Electricity & Electronics

Electricity and Electronics

Component Level circuit construction

Identification of individual components

Wide range of Curriculum coverage

Analogue and Digital Trainers

Conventional Instruments

PC based Instrumentation

Hard Copy or PC delivered Tuition

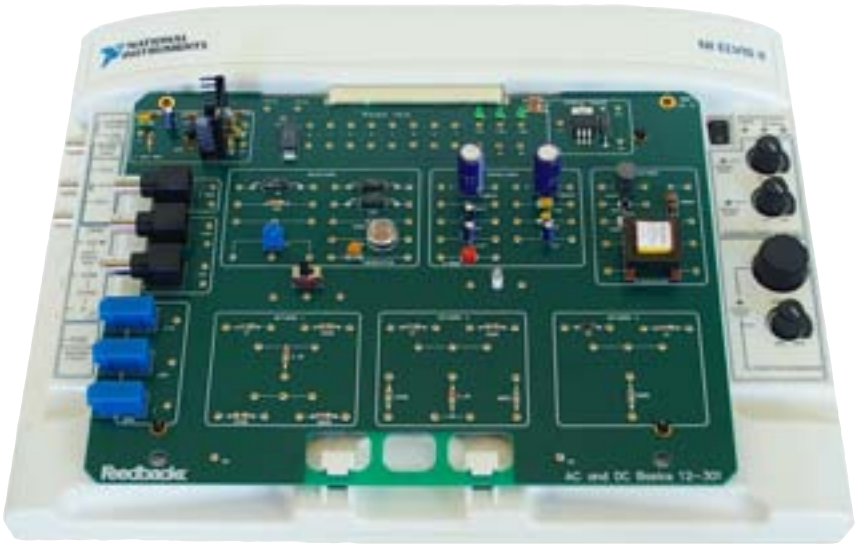
Electricity and Electronics is a primary requirement in all branches of engineering and education. A challenging and interesting medium is required to hold the attention of students in such a multi-discipline area of study.

The wide range of work boards available from Feedback meets the majority of needs in academic, vocational and industrial training establishments, and provide a hands-on approach.

Hardware is supported by comprehensive teaching manuals and, in many cases, detailed Espial software for Computer Assisted Learning is available. Espial courseware provides the student with on-screen assignments and PC based instrumentation when applicable.

The use of conventional instruments; oscilloscope, frequency and digital multimeters etc. - in making measurements is of importance in the training of service technicians and engineers. The use of PC based instrumentation and courseware offers a reduction on lab requirements for conventional test equipment and is more suited to general electricity and electronic course training needs.

Two types of work boards are available, one that requires the circuit to be constructed by the student from discrete components mounted on pin carriers and the other that has pre-mounted components required for a specific area of study.



NI ELVIS platform

The 12-300 series is a set of workboards that provide hands-on teaching of basic electricity, electronics and magnetism. Each board contains pre-constructed circuit elements that may be connected in different ways to perform a series of student assignments, in conjunction with Feedback's Espial software.

The boards connect to the NI ELVIS console which provides power and signal acquisition. Teaching material and PC based instrumentation are delivered by Feedback's own Espial software which teaches theoretical concepts and provides on screen instruction to set up the assignments. There is the potential to edit the existing assignments or to create completely new teaching material.

NI ELVIS - is a hands-on design and prototyping platform that integrates the 12 most commonly used instruments – including oscilloscope, digital multimeter, function generator, bode analyzer, and more – into a compact form factor ideal for the lab or classroom. It connects to a pc through USB connection, providing quick and easy acquisition of measurements.

Each assignment contains up to four practical exercises which have detailed instructions to achieve reliable results. Students are then able to save results, graphs and instrumentation screens in order that they can be printed or used at a later date. A corresponding 'concepts' reference section is provided for each excercise to give the student sufficient background knowledge.

The instrumentation is pre-configured so that students are able to concentrate on understanding the concepts but are then able to change settings as part of a practical exercise. The instruments include oscilloscope, DMM, function generator, spectrum analyser, phase-meter and gain phase analyser. The exercises include familiarisation with the characteristics and application of instrumentation, which closely replicate actual laboratory equipment.

