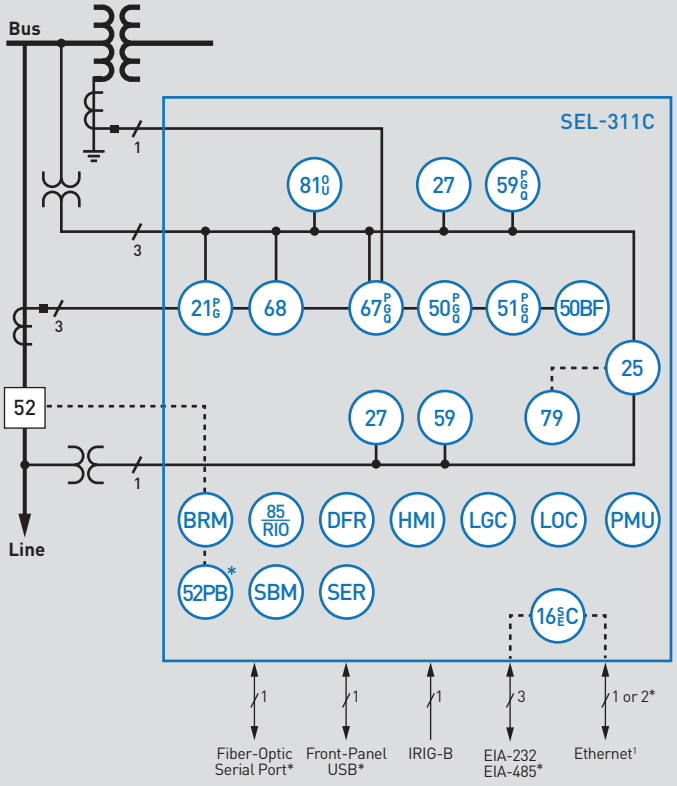
SEL-311C

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)
25	Synchronism Check
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 RIO	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

[1] Copper or Fiber-Optic
*Optional Feature

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.

