

**SECTION 26 09 13**  
**ELECTRICAL POWER MONITORING AND CONTROL**

**PART 1 - GENERAL**

1.1 SCOPE

- A. This section includes the supply and installation of a complete Enterprise Wide Electrical Power Management and Control System (EPMS) as detailed in the drawings and as described in this specification. This system shall include advanced Power Quality Analysis features and screens.
- B. The contractor shall furnish and install the equipment specified herein. The equipment shall be as shown in the drawings and outlined below.
- C. System Description Overview
  - 1. The Electrical Power Management System (EPMS) shall be a Web Based Monitoring system that monitors all specified locations in the distribution system without any further configuration or setup required after complete installation by the contractor. The EPMS is defined to include, but not to be limited to, remote devices for monitoring, protection devices, device communication interface hardware, intercommunication wiring, monitoring stations, software, software configuration, 3<sup>rd</sup> party equipment, startup and training services.
  - 2. The EPMS software shall be designed specifically for Power Monitoring.
- D. Communications Overview
  - 1. The EPMS system shall be able to utilize the following standard communications configurations, as a minimum, at the same time:
    - a. Direct RS485 serial communications for cable runs of less than 4000ft. Longer RS-485 runs can be achieved with the use of a RS485 repeater. RS485 supports communication with up to 32 devices per communications string. Each string shall consist of good quality 24 AWG (or greater) twisted pair shielded cable for RS485 communications.
    - b. Standard Ethernet TCP/IP, 802.3 communications networks. Ethernet communications of either CAT-5e, CAT-6 or Fiber Optic shall be supported at a 10/100BaseT communications speed.
    - c. Short haul, Radio Modem and standard Telephone modem communications shall be supported.
    - d. The EPMS system shall be able to utilize the facilities Intranet network and Internet WAN communications networks.
  - 2. Individual equipment line-ups shall be fully wired and tested by the manufacturer such that the contractor need only provide one connection for communication.

1.2 RELATED DOCUMENTS

- A. ***[Refer to the following related sections for details on quantities of monitoring points.***
  - 1. ***[LIST ALL RELATED SECTIONS FOR EQUIPMENT WITH MONITORING DEVICES INSTALLED] ]***

1.3 SUBMITTALS

- A. The following information shall be submitted to the Engineer and Owner prior to design or installation.
  - 1. System description including an overview of the system provided with detailed description of suggested communication architecture and the screens to be provided.
  - 2. Bill of Material including a complete listing of all hardware, software, configuration, training and start-up services being supplied under this contract.

3. Hardware and software description shall be provided in detail for all communications hardware, software, including sensor devices gathering data to be transmitted over the network and the Power Management Engineering Station.
  4. Details of the Power Quality analysis or waveform capture features supported in the software.
- B. Final closeout submittal data shall include a system operation manual which shall include all the information required by item 1.4.A. In addition, the systems operation manual shall include the following information:
1. A system description overview
  2. Descriptive bulletins and/or sales aids covering each of the components in the system.
  3. Manuals for all products used in the system.
  4. The following information shall be provided as a back-up to the information stored on the computer:
    - a. All software programs with original licenses.
    - b. Software data files.
    - c. All application software screens.
    - d. A complete list of all devices in the system with addresses and other communications related data.

#### 1.4 RELATED STANDARDS

- A. Codes and standards: Provide EPMS components conforming to the following:
1. ANSI/IEEE C37.90
  2. UL Listed or Recognized
  3. CSA Approved
  4. FCC Emission Standards

