

Tech Source



Raptor 4000/4000e Drivers **Installation and Reference** **Solaris Manual**

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PREFACE

This publication documents the Tech Source, Inc. Raptor 4000/4000e series cards. This manual is intended for users who incorporate the Tech Source, Inc. Raptor Cards into Sun PCI and PCI Express systems.

This also serves as a guide to configuring and using X Windows software. All systems vary to a degree. Knowledge of the features of your system is helpful during the installation process.

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1 Introduction

1.1 Overview

Thank you for purchasing a Tech Source, Inc. Raptor graphics card for use with your Sun PCI/PCI Express desktop/server. This manual describes the installation and configuration of the Raptor graphics card and the accompanying software. All systems vary somewhat, therefore some knowledge of the features of your system and a basic understanding of UNIX shell commands are helpful during the software installation process.

From this point forward, Tech Source, Inc. will be referred to as Tech Source or TSI.

The software runs on Sun PCI desktops/servers and supports the Raptor 4000/4000e graphics cards. The software is provided on a CD-ROM and consists of:

- Raptor device drivers for Solaris
- Raptor loadable module (DDX) for X Windows
- MOX extension loadable module and libraries

The following products are supported:

| | |
|---------------|---|
| Raptor 4000 | Supports 2048x2048 resolutions (digital and analog) on a PCI bus. |
| Raptor 4000/e | Supports 2048x2048 resolutions (digital and analog) on a PCI Express bus. |

The software supports Solaris 9 and 10. Please contact Tech Source at: hotline@techsource.com if you need support for a different version of Solaris OS.

1.2 Conventions

This manual will follow certain conventions throughout.

Whenever a variable name, command name, directory, or filename is used in a paragraph it will appear in a `mono-spaced` font.

At times the reader will be instructed to enter commands at a prompt. In this case a transcript of a sample session will be provided where a prompt will be followed by the commands the reader is to enter. The entire transcript will be in a `mono-spaced` font with the prompt in a normal weight and the user's entries in **bold**.

The prompt used in a transcript varies depending on the circumstances. The following are some common prompts and when they are used:

| | |
|----------------------|--|
| <code>prompt#</code> | used when the user is required to have root privileges |
| <code>prompt%</code> | used when the user is not required to have root privileges |
| <code>ok</code> | prompt displayed when the user is in Boot PROM mode |

2 Hardware Installation

2.1 Hardware Configurations Supported

The Raptor cards have been tested on and currently support the following Sun Microsystems workstations:

- Ultra 25
- Ultra 45

NOTE: If your Sun hardware (workstation) is not listed here, please contact Tech Source for compatibility verification.

2.2 Installation Instructions

Installing a Raptor card is simple and consists of a few easy steps.

NOTE: Remember which cables go to which connectors. You may want to label the cables and connectors before disconnecting them.

- Step 1: Shut down the system and turn the power OFF. Remove the system's cover along with any cables that prevent you from doing so. Find an available PCI or PCI Express slot, and remove the bracket and screw. Ground yourself by touching the metal part of the case.
- Step 2: Install the Raptor card firmly into the PCI or PCI Express slot. Take care to press it evenly and snugly into the slot. Once you are certain the card is installed properly in the slot, secure it with the bracket screw.
- Step 3: Secure the system cover and reattach any previously removed cables, and connect the video cable to the monitor.

NOTE: Installation of Raptor4000/4000e driver software is discussed in Section 3.3

NOTE: If the system is currently using a secondary TSI graphics device, refer to Appendix A for configuring one of the cards as the console. The console device is the screen on which the boot up messages will appear. The monitor must be connected to the console device before you proceed to one of the following software installation chapters.

The Raptor card is now installed and the system is ready for software installation. Refer to Chapter 3 for instructions on installing the software.

3 Software Installation

3.1 Overview

This Chapter describes how to install and configure the Raptor 4000/4000e cards. The software called “Raptor 4000/4000e Drivers (Solaris)” currently supports the following cards:

- Raptor 4000 (PCI card)
- Raptor 4000e (PCI Express card)

NOTE: This software must be installed on your system prior to running X Windows on these cards.

