**Revenue Metering**

- ANSI C12.20 0.1 Accuracy Class
- Perpetual Time of Use, Transformer/Line Loss Compensation, and Test Mode
- Real Time SCADA Communication Capability; Modbus RTU, Modbus TCP/IP, Level 2 DNP3, and IEC 61850
- Multiple Communication Ports: USB Front Port, RS485 Port, and Two Optional Ethernet Ports
- 128 MB Memory for Logging and Data Storage
- Upgradable I/O
- Cyber Secured Configuration
- MV90 Support
- Rugged Design

**Power Quality Metering**

- PQ Analyzer with Limits, THD Monitoring, and Harmonics Recording
- 512 Samples/Cycle Waveform Recording on Surge and Sag Events
- Large Onboard Waveform Storage
- Millisecond Time Stamp for Accurate CBEMA and SEMI F47 Data Analysis

**Applications**

- Utility Substation Metering
- Distribution Automation
- Alternative Energy
- Industrial Control Panels
- Power Quality Studies
- SCADA Metering
Introduction

The Shark® 250 meter is the latest addition to the Shark® Series power and energy meter line. It is designed for utility substation and critical industrial applications. Its features include:

- Enhanced revenue metering features, such as onboard time of use, CT/PT compensation, test mode and energy presets, pulse accumulators and totalizers
- Multiple serial or Ethernet ports for redundant communication
- Front panel USB port
- Large memory capacity for more significant load studies, including longer storage without overwriting of data
- Cyber secured configuration for protecting data in substation use
- Rugged design for harsh environments, with standard conformal coating and superior surge withstand capability
- Level 2 DNP3 and IEC 61850

Enhanced 0.1% Class Revenue Metering Features

Utilities need meters that are both highly accurate and verifiable. They also need reliable meters that are designed for a long operation life. The Shark® 250 meter meets these requirements with advanced metering technology and superior engineering to improve reliability. The meter is an ANSI C12.20 0.1 Accuracy Class meter that also conforms to the IEC 62053-22 CL 0.2S standard for accuracy. The Shark® 250 meter provides precise and reliable measurements that are highly stable and that maintain accuracy over a long period of time. It provides a comprehensive revenue energy measurement capability, including:

- Energy test pulse
- Test mode and energy presets
- Perpetual time of use
- CT/PT compensation
- Pulse accumulators and totalizers
- Up to 8 pulse outputs and 8 pulse inputs

Time of Use

Set up multiple tariffs that meet any contractual obligation with the Shark® 250 meter’s time of use (TOU) calendar. Features of the meter’s TOU implementation are:

- Perpetual TOU calendar – set up once and use indefinitely
- Up to four customizable seasons
- Up to 12 months per year - set independently from seasons
- Flexible billing periods/rates/holidays/schedules
- Up to 16 configurable datasets with 38 channels of data, including all energy channels, pulse data, readings per quadrant and phase, pulse aggregators, and RTU Master readings
- Cumulative and continuous cumulative demand

CT/PT Compensation

Utility and other critical metering applications have stringent accuracy requirements. Because of this, utilities must compensate for inaccuracies of instrument transformers in their system. The Shark® 250 meter has built-in features for compensation of these inaccuracies through amplitude and phase angle adjustment. If needed, CT reversal setting is also supported.

Loss Compensation

Utilities must also compensate energy readings for transformer and line losses (TLC) for accurate customer usage billing. The Shark® 250 meter’s TLC compensation supports correct billing, even if the meter is placed on the secondary side of the transformer.
Cyber Secured Configuration

Data security is a requirement of all critical metering applications today. The Shark® 250 meter provides a multi-level cyber secure encrypted configuration that protects your metering data. The meter’s cyber security prevents tampering and hacking with robust features, including the following:

- Highly secure encrypted passwords
- 9 user IDs and passwords
  - Supports an administrator and up to 8 user IDs
  - Up to 30 character length ensures password strength
- Password fail timeouts eliminate brute force attacks
- Access to the following functions can be controlled:
  - Reset energy readings
  - Upload firmware
  - Reset demand
  - Download and reset logs – access can be controlled for each log, independently
  - Edit TOU calendar, read TOU data, and reset TOU accumulators
  - Edit and upload programmable settings
  - Execute test mode
  - Edit CT/PT compensation
  - Back up meter files
  - Control read access for a Com port
  - Access control functions for I/O
  - Reset input and output counters
  - Meter restart
  - Manual waveform capture date/time
  - Set preset energy
  - Change V-Switch™ key

The meter’s cyber secured configuration is easily set up using EIG’s CommunicatorPQA® software.

