



Battery Management System

AP9930

Installation and
Quick-Start Manual



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Overview



Caution

When installing the Battery Management System:

- Use tools with insulated handles.
- Avoid short-circuiting the battery terminals; it could cause them to melt.
- Do not lay tools or metal parts on top of the batteries.
- Remove watches, rings, and other metal objects.
- Use only cables supplied by APC unless otherwise noted.
- When used outdoors, the Battery Management System and all cables must be contained within a weather-protected enclosure.

Overview

The Battery Management System connects to one or two separate strings of batteries. Each string may have two, three, or four 12V batteries, but each string must have the same number of batteries.

In these installation instructions, “last battery” refers to the second of two batteries, the third of three batteries, or the fourth of four batteries.



Note

Do not apply power to the unit until the wire harnesses are connected and the DIP switches are configured.

Inventory

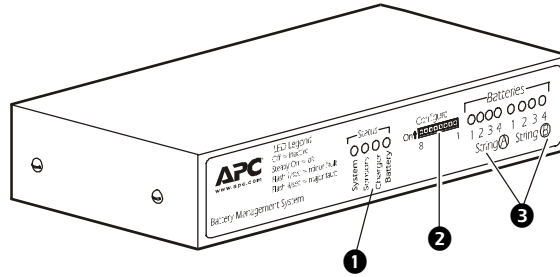
Quantity	Item
1	Battery Management System unit
1	Battery harness
1	Power cable
7	Fuses
1	Hardware kit (tab washers and wire ties)
4	Rubber feet
2	Mounting brackets for a 19-inch rack
1	Hook and loop fastener kit
1	Current sensor and cable
1	Ambient temperature sensor
1	Ground wire and screw
1	Battery number label set

Additional options

The following options are available:

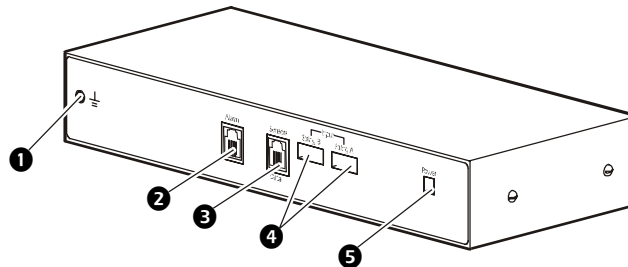
- AP9930BRK23: mounting kit for a 23-inch rack or enclosure
- AP9930BRKWM: mounting kit for a wall or outdoor enclosure
- AP9930SENKT: sensor kit (includes current sensor and cable, battery harness, fuses, and required hardware)
- AP9930DIAG: diagnostic kit for updating firmware and monitoring the Battery Management System through a local computer

Front view



- ❶ Status LEDs
- ❷ Configuration DIP switches
- ❸ Battery status LEDs

Rear view



- ❶ Ground wire connection
- ❷ Alarm port
- ❸ Sensor/Data port
- ❹ Battery harness ports
- ❺ Power connection

Install the Unit

Install the unit using the rubber feet, the brackets for a 19-inch enclosure or rack, or the hook-and-loop fasteners.

Install using the rubber feet

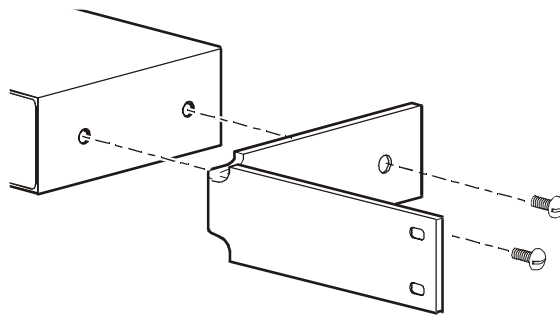
To install the unit using the rubber feet (provided):

1. Attach the rubber feet to the bottom of the unit, placing one at each corner.
2. Place the unit on an even surface, where it will be accessible for connection procedures.

