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Document Title:
Power Quality Meter (PQM) and Phasor Measurement Unit (PMU)

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Version History

Version	Date	Revision
01	May 16, 2023	Initial release.
02	August 28, 2025	Added new item 018-87721 PMU with UPS, Appendix (TOC) and Title. Changed Document Number (Legacy Number: 4350.313) to new Engineering Records nomenclature number 4300.50.313.

Warehouse Catalog #	Asset Suite #	Version	Date
018-84788	84788	2	August 28, 2025
018-87721	87721	1	August 28, 2025

1. Introduction

This is a general specification that covers the minimum requirements for Power Quality Meter (PQM) and Phasor Measurement Unit (PMU) to be used in the distribution system in Puerto Rico. Further information will be provided by LUMA Energy at the time of order placement and will provide information on site specific conditions, quantity, and other requirements. This document includes the general electrical and mechanical characteristics of the equipment/material.

2. Special Requirements

Samples shall be furnished as requested by LUMA Energy. Vendors that have supplied this equipment/material to LUMA in previous orders will not have to furnish samples at bid opening. The equipment/material will be received at LUMA's general warehouse (011) at Palo Seco, Puerto Rico. Shipping will include transportation and unloading at the indicated warehouse.

3. Literature

3.1. Descriptive and technical literature must be supplied by the vendor at the time of bidding. This literature must include, but is not limited to, details of material, drawings, documented testing, and instructions for use and installation. **The literature must be an official document from and certified by the manufacturer.** Failure to submit documents on time and duly certified by the manufacturer will cause bidder disqualification.

3.2. If required by LUMA, final drawings and documentation shall be submitted by the vendor before the manufacturing and shipping process for approval.

4. Compatible with

For compatible manufacturers and models, see Table 1. These models are examples of the equipment/material described in this document and do not represent a preference. LUMA will evaluate equally any model not listed here during any acquisition event.

5. Markings

5.1. Containers shall be marked outside with LUMA Energy's purchase order and item number.

5.2. Individual package(s) shall be clearly marked with the manufacturer's name and item information (part number, serial number, quantity, etc.). Packaging labels and tags shall be waterproof.

6. Packaging

6.1. All equipment/material shall be packaged and marked in such a way as to facilitate handling and protection from damage and that the receiving warehouse can readily identify it and send it, in one complete unit, to a field location without opening crates or boxes to sort items and/or parts.

6.2. A list of all parts included in the container and/or package must be provided at the time of delivery so that the receiving personnel can verify that everything requested is present, avoiding any delay in the receiving process.

6.3. If the equipment includes any electronic components that cannot be exposed to the outdoor elements, this must be reported to the warehouse to ensure proper preservation. If the equipment contains any type of battery that requires charging for preservation, this must also be communicated. Failure to provide proper notification will result in the manufacturer assuming responsibility for any repair costs.

7. Number Per Package (Logistics)

The package contains One (1) unit per standard package, as outlined in Table 1, or as otherwise specified by LUMA.

8. Acceptance Criteria

8.1. Test required: certified by qualified external laboratories.

8.2. The product shall be manufactured in accordance with the latest issue below (section 8). When conflicts occur between the purchaser's specifications and the latest issue below, the purchaser's specifications shall prevail.

8.3. Latest applicable codes, standards, and other regulations:

a. ANSI C12.20-2015 Class 0.1 - Electricity Meters – 0.1, 0.2, and 0.5 Accuracy Classes
b. IEC 61000-4-30 Class A - Testing and Measurement Techniques - Power quality measurement methods
c. IEEE C37.118.1a-2014 - Synchro phasor Measurements for Power Systems
d. IEC/IEEE 60255-118-1-2019 (IEEE/IEC International Standard - Measuring Relays and Protection Equipment), for P-Class, and optionally for M-Class.
e. IEEE 1815-2012 - Electric Power Systems Communications-Distributed Network Protocol (DNP3)
f. IEEE C37.90 - Standard for Relays and Relay System Associated with Electric Power Apparatus.
g. IEEE 519-2022 – Standard for Harmonic Control Electric Power System
h. IEC/IEEE 60255-118-1-2019 (IEEE/IEC International Standard - Measuring Relays and Protection Equipment), for P-Class, and optionally for M-Class.
i. IEEE C37.118.2-2011 IEEE Standard for Synchro phasor Data Transfer for Power Systems.
j. IEC 61850-8-1 Edition 2 or later (preferably 2.1) GOOSE messaging publisher and subscriber functions on Ethernet.
k. IEC/IEEE 60255-118-1-2019 (IEEE/IEC International Standard - Measuring Relays and Protection Equipment), for P-Class, and optionally for M-Class.

