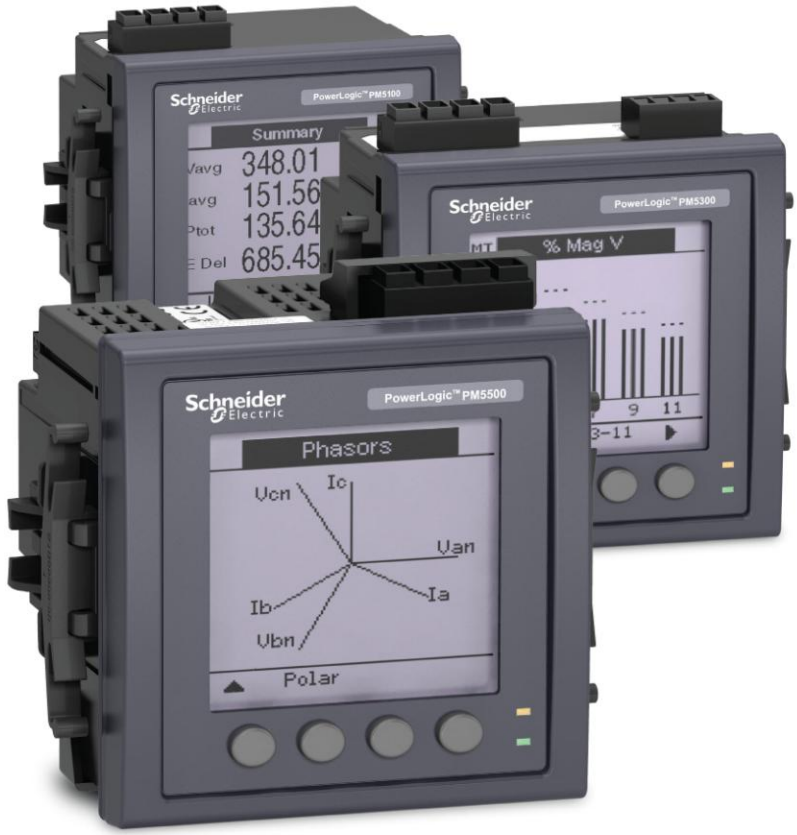
PowerLogic PM5000 series



Industry Buildings

Schneider Electric

Specification for PowerLogic PM5000 Series Meter

PM5000 series meters are 3-phase AC power meters specifically designed for energy costg management applications.

February 2013

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1. General

1.1. Scope

Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for power meter devices in energy cost management applications as required for the complete performance of the work, and as shown on the drawings and as herein specified.

1.2. Applicable products

The present specification applies to power meter devices from 110V to 690V direct connect or up to 1MV with potential transformers in different system configurations from single phase to three phase AC (50/60Hz).

The following types of power meters shall be included as part of this project and identified on the single-line drawings with the designations listed below:

- (B1) – Basic level 1 monitoring with the features to include energy, demand, power, harmonics, 3 current transformer inputs and real time battery backed clock.
- (B2) – Basic level 2 monitoring with the features to include B1 plus serial or Ethernet communication, 4-rate multi-tariff, 31st Individual harmonics, 2 digital inputs, 2 digital outputs, 2 relay outputs and total of 40 alarms events.
- (B3) – Basic level 3 monitoring with the features to include B2 plus serial and dual Ethernet communication, 8-rate multi tariff, up to 63rd Individual harmonics, 4 digital inputs, 2 solid state outputs, 52 alarms events, 4 current transformer inputs and on-board logging memory.

2. References

2.1. Scope

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.

