AXPvme
Single-Board Computer

Installation/User Guide

Order Number: EK–EBV1X–IN. B01

Digital Equipment Corporation
Maynard, Massachusetts

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The prepaid Reader's Comments form at the end of this document requests your critical evaluation to assist in preparing future documentation.

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Introduction

1.1 Overview

The AXPvme single-board computer is a 6U-sized Versa Module Eurocard bus (VMEbus) device with a high-performance Alpha AXP processor. The AXPvme module has built-in network and small computer systems interface (SCSI) device controllers (except for the AXPvme 64LC module that has no SCSI controller). The AXPvme module supports a peripheral component interconnect (PCI) mezzanine option card as well. A memory daughterboard is required and available in the following sizes: 8 MB, 16 MB, 32 MB, 64 MB, and 128 MB.

2
Installation

2.1 Unpacking

Your AXPvme hardware kit contains the items listed in Table 2–1. Save the original packing material in case a factory return is necessary.

Note

The kits in Table 2–1 contain hardware only. The option you receive may include software licenses or software, depending on what is ordered.

The AXPvme 64, 64LC, and 100 use breakout module (54-22605-01). The AXPvme 160, 166, and 230 use breakout module (54-22621-01).

Table 2–1 AXPvme Hardware Kit Items

Item	Part Number
AXPvme 160 kit (EBV12-AD)	
AXPvme 160 module	54–22593–01
AXPvme Breakout module	54–22621–01
Installation/User guide	EK–EBV1X-IN
Antistatic wriststrap	12–36175-01
AXPvme 64 kit (EBV10-AA)	
AXPvme 64 module	54–22593–02
AXPvme Breakout module	54–22605–01
Installation/User guide	EK–EBV1X-IN

(continued on next page)

Table 2–1 (Cont.) AXPvme Hardware Kit Items

Item	Part Number
Antistatic wriststrap	12–36175–01
AXPvme 64LC kit (EBV10-BA)	
AXPvme 64LC module	54–22593–03
AXPvme Breakout module	54–22605–01
Installation/User guide	EK–EBV1X-IN
Antistatic wriststrap	12–36175–01
AXPvme 100 kit (EBV10-AB)	
AXPvme 100 module	54–24121–02
AXPvme Breakout module	54–22605–01
Installation/User guide	EK–EBV1X-IN
Antistatic wriststrap	12–36175-01
AXPvme 166 kit (EBV12-AC)	
AXPvme 166 module	54–24121–03
AXPvme Breakout module	54–22621–01
Installation/User guide	EK–EBV1X-IN
Antistatic wriststrap	12–36175-01
AXPvme 230 kit (EBV12-AE)	
AXPvme 230 module	54–24121–01
AXPvme Breakout module	54–22621–01
Installation/User guide	EK–EBV1X-IN
Antistatic wriststrap	12–36175-01

In order to install the AXPvme module, you must also have one of the memory modules listed in Table 2–2.

Table 2–2 AXPvme Memory Modules

Memory Size (MB)	Kit Number	Part Number
8	EBVXM-AA	54–22595–03
16	EBVXM-BA	54–22595–02
32	EBVXM-CA	54–22595–01
64	EBVXM-DA	54–22625–01
128	EBVXM-EA	54–22625–02

Depending on how you plan to use the AXPvme system, you may need one or more of the items listed in Table 2–3 that *are not* part of the AXPvme kit.

Table 2–3 Additional Hardware Installation Items

Item	Supplier	Part Number
Serial line cable for console and auxiliary terminals	Digital	BC16E–*nn*[1]
IEEE 802.3 AUI cable	Digital	BNE4C–*nn*[1]
IEEE 802.3 AUI to Thickwire transceiver	Digital	H4005
IEEE 802.3 AUI to ThinWire transceiver	Digital	DECXM–AA
IEEE 802.3 AUI to twisted-pair transceiver	Digital	DETPM–AA
IEEE 802.3 loopback connector	Digital	H3278
SCSI cable with active terminator (1 m long with connectors for four devices) or see the *SCSI Developer's Guide* (EK-SCSIS-DK) for compatible cable information	Digital	17-03459-02

[1]The *nn* = cable length.

2.2 Physical and Environmental Requirements

The AXPvme module requires a VME chassis with sufficient cooling. You must have at least 200 linear feet/minute (lfm) of airflow at an ambient temperature of not more than 50°C (122°F) across the processor heatsink. The processor heatsink is the large, square, aluminum heatsink at the center of the AXPvme module.

Table 2–4 shows the physical and environmental specifications for the AXPvme module. Table 2–5 shows the power supply current and power for the AXPvme module. Stresses beyond those specified may cause permanent damage to the module.

Table 2–4 Physical and Environmental Specifications

Characteristic	Specification
Industry standard	VME 6U module
Operating temperature	0°C to 50°C (32°F to 122°F)
Storage temperature	–40°C to 66°C (–40°F to 151°F)
Temperature change	20°C/hour (36°F/hour)
Relative humidity	10% to 95% (noncondensing)
Airflow	200 lfm minimum over at 50°C ambient inlet air temperature over the large square processor heatsink at the center of the AXPvme module
Vibration:	Operating in a suitable enclosure
	0.5g Pk 22.1–260 Hz
	0.25g Pk 200–500 Hz

Table 2–5 Power Supply Current and Module Power Dissipation

CPU Modules w/Memory	Amps @ 5 V	Amps @ 12 V (note 1)	Amps @–12 V	Module Heat Dissipation
AXPvme 230	9.9 A	0.5 A	0.1 A	57 W
AXPvme 166	8.0 A	0.5 A	0.1 A	47 W
AXPvme 100	6.2 A	0.5 A	0.1 A	38 W
AXPvme 160	9.4 A	0.5 A	0.1 A	54 W
AXPvme 64	6.5 A	0.5 A	0.1 A	40 W
AXPvme 64LC	6.0 A	0.5 A	0.1 A	37 W

Options	Amps @ 5 V	Amps @ 12 V	Amps @–12 V	Power Dissipation
SCSI Termination	0.8 A Max	0.0 A	N/A	4 W Max
PMC Option Slot Budget (actual use)	2.0 A Max	N/A	N/A	10 W Max

Note 1: The 12 V is used to provide power to the AUI Ethernet port. If an external device, such as a DELNI, is used include its power in your calculations. 80% of the 0.5 A is allotted for flash blasting during ROM updates.

Note 2: Heat dissapation assumes nominal voltages (5.0 V, 12.0 V, and –12 V). Add 10% to the current values for a worst case power and heat scenario.

2.3 Installation

To install the AXPvme module, perform the following steps:

1. Select a slot or slots in your VME backplane for the AXPvme module. The AXPvme dual-slot module requires two slots; the AXPvme single-slot module require one slot.

Note

There must be sufficient space on the back of the VME backplane slot or slots selected to install the Breakout module. The AXPvme Dual-slot Breakout module requires a minimum of 38.1 mm (1.5 in). The AXPvme Single-slot Breakout module requires a minimum of 63.5 mm (2.5 in).

Caution

Static electricity can destroy the circuits on the modules in your AXPvme kit. When you handle modules wear the antistatic wriststrap with the wire clipped to the frame of your VME chassis. Also, place the modules on top of the conductive plastic bags they came in while you work.

2. Set the configuration switches on the AXPvme module as outlined in Table 2–6. Also refer to Figure 2–1 for the configuration switch settings.

Table 2–6 AXPvme Module Configuration Switches

Switch	Setting	Function
1	Closed	Supplies +5 V from the VMEbus +5 V Standby signal to the time-of-year (TOY) clock and the nonvolatile random-access memory (NVRAM) to supplement the internal battery when the AXPvme module is turned off.
	Open	Does not supply power from the VMEbus +5 V Standby signal. The internal battery will last for about 10 years with the AXPvme module power turned off.
2	Closed	Enables writing of flash ROMs under program control.
	Open	Disables writing of flash ROMs.
3	Closed	Resets the AXPvme module on VMEbus Reset signal.
	Open	Does not reset the AXPvme module on VMEbus Reset signal.
4	Closed	AXPvme module is VMEbus system controller.
	Open	AXPvme module is not VMEbus system controller.

