

VAXstation 4000 3D Graphics Options

Maintenance Guide

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About This Guide

This guide is a support and reference document for Digital Services personnel who install and maintain the PV61G-BA 8-plane and PV61G-AA 24-plane 3D graphics options in the VAXstation 4000 Model 60. It is also intended for Digital customers who have a self-maintenance agreement with Digital.

Structure of this Guide

This guide contains three chapters, three appendices, and an index.

- Chapter 1 tells you how to prepare the system for installing either of the 3D graphics options.
- Chapter 2 tells you how to remove and replace a 3D graphics option.
- Chapter 3 tells you how to restore, start, and test the system. It also lists the field replaceable units (FRUs) and their part numbers and tells you how to handle problems.
- Appendix A describes the 3D graphics option diagnostic tests resident in the self-test ROM.
- Appendix B lists option hardware specifications.
- Appendix C lists associated documents.
- The index refers you to the page containing specific topics and keywords. It is also a convenient reference to diagnostic tests by decimal and hexadecimal number and name.

Conventions

The following conventions are used in this guide:

Convention	Meaning
<i>Warning</i>	Warnings provide information to prevent personal injury. Read these carefully.
<i>Caution</i>	Cautions provide information to prevent damage to equipment or software. Read these carefully.
<i>Notes</i>	Notes provide general information about the current topic.
❶	Circled numbers in text refer to circled numbers in associated figures.

Overview and System Preparation

Note *If you are adding a 3D graphics option in a VAXstation 4000 Model 60 to replace the 2D graphics, use the VAXstation 4000 3D Graphics Options Option Guide supplied with the option kit.*

For the VAXstation 4000 Model 60, the 3D graphics options are the PV61G-BA 8-plane option and the PV61G-AA 24-plane option. Both are three-dimensional color graphics and continuous-tone imaging (3D/CTI) options.

At the time of writing, the PV61G-BA 8-plane and PV61G-AA 24-plane 3D graphics options are compatible with the following monitors:

VR320
VRT16
VRT19

The instructions in this guide assume you are familiar with the VAXstation 4000 Model 60 and the following displays:

- System power-up messages.
- SHOW CONFIG console command and associated configuration display.
- System exerciser (TEST 100/101/102) console command for running and associated display.

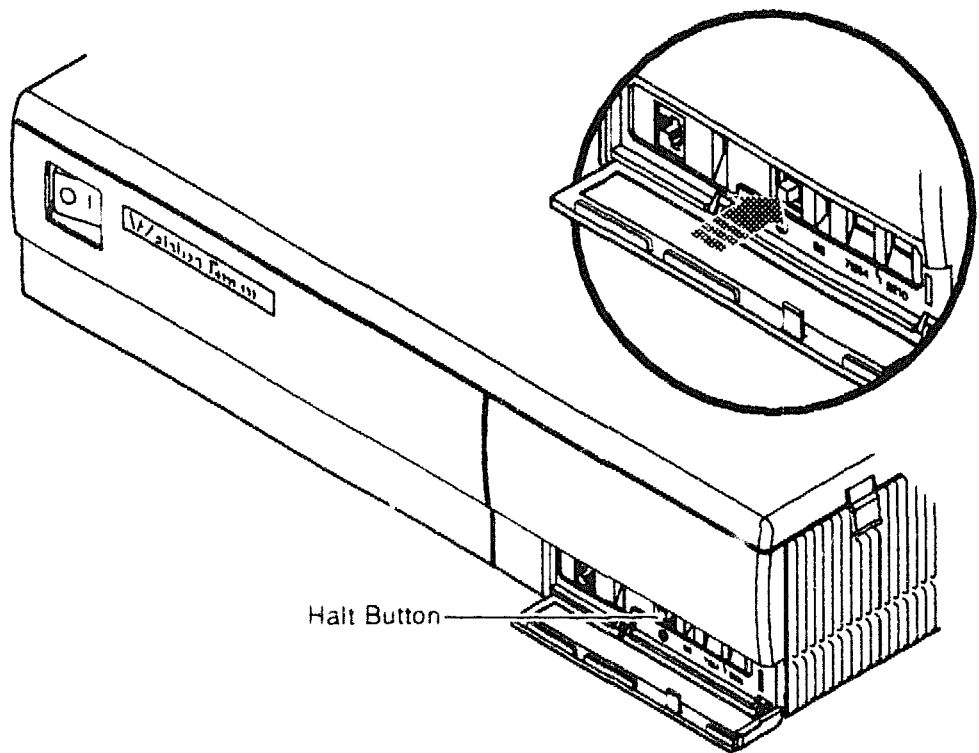
1.1 Preparing the System

Shut down the system as follows:

Note See the operating system documentation for shutdown procedures. If the system is part of a networked work group, notify group members before turning off, halting, or restarting the system.

- 1 Shutdown the operating system.
- 2 Put the system into console mode by pressing the Halt button on the front of the system unit (behind the door on the lower right). Figure 1-1 shows the Halt button.

Figure 1-1 Halt Button

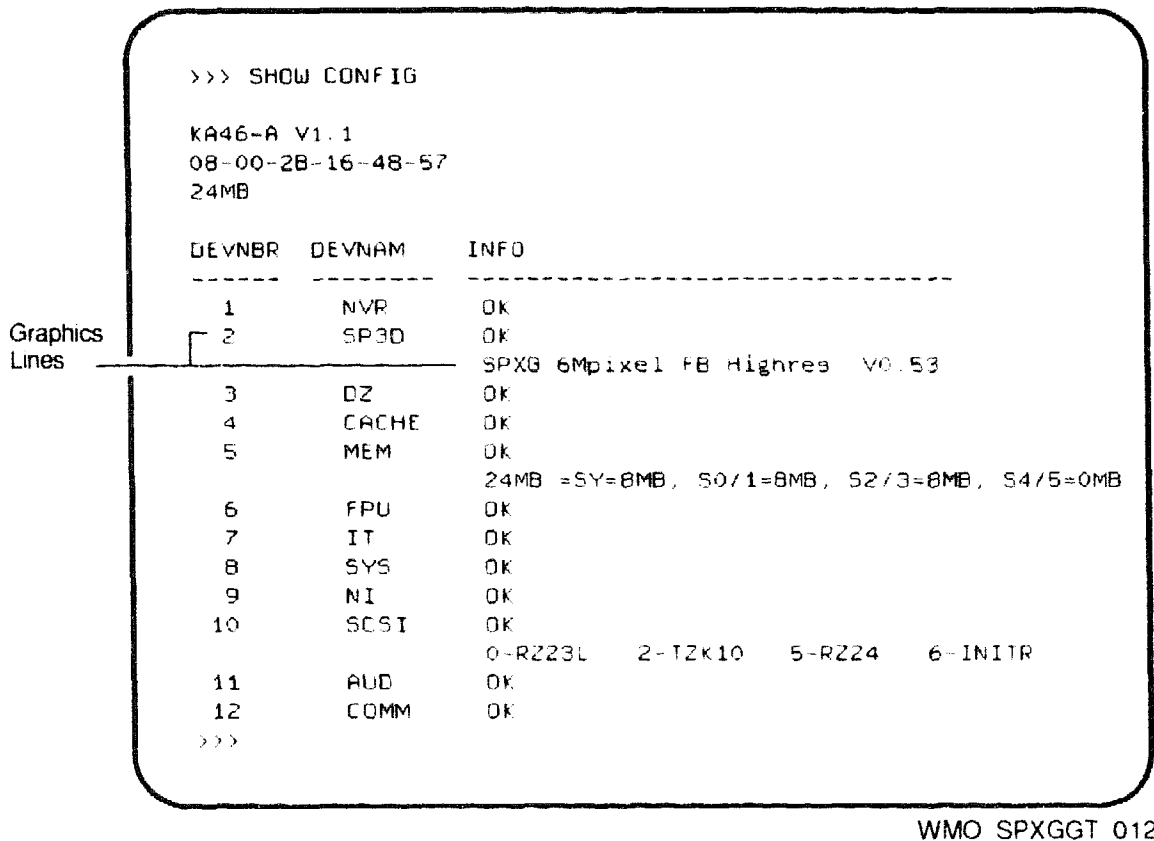


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- 3 Review the system configuration and record the information for reference. After replacing the FRU, you can compare the initial and current configurations to help verify the presence and operation of system devices and components.

To review the system configuration, use the **SHOW CONFIG** command. It displays the presence and status of the devices and components installed in the system. Figure 1-2 shows a typical configuration display. (The console commands and displays are described in more detail in the *VAXstation 4000 Model 60 Service Information*.)

Figure 1-2 Initial SHOW CONFIG Command Display



You should see the message **OK** next to each device name. Two question marks (??) are the error indicator, as shown in Figure 1-3. If you see any errors, see the *VAXstation 4000 Model 60 Service Information*; otherwise, proceed with the following steps.

Figure 1-3 Initial SHOW CONFIG Command Error Display

```
>>> SHOW CONFIG
```

```
KA46-A V1.1
08-00-2B-16-48-57
24MB
```

DEVNBR	DEVNAM	INFO
1	NVR	OK
2	LOG	OK
3	DZ	LR-MONO FB-1.0
4	CACHE	OK
5	MEM	OK
		24MB =SY=8MB, S0/1=8MB, S2/3=8MB, S4/5=0MB
6	FPU	OK
7	IT	OK
8	SYS	OK
9	NI	?? 001 0172
10	SCSI	OK
		0-RZ23L 2-T2K10 5-RZ24 6-INTR
11	AUD	OK
12	COMM	OK

```
>>>
```

Error Indicator

WMO_SPXGGT_003

- 4 Turn the system unit off (0).
- 5 Turn all expansion boxes off (0).
- 6 Turn all peripheral devices (such as printers and modems) off (0).
- 7 Turn the monitor off (0).

Warning *Internal voltage remains for a short while after the monitor is turned off. To avoid minor injury, wait several minutes before disconnecting the monitor power cord from the system unit.*

- 8 Disconnect the monitor power cord from the system unit.
- 9 Disconnect the system power cord from the power receptacle.
- 10 Disconnect and remove the monitor video cable from the system unit.

Warning *The monitor is heavy and you may need help from another person to lift it.*

11 Remove the monitor from the top of the system unit and set it aside.

12 Make sure that the system unit is on a flat and level surface.

Warning *Before you remove the system unit cover (Figure 1-4), wait at least five minutes after turning off system unit power. The power supply capacitors will safely discharge during this time.*

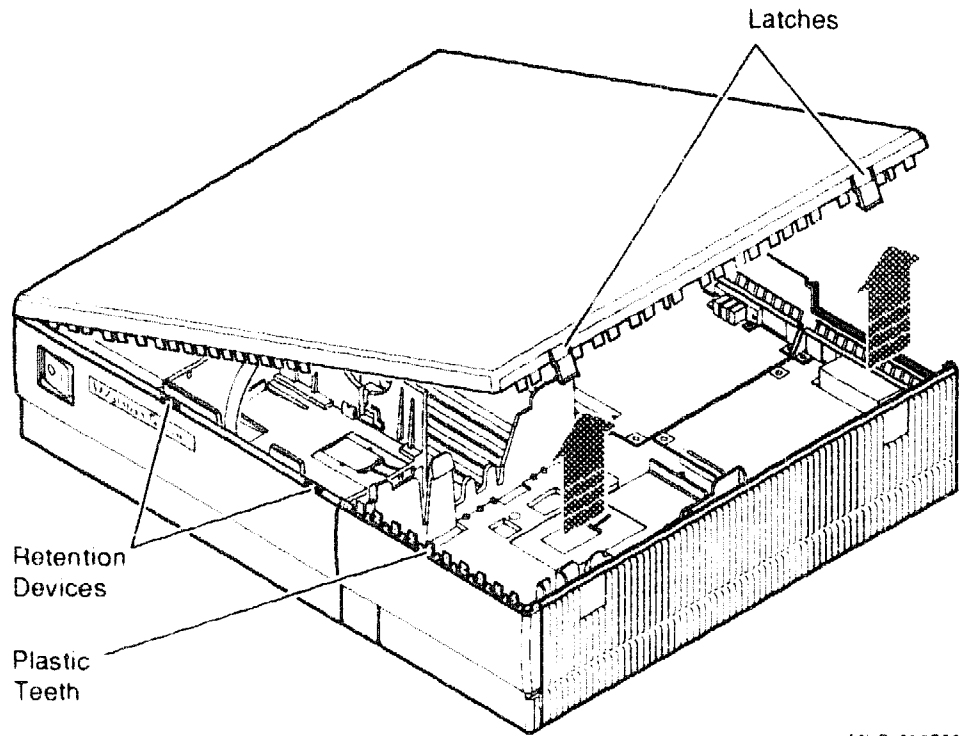
Note *When removing the system unit cover, you will have to pull with enough force to release the retention devices on the front and rear edges of the cover. Pulling forcefully will not break the cover.*

Warning *When removing the system unit cover, do not touch the plastic teeth on the top edge of the bezel. Also, do not touch the metal shielding under the front edge of the cover.*

Caution *To avoid damage from static discharge, as soon as you remove the cover, and each time before touching anything inside the system unit, touch the space marked TOUCH HERE on the top of the power supply.*

13 See Figure 1-4. Remove the system cover by carefully releasing the latches on the side of the cover, then pulling the cover up and away.

Figure 1-4 Removing the System Unit Cover



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3D Graphics Option Removal and Replacement

This chapter tells you how to remove and replace the PV61G-BA 8-plane (Section 2.1.2) and the PV61G-AA 24-plane (Section 2.2.2) 3D graphics option FRUs.

