**FAULT INDICATORS, SENSORS, AND CTs OVERVIEW**

**SEL-FLT AND SEL-FLR**
Improve distribution reliability with the SEL-FLT and SEL-FLR Fault and Load Transmitter and Receiver System, which enables faster fault locating, reduces outage durations, and improves the average restoration time.

**AR360**
The AR360 Overhead AutoRANGER® constantly monitors the system load current in distribution systems up to 34.5 kV and automatically adjusts the trip threshold. It provides 360 degrees of visibility for fault indication.

**AR-OH**
The AR-OH Overhead AutoRANGER Fault Indicator constantly monitors the system load current in distribution systems up to 69 kV and automatically adjusts the trip threshold.

**ERL**
The ERL Electrostatic Reset Fault Indicator offers a battery-free design and automatic voltage reset for maintenance-free fault indication.

**MR**
The MR Manual Reset Fault Indicator is an economical troubleshooting tool for overhead and underground applications.

**RADIORANGER®**
The RadioRANGER Wireless Fault Indication System reduces the need to access vaults or open pad-mounted enclosures to retrieve the fault indicator status, reducing fault-locating time and improving safety.

**SEL-8301**
Optimize outage management and improve underground reliability with the SEL-8301 Underground Distribution Sensor.

**AR-URD**
Use the Dynamic Delayed Trip feature in the AR-URD Underground AutoRANGER Fault Indicator to improve coordination with upstream protection, maximizing reliable performance.

**PILC FCI**
Paper-Insulated Lead-Covered Cable Faulted Circuit Indicators feature a rugged design for use in applications with submersion in up to 15 feet of water.
VIN Voltage Indicators are line-powered and indicate the presence of voltage at or above 2 kV (phase to ground) by flashing a neon lamp. Easily install VINs on the test point of a 200 A elbow, 600 A T-body, or 600 A basic insulating plug.

CR Current Reset Fault Indicators monitor underground systems. The CR is powered by the load current present on an energized line.

TPR The Test Point Reset Fault Indicator is easy to install on most brands of 200 A or 600 A elbows with capacitive test points and is ideal for pad-mounted transformer and switchgear applications.

3VR Apply the 3VR Three-Phase Voltage Reset phase sensors to distribution cables where there is insufficient load current to power a current reset fault indicator. The 3VR receives power from a single 600 A basic insulating plug.

SEL-8315 Apply the SEL-8315 Phase Comparison Faulted Circuit Indicator to locate faults in underground transmission cables and wirelessly communicate the fault status to line crews using the RadioRANGER.

MW Apply the MW Microcontroller-Based Wye Voltage Sensor in place of PTs to detect system voltage loss where exact system voltage measurement reporting is not required. The MW indicates voltage loss via a contact output.

SR Apply SR Secondary/Low-Voltage Reset Fault Indicators to pad-mounted transformers when there is insufficient primary current to power and reset current-powered fault indicators.

GFD Apply the GFD Ground Fault Detector over a three-phase cable bundle at ground potential in switchgear to identify faults on circuits feeding medical facilities, mining equipment, and other industrial equipment.

CT Economically add SEL CTs to existing wiring and electrical equipment without interrupting service.
 Reduce operational and maintenance costs, restore service faster, and improve distribution protection using SEL fault indicators and sensors. SEL fault indicators sense the magnetic field produced by current flowing through a conductor. When fault current passes the fault indicator, the fault indicator “trips,” indicating a fault. SEL fault indicators and sensors address a wide range of applications. In addition to local fault indication, SEL offers wireless reporting options using various radio technologies. SEL also offers high-accuracy load monitoring and low-latency wireless sensors that coordinate with recloser controls to enhance distribution protection.

**OVERHEAD, UNDERGROUND, AND WIRELESS APPLICATIONS**

Easy-to-see displays on SEL fault indicators lead the line crew to the faulted section of the overhead line or underground cable, allowing personnel to visually identify the faulted line section without going through a time-consuming re-fuse and sectionalize process. Applying fault indicators in areas affected by permanent and momentary outages helps resolve disruptions quickly.

Wireless technology further speeds up fault-finding times by reducing the need for patrolling the line to locate the fault. The SEL-FLT and SEL-FLR Fault and Load Transmitter and Receiver System interconnects with existing SCADA, outage management, and distribution management systems to improve situational awareness.

