2011 Fault Indicators and Sensors

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

Overview

In 1950, after presenting ideas and prototypes to Commonwealth Edison in Chicago, Edmund O. Schweitzer, Jr. founded E. O. Schweitzer Manufacturing to design and manufacture line-powered fault indicators. The company, started by SEL founder Edmund O. Schweitzer, III's father, has been a division of SEL since 2005. In 2011, it becomes the SEL Fault Indicator and Sensor Division. SEL will continue to supply utilities around the world with fault indicators and sensors that help reduce fault-finding time, so power can be restored quickly after a fault occurs.

The SEL Fault Indicator and Sensor Division has sold millions of high-quality fault indicators, voltage indicators and sensors, and split-core current transformers to over 1,000 domestic and international customers. Located in the Chicago suburb of Lake Zurich, Illinois, the division continues to find innovative ways to reduce fault-finding time, leading the way in development of sensor technology that includes radio frequency fault indicator solutions for both underground and overhead applications.

SEL Fault Indicator and Sensor Division, Lake Zurich, Illinois, USA

Letter From the President

The world of electric power has changed significantly over the past three decades, and the pace may even be accelerating. New regulatory structures, environmental issues, the integration of intermittent sources of energy, increasing reliability expectations, and the basic needs of society for economic sources of energy challenge all of us daily.

Our company's purpose is to make electric power safer, more reliable, and more economical. We focus on innovation, quality, and customer service, in order to pursue our purpose in the context of energy needs. We strive to make it simple to get the job done at all stages: concept, evaluation, specification, purchasing, training, installation, integration, maintenance, and use. We enjoy working closely with you—listening, learning, and sharing—because the world is changing, and we know the problems you may face today may not be solved with yesterday's solutions.

SEL fault indicators, split-core current transformers, and voltage sensors and indicators, designed and manufactured by SEL's Fault Indicator and Sensor Division, are part of the complete SEL distribution system solutions for electric power utilities, cooperatives, universities, military installations, and many other types of customers around the world. Renewable generation facilities make up another growing market for SEL fault indictors and sensors. We continue to invest in research and development, adding new products such as our wireless sensor for overhead lines, a communications sensor with an integrated radio. Our commitment is to create new products and technologies that will serve our customers well today and in the future.

The following pages contain more information about SEL fault indicators and sensors. We invite you to consider the many applications these may support in your industry: finding faults on long rural feeders using AutoRANGER® technology, identifying fault locations in urban networks with underground vaults using the RadioRANGER® Wireless Fault Indication System, monitoring current with easy-to-install split-core current transformers, and keeping personnel safe with voltage indicators.

The privilege of joining with our customers around the world—in thousands of businesses and with many different goals—is truly an honor. All of us at SEL look forward to working together with you to create the best solutions for the electric power industry.

Sincerely,

Edmund O. Schweitzer, III Ph.D.
President

Warranty

All products manufactured by the SEL Fault Indicator and Sensor Division come with a full, five-year product warranty, the longest in the fault indicator industry. The RadioRANGER Wireless Fault Indication System comes with a full, ten-year warranty.

Product Index

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Underground Fault Indicators

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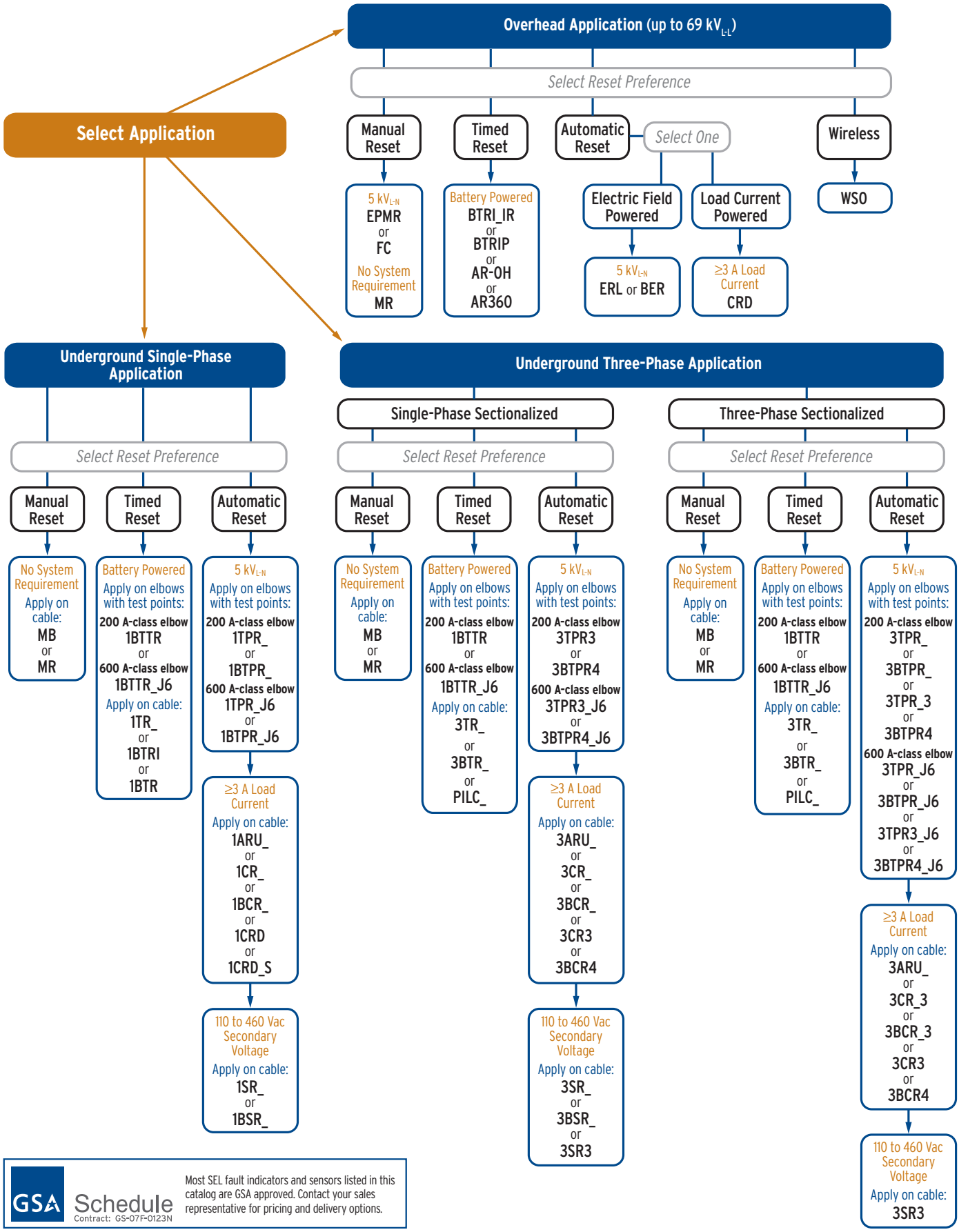
Ordering and Customer Support

SEL Fault Indicator Selection Guide

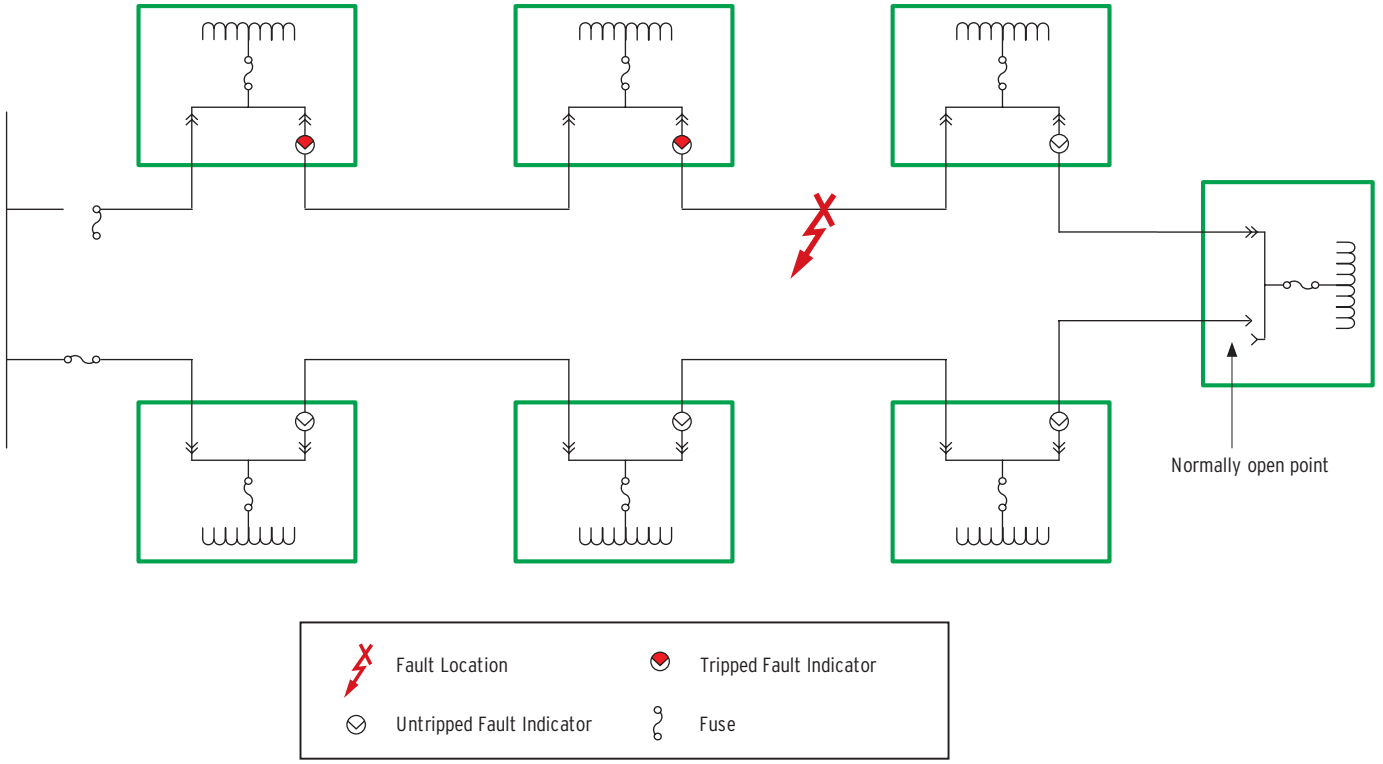


GSA Schedule
Contract: GS-07F-0123N

Most SEL fault indicators and sensors listed in this catalog are GSA approved. Contact your sales representative for pricing and delivery options.

Applying SEL Fault Indicators

SEL fault indicators sense the magnetic field produced by current flowing through a conductor. When fault current passes through the fault indicator, the fault indicator "trips," indicating a fault. Because SEL offers a variety of fault indicator displays, the trip might be indicated by a reflective target, flashing light, or combination of the two display types. The Tamperproof Bolt Display, read by a compass-like tool, and RadioRANGER® Remote Fault Reader provide other display options.



Line crews find the location of faults by isolating the section of line between the last tripped (red) fault indicator and the first untripped (white) fault indicator.

Underground

In underground applications, a utility usually places a fault indicator on each primary cable. If a fault causes a feeder fuse to operate, the indicators upstream of the fault trip, and the indicators after the fault remain in the untripped position. As a result, the utility can easily identify the faulted section of cable without going through a time-consuming re-fuse and sectionalize process.

Underground applications include subsurface or pad-mounted transformers, subsurface or pad-mounted switchgear and sectionalizing cabinets, junction boxes, and splices. An auxiliary contact option provides SCADA compatibility.

The RadioRANGER Wireless Fault Indication System, designed for underground vault applications, uses radio frequency to communicate fault status to a handheld Remote Fault Reader (see page 20).

Overhead

When a fault occurs on an overhead system, the easy-to-spot displays on the SEL fault indicators lead the line crew to the faulted section of line.

Overhead applications include unfused taps, long feeders with midline reclosers or sectionalizers, overhead-to-underground transitions, and feeders that experience recurring faults.