The software for the Raptor 4000/4000e cards is provided on a **CD-ROM** or is available by FTP and is composed of the following packages:

- TSIafp Device drivers for the Raptor 4000 cards.
- TSIafpw DDX for the Raptor 4000 cards.
- TSIcox Device driver package for MOX capability.

NOTE: The current version of this software supports only the high resolution head, which is the head closest to the PCI/PCI Express bus.

3.2 Requirements

The following are prerequisites for installing the Raptor 4000/4000e drivers for Solaris:

- The system is running Solaris 9 or higher.
- At least 2MB of disk space is available in `/usr` and `/`.
- One or more of the cards listed in Section 4.1 are presently installed in the system.

3.3 Installing Raptor 4000/4000e Card Driver Software

The following are step-by-step instructions for installing the “Raptor 4000/4000e Drivers (Solaris)” software from a CD-ROM.

1. Install a Raptor card in the computer as described in Chapter 2.
2. Boot the computer with the `-r` (reconfiguration) option by performing the following steps:
 - Power ON the computer.
 - Wait until you see boot messages displaying on the screen, then press and hold the `Stop` (L1) key, and then press the `A` key.
 - At the `ok` prompt, type `boot -r`.
3. After the system comes up, log in as `root`.
4. Insert the CD-ROM labeled “Raptor 4000/4000e Drivers (Solaris)” into the drive.
5. If `/cdrom/cdrom0` exists, the CD-ROM was automatically mounted. Change directories to the CD-ROM by typing the following:

```
prompt# cd /cdrom/cdrom0/
```

If `/cdrom/cdrom0` does not exist, mount the CD-ROM by typing the following:

```
prompt# mount -F hsfs -O -o ro \
/dev/dsk/c0t6d0s0 /cdrom
```

```
prompt# cd /cdrom/
```

6. To install the software, type:

```
prompt# ./install_all
```

This script will ask you a number of yes-or-no questions (generated by Sun's `pkgadd` installation program). Answer these questions appropriately.

7. To install the MOX module and libraries type:

```
prompt# cd /cdrom/cdrom0/mox
```

or

```
prompt# cd /cdrom/mox  
[if the CD-ROM was mounted as outlined in Step 5 above]
```

```
prompt# pkgadd -d . TSImox
```

| |
|--|
| Note: You must install the MOX package in order to use the MOX extension. |
|--|

8. Reboot the system to complete the installation.

One new device name is created in the `/dev/fbs` directory for each head on a Raptor 4000/4000e card. It is denoted by `rapafp#` for each Raptor 4000/4000e (where # represents a minor number assigned by the operating system). For example, `/dev/fbs/rapafp0` is the first head seen by the system, `/dev/fbs/rapafp1` will be the second head seen by the system.

3.4 Changing Resolution and Bit-Depths

The default resolution can be determined using the Auto-Detect feature if you are using a monitor that supports DDC2B/EDID protocol. Connection to the monitor must occur during the boot process for the DDC/EDID protocol to be effective. For more information about the functionality of the DDC2B/EDID protocol with your Raptor card, please refer to Appendix A.

3.4.1 Resolution

The resolution of the Raptor 4000/4000e card can be changed through the `atconfig` utility. By using this utility, the user can select a resolution to be displayed, which will be written in the `OWconfig` file. This utility is described in Section 3.5.

If DDC is not used, or if the monitor doesn't report a valid resolution, then the software will check for a valid resolution specified in the `/usr/openwin/server/etc/OWconfig` file. If a valid resolution is specified and a reference for the timing numbers occurs in the `rapafpresinfo` file, then that resolution is used. If the timing numbers are not specified or there is no specific resolution in the `OWconfig` file, then the default resolution will be set to 2048x2048@60, analog.

To override the resolution specified by the DDC/EDID protocol, select the new resolution using the `atconfig` utility and then type the following command prior to starting the X server:

```
prompt# setenv NO_DDC_CHECK
```

3.4.2 Bit Depths

The bit depth of the Raptor 4000/4000e card can be changed through the `atconfig` utility.

