

Power Generation Solutions



SEL-700G Generator Protection Relay Applications



Features and Benefits

Complete Generator Protection

The compact SEL-700G Generator Protection Relay contains all the protection and control features of relays three times its size and cost. The SEL-700G offers reliable, fast, and secure protection that's flexible enough to match any generator application.

High-Accuracy Synchrophasors

Built-in IEEE C37.60 compliant synchronized phasor measurement provides precise phase monitoring and control.

Fast Frequency Measurement

High-accuracy frequency elements detect changes in frequency quickly for easy application in protection or control schemes.

Detailed Event Reports

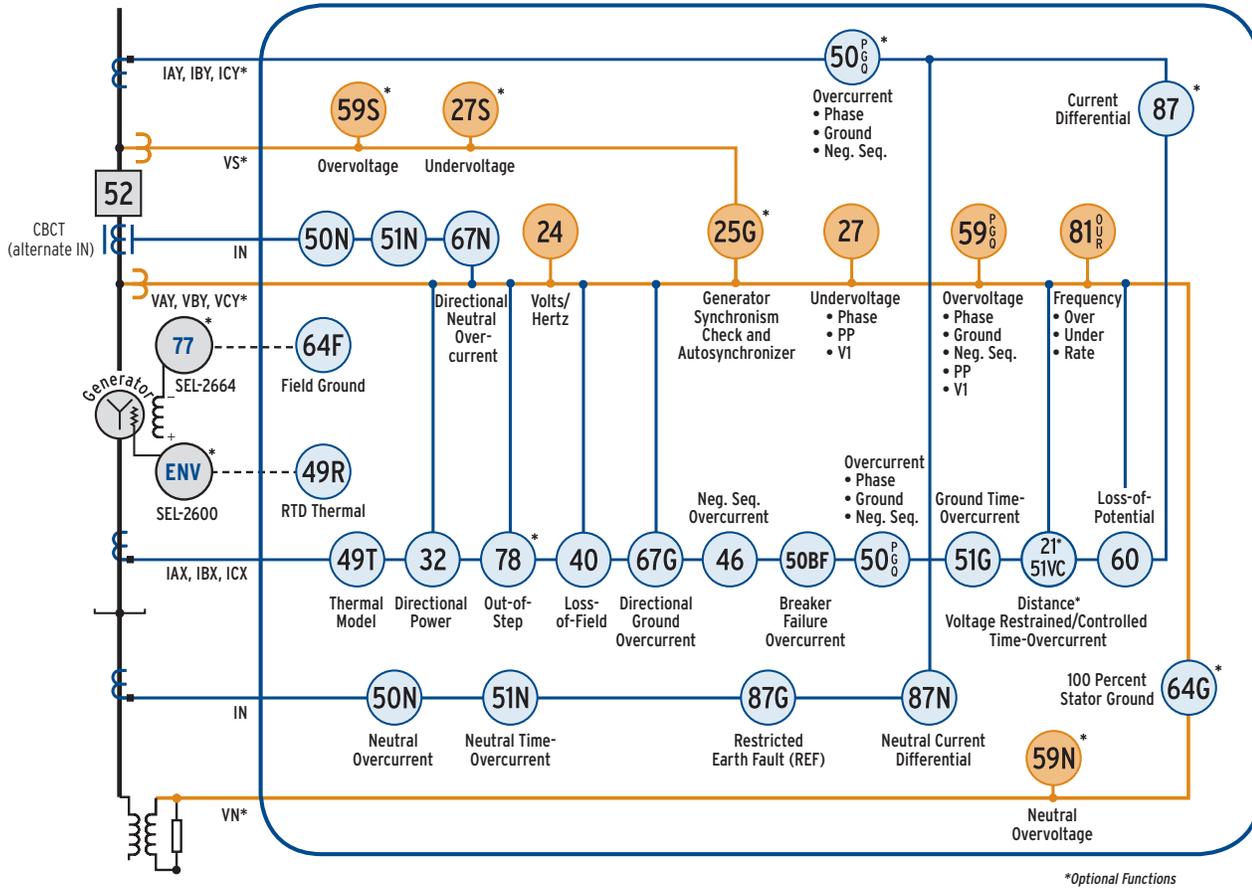
Capture all the important data before, during, and after a fault. Review waveforms, digital events, element logic, and sequence for every fault. Get to root cause and back online quickly.

Flexible Communications

IEC 61850, Modbus[®], DNP3, and other protocols provide flexible, secure communications and real-time access and control. The SEL-700G Relay includes connection options for Ethernet, serial, and DeviceNet[™] media.

