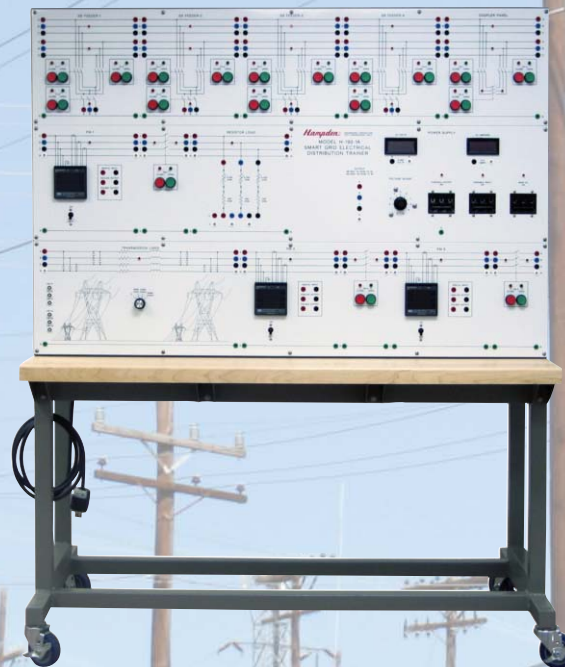


**Recommended
Training Equipment
in the U.S.**

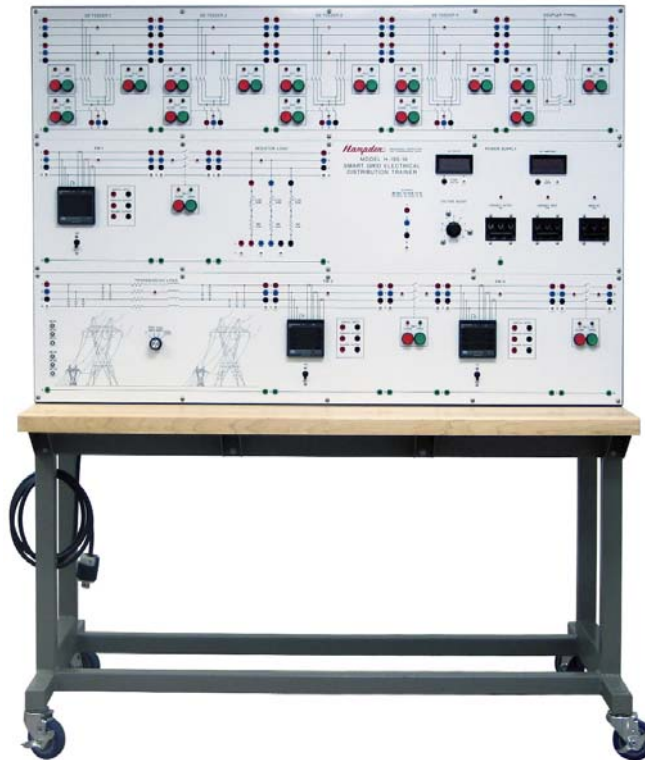
SMART GRID TECHNOLOGY PROGRAM WITH CURRICULUM



Hampden[®]
ENGINEERING CORPORATION



SMART GRID TRAINERS



Hampden Model H-190-1A Smart Grid Electrical Distribution Trainer

The Hampden **Model H-190-1A** Smart Grid Electrical Distribution Trainer is focused on the area of power distribution. Covering electric power distribution, transmission lines and line protection.

Features

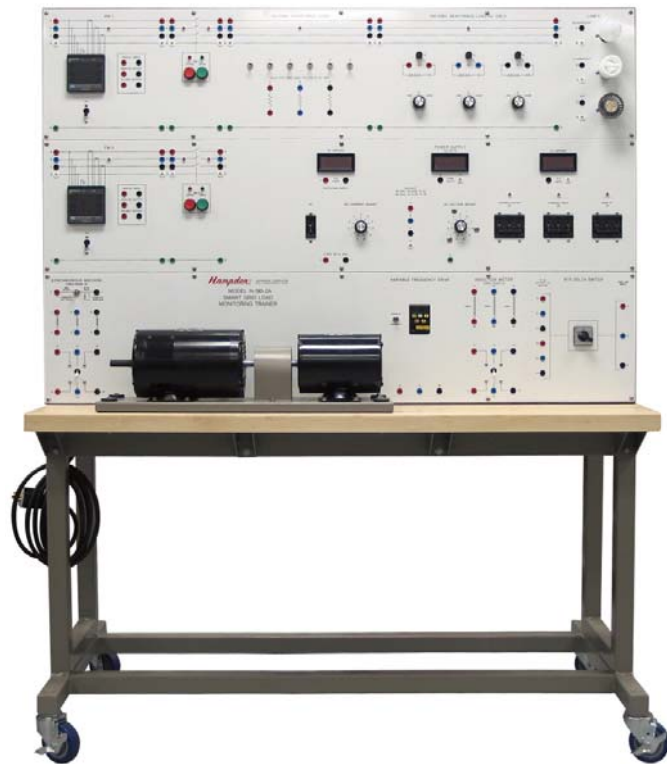
- Three Phase Feeder Sections (4)
- Three Phase Coupler Section
- Transmission Line Section with (3) Line Distances
- Resistance Load Section with Wye-Delta Configurations
- AC Power Supply Section
- Three Phase Power Meter (3)
- H-LTCS Laptop Computer
- Manuals
- Software (SCADA)
- Interconnection Cables
- Color Coding

Topics Covered

- Basic Three Pole Circuits
- Busbar Switch Over
- Algorithm Preparation
- Busbar Coupling
- Voltage Increases
- Voltage Drops
- Power Loss
- Local & Remote Operation
- Phase Shift
- Overcurrent Protection
- Circuit Breaker Behavior

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Hampden Engineering Corporation
SMART GRID TRAINERS



Hampden Model H-190-2A Smart Grid Load Monitoring Trainer

The Hampden **Model H-190-2A** Smart Grid Load Monitoring Trainer focuses on the area of consumer consumption. Investigating the best ways to maximize power usage. Covering dynamic loads and manual and automatic compensation of reactive power.

