



## Using Apple Xserve Diagnostics

You can use Apple Xserve Diagnostics (AXD) to test your server's hardware. AXD performs several tests of the server hardware and creates a test report. You can use a remote administrator computer to control the diagnostic tool to run the tests on an Intel-based Xserve or run the tests directly on an Intel-based Xserve. Apple Xserve Diagnostics runs Mac OS X-based tests and EFI-based tests.

Please read the Additional Information section at the end of this document to learn specifics about how tests run and how to avoid known problems.

### Overview of Running Apple Xserve Diagnostics

From Mac OS X:

To run tests, select the "Test" button at the top, left of the main window. AXD runs the selected tests (from the left side of the main window). You may choose to loop tests for a set amount of time or for a set number of loops. By default, AXD stops testing when encountering an error; however, you can change this to "continue" on error (using the "On Error:" popup), which is helpful for tracking intermittent problems.

If you wish to view a detailed hardware description of the Xserve being tested, select the "Hardware Info" button at the bottom of the main window. AXD displays a drawer listing all of the hardware information that it found; AXD provides more of a "raw" view of the hardware compared to what Apple System Profiler presents.

AXD provides an "auto log" capability. If you enable this preference, AXD writes out to this log every test result it writes to the log in its main window. This file is updated every time a write happens. In the preferences panel, you can choose where to save this log, what its name is, along with options to better identify the log (appending the Ethernet or time). AXD does not read the auto log; however, most text editing programs (such as TextEdit) do.

Use the "Save As..." File menu item to save your test results and hardware profile. AXD and text editing programs can read this RTF text file; however, AXD localizes it, meaning that if you saved the file in Japanese, then opened it while running on an English system, AXD presents the text in English.

From EFI:

To run tests, select the "Test" button at the bottom of the main window. AXD runs the selected tests (from the left side of the main window). To change your test options, you need to change to the "Controls" tab near the top, left of the main window.

You can view the hardware information by selecting the "Hardware Info" menu item, bringing up a window listing the gathered hardware information. You must close this window before continuing.

While running in EFI, AXD cannot save results; to save EFI results, you need to be connected to the EFI client, and save the results from the Mac OS X host.

### Overview of Using Apple Xserve Diagnostics

Apple Xserve Diagnostics offers three testing modes: local, local client, and remote.

In local mode, you run and control tests on your Xserve. When running in local mode:

- You need to attach a keyboard, mouse, and display.
- If you're running Mac OS X, you need to run tests as the root user.

In local client mode, you run tests on your Xserve, but control them from another computer running in Remote mode. When running in local client mode:

- EFI only: AXD always first looks for a remote host to control it.
- Mac OS X only: You need to be running as the root user.
- If AXD doesn't find a remote host, it starts up in local mode.

In remote mode, you control an Intel-based Xserve over the network. When using remote mode:

- You can run as a remote host from any Macintosh computer, as long as Mac OS X 10.4.4 (10.4.8 recommended) is installed.
- If you launch AXD from any computer that is not an Intel-based Xserve, it automatically goes into remote mode.
- If you are not the root user, AXD automatically goes into remote mode.
- To run tests remotely, you must first start up the remote client, and then the local client.
- You can run tests from the same computer that is serving the AXD NetBoot image.

You can launch the EFI diagnostic application three ways:

- You can NetBoot it from a server in the same subnet as your Xserve, using the F1 key or from the front panel via light 8.
- You can launch it from the Admin Tools disc holding down the D key from a keyboard.

- Reboot, and using the option key on a keyboard, launch it from a prepared internal or external (recommended) volume. See details on how to create a diagnostic volume in the Creating a Diagnostic Test Environment section.

You can launch the Mac OS X diagnostic application two ways:

- You can launch it from any Mac OS X 10.4.4–based Macintosh (10.4.8 recommended), when using it to control an Intel–based Xserve.
- You can launch it, as a root user, on an Intel–based Xserve and test locally, become a local client, or control another Intel–based Xserve.