PRODUCT OVERVIEW

FRONT PANEL

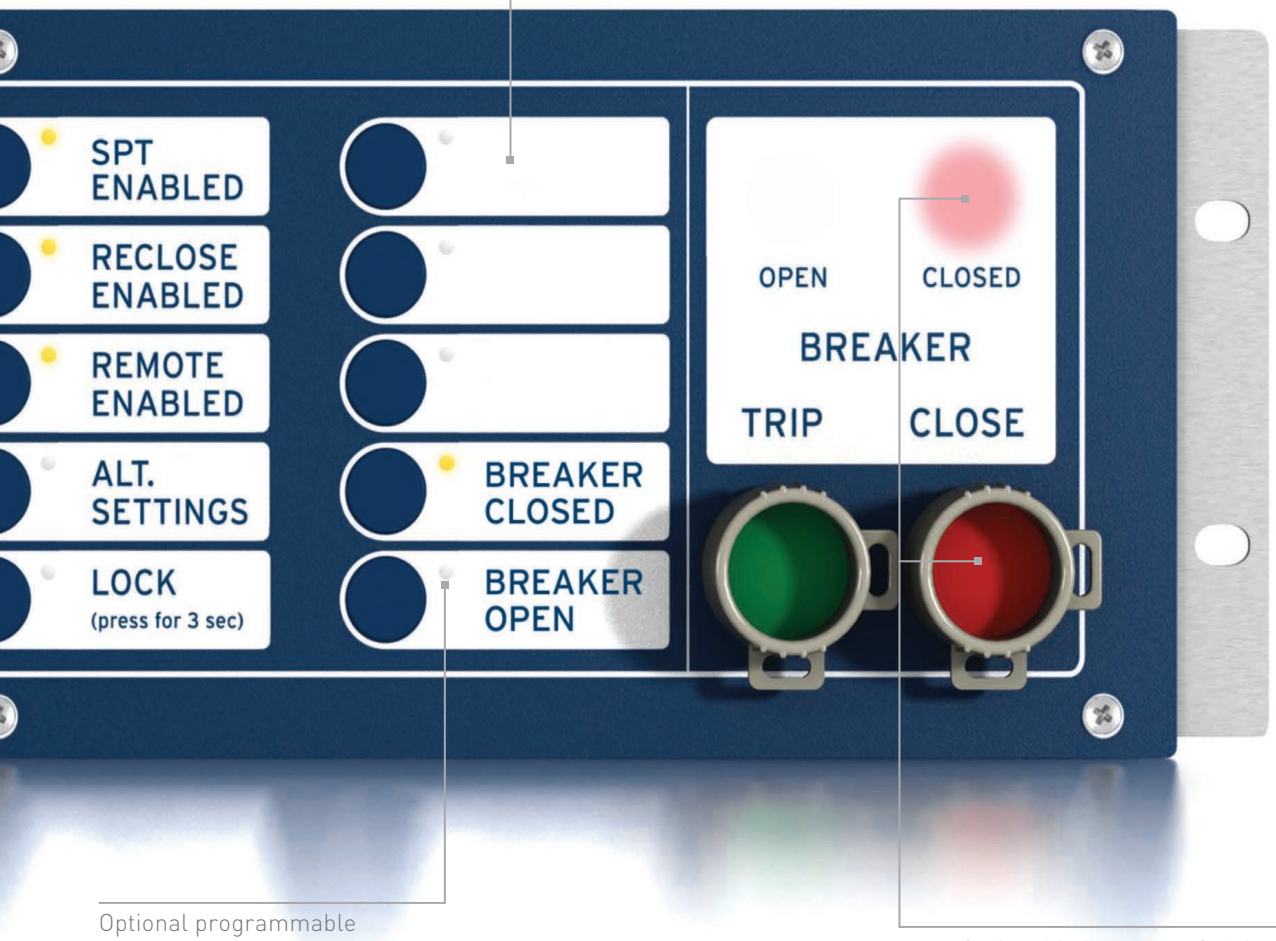
Simplify local connection and speed up relay communications with the optional front-panel USB port.

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.

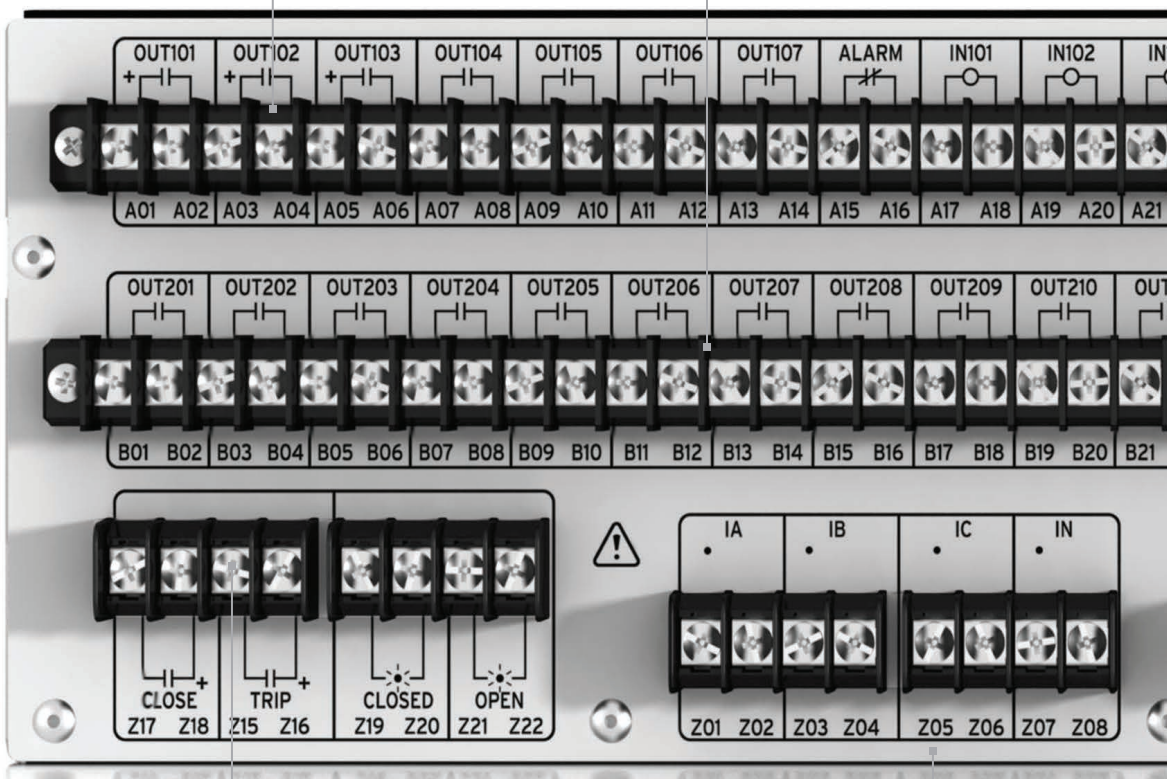
Optional independent SafeLock® trip/close pushbuttons with high-visibility indication.