Robust Communication for Utilities

The Shark® 250 meter is equipped with an advanced communication architecture suited to the specific needs of utilities. The meter provides up to four serial and Ethernet communication ports, including a front panel USB, a standard RS485, optional RS232/RS485, and up to two Ethernet ports. Supported protocols include:

- Level 2 DNP3 (available for 1 serial and/or 1 Ethernet port) and/or IEC 61850
- Modbus RTU/ASCII/TCP
- NTP, SMTP, HTTP Ethernet protocols

Standard Communication

USB Port

- For laptop PC read and programming
- Modbus ASCII, 57.6k baud

RS485 Port

- Level 2 DNP3
- Modbus RTU/ASCII, up to 57.6k baud
Field-Expandable I/O and Communication Capabilities

Once meters have accurately measured real time electrical data, they must communicate it to other systems for analysis, billing, controls, or other applications. The Shark® 250 meter has a flexible communication architecture that integrates directly into most existing systems. In addition to its standard communication capability, the meter offers unequaled I/O expandability. Its two universal option card slots accept and auto-detect new I/O cards even after installation. Up to 2 cards of any type can be used per meter. The Shark® 250 meter's standard and optional communication supports multiple open protocols, including Modbus RTU/ASCII/TCP, Level 2 DNP3, and IEC 61850. The meter's optional I/O is detailed on this page.

INP100S: 100BaseT Ethernet

- NTP time server for high accuracy network time synchronization
- 12 simultaneous Modbus TCP/IP connections
- 5 simultaneous Level 2 DNP3 over Ethernet connections

INP300S: IEC 61850 Protocol Ethernet

- Simultaneous communication of IEC 61850 and Modbus TCP/IP
- 5 simultaneous MMS clients
- Multiple logical nodes

1mAOS: Four Channel Bi-directional 0-1 mA Outputs

- Assignable to any parameter
- 0.1% of full scale
- Max. load impedance 10 kΩ

20mAOS: Four Channel 4-20 mA Outputs

- Assignable to any parameter
- 0.1% of full scale
- 850 Ω at 24 V DC
- Loop powered using up to 24 V DC

PO1S: Four Pulse Outputs / Four Status Inputs

- Programmable to any energy parameter and pulse value
- Form A: Normally open contacts
- Also used for end of interval pulse

RO1S: Two Relay Outputs / Two Status Inputs

- 250 V AC / 30 V DC - 0.25 A relays, form C
- Trigger on user set alarms
- Set delays and reset delays

FOVPS or FOSTS: Fiber Optic Card

- EIG’s exclusive fiber optic daisy chain switchable built-in logic mimics RS485 half duplex bus. This lets you daisy chain meters for lower installation costs; full duplex is also assignable.
- ST terminated option (-FOSTS)
- Versatile link terminated option (-FOVPS)
- Modbus and Level 2 DNP3 protocols

RS1S: Serial Communication Card

- Programmable RS485 or RS232 port
- Up to 2 ports per meter in addition to the standard RS485 port
- One session at a time of Level 2 DNP3 serial communication is available per meter.
Large Memory Capacity

The Shark® 250 meter has up to 128 MB memory for logging and data storage. This large memory capacity facilitates:

- More significant load studies
- Longer storage without overwriting of data
- Flash sector profiling for improved long-term operation

