Sentry-6002NEMA

Advanced Battery Health Monitoring for Power Plants and Substations
**Key Features**

- **Ultra Precise IR** - Internal Resistance measurement is performed on each cell with **advanced DC method**, to detect dry-out, electrolyte level low and deterioration, as well as capacity loss long before a problem occurs.

- **Discriminated inter-cell resistance** to identify connection/connectivity problems without a discharge. Fulfill NERC continuity requirement.

- **IP65 (NEMA4)** grade protection allows unit(s) to be installed inside the battery room, without concern of corrosive environment. All-in-One compact design allows for easy installation on a rack or wall.

- **Automatic Discharge Capture** to record cell level data for planned load test and unplanned power outage.

- **Easy to Install** – Four-terminal measurement principle, ohmic accuracy is not affected by the sampling wire length. Optimized wiring design for quick and reliable installation for variety of battery sizes, post types and rack layouts.

- **Reliable Solid State Scanning** - (rather than mechanical relay) provides the highest reliability for industrial applications.

- **HMI Panel** - The plug and play touch panel (optional, handheld or panel mounting) displays battery data and alarms. It allows the technician to configure and calibrate without the need of a PC.

- **Access Data/Alarm from Anywhere** - Firewall friendly communication, plug and play, easy to manage large number of sites from anywhere via internet or private network. Alarming through email or SMS.

- **SCADA Integration** - The system fully supports 3rd party SCADA or site management systems with Modbus-RTU, Modbus-TCP, API and hyperlink to real-time data.

- **NERC Report** - 1-click Excel “Auto-fill” NERC report generation with realtime data from remote site. Easy to plot trending with stored data in remote unit.

- Designed, manufactured, and supported by BatteryDAQ in Maryland USA.

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**Introduction**

**Sentry-6002NEMA** is a proven battery monitoring system for power plants and substations with vented (flooded) or valve regulated lead acid. The core measurement unit has continuously evolved from our first generation BM6500 model in 1996 (many are still in service), due to our focused effort to make it precise, reliable, and easy to install and use. Our rich experiences with IT security, data management, SCADA integration and NERC report generation ensures a smooth implementation, at any scale.

Sentry-6002NEMA has been installed into many utility companies across North America and worldwide to meet the IEEE standards and latest NERC PRC-005 compliance requirements. (References available)

**Functions**

**Sentry-6002NEMA** is designed to automate recommended measurements in IEEE and NERC standards for Vented and Valve Regulated Lead Acid Batteries to ensure safe operation, efficient battery maintenance, and optimal battery service life.

1) Continuously monitors Voltage, Current, Ambient and Battery Temperature to ensure batteries are in correct float charging condition.

2) Online Internal Ohmic monitoring to detect battery premature or normal deterioration such as
   - Dryout /Electrolyte Low
   - Loss of Compression
   - Swelling and Expansion
   - Grid or Strap Corrosion
   - Loss of Active Material
   - Negative Plate Discharge
   - Other Capacity Losing Mechanisms.

3) Provides actionable data and graph via Web and/or PC software for weak battery identification, alarm handling, preventative battery services and battery replacement.

4) Enables user to efficiently manage large number of battery banks and sites nationwide or worldwide.

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**IEEE and NERC Standard Reference**

- **IEEE Std. 1188**: Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead- Acid (VRLA) Batteries for Stationary Applications
- **IEEE Std. 450**: Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications
- **Standard PRC-005-2**: Protection System Maintenance ([NERC Link](https://www.nerc.com) or [BatteryDAQ Fulfillment Link](https://www.batterydaq.com))

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For NiCad batteries, please refer to Model **Sentry-6002-NiCad** Datasheet for details.
# Streamline Battery Maintenance

<table>
<thead>
<tr>
<th>Maintenance Activity</th>
<th>BatteryDAQ Monitoring Solution</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check Charger Output and Environment</td>
<td>Continuous monitoring of DC supply voltage (Bus Voltage), float charge current, ripple current, charge/discharge current, ambient temperature, and pilot battery temperature.</td>
<td>√</td>
</tr>
<tr>
<td>Verify Cell Float Voltage</td>
<td>Voltage monitoring for each cell. Color-coded bar graph display to easily identify cells with low/high voltage.</td>
<td>√</td>
</tr>
<tr>
<td>Measure Internal Ohmic Value for Each Cell</td>
<td>Precise internal resistance online measurement for each cell. Data is more consistent than manual measurement.</td>
<td>√</td>
</tr>
<tr>
<td>Inspect Electrolyte Level</td>
<td>Low electrolyte cell will be identified/indicated with high Internal Resistance.</td>
<td>√</td>
</tr>
<tr>
<td>Verify Battery Terminal Connection Resistance</td>
<td>Precise connection resistance monitoring can identify connection/corrosion problems, without a discharge. More reliable than visual inspection.</td>
<td>√</td>
</tr>
<tr>
<td>Verify Battery Continuity</td>
<td>Active load to test string continuity. Any continuity issue will be identified even when the voltage and internal resistance may appear normal.</td>
<td>√</td>
</tr>
<tr>
<td>Prepare NERC Report</td>
<td>“1-Click” to prepare NERC report on Excel sheet filled with realtime data. Full history archive for trending and audit</td>
<td>√</td>
</tr>
</tbody>
</table>
**Wiring**

**Wiring Example: 60x2V, 2-wire mode.**

One string is divided into 4 sections to apply Internal Resistance excitation current.

