



Distribution Protection Overview



SEL-851 **NEW**

A compact relay for utility and industrial applications that provides powerful feeder protection, monitoring, and control as well as fast and secure arc-flash detection.



SEL-751

Ideal for industrial and utility feeder protection, offering an intuitive color touchscreen, fast and secure arc-flash detection, flexible I/O, and advanced communications.



SEL-451

Flexible overcurrent protection with complete substation bay control.



SEL-351

Transmission or distribution overcurrent protection, monitoring, and control.



SEL-351A

An economical solution for distribution feeder protection.



SEL-351S

Comprehensive feeder and overcurrent protection perfect for industrial and utility feeder applications.



SEL-501

Two complete and independent groups of protection in one low-cost unit for feeders, buses, transformers, motors, and breakers.



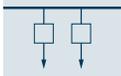
SEL-551/551C

Distribution protection and control in new and retrofit installations.

Applications	SEL-451	SEL-351	SEL-351A	SEL-351S	SEL-851	SEL-751	SEL-751A	SEL-501/501-2	SEL-551/551C
Distribution Feeder Protection	■	■	■	■	■	■	■	■	■
Breaker Failure Protection	■	■	f	■	■	■	■	+	f
Generator Inertia Protection	■	■	■	■		+	+		
Synchronism Check	■	■	■	■		+	+		
Underfrequency Load Shedding	f	■	■	■	■	■	■		
Undervoltage Load Shedding	f	■	■	■	+	+	+		
Protection									
27/59 Under-/Overvoltage	■	■	■	■	+	+	+		
32 Directional Power Elements	■	+		+	+	+	+		
49 IEC Line/Cable Thermal Overload	f					■			
50 (P,N,G,Q) Overcurrent Element (Phase, Neutral, Ground, Negative Sequence)	■	■	■	■	■	■	■	■	■
51 (P,N,G,Q) Time Overcurrent Element (Phase, Neutral, Ground, Negative Sequence)	■	■	■	■	■	■	■	■	■
67 (P,N,Q) Directional Overcurrent (Phase, Neutral, Negative Sequence)	■	■	■	■		+			
78VS Vector Shift							+		
81 Over-/Underfrequency	■	■	■	■	+	■	+		
Separate Neutral Overcurrent	■	■	■	■	■	■	■		■
Load Encroachment Supervision	■	■	■	■		■			
Low-Energy Analog (LEA) Voltage Inputs	+					+			
Directional Sensitive Earth Fault Protection		+	+	+		+			
Pilot Protection Logic	■	■		■					
Rate-of-Change of Frequency (df/dt)	■	■	■	■		+	+		
Harmonic Blocking	■	■	+	■	■	■			
Arc Sense™ Technology (AST) High-Impedance Fault Detection	+					+			
Arc-Flash Detection					+	+	+		
Phantom Phase Voltage		■	■	■					
Current/Voltage Channels	6/6	4/4	4/4	4/4	4/3	4/3	4/0	6/0	4/0
Complete Two-Breaker Control	■							■	

Instrumentation and Control	SEL-451	SEL-351	SEL-351A	SEL-351S	SEL-851	SEL-751	SEL-751A	SEL-501/501-2	SEL-551/551C
79 Automatic Reclosing	■	■	■	■	■	+	+		■
Fault Locating	■	■	■	■		+			
SELogic® Control Equations With Remote Control Switches	■	■	■	■	■	■	■		■
SELogic Counters	■				■	■	■		
Voltage Check on Closing	■	■	■	■		+	+		
SELogic Nonvolatile Latch	■	■	■	■	■	■	■		+
Nonvolatile Local Control Switches	■	■	+	■		■	■		■
Substation Battery Monitor	■	■	■	■		+	+		
Breaker/Recloser Wear Monitor	■	■	■	■	■	■	■		
Trip Coil Monitor	f	f	f	f		f	f		f
Voltage Sag, Swell, and Interruption (VSSI)	■	+		+					
Load/Signal Profile Recorder	■	+		+	■	■	■		
Sequential Events Recorder	■	■	■	■	■	■	■		■
Software-Invertible Polarities	■								
IEC 60255-Compliant Thermal Model	■								
DNP3 Level 2 Outstation	■	■	■	■	+	+	+		
Parallel Redundancy Protocol (PRP)	+	■	■	■		+			
IEEE 1588 Precision Time Protocol Version 2 (PTPv2)	+					+			
Time-Domain Link (TiDL®) Technology	+								
IEEE C37.118 Synchrophasors	■	■	■	■		■	■		
Bay Control	■					+			
Ethernet	+	■	■	■	+	+	+		
EtherNet/IP						+			
IEC 61850	+	+	+	+	+	+	+		
IEC 61850 Edition 2	+				+	+			
IEC 61850-9-2 Sampled Values Technology	+								
Simple Network Time Protocol (SNTP)	■	■	■	■	+	+	+		
Harmonic Metering		■	■	■	■				
RMS Metering	■	■	■	■	■	■	■		

