



SEL-8301 Underground Distribution Sensor



Major Features and Benefits

The SEL-8301, SEL-8302 Current Transformers, and the integrated RPMA[®] (Random Phase Multiple Access) Radio comprise a fault detection and load measurement system suitable for underground vaults or pad-mount installations. The system harvests operating energy from the underground cables, eliminating the need for auxiliary power sources. The SEL-8301 communicates with the RPMA Network to provide remote system monitoring. The SEL-8302 Current Transformers (as many as 12) provide outage reports, fault detection reports, and load current measurements. Equipped with the water depth accessory, the SEL-8301 system also reports the water volume in flooded vaults. The SEL-8301 includes the following additional features:

- **Event Detection.** Improve system reliability by remotely monitoring underground distribution circuits for faults and outages.
- **AutoRANGER[®] Trip Logic.** Account for system-wide load variations with the auto-adjusting trip threshold logic.
- **Accurate Load Data.** Monitor load data accurately: 1.5% typical.
- **Configurable Reporting Intervals.** Optimize the update interval based on available load current.
- **Power Harvesting.** Extend the product life and reduce maintenance.
- **Water Depth Sensor.** Approximate the volume of water in flooded subsurface vaults.
- **System Updates.** Receive load data updates as frequently as every three hours.
- **Underground Applications.** Install the system in pad-mount enclosures and subsurface vaults.
- **Seamless Integration.** Combine the SEL-8301 and WSO-11 Wireless Sensor for Overhead Lines to provide a complete distribution fault monitoring solution for both overhead and underground circuits.
- **Field Upgradeable.** Perform over-the-air software updates.
- **10-Year Warranty.** Take advantage of an industry-leading SEL world-wide 10-year warranty.

