

SECTION 26 09 13 42 00
ELECTRICAL POWER MONITORING AND CONTROL

PART 1 - GENERAL

1.1 SCOPE

- A. This section defines low voltage power metering for use in AC systems. These low voltage power meters may be applied on systems rated 600V or less without PT's or on higher voltage systems with PT's.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. *[Related Sections include the following:*
1. *Section 26 09 26.03 – Lighting Control Devices*
 2. *Section 26 23 00 – Low Voltage Switchgear*
 3. *Section 26 24 13 – Switchboard*
 4. *Section 26 24 16 – Panelboards*
 5. *Section 26 24 19 – Motor Control Centers]*

1.3 SUBMITTALS

- A. Submit shop drawings and product data for approval and final documentation in the quantities listed according to the Conditions of the Contract. Customer name, customer location and customer order number shall identify all transmittals.
- B. *[Final Documents: Record documentation to include wiring diagrams, [certified test reports,] instruction and installation manuals.]*

1.4 RELATED STANDARDS

- A. Meet the following recognized standards for application in hardened environments:
1. Device must meet all international standards for Safety and Construction applicable to this type of device:
 - a. ANSI C12.20 and IEC60687 0.2S, 0.5% Revenue requirements
 - b. IEC 61557-12 (Class 0.5%) - Electrical safety in low voltage distribution systems. Equipment for testing, measuring or monitoring of protective measures - Part 12: Performance measuring and monitoring devices (PMD)
 - c. IEC61557-12 accuracy certified samples at over 2048 per 10/12 cycles samples per cycle or 170 samples/cycle.
 2. The meter shall also meet the followings standard compliances:
 - a. UL, CSA and CE Approvals:
 - 1.) UL 61010-1, 2nd Ed.
 - 2.) CAN/CSA-C22.2 NO. 61010-1-04, 2nd Ed.
 - 3.) CE approved.
 - 4.) Class 0.2 S acc. to IEC61557-12. (Correlates to IEC62053-22)
 - 5.) IEC 62053-23
 3. The meter shall meet the following Safety / Construction Standards:
 - a. IEC61010-1 (EN61010-1): Safety Requirements for Electrical Equipment, Control and Laboratory Use.
 - b. CAN/CSA C22.2 No. 61010-1-04, 2nd Ed.: Safety requirements of Canadian Standard Association.

1.5 QUALITY ASSURANCE.

- A. Manufacturer Qualifications: Manufacturer of this equipment shall have a minimum of 5 years experience producing similar electrical equipment.

1. Comply with requirements of latest revisions of applicable industry standards.
2. No recalibration shall be required.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations. If the meters are installed in equipment, store the equipment so condensation will not form on or in it. If necessary, apply temporary heat where required to obtain suitable service conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. *[The low voltage power meter shall be type SENTRON PAC4200 by Siemens Industry Inc. or pre-approved equal. Approved manufacturers are as follows:*
 1. *Siemens (EM PDS)*
 2. *.J*

2.2 COMPONENTS

- A. Revenue accurate multifunction power meter.
 1. Provide a high accuracy power meter meeting the requirements set forth in this specification. Note any exceptions taken with a detailed description.
 - a. Meter shall be Siemens Type SENTRON PAC4200 Power Meter with options and features described in this section.
 2. The meter shall have at least the following features:
 - a. Current inputs: The meter shall accept three 1A or 5A nominal current inputs. The current inputs are capable of measuring up to 5A RMS (300V RMS maximum voltage). All current inputs provide:
 - 1.) Dielectric withstand of 3000Vrms 47-63 Hz for 1 minute.
 - 2.) Surge protection of 120A RMS for 1 second, non-recurring.
 - b. The meter shall have three voltage inputs (V1, V2, and V3). The voltage inputs can measure from 0 to 400Vrms (line-to-neutral) or from 0 to 690Vrms (line-to-line).
 - c. The meter shall have provisions for direct connection (require no PTs) for Wye (Star) systems up to 400VAC (line-to-neutral) or 690VAC (line-to-line). All voltage inputs provide:
 - 1.) Dielectric withstand of 3250VAC RMS, 60 Hz for 1 minute.
 - 2.) Overload protection of 1500VAC RMS continuous.
 - d. Power supply:
 - 1.) *[95-240VAC ± 10% 50/60Hz/110-340VDC ± 10%]*
 - 2.) *[DC Model: 22-65VDC ±10% (power supply unit with extra-low voltage)]*
 - e. Typical burden is 6VA, maximum burden is 8VA. Dielectric withstand is 2000VAC RMS, 60Hz for 1 minute.
 - f. The meter shall provide for Ring Tongue or Screw terminals to meet various regulations.
 - g. Operating frequency: 45 to 64Hz.
 - h. Standard Communications port shall be a RJ45 Modbus TCP 10/100BaseT Copper Ethernet communication.
 - i. The meter shall have the ability to communicate with up to three different protocols at the same time allowing communications to multiple systems.
 - j. The metering instrument shall have the following communications ports:
 - 1.) *[Profibus DP*
 - a.) *Profibus DP will be programmable to communicate 9600 BPS to 12 MPBS with supplied .GSD file.]*
 - 2.) *[ProfiNet*