Supported Switch Settings

For AXPvme modules installed in slot 1 (system controller):

Switch	Setting
1	Closed
2	Open
3	Open[1]
4	Closed[1]

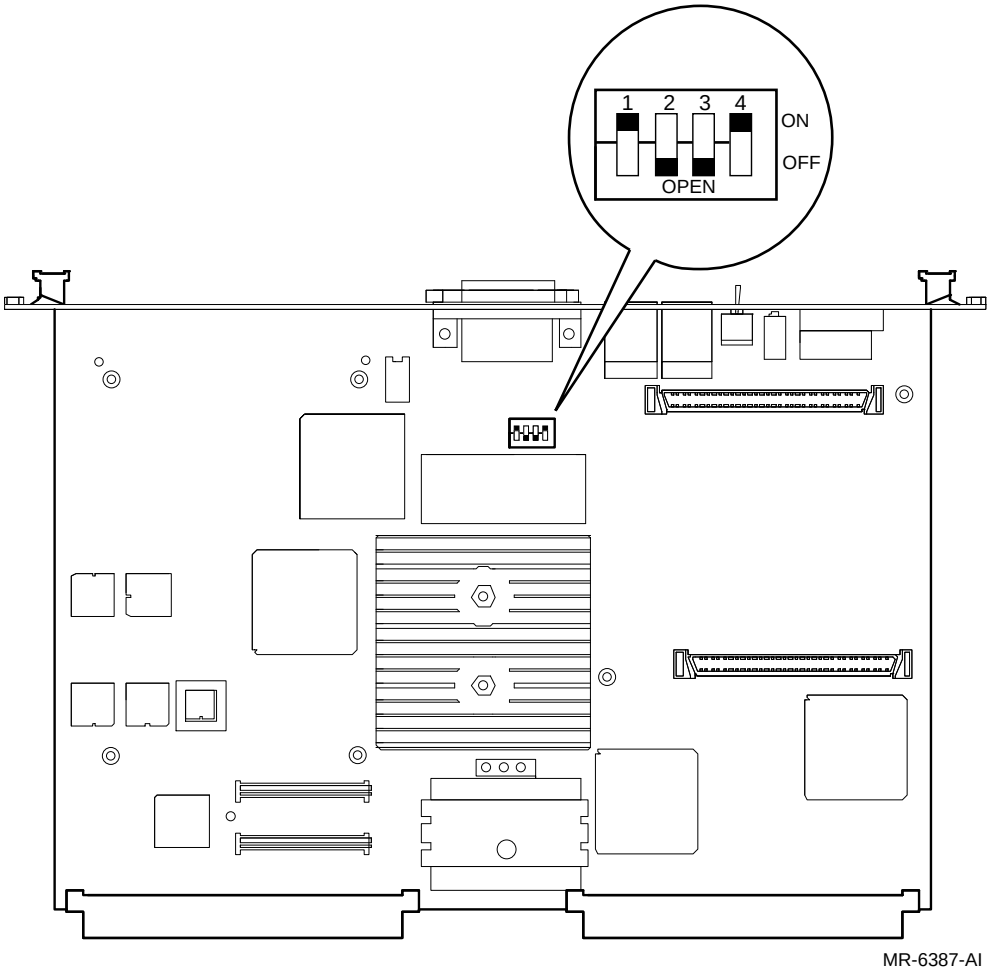
[1]These switches are *required* to be in the indicated positions for reliable system operation during a VMEbus Reset.

For AXPvme modules installed in other than slot 1 (nonsystem controller):

Switch	Setting
1	Closed
2	Open
3	Closed[1]
4	Open[1]

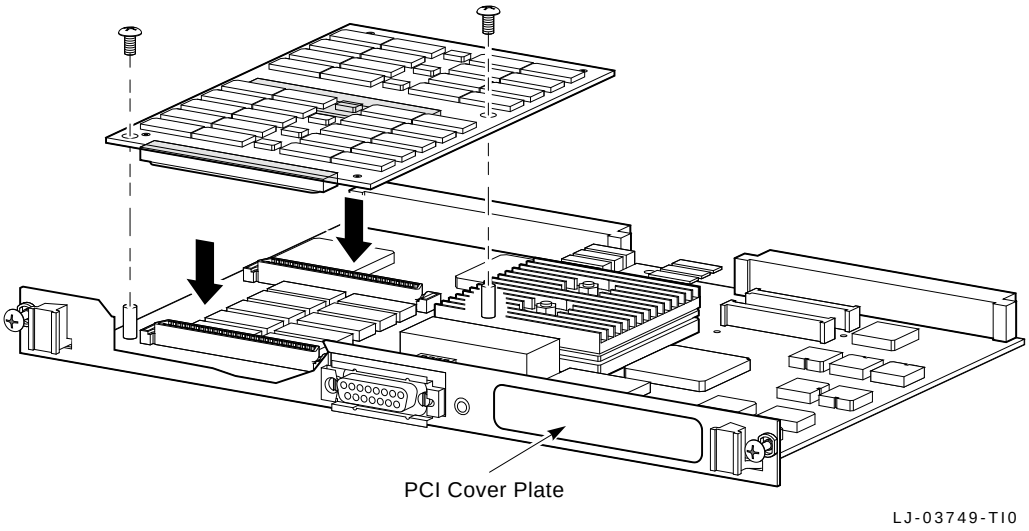
[1]These switches are *required* to be in the indicated positions for reliable system operation during a VMEbus Reset.

Figure 2–1 AXPvme Module Configuration Switches



3. Install the memory module on your AXPvme module (refer to Figure 2–2).

Figure 2–2 Installing the Memory Module



Note

Mounting hardware for the memory module and the PCI mezzanine module should come with the module. If the mounting hardware is misplaced, replacement hardware consists of:

M2.5x5 mm screws—90-10959-01
M2.5 standoffs—74-49014-04

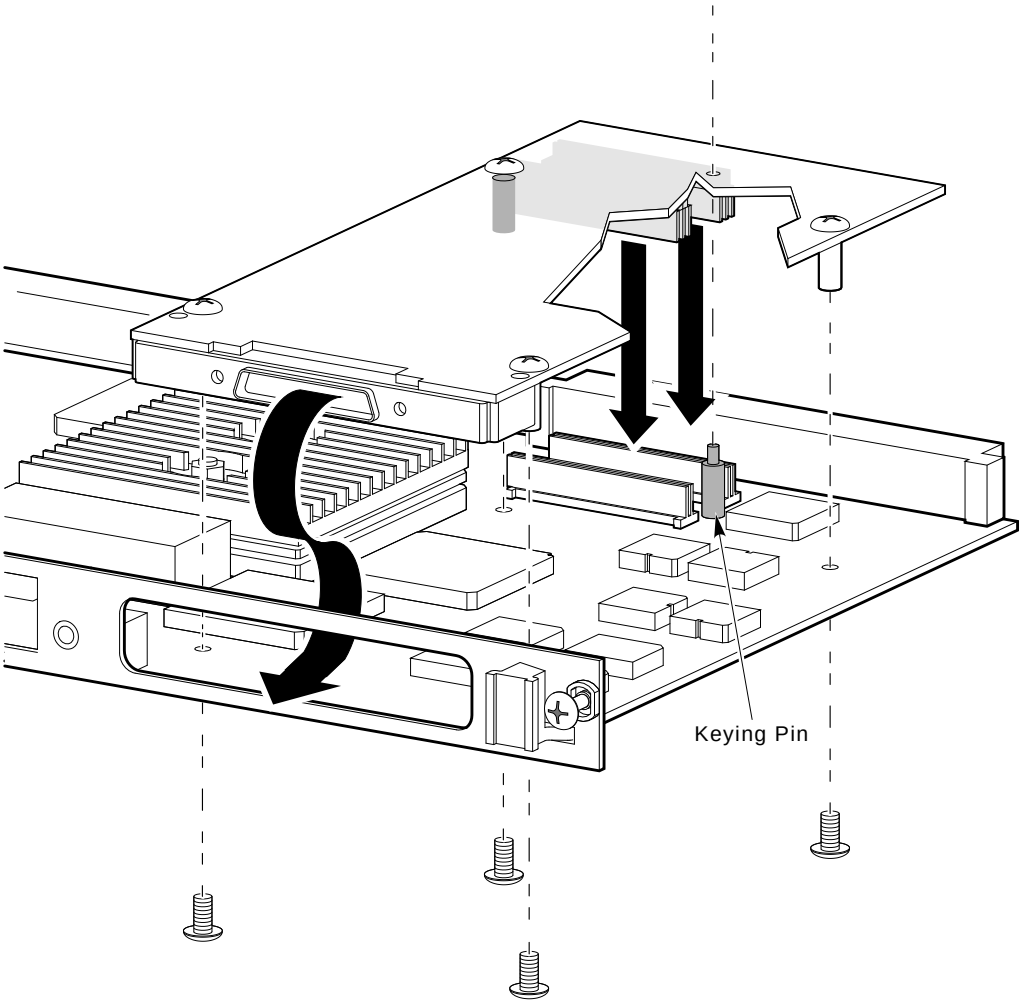
4. If you have a PCI mezzanine module for your AXPvme module, remove the PCI cover plate and install your PCI module now (refer to Figure 2–3).

   The AXPvme module supports *only* +5 V PCI modules. A keying pin on the AXPvme module prevents +3 V PCI modules from being installed. If your PCI module does not seat into the connectors, you may have a +3 V PCI module. Never remove or alter the position of the keying pin.

Note

If a PCI module is not installed, the PCI cover plate on the memory module should be left in place. This ensures proper airflow across the module and reduces EMI/RF emissions.

Figure 2–3 Installing a PCI Module



5. Install the AXPvme module into the VME chassis (refer to Figure 2–4 or Figure 2–5). Note that the AXPvme dual-slot module requires two backplane slots. Secure the module with screws as shown.

Caution

Applying power to the AXPvme module without a Breakout module in place may damage your backplane, the AXPvme module, or both. Also, do not press on the LED window when you install the module.

