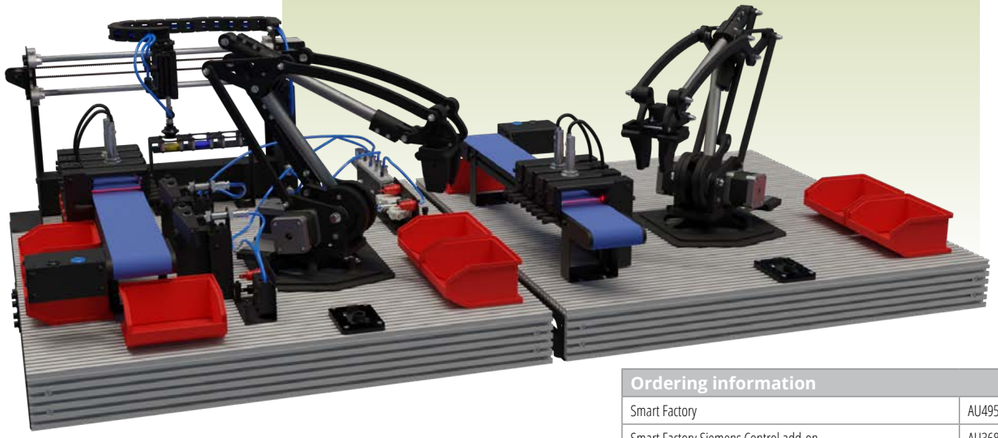
Smart Factory Curriculum

The Smart Factory curriculum is split into four key areas. These cover the conveyor system, the gantry system and the robot arm integration, before bringing all the knowledge together to work with a complete Smart Factory. The benefits of our modular system are that students can work in small groups on each section of the curriculum. Students are expected to have an understanding of Siemens software and programming PLC's to work with the system effectively.



Smart Factory Extended

The Smart Factory can be programmed to work in unison with other Smart Factories, off loading counters between multiple setups.



Ordering information	
Smart Factory	AU4956
Smart Factory Siemens Control add-on	AU3686
Smart Factory MIAC Control add-on	AU4417
Allcode Robot Arm Production Cell	RB1387
Corresponding curriculum	CP7329
You will also need	
Compressor	AU1050

