SEL powerMAX® Power Management for Industrials

Prevent, detect, and mitigate blackouts

- Maintain system uptime, maximize asset utilization, and prevent outages.
- Improve total system performance awareness.
- Keep critical processes online during grid disturbances.
- Scale to fit any power system size.

Engineered to Meet the Demands of Industrial Operations

SEL POWERMAX Power Management and Control System technology is specifically engineered for industries with critical processes that need to stay online, including:

- Oil and petrochemical refining operations.
- Pulp and paper manufacturing facilities.
- Mining and metals processing facilities.
- Water and wastewater treatment plants.
- Data centers.
- Any production facility with onsite generation.

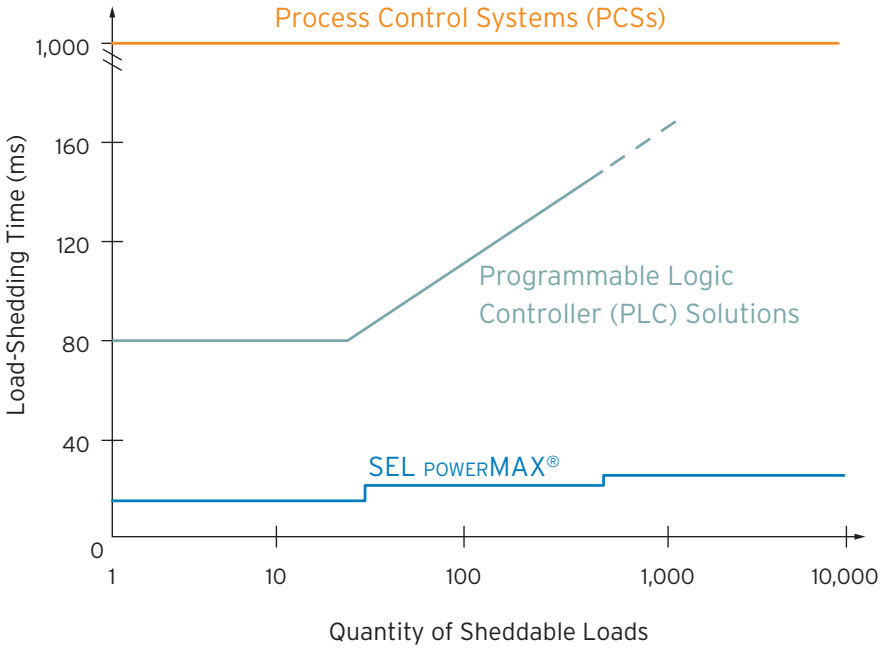
POWERMAX is a proven solution that improves power system reliability, personnel safety, and process uptime.

Benefit From Proven Performance

Since 2004, SEL engineers have completed over 200 POWERMAX projects for industrial facilities. POWERMAX is cost-effective, as many of these systems provide users with full payback on their investment the first time the system prevents a blackout or process outage.

SEL-patented subcycle (16-millisecond) load- and generation-shedding techniques are a proven method of preventing power system blackouts. These fast control schemes prevent frequency collapse, voltage collapse, and out-of-step-induced outages by operating faster than one power system cycle. POWERMAX Systems can simultaneously avoid process impact and prevent blackouts by intelligently shedding interruptible process loads.