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

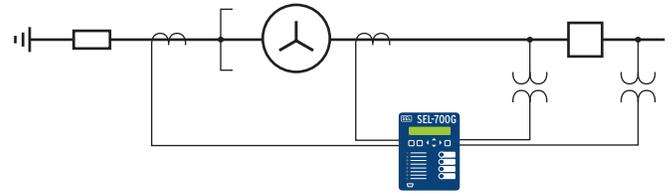
Functional Overview



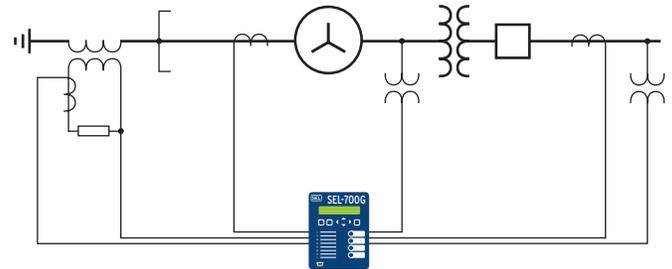
- Two-zone, positive-sequence impedance mho element for loss-of-field detection (40).
- 100 percent stator ground fault detection with neutral overvoltage plus neutral and terminal third-harmonic voltage differential (64G).
- DC field ground protection (64F) based on switched dc voltage injection method. (Requires SEL-2664 Field Ground Module.)
- Out-of-step protection based on single or double blinders (78).
- Overexcitation detection based on volts/hertz measurement. Definite, composite definite/inverse-time, and custom curve elements (24).
- Negative-sequence overcurrent elements, including definite-time and inverse-time operating characteristics (46).
- Sensitive directional power elements with flexibility to provide antimotoring, over-power, or low-forward power indication (32).
- Two-zone compensator distance and voltage-restrained element (21) or voltage-controlled phase time-overcurrent element (51V, C) for backup protection.
- Phase, residual, neutral, and negative-sequence instantaneous and definite-time overcurrent elements (50P, G, N, Q), and inverse-time residual and neutral overcurrent elements (51G, N).
- Restricted earth fault (REF) protection element for the detection of ground faults in wye-connected windings.
- Directional residual-ground and neutral overcurrent elements (67G, N).
- Phase, phase-to-phase, positive-sequence, negative-sequence, and residual overvoltage elements (59P, PP, V1, Q, G); phase, phase-to-phase, and positive-sequence undervoltage elements (27P, PP, V1); and synchronism-check voltage input over- and undervoltage elements (59S/27S).
- Inadvertent energization protection (50/27).
- Unit breaker failure protection (50BF).
- Supervision of voltage-based protection functions by loss-of-relaying-potential detection logic (60).
- Over-/underfrequency elements (81) and rate-of-change-of-frequency elements (81R).
- Percentage restraint and unrestrained phase current differential elements (87) with fixed or variable percentage, using one or two settable slopes, and ground differential element (87N). Second-, fourth-, and fifth-harmonic elements, with the choice of either harmonic blocking or harmonic restraint to prevent restrained differential element operation during inrush or overexcitation conditions.
- Full current compensation, in 30-degree increments, to accommodate any type of transformer/generator and CT winding connection.
- Synchronism-checking element (25) and autosynchronizer with speed control and voltage control outputs.
- Thermal model element (49T) for overload protection and RTD-based thermal protection (49R).
- Synchronized phasor measurement (synchrophasor) output, meeting IEEE C37.118 standards.

Example Applications

- For complete primary and backup protection on large generators, connect the SEL-700G with optional current differential elements across the generator. By adding a neutral voltage connection, you can provide 100 percent stator ground protection for most generators.
- With the built-in automatic synchronizer function, eliminate external generator control and synchronizer relays, and monitor the generator synchronization process using generator start reports and the PC-based synchroscope.
- Protect the generator and the step-up transformer by applying sensitive percentage-restrained current differential elements, an unrestrained element, synchronism check, and volts-per-hertz elements across the entire unit.
- Trip for under- and overfrequency operation while accumulating off-nominal frequency time in up to six frequency bands by using the high-accuracy, six-level frequency elements.
- Record stopped time, run time, full load hours, average power, and average power factor with internal meters.
- Record accumulated breaker contact wear with the breaker monitor function, which uses the manufacturer's specifications for defining breaker operation limits.
- Protect generators from damage by responding to low field resistance warnings and monitoring field ground resistance with state-of-the-art voltage injection.



Typical generator protection application example.



Generator and transformer protection application example.

Primary and Backup Protection

The SEL-700G provides high-performance features in a package economical enough for small generator protection (1 to 5 MW generators). By specifying additional options, the SEL-700G can also protect the largest generators, providing comprehensive protection. Combining the connection examples shown above provides you with primary and backup protection for any size of synchronous generator. The SEL-300G Generator Relay can also be an excellent complement to an SEL-700G for primary and backup protection when different hardware is required.

