Power & Water Utilities: Automating Power Information Using Metering Solutions

Groton Utilities is a municipally owned provider of electric power and water services. Located on Connecticut's scenic coastline at the mouth of the Thames River, the utility serves more than 35,000 customers in Southeastern Connecticut. Customers include many private homes, small and medium size businesses and a number of large customers, such as Pfizer Pharmaceuticals, General Dynamics Electric Boat (builders of submarines) and the U.S. Naval Submarine Base.

The utility runs at 85MW Annual Peak Demand. When costs are lowered, the utility enjoys giving a dividend (in the form of a lower rate) back to its customers and a contribution to the city. For this reason, management is continually looking for ways to run the operation more efficiently and effectively without increasing costs to its customers.

The Problem:
No Automatic Data Collection on Substation Parameters

Until recently, most of the utility's metering was done by analog meters that lacked the ability to communicate. Personnel were required to monitor the meters. Data gathering was inadequate and inaccurate at times and required many man-hours to collect and calculate facts. Personnel had to physically visit the substations to download historic data. Analyzing the data required even more man-hours.

To upgrade that system to one that would facilitate communication among the meters, transducers would have had to be installed and the limited features of the analog meters would still be a factor that needed consideration.

project thumbnail

Application

Power & Water Utility

System

CPU 1000 Monitors

Nexus Communicator power monitoring software

Plant Ethernet LAN

Benefits

Improved plant electrical monitoring

Instantaneous alarm reporting (local and remote)

True sequence of events recording for outage reconstruction

Electrical equipment loading history

Scalable architecture for simple expansion

Utility operations engineers decided in 1999 that it was time to plan a better system. Engineer Warren Ott headed the team to investigate the various types of centralized monitoring systems. A study was done to determine the requirements of a new system. The results of that study are shown in Figure 1.

Various systems were considered and ultimately the team selected the CPU1000 Meter from Electro Industries/GaugeTech. The team chose the CPU1000 over other monitoring systems due to the design advantages for municipal power utility applications. In this application, they needed a product that would meet all the system requirements. These requirements included:

● A smart transducer metering device that provided multiple communication paths. The multiple paths are used to bring data back to a SCADA system via DNP 3.0 protocol and also bring back stored data to a local PC database.

● On-Board Logging and Waveform Recording - This allows the utility to remotely retrieve historical and waveform information on both load usage and system reliability. The CPU1000 units provided a cost effective solution to substation upgrades without rewiring and reconfiguring the protective schemes.

● Remote Displays -The remote display capability of the CPU1000 allowed the utility to provide the metering information with the same presentation format as the replaced analog meters. This allowed for easy field acceptance.

● Analog Retransmit for Existing RTUs - For the applications in which there was an existing RTU, the CPU1000 provides an internal 10 channel analog output module enabling the utility to bring backbit-directional 0-1mA outputs when required.

The team had performed a series of tests on the meter. The CPU1000 met or exceeded all of the required specifications and, in the process of testing the meter, the team found the meter simple to operate and extremely accurate. The team even discovered additional features, such as transient waveform recording. When triggered, the unit stores the graphic waveform of all six channels of volts and amps.

CPU1000

Figure 1

system requirements

Accurate measuring, displaying, recording and analysis of all electrical parameters with one meter.
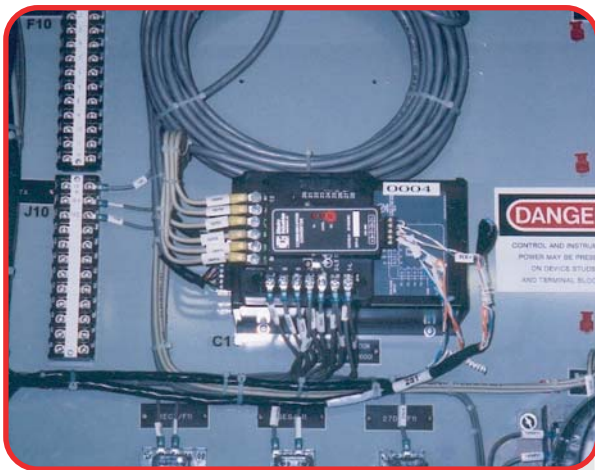
A Programmable System that can communicate with the SCADA System using DNP 3.0 Protocol.

Dual Port Capability providing real time communication to a SCADA system using DNP 3.0 Protocol.

Durable equipment that would stand the test of the substation environment.

System Installation

Dick Mikna, Operations Foreman, headed the installation team. The CPU1000 Monitors with RS232/RS485 converters replaced existing meters. Ten channels of on-board analog transducer outputs replaced any existing transducers and P34 Multifunction Displays replaced existing single function displays. The team was pleased at how easily the system was installed. Programming of the CPU1000 meters was accomplished quickly with Communicator software. And, the displays were easily programmed through the face of each display.

Dual Communication Ports

The CPU1000 utilizes dual communication ports coupled with on-board mass memory to store data throughout the system.

Com Port 1 communicates via DNP 3.0 protocol with the RTU, which is polled by the SCADA System. The utility simply polls the first port of every CPU1000 (approximately 60 at Groton Utilities) to determine if any data is out of limits. The first port polls for only exceptions and problems or for quick real time basic readings. Small amounts of polled data are communicated over RS485 to provide fast response time.

Com Port 2 collects historical, waveform and event data and analysis. Groton Utilities plans to incorporate Port 2 into its system in the near future.

The team then proceeded to embark on the DNP 3.0 integration. With the help of Electro Industries Technical Support personnel, the team made the proper adjustments enabling reliable communication.

The team was more than satisfied with displays of true RMS readings for every electrical power parameter including: Volts, Amps, kW, kVAR, kVA, kWh, kVARh and PF. FREQ, %THD, K-Factor and Max/Min Demand were provided for every instantaneous value and complete harmonic power quality analysis was available.

The Solution

Operations Managers at Groton Utilities have been very pleased with the results of the system implementation.

Presently, five substations within 5 square miles are communicating on a SCADA System utilizing 60 CPU1000 meters with RS485 converters, an RTU and a variety of displays. One more substation will be added to the system this fall. Below is a diagram of typical Utility Substation Applications (Figure 2).

Dick Mikna says, "We are very comfortable with our new system. The onboard memory is a lot more convenient and accurate for real time data collection and the CPU1000 meters are extremely reliable and trouble-free. We plan to expand the system as we can."

Figure 2   **Utility Substation Applications**

DIGITAL COM1
DNP 3.0 or
Modbus RTU/ASCII

DIGITAL DOWNLOAD BUS

RTU, SCADA, PLC

RS-485-232 CONVERTER

CPU 1000

CPU 1000

UP TO 10,000 DEVICES ON ONE BUS

CPU 1000

FORENSIC ANALYSIS ENGINEER (Download Recipient)

RS-485-232 CONVERTER

CPU 1000

COMMUNICATOR SOFTWARE