2.1 PV61G-BA 8-Plane Option

The PV61G-BA 8-plane option includes the following:

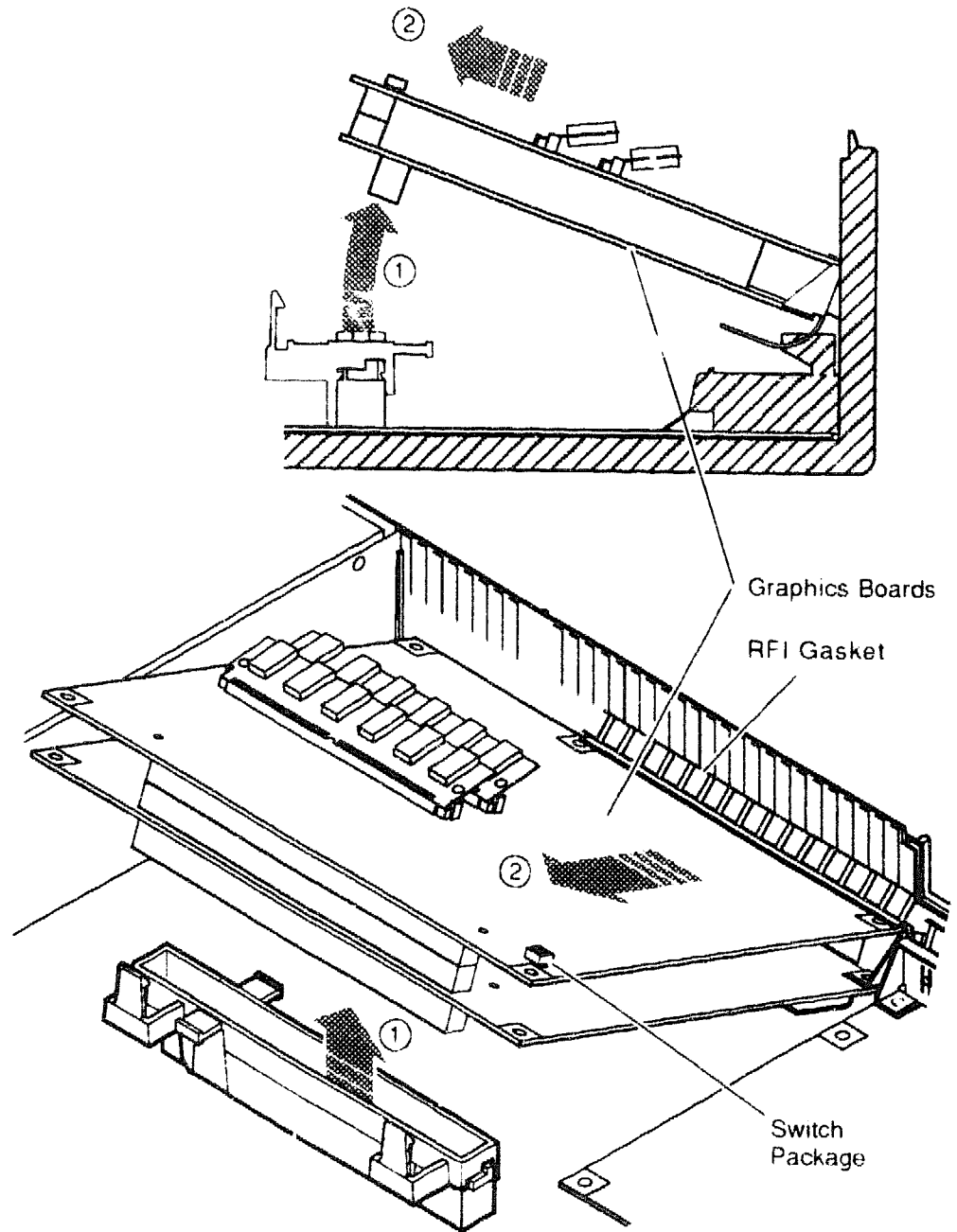
- One graphics subsystem processor module
- One 8-plane frame buffer module
- Two 2-Mbyte single in-line memory modules (SIMMs)
- Video connector bracket (attached to graphics subsystem processor module)
- Radio frequency interference (RFI) gasket

2.1.1 Removing the PV61G-BA 8-Plane Option

See Figure 2-1. To remove the PV61G-BA:

- 1 Release the board latches ❶.
- 2 Lift the option assembly free of the system module connector and remove it from the system box ❷.
- 3 Remove the failed FRU.

Figure 2-1 **Removing the PV61G-BA 8-Plane Option**



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2.1.2 Replacing the PV61G-BA 8-Plane Option

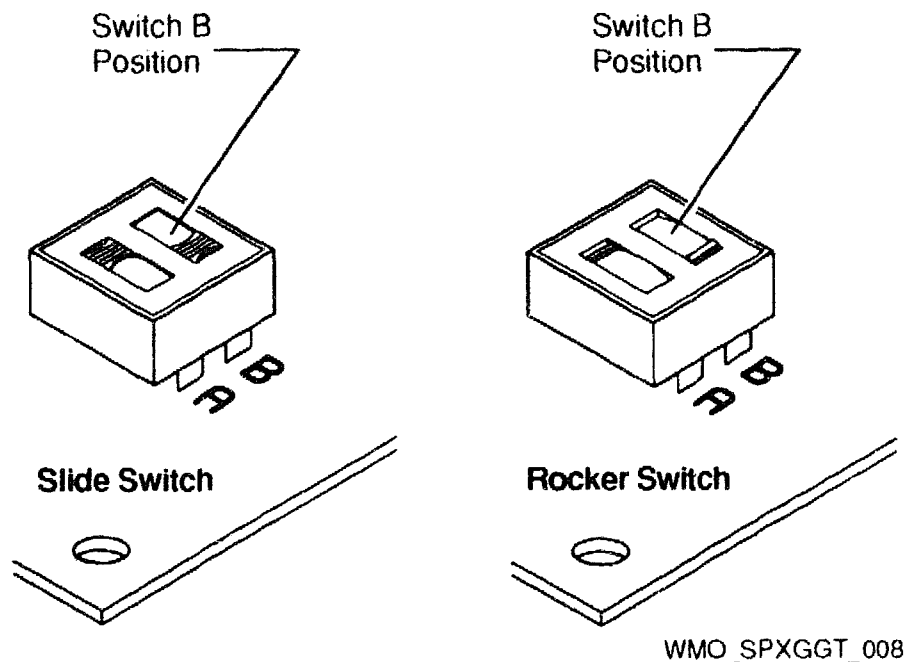
Reassemble the option assembly with the new FRU as follows:

- 1 If the new FRU is a SIMM, install it on the frame buffer module.
- 2 Check switch B setting.

Before installing the PV61G-BA, make sure that switch B of the two-switch package on the frame buffer module is in the position shown in Figure 2-2. The switch may be a slide switch or rocker switch, as shown.

The switch package is located as shown in Figure 2-4. The switch labels A and B are on the module. Ignore any switch identifiers on the switch package. If you must reset switch B, use a small stylus, such as a ball-point pen, to set the switch to the correct position. Switch A is not used and can be in either position.

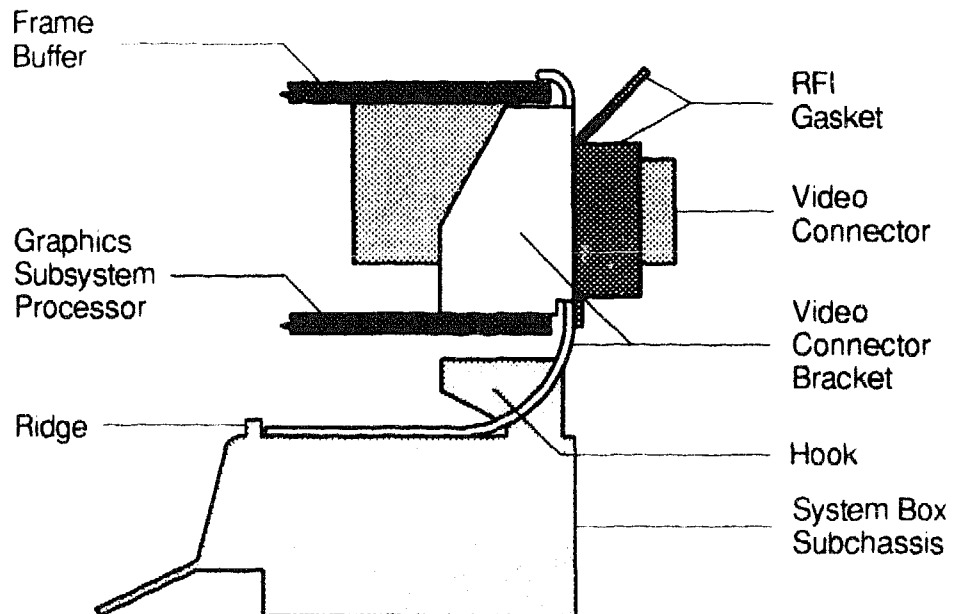
Figure 2-2 Switch B Position



- 3 If the modules were separated, align and mate the graphics subsystem processor and frame buffer module inter-module connectors.
- 4 Install the RFI gasket.

See Figure 2-3. Press the RFI gasket over the video connector on the graphics subsystem processor module. The angled top and sides of the gasket face away from the connector bracket. This compresses the gasket between the connector and system box when the option is installed.

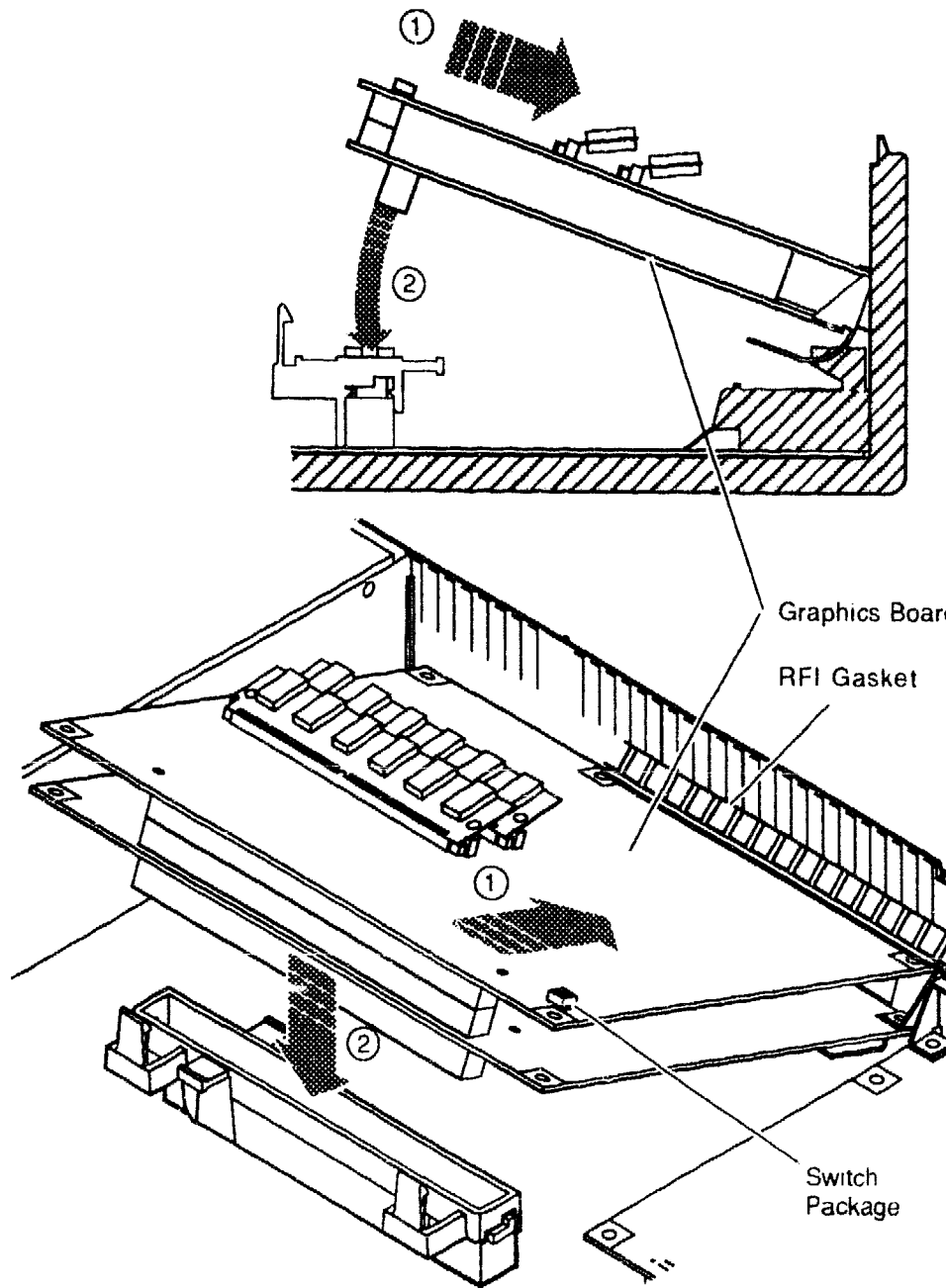
Figure 2-3 Installation Details



WMO_SPXGGT_009

- 5 See Figure 2-4. Carefully tilt the assembly into position ①. The two hooks on the system box subchassis slip through the square holes in the lower curve of the connector bracket. The bottom surface of the connector bracket sits on the subchassis, held in place by the hooks and the square ridge on the subchassis. Figure 2-3 is a detailed side view.
- 6 With the assembly in position, align the graphics subsystem processor and system module inter-module connectors. Mate the connectors by pressing down on the frame buffer module above the inter-module connectors ②. The board latches should snap into place to secure the 3D graphics option assembly.

Figure 2-4 **Installing the PV61G-BA 8-Plane Option**



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2.2 PV61G-AA 24-Plane Option

The PV61G-AA 24-plane option includes the following (the modules, connector bracket, and and tail bracket are pre-assembled):

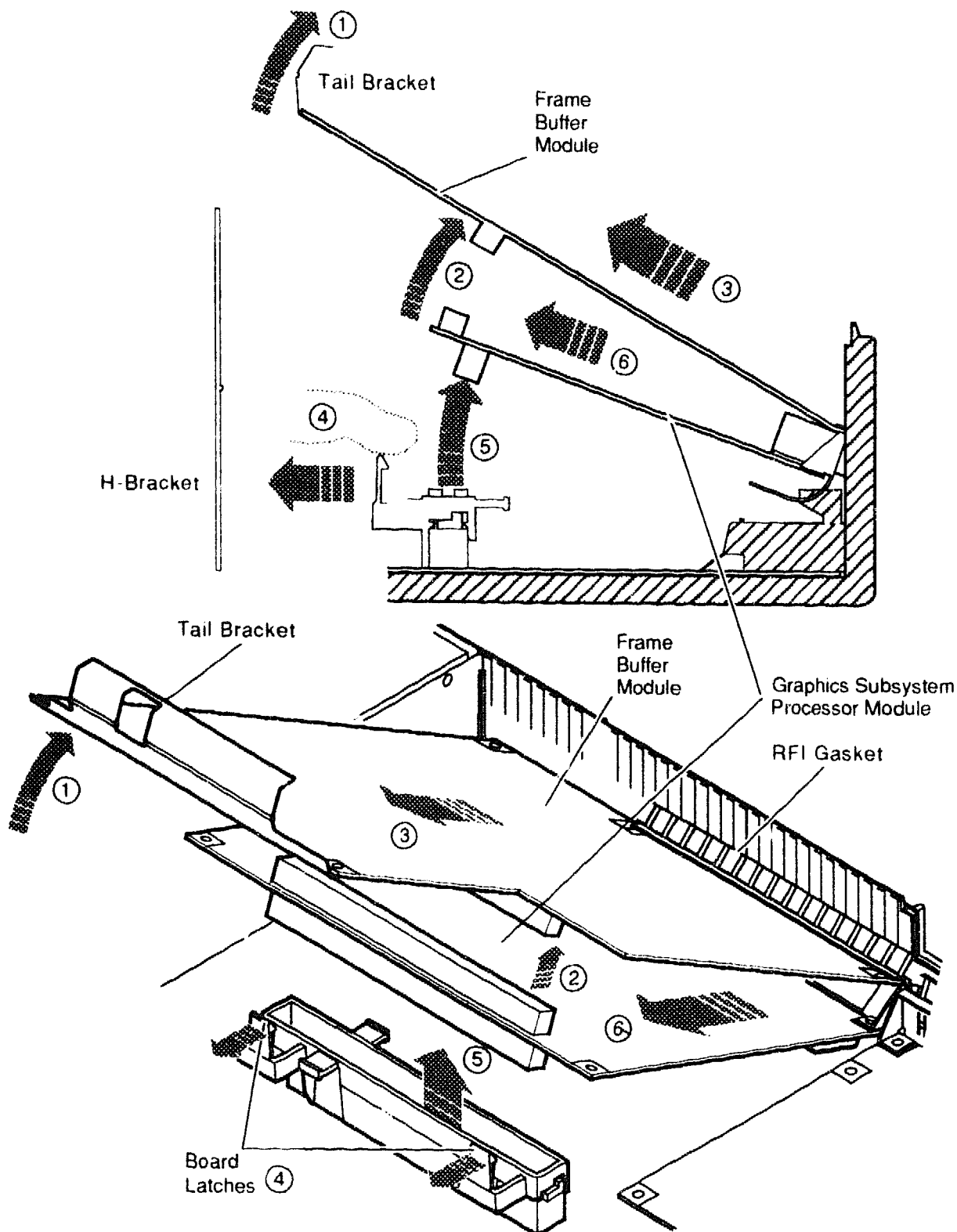
- One graphics subsystem processor module
- One 24-plane frame buffer module
- Plastic module clip (attached to graphics subsystem processor and frame buffer modules)
- Video connector bracket (attached to graphics subsystem processor module)
- Frame buffer module tail bracket (attached to the frame buffer module)
- Radio frequency interference (RFI) gasket
- Board latch

