

TURBOchannel

Maintenance Guide

First printing, September 1990
Revised, October 1990
Revised, April 1991
Revised, October 1991

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Using This Guide

Intended Audience

This guide is for Digital customer service representatives who have completed training in DECstation/DECsystem maintenance. This guide assumes that you are familiar with basic maintenance and troubleshooting operations and that you have experience with desktop computer systems.

How To Use This Guide

This guide explains how to identify and replace failed field replaceable units (FRUs) for TURBOchannel option modules.

For an overview of TURBOchannel configurations and how to remove and replace TURBOchannel option modules refer to Chapter 1, “Working with TURBOchannel Option Modules.”

For a description of the hardware, troubleshooting procedures, and individual tests for a specific option module, refer to the chapter that discusses the FRU in which you are interested. See the table of contents for a list of the option modules discussed in this guide.

For equipment part numbers and a recommended spares list, refer to Appendix A.

Table 1. Conventions Used in This Guide

Convention	Use
Monospace type	Anything that appears on your monitor screen is set in monospace type, like this.
Boldface type	Anything you are asked to type is set in boldface type, like this.
<i>Italic type</i>	<i>Any part of a command that you replace with an actual value is set in italic type, like this.</i>

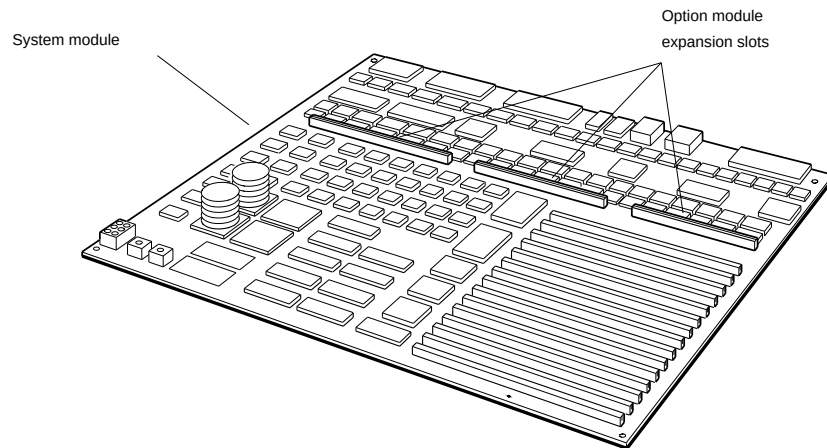
Working with TURBOchannel Option Modules

This chapter discusses

- Uses for TURBOchannel option module hardware
- Possible combinations of TURBOchannel option modules
- How to remove and install TURBOchannel option modules

TURBOchannel Option Module Hardware

TURBOchannel is a group of option modules that operate on any base system that has TURBOchannel option slots. You can combine TURBOchannel option modules to create different configurations for individual systems.



WSETM001

Figure 1-1. TURBOchannel expansion slots on the DECstation/DECsystem 5000 Model 200 system module

TURBOchannel Hardware Configurations

You can add option modules to a base system until the TURBOchannel expansion slots are full. However, you must follow these restrictions when you install graphics modules:

- Do not combine 3D graphics modules with other graphics modules.
- Combine color frame-buffer graphics modules only with other color frame-buffer modules or modules that are not graphics modules.
- Combine monochrome frame-buffer graphics modules only with other monochrome frame-buffer modules or modules that are not graphics modules.
- Combine 2D graphics accelerator modules only with other 2D graphic accelerator modules or modules that are not graphics modules.

Table 1-1 lists which figure shows the possible combinations for each type of graphics module.

Table 1-1. Figures of Possible Configurations for Graphics Modules

Graphics Module	Figure That Shows Possible Configurations
3D graphics	Figure 1-2
2D graphics accelerator	Figure 1-3
Color frame-buffer module	Figure 1-4
Monochrome frame-buffer	Figure 1-5

One low or mid three-dimensional graphics module		Any module other than a graphics module
Option slot 0	Option slot 1	Option slot 2

or

One high three-dimensional graphics module		
Option slot 0	Option slot 1	Option slot 2

 Indicates that slot number does not appear in configuration display.

WSETM002

Figure 1-2. Possible configurations that include 3D option modules

Option slot 0	Option slot 1	Option slot 2
One 2D graphics accelerator module	Any module other than a graphics module	Any module other than a graphics module

OR

Option slot 0	Option slot 1	Option slot 2
Any module other than a graphics module	One 2D graphics accelerator module	Any module other than a graphics module

WSETM010

Figure 1-3. Possible configurations that include a 2D graphics accelerator module

Option slot 0	Option slot 1	Option slot 2
One color frame-buffer module or Any module other than a graphics module	One color frame-buffer module or Any module other than a graphics module	One color frame-buffer module or Any module other than a graphics module

WSETM008

Figure 1-4. Possible configurations that include color frame-buffer modules

Option slot 0	Option slot 1	Option slot 2
One mono frame-buffer module or Any module other than a graphics module	One mono frame-buffer module or Any module other than a graphics module	One mono frame-buffer module or Any module other than a graphics module

WSETM009

Figure 1-5. Possible configurations that include monochrome frame-buffer modules

How to Remove and Install Option Module Hardware

To remove and install an option module, refer to “To Remove and Install an Option Module” for directions.

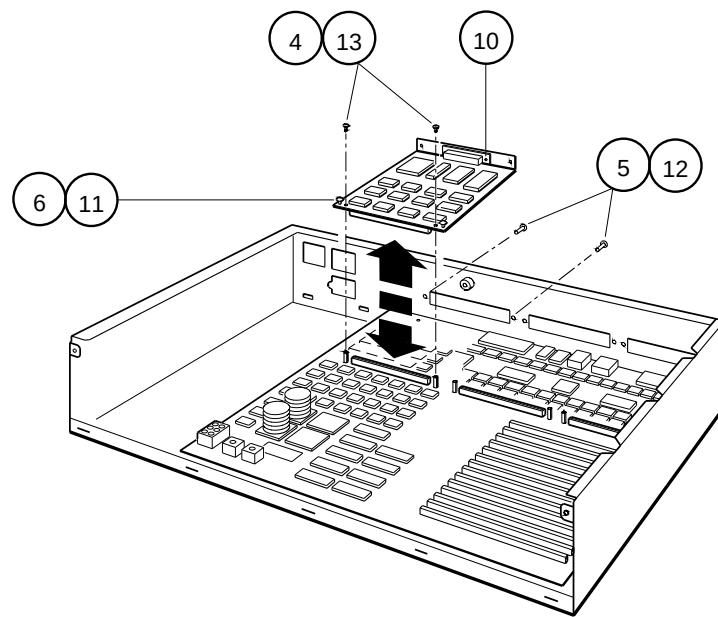
To remove and install an ESAR chip, refer to “To Remove and Install an ESAR Chip” in the next section in this chapter.

To remove and install a video inline memory module, which commonly is referred to as a VSIMM, on a graphics module, refer to “To Remove and Install a VSIMM or z-Buffer Module on a Graphics Module” later in this chapter.

To Remove and Install an Option Module

Figure 1-6 shows how to remove and install an option module.

Caution: Always follow antistatic procedures when handling an option module or other static-sensitive device.



WSE2M030

Figure 1-6. Removing and installing an option module

To remove an option module,

1. Turn off the system unit and remove the system unit cover.
2. If the module is a ThickWire Ethernet option module, save the ESAR chip for installation onto the new ThickWire option module. Refer to “To Remove and Install an ESAR Chip” later in this chapter for an explanation of how to remove the ESAR chip.
3. Disconnect any external cables connected to the option module.
4. Remove the screws that hold the option module to the support posts.
5. Remove the screws that hold the option module to the back of the system unit.
6. Grip the option module end near the expansion slot and pull the option module out of the slot. If necessary, gently rock the module to loosen it.

To install an option module,

1. Turn off the system unit and remove the system unit cover.
2. If there is a blank plate over the opening for the option module connector, remove the two screws and remove the plate.
3. Pass the option module cable connector through the opening on the back of the system unit.
4. Firmly press the end of the option module that connects to the system module into the expansion slot.
5. Insert and tighten the screws that hold the option module to the back of the system unit.
6. Insert the screws that hold the option module to the support posts.
7. If the module is a ThickWire Ethernet module, insert the ESAR chip from the old ThickWire Ethernet option module onto the new ThickWire Ethernet option module. Refer to “To Remove and Install an ESAR Chip” later in this chapter for an explanation of how to install an ESAR chip.

8. Reconnect any external cables that were attached to the original option module. If you reconnect a video cable to a graphics module, make sure that the DIGITAL logo faces up when you connect the cable.

To Remove and Install an ESAR Chip

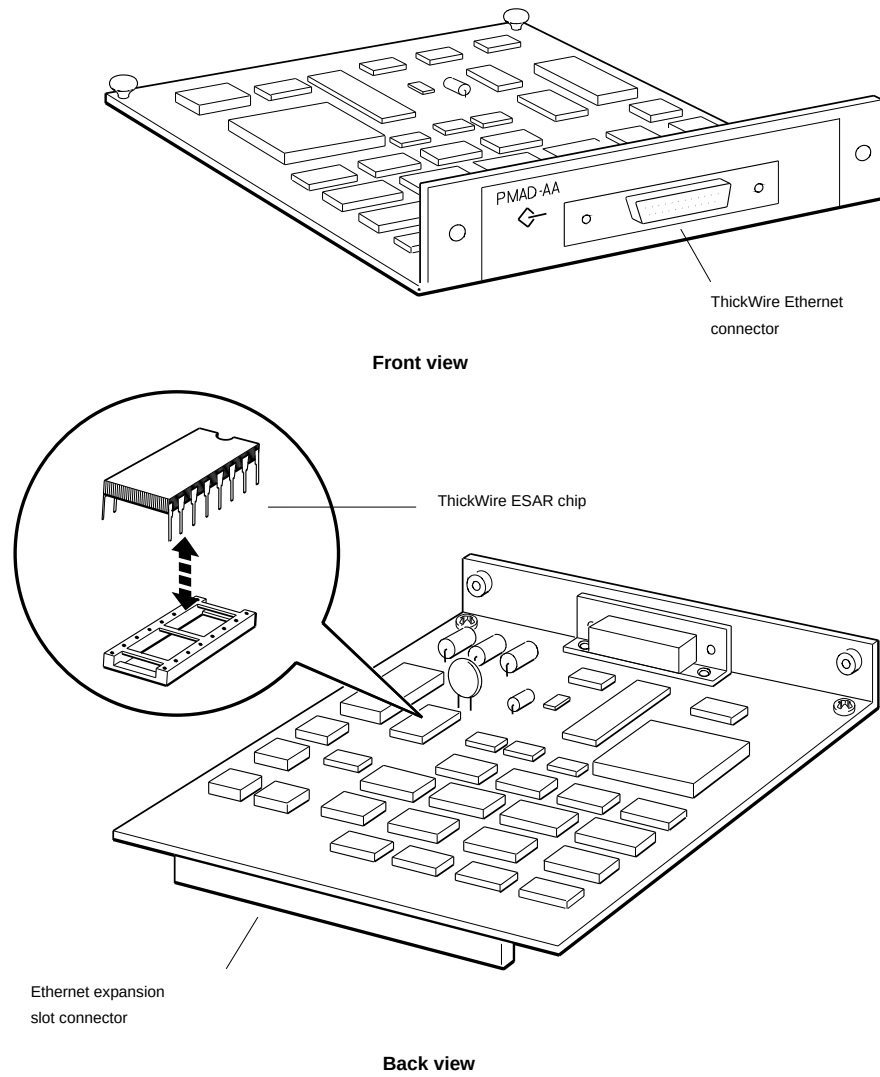
Figure 1-7 shows how to remove and install an ESAR chip on a ThickWire Ethernet option module.

To remove an ESAR chip,

1. Locate the ESAR chip on the Ethernet controller module. Note that the notch in the ESAR chip faces the ThickWire Ethernet connector.
2. Pry the ESAR chip loose from the ThickWire Ethernet option module.

To insert an ESAR chip,

1. Align the ESAR chip over the ESAR socket on the ThickWire Ethernet controller option module. Make sure that the notch on the ESAR chip faces the ThickWire Ethernet connector.
2. Evenly press the pins on the ESAR chip into the ESAR socket. Be careful not to bend the pins on the ESAR chip.



WSE2M028

Figure 1-7. Removing and installing an ESAR chip

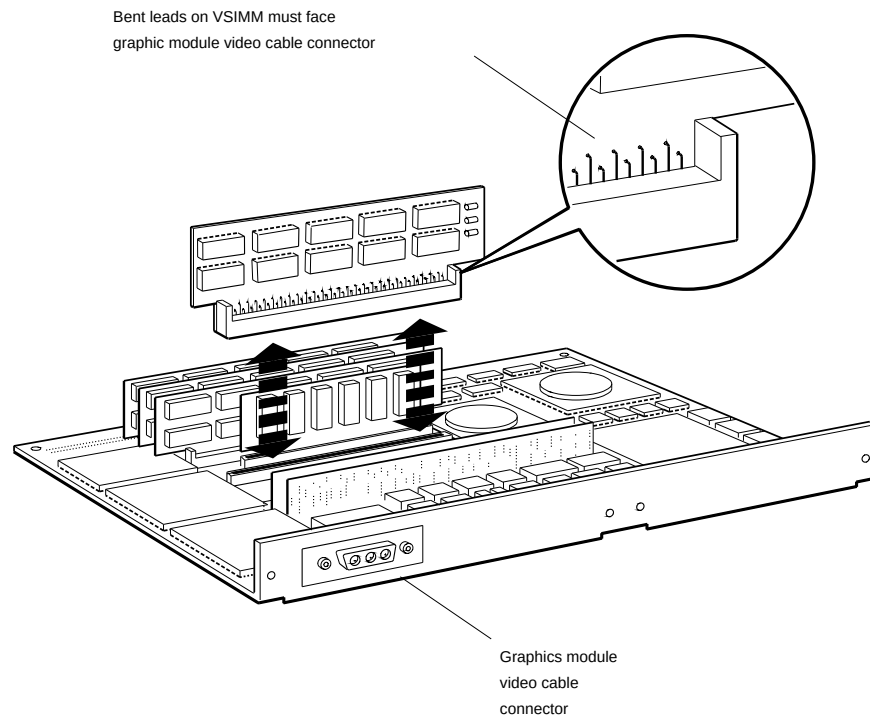
To Remove and Install a VSIMM or z-Buffer Module on a Graphics Module

Figure 1-8 shows how to remove and install a VSIMM or z-buffer module on a 2D graphics accelerator or 3D graphics module.

To remove a VSIMM or z-buffer module from a graphics module, firmly grip each end of the VSIMM or z-buffer module and pull it out of its connector.

To install a VSIMM or z-buffer module onto a graphics module,

1. Find the proper slot for the VSIMM or z-buffer module. The connector on the module is the same color as the slot connector into which you are installing the module.
 - VSIMM connectors are black.
 - z-buffer module connectors are gray.
2. Align the VSIMM or z-buffer module so that the bent leads on the VSIMM or z-buffer module face the video cable connector.
3. Push the VSIMM or z-buffer module all the way into the connector on the graphics module.
4. After you install the VSIMM or z-buffer module, make sure that the new module appears in the configuration display. Type **cnfg** and press Return. If the new VSIMM or z-buffer module is missing from the configuration display, make sure that the VSIMM or z-buffer module is inserted correctly.



WSE2M061

Figure 1-8. Removing and replacing a VSIMM or z-buffer module on a graphics module

Part I

Graphics Modules

Monochrome Frame-Buffer Graphics Module

This chapter discusses the following items for the monochrome frame-buffer graphics module:

- Module hardware
- Troubleshooting procedures
- Individual self-tests

Monochrome Frame-Buffer Graphics Module Hardware

The monochrome frame buffer TURBOchannel module generates monochrome graphics.

The workstation can support as many monochrome frame buffer graphics modules as there are available option slots on the system module. Do not combine monochrome frame-buffer modules with other types of graphics modules.

If the system has more than one monochrome frame-buffer module, the monitor connected to the graphics module that has the lowest slot number acts as the console. Any error messages about the other graphics modules will appear on the console monitor.

To operate monochrome frame buffer option modules, the workstation must use ULTRIX version 4.2 or higher.

Combining Monochrome Frame Buffer Modules and Monitors

The following 72-Hz monitors can display graphics generated by the monochrome frame buffer graphics module:

- VR319-DA monochrome monitor
- VRM17-AA monochrome monitor

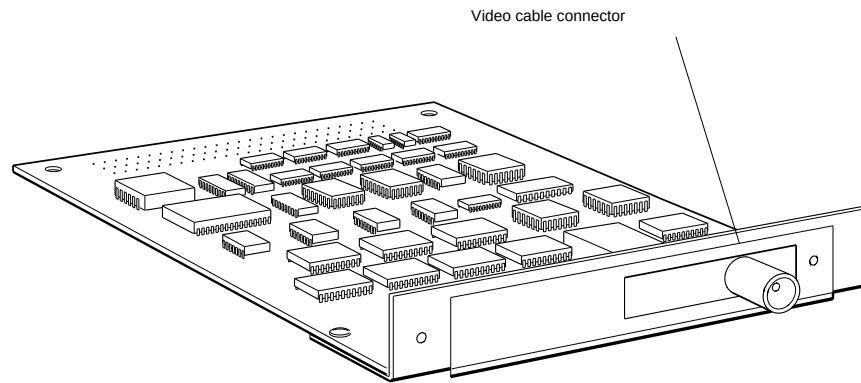
Figure 2-1 shows the monochrome frame-buffer graphics module and its connectors.

Troubleshooting a Monochrome Frame-Buffer Graphics Module

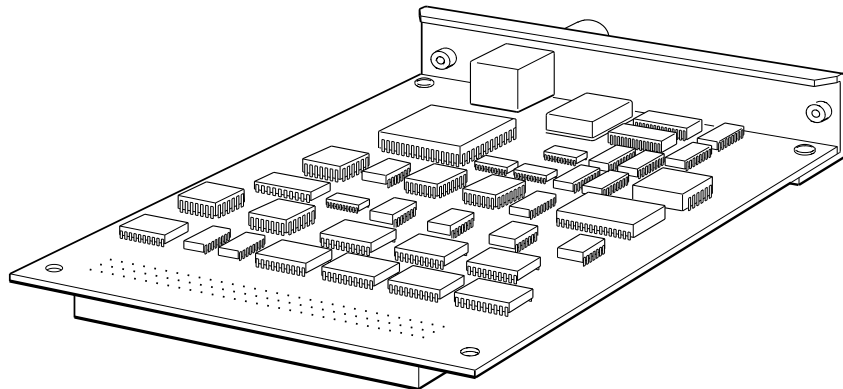
If an error message lists curs, int, or vdac as the test that failed, replace the monochrome frame-buffer graphics module that has the slot number that appears in the error message. Refer to “How to Remove and Install Option Module Hardware” in Chapter 1 for directions.

If an error message lists ptrns as the test that failed, the problem is in the monitor or video cable. Refer to Chapter 10 to troubleshoot.

For a detailed explanation of an error message, refer to the section later in this chapter that describes the individual test that failed.



Front view



Back view

WSETM007

Figure 2-1. Monochrome frame-buffer graphics module

Individual Monochrome Frame-Buffer Graphics Module Tests

The following pages explain each individual monochrome frame-buffer test and its command and error messages.

Table 2-1 lists the name and command for each individual monochrome frame-buffer graphics module test.

Table 2-1. Monochrome Frame-Buffer Tests

Test Name	Test Command ¹
Cursor test	t <i>slot_number</i> /curs
Font test	t <i>slot_number</i> /font [<i>character</i>]
Interrupt test	t <i>slot_number</i> /int
Monochrome frame-buffer patterns test	t <i>slot_number</i> /ptrn [<i>action</i>]
Initialize video-to-analog converter (VDAC) test	t <i>slot_number</i> /vdac
Video RAM test	t <i>slot_number</i> /vram [<i>pattern</i>]

¹The *slot_number* variable represents the slot number of the monochrome frame-buffer module.

Cursor Test

The cursor test checks the cursor RAM. To run the cursor test, type **t slot_number/curs**, where you replace *slot_number* with the monochrome frame-buffer graphics module slot number, and press Return.

Cursor test error messages

Cursor test error messages have the form

?TFL: *slot_number/curs* (*code*: exp=*x* adr=*y*) PMAG-BA

- ?TFL *slot_number/curs* indicates that the cursor test reported an error. *slot_number* represents the slot number of the graphics module that reported the error.
- *code* represents a code that identifies which portion of the test failed.
- The exp value is the expected cursor RAM contents.
- The adr value is the actual cursor RAM contents.
- PMAG-BA is the monochrome frame-buffer graphics module identifier.

Table 2-2 lists error codes used in cursor test error messages.

Table 2-2. Cursor Test Error Codes

Error Code	Meaning
1	Test failed to read ID or initialize VDAC.
2	Cursor RAM failed incremented values test.
3	Cursor RAM failed decremented values test.

Font Test

The font test fills the monitor screen with a specified character that you can display when you adjust the monitor. To run the font test, type **t slot_number/font** [*character*] and press Return.

When you type the font test command,

- Replace *slot_number* with the monochrome frame-buffer graphics module slot number.
- Replace the optional *character* parameter with the hexadecimal value for the specific character you want to display.
 - Specify 37 to display a screen filled with the letter E.
 - Specify 40 to display a screen filled with the letter H.
 - Specify no additional parameters to have the entire font scroll across the screen.

Font test error messages

The font test is used for adjusting the monitor and generates no error messages.

Interrupt Test

The interrupt test attempts to initialize the VDAC interrupt line. To run the interrupt test, type **t slot_number/int**, where you replace *slot_number* with the monochrome frame-buffer graphics module slot number, and press Return.

Interrupt test error messages

The only interrupt test error message is ?TFL: *slot_number/int* (1) PMAG-BA, which indicates that the CPU did not receive the interrupt.

Monochrome Frame-Buffer Patterns Test

The monochrome frame-buffer patterns test displays a series of patterns on the monitor. To run the monochrome frame-buffer patterns test, type **t slot_number/ptrn action** and press Return.

When you type the monochrome frame-buffer patterns test,

- Replace *slot_number* with the monochrome frame-buffer graphics module slot number.
- Replace *action* with a value that specifies how the test displays patterns.
 - Specify 0 to display all patterns continuously.
 - Specify 1 to have each pattern remain on the screen until you press any key on the keyboard.

Monochrome frame-buffer patterns test error messages

Patterns test error messages have the form

?TFL: *slot_number/ptrns* (*code*: exp=*x* adr=*y*) PMAG-BA

- ?TFL *slot/ptrns* indicates that the patterns test reported an error.
- *code* represents a code that identifies which portion of the test failed.
- The exp value is the expected cursor RAM contents.
- The adr value is the actual cursor RAM contents.
- PMAG-BA is monochrome frame-buffer graphics module identifier.

Table 2-3 lists error codes used in monochrome frame-buffer patterns test error messages.

Table 2-3. Monochrome Frame-Buffer Patterns Test Error Codes

Error Code	Meaning
1	Monochrome bars test failed.
4	White screen test failed.
10	Pseudo-gray scales test failed.

Initialize Video Digital-to-Analog Converter (VDAC) Test

The initialize video digital-to-analog converter (VDAC) test initializes and tests the VDAC registers. To run the initialize VDAC test, type **t slot_number/vdac**, where you replace *slot_number* with the slot number of the monochrome frame-buffer graphics module, and press Return.

Initialize VDAC test error messages

Initialize VDAC test error messages have the form
?TFL: *slot_number/vdac (code, P1=x, P2=y, P3=z) PMAG-BA*

- ?TFL *slot/vdac* indicates that the vdac test reported an error.
- *code* represents a number that identifies which portion of the test failed.
- The P1 value is the VDAC register contents.
- The P2 value is the VDAC address low register contents.
- The P3 value is the VDAC address high register contents.
- PMAG-BA is the monochrome frame-buffer graphics module identifier.

Table 2-4 lists error codes used in initialize VDAC error messages.

Table 2-4. Initialize VDAC Registers Test Error Codes

Error Code	Meaning
1	Test could not initialize color map.
2	Test could not initialize overlay map.

Video RAM Test

The video RAM test performs a read and write operation on the video RAM. To run the video RAM test, type **t slot_number/vram [pattern]** and press Return.

When you type the video RAM test command,

- Replace *slot_number* with the graphics module slot number.
- Replace *pattern* with the pattern you want to use for the last test pass.

Video RAM test error messages

Video RAM test error messages have the form
?TFL: slot_number/vram (code, addr=xxxxxxx, exp=yyyyyyy, act=zzzzzzzz) PMAG-BA

- **?TFL slot_number/vram** indicates that the video RAM test reported an error. *slot_number* represents the slot number of the monochrome frame-buffer module that reported the error.
- *code* represents a code that identifies which portion of the test failed.
- The *addr* value is the RAM address where the failure occurred.
- The *exp* value is the expected RAM contents.
- The *act* value is the actual RAM contents.
- **PMAG-BA** is the monochrome frame-buffer graphics module identifier.

Table 2-5 lists error codes used in video RAM test error messages.

Table 2-5. Video RAM Test Error Codes

Error Code	Meaning
1	Error occurred during write loop.
2	Values in memory miscompared.
3	Complemented values in memory miscompared.

Color Frame-Buffer Graphics Module

This chapter discusses the following items for the color frame-buffer graphics module:

- Module hardware
- Troubleshooting procedures
- Individual self-tests

Color Frame-Buffer Graphics Hardware

Color frame buffer TURBOchannel modules generate two-dimensional color graphics.

The workstation can support as many color frame buffer modules as there are TURBOchannel slots on the system module. Do not combine a color frame-buffer module with a different type of graphics module.

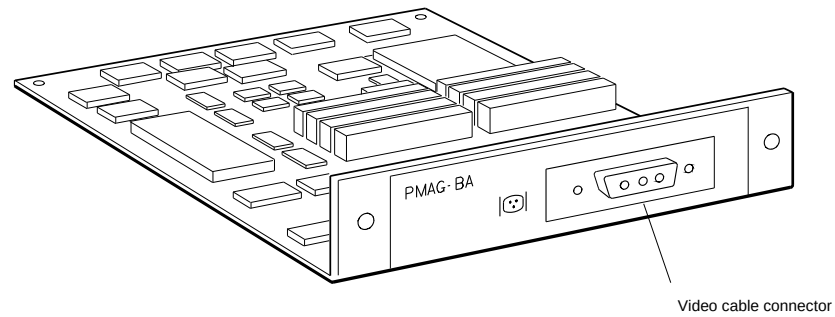
If the system has more than one color frame-buffer module, the monitor connected to the graphics module that has the lowest slot number acts as the console.

To operate more than one color frame buffer module, the workstation must use ULTRIX version 4.2 or higher.

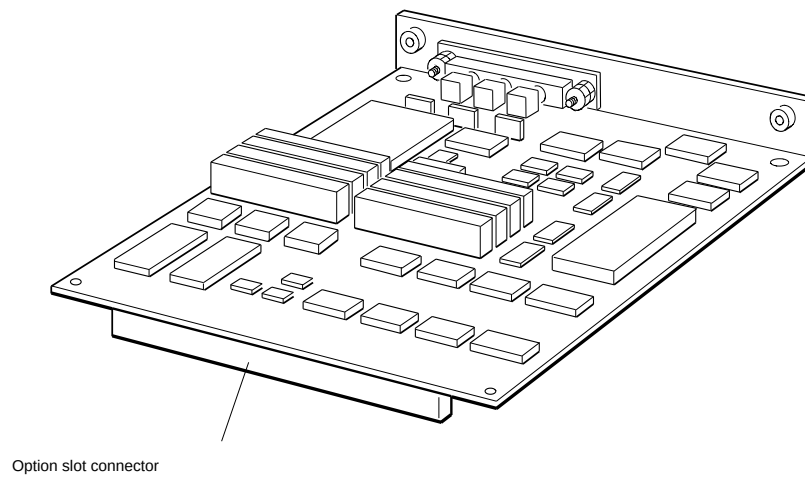
Combining Color Frame Buffer Modules and Monitors

There are two types of color frame buffer TURBOchannel modules, module type PMAG-BA and PMAG-JA. The module type is printed on the front of the color frame buffer module.

- Module type PMAG-BA operates at 60 Hz. The following monitors can display graphics generated by the PMAG-BA color frame buffer module:
 - VR262-AA gray-scale monitor
 - VR297-DA color monitor
 - VR299-DA color monitor
- Module type PMAGB-JA, which is also known as the true color frame buffer module, operates at 72 Hz. The following monitors can display graphics generated by the PMAG-JA true color frame buffer module:
 - VRT16-HA color monitor
 - VRT19-HA color monitor
 - VR319-DA monochrome monitor
 - VR320-CA color monitor



Front view



Back view

WSE2M027

Figure 3-1. Color frame buffer TURBOchannel module

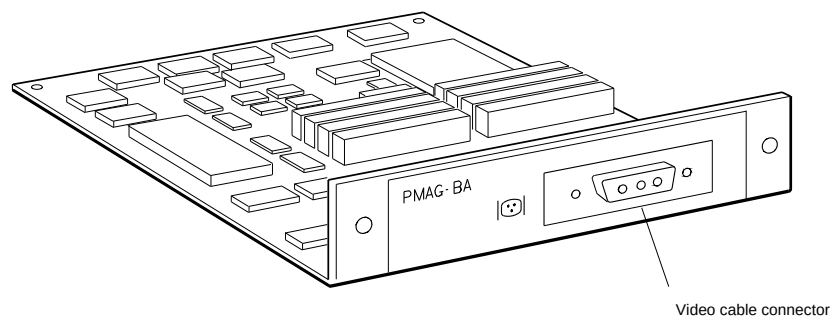
Figure 3-2 shows the color frame-buffer graphics option module and its connectors.

Troubleshooting a Color Frame-Buffer Graphics Module

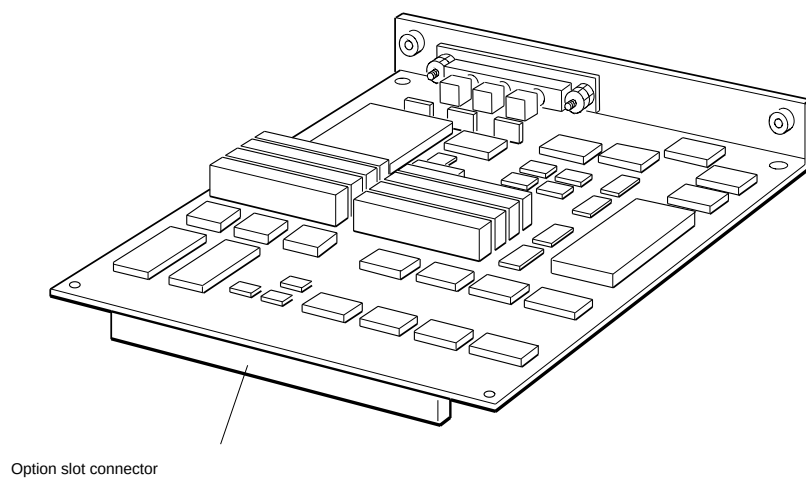
If a color frame-buffer graphics module reports an error in the curs, int, or vdac test, replace the color frame-buffer graphics module. Refer to “How to Remove and Install Option Module Hardware” in Chapter 1 for directions.

