Peace of Mind

MIDTRONICS

Cellguard™ System

Battery Monitoring Solution with Wireless Communications Architecture

Critical power-backup systems must be ready to go the instant they're needed. When the Cellguard System Battery Monitoring Solution is on the job, they will be.

The Midtronics Cellguard System combines the latest wireless communications technology with patented, field-proven battery conductance testing for the most thorough stationary battery health analysis in the industry.

Features:

- Continuous 24/7 on-line monitoring for system integrity assurance
- Full Conductance, battery temperature and voltage monitoring for comprehensive battery state of health analysis
- Wireless Communication Architecture ensures proper installation, efficient, hassle-free operation, and reduced maintenance costs
- Intercell connection integrity monitoring ensures system effectiveness
- Economical total cost of ownership reduces installation cost, reasonable hardware price, and simple system maintenance
- Applies test signal to an individual cell or monoblock for high resolution of system state of health
- Web enabled communications for remote surveillance
- Full monitoring of string charge and discharge current, and discharge performance recording
- Advanced notification of battery problems via email or text message
- Conductance Advantages: safe, simple, accurate battery prognostics
- Industry choice conductance testing is the accepted standard for battery testing

MIDTRONICS

Battery Management Innovation

CELLGUARD SYSTEM

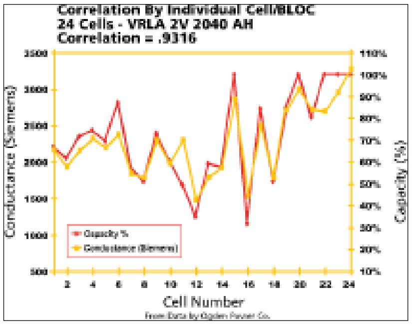
Conductance Based Battery Monitoring Solution

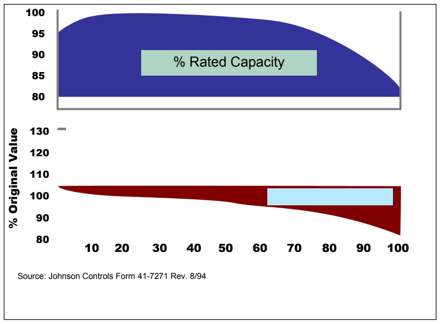
The Technology: Conductance

Battery Conductance was originally researched in the 1970s at the University of Minnesota as a variable to be used in the prediction of battery capacity. The Conductance measurement is an indication of the ability of a battery to conduct electrical current. Years of laboratory and field test data have proven that linear conductance provides a reliable indication of battery state of health and a correlation to battery capacity.

As a battery ages, the plate surface can sulfate or shed active material, which adversely affects its ability to perform. Conductance can be used to detect cell defects, shorts, and open circuits which can cause the battery to fail.

The following diagrams illustrate the high correlation between battery Conductance and capacity:

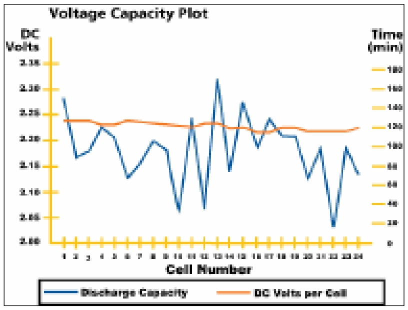




Conductance vs. Voltage Monitoring

Conductance has been proven to correlate with battery capacity and has been demonstrated in a variety of forms (testing programs, monitors) to provide predictive battery management benefits. Conversely, voltage has proven unrelated to battery capacity.

Therefore, when used in place of a predictive variable, such as conductance, it has demonstrated little value. Voltage is effective, as a measurement of battery charge levels, although it does not correlate directly with battery state of charge.