4-terminal principle for precise sampling of Battery Internal Resistance and Inter-Cell Connection Resistance.

Refer manual for less than 60 cells per unit.
Technical Data

**Battery Bank Working Range**
Compatible with **Vented and Valve Regulated** Lead Acid Batteries.

**System Voltage**
- Sentry-6002NEMA-120: 90 – 150V
- Sentry-6002NEMA-240: 180 – 300V

**Battery Capacity**: 100Ah to 6,000Ah

**Cell/Block Voltage**: 2V, 4V

**Current Range**: +/- 3,000A (with proper CT)

**Power Supply**
- Powered by battery bank, 90 – 300V
- Maximum power consumption: 10W
- Optional: 12V 10W power adapter

**Voltage Measurement**

- **String Voltage**: 0 – 300V, 0.1% / 0.1V
- **Cell/Unit Voltage**: +/- 3V (+/-6V for 4V) 0.1% / 0.001V
- **Sensing Leads**: 0.5A inline fuse

**Current Measurement**

- **DC Current**: 0.1% / 0.1A + sensor accuracy
- **Ripple Current**: RMS ripple current, 0.1A resolution

**Current Transducer Size**

- Default CT: SCKT-300A, measurement range +/- 450A, window size D-35mm.
- Optional split core CT: CY5-300A 64mmx16mm, CY10-300A 104mmx40mm
- Same sensor is used for **ripple current** measurement

**CT operating temperature**: -25°C to +85°C

**Ohmic Measurement**

- **Internal Resistance**: 0 to 3mΩ, 0.005 mΩ resolution
- **Contact Resistance**: 0 to 3mΩ, 0.005 mΩ resolution (2-wire mode only)
- **IR Leads**: 10A inline fuse

**Temperature Measurement**

- **Temperature**: Precision AD592. (1) ambient temperature sensor, (2) pilot sensors.
- **Range**: -40 to 85°C (-40 to 185°F) Accuracy: 1°C

**Operating Temperature**: -20C to 65°C (-4 – 149°F)

**Operating Humidity**: 5 – 95% RH

**Communication and Networking**

**Serial Ports**:
- Isolated RS-232C and RS-485 interface
- MODBUS RTU, 9600-8-1-None
- RS232C port supports Plug & Play HMI touch screen display

**Ethernet**:
- One DTU per battery room to manage up to 8 Sentry units.
- Embedded web page with battery data and graph, compatible with Battery Analyzer software
- Modbus-TCP for SCADA integration

**Wi-Fi (Optional)**
- **Cellular** (Optional) IoT cellular adapter, additional SIM card or monthly fee.

**LED Indication**
- Dual-color LEDs for status
- Orange LED for service alarm
- Red LED for urgent alarm

**Digital Inputs**

- 2 mechanical/open collector switch signal inputs
- 1 voltage signal input (Low 0 to 1V, High 3 to 10V)
- Digital signal can be read with Modbus protocol.

**Alarm Settings**

- Bank/Charger Voltage High/Low
- Ambient/Pilot Temperature High
- Battery Voltage High/Low
- Internal Resistance High/Low
- Connection Resistance High

**Alarm Outputs**

**Voltage Free Dry Contacts**:
- Service Alarm (Normal Close, 60V 0.1A capacity)
- Urgent Alarm (Normal Close, 60V 0.1A capacity)

**Enclosure Dimensions and Unit Weight**

- NEMA 4/4X/12/13, EN/IEC60204-1 and 60529 Type IP66
- 13.50” (H) x 11.27” (W) x 7.18” (D)
- 343mm (H) x 286mm (W) x 182mm (D)
- 10 lbs per unit (about 4.5kg)