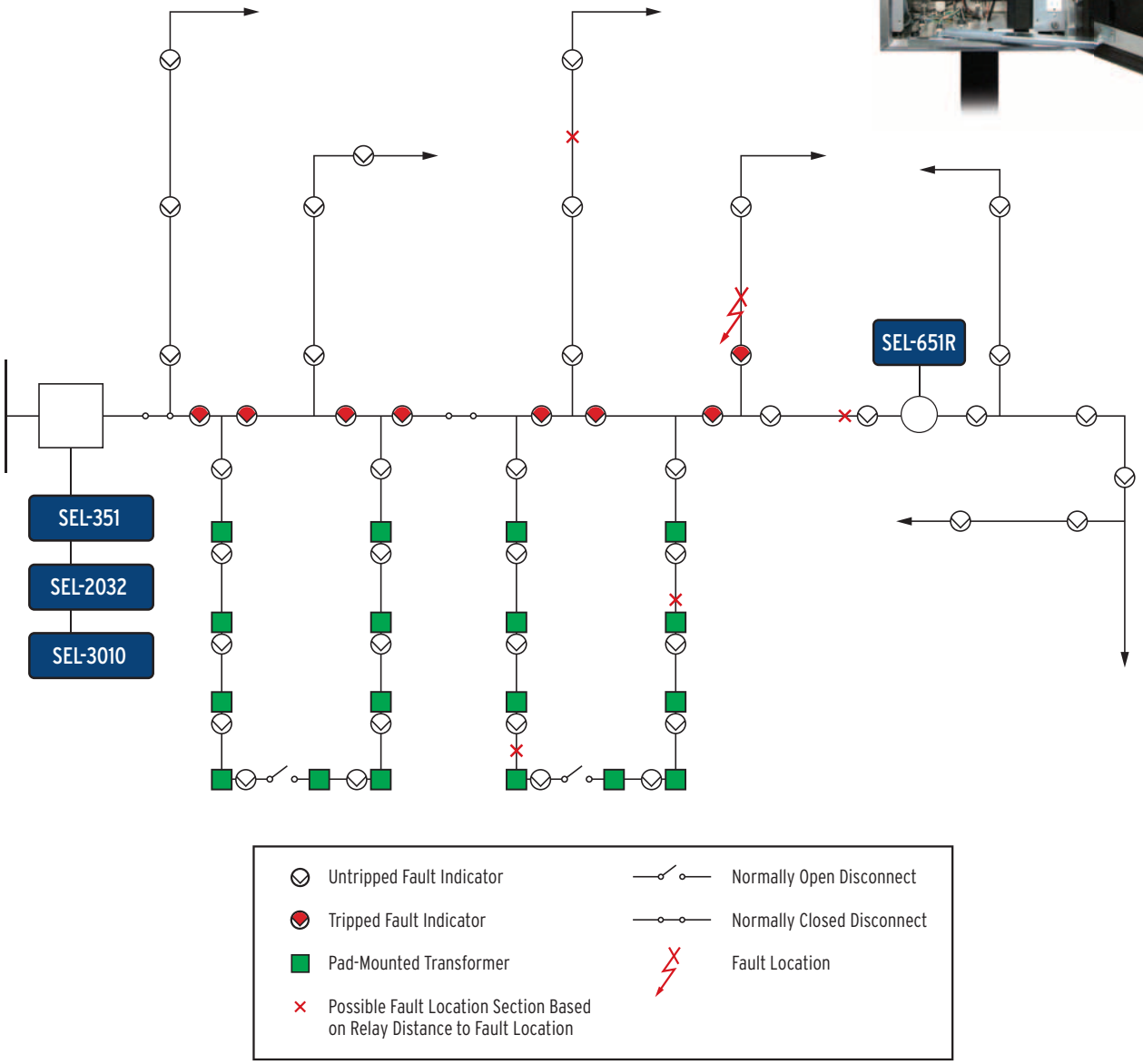
Applying fault counters and timed reset fault indicators in areas affected by momentary outages and flickering lights is an efficient means of identifying the location of temporary faults. This application of fault indicators provides utilities with the information to resolve these disruptions. Using fault indicators reduces costs to utilities and their customers and improves utilities' reliability indices.

Applying Fault Indicators With Other SEL Products

Use SEL fault indicators and distribution protection equipment together to identify the location of a fault.

When a fault occurs, the SEL feeder relay calculates the fault location as a distance from the substation to the fault, information that could be communicated to a lineman's cell phone via the SEL-3010 Event Messenger. When a feeder has multiple taps, as shown in the diagram below, the line crew is unable to determine which tap to follow to find the location of the fault. SEL fault indicators provide a solution by pointing the way to the correct tap, then to the faulted section of line.

Combine fault indicators with recloser controls to find faults even faster. Recloser controls sectionalize the line and quickly determine the distance to a fault. Apply fault indicators to identify faulted circuits and reduce fault-finding time.



SEL Fault Indicators

Overhead Fault Indicators

WSO—Wireless Sensor for Overhead Lines

AR360—360° Overhead AutoRANGER®

AR-OH—Overhead AutoRANGER

BTRIP—BEACON® Field-Programmable Timed Reset

BTRI_IR—BEACON Timed Reset

BER—BEACON Electrostatic Reset

ERL—Electrostatic Reset

CRD—Current Reset

Underground Fault Indicators

AR-URD—Underground AutoRANGER

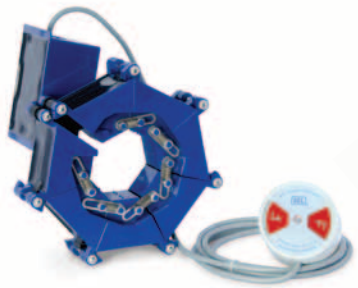
TPR—Test Point Reset

TR—Timed Reset

CR—Current Reset

MB—Manual Reset With Reset Button

MR—Manual Reset



PILC—Paper-Insulated Lead Cable Fault Indicator

SR—Secondary/ Low-Voltage Reset

GFD—Ground Fault Detector

RadioRANGER®—Wireless Fault Indication System

Overhead Fault Indicator Feature Table

Overhead Fault Indicators	Manual Reset		Electrostatic Reset		Current Reset	Timed Reset			Wireless
	MR	FC	ERL†	BER	CRD	BTRI_IR	AR-OH/AR360	BTRIP	WSO
APPLICATION									
Single-Phase	•	•	•	•	•	•	•	•	•
Three-Phase (Use 3 Single-Phase FCIs)	•	•	•	•	•	•	•	•	•
Troubleshooting	•	•				•	•	•	•
Also Applicable Underground	•		•		•				
RESET TYPE									
Manual Reset	•	•							
Electrostatic Reset			•	•					•
Current Reset					•				
Timed Reset						•	•	•	
DISPLAY OPTIONS									
Integral Target	•		•	•	•				•
Integral Pointer		•							
Integral LED(s)				•		•	•	•	
STANDARD FEATURES									
Inrush Restraint		•	•	•	•	•	•	•	•
Undelayed Trip (1 ms)		•	•	•	•	•			
Undelayed Trip (8 ms)	•								
Delayed Trip (24 ms)							•	•	•
Replaceable Lithium AA Cell				•		•			
Nonreplaceable Lithium C Cell							•	•	•
Daylight Restraint®				•					
AVAILABLE OPTIONS*									
Delayed Trip (24 ms)		•	•	•	•	•			
Nonreplaceable Lithium C Cell				•		•			
Constant Calibration			•	•					
TRIP RATINGS									
Self-Adjusting (50 to 1200 A)							•		•
Field-Programmable (50 to 1200 A)								•	
100 to 800 A	•								
50 to 1000 A		•							
50 to 1200 A			•	•		•			
100 to 1200 A					•				
POWER SOURCE									
Fault-Powered	•								
Line-Powered		•	•	•	•				
Battery				•		•	•	•	•
ARMING REQUIREMENTS (MAINTAIN READINESS TO TRIP)									
No Arming Requirement	•								
5 kV_{L-N} Continuous		•	•	•		•			
3 A Continuous					•				
2.4 kV_{L-N} and 10 A Continuous Load Current							•	•	•
RESET REQUIREMENTS									
Human Intervention	•	•							
5 kV_{L-N}			•	•					
3 A					•				
Time						•	•	•	•
OUTER DIAMETER CLAMPING RANGE (SPECIFY CABLE OUTER DIAMETER WHEN ORDERING)									
0.25" to 1.60"	•	•	•	•		•			
0.30" to 1.10"					•				
0.30" to 1.50"									
0.162" to 1.50"							•	•	•
SYSTEM VOLTAGE RANGE									
Up to 38 kV_{L-L}	•	•			•				•
8660 V_{L-L} to 69 kV_{L-L}			•	•					
4160 V_{L-L} to 69 kV_{L-L}							•	•	
8660 V_{L-L} to 38 kV_{L-L}						•			

* *Not all options are available on all models of a product family.*

† *Specify the snap-action clamp when applying the ERL on live-front switchgear lugs in underground applications. Snap-action clamping range from 1.0" to 2.3".*

WSO—Wireless Overhead Sensor

This distribution automation sensor stores load and temperature data, and monitors the distribution line for loss of voltage, loss of current, or fault events. Reports are transmitted to an access point on a communications network using an integrated radio.

Key Features

- Monitors average load current, ambient temperature, fault threshold, battery status, and history of outages and surge events.
- Allows more efficient maintenance scheduling using stored data profiles.
- Prevents false tripping with the inrush restraint feature, which allows for coordinated integration with automated reclosing schemes.
- Installs quickly using a standard hot stick.
- Displays visual target in addition to remote indication.
- Employs AutoRANGER® technology.
- Automatically adjusts fault threshold based on steady-state load.

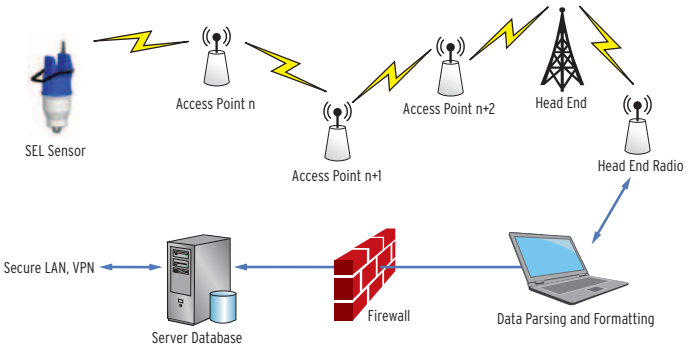
Note: Consult factory for available radio solution

Specifications	
Fault Sensing Range	50 A to 1200 A
System Voltage Range (L-L)	4.16 V to 34.5 kV
Maximum Fault Current	25 kA for 10 cycles
Battery	3.6 V high-capacity 19 Ah lithium battery with a 20-year shelf life
Temperature Range	−40° to +85°C
Approximate Weight	600 g (1.32 lbs)

Designed to meet IEEE 495 standards.

Applications

Reduce fault-finding time by communicating fault status back to a central location. Utilities are able to locate faults more quickly, thereby improving distribution reliability. Apply on overhead lines. The integrated radio operates in conjunction with a utility's existing communications infrastructure, such as a mesh or other radio network, as pictured in the example below:



As each application may vary, depending on the existing or planned communications system, its current use, and the desired reporting content and features, please consult SEL for additional information.

AR360—Overhead AutoRANGER®

360° visibility with intelligent display.

Key Features

- Intelligent display allows 360 degree visibility with six ultrabright, wide-angle LEDs that provide overlapping fields of light.
- Distinct temporary (amber) and permanent (red and amber) flashing patterns provide flexibility of locating cause of permanent and self-clearing faults.
- Auto-adjusting trip-level selection can detect faults with as little as 50 A of current when loads are light. Automatically steps up its trip threshold up to 1200 A for heavily loaded circuits.
- Inrush restraint feature allows coordinated integration with automatic reclosing schemes.
- The best battery-saving technology in the industry provides more than 1,800 flashing hours of operation.
- Patented Ramp-Down Restraint® feature prevents false activation after extended circuit lockout.
- Rugged construction ensures long product life.
- Quick, simple installation.
  - Installs with a single hot stick—no extra clamps or screws
  - Zero maintenance
  - Test and manually reset with the CRSRTT tool

Specifications	
Trip Value Range	50 to 1200 A
System Voltage Range (L-L)	4160 V to 34.5 kV
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	24 ms, nominal
Permanent Flash Clearing Times	
50 and 100 A Trip Levels	8 hours
200 to 1200 A Trip Levels	4 or 8 hours
Temporary Flash Clearing Times	0, 4, 8, 16, or 24 hours
Outer Diameter Clamping Range	0.162" to 1.50"
Battery	3.6 V high-capacity 17 Ah lithium battery with a 20-year shelf life
Flash Life	1800+ hours
Temperature Range	–40° to +85°C
Approximate Weight	825 g (1.82 lbs)

Applications

Overhead

- Provides clear visual indication of the fault path to line crews in the field.
- Reduces fault-locating time by guiding line crews to the faulted line section.
- Allows line crews to easily distinguish between temporary and permanent faults. Permanent faults are displayed with a red-amber flashing pattern that appears to rotate around the device. Temporary faults are displayed with an amber, nonrotating flash pattern.
- Provides a simple, economical way to improve utility reliability metrics by reducing outage durations.

Rural

- Automatic trip value selection as low as 50 A.
- TR(TV)™ feature (Timed Reset as a function of Trip Value) allows additional time for line crews to find faults on remote lines.

Troubleshooting

- Distinct temporary indication leads line crews to troubleshoot problematic sections of line.
- Allows line crews to investigate the cause of self-clearing faults and successful trip and reclose operations to improve circuit reliability.

Use the CRSRTT tool (sold separately) to field-test and manually reset the AR360 Overhead AutoRANGER®.

Flashing sequence rotates around the device indicating whether a fault is temporary or permanent.

AR-OH—Overhead AutoRANGER®

Self-adjusting fault indicator for system-wide application—one long-life product for all system loads.

Key Features

- Reduce engineering time, inventory, and misapplication with self-adjusting trip levels.
- Automatically adjusts its trip value based on the load current, eliminating the need to specify a trip value.
- Distinct temporary (amber) and permanent (red) fault indications provide the flexibility of tracking down self-clearing faults.
- The inrush restraint feature allows for coordinated integration with automatic reclosing schemes.
- Intelligent LED display provides the appropriate level of intensity for ambient lighting conditions.
- The best battery-saving technology in the industry provides more than 2,500 flashing hours of operation.
- Patented Ramp-Down Restraint® feature prevents false activation after extended circuit lockout.
- Rugged construction ensures long product life.
- Quick, simple installation.
  - Installs with a single hot stick—no extra clamps or screws
  - Zero maintenance
  - Test and manually reset with the CRSRTT tool

Specifications	
Trip Value Range	50 to 1200 A
System Voltage Range (L-L)	4160 V to 69 kV
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	24 ms
Permanent Flash Clearing Times	
50 and 100 A Trip Levels	8 hours
200 to 1200 A Trip Levels	4 or 8 hours
Temporary Flash Clearing Times	0, 4, 8, 16, or 24 hours
Outer Diameter Clamping Range	0.162" to 1.50"
Battery	3.6 V high-capacity 8.5 Ah lithium battery with a 20-year shelf life
Flash Life	2500+ hours (625 four-hour events*)
Temperature Range	−40° to +85°C
Approximate Weight	575 g (1.27 lbs)

** Based on AR4-8-OH. Others dependent on configuration.*

Applications

Overhead

- Provides clear visual indication of the fault path to line crews in the field.
- Reduces fault-locating time by guiding line crews to the faulted line section.
- Allows line crews to easily distinguish between temporary and permanent faults.
- Provides a simple, economical way to improve utility reliability metrics by reducing outage durations.

