VAX 6200 Options and Maintenance

Order Number EK-620AA-MG-001

This manual is intended for DIGITAL field service representatives. It covers the installation of modules and removal and replacement of field-replaceable units (FRUs).

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Intended Audience

This manual is written for DIGITAL field service representatives servicing the VAX 6200 system. This manual covers the installation of modules and removal and replacement of field-replaceable units (FRUs).

Document Structure

The manuals in the VAX 6200 documentation set are designed using structured documentation theory. Each topic has a boldface indented abstract, to help you use the manual as a reference tool. Other typical components of a topic include an illustration or example, a chart or list, and descriptive text.

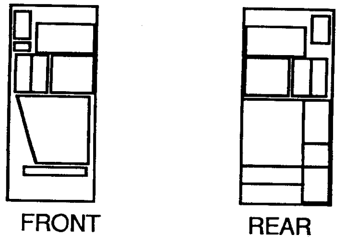
This manual has 10 chapters and two appendixes:

- **Chapter 1, Introduction** gives an overview of the system, including system specifications, field-replaceable units, system architecture, and location of major assemblies.
- **Chapter 2, Diagnostics**, describes the levels of diagnostic design, their implementation, and a patch mechanism for updating the programs.
- **Chapter 3, KA62A Processors, Chapter 4, MS62A Memory**, and **Chapter 5, DWMBA Adapter** give module specifications, configuration rules, main registers, module diagnostics, and self-test information.
- **Chapter 6, XMI Card Cage**, and **Chapter 7, VAXBI Card Cage**, describe the system card cage and the I/O card cage, respectively, and their removal and replacement procedures.
- **Chapter 8, Control Subsystem Assemblies,** presents the four subassemblies housed in the system control assembly area and gives the removal and replacement instructions for each subassembly.
- **Chapter 9, Power Subassemblies**, discusses each field-replaceable unit of the power system, its diagnostics, and the removal and replacement procedure for the unit.

- **Chapter 10, Cabinet and Airflow Subsystem**, presents the field-replaceable units that are specific to the cabinet and their removal and replacement instructions.
- **Appendix A** is the cable list. **Appendix B** is a troubleshooting chart. A **Glossary** and **Index** provide additional reference support.

Conventions Used in this Document

In illustrations, icons are used for designating part placement within the VAX 6200. The shaded area within the icon shows the location of the component or part being discussed. The icons used include:



VAX 6200 Documents

Documents in the VAX 6200 documentation set include:

Title	Order Number
VAX 6200 Installation Guide	EK-620AA-IN
VAX 6200 Owner's Manual	EK-620AA-OM
VAX 6200 Mini-Reference	EK-620AA-HR
VAX 6200 System Technical User's Guide	EK-620AA-TM
VAX 6200 Options and Maintenance	EK-620AA-MG

Associated Documents

Other documents that you may find useful include:

Title	Order Number
CIBCA User Guide	EK-CIBCA-UG
Guide to VAXclusters	AA-Y513A-TE
Guide to VAX/VMS Software Installation	AA-Y514B-TE
HSC50 User's Guide	EK-HSC50-UG
H9657-EU Installation Guide	EK-VBIEU-IN
KDB50 Disk Controller User's Guide	EK-KDB50-UG
RA82 Disk Drive User's Guide	EK-ORA82-UG
SC008 Star Coupler User's Guide	EK-SC008-UG
TK50 Tape Drive Subsystem User's Guide	EK-OTK50-UG
TU81/TA81 and TU81 PLUS Subsystem User's Guide	EK-TUA81-UG
VAX/VMS Networking Manual, *VAX/VMS Volume 6, Networking*	AA-Y512C-TE
The VAX Architecture Reference Manual	EY-3459E-DP
VAX Diagnostic Design Guide	EK-1VAXD-TM
VAX Diagnostic Software Handbook	AA-F152A-TE
VAX Diagnostic Supervisor User's Guide	EK-VXDSU-UG
VAX Hardware Handbook	EB-25949-46
VAX Software Handbook Set	EJ-28250-DP
VAX/VMS Networking Manual	AA-Y5120-TE
VAXBI Expander Cabinet Installation Guide	EK-VBIEA-IN
VAXBI Options Handbook	EB-29228-46

Chapter 1
Introduction

This chapter introduces the VAX 6200 system, its architecture and system specifications, the location of components in the cabinet, and the field-replaceable unit list. Sections include:

- System Physical Description
- System Functional Description
- System Packages
- VAX 6200 Front View
- VAX 6200 Rear View
- Field-Replaceable Units

1.1 System Physical Description

A typical VAX 6200 system has a main cabinet with a TK tape drive, a console terminal, a disk drive cabinet, an accessories kit, and a set of documentation. The system may have additional tape or disk drives and may be a member of a VAXcluster.

Figure 1-1: Typical VAX 6200 System

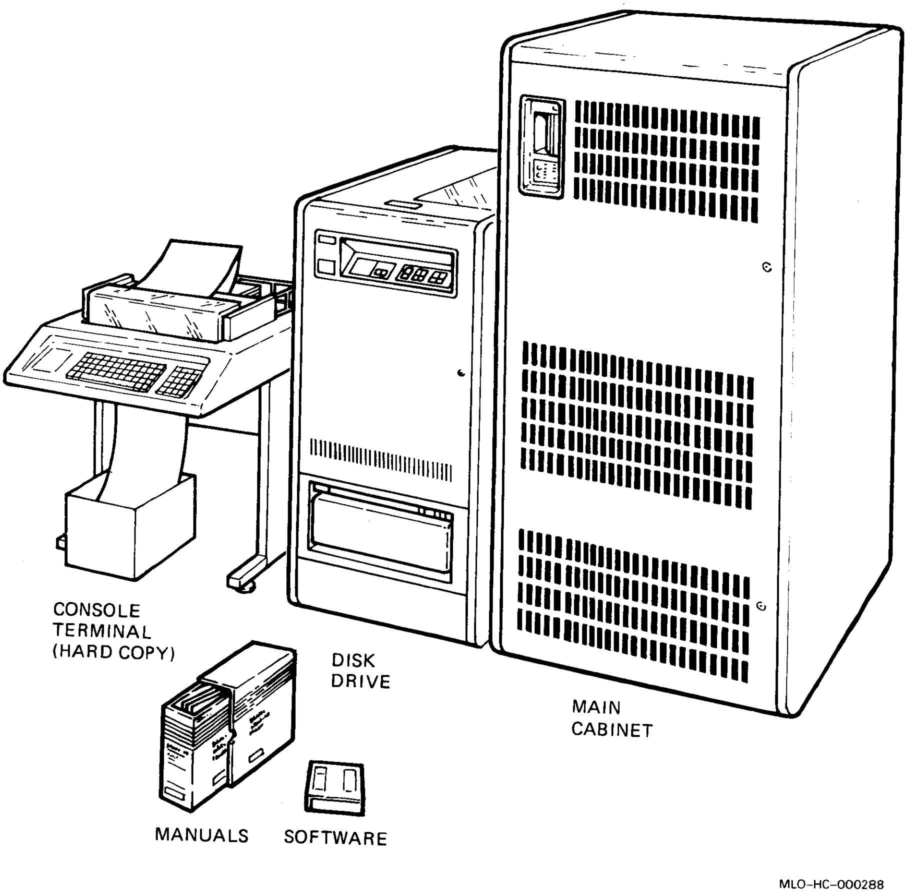


Figure 1-1 shows a typical system.

