Installation

Battery Management System

AP9921X
AP9921XS
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Overview

System Information

The American Power Conversion (APC®) Battery Management System connects to one of the following:

- A single UPS with one string of up to 244 lead-acid batteries or 375 nickel-cadmium batteries.
- A single UPS with two strings of up to 244 lead-acid batteries or 256 nickel-cadmium batteries.

The system provides battery management for nominal 2 V, 4 V, 8 V, or 12 V lead-acid batteries; or 1.2 V or 2.4 V nickel-cadmium batteries. A system is comprised of one AP9921X master unit and up to seven AP9921XS expansion units. Each unit supports up to 64 batteries.

For more information on the features and capabilities of the Battery Management System, see the initial sections of the Battery Management System User's Guide, which is available on the supplied Utility CD.

**Note:** Do not turn on the power to the system until the DIP switches are configured and the wire harnesses are connected to the Battery Management System and the batteries.

**Inventory (AP9921X)**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Battery Management master unit (with internal Network Management capability)</td>
</tr>
<tr>
<td>1</td>
<td>Configuration cable (APC part number 940-0103)</td>
</tr>
<tr>
<td>1</td>
<td>Temperature sensor assembly</td>
</tr>
<tr>
<td>1</td>
<td>Ground wire assembly</td>
</tr>
<tr>
<td>2</td>
<td>Brackets for wall- or cabinet-mounting (with 8 pan-head screws)</td>
</tr>
<tr>
<td>6</td>
<td>Rubber feet (with alcohol pads)</td>
</tr>
</tbody>
</table>

**Inventory (AP9921XS)**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Battery Management expansion unit</td>
</tr>
<tr>
<td>2</td>
<td>Brackets for wall- or cabinet-mounting (with 8 pan-head screws)</td>
</tr>
<tr>
<td>1</td>
<td>Ground wire assembly</td>
</tr>
<tr>
<td>1</td>
<td>Expansion cable</td>
</tr>
<tr>
<td>6</td>
<td>Rubber feet (with alcohol pads)</td>
</tr>
</tbody>
</table>
Additional options

The following options are available for use with the Battery Management System:

- Additional expansion units (AP9921XS)
- 5-foot battery wire harness (AP9924)
- 25-foot battery wire harness (AP9925)
- 50-foot battery wire harness (AP9926)
- 100-foot battery wire harness (AP9927)
- Current sensor kit (AP9920CS)
- 2000-amp current sensor kit (AP9920CS2000)
- Alarm beacon (AP9324)

Additional documentation


The User’s Guide contains additional information about the following topics related to the unit:

- Management interfaces
- User accounts
- Customizing setup
- Security
- The Device IP Configuration Wizard
- File transfers
- The Security Wizard

Wire harness installation

Wire harnesses are required for connecting batteries to the Battery Management System. Purchase the harnesses separately and install them according to the instructions in the installation manuals provided with the wire harnesses.

Receiving inspection

Inspect the package and contents for shipping damage, and make sure that all parts were sent. Report any damage immediately to the shipping agent. Report missing contents, damage, or other problems immediately to APC or your APC reseller.

Please recycle

The shipping materials are recyclable. Save them for later use, or dispose of them appropriately.
Safety Information

**Electrical Hazard:** Risk of electric shock—battery cabinets contain potentially lethal voltages! Batteries are energized even when AC power has been disconnected.

All electrical equipment must be rated for the voltage of your Battery Management System.

**Warning:** Only qualified personnel, trained in battery operation and safety, may install the harnesses. Keep unauthorized personnel away from the batteries.

When installing the Battery Management System:

- Cover the batteries with an electrical insulating blanket before installing the harnesses.
- Wear rubber gloves, rubber boots, and safety goggles.
- Use double-insulated tools.
- Do not short-circuit the battery terminals; this could cause the batteries to explode.
- Do not lay tools or metal parts on top of the batteries or near the cable lugs.
- Remove watches, rings, and other metal objects.
- For the UPS and switch gear, use lock-out/tag-out safety procedures (which remove access to a device and physically label the device as intentionally out of service) before working on the batteries.
- Use only cables supplied by APC unless otherwise indicated.
- Avoid skin contact with battery components, such as electrolyte.

**Lockout/Tagout the UPS**

**Note:** Lockout/Tagout safety procedures remove access to a device and physically label the device as intentionally out of service.

Before installing the Battery Management System, use lockout/tagout safety procedures for the UPS and any attached equipment, such as high-voltage power supplies. If possible, disconnect the main output lead from the battery string to the load.

