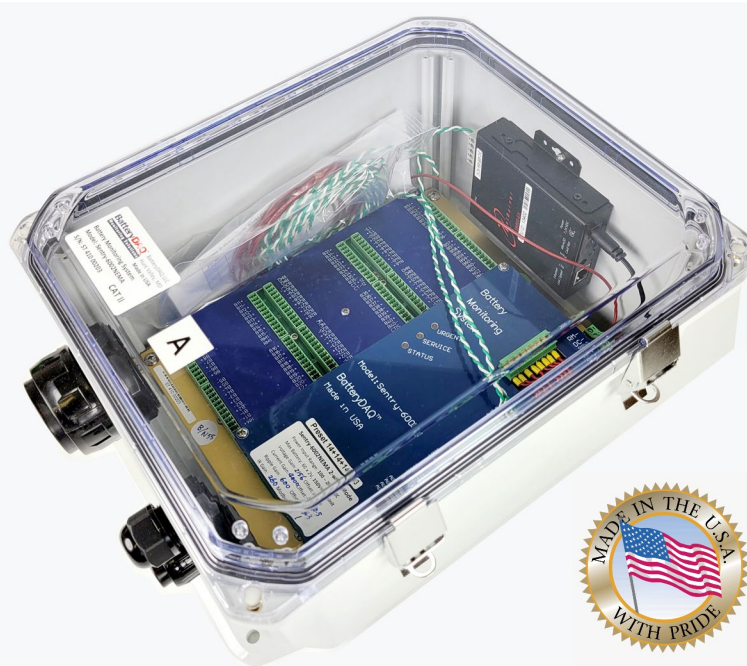# BatteryDAQ
MONITORING SOLUTIONS

The Leader in Battery Monitoring for Power Utility Automation

Sentry-6002NEMA

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

Proven High Accuracy	Web Based Software	Centralized Dashboard

Key Features

- **Ultra Precise Internal Resistance Measurement** Our proprietary pulsed DC method conducts accurate IR measurement on each cell, accommodating capacities of up to 6,000Ah. This level of precision exceeds what is attainable with competitor's modular BMS. The IR value reflects the electrochemical property changes that occur as batteries age. (Contrastingly, the AC method solely measures "pure" electric resistance and cannot penetrate the battery plate surface, limiting its insight into battery health.)

- **Discriminated Inter-Cell Resistance:** Identify cell-to-cell connection and string connectivity problems without requiring a discharge. This feature fulfills **NERC continuity** requirement.

- **IP65 (NEMA4) Grade**, **UL Certified Airtight Protection**: Allows unit(s) to be installed inside battery rooms, without concern of corrosive environment. The All-in-One design has been optimized for easy installation on rack or wall.

- **Automatic Discharge Capture:** Archive cell-level data during power outages.

- **Interactive Load Test Recording:** Visualize the discharge course and identify weak cell(s). Full course data is saved in Excel friendly format.

- **Easy Installation:** The four-terminal principle ensures that ohmic accuracy remains unaffected by the sampling wire length. Our optimized wiring design facilitates quick and reliable installation for a variety of battery sizes, post types and rack layouts.

- **HMI Panel** (Optional): The plug-and-play touch panel offers an intuitive interface to display battery data and alarms. Technicians can configure, calibrate and troubleshot alarms without requiring a PC.

- **Remote Access:** Easily access data and alarms from anywhere with firewall-friendly communication. Manage a large number of sites through the internet or private network.

- **SCADA, PI System Integration:** Enjoy seamless integration with SCADA, PI System or other EMS using Modbus-RTU, Modbus-TCP, API and hyperlink to real-time data.

- **NERC Reporting:** 1-click Excel "Auto-fill" generates NERC report with real-time data from remote site. Plot trends effortlessly with stored data in remote unit.

