

# H-CAI Electricity and Electronic Kits

Educational Training Equipment for the 21st Century

Bulletin 286-3D

## Electricity Program Model H-CAI-EE

The Hampden H-CAI-EE Kit assumes no previous training in electricity. A unified presentation of subjects enables students to develop a thorough understanding of electricity and its applications. Complete resources for the quick assembly and disassembly of simple breadboard experiments included. (No Soldering Required)

A Student Workbook guides students in the connection of circuits, making measurements and observations, and arriving at conclusions. All experiments are performed at low voltage levels. Each concept is presented simply with easy-to-follow circuit diagrams.

### Description

This kit provides all necessary components and breadboarding apparatus required to complete the topics covered in *Fowler's Electricity: Principles & Applications*.

The Activities Manual for Electricity provides the basis of coverage for basic circuits and components, complex circuit analysis, magnetism, AC voltage, Capacitance, Inductance, transformers, RCL circuits, electric motors and instrumentation.

Each component is permanently secured to its own sturdy plastic base—Velcro® backed for fast and easy assembly of circuits on the supplied Velcro work board. This “Velcro” attachment system has become the preferred method for laboratory circuit assembly due to its simplicity, ease of use and durability.

All components are secured to Velcro-covered sliding trays. All kits can be ordered as drawer storage kits using the supplied glue-on tray support panels (two per drawer) or with heavy-duty lockable cabinets.

### Hardware Features

- Lockable Storage & Carrying Case
- Neat Work Areas
- Ease of Circuit Assembly & Disassembly
- Individually Mounted Components
- Low Voltage

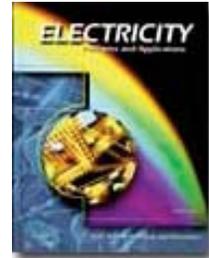


Optional Drawer Storage Available

### Courseware Features

- Background Theory
- Easy to Follow Sequence
- Experiments and Tests

All the necessary components & breadboarding apparatus required to complete >



### Fowler's Electricity: Principles & Applications



### ■ Topics

#### Basic Concepts

Work and Energy  
Unit of Energy  
Energy Conversion  
Efficiency  
Structure of Matter  
Electric Charge

Valence Electrons  
Free Electrons  
Ions  
Static Charge and Static Electricity  
Static Discharge  
Uses of Static Electricity

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All Hampden units are available for operation at any voltage or frequency

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## Electricity Program Model H-CAI-EE

### ■ Topics Continued

#### Electrical Quantities and Units

Charge  
Unit of Charge  
Current and Current Carriers  
Current in Solids  
Current in Liquids and Gases  
Current in Vacuum  
Unit of Current - The Ampere  
Voltage  
Unit of Voltage - The Volt  
Polarity  
Sources of Voltage  
Resistance  
Conductors  
Insulators  
Semiconductors  
Unit of Resistance - The Ohm  
Temperature Coefficient  
Resistivity  
Resistors  
Power and Energy  
Unit of Power  
Efficiency  
Powers of 10  
Multiple and Submultiple Units  
Special Units and Conversions

#### Basic Circuits, Laws, and Measurements

Circuit Essentials  
Circuit Symbols and Diagrams  
Calculating Electrical Quantities  
Measuring Electrical Quantities

#### Circuit Components

Batteries and Cells  
Lead-Acid Cells  
Nickel-Cadmium Cells  
Carbon-Zinc and Zinc Chloride Cells  
Alkaline-Manganese Dioxide Cells  
Mercuric Oxide Cells

Silver Oxide Cells  
Lithium Cells  
Fuel Cells  
Miniature Lamps and LEDs  
Resistors  
Switches  
Wires and Cables  
Fuses and Circuit Breakers  
Other Components

#### Multiple-load Circuits

Subscripts  
Power in Multiple-Load Circuits  
Series Circuits  
Maximum Power Transfer  
Parallel Circuits  
Conductance  
Series-Parallel Circuits  
Voltage Dividers and Regulators