#### 1.5 QUALITY ASSURANCE

- A. The manufacturer of the equipment shall have been regularly engaged in the manufacture of the specified remote devices for a period of at least ten (10) years and demonstrate that these products have been utilized in satisfactory use in functioning systems for similar applications. The manufacturer shall have at least ten (10) years demonstrated capability in EPMS design, installation and start-up.
- B. The manufacturer shall submit a list of existing operating installations, including major facilities, each having a minimum of 50 remote devices communicating with a Power Management Engineering Station or network.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver material in manufacturer's original unopened protective packaging unless it is built into new distribution equipment.
- B. Securely store materials in original packaging in a manner to prevent soiling, physical damage, incursion of moisture or corrosion prior to installation.
- C. Handle in a manner to prevent damage to finished surfaces.
- D. Maintain protective coverings until installation is complete and remove such covers as part of final clean-up.
- E. Touch up any damage to finishes to match adjacent surfaces to the satisfaction of the Design Team.
- F. Where applicable, the EPMS components included with power equipment lineups shall be factory installed, wired and tested prior to shipment to the job site.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. *[The low voltage power meter system shall be supplied by Siemens Industry Inc. or pre-approved equal. Approved manufacturers are as follows:*
1. **SIEMENS**
  2. . ]

## 2.2 EPMS SERVER & CLIENT REQUIREMENTS

- A. *[The EPMS Server computer shall include [ ] factory supplied server computers with at least the following features: EPMS Server Resources are based on the amount and type of devices*
1. **Server computer with [ ] GB RAM, [CPU ] ([ ] core) or better, [ ] GB HDD, CD/DVD RW drive, [ ]" Flat screen monitor, XGA video card, full-size 101-key enhanced keyboard and a mouse.**
  2. **Windows [ ] OS/Server OS ] or**
  3. **Microsoft Office Excel 2016**
  4. **Dual NIC Card - 10/100Base T**
  5. **Auto-reboot capability upon return from power failure. Necessary programs must then automatically launch without user intervention.**
  6. **One 1300VA, 120VAC, plug-in UPS]**
- B. *[The EPMS project shall include [ ] Engineering Client computers with the following features:*
1. **Minimum computer with 4 GB RAM, , [CPU ] 2 core or better processor, Monitor resolution of 1280 x 1024, full-size 101-key enhanced keyboard and a mouse.**
  2. **Cross Browser Platform.**
  3. **Optional One 1300VA, 120VAC, plug-in UPS ]**
- C. *[The EPMS project shall include [ ] Web Based Client computers with the following features:*
1. **Minimum computer with 4 GB RAM, 2 GHz Dual Core processor, Monitor resolution of 1280 x 1024, full-size 101-key enhanced keyboard and a mouse.**
  2. **Cross Browser Platform.**
  3. **Optional One 1300VA, 120VAC, plug-in UPS]**

## 2.3 EPMS WEB BASED SOFTWARE OVERVIEW

- A. The EPMS Server software shall be designed on a MICROSOFT WINDOWS-based Package and have on-line full-screen editing to facilitate the programming and monitoring of the system. The Power Management Server and Web Based Client locations will allow the monitoring of vital system parameters and provide a scalable system for future expansions without replacement of the EPMS system hardware or software.
- B. The EPMS screens shall be capable of showing all parameters which are available from the individual remote devices by device, including but not limited to all metered values, load status, alarm status, energy data, device position and/or status, device data logs, waveform capture, sag/swell events, etc. In addition, the screens shall be capable (if allowed by the owner) of providing for suitable tripping, closing and opening of appropriate remote devices.
- C. The EPMS software shall provide, as standard, the following software package to allow for maximum flexibility and expandability. Additional devices can be added for both Siemens ION and Modbus devices.
1. The proposed system will include a EPMS system that supports 1 Engineering client and 2 Web Based clients and the following device point level packages:
    - a. **Five (5) metering device package – Siemens WinPM.Net or equal**
    - b. **Additional ( ) Siemens metering devices**
    - c. **Additional ( ) Modbus RTU or Ethernet**
    - d. **Additional ( ) Engineering Client**
    - e. **Additional ( ) Web Client**