Functional Overview

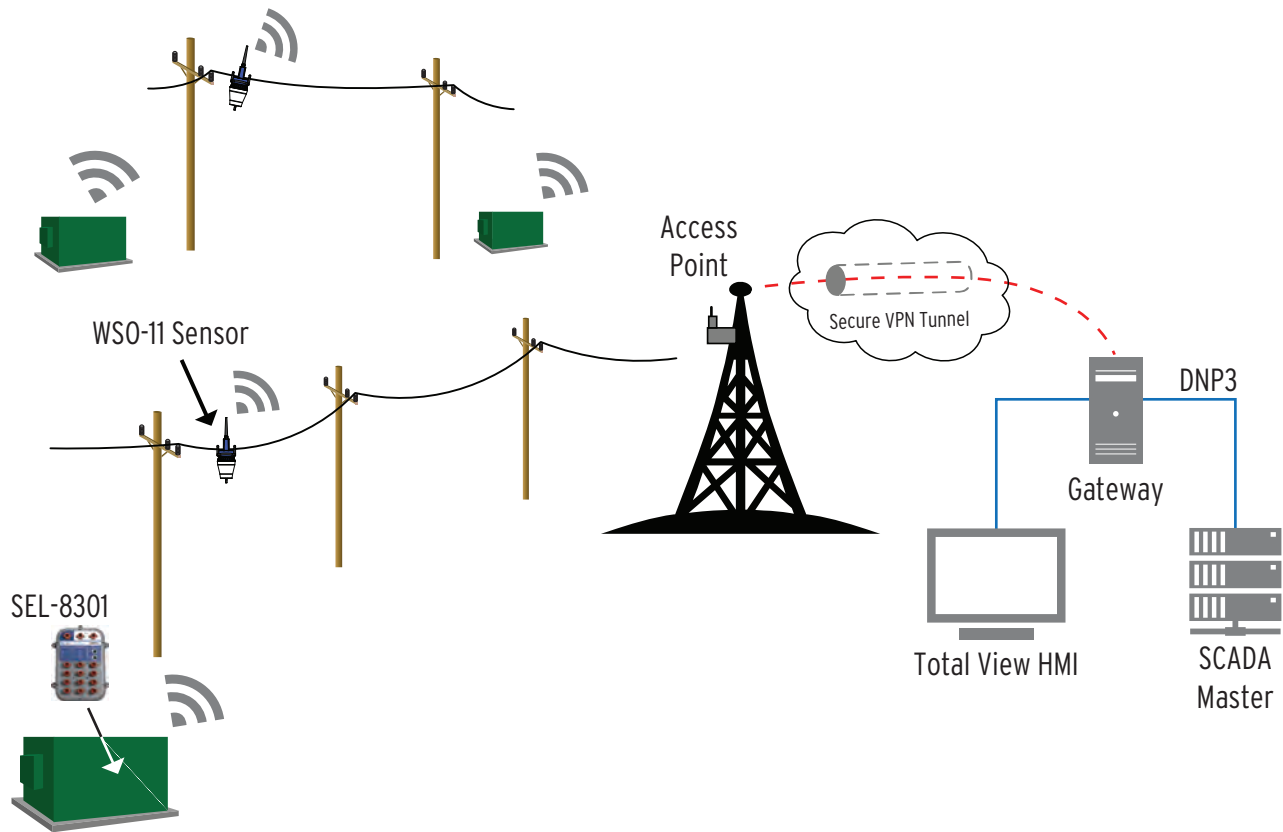


Figure 1 Complete Distribution Fault Location and Load Monitoring Solution

Device Overview

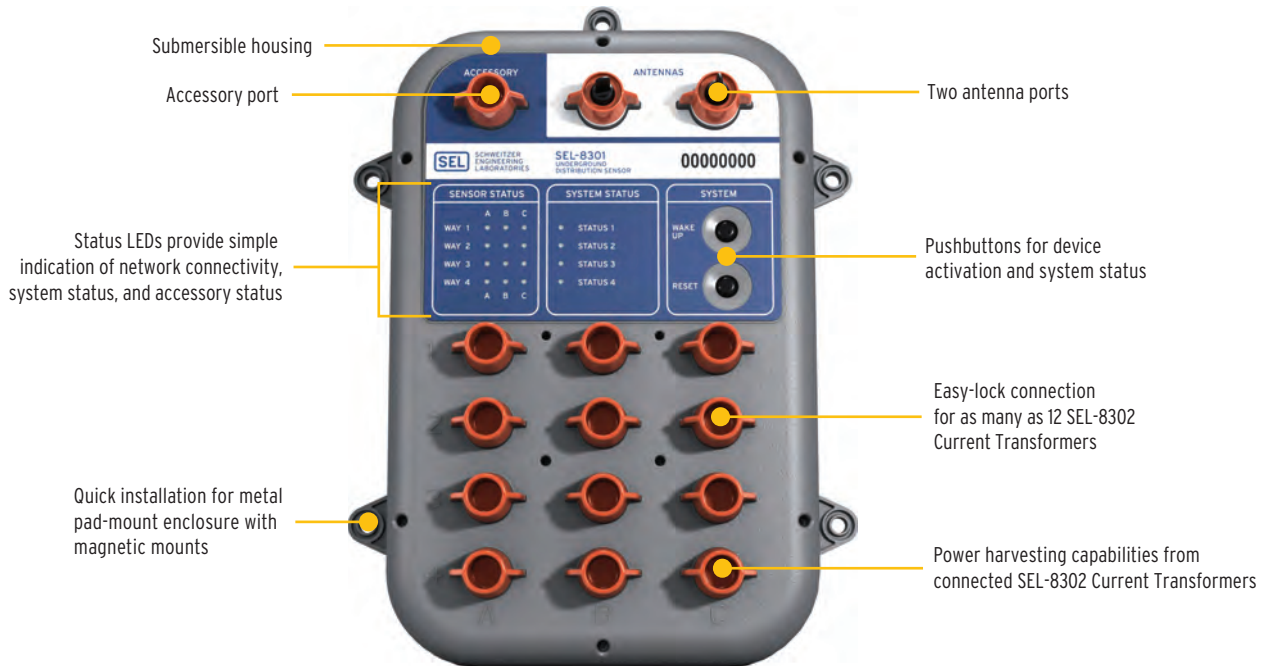


Figure 2 SEL-8301 Device Overview

SEL-8301 Capabilities

Fault Detection

Identify fault locations quickly and remotely on underground distribution circuits. The SEL-8301 automatically selects the best-fit trip threshold based on measured load current. Eight distinct trip thresholds from 50 A to 1200 A provide system-wide flexibility. When current exceeds the configured trip threshold, the SEL-8301 determines whether the event is a permanent or momentary fault. Select to have each fault status (permanent or momentary) either reported by exception or at the next update interval.

Current Measurements

Monitor load current on as many as 12 phases using SEL-8302 Current Transformers. The system records and reports accurate load data, 1.5% typical, at every update interval. The SEL-8301 sends load data in either average or peak values.

Power Harvesting

Harvest power from SEL-8302 Current Transformers to power the SEL-8301. With three connected phase sensors, the system requires a minimum of 20 A per phase to operate with a 3-hour update interval. The update interval affects power harvesting requirements; faster update intervals require more load current.

Easy-Lock Connectors

Install the SEL-8302 Current Transformers and SEL-8301 accessories effortlessly with the easy-lock connectors. The quarter-turn and lock connectors install quickly in the field, and provide a submersible environmental seal. Unique key slots for each port type prevent improper installation.

Water Depth Sensor