Improve system planning and operational decision-making by using accurate load data from either the SEL-8301 Underground Distribution Sensor or the SEL-FLT and SEL-FLR System. These solutions provide underground or overhead load monitoring capability in addition to fault indication.

**HIGH-SPEED DISTRIBUTION PROTECTION**

Improve speed, selectivity, and safety in distribution protection by using the SEL-FT50 and SEL-FR12 Fault Transmitter and Receiver System. Using low-latency communications, the system is fast enough to enable fuse-saving schemes when employed with SEL-651R Advanced Recloser Controls, allowing tripping in 3 to 4 cycles.

To learn more about the SEL-FT50 and SEL-FR12 System, see the product page in the “Distribution Control” section or visit selinc.com/products/FT50.
INTEGRATION WITH DISTRIBUTION SYSTEMS
Use SEL fault indicators with distribution protection and automation equipment to improve system reliability indices and reduce operational and maintenance costs. SEL wireless faulted circuit indicators and sensors send information to a DNA® (Distribution Network Automation) or SCADA system to improve decision-making and situational awareness.

Place SEL-FLT Transmitters next to manual- or remote-operated switches to quickly communicate fault and load status to a single SEL-FLR connected to SCADA through an IP backhaul. This provides operations personnel with the status confirmation needed to reconfigure the circuit and restore power to as many customers as possible.

Communicate the fault location to a SCADA system for quick power restoration.
SEL-FLT AND SEL-FLR
FAULT AND LOAD TRANSMITTER AND RECEIVER SYSTEM

Starting Price
SEL-FLT Fault and Load Transmitter: $770 USD
SEL-FLR Fault and Load Receiver: $1,188 USD

The SEL-FLT and SEL-FLR System improves the overall reliability of your distribution system through accurate fault indication and load monitoring. The SEL-FLT Fault and Load Transmitter and the SEL-FLR Fault and Load Receiver work together over unlicensed 900 MHz wireless communications with a range of 10 miles to locate faults faster and make informed switching decisions. Restoring power quickly is essential to ensuring satisfied customers and better Customer Average Interruption Duration Index (CAIDI) reliability metrics. Locating momentary faults also allows you to address system issues and improve Momentary Average Interruption Frequency Index (MAIFI) metrics. Highly accurate (1% typical) load data enable phase balancing and system planning. Line powering, with as little as 3.5 A of continuous current, reduces ongoing maintenance and allows you to use the SEL-FLT throughout your distribution system. SEL-FLR Receivers are easy to integrate in existing systems with DNP3/IP output and comprehensive security.
SEL-FLT AND SEL-FLR SYSTEM INTEGRATES WITH YOUR EXISTING SYSTEM

The SEL-FLT integrates easily into existing networks and centralized SCADA systems with standard Ethernet ports and DNP3/IP output. The SEL-FLT can pair with a cellular modem/router or Ethernet radio or plug directly into a wired Ethernet network. Once connected, data from the SEL-FLT Transmitters can flow into a SCADA system, outage management system (OMS), or distribution management system (DMS). You can perform configuration and troubleshooting of the SEL-FLT and SEL-FLR System over the network.

With fault information from the SEL-FLT and SEL-FLR System, utility operations teams can dispatch crews to fault locations faster, speeding up restoration. Flashing LEDs on the SEL-FLT Transmitters help line crews confirm the fault location reported through a SCADA system or OMS.

The SEL-FLT and SEL-FLR System can also help locate momentary faults. Addressing the causes of these faults, such as overgrown tree limbs or aging insulators, reduces future faults and momentary interruptions.

Highly accurate and timely load data from SEL-FLT Transmitters on taps and laterals enables better decision-making in emergency switching situations. Load data are also essential for phase balancing, system planning, and identifying power theft.
The AR360 and AR-OH are self-adjusting fault indicators for distribution systems. The advanced algorithms in the microprocessor-based technology continually measure the load current and automatically step up or down the trip threshold to coordinate with the load. After an event, the fault indicators analyze system conditions to determine a display notification of either a momentary or permanent fault. They also use inrush restraint technology that activates on the loss of current or voltage to prevent tripping on reclosing attempts.