Note: to run Apple Xserve Diagnostics locally on Mac OS X, you should not run it from the volume that your Xserve normally starts up from—you should install Mac OS X Server to an empty volume or (recommended) to an external FireWire or USB drive and reboot. This greatly reduces the chances that any problems with the currently running software might affect the test results of Apple Xserve Diagnostics. See details on how to create a diagnostic volume in the Creating a Diagnostic Test Environment section.

General requirements:

- An Intel–based Xserve system on which to perform the tests; the server must be running Mac OS X Server v10.4.8 or later.
- The AXD NetBoot image can be installed on any computer (server) running Mac OS X Server 10.4.4 or later (10.4.8 or later recommended) that is on the same subnet as the server to be tested.
- AXD, running as a remote host, runs on any 10.4.4–based computer (10.4.8 recommended)

The Admin Tools disc contains Apple Xserve Diagnostics in three forms:

- EFI diagnostics that you can boot to directly using the D key.
- Drag–installable and copyable (using ditto in Terminal) EFI and OS diagnostics in the /Installers/AppleXserveDiagnostics folder:

The AXD\_EFI folder contains the AXD EFI pieces that you copy over (using ditto in Terminal) to an empty volume, reboot, and select using the Option key.

The AXD\_OS folder contains the AXD Mac OS X pieces that drag over to the location you wish to run AXD remotely from; you may also copy these pieces (using ditto in Terminal) to a Mac OS X Server volume that you have prepared.

See the Creating a Diagnostic Test Environment section for details on creating Mac OS X, EFI, and NetBoot environments.

- NetBoot installer for the AXD EFI NetBoot image in the Installers folder.

## Creating A Diagnostic Test Environment

You may want to create one of three Apple Xserve Diagnostics testing environments:

- A NetBoot server
- A Mac OS X Intel–based Xserve bootable volume
- An EFI bootable volume

### Preparing the NetBoot Server

You may wish to use a NetBoot server to assist with the diagnostic tests. In addition to installing Apple Xserve Diagnostics on this server, you should make certain that it is set up for NetBoot use.

To set up the NetBoot server:

1. Open Server Admin and select NetBoot in the Computers & Services list.
2. Click the Settings button, then click General.
3. Click Enable next to the network ports you want to use for serving images.
4. Click the boot volume in the Images column of the Volume list to choose where to store images.
5. Click the boot volume in the Client Data column of the Volume list to specify the storage location for shadow files used by Mac OS 9 clients and diskless Mac OS X clients.
6. Click Save.
7. Run the provided installer from the Installers folder on your Admin Tools disc to install the AXD NetBoot image.

### Preparing a Bootable Volume

You may wish to install the AXD EFI software on a portable drive (USB or FireWire) that you can take and run on many machines. You may install both the EFI AND OS diagnostics on the same drive by creating multiple partitions on that drive.

Requirements:

- The partition type (set with Apple's Disk Utility) MUST be GUID to boot an Intel-based Xserve.
- The EFI partition requires at least a 15 MB partition
- The Mac OS X partition requires at least a 3.8 GB partition
- You may use thumb/FLASH drives; for OS diagnostics, you need to use at least a 4 GB drive.

If your drive is not prepared correctly, please use Apple's Disk Utility to create the correct partition types. If you wish to put both EFI and Mac OS X diagnostics on the same drive, you'll need to create at least two partitions.

### Preparing an EFI Bootable Volume

Once you set up your drive via Disk Utility, you'll need to use Terminal to copy over the EFI pieces:

1. Insert the Admin Tools disc.
2. Launch Terminal.
3. Type "sudo ditto "/Volumes/Administration Tools/Installers/AppleXserveDiagnostics/AXD\_EFI " "/Volumes/<your volume name>".

Notes:

- Quotes (") are required around paths that have spaces.
- The sudo command requires your administrator's password.
- The above command places the contents of the AXD\_EFI folder at the root level of your drive.

For example, if you named your EFI volume "AXD EFI 3X100" (the name that shows up when you use the Option key when booting): sudo ditto "/Volumes/Administration Tools/Installers/AppleXserveDiagnostics/AXD\_EFI" " /Volumes/AXD EFI 3X100".