Features

- Espial Software
- Suitable for a wide range of courses
- Hands-on practical assignments
- Pre-constructed circuit elements for rapid configuration
- Through-hole and surface mount components
- Comes complete with all teaching material
- PC based instrumentation integrated with assignments
- Utilises the NI ELVIS console


12-301


12-302


12-303


12-304

12-301 a.c. and d.c. Basics - The courseware for this board introduces common electronics terms and principles and then follows with the relationship between voltage, current and resistance, commonly known as Ohm's Law. The behaviour of passive components is then investigated using the on-screen instrumentation, using both a.c. and d.c. signals. The student then studies the properties of ac waveforms including RMS values and power.

12-302 a.c. Resonant Circuits & Filters - The concept of impedance is introduced by observing the behaviour of passive components under a.c. conditions. Espial software is used to generate test signals for resistors, capacitors and inductors and the corresponding phase and amplitude shifts are observed using the on-screen oscilloscope. The principle of resonance in passive circuits is demonstrated along with calculating the fundamental frequency.

12-303 Magnetic Devices - Students learn the principle of operation of the transformer by means of exploring the behaviour of mutually coupled coils. The turns ratio and efficiency are covered such that the student can understand step-up and step-down configurations. The module then covers electromagnetic components such as the relay, the Hall Effect device, the d.c. motor and the principle of electrical generation.

12-304 Semiconductors 1 - The semiconductor diode is the starting point of this assignment with an introduction to the electrical characteristics of a p-n junction and recognition of diode types and polarity. The transistor is then introduced by allowing the student to test and measure its characteristics using the on-screen instrumentation. Common transistor circuits are then constructed and tested.


12-305


12-306


12-307


12-308

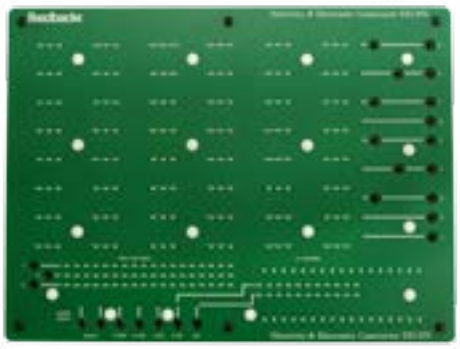
12-305 Semiconductors 2 - Common applications of the diode are presented such as clipping and clamping, back EMF protection and rectification. By progressing from half-wave to full-wave rectification, the student can appraise the relative benefits and shortcomings of each. The courseware also covers how to apply a zener diode to clip a signal and utilising it as a simple voltage regulator.

12-306 Semiconductors 3 - The principles of gain, biasing and distortion allow the student to evaluate transistor performance when used as an amplifier. The operational amplifier is introduced and the ideal versus real characteristics are able to be demonstrated using the on screen instrumentation. The inverting and non-inverting amplifier configurations are used as a foundation for covering the integrator and differentiator operations.

12-307 Basic Logic Circuits - The student is introduced to digital electronics by investigating the various topologies that constitute the logic gates. The student is able to measure transistor characteristics using the on screen instrumentation such that the fundamentals of RTL, DTL, TTL and CMOS are understood. The operations and truth tables of different logic gates are presented.

12-308 Combinational Logic - This assignment addresses how logic gates may be interconnected and how Boolean algebra is used to define their combined effect on a given input. The use of logic gates to perform operations such as binary addition and subtraction is explained, along with more complex applications such as magnitude comparators and binary coded decimal encoders/decoders.

