



Submitter Information:

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Award Category: Small Enterprise:

Nominated Company/Organization Overview:

Organization: Automation Engineering Corporation

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Annual revenues

of full-time employees

Automation Engineering Corporation

AEC provides automation systems and products to manufacturing companies. This includes custom engineered products and services for assembly, inspection, material handling, packaging, data collection, reporting, and diagnostics.

AEC services include:

- ✓ Machine design and fabrication
- ✓ Electrical design
- ✓ Control system design and fabrication
- ✓ Installation, Startup, and Training
- ✓ Service and Support

AEC was founded in 1981 in Gaffney, South Carolina.

Beginning with four employees, **AEC** has emphasized steady growth, progressive leadership, aggressive use of the latest technology, and innovative ideas to bring about expansion to thirty-five employees in 2002.

AEC relocated to Greer, South Carolina in 1988. **AEC** moved to Pelham Road area in Greenville in 2002.

AEC is an employee owned Corporation and serves the southeastern United States.

AEC Quality Management System is registered to ISO9001-2000.

In First Quarter 2002 AEC designed and produced the **AECWebMeter**, an **Internet capable** device, to measure and report electrical power use and electrical demand.

Important features of **AECWebMeter**:

- Intended to provide factories and commercial buildings with an economical and easy to use means of monitoring electrical energy.
- Presents information in real-time so that decisions can be made promptly and accurately to manage electrical energy cost.
- Installs easily. Uses standard serial port for configuration and setup. Connects to existing meters using simple wiring connection. Connects to Ethernet using standard connectors.
- Synchronizes with the electrical utility provider's equipment so that measurement of electrical usage can be reconciled with those made by the electrical utility provider.
- Forecasts electrical usage. If electrical use approaches, or will approach a high limit, that would invoke a penalty or surcharge from the utility provider an output signal is produced and a message is presented on the Internet browser.
- Stores and presents a history of peak demand power use in tabular or graphical form.
- Makes information available to any **web capable** computer using an Internet browser.
- Stores data in industry standard **SQL database**. Additional software can be used for long-term datalogging, data analysis, cost accounting, or other function.



AECWebMeter represents a distinct advantage to existing methods of measuring electrical use. Electrical metering products on the market today typically:

- are more expensive and more difficult to install and use.
- require addition of new sensors and require that the factory electrical system be deenergized for installation. This usually requires that the plant or facility be shutdown.
- provide data output via a computer serial port. This requires installation of special wiring and custom software.
- make data available in a non-standard, oftentimes proprietary form that is difficult to use.

AECWebMeter uses a state of the art computer to set a new standard in effective electrical meter interface.

- Connects directly to existing electrical metering equipment
- Reports electrical usage and electrical demand via a **Web Server**
- Monitors and reports usage of electricity, steam, water, compressed air, and any other flow measured by metering devices that produce pulse output
- Uses embedded computer system technology
- Simple to install and operate
- Makes information available via Internet browser
- Makes data available via XML for import into computerized analysis packages

AECWebMeter can be modified and extended to perform other functions in a web-enabled, low cost form. Future plans include:

- Temperature and humidity measurement and control. Devices in large warehouses or factories can be centrally monitored via Internet browser.
- Pressure reporting and water level control. User-friendly, low cost weather reporting stations for business, home, or scientific functions.

Marketplace for electrical energy is changing.

Electrical utilities are transitioning into deregulated markets. Customers need to understand how to manage energy use; they need an energy management system for this new environment. High cost of energy, along with good operating practice, require that factories monitor energy consumption and make plans to maximize efficiency of energy.

An energy management system, consisting of meters, communications, and software, can help to meet these challenges. A key element of the system is the billing meter installed at the User's main service entrance. The utility provider uses this meter to bill for basic electrical usage.

Metering equipment in most factories and commercial buildings produce electrical pulses to indicate how much electricity is being used. Existing meters can be replaced with devices capable of providing much more information and making this information available for computer storage and analysis.



- The new meters are expensive and complicated to install.
- Much of the monitoring capability built into existing power monitoring equipment is not generally used (harmonic analysis and fault monitoring for example).
- Data is not readily available. Most software to analyze and report the data is proprietary and available only from the product manufacturer.

- Alternatively, **AECWebMeter** reports the amount of electricity being used and reports the demand (total energy used in a time interval) that the utility provider uses to calculate billing statements.

AECWebMeter can be a very useful part of a low cost energy management system.

As a key part of an adaptable energy management system, **AECWebMeter** offers many benefits, including the ability to monitor the utility providers billing scheme, or even select aggressive new billing schemes without costly replacement of legacy metering equipment. This opens the door to performance contracts based on power quality, demand response and load curtailment programs, real-time pricing, and performance-based tariffs — opportunities which can benefit the utility and the customer alike.

