**GENERIC SPECIFICATION FOR TRANSIENT RECORDER AND POWER METER WITH ADVANCED**

**POWER QUALITY AND COMMUNICATION**

**GE EPM9900 Meter**

2. PRODUCT

## 2.1 MANUFACTURER

## General Electric Company products have been used as the basis for design. Other manufactures’ products of equivalent quality and operating features may be acceptable, at the engineer’s discretion, if they comply with all requirements specified or indicated in these Contract documents.

* 1. Power Meter

1. The meter shall be UL listed and CE marked.
2. The meter shall be designed for multifunction electrical measurement on 3 phase power systems.
3. The meter shall support 3-element Wye, 2.5 element Wye, 2 element Delta, and

4-wire Delta systems.

1. The meter’s surge withstand shall conform to IEEE C37.90.1 and ANSI C62.41 (6kV).
2. The meter shall be user programmable for voltage range to any CT or PT ratio.
3. The meter shall have a voltage burden of not more than 0.072VA per phase Max at 600V, and 0.003VA per phase Max at 120 Volts.
4. The meter shall have a current inputs burden of not more than 0.008VA per phase Max at 20 Amps.
5. The meter shall accept a voltage input range of (5 to 347) VAC Line to Neutral, and a range of (10 to 600)VAC Line to Line.
6. The meter shall accept a current reading of up to 20 Amps continuous. Start up current for a 5 Amp input shall be no greater than 0.005 Amps.
7. The meter shall have a frequency range of (45 to 69.9)Hz.