If a color frame-buffer graphics module returns an error code that includes ptrn, the problem is in the monitor or video cable. Refer to Chapter 10 to troubleshoot.

To obtain detailed information about the failure, use the individual graphics tests described in “Individual Color Frame-Buffer Graphics Module Tests” later in this chapter.



Front view



Back view

WSE2M027

Figure 3-2. Color frame-buffer graphics module

Individual Color Frame-Buffer Graphics Module Tests

The following pages explain each individual color frame-buffer test and its command and error messages.

Table 3-1 lists the name and command for each individual color frame-buffer graphics module test.

Table 3-1. Color Frame-Buffer Tests

Test Name	Test Command ¹
Box test	<i>slot/box</i>
Cursor test	<i>slot/curs</i>
Font test	<i>slot/font [character]</i>
Interrupt test	<i>slot/int</i>
Color frame-buffer patterns test	<i>slot/ptrn [action]</i>
Initialize video-to-analog converter (VDAC) test	<i>slot/vdac</i>
Video RAM test	<i>slot/vram [pattern]</i>

¹The *slot* variable represents the slot number of the failed controller or module.

Box Test

The box test displays a grid of vertical and horizontal lines of pixels at the monitor perimeter. To run the box test, type **t slot/box**, where *slot* represents the color frame-buffer graphics module slot number, and press Return.

Box test error messages

The box test is used for adjusting the monitor and generates no error messages.

Cursor Test

The cursor test checks the cursor RAM. To run the cursor test, type **t slot/curs**, where *slot* represents the color frame-buffer graphics module slot number, and press Return.

Cursor test error messages

Cursor test error messages have the form
?TFL: *slot/curs* (*code*: exp=*x* adr=*y*) PMAG-AA

- ?TFL *slot/curs* indicates that the cursor test reported an error.
- *code* represents a code that identifies which portion of the test failed.
- The exp value is the expected cursor RAM contents.
- The adr value is the actual cursor RAM contents.
- PMAG-AA is the color frame-buffer graphics module identifier.

Table 3-2 lists error codes used in cursor test error messages.

Table 3-2. Cursor Test Error Codes

Error Code	Meaning
1	Test failed to read ID or initialize VDAC.
2	Cursor RAM failed incremented values test.
3	Cursor RAM failed decremented values test.
4	Cursor signature analysis failed.

Font Test

The font test fills the monitor screen with a specified character that you can display when you adjust the monitor. To run the font test, type **t slot/font** [*character*] and press Return.

When you type the font test command,

- Replace *slot* with the color frame-buffer graphics module slot number.
- Replace the optional *character* parameter with the hexadecimal value for the specific character you want to display.
 - Specify 37 to display a screen filled with the letter E.
 - Specify 40 to display a screen filled with the letter H.
 - Specify no additional parameters to have the entire font scroll across the screen.

Font test error messages

The font test is used for adjusting the monitor and generates no error messages.

Interrupt Test

The interrupt test attempts to initialize the VDAC interrupt line. To run the interrupt test, type **t slot/int**, where *slot* represents the color frame-buffer graphics module slot number, and press Return.

Interrupt test error messages

The only interrupt test error message is ?TFL: *slot/int* (1) PMAG-BA, which indicates that the CPU did not receive the interrupt.

Color Frame-Buffer Patterns Test

The color frame-buffer patterns test displays a series of patterns on the monitor. To run the color frame-buffer patterns test, type **t slot/ptrn** *action* and press return

When you type the color frame-buffer patterns test,

- Replace *slot* with the color frame-buffer graphics module slot number.
- Replace the *action* parameter with a value that specifies how the test displays patterns.
 - Specify 0 to display all patterns continuously.
 - Specify 1 to have each pattern remain on the screen until you press any key on the keyboard.

Color frame-buffer patterns test error messages

Patterns test error messages have the form

?TFL: *slot/ptrns* (*code*: exp=*x* adr=*y*) PMAG-AA

- ?TFL *slot/ptrns* indicates that the patterns test reported an error.
- *code* represents a code that identifies which portion of the test failed.
- The exp value is the expected cursor RAM contents.
- The adr value is the actual cursor RAM contents.
- PMAG-AA is the color frame-buffer graphics module identifier.

Table 3-3 lists error codes used in color frame-buffer patterns test error messages.

Table 3-3. Color Frame-Buffer Patterns Test Error Codes

Error Code	Meaning
1	Color bars test failed.
2	Gray-scale bars test failed.
3	Red screen test failed.
4	Green screen test failed.
5	Blue screen test failed.
6	Blue-red screen test failed.
7	Blue-red to blue-green pattern test failed.
8	Red-green to blue-green test failed.
9	Red-green to red-blue test failed.
10	White test failed.

Initialize Video Digital-to-Analog Converter (VDAC) Test

The initialize video digital-to-analog converter (VDAC) test initializes and tests the VDAC registers. To run the initialize VDAC test, type **t slot/vdac**, where you replace *slot* with the slot number of the graphics module, and press Return.

Initialize VDAC test error messages

Initialize VDAC test error messages have the form
?TFL: *slot/vdac (code, P1=x, P2=y, P3=z) PMAG-AA*

- ?TFL *slot/vdac* indicates that the vdac test reported an error.
- *code* represents a code that identifies which portion of the test failed.
- The P1 value is the VDAC register contents.
- The P2 value is the VDAC address low register contents.
- The P3 value is the VDAC address high register contents.
- PMAG-AA is the color frame-buffer graphics module identifier.

Table 3-4 lists error codes used in initialize VDAC error messages.

Table 3-4. Initialize VDAC Registers Test Error Codes

Error Code	Meaning
1	Test could not read ID register.
2	Test could not initialize command registers.
3	Test could not initialize cursor command registers.
4	Test could not initialize cursor RAM.
5	Test could not initialize color map.
6	Test could not initialize overlay map.
7	Test could not initialize cursor palette.

Video RAM Test

The video RAM test performs a read and write operation on the video RAM. To run the video RAM test, type **t slot/vram [pattern]** and press Return.

When you type the video RAM test command,

- Replace *slot* with the graphics module slot number.
- Replace *pattern* with the pattern you want to use for the last test pass.

Video RAM test error messages

Video RAM test error messages have the form
?TFL: *slot/vram (code, addr=xxxxxxxx, exp=yyyyyyyy, act=zzzzzzzz) PMAG-AA*

- ?TFL *slot/vram* indicates that the video RAM test reported an error.
- *code* represents a code that identifies which portion of the test failed.
- The *addr* value is the RAM address where the failure occurred.
- The *exp* value is the expected RAM contents.
- The *act* value is the actual RAM contents.
- PMAG-AA is the color frame-buffer graphics module identifier.

Table 3-5 lists error codes used in video RAM test error messages.

Table 3-5. Video RAM Test Error Codes

Error Code	Meaning
1	Error occurred during write loop.
2	Values in memory miscompared.
3	Complemented values in memory miscompared.

Two-Dimensional Graphics Accelerator Modules

This chapter discusses the following item for the two-dimensional (2D) graphics accelerator module:

- Module hardware
- Troubleshooting procedures
- Individual self-tests

2D Graphics Accelerator Module Hardware

The 2D graphics accelerator module rapidly generates high-resolution, two-dimensional, 256-color graphics.

Each 2D graphics accelerator module holds one VSIMM that connects to a 120-pin connector on the two-dimensional graphics accelerator module. This VSIMM has 1.25 Mbytes of DRAM and 1.25 Mbytes of VRAM.

The workstation can support as many 2D graphics accelerator modules as there are available TURBOchannel slots on the system module. Do not combine the 2D graphics accelerator module with other types of graphics modules.

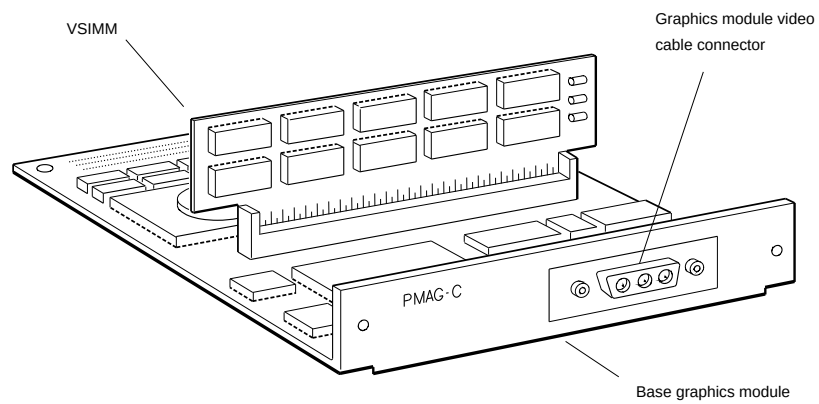
For the 2D graphics accelerator module to work correctly, your workstation must use ULTRIX version 4.0 or higher.

Combining 2D Graphics Accelerator Modules and Monitors

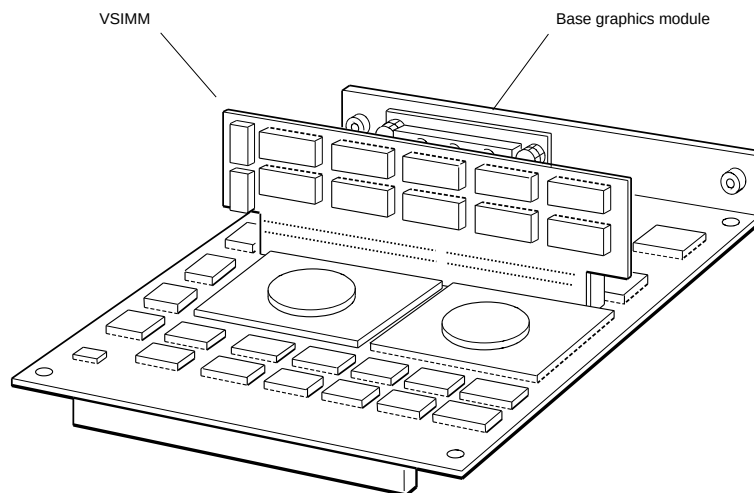
The following 66-Hz monitors can display graphics generated by the 2D graphics accelerator TURBOchannel module:

- VRT16-DA color monitor
- VRT16-HA color monitor
- VRT19-DA color monitor
- VRT19-HA color monitor
- VR319-CA monochrome monitor
- VR320-CA color monitor

Figure 4-1 shows the two-dimensional graphics accelerator module and its connectors.



Front view



Back view

WSE2M053

Figure 4-1. Two-dimensional graphics accelerator module

Troubleshooting a 2D Graphics Accelerator Module

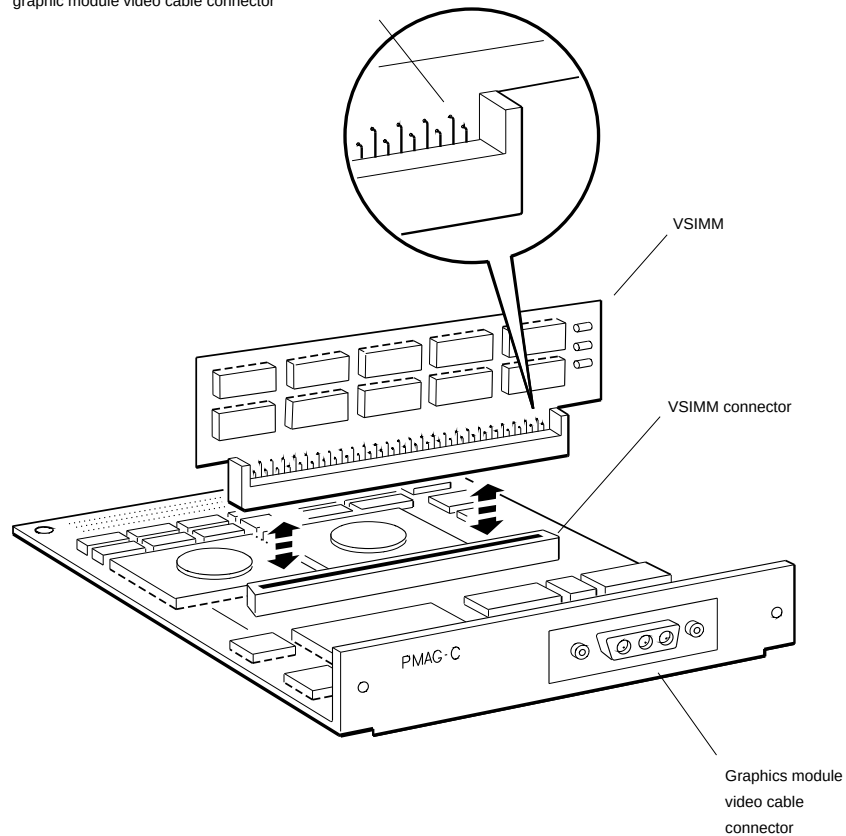
- *If a 2D graphics accelerator module reports an error in the stic test, the problem is in the two-dimensional graphics accelerator module or the system module. Insert the two-dimensional graphics accelerator module in another option slot and repeat the two-dimensional graphics accelerator test script.*
 - If the two-dimensional graphics accelerator module reports no errors in the new slot, replace the system module.
 - If the two-dimensional graphics accelerator module in the new slot still returns an error message that includes stic, replace the two-dimensional graphics accelerator module.
- *If a 2D graphics accelerator module reports an error in one of the following tests, replace the two-dimensional graphics accelerator module:*
 - dmaaddrs
 - intr-dma
 - shade
 - stamp
 - vdac
- *If a 2D graphics accelerator module reports an error in the fb, fbfill, or vdacsig test, the problem is possibly in the VSIMM. Insert a good VSIMM on the two-dimensional graphics accelerator module. Figure 4-2 shows how to install a VSIMM onto the two-dimensional graphics accelerator module.*

After you insert a new VSIMM, run the graphics test script to check the new VSIMM. Type **sh slot/pst-t**, where you replace *slot* with the slot number of the 2D graphics accelerator module.

If the fb or fbfill test still reports an error, replace the 2D graphics accelerator module. Refer to “How to Remove and Install Option Module Hardware” in Chapter 1 for directions.

- *If the monitor display has missing or extra pixels, replace the VSIMM. If the problem persists after you replace the VSIMM, replace the two-dimensional graphics accelerator module.*

Bent leads on VSIMM must face the
graphic module video cable connector



WSE2M054

Figure 4-2. Removing and replacing a VSIMM on a two-dimensional graphics accelerator module

Individual 2D Graphics Accelerator Module Tests

The following sections explain the command and error message format for each 2D graphics accelerator module test.

Table 4-1 lists the name and command for each individual 2D graphics accelerator test.

Table 4-1. 2D Graphics Accelerator Tests

Test Name	Test Command
Direct memory access (DMA) address lines test	<i>slot/dmaaddrs</i>
Video memory data path test	<i>slot/fb</i>
VSIMM read and write test	<i>slot/fbfill [pattern] [buffer]</i>
2D graphics accelerator patterns test	<i>slot/patrn [action]</i>
Shade and half-space test	<i>slot/shade</i>
Stamp chip arithmetic logic unit (ALU) test	<i>slot/stamp</i>
Stamp interface chip (STIC) read and write test	<i>slot/stic</i>
Video digital-to-analog converter (VDAC) read and write test	<i>slot/vdac</i>
Video digital-to-analog converter (VDAC) analog output and signature test	<i>slot/vdacsig</i>

Direct Memory Access (DMA) Address Lines Test

The direct memory access (DMA) address lines test checks the STIC DMA address lines. To run the DMA address lines test, type *slot/dmaaddrs*, where *slot* represents the slot number of the 2D graphics accelerator module, and press Return.

DMA address lines test error messages

DMA address lines test error messages have the form
?TFL: *slot/dmaaddrs (n: description)*

- ?TFL *slot/dmaaddrs* indicates that the DMA address lines test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-2 lists the error codes and descriptions used in DMA address lines test error messages.

Table 4-2. DMA Address Lines Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit during STIC DMA.
(1: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(2: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit during STIC DMA.
(2: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(3: addrMsk= <i>x</i>)	Error occurred in a STIC DMA address line. The <i>x</i> represents a mask that identifies the specific lines that reported the error.

Video Memory Data Path Test

The video memory data path test checks the data path and address path to the video memory. To run the video memory data path test, type **t slot/fb** [*buffer*] and press Return.

When you type the video memory data path test command,

- Replace *slot* with the slot number of the 2D graphics accelerator module.
- Replace *buffer* with the value that specifies the buffer you want to test.
 - Specify 0 to test the VRAM.
 - Specify 1 to test the DRAM.
 - Specify an asterisk (*) to test both buffers.

Video memory data path test error messages

Video memory data path test error messages have the form
?TFL: slot/fb (n: description)

- **?TFL slot/fb** indicates that the video memory data path test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-3 lists error codes and messages used in video memory data path test error messages.

Table 4-3. Video Memory Data Path Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: sticEOP=0, exp=1)	STIC did not set end-of-packet bit in STIC DMA.
(1: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(2: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in STIC DMA.
(2: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(2: ?dma= NoPxls)	DMA did not send pixel data to the expected system memory address.
(3: pxl[N]= x:exp= y)	Pixel data miscompare occurred. The pxl value is the actual pixel data. The exp value is what the pixel data should have been.
(4: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in STIC DMA.
(4: ?dma= sticbsy)	STIC reported it was busy when it should not have been.
(5: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in STIC DMA.
(5: ?dma= sticbsy)	STIC reported it was busy when it should not have been.
(5: ?dma= NoPxls)	DMA did not send pixel data to the expected system memory address.
(6: addrMsk= x, buff=N)	Error occurred in an address line. The <i>x</i> is a mask that indicates the address line where the error occurred. The <i>N</i> represents the buffer where the error occurred.

VSIMM Read and Write Test

The VSIMM read and write test checks all the memory cells in a video frame buffer. To run the VSIMM read and write test, type **t slot/fbfill** [*pattern*] [*buffer*] and press Return.

VSIMM read and write test error messages

VSIMM read and write test error messages have the form
?TFL: *slot/fbfill* (*n*: *description*)

- ?TFL *slot/fbfill* indicates that the VSIMM read and write test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-4 lists error codes and descriptions used in VSIMM read and write cells test error messages.

Table 4-4. VSIMM Read and Write Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(1: ?dma= sticbsy)	STIC reported it was busy when it should not have been.
(2: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(2: ?dma= sticbsy)	STIC reported it was busy when it should not have been.
(2: ?dma=NoPxls)	DMA did not send pixel data to the expected system memory address.

(continued on next page)

Table 4-4 (Cont.). VSIMM Read and Write Test Error Codes and Descriptions

Error Code and Description	Meaning
(3: pxl[x,y]= z1: exp= z2)	Pixel miscompare occurred. – The <i>x</i> and <i>y</i> values represent the x and y coordinates of the pixel involved in the miscompare. – The <i>z1</i> value is the actual pixel data. – The <i>z2</i> value is what the pixel data should be.

Stamp Interface Chip (STIC) Interrupt and DMA Test

The stamp interface chip (STIC) interrupt and DMA test uses the STIC chip to check DMA and to perform vertical retrace and end-of-packet interrupt operations. To run the STIC interrupt and DMA test, type **t slot /intr-dma**, where *slot* represents the slot number of the 2D graphics accelerator module, and press Return.

STIC interrupt and DMA test error messages

STIC interrupt and DMA test error messages have the form ?TFL: *slot/intr-dma (n description)*

- ?TFL *slot/intr-dma* indicates that the STIC interrupt and DMA test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-5 lists the error codes and descriptions used in STIC interrupt test error messages.

Table 4-5. STIC Interrupt Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: mb_sticint= 0: exp= 1)	STIC failed to interrupt the CPU during a vertical blanking interval.
(2: sticint= N: exp= 1)	The vertical interrupt bit did not get set in the STIC interrupt register.
(3: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(4: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(5: ?dma=NoPxls)	DMA did not send pixel data to the expected system memory address.

2D Graphics Accelerator Patterns Test

The 2D graphics accelerator patterns test displays a series of patterns on the monitor. To run the 2D graphics accelerator patterns test, type *slot/patrn*s [action] and press Return.

When you type the 2D graphics accelerator patterns command,

- Replace *slot* with the slot number of the 2D graphics accelerator module.
- Replace the optional *action* parameter with a value that specifies how the patterns are displayed.
 - Specify 0 to display the patterns continuously.
 - Specify 1 to have each pattern remain on the monitor screen until you press any key on the keyboard.

2D graphics accelerator patterns test error messages

2D graphics accelerator patterns test error messages have the form ?TFL: *slot/patrns* (*n*: *description*)

- ?TFL *slot/patrns* indicates that the 2D graphics accelerator patterns test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-6 lists error codes and descriptions used in 2D graphics accelerator patterns test error messages.

In these error messages, *M* represents the portion of the 2D graphics accelerator test that failed to set the end-of-packet bit. *N* represents the portion of the test that reported that the STIC was busy when it should not have been.

Table 4-6. 2D Graphics Accelerator Patterns Test Error Codes and Descriptions

Error Code and Description	Meaning
(M: sticEOP=0, exp=1)	STIC did not set end-of-packet bit in STIC interrupt register.
(N: ?dma= sticbsy)	STIC reported it was busy when it should not have been.

Shade and Half-Space Test

The shade and half-space test checks the ability of the stamp chip to produce smooth shades and calculate half-space coordinates. To run the shade and half-space test, type *slot/shade*, where *slot* represents the slot number of the 2D graphics accelerator module, and press Return.

Shade and half-space test error messages

Shade and half-space test error messages have the form ?TFL: *slot/shade (n: description)*

- ?TFL *slot/shade* indicates that the shade and half-space test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-7 describes the error codes and descriptions used in shade and half-space test error messages.

Table 4-7. Shade and Half-Space Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: sticEOP=0, exp=1)	STIC did not set end-of-packet bit in the STIC interrupt register.
(1: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(2: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(2: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(2: ?dma= NoPxls)	DMA operation did not send pixels to the expected system memory address.
(3: tri smth shd err, indx=0)	The system discovered a miscompare when drawing a smooth, shaded triangle to the RGB buffer. The indx value is a code that identifies the failed pixel.

(continued on next page)

Table 4-7 (Cont.). Shade and Half-Space Test Error Codes and Descriptions

Error Code and Description	Meaning
(4: tri smth shd err, indx= N)	The system discovered a miscompare when drawing a smooth, shaded triangle to the RGB-buffer. The indx value is a code that identifies the failed pixel.
(5: tri smth shd err, indx= N)	The system discovered a miscompare when drawing a smooth, shaded triangle to the RGB-buffer. The indx value is a code that is a code that identifies the failed pixel.
(6: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(6: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(7: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(7: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(7: ?dma= NoPxls)	DMA operation did not send pixels to the expected system memory address.
(8: Zbuff tri smth shd err, indx=0)	The system discovered a miscompare when drawing a smooth, shaded triangle to the z-buffer. The indx value is a code that identifies the failed pixel.
(9: zbuff tri smth shd err, indx= N)	The system discovered a miscompare when drawing a smooth, shaded triangle to the z-buffer. The indx value is a code that identifies the failed pixel.
(10: zbuff tri smth shd err, indx= N)	The system discovered a miscompare when drawing a smooth, shaded triangle to the z-buffer. The indx value is a code that identifies the failed pixel.
(12: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(12: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(13: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in STIC interrupt register.

(continued on next page)

Table 4-7 (Cont.). Shade and Half-Space Test Error Codes and Descriptions

Error Code and Description	Meaning
(13: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(14: hlf_spc= x , exp= y , line= M , pxl= N)	STAMP chip did not calculate the half-space coordinates of an unaligned triangle correctly. – The x represents the actual pixel data. – The y represents the expected pixel data. – The M represents the line where the error occurred. – The N represents the pixel where the error occurred.
(15: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(15: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(16: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(16: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(17: zbuf hlf_spc= x , exp= y , line= M , pxl= N)	STAMP chip did not calculate the z-buffer half-space coordinates of an unaligned triangle correctly. – The x represents the actual pixel data. – The y represents the expected pixel data. – The M represents the line where the error occurred. – The N represents the pixel where the error occurred.

Stamp Chip Arithmetic Logic Unit (ALU) Test

The stamp chip arithmetic logic unit (ALU) test checks stamp chip ALU operation and the data and address lines between the STIC and STAMP chips. To run the stamp chip ALU test, type **t slot/stamp**, where *slot* represents the slot number of the 2D graphics accelerator module, and press Return.

Stamp chip ALU test error messages

Stamp chip ALU test error messages have the form
?TFL: *slot/stamp (n: description)*

- ?TFL *slot/stamp* indicates that the stamp chip ALU test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-8 lists error codes and descriptions used in stamp ALU test error messages.

Table 4-8. Stamp Chip ALU Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(2: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(2: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(3: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(3: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(3: ?dma= NoPxls)	DMA operation did not send pixel data to the expected system memory address.

(continued on next page)

Table 4-8 (Cont.). Stamp Chip ALU Test Error Codes and Descriptions

Error Code and Description	Meaning
(4: ALU [#N]= x, exp =y)	Results of an ALU operation were incorrect. – The ALU value is the actual result of the ALU operation. <i>N</i> represents a number that indicates the specific function that failed. The <i>x</i> value is the actual result of the ALU operation. The <i>exp</i> value is what the result of the ALU operation should be.
(5: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(5: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(6: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(6: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(7: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(7: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.
(7: ?dma= NoPxls)	DMA operation did not send pixel data to the expected system memory address.
(8: SDAL= x: exp= y)	Data sent through the SDAL lines resulted in a miscompare. The SDAL value is the actual data in the SDAL line. The <i>exp</i> value is what the data in the SDAL line should be.
(9: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit in the STIC interrupt register.
(9: ?dma= sticbsy)	STIC reported that it was busy when it should not have been.

Stamp Interface Chip (STIC) Read and Write Test

The stamp interface chip (STIC) read and write test performs a read and write operation through the 32-bit data path to the 2D graphics accelerator module and then performs a STIC self-test. To run the STIC read and write test, type **t slot/stic**, where *slot* represents the slot number of the 2D graphics accelerator module, and press Return.

STIC read and write test error messages

STIC read and write test error messages have the form

?TFL: *slot/stic* (*n*: *description*)

- ?TFL *slot/stic* indicates that the STIC read and write test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-9 lists error codes and descriptions used in STIC read and write test error messages.

Table 4-9. STIC Read and Write Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: sticCSR=x: exp= 0)	Miscompare occurred reading the STIC CSR. The expected sticCSR value was 0.
(1: sticCSR=x: exp= ff)	Miscompare occurred reading the STIC CSR. The expected sticCSR value was ff.
(1: sticCSR=x: exp= y)	Miscompare occurred reading the STIC CSR. The exp value is what the value in the CSR should be.
(2: sig@2000= x: exp= y)	The signature value that the self-test read at 2000 iterations is incorrect. The <i>x</i> represents the actual signature value that the test read. The <i>y</i> represents what the signature value should be.

(continued on next page)

Table 4-9 (Cont.). STIC Read and Write Test Error Codes and Descriptions

Error Code and Description	Meaning
(2: sig@20000= x: exp= y)	The signature value that the self-test read at 20,000 iterations is incorrect. The <i>x</i> represents the actual signature value that the test read. The <i>y</i> represents what the signature value should be.

Video Digital-to-Analog Converter (VDAC) Read and Write Test

The video digital-to-analog converter (VDAC) read and write test performs a read and write operation on the VDAC chip and color map. To run the VDAC read and write test, type **t slot/vdac**, where *slot* represents the slot number of the 2D graphics accelerator module, and press Return.

VDAC read and write test error messages

VDAC read and write test error messages have the form
?TFL: *slot/vdac (n: description)*

- ?TFL *slot/vdac* indicates that the VDAC read and write test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-10 lists the error codes and descriptions found in VDAC read and write test error messages.

Table 4-10. VDAC Read and Write Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: vdacID= x: exp= 4a <addrlo= y, addrhi= z>)	A read operation on the VDAC ID register did not return the correct value, which is 4a. – The <i>x</i> represents the actual value that the test read. – The <i>y</i> represents the value in the VDAC address low register. – The <i>z</i> represents the value in the VDAC address high register.

(continued on next page)

Table 4-10 (Cont.). VDAC Read and Write Test Error Codes and Descriptions

Error Code and Description	Meaning
(2: vdacreg= x: exp= 4a <addrlo= y, addrhi= z>)	A read operation on the VDAC command register did not return the correct value, which is 4a. – The <i>x</i> represents the actual value that the test read. – The <i>y</i> represents the value in the VDAC address low register. – The <i>z</i> represents the value in the VDAC address high register.
(3: Rcmmap= x: exp= y <addrlo= z1, addrhi= z2>)	A miscompare occurred during the decrementing red part of the color map read and write test. – The <i>x</i> represents the actual value the test read from the color map. – The <i>y</i> represents the value the test should have read from the color map. – The <i>z1</i> represents the value in the VDAC address low register. – The <i>z2</i> represents the value in the VDAC address high register.
(4: Gcmmap= x: exp= y <addrlo= z1, addrhi= z2>)	A miscompare occurred during the decrementing green part of the color map read and write test. – The <i>x</i> represents the actual value the test read from the color map. – The <i>y</i> represents the value the test should have read from the color map. – The <i>z1</i> represents the value in the VDAC address low register. – The <i>z2</i> represents the value in the VDAC address high register.

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Table 4-10 (Cont.). VDAC Read and Write Test Error Codes and Descriptions

Error Code and Description	Meaning
(5: Bcmap= <i>x</i> : exp= <i>y</i> <addrlo= <i>z1</i> , addrhi= <i>z2</i> >)	A miscompare occurred during the decrementing blue part of the color map read and write test. – The <i>x</i> represents the actual value the test read from the color map. – The <i>y</i> represents the value the test should have read from the color map. – The <i>z1</i> represents the value in the VDAC address low register. – The <i>z2</i> represents the value in the VDAC address high register.
(6: Rcmap= <i>x</i> : exp= <i>y</i> <addrlo= <i>z1</i> , addrhi= <i>z2</i> >)	A miscompare occurred during the incrementing red part of the color map read and write test. – The <i>x</i> represents the actual value the test read from the color map. – The <i>y</i> represents the value the test should have read from the color map. – The <i>z1</i> represents the value in the VDAC address low register. – The <i>z2</i> represents the value in the VDAC address high register.