- a.) *ProfiNet will be programmable to communicate 10 /100 Mbit/s with supplied .GSD file.]*
- 3.) *[Modbus RTU (RS-485) serial*
 - a.) *Modbus will be programmable to communicate at speeds from 4800 to 38.4 bits per second]*
- 4.) *[Expanded I/O with four Digital In and two digital out - both wet contacts.]*
- 5.) *[Expansion module "I(N), I(Diff), analog expansion" possible to have a neutral current measurement, and 2 analog inputs.]*
- k. The meter shall support broadcast messages from three (3) master control systems at the same time.
- l. The meter shall have two additional expansion slots for add-on modules.
- m. The meter shall provide as "standard" the following Inputs/Outputs:
 - 1.) Two Dry Digital Input – rated at 24VDC / 0.7mA
 - 2.) Two Dry Digital Output – rated 12-24VDC, 0-10mA
- n. The meter shall have the following optional I/O module:
 - 1.) Expansion module with eight additional digital Inputs and four additional digital outputs.
- o. A universal counter shall be designed into the meter to count pulses coming into the digital inputs for measuring variables such as Water, Air, Gas, Electric and Steam.
- p. Sample Rate shall be at least 170 samples / cycle.
- q. Meter shall support multiple languages including English, German, French, Spanish, Italian, Portuguese, Turkish, Chinese and Russian.
- r. Meter design shall be:
 - 1.) A background-illuminated graphic LCD sized 128 x 96 pixel resolution.
 - 2.) High degree of protection IP65
 - 3.) An overview size of 3.78"L x 3.78"W (96 x 96mm) and 2.00"D (51mm), with an optional module added the depth shall be 2.87" (73mm).
- s. Basic meter design shall provide for (2) two expansion slots.

2.3 OVERVIEW

- A. The meter shall be able to be upgraded in the field without removing the meter.
- B. The meter shall measure the following variables as standard without optional plug in modules or optional cards:
 - 1. Basic Measurements
 - a. Voltage (I-n) per phase, Voltage (I-I) per phase, Voltage (I-I) average, Voltage (I-n) average, Current per phase, Current average total, Active Power (kW) per phase and total, Apparent Power (kVa) per phase and total, Reactive Power (kVAR) per phase and Total.
 - 2. Advanced Measurements (Included)
 - a. Power factor (per phase and total), Voltage THD per phase, Current THD per phase, Frequency, Total active power demand import/export, Meter running counter, Universal counter and Limit alarming for 6 values.
 - 3. Min/Max Values
 - a. Voltage (I-n) per phase, Voltage (I-I) per phase, Average Voltage (I-I) and (I-n) total, Current per phase, Active Power (kW) per phase and total, Apparent Power (kVa) per phase and total, Reactive Power (kVAR) per phase and total, Power factor (per phase and total), Voltage THD and individual up to 31st per phase, Current THD and individual up to 31st per phase and Frequency.
 - 4. Energy Measurements
 - a. Energy (kWh) import/export high/low tariff, Apparent energy (kVAh) high/low tariff, Reactive energy (kVARh) import/export high/low tariff peak power demand (kW), Current demand, Peak current demand, Neutral current, Reactive power (kVAR) peak demand and Apparent power (kVA) peak demand.