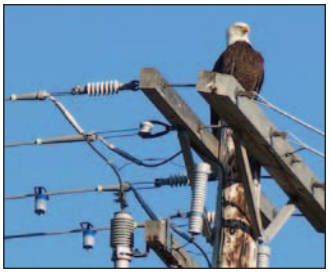
Rural

- Automatic trip value selection as low as 50 A.
- TR(TV)™ feature (Timed Reset as a function of Trip Value) allows additional time for line crews to find faults on remote lines.

Troubleshooting

- Distinct eight-hour temporary indication leads line crews to troubleshoot problematic sections of line.
- Allows line crews to investigate the cause of self-clearing faults and successful trip and reclose operations to improve circuit reliability.

Use the CRSRTT tool (sold separately) to field-test and manually reset the Overhead AutoRANGER®.



AutoRANGER® Fault Indicators providing fault indication in Kodiak, Alaska.

Install the AutoRANGER® with a single hot stick.

BTRIP—BEACON® Field-Programmable Timed Reset

Select your trip value in the field. Stock one fault indicator for a variety of system conditions.

Key Features

- Indicator's trip value is field-selectable based on circuit load and available fault current—stock one fault indicator for a variety of system conditions.
- Provides clear visual indication of the fault path to line crews in the field.
- Reduces fault-locating time by guiding line crews to the faulted line section.
- Provides a simple, economical way to improve utility reliability metrics by reducing outage durations.
- Inrush restraint feature allows for coordinated integration with automatic reclosing schemes, preventing false tripping.
- Rugged construction ensures long product life.
- Quick, simple installation.
  - Installs with a single hot stick—no extra clamps or screws
  - Zero maintenance
  - Test and manually reset with the CRSRTT tool

Specifications	
Trip Value Range	Select a set of four defined values between 50 A and 1200 A (see ordering table on page 16)
System Voltage Range (L-L)	4160 V to 69 kV
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	24 ms
Reset Time	4 or 8 hours (specify when ordering)
Outer Diameter Clamping Range	0.162" to 1.50"
Battery	3.6 V high-capacity 8.5 Ah lithium battery with a 20-year shelf life
Flash Life	2100+ hours
Temperature Range	–40° to +85°C
Approximate Weight	575 g (1.27 lbs)

Use the CRSRTT tool (included) to program, field-test, and manually reset the BTRIP.

BTRIP Fault Indicators provide the flexibility of field-selectable trip value.

The BTRIP's simple, strong clamp is easy to install on overhead lines.

BTRI_IR—BEACON® Timed Reset

Economical timed reset fault indicator eliminates false reset concerns.

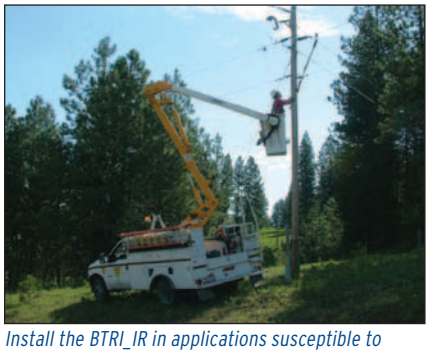
Key Features

- Applicable on overhead taps, overhead-to-underground transitions, and at overhead midfeeder disconnects.
- No minimum load current necessary for reset.
- Permanently installed high-capacity lithium battery provides an average of 3,000 flashing hours (1,200 for models with a replaceable battery, shown in the photo above).
- Time delay between system restoration and reset makes the BTRI_IR a good choice for troubleshooting temporary faults.
- Inrush restraint feature allows for coordinated integration with automatic reclosing schemes, preventing false tripping.

Specifications	
Power Source	High-capacity 3.6 V lithium battery
Replaceable Battery	1200-hour flashing life (2.4 Ah cell)
Nonreplaceable Battery	3000-hour flashing life (8.5 Ah cell)
Nominal Trip Ratings	50 to 1200 A
Trip Tolerance	±10%
System Voltage Range (L-L)	8660 V to 38 kV
Maximum Fault Current	25 kA for 10 cycles at 60 Hz
Display	Flashing red LED with a 4- or 8-hour clearing time
Outer Diameter Clamping Range	0.25" to 1.6" (please specify clamping diameter or range when ordering)
Housing Material	UV-stabilized polycarbonate resin
Clamp Material	Stainless-steel clamp with a UV-stabilized rubber sleeve
Temperature Range	–40° to +85°C
Approximate Weight	400 g (0.88 lbs)

Use the CRSRTT tool (sold separately) to field-test and manually reset the BTRI_IR.

BTRI_IR Fault Indicators installed on an overhead system.



Install the BTRI_IR in applications susceptible to temporary faults.

ERL—Electrostatic Reset

Battery-free automatic reset fault indicator provides maintenance-free fault indication.

Key Features

- Automatically resets upon restoration of system voltage.
- Apply at strategic intervals along overhead conductors and at midfeeder disconnects to minimize fault-finding time and optimize reliability statistics.
- Inrush restraint feature prevents false tripping during recloser operations.
- The reflective red target (the largest display in the industry) is easy to spot both at night and during the day.
- Zero maintenance: no battery to replace or monitor.
- Models with the snap-action clamp option are applicable on live-front switchgear—simply install the ERL onto the barrel of the cable termination lug.

Specifications	
Power Source	Electric field potential gradient
Nominal Trip Ratings	50 to 1200 A
Trip Tolerance	±10%
System Voltage Range (L-L)	8660 V to 69 kV
Reset Time	Approximately 5 minutes at 5 kV_{L-N} (higher voltages result in quicker reset)
Display	Reflective red target
Maximum Fault Current	25 kA for 10 cycles at 60 Hz
Trip Response Time	1 ms
Inrush Restraint Response Time	300 ms
Outer Diameter Clamping Range	0.25" to 1.6" (please specify clamping diameter or range when ordering)
Housing Material	UV-stabilized polycarbonate resin
Clamp Material	Stainless-steel clamp with a UV-stabilized rubber sleeve
Temperature Range	−40° to +85°C
Approximate Weight	240 g (0.53 lbs)

Side view of the ERL.

The ERL, SEL's best-selling overhead fault indicator, automatically resets upon system restoration.

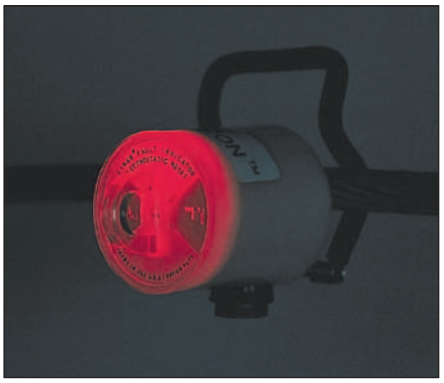
BER—BEACON® Electrostatic Reset

Combination LED and target display provides optimal night and day indications, and maximizes battery life.

Key Features

- Dual-display faulted circuit indicator (FCI) incorporates an LED with a reflective red mechanical target (the largest in the industry) to provide excellent visual indication, even in low light conditions.
- 1,200 flashing hours standard; 3,000 flashing hours with the non-replaceable battery.
- The mechanical target continues to provide indication regardless of battery status.
- Automatic reset upon restoration of system voltage.
- Daylight Restraint® conserves battery life by activating the LED only in reduced ambient light conditions.
- Apply at strategic intervals along overhead conductors and at midfeeder disconnects to minimize fault-finding time and optimize reliability statistics.
- Inrush restraint feature prevents false tripping during recloser operations.

Specifications	
Power Source	Electric field potential gradient
Nominal Trip Ratings	50 to 1200 A
Trip Tolerance	±10%
System Voltage Range (L-L)	8660 V to 69 kV
Reset Time	Approximately 5 minutes at 5 kV_{L-N} (higher voltages result in quicker reset)
Display	Reflective red target with LED
Maximum Fault Current	25 kA for 10 cycles at 60 Hz
Trip Response Time	1 ms
Inrush Restraint Response Time	300 ms
Outer Diameter Clamping Range	0.25" to 1.6" (please specify clamping diameter or range when ordering)
Battery	3.6 V high-capacity lithium battery with a 20-year shelf life
Flash Life	1200+ hours standard (replaceable 2.4 Ah cell); 3000+ hours (nonreplaceable 8.5 Ah cell)
Housing Material	UV-stabilized polycarbonate resin
Clamp Material	Stainless-steel clamp with a UV-stabilized rubber sleeve
Temperature Range	–40° to +85°C
Approximate Weight	390 g (0.86 lbs)



The BER Fault Indicator provides excellent fault indication at night because of its high-intensity LED display.

CRD — Current Reset

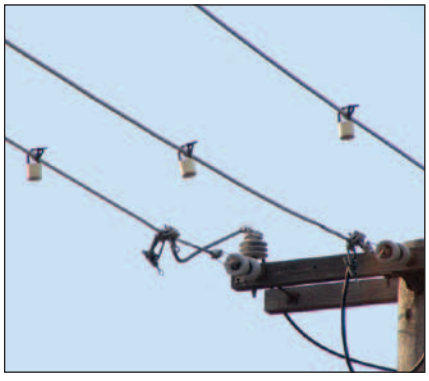
Load current-powered FCI with no minimum voltage requirement provides a solution for low-voltage applications.

Key Features

- Load current-powered—no battery necessary.
- No minimum voltage requirement.
- Automatically resets upon restoration of load current.
- Inrush restraint feature prevents false tripping during recloser operations.
- Maintains trip tolerance throughout the clamping range.
- Easy to install with a single hot stick.
- UV-stabilized materials provide excellent weatherability.

Specifications	
Power Source	Load current
Nominal Trip Ratings	100 to 1200 A
Trip Tolerance	±10%
System Voltage Range (L-L)	Up to 38 kV
Reset Time	25 seconds at 3 A
Reset Current	3 A
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	1 ms
Inrush Restraint Response Time	300 ms
Outer Diameter Clamping Range	0.3" to 1.1" (please specify clamping diameter or range when ordering)
Housing Material	UV-stabilized polycarbonate resin
Transformer Core	Silicon steel with vinyl coating
Temperature Range	−40° to +85°C
Approximate Weight	510 g (1.12 lbs)

The CRD Fault Indicator is easy to install on an overhead line using a single hot stick.



CRDs provide fault indication in a low-voltage application.

Overhead Fault Indicator Ordering Tables

Instructions for Creating Overhead Fault Indicator Part Numbers

1. Select one code (in bold) from each column (i.e., B, TRI, P3, etc.). For the Overhead BEACON® Timed Reset, both options can be selected from the Options column. List option codes in the order that they appear in the column.[1]
2. Follow your usual process to issue a purchase order, or complete a specification for standards.

Example Part Numbers

AR4–0H

BTRI0300IR4DT

Overhead AutoRANGER

AutoRANGER	Permanent Time-Out	Temporary Time-Out	Overhead Designation
AR	**4** 4 hrs	**–0** 0 hrs	**–0H**
	8 8 hrs	**–4** 4 hrs	
		–8 8 hrs	
		–16* 16 hrs	
		–24* 24 hrs	

Overhead AutoRANGER AR360 High Visibility

AutoRANGER	Permanent Time-Out	Temporary Time-Out
AR360	**–4** 4 hrs	**–0** 0 hrs
	–8 8 hrs	**–4** 4 hrs
		–8 8 hrs
		–16* 16 hrs
		–24* 24 hrs

* Extended time-out may affect battery life. Please consult factory.

Overhead BEACON Field-Programmable Timed Reset

BEACON LED	Timed Reset Designation	Programmable Trip Level Options	Trip Level Set at Shipment	Inrush Restraint	Time-Out Period
B	**TRI**	**P1** (100, 200, 400, 800 A)	**S1** Setting 1	**IR**	**4** 4 hrs
		P2 (200, 600, 800, 1200 A)	**S2** Setting 2		**8** 8 hrs
		P3 (400, 600, 800, 1000 A)	**S3** Setting 3		**16** 16 hrs
		P4 (600, 800, 1000, 1200 A)	**S4** Setting 4		**24** 24 hrs
		P5 (50, 100, 200, 400 A)			

Overhead BEACON Timed Reset

BEACON Timed Reset Designation	Trip Level	Inrush Restraint	Time-Out Period	Options
BTRI	**0050** 50 A	**IR**	**2** 2 hrs	**–** No options
	0100 100 A		**4** 4 hrs	**DT** Delayed trip (24 ms)
	0200 200 A		**8** 8 hrs	**N** Nonreplaceable battery
	0300 300 A		**M** Manual reset	
	0400 400 A			
	0600 600 A			
	0800 800 A			
	1000 1000 A			
	1200 1200 A			

Other time-out periods may be available for your application. For details, please call Customer Service at +1.847.362.8304.

