



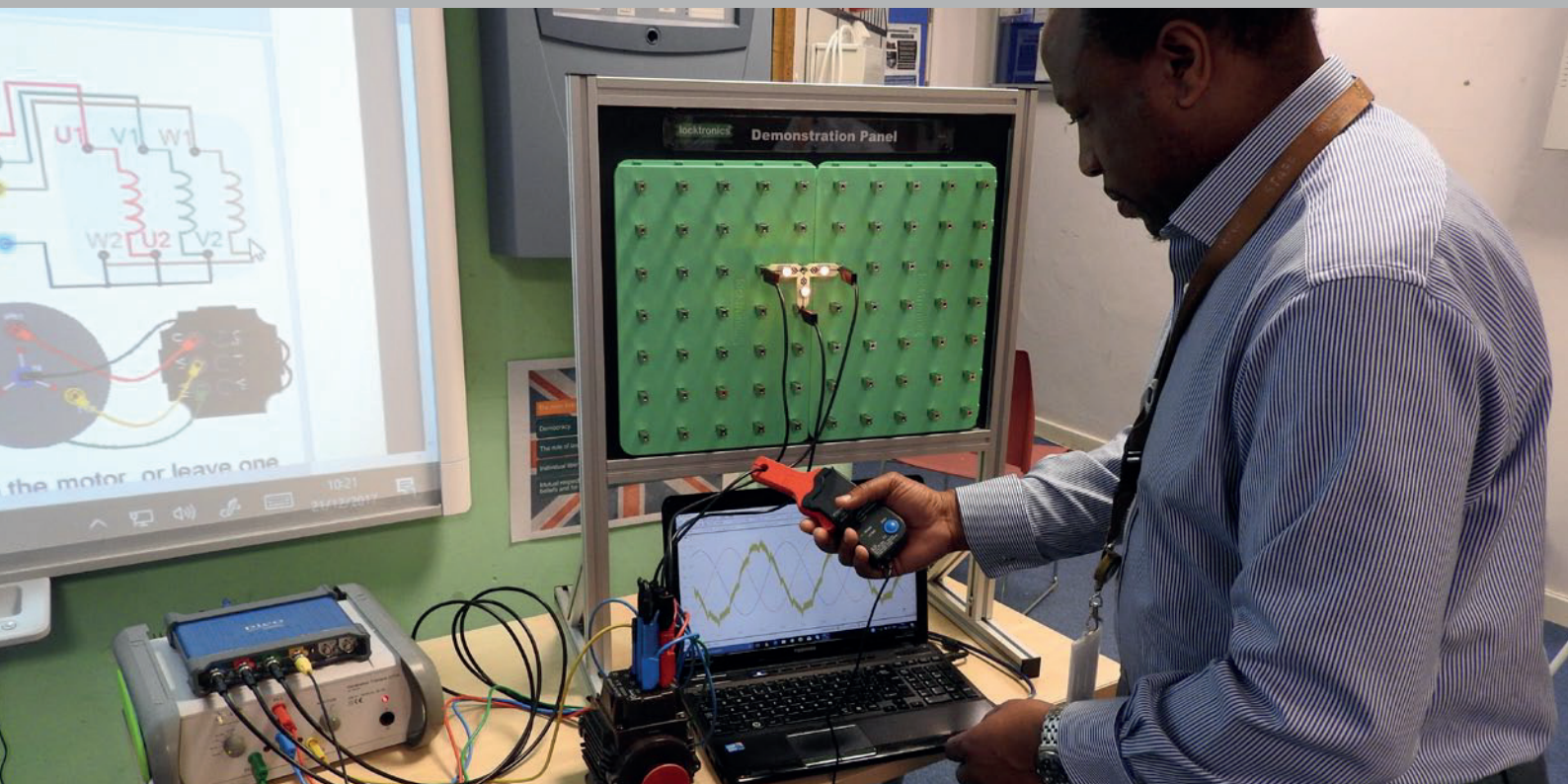
Electrical Installation Solutions

MATRIX

www.matrixtsl.com

Electrical Installation

The electrical installation range has been designed to meet the requirements of the popular City and Guilds courses for both electricians and plumbers. The objective here is to help students understand the fundamental theory and practice of the Electrical Science parts of units 7202, 7365 with hands on activities. Following the success of our electrical installation range, we have developed five further solutions to allow technicians studying City & Guilds level 3 (units 8202) access to a suite of unique training equipment. All of our solutions in electrical installation are also suitable for the corresponding EAL qualifications.



