Real-time visualization for detecting and solving power system challenges

- Automatically detect transients induced by renewable generation.
- Gain power system insight that SCADA can’t provide, with 60 message-per-second updates.
- Determine the order of operations of system events with instant access to real-time and historical data.
- Improve operator situational awareness with phase angle difference measurements across key transmission lines.
Features and Benefits

Automate Oscillation and Disturbance Detection
Quickly analyze power system oscillations and disturbances automatically detected by SEL-5078-2 SYNCHROWAVE Central Software. For each detected oscillation and disturbance, information provided by SYNCHROWAVE Central helps operators and engineers determine the location and impact. Email notification of detected disturbances keeps everyone informed of current events on the power system.

See the Real-Time System State
Improve situational awareness by viewing live, subsecond, and time-aligned information from across the entire power system. Understanding dynamic behavior enhances decision-making.

Combine Relay Event Data With Synchrophasors
Correlate synchrophasor data and relay event reports to develop a new level of understanding for wide-area analysis and monitoring. Powerful mathematical functions aid in determining the disturbance's root cause.

Turn Information Into Action
Monitor events in real time while simultaneously seeing trended signal behavior. Gain insight into conditions prior to the present state.

Quickly Find and Analyze System Events
Combine streaming synchrophasor data with time-aligned relay event reports to improve event analysis response times and understanding. Search historical data to aid in determining the event’s root cause. View system data over large periods of time, and zoom in for subsecond-level detail.

Improve Productivity
Quickly learn SYNCHROWAVE Central with the intuitive, easy-to-use web-based user interface. Share data, views, and results with fellow engineers.

Access Data on the Network
Conveniently access SYNCHROWAVE Central with a web browser from any computer on the network. Individual authentication provides secure access for all users.
Key Innovations

Automatically Detect Disturbances
Algorithms in SYNCHROWAVE Central automatically detect disturbances and oscillations in real time and with historical data, quickly providing operators and engineers new insights into their system performance.

Receive Automatic Notifications
Alarms and email alerts provide automated notification during a significant system disturbance.

Determine the Disturbance Location
Possible disturbance locations are listed by measured impact, providing operators and engineers the information needed to determine the location. The top three phasor measurement units (PMUs) in this example were located in a substation next to a solar farm.

Understand the Impact
Frequency bins provide a representation for the type of disturbance or oscillation detected. A high frequency may point to a solar or wind farm, whereas a lower frequency may represent a more traditional generation source.
SYNCHROWAVE Central Capabilities

See the bigger picture. Correlate wide-area signals (upper) with relay event reports (lower). Open event reports by selecting circular event indicators.

Analyze Synchrophasor Data
Monitor synchrophasor data on trended charts and phasor diagrams in real time or offline with an easy-to-use web client interface.

Correlate Relay Events With System-Wide Events
Quickly correlate relay events with system disturbances. Automate relay event retrieval with ACCELERATOR TEAM® SEL-5045 Software.

Find Past Events
Quickly locate archived power system disturbances with SYNCHROWAVE Central’s database search.

Employ Automatic Failover
Implement a fully redundant system with automatic failover to ensure that application downtime is minimized during server failures, communications failures, and software upgrades.

Explore Geographic Contour Map
Instantly see the system state with the geographic contour map. Display voltage magnitude and angle differences between locations.

Monitor System Modes
View modal analysis results on both real-time and archived synchrophasor data. SYNCHROWAVE Central automatically calculates and archives power system oscillations.

Configure Custom Alarms
Alert operators and engineers to changing conditions, and help them determine appropriate control actions.

Concentrate Phasor Data
Connect multiple phasor data concentrator (PDC) and phasor measurement unit (PMU) devices for synchrophasor visualization by using the PDC input capability.

Find Past Events
Quickly locate archived power system disturbances with SYNCHROWAVE Central’s database search.

Share Views and Snapshots
Share customized views and events with engineers and operators throughout the company for faster event analysis.

Export Data
Easily export synchrophasor data from the client to CSV and COMTRADE formats for further analysis with other applications.

Improve Security
Authenticate users with Microsoft® Active Directory® and role-based access.
SYNCHROWAVE Event

Analyze local relay analog and digital signals with the SYNCHROWAVE Event Viewer, which is integrated into SYNCHROWAVE Central.

Analyze Relay Event Data
Plot relay oscillography, display phasor magnitudes and angles, and monitor the digital status.

Time-Align Event Reports
Easily coordinate event report time for accurate comparison and analysis of signals from multiple relays or past event reports. Compare measurements at different times throughout the event report by using cursors.