(continued on next page)

Table 4-10 (Cont.). VDAC Read and Write Test Error Codes and Descriptions

Error Code and Description	Meaning
(7: Gcmap= <i>x</i> : exp= <i>y</i> <addrlo= <i>z1</i> , addrhi= <i>z2</i> >)	A miscompare occurred during the incrementing green part of the color map read and write test. – The <i>x</i> represents the actual value the test read from the color map. – The <i>y</i> represents the value the test should have read from the color map. – The <i>z1</i> represents the value in the VDAC address low register. – The <i>z2</i> represents the value in the VDAC address high register.
(8: Bcmap= <i>x</i> : exp= <i>y</i> <addrlo= <i>z1</i> , addrhi= <i>z2</i> >)	A miscompare occurred during the incrementing blue part of the color map read and write test. – The <i>x</i> represents the actual value the test read from the color map. – The <i>y</i> represents the value the test should have read from the color map. – The <i>z1</i> represents the value in the VDAC address low register. – The <i>z2</i> represents the value in the VDAC address high register.

Video Digital-to-Analog Converter (VDAC) Analog Output and Signature Test

The video digital-to-analog converter (VDAC) analog output and signature test checks the analog output from the VDAC and the VDAC signature while colors are being displayed on the monitor. To run the VDAC output and signature test, type **t slot /vdacsig**, where *slot* represents the slot number of the 2D graphics accelerator module, and press Return.

VDAC analog output and signature test error messages

VDAC analog output and signature test error messages have the form ?TFL: *slot*/vdacsig (*n description*)

- ?TFL *slot*/vdacsig indicates that the VDAC analog output and signature test reported an error.
- The *n* represents a code that identifies which portion of the test failed.
- *description* represents additional information that describes the error.

Table 4-11 describes the error codes and error descriptions found in VDAC analog output and signature test error messages.

Table 4-11. VDAC Analog Output and Signature Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: sticEOP= 0: exp= 1)	STIC did not set the end-of-packet interrupt bit in the STIC interrupt register.
(1: ?dma= sticBSY)	STIC reported it was busy when it should not have been.
(2: Pxl#= N: patt= x: R[exp]=act: G[exp]= act: B[exp]=act)	Signature pattern is incorrect. – The patt value is the pixel pattern in the VSIMM. – N represents the number of the pixel with the problem signature pattern. – The R, G, and B values indicate the actual and expected values for the R, G, and B signals.
(1: ?dma= sticBSY)	STIC reported it was busy when it should not have been.
(3: sticEOP= 0: exp= 1)	STIC did not set the end-of-packet interrupt bit in the STIC interrupt register.
(3: ?dma= sticBSY)	STIC reported it was busy when it should not have been.
(4: ?montr cbl)	The video cable is not connected properly or is faulty.
(5: sticEOP= 0: exp= 1)	STIC did not set the end-of-packet interrupt bit in the STIC interrupt register.
(5: ?dma= sticBSY)	STIC reported it was busy when it should not have been.
(6: G != B: <addrlo= x, addrhi=x>)	Green analog output is not greater than blue analog output. – The addrlo value is the value in the VDAC address low register. – The addrhi value is the value in the VDAC address high register.

(continued on next page)

Table 4-11 (Cont.). VDAC Analog Output and Signature Test Error Codes and Descriptions

Error Code and Description	Meaning
(7: sticEOP= 0: exp= 1)	STIC did not set the end-of-packet interrupt bit in the STIC interrupt register.
(7: ?dma= sticBSY)	STIC reported it was busy when it should not have been.
(8: R != B: <addrlo= x, adrhi=x>)	Red analog output is not greater than blue analog output. – The addrlo value is the value in the VDAC address low register. – The adrhi value is the value in the VDAC address high register.
(9: sticEOP= 0: exp= 1)	STIC did not set the end-of-packet interrupt bit in the STIC interrupt register.
(9: ?dma= sticBSY)	STIC reported it was busy when it should not have been.
(10: B != R: <addrlo= x, adrhi=x>)	Blue analog output is not greater than red analog output. – The addrlo value is the value in the VDAC address low register. – The adrhi value is the value in the VDAC address high register.

Smart Frame-Buffer Graphics Module

This chapter discusses the following items for the smart frame-buffer graphics module:

- Module hardware
- Troubleshooting procedures
- Individual self-tests

The terms CXTurbo and HX also refer to the smart frame-buffer graphics module. In cnfg displays, the smart frame-buffer module is identified by the terms PMAGB-BA and HX.

Smart Frame-Buffer Graphics Module Hardware

The smart frame-buffer graphics module generates eight-plane color graphics. The smart frame-buffer graphics module includes the following components:

- One smart frame-buffer application-specific integrated circuit (ASIC)
- Two banks of 256-Kbyte x 4 video random-access memory (RAM)
- One BT459 RAM digital-to-analog converter (RAMDAC)
- One BT438 crystal oscillator
- One 128-Kbyte flash electrically erasable programmable read- only memory (EEPROM)

Figure 5-1 shows the smart frame-buffer graphics module and its connectors.

Smart Frame-Buffer Module Versions

There are three versions of the smart frame-buffer graphics module:

- PMAGB-BA
- PMAGB-BC
- PMAGB-BE

Note: *In all displays, the smart frame-buffer graphics module is identified by the expression PMAGB-BA regardless of its version.*

To display the abbreviated cnfg display for the entire system, type **cnfg** and press Return.

The display line for all versions of the smart frame-buffer graphics module in the abbreviated cnfg display has the format:
0: PMAGB-BA DEC V1.0 TCF0 (HX --- d=8)

The number in the leftmost column is the number of the slot where the smart frame-buffer graphics module is installed. In this example, the module is installed in TURBOchannel slot 0.

To display the expanded cnfg display for a smart frame-buffer graphics module, type **cnfg/slot** and press Return. Replace *slot* with the slot number of the module.

0:	PMAGB-BA	DEC	V1.0	TCF0	(HX	--	d=8)
	Video Ram Size				2097152		
	Number of Planes				8		
	Number of Rows				1024		
	Number of Columns			1280			
	Crystal Selected (Mhz)			130			
	Refresh Rate (Hz)				72		
	Vertical Scanlines				1024		
	Vertical Front Porch			3			
	Vertical Back Porch			34			
	Vertical Sync				3		
	Horizontal pixels				1280		
	Horizontal front porch			32			
	Horizontal back porch			232			
	Horizontal sync				160		
	Refresh count				468		
	Cursor X					368	
	Cursor Y					38	
	Cursor Test Signature			0x3a 0x0	0x51		
	Pattern Test Signature			0xcd 0xfb	0x8a		
	Line Test Signature			0x78 0xbd	0xa0		

Different versions support different monitors. Each version has two configurations of screen update frequency and screen pixel dimensions. The presence or absence of a jumper on the frequency setting pins determines the configuration.

Table 5-1 lists the screen update frequency, screen pixel dimensions, jumper setting, and supported monitors for each smart frame-buffer version and configuration.

Table 5-1. Characteristics of Each Smart Frame-Buffer Version

Version	Jumper Setting	Screen Update Frequency	Screen Pixel Dimensions	Monitors
PMAGB-BA	Off	72	1280 x 1024	VR320-DA VRM17-DA VRT16-HA VRT19-HA
	On	66	1280 x 1024	VR320-CA VRC16-CA VRT16-DA VRT16-HA VRT19-DA VRT19-HA
PMAGB-BC	Off	72	1280 x 1024	VR320-DA VRM17-DA VRT16-HA VRT19-HA
	On	60	1024 x 864	VR262-AA VR297-DA VR299-DA
PMAGB-BE	Off	72	1280 x 1024	VR320-DA VRM17-DA VRT16-HA VRT19-HA
	On	72	1024 x 768	VRC16-CA VRM17-AA

Smart Frame-Buffer Jumpers

The smart frame-buffer graphics module has two sets of jumper pins:

- The frequency setting pins
- The EEPROM access pins

The frequency setting jumper controls the frequency and pixel dimensions. See the "Versions" section of this chapter.

The EEPROM access jumper enables and disables EEPROM programming. When the jumper is on, you can program the EEPROM. When the jumper is off, you cannot program the EEPROM.

A 4-pin jumper holder next to the EEPROM access pins provides a place to store two jumpers that have been removed from the jumper pins.

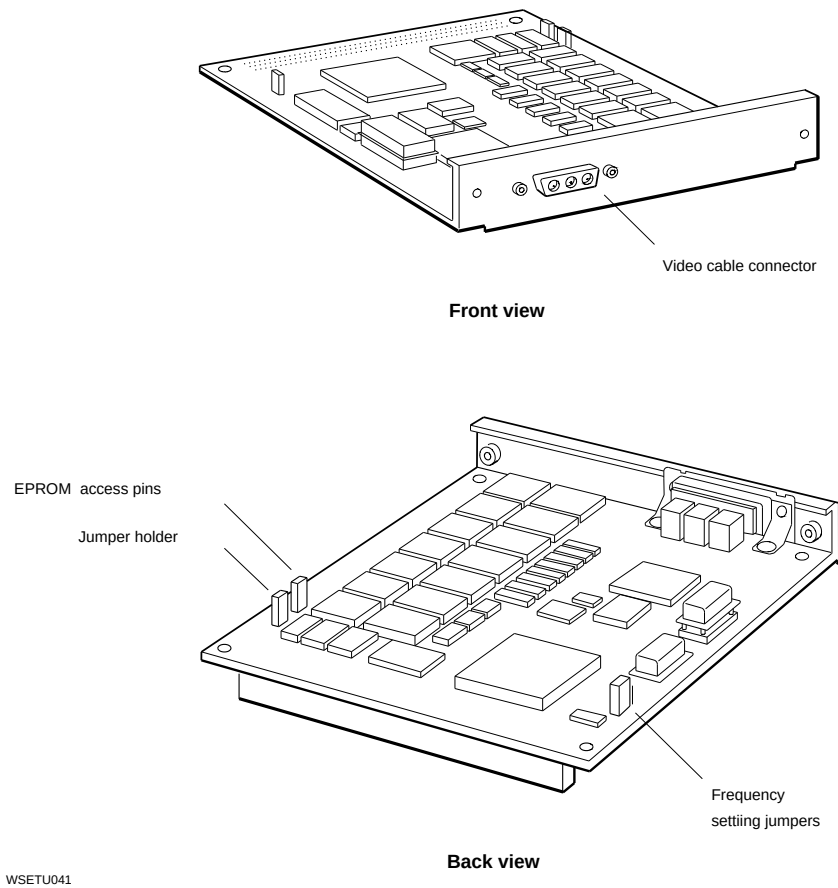


Figure 5-1. Smart frame-buffer graphics module

Troubleshooting a Smart Frame-Buffer Graphics Module

- When a graphics module malfunctioning, the normal display of error messages is sometimes disrupted. For this reason, use an alternate terminal as the console when troubleshooting a graphics module.
- *If the monitor and the smart frame-buffer graphics module cannot synchronize*, check whether the module configuration is correct for the monitor. This condition is indicated by scrambled horizontal lines on the monitor. The expanded cnfg display lists the refresh rate and the number of rows and columns set for the module. Table 5-1 lists the monitors that each version of the smart frame-buffer module supports. Remove or install the frequency setting jumper as appropriate.

If the monitor and the graphics module still does not synchronize, there is probably a mismatch between the version of the graphics module and the monitor type. Change the monitor or graphics module as appropriate.

- *If no monitor is connected to the smart frame-buffer graphics module*, the red screen subtest of the patterns test will fail. Check that a monitor is installed and properly connected. If the patterns test still fails, replace the smart frame- buffer graphics module.
- *If a smart frame-buffer graphics module self-test other than the patterns test fails*, replace the smart frame-buffer graphics module.

Individual Smart Frame-Buffer Graphics Module Self-Tests

Table 5-2 lists the individual smart frame- buffer graphics module self-tests and their commands. Descriptions of these individual self-tests appear later in this chapter in the same order in which they appear in Table 5-2.

Table 5-2. Smart Frame-Buffer Graphics Module Tests

Test Name	Test Command
Video RAM test	t slot/vram [?] [-v] [-tn] [-d]
Video RAMDAC test	t slot/vdac [?] [-v] [-tn] [-d]
Patterns test	t slot/patt [?] [-v] [-tn] [-d]
Box test	t slot/box [?] [-v] [-tn] [-d]
Font test	t slot /font [?] [-fn] [-b] [-m]
Register test	t slot/reg [?] [-v] [-tn] [-d]
Interrupt test	t slot/int [?] [-v] [-tn] [-d]
Stipple mode test	t slot /stip [?] [-v] [-tn] [-sr] [-d]
Line draw mode test	t slot/line [?] [-v] [-tn] [-nc] [-d]
Area copy mode test	t slot /copy [-cr] [-tn] [-v] [-d]
Boolean operation test	t slot /bool [?] [-v] [-tn] [-d]
Planemask test	t slot/plane [?] [-v] [-tn] [-d]
Pixel shift test	t slot/pshift [?] [-v] [-tn] [-d]
Cross-hair cursor utility	t slot/chair [-v]
Ras test	t slot/ras [?] [-v] [-tn] [-d]
Background test	t slot/back [?] [-v] [-tn] [-d]

Video RAM Test

The video RAM test writes and reads color pattern data to smart frame-buffer RAM. As each pattern is written, the screen displays the corresponding color.

To run the video RAM test, type **t slot/vram [?] [-v] [-tn] [-d]** and press Return.

When you type the video RAM test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- Include the -tn option to execute subtest number n.
- Include the -d option to keep the display active during the test.

Table 5-3 lists the video RAM subtests.

Table 5-3. Video RAM Subtests

Subtest Number	Description
1	VRAM: Load color map
2	VRAM: Write 55555555 test
3	VRAM: Read 55555555/write AAAAAAAAA test
4	VRAM: Read AAAAAAAAA/write EEEEEEEE test

Video RAM test error messages

Video RAM test error messages have the form
? TFL: *slot* PMAGB-BA VRAM:*Description* Address=xxxxxxx,
Expect= yy, Actual = zz *data*

- ? TFL: *slot* PMAGB-BA VRAM: indicates that the smart frame-buffer graphics module in slot *slot* reported a video RAM test error.
- *Description* identifies the subtest that failed.
- The Address value is the RAM address where the failure occurred.

- The Expect value is the expected RAM contents.
- The Actual value is the actual RAM contents.
- *data* represents the first eight longwords of data, starting at the address that failed, which the system displays in this error message.

Video Random-Access Memory Digital-to-Analog Converter (RAMDAC) Test

The video random-access memory digital-to-analog converter (RAMDAC) test tests the BT459 RAMDAC.

To run the video RAMDAC test, type **t slot /vdac [?] [-v] [-tn] [-d]** and press Return.

When you type the video RAMDAC test command,

- Replace *slot* with the slot number of the graphics module.
- Include the *?* option to list the subtests.
- Include the *-v* option to run the test in verbose mode.
- Include the *-tn* option to execute a subtest. Replace *n* with the number of the subtest.
- Include the *-d* option to keep the display active during the test.

Table 5-4 lists the video RAMDAC subtests.

Table 5-4. Video RAMDAC Subtests

Subtest Number	Description
1	VDAC: Fill video RAM
2	VDAC: ID register test
3	VDAC: Revision register test
4	VDAC: Monitor connected test
5	VDAC: Command register test
6	VDAC: Overlay RAM test
7	VDAC: Color RAM test
8	VDAC: Load color map
9	VDAC: Cursor command register test
10	VDAC: Cursor RAM test
11	VDAC: Cursor color test
12	VDAC: Cursor crosshair test
13	VDAC: Cursor signature test

Notes: *The blue band sometimes appears to be out of alignment with the other colors of the cursor. This does not constitute a failure.*

The VDAC monitor connected test does not check for the presence of a monitor.

Video RAMDAC test error messages

Video RAMDAC test error messages have the form

? TFL: *slot* PMAGB-BA VDAC: *Description* Address=xxxxxxx,
Expect= yy, Actual = zz

- ? TFL: *slot* PMAGB-BA VDAC: indicates that the smart frame-buffer graphics module in slot *slot* reported a video RAMDAC test error.
- *Description* identifies the subtest that failed.
- The Address value is the RAM address where the failure occurred.
- The Expect value is the expected RAM contents.
- The Actual value is the actual RAM contents.

Patterns Test

The patterns test sends patterns to the screen by setting up the color look-up table and video RAM with the required data patterns. The patterns test requires a video monitor.

To run the patterns test, type **t slot /patt [?] [-v] [-tn] [-d]** and press Return.

When you type the patterns test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- Include the -tn option to execute a subtest. Replace *n* with the number of the subtest.
- Include the -d option to keep the display active during the test.

Table 5-5 lists the patterns subtests.

Table 5-5. Patterns Subtests

Subtest Number	Description
1	PATT: Fill video RAM
2	PATT: Color bar test
3	PATT: Color bar reference voltage test
4	PATT: Gray scale test
5	PATT: Red screen test
6	PATT: Green screen test
7	PATT: Blue screen test
8	PATT: Blue/red test
9	PATT: Blue/red to blue test
10	PATT: Blue to green test
11	PATT: Signature analysis test
12	PATT: White screen test

Patterns test error messages

Patterns test error messages have the form ? TFL: *slot* PMAGB-BA PATT:*Description*

- ? TFL: *slot* PMAGB-BA PATT: indicates that the smart frame-buffer graphics module in slot *slot* reported a patterns test error.
- *Description* identifies the subtest that failed.

The patterns test posts an error if the monitor cable is not connected to the module. The patterns test signature mode subtest must be run after the other subtests since it requires an active video signature. If the patterns signature subtest fails, the error message includes the red, green, and blue signature values for pixels A,B,C and D.

Box Test

The box test displays a grid of vertical and horizontal lines on the monitor with a circle overlaid on the grid.

To run the box test, type **t slot /box [?] [-v] [-tn] [-d]** and press Return.

When you type the box test command,

- Replace *slot* with the slot number of the graphics module.
- Include the *?* option to list the subtests.
- Include the *-v* option to run the test in verbose mode.
- Include the *-tn* option to execute a subtest. Replace *n* with the number of the subtest.
- Include the *-d* option to keep the display active during the test.

Table 5-6 lists the box subtests.

Table 5-6. Box Subtests

Subtest Number	Description
1	BOX: Load grid map
2	BOX: Load circle on the grid

Box test error messages

Box test error messages have the form *? TFL: slot PMAGB-BA BOX:Description*

- *? TFL: slot PMAGB-BA BOX:* indicates that the smart frame-buffer graphics module in slot *slot* reported a box test error.
- *Description* identifies the subtest that failed.

The box test provides no extended error information.

Font Test

The font test fills the screen with the font set and then scrolls the display until any character is typed on the keyboard.

To run the font test, type **t slot /font [?] [-fn] [-b] [-m]** and press Return.

When you type the font test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- To display a specific character, include the -fn option, replacing *n* with the desired character.
- Include the -b option to display black characters on a white background.
- Include the -m option to specify the 8-bit multinational font set.

These are some sample font test commands:

Command	Description
t slot/font	Displays the ascii fonts
t slot/font -fH	Displays H's
t slot/font -fE	Displays E's
t slot/font -b	Displays black characters on white
t slot/font -m	Displays the multinational font set

Font test error messages

Font test error messages have the form ? TFL: *slot* PMAGB-BA FONT ? TFL: *slot* PMAGB-BA FONT: indicates that the smart frame-buffer graphics module in slot *slot* reported a font test error.

The font test provides no extended error information.

Register Test

The register test writes to all visible registers and verifies the contents.

Note: *The register test corrupts the video subsystem registers. If the diagnostic test is run interactively from the CRT console using the -v qualifier, the display is corrupted during the test. The display is initialized when the test has completed.*

*Any errors that occur while the display is disabled are recorded in the error logs. To view the error logs, type **erl** and press Return.*

To run the register test, type **t slot /reg [?] [-v] [-tn] [-d]** and press Return.

When you type the register test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- Include the -tn option to execute a subtest. Replace *n* with the number of the subtest.
- Include the -d option to keep the display active during the test.

Register test error messages

Register test error messages have the form

? TFL: *slot* PMAGB-BA REG: Address=xxxxxxx, Expect= yy,
Actual = zz

- ? TFL: *slot* PMAGB-BA REG: indicates that the smart frame-buffer graphics module in slot *slot* reported a register test error.
- The Address value is the RAM address where the failure occurred.
- The Expect value is the expected RAM contents.
- The Actual value is the actual RAM contents.

Interrupt Test

The interrupt test verifies that the smart frame-buffer graphics module can post an interrupt to the MIPS processor, and that the module will not interrupt the MIPS processor when the interrupt enable register is clear.

To run the interrupt test, type **t slot /int [?] [-v] [-tn] [-d]** and press Return.

When you type the interrupt test command,

- Replace *slot* with the slot number of the graphics module.
- Include the *?* option to list the subtests.
- Include the *-v* option to run the test in verbose mode.
- Include the *-tn* option to execute a subtest. Replace *n* with the number of the subtest.
- Include the *-d* option to keep the display active during the test.

Table 5-7 lists the interrupt subtests.

Table 5-7. Interrupt Subtests

Subtest Number	Description
1	INT: Interrupt assertion test
2	INT: No interrupt assertion test

Interrupt test error messages

Interrupt test error messages have the form

? TFL: *slot* PMAGB-BA INT:*Description*

- ? TFL: *slot* PMAGB-BA INT: indicates that the smart frame-buffer graphics module in slot *slot* reported a interrupt test error.
- *Description* identifies the subtest that failed.

The interrupt test provides no extended error information.

Stipple Mode Test

The stipple mode test fills video RAM with a bitmap pattern.

The stipple test stipples the first row with red and the middle row with blue. As more rows are stippled using the `-s` qualifier, the screen will stipple to the maximum number of rows for the monitor geometry.

To run the stipple mode test, type `t slot /stip [?] [-v] [-tn] [-sr] [-d]` and press Return.

When you type the stipple mode test command,

- Replace *slot* with the slot number of the graphics module.
- Include the `?` option to list the subtests.
- Include the `-v` option to run the test in verbose mode.
- Include the `-tn` option to execute a subtest. Replace *n* with the number of the subtest.
- Include the `-sr` option to specify how many rows to stipple. Replace *r* with the number of rows to stipple.
- Include the `-d` option to keep the display active during the test.

Table 5-8 lists the stipple mode subtests.

Table 5-8. Stipple Mode Subtests

Subtest Number	Description
1	STIP: Stipple foreground test
2	STIP: Stipple background test
3	STIP: Stipple VRAM screen test

Stipple mode test error messages

Stipple mode test error messages have the form
`? TFL: slot PMAGB-BA STIP:Description Address=xxxxxxxxx,
Expect= yy, Actual = zz`

- ? TFL: *slot* PMAGB-BA STIP: indicates that the smart frame-buffer graphics module in slot *slot* reported a stipple mode test error.
- *Description* identifies the subtest that failed.
- The Address value is the RAM address where the failure occurred.
- The Expect value is the expected RAM contents.
- The Actual value is the actual RAM contents.

Line Draw Mode Test

The line draw mode test draws a line and verifies the presence of a line at the specified location in video RAM.

To run the line draw mode test, type **t slot /line [?] [-v] [-tn] [-nc] [-d]** and press Return.

When you type the line draw mode test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- Include the -tn option to execute a subtest. Replace *n* with the number of the subtest.
- Include the -nc option to specify how many lines to draw in each quadrant. Replace *c* with the number of lines to be drawn in each quadrant. For example, **t 1/line -n20** commands the smart frame-buffer in slot 1 to draw 20 lines per quadrant.
- Include the -d option to keep the display active during the test.

Table 5-9 lists the line draw mode subtests.

Table 5-9. Line Draw Mode Subtests

Subtest Number	Description
1	LINE: Transparent short line (Triangle) test
2	LINE: Transparent centered horizontal line test
3	LINE: Transparent alternate horizontal line test
4	LINE: Transparent centered vertical line test
5	LINE: Transparent diagonal line decrement address test
6	LINE: Transparent diagonal line increment address test
7	LINE: Transparent $m < 1$ $x_a < x_b$ quadrant 1 test
8	LINE: Transparent $m < 1$ $x_a > x_b$ quadrant 2 test
9	LINE: Transparent $m > 1$ $x_a < x_b$ quadrant 1 test
10	LINE: Transparent $m > 1$ $x_a > x_b$ quadrant 2 test
11	LINE: Opaque $m < -1$ $x_a < x_b$ quadrant 3 test
12	LINE: Opaque $m < -1$ $x_a > x_b$ quadrant 4 test
13	LINE: Opaque $m > -1$ $x_a < x_b$ quadrant 3 test
14	LINE: Opaque $m > -1$ $x_a > x_b$ quadrant 4 test
15	LINE: Line signature mode test

Line draw mode test error messages

Line draw mode test error messages have the form

? TFL: *slot* PMAGB-BA LINE:*Description*

- ? TFL: *slot* PMAGB-BA LINE: indicates that the smart frame-buffer graphics module in slot *slot* reported a line draw mode test error.
- *Description* identifies the subtest that failed.
- The Address value is the RAM address where the failure occurred.
- The Expect value is the expected RAM contents.
- The Actual value is the actual RAM contents.

If the line signature mode test fails, the error message will contain the red, green, and blue signature values for pixels A, B, C, and D.

Note: *Because the line signature mode subtest is a signature of the video subsystem, that subtest can run only after all other subtests have executed. The line signature mode subtest can be run for only the default lines per quadrant, since using the qualifier -n would change the signature.*

Area Copy Mode Test

The copy mode test copies up to 32 consecutive pixels from a source to a destination. The copy mode test copies the first character row to the middle of the screen.

To run the copy mode test, type **t slot /copy [-cr] [-tn] [-v] [-d]** and press Return.

When you type the copy mode test command,

- Replace *slot* with the slot number of the graphics module.
- Include the *-cr* option to command the test to copy *r* rows. For example, **t 1/copy -c20** commands the smart frame-buffer in slot 1 to copy 20 rows from the top to the bottom of the screen.
- Include the *-tn* option to execute a subtest. Replace *n* with the number of the subtest.
- Include the *-v* option to run the test in verbose mode.
- Include the *-d* option to keep the display active during the test.

Table 5-10 lists the copy mode subtests.

Table 5-10. Copy Mode Subtests

Subtest Number	Description
1	COPY: Copy aligned data test
2	COPY: Copy aligned 1 to 32 bytes test

Copy mode test error messages

Copy mode test error messages have the form
? TFL: *slot* PMAGB-BA COPY:*Description* Address=xxxxxxx,
Expect= yy, Actual = zz

- ? TFL: *slot* PMAGB-BA COPY: indicates that the smart frame-buffer graphics module in slot *slot* reported a copy mode test error.
- *Description* identifies the subtest that failed.

- The Address value is the RAM address where the failure occurred.
- The Expect value is the expected RAM contents.
- The Actual value is the actual RAM contents.

Boolean Operation Test

The Boolean operation test verifies the Boolean functions. Table 5-11 lists the Boolean functions. The *src* field is the input data, and the *dst* field is the value currently in video RAM.

Table 5-11. Boolean Functions

Function Number	Boolean Function
0	0
1	src AND dst
2	src AND NOT dst
3	src
4	NOT (src) AND dst
5	dst
6	src XOR dst
7	src OR dst
8	NOT (src) AND NOT (dst)
9	NOT(src) XOR(dst)
0xa	NOT dst
0xb	src OR (NOT dst)
0xc	NOT src
0xd	(NOT src) OR dst
0xe	(NOT src) OR (NOT dst)
0x	0xffffffff

To run the Boolean operation test, type **t slot /bool [?] [-v] [-tn] [-d]** and press Return.

When you type the Boolean operation test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- Include the -tn option to execute a subtest. Replace *n* with the number of the subtest.

- Include the -d option to keep the display active during the test.

Table 5-12 lists the Boolean operation subtests.

Table 5-12. Boolean Operation Subtests

Subtest Number	Description
1	BOOL: Boolean simple frame test
2	BOOL: Boolean mode test
3	BOOL: Boolean stipple mode test
4	BOOL: Boolean line mode test

Boolean operation test error messages

Boolean operation test error messages have the form
 ? TFL: *slot* PMAGB-BA BOOL:*Description* Address=xxxxxxx,
 Expect= yy, Actual = zz

- ? TFL: *slot* PMAGB-BA BOOL: indicates that the smart frame-buffer graphics module in slot *slot* reported a Boolean operation test error.
- *Description* identifies the subtest that failed.
- The Address value is the RAM address where the failure occurred.
- The Expect value is the expected RAM contents.
- The Actual value is the actual RAM contents.

Planemask Test

The planemask test writes to video RAM for each value of the planemask register and then verifies the contents of video RAM.

To run the planemask test, type **t slot /plane** [?] [-v] [-tn] [-d] and press Return.

When you type the planemask test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- Include the -tn option to execute a subtest. Replace *n* with the number of the subtest.
- Include the -d option to keep the display active during the test.

The planemask test has no subtests.

Planemask test error messages

Planemask test error messages have the form

? TFL: *slot* PMAGB-BA PLANE Address=xxxxxxx, Expect=yy, Actual=zz

- ? TFL: *slot* PMAGB-BA PLANE: indicates that the smart frame-buffer graphics module in slot *slot* reported a planemask test error.
- The Address value is the RAM address where the failure occurred.
- The Expect value is the expected RAM contents.
- The Actual value is the actual RAM contents.

Pixel Shift Test

The pixel shift test verifies that the module shifts video RAM data by the amount specified in the pixel shift register.

To run the pixel shift test, type **t slot /pshift [?] [-v] [-tn] [-d]** and press Return.

When you type the pixel shift test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- Include the -tn option to execute a subtest. Replace *n* with the number of the subtest.
- Include the -d option to keep the display active during the test.

Table 5-13 lists the pixel shift subtests.

Table 5-13. Pixel Shift Subtests

Subtest Number	Description
1	PSHIFT: 32-byte positive shift test
2	PSHIFT: 32-byte negative shift test

Pixel shift test error messages

Pixel shift test error messages have the form

? TFL: *slot* PMAGB-BA PSHIFT:*Description* Address=xxxxxxx,
Expect= yy, Actual = zz

- ? TFL: *slot* PMAGB-BA PSHIFT: indicates that the smart frame-buffer graphics module in slot *slot* reported a pixel shift test error.
- *Description* identifies the subtest that failed.
- The Address value is the RAM address where the failure occurred.
- The Expect value is the expected RAM contents.

- The Actual value is the actual RAM contents.

Crosshair Cursor Utility

The crosshair cursor utility displays a full-screen crosshair cursor with a width of 1 pixel. The cursor can be moved around the screen using the arrow keys on the alternate console or number keys 1, 2, 3, and 4 on the CRT console.

To run the crosshair cursor utility, type **t slot/chair [-v]** and press Return.

When you type the crosshair cursor utility command,

- Replace *slot* with the slot number of the graphics module.
- Include the -v option to run the test in verbose mode.

To stop the crosshair cursor test, enter ctrl-C or the character **q** or **Q**.

The crosshair cursor utility returns no error messages.

Ras Test

The ras test tests ras timing and power consumption. The ras test displays a vertical line of pixels every four scanlines on a 1024-horizontal-pixel monitor.

To run the ras test, type **t slot/ras [?] [-v] [-tn] [-d]** and press Return.