2.2.1 Removing the PV61G-AA 24-Plane Option

The shape and size of the 24-plane frame buffer module prohibits removing the PV61G-AA as an assembly. See Figure 2–5 and remove the components as follows:

- 1 Turn off system power, move the monitor, and open the system unit cover as described in Section 1.1.
- 2 Remove the plastic clip (not shown) that holds the graphics subsystem processor module to the frame buffer module.
- 3 Lift the frame buffer tail bracket to free it from the ridge on the disk drive H-bracket ❶.
- 4 Gently work the frame buffer module loose from the graphics subsystem processor inter-module connectors ❷. The graphics subsystem processor module remains connected to the system module.
- 5 Pull the frame buffer free of the RFI gasket ❸. The gasket will remain in place, held by the video connector bracket on the graphics subsystem processor module.
- 6 Release the board latches ❹ and lift the graphics subsystem processor module free of the system module connector ❺.

Figure 2-5 Removing the PV61G-AA 24-Plane Option



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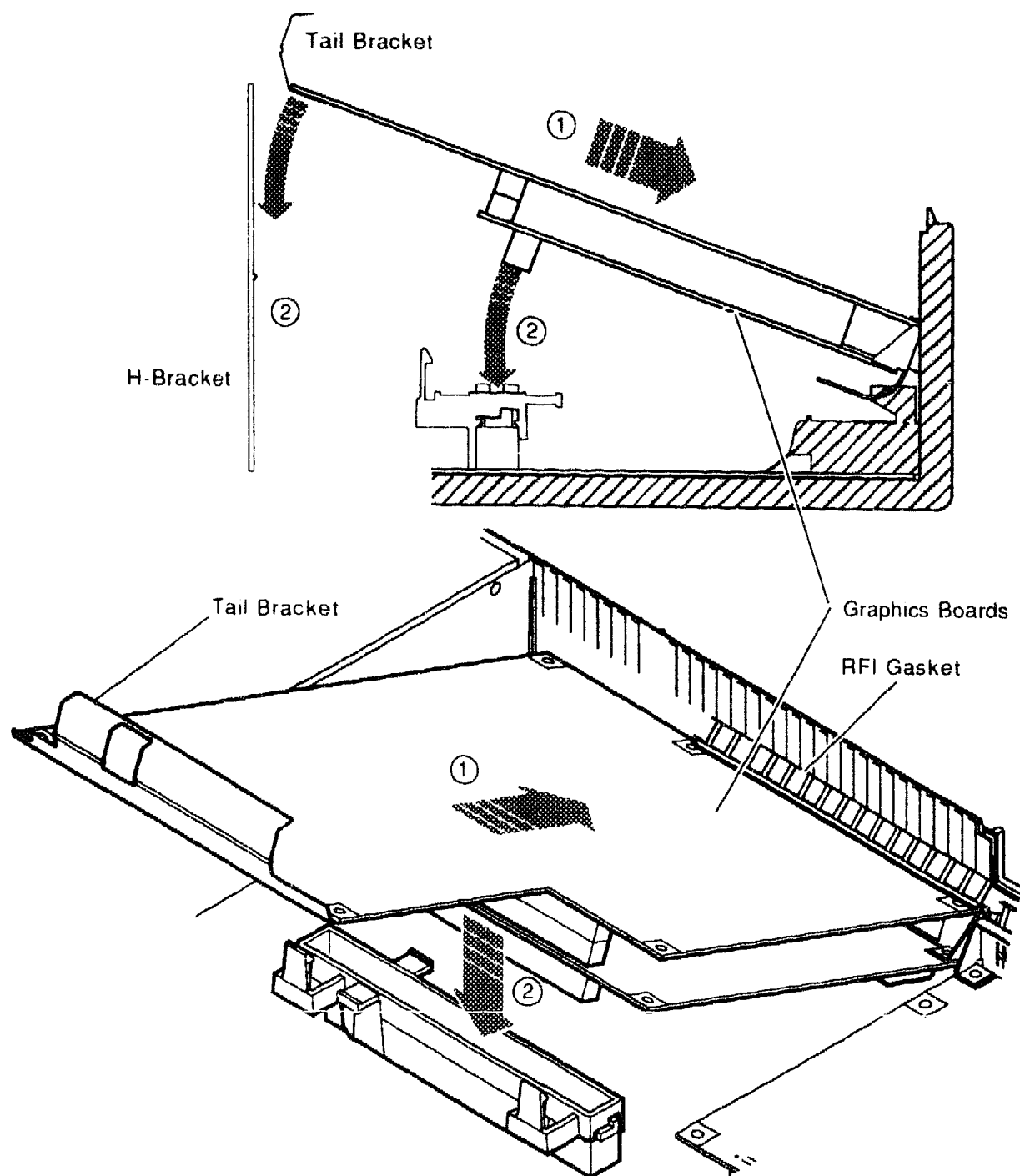
- 7 Remove the graphics subsystem processor module from the system box ⑤.
- 8 Remove the failed FRU.

2.2.2 Replacing the PV61G-AA 24-Plane Option

Reassemble the option assembly with the new FRU as follows:

- 1 Align and mate the graphics subsystem processor and frame buffer module inter-module connectors.
- 2 Install the RFI Gasket
See Figure 2-3. Press the RFI gasket over the video connector on the graphics subsystem processor module. The angled top and sides of the gasket face away from the connector bracket. This compresses the gasket between the connector and system box when the option is installed.
- 3 See Figure 2-6. Carefully tilt the assembly into position ①. The two hooks on the system box subchassis slip through the square holes in the lower curve of the connector bracket. The bottom surface of the connector bracket sits on the subchassis, held in place by the hooks and the square ridge on the subchassis. Figure 2-3 is a detailed side view.
- 4 With the assembly in position, align the graphics subsystem processor and system module inter-module connectors. Mate the connectors by pressing down on the frame buffer module above the inter-module connectors ②. The board latches should snap into place and the frame buffer module tail bracket should snap over the ridge on the disk drive H-bracket to secure the 3D graphics option assembly.

Figure 2-6 Installing the PV61G-AA 24-Plane Option



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Restoring the System

This chapter tells you how to restore the system after you have installed a 3D graphics option. It describes how to close the system unit, restart and test the system, and handle problems.

3.1 Closing the System Unit

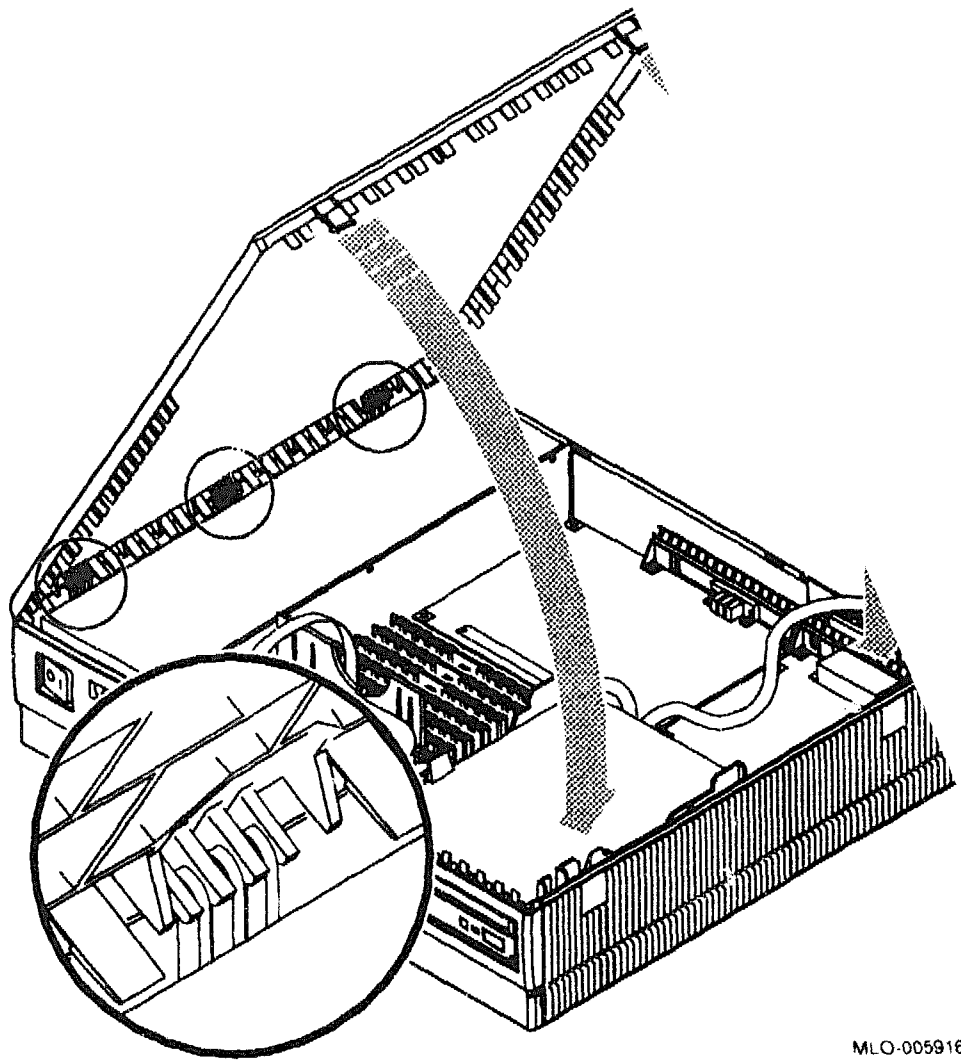
Warning *Failure to replace the system cover before turning on the system is a potential fire hazard.*

Warning *When replacing the system unit cover, do not touch the plastic teeth on the top edge of the removable media bezel or the blank bezel.*

- 1 See Figure 3-1. Mesh the teeth on the cover with the teeth on the side of the system unit. Then lower the cover until the cover latches click into the depressions on the side of the system unit. Press firmly on the front and rear edges of the cover until you hear a click from each.
- 2 Replace the monitor on top of the system unit.

Warning *The monitor is heavy and you may need the help of another person to lift it.*

Figure 3-1 Replacing the System Un



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3.2 Restarting the System

Caution *The video connector on the 3D graphics options is mounted **upside down** with respect to the video connector on 2D graphics modules. The monitor video cable has a tendency to develop a “set” in the position in which it was originally installed. It is possible to force the cable over the connector in the inverted position. When connecting the cable to the new 3D graphics options, be sure the connector is correctly oriented.*

- 1 Reconnect the monitor video cable.
- 2 Reconnect the monitor power cord to the system unit.
- 3 Reconnect the system unit power cord to the power receptacle.

- 4 To start the system, turn the equipment on (|) in the following order:
 - a Expansion boxes
 - b Printer and modem
 - c Monitor.
 - d System unit
- 5 If there is no display or the display is unintelligible, see Section 3.5.1.
- 6 If a graphics error message is displayed, see Section 3.3.1.

3.3 Testing the System

When power is applied, the system automatically runs self test. You should do additional testing with the SHOW CONFIG console command followed by the system exerciser (TEST 100/101/102) console command. These tests are described in Sections 3.3.1 through 3.3.3.

3.3.1 Automatic Self Test Error Messages

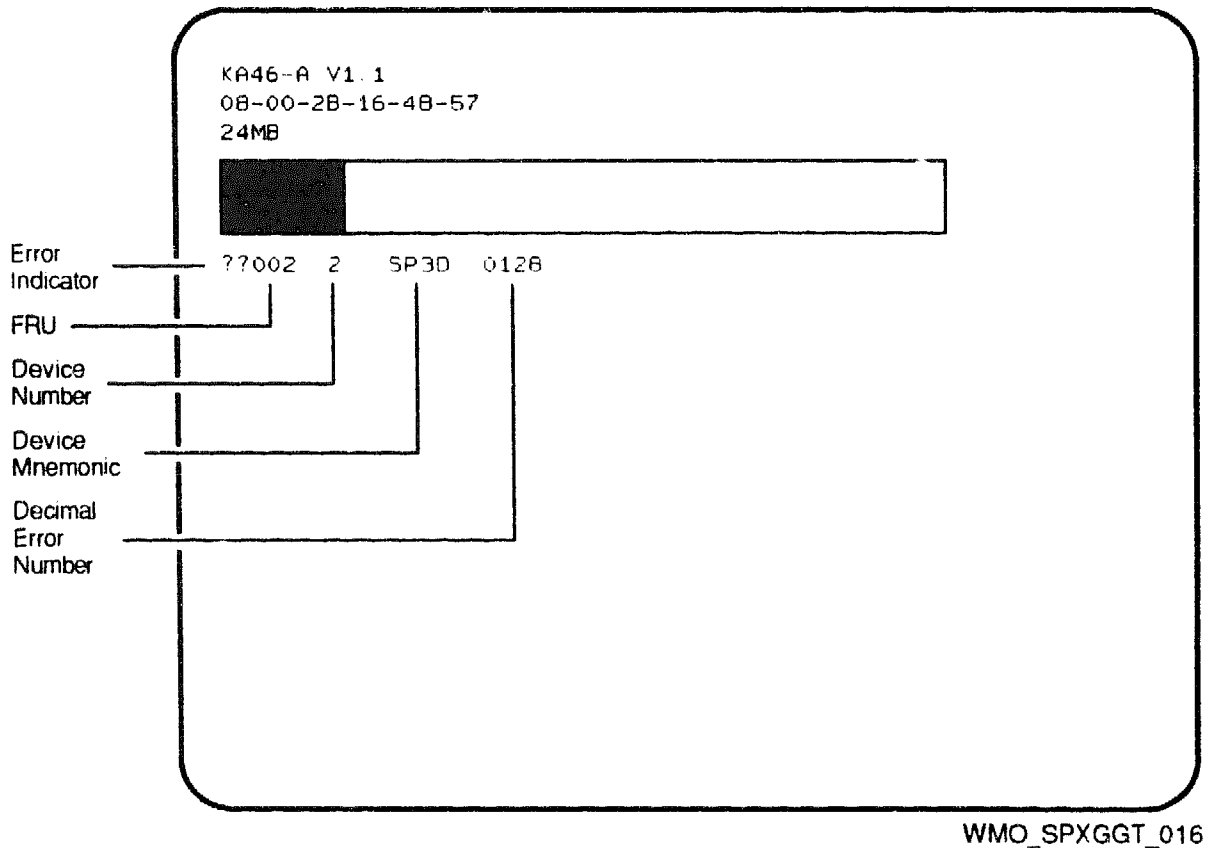
Figure 3-2 shows an automatic self test display with a graphics error message. The Field Replaceable Unit (FRU) is the failing 3D graphics option module. The FRUs and numbers are listed in Table 3-1 along with the part numbers. The error number is the decimal number of the test that the 3D graphics option failed. The tests are described in Appendix A. The error numbers and tests are listed in Table A-2.

