Power Meter PQM *(EnerSure Enkapsis)*
Guide Form Specification

PART 1: GENERAL

1.01 **SUMMARY:**

The following technical specification describes the requirements of the high-accuracy standalone 3-phase Power Quality Meter. The meter is ideal for advanced power monitoring applications, including power quality and revenue grade metering. The system shall be known as a Power Quality Meter (PQM).

1.02 **STANDARDS:**

A. The PQM shall be designed, tested (or certified) and manufactured to the following standards and accuracy as a complete system including current transformers. Solutions available to meet the following specifications.
   - ANSI C12.20 .5%
   - IEC 62053-21 Class 1 and Class 2
   - IEC 62053-22 Class 0.5S real and reactive power and energy
   - IEC 62053-23, EN 50470-1, EN 50470-3, ANSI C12.20, and IEEE1459 standards

B. Regulatory: The device shall be UL/CE or ETL listed to UL 508A of the latest applicable safety standards.

1.03 **QUALITY ASSURANCE:**

A. Manufacturers firms regularly engaged in manufacture of Power Quality Meters, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Manufacture components included within the power equipment lineups shall be factory installed, wired and tested prior to shipment to the job site.

C. NEC Compliance: Comply with NEC as applicable to construction and installation.

D. UL and CE Compliance Labeling: Provide Power Quality Meters which have been listed and labeled per UL and CE.

E. NEMA Compliance: Comply with NEMA Standards for Power Quality Meters.

1.04 **WARRANTY:**

A. The PQM manufacturer shall guarantee the entire system against defective material and workmanship for a period of one (1) year from date of shipment.

PART 2: Product

2.01 **SYSTEM DESCRIPTION:**

Environmental Requirements

A. The PQM shall be capable of withstanding any combinations of the following environmental conditions without mechanical or electrical damage or degradation of operation.
   - Operating temperature: -20°C to 60°C
   - Storage temperature: -40°C to 85°C
   - Relative humidity: 5% to 90% non-condensing
   - Maximum operating altitude: 2,000 meters
   - Non-operating altitude: 15,000 meters
   - Noise level: <65dba at six feet from the PQM
   - Accuracy Class: 0.5S, 0.5, 1.0 including CT's
   - Sampling rate: 133 samples per cycle
   - Data logging rate: 30 second intervals
   - Storage Capacity: 8GB Class 10 SD card

2.02 **Electrical Requirements:**

- Normal input voltage: **[120] [208] [380] [400] [415] [480]** VAC, **[single phase (2) wire plus ground], [three (3) wire plus ground or four (4) wire plus ground]**
- Normal input frequencies: **[50 Hz] [60 Hz]**
- Normal operating Control Power 24VDC **[Single] [Redundant]**
- Supports CT sizes from 75 Amp to 6000 Amp with internal burdened resister and 250mVac signal. (No shorting blocks required)
- The CT's shall be **[solid core] [split core]** type current transformers that have a **[0.2%] [0.5] [1.0%]** accuracy with a max voltage of 600V. The CT's shall be accurate from 1 -100% of the range and be factory calibrated to ensure system accuracy.

2.03 **Power and Energy Monitoring System:**

A. The power meter must be serviceable without requiring the module to be removed or powered down.
B. The device shall be configurable via the web interface for addressing system IPs, voltages, currents, alarm thresholds, environmental and device description IDs without the need of external software.
C. The power meter firmware shall be field upgradeable.

D. All setup parameters required by the power meter shall be stored in nonvolatile memory and retained in the event of a control power interruption.