**AR360**
The AR360 works on systems up to 34.5 kV and offers 1,800 flashing hours and a 360-degree ultrabright flashing LED display.

**AR-OH**
The AR-OH works on systems up to 69 kV and offers 2,500 flashing hours and a forward-facing LED display.
BER Fault Indicators are powered by line voltage and provide two distinctive displays to indicate a permanent fault: a red reflective target display and a super-bright red LED. A high-capacity, long-life, replaceable lithium battery (or optional nonreplaceable battery) powers the LED display. To maximize battery life, the target display uses no battery energy.

The line-powered ERL displays a permanent fault condition by showing a large reflective red target. The red target remains visible until after the line is re-energized. The hermetically sealed UV-stabilized housing and stainless-steel clamp make the ERL tough enough to handle harsh outdoor environments.

The BTRIP locates momentary or permanent faults in 4,160 V to 69 kV overhead system applications. It is quick and easy to apply using a single hot stick. A super-bright flashing LED display provides clear indication of an overcurrent event. The BTRIP is completely powered by a 3.6 V high-capacity 8.5 Ah lithium battery with a 20-year shelf life.

The battery-powered overhead BTRI_IR provides automatic reset at the end of a fixed reset period to allow time for crews to locate permanent and momentary faults. It is ideal for locations where false resets from backfeed are a concern, such as applications with single-phase sectionalizing on a three-phase circuit. The loss-of-voltage-activated inrush restraint feature prevents the BTRI_IR from responding to automatic reclosing events.

For underground applications, visit selinc.com/products/TR.
RADIORANGER®
WIRELESS FAULT INDICATION SYSTEM

Starting Price
Interface, reader, and 3 FCIs: $943 USD
selinc.com/products/RadioRANGER

RadioRANGER® System reduces the need to access vaults to retrieve the status of faulted circuit indicators (FCIs), decreasing fault-locating times and improving utility personnel safety. Utility personnel can quickly and safely retrieve the subsurface FCI status, at street level, through wireless communication between the SEL-B300 Wireless Interface and the handheld SEL-B310 Remote Fault Reader. A two-way communications link transmits both faulted (tripped) and normal (reset) status information, preventing any uncertainty in determining if FCIs are plugged into the interface and functioning.

The IP68-rated SEL-8300 and waterproof interconnection system (rated to 4.5 m [15 ft] of submersion in water) ensure environmental integrity for vault applications. Up to 12 SEL FCIs equipped with magnetic RadioRANGER Interface Probes inductively communicate their status to an SEL-8300. The rugged SEL-8310 provides the ID of nearby SEL-8300 Wireless Interfaces as well as the phase and direction of the fault path. To maximize application efficiency, the modular and scalable system works in a variety of vault configurations and offers an estimated 15 years of product life.

RadioRANGER SEL-8300 Wireless Interface
The Wireless Interface communicates fault indicator information to the Remote Fault Reader.
- Connects up to 12 fault indicators wired with RadioRANGER Interface Probes.
- Sealed, waterproof, and IP68-rated case.
- Circuit and cable phase labels debossed next to ports to make matching FCIs with cables and circuits simple during installation.

RadioRANGER SEL-8310 Remote Fault Reader
The Remote Fault Reader identifies the phase and location of underground faults.
- Flexible antenna.
- Durable, buoyant case rated to IP54.
- Operates on three alkaline or rechargeable AA batteries.
- Wireless Interface health monitor.
- Displays up to eight unique Wireless Interface IDs.
- Communicates fault indicator presence and status: Red—Tripped fault indicator, Green—Untripped fault indicator, Off—No fault indicator present.
- Easy-to-use keypad.

Integral antenna (or optional remote antenna).
Eight easy-to-set IDs allow application in dense areas.

Look for this symbol to identify RadioRANGER-compatible fault indicators and sensors.

FAULT INDICATORS, SENSORS, AND CTs
The SEL-8301 optimizes outage management and improves power system reliability. Using a wireless RPMA® network, the SEL-8301 sends fault, load current, and water depth information to your control center so you can efficiently dispatch repair crews and reduce outage durations. With a line current measurement accuracy of 1.5 percent, it enables effective switching decisions, letting you restore power to more customers. The flexible design makes the SEL-8301 ideal for underground vaults, pad-mounted switchgear and transformers, and high-rise distribution feeders and transformer rooms.