You can display additional error information with the SHOW ERROR console command as described in Section A.1.1.

To correct the problem indicated by a graphics error message, see Section 3.5.2.

If automatic self test displays an error or status message for any other system device or component, see the *VAXstation 4000 Model 60 Service Information*.

Figure 3-2 Self Test Display with Error Message



3.3.2 Show System Configuration

- 1 If the console mode prompt is not displayed, put the system into console mode by pressing the Halt button on the front of the system unit (Figure 1-1).
- 2 Display the current system configuration using the SHOW CONFIG command (Figure 3-3). Compare the current configuration display with the configuration information you recorded when preparing the system for the 3D graphics option replacement.

Note Figure 3-3 shows the graphics line for the PV61G-BA 8-plane option. The graphics line for the PV61G-AA 24-plane option is similar, but "SPXGT" replaces "SPXG".

- 3 If you see any error messages on the graphics line, see Section A.1.2.

If an error message is displayed for any other system device or component, see the *VAXstation 4000 Model 60 Service Information*.

Figure 3-3 Current SHOW CONFIG Command Display

Graphics Lines

```

>>> SHOW CONFIG

KA46-A V1.1
08-00-2B-16-48-57
24MB
  
```

DEVNBR	DEVNAM	INFO
1	NVR	OK
2	SP3D	OK
3	DZ	OK
4	CACHE	OK
5	MEM	OK
6	FPU	OK
7	IT	OK
8	SYS	OK
9	NI	OK
10	SCSI	OK
11	AUD	OK
12	COMM	OK

```

24MB =S1=8MB, S0/1=8MB, S2/3=8MB, S4/5=0MB
0-RZ23L 2-TZK10 5-RZ24 6-INTR
>>>
  
```

WMO_SPXGGT_012

3.3.3 Run the System Exerciser

The system exerciser commands are:

T100 — Customer mode

T101 and T102 — Digital Services mode

- 1 If the console mode prompt is not displayed, put the system into console mode by pressing the Halt button on the front of the system unit (Figure 1-1).

Note Before using T101 or T102, the diagnostic environment must be set to 2, for example:

```
>>> SET DIAG 2
```

For more information, see the VAXstation 4000 Model 60 Service Information.

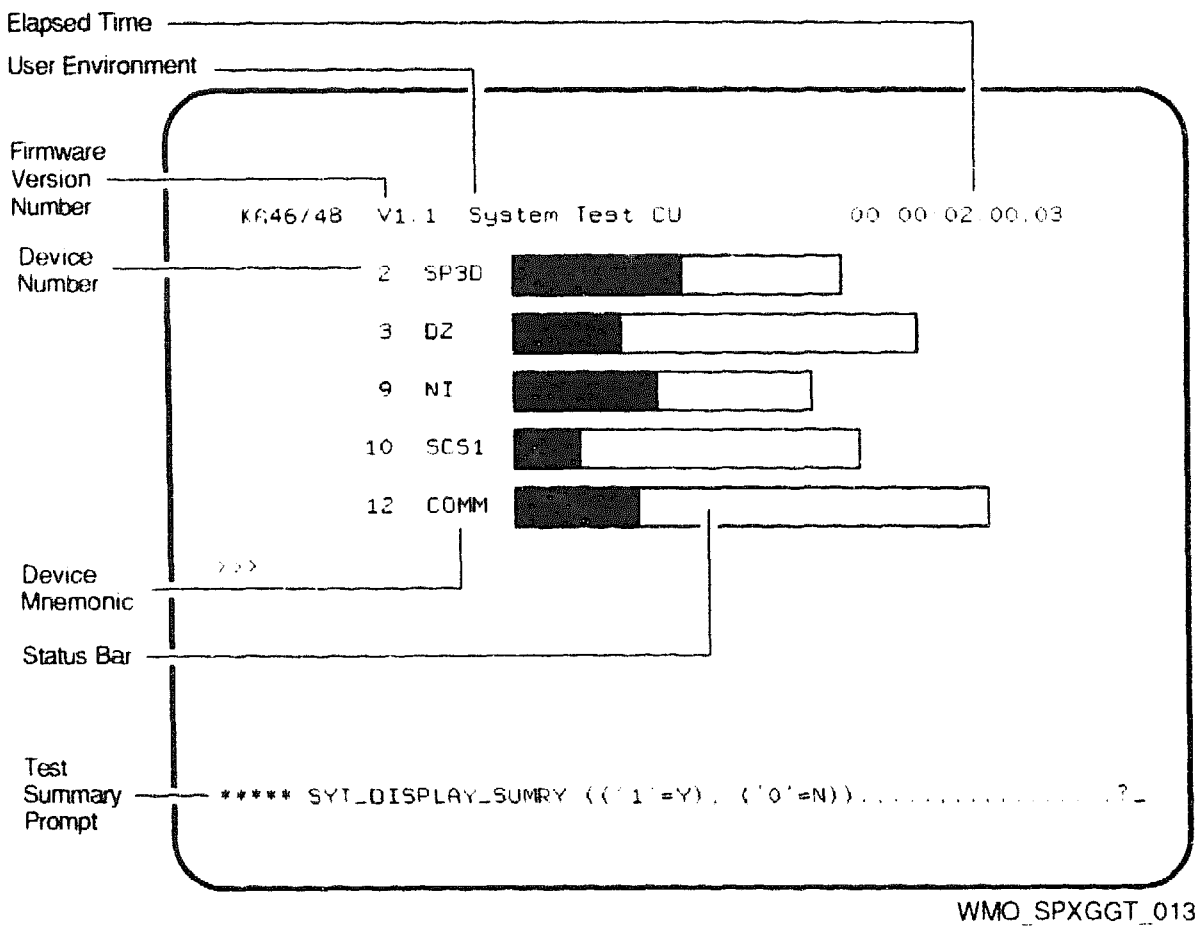
- 2 Run the system exerciser and verify that the system devices and components are interacting correctly.

Note *The 2D graphics and 3D graphics system exerciser displays are significantly different.*

When the the TEST 100 command is executed with one of the 3D graphics options installed, the first display consists of gray-shaded diagonal bars drawn continuously between the four sides of the screen. The dynamic diagonal bar display continues to fill the screen for approximately 30 seconds. The screen is then cleared and the device status display begins. Figure 3-4 shows a typical normal device status display.

The “checkerboard” pattern (shown in the *VAXstation 4000 Model 60 Owner’s and System Installation Guide*) does not appear at the bottom of the system exerciser display. That pattern is generated by 2D graphics modules.

Figure 3-4 System Exerciser Device Status Display



- 3** If a 3D graphics option (SP3D) error message is displayed, see Section A.1.2.1.
- If an error message is displayed for any other system device or component, see the *VAXstation 4000 Model 60 Service Information*.

3.4 Field Replaceable Units

Table 3-1 lists the FRUs and part numbers.

Table 3-1 Field Replaceable Units

FRU Number	FRU Description	Part Number
000	No failure	—
001	Graphics subsystem processor module	54-20450-01
002	Frame buffer module (8-plane)	54-20452-01
	Frame buffer module (24-plane)	54-20854-01
003	Graphics subsystem processor module or frame buffer module	—
004	Single in-line memory module (SIMM) 1	54-20454-01
008	SIMM 2	54-20454-01

3.5 Handling Problems

Problems with the PV61G-BA or PV61G-AA 3D graphics options can appear as display problems, such as no display or an unintelligible display, or error messages.

3.5.1 Display Problems

If there is no display after two minutes, the display is not synchronized, or the display is otherwise unintelligible:

- Check the diagnostic LEDs. Table A-5 shows the LED error codes and corresponding diagnostic tests.
- Make sure that all cables and cords are properly connected and that the monitor video cable is correctly oriented.
- Make sure that the monitor power switch is on (|).
- Adjust the monitor brightness and contrast controls.
- Turn off system power as described in Section 1.1.
 - 1 Make sure the alternate console switch is off (down). See the *VAXstation 4000 Model 60 Service Information* for more information about this switch.
 - 2 Check the monitor fuse. See the monitor manual for fuse replacement instructions.
 - 3 Move the monitor and open the system unit cover as described in Section 1.1.
 - 4 Make sure that all the modules are correctly seated.

- 5** Close the system unit and restart the system as described in Sections 3.1 and 3.2.

If you continue to have 3D graphics option display problems, replace the 3D graphics option.

3.5.2 Error Messages

If a graphics error message is displayed:

- 1** Write down the error information.
- 2** Turn off system power, move the monitor, and open the system unit cover as described in Section 1.1.
- 3** Make sure that all the modules are correctly seated.
- 4** Close the system unit and restart the system as described in Sections 3.1 and 3.2.

If the graphics error message reappears, replace the failing FRU.

Diagnostics and Utilities

This appendix describes the diagnostic tests and utilities resident in the PV61G-BA and PV61G-AA self-test ROM.

A.1 Test Overview

The self-test and SHOW CONFIG displays and error messages are described in Chapter 3. Table A-1 repeats Table 3-1 and lists the FRUs. This appendix provides additional fault isolation information about the error.

A.1.1 SHOW ERROR Command

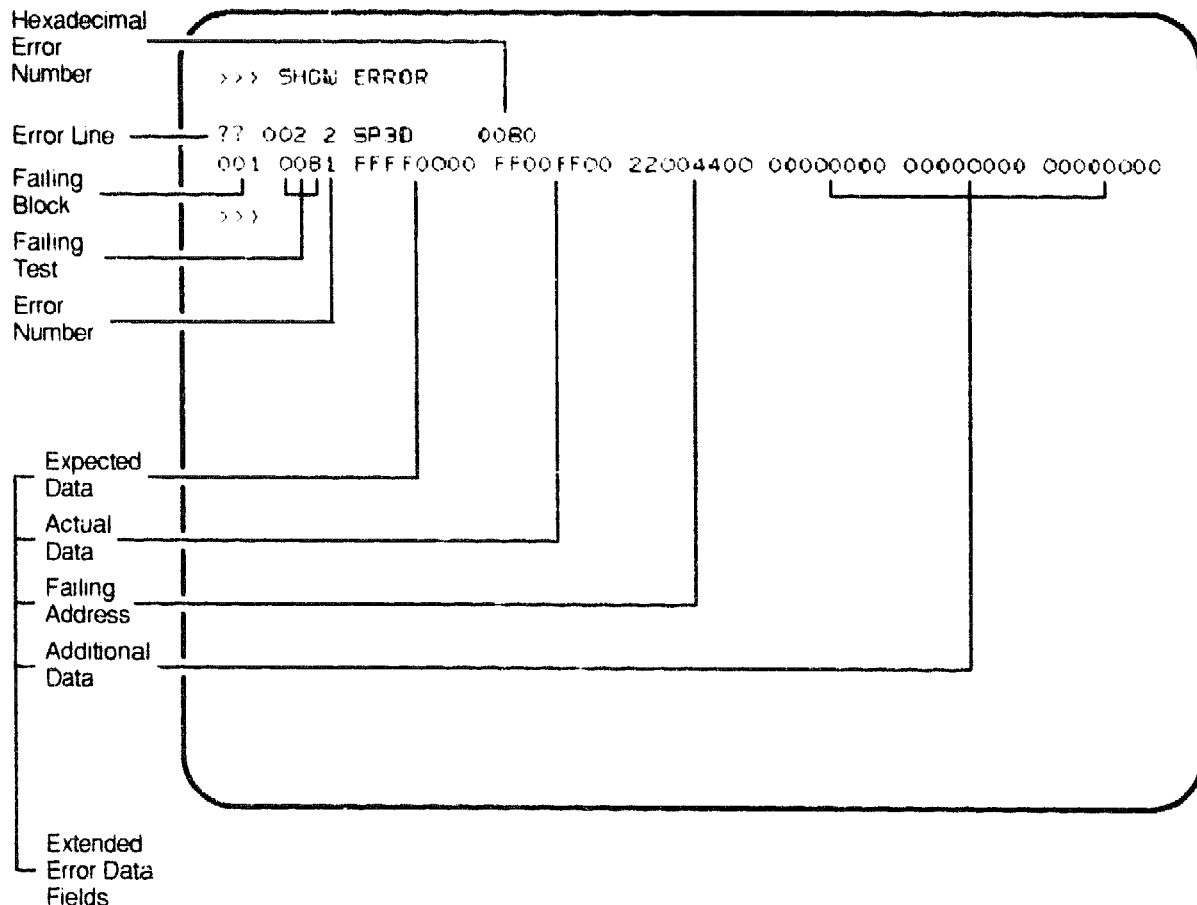
When self test (Section 3.3.1) or the SHOW CONFIG command (Section 3.3.2) displays an error message, you can display additional error information by executing the SHOW ERROR console command. Figure A-1 shows the additional error information displayed for an error. The information is interpreted as follows:

- The error line is similar to the initial error information; however, in this display the error number is a hexadecimal number.
- The failing block is the functional block where the error was detected. The hexadecimal block numbers and descriptions are listed in Table A-3.
- The failing test corresponds to the error number in the initial error line. It is the number of the test that the 3D graphics option failed. The test numbers are listed in Table A-2.
- The hexadecimal error number identifies the specific test function that failed. The tests are listed in Table A-2 and described in Sections A.2.1 through A.2.39.