**Electrical Hazard:** Voltage is present in the battery cabinet even after disconnecting from the main load. Use caution when working with the batteries.

Each battery should be treated as though the entire string voltage were present at its terminals.
## Master and Expansion Units

### Front panel—master unit (AP9921X)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>LED Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ON/OFF Button</td>
<td>Used to enable or disable the unit. The unit is “On” when the button is pressed in.</td>
</tr>
<tr>
<td>2</td>
<td>Alarm/Beacon Reset</td>
<td>Resets the alarm or beacon if either is active.</td>
</tr>
<tr>
<td>3</td>
<td>Management Controller LED</td>
<td>Indicates the status of the Battery Management System and its connections.</td>
</tr>
<tr>
<td></td>
<td>Off: The Battery Management System is not receiving power or the LED is not functioning properly.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Batteries LED</td>
<td>Indicates the status of the batteries.</td>
</tr>
<tr>
<td></td>
<td>Solid: The associated status is OK.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Charger LED</td>
<td>Indicates the status of the charger’s (UPS) voltage or ripple current.</td>
</tr>
<tr>
<td></td>
<td>Flashing: The associated status is outside its configured limits and is in an alarm condition.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Environment LED</td>
<td>Indicates the status of the battery environment (temperature) or external sensors.</td>
</tr>
</tbody>
</table>
### Rear panel—master unit (AP9921X)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground Ground wire connection.</td>
</tr>
<tr>
<td>2</td>
<td>Battery harness connector (B) Connects the Battery Management System to the battery harness.</td>
</tr>
<tr>
<td>3</td>
<td>Network/Ethernet port Connects to the network using a CAT5 cable.</td>
</tr>
</tbody>
</table>
| 4    | Link RX/TX LED Indicates the status of the network connection.  
  • Off: The unit is not receiving power, or the LED is not functioning properly.  
  • Flashing: The unit is receiving data packets from or sending data packets to the network. Flashing orange indicates a transfer speed of 10 Mb, flashing green indicates a transfer speed of 100 Mb. |
| 5    | Status LED Indicates the status of traffic over the network connection.  
  • Off: The unit is not receiving power, or the Battery Management System is not functioning properly.  
  • Solid green: The unit has valid TCP/IP settings.  
  • Flashing green: The unit does not have valid TCP/IP settings.  
  • Solid orange: The unit’s Management Card has detected a hardware failure. Contact APC Customer Support.  
  • Flashing orange: The unit is making BOOTP requests.  
  • Alternately flashing orange and green: If the LED is alternately flashing slowly, the Battery Management System is making DHCP requests. If the LED is alternately flashing rapidly, the Battery Management System is starting up. |
| 6    | A-Link port (2) Reserved for future use. |
| 7    | Expansion Bus ports (2) Used to cascade one to seven expansion units (AP9921XS) to a single master unit (AP9921X). See “Connect Multiple Units” on page 13. |
| 8    | Powerview port Reserved for future use. |
| 9    | Beacon Connects to optional alarm beacon (APC part number AP9324). |
| 10   | Alarm Contact port Used to connect external equipment such as an automatic dialer to signal an alarm. This is a summary alarm. |
| 11   | Settings (DIP Switch) Configures the unit address and termination resistors. (See “Configure the DIP Switches” on page 9). |
| 12   | Remote LEDs port Connects the unit to the remote alarm reset, or two auxiliary environmental inputs. |
| 13   | Temperature sensors port Connects the temperature sensor assembly (940-0089). |
| 14   | RS-232/485 port Connects to Modbus and configures the network card. |
| 15   | Current sensor ports (A and B) Connects the Battery Management System to the charge/discharge string current sensors. |
| 16   | Battery harness connector (A) Connects the Battery Management System to the battery harness and to unit power. |
| 17   | Unit # Use this space to write the number of the unit for easy identification and for setting the DIP switches. |
### Front panel—expansion unit (AP9921XS)

![Front panel diagram](image)

### Rear panel—expansion unit (AP9921XS)

![Rear panel diagram](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Battery Input B&lt;br&gt;Connects the Battery Management System to the battery harness.</td>
</tr>
<tr>
<td>2</td>
<td>Expansion Bus ports&lt;br&gt;Used to cascade one to seven AP9921XS units to a single AP9921X unit. See “Connect Multiple Units” on page 13.</td>
</tr>
<tr>
<td>3</td>
<td>Settings (DIP Switch)&lt;br&gt;Configures the unit address and termination resistors.</td>
</tr>
<tr>
<td>4</td>
<td>Battery/Power Input A&lt;br&gt;Connects the Battery Management System to the battery harness.</td>
</tr>
<tr>
<td>5</td>
<td>Unit #&lt;br&gt;Use this space to write the number of the unit for easy identification and for setting the DIP switches.</td>
</tr>
</tbody>
</table>
Installation

Install the Unit

Overview

Install the units using rubber feet or using brackets for wall- or cabinet-mounting.