8.4. If any other standard different from the ones indicated in this document is used, the supplier must provide information showing compatibility with the required ones.

9. Description

9.1. A Phasor Measurement Unit (PMU) integrates a power quality meter, synchronized satellite clock, and communication interface to measure, process, and transfer data related to the magnitude and phase angle of AC voltage and current at a specific location on a power line. PMU data is time-stamped using Global Positioning System (GPS) signals. PMUs provide precise, time-synchronized measurements of the electrical state of a power system.

An optional Uninterruptible Power Supply (UPS) kit can be included with the PMU to ensure continuous operation during power outages or voltage disturbances. The UPS kit provides backup power to the PMU and its associated components, maintaining data integrity and time synchronization during temporary loss of primary power.The power quality meter: Material: Silicone Rubber

a. Shall be fully Class A compliant to the IEC 61000-4-30 power quality standard and must exceed ANSI C12.20-2015 Class 0.1 accuracy requirements.

b. Shall be capable of accurately reporting bidirectional energy even in the presence of harmonics and distorted waveform.

c. Must accept a power supply voltage range of 120 to 240 Vac with a continuous operating limit between 85 to 264 Vac. This power supply should be secured and protected using an uninterruptible power supply (UPS) and a surge protector. The minimum UPS runtime will be 8 hours.

d. Shall be capable of being powered from a potential transformer (PT) circuit.

e. Shall support Form 9 input signal connection for a 4-wire wye configuration.

f. The PT input range must be at least: 11 to 300 V_{L-N} and must have a burden equal to or higher than 10 MW.

g. The current transformer (CT) input range must be at least 0.001 to 22 A. Device burden at CT input is less than 0.5 VA.

h. Shall be capable of compensating for each instrument transformer errors individually. Device must provide angular and magnitude compensation on each phase to correct delays and errors.

i. Must accept demodulated IRIG-B satellite clock signal.

j. General Shall comply with the following power quality and recording options:

Shall comply with the following power quality and recording options:**General**	
Memory	1 GB
Max Harmonic Order	63rd
Waveform Capture	
Samples Per Cycle	16, 128, 512
Duration (cycles)	15–600
Number of Events	101–10,000
Load Profile Data	
Recorders × Channels	32 × 16
Acquisition Rates	3–59 s, 1–120 min
Storage Duration for 10 min. Interval Data	0–20 years, varies with acquisition rate and number of channels used
16 Channels	20 years
192 Channels	9.5 years
512 Channels	3.5 years
Voltage Sag, Swell, Interruption (VSSI) Recorder	
Typical Number of Summary Events	600
Number of Detailed Rows	>130,000
Minimum Disturbance Duration	1/4 cycle
Sampling Rate	4 samples/cycle–1 sample/day, adaptive
Sequential Events Recorder (SER)	
Number of Events	>80,000
Number of Channels Monitored	≤72
IEC 61000-4-30 PQ Compliance	
150/180-Cycle, 10-Minute, 2-Hour	Class A
Flicker	Class A (1-min, 10-min, 2-hr updates)
Voltage Harmonics	Class A
Current Harmonics	Class A

k. Shall measure and report reliable power quality indicators such as harmonics, inter harmonics, flicker, power factor, voltage disturbance and K-factor.

l. Shall have load profile recorder capable of simultaneous meter and power quality logging of up to 512 analog channels.

m. Must be capable of recording oscillography events associated with programmable trigger conditions such as voltage interruption. It must be able to capture real-time voltage and current signals in both the time and frequency domains.

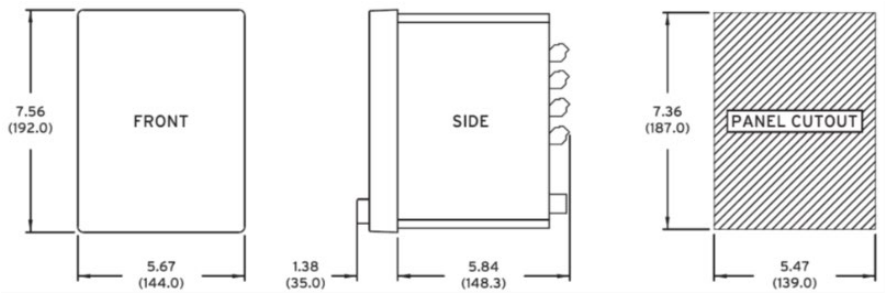
n. Shall be capable of recording voltage sag, swell, and interruption data with time stamp and up to 4 ms resolution.