#### Complex-Circuit Analysis

Simultaneous Equations  
Loop-Equations Technique  
Node Voltage Technique  
Superposition Theorem  
Voltage Sources  
Thevenin's Theorem  
Current Source  
Norton's Theorem  
Comparison of Techniques

#### Magnetism and Electromagnetism

Magnetism and Magnets  
Magnetic Fields, Flux, and Poles  
Electromagnetism  
Magnetic Materials  
Magnetizing Magnetic Materials  
Magnetomotive Force  
Saturation  
Demagnetizing  
Residual Magnetism  
Reluctance  
Magnetic Shields  
Induced Voltage  
Magnetic Quantities and Units  
Electromagnets

DC Motors  
Solenoids  
Relays  
Hall-Effect Devices

#### Alternating Current And Voltage

AC Terminology  
Waveforms  
Types of AC Waveforms  
Quantifying Alternating Current  
The Sine Wave  
AC Generator  
Advantages of Alternating Current  
Three-Phase Alternating Current

#### Power In AC Circuits

Power in Resistive AC Circuits  
Power in Out-of-Phase Circuits  
True Power, Apparent Power  
Power Factor  
Power in Three-Phase Circuits

#### Capacitance

Terminology  
Basic Capacitor Action  
Voltage Rating  
Unit of Capacitance  
Determining Capacitance  
Types of Capacitors  
Schematic Symbols  
Capacitors in DC Circuits  
Capacitors in AC Circuits  
Capacitors in Series  
Capacitors in Parallel  
Detecting Faulty Capacitors  
Undesired, or Stray, Capacitance  
Capacitor Specifications  
Uses of Capacitors

#### Inductance

Characteristics of Inductance  
Unit of Inductance - The Henry  
Factors Determining Inductance  
Types of Inductors  
Ratings of Inductors

Inductors in DC Circuits  
Ideal Inductors in AC Circuits  
Real Inductors in AC Circuits  
Inductors in Parallel  
Inductors in Series  
Time Constants of Inductors  
Preventing Mutual Inductance  
Undesired Inductance

#### Transformers

Transformer Fundamentals  
Efficiency of Transformers  
Loaded and Unloaded Transformers  
Transformer Cores  
Types of Transformers  
Impedance Matching  
Transformer Ratings  
Series and Parallel Windings  
Off-Centered-Tapped Windings  
Three-Phase Transformers

#### R, C, and L Circuits

Impedance  
Adding Phasors  
Solving RC Circuits  
Solving RL Circuits  
Solving RCL Circuits  
Resonance  
Filters

#### Electric Motors

Motor Classifications  
Motor Ratings  
Motor Enclosures  
Squirrel-Cage Induction Motors  
Synchronous Motors  
Other Types of Motors

#### Instruments and Measurements

Digital Multimeter  
Meter Movements  
Analog Ammeters  
Analog Voltmeters  
Meter Loading  
Analog Ohmmeters  
Insulation Testers  
Wheatstone Bridge

Wattmeters  
Frequency Meters  
Measuring Impedance  
Measuring Inductance and Capacitance

#### Residential Wiring Concepts

Electrical Codes  
Power Distribution  
Service Entrance  
Cables and Conductors  
240V Branch Circuits  
120V Branch Circuits  
Switched Receptacle Outlet  
Multiple Switching  
Lighted-Handle Switches  
Circuit Interrupters  
Feeder Circuits  
Low-Voltage Control Circuits  
Electronic Control Circuits

#### Common Tools

#### Solder and the Soldering Process

#### Formulas and Conversions

#### Copper Wire Table

#### Resistivity of Metals and Alloys

#### Temperature Coefficients of Resistance

#### Trigonometric Functions

#### Capacitor Codes and Color Codes

#### The Oscilloscope

#### Basis of Cramer's Rule

#### Renewable Energy Sources and Technologies

### ■ Courseware

Text: *Electricity: Principles & Applications*, Richard Fowler  
Manual: *Experiment Manual for Electricity*, Richard Fowler

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