# Technical Reference Manual for OEMs

## HP Models 743, 744, and 748


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## Safety Symbols and Conventions

This manual uses the following conventions:

| | |
|---|---|
| ***NOTE:*** | Notes contain important information set off from the text. |
| ***CAUTION:*** | Caution messages indicate procedures which, if not observed, could result in damage to equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met. |
| ***WARNING:*** | **Warning messages indicate procedures or practices which, if not observed, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.** |

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# 1

# General Information

The General Information Chapter provides general information on the Model 743 and Model 744 VME Board Computers, the Model 748 Ruggedized Workstation, environmental specifications for the supported monitors, and OEM support.

# Model 743 and Model 744 VME Board Computers

The sections that follow contain the Model 743 and Model 744 VME Board Computer product descriptions and functional descriptions.

## Product Description

HP Model 744 VME Board Computers are based on the PA 7300LC CPU. HP Model 743 VME Board Computers are based on the PA 7100LC CPU. Running either HP-UX or HP-RT operating systems, they are typically installed in a VME backplane.

- Model 744/165L: HP-UX operating system, 165 MHz system clock
- Model 744*rt*/165L: HP-RT operating system, 165 MHz system clock
- Model 744/132L: HP-UX operating system, 132 MHz system clock
- Model 744*rt*/132L: HP-RT operating system, 132 MHz system clock
- Model 743*i*/64: HP-UX operating system, 64 MHz system clock
- Model 743*i*/100: HP-UX operating system, 100 MHz system clock
- Model 743*rt*/64: HP-RT operating system, 64 MHz system clock
- Model 743*rt*/100: HP-RT operating system, 100 MHz system clock

Each board computer is complete with the core I/O of an HP-PA workstation in a single-slot VME solution with expandability for more I/O or RAM in a two-slot or three-slot VME solution. The core design includes application-specific integrated circuits (ASICs) that add VME and real-time features.

Figure 1-1 illustrates the front panel of Model 743 and Model 744 Board Computers.

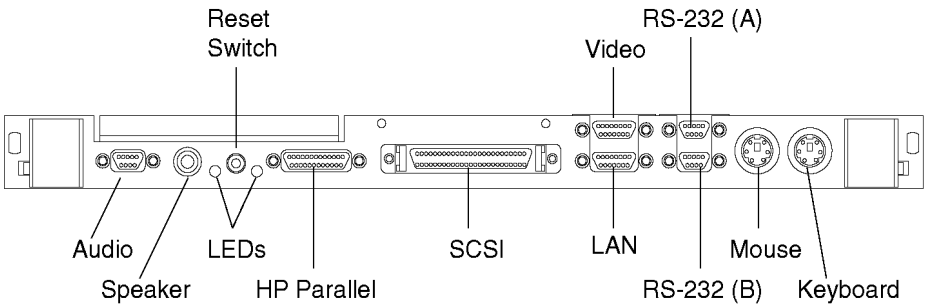


**Figure 1-1 Model 743 and Model 744 VME Board Computer Front View**

Table 1-2 lists the feature sets of the Model 743*i* VME Board Computer

.

**Table 1-1 Model 743*i* (A4260A) and 743*rt* (A4261A) Features**

| Feature | Specifications |
|---|---|
| VME Slot Configuration | Single Slot - Standard features<br>Two Slots - GSC expansion kit (A4219A), or PMC Bridge Adapter (A4504A)<br>Three Slots - ATM card (J3420A) and GSC expansion kit (A4219A), or PCI Mezzanine Card (PMC) Expansion Adapter (A4509A) |
| CPU | 64 or 100 MHz PA-RISC PA7100-LC<br>256 KB cache<br>1 KB on-chip instruction cache<br>Floating point coprocessor<br>64-bit wide ECC memory controller |
| Clocks | Battery backed real-time clock<br>Interval timers (one 32-bit and two 16-bit)<br>Watchdog timer |
| Operating System | HP-UX 9.05 or later, or<br>HP-RT 2.21 patch or later |
| User Interface | HP VUE graphical user interface (HP-UX 9.05 or later)<br>HP CDE graphical user interface (HP-UX 10.10 or later)<br>HP-RT |
| Compatibility | Source and binary code compatible with the Series 700 product family |
| Monitors | Single or multiple display depending on the number of installed graphics options (on-board and/or external). HP-UX 9.x supports up to two displays and HP-UX 10.x supports up to three displays.<br>Color monitors<br>17-inch, 1280 x 1024<br>19-inch, 1280 x 1024<br>Terminals - Text only connected to RS-232C port |
| Optional Graphics | On-board (option 202=64MHz w/graphics or option 204=100MHz w/graphics) |
| Main Memory | Single VME Slot Configuration - 32 to 128 MB (A4265A=32MB, or A4266A=64MB)<br>Two VME Slots Configuration - 32 to 256 MB |
| Standard Features | Internal SCSI-2 single-ended bus<br>CD-Quality audio (not supported on HP-RT)<br>Two asynchronous RS-232-C ports<br>One HP parallel port<br>One LAN AUI port<br>Two mini-DIN PS/2 ports<br>Two sites for memory cards<br>Video connector for onboard graphics |
| Two Slot Upgrades | PMC Bridge Adapter (A4504A) with two PMC sites<br>GSC Expansion kit (A4219A) with two GSC sites |

**Table 1-1 Model 743*i* (A4260A) and 743*rt* (A4261A) Features**

| Feature | Specifications |
|---|---|
| Three Slot Upgrades | PMC Expansion Adapter (A4509A) with two additional PMC sites<br>ATM card (J3420A) (Requires GSC expansion kit A4262A - one additional site supported for 3x5 GSC card) (Not available with HP-RT) |

Table 1-2 lists the feature sets of the Model 744/132L VME Board Computer

.

**Table 1-2 Models 744/132L (A4500A) and 744*rt*/132L (A4520A) Features**

| Feature | Specifications |
|---|---|
| VME Slot Configuration | Single Slot - Standard features<br>Two Slots - PMC Bridge Adapter (A4504A)<br>GSC expansion kit (A4219A)<br>HCRX graphics (A4315A or A4316A)<br>FWD SCSI (A4268A)<br>8-plane graphics (A4267A)<br>Three Slots - ATM card (J3420A) and expansion kit (A4219A), or<br>PMC Expansion Adapter (A4509A) |
| CPU | 132 MHz PA-RISC PA7300-LC<br>128 KB Primary internal cache (64 KB instruction cache, 64KB data cache) |
| Clocks | Battery backed real-time clock<br>Interval timers (one 32-bit and two 16-bit)<br>Watchdog timer |
| Operating System | HP-UX 10.20 or later, or HP-RT 2.21 patch or later |
| User Interface | HP VUE graphical user interface (HP-UX)<br>HP CDE graphical user interface (HP-UX)<br>HP-RT |
| Compatibility | Source and binary code compatible with the Series 700 product family |
| Monitors | Single or multiple display depending on the number of installed graphics options (on-board and/or external)<br>Color monitors<br>17-inch, 1280 x 1024<br>19-inch, 1280 x 1024<br>Terminals - Text only connected to RS-232C port |
| Optional Graphics | Onboard (A4500A option 120)<br>PMC Visualize-EG Graphics Card (A4979A)<br>Note: A maximum of four graphics displays are allowed with HP-UX 10.10 ACE and later releases, a maximum of one graphics display with HP-RT. |
| Main Memory | Single VME Slot Configuration - 64 to 256 MB A4503A, A4449A, A6005A)<br>Two VME Slots Configuration - 64 to 1024 MB |

**Table 1-2 Models 744/132L (A4500A) and 744*rt*/132L (A4520A) Features**

| Feature | Specifications |
|---|---|
| Standard Features | Internal SCSI-2 single-ended bus<br>CD-Quality audio (not supported on HP-RT)<br>Two asynchronous RS-232-C ports<br>One HP parallel port<br>One LAN AUI port<br>Two mini-DIN PS/2 ports<br>One site for memory card stack<br>Video connector for onboard graphics<br>Conversion cables are included in base kit. |
| Two Slot Upgrades | PMC Bridge Adapter (A4504A) with two PMC sites<br>GSC Expansion kit (A4219A) with two GSC sites) |
| Three Slot Upgrades | PMC Expansion Adapter (A4509A)<br>ATM card (J3420A) (Requires GSC expansion kit A4219A - one additional site supported for 3x5 GSC card) (Not available with HP-RT.) |

Table 1-3 lists the feature sets of the Model 744/165L VME Board Computer

.

**Table 1-3 Model 744/165L (A4511A) and 744*rt*/165L (A4512A) Features**

| Feature | Specifications |
|---|---|
| VME Slot Configuration | Single Slot - Standard features<br>Two Slots - PMC Bridge Adapter (A4504A)<br>GSC expansion kit (A4219A)<br>Three Slots -ATM card (J3420A) and expansion kit (A4219A), or<br>PMC Expansion Adapter (A4509A) |
| CPU | 165 MHz PA-RISC PA7300-LC<br>128 KB Primary internal cache (64 KB instruction cache, 64KB data cache)<br>512 KB Secondary external cache |
| Clocks | Battery backed real-time clock<br>Interval timers (one 32-bit and two 16-bit)<br>Watchdog timer |
| Operating System | HP-UX 10.20 or later, or HP-RT 3.01 patch or later |
| User Interface | HP VUE graphical user interface (HP-UX)<br>HP CDE graphical user interface (HP-UX)<br>HP-RT |
| Compatibility | Source and binary code compatible with the Series 700 product family |

**Table 1-3 Model 744/165L (A4511A) and 744*rt*/165L (A4512A) Features**

| Feature | Specifications |
|---|---|
| Monitors | Single or multiple display depending on the number of installed graphics options (on-board and/or external)<br><br>Color monitors<br>17-inch, 1280 x 1024<br>19-inch, 1280 x 1024<br><br>Terminals - Text only connected to RS-232C port |
| Optional Graphics | Onboard (A4500A option 120)<br>PMC Visualize-EG Graphics Card (A4979A)<br>Note: A maximum of four graphics displays are allowed with HP-UX 10.10 ACE and later releases, a maximum of one graphics display with HP-RT. |
| Main Memory | Single VME Slot Configuration - 64, 128, or 256 MB (A4503A, A4449A or A6005A)<br>Two VME Slots Configuration - 64 MB to 1024 MB |
| Standard Features | Internal SCSI-2 single-ended bus<br>CD-Quality audio (not supported on HP-RT)<br>Two asynchronous RS-232-C ports<br>One HP parallel port<br>One LAN AUI port<br>Two mini-DIN PS/2 ports<br>One site for memory card stack<br>Video connector for onboard graphics<br>Conversion cables are included in base kit. |
| Two Slot Upgrades | PMC Bridge Adapter (A4504A) with two PMC sites<br>GSC Expansion kit (A4219A) with two GSC sites |
| Three Slot Upgrades | PMC Expansion Adapter (A4509A)<br>ATM card (J3420A) (Requires GSC expansion kit A4219A - one additional site supported for 3x5 GSC card) (Not available with HP-RT.) |

## Supported Configurations

This section discusses the following supported configurations: memory, system graphics, external devices, cables, and keyboard and mouse.

Hewlett-Packard only supports products having Hewlett-Packard approved parts, accessories, peripherals, operating systems, and application programs.

### Model 743 Memory

Standard memory is Error Checking and Correcting (ECC) RAM cards. Up to four RAM cards may be installed. RAM upgrades include:

- HP A4265A 32 MB RAM Card
- HP A4266A 64 MB RAM Card

Model 743 VME Board Computers use custom 60-ns TSOP-based RAM cards. Use of TSOP packaging allows adequate cooling in single-slot installations.

Two stack locations for RAM cards are used. The primary RAM stack is on the right side, the secondary one is on the left side. Only one RAM card can be used in the secondary, or left stack, if a GSC+ card is added in the secondary GSC+ slot. Three RAM cards can be used in the primary stack. If more than one RAM card is used in either stack, the optional HP 4262A GSC Expansion Kit or A4504A PMC Bridge Adapter (HP-UX only) must be installed; then the board computer will occupy two VME slots in a VME chassis.

RAM cards may be placed in any order. A higher density card can be added on top of a low density card and vice versa.

### Model 744 Memory

Standard memory is Error Checking and Correcting (ECC) RAM cards. Up to four RAM cards may be installed. RAM upgrades include:

- HP A4501A 64 MB RAM Card
- HP A4449A 128 MB RAM Card
- HP A6005A 256 MB RAM Card

Model 744 VME Board Computers use custom TSOP-based RAM cards. Use of TSOP packaging allows adequate cooling in single-slot installations.

There is only one stack location for RAM cards on the Model 744. Memory cards are stacked in the same orientation; that is, there is no need to rotate cards 180 degrees relative to the previously inserted card as in the Model 743. If more than one RAM card is used, the optional HP 4219A GSC expansion kit must be installed; then the board computer will occupy two VME slots in a VME chassis.

When mixing the 128 MB and 256 MB RAM card with cards of a different capacity, the 128 MB and 256 MB card(s) must always be in the lower memory slots.

### System Graphics

The Model 743 and Model 744 Board Computers can be ordered with optional on-board graphics.

The Model 744 supports up to four optional PMC Visualize-EG graphics cards.

The HP-UX 10.20 ACE operating system supports up to four displays.

The HP-RT operating system supports only one graphics display.

Table 1-4 shows the display resolutions and refresh rates that are supported on current and older graphics devices.

***NOTE:*** The HCRX graphics options support a Frame Buffer of 1280 by 1024; therefore, the monitor selected must support a resolution of 1280 by 1024.

**Table 1-4 Supported Graphics Configurations**

| Display Pixel Resolution | Display Refresh Rate | On-board Graphics | HP A4267A 8-Plane GSC Card | HP A4315A 8-Plane or HP A4316A 24-Plane HCRX Graphics |
|---|---|---|---|---|
| 1280x1024* | 75 Hz<br>72 Hz | •* | •* | •<br>• |
| 1024 x 768* | 75 Hz<br>70 Hz | •* | •* | |
| 800 x 600 | 75 Hz | • | • | |
| 640 X 480 | 75 Hz<br>60 Hz | • | • | |

With the D8900A monitor, HP-UX 10.20 ACE or 11.00, and the A4267A graphics card or Model 743 onboard graphics, these resolutions are not supported.

### Model 743 and Model 744 External Devices

The Model 743 and Model 744 support the following external devices:

- LAN Transceiver (Medium Attachment Unit)

  HP 28641B ThinLAN Ethernet Transceiver (order number A2670A)

  HP 28685B Ethertwist Transceiver (order number A2671A)

  HP 28683A Fiber Optic Hub/Transceiver

- Speaker: 8 ohm impedance with $^{1}/_{8}$-inch sub-miniature stereo connector
- Single-ended SCSI through the onboard SE SCSI adapter

### Keyboard and Mouse

The Model 743 and Model 744 support the mouse with mini-DIN connector (PS/2) and keyboard with mini-DIN connector (PS/2) included in the HP A4030D Localization Kit.

### Model 743 and Model 744 Cables

Table 1-5 and Table 1-6 show the part numbers for standard cables and conversion cables used to interface with the Model 743 and Model 744 I/O backplanes.

Drawings showing mechanical and electrical characteristics for these cables are available. Refer to chapter 4 in this manual for more information.

**Table 1-5 Model 743 and Model 744 Standard Cables**

| Product Number | Interface | Cable Type |
|---|---|---|
| HP 24524G | RS-232 | 3-meter terminal cable; 9-pin female to 25-pin male |
| HP 24524H | RS-232 | 3-meter modem cable; 9-pin female to 25-pin female |
| HP C2950A | HP Parallel | DB 25-pin male to 36-pin Centronics male |
| HP 92284A | HP Parallel | DB 25-pin male to 25-pin male |
| HP K2296 | SCSI-2 | 0.9 meter high-density 50-pin to standard bail lock[a] |

a.Additional lengths are available.

Conversion cables provide a way to connect a standard cable to the high-density connectors on the Model 743 and Model 744 front panels.

All conversion cables, except the A4167A, are 762 plus/minus 30mm (30 plus/minus 1.18 inch) long. The A4167A cable is 250 mm (10 inches) long.

**Table 1-6 Model 743 and Model 744 Conversion Cables**

| Product Number | Interface | Cable Type |
|---|---|---|
| HP A4300A | HP parallel | High-density 25-pin to standard 25-pin female |
| HP A4301A | RS-232 | High-density 9-pin to standard 9-pin male |
| HP A4302A | Audio | High-density 9-pin to stereo line-in |
| HP A4303A | LAN | High-density 15-pin to 15-pin AUI |
| HP A4304A | Video (743) | High-density 15-pin to standard 15-pin female |
| HP A4223A | Video (744) | High-density 15-pin to standard 15-pin female |
| HP A4305A | Video (743/744) | High-density 15-pin to EVC connector |
| HP A4167A | Video (GSC card) | Standard 15-pin to EVC connector |

## Model 743 and Model 744 Functional Description

This section describes the major components of the Model 743 and Model 744 VME board computers

The system board contains the following functionality:

- Boot ROMs
- CPU
- Graphics
- I/O controller, which controls these interface circuits:
  - Audio
  - HP Parallel
  - LAN
  - RS-232-C
  - SE SCSI
  - Keyboard and mouse
  - Battery-backed Real Time/Time-of-Day clock
- Memory controller

Figure 1-2 shows the major components of the Model 743.

Figure 1-3 shows the major components of the Model 744.

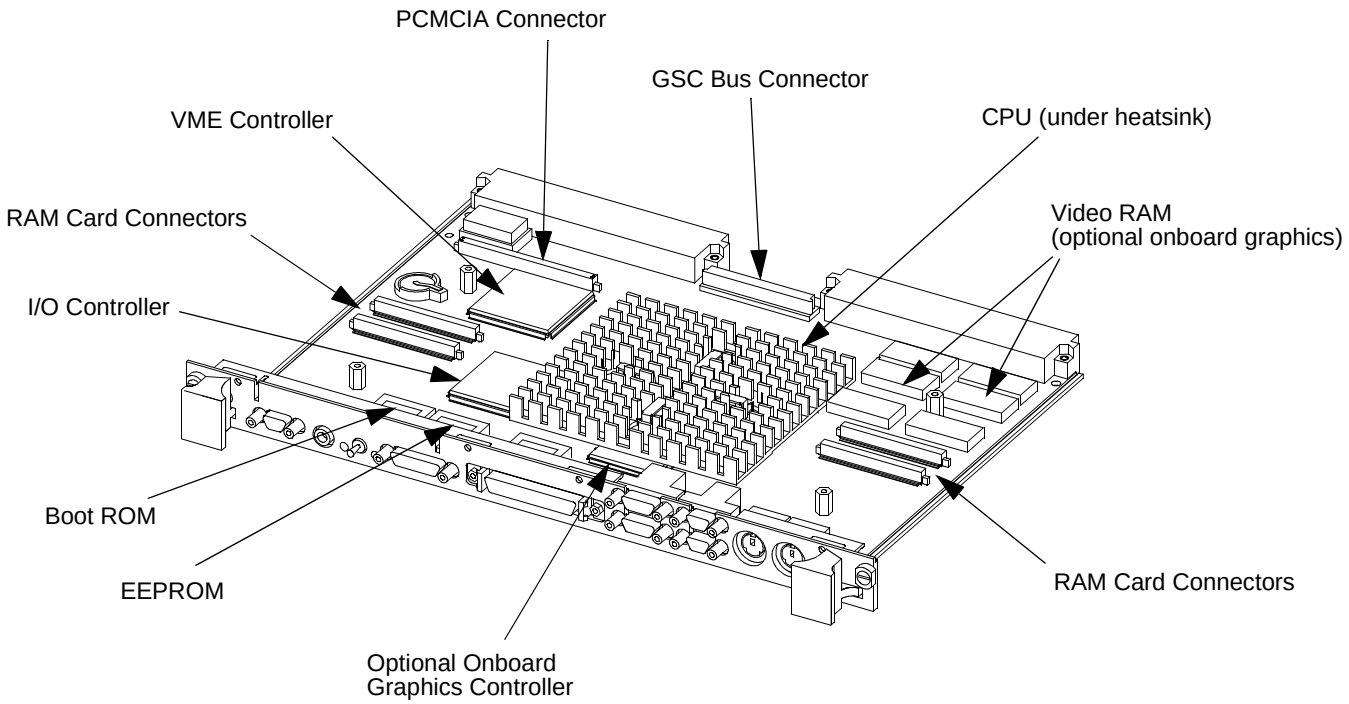


**Figure 1-2 Model 743 VME Board Computer Functional Components**

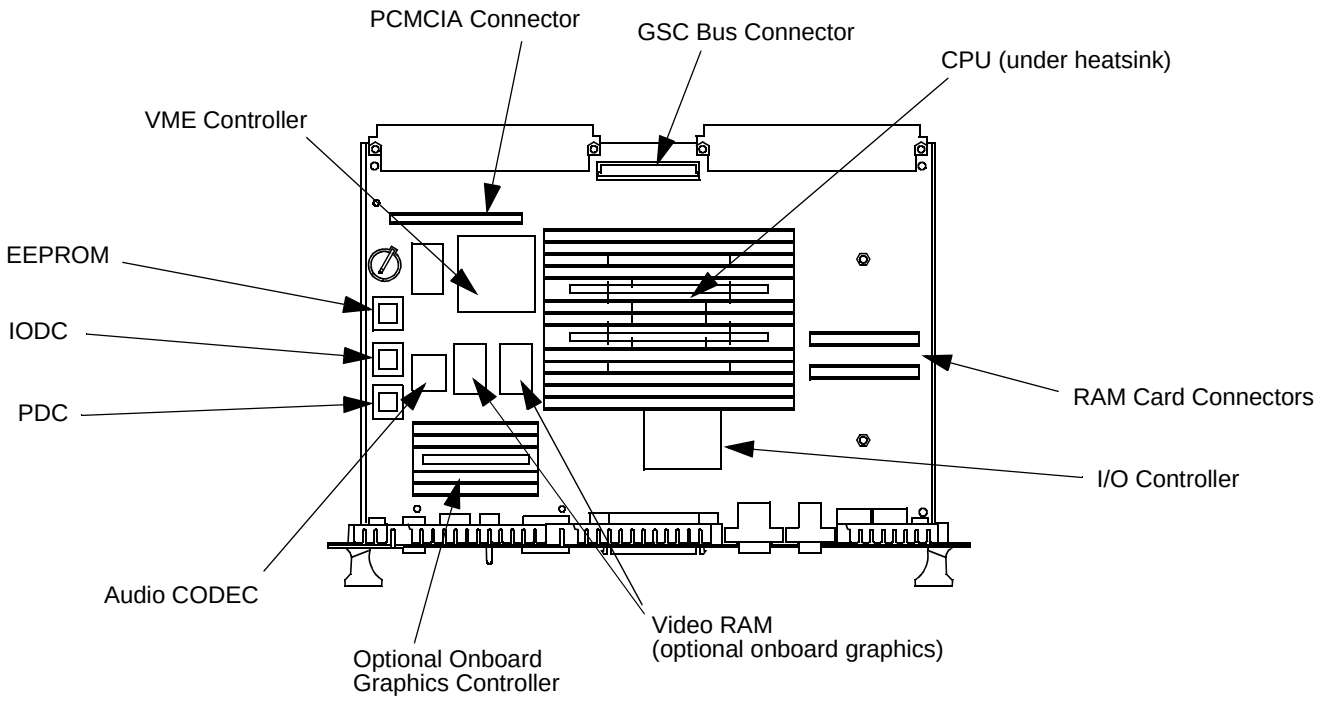


**Figure 1-3 Model 744 VME Board Computer Functional Components**

Figure 1-4 illustrates the functional architecture of the Model 743 system board.

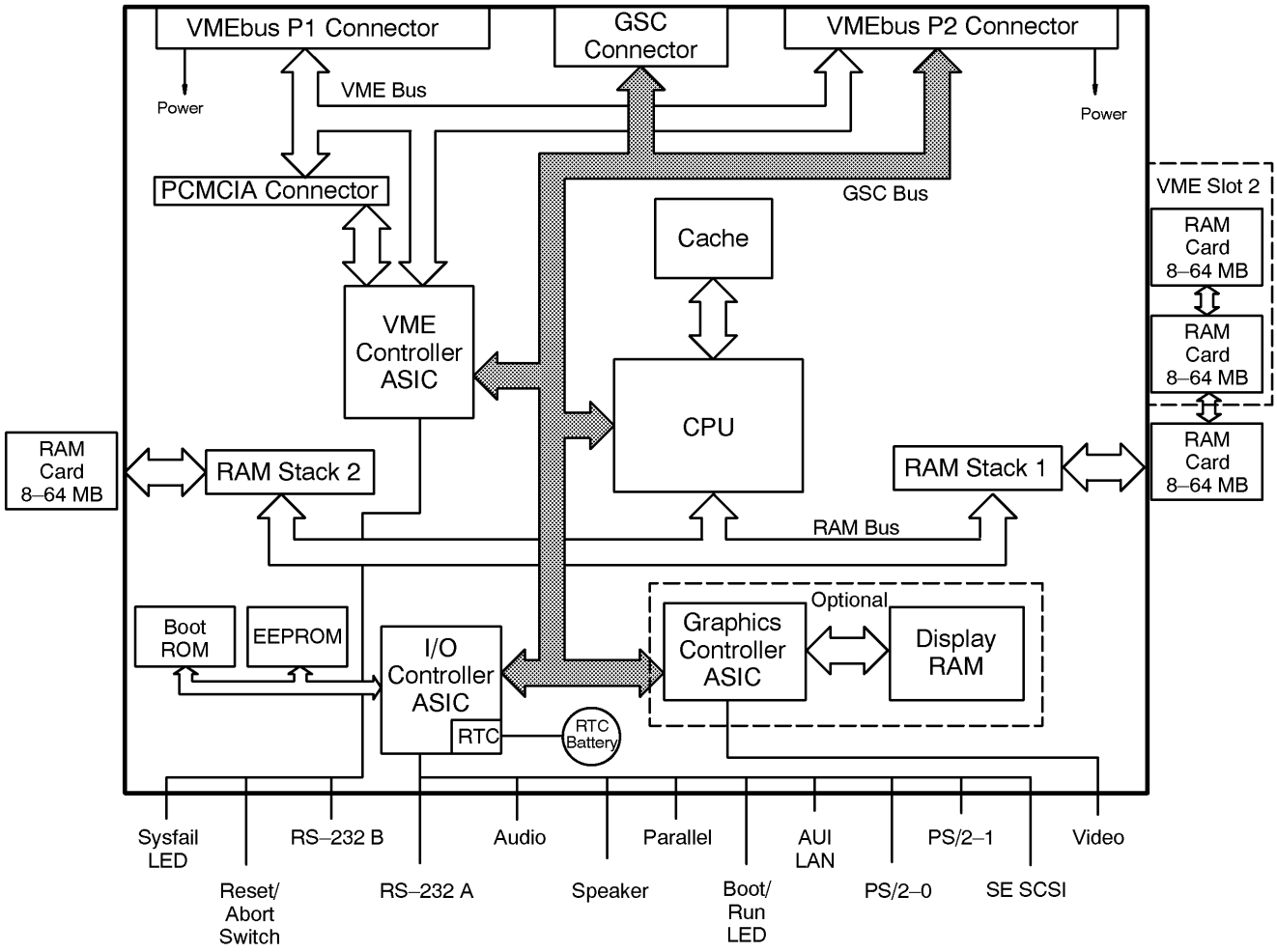


**Figure 1-4 Model 743 Functional Block Diagram**

### Model 744 Block Diagram

Figure 1-5 illustrates the functional architecture of the Model 744 system board.

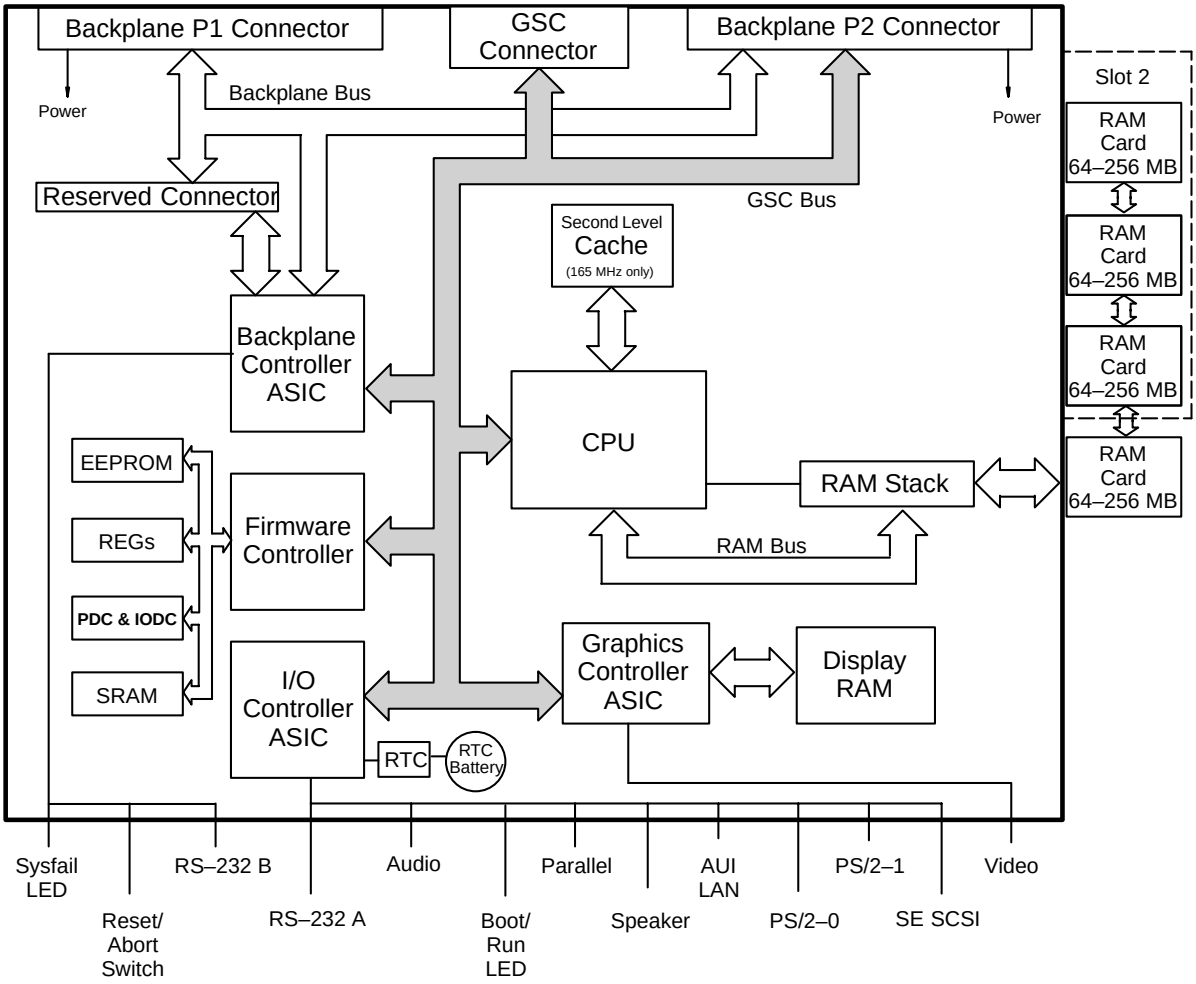


**Figure 1-5 Model 744 Functional Block Diagram**

### CPU Circuit

The Model 743 uses a Hewlett-Packard PA-RISC 7100-LC CPU chip and the Model 744 uses a Hewlett-Packard PA-RISC PA7300-LC CPU chip. The CPU chip is the heart of the CPU circuit. It executes instructions and controls the other circuits.

Table 1-7 lists the CPU performance figures of the Model 743 with HP-UX and Table 1-7 lists the CPU performance figures for the Model 744 with HP-UX.

**Table 1-7 Model 743 CPU Performance**

| **Model** | **743*i*/64** | | **743*i*/100** | |
|---|---|---|---|---|
| **HP-UX Version** | **9.05** | **10.x** | **9.05** | **10.x** |
| MFLOPS (DP) | 25.3 | 22.2 | 37.8 | 34.3 |
| MIPS | 77.7 | | 121.6 | 121.8 |
| SPECfp92 | 96.5 | 97.05 | 137.0 | 138.3 |
| SPECint92 | 66.6 | 81.1 | 100.1 | 115.0 |
| SPECfp95 | | 2.6 | | 3.47 |
| SPECint95 | | 1.9 | | 2.89 |

**Table 1-8 Model 744 CPU Performance**

| **Model 744 Performance Based on HP-UX 10.20** | **132 MHz** | **165 MHz** |
|---|---|---|
| SPECint95 | 5.90 | 7.90 |
| SPECfp95 | 6.22 | 7.64 |

### Boot ROM Circuit

The Boot ROM circuits have Boot ROMs containing 2x526 Kilobytes (Model 744) or 512 Kilobytes (Model 743) of information that does the following:

- Manages the internal interface configurations
- Searches for and boots an operating system
- Self-tests the board computer's main circuits
- Starts the CPU functions

An EEPROM stores the following information:

- Internal interface configurations
- LAN ID number
- System board serial number

***NOTE:*** The workstation's LAN ID number's last 6 characters are labeled on the EEPROM. The first group of six digits are typically “080009” or “0060b0” (the HP-owned prefix).

A PLL Clock Module generates the system clock, on which all timing is based.

### Graphics Circuit

System boards with on-board graphics or graphics cards have a graphics controller ASIC and the display RAM. Resolution and refresh rate can be configured using the boot console handler for several types of monitors.

A keyboard must be connected to the PS/2 0 port if graphics are used as part of the console path. When a graphics device is specified as the console path, the boot ROM first checks for a keyboard by using the keyboard search list. If a keyboard is not found in this search list, graphics are not enabled.

Table 1-9 summarizes the graphics performance figures for the Model 743 with HP-UX and Table 1-9 summarizes the graphics performance figures for the Model 744 with HP-UX.