Large Generator Applications

- Large Coal Plants
- Nuclear Facilities
- Steam Turbines
- Large Hydroelectric Stations
- Natural Gas Operations
- Unit Protection

Small Generator Applications

- Wind Turbines
- Fossil Fuel Extraction
- Small Hydroelectric Stations
- Data Centers
- Backup Generators
- Intertie

Fiber-Optic Communications

Bring in remote data via fiber-optic communications links from either the SEL-2664 Field Ground Module or the SEL-2600 RTD Module. Avoid voltage step potentials and cross-connected control and field cabinets by installing self-testing fiber-optic cables.



SEL-2600A RTD Module



SEL-2664 Field Ground Module

SEL-700G Generator Protection Relay Applications

Communications Options

Communications Media

- Ethernet 10/100BASE-T
- Ethernet 100BASE-FX
- Single or Dual Ethernet Port(s)
- Fiber-Optic Serial Multimode ST®
- EIA-232 Serial
- EIA-485 Serial

Communications Protocols

- SEL ASCII
- MIRRORRED BITS® Communications
- IEC 61850
- DNP3 Serial, LAN/WAN
- Modbus RTU/TCP
- DeviceNet
- Telnet
- File Transfer Protocol (FTP)
- Simple Network Time Protocol (SNTP)
- Synchrophasors (IEEE C37.118)

Simultaneous sessions of multiple protocols supported.

Mounting Options

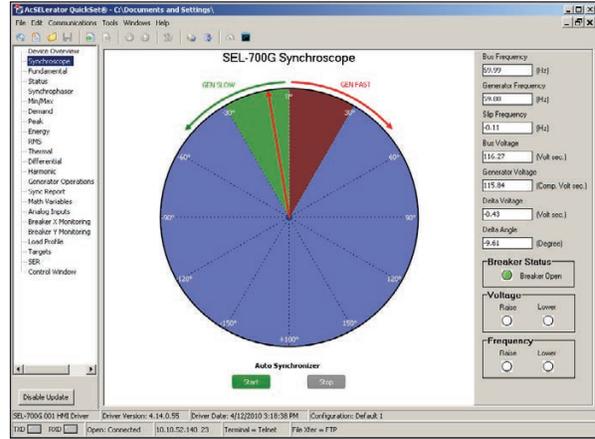
Retrofit Replacement Kits

Replace existing generator protection with the SEL-700G and the applicable mounting kit. These kits provide everything needed to replace many existing generator relays with the SEL-700G.

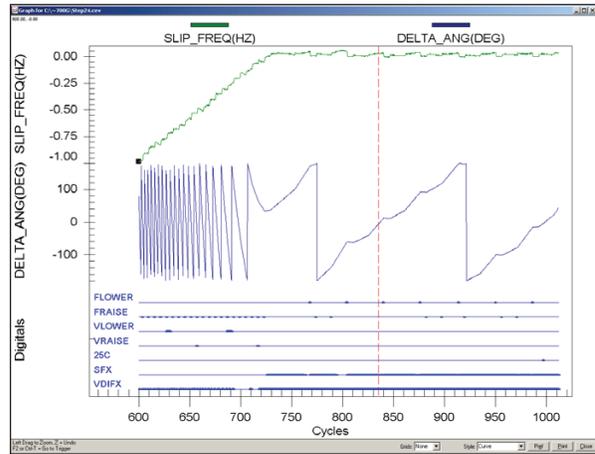
No cutting or drilling is required when you use the optional mounting kits. Replacement of existing protection is quick and easy!



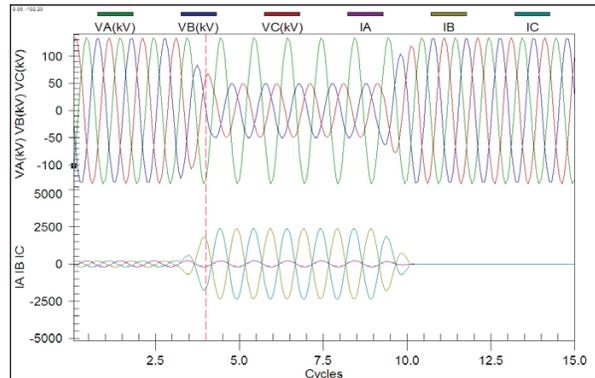
Graphical Information Displays



Integrated Automatic Synchronizer Option



Graphical Generator Synchronizer Report



Automatic Event Capture Oscillography Report



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