Features

- Lamp Load
- Inductive Load
- Capacitance Load
- Resistance Load
- Synchronous Machine
- Induction Motor
- Power Controller
- Wye-Delta Switch
- AC/DC Power Supply
- Three Phase Power Meter (2)
- H-LTCS Laptop Computer
- Manuals
- Interconnection Cords

- Coupling and Shaft Guard
- Color Coding

Topics Covered

- Wye and Delta Connections
- Synchronous and Asynchronous Loads
- First and Second Power Monitoring
- Dynamic Loads
- Energy Flow Reversal
- Compensation Capacitors
- Staged Power
- Reactive Power
- Local & Remote Operation

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SMART GRID TRAINERS

Hampden Model H-190-3 Smart Grid Electrical Generation Synchronization Trainer

The Hampden **Model H-190-3** Electrical Generation Synchronization Trainer is designed to demonstrate the need for synchronization. With power being generated by multiple sources, there is a need to have this power be in sync. The frequencies, phase shifts and voltages may vary greatly. If these outputs are not properly synchronized the grid may be damaged.

The Hampden **Model H-190-3** Electrical Generation Synchronization Trainer consists of a synchroscope, synchronization switches, and sync lights for bringing the incoming source to the running generator.

The incoming line serves as the turbine 1 generator. Turbine 2 is a motor coupled to a generator driven by a VFD that regulates frequency, which controls the motor speed. Voltage adjust switches increase and decrease the outputs of each turbine. A laptop computer represents the control room, which provides control and feedback at a remote location.

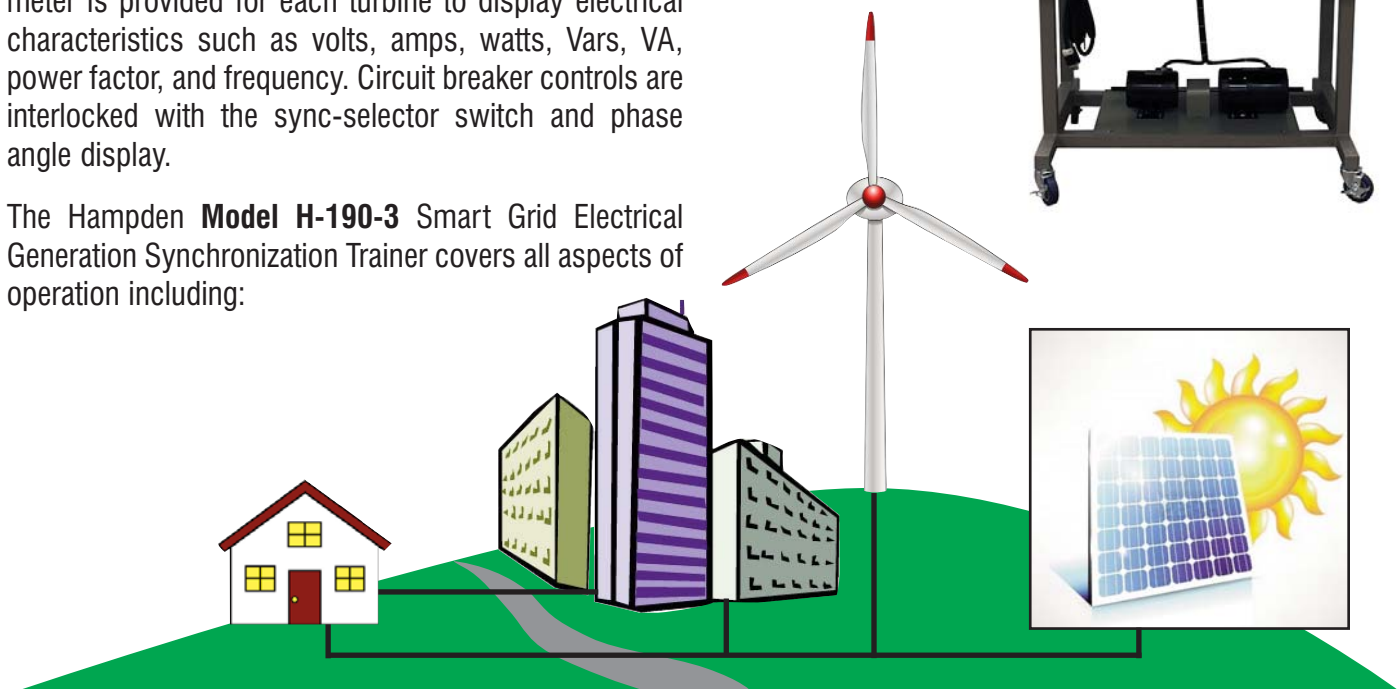
Three separate inductive, resistive, and capacitive loads can be turned on and off, reinforcing the effects of reactive load and how power factor can change. A power meter is provided for each turbine to display electrical characteristics such as volts, amps, watts, Vars, VA, power factor, and frequency. Circuit breaker controls are interlocked with the sync-selector switch and phase angle display.

The Hampden **Model H-190-3** Smart Grid Electrical Generation Synchronization Trainer covers all aspects of operation including:

Features

- Energize a dead bus.
- Perform iso-synchronous operations.
- Correctly perform paralleling operations.
- Demonstrate the operation of generators in parallel and load sharing.
- Observe generator response to inductive, resistive, and capacitive loads.
- Calculate power factor.
- Stand alone operation or connection with other H-190 Smart Grid Trainers.

Also included will be a compliment of digit I/O modules that will allow the trainer to be remote controlled by the operator or "SCADA" controlled.