Figure 2–4 Installing the AXPvme Dual-Slot Module

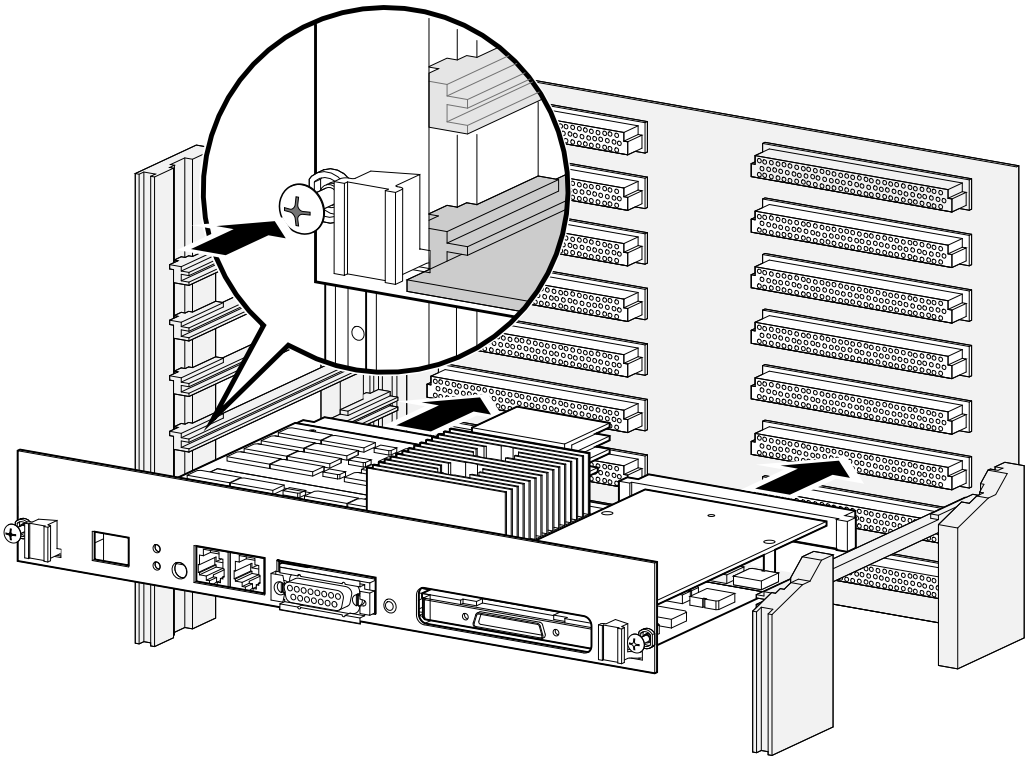


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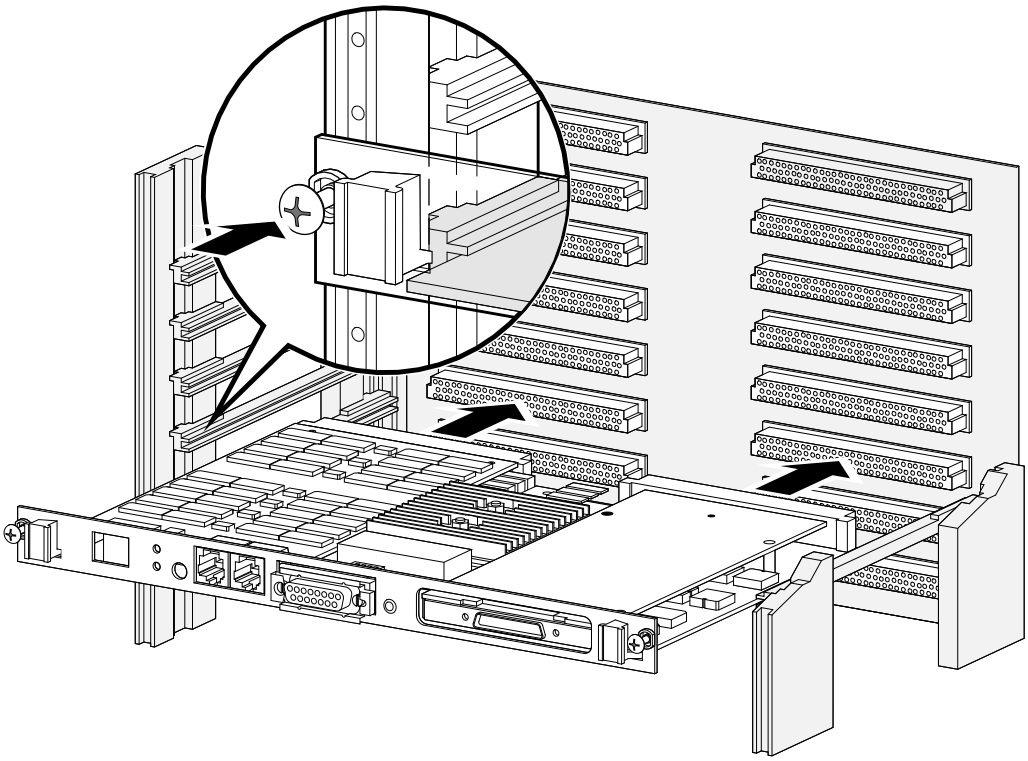
Figure 2–5 Installing the AXPvme Single-Slot Module



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6. Set the SCSI termination jumper on the Breakout module (refer to Figure 2–6).

   The SCSI bus must be terminated at *each* end. In most installations, the Breakout module is one end of the SCSI bus and the far end of the SCSI ribbon cable is the other end of the SCSI bus. In this case, enable the SCSI termination by placing the jumper across pins 1 and 3 (default).

   If the Breakout module is not at the end of the SCSI bus, disable the SCSI termination by placing the jumper across pins 3 and 5.

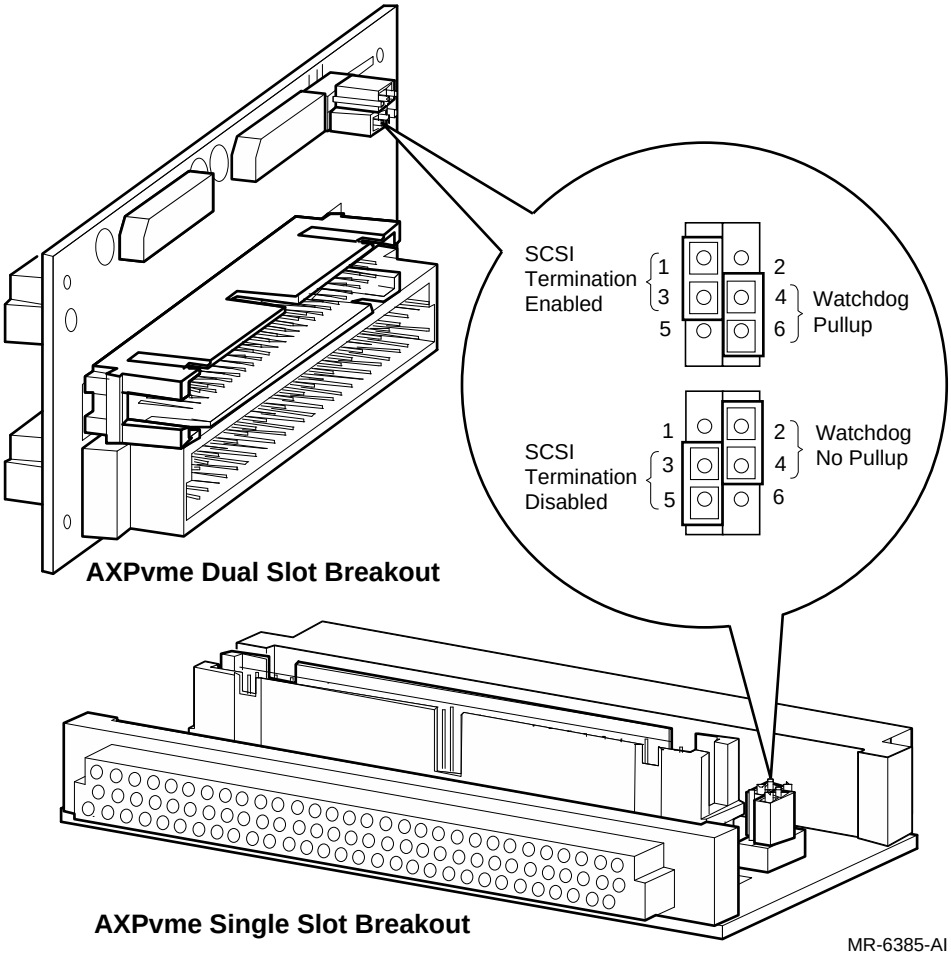
7. Set the watchdog signal jumper on the Breakout module (refer to Figure 2–6).

   The AXPvme module supplies an external Watchdog Reset signal that you can connect to a monitoring device. If you make no connection to this external signal, the setting of the jumper makes no difference.

   Setting the jumper across pins 4 and 6 (default) provides an internal 2 kOhm to +5 V pullup for this signal. Setting the jumper across pins 2 and 4 provides no pullup. This allows you to attach a monitoring device that operates at a different voltage level. The monitoring device must provide voltage and a pullup resistor that do not exceed the output specifications of a 74LS05 component. The monitoring device must also be connected to the same ground reference as the AXPvme module.