Connect the optional water depth sensor to the SEL-8301 Accessory port to identify whether a subsurface vault is flooded before dispatching troubleshooting crews. The water depth sensor accurately measures the distance from the vault ceiling to the water surface, providing a depth measurement that can be used to calculate the volume of water in the vault.

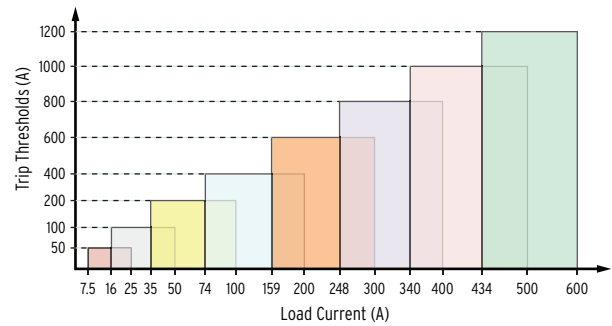


Figure 3 Trip Thresholds



Figure 4 SEL-8302



Figure 5 Easy-Lock Connector



Figure 6 Water Depth Sensor

Outage Detection

Detect outages on underground distribution circuits. The SEL-8301 detects a loss of current after any protection operation and evaluates the duration to determine if it was a permanent or momentary outage. Configure the SEL-8301 to report permanent or momentary outages by either sending an exception packet or including it in the next periodic update.

RPMA Network Connection

Communicate data over the RPMA Network. The SEL-8301 transmits on the license-free 2.4 GHz ISM frequency band for reliable communication. View all the SEL-8301 data with the Total View HMI and send alerts via email to personnel.

Over-the-Air Updates

Upgrade the SEL-8301 with the latest firmware and modify settings in the field by sending over-the-air updates. You can distribute over-the-air updates globally to all SEL-8301 devices on the network or target specific units.

Inrush Restraint

Improve the dependability of reported fault events on circuits that implement an automatic reclosing scheme with the inrush restraint feature of the SEL-8301. Upon detecting a protection operation (e.g., a loss of current), the system enters Inrush Restraint mode and will not register events based on inrush currents from reclosing attempts. The system automatically resets and rearms after restoration of load current.

