

# BATTERY MANAGEMENT SYSTEM



Front view of BMS2000V



BMS2000V Key Pad

The BMS 2000V Battery Management System from Solidstate Controls gives Users the ability to **Proactively** monitor and analyze the condition of their batteries in order to **Predict** impending problems with their battery system, and take the appropriate **Preventive** action.

The BMS 2000V features state-of-the-art monitoring and analyzing methods and processes:

- \* Continuous, 24/7 monitoring of the battery
- \* Trending of all important battery performance criteria against a pre-established benchmark
- \* Virtual Cell mathematical modeling technique
- \* Calculates and displays the battery's "Performance Index" as a percentage of battery capacity remaining
- \* Local and remote communications capability via RS232, modem, Ethernet, or RS485 RTU
- \* Capability to monitor multiple strings of batteries

A battery system is one of the most critical components of a UPS system, or stand-alone DC power system. Unfortunately, it is often the most overlooked and ignored component as well. Knowing the condition of a battery system **before** it is needed to provide emergency power to a critical load requires constant vigilance and a high degree of maintenance. The BMS2000V from AMETEK Solidstate Controls is a very powerful tool that can enhance, (or in some cases replace) Users' maintenance procedures and routines. Practicing the 3-Ps of battery monitoring (Proactive, Predictive and Preventive) can provide Ease of Mind for anyone tasked with assuring that critical processes survive a power failure.

The BMS2000V is ideally suited for any permanent battery installation, offering continuous surveillance of essential battery parameters. By measuring and evaluating critical indicators - overall and individual cell voltage, impedance, discharge/charge current and battery temperature - BMS2000V users can accurately predict a battery's condition, and decrease maintenance costs. The performance of the BMS2000V is enhanced with the use of the Windows based Virtual Cell Software (VCS2000V). This powerful software allows the user to monitor multiple battery locations and provides a real time status of the system including **graphical analysis and archiving of battery data**.

A full analysis of the battery is achieved using the Virtual Cell Software by means of a sophisticated mathematical modeling system. This unique "Virtual Cell" technique allows the BMS2000V to analyze battery discharges, under natural or scheduled conditions. The Virtual Cell model compares measured battery performance to a known performance specification. The resulting value is expressed as a "Performance Index" and displayed as a percentage of the ideal battery capacity remaining. In addition to the Virtual Cell discharge analysis modeling, the battery's impedance values (overall string and individual cells) are measured and logged as a performance index. A change in the logged impedance performance index can be used to determine the health of individual cells and probable life expectancy of the battery.

The BMS2000V is a high precision, isolated, total battery and cell/bloc voltage, current and discharge data-gathering unit. The BMS2000V can be configured for use in a broad range of stationary battery applications ranging from 24VDC to 600VDC including Flooded /Wet Cell and Valve Regulated Lead Acid and Nickel Cadmium battery technologies. Large battery systems over 62 cells/ blocs or multiple parallel strings may be accommodated by serially linking multiple BMS2000V boards together in master/slave configurations.



Typical Installation

# BATTERY MANAGEMENT SYSTEM

## BMS 2000V GENERAL SPECIFICATIONS Standard Features

### **Operation:**

#### **Normal Mode:**

The normal operating mode of the BMS2000V is to continuously scan all battery parameters. As readings are taken, they are compared to the user-programmed levels. If on two consecutive readings, a parameter is outside those pre-set conditions, an alarm is energized and the front panel LED illuminates. A record of the alarm condition is stored in data log and the unit can automatically call out to a central computer to report and record the alarm.

#### **Discharge Mode:**

Automatic data logging occurs in the event of any battery discharge. Data is stored in the discharge log by exception. Examining the contents of the discharge log will reveal the condition of the battery. The Low Capacity Alarm reports when the battery capacity percentage has dropped below a preset limit during the discharge. The unit will also call out to a central computer to report that the battery is discharging.

#### **Parameters Measured:**

- \* Overall battery voltage
- \* Battery string currents
- \* Individual block voltages (0-15V)
- \* Ambient and battery temperatures
- \* Cell and overall string impedances

#### **Battery Data Collection:**

Each BMS2000V Board is capable of measuring:

- \* 2 to 62-cell/block voltages per board (0-15 VDC; 0.1 % on fast scan)
- \* 1 overall voltage channel per board; (0-600 VDC auto-ranging, +/- 0.1%)
- \* Up to 6 temperature channels per master board; (-55°C - +125°C; ± 0.5 °C)
- \* Up to 6 current channels per master board (Split core Hall effect current transducer)
- \* 10 digital optically isolated inputs (+5V-wetting voltage is provided therefore voltage free contacts or open collector devices can be used)

