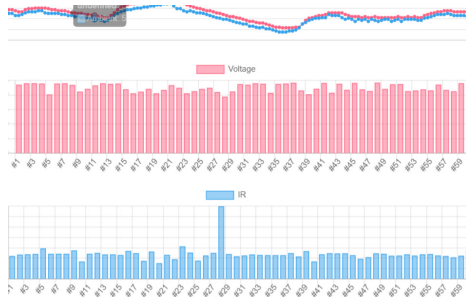


Sentry-6002-NiCad

Advanced Battery Health Monitoring for **Power Plants and Substations**
Nickel Cadmium Batteries



Embedded Web

BatteryDAQ Carrier A East Region

#	Alarm	Status	DTU#	Name	IP	MID	No.	Type	IR Base	DelV	Amp	Repln	Room/C
38	0	Normal	12302	175VDC	72.167.223.110	34	80	2	300	133.9	1.3	1.1	23.2
26	1	Service	12306	6KCK_2R	72.167.223.110	22	8	8	300	54.8	0.2	41.5	13.0
19	1	Service	12318	4E_MN	72.167.223.110	15	8	8	300	54.6	-0.3	39.9	10.2
23	0	Normal	12322	IN-1	72.167.223.110	19	4	8	300	54.5	-0.4	40.0	14.2
20	0	Normal	12329	55S STR 1	72.167.223.110	25	4	8	300	54.5	-0.6	46.0	13.3
24	1	Service	12324	19AAL_2R	72.167.223.110	20	8	8	300	54.3	0.7	41.4	22.0
35	1	Service	12367	ETNA	72.167.223.110	31	8	8	300	54.3	-0.4	0.0	20.6
34	1	Service	12366	IN-1	72.167.223.110	30	4	8	300	54.1	0.0	24.5	12.3
25	1	Service	12325	6PCK STR 1	72.167.223.110	21	4	8	300	54.0	-0.3	4.6	14.8
18	0	Normal	12317	IN-1	72.167.223.110	14	4	8	300	53.6	-0.4	43.9	14.4

Centralized Dashboard



Remote Access



Key Features

- **Ultra Precise IR** - Resistance measurement is performed on each cell with *advanced DC method*, to detect battery failure, electrolyte level low and corrosion on inter-cell connection for preventative maintenance.
- **1-wire mode** – Simple to install. One sampling wire to each cell.
- **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.**

Introduction

High quality vented Ni-Cad batteries in standby stationary applications can last for 20+ years, but they need proper maintenance in order to prolong the battery service life and optimize DC system performance. Without monitoring, inspections and maintenance can be scheduled on a calendar basis. However, manual verification of a large number of cells is time consuming and unreliable, especially for terminal connection resistance and inter-cell connection resistance measurements. Effective monitoring provides remote indications of abnormal operation and cell condition, including battery bus voltage, charging current, string continuity, temperature, electrolyte level, cell voltage, and corrosion caused by potassium carbonate (gray-white deposits) buildup. Effective monitoring also automatically records the discharge performance and facilitates scheduled capacity testing.

Giving the nature of pocket plate NiCad batteries, the aging and deterioration mechanisms are distinctly different from Lead Acid. A NiCad cell does not experience continual corrosion of the positive plate and grid structure throughout its operation life. Only the gradual aging or the active materials influences the service life. Degradation is primarily due to recrystallization of the nickel hydroxide in the positive plate. This aging contributes to a small portion of Internal Resistance so the Internal Resistance for NiCad cells remains steady over service life. **1-wire Mode Resistance** reflects Cell Internal Resistance, Cell-to-Cell Connection Resistance and Electrolyte Low Abnormality.

Sentry-6002 is a time-proven, reliable, and powerful battery monitoring system for power generation plants and distribution substations. The **Sentry-6002-NiCad** 1-wire mode version has the same electronics and housing design as Sentry-6002NEMA (2-wire mode for vented or valve regulated lead acid battery) systems, but also has optimized firmware and connection panel, for NiCad applications.

Sentry-6002-NiCad automates recommended measurements in IEEE and NERC standards for NiCad batteries to ensure its safe operation, efficient battery maintenance, and optimal battery service life.