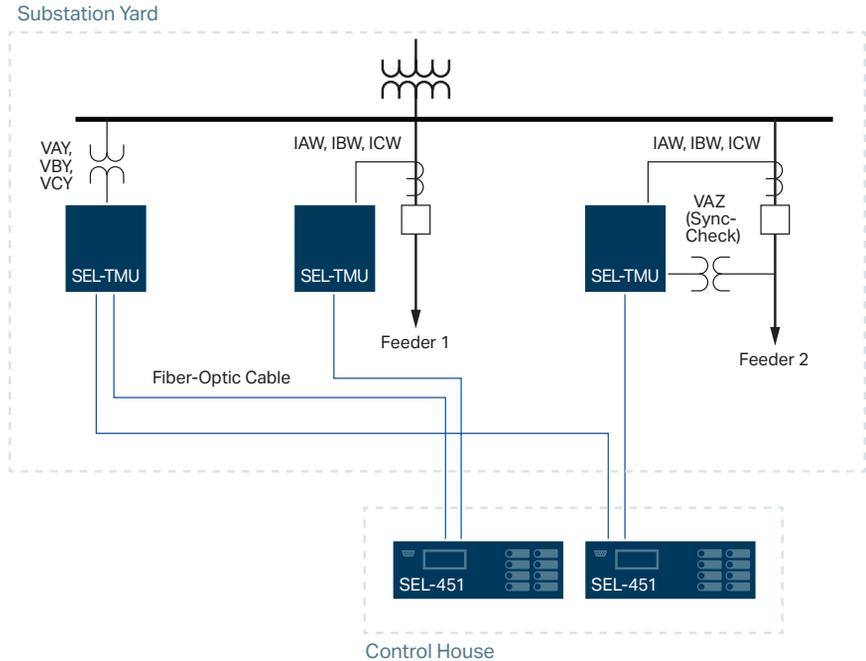
■ Standard feature + Model option f May be created using settings



Distribution Protection Applications

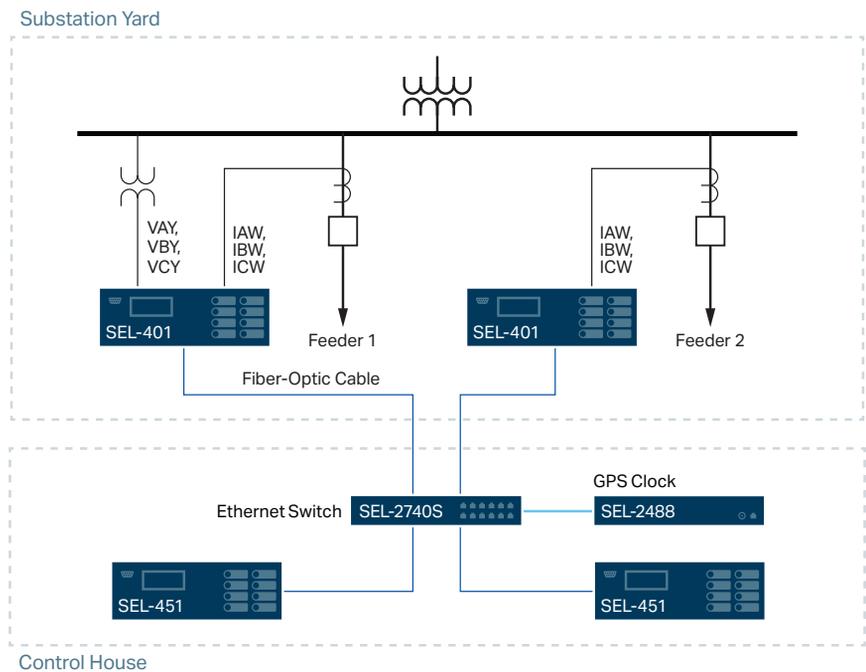
Time-Domain Link (TiDL®) technology

TiDL is a simple and innovative digital secondary system solution that is easy to implement, with no external time source or network engineering required. The SEL-TMU TiDL Merging Unit in the yard provides remote I/O, digitizes analog signals, and sends the signals over fiber-optic cables to the TiDL-enabled SEL-451 Protection, Automation, and Bay Control System in the control house.



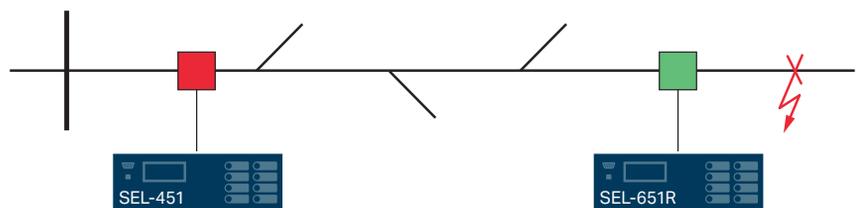
SEL Sampled Values (SV) technology

SEL SV combines protection in the merging unit with the flexibility of IEC 61850-9-2. The SEL-451-6 with SEL SV technology receives SV data from SEL merging units or other SV-compliant units via a fiber-based Ethernet network.



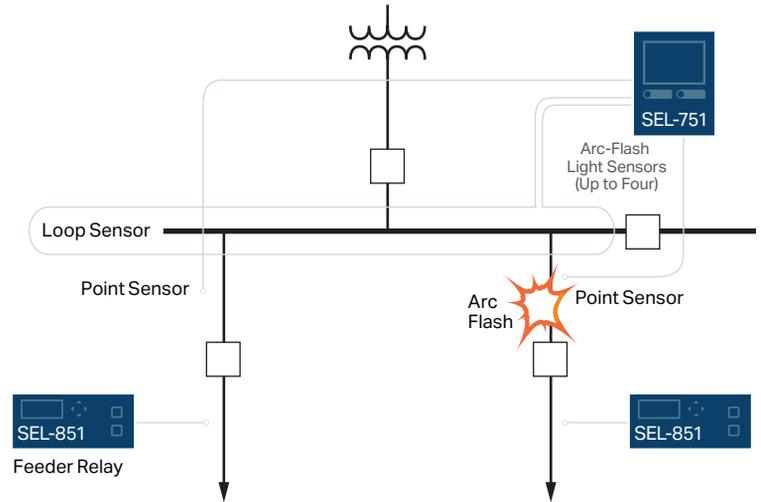
High-impedance fault detection

Detect high-impedance, arcing faults by using Arc Sense™ technology (AST). SEL relays with AST will send an alarm or trip signal for faults that produce low fault current and are undetectable with conventional overcurrent relays.



