Pacific Gas & Electric Improves Operation and Engineering with Advanced Load Monitoring

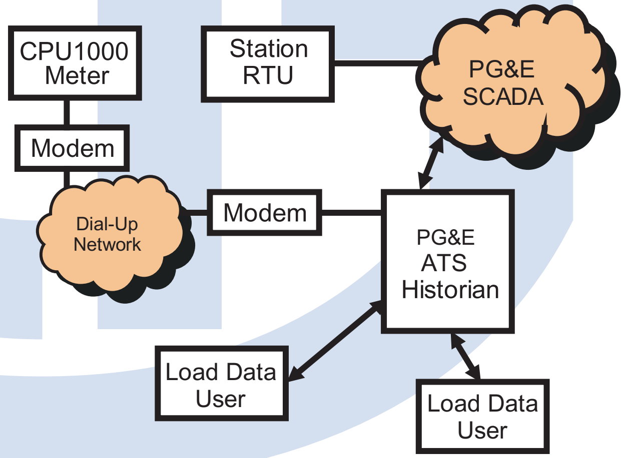
Pacific Gas and Electric Company

Pacific Gas & Electric, like many utilities, has relied on paper load recorders for transformer monitoring. Also like many utilities, they had begun to experience failures with paper chart recorders and needed a suitable replacement product. Data accuracy was also becoming a serious problem as system expansion decisions relied more on accurate load data. In 1998 PG&E engineers began looking for a new method to monitor transformer loads and replace the paper chart recorders. Bill Manson, Senior Electrical Engineer with responsibility for SCADA system engineering was tasked with finding an acceptable replacement that would meet the needs of the many different users of load data. After consulting with the various users of load data it was determined that the solution must provide:

- data to PG&E SCADA system using DNP protocol
- easy-to-use display in station
- historical data for studies
- a design that would withstand a substation electrical environment
- a package that will easily fit in a 19-inch rack

Existing meters provided the SCADA connection and the user display in the station. But the requirement for historical data was a problem. PG&E had used their SCADA system to log historical data but had discovered that the system was really not suitable for most users. The SCADA system data requirements did not match the needs of most historical data users because the data collected for SCADA was fundamentally different from the needs of the historical data users. As a result a formal search was begun to identify a new meter that would meet all user requirements. The block diagram (Figure 1) gives an overview of the system implemented by PG&E engineers. During the investigation, engineers became acquainted with the CPU1000 power meter from Electro Industries / GaugeTech.

Figure1: Data Load System



project thumbnail

Application

Electric Utility

System

CPU-1000 Advanced Power Meter
EIG Automated Download Software
PG&E ATS Load Historian

Benefits

Accurate metering of all electrical parameters with a single meter

Easy connection to existing DNP SCADA RTUs

Load and event recording in the station

Automated downloading of station load history without disruption to SCADA data

Simple interface makes station load history available to PG&E employees

The CPU1000 seemed to provide everything they needed. The meter's features included:

- Accurate measurement
- Easy-to-use display
- Historical data logging
- Simple SCADA integration
- Data must be retained for loss of power

In addition to meeting the PG&E meter requirements the CPU1000 included transient waveform recording and multiple communication ports to support full-time SCADA connection and user-controlled downloads of historical data.

PG&E conducted extensive tests of the meter and numerous factory inspections to ensure that the meter was designed and manufactured to withstand the rigors of substation application. In each case, the meter met or exceeded PG&E's strict design and quality requirements.

The next step was to create a package that would fit the PG&E installation requirements. An EIG application engineer worked closely with PG&E engineers to design a 19-inch, rack-mount package that would fit the meter and an integrated test switch into the four-rack unit space that PG&E designs allocated for metering.

During design discussions with PG&E personnel, operations personnel requested the meter display three-phase amps continuously with user-scrolling capability to view all voltage, current, and power parameters.

The CPU1000's standard support for multiple displays made it very simple to meet this new requirement. An additional display (from one of the many available displays) was added to the rack-mount design. In the final design, operators would have direct access to three-phase amp readings and could scroll through the second display to view voltage and power readings.

The initial requirements included providing data to the SCADA system and a PG&E database. The CPU1000 has multiple communication ports to enable communication to a SCADA system and to support manual or automated downloading of stored data. Making the SCADA connection was simple.

But PG&E also wanted to create a separate historical database for gathered information. PG&E assigned Electrical Engineer Scott Bricker to implement the EI meter and integrate the associated equipment into the newly developed architecture.

Getting data to a database required a communication medium from the meter to a central location and a suitable database to store the retrieved data. Standard telephone lines were selected as the initial communication medium. In many locations the phone line will be the final communication method, but in other locations they will eventually move to a LAN/WAN connection.