1. The power meter shall use a dual input method for current inputs. Method one shall allow the CT to pass directly through the meter without any physical termination on the meter, ensuring the meter cannot be a point of failure on the CT circuit. The second method shall provide additional termination pass-through bars that allow the CT leads to be terminated on the meter.
2. The Fault Current Withstand shall be 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second at 23o C.
3. The Pass-through wire gauge dimension of 0.177” / 4.5 mm shall be available.
4. All inputs and outputs shall be isolated to 2500 Volts AC.
5. The power meter shall measure and report the following quantities at a minimum:
6. Watts (total and per phase), VARs (total and per phase), VA (total and per phase), Power Factor (total and per phase), voltage max/min in the Interval, and Frequency. 100 millisecond and one second readings shall be available simultaneously. Readings shall be available for both metering and control. All specified readings shall be made available through the meter’s standard and optional communication ports.
7. Accumulated Watt-hr, VA-hr, and VAR-hr; Watt-hr received; Watt-hr delivered; VAR-hr and VA-hr reading shall be accumulated and stored for each of the 4 quadrants of power.
8. Power demand shall be simultaneously calculated using five different averaging methods: Fixed Window (Block) Average, Sliding Window (Rolling Block) Average, Thermal Average, Predicted Average, and Cumulative Demand. Values for all averaging intervals must be available simultaneously.
9. Fixed Window (Block) Average interval shall be user-settable from one second to 18 hours. Sliding Window (Rolling Block) Average sub-interval shall be user-settable from one-second to 18 hours. The number of intervals in the Sliding Window (Rolling Block) Average shall be user-settable from one to 255 sub-intervals.
10. The power meter shall compensate for errors in current transformers and potential transformers.
11. Errors shall include voltage, multipoint current, multiphase angle, and better than .01% resolution.
12. The unit shall utilize five different current compensation points per phase wherein the points shall be concentrated at the lower end of the dynamic range.
13. The power meter shall provide the following accuracies. Accuracies shall be measured as percent of reading at standard meter test points.
14. Power meter shall meet ANSI C12.20 for Class 2 and IEC 62053-22 accuracy requirements.
15. Voltage accuracy shall be within less than 0.05% for the one second reading and less than 0.1% for 100 millisecond reading.
16. Current accuracy shall be within less than 0.025% for the one second reading and less than 0.1% for the 100 millisecond reading.
17. Frequency shall have a display resolution accuracy of less than 0.01 Hz for the one second reading and less than 0.03 Hz for the 100 millisecond reading.
18. The power meter shall have Auto-calibration components that include:
19. Precision internal references with real-time auto calibration for voltage and current channels.
20. An internal temperature sensor that enables recalibration of the meter upon change of temperature in real time, while under operation.
21. The power meter shall include Software options that shall enable in-field upgrade without removing the installed meter.
22. The three Software options shall be:
23. A - Standard power meter as described in this document with 128 MegaBytes memory and 512 samples per cycle.
24. B – Software option A plus 1 Gigabyte memory and 1024 samples per cycle.
25. C - Software option A plus 10MHz Transient recording.
26. Software Option A and V-3 shall enable an IEC 61850 Protocol Network Server for the standard Ethernet port.
27. The power meter shall include an integrated 5.7-inch touch screen TFT LCD color display with multiple display modes.
28. Display shall support 4 groups of screens: Real Time, Trending, Alarms, and Power Quality modes. Groups of screens shall include:
29. Real Time viewing of voltage, current, power, demand
30. Accumulated Energy and Time of Use readings
31. Flicker readings in Instantaneous, Short Term (PST), and Long Term (PLT)
32. Alarm conditions
33. Phasor analysis
34. Harmonic spectrum analysis and waveform scopes for both voltage and current
35. Real Time trending
36. Log status
37. Configuration settings
38. The Display shall be constructed of bright TFT glass with a high temperature and long-life LED backlight. CCFL backlight shall not be acceptable.
39. The meter shall have two infrared accuracy test pulses on the meter front.
40. The display shall support screen rotation to enable vertical meter mounting.
41. The display shall be selectable for both English and Spanish text.
42. The display shall have a Demand Reset lock located on the bottom left section of the display. The Demand lock shall allow for a physical locking device to seal a Demand Reset switch.
43. The power meter shall provide multiple digital communication ports and support multiple open protocols:
44. The meter shall include an ANSI Optical port for communication to external devices that supports speeds of up to 57,600 bps.
45. The meter shall have one standard 10/100BaseT Ethernet port. With Software option B and C, this Ethernet port shall provide IEC 61850 protocol in addition to Modbus/TCP. The IEC 61850 Protocol Ethernet Network server shall provide the following features:
46. Integrates into any IEC 61850 network.
47. Provides support for Modbus and IEC 61850 protocols simultaneously.
48. Configurable for multiple logical nodes.
49. Provides buffered and unbuffered reporting.
50. Provides configurable .ICD and .CID files.
51. The meter shall have a second Ethernet port. Optional Ethernet port shall be available as either 10/100BaseT or 10/100Base-FX Fiber Optic configuration.