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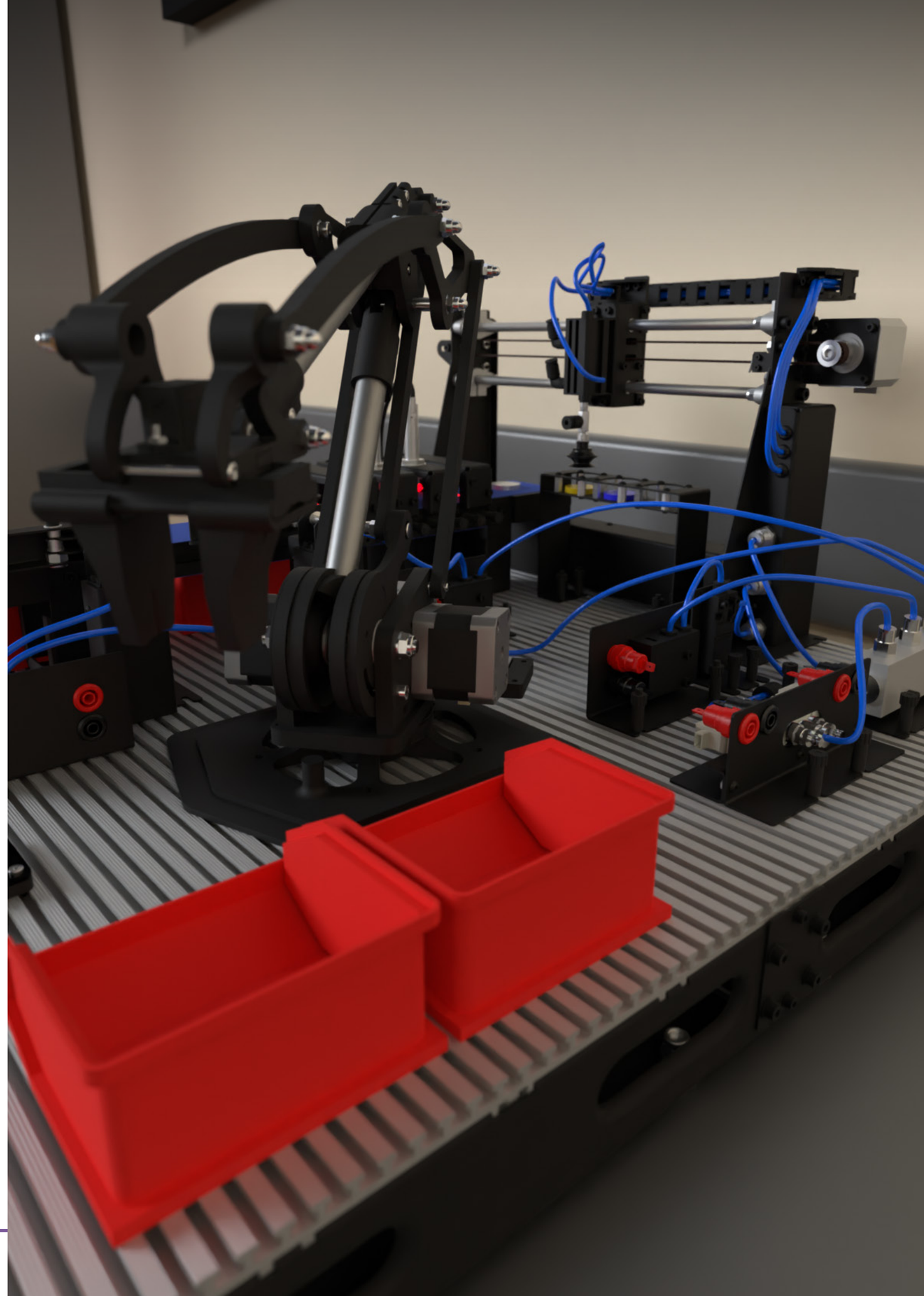
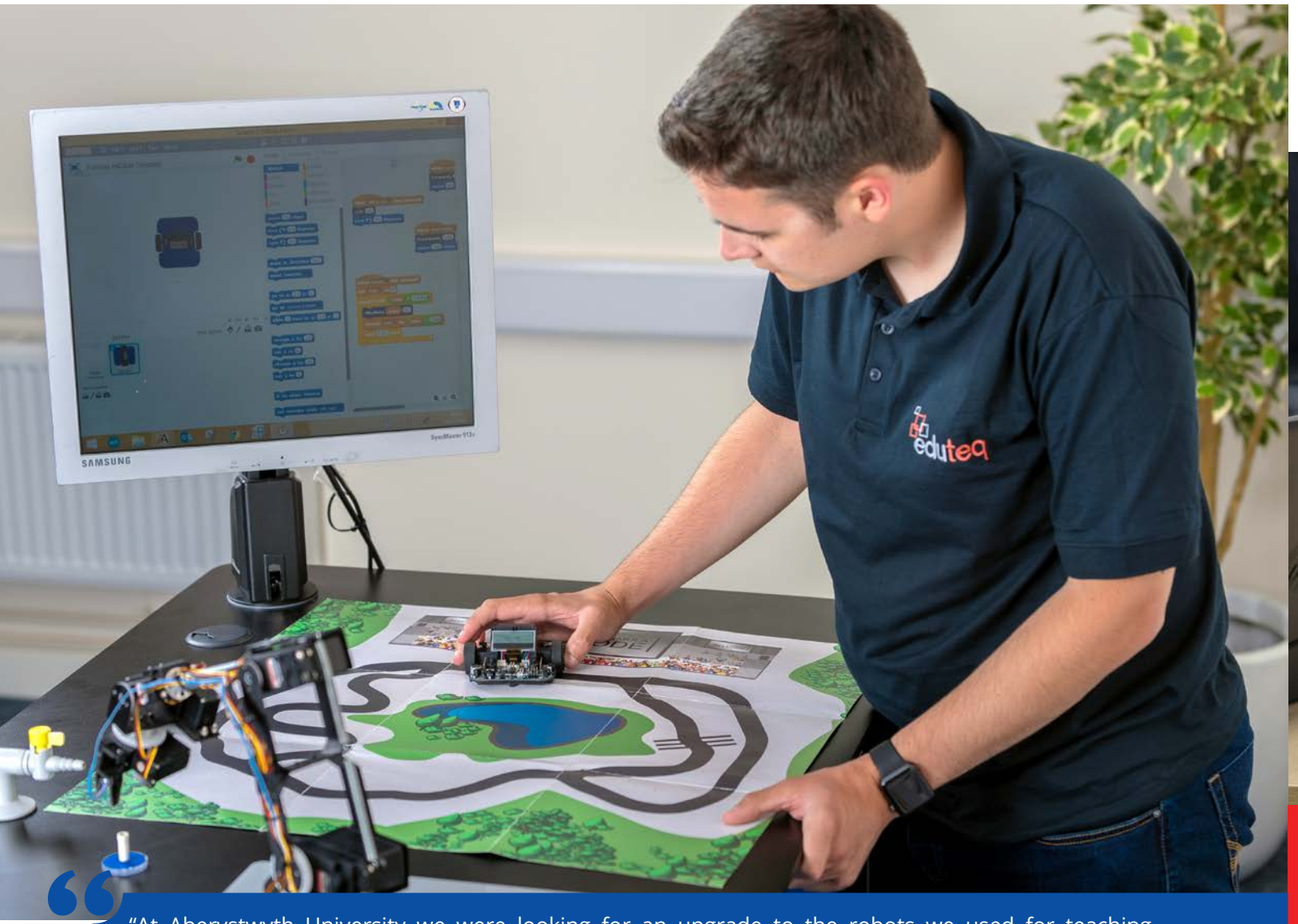