Overhead Electrostatic Reset

Electrostatic Reset Designation	Trip Level	Inrush Restraint	Options
ERL	**0050** 50 A	**IR**	**–** No options
	0100 100 A		**DT** Delayed trip (24 ms)
	0200 200 A		
	0300 300 A		
	0400 400 A		
	0600 600 A		
	0800 800 A		
	1000 1000 A		
	1200 1200 A		

Overhead BEACON Electrostatic Reset

BEACON Electrostatic Reset Designation	Trip Level	Inrush Restraint	Options
BER	**0050** 50 A	**IR**	**–** No options
	0100 100 A		**DT** Delayed trip (24 ms)
	0200 200 A		**N** Nonreplaceable battery
	0300 300 A		
	0400 400 A		
	0600 600 A		
	0800 800 A		
	1000 1000 A		
	1200 1200 A		

Overhead Current Reset

Current Reset Designation	Large Integral Display	Trip Level	Inrush Restraint	Options
CR	**D**	**0100** 100 A	**IR**	**–** No options
		0200 200 A		**DT** Delayed trip (24 ms)
		0300 300 A		
		0400 400 A		
		0600 600 A		
		0800 800 A		
		1000 1000 A		
		1200 1200 A		

1 Consult Customer Service at +1.847.362.8304 if you are preparing to order a part number you have not ordered before.

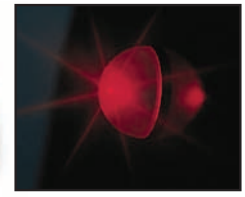
Underground Fault Indicating and Sensing

Advantages of SEL Underground Fault Indicators

- Compact, lightweight construction simplifies installation.
- All products manufactured by SEL Fault Indicator and Sensor Division come with a full, five-year product warranty; the RadioRANGER® Wireless Fault Indication System comes with a ten-year warranty.
- The RadioRANGER eliminates the need to open, enter, pump, or drain multiple underground vaults to find the location of a fault.
- Trip-value settings range from 50 A to 1200 A, and the AutoRANGER automatically adjusts its trip value based on the load current.
- Displays are easy to spot, easy to read, and require a minimal number of holes to be drilled in a transformer cabinet for installation.
- Any SEL fault indicator that uses batteries relies on patented technology, offering the longest cumulative flashing-hour life in the industry. As a result, SEL fault indicators require little, if any, maintenance.
- Auxiliary contact options available on most underground models enable SCADA compatibility.
- Magnetic cable guides keep remote display and sensor wiring neatly in place.
- The paper-insulated lead cable (PILC) fault indicator is a one-of-a-kind solution for fault finding on these cables.

Underground Display Options

Tamperproof Bolt Display



BEACON Bolt® Display

Standard "V" Display (BEACON® versions also available)

Three-Phase "3" Display (BEACON versions also available)

Large "L" Display (BEACON versions also available)

RadioRANGER® Remote Fault Reader (SEL-8310) Display

Fiber-Optic Display

Underground Fault Indicator Feature Table

	Manual Reset Fault Indicators		Voltage Reset Faulted Circuit Indicators (FCIs)											PILC Family
				Test Point Voltage Reset Family					Secondary Voltage Reset Family					
	MR	MB	ERL†	TPRI	TPRV	TPRL	TPRB	TPR3	SRI	SRV	SRL	SRB	SR3	
APPLICATION														
Single-Phase	●	●	●	●	●	●	●		●	●	●	●		
Three-Phase	+	+	+	+	●	●	●	●	+	●	●	●	●	●
Troubleshooting	●	●												
Three-Phase Reset								●					●	
RESET TYPE														
Manual Reset	●	●												
Electrostatic Reset			●											
Test Point Voltage Reset				●	●	●	●	●						
Secondary Voltage Reset									●	●	●	●	●	
Current Reset														
Timed Reset														●
DISPLAY OPTIONS														
Integral Target	●	●	●	●					●					
Remote Target					●	●				●	●			●
Integral LED														
Remote LED, Hard-Wired							B					B		
Remote Target With LED					B	B				B	B			
Remote LED Fiber-Optic Display														
Three-Phase Target								●					●	
Three-Phase Target With LED								4						
Tamperproof Bolt Display							●					●		
RadioRANGER® Magnetic Probe														●
STANDARD FEATURES														
Undelayed Trip (1 ms)			●	●	●	●	●	●	●	●	●	●	●	
Undelayed Trip (8 ms)	●	●												
Delayed Trip Response Time														
Replaceable Lithium AA Cell														
Nonreplaceable Lithium C Cell														
Inrush Restraint			●											
Discrete Time-Current Curve														●
OPTIONAL FEATURES*														
Inrush Restraint				●	●	●	●	●	●	●	●	●	●	
Auxiliary Contact				●	●	●	●	●	●	●	●	●	●	
Window Mounting Kit						●					●			
Delayed Trip (24 ms)			●	●	●	●	●	●	●	●	●	●	●	
Snap-Action Clamp			●											
Nonreplaceable Lithium C Cell														
Junction Shield				●	●	●	●	●						
Constant Calibration			●											
Test Point Phase Sensor				●	●	●	●	●						
TRIP RATINGS														
25 to 800 A		●												
50 to 1000 A									●	●	●	●	●	
50 to 1200 A			●											
60 to 1200 A				●	●	●	●	●						
100 to 800 A	●													
100 to 1200 A														
600 to 1200 A														●
Self-Adjusting (50 A to 1200 A)														
POWER SOURCE														
Line-Powered			●	●	●	●	●	●						
Secondary Source									●	●	●	●	●	
Battery					B	B	B	B		B	B	B		●
ARMING REQUIREMENTS (MAINTAIN READINESS TO TRIP)														
No Arming Requirement	●	●												●
5000 V_{L-N}			●	●	●	●	●	●						
110 to 460 Vac									●	●	●	●	●	
3 A [LC]														
RESET REQUIREMENTS														
Human Intervention	●	●												
5000 V_{L-N} Continuous			●	●	●	●	●	●						
110 to 460 Vac									●	●	●	●	●	
3 A Continuous [LC]														
Time														●
OUTER DIAMETER CLAMPING RANGE (SPECIFY CABLE OUTER DIAMETER WHEN ORDERING)														
0.25" to 1.60"	●		●											
0.25" to 1.40"		●												
0.75" to 1.60"									●	●	●	●	●	
0.75" to 2.10"														
2.2" to 4.64"														●
Larger Clamp Options	C	C							C	C	C	C	C	
SYSTEM VOLTAGE RANGE														
Up to 35.5 kV_{L-L}	●	●												
Matches Shielded URD Cable Rating				●	●	●	●	●	●	●	●	●	●	●
8660 V_{L-L} to 34.5 kV_{L-L}			●											

3 *Option is available when selecting the 3 suffix (three-phase reset)*

4 *Reflective red targets with a center BEACON® LED*

B *Option is available when selecting the B prefix (BEACON LED) in model selection*

T *Test point phase sensor*

C *Please consult factory*

* *Not all options are available on all models of a product family*

Current Reset Faulted Circuit Indicators (FCIs)											Timed Reset Fault Indicators				
Current Reset Family					Underground AutoRANGER Family						Timed Reset Family				
CRI	CRV	CRL	CRB	CR3	1ARUI	1ARUV	1ARUL	1ARUB	3ARU3	1BARUZR	TRI	TRV	TRL	TRB	TR3
•	•	•	•		•	•	•	•		•	•	•	•	•	
+	•	•	•	•	+	+	+	+	•		+	•	•	•	•
											•	•	•	•	•
	3	3	3	•					•						•
					CATR	CATR	CATR	CATR	CATR		•	•	•	•	
•	•	•	•	•	•	•	•	•	•	•					
					CATR	CATR	CATR	CATR	CATR	•	•	•	•	•	•
•					•						•				
	•	•				•	•					•	•		
											B				
			B					B						B	
	B	B				B	B					B	B		
										•					
				•					•						•
				4											
			•					•						•	
•	•	•	•	•							•	•	•	•	•
					•	•	•	•	•	•					
											B	B	B	B	
											•	•	•	•	•
					•	•	•	•	•	•					
•	•	•	•	•											
•	•	•	•	•											
		•					•						•		
•	•	•	•	•						•	•	•	•	•	•
											•	•	•	•	•
											B			B	
•	•	•	•	•											
												T	T	T	T
											•	•	•	•	•
												T	T	T	T
•	•	•	•	•											
					•	•	•	•	•	•					
•	•	•	•	•	•	•	•	•	•						
	B	B	B	B		B	B	B		•	•	•	•	•	•
											•	•	•	•	•
•	•	•	•	•	•	•	•	•	•						
•	•	•	•	•	•	•	•	•	•	•					
					CATR	CATR	CATR	CATR	CATR	•	•	•	•	•	•
											•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•					
C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

† *ERLs can only be installed on live-front switchgear lugs for URD applications*

LC *1.5 A if a Low Current Reset (LC) option is selected*

\+ *Use three single-phase FCIs*

CATR *Optional time delay reset*

- All BEACON displays are battery powered
- BEACON products are not available with an auxiliary contact ("A" option)

RadioRANGER® Wireless Fault Indication System

RADIORANGER®
WIRELESS FAULT INDICATION SYSTEM

Let the RadioRANGER Wireless Fault Indication System point you to the underground fault location.

- Minimize fault-finding time and troubleshooting crew size. No need to open, enter, pump, or drain multiple vaults while blocking traffic.
- Improve line crew safety. Avoid leaving the truck and entering vaults in busy streets.
- Benefit from the proven reliability and quality record of SEL fault indicators.
- Choose from multiple SEL fault indicator types to match your applications and system requirements.
- Display fault-path information on the handheld Remote Fault Reader.
- Maximize application efficiency using the modular and scalable system in a variety of vault configurations.
- Choose the PILC Fault Indicator for hard-to-troubleshoot, paper-insulated lead cables.

Reduce fault-finding time in subsurface vault applications.

Communicate subsurface fault indicator status to street-level personnel.

Also Applicable in Pad-Mounted Enclosures

Tel: +1.847.362.8304 | Fax: +1.847.362.8396 | www.selinc.com

RadioRANGER Wireless Fault Indication System

Fault Indicators Compatible With the Wireless Interface

RadioRANGER Interface Probe

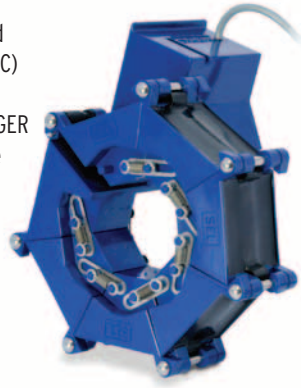
Underground AutoRANGER® With RadioRANGER Interface Probe

Current Reset With RadioRANGER Interface Probe

Test Point Reset With RadioRANGER Interface Probe

Timed Reset With RadioRANGER Interface Probe

Paper-Insulated Lead Cable (PILC) Fault Indicator With RadioRANGER Interface Probe



Key Features

- Simple street-level fault indicator status retrieval eliminates the need for fault-finding crews to remove utility access covers and enter vaults.
- Multiple IDs allow the crew to easily identify the vault, way, and phase on which the fault occurred.
- IP68-rated Wireless Interface and waterproof interconnection system (rated to 15 feet submersion) ensure environmental integrity required for vault applications.
- Remote Fault Reader displays Wireless Interface system health and fault indicator status.
- Vehicle accessory kit option maximizes the performance of the Remote Fault Reader in a vehicle.
- Two-way communications link prevents ambiguity by transmitting both tripped and reset fault indicator information. Users can retrieve Wireless Interface and fault indicator status at any time.

Tip From Ranger

For complete RadioRANGER features, applications, and specifications, visit **www.eosmfg.com/products/radio_ranger.html**

SEL fault indicators equipped with magnetic RadioRANGER® Interface Probes communicate their status to the Wireless Interface. Utility personnel can quickly retrieve subsurface FCI status at street level via the wireless communications link between the Wireless Interface and Remote Fault Reader. The RadioRANGER solution reduces the need to access vaults to retrieve FCI status, reducing fault-locating time and improving utility personnel safety.

RadioRANGER® Wireless Fault Indication System

Ordering Tables

Important: Please consult your independent sales representative or Customer Service (+1.847.362.8304) for assistance in selecting the best RadioRANGER model for your application.