### Preparing a Mac OS X Bootable Volume

After you set up your drive using Disk Utility, you need to use both the Mac OS X Server Install disc and the Admin Tools disc that came with your Intel-based Xserve:

1. Insert the Mac OS X Server Install disc.
2. Double-click on the Install icon. This restarts your computer.
3. Choose to install onto the partition that you set up.
4. If you are installing onto a small drive (such as a thumb/FLASH drive), you may wish to deselect all other options (extra fonts, etc).

Once the install has completed and you have restarted from your newly created install:

1. You need to enable the root user, using the NetInfo Manager application in the Utilities folder.
2. Log out and log back in as the root user.
3. Set up the preferences:

Energy Saver: set sleep and display to "Never" and turn hard disk sleep off.

Desktop & Screen Saver: set Start screen saver to "Never".

CDs/DVDs: set all options to "ignore".

Dashboard: set all shortcuts to "-" (recommended).

Software Update: turn off "Check for update".

4. Eject your Mac OS X Server install disc and insert the Admin Tools disc.
5. Launch Terminal to finish the setup.

Copy the AXD OS software by typing: ditto "/Volumes/Administration Tools/Installers/AppleXserveDiagnostics/AXD\_OS " " /Volumes/<your volume name>".

Set AXD as the first app to launch by typing: defaults write com.apple.loginwindow Finder /AXD.app

### Running Diagnostics Tests on a Server

The examples below provide instructions for using the Apple Xserve Diagnostics on a working server and on a server that does not start up normally (or does not have Mac OS X Server installed on it).

#### Example 1: Using Diagnostics on a Server That Is Able to Run Mac OS X Server

To run diagnostic tests on an Intel-based Xserve system that is functioning and able to start up, you can use another computer on the same subnet to begin the tests.

To begin tests on a working server:

1. Alert any clients using the server that it will be unavailable during testing.
2. Choose the type of diagnostics to run (EFI or OS) and the boot mode (for EFI: NetBoot, external drive boot, or "Administration Tools" "D" key boot; for OS the external drive).
3. Launch Apple Xserve Diagnostics on your remote computer (on the same subnet as the Intel-based Xserve to be tested); choose the "Connect to remote Xserve" option, if available; (AXD automatically starts up in this mode if the remote host is not another Intel-based Xserve).

4. On your Intel-based Xserve:

To launch EFI diagnostics from NetBoot: hold down the F1 key or use light 8 on the front panel.

To launch EFI or Mac OS X diagnostics from a connected external drive: hold down the Option key to choose the AXD EFI or OS client boot volume containing the respective installed Apple Xserve Diagnostics.

To launch EFI diagnostics from the Admin Tools CD: Insert the Admin Tools disc, hold down the D key.

The remote client finds what tests are available, and connects to your remote computer.

- You should see a list of available tests on your remote computer.
- Select the tests that you wish to run, and select the Test button.

#### **Example 2: Using Diagnostics on a Server That Is in an Unknown State**

To run diagnostic tests on an Intel-based Xserve system that is not able to start up normally or does not have Mac OS X Server installed on it, you use the front panel of the server to put it into diagnostics mode and then initiate the tests from another computer on the same subnet.

To begin tests on a server that is not working correctly:

- On the remote computer, launch Apple Xserve Diagnostics, and choose the "Connect to remote Xserve" option (AXD automatically starts up in the mode if your remote computer is not an Intel-based Xserve).
- Use light 8 on the Intel-based Xserve system's front panel to put the server into diagnostics NetBoot mode. Note: the NetBoot server must be in the same subnet as the Xserve to be tested.

### **Initiating Diagnostics Mode From the System's Front Panel**

You can use the system identifier button on the server's front panel to put the server into diagnostic test mode. This operation is essential if the server will not start up normally and you want to use the diagnostics tools to help determine the problem. You put the server into diagnostic mode by using a combination of the system identifier button and light 8 (NetBoot).