Standard Products...Designed to Meet your Growing Needs!

Hampden Model H-190-4 Smart Grid Photovoltaic and Wind Turbine Trainer

The Hampden **Model H-190-4** Solar Photovoltaic and Wind Turbine Trainer shall simulate a typical Solar Field and typical Wind Farm. The grid system will have the ability to bring on line the power generated. This power generated can be the main supply to the consumer or it can be bought on line during peak demand as a supplemental source for the grid.

Variable voltage DC power supplies will simulate the power generated from the solar panels. By adjusting the output of the power supply the user can simulate the effect that the environmental conditions will have on the output of the solar panels, such as a cloudy day. The user will also be able to insert faults to simulate defective solar panels.

The Solar panel section will include a Solar Charge Controller and a DC to AC Inverter.

The DC power generated from the Solar Field must be converted to AC before it can be introduced onto the grid.

The user will be able to insert faults to simulate a disabled turbine.

The wind farm will be a representation of wind turbines. The simulation of the wind turbine is a motor coupled to a generator driven by a VFD that regulates frequency, which controls the motor speed.

A power meter is provided to display electrical characteristics such as voltage, amperage, watts, Vars, VA, power factor, and frequency. I/O modules interfaced with a laptop computer provide SCADA control and represent the control room which provides control and feedback at a remote location. The H-190-4 operates as a stand alone or connects to other H-190 Smart Grid Trainers.



Hampden Model H-190-5A Smart Grid Power Shedding and Load Management Trainer

The Hampden **Model H-190-5A** Smart Grid Power Shedding and Load Management Trainer shall simulate the ability of the utility to automatically monitor power systems loading levels and reduce loading when required. The load shed processes automatically sense overload conditions, then sheds enough load to relieve the overloaded equipment before there is loss of generation, line tripping, equipment damage, or a random shutdown of the system.

Power systems are designed and operated for any normal system condition. However Smart Grid systems include a defined set of contingency conditions to make sure that there is adequate generating and transmission capacities to meet load requirements. For those rare conditions where the systems capability is exceeded, there are processes in place to shed loads.

The Hampden **Model H-190-5A** Smart Grid Power Shedding and Load Management trainer simulates two (2) typical "Smart Meter" installations. Installation one will simulate a typical industrial installation and installation two a typical res-

idential installation. Both installations will include a watt-hour Smart Meter. The Smart Meter will include a commercial and residential system Interface.

Four loads will be included on each installation to simulate "Smart Appliances". Loads will include:

- Motor
- Resistors
- Inductors
- Capacitors
- Electric Vehicle Charging

Included will be a compliment of digit I/O modules that will allow the trainer to be remote controlled by the operator or "SCADA" controlled.



Hampden Model H-190-PRT Smart Grid Protective Relay Trainer



When used with the Hampden **Series 190** Smart Grid Systems and owner supplied or Hampden optional Protection Relays, the student will be provided with hands-on training in the following areas of study:

- Generation and Protection
- Transformer and Protection
- Transmission and Protection
- Distribution and Protection
- Motor Protection

The Hampden **Model H-190-PRT-100** Protective Relay Simulator Program consists of the following panels, mobile racks and safety cord set: Each panel consists of the listed component pre-wired to safety jacks.

- **SEL-551** Overcurrent and Reclosing Relay
- **SEL-735** Power Quality and Revenue Meter
- **SEL-751** Feeder Protection Relay
- **SEL-787** Transformer Protection Relay

CURRICULUM

Smart Grid Training Course

First Semester

Description	No. of Hours
2D Essentials	2
Fluids 1: Basic Pneumatics	1
Fluids 2: Basic Hydraulics	1
Digital 1: Logic	1
Digital 2: Sequential	1
DC 1: Introduction	1
DC 2: Circuits	1
DC 3: Circuit Theorems	1
Automation 1: Control Logic	1
Automation 2: Motor Control	1
Interm Algebra w Apps	4
Intro to Psychology	3
SEMESTER TOTAL HOURS	18

Second Semester

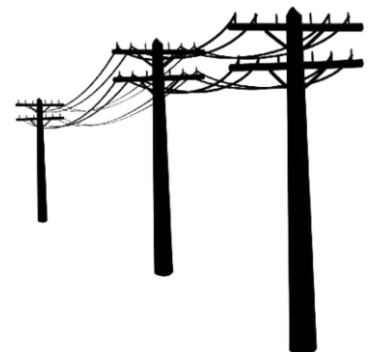
Description	No. of Hours
Metal Fabrication 1	2
Utility Safety	2
AC 1: Properties	1
AC 2: Reactance	1
AC 3: RLC Circuits	1
Electronics 1: Diodes-Basic	1
Automation 3: PLC	1
Automation 4: PLC	1
Automation 5: PLC	1
Trigonometry w Apps	3
College Physics 1	3
SEMESTER TOTAL HOURS	17

Third Semester

Description	No. of Hours
Utility Power Systems Coord	3
Utility Generation Systems	2
Power Electronics 1: Devices	1
Power Electronics 2: Drives	1
Power Electronics 3: Drives	1
Power Electricity 1: Motors	1
Power Electricity 2: Motors	1
Control 1: Discrete Systems	1
Control 2: Process Systems	1
Control 3: Motion Systems	1
English Composition 1	3
SEMESTER TOTAL HOURS	16

Fourth Semester

Description	No. of Hours
Utility Project Execution	3
Utility Systems Maintenance	3
Utility Systems-Natural Gas	3
CAD	2
Technical Reporting	3
Race Ethnic & Diversity	3
SEMESTER TOTAL HOURS	17
TOTAL HOURS	68



**Associate of Science Degree
 Intelligent Energy Management Systems**

First Semester

Description	No. of Hours
English Composition	3
College Algebra	4
Fundamentals of Electricity and Electronics	4
Fundamentals of Database Information Systems	3
TOTAL CREDITS	14