   The external Watchdog Reset signal is on pin 9C of the VMEbus J2 connector on the Breakout module. This signal is low during normal operation and high during a watchdog timer reset (provided that pullup power is connected).

Figure 2–6 Breakout Module Jumpers



8. If your AXPvme system has SCSI devices, connect the SCSI cable to the Breakout module (refer to Figure 2–7 or Figure 2–8). Both Breakout modules use a standard nonshielded 50-pin low-density SCSI connector.

Figure 2–7 Connecting the SCSI Cable to the AXPvme Dual-Slot Breakout Module

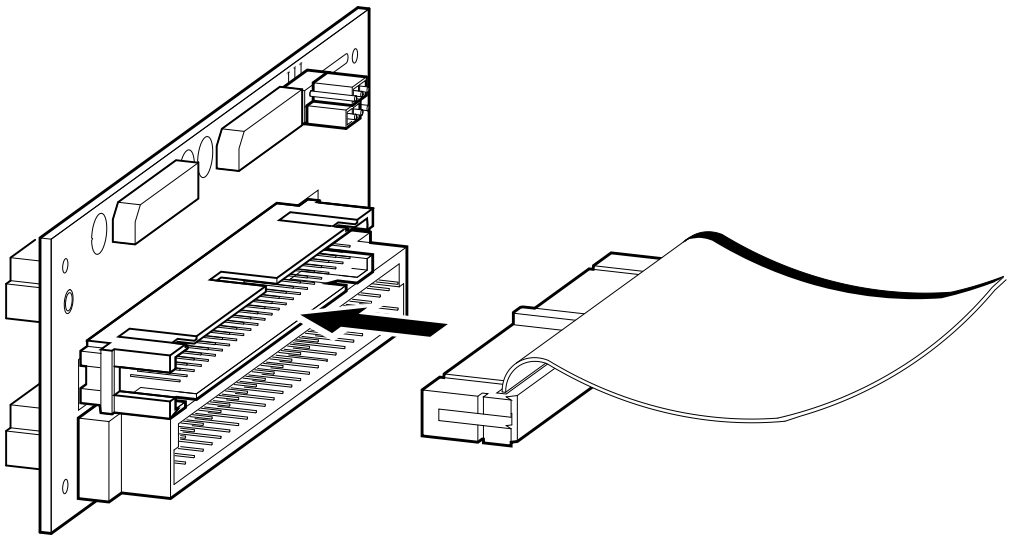


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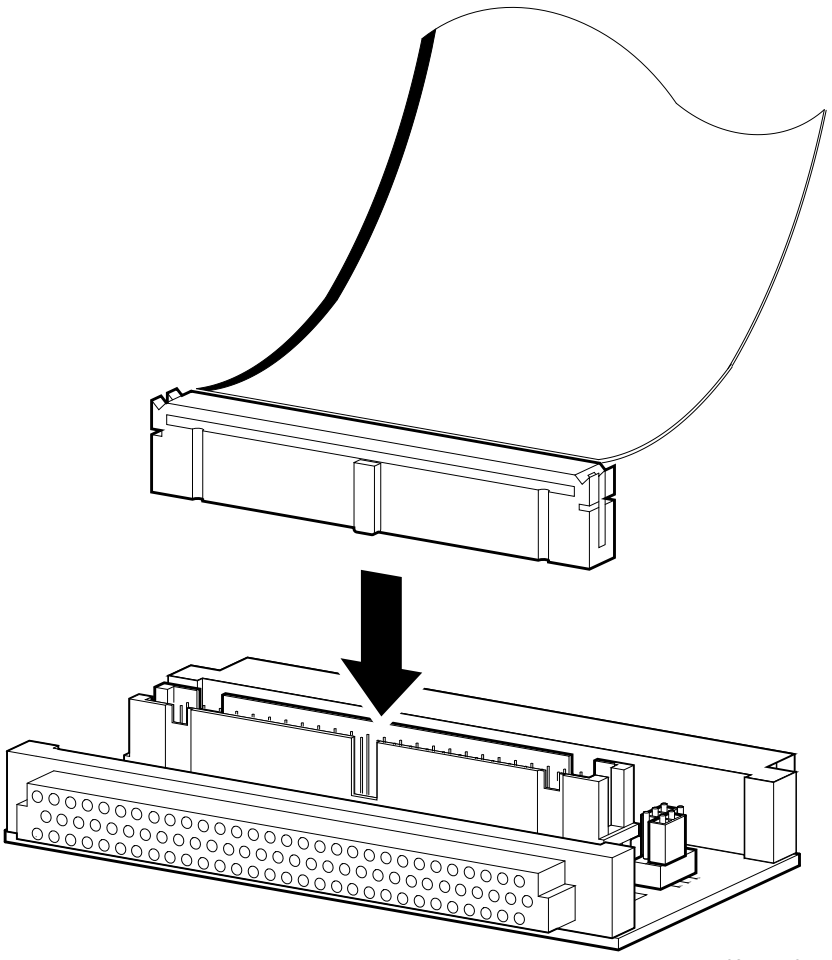
Figure 2–8 Connecting the SCSI Cable to the AXPvme Single-Slot Breakout Module



9. Install the Breakout module (refer to Figure 2–9 or Figure 2–10). Ensure that the Breakout module is installed behind the slots occupied by the AXPvme module (as shown).

   If multiple AXPvme single-slot modules are being installed in adjacent slots, it is recommended that one of the end connectors on the SCSI cable be used to connect to the Breakout modules.

Caution

Running the AXPvme module when it is not in a slot that is opposite the correct slot of the Breakout module (refer to Figure 2–9) may damage your backplane, the AXPvme module, or both.

Never insert a module other than an AXPvme module into a slot opposite the Breakout module. The Breakout module feeds power to several of the user-defined pins on the J2 backplane connector. This may damage another VME module.

It is recommended that the slot number and type of Breakout module be recorded to ensure that the AXPvme modules are always installed into a slot with the appropriate Breakout module.

Note

If you have an AXPvme dual-slot module, the current drawn by the module exceeds the rating for a single VME slot. The Breakout module draws extra power from the power pins in the second slot and feeds it to the AXPvme module by way of user-defined pins on the P2 connector.