- **Designed, Manufactured, and Supported in the USA.**

Introduction

Sentry-6002NEMA is a time-tested battery monitoring system tailored for power plants and substations with vented (flooded) or valve-regulated lead acid batteries. Our journey began with the pioneering BM6500 model in 1996, and today, our core measurement unit stands as a testament to continuous innovation. Remarkably, many of our initial units from that era remain operational, underlining our commitment to precision, reliability, and user-friendliness.

With a solid presence in key utility companies across North America and worldwide, the Sentry-6002NEMA meets and exceeds the requirements of IEEE standards and the latest NERC PRC-005. Our history of successful installations underscores the robustness of our offering, making it the go-to choice for critical battery monitoring for power utility automation needs.

Sentry-6002NEMA automates the recommended measurements in IEEE and NERC standards to ensure safe operation, efficient battery maintenance, and optimal battery service life.

1) 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 for weak battery identification, alarm handling, preventative battery services, load test, and battery replacement.

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

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

IEEE Std. 1491: IEEE Guide for Selection and Use of Battery Monitoring Equipment in Stationary Applications

NERC Standard PRC-005-2: Protection System Maintenance (NERC Link or BatteryDAQ Fulfillment Link)

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

Streamlined Battery Maintenance for NERC Compliance

Maintenance Activities	BatteryDAQ™ Monitoring Solution	Coverage
Checking Charger Output and Temperature	Constantly monitors DC supply voltage (Bus Voltage), float charge current, ripple current, charge/discharge current, ambient temperature, and multiple pilot battery surface temperature.	√
Verifying Cell Float Voltage	Monitors voltage for each cell, displayed with color-coded bar graph for easy identification of weak/abnormal cells with low/high voltage.	√
Measuring Internal Ohmic Value for Each Cell	Precise online measurement of internal resistance for each cell, providing more consistent data compared to manual measurement.	√
Inspecting Electrolyte Level & Topping Water	Identifies cells with low electrolyte by indicating high Internal Resistance, or abnormal voltage due to leakage, guiding mandatory quarterly **Visual Electrolyte Inspection**.	√
Verifying Battery Connection/Torque	Monitors cell-to-cell and inter-tier connection resistance, identifying connection/torque or corrosion problems without requiring a discharge.	√
Verifying Battery String Continuity	Performs active loop tests to check string continuity; detects continuity issue even when voltage and internal resistance seem normal.	√
Preparing NERC Report	Generates NERC battery inspection report in Excel format with real-time data at a single click. PDF/printout are archived for audits.	√
Trending IR or Current	Archives full historical data for each cell and floating current, facilitating easy trend analysis with Excel.	√
Performing a Load Test	Easily records and archives load test without the need for extra software.	√

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 wiring for 100-250VAC power input*

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: CY10-300Q 104mmx40mm (Optional) Shunt 250A / 500A, precision, low drift, isolated The 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 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 **Operation 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 for 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) **Optic Fiber** (Optional) SFP to Ethernet converter **Cellular** (Optional) IoT cellular adapter or private LTE router/gateway

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
Flame rating UL94 V-0, UL746C 5VA
13.5" (H) x 11.3" (W) x 7.7" (D)
337mm (H) x 286mm (W) x 196mm (D)
10 lbs. per unit (about 4.5kg) |

*Specifications subject to change without notice

Wiring

Wiring Example: 60x2V, 2-wire mode.

One string is divided into 4 sections for applying Internal Resistance excitation current.

