



Auto-Sectionalizing and Restoration Without SCADA

S&C Featured Solution: Scada-Mate® Switching System

Location: Midwestern U.S.

Customer Challenge

A large Midwestern utility was dedicated to finding the lowest-cost solutions for maintaining their distribution system. Traditionally, this meant upgrading existing equipment and extending existing circuits. More recently, however, distribution automation (DA) technology was considered.

One problem: Although this utility had applied SCADA in their major substations, it did not have the master station and communications in place to extend SCADA to their distribution feeders.

Utility engineers were challenged to reap immediate benefits from DA without implementing SCADA and, in the process, to increase customer satisfaction and loyalty through improved service reliability.

The utility worked with S&C Electric Company to develop a Distribution Automation system with peer-to-peer communication using Metricom radios. In this system, S&C Scada-Mate Switches equipped with S&C 6800 Series Automatic Switch Controls isolate a faulted line section and restore service to unaffected sections from the other end of the feeder loop. No human intervention is involved. Nor is communication with, or instruction from, a master station. Although a SCADA infrastructure isn't required, S&C IntelliTeam® Automatic Restoration System technology fully supports communication and control through SCADA.

In the auto-sectionalizing mode, the 6800 Automatic Switch Controls react to a fault by opening switches based on local data, then isolate the fault and restore service based on intelligence provided by neighboring switches on the same feeder loop.

The utility presently uses IntelliTeam systems in two different applications.

The most common is a three-member team in a split-bus auto-transfer arrangement for two 34.5/15-kV distribution load centers served from open-loop 34.5-kV overhead circuits—with one normally open switch between two normally closed switches. The transformers on the two distribution

A three-member IntelliTeam Automatic Restoration System.



load centers are normally fed from either side of the normally open switch. If either 34.5-kV circuit is faulted, the Scada-Mate Switches automatically isolate the affected section and transfer the associated transformer to the other circuit.

The second application is on long, 34.5-kV radial feeders. Up to four IntelliTeam system members are employed to sectionalize faults on each radial feeder and to restore service up to the last Scada-Mate Switch that “sees” the fault. Assuming fault occurrence is random, a 50% improvement in service reliability will result on these feeders.

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Here's how a typical IntelliTeam system works:

Consider the open-loop distribution circuit shown below. In this example, three Scada-Mate Switches are employed per feeder with the normally open tie switch counted as the fourth member of each feeder. The result is a seven-member team.

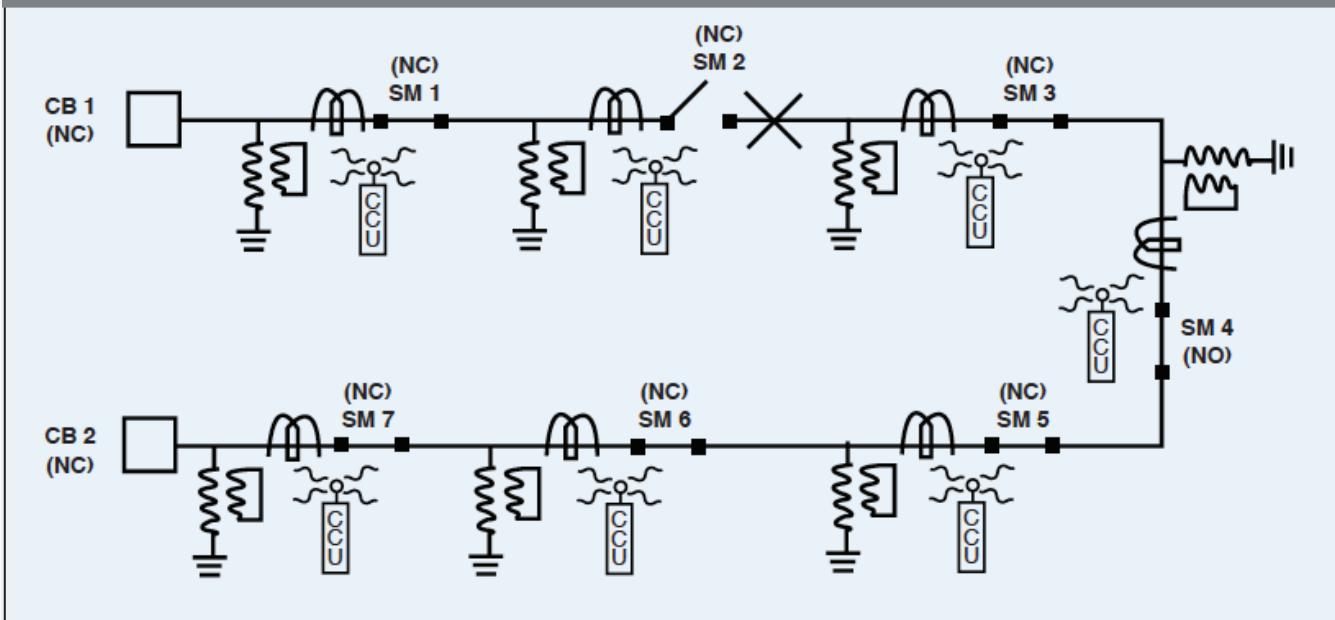
All team members continuously communicate with one another and report data, and each team member maintains a database on the other team members. Each team member's control is configured to sense loss-of-voltage and overcurrent events, count substation circuit breaker operations because of overcurrents, and track loss-of-voltage duration. Should a fault occur, each Scada-Mate Switch in the team will coordinate with the reclosing sequence of the substation circuit breaker (in this case, CB1) to isolate the fault before lockout occurs.

After the appropriate Scada-Mate Switch (in this case, SM2) has isolated the fault, all de-energized downstream switches will open. Each switch will report its change of state to the rest of the team. Based upon this shared data, each switch not in a position to feed the fault will then reclose to restore service, provided pre-fault load levels indicate the circuits will not be overloaded.

The total time to reconfigure depends on the number of switches involved, the location of the fault, and the specific communication characteristics... generally less than one minute.

When the team members have restored service to unfaulted segments, no further team response is allowed until the problem has been investigated and repaired and the team is returned to normal operation—either locally, by means of SCADA, or via the switch control's auto-return-to-normal option.

A seven-member IntelliTeam system automatically sectionalizes a fault and restores service to unaffected sections of the line.



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S&C Solution

The utility has now installed over 200 S&C Scada-Mate Switches with 6800 Series Automatic Switch Controls. The utility began to benefit from the auto-sectionalizing and restoration capabilities immediately after the first circuits were automated. In the first year of operation, 232 MVA of connected load were saved from sustained interruption by auto-sectionalizing using Scada-Mate systems and the IntelliTeam system approach.

Nine team operations were experienced that year. Eight involved source-side faults for which the team successfully transferred load. In each instance, the team isolated the fault and restored service in well under a minute. And the team correctly inhibited load transfer during one load-side fault.

To date, \$7 million has been spent on the installation of automated sectionalizing switches—less than what was spent annually rebuilding 34.5-kV lines but providing far greater improvement to system reliability.

The utility is committed to the installation of an additional 200 teams, not only in the interest of further improving reliability of service but for the sake of remaining competitive in this now-regulated industry.