- The six 8-digit fields are used (or not) according to specific test and error reporting requirements. As shown in Figure A-1, most of the diagnostic tests use the first three fields for expected data, actual data, and an address. The fields are described in Tables A-85 through A-9.

Figure A-1 shows the error and extended error information for a failing ScanProc Register Test. The test and error information are described in Section A.2.8 and Tables A-22 and A-23.

Figure A-1 SHOW ERROR Command Display



WMO_SPXGGT_028

A.1.2 SHOW CONFIG Error Messages

Figure A-2 is a SHOW CONFIG display with a graphics error message. The FRU is the failing 3D graphics option module. The FRUs and numbers are listed in Table A-1. The decimal error number is the number of the test that the 3D graphics option failed. Note that this is the same error reported in Figure A-1

with a hexadecimal number. The tests are listed in Table A-2 and described in Sections A.2.1 through A.2.39.

You can display additional error information with the **SHOW ERROR** console command, as described in Section A.1.1.

To correct the problem indicated by a graphics error message, see Section 3.5.2.

Figure A-2 Current SHOW CONFIG Command Error Display

	>>> SHOW CONFIG		
	KA46-A V1.1		
	08-00-2B-16-4B-57		
	24MB		
	DEVNBR	DEVNAM	INFO
Error Indicator	1	NVR	OK
	2	SP3D	?? 002 0128
FRU of Failed Device	3	DZ	OK
	4	CACHE	OK
Decimal Error Number	5	MEM	OK
	6	FPU	24MB =SY=8MB, 50/1=8MB, 52/3=8MB, 54/5=0MB
	7	IT	OK
	8	SYS	OK
	9	NT	OK
	10	SCSI	OK
			0-R223L 2-T2K10 5-R224 6-IN1TR
	11	AUD	OK
	12	COMM	OK
	>>>		

WMO_SPXGGT_017

Table A-1 Field Replaceable Units

FRU Number	FRU Description	Part Number
000	No failure	—
001	Graphics subsystem processor module	54-20450-01
002	Frame buffer module (8-plane)	54-20452-01
	Frame buffer module (24-plane)	54-20854-01
003	Graphics subsystem processor module or frame buffer module	—
004	Single in-line memory module (SIMM) 1	54-20454-01
008	SIMM 2	54-20454-01

A.1.2.1 System Exerciser Error Messages

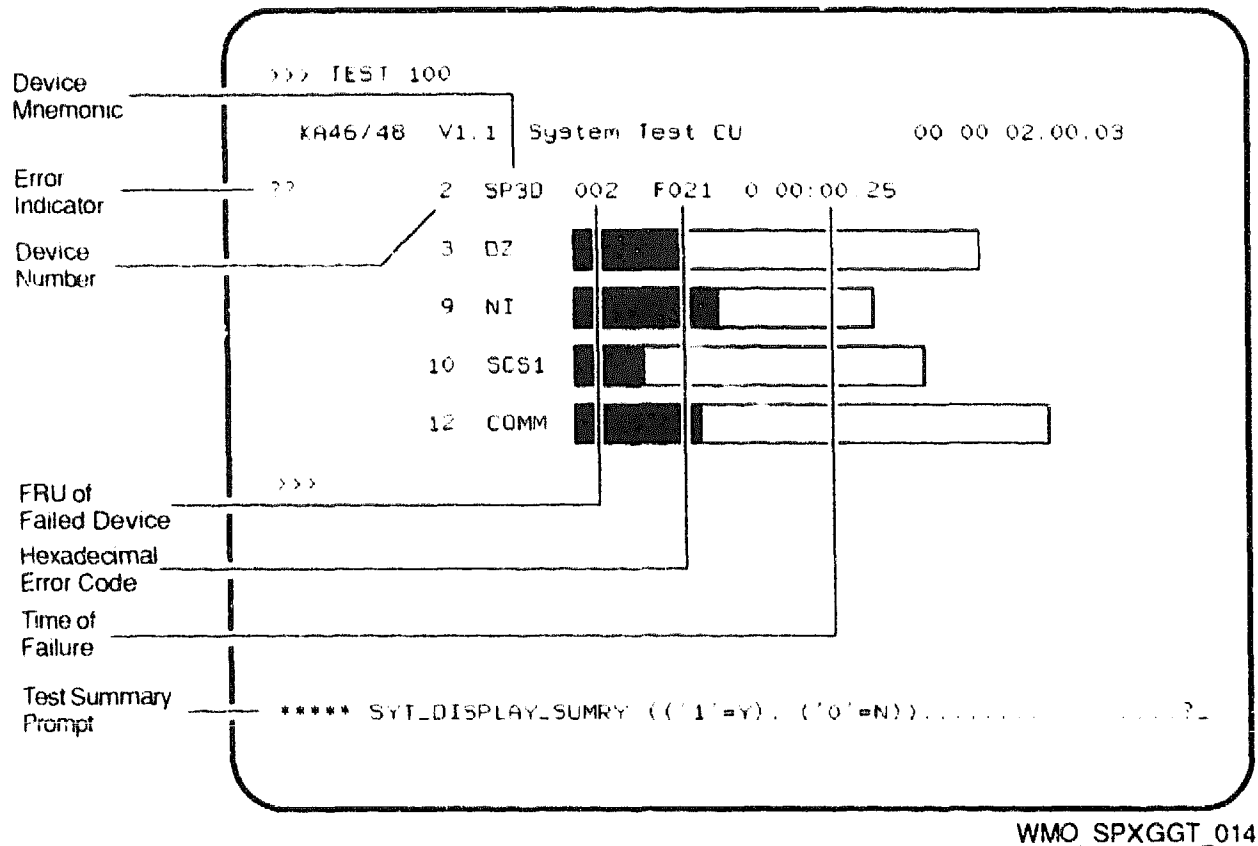
Figure A-3 shows a system exerciser display with a 3D graphics option error. Note that this is a different error than the one shown in Figures A-1 and A-2. The FRUs and numbers are listed in Table A-1. The hexadecimal error codes are listed and described in Table A-4.

You can display additional information if you type 1 (yes) in response to the test summary prompt (see Section A.1.3). If you type 0 (no) in response to the test summary prompt, the system halts, displays a halt message, and returns you to the console prompt; for example:

```
?06 HLT INST
    PC=00000F09  PSL=00000000
>>>
```

To correct the problem indicated by a graphics error message, see Section 3.5.2.

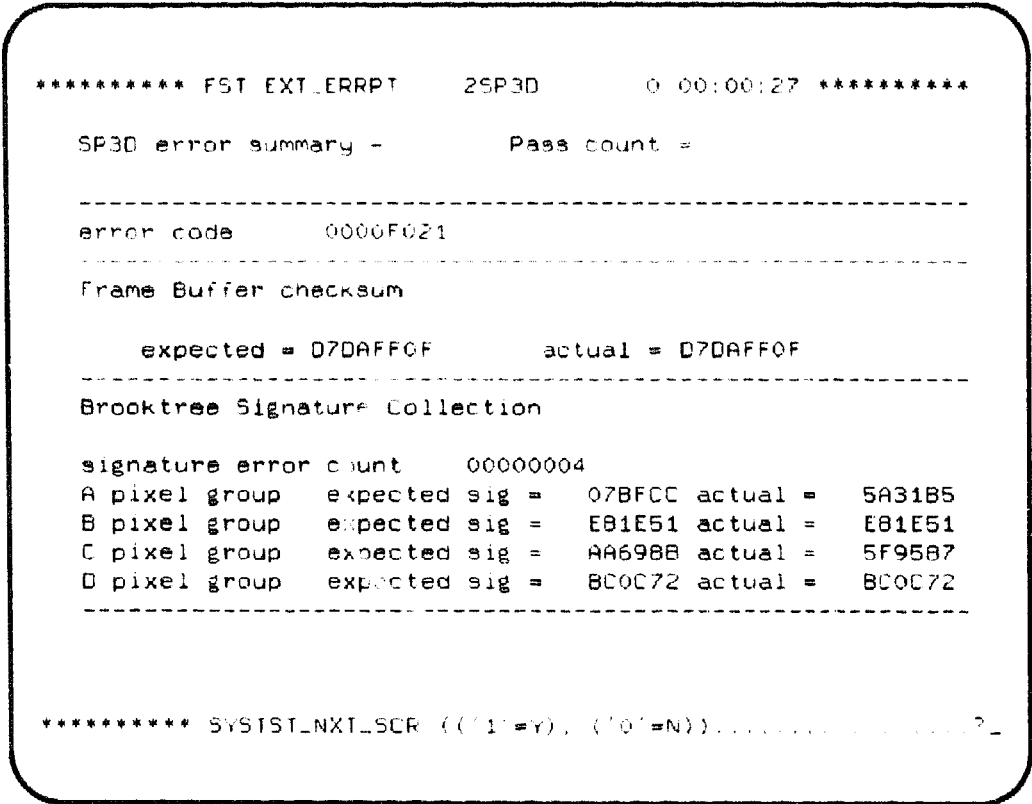
Figure A-3 System Exerciser Device Status Error Display



A.1.3 Test Summary Information

Figure A-4 shows the additional information you can display about a system exerciser error if you answer 1 (yes) to the test summary prompt.

Figure A-4 Test Summary Display



WMO_SPXGGT_015

A.1.4 Test and Error Numbers

Table A-2 lists all the tests in the self-test ROM. The decimal or hexadecimal test number is displayed in the error number field or failing test field, depending on the error message.

Table A-2 Test and Error Numbers

Test/Error Number	Description
0016/0010h ¹	JChip Register Test
0032/0020h	SRAM Test
0048/0030h	FIFO Register Test
0064/0040h	FIFO Auto Increment Location Test

¹Decimal/hexadecimal. The letter h, indicating the hexadecimal number, is not displayed.

(continued on next page)

Table A-2 (Cont.) Test and Error Numbers

Test/Error Number	Description
0080/0050h	FIFO Auto Increment Buffer Test
0096/0060h	i860 Doorbell Test
0112/0070h	Brooktree Register Test
0128/0080h	Scanproc Register Test
0144/0090h	ScanProc SRAM Test
0160/00A0h	i860 ScanProc Register Test
0176/00B0h	VRAM Test
0192/00C0h	Scanproc Basic Rectangle Test
0208/00D0h	Scanproc Clip Rectangle Test
0224/00E0h	Scanproc Fill Rectangle Mask Test
0242/00F0h	Scanproc Draw Logical Ops Test
0256/0100h	Scanproc Copy Rectangle Test
0272/0110h	Scanproc Copy Rectangle Logical Ops Test
0288/0120h	Scanproc Copy Rectangle Mask Test
0304/0130h	ScanProc Copy Stipple Test
0320/0140h	ScanProc Copy Opaque Test
0336/0150h	ScanProc Stream Write Test
0352/0160h	FIFO Transfer Test
0368/0170h	ScanProc External Write Test
0384/0180h	ScanProc Stream Read Test
0400/0190h	LCG DMA Test
0416/01A0h	LCG OTF Test
0432/01B0h	DMA Stream Test
0448/01C0h	OTF Stream Test
0464/01D0h	Auto Increment Location Stream Test
0480/01E0h	Command FIFO OTF Stream Test
0496/01F0h	Command FIFO External Stream Test
0512/0200h	Brooktree Plane Walk Test
0528/0210h	Brooktree Output Signature Test
0544/0220h	Brooktree Off Screen Test
0560/0230h	Brooktree Input Signature Test
0576/0240h	Brooktree Cursor Window Test
0592/0250h	JCHIP Window Test
0608/0260h	Brooktree Analog Compare Test
0624/0270h	Set/Clear Interrupt Test

Table A-3 lists the failing functional blocks called out in SHOW ERROR displays. The Failing Block field points to an area that can be used as a starting point for diagnosing the fault. This does not mean that it is the actual fault, but that the error was detected at that point.

Table A-3 Failing Block

Block Number	Functional Block
001	ScanProc
002	VRAM
003	SIMM1
004	SIMM2
005	JChip
006	i860
007	Cursor Generator 0
008	Cursor Generator 1
009	SRAM
00A	VDAC

Table A-4 describes the system exerciser error codes.

Table A-4 System Exerciser Error Codes

Error Code	Error Description
F000 through F012	Memory allocation failure
F00C	WST initialization failure
F020	Frame buffer checksum failure
F021	Pixel group A signature analysis failure
F022	Pixel group B signature analysis failure
F023	Pixel group C signature analysis failure
F024	Pixel group D signature analysis failure

Table A-5 shows functional areas covered by each of the diagnostic tests and the corresponding LED error codes displayed if any of the functional area tests fails.

Table A-5 Functional Test Areas

Diagnostic LEDs ¹	Functional Area / Test Description	Test Number dec/hex
0000 0000	JChip/SRAM	
	JCHIP Register Test	0016/0010h
	SRAM Test	0032/0020h
	FIFO Register Test	0048/0030h
	FIFO Auto Increment Location Test	0064/0040h
	FIFO Auto Increment Buffer Test	0080/0050h
	FIFO Transfer Test	0352/0160h
0000 0000	i860/ScanProc/Frame Buffer	
	i860 Doorbell Test	0096/0060h
	Brooktree Register Test	0112/0070h
	Scanproc Register Test	0128/0080h
	ScanProc SRAM Test	0144/0090h
	i860 ScanProc Register Test	0160/00A0h
	VRAM Test	0176/00B0h
0000 0000	ScanProc Drawing Operations	
	Scanproc Basic Rectangle Test	0192/00C0h
	Scanproc Clip Rectangle Test	0208/00D0h
	Scanproc Fill Rectangle Mask Test	0224/00E0h
	Scanproc Draw Logical Ops Test	0242/00F0h
	Scanproc Copy Rectangle Test	0256/0100h
	Scanproc Copy Rectangle Logical Ops Test	0272/0110h
	Scanproc Copy Rectangle Mask Test	0288/0120h
	ScanProc Copy Stipple Test	0304/0130h
	ScanProc Copy Opaque Test	0320/0140h
	ScanProc Stream Write Test	0336/0150h
0000 0000	Stream Transfers	
	ScanProc External Write Test	0368/0170h
	ScanProc Stream Read Test	0384/0180h
0000 0000	OTF and Normal DMA	
	LCG DMA Test	0400/0190h
	LCG OTF Test	0416/01A0h
	DMA Stream Test	0432/01B0h
	OTF Stream Test	0448/01C0h
	Auto Increment Location Stream Test	0464/01D0h
	Command FIFO OTF Stream Test	0480/01E0h
	Command FIFO External Stream Test	0496/01F0h
0000 0000	RAMDAC Operations	
	Brooktree Plane Walk Test	0512/0200h
	Brooktree Output Signature Test	0528/0210h

¹ 0 = off. • = on.

