***GENERIC SPECIFICATION FOR POWER QUALITY METER WITH PHASOR MEASUREMENT UNIT,
NEXUS® 1500+ METER***

1. PRODUCT

2.1 Power Quality Meter with PMU

1. The meter shall be UL listed and CE marked. Meter shall have third party testing and/or certification for the following standards:
	* + 1. IEC 61000-4-30 Class A Ed. 3 Certification.
			2. IEC 61326-1, IEC 61000-3-2, IEC 61000-3-3 and subordinate standards.
			3. CISPR11, CISPR22.
			4. FCC Part 15, Subpart B.
			5. ANSI C12.20 0.2 CL Certification.
			6. IEC 62053-22 0.2S Certification.
			7. IEC 61850 Level A Ed. 2 Certification.
2. Meter shall be designed for multifunction electrical measurement on 3 phase power systems.
	* + 1. Meter shall measure voltage and current, 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.
			2. Meter shall accumulate readings for watt-hour, VA-hour, and VAR-hour. All readings shall be accumulated and stored for each of the 4 quadrants of power.
			3. Power demand shall be simultaneously calculated using four different averaging methods: Fixed Window (Block) Average, Sliding Window (Rolling Block) Average, Thermal Average, and Cumulative window demand.
			4. Meter shall provide high-speed readings updated every cycle, a programmable 2-20 cycles, and one second, simultaneously.
			5. Meter shall calculate readings that are CT and PT compensated and transformer/line loss compensated. Both compensated and uncompensated readings shall be available simultaneously.
			6. Meter shall offer perpetual time of use with configurable rates/seasons and cumulative/continuous cumulative demand.
3. Meter shall automatically perform self-calibration to an internal reference every ten seconds, for the meter’s life. Meter must stabilize its readings within ten seconds of powering up.
4. Meter shall provide the following accuracies, measured as percent of reading at standard meter test points.
	* + 1. ANSI C12.20 0.1 CL and IEC 62053-22 0.2S class accuracy.
			2. 0.06% energy accuracy.
			3. Voltage accuracy within less than 0.05% for one second reading and less than 0.1% for high-speed readings.
			4. Current accuracy within less than 0.025% for one second reading and less than 0.1% for high-speed readings.
			5. Meter shall provide a one cycle high-speed frequency reading with a frequency resolution of better than 10 mHz.
			6. Meter’s internal precision real time clock shall provide max accuracy of 3.5 ppm at full temperature range, with less than 10 seconds per month drift.
			7. Meter shall provide accuracy test mode via software and the two front KYZ pulses. Test mode shall support positive/negative Wh, positive/negative VARh, per quadrants; test with or without TLC and PT/CT Compensation.
			8. Meter shall support ability to pre-set accumulators to be used when swapping out a meter for accuracy testing and validation.
5. Meter shall measure power quality and be 3rd party certified in accordance with the IEC 61000-4-30 Class A Edition 3 standard.
	* + 1. Flicker measurements shall be performed in accordance with the IEC 61000-4-15 standard and calculate instantaneous, short term, and long-term measurements.
			2. Meter shall allow viewing of voltage and current harmonic magnitudes in real time to the 127th order. Meter’s harmonic measurement shall be in accordance with the IEC 61000-4-7 standard.
			3. Meter shall have 16-bit waveform and fault recorder, recording up to 1024 samples/cycle continuously on all 8 channels simultaneously.
			4. Meter shall capture transients on 4 voltage input channels with at least 800,000 samples/cycle or 50 MHz sampling speed.
			5. Meter shall support EN 50160 reporting with user customizable setpoints to meet jurisdictional requirements.
6. Meter shall have an integrated high-visibility 5.7-inch touch screen TFT LCD color display with over 60 display screens for real time readings, trending, alarms, power quality, and test mode screens.
	* + 1. The display shall support both a horizontal and vertical presentation to support horizontal or vertical meter installation.
			2. The display shall support the following languages: English, Spanish, Hebrew, Portuguese, French, Chinese, and Polish.
7. Meter shall provide six simultaneously operating communication ports and support multiple open protocols. Ports shall include:
	* + 1. ANSI Optical port.
			2. Two 10/100BaseT Ethernet ports - one standard and one optional, with unique IP/MAC addressing.
				1. Ethernet ports shall be separately configurable to enable or disable each port’s protocol and service.
				2. Ethernet ports shall support DNP3 Level 2 over Ethernet and Modbus TCP/IP. Up to 64 simultaneous connections shall be available.
				3. With V2-V3 and V5-V6 upgrade packs, either Ethernet port shall offer IEC 61850 Ed. 2. IEC 61850 protocol shall include GOOSE messaging and shall provide alarms and waveform capture in response to GOOSE messages. Meter shall support distributed fault recording using GOOSE cross-triggers.
				4. With V4-V6, either Ethernet port can be configured as a phasor measurement unit (PMU) in a synchrophasor system outputting IEEE C37.118.2-2011 real time exchange of synchronized phasor measurement data.

 Synchrophasor functionality shall meet the IEEE C37.118.1a-2014 Class P and M standard. Either class shall be available.

Time synchronization methods of IRIG-B and IEEE 1588 PTPv2 shall be available.

Either port, but only one at a time, can be enabled for synchrophasor communication. PMU setting shall be available for Ethernet or Fiber Optic.

Meter as PMU measures and provides individual voltage/current phasors, symmetrical components phasors, frequency, rate of change of frequency, readings from built-in high-speed inputs, and analog data for fundamental power and displacement power factor.

Supported data frames shall be for 50 Hz 10/25/50 frames per second and for 60 Hz 10/12/15/20/30/60 frames per second.