**Table 1-9 Model 743 Graphics Performance**

| | **Model 743 *i*/64** | | **Model 743 *i*/100** | |
|---|---|---|---|---|
| | **8 Plane** | **HCRX 8 and 24** | **8 Plane** | **HCRX 8 and 24** |
| 2D/3D vectors/sec | 1.4M | 1.5M | 1.6M | 2.3M |
| Lighted, shaded quadrilateral/sec | 15K | 14K | 23K | 23K |
| PLBsurf | 19 | 21 | 23 | 32 |
| Triangles/sec | 26K | 25K | 40K | 40K |
| X11 Vec/sec | 1.2M | 1.5M | 1.2M | 2.1M |
| Xmark93 | 8.1 | 9.3 | 8.6 | 12.1 |

**Table 1-10 Model 744 Graphics Performance**

| On-board HP Visualize-EG Graphics | 132 MHz | 165 MHz |
|---|---|---|
| X11 Lines | 5.74M | TBD |
| Xmark93 | 33.11 | 36.47 |
| PLBsurf93 | 49.7 | TBD |
| PLB wire93 | 116.1K | 135.4K |
| 2D/3D vectors/sec | 3.1M | TBD |

### Model 743 Memory Controller Circuit

The CPU's memory controller circuit manages memory. Up to 256 MB of RAM may be installed. An Error Checking and Correcting (ECC) function checks memory word read/write operations. The ECC function detects single-bit and double-bit errors. Single-bit errors are corrected. Double-bit errors are detected but not corrected. The memory controller circuit uses a 64-bit memory bus. The following two RAM card locations are used:

- RAM stack 1, behind the PS/2 connectors on the system board. Up to three RAM cards are supported.

  Physical RAM slot positions are:

  Bottom RAM card, slot 0

  Middle RAM card, slot 1

  Top RAM card, slot 2

- RAM stack 2, behind the audio connectors on the system board. One RAM card is supported and is in physical RAM slot 3.

### Model 744 Memory Controller Circuit

The CPU's memory controller circuit manages memory. Up to 1 GB of RAM may be installed. An Error Checking and Correcting (ECC) function checks memory word read/write operations. The ECC function detects single-bit and double-bit errors. Single-bit errors are corrected. Double-bit errors are detected but not corrected. The memory controller circuit uses a 132-bit memory bus. One RAM card location is used, behind the PS/2 connectors on the system board. Up to four RAM cards are supported.

Physical RAM slot positions are:

Bottom RAM card, slot 0

Second RAM card, slot 1

Third RAM card, slot 2

Fourth RAM card, slot 3

**RAM Cards** When mixing RAM cards of different capacities that include 128 MB and 256 MB cards, the 128 MB and 256 MB cards must be installed into the lowest numbered memory sites. Memory mapping at turn on determines the size of the card in each location.

### LED Displays

Model 743 and 744 VME Board Computers have two LEDs that indicate various system functions: a system failure LED and a functional LED. See Table 1-11.

**Table 1-11 LED Meanings**

| SYSFAIL (Red) | POWER (Green) | Meaning | Possible Solution |
|---|---|---|---|
| Off | Off | No Power | Check for board seating in chassis. |
| On | 2Hz Flash | Normal Power-on/self-test | |
| On | Off | Memory Failure | Troubleshoot for failed RAM card or problem with the RAM connection. |
| On | 1 Flash/sec. | CPU (board) Failure | Replace the system board. |
| On | 4 Flash/sec. | No console identified | Check the console search path and keyboard connections. If no problem is found, replace the system board. |
| On | On | OS is booted with VME services failure | Check the Operating System VME services. Check that VME services is configured in the kernel. |
| Off | On | OS is booted with VME services OK | |

### I/O Controller ASIC

I/O control by the system board's I/O controller ASIC includes the following interfaces:

- Audio
- AUI LAN
- HP Parallel
- PS/2 Ports 0 and 1
- RS-232 Port A
- Single-Ended SCSI
- Speaker

The battery-backed real-time clock is also implemented in the I/O controller ASIC.

The connectors for the system board's built-in interfaces are on the front panel. Most use micro-miniature connectors that require special conversion cables in order to use standard interface cables.

Table 1-12 summarizes I/O performance figures for the Model 743.

**Table 1-12 Model 743 I/O Performance**

| I/O Type | Performance | Notes |
|---|---|---|
| Audio * | 48 KHz | Sampling rate |
| FW SCSI * | 10 MB/second | Asynchronous |
| | 20 MB/second | Synchronous |
| GSC | 32 MHz | 64 MHz clock frequency |
| | $33^{1}/_{3}$ MHz | 100 MHz clock frequency |
| HP Parallel | 300+ KB/second | With DMA |
| | 200 KB/second | Sustained |
| LAN | 10 Mb/second | |
| PS/2 | 2.5 K 11-bit samples/sec | |
| RS-232 | 460.8 Kbps | |
| SE SCSI | 5 MB/second | Synchronous |
| | 1.5 MB/second | Asynchronous |
| * Not supported in HP-RT | | |

Table 1-13 summarizes I/O performance figures for the Model 744

**Table 1-13 Model 744 I/O Performance**

| I/O Type | Performance | Notes |
|---|---|---|
| Audio * | 48 KHz | Sampling rate |
| FW SCSI * | 10 MB/second | Asynchronous |
| | 20 MB/second | Synchronous |
| GSC | 33 MHz | 132 or 165 MHz clock frequency |
| HP Parallel | 300+ KB/second | With DMA |
| | 200 KB/second | Sustained |
| LAN | 10 Mb/second | |
| PS/2 | 2.5 K 11-bit samples/sec | |
| RS-232 | 460.8 Kbps | |
| SE SCSI | 5 MB/second | Synchronous |
| | 1.5 MB/second | Asynchronous |
| * Not supported in HP-RT | | |

The sections that follow explain the functions of the interfaces.

**Audio** Model 743 and Model 744 Board Computers provide compact disc-quality audio input and output, in stereo, with a 16-bit coder-decoder (CODEC) over a frequency range of 25-20,000 Hz. A stereo headphone mini-plug (8 ohms impedance) provides output. The stereo line-in and mono microphone mini-plugs provide input with the HP A4302A Audio Cable.

The CODEC combines CD quality stereo A/D converters for microphone and line input levels. D/A converters for driving headset and line outputs are used. The input sampling rate and format are programmable, as are the input gain control (used for software control of recording levels) and output attenuation.

A $^{1}/_{8}$-inch mini-jack is used for the speaker out connection. The other audio signals are on a 9-pin micro D-sub connector. The output is capable of driving a minimum of 8 ohms. It can also be used for higher impedance devices with little or no additional distortion.

A voice-quality audio output may be used.

For information on programming for audio, refer to *Using the Audio Developer's Kit* (B2355-90069) and the man page *audio*.

Table 1-14 lists the Model 743 and Model 744 audio specifications.

**Table 1-14 Model 743 and Model 744 Audio Specifications**

| Function | Range |
|---|---|
| Headphone maximum output level | 2.75 V pp at 50 ohms |
| Input sensitivity | Line in, 2.0 V pp at 47 K ohms microphone, 22 mV at 1 K ohm |
| Programmable input gain | 0 to 22.5 dB in 1.5 dB steps |
| Programmable output attenuation | 0 to 96 dB in 1.5 dB steps |
| Programmable rates | 8, 11.025, 16, 22.05, 32, 44.1, 48 KHz |
| Signal to noise ratio | Headphone, 61 dB<br>Line in, 61 dB<br>Microphone, 57 dB |

***NOTE:*** Audio CD ROMs cannot output to the audio out connector.

**AUI LAN** LAN circuits use the Ethernet/IEEE 802.3 standard interface. Only the Attachment Unit Interface (AUI) version is used; no BNC connector is provided for ThinLAN. The AUI connector enables connections to an external MAU using the HP A4303A adapter cable.

Table 1-15 summarizes the LAN AUI interface specifications.

**Table 1-15 LAN AUI Specifications**

| | |
|---|---|
| Connector type | 15-pin MDSM |
| Controller | Intel 82596CA compatible megacell |
| Data rate | 10 Mbits/sec |
| Electrical interface | AUI |
| Type | IEEE 802.3, Ethernet 1.0 |

**Single-Ended SCSI** The 8-bit single-ended implementation is compatible with the current Series 700 products and supports 5 MB/sec data transfer rates.

The SCSI bus is terminated to 3.3 volts through 127 ohms on the system board. If the board computer is used in a VME chassis having internal mass storage devices, all devices except the last one must have their terminator removed. If an external disk drive is used, an active terminator must be used on the last drive's uncabled connector.

Table 1-16 summarizes the specifications for the single-ended SCSI interface.

**Table 1-16 Single-Ended SCSI Interface Specifications**

| | |
|---|---|
| Controller | NCR 53C710 compatible macrocell, Rev D |
| Connector type | SCSI-II, ALT-1 50-pin high-density thumbscrew |
| Data rate | Asynchronous, 1.5 MBs/second<br>Synchronous, 5 MB/second |
| Device limits | 7 internal and/or external devices plus the host controller[a] |
| Maximum external cable length | 4 meters (13.1 feet) |
| Type | SCSI-II (ANSI X3.131-1986), 8-bit, single-ended |

a.The board computer is the host controller.

**HP Parallel** The parallel port is compatible with Centronics standards, plus some additional features found in HP Series 700 workstations. It supports a bi-directional register model interface. An 8-bit parallel, synchronous interface is used.

A high-density micro D-sub connector is used for the HP Parallel interface. An HP A4300A adaptor cable is required to convert to standard PC compatible 25-pin female D-sub.

Table 1-17 summarizes the specifications for the HP parallel interface.

**Table 1-17 HP Parallel Interface Specifications**

| | |
|---|---|
| Connector type | Female 25-pin micro D-sub |
| Data rate | >300 Kilobytes/second with DMA<br>200 Kilobytes/second sustained |
| Device limit | 1 |
| Type | Centronics® and BUSY handshakes |

**PS/2 Ports 1 and 0** There are two PS/2 style serial ports: one PS/2 keyboard port and one PS/2 mouse port.

**RS-232** There are two serial interfaces. The I/O controller ASIC controls port A, and the VME controller ASIC controls port B. Each supports CTS/RTS hardware handshaking. An HP A4301A adaptor cable is required to convert it to a standard PC compatible, 9-pin male D-sub. The maximum baud rate listed in Table 1-18 is the hardware limit. Actual transfer rates depend upon the operating system and application load.

Table 1-18 summarizes the specifications for RS-232-C.

***NOTE:*** The RS-232 port B is not active until VME Services is up and running.

**Table 1-18 RS-232-C Interface Specifications**

| | |
|---|---|
| Baud rate | 50 to 460.8 Kb/second |
| Connector type | 9-pin female micro D-sub |
| Controller | 16550 UART compatible megacell |
| Parity | Odd, even, none, one, zero |
| Stop bits | 1, 1.5, 2 |
| Type | EIA RS-232-C, CCITT V.24/V.28 |
| Word size | 5 to 8 bits |

**Battery-Backed Real-Time Clock** The battery-backed clock is implemented in the I/O controller ASIC. Once power is applied to the system board, the battery-backed clock time is read by the operating system only during system initialization. Once the operating system is booted, real time is kept by using the timer built into the CPU. The battery-backed real-time clock is updated by the operating system only when the user (“root” or “super-user”) explicitly requests it though the **date** command. The clock has a resolution of 1 second. The accuracy of the clock is within ±5 seconds every 24 hours when the operating temperature is from 0 to 55 Deg.C.

### VME Controller ASIC

A VME controller ASIC, with the VME backplane it plugs into, manages the board computer's interface to the VMEbus. The VME controller ASIC also controls the RS-232 B port interface.

Table 1-19 shows the VME addressing capabilities and Table 1-20 shows data transfer capabilities of the VME controller ASIC.

**Table 1-19 VME Addressing Capabilities**

| Function | Capabilities |
|---|---|
| DMA as master | A16, A24, A32 with programmable address modifiers |
| Location monitor | A16, A24, A32 |
| Message FIFO as slave | A16, A24, A32 |
| PA memory as slave | A24, A32 |
| Processor as master | A16, A24, A32 with programmable address modifiers |

**Table 1-20 VME Data Transfer Capabilities**

| Function | Capabilities | Supported Transfer Type |
|---|---|---|
| DMA as master | D08 | Only for first cycle/last cycle alignment |
| | D16 | Block or non-block |
| | D32 | |
| | D64 | Block only |
| Message FIFO as slave | D08 | O |
| | D16, D32 | Non-block only, only D7-D0 are significant |
| PA memory as slave | D08 | EO |
| | D16 | Block |
| | D32 | |
| | D64 | |
| Processor as master | D08, D16, D32 | Non-block only |

The VME controller ASIC supports the following additional features:

- 16 deep by 1 byte message FIFO with interrupt on not empty
- 256 µs arbitration timer
- Ability to generate interrupts on any one of IRQ1 to IRQ7; programmable IACK status/ID.
- Automatic slot 1 detect by way of sensing VME BGIN[3] at power up.
- DMA controller with programmable bus tenure
- Independent location monitor
- IRQ1 to IRQ7 interrupt handling individually programmable.
- Programmable BR0 to BR3 levels (processor and DMA programmed separately)
- Programmable bus error timer from 10 µs to 1.28 ms
- Programmable request mode: ROR, RWD, RWD/Fair
- Reception of read-modify-write cycles (Software protocol must be enforced for processor accesses to insure mutual exclusivity.)
- Selective generation of read-modify-write cycles
- Slot 1 arbiter programmable for RR or PRI bus arbitration
- VME64 "lock" address modifier cycles

Table 1-21 summarizes VME performance. The values shown in this table reflect raw hardware speed and do not include software overhead or system overhead.

**Table 1-21 VME Performance in MB/sec**

| | D32 | | MBLT | |
|---|---|---|---|---|
| | **Read** | **Write** | **Read** | **Write** |
| Master | 10 | 12 | 38 | 44 |
| Slave | 9 | 13 | 33 | 38 |

**Interval Timers** Three interval timers are part of the VME controller ASIC. These timers provide interrupts on terminal count and interrupt and restart on terminal count capability.

Table 1-22 summarizes the specifications for the interval timer.

**Table 1-22 Interval Timer Specifications**

| Resolution | Drift |
|---|---|
| Timer 1 length | 32 bits, cascadeable into timer 2 |
| Timer 2 length | 16 bits, cascadeable into timer 3 |
| Timer 3 length | 16 bits |

**Watchdog Timer** The VME controller ASIC also includes a watchdog timer used with the HP-RT operating system.

### I/O Expansion

The Model 743 and Model 744 board computers are capable of accepting expansion adapters allowing greater functionality through expansion I/O cards. The PMC bridge adapter (for HP-UX systems only) occupies an additional VME slot directly above or adjacent to the board computer, and has two sites for industry standard +5V signalling PMC cards. The PMC expansion adapter occupies another VME slot adjacent to or above the PMC bridge adapter, and provides two additional sites for PMC cards. The GSC expansion adapter has two sites for GSC expansion cards, and occupies one VME slot adjacent to or above the board computer. The PMC adapters and the GSC adapter cannot function together.

HP provides three GSC solutions for expanded I/O:

- 8-plane color graphics controller
- FWD SCSI controller
- ATM network controller

**Fast, Wide, Differential SCSI (GSC) (HP-UX only)** The FWD 16-bit implementation supports 20 MB/sec data transfer rates.

The internal, removable, differential bus terminators allow the card to be located at either end or between the ends of a SCSI bus. The host SCSI ID for the port is set by the user by way of the 4-position address selector DIP-type switch.

By default, the FWD SCSI card terminates one end of the SCSI bus by using removable terminator resistors that are on the card. Remove these terminator resistors if the card is in the middle of the bus.

Table 1-23 summarizes the FWD SCSI interface specifications.

**Table 1-23 FWD SCSI Interface Specifications**

| | |
|---|---|
| Connector type | SCSI-3, 68-pin high-density thumbscrew |
| Controller | NCR 53C720 |
| Data rate | Asynchronous, 10 MB/second<br>Synchronous, 20 MB/second |
| Device limits | 15 internal and/or external devices |
| Maximum external cable length | 25 meters (82 feet) |
| Type | SCSI-II, 16-bit |

### I/O Expansion Block Diagrams

Figure 1-6 illustrates the functional architecture of the PMC adapters, and Figure 1-7 illustrates the functional architecture of the GSC adapter.

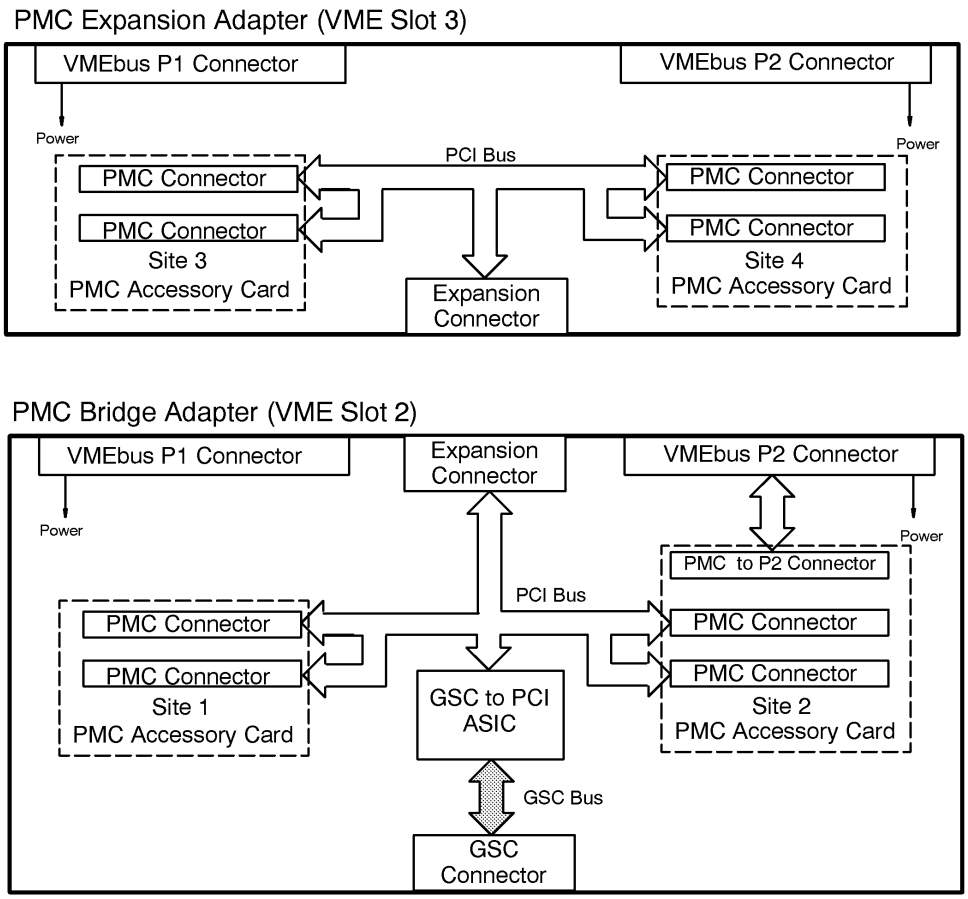


**Figure 1-6 PMC Adapters Block Diagrams**

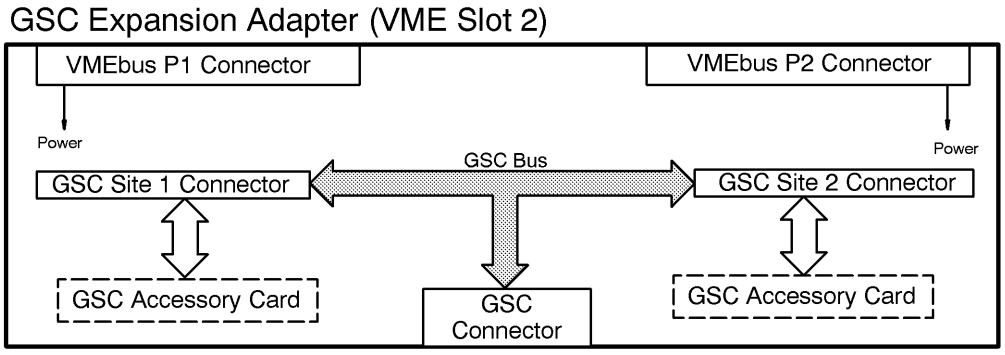


**Figure 1-7 GSC Adapter Block Diagram**

# Model 748 Ruggedized Workstation

The sections that follow contain the Model 748 Ruggedized Workstation product description and the Model 748 Ruggedized Workstation functional description.

## Product Description

Hewlett-Packard offers the following HP 9000 products:

- Model 748/132L Ruggedized Workstation
- Model 748/165L Ruggedized Workstation

The 748/132L and 748/165L model incorporates the HP 744/132L and HP 744/165L VME Board Computers that are based on the PA-RISC 7300LC central processing unit (CPU). All models provide a variety of interface, graphics, mass storage, and accessory card configurations. Table 1-24 summarizes the features of the Model 748.

**Table 1-24** **Model 748** Ruggedized Workstation Features

| Feature | Functionality |
|---|---|
| Operating system | HP-UX |
| System board | See the feature set for the Model 743 or 744 Board Computer |
| Monitors | 17 or 19-inch color monitors<br>72 or 75 Hz refresh rate, multi-mode |
| Mass storage module | Up to four of the following devices:<br>4 GBor 9GB SE hard disk drive<br>DDS-1, 2 GB native capacity yielding up to 4 GB w/Data compression.<br>DDS-2, 4 GB native capacity yielding up to 8 GB w/Data compression.<br>DDS-3, 12 GB native capacity, up to 24 GB w/Data compression<br>3.5-inch flexible disk drive<br>CD-ROM drive |
| VME module | 8 VME slots (six slots for VME add-in cards, two for board computer) |
| EISA module | 4 EISA accessory cards |
| PCI module (option) | 4 PCI accessory cards (PCI module replaces EISA module) |
| Power supply | Two 300 watt power supplies |

## Supported Configurations

This section discusses the following supported configurations: mass storage, monitors, GSC mezzanine slot, built-in interfaces, EISA module, PCI module, and VME module.

**Mass Storage**

Model 748 uses several factory-installed mass storage devices. One or two removable media devices may be installed. Model 748 mass storage devices are factory installed with the removable media drives accessed from the front. Users may reconfigure devices to reverse the access. Hard disk drives are typically installed behind the removable media devices.

Mass storage devices are also available as the following upgrades:

- HP A4484A 4 GB SE SCSI Hard Drive Upgrade
- HP A5006A 9 GB SE SCSI Hard Drive Upgrade
- HP A2643A 2 - 4 GB DDS (DDS-1, 2 GB native, 4 GB with data compression) Tape Drive Upgrade
- HP A4307A 4-8 GB DDS (DDS-2, 4 GB native, 8 GB with data compression) Tape Drive Upgrade
- HP A4252A 12 - 24 GB DDS (DDS-3, 12 GB native, 24 GB with data compression) Tape Drive Upgrade
- HP A2645A 3.5-inch Flexible Disk Drive Upgrade
- HP A4496A Fast CD-ROM Disk Drive Upgrade

**Monitors**

Table 1-25 lists the monitors supported. Grayscale monitors are not supported.

**Table 1-25 Model 748 Supported Monitors**

| Type | Resolution | Comments |
|---|---|---|
| 17-inch color | 1280 by 1024 | |
| 20-inch color | 1280 by 1024 | |

**GSC Mezzanine Slot GSC**

Model 748 Ruggedized Workstations have a GSC Mezzanine slot.

**SCSI Interface** The mass storage module has a SCSI connector for connecting external SCSI device cables. When the external SCSI interface connector is not used, a SCSI terminator should be plugged into the SCSI connector.

A cable from the mass storage module connects to the system board's SCSI connector and must be connected for internal drives to operate. SCSI interface circuits use high-density, shielded connectors. The internal cable length is 1.8 meters (5.9 feet).

The last device on each SCSI bus must be terminated. Internal drives do not have terminators enabled. The SCSI bus terminator(s) shipped with the Model 748 must be installed on the external bus connector(s) if no external devices are connected. The single-ended terminator is part number A1658-62016, and the FWD terminator part number is A1658-63013.

**EISA Module** The Model 748 is available with a 4-slot EISA module. Table 1-26 shows the EISA accessory cards that are supported. In addition, the EISA module also supports the HP Human Interface Link (HP-HIL). However, HP-HIL devices are no longer offered by HP.

***NOTE:*** Only one of the Human Interfaces (HP-HIL or PS/2) can be used at a time. Use of one interface excludes the other interface.

**Table 1-26 Supported EISA Accessory Cards**

| Product Number | Product Name | Quantity Supported | Notes |
|---|---|---|---|
| HP 2070B | Instrument HP-IB | Up to 4 | |
| HP 20711 | High-Speed Instrument HP-IB | Up to 4 | |
| | GPIO Interface Card | 1 | |
| HP 25525B | Differential SCSI | Up to 4 | |
| HP 25560A | HP-IB Host Adaptor | 1 | |
| HP 25567B | IEEE 802.3 Thin/AUI LAN | Up to 4 | |
| HP J2159A | PSI/X.25 Interface | Up to 4 | |
| HP J2165A | Token Ring 802.5 | Up to 4 | |
| HP J2645AA | 100VG-Any LAN | Up to 4 | |
| HP J2802B | HP ATM Adapter Card | Up to 4 | |

**PCI Module** The Model 748 is available with a module that provides four slots for customer provided PCI accessory cards. The module supports the +5 Vdc PCI bus signalling card type.

**VME Module** A variety of VME accessory cards can be installed in the Model 748 's 8-slot VME module (slots 3 through 8 are for add-on cards). The slots conform to the 6U form factor. Slot numbers are 8 through 1, top to bottom. The VME backplane provides an interconnect connector for the EISA module.

***NOTE:*** A Model 743 or 744 must be installed in VME **Slot 1** to provide VME Slot 1 controller functions (bus arbitration) for *any* VME boards installed in VME slots 3 through 8.

### Model 748 Ruggedized Workstation Functional Description

The section that follows contains a block diagram of the Model 748 Ruggedized Workstation and describes EISA bus performance.

**EISA Bus Performance** The ideal slave read/write transfer rate is 25/25 MB/sec.

#### Block Diagram

Figure 1-8 shows the functional architecture of the Model 748 workstation.

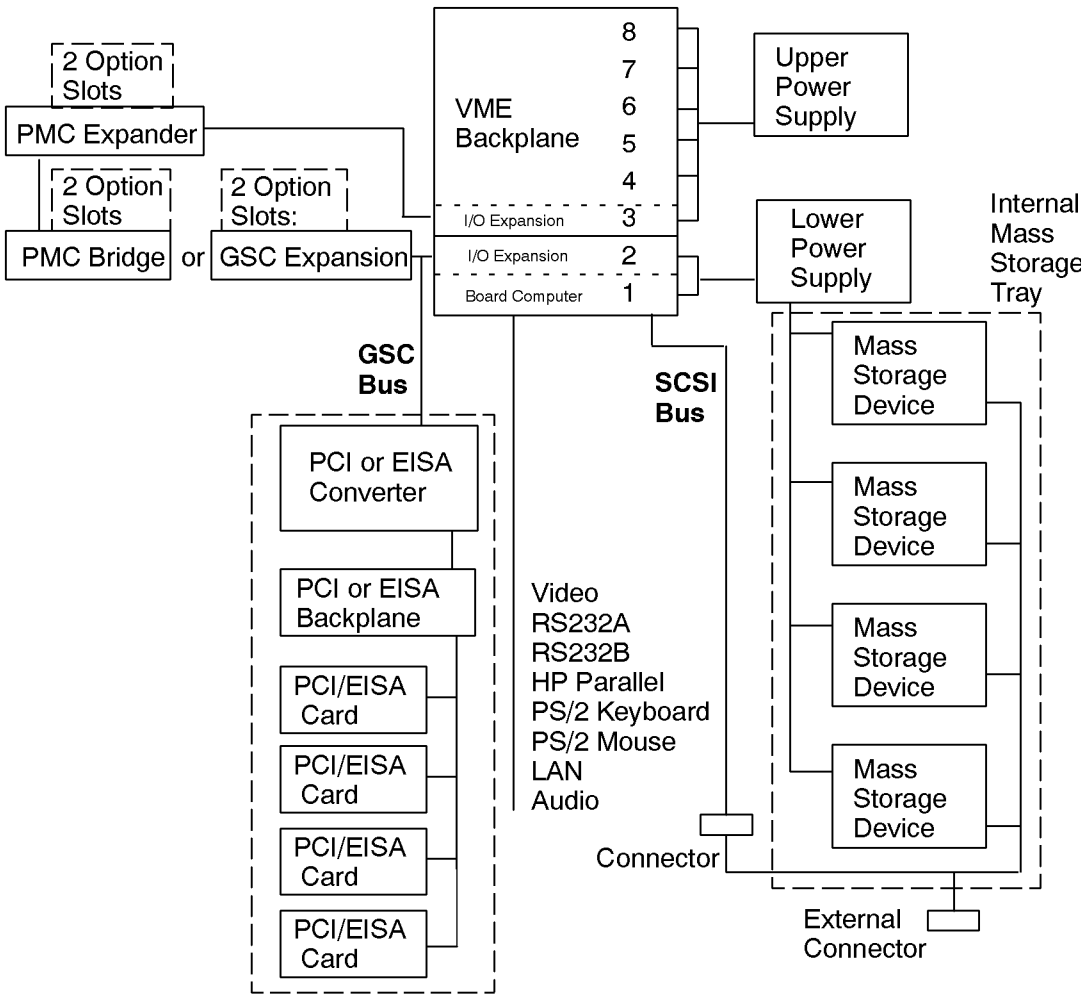


**Figure 1-8** **Model 748 Functional Block Diagram**

## Environmental Specifications for Monitors

This section describes the environmental specifications for the HP D2806A, HP A4490D, and HP A4331A/D color monitors.

Table 1-27 lists the operating, non-operating or storage, and recommended specifications for altitude, humidity, and temperature for the monitors.

**Table 1-27 Environmental Specifications for Monitors**

| Environmental Condition | Specification |
|---|---|
| Altitude, non-operating | 15,240 m (49,530 ft.) |
| Altitude, operating | 3,658 m (11,888 ft.)[a] |
| Humidity, nonoperating or storage | 5% to 95% RH |
| Humidity, operating | 10% to 80% RH |
| Humidity, recommended operating at 22 Deg C | Non-condensing RH |
| Temperature, nonoperating or storage | -40 Deg C to 60 Deg C |
| Temperature, operating | 0 Deg C to 40 Deg C |
| Temperature, recommended operating | 10 Deg C to 40 Deg C |

a.Temperature derating above 2,500-m (8,000 ft.): 1.1 degrees C for each 1,000 feet above 7,500 feet.

## Original Equipment Manufacturer (OEM) Support Overview

The sections that follow describe standard OEM support and additional OEM support.

### Standard Support

OEMs may obtain the following standard hardware and software support through their local Hewlett-Packard Sales and Service Office:

- Customer support programs for servicing Hewlett-Packard products
- System/product hardware/software configurations
- System support options, including the following:
  - HP SupportLine electronic support
  - License to use software updates
  - Media and document updates
  - On-site response

### Additional OEM Support Programs

Contact your Hewlett-Packard OEM Sales Representative regarding the availability of the following OEM support:

- Detailed product qualification programs information
- Drawings: electrical and mechanical
- Engineering consulting time
- Hewlett-Packard specifications for products
- Peripheral device specifications
- Product component lists and specifications

# 2

# References

This chapter lists the titles and part numbers for hardware and software manuals associated with the Model 743/744 and Model 748.

## HP Hardware Manuals

This section contains tables listing the hardware installation guides, service manuals, and diagnostic manuals for the Model 743/744 and Model 748.

### Installation Guides

Table 2-1 lists the hardware installation guides available for the Model 743 and Model 748.

**Table 2-1 System Installation/Owner's Manuals**

| Manual Title | Part Number |
|---|---|
| HP Model 743 VMEbus Board Computer Owner's Guide | A2636-90603 |
| HP Model 744 VMEbus Board Computer Owner's Guide | A4511-90606 |
| HP Model 748 Workstation Owner's Guide | A4511-90604 |

### Service Manuals

Table 2-2 lists the hardware service manuals available for the Model 743/744 and Model 748.

**Table 2-2 Related Service Manuals**

| Manual Title | Part Number |
|---|---|
| HP Model 743 VMEbus Board Computer | A2636-90604 |
| HP Model 748 | A4511-90605 |
| HP Model 744 | A4511-90603 |

### Diagnostic Manuals

Table 2-3 lists the hardware diagnostic manuals available for the Model 743/744 and Model 748.

**Table 2-3 Diagnostic Manuals**

| Manual Title | Part Number |
|---|---|
| PA-RISC Support Tools Manual Licensed Users Volume 1, SPU | 5960-3149 |
| PA-RISC Support Tools Manual Licensed Users Volume 2, Device Adapters/MUXes | 5960-3151 |
| PA-RISC Support Tools Manual Licensed Users Volume 3, LAN | 5960-3153 |
| PA-RISC Support Tools Manual Licensed Users Volume 4, SCSI | 5960-3155 |
| PA-RISC Support Tools Manual Licensed Users Volume 5, Disks | 5960-3157 |
| PA-RISC Support Tools Manual Licensed Users Volume 6, Tapes/ Printers | 5960-3159 |
| PA-RISC Support Tools Manual Licensed Users Volume 7, Utilities | 5960-3161 |
| PA-RISC Support Tools Manual Licensed Users Volume 8, ISL Support Tools | 5960-3163 |
| PA-RISC Support Tools Manual for HP Employees | 5960-3165 |
| Support Tools Manager User’s Manual; HP 9000 Series 700 and 800 | 5961-1612 |
| HP Apollo 9000 Series 700 Diagnostics Manual, Volume 1 | 09740-90041 |
| HP Apollo 9000 Series 700 Diagnostics Manual, Volume 2 | 09740-90043 |
| HP Apollo 9000 Series 700 Support Tape/CD-ROM User’s Manual | B2380-90000 |

## HP Software Manuals

This section contains tables listing the software system usage manuals and development manuals for the Model 743/744 and Model 748.