The following bit-depths are supported:

| | |
|-------|--|
| 8 | 8-bit Pseudo Color |
| 8+24 | Simultaneous 8-bit PsuedoColor and 24-bit True Color |
| 24 | 24-bit True Color |
| 8+8 | Two 8-bit Normal 13-bit Group 5-bit Absolute |
| mox24 | MOX, 8-bit Normal, 21-bit Group, 13-bit Absolute |
| mox32 | MOX, 8-bit Normal, 24-bit Group, 21-bit Absolute |

3.5 atcconfig Utility

After installation you can configure the X Window screen resolution, bit-depth, and refresh rate for your monitor to be different from the default settings. The `atcconfig` utility can be used any time after installation to change these settings.

The next section describes how to use `atcconfig` to configure the Raptor card.

3.5.1 Interactive Configuration

The `atcconfig` utility has an interactive menu-style interface (See **Figure 3.1**). To use this program to configure your Raptor card, type:

```
prompt# atcconfig
```

NOTE: If X Windows is running on the Raptor card(s) to be configured, please exit out of it before running `atcconfig`. Failure to do so could result in a corrupted screen for the remainder of the X Window session.

The Raptor device(s) will be listed in the left column of the configuration screen displayed by `atcconfig`. (See **Figure 3.1**).

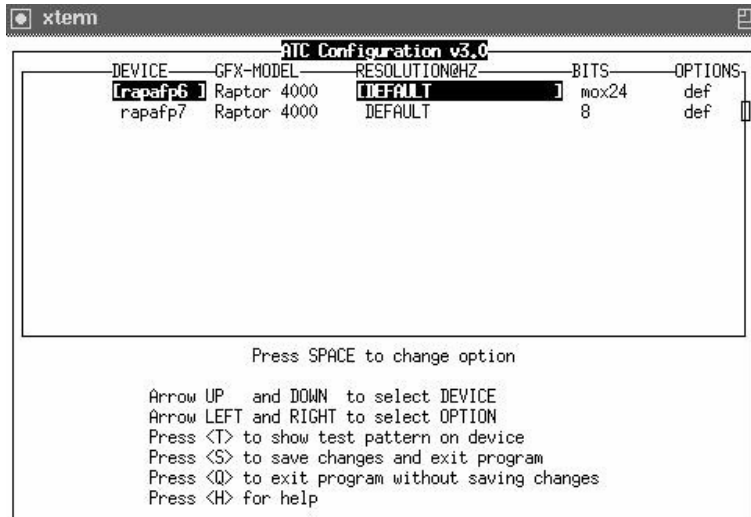


Figure 3.1 - atconfig

A description of the commands in the utility is as follows:

- Up/Down Arrow selects the desired graphics device to modify

- Left/Right Arrow selects the parameter to modify (e.g. resolution, bit-depth, or sync)

- Space Bar modifies the parameter for the selected graphics device (will bring up a menu when applicable)

- 't' puts a test pattern on the entire display (hit any key to return to the main screen)

- 's' saves current settings and exits

- 'h' help

- 'q' exits the program without saving any changes.

3.6 Setting Raptor 4000/4000e as the Console (Optional)

Refer to Appendix A for instructions on how to configure the Raptor 4000/4000e card as the console framebuffer.

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4 Starting X

4.1 Overview

This section describes how to start up X Windows on the Raptor 4000/4000e cards. The examples in this chapter use `rapafp0` as the device name.

Note: The device number corresponding to `rapafp#` of your card is assigned by the operating system and could vary for each head.

The following table lists the different Raptor cards and their device name locations. The device name will have the card's minor number appended to it. For example, the first instance of a Raptor 4000/4000e card will have a device name and number of `rapafp0` for the first head and `rapafp1` for the second head. The second instance will have a device name and number of `rapafp2` for the first head and `rapafp3` for the other head.

| Raptor Card | Device Name |
|---------------------|-------------------------------|
| 4000 (First Head) | <code>/dev/fbs/rapafp0</code> |
| 4000 (Second Head) | <code>/dev/fbs/rapafp1</code> |
| 4000e (First Head) | <code>/dev/fbs/rapafp2</code> |
| 4000e (Second Head) | <code>/dev/fbs/rapafp3</code> |

4.1.1 Starting the X server

Determine the device for your card(s) by running the command, `dmesg | grep rapafp`. Use the device name as the option to the following commands. For the examples below, we assume that the first head of your device is assigned as `/dev/fbs/rapafp0` and the second head as `/dev/fbs/rapafp1`.