#### **Data Storage Capabilities:**

- \* E<sup>2</sup> memory storage for Calibration constants and setup information
- \* Data logging of up to 16000 alarm events, 16 Average Discharges
- \* 8K Bytes for E<sup>2</sup> memory and firmware revision updates

#### **Data Logging and Storage:**

- \* Battery discharges
- \* All alarms and events
- \* Daily minimum/maximum batter parameters
- \* Stores up to 16,000 alarm records with date/time stamp
- \* Impedance values

#### **Calculations:**

- \* Performance index
- \* Depth of discharge
- \* Discharge time remaining

#### **Communication Capability:**

- \* Three (3) local serial communication ports
- \* External telephone modem
- \* Internal Orion TCP/IP network card (optional)
- \* External wireless modem card (optional)
- \* RS485 RTU network card (optional)

#### **Cabinet:**

- \* Designed for mounting in a standard 3U instrument rack. Unit is furnished with a wall mounting bracket as standard; NEMA 1 cabinet optional
    - \* Dims: 5.25" H x 14.5" D x 19" W (+1.6" for handles) (133mm x 368mm x 483mm) (+40mm for handles)
    - \* Weight: 16 lbs. (7.3kg)
- \*\*Certain optional features and/or combinations may require larger cabinets. Contact factory.

#### **Environmental:**

- \* Storage/operating temperature: 0-160° F (0-70°C)
- \* Relative humidity: 0-95%, non-condensing

#### **Controls and Indicators:**

- \* Function keys with keypad (0-9)
- \* Large 4 x 40 character LCD display
- \* LED system status indicators
- \* VCS2000 Virtual Cell software
- \* Up to eight (8) programmable optically isolated digital alarm outputs
  - \* One alarm is pre-assigned as "Common Alarm";
  - \* Each alarm is rated @nominal 250 mA with "flyback" voltage protection
- \* 62 cell/block inputs per board

# BATTERY MANAGEMENT SYSTEM

## BMS2000V GENERAL SPECIFICATIONS (cont.)

### Standard Features (cont.):

#### User Interface:

- \* 3 rear-mounted serial communication ports
- \* Optional modem
- \* RS485 RTU or RS232 Modbus
- \* Ethernet network interface
- \* VCS2000V Virtual Cell software can be used to:
  - \* Program alarms
  - \* Calibrate parameters
  - \* Upload data
  - \* View battery status
  - \* Perform battery analysis
  - \* Can communicate to local computer or building management system

#### Input Power Requirements: (Equipped with a Universal Power Supply)

- \* Standard: 90-360 VDC internal DC – DC Converter (Includes connector and "pigtail" for connection to battery)
- \* **Optional:** 90-264VAC, 1-phase, 50/60 Hz Power Converter (requires protected AC power source)

### The following communications systems are provided:

**Supplied software:** VCS2000V Virtual Cell Software as described below is included with each BMS2000V.

#### VCS2000V Virtual Cell Software:

Enables trending capability of the various parameters measured, with a special emphasis on internal impedance measurements. Data can be displayed in various graphic or tabular formats. Allows for playback of discharge or controlled run download test. Provides capability of automating and remote monitoring and analysis of numerous BMS2000V sites within a given maintenance area or region.

#### The Virtual Cell Software features:

- \* MS Windows 95/98SE/NTC/2000/XP compatible
- \* Setup function that allows the user to build a list of all monitor locations displaying: site name, telephone number, battery configuration, polling interval, etc.
- \* Communications: Notification of an alarm. Flexible communication capability to query monitor status, responds to alarms, such as battery discharging status. Manual polling is also possible.
- \* Ability to display battery activity, and alarm event history.
- \* Data is stored in text delimited format for use with multiple applications.

#### Virtual Cell Software:

The MS Windows based VCS2000V software allows battery analysis of one or more BMS2000V Battery Management Systems. When the user's Central Computer is connected to a BMS2000V, it will provide an on line, real-time view of the battery status with a graphical display of information. The battery data logs (e.g., Discharge Logs) are collected and appended in the Central Computer providing a continuous archive of the battery's performance. These historical logs can be used to trend the battery's performance and assist in determining life expectancy based on the performance index and impedance data.

### Optional Features:

#### Auxiliary Relay Contacts:

Programmable Form 'C' alarm relay contacts can be provided for user interface to plant annunciation systems. Each contact is rated 0.5Amps @ 125 VAC; 2Amps @ 30 VDC.

#### Analog Outputs:

A fully floating adjustable  $\pm 15$ VDC analog output is available as an option. The value(s) is stored in E<sup>2</sup> memory and can be retrieved and adjustments made. This feature can be used for temperature compensation of the battery charger, or to control a battery discharge load test (in some applications).