*Specifications subject to change without notice*
## Software and Alarm Delivery

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded Web</td>
<td>Immediate access battery data/graph with web browser</td>
<td>Included</td>
</tr>
<tr>
<td>Battery Analyzer</td>
<td>PC software to manage multiple systems. Email/SMS alarm.</td>
<td>FREE</td>
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<tr>
<td></td>
<td>Powered by Microsoft® SQL Server® Express database.</td>
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<tr>
<td></td>
<td>1) Display battery data from remote sites</td>
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<tr>
<td></td>
<td>2) Analyze data and manage alarms</td>
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<td></td>
<td>3) Achieve historical data for trending and tracing</td>
<td></td>
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<td></td>
<td>4) Capture discharge events or load test data</td>
<td></td>
</tr>
<tr>
<td>Excel NERC Report</td>
<td>1) To manage hundreds of battery banks remotely in one Excel workbook</td>
<td>FREE</td>
</tr>
<tr>
<td>Workbook</td>
<td>2) To automatically analyze battery data with set thresholds and highlight rows with an alarm</td>
<td></td>
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<tr>
<td></td>
<td>3) To automatically prepare NERC report with real-time battery data and date/time stamp</td>
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<tr>
<td></td>
<td>4) To highlight weak cells on the NERC report</td>
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<td></td>
<td>5) To archive historical battery data</td>
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<td></td>
<td>6) No database required</td>
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<td></td>
<td>7) Transparent code for IT security inspection</td>
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<td></td>
<td>8) Easy to add/remove/enable/disable a battery bank</td>
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<td></td>
<td>9) Easy to set alarm thresholds for different battery types without tedious setting on each bank.</td>
<td></td>
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<tr>
<td></td>
<td>10) To utilize convenient Excel functions such as sorting with any column.</td>
<td></td>
</tr>
<tr>
<td>Master-800 Dashboard</td>
<td>Run parallel with SCADA. Effectively manage multiple remote systems nationwide or worldwide in private network, without PC software and IT security concerns. Email/SMS alarm.</td>
<td>Master-800 not included</td>
</tr>
<tr>
<td>MyBattery Platform</td>
<td>Secured cloud/public platform for unlimited (1,000,000+) sites and batteries. Access data worldwide with smart phone and/or laptop.</td>
<td>FREE Subscription</td>
</tr>
<tr>
<td>SCADA</td>
<td>Modbus-TCP, Modbus-RTU, API integration</td>
<td>FREE Technical Support</td>
</tr>
</tbody>
</table>

### Site Survey for Power Plants and Substations

Please complete this survey in a Word Document, replacing or attaching photos, and forward to BatteryDAQ for accurate job preparation. (tech@batterydaq.com)

https://batterydaq.com/site-survey-power-plants-substations/
## Ordering Information

<table>
<thead>
<tr>
<th>System</th>
<th>Sentry-6002NEMA-120</th>
<th>Sentry-6002NEMA-240</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Battery Configuration</strong></td>
<td>60 x 2V 2-wire mode (56 to 60 cells)</td>
<td>120 x 2V 2-wire mode (100 to 120 cells)</td>
</tr>
<tr>
<td><strong>Sentry units</strong></td>
<td>ST-6002 x 1</td>
<td>ST-6002 x 2 (Unit A + Unit B)</td>
</tr>
<tr>
<td><strong>Connection Kit</strong></td>
<td>1) Full set of terminal plugs</td>
<td>1) Full set of terminal plugs</td>
</tr>
<tr>
<td></td>
<td>2) 10A QDC leads (5)</td>
<td>2) 10A QDC leads (10)</td>
</tr>
<tr>
<td></td>
<td>3) (3) Temperature sensors, (3) stainless steel tape.</td>
<td>3) (6) Temperature sensors, (6) stainless steel tape.</td>
</tr>
<tr>
<td></td>
<td>4) (1) CT connector with 6FT cable.</td>
<td>4) (1) CT connector with 6FT cable.</td>
</tr>
<tr>
<td><strong>Tab washers</strong></td>
<td>130 pcs per unit (specified size 6mm/8mm/10mm)</td>
<td>260 pcs per unit (specified size 6mm/8mm/10mm)</td>
</tr>
<tr>
<td><strong>Sensing leads</strong></td>
<td>130 pcs fused QDC leads per unit</td>
<td>260 pcs fused QDC leads per unit</td>
</tr>
<tr>
<td><strong>Current Transducer</strong></td>
<td>SCK12T-300A D35mm default</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optional split core CT: CY5-300A 64mmx16mm, CY10-300A 104mmx40mm</td>
<td></td>
</tr>
<tr>
<td><strong>Harness (Optional)</strong></td>
<td>Pre-assembled 12-conductor cable with plug, default 30FT each (x12) per unit, labeled #1 to #12. Sampling plugs and ferrules are assembled with cables.</td>
<td></td>
</tr>
<tr>
<td><strong>HMI (Optional)</strong></td>
<td>HMI touch screen for onsite display, or as a service tool</td>
<td></td>
</tr>
<tr>
<td><strong>IOT Adapter (Optional)</strong></td>
<td>IoT Cellular communication adapter, can work in parallel with DTU-800.</td>
<td></td>
</tr>
<tr>
<td><strong>Master-800 (Optional)</strong></td>
<td>Centralized Web Dashboard. Manage multiple remote sites/battery banks.</td>
<td></td>
</tr>
<tr>
<td><strong>Electrolyte Level and Cell Temperature Monitor (Optional)</strong></td>
<td>ELM-Series</td>
<td>ELM-Series</td>
</tr>
<tr>
<td></td>
<td>Electrolyte level low detection and temperature for each cell. Signal can be fetched from ELM controller or Sentry-6002 via Modbus-TCP.</td>
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</tr>
<tr>
<td><strong>Ground Fault Detector (Optional)</strong></td>
<td>GF-100 Ground Fault Detector</td>
<td>GF-100 Ground Fault Detector</td>
</tr>
<tr>
<td></td>
<td>Intelligent ground fault detection, 100 to 300V range, default sensitivity 5K ohm.</td>
<td>Intelligent ground fault detection, 100 to 300V range, default sensitivity 5K ohm.</td>
</tr>
</tbody>
</table>

**Battery DAQ**

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