

POWER SOLUTIONS FOR WIND ENERGY



Wind Generator Feeder Protection
Grid Interconnection
Fault Indication Solutions
Revenue and Power Quality Metering
Engineering Services and Consulting





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

Schweitzer Engineering Laboratories has delivered solutions for over 25 years that make electrical power systems safer, more reliable, and more economical. Wind energy operations worldwide deploy advanced power management solutions from SEL and are supported by SEL engineers who know their industry and business.

Headquartered in Pullman, Washington, USA, and with three world-class manufacturing centers, SEL has sales offices in 15 countries and technical service centers in over 30. We have provided solutions for critical operations in over 135 countries and for some of the most recognizable companies in the world, including:

BP Alternative Energy
Horizon Wind Energy
Texas Wind Power Company
Iberdrola Renewables, Inc.

Innovative Research and Development

Through meticulous research and development, SEL consistently delivers innovative, practical products with unmatched features and performance for protecting and securing electric power systems. SEL products provide secure power system protection, monitoring, automation, communication, metering, and control.

Reliability

SEL designs and manufactures products for the world's most challenging production environments to exceed all industry standards for temperature, shock, and electric stress. SEL products operate in a temperature range of -40° to $+85^{\circ}\text{C}$ (-40° to $+185^{\circ}\text{F}$). They can withstand electrostatic shock up to 15 kV and are vibration/shock resistant up to 15 g.

Ten-Year Worldwide Warranty

The SEL ten-year, worldwide product warranty is proof of our confidence in the quality products we manufacture, following the strictest industry standards.



SEL Product Hospital quickly restores devices to proper operating condition and collects valuable product information. SEL measures and reports data using mean time between failures (MTBF) and mean time between removal (MTBR) statistics.

Learn more by visiting us online at www.selinc.com/renewables.

SEL provides innovative, technologically advanced power management solutions and was chosen #1 among protective relay manufacturers across all categories in a recent study by Newton-Evans Research Company. SEL protection, monitoring, and control solutions meet the specific needs of the wind energy industry.

