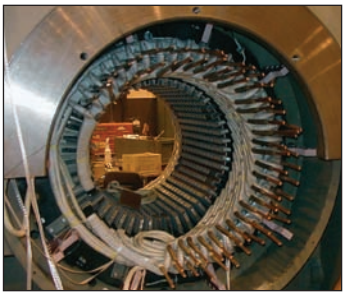
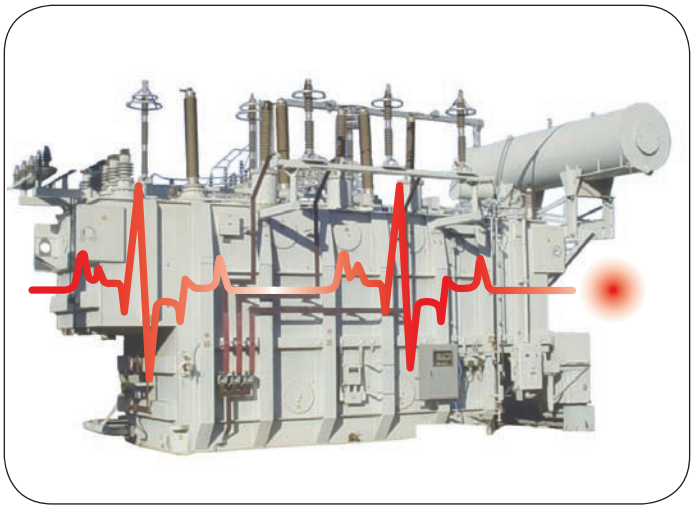
SEL Asset Optimization Solutions



Integrate Relay Data to Simplify Asset Optimization and Reduce Ownership Costs



Predict impending problems.

Make informed decisions.

Measure aging and loss-of-life.

Avoid unnecessary maintenance.

Making Electric Power Safer, More Reliable, and More Economical®

Power System Optimization

SEL-7000 Integrated Substation System and SEL POWERMAX® Power Management and Control System

Reduce maintenance and inspection costs by performing preventive maintenance based on actual performance statistics rather than periodic time schedules. Detect the earliest signs of failure using trended motor operation statistics, instantaneous quantities, and harmonic components.

Work-Order Generation

Prioritize work orders by alerting operations and maintenance staff to failures or excessive wear of critical assets.

Transformer Loss-of-Life

Prevent excessive insulation aging or loss-of-life with relay thermal elements. Activate a control or issue a warning when the transformer overheats.

Breaker Wear

Track average and last circuit breaker operate times, and alert operators of anomalies.

Motor Starting

Utilize actual start performance data to check for out-of-tolerance motor starting, and perform preventive maintenance before an unplanned failure occurs.

Thermal Model

Improve system loading with calculated conductor temperature.