PRODUCT OVERVIEW

REAR PANEL

High-current interrupting output contacts.

Optional expanded I/O.

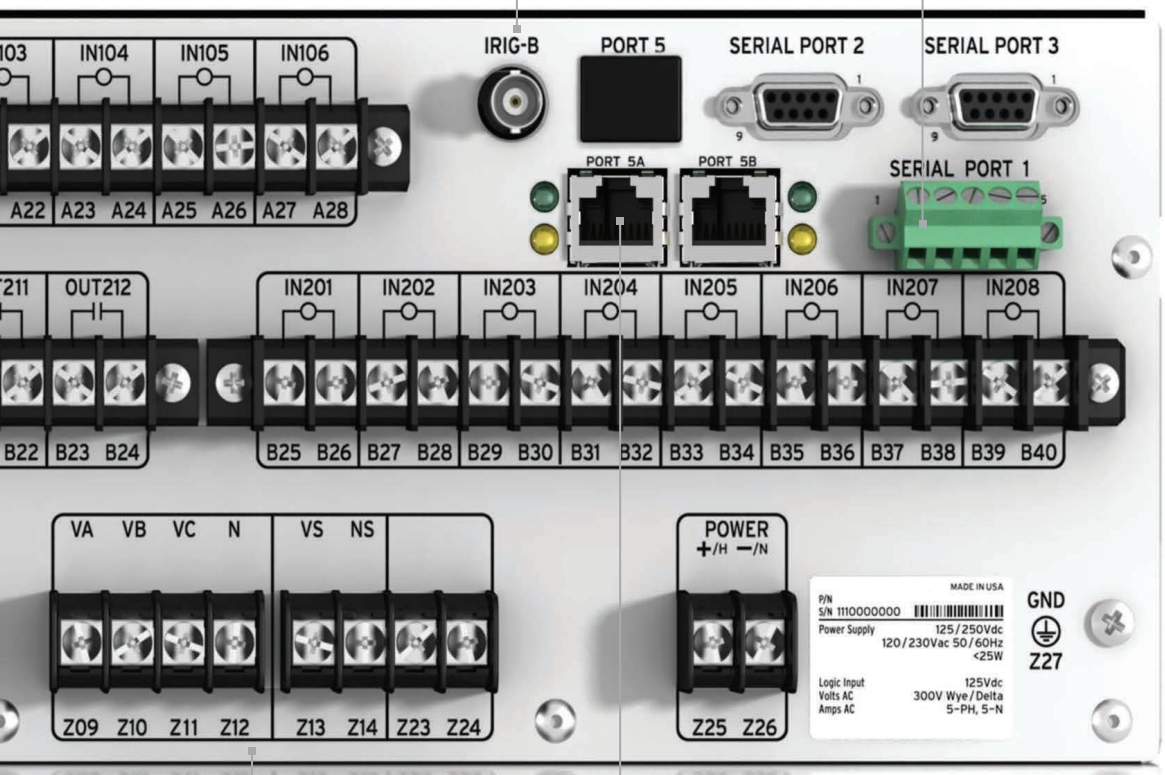


Independent terminals for SafeLock® trip/close pushbuttons.