2.2. American National Standards Institute (ANSI)

2.2.1. ANSI C12.20, "Electricity Meters - 0.2 and 0.5 Accuracy Classes”

2.3. European Standards (EN)

2.3.1. EN 50470-1, “Electricity Metering Equipment (A.C.); General Requirements, Tests and Test Conditions; Metering Equipment (Class Indexes A, B, and C)”

2.3.2. EN 55011, “Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific, and Medical Equipment”

2.4. Federal Communications Commission (FCC)

2.4.1. FCC 47 CFR Part 15, "Radio Frequency Devices"

2.5. International Electrotechnical Commission (IEC)

2.5.1. IEC 61000-3-2, "Electromagnetic Compatibility (EMC) - Part 3-2: Limits - Limits for Harmonic Current Emissions (Equipment Input Current ≤16 A Per Phase)"

2.5.2. IEC 61000-3-3, "Electromagnetic Compatibility (EMC) - Part 3-3: Limits - Limitation of Voltage Changes, Voltage Fluctuations and Flicker in Public Low-Voltage Supply Systems, for Equipment with Rated Current ≤16 A Per Phase and not Subject to Conditional Connection"

2.5.3. IEC 61000-4-2, "Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques; Electrostatic Discharge Immunity Test"

2.5.4. IEC 61000-4-3, "Electromagnetic Compatibility (EMC) - Part 4-3: Testing and Measurement Techniques; Radiated, Radio Frequency, Electromagnetic Field Immunity Test"

2.5.5. IEC 61000-4-4, "Electromagnetic Compatibility (EMC) - Part 4-4: Testing and Measurement Techniques; Electrical Fast Transient/Burst Immunity Test"

2.5.6. IEC 61000-4-5, "Electromagnetic Compatibility (EMC) - Part 4-5: Testing and Measurement Techniques; Surge Immunity Test"

2.5.7. IEC 61000-4-6, "Electromagnetic Compatibility (EMC) - Part 4-6: Testing and Measurement Techniques; Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields"

2.5.8. IEC 61000-4-8, "Electromagnetic Compatibility (EMC) - Part 4-8: Testing and Measurement Techniques - Power Frequency Magnetic Field Immunity Test"

2.5.9. IEC 61000-4-11, "Electromagnetic Compatibility (EMC) - Part 4-11: Testing and Measurement Techniques - Voltage Dips, Short Interruptions, and Voltage Variations Immunity Tests"

2.5.10. IEC 61010-1, "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements"

2.5.11. IEC 61557-12, "Electrical Safety in Low Voltage Distribution Systems up to 1000 V AC. and 1500 V DC - Equipment for Testing, Measuring, or Monitoring of Protective Measures - Part 12: Performance Measuring and Monitoring Devices (PMD)"

2.5.12. IEC 62052-11, "Electricity Metering Equipment (AC) - General Requirements, Tests and Test Conditions - Part 11: Metering Equipment"

2.5.13. IEC 62053-22, “Electricity Metering Equipment (AC) - Particular Requirements - Part 22: Static Meters for Active Energy (Classes 0,2 S and 0,5 S)”

2.5.14. IEC 62053-23, “Electricity Metering Equipment (AC) - Particular Requirements - Part 24: Static Meters for Reactive Energy (Classes 0,5 and 1)”

2.6. International Organization for Standardization (ISO)

2.6.1. ISO 9001, "Quality Management Systems - Requirements"

2.6.2. ISO 14001, “Environmental Management Systems - Requirements with Guidance for Use”

2.6.3. ISO 14062, “Environmental Management - Integrating Environmental Aspects into Product Design and Development”

2.7. International Organization for Standardization (ISO)

2.7.1. UL 61010-1, “Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements”

3. Submittals

3.1. General: Submit the following in accordance with conditions of the contract and Division 01 - General Requirements.

3.2. Product data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the drawings and specifications.

3.3. Shop drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer’s standard product data.

3.4. 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.

3.5. Operation and maintenance data: Submit operation and maintenance data for power meter devices in energy cost management applications to include in operation and maintenance manuals specified in Division 01 - General Requirements.

4. Quality assurance

4.1. Qualifications:

4.1.1. Manufacturer qualifications: Manufacturer shall be a firm engaged in the manufacture of power meter devices in energy cost management applications of types and sizes

required, and whose products have been in satisfactory use in similar service for a minimum of five years.

4.1.2. Production site organization shall be non-polluting and certified to comply with ISO 9001 and ISO 14001 standards.

4.1.3. Power meter shall be designed according to eco-design complying with ISO 14062, materials shall be halogen free.

4.1.4. Power meter shall be designed for easy disassembly and recycling at end of life, and complies with environmental directives RoHS (Restriction of Hazardous Substances) and WEEE (Wate Electrical and Electronic Equipment Directive).

