SEL-311C
TRANSMISSION PROTECTION SYSTEM
ADVANCED TRANSMISSION LINE PROTECTION, AUTOMATION, AND CONTROL

ANSI NUMBERS/ACRONYMS AND FUNCTIONS

- 21 [P,G] Distance (Phase Mho, Ground Mho, Ground Quad)
- 27 Undervoltage
- 50 [P,G,Q] Overcurrent (Phase, Ground, Neg. Seq.)
- 51 [P,G,Q] Time-Overcurrent (Phase, Ground, Neg. Seq.)
- 52PB Trip/Close Pushbuttons*
- 59 [P,G,Q] Overvoltage (Phase, Ground, Neg. Seq.)
- 67 [P,G,Q] Directional Overcurrent (Phase, Ground, Neg. Seq.)
- 68 Out-of-Step Block/Trip
- 79 Autoreclosing
- 81 [O,U] Over-/Underfrequency
- 85 RID SEL Mirrored Bits® Communications
- DFR Event Reports
- HMI Operator Interface
- LGC SElogic® Control Equations
- MET High-Accuracy Metering
- PMU Synchrophasors
- SER Sequential Events Recorder

ADDITIONAL FUNCTIONS

- BRM Breaker Wear Monitor
- LDE Load Encroachment
- LOC Fault Locator
- SBM Station Battery Monitor

* Optional Feature

1 Copper or Fiber-Optic
KEY FEATURES

PROVIDE UNIVERSAL TRANSMISSION LINE PROTECTION WITH ADVANCED PROTECTION, AUTOMATION, AND CONTROL.

Distance Protection
Increase transmission line loading, reduce equipment damage, and improve system stability with phase and ground distance elements. The SEL-311C Transmission Protection System provides four zones of phase mho, ground mho, and ground quadrilateral distance elements. The SEL-311C-1 features the ability to connect either wye or delta voltage transformers (VTs) for phase distance protection.

Subcycle Distance Protection
The SEL-311C-3 adds three zones of high-speed phase mho and ground mho distance elements to provide subcycle tripping times.

Breaker Failure Detection
Quickly detect failed circuit breakers with the built-in breaker failure detection elements and logic. The high-speed breaker failure element drops out less than one cycle after successful breaker operation, even with subsidence current.

Reclosing
Restore service following transient faults by using programmable four-shot breaker autoreclosing with synchronism and voltage check logic. The synchronism check function compensates for breaker close time, frequency, magnitude, and angle differences between the two voltage sources used for synchronism.

Fault Location
Calculate accurate distance-to-fault measurements with the impedance-based fault locator. Obtain fault resistance calculations for enhanced fault studies.

Load Shedding
Operate six levels of frequency elements as either an under- or overfrequency element. The frequency elements are suited for applications such as under-frequency load shedding and restoration control systems.

Communications-Assisted Tripping Schemes
Configure protection for transmission lines without any need for external coordination devices. The SEL-311C includes settings for permissive overreaching transfer trip (POTT), directional comparison unblocking (DCUB), and directional comparison blocking (DCB) schemes.

Out-of-Step Blocking and Tripping
Detect stable or unstable power swings with out-of-step detection logic. Enhance security with out-of-step blocking to block distance elements during stable swing conditions. Implement out-of-step tripping during unstable power swing conditions to maintain a generation load balance.

Innovative Logic for Secure Operation
Use loss-of-potential logic to detect blown potential transformer (PT) fuses and disable distance and directional elements that are affected by voltage. Recognize coupling capacitor voltage transformer (CCVT) transients during Zone 1 faults with built-in CCVT detection logic. Delay the distance element during CCVT transients to prevent a Zone 1 distance overreach and improve sensitivity.
Simplify local connection and speed up relay communications with the optional front-panel USB port.

Use default displays, or program custom messages.

Built-in phasor measurement unit.

Mirrored Bits® communications.
Optional field-configurable, programmable operator pushbuttons with user-configurable labels.

Optional programmable front-panel LEDs for custom alarms.

Optional independent SafeLock® trip/close pushbuttons with high-visibility indication.
PRODUCT OVERVIEW

REAR PANEL

- High-current interrupting output contacts.
- Optional expanded I/O.
- Independent terminals for SafeLock® trip/close pushbuttons.
Advanced SELogic® control equations.

IRIG-B input for precise timing.

Optional EIA-485 or fiber-optic serial port.