AECWebMeter helps power suppliers and consumers satisfy billing requirements, minimize hardware investment, reduce operating costs, and extend life of existing equipment.

An aggressive approach to metering makes a huge difference by tracking usage and controlling consumption. In many cases, **AECWebMeter** can satisfy needs for revenue metering. In industrial or commercial facilities with little or no metering in place, a single device can fulfill the needs of multiple departments and can deliver considerable savings from an initial hardware cost standpoint and increases in efficiency.

AECWebMeter makes vital power system information available to the factory

- Displays information through a standard Web Browser, such as Microsoft® Internet Explorer, and requires no additional software or special configuration.
- Authorized Users can check on their energy management system from anywhere on their corporate network.
- Users can copy and paste data logs from the meter to other enterprise applications, such as Microsoft® Excel, for custom reporting and analysis.
- Designed to help energy suppliers, service providers, and consumers take charge of the quality, reliability and cost of their electricity.
- Offers a unique combination of energy information, control capabilities, and low cost to simultaneously address billing, load aggregation, cost allocation, power quality management and distributed generation.
- Leverages popular communications infrastructures - Internet, Ethernet, telephone, and wireless – to provide a high degree of accessibility, responsiveness and affordability.

AECWebMeter is flexible and adaptable to other uses

- Monitors and reports water, steam, air, and any other energy or utility supply that is metered by a pulse type meter.
- Future capabilities will include measurement and logging of process parameters such as humidity, temperature, pressure, and level. This opens the door to HVAC control and optimization, and meteorological reporting.
- Can be enhanced to control process parameters as well as monitor and log actual performance.
- Remote facilities can be easily monitored by addition of a telephone modem, wireless modem, or wireless Ethernet.
- Software is stored in non-volatile memory and can be field upgraded as additional features are developed.

Embedded Web Server

Traditionally, Operator Interface on the factory floor and commercial operations has been implemented in custom and, oftentimes, proprietary software development environments which keeps the cost of collecting information from the process high.

Embedded **Web Servers** are beginning to appear on the factory floor. Embedded Web Servers permit information to be distributed via easy to use Web Browsers such as Microsoft® Internet Explorer. Web Browsers are easy to setup and use. Most computer Users are familiar with these products and require no training.

AECWebMeter uses an off the shelf microprocessor core module to provide Web Server functionality. Custom designed interface circuitry performs monitoring, data collection and alarming functions.

Electrical use metering

Most older metering devices provide an external signal. This signal is a simple switch (**KYZ pulse**) that closes and opens at a rate in proportion to the rate of energy usage. Each pulse indicates that a certain number of **kilowatt hours (KWH)** have been consumed. The utility provider counts these pulses in order to calculate the amount to bill to the customer.

AECWebMeter counts the pulses at this output. The number of pulses is scaled to convert to KWH. KWH is then logged to a data file and presented to the User via Web Browser.

Electrical Demand

In addition to billing for electrical usage, utility providers also charge a separate amount based on demand. **Demand** is a measure of the total electricity used in a given time period (typically 15 or 30 minutes).

The utility provider must have sufficient installed capacity to provide for the peak amount of electricity that a customer will ever use, even if this peak demand is used only once per year. The electrical utility provider wants to encourage customers to manage peak electrical usage. They also need to recoup the cost of installing electrical supply capacity that may never be used. So, the utility provider charges a premium anytime a new peak demand is exceeded. This encourages the customer to monitor electrical usage and avoid unnecessary peak loads on the electrical distribution system.

Peak demand charges are sometimes 50% of the total electrical bill. Peak demand charges may be invoked for several months to a year after a single peak demand event.

AECWebMeter forecasts peak demand at the end of the demand window based on current demand. Using this forecast, the electrical User can decide to continue operations or to stop electrically operated equipment to reduce the demand. Decisions to stop equipment for a few minutes at a critical moment can result in savings of thousands of dollars per month for several months. **AECWebMeter** lets Users enter a high demand limit. When this User specified demand limit is exceeded an alarm relay is closed. This relay can be used to either control equipment or inform Operators of excessive demand. The demand limit can be changed as needed using a standard Web Browser.

Since demand is measured over a specific time interval, it is necessary to synchronize the demand calculation with the provider's meter. The power meter provides a KYZ pulse that signals the beginning of each demand window. **AECWebMeter** accepts this input from the power meter and synchronizes with the utility provider's calculations.