EEC470 SERIES
Self-construction trainers



EEC470 - Electricity & electronics Constructor Deck

92-445 - a.c./d.c. Comprehensive power supply

Features - EEC470

- Choice of training methodology - Conventional or Virtual instrumentation
- Identification of individual components
- Choice of power supply options
- Fully protected supply outputs
- Mixed work board (A and B) student stations possible
- All necessary power supplies provided
- Low cost power supply option
- Can be used with own instrumentation
- Virtual instruments option
- Additional work boards can be added at a later date
- Common delivery platform options

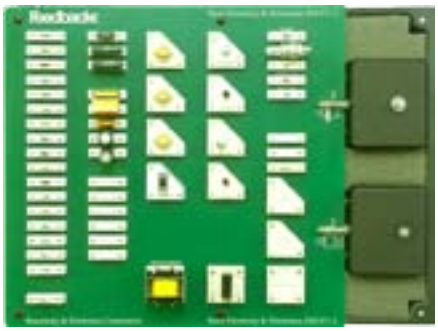
A. Self construction circuit trainers EEC470 series consist of discrete components mounted on small printed circuit carriers, from 2-pin devices through to 16-pin integrated circuits. Power semi-conductor components, in many circumstances, are mounted on plug-in heat sinks. Other large components and assemblies have metal or large PCB carriers.

This series of products is used with the Electricity & Electronics Constructor Deck EEC470. The carrier-mounted components are plugged into the deck's spring contact matrix to build the circuit to be investigated.

B. Pre-mounted circuit trainers have pre-mounted components on the circuit boards, conveniently laid out in a circuit format that requires the minimum amount of interconnection. There is very little preparation required by the student to start the assignments, which leaves maximum time for investigation of the assignment objectives.

Both categories of work boards require an external power supply that can be provided by one of two options:

EEC470 - requires 92-445 series power supply, Pre-mounted - 01-100 trainers or 92-445.



EEC471-2

The **EEC471-2 Basic Electricity and Electronics.** These components are used to construct circuits on the EEC470 deck (see previous page), and introduce the student to basic principles of electrical & electronic theory and circuits.

EEC471-2 benefits

- Resistance, Capacitance and Inductance
- Series and Parallel Networks
- a.c. circuits, Impedance and Resonance
- Reactance, Power, RMS Values
- Electromagnetic Induction and Transformers
- Diodes, Half and Full-wave Rectification
- Transistor Characteristics

EEC473-4

The **EEC473-4 Amplifiers and Electronic Circuit Applications.** These components are used to construct circuits on the EEC470 deck and cover Amplifiers, Electronic circuit applications theory and circuits.

EEC473-4 benefits

- Electronic amplifiers, a.c. and d.c. gain
- Negative Feedback and Frequency Response
- Operational Amplifier characteristics
- Transistor Amplifiers
- The Schmitt Trigger
- Voltage Regulators
- Logic Gates and Flip-Flops

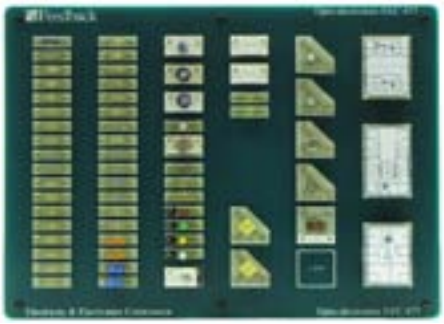
EEC475

EEC475 Power Supply Design is used in conjunction with the EEC470 deck to provide a course of study covering a variety of different types of Power Supply. The hardware comprises a component storage board containing an assortment of passive and active components.

EEC475 Power Supply Design

- Rectification
- Capacitive filters
- Voltage doublers
- Simple voltage stabilisers
- Circuit protection
- Variable d.c. supplies
- Integrated circuit voltage regulator
- Inverters and Converters; Switch-mode regulator

EEC476



EEC477

EEC476 Electronic Control of Machines is for use with the EEC470 deck and covers a wide range of power related subjects, dealing with semiconductor device characteristics, theory of operation and a wide range of power related applications.

EEC477 Opto-Electronic devices are widely used in digital communications and analogue systems. The trainer provides the study of a wide range of typical opto-electronic emitters and detectors covering their characteristics and circuit requirements. The individual circuits are assembled on the EEC470 construction deck.