4-terminal principle for precise sampling of Battery Internal Resistance and Inter-Cell Connection Resistance.
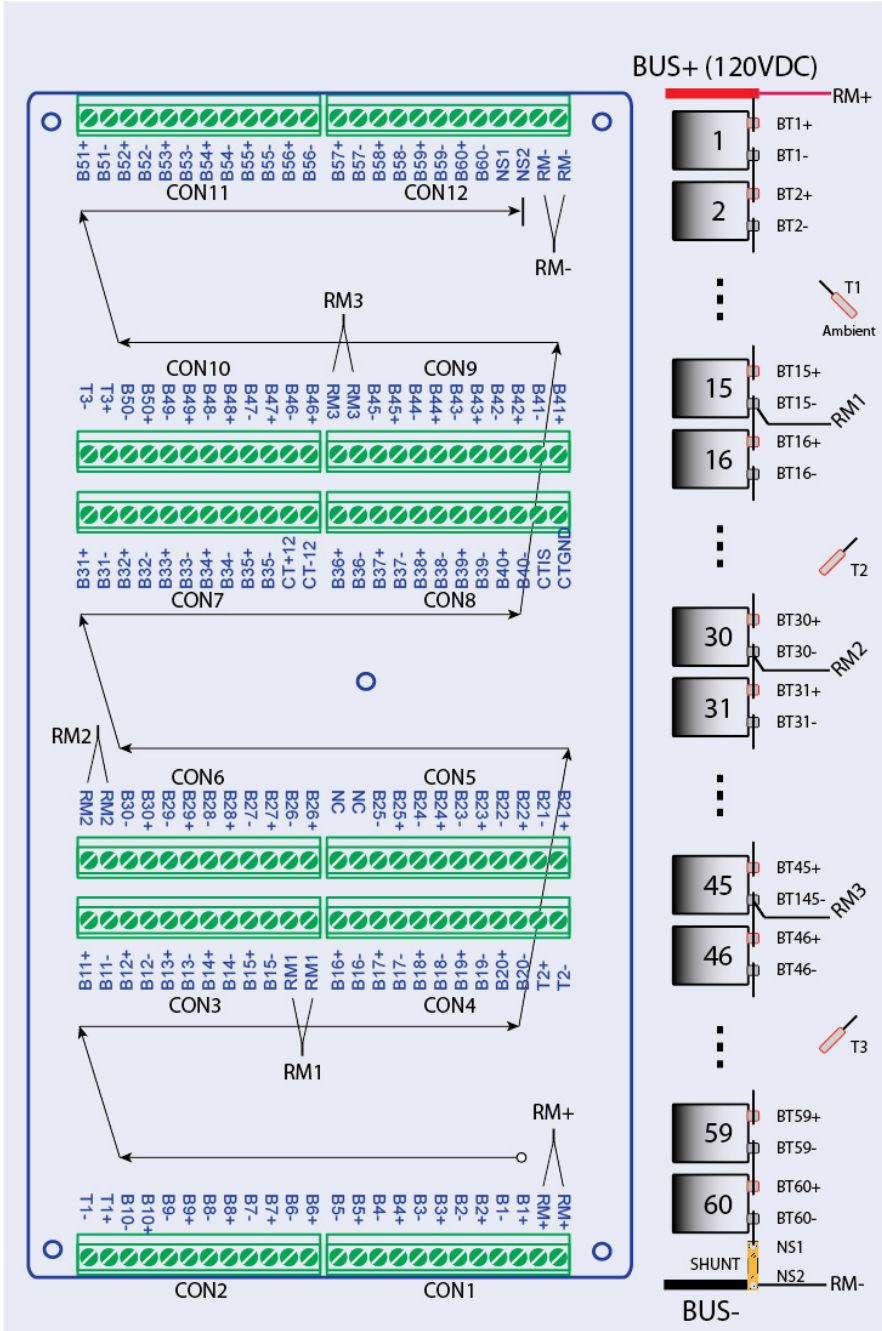
[Follow the manual instructions for less than 60 cells per unit.]

Download preparation checklist and installation instruction sheets:
https://batterydaq.com/models/sentry-6002nema/

