GENERIC SPECIFICATION FOR POWER AND ENERGY METER FOR UTILITY AND CRITICAL INDUSTRIAL SUBSTATIONS,
SHARK® 250 METER IN ENCLOSURE

2. PRODUCT

2.1 POWER METERS

A. The meter shall be UL listed and CE marked.

B. The meter shall come pre-wired as per NEC coloring code in either a UL approved NEMA 1 enclosure or a UL approved NEMA 4X enclosure.
   1. The enclosure shall be available in either of two configurations: 277/480 volt or 120/240 volt.
      a. The 277/480 volt enclosure shall come equipped with a control power transformer.
   2. The enclosure shall come with voltage fuses and a shorting block for use with current transformers.
   3. The enclosure shall have a lockable door.

C. The meter shall be designed for Multifunction Electrical Measurement on 3 phase power systems. The meter shall perform to spec in harsh electrical applications in high and low voltage power systems.
   1. The meter shall support 3 Element Wye, 2.5 Element Wye, 2 Element Delta, 4 wire Delta systems.
   2. The meter shall accept universal voltage input.
   3. The meter's surge withstand shall conform to IEEE C37.90.1.
   4. The meter shall be user programmable for voltage range to any PT ratio.
   5. The meter shall accept a burden up to 0.018 W at 120 V.
   6. The meter shall accept a voltage input range of up to 576 V Line to Neutral, and up to 721 V Line to Line.
   7. The meter shall accept a current reading of up to 11 A continuous.
   8. The meter shall have color-coordinated voltage and current inputs.
   9. The meter shall have a phasor diagram, through software, that clearly shows wiring status.

D. The 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. The second method shall provide additional termination pass through bars, allowing the CT leads to be terminated on the meter. The meter must support both termination methods.
   1. Fault Current Withstand shall be 100 A for 10 seconds, 300 A for 3 seconds, and 500 A for 1 second.
   2. The meter shall be programmable for current to any CT ratio. DIP switches or other fixed ratios shall not be acceptable.
   3. The meter shall accept a burden of 0.005 VA per phase, Max at 11 A.
   4. The meter shall begin reading at 0.1% of the nominal current.
   5. Pass through wire gauge dimension of 0.177” / 4.5 mm shall be available.
   6. All inputs and outputs shall be galvanically isolated to 2500 V AC.
   7. The meter shall accept current inputs of Class 10: (0.005 to 11) A, 5 A Nominal, 18 A max; and Class 2 (0.001 to 2) A, 1 A Nominal Secondary; 2 A max.

E. The meter shall have an accuracy of +/- 0.1% or better for voltage and amperes, and 0.2% for power and energy functions. The meter shall meet the accuracy requirements of IEC 62053-22 (Class 0.2%) and ANSI C12.20 (Class 0.2%). The meter shall have a Frequency measurement accuracy of not less than 0.007 Hz.
   1. The meter shall provide true RMS measurements of voltage, - phase to neutral and phase-to-phase; and current, per phase and neutral.
   2. The meter shall calculate RMS readings, sampling at over 400 samples per cycle on all channels of measured readings continuously, with no cycle blind spots.
   3. The meter shall utilize 24 bit Analog to Digital conversion.
   4. The meter shall provide THD (Total Harmonic Distortion). Harmonic magnitude recording to the 40th order shall be available for voltage and current harmonics.

F. The meter shall provide a simultaneous voltage and current waveform recorder.
   1. The meter shall be capable of recording 512 samples per cycle for a voltage sag or swell or for a current fault event.
   2. The meter shall provide pre and post-event recording capability.
   3. The meter shall have a programmable sampling rate for the waveform recorder.
   4. The meter shall have an advanced DSP design that allows power quality triggers to be based on a 1 cycle updated RMS.
   5. Up to 319 events shall be recorded.
   6. The meter shall store waveform data in a first-in, first-out circular buffer to insure that data is always being recorded.

G. The meter shall include a three-line, bright red, .56" LED display.
   1. The meter shall fit in both DIN 92 mm and ANSI C39.1 round cut-outs.
   2. The meter must display a % of Load Bar on the front panel to provide an analog feel. The % Load bar shall have not less than 10 segments.

H. The meter shall be a traceable revenue meter, which shall contain a utility grade test pulse allowing power providers to verify and confirm that the meter is performing to its rated accuracy.

I. The meter shall include virtual measurement upgrade packs (V-Switch™ keys), which shall allow user to upgrade in field without removing installed meter.
   1. The four Virtual Upgrade packs shall be:
      a. Volts, Amps, kW, kVAR, PF, kVA, Freq., kWh, kVAh, kVARh, and I/O Expansion - V1
      b. Above with 2 Megabytes of memory for Data-logging - V2
      c. Above with 128 samples per cycle waveform recording and 10 Megabytes memory – V3.
      d. Above, with 512 samples per cycle waveform recording and 128 Megabytes memory - V4.
   2. The V-Switch™ keys must be able to be implemented without physically removing the installed meter.