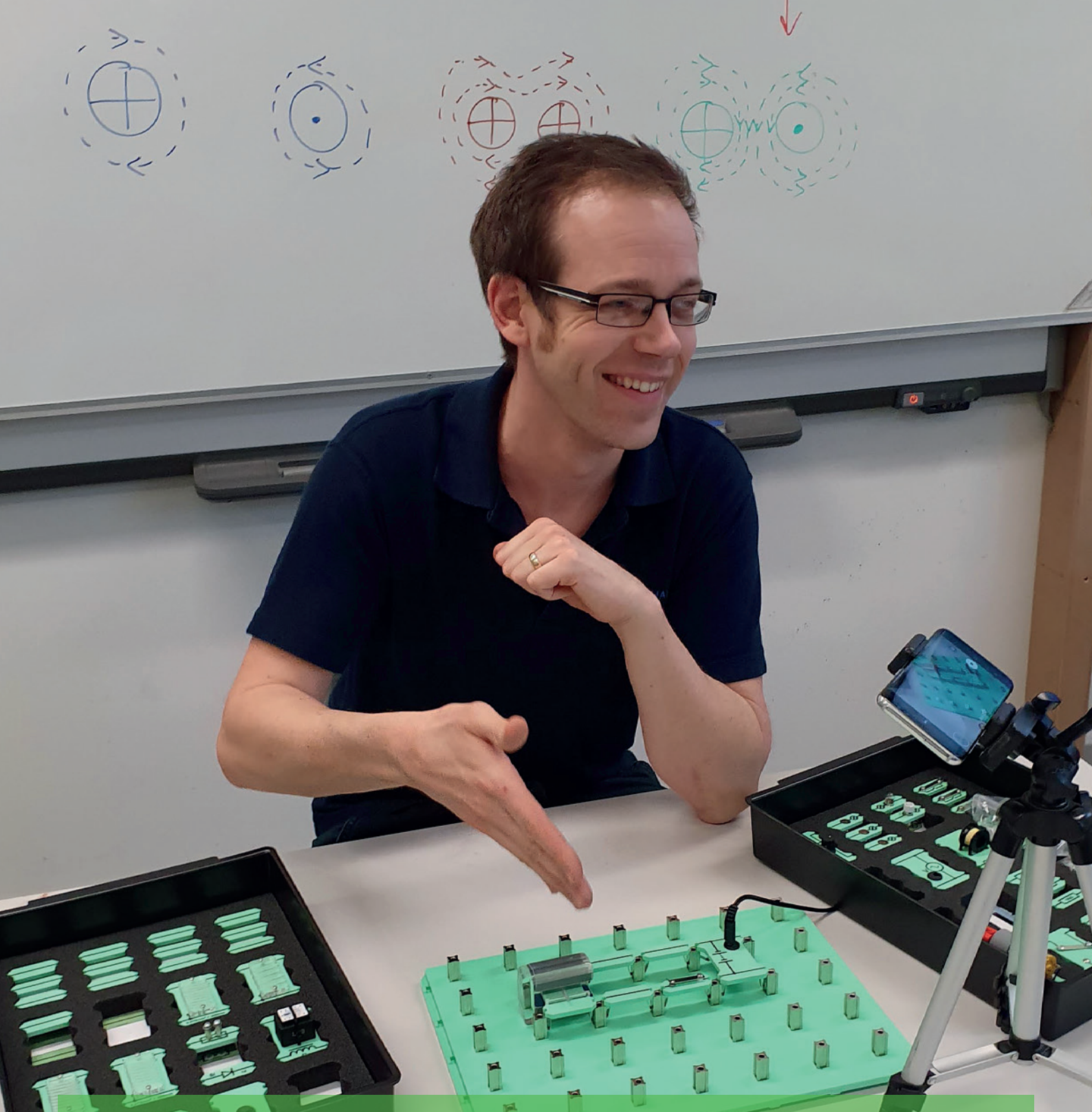
Our learning solutions:

