GENERIC SPECIFICATION FOR HIGH PERFORMANCE POWER MONITORING, REVENUE METERING, POWER QUALITY RECORDING, AND RTU FUNCTIONALITY
GE EPM 9700 Meter

2. PRODUCT

2.1 Energy Meter

A. The meter shall be a multi-function 3 phase solid state unit with ability to connect to any of: 3 phase, 4 wire Wye or 3 phase, 3 wire delta circuits.

B. Voltage and current inputs to the meter shall conform to the following at a minimum:

1. Monitor shall accept input of four (4) independent voltage inputs and four (4) independent current inputs of the stated capacity.

2. Voltage input range shall be (20 to 720) V AC, with a pickup voltage of 5 V AC.

3. Voltage input shall be isolated to 2500 volts DC. Shall meet or exceed ANSI C37.90.1 (Surge Withstand Capability)

4. Current input shall support Class 2 and Class 20 in one input configuration. Current inputs shall be programmable to any CT ratio.

5. Current inputs shall be solid U-Bolt stud inputs with a ten-second over-current rating of 100 A, a three second over-current rating of 300 A, and a one-second over-current rating of 500 A; at 23 ^{o}C.

C. The meter shall measure and report the following quantities at a minimum:

1. Voltage, both phase to neutral and phase to phase, for all three phases; Auxiliary voltage; Phase angles for each voltage relative to each other.

2. Current, phase A, B, C, N-measured, and N-calculated; Phase angles for each current relative to voltages.

3. Watts (total and per phase), VARs (total and per phase), VA (total and per phase), Power Factor (total and per phase) and Frequency.

4. Accumulated Wh, VAh, and VARh; Wh received; Wh delivered. VARh and VAh reading shall be stored in each of the 4 quadrants of power.

5. Power demand shall be calculated using four (4) different averaging methods: Thermal Average, Fixed Window Average, and Rolling Window Average.

6. Power meter shall provide updates of all voltage and current readings at intervals of one cycle, fast update which is user programmable at the rate of between 2 and 20 cycles, and 1 second. Readings shall be available for both metering and control. All specified readings shall be made available via RS485, RS232, and Ethernet ports.

7. Power meter shall provide time-stamped maximum and minimum readings for every measured parameter, e.g., max/min on thermal average readings, flicker, and demand readings, among others.

8. Power meter shall provide coincident VAR readings for all maximum Watt readings.

D. The meter shall use MultiGain™ technology to assure high accuracy with wide input range. The meter shall provide the following accuracies:

Parameter	1 Second Update	Accuracy Input Range
Voltage L-N	0.04% of reading	(20 to 480) V AC
Voltage L-L	0.04% of reading	(20 to 720) V AC
Current	0.04% of reading	(0.025 to 20) A AC
Neutral Current	0.1%	(0.025 to 20) A AC
Frequency	0.004 Hz	V: 20 V AC minimum
Active Power Total [W]	0.06% of reading	I: (0.025 to 20) A AC V: (57 to 480) V PF: 1.0
	0.1% of reading	I: (0.05 to 20) A AC V: (57 to 480) V PF: +/-(0.5 to 1) lag/lead
	0.15% of reading	I: (10 to 20) A AC V: (57 to 480) V PF: +/-(0.5 to 1) lag/lead

Active Energy Total [Wh]	0.06% of reading	I: (0.025 to 20) A AC V: (57 to 480) V PF: 1.0
	0.1% of reading	I: (0.05 to 20) A AC V: (57 to 480) V PF: +/-(0.5 to 1) lag/lead
	0.15% of reading	I: (10 to 20) A AC V: (57 to 480) V PF: +/-(0.5 to 1) lag/lead
Reactive Power Total [VAR]	0.15% of reading	I: (0.025 to 10) A AC V: (57 to 480) V PF: +/-(0.5 to 1) lag/lead
Reactive Energy Total [VARh]	0.15% of reading	I: (0.025 to 20) A AC V: (57 to 480) V PF: +/-(0.5 to 1) lag/lead
Apparent Power Total [VA]	0.06% of reading	I: (0.025 to 20) A AC V: (57 to 480) V PF: 1.0
	0.1% of reading	I: (0.05 to 20) A AC V: (57 to 480) V PF: +/-(0.5 to 1) lag/lead
Apparent Energy Total [VAh]	0.06% of reading	I: (0.025 to 20) A AC V: (57 to 480) V PF: 1.0
	0.1% of reading	I: (0.05 to 20) A AC V: (57 to 480) V PF: +/-(0.5 to 1) lag/lead
Power Factor	0.15% of reading	(45 to 65) Hz
THD	2.5% of reading	I: (0.1 to 10) A AC V: (57 to 480) V
Flicker	5.0% of reading	Pst: 0.2 to 10
Unbalance	0.15% of reading	0.5% to 5% as measurement range
Mains Signaling	5% of reading	3% to 15% as measurement range