Definitions

Option Abbreviation	Option
L	Large core
IR	Inrush restraint
DT	Delayed trip
J	Junction shield
J6	600 A-class junction shield

Specifications

Power Source	
Wireless Interface (8300)	3.6 V high-capacity lithium battery with 20-year shelf life
Remote Fault Reader (8310)	Three 1.5 V AA size cells
Wireless Interface Product Life	15-plus years
Certifications	
FCC	15.249
IEC	RSS-210
IP Rating	
Wireless Interface (8300)	IP68
Remote Fault Reader (8310)	IP54
Wireless Interface Submersibility	Up to 15 feet
Wireless Interface Temperature Range	−40° to +85°C (−40° to +185°F)
Fault Indicator Specifications	See individual fault indicator catalog pages

RadioRANGER Components

Remote Fault Reader

Style	Model Number
Remote Fault Reader with integral antenna	SEL-8310

Wireless Interface

Style	Model Number
Wireless Interface with integral antenna	SEL-8300
Wireless Interface with remote antenna	SEL-8300A

Fault Indicators

Underground AutoRANGER

Model Number	RadioRANGER Magnetic Probe Designation	Current Activated Timed Reset Duration		Options	Probe Lead Length Options		Factory Code
1ARU	M	0	0 hrs	No options (leave blank)	G	6 ft	Y2
		2	2 hrs	L	P	12 ft	
		4	4 hrs		Q	20 ft	
		8	8 hrs				
		12	12 hrs				

Test Point Reset

Model Number	RadioRANGER Magnetic Probe Designation	Nominal Trip Ratings		Options	Probe Lead Length Options	
1TPR	M	0080	80 A	No options (leave blank)	G	6 ft
		0100	100 A	IR	P	12 ft
		0160	160 A	DT	Q	20 ft
		0200	200 A	J*		
		0250	250 A	J6*		
		0300	300 A			
		0400	400 A			
		0600	600 A			
		0800	800 A			
		1000	1000 A			
		1200	1200 A			

* Required ≤200 A

RadioRANGER Wireless Fault Indication System

Fault Indicators (continued)

Timed Reset (Clamp Style)

Model Number	RadioRANGER Magnetic Probe Designation	Nominal Trip Ratings		Time-Out Period		Options	Nonreplaceable Lithium Cell	Probe Lead Length Options	
1TR	M	0100	100 A	2	2 hrs	No options (leave blank)	N	G	6 ft
		0200	200 A	4	4 hrs	DT		P	12 ft
		0300	300 A	8	8 hrs			Q	20 ft
		0400	400 A						
		0600	600 A						
		0800	800 A						
		1000	1000 A						
		1200	1200 A						

Underground Load Current With RadioRANGER Magnetic Probe

Number of Phases	Model Family Designation	RadioRANGER Magnetic Probe Designation	Nominal Trip Ratings		Options	Probe Lead Length Options	
1 - Single Phase	CR	M	0100	100 A	No options (leave blank)	G	6 ft
3 - Three Phase			0200	200 A	IR	P	12 ft
			0300	300 A	DT	Q	20 ft
			0400	400 A	L		
			0600	600 A			
			0800	800 A			
			1000	1000 A			
			1200	1200 A			

Paper-Insulated Lead Cable

Model Number	RadioRANGER Magnetic Probe Designation	Nominal Trip Ratings		Mounting Range	Time-Out Period		Probe Lead Length Options		Time-Current Curve Characteristic
PILC	M	06	600 A	D*	01	1 hr	G	6 ft	1
		08	800 A	E*	02	2 hrs	P	12 ft	2
		10	1000 A	F*	04	4 hrs	Q	20 ft	3
		12	1200 A		08	8 hrs			4
					12	12 hrs			
					24	24 hrs			

* See Paper-Insulated Lead Cable Mounting Range Cable Sizes table below

Paper-Insulated Lead Cable Mounting Range Cable Sizes

3 Conductor PILC Cable		Triplexed Single-Phase Cable			
3C Cable Diameter		Single Cable Diameter		Circumscribed Diameter	
D	2.2" to 3.1"	D	1.1" to 1.48"	D	2.38" to 3.2"
E	3.12" to 3.84"	E	1.5" to 1.85"	E	3.24" to 4.0"
F	4.0" to 4.44"	F	1.92" to 2.14"	F	4.16" to 4.64"

RadioRANGER Starter Kit

Product	Model Number
Starter Kit: 1 Wireless Interface, 1 Remote Fault Reader, 3 1ARUM Fault Indicators	RRKIT101

AR-URD—Underground AutoRANGER®

Now Available With Fiber-Optic BEACON® Display

Choose one low-maintenance fault indicator for your underground applications.

See page 20 for application with the RadioRANGER® Wireless Fault Indication System.

Key Features

System-Wide Adaptability

The Underground AutoRANGER's autoconfiguration features decrease the need for crew training, selection analysis, and inventory, resulting in fewer application errors.

Minimal Maintenance

The AutoRANGER's ability to adjust for load fluctuations results in a decreased need for field service. Choose a target-only (no LED) display option to eliminate the need for a battery. BEACON LED models have a 15-plus-year product life—minimize trips to the field to replace batteries.

Configuration Choices Optimize Performance

Ensure the best fault-indicating solution for your underground application by choosing from a wide variety of single- and three-phase display options, including remote displays that eliminate the need to open the enclosure to check the fault indicator's status.

Autoadjusting Trip-Level Selection

Automatic trip-level selection based on sampled load current makes the AR-URD suitable for applications with fault currents ranging from as low as 50 A to greater than 1200 A. This feature simplifies ordering and inventory, and reduces maintenance and application errors.

Line-Powered Functionality

Energy required to power the microprocessor comes from monitored load current rather than a battery, decreasing maintenance and cost of ownership.

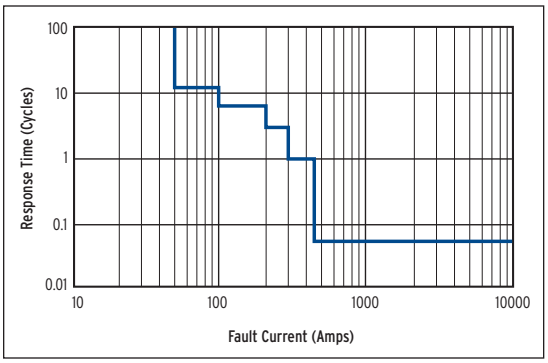
Dynamic Trip Response Times

By monitoring current, the AR-URD automatically adjusts its trip response time to better coordinate with upstream protection.

Current-Activated Timed Reset

Each AR-URD derives a normalization current as a function of measured circuit load. The AR-URD uses the normalization current to distinguish circuit restoration from backfeed current; it is this threshold that the AR-URD must detect before initiating the reset timer (0, 2, 4, or 8 hours).

Underground AutoRANGER® application.

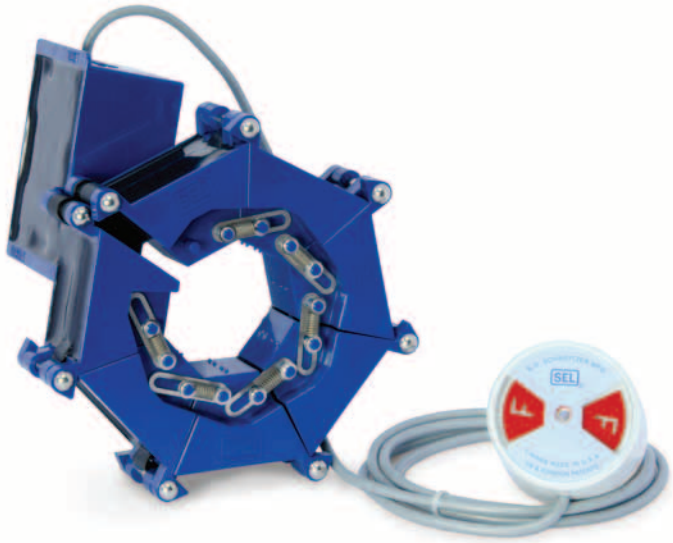


The Underground AutoRANGER's dynamic trip response time improves coordination with upstream protection, maximizing reliable performance.

Specifications	
Fault-Sensing Range	50 to 1200 A
Voltage Range	Equal to voltage class of shielded underground cable
Minimum Operating Current	3 A
Current-Activated Timed Reset	0, 2, 4, or 8 hours
Battery (for BEACON LED display only)	3.6 V high-capacity lithium battery with a 20-year shelf life
Dynamic Trip Response Time	Function of trip level (see graph above)
Inrush Restraint Response Time	5 cycles
Temperature Range	–40° to +85°C

Note: Selection of fiber-optic BEACON display option will change product functionality. Consult SEL for details.

PILC—Paper-Insulated Lead Cable



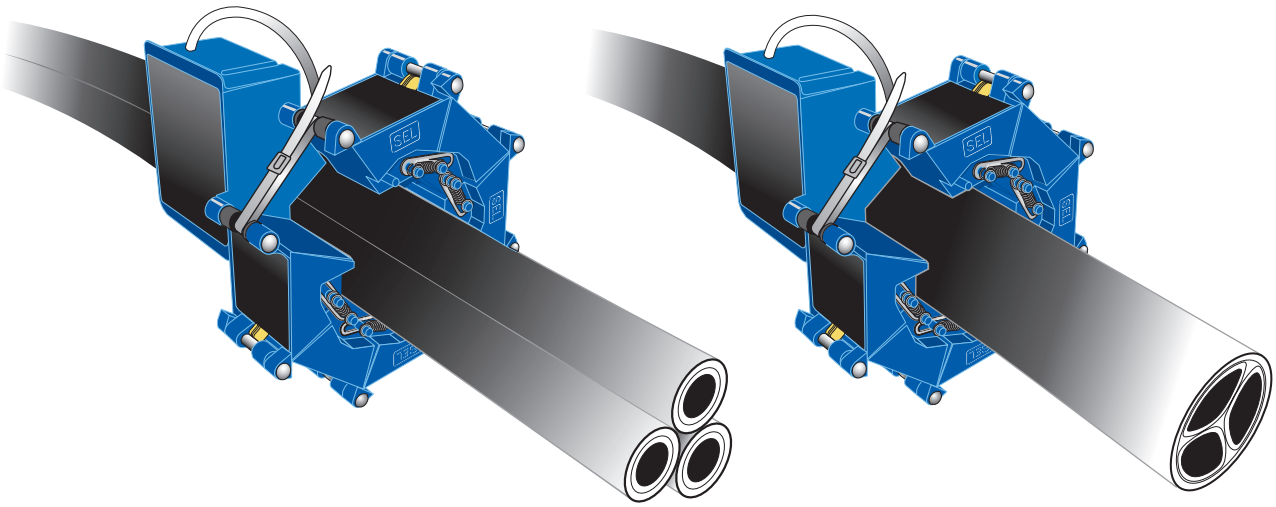
Find faults faster on urban systems with the PILC Fault Indicator.

See page 20 for application with the RadioRANGER® Wireless Fault Indication System.

Key Features

Simplify Fault Finding on PILC

- Narrows possible fault locations to one or two spans of cable.
- Choice of a remote target or RadioRANGER compatibility maximizes display options.
- Sensor design accommodates PILC diameters ranging from 2.2 to 4.64 inches.
- Four- and eight-hour timed reset options ensure sufficient fault-finding time.
- Split-cuff design makes installation simple.
- Fully encapsulated circuitry and stainless-steel parts withstand harsh underground environments.
- Durable construction, 3.6 V lithium battery, and reliable circuitry provide more than 15 years of maintenance-free operation.



Apply the PILC Fault Indicator on triplexed, single-phase PILC (left) and on three-phase sector (or round) PILC (right). It also provides fault indication on triplexed polycable.

For up-to-date specifications, ordering information, and application suggestions, please visit ***www.selinc.com/FCI/Underground/Paper-InsulatedLeadCable.***

TPR—Test Point Reset

The most economical fault-indicating solution for elbow test point applications.

Key Features

- The most economical solution for underground applications.
- Easy to install on most brands of 200 or 600 A-class elbows with capacitive test points.
- Automatic reset upon restoration of system voltage.
- Ideal for pad-mounted transformer and switchgear applications.
- Several remote display options eliminate the need to open an enclosure cabinet to determine the indicator's status.
- Available in single- and three-phase models.
- Simply remove the fault indicator to access the test point.
- Auxiliary contact option for SCADA compatibility.
- Junction shield option prevents false tripping due to adjacent phase effects. Please consult SEL.

Test Point Reset Fault Indicators are available with a variety of remote displays.

Specifications	
Power Source	Capacitive test point voltage
Nominal Trip Ratings	80 to 1200 A
Trip Tolerance	±10%
Reset Voltage (L-N)	≥5 kV
Reset	Automatic at minimum voltage
Reset Time	3 minutes typical, dependent on system voltage
Maximum Fault Current	25 kA for 10 cycles at 60 Hz
Trip Response Time	1 ms
Inrush Restraint Response Time	300 ms (add "IR" option)
Elbow Style	200 or 600 A-class with test point
Housing Material	Conductive EPDM rubber
Temperature Range	−40° to +85°C

A Test Point Reset Fault Indicator with junction shield provides indication in a switchgear cabinet.

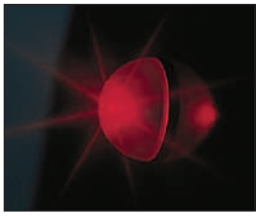
See page 20 for application with the RadioRANGER® Wireless Fault Indication System.

TR—Timed Reset

Automatic timed reset provides permanent and transient fault-finding capability.

Key Features

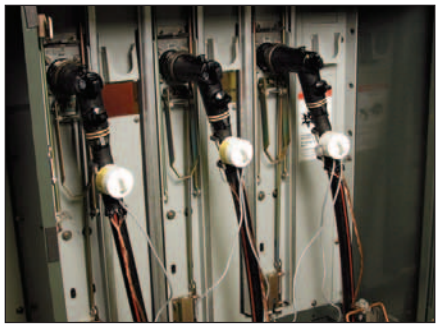
- Automatic reset at the end of a fixed reset period allows time for crews to locate permanent and transient faults.
- Ideal in locations where false reset because of feedback is a concern.
- Several remote display options eliminate the need to open an enclosure cabinet to determine the indicator's status.
- Available with test point or clamp-on sensors for single- and three-phase applications.
- Auxiliary contact option for SCADA compatibility.



Illuminated BEACON Bolt® Display.