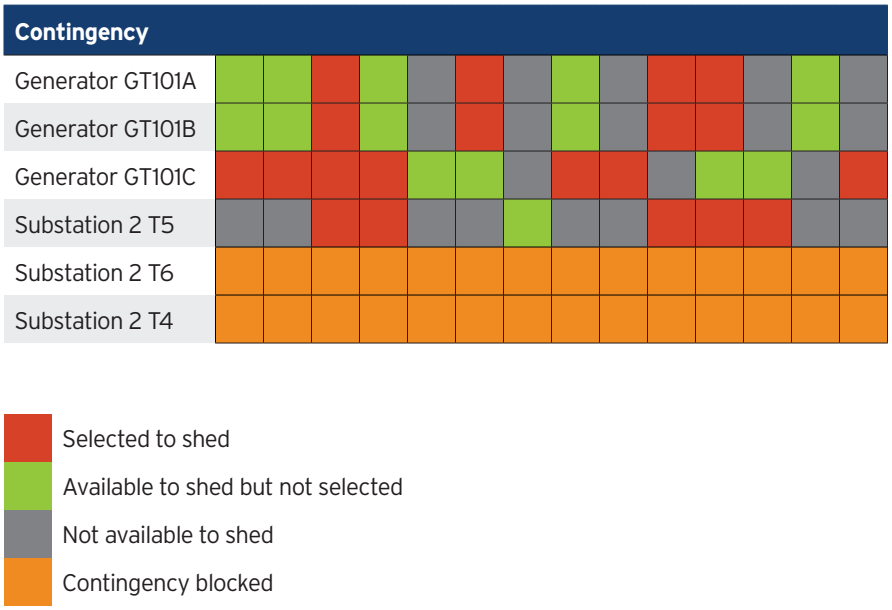
POWERMAX includes both fast- and slow-acting load-rebalancing schemes to prevent outages. Fast rebalancing schemes, such as subcycle load and generation shedding, prevent out-of-step behavior, rotor angle notabilities, frequency decay, and voltage collapse. Slower schemes prevent generator overload, automate synchronization, and provide utility curtailment. These methods provide a seamless transition between grid and island operation without interrupting critical processes.



POWERMAX Systems scale up for any size of power system.

Scalable to Any Power System

POWERMAX architectures scale to power systems of any size and in any location. Deterministic and predictable performance for any size of power system is possible using proven architectures, networks, and protocols. POWERMAX includes algorithms tailored specifically for controlling combustion turbines, steam turbines, and reciprocating engine sets. Mature visualization systems consolidate millions of data points into usable information. This allows personnel to be proactive instead of reactive to incidents and minimizes process downtime.

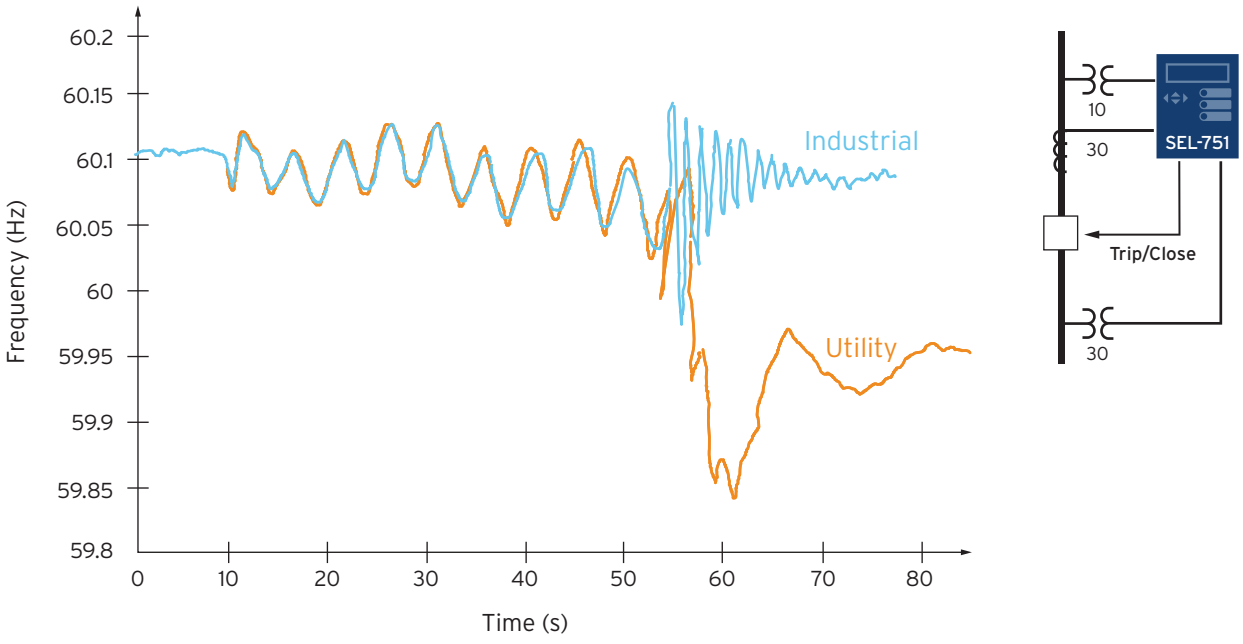


Mature graphics allow the operator to quickly understand system operation.