- D. The EPMS software Web Bases clients shall require No loading of software to view all the EPMS screens and data.
- E. The EPMS software shall allow unlimited screens and unlimited screen penetration to lower-level detailed screens.
- F. The Software Package web applications shall be simultaneously accessible from their unique web addresses so that they may be embedded in other web-based software environments.
- G. The functionality of the Software Package shall be extensible whereby additional capabilities may be added via software license activation codes without the need to install additional software modules or add-ons.
- H. The Software Package shall be designed to integrate and embed within the vendor's Building Management System (BMS) software platform to provide Energy and Power Management applications within the context of the BMS environment.
- I. The Software Platform shall have a variety of natively supported devices and shall have the ability to support devices specifically designed for power distribution and power quality monitoring including: power meters, Automatic Transfer Switch, branch and multi-circuit meters, communicating circuit breakers, and protection relays.
  - 1. All registers shall be pre-mapped to standard measurement names – no additional register mapping required.
  - 2. All native device types will come with a comprehensive set of a factory device graphical screens – no additional graphics creation or installation required.
  - 3. All native device types have been factory-tested and proven to perform.
- J. The EPMS software shall provide the following screens as standard in the software:
  - 1. Real-time Device information like Line to Line and Line to Neutral voltage and current readings for all Power Meters in a 3-Line diagram format.
  - 2. Event Logs
  - 3. Alarm Logs
  - 4. Historical trend plots
  - 5. Real-time and historical trend plots
  - 6. Waveform capture display with zoom in/out capability
  - 7. Harmonic analysis display
  - 8. Phasor display
  - 9. Time-of-use display
  - 10. Power Quality & Power Incident summary display
  - 11. I/O status & control display
  - 12. Set point and setup display
  - 13. Device log and setup display
  - 14. CBEMA curve display
  - 15. Network diagram display
  - 16. Dashboard display
  - 17. Smart Alarm notifications
  - 18. One-click access to device logs, including long-term min/max, voltage, current, power, frequency and power factor trending.
  - 19. Display Flicker data tables
  - 20. All I/O shall be displayed including current state.
  - 21. Device "OPEN", "CLOSED", "TRIPPED" and "COMMUNICATION" status.
  - 22. All measured values supported by the given device as selected by the customer
- K. Customer shall have the ability to remove any non-essential parameters from the real-time list of each device to minimize searching through non-essential information.
- L. The base EPMS software package shall have as a minimum the following specified features.
  - 1. System/device alarm logging and reporting: Any changes in any device or the system itself including log on/off, power on/off at system master computer, shall be identified and alarmed.

2. Time/event logging: The time and causes of each event shall be logged directly to the master control unit file and/or a printer. Time stamping capability in seconds shall be provided at the system master computer of device on/off, device alarm, device trip and device no response.
  3. Data Trending: The software shall include the following trending features:
    - a. All information monitored by every remote device shall be capable of being communicated and automatically trended.
    - b. Trending time interval and amount of information to be trended shall be user-selectable. Trends shall have the ability to combine information from multiple devices. Time interval selection shall be user-selectable in discrete time blocks from 1 second to many hours. Additionally, time intervals shall have the capability of limiting recording to certain time windows of each day or a certain date range. Automatic start and stop day/times shall be available for unattended recording.
- M. Real Time Monitoring:
1. The Software Package shall support Auto Network Diagram Creation whereby a comprehensive set of linked hierarchical graphical diagrams is automatically created for all directly connected devices in the power monitoring network.
  2. The Software Package shall support advanced power quality meters with onboard High Speed Power Analysis with Disturbance Direction Detection (DDD) capabilities and come equipped with a built-in set of real-time graphical indicators for use in electrical one-line diagrams that indicate:
    - a. The type of Power Quality Disturbance (sag, swell, transient).
    - b. The direction of Power Quality Disturbance relative to the compliant DDD device (upstream, downstream).
  3. The Software Package shall provide real-time indication of the aggregated demand being measured by one or more devices in a predefined zone. The application shall allow:
    - a. The demand for the zone to be expressed using either Kilowatts or normalized Kilowatts/Area.
    - b. Visual indication of how the present demand for a zone compares with four (4) configurable limits / targets using a color scale.
    - c. Configurable limits shall be further configurable to allow for the use of different values during an On-Peak period compared to an Off-Peak period.
  4. The Software Package shall allow web client users to quickly and easily create interactive dashboard visualization of any real-time measurements that:
    - a. Display tabular and trend line views to compare device readings from multiple devices in the power monitoring network including power meters, circuit breakers, protection relays, uninterruptable power supplies, automatic transfer switches and generators.
    - b. Permit users to create, modify, view and share views directly from the web client browser without the need for a separate software application.
    - c. Support both physical and virtual devices defined in the system.
    - d. Support exporting real time data into Excel formats directly from the web client browser environment.
- N. Alarm and Event Analysis and Notification:
1. The Software Package shall be able to acquire specialized, high speed power disturbance data directly from onboard advanced power quality meters for the purpose of Power Events Analysis, including:
    - a. Timestamped Power Events with Disturbance Direction Detection (DDD).
    - b. Timestamped high speed (1/2 cycle sample rate) pre/post event RMS data.
    - c. Pre/post event waveform captures (Voltage and Current all phases).
  2. The Software Package shall provide a web based power events analysis application that includes but is not limited to the following features:

- a. Automatic, intelligent clustering of events into alarms and multiple alarms from multiple devices into “incidents” to simplify the analysis of multiple cascading events.
  - b. Automatic categorization of alarms and incidents into predefined categories such as Power Quality, Power Availability, Diagnostics and Other.
  - c. Predefined views for events, alarms and incidents with intuitive navigation and easy to use, configurable filters based on priority, status, source and categories.
  - d. Ability to create private or shared event, alarm and incident views with custom filters.
  - e. Popup window with detailed information about where, what and when an alarm or incident happened, plus other relevant information including Power Quality details and a thumbnail summary view of all waveforms associated with the alarm or incident.
  - f. For Power Quality alarms or incidents captured by Disturbance Direction Detection (DDD) compliant devices there shall be clear graphical indication of the direction of the disturbance (upstream or downstream relative to the DDD compliant device).
3. The Software Package shall provide a graphical timeline view of alarms and events that constitute an “incident” in the electrical distribution network. The timeline view shall:
    - a. Display alarms/events stacked by order of time for sequence of events analysis.
    - b. Display the start and end of alarms/events with color-coded dots.
    - c. Indicate the direction of a Power Disturbance and if there are captured waveforms associated with the incident.
    - d. Have a configurable analysis window with a color-coded time slider that uses color to indicate areas in the timeline where there are greater numbers of alarms.
    - e. Be able to display pre- and post-event high speed RMS data coming from supported power quality meters.
  4. The Software Package shall include a web-based Smart Waveform Analyzer interface with the following capabilities:
    - a. Toggle on/off Voltage/Current channels.
    - b. RMS calculation, zoom, pan, export to CSV.
    - c. Interactive phasor and harmonic (voltage and current) diagrams.
    - d. Allow multiple waveforms to be compared to each other.
  5. The Software Package shall include an alarm annunciator to display the total number of unacknowledged alarms with a breakdown of how many are high, medium and low priority and shall allow easy navigation to the alarm viewer with a single click.
  6. The Software Package shall have the ability to send email notifications based on recent changes to the system. Provided that the EPMS server has access to an SNMP server. These email notifications which will be used to formulate notification types including:
    - a. Communication Loss Notification – sent when the Software Package loses communication with selected devices.
    - b. Alarm Summary Notification – sent regularly to indicate changes in the average amount of high, medium, and low priority alarms.
    - c. Power Quality Event Notification – sent regularly to indicate changes in the average amount, duration, and magnitude of Sag, Swell and Transient power disturbances.
  7. The Software Package shall have a web-based Alarm Configuration interface to allow end users to create smart alarms with the following capabilities:
    - a. Realtime Analog and Digital Setpoints with options for time delays and custom alarm labels.
    - b. Smart Over/Under Setpoints designed specifically for energy (WAGES) and power alarms based on historical average, standard deviation or maximum with options for time ranges, aggregation periods, multipliers and ability to compare specific time periods (Same Hour of Day and/or Same Day of Week).
    - c. Communication Loss alarms with options for sensitivity and custom alarm labels.