ROBOTICS

Robotics has long been a key area of what Matrix has to offer. With the tight integration our robotics solutions have with Flowcode and the AllCode technology built in to all of our robotics hardware devices, we are able to provide academic institutions with products that allow them to teach coding and programming technology for robots, automation systems and pick and place plus much more.



“At Aberystwyth University we were looking for an upgrade to the robots we used for teaching undergraduate coursework. After evaluating several different options we chose Formula AllCode, as it provides an all-in-one solution including Bluetooth connectivity, a good range of on-board sensors and built-in battery charging circuitry. The PIC microcontroller used in the AllCode robots allows us to teach more advanced control courses than would be possible with similar Arduino-based products.”

Pete Todd, Aberystwyth University

//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

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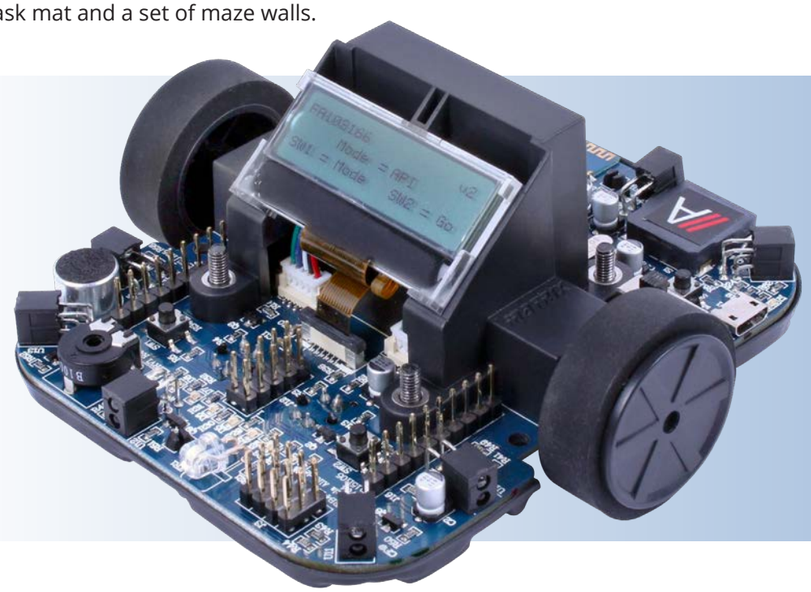
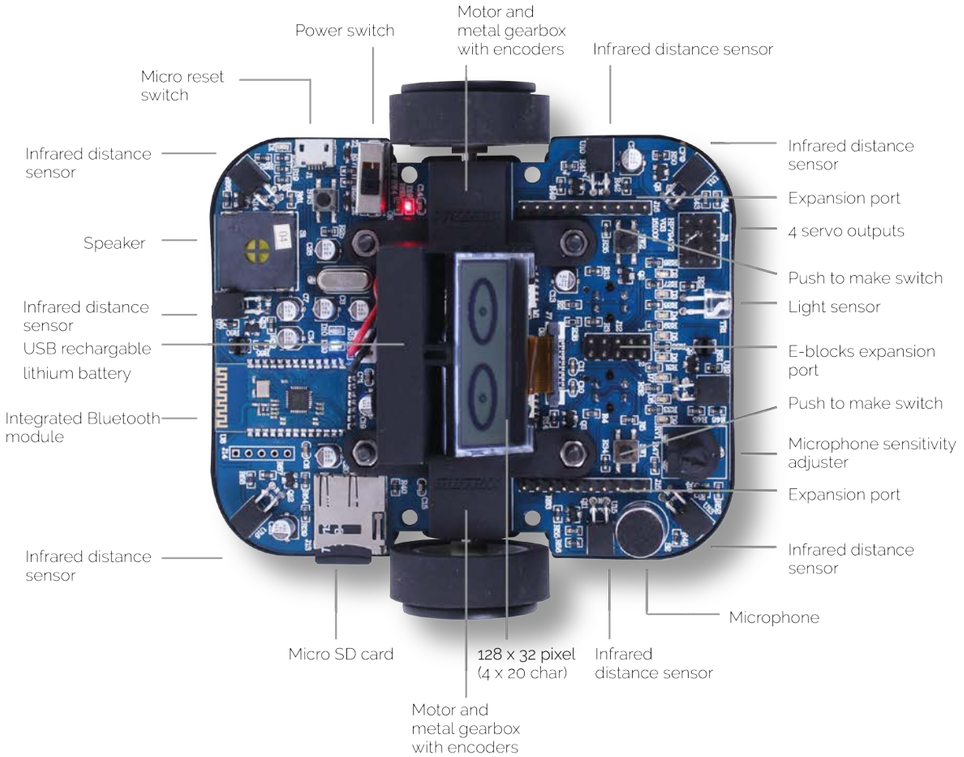
Formula AllCode

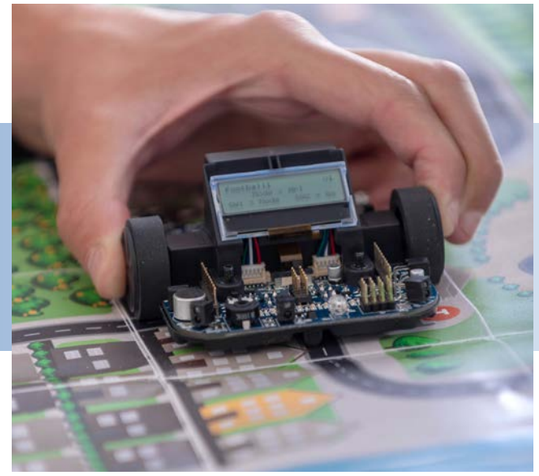
This training solution provides a course in robotics with a sequence of staged exercises including line following and maze solving. The course makes use of the high specification Formula AllCode robot which can be programmed with a number of languages on various operating systems including Flowcode, 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.