Perform Calculations
Create equations to analyze specific trip conditions. Instantly plot calculation results for quick event analysis.

Quickly Get Results
Access all relay event and synchrophasor data from any authenticated web browser.
SYNCHROWAVE Applications

Quickly zoom in on areas of interest.

Turn Data Into Information
Send time-aligned measurements up to 60 times per second with synchrophasor devices. Measurements include the magnitudes, angles, frequency, power, and digital status. SYNCHROWAVE Central completes your synchrophasor system with a powerful, easy-to-use solution for visualizing and analyzing real-time streaming data and archived data.

Get Instant Feedback
Promptly see the system response after switching a line in or out of service. Never miss unreliable behavior, like a growing oscillation. See exactly what is happening now—and with subsecond resolution.

Validate and Improve System Models
Record the system response to capacitor switching, generator trips, load shedding, or other events. Analyze archived system responses, and compare them to models. Identify system oscillations with modal analysis. Conveniently save data for external modeling applications by using the graphical export functionality. Supported formats are CSV, binary COMTRADE, and ASCII COMTRADE.

Validate and Improve System Settings
View the inertial, governor, and automatic generation control (AGC) response of your system with high-resolution, time-aligned information. Measure any induced oscillation frequency and decay characteristics. Use this information to make sure settings in governors, power system stabilizers, and other controllers are correct.

Understand Root Cause
Accelerate your understanding of system performance by examining wide-area responses through multiple views. Get to root cause of all device trips with the relay event analysis capability.

Reliably Integrate Generation
Use the high-resolution displays in SYNCHROWAVE Central to measure and track the impact of renewables on your system. Incorporate this information as part of a methodology to improve reliability. Integrating an increasing amount of renewable energy into the power system can result in reduced system stability and the introduction of new oscillatory modes. System dynamics from these generation sources change quickly—too fast to see at traditional SCADA rates.
SYNCHROWAVE System Architecture

View Synchrophasor Data
Display synchrophasor data from SEL PDCs and PMUs or from IEEE C37.118-2005-compliant PDCs by using SYNCHROWAVE Central.

Collect Event Report Data
Connect to the acSELERATOR® Database with SYNCHROWAVE Central. You can manually enter event reports into the database or automatically collect them with acSELERATOR TEAM.

acSELERATOR TEAM
acSELERATOR TEAM automates the collection of power system data from multiple devices and stores the data in a central location for easy access. Optionally combine TEAM with SYNCHROWAVE Central to fully automate event report retrieval and display.

Accelerated Event Analysis
Easily automate the collection and grouping of event reports from multiple devices into one database. Spend less time gathering and more time analyzing the information generated by your devices.

Reduced Costs
Improve efficiency by eliminating time spent in the field manually collecting data from devices.

View relay events collected by acSELERATOR TEAM in SYNCHROWAVE Central’s Event Timeline.

Convenient Configuration
TEAM integrates with acSELERATOR QuickSet® SEL-5030 Software, putting all device management in one convenient location with a common interface.

Flexible Installation
Install TEAM at a single master location or separately at each substation to provide a complete event data collection solution.
## Specifications

### Minimum System Requirements

<table>
<thead>
<tr>
<th>Operating Systems Supported</th>
<th>Server</th>
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<tbody>
<tr>
<td></td>
<td>Microsoft Windows® 10 (32- and 64-bit)</td>
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<td></td>
<td>Microsoft Windows 8 (32- and 64-bit)</td>
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<td>Microsoft Windows 7 (32- and 64-bit)</td>
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<td></td>
<td>Microsoft Windows Server® 2012 (64-bit)</td>
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<td></td>
<td>Microsoft Windows Server 2008 R2 (64-bit)</td>
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<td></td>
<td>Microsoft Windows Server 2008 (32- and 64-bit)</td>
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<td></td>
<td><strong>Client (Requires Microsoft Internet Explorer® 9 or higher)</strong></td>
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### Product Configuration

<table>
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<tr>
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<th>Disturbance Monitoring</th>
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<tbody>
<tr>
<td></td>
<td>One simultaneous user</td>
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<tr>
<td></td>
<td>Three simultaneous users</td>
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<th>Wide-Area Situational Awareness</th>
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<th>Configuration Requirements</th>
<th>SYNCHROWAVE Central requires one or more IEEE C37.118-2005–compliant synchrophasor sources. Source data can stream directly from the PMU(s) or be concentrated via the PDC(s).</th>
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<tbody>
<tr>
<td></td>
<td>SYNCHROWAVE Central requires ACSELERATOR Database for event report archiving.</td>
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