52. The meter shall have two optional RS485 ports through the Dual Pulse Output/RS485 card. The card shall have 4 user-programmable KYZ pulse outputs. Each RS485 port shall be user configurable with regard to speed, protocol, address, and other communications parameters. All ports shall support a minimum communication speed of up to 115k baud simultaneously and be assignable for Modbus or DNP 3.0 communication.
53. The meter shall have a high-speed USB port mounted on the front panel.
54. The meter shall communicate simultaneously using Modbus RTU, Modbus ASCII, DNP 3.0, Modbus TCP/IP, DNP over Ethernet, and, with Software option B and C, IEC 61850 protocols as standard configurations. All instantaneous data, logged data, event data, power quality analysis and waveform information shall be available using both Modbus TCP and FTP file transfer format. The meter shall also provide means for custom Modbus mapping.
55. The meter shall include DNP 3.0 protocol utilizing a level 2 implementation for communication to SCADA systems. All instantaneous data and average data shall be available using DNP 3.0 protocol. User shall be able to custom map data into DNP protocol using Windows based GE Communicator software.
56. The meter shall have Input/Output expandability through four Option card slots on the meter’s back and through optional External Output modules.
57. The Option cards shall be capable of being installed in the field, without removing the meter from installation.
58. The meter shall auto-detect the presence of any Option cards.
59. The available Option cards shall be:
60. Dual RS485/Pulse Output card,
61. Ethernet card with RJ45 or Fiber Optic port with 100BaseT support,
62. Up to two Relay Output cards with 6 output relays on each card,
63. Up to two Digital Input Status cards with 16 inputs on each card.
64. The meter shall have optional External Output Modules in the following configurations:
65. The meter shall support up to 4 Analog Output Modules in 0-1mA or 4-20mA, in either 4 or 8 analog output models.
66. The meter shall support up to one Digital Dry Contact Relay Output Module, with 4 relay outputs.
67. The meter shall support up to 4 Digital Solid State Pulse Outputs modules for KYZ pulsing.
68. The meter shall support up to 4 Analog Input Modules for external sensing of temperature or process conditions.
69. External Output modules shall be powered by external power source and attached to the meter with mounting brackets.
70. The power meter's Ethernet port(s) shall act as a Web server.
71. Web server shall host webpages with meter information. Multiple meters may be displayed on the webpages. Webpages shall be viewable using any standard  
    Internet browser. Webpages shall provide access to live meter readings, power quality information, and general meter information, and also shall enable remote upgrades to the Ethernet card's firmware.
72. Web server shall operate without ActiveX controls or Java Applets and shall be readable via smart phone and/or tablet computing devices.
73. Web server shall operate through firewalls.
74. Web server shall support emailing of alarm conditions to configured email addresses.
75. Web server shall be fully customizable.
76. Web server shall support DNP over Ethernet and at least 8 simultaneous sockets Modbus TCP/IP.
77. The power meter shall internally record and store Time of Use data.
78. The following Time of Use parameters must be included:
79. Bi-directional consumption and demand
80. Eight (8) TOU Schedules
81. Twenty (20) Year Calendar
82. Four (4) seasons per year.
83. The meter must provide the following TOU information for all rates in real-time:
84. Hourly accumulations
85. Daily accumulations
86. Weekly accumulations
87. Current month accumulations
88. Previous month accumulations
89. Current season accumulations
90. Previous season accumulations
91. Total accumulations to date
92. Programmable Freeze Registers
93. Cumulative Demand.
94. Full four quadrant accumulations for Watt-hr, VAR-hr, VA-hr and coincident VARs during peak watt demand including max demand, shall be available for each rate schedule, each season and for total accumulations.
95. The power meter shall have eight built-in digital high-speed status inputs:
96. Inputs shall automatically sense when the circuit is externally wetted.
97. If externally wetted, inputs shall accept up to 300VDC; if internally wetted the meter shall supply the necessary voltage for the control application.
98. Status inputs shall be configurable for pulse accumulation, pulse synchronization, or event monitoring. When used for pulse accumulation, each input shall have an accumulating register to count incoming pulses.
99. All changes in status shall be time stamped to the nearest millisecond and placed in an event log with time and event label information.
100. Event log shall enable users to recreate sequence of events involving external status points.
101. High-speed status inputs shall be able to trigger waveform recording to the waveform log.
102. The power meter shall enable users to perform Flicker analysis and reporting and shall comply fully with the requirements of EN61000-4-15 and EN61000-4-30 Class A.
103. The meter shall provide logging and monitoring for Instantaneous, Short term readings (PST-10min) and Long term readings (PLT-4 hour).
104. Flicker shall support both 220Volt/50Hz systems and 120Volt/60Hz systems.
105. The meter shall offer full reporting of power quality conditions using the EN61000-4-30 Class A methodology. The meter shall support automatic generation of EN50160/IEC61000-4-30 reports at user-settable intervals. Reports shall be viewable with a Log Viewer program and downloadable to other applications. In support of EN61000-4-30 Class A methodology, the meter shall calculate group and sub-group values for harmonics and inter-harmonics, up to the 51st order. Thresholds for the values shall be programmable. The sub-group readings and over-threshold status shall be available through the Flicker log and Modbus registers.