Table 2-4 lists the software system usage manuals available for the Model 743/744 and Model 748.

**Table 2-4 System Usage Manuals**

| Manual Title | Part Number |
|---|---|
| HP-RT System Administration Tasks | B5487-90002 |
| VME Backplane Networking System Administration Guide | B5489-90001 |

Table 2-5 lists the software development manuals available for the Model 743/744 and Model 748.

**Table 2-5 Software Development Manuals**

| Manual Title | Part Number |
|---|---|
| HP-UX 9.05 Device Drivers | A2636-90020 |
| VME Services HP-UX 10 | A4412-90022 |
| Driver Writing in the HP-RT Environment | B5487-90003 |

# 3

# Quality

The Quality Chapter discusses safety compliance programs, electromagnetic compatibility programs, climatic and dynamic environmental tests, acoustics levels, statistical reliability, and manufacturing quality programs.

# Safety Compliance Programs

The sections that follow describe the Underwriter's Laboratories, Canadian Standards Association, and TUV Rheinland programs.

### Introduction

Models 743, 744, and 748 are designed, manufactured, and marketed in compliance with the published safety standards stated below. Validation testing was done with one unit representative of the product shipped to the customer. Continued compliance is measured by periodic regulatory audits; production units are tested for each audit. Models 743, 744, and 748 are in compliance with adopted safety standards issued by the following standards bodies:

- Underwriter's Laboratories (USA)
- Canadian Standards Association (Canada)
- TUV Rheinland (Germany)

The sections that follow explain each standard.

#### Underwriter's Laboratories (USA)

- UL Standard 1950 Information Technology Equipment

As evidence of UL's listing, the products are marked with the UL listing mark.

#### Canadian Standards Association (Canada)

- CSA Standard 22.2 No. 950 Safety of Information Technology Equipment including Electronic Business Equipment

As evidence of CSA's certification, the products are marked with the CSA monogram.

#### TUV Rheinland (Germany)

- Standards:
  - Safety - EN60950 Safety of Information Technology Equipment including Electronic Business Equipment; International Electrotechnical Commission, Publication 950
  - Ergonomics - ZH1/618 Safety Regulations for Display Work Places in the Office Sector

As evidence of TUV's certification, the products are marked with the TUV GS mark.

# Electromagnetic Compatibility Programs

The sections that follow discuss the Federal Communications Commission, European Community, and Voluntary Control Council for Interface standards bodies.

### Introduction

Models 743, 744 and 748 comply with published standards for Electromagnetic Compatibility (EMC). In general, testing to required standards was performed using statistically significant quantities of typical Models 743, 744 and 748 configurations representative of the product shipped to customers. These tests' statistical basis demonstrates that with 80% confidence, at least 80% of the production population meets the specified margins to each standard. Additional configurations are also tested to reduce the probability that non-conforming configurations exist. Continued compliance is measured by periodic regulatory audits; production units are tested for each audit. The Models 743, 744 and 748 are in compliance with adopted EMC standards issued by the following standards bodies:

- Federal Communications Commission (USA)
- European Community
- Voluntary Control Council for Interference (Japan)

### Federal Communications Commission (USA)

- Compliance Date: 6 November 1992 (dates of subsequent revisions available upon request)
- Self-Certified to 47 CFR (Code of Federal Regulations), parts 2 and 15, Class A

As evidence of compliance, products are marked with the FCC A statement.

### European Community

- Compliance Date: 6 November 1992 (dates of subsequent revisions available upon request)
- Compliant to the EMC Directive 89/33/EEC and 92/31/EEC for Information Technology Equipment (ITE) per EN55022, and for Industrial, Scientific, and Medical Equipment (ISM) per EN55011

As evidence of compliance, products are marked with the CE mark, and the product manuals include a Declaration of Conformity.

### Voluntary Control Council for Interference (Japan)

- Compliance Date: 9 December, 1992. (dates of subsequent revisions available upon request)
- Registered to VCCI as a Class A product, according to CISPR 22

As evidence of compliance, products are marked with the VCCI statement.

### Overview

The sections that follow summarize the Electromagnetic Compatibility Programs. The following is a list of those programs:

1. Electromagnetic field emissions test suite
   - Radiated emissions (Table 3-1)
   - Conducted emissions (Table 3-2)
   - Magnetic emissions (Table 3-3 and Table 3-4)
2. Electromagnetic field immunity/susceptibility test suite
   - Electro-Static discharge field immunity (Table 3-5)
   - Radiated field immunity (Table 3-6)
   - Magnetic field immunity (Table 3-7)
3. Line transients immunity/susceptibility test suite
   - Electrical fast transients (Table 3-8)
   - Surge transients (Table 3-9)
   - Conducted immunity (Table 3-10)
   - Line sag (Table 3-11) Line surge (Table 3-12)
   - Line blackout/dropout (Table 3-13)
   - Line brownout (Table 3-14)
   - Line brownout/recovery (Table 3-15)

### Electromagnetic Field Emissions Test Suite

This section summarizes the Electromagnetic Field Emissions Test Suite.

Table 3-1 summarizes the radiated emissions tests during operating.

**Table 3-1 Radiated Emissions Tests During Operation**

| Standard | Level |
|---|---|
| EN55011 (ISM) | CISPR 11 class A |
| EN55022 (ITE) | CISPR 22 class A |
| FCC CFR 47 parts 2 and 15 | FCC Class A |
| VCCI class A | CISPR 22 class A |

Table 3-2 summarizes the conducted emissions tests during operation.

**Table 3-2 Conducted Emissions Tests During Operation**

| Standard | Level |
|---|---|
| EN55011 (ISM) | CISPR 11 class A |
| EN55022 (ITE) | CISPR 22 class A |

**Table 3-2 Conducted Emissions Tests During Operation**

| Standard | Level |
|---|---|
| FCC CFR 47 parts 2 and 15 | FCC Class A |
| VCCI class A | CISPR 22 class A |

Table 3-3 summarizes the magnetic emissions tests while the equipment is not operating.

**Table 3-3 Magnetic Emissions Tests While Non-Operating**

| Standard | Level |
|---|---|
| HP Standard 765.006 complies with CFR49<br>IATA Dangerous Goods Regulations, 30ed | <2 milligauss at 2.1 m |

Table 3-4 summarizes the magnetic emissions tests during operation.

**Table 3-4 Magnetic Emissions Tests During Operation**

| Standard | Level |
|---|---|
| HP Standard 765.007 | < 5 gauss p-p |

### Electromagnetic Field Immunity/Susceptibility Test Suite

This section summarizes the Field Immunity/Susceptibility Test Suite.

***NOTE:*** All tests in this suite were performed while the product was operating.

Table 3-5 summarizes the electro-static discharge field immunity tests.

**Table 3-5 Electro-Static Discharge Field Immunity**

| Standard | Level |
|---|---|
| HP Standard 765.002 | 15 KV A.D. (operating) |
| IEC 801-2 level 2 | 4 KV C.D., 8 KV A.D. |
| prEN50082-2 | (ISM) 4 KV C.D., 8 KV A.D. |
| prEN55024-2 | (ITE) 3 KV C.D., 8 KV A.D. |

Table 3-6 summarizes the radiated field immunity test.

**Table 3-6 Radiated Field Immunity**

| Standard | Level |
|---|---|
| prEN55024-3 (ITE/ISM | 3 V/m (IEC 801-3 level2) |

Table 3-7 summarizes the magnetic field immunity tests.

**Table 3-7 Magnetic Field Immunity**

| Standard | Level |
|---|---|
| HP Standard 765.001 | 317 A/m |
| IEC 801-8 level 5 | 100 A/m |

### Line Transients Immunity/Susceptibility Test Suite

This section summarizes the Line Transients Immunity/Susceptibility Test Suite.

***NOTE:*** All tests in this suite were performed while the product was operating.

Table 3-8 summarizes the electrical fast transients test.

**Table 3-8 Electrical Fast Transients**

| Standard | Level |
|---|---|
| prEN55024-4 (ISM) | 2 KV mains, 1 KV I/O ports |

Table 3-9 summarizes the surge transients tests.

**Table 3-9 Surge Transients**

| Standard | Level |
|---|---|
| HP Standard 765.003 | 1 KV DM/CM high energy transient |
| HP Standard 765.003 | 1 KV DM/CM low energy transient |
| HP Standard 765.003 | 3 KV peak DM/CM low energy ring wave |
| IEC 801-5 level 3 | 1 KV DM, 2KV CM |

Table 3-10 summarizes the conducted immunity test.

**Table 3-10 Conducted Immunity**

| Standard | Level |
|---|---|
| EN55082-1, IEC801-6, level 2 | 3 V rms |

Table 3-11 summarizes the line sag test.

**Table 3-11 Line Sag**

| Standard | Level |
|---|---|
| HP Standard 765.003 | 500 ms, 33% sag |

Table 3-12 summarizes the line surge test.

**Table 3-12 Line Surge**

| Standard | Level |
|---|---|
| HP Standard 765.003 | 500 ms, 25% surge |

Table 3-13 summarizes the line blackout/dropout test.

**Table 3-13 Line Blackout/Dropout**

| Standard | Level |
|---|---|
| HP Standard 765.003 | 20 ms |

Table 3-14 summarizes the line brownout test.

**Table 3-14 Line Brownout**

| Standard | Level |
|---|---|
| HP Standard 765.003 | Minimum rated line voltage to 0 V in 30 minutes. |

Table 3-15 summarizes line brownout/recovery test.

**Table 3-15 Line Brownout/Recovery**

| Standard | Level |
|---|---|
| HP Standard 765.003 | 0 V to minimum rated line voltage in 30 minutes. |

# Climatic and Dynamic Environmental Ruggedness

The sections that follow summarize the climatic and dynamic environmental tests suites.

### Introduction

Models 743, 744 and 748 are designed for use in an environment that involves moderately high and low temperatures, humidity variations, and occasional vibration. Many of the test limits the workstations are subjected to during development are more severe than those documented.

The tests were developed to cause product failure so that product weaknesses are identified, understood, and eliminated, when possible and to provide greater assurance of long-term compliance to product specifications.

An effective qualification program establishes appropriate assurances. Our development and manufacturing process capabilities are well understood.

Significant quantities of Models 743, 744, and 748 were tested prior to release for volume production. Representative samples of customer-shippable workstations were tested in various configurations through the environmental tests to evaluate corner-case conditions.

***NOTE:*** Presentation of these test suites does not imply a guarantee of product performance, nor a guarantee of performance to these levels by the entire population of Models 743, 744, and 748 computer systems.

### Overview

The following is a list of the climatic and environmental ruggedness tests suites summarized in this section:

**1** Temperature, humidity, and altitude test suite

- Temperature (Table 3-16 and Table 3-17)
- Humidity (Table 3-18 and Table 3-19)
- Altitude (Table 3-20 and Table 3-21)

**2** Vibration and shock test suite

- Vibration (Table 3-22)
- Shock (Table 3-23 and Table 3-24)

### Temperature, Humidity, and Altitude Test Suite

Table 3-16 and Table 3-17 summarize the temperature tests suite.

**Table 3-16 Temperature Tests While Non-Operations**

| Standard | Level |
|---|---|
| HP class B1 (IEC 654 Part 1 class C3 compatible) | -40 Deg C to 71 Deg C (-40 Deg F to 159.8 Deg F) |

**Table 3-17 Temperature Tests During Operation**

| Standard | Level |
|---|---|
| HP class B1<br>(IEC 654-1 class Bx compatible) | 0 Deg C to 55 Deg C (41 Deg F to 131 Deg F) |
| Temperature slew rate<br>(exceeds IEC 654-1) | 10 Deg C/minute (50 Deg F/minute) |

Table 3-18 and Table 3-19 summarize the humidity tests suite.

**Table 3-18 Humidity Tests While Non-Operational**

| Standard | Level |
|---|---|
| HP class B | 90% relative humidity at 65 Deg C |

**Table 3-19 Humidity Tests During Operation**

| Standard | Level |
|---|---|
| Condensation | <5 minutes recovery |
| HP class B | 15% to 95% relative humidity at 40 Deg C |

Table 3-20 and Table 3-21 summarize the altitude test suite.

**Table 3-20 Altitude Tests While Non-Operating**

| Standard | Level |
|---|---|
| HP Standard 761 (class B) (exceeds IEC 654-1) | 4.6 Km (15 Kft) |

**Table 3-21 Altitude Tests During Operation**

| Standard | Level |
|---|---|
| HP Standard 761 (class B) (exceeds IEC 654-1) | 4.6 Km (15 Kft) |

Table 3-22 summarizes the vibration tests suite.

**Table 3-22 Vibration Tests While Non-Operating**

| Standard | Level |
|---|---|
| HP Standard 759 (class B1)(exceeds IEC 654-3/VH2) | 7.4 $m/s^2$ (0.75 g 0-p) swept sine |
| Packaging tests<br>HP Standard 762 | 4.9 $m/s^2$ (0.5 g 0-p) swept sine |
| Packaging tests<br>HP Standard 762 | 0.015 $g^2$ /Hz (.3 g rms) random |

Table 3-23 and Table 3-24 summarizes the shock tests suite.

**Table 3-23 Shock Tests While Non-Operational**

| Standard | Level |
|---|---|
| Bump test<br>HP Standard 760 (class B) | > 294 $m/s^2$ (>30g) trapezoidal wave |
| Packaging drop test<br>HP Standard 762<br>IEC 654-3 | .61 meters (24 inches) |

**Table 3-24 Shock Tests During Operation**

| Standard | Level |
|---|---|
| HP Standard 760 (class B), IEC 654-3 | 150 cm/s < 3ms 1/2 half sine |

## Acoustics

This section summarizes the sound power level test suite.

### Sound Power Levels

Table 3-25 summarizes the sound power level test suite. Sound power levels are A-weighted for these tests.

**Table 3-25 Sound Power Levels**

| Standard | Level | Equipment Under Test Conditions, Procedures, and Measurements (Acceptance Criteria) |
|---|---|---|
| HP Environmental tests, Section 767 | Model 748: 6.22 Bels | Fan(s) operating at high speed. |
| | Model 748: 5.72 Bels | Fan(s) operating at low speed. |

# Statistical Reliability

The sections that follow explain the Annualized Failure Rate (AFR) and the Mean Time Between Failure (MTBF) computations.

## Annualized Failure Rate Projections

Estimated AFR is based on a parts count and the failure rates of those parts in similar products. The AFR is estimated from the sum of the failure rates of the components' assemblies. A key assumption is that AFR is constant beyond the early life of the product and before long-term wear out.

Projected Failure Rate is the mature AFR, estimated from the failure rates of the components of the product. The "Estimated Long-Term Annualized Failure Rate" is a future projection of an average realistic failure rate beyond the typical infant failure period that occurs in the first few months of use and before long-term wear out, which occurs after many years of use.

### Mean Time Between Failure Computations

The MTBF is the reciprocal of the AFR. MTBF uses the following two units of time:

- Annualized MTBF (A-MTBF), the time units are years, or annually.
- Hourly MTBF (H-MTBF), the time unit is the hour.

This is derived by factoring out the AFR's annualized percentage, then finding its reciprocal. A resultant A-MTBF term is in years.

**Table 3-26 MTBF Example**

| Example | AFR |
|---|---|
| Model 744 VME board computer with graphics | 4.8%/year |
| Add one 32MB RAM card | 0.72%/year |
| Total | 5.5%/year |

$$\frac{1}{0.055 \,/\, 8766\ \textit{hours}} = 159{,}381\ \textit{hours}$$

The H-MTBF numbers in the following tables are rounded to the nearest 100 hours.

**Table 3-27 Model 748 Ruggedized Workstation With Model 743 CPU AFR Projections (%/Year)**

| Hardware Configurations | | Projected AFR (%/Yr.) |
|---|---|---|
| 743 VME Board Computer, 32 MB RAM (two 16 MB cards), no on-board graphics | | 11.5 |
| Option | 64 MB RAM card (one card using 16 Mbit DRAM) | 1.5 |
| | 8-Plane Color Graphics (GSC mezzanine card) | 1.7 |

**Table 3-28 Model 748 Ruggedized Workstation With Model 744 CPU AFR Projections (%/Year)**

| Hardware Configurations | | Projected AFR (%/Yr.) |
|---|---|---|
| 744 VME Board Computer, 32 MB RAM, EISA Tray, 2.0-GB FWD SCSI Disk, 17-inch Monitor | | 11.8 |
| Option | 64 MB RAM card (one card using 16 Mbit DRAM) | 1.23 |
| | HCRX 8-Plane Graphics | 1.38 |

**Table 3-29 Model 743 VME Board Computer AFR Projections (%/Year)**

| Hardware Configurations | | Projected AFR (%/Yr.) |
|---|---|---|
| 743 VME Board Computer, no graphics | | 3.1 |
| 743 VME Board Computer, and on-board 8-plane color graphics | | 3.8 |
| Memory | 8 MB RAM card (one card using 4 Mbit DRAM) | 0.6 |
| | 16 MB RAM card (one card using 4 Mbit DRAM) | 1.2 |
| | 32 MB RAM card (one card using 16Mbit DRAM) | 0.7 |
| | 64 MB RAM card (one card using 16Mbit DRAM) | 1.5 |
| Option | 8-Plane Color Graphics (GSC mezzanine card) | 1.7 |
| | HCRX-8 | 1.38 |
| | HCRX-24 | 1.54 |
| | ATM | 2.0 |
| | PMC Bridge | 2.0 |
| | PMC Bridge and Expander | 3.0 |

**Table 3-30 Model 744 VME Board Computer AFR Projections (%/Year)**

| Hardware Configurations | | Projected AFR (%/Yr.) |
|---|---|---|
| 744 VME Board Computer with on-board graphics option | | 4.8 |
| Memory | 32 MB RAM card (one card using 16Mbit DRAM) | 0.7 |
| | 64 MB RAM card (one card using 16Mbit DRAM) | 1.23 |
| | 128 MB RAM card (one card using 64Mbit DRAM) | 2.1 |
| Option | 8-Plane Color Graphics (GSC mezzanine card) | 1.7 |
| | HCRX-8 | 1.38 |
| | HCRX-24 | 1.54 |
| | ATM | 2.0 |
| | PMC Bridge | 2.0 |
| | PMC Bridge and Expander | 3.0 |

Table 3-31 summarizes the MTBF for the Model 743.

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**Table 3-31 Model 743 VME Board Computer MTBF (hr-MRBF) Computations**

| Hardware (Includes Model 743 VME Board Computer) | No On-Board Graphics MTBF (Hours) | On-Board Graphics MTBF (Hours) |
|---|---|---|
| 16 MB RAM (one 16 MB card using 4 Mbit DRAM) | 186,000 | 160,000 |
| 32 MB RAM (one 32 MB card using 16Mbit DRAM) | 210,000 | 177,800 |
| 64 MB RAM (one 64 MB card using 16 Mbit DRAM) | 173,900 | 153,800 |
| 128 MB RAM (two 64 MB cards using 16 Mbit DRAM) | 131,100 | 117,600 |
| 256 MB RAM (four 64 MB cards using 16 Mbit DRAM) | 87,900 | 81,600 |

# 4

# Mechanical Information

This chapter contains mechanical information about the components of the Model 743 and Model 744 VME Board Computers and the Model 748 Ruggedized Workstation. Included is air flow requirements, interface connector manufacturing data, system board and accessory card dimensions, chassis and module dimensions and weights, mounting and support, and mechanical drawings.

# Model 743 and Model 744 VME Board Computers

## Key Components

Figure 4-1 shows key components on the Model 743 VME Board Computer.

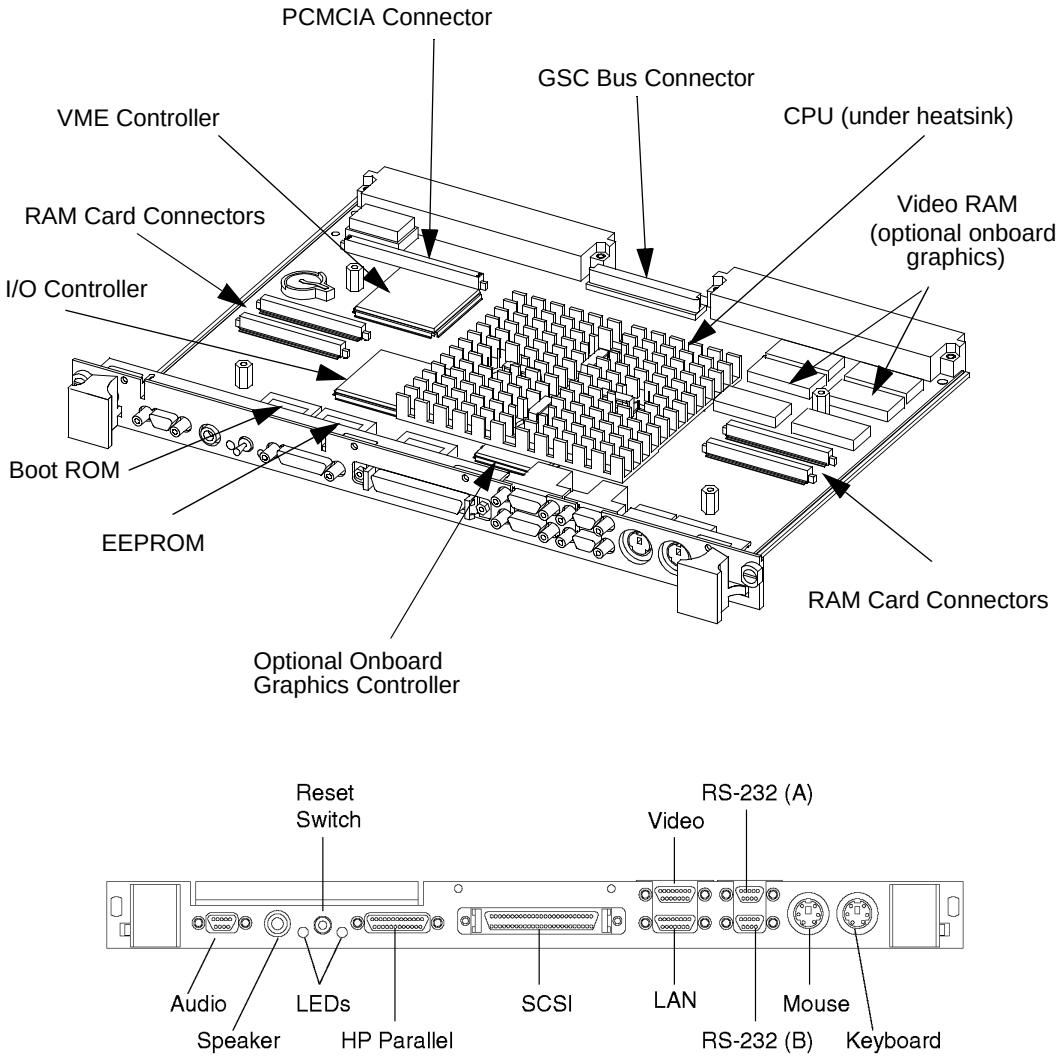



**Figure 4-1** **Model 743 Key Components**

Figure 4-2 shows key components on the Model 744 VME Board Computer.

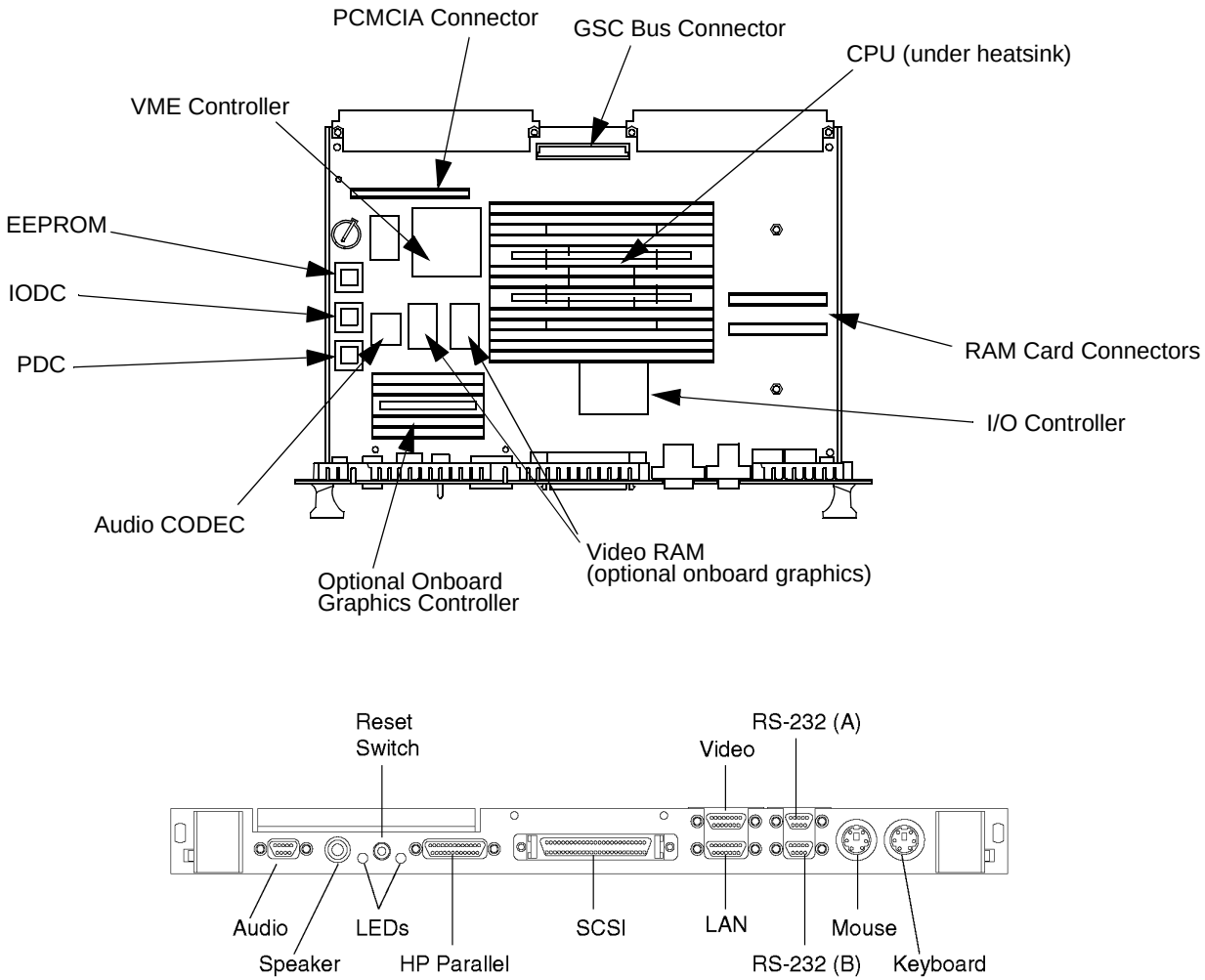



**Figure 4-2 Model 744 Key Components**

## Air Flow Requirements

The air flow requirements for the Model 743 and Model 744 are as follows:

46 linear meters (150 linear feet) per minute, -5 Deg C to 35 Deg C (23 Deg F to 95 Deg F)

61 linear meters (200 linear feet) per minute, 35 Deg C to 55 Deg C (95 Deg F to 151 Deg F)

***NOTE:*** Model 743 and Model 744 VME Board Computers are to be operated only in an environment that is free from conductive pollution, including dry non-conductive pollution which could become conductive due to expected condensation.

***CAUTION:*** Integrated circuit case and junction temperatures must not exceed those shown in Figure 4-3 and Figure 4-4.

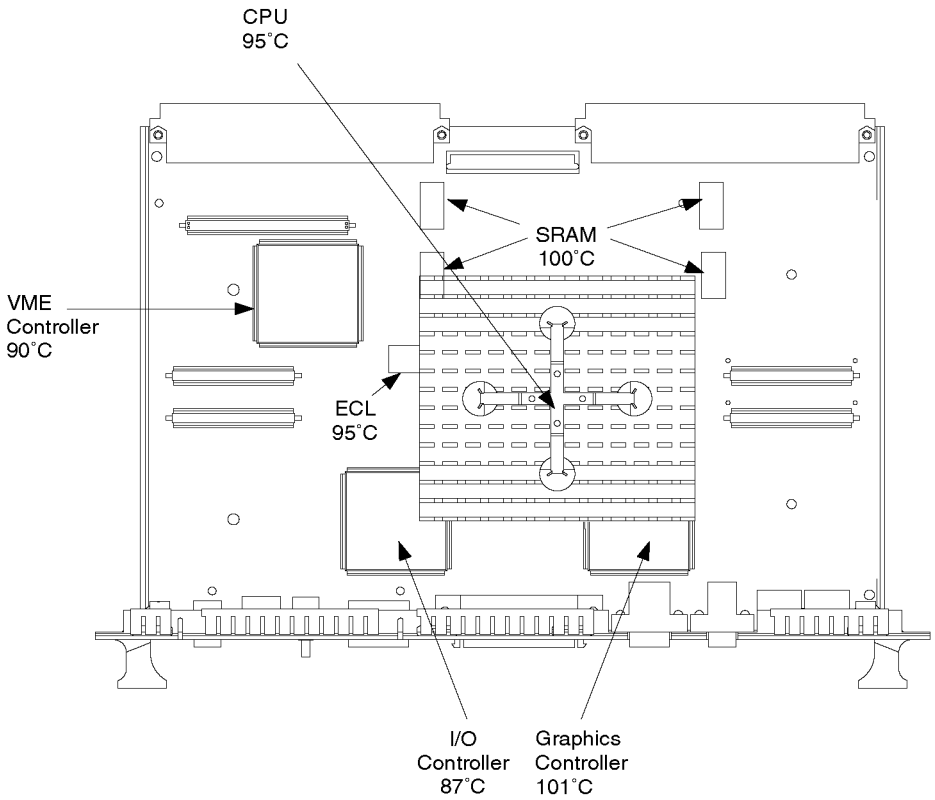
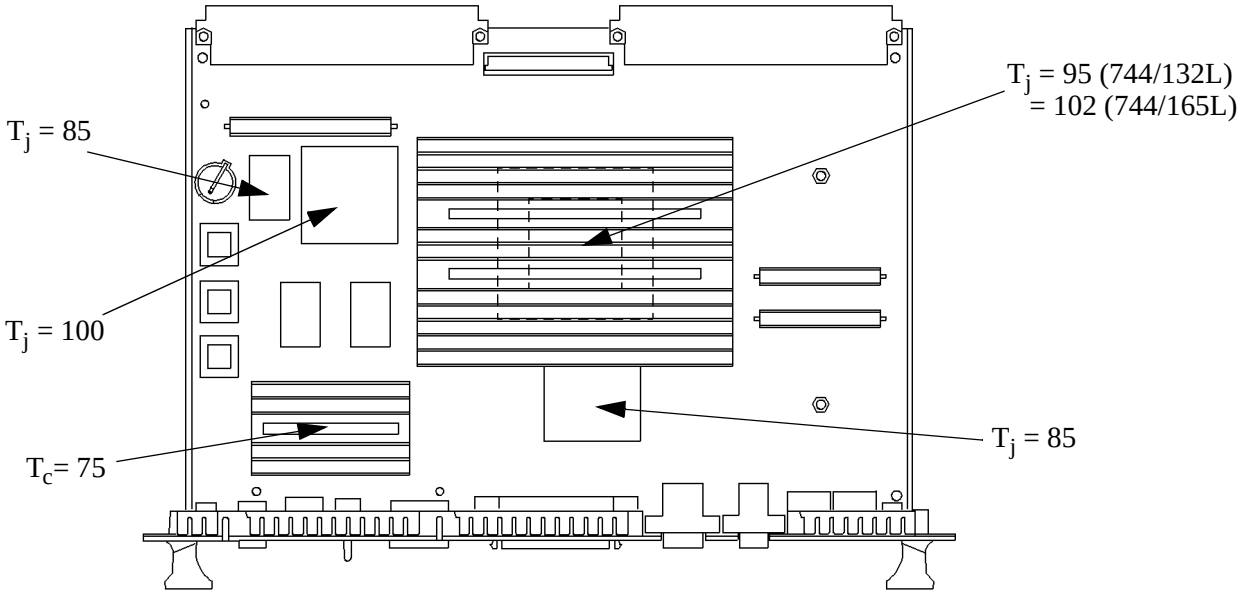



**Figure 4-3 Model 743 Integrated Circuit Case Temperature Limits**




$T_j$ = Maximum junction temperature in degrees centigrade
$T_c$ = Maximum case temperature in degrees centigrade

**Figure 4-4 Model 744 Integrated Circuit Case Temperature Limits**

## Interface Connectors

Table 4-1 lists the interface connector manufacturing data.

**Table 4-1 Interface Connector Manufacturing Data**

| Connector | Manufacturing Data | Manufacturing Part Number |
|---|---|---|
| Audio | ITT Canon | MDSM-9PE-Z10 or equivalent |
| HP Parallel | ITT Canon | MDSM-25PE-Z10 or equivalent |
| Mouse/Keyboard | AMP | 750071-1 or equivalent |
| P1 | AMP | 215606-4 or equivalent |
| P2 | AMP | 650988-0 or equivalent |
| SCSI II | AMP | 749830-5 or equivalent |
| Serial | ITT Canon | MDSM-18PE-Z22 or equivalent |
| Speaker | Hosiden | HSJ3062-01-410 or equivalent |
| Video/LAN | ITT Canon | MDSM-30PE-z10 or equivalent |

## Mechanical Dimensions

Figure 4-5 and Figure 4-6 show the dimensions of the Model 743 board computer.