Electronic Control EEC476

- Characteristics of the MOSFET, SCR, TRIAC and UJT
- Zener diode stabilizer characteristics
- Phase angle control
- Frequency to voltage conversion
- Electronic Tachogenerator calibration
- Speed-torque characteristic
- Pulse Width Modulation Control of a d.c. motor

EEC477 benefits

- Light emitter characteristics
- LEDs in Series and Parallel
- LEDs in a.c circuits
- Flasher circuits
- Photo-detection circuits
- Optocouplers

12-100 & LT345
Pre-mounted training board

OAT343

OAT343 Operational Amplifier Tutor is a component level board features four operational amplifier circuits - one of these circuits is constructed completely with discrete components, enabling detailed investigations to be carried out on the circuit operation.

Subject Areas OAT343

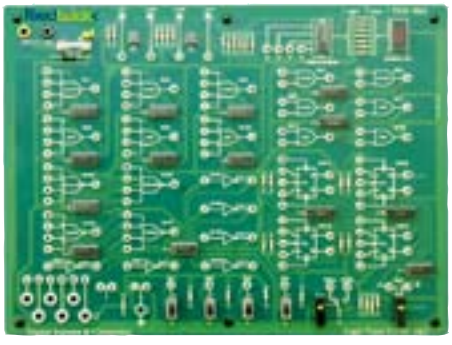
- Op-Amp Feedback Requirements Input Offset Voltage
- Slew Rate
- Frequency Response
- Common Mode Rejection Ratio
- Operational Amplifier Characteristics
- Inverting and Non-Inverting Modes
- Open-loop Voltage Gain
- CMRR
- Sign Changer or Inverter
- Scale Changer
- Summing Amplifier

12-100

The **12-100 Electromagnetism Trainer** provides an introduction to the application of magnetic fields through the use of various components and materials. The practical exercises cover many of the topics required to be addressed in this subject area that appear in course curriculum for electricity and electronics study.

Subject Areas - 12-100

- RMS value of an a.c. waveform
- Electromagnetic induction
- Inductance
- Inductive circuit at a.c. inductive reactance series resonance
- Parallel resonance
- The Transformer
- Magnetic circuits & materials
- Magnetic reed switches
- Relays
- Latched relay motor control
- d.c. motor characteristics
- d.c. generator



LT345

The **LT345 Logic Tutor** is a component-level board featuring a range of commercial integrated circuits containing various basic logic gates that can be inter-connected to form combinational and sequential digital circuits.

Included on the board are input switches LEDs and a seven segment alpha-numeric display.

Subject Areas - LT345

- Binary Numbers Basic Logic Operations
- Combinational Logic Karnaugh Maps
- The Simple Latch
- Clocked Flip-Flops
- The JK Flip-Flop
- Equivalence
- Non-equivalence and other circuits binary Addition
- Registers
- Synchronous Counters
- Asynchronous Counters
- Codes & Code Converters
- 7-SegmentDisplay

CK342A & CK342B
Digital training systems

Subject Areas - CK342A

- Registers
- Counters
- The Arithmetic Unit ALU
- Data Storage and Retrieval
- Fetching an Instruction and its Operandi

Subject Areas - CK342B

- D to A Conversion DAC
- DAC using Analogue Switch DAC based on R-2R Network Monolithic DAC
- A to D Conversion ADC
- Integrating ADC
- Sample & Hold

Analogue & Digital Trainer CK342 - Two component-level boards continue the study of logic circuits up to microprocessor systems and use a range of medium scale integration devices. CK342A covers digital devices and CK342B explores Analogue to Digital & Digital to Analogue conversion. CK342A can be used on its own, but CK342B must be used in conjunction with CK342A.

CK342A

CK342B

Microprocessors

Electricity and Electronic Series

Digital Systems

Microcontroller Training Systems

Microprocessor Training Systems

Programmable Logic Development

PIC Development

PC Applications Training System

The teaching of electronics in the 21st century would not be complete without a range of microprocessor and microcontroller products.

Each trainer plugs into the applications board - 24-200 which comes with the stepper motor module and LCD module as optional extras. The applications board is used with all the microprocessors, and there is only a need to buy one board for all the selected trainers.