**SEL-8301 UNDERGROUND DISTRIBUTION SENSOR**

**Starting Price**
3-Phase System: $2,100 USD

[selinc.com/products/8301](https://selinc.com/products/8301)

Water depth sensor uses ultrasonic waves to determine the water volume in the vault.

SEL-8302 Current Transformers can continuously monitor up to 12 different phases. The split-core design makes it easy to attach the sensors to insulated, shielded distribution cables.

Twist-lock keyed connectors and magnetic mounting make installation easy, even when wearing gloves.

You can mount remote antennas up to 20 feet from the unit for improved wireless signal strength in underground vaults.
AR-URD
UNDERGROUND AUTORANGER® FAULT INDICATOR

Starting Price
$109 USD

Compatible With RadioRANGER®

The AR-URD is a reliable, settings-free fault indicator that automatically selects a minimum trip threshold based on the sampled load current. This feature simplifies ordering and inventory, reduces maintenance, and simplifies applications. The Dynamic Delayed Trip feature automatically adjusts the trip response time to better coordinate with upstream protection, maximize performance, and increase the reliability of underground distribution systems.

Display options provide flexibility for pad-mounted or vault installations. The power options (line-powered or battery) and restoration reset features ensure reliable performance for any application.

PILC FCI
PAPER-INSULATED LEAD-COVERED CABLE
FAULTED CIRCUIT INDICATOR

Starting Price
$599 USD

Compatible With RadioRANGER

PILC FCIs support a wide range of paper-insulated, lead-covered cable (PILC) configurations and applications, including triplexed, single-phase, and three-phase sector (or round) cables from 5.58 to 11.78 cm (2.2 to 4.64 in.) in diameter. A split-core design lets you quickly and easily install the PILC FCI without disconnecting the cable. Its rugged construction can withstand submersion in up to 4.5 m (15 ft) of water. The PILC FCI is compatible with the RadioRANGER Wireless Fault Indication System. Used together, they make it easier and faster to find faults on urban systems.
SEL-8315
PHASE COMPARISON FAULTED CIRCUIT INDICATOR (PC FCI)

Starting Price
$2,658 USD

The SEL-8315 is a fault indicator for underground transmission cable systems. It detects solid dielectric cable failures and quickly communicates faults to line crews using the RadioRANGER Wireless Fault Indication System. There is no need to open, enter, pump, or drain multiple vaults or manholes to determine the fault status. The two primary applications for PC FCIs are monitoring underground splices and monitoring cable sections where a mix of overhead conductors and underground transmission cables results in inaccurate impedance-based distance-to-fault calculations. The SEL-8315 is submersible in up to 4.5 m (15 ft) of water and withstands harsh environments.

TPR
TEST POINT RESET FAULT INDICATOR

Starting Price
$69 USD

The TPR is an underground fault indicator that attaches to capacitive test points in single- or three-phase systems. It replaces the protective cap on capacitive test points, with the benefit of providing fault indication. The TPR eliminates the need to account for the position of the concentric neutral, as is common with cable-mounted fault indicators. It automatically resets upon system voltage restoration. The TPR is easy to install with a hot stick attached to its molded rubber hook eye. Powered by line voltage, the TPR does not have a minimum current requirement, making it great for lightly loaded circuits.

You can choose from a variety of display options, including a built-in, battery-free mechanical flag display or a remote bright BEACON® LED display. Remote display options reduce fault-finding times by eliminating the need for crews to open medium-voltage enclosures during patrols.
The CR uses continuous load current to automatically reset so it is ready to respond to faults. Powered by the load current on an energized underground distribution cable, the CR responds to a fault and remains in the faulted-display condition until the line is energized with normal line load.

The GFD detects ground faults by sensing the vector sum of the current flowing through a three-conductor cable. You can install the split-core sensor on three-phase cables or a bundle of three single-phase cables without opening the primary. Three reset options are available: secondary voltage, load current, or time.

Apply the SR in single- and three-phase pad-mounted transformer applications where there is insufficient load current or no capacitive test points to power fault indicators. The SR’s reset cable feeds off the transformer secondary voltage to operate, eliminating the need for a battery.