- Are suitable for City and Guilds, EAL and many other awarding bodies
- Are accompanied by detailed colour workbooks
- Provide hands on equipment and activities
- Are supplied in rugged storage trays

“The Electrical Installation range has proven an invaluable tool in the teaching and learning of our science modules. Using real-life experiments consolidates our students learning through building practical exercises and makes the teaching so much more engaging. The free lesson plans save our lecturers hours of planning, and ensure the kits are used to their full potential, they are worth their weight in gold.

Matrix were easy to work with from start to finish and I would definitely recommend them for their electrical installation range.”

Neil Benjamin-Miller
Uxbridge College



“Having worked with the Matrix Locktronics kits in two different places of employment I can heartily recommend them as a teaching aid. While they are invaluable for use in my YouTube videos the real appeal lies in using them in my classroom on a daily basis. I will often connect a camera to the big screen when teaching to show the Locktronics board and then explain step by step what is taking place inside the circuits we have built. This has a really positive impact on learning, much more so than just drawing it out on a board or by a slide presentation and learners will often express their appreciation for the increased level of understanding. I can honestly say that these kits bring electrical science and principles to life in a way that is hard to match with other visual aids.”

Joe Robinson
Joe Robinson Training, United Kingdom



Electrical Installation Level 1

This solution allows students who aspire to go on to become plumbers or electricians to gain a fundamental understanding of the basic principles of electricity. The learning outcomes are closely aligned with City and Guilds 7202 unit 107 in Electrical science. The kit includes a comprehensive range of practical assignments in electricity, basic circuits, and the use of multimeters for measuring and fault diagnosis. The kit is supplied with a comprehensive set of printable worksheets and teacher's notes.



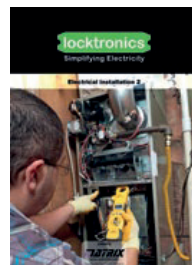
Ordering information	DIN	ANSI
Electrical Installation Level 1	LK5000	LK5000A
Corresponding curriculum	LK4098	
Instruments Required		
Multimeter	LK1110	

Learning objectives / experiments:

- The basic principles of electron flow theory
- Simple units of electrical measurement
- Using multimeters
- The effects of an electric current
- Simple electrical calculations
- AC and DC supplies
- Simple electrical circuits

Electrical Installation Level 2

This kit allows students to understand the electrical science required to become a competent electrician at level 2 through completion of a range of worksheet driven tasks and experiments in electricity and electrical circuits. The learning outcomes are closely aligned with City and Guilds 8202 unit 202 in Electrical science. The kit includes a comprehensive range of practical assignments in electricity, basic circuits, and the use of multimeters for measuring and fault diagnosis. The kit is supplied with a comprehensive set of printable worksheets and teacher's notes.



Ordering information	DIN	ANSI
Electrical Installation Level 2	LK4063	LK4063A
Corresponding curriculum	CP8475	
Instruments Required		
Multimeter	LK1110	

Learning objectives / experiments:

- The principles of electricity
- The principles of basic electrical circuits
- The principles of electromagnetism
- The operating principles of a range of electrical equipment
- The principles of A.C theory
- Includes our new residual current device

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.