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

4.1.6. Installer qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing power meter devices in energy cost management applications similar in type and scope to that required for this project and shall be approved by the manufacturer.

4.2. Regulatory requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of federal, state, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

4.3. 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.

4.4. Single source responsibility: Obtain power meter devices in energy cost management applications and required accessories from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work. Any materials which are not produced by the manufacturer shall be acceptable to and approved by the manufacturer.

5. Delivery, storage and handling

5.1. 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 lot number, if any.

5.2. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

6. Power meter devices in energy cost management applications

6.1. Manufacturers

The power meter device shall be a “PM5xxx series, three phase AC power meter” manufactured by Schneider Electric or equivalent.

6.2. Compliance with standards

Power meters shall be compliant with the standards listed below:

6.2.1. Accuracy

Standard	Title	Usage
IEC 62053-22	Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)	
IEC 62053-23	Part 24: Static meters for reactive energy (classes 0,5 S, 1S and 1)	IEC 62053-24 not yet released at the time of development.
ANSI C12.20	Active energy accuracy	Tests 2 – 9, 11, 13, 14

6.2.2. Electromagnetic compatibility

Standard	Title	Usage
IEC 61000-4-2	Electrostatic discharge	
IEC 61000-4-3	Immunity to radiated fields 80 MHz to 2 GHz current of in applied	
	Immunity to radiated fields 80 MHz to 2 GHz currents open circuit	
	Immunity to radiated fields 2 GHz to 2.7 GHz currents open circuit	
IEC 61000-4-4	Immunity to fast transients voltage and current inputs	
	Immunity to fast transients aux. circuits >40V	
IEC 61000-4-5	Immunity to impulse waves DM: voltage/current/power supply Level 4 DM: aux. circuits>40V level 2 CM: Power supply line and neutral level 3	

IEC 61000-4-6	Conducted immunity 150kHz to 80MHz – Level 3	
IEC 61000-4-8	Immunity to magnetic fields – Level 4	
IEC 61000-4-11	Immunity to voltage dips – class 1	
FCC part 15, EN 55011	Radiated emissions & conducted emissions class B	

6.2.3. Safety

Standard	Title	Usage
IEC 61010-1 Ed. 3 & IEC 62052-11		CE marking
UL61010-1 (3rd edition)		cULus, UL marking
Overvoltage category		CAT III up to 400V L-N / 690V L-L nominal per IEC 61010-1 CAT III up to 347V L-N / 600V L-L nominal per UL 61010-1

6.3. **Power meter design**

6.3.1. General provisions & common features

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

The power meter may be applied in single phase, three-phase, three- or four-wire systems in WYE or Delta mode.

The power meter shall be capable of being applied without modification at nominal frequencies of 50 or 60Hz.

The power meter shall have a real-time clock with battery back-up with at least 1 year ride-through time without external power.

6.3.2. Mechanical

The power meter unit shall have removable connectors for voltage inputs, control power, communications, input and outputs.

The power meter unit shall be easily mounted in the pre-made cut-out without tools.

Power meter form factor shall be ¼ DIN with 92 x 92 mm (3.622” x 3.622”) cut-out and 96 x 96 mm (3.78” x 3.78”) panel mount integrated display.

6.3.3. Sampling and harmonic resolution

The current and voltage signals shall be digitally sampled at a rate high enough to provide true rms accuracy to the 31st harmonic (fundamental of 50/ 60 Hz). The power meter shall provide continuous sampling at a minimum of up to 64 samples/cycle, simultaneously on all voltage and current channels in the meter.

The current and voltage signals shall be digitally sampled at a rate high enough to provide true rms accuracy to the 63rd harmonic (fundamental of 60 Hz). The circuit monitor shall provide continuous sampling at a minimum of up to 128 samples/cycle, simultaneously on all voltage and current channels in the meter. ☐ B3

6.3.4. Current inputs

0-10 amps with 5 amps nominal input from CT secondary.

The power meter may be applied in three-phase, three- or four-wire systems.

Residual current shall be calculated by vectorial addition of the phase currents.