Configurable Update Interval

Optimize the update interval to achieve high-resolution load data. Configure the update interval to 3, 4, 6, 8, 12, or 24 hours (shorter update intervals provide higher resolution). The system reports 12 load data points for each port per update interval (e.g., a 3-hour update interval results in 15-minute load-data resolution). Shorter update intervals increase power harvesting load current requirements.

Wireless Reporting

Retrieve data from the SEL-8301 wirelessly by scheduled recurring reports or event-triggered reports. The SEL-8301 provides the following reports:

- Periodic updates (three hours by default)
- Exception reports
 - Deployment
 - Restoration
 - Permanent fault
 - Permanent loss of current
 - Momentary fault
 - Momentary loss of current
 - Load pickup

Applications

Pad-Mount Enclosures

Expand the benefits of the SEL-8301 system to aboveground pad-mount enclosures. The remote 1 m (3 ft) antenna cables and remote antenna bracket allow for mounting the antennas in a vertical orientation off the SEL-8301 housing. The magnetic mounting kit attaches to the SEL-8301 mounting holes and allows for quick installation to any magnetic surface. Connect as many as twelve SEL-8302 Current Transformers, one to each sensor port.



Figure 7 Pad-Mount Enclosure Assembly

Subsurface Vaults

The SEL-8301 system is suitable for harsh subsurface vault applications susceptible to flooding. The submersible 6 m (20 ft) antenna cables and remote antenna bracket allow for mounting the antennas near the vault opening in a vertical orientation. Adding the water depth sensor accessory provides approximate water volume measurements for flooded vaults. Connect as many as twelve SEL-8302 Current Transformers, one to each sensor port.



