Platform Notes: SPARCstation 10SX and SPARCstation 20 System Configuration Guide

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Contents

Preface

This manual, *SPARCstation™ 10SX and SPARCstation 20 System Configuration Guide*, describes the machine-dependent functions of the Solaris™ graphics and window system APIs (Application Program Interfaces) such as Xlib, as related to the SX video subsystem.

Note – The XIL graphics software in this Solaris release does not provide performance enhancements specifically for the SPARCstation 10SX and SPARCstation 20. The last release to provide XIL acceleration specifically for these systems was the Solaris 2.5.1 release.Also, in this Solaris release, XGL support is no longer provided. The last release to provide XGL support was the Solaris 7 release.

This document should be used as an addendum to the graphics developer documentation for your Solaris release and to the *SPARCstation 10SX Hardware Owner's Guide* or *SPARCstation 20 Hardware Owner's Guide*.

How This Book Is Organized

Chapter 1 gives a brief description of the SPARCstation 10SX and 20SX.

Chapter 2 discusses issues pertinent to configuring the SPARCstation 10SX and SPARCstation 20 to enhance Sun Pixel Arithmetic Memory processor (SX) accelerator performance.

Chapter 3 discusses the visuals that are present when running OpenWindows on the SPARCstation 10SX and SPARCstation 20.

Appendix A shows messages displayed on the SPARCstation 10SX or 20SX during the boot process following SXDRAM configuration.

Using UNIX Commands

This document may not contain information on basic UNIX® commands and procedures such as shutting down the system, booting the system, and configuring devices.

See one or more of the following for this information:

- AnswerBook™ online documentation for the Solaris™ software environment
- Other software documentation that you received with your system

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CHAPTER 1

Introduction to Graphics on the SPARCstation 10SX and SPARCstation 20

The SPARCstation 10SX is a variant of the SPARCstation 10. The critical architectural difference between the SPARCstation 10 and the SPARCstation 10SX is the video subsystem. The SPARCstation 10SX integrates the graphics/imaging accelerator into the system memory controller. This assembly is referred to as the Scalable Memory Controller (SMC). SMC is an integer vector processor which is used for graphics and imaging acceleration. The accelerator renders directly into DRAM or video RAM. The Sun Microsystems Computer Systems official product name for the graphics/imaging accelerator is *SX*.

All SPARCstation 20 machines have the SX graphics/imaging accelerator.

The video RAM (here referred to as the frame buffer) for the SPARCstation 10SX is integrated into the system main memory address space. It is available on a video SIMM card (VSIMM) in two configurations:

- With 4 MBytes of video RAM
- With 8 MBytes of video RAM.

This frame buffer offers true color functionality.

The video SIMM by itself functions as a dumb frame buffer. The acceleration when rendering to the video memory is provided by the SX imaging and graphics accelerator. The Sun Microsystems Computer Systems official product name for the frame buffer in SPARCstation 10SX and SPARCstation 20 workstations is *cgfourteen*.

CHAPTER 2

Reserving DRAM for SX Accelerated Applications

Introduction

One of the performance enhancements for SX applications is the availability of physically contiguous DRAM. Physically contiguous DRAM for SX will be referred to in this document as *SXDRAM*. This document describes:

- The process of configuring SXDRAM for exclusive use by the SX accelerated applications.
- The application context in which SXDRAM is used
- The advantages of using SXDRAM

SX provides acceleration of the graphics and imaging segments of applications that run on a SPARCstation 10SX or SPARCstation 20 workstation. Acceleration can be used for a wide range of pixel operations, including 2D and 3D graphics rendering, multimedia, and image processing.

The SX accelerator, built into the SMC, can directly accelerate operations on both the system main memory (DRAM) and the video memory (VRAM). The SMC is comprised of:

1. An error-correcting code memory controller which interfaces with both the system main memory (DRAM) and the video memory (VRAM; the frame buffer) to the system memory bus.

2. The SX imaging and graphics accelerator.

Advantages of Using SXDRAM

As a configuration option, you can reserve SXDRAM. When SXDRAM is reserved, the SX has additional optimizations available to it when accessing SXDRAM, and operations on SXDRAM execute more quickly. The reserved memory, however, is then not available for use by other applications. For example, on a 48-megabyte system, allocating 16 megabytes of SXDRAM means that the system will in effect run as a 32-megabyte system.