- **The main cabinet** houses a TK tape drive, the XMI card cage (which contains the processors and memories), two VAXBI card cages, the control panel switches, status indicators, and restart controls.
- **The TK tape drive** in the main cabinet is used for installing operating systems, software, and some diagnostics.
- **The disk drive cabinet** has local storage and archiving capability.
- **The console terminal** is used for booting and for system management operations.
- **VAX 6200 documentation** that ships with the system includes:
  - *VAX 6200 Installation Guide*
  - *VAX 6200 Owner's Manual*
  - *VAX 6200 Mini-Reference*

  See the Preface for a complete list of system documentation and associated documents.

Table 1-1: VAX 6200 System Characteristics

Physical		cm (in)
	Height	154 (60.5)
	Width	78 (30.5)
	Depth	76 (30.0)
	Weight	318 kg (700 lbs)
Environmental		
Heat dissipation (max)		5440 Btu/hr (5712 KJ/hr)
Operating temperature	TK not in use	10° to 40°C (50° to 104°F)
	TK in use	15° to 32°C (59° to 90°F)
Operating humidity	TK not in use	10 to 90% relative humidity
	TK in use	20 to 80% relative humidity
Altitude	Non-operational	0 to 9.1 km (0 to 30,000 ft)
	Operating	0 to 2.4 km (0 to 8000 ft)
Cooling System		
	Type	Pressurized, with air moving device
	Air mover	Dual backward curved blowers
	Air source	Filtered ambient air

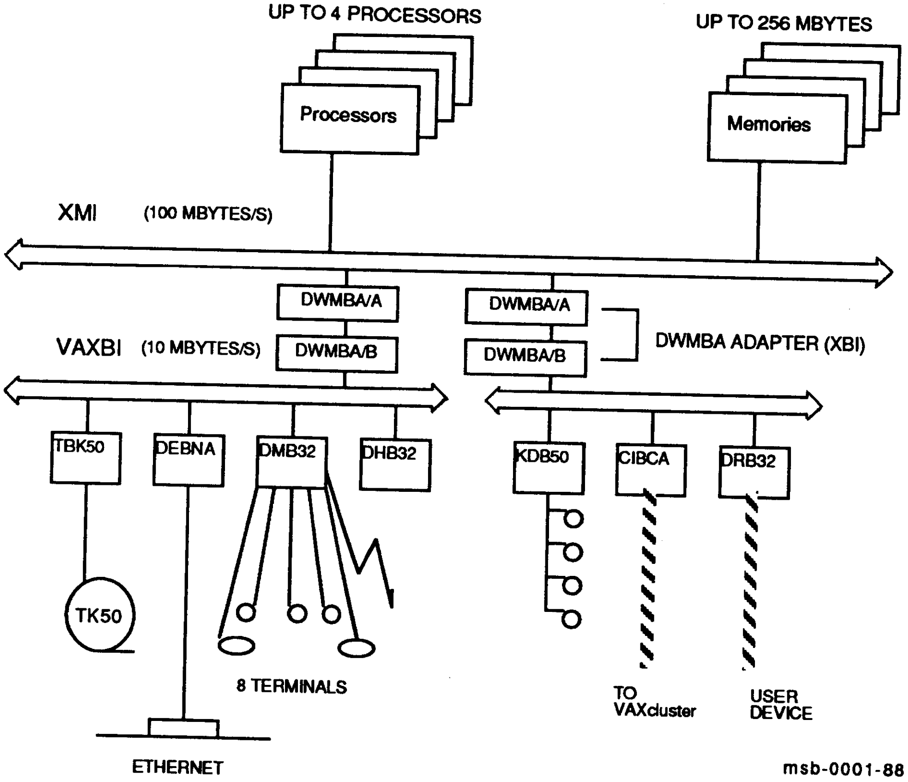
Table 1-1 (Cont.): VAX 6200 System Characteristics

Electrical		
AC power consumption (max)		1.6 kW
AC current (max)	60 Hz	8 A (208 V)
	50 Hz	4 A (416 V), 4.5 A (380 V)
Voltage input	60 Hz	3-phase 208 VRMS
	50 Hz	3-phase 380/416 VRMS
Frequency tolerance		47-63 Hz
Surge current		60 A

1.2 System Functional Description

The VAX 6200 system supports multiprocessing with up to four KA62A processors. The system uses a high-speed system bus called the XMI bus to interconnect its KA62A processors and its MS62A memory modules. All I/O devices connect to the VAXBI bus. Optional hardware includes the VAXBI expander cabinet and disk or tape drives.

Figure 1-2: VAX 6200 System Architecture



The XMI is the VAX 6200 system bus; the VAXBI bus supports the I/O subsystem. The XMI is a 64-bit system bus[1] that interconnects the central processors, memory modules, and VAXBI I/O adapters.

The VAXBI and XMI share similar but incompatible connector and module architecture. Both the VAXBI and XMI buses use the concept of a **node**. A node is a single functional unit that consists of one or more modules. A node may be one or two modules operating as a single functional unit.

The XMI has three types of nodes: processor nodes (KA62A), memory nodes (MS62A), and the XMI-to-VAXBI I/O adapters (DWMBA).

A **processor node**, called a KA62A, is a single-board VAX processor. It contains a central processor unit (CPU) chip with its own cache, a floating-point processor, a secondary cache, a writable PROM for system parameters, and a custom gate array for interfacing to the XMI bus.

Processors communicate with main memory over the XMI bus. The system supports multiprocessing of up to four processors. One processor becomes the boot processor during power-up, and that boot processor handles all system communication. The other processors become secondary processors and receive system information from the primary processor (see Section 3.4).

A **memory node** is an MS62A. Memory is a global resource equally accessible by all processors on the XMI. Each MS62A module has 32 Mbytes of memory, consisting of MOS 1-Mbit dynamic RAMs, ECC logic, and control logic. The memories are automatically interleaved for maximum performance, or may be custom set by console command. An optional battery backup unit protects memory in case of power failure.