When you type the ras test command,

- Replace *slot* with the slot number of the graphics module.
- Include the ? option to list the subtests.
- Include the -v option to run the test in verbose mode.
- Include the -tn option to execute a subtest. Replace *n* with the number of the subtest.
- Include the -d option to keep the display active during the test.

The ras test displays no error messages.

Background Test

The background test displays pixel patterns. The default pattern is the same pattern used for the system window manager after the system is booted. The default pixel color entry is white.

To run the background test, type **t slot /back [?] [-v] [-tn] [-d]** and press Return.

When you type the background test command,

- Replace *slot* with the slot number of the graphics module.
- Include the *?* option to list the subtests.
- Include the *-v* option to run the test in verbose mode.
- Include the *-tn* option to execute a subtest. Replace *n* with the number of the subtest.
- Include the *-d* option to keep the display active during the test.

These are some sample background test commands:

Command	Description
t slot/back -d	Displays the default pattern on the screen
t slot/back -v	Prompts for a scanline pattern and RGB

Test Scripts

The smart frame-buffer provides the following test scripts:

- `cnsltest`
- `pst-m`
- `pst-v`

cnsltest Script

The `cnsltest` script is invoked during power up initialization.

```
init ${slot} e
t ${slot}/int
t ${slot}/patt
t ${slot}/vram
t ${slot}/stip
t ${slot}/copy
t ${slot}/line
```

You can command the `cnsltest` script to loop until an error occurs by using the following command:

```
>>sh slot/cnsltest -l -e
```

Replace *slot* with the slot number of the graphics module.

pst-m Script

The pst-m script runs all of the smart frame-buffer self- tests:

```
t ${slot}/int
t ${slot}/vram
t ${slot}/vdac
t ${slot}/patt
t ${slot}/box
t ${slot}/stip
t ${slot}/copy
t ${slot}/bool
t ${slot}/plane
t ${slot}/pshift
t ${slot}/ras
t ${slot}/line
t ${slot}/chair
t ${slot}/back
t ${slot}/reg
init ${slot} e
```

You can command the pst-m script to loop until an error occurs by using the following command:

```
>>sh slot/pst-m -l -e
```

Replace *slot* with the slot number of the graphics module.

pst-v Script

The pst-v script tests in the verbose mode. In verbose mode, the script prompts the user and displays ASCII text to the alternate console during testing. Verbose mode provides interactive testing and gives the user more information on the tests being executed.

You can command the pst-v script to run by using the following command:

```
>>sh slot/pst-v
```

Replace *slot* with the slot number of the graphics module.

The pst-v script runs all of the smart frame-buffer self- tests:

```
t ${slot}/vdac -v
t ${slot}/vram -v
t ${slot}/box -v
t ${slot}/patt -v
t ${slot}/int -v
t ${slot}/stip -v
t ${slot}/copy -v
t ${slot}/bool -v
t ${slot}/plane -v
t ${slot}/pshift -v
t ${slot}/ras -v
t ${slot}/reg -v
t ${slot}/line
t ${slot}/back
t ${slot}/chair
```

Special Notes

Use the verbose qualifier to run the tests in interactive mode. If you set the verbose qualifier from the monitor console, tests do not display any text. For this reason, you should use the alternate console to run the tests in interactive mode and to display the messages for tests that are executing.

The system board LEDs indicate which subtest of a test is running.

If a self-test error occurs when the system is using the monitor for the console, the video system is reset to clear memory and reset the video.

If an alternate terminal or any device other than a monitor is being used as the console, the video system is not reset.

When testing graphics modules, you normally should use an alternate terminal as the console to run tests and view error messages.

To make the system use the alternate terminal as the console, type **setenv console s**. Then press Return.

To make the system use the monitor as the console, type **setenv console ***. Then press Return. % === Internet headers and postmarks (see DECWRL::GATEWAY.DOC) %
Received: by fenris.pa.dec.com; id AA25373; Tue, 26 Nov 91 13:46:10 -0800

Three-Dimensional Graphics Modules

This chapter discusses the following items for the three-dimensional (3D) graphics modules:

- Low and mid 3D graphics module hardware
- High 3D graphics module hardware
- Low and mid 3D graphics module troubleshooting procedures
- High 3D graphics module troubleshooting procedures
- How to upgrade 3D graphics module hardware
- Individual 3D graphics module self-tests

Low and Mid 3D Graphics Module Hardware

The low and mid 3D graphics modules use identical base graphics modules, but have different numbers of VSIMMs and video digital-to-analog converters (VDACs).

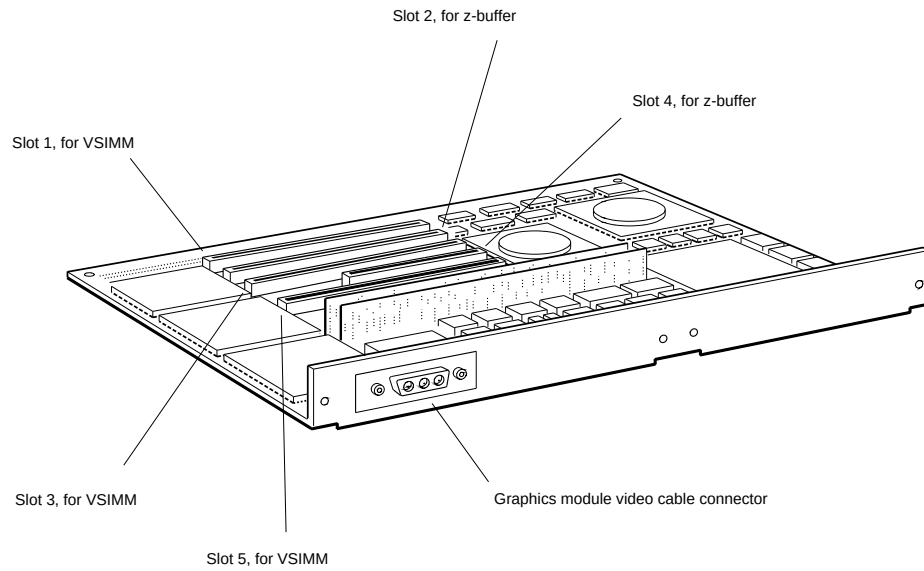
The low and mid 3D base graphics module requires two option slots and must be installed in option slots 0 and 1.

The low and mid 3D base graphics module has slots for VSIMMs and optional z-buffer modules. The slots are numbered 1 through 5, starting with the slot farthest from the video cable connector on the graphics module.

- VSIMMs can reside in slots 1, 3, and 5.
- Two optional z-buffer modules, which have different lengths, can be added in slots 2 and 4.
 - The longer z-buffer module resides in slot 2.
 - The shorter z-buffer module resides in expansion slot 4.

Figure 6-1 shows the slot numbers assigned to each of these VSIMM and z-buffer slots.

To generate graphics efficiently, the high 3D graphics module requires 16 Mbytes of base system RAM.



WSE2M066

Figure 6-1. Slot numbers for VSIMM and z-buffer modules on low and mid 3D graphics modules

Low 3D Graphics Module Hardware

The workstation can support one low 3D graphics TURBOchannel module, which provides 8-plane, three-dimensional color graphics.

The low 3D graphics module has one VDAC in the VDAC socket farthest from the video cable connector, and one VSIMM in slot 1.

To enhance 3D graphics generation, two optional z-buffer modules can be inserted in slots 2 and 4 on top of the base graphics module.

For the low 3D graphics accelerator module to work correctly, your workstation must use ULTRIX version 4.1 or higher.

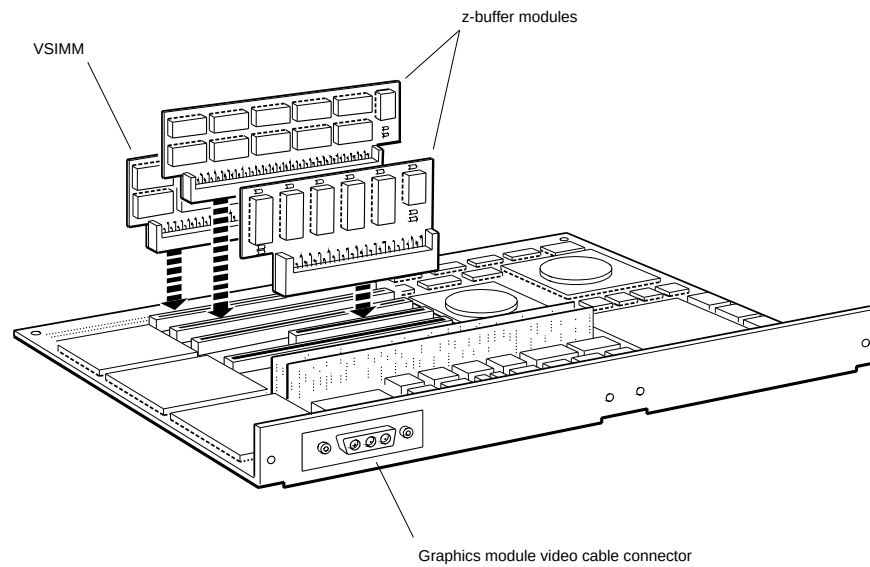
Combining Low 3D Graphics Modules and Monitors

There are three types of low 3D graphics TURBOchannel modules, PMAG-DA, PMAGB-DC, and PMAGB-DA. The module type is printed on the front of the low 3D graphics module.

- Module types PMAG-DA and PMAGB-DC, operate at 66 Hz. The PMAGB-DC is also called the low 3D graphics plus module. The following monitors can display graphics generated by the PMAG-DA and PMAGB-DC graphics modules:
 - VRT16-DA color monitor
 - VRT16-HA color monitor
 - VRT19-DA color monitor
 - VRT19-HA color monitor
 - VR319-CA monochrome monitor
 - VR320-CA color monitor
- Module type PMAGB-DA operates at 72 Hz, and is also known as the low 3D graphics plus module. The following monitors can display graphics generated by the PMAGB-DA graphics module:
 - VRT16-HA color monitor
 - VRT19-HA color monitor
 - VR319-DA monochrome monitor

- VR320-DA color monitor
- VRM17-AA monochrome monitor

Figure 6-2 shows a low 3D graphics module that also has two optional z-buffer modules attached.



WSE2M067

Figure 6-2. Low 3D graphics module

Mid 3D Graphics Module Hardware

The workstation can support one mid 3D graphics accelerator module, which generates three-dimensional color graphics. Three VDACS connect to the VDACS sockets and three VSIMMs connect to slots 1, 3, and 5 on the base graphics module.

Three video serial inline memory modules, which are known as VSIMMs, attach to the top of the mid 3D module.

To enhance 3D graphics generation, two optional z-buffer modules can be inserted in slots 2 and 4 on top of the base graphics module.

For the mid 3D graphics accelerator module to work correctly, your workstation must use ULTRIX version 4.1 or higher.

Combining Mid 3D Graphics Modules and Monitors

There are three types of mid 3D graphics TURBOchannel modules, module type PMAG-EA, module type PMAGB-EC, and module type PMAGB-EA. Module type PMAG-EA is often called a mid 3D graphics module. Module types PMAGB-EA and PMAGB-EC are often called mid 3D graphics plus modules. The module type is printed on the front of the mid 3D graphics module.

- Module types PMAG-EA and PMAGB-EC operate at 66 Hz. The following monitors can display graphics generated by the PMAG-EA and PMAGB-EC graphics modules:
 - VRT16-DA color monitor
 - VRT16-HA color monitor
 - VRT19-DA color monitor
 - VRT19-HA color monitor
 - VR319-CA monochrome monitor
 - VR320-CA color monitor
- Module type PMAGB-EA operates at 72 Hz. The following monitors can display graphics generated by the PMAGB-EA graphics module:
 - VRT16-HA color monitor

- VRT19-HA color monitor
- VR319-DA monochrome monitor
- VR320-DA color monitor
- VRM17-AA monochrome monitor

Figure 6-3 shows the mid 3D graphics module with its three VDACs and three VSIMMs. This particular mid 3D graphics module also has the two optional z-buffer modules.

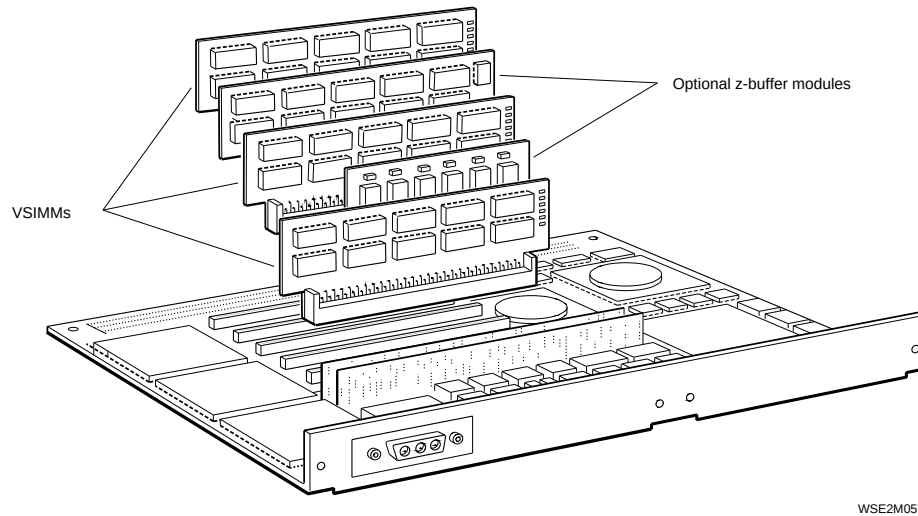


Figure 6-3. Mid 3D graphics module

High 3D Graphics Module Hardware

The workstation can support one high 3D graphics accelerator module, which provides 24-plane, three-dimensional color graphics.

Six VSIMMs connect to the top of the high 3D base graphics module. The VSIMM slots are numbered from 1 to 6, starting with the slot farthest from the graphics module video cable connector.

To generate graphics efficiently, the high 3D graphics module requires 16 Mbytes of base system RAM

For the high 3D graphics accelerator module to work correctly, your workstation must use ULTRIX version 4.1 or higher.

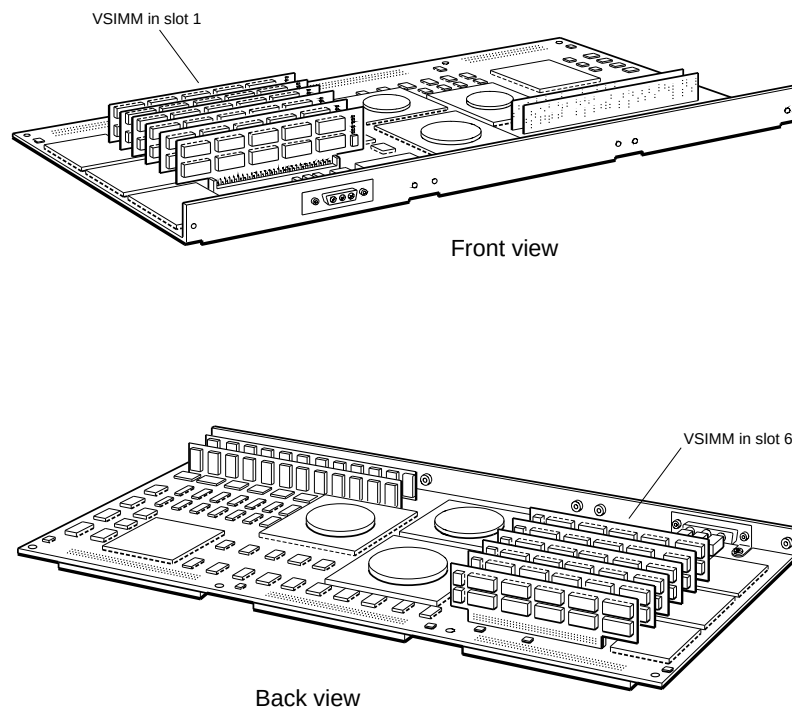
Combining High 3D Graphics Modules and Monitors

There are two types of high 3D graphics TURBOchannel modules, model type PMAG-FA, and model type PMAGB-FA. The module type is printed on the front of the high 3D graphics module.

- Module type PMAG-FA operates at 66 Hz. The following monitors can display graphics generated by the PMAG-FA high 3D graphics module:
 - VRT16-DA color monitor
 - VRT16-HA color monitor
 - VRT19-DA color monitor
 - VRT19-HA color monitor
 - VR319-CA monochrome monitor
 - VR320-CA color monitor
- Module type PMAGB-FA, which is also known as the high 3D plus graphics module, operates at 72 Hz. The following monitors can display graphics generated by the PMAGB-FA high 3D plus graphics module:
 - VRM17-AA color monitor
 - VRT16-HA color monitor

- VRT19-HA color monitor
- VR319-DA monochrome monitor
- VR320-DA color monitor

Figure 6-4 shows the high 3D graphics module and its six VSIMMs.



WSE2M058

Figure 6-4. High 3D graphics module

Troubleshooting a Low 3D or Mid 3D Graphics Module

Troubleshoot a low or mid 3D graphics module as follows:

- *If a 3D graphics test error message includes the phrase (cnfgtbl= ???), the configuration table is corrupted.*
 1. Attempt to rebuild the configuration table. Type **t slot/mkcnfgtbl** and press Return.
 2. Then run the sram test. Type **t slot/sram** and press Return.
 - If the sram test reports no errors, rebuilding the configuration table corrected the problem.
 - If the sram test reports an error, run the stic test. Type **t slot/stic** and press Return.

If the stic test reports no errors, replace the graphics module. Refer to “How to Remove and Install Option Module Hardware” in Chapter 1 for directions.

If the problem persists after you replace the graphics module, replace the system module.
- *If the fb, fbfill, or vdacsig test reports an error, the problem is in the base graphics module or a VSIMM.*

Note: *If the fb test fails, the system often reports additional graphics module errors. Whenever the fb test fails, always troubleshoot the fb test failure first. Then check whether the other tests continue to fail.*

Check whether the error message ends with the phrase **vsimm= number**, where *number* represents a string of numbers.

- If the error message includes no **vsimm=number** phrase, the base graphics module has probably failed. Replace the base graphics module.
- If the error message ends with the phrase **vsimm=number**, a VSIMM or z-buffer module has probably failed.

1. Remove any z-buffer modules attached to the graphics module and repeat the test.

If the problem persists, isolate the faulty VSIMMs. The number string that follows `vsimm=` is a list of the slot numbers of the problem VSIMMs separated by zeros. For example, the string 103 indicates that the VSIMM in slot 1 or slot 3 could be faulty.

2. Replace the failed VSIMM with a good VSIMM. Refer to “To Remove and Install a VSIMM or z-Buffer on a Graphics Module” in Chapter 1 for directions.
3. After you insert a new VSIMM, run the graphics test script to check the new VSIMM. Type `t slot/pst-t` and press Return. If the `fb`, `fbfill`, or `vdacsig` test still fails, replace the low or mid 3D graphics module. Refer to “To Remove and Install a VSIMM or z-Buffer Module on a Graphics Module” in Chapter 1 for directions.

- *If one of the following tests reports an error, the problem is in the graphics module or the system module:*

`intrdma`
`i860`
`patrns`
`sdmaaddrs`
`shade`
`stamp`
`stic-reg`
`vdacreg`

Move the low or mid 3D graphics module to option slots 1 and 2.

Caution: *Never place the system unit cover on the system unit when a low or mid 3D graphics module is in option slots 1 and 2. The system unit cover can damage the VSIMMs on top of the graphics module when a low or mid 3D graphics module is in option slots 1 and 2.*

- If the low or mid 3D graphics module still returns an error code in the new slot, replace the low or mid 3D graphics module. Refer to “To Remove and Install a VSIMM or z-Buffer Module on a Graphics Module” Chapter 1 for directions.
- If the low or mid 3D graphics module reports no errors in the new slot, replace the system module.
- *If the monitor display has missing or extra pixels*, replace any VSIMMs on the low or mid 3D graphics module that the error messages report are bad. If the problem persists after you replace the failed VSIMM, replace the low or mid 3D graphics module.

Troubleshooting a High 3D Graphics Module

Troubleshoot a high 3D graphics module as follows:

- *If a 3D graphics tests error message includes the phrase (cnfgtbl= ???), the configuration table is corrupted.*
 1. Attempt to rebuild the configuration table. Type **t slot/mkcnfgtbl** and press Return.
 2. Then run the sram test. Type **t slot/sram** and press Return.
 - If the sram test reports no errors, rebuilding the configuration table corrected the problem.
 - If the sram test reports an error, run the stic test. Type **t slot/stic** and press Return.

If the stic test reports no errors, replace the graphics module. Refer to “How to Remove and Install Option Module Hardware” in Chapter 1 for directions.

If the problem persists, replace the system module.
- *If the fb, fbfill, or vdacsig test reports an error, the problem is in the base graphics module or a VSIMM.*

Note: *If the fb test fails, the system often reports additional graphics module errors. Whenever the fb test fails, always troubleshoot the fb test failure first. Then check whether the other tests continue to fail.*

Check whether the error message ends with the phrase **vsimm= number**, where *number* represents a string of numbers.

- If the error message includes no **vsimm=number** phrase, the base graphics module has probably failed. Replace the base graphics module.

- If the error message ends with the phrase `vsimm=number`, a VSIMM has probably failed.

The string of numbers that follows `vsimm=` is a list of the slot numbers of the problem VSIMMS separated by zeros. For example, the string 103 indicates that the VSIMM in slot 1 or slot 3 may be faulty.

- Isolate the failed VSIMM and replace it with a good VSIMM. Refer to “To Remove and Install a VSIMM or z-Buffer Module on a Graphics Module” in Chapter 1 for directions.
 - After you replace the problem VSIMM, run the graphics test script to check the new VSIMM. Type `t slot/pst-t` and press Return. If the `fb`, `fbfill`, or `vdacsig` test still fails, replace the high 3D graphics module. Refer to “To Remove and Install a VSIMM or z-Buffer Module on a Graphics Module” in Chapter 1 for directions.
- *If one of the following tests reports an error, the problem is in the graphics module or the system module:*

```
intrdma
i860
patrns
sdmaaddrs
shade
stamp
stic-reg
vdacreg
```

Replace the high 3D graphics module. Refer to “To Remove and Install a VSIMM or z-Buffer Module on a Graphics Module” in Chapter 1 for directions.

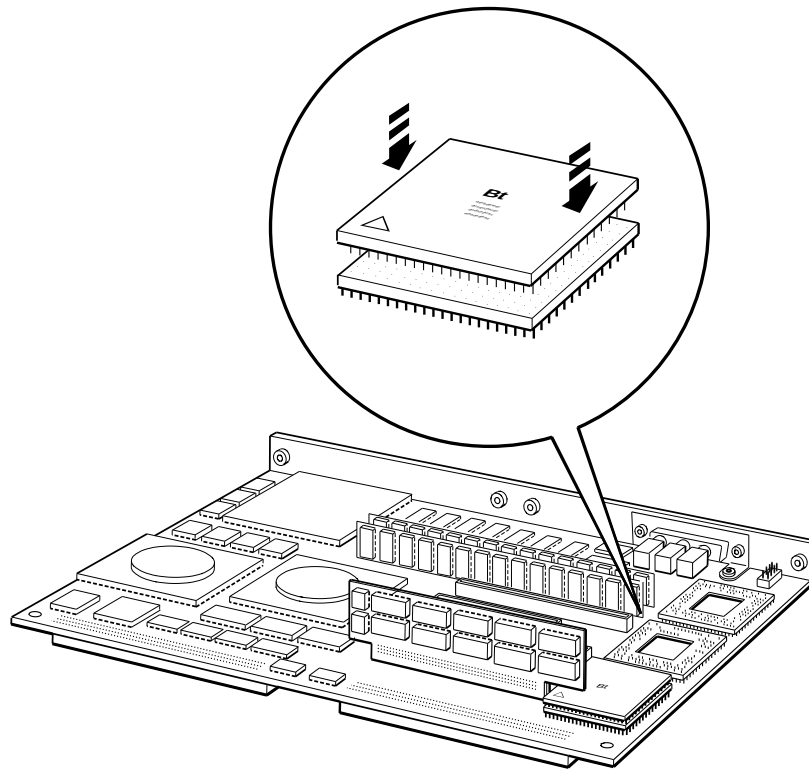
If the `intrdma`, `i860`, `patrns`, `sdmaddrs`, `shade`, `stamp`, `stic-reg`, or `vdacreg` test fails after you replace the high 3D graphics module, replace the system module.

- *If the monitor display has missing or extra pixels*, replace any VSIMMs on the high 3D graphics module that the error messages report are bad. If the problem persists after you replace the failed VSIMM, replace the high 3D graphics module.

How to Upgrade from a Low to a Mid 3D Graphics Module

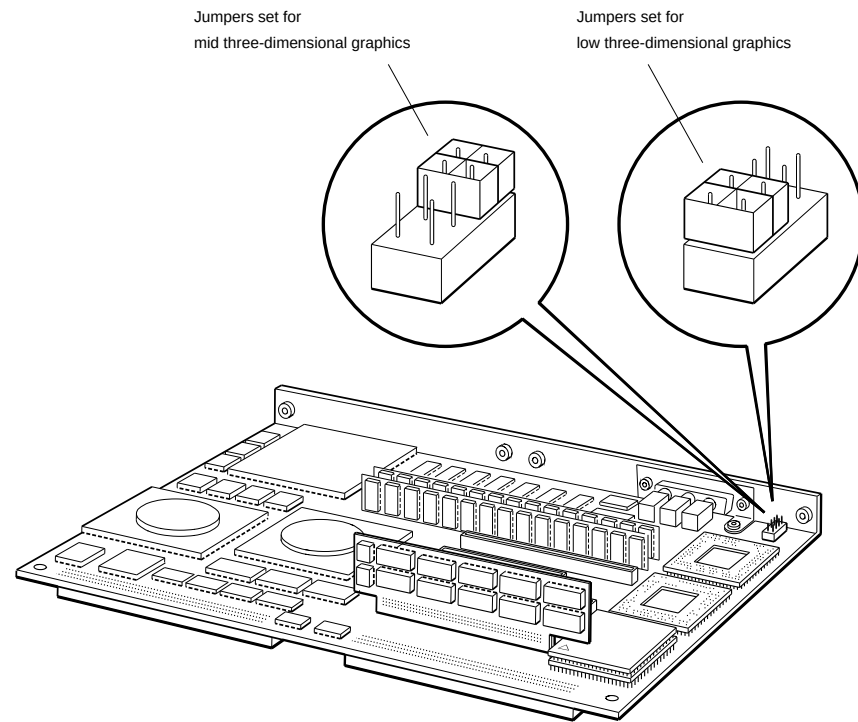
Upgrade a low 3D graphics module to a mid 3D graphics module as follows.

1. Insert the two VSIMMs in the graphics module upgrade kit into slots 3 and 5. Refer to “To Remove and Install a VSIMM or z-Buffer Module on a Graphics Module” in Chapter 1 for directions.
2. Install the two VDACS in the upgrade kit onto the low 3D graphics module.
 - a. Position the VDAC above the VDAC connector on the low 3D graphics module. Figure 6-5 shows where to find the VDAC socket.
 - b. Align the VDAC so that the arrow on the corner of the chip points toward the graphics module video cable connector. Figure 6-5 shows the correct VDAC position.
 - c. Move the VDAC so that the pins on the bottom of the chip slide down into the recessed areas around each hole on the VDAC socket.
 - d. Firmly and evenly press the VDAC all the way into the VDAC connector.
3. Move the graphics module jumpers on the graphics module to the correct position for the mid 3D graphics module. Figure 6-6 shows where to place the graphics module jumpers.



WSE2M071

Figure 6-5. Inserting a VDAC onto a low 3D graphics module



WSE2M072

Figure 6-6. 3D graphics module jumper settings

Individual 3D Graphics Module Self-Tests

All 3D modules use the same individual test commands and error messages. The following entries explain each individual 3D graphics module test and its test commands and error messages. Table 6-1 lists the name and command for each individual 3D graphics test.

Table 6-1. 3D Graphics Tests

Test Name	Test Command
Dispatch utility	<i>slot/dispatcher</i>
VSIMM address and data path test	t slot/fb buffer
i860 direct memory access (DMA) test	t slot/i860/dma [action] [count]
Full frame-buffer test	t slot/i860/fbfill [pattern] [buffer]
i860-host interrupt test	t slot/i860/intrhost
Stamp interface chip (STIC) DMA address test	t slot/i860/sdmaaddr
Stamp interface chip (STIC) read and write test	t slot/i860/stic
i860 stamp interface chip (STIC) interrupt test	t slot/i860/sticintr
Stamp interface chip (STIC) interrupt test	t slot/intr- dma
3D patterns test	t slot/patrns [action]
3D shade test	<i>slot/shade</i>
Static RAM (SRAM) test	t slot/sram
SRAM fill test	t slot/sramfill [start] [end]
3D stamp test	t slot/stamp
Stamp interface chip (STIC) registers test	t slot/stic-reg
Load ROM code utility	t slot/utl/i860exc [mode] [code] [location] [run]
3D configuration table utility	t slot/mkcnfgtbl
3D video digital-to-analog converter (VDAC) test	t slot/vdac
Video-digital-to-analog converter (VDAC) signature test	t slot/vdacsig

Dispatch Utility

The dispatch utility calls individual tests invoked by the system. This utility runs automatically whenever you run a test.

Dispatch utility error messages

Dispatch utility error messages have the form
?TFL: *slot/dispatcher* (i860 -> *description*)

- ?TFL *slot/dispatcher* i860 -> indicates that the utility reported an error.
- *description* represents additional information that describes the error.

Table 6-2 lists the error descriptions found in dispatch utility error messages.

Table 6-2. Dispatch Utility Descriptions

Error Description	Meaning
(i860 -> HNG)	Host CPU timed out while waiting for the i860 chip to report whether the test passed or failed.
(i860 -> NOSTRT)	Host CPU timed out while waiting for the i860 chip to report that the test started.
(i860 -> INVLD RSLT ? <i>x</i>)	i860 chip returned an invalid tests result. The <i>x</i> represents the test result that the i860 chip returned.
(i860 -> NOSUCH TST ? <i>N</i>)	i860 chip could not identify the test sent by the host CPU. The <i>N</i> represents the number of the invalid test.

VSIMM Address and Data Path Test

The VSIMM address and data path test checks the address and data paths to the VSIMMs. To run the address and data path test, type **t slot/fb buffer** and press Return.

When you type the VSIMM address and data path test command,

- Replace *slot* with the slot number of the 3D graphics module.
- Replace *buffer* with a value that specifies the buffer you want to test.
 - If you are testing a low or mid 3D graphics module, specify 0 to test the VRAM. Specify 1 to test the DRAM. Specify 2 to test the z-buffer modules, if any are present. Specify an asterisk (*) to test all buffers.
 - If you are testing a high 3D graphics module, specify 0 or 1 to test the VRAM. Specify 2 or 3 to test the DRAM. Specify an asterisk (*) to test all buffers.