When to Reserve SXDRAM

Caution – The memory reserved for SXDRAM will not be available for system use. When reserving SXDRAM, consider the amount of memory left for system use. Ensure that there is sufficient memory left for system use that system performance is not adversely affected.

Reserving SXDRAM can improve the performance of an application. The default configuration is to use no SXDRAM.Typically, 4 MBytes must be reserved when Z-buffering is used or when double-buffering is used alone. 8 MBytes of SXDRAM must be reserved if both Z-buffering and double-buffering are used.

For image rotation operations, the amount of SXDRAM that must be reserved should be the same as the size of the image, rounded up to the nearest integer multiple of 1 MByte. For example, a 1200 x 1200 image with four 8-bit channels per pixel will fit in 5.493 MBytes, requiring 6 MBytes of SXDRAM.

Calculating the Amount of SXDRAM to Reserve

To calculate the amount of SXDRAM to reserve, add up the individual requirements and round up to the next multiple of 1 MByte.

Configuring SXDRAM

This section lists the steps to follow in order to configure SXDRAM. It also discusses the constraints imposed by the system software and hardware. It is essential that you understand the system memory map before you configure SXDRAM.

Note that there are some key differences in the way memory is arranged on the SPARCstation 10SX and the SPARCstation 20:

- The physical sequence of slots is different
- The slots that can use VSIMMs are different

Information specific to the SPARCstation 20 is provided in Section "Memory Bank Layout on the SPARCstation 20" on page 8. To plan SXDRAM configurations for those systems, take this information into account when applying the principles explained in the material covering the SPARCstation 10SX.

Memory Bank Layout on the SPARCstation 10SX

There are two memory banks on a SPARCstation 10SX. Bank 0 is comprised of slots 0, 1, 2, and 3. Bank 1 is comprised of slots 4, 5, 6, and 7. These 8 slots are available for configuring memory on the SPARCstation 10SX. Each bank of memory can map 256 MByte of physical address space. Each slot in each memory bank maps 64 MByte of physical address space.

The beginning physical address for bank 0 is 0. For bank 1, it is 0x10000000.

Slots 4 must be configured with a VSIMM; slot 5 may be configured with either a DSIMM or a VSIMM (CG14). The SPARCstation 10SX supports 16 MByte and 64 MByte DSIMMs, and 4 MByte and 8 MByte VSIMMs. Each slot maps 64 MByte of physical address space regardless of the size and type of SIMM that is configured in the slot.