More economical than a PT or analog sensor, the MW detects system voltage loss where exact system voltage measurement reporting is not required. You can easily install the MW on capacitive test points of distribution elbows. It learns and adapts to the unique voltage output level of the capacitive test points to simplify product calibration.
3VR
THREE-PHASE VOLTAGE RESET FAULT INDICATOR

Starting Price
$290 USD
selinc.com/products/3VR

The 3VR is designed for wind farms where there are no capacitive test points on the T-body. The 3VR uses a single 600 A-class basic insulating plug (BIP) for power and reset, and it doesn’t require batteries. Fault sensors mount to each cable phase and detect faults when current exceeds a factory-set nominal trip rating. The 3VR helps crews quickly locate the fault, isolate the faulted section, and restore the rest of the wind farm to service.

REMOTE DISPLAY OPTIONS
UNDERGROUND FAULT INDICATORS

Choose from a variety of display options, including nonbattery mechanical flag displays and bright BEACON® LED displays.

Remote displays eliminate the need for crews to open high-voltage enclosures or enter subsurface vaults, improving fault-finding times and reducing arc-flash risks.
ACCESSORIES AND TOOLS

**MB Manual Button Reset Fault Indicator**
Troubleshoot underground applications.

**Starting Price**
$43 USD

**MR Manual Reset Fault Indicator**
Troubleshoot overhead and underground applications.

**Starting Price**
$36 USD

**MT Manual Reset Tool**
Manually reset the MR Fault Indicator.

**Starting Price**
$60 USD

**FC Fault Counter**
Narrow down the source of intermittent, hard-to-find temporary or permanent faults on overhead circuits.

**Starting Price**
$206 USD

**FCRT Fault Counter Reset Tool**
Reset an FC Fault Counter without removing it from the line.

**Starting Price**
$250 USD

**VIN Voltage Indicators**
Install this line-powered tool on test point elbows, T-bodies, or basic insulating plugs to indicate the presence of voltage.

**Starting Price**
$37 USD

**HHT Silver Tamperproof Bolt Test Tool**
Determine the status (tripped or untripped) of fault indicators with tamperproof bolt displays.

**Starting Price**
$60 USD

**BTT BEACON Bolt® Test Tool**
Field-test fault indicators with BEACON Bolt displays.

**Starting Price**
$30 USD

**CRSRTT Current and Secondary Reset Test Tool**
Field-test and manually reset the AutoRANGER®, BTRIP, BTRI_IR, and other current reset and timed-reset products.

**Starting Price**
$50 USD

**ERLTT Electric Field Reset Test Tool**
Field-test electrostatic reset ERL and BER Fault Indicators.

**Starting Price**
$50 USD

**Mini Current Loop**
Use for demonstration purposes or to trip or reset fault indicators.

**Starting Price**
$300 USD

**MCG Magnetic Cable Guide**
Keep remote display and sensor cables neat and secure.

**Starting Price**
$6 USD
SPLIT-CORE CURRENT TRANSFORMER

Starting Price
$141 USD

SCTs are designed for applications where it is difficult or uneconomical to open the primary conductor to install a solid-core-type CT. The separable-core design allows you to open the SCT to the nominal window diameter and install it over bushings or cables without interrupting the connection. SCTs are held in place with cable ties. A submersible design option provides reliable use in subsurface vaults where flooding can occur.

The SCT is encapsulated in flexible vinyl plastic with 600 V-class insulation and consists of a separable two-part assembly. The SCT base and body can be pulled apart, placed around a cable, and reconnected. Two included stainless-steel worm gear clamps secure the base and body of the CT while also preventing water intrusion into the CT core.

Volume pricing is available.

SUBMERSIBLE SEPARABLE-CORE CURRENT TRANSFORMER

Starting Price
$172 USD

SCTs are designed for applications where it is difficult or uneconomical to open the primary conductor to install a solid-core-type CT. The separable-core design allows you to open the SCT to the nominal window diameter and install it over bushings or cables without interrupting the connection. SCTs are held in place with cable ties. A submersible design option provides reliable use in subsurface vaults where flooding can occur.

The SCT is encapsulated in flexible vinyl plastic with 600 V-class insulation and consists of a separable two-part assembly. The SCT base and body can be pulled apart, placed around a cable, and reconnected. Two included stainless-steel worm gear clamps secure the base and body of the CT while also preventing water intrusion into the CT core.

Volume pricing is available.