

## **Installation and Hardware Guide**

# **AAA-131CA**

**PCI-to-Wide UltraSCSI Array Adapter**





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Printed in Singapore  
STOCK NO.: 511694-00, Rev. A KL 10/97

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PCI-to-Wide UltraSCSI Array Adapter

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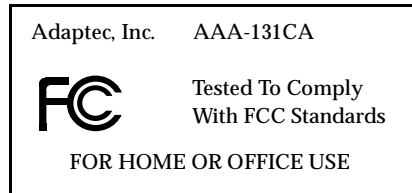
WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. However, if this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Use a shielded and properly grounded I/O cable and power cable to ensure compliance of this unit to the specified limits of the rules.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.



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Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.



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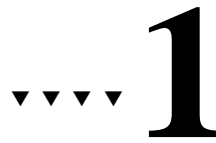
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## Introduction

The Adaptec® AAA™-131CA PCI-to-Wide UltraSCSI Array Adapter provides powerful disk array support in PCI Windows NT personal workstations. The AAA-131CA is a single-channel, half-size PCI array adapter, with 50-pin and 68-pin internal connectors and a 68-pin external connector.

This *Installation and Hardware Guide* explains how to initially install the AAA-131CA adapter, create the first array, and then install the supporting software. The *Array1000™ CA Family Array Management Guide*, which is also included with your array adapter, explains how to use the supporting software to create and manage additional arrays.

## System Requirements

The minimum system requirements for the AAA-131CA are

- PCI-based 90-MHz Pentium or equivalent motherboard with PCI-to-PCI bridge support
- An available half-length, unobstructed PCI slot that supports Bus Mastering
- A minimum of one SCSI hard disk drive
- A standard 72-pin, 16-MByte, Fast-page mode 70-ns or faster SIMM (non-EDO). (See the Adaptec Web Site at <http://www.adaptec.com/RAID> for a list of approved SIMMs and vendors.)
- Five MBytes of hard disk space for the AAA-131CA software (five MBytes of free hard disk space on the Windows system)

### **AAA-131CA Installation and Hardware Guide**

disk are also required for the temporary files created during installation of the software)

- Windows NT™ Workstation 3.51 or 4.0
- A 3.5-inch 1.44-MByte primary (boot) floppy disk drive
- A minimum of 64 MBytes memory
- Installed CD-ROM drive, for installation of Adaptec CI/O™ Workstation Array Management Software (optionally, you can request the installation files on floppy diskettes)

## **Installation Overview**

- Install the AAA-131CA adapter in the desktop system
- Connect the SCSI devices to the AAA-131CA
- Create the first (bootable) array with the *ArrayConfigCA*™ program
- Install the AAA-131CA driver along with Windows NT
- Install the Adaptec CI/O Workstation Array Management Software on your system



# ...2

## Installing the AAA-131CA Adapter and Connecting SCSI Devices

To install the AAA-131CA your SCSI devices, you will need to

- Install SIMM memory
- Back up any existing data
- Install the AAA-131CA in your system
- Connect SCSI devices

## AAA-131CA Layout

Figure 2-1 identifies the major components on the AAA-131CA. You may find it helpful to refer to this figure while installing your adapter.

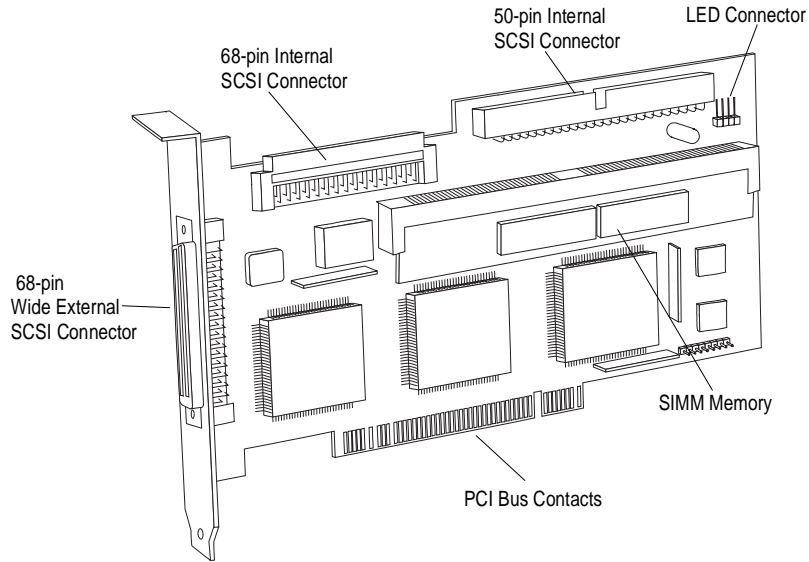


Figure 2-1. AAA-131CA Major Components

## Installing SIMM Memory

Before you can use the AAA-131CA adapter, the SIMM memory socket must be populated with a standard 72-pin 16-MByte Fast-page mode SIMM, as shown in Figure 2-2. (The SIMM may already be installed in the socket.) Visit the Adaptec Web Site at <http://www.adaptec.com/RAID> for a list of approved SIMMs and vendors.

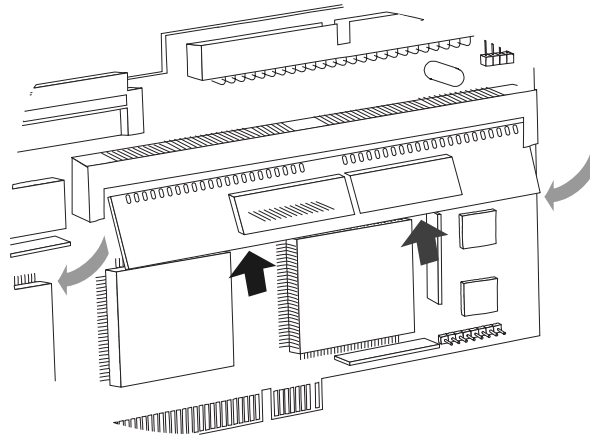


Figure 2-2. Installing SIMM in the SIMM Memory Socket

## Installing the AAA-131CA Array Adapter

Follow these steps to install the AAA-131CA adapter:



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**Note:** If you are installing the AAA-131CA adapter in an existing system, back up all data before continuing with installation. You can restore this data after you reconnect your devices and you create your array(s).

---

- 1 Turn OFF power to the computer and disconnect the power cord.
- 2 Remove the cover from the computer case. (If necessary, refer to the instructions in your computer documentation.)
- 3 Locate an unused, unobstructed, 5-volt PCI expansion slot that supports bus mastering. Unscrew and remove the expansion slot bracket that covers the card-slot opening.

- 4 Insert the AAA-131CA adapter in the PCI slot, as shown in Figure 2-3. Press down firmly so that the PCI bus contacts are securely seated in the slot. Secure the adapter bracket with the screw you removed in Step 3.