User and student manuals are supplied with all the microprocessor trainers, and all are compatible with the 24-200, which will allow full utilisation of all the exercises provided in the manuals. This section shows the many different microprocessor trainers and their applications.

24-200
Applications board

Applications Board 24-200 - is a highly versatile board, compatible with all our micro trainer hardware or a PC. It is ideal for teaching the basics of microprocessor programming and applications such as decision making, D/A and A/D conversion, open and closed-loop control, delay loops, sub-routines & event counting. Fibre optics, keyboard entry, digital sound production, d.c. motor control, infra-red sensing, heating and cooling and visual displays.

Inputs
- Optical fibre receiver
- 8-bit digital switch bank
- Numerical keypad
- Optical speed & position sensor
- Temperature sensor
- Slide potentiometer
- External analogue input

Outputs
- Optical fibre transmitter
- d.c. motor
- 8 LEDs
- Heater
- 2 dual segment displays
- Analogue output
- Speaker

The Liquid Crystal Display Module 24-202 provides extensive programming possibilities in the use of this type of display for announcements and warning messages, as used on small instruments or large public displays such as those found at stations and airports etc. The techniques for rolling, flashing or alternating messages can be practised.

Subject Areas
- Inputting & outputting data
- Subroutines & delays
- The digital to analogue conversion (DAC)
- Analogue to digital conversion (ADC)
- Successive approximation ADC
- Multiplexing seven segment display
- Scanning the keypad
- Control of a d.c. motor
- d.c. motor speed control with IR sensor
- Temperature control
- Fibre optic link

Optional accessories for the 24-200 are available – Stepper Motor 24-201 and Liquid Crystal Display 24-202.

24-160
ARM7S Microcontroller

ARM7S'C' Development and Training System 24-160 and 24-161 are based on the Atmel range of micro-controllers with high performance 32-bit RISC architecture and high density 16-bit instruction set with real-time emulation and embedded trace support, which combine Microcontroller with embedded high-speed flash memory.

Designed for educational and training purposes the ARM7S Development and Training System provides the opportunity to learn about this range of microcontrollers and the development of programs applied to a wide range of applications using the Applications Board 24-200. The training system is available in two versions. The 24-160 that comprises the ARM7S target board, 'C' development software, Jtag debug hardware to plug into the target board, d.c power supply, student's exercise and user manual. The second version, 24-161, comprises the ARM7S Target board, d.c. power supply, student and manual for those wishing to use their own development software.

Features

- ARM7S 32/16-bit micro-controller
- De-bug hardware & software
- Full accsess to controllers ports
- USB or RS232 Serial port connectivity
- 8 channels of 10-bit ADC
- Advanced interrupt controller
- Comprehensive training system (24-160)
- Development and testing of ARM7S programs
- Can be used with Applications Board 24-200
- Available as a minimal cost system (24-161)
- Student's exercise and user manuals on hard copy and CD ROM
- d.c. power supply included

24-170
ARM3S Microcontroller

24-170 is based on the Atmel® AT91SAM3S range of microcontrollers with high performance 32-bit RISC architecture and a high density 16-bit instruction set with real-time emulation and embedded trace support, which combine micro-controller with embedded high-speed flash memory.

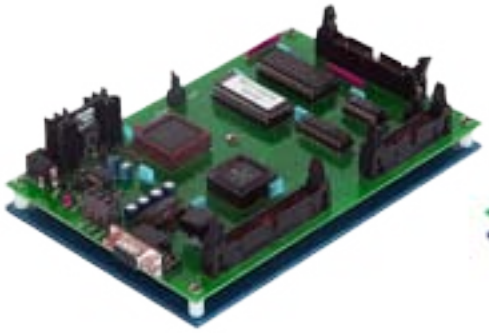
The Atmel® SAM3S Cortex™-M3 is a Flash MCU based on the high performance 32 bit ARM® Cortex-M3 RISC processor integrating features to simplify system design and reduce power consumption.