Installation guidelines

- If the unit is installed in an enclosed communications rack, the maximum allowable ambient temperature inside the enclosure is 40°C (104°F). Allow for adequate airflow to ensure that the maximum temperature is not exceeded.
- When installing units and the included sensors, ensure that the weight of the system is evenly distributed and that the enclosure and flooring can support the total weight.
- Maintain reliable earth grounding of the unit.

Install the unit using rubber feet

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

1. Use the alcohol pad (provided) to clean the surface of the bottom of the unit. 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.

Mount the unit on the wall or door of the battery cabinet

1. Attach the mounting brackets to the unit, using eight pan-head screws (provided).
2. Mount the unit to the door of the battery cabinet:

*If your cabinet has available mounting studs:*

a. Align the bolts on the door with the slots on the free flanges of the mounting brackets on the unit.

b. Place the unit on the studs in the battery cabinet door so that the bolts are aligned with the top of each slot on the flange. Secure the flanges to the bolts with hex nuts.

*If your cabinet or wall does not have available mounting studs:*

a. Align the free flanges of the mounting brackets on the unit, and mark the locations of the top of each slot on the flange. This is where the bolts or studs will need to be placed.

b. Drill holes in the marked positions, and insert appropriate mounting bolts or studs.

c. Place the unit so that the bolts are aligned with the top of each slot on the flange. Secure the flanges to the bolts with hex nuts.

**Connect the ground wire**

To connect the ground wire to the unit:

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

2. Connect the other end of the ground wire to a convenient solid ground support.

⚠️ **Note:** Consult your national and local electrical codes for guidance regarding installation and grounding requirements.
Configure the DIP Switches

Use the information below to configure the DIP switches on the rear panel of the Battery Management unit. The switches are recessed inside the space marked **Settings**. Use a small tool such as a pocket screwdriver to push each switch into the correct position. Note that the DIP switches are numbered from 1 to 8, starting with 1 on the right side, when viewed from the rear of the unit.

<table>
<thead>
<tr>
<th>DIP Switch Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>System Address # 1† (AP9921X master unit)</td>
</tr>
<tr>
<td>System Address # 2 (AP9921XS expansion unit)</td>
</tr>
<tr>
<td>System Address # 3 (AP9921XS expansion unit)</td>
</tr>
<tr>
<td>System Address # 4 (AP9921XS expansion unit)</td>
</tr>
<tr>
<td>System Address # 5 (AP9921XS expansion unit)</td>
</tr>
<tr>
<td>System Address # 6 (AP9921XS expansion unit)</td>
</tr>
<tr>
<td>System Address # 7 (AP9921XS expansion unit)</td>
</tr>
<tr>
<td>System Address # 8 (AP9921XS expansion unit)</td>
</tr>
<tr>
<td>Modbus Terminator Out†</td>
</tr>
<tr>
<td>Modbus Terminator In</td>
</tr>
<tr>
<td>RS-232 Communications Console Selected†</td>
</tr>
<tr>
<td>RS-485 Modbus Communications Console Selected</td>
</tr>
<tr>
<td>Expansion Bus Terminator Out†</td>
</tr>
<tr>
<td>Expansion Bus Terminator In</td>
</tr>
</tbody>
</table>

† Factory default setting.
Install the Temperature Sensor Assembly

The temperature sensor assembly monitors two separate temperatures for the batteries: the temperature of the pilot battery (the battery to which the sensor is attached) and the ambient temperature of the air surrounding the batteries.

To install the sensors:

1. Attach the sensor marked **Pilot** to the battery you selected to be the pilot battery using a non-conductive, non-corrosive material (such as a wire tie).

2. Place the sensor marked **Ambient** around the batteries, so that it will measure the warmest area. Make sure the black receptor on the flat side of the sensor is not in contact with any other surface.

   **Note:** Install the sensor in a location that represents the air to be monitored. Avoid placing the sensor anywhere that may affect the sensor reading, such as near windows, room entrances, air ducts, other heat sources, or direct sunlight.