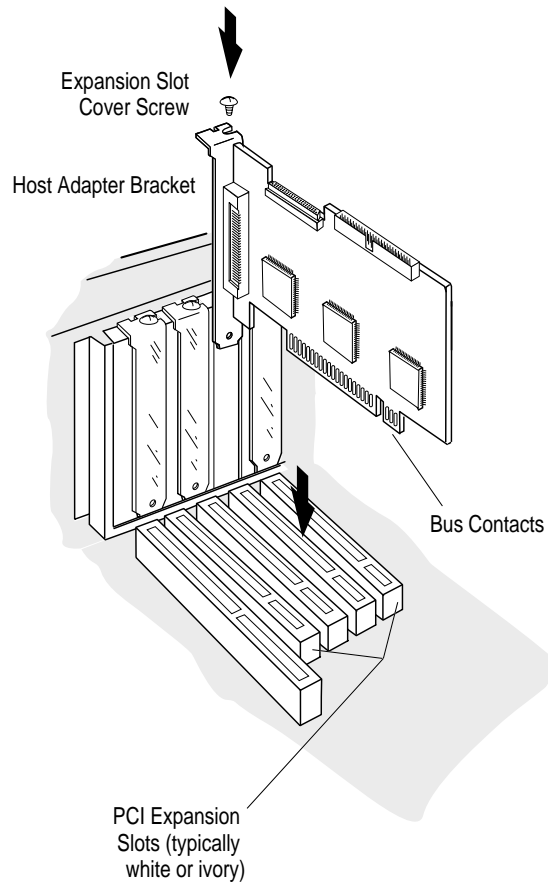


Figure 2-3. Installing an AAA-131CA in a PCI Expansion Slot



## Connecting the LED Activity Indicator

(Optional) An LED on the front panel of most computers lights to indicate non-SCSI hard disk activity. If you want the LED to light whenever there is activity on the AAA-131CA adapter instead, you must disconnect the LED cable from the motherboard and connect it to the LED connector on the AAA-131CA adapter. If the LED has a two-position cable, connect the cable to pins 1 and 2 of the LED connector, as shown in Figure 2-4.



---

**Note:** If you are using non-SCSI disk drives (e.g., IDE), the LED will no longer indicate activity on these drives when you connect the LED cable to the AAA-131CA adapter.

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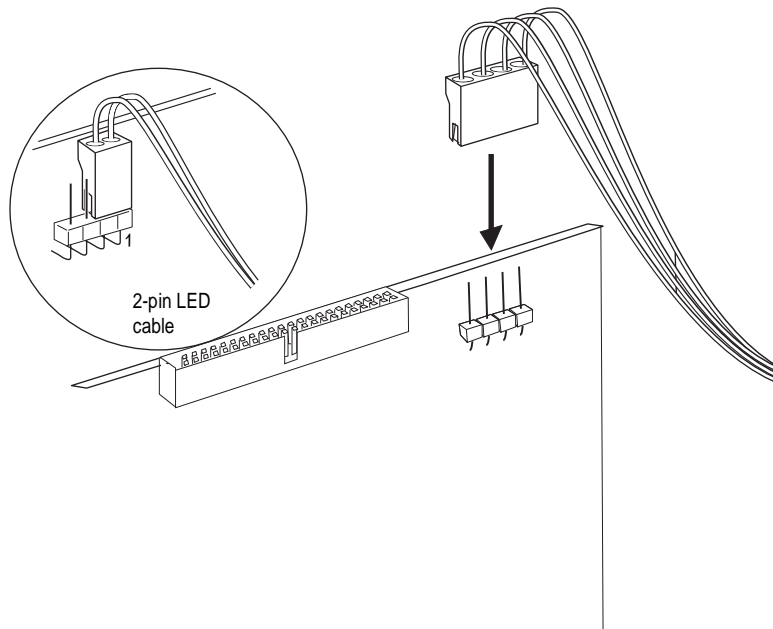


Figure 2-4. Connecting the LED Activity Indicator

## Connecting SCSI Devices

The AAA-131CA adapter supports both internal and external SCSI devices. Up to 15 SCSI devices can be supported on each SCSI channel—either 16-bit devices alone or a combination of 16-bit and up to seven 8-bit devices.



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**Note:** If you are installing your SCSI devices inside an external array enclosure, see *Connecting External SCSI Array Enclosures (Storage Subsystems)* on page 2-11.

---

## Choosing SCSI Cables

To connect your SCSI devices, make sure you have the appropriate cable and connectors as described in the following table (see *Installation Hints for Connecting SCSI Devices* on page 2-12 as well as Appendix D, *Obtaining SCSI Cables and Converters* for additional information on cabling SCSI devices):

To Install...	You Will Need...
8-bit Internal SCSI Devices	<ul style="list-style-type: none"><li>• A 50-pin Internal SCSI cable with enough connectors to accommodate all of your internal SCSI devices.</li></ul>
8-bit External SCSI Devices	<ul style="list-style-type: none"><li>• A 68-pin to 50-pin external converter.</li><li>• A 50-pin Ultra external SCSI cable.</li></ul>
16-bit Internal SCSI Devices	<ul style="list-style-type: none"><li>• A 68-pin Ultra Wide internal SCSI cable with enough connectors for all of your internal SCSI devices.</li></ul>
16-bit External SCSI Devices <sup>1</sup>	<ul style="list-style-type: none"><li>• A 68-pin Ultra Wide External SCSI cable for each device.</li></ul>
16-bit External Array Enclosure <sup>1</sup>	<ul style="list-style-type: none"><li>• A 68-pin Ultra Wide External SCSI cable.</li></ul>
8-bit External Array Enclosure	<ul style="list-style-type: none"><li>• A 68-pin to 50-pin external converter.</li><li>• A 50-pin Ultra external SCSI cable.</li></ul>

<sup>1</sup> Use only high-quality external cables with a single-ended impedance range of 80-110 ohms.

## Connecting Internal SCSI Devices

Follow these steps to connect internal SCSI devices:

- 1 Prepare each SCSI device for installation:
  - Make sure each device (internal and external) is assigned a unique SCSI ID number from 0 to 15—no duplicate IDs are permitted on a channel. Do not assign SCSI ID 7, because each SCSI channel uses this ID by default. (See *SCSI ID Numbers* on page 2-13 for additional information.)
  - Install (or enable) the terminators on the internal device you are attaching to the end of the cable only. (See *SCSI Termination* on page 2-14 for additional information.)
- 2 Install and mount each internal SCSI device in an available drive bay inside your computer. (Refer to your computer and device documentation for instructions.)
- 3 If you are connecting 8-bit internal SCSI devices, attach one end of the 50-pin cable to the 50-pin internal SCSI connector on the AAA-131CA adapter. If you are connecting 16-bit internal SCSI devices, attach one end of the 68-pin cable to the 68-pin internal SCSI connector on the AAA-131CA adapter.

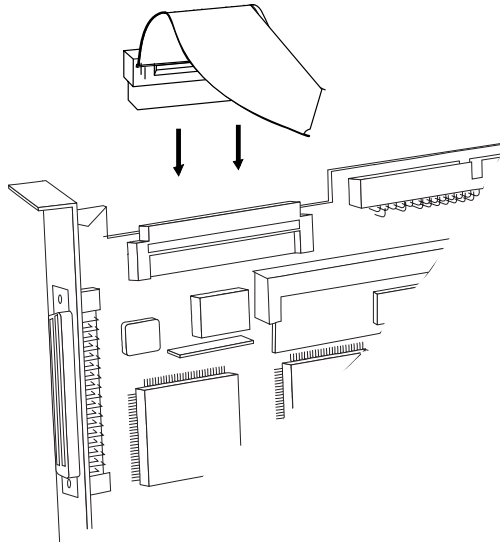


Figure 2-5. Attaching 68-pin Internal Ribbon Cable

- 4 Attach the remaining connectors on the cable to the remaining internal devices.
- 5 Connect an available DC power cable (from your computer's power supply) to the power input connector on each SCSI device.

### Connecting External SCSI Devices

For each external SCSI device, you must obtain a high-quality external cable with a single-ended impedance range of 80-110 ohms. For additional information on cabling SCSI devices, see *Installation Hints for Connecting SCSI Devices* on page 2-12. Follow these steps to connect external SCSI devices:

- 1 Make sure each device (internal and external) is assigned a unique SCSI ID number from 0 to 15—no duplicate IDs are permitted on a channel. (See *SCSI ID Numbers* on page 2-13 for additional information.)
- 2 Attach one end of the 68-pin cable to the 68-pin Ultra Wide external SCSI connector on the adapter (shown in Figure 2-6.)