E. MultiGain™ Technology shall have the following attributes:

1. There shall be two sensors on the current inputs – high gain and low gain sensors.

2. Sensors shall each measure the current signal from CTs, simultaneously.

3. The meter's processors shall analyze the signal and determine the optimal sensing circuit for the highest accuracy.

F. The meter shall provide multiple digital communication ports and support multiple open protocols.

1. The meter shall include four independent, digital serial communication ports. Each port shall be RS485 architecture. One of the serial ports shall be user selectable as either RS232 or RS485 architecture.

2. Each port shall be user configurable with regard to speed, protocol, address, and other communications parameters. All ports shall support a maximum communication speed of 115k baud simultaneously.

3. The meter shall include one standard RJ45 Ethernet port and one standard Fiber Optic Ethernet port.

a. The Ethernet ports shall enable an HTML5-based Web server.

b. Each Ethernet port shall allow up to 16 simultaneous sockets of TCP/IP to the meter and 28 simultaneous connections on both Ethernet ports together.

c. Each Ethernet port shall have a separate IP address.

d. Each Ethernet port shall be available simultaneously.

e. Each Ethernet port shall be configured to allow or disallow specific web services.

4. Modbus ASCII/RTU, Modbus TCP/IP, and DNP 3.0 Level 2 protocols shall be supported.

G. The WebView™ Energy Dashboard web server shall provide all meter readings over the Internet, using a standard web browser that supports HTML5.

1. The Energy Dashboard shall provide real-time readings of the meter's voltage, current, power, energy, power quality, pulse accumulations and high speed digital inputs, as well as additional meter information, alarm/email information and diagnostic information.

2. The Energy Dashboard shall provide detailed waveform recording viewing with zoom and pan capabilities.

3. The meter's firmware shall be upgradeable through a webpage interface.

H. The meter shall enable users to perform Flicker analysis according to IEC 61000-4-15 Class A standard.

1. The unit shall provide users with logging and monitoring for instantaneous Short term readings (PST-10min) and Long term readings (PLT-2 hour).

2. The meter shall be able to log Flicker readings.

3. Flicker shall be available for both 50 Hz and 60 Hz systems.

4. The Flicker algorithm shall support both 120 and 230 Volts power systems.

I. The meter shall be capable of recording time-stamped Flicker readings in an EN 50160 log.

1. The log shall be viewable through a Log Viewer application.

a. EN 50160 readings shall be viewable in chart format or displayed values format.

b. Log shall be downloadable from Log Viewer application.

c. Log shall be printable from Log Viewer application.

J. The meter shall support Power Quality reporting to the IEC 61000-4-30 Class A Edition 3 standard.

K. The meter shall provide sequence of events capture and recording.

1. The meter shall have eight digital status inputs for capturing external events.

2. The Digital Input log shall enable users to recreate sequence of events involving external status points.

3. The digital status inputs shall be able to trigger waveform recording to the waveform log.

4. The digital status inputs shall be configurable for event monitoring, pulse accumulation, or pulse synchronizing.

L. The meter shall provide, in addition to clock crystal, the following time synchronization methods:

1. The meter shall provide a separate IRIG-B input for time synchronizing to GPS time signal.

a. The IRIG-B input shall accept un-modulated time signal input from a standard GPS satellite clock.

b. The time input shall enable time synchronizing to one millisecond and shall not be subject to network or other delays.

2. The meter shall support SNTP time synchronization through its two Ethernet ports.

3. The meter shall support Line Frequency time synchronization.

M. The meter shall provide external displays to accommodate access to readings locally and/or remotely. The displays shall be capable of being connected up to 5,000 feet from the meter.

1. The master display shall be a three line, LED format, P40N+ display.

2. The meter shall be capable of providing readings to a P40N+, a P41N+ (slave), and a P43N+ (slave) series of LED displays simultaneously.