Install in an enclosure or rack

To install the unit in a NetShelter[®] or other standard 19-inch enclosure or rack:

1. Remove the screws that are pre-installed in the sides of the unit.
2. Attach the brackets to the unit, using the screws removed in step 1.

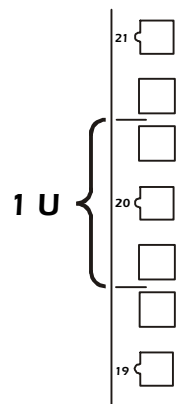


3. Choose a location for the unit:



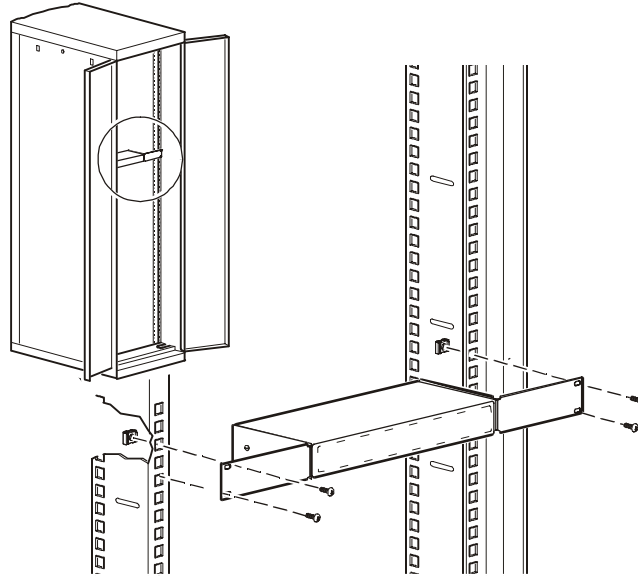
Note

The unit occupies one U-space. The numbers on the enclosure's vertical rail denote the middle of a U-space.



- a. Insert a caged nut (provided with the enclosure) above and below a notched hole on both vertical mounting rails in your chosen location.

- b. Align the mounting holes of the brackets with the installed caged nuts. Insert and tighten the screws.



Hook-and-loop mounting (for outdoor enclosures)

To mount the unit using the hook-and-loop fasteners:

1. Use the alcohol pad (provided) to clean the mounting surface (typically the top of the unit and the wall of an outdoor enclosure).
2. Attach the loop disk (soft disk) to the unit.
3. Attach the hook disk (rough disk) to the desired mounting location.



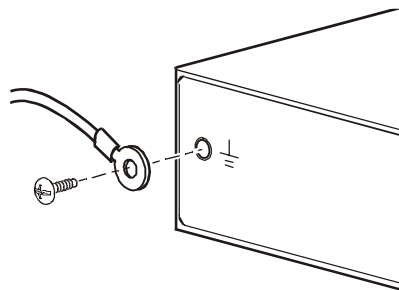
Note

The disks bond in 24 hours if the disks are applied at 68° F or higher. This attachment method is suitable for temperatures between -40 and 140° F.

Connect the ground wire

To connect the ground wire to the Battery Management System:

1. Attach the smaller ring terminal to the unit by inserting the included ground screw through the ring and securing it to the back of the unit.



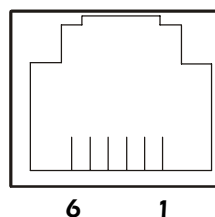
2. Connect the other end of the ground wire to a convenient solid ground support. Consult the National Electric Code (NEC), Article 250, for guidance.

Alarm Overview

Pin configuration

The alarm port contains six pins. The maximum rating for the connector is 30V and 0.2A.

View of the female alarm port:



Pin	Alarm type	Position
1	Major	Normally closed [†]
2	Major	Relay 1 common
3	Major	Normally open [‡]
4	Minor	Normally closed [†]
5	Minor	Relay 2 common
6	Minor	Normally open [‡]

[†] Contact with common is broken in an alarm situation.
[‡] Makes contact with associated common in an alarm condition.



Note

An alarm cable for connection to the Battery Management System must be purchased separately. The cable must not exceed three (3) meters in length, and it must be able to connect the Battery Management System to a terminal box, which will then be connected to an alarm.