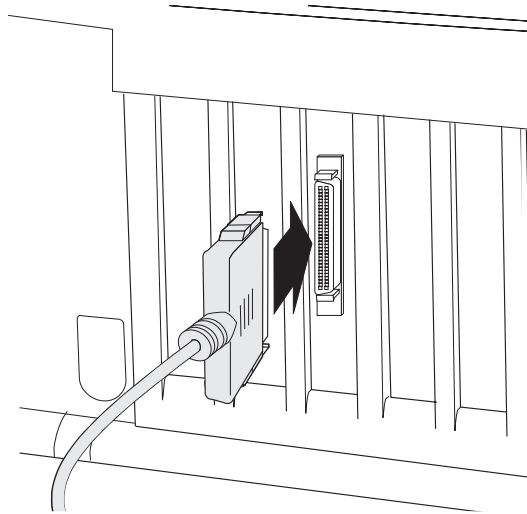


Figure 2-6. Attaching an External Cable to the External SCSI Connector

*Installing the AAA-131CA Adapter and Connecting SCSI Devices*

- 3** Attach the connector at the other end of the cable to either one of the SCSI connectors on the external SCSI device, as shown in Figure 2-7. (If you are installing only one external device, attach an active terminator to the device.)

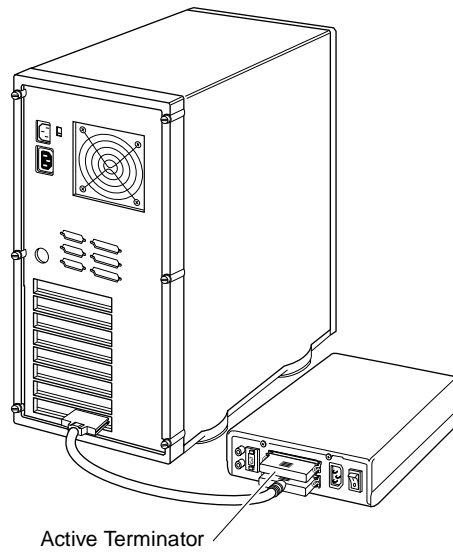


Figure 2-7. Attaching a Single External Device

- 4 Connect other external SCSI devices by daisy-chaining each device to the previous device until all external SCSI devices have been connected, as shown in Figure 2-8. (The device at the end of the chain must have an active terminator installed. See *SCSI Termination* on page 2-14 for additional information.)

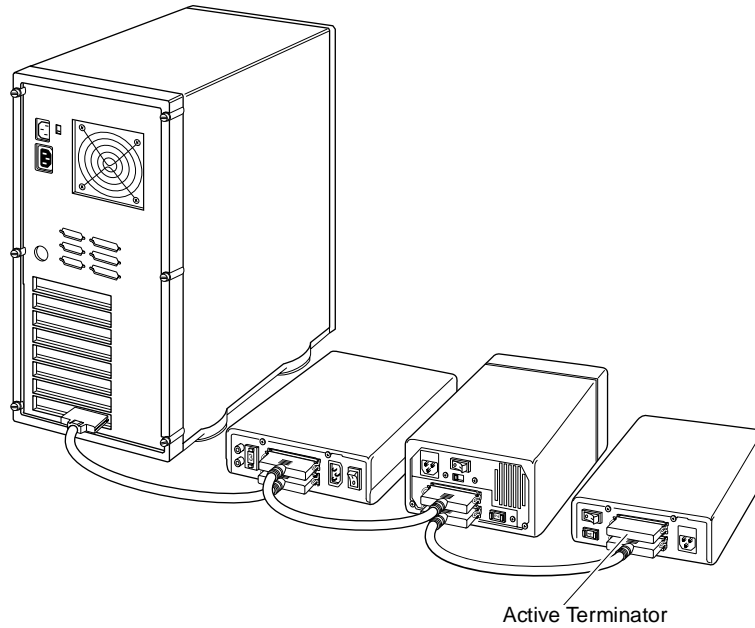


Figure 2-8. Attaching Multiple External Devices

## Connecting External SCSI Array Enclosures (Storage Subsystems)

If you are installing the AAA-131CA adapter in a powerful, high-end desktop system, you may decide to use a SCSI array enclosure for your SCSI disk drives, instead of installing the drives in the computer itself. Array enclosures offer a number of advantages:

- New disks can easily be added.
- Bad disks can easily be identified and replaced.
- If the enclosure supports *hot swapping*<sup>1</sup>, you can add or remove disks without pausing data I/O on the SCSI bus or shutting down the system.

Figure 2-9 shows a typical setup between the array enclosure and the computer. To install your SCSI devices in an array enclosure, refer to the enclosure's documentation. The following information is provided to help you properly connect your enclosure to the computer. (See Appendix E, *Listing of Vendors* for a list of popular array storage enclosure and disk drive manufacturers.)

- All rules for SCSI ID and termination must be followed when installing SCSI devices in an array enclosure.
- Ideally, the array enclosure itself should provide termination capability, either on the SCSI backplane or with an attachable active terminator, as shown in Figure 2-9, and you should disable termination on all the drives in the enclosure. If you terminate the SCSI bus by enabling termination on a drive, you may run into problems if you have to replace that drive and you then forget to terminate the replacement drive.

---

<sup>1</sup> *Hot swapping* support means that the array enclosure electrically isolates the bad disk's SCSI connector from the SCSI bus while the disk is being swapped to prevent data corruption. Data can still be transferred to and from the remaining good disks while the bad disk is replaced. Check with the manufacturer of the array enclosure if you are not sure whether it supports hot swapping

- If the enclosure you are using for the array drives is not specifically designed as a array enclosure (such as a standard *tower* unit), be sure it has adequate cooling and ventilation.

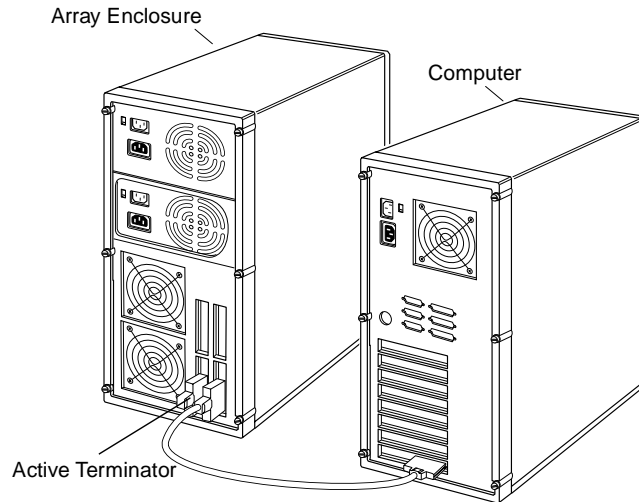


Figure 2-9. A Typical Array Enclosure Setup

## Installation Hints for Connecting SCSI Devices

### All SCSI Devices

- If you are booting your computer from a single SCSI hard disk drive or bootable array, the boot order (or *virtual device order*) of the disk or array must be set to 0.
- Enable termination power on all SCSI devices in the computer (or array enclosure) so that if you remove a drive that is supplying termination power other devices will still provide it. The devices supplying termination power should be located near the end of the SCSI bus.
- Symptoms of SCSI cabling-related problems are drives not being recognized, drives locking up, or drives that deactivate.
- Use good-quality SCSI cabling, and minimize the stub lengths. Good-quality cables should not be limp when you pick them up. The quality of the cable becomes much more critical when you use higher-speed (that is, *UltraSCSI*) data transfer rates.



### **Cable Lengths**

- The total length of cabling (internal and external) on each SCSI channel should not exceed the following:
  - Three meters (9.8 ft) if you are using Fast SCSI data transfer rates (10 MBytes/sec).
  - Three m (9.8 ft) if you are using UltraSCSI data transfer rates (20 MBytes/sec for 8-bit devices, and 40 MBytes/sec for 16-bit devices) and have four or less devices (including the Array controller).
  - One and one-half m (4.9 ft) if you are using UltraSCSI data transfer rates and have between four and eight devices (including the Array controller).



