Time Synchronization Solutions

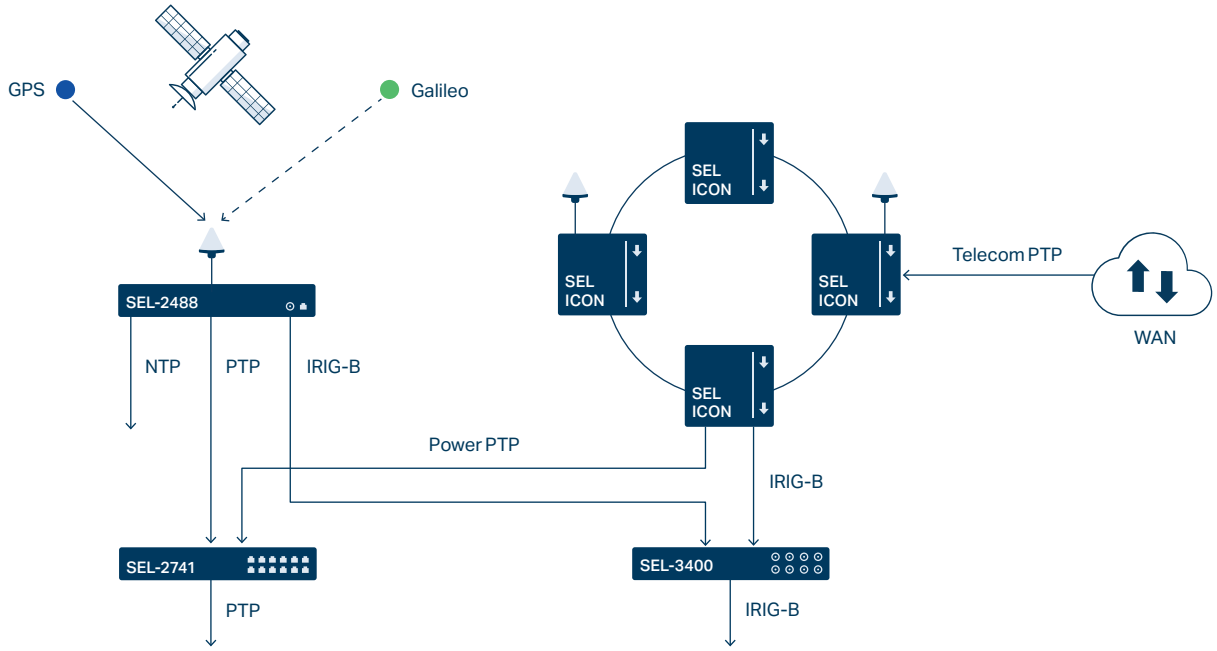
Layer innovative technologies to build dependability and security into your time synchronization system

- Build a resilient network with longer holdover and the Parallel Redundancy Protocol (PRP).
- Protect your system from time source disruptions by using input redundancy.
- Defend against GPS spoofing attacks with satellite and IRIG-B signal verification.

Mitigate GPS Vulnerabilities

Many applications for protection, monitoring, and control of electric power systems require precise time synchronization. Often, precise time synchronization systems rely on Global Navigation Satellite Systems (GNSSs), including GPS and GLONASS, which are highly accurate and effective but may not always be available or secure. We offer solutions that improve the reliability and security of time distribution and mitigate the effects of the following situations:

- Atmospheric interference caused by solar flares
- Multipath errors due to reflected radio signals
- Equipment failure
- Intentional and unintentional jamming
- Equipment maintenance or testing
- Spoofing attacks, in which a satellite system receiver locks to a counterfeit signal



SEL Solutions Build Greater Reliability Into Your Time Synchronization System

We understand that precise time is critical to the optimal operation of power systems. That's why we provide a variety of time synchronization solutions for detecting and responding to GPS signal loss or degradation. You can use the following products either individually or combined into a multilayered system to ensure highly reliable time synchronization in your application.

SEL ICON® Integrated Communications Optical Network

The SEL ICON provides a new approach to solving voice and data communications network design. By combining SONET and Ethernet technologies with flexible interfaces, the ICON integrates data and voice communications in a single platform. The ICON provides the communications infrastructure for complete end-to-end solutions and complex applications, including:

- Precise time distribution, <1 µs across the entire wide-area network
- Synchrophasor control of power systems
- Teleprotection
- Security management

Each ICON node can be timed by GPS or over the WAN using SONET or Precision Time Protocol (PTP) Telecom input for Ethernet transport. Each ICON node can generate IRIG-B and IEEE 1588 Power Profile time references for IEDs in substations. Timing accuracy of <1 µs can be maintained if the ICON network is locked to a suitable reference (GPS or Stratum 1 clock). With multiple time references, the ICON network is resilient to localized or wide-area GPS outages, equipment failures, and GPS spoofing. SEL-5051/5052 Client/Server Network Management System (NMS) Software enables centralized monitoring and troubleshooting of time synchronization.

