

SECTION [26 27 13.23][16290]

TENANT SUB-METERING SYSTEM

EcoStruxure™ Power Monitoring Expert and Powerlogic™ Meters & Enclosures by Schneider Electric

Schneider Electric Editor's Note:

This guide specification is written in accordance with the Construction Specifications Institute (CSI) Master Format. This section must be carefully reviewed and edited by the architect or the engineer to meet the requirements of the project. Coordinate this section with other specification sections within the Contract Documents and Drawings.

To properly use / edit this document, show formatting and hidden text by selecting ¶ on the menu or by typing (Ctrl+*) simultaneously. Except for these introductory paragraphs, green hidden text will not print. Text in red is optional. Red text in [brackets] denotes multiple options where one or more should be chosen. All red text should be edited and changed to black for final project conformation. In addition, these introductory paragraphs should be deleted or changed to hidden text.

This specification may be used in whole or in part. It is intended that this document specify subcomponent products to be referenced by other specification sections or drawings for the furnishing of completed assemblies or systems. The Part 2 – Product subsections may also be copied into other specification sections in lieu of including this specification section in the Contract Documents.

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for tenant sub-metering systems (also identified as tenant metering or electric sub-metering) as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Related Sections: Related sections include, but shall not be limited to, the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
 - 2. Applicable general requirements for electrical Work specified within Division 26 Specification Sections apply to this Section.

1.2 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
 - 1. American National Standards Institute (ANSI):
 - a. ANSI C12.18, "Protocol Specification for ANSI Type 2 Optical Port."
 - b. ANSI C12.20, "Electricity Meters - 0.2 and 0.5 Accuracy Classes."
 - 2. American Water Works Association (AWWA):
 - a. AWWA C708, "Cold Water Meters - Multijet Type."
 - 3. Institute of Electrical and Electronics Engineers (IEEE)
 - a. ANSI/IEEE C37.90, "Relays and Relay Systems Associated with Electric Power Apparatus."
 - b. ANSI/IEEE C62.41, "Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits."
 - 4. International Organization for Standardization (ISO):
 - a. ISO 9000, "Quality Management Systems - Fundamentals and Vocabulary."

5. NSF International (NSF):
 - a. NSF 61, "Drinking Water System Components - Health Effects."
6. Underwriters Laboratories, Inc. (UL):
 - a. UL 61010, "Electrical Equipment for Measurement, Control, and Laboratory Use."
 - b. UL 61010-1, "Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements."

1.3 DEFINITIONS

- A. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common industry practice.

1.4 SUBMITTALS

- A. General: Submittals shall be in accordance with the requirements of Section [01 33 00][01300] Submittals and Section [26 00 00][16000] Electrical, in addition to those specified herein.
 1. Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.
 2. Deviations from the Contract Documents shall be indicated within the submittal. Each deviation shall reference the corresponding drawing or specification number, show the Contract Document requirement text and/or illustration, and shall be accompanied by a detailed written justification for the deviation.
 3. Product Data: Submit product data for each product and accessory furnished.
 - a. Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
 4. Shop Drawings: Submit shop drawings for each product and accessory furnished. Include information not fully detailed in manufacturer's standard product data.
 - a. Indicate electrical and mechanical characteristics and connection requirements. Tenant metering system components shall be installed by the power equipment manufacturer, the shop drawings shall clearly identify the components with the internal connections, and all contractor connections.
 - b. Wiring Diagrams: Submit wiring diagrams detailing power, signal, and control systems, clearly differentiating between manufacturer-installed wiring and field-installed wiring, and between components provided by the manufacturer and those provided by others.
- B. Operation & Maintenance (O&M) manuals shall be provided in accordance with the minimum requirements specified in Section [01 78 23][1780] Operation and Maintenance Data, Section [26 00 10][16000] Electrical Requirements and additional requirements specified herein.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.
 1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third-party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.

2. The manufacturer or their representative shall have service, repair, and technical support services available 24 hours 7 days a week basis.
 - a. Meter manufacturer shall maintain a full-time technical support group.
 - 1) Free telephone tech support center.
 - 2) Free tech support web site.
 - 3) Optional priority support.
 - b. Meter manufacturer shall maintain a full-time engineering services group.
 - 1) System integration capabilities.
 - 2) Energy usage consulting capabilities.
 - 3) Power quality consulting capabilities.
 - c. Meter manufacturer shall maintain a full-time customer training group.
- B. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing tenant sub-metering systems similar in type and scope to that required for this Project and shall be approved by the manufacturer.
- C. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Equipment, assemblies and materials shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.
- B. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.
- C. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

1.7 WARRANTY

- A. General: Refer to [\[Section 01 77 00 - Closeout Procedures\]](#) [\[Section 01770 - Closeout Procedures\]](#).
- B. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.8 SPECIAL TOOLS AND SPARE PARTS [- NOT USED]

- A. The Contractor shall provide a recommended spare parts list with the following information provided as a minimum:
 1. Contact information for the closest parts stocking location to the Owner.
 2. Critical spare parts shall be identified as those parts being associated with long lead times and/or those being critical to the unit's operation.