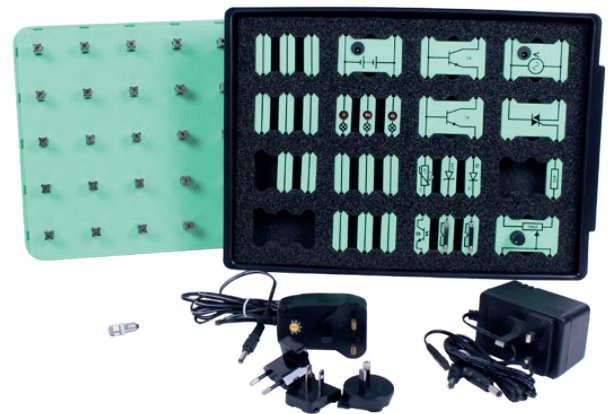
Ordering information	DIN	ANSI
Three Phase Systems	LK4961	LK4961A
Corresponding curriculum	LK2686	
Instruments Required		
Pico 4 Phase Oscilloscope	HP5834	
AC/DC Current Clamp	HP5561	

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

Electronic Components and Circuits Pack

This pack allows students to understand the operation of a range of commonly used components in both DC and AC circuits. The learning outcomes are closely aligned with the requirement of City and Guilds 8202 level 2 topic 4: Understand electronics components. The kit includes a range of practical assignments which guide students from simple circuits that allow them to understand component operation through to circuits that are made up of a number of components that perform useful tasks in electrical systems. A full set of colour printable worksheets and teacher's notes are supplied.



Ordering information	DIN	ANSI
Electronic Components and Circuits Pack	LK2901	LK2901A
Corresponding curriculum	CP2813	
Instruments Required		
Multimeter	lk1110	

Learning objectives / experiments:

- Operation of resistors, capacitors, thermistors, diodes, zener diodes, photo transistor, transistor, and triac.
- AC and DC circuits including rectification, amplification, dimming, soft start, current limiting, light indicators, sensors
- Full worksheets available online
- Shipped in standard storage cases

Principles of Lighting

This solution allows students to understand the principles of designing lighting systems for domestic and industrial buildings. The kit consists of a Locktronics base board, a set of high power MES LED bulbs, switch and connectors and a light meter. Students can arrange the bulbs in varying positions and densities and measure light intensity using the light meter provided. Students can explore the different effects on light intensity through the angle of lighting, the distance away from the light source, and the density of light sources.

A full set of worksheets is available for download.



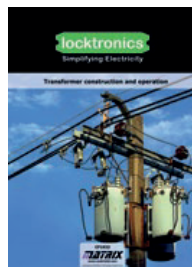
Ordering information	DIN	ANSI
Principles of Lighting	LK2285	LK2285A
Corresponding curriculum	CP2273	
Instruments Required		
Multimeter	LK1110	

Learning objectives / experiments:

- Lighting system design
- Units of measurement for light
- Energy efficiency
- The effect of distance
- The effect of angles
- The effect of reflectors

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. AC power supply required



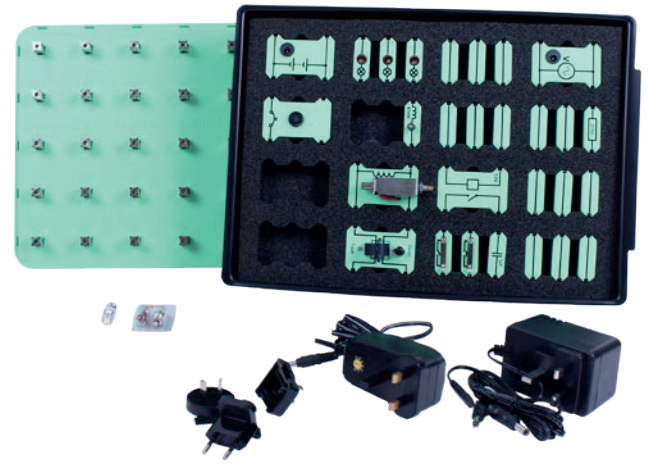
Ordering information	DIN	ANSI
Transformer Construction and Operation	LK1989	LK1989A
Corresponding curriculum	CP1933	
Instruments Required		
Multimeter (x2)	LK1110	
AC power supply (240V: 12V @ 5amps)	HP3728	

Learning objectives / experiments:

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

Electrical Installation Circuit Principles

This pack covers two separate topics. Firstly students can use the Locktronics components and a signal generator to export inductive and capacitive reactance and to compare the effects these have on circuits with resistance. Secondly the pack includes a selection of components that allows students to explore how solenoids and relays are used in electronics circuits, and how circuit breakers and RCDs are used in electrical safety systems.