Figure 8 Subsurface Vault Assembly

Dimensions and Mounting

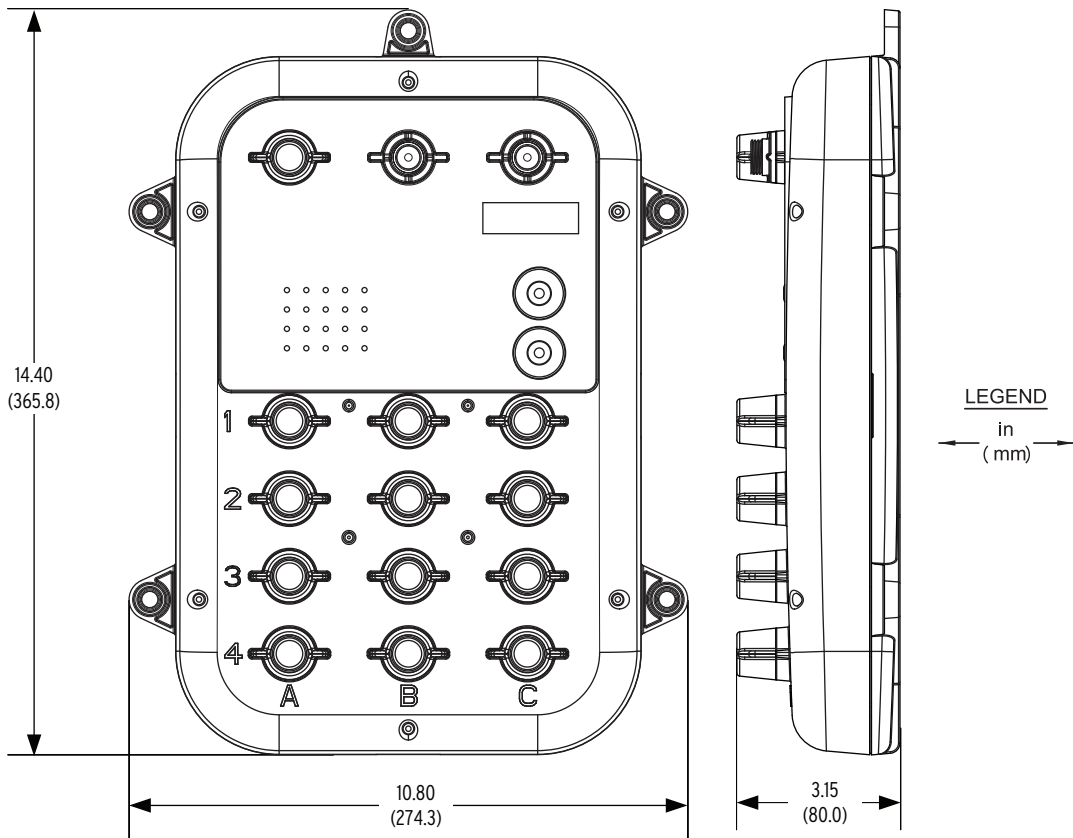


Figure 9 SEL-8301 Dimensions

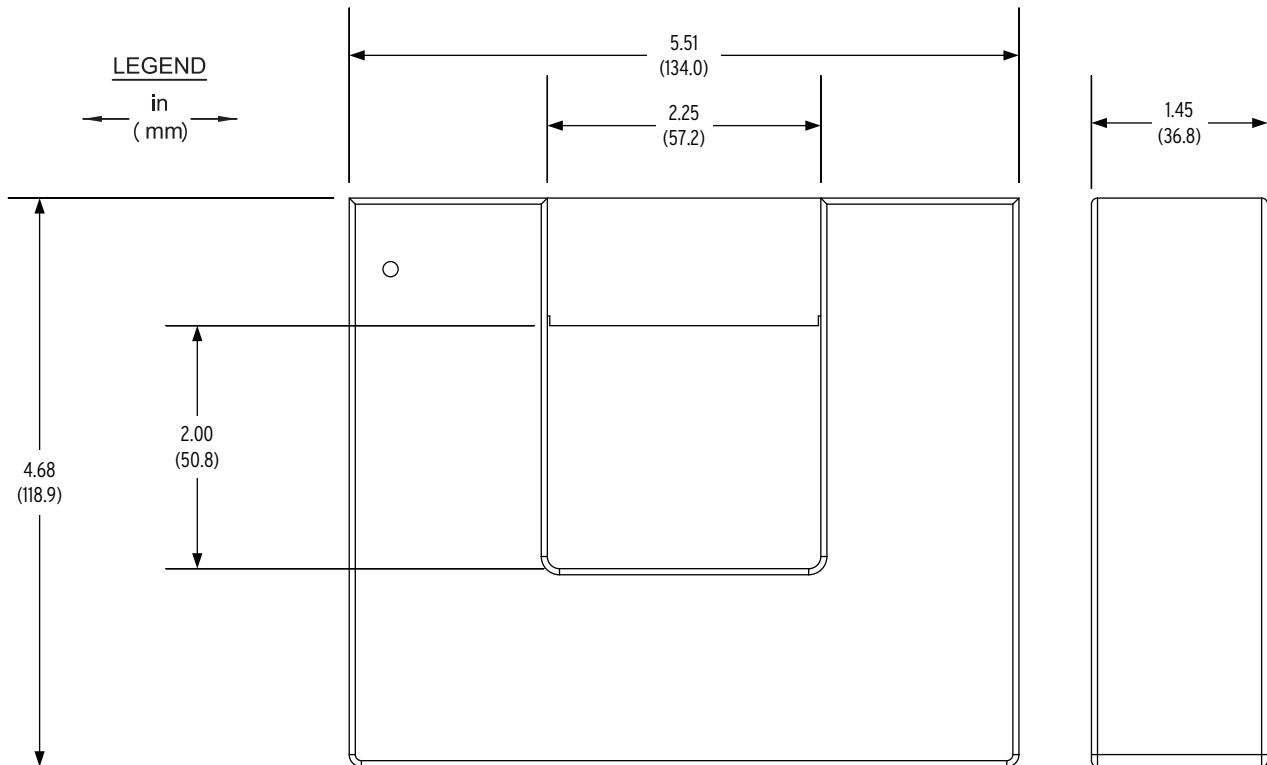


Figure 10 SEL-8302 Dimensions

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

General

Fault Threshold Range:	50–1200 A
Operating Temperature Range:	–40° to +80°C (–40° to +176°F)
Storage Temperature Range:	–40° to +85°C (–40° to +185°F)
Trip Response Time:	24 ms (default)
Shelf Life:	1 year
Outage Time:	5 months
Weight:	1.9 kg (4.2 lb)
Power Requirement (3-hour update interval, 3 or more SEL-8302):	20 A per phase

Radio

Operating Frequency:	2.4 GHz
Update Interval:	3 hours (default)
Network:	RPMA Network Infrastructure

Regulatory

Federal Communications Commission:	FCC Part 15, Subpart B (Unintentional Radiators)
Industry Canada:	ICES-003, Issue 5, Class B (Unintentional Radiators)

SEL-8302

Current Measurement Range:	20–650 A
Maximum Continuous Current Rating:	650 A
Current Measurement Error (20–650 A):	±4%
Current Measurement Error (balanced load, at 25°C):	±1.5%
Trip Threshold Error:	±15%
Crosstalk Immunity (at 0.15 m [6.00 in]):	–60 dB
Minimum Current Detection:	7.5 A
Outer Diameter Mounting Range:	19–50 mm (0.75–2.00 in)
Weight:	1.2 kg (2.7 lb)

Water Depth Sensor

Accuracy:	±12.7 mm (0.5 in) + 1% of reading
Operating Temperature Range:	–35° to +60°C (–31° to +140°F)
Storage Temperature Range:	–40° to +85°C (–40 to +185°F)
Weight:	0.84 kg (1.9 lb)

Type Tests

Electromagnetic

Radio Frequency Immunity:	IEC 60255-22-3:2000 10 V/m IEC 61000-4-3:2002 10 V/m