3. Maintenance spares shall be identified as being those parts required to regularly perform scheduled maintenance on the furnished equipment. These spares shall include, but shall not be limited to, consumable spares that are required to be exchanged during scheduled maintenance periods.
- B. Spare parts shall be provided for each type and size of unit installed. At a minimum, the following shall be provided:
1. Provide the minimum spare parts recommended by the manufacturer.
 2. Provide [1] set of each type of power and control fuse installed within equipment
- C. Any manufacturer specific special tool, not normally found in an electrician's toolbox, required to remove and install recommended or furnished spare parts shall be furnished. At a minimum the following shall be provided:
1. If available from manufacture, provide PC-based configuration software tool and a minimum of [one] communication interface cable for each type of cable required to connect a PC-based computer to the devices specified herein for configuration and programming.
 2. Electronic configuration files, in a media format acceptable by the Owner (e.g. CD, USB stick, etc.), updated to an as-installed and commissioned state.
- D. Spare parts shall be properly marked and packaged for long term storage. Printed circuit boards shall be provided in separate anti-static containers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. [Basis-of-Design Product: Subject to compliance with requirements, provide PowerLogic electric sub-metering by Schneider Electric.]
- B. Acceptable Products: Products specified herein shall be the product of a single manufacturer. Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date:

2.2 GENERAL REQUIREMENTS

- A. The system shall be designed to include remote devices for sub-metering, communication interface hardware, inter-communication wiring, personal computer workstation, software, printer, etc., where specified.
- B. The tenant metering system shall utilize Ethernet as the high-speed backbone network that shall support connection of computing equipment with the metering devices connected to the network.
- C. System shall include the software and which shall be configured specifically for the Project and be ready for operational use.
- D. Meters shall also have ± 1 percent overall system accuracy (including, but not limited to, instrument transformer accuracy) or better from 2 percent to 100 percent of rated load. Accuracy shall meet or exceed ANSI C12.20.
- E. The water meters shall conform to AWWA C708, and NSF 61 Certified.
- F. The gas meter shall be an indoor non-compensated meter four chamber synthetic diaphragm style.

- G. Tenant metering system components included within the power equipment lineups shall be factory installed, wired and tested prior to shipment to the job site.

2.3 MULTI METER UNIT (MMU) CABINET AND ENERGY METERS [- NOT USED]

- A. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: iEM3000 series meter and factory assembled MMU enclosure by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
- B. The MMU cabinet shall be a minimum NEMA Type 1 UL listed steel enclosure. The cabinet shall be lockable and shall provide for the application of a security seal.
- C. MMU cabinets shall be provided in configurations of up to 24 energy meters. Energy meters shall be readable external to the cabinet without opening a door.
- D. The MMU cabinet, energy meters, and communications devices shall be provided as a UL listed factory assembled enclosure.
- E. The MMU cabinet shall have a set of incoming terminals with fuses for connecting the voltage metering leads. Control and voltage sensing power shall be distributed to each meter from this main set of incoming terminals.
- F. The MMU cabinet shall have finger-safe terminals. Color coded and labeled wiring shall connect all meters to control and voltage sensing power.
- G. The MMU cabinet shall have terminal blocks for incoming and outgoing communication circuit connections in which energy meters are connected with common, single-loop daisy-chain communication wiring. Communication wiring shall be arranged in such a manner as to minimize interference from the power wiring.
- H. The MMU cabinet shall provide internal space for a gateway, data logger, and/or energy server with support for optional communications interfaces including, but not limited to, Ethernet.
- I. The energy meter shall be UL and cUL listed per UL 61010-1. The meter shall be rated for an operating temperature range of -13 degrees F (-25 degrees C) to 158 degrees F (70 degrees C) minimum.
- J. The energy meter shall directly accept both single-phase or three-phase voltage input up to and including 480 volts line-to-line.
- K. The energy meter current inputs shall support both x/0.333V and x/1.0V low-voltage current transformers (LVCT) or Rogowski coil type sensors. The current range of the energy meter shall be configurable and capable of monitoring circuits up to 5000 amperes.
- L. The energy meter shall be equipped with anti-tamper security features to ensure the integrity of all measurements and provide an additional safety barrier. The energy meter shall have password-protection to prevent tampering from the front panel.
- M. The energy meter shall be self-enclosed to prevent exposure to live parts and protect sensitive electronics if the enclosure cabinet is open. Meters shall snap-on and be easily removable for serviceability.
- N. The Energy Meter shall be designed to meet 0.5% accuracy for real energy and real power defined by ANSI C12.20 and IEC 62053-22. No annual recalibration shall be required to maintain accuracy.
- O. The energy meter shall provide an on-board RS-485 data port using Modbus (RTU) or BacNet MS/TP protocol to allow multipoint communications. The energy meter shall have removable connectors for communication wiring.

- P. The energy meter shall support up to 4 tariffs for the accumulation of real energy controlled by internal clock, digital input, or communications.
- Q. The energy meter shall provide one (1) digital input configurable for tariff control or WAGES input. The energy meter shall provide one (1) digital output configurable for kWh pulse or kW overload alarm.
- R. The energy meter shall provide the following measurements: Real energy (kWh) four-quadrant, Reactive energy (kVARh) four-quadrant, Active power (kW), Reactive power (kVAR), Current per phase (I), Voltage per phase (V), Power factor (PF), Frequency (F), Overload alarm, Hour counter. The values shall be read directly from the energy meter display without the need for multipliers.
- S. The energy meter shall provide the following capabilities for measurement of demand: – Fixed block or sliding block demand modes with selectable interval, providing measurement of total active, reactive, and apparent power demand (accessible through front panel or communications); Current demand per each phase, neutral, and average (available through communications); Peak demand for all demand parameters, maintained in non-volatile memory with date and time of peak since last reset accessible through front panel or communications; Demand parameters resettable from front panel and communications.