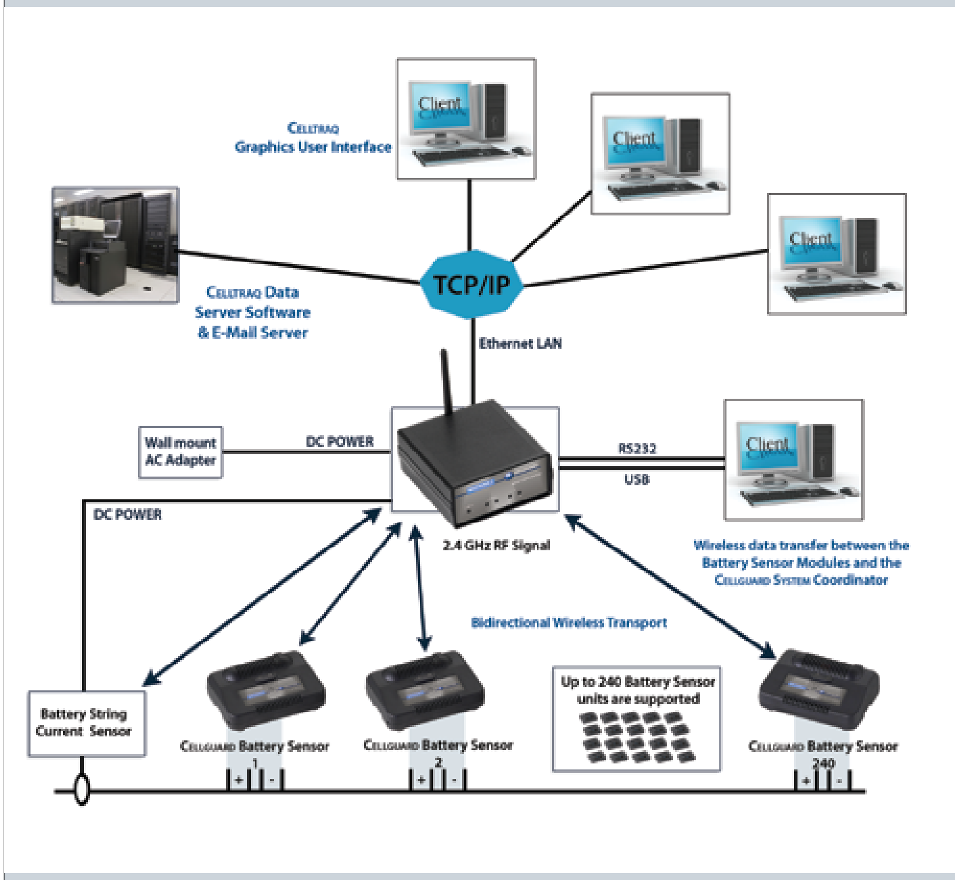
The above diagram illustrates the lack of relationship between voltage and battery capacity.

Conductance vs. Impedance or Resistance Monitoring

Some battery monitoring and testing systems available today utilize internal resistance or impedance to make assessments of battery state of health. While these methods can be effective, the use of conductance has clear advantages:

- Conductance is a more passive method of battery assessment, requiring 1 amp or less removed from the battery for most systems, up to 5 amps in cases where system ripple current is the most extreme. Other methods can require as much as 75 amps.
- The unique conductance frequency used by Midtronics has been optimized to detect battery degradation based upon 20+ years of laboratory and field testing. It is not a "one size fits all" measurement, and extensive research has been conducted to ensure effectiveness on a wide range of stationary power batteries in numerous applications.
- Conductance declines as the battery capacity degrades, forming an intuitive correlation between the two parameters.
- Conductance is an accepted standard at global telecommunications service providers, power generation providers (including nuclear facilities), and battery manufacturers worldwide.

CELLGUARD SYSTEM Architecture



The CELLGUARD SYSTEM has been designed for simple expansion and worldwide accessibility.

System Architecture

The **Cellguard System** is comprised of three base components, simplifying installation and long-term serviceability. At the heart of the system is the Test and Transmit sensor module. Attached at the posts of each battery block and intercell connecter, the Test and Transmit sensor module contains the proprietary Conductance test circuit, voltage and temperature measuring electronics and advanced the wireless communications components. The module communicates with the Base Coordinator Device, designed to capture data from the module and transfer collected data via Ethernet connection, USB, or serial output. Lastly, proprietary server level software allows for the effective management and reporting on system state of health via a simple web browser interface.

Test and Transmit Sensor Module

- Modules compatible with 2 through 12 volt batteries
- Testing circuitry utilizes advanced Conductance technology, similar in measurement capability to **Celltron Ultra** battery analyzer
- Passive test signal does not discharge the battery
- Compatible with low-noise telecom DC power plants, UPS and other systems producing 25-50 Amps RMS of electrical interference
- Measures battery conductance, voltage and temperature, and intercell integrity (resistance)
- Connects only to battery posts with simple Kelvin wiring connection harness (no extraneous wiring)
- Two-way communication to receiver module via IEEE standard radio frequency
- Powered by the battery being monitored (no external power required), with very low power consumption
- Timed interval test actuation

String Voltage, Temperature and Current Module

- Captures system level voltage (up to 600 volts), ambient/cabinet temperature and charge (float)/discharge current
- Ensures proper charging of system by providing system warnings if threshold levels are exceeded
- Ambient/cabinet temperature measurement enables comparison to individual battery temperature for threshold alarms, also indicates if room heating or cooling system is in working order
- Captures discharge currents and string voltages for advanced battery performance measurement

Base Coordinator Device

- RS-232 and USB output module for direct serial connection to **Celltraq** RF PC software
- TCP/IP Ethernet output module (for connection to Ethernet connection for communication via internet)
- Receiver module captures data from all test and transmit modules

Base Specifications Table

Element	Range
Battery conductance range	100 S < G < 20,000 S
Battery voltage range	1.75 V < V < 2.5 V (2 Volt Battery) 10.5 V < V < 15 V (12 Volt Battery)
Battery temperature measurement range	0° C < T < 65° C
Electronics temperature range	0° C < T < 65° C

User Interface/Remote Software Options

Two primary options are available. The first is a full client server web based system that communicates by a standard Ethernet link. This allows quick and easy access to system data anywhere in the world.
The second option is a standalone proprietary PC application that can collect data also by Ethernet connection or by serial connection to the PC from the Base Coordinator Device. This software provides advanced data processing and reporting capabilities.