Second Semester

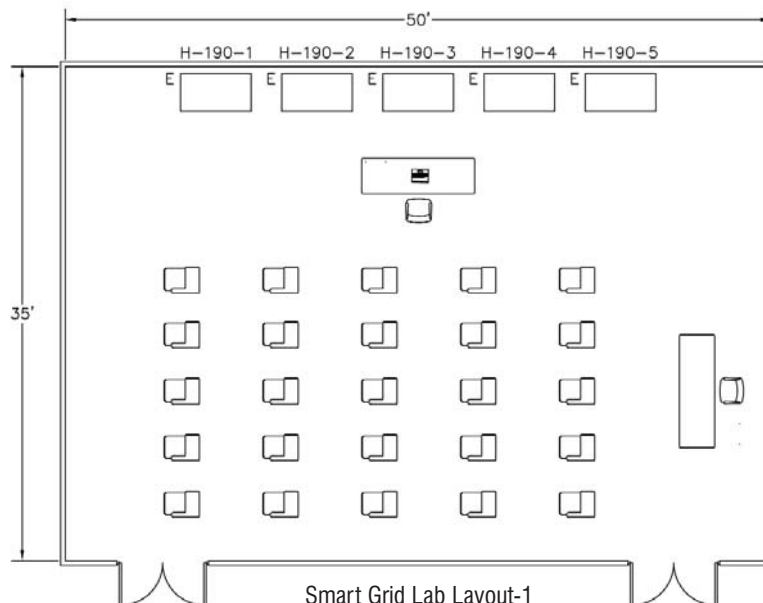
Description	No. of Hours
Safety Health and Environment	3
Power Generation, Transmission and Distribution	4
Intelligent Energy Management Systems - Fundamentals	3
SCADA - Industrial Control Systems	4
Computer Networking I	4
TOTAL CREDITS	18

Third Semester

Description	No. of Hours
SCADA - Industrial Control Equipment	4
Computer Networking II	3
Intelligent Energy Management Systems - Architecture	4
Geography and the Natural Environment	3
History Elective	3
SEMESTER TOTAL HOURS	17

Fourth Semester

Description	No. of Hours
Advanced Metering Infrastructure	3
Fundamentals of Industrial and Utility Security	3
Intelligent Energy Management Systems - Interoperability	4
Social Science Elective	3
Arts/Humanities/Literature Elective	3
SEMESTER TOTAL HOURS	13
TOTAL HOURS	62



Associate of Applied Science Degree Intelligent Energy Management Systems

First Semester

Description	No. of Hours
English Composition or Technical Writing	3
College Algebra or Applied Mathematics	4
Fundamentals of Electricity and Electronics	4
Fundamentals of Database Information Systems	3
SEMESTER TOTAL HOURS	14

Second Semester

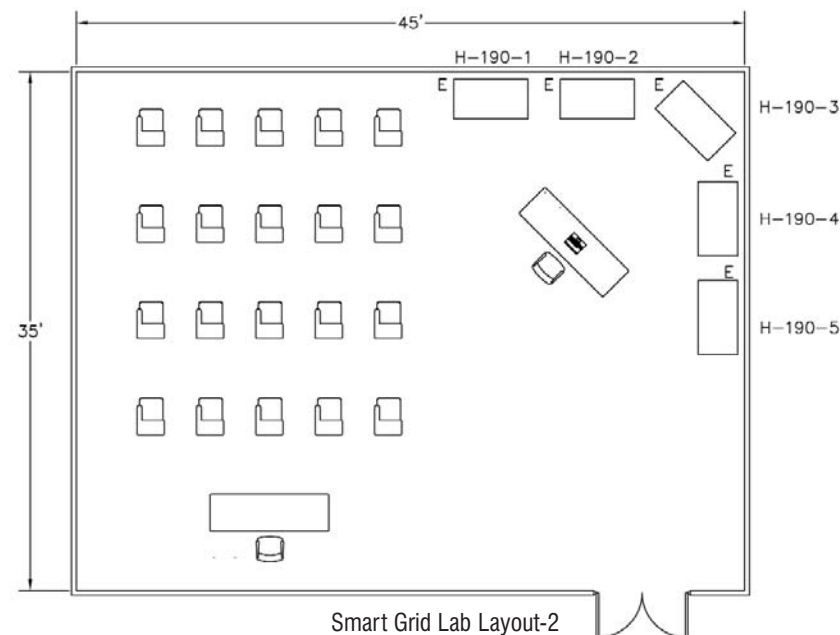
Description	No. of Hours
Safety Health and Environment	3
Power Generation, Transmission, and Distribution	4
Intelligent Energy Management Systems - Fundamentals	3
SCADA – Industrial Control Systems	4
Computer Networking I	4
SEMESTER TOTAL HOURS	18

Third Semester

Description	No. of Hours
SCADA – Industrial Control Equipment	4
Computer Networking II	3
Intelligent Energy Management Systems - Architecture	4
Geography and the Natural Environment	3
SEMESTER TOTAL HOURS	14

Fourth Semester

Description	No. of Hours
Advanced Metering Infrastructure	3
Fundamentals of Industrial and Utility Security	3
Intelligent Energy Management Systems - Interoperability	4
History Elective	3
Social Science/Arts/Humanities/Literature Elective	3
SEMESTER TOTAL HOURS	16
TOTAL HOURS	62



Certificate of Achievement Power Distribution and Control Systems

Description	No. of Hours
Technical Writing	3
Applied Mathematics	4
Fundamentals of Electricity and Electronics	4
Introduction to Smart Grid	1
Safety Health and Environment	3
Power Generation, Transmission, and Distribution	4
Intelligent Energy Management Systems - Fundamentals	3
Intelligent Energy Management Systems - Architecture	4
SCADA - Industrial Control Systems	4
SCADA – Industrial Control Equipment	4
TOTAL CREDITS	34

