



## Case Study 6: Voltage Monitoring and Auto-Throwover

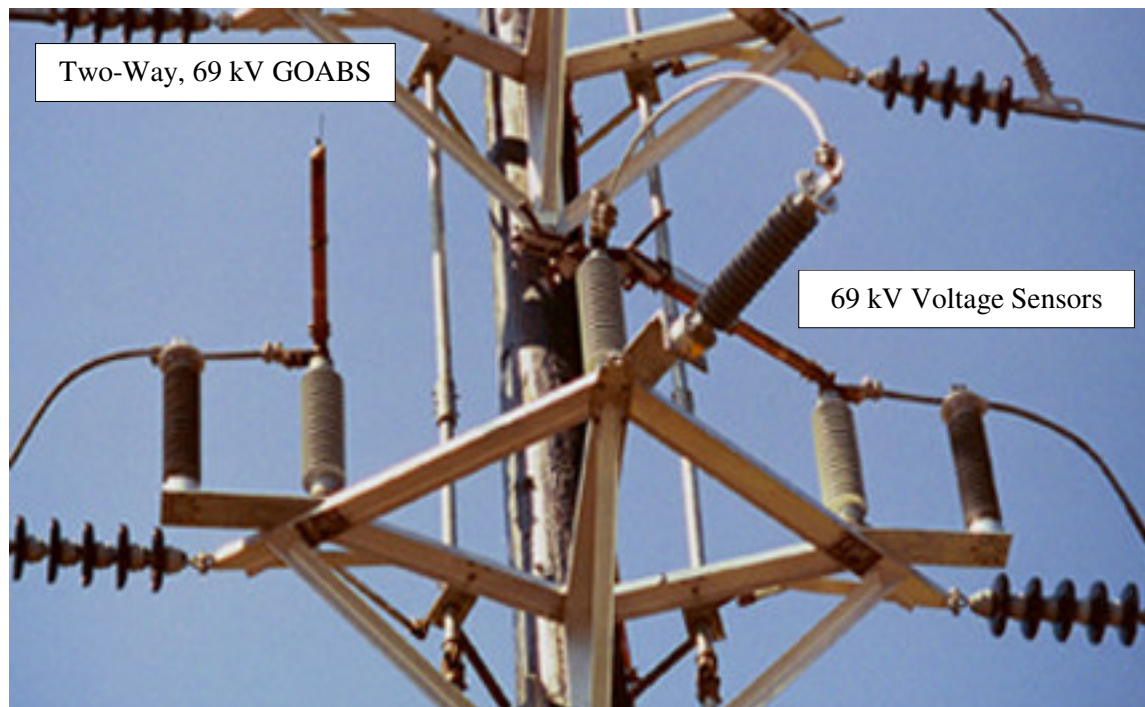


Figure 1

**Customer:** Investor Owned Utility

**Location:** Midwest U.S.

**Problem Definition:** This large, nationally prominent utility had an established means for automatically locating and isolating faults on 69 kV transmission circuits. This auto-throwover application utilized traditional PT's for potential indication, motor operators to autonomously operate the disconnect switches upon gain or loss of potential and an enclosure which housed relays, timers and other control components. The utility historically has used disconnect switches in a phase-over-phase configuration to sectionalize their lines for maintenance, load management and fault isolation purposes.

The existing method proved accurate and reliable, however the customer was increasingly interested in cost reduction opportunities and additional features and benefits that might be achieved by looking at newer technologies.

**Business Objective(s):** Reduce cost, improve reliability and investigate new technologies.

The primary functional requirements of this project were to include: (1) potential indication, (2) a means for operation and control of the disconnect switches, and (3) control logic for independent and automatic operation (auto-throwover).

Other requirements included: (4) provide a system that reduces field installation time, (5) a more efficient design that simplifies or reduces material cost, space and mounting requirements, and (6) a single vendor solution to reduce coordination issues and to insure proper integration of all elements of the system.



**Solution:** To meet the customer's objectives SEECO provided an integrated solution, which included these major system components:

- (1) SEECO 69 kV two-way, phase-over-phase disconnect switch
- (3) SEECO 69 kV voltage-only sensors
- (1) SEECO 24 VDC motor operator with power supply (batteries, charger, battery management system)
- (1) SEECO 24 VDC motor operator without power supply
- (2) SEECO auto-sectionalizing boards; one per motor operator

**Implementation:** The transmission line selected for the pilot project was an older 69 kV line that provided service to an adjacent shopping mall. The line had a history of periodic faults that caused service interruption to the mall and surrounding businesses. An existing, older 69 kV switch with wood pole structure was removed at the project site to make room for the new 69 kV two-way switch and pole structure. Though the new auto-throver equipment package would have worked with the existing switch and structure, the customer elected to replace both so that the evaluation of the new material package would not be affected by their advanced age and condition.

Three SEECO voltage-only sensors were located on the lower frame of the two-way switch (figure 1) to provide presence of voltage on both legs of the through line and the tap line. The sensors are extremely light weight (32 lbs each) and compact, which allowed the units to be mounted directly to the aluminum frame structure. The voltage output signal is conveyed from the sensor units to the motor operator using a cable assembly, which is supplied to length and pre-terminated with mil-spec connectors at each end; field connection is plug and turn. Compared to traditional oil-filled PT's, field installation of the sensors was quick, simple and straightforward. The sensors also eliminated the need for special pedestal structures or pole mounting brackets typically required by PT's, which substantially reduced installation time and material cost.

Operation and control of the two-way switch is provided through two SEECO 24 VDC motor operators. One operator is supplied with an integral power supply, including batteries, charger and battery management system. The second operator is slaved to (shares) the power supply of the first operator.

Each motor operator is also provided with SEECO's auto-sectionalizing board, a proprietary device which provides the control logic for each operator. The auto-sectionalizing board is a plug-in device which utilizes the voltage signal of the sensor unit to open or close the associated switch upon gain or loss of potential, with or without time delay. For most auto-throver applications customer personnel supply three controlling parameters to accomplish the desired switching sequence of operation: voltage condition (gain or loss of potential), switch operation (open or close) and time delay. For this pilot project the control logic required more complex parameters and conditional (if-then) rules than is typical, including the coordination of multiple breakers, disconnect switches, voltage conditions and time delays. Due to the unusual complexity SEECO engineering personnel assisted with the configuration of the auto-sectionalizing boards for this customer.

Locating the control logic and the power supply within the enclosure of one operator was a significant improvement over the customer's previous practice. This allowed for the elimination of the customer's separate enclosures for relay (control logic) and power supply. Also reduced or eliminated was the inter-wiring between several enclosures, the support structure and right of way for the relay enclosure, and the security barrier required in some applications.

**Conclusion:** The pilot project has been operational for several months and successfully tested by multiple fault events. Project personnel estimate that the SEECO automation package will dramatically reduce material and installation costs on subsequent installs compared to their previous practice. The SEECO automation package has been approved for further deployment throughout their transmission system as their new design standard.