

# Smart Grid Trainers

Educational Training Equipment for the 21st Century

Bulletin 190-3A

## 190 Series Smart Grid Trainers

### Purpose

The **Hampden 190 Series** of Smart Grid Trainers have been developed to educate students with the technology being used in the field of electrical power generation and distribution. Each individual module will demonstrate a key section of the power grid. When the individual modules are combined a modern smart grid is created.

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.



**Hampden Model H-190-3**  
Electrical Generation Synchronization Trainer  
Dimensions: 75"H x 44"W x 32"D  
Shipping Weight: 854 lbs.

### Features

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

- 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.



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

**Hampden**  
ENGINEERING CORPORATION