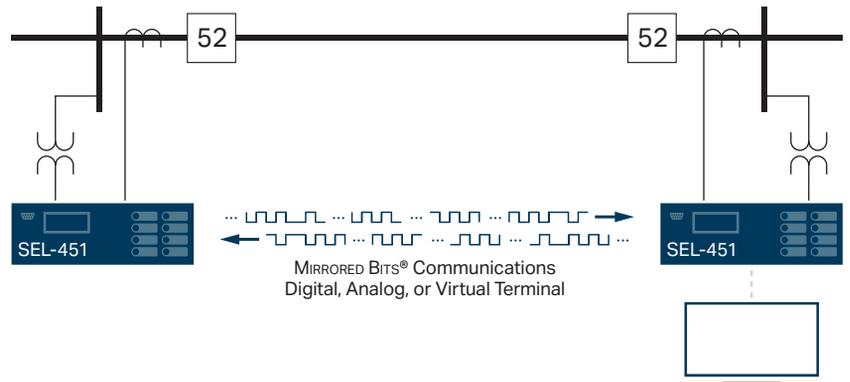
Arc-flash mitigation

Improve safety and prevent equipment damage with arc-flash detection in the SEL-851, SEL-751, and SEL-751A Feeder Protection Relays. Light-sensing technology combined with fast overcurrent protection provides high-speed arc-flash detection as fast as 2 ms without false tripping. You can choose point sensors, loop sensors, or a combination to protect a wide variety of switchgear configurations.



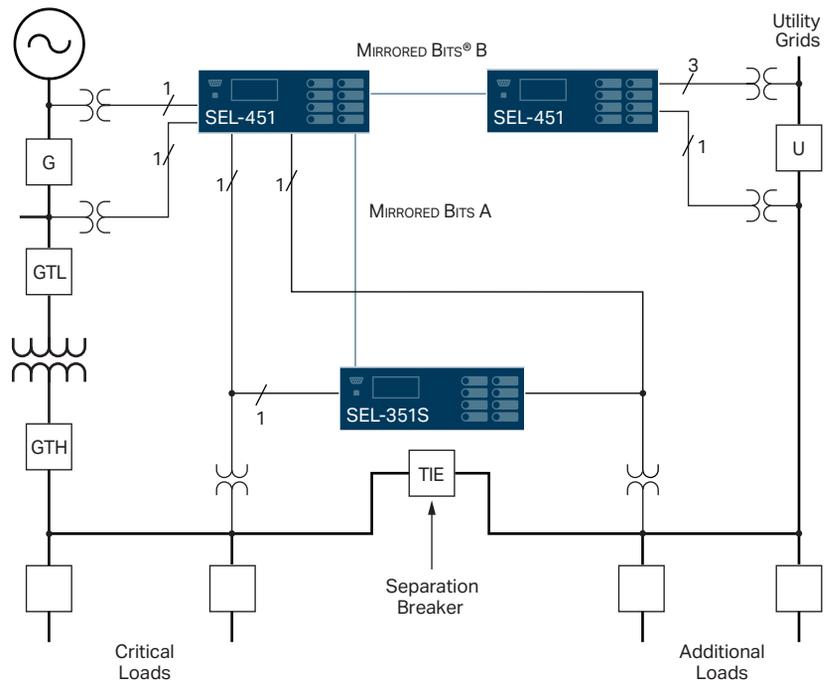
MIRRORED BITS® communications

This field-proven technology provides simple and powerful bidirectional digital communications between devices. MIRRORED BITS communications can transmit/receive information between upstream relays and downstream recloser controls to enhance coordination and generate faster tripping for downstream faults.



Autosynchronization

Automatically close the breaker that separates two systems after measuring the voltage and frequency of a generator and the power system. You can send control signals to adjust the governor and exciter as necessary to ensure safe and secure connection of generation.