IEEE and NERC Standard Reference

IEEE Std. 1106: Recommended Practice for Installation, Maintenance, Testing, and Replacement of Vented Nickel-Cadmium Batteries for Stationary Applications

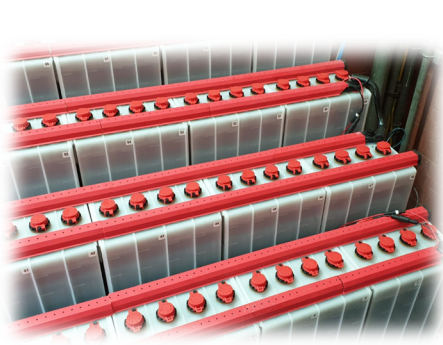
Standard PRC-005-2: Protection System Maintenance Table 1-4(c) ([NERC Link](#) or [BatteryDAQ Fulfillment Link](#))

For Cost Saving multi-cell monitoring, choose Sentry-2412-120 (every 4-cells) or Sentry-2412-240 (every 8 cells).
Compatible with any cell number. 87 = 4 x 21 + 3 (last channel); 89 = 4 x 21 + 5 (last); 175 = 8 x 21 + 7 (last)



Streamline Maintenance for NiCad Batteries

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

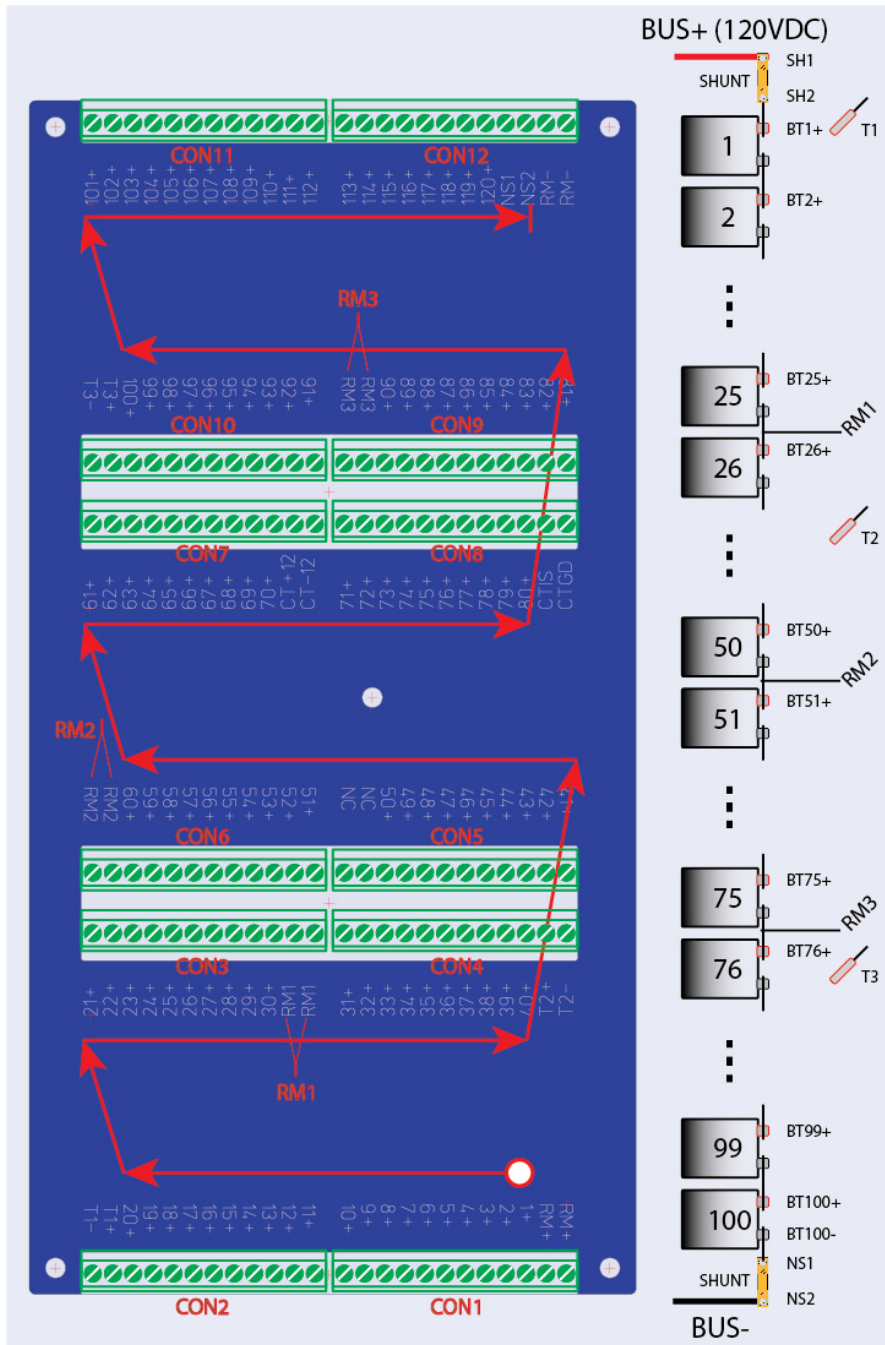


Wiring

Wiring Example: 100 x 1.2V, 1-wire mode.

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

4-terminal principle for precise sampling of Resistance.



Refer manual for connection/wiring details.

Popular Battery Numbers

Bank Voltage	Batteries per String	Per Section
120V	86	S1: 22; S2: 22 S3: 21; S4: 21
120V	87	S1: 22; S2: 22 S3: 22; S4: 21
120V	88	S1: 22; S2: 22 S3: 22; S4: 22
120V	89	S1: 23; S2: 22 S3: 22; S4: 22
120V	90	S1: 23; S2: 23 S3: 22; S4: 22
		Two Units
240V	172	S1: 22; S2: 22 S3: 21; S4: 21 S5: 22; S6: 22 S7: 21; S8: 21
240V	174	S1: 22; S2: 22 S3: 22; S4: 21 S5: 22; S6: 22 S7: 22; S8: 21
240V	176	S1: 22; S2: 22 S3: 22; S4: 22 S5: 22; S6: 22 S7: 22; S8: 22
240V	178	S1: 23; S2: 22 S3: 22; S4: 22 S5: 23; S6: 22 S7: 22; S8: 22
240V	180	S1: 23; S2: 23 S3: 22; S4: 22 S5: 23; S6: 23 S7: 22; S8: 22



Technical Data

<p>Battery Bank Working Range</p> <p>Suitable for NiCad Batteries</p> <p>System Voltage</p> <p>Sentry-6002NiCad-120: 90 – 150V per unit 1.2V NiCad, maximum 100 channels per unit</p> <p>Sentry-6002NiCad-240: 180 – 300V per unit 2x1.2V NiCad (every 2-cell), maximum 100 channels</p> <p>Battery Capacity: 50Ah to 1,000Ah</p> <p>Current Range: +/- 3,000A (with proper CT)</p>	<p>Communication