- d. Schedules interface for end users to configure when smart software alarms are active or not.
- O. Data Analytics and Visualization:
1. The Software Package shall include an interactive, web-based Dashboard application that provides auto-updating dashboard views that may contain not only energy and power data but water, air, gas, electric, and steam (WAGES), historical data trends, power quality performance data, images, and content from any accessible URL address.
  2. Users shall be able to create, modify, view, and share their dashboards (including graphics, labels, scaling, measurements, date ranges, etc.) using only a browser and without the need for a separate software application to design, create, modify or publish dashboards.
  3. The Software Package shall support kiosk slideshow displays by assigning individual dashboards to slideshows to run in unattended mode, scrolling through designated dashboards at a configurable time interval.
    - a. Any number of kiosk slideshow displays may be created and configured to run independently on any computer using a browser.
  4. The Dashboard application shall provide a library of standard graphical objects (gadgets) including Bar, Pie, Trend, Real Time, Period Over Period Comparison, and Web Portal.
  5. The Software Package shall provide an interactive, web-enabled Reports application that allows users to generate, modify, save and manage reports based on pre-formatted report templates that are designed to support the following:
    - a. Energy Cost Allocation and Bill Verification.
    - b. Energy Usage and Trend profile.
    - c. Power Quality Performance and Compliance (EN50160 and IEEE 519).
  6. The reporting tool shall support automatic distribution (via email with access to SNMP server or shared folder) on a schedule basis or based on event or manual export using the following output formats: .csv, .xlsx, .pdf, .tiff, .html, .xml.
- P. Technical Infrastructure:
1. The Software Package shall be able to be installed on a physical computer or virtual machine and shall support a variety of Windows operating systems including Server and non-Server class Windows operating systems.
  2. The Software Package shall support a variety of SQL Server Editions including Enterprise, Standard and Express Editions.
  3. The Software Package shall only require SQL Server Database Engine Services and Basic Management Tools and not require the installation of any other additional SQL components such as Analysis Services or Reporting Services.
  4. The Software Package shall support the following cybersecurity features:
    - a. Encrypt the transmission of data between the Software Package Server and its Web Clients using Transport Layer Security (TLS) version 1.2.
    - b. Establish secure authentication between the Software Package Server and its Web Clients using Certification Authority (CA) certificates.
    - c. Encryption and hashing of system credentials using AES256 and SHA-512 respectively.
    - d. Capable of installing into a Federal Information Processing Standard (FIPS) compliant environment.
  5. The Software Package shall support the integration of Windows Active Directory for users and groups from across multiple domains to facilitate the following:
    - a. Login to the Software Package using Windows credentials.
    - b. Enforce password policies via Windows (complexity and expiration).
    - c. Role-Based Access Control (RBAC).
  6. The Software Package shall intelligently and automatically acquire data from devices, including onboard events, trends and waveforms from natively-supported device types:

- a. Without any need for software configuration or data upload scheduling.
  - b. Onboard, high resolution timestamps (1ms) shall be retrieved without degradation or modification for devices that support clock synchronization via GPS, IRIG-B, NTP or PTP (Precision Time Protocol).
7. The Software Package shall support logical device definitions based on inputs/outputs or channels on devices that represent a downstream device with the following features:
  - a. Software user interface for device and measurement mapping.
  - b. Bulk-import capability to create large numbers of logical devices without manual single-device configuration.
8. The Software Package shall support real-time and historical data aggregation within defined hierarchy views (e.g. Tenants/Racks/Circuits, PDUs/RPPs/Panels, Buildings/Floors/Rooms, or any user defined view) with the following capabilities:
  - a. Web-based, end user interface.
  - b. Automatic and intelligent data aggregation across all nodes in the hierarchy for data visualization in Dashboards, Trends and Reports.
  - c. Creation of virtual devices to enable applications such as net metering, common area allocation and apportionment.
  - d. Update node names and associated time ranges in the hierarchy to properly reflect and accurately report on facility changes (e.g. tenant move in – move out).
  - e. Bulk-import capability to create and edit large hierarchies without manual per-device setup.
9. The Software Package shall support OPC DA Server 2.01 with the following capabilities:
  - a. Provide default OPC Server tag mappings for all natively supported device types without the need to select, configure, or program the mapping of device registers to OPC tags.
  - b. Provide a flexible means to add or change OPC mappings and shall support the ability to add custom measurements.
10. The Software Package shall support OPC DA Client 2.01 and come with a built in OPC Test Client.
11. The Software Package shall support device-level Modbus integration with the following capabilities:
  - a. Modbus master to read/write registers in Modbus devices for monitoring and control applications.
  - b. Support for at least 70 Modbus data formats including 16bit Signed/Unsigned Integers (S16-21, S16-12, U16-21, U16-12, S16-1-15), 16bit Signed/Unsigned Array (U16-21-ARRAY U16-12-ARRAY), 32bit Signed/Unsigned Integers Big-Endian and Little-Endian (S32-4321, S32-1234, U32-4321, U32-1234), 64bit Signed/Unsigned Integers (S64-21-87, U64-21-87, S64-87-21, U64-87-21), Signed/Unsigned Modulo10000 (S32-M10k-4321, S32-M10k-1234, U32-M10k-4321, U32-M10k-1234, S64-M10k-21-87, U64-M10k-21-87, S48-M10k-21-65, U48-M10k-21-65, S48-M10k-65-21, U48-M10k-65-21), Signed/Unsigned Modulo1000 (S64-M1K-87-21 U64-M1K-87-21), IEEE Float/Swapped Float (F32-4321, F32-1234, F64-87-21, F64-12-78), ASCII/ASCII Reverse, Packed Boolean/ Masked Boolean, Inverted Masked Boolean, Binary Coded Decimal (BCD, Packed BCD), Formats for Power Factor (PF Nexus, PF32, PF\_ALT), Formats for Date-Time (DateTime4.UTC, DateTime4.LOCAL, DateTime4, DateTime3.UTC, DateTime3.LOCAL, DateTime3, DateTime\_YMDhms.UTC, DateTime\_YMDhms.LOCAL, DateTime\_YMDhms, DateTime\_IEC870.UTC, DateTime\_IEC870.LOCAL, DateTime\_IEC870, DateTime3\_IEC870.UTC, DateTime3\_IEC870.LOCAL, DateTime3\_IEC870, DateTime3\_MDYhms.UTC, DateTime3\_MDYhms.LOCAL, DateTime3\_MDYhms, DateTime4\_MDYhms.UTC, DateTime4\_MDYhms.LOCAL, DateTime4\_MDYhms, DateTime2\_s2000, DateTime3\_s2000, DateTime4\_shmMDY, DateTime6\_smhDMY,

DateTime7\_YMDhms, DateTime8\_MDYdowhmsc, DateTime6\_MDYhmms, DateTime\_NSX2\_UTC, DateTime\_NSX2\_LOCAL, DateTime\_NSX3\_UTC, DateTime\_NSX3\_LOCAL).