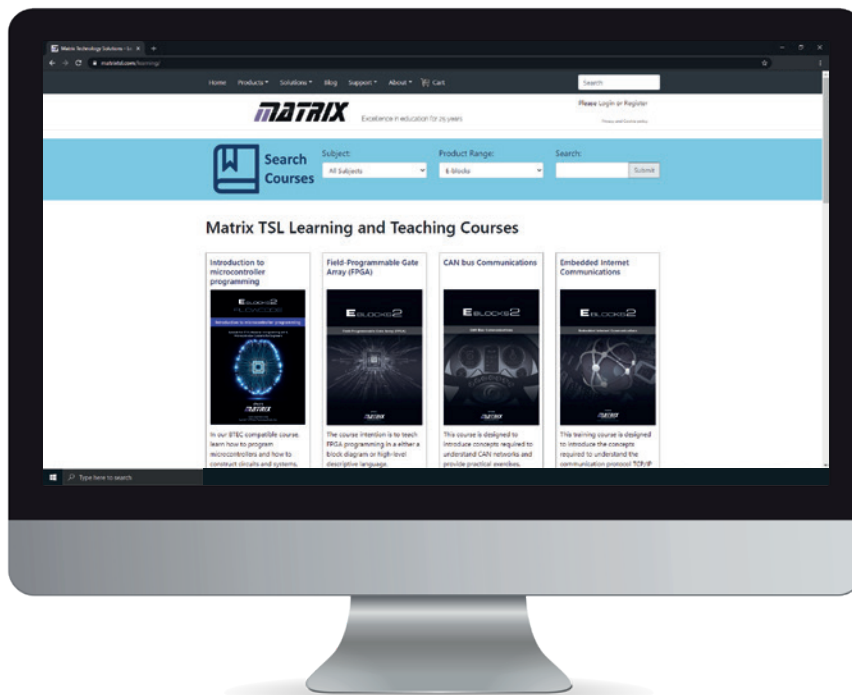


Ordering information	DIN	ANSI
Electrical Installation Circuit Principles	LK4562	LK4562A
Corresponding curriculum	CP0295	
Instruments Required		
Multimeter	LK1110	
Signal Generator	HP7894	

Learning objectives / experiments:

- Inductive and capacitive reactance
- Impedance in AC circuits
- Contactors, relays, solenoids
- Safety systems and earth systems
- MCB, RCD operation

Learning Centre



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

FREE CURRICULUM
www.matrixsl.com/learning

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 controller of the different machine types. Further to this, we provide four separate curriculum manuals.



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

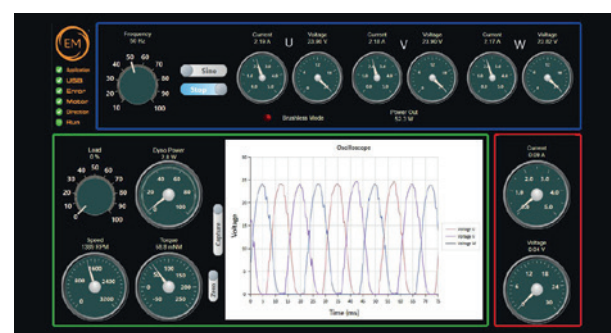
- Select DC, single-phase AC and 3-phase AC outputs
- Integrated voltage and current measurement
- Adjustable resistive loads for dynamometer and series winding resistor
- Switchable start and run capacitor
- 14 different instruments embedded within it
- A unique API, allowing connection to be made to 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

Electrical Installation Learning Objectives

- Motor Types and Construction
- Understand single phase induction motors and the use of start/run capacitors
- Torque and the use of the balance to measure torque
- Understand rough speed torque curves for each motor and make a quick manual plot or a spreadsheet plot
- Different motors are used in different applications
- RMS
- Power in and power out and efficiency