(continued on next page)

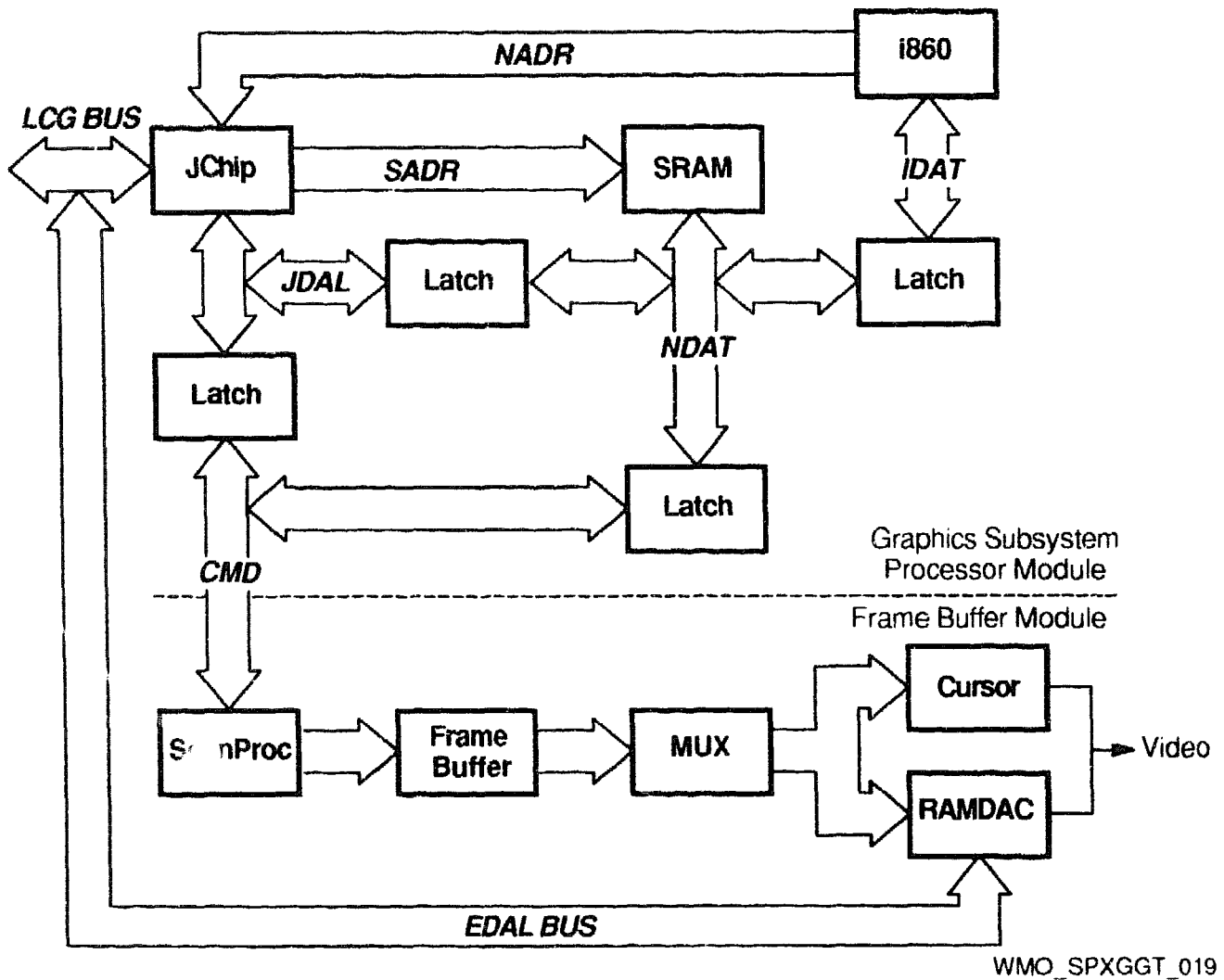
Table A-5 (Cont.) Functional Test Areas

Diagnostic LEDs¹	Functional Area / Test Description	Test Number dec/hex
	Brooktree Off Screen Test	0544/0220h
	Brooktree Input Signature Test	0560/0230h
	Brooktree Cursor Window Test	0576/0240h
	JCHIP Window Test	0592/0250h
	Brooktree Analog Compare Test	0608/0260h
o o o o o o o o	<i>Interrupts</i>	
	Set/Clear Interrupt Test	0624/0270h

¹ o = off. • = on.

Figure A-5 is a simplified block diagram of the 3D graphics options. It shows the functional areas exercised by the diagnostic tests.

Figure A-5 3D Graphics Option Block Diagram



A.1.5 Tested Logic Matrices

Tables A-6 and A-7 show the buses and latches covered in the diagnostic tests.

Table A-6 Test Number to Bus Matrix

Test	LCG Bus	NADR Bus	SADR Bus	JDAL Bus	NDAT Bus	IDAT Bus	CMD Bus	EDAL Bus
0010h	X							
0020h	X		X	X	X			
0030h	X							
0040h	X		X	X	X			
0050h	X		X	X	X			
0060h	X	X	X	X	X	X		
0070h								X
0080h	X			X			X	
0090h	X			X			X	
00A0h	X			X			X	
00B0h	X			X			X	
00C0h	X			X			X	
00D0h	X			X			X	
00E0h	X			X			X	
00F0h	X			X			X	
0100h	X			X			X	
0110h	X			X			X	
0120h	X			X			X	
0130h	X			X			X	
0140h	X		X	X	X			
0150h	X		X	X	X			
0160h	X		X	X	X			
0170h	X		X	X	X			
0180h	X	X	X	X	X	X	X	
0190h	X		X	X	X			
01A0h	X	X	X	X	X	X	X	
01B0h	X		X	X	X		X	
01C0h	X		X	X	X		X	
01D0h	X		X	X	X		X	
01E0h	X		X	X	X		X	
01F0h	X		X	X	X		X	
0200h	X			X			X	X
0210h	X			X			X	X
0220h	X			X			X	X
0230h	X			X			X	X
0240h	X			X			X	X
0250h	X			X			X	X
0260h	X			X			X	X
0270h	X	X	X	X	X	X	X	

Table A-7 Test Number to Latch Matrix

Test	JDAL NDAT Latch	NDAT IDAT Latch	NDAT CMD Latch	CMD JDAL Latch
0010h				
0020h	X			
0030h				
0040h	X			
0050h	X			
0060h	X	X	X	
0070h				X
0080h				X
0090h				X
00A0h				X
00B0h				X
00C0h				X
00D0h				X
00E0h				X
00F0h				X
0100h				X
0110h				X
0120h				X
0130h				X
0140h	X		X	X
0150h	X		X	X
0160h	X		X	X
0170h	X		X	X
0180h	X	X	X	X
0190h	X			
01A0h	X	X		
01B0h	X	X	X	X
01C0h	X	X	X	X
01D0h	X	X	X	X
01E0h	X	X	X	X
01F0h	X	X	X	X
0200h				X
0210h				X
0220h				X
0230h				X
0240h				X
0250h				X
0260h				X
0270h	X	X	X	X

A.2 Test Descriptions

The following sections describe each test and the extended error information (Figure A–1) for each test.

Note *The test descriptions do not indicate failing FRUs. A failing test is indicated in an error message and the same error message also indicates the failing FRU(s).*

Note that each test description includes two tables: an error summary table and an extended error information table. The test error summary table lists the error number and description for each error detected by the test. The extended error information table describes the contents of the six eight-digit extended error information fields for each error detected by the test.

A.2.1 JChip Register Test

Test Number: 0016/0010h

This test verifies the data path to most of the JChip registers.

Table A–8 JChip Register Test Error Summary

Error	Description
1	JChip data bus error
2	JChip register verify error
3	JChip register decode error

Table A–9 Extended Error Information

Error	Field	Description
1–3	1	Expected data
1–3	2	Actual data
1–3	3	Failing address
1–3	4–6	Unused

A.2.2 SRAM Test

Test Number: 0032/0020h

This test verifies every cell in the static RAM on the graphics subsystem processor module. It also ensures that there are no shorts between the two banks.

Table A-10 SRAM Test Error Summary

Error	Description
1	SRAM address path failure
2	SRAM data path failure
3	SRAM verify cell failure
4	SRAM bank select failure

Table A-11 Extended Error Information

Error	Field	Description
1-4	1	Expected data
1-4	2	Actual data
1-4	3	Failing address
1-4	4-6	Unused

A.2.3 FIFO Register Test

Test Number: 0048/0030h

This test verifies the functionality of all the FIFO registers by accessing the auto increment registers.

Table A-12 FIFO Register Test Error Summary

Error	Description
1	FIFO register functionality failure
2	FIFO forced alignment functionality failure

Table A-13 Extended Error Information

Error	Field	Description
1, 2	1	Expected data
1, 2	2	Actual data
1, 2	3	Failing address
1, 2	4-6	Unused

A.2.4 FIFO Auto Increment Location Test

Test Number: 0064/0040h

This test verifies the functionality of the auto increment long-converted and unconverted locations.

Table A-14 FIFO Auto Increment Location Test Error Summary

Error	Description
1	Error in AIL write to SRAM
2	Error in AIL writing to converted SRAM location
3	Error in AIL read from SRAM
4	Error in AIL converted write to SRAM
5	Error in AIL converted not writing to unconverted SRAM location
6	Error in AIL converted read from SRAM
7	Error DECF to IEEE convert — decf.exp=0 && decf.sign=1
8	Error DECF to IEEE convert — decf.exp=0 && decf.sign=0
9	Error DECF to IEEE convert — decf.exp=3
10h	Error DECF to IEEE convert — decf.exp=2
11h	Error DECF to IEEE convert — decf.exp=1

Table A-15 Extended Error Information

Error	Field	Description
1, 2, 4, 5, 7-11	1	Expected data
1, 2, 4, 5, 7-11	2	Actual data
1, 2, 4, 5, 7-11	3	Failing address
1, 2, 4, 5, 7-11	4-6	Unused
3, 6	1	Expected data
3, 6	2	Actual data
3, 6	3	Auto increment location
3, 6	4	Get register value
3, 6	5	Put register value
3, 6	6	Free locations register Value

A.2.5 FIFO Auto Increment Buffer Test

Test Number: 0080/0050h

This test verifies the functionality of the auto increment buffer address range. It will test both the JChip and ScanProc address /data pair in the SRAM.

Table A-16 FIFO Auto Increment Buffer Test Error Summary

Error	Description
1	Error in FIFO put register for AIB writes
2	Error in FIFO free register for AIB writes
3	Error in expected address in SRAM for AIB writes
4	Error in expected data in SRAM for AIB writes
5	Error in expected address in SRAM for AIB writes
6	Error in expected data in SRAM for AIB writes

Table A-17 Extended Error Information

Error	Field	Description
1	1	Expected Data
1	2	Actual Data
1	3	Put pointer value
1	4	AIB value
1	5, 6	Unused
2	1	Expected Data
2	2	Actual Data
2	3	Free locations pointer value
2	4	AIB value
2	5, 6	Unused
3, 5	1	Expected Data
3, 5	2	Actual Data
3, 5	3	SRAM address
3, 5	4	AIB value
3, 5	5, 6	Unused
4, 6	1	Expected Data
4, 6	2	Actual Data
4, 6	3	SRAM address
4, 6	4-6	Unused

A.2.6 i860 Doorbell Test

Test Number: 0096/0060h

This test verifies the ability of the i860 to write to the JChip Doorbell Registers.

Table A-18 i860 Doorbell Test Error Summary

Error	Description
1	Timeout waiting for i860 to write Doorbell Register failure

Table A-19 Extended Error Information

Error	Field	Description
1	1	Expected data
1	2	Actual data
1	3	JChip Doorbell Register address
1	4-6	Unused

A.2.7 Brooktree Register Test

Test Number: 0112/0070h

The Brooktree register test verifies the ability to read and write to the registers through the LCG Bus.

Table A-20 Brooktree Register Test Error Summary

Error	Description
1	Brooktree DAC data path failure
2	Brooktree DAC C0:C1 decode failure
3	Brooktree DAC register verify failure
4	Brooktree DAC register decode failure
5	Cursor generator register verify failure
6	Cursor generator register decode failure
7	Cursor generator RAM failure
8	Brooktree DAC MOD3 register verify failure
9	Brooktree DAC color palette verify failure
10h	Brooktree DAC cursor RAM verify failure
11h	Brooktree DAC window table verify failure
12h	Cursor generator data path failure
13h	Cursor generator C0:C1 decode failure

Table A-21 Extended Error Information

Error	Field	Description
1, 3, 5, 7, 12	1	Expected data
1, 3, 5, 7, 12	2	Actual data
1, 3, 5, 7, 12	3	Failing address
1, 3, 5, 7, 12	4-6	Unused
2, 13	1	Expected address low data
2, 13	2	Actual address low data
2, 13	3	Address low
2, 13	4	Expected address high data
2, 13	5	Actual address high data
2, 13	6	Address high
4, 6	1	Expected data
4, 6	2	Actual data
4, 6	3	Failing address
4, 6	4	Mask used
4, 6	5	Data pattern
4, 6	6	Unused
8-11	1	Failing address
8-11	2	Expected red data in the upper 16 bits, actual red data in the lower 16 bits
8-11	3	Expected green data in the upper 16 bits, actual green data in the lower 16 bits
8-11	4	Expected blue data in the upper 16 bits, actual blue data in the lower 16 bits
8-11	5, 6	Unused

A.2.8 ScanProc Register Test

Test Number: 0128/0080h

The ScanProc Register Test verifies the Main-Bus and ALU registers for each ScanProc in the system. The ScanProc chip has two register sets, the Main-Bus registers and the ALU registers, that control and define specific functions in the chip.

Table A-22 ScanProc Register Test Error Summary

Error	Description
1	ScanProc ALU 0 register failure
2	ScanProc ALU register failure
3	ScanProc Main-Bus register failure

(continued on next page)

Table A-22 (Cont.) ScanProc Register Test Error Summary

Error	Description
4	ScanProc-Host byte mask failure
5	ScanProc ALU register mask failure
6	ScanProc Main-Bus register mask failure
7	ScanProc mask data register access failure
8	ScanProc Test Output line not set after reset
9	ScanProc internal diagnostic failure

Table A-23 Extended Error Information

Error	Field	Description
1, 8, 9	1	Expected data
1, 8, 9	2	Actual data
1, 8, 9	3	Failing address
1, 8, 9	4-6	Unused
2, 3	1	Expected data
2, 3	2	Actual data
2, 3	3	Failing address
2, 3	4	Failing ScanProc
2, 3	5, 6	Unused
4-7	1	Expected data
4-7	2	Actual data
4-7	3	Failing address
4-7	4	Byte Mask bits
4-7	5	Failing ScanProc
4-7	6	Unused

A.2.9 ScanProc SRAM Test

Test Number: 0144/0090h

This test verifies the scratch memory in each ScanProc chip. The scratch memory has 32 data bits with four mask bits for byte masking operations. Testing is divided into two sections: The first section verifies the scratch data memory data and address. The second section verifies the scratch mask bits for every scratch data location.