2.4 HIGH DENSITY METERING (HDM) CABINET AND POWER METERS [- NOT USED]

- A. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: PowerLogic PM5000 series meter and factory assembled HDM enclosure by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
- B. The HDM cabinet shall be a minimum UL Type 1 listed steel enclosure with factory supplied knock-outs.
- C. HDM cabinets shall be provided in multiple configurations to support one, four, and eight meters. Each HDM cabinet configuration shall support a full complement of meters or subset of meters with wiring where no meters are installed.
- D. The HDM cabinet shall be lockable and shall provide for the application of a security seal.
- E. The HDM cabinet shall be approved for Type 1 and Type 3R applications.
- F. The HDM cabinet shall have one set of incoming terminals for connecting the voltage metering leads.
- G. Control power and voltage sensing power shall be separated for distribution to each meter from this main set of incoming terminals.
- H. External control power transformers shall not be needed for any power systems up to and including 480 volts.
- I. Standard wiring harnesses for control power and voltage sensing shall be used to internally connect each power meter. The harness may daisy-chain the voltage connections from meter to meter on each row of meters. Finger safe terminals shall be used to terminate the meter end of the wiring harness.
- J. The power meters shall be connected with common daisy chain wiring for the communications leads. The communication wiring shall be a single loop with meters connected to the circuit and each end terminated in a common location. Communication wiring shall be arranged in such a manner as to minimize interference from the power wiring.
- K. The HDM cabinet shall have shorting terminal blocks for connecting the current transformer leads from the field to the power meters. Shorting terminal blocks shall only be provided for the number of meters ordered with each enclosure. A factory installed wiring harness shall be provided to connect the CT circuit from the shorting block to the meter.

- L. The HDM cabinet shall make provisions for adding power meters in the field without cutting or splicing the voltage or communication wiring harnesses.
- M. The HDM cabinet shall have shall have terminal blocks for incoming and outgoing communications circuit connections.

2.5 POWER METER – STANDARD [- NOT USED]

- A. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: PowerLogic PM5560 series meter by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
- B. Connections and form factor - direct connect to circuits up to 600 VAC, eliminating the need for voltage (potential) transformers; five (5) amperes (A) nominal current inputs. Removable connectors for voltage inputs, control power, communications, inputs and outputs; easily mountable in the pre-made cutout without tools; form factor shall be ¼ DIN with 92 X 92 cut-out and 96 x 96 panel mount integrated display.
- C. Supported monitoring parameters—full range of 3-phase voltage, measure each phase and neutral current using 4 current inputs, power and energy measurements, power factor, frequency, total harmonic distortion (THD), individual power harmonics (up to 63rd order).
- D. Accuracy standards - use four-quadrant metering and sample current/voltage simultaneously without gaps with 128 samples per cycle (zero blind); comply with ANSI C12.20 class 0.2 and IEC 61557-12 class 0.2 for revenue meters.
- E. Display - Backlit dot-matrix LCD display, anti-glare and scratch resistant with a minimum of 128 x128 pixels, capable of displaying four values in one screen simultaneously; a summary screen to allow the user to view a snapshot of the system; support either integrated or remote display.
- F. Support four (4) digital inputs for Demand Synch Pulse, Time Synch Input, and Conditional Energy Control; have two (2) digital outputs that operate either by user command sent over communication link, or in response to a user defined alarm or event.
- G. Communications - serial RS-485 Modbus, Ethernet Modbus TCP, and Ethernet BACnet IP (BTL listed); provide two Ethernet ports to allow wiring from meter to meter as a daisy-chain; be capable of serving data over the Ethernet network accessible through a standard web browser; the monitor shall contain default pages from the factory.
- H. Onboard data logging capabilities - to log data, alarms and events; logged information shall include data logs, minimum/maximum log files of selected parameter values, and alarm logs for each user defined alarm or event log; support the following on-board nonvolatile memory—14 parameters every 15 minutes for 90 days.
- I. Alarming capabilities - support 29 set-point driven alarms, four (4) digital alarms, (4) unary alarms, 10 Boolean alarms and five (5) custom alarms; user definable alarm events; set-point driven alarms shall be available for voltage/current parameters, input status, and end of interval status; shall send emails and/or text messages containing alarm condition indication via Simple Mail Transfer Protocol [SMTP]; Shall have the capability to manage and monitor devices on the IP network via Simple Network Management Protocol [SNMP]; Indication of an alarm condition shall be delivered by SNMP Traps.
- J. Firmware-upgradeable to enhance functionality through the Ethernet or serial communication connection and shall allow upgrades of individual meters or groups.
- K. Integrated gateway functionality, enabling the capability to connect via Ethernet to downstream, serially connected devices.