Figure 2–9 Installing the AXPvme Dual-Slot Breakout Module

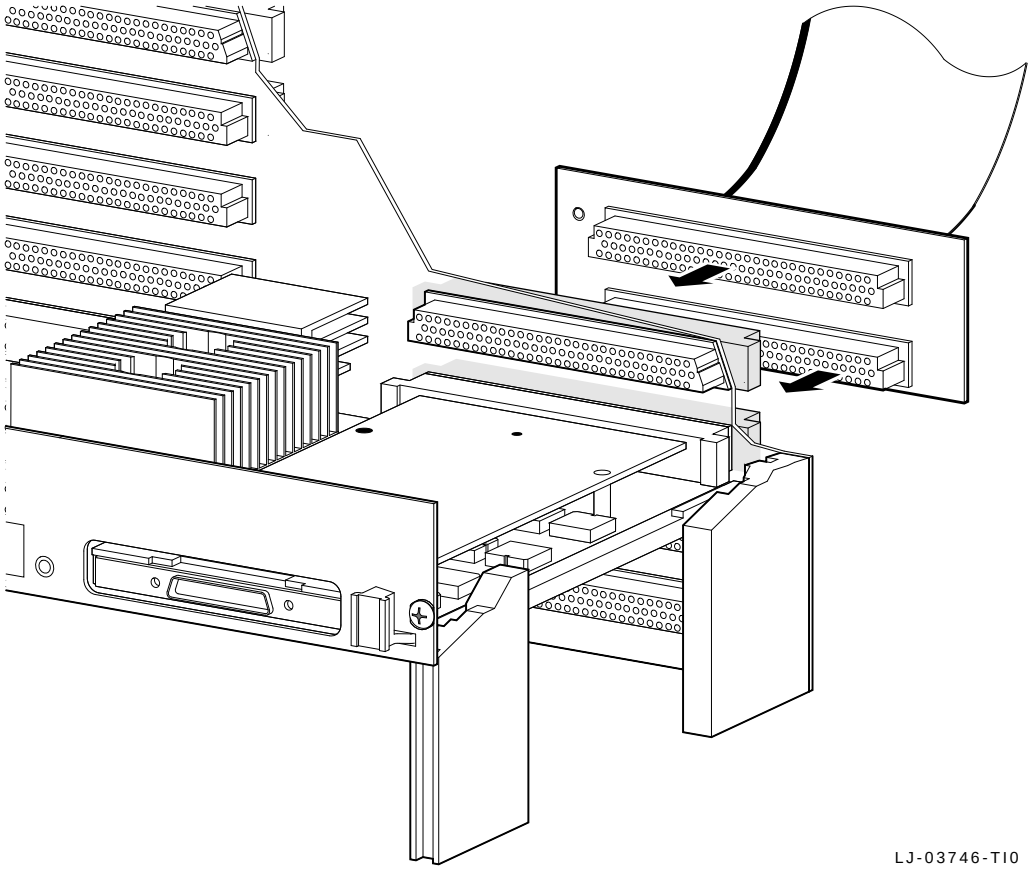
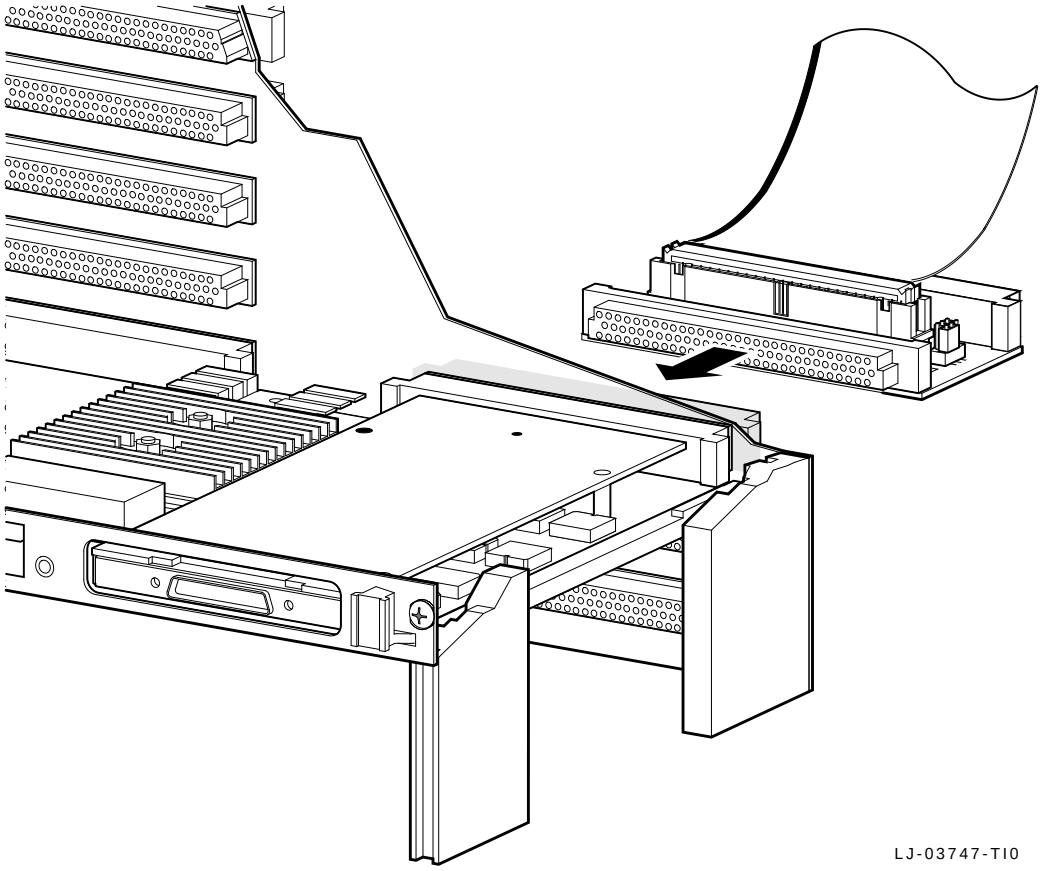
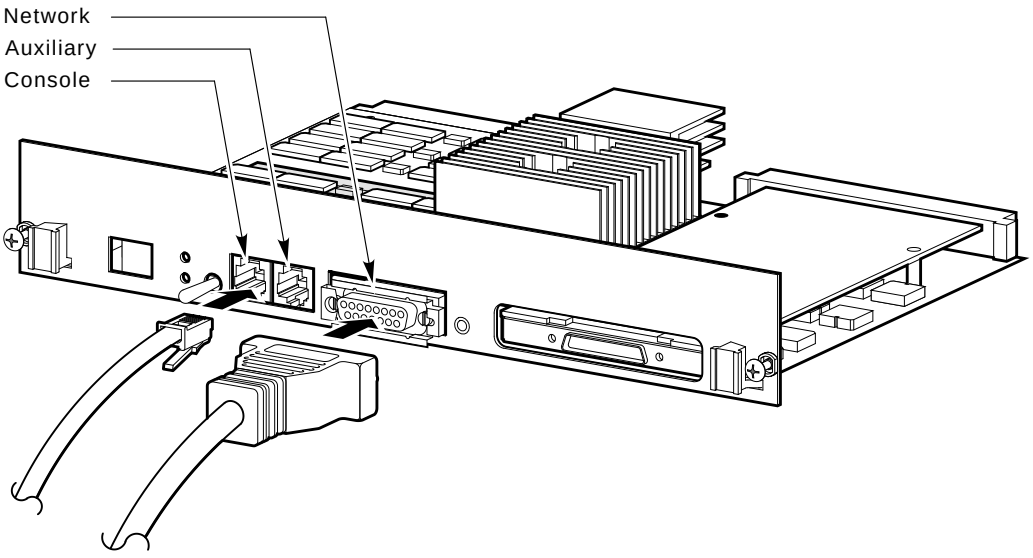


Figure 2–10 Installing the AXPvme Single-Slot Breakout Module



10. Connect the network cable (if any) and the console terminal cable to the AXPvme module (refer to Figure 2–11). If you have an auxiliary terminal, connect it now. Set your console terminal to a speed of 9600 bits/second, an 8-bit data word, and no parity. These are the default settings provided from the factory.

Figure 2–11 Connecting Network and Console Terminal Cables



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11. Insert conductive blank panels into the vacant slots of the VME chassis. This improves airflow and reduces electromagnetic interference (EMI) radiation.
12. Your installation is complete and power can be turned on.
13. When you turn power on, the Power LED lights (refer to Figure 3–1) and the AXPvme module runs its power-up self-test display (POST). This takes about 30 seconds.

    The POST runs a number of tests that show their status on the LED display. These tests complete successfully when the display counts down to zero.

The POST then runs a number of additional tests that display their status on the console terminal. These tests complete successfully when the console prompt appears (>>>) and the LED displays a rotating bar. For more information on the POST, refer to Chapter 5.

2.4 Troubleshooting

The AXPvme modules include extensive diagnostic (POST) capabilities that are normally executed on power-up. These include both SROM and flash ROM-based code.

SROM-based diagnostics are always executed on power-up and use decreasing numeric codes (9, 6, ...1) to indicate status on the dot matrix display. All SROM-based tests must pass successfully before the flash ROM-based diagnostics and console diagnostics are run. If one or more SROM diagnostics fail, the flash ROM-based dignostics and the console diagnostics will not be loaded and a single > prompt will be displayed on the console terminal. The code of the failing diagnostic will be on the dot matrix display. Additional information appears on the console terminal if present.

Once the SROM diagnostics complete successfully, the flash ROM diagnostics will be loaded, decompressed and executed. Flash ROM diagnostics use an ascending (A, B, ...,N) character-based code to indicate progress. If one or more flash ROM-based diagnostics fail, the code representing the FIRST error will remain on the dot matrix display and alternate between dim and bright intensity.

If all SROM and and flash ROM-based diagnostics pass, and on *auto_action* [1] boot command has been set, the >>> console prompt appears on the console terminal and the dot matrix display will display a "rotating bar."

Note that a problem in the PCI option card that hangs the PCI bus signal lines could cause diagnostics to report problems throughout the I/O subsystem and in the PCI controller of the processor chip. If you have a PCI option installed and are experiencing diagnostic failures, remove the option and repeat the POST.

It is important to remember that the dot matrix display is useable by operating system software and by user applications as well. Once the system is booted, the dot matrix display is no longer under control of the console code and may change. The console will automatically clear the display before booting any image.

[1] See Table 3–3

Table 2–7 lists symptoms and corrective actions that can be used for troubleshooting the AXPvme modules.

Table 2–7 Troubleshooting

Symptom	Corrective Action
No LEDs lit, no console prompts.	Check power. If 5 V power is out of specification, the module will be held in reset.
Green LED on, blank dot matrix display, and no console prompts	Check the seating of SROM (8-pin socketed device near PCI port). See Figure A–1.
Green LED on, dot matrix displays the number 5 on power-up.	Check the seating of the Memory daughter-board.
Green LED on, dot matrix displays the number 0 on power-up.	Ensure that the console terminal is not in "hold screen" mode.
Green LED on, dot matrix displays a flashing letter A on power-up.	Breakout module is not installed correctly. Check the type and the slot alignment of the Breakout module (see Figure 2–9 or Figure 2–10).
Green LED on, dot matrix displays a flashing letter C on power-up.	Check the seating of the Memory daughter-board.
Green LED on, dot matrix displays a flashing letter E on power-up.	Check the SCSI termination, the seating of the AXPvme module, the seating of the Breakout module, the seating of the SCSI cable, and the seating of other SCSI devices.
Green LED on, dot matrix displays a flashing letter I on power-up.	Check that the TOY/NVRAM device is seated properly (see Figure A–1).
Green LED on, dot matrix displays a flashing letter K on power-up.	Check the seating of the Network Address ROM (see Figure A–1).
Green LED on, dot matrix displays a flashing letter L on power-up.	Check the seating of the AUI cable and the nearest network transceiver.
Green LED on, dot matrix displays a flashing letter N on power-up.	Check the seating of the AXPvme module, the seating of the Breakout module, and the seating of other VME devices.
Diagnostics pass but the SCSI tests take an inordinate amount of time (greater than 10 seconds).	Check the SCSI termination, the seating of the AXPvme module, the seating of the Breakout module, the seating of the SCSI cable, and the seating of other SCSI devices.