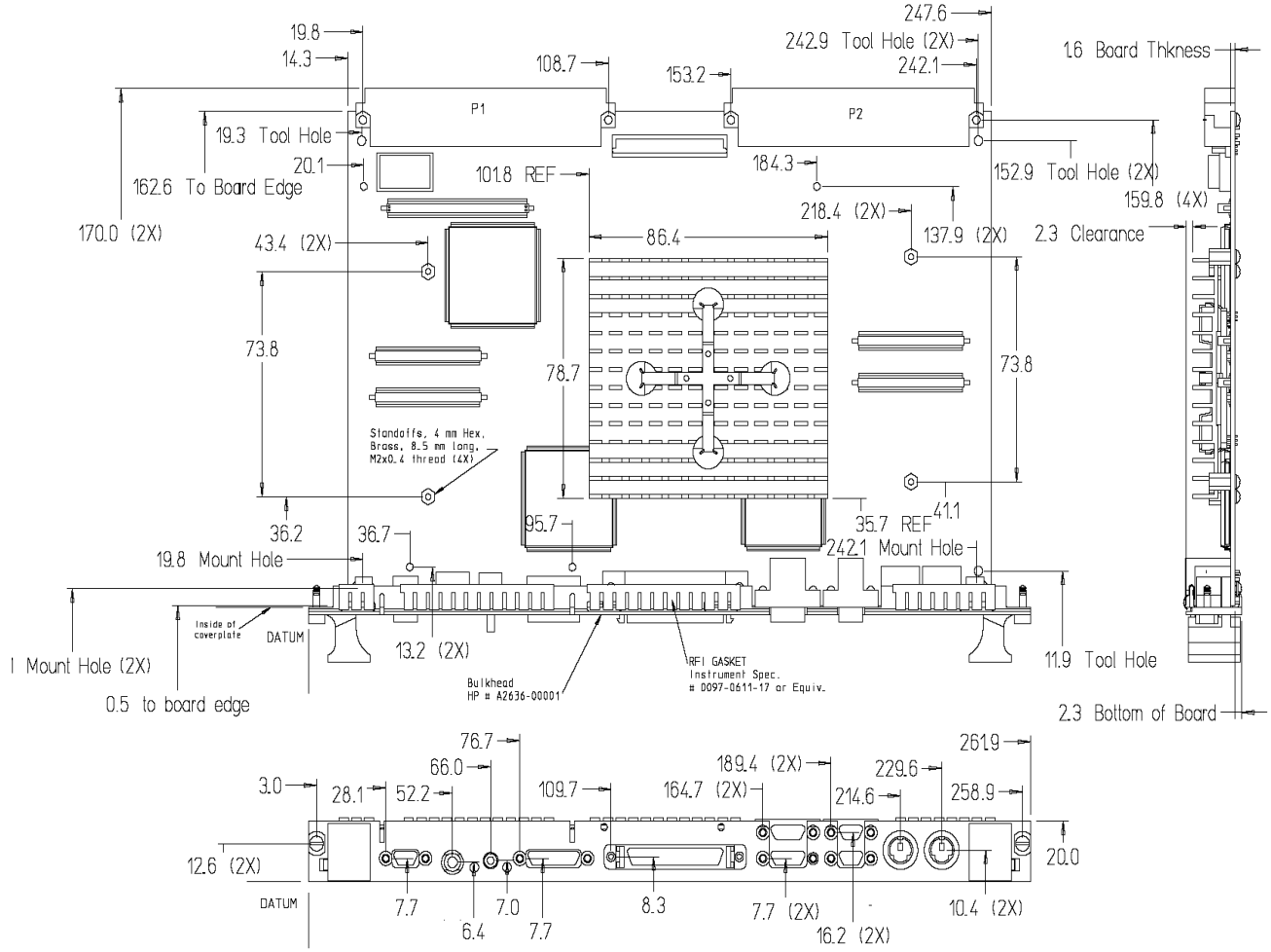



**Figure 4-5 Model 743 Board Computer**

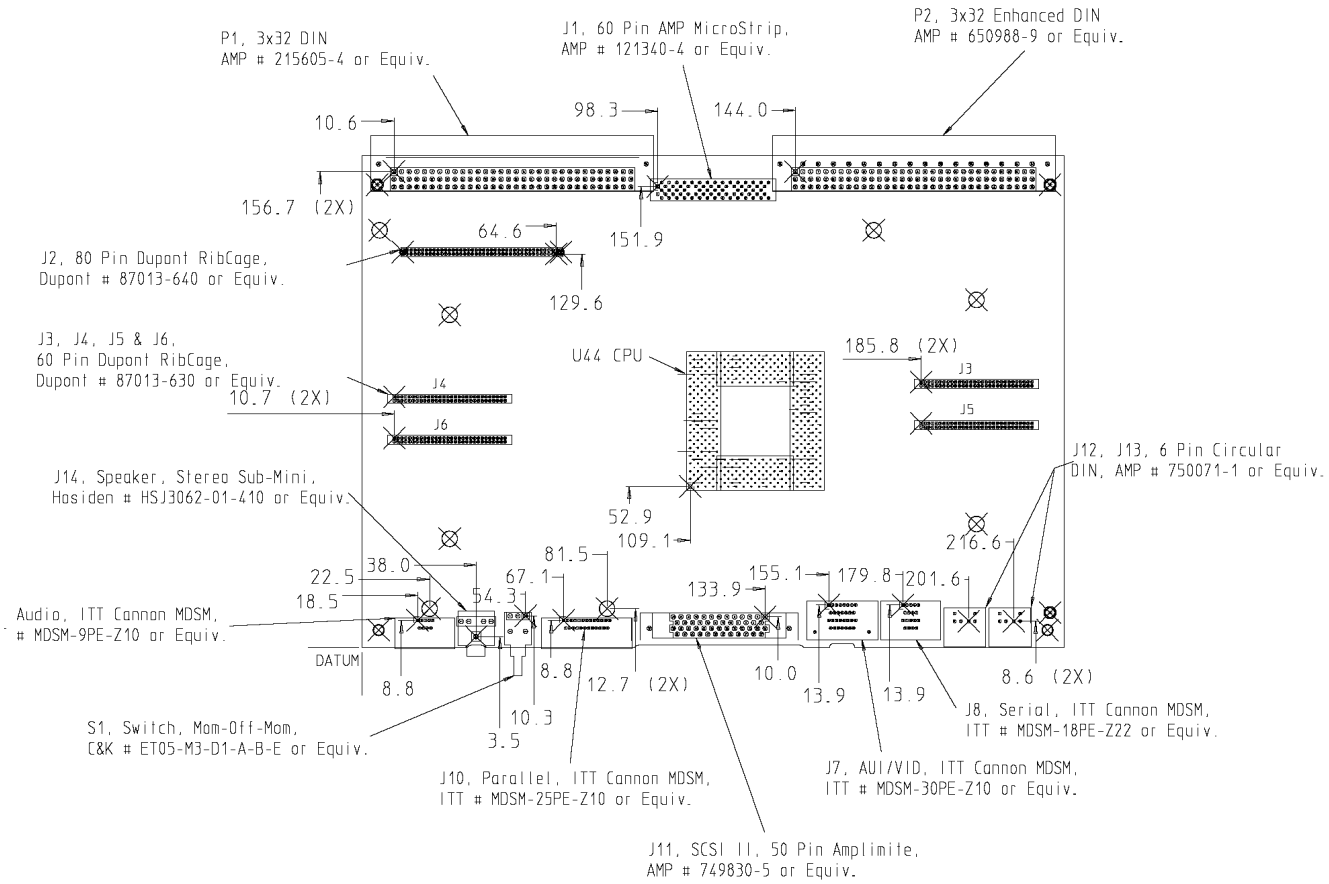



**Figure 4-6 Model 743 Board Computer (Continued)**

Figure 4-7 shows the dimensions of a Model 743 RAM card.

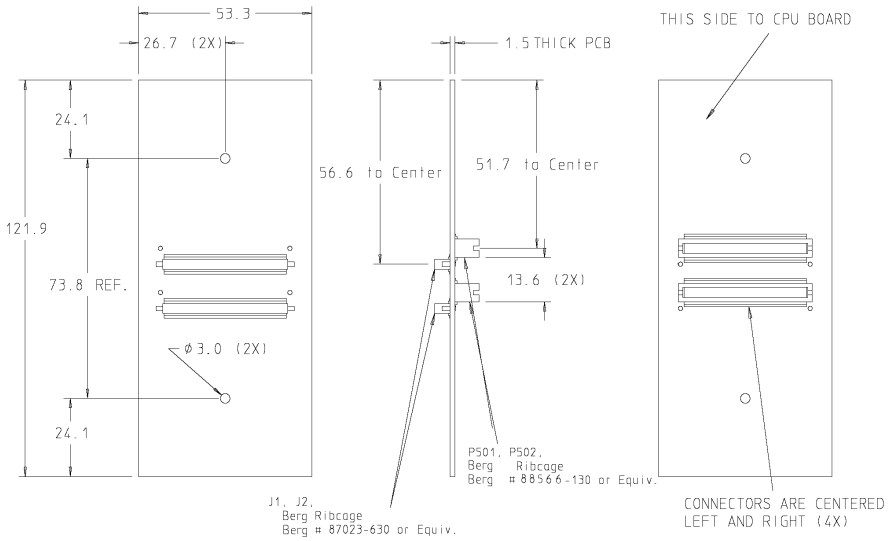



**Figure 4-7 Model 743 RAM Card**

Figure 4-8 through Figure 4-12 show the dimensions of the Model 744 system board.

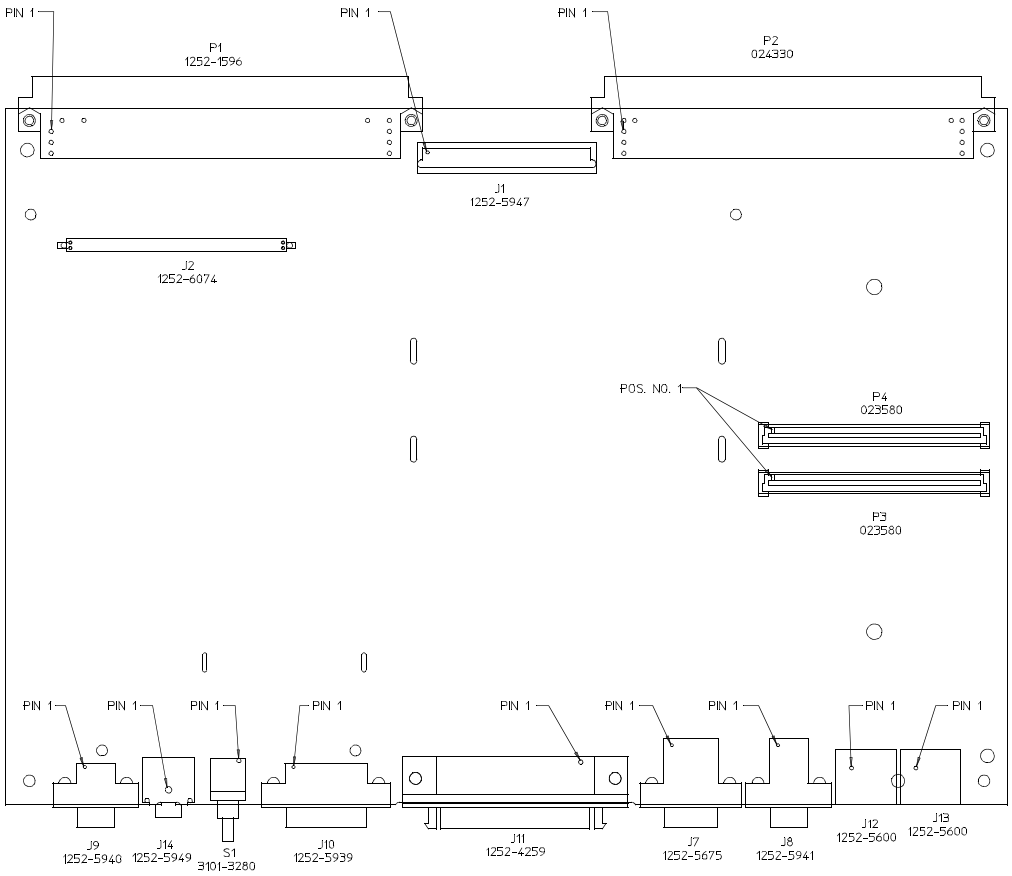



**Figure 4-8 Model 744 Board Computer**

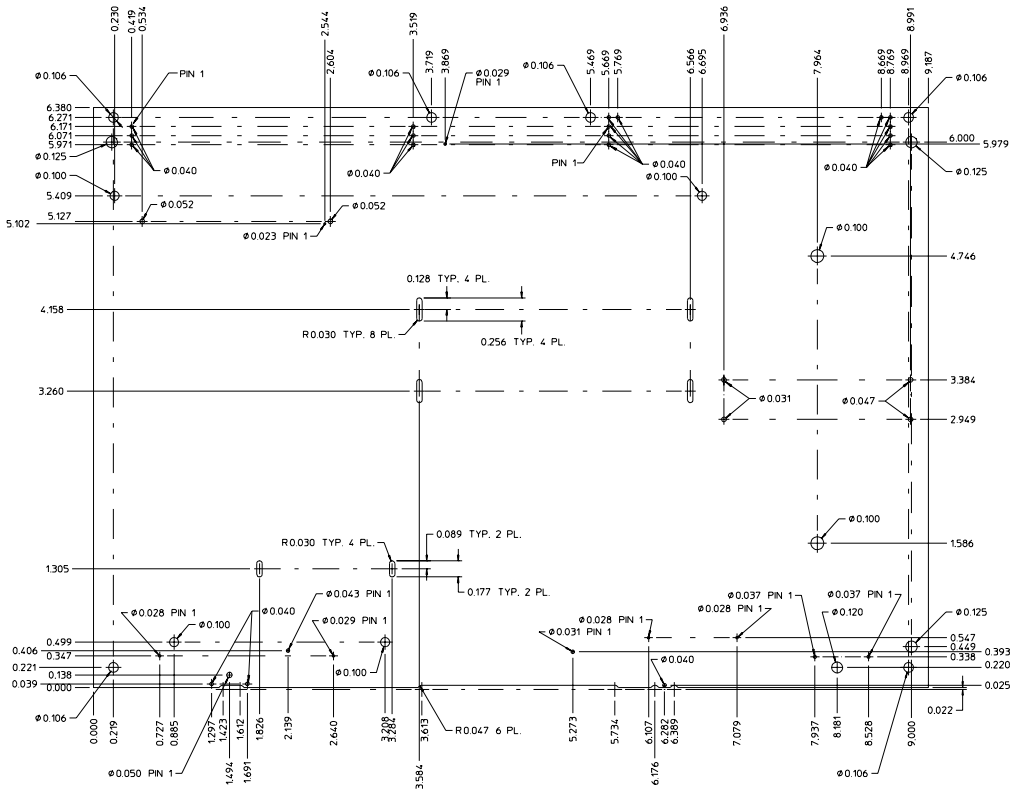



**Figure 4-9 Model 744 Board Computer (Continued)**

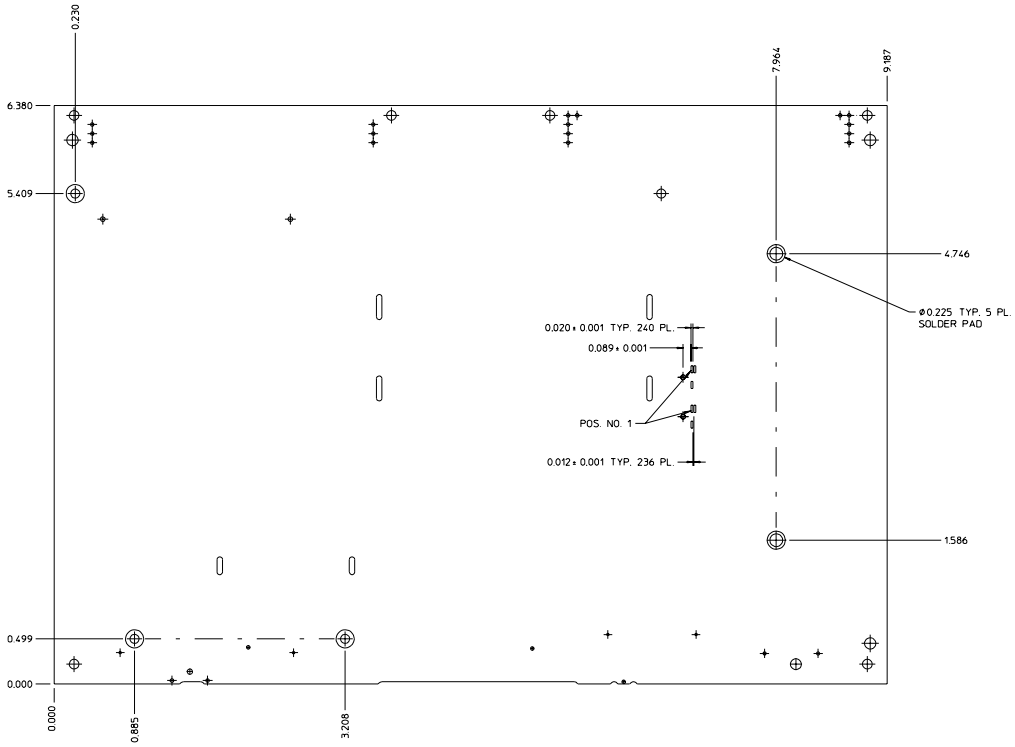



**Figure 4-10 Model 744 Board Computer (Continued)**

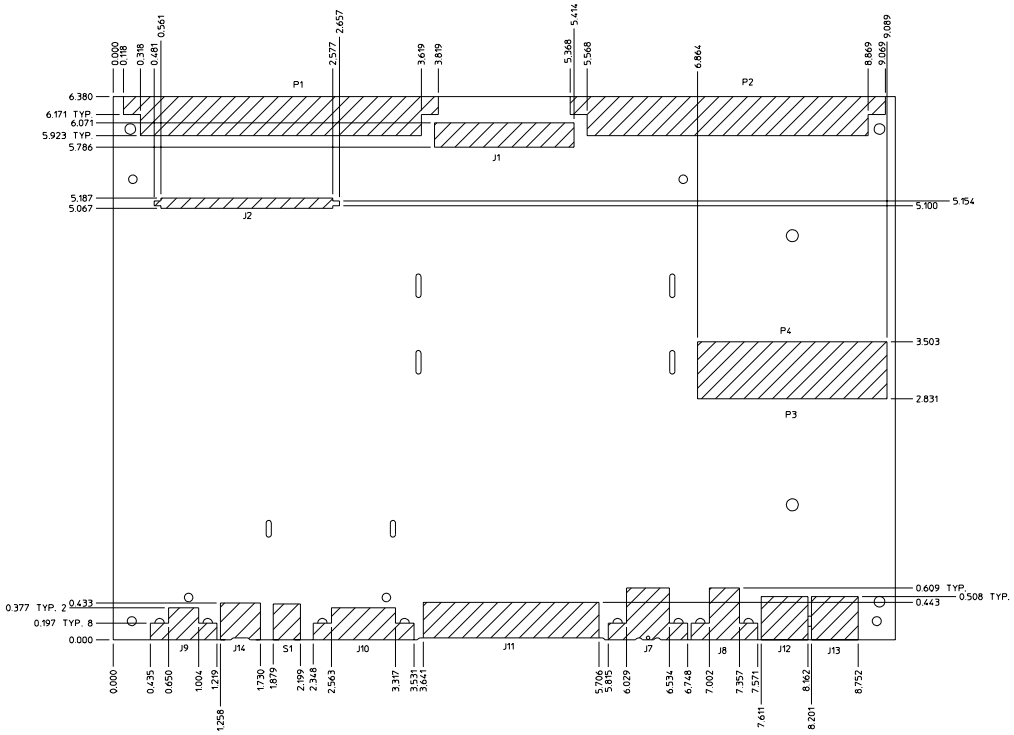



**Figure 4-11 Model 744 Board Computer (Continued)**

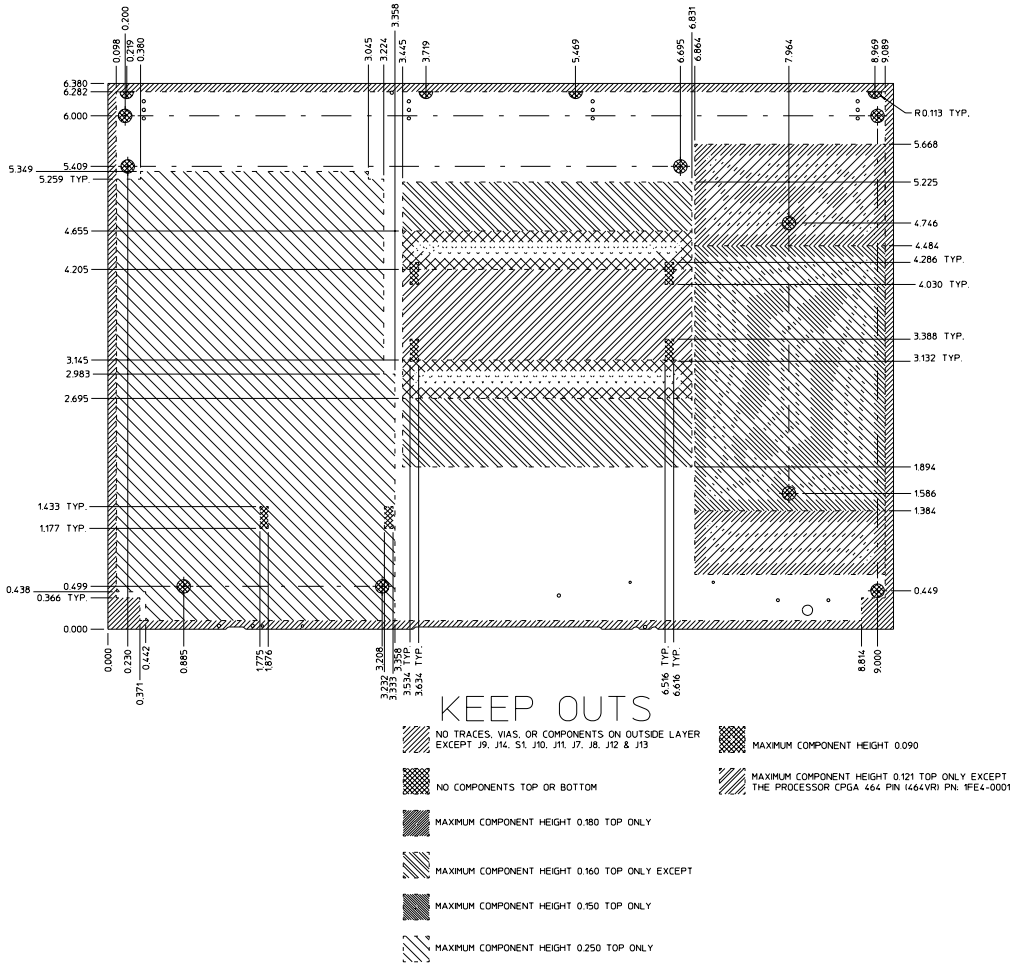



**Figure 4-12 Model 744 Board Computer (Continued)**

Figure 4-13 through Figure 4-15 show the dimensions of a Model 744 RAM card.

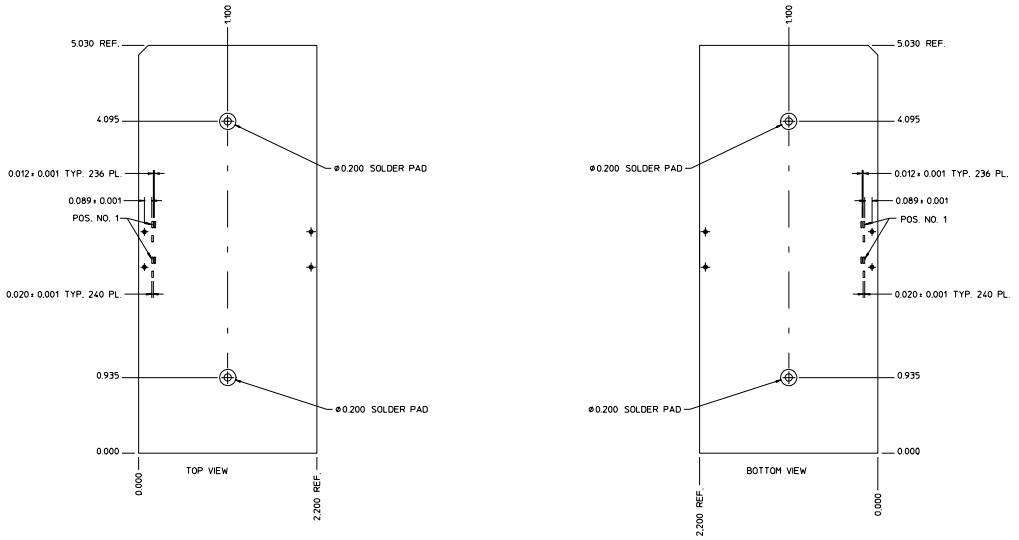



**Figure 4-13 Model 744 RAM Card**

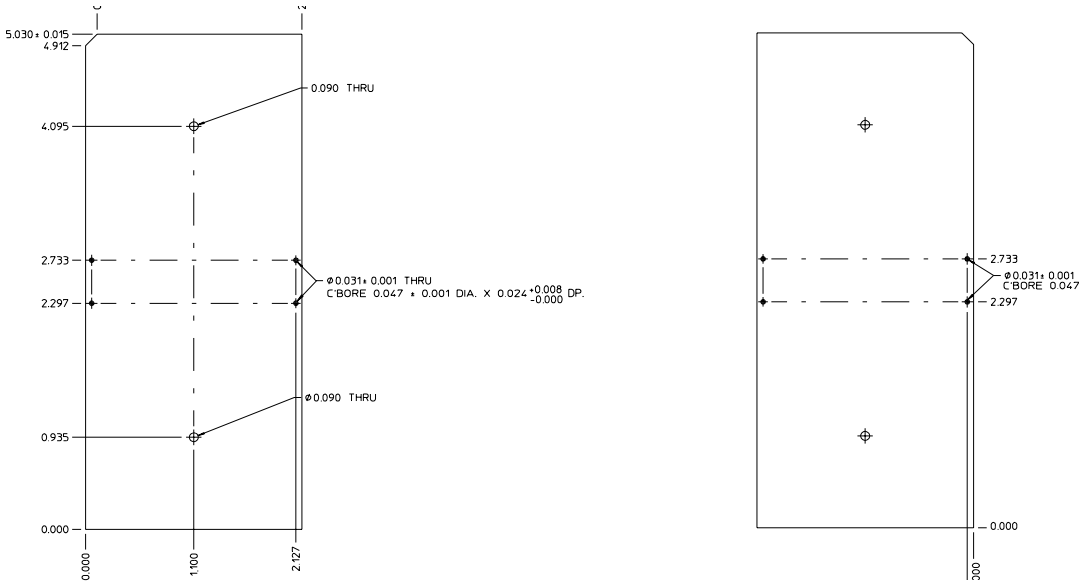



**Figure 4-14 Model 744 RAM Card (Continued)**

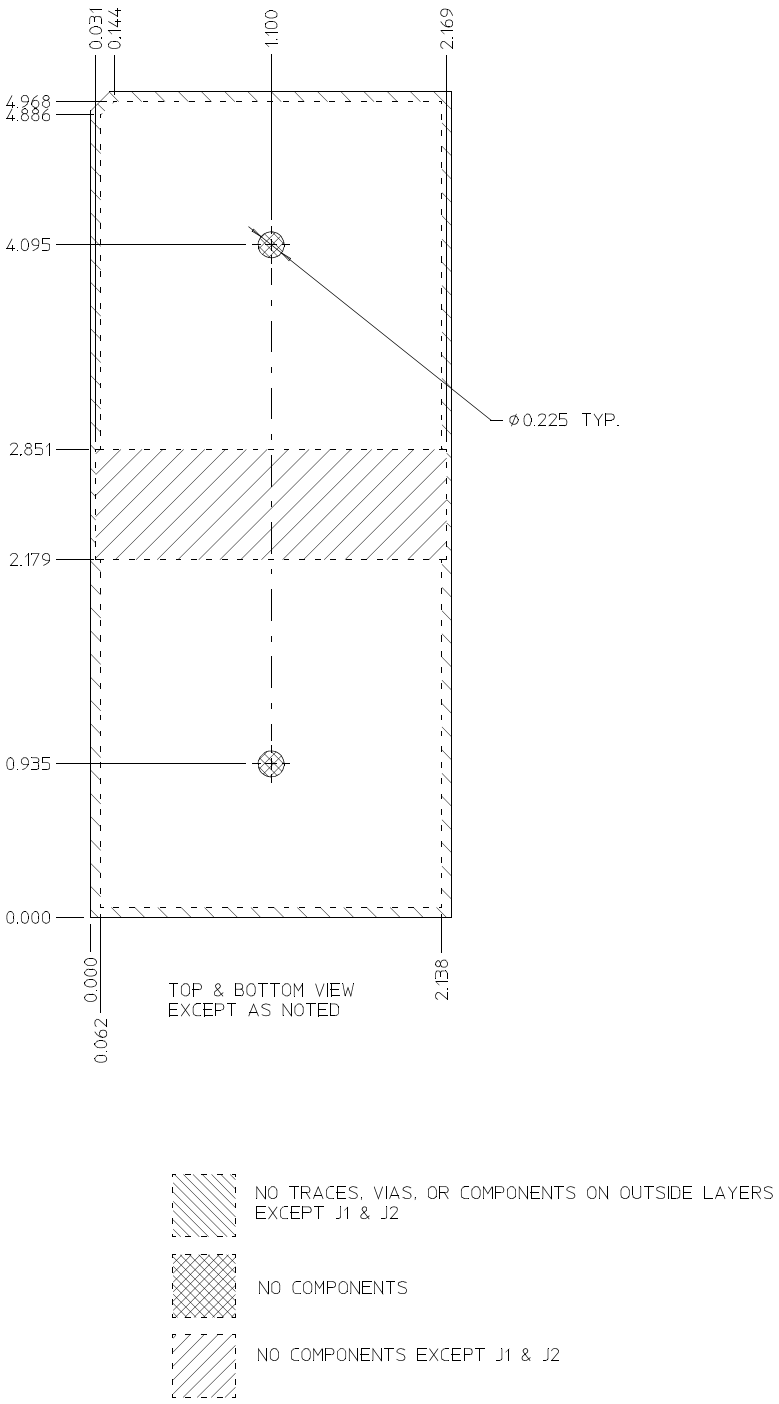



**Figure 4-15 Model 744 RAM Card (Continued)**

Figure 4-16 shows the dimensions of a GSC+ accessory card.

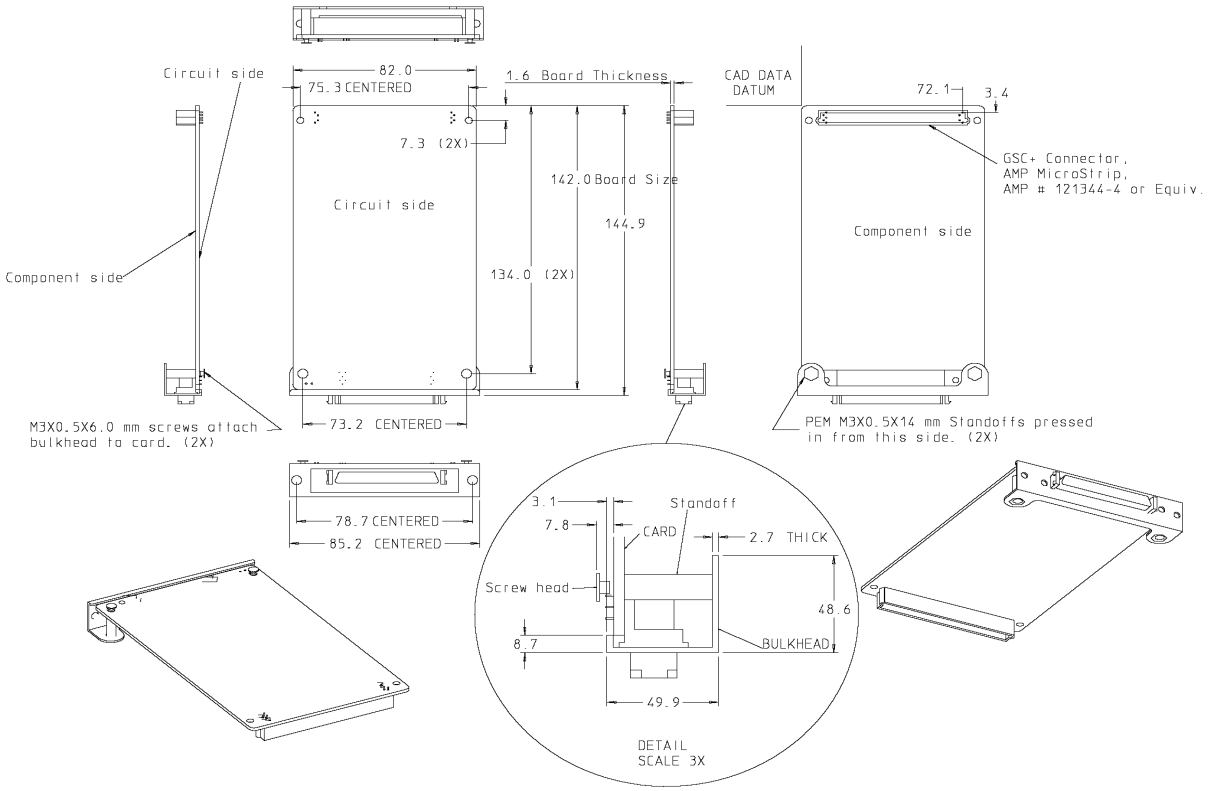



**Figure 4-16 GSC Accessory Card**

Figure 4-17 shows the dimensions of the PMC Bridge Adapter.