Table A-24 ScanProc Scratch RAM Test Error Summary

Error	Description
1	ScanProc scratch RAM addressing failure detected
2	ScanProc scratch RAM data failure detected
3	ScanProc scratch RAM mask data failure detected

Table A-25 Extended Error Information

Error	Field	Description
1	1	First address line under test
1	2	Second address line under test
1	3	Resulting ScanProc scratch RAM addressing error
1	4	ScanProc number under test
1	5, 6	Unused
2, 3	1	Expected data loaded into scratch RAM
2, 3	2	Actual data read for scratch RAM
2, 3	3	Internal scratch RAM address (address range 0-79)
2, 3	5	Scratch Ram address
2, 3	6	ScanProc number under test

A.2.10 i860 ScanProc Register Test

Test Number: 0160/00A0h

This test verifies the ability of the i860 to read and write to the ScanProc Main and ALU registers.

Table A-26 i860 ScanProc Register Test Error Summary

Error	Description
1	Timeout waiting for i860 test to complete failure
2	Error detected with i860 ScanProc registers failure

Table A-27 Extended Error Information

Error	Field	Description
1	1-6	Unused
2	1	Value in Doorbell Register 1
2	1	Value in Doorbell Register 2
2	1	Value in Doorbell Register 3
2	4-6	Unused

A.2.11 VRAM Test**Test Number: 0176/00B0h**

This test verifies the VRAM/SIMM for the graphics subsystem processor module. Data path testing occurs on every bank of memory followed by byte mask verification. The final section verifies every cell in the full Frame Buffer address space.

Table A-28 VRAM Test Error Summary

Error	Description
1	VRAM data path failure
2	VRAM bank select failure
3	VRAM address line failure (open/short)
4	VRAM Address line failure (address shorted to address)
5	VRAM cell failure

Table A-29 Extended Error Information

Error	Field	Description
1, 2	1	Expected data in VRAM
1, 2	2	Actual data in VRAM
1, 2	3	Virtual address of VRAM location that failed
1, 2	4-6	Unused
3	1	Expected data
3	2	Actual data
3	3	Failing address
3	4	MA_Bus value
3	5	Physical Failing Address
3	6	Virtual Failing Address

(continued on next page)

Table A-29 (Cont.) Extended Error Information

Error	Field	Description
4	1	Expected data
4	2	Actual data
4	3	Failing shorted address
4	4	Failing address
4	5	Physical failing address
4	6	Virtual failing address
5	1	Expected data
5	2	Actual data
5	3	Physical virtual address
5	5	Host Frame Buffer Map value
5	6	Unused

A.2.12 ScanProc Basic Rectangle Test**Test Number: 0192/00C0h**

The ScanProc Draw Solid Rectangle operation is a means of bounding a region in frame buffer memory. This provides a unique means of addressing memory. Tests 0192/00C0h through 0320/0140h are designed to verify the generation of frame buffer addressing during the Draw Solid Rectangle mode of operation.

Table A-30 ScanProc Basic Rectangle Test Error Summary

Error	Description
01	ScanProc timed out drawing the rectangle
02	Rectangle drawn incorrectly in Frame Buffer

Table A-31 Extended Error Information

Error	Field	Description
1	1-6	Unused
2	1	Expected data in Frame Buffer
2	2	Actual data in Frame Buffer
2	3	Frame Buffer address of failure
2	4	X coordinate of failing rectangle
2	5	Y coordinate of failing rectangle
2	6	Unused

A.2.13 ScanProc Clip Rectangle Test

Test Number: 0208/00D0h

This test verifies the ability of the ScanProc to draw an object using a clipping rectangle region. The resulting rectangle in video memory is verified through direct access into the Frame Buffer.

Table A-32 ScanProc Clip Rectangle Test Error Summary

Error	Description
1	ScanProc timed out drawing the rectangle
2	ScanProc failed to clip to clipping rectangle

Table A-33 Extended Error Information

Error	Field	Description
1	1-6	Unused
2	1	Expected data in Frame Buffer
2	2	Actual data in Frame Buffer
2	3	Frame Buffer address of failure
2	4	X coordinate of failing rectangle
2	5	Y coordinate of failing rectangle
2	6	Unused

A.2.14 ScanProc Fill Rectangle Mask Test

Test Number: 0224/00E0h

This test verifies the ability of the ScanProc to draw a rectangle using the destination mask. The test initializes a rectangle with all 0s. The foreground register is set to all 1s.

The destination mask is tested with a floating 1 data pattern and the binary divide data pattern. The resulting rectangle is verified for the correct results.

Table A-34 ScanProc Fill Rectangle Mask Test Error Summary

Error	Description
1	Rectangle drawn incorrectly in Frame Buffer with write masking

(continued on next page)

Error	Description
2	Rectangle drawn incorrectly in Frame Buffer with read masking

Table A-35 Extended Error Information

Error	Field	Description
1, 2	1	Expected data in Frame Buffer
1, 2	2	Actual data in Frame Buffer
1, 2	3	Frame Buffer address of failure
1, 2	4-6	Unused

A.2.15 ScanProc Draw Logical OPs Test

Test Number: 0242/00F0h

This test verifies the Cons_Fill_Basic_Rectangle using the Logical Operation when drawing to the Frame Buffer.

Table A-36 ScanProc Draw Logical OPs Test Error Summary

Error	Description
1	Detected illegal pixel depth for JChip CPORT Format register
2	ScanProc failed to complete the drawing operation
3	Draw rectangle failed with specified logical operation

Table A-37 Extended Error Information

Error	Field	Description
1, 2	1-6	Unused
3	1	Expected data in Frame Buffer
3	2	Actual data in Frame Buffer
3	3	Frame Buffer address of failure
3	4	X coordinate of failing rectangle
3	5	Y coordinate of failing rectangle
3	6	Unused

A.2.16 ScanProc Copy Rectangle Test

Test Number: 0256/0100h

The ScanProc Copy Basic Rectangle Test verifies the ScanProc microcode ROM routine `Cons_Fill_Copy_Rect` which copies the pixels from a source rectangle to a destination rectangle of the same size. This test also verifies “swizzle.” Swizzle is the transfer of pixel data from one ScanProc to another ScanProc over the system Command Bus.

Table A-38 ScanProc Copy Rectangle Test Error Summary

Error	Description
01	ScanProc timed out drawing the rectangle
02	Rectangle drawn incorrectly in Frame Buffer

Table A-39 Extended Error Information

Error	Field	Description
1	1-6	Unused
2	1	Expected data in Frame Buffer
2	2	Actual data in Frame Buffer
2	3	Frame Buffer address of failure
2	4	X coordinate of failing rectangle
2	5	Y coordinate of failing rectangle
2	6	Unused

A.2.17 ScanProc Copy Rectangle Logical OPs Test

Test Number: 0272/0110h

The ScanProc Copy Rectangle with Logical Operations Test verifies that the ScanProc microcode ROM routine `Cons_Fill_Copy_Rect`, which was verified in the ScanProc Copy Basic Rectangle Test, works correctly when Boolean operations are specified for the “inner loop” routine.

Table A-40 ScanProc Copy Rectangle Logical OPs Test Error Summary

Error	Description
1	ScanProc failed illegal pixel depth
2	ScanProc failed illegal pixel depth
3	ScanProc timeout failure
4	Copy rectangle failed with specified logical operation

Table A-41 Extended Error Information

Error	Field	Description
1-3	1-6	Unused
4	1	Expected data in Frame Buffer
4	2	Actual data in Frame Buffer
4	3	Frame Buffer address of failure
4	4	X coordinate of failing rectangle
4	5	Y coordinate of failing rectangle
4	6	Unused

A.2.18 ScanProc Copy Rectangle Mask Test

Test Number: 0288/0120h

This test verifies the ability of the ScanProc to draw a rectangle using the destination and source mask.

Table A-42 ScanProc Copy Rectangle Masking Test Error Summary

Error	Description
1	Rectangle copied incorrectly in Frame Buffer with write masking
2	Rectangle copied incorrectly in Frame Buffer with read masking
3	Time out copying the rectangle with masking

Table A-43 Extended Error Information

Error	Field	Description
1, 2	1	Expected data in Frame Buffer
1, 2	2	Actual data in Frame Buffer
1, 2	3	Frame Buffer address of failure
1, 2	4-6	Unused
3	1-6	Unused

A.2.19 ScanProc Copy Stipple Test**Test Number: 0304/0130h**

This test verifies the ability of the ScanProc to draw a rectangle using the stipple source loop to determine the frame buffer result.

Table A-44 ScanProc Copy Stipple Test Error Summary

Error	Description
1	ScanProc timed out drawing the rectangle
2	Stipple rectangle copied incorrectly in Frame Buffer
3	Stipple rectangle copied incorrectly in Frame Buffer

Table A-45 Extended Error Information

Error	Field	Description
1	1-6	Unused
2, 3	1	Expected data in Frame Buffer
2, 3	2	Actual data in Frame Buffer
2, 3	3	Frame Buffer address of failure
2, 3	4	X coordinate of failing rectangle
2, 3	5	Y coordinate of failing rectangle
2, 3	6	Unused

A.2.20 ScanProc Copy Opaque Test**Test Number: 0320/0140h**

This test verifies the ability of the ScanProc to draw a rectangle using the opaque source loop to determine the frame buffer result.

Table A-46 ScanProc Copy Opaque Test Error Summary

Error	Description
1	ScanProc timed out drawing the rectangle
2	Opaque rectangle copied incorrectly in Frame Buffer
3	Opaque rectangle copied incorrectly in Frame Buffer

Table A-47 Extended Error Information

Error	Field	Description
1	1-6	Unused
2, 3	1	Expected data in Frame Buffer
2, 3	2	Actual data in Frame Buffer
2, 3	3	Frame Buffer address of failure
2, 3	4	Pixel depth for Cport frame buffer format register
2, 3	5, 6	Unused

A.2.21 ScanProc Stream Write Test**Test Number: 0336/0150h**

This test verifies the ScanProc stream write operation over different boundary conditions.

Table A-48 ScanProc Stream Write Test Error Summary

Error	Description
1	Time out waiting for the streaming transfer to complete
2	Stream write failed, incorrect data in Frame Buffer

Table A-49 Extended Error Information

Error	Field	Description
1	1	Expected data
1	2	Actual data
1	3	Failing address
1	4-6	Unused
2	1	Expected data in Frame Buffer
2	2	Actual data in Frame Buffer

(continued on next page)

Table A-49 (Cont.) Extended Error Information

Error	Field	Description
2	3	Frame Buffer address of failure
2	4-6	Unused

A.2.22 FIFO Transfer Test**Test Number: 0352/0160h**

This test verifies the functionality of FIFOs writing to JChip and ScanProc registers. This is done for all four FIFOs to ensure proper functionality of the FIFO Allocation Register.

Table A-50 FIFO Transfer Test Error Summary

Error	Description
1	Timeout waiting for FIFO transfer to complete failure
2	Error with FIFO writing Doorbell Register failure
3	Error with FIFO writing ScanProc ALU Registers failure

Table A-51 Extended Error Information

Error	Field	Description
1	1	Put pointer value
1	2	Get pointer value
1	3	Get pointer address
1	4-6	Unused
2	1	Expected data
2	2	Actual data
2	3	Doorbell register address
2	4-6	Unused
3	1	Expected data
3	2	Actual data
3	3	ScanProc register address
3	4-6	Unused

A.2.23 ScanProc External Write Test**Test Number: 0368/0170h**

This test verifies the ScanProc external write operation over different boundary conditions.

Table A-52 ScanProc External Write Test Error Summary

Error	Description
1	Timeout failure
2	Expected not equal to actual failure
3	Expected not equal to actual failure

Table A-53 Extended Error Information

Error	Field	Description
1-3	1	Expected data
1-3	2	Actual data
1-3	3	Failing address
1-3	4-6	Unused

A.2.24 ScanProc Stream Read Test**Test Number: 0384/0180h**

This test verifies the ScanProc stream read operation over different boundary conditions.

Table A-54 ScanProc Stream Read Test Error Summary

Error	Description
1	Time out waiting for the streaming transfer to complete
2	Stream read failed, incorrect data in FIFO

Table A-55 Extended Error Information

Error	Field	Description
1	1	Expected data
1	2	Actual data
1	3	Failing address
1	4-6	Unused
2	1	Expected data
2	2	Actual data
2	3	FIFO under test
2	4-6	Unused

A.2.25 LCG DMA Test

Test Number: 0400/0190h

This test verifies the functionality of SChip DMA transfer to SRAM on the graphics subsystem processor module. DMA write is done to the SRAM and verified, then DMA read and verify.

Table A-56 LCG DMA Test Error Summary

Error	Description
1	LCG DMA write failure
2	LCG DMA read failure
3	LCG DMA write failure
4	LCG DMA read failure
5	LCG DMA write failure
6	LCG DMA read failure
7	LCG DMA write failure
8	LCG DMA read failure

Table A-57 Extended Error Information

Error	Field	Description
1, 2	1	Expected data
1, 2	2	Actual data
1, 2	3	Failing SRAM address
1, 2	4	Transfer count
1, 2	5, 6	Unused
3-8	1	Expected data
3-8	2	Actual data
3-8	3	Failing SRAM address
3-8	4-6	Unused

A.2.26 LCG OTF Test

Test Number: 0416/01A0h

This test verifies the functionality of SChip DMA transfer to SRAM on the graphics subsystem processor module. DMA write is done to the SRAM and verified, then DMA read and verify.

Table A-58 LCG OTF Test Error Summary

Error	Description
1	LCG OTF write to FIFO failure
2	OTF DMA unconverted write failure
3	LCG OTF write to FIFO failure
4	LCG OTF write to FIFO failure
5	LCG OTF write to FIFO failure
6	LCG OTF write to FIFO failure
7	LCG OTF write to FIFO failure

Table A-59 Extended Error Information

Error	Field	Description
1	1	Expected data
1	2	Actual data
1	3	Failing address
1	4	Number of transfers
1	5	FIFO base address
1	6	SRAM pointer address
2-7	1	Expected data
2-7	2	Actual data
2-7	3	Failing address
2-7	4	FIFO under test
2-7	5, 6	Unused

A.2.27 DMA Stream Test

Test Number: 0432/01B0h

This test verifies the ScanProc stream write operation over different boundary conditions.

Table A-60 DMA Stream Test Error Summary

Error	Description
1	Timeout waiting for stream to complete failure
2	Expected not equal to actual failure

Table A-61 Extended Error Information

Error	Field	Description
1, 2	1	Expected data
1, 2	2	Actual data
1, 2	3	Failing address
1, 2	4-6	Unused

A.2.28 OTF Stream Test**Test Number: 0448/01C0h**

This test verifies the ScanProc stream write operation over different boundary conditions.