- L. Designed accordingly to eco-design complying with ISO 14062, especially MCCB materials shall be halogen free type; designed for easy disassembly and recycling at end of life, and comply with environmental directives ROHS and WEEE.
- M. The meter shall provide 4 digital inputs configurable for input metering with on-board pulse weight calculation and conversion to standard units for external water, air, gas, electrical or steam (WAGES) meters.

2.6 POWER METER – BASIC [- NOT USED]

- A. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: PowerLogic PM5110 series meter by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
- B. Connections and form factor - direct connect to circuits up to 600 VAC, eliminating the need for voltage (potential) transformers; five (5) amperes (A) nominal current inputs. Removable connectors for voltage inputs, control power, communications, inputs and outputs; easily mountable in the pre-made cutout without tools; form factor shall be ¼ DIN with 92 X 92 cut-out and 96 x 96 panel mount integrated display.
- C. Supported monitoring parameters—full range of 3-phase voltage, measure each phase using 3 current inputs, power and energy measurements, power factor, frequency, total harmonic distortion (THD), individual power harmonics (up to 15th order).
- D. Accuracy standards - use four-quadrant metering and sample current/voltage simultaneously without gaps with 64 samples per cycle (zero blind); comply with ANSI C12.20 class 0.5 and IEC 61557-12 class 0.5 for revenue meters.
- E. Display - Backlit dot-matrix LCD display, anti-glare and scratch resistant with a minimum of 128 x128 pixels, capable of displaying four values in one screen simultaneously; a summary screen to allow the user to view a snapshot of the system; support either integrated or remote display.
- F. One digital output providing kWh pulse.
- G. Communications - serial RS-485 Modbus.
- H. Onboard logging capability to log min/max data.
- I. Alarming capabilities - support 29 set-point driven alarms, (4) unary alarms shall be available for voltage/current parameters.
- J. Firmware-upgradeable to enhance functionality through the serial communication connection.
- K. Designed accordingly to eco-design complying with ISO 14062, especially MCCB materials shall be halogen free type; designed for easy disassembly and recycling at end of life, and comply with environmental directives ROHS and WEEE.
- L. The HDM cabinet shall support optional communications interfaces including, but not limited to, Ethernet.

2.7 MULTI CIRCUIT METERS [- NOT USED]

- A. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: PowerLogic EM4900 by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].

- B. The metering device used to monitor multiple circuits for purposes of energy cost management, energy allocation, and operational efficiency shall provide the following minimum features:
- C. The operating environment of the multi circuit meter shall meet or exceed the following environmental parameters: Operational Temperature: 0 to 60 °C (32 to 140 °F) (<95% RH non-condensing); Maximum Operational Altitude: 3000m (10,000 ft); Storage temperature: -40 to 70 °C (-40 to 158 °F)
- D. The multi circuit meter shall accommodate varied control power sources and system types:
- E. The multi circuit meter shall operate on a wide input power range of at least 100 to 277 Vac line-to-neutral, 50/60 Hz to allow for power fluctuation.
- F. The multi circuit meter shall support the following system wiring configurations: 120/240 V Delta High Leg; 3-Wire (Ungrounded) Delta; 4-Wire Wye; 3-Wire split-phase; and 2-wire single phase.
- G. The multi circuit meter shall provide a full set of measurements for a variety of applications:
- H. The multi circuit meter shall be configurable to accommodate varied measurement needs. It shall allow configuring individual measurement channels as 1ph, 2ph or 3ph circuits, or a mix thereof. The meter shall support on site configuration for re-assignment of the channels if circuits are modified during facility evolution.
- I. The multi circuit meter shall be available with different input densities to economically fit a variety of applications up to a maximum of 84 inputs or 28 three-phase meters. The multi-circuit meter shall have a minimal sample rate of 2560 Hz and a refresh rate per meter of no more than 1.8 seconds when configured for the maximum number of meters.
- J. The current inputs of the multi circuit meter shall accept low voltage current transformers (LVCTs), and shall support an ampacity range from at least 50A to 5,000A. Lead length of low voltage current transformers shall be up to 100 ft. (33 m). Current inputs shall utilize push pin terminals accepting wire leads of 26 to 16 AWG to simplify installation.
- K. The multi circuit meter shall provide the following real-time measurements: Current per phase, multi-phase average, and phase angle per branch; Real power (kW) per phase and multi-phase total; Apparent power (kVA) per phase and multi-phase total; Power factor per phase and multi-phase total.
- L. The multi circuit meter shall provide the following demand measurements: Current present demand per phase and multi-phase average; Real power (kW) present demand per phase and multi-phase average.
- M. The multi circuit meter shall provide the following historic maximums: Maximum instantaneous current per phase and multi-phase average; Maximum current demand per phase and multi-phase average; Maximum real power demand per phase and multi-phase average.
- N. The multi circuit meter shall provide accumulated energy (kWh) per phase and multi-phase average, and shall also provide energy snapshots (kWh) per phase and multi-phase average.
- O. The multi circuit meter shall provide total harmonic distortion (THD) measurements for every channel/meter, with measurements comprised of: THD % of line-to-line voltage, THD % of line-to-neutral voltage, and THD % of current.
- P. The multi circuit meter shall provide [Modbus RTU] [Modbus RTU/TCP, BACnet IP, SNMP V2] network communications protocols. Ethernet protocols shall be able to run concurrently to support multiple client systems.
- Q. The multi circuit meter shall provide 4 levels of onboard alarming with configurable thresholds: Low level to inform of a value below the expected range, High level to inform of a value above the expected

range, Low-Low level to inform of a value much below the expected range, and High-High level to inform of a value much higher than the expected range.