**Note:** UltraSCSI data transfer rates do not currently support more than eight devices per channel.

---

- Six m (19.7 ft) if you are using 5-MByte/sec asynchronous or synchronous data transfer rates.
- When calculating the total length of the bus, be sure to include the cabling inside any array enclosure.

### **SCSI ID Numbers**

Each device attached to a SCSI channel on the AAA-131CA adapter, as well as the SCSI channel itself, must be assigned a unique SCSI ID number from 0 to 15—no duplicate IDs are permitted on a channel.

- We recommend that you leave each adapter channel set to its default setting of SCSI ID 7.
- SCSI ID 7 has the highest priority on the channel. The priority of the remaining IDs, in descending order, is 6 to 0, then 15 to 8.
- If you have 8-bit SCSI devices, they must use SCSI IDs 0, 1, 2, 3, 4, 5, or 6. (To change the SCSI ID on your hard disk and other SCSI devices, refer to the device's documentation.)
- If you wish to use a single SCSI disk drive (instead of an array) as your boot device, we recommend that you set the SCSI ID for the device to zero.

- In general, use lower SCSI IDs for single disks; and use higher SCSI IDs for drives used as array members or spares.

### SCSI Termination

To ensure reliable communication on the SCSI bus, *terminators* must be installed (or enabled) on the devices at the physical ends of each SCSI channel. The terminators on all devices between the physical ends must be removed (or disabled).

#### Terminating SCSI Channels on the AAA-131CA Adapter

Termination on the AAA-131CA adapter itself is controlled via the *SCSISelect* utility. We recommend that you leave each channel on the AAA-131CA adapter at its default setting of *Auto Mode* (the terminators are enabled or disabled according to the SCSI connectors in use). If you want to manually disable the AAA-131CA adapter termination setting, see Chapter 5, *Configuring the AAA-131CA Adapter with SCSISelect*.

#### Terminating SCSI Devices

On most internal SCSI devices the termination setting is controlled by setting a jumper or a switch, or by physically removing or installing resistor modules. On most external SCSI devices, termination is controlled by installing or removing a terminating plug (see Figures 2-7 and 2-8). Read the device's documentation to determine how to enable or disable termination on your particular SCSI device.

The internal SCSI cables supplied in the Adaptec AAA-131CA kits have attached terminators, so you should disable termination on all internal SCSI devices connected to the cable. In general, we recommend that you terminate the internal cable instead of terminating the SCSI devices. If you are using an array enclosure, we recommend that you terminate the SCSI backplane or install an active terminator on the second SCSI connector on the rear panel instead of terminating the individual SCSI devices. If you follow these recommendations, SCSI bus termination will not be affected when you remove or replace SCSI devices.



**Note:** We recommend that you enable termination power on all SCSI devices in the computer so that termination power will still be supplied if you replace one or more drives on the SCSI bus.

---

## Completing the Installation

Reinstall the computer cover and connect all power cables. To verify that the SCSI devices work properly, turn on the external SCSI devices first, then turn on the computer. When the computer boots, the adapter BIOS sign-on message should appear on the screen, and each device connected to the adapter should be listed. If the BIOS message does not appear, see Appendix A, *Troubleshooting*.



**Note:** If you need to configure the SCSI options (for example, ID, Parity Checking, and Termination) of your system after the AAA-131CA adapter is installed, see Chapter 5, *Configuring the AAA-131CA Adapter with SCSISelect*.

---





# ... 3

## Creating the First Array with the *ArrayConfigCA* Initial Boot Array Installation Utility

This chapter explains how to use the *ArrayConfigCA* Initial Boot Array Installation Utility to create the first bootable or non-bootable array on your computer. *ArrayConfigCA* runs from a convenient, self-booting diskette. Before creating the array, make sure the disks for the array are connected and installed in your computer (or array enclosure).



---

**Note:** This chapter describes the easy-to-use Express Setup option. You can use the *ArrayConfigCA* Custom Setup option if you want to have more control over the array parameters of if you want to add spare disks to the array. For more information on using *ArrayConfigCA*, see the *Adaptec Array1000CA Family Array Management Guide*.

---

Follow these steps to create an initial array with the *ArrayConfigCA* Express Setup. (You can probably complete the Express Setup process by simply following the simple instructions that appear on the screen.)



---

**Note:** To select Array*Config*CA menu options, type the *hot key*—the letter that appears in a different color. (The hot key letters are underlined in the following instructions). You can also press the ↑ and ↓ keys until the option is highlighted and then press **Enter**.

---

- 1 Insert the Array*Config*CA diskette in drive A and reboot your computer. Wait until Array*Config*CA starts automatically.
- 2 Read the text that appears on the initial Array*Config*CA screens. Press any key to view the next screen, or press **Esc** to return to the previous screen.
- 3 When you see the Setup Type Selection Menu, select **Express Setup**.
- 4 When the next screen appears, select the type of array you want to create:
  - Select **Optimized for Performance** if you want the fastest possible data input and output from the new array. This type of array does not have special data protection features, however. If one disk fails, all data on the array is lost and you must restore it from a backup stored on tape or on some other medium. When prompted, type the number of disks you want in this array.
  - Select **Optimized for Data Protection** if your main concern is to protect the files on the array from disk failure. This type of array safeguards files in the array even if one of the array disks fails. (This kind of array has two disks by definition, so you will *not* be prompted to enter the number of disks you want in the array.)
- 5 When the next menu appears, select the type of application that you will run on your computer. (Select **Others** if you are not sure what type of application you will use.) Array*Config*CA will use your answer to create the best array configuration for your applications.
- 6 When the next menu appears, select a boot order for the new array.

*Creating the First Array with the ArrayConfigCA Initial Boot Array Installation Utility*

- Select **Disk Array will be Boot Drive** (recommended) if you want your computer to boot from the new array. If you selected **Optimized for Data Protection** in Step 4, booting from an array safeguards the information on your boot drive. If you selected **Optimized for Performance**, booting from an array increases operating system performance. (To boot from an array, you must also install the operating system software on the array.)
  - Select **Disk Array will not be a Boot Drive** if you do not want your computer to boot from the new array.
- 7** When you have finished all these menu selections, wait while *ArrayConfigCA* creates the array. This may take a long time, especially if the disk drives are large.
- A message appears when the array has been created. An error message appears if fewer than two disks are available or if *ArrayConfigCA* encounters some other problem. If this happens, install more disk drives or run *ArrayConfigCA* again and use the **Custom Setup** option.
- 8** If you created a bootable array, install Windows NT on the new array. To do this, follow the instructions in the Microsoft documentation. (Chapter 4 of this *Installation and Hardware Guide* also has instructions for installing Windows NT and the other AAA-131CA software.)







# ...4

## Installing Software

This chapter explains how to install the software required to use the AAA-131CA in a computer system using Windows NT 3.51 or 4.0. Before installing the software, make sure the AAA-131CA adapter is already installed. If you plan to boot from an array, make sure the array is already created. To install all of the software, you must complete the following in the order presented:

- 1 Install the *cda1000.sys* driver for Windows NT
- 2 Install the Adaptec CI/O Workstation Array Management Software for Windows NT

Once all software is installed, refer to the *Adaptec Array1000CA Family Array Management Guide* for instructions on adding, deleting, and managing your arrays.



**Note:** If your computer has an Adaptec AHA-2940, AHA-3940 or any other AIC™-78x0 based host adapter installed, the *aic78xx.sys* driver for these host adapters must be from the Adaptec 7800 Family Manager Set v1.3 or later.

---

## Installing the Array1000CA Driver for Windows NT

This section explains how to install the Adaptec Array1000CA Miniport Driver (*cda1000.sys*) for Windows NT. To begin driver installation, see either *Installing the Driver When Installing Windows NT* below, or *Installing the Driver When Windows NT is Already Installed* on page 4-4.



---

**Note:** We recommend that you install your Windows NT operating system on a bootable array to take advantage of the performance or redundancy features of the array.