Standard multisession Modbus® TCP and DNP3. Optional IEC 61850.

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.

Advanced SELOGIC® control equations.

APPLICATIONS

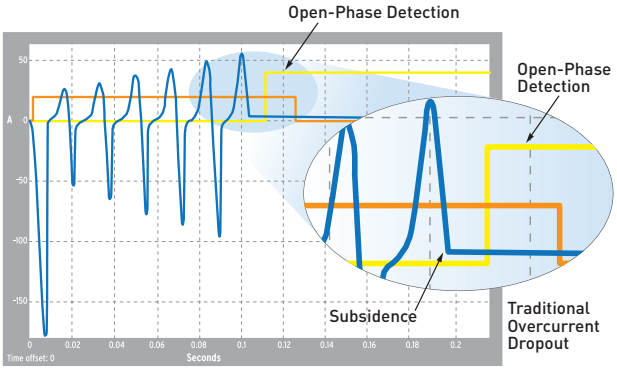
HIGH-SPEED BREAKER FAILURE PROTECTION

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

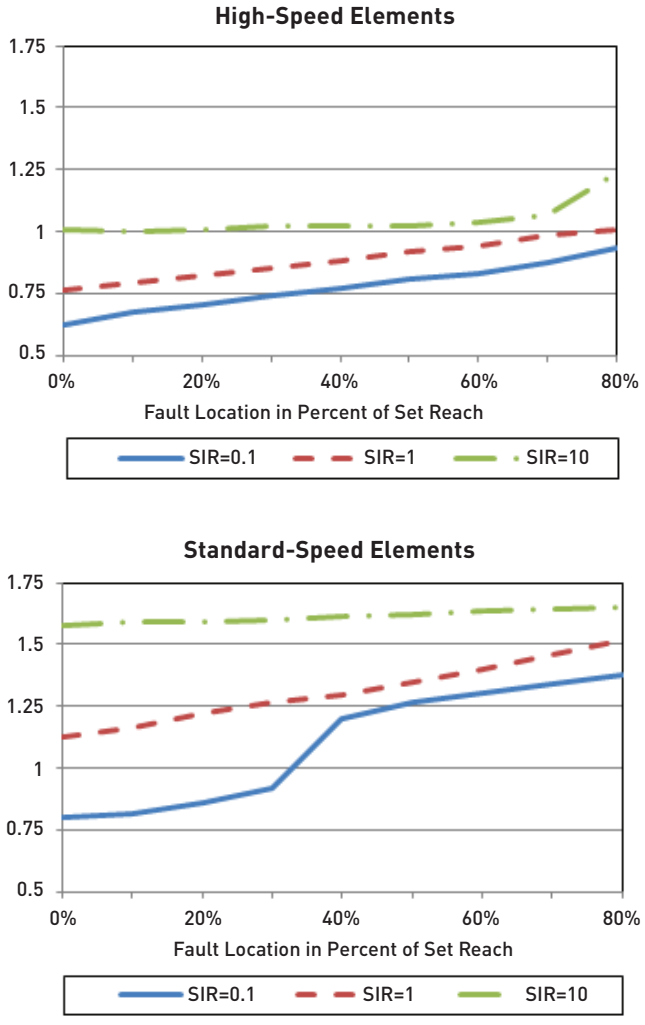
Set the breaker failure trip and retrip timers to trigger dedicated breaker failure trip logic. Built-in breaker failure elements and logic save valuable programmable logic for other tasks.



High-speed, open-pole detection logic detects open-pole conditions in less than 1 cycle to reduce breaker failure coordination times.

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.