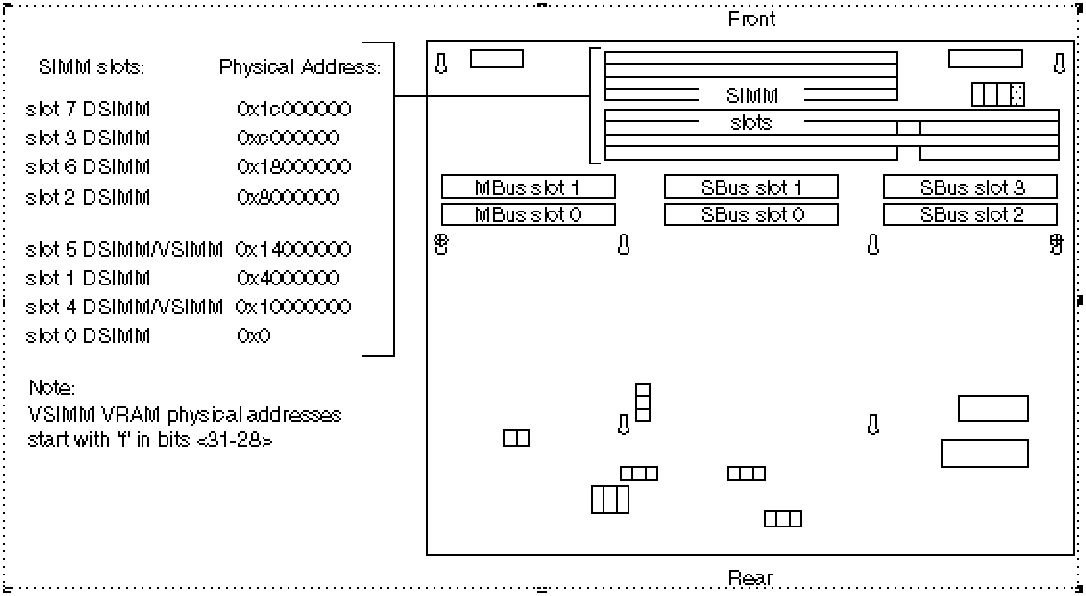

FIGURE 2-1 Memory Layout on Mother Board of SPARCstation 10SX

The table below illustrates the physical address map of a system configured with 16 MByte DSIMMS in all the slots

TABLE 2-1 SPARCstation 10SX System Memory Layout 16 MByte DSIMMs only

SIMM Slots	DSIMM Size	Physical Address
Slot 7	16 MByte DSIMM	0x1c000000
Slot 3	16 MByte DSIMM	0xc000000
Slot 6	16 MByte DSIMM	0x18000000
Slot 2	16 MByte DSIMM	0x8000000
Slot 5	16 MByte DSIMM	0x14000000
Slot 1	16 MByte DSIMM	0x4000000
Slot 4	16 MByte DSIMM	0x10000000
Slot 0	16 MByte DSIMM	0x0

TABLE 2-2 below illustrates the physical address map of a system configured with one 4 MByte VSIMM installed in slot 4 and 16 MByte DSIMMs in the remaining slots.

TABLE 2-2 SPARCstation 10SX System Memory Layout
One 4 MByte VSIMM, Seven 16 MByte DSIMMs

SIMM Slots	DSIMM/VSIMM Size	Physical Address
Slot 7	16 MByte DSIMM	0x1c000000
Slot 3	16 MByte DSIMM	0xc000000
Slot 6	16 MByte DSIMM	0x18000000
Slot 2	16 MByte DSIMM	0x8000000
Slot 5	16 MByte DSIMM	0x14000000
Slot 1	16 MByte DSIMM	0x4000000
Slot 4	4 MByte VSIMM	0xf0000000
Slot 0	16 MByte DSIMM	0x0

Thus, on systems configured with 16 MByte DSIMMS, the maximum size of a physically contiguous block of DRAM is 16 MByte. However, you can reserve multiple blocks of SXDRAM on such systems. In order to be able to configure a single block of SXDRAM greater than 16 MByte, the system must be configured with 64 MByte DSIMMs.

TABLE 2-3 illustrates a system configured with one 4 MByte VSIMM and seven 64 MByte DSIMMs.

TABLE 2-3 SPARCstation 10SX System Memory Layout
One 4 MByte VSIMM, Seven 64 MByte DSIMMs

SIMM Slots	DSIMM/VSIMM Size	Physical Address
Slot 7	64 MByte DSIMM	0x1c000000
Slot 3	64 MByte DSIMM	0xc000000
Slot 6	64 MByte DSIMM	0x18000000
Slot 2	64 MByte DSIMM	0x8000000
Slot 5	64 MByte DSIMM	0x14000000
Slot 1	64 MByte DSIMM	0x4000000
Slot 4	4 MByte VSIMM	0xf0000000
Slot 0	64 MByte DSIMM	0x0

This layout results in one contiguous block of 256 MBytes (slots 0, 1, 2, and 3) beginning at physical address 0, and another block of 192 MBytes (slots 4, 5, 6, and 7) beginning at physical address 0x14000000. Therefore, the maximum amount of DRAM that can be installed in this configuration is 448 MBytes.

A typical system will most likely have 16 MByte and 64 MByte DSIMMs, and VSIMMs. There are a large number of possible permutations of the system configuration which, due to space limitations, will not be discussed here.

To be able to allocate the largest possible block of SXDRAM with a given set of VSIMMs and DSIMMs, use the illustrations in this section as a guide.

The next section provides some information unique to the SPARCstation 20. The two sections following that discuss system software constraints and configuration recommendations that involve both systems.