---

### Installing the Driver When Installing Windows NT

To install the *cda1000.sys* driver when you are installing Windows NT, follow the instructions below for the version of Windows NT you are installing.



---

**Note:** If you have multiple arrays, we recommend temporarily powering off all devices except for the boot array before installing Windows NT; otherwise, Windows NT limits the size of the partitions you can create to 1 GByte. When Windows NT installation is complete, power on all devices and reboot the system.

---

### Windows NT 3.51

To install the *cda1000.sys* driver when you are installing Windows NT 3.51, follow these steps:

- 1 If you are installing Windows NT from a floppy drive, locate the Windows NT Setup Disk 1 for Floppy Installation.  
If you are installing from a CD-ROM drive, locate the Windows NT Setup Disk 1 for CD-ROM Installation.
- 2 Insert the diskette into drive A (not drive B) and turn ON your computer. When prompted, insert Windows NT Disk 2.
- 3 From the Welcome to Setup Screen, press **Enter** to set up Windows NT.

- 4 When prompted, select **Custom** setup.
- 5 Press **S** to skip mass storage device detection. This allows you to manually select the driver for your host adapter.
- 6 Since mass storage device detection was skipped in the previous step, Windows NT Setup displays none in the list of recognized devices. Press **S** to configure additional SCSI adapters.
- 7 From the list of additional SCSI adapters, expand the list, select **Other**, and press **Enter**.
- 8 Insert the Adaptec Array1000CA Family Manager Set drivers diskette into drive **A** and press **Enter**.
- 9 Browse to the *a:\winnt\* directory. The screen displays the adapter drivers supported on the diskette. The Adaptec Array1000CA Family Adapter driver is highlighted by default; press **Enter**.
- 10 If you want to add drivers for other host adapters (other than the AAA-131CA), do so at this time by repeating Step 7 for each additional adapter and inserting the appropriate disk provided by the hardware manufacturer.
- 11 Press **Enter** to continue with the Windows NT operating system setup. Follow the instructions given onscreen and in the Windows NT installation documentation.

#### Windows NT 4.0

To install the *cda1000.sys* driver when you are installing Windows NT 4.0, follow these steps:

- 1 Start your system with the Windows NT Boot Diskette in the floppy drive *or* the Windows NT Boot CD-ROM in the CD-ROM drive.



**Note:** To install Windows NT from a bootable CD-ROM, make sure BIOS Support for Bootable CD-ROM is *enabled* in *SCSISelect*. See Chapter 5, *Configuring the AAA-131CA Adapter with SCSISelect*.

---

- 2** *Boot diskette installation:* When prompted, insert diskette #2 in your floppy drive. After a few moments you will see a blue screen. To setup Windows NT now, press **Enter** and continue with Step 3 below.

*Boot CD-ROM installation:* When the following message appears onscreen, press the **F6** key and skip to Step 4 below.

Setup is inspecting your computer's hardware...

- 3** Press **S** to skip auto-detection of your AAA-131CA array adapter.
- 4** Press **S** again to specify an additional device.
- 5** Press **Enter** to select Others; insert the Adaptec Array1000CA Family Manager Set drivers diskette in your floppy drive.
- 6** The screen displays the adapter drivers supported on the diskette. Select the Adaptec Array1000CA Family Adapter and press **Enter**.
- 7** If you want to add drivers for other host adapters (other than the AAA-131CA), do so at this time by pressing **S** and repeating Step 5 for each additional adapter and inserting the appropriate disk provided by the hardware manufacturer.
- 8** Press **Enter** to continue with the Windows NT operating system setup. Follow the onscreen instructions and in the Windows NT documentation to complete the installation.

## Installing the Driver When Windows NT is Already Installed

To update or install the *cda1000.sys* driver if Windows NT is already installed, follow the instructions below for the version of Windows NT that is already installed.

### Windows NT 3.51

To install the *cda1000.sys* driver when Windows NT 3.51 is already installed, follow these steps:

- 1** Start the Windows NT Setup program. (Its icon is usually found in the Main program group.) There is a brief pause while Windows NT Setup scans your hardware configuration.

- 2 Select the **Options** menu and then select **Add/Remove SCSI Adapters**. The SCSI Adapter Setup program displays a list of all host adapters currently installed.
- 3 Click **Add** to add another host adapter type to the list. A list of additional SCSI adapters appears.
- 4 Expand the list of additional SCSI adapters. Select **Other**, and press **Enter**.
- 5 Insert the Adaptec Array1000CA Family Manager Set drivers diskette into drive A. Enter the following path to the installation files and then click **OK**:  

a:\winnt
- 6 The screen displays the adapter drivers supported on the diskette. The Adaptec Array1000CA Family Adapter driver is highlighted by default; click **OK**. The driver is added to the list of SCSI adapters.
- 7 Select Adaptec Array1000CA Family Adapter from the list of SCSI adapters, and click **Install**. At this point, Windows NT Setup checks if the specified driver (in this example, *cda1000.sys*) has already been copied to the system disk.
- 8 If the following message appears, click **New** to replace the existing driver and skip to Step 10:  

The driver(s) for this SCSI Adapter are already on the system. Do you want to use the currently installed driver(s) or install new one(s).

If the following message appears, continue with Step 9:

Please enter the full path to the Windows NT SCSI Adapter files
- 9 Change the path to the directory with the desired device driver (i.e., *a:\winnt*), and then click **Continue**. The device driver is copied to your system disk, and the Windows NT configuration is updated so that the new device driver loads when Windows NT reboots.
- 10 When the installation is complete, Windows NT Setup again displays a list of currently installed host adapter types. Verify that the new host adapter appears on the list; the text string should look similar to Adaptec Array1000CA Family Adapter.

- 11 Add other types of host adapters if necessary (see Step 4 above), or click **Close** to exit the SCSI adapters portion of Windows NT Setup, and then close the program.
- 12 When you see this message, click **OK** to exit:  

The changes you have made will not take effect until the computer is restarted

If this message does not appear, no changes have been made to the Windows NT system configuration.
- 13 Restart your computer and Windows NT. Some drive letter assignments may change from the previous configuration.

#### Windows NT 4.0

To install the *cda1000.sys* driver when Windows NT 4.0 is already installed, follow these steps:

- 1 Start Windows NT.
- 2 Click the **Start** button on the Windows NT task bar, and then point to Settings.
- 3 Click the **Control Panel**.
- 4 Double-click the **SCSI Adapters** icon.
- 5 Click the **Drivers** tab, and then click the **Add** button.
- 6 In the Install Driver window, click the **Have Disk** button.
- 7 Insert the Adaptec Array1000CA Family Manager Set drivers diskette into drive A; enter the following path to the installation files and then click **OK**.  

a:\winnt

The Adaptec Array1000CA Family Adapter is highlighted by default.
- 8 In the Install Driver window, Click **OK**.
- 9 Click the **New** button when asked if you want to use the currently installed driver(s) or install new one(s).
- 10 Type a:\winnt again, and click **Continue**. The driver is now installed.

- 11 You must restart your computer for the changes to take effect. Click **Yes** to restart your computer.

## Installing Adaptec CI/O Workstation Array Management Software for Windows NT

Follow these steps to install the Adaptec CI/O Workstation Array Management Software for Windows NT:

- 1 Start Windows NT.
- 2 Insert the Adaptec CI/O Workstation Array Management Software CD-ROM in your CD-ROM drive. If you are installing the software from diskettes, insert Disk 1 of the Adaptec CI/O Workstation Array Management Software for Windows NT in the floppy disk drive.
- 3 Select **Run** from the File menu (Windows NT 4.0 users select **Start**, and then **Run**), type the following, and press **Enter**:

`[pathname]setup.exe`

(The *setup.exe* file is located at `\win_nt\disk1\setup.exe` on the CD-ROM, and at `setup.exe` on Disk 1 of the Adaptec CI/O Workstation Array Management Software for Windows NT.)