Inspired by the best-selling SAM7S series, the SAM3S is the ideal migration path to a more powerful and feature-rich MCU. The SAM3S series is pin compatible with the SAM7S series of devices.

Features

- Advanced optimizing embedded C++/ ANSI C compiler and libraries
- Code Creation Wizards for on-chip peripherals
- Source level simulation of instructions and on-chip peripherals
- Simulation of complete target system using Crossware Virtual Workshop Interface
- Source level JTAG debugging via USB
- Multiple application debugging
- Multi-threaded, multi-target environment

68HC11 & 8051
Microcontroller Trainers



68-HC11 Microcontroller Trainer - 24-102 - The 24-102 is a comprehensive single board computer, based on the Motorola MC68HC11 microcontroller unit (MCU). The unit may be used as a development system or trainer. A suitable d.c. power supply is supplied.

Programming - A ROM-resident monitor allows user programs to be assembled quickly on a line-by-line basis, then run and debug. More advanced programs may be assembled on the host PC using the cross-development software 24-904. The assembled code may then be downloaded, run and debugged. A serial cable and power supply is supplied with the Trainer.

8051 Microcontroller development & Training System 24-104 - The highly flexible 8051 single board computer, based on the Atmel AT89C51ED2. "In System Programmable" member of the MCS51 family of microcontrollers, can be used as an educational trainer or target board and user and experiment manuals are supplied. This product is compatible with the Applications Board 24-200 and the 8051 cross-assembler 24-946.

Programming - Using the PC serial port, Intel Hex format programs are entered directly into the Windows based Cross-assembler, disassembled & debugged with the powerful monitor facilities. Register contents can be displayed on the screen. The monitor software may be integrated into user code for flexible code development. Programs can be developed in high level languages, compiled and then assembled into Intel Hex format.

Features - 24-102

- 2 MHz MCU
- 256 bytes of RAM
- RS232 serial communications
- Two input/output ports
- 8 k monitor program-ROM
- Hardware reset button
- Register contents can be viewed and modified
- Debugging facility
- Hexadecimal number handling

Features - 24-104

- Operates up to 33 MHz
- 64 K bytes of Flash memory
- 1 K x 8 bit RAM
- Programmable UART serial port
- 32 programmable I/O lines
- Full debug facilities
- Single step facility
- Memory view/alter facility
- On-screen help
- Trace facility

24-100/28-107
Microprocessor Trainers

Features 24-141

- 2 MHz MCU
- 256 bytes of RAM
- RS232 serial communications
- Two input/output ports
- 8 k monitor program-ROM
- Hardware reset button
- Register contents can be viewed and modified
- Debugging facility
- Hexadecimal number handling

Features 28-107

- Operates up to 33 MHz
- 64 K bytes of Flash memory
- 1 K x 8 bit RAM
- Programmable UART serial port
- 32 programmable I/O lines
- Full debug facilities
- Single step facility
- Memory view/alter facility
- On-screen help
- Trace facility

68000 Microcontroller Trainer - 24-141 is based on the MC68000 16-bit microprocessor, this is a complete computer suitable for many stand-alone applications, especially for real-time control, where power and speed are important. It is supplied with comprehensive EPROM based monitor, line-by-line assembler programs and PC compatible communications software. Cross-assembler 24-944 and applications boards are also available.

On-board 16-bit wide static RAM & EPROM are provided with expansion facilities and extensive serial & parallel I/O hardware. A serial cable and suitable power supply is supplied with the Trainer.

Programmable Logic Development & Training system - 28-107 is a low cost introduction to 'in system' PLD programming and application. This board comes with design software and is fitted with the powerful LATTICE ispLSI2032E PLD. Comprehensive user and experiment manuals are also supplied. Connects to a PC via a parallel port. Applications boards are also available.

Programming - LATTICE ISP Design Expert Starter Software is supplied, including ISP Encyclopaedia, applications notes, Design techniques, lattice data book and ISP development and download software. The hardware is also compatible with the LATTICE ISP Design Expert Software Pack.

For both Microprocessor Trainers a PC is required that runs an operating system of WIN 98 or higher.