A fourth CT input shall be available to measure neutral or ground current. ☐ B3

6.3.5. Voltage inputs

Nominal of 400 V L-N / 690 V L-L.

Maximum of 480 V L-N / 828 V L-L.

6.3.6. Control power (device)

The monitoring device control power shall be:

- 100-415 VAC L-N ±10% or 125-250 ± 20% VDC
- 110-480 ±10%, VAC or 125-250 ± 20% VDC ☐ B3**Environmental characteristics**

- Operating temperature range for meter: -25 to 70 °C (-13 to 158 °F)
- Operating temperature range for display: -20 to 70 °C (-4 to 158 °F)

6.3.8. Accuracy

The power meter unit shall use four-quadrant metering The power meter shall sample current and voltage simultaneously without gaps with 64 samples per cycle (zero blind).

The power meter device shall comply with ANSI C12.20 Class 0.5 and IEC 61557-12 Class 0.5 for revenue meters.

IEC 61557-12 Class 0.2 for revenue meters ☐ B3.

Accuracy for active energy of the power meter shall be class 0.5S as per IEC 62053-22.

Class 0.2 as per IEC 62053-22 for revenue meters ☐ B3.

Accuracy for reactive energy of the power meter shall be class 1 as per IEC 62053-24 (reactive energy).

The power meter shall be compliant to EN50470-1 (MID).

No annual calibration shall be required to maintain this accuracy.

6.3.9. Inputs/outputs

The power meter shall support 2 digital inputs for demand interval synch pulse, time synch input, conditional energy control, and 2 mechanical relay outputs. ☐ B2

The power meter shall support 4 digital inputs for demand interval synch pulse, time synch input, conditional energy control, and 2 solid state outputs. ☐ B3

6.3.10. Output relay control

Relay outputs shall operate either by user command sent over the communication link, or in response to a user-defined alarm or event. The output relays will have normally-open and normally-closed contacts and can be configured to operate in several modes: normal contact closure, latched mode, timed mode, end of power demand interval and energy pulse output.

6.3.11. Energy quantities

Cumulative quantities for real, reactive and apparent energies shall be stored in non-volatile memory.

The power meter shall allow the user to pre-set the energy quantity at any value within the register range via communications, to match a unit being replaced in the field.

The power meter shall provide the user the ability to reset the cumulative energy quantities from the display of the unit or via communications.

6.3.12. Logging

The power meter shall provide for onboard data logging. Each power meter shall be able to log data, alarms and events, and waveforms (if applicable). Logged information to be stored in each power meter include the following: data logs, min/max log files of selected parameter values, alarm logs for each user-defined alarm or event and waveform log. The meters shall offer the following on-board nonvolatile memory: 1.MB ☐ B3.

The power meter shall have onboard memory big enough to log 14 values every 15 minutes for 90 days ☐ B2 or 2 values for 60 days ☐ B3.

6.3.13. Alarming

Alarm events shall be user-definable.

Setpoint-driven alarm events shall be available for voltage/current parameters, input status, and end of interval status. For each over/under metered value alarm, the user shall be able to define a pick-up, drop-out, and delay.

The power meter shall have a minimum of 28 setpoint-driven alarms, or 29 setpoint-driven alarms, 4 digital alarms, 4 unary alarms, 10 boolean alarms and 5 custom alarms ☐ B3

There shall be four alarm severity levels in order to make it easier for the user to respond to the most important events first.

Historical alarms shall have a time-stamping with 1-second accuracy. The meter's real-time clock shall be able to synchronize using communications command.

Indication of an alarm condition shall be given on the front panel.

6.3.14. Communications

The power meter shall communicate via serial RS-485 Modbus or Jbus protocol.

The power meter shall provide Ethernet communications using Modbus TCP at 10/100Mbaud using UTP. ☐ B2

The power meter shall provide two Ethernet ports to allow wiring from meter to meter as a daisy-chain. ☐ B3

The power meter shall have the capability to serve data over the Ethernet network accessible through a standard web browser. The monitor shall contain default pages from the factory. The power meter shall push logging information through the Ethernet communication port. ☐ B3

6.3.15. Display

The power meter display shall be backlit dot-matrix LCD for easy viewing. Display shall also be anti-glare and scratch resistant with a minimum of 128x128 pixels (PM device).