3. Neatly route and secure the 8-foot cord with tie-wraps or cable clips.

4. Plug the sensor connector into the port marked **Temp Sensors** on the rear panel of the unit.

   **Warning:** If you attach the sensors to a battery, use only adhesives designed for use on batteries. Some adhesives may react with the battery material, causing acid leakage.
Install the Current Sensor

1. Remove the screw and nut from either side of the current sensor and loosen the screw on the other side.

![Image of current sensor being installed](image)

2. Separate the top and bottom sections of the sensor by twisting the sections apart.

![Image of current sensor being separated](image)

**Note:** Make sure the arrow on the current sensor is pointing away from the positive battery terminal connected to the lead on which that sensor is placed.
3. Place the separated parts of the sensor around the main output battery lead on any battery. Secure the sensor in place using the screw and nut removed in step 1. Tighten the remaining screw.

4. Plug each sensor cable into a sensor port on the rear of the Battery Management unit (AP9921X) with the unit address of #1. Each string of batteries connected to the Battery Management System must have a current sensor:

   − If you are connecting only one string of batteries to the Battery Management System master unit, your system requires only one current sensor. Plug the sensor into the port marked **Probe A** on the rear panel of the master unit (DIP switch address #1).

   − If you connect a second string of batteries, your system requires two current sensors. Plug the second sensor into the port marked **Probe B** on the rear panel of the master unit (DIP switch address #1).
Connect Multiple Units

Connect up to seven Battery Management expansion units to one Battery Management master unit, if each unit connects to the same UPS, to monitor the units using one network connection. You must connect the units serially and set the DIP switches to identify the addresses of the units.

1. Plug a serial cable (0466-25) into the rear of a unit in either port marked **Expansion Bus**.
2. Connect the other end of the serial cable to an **Expansion Bus** port on the rear of a second unit of the Battery Management System.
   - If you connected the serial cable to the bottom **Expansion Bus** port of a unit, connect the other end of the serial cable to the top **Expansion Bus** port of the next unit (as shown in the diagram below).
   - If you connected the serial cable to the top **Expansion Bus** port of a unit, connect the other end of the serial cable to the bottom **Expansion Bus** port of the next unit.
3. Continue to connect the units using the Expansion Bus ports until they are all connected.
4. Set the address for each unit. The first unit (master unit) must be addressed as #1 (all DIP switches **OFF**) for the configuration to work, and each additional unit (expansion units) should be sequentially and consecutively addressed. Assign a number to each unit and write the number in the space marked **Unit #** on the back of each unit. See “Configure the DIP Switches” on page 9.
5. For the first and last units on the network, set DIP switch #8 to **ON** to enable the terminator.

The following cascaded configuration shows three units serially connected. Your setup may vary from the one shown.

1. Expansion unit: In this cascading example, this is unit #3 (AP9921XS). The second **Expansion Bus** port is not used.
2. Expansion unit: In this cascading example, this is unit #2 (AP9921XS).
3. Master unit: In this cascading example, this is unit #1 (AP9921X). The second **Expansion Bus** port is not used.
4. Serial cable to connect each unit.
Quick Configuration (AP9921X only)

Overview

Warning: Disregard the procedures in this section if you have APC InfraStruXure® Manager as part of your system. See the InfraStruXure Manager’s documentation for more information.

You must configure the following TCP/IP settings before the Battery Management System can operate on a network:

- IP address of the master unit
- Subnet mask
- Default gateway

Note: If a default gateway is unavailable, use the IP address of a computer that is located on the same subnet as the unit and that is usually running. The unit uses the default gateway to test the network when traffic is very light.

Caution: Do not use the loopback address (127.0.0.1) as the default gateway address for the Management Card. It disables the card and requires you to reset TCP/IP settings to their defaults using a local serial login.

See “Watchdog Features” in the Battery Management System User’s Guide for more information about the watchdog role of the default gateway.

TCP/IP Configuration Methods

Use one of the following methods to define the TCP/IP settings needed by the unit:

- APC Device IP Configuration Wizard (See “Device IP Configuration Wizard” on page 14.)
- BOOTP or DHCP server (See “BOOTP & DHCP configuration” on page 15.)
- Local computer (See “Local access to the control console” on page 16.)
- Networked computer (See “Remote access to the control console” on page 17.)

Device IP Configuration Wizard

You can use the Device IP Configuration Wizard at a computer running Windows® 2000, Windows 2003, or Windows XP to discover an unconfigured Battery Management master unit and configure its basic TCP/IP settings.

To configure one or more master units by exporting configuration settings from a configured master unit, see “How to Export Configuration Settings” in the User’s Guide on the Utility CD.