SEL-851

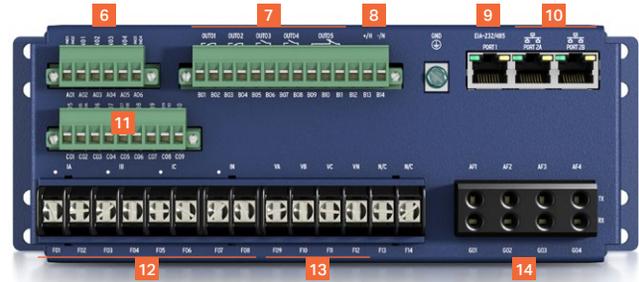
Feeder Protection Relay NEW

selinc.com/products/851 

 Select models typically ship in 2 days

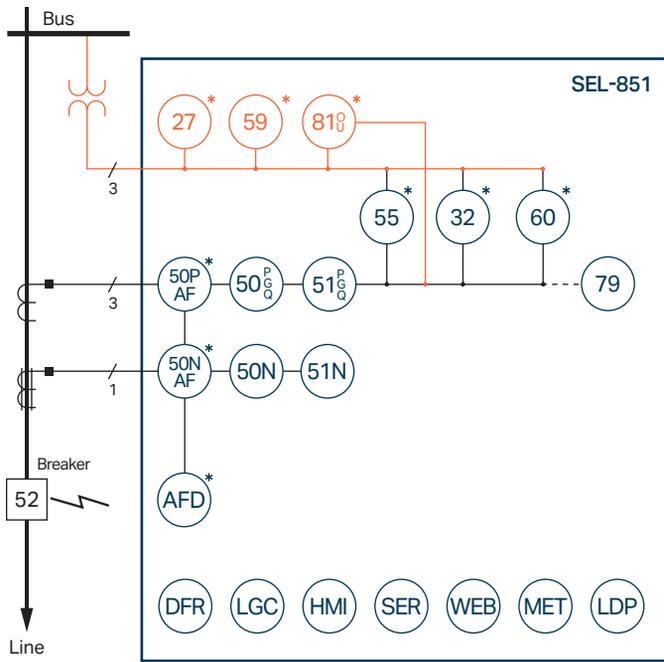
The SEL-851 provides powerful feeder protection, monitoring, and control for utility and industrial applications in a compact device. It includes arc-flash protection that significantly reduces incident energy by sending a trip signal to a breaker in as fast as 1 ms. With high-resolution currents

and voltages sampled at 10 kHz, the SEL-851 allows you to gain better visibility of your system. It includes SEL-5037 Grid Configurator Software to help you quickly create, manage, and deploy settings for SEL power system devices.



- 1 Large LCD display for navigation, relay control, and diagnostics
- 2 Context-adjusted navigation keys
- 3 USB port
- 4 Two fixed and eight programmable tricolor LEDs
- 5 Fundamental feeder controls
- 6 4 digital inputs
- 7 5 digital outputs (1 Form C, 2 Form A Standard, 2 Form A Hybrid)

- 8 Universal power supply (24–250 Vdc, 110–240 Vac)
- 9 EIA-232/EIA-485 serial port
- 10 Single or dual 10/100BASE-T Ethernet port(s)
- 11 6 additional digital inputs
- 12 Current inputs
- 13 Three-phase ac voltage inputs (300 Vac)
- 14 4 arc-flash inputs



ANSI Functions

27	Undervoltage*
32	Directional Power*
50N	Neutral Overcurrent
50 (P,G,Q)	Overcurrent (Phase, Ground, Negative Sequence)
50N AF	Arc-Flash Neutral Overcurrent*
50P AF	Arc-Flash Phase Overcurrent*
51 (P,G,Q)	Time Overcurrent (Phase, Ground, Negative Seq.)
51N	Neutral Time Overcurrent
55	Power Factor*
59	Overvoltage*
60LOP	Loss of Potential*
79	Autoreclosing
81 (O,U)	Over-/Underfrequency*

Additional Functions

85 RIO	SEL MIRRORRED BITS® Communications
AFD	Arc-Flash Detector*
BF	Breaker Failure
DFR	Event Reports
HMI	Operator Interface
LDP	Load Data Profiling
LGC	SELogic® Control Equations
MET	High-Accuracy Metering
SER	Sequential Events Recorder
WEB	Web Server

*Optional feature

SEL-751

Feeder Protection Relay

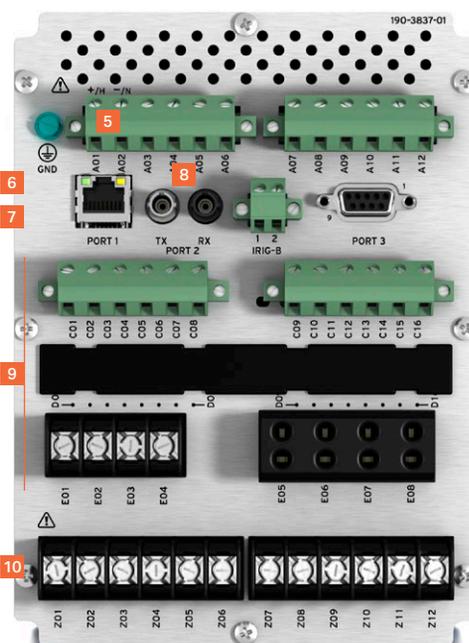
Starting price
\$990 USD

selinc.com/products/751

Select models typically ship in 2 days

The SEL-751 is ideal for directional overcurrent, fault location, arc-flash detection, incipient-fault detection, and high-impedance fault detection applications. Flexible I/O options, easy mounting, and fast settings make the SEL-751 the right solution for industrial and utility feeder protection. It provides complete feeder protection, with overcurrent, overvoltage, undervoltage, directional power, IEC cable/line thermal, vector shift, sensitive earth fault (SEF), load encroachment, and frequency elements. The 5-inch, 800 × 480 color

touchscreen display option lets you directly set, monitor, and control your system. A small form factor and multiple mounting adapters let you easily upgrade protection without cutting or drilling existing cutouts. You can quickly integrate the SEL-751 into serial- or Ethernet-based communications with IEC 61850 Edition 2, IEC 60870-5-103, the IEC 62439 Parallel Redundancy Protocol (PRP), MIRRORING BITS® communications, Modbus, DNP3, EtherNet/IP, the IEEE 1588 Precision Time Protocol (PTP), and other protocols.



- 1 The 5-inch, 800 × 480 display offers direct navigation via a capacitive touchscreen.
- 2 Folders and applications provide quick access to bay screens, metering and monitoring data, reports, settings, and more.
- 3 Programmable front-panel LEDs with user-configurable labels alert operators to faulted phases, the relay's status, and element operation.
- 4 Programmable operator pushbuttons with user-configurable labels allow front-panel customization.
- 5 Power supply options include 24–48 Vdc or 110–250 Vdc/110–240 Vac.