3. LED displays shall be 0.56-inch size and display shall include 10-character alphanumeric segment to provide legend and scaling information for displayed values. The LED display shall use one communication port.

4. The display shall connect to the meter via RS485 communications architecture. The communication channel shall be isolated at the display to avoid the introduction of noise.

5. The display shall be able to be powered directly from Power Meter or from an auxiliary power supply.

6. The display shall be surface mounted for ease of installation.

7. P40N+ display shall have a USB port to allow direct data downloads to a PC from the display.

N. The meter shall be equipped with non-volatile RAM for recording logs and programming information.

1. Up to 1.2 GB of memory shall be available.

2. The meter shall store historical trending data, power quality data, and waveform recordings in memory.

3. Memory shall be allocated to the various logging functions required. All logging features required shall be simultaneously available at the specified levels. Exercising any one feature at the specified level shall not limit exercising of any or all other features to their full, specified level.

4. The meter shall store all programming and set-up parameters in non-volatile memory. In the event of loss of control power, meter programming data stored in memory shall be retained for at least 5 years.

O. The meter shall provide historical data logging for trending of measured values.

1. The meter shall have a Core log that stores over 270 values every 15 minutes, automatically.

2. The meter shall support up to eight historical logs.

a. Each historical log shall be user configurable.

b. Each log shall allow up to 64 data channels with a logging interval of 1/3/5/10/15/30/60 minutes.

c. Logging interval shall be user configurable.

P. The meter shall provide cyber secured configuration and anti-tampering features:

1. The meter shall provide one Admin user and up to ten other configurable users.

2. The username for the Admin user shall be "admin," the password for the Admin user and the ten configurable users shall allow up to 30 characters.

3. The Username and password shall be encrypted as they are sent to the meter.

4. There shall be four roles that can be assigned permissions, i.e., permitted actions.

5. Each configurable user can be assigned one of the four roles.

6. There shall be a legacy user to support MV90 customers.

7. The meter shall offer a text file of all users and their assigned roles.

8. The meter shall provide security status showing the user currently signed on.

9. The meter shall support sealing switch mode, so that the sealing switch needs to be pressed in order to perform restricted functions.

10. The meter shall support security lockout, so that security cannot be disabled.

11. The meter shall have two physical meter seal locations.

12. The meter shall have a lockable cover for voltage and current inputs.

13. The meter shall have two standard pulses for Wh and VARh testing.

14. The meter shall have an anti-tampering System Events log, which shall log all password entries, meter resets, device profile changes, etc.

Q. The meter shall internally record and store Time of Use data using a perpetual TOU calendar.

1. The following Time of Use parameters must be included:

a. Bi-directional consumption and demand.

b. Configurable month and season accumulators.

c. Up to four seasons and 12 months.

2. The meter must provide the following TOU information for all rates in real time:

a. Current month accumulations

b. Previous month accumulations

c. Current season (or weekly, or daily) accumulations

d. Previous season (or weekly, or daily) accumulations

e. Total accumulations to date

f. Cumulative Demand

R. The meter shall provide extensive power quality monitoring capability.

1. Power meter shall measure and record the magnitude and phase angle of all real time harmonics through the 128^{th} for all voltages and currents. The meter shall provide THD, TDD, and K-Factor for all channels.

2. All harmonic angle/magnitude values shall be available through the digital communications ports in real time.

3. The meter shall capture and record all ITI (CBEMA) Curve quality events.

4. ITI (CBEMA) events shall be date/time stamped to the millisecond. Entries to CBEMA log shall include date/time stamp, duration, and magnitude information. The CBEMA log shall be downloadable through the digital communications ports.

5. The CBEMA log shall hold over 1024 events in a revolving FIFO format.

6. The meter shall capture and record out-of-limit conditions in a log. Entries to Limits log shall be made anytime a monitored quantity exceeds the user set limit assigned to that quantity.

7. Entries to the Limits log shall be time stamped to the millisecond and include the measured quantity value, limit ID, and state (going out of limit or returning to limit).

8. The Limits log shall hold over 1024 events in a revolving FIFO format.

S. The meter shall provide waveform recording to capture and record transients and quality problems on current and voltage waveforms.