Note: Most software firewalls must be temporarily disabled for the Wizard to discover unconfigured Battery Management master units.
1. Insert the Battery Management System Utility CD into a computer on your network.
2. Select the Device IP Configuration Wizard from the main menu.
3. When the Wizard discovers the unconfigured master unit, follow the on-screen instructions.

Note: If you leave the Start a Web browser when finished option enabled, you can access the unit through your browser by using apc (the default) for both the user name and password.

**BOOTP & DHCP configuration**

The default TCP/IP configuration setting, **BOOTP & DHCP**, assumes that a properly configured BOOTP or DHCP server is available to provide TCP/IP settings to units. The unit first attempts to discover a properly configured BOOTP server, and then a DHCP server. It repeats this pattern until it discovers a BOOTP or DHCP server.

If neither of these servers is available, see “Device IP Configuration Wizard” on page 14, “Local access to the control console” on page 16, or “Remote access to the control console” on page 17 to configure the required TCP/IP settings.

A user configuration (.ini) file can function as a BOOTP or DHCP boot file. For more information, see the TCP/IP configuration section of the Battery Management System User’s Guide, available from the Utility CD or the APC Web site, www.apc.com.

**BOOTP.** To configure the TCP/IP settings for the unit, use an RFC951-compliant BOOTP server.

Note: The **DHCP & BOOTP** setting assumes that a properly configured DHCP or BOOTP server is available to provide TCP/IP settings to units.

For the Battery Management System to use a BOOTP server to configure its TCP/IP settings, it must find a properly configured RFC951-compliant BOOTP server.

In the BOOTPTAB file of the BOOTP server, enter the unit’s MAC address, IP address, subnet mask, and default gateway, and, optionally, a bootup file name. For the MAC address, look on the bottom of the unit or on the Quality Assurance slip included in the package.

When the unit reboots, the BOOTP server provides it with the TCP/IP settings.

- If you specified a bootup file name, the unit attempts to transfer that file from the BOOTP server using TFTP or FTP. The unit assumes all settings specified in the bootup file.
- If you did not specify a bootup file name, you can configure the other settings of the unit remotely through its Web interface or control console; user name and password are both apc, by default.

To create the bootup file, see your BOOTP server documentation.
You can use an RFC2131/RFC2132-compliant DHCP server to configure the TCP/IP settings for the master unit.

This section briefly summarizes the unit communication with a DHCP server. For more detail about how a DHCP server is used to configure the network settings for a master unit, see “DHCP Configuration Settings” in the Battery Management System User’s Guide.

1. A master unit sends out a DHCP request that uses the following to identify itself:
   – A Vendor Class Identifier (APC by default)
   – A Client Identifier (by default, the unit’s MAC address value)
   – A User Class Identifier (by default, the identification of the unit’s application firmware)

2. A properly configured DHCP server responds with a DHCP offer that includes all of the settings that the unit needs for network communication. The DHCP offer also includes the Vendor Specific Information option (DHCP option 43). By default, the unit will ignore DHCP offers that do not encapsulate the APC cookie in the Vendor Specific Information option using the following hexadecimal format:
   Option 43 = 01 04 31 41 50 43
   where
   – the first byte (01) is the code
   – the second byte (04) is the length
   – the remaining bytes (31 41 50 43) are the APC cookie.

To disable the requirement that a DHCP offer include the APC cookie, use the DHCP Cookie Is setting in the control console.
Path: Main > Network > TCP/IP > Boot Mode > DHCP only > Advanced > DHCP Cookie Is.

Local access to the control console

1. Select a serial port on the local computer and disable any service that uses that port.
2. Set DIP switch #7 to the OFF position to operate at RS-232 communications mode.
3. Connect the provided configuration cable (APC part number 940-0103) to the master unit’s RS-232/485 serial port and to the serial port on the local computer.
4. Run a terminal program (such as HyperTerminal) and configure the selected port for 9600 bps (or 19200 bps, depending on the speed configured for Modbus), 8 data bits, no parity, 1 stop bit, and no flow control. Save the changes.
5. Press ENTER, repeatedly if necessary, to display the User Name prompt.
6. Use apc for the user name and password.

See “Control console” on page 17 to finish the configuration.
Remote access to the control console

From any computer on the same subnet as the master unit, you can use ARP and Ping to assign an IP address to a master unit, and then use Telnet to access the master unit’s control console and configure the other TCP/IP settings.

**Note:** After a unit has its IP address configured, you can use Telnet, without first using ARP and Ping, to access that unit.