Memory Bank Layout on the SPARCstation 20

On the SPARCstation 20, the physical sequence of slots is different from that slots on the SPARCstation 10SX. The slots that can be used for VSIMMs differ as well. The different layouts are compared in TABLE 2-4.

TABLE 2-4 Comparing Slot Locations on the SPARCstation 10SX and SPARCstation 20

Slot Names on SPARCstation 10SX	Slot Names on SPARCstation 20
Slot 7	Slot 0
Slot 3	Slot 2
Slot 6	Slot 5
Slot 2	Slot 3
Slot 5 (can be VSIMM 1)	Slot 6
Slot 1	Slot 1
Slot 4 (can be VSIMM 0)	Slot 7 (can be VSIMM 0)
Slot 0	Slot 4 (can be VSIMM 1)

System Software Constraints for SXDRAM Configuration

The following constraints are described in terms of the SPARCstation 10SX, but the same concerns apply to the SPARCstation 20.

1. The first slot (slot 0) *must always* be configured with a DSIMM.

2. The minimum recommended amount of memory required for reasonable SPARCstation 10SX performance is 32 MByte. Thus, to be able to reserve SXDRAM, a system should be configured with more than 32 MBytes of DRAM. However, users can configure the minimum amount of memory that must be reserved for system use by using the `-l` option of the *sxconfig* (1M) command. The difference between the amount of DRAM installed on the system and the configured minimum limit (32 MBytes by default) is the maximum amount of memory that can be reserved for SXDRAM.

3. The amount of physically contiguous memory that should be reserved must be specified as an integer multiple of 1 MByte. Thus, the minimum amount that can be reserved is 1 MByte.

Recommended DSIMM / VSIMM Configuration for the SPARCstation 10SX

1. The VSIMM can only be installed in slots 4 or 5 on the SPARCstation 10SX. If there is only one VSIMM, it can be installed in either slot 4 or 5. To install the VSIMM in slot 5, an AVB (Auxiliary Video Board) card is required. This card is not bundled with the SPARCstation 10SX.

2. Always install a 16 MByte DSIMM in slot 0 when you have a combination of 16 MByte and 64 MByte DSIMMs.

3. If the memory system consists only of 16 MByte DSIMMs. They can be configured in any slots, provided that the first 16 MByte DSIMM is installed in slot 0.

4. Within a memory bank, always install the DSIMMs in the order of decreasing DSIMM sizes (the ordering does not matter if all the DSIMMs are of the same size). In other words, if there is a combination of 64 MByte DSIMMs and 16 MByte DSIMMs, install the 64 MByte DSIMM in the lowest-number slot, followed by the 16 MByte in the immediate next slot.

When configuring the memory subsystem with 64 MByte DSIMMs and 16 MByte DSIMMs, the following examples can be used as a guide:

System configuration: 1 VSIMM, 2 16 MByte DSIMMs, 2 64 MByte DSIMMs.

This an be configured as:

- 1 16 MByte DSIMM in slot 0
- 1 16 MByte DSIMM in slot 7
- 1 64 MByte DSIMM in slot 6
- 1 64 MByte DSIMM in slot 5
- 1 VSIMM in slot 4

or be configured as:

- 1 16 MByte DSIMM in slot 0
- 1 16 MByte DSIMM in slot 3
- 1 64 MByte DSIMM in slot 2
- 1 64 MByte DSIMM in slot 1
- 1 VSIMM in slot 4 or 5

SXDRAM Configuration

The operating system includes a driver for reserving and managing physically contiguous memory. The memory should be reserved as part of the boot process, because it is likely to be the least fragmented at this time, and chances of finding large blocks of physically contiguous memory are higher during boot time.

The amount of SXDRAM to reserve can be specified by using the `sxconfig(1M)` command. `sxconfig` can be executed only by a process with superuser privileges. Here are some examples of `sxconfig` command use.

To disable fragmentation, enter:

```
# sxconfig -n
```

To restore all configuration parameters to the default values, enter:

```
# sxconfig -d
```

By default, 0 MBytes of physically contiguous memory is reserved, fragmentation is not allowed, and 32 MBytes of memory is reserved for system use.