Install the Tab Washers and Fuses



Note

Do not disturb existing battery connections. Place the tab washers and nuts on top of the existing battery connections. You must provide your own nuts for tab washer installation.

Before you begin:

- Identify Battery 1. Battery 1 is always the battery located at the far left of the battery string.
- Identify whether the main output lead to the load is connected to the positive or negative terminal of Battery 1.

Use the battery string labels (provided) to mark the location of each battery by attaching a label to the enclosure shelf in front of each battery.

If the main output lead on Battery 1 is on the negative terminal:

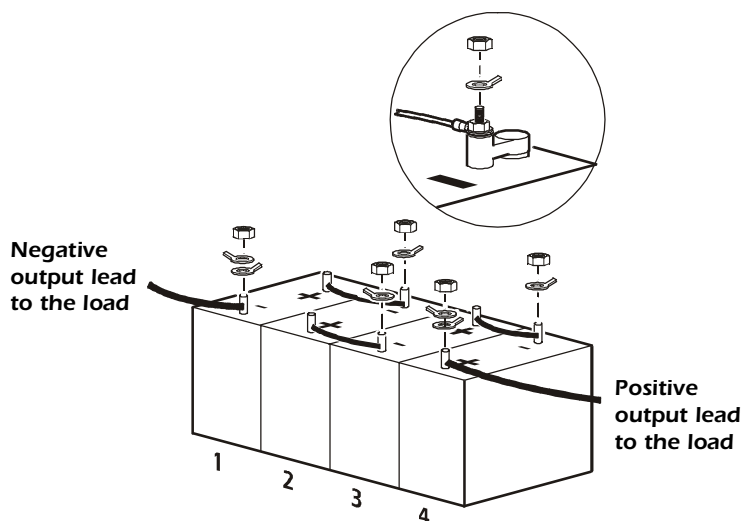
1. Attach tab washers on the following terminals:
 - all negative terminals
 - the positive terminal of the last battery



Note

For the string that will power the Battery Management System, use two tab washers for the two terminals with output leads to the load (they may be stacked one on top of the other, and offset).

2. Secure the washers onto the terminals, using the nuts.
3. Coat the tab washers and nuts with approved antioxidant grease.



If the main output lead to the load on Battery 1 is on the positive terminal:

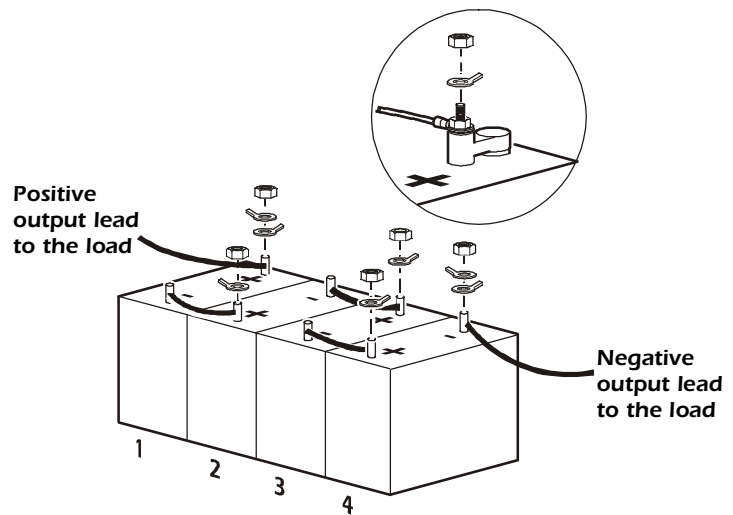
1. Attach tab washers on the following terminals:
 - all positive terminals
 - the negative terminal of the last battery



Note

For the string that will power the Battery Management System, use two tab washers for the two terminals with output leads to the load (they may be stacked one on top of the other, and offset).

2. Secure the washers onto the terminals, using the nuts.
3. Coat the tab washers and nuts with approved antioxidant grease.