Some examples:

Figure 1. User interface—an organized approach to managing data/user interface

Figure 2. An example of graphical data output

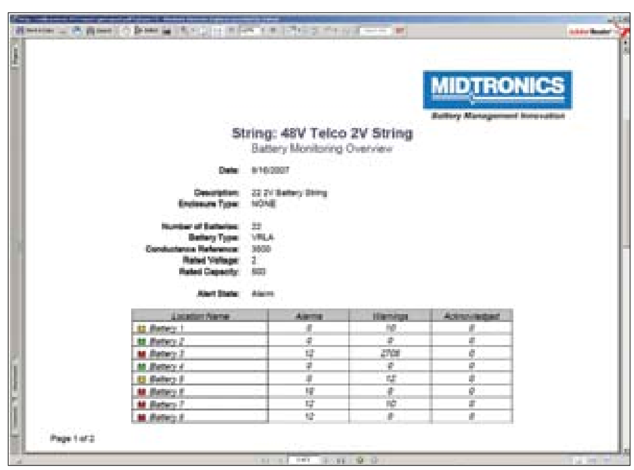


Figure 3. Printed report output

MIDTRONICS

Battery Management Innovation

Cellguard System

Battery Monitoring Solution

Specifications

Communications Interfaces

Ethernet 10 Mbps
RS232 or serial USB (@ 57.6 kbps)
802.15.4 compliant RF transport @ 2.4 GHz Radio Band

Temperature

Operating Temperature
(0° C to +65° C)

Storage Temperature
(-10° C to +80° C)

Protection

Sensor (2 V & 12 V)
Test load and power paths are fused, PolySwitch protection for high heat detection

Power Requirements

Base Coordinator Unit Power
Powered by 9 V DC wall plug adaptor or powered from VTC (optional)

VTC Unit Power
Powered from the battery (< 60 mA)

2 V Sensor Power
Powered from the battery under surveillance

12 V Sensor Power
Powered from the battery under surveillance.

Conductance Measurement Range

2V Sensor
100 to 15,000 Siemens

12V Sensor
100 to 4000 Siemens

Strap Resistance Measurement

2 micro Ohms minimum

Test Current

2V & 12V Sensors
Test current is approximately 5 Amps RMS

Voltage Measuring Characteristics

2V Sensor
Voltage range: 1.75 V to 2.5 V
Resolution: +/- 10 mV

12V Sensor
Voltage range: 8.7 V to 15.7 V
Resolution: +/- 20 milli Volts

Sensor Negative Battery Post Temperature Reading

Temperature Range
(0° C to +65° C)

Measurement Accuracy
(+/- 2° C)

String Voltage Measurement

Input Range
42 to 600 Volts DC

String Current Measurement

Float State	300 milli-Amps to 10 Amps
Charge State	10 to 200 Amps
Discharge State	10 to 200 Amps

Physical Dimensions

Base Coordinator Unit
5.08 in x 5.25 in x 2.25 in
12.9 cm x 13.3 cm x 5.7 cm

VTC String Monitor
5.08 in x 5.25 in x 2.25 in
12.9 cm x 13.3 cm x 5.7 cm

2 V & 12 V Sensor
4.45 in x 3.15 in x 1.5 in
11.3 cm x 8 cm x 3.8 cm

Simple installation process improves reliability and reduces total cost of ownership.

MIDTRONICS www.midtronics.com

Corporate Headquarters
Willowbrook, IL USA
USA Toll Free: 1.800.776.1995
Phone: 1.630.323.2800
Fax: 1.630.323.2844
E-Mail: net2@midtronics.com

Canadian Inquiries
Toll Free: 1.866.592.8053
Fax: 1.630.323.7752
E-Mail: canada@midtronics.com

Midtronics b.v.
European Headquarters
Serving Europe, Africa, the Middle East, and The Netherlands
Phone: +31 306 868 150
Fax: +31 306 868 158
E-Mail: info-europe@midtronics.com

European Sales Locations
IJsselstein, The Netherlands
Paris, France
Dusseldorf, Germany

Midtronics China Office
China Operations
Shenzhen, China
Phone: +86 755 8202 2037
Fax: +86 755 8202 2039
E-Mail: chinainfo@midtronics.com
Asia/Pacific (excluding China)
Contact Corporate Headquarters at +1.630.323.2800 or
E-Mail: asiapacinfo@midtronics.com