Standard single copper Ethernet. Optional dual copper or fiber-optic Ethernet with fiber-optic serial port. Optional one copper, one fiber-optic Ethernet with fiber-optic serial port.
SUBCYCLE TRIPPING TIMES USING OPTIONAL HIGH-SPEED ELEMENTS

Protect overhead transmission lines and underground cables with distance protection elements and control logic built into the SEL-311C. The SEL-311C includes four zones of phase and ground mho distance elements plus four zones of ground quadrilateral distance elements. Phase and ground mho Zones 1–3 include high-speed elements to provide subcycle tripping times. These distance elements, together with overcurrent functions, are applied in communications-assisted and stepped-distance protection schemes. You can further tailor the relay to your particular application by using advanced SELogic control equations.

APPLICATIONS

HIGH-SPEED BREAKER FAILURE PROTECTION

Faster Response
Detect a failed circuit breaker quickly with built-in breaker failure detection elements and logic. Dropout of conventional overcurrent elements can be extended by subsidence current (as shown), especially following high-current faults. The high-speed 50BF element drops out less than one cycle after successful breaker operation, even with subsidence current. Faster dropout times mean faster breaker failure detection and clearing times.

Dedicated Trip Logic
Set the breaker failure trip and retrip timers to trigger dedicated breaker failure trip logic. Built-in breaker failure elements and logic save valuable programmable logic for other tasks.

Open-Phase Detection
High-speed, open-pole detection logic detects open-pole conditions in less than 1 cycle to reduce breaker failure coordination times.
**COMPLETE FAULT AND LOAD COVERAGE**

**Secure Protection Under High Loads**
Prevent operation of the phase-distance elements under high-load conditions with built-in load-encroachment logic. This unique feature permits load to enter a predefined area of the phase-distance characteristic without causing a trip.

**Improve Coverage**
Implement quadrilateral phase and ground distance elements for improved fault and arc resistance coverage and reach-limiting action on short lines.

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**MHO AND QUADRILATERAL DISTANCE ELEMENTS**

**Easily Set Mho Distance Elements**
To achieve both phase-distance and load-encroachment protection, enable mho phase distance elements and adjust the reach parameters with the acSELerator QuickSet® SEL-5030 Software Graphical Settings Editor. Two zones of mho distance protection are fixed in the forward direction, and the remaining two zones can be set for either forward or reverse.

**Avoid Under- and Overreaching**
Four zones of quadrilateral ground-distance characteristics allow automatic adjustment for load flow. The top line of the quadrilateral characteristic automatically tilts with load flow to avoid under- and overreaching. The ground mho and quadrilateral distance elements can be used individually, concurrently, or not at all.

**Compensate for System Conditions**
The reach for each of the eight ground-distance elements can be individually set. The ground-distance elements include two zero-sequence compensation factor settings (k01, k0) to accurately calculate ground fault impedance.
WEB SERVER
Access basic SEL-311C information on a standard Ethernet network with the built-in web server. View relay status, Sequential Events Recorder (SER) data, metering information, and settings through easy access within a local network. Also, conduct your firmware upgrades remotely through the Ethernet connection. Web server access requires a relay password and is limited to read-only viewing of information.

ADD SYNCHROPHASORS TO YOUR SYSTEM
Improve system performance with synchrophasor technology. SEL offers complete synchrophasor solutions, including hardware, communications, data collection, viewing and analysis software, and data archiving.

- Improve system performance using real-time system state measurement with time-synchronized voltages and currents available in the SEL-311C.
- Help system operators prevent cascading blackouts and monitor system stability with a new synchrophasor view of the power system.
- Use SEL-5078-2 synchroWAVE® Central Software or third-party software to view and analyze system phase angles, load oscillations, voltage profiles, and other critical system information. Stream synchrophasor data with the IEEE C37.118 standard format.
MIRRORED BITS COMMUNICATIONS

Mirrored Bits communications technology provides bidirectional digital communications between devices. Use Mirrored Bits communications to transmit/receive information between upstream relays and downstream recloser controls to enhance coordination and achieve faster tripping for downstream faults.

Patented Mirrored Bits communications is simple, powerful, field-proven technology.

ELIMINATE PANEL-MOUNTED BREAKER CONTROL SWITCHES

The SEL-311C allows you to specify optional SafeLock® trip/close pushbuttons and indication lamps for your application. The independently operated switches and breaker status lamps are functional even if the relay is out of service. Switch contacts and indicating lamps are separately wired to screw-terminal blocks on the rear of the relay. Choose the wiring arrangement that best suits your need for breaker control and status indication. The trip/close pushbuttons are equipped with the SafeLock system to prevent inadvertent operation and facilitate tagout procedures.

Optional trip/close pushbuttons operate independently from the relay function.

FLEXIBLE COMMUNICATIONS

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*Optional Feature