To start the Xserver type:

```
prompt# /usr/openwin/bin/X -dev /dev/fbs/rapafp0
```

This will start the Xserver only on the first head. If you want to start the Xserver in multiscreen configuration on both heads, both device names should be specified on the command line.

For example:

```
prompt# /usr/openwin/bin/X -dev /dev/fbs/rapafp0 \  
-dev /dev/fbs/rapafp1
```

4.1.2 xinit

The xinit program can be directly used to start the X Window System server. The xinit format is as follows:

```
xinit [[client] options] [ -- [server]          [display]  options ]
```

If no specific client program is given on the command line, xinit will look for a file in the user's home directory called `.xinitrc` to run as a shell script to start up client programs. If no such file exists, xinit will use the following as a default:

```
xterm -geometry +1+1 -n login \  
-display :0
```

If no specific server program is given on the command line, xinit will look for a file in the user's home directory called `.xserverrc` to run as a shell script to start up the server. If no such file exists, xinit will use the following as a default:

```
X :0
```

Note that the following example assumes that a program named `x` is in the current search path. The xinit script is located in the `/usr/openwin/bin` directory.

To startup the server using xinit, type:

```
prompt% xinit -- /usr/openwin/bin/X -dev \  
/dev/fbs/rapafp0
```

You may also add any other command line arguments to the end of the line. For additional information on the use of `xinit`, refer to the man page for `xinit`.

4.1.3 Raptor as the Secondary Framebuffer

The Raptor 4000/4000e card can work with other cards to display in multi-screen mode. In the following example, an Nvidia video card is assumed to be the console and a Raptor 4000/4000e is the secondary card.

To start the X server on both cards, in multi-screen mode, type the following commands:

```
prompt# cd /usr/openwin/bin/

prompt# xinit -- ./X -dev /dev/fbs/nfb0 \
        -dev /dev/fbs/rapafp0
```

The assigned OpenWindows screen numbers correspond to the order of the devices on the command line.

NOTE: In the above example, the `rapafp` device number is 0 and it corresponds to the first head of the Raptor card. This may be different in your configuration. Please check in the `/dev/fbs` directory or run `dmesg | grep afp` to obtain the correct device number for the card installed on your system.

4.2 Common Desktop Environment (CDE)

Common Desktop Environment (CDE) is available with Solaris 2.5 and higher versions and it is independent of the Raptor software.

If you have installed CDE and would like the CDE login screen to appear on the Raptor display, you will need to change your

`/usr/dt/config/Xservers` file to include the following line:

```
:0 Local local-uid@console root \  
/usr/openwin/bin/X :0 -dev /dev/fbs/rapafp0
```

You may add any other command line arguments to the end of the line. In addition, since the graphics devices are dynamically allocated during each reconfiguration boot, you should check your `/dev/fbs` directory for the name of your Raptor device (e.g. `rapafp0` or `rapafp1`, etc.) or run `dmesg |grep rapafp` and then modify the `Xservers` file accordingly.

When `dtlogin` is started, a login screen will appear on the Raptor display. The user may log on to this display using the console keyboard and mouse.

4.3 Setting Bit-Depth on 4000/4000e Cards

Raptor 4000/4000e cards support 8-bit, 24-bit, 8+24 bit, 8+8, `mox24` and `mox32` modes. By default X Windows comes up in 24-bit mode on these cards. Changes to the desired bit-depth can be made by using the `atconfig` utility (see Section 3.5).

4.4 MOX Modes

The following MOX modes apply to the Raptor 4000/4000e cards:

| | |
|--------------------|--|
| <code>Mox16</code> | MOX, 8-bit Normal, 13-bit Group, 5-bit Absolute |
| <code>mox24</code> | MOX, 8-bit Normal, 21-bit Group, 13-bit Absolute |
| <code>mox32</code> | MOX, 8-bit Normal, 32-bit Group, 24-bit Absolute |

NOTE: Details of the MOX extension to X Server are in a separate technical white paper. This may be obtained from Tech Source.

5 Uninstalling Software

5.1 Uninstalling Raptor Software

To remove the Raptor 4000/4000e software packages type:

```
prompt# pkgrm TSIafp TSIafpw
```

To uninstall the Mox package, type:

```
prompt# pkgrm TSIimox
```

WARNING: This uninstall procedure is **not** for use with older versions of the Raptor software. It is important to use the procedure, which was provided with the previous release to uninstall a previous release.

