POWERMAX® ['pou (ə)r 'maks] noun: a system designed to maintain stability

Niraj Shah
SPS Branch of SEL Engineering Services Inc.
Agenda

• POWERMAX – Power Management System Introduction
• POWERMAX – Functionalities (IDDS, LSP, GCS, A25A)
• POWERMAX – Simulators
• MOTORMAX – LV Motor Management System Introduction
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POWERMAX Simulators

- Static simulator
- Simulator with load flow
- Simulator with playback
- Dynamic simulator (RTDS)

It is recommend to at least perform a static simulator with load flow
PMS Simulator Rack

Main HMI Screen
Main HMI
LSP A
LSP B

Simulator HMI Screen
Simulator HMI
Simulator Platform
Real Time Digital Simulator (RTDS)

• Electromagnetic Transients Program (EMTP) simulator
• Advanced parallel processing techniques
• Power system state calculation every 50 $\mu$s
• Ability to perform closed-loop testing with physical protection and control devices in real-time
System Modeling and Testing Services

- Power system model development
- Load flow and short-circuit analysis
- Harmonic analysis
- Coordination studies
- Reports
- System protection scheme design, setting, and validation
- Inrush studies
- Frequency and voltage stability analysis
Dynamic Simulations Using Real-Time Simulator

- Combines detailed system model with real-time closed-loop testing
- Validates schemes’ functionality for speed and reliability
- Optimizes thresholds through test case iteration
- Improves understanding of system dynamics
Control Cost, Quality, and Features With HIL Testing

Both mechanical and electrical systems must be modeled accurately.
Real-Time Interaction – System Dynamics
DER Capability Modeling

- Q (MVAR) Turbine Capability
- Allowable Operating Region
- Generator Capability Curve
- Operator-Entered Regulation Limits
- P (MW)
- Short-Term Capacity Limit
- Long-Term Capacity Limit
- Allowable Operating Region
Hardware-in-the-Loop Testing

SEL PMS Controller
Fit for Function Modeling

![Graph showing the relationship between time and frequency for simulation and field data. The graph has a time axis from 0 to 40 seconds and a frequency axis from 59 to 66 Hz. The graph indicates that the frequency for both simulation and field data peaks around 10 seconds and then decreases over time.]
Factory Acceptance Testing
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SEL MOTORMAX™ Redefines LV Motor Management

• SEL protection
• Complete HMI
• Arc-flash protection
• Remote management
• Scales for any size MCC
• Engineering tools
• 100% factory tested!
Eliminate Hard Wiring With One Ethernet Cable

Power Management System

SEL-2730M

- Fast AFD and Commands
- Metering Data

SEL-3530 RTAC

- Web-Based HMI

SEL-2730M

SEL-3421

Motor / LV Feeder Management Relay

SEL-751

Incoming Feeder, Bus Tie, and Large Outgoing Feeder Protection

SEL-849

Eliminate Hard Wiring With One Ethernet Cable

Arc Flash!

Trip Signal in 9–14 ms!
100% Situational Awareness With Intuitive One-Line Diagrams
SEL-751 Detailed Pop-Up Screen Provides More Details
Safely Manage Motors Remotely

HMI bus views mimic MCC general arrangements

SEL-849
LOAD OFF
C5F-08
59-HOLD-3.05
Summarizes Full SEL-849 Data Set
Linking Process Control to POWERMAX

POWERMAX Network

- Load Shedding
- Turbine Dispatch
- Generator / Exciter Dispatch
- SCADA
- Engineering
- HV Protection
- MV Protection
- LV Protection
- MOTORMAX

PCS Network

- Steam Dispatch
- Process Optimization
- HMI
- Engineering Databases

Windows®-Based Systems