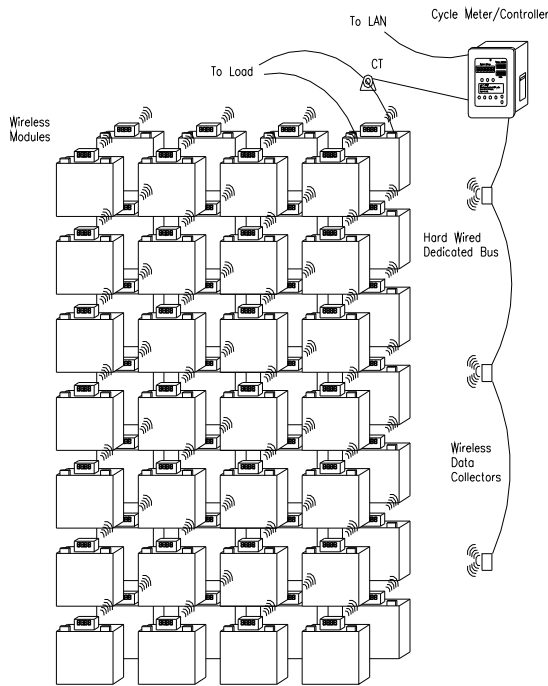


SERIES SENTRY Wireless Battery Monitor



SERIES **SENTRY**

INTRODUCTION:

You have invested in uninterruptible power equipment for your critical loads, don't let the weakest link catch you off guard. Even the most complex backup power may have to rely on unpredictable batteries.

Avoid the risk of costly failures, monitor the "WEAK LINK" in your system!

A battery management program that reduces and identifies potential battery failure is the best way to ensure the integrity of your complete backup power system.

One battery can cause a system failure. Put the SERIES **SENTRY** on duty to protect your investment!

WIRELESS BATTERY MONITOR

GENERAL DESCRIPTION:

The Series **SENTRY** is the right tool to protect your "mission critical" power concerns. Simply stated the **SENTRY** is on constant duty to monitor the DC power plant in your system. The Series **SENTRY** stays on guard and provides "real-time" data 24 x 7 to keep you informed of the health of your battery plant(s).

With the Series **SENTRY ON DUTY** you will avoid the false security of periodic battery testing, because the Series **SENTRY** alerts you of developing problems well in advance of potential failures.



The Series **SENTRY** is a proprietary system using the latest technology to protect your critical power. The system is comprised of Wireless Battery Monitors, Parameter Collectors (DACM), Cycle Meter/Controller, DC current transformers, interconnect wires, and fused links. The Cycle Meter/Controller is the master controller for the system with a 3 window LED readout for System Volts, Charge/Discharge, and AC Ripple/AC Volts. A LCD screen monitors all of the parameters and can be adjusted locally in the event the **SENTRY** software is not being utilized.

- The **SENTRY** is a completely passive system, so DC loading is not constantly discharging the system and reducing the battery cycle life.
- The **SENTRY** allows the user to utilize the existing charging system.
- The **SENTRY** is powered by either the DC power or a house power.
- The **SENTRY** was designed and developed by the “World Class Engineering Division” of Power Systems & Controls.



PS&C has over 40 years of experience providing products that make sense. Our products are designed and built by people who understand your critical power needs.

SYSTEM DESCRIPTION & BENEFITS:

The **SENTRY** is designed to allow constant monitoring and trend analysis of battery integrity up to a string voltage of 642 volts. The complete system consists of a series of **WIRELESS** modules, that are connected to each battery by two (2) wires. Each of these modules transmits “**REAL TIME**” events to **WIRELESS** data collectors. These **WIRELESS** data collectors then transmit data over a dedicated bus to a Cycle Meter/Controller which can be connected via ethernet to software on a central computer system (for remote viewing and trending). Each module give a visual indication of the condition of each battery at the battery.

SERIES *SENTRY* SYSTEM COMPONENTS:

- | | | |
|----|--|--------------------|
| 1. | Individual Cell Modules with Fused Links | Model No. WBM-LM |
| 2. | DACM Data Collector | Model No. WBM-WC |
| 3. | System Cycle Meter/Controller | Model No. WBM-BM1 |
| 4. | Software CD | Model No. WBM-CD |
| 5. | Ground Fault Detector Module | Model No. WBM-CTGF |
| 6. | Current Sensor with Wiring | Model No. WBM-CTCS |
| 7. | Optional Programmer | Model No. WBM-P |

DATA COLLECTION and PRINTING:

1. Data is displayed and transmitted “real-time” from each Battery Module to the Cycle Meter/Controller for data collection and trending.
2. The Cycle Meter/Controller can be printed on a system printer via SNMP support over Ethernet, TCP/IP – RS485 & RS232.
3. The Series **SENTRY** system will operate with or without a PC.
4. A Series **SENTRY** system is required for each battery string.
5. The system is provided with dry contacts
6. Each Series **SENTRY** system is provided with user software programmable for interface with building management and reporting systems as well as trending, monitoring and remote control.