To verify which Raptor packages are installed on your system, type the following command:

```
prompt# pkginfo | grep TSI
```

This will list the packages from Tech Source that are installed on your system.

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6 Technical Assistance

6.1 Who to Call for Help

If you need help, please call our Technical Support Team at (800) 330-8301, or directly at (407) 262-7100 between the hours of **9:30am - 5:30pm EST** Monday through Friday.

Please have the software part number, version, and serial number for your Raptor card(s) available when contacting Tech Source in order to expedite support. Please make a note of this information in the area below:

DETAILS OF YOUR CARD(S):

P/N: _____

Model Name: _____

Serial Number(s): _____

NOTE: Technical Assistance will be available only for products under standard or extended warranty.

6.2 Email Address

Our email address is: hotline@techsource.com.
International customers should use email or our fax line at (407) 339-2554.

6.3 Website

Detailed product information and Frequently Asked Questions (FAQs), are available on our website located at:
<http://www.techsource.com>

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Appendix A: Console Resolution

A.1 Overview

The Raptor 4000 series cards can be configured to be the console in a typical SPARC desktop/server. The card has a default console resolution and default depth as shown in the following table:

| Board | Resolution | Refresh | Bits/Pixels | Sync |
|-------|-------------|---------|-------------|--------------------|
| 4000 | Auto Detect | - | 8 | Separate/composite |
| 4000e | Auto Detect | - | 8 | Separate/composite |

It is possible to change the default resolution on a Raptor 4000/4000e card. The procedures described in this appendix are:

- EDID Auto-Detect feature
- Output Device Method
- Video-Mode Method
- Video-Timing Method

This appendix includes a troubleshooting section describing possible problems and answers associated with changing the console resolution.

A.1.1 Reason for Changing the Console Resolution

Normally the default console resolution is sufficient for most users. An example of when you might be required to change the default resolution is described below:

- If the monitor does not "sync up" at the default console resolution, it may be necessary to choose a different console resolution.

A.1.2 EDID Auto-Detect Feature

If you are using a monitor with DDC2B/EDID protocol the default resolution will be determined using the Auto-Detect feature.

With this protocol, the Raptor 4000/4000e card first checks the Detailed Timing and Established Timing Identifiers (taking the first one supported) and then tries to match the Standard Timings.

NOTE: The monitor must be turned ON prior to booting the system in order for a Raptor 4000/4000e series card to communicate with it. **Some adapters and cables may block this signal.**

If the Auto-Detect feature fails the card will default to 2048x2048@60,analog.

Other methods described in this appendix will override any information obtained via EDID.

A.2 Output-Device Method

For systems with multiple displays, the `output-device` variable provides a method to specify which should be used as the console. When using a Sparc Ultra 25 or 45, please be aware that there is a limitation in the number of characters you can assign to the `output-device` variable. To avert this limitation, you will need to use the `devalias` command to set your Raptor 4000/4000e card as the console device.

The following steps will set a Raptor 4000/4000e card to display console video by using the `output-device` variable. Be sure to make a note of your configuration prior to changing your settings.

1. Connect your cable to the appropriate connector on your monitor and Raptor 4000/4000e card.

2. At the prompt type:
`ok show-displays`

This command will list the installed graphics devices and a prompt to enter a selection.

3. Type the letter that corresponds to the Raptor card that you want to use as the console device. Raptor cards can be identified by looking for the string `TSI` in the list of device names.

For example:
`/pci@1e,600000/pci@0/pci@3/pci@0/TSI,rapafp@0`

4. At the `ok` prompt, type :
`ok nvalias <alias name> <Control-Y>`

This command will set the specified variable to the path of the Raptor card. When you type `<Control-Y>`, the string of the display that was selected in step 3 will be inserted in the command line.

5. The next step is to set the specified variable to the output-device. The command to do so is as follows:

At the `ok` prompt, type :
`ok setenv output-device <alias name>`

6. Save your settings and reset the system by typing:

At the `ok` prompt, type :
`ok reset-all`

7. Once the system is reset, all console messages will be directed to the Raptor card.

NOTE: To restore the default graphics device as the console when using the `output-device` setting, set the `output-device` variable back to its default value of `screen` by typing the following command:

```
ok setenv output-device screen  
ok reset-all
```

A.3 Video-Mode Method

For systems with multiple displays, configurations made with the `video-mode` method provide a process to specify which device should be used as the console. The following steps will configure a Raptor 4000/4000e card to display console video by using this method. Be sure to make a note of your configuration prior to changing your settings.