Flexibility to Optimize Your Operations

SEL-patented algorithms run as embedded code within SEL Real-Time Automation Controllers (RTACs). These algorithms communicate directly to SEL relays for status and control. With the POWERMAX library and robust SEL devices, you get a system engineered to your unique requirements and operating scenarios. Some popular capabilities include:

- Fast load shedding rebalances load with generation within 16 ms.
- Automatic islanding system seamlessly disconnects the power system from an unstable utility source to create a system island.
- As bus configurations (topologies) change, POWERMAX automatically modifies generator operating modes, adjusts system set points, and reoptimizes the power system so processes stay online.
- Intertie scheduler minimizes your utility bill by avoiding peak demand charges and providing continuous dispatch of onsite generation.
- Automatic load restoration re-energizes loads without jeopardizing power system stability.
- Synchronized phasor measurements (synchrophasors) enable a POWERMAX System to accurately monitor and control a facility's power system. This helps ensure synchronized data for root cause investigation and maintenance activities.
- Automatic synchronization systems safely reconnect grids (of any complexity, including any number of generators) to the power system.

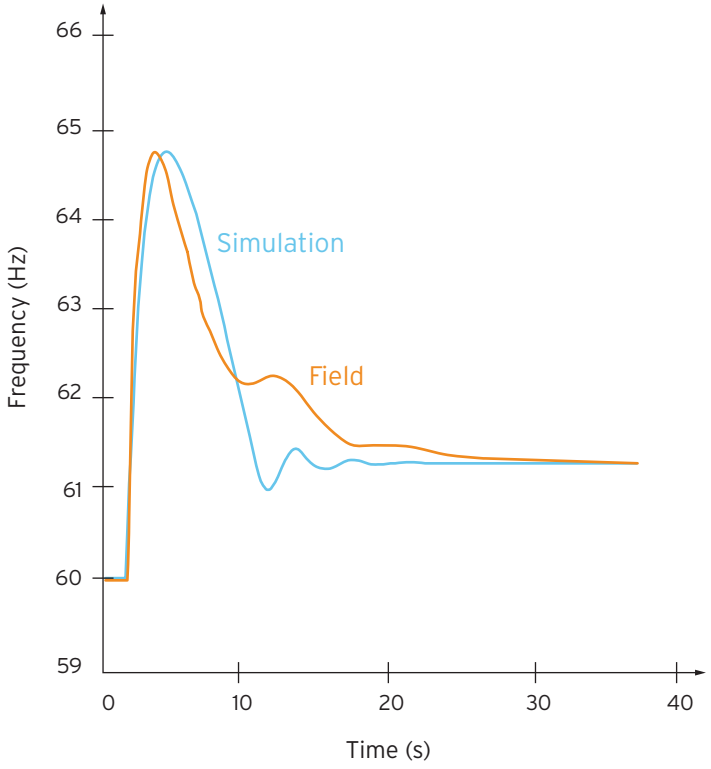


SEL relays distributed throughout a POWERMAX System provide seamless islanding and resynchronization.

Hardware-in-the-Loop (HIL) Testing Ensures Reliable Operation and Faster Deployment

Test your systems before they arrive at your site. SEL modeling experts test POWERMAX Systems on an HIL Real Time Digital Simulator (RTDS®) to validate power system models with data from the field. We use the RTDS HIL platform during factory acceptance tests (FATs) that you attend.

During factory HIL testing, our engineers perform thousands of tests in a few days, providing you with years of operational experience. HIL testing is useful for scenarios that are impossible or too risky to field-test. The results of these tests provide the necessary proof and confidence that the solution will maintain system stability.