12. The Software Package shall have a single, end user software application specifically designed for integrating Modbus and OPC device types and shall have the following capabilities:
  - a. Simple creation and management of Modbus and OPC device definitions (device drivers) and association of device graphic template screens.
  - b. Pre-defined, default measurement system (Common Data Model) for consistent mapping of Modbus registers and OPC tags to standard measurements.
13. The Software Package shall support Web Services interoperability with the following capabilities:
  - a. Web Services Server for sharing real-time, historical (i.e. timestamped trend data), and alarm data (i.e. timestamped event strings) from the Software Package to other Web Services Client applications.
  - b. User interface for Web Services configuration and mapping.
  - c. Provide the ability to acknowledge alarms by authenticated and authorized clients.
14. The Software Package shall support system-wide programs using a graphical, object-oriented application engine capable of logic and arithmetic functions, database queries, XML data import, complex logic-based alarming and data logging, email and text notifications.
15. The Software Package shall remain online (including communications, logging, and alarming) and not require an operator to take the system offline during all system administration functions such as adding, modifying, or removing devices in the system; creating, modifying, or removing graphical diagrams, dashboards, tables, and reports; creating, modifying, or removing application logic programs in the application logic engine.
16. The Software Package shall support offline software configuration management for efficient system deployments and upgrades with a dedicated user interface for creating, copying and deploying software configuration projects.
17. Password Protection: The following password security protection features shall be provided:
  - A. The EPMS software shall be capable of having an unlimited number of separate user-defined passwords.
  - B. All actions; i.e., log on/off, device control, alarm acknowledgment, etc. shall be time and date stamped in the event log.
  - C. Password security access shall provide for flexible functional access. Functions such as alarm acknowledgment, device control, device configuration, etc. shall be individually customized to each user name assigned.
  - D. The EPMS software password security shall be capable of being utilized for both local and remote computers. Individual operator passwords shall be required at every computer location. Each operator's capability to interface with the system shall be keyed to his/her entered password and his/her associated security level at each designated station.
18. Diagnostics shall be provided to provide information on device or system malfunction, such as devices not communicating, system performance, watchdog alarm and stale data indication.
19. The software shall allow the user to set an unlimited number of individual computer alarm levels for all monitored parameters, such as setting low and high alarm levels for voltage, current, motor run time, etc. These alarm levels shall be independent of device built-in alarm levels. The alarm settings shall support signed values (+/-) as well as high and low limits.
20. The software shall support setting multiple limits, providing additional alarm points above or below the initial limit.
21. The software shall display the analog value that caused the alarm on the alarm screen (time and date stamped) and log same information to the event file.

22. The software shall be capable of taking the following actions based on any alarm:
    - A. Display custom text in a popup screen at the Power Management Engineering Stations
    - B. Display animated GIF's on diagrams based on the activation of the alarm
    - C. Play any \*.wav file accessible by the Power Management Engineering Station
    - D. Loop the playback of the \*.wav file until an operator acknowledges the alarm
    - E. Activate any output on any power monitoring device in the system, as determined by the owner.
    - F. Email any alarm or event
  23. The software shall have on line, context sensitive help capability included to aid in operating the software.
  24. The EPMS system shall communicate to each breaker's microprocessor based trip units, protective relay and any digital meters on the electrical distribution system defined in this specification. Additional analog and discrete statuses required to be monitored by this specification shall be tied back to I/O units and communicated back to the power monitoring software.
  25. Ability to perform mathematical operations and alarm on those calculations on the incoming monitored data.
  26. Display in a real-time trending mode a graphical representation of either monitored or calculated data.
  27. The system shall have the capability of being programmed and modified on-line. It shall not be necessary to shut down any part of the system during programming operations.
- 2.4 EPMS STANDARD REPORTING / BILLING FEATURES
- A. The reporting/billing package shall be built into the EPMS software as standard and allow the user to create the following standard reports using a built-in report wizard.
  - B. The following reports will be available in PDF, TIF, and Excel format.
  - C. Any computer with an Internet Browser shall be able to view the HTML reports with no special software. Standard reports shall include:
    1. Energy Period Over Period Report
    2. Energy by Shift Reports
    3. Energy Cost (Billing) Report
    4. Trend / Load Profile Report
    5. Event History Report
    6. System Configuration Report
    7. Consumption ranking report
    8. Data Export/Tabular reports
    9. Power Quality/Harmonics reports
    10. EN50160 reports
    11. IEC6100-4-30 Report
  - D. Unlimited reports based on standard reports
- 1.2 EPMS STANDARD GRAPHIC DISPLAY FEATURES
- A. The EPMS installation shall include as standard a visual display program that allows custom-developed graphic screens to match customer one-line drawings, customer floor plan or actual power distribution equipment front elevations, as agreed upon by owner. Owner shall be able to select colors, numbering scheme and general arrangement of screens.
    1. **The EPMS system shall include [ ] custom graphical screens.**
    2. The visual display program and any licenses shall be included.
    3. Standard graphical pictures for analog dials, bar charts, hot-link buttons, etc. shall be included. No additional software will be required to add pictures or links to the software.
    4. The visual display program shall provide a master overview screen listing all subscreens by contract designation and from which any subscreen can be selected by mouse click operation.
    5. The visual display program shall support representing breaker position (where supported by the device), loading levels and links to real-time screens of individual devices represented on the active screen.