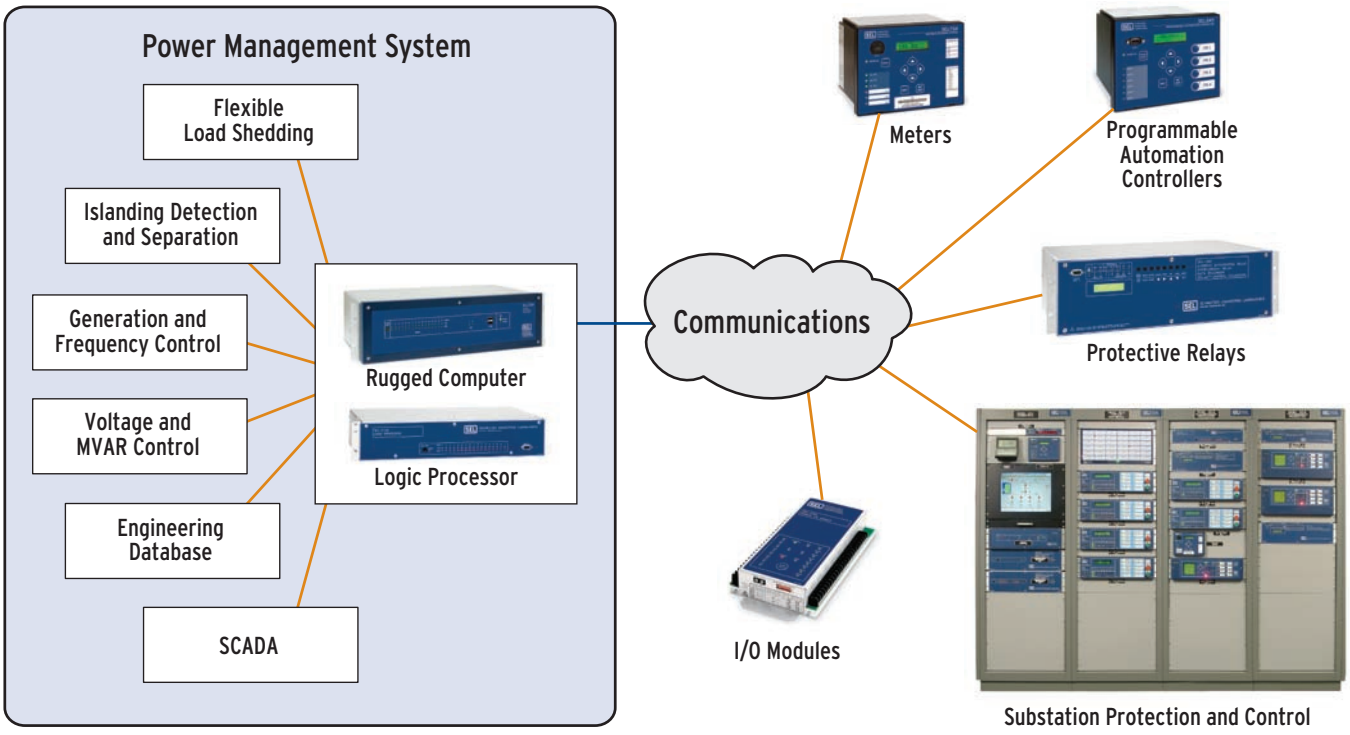
Dynamic Load Leveling

Automatically balance loads on looped or multibus networks with advanced algorithms.

Outage Minimization

Reduce customer outages on critical loads by applying advanced blackout remediation and mitigation techniques.

The SEL-7000 provides integrated human-machine interface (HMI) and event reporting for engineering analysis.



SEL POWERMAX® supports innovative power management applications with secure, high-speed communications.

Substation Transformer Optimization

SEL-487E Transformer Protection Relay

Through-Fault Monitoring

With through-fault monitoring, thermal monitoring, and a built-in IEEE-compliant transformer thermal model, the SEL-487E keeps users informed with timely and complete operational and historical data from substation assets.

Passage of fault current in a transformer winding produces very high mechanical forces as well as high winding temperatures. Damage accumulates each time a transformer passes downstream fault current. IEEE design standards provide lifetime through-fault accumulation guidelines to simplify setting alarm points. Simple preloading of a through-fault value into the relay sets an estimate of prior history for retrofit applications. Reduce maintenance expenses by using accumulated fault duty to schedule winding inspection or preventive maintenance only when the transformer has seen severe duty, not based on a "time only" schedule that may increase maintenance and expenses.

The SEL-487E Transformer Protection Relay provides thermal modeling for monitoring and protection of a single three-phase transformer or three independent single-phase transformers.

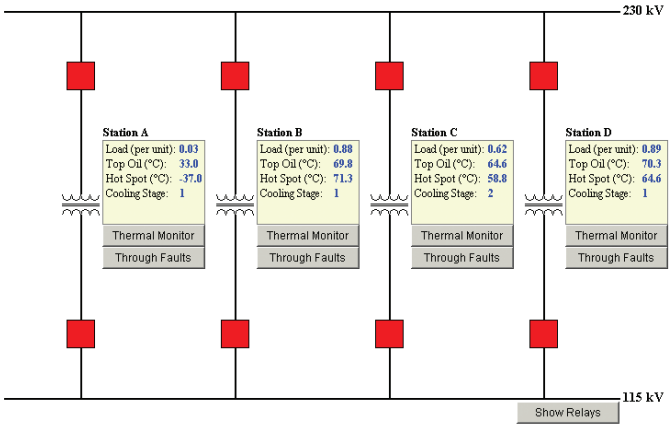
Relay Thermal Monitor Alarms

Top Oil Temperature

The SEL-487E Relay will calculate top oil temperature based on ambient temperature and transformer loading. Calculated top oil temperature is also compared to measured top oil temperature to evaluate cooling effectiveness.