J. The meter shall include 2 independent communications ports on the back and face plate, with advanced features.
   1. One port shall provide RS485 communication speaking Modbus ASCII, Modbus RTU, or DNP3 protocol through the back plate. Baud rates shall be from 1200 baud to 57600 baud for the RS485 port.
   2. The meter shall have a USB port (through the faceplate) as the second standard communication port, which shall allow the unit to be set up and programmed using a laptop computer. Baud rate for the USB port shall be 57600; Modbus ASCII protocol, no Parity, 8 Data bits, and 1 Stop bit shall be supported.

K. The meter shall provide user configured fixed window or rolling window demand. This shall allow the user to set up the particular utility demand profile.
   1. Readings for kW, kVAR, kVA and PF shall be calculated using utility demand features.
   2. All other parameters shall offer max and min capability over the user selectable averaging period.
   3. Voltage shall provide an instantaneous max and min reading displaying the highest surge and lowest sag seen by the meter.
   4. The meter shall provide an update rate of every 6 cycles for W, VAR and VA and Wh, VARh, and VAh. All other parameters shall be every 60 cycles.

L. The meter shall support a power supply of (90 to 265) V AC or (100 to 370) V DC. Universal AC/DC Supply shall have a burden of 10 VA max. An optional power supply of (18 to 60) V DC shall be available.

M. The meter shall provide Limits/Alarms and control capability as follows:
   1. Limits can be set for any measured parameter.
   2. Up to 16 limits can be set.
   3. Limits shall be based on % of Full Scale settings.
   4. Manual relay control shall be available through software.
   5. Relay set delays and reset delays shall be available.
   6. Relay control shall be available through DNP3 over Ethernet with the Ethernet Option card.

N. The meter shall have data logging capability of up to 128 MB memory. The meter shall have a real time clock that allows for time stamping of all the data in the meter when log events are created.
   1. The meter shall have up to six historical logs for trending profiles. Each log shall be capable of being programmed with up to 64 parameters. The user shall have the ability to allocate memory between the three historical logs in order to increase or decrease the memory allotted to each of the logs. The duration of a historical log with 4 data channels being recorded at 15 minute intervals shall be 76 months.
   2. 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. The log must be capable of recording up to 2048 events.
   3. 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, Programmable Settings Changes, and Critical Data Repairs.
   4. The meter shall have a log for I/O changes. The I/O Change log shall provide a time-stamped record of any Relay Outputs and any Input Status changes. The log must be capable of recording up to 2048 events.
   5. The meter with Virtual Upgrade packs 3 and 4 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. Up to 319 waveform events can be stored.

6. The meter shall have a log for PQ events, with millisecond recording of waveform events.

O. The meter shall have I/O expandability through two Option card slots on the back.
   1. The cards shall be capable of being installed in the field, without removing the meter from installation.
   2. The meter shall auto-detect the presence of any I/O Option cards.
   3. The Option card slots shall accept I/O cards in all of the following formats: 100BaseT Ethernet Communication Card; Four Channel Bi-directional 0-1mA Output Card; Four Channel 4-20mA Output Card; Two Relay Outputs/2 Status Inputs Card; Four Pulse Outputs/4 Status Inputs Card; Fiber Optic Card; IEC 61850 Protocol Ethernet Network Card; RS232/RS485 Serial Communication Card.
   4. The meter shall be capable of accepting any combination of up to two cards.
      a. When two Ethernet cards are installed in the meter, an independent IP address and MAC address shall be assignable to each card.
   5. The Ethernet Option Card shall provide the meter with 100BaseT Ethernet functionality. The Ethernet Option card shall:
      a. Allow the meter to speak with 12 simultaneous sockets of Modbus TCP, so that multiple requests for data can be received simultaneously.
      b. Allow the meter to speak with 5 simultaneous sockets of DNP3 over TCP/IP.
      c. Allow the meter to speak with both Modbus TCP and DNP3 over Ethernet simultaneously.
      d. Allow auto transmit/receive detection for straight or crossover RJ45 cables.
      e. Provide an embedded Web server that allows access to metered readings through the Internet, using any standard Web browser from a PC, smart phone, or tablet PC.
      f. Provide email on configured alarms.
      g. Provide email notification of meter status and reading data on a programmed schedule.
   6. The 1mAO Option Card shall provide the following features:
      a. 4 channel, bi-directional 0-1 mA outputs.
      b. Assignable to any measured parameter.
      c. 0.1% of Full Scale accuracy throughout range and load.
      d. Maximum load impedance to 10 kΩ, with no accuracy losses.
   7. The 20mAO Option Card shall provide the following features:
      a. 4 channel, 4-20 mA outputs.
      b. Assignable to any measured parameter.
      c. 0.1% of Full Scale accuracy throughout range and load.
      d. Maximum load impedance to 850 Ω, with no accuracy losses.
      e. Loop powered using up to 24 V DC.
   8. The Relay Output/Status Input Option Card shall provide the following features:
      a. 2 Relay outputs, 2 Status inputs.
      b. Status Inputs – Wet/Dry Auto Detect up to 150 V DC.
      c. Trigger on user-set Limits/Alarms.
      d. Set delays and Reset delays.
   9. The Pulse Output/Digital Input Option Card shall provide the following features:
      a. 4 KYZ pulse/4 Status inputs.
      b. Programmable to any energy parameter and pulse value.
      c. Programmable to End of Interval pulse.
      d. Can function for manual relay control and limit based control.
      e. 120 mA continuous load current.
      f. DNP3 input.
   10. The Fiber Optic Option Card shall provide the following features:
      a. Built in logic to mimic RS485 half-duplex bus, allowing the user to daisy chain meters for low installation cost.
      b. ST Terminated Option.