6. The visual display program shall allow unlimited users to view and modify the visual screens.
  7. The visual display program shall have the ability to turn logging on and off from the native device interface screen with one-click access.
- B. The visual display program will provide animation of status of device objects (i.e. breaker status, generator status, ...)
  - C. The visual display program will be capable of animating (changing of color) lines on the screen based on a change of incoming monitored data and/or a software-performed calculation. For example, changing of the single-line bus color based on open or closed status of a circuit breaker or starter. The Vendor shall include as an option in his bid for status color change for "Single Line Diagrams".

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. The Electrical Contractor shall furnish, install, terminate and test all communication conductors and associated conduits external to any factory supplied equipment.
- B. All communication conductor wiring and routing shall be per the manufacturer's recommendations and as shown on the contract drawings.
- C. Where applicable, the EPMS components included with power equipment lineups shall be factory installed, wired and tested prior to shipment to the job site.
- D. Configure and/or program meters, servers and network components to ensure operation of system.
- E. Cleaning:
  1. Clean up debris resulting from EPMS vendor field personnel activities daily. Remove cartons, containers, crates, etc., under vendor control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
  2. At the completion of work in any area, the Contractor shall clean work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
- F. All communication conductor wiring and routing shall be per the manufacturer's recommendations and as shown on the contract drawings.
- G. Where applicable, the EPMS components included with power equipment lineups shall be factory installed, wired and tested prior to shipment to the job site.

### **3.2 WARRANTY**

- A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.
- B. Engineering work is warranted for 90 days following completion of the final testing of system.

### **3.3 SERVICE AGREEMENTS**

- A. The electrical equipment manufacturer shall include a [1] [2] [3] year[s] Software Service Agreement which provides customer with software upgrades for the software specified above as they are available.
- B. The electrical equipment manufacturer shall include a [1] [2] [3] year[s] System Service Agreement which will provide customer with Quarterly PM visits to ensure optimal operation of the system.

### **3.4 SYSTEM START-UP AND TRAINING**

- A. Project management shall be provided for the entire project through a single source of contact. The end-user shall also provide a single source of contract with authority over the project to make decisions on timely bases.
- B. On-Site start-up and training of the Owners personnel on the EPMS shall be included in the project bid.
- C. Start-Up shall consist of complete configuration and in-service testing of the system, to confirm proper operation of the EPMS.
- D. Training shall include any documentation and hands-on exercises needed by the owner's personnel, to assume full responsibility for the EPMS.
- E. Supplier shall have a remote fully functional training facility for advanced EPMS training classes.
- F. The project bid shall include a minimum of:
  - 1. [ ] trips for pre-startup review meetings.
  - 2. [ ] days for remote design of EPMS system based on Vendor Submittals.
  - 3. [ ] days for on-site start-up services which includes installing the EPMS software at the server location and final configuration of the software & metering devices.
  - 4. [ ] days of on-site EPMS training will be provided that includes hands-on and written material.
  - 5. The bid shall include [ ] follow-up days for completion/modification of work as needed.

**END OF SECTION**