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Table 2–7 (Cont.) Troubleshooting

Symptom	Corrective Action
Diagnostics pass but there are no (or unreadable) characters displayed on the console.	Check the console terminal connections, and settings (9600 baud, 8-bits, no parity). The terminal should be plugged into the (CON) port.

2.5 Repair and Warranty Information

If your AXPvme kit was damaged in shipping, contact the shipping company. If you need repair or warranty service in the United States, contact the Customer Returns Center at 1-800-225-5385. For repair or warranty service outside the United States, contact the Customer Support Center or the local sales office for your area.

3

Operating the AXPvme Computer

3.1 Controls and Indicators

Figure 3–1 shows the front panel controls and indicators and Table 3–1 describes their function.

Figure 3–1 Controls and Indicators

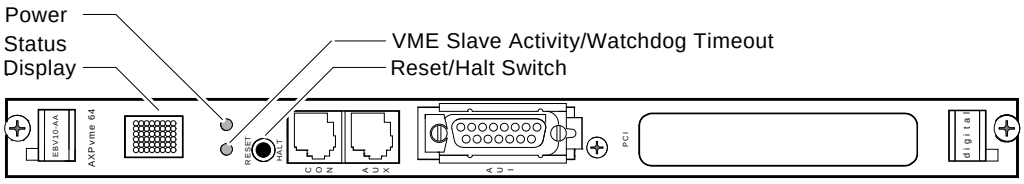

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Table 3–1 Controls and Indicators

Control or Indicator	Description
VME Slave Activity /Watchdog Timeout LED	An amber LED with two functions. The LED flashes when the AXPvme module is accessed as a slave by another device on the VMEbus. The LED lights continuously when the watchdog timer has timed out. **Note:** The LED can appear to light continuously when the module is receiving slave accesses. Since the LED glows for 1/3 of a second each time it flashes, three slave accesses per second could make the LED light continuously.
Power LED	A green LED that is lit when the power is on.

(continued on next page)

Table 3–1 (Cont.) Controls and Indicators

Control or Indicator	Description
Status display	A display that shows which test is running during the POST. After that, the display is under the software control of the operating system or an application program.
RESET/HALT switch	A switch that resets the AXPvme system when pressed in the RESET direction. When pressed in the HALT direction this switch halts the operating system and the module enters console mode.

3.2 Console Mode

Console mode is automatically entered when the POST is finished. Console mode can also be entered in the following ways:

- Pressing the HALT or RESET switches on the front panel.

  Caution

  Depending on the operating system and applications running at the time, this could damage application files that are open and have not been saved.

- The module receives a VMEbus Reset signal and switch 3 of the configuration switches on the AXPvme module is enabled.

  Caution

  Depending on the operating system and applications running at the time, this could damage application files.

- Using the operating system command to enter console mode.
- The operating system executes a HALT instruction.
- The operating system encounters a fatal error.

Exit the console mode by issuing the boot, start, or continue commands.

The commands in Table 3–2 are supported by the AXPvme console program. For more information, use the help command or refer to the *AXPvme Single-Board Computer Technical Description* (EK-EBV1X-TD).

Table 3–2 Console Commands Summary

Command	Description
! #	Comment characters
alloc	Allocates a block of memory
boot	Bootstraps the system
bpt	Enters debugger
break	Breaks from a program loop
cat	Creates, copies, and appends files
chmod	Changes file attributes
chown	Changes ownership of a memory block
clear	Deletes an environment variable
clear_log	Clears the error log in NVRAM
continue	Resumes program execution
crc	Generates the cyclic redundancy check (CRC) for a file
date	Displays or changes the time
deposit	Writes data to memory
dynamic	Shows the state of memory
echo	Outputs a line of text
edit	Edits a file
eval	Evaluates a numeric expression
examine	Displays data in memory
exer	Exercises one or more devices
exit	Exits from the current shell
false	Returns failure status
free	Deallocates memory
grep	Searches a file for a character string
hd	Dumps a file to your screen
help, man	Displays help on commands
init	Initializes the console, a device, or the processor
kill	Deletes a process
line	Reads a line of data

(continued on next page)

Table 3–2 (Cont.) Console Commands Summary

Command	Description
ls	Lists file names
memexer	Runs a memory exerciser
memtest	Runs a memory test
net	Executes maintenance operations protocol (MOP) function
nettest	Runs MOP loopback test
ps	Shows information about a process
pwrup	Runs the power-up diagnostics
rm	Removes a file
semaphore	Displays the system semaphores
set	Sets an environment variable
set led	Displays a character on the LED display
sh	Creates a new shell
show config	Displays system configuration information; firmware version numbers, memory, VME system controller setting, and PCI configuration
show device	Displays devices
show hwrpb	Displays the address of the hardware reset parameter block
show_iobq	Displays the I/O counter blocks
show led	Shows the character currently displayed on the LED display
show_log	Displays faults from NVRAM
show map	Displays a map of memory
sleep	Suspends program execution
sort	Sorts the lines of a file alphabetically
sp	Sets the priority of a process
start	Starts a program
stop	Stops the processor or a device

Table 3–3 lists the environmental variables that can be changed. Do not attempt to change any of these variables without understanding the implications of the change. For more information refer to the *AXPvme Single-Board Computer Technical Description* (EK-EBV1X-TD).

Table 3–3 Environmental Variables Summary

Variable	Description
auto_action	Defines console action following an error, halt, or powerup.
boot_dev	Device list used by the last, or currently in progress, bootstrap attempt.
bootdef_dev	Device list from which bootstrapping is to be attempted when no path is specified by a BOOT command.
booted_dev	Devices used by the last or currently in progress bootstrap attempt.
boot_file	Filename to be used when a bootstrap requires a filename and when bootstrap is not the result of a BOOT command or when no filename is specified on a BOOT command.
booted_file	Filename used by the last or currently in progress bootstrap attempt.
boot_osflags	Additional parameters to be passed to system software when the bootstrap is not the result of a BOOT command or when none is specified on a BOOT command.
booted_osflags	Additional parameters passed to system software during the last or currently in progress bootstrap attempt.
boot_reset	Indicates whether a full system reset is performed in response to an error halt or boot.
dump_dev	Device to write operating system crash dumps.
enable_audit	Indicates whether audit trail messages are to be generated during bootstrap.
license	Software license in effect.
char_set	Current console terminal character-set encoding.
language	Current console terminal language (integer ID).
language_name	Current console terminal language.
tty_dev	Current console terminal unit.
d_bell	Bell on error.

(continued on next page)

Table 3–3 (Cont.) Environmental Variables Summary

Variable	Description
d_cleanup	Cleanup code executed at diagnostic end.
d_complete	Display diagnostic completion message.
d_eop	Display end-of-pass messages.
d_group	Diagnostic group to be executed.
d_harderr	Action following a hard error detection.
d_oper	Operator present.
d_passes	Diagnostic pass count.
d_report	Level of information provided by the diagnostic error reports.
d_softerr	Action taken following a soft error detection.
d_startup	Display diagnostic startup message.
d_trace	Display trace messages.
ewa0_arp_tries	Number of transmissions that are attempted before the ARP protocol fails.
ewa0_bootp_file	Generic file name to be included in a BOOTP request.
ewa0_bootp_server	Server name to be included in a BOOTP request.
ewa0_bootp_tries	Number of transmissions that are attempted before the BOOTP protocol fails.
ewa0_def_ginetaddr	Initial value for ewa0_ginetaddr when the interface's internal internet database is initialized from BOOTP (i.e., ewa0_inet_ init is set to "bootp").
ewa0_def_inetaddr	Initial value for ewa0_inetaddr when the interface's internal internet database is initialized from BOOTP (i.e., ewa0_inet_ init is set to "bootp").
ewa0_def_inetfile	Initial value for ewa0_inetfile when the interface's internal internet database is initialized from BOOTP (i.e., ewa0_inet_ init is set to "bootp").
ewa0_def_sinetaddr	Initial value for ewa0_sinetaddr when the interface's internal internet database is initialized from BOOTP (i.e., ewa0_inet_ init is set to "bootp").
ewa0_inet_init	Determines whether the interface's internal internet database is initialized from NVRAM or from a network server (via the BOOTP protocol).
ewa0_loop_count	Number of times each message is looped.

(continued on next page)

Table 3–3 (Cont.) Environmental Variables Summary

Variable	Description
ewa0_loop_inc	Amount the message size is increased from message to message.
ewa0_loop_patt	Type of data pattern to be used when doing loopback.
ewa0_loop_size	Size of the loop data to be used.
ewa0_lp_msg_node	Number of messages originally sent to each node.
ewa0_protocols	Network protocol enabled for booting and other functions.
ewa0_tftp_tries	Number of transmissions that are attempted before the TFTP protocol fails.
ncr*_setup	Defined values for "*" are 0, 1, 2, 3, or 4, corresponding to the storage bus adapters A, B, C, D, or E, respectively.
pal	Versions of VMS and OSF PALcode in the firmware.
pci_arb_mode	PCI arbitration mode.
pci_park_dev	PCI park device.
sys_serial_num	The system serial number set by manufacturing.
tt_baud	This EV is used to change the baud rate of the UARTs.
version	Version of the console code firmware.
vme_config	VME setup mode (TBD).
vme_a32_base	Base address of VMEbus A32 space.
vme_a32_size	Size of A32 VMEbus address space.
vme_a24_base	Base address of VMEbus A24 space.
vme_a24_size	Size of A24 VMEbus address space.
vme_a16_base	Base address of VMEbus A16 space.
vx_bootline	Filename used for VxWorks bootstrap.