- C. The meter shall calculate the following information for any reading at 1-second intervals:
 1. Sliding window demands for any parameter with user-programmable length of demand period.
 2. Number of sub-periods to match local utility billing method.
- D. The meter shall display “actual” readings on the display. No manual calculation shall be required to obtain actual readings.
- E. The meter shall display all measured parameters on the front display.
- F. The meter shall have integrated web pages to display real-time data.
- G. Harmonic Bar Charts shall be available on the display up to 63rd harmonic.
- H. Meter shall have extensions to support IT security (signed firmware, penalty time, new IP filter, configurable IP Ports)
- I. Meter shall have HW write protection settable via local HMI
- J. Meter shall have DHCP Client
- K. Meter shall allow parameterizable default screen
- L. The meter shall have calculation of average values for current, voltage, power for two intervals (e.g. 10 secs, 15 mins.)
- M. Phasor Diagram shall be available on the display to provide fast system diagnostics.
- N. Alarm display shall be available showing up to 12 alarm status
- O. Custom logic display (AND / OR / XOR) shall be available to display and design custom I/O programming in meter.
- P. Remote access to all metering parameters shall be available through the Ethernet communications port and Serial port at the same time.
- Q. Meter shall provide as standard the ability to customize up to four screens.
- R. Meter shall have SNTP GPS time synchronization.
- S. The meter shall act as a “Gateway” allowing up to 31 Modbus serial to be connected to the meter and the data passed to the Ethernet LAN.
- T. An internal clock shall be provided to allow time and date stamping of data.
- U. The meter shall have the ability to monitor as least twelve (12) different set points for alarming. These include: V, I, Power, VAR, VA, Freq, THD and PF. Limit value monitoring.
- V. Standard logic functionality shall be available in the meter for setting up custom alarms that can be sent out via the digital output or through the communications port.
- W. The meters shall be field programmable as follows:
 1. Basic parameters: Voltage input scale, voltage mode (Wye, Delta, single phase), current input scale, auxiliary input and output scales, and communications setup parameters are programmable from the front panel.
 2. All basic parameters described above may be programmed via the communications port using a portable or remotely located computer terminal.
 3. Provisions must be made to ensure that programming through a computer can be secured by user ID and password.
 4. Provisions must be made to ensure that programming through the front panel is secured by password.
- X. The meter shall include flash memory to store in non-volatile memory the following:
 1. All setup data
 2. Accumulated energy, demand data, all data logs and alarm logs.

- Y. The meter shall include data and event logging, as follows:
 - 1. Kw, kWd, Min/Max values for up to 40 days at 15 min intervals.
 - 2. Event logging for up to 4096 operations.
 - 3. Logs shall be first in first out or fixed.
 - 4. Date and time synchronization shall be through the digital input, communication interfaces or internal clock.
 - Z. Storage of load demand values
 - 1. Meter shall have storage capacity of up to 4096 operation, control or system events
 - 2. Power demand values (load profile) for apparent, active and reactive power for 4 months with minimum & maximum values at a 15min. measuring period
 - 3. Total reactive power, fundamental reactive power or distorted reactive power, selectable
 - 4. Arithmetic or cumulated power demand values could be calculated
 - 5. Synchronization via digital input, communication interfaces or internal clock
 - 6. Supports fixed or rolling block method.
- 2.4 DESIGN **[Select either 2.4.A.1 or 2.4.A.4. For 2.4.A.4, select a, b, c, d, e, f or g]**
- A. The SENTRON PAC4200 meter shall be available in the following unit design configurations:
 - 1. ***[One-piece design that fits into a 96mm x 96mm cutout.]***
 - 2. ***Din Rail Mountable Version***
 - 3. ***Watt-hour draw out configuration for retrofit locations***
 - 4. ***[Multi Meter Pack Enclosure (NEMA 1) with the following sizes:***
 - a. ***[One meter]***
 - b. ***[Up to Two meters]***
 - c. ***[Up to Four meters]***
 - d. ***[Up to Six meters]***
 - e. ***[Up to Eight meters]***
 - f. ***[Up to Ten meters]***
 - g. ***[Up to Twelve meters]***

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall furnish, install and terminate 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. Additional connections to metering systems, where applicable, shall be done in the field by ***[the manufacturer's start-up service group] [the installing contractor].***

3.2 ADJUSTING AND CLEANING

- A. The meters shall be adjusted so that accurate readings appear on the front of the meter and that the readings are within the meter's accuracy range.
- B. Clean exposed surfaces using manufacturer recommended materials and methods.

3.3 TESTING

- A. Perform factory and installation tests in accordance with applicable NEC, NEMA and UL requirements.

3.4 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.

3.5 ***[STARTUP SERVICES***

- A. ***[Engage a factory-authorized service representative to perform startup service.***
- B. ***Train Owner's maintenance personnel on procedures and schedules for energizing and de-energizing, troubleshooting, servicing and maintaining equipment and schedules.***
- C. ***Verify that the [meter is] [meters are] installed and connected according to the Contract Documents.***
- D. ***Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 26 Sections.***
- E. ***Complete installation and startup checks according to manufacturer's written instructions.]***

3.6 SUPPORT

- A. The electrical equipment manufacturer shall provide a 24x7, 1-800 number for telephone support.
- B. PMCS Vendor shall provide training at a dedicated training facility within their Power Monitoring Headquarters, complete with software, devices and demonstrations.
- C. The PMCS vendor shall also provide on-line support for technical information and literature.

END OF SECTION