Winding Hot Spot Temperature

With measured ambient temperature and/or measured top oil temperature, the relay will calculate the winding hot spot temperature. Use hot spot temperature to optimize transformer loading and provide operators a tool to redistribute load or judge emergency loading level acceptability.



Load, top oil and hot spot temperature, and cooling stage data are provided by the individual SEL-487E Relays protecting each transformer.

Calculated Transformer Indicators

Insulation Aging Acceleration Factor

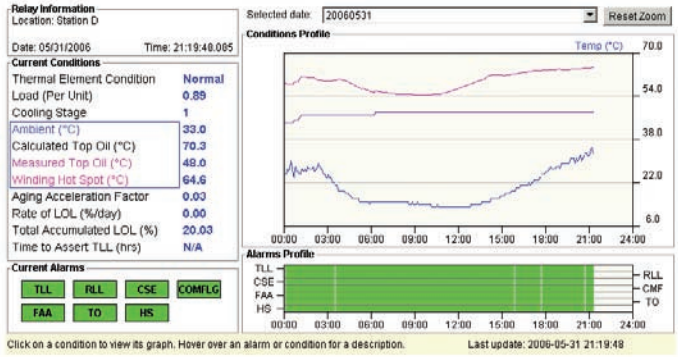
The SEL-487E calculates and reports the rate of insulation aging based on temperature. Optimize transformer loading with the aging rate.

Daily Loss-of-Life

Apply proven IEEE calculation methodology within the relay to report and alarm on high transformer loss-of-life on any given day.

Total Loss-of-Life

Reduce costs by basing maintenance on accumulated loss-of-life instead of calendar time.



An individual transformer thermal report and graph use relay data to show a 24-hour trend for the transformer top oil and hot spot temperature accumulated history.

Circuit Breaker Optimization

SEL-421, SEL-451, and SEL-487E Relays

Complete circuit breaker operation history and performance are recorded in the SEL-421, SEL-451, and SEL-487E Relays. Reduce lifetime costs of circuit breaker installations with operation and condition-based maintenance.

Slow Trip/Slow Close

Mechanical and electrical operate times are recorded and trended within SEL-421, SEL-451, and SEL-487E Relays. If the operate time is longer than a pre-set time or longer than the average, an alarm signal can be sent to maintenance personnel.

Operation Counter

Number of trip and close operations is recorded and available in relay-supplied SCADA data.

Trip/Close Coil Continuity

Eliminate the main cause of breaker failure with continuous trip and close coil monitoring. Avoid missed failures with relay alarms.

Accumulated Interrupted Current

Avoid contact face inspection by recording fault interruption through the relay.

Circuit Breaker Condition Monitor

View compressor motor run time, breaker inactivity time, and other values in the relays' recorders to determine whether or not the breaker needs maintenance.

SEL-421 Protection, Automation, and Control System.

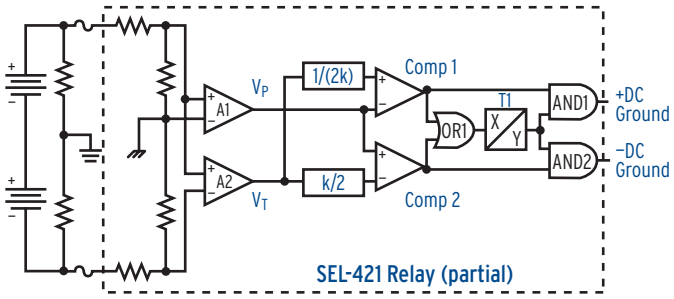
SEL-451 Protection, Automation, and Control System.

SEL-487E Transformer Protection Relay.

Monitor circuit breaker operating characteristics and history to optimize maintenance schedules.

DC Ground Detection

The SEL-421, SEL-451, and SEL-487E have dc ground detector capabilities and can identify and help locate inadvertent dc grounds on the station battery system. By finding grounds quickly, damage is limited, and maintenance time is saved.



Battery ground detection functional diagram.

Pullman, Washington USA
Tel: +1.509.332.1890 • Fax: +1.509.332.7990 • www.selinc.com • info@selinc.com