1. Use the unit’s MAC address in the ARP command to define the IP address.

**Note:** For the MAC address, look on the bottom of the unit or on the Quality Assurance slip included in the package.

For example, to define 156.205.14.141 as the IP address of a unit with 00 c0 b7 63 9f 67 as its MAC address, use one of the following commands:
- Windows command format:
  ```cmd
  arp -s 156.205.14.141 00-c0-b7-63-9f-67
  ```
- LINUX command format:
  ```cmd
  arp -s 156.205.14.141 00:c0:b7:63:9f:67
  ```

2. Use Ping with a size of 113 bytes to assign the IP address defined by the ARP command. For the IP address defined in step 1, use one of the following commands:
- Windows command format:
  ```cmd
  ping 156.205.14.141 -l 113
  ```
- LINUX command format:
  ```cmd
  ping 156.205.14.141 -s 113
  ```

3. Use Telnet to access the unit at its newly assigned IP address. For example:

```cmd
telnet 156.205.14.141
```

4. Use `apc` for both user name and password.

5. See “Control console” on page 17 to finish the configuration.

Control console

After you log on at the control console, as described in “Local access to the control console” on page 16 or “Remote access to the control console” on page 17:

1. Choose **Network** from the **Control Console** menu.
2. Choose **TCP/IP** from the **Network** menu.
3. If you are not using a BOOTP or DHCP server to configure the TCP/IP settings, select the **Boot Mode** menu and then select **Manual**.
4. Set the **System IP**, **Subnet Mask**, and **Default Gateway** address values. (Changes take effect when you log off.)
5. Press ENTER to return to the TCP/IP menu.
6. Press CTRL+C to exit to the **Control Console** menu.
7. Log out (option 4 in the **Control Console** menu).

**Note:** If you disconnected a cable during the procedure described in “Local access to the control console” on page 16, reconnect that cable and restart the associated service.
If you changed the DIP switch configuration, reset the DIP switch to the configuration you had before step 2 of the procedure “Local access to the control console” on page 16.
Configure Modbus

Modbus pin-out and baud rate

Modbus lets you view the Battery Management System through the interface of your building management system. It is read-only.

⚠️ Note: Modbus and the control console share a common serial port. You can use either one or the other, one at a time, to access the Battery Management System.

Configure the DIP switch settings to enable Modbus communication. See “Configure the DIP Switches” on page 9.

The Modbus interface supports 2-wire RS-485. Use the following pin-out for the Modbus interface:

- Pin 2: D0
- Pin 3: D1
- Pin 5: GND

⚠️ Note: Modbus runs at 9600 or 19200 bps. To use the control console when Modbus is enabled, your computer’s serial port must communicate at the same serial baud rate as Modbus.

To configure Modbus using the Web interface:

1. Select the Administration tab, the top menu bar option General, and the left navigation menu option Serial Modbus.
2. Enter your settings and click Apply.

To configure Modbus using the control console:

1. Select Device Manager, then Network.
2. Select Serial Modbus.
3. Enter settings by selecting Access, Unique Target ID, or Baud Rate from the menu list.
4. Apply changes by selecting Accept changes.

The Modbus register map for the Battery Management System defines the data (type, location, and valid responses) available through Modbus. To see if an update to this register map is available, go to the Web page www.apc.com/search/index.cfm, search the APC Web site for the part number AP9921X, click on the link to the register map in the list of documentation, and check the publication date at the start of the file.
Access a Configured Unit

Overview

After the Battery Management System is running on your network, you can use the interfaces summarized here: Web interface, Telnet and SSH, SNMP, FTP and SCP.

For additional information about using any of the interfaces identified here, see the User’s Guide.

For detailed information on configuring system parameters through either the Web interface or control console, see the User’s Guide. For the system configuration parameters, you must configure Battery Type, Number of Strings, Number of Cells per Battery, and Number of Batteries per String. Change other system configuration parameters only if you have consulted with an APC Customer Support or Customer Service representative.

Web interface

Use Microsoft® Internet Explorer (IE) 5.5 or higher (on Windows operating systems only), Firefox, version 1.x, by Mozilla Corporation (on all operating systems), or Netscape® 7.x or higher (on all operating systems) to access the Web interface of the Battery Management System. Other commonly available browsers may work but have not been fully tested by APC.

You can use either of the following protocols when you use the Web interface:

- The HTTP protocol (enabled by default), which provides authentication by user name and password but no encryption.
- The HTTPS protocol, which provides extra security through Secure Sockets Layer (SSL), encrypts user names, passwords, and data being transmitted, and authenticates the Battery Management System by means of digital certificates.