**Bill
reconciliation
and Cost
Accounting**

Electrical usage varies dramatically during the course of a day. Electrical providers charge a premium for electricity used during high demand time periods. These periods vary during time of day, day of week, and time of year. Any meaningful calculation of electrical usage and peak demand must take into account the particular **billing scheme** in effect from the utility provider.

Using accurate billing information, an electrical customer can calculate current charges for electricity. This can be reconciled with the periodic statement from the utility provider.

This combination of embedded Web Server and measurement device provide a low cost and easy to use tool for factory and commercial facility managers to collect information and make decisions to reduce the cost of electricity or other metered utilities.

Basic Construction and Operation

AECWebMeter includes an embedded computer to operate data collection and analysis, web service, setup and configuration, and alarming. Input devices include sensors isolated to protect against high voltage.

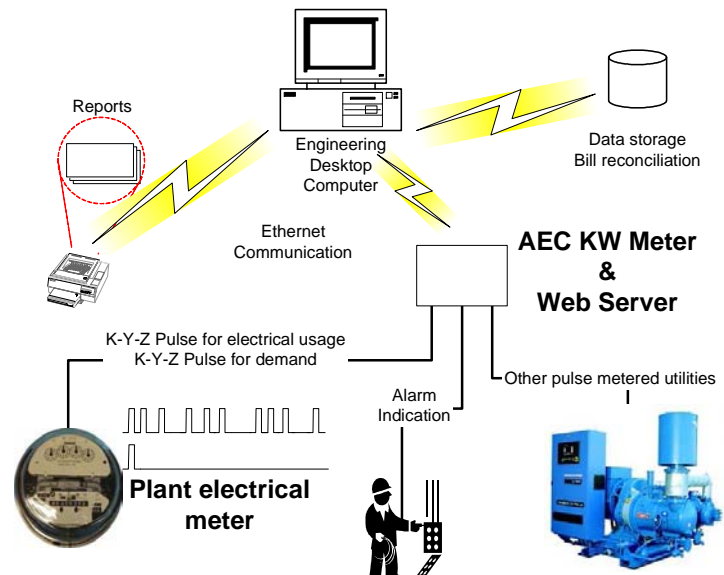
AECWebMeter can monitor up to four pulse input meters. Each pulse input has a separate demand input, alarm relay, and alarm trip level.

In the event that no synchronization pulse is available, **AECWebMeter** will generate it's own data collection and forecasting window. The period of the generated window is configured as a part during meter setup.

Setup is done using any computer with a serial port and standard serial cable. User friendly dialog and help messages assist the User to configure Ethernet address, operating parameter, alarm setpoints, and other variables. Once setup is complete, all parameters are saved to battery-protected memory. All other operations and interace are performed via Ethernet.

AECWebMeter has sufficient battery backed memory to hold over 100 days worth of collected data. Battery backup of the memory prevents loss of configuration or data in the event that the main power supply to the meter is lost.

AECWebMeter is designed for a harsh industrial environment. It may be exposed to extremes in temperature, subjected to rough handling, and may be inadvertently connected to extreme and damaging voltages.



**Strategic,
financial,
operational
impact**

For more than 21 years **AEC** has provide engineering services to the manufacturing community. Over the years, **AEC** engineering services have expanded to include panel fabrication, machine design, electrical installation, mechanical installation, field support and most recently, machine fabrication.

AEC offerings are almost exclusively project related. Work is performed and revenue is generated based on specific projects. Factory automation project work fluctuates based on the calendar, the economy, individual project results, and several other factors. Capital spending is very susceptible to changes in the economy as this spending is the first to be cut in a downturn and the last to be increased in an upturn. This results in a dramatic variability in workload and revenue.

For these reasons **AEC** owners and management recognized the need and opportunity to provide a product that would provide the following benefits:

- Diversify our internal manufacturing capability.
- Diversify revenue generation.
- Develop a product that offers a synergy with our service offerings.

**Customer
impact**

AEC saw a gap in the market for power measuring and monitoring in industrial and commercial facilities.

- High-end market offerings provide extensive capability at a high cost. Most industrial or commercial users want the ability to measure electrical use for cost accounting or productivity monitoring. Advanced features are quite often not required and are not used.
- Low-end offerings require addition of separate measuring devices, or provide output only via serial port.

The opportunity is to offer a low cost, easy-to-use device that would provide an immediate commercial benefit to the user.

**AECWebMeter
was designed on
a Fast Track.**

- Concept was developed and validated and a prototype was produced in June.
- Hardware and software design were completed in July.
- As of mid-July, the manufacturing plan was under development.
- Beta evaluation devices will be ready to ship by end of August.
- The device is expected to enter the market in production quantities by October 2002.