Electrical Fast Transient Burst:	IEC 60255-22-4:2008 Level 4 IEC 61000-4-4:2011 Level 4
Magnetic Field Interference:	IEC 61000-4-8:2001 Level 5 (100 A/m [60 seconds], 1000 A/m [3 seconds]) IEC 61000-4-9:2001 Level 5 (1000 A/m) IEC 61000-4-10:2001 Level 5 (1000 A/m)

Electrostatic Discharge Immunity

ESD:	IEC 60255-22-2:2008 8 kV contact discharge, 15 kV air discharge IEC 61000-4-2:2008 8 kV contact discharge, 15 kV air discharge IEEE C37.90.3-2001 8 kV contact discharge, 15 kV air discharge
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Environmental Tests

Temperature Cycling:	IEEE 495 sec 4.4.1-2007
Cold:	IEC 60068-2-1:2007
Dry Heat:	IEC 60068-2-2:2007
Electric Cord Pull (SEL-8302):	IEEE 495 sec 4.4.5-2007
Ingress Protection	
SEL-8301:	IP-68 (up to 4.6 m [15 ft]) IEEE 495 sec 4.4.2-2007
SEL-8302:	IP-68 (up to 4.6 m [15 ft]) IEEE 495 sec 4.4.2-2007
Antenna:	IP-67
Water Depth Sensor:	IP-67

Regulatory Compliance

The radio module has been designed to meet the following standard: FCC-CFR Part 15.247 Radio Frequency Devices, Subparts A-General and B-Unintentional Radiators (testing is done at module level for Modular Approval).

FCC ID: XTE-ULPD100
IC: 8655A-ULPD100

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

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RPMA is a registered trademark of On-Ramp Wireless, Inc.

This product is covered by the standard SEL 10-year warranty. For warranty details, visit selinc.com or contact your customer service representative.

SEL-8301 Data Sheet

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