Note

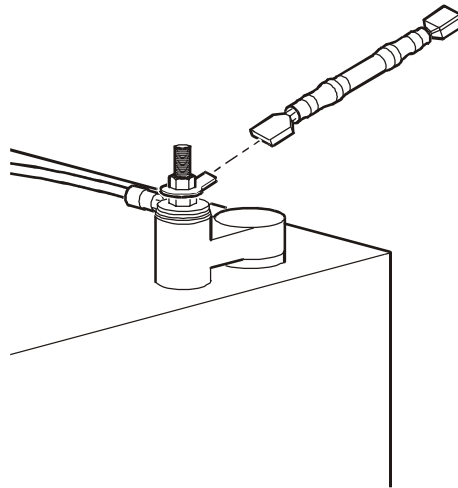
In two-string configurations, the polarity of both strings must match. For example, do not attach the output lead of Battery 1 on String A to its negative terminal and the output lead of Battery 1 on String B to its positive terminal.

Attach the fuses



Do not attempt to operate the Battery Management System without the specified fuses installed. Damage to the unit could result.

Attach the fuse to the tab washer by sliding the receptor end of the fuse onto the tab. Repeat this procedure for each tab washer, including the extra tab washers on the first and last batteries of the string providing power to the Battery Management System (typically the first string).



Connect the Batteries



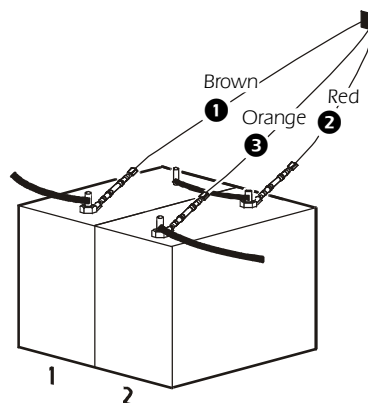
Warning

When adding or removing a battery string, first disconnect power to the Battery Management System by unplugging the power cable to avoid causing sparks that could cause a battery to explode.

1. Connect the wire harness to the batteries by attaching the appropriate color-coded wire to the fuse of the listed battery (see table and illustrations below).

Wire #	Wire Color	Battery Number		
		2 batteries	3 batteries	4 batteries
1	Brown	1	1	1
2	Red	2	2	2
3	Orange	2	3	3
4	Yellow	unused	3	4
5	Green	unused	unused	4

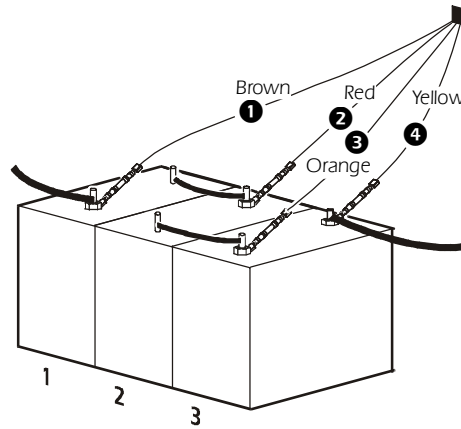
Two batteries:



Note

With only two batteries, the yellow (#4) and green (#5) wires are not used.

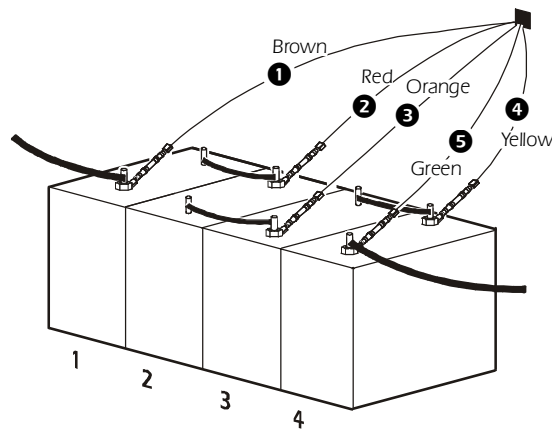
Three batteries:



With only three batteries, the green wire (#5) is not used.