If EFI Security is turned on for the system, front panel mode is not available. In this situation, the two rows of lights on the front panel flash twice when you try to enter a boot command with the system identifier. Then the system resumes its regular startup sequence.

Follow these steps to initiate diagnostics mode from the server's front panel:

1. With the power off, hold in the system identifier button while you press the on/standby button.
2. Continue holding in the system identifier button until the top row of blue lights blinks sequentially.
3. Release the system identifier button. The rightmost light in the bottom row turns on.
4. Press the button to light the next light in the bottom row, moving from right to left.
5. Press the button again to change lights until the leftmost light (number 8) turns on.
6. With light 8 on, hold in the system identifier button for at least 2 seconds, until all lights in the top row are on.
7. Release the button.

### **Creating a Custom Set of Diagnostic Tests**

When running remotely, or locally from an Intel-based Xserve, AXD provides you two methods to create custom set of diagnostic tests. AXD saves both the tests selected and the test options (looping states and the continue on error state). Once you have selected the tests that you wish to run, you have two choices: either save this set of selections to a file, or save them into your preferences.

When saving to the preferences, you use the Save Test Group popup at the bottom left of AXD's window. AXD asks you to name this group (it must be unique). At any time in the future, you can use the popup to change the selections by selecting which popup is default. Whatever selection was last made when you quit AXD becomes the default when you relaunch.

When saving them to a file, you use the Save Test Groups File menu item, and choose where and what name to save your file. At a later time, you can load this file into AXD (via the Open menu item); AXD makes the saved test group options the default for the Test Group popup at the bottom left of the testing window. AXD adds these options to its preferences, so they'll be available at subsequent launches.

## **Summary of Diagnostic Tests**

### **EFI Tests**

Boot ROM Checksum Test: Verifies the Boot ROM checksum Boot ROM FW GUID

MAC Addr Checksum Test: Verifies the Boot ROM FireWire GUID MAC address checksum.

#### Ethernet Controller Tests

- MAC Address Verification Test:
- Verifies MAC Address is not all FFs or 00s
- PCIe 4 LinkWidth Verification Test: Verifies PCIe link width is 4

#### Hard Drive Tests

- Full Read Test (DMA Full Read Scan at 1250: Reads the entire HD checking for slow-read failures. This takes about 1/2 for an 80 GB drive to about 4 hours for a 750 GB drive.
- Quick Disk Test: Quick read/write test

#### Memory Tests

- Address as Data Test: Test memory using address as data and !address as data
- Patterns Test: Test memory using different data patterns
- Marching ones and zeros Test
- Knaizuk Hartmann Test
- MOD3 Test
- Test memory using Van de Goor's March U
- Test memory using Pseudo-random values
- Extended Memory Test P00F: Test memory (pattern 0 FailOnError)
- Extended Memory Test P01F: Test memory (pattern 1 FailOnError)
- Extended Memory Test P02F: Test memory (pattern 2 FailOnError)
- Extended Memory Test P03F: Test memory (pattern 3 FailOnError)
- Extended Memory Test P04F: Test memory (pattern 4 FailOnError)
- Extended Memory Test P05F: Test memory (pattern 5 FailOnError)
- Extended Memory Test P06F: Test memory (pattern 6 FailOnError)
- Extended Memory Test P07F: Test memory (pattern 7 FailOnError)

#### Power Supply Tests

- Check if the Power Supply's Good bit is set
- Power Supply Quick Test: Run with this supply only.