2.8 BILLING MULTI-CIRCUIT METERS [- NOT USED]

- A. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: PowerLogic EM4800 by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
- B. The meter shall be approved for revenue billing applications in California and New York.
- C. The metering device used to monitor branch circuits for energy cost allocation shall have at minimum the following features:
- D. The meter shall be tested to UL 61010 and certified under UL/cUL as well as TUV. The meter module shall be rated for an operating temperature range of -40 °F (-40 °C) to 158 °F (70 °C).
- E. The meter shall provide 24 current inputs that can be configured for 24 circuits of 1 CT, 12 circuits of 2 CTs, or 8 circuits of 3 CTs.
- F. The meter shall be calibrated as a system and be accurate to ±0.5 percent from 2 percent to 100 percent of the rated current over a temperature range of -40 °F (-40 °C) to 158 °F (70 °C) according to ANSI C12.20. No annual recalibration by users shall be required to maintain accuracy.
- G. The meter shall directly accept both single-phase or three-phase voltage input up to and including 208Y volts line-to-line. The Meter shall support voltage inputs of 277/480 volts and 347/600 volts with the use of voltage transformers.
- H. The meter shall be capable of monitoring circuits up to 5000 A and shall be user configurable.
- I. The meter shall have a local display that shall provide information from each metering point as well as diagnostic information. The display shall allow the user to navigate to information from individual metering points.
- J. Each meter shall have as standard a 10/100 Base 100TX Ethernet data port and a V.90 telephone modem utilizing Modbus TCP/IP, HTTP, FTP, and SNMP protocols.
- K. The information and capabilities provided by the meter shall include, but shall not be limited to, the following: Real energy (kWh), Reactive energy (kVARh), Apparent energy (kVAh), Real power (kW), Reactive power (kVAR), Apparent power (kVA), Power factor, Current per phase, Voltage per phase. The values shall be read directly from the meter display without the need for multipliers.
- L. The meter shall have the capability to push data using FTP on a user defined schedule ranging from 5 minutes to once per day.
- M. The meter shall server real-time data via Modbus TCP/IP protocol.
- N. The meter shall be remotely configurable via an Ethernet network.
- O. The meter shall log data on a user defined interval of 5 minutes to 60 minutes and store up to 2.4 years at 60-minute interval.
- P. The meter shall automatically synchronize its internal clock via the Ethernet network.
- Q. The meter shall include, but shall not be limited to, a web server and shall provide real-time data and meter status in a form accessible by a standard web browser.

- R. The meter shall support CTs with secondaries of 5 A, 80 mA, or 0.333 volts.
- S. The meter shall be suitable for mounting internal to an electrical switchboard or panelboard to facilitate accuracy of installation and reduce field wiring labor costs.
- T. Modular interface cables shall be provided for current inputs with each meter.
- U. The meter shall provide inputs capable of counting pulses from transducers or other meters.
- V. The meter shall provide a physical internal switch to secure meter configuration.
- W. The meter shall have a sealable internal cover provided to protect the meter security switch. The meter shall have an optical mechanism to detect if this cover is removed and shall have the ability to communicate this event to the user.
- X. The meter shall have a sealable outer cover to protect wiring connections.
- Y. The meter shall be provided with PC based configuration software. The configuration software shall be file based providing support for both online and offline configurations.

2.9 S-BASED SOCKET ELECTRIC METERS [- NOT USED]

- A. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: PowerLogic E5600 by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
- B. The meter shall be tested to IEC 62052-11, ANSI/IEEE C62.41, ANSI/IEEE C37.90, and shall provide 4 kV of isolation.
- C. The meter module shall be rated for an operating temperature range of -40 degrees F (-40 degrees C) to 185 degrees F (85 degrees C).
- D. The meter shall be calibrated as a system and be accurate to ± 0.2 percent from 0.05 to class of the rated current over a temperature range of -40 degrees F (-40 degrees C) to 185 degrees F (85 degrees C) according to ANSI C12.20. No annual recalibration by users shall be required to maintain these accuracies'.
- E. The meter shall provide a connecting mechanism compatible with utility standard S-base sockets and shall be capable of being plugged into the electrical circuit without additional user wiring.
- F. The meter shall be provided with internal 200 ampere CTs (self-contained) in meter forms 2S, 12S, and 16S (Class 200) or compatible with external CTs (transformer rated) in meter forms 9S, 36S, and 45S (Class 20).
- G. The meter shall directly accept both single-phase or three-phase voltage input up to and including 480 V line-to-line and shall provide four quadrant metering.
- H. The meter shall be auto ranging supporting voltages from 120 volts to 480 volts without user configuration.
- I. Each meter shall have as standard an RS-485 data port using Modbus (RTU) protocol to allow multipoint communication. The RS-485 communications shall provide communications links up to 10,000 feet (3048 m) in length.
- J. The meter shall provide visible indicators of serial communications including, but not limited to, transmit, receive, and status.

