

SECTION 16901

MICROPROCESSOR METERING EQUIPMENT

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cutler-Hammer
- B. <sup>3</sup> \_\_\_\_\_
- C. <sup>3</sup> \_\_\_\_\_

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 MICROPROCESSOR-BASED METERING EQUIPMENT

A. IQ Analyzer

1. Where indicated on the drawings provide a digital line PQM&A Power Quality Meter & Analyzer (PQM&A) device equal to Cutler-Hammer type IQ Analyzer having the features and functions specified below. The PQM&A shall be UL, CSA and CUL listed, CE marked and also meet ANSI Standard C37.90.1 for surge protection. The PQM&A device will also meet ANSI C12.20 (0.5%) energy revenue metering accuracy standard.
2. The PQM&A shall provide direct reading metered or calculated values of the items listed below and shall auto range between Units, Kilo-units and Mega-units for all metered values. <sup>2</sup>[The device shall be capable of displaying the frequency distribution in graphic form and shall be capable of displaying the Wave Form in graphic form.] The device shall be capable of displaying multiple parameters at once, including four (4) user-configurable custom screens displaying any seven (7) of the parameters listed. Indicator LED shall always remain active to display device status for safety and trouble-shooting purposes. Time, date, software version, and network address shall

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<sup>2</sup> Note to Spec. Writer -- Optional

<sup>3</sup> Note to Spec. Writer -- Insert data in blanks

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also be displayed. Accuracy indicated below to be of read or calculated values based on 3 to 300% of full scale.

- a. AC Current (Amperes) in A, B, and C phase, 3-Phase Average, Neutral (N) and Ground (G). A total of 5 current inputs shall be provided. Accuracy of all current inputs will be +/- 0.2% (provide neutral and ground current transformer) The 5 ampere current inputs shall withstand 40 amperes continuous and 300 amperes for 1 second.
- b. AC Voltage (Volts) for A-B, B-C, and C-A, Phase Average, A-N, B-N, and C-N, Average Phase to N, and N to G. Accuracy +/- 0.2%
- c. Real Power (WATTS), Reactive Power (VARs), Apparent Power (VA), for each phase and system. Accuracy +/- 0.4%. Forward/Reverse indication shall be provided.
- d. Real Energy (WH), Reactive Energy (VARH), Apparent Energy (VAH) for each phase and system. Accuracy +/- 0.4%. Forward/Reverse indication shall be provided.
- e. Frequency (HERTZ) Accuracy +/- 0.4%
- f. Demand values for System Current (AMPERES), System Real Power (WATTS), System Reactive Power (VARs), and System Apparent Power (VA)
- g. Power Factor for both Displacement only 60-cycle fundamental WATTS to VA and Apparent total WATTS to total VARs including harmonics for A, B, and C phase and system. Accuracy +/- 0.8%
- h. Current Percent Total Harmonic Distortion (THD) in A, B, and C phase and N
- i. Voltage percent THD in A-B, B-C, and C-A phase, A-N, B-N and C-N
- j. K-Factor (sum of the squares of harmonic currents times the square of their harmonic numbers)
- k. Transformer Derating Factor (1.414 divided by the Crest Factor)
- l. Crest Factor (ratio of peak current to RMS current)

3. The PQM&A shall provide the following advanced analysis features:
  - <sup>2</sup>a. On-board logging capability, including the ability to log a total of 24 parameters with intervals ranging from 0.13 seconds (every 8 cycles) to twice a week (5040 minutes). Four separate trends shall be available. Each trend can be independently configured. When recording an energy parameter every 15 minutes 234 days of readings will be stored.
  - b. Trend Analysis Screens displaying the minimum and maximum values for each metered value, with all parameters time stamped to 10 millisecond resolution.
  - <sup>2</sup>c. Time of use Metering Capability to store energy usage data for time of use revenue metering. Provide complete programmability for 32 schedules including weekday, Saturday, Sunday, 22 holidays, 8 seasons, , and 10 time periods per schedule for up to 4 different utility rates. The PQM&A will store the following energy data in non-volatile memory:
    1. Watt hours
    2. VAR hours
    3. VA hours
    4. Current demand
    5. Watt demand
    6. VA demand
    7. VAR demand
  - d. Demand Analysis Screens displaying present demand and peak demands for current (phase A, B, C, N, and G) and power (system real (kW), reactive (kVAR), and apparent (kVA). Peak demands shall display time and date stamped to within 10-millisecond resolution. Demand Window Selection for metered demand values shall be selectable either as:
    1. A user selectable fixed window (programmable from 1- to 60-minutes)