o. Must include multiple communication options that include at least 1 port EIA-232, 2 ports 10/100 BASE-T, and 2 ports 100 BASE-LX LC single mode. PMU communication requirement can be achieved through an external ethernet switch / gateway installed in the same PMU enclosure. If an external ethernet switch is used due to another communication requirement, it must be pre-installed, pre-wired, and connected to the same power source as the power quality meter. Any hardware modifications must be pre-approved by the Standards and Materials Department before submitting a purchase order.

p. Shall have a front USB Type-C communication port and at least four (4) customizable local control buttons. USB-A to USB-C communication cable must be included in the PMU package.

q. Printed circuit boards shall be protected with a conformal coating to protect the boards and its components from the environment and corrosion.

r. Must have approximately the following dimensions (Inches (mm)), However, different dimensions and form factors may be permitted with prior approval from the Standards and Materials Department before submitting a purchase order.



s. Shall include a power quality reporting software license for each device.

9.2. The PMU must include a satellite clock to provide timing signals to the power quality meter.

9.3. The satellite clock:

a. Shall provide a single demodulated IRIG-B signal output.

b. Shall be capable of synchronizing with accuracy less than 100 ns.

c. Shall include a low-profile GPS external antenna. The antenna must come factory installed in the PMU enclosure and the installation must include a gas tube coaxial surge protector.

d. Must come factory connected to a power source compatible with the power quality meter.

e. The power source could be an external power supply installed inside the PMU enclosure. Power supply input voltage must match the power quality meter input voltage range.

9.4. All electronic devices and accessories that comprise the PMU shall be pre-installed and pre-wired inside outdoor enclosures.

9.5. The outdoor enclosure:

The vendor is required to supply an enclosure capable of accommodating the PMU, a test switch, a GPS clock, an uninterruptible power supply, and an Ethernet switch (if needed), If requested, the enclosure should accommodate a cellular network router.

a. Must be a fully sealed enclosure that complies with NEMA 4X rating.

b. Material shall be aluminum or fiberglass. If the material is fiberglass, it shall have an aluminum chassis to increase enclosure strength and support the hinges.

c. Minimum outside dimensions shall be 18 in (45.7 cm) W x 20 in (50.8 cm) H x 10 in (26.4 cm) D without UPS , 24 in (60.96 cm) W x 25.96 in (65.93cm) H x 17 in (43.18 cm) D with UPS.

d. Must be double door type. The exterior and interior door must be hinged.

e. Shall have DIN rails for accessories support.

f. Shall have a lockable, stainless steel latching system.

g. Shall have interior grounding provision that accepts copper stranded wire #14 to #4 AWG.

h. Must include wall-mount bracket.

i. Enclosure with optional UPS providing up to 8 hours of battery backup

9.6. The PMU shall include a test switch installed and prewired.

9.7. The PMU must include USB-C communication cables for onsite configuration and device access.

9.8. The PMU must include configuration and reporting software.

9.9. The reporting software:

a. Could be server-based software.

b. Shall include all associated software necessary for data retrieving and reporting.

c. Must include report templates to support meter data analysis including Load DATA Profile, and Voltage-Sag-Swell-Interrupts.

d. Must include IEEE 519 compliance report templates for harmonics voltage compliance.

e. Shall be capable of automatically generating reports and sending these reports by email.

f. Shall be capable of exporting files to third-party databases for trending or analysis.

g. Shall have security features for DATA transfer and user authentication.

10. Inspection

10.1. Upon inspection of incoming equipment/material, the purchaser reserves the right to refuse product shipments and to determine the acceptability or rejection of the product received. The supplier shall be liable for all costs incurred for a product that is rejected.

10.2. The acceptance of any equipment/material shall in no way relieve the vendor from his responsibility to meet all the requirements of this specification, and it would not prevent subsequent rejection if such equipment/materials were found later to be defective.

11. Proposal Information

11.1. Submitted proposals must include:

a. Technical information, drawings, and tests.

b. Table of Compliance completed by the bidder with reference (see Appendix 1).