#### User Controlled Software:

With this option, the user develops his own communications software and integrates the monitoring function with existing system software. Solidstate Controls' responsibility under this option is to supply a user defined protocol that allows access to all of the features of the monitor. The user decides how often to poll the battery, and how to process the data.

# BATTERY MANAGEMENT SYSTEM

## BMS2000V GENERAL SPECIFICATIONS (cont.)

The event log contents may be displayed on the LCD readout, printed on a local printer, or downloaded to a central computer. Communications are available remotely via modem, the optional TCP/IP network card, or RS485 RTU. Local communication is available via the front panel controls or through the Serial Communication Port to a local computer. A special interface cable is provided with each unit to allow local communications, and a MODBUS protocol allows the unit to be incorporated into large facility monitors if desired.

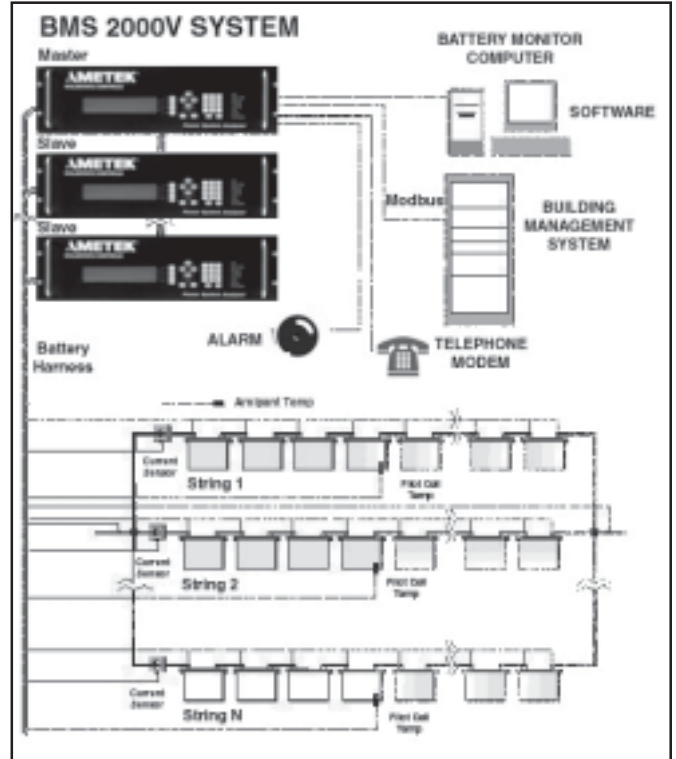
With the VCS2000 Virtual Cell Software a single central computer can manage multiple battery sites using the Software's automatic features and data transfer algorithms. The BMS2000V automatically calls out and reports system status to the central computer. This enables the user to immediately determine the overall health of the battery. Data can be stored and retrieved any time for analysis. With the system's flexibility, battery status is available 24 hours a day/7 days a week. At any given time service personnel can call up a specific battery installation from either the central computer, a remote location using the modem or network card, or locally at the BMS2000V using the RS232 port.

The BMS2000V will automatically perform periodic checks to verify the operational integrity of the battery, and provide an alarm for any out-of-tolerance condition. This **proactive** feature includes measuring the battery's internal impedance for the complete module at user programmed intervals. By tracking impedance, the system can predict (and report) impending battery failures **before** they occur. In addition to proactive monitoring, the BMS2000V features a Battery Discharge Monitor that will record battery discharge voltage and current for later playback. This further enhances the BMS2000V **predictive** capability of an impending battery failure, as well as provide the user the amount of battery run time remaining during a discharge event.

The BMS2000V measures each cell/bloc voltage individually in differential mode. The sense wire is protected at each bloc through a fusible metal film resistor for current limiting safety. Central Battery monitoring has been simplified with easy to understand VCS2000V Software. Battery Status display will provide a quick summary of an occurrence once the condition has been reported. A change in status can immediately alert responsible maintenance personnel to alarm conditions and battery status.

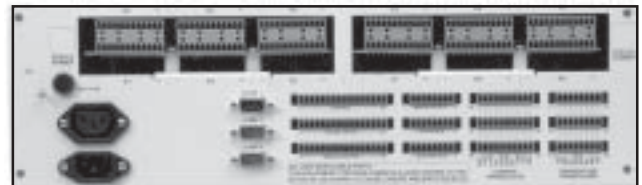
### Installing the BMS2000V

Installation of the BMS2000V Battery Management has been made even more User friendly. All of the necessary cables, hardware and mounting brackets required for ease of installation are supplied with your unit. The operation/instruction manual provided with each system gives detailed step-by-step instructions for complete installation.



Typical System Configuration

### Rear View of the BMS 2000V



Shown with 124 channels and AC Input option



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