Single-Phase-to-Ground Faults

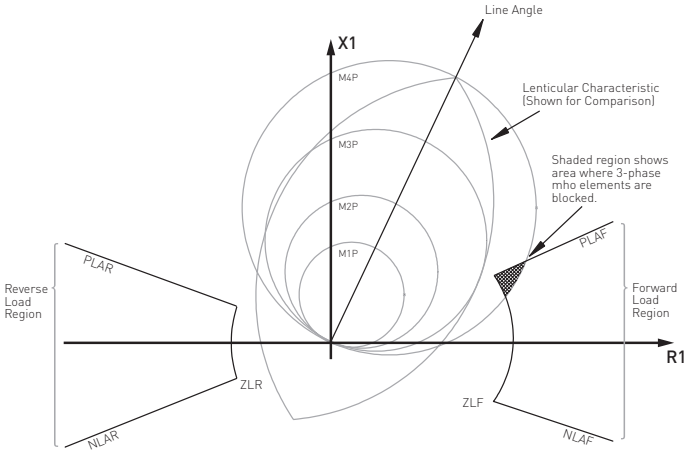
COMPLETE FAULT AND LOAD COVERAGE

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.



Load-Encroachment Characteristic

MHO AND QUADRILATERAL DISTANCE ELEMENTS

Easily Set Mho Distance Elements

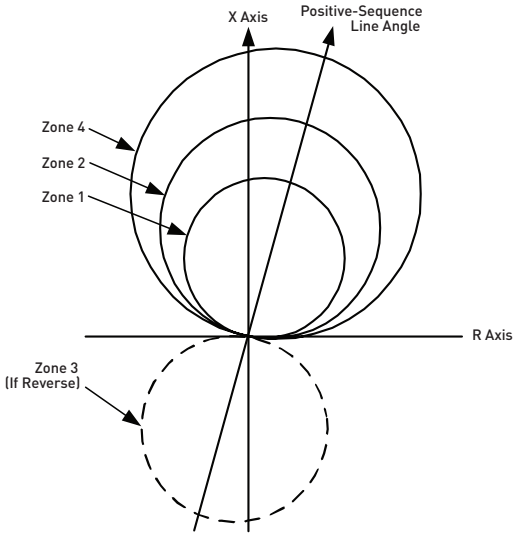
To achieve both phase-distance and load-encroachment protection, enable mho phase distance elements and adjust the reach parameters with the ACSELERATOR QuickSet® SEL-5030 Software Graphical Settings Editor. Two zones of mho distance protection are fixed in the forward direction, and the remaining two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

Avoid Under- and Overreaching

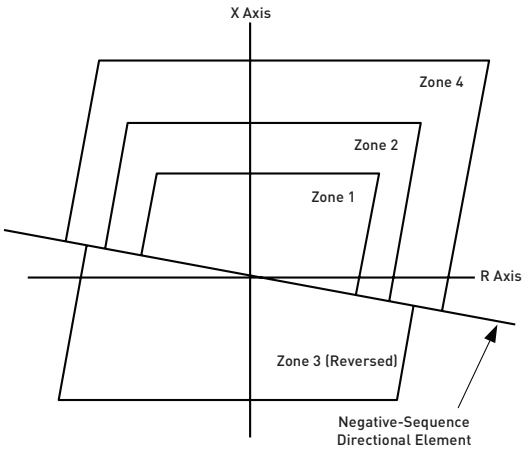
Four zones of quadrilateral ground-distance characteristics allow automatic adjustment for load flow. The top line of the quadrilateral characteristic automatically tilts with load flow to avoid under- and overreaching. The ground mho and quadrilateral distance elements can be used individually, concurrently, 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.