E. The power meter shall preform the following measurements:
   - Accumulated Real Energy (kWh) per phase and total of all phases
   - Accumulated Reactive Energy (kVARh) and Apparent Energy (kVAh) per phase and totals for all phases
   - Instantaneous Real (kW), Reactive (kVAR) and Apparent Power (kVA), by phase and in total
   - Current (amps) per phase and total of all phases
   - Phase-to-phase voltage per phase and average of all phase pairs
   - Phase-to-neutral voltage per phase and average of all phases
   - Power factor per phase and average of all phases
   - Frequency
   - Voltage and Current Waveform capture
   - Voltage and Current harmonics
   - Current and Voltage Harmonic Magnitudes & Angles (per phase)
   - Voltage THD
   - Current THD
   - Ground leak detection

F. The power meter shall have the following device event alarming:
   - User configurable low-low, low, high, and high-high alarm thresholds.
   - Over/Under Voltage
   - Over/Under Current

G. The power meter shall be configured to accommodate circuits numbered in series or in odd/even configuration and varying amperages (up to 6000 Amps)

H. The power meter shall provide steady state waveform captures of the voltage and current channels and the capture shall be for 12 cycle duration.

I. The power meter shall be capable of viewing the waveform data from onboard web or downloadable to CSV file for analysis.

J. The power meter must have onboard date logging capability.

K. The power meter shall be designed to utilize manufacturer supplied mounting plate(s) to accommodate a variety of manufacturers' switchgear, panelboards, power distribution units (PDUs), or remote power panels (RPPs).

2.04 **NETWORK COMMUNICATIONS:**

A. Modbus RTU protocol must be native to the product firmware and accessible via a standard RS-485 cable connection.
B. MODBUS TCP/IP, BACnet and SNMP protocols must be native to the product firmware and accessible via 10/100Base-TX, RJ45 connection.
C. Dual Ethernet port allowing daisy chain 10/100mbps or allowing split network operation with built-in firewall.
D. Device must have ability to simultaneously be polled by a minimum of three (3) software platforms.

Part 3: Branch Circuit Management and Additional Options

3.01 ***BRANCH CIRCUIT OR SUB-FEED MONITORING SYSTEM BCPM2.0: (Optional)***

A. Where indicated on the drawing, provide a microprocessor-based monitoring system having the features and functions specified below.
B. The device shall provide direct reading metered or calculated values for up to one hundred ninety-two (192) branch circuits or a combination of panelboards and sub-feed breakers with auxiliary inputs available for one (1) three-phase main device and one (1) neutral.
C. Monitoring must support 1, 2 and 3 pole circuits with varying current configurations. Supports CT sizes from 75 Amp to 6000 Amp with internal burdened resister and 250mVac signal. (No shorting blocks required)
D. The CTs shall be **[solid core] [split core]** type current transformers that have **[0.2%] [0.5] [1.0%]** accuracy with a max voltage of 600V. The CTs shall be accurate from 1 -100% of the range and be factory calibrated to ensure system accuracy.
E. Monitored values at the branch or sub-feed circuit level include:
   - Current per branch and sum of all phases
   - Energy (kWh) per branch and sum of all phases
   - Real power (kW) per branch and sum of all phases
   - Apparent Power (kVA) per branch and sum of all phases
   - Power Factor per branch and total (signed, to show leading or lagging current)
   - Voltage Line-to-Line and average
   - Voltage Line-to-Neutral and average
   - Frequency
   - Voltage THD
   - Current THD
   - Voltage and Current Waveform capture (**Optional**)
   - Power factor (signed, to show leading or lagging current), per branch and average of all phases for multi-phase logical circuits

- Ground leak detection

F. The power meter shall have the following device event alarming:
   - User configurable low-low, low, high, and high-high alarm thresholds
   - Over/Under Voltage
   - Over/Under Current

G. The power meter shall be configurable to accommodate panelboard circuits numbered in series or in odd / even configurations and varying amperages (up to 6000 Amps).

H. The power meter must have onboard data logging capability.

I. The power meter shall be designed to utilize manufacturer supplied mounting plate to accommodate a variety of manufacturers' switchgear, panelboards, power distribution units (PDUs), or remote power panels (RPPs).

3.02 ***BRANCH CIRCUIT MONITORING SYSTEM iBCPM2.0: (Optional)***

A. Where indicated on the drawing, provide a microprocessor-based monitoring system having the features and functions specified below.

B. The device shall provide direct reading metered or calculated values for up to one hundred ninety-two (168) branch circuits with auxiliary inputs available for one (1) three-phase main device and one (1) neutral.

C. The CT monitoring boards are available in 21-circuit strips to align with the panelboard branch circuit breakers and be supplied with a male disconnect for each branch circuit for ease of replacement.