VSIMM address and data path test error messages

VSIMM address and data path test error messages have the form ?TFL: *slot/fb (number: description)*

- ?TFL *slot/fb* indicates that the VSIMM address and data path test reported an error.
- *number* represents a number that identifies when in the test sequence the failure occurred.
- *description* represents additional information that describes the error.

Table 6-3 lists the error descriptions found in VSIMM address and data path test error messages.

Table 6-3. VSIMM Address and Data Path Test Error Descriptions

Error Description	Meaning
cnfgtbl= ???	3D graphics module configuration table is corrupted.
invld buff= x	Buffer specification in test command is invalid. The x represents the invalid buffer number.
buff x not prsnt	Buffer specified in the test command is nonexistent.
sticEOP=0, exp=1	STIC did not set end-of-packet bit during STIC DMA.
?dma= sticbsy	STIC reported that it was busy when it should not have been.
?dma= nopxls	DMA operation failed to send pixel data to the expected SRAM address.
pxl[$x1$]= $x2$, buff= N , vsimm= y	Pixel miscompare occurred. – The $x1$ represents the x coordinate of the first pixel that failed. – The $x2$ represents the actual data that was read from the frame buffer. – The N represents the number of the buffer in which the error occurred. – The vsimm value is a string of numbers that includes the slot number of any failed VSIMMs, with zeros separating the slot numbers.
(addrmsk= x , buff= M , vsimm= N)	Addressing error occurred. – The x represents a mask that indicates the failing address lines. – The M represents the number of the buffer in which the error occurred. – The vsimm value is the slot number of the VSIMM that reported the error.

i860 Direct Memory Access (DMA) Test

The i860 DMA test uses the i860 chip to perform a write and read operation on the system module memory. To run the i860 DMA test, type **t slot/i860/dma** [*action*] [*count*] and press Return.

When you type the i860 DMA test command,

- Replace *slot* with the slot number of the 3D graphics module.
- Replace the optional *action* parameter with a number that specifies the type of DMA the test performs.
 - Specify **r** to perform a read operation. A read operation is the default value.
 - Specify **w** to perform a write operation.
- Replace the optional *count* parameter with the number of words included in the read or write operation. You must specify a hexadecimal number from 1 to 80. The default value is 80.

i860 DMA test error messages

i860 DMA test error messages have the form
?TFL: slot/i860/dma (*number: description*)

- **?TFL slot/i860/dma** indicates that the i860 DMA test reported an error.
- *number* represents a number that indicates when in the test sequence the failure occurred.
- *description* represents additional information that describes the error.

Table 6-4 lists the error descriptions found in test error messages.

Table 6-4. i860 DMA Test Error Descriptions

Error Description	Meaning
STX: dmacnt > 128, = <i>N</i>	Value specified for the <i>count</i> parameter was greater than 80 hexadecimal.
STX: i860 addr unalgn'd, i860addr= <i>x</i>	Test attempted to use an unaligned address.
i860->hst msg err	Host CPU received an incomprehensible message from the i860 chip.
invld dma type <i>x</i>	Value specified for the <i>action</i> parameter was invalid.
4: i860 dma rd mscmp, cnt= <i>N</i> , exp= <i>x</i> , act= <i>y</i>	Data miscompare occurred during a read operation. The cnt value is the number of the individual read operation that reported the miscompare. The exp value is what the value to be read should be. The act value is the actual value that was read.
hst tmout? i860 dma <i>x</i>	Host CPU timed out while waiting for the i860 chip to report that a DMA is finished.
i860 dma rd, no strt	DMA read operation did not start or transferred no data.
i860 dma wr, no strt	DMA write operation did not start or transferred no data.
i860 dma wr mscmp, cnt= <i>N</i> , exp= <i>x</i> , act= <i>y</i>	Data miscompare occurred during a write operation. The cnt value is the number of the individual write operation that reported the miscompare. The exp value is what the value to be written should be. The act value is the actual value that was written.
invld errno, err dma rd	i860 chip reported an error that the host CPU did not understand.

Full Frame-Buffer Test

The full frame-buffer test performs a read and write operation on each cell in one 1280 x 1024 pixel frame buffer. To run the full frame-buffer test, type **t sloti860/fbfill** [*pattern*] [*buffer*] and press Return.

When you type the full frame-buffer test command,

- Replace *slot* with the slot number of the 3D graphics module.
- Replace *pattern* with a specific pattern that you want to use in the read and write operation. Specify any pattern from 000000 to ffffff. The default value is ffffff.
- Replace *buffer* with a value that specifies the buffer you want to test.
 - If you are testing a low or mid 3D graphics module, specify 0 to test the VRAM. Specify 1 to test the DRAM. Specify 2 to test the z-buffer modules, if any are present. Specify an asterisk (*) to test all buffers.
 - If you are testing a high 3D graphics module, specify 0 or 1 to test the VRAM. Specify 2 or 3 to test the DRAM. Specify an asterisk (*) to test all buffers.

Full frame-buffer test error messages

Full frame-buffer test error messages have the form
?TFL: *slot/i860/fbfill* (*number*: *description*)

- ?TFL *slot/i860/fbfill* indicates that the full frame-buffer test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-5 lists the error descriptions found in full frame-buffer test error messages.

Table 6-5. Full Frame-Buffer Test Error Descriptions

Error Description	Meaning
cnfgtbl= ???	3D graphics module configuration table is corrupted.
buff <i>N</i> not prsnt	Buffer specified in the test command is nonexistent. The <i>N</i> represents the invalid buffer number that was specified in the test command.
sticEOP=0, exp=1	STIC did not set the end-of-packet bit during STIC DMA.
sticEOP=0, exp=1, line= <i>x</i>	DMA occurred during a test on a frame-buffer scan line. The line value is the y coordinate of the scan line.
?dma= sticbsy	STIC reported that it was busy when it should not have been.
?dma= sticbsy, line= <i>x</i>	STIC reported that it was busy when it should not have been. The <i>line</i> value is the y-coordinate of the pixel that returned the busy signal.
?dma= nopxls, line= <i>x</i>	DMA operation failed to send pixel data to the expected SRAM address. The line value is the y coordinate of the frame buffer scan line.
pxl= <i>x</i> , exp= <i>y</i> , line= <i>M</i> , vsimm= <i>N</i>	Cell miscompare occurred. – The <i>x</i> represents the actual data for the failed pixel. – The <i>y</i> represents the actual y coordinate for that pixel. – The <i>M</i> represents the number of the line in which the error occurred. – The vsimm value lists the slot number of any failed VSIMMs, with zeros separating the slot numbers.
? invld errno ?	i860 chip returned an error number that the host CPU cannot interpret.

i860-Host Interrupt Test

The i860-host interrupt test attempts to have the i860 and host CPU interrupt each other. To run the i860-host interrupt test, type **t slot/i860/intrhost**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

i860-host interrupt test error messages

i860-host interrupt test error messages have the form ?TFL: *slot/i860/intrhost* (*number*: *description*)

- ?TFL *slot/i860/intrhost* indicates that the i860-host interrupt test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-6 lists the error descriptions found in i860-host interrupt test error messages.

Table 6-6. i860-Host Interrupt Test Error Descriptions

Error Description	Meaning
i860->hst msg err	Host CPU could not interpret a message sent by the i860 chip.
hst tmout, i860 not intr	Host CPU timed out while waiting for the i860 chip to report that it had been interrupted.
i860 tmout, hst->i860 not intr	i860 timed out waiting for an interrupt from the host CPU.
hst->i860 unknown stat= <i>n</i>	i860 reported an unrecognizable status while waiting to be interrupted.
(4:i860->hst no clr intr)	Host CPU was unable to clear all pending interrupts.
(5: i860->hst no intr)	Host CPU timed out while waiting to be interrupted.

Stamp Interface Chip (STIC) DMA Address Test

The STIC DMA address test checks the ability of the STIC to perform a DMA to different addresses in SRAM. To run the STIC DMA address test, type **t slot/i860/sdmaaddr**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

STIC DMA address test error messages

STIC DMA address test error messages have the form
?TFL: *slot/i860/sdmaaddr (number: description)*

- ?TFL *slot/i860/sdmaaddr* indicates that the STIC DMA address test reported an error.
- *number* represents a number that identifies when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-7 lists the error descriptions found in STIC DMA address test error messages.

Table 6-7. STIC DMA Address Test Error Descriptions

Error Description	Meaning
sticEOP=0, exp=1	STIC did not set the end-of-packet bit during STIC DMA.
?dma= sticbsy	STIC reported that it was busy when it should not have been.
NoPxls! dmaaddr= <i>x</i> , sticaddr= <i>y</i>	STIC did not DMA pixel data to the correct SRAM address. The dmaaddr value is the address where the error occurred. The sticaddr value is the dmaaddr value mapped into the STIC address range.
? invld errno ?	i860 returned an error number that the CPU does not understand.

Stamp Interface Chip (STIC) Read and Write Test

The STIC read and write test performs a read and write operation on the STIC registers. To run the STIC read and write test, type **t slot/i860/stic**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

STIC read and write test error messages

STIC read and write test error messages have the form
?TFL: *slot/i860/stic (number: description)*

- ?TFL *slot/i860/stic* indicates that the STIC read and write test reported an error.
- *number* represents a number that identifies when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-8 lists the error descriptions found in STIC read and write test error messages.

Table 6-8. STIC Read and Write Test Error Descriptions

Error Description	Meaning
sticCSR= <i>x</i> , exp= <i>y</i> , sram= <i>n</i>	STIC read and write operation failed. The sticCSR value is the actual value in the STIC CSR register. The exp value is what the STIC CSR register value should be. The sram value is the number of the SRAM module that has the bidirectional register for that particular STIC register.
sticCSR= <i>x</i> , exp= <i>y</i> , sram= <i>N</i>	STIC read and write operation failed. The sticCSR value is the actual value in the STIC CSR register. The exp value is what the STIC CSR register value should be. The sram value is the number of the SRAM module that has the bidirectional register for that particular STIC register.

(continued on next page)

Table 6-8 (Cont.). STIC Read and Write Test Error Descriptions

Error Description	Meaning
busadr= <i>x</i> , exp= <i>y</i> , sram= <i>N</i>	STIC read and write operation failed. The busadr value is the actual value in the BUSADR register. The exp value is what the value in the BUSADR register should be. The sram value is the number of the SRAM module that has the bidirectional register for that particular STIC register.
? invld errno ?	i860 returned an error number that the CPU does not understand.

i860 Stamp Interface Chip (STIC) Interrupt Test

The i860 STIC interrupt test checks the STIC vertical and end-of-packet interrupts. To run the i860 STIC interrupt test, type **t slot/i860/sticintr**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

i860 STIC interrupt test error messages

i860 STIC interrupt test error messages have the form ?TFL: *slot/i860/sticintr (number: description)*

- ?TFL *slot/sticintr* indicates that the i860 STIC interrupt test reported an error.
- *number* represents a number that identifies when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-9 lists the error descriptions found in i860 STIC interrupt test error messages.

Table 6-9. i860 STIC Interrupt Test Error Descriptions

Error Description	Meaning
tmout: no vrt retrce intr	i860 chip timed out while waiting for a vertical retrace interrupt.
EOP intr bit nt set	STIC did not set end-of-packet bit in the interrupt register after the STIC sent a graphics command package.
?dma= sticbsy	STIC reported that it was busy when it should not have been.
EOP > i860 nt intr	i860 chip did not receive a STIC end-of-packet interrupt.
?dma=noPxls	DMA operation sent no pixel data or sent the data to the wrong SRAM address.
? invld errno	i860 chip returned an error number that the host CPU could not interpret.

Stamp Interface Chip (STIC) Interrupt Test

The STIC interrupt test checks the ability of the STIC to handle vertical and end-of-packet interrupts. To run the STIC interrupt test, type **t slot/intr-dma**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

STIC interrupt test error messages

STIC interrupt test error messages have the form
?TFL: *slot/intr-dma (number: description)*

- ?TFL *slot/intr-dma* indicates that the STIC interrupt test reported an error.
- *number* represents a number that identifies when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-10 lists the error descriptions found in STIC interrupt test error messages.

Table 6-10. STIC Interrupt Test Error Descriptions

Error Description	Meaning
intr tmout v_retrce=0: exp= 1	Host CPU timed out while waiting for a vertical retrace interrupt.
no v_retrce intr	System did not set the vertical retrace bit in the STIC interrupt register.
3: sticEOP=0: exp=1	System did not set the end-of-packet bit in the STIC interrupt register.
?dma= sticBSY	STIC reported that it was busy when it should not have been.
?dma= noPxls	DMA operation did not send pixel data to the correct SRAM address.

3D Patterns Test

The 3D patterns test displays a series of patterns on the monitor. To run the 3D patterns test, type **t slot/patrn**s [action] and press Return.

When you type the 3D patterns test command,

- Replace *slot* with the slot number of the 3D graphics module.
- Replace the optional *action* parameter with the value that specifies how the monitor displays the patterns.
 - Specify 0 to have the test display the patterns without stopping. The default value is zero.
 - Specify 1 to have each pattern remain on the monitor until you press any key on the keyboard.

3D patterns test error messages

3D patterns test error messages have the form
?TFL: *slot/patrn*s (*number*: *description*)

- ?TFL *slot/patrn*s indicates that the 3D patterns test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-11 lists the error descriptions found in 3D patterns test error messages.

Table 6-11. 3D Patterns Test Error Descriptions

Error Description	Meaning
cnfgTbl= ???	Configuration table for the 3D graphics module is corrupted.
sticEOP=0, exp=1	STIC did not set the end-of-packet bit during a STIC DMA.
?dma= sticbsy	STIC reported that it was busy when it should not have been.

3D Shade Test

The 3D shade test checks the ability of the stamp chip to produce smooth shades and calculate half-space coordinates. To run the 3D shade test, type *slot/shade*, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

Shade and half-space test error messages

Shade and half-space test error messages have the form ?TFL: *slot/shade (number: description)*

- ?TFL *slot/shade* indicates that the shade and half-space test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-12 describes the error descriptions found in shade and half-space test error messages.

Table 6-12. Shade and Half-Space Test Error Descriptions

Error Description	Meaning
cnfgTbl??	3D configuration table is corrupted.
sticEOP=0, exp=1	STIC did not set end-of-packet bit in the STIC interrupt register.
?dma= sticbsy	STIC reported that it was busy when it should not have been.
tri smth shd err, indx= <i>i</i> , stamp= <i>s</i>	System discovered a pixel miscompare while verifying that the smooth, shaded triangle was drawn correctly. The <i>indx</i> value is the number of the pixel in which the miscompare occurred. The <i>stamp</i> value is the number of the stamp chip involved in the miscompare.
?dma= NoPxls	DMA operation sent no pixels or did not send pixels to the expected SRAM address.

(continued on next page)

Table 6-12 (Cont.). Shade and Half-Space Test Error Descriptions

Error Description	Meaning
(8: Zbuff tri smth shd err, indx= <i>i</i> , stamp= <i>s</i>)	A pixel miscompare was discovered while writing to the z-buffer to verify that the smooth, shaded triangle was drawn correctly. The indx value is the number of the pixel in which the miscompare occurred. The stamp value is the number of the stamp chip involved in the miscompare.
(hlf_spc= <i>x</i> , exp= <i>y</i> , ln= <i>m</i> , pxl= <i>n</i>), stamp= <i>s</i>	STAMP chip did not calculate half-space coordinates correctly. – The <i>x</i> represents the actual pixel data. – The <i>y</i> represents the expected pixel data. – The <i>m</i> represents the line where the error occurred. – The <i>n</i> represents the pixel where the error occurred. – The <i>s</i> represents the stamp chip in which the error occurred.
Zbuf hlf_spc= <i>x</i> , exp= <i>y</i> , ln= <i>m</i> , pxl= <i>n</i> , stamp= <i>s</i>	STAMP chip did not calculate z-buffer half-space coordinates correctly. – The <i>x</i> represents the actual pixel data. – The <i>y</i> represents the expected pixel data. – The <i>m</i> represents the line where the error occurred. – The <i>n</i> represents the pixel in which the error occurred. – The <i>s</i> represents the number of the stamp chip that reported the error.

Static RAM (SRAM) Test

The SRAM test writes walking 1 and 0 patterns to the 3D module SRAM through the data and address paths. To run the SRAM test, type **t slot/sram**, where you replace *slot* with the graphics module slot number, and press Return.

Static RAM test error messages

Static RAM test error messages have the form

?TFL: *slot/sram (number: description)*

- ?TFL *slot/sram* indicates that the static RAM test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-13 lists the error descriptions found in SRAM test error messages.

Table 6-13. SRAM Test Error Descriptions

Error Description	Meaning
$x = y, \text{exp} = z, \text{sram} = N$	Data miscompare occurred. The x represents the address where the error occurred. The y represents the actual value at that address. The z represents what the actual value should be. The N represents the number of the SRAM module that reported the error.
$t_addr[x1] = x2, \text{exp} = x3; o_addr[y1] = y2, \text{exp} = y3$	Read operation failed to return either the test pattern or the pattern written to an alternate address. – The $x1$ represents the address being tested. The $x2$ represents the value found at that address. The $x3$ represents what the value at that address should be. – The $y1$ represents the alternate address. The $y2$ represents the value found at the alternate address. The $y3$ represents what the value at the alternate address should be.
$\text{addrMsk} = x, \text{sram\#} = N$	Error occurred in an address line. The x represents a mask that identifies the specific lines that reported the error. The N represents the number of the SRAM that reported the error.

SRAM Fill Test

The SRAM fill test performs a write and read operation on every SRAM cell of the 3D graphics module. To run the SRAM fill test, type **t slot/sramfill** [*start*] [*end*] and press Return.

When you type the SRAM fill test command,

- Replace *slot* with the slot number of the 3D graphics module.
- Replace the optional *start* parameter with the address at which you want the test to start. Specify a value from 0 to 1fffc that is less than the specified ending address. The default value is zero.
- Replace the optional *end* parameter with the address at which you want the test to stop. Specify a value from 0 to 1fffc that is greater than the starting address. The default value is 1fffc.

SRAM fill test error messages

SRAM fill test error messages have the form

?TFL: *slot/sramfill* (*number*: *description*)

- ?TFL *slot/sramfill* indicates that the SRAM fill test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-14 lists the error descriptions found in SRAM fill test error messages.

Table 6-14. SRAM Fill Test Error Descriptions

Error Description	Meaning
STX addr invld lo= <i>x</i> , hi= <i>y</i>	Test command included invalid test parameters. The lo value is the starting test address. The hi value is the ending test address.
mscmp= <i>x</i> , exp= <i>y</i> , lo= <i>adr1</i> , hi= <i>addr2</i> , sram= <i>N</i>	Miscompare occurred. The mscmp value is the actual value that was read from the low address. The exp value is the value the low address should contain. The lo value is the low address where the miscompare occurred. The hi value is the ending test address. The sram value is the number of the SRAM where the miscompare occurred.

3D Stamp Test

The 3D stamp test checks stamp chip ALU operation and the lower 32 SDAL lines. To run the 3D stamp test, type **t slot/stamp**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

3D stamp test error messages

3D stamp test error messages have the form

?TFL: *slot/stamp (number: description)*

- ?TFL *slot/stamp* indicates that the 3D stamp test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-15 lists the error descriptions found in 3D stamp test error messages.

Table 6-15. 3D Stamp Test Error Descriptions

Error Description	Meaning
cnfgTbl= ???	3D graphics module configuration table is corrupted.
sticEOP=0, exp=1	STIC did not set end-of-packet bit in STIC DMA.
?dma= sticBSY	STIC reported that it was busy when it should not have been.
?dma= noPxls	Test did not send pixel data to the correct SRAM address.
ALU[#N]= <i>x</i> , exp= <i>y</i> , stamp= <i>N</i>	An ALU error caused a pixel miscompare. The <i>N</i> represents the number of the ALU where the error occurred. The <i>x</i> represents the value found at the ALU that reported the error. The exp value is what the value at the ALU should be. The stamp value is the number of the SRAM chip that reported the error.
SDAL= <i>x</i> , exp= <i>y</i> , stamp= <i>N</i>	SDAL line reported an error. The SDAL value is the actual value read from the SDAL line where the error occurred. The exp value is what the value in the SDAL line should be. The stamp value is the number of the SRAM chip that reported the error.

Stamp Interface Chip (STIC) Registers Test

The STIC registers test performs a read and write operation on the STIC registers and then performs a STIC self-test. To run the STIC registers test, type **t slot/stic**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

STIC registers test error messages

STIC registers test error messages have the form

?TFL: *slot/stic (number: description)*

- ?TFL *slot/stic* indicates that the STIC registers test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-16 lists the error descriptions found in STIC registers test error messages.

Table 6-16. STIC Registers Test Error Descriptions

Error Description	Meaning
sticCSR= x , exp= y , sram= N	STIC CSR read and write operation failed. The sticCSR value is the actual value in the STIC CSR register. The exp value is what the value in the STIC CSR register should be. The sram value is the number of the SRAM that has the bidirectional register that feeds the failing STIC register.
busadr= x , exp= y , busdat= z , sram= N	32-bit read and write operation failed. The busadr value is the actual value in the BUSADR register. The sram value is the number of the SRAM with the bidirectional register that feeds the failing STIC register.
busdat= x , exp= y , busadr= z , sram= N	32-bit read and write operation failed. The busadr value is the actual value in the BUSADR register. The sram value is the number of the SRAM with the bidirectional register that feeds the failing STIC register.
sig@2000= x ; exp= y	Self-test failed at cycle count of 2000. The x represents the actual value in the STIC register. The y represents what the value in the STIC register should be.
sig@20000= x ; exp= y	Self-test failed at cycle count of 20,000. The x represents the actual value in the STIC register. The y represents what the value in the STIC register should be.

Load ROM Code Utility

The load ROM code utility loads code into the i860. The code then runs a basic self-test on the i860 chip. To run the load ROM code utility, type **t slot/utl/i860exc** [*mode*] [*code*] [*location*] [*run*] and press Return.

When you type the load ROM code utility command,

- Replace *slot* with the slot number of the 3D graphics module.
- Replace the optional *mode* parameter with the value that specifies the action the load ROM code utility should take.
 - Specify **f** to have the utility start the i860 chip whether or not the chip is currently running. The default value is **f**.
 - Specify **k** to stop the i860 chip only.
 - Specify **s** to start the i860 chip only if the chip is not operating.
- Replace the optional *code* parameter with the value that specifies the type of code to load.
 - Specify **j** to load only the jump vector segment.
 - Specify **d** to load only the main diagnostics for the 3D module.
 - Specify an asterisk (*) to load both the jump vector and the main diagnostics. An asterisk is the default value.
- Replace the optional *location* parameter with the value that specifies where the utility searches for the ROM code.
 - Specify **sys** to search for i860 code in system module memory.
 - Specify **rom** to search for i860 code in the 3D graphics module ROM chip. The default value is **rom**.
- Replace the optional *run* parameter with the value that specifies whether to start the i860 chip after the ROM code is loaded.
 - Specify **e** to start the i860 chip after the utility loads the ROM code.

- Specify n not to start the i860 chip after the utility loads the ROM code.

Load ROM code utility error messages

Load ROM code utility error messages have the form
?TFL: *slot/utl/i860exc (number: description)*

- ?TFL *slot/utl/i860exc* indicates that the load ROM code utility reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-17 lists the error descriptions found in load ROM code utility error messages.

Table 6-17. Load ROM Code Utility Error Descriptions

Error Description	Meaning
STX: mode= <i>s</i> ???	Mode parameter in the utility command is invalid. The <i>s</i> represents the invalid value used in the command.
STX: execut= <i>s</i> ???	Run parameter in the utility command is invalid. The <i>s</i> represents the invalid value used in the command.
STX: code= <i>s</i> ???	Code parameter in the utility command is invalid. The <i>s</i> represents the invalid value used in the command.
STX: loc <i>s</i> ???	Location parameter in the utility command is invalid. The <i>s</i> represents the invalid value used in the command.
invld rom wrppr! src@ <i>x</i> = <i>y</i> , exp= <i>z</i>	Host CPU could not interpret code wrapper. The <i>x</i> represents the specific field that the CPU could not interpret. The <i>y</i> represents the value found in that field. The <i>z</i> represents what the value should be.
wrppr not fnd! exp= <i>x</i>	Host CPU could not find the wrapper for a code segment and was unable to load the ROM code.
TMOUT! i860 bsy	Host CPU timed out while waiting for the i860 chip to report a pass or fail condition.
errno= <i>N</i> , hi= <i>x1</i> , exp= <i>x2</i> lo= <i>y1</i> , exp= <i>y2</i>	One of the i860 chip self-tests failed. The <i>N</i> represents the number of the failed test. The <i>x1</i> represents the high 32-bits of the actual data that the test returned. The <i>x2</i> represents what the high 32-bits should be. The <i>y1</i> represents the low 32-bits of the actual data that the test returned. The <i>y2</i> represents what the low 32-bits should be.
i860 nogo	i860 CPU never started.

3D Configuration Table Utility

The 3D configuration table utility builds the 3D configuration table in the SRAM on the 3D graphics module. To run the 3D build configuration table utility, type **t slot/mkcnfgtbl**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

Note:: *Most 3D graphics tests require a valid 3D configuration table. If a 3D graphics test returns the error message cnfgTbl= ???, use the 3D configuration table utility to rebuild the 3D configuration table.*

3D configuration table utility error messages

3D configuration table utility error messages have the form ?TFL: *slot/mkcnfgtbl (number: description)*

- ?TFL *slot/mkcnfgtbl* indicates that the 3D build configuration utility reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-18 lists the error descriptions found in 3D configuration table utility error messages.

Table 6-18. 3D Build Configuration Table Utility Error Descriptions

Error Description	Meaning
stampCnfg= <i>x</i> , exp= <i>y</i>	Host CPU read an unknown stamp chip configuration from the STIC MODTYPE register. The <i>x</i> represents the actual value that the host CPU read. The <i>y</i> represents the value that the host CPU should have read.
vdacID= <i>x</i> , exp= (<i>id</i>)	Host CPU read an incorrect VDAC ID when building the configuration table. The <i>x</i> represents the incorrect VDAC ID that the host CPU read. The exp value is what the VDAC ID should be.
(2: sticEOP=0, exp=1)	STIC did not set the end-of-packet bit during STIC DMA.
(2: sticDMA= NoPxls)	DMA sent no pixel data or sent pixel data to an incorrect SRAM address.
ZbuffCnfg: cnt8= <i>x</i> ; cnt16= <i>y</i> ; cnt24= <i>z</i> ; cnthuh= <i>i</i>)	z-buffer configuration is unknown. The numbers that follow cnt8, cnt16, and cnt24 are the 8-plane, 16-plane, and 24-plane pixel values that the system counted.
stampCnfg= <i>x</i> , exp= <i>y</i>	Host CPU read an unknown stamp chip configuration from the STIC MODTYPE register. The <i>x</i> represents the actual value that the host CPU read. The <i>y</i> represents the value that the host CPU should have read.

3D Video Digital-to-Analog Converter (VDAC) Test

The 3D VDAC test checks the VDAC registers and color map. To run the 3D VDAC test, type **t slot/vdac**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

3D VDAC test error messages

3D VDAC test error messages have the form
?TFL: slot/vdac (number: description)

- **?TFL slot/vdac** indicates that the 3D vdac test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-19 lists the error descriptions found in 3D VDAC test error messages.

Table 6-19. 3D VDAC Test Error Descriptions

Error Description	Meaning
cnfgTbl= ???	3D configuration table is corrupted.
vdacID= x: exp= 4a <alo= y, ahi= z>	VDAC ID is not 4a, which is the correct value. The <i>x</i> represents the VDAC ID that the host read. The <i>alo</i> value is the value in the address low register. The <i>ahi</i> value is the value in the address high register.
(2:alo= x1, exp= x2: <ahi= y, exp= a5>)	The VDAC read and write operation on the address low register failed. The <i>x1</i> represents the actual value in the address low register. The <i>exp</i> value is what the value in the address low register should be. The <i>ahi</i> value is the value in the address high register, which should be a5.

(continued on next page)

Table 6-19 (Cont.). 3D VDAC Test Error Descriptions

Error Description	Meaning
(3:Rcmap= <i>x1</i> : exp= <i>x2</i> : <alo= <i>y1</i> , ahi= <i>y2</i> >)	Red color map contained an incorrect value. The <i>x1</i> represents the incorrect value in the color map. The <i>x2</i> represents what the color map value should be. The alo value is the value in the address low register. The ahi value is the value in the address high register.
(4:Gcmap= <i>x1</i> : exp= <i>x2</i> : <alo= <i>y1</i> , ahi= <i>y2</i> >)	Green color map contained an incorrect value. The <i>x1</i> represents the incorrect value in the color map. The <i>x2</i> represents what the color map value should be. The alo value is the value in the address low register. The ahi value is the value in the address high register.
(5:Bcmap= <i>x1</i> : exp= <i>x2</i> : <alo= <i>y1</i> , ahi= <i>y2</i> >)	Blue color map contained an incorrect value. The <i>x1</i> represents the incorrect value in the color map. The <i>x2</i> represents what the color map value should be. The alo value is the value in the address low register. The ahi value is the value in the address high register.

Video Digital-to-Analog Converter (VDAC) Signature Test

The VDAC signature test checks the output from the VSIMM to the VDAC. To run the VDAC signature test, type **t *slot*/vdacsig**, where you replace *slot* with the slot number of the 3D graphics module, and press Return.

VDAC signature test error messages

VDAC signature test error messages have the form

?TFL: *slot*/vdacsig (*number*: *description*)

- ?TFL *slot*/vdacsig indicates that the VDAC signature test reported an error.
- *number* represents a number that indicates when in the test sequence the error occurred.
- *description* represents additional information that describes the error.

Table 6-20 lists the error descriptions found in VDAC signature test error messages.

Table 6-20. VDAC Signature Test Error Descriptions

Error Description	Meaning
cnfgTbl= ???	3D configuration table is corrupted.
sticEOP=0, exp=1	STIC did not set the end-of-packet bit during STIC DMA.
?dma= sticbsy	STIC reported that it was busy when it should not have been.
Pxl[N]= <i>x</i> , R[r1]= <i>r2</i> , G[g1]= <i>g2</i> , B[b1]= <i>b2</i> ; vsimm= <i>V</i>	Signature miscompare occurred. The Pxl[N] value, where <i>N</i> represents the number of the pixel in which the miscompare occurred, is the signature that the test read. – The <i>x</i> represents what the signature value should be. – The <i>r1</i>, <i>g1</i>, and <i>b1</i> values are the actual values for the red, green, and blue signatures. – The <i>r2</i>, <i>g2</i>, and <i>b2</i> values are what the red, green, and blue signatures should be. – The <i>V</i> value is a list of the problem VSIMM slot numbers separated by zeros.