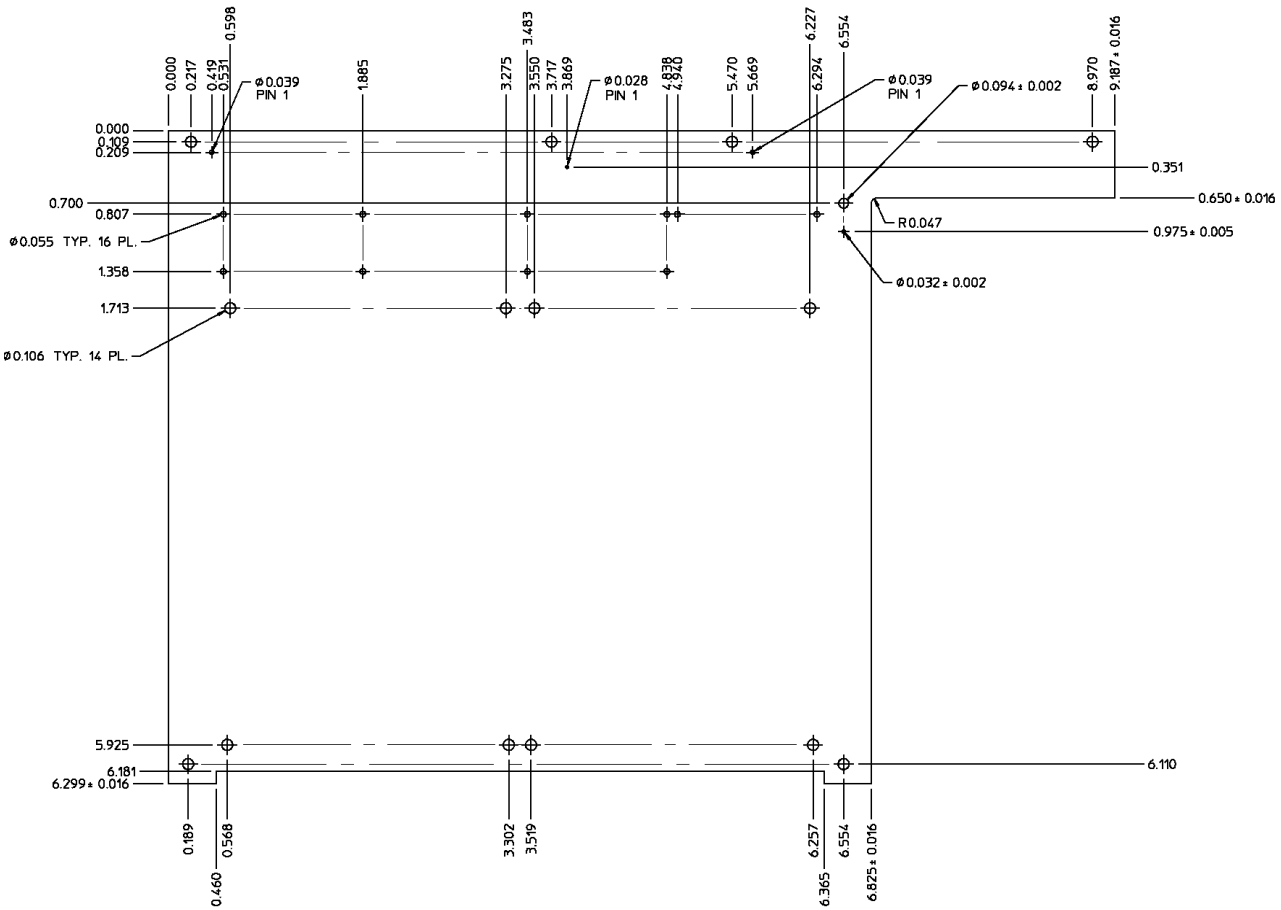



**Figure 4-17 PMC Bridge Adapter**

Figure 4-18 shows the dimensions of the PMC Expansion Adapter.

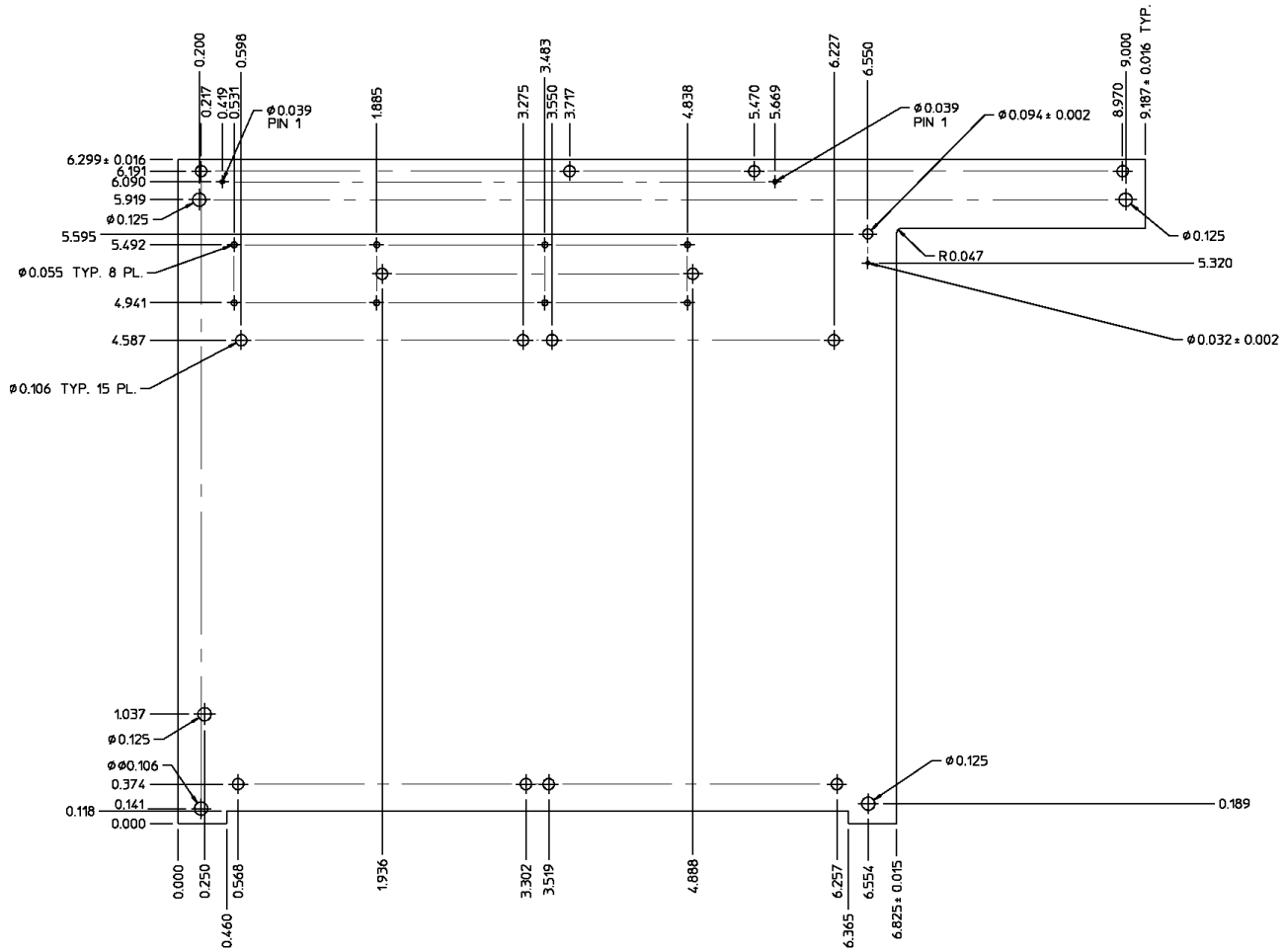



**Figure 4-18 PMC Expansion Adapter**

# Model 748 Chassis and Modules

Figure 4-19 shows the dimensions of the Model 748 chassis.

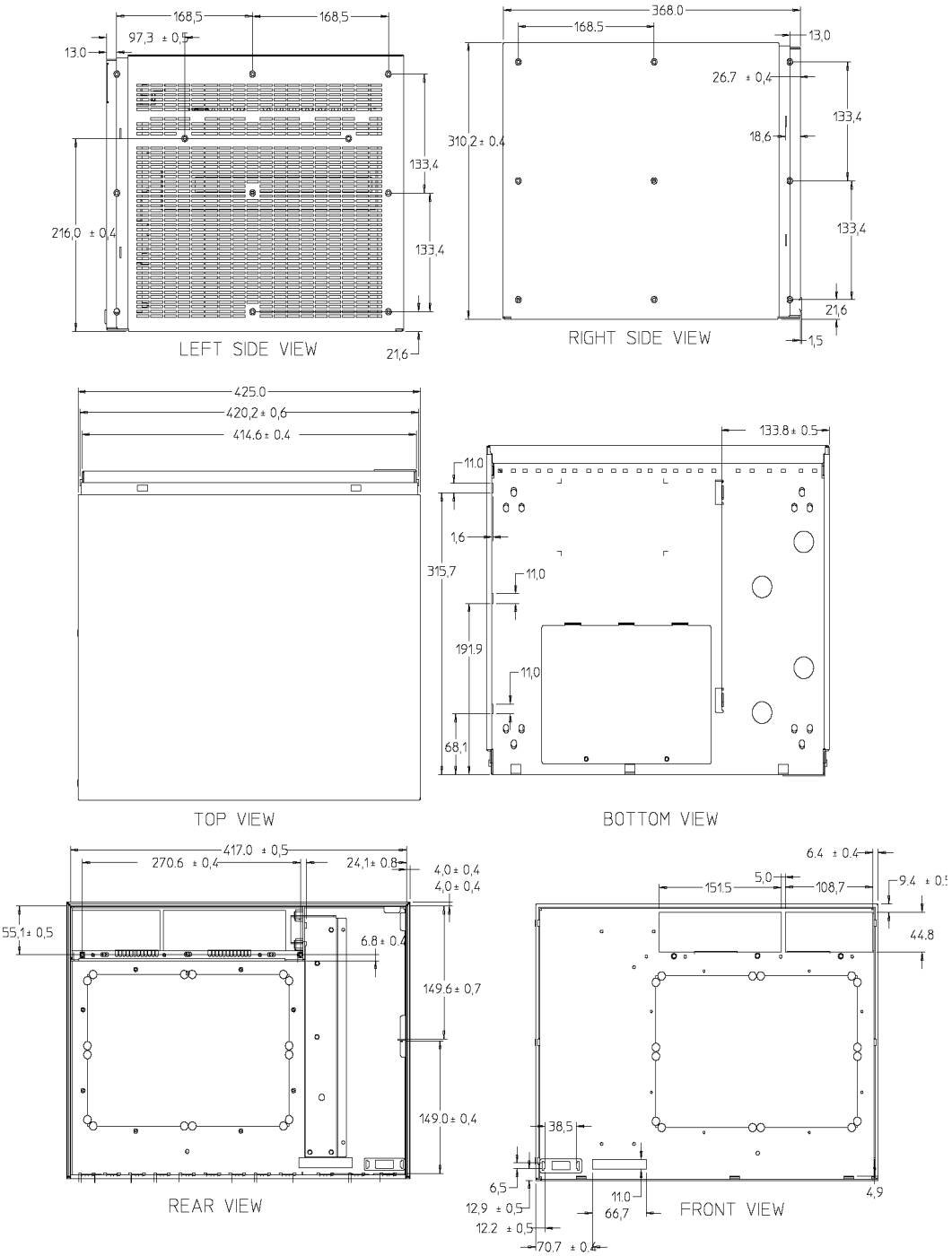



**Figure 4-19** **Model 748 Main Chassis**

Figure 4-20 shows the dimensions of the Model 748 outside wall.

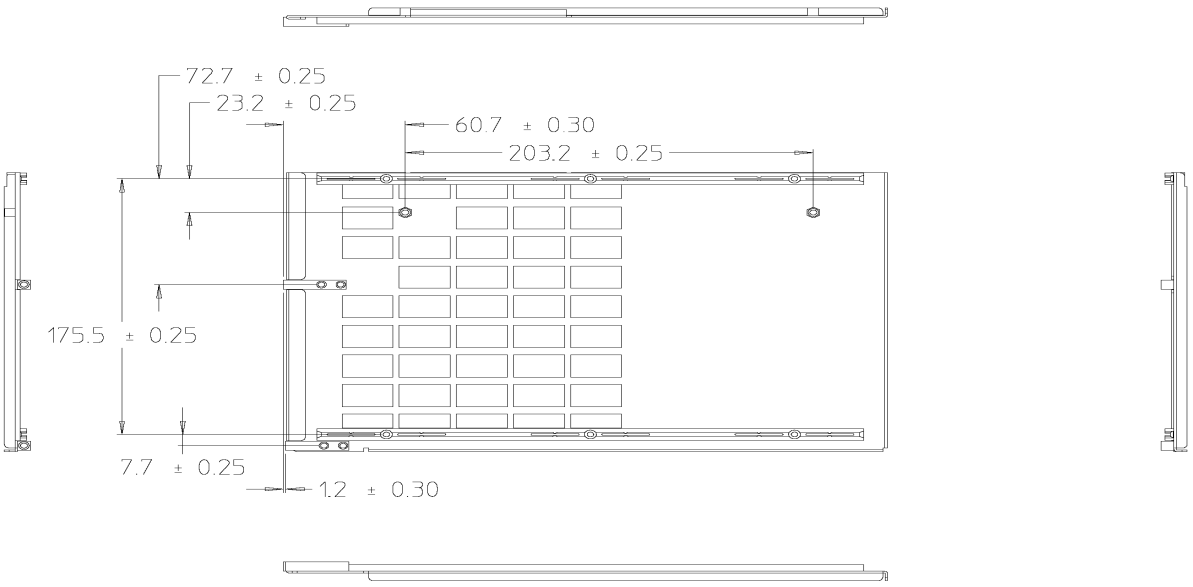



**Figure 4-20 Model 748 Outside Wall**

Figure 4-21 shows the dimensions of Model 748 center wall.

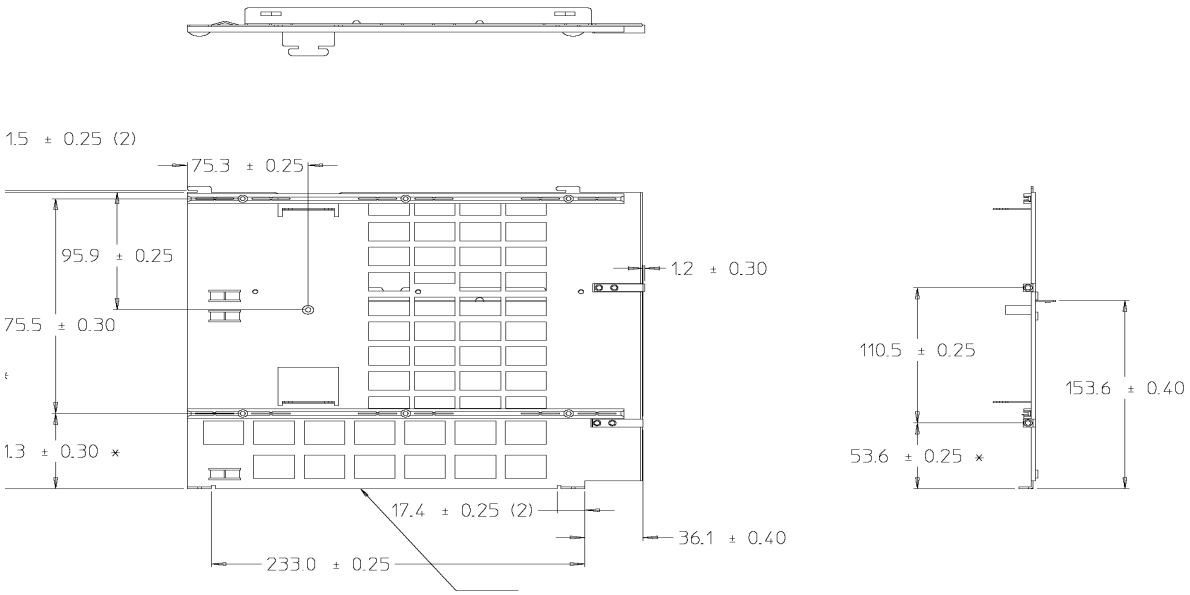



**Figure 4-21 Model 748 Center Wall**

Figure 4-22 shows the dimensions of the Model 748 mass storage module chassis.

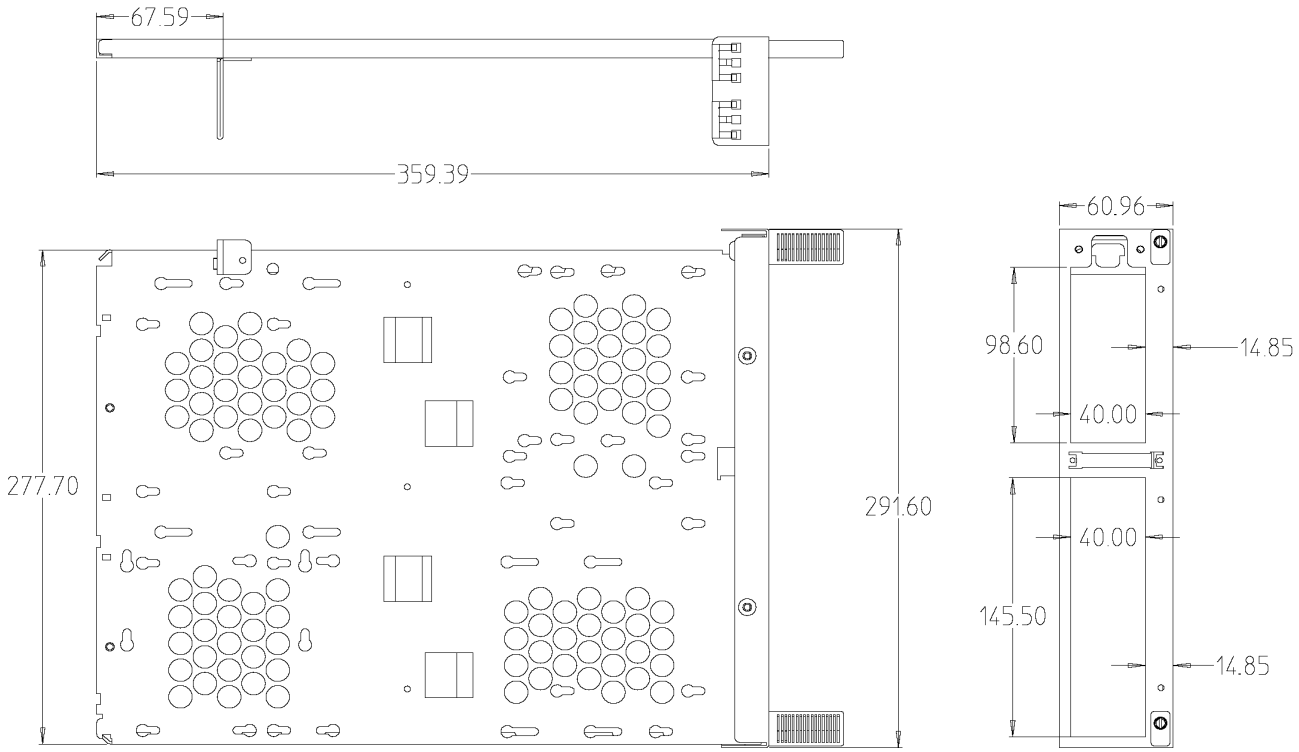



**Figure 4-22 Model 748 Mass Storage Module Chassis**

Figure 4-23 shows the dimensions of the Model 748 VME module chassis.

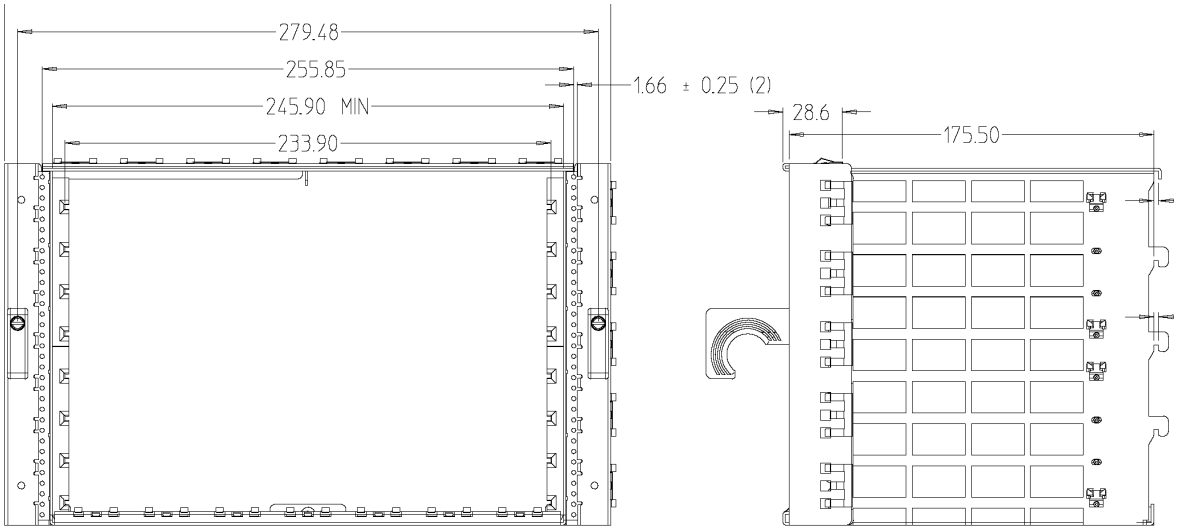



**Figure 4-23 Model 748 VME Module Chassis**

Figure 4-24 shows the dimensions of the Model 748 PCI/EISA module chassis.

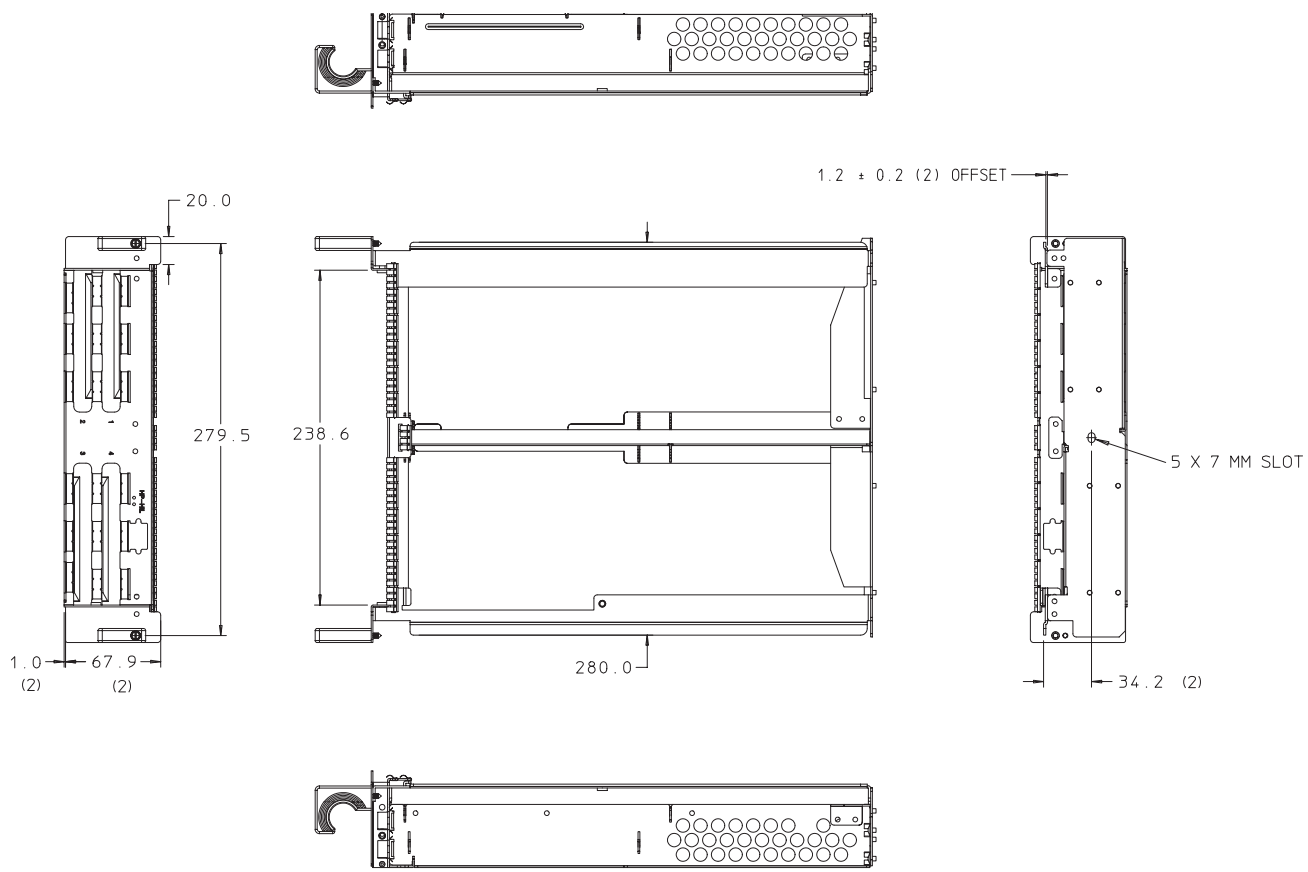



**Figure 4-24 Module 748 PCI/EISA Module Chassis**

Figure 4-25 shows the dimensions of the Model 748 EISA converter board.

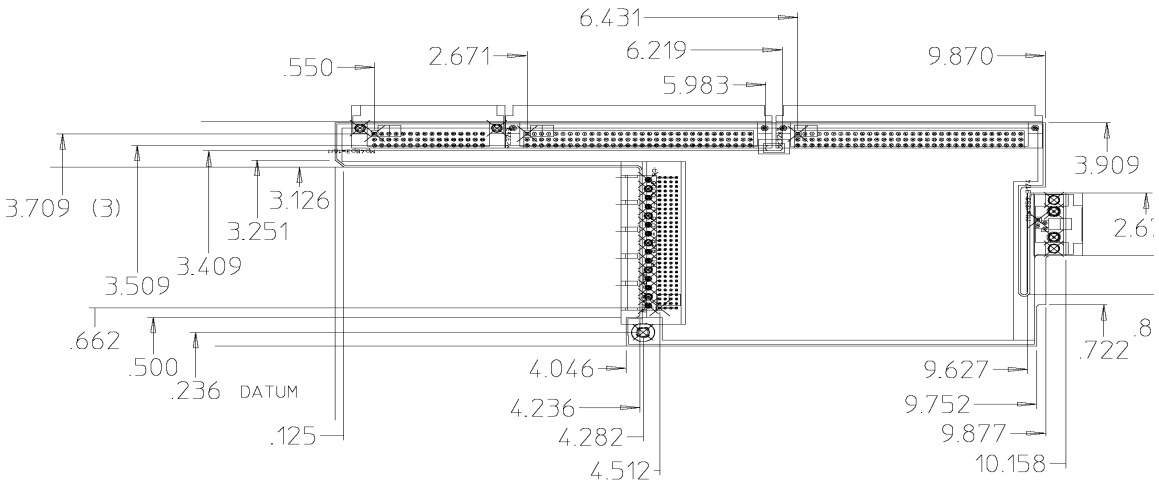



**Figure 4-25 Model 748 EISA Converter Board**

Figure 4-26 shows the dimensions of the Model 748 PCI converter board.

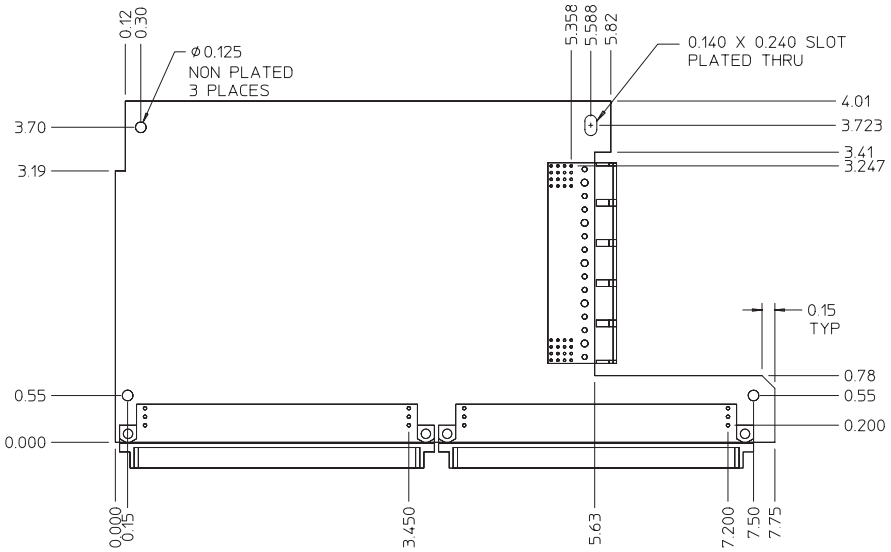



**Figure 4-26 Model 748 PCI Converter Board**

Figure 4-27 shows the dimensions of the Model 748 VME backplane board.

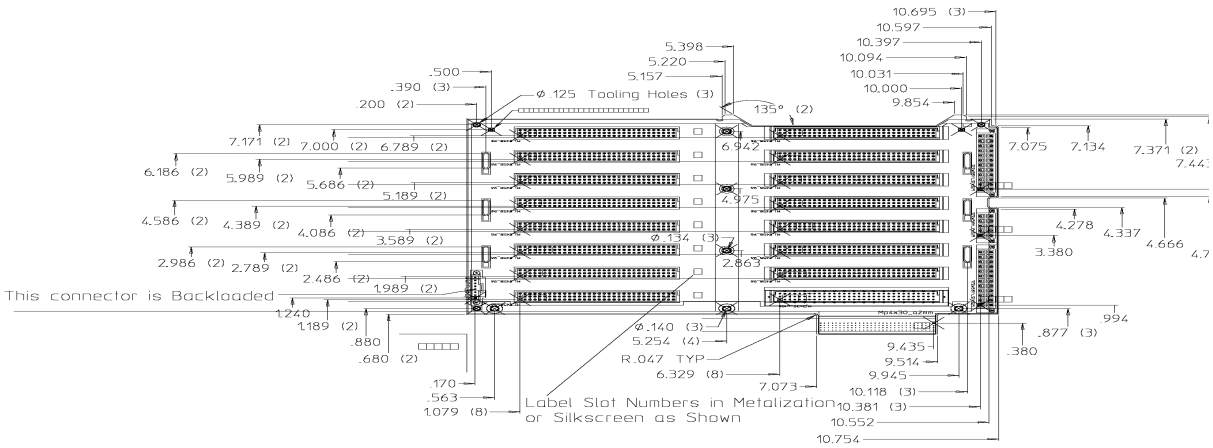



**Figure 4-27 Model 748 VME Backplane Board**

Figure 4-28 shows the dimensions of the Model 748 power distribution board.

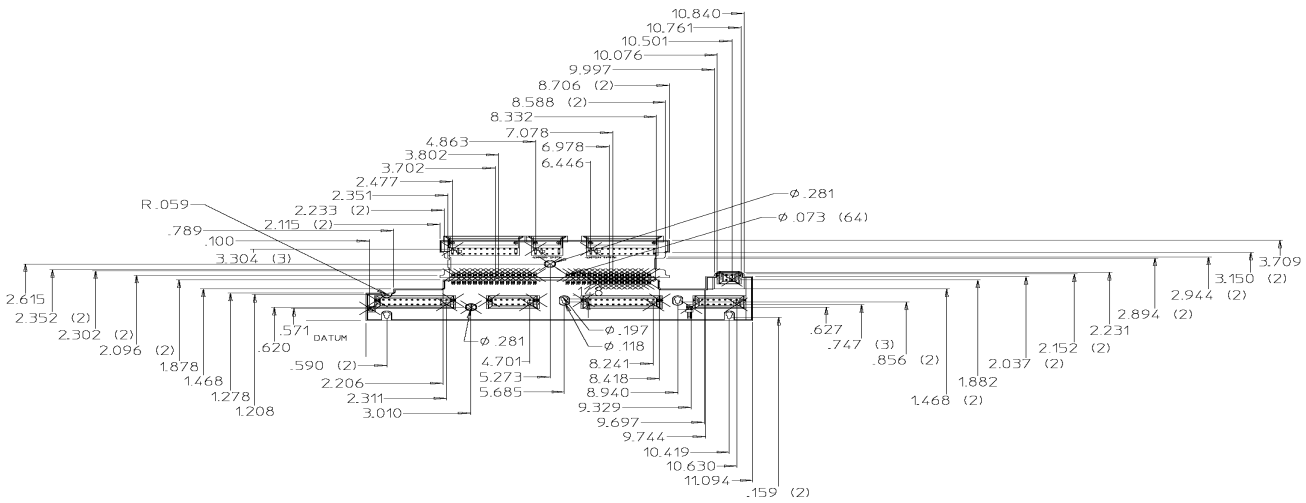



**Figure 4-28 Model 748 Power Distribution Board**

## Weights

Table 4-2 lists the weights of the components of the Model 748 workstation.