1. The meter shall sample waveform at a user configurable rate of 16 to 1024 samples per cycle (60 Hz cycle).

2. Each waveform record shall include pre-event and post-event data.

3. Waveforms shall be recorded with time resolution to within one (1) millisecond.

4. A waveform record shall be taken whenever the RMS value of voltage or current exceeds user-set limits.

5. The user shall be able to configure meter so that a waveform record shall be taken whenever a status change occurs on any one of the eight high-speed status inputs.

6. The meter shall provide up to 1024 samples per cycle for waveform recording.

T. The meter shall have expandable auxiliary I/O capability.

1. Meter shall allow connection of external I/O modules.

2. Up to four (4) 8 channel external I/O modules shall be capable of being powered directly from the power meter. An auxiliary power supply shall be available to power additional I/O modules if needed.

3. External I/O modules shall be isolated from the power meter and from each other.

4. I/O modules shall connect to the power meter using RS485 communication architecture and shall be capable of being placed up to 5000 feet from the power meter.

5. External I/O modules shall communicate with the power meter using Modbus protocol. Closed protocols shall not be accepted.

6. External I/O modules shall include analog output modules that have four to eight channels each and shall allow the use of 0-1 mA outputs or 4-20 mA outputs; analog input modules that have 8 channels; digital pulse outputs; control relay outputs, and digital outputs.

7. External I/O modules shall be able to be added to the meter after installation to provide upgrade capability after the initial installation is complete. Changing the power meter shall not be required to provide this upgrade capability.

U. The meter shall be programmable by software supplied by the meter manufacturer.

1. Software shall have a user-friendly, Windows compatible interface.

2. Software shall operate on Windows® Server 2008/2012/2016/7/8/8.1/10 Professional operating systems.

3. Software shall include capacity to program meter, download meter, and analyze downloaded data files.

4. Software shall store all data in an ODBC compliant database. Data based storage shall include all log and waveform data.

V. The meter shall offer ElectroLogic™ programmable logical protection and control.

1. The 2100 values that the meter measures shall be programmable with limits and logic that trigger operations.

2. The programmable logic structure shall allow users to develop up to three levels of logic control based on limits and status conditions.

3. The logic structure shall be programmable through a graphical tree structure, and shall allow the user to set logical descriptors such as:

a. AND/NAND/XAND gates

b. OR/NOR/XOR gates

c. Hysteresis/NHysteresis control

4. The graphical programming structure shall be easily configurable to the user's desired logical scheme.

5. The control function shall be extendible to at least sixteen relay outputs.

W. The meter shall be appropriately constructed to provide long life in abusive physical and electrical environments.

1. Meter shall be housed in an all-metal enclosure with no visible openings and no exposed circuit boards.

2. Meter shall operate successfully at temperature extremes from (–25 to +70) ^{o}C.

3. Meter shall be UL listed.

4. The meter shall operate with control power from (90 to 276) volts AC/DC; the meter shall have a power supply option to operate with control power of (18 to 60) volts DC.

5. The meter shall have a standard 4-year warranty.

X. The power meter shall be a General Electric Company, Model EPM 9700 Meter with no substitutes allowed.

The approved part number is: PL9700-X-0-0-B-XXX

1. Approved I/O modules options list:

a. PL90001MAON4000 – 4 analog outputs, 0+/-1 mA

b. PL90001MAON8000– 8 analog outputs, 0+/-1 mA

c. PL900020MAON400 – 4 analog outputs, 4-20 mA

d. PL900020MAON800 – 8 analog outputs, 4-20 mA

e. PL90004RO100000 – 4 relay outputs

f. PL90004PO100000 – 4 solid state pulse outputs

g. PL90008AI100000 - 8 analog inputs, 0+/-1 mA, scalable and bi-directional

h. PL90008AI200000 - 8 analog inputs, 4-20 mA, scalable

i. PL90008AI300000 - 8 analog inputs, 0+/-5 V DC

j. PL90008AI400000 - 8 analog inputs, 0+/-10 V DC

k. PL90008DI100000 – 8 digital status outputs, wet/dry

l. PL9000MBIO – Output module mounting bracket (must be ordered with purchase of Output Module)

m. PL9000PSI000000 – Power supply for additional 10 modules

n. PL9000ACCDIN – EPM 9700 DIN Rail Mount Kit

o. PLSOFTCOMS – GE Communicator - EPM Meter Setup Software License

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