- 6 A wide variety of communications protocols and media provide flexibility to communicate with other devices and control systems.
- 7 An integrated web server enables direct relay access for metering and monitoring data without the need for external PC software.
- 8 The optional fiber-optic serial port provides quick and easy engineering access.
- 9 Card slots include positions for optional I/O or an arc-flash detection/Vsync/Vbat card.
- 10 CT and PT inputs are located on one card, allowing more I/O in other slots.

SEL-451

Protection, Automation, and Bay Control System

Starting price
\$4,350 USD

selinc.com/products/451 

The SEL-451 is a standalone system with the speed, power, and flexibility to combine complete substation bay control with high-speed breaker protection in one economical system. You can use the SEL-451 as an integral part of a full substation protection, control, and monitoring solution. It lets you reduce maintenance costs by accurately tracking the breaker operation. Monitoring breaker interruption

times and the accumulated breaker duty makes it easy to determine the need for proactive maintenance. Integrating information with SCADA or automation systems is simple through a communications processor or directly via the Ethernet port. Optional Time-Domain Link (TiDL®) technology and SEL Sampled Values (SV) technology using IEC 61850-9-2 transform the way you modernize your substation.

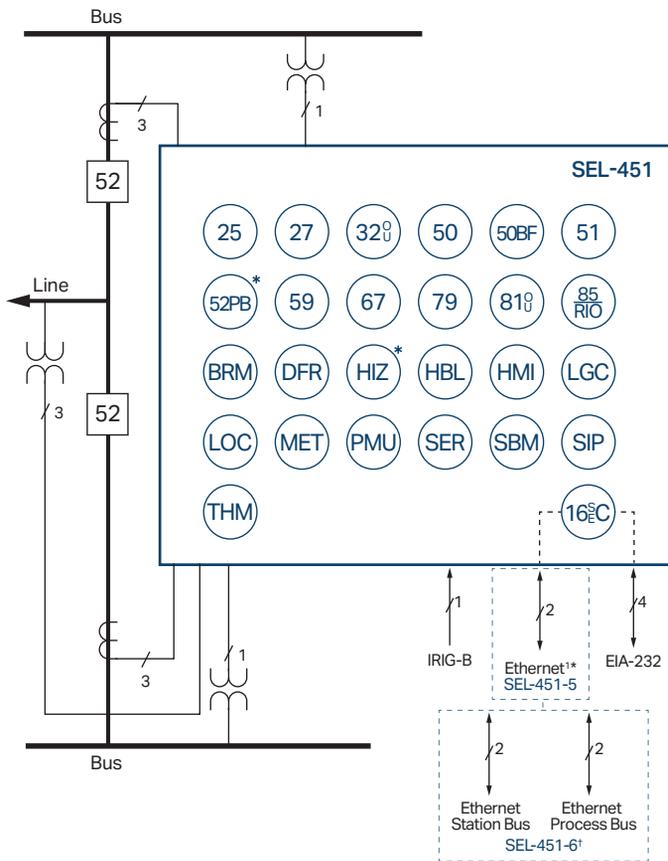


- 1 EIA-232 front serial port is quick and convenient for system setup and local access.
- 2 Interactive bay display with user-configurable apparatus labels allows the operator to view the status of breakers and disconnect switches and to control them.
- 3 Easy-to-use keypad aids simple navigation.
- 4 Front-panel LEDs indicate custom alarms and provide fast and simple information to assist dispatchers and line crews with rapid power restoration.
- 5 Programmable operator pushbuttons with user-configurable labels allow front-panel customization.
- 6 Choose from a vertical or horizontal, panel-mount or rack-mount chassis and different size options.
- 7 Use a maximum of 68 output contacts.¹

- 8 Communications protocols include FTP, Telnet, synchrophasors, DNP3 LAN/WAN, the Parallel Redundancy Protocol (PRP), the IEEE 1588 Precision Time Protocol Version 2 (PTPv2),** and IEC 61850 Edition 2.*
- 9 Use one front and three rear EIA-232 ports for MIRRORING BITS® communications, DNP3, SCADA, and engineering access.
- 10 Use a maximum of 103 input contacts.¹
- 11 Order six current inputs in standard terminal blocks (as shown) or a Connectorized® hardware configuration.
- 12 Choose six voltage inputs in either standard terminal blocks, a Connectorized hardware configuration, or a low-energy analog (LEA) hardware configuration.
- 13 Choose from power supply options such as 24–48 Vdc; 48–125 Vdc or 110–120 Vac; or 125–250 Vdc or 110–240 Vac.

¹Requires 8U chassis *Optional feature

**For PTP implementation, Ports 5A and 5B must be ordered as an option.



ANSI Functions

25	Synchronism Check
27	Undervoltage
32 (O,U)	Over- and Underpower
50	RMS Overcurrent
50BF	Dual Breaker Failure Overcurrent
51	Time Overcurrent
52PB	Trip/Close Pushbuttons*
59	Overvoltage
67	Directional Overcurrent
79	Autoclosing
81 (O,U)	Over-/Underfrequency

Additional Functions

16 SEC	Access Security (Serial, Ethernet)
50G	Best Choice Ground
85 RIO	SEL MIRRORRED BITS Communications
BRM	Breaker Wear Monitor
DFR	Event Reports
HBL	Harmonic Blocking
HIZ	High-Impedance Fault Detection With Arc Sense™ Technology*
HMI	Operator Interface
LDE	Load Encroachment
LGC	Expanded SELLogic® Control Equations
LOC	Fault Locator
MET	High-Accuracy Metering
PMU	Synchrophasors
SBM	Station Battery Monitor
SER	Sequential Events Recorder
SIP	Software-Invertible Polarities
SV	IEC 61850-9-2 Sampled Values Technology*†
THM	IEC 60255-Compliant Thermal Model
TiDL	Time-Domain Link Technology*

*Optional feature †Copper or fiber-optic

†TiDL and SV relays receive current and voltage values from remote merging units.