Software and Alarm Delivery

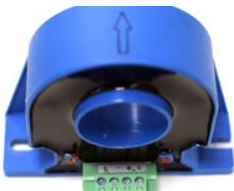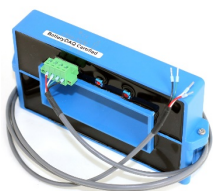| Software	Main Functions *(Contact BatteryDAQ for a free demo via web conference)*
DTU-800 Edge Computing with Embedded Web	1) Collects battery data from up to 8 Sentry units in one location. 2) Analyzes data and generates alarm for different battery types on a site. 3) Provides immediate access to battery data, colored bar graph via web browser. 4) Presents instant most recent 3-day data plot for emergency response and troubleshooting. 5) Stores lifetime (+20 years) battery data in Excel friendly format. 6) Records full course of load test for each cell. 7) Provides Modbus-TCP for multiple clients.
Master-800 Centralized Dashboard	1) Effectively manages hundreds of remote systems within enterprise or nationwide in private or public network, without PC software and IT security concerns. 2) Delivers alarm via Email/SMS/SNMP. 3) Runs in parallel with SCADA or other EMS.
Excel NERC Report Workbook	1) Manages hundreds of battery banks remotely in one Excel workbook. 2) Automatically analyzes battery data with thresholds and highlights rows with alarm. 3) Prepares NERC report with real-time battery data and date/time stamp. 4) Highlights weak cells on the NERC report. 5) Archives historical battery data to Network Attached Storage (NAS). 6) Transparent scripts are available for IT security inspection. 7) Enables user to add/remove/enable/disable a battery bank. 8) Enables user to set alarm thresholds for different battery types without tedious setting for each bank. 9) Utilizes convenient Excel functions such as sorting by any column.
SCADA Integration Grid Automation	Standard: Modbus-TCP, Modbus-RTU Optional SNMP, DNP3 and IEC 61850 (Contact tech support for details.)
Legacy PC Software	*Battery Analyzer PC software is not required for any scale implementation.*

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 ordering and job preparation. (tech@batterydaq.com)
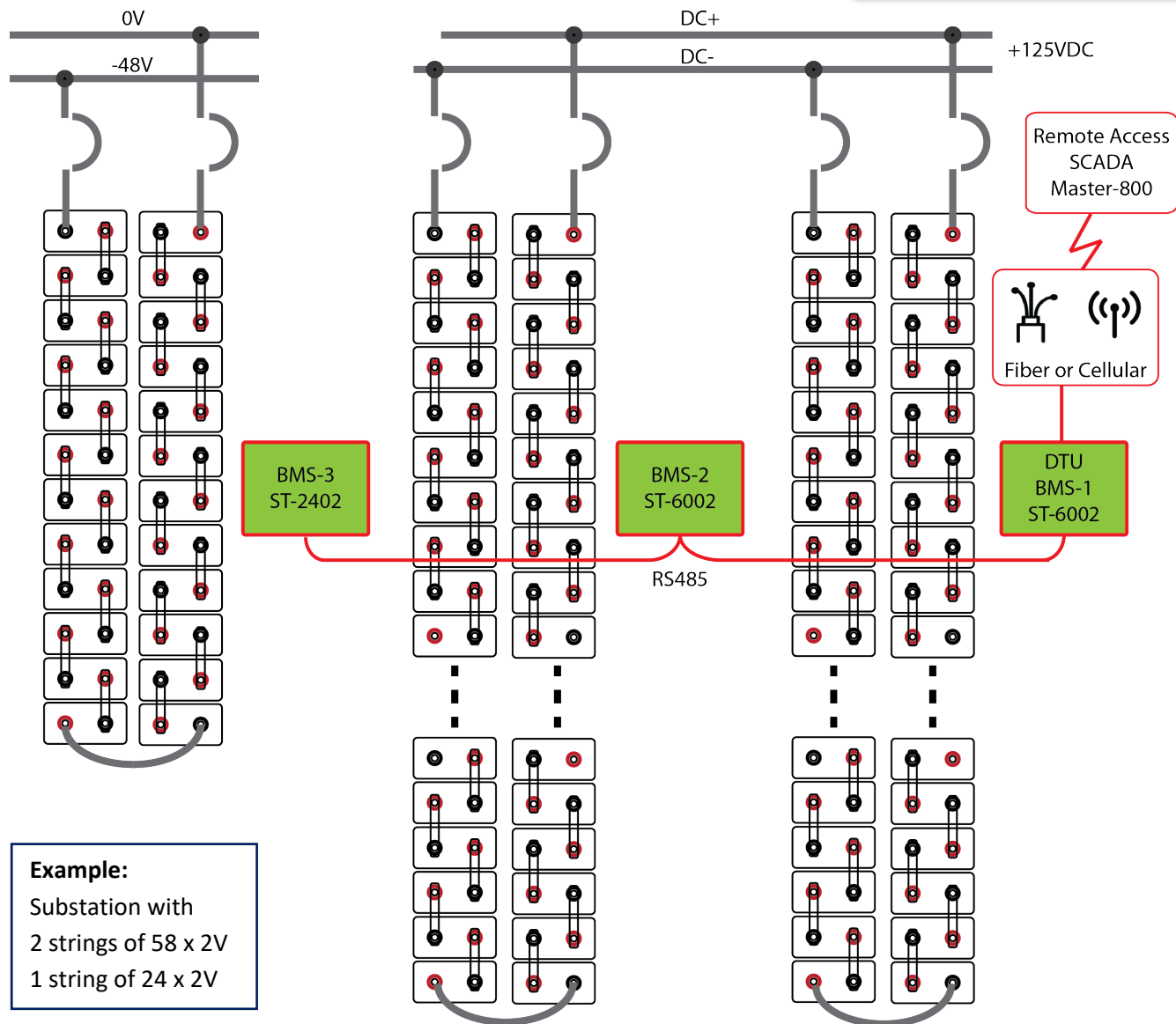
https://batterydaq.com/site-survey-power-plants-substations/