MODULE LED FEATURES:

1. Cell modules have (8) segments, (4) four digit tri-colored displays
2. Automatically adjust the brightness level of displays in relation to ambient lighting conditions
3. Modules use 600V wiring and an in-line fuse
4. Each module is constructed of acid resistant ABS polymer
5. Operating power of modules is less than 10 milliamps (no battery discharge)
6. **Green** – (all parameters normal)
7. **Yellow** – (parameter warning)
8. **Red** – (normal parameters exceeded)





WIRELESS DATA COLLECTOR FEATURES:

1. DACM's can be positioned up to 100 feet from the batteries
2. DACM's use RS485 dedicated bus connection for efficient "Daisy-Chain" installation
3. Each DACM is programmed to determine which Battery Modules it reads.

CYCLE METER/CONTROLLER FEATURES:

1. A Tri-Color LED indicator provides the user a quick visual representation of overall system status denoting cell condition:
 - A. **Green** – (parameters normal)
 - B. **Yellow** – (parameter out of tolerance)
 - C. **Red** – (parameters exceeded - action required)
2. 3 independent LED numeric displays inform the user of the Overall System String Voltage, Charge and Discharge Voltage / Condition, AC Millivolts and AC Ripple.
3. Backlit 4 x 20 LCD display for time and date of battery events, network connection status, time/date, ambient temperature, Cycle Meter unit number and display for all cycle meter parameter menu selection options.
4. Multifunction buttons
 - A. Alarm Silence
 - B. Toggle (changes visual display status of each modules)
 - C. Set Limits
 - D. Local/Remote Control
5. (1) One audible alarm
6. Capability to power unit from 120 AC Volts @ 50Hz / 60Hz or an optional battery supply can be used.

MEASUREMENT CAPABILITIES:

1. Voltage up to 642 volts
2. Unit volt range up to 20.48Vdc
3. Maximum number of cells - 250
4. Cell resistance – 0 to 32,000 Ohms +/- 5%
5. Temperature – Ambient 0 F to 257 F (Range)
6. Discharge Rate – Date & Time duration
7. Data logging for total system voltage and current
8. Data logging for individual cells

MEASUREMENT ACCURACY:

1.	Total Voltage	+/-1%	Total String
2.	Cell Voltage	+/-1%	Each Cell
3.	Cell Impedance	+/-2%	Each Cell
4.	Temperature	+/-1%	Each Cell / Ambient
5.	Humidity	+/-1%	Ambient
6.	AC / DC Impedance	+/- 2%	Total String
7.	AC Millivolts	+/- 2.5%	Total String
8.	Impedance Range	0 to1.000 micro-ohms	Total String
9.	Setting per reading	“Real-Time”	Total String

EXTERNAL POWER REQUIREMENTS:

1. Cycle Meter/Controller input voltage – AC 120 Volts @ 50Hz / 60 Hz or 12 Volts DC

ENCLOSURES:

1. **SENTRY** Cycle Meter/Controller is suitable for wall or rack mounting. DIMENSIONS: 10" W x 8" D x 13" H.
2. **SENTRY** Wireless Modules are suitable to be positioned on or near each battery. DIMENSIONS: 1.25" W x 2.25" H x 3.25" L.
3. **SENTRY** DACM's are suitable for battery cabinet/shelf mounting. DIMENSIONS: 1.25" W x 2.25" H x 3.25" L.

WIRED CONNECTIONS:

1. The Series **SENTRY** battery module is connected to each battery on the positive and negative terminals with conventional connectors.
2. The wireless data collectors are hard-wired (RS485) to the Cycle Meter / Controller for transmission of data.
3. The Cycle Meter / Controller is powered by conventional 120 Power Outlet or the string if preferred.

SOFTWARE:

1. The Series **SENTRY** remote monitoring software is “Windows” based and will operate on a Pentium or better PC running Windows 2000 or Windows XP via CAT5e Ethernet.
2. The software is designed to archive collected data or sort, print, plot and provide tools for identifying unacceptable conditions prior to *Battery System* failure.
3. Software is capable of managing an unlimited number of cells or battery strings with real-time data.
4. The software will notify you when action is required via local alarm, remote annunciation on desktop, text message, and or e-mail.

APPLICATIONS:

The Series **SENTRY** measures and monitors battery parameters for flooded and sealed nickel-cadmium and lead-acid batteries. The information obtained through sample measurement capabilities allows operators to determine cell replacement criteria as well as identifying weak cells and potential system problems. Typical system applications include critical plant systems such as data and revenue streams, mechanical systems and critical back-up equipment.

TESTING PROCEDURES:

The Series **SENTRY** is a passive sampling system that continuously records and gathers battery base measurements using a real-time platform. This information and performance data is continuously gathered which allows the operator to make informed decisions with real-time battery performance information. In addition, the Cycle Meter/Controller and software will store historical data (amount of stored data is dependent upon the size of the storage available) and performance information for future re-call, long term trending and print outs.