Specifications (Single Phase)*	
Nominal Trip Ratings	50 to 1200 A
Trip Tolerance	±10%
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	1 ms
Housing Material	UV-stabilized polycarbonate resin and/or conductive EPDM rubber
Clamp Material	Rubber-sleeved stainless steel
Battery (on BEACON® models)	3.6 V lithium battery with a 20-year shelf life and 1200 flashing hours
Temperature Range	–40° to +85°C

* Please call for three-phase specifications



A three-phase Timed Reset Fault Indicator with a remote display (see page 17 for display options).

See page 20 for application with the RadioRANGER® Wireless Fault Indication System.

CR—Current Reset

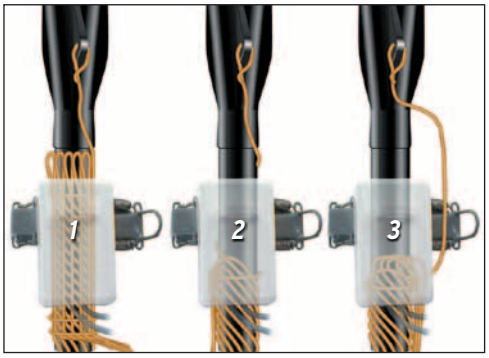
Line-powered fault indicator provides years of maintenance-free operation.

Key Features

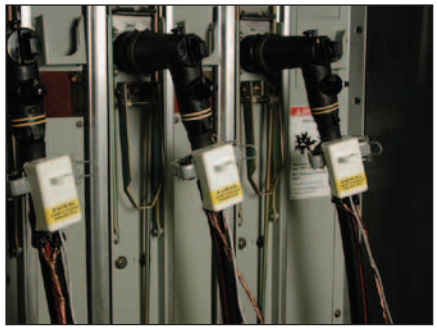
- Automatic reset upon restoration of load current.
- Closed-core design provides adjacent phase immunity.
- Available for single- and three-phase applications.
- Choose from BEACON® LED, target, and combination displays, depending on your application and operating practices.
- Ideal for installation in pad-mounted equipment without elbow test points; install the fault indicator outside of the influence of the ground return path of the cable's concentric neutral.
- Installation on low-voltage secondary lines is an ideal fault-finding solution in industrial environments.
- Choose the auxiliary contact option for SCADA compatibility.
- Fault-powered current reset models also available for low-load current applications. Please consult SEL.

Specifications	
Power Source	
Current Reset	Load current ≥3 A
Trip Value	
Current Reset	100 to 1200 A
Fault Powered	200 to 800 A
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	
Current Reset	1 ms
Fault Powered	8 ms nominal (function of current)
Outer Diameter Clamping Range	0.75" to 2.10" (please specify clamping diameter or range when ordering)
Reset Requirements	3 A
Housing Material	UV-stabilized polycarbonate resin
Clamp Material	Vinyl-coated silicon steel
Submersibility	Up to 15 feet
Temperature Range	–40° to +85°C

See page 20 for application with the RadioRANGER® Wireless Fault Indication System.



Double-back concentric neutral training is recommended (see 1 above). Examples 2 and 3 above indicate other acceptable neutral training methods.



A three-phase Current Reset Fault Indicator in a switchgear application.

SR—Secondary/Low-Voltage Reset

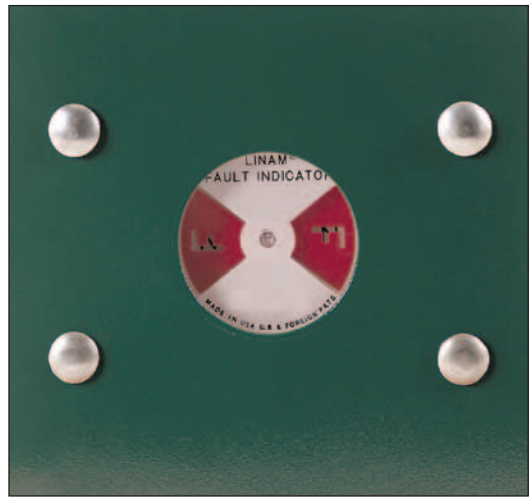
Arms and resets from transformer secondary voltage—no minimum load current necessary.

Key Features

- Line-powered arm and reset eliminate the need for a battery.
- The secondary voltage supplies the necessary arm and reset requirements in applications where there is insufficient load current to use a CR product.
- Available for single- and three-phase applications.
- Choose from BEACON® LED, target, and combination displays, depending on your application and operating practices.
- Reset restraint option prevents undesired reset from backfeed voltage. Please consult SEL.

Specifications	
Power Source	Secondary voltage
Secondary Voltage	110 to 460 Vac
Nominal Trip Ratings	50 to 1000 A
Trip Tolerance	±10%
Reset Time*	Approximately 30 seconds at 120 Vac
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	1 ms
Outer Diameter Clamping Range	0.75" to 1.6" (please specify clamping diameter or range when ordering)
Housing Material	UV-stabilized polycarbonate resin
Clamp Material	Stainless steel
Temperature Range	–40° to +85°C

*Product may vary depending on configuration



An SEL Type L large display indicates that a Secondary Reset Fault Indicator has tripped.

MR and MB—Manual Reset

MB—Manual Reset Fault Indicator with a reset button.

MR—Manual Reset Fault Indicator.

Economical troubleshooting device with 50-plus years of field-proven reliability.

Key Features

- After a fault occurs, use an MR or MB before reclosing for inexpensive, efficient fault location.
- Line-powered, battery-free.
- The built-in reset button in the MB model eliminates the need for a separate reset tool.
- The MR model is available in a convenient kit to keep on a truck—three MRs and a reset tool in a sturdy, lightweight carrying case.
- MR models are also applicable on overhead systems. MB models are only for underground applications.
- More than 50 years of field-proven reliability.

Specifications	
Nominal Trip Ratings	
MB	25 to 800 A
MR	100 to 800 A
Trip Tolerance	±10%
System Voltage Range	
Overhead (MR only)	Up to 38 kV_{L-L}
Underground	Matches the URD cable rating
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	8 ms
Outer Diameter Clamping Range	0.25" to 1.4" (please specify the clamping diameter or range when ordering)
Temperature Range	−40° to +85°C
Approximate Weight	
MB	170 g (0.37 lbs)
MR	140 g (0.31 lbs)

The Manual Reset Fault Indicator is an excellent troubleshooting tool for both overhead and underground applications.

Keep MR kits on a line truck as a convenient troubleshooting tool.

GFD — Ground Fault Detector

Reliable ground fault detection for three-conductor cable applications.

Key Features

- Detects ground faults by sensing the vector sum of the current flowing through a three-conductor cable.
- Choice of three reset options (secondary voltage, load current, or time) to meet various application needs.
- Install the split-core sensor on three-phase cables without opening the primary.
- Large reflective red target is easy to see both at night and during the day.
- Submersible vinyl-coated sensing core.
- Stainless-steel hardware and UV-stabilized materials ensure long product life.
- Thousands of SEL GFDs in service today help customers around the world quickly locate ground faults.

Specifications	
Power Source	Secondary voltage (120 to 240 Vac_{L-N} at 50 to 60 Hz); load current (≥3 A); or lithium battery for timed reset products
Reset Time (timed reset models only)	2, 4, or 8 hours
Nominal Trip Ratings	20, 40, 50, or 100 A
Trip Tolerance	±10%
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	1 ms
Outer Diameter Clamping Range	4" (6" optional)
Housing Materials	UV-stabilized polycarbonate resin
Submersibility	Up to 15 feet
Temperature Range	–40° to +85°C

A Ground Fault Detector (Model GFD50SA) provides fault indication in the Middle East.

Underground Fault Indicator Ordering Tables

Instructions for Creating Underground Fault Indicator Part Numbers

1. Select one code (in bold) from each column (i.e., 1, B, IR, etc.). It is possible to select more than one code from the Options column. List option codes in the order that they appear in the column. Please consult the factory if you are choosing more than one option from the options column. Consult the SEL Fault Indicator and Sensor Division if you are preparing to order a part number you have not ordered before.

2. Follow your usual process to issue a purchase order, or complete a specification for standards.

Example Part Numbers

1TPRV0200IRAJ

1BTPRB0600IR

1SRI0050DT

Underground AutoRANGER—Single-Phase

Single-Phase	BEACON LED Option	Underground AutoRANGER Designation	Display	Current Activated Timed Reset Duration	Options	Factory Code
1	**–** No BEACON **B** BEACON LED	**ARU**	**I** Integral **V** Standard remote **L** Large remote **B** Bolt	**0** 0 hrs **2** 2 hrs **4** 4 hrs **8** 8 hrs **12** 12 hrs	**–** No options **L** Large core 1.8" to 2.5" **W** Window-mounting kit for large remote display	**Y2**

Underground AutoRANGER—Three-Phase

Three-Phase	Underground AutoRANGER Designation	Display	Current Activated Timed Reset Duration	Options	Factory Code
3	**ARU**	3	**0** 0 hrs **2** 2 hrs **4** 4 hrs **8** 8 hrs **12** 12 hrs	**–** No options **L** Large core 1.8" to 2.5"	**Y2**

Underground AutoRANGER—Single-Phase, Fiber-Optic Display

Single-Phase	BEACON LED Option	Underground AutoRANGER Designation	Display Type Option	Timed Reset Period	Trip Value	Options	Display Lead Length	Factory Code
1	**B** BEACON LED	**ARUZ**	**R** Remote fiber-optic	**0** 0 hrs **2** 2 hrs **4** 4 hrs **8** 8 hrs	**–** Autoranging	**–** No options **L** Large core 1.6" to 2.5" (consult factory)	**G** 6 ft **P** 12 ft **Q** 20 ft	**Y2**

Underground Test Point Reset—Single-Phase

Single-Phase	BEACON LED Option	Test Point Reset Designation	Display	Trip Level	Options
1	**–** No BEACON **B** BEACON LED	**TPR**	**I** Integral **V** Standard remote **L** Large remote **B** Bolt	**0080** 80 A **0100** 100 A **0160** 160 A **0200** 200 A **0250** 250 A **0300** 300 A **0400** 400 A **0600** 600 A **0800** 800 A **1000** 1000 A **1200** 1200 A	**–** No options **IR** Inrush restraint **A** Auxiliary contact **DT** Delayed trip (24 ms) **J** Junction shields* **J6** 600 A-class junction shields* **W** Window-mounting kit for large remote display

* Required ≤200 A; suggested for junction enclosure applications or when phase distinction is required.

Underground Fault Indicator Ordering Tables

Underground Test Point Reset—Three-Phase

Three-Phase	BEACON LED Option	Test Point Reset Designation	Display	Trip Level	Options
3	– No BEACON	TPR	3 Three-phase	0080 80 A	– No options
	B BEACON LED		V Standard remote	0100 100 A	IR Inrush restraint
			L Large remote	0160 160 A	A Auxiliary contact
			B Bolt	0200 200 A	DT Delayed trip (24 ms)
			4 Three-phase target with single LED**	0250 250 A	J Junction shields*
				0300 300 A	J6 600 A-class junction shields*‡
				0400 400 A	W Window-mounting kit for large remote display
				0600 600 A	
				0800 800 A	
				1000 1000 A	
				1200 1200 A	

* Required for trip levels ≤200 A
‡ Required on 600 A-class elbows with "3" display
** Must select BEACON LED option in column 2

Underground Timed Reset— Clamp Style

Underground Phase Designation	BEACON LED Option	Clamp-Style Timed Reset	Display	Trip Level	Time-Out Period	Options
1 Single-phase	– No BEACON	TR	I Integral	0050 50 A	2 2 hrs	– No options
3 Three-phase	B BEACON LED		L Large remote	0100 100 A	4 4 hrs	A Auxiliary contact
			V Standard remote	0200 200 A	8 8 hrs	DT Delayed trip (24 ms)
			B Bolt	0300 300 A		N Nonreplaceable battery
				0400 400 A		S Snap-action clamp
				0600 600 A		W Window-mounting kit for large remote display
				0800 800 A		
				1000 1000 A		
				1200 1200 A		

Underground Timed Reset—Test Point Style

Underground Phase Designation	BEACON LED Option	Test Point-Style Timed Reset	Display	Trip Level	Time-Out Period	Options
1 Single-phase	– No BEACON	TTR	L Large remote	0080 80 A	2 2 hrs	– No options
3 Three-phase	B BEACON LED		V Standard remote	0100 100 A	4 4 hrs	A Auxiliary contact
			B Bolt	0160 160 A	8 8 hrs	DT Delayed trip (24 ms)
				0200 200 A		N Nonreplaceable battery
				0250 250 A		J Junction shields*
				0300 300 A		J6 600 A-class junction shields*
				0400 400 A		W Window-mounting kit for large remote display
				0600 600 A		
				0800 800 A		
				1000 1000 A		
				1200 1200 A		

* Required ≤200 A

Underground Current Reset

Underground Phase Designation	BEACON LED Option	Current Reset Designation	Display	Trip Level	Options
1 Single-phase	– No BEACON	CR	I Integral	0050 50 A	– No options
3 Three-phase	B BEACON LED		V Standard remote	0100 100 A	IR Inrush restraint
			L Large remote	0200 200 A	A Auxiliary contact
			B Bolt	0300 300 A	DT Delayed trip (24 ms)
			3 Three-phase	0400 400 A	3 Three-phase reset
			4 Three-phase target with single LED*	0600 600 A	L Large core 1.8" to 2.5"
				0800 800 A	W Window-mounting kit for large remote display
				1000 1000 A	
				1200 1200 A	