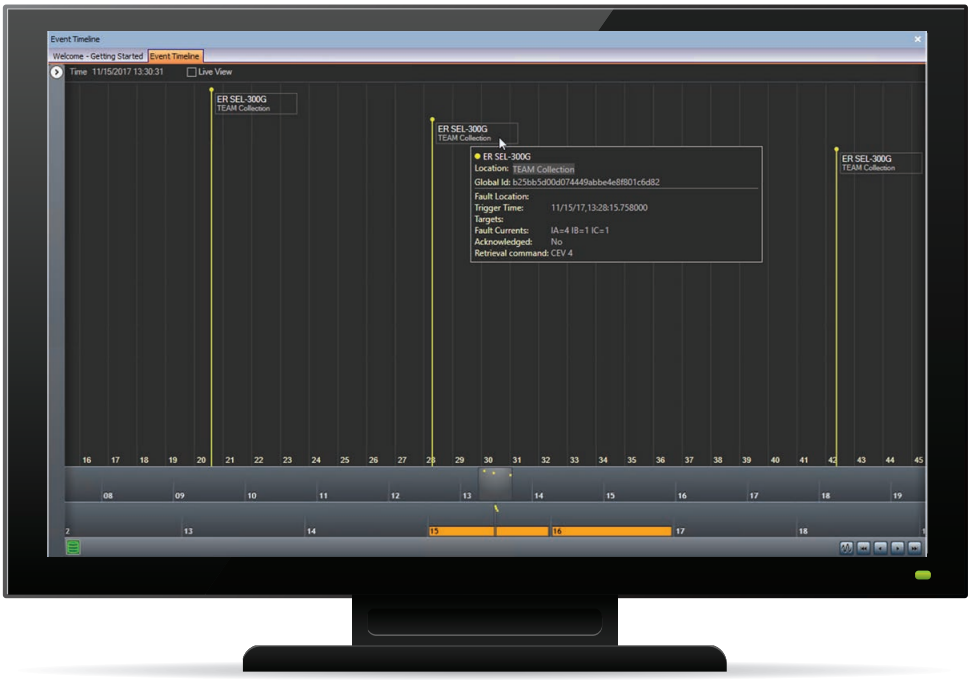
SEL maintains a large HIL testing laboratory that uses validated models to verify the performance of POWERMAX Systems.

Robust Cybersecurity Protection

Our designs, processes, and culture ensure best-in-class security against human error, malware, or malicious attacks, including advanced nation-state zero-day attacks. Since 1984, we have designed security into our products, ensuring the safe, secure, and reliable operation of the power system. SEL engineering teams use proven cybersecurity best practices, system architectures, monitoring methods, and defense-in-depth techniques. SEL systems offer encrypted communications, exe-GUARD® embedded whitelisting technology and a layered cybersecurity architecture. These solutions meet NERC CIP, NIST, and risk management framework (RMF) compliance requirements.

Root-Cause Analysis

All SEL relays, controllers, gateways, and networking equipment provide time-stamped data collection. These data include Sequence of Events (SOE) records, oscillography, synchrophasor data, customer reports, or Simple Network Management Protocol (SNMP) alerts. Time-synchronized data collection ensures you get to the root cause of events every time.



Quickly identify events using the Event Timeline viewer in ACSELERATOR TEAM® SEL-5045 Software. You can hover over the flags to find the fault trigger time and fault currents.

Redundancy for Mission-Critical Power Systems

POWERMAX Systems offer hot-standby, dual-primary, and triple-modular redundancy (TMR), so you can select the system reliability that matches your needs.

All dual systems can be hot, standby, or dual primary.

Simultaneous Event Handling

Proven state estimation techniques ensure that the POWERMAX System continues to make the right decision during events that occur within milliseconds of each other. For example, simultaneous circuit breakers opening at the point of common coupling (PCC) frequently create nested grid sections that require multiple simultaneous load-shedding decisions.

Industry-Leading Support and Quality

Simplify your maintenance with guaranteed support from SEL experts and 24 × 7 availability. We provide personalized, regional technical support from more than 75 regional technical service centers worldwide. Our commitment to quality extends through a product's installation and life cycle as part of your critical infrastructure.

The SEL ten-year, no-questions-asked, worldwide product warranty is proof of our confidence in the quality of products we manufacture. In our company's history, we have never charged to replace or repair a product.

All SEL devices and POWERMAX Systems are designed, tested, and manufactured in the USA. SEL is the chosen protective relay provider for nearly every utility in the United States and is a recognized leader in the electric power industry. Our commitment to making electric power safer, more reliable, and more economical enables us to provide you with innovative products and solutions, outstanding support, and experienced engineers who are committed to your success.

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