- K. The information and capabilities provided by the meter shall include, but shall not be limited to, the following: Real energy delivered (kWh), Real energy received (kWh), Reactive energy delivered (kVARh), Reactive energy received (kVARh), Apparent energy (kVAh), Real power (kW), Reactive power (kVAR), Apparent power (kVA), Power factor, Current, per phase, Voltage, per phase, Real power demand, Reactive power demand, Apparent power demand, Frequency, Meter diagnostics (including wiring errors), Voltage and current magnitudes and angles, Voltage and current magnitudes and angles. The values shall be read directly from the meter display without the need for multipliers.
- L. The meter shall log real and reactive energy and pulse inputs on a 15-minute interval basis in non-volatile memory for a minimum of 82 days.
- M. The meter shall have an infrared communications port that is compatible with ANSI C12 probes.
- N. The meter shall have two inputs capable of receiving pulses from transducers or other meters.
- O. The meter shall provide two KY pulse outputs.
- P. The meter shall have a polycarbonate cover.
- Q. The meter shall be provided with PC based configuration software. Configuration software shall support meter configuration through the meter's ANSI C12.18 infrared port and through the meter's RS485 Modbus interface.

2.10 WATER METERS [- NOT USED]

- A. Water meter shall be provided for each tenant location on the incoming cold water supply.
- B. The meter shall be positive displacement or water jet style meter, housed in bronze or polymer reinforced plastic.
- C. The meter shall conform to AWWA C708, and NSF 61 Certified.
- D. The meters shall range from 5/8 inch (16 mm) to 2 inches (51 mm).
- E. Registers shall be permanently sealed, dustproof and waterproof, with tamperproof features and incorporating six-wheel odometer totalizer.
- F. Registers shall be available in U.S. gallons, cubic feet, or cubic meters.
- G. Registers shall have an output contact for field interface to tenant metering system. The output contact shall correspond to one pulse per unit of register reading (U.S. gallon, cubic feet, or cubic meter). Contacts shall be rated 30 volts DC at minimum of 1 ma.
- H. Wireless metering systems can be utilized vs. hard contact totalizer, but shall be approved prior to installation. System shall utilize 902-928 MHz frequency band with spread spectrum frequency hopping radio technology.
- I. Tenant meter system provider shall provide and certify the water metering system.

2.11 GAS METERS [- NOT USED]

- A. Gas meter shall be provided for each tenant location on the incoming natural gas supply.
- B. The meter shall be synthetic diaphragm style with four measuring chambers. Operating range shall be from -4 degrees F (-20 degrees C) to 122 degrees F (50 degrees C).

- C. The gas meter shall be designed for indoor applications only. The meter shall be a non-compensated gas meter with cyclometer register.
- D. The register shall provide a reed output contact for interfacing to tenant metering system. Contacts shall be rated 12 volts DC at minimum of 10 mA.
- E. Maximum flow rate shall be 200 cfh (5.66 cmh) and minimum flow rate shall be 1.4 cfh (0.04 cmh), and maximum pressure shall be 5 psi (34 kPa).
- F. Tenant meter system provider shall provide and certify the gas metering system.

2.12 COMMUNICATIONS

A. ETHERNET GATEWAY [- NOT USED]

1. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: Link 150 (EGX150) by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
2. The Ethernet gateway shall utilize Modbus protocol and provide the ability to convert Modbus Serial protocol into Modbus TCP/IP. The Ethernet gateway shall offer complete access to status and measurement information provided by the connected devices via a connected software.
3. Safety - The gateway shall have IEC 60950, IEC 61010 Ed 3, and cULus 61010-2-201 safety certifications.
4. Operating environment - The gateway shall be able to operate in the -25°C to + 70°C temperature range. The gateway shall be rated IP20 & IP40 (front panel).
5. Power supply - The gateway shall be able to operate using 24 V DC (+20% /-10%) and Power Over Ethernet (POE Class3 IEEE 802.3 af) at 15 Watts.
6. Ethernet ports - The gateway shall have two Ethernet ports which can be used as a switch. The gateway shall be configurable as choice of DHCP/bootp client and Static IP address.
7. Modbus port - The gateway shall support RS232 and RS485 through RJ45 interface. The gateway shall support both 2-wire and 4-wire RS485 configurations.
8. Protocol support - The gateway shall support the following protocols over Ethernet: Modbus TCP/IP, HTTP, FTP, SNMP (MIB2), ARP. The gateway shall support the following protocols over serial: Modbus and Powerlogic.
9. Setup - Setup of the Gateway shall be accomplished via the on-board Ethernet port and a web browser. No software shall be required for configuration of the gateway that is not a standard component in off-the-shelf operating systems.
10. Web services - The gateway shall be equipped by DPWS (Device Profile for Web Services) technology (available on Windows operating systems starting with Vista) with discovery and identification web services.
11. User groups - The gateway shall provide administrators with the ability to create Users and assign Users to groups and restrict access to functionality based on User membership within these groups.
12. Passwords - Users shall have the ability to set their own passwords which follows Cybersecurity best practices. The password can contain letters, numbers and special characters.
13. Cybersecurity - The gateway shall provide Modbus TCP/IP filtering which specifies whether each master device shall have "read-only" or "full access" to connected serial slave devices. The gateway shall only accept signed firmware from the gateway provider.
14. Troubleshooting - The gateway shall have a power LED troubleshooting indicator to show inoperative mode and firmware updating issue.