Note

Four batteries:



2. Using the wire ties, bundle and secure any unused wires out of the way.
3. Plug the wire harness into the appropriate port on the back of the unit (String A or String B input ports). In the cabinet, String A is on the top, and String B is on the bottom.



A single-string configuration must use String A.

Note

4. If you are connecting two battery strings, repeat steps 1–3 for the second set of batteries.

Configure the DIP switches

Use the information below to configure the DIP switches on the front panel of the Battery Management System. The switches are recessed inside the space marked **Configure**. Use a small tool such as a pocket screwdriver to push each switch into the correct position.

Condition	Dip Switch Number							
	8	7	6	5	4 ‡	3	2	1
Gel Batteries †	-	-	-	-	-	-	-	OFF
AGM Batteries	-	-	-	-	-	-	-	ON
Four-battery string †	-	-	-	-	-	OFF	OFF	-
Three-battery string	-	-	-	-	-	OFF	ON	-
Two-battery string	-	-	-	-	-	ON	OFF	-
Ambient temperature compensation †	-	-	-	-	OFF	-	-	-
Battery temperature compensation	-	-	-	-	ON	-	-	-
25 amp-hr batteries †	OFF	OFF	OFF	OFF	-	-	-	-
30 amp-hr batteries	OFF	OFF	OFF	ON	-	-	-	-
35 amp-hr batteries	OFF	OFF	ON	OFF	-	-	-	-
40 amp-hr batteries	OFF	OFF	ON	ON	-	-	-	-
45 amp-hr batteries	OFF	ON	OFF	OFF	-	-	-	-
50 amp-hr batteries	OFF	ON	OFF	ON	-	-	-	-
60 amp-hr batteries	OFF	ON	ON	OFF	-	-	-	-
70 amp-hr batteries	OFF	ON	ON	ON	-	-	-	-
80 amp-hr batteries	ON	OFF	OFF	OFF	-	-	-	-
90 amp-hr batteries	ON	OFF	OFF	ON	-	-	-	-
100 amp-hr batteries	ON	OFF	ON	OFF	-	-	-	-
115 amp-hr batteries	ON	OFF	ON	ON	-	-	-	-
125 amp-hr batteries	ON	ON	OFF	OFF	-	-	-	-
150 amp-hr batteries	ON	ON	OFF	ON	-	-	-	-
175 amp-hr batteries	ON	ON	ON	OFF	-	-	-	-
200 amp-hr batteries	ON	ON	ON	ON	-	-	-	-

† Factory default setting.

‡ APC charging equipment uses the internal battery temperature as a reference. The Battery Management System will adjust automatically for charger voltage temperature compensation of 30 millivolts for each degree below 25° C and -30 millivolts for each degree above 25° C.

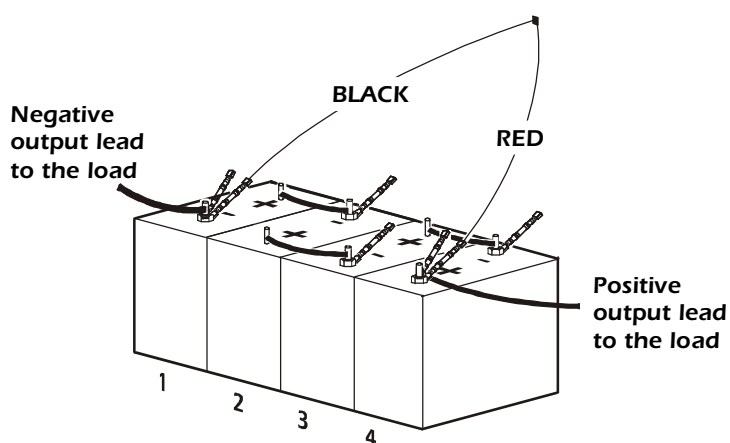
Connect the Power Cable



Note

If you are using more than one string of batteries, you can attach the power cable to either String A or B.

1. Attach the **red** wire of the power cable to the extra fuse on the terminal of the positive output lead to the load.
2. Attach the **black** wire of the power cable to the extra fuse on the terminal of the negative output lead to the load.



