Centralized Protection and Control Solution Using SEL-487E

Apply centralized protection and control (CPC) schemes with the SEL-487E

- Simultaneously protect transformers, buses, lines, and feeders using differential, overcurrent, and distance elements available in a single device.
- Reduce device count and complexity by replacing multiple application-specific devices with one relay.
- Simplify CPC applications by using the familiar SEL-487E Transformer Protection Relay in new configurations.
- Meet your goals for redundancy by simply applying additional SEL-487E relays.
- Reduce wiring for CPC applications utilizing SEL digital secondary system (DSS) solutions.
Overview

The SEL-487E delivers a CPC solution that offers complete protection for small substations and is highly adaptable, maximizing the benefits of any given application. Connect to conventional instrument transformers using traditional copper connections or as part of a DSS solution, such as IEC 61850-9-2 Sampled Values (SV) or Time-Domain Link (TiDL®) technology. In these DSS applications, merging units acquire data close to the instrument transformers and send the data to remote SEL-487E relays to provide the required information.
Key Features

Multiple Analog Inputs
Connect to multiple instrument transformers and provide substation-wide protection using the SEL-487E relay CT and PT inputs. The SEL-487E supports up to 18 CT inputs and six PT inputs.

Comprehensive Differential Protection
Implement fast, sensitive, dependable, and secure differential protection with a differential element characteristic that automatically adapts to internal or external fault conditions. The adaptive differential element responds to internal fault conditions in less than 1.5 cycles. The SEL-487E includes two differential elements: one intended for protecting transformers and the other intended for protecting busbar applications.

Configurable Distance Protection
Apply up to four zones of phase and ground distance protection using mho or quadrilateral characteristics. The SEL-487E distance elements can be applied as a primary transmission line or as backup transformer protection.

Dependable Overcurrent Protection
Provide protection with phase-, negative-, and zero-sequence overcurrent elements and 20 configurable time-overcurrent elements. In breaker failure protection applications, reduce breaker failure coordination time when subsidence current is present with fast open-phase detection.

Diverse Protection Applications
Simultaneously protect multiple assets—such as transformers, buses, lines, and feeders—in centralized protection applications. Protect large transformers and autotransformers with double breakers in the high- and low-side buses of the power transformer. You can also configure the SEL-487E for a typical two-winding transformer application and use the remaining three-phase current inputs for feeder or line backup protection. The SEL-487E can provide complete feeder protection for up to six feeders.

DSS Technology
Modernize your substation by applying a DSS solution such as SEL TiDL or SEL SV technology. DSS solutions replace copper wires with fiber-optic cables to increase safety, reduce costs, and limit the impact of electromagnetic interference in secondary circuits.

SV systems combine a flexible Ethernet communications network with the interoperability of an international standard. The SV solution combines protection functionality included in the merging units with the data-sharing capability of the IEC 61850 SV architecture. SEL SV merging units (or other IEC 61850-9-2 SV-compliant units) digitize signals and transmit them via fiber-optic-based Ethernet to an SEL-487E-5 SV relay in the control house.

The TiDL solution is a secure and easy-to-implement point-to-point solution that does not require an external time source or network engineering. SEL-TMU TiDL Merging Units placed in the yard digitize signals and transmit them over fiber-optic cables to the SEL-487E-5 TiDL relay in the control house.
SV Technology

For CPC schemes that require both the flexibility of a network and standard-compliant interoperability, SEL offers an IEC 61850-compliant SV solution.

Advanced Merging Units With Built-In Protection
Use either SEL-401 Protection, Automation, and Control Merging Unit or SEL-421-7 Protection, Automation, and Control System With Sampled Values or TiDL technology merging units to digitize analog signals from CTs and PTs. The SEL-401 includes overcurrent and breaker failure protection, while the SEL-421-7 includes full line protection functionality.

A Robust, Deterministic Network
Build a more robust Ethernet network using SEL operational technology (OT) software-defined networking (SDN) technology. SDN uses predetermined, engineered traffic flows to provide both deterministic performance and high-speed recovery in case of a failed link. Use the Parallel Redundancy Protocol (PRP) or failover functionality to increase system availability.

System-Wide Time Synchronization
Synchronize every device on your system using the SEL-2488 Satellite-Synchronized Network Clock. The SEL-2488 can supply time in either IRIG-B or the IEEE 1588 Precision Time Protocol (PTP) to provide high-accuracy time that is suitable for SV applications. The optional oven-controlled crystal oscillator provides high holdover accuracy in case of satellite signal loss.
TiDL Technology

When it comes to creating distribution substation protection and control schemes, SEL TiDL-based solutions are easy to deploy and include software to simplify the commissioning process.

Simple, Intuitive Installation
Compact TiDL merging units easily fit into existing cabinets. Flexible I/O options include digital I/O and allow for 4 PT/4 CT or 8 CT configurations. Each merging unit can serve up to four different TiDL-enabled relays and simplifies device management by not requiring settings.

Streamlined Settings Management
SEL Grid Configurator Software creates settings for the entire system. Use intuitive interfaces to easily create and deploy settings, program custom relay logic, and commission TiDL systems with an intuitive, easy-to-use interface.

Rapid Deployment and Troubleshooting
Use automated commissioning reports and information from the relay to quickly troubleshoot or verify the proper installation of the system. Receive quick feedback, and identify any existing errors by comparing these reports to settings developed during the engineering and commissioning phases.
# SEL-487E Specifications

## General

<table>
<thead>
<tr>
<th>AC Current Inputs</th>
<th>5 A nominal</th>
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<tbody>
<tr>
<td>(18 total)</td>
<td>1 A nominal</td>
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<tr>
<td></td>
<td>1 A/5 A nominal (Y terminal only [REF])</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>AC Voltage Inputs</th>
<th>0–300 V&lt;sub&gt;L-N&lt;/sub&gt; operational</th>
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</thead>
<tbody>
<tr>
<td>(6 total)</td>
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<tr>
<th>LEA Voltage Inputs</th>
<th>0–8 V&lt;sub&gt;L-N&lt;/sub&gt; operational</th>
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<tr>
<th>Communications Protocols</th>
<th>FTP, Telnet, SEL ASCII, SEL Fast Message, synchrophasors, DNP3, PRP, PTPv2, and IEC 61850 Edition 2 (optional)</th>
</tr>
</thead>
</table>

## TiDL Ports
- Fiber-optic SFP ports: 8
- Range: ~2 km
- Data rate: 100 Mbps
- Protocol: SEL T-Protocol

## SV Ports
- Subscriber: As many as 7 SV data streams
- Data rate: 4.8 kHz for 60 Hz system or 4 kHz for 50 Hz system
- Protocol: IEC 61850-9-2

## Precise-Time Input
- Demodulated IRIG-B time input and PTPv2

## Processing
- AC voltage and current inputs: 8,000 samples per second
- Protection and control processing: 8 times per power system cycle

## Power Supply
- 24–48 Vdc
- 48–125 Vdc or 110–120 Vac
- 125–250 Vdc or 110–240 Vac

## Operating Temperature
- −40° to +85°C (−40° to +185°F)