An **XMI-to-VAXBI adapter**, called a **DWMBA**, is a 2-board adapter that maps data between these two buses. The DWMBA/A module is installed on the XMI bus; it communicates with the DWMBA/B module on the VAXBI using a 120-pin cable. Every VAXBI on this system must have a DWMBA adapter. Therefore, systems with two VAXBI channels have two DWMBA/A modules on the XMI bus, and each VAXBI has a DWMBA/B module in its card cage. System error messages and self-test results refer to the pair of DWMBA modules as XBI.

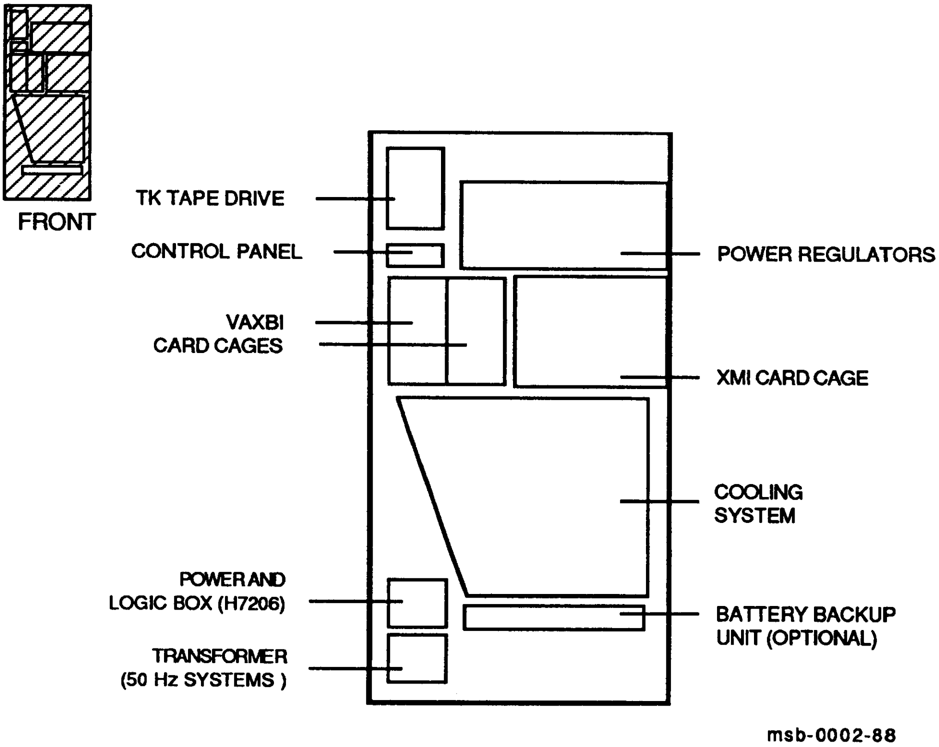
The VAXBI, in turn, passes data between the system and the peripheral devices.

[1] The XMI has a 64-nanosecond bus cycle, with a maximum throughput of 100 Mbytes per second.

1.3 VAX 6200 Front View

The TK tape drive and control panel are on the front of the system cabinet, accessible with the doors closed. With the front door open, field service representatives can access the VAXBI and XMI card cages, the cooling system, the battery backup unit, if present, and power regulators.

Figure 1-3: VAX 6200 System (Front View)



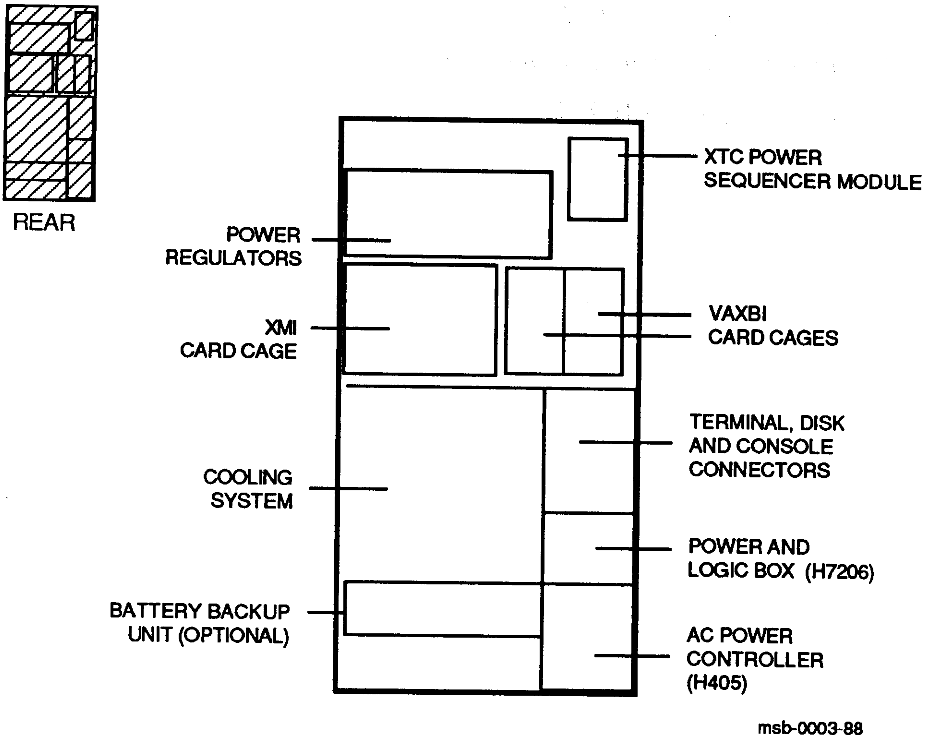
These components are visible from the inside front of the cabinet (see Figure 1-3 for their location):

- TK tape drive
- Control panel
- Power regulators
- Two VAXBI card cages
- XMI card cage
- Cooling system
  One of the two blowers is visible from the front of the cabinet.
- Battery backup (if installed)
- Transformer (on 50 Hz systems only)
- Power and logic box (H7206)

1.4 VAX 6200 Rear View

With the rear door open, field service representatives can access the power regulators; power sequencer module (XTC); cooling system; power and logic box; battery backup unit, if present; AC power controller; terminal, disk, and console connectors; and the I/O bulkhead space.