Phase and Ground Mho Distance Characteristics

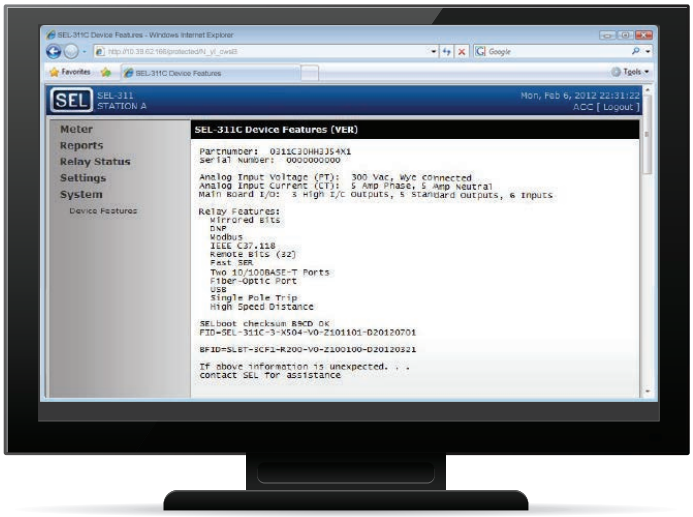


Quadrilateral Ground-Distance Characteristics

ACCESSIBILITY

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.



Web server menu screen.

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.

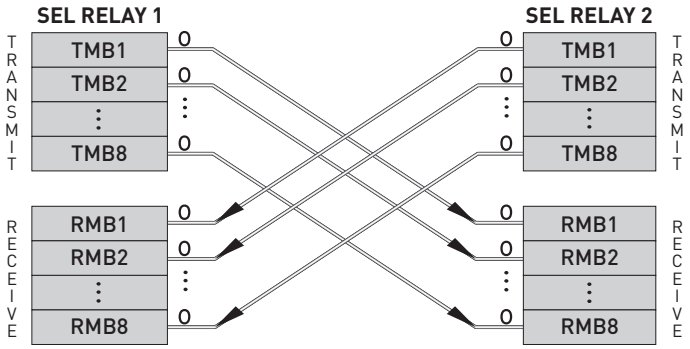
- Improve system performance using real-time system state measurement with time-synchronized voltages and currents available in the SEL-311C.
- Help system operators prevent cascading blackouts and monitor system stability with a new synchrophasor view of the power system.
- Use SEL-5078-2 SYNCHROWAVE® 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.

Real-time SYNCHROWAVE Central data.

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.

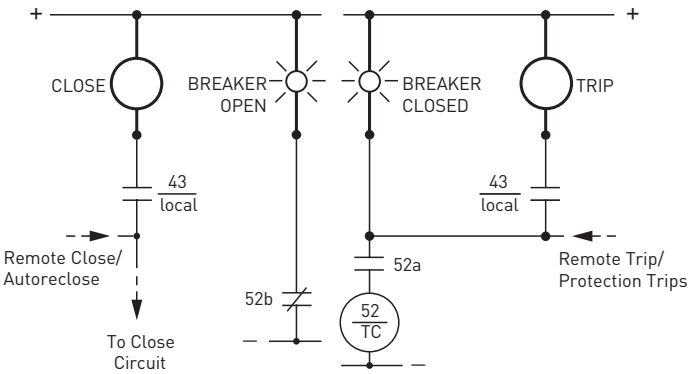
Patented Mirrored Bits communications is simple, powerful, field-proven technology.



Improve performance with SEL Mirrored Bits communications.

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		
Communications Protocols		**Communications Media**
Mirrored Bits Communications	DNP3 Serial	Ethernet 10/100BASE-T
IEEE C37.118 Synchrophasors	DNP3 IP	Ethernet 100BASE-FX*
IEC 61850 GOOSE*	Web Server	EIA-232 Serial
IEC 61850 MMS*	Simple Network Time Protocol (SNTP)	EIA-485 Serial*
Parallel Redundancy Protocol (PRP)*	FTP	
Modbus TCP	SEL Fast Messages	USB Type B*
Modbus RTU	ASCII	Fiber-Optic Serial Port*
Telnet	IRIG-B	

*Optional Feature

**MAKING ELECTRIC POWER SAFER,
MORE RELIABLE, AND MORE ECONOMICAL**

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