Part II

Communications Controllers

Ethernet Controllers

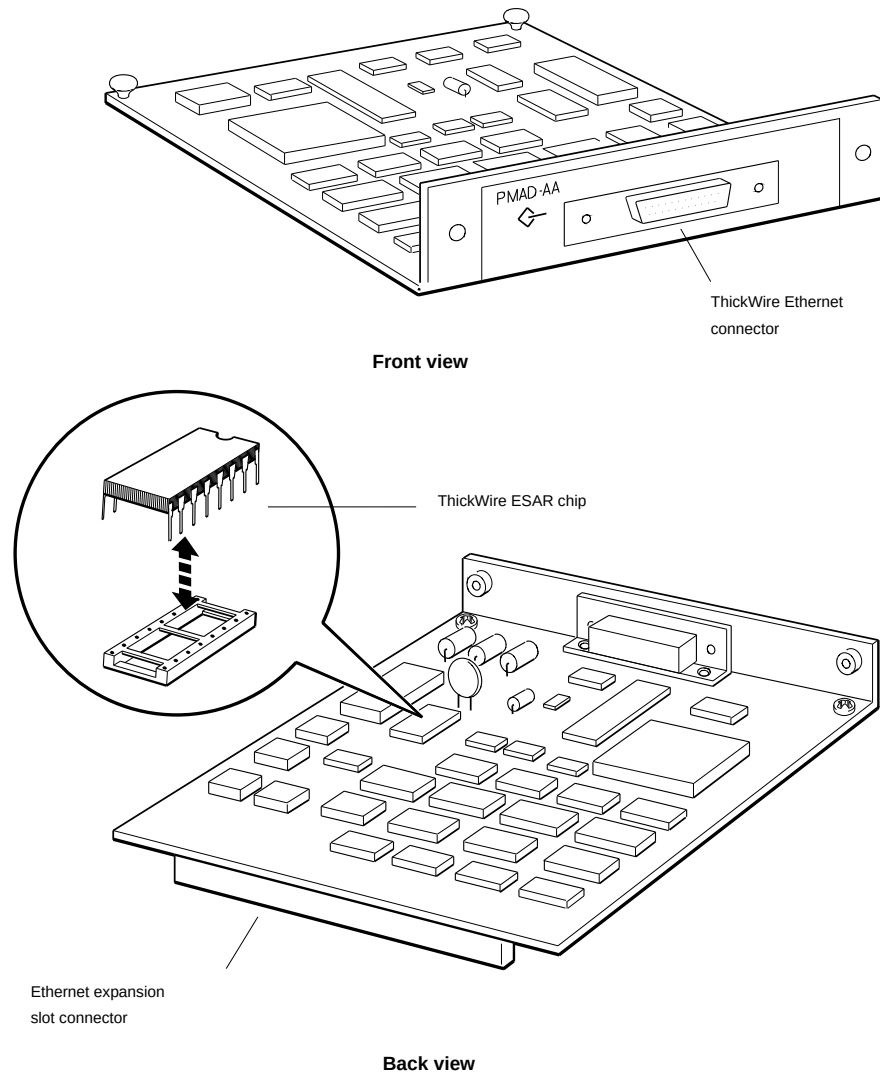
This chapter discusses the following items for Ethernet controller modules:

- Hardware
- Troubleshooting procedures
- Individual Ethernet controller tests

Ethernet Controller Hardware

Each Ethernet controller provides an Ethernet connection.

Base systems can have a ThinWire or ThickWire Ethernet controller on the system module and can support up to three additional ThickWire Ethernet controllers in the option slots. Figure 7-1 shows the ThickWire Ethernet controller option module and its connectors.



WSE2M028

Figure 7-1. ThickWire Ethernet controller option module

Troubleshooting an Ethernet Controller Module

If one of the following tests reports an error, replace the Ethernet controller.

cllsn
crc
esar
init
int-lb
m-cst
promisc
ram
regs

The slot number in the error message is the slot number of the problem Ethernet controller.

If the ext test reports an error, make sure that the Ethernet connection is sound. Then run the Ethernet external loopback test described in the following section.

If the Ethernet connection is sound and the Ethernet controller still fails the external loopback test, replace the faulty Ethernet controller.

- If the faulty Ethernet controller is on the system module, replace the system module. Refer to the maintenance guide for the base system that has the faulty Ethernet controller.
- If the faulty Ethernet controller is on an option module, replace the option module. Be sure to insert the ESAR chip on the old Ethernet option module onto the new Ethernet option module. Refer to “To Remove and Install an Option Module” in Chapter 1 for directions.

For more information about an Ethernet controller failure, refer to the description of the individual Ethernet controller tests later in this chapter.

Individual Ethernet Controller Tests

The following pages explain each individual Ethernet controller test and its command and error messages.

Table 7-1 lists the name and command for each individual Ethernet controller test.

Table 7-1. Ethernet Controller Tests

Test Name	Test Command ¹
Collision test	<i>slot/cllsn</i> [offset]
Cyclic redundancy code(CRC) test	<i>slot/crc</i> [offset]
Ethernet station address (ESAR) test	<i>slot/esar</i>
External loopback test	<i>slot/ext-lb</i> [offset]
Interrupt request (IRQ) test	<i>slot/int</i> [offset]
Internal loopback test	<i>slot/int-lb</i> [offset]
Multicast test	<i>slot/m-cst</i> [offset]
Promiscuous mode test	<i>slot/promisc</i> [offset]
Ethernet RAM test	<i>slot/ram</i> [offset] [increment]
Registers test	<i>slot/regs</i>

¹The *slot* variable represents the slot number of the failed controller or module.

Collision Test

The collision test checks Ethernet collision detect circuitry by forcing a collision on transmission. To run the collision test, type **t slot/cllsn [offset]** and press Return.

When you type the collision test command,

- Replace *slot* with the slot number of the Ethernet controller that you want to test.
- Replace the optional *offset* parameter with the Ethernet RAM address where you want the test to start. The *offset* parameter must be between 0 and 1F000.

Collision test error messages

Collision test error messages have the form
?TFL: *slot/cllsn* [PAD-AA] (*code*: *description*).

- ?TFL: *slot/cllsn* [PAD-AA] indicates that the collision test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure.

Table 7-2 lists the error codes and error descriptions found in collision test error messages.

Table 7-2. Collision Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: rd ESAR err)	Error occurred when the system tried to access the Ethernet station address ROM.
(2: xmt err)	Error occurred in transmitting a packet.
(3: clsn not dtctd)	Ethernet controller chip failed to detect an Ethernet collision.
(4: xmt [x])	Ethernet controller chip transmission failed.
(6: LANCE-init [x])	Ethernet controller chip failed to initialize.

Cyclic Redundancy Code (CRC) Test

The cyclic redundancy code (CRC) test checks the Ethernet CRC verification and bad CRC detection abilities. To run the CRC test, type **t slot/crc** [*offset*] and press Return.

When you type the CRC test command,

- Replace *slot* with the slot number of the Ethernet controller you want to test.
- Replace the optional *offset* parameter with the Ethernet address where you want the test to start. The *offset* parameter must be between 0 and 1F000.

CRC test error messages

CRC test error messages have the form
?TFL: *slot/crc* [PAD-AA] (*code*: *description*).

- ?TFL: *slot/crc* [PAD-AA] indicates that the CRC test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information statement that describes the failure.

Table 7-3 lists the error codes and error descriptions found in CRC test error messages.

Table 7-3. CRC Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: ESAR rd err)	Test could not access the Ethernet station address ROM.
(2: LANCE-init [x])	System could not initialize the Ethernet controller chip.
(3: xmt [x])	Error occurred during packet transmission.
(4: rcv err)	Error occurred receiving a packet.
(5: fls CRC err)	Ethernet chip flagged a good CRC on a packet with a bad CRC.
(6: rcv [x])	Error occurred receiving a packet.
(7: LANCE-init [x])	Error occurred when the test attempted to initialize the Ethernet controller chip.
(8: xmt [x])	Error occurred transmitting data packet.
(9: rcv err)	Error occurred receiving data packet.
(10: bad CRC not dtctd)	Ethernet chip did not detect a bad CRC in an incoming packet.
(11: rcv [x])	Error occurred in packet receive operation.

Ethernet Station Address ROM (ESAR) Test

The Ethernet station address ROM (ESAR) test checks the ESAR on the Ethernet controller. To run the ESAR test, type **t slot/esar**, where *slot* represents the slot number of the Ethernet controller you want to test, and press Return.

ESAR test error messages

ESAR test error messages have the form
?TFL: *slot/esar* [PAD-AA] (*code: description*).

- ?TFL: *slot/esar* [PAD-AA] indicates that the ESAR test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure.

Table 7-4 lists error codes and descriptions found in ESAR test error messages.

Table 7-4. ESAR Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: ESAR)	Timeout occurred when the test tried to read the ESAR.
(2: ESAR[0-5] = 0's)	First 6 bytes of the ESAR were all zero.
(3: ESAR[0] = brdcst-sdrs)	ESAR contained broadcast address.
(5: checksum)	ESAR checksum verification failed.
(7: rvrs cpy !=)	Reverse copy mismatch occurred.
(8: frwrdr cpy !=)	Forward copy mismatch occurred.
(9: ESAR[24-28] !=FF)	Test pattern FF mismatch occurred.
(10: ESAR[25-29] !=00)	Test pattern 00 mismatch occurred.
(11: ESAR[26-30] =55)	Test pattern 55 mismatch occurred.
(12: ESAR[27-31] !=AA)	Test pattern AA mismatch occurred.

External Loopback Test

The external loopback test checks the Ethernet controller and its connection to the network.

Before you run the external loopback test, first install a terminator or loopback connector on the Ethernet controller you want to test.

- To test a ThinWire Ethernet controller, install a terminated ThinWire T-connector on the ThinWire connector.
- To test a ThickWire Ethernet controller, install a ThickWire loopback connector on the ThickWire connector.

To run the external loopback test, type **t slot/ext-lb** and press Return. When you type this test command, replace *slot* with the slot number of the Ethernet controller you want to test.

The external loopback test sends an external loopback packet and tests the system connection to the network. To run the external loopback test, type **t slot/ext-lb [offset]** and press Return.

When you type the external loopback test command,

- Replace *slot* with the slot number of the Ethernet module you want to test.
- Replace *offset* with a specific address between 0 and 1 F000 where you want the test to start.

External loopback test parameters and error codes

ESAR test error messages have the form
?TFL: slot/ext-lb [PAD-AA] (code: description).

- **?TFL: slot/ext-lb [PAD-AA]** indicates that the external loopback test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure.

Table 7-5 lists the error codes and descriptions found in external loopback test error messages.

Table 7-5. External Loopback Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: LANCE-init [x])	Error occurred initializing the Ethernet controller chip.
(2: rd ESAR err)	The system could not access the Ethernet station address ROM.
(3: xmt [x, x/ x])	System did not transmit packet; Ethernet connection is probably bad.
(4: rcv [x,x])	System did not receive packet.
(6: pkt-data !=)	Transmitted packet was not received.
(7)	Fatal error occurred.

Interrupt Request (IRQ) Test

The interrupt request (IRQ) test checks whether the Ethernet controller can generate an interrupt to the R3000 chip. To run the IRQ test, type **t slot/int [offset]** and press Return.

When you type the IRQ test command,

- Replace *slot* with the slot number of the Ethernet controller that you want to test.
- Replace the optional *offset* parameter with an Ethernet RAM buffer address between 0 and 1F000 where you want the test to start.

IRQ test parameters and error codes

IRQ test error messages have the form
?TFL: slot/int [PAD-AA] (code: description).

- **?TFL: slot/int [PAD-AA]** indicates that the IRQ test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure.

Table 7-6 lists the error codes and descriptions found in IRQ test error messages.

Table 7-6. IRQ Test Error Codes and Descriptions

Error Code and Description	Meaning
(1:int pndng)	Pending interrupt was invalid.
(2: init LANCE err = x)	Error occurred when the system tried to initialize the Ethernet controller chip.
(4: intr err xmt-stat=x)	System generated no interrupt on packet transmission.

Internal Loopback Test

The internal loopback test sends and receives data packets to and from Ethernet in internal loopback mode. To run the internal loopback test, type **t slot/int-lb [offset]** and press Return.

When you type the internal loopback test command,

- Replace *slot* with the slot number of the Ethernet controller you want to test.
- Replace the optional *offset* parameter with a specific Ethernet RAM address between 0 and 1F000 where you want the test to start.

Internal loopback test parameters and error codes

Internal loopback test error messages have the form ?TFL: *slot/int-lb* [PAD-AA] (*code: description*).

- ?TFL: *slot/int-lb* [PAD-AA] indicates that the internal loopback test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure.

Table 7-7 lists the error codes and error descriptions found in internal loopback test error messages.

Table 7-7. Internal Loopback Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: rd ESAR err)	The system could not access the Ethernet station address ROM.
(2: LANCE-init [x])	Error occurred initializing the Ethernet controller chip.
(3: xmt [x])	System did not transmit packet.
(4: rcv [x])	System did not receive packet.
(5: rcvd size=x, xptd=x)	Packets received and packets sent had different sizes.
(6: pkt-data !=)	Data received and data sent did not match.
(7)	Received CRC was incorrect.

Multicast Test

The multicast test checks the Ethernet ability to filter multicast packets. To run the multicast test, type **t slot/m-cst [offset]** and press Return.

When you type the multicast test command,

- Replace *slot* with the slot number of the Ethernet controller that you want to test.
- Replace the optional *offset* parameter with a specific Ethernet RAM address between 0 and 1F000 where you want to start the test.

Multicast test error messages

Multicast test error messages have the form
?TFL: slot/m-cst [PAD-AA] (code: description).

- **?TFL: slot/m-cst [PAD-AA]** indicates that the multicast test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure.

Table 7-8 lists the error codes and error descriptions found in multicast test error messages.

Table 7-8. Multicast Test Error Codes and Descriptions

Error Message Code and Description	Meaning
(1: rd ESAR err)	Error occurred reading Ethernet station address ROM.
(2: LANCE-init [x])2	System failed to initialize the Ethernet controller chip.
(3: xmt [x])	Ethernet controller failed to send packet.
(4: rcv err)	Ethernet controller failed to receive packet.
(5: rcvd invld m-cst)	Ethernet controller received a multicast packet when multicast function was disabled.
(6: rcv [x])	Packet receive routine reported an error.
(7: LANCE-init [x])	Error occurred when the system tried to initialize the Ethernet chip.
(8: xmt [x])	Ethernet controller failed to transmit packet.
(9: rcv [x])	Ethernet did not receive expected packet.

Promiscuous Mode Test

The promiscuous mode test checks that the Ethernet controller can receive packets in promiscuous mode. To run the promiscuous mode test, type **t slot/promisc** [offset] and press Return.

When you type the promiscuous mode test command,

- Replace *slot* with the slot number of the Ethernet controller that you want to test.
- Replace the optional *offset* parameter with a specific Ethernet RAM buffer address between 0 and 1F000 where you want to start the test.

Promiscuous mode test error messages

Promiscuous mode test error messages have the form ?TFL: *slot/promisc* [PAD-AA] (*code: description*).

- ?TFL: *slot/promisc* [PAD-AA] indicates that the promiscuous mode test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure.

Table 7-9 lists the error codes and error descriptions found in promiscuous mode test error messages.

Table 7-9. Promiscuous Mode Test Error Codes and Descriptions

Error Message Code and Description	Meaning
(1: rd ESAR err)	System could not read the Ethernet station address ROM.
(2: LANCE-init [x])	Ethernet controller initialization failed.
(3: xmt [x])	Packet transmission failed.
(4: rcv err)	Packet reception failed.
(5: rcvd invld adrs)	An inappropriate packet was received in nonpromiscuous mode.
(6: rcv [x])	Packet receive routine failed.
(7: LANCE-init [x])	System failed to initialize Ethernet controller in promiscuous mode.
(8: xmt [x])	Packet transmission failed.
(9: rcv [x])	Ethernet did not receive the expected packet while in promiscuous mode.

Ethernet RAM Test

The Ethernet RAM test checks the Ethernet RAM operation. To run the Ethernet RAM test, type **t slot/ram** [*offset*] [*increment*] and press Return.

When you type the Ethernet RAM test command,

- Replace *slot* with the slot number of the Ethernet controller you want to test.
- Replace the optional *offset* parameter with a specific address between 0 and 1F000 where you want the test to start.
- Replace the optional *increment* parameter with the value by which the test increases the RAM buffer address for each read and write operation.

Ethernet RAM test error messages

Ethernet RAM test error messages have the form

?TFL: *slot/ram* [PAD-AA] (*code: description*).

- ?TFL: *slot/ram* [PAD-AA] indicates that the Ethernet RAM test reported a problem.
- *code* represents a number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure. Some additional information statements for the Ethernet RAM test list the address and mismatched values that caused a read or write error.
 - The *adrs* parameter lists the address where the error occurred.
 - The *rd* parameter lists the actual value that the test read.
 - The *xpct* parameter lists the expected value for the address where the error occurred.

Table 7-10 lists the error codes and descriptions found in Ethernet RAM test error messages.

Table 7-10. Ethernet RAM Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: wrt RAM err)	Write operation to Ethernet RAM failed.
(2: adrs= <i>x</i> , rd= <i>y</i> , xpct= <i>z</i>)	Word that was read did not equal 55555555.
(3: adrs= <i>x</i> , rd= <i>x</i> , xpct= <i>x</i>)	Read miscompare occurred on the second pass.

Registers Test

The registers test performs a read and write operation on the Ethernet registers. To run the registers test, type **t slot/regs**, where *slot* represents the slot number of the Ethernet controller you want to test, and press Return.

Registers test error messages

Registers test error messages have the form
?TFL: *slot/regs* [PAD-AA] (*code: information*).

- ?TFL: *slot/regs* [PAD-AA] indicates that the registers test reported a problem.
- *code* represents some number that identifies the type of failure that occurred.
- *description* represents additional information that describes the failure.
 - The CSR[*n*] parameter, where *n* represents the number of a specific CSR register, indicates the actual value in the CSR register.
 - The xpctd parameter indicates the expected value for the same CSR register.

Table 7-11 lists the error codes and descriptions found in registers test error messages.

Table 7-11. Registers Test Error Codes and Descriptions

Error Code and Description	Meaning
(1: CSR[n]=x - xpctd 0)	Write and read operation to Ethernet CSR[n] failed.
(3: CSR[1]=x - xpctd FFFE)	Reading and writing FFFE with CSR [1] failed.
(4: CSR[2]=x - xpctd 00FF)	Reading and writing 00FF with CSR1 failed.
(5: CSR[1]=x - bit lk frm CSR[1])	Bit leak from CSR2 to CSR1 occurred.
(6: CSR[2]= x - bit lk frm CSR[1])	Bit leak from CSR1 to CSR2 occurred.
(7: immediate write/read flr)	Immediate write and read test failed.

Part III

SCSI Controllers

SCSI Controllers

This chapter discusses the following about SCSI controllers:

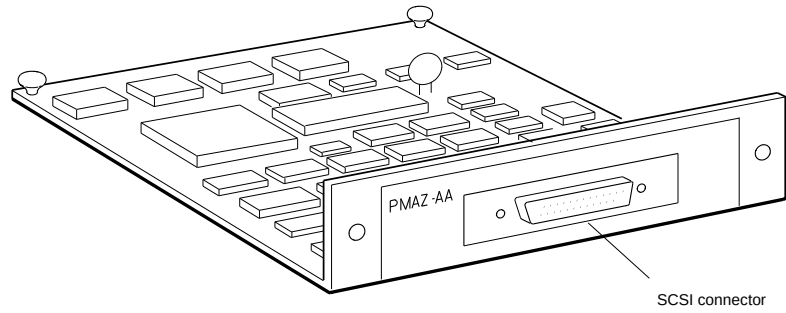
- SCSI option module hardware
- Troubleshooting procedures
- Individual SCSI controller tests

SCSI Controller Hardware

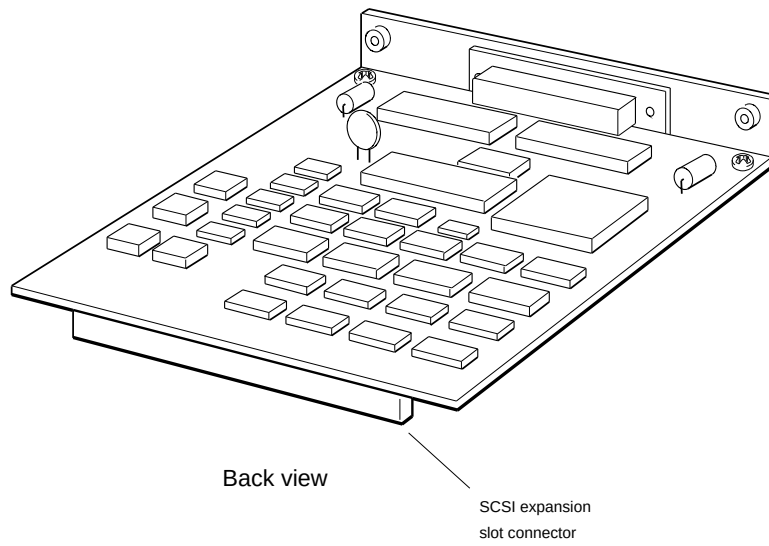
The SCSI controllers link the system module and the system hard disk, tape, and optical compact disc drives. Each SCSI controller can support up to seven external drives, which connect to the SCSI controller through a cable that attaches to the back of the system unit.

Each base system has one SCSI controller on the system module and supports additional SCSI controller option modules.

Figure 8-1 shows a SCSI controller option module and its connectors.



Front view



Back view

WSE2M029

Figure 8-1. SCSI controller option module

Troubleshooting a SCSI Controller

If the cntl or sram test reports an error, replace the faulty SCSI controller.

- If the faulty SCSI controller is on the system module, replace the system module. Refer to the maintenance guide for the system that has the faulty SCSI controller for directions.
- If the faulty SCSI controller is an option module, replace the option module. Refer to “How to Remove and Install an Option Module” in Chapter 1 for directions.

If the sdiag test reports an error, the problem is in the SCSI controller or a drive connected to the SCSI controller. Refer to Chapter 9 to troubleshoot the drive.

To check a SCSI controller and its drives thoroughly, use the SCSI test script. Type **sh slot/pst-t**, where you replace *slot* with the slot number of the SCSI controller for the drive you want to test. Then press Return. The SCSI test script then checks the SCSI controller and each drive on the bus.

For detailed information about a particular SCSI controller test, see the individual SCSI tests described later in this chapter.

Individual SCSI Controller and Drive Tests

The following entries explain commands and error messages for SCSI controller and SCSI drive tests.

Table 8-1 lists the name and command for each individual SCSI test.

Table 8-1. Individual SCSI Tests

Test Name	Test Command ¹
SCSI controller test	<i>slot/cntl</i>
SCSI RAM test	<i>slot/sram [w] [p pattern] [l number]</i>
SCSI send diagnostics test	<i>slot/sdiag SCSI_ID [d] [u] [s]</i>
SCSI target test	<i>slot/target device [w] [l loops]</i>

¹The *slot* variable represents the slot number of the failed controller or module.

SCSI Controller Test

The SCSI controller test checks SCSI controller operation. To run the SCSI controller test, type **t slot/cntl**, where *slot* represents the slot number of the SCSI controller you want to test, and press Return.

SCSI controller test error messages

SCSI controller test error messages have the form
?(TFL: | STX:) *slot/cntl (description) PMAZ-AA*

- The leftmost parameter indicates the type of error that occurred.
 - ?TFL indicates that the test failed.
 - ?STX indicates that the test command was invalid.
- *slot/cntl* indicates that the SCSI controller test reported the error. *slot* represents the slot number of the SCSI controller that reported the error.
- *description* represents additional information that describes the failure.
- PMAZ-AA is the code name for the SCSI controller hardware.

Table 8-2 lists error descriptions found in SCSI controller test error messages.

Table 8-2. SCSI Controller Error Descriptions

Error Description	Meaning
(rd cnfg)	Values written to and read from configuration register did not match.
(fifo flg)	First in, first out (FIFO) load and FIFO flags did not match.
(cnt xfer)	Write and read operation on TCL register reported a mismatch.
(illg cmd)	Command was illegal and did not generate an interrupt.
(int reg)	Controller cannot clear internal interrupt register.
(invl arg)	Test command was invalid.

SCSI RAM Test

The SCSI RAM test performs a read and write operation on the SCSI RAM. To run the SCSI RAM test, type **t slot/sram [w] [p pattern] [l number]** and press Return.

When you type the SCSI RAM test command,

- Replace *slot* with the slot number of the SCSI controller you want to test.
- Specify the optional *w* parameter to run a walking-bit test.
- Specify the optional *p* parameter to use a specific pattern in the test. Replace *pattern* with the pattern you want to use.
- Specify the optional *l* parameter to have the test loop. Replace *number* with the number of times you want the test to loop.

SCSI RAM test error messages

SCSI RAM test error messages have the form
?(TFL: | STX:) slot/cntl (*description*) PMAZ-AA

- The leftmost parameter indicates the type of error that occurred.
 - ?TFL indicates that the SCSI RAM test failed.
 - ?STX indicates that the SCSI RAM test command was invalid.
- *slot/sram* indicates that the SCSI RAM test reported the error. *slot* represents the slot number of the SCSI controller that reported the error.
- *description* represents additional information that describes the failure.
- PMAZ-AA is the code name for the SCSI controller.

Table 8-3 describes error descriptions found in SCSI RAM test error messages.

Table 8-3. SCSI RAM Test Error Descriptions

Error Description	Meaning
(inval arg)	Test command syntax was not valid.
(exp=xx act=yy adr=zz <i>number</i>)	Read and write operation reported a mismatch. – The exp value is the expected value in the RAM. – The act value is the actual value in the RAM. – The adr value is the address where the mismatch occurred. – <i>number</i> represents the slot number of the SCSI controller that reported the error.

SCSI Send Diagnostics Test

The SCSI send diagnostics test runs the self-test for an individual SCSI device. You can specify whether the test runs with the SCSI device and unit offline bits set.

To run the SCSI send diagnostics test, type **t slot/sdiag scsi_id [d] [u] [s]** and press Return.

When you type the SCSI send diagnostics command,

- Replace *slot* with the slot number of the SCSI controller for the device you want to test.
- Replace *scsi_id* with the SCSI ID of the device you want to test.
- Include the optional *d* parameter to allow the test to alter internal drive parameters.
- Include the optional *u* parameter to run to include a write operation in the send diagnostics test.
- Include the optional *s* parameter to suppress the error message display.

Caution:: *On some devices, you can ruin existing data if you run the send diagnostics test with a device or unit off line. Specify only the default power-up self-test unless you are sure how the device responds.*

SCSI send diagnostics test error messages

SCSI send diagnostic test error messages have the form
?(TFL: | STX:) *slot/sdiag* TID=*scsi_id* FRU=*part (description)*
PMAZ-AA

- The leftmost parameter indicates the type of error that occurred.
 - ?TFL *slot/sdiag* indicates that the SCSI send diagnostics test reported an error. *slot* represents the slot number of the SCSI controller that reported the error.
 - ?STX *slot/sdiag* indicates that the SCSI send diagnostics test command was invalid. *slot* represents the slot number of the SCSI controller that attempted the invalid command.

- The TID value is the SCSI ID of the device that reported the error.
- The FRU value, if the failed drive is an RZ56 or RZ57 drive, indicates which part in the drive failed. The FRU value has no meaning for drives other than RZ56 or RZ57 hard disk drives.
 - E0 indicates that the printed circuit board is faulty.
 - D0 indicates that the head and disk assembly is faulty.
 - 00 indicates that either the printed circuit board or the head and disk assembly is faulty.
- *description* represents additional information that describes the failure.
- PMAZ-AA is an identification number for the SCSI controller hardware.

Table 8-4 lists error descriptions found in SCSI send diagnostics test error messages.

Table 8-4. SCSI Send Diagnostics Test Error Descriptions

Error Description	Meaning
(sdiag)	The device failed the send diagnostics test.
(dev ol)	Test could not bring the unit on line.
(inval arg)	Test command was invalid.
(cID = tID)	Device ID was the same as the controller ID.
(cmp)	Read and write values did not match.
(dev type)	Test does not work on the specified device.
(ro dev)	Test cannot perform write operation. Device is a read-only device.
(tst nocomp)	Command entered from the keyboard aborted the test.

SCSI Target Test

The SCSI target test performs a read test on a specific SCSI device. If you include the optional write parameter, the test also performs a write test. To run the SCSI target test, type **t slot/target scsi_id [w] [l loops]** and press Return.

When you type the SCSI target test command,

- Replace *slot* with the slot number of the SCSI controller for the device you want to test.
- Replace the *scsi_id* parameter with the SCSI ID of the device you want to test.
- Specify the optional *w* parameter to include a write operation in the SCSI target test.
- Specify the optional *l* parameter to have the test repeat a specified number of times. If you include the *l* parameter, replace *loops* with the number of times you want the test to repeat.

SCSI target test error messages

SCSI target test error messages have the form
?(TFL: | STX:) slot/target TID=scsi_id (description) PMAZ-XX

- The leftmost parameter indicates the type of error that occurred.
 - ?TFL *slot/target* indicates that the SCSI target test reported an error. *slot* represents the slot number of the SCSI controller that reported the error.
 - ?STX *slot/target* indicates that the SCSI target test command was invalid. *slot* represents the slot number of the SCSI controller that reported the invalid command.
- The TID value is the SCSI ID of the device that reported the error.
- *description* represents additional information that describes the failure.
- PMAZ-XX is the hardware identification number for the SCSI controller. XX represents the SCSI hardware revision number.

Table 8-5 lists error descriptions found in SCSI target test error messages.

Table 8-5. SCSI Target Test Error Description

Error Description	Meaning
(dev ol)	Test could not bring the device online.
(inval arg)	Test command was invalid.
(cID = tID)	Device ID was the same as the controller ID.
(cmp)	Read and write values did not match.
(dev type)	Test does not work on the specified device.
(ro dev)	Test cannot perform write operation. Device is a read-only device.
(tst nocomp)	Command entered from the keyboard aborted the test.

Part IV

Drives

System Drives

This chapter describes the hard disk, tape, and optical compact disc drives supported by TURBOchannel option modules. It explains

- Drive hardware
- How to troubleshoot drive problems
- How to remove and install external drives

Drive Hardware

SCSI controllers can support drives that reside in several different expansion boxes. Following are some typical expansion boxes with drives that SCSI controllers support. These expansion boxes are shown in Figures 9-1 through 9-4.