**Table 4-2 Weights of Model 748 Workstation Product and Modules**

| Part Name | Metric Weight | English Weight |
|---|---|---|
| Model 748 Ruggedized Workstation chassis including power distribution board, on/off switch, and front cover (does not include modules or board computer) | 9.50 Kg | 21 lbs. 2.0 oz. |
| SE Mass storage module including SCSI and power cables | 2.03 Kg | 4 lbs. 8.1 oz. |
| FWD Mass storage module including SCSI and power cables | 2.25 Kg | 5 lbs. 0 oz. |
| Disk drives (maximum weight) | 0.95 Kg | 2 lbs. 1.6 oz. |
| VME backplane | 0.63 Kg | 1 lb. 6.4 oz. |
| VME module (including six slot cover) | 1.91 Kg | 4 lbs. 4.0 oz. |
| VME module (without slot covers) | 1.65 Kg | 3 lbs. 10.4 oz. |
| VME slot cover | 0.05 Kg | 1.7 oz. |
| PCI/EISA module | 1.13 Kg | 2 lbs. 8.3 oz. |
| EISA converter board/backplane | 0.47 Kg | 1 lb. 0.7 oz. |
| PCI converter board/backplane | 0.37 Kg | 13.2 oz. |
| Power supply | 3.43 Kg | 7 lbs. 9.5 oz. |
| Model 743 Board Computer with on-board graphics (no other options) | 0.47 Kg | 1 lb. 0.7 oz. |
| Model 744 Board Computer with on-board graphics (no other options) | 0.62 Kg | 1 lb. 1.7 oz. |
| Model 743 RAM card | 0.05 Kg | 1.6 oz. |
| Model 744 RAM card | 0.05 Kg | 1.6 oz. |
| GSC Expansion kit | 0.17 Kg | 6.1 oz. |
| PMC bridge board with mounting hardware (no blank bezels) | 0.27 Kg | 7.6 oz. |
| PMC expansion board with mounting hardware (no blank bezels or sleeves) | 0.24 Kg | 6.8 oz. |
| PMC blank bezels (each) | 0.03 Kg | 0.8 oz. |
| PMC ejector handle sleeves | 0.02 Kg | 0.7 oz. |
| GSC graphics card | 0.10 Kg | 3.6 oz. |
| GSC FWD SCSI card | 0.11 Kg | 3.8 oz. |
| HCRX/8 graphics card | 0.27 Kg | 7.7 oz. |
| HCRX/24 graphics card | 0.29 Kg | 8.4 oz. |
| GSC ATM card | 0.14 Kg | 4.0 oz. |

## Mounting and Support

Each Model 748 workstation is shipped with a rack mount kit including flanges, spacers, and screws. In this section, the term "back" refers to the cable-out side of the workstation. Model 748 satisfies three rack mount orientations:

- Mast mount
- Rack mount, either front out or back out

Power switching is accessible from both front and back. A single power LED is on the front. Status and test LEDs are located on the Model 743 Model 744 VME Board Computers. If the power supply and VME board computer LEDs must be visible, mount the workstation back out. Devices within the mass storage module can be arranged for front or back accessibility.

- Wall mount

PCI/EISA and VME card cages are fixed and cannot be reversed.

## Mechanical Drawings

For OEMs that have signed a Hewlett-Packard non-disclosure agreement, the mechanical drawings are available by request from the Workstation Systems Group through your Hewlett-Packard OEM Sales Representative. These drawings are Hewlett-Packard confidential and cannot be redistributed.

When you ask for drawings, please specify the following:

- Drawing part number, size, and page number, if needed
- Name, assembly or subassembly

The drawings are sent to your Sales and Service Office.

## Conversion Cables

All conversion cables are 762 plus or minus 30 mm (30 plus or minus 1.18 inch) long. The end of the cable that connects to the board computer uses a micro D-sub male (MDSM) connector. The other end of the cable uses a standard D-sub or other connector.

## Chassis Parts and Models

Table 4-3 shows the assembly group, included subassemblies, and mechanical drawing reference number for the Model 748 chassis parts and modules.

**Table 4-3 Mechanical Drawings for Chassis Parts and Modules**

| Assembly Group | Included Subassemblies | Subassembly Drawing Number |
|---|---|---|
| Model 748 chassis | Trim piece | C-A2261-40019-10 |
| | Front bezel (cover) | D-A2261-40003-10 |
| | Light pipe assembly | D-A2261-40004-10 |
| | Removable wall | C-A4309-00003-10 |
| | Left wall assembly | C-A4309-00004-10 |
| | Chassis | D-A4309-00011-10 |
| | Power distribution board | D-A4309-66002-10 |
| Mass storage module | Tray | D-A4309-00005-10 |
| PCI/EISA module | 4-slot chassis | C-A4309-00010-10 |
| VME module | Card cage | D-A4309-00006-10 |
| Power supply module | | D-0950-2303-10 |
| Model 743/744 system board | Front panel | D-A2636-00001-10 |
| GSC expansion | GSC video bulkhead | C-A2636-00005-10 |
| | Double-high bulkhead | D-A2636-00002-10 |
| | GSC blank bulkhead | C-A2636-00010-10 |
| | Blank VME bulkhead | D-A2636-00004-10 |
| | Two-slot adapter board | D-A2636-66012-10 |
| PMC expansion | PMC bridge adapter | D-A4504-66001-10 |
| | PMC expansion adapter | D-A4505-66002-10 |

# 5

# Electrical Information

The Electrical Information Chapter contains information on the connector pinouts, real-time clock battery, and video output signal specifications.

The sections that follow contain figures and tables of the connector pinouts and the wiring tables for video, audio, HP parallel, RS-232, AUI LAN, single-ended SCSI, FW SCSI, PS/2, and VMEbus; specifications for the real-time battery clock, video output signals, and video timing.

## Video Connector Pinouts

This section contains a figure of the video connector, a table of the video connector pinouts, the HP4304A conversion video cable connectors diagrams, and the conversion video cable wiring table.

Figure 5-1 illustrates the video connector pin locations for the Model 743 and Model 744 I/O backplane.

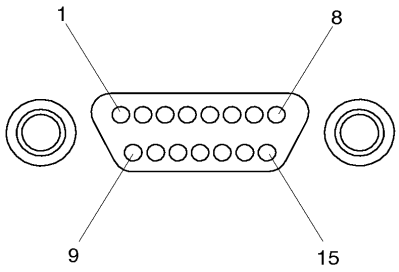



**Figure 5-1 Video Connector**

Table 5-1 identifies the pins on the Model 743 and Model 744 I/O backplane video connector.

**Table 5-1 Video Connector Pinouts**

| Pin Number | Signal 743 / 744 | Pin Number | Signal 743 / 744 | Pin Number | Signal 743 / 744 |
|---|---|---|---|---|---|
| 1 | GND / DDC | 6 | GND | 11 | GND / +5 |
| 2 | GND | 7 | BLUE | 12 | GND |
| 3 | RED | 8 | GND | 13 | NC / SSYNC |
| 4 | GND | 9 | GND | 14 | GND |
| 5 | GREEN | 10 | HSYNC | 15 | VSYNC |

Figure 5-2 illustrates the connector pin locations on each end of the HP A4304A conversion video cable.

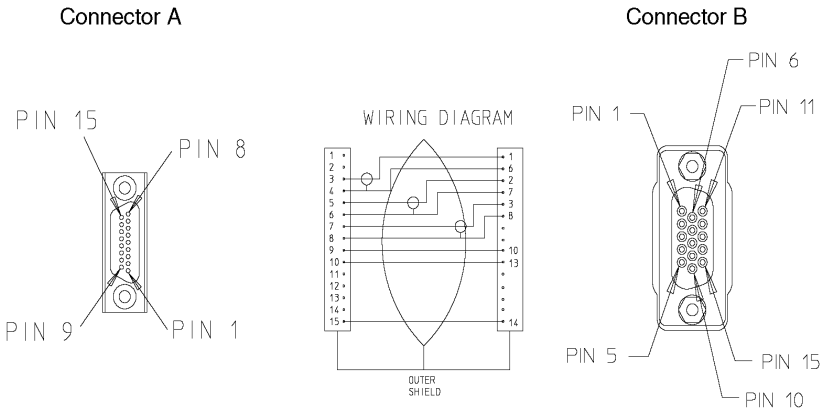



**Figure 5-2** **HP A4304A Conversion Video Cable Connectors**

Table 5-5 identifies HP A4304A conversion video cable pins.

**Table 5-2** **A4304A Conversion Video Cable Wiring Table**

| 15-Pin MDSM | 15-Pin D-Sub |
|---|---|
| Pin 1 | |
| Pin 2 | |
| Pin 3 | Pin 1 |
| Pin 4 | Pin 6 |
| Pin 5 | Pin 2 |
| Pin 6 | Pin 7 |
| Pin 7 | Pin 3 |
| Pin 8 | Pin 8 |
| Pin 9 | Pin 10 |
| Pin 10 | Pin13 |
| Pin 11 | |
| Pin 12 | |
| Pin 13 | |
| Pin 14 | |
| Pin 15 | Pin 14 |

Figure 5-3 illustrates the connector pin locations on each end of the HP A4223A conversion video cable.

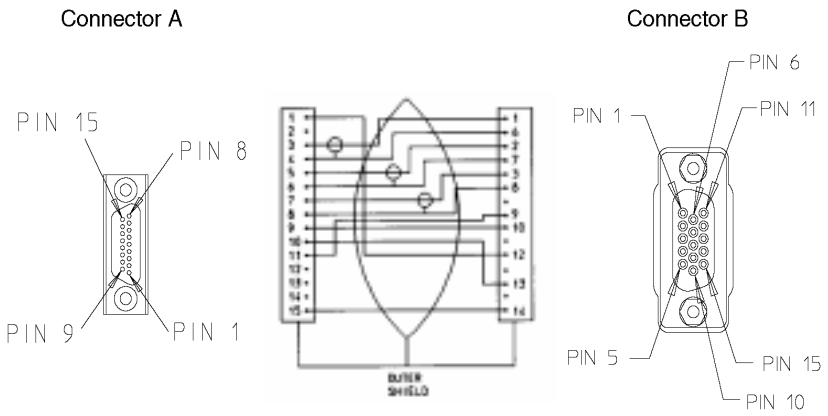



**Figure 5-3 HP A4223A Conversion Video Cable Connectors**

Table 5-3 identifies HP A4223A conversion video cable pins.

**Table 5-3 A4223A Conversion Video Cable Wiring Table**

| 15-Pin MDSM | 15-Pin D-Sub |
|---|---|
| Pin 1 | Pin 12 |
| Pin 2 | |
| Pin 3 | Pin 1 |
| Pin 4 | Pin 6 |
| Pin 5 | Pin 2 |
| Pin 6 | Pin 7 |
| Pin 7 | Pin 3 |
| Pin 8 | Pin 8 |
| Pin 9 | Pin 10 |
| Pin 10 | Pin13 |
| Pin 11 | Pin 9 |
| Pin 12 | |
| Pin 13 | |
| Pin 14 | |
| Pin 15 | Pin 14 |

Figure 5-4 illustrates the connector pin locations on each end of the HP A4305A conversion video cable.

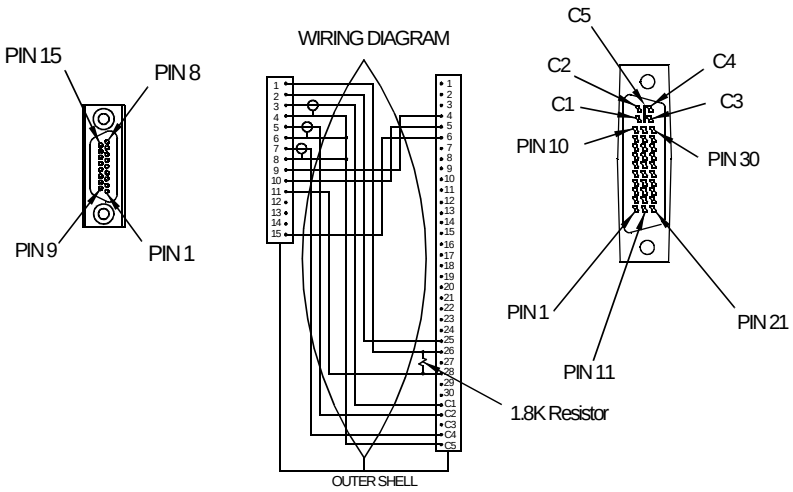



**Figure 5-4 HP A4305A Conversion Video Cable Connectors**

Table 5-4 identifies HP A4305A conversion video cable pins.

**Table 5-4 A4305A Conversion Video Cable Wiring Table**

| 15-Pin MDSM | 35-Pin EVC |
|---|---|
| Pin 1 | Pin 26 |
| Pin 2 | Pin 25 |
| Pin 3 | Pin C1 |
| Pin 4 | Pin C5 |
| Pin 5 | Pin C2 |
| Pin 6 | Pin C5 |
| Pin 7 | Pin C4 |
| Pin 8 | Pin C5 |
| Pin 9 | Pin 4 |
| Pin 10 | Pin 5 |
| Pin 11 | Pin 28 |
| Pin 12 | |
| Pin 13 | |
| Pin 14 | |
| Pin 15 | Pin 6 |

Figure 5-5 illustrates the connector pin locations on each end of the HP A4167A conversion video cable.

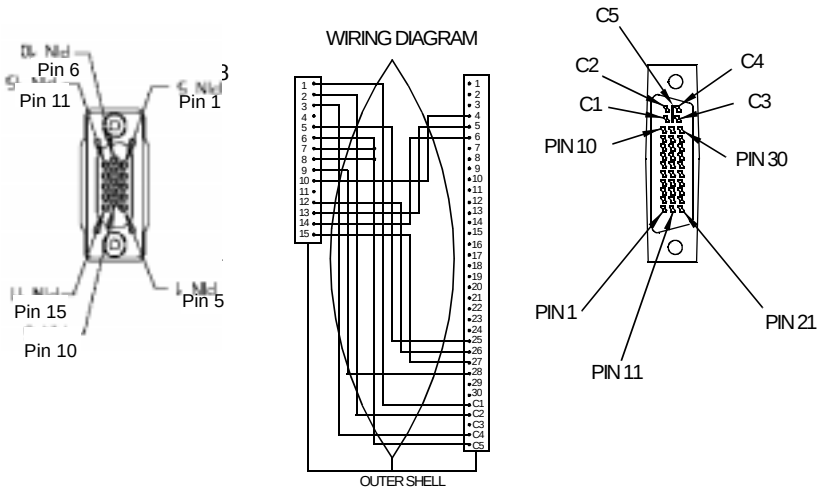



**Figure 5-5 HP A4167A Conversion Video Cable Connectors**

Table 5-5 identifies HP A4167A conversion video cable pins.

**Table 5-5 A4167A Conversion Video Cable Wiring Table**

| 15-Pin D-Sub | 35-Pin EVC |
|---|---|
| Pin 1 | Pin C1 |
| Pin 2 | Pin C2 |
| Pin 3 | Pin C4 |
| Pin 4 | |
| Pin 5 | Pin 25 |
| Pin 6 | Pin C5 |
| Pin 7 | Pin C5 |
| Pin 8 | Pin C5 |
| Pin 9 | Pin 28 |
| Pin 10 | Pin 4 |
| Pin 11 | |
| Pin 12 | Pin 26 |
| Pin 13 | Pin 5 |
| Pin 14 | Pin 6 |
| Pin 15 | Pin 27 |

## Audio Connector Pinouts

This section contains a figure of the audio connector and a table of the audio connector pinouts.

Figure 5-6 illustrates the audio connector pin locations.

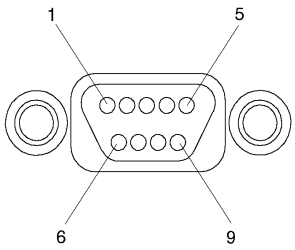



**Figure 5-6 Audio Connector**

Table 5-6 identifies the audio connector pins.

**Table 5-6 Audio Connector Pinouts**

| Pin Number | Signal |
|---|---|
| 1 | Mic in GND |
| 2 | Line in left |
| 3 | Line in right |
| 4 | Headset right |
| 5 | Headset left |
| 6 | Mic in A |
| 7 | Mic Vref |
| 8 | Line in GND |
| 9 | Headset GND |

Figure 5-7 illustrates the connector pin locations on each end of the HP A4302A conversion audio cable.

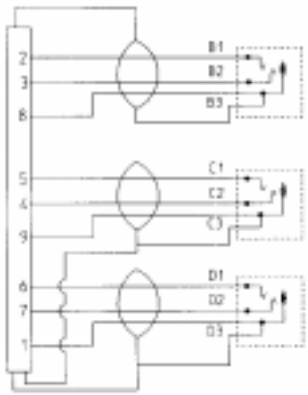



**Figure 5-7 HP A4302A Conversion Audio Cable Connectors**

## HP Parallel Connector Pinouts

This section contains a figure of the HP parallel connector, a table of the HP parallel connector pinouts, the HP4300A conversion HP parallel cable connectors diagrams, and the conversion HP parallel cable wiring table.

Figure 5-8 illustrates the HP parallel connector pin locations.

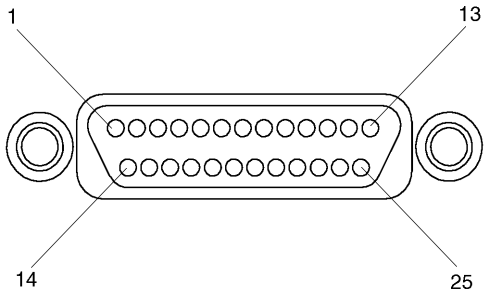



**Figure 5-8 HP Parallel Connector**

Table 5-7 identifies the HP parallel connector pins.

**Table 5-7 HP Parallel Connector Pinouts**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | STROBE | 14 | AFD |
| 2 | Data 0 | 15 | ERROR |
| 3 | Data | 16 | INIT |
| 4 | Data | 17 | SCT IN |
| 5 | Data | 18 | GND |
| 6 | Data | 19 | GND |
| 7 | Data | 20 | GND |
| 8 | Data | 21 | GND |
| 9 | Data | 22 | GND |
| 10 | ACK | 23 | GND |
| 11 | BUSY | 24 | GND |
| 12 | PE | 25 | GND |
| 13 | SLCT | | |

Figure 5-9 illustrates the connector pin locations on each end of the HP A4300A conversion HP parallel cable

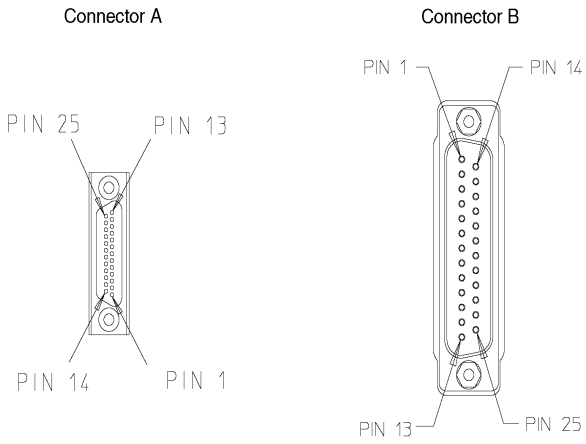



**Figure 5-9 HP A4300A Conversion HP Parallel Cable Connectors**

Table 5-8 identifies the HP A4300A conversion HP parallel cable pins.

**Table 5-8 Conversion HP Parallel Cable Wiring Table**

| 25-Pin MDSM | 25-Pin D-Sub | 25-Pin MDSM | 25-Pin D-Sub |
|---|---|---|---|
| Pin 1 | Pin 1 | Pin 14 | Pin 14 |
| Pin 2 | Pin 2 | Pin 15 | Pin 15 |
| Pin 3 | Pin 3 | Pin 16 | Pin 16 |
| Pin 4 | Pin 4 | Pin 17 | Pin 17 |
| Pin 5 | Pin 5 | Pin 18 | Pin 18 |
| Pin 6 | Pin 6 | Pin 19 | Pin 19 |
| Pin 7 | Pin 7 | Pin 20 | Pin 20 |
| Pin 8 | Pin 8 | Pin 21 | Pin 21 |
| Pin 9 | Pin 9 | Pin 22 | Pin 22 |
| Pin 10 | Pin 10 | Pin 23 | Pin 23 |
| Pin 11 | Pin 11 | Pin 24 | Pin 24 |
| Pin 12 | Pin 12 | Pin 25 | Pin 25 |
| Pin 13 | Pin 13 | | |

## RS-232 Connector Pinouts

This section contains a figure of the RS-232 connector, a table of the RS-232 connector pinouts, the HP 4301A conversion RS-232 cable connectors diagrams, and the conversion RS-232 cable wiring table.

Figure 5-10 illustrates the RS-232 connector pin locations.

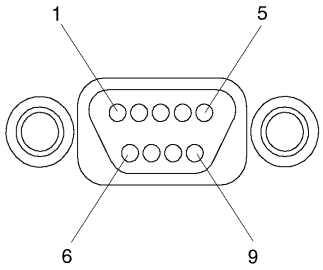



**Figure 5-10** **RS-232 Serial Connector**

Table 5-9 identifies the RS-232 connector pins.

**Table 5-9** **RS-232-C Connector Pinouts**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | DCD | 6 | DSR |
| 2 | RXD | 7 | RTS |
| 3 | TXD | 8 | CTS |
| 4 | DTR | 9 | RI |
| 5 | GND | | |

Figure 5-11 illustrates the connector pin locations on each end of the HP A4301A conversion RS-232 cable.

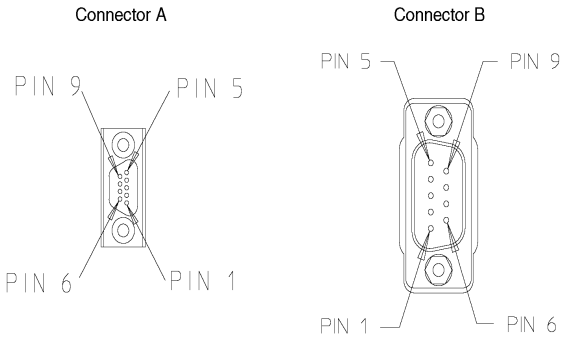



**Figure 5-11 HP A4301A Conversion RS-232 Cable Connectors**

Table 5-10 is the wiring table for the HP A4301A conversion RS-232 cable.

**Table 5-10 Conversion RS-232 Cable Wiring Table**

| 9-Pin MDSM | 9-Pin D-Sub |
|---|---|
| Pin 1 | Pin 1 |
| Pin 2 | Pin 2 |
| Pin 3 | Pin 3 |
| Pin 4 | Pin 4 |
| Pin 5 | Pin 5 |
| Pin 6 | Pin 6 |
| Pin 7 | Pin 7 |
| Pin 8 | Pin 8 |
| Pin 9 | Pin 9 |

## AUI LAN Connector Pinouts

This section contains a figure of the AUI LAN connector, a table of the AUI LAN connector pinouts, the HP 4303A conversion AUI LAN cable connectors diagrams, and the conversion AUI LAN cable wiring table.

Figure 5-12 illustrates the AUI LAN connector pin locations.

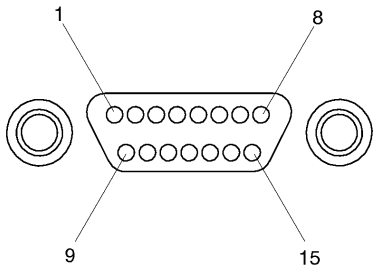



**Figure 5-12 AUI LAN Connector**

Table 5-11 identifies the AUI LAN connector pins.

**Table 5-11 AUI LAN Connector Pinouts**

| Pin Number | Signal | Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|---|---|
| 1 | GND | 6 | GND | 11 | DO-S (GND) |
| 2 | CI-A | 7 | CO-A (NC) | 12 | DI-B |
| 3 | DO-A | 8 | CO-S (NC) | 13 | + 12 V |
| 4 | DI-S (GND) | 9 | CI-B | 14 | GND |
| 5 | DI-A | 10 | DO-B | 15 | CO-B (NC) |

Figure 5-13 illustrates the connector pin locations on each end of the HP A4303A conversion LAN cable.

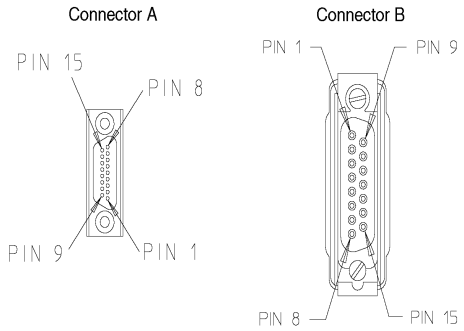



**Figure 5-13 HP A4303A Conversion LAN Cable Connectors**

Table 5-12 is the wiring table for the HP A4303A conversion LAN cable.

**Table 5-12 Conversion LAN Cable Wiring Table**

| 15-Pin MDSM | 15-Pin D-Sub | 15-Pin MDSM | 15-Pin D-Sub |
|---|---|---|---|
| Pin 1 | Pin 1 | Pin 9 | Pin 9 |
| Pin 2 | Pin 2 | Pin 10 | Pin 10 |
| Pin 3 | Pin 3 | Pin 11 | Pin 11 |
| Pin 4 | Pin 4 | Pin 12 | Pin 12 |
| Pin 5 | Pin 5 | Pin 13 | Pin 13 |
| Pin 6 | Pin 6 | Pin 14 | Pin 14 |
| Pin 7 | Pin 7 | Pin 15 | Pin 15 |
| Pin 8 | Pin 8 | | |

## Single-Ended SCSI Connector Pinouts

The section that follows contains a figure of the single-ended SCSI connector and a table of the single-ended SCSI connector pinouts.

Figure 5-14 illustrates the single-ended SCSI connector pin locations.

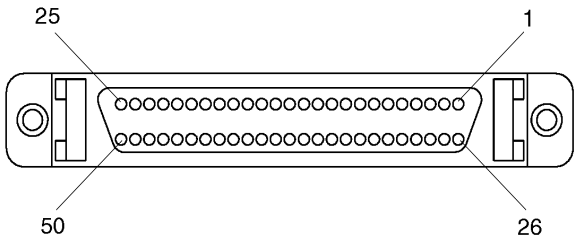



**Figure 5-14 Single-Ended SCSI Connector**

Table 5-13 identifies the single-ended SCSI connector pins.

**Table 5-13 Single-Ended SCSI Connector Pinouts**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | GND | 26 | DATA 0 |
| 2 | GND | 27 | DATA 1 |
| 3 | GND | 28 | DATA 2 |
| 4 | GND | 29 | DATA 3 |
| 5 | GND | 30 | DATA 4 |
| 6 | GND | 31 | DATA 5 |
| 7 | GND | 32 | DATA 6 |
| 8 | GND | 33 | DATA 7 |
| 9 | GND | 34 | Data Parity |
| 10 | GND | 35 | GND |
| 11 | GND | 36 | GND |
| 12 | GND | 37 | GND |
| 13 | GND | 38 | Term_Pwr |
| 14 | GND | 39 | GND |
| 15 | GND | 40 | GND |
| 16 | GND | 41 | ATN |
| 17 | GND | 42 | GND |
| 18 | GND | 43 | BSY |
| 19 | GND | 44 | ACK |
| 20 | GND | 45 | RST |
| 21 | GND | 46 | MSG |
| 22 | GND | 47 | SEL |
| 23 | GND | 48 | CD |
| 24 | GND | 49 | REQ |
| 25 | GND | 50 | IO |

## FW SCSI Connector Pinout

The section that follows contains a figure of the FW SCSI connector and a table of the FW SCSI connector pinouts.

Figure 5-15 illustrates the FW SCSI connector pin locations.

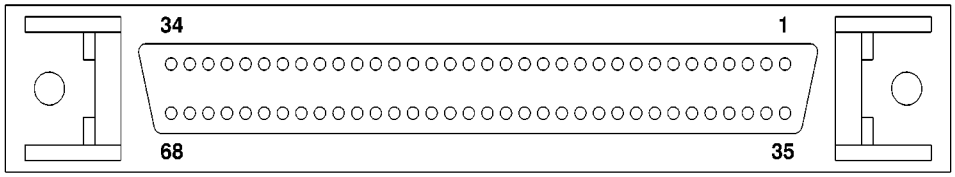



**Figure 5-15 FW SCSI Connector**

Table 5-14 identifies the FW SCSI connector pins.

**Table 5-14 FW SCSI Connector Pinouts**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | FW_SD12+ | 35 | FW_SD12- |
| 2 | FW_SD13+ | 36 | FW_SD13- |
| 3 | FW_SD14+ | 37 | FW_SD14- |
| 4 | FW_SD15+ | 38 | FW_SD15- |
| 5 | FW_SD1+ | 39 | FW_SP1- |
| 6 | GND | 40 | GND |
| 7 | FW_SD0+ | 41 | FW_SD0- |
| 8 | FW_SD1+ | 42 | FW_SD1- |
| 9 | FW_SD2+ | 43 | FW_SD2- |
| 10 | FW_SD3+ | 44 | FW_SD3- |
| 11 | FW_SD4+ | 45 | FW_SD4- |
| 12 | FW_SD5+ | 46 | FW_SD5- |
| 13 | FW_SD6+ | 47 | FW_SD6- |
| 14 | FW_SD7+ | 48 | FW_SD7- |
| 15 | FW_SP0+ | 49 | FW_SP0- |
| 16 | FW_DIFFSENS | 50 | GND |
| 17 | FW_TERM POWER | 51 | FW_TERM POWER |
| 18 | FW_TERM POWER | 52 | FW_TERM POWER |
| 19 | NC | 53 | NC |
| 20 | FW_SATN+ | 54 | FW_SATN- |
| 21 | GND | 55 | GND |
| 22 | FW_SBSY+ | 56 | FW_SBSY- |
| 23 | FW_SACK+ | 57 | FW_SACK- |
| 24 | FW_SRST+ | 58 | FW_SRST- |
| 25 | FW_SYMSG+ | 59 | FW_SMSG- |
| 26 | FW_SSEL+ | 60 | FW_SSEL- |
| 27 | FW_SCD+ | 61 | FW_SCD- |
| 28 | FW_SREQ+ | 62 | FW_SREQ- |
| 29 | FW_SIO+ | 63 | FW_SIO- |
| 30 | GND | 64 | GND |
| 31 | FW_SD8+ | 65 | FW_SD8- |
| 32 | FW_SD9+ | 66 | FW_SD9- |
| 33 | FW_SD10+ | 67 | FW_SD10- |
| 34 | FW_SD11+ | 68 | FW_SD11- |

## PS/2 Connector Pinouts

The following section contains a figure of the PS/2 connector and a table of the PS/2 connector pinouts.

Figure 5-16 illustrates the PS/2 connector pin locations.

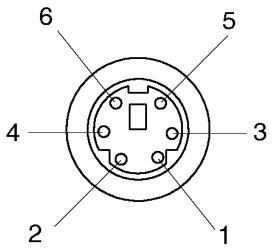



**Figure 5-16 PS/2 Connector**

Table 5-15 identifies the PS/2 connector pins.

**Table 5-15 PS/2 Connector Pinouts**

| Pin Number | Signal |
|---|---|
| 1 | Data |
| 2 | Not used |
| 3 | GND |
| 4 | +5 |
| 5 | Clock |
| 6 | Not used |

## VME Connector Pinouts

This section contains tables for the Model 743, Model 744, and the Model 748 VMEbus P1/J1 pin assignments and signal mnemonics; the Model 748 VMEbus P2/J2, slots 2-8, pin assignments and signal mnemonics; the Model 743 and Model 744 VMEbus P2/J2, slot 1 pin assignments and signal mnemonics. Slot 1 in the Model 748 is reserved for the Model 743 and 744 CPU boards.

Table 5-16 identifies the VMEbus connector pin assignments and signal mnemonics for the Model 743, Model 744, and the Model 748 VME P1/J1.

**Table 5-16 Model 743 and 744/Model 748 VME P1/J1 Pin Assignments and Signal Mnemonics**

| Pin Number | Row A | Row B | Row C |
|---|---|---|---|
| 1 | D00 | BBSY | D08 |
| 2 | D01 | BCLR | D09 |
| 3 | D02 | ACFAIL | D10 |
| 4 | D03 | BG0IN | D11 |
| 5 | D04 | BG0OUT | D12 |
| 6 | D05 | BG1IN | D13 |
| 7 | D06 | BG1OUT | D14 |
| 8 | D07 | BG2IN | D15 |
| 9 | GROUND | BG2OUT | GROUND |
| 10 | SYSCLOCK | BG3IN | SYSFAIL |
| 11 | GROUND | BG3OUT | BERR |
| 12 | DS1 | BR0 | SYSRESET |
| 13 | DS0 | BR1 | LWORD |
| 14 | WRITE | BR2 | AM5 |
| 15 | GND | BR3 | A23 |
| 16 | DTACK | AM0 | A22 |
| 17 | GND | AM1 | A21 |
| 18 | AM2 | AM2 | A20 |
| 19 | AM3 | AM3 | A19 |
| 20 | GND | GND | A18 |
| 21 | IACKIN | NC | A17 |
| 22 | IACKOUT | NC | A16 |
| 23 | AM4 | GND | A15 |
| 24 | A07 | IRQ7 | A14 |
| 25 | A06 | IRQ6 | A13 |
| 26 | A05 | IRQ5 | A12 |
| 27 | A04 | IRQ4 | A11 |
| 28 | A03 | IRQ3 | A10 |
| 29 | A02 | IRQ2 | A09 |
| 30 | A01 | IRQ1 | A08 |
| 31 | -12Vdc | NC | +12Vdc |
| 32 | +5Vdc | +5Vdc | +5Vdc |

Table 5-17 identifies the VMEbus connector pin assignments and signal mnemonics for the Model 748 VME P2/J2, slots 2 - 8.

**Table 5-17 Model 748 VME P2/J2 Pin Assignments and Signal Mnemonics**

| Pin Number | Row A | Row B | Row C |
|---|---|---|---|
| 1 | User defined | +5Vdc | User defined |
| 2 | User defined | GND | User defined |
| 3 | User defined | Reserved | User defined |
| 4 | User defined | A24 | User defined |
| 5 | User defined | A25 | User defined |
| 6 | User defined | A26 | User defined |
| 7 | User defined | A27 | User defined |
| 8 | User defined | A28 | User defined |
| 9 | User defined | A29 | User defined |
| 10 | User defined | A30 | User defined |
| 11 | User defined | A31 | User defined |
| 12 | User defined | GND | User defined |
| 13 | User defined | +5Vdc | User defined |
| 14 | User defined | D16 | User defined |
| 15 | User defined | D17 | User defined |
| 16 | User defined | D18 | User defined |
| 17 | User defined | D19 | User defined |
| 18 | User defined | D20 | User defined |
| 19 | User defined | D21 | User defined |
| 20 | User defined | D22 | User defined |
| 21 | User defined | D23 | User defined |
| 22 | User defined | GND | User defined |
| 23 | User defined | D24 | User defined |
| 24 | User defined | D25 | User defined |
| 25 | User defined | D26 | User defined |
| 26 | User defined | D27 | User defined |
| 27 | User defined | D28 | User defined |
| 28 | User defined | D29 | User defined |
| 29 | User defined | D30 | User defined |
| 30 | User defined | D31 | User defined |
| 31 | User defined | GND | User defined |
| 32 | User defined | +5Vdc | User defined |

Table 5-18 identifies the VMEbus connector pin assignments and signal mnemonics for the Model 743 P2.