<table>
<thead>
<tr>
<th>Feature</th>
<th>V-Switch™ Key 3</th>
<th>V-Switch™ Key 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage and Logging Memory</td>
<td>10 MB</td>
<td>128 MB</td>
</tr>
<tr>
<td>Logging Capability</td>
<td>36 months of recording and storage for 4 energy values recorded every 15 minutes; up to 79 waveform record captures</td>
<td>76 months of recording and storage for 4 energy values recorded every 15 minutes; up to 319 waveform record captures</td>
</tr>
<tr>
<td>Waveform Recording</td>
<td>Up to 128 samples per cycle</td>
<td>Up to 512 samples per cycle</td>
</tr>
</tbody>
</table>

Historical Logs

- Up to 6 assignable historical logs
- Independently programmed trending profiles
- Up to 64 parameters per log

System Events Log

For this anti-tampering log, the meter records and logs the following actions with a timestamp:

- Demand resets
- System startup
- Energy resets
- Log resets
- Critical data repairs
- Programmable settings changes
- Password requests/sealing switch changes

I/O Change Log

- Provides a timestamped log of any relay output
- Provides a timestamped log of input status changes
- 2048 events available

Limit/Alarm Log

- Provides magnitude and duration of an event
- Includes timestamps and alarm value
- 2048 events available
- Email on alarm capability with INP100S Ethernet card

Limit Alarms and Control Capability

Limit events:

- Any measured parameter
- Up to 16 limits
- Voltage unbalance
- Current unbalance
- Based on % of full scale settings

Rugged Design

The Shark® 250 meter is designed for harsh environments. It features:

- Compliance with IEC 610186-1/2/3 (high reliability)
- Improved surge withstand capability
- Intrinsically safe current connections
Power Quality Measurement and Analysis

The Shark® 250 meter records up to 512 samples per cycle for a voltage sag or swell or a current fault event. The unit provides the pre- and post-event recording capability shown in the table below. Waveform records are programmable to the desired sampling rate. V4 provides up to 128 MB of storage.

The meter’s advanced DSP design allows power quality triggers to be based on a 1 cycle updated RMS. Hundreds of events can be stored until the memory is full. The meter stores waveform data in a first-in/first-out circular buffer, ensuring that data is always recording.

Optional Waveform Recorder

<table>
<thead>
<tr>
<th>Samples per Cycle</th>
<th>Pre-Event Cycles</th>
<th>Post-Event Cycles</th>
<th>Max Waveforms per Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>V3</td>
<td>32</td>
<td>16</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>128</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>V4</td>
<td>256</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>512</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Sampling rate based on 60 Hz systems. For 50 Hz systems, multiply by 1.2.

Waveform Scope

The unit uniquely offers a waveform scope that lets you view the real time waveform for voltage and current. The waveform scope lets you use the meter as a basic oscilloscope throughout a power system.

Independent CBEMA (or SEMI F47) Log Plotting

The meter stores an independent CBEMA or SEMI F47 log for magnitude and duration of voltage events. This lets you quickly view total surges, total sags, and duration, without retrieving waveform data. The meter also fully supports MV90. Timestamps are stored with millisecond accuracy.

Harmonic Recording to the 40th Order

The Shark® 250 meter provides advanced harmonic analysis to the 40th order for each voltage and current channel, in real time. Using the stored waveforms, harmonic analysis is available to the 255th order.

V-Switch™ Key Technology Upgrades

The Shark® 250 meter has EIG’s V-Switch™ key technology, a virtual firmware-based switch that lets you enable meter features through software communication. V-Switch™ key technology allows meter upgrade after installation, without removal from service.

<table>
<thead>
<tr>
<th>Features</th>
<th>V1</th>
<th>V2</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Measurements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multifunction Measurement</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Programmable Display</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Time of Use</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>System Events</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Input Status Change</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Limits</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Harmonics</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>2 MB Memory *(3 Historical logs)</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 MB Memory *(6 Historical logs)</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>128 MB Memory *(6 Historical logs)</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waveform 128 samples/cycle</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waveform 512 samples/cycle</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT/PT Compensation</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>TLC Compensation</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>IEC 61850 Protocol **</td>
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<td></td>
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<tr>
<td>Level 2 DNP3</td>
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<td>✔</td>
<td></td>
</tr>
<tr>
<td>Modbus Protocol ***</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

* Note that some memory is reserved for internal operations.
** INP300S option card required
*** See the Shark® 250 Meter Modbus Protocol Application Guide for instructions on using Modbus with the meter.