3.3 Booting an Operating System

Refer to the *VxWorks: Digital AXPvme Single-Board Computers Hardware Supplement* (AA-QA5HA-TE) and the *VxWorks Programmer's Guide* (AA-Q3YLB-TE) or the *DEC OSF/1 Installation Guide* (AA-PS2DD-TE) for information about booting the operating system.

3.4 Updating Firmware

Refer to the *Firmware Update Release Notes* shipped with the firmware release and either the *VxWorks Digital AXPvme Single-Board Computers Hardware Supplement* (AA-QA5HA-TE) or the *DEC OSF/1 Installation Guide* (AA-PS2DD-TE) for information about updating the firmware.

4
Hardware Overview

4.1 Introduction

This chapter contains an overview of the AXPvme system to help you better interpret diagnostic error messages.

The field replaceable units (FRUs) in the AXPvme system are the AXPvme module, the Breakout module, and the memory daughterboard. Devices external to the AXPvme module can also cause failure, such as SCSI cables and devices, Ethernet cables and devices, and the PCI mezzanine module.

Figure 4–1 shows a block diagram of the systems on the AXPvme module.

4.2 Processor

The AXPvme dual-slot module has a DECchip 21066/A Alpha AXP processor. The AXPvme single-slot modules have a DECchip 21068/A Alpha AXP processor. Table 4–1 shows which DECchip processor resides on the AXPvme modules. The processor provides full floating-point support, contains internal 8-kB data and 8-kB instruction caches, a full high-performance memory, and I/O bus controllers, as well as a clock generator.

Table 4–1 DECchip Alpha AXP Processor Module Assignments

AXPvme Module	DECchip Alpha Processor
64	21068
64LC	21068
100	21068A
160	21066
166	21066A
230	21066A

4.3 Memory Subsystem

The memory subsystem of the AXPvme system is divided into two sections:

- Main memory
- Secondary cache

The internal memory controller circuitry is located on the processor chip and handles all interface operations to the main memory and the external secondary memory cache.

4.3.1 Main Memory

Main memory for the AXPvme system is located on a daughterboard. The memory daughterboard is available in the following sizes: 8, 16, 32, 64, and 128 MB. Memory on the daughterboard is connected to the processor chip by a 72-bit bus with a transfer rate of approximately 64 MB/s. This provides a path for 64 bits of data plus an 8-bit error correction code (ECC). With ECC, the memory controller can correct single-bit data errors and can detect double-bit data and 4-bit nibble errors.

4.3.2 Secondary Cache

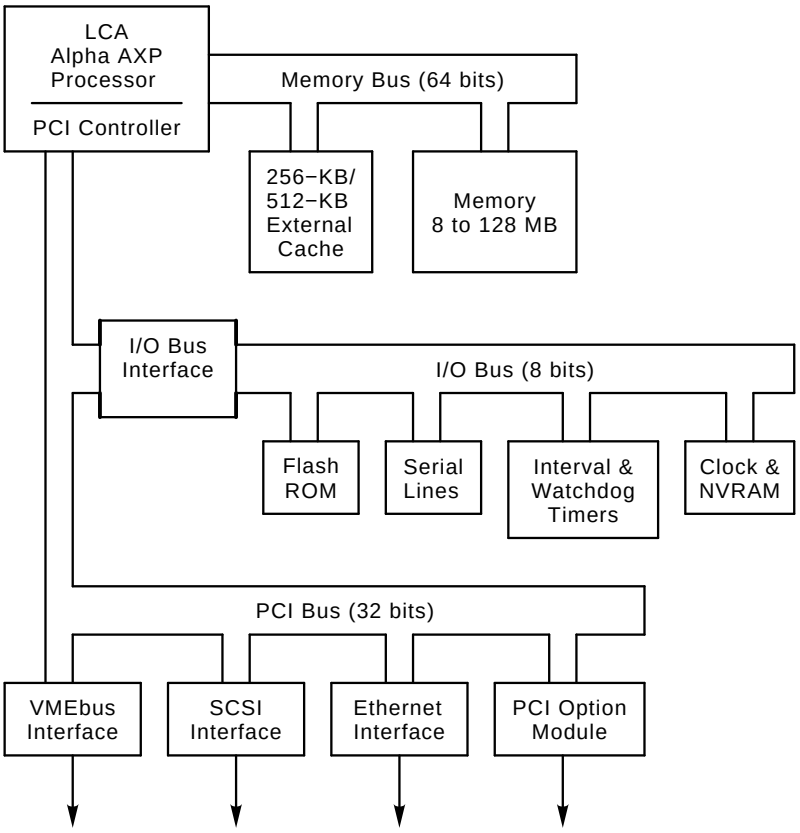
The external secondary memory cache is an optional subsystem which increases overall system performance by returning cached data faster than is possible from main memory.

The secondary cache is a write-back configuration and the cache word size is 64 bits with 8-bit ECC.

The AXPvme 64 and the AXPvme 160 modules have a 256-kB external secondary memory cache on the module. The AXPvme 64LC module has no external secondary memory cache.

The AXPvme 100, 166, and 230 modules have a 512 Kbyte external secondary memory cache on the module.

Figure 4–1 AXPvme Module Block Diagram



Note

The 256-kB or 512-kB external cache and the SCSI interface are not provided on the AXPvme 64LC.

4.4 PCI Bus

The I/O subsystem is connected to the processor chip with a 32 MHz peripheral component interconnect (PCI) bus that has a peak data transfer rate of 128 MB/s. The PCI is used as the system I/O bus. The PCI bus provides a 32-bit data path and a 32-bit address space. The DECchip 2106x processor has an internal PCI controller. Byte, word, longword, and quadword accesses over the PCI are supported for CPU initiated cycles. The PCI controller acts as a PCI to main memory bridge for I/O initiated transfers and direct memory access (DMA) data transfers between PCI peripherals and main memory.

The PCI bus provides the connection path for the VMEbus interface, the SCSI interface, the Ethernet interface, and a PCI option module.

4.4.1 VMEbus Interface

The VME interface processor (DECchip 7407B) and VME interface controller VIC64 chips provide the interface between the VMEbus and the PCI bus. This interface allows transfers, including DMA transfers, between devices on the VMEbus and main memory.

The AXPvme supports a full master/slave VME interface. The VME interface operates in A16, A24, and A32 addresses spaces for master transactions and A24 and A32 addresses spaces for slave transactions, with 8, 16, 32, and 64-bit data transfers in either mode.

The scatter/gather RAM maps blocks of addresses in main memory to blocks of addresses in the VMEbus address space. This allows DMA transfers with a variety of VME devices with widely differing VMEbus addresses.

The DECchip 7407B hardware also performs byte swapping under program control. This allows data exchange between the little-endian Alpha AXP processor and other architectures with little software overhead. The hardware supports byte swap, word swap, longword swap, and also supports swapping the order of longwords in a 64-bit transfer.

4.4.2 IEEE 802.3 Interface

The interface between the network and the PCI bus is provided by the DECchip 21040 Ethernet controller chip. Connection to a network is by an attachment unit interface (AUI) on the front panel of the AXPvme module.

4.4.3 SCSI Interface

The PCI-to-SCSI interface is provided by an NCR® 53C810 chip. (The AXPvme 64LC module does not have a SCSI controller.) The SCSI signal lines leave the module on user-defined pins of the VMEbus P2 connector and connect to the SCSI connector on the Breakout module.

4.4.4 PCI Option Module

The AXPvme module has connectors to allow one 32-bit PCI mezzanine (IEEE P1386.1) option card to be plugged in. The PCI bus arbitration logic in the AXPvme supports one option card with four PCI interrupt request lines.

4.5 I/O Bus

A number of the slower I/O devices on the AXPvme module are connected by an internal 8-bit I/O bus. The controller for the I/O bus interface is a device on the PCI bus. The following are I/O bus devices:

- Flash ROM
- Nonvolatile memory (NVRAM)
- Time-of-year (TOY) clock
- Interval timers
- Watchdog timer
- Serial lines
- Front panel LED display
- Network address register

4.5.1 Flash ROM

Flash ROM is an electrically programmable read-only memory (EPROM) device. Half of flash ROM is used to store the console code, system diagnostics, and privileged architecture language code (PALcode). The other half is available for storing on-board operating system code. The flash ROM space can be rewritten. Updates are enabled/disabled by way of software and a AXPvme module configuration switch. You program flash ROM with the console code "update" command. Table 4–2 shows the amount of flash ROM that resides on the AXPvme modules.