Transferring substation data via a phone line has always been a challenge for utility engineers and this proved to be true in this plan as well. Communication problems almost always arise when trying to synchronize the fixed data rate of an intelligent electronic devise (IED) with the variable data rate used by modems and computers. The typical results are missed data and lots of call retries.

This problem was alleviated in most locations by the addition of another EIG product. The Modem Manager (MM1) provides a conversion from RS-485 to RS-232. But unlike simple converters, the MM1 acts like a little computer to manage the data flow. It buffers data flow between the fixed-rate IED and the variable rate modem. This enables faster data flow and fewer data errors, virtually eliminating call retries.

While telephone line problems were being resolved, PG&E programmers began work on the company-wide database. PG&E utilized the EIG meter software to perform the scheduled downloads automatically. Jim Greenhaw led the PG&E programming effort to get downloaded data into the company-wide database. Working with an EIG applications engineer, Greenhaw developed a download routine that converts the downloaded data into a file format that will fit into the PG&E historical database, ATS Historian.

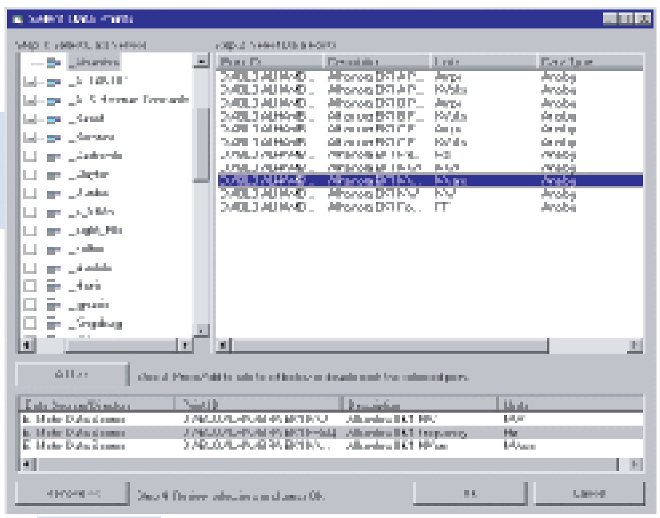


Figure 2: ATS Data Source Screen

ATS Historian provides users with a simple, web-based solution to obtain load data on any station.

Figure 2 illustrates the data sources in which the EI meter data is stored and referenced by the ATS Historian.

Figure 3 depicts the actual load graphs created by the ATS Historian web tool. These trending tools can compare SCADA data with actual downloaded data, which help to determine indifferent data.

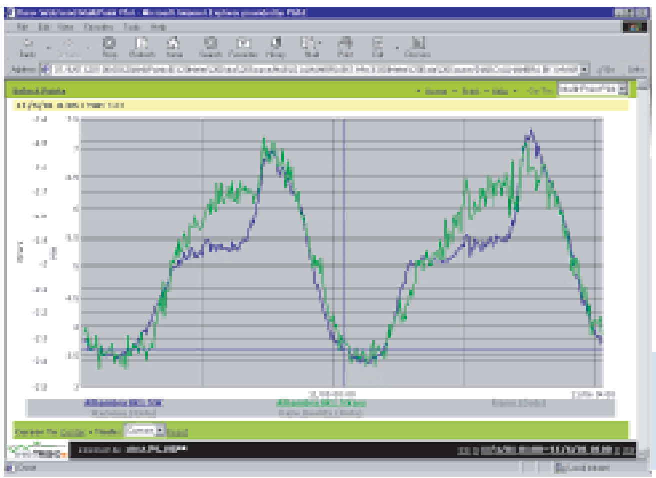


Figure 3: ATS Load Graphs

PG&E has completed installation of the CPU 1000 meters at many stations. They plan to continue to expand the use of the CPU1000 meter and their ATS Historian software. Using the system, PG&E engineers can access load data for any substation, at their desk, anytime.

Bill Manson has been pleased with the results of the system implementation. He said, "After exposure to the meters and the system and a little bit of training, users have given an enthusiastic thumbs up. The most common feedback we get from the field is proposed locations for further deployment of EI meters."

Manager of System Automation Keith Williams has noted, "The deployment of the EI meters and the automated data collection system has successfully met our expectations and has fulfilled many of the business needs of several internal groups."

The CPUI1000 power meter enabled PG&E to collect and report all the station load data, and present it via ATS Historian. As a bonus they were able to collect other valuable operating information, such as recorded waveforms during line faults.

The integrated data system, built on the features of the CPU1000, has significantly increased engineering, operations, and planning efficiency by putting the right data in the hands of the right people at the time they need it.