Shark® 250T Transducer Mounting

This transducer version of the Shark® 250 meter does not have a display. The unit mounts directly to a DIN rail and provides an RS485 Modbus or Level 2 DNP3 output and expandable I/O.
The unit mounts directly into an ANSI C39.1 or an IEC 92 mm DIN square form, making it perfect for new and existing installations.

3 Phase 4 Wire WYE Direct

3 Phase 4 Wire WYE with PTs

3 Phase 3 Wire Delta Direct

3 Phase 3 Wire Delta with PTs
### Specifications

**Voltage Inputs:**
- Absolute Range: (20-576) Volts Line to Neutral, (0-721) Volts Line to Line
- Universal Voltage Input
- Input Withstand Capability – Meets IEEE C37.90.1 (Surge Withstand Capability)
- Programmable Voltage Range to Any PT Ratio
- Supports: 3 Element WYE, 2.5 Element Delta, 4 Wire Delta Systems
- Burden: Input Impedance 8 MΩ; Burden 0.008 W at 120 Volts
- Input Wire Gauge: AWG#12 – 26/7 (0.129 - 3.31) mm²

**Current Inputs:**
- Class 10: (0.005 to 10) A, 5 A Nominal
- Class 2: (0.001 to 2) A, Class 2: 1 mA
- Pass Through Wire Diameter: 0.177 / 4.5 mm
- All Inputs and Outputs are Galvanically isolated to 2500 Volts

**Isolation:**
- Off State Leakage Current @350 Volts: 5 mA, Class 10: 1 mA
- Peak Load Current: 350 mA (10 ms)
- Peak State Leakage Current @350 V DC: 1 uA

**Environmental Rating:**
- Storage: (-20 to +70) °C
- Operating: (-20 to +70) °C
- Humidity: to 95% RH Non-Condensing

**Continuous Load Current:**
- 120 mA

**Specifications**

**Ordering Information** - All fields must be filled in to create a valid part number.

<table>
<thead>
<tr>
<th>Model</th>
<th>Frequency Range</th>
<th>Current Input</th>
<th>V-Switch™ Pack</th>
<th>Power Supply</th>
<th>I/O Slot 1*</th>
<th>I/O Slot 2*</th>
<th>Mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shark250</td>
<td>60 Hz System</td>
<td>1 A Nominal</td>
<td>V1 D2 INP100S</td>
<td></td>
<td>X</td>
<td>X</td>
<td>DIN</td>
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<tr>
<td>Shark250T</td>
<td>50 Hz System</td>
<td>1 A Nominal</td>
<td>V1 D2 INP100S</td>
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<td>X</td>
<td>ANSI</td>
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</table>

**Accessories**

<table>
<thead>
<tr>
<th>E205301</th>
<th>CAB26522</th>
<th>Unicorn 2500</th>
<th>Unicorn 2500-F</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS485 to USB Adapter</td>
<td>USB-A to USB Mini-B Cable</td>
<td>RS485 to RS232 Converter</td>
<td>RS485 to RS232 to Fiber Optic Converter</td>
</tr>
</tbody>
</table>

**Certificate of Calibration, Part #: CCaL**

This provides Certification of Calibration with NIST traceable Test Data.

**Software**

<table>
<thead>
<tr>
<th>COMPQA5P1Y</th>
<th>ENERGYPQA-Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>CommunicatorPQA® 5.0 for Windows Single-Computer License (One Year)</td>
<td>Cloud-based Energy Management Solution</td>
</tr>
</tbody>
</table>

*I/O cards can be ordered separately using the part numbers shown in the ordering information, with -KT added, e.g., INP100S-KT.