To display the current configuration parameters in the driver configuration file, enter:

```
# sxconfig -c
```

If the system was not booted after the last time the configuration parameters were changed, then the displayed values will not reflect the actual system set-up. For more information about using `sxconfig`, refer to the on-line `man` page.

The `sxconfig` command resides in the directory `/platform/SUNW,SPARCstation-10,SX/sbin`; the shell environment variable `PATH` must include this directory. To find out whether the `PATH` environment variable includes the `/platform/SUNW,SPARCstation-10,SX/sbin` directory, type:

```
# echo $PATH
```

Your search path will be displayed. An example:

```
/bin:/etc/:/usr/bin:
```

If the line displayed does not include `/platform/SUNW,SPARCstation-10,SX/sbin`, enter the following if you are in either the Bourne shell or the Korn shell:

```
# PATH=$PATH:/platform/SUNW,SPARCstation-10,SX/sbin export PATH
```

followed by:

```
# export PATH
```

if you are in the Bourne shell.

If you are in the C shell, enter:

```
# setenv PATH "$PATH /platform/SUNW,SPARCstation-10,SX/sbin"
```

If 16 MBytes of memory must be reserved, enter:

```
# sxconfig -s 16
```

On a system configured with 16 MByte DSIMMs, the maximum amount of SXDRAM that can be reserved in a single block is 16 MBytes. On such systems, when more than 16 MBytes of memory must be reserved for SXDRAM, the `sxconfig` command can be used to specify that fragmented reservation of the requested amount of SXDRAM is allowed. For example, to reserve 32 MBytes of memory on a system configured with 16 MBytes, enter:

```
# sxconfig -s 32 -f
```

`sxconfig` and `reboot` causes a search of the system page pool for a contiguous block of memory of the specified size. If the block of memory is found, it is reserved. If fragmentation is specified (as shown above), more than 16 MBytes is specified, and the search fails, the operating system searches for contiguous blocks of 16 MBytes. If no blocks of this size are found, the operating system searches for contiguous blocks of 256 KBytes.

When the SXDRAM configuration is finished, halt the system:

```
# halt
```

The Open Boot PROM prompt is displayed on the console:

```
ok
```

Boot the system by entering:

```
ok  boot disk -rv
```

The `-r` option specifies a reconfiguration boot. The `-v` option specifies verbose mode. As part of the boot process, the requested amount of SXDRAM will be reserved. Refer to Appendix “” for a listing of the messages that will be displayed.

After the system is rebooted, log in, start OpenWindows, and start the application of your choice.

CHAPTER 3

Running OpenWindows on the SPARCstation 10SX and SPARCstation 20

This chapter discusses the visuals that are present when running OpenWindows on the SPARCstation 10SX and SPARCstation 20.

CG14 Pixel Modes for Running the Window System

The cgfourteen frame buffer is configurable to scan out either 8-bit pixels or 32-bit pixels. This allows the cgfourteen to be used in high resolution modes. For example, you can configure a 4MByte cgfourteen connected to a multi-sync monitor to display 8-bit pixels at 1280x1024 resolution with the command:

```
/platform/SUNW,SPARCstation-10,SX/sbin/cg14config -r
1280x1024@66
```

When the system is rebooted the monitor displays at the new resolution. Since 4MBytes is insufficient memory to have 32 bits per pixel, invoking OpenWindows will automatically select 8-bit pixels only.

The same hardware, when configured to display at 1152x900 resolution with the command:

```
/platform/SUNW,SPARCstation-10,SX/sbin/cg14config -r 1152x900@76
```

will allow OpenWindows to use 32 bits per pixel, after rebooting.

In both modes, the left-over VRAM not displayed on the screen is utilized by the window system for pixmap allocation.

It is possible to use the frame buffer in 8-bit pixel mode even when there is sufficient VRAM for 32-bit pixels. There is a significant performance improvement when the frame buffer is in 8-bit pixel mode. To force the pixel mode, put the verb `pixelmode=”8”` in the `OWconfig` file used by the server. The `OWconfig` file is typically in `/usr/openwin/server/etc`.