106. The power meter shall have 16-bit Waveform and Fault Recorder.
107. The meter shall record up to 1024 samples per cycle continuously on all 8 channels simultaneously, and transient captures sensitive to at least 166,000 samples per cycle. Storage for recorded waveform samples shall be up to 1000 MegaBytes.
108. The meter shall perform voltage and current recording with pre- and post-event analysis when a waveform limit is exceeded. Pre and post event shall be configurable to up to 30 cycles pre- and up to 300 cycles post-event.
109. Fault recording shall offer 8 times full scale capture capability.
110. The meter shall allow viewing of Harmonic magnitudes to the 512th order. Real time Harmonic magnitudes shall be resolved to the 128th order.
111. Percent THD and K-factor shall be calculated by the meter.
112. The accuracy of the IRIG-B time stamping of the waveform capture shall be 100 microseconds.
113. The power meter with Software option C shall have a sub-cycle Transient recorder.
114. The transient recorder shall process 10MHz high-speed voltage transients.
115. Transient will be analyzed utilizing a field programmable gate array (FPGA) to designate the high peak transient magnitude and its duration in nanoseconds.
116. The power meter shall be equipped with extensive non-volatile memory for recording logs and Programming data.
117. The meter shall have at least 1000 MegaBytes of non-volatile storage. Equipped with 1000 MegaBytes of memory, the meter shall be able to store 800 files or a total of 800 MegaBytes in logs.
118. In the event of loss of control power, the data stored in memory shall be retained for no less than ten years.
119. The meter shall have no less than eight historical logs. Each historical log shall be user configurable, and the user can allot the amount of memory for each log. The user must be able to select up to 128 parameters per log.
120. The meter shall have a log for Limits/Alarms. The Limits log shall provide magnitude and duration of an event, time-stamp, and log value.
121. The meter shall have a log for System Events. The System Events log shall record the following occurrences with a time-stamp: Demand Resets, Password Requests, System Startup, Energy Resets, Log Resets, Log Reads, and Programmable Settings Changes.
122. The meter shall have a log for High-speed Input status changes.
123. The meter with Software option C shall have a log which is capable of recording a waveform both when a user-programmed value goes out of limit and when the value returns to within limit.
124. The meter shall store a separate ITIC/CBEMA log that records magnitude and duration of voltage and current surges and sags for every power quality event. The CBEMA log shall be downloadable through the digital communication ports.
125. The power meter shall provide a separate IRIG-B input for time synchronizing to GPS time signal.
126. IRIG-B input shall accept un-modulated time signal input from a standard GPS satellite clock.
127. Time input shall enable synchronizing of meter time to within one millisecond of Universal Standard Time as transmitted by the GPS clock system. Synchronizing shall not be subject to network or other delays.
128. The power meter shall be programmable by software supplied by the meter manufacturer.
129. Software shall have a user-friendly, Windows® OS compatible interface.
130. Software shall include capacity to program meter, download meter, and analyze downloaded data files.
131. Software shall store all data in an ODBC compliant database. Data based storage shall include all log and waveform data.
132. The power meter shall provide Limits alarms and Control capability as follows:
133. Limits can be set for any measured parameter.
134. Up to 32 limits can be set.
135. Limits shall be based on % of Full Scale settings.
136. Manual Relay Control shall be available through software.
137. Relay set delays and reset delays shall be available.
138. The power meter shall be able to act as a Master RTU device.
139. The meter shall have the ability to poll Remote Modbus slave devices, read data from the slave devices and log the data for RTU concentrator functions.
140. The meter's Master RTU port shall support Modbus RTU.
141. The power meter shall have password and sealing switch protection.
142. The meter shall support a bi-level and extended password configuration.
143. Level 1 shall provide access to TOU accumulations.
144. Level 2 shall provide access to all password protected functions.
145. Level 2 shall allow the creation of up to 8 additional password profiles with specific restrictions and capabilities.
146. The meter shall support a sealing switch consisting of a physical switch located on the front panel and a software setting to enable/disable the sealing switch. When it is enabled, the sealing switch shall further restrict access to password protected features.
147. The power meter shall be appropriately constructed to provide long life in abusive physical and electrical environments.
148. Meter firmware shall be held in flash RAM and shall be upgradeable through one of the communications port without removing the unit from service.
149. Meter shall operate successfully at temperature extremes from –20ºC to +70ºC.
150. Depending on ordered option, meter shall operate with control power from either (100-240)VAC or (90-265)VAC@50/60Hz ; (100-370)VDC; or (18-60)VDC.
151. The Meter shall have a standard 10 Year Warranty
152. The power meter shall be a General Electric Company, Model EPM 9900 Meter with no substitutes allowed.