Wind Generator Feeder Protection

Grid Interconnection

Fault Indication

Revenue and Power Quality Metering

Capacitor Control

Feeder Protection

Alarm and Annunciation

Satellite-Synchronized Timing

Information Processors

Transformer Protection

Breaker Protection

Line Protection

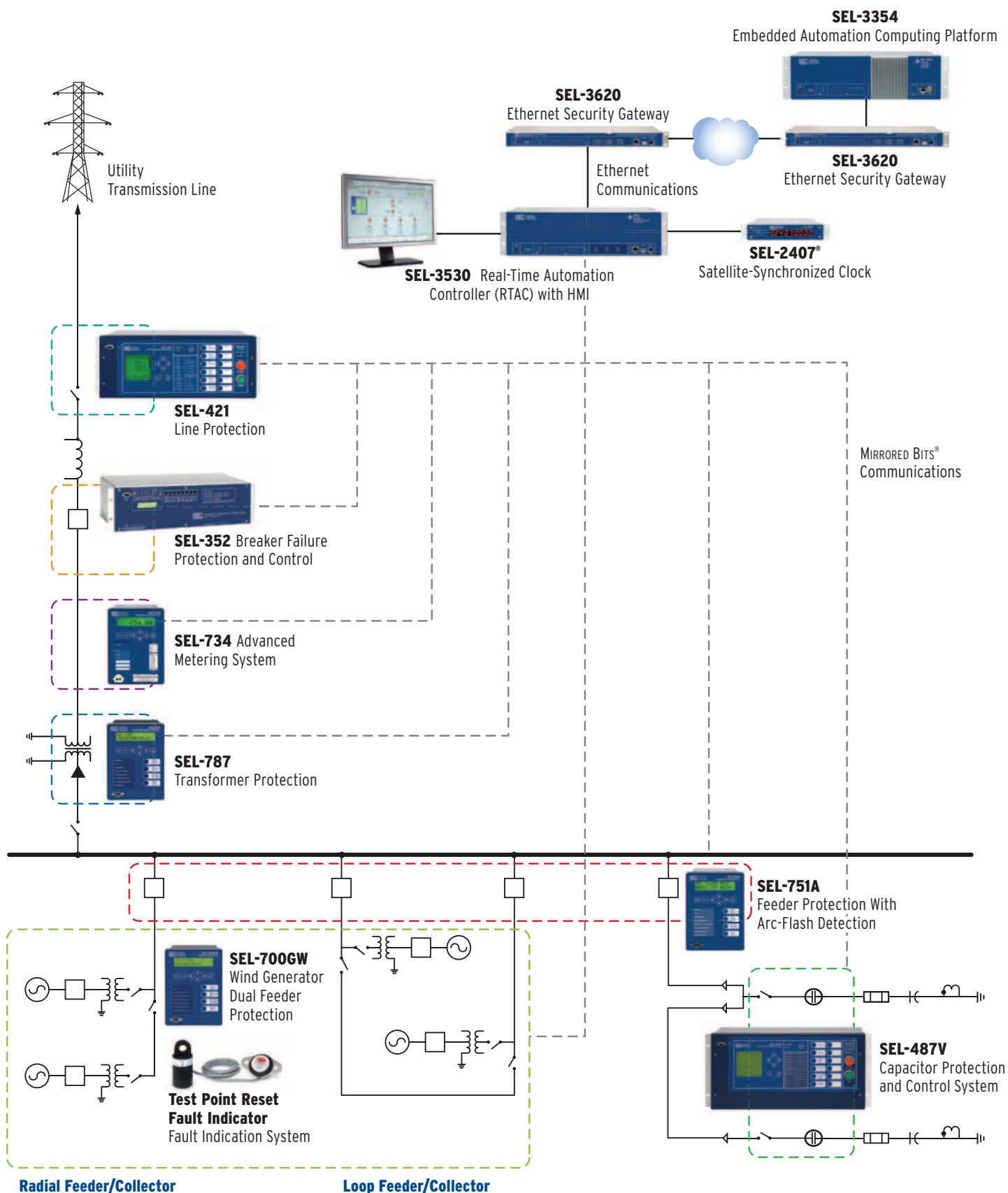
Secure Communications

Engineering Services and Consulting



Trust SEL to Protect, Monitor, and Control Wind Power Systems

Use one platform to collect and display power system data for wind power system automation and control.



One-line diagrams are for illustrative purposes only.
Actual feeder/collector configurations may vary.



SEL-700GW Wind Generator Protection Relay

Wind Generator Feeder Protection

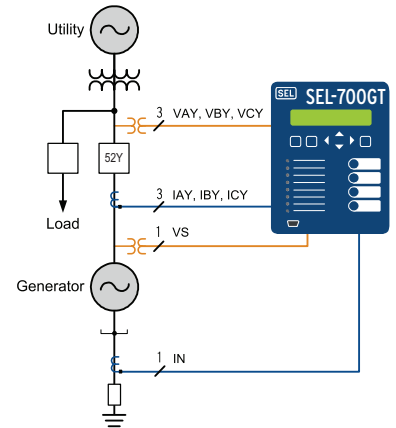
The SEL-700GW provides complete dual feeder protection for distributed generation. High system availability is obtained by using two sets of overcurrent elements (50/51) to detect and isolate a fault on either feeder. The SEL-700GW also provides many functions of a programmable logic controller (PLC). Multiple communications options, a variety of I/O choices, and programmable SELogic® control equations make the SEL-700GW a complete solution.



SEL-700GT Intertie Protection Relay

Grid Interconnection

The SEL-700GT provides an IEEE 1547-compliant intertie protection solution for distributed generation. Optional synchronous generator protection and synchronization provide complete generator and intertie protection in one compact and economical package. Multiple communications options, various I/O choices, and programmable SELogic control equations make the SEL-700GT a complete solution for intertie and generator protection.