SEL-451 TiDL Option

- 1 4U chassis with horizontal mounting options (panel or rack) accommodates your application needs.
- 2 LEDs indicate the connection status to an SEL-TMU TiDL Merging Unit on a per-port basis.
- 3 Eight 100 Mbps fiber-optic ports allow the TiDL-enabled relay to connect with eight remote SEL-TMU nodes and to receive remote analog and digital data.



SEL-451 SV Option

- 1 The 4U chassis has various mounting options to accommodate hardware needs.
- 2 Select fiber-optic, copper, or mixed Ethernet with separate ports for SV data and engineering access.
- 3 Choose from power supply options such as 24–48 Vdc; 48–125 Vdc or 110–120 Vac; or 125–250 Vdc or 110–240 Vac.



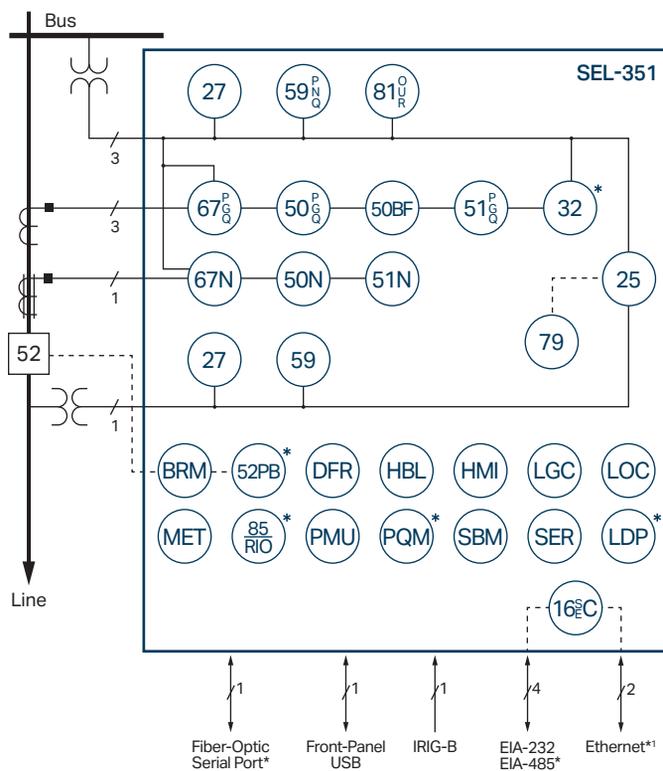
SEL-351

Protection System

selinc.com/products/351

Starting price
SEL-351-5, -6: \$2,570 USD
SEL-351-7: \$3,230 USD

The SEL-351 has built-in Ethernet and IEEE C37.118 synchrophasors and is ideal for directional overcurrent applications. Optional MIRRORING BITS® communications and power quality monitoring add flexibility. The SEL-351 is the protection standard for utility and industrial electrical systems around the world.



ANSI Functions

16 SEC	Access Security (Serial, Ethernet)
25	Synchronism Check
27	Undervoltage
32	Directional Power*
50BF	Breaker Failure Overcurrent
50N	Neutral Overcurrent
50 (P,G,Q)	Overcurrent (Phase, Ground, Negative Sequence)
51N	Neutral Time Overcurrent
51 (P,G,Q)	Time Overcurrent (Phase, Ground, Negative Sequence)
52PB	Trip/Close Pushbuttons*
59 (P,N,Q)	Overvoltage (Phase, Neutral, Negative Sequence)
67N	Directional Neutral Overcurrent
67 (P,G,Q)	Directional Overcurrent (Phase; Ground, SEF*; Neg. Seq.)
79	Autoreclosing
81 (O,U,R)	Frequency (Over, Under, Rate)
85 RIO	SEL MIRRORING BITS Communications*
DFR	Event Reports
HMI	Operator Interface
LGC	SELogic® Control Equations
MET	High-Accuracy Metering
PMU	Synchrophasors
PQM	Voltage Sag, Swell, and Interruption*
SER	Sequential Events Recorder

Additional Functions

BRM	Breaker Wear Monitor
HBL	Harmonic Blocking
LDE	Load Encroachment
LDP	Load Data Profiling*
LOC	Fault Locator
PPV	Phantom Phase Voltage
SBM	Station Battery Monitor