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2. Sliding window method with programmable 1- to 60-minute subintervals, for power (kW, kVAR, kVA) demand only
  3. Initiated from a synch pulse for power (kW, kVAR, kVA) demand only
  4. Communication signal initiated from a Cutler-Hammer type IMPACC/PowerNet network master computer.
- e. Harmonic Analysis Screens shall be capable of being function key triggered to capture a high-speed wave form of two (2) cycles of data sampled at 128 samples per cycle, simultaneously recording current in A, B, and C phases, N, and G as well as all voltages A-B, B-C, and C-A phases, A-N, B-N, C-N, and N-G. Data captured shall include the magnitude (% of the fundamental) and the direction of harmonic source (phase angle) for all odd and even multiples of fundamentals from 1st through the 50th.
- f. Event/Alarm Analysis Screens shall display data recorded for up to ten (10) event/alarm conditions. The initiation level of the declaration of an event/alarm condition shall be field programmable for all measured parameters. For each event/alarm a description of the event/alarm, date, and time of event/alarm shall be recorded (10 ms resolution). In addition, a capture shall be made of all metered values available and all current and voltage distortion information available on the Harmonic Analysis Screens.
- g. The PQM&A shall be capable of transmitting all data at time of the event via communications to a personal computer for creating and displaying wave forms. In addition, the Event/Alarm Analysis Screens shall be capable of being initiated from an energized discrete input circuit, or through the communications port.
- h. The PQM&A shall have the ability to store the last 504 meter events in non-volatile memory. Each event will be date and time stamped with 10 millisecond accuracy. The PQM&A shall provide the ability to view the events via the local display or via communications.
- i. Event/Alarm Condition Levels shall be capable of being triggered by up to 7 of any of 61 conditions when the programmed threshold is exceeded. All shall have

programmable time delays from 0.1 to 60 seconds except voltage disturbance which shall be programmable from 0 to 3600 cycles.

Voltage Disturbances

1. Undervoltage/sag -- A-B, B-C, A-C  
(selectable from 50 to 100%)
2. Undervoltage/sag -- A-N, B-N, C-N  
(selectable from 50 to 100%)
3. Overvoltage/swell -- A-B, B-C, A-C  
(selectable from 100 to 150%)
4. Overvoltage/swell -- A-N, B-N, C-N  
(selectable from 100 to 150%)

If time delay is programmed, any disturbance lasting two (2) cycles (less if magnitude is sufficient to affect RMS readings) shall trigger voltage disturbance event/alarm.

Maximum Threshold Exceeded

- 5-24 Percent THD (2-1000) or Magnitude of THD for:
  - Current Phases A, B, C
  - Voltage A-B, B-C, C-A
  - Voltage A-N, B-N, C-N
- 25-31 Demand
  - Current Phases A, B, C, Average
  - System Power-watts, vars, VA
- 32 Voltage -- Neutral to Ground
- 33-34 Current -- Neutral or Ground

Minimum or Maximum Threshold Exceeded

- 33-40 Current Phases A, B, C
- 41-46 System Power-watts, vars, VA
- 47-49 Frequency High, Low, High or Low
- 50-53 System Power Factor
  - Displacement Minimum and Maximum
  - Apparent Minimum and Maximum