Figure 1-4: VAX 6200 System (Rear View)



These components are visible from the rear of the cabinet (see Figure 1–4):

- Five field-replaceable power regulators
- Power sequencer module (XTC) located on the back of the TK tape drive and control panel unit
- I/O bulkhead space
  The panel covering the XMI and VAXBI areas is the I/O bulkhead panel and provides space for additional I/O connections.
- Cooling system, with open grid over a blower
- VAXBI and XMI adapter bulkhead cables
- Terminal, disk, and console connectors
- Power and logic box (H7206)
- Battery backup unit (optional)
- AC power controller (H405)

1.5 Field-Replaceable Units

Table 1–2 lists the major recommended spares and their part numbers for the VAX 6200. CD indicates whether the part is in the field service kit.

Table 1–2: Field-Replaceable Units

	Part Number	CD Kit	Description
Kernel:	T1043	Y	VAXBI adapter (DWMBA/B)
	T2011	Y	CPU module (KA62A)
	T2012	Y	VAXBI adapter (DWMBA/A)
Memory:	T2014-B	Y	32 Mbyte memory (MS62A)
VAXBI Card Cage:	H9400-AA	N	VAXBI card cage
XMI Card Cage:	70-24373-01	N	XMI 14-slot card cage
	54-18172-01	Y	XMI daughter card
System Control Assembly:	54-16574-01		Control panel assembly
	54-17243-01 or 20-29176-01	Y	XTC power sequencer
	TK50	Y	Tape drive
	12-19245-02	N	TOY clock battery
Power Supply:	H7214	Y	5 V regulator
	H7215	Y	5 V regulator
	H7206	Y	Power and logic box
	H405E	N	60 Hz AC power controller
	H405F	N	50 Hz AC power controller
Battery Backup:	H7231-N	N	250 W battery backup option

Table 1-2 (Cont.): Field-Replaceable Units

	Part Number	CD Kit	Description
Miscellaneous:	12-11255-24	N	Air filter, front
	12-11255-17	N	Air filter, rear
	12-27848-01	N	Blower assembly
	12-24701-06	N	H7206 fan
	17-01844-01	N	Temperature sensor
	12-25024-11	N	Airflow sensor
	16-28393-01	N	Transformer

Chapter 2
Diagnostics

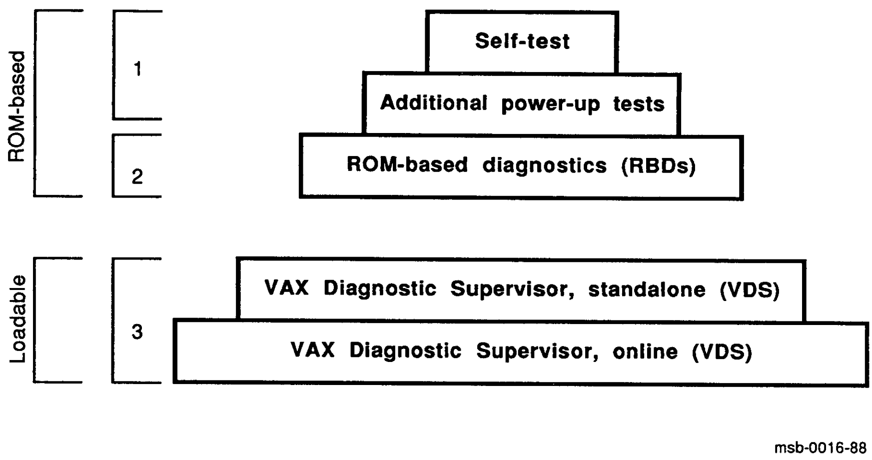
This chapter discusses the design of the VAX 6200 diagnostics, the self-test, ROM-based diagnostic monitor program, VAX diagnostic supervisor tests, and EEPROM patching. Sections include:

- Diagnostic Overview
- Self-Test
- ROM-Based Diagnostic Monitor Program
  - RBD Monitor Control Characters
  - DEPOSIT and EXAMINE Commands
  - START Command
  - START Command Qualifiers
  - RBD Test Printout, Passing
  - RBD Test Printout, Failing
  - Sample RBD Session
- VAX Diagnostic Supervisor Programs
  - Running VDS
  - Sample VDS Session
  - VDS Diagnostics

2.1 Diagnostic Overview

The VAX 6200 system has five levels of diagnostics: three levels are ROM-based, and two are loadable. These tests include ROM-based self-tests to test system modules; additional tests that are run at power-up; ROM-based diagnostics (RBD) invoked from the console program; and two levels of loadable VAX diagnostic supervisor (VDS) tests (see Figure 2–1).

Figure 2–1: Diagnostics Design



Self-Tests
Modules on the XMI have their own self-test resident in ROM, except for the DWMBA/A module. At power-up, initialization, booting, or system reset, each KA62A processor and MS62A memory module runs its own self-test. The processor self-test completes in 10 seconds, and the memory test completes within 60 seconds.

Additional Power-Up Tests
Following the modules' self-tests, two additional programs are run and reported to self-test results: CPU/Memory tests and DWMBA tests.

The extended CPU/Memory test checks that the processors can access memory. Memory also has a self-test that tests actual memory locations. The extended CPU/Memory test is the second test for memory and serves as a check on the memory's XMI interface. Results are printed on the ETF line on self-test (see Chapter 6 of the *VAX 6200 Owner's Manual* for an explanation of self-test results).

The DWMBA modules are tested by the processor, before the boot processor queries the VAXBI options for the results of their self-tests. Results from both tests are printed in the XBI lines on the self-test printout (see Example 2–1).

ROM-Based Diagnostics
From the console prompt, you can enter RBD mode and run any of five ROM-based diagnostics. These five tests include KA62A self-tests, VAXBI tests, memory tests, and second-level cache tests. In RBD mode, you have the capability of running tests with a trace, to indicate which test is failing.

VAX Diagnostic Supervisor (VDS)
From the console prompt, you can boot VDS from the TK tape and run stand-alone VDS level 3 diagnostics (stand-alone mode). From your operating system, run VDS and run level 2R diagnostics (online mode). Level 2 VDS diagnostics may be run either in stand-alone or online mode. See Table 2–9 for a listing of VDS diagnostics.

2.2 Self-Test

The self-test diagnostics reside in ROM on the processors and on-board some other modules. These self-tests check each module at power-up, when the system is reset, and during booting, or when the self-tests are invoked from the RBD monitor program. Self-test results are written to the console terminal, as shown in Example 2-1.