Note

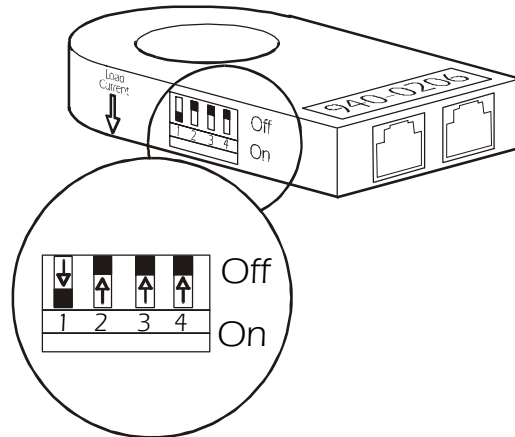
Do not connect the power cable to the Battery Management System until you are instructed to do so later in this manual.

Connect the Sensors

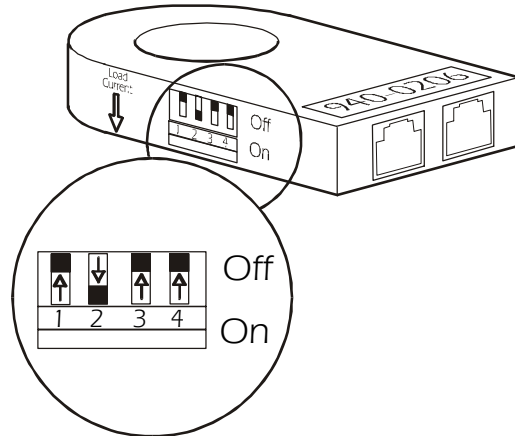
Set the address

Set the address for the sensor unit by adjusting the settings of the DIP switches on the side of the sensor to identify String A (top shelf) or String B (bottom shelf).

String A (Position DIP switch #1 ON)



String B (Position DIP switch #2 ON)

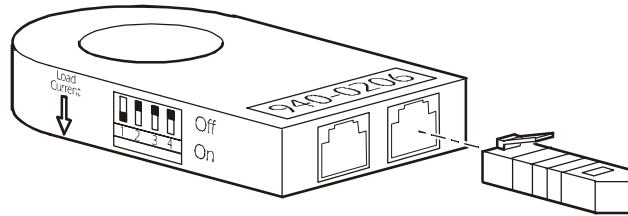


To purchase the second sensor, order a Sensor Kit from APC (AP9930SENKT).

Note

Connect the ambient temperature sensor

Connect the ambient temperature sensor to the unused port on the sensor in the warmest area of the enclosure and not in contact with any surface. If there are two levels of batteries, place the sensor in the top level.



Calibrate the current sensors



There must be no current running through a sensor while it is calibrating.

Note

To calibrate one or two current sensors:

1. Without changing any other DIP switch settings, set DIP switch #4 to **On** for each current sensor being calibrated.
2. If two strings are being used, connect the current sensors together, using the sensor cable (provided). Then use a sensor cable to connect the remaining port on the current sensors to the **Sensor/Data** port on the rear of the Battery Management System.
3. Plug the power cable into the port marked **Power** on the back of the Battery Management System.
4. After the LED test, the Battery Management System will light the Status LEDs while reading the sensors. It will then enter sensor calibration mode and begin flashing all Status LEDs, along with all Battery LEDs for each string being calibrated. Allow the LEDs to flash at least five (5) times to ensure zero calibration is complete.
5. When calibration is complete, reset the current sensor DIP switch #4 to **Off** for each calibrated sensor. Failure to do so will cause the Battery Management System to reenter sensor calibration when power is applied.
6. Unplug the power cable from the back of the Battery Management System.