1. Connect your cable to the appropriate connector on your monitor and Raptor 4000/4000e card.
2. The `video-mode` method requires the `output-device` variable in NVRAM to be configured with the actual path of the desired Raptor 4000/4000e card. The path can be determined by searching for the string `TSI` in the `/tree` at the `ok` prompt.

To find the path to the 4000/4000e device, type the following:

```
ok show-devs
```

At least one entry containing the string `TSI` will be displayed. For example, `TSI,rapafp@#`, where `#` will be a digit representing your Raptor's PCI slot number.

2. Use the entry displayed for the Raptor card to set your card as the console device. For example, if the path to the Raptor 4000/4000e device `TSI,rapafp@#` is `/pci@1f,4000`, then type the following command:

```
ok nvedit
0: devalias screen1 \
/pci@1e,600000/pci@0/pci@3/pci@0/TSI,rapafp@0
```

NOTE: Replace # with the digit representing your Raptor's PCI slot number.

3. Type <Control-C> to exit the `nvedit` mode.

4. To store your new settings type:

```
ok nvstore
```

5. The variable `use-nvramrc?` must also be set to `true` in order for the configuration in `nvram` to take effect.

To set this variable to `true` type:

```
ok setenv use-nvramrc? true
```

6. Save your settings and reset the system by typing:

At the `ok` prompt, type :

```
ok reset-all
```

8. Once the system is reset, all console messages will be directed to the Raptor 4000/4000e card.

NOTE: To restore the default graphics device as the console when using the `video-mode` method, set the `use-nvramrc?` variable to `false` as given below:

```
ok setenv use-nvramrc? false
ok reset-all
```

A.4 Video-Timing Method

If all of the previously described methods fail for your configuration, it is possible to specify the exact timing numbers for a particular resolution. The last method for setting the console resolution also uses `nvedit`. This method is more involved and requires knowledge of all timing parameters for the desired resolution, and is only meant for monitors whose resolutions are not available in the `video-mode` method. Please refer to Appendix C for detailed instructions on using `nvedit`.

NOTE: The video-timing method should be used **only** if the previous methods have been unsuccessful.

A.5 Priority Scheme for the Console

| Problem | Solution |
|--|---|
| Used the method described in the Appendix to configure the console resolution, but the card still defaults to something other than the resolution specified. | <p>A priority scheme is used to determine the boot console resolution. The Raptor 4000/4000e firmware checks the various methods in the order of priority discussed below. If it finds the resolution from the current method, it uses it; otherwise, it goes down the priority list to find the resolution information. Finally, if there is no resolution information, it uses the default resolution. The resolution-setting methods are enumerated in order of decreasing priority:</p> <ol style="list-style-type: none"><li data-bbox="669 961 1159 989">1. <code>output-device</code> method (Section A.2)<li data-bbox="669 993 1146 1020">2. <code>video-timing</code> method (Section A.4)<li data-bbox="669 1024 1114 1052">3. <code>video-mode</code> method (Section A.3)<li data-bbox="669 1056 1040 1083">4. DDC2B/EDID (Section A.1.2)<li data-bbox="669 1087 1040 1115">5. Default resolution for the card |

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Appendix B: Using Nvedit

B.1 NVRAM Edit Commands

This section discusses the use of NVRAM. The NVRAM is used for setting resolution in the Video-Mode and Video-Timing methods. To edit the NVRAM, type `nvedit` at the `ok` prompt. There are several commands that you must use to edit the variables in NVRAM:

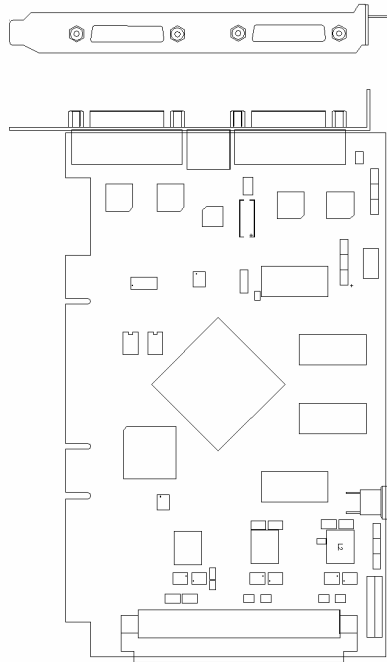
| | |
|------------------|---|
| <Backspace> | deletes the character preceding the cursor |
| <Ctrl-l> | lists NVRAM current values |
| <Ctrl-p> | moves to the previous line |
| <Ctrl-n> | moves to the next line |
| <Ctrl-b> | moves to the previous character |
| <Ctrl-f> | moves to the next character |
| <Ctrl-u> | deletes to the beginning of the line |
| <Ctrl-k> | joins the current and next line |
| <Ctrl-u><Ctrl-k> | deletes the current line |
| <Ctrl-c> | exits the NVRAM editor (back to the <code>ok</code> prompt) |

The changes will only take effect if they are stored using the `nvstore` command entered at the `ok` prompt. Once the changes are stored, the NVRAM must be enabled before the system will execute it. This is done by setting the environment variable `use-nvramrc?` to `true`. Type `reset` to reboot the system and make the changes effective.

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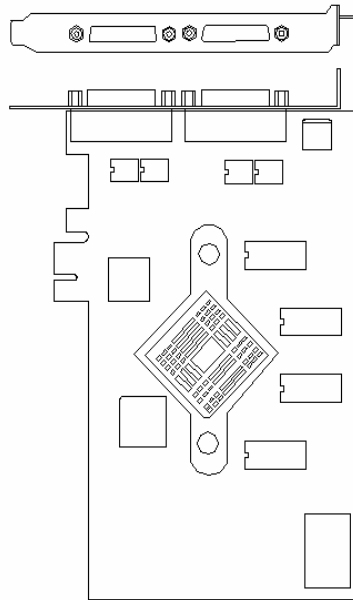
Appendix C: Card Specifications

C.1 Raptor 4000 Specifications



| | |
|--|--|
| Frame Buffer: | 256 MB |
| MOX Hardware: | Tech Source MOX 32 ASIC; 24 Layer Management |
| Color Lookup Table: | 2048 entries from a palette of 16 million colors + 2 AUX 256entry maps |
| Bits per Pixel: | 8, 16, 24 or 32 (software configurable) |
| Dynamic Color Plane Groups: | 32 |
| I/O Interface: | PCI, 66 MHz, 64-bit |
| Video Connector: | DVI-Dual Link Digital, up to 2048x2048 High Resolution Head (Analog up to 360 MHz, 50Ω RGB) DVI-Dual Link Digital, up to 1920x1200 High Resolution Head (Analog up to 330 MHz, 75Ω RGB) |
| Temperature Rating: | 10 ⁰ to 50 ⁰ C (operating) -10 ⁰ to 70 ⁰ C (non-operating) |
| Humidity Rating: | 10 to 90% (non-condensing) |
| Dimensions: | 6.6 in. (168mm) x 4.37 in. (111mm) |

C.2 Raptor 4000e Specifications



| | |
|--|--|
| Frame Buffer: | 256 MB |
| MOX Hardware: | Tech Source MOX 32 ASIC; 24 Layer Management |
| Color Lookup Table: | 2048 entries from a palette of 16 million colors + 2 AUX 256entry maps |
| Bits per Pixel: | 8, 16, 24 or 32 (software configurable) |
| Dynamic Color Plane Groups: | 32 |
| I/O Interface: | PCI, 66 MHz, 64-bit |
| Video Connector: | DVI-Dual Link Digital, up to 2048x2048 High Resolution Head (Analog up to 360 MHz, 50Ω RGB) DVI-Dual Link Digital, up to 1920x1200 High Resolution Head (Analog up to 330 MHz, 75Ω RGB) |
| Temperature Rating: | 10 ⁰ to 50 ⁰ C (operating) -10 ⁰ to 70 ⁰ C (non-operating) |
| Humidity Rating: | 10 to 90% (non-condensing) |
| Dimensions: | 6.6 in. (168mm) x 4.37 in. |

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