Certificate of Achievement Networking and Advanced Metering Infrastructure

Description	No. of Hours
Technical Writing	3
Applied Mathematics	4
Fundamentals of Electricity and Electronics	4
Fundamentals of Database Information Systems	3
Introduction to Smart Grid	1
Safety Health and Environment	3
Intelligent Energy Management Systems - Fundamentals	3
Computer Networking I	4
Computer Networking II	3
Fundamentals of Industrial and Utility Security	3
Advanced Metering Infrastructure	3
TOTAL CREDITS	34

CERTIFICATE

Certificate of Completion Intelligent Energy Management Systems

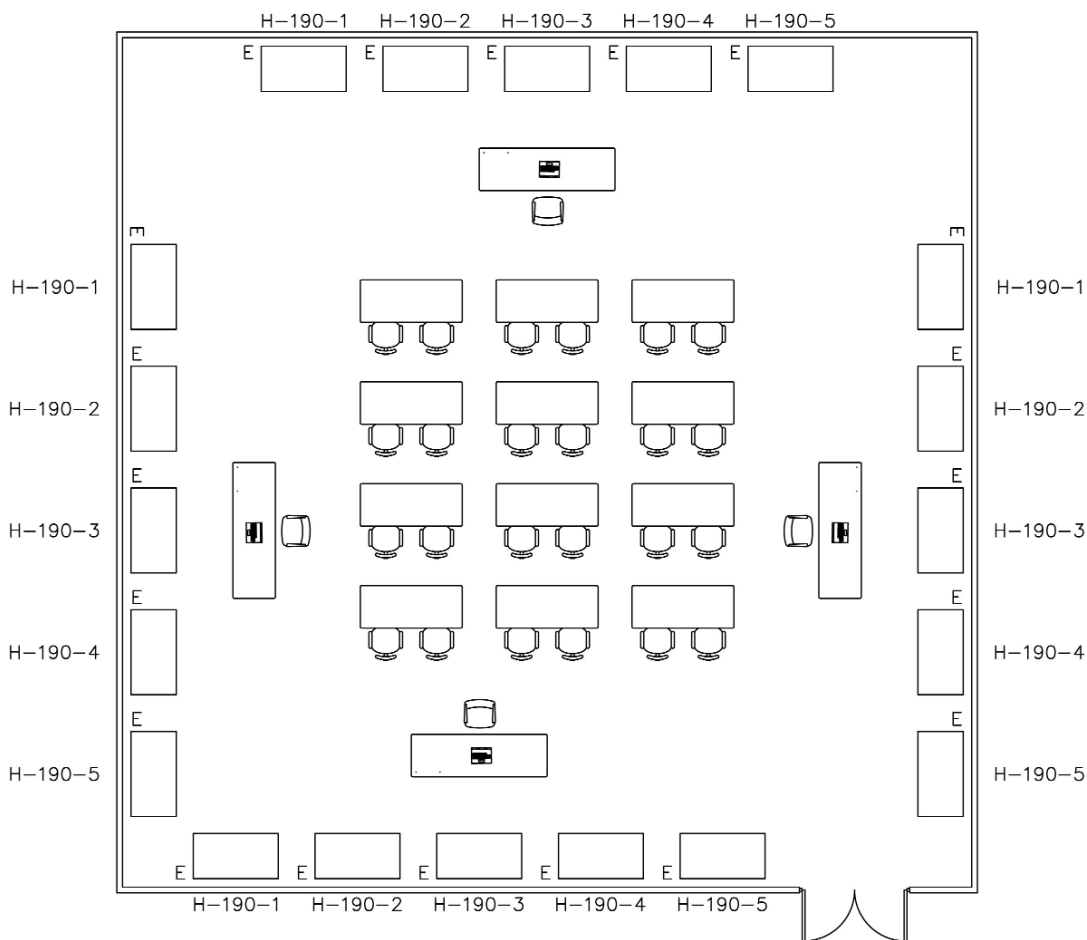
Description

Technical Writing	3
Applied Mathematics	4
Fundamentals of Electricity and Electronics	4
Introduction to Smart Grid	1
Safety Health and Environment	3
Power Generation, Transmission, and Distribution	4
Intelligent Energy Management Systems - Fundamentals	3

No. of Hours

TOTAL CREDITS

22



Smart Grid Lab Layout-3

Standard Products...Designed to Meet your Growing Needs!

CONSUMPTION TRAINERS

Hampden H-RCSD-2B Residential Remote Control Switching Demonstrator



The Hampden **Model H-RCSD-2B** Residential Remote Control Switching Demonstrator provides a complete trainer showing a state-of-the-art home wiring system via programmed or manual remote control of lighting and appliances.

The **Model H-RCSD-2B** Residential Remote Control Switching Demonstrator is based on the Lutron 'Caseta Home Controls' using the various Caseta Smart Bridge Components designed to simulate a residential house wiring system including a complete comprehensive training program.

Hampden H-RCSD-3C Residential/Commercial Remote Control Switching Demonstrator



The Hampden **Model H-RCSD-3C** Residential/Commercial Remote Control Switching Demonstrator provides a complete trainer showing a state-of-the-art building wiring system control of lighting and appliances via programmed or manual remote.

The **Model H-RCSD-3C** Residential/Commercial Remote Control Switching Demonstrator is based on the Lutron 'Castea Home Controls' using the various Caseta Smart Bridge Components in addition to Ring, Nest, and Amazon components designed to simulate a residential/commercial system, including a complete comprehensive training program.

Hampden H-RCSD-4 Home Audio, Video and Surveillance Control Wiring Demonstrator



The Hampden **Model H-RCSD-4** Home Audio, Video and Surveillance Control Wiring Demonstrator provides a complete trainer showing a state-of-the-art home wiring system.