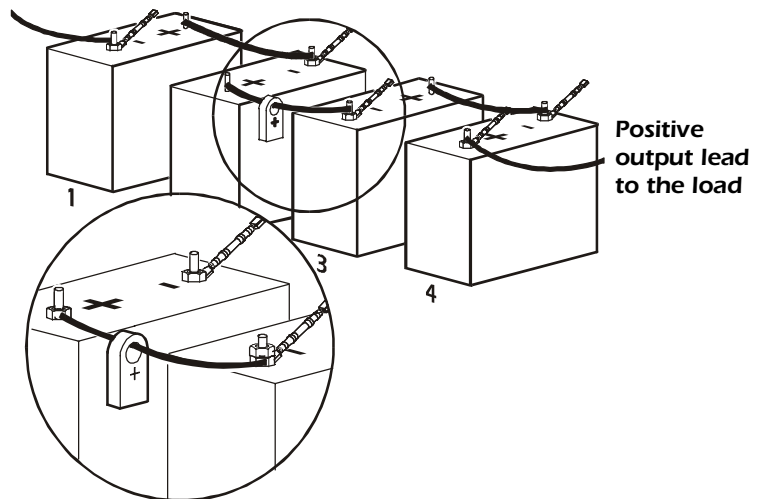
Install the current sensor

1. To attach the sensor:
 - a. Remove one end of any one of the battery cables that connect the batteries together.
 - b. Slide the sensor onto the cable.

**Note**

Make sure the sensor polarity symbol is pointed at the positive output lead, as shown below.

- c. Replace the battery cable onto the terminal.

**Apply power to the Battery Management System**

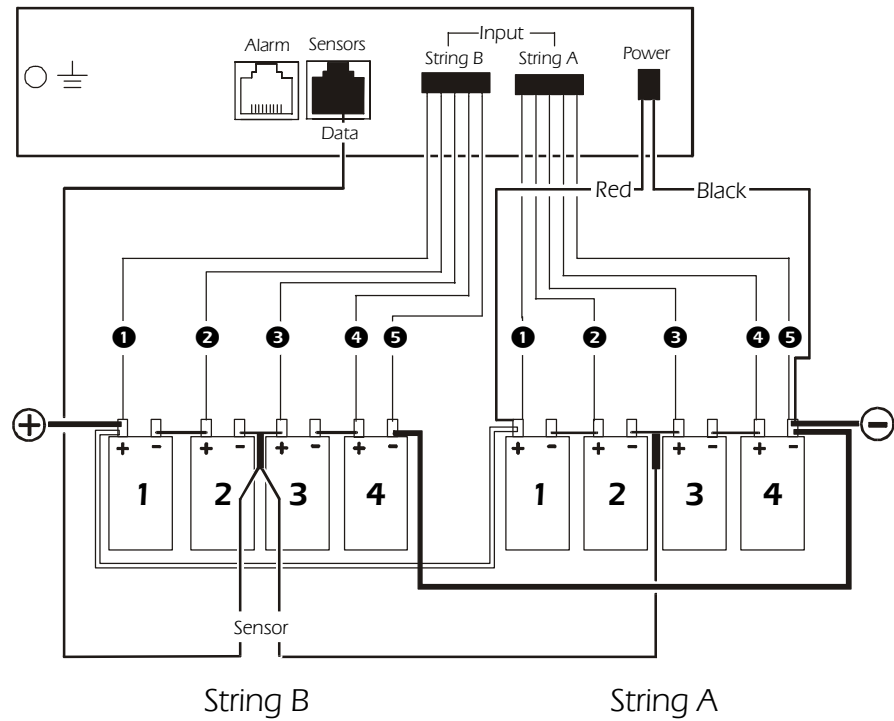
Plug the power cable into the port marked **Power** on the back of the unit. The Battery Management System will begin operating, and after several seconds all LEDs will turn on and remain lit for three seconds. The Battery Management System will automatically detect any string that is attached. Verify that the LEDs correspond to the Configuration DIP switch settings you selected. If one or more LEDs begin flashing, verify all sensor and battery connections and sensor DIP switch settings.

**See also**

If a problem persists, see the *Battery Management System User's Guide* for alarm and fault indications.

