CASE STUDY

Pre-engineered, Preassembled Integrated Systems for Improved Protection, Control, and Management of Industrial Substations

Integrated Substation System for More Reliable Power, Plus Savings on Protection and Energy Costs

The SEL-7000 Integrated Substation System family offers pre-engineered, preassembled integrated systems for improved protection, control, and management of industrial substations—in packages that make higher performance the "lower cost" choice.

Pullman, WA—We are now in an era when merely providing superior protection at the industrial substation is no longer sufficient. It has also become increasingly vital to maintain delivery of power to the factory floor. Yet, as industrial plants modernize with increasingly complex and sensitive computer-controlled systems, plant managers often don't realize that their power protection and power delivery control systems have become inadequate and beyond patching. When a power interruption or disturbance occurs and expensive manufacturing equipment is disabled or damaged, facility managers are often left with unanswered questions and in some instances the power company is blamed.

This is also an era of increasingly complex power applications. Power system engineers must continually update their training on sophisticated devices that must be integrated faultlessly to provide safe and reliable power. At the same time, the demand for improved power system management has grown steadily, calling for industrial users to integrate their systems in order to gain improved performance and lower costs. Increased automation and information are needed to continually evaluate system components.

Figure 1—The SEL-7000 Integrated Substation System is a family, or series, of preassembled "packages" that offer complete application solutions coupled with advanced system automation, communication, and intelligence capabilities that enable users to manage their power systems with added convenience, safety, reliability, and economy.

However, system integration and automation are not simple tasks. Designing today's new or upgraded electric power systems requires expertise that industrial users—and even utilities—can no longer afford to have on staff. Power system protection, monitoring, and control devices are more powerful, to be sure. But to integrate them properly and leverage their capabilities requires the interconnection of IEDs (intelligent electronic

devices), use of new communications technologies, and installation of advanced power management controls. Few industrial users are likely to have that kind of talent on board.

"If you really study today's power system requirements, you'll see a growing need for improved system management," says Dave Dolezilek, Automation Technology Manager at Schweitzer Engineering Laboratories, Inc. (SEL). "That's what many of these IEDs and other technologies and product features can enable. By better managing power system assets, users will be operating their systems in a financially prudent manner while improving system reliability and security."

The solution for new plants and those in need of updated power protection and control systems is the "drop-in" substation control room. Through the evolution of new protection, monitoring, and control installations, engineers can now purchase a complete turnkey, or drop-in, control house shipped directly from the factory from select vendors such as SEL. The company recently announced their turnkey solution for the market that they call the SEL-7000 Integrated Substation System family of products.

"Industrial users, in particular, don't have or can't afford the skills needed to design and implement an optimal solution," Dolezilek explains. "At the same time, they have different philosophies on how they would protect a distribution line, for example, with a radial feed or loop scheme. They have their own ideas, which they have developed over time. The SEL-7000 product line offers the flexibility to meet their preferences as well as best engineering practices for their locations."

The SEL-7000 Integrated Substation System is a new family, or series, of preassembled "packages" that offer complete application solutions coupled with advanced system automation, communication, and intelligence capabilities that enable users to manage their power systems with added convenience, safety, reliability, and economy.

The SEL-7000 family is aimed at providing simplified application design, system integration, and improved system management. Individual panels or the entire control building are pre-engineered, designed, prefabricated and tested off-site before being installed at the industrial substation. This new solution is less expensive and more reliable than multivendor solutions and also saves on installation, training, operating, and maintenance costs.

According to Dolezilek, the development of the SEL-7000 Integrated Substation System was an outgrowth of SEL's involvement with progressive utility companies, including Duke Power's innovative Transmission Substation Automation & Relay Team (TSAR-Team). "Duke Power has progressed the use of integrated information and protection and control beyond anything I've seen anywhere. The TSAR-Team wrings every ounce of value out of a system. And they use information extensively—not just for running the substation, but to help their company make business and planning decisions."

Adopting the sophistication and cost-performance benefits of the drop-in control house, the SEL-7000 family is designed to offer power system operators higher performance at lower costs. SEL-7000 systems include an integrated array of preconfigured and pretested

power protection and management modules that provide complete solutions according to customer needs, ranging from simple applications to complex substation power management systems.

SEL-7000 family solutions range from application modules, such as protection, management and control of individual circuit breakers, to complete turnkey substation systems that include all the communications, automation, and security systems supported by HMI, graphical displays, and an on-board computer processor. All SEL-7000 solutions incorporate best engineering practices and are delivered prewired and pretested, ready to connect to the user's power environment.

The use of multifunctional products such as SEL digital relays can represent a 78% to 90% reduction in capital equipment investments. Modern relay technology also offers advanced diagnostics, alarming, and sequence-of-events and status information, all of which enhance system operability, lower overhead and maintenance costs, and facilitate service restoration should a fault occur.

"Through the integration of IEDs involved in various protection, automation and control equipment, the SEL-7000 leverages the individual capabilities in these devices to provide greater power system management at lower cost," says Dolezilek. "The SEL-7000 promises power system owners lower initial cost, plus lower energy and maintenance costs."