B. ENERGY SERVER [-NOT USED]

1. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: Com'X 210 (EBX210) by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
2. The energy server appliance shall collect and log WAGES (water, air, gas, electricity, steam) data by connecting to meters, as well as environmental parameters, such as temperature, humidity, and CO2 levels, connected to its inputs and outputs. The appliance shall be capable of the following:
 3. Logging the historical data for up to one (1) month to its own local storage.
 4. Transmitting the data to a centralized server or cloud application.
 5. Communicating directly to compatible on premise software for gateway access to real-time or historical data used in dashboards, real-time screens, and reports.
6. Gateway Features.
7. The energy server shall have the ability to serve as a Modbus serial to Modbus TCP/IP gateway for connected software.
8. The energy server shall have the ability to serve as a gateway for connected input devices.
9. Appliance Operating Features—the appliance shall support the following minimum features:
 10. Environmental—operating temperature range -25°C to + 70°C; Humidity 5% to 95%.
 11. Power Supply—24 VDC (+/- 10%); Power over Ethernet (POE Class 3, IEEE 802.3 af) at 50 W.
 12. Internal Memory—internal memory for web pages used for setup and configuration.
 13. Connectivity—support for a maximum of 64 connected devices (serial port, Ethernet network via another Ethernet gateway or devices with embedded Modbus TCP) for real-time readings and data logging.
 14. Digital Inputs—minimum of six (6) IEC62053-31 Class A with LED indication for status and pulse reception. The digital input shall be supplied directly from the data logger (see power supply output section below) or from a 10 to 30 VDC external power supply. The maximum pulse frequency is 25 Hz.
 15. Analog Inputs—minimum two inputs supporting RTD probes (1% accuracy), 0-10 V sensors (0.5% accuracy), or 4-20 MA sensors (0.5% accuracy).
 16. Ethernet ports—two Ethernet ports, which can be used either as a switch or separated ports (one (1) IP address for each). Ethernet port shall be configurable as DHCP client or DHCP server.
 17. Serial port—configurable for RS232/485 with 2-wire and 4-wire support.
 18. Protocol—Ethernet—Modbus TCP/IP, HTTP, FTP, SNMP (MIB2), TCP, UDP, IP, ICMP, ARP; Serial—MODBUS.
 19. Troubleshooting—indicators to show failure mode and firmware updating; detection and reporting for device communication loss, CPU and memory overuse, weak GPRS signals.
 20. Power Output – one 12V DC (+/-10%) power supply available for pulse metering contact or status reading and one 24V DC (+/-10%) power supply available for sensors (analog inputs)
21. Communications Interface—the appliance shall support the following modes of communication depending on the specified ordering option:
 22. Wi-Fi—two modes, connection to LAN infrastructure as an access point without additional Wi-Fi infrastructure, shall be supported. The appliance shall support uploading logged data through the Wi-Fi connection to a centralized server.
 23. GPRS/3G—when equipped with the appropriate cellular contract and SIM card, the appliance shall support uploading logged data through a GPRS or 3G network to a centralized server. Management of the GPRS/3G telecom contract is the responsibility of the customer and is out of scope for this specification.
24. Direct Connect (Gateway) —connect directly to compatible on premise software as specified in the other sections of the specification.

25. ZigBee Pro – The data logger shall be compatible with a ZigBee Pro adapter to communicate wirelessly to various supported ZigBee devices.
26. Configuration and Setup—appliance configuration shall include the following capabilities:
27. On-board web pages for setup and configuration.
28. Equipped with DPWS (Device Profile for Web Services) technology (available on Windows operating systems starting with Vista) with two specific web services, discovery and identification.
29. Login secured with https: SSL protocol.
30. Configure data logging intervals of 5, 15, 30, or 60 minutes.
31. Configure different logging interval for each of six (6) device types—water, air, gas, electricity, steam, or environmental values.
32. Count and calculate accumulated on time for digital inputs.
33. Export logged data in CSV format.
34. Manage data export through proxy servers.
35. Ability to schedule data file export through email or FTP.
36. Ability to connect to a remote or digital service provider for M2M services.
37. Allow the user to create, edit, delete, download, and import custom device models.
38. Only accept signed firmware from the data logger provider
39. Allow users to set their own passwords which must contain letters, numbers and special characters and be stored encrypted.

C. Additional Network Media Options:

1. Ethernet shall be used where shown on the Drawings. Ethernet gateways shall be provided by the TMS vendor and installed by System Installer where specified. Ethernet network connections shall be established using industry standard Ethernet protocols such TCP/IP. Components shall work with existing Ethernet gateway, router, and hub technology. Use of Ethernet shall be transparent to TMS software and monitoring devices.
2. Fiber optics shall be installed where shown on the Drawings. Fiber optic modems and interface hardware shall be provided by the tenant metering system vendor and installed by System Installer where specified. Use of fiber optics shall be transparent to the tenant metering system software and monitoring devices.
3. Wireless Ethernet shall be installed where shown on the Drawings. Wireless Ethernet and interface hardware shall be provided by the TMS vendor and installed by System Installer where specified. Use of wireless Ethernet shall be transparent to the tenant metering system software and monitoring devices.