and Networking</p> <p>Serial Ports:</p> <p>Isolated RS-232C and RS-485 interface MODBUS RTU, 9600-8-1-None RS232C port supports Plug & Play HMI touch screen display</p> <p>Ethernet:</p> <p>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</p> <p>Modbus-TCP for SCADA integration</p> <p>Wi-Fi (Optional)</p> <p>Cellular (Optional) IoT cellular adapter, additional SIM card or monthly fee.</p>
<p>Power Supply</p> <p>Powered by battery bank, 90 – 300V Maximum power consumption: 10W Optional: 12V 10W power adapter</p>	<p>LED Indication</p> <p>Dual-color LEDs for status Orange LED for service alarm Red LED for urgent alarm</p>
<p>Voltage Measurement</p> <p>String Voltage: 0 – 300V, 0.1% / 0.1V Cell/Unit Voltage: +/- 4V; 0.1% / 0.001V Sensing Leads: 0.5A inline fuse</p>	<p>Digital Inputs</p> <p>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.</p>
<p>Current Measurement</p> <p>DC Current: 0.1% / 0.1A + sensor accuracy Ripple Current: RMS ripple current, 0.1A resolution</p>	<p>Alarm Settings</p> <p>Bank/Charger Voltage High/Low Ambient/Pilot Temperature High Battery Voltage High/Low Internal Resistance High/Low Connection Resistance High</p>
<p>Current Transducer Size</p> <p>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</p>	<p>Alarm Outputs</p> <p>Voltage Free Dry Contacts:</p> <p>Service Alarm (Normal Close, 60V 0.1A capacity) Urgent Alarm (Normal Close, 60V 0.1A capacity)</p>
<p>Ohmic Measurement</p> <p>1-wire Mode</p> <p>Internal Resistance: 0 to 3mΩ, 0.005 mΩ resolution IR Leads: 10A inline fuse</p>	<p>Enclosure Dimensions and Unit Weight</p> <p>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)</p>
<p>Temperature Measurement</p> <p>Temperature: Precision AD592. (1) ambient temperature sensor, (2) pilot sensors. Range: -40 to 85°C (-40 to 185°F) Accuracy: 1°C</p> <p>Operation Temperature: -20C to 65°C (-4 – 149°F) Operating Humidity: 5 – 95% RH</p>	<p>*Specifications subject to change without notice</p>