**The acceptable part number is:** PL9900-AC-6-5A-C-S-E1-R1-D1

1. For additional specification information please contact:

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1. The following options shall be available for ordering:

EPM 9900 Meter

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Base Meter** | **Control Power** | **Frequency** | **Current Inputs** | **Software** | **Slot 1** | **Slot 2** | **Slot 3** | **Slot 4** | **Description** |
| PL9900 |  |  |  |  |  |  |  |  |  |
|  | AC |  |  |  |  |  |  |  | 100-240VAC |
|  | HI |  |  |  |  |  |  |  | 90‐265VAC or 100‐240VDC |
|  | LD |  |  |  |  |  |  |  | 18-60VDC (24-48VDC Systems) |
|  |  | 6 |  |  |  |  |  |  | 60 Hz |
|  |  | 5 |  |  |  |  |  |  | 50 Hz |
|  |  |  | 5A |  |  |  |  |  | 5 Amps |
|  |  |  | 1A |  |  |  |  |  | 1 Amp |
|  |  |  |  | A |  |  |  |  | 128MB memory with 512 samples/cycle |
|  |  |  |  | B |  |  |  |  | 1GB memory with 1024 samples/cycle, IEC 61850 Communications Protocol |
|  |  |  |  | C |  |  |  |  | 1GB memory with 1024 samples/cycle, IEC 61850 Communications Protocol and 10MHz Transient Recording |
|  |  |  |  |  | S |  |  |  | 2-ports RS495 and 4 Pulse Outputs |
|  |  |  |  |  | X |  |  |  | Empty Slot |
|  |  |  |  |  |  | E1 |  |  | Second Ethernet Port - 10/100BaseTX, RJ45 |
|  |  |  |  |  |  | E2 |  |  | Second Ethernet Port - 100FX, Multimode ST Connector |
|  |  |  |  |  |  | X |  |  | Empty Slot |
|  |  |  |  |  |  |  | R1 | R1 | 6 Relay Outputs |
|  |  |  |  |  |  |  | D1 | D1 | 16 Status Inputs |
|  |  |  |  |  |  |  | X | X | Empty Slot |

EPM 9900 Accessories

|  |  |  |
| --- | --- | --- |
| **Accessory** | **Description** | **GE Part Number** |
| EPM 9900 Slot 1 |  |  |
| 2-ports RS485 and 4 Pulse Outputs | 2-ports RS485 and 4 Pulse Outputs | PL9900-ACC-SXX |
| EPM 9900 Slot 2 |  |  |
| Second Ethernet Port, 10/100BaseTX, RJ45 | Second Ethernet Port, 10/100BaseTX, RJ45 | PL9900-ACC-E1X |
| Second Ethernet Port, 100FX, Multimode, ST connector | Second Ethernet Port, 100FX, Multimode, ST connector | PL9900-ACC-E2X |
| EPM 9900 Slot 3 |  |  |
| 6 Relay Outputs | 6 Relay Outputs | PL9900-ACC-R1X |
| 16 Status Inputs | 16 Status Inputs | PL9900-ACC-D1X |
| EPM 9900 Slot 4 |  |  |
| 6 Relay Outputs | 6 Relay Outputs | PL9900-ACC-R1X  (same as Slot 3) |
| 16 Status Inputs | 16 Status Inputs | PL9900-ACC-D1X  (same as Slot 3) |
|  |  |  |
| Software upgrade |  |  |
| Upgrade Software Option A to B: 1GB memory with 1024 samples/cycle, IEC 61850 Communications Protocol | Upgrade Software option A to B: 1GB memory with 1024 samples/cycle, IEC 61850 Communications Protocol | PL9900-ACC-SAB |
| Upgrade Software Option A to C:1GB memory with 1024 samples/cycle, IEC 61850 Communications Protocol and 10MHz Transient Recording | Upgrade Software option A to C:1GB memory with 1024 samples/cycle, IEC 61850 Communications Protocol and 10MHz Transient Recording | PL9900-ACC-SAC |
| Upgrade Software Option B to C:1GB memory with 1024 samples/cycle, IEC 61850 Communications Protocol and 10MHz Transient Recording | Upgrade Software option B to C:1GB memory with 1024 samples/cycle, IEC 61850 Communications Protocol and 10MHz Transient Recording | PL9900-ACC-SBC |