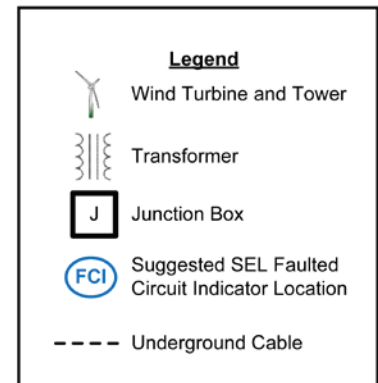
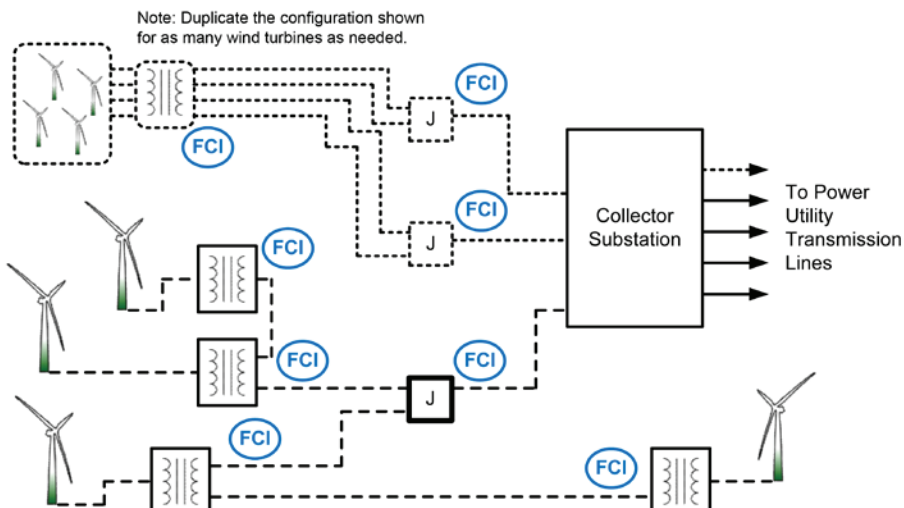
Fault Indication

SEL Faulted Circuit Indicators (FCIs) help operations personnel quickly determine the fault location, isolate the faulted section, and restore power. As depicted in the illustration below, the terminations used for underground cables in the transformers and junction boxes are excellent locations to install faulted circuit indicators. Features and benefits include:

- Line-powered operation (no batteries required) means longer life and limited maintenance.
- High 1200 A current trip value with delayed trip response time option coordinates with most systems.
- Remote display allows indicator status to be quickly determined without opening the enclosures.
- Easy installation on terminators with capacitive test points saves time.
- Integrated junction shields ensure adjacent phase immunity in junction box applications.
- Applicability in both transformers and junction boxes reduces installation errors.



SEL Test Point Rest Faulted Circuit Indicator





*SEL-547 Distributed
Generator Interconnection Relay*

Distributed Generation Interconnection

The SEL-547 Distributed Generator Interconnection Relay allows a wind turbine to be connected to the electric utility grid. When the SEL-547 detects a condition that could adversely affect the generator or the electric grid, it sends a trip signal to the breaker, separating the wind turbine from the utility supply.

- Low-cost compact package incorporating essential protection and control elements for distributed generation
- Protection and control elements required by IEEE 1547
- Modbus® and SEL communications interface



SEL-734 Advanced Metering System

Revenue and Power Quality Metering

The SEL flagship SEL-734 and SEL-734P Advanced Metering Systems provide high-accuracy, four-quadrant metering with advanced load profile recording. In addition to revenue metering, the SEL-734P meter provides advanced yet user-friendly power quality reports, capacitor bank control, and time-synchronized phasor measurements. Indoor mounting options and prewired outdoor enclosures from SEL facilitate high-end metering at virtually any location.



*SEL-751A Feeder Protection Relay
With Arc-Flash Detection*

Feeder Protection

SEL feeder protection solutions provide complete feeder protection, with overcurrent, overvoltage, undervoltage, and frequency elements with flexible I/O options, easy mounting, and fast settings. With the SEL-751A Feeder Protection Relay, you can easily upgrade protection without cutting or drilling existing cutouts with a small form factor and multiple mounting adapters. Quickly integrate into serial- or Ethernet-based communications with IEC 61850, MIRRORED BITS®, DeviceNet™, and other protocols. The SEL-751A also provides fully automatic protection against dangerous arc-flash events. Without arc-flash detection (AFD), an arc flash can cause severe personal injury, extensive equipment damage, and lengthy system outages. AFD interrupts power to the arc flash before it can cause significant damage.



