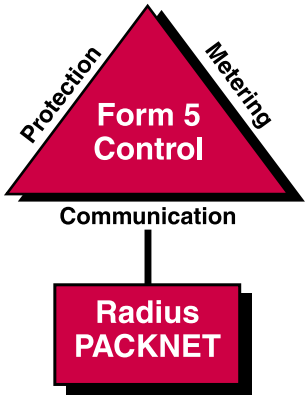

South Africa's ESKOM Chooses Cooper's System Solution for Automation Upgrade

South Africa's ESKOM chose Cooper to be their exclusive recloser and recloser control provider after Cooper, in conjunction with Radius, demonstrated custom DA solutions which added new levels of control and reliability to their existing system.

South Africa's ESKOM wanted to know how they could upgrade their distribution automation while still keeping their existing control and protection equipment. So they challenged equipment suppliers around the world to develop a solution. Engineers at Cooper Power Systems and Radius developed a method of achieving these goals, and a demonstration project to prove the method.

The demonstration project consisted of a Master Station simulator, a substation Remote Terminal Unit (RTU) acting as a data concentrator and four Intelligent Electronic Devices (IED's). Two of the IED's were new product developments (Form 5 controls) while the other two were based upon existing products (Form 4C controls) in service for many years. The IED's in the demonstration project were all micro-processor-based recloser controls. Also, four recloser/control test sets were used to inject load and fault currents on the simulated distribution system at various locations. The performance of IED's for metering and protection was observed, and combined with performance of the SCADA System, providing a real representation of an actual distribution system.

The demonstration project was completely assembled and functional for the utility to study and operate on a real time basis without affecting any existing systems or customers. Cooper's expertise in automation integration and Radius' in systems communications created an effective yet economical solution to ESKOM's challenge.

REQUIREMENTS AND CHALLENGES

Distance and Geographic Topology

The existing communication infrastructure used radio as the transmission medium. Many of the IED nodes were geographically distant (feeder lengths exceeding fifty kilometers) or obscured by mountainous terrain from the RTU, preventing the necessary line of sight requirement between the devices. A method to store and forward messages along intermediate nodes was developed to accomplish complete end to end communication.

Legacy Equipment

Many of the components of the overall system were already in place – the Master station, the RTU's, the use of radio for data transmission and existing IED's. Use of the existing system is usually the least expensive route, but alternatives could be recommended to arrive at the lowest cost solution.

Volume of Data

Typical message transactions between a Master and RTU or IED include reading inputs (analog, status and accumulator data), or telecontrol of output points. Normally there is a small number of inputs or outputs associated with the IED, but the full featured device has hundreds of input and output points. A simple polled mode request for all of the input data could result in a large response from all the IED's with large volumes of data in each message, wasting bandwidth on data that may not have changed.

EQUIPMENT DESIGN

During the initial analysis of the existing system IED's, a third IED variation was demonstrated that combined legacy controls with a new protocol to the utility, Distributed Network Protocol version 3.0 (DNP 3.0). The multiple IED configurations

Ground and Phase Current Metering
Instantaneous current
Instantaneous current harmonics-2nd through 15th, as a percent of the fundamental
Instantaneous total harmonic distortion (THD), as a percent of the fundamental
Demand current
Phase Voltage Metering
Instantaneous voltage
Instantaneous current harmonics-2nd through 15th, as a percent of the fundamental
Instantaneous THD, as a percent of the fundamental
Demand voltage
Demand phase voltage THD
Power Data (Single-Phase & Three-Phase)
Instantaneous Power Factor
Demand Power Factor
Instantaneous KVA
Demand KVA
Instantaneous KW
Demand KW
Instantaneous KVAR
Demand KVAR
Energy
Single-Phase KWh
Three-Phase KWh

Table 1. Representative F5 Control Metering Data

provide challenges to the integration, but are required based upon the economics of the integration of new IED designs with legacy systems.

The existing recloser controls are Cooper type F4C controls. The recloser control includes Cooper 2179 as the resident protocol and was updated to include a larger power supply to satisfy the protocol converter module and the data radio directly connected via an RS-232 connection, the Radius PACKNET™.

The Form 5 provides DNP3.0 protocol as the resident protocol, available on multiple communication ports.

The F5 recloser control design includes a common power supply for operation of the control and ancillary communication equipment. To meet the geographical conditions for SCADA applications, a Radius data radio with repeater functionality was used in the application. The store and forward repeating functionality of the radio receives the message from the substation RTU and transmits the message to the downline device.

The F5 recloser control includes significantly more available data when compared to the legacy F4C recloser control. Extensive data are available in the control, status, analog, and counters that require systematic integration with the SCADA system. As an example, Table 1 illustrates representative metering data available with the F5 recloser control.

DUAL NETWORK

The solution was a combination of new and existing equipment that actually used two communication systems — a DNP network and a Cooper 2179 network.

The demonstration project performed so successfully that ESKOM awarded Cooper Power Systems a multi-year, multi-million dollar contract for distribution automation and reliability products, with delivery starting in 1999.

The system changes will increase system reliability and reduce outage times based on unlimited coordination flexibility of time-current curves. The new controls can also supply precision metering accuracy to dynamically regulate voltage and load flow analysis for system efficiency.

Distribution Automation Solutions from Cooper Power Systems

- Easy integration into existing systems
- Interrogation and programming via personal computer
- User-friendly Microsoft® Windows® based application solutions
- Communications capability for SCADA systems
- Variety of protocols utilizing radio communications
- Solutions with a wide range of products: relays, reclosers, regulators, three-phase switches, capacitors, fault indicators, etc.

Contact your Cooper Power Systems Representative, or call 1-877-CPS-INFO for more information.

U. S. Power, Eden Prairie, MN, Sinesonics (pty) ltd., Evandale, South Africa, and RADIUS Radio, Karlskrona, Sweden were also closely involved as other system integrators.

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