Example 2-1: Sample Self-Test Results

```
F   E   D   C   B   A   9   8   7   6   5   4   3   2   1   0   NODE #

    A   A   .   .   .   M   M   M   M   .   P   P   P   P       TYP
    o   o   .   .   .   +   +   +   +   .   +   +   +   +   .   STF
    .   .   .   .   .   .   .   .   .   .   E   E   D   B       BPD
    .   .   .   .   .   .   .   .   .   .   +   +   +   +       ETF
    .   .   .   .   .   .   .   .   .   .   E   E   D   B       BPD

.   .   .   .   .   .   .   .   .   +   +   .   +   .   +   .   XBI D +
.   .   .   .   .   .   .   .   .   +   +   .   .   .   +   .   XBI E +

    .   .   .   .   .   A4  A3  A2  A1  .   .   .   .   .       ILV
    .   .   .   .   .   32  32  32  32  .   .   .   .   .       128Mb

ROM = 3.0     EEPROM = 2.0/3.0     SN = SG01234567
>>>
```

The self-tests are invoked and results are written to the console under several circumstances:

- At power-up
- At system reset (following power interrupt when the system is in Auto Start mode, or when the control panel Restart button is hit)
- During boot procedure
- In console mode, with the INITIALIZE command

The memory parts of the printout can be individually requested, using the console command SHOW MEMORY. This command prints the ILV line and the line following it that displays memory interleave configuration, each memory's size, and the total working memory of the system.

The tests run during self-test can be individually invoked in RBD mode using the ROM-based diagnostics monitor program. Here you can examine each test more closely and determine which test is failing. Table 2–1 describes the tests run during self-test.

Table 2–1: Self-Test Components

Test	Description
KA62A	Each processor runs its own self-test resident in its own ROM.
MS62A	Each memory runs its own self-test resident in its sequencer.
DWMBA	The XMI-to-VAXBI adapter is tested by the boot processor.
VAXBI	Each VAXBI on the system is checked, and each node on the VAXBI runs its own self-test; results are reported.

The self-test printout in Example 2–1 reflects a specific configuration. A detailed explanation of self-test results is available by typing HELP SELF at the console prompt. Self-test is also described in Chapter 6 of the *VAX 6200 Owner's Manual.*

2.3 ROM-Based Diagnostic Monitor Program

The ROM-Based Diagnostic Monitor program is accessed through the console program. Type T/R at the console prompt to enter RBD mode. RBD mode has five commands with qualifiers and a set of control characters that run the RBD tests.

Table 2–2: RBD Monitor Commands

Command	Function
D[EPOSIT]	Deposits data at the address specified
E[XAMINE]	Examines data at the address specified
ST[ART] n	Starts diagnostic sequence *n*, where *n* is the number of the test listed in Table 2-3
SU[MMARY]	Prints a summary report of the last test run
QU[IT]	Exits the RBD monitor and returns control to the console program

Table 2–3: ROM-Based Diagnostics Programs

RBD Program	Test Totals	Default Totals	Description
0	34	34	Runs CPU tests
1	20	20	Runs extended CPU/memory tests
2	26	21	Runs DWMBA tests
3	12	7	Sizes and runs extended tests on the entire memory
4	8	0	Miscellaneous tests of second-level cache

To enter RBD mode, at the console prompt enter:

```
>>>  T/R              !  This is the console command for TEST/RBD.
                      !
RBDn>                 !  RBD prompt appears signifying entrance into
                      !  RBD mode, where n is the XMI node number of
                      !  the processor running the RBD monitor program.
```

The five RBD commands are explained here and in Section 2.3.2 and Section 2.3.3. Table 2-2 gives the commands, their abbreviations, and functions.

Five programs run from the ROM-based diagnostics (RBD) monitor program. The programs are CPU self-test, CPU/Memory tests, the DWMBA tests, memory RBD tests, and second-level cache RBD tests. Each of these programs has several tests, as shown in Table 2-3. The RBDs are designed for use by DIGITAL field service personnel.

Each RBD has a default number of tests that run when the test is invoked (see Table 2-3). The CPU and CPU/Memory tests (RBD 0 and 1) run all their tests when invoked. The DWMBA tests (RBD 2) runs 21 of the 26 tests available; tests 2, 3, 4, 10, and 11 must be specifically invoked by qualifier. For RBD 3, the Memory tests, 7 of 12 tests run when invoked; tests 2 through 8 are defaults. And for RBD 4, the second-level cache test, all 8 of the tests must be specifically invoked. For instance, the following command invokes all the DWMBA tests available.

```
START 2/T=1:26
```

It is useful to use the /TRACE qualifier with the RBD START command. /TRACE shows each individual test as it is passed. If a test fails, the program brings back error messages. By default, the RBDs continue testing after an error is encountered. Adding the /HE qualifier causes the program to Halt on Error (HE) when the first error is encountered. Testing can be aborted at any time by using a CTRL/C.

To exit RBD mode, type QUIT at the RBD prompt. Your next prompt is from console mode.

2.3.1 RBD Monitor Control Characters

Several control characters are supported by the RBD monitor program. These characters manage the program process as shown in Table 2-4.

Table 2-4: RBD Monitor Control Characters

Character	Environment	Function
CTRL/C	Test running	Stops the execution of an RBD test and executes cleanup code.
DELETE	RBD command line	Use for deleting erroneous characters entered on the command line.
CTRL/Q	Test running	Resumes output to terminal that was suspended with CTRL/S.
CTRL/S	Test running	Suspends output to the terminal until CTRL/Q is typed.
CTRL/U	At RBD prompt	Disregards previous input.
CTRL/Y	Test running	Stops the execution of an RBD test and does not execute any cleanup code.
CTRL/Z	At RBD prompt	Exits RBD monitor program and enters console program; same effect as the QUIT command.

As soon as a CTRL/C is entered from the console terminal that began execution of the RBD test, the diagnostic stops execution, runs cleanup code, and returns control to the RBD monitor program. If CTRL/C is typed at the RBD monitor prompt, it has the same effect as CTRL/U.

When you use the DELETE key (or rubout key), characters being deleted are preceded by a backslash (\ ) and print as they are rubbed out. When the next valid character is typed, it is preceded by a backslash (\ ) to delineate the deleted characters.

When the RBD monitor program receives a CTRL/U, the program disregards all previous input typed and issues a carriage return and linefeed (<CR><LF>) and returns the RBD prompt. If a test is running when CTRL/U is entered, CTRL/U is ignored.

When a CTRL/Y is received by the RBD monitor program from the console terminal that began execution of the RBD test, the diagnostic stops execution and returns control to the RBD monitor program. No cleanup code is run, and the unit under test is left in an indeterminate state. A CTRL/Y entered at the RBD monitor prompt has the same effect as CTRL/U.

When the RBD monitor program receives a CTRL/Z, the program exits and control is returned to the console program. The next prompt is the console prompt. CTRL/Z has the same effect as the QUIT command. If CTRL/Z is entered while an RBD test is running, CTRL/Z has the same effect as CTRL/C: it halts the test and executes cleanup code.