A complete entry with this in the file would look like:

```
# CG14 display adapter
class=”XSCREEN” name=”SUNWcg14”
      ddxHandler=”ddxSUNWcg14.so.1” ddxInitFunc=”sunCG14Init” pixelmode= “8”;
```

Visuals Supported By Openwindows 3.3

When the window system runs in 8-bit mode, it exports the same visuals that are exported by Openwindows 3.3 on other 8-bit frame buffers:

- 8-bit `StaticGray`
- 8-bit `GrayScale`
- 8-bit `StaticColor`
- 8-bit `PseudoColor`
- 8-bit `TrueColor` and
- 8-bit `DirectColor`.

Only one hardware color lookup table is available to be shared by all X11 colormaps.

In 32-bit mode, the server supports a 24-bit `TrueColor` visual, in addition to all of the visuals present in 8-bit mode.

When the server is started with the following option:

```
/usr/openwin/bin/openwin -dev /dev/fbs/cgfourteen0 defdepth 8
```

the default visual, in which the root window is created, is an 8-bit `PseudoColor` visual.

When the following option is used:

```
/usr/openwin/bin/openwin -dev /dev/fbs/cgfourteen0 defdepth 24
```

the default visual is a 24-bit `TrueColor` visual.

False Color Effects

The phenomenon of seeing the wrong colors in a window because another X11 colormap is installed in the hardware is called *false color*.

The best way to avoid false color is to use a `TrueColor` visual. Since all 32 bits are available for `TrueColor` visuals, the colors always show up correctly. The SX hardware renders 24-bit visuals with the same speed as it renders 8-bit visuals, so there is no performance penalty when using 24-bit visuals.

In 32-bit mode the `StaticGray` visual has its own dedicated hardware color lookup table (actually a linear ramp). Hence `StaticGray` windows in 32-bit mode will never cause other 8-bit windows to appear incorrectly.

APPENDIX **A**

Boot Messages

This Appendix lists typical messages such as are displayed on the SPARCstation 10SX or SPARCstation 20 during the boot process following SXDRAM configuration. These messages provide information regarding the amount of contiguous memory that has been reserved.

TABLE A-1 Typical Boot Messages Following SXDRAM Configuration

```
SunOS Release 5.3 Version alpha2.3 [UNIX(R) System V Release 4.0]
Copyright (c) 1983-1993, Sun Microsystems, Inc.
pac: enabled - SuperSPARC/SuperCache
cpu 0: TI,TMS390Z55 (mid 8 impl 0x0 ver 0x0 clock 40 MHz)
mem = 49152K (0x3000000)
avail mem = 41820160
Ethernet address = 8:0:20:13:0:37
root nexus = SUNW,Premier-24
iommu0 at root: obio 0xe0000000
sbus0 at iommu0: obio 0xe0001000
espdma0 at sbus0: SBus slot f 0x400000
esp0 at espdma0: SBus slot f 0x800000 sparc ipl 4
sd0 at esp0: target 0 lun 0
sd0 is /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f, 800000/sd@0,0
<SUN0669 cyl 1614 alt 2 hd 15 sec 54>
sd2 at esp0: target 2 lun 0
sd2 is /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f, 800000/sd@2,0
<SUN0424 cyl 1151 alt 2 hd 9 sec 80>
sd3 at esp0: target 3 lun 0
sd3 is /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f, 800000/sd@3,0
<SUN0424 cyl 1151 alt 2 hd 9 sec 80>
sd6 at esp0: target 6 lun 0
sd6 is /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f, 800000/sd@6,0
<>
Unable to install/attach driver 'isp'
root on /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f, 800000/
sd@3,0:a fstype ufs
obio0 at root
zs0 at obio0: obio 0x100000 sparc ipl 12
```