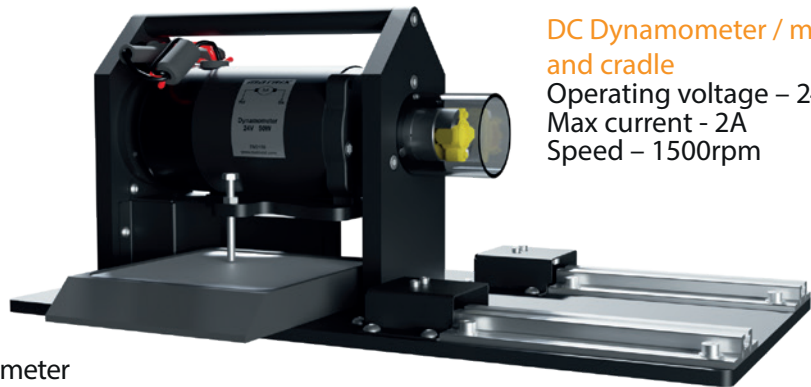
PC Software

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. 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.



Motors

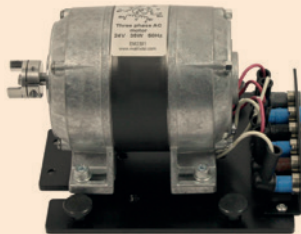
The aluminium cradle which houses our dynamometer features a rugged and safe sliding mechanism into which each of the other six motors in the range fix into position. The motor coupling meets the dynamometer in a protected housing and allows for safe study of each machine type at 24 volts. When using 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.



DC Dynamometer / motor and cradle
 Operating voltage – 24V AC
 Max current - 2A
 Speed – 1500rpm

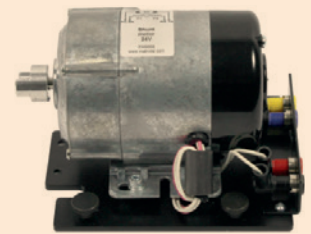
Three phase induction motor

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



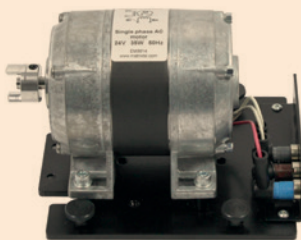
Shunt motor

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



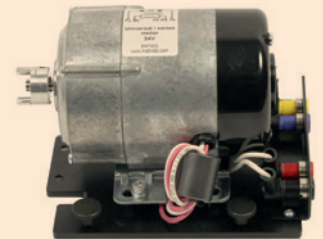
Single phase induction motor

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



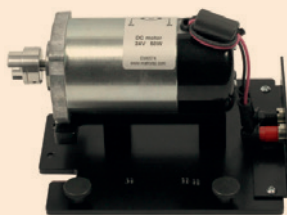
Universal / Series motor

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



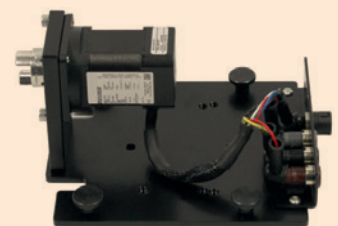
DC motor

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



Brushless DC motor / 3 phase generator

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



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
Also Available	
Transformer add-on	EM4425
Locked Rotor add-on	EM2551





“Locktronics solutions are portable, easy to store and simple to use; Ideal for practical lab-work in classroom environments. The included curriculum material was suitably designed for teaching of BTEC qualifications and can be easily adapted to meet the Scottish Electrical engineering curriculum from National 4/5 through to HNC/D level. With these kits our students can quickly build and test a wide range of circuits. The simple connection method makes it easy for students to try different component values and configurations, thereby gaining a deeper understanding of electrical principles and circuit operation.”

Bill Crawford,
Forth Valley College, United Kingdom

Electrical Installation Solutions

For more information, do not hesitate to contact us

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