2.3.2 DEPOSIT and EXAMINE Commands

The DEPOSIT command deposits data to the address specified, and the EXAMINE command displays the data stored at the specified address. Both commands take the same qualifiers.

Example 2-2: DEPOSIT and EXAMINE Commands

```
❶
  RBD2> D 27 0                     ! Deposits the value of zero to
                                   ! address 27; boot processor is
                                   ! at node 2.
❷
  RBD2> E/G                        ! Examines registers R0-R11
❸
  RBD2> EXAMINE/B/N:1FF            ! Examines the first 512 bytes
                                   ! of physical memory
❹
  RBD2> EXAMINE/N:5/W - 0          ! Examines the previously referenced
                                   ! word in the virtual address space
                                   ! and the next five words
❺
  RBD2> DEPOSIT/B/N:1FF 0 0        ! Deposits zeros to the first
                                   ! 512 bytes of physical memory
                                   ! beginning with address 0
```

Table 2-5: DEPOSIT and EXAMINE Command Qualifiers

Qualifier	Meaning
/B	Defines data size as a byte.
/G	For the EXAMINE command only; shows a copy of the contents of general registers R0 through R11 when the diagnostic halted.
/L	Defines data size as a longword.
/W	Defines data size as a word.

The command syntax is:

```
D[EPOSIT] [/qualifier] <address> <data>
E[XAMINE] [/qualifier] <address>
```

The qualifiers must be placed immediately following the command.

The variable <data> is a numeric value to be stored. The value must fit in the data size to be deposited. In the RBD program, addresses are always considered to be physical addresses, not register references. You can only examine the register contents (using E/G in RBD mode); you cannot deposit to the registers.

The variable <address> is a 1- to 8-digit hexadecimal value or one of the following:

- +, the location immediately following the last location you referenced in an EXAMINE or DEPOSIT command. For physical and virtual memory, the referenced location is the last location plus the size of the reference (1 for byte, 2 for word, 4 for longword). For other address spaces, the address is the last referenced address plus one.
- –, the location immediately preceding the last location you referenced in an EXAMINE or DEPOSIT command. For physical and virtual memory, the referenced location is the last location minus the size of the reference (1 for byte, 2 for word, 4 for longword). For other address spaces, the address is the last referenced address minus one.
- *, the last location you referenced in an EXAMINE or DEPOSIT command.

The DEPOSIT command directs data into the specified address. If you do not specify any address or data size qualifiers, the defaults are based on the last address or data size specified in a DEPOSIT or EXAMINE command. After processor initialization, the default address space is physical memory, the default data size is longword, and the default address is zero.

The address and data must be entered as hexadecimal characters. The data specified must be able to fit into the current data length: 2 hex digits for byte length, 4 for word length, and 8 for longword length.

If an EXAMINE command is followed by a carriage return (E<CR>), the RBD program interprets it as an E+ command.

2.3.3 START Command

The RBD monitor START command invokes a specific RBD program. It takes an argument indicating the RBD program to be run, and can take any of 13 qualifiers.

Example 2-3: START Command

❶

```
>>> T/R                     ! Command to enter RBD monitor program;
RBDn>                       ! RBD monitor prompt, where n is the hexa-
                            ! decimal node number of the processor
                            ! that is currently receiving your input.
RBD3> ST 2 /TR 1            ! Runs the XBI self-test, testing the DWMBA
                            ! on XMI node number 1. Test
                            ! results written to the console terminal.
```

❷

```
RBDn> ST 1 /HE /IE /BE      ! Runs the CPU/Memory RBD, halting on
                            ! the first error encountered, inhibiting
                            ! error output, ringing the bell when the
                            ! first error is  encountered.
```

The START command syntax is:

```
START n [<DWMBA/A node number>] [/qualifier]
```

where *n* is the RBD to be run (see Table 2-3), and for test 2 only <DWMBA/A node number> is the node number of the DWMBA/A adapter to be tested.

See Section 2.3.4 for a listing and description of the START command qualifiers.

2.3.4 START Command Qualifiers

The START command is the primary RBD program command. Its qualifiers act as switches, allowing you to control the output of the tests—to run portions of a test, to run nondefault tests, and to loop on tests.

Table 2–6: START Command Qualifiers

Qualifier	Default	Function
/ATE	Disabled	Use only with automatic test equipment
/BE	Disabled	Bell strikes when an error is encountered
/C	Disabled	Destructive test confirmation
/DS	Disabled	Disable status reports
/HE	Disabled	Halt on the test that incurs an error
/IE	Disabled	Inhibit all error output
/IS	Disabled	Inhibit summary reports
/LE	Disabled	Loop on the test that incurs an error
/P=*n*	Enabled	Make *n* passes of the test or tests indicated
/QA	Disabled	Runs the diagnostic in quality assurance mode; reserved for diagnostic development
/QV	Disabled	Quick verification test
/T=*n[:m]*	Enabled	/T=*n* runs test *n*; /T=*n:m* runs a range of tests from *n* through *m*
/TR	Disabled	Print a trace of test numbers, as they run

See Example 2–3 for examples and a description of the START command syntax.

Use the /ATE qualifier only with automatic test equipment that can monitor points on the board to determine test failure or pass. /ATE causes all errors to be ignored so that the code flow is identical whether or not an error occurs. With this switch enabled, the board appears to pass all tests.

With /BE, the RBD monitor program rings a bell on the console terminal whenever an error is encountered. This is useful when error printout is inhibited and a loop is being performed on an intermittent error (/LE).

/C enables execution of destructive tests. See Example 2–5 for information on the destructive tests.

/DS disables printout of the diagnostics test results. The summary report is still run, unless it is specifically disabled.

/HE halts on error and stops execution of tests as soon as the first error is encountered. The test number is printed out, and a summary line indicating failure of the RBD is printed to the console terminal. Also the RBD monitor prompt is returned. Continue on error is the default condition, so if you want a halt on error, you must specifically invoke it in your command line.

/IE inhibits all error output, suppressing printing of RBD results. This qualifier is used primarily for module repair, in conjunction with the /LE qualifier. Errors are counted even when the printing is disabled.

/IS suppresses printout of RBD results after the end of the last pass performed by the RBD.

/LE loops on the test where the first error is detected. Even if the error is intermittent, looping continues on the test indicated. To terminate /LE, enter CTRL/C, CTRL/Z, or CTRL/Y. After entering one of these control characters, a summary report prints out and the RBD monitor prompt returns.

/P=*n* runs *n* number of passes of the RBD test invoked, where *n* is a decimal number. If *n* is 0, all selected tests run for an infinite number of passes. If the /P qualifier is not used, the program defaults to one pass of the test invoked. When used with the /T=*n:m* qualifier, you run a range of tests. To terminate /P=*n*, enter CTRL/C, CTRL/Z, or CTRL/Y. After entering one of these control characters, a summary reports prints out and the RBD monitor prompt returns.