c. Versatile Link Terminated Option.
d. Modbus and DNP3 protocols available.

11. The IEC 61850 Protocol Ethernet Network Option Card shall provide the following features:
    1. Integrates into any IEC 61850 network.
    2. Provides support for Modbus TCP and IEC 61850 protocols simultaneously.
    3. Configurable for multiple logical nodes.
    4. Provides buffered and unbuffered reporting.
    5. Is certified by a 3rd party Authorized IEC 61850 Test Laboratory.
    6. Is capable of supporting two Ethernet cards with separate /IP addresses, each running IEC 61850 protocol.
12. The RS1S Communication card adds another serial communication port - either RS232 or RS485.

P. The meter shall have transformer loss, line loss, and total substation loss compensation.
    1. Substation losses shall be programmable for Watts and VARs, and for Ferris and Copper losses.
    2. The meter shall compensate for errors in current transformers and potential transformers.
    3. Errors shall include voltage, multipoint current, multiphase angle, and better than .01% resolution.

Q. The meter shall internally record and store Time of Use data in a perpetual TOU calendar.
    1. The following Time of Use parameters must be included:
        a. Bi-directional consumption and demand.
        b. Configurable 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.
        g. Continuous cumulative demand shall be available.

R. The meter shall provide multi-level Cyber Security:
    1. The meter shall have highly secure encrypted passwords of up to 30 characters in length.
    2. The meter's security shall allow for 9 user IDs and passwords.
    3. There shall be one admin level and up to 8 customizable user levels.
    4. There shall be password fail timeouts.
    5. Password restriction shall be available for most meter functions.

S. The meter shall be able to be stored in (-20 to +70) ^{o}C.
    1. Operating temperature shall be (-20 to +70) ^{o}C.
    2. NEMA 1 faceplate rating shall be available.
    3. Humidity rating to 95% R.H.
    4. Standard conformal coating on PCBs.

T. The meter shall have a standard 4 year warranty.

U. The following options shall be available for ordering:

Model	Voltage	Frequency	Current Input	V-Switch™ Pack	Power Supply	I/O Slot 1	I/O Slot 2
ENCSHK250 Shark® 250 Meter in NEMA 1 Enclosure ENC4XSHK250 Shark® 250 Meter in NEMA 4X Enclosure	-120: 120-240 volts	-50: 50 Hz System	-10: 5 A Secondary	-V1: Multi-function meter	-D2: (90-265) V AC @ 50/60 Hz 0r (100 to 370) V DC	-X: None	-X: None
	-277: 277 volts	-60: 60 Hz System	-2: 1 A Secondary	-V2: Above, plus 2MB Datalogging memory		-INP100S: 100BaseT Ethernet	-INP100S: 100BaseT Ethernet
				-V3: Above, plus 10 MB datalogging memory and 128 samples/cycle waveform recording		-RO1S: 2 Relays/2 Status Inputs	-RO1S: 2 Relays/2 Status Inputs
				-V4: Above, plus 128 MB datalogging memory and 512 samples/cycle waveform recording		-PO1S: 4 Pulses/4 Status Inputs	-PO1S: 4 Pulses/4 Status Inputs
						-1mAOS: 4 Channel Analog Output, 0-1 bi-directional	-1mAOS: 4 Channel Analog Output, 0-1 bi-directional
						-20mAOS: 4 Channel Analog Output, 4-20 mA	-20mAOS: 4 Channel Analog Output, 4-20 mA
						-FOSTS: Fiber Optic Output ST Terminated	-FOSTS: Fiber Optic Output ST Terminated
						-FOVPS: Fiber Optic Output Versatile Link Terminated	-FOVPS: Fiber Optic Output Versatile Link Terminated
						-INP300S IEC61850 Protocol Ethernet	-INP300S IEC61850 Protocol Ethernet
						-RS1S RS485/ RS232 Comm Card	-RS1S RS485/ RS232 Comm Card

V. Acceptable product is Electro Industries/GaugeTech,
Model ENC4XSHK250-120-60-10-V1-D2-X-X for 120 V AC services and/or
Model ENC4XSHK250-277-60-10-V1-D2-X-X for 277/480 V AC services.

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