The Hampden **Model H-RCSD-4** Home Audio, Video and Surveillance Control Wiring Demonstrator is based on Leviton® components. Designed to simulate a modern high-tech residential wiring system. The system takes the student through the complete installation, from making connection to programming the controls. Instructor insertable faults are included to teach troubleshooting techniques and skills.

Hampden Hampden H-MZBM Multi-Zone Building Energy Management Trainers

Purpose

The **H-MZBM-T1C** and **H-MZBM-J2A** Multi-Zone Building Energy Management Trainer provides a means for training students in the installation, operation, and troubleshooting of a variable air volume unit and a constant volume air handler.

The control system allows on-screen menu-prompting displays and operator responses. The controller is used to permit the operator to control every phase of the Energy Management process.



Hampden H-MZBM-T1C Multi-Zone Building Energy Management Trainer

Features

- State-of-the-art Honeywell Controls
- Remote Computer Communications
- Programmable
- Simulated Fault Conditions - Five Selectable
- Graphic Displays
- Selectable Loads and Environments
- Safety - Access to 24V AC only
- Courseware - Student & Instructor
- Honeywell - WEB-8000 Controller with WEBS-N4 and Niagra Framework



Hampden H-MZBM-J2A Multi-Zone Building Energy Management Trainer

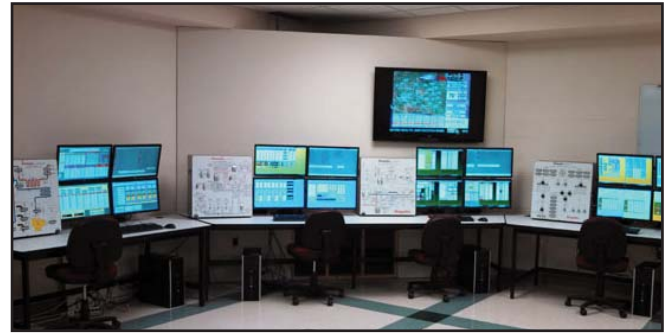
Features

- State-of-the-art Johnson Controls
- Remote Computer Communications
- Programmable
- Simulated Fault Conditions - Five Selectable
- Logic Displays
- Selectable Loads and Environments
- Safety - Access to 24V AC only
- Courseware - Student & Instructor
- Facility Explorer Software

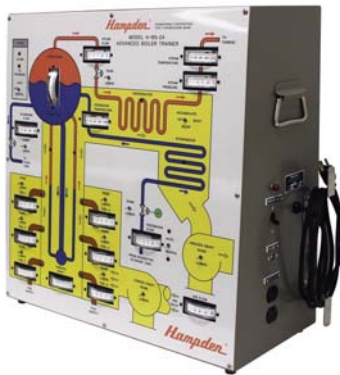
Standard Products...Designed to Meet your Growing Needs!

GENERATION AND DISTRIBUTION SIMULATORS

“Smart grid” generally refers to a class of technology being used to bring utility electricity delivery systems into the 21st century, using computer-based remote control and automation. These systems are made possible by two-way communication technology and computer processing that has been used for decades in other industries. They are beginning to be used on electricity networks, from the power plants and wind farms all the way to the consumers of electricity in homes and businesses. They offer many benefits to utilities and consumers - mostly seen in big improvements in energy efficiency on the electricity grid and in the energy users’ homes and offices.



Hampden H-185-2A Advanced Boiler Trainer



MODEL H-185-2A Advanced Boiler Trainer

The Hampden **MODEL H-185-2A** Hampden Advanced Boiler Trainer serves to demonstrate principles of operation and troubleshooting techniques of a current model boiler system.

The boiler system simulation is based on a typical fossil-fired power plant including operational systems, digital controls, analog control loops, alarms and trips.

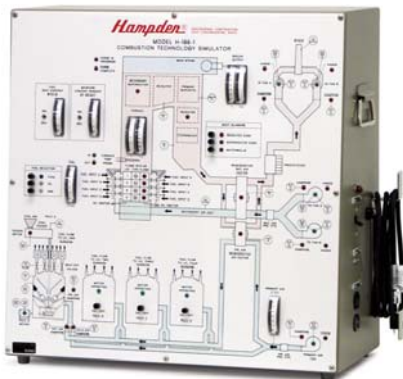
Operational hands-on activities performed by students also include; real time, dynamic experience with all phases of oil, gas and pulverized coal firing.

The **MODEL H-185-2A** Advanced Boiler Trainer is a fully computer-controlled unit designed to interface with a supplied Laptop Computer and covers all aspects of plant operation.

The following insertable malfunctions may be accessed via the computer program:

- Forced Draft
- Induced Draft
- Drum Level High
- Drum Level Low
- Boiler Temp High
- Boiler PSI High
- Low Oxygen
- Pollution
- Feedwater

Hampden H-186-1 Combustion Technology Simulator



MODEL H-186-1 Combustion Technology Simulator

The Hampden **MODEL H-186-1** Combustion Technology Simulator serves to demonstrate principles of operation and troubleshooting techniques of a current power plant combustion system.

The combustion technology simulation is based on a typical modern power plant balance draft combustion system with simulation to include air and fuel systems, analog control loops, digital controls, alarms and trips.

The **MODEL H-186-1** Combustion Technology Simulator is a fully computer-controlled unit designed to interface with a supplied Laptop Computer. Instructors may insert simulated system faults into the system, such as:

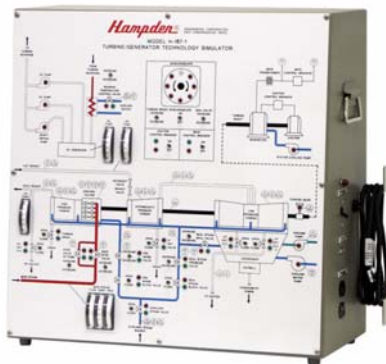
- Heater Level High
- Oil Gun Off/Trip
- Gas Gun Off/Trip
- ID Fan Trip
- FD Fan Trip
- Master Fuel Trip
- Furnace PSI Trip
- Main Gas Valve Trip
- Air Velocity Low
- Pulverizer Motor Trip

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

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Real-Time Training & Troubleshooting...in the Classroom

Hampden H-187-1 Turbine/Generator Technology Simulator



MODEL H-187-1
Turbine/Generator Technology Simulator

The Hampden **MODEL H-187-1** Turbine/Generator Technology Simulator demonstrates principles of operation & troubleshooting skills of a steam turbine/generator system.