Software and Alarm Delivery

Option	Description	Note
Embedded Web	Immediate access to battery data/graph with web browser	Included
Battery Analyzer	PC software to manage multiple systems. Email/SMS alarm. Powered by Microsoft® SQL Server® Express database. 1) Display battery data from remote sites 2) Analyze data and manage alarms 3) Achieve historical data for trending and tracing 4) Capture discharge events or load test data	FREE
Excel NERC Report Workbook	1) To manage hundreds of battery banks remotely in one Excel workbook 2) To automatically analyze battery data with set thresholds and highlight rows with an alarm 3) To automatically prepare NERC report with real-time battery data and date/time stamp 4) To highlight weak cells on the NERC report 5) To archive historical battery data 6) No database required 7) Transparent code for IT security inspection 8) Easy to add/remove/enable/disable a battery bank 9) Easy to set alarm thresholds for different battery types without tedious setting on each bank. 10) To utilize convenient Excel functions such as sorting with any column.	FREE
Master-800 Dashboard	Runs in parallel with SCADA. Effectively manage multiple remote systems nationwide or worldwide in private network, without PC software and IT security concerns. Email/SMS alarm.	Master-800 is additional.
MyBattery Platform	Secured cloud/public platform for unlimited (1,000,000+) sites and batteries. Access data worldwide with smart phone and/or laptop.	FREE Subscription
SCADA	Modbus-TCP, Modbus-RTU, API integration	FREE Technical Support

Site Survey for Power Plants and Substations



The diagram shows a battery bank layout with four rows of batteries labeled L1, L2, L3, and L4. A red dashed line outlines the perimeter of the battery bank. A floor indicator is shown at the bottom left.

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

Monitoring Option	120V (every cell)	240V (every 2-cell)	240V (every cell)
Sentry units	ST-6002-NC120	ST-6002-NC240	ST-6002-NC120 (2 units)
Battery Configuration (Specify cell number in order)	Up to 100 x 1.2V cells per system 1-wire mode	Up to 100 x 2.4V per system 1-wire mode	Up to 200 x 1.2V cells per system 1-wire mode
Connection Kit	1) Full set of terminal plugs 2) 10A QDC leads (5) 3) (3) Temperature sensors, (3) stainless steel tape. 4) (1) CT connector with 6FT cable.	1) Full set of terminal plugs 2) 10A QDC leads (5) 3) (3) Temperature sensors, (3) stainless steel tape. 4) (1) CT connector with 6FT cable.	1) Full set of terminal plugs 2) 10A QDC leads (10) 3) (6) Temperature sensors, (6) stainless steel tape. 4) (1) CT connector with 6FT cable.
Tab washers	120 pcs per unit (specified size 6mm/8mm/10mm)	120 pcs per unit (specified size 6mm/8mm/10mm)	240 pcs per unit (specified size 6mm/8mm/10mm)
Sensing leads	120 pcs fused QDC leads per unit	120 pcs fused QDC leads per unit	240 pcs fused QDC leads per unit
Current Transducer	SCK12T-300A D35mm default Optional split core CT: CY5-300A 64mmx16mm, CY10-300A 104mmx40mm		
Harness (Optional)	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.		
HMI (Optional)	HMI touch screen for onsite display, or as a service tool		
IOT Adapter (Optional)	IoT Cellular communication adapter, can work in parallel with DTU-800.		
Master-800 (Optional)	Centralized Web Dashboard. Manage multiple remote sites/battery banks.		
Ground Fault Detector (Optional)	GF-100 Ground Fault Detector Intelligent ground fault detection, 100 to 300V range, default sensitivity 5K ohm.		



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