2.13 TENANT METERING SOFTWARE (TMS) [- NOT USED]

- A. Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date: EcoStruxure Power Monitoring Expert for Tenant Billing by Schneider Electric, [2nd manufacturer] or [3rd manufacturer].
- B. The Tenant Metering System (TMS) software shall include energy cost allocation and bill generation features designed for the following applications.
 1. Internal Cost Allocation
 2. Tenant Bill Generation
 3. Utility Bill Verification (Shadow Bill Generation)
- C. The TMS cost allocation and bill generation features shall include
 1. Reporting on energy costs for all energy sources - WAGES (Water, Air, Gas, Electrical and Steam)

2. Aggregating energy costs up to any point in the organizational hierarchy, such as areas, departments, cost centers, tenants etc.
 3. Configurable start and end dates for energy cost reporting.
 4. Calculated apportionment by creating virtual measurements allocating percentages of physical meters, for example, 20% (Meter 2) + 80% (Meter 3).
 5. Calculated net metering by creating summed or subtracted physical meters, for example, Meter 1 + Meter 2 – Meter 3.
 6. Common area allocation to allocate calculated values to various entities in the organization hierarchy
 7. Allocation of cost by standard time intervals, such as daily, weekly, monthly, yearly, or by specified time intervals like production shift
 8. Data integrity checks including warnings for data gaps or duplicates.
 9. Customization of energy cost reports to allow for custom logos and headers.
- D. The TMS shall include a rate engine with the following capabilities.
1. Pre-engineered rate files for common utility rate structures.
 2. Support for rate schedule configuration and business logic through configuration files (no programming)
 3. Support for common rate determinants including:
 4. Energy usage (kWh, kVARh, kVAh)
 5. Demand (kW, kVAR)
 6. Power factor penalties
 7. Co-incident demand
 8. Time of use rates (off-peak, on-peak, etc.)
 9. Seasonal rates (summer, winter, etc.)
 10. Daily charges
 11. Tiered or block energy rates (kWh)
 12. Taxes
 13. Dynamic rate formulas
 14. Web based interface for rate schedule editing.
- E. The TMS shall include the following user-configurable report templates to facilitate energy analysis.
1. Billing Report: Billing report for any entity in the hierarchy with
 2. configurable time-periods and rate structures
 3. Itemized entries with each item in the rate structure and associated costs clearly specified
 4. Billing Summary Report: Billing Report for multiple entities in the hierarchy with
 5. Energy costs per entity represented as a subtotal section
 6. Grand Total for all entities
 7. Multiple Billing Report: Billing Report for multiple entities in the hierarchy with
 8. Each individual entity represented as a distinct section
 9. Itemized entries with each item in the rate structure and associated costs clearly specified
- F. The TMS will support customizing the cost allocation reporting to different environments such as:
1. Industrial Environment:
 2. Energy cost while in operation versus shut down, by shift etc.
 3. Energy cost per unit of production.
 4. Building Environment:
 5. Energy cost while building occupied versus empty.

6. Energy cost per occupant.
 7. Data Centers:
 8. Energy cost by colocation tenant.
 9. Energy cost by PDU, rack etc.
 10. Provide above comparisons in graphical format such as bar and pie charts.
- G. The TMS shall have the capability of exporting energy cost data, along with pertinent metadata, to integrate with external billing systems. The export mechanisms must be flexible with
1. Support for common data file formats such as xml, csv and multiple files
 2. Support for XSLT transformations to customize format to match systems for billing, accounting, SAP, ERP etc.

PART 3 - EXECUTION

3.1 GENERAL

- A. In addition to the requirements specified herein, execution shall be in accordance with the requirements of Specification Section [26 00 10][16010] and Drawings.
- B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.
- C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
- D. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.
- E. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
- F. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.

3.2 INSTALLATION

- A. Pre-Installation Conference: Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, manufacturer's representatives, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect.
- B. Install tenant sub-metering systems in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
- C. Control power, CT, PT, RS485 and Ethernet data communications wire shall be field installed by System Installer.
- D. Wiring required to connect equipment lineups shall be installed by the System Installer.
- E. Contractor metering interconnection wiring requirements shall be clearly identified on the TMS network drawings, including, but not limited to, standard product data sheets and typical wiring diagrams.

3.3 DEMONSTRATION [- NOT USED]

- A. Provide the services of a factory-authorized service representative of the manufacturer to provide start-up service [and to demonstrate and train the Owner's personnel].
1. On-site start-up and training of the tenant metering system shall be included in the Work. Tenant metering system vendor shall include one-half day of on-site, hands-on orientation training for Owner personnel with the fully commissioned tenant metering system.
 2. Start-up shall include, but shall not be limited to, a complete working demonstration of the tenant metering system.
 3. Training shall include, but shall not be limited to, standard documentation and hands-on exercises for Owner's electrical operations personnel to become familiar with operation of the tenant metering system.
 4. The Work shall include a minimum of [] days start-up assistance to include [] trip(s).
 5. The power monitoring manufacturer shall provide a dedicated telephone technical help center for customers.

END OF SECTION [26 27 13.23][16290]