*Optional feature ¹ Copper or fiber-optic

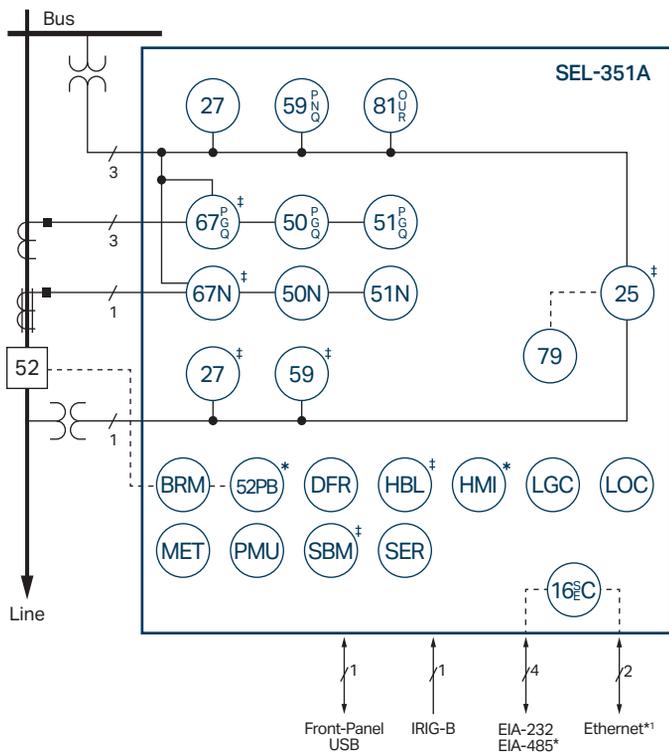
SEL-351A

Protection System

selinc.com/products/351A

Starting price
SEL-351A-1: \$1,410 USD
SEL-351A-0: \$1,600 USD

The SEL-351A has built-in Ethernet and IEEE C37.118 synchrophasors and is the economical solution for overcurrent protection. Easy-to-use feeder protection and innovative features like SEL's Best Choice Ground Directional Element® logic and SELogic® control equations provide superior protection on utility and industrial power systems.



ANSI Functions

16 SEC	Access Security (Serial, Ethernet)
25	Synchronism Check [†]
27	Undervoltage
50N	Neutral Overcurrent
50 (P,G,Q)	Overcurrent (Phase, Ground, Negative Sequence)
51N	Neutral Time Overcurrent
51 (P,G,Q)	Time Overcurrent (Phase, Ground, Negative Sequence)
52PB	Trip/Close Pushbuttons*
59 (P,N,Q)	Overvoltage [‡] (Phase, Neutral, Negative Sequence)
67N	Directional Neutral Overcurrent [†]
67 (P,G,Q)	Directional Overcurrent (Phase; Ground, SEF [†] ; Neg. Seq.) [†]
79	Autoreclosing
81 (O,U,R)	Frequency (Over, Under, Rate)
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
HBL	Harmonic Blocking [†]
LDE	Load Encroachment [†]
LOC	Fault Locator
PPV	Phantom Phase Voltage
SBM	Station Battery Monitor [†]

*Optional feature ¹ Copper or fiber-optic

[†]Available on the SEL-351A-0

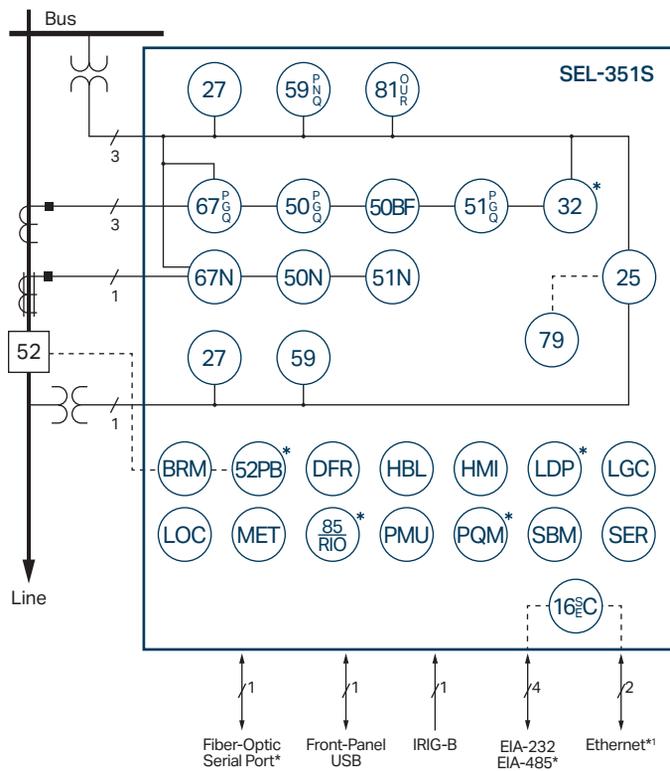
SEL-351S

Protection System

selinc.com/products/351S

Starting price
SEL-351S-5, -6: \$2,750 USD
SEL-351S-7: \$3,410 USD

The SEL-351S offers comprehensive feeder and overcurrent protection that is perfect for industrial and utility feeder applications. The relay enhances your quality of service with lower costs and innovative features like MIRRORING BITS® communications, IEEE C37.118 synchrophasors, expanded operator controls, and SEL's Best Choice Ground Directional Element® logic.



ANSI Functions

16 SEC	Access Security (Serial, Ethernet)
25	Synchronism Check
27	Undervoltage
32	Directional Power*
50BF	Breaker Failure Overcurrent
50N	Neutral Overcurrent
50 (P,G,Q)	Overcurrent (Phase, Ground, Negative Sequence)
51N	Neutral Time Overcurrent
51 (P,G,Q)	Time Overcurrent (Phase, Ground, Negative Sequence)
52PB	Trip/Close Pushbuttons*
59 (P,N,Q)	Overvoltage (Phase, Neutral, Negative Sequence)
67N	Directional Neutral Overcurrent
67 (P,G,Q)	Directional Overcurrent (Phase; Ground, SEF*; Neg. Seq.)
79	Autoreclosing
81 (O,U,R)	Frequency (Over, Under, Rate)
85 RIO	SEL MIRRORING BITS Communications*
DFR	Event Reports
HMI	Operator Interface
LGC	SELogic® Control Equations
MET	High-Accuracy Metering
PMU	Synchrophasors
PQM	Voltage Sag, Swell, and Interruption*
SER	Sequential Events Recorder