The power meter display shall be capable of allowing the user to view four values on one screen at the same time. A summary screen shall also be available to allow the user to view a snapshot of the system (PM device).

The power meter display shall allow the user to select a date/time format.

The power meter display shall allow configuration for IEC or IEEE visualization of quantities (CM device).

The power meter display shall allow the user to change the language between English, Spanish, French, Portuguese, Italian, German, Chinese or Russian (CM device).

6.3.16. Firmware Upgrade

It shall be possible to field-upgrade the firmware in the power meters to enhance functionality. These firmware upgrades shall be done through the Ethernet or serial communication connection and shall allow upgrades of individual meters or groups.

6.4. **Measured values**

The power meters shall provide the following, true RMS metered quantities. In addition, the power meters shall record and save in nonvolatile memory the minimum and maximum values of all listed values since last reset. The power meters shall also record and save in nonvolatile memory the interval minimum, maximum, and average of any of the values pre-defined over a user specified interval.

6.5. **Real-time readings**

- Current (per-phase, 3-phase avg, % unbalanced)
- Neutral and ground (4 CTs) ☐ B3
- Voltage (L–L per-phase, L-L 3-phase avg, L–N per-phase, 3-phase avg, % unbalanced)
- Real power (per-phase, 3-phase total)
- Reactive power (per-phase, 3-phase total)
- Apparent power (per-phase, 3-phase total)
- Power factor (true/displacement)(per-phase, 3-phase total)
- Frequency
- THD, thd, TDD (current and voltage), neutral & ground current THD in ☐ B3
- Individual harmonics up to the order of 15th ☐ B1, 31st in ☐ B2 & 63rd in ☐ B3
- Temperature (internal ambient) ☐ B3
- K-factor (per-phase) ☐ B3
- Crest factor (per-phase) ☐ B3

6.6. **Energy readings**

- Accumulated energy (real kWh, reactive kVARh, apparent kVAh) (signed/absolute)
- Active energy delivered for 4 independent rates in ☐ B2, for 8 independent rates in ☐ B3
- Reactive energy delivered for 4 independent rates in ☐ B2, for 8 independent rates in ☐ B3
- Energy / total consumption for up to 4 water, air, gas, electrical or steam (WAGES) for external meters metering channels for 8 rates (32 buckets) in ☐ B3

6.7. **Demand readings**

- Demand current calculations (per-phase, 3-phase avg, neutral)- present and peak

6.8. **Demand calculations (3-phase total)**

- Real power
- Reactive power
- Apparent power

6.9. **Power demand calculation methods**

All power demand calculations shall use any one of the following calculation methods, selectable by the user:

- Thermal demand using a sliding window technique.
- Block interval, with optional sub-intervals. Block methods available are sliding, fixed and rolling.
- Demand can be calculated using a synchronization signal:
- Demand can be synchronized to an input pulse from an external source.
- Demand can be synchronized to a communication signal.
- Demand can be synchronized to the clock in the power meter

6.10. **Power analysis values**

- THD, thd – voltage, current (3-phase, per-phase, neutral & ground current ☐ B3)
- Power factor (per-phase, 3-phase)
- Displacement power factor (per-phase, 3-phase)
- Fundamental voltage, magnitude and angle (per-phase)
- Fundamental currents, magnitude and angle (per-phase)
- Fundamental real power (per-phase, 3-phase)
- Fundamental reactive power (per-phase)

- Harmonic power (per-phase, 3-phase)
- Phase rotation ☐ B3
- Unbalance (current and voltage)
- Harmonic magnitudes & angles ☐ B3 (per-phase)
- Total demand distortion factor (TDD)

7. Execution

7.1. **Examination**

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 architect, 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.

7.1.1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the installer.

7.2. **Installation**

Install power meter devices in energy cost management applications in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the drawings.

7.3. **Demonstration**

7.3.1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

7.3.2. Train the owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.

7.3.3. Review data in operation and maintenance manuals with the owner's personnel.

7.3.4. Schedule training with the owner, through the architect, with at least seven days' advanced notice.