* Must select BEACON LED option in column 2

Underground Fault Indicator Ordering Tables

Underground Secondary/Low-Voltage Reset

Underground Phase Designation		BEACON LED Option		Secondary Reset Designation	Display		Trip Level		Options	
1	Single-phase	**–**	No BEACON	**SR**	**I**	Integral	**0050**	50 A	**–**	No options
3	Three-phase	**B**	BEACON LED		**V**	Standard remote	**0100**	100 A	**IR**	Inrush restraint
					L	Large remote	**0200**	200 A	**RR**	Reset restraint
					B	Bolt	**0300**	300 A	**A**	Auxiliary contact
					3	Three-phase	**0400**	400 A	**DT**	Delayed trip (24 ms)
							0600	600 A	**W**	Window-mounting kit for large remote display
							0800	800 A		
							1000	1000 A		
							1200	1200 A		

Paper-Insulated Lead Cable

Model Number	Display Version		Nominal Trip Ratings		Mounting Range	Time-Out Period		Display Lead Length		Time-Current Curve Characteristic	Options	
PILC	**L**	Large Remote	**06**	600 A	**D****	**01**	1 hr	**G**	6 ft	**1**	**A***	Auxiliary Contact
	M	RR Magnetic Probe (RadioRANGER® Only)	**08**	800 A	**E****	**02**	2 hrs	**P**	12 ft	**2**		
			10	1000 A	**F****	**04**	4 hrs	**Q**	20 ft	**3**		
			12	1200 A		**08**	8 hrs			**4**		
						12	12 hrs					
						24*	24 hrs					

* "L" display only

** See Paper-Insulated Lead Cable Mounting Range Cable Sizes table below

Paper-Insulated Lead Cable Mounting Range Cable Sizes

3 Conductor PILC Cable		Triplexed Single-Phase Cable			
3C Cable Diameter		Single Cable Diameter		Circumscribed Diameter	
D	2.2" to 3.1"	**D**	1.1" to 1.48"	**D**	2.38" to 3.2"
E	3.12" to 3.84"	**E**	1.5" to 1.85"	**E**	3.24" to 4.0"
F	4.0" to 4.44"	**F**	1.92" to 2.14"	**F**	4.16" to 4.64"

Manual Reset

Manual Reset Designation	Trip Level		Clamp Size	
MR	**0100**	100 A*	**–**	Standard size for up to 1.4" OD cables
	0200	200 A	**L**	Large size for 0.8" to 2.0" OD cables
	0400	400 A	**K**	Kit case (MR fault indicators and 1 MT reset tool in a hard-sided carrying case)
	0450	450 A		
	0800	800 A		

* MR0100 is appropriate for a 1.0" maximum cable diameter and is not available with the "L" option.

Manual Reset With Button

Manual Button Designation	Trip Level		Core Size	
MB	**0025**	25 A	**–**	Standard core size for 0.6" to 1.4" OD cables
	0050	50 A	**L**	Large core size for 1.2" to 2.3" OD cables
	0100	100 A		
	0200	200 A		
	0300	300 A		
	0400	400 A		
	0450	450 A		
	0800	800 A		

Ground Fault Detectors

Ground Fault Detector Designation	Auxiliary Contact		Trip Response		Display		Trip Level		Reset Type		Time-Out Period		Core Size	
GFD	**–**	No auxiliary contact	**–**	Standard 1 ms trip response time	**–**	Large remote	**20**	20 A	**–**	Secondary reset	**–**	Not a timed reset (TR) model	**–**	100 mm core, 4.0" ID
	A	Auxiliary contact	**DT**	Delayed trip (24 ms)	**I**	Integral	**40**	40 A	**CR**	Current reset	**2**	2 hrs	**L**	150 mm core, 6.0" ID
					V	Small remote	**50**	50 A	**TPR**	Test point reset	**4**	4 hrs		
					B	Bolt	**100**	100 A	**TR**	Timed reset	**8**	8 hrs		
									X	Factory-defined special	**16**	16 hrs		
											24	24 hrs		

Tools and Sensors Ordering Tables

Tools and sensors shown starting on page 36.

Voltage Indicators

Voltage Indicator Designation	Voltage Application	
VIN	200	Capacitive test point installation
	600	Basic insulation plug installation

Fault Counters

Fault Counter Designation	Trip Level		Inrush Restraint	Options	
FC	0050	50 A	IR	–	No options
	0100	100 A		DT	Delayed trip (24 ms)
	0200	200 A			
	0300	300 A			
	0400	400 A			
	0600	600 A			
	0800	800 A			
	1000	1000 A			

Split-Core Current Transformers

Secondary Output (amps)	Primary Current (amps)	Window Diameter (in)
5A	600	D35
5A	600	D45
5A	1000	D45
5A	1000	D60
5A	2000	D45
5A	2000	D60
5A	2000	D80
5A	3000	D45
5A	3000	D60
5A	3000	D80

Instructions for Creating Split-Core Current Transformer Part Numbers

Each row represents a complete part number.

Select the inner diameter of your Split-Core Current Transformer by choosing a code from the Window Diameter column. For example, D35 indicates a 3.5" inner diameter, D60 indicates a 6.0" inner diameter, etc.

Example Part Numbers

5A600D35
(5 A secondary output, 600 A primary current, 3.5" inner diameter)

5A2000D45
(5 A secondary output, 2000 A primary current, 4.5" inner diameter)

VIN—Voltage Indicators

Improve safety by indicating the presence of voltage.

Key Features

- Indicates the presence of system voltage to ensure safety.
- Flashing neon bulb indicates voltage is present. Faster flash rate indicates higher voltage.
- Install in pad-mounted transformers, switchgear, and other underground distribution enclosures with basic insulating plugs or capacitive test points.
- Applicable on most brands of test point elbows. Both 200 A and 600 A models available.
- Compact, lightweight, and durable design makes the voltage indicator easy to install.
- Three-phase version also available. Please consult SEL.

Specifications	
Power Source	Test point elbow terminator voltage
Primary Voltage (L-L)	2 kV to 35 kV
Flash Response Time	30 seconds at 2 kV_{L-L}
Flash Rate	Proportional to voltage
Elbow Style	200 or 600 A-class elbows with test points or basic insulating plugs
Housing Material	Conductive EPDM rubber
Temperature Range	−40° to +85°C
Approximate Weight	100 to 180 g (0.22 to 0.40 lbs)

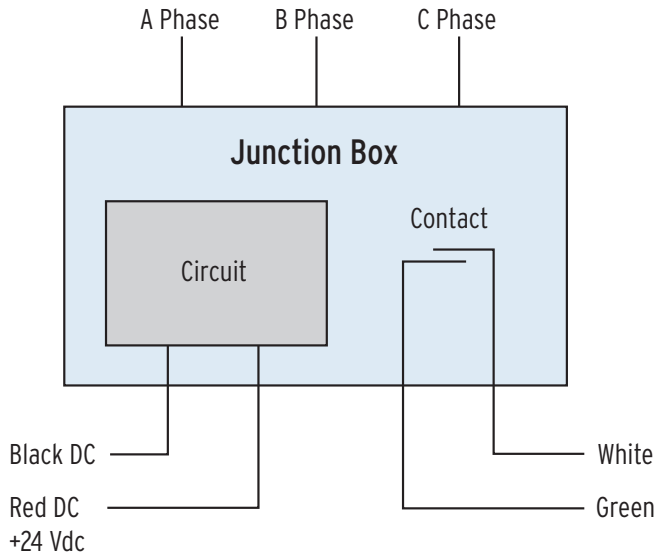
200 A Voltage Indicator alerts utility personnel to the presence of voltage.

VS—Voltage Sensors

Economically sense voltage, and eliminate the need for potential transformers or analog sensors.

Key Features

- Three-phase voltage sensors detect primary system voltage on main and alternate sources in pad-mounted automatic transfer schemes.
- Voltage sensors detect voltage via the test point of the separable connector component. The presence of system voltage is indicated by an electrically isolated contact.
- SEL makes and calibrates each voltage sensor as a complete custom solution for each application.
- Sensor circuitry monitors primary system voltage and controls contact status.
- Wye and ungrounded delta models allow you to match your system configuration.
- Contacts latch closed when system voltage on three phases is above 90 percent. Contacts latch open when system voltage on any phase drops below 75 percent. Delta units require voltage drop in two or more phases.



Specifications	
Isolated Power Supply	24 Vdc with a 50 mA maximum dc draw
Arming Requirement	24 Vdc nominal supply voltage
Voltage Pull-In	≥90% of system voltage
Voltage Dropout	≤75% of system voltage
Phase Sensor Material	Conductive EPDM rubber
Separable Connector Component	200 or 600 A-class connector with test points or basic insulating plugs
Voltage Class	15, 25, or 35 kV class
Contact Rating	40 VA, 1.0 A maximum, 200 Vdc maximum

FC—Fault Counters

Troubleshoot problematic sections of overhead systems.

Key Features

- Count the number of temporary and permanent faults on sections of line with problems caused by defective insulators, tree branches, etc.
- Clock-style face with a reflective red pointer counts up to ten faults.
- Manually reset with a hot-stick-mounted tool.
- Single hot-stick installation.
- Prevent false tripping during recloser operations with the inrush restraint feature.

Specifications	
Power Source	Electric field
Nominal Trip Ratings	50 to 1200 A
Trip Tolerance	±10%
System Voltage Range (L-N)	5 kV to 20 kV
Maximum Fault Current	25 kA for 10 cycles
Trip Response Time	1 ms
Inrush Restraint Response Time	300 ms
Outer Diameter Clamping Range	0.25" to 1.6" (please specify clamping diameter or range when ordering)
Housing Material	UV-stabilized polycarbonate resin
Clamp Material	Rubber-sleeved stainless steel
Temperature Range	–40° to +85°C
Approximate Weight	430 g (0.95 lbs)

Reset the Fault Counter with a battery-powered, hot-stick-held reset tool, model FCRT (sold separately).

CT—Split-Core Current Transformers

Install current monitoring sensors without interrupting service.

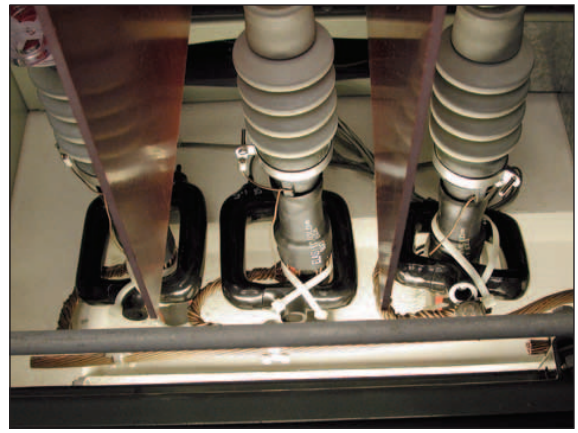
Key Features

- Split-core design eliminates the need to open the primary cable during installation over existing bushings or cable, resulting in lower installation cost and time than closed-core designs.
- Four window diameters available: 3.5", 4.5", 6.0", and 8.0".
- Flexible encapsulation provides 600 V class insulation and ensures long product life.
- Secondary terminals are protected with vinyl coating.
- One-piece design simplifies installation and use.
- Design allows for installation when secondary load is present.

Specifications	
Primary Current	600 to 3000 A
Secondary Current	5 A
Accuracy	±3% at rated burden
Metering Burden	B-0.2 (ANSI C57.13)
Nominal Window Diameters	3.5", 4.5", 6.0", and 8.0"
Core Design	Flexible split core
Core Material	Grain-oriented silicon steel
Insulation Class	600 V (can be used on higher voltage circuits when installed over insulated conductors)
Secondary Winding Material	Copper
Electrical Terminals	Nickel-plated brass threaded posts
Markings	Hot stamped for polarity, catalog number, and ratio
Operating Temperature	–40° to +85°C
Installation Temperature	–10° to +85°C

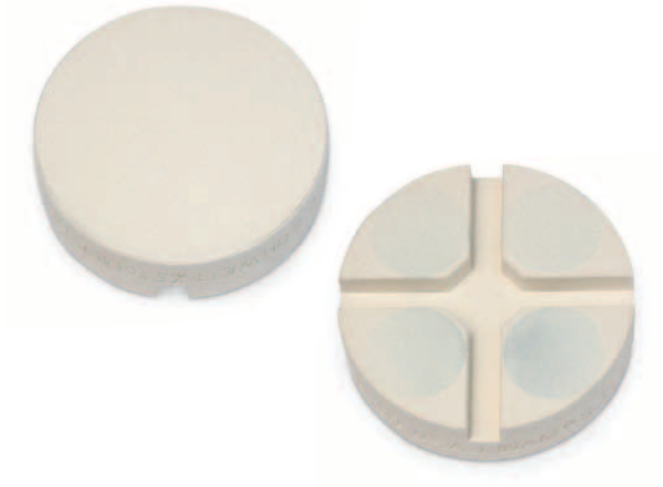
Applications

- Electrical load surveys.
- Industrial energy management systems.
- Submetering for department costing.
- In conjunction with:
  - Demand meters
  - Kilowatt-hour meters
  - Power factor meters
  - Current transducers
  - Watt transducers
  - Current-sensing relays



Split-Core Current Transformers provide current measuring for a variety of switchgear applications.

MCG—Magnetic Cable Guide



Keep remote display and sensor cables neat and secure.