To access the Web interface and configure the security of your device on the network:

1. Address the Battery Management System by its IP address (or its DNS name, if a DNS name is configured).
2. Enter the user name and password (by default, apc and apc for an Administrator).
3. To enable or disable the HTTP or HTTPS protocols, use the Network menu on the Administration tab, and select the access option under the Web heading on the left navigation menu.

See the Security Handbook, available on the Battery Management System Utility CD or from the APC Web site, www.apc.com, for more information on selecting and configuring network security.

Telnet

You can access the control console through Telnet or Secure SHell (SSH), depending on which is enabled. To enable these access methods, select the Administration tab, the Network menu on the top menu bar, and the access option under Console on the left navigation menu. By default, Telnet is enabled. Enabling SSH automatically disables Telnet.
**Telnet for basic access.** Telnet provides the basic security of authentication by user name and password, but not the high-security benefits of encryption. To use Telnet to access the Battery Management System’s control console from any computer on the same subnet:

1. At a command prompt, use the following command line, and press ENTER:

   ```
   telnet address
   ```

   As `address`, use the Battery Management System’s IP address or DNS name (if configured).

2. Enter the user name and password (by default, `apc` and `apc` for an Administrator, or `device` and `apc` for a Device User).

**SSH for high-security access.** If you use the high security of SSL for the Web interface, use Secure SHell (SSH) for access to the control console. SSH encrypts user names, passwords, and transmitted data.

The interface, user accounts, and user access rights are the same whether you access the control console through SSH or Telnet, but to use SSH, you must first configure SSH and have an SSH client program installed on your computer.

See the *User’s Guide* for more information on configuring and using SSH.

**Simple Network Management Protocol (SNMP)**

**SNMPv1 only.** After you add the PowerNet® MIB to a standard SNMP MIB browser, you can use that browser to access the Battery Management System. All user names, passwords, and community names for SNMP are transferred over the network as plain text. The default read community name is `public`; the default read/write community name is `private`.

**SNMPv3 only.** For SNMP GETs, SETs, and trap receivers, SNMPv3 uses a system of user profiles to identify users. An SNMPv3 user must have a user profile assigned in the MIB software program to perform GETs and SETs, browse the MIB, and receive traps.

**Note:** To use SNMPv3, you must have a MIB program that supports SNMPv3.

The Battery Management System supports only MD5 authentication and DES encryption.

**SNMPv1 and SNMPv3.** To use InfraStruXure Manager to manage the Battery Management System on the public network of an InfraStruXure system, you must have SNMPv1 enabled in the unit interface.

To enable or disable SNMP access, you must be an Administrator. Select the `Administration` tab, select the `Network` menu on the top menu bar, and use the `access` option under `SNMPv1` or `SNMPv3` on the left navigation menu.

**FTP and SCP**

You can use FTP (enabled by default) or SCP to transfer downloaded firmware to a unit, or to access a copy of a unit’s event or data logs.

To use InfraStruXure Manager to manage the Battery Management System, you must have **FTP Server** enabled in the unit interface.

To enable or disable **FTP Server** access, you must be an Administrator. Select the `Administration` tab, select the `Network` menu on the top menu bar, and use the **FTP Server** option on the left navigation menu.
In the Battery Management System User’s Guide, see the following sections:

- To transfer firmware, see “File Transfers.”
- To retrieve a copy of the event or data log, see “How to use FTP or SCP to retrieve log files.”

Recover From a Lost Password

You can use a local computer that connects to the Battery Management System master unit through the serial port to access the control console.

1. Select a serial port at the local computer and disable any service that uses that port.
2. Set DIP switch #7 to the OFF position.
3. Connect provided configuration cable (APC part number 940-0103) to the master unit’s serial port and to the serial port on the local computer.
4. Run a terminal program (such as HyperTerminal) and configure the selected port for 9600 bps (or 19200 bps, depending on the speed configured for Modbus), 8 data bits, no parity, 1 stop bit, and no flow control. Save the changes.
5. Press ENTER, repeatedly if necessary, to display the User Name prompt. If you are unable to display the user name prompt, verify the following:
   - The serial port is not in use by another application.
   - The terminal settings are correct as specified in step 4.
   - The correct cable is being used as specified in step 3.
   - The DIP switches are set correctly as specified in step 2.
6. Press the recessed Reset button on the rear panel of the master unit. The Status LED will flash alternately orange and green. Press the Reset button a second time immediately while the LED is flashing to reset the user name and password to their defaults temporarily.
7. Press ENTER as many times as necessary to redisplay the User Name prompt, then use the default, apc, for the user name and password. (If you take longer than 30 seconds to log on after the User Name prompt is redisplayed, you must repeat the procedure beginning with step 6.)
8. From the Control Console menu, select System, then User Manager.
9. Select Administrator, and change the User Name and Password settings, both of which are now apc.
10. Select Accept changes.
11. Press CTRL+C, log off, reconnect any serial cable you disconnected and restart and service you disabled.
12. Reset the DIP switches to the configuration you had before step 2.