Voltage Phase Unbalance

- 54-55 Voltage Line-to-Line or Line-to-Neutral

Current Phase Unbalance

- 56 Current comparison between Phases A, B, C

Discrete Input Energized

- 57-59 Input 1, 2, 3

IMPACC/PowerNet Communication

- 60 Remote command through communications port

Manual Capture

- 61 Manual capture from pushbutton at device

4. The PQM&A shall be capable of receiving the following inputs:
  - a. Instrument transformers: Input ranges of the PQM&A shall accommodate external current transformers with ranges from 10,000/5 through 5/5 amperes. Provide external current transformers for each phase, neutral and ground circuit with rating as indicated on the drawing or sized for incoming service or associated feeder. PQM&A shall be capable of overranging up to eight (8) times nominal current rating. Potential transformers shall be self included and fused for up to 600 volts with potential connections suitable for 3-phase 100-volt, 120-volt, 208/220/240-volt, 380/416-volt, 460/575-volt. Above 600 volts, provide fused external potential transformers for up to 500 kV.
  - b. Control Power: The PQM&A control power shall be capable of being supplied from the monitored incoming AC line up to 600 volts without the need for a separate AC control circuit unless a

separate 120- or 240-volt source is indicated on the drawings. The device shall also be capable of being supplied from a separate control power source when indicated on the drawings (input range of 100 to 240 volts AC or 100 to 250 volts DC). Or the PQM&A can be powered from 24 to 48 VDC if so indicated on the drawings.

- c. Dry Contacts: Three (3) dry discrete input contacts shall be capable of being monitored which may be programmed by the user to perform any of the following functions. The status of the input contacts shall be locally displayable and accessible through the communications port.
  1. Trigger an Event/Alarm Analysis including Harmonic Analysis information for display on the device and information for Wave Form Analysis and display at a personal computer.
  2. Act as an synchronizing pulse input to synchronize demand windows with a utility provided synchronizing pulse.
  3. Actuate a relay output.
  4. Reset a relay output, peak demand, Minimum/Maximum, or Event Analysis records.
5. Furnish Relay Output Contacts with four Form C (NO/NC) relay output contacts which shall be capable of being independently programmed for the following functions:
  - a. Act as a kWh, kVARH, or kVAH pulse initiator output.
  - b. Actuate on one (1) or more Event/Alarm conditions, including discrete inputs and Communication Command signal. Each relay contact shall be capable of being set for Auto or Manual Reset with 0- to 30-minute release delay in one second increments. Relay contacts programmed to actuate on undervoltage shall also have a programmable 0- to 30-minute delay on power-up for transfer applications.
6. Furnish one (1) 0 to 20mA analog input and three (3) 0 to 20mA outputs. The input values shall be capable of being displayed on the device as a percentage and shall also be accessible throughout the communications port. Each analog output shall be programmable to reflect a phase current, voltage, power, demand, %THD, power factor, or system frequency.

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7. The device shall be fully programmable from the faceplate, including alarm relay and power quality (e.g., harmonic distortion) settings. Programming shall be password protected.
8. <sup>1</sup>[Provide] [Make provisions for] an addressable communication card capable of transmitting all data, remotely controlling and programming the PQM&A over a compatible two-wire local area network to a central personal computer for storage, analysis, display, and printout. The network shall also be capable of transmitting data in RS232c format via a translator module. There shall also be an option to connect the PQM&A to an Ethernet network via either a 10BaseT copper cable or fiber optic cable. The following minimum functions shall be available through communications at the personal computer with appropriate Windows-based software:
  - a. Monitoring and trending of all locally displayed values and device status
  - b. Initiating an Event/Alarm
  - c. Retrieving Event/Alarm information
  - d. Retrieving Harmonic Analysis/Wave Form Analysis information including construction of the Harmonic Profile to graphically display simultaneously the relative magnitudes of the multiples of the fundamental frequency for both current and voltage of a given phase
  - e. Retrieving Harmonic wave form analysis information for display of eight-cycle wave shapes of all simultaneously recorded current (phase A, B, C, N, and G) and voltages L-L and N-G
  - f. Activating relay output contacts
  - g. Programming device configuration and setpoints
  - h. Synchronizing device clocks to within 30 milliseconds (for demand windows and time stamping).

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<sup>1</sup> Note to Spec. Writer -- Select one