- 4 Follow the directions that appear on the screen.
- 5 When installation is complete, reboot the system. The following NT Services start automatically in the background:

CIO Array Management Service  
CIOArrayManager RPC Command  
CIOArrayManager RPC Event  
NobleNet Portmapper



**Note:** These NT Services are configured to start automatically at boot time. After installation you can start or stop these services through the Services icon in the Windows NT Control Panel.

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- 6** Double-click the CI/O Array Management Software icon to start the program.

See the *Adaptec Array1000CA Family Array Management Guide* for information on using the Adaptec CI/O Workstation Array Management Software to add, delete, or manage your arrays.





# ...5

## Configuring the AAA-131CA Adapter with *SCSISelect*

The AAA-131CA adapter has the onboard *SCSISelect* configuration utility, which allows you to change adapter settings without opening the computer or handling the adapter. This chapter describes the default settings, explains when you should change them, and tells you how to do it.

*SCSISelect* also includes SCSI disk utilities to list the SCSI IDs of devices on the AAA-131CA adapter, format SCSI disk drives, and check them for defects. Instructions for using these utilities are included.

## Default AAA-131CA Adapter Settings

The default *SCSISelect* settings, shown in the table below, are appropriate for using the AAA-131CA in most computer systems. For situations where you might want or need to change the settings, see the descriptions of each setting beginning on page 5-5. To change any setting, or if you would like to run the *SCSISelect* utilities, see *Starting the SCSISelect Utility* on page 5-3.

<b>SCSI Bus Interface Definitions</b>	<b>Default</b>
Host Adapter SCSI ID	7
SCSI Parity Checking	Enabled
Host Adapter SCSI Termination	Auto Mode
Host Adapter UltraSCSI	Disabled
<b>Additional Options (SCSI Device Configuration)</b>	<b>Default</b>
Initiate Sync Negotiation	Yes (Enabled)
Maximum Synchronous Transfer Rate	20.0 MBytes/sec. <sup>1</sup>
Enable Disconnection	Yes (Enabled)
Initiate Wide Negotiation	Yes (Enabled)
Send Start Unit Command	No (Disabled)
Include In BIOS Scan	Yes (Enabled)
<b>Additional Options</b>	<b>Default</b>
Array 1000CA BIOS	Enabled
BIOS Support for Bootable CD-ROM	Disabled

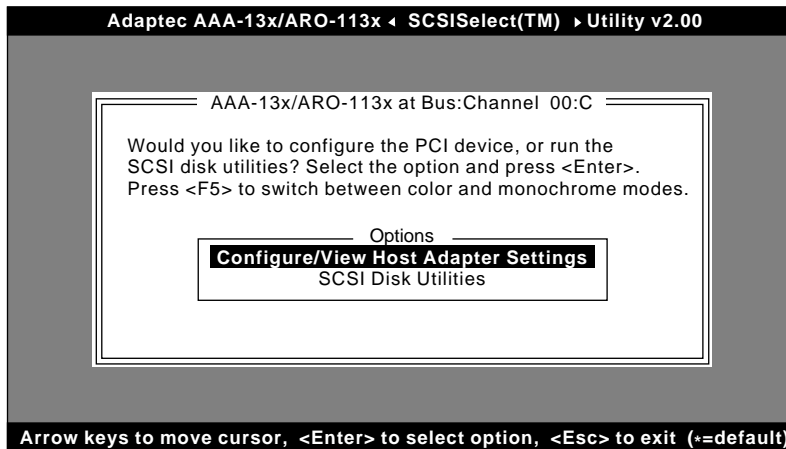
<sup>1</sup> This is 10 MBytes/sec if Wide Negotiation is not enabled.

## Starting the SCSISelect Utility

To start SCSISelect, press **Ctrl-A** when the following prompt appears when you turn on or reboot your computer:

Press <Ctrl><A> for SCSISelect (TM) Utility!

The menu that appears displays the options Configure/View Host Adapter Settings and SCSI Disk Utilities.



## Using SCSISelect Menus

To select a SCSISelect menu option, move the cursor to the option with the **↑** and **↓** keys, then press **Enter**. In some cases, selecting an option displays another menu. You can return to the previous menu at any time by pressing **Esc**.

To restore the original SCSISelect default values, press **F6** from the main SCSISelect screen. To toggle the display between color and monochrome modes, press **F5** from the main SCSISelect screen (this feature may not work on all monitors).

## Exiting SCSISelect

To exit SCSISelect, press **Esc** until a message prompts you to exit (if you changed any host adapter settings, you are prompted to save the changes before you exit). Select **Yes** to exit, then press any key to reboot the computer. Any changes you made in SCSISelect take effect after the computer boots.

## Using the SCSI Disk Utilities

To access the SCSI disk utilities, select the **SCSI Disk Utilities** option from the menu that appears after starting *SCSISelect*. Once the option is selected, *SCSISelect* immediately scans the SCSI bus (to determine the devices installed) and displays a list of all SCSI IDs and the devices assigned to each ID.

When you select a specific ID and device, a small menu appears, displaying the options **Format Disk** and **Verify Disk Media**.

- **Format Disk**—This utility allows you to perform a low-level format on a hard disk drive. Each hard disk drive must be low-level formatted before you can use your operating system's partitioning and file preparation utilities, such as MS-DOS *Fdisk* and *Format*.

Most SCSI disk devices are preformatted at the factory and do not need to be formatted again. The Adaptec **Format Disk** utility is compatible with nearly all SCSI disk drives.



**Caution:** A low-level format destroys all data on the drive. Be sure to back up your data before performing this operation. You *cannot* abort a low-level format once it is started.

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- **Verify Disk Media**—This utility allows you to scan the media of a hard disk drive for defects. If the utility finds bad blocks on the media, it prompts you to reassign them; if you select *yes*, those blocks are longer used. You can press **Esc** at any time to abort the utility.

## SCSISelect Settings

### SCSI Bus Interface Definitions

The following settings are the SCSISelect settings most likely to require any modification.

- **Array Adapter SCSI ID**— This option sets the AAA-131CA adapter's SCSI ID. The default setting is SCSI ID 7, which gives the adapter the highest priority on the SCSI bus. We recommend that you not change this setting.
- **SCSI Parity Checking**—This option determines whether the AAA-131CA adapter verifies the accuracy of data transfer on the SCSI bus. The default setting is *Enabled*. You should disable SCSI Parity Checking on the adapter and all SCSI devices if any SCSI device connected to the adapter does not support SCSI parity; otherwise, leave it enabled. Most SCSI devices do support SCSI parity. If you are not sure whether a device supports SCSI parity, consult the documentation for the device.
- **Array Adapter SCSI Termination**—This option sets termination on the AAA-131CA adapter. The default setting is *Auto Mode*. This means the adapter will detect whether internal or external SCSI devices are connected to it and whether they are Wide or Narrow SCSI devices. The adapter will then adjust its termination accordingly. Under normal operation, you should never need to change this setting.
- **Array Adapter UltraSCSI**—This option determines whether the adapter supports UltraSCSI devices. The default setting is *Disabled*. If you have any installed UltraSCSI devices installed, you should enable this setting. When this setting is enabled, the adapter negotiates for data transfer speeds of up to 20 MBytes/sec. (or 40 MBytes/sec. for Wide SCSI devices).



**Note:** If you use UltraSCSI data transfer speeds, be sure to use high-quality cables to connect the disk drives to the adapter. The quality of the cable is much more critical when you use higher-speed data transfer. See *Installation Hints for Connecting SCSI Devices* on page 2-12 for additional information on cabling SCSI devices.

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## Additional Options (SCSI Device Configuration)

The SCSI device settings allow you to configure certain parameters for each device on the SCSI bus. To configure settings for a specific device, you must know the SCSI ID assigned to that device. If you are not sure of the SCSI ID, see *Using the SCSI Disk Utilities* on page 5-4.