TABLE A-1 Typical Boot Messages Following SXDRAM Configuration

```
zs0 is /obio/zs@0,100000
zs1 at obio0: obio 0x0 sparc ipl 12
zs1 is /obio/zs@0,0
configuring network interfaces:ledma0 at sbus0: SBus slot f 0x400010
le0 at ledma0: SBus slot f 0xc00000 sparc ipl 6
le0 is /iommu@f,e0000000/sbus@f,e0001000/ledma@f,400010/le@f, c00000
 le0.
Hostname: example
dump on /dev/dsk/c0t3d0s1 size 65860K
Configuring the /devices directory
Unable to install/attach driver 'bwtwo'
Unable to install/attach driver 'audio'
Unable to install/attach driver 'cgthree'
st4:    <Archive QIC-150>
st4 at esp0: target 4 lun 0
st4 is /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f, 800000/st@4,0
Unable to install/attach driver 'isp'
SUNW,fdtwo0 at obio0: obio 0x700000 sparc ipl 11
SUNW,fdtwo0 is /obio/SUNW,fdtwo@0,700000
Unable to install/attach driver 'cgsix'
Unable to install/attach driver 'vme'
Unable to install/attach driver 'ipi3sc'
Unable to install/attach driver 'id'
Unable to install/attach driver 'vme'
Unable to install/attach driver 'vmemem'
sbusmem0 at sbus0: SBus slot 0 0x0
sbusmem0 is /iommu@f,e0000000/sbus@f,e0001000/sbusmem@0,0
sbusmem1 at sbus0: SBus slot 1 0x0
sbusmem1 is /iommu@f,e0000000/sbus@f,e0001000/sbusmem@1,0
sbusmem2 at sbus0: SBus slot 2 0x0
sbusmem2 is /iommu@f,e0000000/sbus@f,e0001000/sbusmem@2,0
sbusmem3 at sbus0: SBus slot 3 0x0
sbusmem3 is /iommu@f,e0000000/sbus@f,e0001000/sbusmem@3,0
sbusmem14 at sbus0: SBus slot e 0x0
sbusmem14 is /iommu@f,e0000000/sbus@f,e0001000/sbusmem@e,0
sbusmem15 at sbus0: SBus slot f 0x0
sbusmem15 is /iommu@f,e0000000/sbus@f,e0001000/sbusmem@f,0
Unable to install/attach driver 'xbox'
SUNW,bpp0 at sbus0: SBus slot f 0x4800000 SBus level 2 sparc ipl 3
SUNW,bpp0 is /iommu@f,e0000000/sbus@f,e0001000/SUNW,bpp@f, 4800000
Unable to install/attach driver 'pn'
Unable to install/attach driver 'lebuffer'
Unable to install/attach driver 'cgeight'
Unable to install/attach driver 'ipi3sc'
SUNW,DBRIe0 at sbus0: SBus slot e 0x10000 SBus level 5 sparc ipl 9
SUNW,DBRIe0 is /iommu@f,e0000000/sbus@f,e0001000/SUNW,DBRIe@e, 10000
MMCODEC: Manufacturer id 1, Revision 1
pseudo-device: vol0
vol0 is /pseudo/vol@0
Unable to install/attach driver 'xbox'
```

TABLE A-1 Typical Boot Messages Following SXDRAM Configuration

```
Unable to install/attach driver 'vme'
Unable to install/attach driver 'mcp'
Unable to install/attach driver 'vme'
Unable to install/attach driver 'mcp'
Unable to install/attach driver 'mcpzsa'
Unable to install/attach driver 'vme'
Unable to install/attach driver 'mcp'
Unable to install/attach driver 'mcpp'
SUNW,sx0 at root: obio 0x80000000 and obio 0x80001000
SUNW,sx0 is /SUNW,sx@f,80000000
cgfourteen0 at obio0: obio 0x0 and obio 0x0 sparc ipl 8
cgfourteen0 is /obio/cgfourteen@1,0
sx_cmem: Installed 112MB
        Reserved 8MB
        Fragment 0
        Avail For System Use 104MB
pseudo-device: sx_cmem0
sx_cmem0 is /pseudo/sx_cmem@0
Unable to install/attach driver 'stc'
Unable to install/attach driver 'isp'
Unable to install/attach driver 'cgtwelve'
Unable to install/attach driver 'gt'
Unable to install/attach driver 'leo'
Unable to install/attach driver 'rtvc'
Unable to install/attach driver 'tcx'
Configuring the /dev directory
Configuring the /dev directory (compatibility devices)
The system is coming up.  Please wait.
...
```

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