12. Table 1: Warehouse and Asset Suite Identification Number.

Item	Description	Warehouse Catalog #	Asset Suite #	Compatible Manufacturer	Model
1	Power Quality Meter (PQM) and Phasor Measurement Unit (PMU) with NEMA 4 Enclosure with test switch	018-84788	84788	Schweitzer Engineering Laboratories	735#Q7H1
2	Power Quality Meter (PQM) and Phasor Measurement Unit (PMU) with NEMA 4 Enclosure with test switch with UPS	018-87721	87721	Schweitzer Engineering Laboratories	735#Q7H1 w UPS Kit

—End of Specification —

Appendix

Appendix 1: Table of Compliance

Line	Description	Pass/Fail (P / F)	Comments
1	The Proponent complies with the corresponding specification document 4350.313.		
2	The Proponent complies with the industry standards established in Section 8 of the specification document 4350.313.		
3	Outdoor Enclosure: Aluminum or Fiberglass		
4	The PMU Package must include an IEC 61000-4-30 Class A compliance Power quality Meter		
5	**The Power Quality Meter:**		
6	Report bidirectional energy.		
7	Accept power supply voltage between 85 to 264 Vac.		
8	Is capable of being powered from a potential transformer (PT) circuit.		
9	Support Form 9 input signal connection for a 4-wire wye configuration.		
10	PT's input range must be at least: 11 to 300 V_{L-N} and burden is equal to or higher than 10 MW.		
11	The current transformer (CT) input range must be at least 0.001 to 22 A. Device burden at CT input is less than 0.5 VA.		
12	Provide angular and magnitude compensation on each phase to correct delays and errors.		
13	Accept demodulated IRIG-B satellite clock signal.		
14	Comply with the power quality and recording options stated in Section 9.2 Subsection J of Specification Document 4350.313.		
15	Measure and report harmonics, interharmonics, flicker, power factor, voltage disturbance and K-factor.		
16	Have load profile recorder capable of simultaneous meter and power quality logging of up to 512 analog channels.		
17	Capable of recording oscillography events associated with programmable trigger conditions.		
18	Capture real-time voltage and current signals in both the time and frequency domains.		
19	Capable of recording voltage sag, swell, and interruption data with time stamp and up to 4 msec resolution.		
22	Include multiple communication options that includes at least 1 port EIA-232, at least 1 port 10/100 BASE-T, and 2 ports 100 BASE-LX LC single mode.		
23	If an external ethernet switch is used, it must be factory installed, prewired, and connected to the same power source as the power quality meter.		
24	have a front USB Type-C communication port and at least four (4) customizable local control buttons. USB-A to USB-C communication cable is included.		
25	All printed circuit boards are protected with a conformal coating.		
26	If equipped with a UPS, the minimum runtime will be 8 hours.		

27	Include a power quality reporting software license for each device.		
28	The PMU package include a satellite clock		
29	**The satellite clock:**		
30	Provide a single demodulated IRIG-B signal output.		
31	Is capable of synchronizing with accuracy less than 100 ns.		
32	Include a low-profile GPS external antenna factory installed in the PMU enclosure. The antenna includes a gas tube coaxial surge protector.		
33	Comes factory connected to a power source compatible with the power quality meter.		
34	All electronic devices and accessories that comprise the PMU comes factory installed and prewire inside an N4X outdoor enclosure.		
35	**The outdoor enclosure:**		
36	Could be made of aluminum or fiberglass. If the material is fiberglass, it shall have an aluminum chassis to increase enclosure strength and support the hinges.		
37	Minimum outside dimensions are 18 in (45.7 cm) W x 20 in (50.8 cm) H x 10 in (26.4 cm) D, 24 in (60.96 cm) W x 25.96 in (65.93cm) H x 17 in (43.18 cm) D with UPS		
38	Is a double door type.		
39	Exterior and interior door must be hinged.		
40	Have DIN rails for accessories support.		
41	Exterior door have a lockable, stainless steel latching system.		
42	Have interior grounding provision that accepts copper stranded wire #14 to #4 AWG.		
43	includes wall-mount bracket.		
44	The PMU includes a factory installed test switch		
45	Enclosure with optional UPS providing up to 8 hours of battery backup		
46	**The Reporting Software:**		
47	Is capable of automatically generating reports and sending these reports by email.		
48	Is capable of exporting files to third-party databases for trending or analysis.		
49	Includes IEEE 519 compliance report templates for harmonics voltage compliance.		
50	Includes Load DATA Profile, and Voltage-Sag-Swell-Interrupts report templates.		
51	Have security features for DATA transfer and user authentication.		

NOTE: This table is only a checklist for reference. The compliance must be with the complete document. Filling out the table with "PASS" won't be accepted as compliance without the technical information required to certify it.

4350.50.313 Power Quality Meter (PQM) and Phasor Measurement Unit (PMU)

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