- **Initiate Sync Negotiation**—This option determines whether synchronous data transfer negotiation (Sync Negotiation) between the device and AAA-131CA adapter is initiated by the adapter. Normally, you should leave the Initiate Sync Negotiation setting enabled, because most SCSI devices support synchronous negotiation and because it allows for faster data transfer. The default setting is *Yes*.
- **Maximum Sync Transfer Rate**—This option determines the maximum synchronous data transfer rate that the AAA-131CA adapter supports. The default setting is 10.0 MBytes/sec. (The effective data transfer rate is doubled when Initiate Wide Negotiation is set to *Yes*. For example, a transfer rate of 10 MBytes/sec becomes 20 MBytes/sec.)
- **Enable Disconnection**—This option determines whether the AAA-131CA adapter allows the SCSI device to disconnect from the SCSI bus (sometimes called Disconnect/Reconnect). The default setting is *Yes*.

You should leave Enable Disconnection set to *Yes* if two or more SCSI devices are connected to the adapter. If only one SCSI device is connected to the adapter, you can set Enable Disconnection to *No* to achieve slightly better performance.

- **Initiate Wide Negotiation**—This option determines whether the AAA-131CA adapter attempts 16-bit data transfer instead of 8-bit data transfer. The default setting is *Yes*. (The effective data transfer rate is doubled when 16-bit data transfer is used. For example, a transfer rate of 10 MBytes/sec becomes 20 MBytes/sec.)

- **Send Start Unit Command**—This option determines whether the Start Unit Command is sent to the SCSI device at bootup (most devices do not require this). The default setting is *No*.
- **Include in BIOS Scan**—This option determines whether the AAA-131CA BIOS controls hard disk drives connected to the adapter. When set to *Yes*, the BIOS controls the hard disk drive. When set to *No*, the BIOS does not control the hard disk drive, and device driver software is needed to control the device. The default setting is *Yes*. You should leave the setting at the default for all drives that are part of an array.

## **Additional Options**

### **Array1000CA BIOS**

This option determines whether the AAA-131CA BIOS is installed at boot time. When set to *Enabled*, the AAA-131CA BIOS is installed, and all Int13 devices are supported. When set to *Disabled*, the AAA-131CA BIOS is not installed. The default setting is *Enabled*.

### **BIOS Support for Bootable CD-ROM**

This option determines whether the AAA-131CA BIOS supports booting from a CD-ROM drive. When set to *Enabled*, the AAA-131CA BIOS allows booting from a CD-ROM drive.









# Troubleshooting

## Troubleshooting Checklist

Check the following if you have problems installing or running the AAA-131CA adapter and SCSI devices:

- Does the AAA-131CA BIOS sign-on message appear during bootup? If not, check the following items:
  - Is the AAA-131CA adapter properly seated in a PCI expansion slot? Refer to your computer documentation for the slot location.
  - Does your computer CMOS setup require you to enable PCI bus parameters (see your computer documentation)? If so, run the CMOS Setup program and assign the parameters—usually IRQ, Enable PCI Slot, and Enable Master.
  - Does the motherboard chipset meet the minimum requirements listed on page 1-1 (especially PCI-to-PCI bridge support)? If not, contact your vendor for a motherboard firmware upgrade.
- Is the SCSI bus terminated properly, and are all SCSI devices turned on?
- Are all SCSI bus cables and power cables connected?
- Does each channel and each device on the channel have a unique SCSI ID?

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- If you are having trouble booting from a SCSI disk drive or array, make sure your computer's CMOS setup is set to **No Drives Installed** (the required setting for SCSI drives). Also, verify that the drive or array has been selected as the boot-first (boot) device and that the boot partition is active.





## Advanced Topics

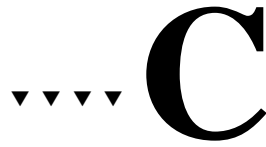
### Installing Multiple Adapters

You can install an AAA-131CA array adapter in computers that have other PCI-, ISA-, or EISA-based host adapters. When installing multiple adapters, keep the following considerations in mind:

- If you are booting from a SCSI disk drive or an array supported by the AAA-131CA adapter, then the adapter must be the card that the computer scans first. Usually, you need to determine by experimentation which PCI slot the computer scans first and then make sure the AAA-131CA adapter is installed in that slot. Some computers boot from the device with the lowest PCI device number; others boot from the device with the highest number. If the system does not boot from the controller you want, move that controller to a different PCI slot and try again. Alternatively, you can disable the BIOS on controllers that are scanned before the desired boot controller.
- In systems with EISA- and ISA-based host adapters, the boot host adapter must have the lowest BIOS base address. The system BIOS automatically controls the AAA-131CA adapter's base address (the user has no control over the assigned address).







## Using a CD-ROM Drive with DOS

You may need to install a CD-ROM drive on your computer so you can load software. The Array1000CA Family Manager Set Drivers diskette contains the DOS driver software necessary to use a CD-ROM connected to the AAA-131CA adapter.

To operate a CD-ROM drive supported by the AAA-131CA adapter under DOS, you need

- The SCSI driver, *aspi8dos.sys* (version 1.27 or later)
- The CD-ROM driver, *aspcd.sys*
- The Microsoft CD-ROM extensions, *mscdex.exe*

The *aspi8dos.sys* and *aspcd.sys* files must be copied from the Array 1000CA Family Manager Set Drivers diskette to a directory (e.g., *c:\scsi*) on your hard disk drive. The *mscdex.exe* file is included with MS-DOS 6.x and above (see your MS-DOS documentation for details).



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**Note:** If you use MS-DOS 5 and do not have *mscdex.exe*, we recommend that you upgrade to MS-DOS 6 or above. You can also obtain *mscdex.exe* from Microsoft's online bulletin board or the CompuServe forum.

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To complete the driver installation, edit the *config.sys* file to include command lines for *aspi8dos.sys* and *aspicd.sys*, and edit the *autoexec.bat* file to include a command line for *mscdex.exe*. The following examples illustrate the command line format and the command options appropriate for most systems.

**Sample Command Lines for *config.sys* File:**

```
device=c:\scsi\aspi8dos.sys /d  
device=c:\scsi\aspicd.sys /d:aspicd0
```

**Sample Command Line for *autoexec.bat* File:**

```
\dos\mscdex.exe /d:aspicd0 /M:12
```

(This assigns the CD-ROM the next available drive letter, typically *D* if there is only one DOS drive.)

The following tables describe the *aspi8dos* and *aspicd* command line options. For a description of *mscdex* command line options, see your Microsoft DOS documentation. You can type command line options in uppercase or lowercase letters. Leave a blank space between options.