/QA is the quality assurance qualifier that forces all branch macros in the diagnostic to fail, in order to verify all of the error paths.

/QV executes the diagnostic in quick verify mode. This switch does not affect diagnostics that are already short.

/T=*n[:m]* selects individual tests (/T=*n*) or a range of tests (/T=*n:m*) where *n* and *m* are decimal numbers. For example, to run tests T0005 through T0008, use /T=5:8. If no /T qualifier is used, the diagnostic runs all its tests.

/TR prints each test number as it is completed. This qualifier allows you to trace the progress of the diagnostic as it runs. Without the /TR qualifier, just the summary line is printed.

A **parameter field** can be appended to the START command string to control aspects of the diagnostic that are not covered by the switches. The parameter must be appended after any switches specified, separated from the switches by a space. The format of the parameter field is 4 hex characters. The use of a parameter field is implementation specific.

2.3.5 RBD Test Printout, Passing

The RBD printout results are different when the RBD tests are passed and when they are failed. Example 2-4 shows a passing printout, and Example 2-5 is a sample failure printout.

Example 2-4: RBD Test Printout, Passing

```
>>>                           ! Console program prompt

>>> T/R                       ! Command to enter RBD monitor program

RBD3>                         ! RBD monitor prompt, where 3 is the hexa-
                              ! decimal node number of the processor
                              ! that is currently receiving your input.

RBD3> START 2 /TRACE 1        ! Runs the XBI self-test, testing the DWMBA
                              ! at XMI node number 1. Test
                              ! results written to the console terminal:

; XBI_SLF ❶          (rev.code) ❷

; T0001  T0005  T0006  T0007  T0008  T0009  T0012  T0013  T0014  T0015
; T0016  T0017  T0018  T0019  T0020  T0021  T0022  T0023  T0024  T0025 ❸

;         P ❹     3 ❺     8001 ❻      1 ❼
; 000000000 00000000 00000000 00000000 00000000 00000000 00000000 ❽


RBD3>                         ! RBD prompt returns; test ran successfully.
RBD3> QUIT                    ! Exit RBD program.
>>>                           ! Console prompt reappears.
```

The callouts in Example 2-4 are explained below.

❶ This entry designates which test is being run. Here it is the XBI_SLF, the self-test for the DWMBA.

XCPST indicates RBD 0, the CPU tests
CPUMEM indicates RBD 1, the CPU/Memory tests
XBI_SLF indicates RBD 2, the DWMBA tests
XMARBD indicates RBD 3, the Memory tests
SLCRBD indicates RBD 4, the Second-Level Cache tests

❷ This field lists the revision number of the RBD program.

❸ These T000*n* fields appear only with the /TRACE qualifier; each entry corresponds to a test being run and prints out as the test is running. In a passing RBD, the final T000n number corresponds to the last test run.

Note that T0002 through T0004 and T0010 and T0011 are not executed. These tests are not part of the default selection and must be individually invoked by qualifier. For a list of the tests for each RBD, and the definition of the tests, see each module's chapter in this book.

❹ This field indicates whether the RBD passed or failed; P for passed, F for failed.

❺ This field is the XMI node number of the boot processor executing the RBD. It will match the number in your RBD prompt, which also indicates the node number of your boot processor.

❻ This field is the device type number of the boot processor executing the RBD; this device number also appears in console mode when you issue a SHOW CONFIGURATION command.

❼ This field displays the total number of passes executed by the RBD. The default number of passes is 1. If you use the START qualifier of /P=5, for example, then this field will show 5, indicating 5 passes were completed.

❽ This line contains the summary of the RBD failures. In a successful RBD run, the line will contain all zeros as shown here. See Example 2-5 for an explanation of failure codes written to this line.

2.3.6 RBD Test Printout, Failing

The RBD printout results are different when the RBD is passed and when it is failed. Example 2-5 is a sample failure printout, and Example 2-4 shows a passing printout.

Example 2-5: RBD Test Printout, Failing

```
>>>                               ! Console program prompt
                                  !
>>> T/R                           ! Command to enter RBD monitor program
                                  !
RBD2>                             ! RBD monitor prompt, where 2 is the hexa-
                                  ! decimal node number of the processor
                                  ! that is currently receiving your input.
                                  !
RBD2> START 0 /TRACE              ! Execute RBD 0 (CPU RBD)
                                  ! and trace results.

; XCPST                  (rev.code)

; T0001  T0002  T0003  T0004  T0005  T0006  T0007  T0008  T0009  T0010
: T0011  T0012  T0013  T0014  T0015  T0016  T0017  T0018  T0019  T0020
; T0021  T0022 (1)

;        F (2)      2 (3)  8001 (4)     1 (5)
;       HE (6)  XBE_ERR (7)    00      T022 (8)
; 00000041(9)  0004A041(10)  00000000(11)  21880004(12)  200GF123(13)  01(14)
; T0023  T0024  T0025  T0026  T0027  T0028  T0029  T0030  T0031  T0032
; T0033  T0034 (15)

;        F         2      8001          1 (16)
; 00000000 00000001 00000000 00000000 00000000 000000000 00000000

RBD2>                             ! RBD prompt returns; test completed.
RBD2> QUIT                        ! Exit RBD program.
>>>                               ! Console prompt reappears.
```

The callouts in Example 2-5 are explained below. (See also Example 2-4 for explanation of other fields of the printout.)

1. This T00*nn* number is the number of the failing test and is followed by a failure report. In this example, test 22 failed.
2. F indicates failure of the previous test listed, test 22.
3. This field is the XMI node number of the boot processor whose EEPROM is executing the RBD. It will match the number in your RBD prompt, which also indicates the node number of your boot processor.
4. This field is the device number of the boot processor whose EEPROM is executing the RBD.
5. This field displays the total number of passes executed by the RBD. The default number of passes is 1.
6. The class of error is displayed here. *HE* indicates that the error was a hard error. *SO* shows the error was a soft error.
7. This field gives an abbreviated name of the test that fails. Here, XBE_ERR stands for test 22 of RBD 2.
8. This field lists the number of the test that failed; test 22 failed here.
9. The expected data is listed here. 00000041 is the data test 22 expected.
10. The received data is listed here. 0004A041 is the data test 22 received.
11. This field shows any unexpected interrupt vectors.
12. This is the address in memory where the referenced error is found.
13. This is the address of the failing PC at the time of error.
14. The error number for the test is given here. Test 22 failed at its error number 01.
15. These T00*nn* fields appear only with the /TRACE qualifier; each entry corresponds to a test being run. The entry prints out as the test is running. This final T00*nn* number corresponds to the number of tests run.
16. This entire line is the summary line, and a repeat of the failure summary given 5 lines before. It lists the pass/fail code (P or F), the node number and device number of the boot processor executing the RBD, and the number of passes of the RBD.