SEL-787 Transformer Protection Relay

Transformer Protection

SEL transformer protection solutions allow you to optimize the life of your transformers by monitoring key health indicators with cumulative through-fault current recording measurement and logic input. With the SEL-787 Transformer Protection Relay, you can apply 2 three-phase winding inputs, and an optional single-phase restricted earth fault input and three-phase voltage input. Benefits include advanced automation and flexibility, single or dual, copper or fiber Ethernet communications ports, asset management data, and easy retrofit of most electromechanical relays.



*SEL-2523 Annunciator Panel
SEL-3010 Event Messenger*

Alarm and Annunciation

Make complex alarming simple with SEL's alarm and annunciation panels, including 42 inputs, 11 outputs, programmable logic, and up to four communications ports supporting DNP3, Modbus, and SEL protocols. You can simplify commissioning and troubleshooting with a built-in sequence of events recorder and full software HMI. Apply an SEL-3010 Event Messenger for telephone voice call-out of critical alarm conditions.

Breaker Failure Protection and Control

SEL solutions provide breaker failure protection, breaker control, and breaker monitoring. Benefits of the SEL-352 Breaker Failure Relay include a cost-saving data recorder and a sophisticated controller to reduce maintenance and manual operations. The relay features circuit breaker failure protection, including failure to trip for fault or load conditions; failure to close, including pole disagreement; failure while open (flashover detection); failure to complete a trip or close due to stuck resistor switches; and loss of dielectric pressure.



SEL-352 Breaker Failure Relay

Line Protection

With SEL, you can protect any transmission line using a combination of five zones of phase- and ground-distance and directional overcurrent elements. A graphical user interface system provides logic and application templates for typical line protection schemes while patented coupling capacitance voltage transformer (CVT) transient overreach logic enhances the security of Zone 1 distance elements. Best Choice Ground Directional Element[®] logic optimizes directional element performance and eliminates many directional settings. Apply the SEL-421 Protection, Automation, and Control System for high-speed distance and directional protection and complete control of a two-breaker bay. Use synchronized phasor measurements (synchrophasors) from SEL relays and meters to detect and correct islanding, interarea oscillations, and other dynamic system conditions.



SEL-421 Protection, Automation, and Control System

Capacitor Control

Simplify relay settings, application, and inventory by using one relay for all of your capacitor bank needs. The versatile SEL-487V Capacitor Protection and Control System can handle grounded and ungrounded, single and double-wye capacitor bank applications. It provides sensitive voltage differential and current unbalance protection with compensation adjustment for small voltage differential levels due to variations in individual capacitor elements from manufacturing, potential transformer, or instrument transformer measurement error. Each differential and unbalance element provides three levels of detection, low set alarm level, trip pickup level, and high-level trip pickup level, each with its own definite time delay. Instantaneous- and time-overcurrent elements, as well as voltage elements, provide backup protection.



SEL-487V Capacitor Protection and Control System

Information Processors

SEL information processors integrate power protection, automation, control, and monitoring by communicating with a variety of microprocessor-based devices. With the SEL-3530 Real-Time Automation Controller (RTAC), you can integrate station control, reporting, and logging through one reliable system. ACSELERATOR RTAC[™] Software simplifies the design of integration and automation while the embedded RTAC web interface speeds setup and monitoring of critical data on network access, user accounts, and system performance.



SEL-3530 Real-Time Automation Controller (RTAC)

Satellite-Synchronized Timing

SEL provides a reliable, accurate, low-price time source for synchrophasor, relay event correlation, and other high-accuracy timing needs. The SEL-2407[®] Satellite-Synchronized Clock provides six demodulated IRIG-B time-code outputs with three user-selectable outputs for 1 PPS or 1 kPPS output.



SEL-2407[®] Satellite-Synchronized Clock

Services and Support

Engineering Services and Consulting

SEL's team of engineers is ready to assist you in the following areas:

- Arc-flash hazard studies
- Engineering studies
- Security studies
- Power management system design
- Custom panel solutions
- Power system studies and relay settings
- Protection and automation scheme design
- Integration system design, testing, and settings
- HMI design and programming

Regional Technical Support

SEL provides personalized, regional technical support to our customers in more than 135 countries from 75 regional technical service centers worldwide.



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