Upgrade Firmware

For a complete description on how to download a firmware upgrade for your Battery Management System and transfer it to the unit, see the User’s Guide on the provided Battery Management System Utility CD.
## Specifications

### Electrical

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage, nominal</td>
<td>75–560 Vdc</td>
</tr>
<tr>
<td>Maximum total current draw (Battery monitoring mode: normal operation)</td>
<td>23 mA at 560 Vdc, 100 mA at 105 Vdc</td>
</tr>
<tr>
<td>Maximum total current draw (Battery boost mode)</td>
<td>77 mA at 560 Vdc, 750 mA at 105 Vdc</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>6 W continuous, 70 W intermittent</td>
</tr>
<tr>
<td>Temperature accuracy</td>
<td>± 2°F</td>
</tr>
<tr>
<td>Operating range per battery</td>
<td>2 V, 4 V, 8 V, 12 V nominal for lead-acid</td>
</tr>
<tr>
<td></td>
<td>1.2 V, 2.4 V for nickel-cadmium</td>
</tr>
<tr>
<td>Alarm relay limitations</td>
<td>1/2 A at 26 Vac, 2 A at 30 Vdc</td>
</tr>
</tbody>
</table>

### Physical

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (H × W × D)</td>
<td>4.34 x 43.18 x 43.18 cm (1.71 x 17.00 x 17.00 in)</td>
</tr>
<tr>
<td>Weight</td>
<td>AP9921X—6.23 kg (13.75 lb)</td>
</tr>
<tr>
<td></td>
<td>AP9921XS—6.03 kg (13.30 lb)</td>
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<tr>
<td>Shipping weight</td>
<td>AP9921X—10.77 kg (23.75 lb)</td>
</tr>
<tr>
<td></td>
<td>AP9921XS—9.34 kg (20.60 lb)</td>
</tr>
<tr>
<td>Maximum number of batteries</td>
<td>64 per unit (up to 8 units)</td>
</tr>
</tbody>
</table>

### Environmental (not including batteries)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Elevation (above MSL)</td>
<td></td>
</tr>
<tr>
<td>Operating:</td>
<td>0 to 3000 m (0 to 10,000 ft)</td>
</tr>
<tr>
<td>Storage:</td>
<td>0 to 15 000 m (0 to 50,000 ft)</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>Operating:</td>
<td>−5 to 45°C (23 to 113°F)</td>
</tr>
<tr>
<td>Storage:</td>
<td>−25 to 65°C (−13 to 149°F)</td>
</tr>
<tr>
<td>Operating humidity</td>
<td>0 to 95%, non-condensing</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>IP 20 under IEC 60529</td>
</tr>
</tbody>
</table>

### Compliance

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic Emissions</td>
<td>CE, FCC Part 15, EN55022, ICES-003, VCCI, AS/NZS CISPR 22, Class A</td>
</tr>
<tr>
<td>Electromagnetic Immunity</td>
<td>CE, EN55024, EN61326</td>
</tr>
<tr>
<td>Safety</td>
<td>CE, UL, cUL, VDE</td>
</tr>
</tbody>
</table>
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.

USA—FCC

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.

Canada—ICES

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.

Japan—VCCI

This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may occur, in which case, the user may be required to take corrective actions.

台湾——BSMI

警告使用者：
这是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，
在這種情況下，使用者會被要求採取某些適當的對策。

Australia and New Zealand

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

European Union

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. APC cannot accept responsibility for any failure to satisfy the protection requirements resulting from an unapproved modification of the product.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide a reasonable protection against interference with licensed communication equipment.

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
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 access documents in the APC Knowledge Base and to submit customer support requests.
  - [www.apc.com](http://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/](http://www.apc.com/support/)
    Global support searching APC Knowledge Base and using e-support.
- Contact the APC Customer Support Center by telephone or e-mail.
  - Local, country-specific centers: go to [www.apc.com/support/contact](http://www.apc.com/support/contact) for contact information.

For information on how to obtain local customer support, contact the APC representative or other distributors from whom you purchased your APC product.