**Table 5-18 Model 743 P2/J2 Pin Assignments and Signal Mnemonics - Slot 1**

| Pin Number | Row A | Row B | Row C |
|---|---|---|---|
| 1 | SYNCL | +5Vdc | GSC_AD[0] |
| 2 | SYNCH | GND | GSC_AD[1] |
| 3 | NC | Reserved | GSC_AD[2] |
| 4 | RESET_L | A24 | GSC_AD[3] |
| 5 | NC | A25 | GSC_AD[4] |
| 6 | GSC_BR_L | A26 | GSC_AD[5] |
| 7 | GSC_BG_L | A27 | GSC_AD[6] |
| 8 | NC | A28 | GSC_AD[7] |
| 9 | GSC_ADDV_L | A29 | GSC_AD[8] |
| 10 | GSC_READY_L | A30 | GSC_AD[9] |
| 11 | NC | A31 | GSC_AD[10] |
| 12 | GSC_ERROR_L | GND | GSC_AD[11] |
| 13 | GSC_PARITY_L | +5Vdc | GSC_AD[12] |
| 14 | GSC_XQ_L | D16 | GSC_AD[13] |
| 15 | GSC_LS_L | D17 | GSC_AD[14] |
| 16 | NC | D18 | GSC_AD[15] |
| 17 | GSC_TYPE[0] | D19 | GSC_AD[16] |
| 18 | GSC_TYPE[1] | D20 | GSC_AD[17] |
| 19 | GSC_TYPE[2] | D21 | GSC_AD[18] |
| 20 | GSC_TYPE[3] | D22 | GSC_AD[19] |
| 21 | NC | D23 | GSC_AD[20] |
| 22 | SYNCTTL | GND | GSC_AD[21] |
| 23 | SP_DETECT | D24 | GSC_AD[22] |
| 24 | ALT_BR_L | D25 | GSC_AD[23] |
| 25 | ALT_BG_L | D26 | GSC_AD[24] |
| 26 | NC | D27 | GSC_AD[25] |
| 27 | NC | D28 | GSC_AD[26] |
| 28 | TDO | D29 | GSC_AD[27] |
| 29 | TDI | D30 | GSC_AD[28] |
| 30 | TCK | D31 | GSC_AD[29] |
| 31 | TMS | GND | GSC_AD[30] |
| 32 | TRST | +5Vdc | GSC_AD[31] |

Table 5-19 identifies the VMEbus connector pin assignments and signal mnemonics for the Model 744 VME P2.

**Table 5-19 Model 744 VME P2 Pin Assignments and Signal Mnemonics**

| Pin Number | Row A | Row B | Row C |
|---|---|---|---|
| 1 | SYNCHWAXL | +5 V | GSC_AD0 |
| 2 | SYNCHWAXH | GND | GSC_AD1 |
| 3 | NC | Reserved | GSC_AD2 |
| 4 | WAX_RST_L | VME_A24 | GSC_AD3 |
| 5 | NC | VME_A25 | GSC_AD4 |
| 6 | GSC_BR_L(2) | VME_A26 | GSC_AD5 |
| 7 | GSC_BG_L(2) | VME_A27 | GSC_AD6 |
| 8 | NC | VME_A28 | GSC_AD7 |
| 9 | GSC_ADDV_L | VME_A29 | GSC_AD8 |
| 10 | GSC_READY_L | VME_A30 | GSC_AD9 |
| 11 | NC | VME_A31 | GSC_AD10 |
| 12 | GSC_ERROR_L | GND | GSC_AD11 |
| 13 | GSC_PARITY_L | +5 V | GSC_AD12 |
| 14 | GSC_XQ_L | VME_D16 | GSC_AD13 |
| 15 | GSC_LS_L | VME_D17 | GSC_AD14 |
| 16 | NC | VME_D18 | GSC_AD15 |
| 17 | GSC_TYPE0 | VME_D19 | GSC_AD16 |
| 18 | GSC_TYPE1 | VME_D20 | GSC_AD17 |
| 19 | GSC_TYPE2 | VME_D21 | GSC_AD18 |
| 20 | GSC_TYPE3 | VME_D22 | GSC_AD19 |
| 21 | NC | VME_D23 | GSC_AD20 |
| 22 | SYNCTTL | GND | GSC_AD21 |
| 23 | SP_DETECT | VME_D24 | GSC_AD22 |
| 24 | ALT_BR_L | VME_D25 | GSC_AD23 |
| 25 | ALT_BG_L | VME_D26 | GSC_AD24 |
| 26 | NC | VME_D27 | GSC_AD25 |
| 27 | NC | VME_D28 | GSC_AD26 |
| 28 | TDO | VME_D29 | GSC_AD27 |
| 29 | TDI | VME_D30 | GSC_AD28 |
| 30 | TCK | VME_D31 | GSC_AD29 |
| 31 | TMS | GND | GSC_AD30 |

**Table 5-19 Model 744 VME P2 Pin Assignments and Signal Mnemonics**

| Pin Number | Row A | Row B | Row C |
|---|---|---|---|
| 32 | TRST | +5 V | GSC_AD31 |

Table 5-29 identifies the PMC JN1 signals on the PMC Bridge J21 connectors.

**Table 5-20 PMC JN1 Signals (Bridge J21)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | TCK | 2 | -12V |
| 3 | Ground | 4 | INTC |
| 5 | INTB# | 6 | INTA |
| 7 | BUSMODE1# | 8 | +5V |
| 9 | INTD# | 10 | PCI-RESERVED |
| 11 | Ground | 12 | PCI-RESERVED |
| 13 | CLK | 14 | Ground |
| 15 | Ground | 16 | GNTB# |
| 17 | REQB# | 18 | +5V |
| 19 | VDD(I/O) | 20 | AD31 |
| 21 | AD28 | 22 | AD27 |
| 23 | AD25 | 24 | Ground |
| 25 | Ground | 26 | C/BE3# |
| 27 | AD22 | 28 | AD21 |
| 29 | AD19 | 30 | +5V |
| 31 | VDD(I/O) | 32 | AD17 |
| 33 | FRAME# | 34 | Ground |
| 35 | Ground | 36 | IRDY# |
| 37 | DEVSEL# | 38 | +5V |
| 39 | Ground | 40 | LOCK# |
| 41 | SDONE# | 42 | SBO# |
| 43 | PAR | 44 | Ground |
| 45 | VDD(I/O) | 46 | AD15 |
| 47 | AD12 | 48 | AD11 |
| 49 | AD09 | 50 | +5V |
| 51 | Ground | 52 | C/BE0# |
| 53 | AD06 | 54 | AD05 |
| 55 | AD04 | 56 | Ground |

**Table 5-20 PMC JN1 Signals (Bridge J21)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 57 | VDD(I/O) | 58 | AD03 |
| 59 | AD02 | 60 | AD01 |
| 61 | AD00 | 62 | +5V |
| 63 | Ground | 64 | REQ64# |

Table 5-29 identifies the PMC JN2 signals on the PMC Bridge J22 connectors.

**Table 5-21 PMC JN2 Signals (Bridge J22)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | +12V | 2 | TRST# |
| 3 | TMS | 4 | TDO |
| 5 | TDI | 6 | Ground |
| 7 | Ground | 8 | PCI-RESERVED |
| 9 | PCI-RESERVED | 10 | PCI-RESERVED |
| 11 | BUSMODE2# | 12 | +3.3V |
| 13 | RST | 14 | BUSMODE3 |
| 15 | +3.3V | 16 | BUSMODE4 |
| 17 | PCI-RESERVED | 18 | Ground |
| 19 | AD30 | 20 | AD29 |
| 21 | Ground | 22 | AD26 |
| 23 | AD24 | 24 | +3.3V |
| 25 | IDSEL(1) | 26 | AD23 |
| 27 | +3.3V | 28 | AD20 |
| 29 | AD18 | 30 | Ground |
| 31 | AD16 | 32 | C/BE2# |
| 33 | Ground | 34 | PMC-RSVD |
| 35 | TRDY# | 36 | +3.3V |
| 37 | Ground | 38 | STOP# |
| 39 | PERR# | 40 | Ground |
| 41 | +3.3V | 42 | SERR# |
| 43 | C/BE1# | 44 | Ground |
| 45 | AD14 | 46 | AD13 |
| 47 | Ground | 48 | AD10 |
| 49 | AD08 | 50 | +3.3V |

**Table 5-21 PMC JN2 Signals (Bridge J22)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 51 | AD07 | 52 | PMC-RSVD |
| 53 | +3.3V | 54 | PMC-RSVD |
| 55 | PMC-RSVD | 56 | Ground |
| 57 | PMC-RSVD | 58 | PMC-RSVD |
| 59 | Ground | 60 | PMC-RSVD |
| 61 | ACK64# | 62 | +3.3V |
| 63 | Ground | 64 | PMC-RSVD |

Table 5-28 identifies the PMC JN1 signals on the PMC Bridge J11 connectors.

**Table 5-22 PMC JN1 Signals (Bridge J11)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | TCK | 2 | -12V |
| 3 | Ground | 4 | INTB |
| 5 | INTC# | 6 | INTD |
| 7 | BUSMODE1# | 8 | +5V |
| 9 | INTA# | 10 | PCI-RESERVED |
| 11 | Ground | 12 | PCI-RESERVED |
| 13 | CLK | 14 | Ground |
| 15 | Ground | 16 | GNTA# |
| 17 | REQA# | 18 | +5V |
| 19 | VDD(I/O) | 20 | AD31 |
| 21 | AD28 | 22 | AD27 |
| 23 | AD25 | 24 | Ground |
| 25 | Ground | 26 | C/BE3# |
| 27 | AD22 | 28 | AD21 |
| 29 | AD19 | 30 | +5V |
| 31 | VDD(I/O) | 32 | AD17 |
| 33 | FRAME# | 34 | Ground |
| 35 | Ground | 36 | IRDY# |
| 37 | DEVSEL# | 38 | +5V |
| 39 | Ground | 40 | LOCK# |
| 41 | SDONE# | 42 | SBO# |
| 43 | PAR | 44 | Ground |

**Table 5-22 PMC JN1 Signals (Bridge J11)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 45 | VDD(I/O) | 46 | AD15 |
| 47 | AD12 | 48 | AD11 |
| 49 | AD09 | 50 | +5V |
| 51 | Ground | 52 | C/BE0# |
| 53 | AD06 | 54 | AD05 |
| 55 | AD04 | 56 | Ground |
| 57 | VDD(I/O) | 58 | AD03 |
| 59 | AD02 | 60 | AD01 |
| 61 | AD00 | 62 | +5V |
| 63 | Ground | 64 | REQ64# |

Table 5-29 identifies the PMC JN2 signals on the PMC Bridge J12 connectors.

**Table 5-23 PMC JN2 Signals (Bridge J12)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | +12V | 2 | TRST# |
| 3 | TMS | 4 | TDO |
| 5 | TDI | 6 | Ground |
| 7 | Ground | 8 | PCI-RESERVED |
| 9 | PCI-RESERVED | 10 | PCI-RESERVED |
| 11 | BUSMODE2# | 12 | +3.3V |
| 13 | RST | 14 | BUSMODE3 |
| 15 | +3.3V | 16 | BUSMODE4 |
| 17 | PCI-RESERVED | 18 | Ground |
| 19 | AD30 | 20 | AD29 |
| 21 | Ground | 22 | AD26 |
| 23 | AD24 | 24 | +3.3V |
| 25 | IDSEL(2) | 26 | AD23 |
| 27 | +3.3V | 28 | AD20 |
| 29 | AD18 | 30 | Ground |
| 31 | AD16 | 32 | C/BE2# |
| 33 | Ground | 34 | PMC-RSVD |
| 35 | TRDY# | 36 | +3.3V |
| 37 | Ground | 38 | STOP# |

**Table 5-23 PMC JN2 Signals (Bridge J12)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 39 | PERR# | 40 | Ground |
| 41 | +3.3V | 42 | SERR# |
| 43 | C/BE1# | 44 | Ground |
| 45 | AD14 | 46 | AD13 |
| 47 | Ground | 48 | AD10 |
| 49 | AD08 | 50 | +3.3V |
| 51 | AD07 | 52 | PMC-RSVD |
| 53 | +3.3V | 54 | PMC-RSVD |
| 55 | PMC-RSVD | 56 | Ground |
| 57 | PMC-RSVD | 58 | PMC-RSVD |
| 59 | Ground | 60 | PMC-RSVD |
| 61 | ACK64# | 62 | +3.3V |
| 63 | Ground | 64 | PMC-RSVD |

Table 5-25 identifies the PMC JN4 User Defined pin outs on the PMC Bridge J14 connector that is wired to the VME backplane P2 connector.

**Table 5-24 PMC JN4 Pin Outs (Bridge J14)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | P2-C1 | 2 | P2-A1 |
| 3 | P2-C2 | 4 | P2-A2 |
| 5 | P2-C3 | 6 | P2-A3 |
| 7 | P2-C4 | 8 | P2-A4 |
| 9 | P2-C5 | 10 | P2-A5 |
| 11 | P2-C6 | 12 | P2-A6 |
| 13 | P2-C7 | 14 | P2-A7 |
| 15 | P2-C8 | 16 | P2-A8 |
| 17 | P2-C9 | 18 | P2-A9 |
| 19 | P2-C10 | 20 | P2-A10 |
| 21 | P2-C11 | 22 | P2-A11 |
| 23 | P2-C12 | 24 | P2-A12 |
| 25 | P2-C13 | 26 | P2-A13 |
| 27 | P2-C14 | 28 | P2-A14 |
| 29 | P2-C15 | 30 | P2-A15 |

**Table 5-24 PMC JN4 Pin Outs (Bridge J14)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 31 | P2-C16 | 32 | P2-A16 |
| 33 | P2-C17 | 34 | P2-A17 |
| 35 | P2-C18 | 36 | P2-A18 |
| 37 | P2-C19 | 38 | P2-A19 |
| 39 | P2-C20 | 40 | P2-A20 |
| 41 | P2-C21 | 42 | P2-A21 |
| 43 | P2-C22 | 44 | P2-A22 |
| 45 | P2-C23 | 46 | P2-A23 |
| 47 | P2-C24 | 48 | P2-A24 |
| 49 | P2-C25 | 50 | P2-A25 |
| 51 | P2-C26 | 52 | P2-A26 |
| 53 | P2-C27 | 54 | P2-A27 |
| 55 | P2-C28 | 56 | P2-A28 |
| 57 | P2-C29 | 58 | P2-A29 |
| 59 | P2-C30 | 60 | P2-A30 |
| 61 | P2-C31 | 62 | P2-A31 |
| 63 | P2-C32 | 64 | P2-A32 |

Table 5-25 identifies the PMC Bridge J3 connector that routes signals from the bridge board to the PMC expander board.

**Table 5-25 PMC Bridge J3 Connector**

| Pin Number | Signal | Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|---|---|
| 1 | SYNC-EXP1 | 39 | GSC-AD23 | 114 | PCI-STOP-L |
| 2 | GSC-READY-L | 40 | GSC-AD24 | 115 | PCI-AD0 |
| 3 | GSC-RESET-L | 41 | GSC-AD25 | 116 | PCI-AD1 |
| 4 | GSC-ADDV-L | 42 | GSC-AD26 | 117 | PCI-AD2 |
| 5 | SYNC-EXP1-L | 43 | GSC-AD27 | 118 | PCI-AD3 |
| 6 | GSC-BR-L | 44 | GSC-AD28 | 119 | PCI-AD4 |
| 7 | GSC-BG-L | 45 | GSC-AD29 | 120 | PCI-AD5 |
| 8 | GSC-INTR-L | 46 | GSC-AD30 | 121 | PCI-AD6 |
| 9 | GSC-ERROR-L | 47 | GSC-AD31 | 122 | PCI-AD7 |
| 10 | GSC-PARITY | 48 | GSC-TYPE0 | 123 | PCI-AD8 |
| 11 | GSC-XO-L | 49 | GSC-TYPE1 | 124 | PCI-AD9 |
| 12 | GSC-LS-L | 50 | GSC-TYPE2 | 125 | PCI-AD10 |
| 13 | TRSTL | 51 | GSC-TYPE3 | 126 | PCI-AD11 |
| 14 | TMS | 52 | VDL | 127 | PCI-AD12 |
| 15 | VDL | 53 | VDL | 128 | PCI-AD13 |

**Table 5-25 PMC Bridge J3 Connector**

| Pin Number | Signal | Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|---|---|
| 16 | GSC-AD0 | 54 | VDL | 129 | PCI-AD14 |
| 17 | GSC-AD1 | 55 | VDL | 130 | PCI-AD15 |
| 18 | GSC-AD2 | 56 | VDL | 131 | PCI-AD16 |
| 19 | GSC-AD3 | 57 | VDL | 132 | PCI-AD17 |
| 20 | GSC-AD4 | 58-95 | No connect | 133 | PCI-AD18 |
| 21 | GSC-AD5 | 96 | PCI-RST-L | 134 | PCI-AD19 |
| 22 | GSC-AD6 | 97 | PCI-SL3-CLK | 135 | PCI-AD20 |
| 23 | GSC-AD7 | 98 | PCI-FRAME-L | 136 | PCI-AD21 |
| 24 | GSC-AD8 | 99 | PCI-SL4-CLK | 137 | PCI-AD22 |
| 25 | GSC-AD9 | 100 | PCI-CBEO | 138 | PCI-AD23 |
| 26 | GSC-AD10 | 101 | PCI-CBE1 | 139 | PCI-AD24 |
| 27 | GSC-AD11 | 102 | PCI-CBE2 | 140 | PCI-AD25 |
| 28 | GSC-AD12 | 103 | PCI-CBE3 | 141 | PCI-AD26 |
| 29 | GSC-AD13 | 104 | PCI-SERR-L | 142 | PCI-AD27 |
| 30 | GSC-AD14 | 105 | PCI-PERR-L | 143 | PCI-AD28 |
| 31 | GSC-AD15 | 106 | PCI-PAR | 144 | PCI-AD29 |
| 32 | GSC-AD16 | 107 | PCI-REQC-L | 144 | PCI-AD30 |
| 33 | GSC-AD17 | 108 | PCI-GNTC-L | 146 | PCI-AD31 |
| 34 | GSC-AD18 | 109 | PCI-REQD-L | 147 | PCI-INTA-L |
| 35 | GSC-AD19 | 110 | PCI-GNTD-L | 148 | PCI-INTB-L |
| 36 | GSC-AD20 | 111 | PCI-TRDY-L | 149 | PCI-INTC-L |
| 37 | GSC-AD21 | 112 | PCI-IRDY-L | 150 | PCI-INTD-L |
| 38 | GSC-AD22 | 113 | PCI-LOCK-L | 151 | PCI-DEVSEL-L |
| | | | | 152 | VDL |

Table 5-26 identifies the PMC JN1 signals on the PMC Expander J31 connectors.

**Table 5-26 PMC JN1 Signals (Expander J31)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | TCK | 2 | -12V |
| 3 | Ground | 4 | INTD |
| 5 | INTA# | 6 | INTB |
| 7 | BUSMODE1# | 8 | +5V |
| 9 | INTC# | 10 | PCI-RESERVED |
| 11 | Ground | 12 | PCI-RESERVED |
| 13 | CLK | 14 | Ground |
| 15 | Ground | 16 | GNTC# |

**Table 5-26 PMC JN1 Signals (Expander J31)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 17 | REQC# | 18 | +5V |
| 19 | VDD(I/O) | 20 | AD31 |
| 21 | AD28 | 22 | AD27 |
| 23 | AD25 | 24 | Ground |
| 25 | Ground | 26 | C/BE3# |
| 27 | AD22 | 28 | AD21 |
| 29 | AD19 | 30 | +5V |
| 31 | VDD(I/O) | 32 | AD17 |
| 33 | FRAME# | 34 | Ground |
| 35 | Ground | 36 | IRDY# |
| 37 | DEVSEL# | 38 | +5V |
| 39 | Ground | 40 | LOCK# |
| 41 | SDONE# | 42 | SBO# |
| 43 | PAR | 44 | Ground |
| 45 | VDD(I/O) | 46 | AD15 |
| 47 | AD12 | 48 | AD11 |
| 49 | AD09 | 50 | +5V |
| 51 | Ground | 52 | C/BE0# |
| 53 | AD06 | 54 | AD05 |
| 55 | AD04 | 56 | Ground |
| 57 | VDD(I/O) | 58 | AD03 |
| 59 | AD02 | 60 | AD01 |
| 61 | AD00 | 62 | +5V |
| 63 | Ground | 64 | REQ64# |

Table 5-27 identifies the PMC JN2 signals on the PMC Expander J32 connectors.

**Table 5-27 PMC JN2 Signals (Expander J32)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | +12V | 2 | TRST# |
| 3 | TMS | 4 | TDO |
| 5 | TDI | 6 | Ground |
| 7 | Ground | 8 | PCI-RESERVED |
| 9 | PCI-RESERVED | 10 | PCI-RESERVED |

**Table 5-27 PMC JN2 Signals (Expander J32)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 11 | BUSMODE2# | 12 | +3.3V |
| 13 | RST | 14 | BUSMODE3 |
| 15 | +3.3V | 16 | BUSMODE4 |
| 17 | PCI-RESERVED | 18 | Ground |
| 19 | AD30 | 20 | AD29 |
| 21 | Ground | 22 | AD26 |
| 23 | AD24 | 24 | +3.3V |
| 25 | IDSEL(3) | 26 | AD23 |
| 27 | +3.3V | 28 | AD20 |
| 29 | AD18 | 30 | Ground |
| 31 | AD16 | 32 | C/BE2# |
| 33 | Ground | 34 | PMC-RSVD |
| 35 | TRDY# | 36 | +3.3V |
| 37 | Ground | 38 | STOP# |
| 39 | PERR# | 40 | Ground |
| 41 | +3.3V | 42 | SERR# |
| 43 | C/BE1# | 44 | Ground |
| 45 | AD14 | 46 | AD13 |
| 47 | Ground | 48 | AD10 |
| 49 | AD08 | 50 | +3.3V |
| 51 | AD07 | 52 | PMC-RSVD |
| 53 | +3.3V | 54 | PMC-RSVD |
| 55 | PMC-RSVD | 56 | Ground |
| 57 | PMC-RSVD | 58 | PMC-RSVD |
| 59 | Ground | 60 | PMC-RSVD |
| 61 | ACK64# | 62 | +3.3V |
| 63 | Ground | 64 | PMC-RSVD |

Table 5-28 identifies the PMC JN1 signals on the PMC Expander J41 connectors.

**Table 5-28 PMC JN1 Signals (Expander J41)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | TCK | 2 | -12V |
| 3 | Ground | 4 | INTA |

**Table 5-28 PMC JN1 Signals (Expander J41)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 5 | INTB# | 6 | INTC |
| 7 | BUSMODE1# | 8 | +5V |
| 9 | INTD# | 10 | PCI-RESERVED |
| 11 | Ground | 12 | PCI-RESERVED |
| 13 | CLK | 14 | Ground |
| 15 | Ground | 16 | GNTD# |
| 17 | REQD# | 18 | +5V |
| 19 | VDD(I/O) | 20 | AD31 |
| 21 | AD28 | 22 | AD27 |
| 23 | AD25 | 24 | Ground |
| 25 | Ground | 26 | C/BE3# |
| 27 | AD22 | 28 | AD21 |
| 29 | AD19 | 30 | +5V |
| 31 | VDD(I/O) | 32 | AD17 |
| 33 | FRAME# | 34 | Ground |
| 35 | Ground | 36 | IRDY# |
| 37 | DEVSEL# | 38 | +5V |
| 39 | Ground | 40 | LOCK# |
| 41 | SDONE# | 42 | SBO# |
| 43 | PAR | 44 | Ground |
| 45 | VDD(I/O) | 46 | AD15 |
| 47 | AD12 | 48 | AD11 |
| 49 | AD09 | 50 | +5V |
| 51 | Ground | 52 | C/BE0# |
| 53 | AD06 | 54 | AD05 |
| 55 | AD04 | 56 | Ground |
| 57 | VDD(I/O) | 58 | AD03 |
| 59 | AD02 | 60 | AD01 |
| 61 | AD00 | 62 | +5V |
| 63 | Ground | 64 | REQ64# |

Table 5-29 identifies the PMC JN2 signals on the PMC Expander J42 connectors.

**Table 5-29 PMC JN2 Signals (Expander J42)**

| Pin Number | Signal | Pin Number | Signal |
|---|---|---|---|
| 1 | +12V | 2 | TRST# |
| 3 | TMS | 4 | TDO |
| 5 | TDI | 6 | Ground |
| 7 | Ground | 8 | PCI-RESERVED |
| 9 | PCI-RESERVED | 10 | PCI-RESERVED |
| 11 | BUSMODE2# | 12 | +3.3V |
| 13 | RST | 14 | BUSMODE3 |
| 15 | +3.3V | 16 | BUSMODE4 |
| 17 | PCI-RESERVED | 18 | Ground |
| 19 | AD30 | 20 | AD29 |
| 21 | Ground | 22 | AD26 |
| 23 | AD24 | 24 | +3.3V |
| 25 | IDSEL4) | 26 | AD23 |
| 27 | +3.3V | 28 | AD20 |
| 29 | AD18 | 30 | Ground |
| 31 | AD16 | 32 | C/BE2# |
| 33 | Ground | 34 | PMC-RSVD |
| 35 | TRDY# | 36 | +3.3V |
| 37 | Ground | 38 | STOP# |
| 39 | PERR# | 40 | Ground |
| 41 | +3.3V | 42 | SERR# |
| 43 | C/BE1# | 44 | Ground |
| 45 | AD14 | 46 | AD13 |
| 47 | Ground | 48 | AD10 |
| 49 | AD08 | 50 | +3.3V |
| 51 | AD07 | 52 | PMC-RSVD |
| 53 | +3.3V | 54 | PMC-RSVD |
| 55 | PMC-RSVD | 56 | Ground |
| 57 | PMC-RSVD | 58 | PMC-RSVD |
| 59 | Ground | 60 | PMC-RSVD |
| 61 | ACK64# | 62 | +3.3V |
| 63 | Ground | 64 | PMC-RSVD |

## Real-Time Clock (RTC) Battery Information

The following section contains information on the real-time clock battery.

### Battery Specifications

Table 5-30 summarizes the RTC battery specifications.

**Table 5-30 RTC Battery Specifications**

| Type | Voltage | Manufacturer | Manufacturer Part No | HP Part No. | Battery Life Power Off | Battery Life Power On |
|---|---|---|---|---|---|---|
| Lithium | 3 Vdc | Panasonic (743)<br>RAYOVAC (744) | BR-1616 (743)<br>BR-1225 (744) | 1420-0525 (743)<br>1420-0541 (744) | .5 Yr (743)<br>1 Yr (744) | 10 Years |

***WARNING:*** **Danger of explosion if battery is incorrectly replaced.**

**Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.**

## Video Output Signal Specifications

The following input signal specifications are typical for all HP monitors:

- Output connector - 15-pin MDSM
- Impedance - 75 ohms Signal levels -
- Signal levels follow EIA standard RS-343A; white is positive. The composite sync is supplied on the green signal only. Horizontal sync pulses do not need to be supplied during the vertical sync pulse. However, the 75 Hz VESA-standard timing should use separate TTL horizontal and vertical syncs. Sync-on-green should not be supplied simultaneously with the separate syncs.

## Video Timing Specifications

This section contains information on video timing specifications. These specifications are not the output timing specifications for any particular graphics option. They are the input specifications for Hewlett-Packard monitors.

Table 5-31 summarizes the timing specifications for the 1024 x 768 and 1280 x 1024 monitors at 60 Hz, 75 Hz, and 72 Hz.

**Table 5-31 Timing Specifications at 60 Hz, 75 Hz, and 72 Hz**

| Signal | D2806A 1024x768 60 Hz | D2806A 1024x768 75 Hz | A4330A/ A4331 1280x1024 60Hz | A4330A/ A4331 1280x1024 72 Hz |
|---|---|---|---|---|
| Horizontal active scan | 15.97µs | 12.105µs | 11.832µs | 9.482µs |
| Horizontal “back porch” | 2.00µs | 1.513µs | 1.849µs | 1.422µs |
| Horizontal blanking | 4.99µs | 3.783µs | 3.956µs | 3.318µs |
| Horizontal “front porch” | 1.00µs | 0.756µs | 0.407µs | 0.474µs |
| Horizontal period (“1H”) | 20.96µs | 15.888µs | 15.788µs | 12.800µs |
| Horizontal sweep frequency | 47.7KHz | 62.936KHz | 63.34KHz | 78.125KHz |
| Horizontal sync width | 2.00µs | 1.513µs | 1.701µs | 1.422µs |
| Pixel clock rate | 64.1088MHz | 84.587MHz | 108.181MHz | 135.000MHz |
| Vertical active period | 16.097ms | 12.202ms | 16.167ms | 13.107ms |
| Vertical “back porch” | 419.20µs (20H) | 1.016ms (64H) | 410.49 µs (26H) | 704.00µs (55H) |
| Vertical blanking | 0.570ms | 1.144ms | .505ms | 0.780ms |
| Vertical frame rate | 60Hz (non-in) | 74.924Hz (non-in) | 60Hz (non-in) | 72.005Hz (non-in) |
| Vertical “front porch” | 62.89µs (3H) | 63.55µs (4H) | 47.36µs (3H) | 38.400µs (3H) |
| Vertical period | 16.667ms | 13.346ms | 16.672ms | 13.887ms |
| Vertical sync width | 83.86µs (4H) | 63.55µs (4H) | 47.36µs (3H) | 38.400µs (3H) |

Table 5-32 summarizes the timing specifications for the 1024 x 768 and 1280 x 1024 monitors at VESA 75 Hz standard.

**Table 5-32 Timing Specifications for VESA 75 HZ Standard**

| Signal | D2806A 1024x768 75 Hz VESA | A4330A/A4331 1280x1024 75 Hz VESA |
|---|---|---|
| Horizontal active scan | 13.003µs | 9.481µs |
| Horizontal “back porch” | 2,235µs | 1.837µs |
| Horizontal blanking | 3.367µs | 3.022µs |
| Horizontal “front porch” | 0.203µs | 0.119µs |
| Horizontal period (“1H”) | 16.660µs | 12.504µs |
| Horizontal sweep frequency | 60.023KHz | 79.976KHz |
| Horizontal sync width | 1.219µs | 1.067µs |
| Pixel clock rate | 78.750 MHz | 135.000Mhz |
| Vertical active period | 12.795ms | 12.804ms |
| Vertical “back porch” | 466.48µs | 475.15µs |
| Vertical blanking | 0.533ms | 0.525ms |
| Vertical frame rate | 75.029Hz (non-in) | 75.025Hz (non-in) |
| Vertical “front porch” | 16.66µs (1H) | 13.000µs (1H) |
| Vertical period | 13.328ms | 13.329ms |
| Vertical sync width | 49.98 µs (3H) | 37.520µs (3H) |

In the past, Hewlett-Packard workstation timing was set with sync-on-green. The VESA standard provides separate TTL syncs, thereby providing an unambiguous way for the monitor to distinguish them.

# 6

# Power Requirements

This chapter discusses power distribution, monitor ac power specifications, and power budgeting.

## Power Distribution

The VMEbus chassis connectors P1 and P2 distribute power to the Model 743 and Model 744 board computer's PC boards as follows:

Graphics cards receive power through the adapter board's P1 and P2 connectors. RAM cards receive power through the RAM stack connectors. The system board and RAM card receive power through the system board's P1 and P2 connectors.

***NOTE:*** VME P1 and P2 connectors use two or more pins to carry power or grounds to the board computer. Check the VME P1 and P2 pinout tables for exact pin identification for power and grounds.

Figure 6-1 and Figure 6-2 illustrate the power distribution for the Model 743 and Model 744 VMEbus board computers. Figure 6-3 and Figure 6-4 illustrate the power distribution for the GSC expansion adapter and the PMC adapters.