The steam turbine/generator simulation is based on a typical modern steam turbine/generator system including turbine operation, analog control loops, digital controls, alarms and trips.

The **MODEL H-187-1** Turbine/Generator Technology Simulator is a fully computer-controlled unit designed to interface with a supplied Laptop Computer.

Instructors may insert simulated mechanical or electrical faults into the system, such as:

- Turbine Trip
- Low Vacuum Trip
- Turbine Exhaust Hood Temp High
- Lube Oil Tank Low
- Generator Field Temp High
- Bearing Trip High
- Bearing Vibration High

Hampden H-188-1 Generation and Distribution Fundamentals Trainer

The Hampden **Model H-188-1** Generation and Distribution Fundamentals Trainer is designed to demonstrate the principles of electrical power generation. The Hampden **Model H-188-1** Generation and Distribution Fundamentals Trainer is a fully computer-controlled unit designed to interface with a supplied Laptop Computer.

A Windows® based computer provides operator control and interaction. A synchroscope display and a phase angle display represent the phase difference between running and incoming sources.

A graphic representation of how load is shared by two machines of different sizes is shown using a generator characteristics curve. The relationship between real load and reactive load is displayed using meters and by a pictorial diagram of a power triangle.

A variety of inductive, resistive, and capacitive loads can be turned on and off, reinforcing the effects of reactive load and how power factor can change. The trainer easily supports instructor demonstration, student practical exercises, and self-study programs.



Hampden **MODEL H-188-1**
Generation and Distribution Fundamentals Trainer



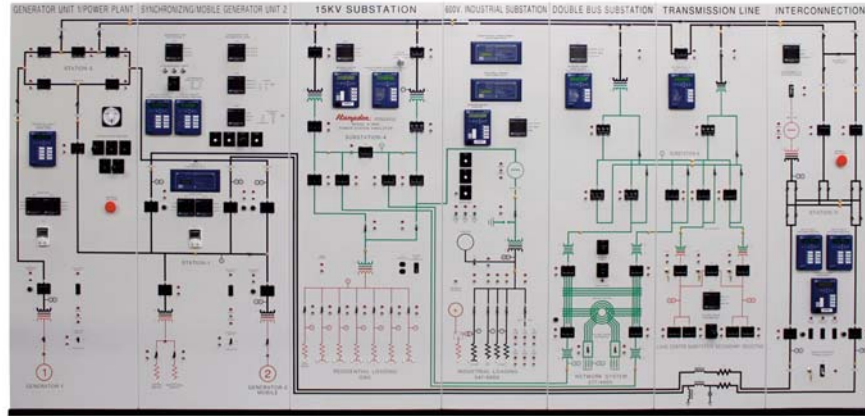
Connected Mode

Connected mode is a feature which combines Hampden's Power Trainers together to create a completely unique training experience. Connected mode combines the Hampden H-186-1 Combustion Technology Simulator, H-185-2A Advanced Boiler Trainer, H-187-1 Turbine/Generator Technology Simulator, and the H-188-1 Electrical Generation Fundamentals Trainer into a complete power generation simulator from generation to final destination.

Standard Products...Designed to Meet your Growing Needs!

GENERATION AND DISTRIBUTION TRAINERS

Hampden 180A Power System Simulator



The essence of all operations are modeled on a typical central station utility.

Basic system operations include:

- Time
- Diversity of Loads
- Multiple Sources of Generation
- Interconnection of Systems

Understanding of these concepts is necessary for any successful presentation or study of basic central station utility systems, and also form the basis for the design and development of new sources of reliable power.

The control panel of Hampden's Power System Simulator has been designed to provide full functionality and control for the following operational factors:

1. **LOADS**
2. **VARIABLES IN THE SUPPLY OF ELECTRICITY**
3. **DEMAND METERING**
4. **TRANSMISSION**
5. **RELIABILITY OF SERVICE**
6. **LOCAL GENERATION**
7. **FEEDER DESIGN**
8. **OTHER EXPERIMENTS**

Hampden H-DTT-26 Transformer Lab Kit



MODEL H-DTT-26
Transformer Lab Kit
Shown with **MODEL H-PRM-26** option

Purpose

The Hampden **Model H-DTT-26** allows students to correctly make connections to power transformers located on utility poles.

Description

Following instruction, students will work in a lab using miniature hardware that mimics the appearance of real-world equipment. They will use an apparatus that looks like a short length of power line. The upper 3 wires will represent the high voltage line (an optional 4th wire, representing a common neutral is also supplied), the lower 3 wires (4 wires for some configurations) will represent the service voltages from the transformer to the customer's secondary connections.

Specifications

Power Source

The model is powered by 120/208V AC, provided from outlets in the lab room. The model contains safety features to limit current should a direct short circuit occur. The **Model H-DTT-26** is designed for 3Ø input. If 120V input is required, specify **Model H-DTT-26-120**.

Safety

Low voltage outputs provide a safe environment for students.

Standard Products...Designed to Meet your Growing Needs!

GENERATION AND DISTRIBUTION TRAINERS

Hampden H-DNT Distribution Network



Purpose

The Hampden **Model H-DNT** Distribution Network Trainer provides students and trainees with practical experience in the operation, maintenance and troubleshooting of network systems. The Distribution Network Trainer can also be used as a working model for lecture demonstrations.