Table A-62 OTF Stream Test Error Summary

Error	Description
1	Timeout waiting for stream to complete failure
2	Expected not equal to actual failure

Table A-63 Extended Error Information

Error	Field	Description
1, 2	1	Expected data
1, 2	2	Actual data
1, 2	3	Failing address
1, 2	4-6	Unused

A.2.29 Auto Increment Location Stream Test**Test Number: 0464/01D0h**

This test verifies the ScanProc stream write operation over different boundary conditions.

Table A-64 Auto Increment Location Stream Test Error Summary

Error	Description
1	Timeout waiting for stream to complete failure
2	Expected not equal to actual failure

Table A-65 Extended Error Information

Error	Field	Description
1, 2	1	Expected data
1, 2	2	Actual data
1, 2	3	Failing address
1, 2	4-6	Unused

A.2.30 Command FIFO OTF Stream Test

Test Number: 0480/01E0h

This test verifies the ScanProc stream write operation over different boundary conditions.

Table A-66 Command FIFO OTF Stream Test Error Summary

Error	Description
1	Timeout waiting for stream to complete failure
2	Expected not equal to actual failure

Table A-67 Extended Error Information

Error	Field	Description
1	1-6	Unused
2	1	Expected data
2	2	Actual data
2	3	Failing address
2	4-6	Unused

A.2.31 Command FIFO External Stream Test

Test Number: 0496/01F0h

This test verifies the ScanProc stream write operation over different boundary conditions.

Table A-68 Command FIFO External Stream Test Error Summary

Error	Description
1	Timeout waiting for stream to complete failure
2	Expected not equal to actual failure

Table A-69 Extended Error Information

Error	Field	Description
1	1-6	Unused
2	1	Expected data
2	2	Actual data
2	3	Failing address
2	4-6	Unused

A.2.32 Brooktree Plane Walk Test

Test Number: 0512/0200h

This test determines whether any of the planes within a pixel word are faulty.

Table A-70 Plane Walk Test Error Summary

Error	Description
1	Signature failure on Brooktree Pixel A inputs
2	Signature failure on Brooktree Pixel B inputs
3	Signature failure on Brooktree Pixel C inputs
4	Signature failure on Brooktree Pixel D inputs

Table A-71 Extended Error Information

Error	Field	Description
1-4	1	Expected signature from Brooktree DAC
1-4	2	Actual signature from Brooktree DAC
1-4	3-6	Unused

A.2.33 Brooktree Output Signature Test**Test Number: 0528/0210h**

This test verifies the VRAM serial shifting function, the data multiplexing, and the output of the Brooktree video DAC. The frame buffer is initialized with a unique pattern that will test for any shorts or opens to the output of the DAC. This code tests the ability of the Brooktree output signature analysis registers to return a unique value.

Table A-72 Brooktree Output Signature Test Error Summary

Error	Description
1	Signature failure on Brooktree pixel A inputs
2	Signature failure on Brooktree pixel B inputs
3	Signature failure on Brooktree pixel C inputs
4	Signature failure on Brooktree pixel D inputs

Table A-73 Extended Error Information

Error	Field	Description
1-4	1	Expected signature from Brooktree DAC
1-4	2	Actual signature from Brooktree DAC
1-4	3-6	Unused

A.2.34 Brooktree Off Screen Test**Test Number: 0544/0220h**

This code tests the ability to load the Brooktree color palettes from off screen memory.

Table A-74 Brooktree Off Screen Test Error Summary

Error	Description
1	Red color palette not loaded from DRAM failure
2	Green color palette not loaded from DRAM failure
3	Blue color palette not loaded from DRAM failure
4	Cursor RAM 0 not loaded from DRAM failure
5	Cursor RAM 1 not loaded from DRAM failure

Table A-75 Extended Error Information

Error	Field	Description
1-3	1	Expected data
1-3	2	Actual data
1-3	3	Failing color palette address
1-3	4-6	Unused
4, 5	1	Expected data
4, 5	2	Actual data
4, 5	3	Failing cursor RAM address
4, 5	4-6	Unused

A.2.35 Brooktree Input Signature Test

Test Number: 0560/0230h

This test verifies the VRAM serial shifting function, the data multiplexing, and the input to the Brooktree video DAC. The frame buffer is initialized with a unique pattern that will test for any shorts or opens to the output of the DAC. This code tests the ability of the Brooktree input signature analysis registers to return a unique value.

Table A-76 Brooktree Input Signature Test Error Summary

Error	Description
1	Signature failure on Brooktree pixel A inputs
2	Signature failure on Brooktree pixel B inputs
3	Signature failure on Brooktree pixel C inputs
4	Signature failure on Brooktree pixel D inputs

Table A-77 Extended Error Information

Error	Field	Description
1-4	1	Expected signature from Brooktree DAC
1-4	2	Actual signature from Brooktree DAC
1-4	3-6	Unused

A.2.36 Brooktree Cursor Window Test**Test Number: 0576/0240h**

This code tests the ability of the cursor chips to access the color palette.

Table A-78 Brooktree Cursor Window Test Error Summary

Error	Description
1	Compare failed on an A pixel
2	Compare failed on an B pixel
3	Compare failed on an C pixel
4	Compare failed on an D pixel

Table A-79 Extended Error Information

Error	Field	Description
1-4	1	Expected data
1-4	2	Actual data
1-4	3-6	Unused

A.2.37 JChip Window Test**Test Number: 0592/0250h**

This code tests the ability of the JChip to access the color palette.

Table A-80 JChip Window Test Error Summary

Error	Description
1	Compare failed on an A pixel
2	Compare failed on an B pixel

(continued on next page)

Table A-80 (Cont.) JChip Window Test Error Summary

Error	Description
3	Compare failed on an C pixel
4	Compare failed on an D pixel

Table A-81 Extended Error Information

Error	Field	Description
1-4	1	Expected data
1-4	2	Actual data
1-4	3-6	Unused

A.2.38 Brooktree Analog Compare Test**Test Number: 0608/02C0h**

The analog compare test verifies that the RAMDAC is terminated and that each of the color channels is outputting the correct analog value.

Table A-82 Brooktree Analog Compare Test Error Summary

Error	Description
1	RED analog compare error
2	GREEN analog compare error
3	RED to BLUE analog compare error
4	GREEN to BLUE analog compare error

Table A-83 Extended Error Information

Error	Field	Description
1, 2	1	Expected data from Brooktree DAC
1, 2	2	Actual data from Brooktree DAC
1, 2	3-6	Unused
3	1	Expected Blue Data from Brooktree DAC
3	2	Expected Red Data from Brooktree DAC
3	3-6	Unused
4	1	Expected Blue Data from Brooktree DAC
4	2	Expected Green Data from Brooktree DAC

(continued on next page)

Table A-83 (Cont.) Extended Error Information

Error	Field	Description
4	3-6	Unused

A.2.39 Set/Clear Interrupt Test**Test Number: 0624/0270h**

This test verifies:

- 1 That interrupts can be set when the Interrupt Mask Register is written to disallow interrupt vectoring.
- 2 That interrupts can be cleared when the Interrupt Mask Register is written to allow interrupt vectoring.

Table A-84 Interrupt Set and Clear Test Error Summary

Error	Description
1	Set Interrupt Path error
2	Clear Interrupt Path error

Table A-85 Extended Error Information

Error	Field	Description
1, 2	1	Expected data
1, 2	2	Actual data
1, 2	3	Interrupt register address
1, 2	4	Interrupts bits that failed
1, 2	5, 6	Unused

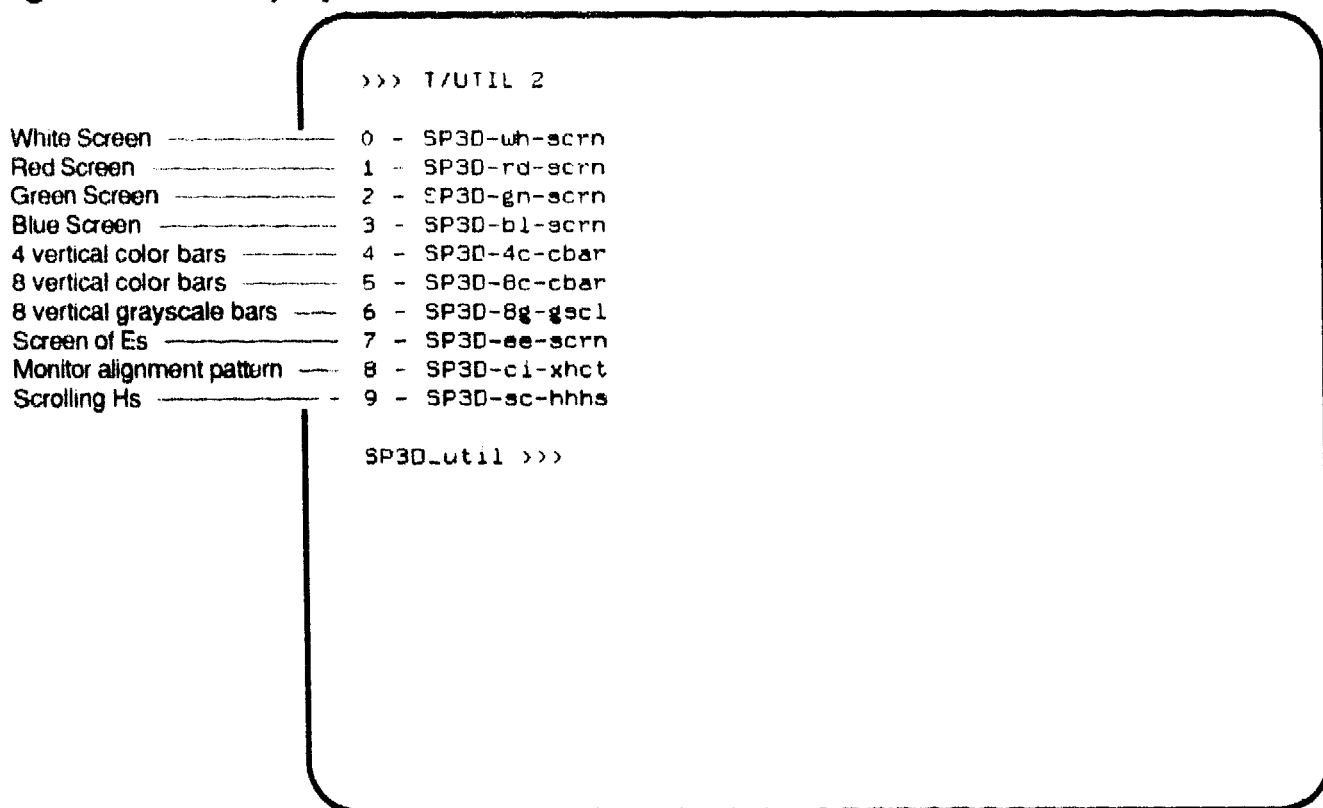
A.3 Display Utilities

The 3D graphics options provide test display patterns to visually verify video output and monitor quality. The console device can be the 3D graphics option or an external terminal connected to the VAXstation 4000 Model 60 serial port.

To run the utilities:

- 1 At the >>> console prompt, enter the T/UTIL 2 command to display the utilities menu shown in Figure A-6.
- 2 At the SP3D_util >>> prompt, type the utility number.
- 3 Press the keyboard space bar to terminate the test, and return to the SP3D_util >>> prompt.
- 4 Type Ctrl/C or Ctrl/Y to terminate the test and return to the >>> console prompt.

Figure A-6 Display Utilities Menu



WMO_SPXGGT_020

Hardware Specifications

This appendix lists environmental specifications for the PV61G-BA 8-plane and PV61G-AA 24-plane graphics options.

Table B-1 PV61G-BA and PV61G-AA Specifications

Operating Conditions	
Temperature Range	15°C to 32°C (59°F to 90°F)
Temperature Change Rate	11°C/hr (52°F/hr) maximum
Relative Humidity	20%-80% noncondensing
Altitude	2400 m (8000 ft)
Maximum Wet Bulb Temperature	28°C (82°F)
Minimum Dew Point	2°C (36°F)
Nonoperating Conditions	
Temperature Range	-40°C to 66°C (-40°F to 151°F)
Relative Humidity	95% @ 66°C (151°F) (may condense)
Altitude	4900 m (16,000 ft)
Maximum Wet Bulb Temperature	28°C (82°F)
Minimum Dew Point	2°C (36°F)
Storage Conditions	
Temperature Range	5°C to 50°C (41°F to 122°F)
Relative Humidity	10%-95% noncondensing
Altitude	0 to 2400 m (0 to 8000 ft)
Maximum Wet Bulb Temperature	32°C (90°F)
Minimum Dew Point	2°C (36°F)

Associated Documents

The following documents provide additional information about the VAXstation 4000 Model 60 workstation.

Title	Order Number ¹
<i>VAXstation 4000 Model 60 Service Information</i> (printed form available only as part of kit EK-V4666-DK)	EK-V4666-DK
<i>VAXstation 4000 Model 60 Owner's and System Installation Guide</i> (printed form available only as part of kit EK-PMARI-DK)	EK-PMARI-DK
<i>VAXstation 4000 Model 60 Options Installation Guide</i> (printed form available only as part of kit EK-PMARI-DK)	EK-PMARI-DK
<i>VAXstation 4000 3D Graphics Options Option Guide</i>	EK-SCP8P-IN
<i>VAXstation 4000 Model 60 3D Graphics Options Technical Summary</i>	EK-SCP8P-TS

¹Printed form order number

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Test

number

decimal

- 0016, A-14
- 0032, A-14
- 0048, A-15
- 0064, A-16
- 0080, A-16
- 0096, A-17
- 0112, A-18
- 0128, A-19
- 0144, A-20
- 0160, A-21
- 0176, A-22
- 0192, A-23
- 0208, A-24
- 0224, A-24
- 0242, A-25
- 0256, A-26
- 0272, A-26
- 0288, A-27
- 0304, A-28
- 0320, A-28
- 0336, A-29
- 0352, A-30
- 0368, A-30

Test

number

decimal (cont'd)

0384, A-31
0400, A-32
0416, A-32
0432, A-33
0448, A-34
0464, A-34
0480, A-35
0496, A-36
0512, A-36
0528, A-37
0544, A-37
0560, A-38
0576, A-39
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hexadecimal

00A0h, A-21
01A0h, A-32
00B0h, A-22
01B0h, A-33
00C0h, A-23
01C0h, A-34
00D0h, A-24
01D0h, A-34
00E0h, A-24
01E0h, A-35
00F0h, A-25
01F0h, A-36
0010h, A-14
0020h, A-14
0030h, A-15
0040h, A-16
0050h, A-16
0060h, A-17
0070h, A-18
0080h, A-19
0090h, A-20
0100h, A-26
0110h, A-26
0120h, A-27

Test

number

hexadecimal (cont'd)

0130h, A-28
0140h, A-28
0150h, A-29
0160h, A-30
0170h, A-30
0180h, A-31
0190h, A-32
0200h, A-36
0210h, A-37
0220h, A-37
0230h, A-38
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