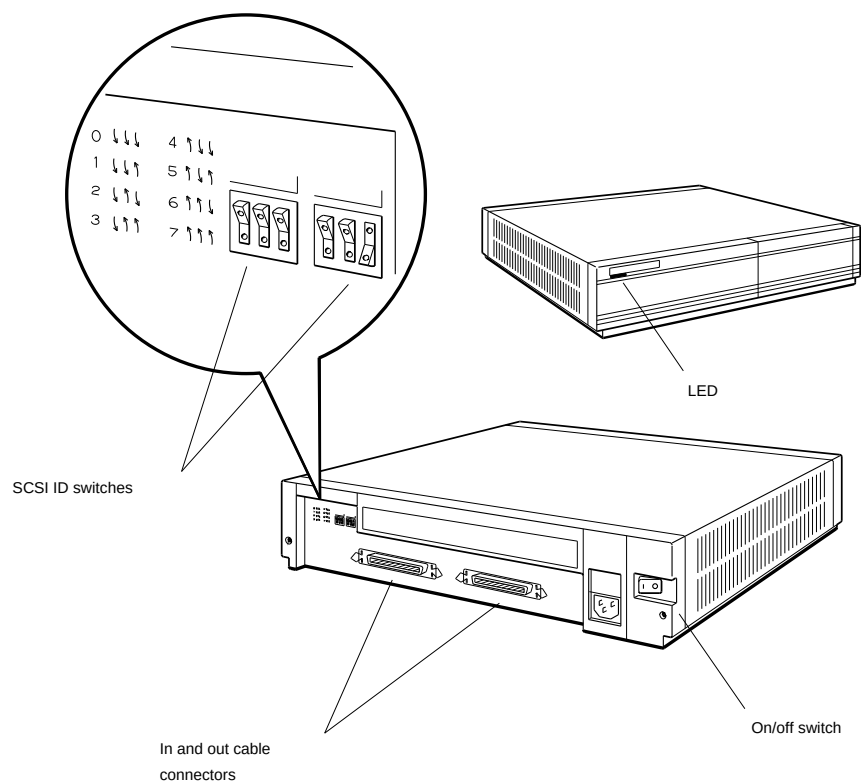
- The BA42 expansion box, which holds one or two drives
 - The side of the box that has a removable insert in the cover supports one removable-media drive or one hard disk drive.
 - The side of the box that has no removable insert in the cover supports one hard disk drive.

For information about the specific drives that the BA42 expansion box supports, refer to the *BA42 Expansion Box Maintenance Guide*.

- The RRD40 box, which holds one RRD40 optical compact disc drive. The RRD40 optical compact disc drive has a capacity of 600 Mbytes.
- The BA40 box, which holds one TK50Z tape drive. The TK50Z tape drive has a capacity of 90 Mbytes.
- The TLZ04 box, which holds one TLZ04 tape drive. The TLZ04 tape drive has a capacity of 1.2 Gbytes.

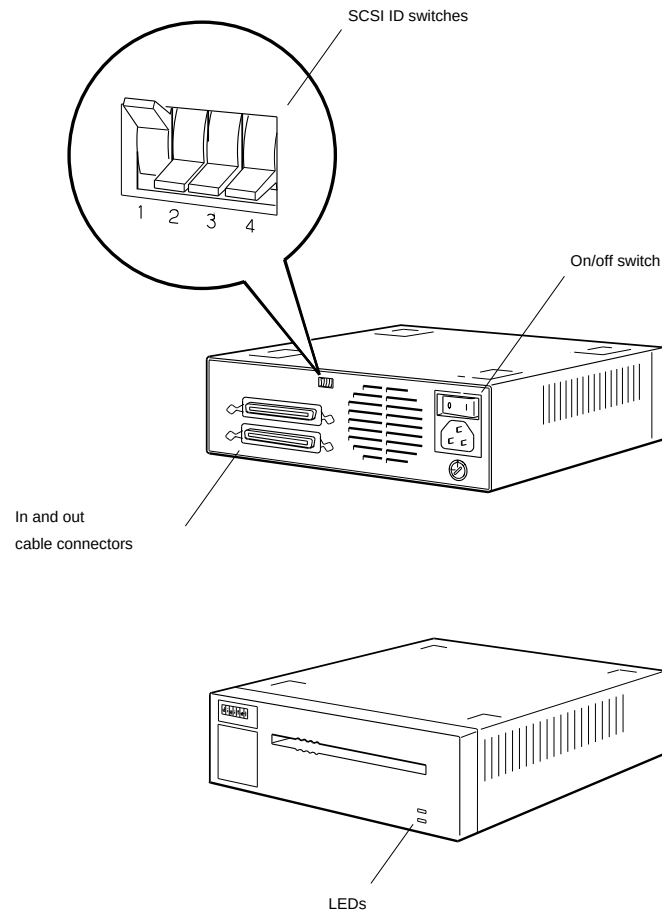
These boxes connect in a chain that attaches to a SCSI connector on the back of the system unit. The unused connector on the last drive in each chain requires a terminator.

Some base systems also have internal drives. For information about internal drives on a base system, refer to the maintenance guide for the base system about which you want information.



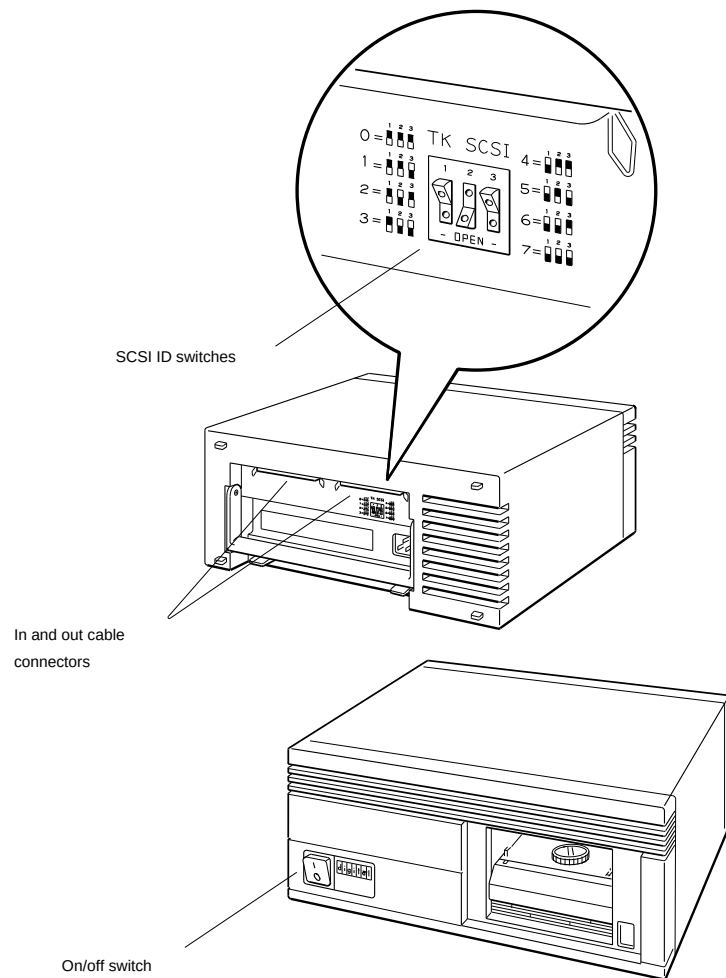
WSE2M036

Figure 9-1. BA42 expansion box



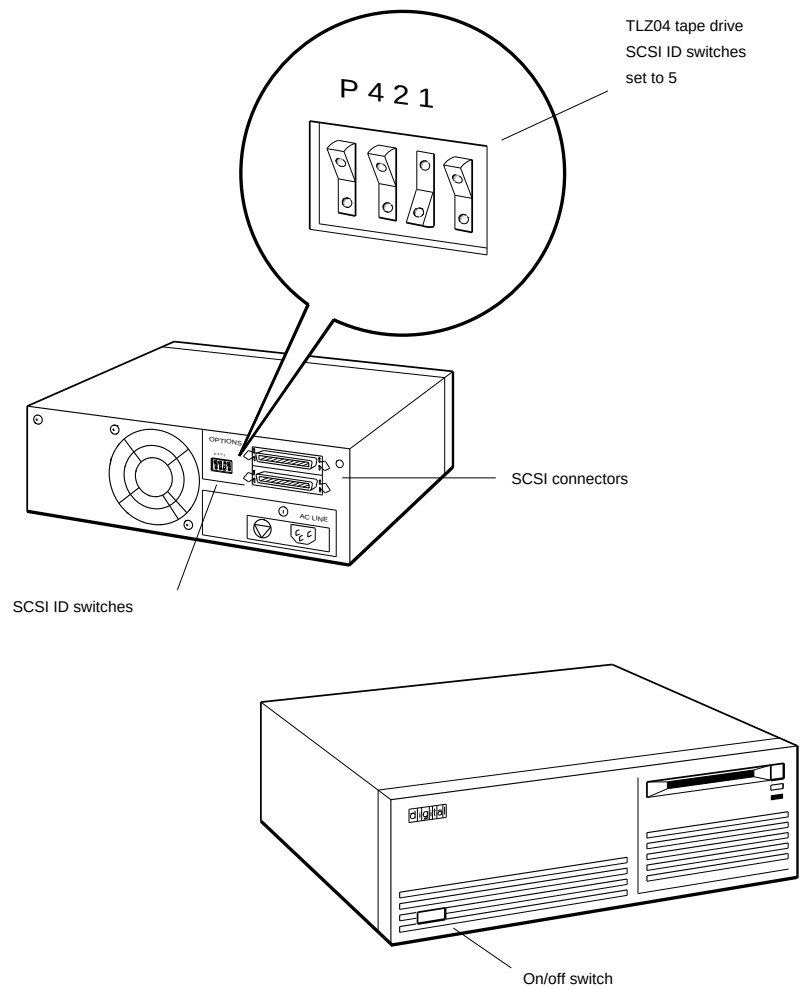
WSE2M032

Figure 9-2. RRD40 box



WSE2M033

Figure 9-3. BA40 expansion box



WSE2M052

Figure 9-4. TLZ04 box

Troubleshooting the Drives

Troubleshoot a faulty drive as follows:

1. Ensure the following:
 - A SCSI chain terminator is on the last drive in the chain.
 - All SCSI cables are connected properly. Replace any cables that appear defective.
 - Any tapes or compact discs are inserted correctly. Correctly insert any that are upside down.
 - Each drive has a different SCSI ID and no drive has its SCSI ID switch set to 7.
2. If the problem persists, run the SCSI test script. Type *slot/pst-t*, where you replace *slot* with the slot number of the SCSI controller you want to test. Then press Return.
3. If the cntl or sram test reports an error, replace the failed SCSI controller.
 - If the failed SCSI controller is on the system module, replace the system module. Refer to the maintenance guide for the base system that you are troubleshooting for directions.
 - If the failed SCSI controller is on an option module, replace the failed option module. Refer to “To Remove and Install an Option Module” in Chapter 1 for directions.
4. If the SCSI test returns the error message *slot/sdiag*, where *slot* represents the slot number of the SCSI controller you are testing, a drive is faulty. Refer to “SCSI Send Diagnostics Test” later in this chapter to troubleshoot.

SCSI Send Diagnostics Test

The SCSI send diagnostics test runs the self-test for an individual drive. You can specify whether to include a read operation and whether to allow the test to alter the internal parameters of the drive.

To run the SCSI send diagnostics test, type **t slot/sdiag device [d] [u] [s]** and press Return.

When you type the SCSI send diagnostics command,

- Replace *slot* with the slot number of the SCSI controller for the device you want to test.
- Replace *device* with the SCSI ID of the device you want to test.
- Include the optional *d* parameter to allow the test to alter certain internal drive parameters.
- For drives discussed in this guide, include the optional *u* parameter to perform a write operation during the self-test. Drives other than those discussed in this guide do not necessarily perform a write operation if you include the *u* parameter.
- Include the optional *s* parameter to suppress the error message display.

Caution: *On some devices, you can ruin existing data if you include the *d* or *u* parameters. Do not specify *d* or *u* unless you are sure how the device responds.*

Send diagnostics test error messages

Send diagnostics test error messages have the form
?TFL: slot/sdiag TID=scsi_id FRU=item description PMAZ-AA.

- **?TFL: slot/sdiag** indicates that the send diagnostics test reported an error. *slot* represents the slot number of the SCSI controller for the SCSI bus that reported the error.
- **TID** indicates the SCSI ID of the drive that reported the error.

- FRU, for some types of drives, identifies the failed item in the drive. For RZ56 and RZ57 hard disk drive tests that include a write operation, the FRU parameter indicates the following:
 - E0 indicates that the printed circuit board is faulty.
 - D0 indicates that the head and disk assembly is faulty.
 - 00 indicates that either the printed circuit board or the head and disk assembly is faulty.
- *description* represents an additional string that describes the failure.

This sample send diagnostics test error message indicates that the drive with SCSI ID 2 on the SCSI bus connected to slot number 1 is faulty:

```
?TFL: 1/sdiag TID=2 FRU=00 (sdiag) PMAZ-AA
```

The FRU parameter is 00. If the drive is an RZ56 or RZ57 hard disk drive, either the drive printed circuit board or the head and disk assembly could be faulty. If the drive is other than an RZ56 or RZ57 drive, the FRU parameter has no meaning.

The error description (sdiag) indicates that the sdiag command reported an error.

SCSI Target Test

The SCSI target test performs a read test on a specific SCSI device. If you include the optional write parameter, the test also performs a write test. To run the SCSI target test, type **t slot/target device [w] [l loops]** and press Return.

When you type the SCSI target test command,

- Replace *slot* with the slot number of the SCSI controller for the SCSI bus you want to test.
- Replace the device parameter with the SCSI ID of the device you want to test.
- Include the optional *w* parameter to include a write operation in the SCSI target test.
- Include the optional *l* parameter to have the test repeat a specified number of times. If you include the *l* parameter, replace *loops* with the number of times you want the test to repeat.

If you specify a write operation in the target test, the prompt **wrt? (1/0)** asks you to confirm that you want the test to perform a write operation.

- Specify 1 to include a write operation in the test.
- Specify 0 to omit a write operation from the test.

Caution: *Performing a write operation can ruin existing data on a drive. Be sure to back up any data before you write to a drive.*

For example, to run a read and write test 50 times on a hard disk drive that has SCSI ID 2 and is on the SCSI bus connected to slot number 5, type **5/target 2 w l 50** and press Return.

SCSI target test error messages

SCSI target test error messages use the format
?TFL: *slot*/target TID=*scsi_id* *description* PMAZ-AA.

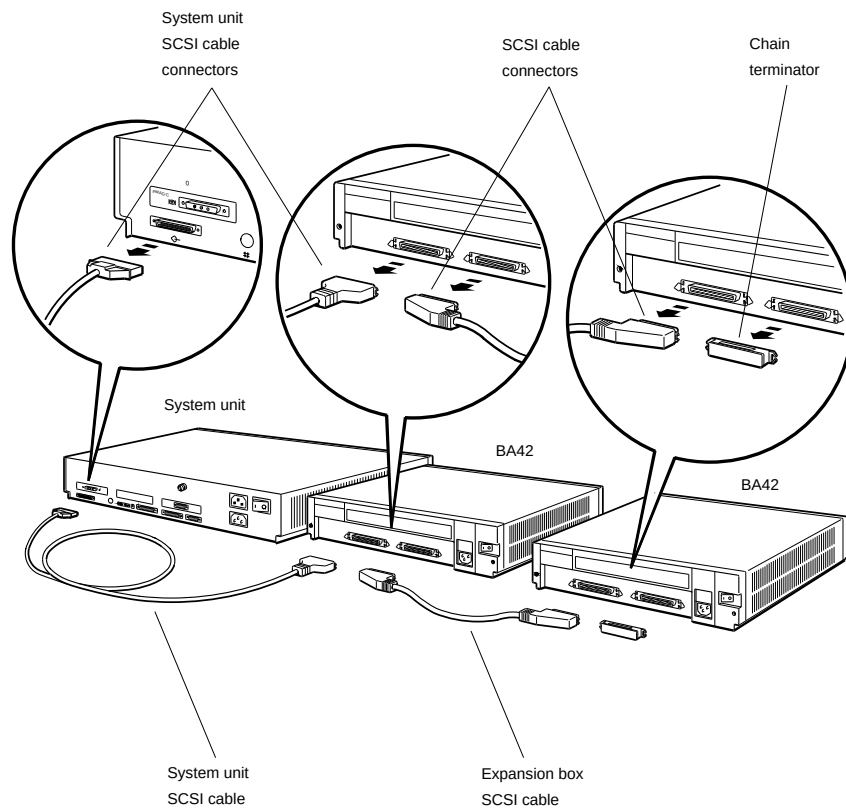
- *slot* represents the slot number of the SCSI controller connected to the SCSI bus.
- TID indicates the SCSI ID of the device that reported the error.
- *description* represents additional information that describes the failure.
- PMAZ-AA is the product ID for the SCSI controller.

Removing and Installing Drive Expansion Boxes

This section describes how to remove and install drive expansion boxes. For an explanation of servicing hardware inside the expansion boxes, refer to the service guide for the particular drive you want to replace.

How to Remove a Drive Expansion Box

Figure 9-5 shows how to remove a drive expansion box.



WSE2M039

Figure 9-5. Removing a drive expansion box

1. Turn off the system unit. Then turn off all drives in the chain with which you are working.
2. Disconnect the SCSI cables connected to the expansion box that holds the drive you want to remove.
3. *If the expansion box is nearest the system unit*, follow these steps to remove the box:
 - a. Disconnect the SCSI cables attached to the expansion box.
 - b. Remove the SCSI cable connected to the next box in the chain.
 - c. If you do not install a new expansion box, connect the SCSI cable on the back of the system unit to the next expansion box in the chain.
4. *If the expansion box is in the middle of the chain*, follow these steps to remove the box:
 - a. Disconnect both SCSI cables attached to the expansion box. Disconnect the other end of one of these cables and remove the cable.
 - b. Connect the free end of the remaining cable to the open connector on the remaining expansion box.
5. *If the drive is at the end of the chain*, follow these steps to remove the drive:
 - a. Remove the SCSI cable connected to the expansion box you are removing. Open the latches holding the cable connector and pull the cable away from the connector.
 - b. Remove the other end of the SCSI cable from the drive connector to which it is attached.
 - c. Insert a SCSI chain terminator on the drive that is now at the end of the chain. Close the latches on each side of the drive connector.

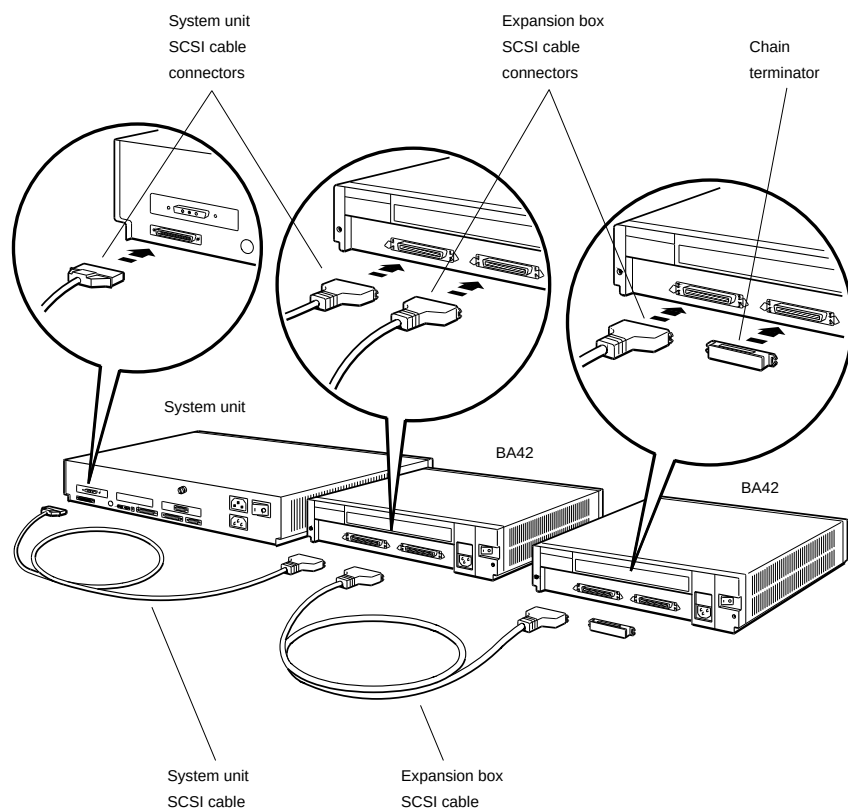
How to Install a Drive Expansion Box

1. Before installation, perform a power-up self-test to make sure the system is operating properly. Correct any problems before you proceed.
2. Use the SCSI ID switches or jumpers for the drive to set the drive SCSI ID. Always number drives from the beginning of the chain, starting with drive 0.

To find an available SCSI ID, use the SCSI bus configuration display. Refer to the maintenance guide for the base system onto which you are installing a drive for an explanation of how to display the SCSI bus configuration.

To determine the SCSI ID switch and jumper settings for a specific drive, refer to the maintenance guide for that drive.

3. Connect the SCSI cables to the drive. Push the cable end onto the drive's SCSI connector. Then close the latches. Figure 9-6 shows how to install a drive.
4. Turn on the system unit. The system performs a power-up self-test and checks its new configuration.
5. If the system reports an error, check all system connections and repeat the test. If an error still occurs, install a disk drive you know is operating properly. Then repeat the test.
6. If the error persists, the problem is probably somewhere else in the system. Refer to the base system maintenance guide to troubleshoot the base system.
7. After the system reports no problems, run the drive self-tests described in the troubleshooting section of this chapter to check the drive.



WSE2M043

Figure 9-6. Installing a drive

For Further Information

For more information about commands related to drive operation, refer to the explanation of SCSI controllers in Chapter 8.

To troubleshoot SCSI controllers, refer to the SCSI troubleshooting directions in Chapter 8.

For more detailed information about any drive, refer to the service guide for the individual drive.

Part V

Monitors

The Monitors

This chapter discusses monitors that TURBOchannel options support. It describes

- Which monitors each graphics option module supports
- What to do if the monitor has no display
- How to troubleshoot and correct simple monitor problems
- How to display patterns that you use to adjust the monitor
- The size, controls, and operating frequency of individual monitors

Combining Monitors and TURBOchannel Graphics Modules

Each monitor requires specific graphics modules to display graphics. See chapters 2 through 5 for information about the various TURBOchannel graphics modules and the monitors that can be combined with each.

For detailed information about monitors, refer to the section later in this chapter that discusses the individual monitor in which you are interested.

Troubleshooting the Monitor

If the monitor display is unclear, refer to Table 10-1 for directions for adjusting the display.

If the monitor has no display at all, follow the steps in Table 10-2 to troubleshoot the system.

Table 10-1. Correcting Simple Monitor Problems

Problem	Remedy
Display is too bright or too dark.	Rotate the brightness knob to increase or decrease the brightness.
Contrast is too high or too low.	Rotate the contrast knob to adjust contrast.
Image is distorted or wavy.	If the monitor has a degauss button, press the degauss button for 10 seconds and then release it. If this does not correct the display, refer to the monitor service guide.
Display colors are incorrect.	Make sure the video cable RGB connectors are connected to the monitor correctly. If the problem persists, replace the video cable. To adjust the monitor color, refer to “Displaying Patterns for Adjusting the Monitor” later in this chapter for directions.

Table 10-2. Troubleshooting When the Monitor Has No Display

Problem	Remedy
The monitor power indicator does not glow.	Make sure the monitor is turned on. Check the monitor power supply and outlet. Refer to the monitor service guide if the monitor power indicator still does not glow.
The workstation power supply LED does not glow.	Make sure the workstation power supply is turned on. Check the workstation power cord and outlet. If the power supply LED still does not glow, troubleshoot the system unit power supply. Refer to the maintenance guide for the problem base system for directions.
The video cable is not correctly connected to the monitor and system unit.	Make sure the cable connections are tight.
The system unit diagnostic LEDs are not all off when the power-up self-test is finished.	Refer to the maintenance guide for the base system to troubleshoot.
A graphics module self-test reports an error.	Refer to the chapter earlier in this guide that discusses the type of graphics module that reported the error to troubleshoot.
The monitor still has no display.	Remove and replace the video cable.
After the video cable is replaced, there is still no display on the monitor.	The problem is probably in the monitor, not the system unit. Refer to the monitor service guide to troubleshoot the monitor.

Testing the Monitor Display

Use the monitor adjustment patterns described later in this chapter to test the monitor display.

If these tests do not produce the correct monitor display, make sure the video cable connectors are attached correctly.

- Make sure that the connectors marked R, G, and B attach to the corresponding R, G, and B connectors on the monitor.
- Check the video cable connection to the back of the system unit. Make sure the Digital logo on the video cable connector faces up. If the Digital logo faces down, disconnect the video cable from the back of the system unit and reinstall the cable connector so the Digital logo faces up.

If the problem persists, refer to the monitor service guide to troubleshoot the monitor.

Displaying Patterns for Adjusting the Monitor

You can display a series of patterns for adjusting the monitor display.

- If your system has a monochrome frame-buffer graphics module, see “Displaying Patterns for Adjusting a Monitor Connected to a Monochrome Frame-Buffer Graphics Module” below.
- If your system has a color frame-buffer graphics module, see “Displaying Patterns for Adjusting a Monitor Connected to a Color Frame-Buffer Graphics Module” below.
- If your system has a 2D graphics accelerator or 3D graphics module, see “Patterns for Adjusting a Monitor Connected to a Two-Dimensional Graphics Accelerator or 3D Graphics Module” below.

Displaying Patterns for Adjusting a Monitor Connected to a Monochrome Frame-Buffer Graphics Module

If the system has a monochrome frame-buffer graphics module, use the patterns test and font test to display patterns for adjusting the monitor.

To display a series of patterns, run the patterns test. Type **t *slot_number*/ptrn 1**, where you replace *slot_number* with the color frame-buffer graphics module slot number, and press Return. The first pattern remains on the screen. Each time you press Return, the monitor displays the next pattern in the series.

The patterns appear in this sequence:

- Alternating black and white bars
- Solid white display
- Four gray patterns

To display the letters E and H, use the font test. Type **t *slot_number*/font [*character*]** and press Return.

When you type this test command,

- Replace *slot_number* with the slot number of the monochrome frame-buffer graphics module.

- Replace *character* with the value for the specific character that you want to display.
 - Specify 37 to display a screen filled with the letter E.
 - Specify 40 to display a screen filled with the letter H.

Displaying Patterns for Adjusting a Monitor Connected to a Color Frame-Buffer Graphics Module

If the system has a color frame-buffer graphics module, use the patterns test, the font test, and the box test to display patterns for adjusting the monitor.

To run the patterns test, type **t slot_number/ptrn 1**, where you replace *slot_number* with the color frame-buffer graphics module slot number, and press Return. Each pattern remains on the screen until you press Return. Each time you press Return, the monitor displays the next pattern in the series.

The patterns appear in this sequence:

- Color bars pattern
- Gray bars from light to dark pattern
- Solid red display
- Solid green display
- Solid blue display
- Solid blue-red display
- Blue-red to blue-green display

- Red-green to blue-green display
- Red-green to red-blue display
- Solid white display

To display the letters E and H, use the font test. Type **t slot_number/font** [*character*] and press Return.

When you type this test command,

- Replace *slot_number* with the slot number of the color frame-buffer graphics module.
- Replace *character* with the value for the specific character that you want to display.
 - Specify 37 to display a screen filled with the letter E.
 - Specify 40 to display a screen filled with the letter H.

To display a circle and crosshatch pattern, use the box test. Type **t slot_number/box**, where you replace *slot_number* with the slot number of the color frame-buffer. Then press Return. A circle and crosshatch pattern then appear on the monitor.

Displaying Patterns for Adjusting a Monitor Connected to a Two-Dimensional Graphics Accelerator or 3D Graphics Module

Run the patterns test to display adjustment patterns on a monitor connected to a 2D graphics accelerator or 3D graphics module.

To run the patterns test, type **t slot_number/patrn**s [1] and press Return.

When you type this command,

- Replace *slot_number* with the 2D graphics accelerator or 3D graphics module slot number.
- Include the optional 1 parameter to have each pattern remain on the monitor screen until you press the Return key.

2D graphics accelerator and 3D graphics test patterns appear in this sequence:

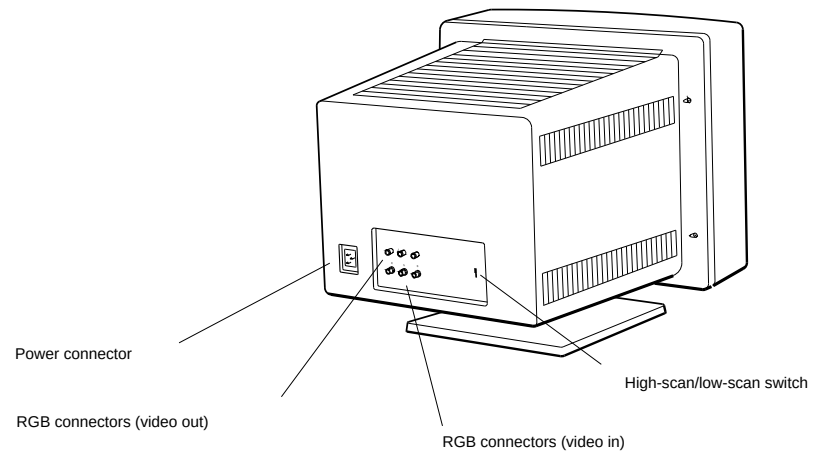
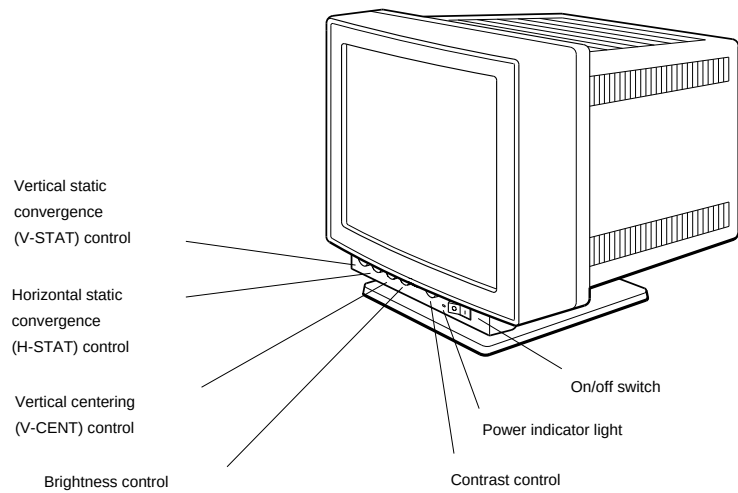
- Solid red display
- Solid green display
- Solid blue display
- Solid white display
- Four color bars display
- Eight color bars display
- Screen filled with the letter E
- Screen filled with the letter H
- Screen filled with a circle and crosshatch pattern

Individual Monitors

This section describes the size, controls, connectors, and operating frequency of some of the common monitors.

VRT16 Monitor

The VRT16 is a 16-inch, 66 Hz color monitor. Figure 10-1 shows the VRT16 monitor and its controls and video cable connectors.



WS330063

Figure 10-1. VRT16 monitor features

Table 10-3 lists the purpose of each control and connector.