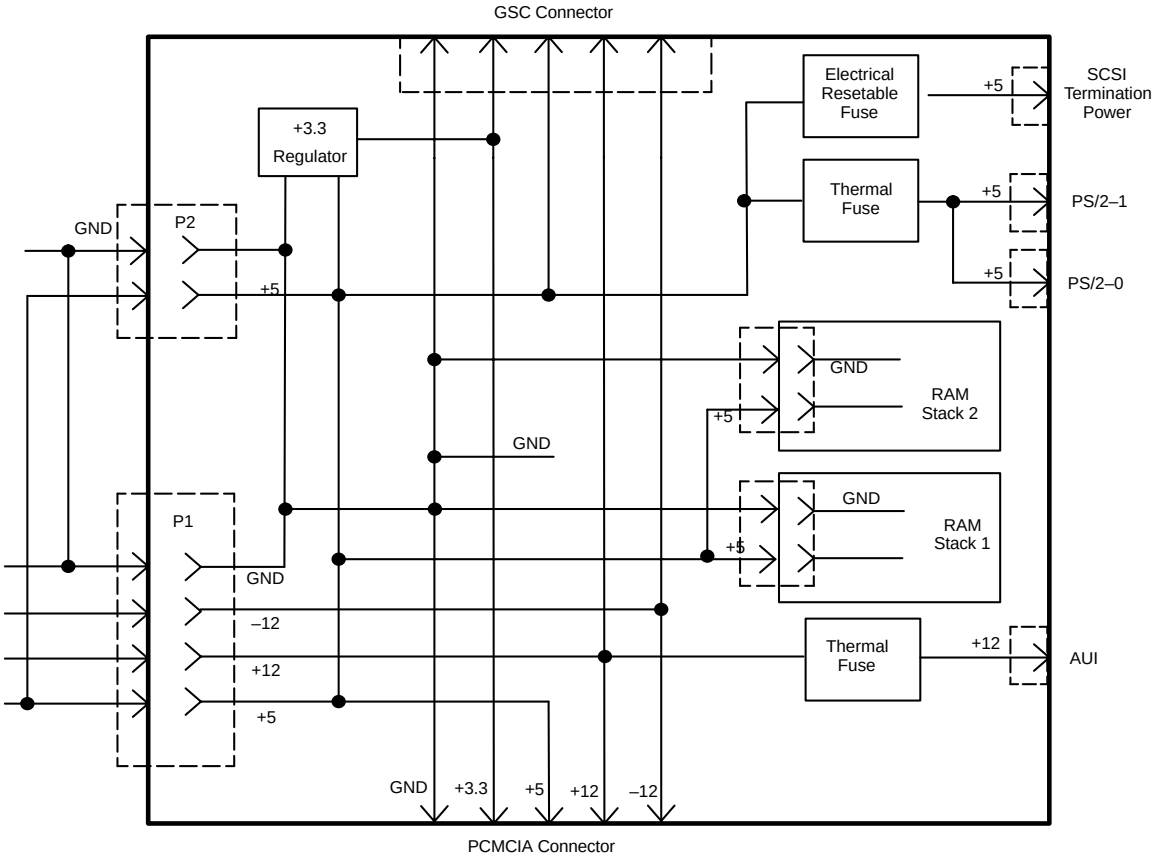



**Figure 6-1 Model 743 Board Computer Power Distribution Diagram**

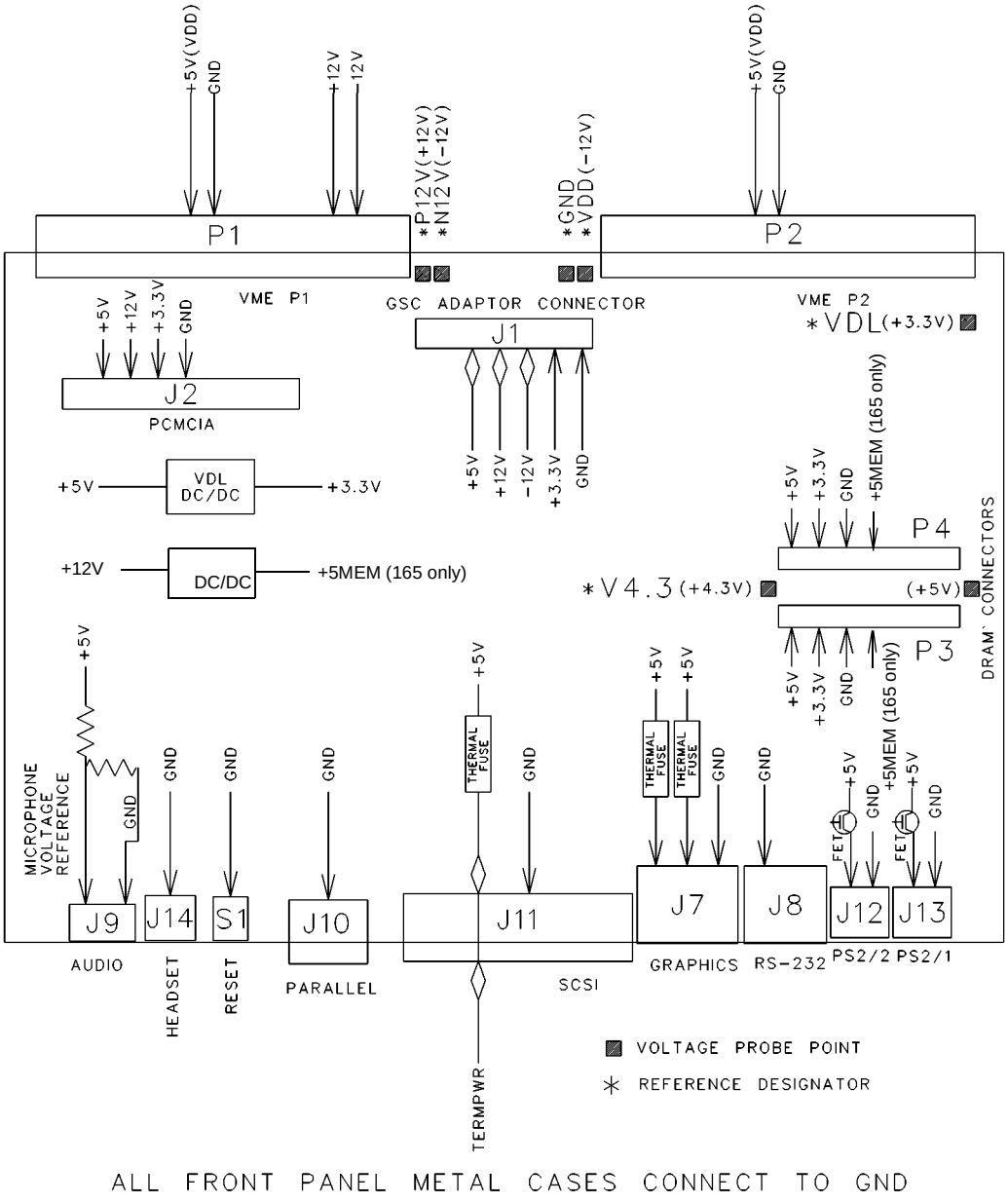



**Figure 6-2** **Model 744 Board Computer Power Distribution Diagram**

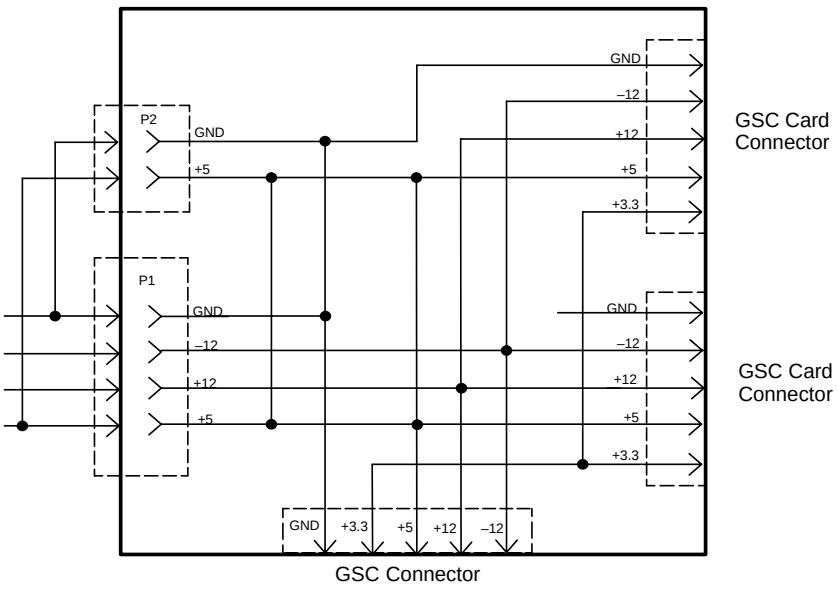



**Figure 6-3 GSC Expansion Adapter Power Distribution**

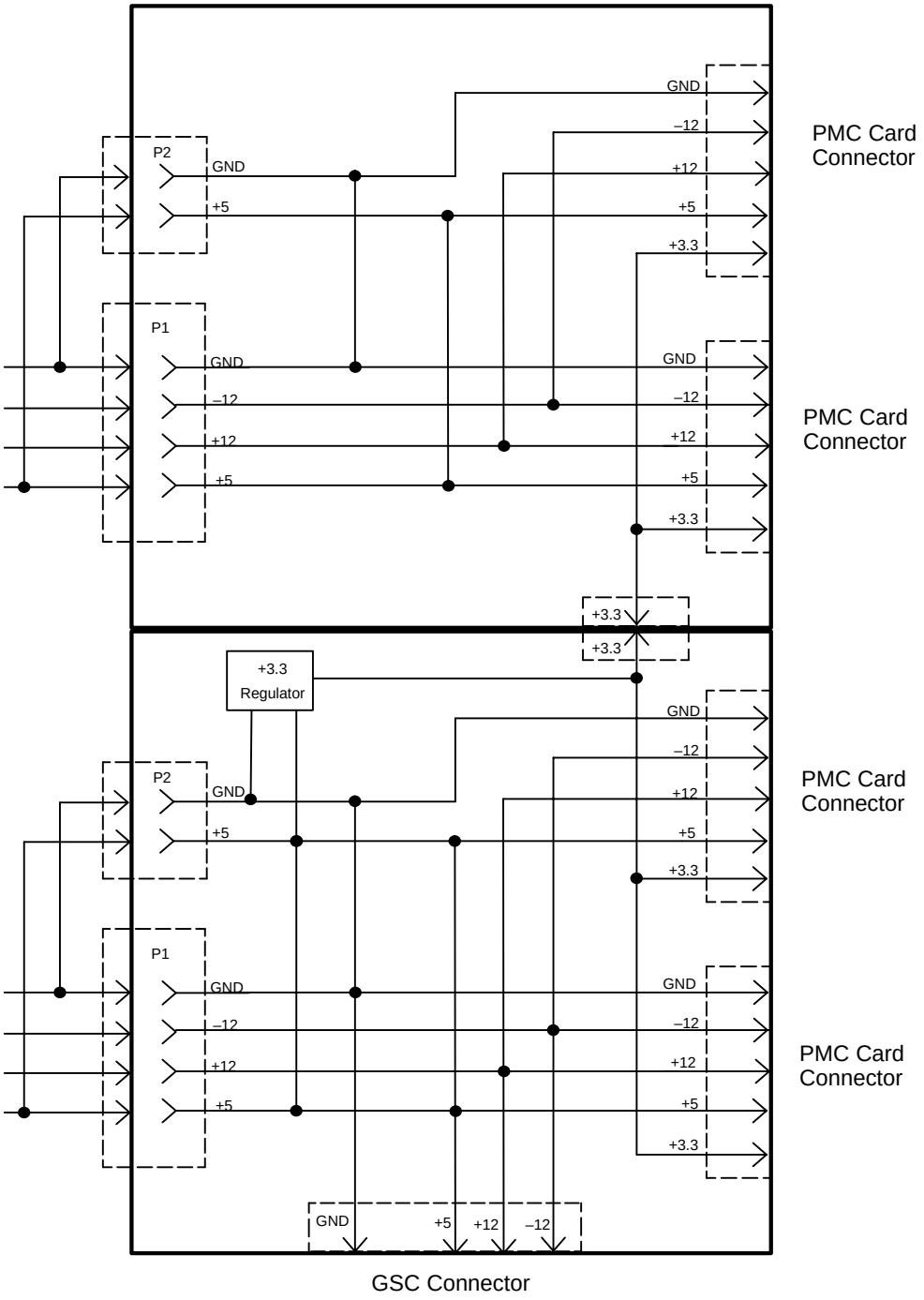



**Figure 6-4 PMC Adapters Power Distribution**

## FW SCSI Estimated Power Consumption

Table 6-1 summarizes the estimated power consumption of the FW SCSI adapter.

**Table 6-1 FW SCSI Power Dissipation**

| HW Component | +5 V Current (VDD0) | +3 V Current (SYS_VDL) | +12 V Current | -12 V Current | P-total |
|---|---|---|---|---|---|
| SCSI terminators[a] | 213 mA | 0 | 0 | 0 | 1.07 W |
| Total[b] | 698 mA | 1.2 mA | 0 | 0 | 3.50 W |

a.On-board SCSI terminators; all signals asserted.
b.Actual power demand is greater due to the requirement of supplying SCSI bus TERM power. This value is limited to 2 A by an on-board fuse. The total power demand could be as high as 12.43 W.

## Monitor Power Specifications

The following section describes the ac power specifications for the 17-inch and 20-inch monitors.

Table 6-2 summarizes the ac power specifications.

**Table 6-2 Monitor Power Specifications**

| Voltage Type | 60 Hz | 50 Hz |
|---|---|---|
| Maximum operating (Vac) | 132 | 288 |
| Minimum operating (Vac) | 90 | 198 |
| Nominal rated (Vac) | 110 | 230 |
| Rated line current (Arms) | 2.7 | 1.5 |
| Frequency range (not-strappable) | 47 Hz to 63 Hz | 47 Hz to 63 Hz |

## Power Budgeting

If your workstation's application requires several accessory cards and mass storage devices, power budgeting may be required. Power budgeting ensures that the power needed for the following internal devices does not exceed the power available:

- Mass storage devices
- Model 743 and Model 744 VMEbus Board Computer(s)
- Standard internal printed circuit boards
- PCI, PMC, VME, or EISA accessory cards

The Model 748 ruggedized workstation uses two power supplies. Each power supply provides voltages to the workstation's modules and accessory card slots as listed in Table 6-8 and Table 6-9.

These tables are also worksheets to use in determining your power budget. You may photocopy these tables as needed.

To determine the workstation's power needs, follow these instructions:

**1** Determine the board computer's current requirements from the Computer Current Requirements Worksheet (Table 6-5 or Table 6-6).

**2** To determine the maximum current usage of the Model 744 memory cards, use Figure 6-5 and Table 6-3 (for Model 744/132L) or Table 6-4 (for Model 744/165L). **Note that some memory cards draw current from +12V on the Model 744/165L**. This is because +12 is converted to +5MEM for the 16MB, 32MB, and 64MB cards (seeFigure 6-2). You must work with the worst case power draw to correctly determine power usage. Determine worst case power draw by examining active memory bank configurations, using the following steps:

**a** Examine your memory card configuration, noting which size card is in each memory slot.

**b** The worst case active memory bank configuration depends on the slot position of the memory cards, and the size of the cards. The 32 MB memory card has two banks per card, and the 16, 64,128, and 256 MB cards each have only one memory bank per card.

- When 32 MB cards are used as a pair in memory slots 2 and 3 they can use three memory banks concurrently.
- When used as a pair in slots 0, 1, or 2, the 32 MB cards can have two active memory banks.
- The 16, 64, 128, and 256 MB cards each have only one memory bank that is active at any one time.

The worst case power draw is when your system has two 32MB cards in slots 2 and 3 (these banks would be considered active, all other memory cards/banks would be considered inactive). The next worst case is a 256 MB card in any slot (all other memory cards in the system would be inactive), followed by a 64 MB card in any slot (all other memory cards in the system would be inactive), followed by two 32 MB cards in slots 0, 1, or 2 (all other memory cards in the system would be inactive), followed by a 128 MB card in any slot, and finally a 16 MB card in any slot (all other memory cards in the system would be inactive).

**c** Inactive memory banks are those banks on cards in your configuration in addition to the worst case active memory banks. They must also be added to the calculation.

**d** Fill in the information in Table 6-3 or Table 6-4.

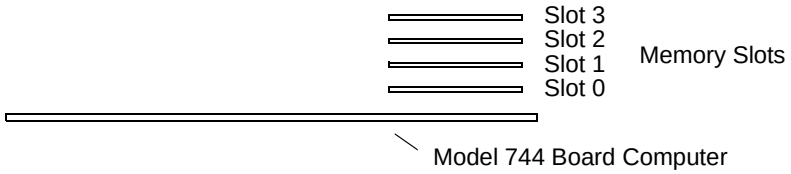



**Figure 6-5 Model 744 Memory Slots**

**Table 6-3 Model 744/132L Memory Card Current Usage Worksheet**

| Memory Card Size | First Active Bank[1] | Second Active Bank | Third Active Bank | Inactive Banks | Totals (+5V) |
|---|---|---|---|---|---|
| 32 MB[2] | 1.15 A | 1.15 A | 1.15 A | 0.05A x ___ | _____ |
| 64 MB | 2.6 A | N/A | N/A | 0.1 A x ___ | _____ |
| 128 MB | 1.45A | N/A | N/A | 0.07 A x ___ | _____ |
| 16 MB | 1.15 A | N/A | N/A | 0.05A x ___ | _____ |
| 256 MB | 2.90 A | N/A | N/A | 0.14 A x ___ | _____ |
| | | | | | _____ |

[1] Choose the worst case active bank(s) for your calculation.

[2] Slot positions and amount of 32MB cards determine the number of active banks.

**Table 6-4 Model 744/165L Memory Card Current Usage Worksheet**

| Memory Card Size | First Active Bank[1] | Second Active Bank | Third Active Bank | Inactive Banks | Totals (+12V) | Totals (+5V) |
|---|---|---|---|---|---|---|
| 32 MB[2] | 0.53 A (+12V) | 0.53 A | 0.53 A | 0.023A x ___ | _____ | |
| 64 MB | 1.2 A (+12V) | N/A | N/A | 0.05 A x ___ | _____ | |
| 128 MB | 1.45 A (+5V) | N/A | N/A | 0.07 A x ___ | | _____ |
| 16 MB | 0.53 A (+12V) | N/A | N/A | 0.023A x ___ | _____ | |
| 256 MB | 2.90 A (+5V) | N/A | N/A | 0.14 A | | _____ |
| | | | | | _____ | _____ |

[1] Choose the worst case active bank(s) for your calculation.

[2] Slot positions and amount of 32MB cards determine the number of active banks.

3 Write in the board computer's current requirements in the line provided for VME slots 1 and 2 in the Lower Power Supply Worksheet (Table 6-9).

4 Determine each device's current requirements from the Internal Device Requirements table and the VME accessory card's specifications sheet (Table 6-7).

5 Write in each device's current requirements in the spaces provided in the Upper or Lower Power Supply current budgeting worksheets (Table 6-8 and Table 6-9).

6 Total each column in both worksheets, then write the total in the Total Current Required line.

7 If *either* worksheet has a column whose current totals exceed the maximum available for that column's voltage, you must reduce the number of devices to lower the total current being drawn at that voltage. You may be able to relocate VME accessory cards between the upper eight and lower two slots to reduce the power required from either power supply.

**Table 6-5** **Model 744 Current Requirements Worksheet**

| Each Model 744 Board Computer | +5V dc Amps | +12V dc Amps | -12V dc Amps |
|---|---|---|---|
| If 132 MHz, current for +5V dc is 4.7A [1]<br>If 165 MHz, current for +5V dc is 6.3A | _____ | 0.1A | 0.1A |
| RAM cards (see Table 6-3 or Table 6-4) | _____ | _____ | |
| Graphics subsystems [2] x 0.9A each = | _____ | | |
| FWD SCSI GSC card x 0.7A each = | _____ | | |
| HCRX graphics board 2.0A | _____ | | |
| PMC bridge adapter 0.6A | _____ | | |
| PMC cards on bridge adapter [3] | _____ | _____ | _____ |
| Totals for Model 744 board computer | _____ | _____ | _____ |

1. Does not include on-board graphics, if installed.
2. On-board graphics and graphics accessory cards are each separate graphics subsystems.
3. PMC cards may also draw +3.3 current that is provided through the +5 on the bridge adapter. The **+3.3 current** FOR ALL PMC CARDS ON THE BRIDGE ADAPTER AND EXPANSION ADAPTER (do not include other expansion adapter currents) must be entered into the +5 column after multiplying the +3.3 current by .75 to convert to the actual +5 current draw.

**Table 6-6** **Model 743 Current Requirements Worksheet**

| Each Model 743 Board Computer | +5V dc Amps | +12V dc Amps | -12V dc Amps |
|---|---|---|---|
| If 64 MHz, current for +5V dc is 6.1A [1]<br>If 100 MHz, current for +5V dc is 7.5A | _____ | 0.1A | 0.1A |
| ____RAM cards x 0.2A each = | _____ | | |
| Graphics subsystems [2] x 0.7A each = | _____ | | |
| FWD SCSI GSC card x 0.7A each = | _____ | | |
| HCRX graphics board 2.0A | _____ | | |
| PMC bridge adapter 0.6A | _____ | | |
| PMC cards on bridge adapter [3] | _____ | _____ | _____ |
| Totals for Model 743 board computer | _____ | _____ | _____ |

1. Does not include on-board graphics, if installed.
2. On-board graphics and graphics accessory cards are each separate graphics subsystems.
3. PMC cards may also draw +3.3 current that is provided through the +5 on the bridge adapter. The **+3.3 current** FOR ALL PMC CARDS ON THE BRIDGE ADAPTER AND EXPANSION ADAPTER (do not include other expansion adapter currents) must be entered into the +5 column after multiplying the +3.3 current by .75 to convert to the actual +5 current draw.

Table 6-7 summarizes the current requirements for internal devices.

**Table 6-7 Internal Device Current Requirements**

| Device | +5.1V dc Amps | +12V dc Amps | -12V dc Amps |
|---|---|---|---|
| Internal mass storage devices: | | | |
| CD-ROM drive | 1.6 A | 1.8 A | |
| DDS tape drive | 1.0 A | 0.8 A | |
| Flexible disk drive | 0.8 A | | |
| 1 GB SE hard drive | 1.2 A | 1.8 A | |
| 2 GB FWD hard drive | 1.1A | 0.9 A | |
| 2 GB SE hard drive | 1.0 A | 0.9 A | |
| 4 GB FWD hard drive | 1.1 A | 1.0 A | |
| 4 GB SE hard drive | 1.0 A | 1.0 A | |
| 9 GB FWD hard drive | 1.2 A | 0.9 A | |
| Hewlett-Packard EISA Cards: | | | |
| HP 25525A SCSI DIFF | 3.1 A | 0.05 A | |
| HP 25525B EISA SCSI | 3.06 A | 5 mA | 5 mA |
| HP 25560A HPIB | 3.1 A | | |
| HP 25567A LAN | 3.4 A | 0.04 A | |
| HP J2156A FDDI | 2.0 A | 0.09 A | 0.05 A |
| HP J2159A X.25 PSI | 3.4 A | 0.04 A | |
| HP J2165A LAN | 2.1 A | | |
| HP J2645AA VG Any LAN | 0.3 A | | |
| HP J2802B ATM | | | |

**Table 6-8 Upper Power Supply Current Budgeting Worksheet**

| Location | Device | +5V dc Amps | +12V dc Amps | -12V dc Amps |
|---|---|---|---|---|
| VME Slot 8 | _____ | _____ | _____ | _____ |
| VME Slot 7 | _____ | _____ | _____ | _____ |
| VME Slot 6 | _____ | _____ | _____ | _____ |
| VME Slot 5 | _____ | _____ | _____ | _____ |
| VME Slot 4 | _____ | _____ | _____ | _____ |
| VME Slot 3 or PMC cards in Expansion Adapter* | _____ | _____ | _____ | _____ |
| | Total Current Required: | _____ | _____ | _____ |
| | Maximum Available: | 34.0A | 8.0A | 1.5A |
| * +3.3 current must be entered into.Table 6-5 or Table 6-6 | | | | |

***CAUTION:*** If you upgrade your Model 748 Ruggedized Workstation, adding more: RAM cards, mass storage devices, GSC, VME, EISA, PCI, or PMC accessory cards, you must recompute the power budget to ensure the new configuration will be within the available current each power supply can provide.

***NOTE:*** The PCI tray provides power for option cards from both a +3.3 Vdc source and a +5 Vdc source. Cards may use either or both power sources, up to 25W per slot. However, the +3.3 V dc source is limited to 39.8 W combined for slots 1 and 2, and 39.8 W combined for slots 3 and 4. For example, if the card in slot 1 draws 25 W at +3.3 V dc, only 14.8 W at +3.3 V dc is available to a card in slot 2. The limits of + 5 Vdc is 25 W per slot.

**Table 6-9 Lower Power Supply Current Budgeting Worksheet**

| Location | Device | +5V dc Amps | +12V dc Amps | -12V dc Amps | -5.2V dc Amps |
|---|---|---|---|---|---|
| Mass Storage Device 1 | _____ | _____ | _____ | | |
| Mass Storage Device 2 | _____ | _____ | _____ | | |
| Mass Storage Device 3 | _____ | _____ | _____ | | |
| Mass Storage Device 4 | _____ | _____ | _____ | | |
| VME Slot 2 and VME Slot 1 | Model 743/ 744 Board Computer | _____ | _____ | _____ | |
| EISA/PCI Slot 1 | _____ | _____ | _____ | _____ | _____ |
| EISA/PCI Slot 2 | _____ | _____ | _____ | _____ | _____ |
| EISA/PCI Slot 3 | _____ | _____ | _____ | _____ | _____ |
| EISA/PCI Slot 4 | _____ | _____ | _____ | _____ | _____ |
| Total Current Required: | | _____ | _____ | _____ | _____ |
| Maximum Available: | | 33.0A | 8.0A | 1.5A | 1.0A |

# Product Design Considerations

The Product Design Considerations Chapter contains information on applications and system integration.

# Application Information

This section contains information on VME Services updates and VME system design considerations.

### VME Services Updates

At HP-UX release 10.10 and later, VME Services ships as part of the standard operating system.

For HP-UX release 9.05 and 9.07, updates to HP-UX Version 9.05 VME Services are available from Hewlett-Packard.

Updates include the following:

- Enhanced driver functionality essential for trouble-free VME applications
- Improved error messages
- On-line man pages
- Support for Model 743 VMEbus Board Computers and Model 748 Ruggedized Workstations

Also available is information that you might need to help you design and configure your VME system to work properly with the Models 743 and 748. A brief description of these VME system design considerations follows. More detailed information and information that becomes available after the printing of this manual is available on request. Please review this information before configuring your VME system or if you are having trouble getting your VME configuration to work properly.

Details on how to get VME Services Updates and Design Consideration information are available through the World Wide Web.

**http://www.hp.com/go/hp_vme**

### VME Systems Design Considerations for Models 743, 744, and 748

This section provides a brief overview of some design considerations when configuring VME system with Models 743, 744, or 748. This overview will help you determine whether these considerations are relevant to your VME system. More detailed information is available on request.

#### Data Transfer Considerations

The sections that follow discuss data transfers within the VME system.

**VME Data Lines During Write Cycle** The VME data lines need to remain stable during the entire write cycle from a non-Model 743/744 VME bus master to the main memory of a Model 743/744 serving as a VME slave. This period includes the time from the assertion of the data strobe by the master to the receipt of the DTACK from the Model 743/744. All data lines need to remain stable in all transactions, including the higher order data lines unused in a D08 or D16 data transaction.

#### Bus Arbitration Considerations

The sections that follow discuss VME cycle time restrictions, FAIR arbitration restrictions, and bus grant daisy chain.

**Bus Grant Daisy Chain** Each of the VME's internal VME bus masters, processor to VME data transfer controller, DMA controller, and the interrupt controller, function as separate devices in the bus grant daisy chain. As a result, each request from an individual VME bus master of the Model 743/744 results in a unique assertion of BBSY and a unique VME bus request/grant on the bus arbitration daisy chain.

## System Integration

The System Integration section provides information for system integrators who are incorporating the HP 9000 Series Model 742*i* into the HP 9000 Series Model 748*i*VME systems and the HP 9000 Series Model 743*i* or 744 into the HP 9000 Series Model 747*i* VME systems running HP-UX into VME systems. Topics include hardware power-on information and VME ASIC VME sysreset behavior.

### Hardware Power On Information

The section that follows contains information about the Models 742*i* and 747*i* and the Models 743*i*, 744, and 748*i* at the time of power on.

#### VME ASIC Slave Behavior at Power On

The VME ASIC on the Model 742*i* responds to VME cycles immediately upon power on. That is, VME cycles to A32 space in the address range 0x00000000 to 0x0fffffff are acknowledged by the VME ASIC, running cycles into the onboard processor RAM. This range of addresses is the default (power-on) location of the ASIC's A32 direct map window. The A32 VME address range of 0x00000000 to 0x00100000 is also acknowledged by the ASIC's A32 slave mapper, running cycles into onboard processor RAM (PA) physical addresses of 0x0 to 0xfff). This power-on behavior cannot be disabled.

VME cycles to A24 space in the VME address range of 0x000000 to 0xfffff are acknowledged by the VME ASIC, running cycles into onboard (PA) processor RAM. This range of addresses is the default (power-on) location of the VME ASIC's A24 direct map window and of the A24 slave map window. This power-on behavior cannot be disabled.

VME cycles to A16, A24, and A32 space of the VME address range of 0x0000 to 0xfff are acknowledged by the VME ASIC. This range of addresses is the default (power on) location of the VME ASIC's location monitor and FIFO register. This power on behavior cannot be disabled.

When the HP-UX operating system is loaded, the VME A32 and A24 space mapped to onboard processor RAM may be moved to another 256 MB boundary location in VME space, based on the information that the EEPROM contains (the value of the EEPROM is set through the vme_config program). The FIFO and location monitor may also be moved; however, the current HP-RT and HP-UX services do not use the FIFO and location monitor capabilities.

The HP-RT operating system sets up the VME space for a conflict-free configuration based on information provided during the system build process. However, if there is no local memory defined on an HP-RT processor, the Model 742's default is still in place. This can lead to a conflict if another memory area is assigned that overlaps the Model 742's defaults.

In a combined Models 742*i* and 747*i* and Models 743*i* and 748*i* backplane containing one or more Models 742*i* and 747*i* VME ASICS, the address areas previously discussed must be unpopulated to avoid conflicts prior to loading the operating system. The lowest 256 MB region should be left unused for system use. For more information on combined systems, refer to /etc/vme/example2.CFG and the HP-RT System Administrator Task Manual.

The VME ASIC in the Models 743*i* and 744 does not respond to VME cycles until it is explicitly enabled by the HP-UX operating system.

**VME ASIC VME Sysreset Behavior**

When the VME ASIC is a slot 1 controller (always on the Model 747*i* and switch selectable on the Model 742*i/rt*), it generates VME sysreset and VME sysfail at power on, but ignores the state of these lines thereafter. If the VME ASIC is not a slot 1 controller, assertion of VME sysreset by another VME card causes the Model 742*i/rt* to reboot.

The VME ASIC in the Models 743*i* and 744 behaves similarly but can be configured as to whether or not a VME sysreset causes a non slot 1 controller to reboot.

**Models 742*i* and 747*i* VME IACK Anomaly at Power On**

Models 742*i* and 747*i* respond to the first interrupt cycle on any irq level after power-on with an invalid status-id by the VME ASIC. This behavior occurs regardless of whether or not Models 742*i* or 747*i* are enabled as an interrupt handler for the associated interrupt level. The patched HP-UX Version 9.05 fixes this behavior; however, the behavior should not cause problems because VME handles multiple interrupts on an irq level.

Models 743*i* and 744 do not exhibit this behavior.

**VME System Configuration Information**

The HP-UX vme_config program helps system integrators generate a conflict-free system configuration. After running vme_config, which writes data into the EEPROM, the system must be rebooted to use the new EEPROM information. For more information, refer to "Required Entity Declarations for HP Processors" in /etc/vme/example(x).CFG and the HP-UX 10.0 VME Device Drivers Manual.

**Runtime VME ASIC Anomalies**

The VME data lines need to remain stable during the entire write cycle from a non-743/744 VME bus master to the main memory of Models 743*i* or 744 serving as a VME slave. The write cycle includes the time from the assertion of the data strobe by the master to the receipt of DTACK from Model 743/744. All data lines need to remain stable in all transactions, including higher order data lines unused in a D08 or D16 data transaction.

***NOTE:*** If the VMEbus card bus master either drives the data lines to a known and stable state or allows the data lines to float to VME's stable high termination, there will be no parity errors. However, if the VMEbus card master drives the lines for part of the cycle and allows them to float for the remainder of the cycle, parity errors are possible on the internal Model 743/744 's bus, resulting in an HP-UX panic and system crash. In HP-UX, this parity error results in a non-zero value of the bus check displayed as part of HP-UX panic. The HP-RT error message indicates that the

High Priority Machine Check (HPMC) was of type bus error with the "check Type" field equal to "20000000", the "sysReqAdd" field equal to "00109180", and the "cache", "tlb", "bus", "assists", "asstState", "sysRsAdd" fields set to zero.

In rare circumstances, Models 742*i* and 747*i* allow non-specified data lines to float, resulting in HP-UX panic. Most often, this behavior occurs when Models 743*i* and 744 are generating IACK as a D08 or D16 interrupter. To avoid this behavior, do not have Models 743*i* and 744 as interrupt handlers for Models 742*i* and 747*i* or configure (in the kernel interface driver that is generating the interrupt) Models 742*i* and 747*i* as D32 interrupters.

Models 742*i* and 747*i* have an internal (SGC) bus watchdog timer set to 1 ms by the boot ROM (PDC) code. When the PA processor starts a read or write transaction to VME I/O space, the watchdog timer starts. If the total time from acquiring the VME bus (arbitration time) to cycle completion time (DTACK or BERR) exceeds 1 ms, the system crashes with a HPMC. In HP-UX, the resulting panic dump message indicates a SGC bus error HPMC (this behavior cannot be changed). In either HP-UX or HP-RT, the operating system cannot recover from an HPMC error.

The system must be configured so that Models 742 or 747 always get the VME bus and complete the first transaction in less than 1 ms. This is done through vme_config in HP-UX, and by setting specific defines, such as bus request priority, to set bus behavior in HP-RT.

Models 743*i* and 744 have an internal bus protocol called "split" that overcomes the 1 ms problem in Models 742*i* and 747*i*, but the processor appears hung until the VME cycle completes.

Current releases of HP-UX and HP-RT do not support the use of the location monitor capability. However, Models 742*i* and 747i and Models 743i and 744 handle monitoring VME locations differently:

Models 742i and 747i ASIC, if enabled, generate a local interrupt when the VME space that is defined for the location monitor is accessed. It also DTACKS the VME cycle.

Models 743i and 744 ASIC, if enabled, generate a local interrupt when the space that is defined for the location monitor is accessed. It does not+ DTACK the VME cycle.

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