#### Video Controller Tests

- Verifies PCI-E link width is 8

### OS Tests

#### Ethernet Controller Tests

- Verifies the Ethernet Controller MAC address is not all 00s or all FFs
- Verifies the Ethernet ROM checksum is valid
- Verifies no data mismatch between sent and received while looping within MAC
- Verifies no data mismatch between sent and received while looping via PHY at 1000 Mbps

#### Hard Drive Tests

- Run a simple disk scan (can take 45 minutes (80 GB drive) to close to 8 hours for a 750 GB drive)

#### Memory Tests

- Address As Data 32 – fills memory with the address of the read and compares to the address read
- Random Pattern Operations 32 – generates random values and writes to different positions in memory; then compares that they are the same, repeats with xor, sub, mult, div, or, and and operations
- Sequential Increment 32 – writes sequentially increasing values in memory and compares that same as read
- Block Checkerboard 32 – alternates 32bit words with all 1s and all 0s, then with all 0s and all 1s
- Bit Checkerboard 32 – alternates bits with all 1s and all 0s, then with all 0s and all 1s
- Sequential Byte Block 32 – fills all bytes sequentially with pattern starting at 0x00 and ending at 0xFF
- Walking Ones 32 – walks ones up and then down memory
- Walking Zero 32 – walks zeros up and then down memory
- Walking Spread Bits 32 – walks 0b01 up and 0b10 down memory
- Walking Bit Flip 32 – alternates words with walking one and walking 0, then alternates with walking 0 and walking 1
- Executes tests concurrently on each available CPU (core)

#### Fan Tests

- System turns on fan motor and verifies motor reaches min/max values, +/- 15 percent threshold. System turns on Motor and verifies Motor reaches min speed +/- 15 percent threshold, max speed +/- 15 percent

#### Power Supply Tests

- Check if the Power Supply's Good bit is set
- Turn off the redundant supply and run on one supply

#### Sensor Tests

- Check to ensure that sensor reads within operating range
- Verifies that the server intrusion switch sensor is reporting cover is closed

#### Thermal Interface Tests

- Check that CPU heatsink is properly attached, using product spec theta dh + 75 percent guardband

#### Video Controller Tests

- OpenGL Point Test
- OpenGL Line Test
- OpenGL Triangle Test
- OpenGL Quad Test

- OpenGL Quad with Texture Test
- OpenGL Rectangle Test
- OpenGL Cube Test
- OpenGL Cube with Fog Test
- OpenGL Wireframe Model Test
- OpenGL Solid Red Model Test
- OpenGL Solid Red Model with Fog Test

## Additional Information

Notes about running Apple Xserve Diagnostics:

- Hard drive test times: In EFI, AXD takes between 1/2 hour (for an 80 GB drive) to close to 4 hours (for a 750 GB drive). The OS test takes about twice as long (up to 8 hours per drive).
- The video controller tests will fail if the display is asleep or if no display is attached; they may also fail if only one display is attached when you have installed two graphics cards (default is off).
- The Ethernet loopback tests may add to network traffic; so you may wish to run these tests with the network disconnected (default is off).
- Installing Mac OS X onto a thumb/FLASH drive that, when connected to a computer, displays an "Eject CD-ROM" type dialog may fail if that drive has two or more partitions (i.e., one has the EFI version of AXD, with the other having the OS version).
- If you wish AXD to startup automatically as a client when running in Mac OS X, you need to create a file or folder callight AXDClient (case matters) at the same level as the AXD application. The file can be empty and should NOT have any extension.
- The Quick Tests run just the sensor tests in the OS and the Patterns memory test in EFI. The memory tests are not chosen in the OS because they take a long time to run (because individual tests can't be broken out), and misconnected sensors are a common failure item with reinstalled logic boards. In EFI, no sensor tests are available and individual memory tests CAN be selected for a quicker test.
- The OS memory tests are both faster (they use all four cores) and have more testing coverage than the EFI tests; however, the EFI tests allow you to choose which of the tests to run, while the OS tests always run all the tests.
- When looping by time, AXD completes all selected tests before stopping. This could mean that tests continue to run for a significant amount of time past what you have set (i.e., if you set the time to 20 hours, but select three hard drive tests, AXD could run for close to twenty-four hours past your "limit").
- When testing the "Processor" in EFI, AXD displays only a "Processor 0" test; however, "Processor 0" tests all four cores.

### Some AXD issues:

- If you have a display hooked up to your Xserve when it is running as an EFI client, the result messages displayed on your Xserve may not completely match what's displayed on your host (the host has the correct information).
- You may have issues starting up a second client and host session on the same subnet.

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