Table 10-3. Controls and Connectors on the VRT16 Monitor

Item	Function
Power indicator light	Glowes green when the monitor power is receiving power.
Contrast control	Adjusts the contrast in the monitor display.
Brightness control	Adjusts the brightness of the monitor display.
Vertical centering (V-CENT)	Moves the picture upward or downward on the screen.
Vertical static convergence (V-STAT) control	Moves the red and blue horizontal lines in the display in relation to the green horizontal line in the display.
Horizontal static convergence (H-STAT) control	Moves the red and blue vertical lines in the display in relation to the green vertical line in the display.
RGB signal cable connectors	Connects the video cable to the monitor.
Fuse	Protects the monitor from electrical damage.
Power connector	Connects the power cord to the monitor.
On/off switch	Turns the monitor on and off.
High-scan/low-scan switch	The VRT16 monitor does not use the high-scan/low-scan switch when connected to a TURBOchannel graphics module.

VRT19 Monitor

The VRT19 is a 19-inch, 66 Hz color monitor. Figure 10-2 shows the VRT19 monitor and its controls and video cable connectors. Figure 10-2 shows the VRT19 monitor and its controls and video cable connectors.

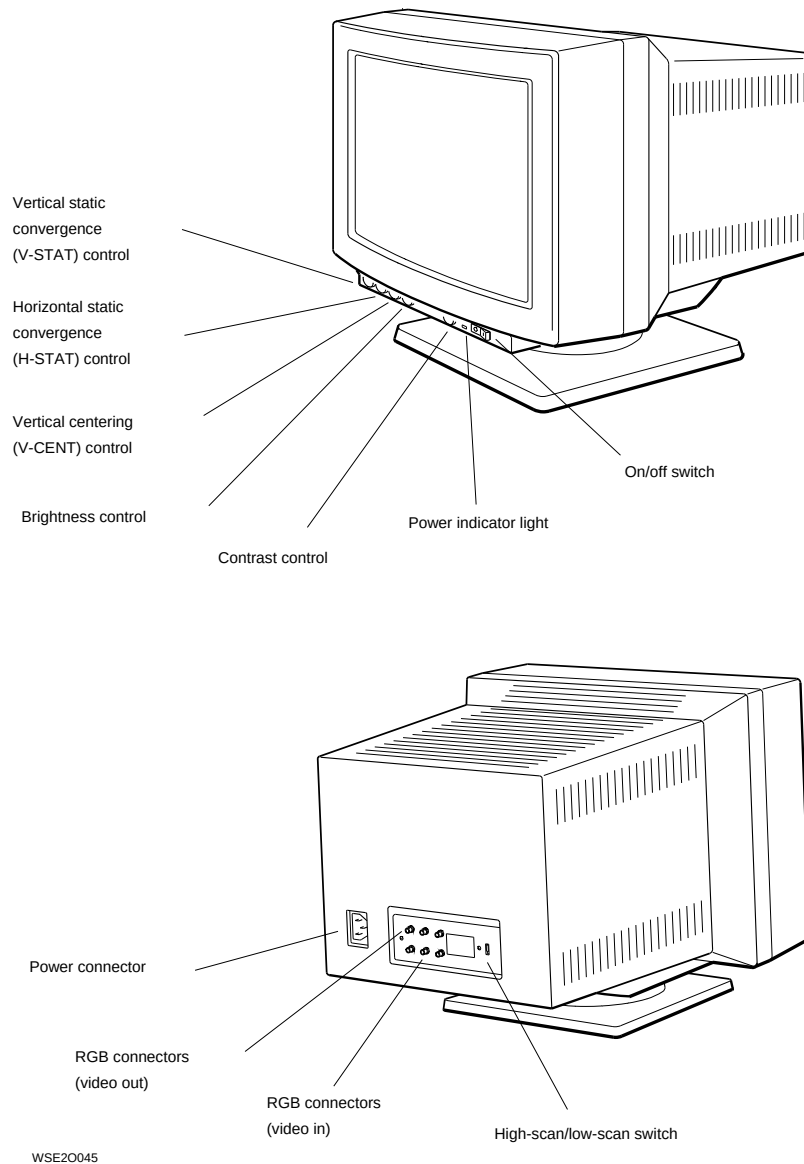


Figure 10-2. VRT19 monitor features

Table 10-4 lists the purpose of each control and connector.

Table 10-4. Controls and Connectors on the VRT19 Monitor

Item	Function
Power indicator light	Glowes green when the monitor power is receiving power.
Contrast control	Adjusts the contrast in the monitor display.
Brightness control	Adjusts the brightness of the monitor display.
Vertical centering (V-CENT)	Moves the picture upward or downward on the screen.
Vertical static convergence (V-STAT) control	Moves the red and blue horizontal lines in the display in relation to the green horizontal line in the display.
Horizontal static convergence (H-STAT) control	Moves the red and blue vertical lines in the display in relation to the green vertical line in the display.
RGB signal cable connectors	Connects the video cable to the monitor.
Fuse	Protects the monitor from electrical damage.
Power connector	Connects the power cord to the monitor.
On/off switch	Turns the monitor on and off.
High-scan/low-scan switch	The VRT16 monitor does not use the high-scan/low-scan switch when connected to a TURBOchannel graphics module.

VRM17 monitor

The VRM17 monitor is a 17-inch, 72-Hz monochrome multisync monitor. Figure 10-3 shows the VRM17 monitor and its controls and video cable connectors.

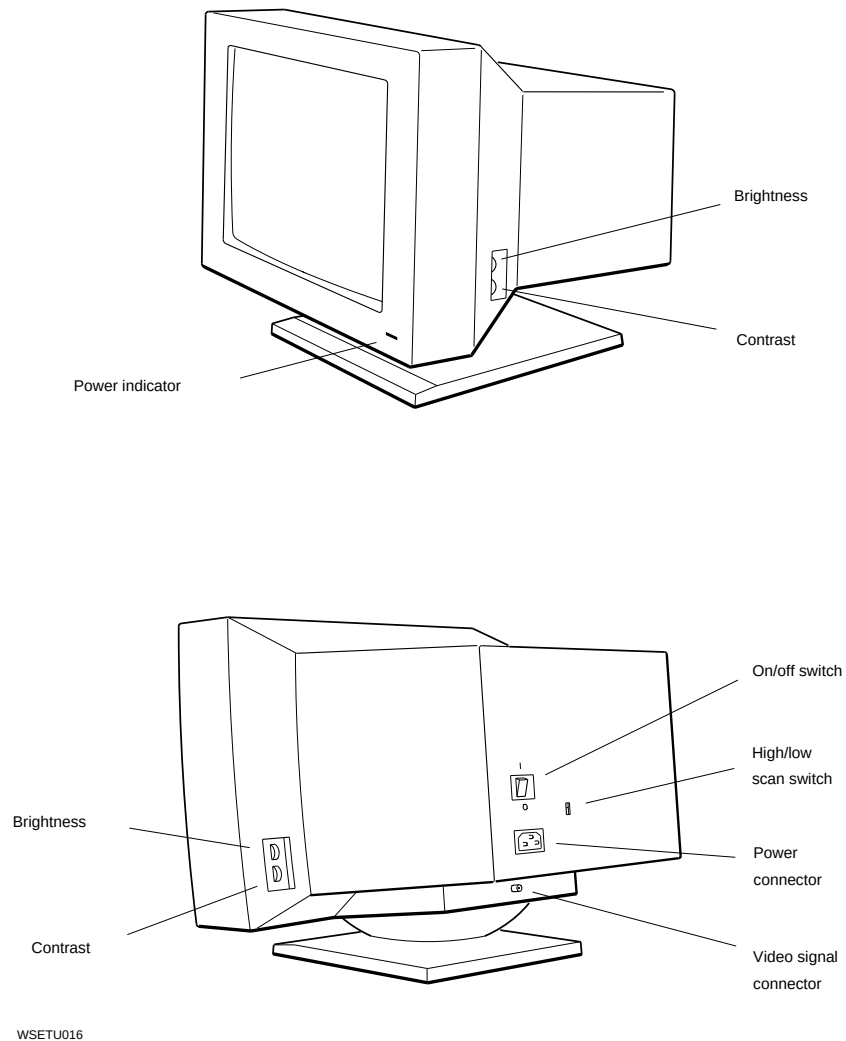


Figure 10-3. VRM17 monitor features

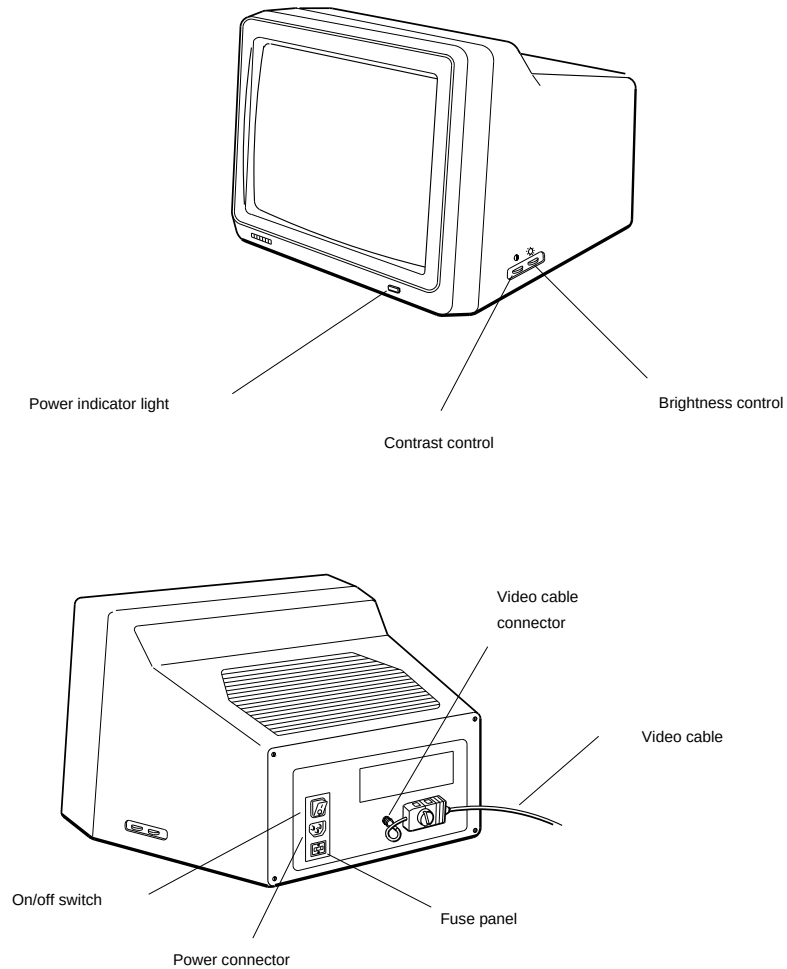
Table 10-5 lists the purpose of each control and connector.

Table 10-5. Controls and Connectors on the VRM17 Monitor

Item	Function
Power indicator light	Glows green when the monitor is receiving power.
Contrast control	Adjusts the contrast in the monitor display.
Brightness control	Adjusts the brightness of the monttor display.
High scan/low scan switch	Selects high scan or low scan.
Video cable connector	Connects the video cable to the monitor.
Power connector	Connects the power cord to the monitor.
On/off switch	Turns the monitor on and off.

VR262 Monitor

The VR262 is a 19-inch, 60 Hz monochrome monitor. Figure 10-4 shows the VR262 monitor and its controls and video cable connector.



DEPG006

Figure 10-4. VR262 monitor features

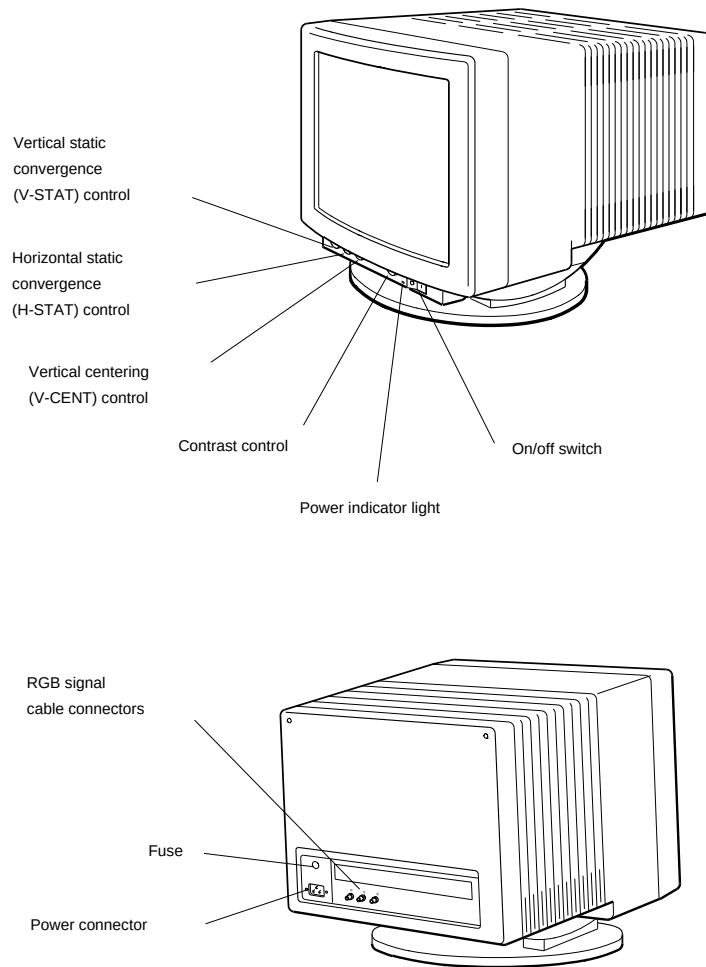
Table 10-6 lists the purpose of each control and connector.

Table 10-6. Controls and Connectors on the VR262 Monitor

Item	Function
Power indicator light	Glowes green when the monitor is receiving power.
Contrast control	Adjusts the intensity of the display on the screen.
Brightness control	Adjusts the brightness of the background on the screen.
Video cable connector	Connects the video cable to the monitor.
Fuse panel	Contains a fuse that protects the monitor from electrical damage.
Power connector	Connects the power cord to the monitor.
On/off switch	Turns the monitor on and off.

VR297 Monitor

The VR297 is a 16-inch, 60 Hz color monitor. Figure 10-5 shows the VR297 monitor and its controls and video cable connectors.



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Figure 10-5. VR297 monitor features

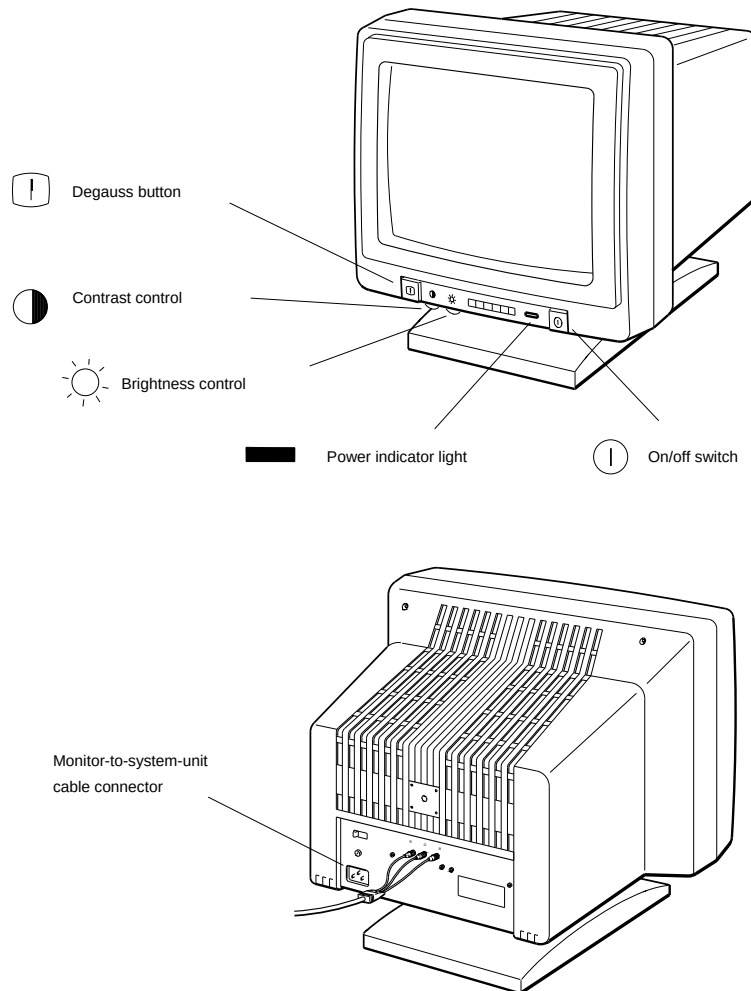
Table 10-7 lists the purpose of each control and connector.

Table 10-7. Controls and Connectors on the VR297 Monitor

Item	Function
Power indicator light	Glowes green when the monitor is receiving power.
Contrast control	Adjusts the intensity of the display on the screen.
Brightness control	Adjusts the brightness of the background on the screen.
Video cable connector	Connects the video cable to the monitor.
Fuse panel	Contains a fuse that protects the monitor from electrical damage.
Power connector	Connects the power cord to the monitor.
On/off switch	Turns the monitor on and off.

VR299 Monitor

The VR299 is a 19-inch, 60 Hz color monitor. Figure 10-6 shows the VR299 monitor and its controls and video cable connector.



WSE2M041

Figure 10-6. VR299 monitor features

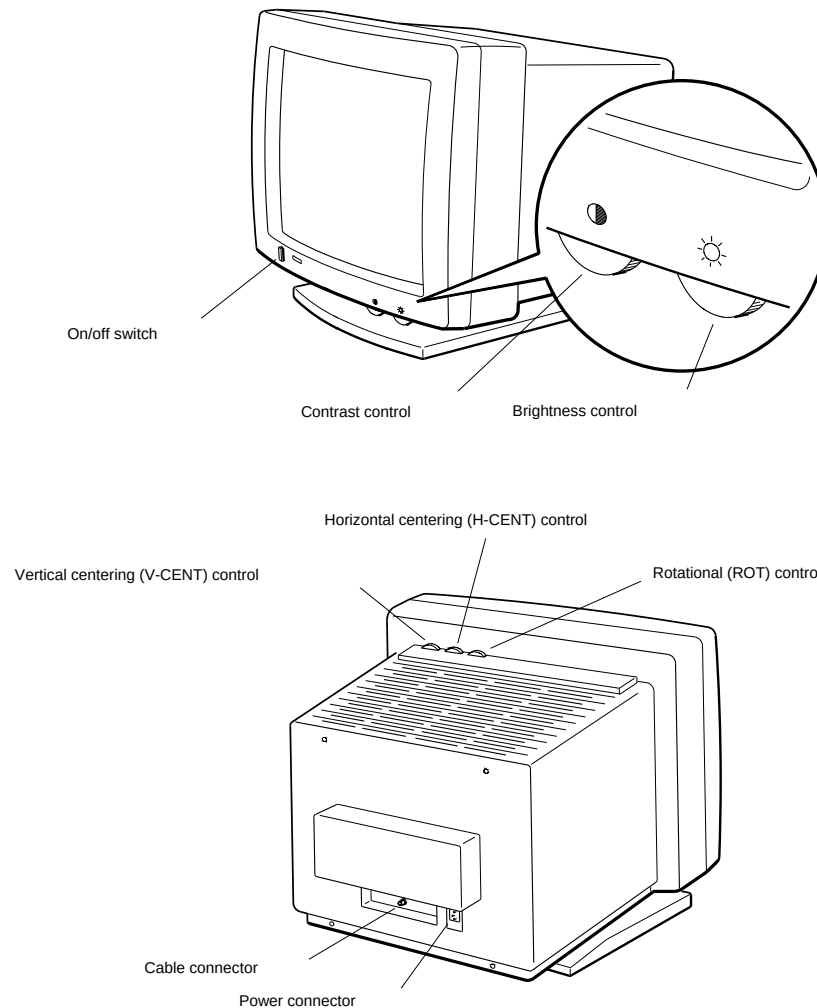
Table 10-8 lists the purpose of each control and connector.

Table 10-8. Controls and Connectors on the VR299 Monitor

Item	Function
Power indicator light	Glowes green when the monitor is receiving power.
Contrast control	Adjusts the contrast in the monitor display.
Brightness control	Adjusts the brightness in the monitor display.
Vertical centering control	Adjusts the picture position upward or downward on the screen.
Horizontal centering control	Adjusts the picture position sideways on the screen.
Degauss button	Clears color distortion caused by magnetic interference.
RGB signal cable connectors	Connect the video cable to the monitor.
Power connector	Connects the power cord to the monitor.
On/off switch	Turns the monitor on and off.

VR319 Monitor

The VR319 is a 19-inch, 72 Hz monochrome monitor. Figure 10-7 shows the VR319 monitor and its controls and video cable connectors.



WS330079

Figure 10-7. VR319 monitor features

Table 10-9 lists the purpose of each control and connector.

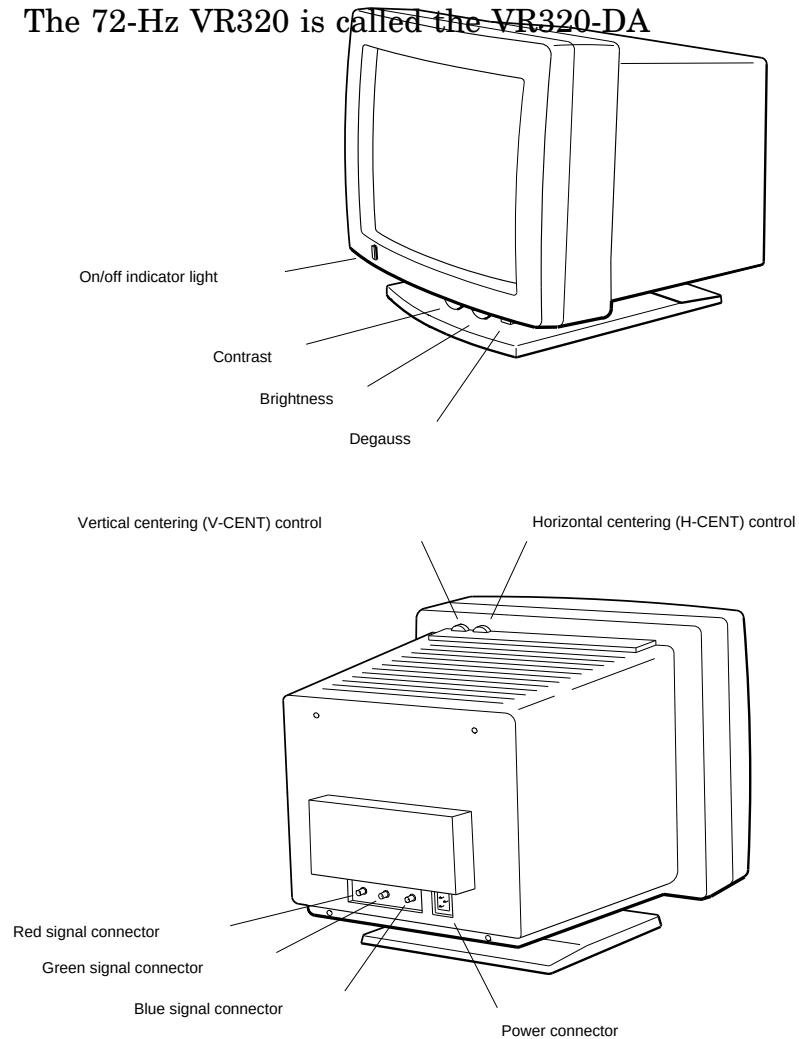
Table 10-9. Controls and Connectors on the VR319 Monitor

Item	Function
Power indicator light	Glowes green when the monitor is receiving power.
Contrast control	Adjusts the intensity of the display on the screen.
Brightness control	Adjusts the brightness of the background on the screen.
Vertical centering (V-CENT)	Moves the picture upward or downward on the screen.
Horizontal centering (H-CENT) control	Moves the picture sideways on the screen.
Rotational (ROT) control	Rotates the picture around the center of the screen.
Video cable connector	Connects the video cable to the monitor.
Power connector	Connects the power cord to the monitor.
On/off switch	Turns the monitor on and off.

VR320 Monitor

The VR320 is a 19-inch color multisync monitor that can operate at 66-Hz and 72-Hz. Figure 10-8 shows the VR320 monitor and its controls and video cable connector.

- The 66-Hz VR320 is called the VR320-CA
- The 72-Hz VR320 is called the VR320-DA



WSETU017

Figure 10-8. VR320 monitor features

Table 10-10 lists the purpose of each control and connector.

Table 10-10. Controls and Connectors on the VR320 Monitor

Item	Function
Power indicator light	Glowes green when the monitor is receiving power.
Contrast control	Adjusts the contrast in the monitor display.
Brightness control	Adjusts the brightness in the monitor display.
Vertical centering control	Adjusts the picture position upward or downward on the screen.
Horizontal centering control	Adjusts the picture position sideways on the screen.
Degauss button	Clears color distortion caused by magnetic interference.
RGB signal cable connectors	Connect the video cable to the monitor.
Power connector	Connects the power cord to the monitor.
On/off switch	Turns the monitor on and off.

A

Recommended Spares List

Tables A-1 through A-6 in this appendix contain the part numbers for TURBOchannel option modules, drives, monitors, loopback connectors, plugs, test media, cords, cables, connectors, and related documentation.

Table A-1. TURBOchannel Option Modules

Option Module	Part Number
SCSI controller option module	54-19876-01
ThickWire Ethernet option module	54-19874-01
Color frame-buffer graphics module	54-19815-01
2D graphics accelerator module	54-20314-01
Low 3D graphics module	54-20185-01
Mid 3D graphics module	54-20185-02
High three-dimensional graphics module	54-20114-AA
8-plane to 24-plane upgrade for PMAG-DA/DB	PMAG-GB
VSIMM module	54-20116-AA
16-bit z-buffer module	54-20352-AA
8-bit z-buffer module	54-20410-AA

Table A-2. Basic Components

Item	Order Number
VR262, 19-inch monochrome monitor, 120 volts	VR262-AA
VR262, 19-inch monochrome monitor, 240 volts	VR262-A3
VR297, 16-inch color monitor, 120 volts	VR297-DA
VR297, 16-inch color monitor, 240 volts, Northern Hemisphere	VR297-D3
VR297, 16-inch color monitor, 240 volts, Southern Hemisphere	VR297-D4
VR299, 19-inch color monitor, 120 volts	VR299-DA
VR299, 19-inch color monitor, 240 volts, Northern Hemisphere	VR299-D3
VR299, 19-inch color monitor, 240 volts, Southern Hemisphere	VR299-D4
VRT19, 19-inch color monitor, 120 volts	VRT19-DA
VRT19, 19-inch color monitor, 240 volts, Northern Hemisphere	VRT19-D3
VRT19, 19-inch color monitor, 240 volts, Southern Hemisphere	VRT19-D4
RZ55 hard disk drive, 332 Mbytes	RZ55-E
- RZ55 hard disk drive PCB	29-27347-01
RZ56 hard disk drive, 665 Mbytes	RZ56-E
- RZ56 hard disk drive HDA and frame assembly	29-27890-01
- RZ56 hard disk drive PCB	29-27889-01
RZ57 hard disk drive, 1.2 Gbytes	RZ57-E
- RZ57 hard disk drive HDA and frame assembly	29-28158-01
- RZ57 hard disk drive PCB	29-28159-01
RRD40 optical compact disc drive, 600 Mbytes	RRD40-FA
TK50Z tape drive, 95 Mbytes, 120 volts	TK50Z-GA
TK50Z tape drive, 95 Mbytes, 240 volts	TK50Z-G3
TLZ04 tape drive, 1.2 Gbytes, 120 volts	TLZ04-DA

Table A-3. Cords, Cables, and Connectors

Item	Part Number	Order Number
Monitor-to-system-unit power cord (U.S.)	17-00442-26	—
System unit or expansion box power cord	17-00606-10	BN19P-K
Expansion-box-to-expansion-box cable	17-01351-04	BC19J-1E
System-unit to expansion-box cable	17-02641-02	BC09D-06
ThickWire cable	17-01321-01	BNE4C-02
Video cable, color, for use with color frame-buffer graphics module	17-02720-01	—
Video cable, color, for use with 2D graphics accelerator and 3D graphics modules	17-02906-01	—
Video cable, monochrome	17-02878-01	—

Table A-4. Loopback Connectors, Plugs, Test Media, and Miscellaneous Items

Item	Part Number
ThickWire loopback connector	12-22196-01
SCSI chain terminator	12-30552-01
RRD40 test disc	30-23507-03
TLZ04 tape drive 1.2 Gbyte data cartridge	TLZ04-CA
TLZ04 tape drive data cartridges, box of five	TLZ04-CB
TLZ04 tape drive cleaning cartridge	TLZ04-HA

Table A-5. Software Documentation

Item	Order Number
ULTRIX Media and Doc-TK50	QA-VV1AA-H5
<i>ULTRIX Guide to the Error Logger</i>	AE-ME95B-TE
<i>Technical Summary for RISC Processors</i>	AA-MM35A-TE
<i>Documentation Overview for RISC Processors</i>	AA-MM05A-TE

Table A-6. Hardware Documentation

Item	Order Number
DECstation 5000 User Documentation Kit	EK-364AA-DK
<i>DECstation 5000 Model 200 Installation Guide</i>	EK-365AA-IN
<i>DECstation 5000 Model 200 Operator's Guide</i>	EK-366AA-OP
<i>DECstation 5000 Model 200 Workstation Reference Card</i>	EK-367AA-IC
<i>DECstation 5000 Model 200 Maintenance Guide</i>	EK-370AA-MG
<i>DECstation 5000 Model 200 Field Service Pocket Guide</i>	EK-371AA-PG
Components and Add-Ons	
<i>The RZ55 Disk Drive Service Manual</i>	EK-RZ55D-SV
<i>The RZ56 Disk Drive Subsystem Service Manual</i>	EK-RZ56D-SV
<i>The RZ57 Disk Drive Subsystem Service Manual</i>	EK-RZ57D-SV
<i>The RRD40 Owner's Manual</i>	EK-RRD40-OM
<i>The TLZ04 Cassette Tape Drive Owner's Manual</i>	EK-TLZ04-OM
<i>Installing and Using the LN03</i>	EK-0LN03-UG
<i>LN03 PLUS User Guide</i>	EK-LN03S-UG
<i>ScriptPrinter Installation Guide</i>	EK-LN03R-UG
<i>ScriptPrinter Operator Guide</i>	EK-LN03R-OG
<i>LA100 Letterwriter User Documentation Kit</i>	EK-LW100-UG
<i>Installing and Using the LA75 Companion Printer</i>	EK-0LA75-UG
<i>Installing and Using the LJ250/252 Companion Color Printer</i>	EK-LJ250-DK
<i>TK50Z Tape Drive Subsystem Owner's Manual</i>	EK-LEP05-OM
<i>TK50Z User's Guide</i>	EK-OTK50-UG
<i>TK50Z Technical Manual</i>	EK-OTK50-TM