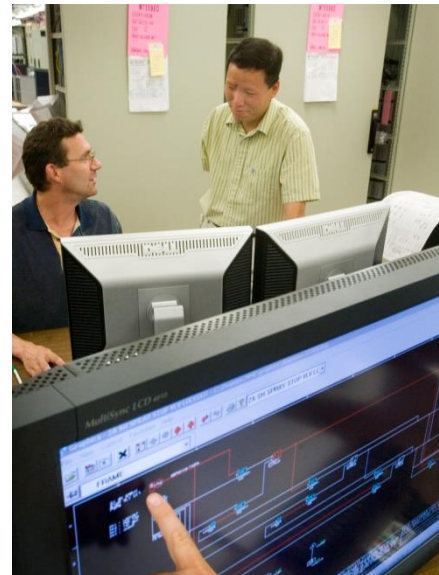


# Ovation™ Simulation with Empirical Models

## Features

- Cost effective tool that uses empirical models to replicate the operation of key plant equipment with simplistic accuracy
- Provides real-time basic operator training on fundamental actions such as plant startup, shutdown and reaction to pre-programmed malfunctions
- Uses simulated software logic that interacts with a replica of the plant's control logic and graphics
- Employs models created from standard Ovation algorithms designed specifically for the power generation industry
- Verifies logic prior to downloading to the "live" control system
- Provides an offline system for development of operating procedures as well as Ovation system familiarization and troubleshooting



## Introduction

For decades, Emerson has delivered leading-edge simulation technology to the power industry that helps to increase plant efficiency and enhance operator performance.

Ovation™ Simulation by Emerson provides scalable, engineered solutions to help smooth personnel and technology transitions during times of change.

With Ovation simulation, the complete understanding of complex operations and unique plant characteristics gained through years of on-the-job experience can be easily transferred from your current operations specialists to new generations.

Ovation simulators can be tailored to meet the unique operational challenges of your facility.

Utilizing a mix of empirical models and comprehensive high-fidelity models, Emerson can provide a wide

range of engineered simulation solutions that best fits your needs and budget.

## Empirical Simulation Models

Ovation simulation using empirical models is an economical tool for fundamental power plant operator training on activities such as basic plant startup, shutdown and reaction to preprogrammed malfunctions. Simulation with empirical models also provides a means for operators to gain familiarization with workstation functions and control system navigation. The extent of empirical simulation can vary depending upon the type and complexity of modeled systems.

Empirical simulation, based upon process relationship observations, replicates the operation of key plant equipment with simplistic accuracy. Simulation models are created using standard

Ovation control algorithms that are programmed with plant specific data and tuned to approximate operating conditions.

The simulation employs a closed loop environment where the models use the factory tested control system outputs and empirical data to calculate simulated control system inputs.

## Flexible & Modular Design

Ovation's empirical simulation uses a modular design which provides customers the flexibility to simulate either the entire plant or a small section of a plant at a time. Simulation capabilities can be expanded or updated to meet plant changes or budgetary constraints. Various components, such as controllers and workstations, can be added to the simulator to keep pace with the plant control system configuration.

## Simulation Inputs and Outputs

Analog simulation is implemented with first order lags along with various math operations including but not limited to integration, steam tables and 3D functions. Appropriate time delays are included to simulate valve travel. Digital simulation includes run/stop or open/close feedback. The table below provides additional details on the simulated analog and digital I/O.

Ovation Empirical Simulation I/O	
<b>Analog I/O</b>	
<b>Constant value</b>	The point will be set to one value and that value will be maintained throughout simulation.
<b>Function of another analog value</b>	The value will act as a function of a more complicated simulated analog value; for example conductivity following megawatts.
<b>Triggered through digital inputs</b>	The value will be triggered to change based on a digital signal; for example a motor breaker signal causing a change in value for amps.
<b>Looped back in basic analog input simulation loop</b>	The input will be a function of the output that would drive the device in the field; for example an analog valve control loop.
<b>Complex calculation</b>	Some more important variables require extra calculation to provide for a realistic simulation; examples include megawatts, drum level and feedwater heater level.
<b>Digital I/O</b>	
<b>Constant value</b>	The point will be set to one value and that value will be maintained throughout simulation.
<b>Looped back</b>	The input will be a function of the output that would drive the device in the field; for example digital valve control.
<b>Linked to analog values</b>	The digital signal will be driven based on simulated analog values; for example high and low alarms for levels.

## Simulator Architecture

The Ovation simulator using empirical models typically includes the following hardware and software components:

- A dedicated virtual controller for the empirical simulator logic
- One non-redundant controller for each redundant controller included in the plant control system. These non-redundant simulator controllers contain a replica of the plant control system logic
- Engineering and operator workstations based on customer requirements
- Replica of existing plant control system graphics
- Up to 20 local permissive graphics
- Software licenses for virtual controllers, engineering workstations and operator workstations
- A graphical interface that provides basic instructor station functionality including run, freeze, load, save and delete

- **Integrate the simulation software with a replica of plant DCS software** – Emerson integrates the simulation application software with a replica of the plant's control system software.
- **Verify simulation application software** – Emerson performs tests to verify simulated signal generation, individual subsystem operation and operation of the integrated simulated plant system.
- **Conduct Factory Acceptance Test** – Emerson and customer representatives' test the proper simulation of individual subsystems and the integrated simulated plant system.

©2017 Emerson. All rights reserved. The Emerson logo is a trademark and service mark of Emerson Electric Co. Ovation™ is a mark of one of the Emerson Automation Solutions family of business units. All other marks are the property of their respective owners. The contents of this publication are presented for information purposes only, and while effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available on request. We reserve the right to modify or improve the designs or specifications of our products at any time without notice.

## Implementation Process

Implementation of an empirical simulation solution consists of the following activities:

- **Confirm the detailed scope of simulation (input signals)** – Typically, within two weeks of contract award, a kickoff meeting is held at the customer's site to confirm the detailed simulation scope and collect the customer's final control system database that includes input/output signals with attributes.
- **Determine the specific type of simulation for each input signal** – Emerson prepares a complete list of input signals and simulation complexity level based on the approved control system. The list is submitted to the customer for review and approval.
- **Generate the control-builder drawings for simulation** – Emerson generates a complete set of empirical simulation drawings based on the approved simulation types and submits the drawings for customer comment and/or approval.