D. Monitoring must support 1, 2 and 3 pole circuits with varying current configurations. Supports CT sizes from 75 Amp to 6000 Amp with internal burdened resister and 250mVac signal. (No shorting blocks required)

E. The CTs shall be **[solid core] [split core]** type current transformers that are supplied with female disconnects for ease of replacement and have **[0.2%] [0.5] [1.0%]** accuracy with a max voltage of 600V. The CTs shall be accurate from 1 - 100% of the range and be factory calibrated to ensure system accuracy.

F. Monitored values at the branch circuit level include:
   - Current per branch and sum of all phases
   - Energy (kWh) per branch and sum of all phases
   - Real power (kW) per branch and sum of all phases
   - Apparent Power (kVA) per branch and sum of all phases
   - Power Factor per branch and total (signed, to show leading or lagging current)
   - Voltage Line-to-Line and average
   - Voltage Line-to-Neutral and average
   - Frequency
   - Voltage THD
   - Current THD
   - Voltage and Current Waveform capture (**Optional**)

- Power factor (signed, to show leading or lagging current), per branch and average of all phases for multi-phase logical circuits.
- Ground leak detection

G. The power meter shall have the following device event alarming:
- User configurable low-low, low, high, and high-high alarm thresholds
- Over/Under Voltage
- Over/Under Current

H. The power meter shall be configurable to accommodate panelboard circuits numbered in series or in odd / even configurations and varying amperages (up to 6000 Amps).

I. The power meter must have onboard data logging capability.

J. The power meter shall be designed to utilize manufacturer supplied mounting plate to accommodate a variety of manufactures' wall panelboards, power distribution units (PDUs), or remote power panels (RPPs).

3.03 ***Busway Tap Monitoring System: (Optional)***

A. Where indicated on the drawing, provide a microprocessor-based monitoring system having the features and functions specified below.

B. The device shall provide direct reading metered or calculated values for up to one hundred ninety-two (192) branch circuits with auxiliary inputs available for one (1) three-phase main device and one (1) neutral.

C. Monitoring must support 1, 2 and 3 pole circuits with varying phase configurations and **4 Circuit** or **8 Circuit** current cards per tap box.

D. Supports CT sizes from 75 Amp to 6000 Amp with internal burdened resister and 250mVac signal. (No shorting blocks required)

E. The CT's shall be **[solid core] [split core]** type current transformers that have **[0.2%] [0.5] [1.0%]** accuracy with a max voltage of 600V. The CT's shall be accurate from 1 -100% of the range and be factory calibrated to ensure system accuracy.

F. The Plug-In Tap units shall preform the following measurements. Plug-in Tap Unit Monitoring must be serviceable without requiring the plug-in to be removed or powered down.
- Current per branch and sum of all phases
- Energy (kWh) per branch and sum of all phases
- Real power (kW) per branch and sum of all phases
- Apparent Power (kVA) per branch and sum of all phases
- Power Factor per branch and total (signed, to show leading or lagging current)
- Voltage Line-to-Line and average
- Voltage Line-to-Neutral and average
- Frequency
- Voltage THD

- Current THD
- Voltage and Current Waveform capture
- Power factor (signed, to show leading or lagging current), per branch and average of all phases for multi-phase logical circuits.
- Ground leak detection

G. The power meter shall have the following device event alarming:
- User configurable low-low, low, high, and high-high alarm thresholds.
- Over/Under Voltage
- Over/Under Current

H. The power meter shall be configurable to accommodate panelboard circuits numbered in series or in odd / even configurations and varying amperages (up to 6000 Amps).

I. The power meter must have onboard data logging capability.

J. The power meter shall be designed to utilize manufacturer supplied mounting plate to accommodate a variety of manufacturers to go on all types of busway products (both plug and tract busway systems)

3.04 ***LCD Display: (Optional)***

Available as options, the PQM shall contain following:

A. LCD Display:
- The power meter shall have the option of an integral graphical LCD display to display all measured values.
- The **[4.0”] [7.0”] [10.0”]** HMI color touch screen display shall be capable of supporting all of the display screens available.