## Using a CD-ROM Drive with DOS

### Command Line Options for *aspi8dos.sys*

Option	Example	Use
<i>/ccbs&lt;count&gt;</i>	<i>/ccbs8</i>	Specifies the maximum number of concurrent ASPI commands that can be supported. The valid range is 1 through 16. The default is 4. If you increase this value, the size of the ASPI manager also increases. Use this option only if you want to run an ASPI program that specifies a higher number of concurrent commands.
<i>/d</i>	<i>/d</i>	Displays information about the AAA-131CA and attached SCSI devices when the computer boots.
<i>/L</i>	<i>/L</i>	Enables <i>aspi8dos</i> to recognize all eight possible LUNs associated with each SCSI ID. If the option is not used, <i>aspi8dos</i> can recognize only LUN 0 for each SCSI ID.
<i>/mn</i>	<i>/m1</i>	Causes <i>aspi8dos</i> to scan the PCI bus. The method used to scan the bus is determined by the value of <i>n</i> : <i>/mb</i> = scan PCI bus using PCI BIOS calls <i>/m1</i> = scan PCI bus using Mechanism #1 <i>/m2</i> = scan PCI bus using Mechanism #2 <i>aspi8dos</i> automatically scans the PCI bus for SCSI devices. It tries to determine which scanning method will work best for the given system configuration. Use the <i>/mb</i> , <i>/m1</i> , and <i>/m2</i> options only if you want to override the <i>aspi8dos</i> internal scanning mechanism. Usually <i>aspi8dos</i> can determine which scanning method is optimal for your system. (PCI BIOS calls are described in the PCI BIOS spec; scanning mechanisms #1 and #2 are described in the PCI spec.
<i>/norst</i>	<i>/norst</i>	Prevents <i>aspi8dos</i> from resetting the SCSI bus when you boot your computer. By default, <i>aspi8dos</i> resets the SCSI bus when you boot the computer if the host adapter BIOS is not present. You can use <i>/norst</i> to prevent this from happening.
<i>/pause</i>	<i>/pause</i>	Pauses the system after loading <i>aspi8dos</i> at bootup, so you can read the message on the screen. After you read the message, press any key to resume booting.
<i>/rst</i>	<i>/rst</i>	Forces <i>aspi8dos</i> to reset the SCSI bus when you boot your computer. By default, <i>aspi8dos</i> does not reset the SCSI bus when you boot your computer if the host adapter BIOS is present.
<i>/s&lt;slot number&gt;</i>	<i>/s1 /s3</i>	Indicates the slot number(s) where you want <i>aspi8dos</i> to look for host adapters. Valid slot numbers = 1 to 15. If you do not use this option, <i>aspi8dos</i> scans all slots for host adapters, beginning at slot 1.

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### Command Line Options for *aspicd.sys*

Option	Example	Use
<code>/d:&lt;name&gt;</code>	<code>/d:aspicd0</code>	Required in the <i>config.sys</i> command line. Assigns a name to the CD-ROM drive so that <i>mscdex</i> can assign the CD-ROM a logical drive letter. The name must exactly match the CD-ROM drive name in the <i>mscdex</i> command line in <i>autoexec.bat</i> . Use any eight-character name.
<code>/id={...}</code>	<code>/id=2+4</code> <code>/id=3+5+1:4</code>	Specifies CD-ROM drives controlled by <i>aspicd</i> . By default, <i>aspicd</i> controls all drives. In the first example, for a computer with one host adapter, <i>aspicd</i> controls the devices with SCSI IDs 2 and 4. In the second example, for a computer with two host adapters, <i>aspicd</i> controls the devices with SCSI IDs 3 and 5 on host adapter 0 and SCSI ID 4 on host adapter 1 (if you do not specify the host adapter number, <i>aspicd</i> assumes it is 0).
<code>/L</code>	<code>/L</code>	Enables <i>aspicd</i> to recognize all eight possible LUNs associated with each SCSI ID. If the option is not used, <i>aspicd</i> can recognize only LUN 0 for each SCSI ID. Add the <code>/L</code> option to the command line if you have a CD-ROM drive that can access multiple discs.  If your computer system includes a Pioneer DRM-600 or DRM-604x multiple-disc CD-ROM drive, you do not need to add the <code>/L</code> option. The <i>aspicd</i> device driver automatically scans multiple LUNs if it detects one of these devices on the SCSI bus.
<code>/norst</code>	<code>/norst</code>	Prevents <i>aspicd</i> from issuing a SCSI Bus Reset message at system start-up. The default is to issue it. The SCSI Bus Reset message (supported by Toshiba, Hitachi, and NEC drives) resets drives that are playing audio CDs when the computer reboots.
<code>/pause</code>	<code>/pause</code>	Makes your system pause after loading <i>aspicd</i> at bootup, so you can read the message on the screen. Press any key to resume booting.
<code>/type:&lt;drive vendor&gt;</code>	<code>/type:sony</code>	Allows <i>aspicd</i> to support audio play mode for CD-ROM drives that are compatible with a supported drive type but are not included on the list of supported drives. If you use the <code>/type:&lt;drive vendor&gt;</code> option, <i>aspicd</i> assumes that all CD-ROM drives on the SCSI bus are made by this vendor—you cannot combine different brands of CD-ROM drives on the bus. The valid entries for this option are chinon, denon, hitachi, lms, nec, panasonic, sony, texel, and toshiba.







## Obtaining SCSI Cables and Converters

High-quality cables are required in high-performance SCSI Array (RAID) systems to ensure data integrity. Adaptec provides the highest quality SCSI cables designed specifically for use with Adaptec AAA-131CA Array adapters. For purchasing information, contact Adaptec:

Adaptec, Inc.  
691 S. Milpitas Boulevard  
Milpitas, CA 95035  
USA  
Tel: (800) 442-7274

Adaptec Europe - Belgium  
Tel: (32) 2-352-34-11  
Fax: (32) 2-352-34-00

Adaptec Japan - Tokyo  
Tel: (81) 3-5365-6700  
Fax: (81) 3-5365-6950

Adaptec Singapore  
Tel: (65) 278-7300  
Fax: (65) 273-0163

See the following page for a list of SCSI cables and converters available directly from Adaptec.

## External Cables

### External Cables

Part Number	Connectors	Length
ACK-W2W-E	High-density 68-pin male to High-density 68-pin male	1 m

## Internal Ribbon Cables

### Internal Ribbon Cables

Part Number	Connectors	Length
ACK-F2F-5IT <sup>1</sup>	5 position (4 devices + SCSI Card), Standard 50-pin female connectors, terminated	2.1 m
ACK-W2W-5IT <sup>1</sup>	5 position (4 devices + SCSI Card), High-density 68-pin male connectors, terminated	1 m

<sup>1</sup> ACK-F2F-5IT and ACK-W2W-5IT have built-in active terminators which eliminate the need to terminate any internal SCSI devices

## Converters

### Cable Converters

Part Number	Description	Connectors
ACK-GCH2L	External Converter	High-density 50-pin female to Standard 50-pin female
ACK-68P-50P-E	External Converter	High-density 68-pin female to High-Density 50-pin male
ACK-68I-68E	Internal to External Converter	Internal High-density 68-pin male to External High-density 68-pin female
ACK-50I-50E	Internal to External Converter	Internal Standard 50-pin female to External High-density 50-pin female





## Listing of Vendors

This appendix contains a partial listing of array storage enclosure and SCSI disk drive manufacturers.

### **Array Storage Enclosure Manufacturers**

JMR Electronics, Inc.  
20400 Plummer Street  
Chatsworth, CA 91311  
USA  
Tel: (818) 993-4801  
Fax: (818) 993-9173  
Internet: <http://www.jmr.com>

Kingston Technology Corporation  
17600 Newhope Street  
Fountain Valley, CA 92708  
USA  
Tel (U.S.): (800) 435-0642  
Fax (U.S.): (714) 438-1847  
Tel (Intl): (714) 437-3334  
Fax (Intl): (714) 438-1820  
Internet: <http://www.kingston.com>

Trimm Technologies  
350 Pilot Road  
Las Vegas, NV 89119  
USA  
Tel: (800) 423-2024  
Fax: (702) 361-6067  
Internet: <http://www.trimm.com>

## SCSI Disk Drive Manufacturers

Fujitsu Computer Products of America, Inc.  
2904 Orchard Parkway  
San Jose, CA 95134-2009  
USA  
Tel (U.S.): (800) 626-4686  
Tel (Intl): (408) 432-6333  
Internet: <http://www.fujitsu.com>

IBM Corporation  
1 Old Orchard Road  
Armonk, NY 10504  
USA  
Tel: (914) 765-1900  
Internet: <http://www.ibm.com>

Quantum Corporation  
500 McCarthy Boulevard  
Milpitas, CA 95035  
USA  
Tel: (800) 624-5545  
Internet: <http://www.quantum.com>

Seagate Technology, Inc.  
920 Disc Drive  
Scotts Valley, CA 95066  
USA  
Tel: (408) 438-6550  
Fax: (408) 429-6356  
Internet: <http://www.seagate.com>



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