Key Features

Designed to keep current sensor and remote display wiring in place against the inside of an enclosure, Magnetic Cable Guides (MCGs) are a favorite tool of customers who use fault indicators with remote displays. MCGs securely position cables against the cabinet wall, but are easy to reposition when pulling elbows, moving fault indicators, or working inside the enclosure. The magnetic strength is large enough to hold approximately 500 grams of weight when placed on a smooth surface.

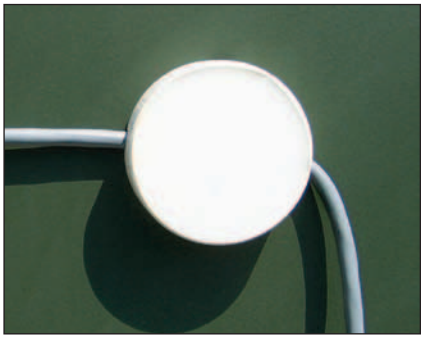
Our creative customers use the MCGs in other ways that we never imagined!

- Use a cable tie to affix an MCG to a meter. Place the meter on the side of a voltage regulator or other cabinet for hands-free operation.
- Secure fiber-optic cables to racks.
- Keep wiring neat and secure underneath surface-mount technology machines.

Purchase MCGs online at **www.sel-com.com/magnetic_cable_guides**.

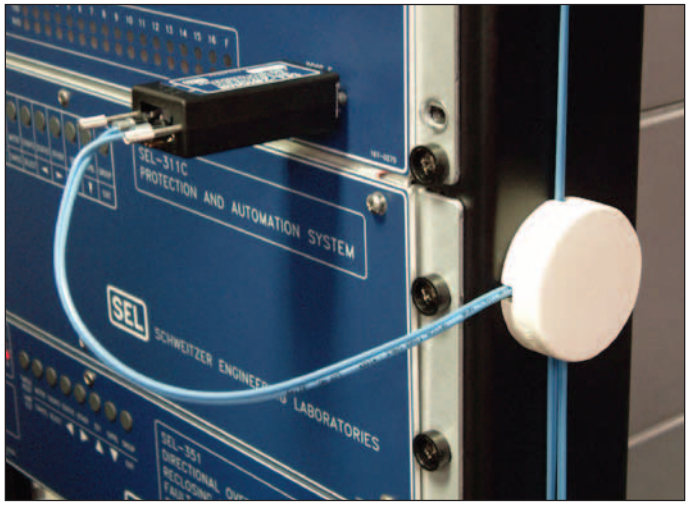
Have a Creative Application for Magnetic Cable Guides?

Send a photograph to **sales@eosmfg.com**, and we'll send you two free MCGs.



MCGs keep cables neat inside of cabinets.

Use MCGs to hold meters to control cabinets for hands-free operation.



Hold fiber-optic cables against racks with MCGs.

Accessories and Tools

HHT
Silver Bolt Test Tool

Determine the status (tripped or untripped) of fault indicators with tamperproof bolt displays.

Works like a compass; the red target built into its face comes into view to indicate a tripped fault indicator.

BTT
BEACON® Test Tool

Field-test fault indicators with BEACON Bolt® Displays.

TMRT
Gold Bolt Test and Reset Tool

Tests and resets fault-powered fault indicators with tamperproof bolt displays.

CRSRTT
Current and Secondary Reset Test Tool

Field-test and manually reset the AutoRANGER®, BTRIP, BTRI_IR, and other timed reset products.

ERLTT
Electric Field Reset Test Tool

Use in conjunction with a hot stick to field-test electrostatic reset ERL and BER fault indicators.

MT
Manual Reset Tool

Manually reset the MR fault indicator.

FCRT
Fault Counter Reset Tool

Reset the Fault Counter with this battery-powered, hot-stick-held reset tool.

(tools sold separately)

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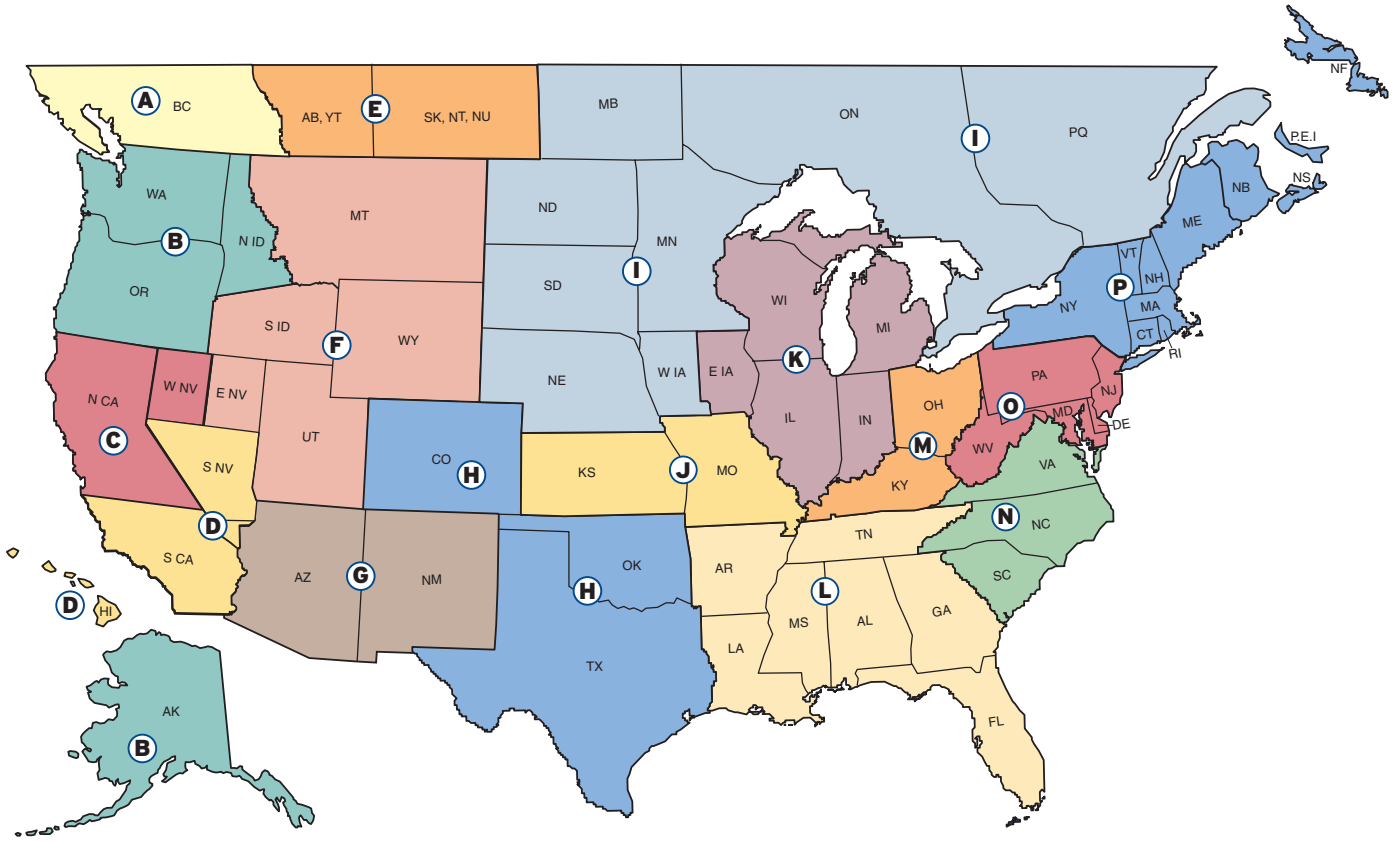

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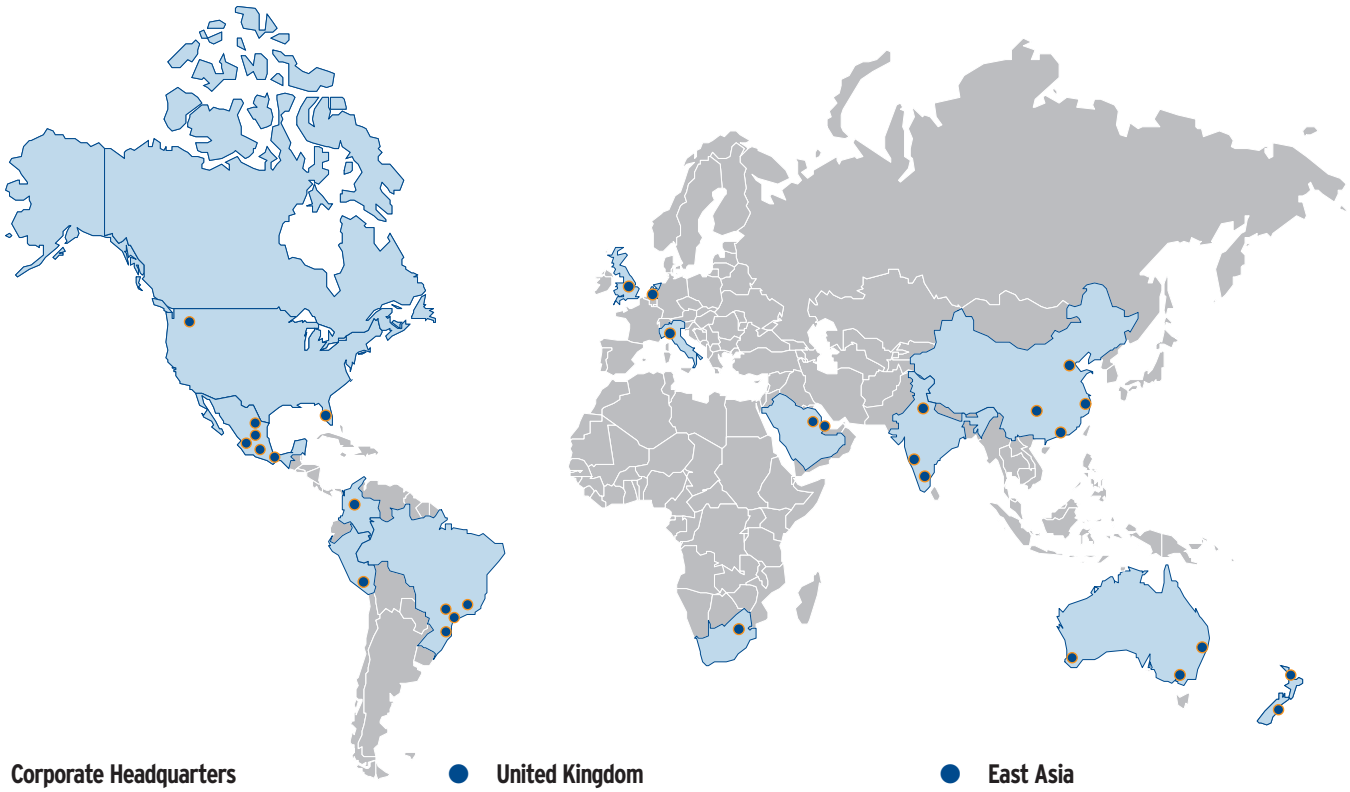

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Top Ten Reasons to Use SEL Fault Indicators on Your Distribution System

1. **Cut Fault-Finding Time in Half**

   Systematically applied fault indicators reduce fault-finding time by 50 percent or more, making them a powerful tool for improving reliability indices such as CAIDI (Customer Average Interruption Duration Index). Shorter outages mean reduced costs to utilities and their customers.

2. **Improve Line Crew Safety**

   Reclosing and sectionalizing to find the location of a fault put line crew safety at risk. Use fault indicators for faster, safer fault finding.

3. **Multiple Displays and Features Meet Your Needs**

   SEL has a solution for your application. Choose from overhead or underground models; LED, target, or radio frequency indication; and a variety of clamp and reset options. Remote displays on underground fault indicators eliminate the need to open an enclosure to determine the fault indicators' status, saving time and making life easier for troubleshooters.

4. **SEL Fault Indicators Need Zero or Little Maintenance**

   Choose a battery-free or nonreplaceable-battery fault indicator for zero maintenance over the product's 15-plus-year lifetime. Durable construction and automatic reset mean that SEL fault indicators do not require operators' attention—unless they're doing their job of leading a line crew to the location of a fault.

5. **Locate Temporary and Permanent Faults**

   Apply timed reset fault indicators and fault counters in areas affected by momentary outages and flickering lights to efficiently locate temporary faults. Using fault indicators reduces costs and improves distribution reliability. The Overhead AutoRANGER® differentiates between temporary and permanent faults with distinct displays.

6. **Restore Power Faster With a Midpoint Sectionalizing Application**

   Applying fault indicators at the midpoint of a feeder allows troubleshooters to restore power to the unaffected portion of the system…even before identifying the exact location of the fault. SEL fault indicator customers applying a midpoint sectionalizing method experience improved reliability and reduced customer outage time.

7. **Complete the Job That Protective Relays and Reclosers Start**

   SEL relays calculate the distance from the station to a fault, but not which tap or branch the fault is on. Fault indicators complete the job by leading line crews down the correct tap so that they can restore power faster and spend less time in the field looking for the specific location of the fault.

8. **Benefit From SEL Customer Service, Field Support, and Warranty**

   All fault indicators manufactured by the SEL Fault Indicator and Sensor Division come with a five-year, "no questions asked" warranty, the best in the world for fault indicators. The RadioRANGER® Wireless Fault Indication System has a ten-year warranty.

9. **Installation Is Line Crew Friendly**

   SEL fault indicators install without the use of special tools, straps, screws, or complicated clamping mechanisms.

10. **Fault Indicators Work!**

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