Robotics

Formula AllCode



Formula AllCode Double Sided Maze Mat Add-On

Formula AllCode Football Mat Add-On

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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Ordering information	
Formula AllCode deluxe kit	RB7971
Formula AllCode standard class set	RB7240
Formula AllCode deluxe class set	RB7518
Corresponding curriculum	CP5894

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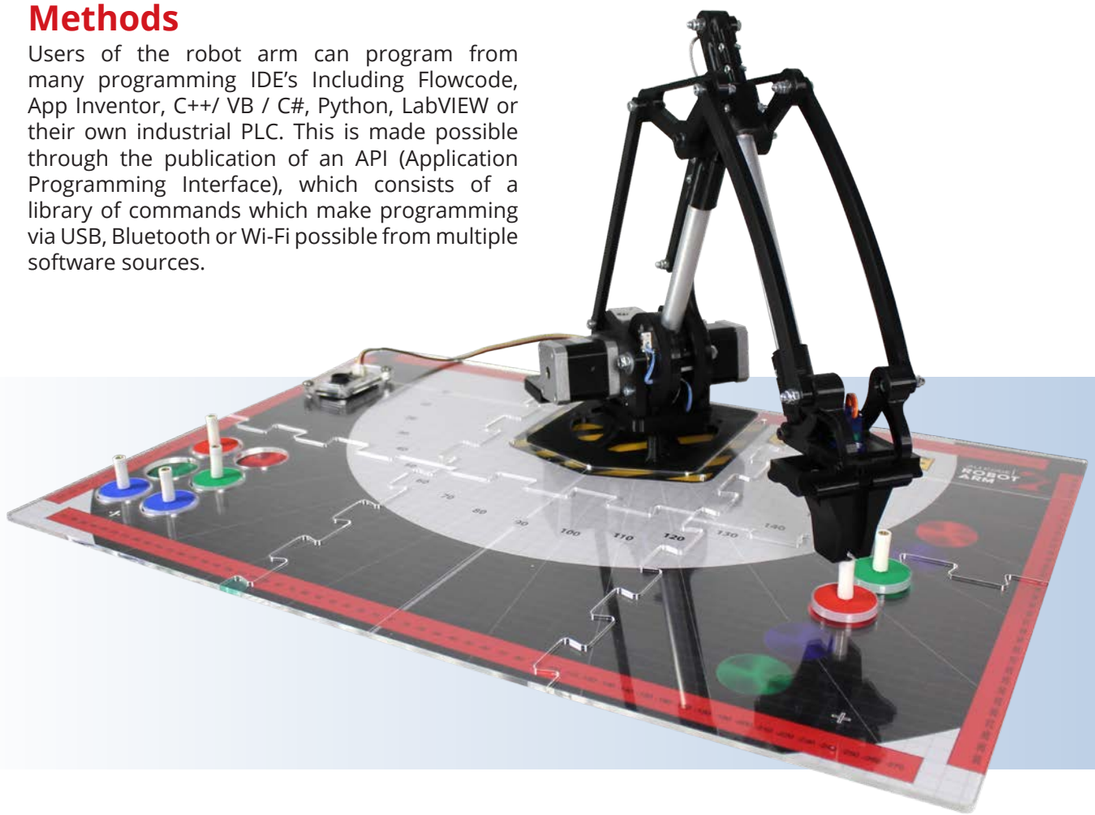
//ALLCODE™ ROBOT ARM PRODUCTION CELL

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.