Sample Connection

The illustration below shows two strings of batteries connected with the output leads to the loads on the **positive** terminals. Your connection may vary; use this illustration as a reference during installation.



Warranty and Service

Limited warranty

APC warrants the Battery Management System to be free from defects in materials and workmanship for a period of two years from the date of purchase. Its obligation under this warranty is limited to repairing or replacing, at its own sole option, any such defective products. This warranty does not apply to equipment that has been damaged by accident, negligence, or misapplication or has been altered or modified in any way. This warranty applies only to the original purchaser.

Warranty limitations

Except as provided herein, APC makes no warranties, express or implied, including warranties of merchantability and fitness for a particular purpose. Some jurisdictions do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

Except as provided above, in no event will APC be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of this product, even if advised of the possibility of such damage.

Specifically, APC is not liable for any costs, such as lost profits or revenue, loss of equipment, loss of use of equipment, loss of software, loss of data, costs of substitutes, claims by third parties, or otherwise. This warranty gives you specific legal rights and you may also have other rights, which vary according to jurisdiction.

Obtaining service

To obtain support for problems with your Battery Management System:

1. Note the serial number and date of purchase. The serial number is located on the bottom of the Battery Management System.
2. Contact Customer Support at a phone number located on the back cover. A technician will try to help you solve the problem by phone.
3. If you must return the product, the technician will give you a return material authorization (RMA) number. If the warranty expired, you will be charged for repair or replacement.
4. Pack the unit carefully. The warranty does not cover damage sustained in transit. Enclose a letter with your name, address, RMA number and daytime phone number; a copy of the sales receipt; and a check as payment, if applicable.
5. Mark the RMA number clearly on the outside of the shipping carton.
6. Ship by insured, prepaid carrier to the address provided by the Customer Support technician.

Life-Support Policy

General policy

American Power Conversion (APC) does not recommend the use of any of its products in the following situations:

- In life-support applications where failure or malfunction of the APC product can be reasonably expected to cause failure of the life-support device or to affect significantly its safety or effectiveness.
- In direct patient care.

APC will not knowingly sell its products for use in such applications unless it receives in writing assurances satisfactory to APC that (a) the risks of injury or damage have been minimized, (b) the customer assumes all such risks, and (c) the liability of American Power Conversion is adequately protected under the circumstances.

Examples of life-support devices

The term *life-support device* includes but is not limited to neonatal oxygen analyzers, nerve stimulators (whether used for anesthesia, pain relief, or other purposes), autotransfusion devices, blood pumps, defibrillators, arrhythmia detectors and alarms, pacemakers, hemodialysis systems, peritoneal dialysis systems, neonatal ventilator incubators, ventilators (for adults and infants), anesthesia ventilators, infusion pumps, and any other devices designated as “critical” by the U.S. FDA.

Hospital-grade wiring devices and leakage current protection may be ordered as options on many APC UPS systems. APC does not claim that units with these modifications are certified or listed as hospital-grade by APC or any other organization. Therefore these units do not meet the requirements for use in direct patient care.

Radio Frequency Interference



Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this user manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference. The user will bear sole responsibility for correcting such interference.

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.



APC Worldwide Customer Support

Customer support for this or any other APC product is available at no charge in any of the following ways:

- Visit the APC Web site to find answers to frequently asked questions (FAQs), to access documents in the APC Knowledge Base, and to submit customer support requests.
 - **www.apc.com** (Corporate Headquarters)
Connect to localized APC Web sites for specific countries, each of which provides customer support information.
 - **www.apc.com/support/**
Global support with FAQs, knowledge base, and e-support.
- Contact an APC Customer Support center by telephone or e-mail.
 - Regional centers:

APC headquarters U.S., Canada	(1)(800)800-4272 (toll free)
Latin America	(1)(401)789-5735 (USA)
Europe, Middle East, Africa	(353)(91)702020 (Ireland)
Japan	(0) 3 5434-2021

- Local, country-specific centers: go to **www.apc.com/support/contact** for contact information.

Contact the APC representative or other distributor from whom you purchased your APC product for information on how to obtain local customer support.

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