Supported data formats shall be configurable float or integer, polar or rectangular.

Up to two simultaneous clients shall be able to communicate with meter as PMU.

* + - * 1. Ethernet ports shall support SNMP protocol. SNMP implementation shall support V1 and V2c standards; provide over 60 measurements; include traps for limits, input change, and power quality; and support cold start trap and authentication failure.
				2. Ethernet port 2 shall support IEEE PTPv2 as slave (for PMU functionality) or master (for master clock functionality).
				3. Ethernet ports shall act as a web server, providing real time reading, diagnostics, and firmware upgrades over the Internet.
				4. Ethernet ports shall provide email on alarm for over limit conditions, waveform captures, or periodic upload of data.
				5. Through a single Ethernet port, meter shall communicate simultaneously using Modbus ASCII/RTU/TCP, DNP3 Level 2, IEC 61850, SMTP, SNMP, HTTP, and IEEE C37.118.2 (PMU).
			1. Meter shall have two optional RS485 ports configurable for DNP3 Level 2 or Modbus TCP through the dual RS485/Pulse Output card. One of the RS485 ports can be configurable as an RTU Master to collect and trend data from slave Modbus devices. Each RS485 card also supports 4 KYZ pulse outputs configurable to any energy accumulation.
			2. Meter shall have high-speed USB port mounted on the front panel for configuration and data download.
1. Meter shall have 4 GB of non-volatile memory for extensive data and waveform recording.
	* 1. Meter shall have no less than eight historical logs with up to 128 parameters per log, a log for limits/alarms, an anti-tampering system events log, a log for high-speed input status changes, a waveform log, and a downloadable ITIC/CBEMA log.
		2. Memory shall be programmable for custom allocation of logging speed from 1 second to multiple hours. Memory depth can be allocated to assign a programmable length of time for more than one year of logging per log.
	1. Meter shall have input/output expandability through four internal I/O option card slots on the meter’s back and through optional external I/O modules.
2. Option cards shall be field-installable. Meter shall auto-detect the presence of any option cards. Option cards shall offer:
	1. RJ45 Ethernet expansion.
	2. Fiber optic Ethernet expansion.
	3. Dual RS485 / 4 pulse outputs.
	4. 6 relay outputs for limit-based control capability.
	5. 16 digital inputs.
3. Optional external I/O modules shall offer analog outputs, digital inputs, relay outputs, and pulse outputs. These modules are expandable for up to 256 points of I/O.
	1. Meter shall have eight built-in digital high-speed status inputs for event monitoring. Digital inputs shall be able to trigger waveform recording and/or send an IEC 61850 GOOSE message for distributed fault recording.
		1. High-speed inputs shall be configurable for pulse accumulation and pulse synchronization. For pulse accumulation, each input shall have an accumulating register to count incoming pulses.
	2. Meter shall have resilient cyber security, which shall provide:
		1. Meter firmware signed with a digital signature that has 512-bit encryption and is embedded in the firmware, to ensure firmware integrity.
		2. Customizable public key.
		3. 128-bit AES encryption of passwords and usernames. Passwords shall allow 24 complex characters.
		4. Admin level with full rights, that can enable/disable security, create users and assign roles, set expiration date for passwords and encryption key.
		5. Ten customizable user levels.
		6. Role-based authorization with eight configurable roles.
		7. Security lockout to prevent security from being disabled.
		8. Password fail timeouts to eliminate brute force hacking.
		9. System events log for all secured transaction attempts.
	3. Meter shall provide a sealing switch, consisting of physical lock on the meter and software setting to enable/disable sealing switch, for enhanced security.
	4. Meter shall include upgrade packs V1-V6 that enable field upgrades without removing meter from installation.
	5. Meter shall be programmable by software supplied by meter manufacturer. Meter shall integrate with cloud-based energy management system for Enterprise-wide power quality and usage analysis, predicted usage and demand, reporting, and email alarms.
	6. Meter shall have a standard 4-year warranty.
	7. Meter shall be Electro Industries/GaugeTech model:
	Nexus® 1500+ meter. Part number example is:
	Nexus1500+ - D2 - 60Hz- V3- 485P – NTFO – 6RO1 – 16DI1

	Acceptable software product is Electro Industries/GaugeTech ENERGYPQA-1Y – Cloud-based energy management system.
		1. No substitutions allowed. Ordering chart is shown below.

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| Base Meter | Control Power | Frequency | Current Class | V-Switch | Comm Expansion Slot 1 | I/O Slot 2 | I/O Slot 3 | I/O slot 4 |
| Nexus® 1500+ Meter | 115AC(100-240) V AC @50/60 Hz | 6060 HZ | 205 A Nominal CT Secondary | V1Standard meter with 512 MB memory/512 samples/cycle | XNo Option | XNo Option | XNo Option | XNo Option |
| D2Universal (100-240) V AC @50/60 Hz or (100-240) V DC | 5050 Hz | 21 A Nominal CT Secondary | V2V1 with 1 GB Memory, 1024 samples/cycle, IEC 61850 | 485P2 RS485 and 4 Pulse Outputs | NTRJSecond RJ45 Network Card | 6RO16 Relay Outputs | 6RO16 Relay Outputs |
| D(18-60) V DC | V3V2 with 4 GB Memory, 50 MHz Transient Recording | NTFOSecond Fiber Optic Network Card (ST Terminated) | 16DI116 Digital Inputs | 16DI116 Digital Inputs |
| V4V1 + Synchrophasor PMU and Resilient Cyber Security |
| V5V2 + Synchrophasor PMU and Resilient Cyber Security |
| V6V3 + Synchrophasor PMU and Resilient Cyber Security |

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