Additional Functions

BRM	Breaker Wear Monitor
HBL	Harmonic Blocking
LDE	Load Encroachment
LDP	Load Data Profiling*
LOC	Fault Locator
PPV	Phantom Phase Voltage
SBM	Station Battery Monitor

*Optional feature ¹ Copper or fiber-optic

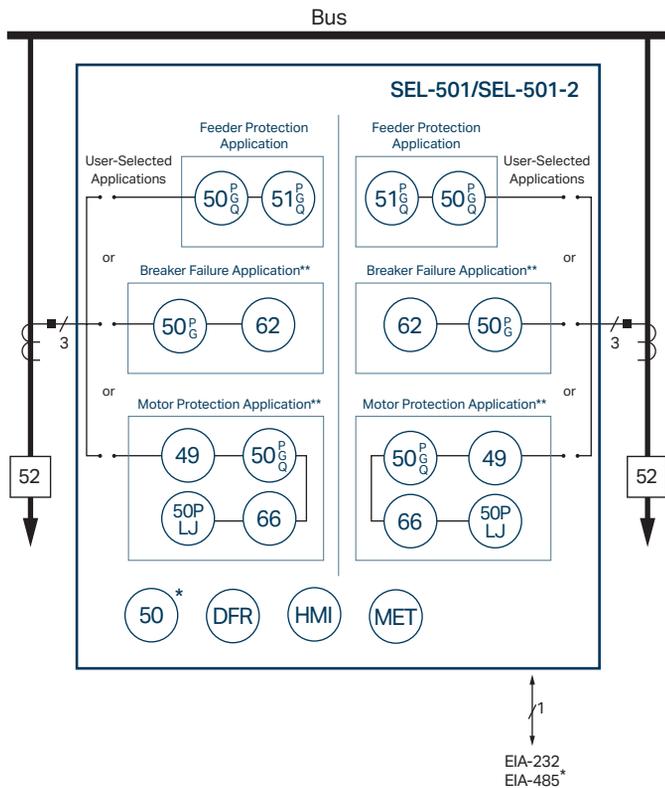
SEL-501/501-2

Dual Overcurrent Relays

Starting price
\$1,040 USD

selinc.com/products/501 

The SEL-501 provides simple and economical protection for transformers, breakers, motors, capacitor banks, feeders, and other apparatus, with two independent three-phase overcurrent relays in a single compact package. The SEL-501-2 is a dual overcurrent relay for feeders, buses, and other apparatus. Both relays contain Relay X and Relay Y, each having separate optoisolated inputs, output contacts, and three-phase current inputs. They also provide numerous protection schemes with user-enabled settings.



ANSI Functions

49	Thermal
50 (P,G)	Overcurrent (Phase, Ground)
50 (P,G,Q)	Overcurrent (Phase, Ground, Negative Sequence)
50P (LJ)	Load Jam/Loss
50	Adaptive Overcurrent*
51 (P,G,Q)	Time Overcurrent (Phase, Ground, Negative Sequence)
62	Timer
66	Starts Per Hour

Additional Functions

DFR	Event Reports
HMI	Operator Interface
MET	High-Accuracy Metering

*Optional feature **Not supported by SEL-501-2

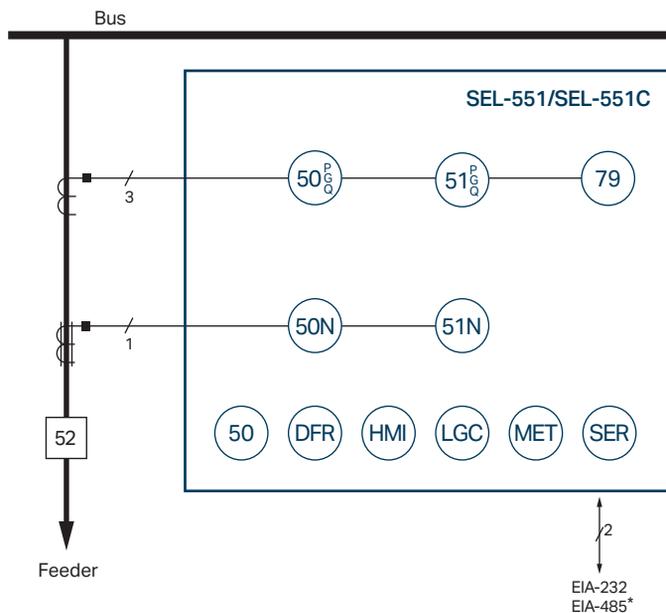
SEL-551/551C

Overcurrent/Reclosing Relays

Starting price
\$870 USD

selinc.com/products/551 or selinc.com/products/551C 

The SEL-551 provides complete overcurrent protection and multishot reclosing in one compact relay. It replaces many relays and control switches and much of the wiring required in traditional distribution substation protection and control panels. The relay also replaces line recloser control packages at a fraction of the cost. The SEL-551C provides flexibility in distribution system protection by offering six inputs, three outputs, and two communications ports for more control options. SELogic® control equations offer rising- and falling-edge triggers and latches for custom logic applications.



ANSI Functions

50N	Neutral Overcurrent
50 (P,G,Q)	Overcurrent (Phase, Ground, Negative Sequence)
50	Adaptive Overcurrent
51N	Neutral Time Overcurrent
51 (P,G,Q)	Time Overcurrent (Phase, Ground, Negative Sequence)
79	Autoreclosing

Additional Functions

DFR	Event Reports
HMI	Operator Interface
LGC	SELogic Control Equations
MET	High-Accuracy Metering
SER	Sequential Events Recorder

*Optional feature