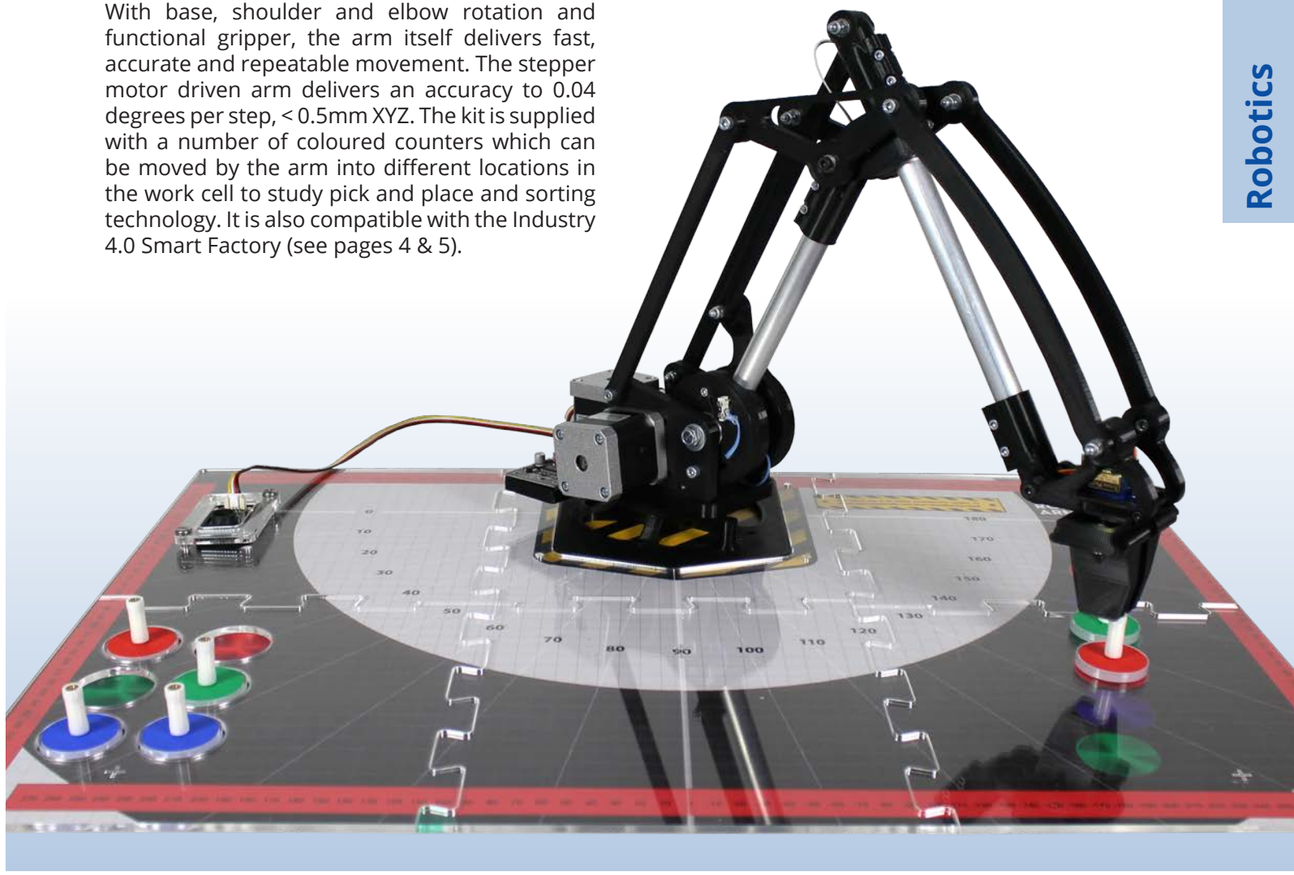


Refined Design

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 platorm and by using a system of levers and cogs to allow the arm to move with great precision within its range of moton.

AllCode Robot Arm

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 (see pages 4 & 5).



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

SCAN TO VISIT PRODUCT PAGE

Ordering information	
AllCode robot arm production cell	RB1387
Corresponding curriculum	CP8656

BTEC NATIONAL

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