Table 4–2 Flash ROM Mbyte Size on AXPvme Modules

AXPvme Module	Flash ROM Size
64	1 Mbyte
64LC	1 Mbyte
100	4 Mbyte
160	1 Mbyte
166	4 Mbyte
230	4 Mbyte

4.5.2 NVRAM

The 32-kB nonvolatile memory (NVRAM), time-of-year (TOY) clock, and watchdog timer are all in a single DALLAS DS1386 component. This component also contains a lithium battery that powers the NVRAM and TOY. This battery lasts for about 10 years at 25°C (77°F). This component is mounted in a socket and can be replaced. A configuration switch on the AXPvme module allows the NVRAM and the TOY clock to be supplied by the backplane 5V standby (to remove dependence on the internal battery). The lowest 16 kB of the NVRAM is used by the firmware and the remaining 16 kB is available for use by the user and the operating system. Refer to Figure A–1 for the component location.

4.5.3 TOY Clock

A basic TOY clock function with battery backup is included as part of the DALLAS® DS1386 functionality on the AXPvme module. Timekeeping information includes 1/100th's of seconds, seconds, minutes, hours, days, date, month, and year. The date at the end of the month is automatically adjusted for months with less than 31 days, including corrections for leap years. The stored time can be selected for 24 hour or 12 hour with AM/PM indication formats.

Timekeeping functionality is maintained in the absence of Vcc by an internal lithium energy cell. In addition, the device internally protects against spurious accesses during power transitions. This device keeps time and date information with a resolution of 0.01 seconds and an accuracy of +/- 1 minute per month, at 25°C.

The TOY clock also generates a fixed 1024 Hz heartbeat interrupt.

4.5.4 Interval Timers

The AXPvme module features three programmable 16-bit interval timers. Two of the timers are driven from a fixed 10 MHz clock. One of them operates as a rate generator with its output going to P2 pin C16. The other one operates as a rate generator with its output going to P2 pin C15 and to the processor as an interrupt request. The third timer is gated by external inputs by way of P2 pin C17 or P2 pin C18 for event counting or synchronization. The output of this third timer goes to the processor as an interrupt request.

4.5.5 Watchdog Timer

The watchdog timer is a programmable fail-safe device for the system software. The timer interval can be set under program control from 0.01 to 99.9 seconds. If the timer is enabled and the software allows it to time out, the board is reset and the console code takes whatever action is specified by the "auto_action" console variable. This action is typically to reboot the operating system. On watchdog reset, an open-collector signal, accessible by way of P2, is asserted and the yellow front panel LED lights.

4.5.6 Serial Lines

The AXPvme module has two general-purpose asynchronous serial communication lines. These lines are data-lead only DEC423 using 6-pin modified modular jack (MMJ) connectors. One of these two lines is dedicated to the system console. The default baud rate setting is 9600. Both have software programmable baud rates of 600, 1200, 2400, 4800, 9600, and 19.2 k.

4.5.7 LED Display

There is a single 5 x 7 dot matrix alphanumeric display on the front panel of the AXPvme module which is accessible in I/O space. The display is used for firmware status information. When not running resident firmware or diagnostics, the display is available for use under user software control.

The green LED indicates that 5 V and 3.3 V power are within specified tolerances. The yellow LED lights when either a VME slave cycle is detected or the watchdog timer has expired.

4.5.8 SROM

The serial ROM (SROM) is an 8-kB ROM that stores the most basic processor self-test diagnostics and a bootstrap to load and start the console code. After the power is turned on, this code is loaded directly from the SROM to the instruction cache on the processor chip over an internal serial line. The code is then executed from the instruction cache.

5
Diagnostics

When you turn on the power or toggle the RESET switch, the AXPvme module runs its POST. The module runs a series of tests stored in the serial read-only memory (SROM) and then runs a series of console code tests stored in the flash ROMs. The SROM tests display their test number on the LED display during execution. If an SROM test fails, the LED display flashes the failing test number. Refer to Table 5–1 for a list of SROM test numbers and functions.

Table 5–1 SROM Test Numbers and Descriptions

Test Number	Function	Description
9	Processor test	Initializes and tests the processor chip
8	I/O device test	Tests devices on the 8-bit I/O bus
7	Console line test	Tests the console universal asynchronous receiver /transmitter (UART) chip
6	Internal data cache test	Tests the 8-kB data cache in the processor chip
5	Main memory test	Tests the first 2 MB of main memory
4	Internal data cache start	Enables the 8-kB data cache in the processor chip
3	External cache check	Checks for the presence of the 256-kB external memory cache
2	External cache test	Tests the external memory cache (if present) and clears the error status register
1	Console code load	Loads the console code from flash ROM to main memory
0	Console code start	Starts execution of the console code in main memory

The console code tests display their test names and results on the console terminal. The console code tests also display their test letter on the LED display as they are being executed. If a console code test fails, the LED display flashes the letter of the failing test. Table 5–2 lists console code test letters and test names.

Table 5–2 Console Code Test Letters and Names

Test Letter	Test Name
A	Breakout module test
B	External cache test
C	Memory ECC (error correction code) test
D	Module configuration register test
E	SCSI control and status register (CSR) test
F	Heartbeat timer test
G	Interval timer test
H	Flash ROM test
I	DS1386 nonvolatile RAM tests
J	Auxiliary UART test
K	Ethernet address ROM test
L	Ethernet internal and external loopback tests
M	Watchdog timer test
N	VME interface processor/VIC64 test

After the POST completes and the system is idle, console outputs a "rotating bar" to the LED display.

For more information about these tests, refer to the *AXPvme Single-Board Computer Technical Description* (EK-EBV1X-TD).

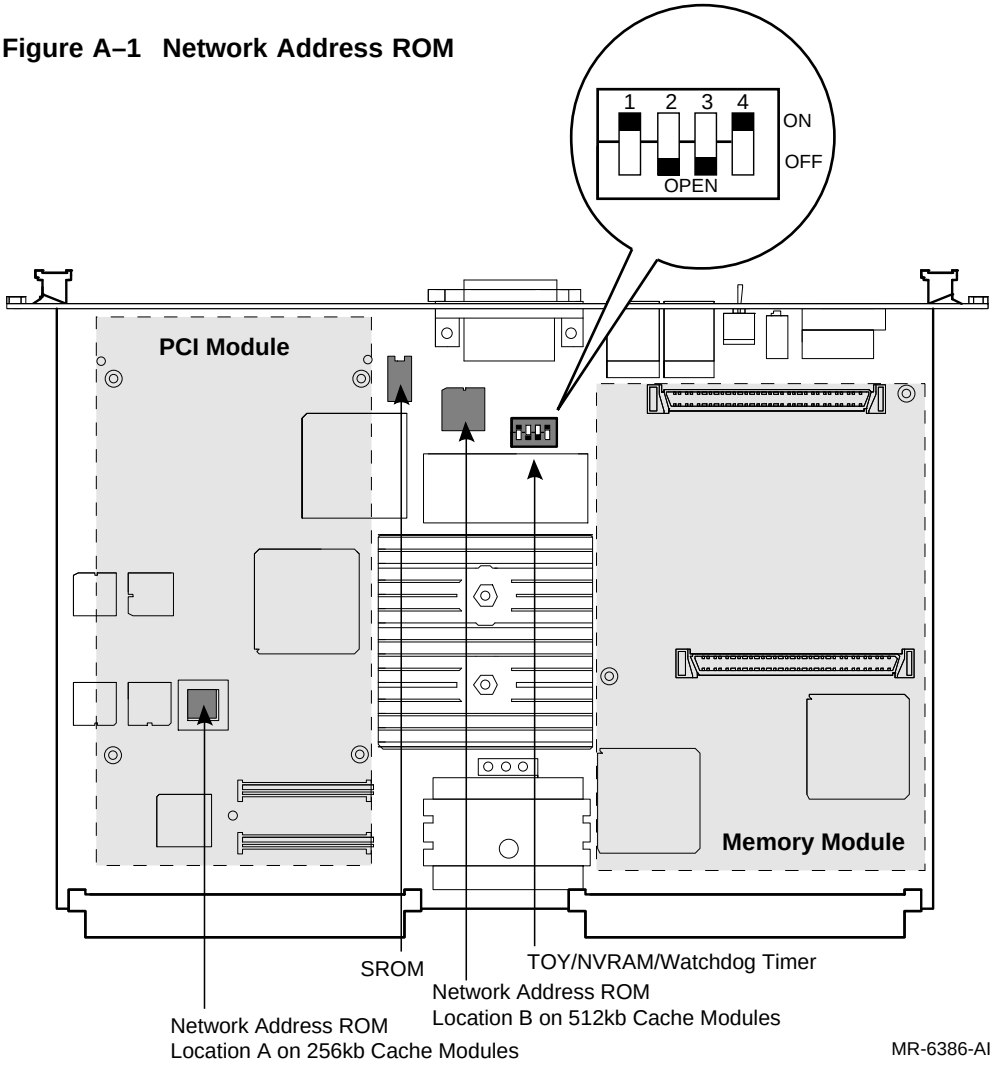
A

Network Address ROM

Figure A–1 shows the location of the network hardware address ROM. This ROM is mounted in a socket so that it can be replaced in order to change the network address of the module.

When you replace a module, you can remove the network address ROM from the old module and place it into the new module if you want the system to keep the same network address.

Figure A–1 Network Address ROM



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