3.05 ***Environmental: (Optional)***

Available as options, the PQM shall contain following:

A. The digital sensor collects and transmits real-time temperature, humidity and dew point data to protect critical data center equipment from heat and moisture.

B. The digital sensor instrument shall be capable of daisy chaining up to 15 devices to monitor up to 45 Temp and Humidity points within the server rack.

C. The unit may be daisy-chained with other digital sensor to form a sophisticated climate monitoring network with real-time data logging and alarming. This is especially useful when achieving in-row temperature monitoring for top, middle and bottom of each rack. The enclosure can easily be mounted anywhere in the data center with screws, magnets or adhesive.

D. **Sensor Details:**
- Temperature Range: -4 °F to 176 °F (-20 °C to 80 °C) +/-0.5 °C
- Humidity: 5% to 95%, +/-3%
- Dew point: -58 °F to 185 °F (-50 °C to 85 °C)

3.06 ***Customer Contact Board: (Optional)***

Available as options, the PQM shall contain following:

A. The power meter instrument shall be capable of having 2 Digital Inputs, 1 Analog Input, 1 Relay Output and 1 CT Input.
B. The customer contact board shall have 2 Ethernet Ports for input and output.
C. The customer contact board shall be capable of connecting up to 8 boards in series.

PART 4 EXECUTION

4.01 **PACKING AND SHIPPING:**

A. The Vendor shall prepare and package all equipment covered by this specification in such a manner as to protect it against damage in transit.
B. All equipment shall be stored under roof at all times except during periods of point-to- point transportation. All equipment shall be transported by enclosed truck.
C. The equipment shall be shipped Freight on Board Jobsite (FOB-Jobsite). The Contractor shall thoroughly inspect shipments for damage upon receipt at the site.

4.02 **FIELD QUALITY CONTROL:**

Installing Contractor Inspections:

A. Comply with manufacturer's written instructions.
B. Inspect interiors of enclosures, including the following:
   - Integrity of mechanical and electrical connections.
   - Component type and labeling verification.
   - Ratings of installed components.

4.03 **INSTALLATION:**

A. The Contractor shall provide labor for the mounting and installation of the new PQM module units plus all associated external wiring for power and controls. All rigging required for unloading and installation shall be the responsibility of the Owner/Contractor.
B. The equipment shall be installed following the Installation Procedures set forth by the Manufacturer. The Manufacturer shall assist the Contractor as required in interpreting the installation instructions. The Contractor shall certify to the Manufacturer and the Engineer that the installation has been performed per the Manufacturer's latest documents and instructions.
C. The Contractor shall install the units where shown on the drawings and insure that all required working clearances are maintained for this equipment and for other adjacent equipment.

4.04 ***On-Site Start-Up: (Optional)***

A. The manufacturer shall nationally employ service organizations of factory-trained field service personnel dedicated to the start-up, maintenance, and repair of the manufacturer’s power equipment.

B. The manufacturer shall maintain (24 hours per day, 365 days per year) an answering service to facilitate in providing technical support and emergency service dispatching.
C. Installation and start up shall include the following:
   - Verify all electrical connections for tightness as specified.
   - Review the field assembly and connection of components.
   - Inspect accessible components for cleanliness, for mechanical and electrical integrity, and for evidence of damage or deterioration.
   - Pretest and adjust all monitoring and/or control parameters as required.
   - Correct all deficiencies before proceeding with tests. Correct deficiencies identified by tests and retests.
   - Record circuit monitors set-ups.
   - Measure voltage and current of circuit's. Verify proper operation of equipment, including circuit monitor and input and output control circuits.

4.05 ***On-Site Training: (Optional)***

A. Concurrent with factory authorized system startup the manufacturer's field service engineer shall train the owner's operating personnel in the proper operation of the system. Training shall last a minimum of two hours and shall include:
   - Safety precautions
   - Features and construction of project equipment
   - Voltage adjustment procedures, if applicable
   - Routine inspection and test procedures
   - Routine cleaning
   - Interpretation of reading of warnings and alarms

END OF SPECIFICATION