SEL-2488 Satellite-Synchronized Network Clock

The SEL-2488 is more than a clock—it's an advanced precise-timing platform packed with capabilities and ease-of-use features for time synchronization. The advanced capabilities of the SEL-2488 make it well-suited for demanding applications, like synchrophasors and event recording, as well as for larger substations with multiple time synchronization requirements. The SEL-2488 offers the following:

- Up to nine demodulated IRIG-B outputs and up to four modulated IRIG-B outputs
- Network Time Protocol (NTP) support
- PTP support
- Average accuracy of ±40 ns to UTC
- Redundant power supplies

Network Resiliency

The SEL-2488 supports as many as two Doubly Attached Node implementing PRP (DANP) interfaces for separate PRP networks or two active-backup port bonded interfaces for Ethernet failover, providing redundancy for Ethernet network applications.

Satellite Signal Verification

The SEL-2488 and SEL-9524 GNSS Antenna receive signals from two satellite constellations to validate GPS time signals, providing a layer of protection from GPS spoofing attacks.

Holdover Oscillator Options

If Global Navigation Satellite System (GNSS) time signals become unavailable, the clock switches to the TCXO holdover, with an accuracy of 36 µs after 24 hours, or to one of the high-stability holdover options:

- OCXO holdover, with an accuracy of 5 µs after 24 hours
- DOCXO holdover, with an accuracy of 2.5 µs after 24 hours

SEL-3400 IRIG-B Distribution Module

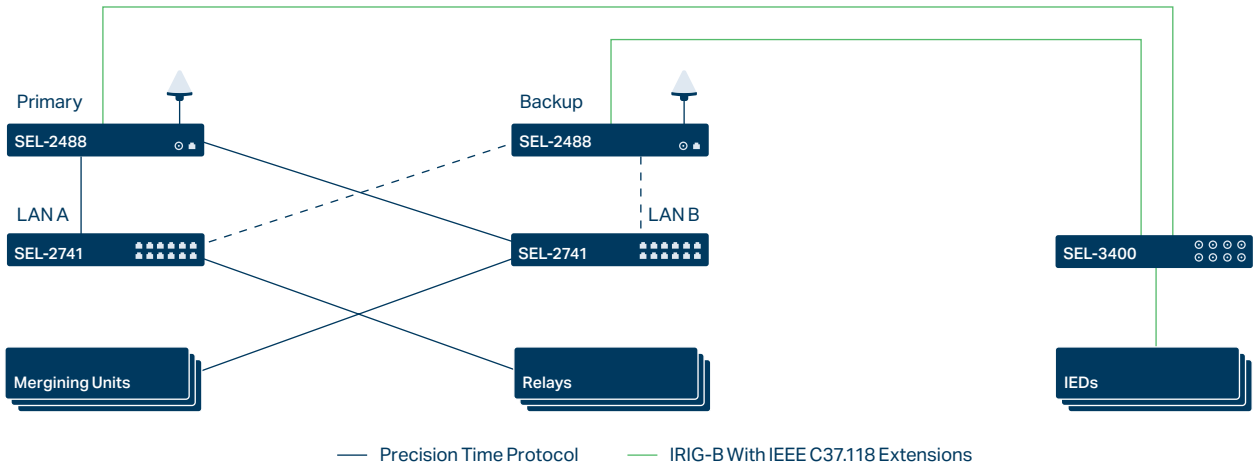
The SEL-3400 includes a visible time display and provides 12 IRIG-B output ports for time synchronization. When two inputs are configured for redundancy, if the primary input is lost or its time quality is worse than the secondary input, the SEL-3400 switches to the secondary input and indicates the change via the alarm contact.

When two inputs are configured for verification, the SEL-3400 will compare the time signals. If the signals match, the SEL-3400 will provide a valid IRIG-B output, but if there is a discrepancy in the signals, the IRIG-B output will report the failed time quality and trigger an alarm.

SEL-9524 GNSS Antenna

The SEL-9524 is a rugged and reliable antenna designed for GNSS devices for critical infrastructure applications. The antenna operates reliably from −50° to +85°C (−58° to +185°F) and is IP68-rated, making it suitable for harsh environments. Industry-leading surge immunity allows this antenna to perform better in the presence of lightning and other surge events. The antenna is equipped with LEDs that provide diagnostic information.

Use the SEL-9524B to receive satellite signals from both GPS and GLONASS satellite constellations for added reliability. The antenna maintains excellent gain (>40 dB) while simultaneously providing strong rejection for signals outside of the nominal frequency band.



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