Description

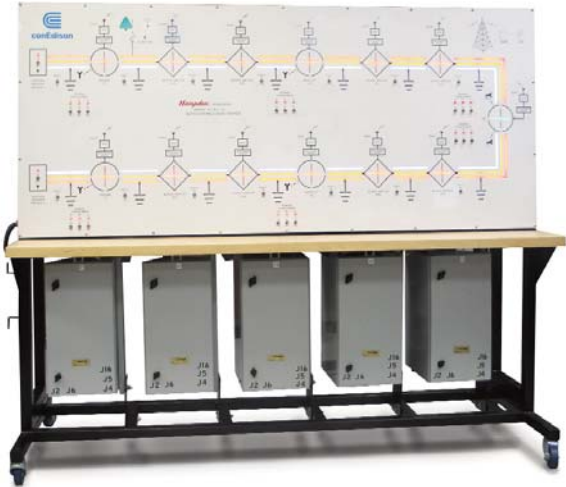
The Hampden **Model H-DNT** Distribution Network Trainer consists of a mobile frame on which a panel and enclosure are mounted. The panel contains switching, instrumentation and graphics depicting a typical network system. Within the enclosure is a computer for control

and instructor interfacing to the system. The monitor and keyboard sit on a shelf mounted on the right hand side of the trainer.

Power into the trainer is via a ten foot power cord which feeds into the main circuit breaker. Both are located on the left hand side of the trainer.

The graphics depict a three circuit substation feeding three distribution lines. The three distribution lines feed seven network units and two fused disconnects. Five of the network units feed a low voltage secondary grid. The remaining two networks feed to a spot network with their outputs feeding a collector bus. The two disconnect switches are connected as a dual primary or loop distribution scheme.

Hampden H-LRT-1 Loop Reclosure Trainer



Purpose

The Hampden **Model H-LRT-1** Loop Reclosure Trainer provides students and trainees with practical experience in the operation, maintenance and troubleshooting of distribution reclosers in general, and reclosers in a loop specifically.

Description

The system depicted on the front panel of this trainer is of a simple loop, fed from two separate transformers. This system utilizes five reclosers on the graphics, two of which are inactive and three that are active. The active reclosers are connected to actual reclosures, while the inactive

reclosures are graphics only and do not interact with the actions of the actual reclosures. The portion of the loop graphics that interact with the three reclosures are connected to the reclosures through the three sets of connectors located on the lower rear of the panel. There is one set of connectors for each simulated Reclosure. These are labeled "Sectionalizing", "Mid-point", and "Tie" to correspond with the three actual reclosures. At each of the three line sections, between the feeder and the three reclosures, any of the three phase voltages can be switched off to simulate a loss of voltage. Also, between the three reclosures, both fused and unfused faults to ground are graphically shown, and can be simulated.

Although the trainer depicts a three phase system, it operates on 120 volts single phase and all voltages are internal so that there is no hazard while operating the trainer. The reclosures can be opened for adjustment, testing and maintenance. The instructions supplied by the manufacturer of the Reclosure must be followed regarding safety and operation. The power is fed into the trainer's main circuit breaker via a three conductor #14 AWG cord, both of which are located on the left hand side of the trainer.

The trainer is controlled by a state of the art computer system, integral to the trainer. It contains the control program, written in a high level language. The program allows the instructor to interact with the trainer as well as providing student tracking. Within the enclosure is a stand-alone controller, which controls the trainer when not interacting with the instructor's connected computer.

Power Required

120 volts, single phase, 15 amperes, 60 hertz, plus a ground.

ADDITIONAL GENERATION TRAINERS

Hampden H-PVIT-1 Photovoltaic Installers Trainer



Purpose

The Hampden **Model H-PVIT-1** Photovoltaic Installers Trainer has been designed with the latest Industrial/Commercial components available. The trainer will provide the necessary training in completing a fully functioning, grid-tied solar electric system. This system will have the capability to be fully monitored and controlled.

Description

The Hampden **Model H-PVIT-1** Photovoltaic Installers Trainer consists of a mobile steel frame with (4) solar panels mounted on the rear. The solar panels are mounted to a frame that allows the panels to be positioned for optimal sun exposure. The front of the frame has all the intricate components mounted for easy access. The frame includes (4) swivel casters, 2 with brakes.

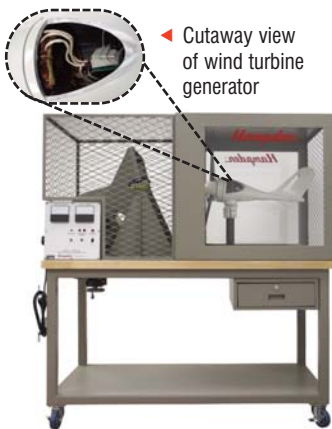
The Hampden **Model H-PVIT-1** Includes the following parts:

- Solar modules
- Combiner Box
- Lightning Arrestor
- Solar Charge Controller
- System Control Panel
- Sealed Gel Cell Batteries (4)
- Power Distribution Panel
- Hybrid Inverter/Charger

Option:

H-PVIT-MAST - Mobile Solar Array with Tracking

Hampden H-WPG-1B Wind Powered Generator



◀ Cutaway view of wind turbine generator

The Hampden **Model H-WPG-1B** Wind Powered Generator has been designed to provide the student with the basic understanding of how wind generators function as an alternate source of energy. This system consists of a wind source, an AC generator, control panel with internal battery and base assembly.

Hampden H-WTS37-CA Wind Turbine Cutaway



The Hampden **Model H-WTS37-CA** Wind Turbine Cutaway demonstrates the internal operation of a wind generator. The Wind Turbine is mounted on a mobile base with two locking casters. For safety reasons the turbine blades have been cut down. The turbine is fully motorized, and is designed to rotate at approximately 3 rpm. The motor is connected to the blade via a slip clutch system that provides an added level of safety.



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