Ordering Information

Product	P/N	Photo	Description
Sentry units	ST-6002NEMA	*(Photo shows a DTU installed)*	60 x 2V, 2-wire mode, pre-configured. Cell number and alarm thresholds can be modified with HMI. For 240V system, 2 units (A+B) shall be utilized. **Each unit includes a connection kit** 1) 10A fused IR leads (**5**) 2) (**3**) Temperature sensors, (**3**) stainless tape 3) (**1**) CT connector cable 4) RS485 wiring to next unit if needed.
DTU	DTU-800EX		One DTU-800 collects data/alarm from multiple Sentry units at a site (battery room).
Fiber Adapter	SFP-100M		Optional Fiber SFP to Ethernet Converter, industrial grade, powered by Sentry-6002NEMA unit
Sensing leads	TL1-OT-xx		120 pcs fused leads per unit, o-ring or tab washer Please specify terminal size 6/8/10mm.
Harness	CA-12P-xx		12-conductor cable pre-assembled with terminal plug, **12** per unit, labeled #1 to #12. Please specify length, default 20FT (CA-12P-20).
HMI	HMI-GT02		HMI touch screen for onsite display, or as a service tool
Master-800	MASTER-800		Centralized Web Dashboard. Manages multiple remote sites/battery banks. 19" rack mount.
Ground Fault Detector	GF-100		**GF-100 Ground Fault Detector** Intelligent ground fault detection, 40 to 300V range, default sensitivity 5K ohm. **[Not required if charger has ground fault detection]**

Current Transducer	SCK12T-300A	CY10-300Q	SSA-250A, SSA-500A
CT type must be specified with Sentry unit order. Shunt and hall transducer are inter-changeable with different **gain settings**.			
Size and Range	Closed core, D35mm Max +/-450A	Split core, 104mmx40mm Max +/-450A	High precision shunt with isolated amplifier. 250A or 500A.

0V

-48V

DC+

DC-

+125VDC

Remote Access
SCADA
Master-800

Fiber or Cellular

BMS-3
ST-2402

BMS-2
ST-6002

DTU
BMS-1
ST-6002

RS485

Example:

Substation with

2 strings of 58 x 2V

1 string of 24 x 2V

BatteryDAQ
MONITORING SOLUTIONS

Hunt Valley, Maryland, USA

TOLL FREE: +1-800-455-8970

TEL: +1-410-337-5233

www.batterydaq.com

tech@batterydaq.com

Turn-key Partner