BATTERY IMPEDANCE AND AC RIPPLE:

UPS battery chargers can impose a significant AC ripple voltage to connected batteries causing measurable AC current to flow through the battery. Because each battery cell has different impedance, this ripple is not evenly distributed between the cells. Conversely since the same AC current flows through each cell, the cells with higher impedance will invariably exhibit a higher AC voltage at their terminals than cells with lower impedance readings (these values can be determined using the following formula: $E = I \times Z$).

The Series **SENTRY** measures and collects AC ripple voltage readings as an indication of individual battery impedance and these readings can be used as valuable trending and troubleshooting tools. The resulting AC current can be measured and the actual impedance can be calculated using the following formula: $Z = E / I$.

BATTERY CONDUCTANCE & TEMPERATURE:

The Series **SENTRY** is capable of measuring conductance and temperature of each battery and the total string. The Cycle Meter/Controller will measure ambient temperature which can be useful for determining the potential for overtemp and increased internal cell resistance. When collecting individual battery conductance/impedance readings, the temperature of the battery should be measured to compare the correlation between these readings. It is a known fact that battery impedance is greatly increased by lowered battery temperatures, which inhibit the chemical reaction within the battery. Therefore when comparing battery impedance readings, temperature values for these readings should be averaged to obtain factual readings for trending.

HIGH TEMPERATURE DECREASES BATTERY LIFE SIGNIFICANTLY.....

The Series **SENTRY** is the only system on the market that will sense for Ground Fault, Hydrogen, and Thermal Runaway and more importantly, can respond to these anomalies, based on the intentions of the customer.

HOW DO *SENTRY* MEASUREMENTS FIT INTO YOUR MAINTENANCE PROGRAM?

The Series ***SENTRY*** Monitoring System will allow you to sample battery cell impedance readings and create a long-term history to better determine individual cell impedance as compared to estimated cell life. Research has shown that a +/- 20 to 40% variation from the initial battery baseline readings indicate a potential cell problem and possible battery failure criterion. Additional sample evaluation between impedance and the overall string capacity can be compiled via the Series ***SENTRY*** software so that you will be able to evaluate your battery's string health on a daily basis.



INSTALLATION & ONSITE TRAINING:

1. Wireless Modules, DACM's, Cycle Meter/Controller must be installed to manufacturer's instructions by authorized manufacturer's representatives in order to validate Warranty.
2. A factory representative is available to provide on site training sessions prior to commissioning.
3. Three-Year Warranty

Series **SENTRY**

WHAT PARAMETERS AFFECT BATTERY LIFE?

Internal Cell Resistance - As internal cell resistance rises batteries begin to lose their ability to deliver load current. Cell resistance alone does not provide an indication of imminent battery failure, but does provide some failure indication and is useful in helping to identify when a battery should be replaced.

Corrosion – As grids and straps corrode, internal resistance increases.

Sulfation – Electrolyte material begins to convert to lead sulfate and internal resistance increases as the battery ages.

Temperature – Higher temperature (up to 102 degrees F.) can affect internal cell resistance. As a guide, battery life is cut in half for every 15 degrees F above 77 degrees F the battery experiences (Europe uses 20 degrees F above 78 degrees F). High temperature can be a big battery “*killer*”. Lower temperatures (65 degrees F. and below) have little effect on internal cell resistance. Higher battery temperatures do have a major influence on battery performance affecting both the desired and undesired (premature aging) chemical reactions. The Arrhenius equation defines the relationship between battery life and temperature. Arrhenius shows that for each 10 degree increase in temperature, chemical action within the battery increases exponentially (the reaction rate doubles).

Grid Corrosion – As the battery ages grid growth occurs, the active material within the battery begins to break from the grid structure causing increased resistance.

Dry Cells – VRLA cells only – Cell drying causes breaks in the battery’s conduction ability between adjacent grids.

Series **SENTRY**

WHAT PARAMETERS AFFECT BATTERY LIFE? (Cont'd)

Age – As batteries age the active components within the battery will continue to change, usually for the worse. The result is that the performance of the cell gradually deteriorates until the cell becomes unserviceable.

Cell Interaction During Cycling – In a battery string it is sometimes noted that a weak cell with reduced capacity can reach its full charge (during cycle) before the remainder of the cells in the string. This condition can result in the weak cell becoming over charged prior to the remainder of the battery string reaching nominal voltage. This type of overcharging, will speed up the chemical reaction within the weak battery resulting in accelerated battery stress and eventual failure.

To improve battery life, a battery management program utilizing a battery monitoring system to maintain the battery string within their designed operating limits is a mandatory cost of doing business for “*mission critical*” environments.



**Green
Normal**



**Yellow
Out of Tolerance**



**Red
Action Required**