Z80 Microprocessor Trainer 24-121 is designed as a general purpose unit that simplifies the teaching of the 8086 CPU and its commonly used peripherals. The 8086 16-bit microprocessor and a set of associated peripheral devices are fitted to this computer board and it is supplied complete with an "on board" EPROM based complete monitor. Driven from a PC serial port, this product is compatible with the 8086 assembler 24-945 and a suitable d.c. power supply is supplied.

Programming - Assembler code programs can be entered into the integral LINE-by-LINE assembler, Disassembled and debugged with the powerful MONITOR facilities. LINE-assembled programs can also be saved and reloaded, when required. Both Register and Memory contents can be displayed on the screen in their

8086 Microprocessor Training & Development system - 24-131 is a comprehensive computer board based on the 8-bit Z80 microprocessor. The board may be used as a development system for Assembler and Machine Code programs. The EPROM based monitor provides a user interface to any standard PC via a serial port. Cross-assembler 24-922 and applications boards are also available.

Programming - Programs are entered directly into memory in Hexadecimal format or downloaded from the host in Intel Hex format. A clear graphical display enables line-by-line assembler programs to be entered and disassembled. Powerful monitor facilities enable programs to be debugged easily, display register contents on screen and give direct

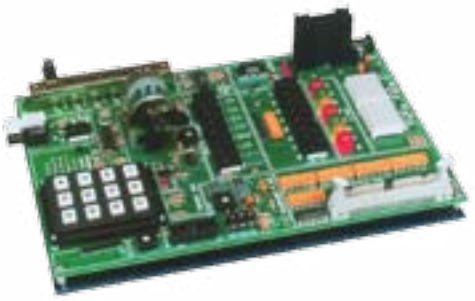
Features 24-121

- 1.79 MHz processor speed
- RS232 serial communications
- I/O lines on IDC connectors
- 8 K static RAM
- 8 K EPROM based monitor
- Interrupt control of peripherals
- Line-by-line assembler
- Single step facility

Features 24-131

- 4.9 MHz processor speed
- RS232 serial communications
- 2 x 16 bit programmable I/O ports
- 8 levels of interrupts
- On-board hardware reset
- Windows monitor software
- Examine/Alter memory and register
- Single step function
- Memory block display
- Port in/out display function

28-122/25-151
Training system boards



Features 28-122

- 10 MHz controller speed
- RS232 serial communications
- 8 K (14-bit) FLASH program memory
- 8 x 10-bit analogue input channels
- In-circuit debugging
- MPLAB PC programs sent direct to PIC device
- Source code viewable when loaded for programming

Features 25-151

- Wide range of components
- d.c. motor with speed and position sensor
- Numerical keypad
- Temperature sensor
- Resistive slide potentiometer
- Optical fibre transmitter and receiver
- 2 x dual seven segment display
- Electrical heater
- Audio speaker

PIC development & Training system - 28-122 - Programmable Interface Controllers (PIC's) are a family of low cost Reduced Instruction Set Computer (RISC) microcontrollers that are powerful and easy to use.

The 28-122 is based on the versatile microchip PIC16F877 CMOS FLASH device in a 44 pin PLCC and has in-circuit debugging. It can be used for various applications; as a target board or for educational purposes. It can also be used as a stand-alone via a serial port to a PC, allowing easy downloads of control code, developed using Microchips MPLAB software or high level language development software.

PC Applications Training system - 25-151-USB - The PC Applications Training System is for demonstrating the use of a PC as a means of controlling an external application (24-200) via a USB port. Supplied as part of the system is a digital I/O adaptor board that connects between the 24-200 Applications Board and a USB to 24 I/O board, also supplied. This connects the 24-200 to the PC USB port.

The options of a Stepper Motor 24-201 and Liquid Crystal Display 24-202 are also available to plug into the Applications board. The Digital Input/Output USB package 24-205 (consisting of the DIO-ADP1 adaptor and the Digital I/O USB module) may be purchased separately for customers already owning the Applications board 24-200.

For more information about any of the products that you see in this catalogue, please contact us:

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