Lower initial costs are a result of cost effective multifunctional devices and reduced requirements for training, engineering design, and documentation labor. Maintenance activities and costs are lowered through the use of highly reliable devices with much longer MTBF (mean time between failures).

An SEL-7000 Integrated Substation System streamlines access to valuable power system information and optimizes engineering time through automatic event report collection, automatic settings management, and event report analysis software.

Working together with power system innovators such as Duke Power and advanced industrial users, SEL developed its new Integrated Substation System family to integrate multifunctional, digital-based devices that enhance system capabilities and ROI (return on investment) while eliminating the need for customers to grapple with new technologies. Whether a new system or an upgrade, the SEL-7000 is designed to deal with power system issues of reliability, obsolescence, and information management.

"What truly differentiates this integrated system from a collection of off-the-shelf devices is the use of information to better manage a power system," says Dolezilek. "We certainly recognize the importance of power protection, and we've gone far beyond that. The SEL-7000 can enable people to operate their systems in a financially prudent manner by providing information that will help them answer questions such as, 'Should this transformer be replaced? Should the circuit breaker be upsized to serve more customers?'

"The SEL-7000 is changing the way people buy and use power control and automation systems," adds Dolezilek. "It's a convenient way to deliver a sys-

tem, which is a substantial value in itself. But this system is far greater than the sum of its parts and modules. When you consider all the data it can pull from everywhere in the power system, data that can be manipulated and used to enhance automation and better manage the system, it has incredible value."

In designing an SEL-7000 solution with a customer, SEL engineers can reduce the number of system devices by interconnecting IEDs and integrating functions, thus providing added savings. "We can use communications connections to do interlocking and high-speed automation control, capabilities that aren't apparent to users who are dealing with individual IEDs but are quite apparent to engineers who design an integrated system with interconnected IEDs," Dolezilek explains.

Incorporation of SCADA systems is another example of the SEL-7000's potential for improving system capabilities while saving on costs. While legacy SCADA systems use costly RTUs (remote telemetry units) and PLCs (programmable logic controllers) that are often unreliable, SEL has integrated remote monitoring through an advanced communications processor located in its Integrated Substation System. SEL-7000 systems can also offer flexible communications to all substation devices such as weather stations and equipment monitors, plus create a common database for all important substation information.

The SEL-7000 provides simplified protection communications via direct digital communications to relays, replacing tone equipment for transfer-trip schemes. Relay meter data replace less reliable transducers, and SEL relay and protection logic replace less reliable PLCs.

In addition to lowering investment and installation costs, the SEL-7000 promises to lower operation and maintenance costs. Operating costs are reduced through the integration of automation and control products from one vendor. Similar look and feel of the system's operator interfaces simplifies training as well as on-the-job operation. Operators are also more efficient in emergency situations because they have fewer interfaces to learn. Applying microprocessor relays with self-test diagnostics and instant digital communications eliminates all periodic maintenance cycles for the installed electric terminals. Maintenance of power system apparatus is enhanced through the collection of information from IEDs. Periodic maintenance of power system assets is being replaced with predictive maintenance because better information indicates when and what type of maintenance should be performed.

Potential human errors are also greatly reduced through the SEL-7000's intelligent supervisory programming of the system's microprocessor relays. The system is designed to prevent errors in the operation of circuit breakers due to improper switching procedures.

The design of each SEL-7000 system also permits easy enhancement of the system via upgrades or replacement of in-service IEDs.

# # #

About David J. Dolezilek

David J. Dolezilek received his BSEE from Montana State University in 1987 and is now the technology director of Schweitzer Engineering Laboratories, Inc. He is an electrical engineer with management and development experi-

ence in electric power protection, integration and automation, communications, control systems, SCADA and EMS design, and implementation. He is the author of numerous technical papers and continues to research and write about innovative design and implementation affecting our industry. Dolezilek is a patented inventor and participates in numerous working groups and technical committees. He is a member of the IEEE, the IEEE Reliability Society, CIGRE working groups, and two International Electrotechnical Commission (IEC) Technical Committees tasked with global standardization and security of communications networks and systems in substations.

About SEL

Schweitzer Engineering Laboratories, Inc. (SEL) has been making electric power safer, more reliable, and more economical since 1984. This ISO 9001-certified company serves the electric power industry worldwide through the design, manufacture, supply, and support of products and services for power system protection, control, and monitoring. For more information about SEL products, locate the SEL representative nearest you by visiting our website at www.selindustrial.com, or contact the SEL Industrial Solutions Group, phone: (615) 507-2184; fax: (615) 507-2188; mail: 130 Seaboard Lane, Suite A7, Franklin, TN 37067.

SCHWEITZER ENGINEERING LABORATORIES, INC.
2350 NE Hopkins Court • Pullman, WA 99163-5603 USA
Tel: 509.332.1890 • Fax: 509.332.7990
www.selinc.com • www.selindustrial.com
Email: marketing@selindustrial.com