2.3.7 Sample RBD Session

Example 2-6 shows a sample RBD session.

Example 2-6: Sample RBD Session

```
❶ >>>  T/R
RBD1>

❷ RBD1> ST0/TRACE

;XCPST           0.10

; T0001  T0002  T0003  T0004  T0005  T0006  T0007  T0008  T0009  T0010
; T0011  T0012  T0013  T0014  T0015  T0016  T0017  T0018  T0019  T0020
; T0021  T0022  T0023  T0024  T0025  T0026  T0027  T0028  T0029  T0030
; T0031  T0032  T0033  T0034

;       P        1      8001         1
;00000000 00000000 00000000 00000000 000000000 00000000 00000000

❸ RBD1> ST1/TR/HE

;CPUMEM          0.06

; T0001  T0002  T0003  T0004  T0005  T0006  T0007  T0008  T0009  T0010
; T0011  T0012  T0013  T0014  T0015  T0016  T0017  T0018  T0019  T0020

;       P        1      8001         1
;00000000 00000000 00000000 00000000 000000000 00000000 00000000

❹ RBD1> ST2 5

;XBI_SLF           3.3

;       S        1      8001         1
;      XX   NO_UNIT        XX     T0000

;       P        1      8001         1
;00000000 00000000 00000000 00000000 000000000 00000000 00000000

❺ RBD1>  ST2/TR/T=2:4/P=3 E

;XBI_SLF             3.3
; T0002  T0003  T0004  T0002  T0003  T0004  T0002  T0003  T0004

;       P        1      8001         3
;00000000 00000000 00000000 00000000 000000000 00000000 00000000
```

1. Enter RBD mode from console mode. RBD prompt appears, and indicates you are operating from the boot processor at node 1.

2. Run RBD 0 and trace the tests. The CPU test runs all 34 tests successfully.

3. Run RBD 1, trace it and halt on the first error found. All of the CPU/memory RBD tests run and pass.

4. Run RBD 2, testing the DWMBA, attached to the XMI bus by the DWMBA/A module at node 5. The value NO_UNIT on the third line of output indicates that the node value of node 5 is not correct; no DWMBA was found at this node. Although the summary line indicates the test passed, the test did was not run since the module could not be located.

5. Run RBD 2, testing the DWMBA attached to the XMI bus by the DWMBA/A module at node E; trace the tests as they run, and run test 2 through 4 of RBD 2; make 3 passes over these selected tests.

   Note that the T00*nn* line lists each of the three tests three times, since the /P=3 called for 3 passes of the tests. And the final parameter in the summary line (line 3 of this output) is a 3, indicating 3 passes were completed.

Example 2-7: Sample RBD Session, continued

```
6 RBD1> ST3/TR/T=10
;XMARBD           2.60
; T0010
RBD1> ST3/TR/T=10

7 RBD1> ST3/TR/T=10/C
;XMARBD           2.60
; T0010
This test will not print out any status messages.
RBD1>

8 RBD1> QUIT
>>>
```

6 Run RBD 3, trace it, and run only test 10 of this RBD. This test is one of the memory tests that is not part of the default suite of tests. This test writes data to memory locations and therefore corrupts memory. You must add a /C qualifier to the START command, to indicate that you do indeed intend to run this destructive test.

The /C qualifier was not given in this example. The RBD program attempts to run the RBD. It indicates it is accessing a memory RBD test (XMARBD) version 2.60, and prints the name of the test being called. When the RBD program recognizes the absence of the /C qualifier required for running T0010, it reprints the command line you entered and pauses at the end of this command.

You cannot add /C to the command line since the machine echoes it. The prompt appears as soon as you begin input on the keyboard. You must enter the command again.

7 Run RBD 3, trace the tests as they run, run only test 10, and /C allows the test to run. The system responds with the line indicating that no status messages will be printed. This test runs for approximately 20 minutes.

8 Exit from RBD mode. Enter console mode.

2.4 VAX Diagnostic Supervisor Programs

The VAX diagnostic supervisor (VDS) is a monitor that controls operation of a diagnostic program. You can use VDS in one of two modes: stand-alone mode (exclusive use of the system) or online mode (under VMS).

Table 2–7: VAX Diagnostic Program Levels

Level	Type of Test	Run-Time Environment
1	System exercisers	Runs under the operating system without VDS
2R	Function tests of peripheral devices	Runs under the operating system with VDS
2	Exercisers and function tests of peripheral devices and processors	Runs under VDS in online mode and stand-alone mode
3	Function tests and logic tests of peripheral devices and processors	Runs under VDS in stand-alone mode

Table 2–8: VDS Documentation

Document	Order Number
VAX Diagnostic Supervisor User's Guide	EK-VXDSU-UG
VAX Diagnostic Software Handbook	AA-F152A-TE
VAX Diagnostic Design Guide	EK-1VAXD-TI
VAX Hardware Handbook	EB-25949-46

The VAX diagnostic supervisor (VDS) can be run in interactive mode. You type commands in response to the VDS program prompt:

```
DS>
```

VDS lets you load diagnostic programs into system memory, select devices to be tested, and run the programs. The VDS command language also lets you control the execution of diagnostic programs; you can specify which tests or sections of a program should run, and how many passes it should run. You can also show the current state of parameters that affect the operation of diagnostic programs. The programs report their results through VDS to the terminal.

VDS contains three types of diagnostic programs:

- Logic tests
  Test a specific section of a device's logic circuitry. Logic tests provide the greatest degree of detail in determining the location of faulty hardware.
- Function tests
  Test the functions of the device. For example, a function test for a disk drive would test the drive's reading and writing capabilities. Function tests can detect the location of faulty hardware, although the results may be less exact than those of a logic test.
- Exercisers
  Test entire systems or subsystems and verify that a system can function properly over a period of time. Exercisers can detect both hardware faults resulting from the simultaneous use of a system's numerous devices and intermittent faults occurring only once or twice over a long period of time.

Table 2-9 lists the VDS programs available for the VAX 6200 system. Each program has a HELP file available. To access the help files for any diagnostic, at the VDS prompt, type:

```
DS>   HELP [VDS diagnostic program name]
```

2.4.1 Running VDS

You can use VDS in one of two modes: stand-alone mode (exclusive use of the system) or online mode (under VMS).

Example 2-8: Running Stand-Alone VDS

```
>>> BOOT/R5:10 CSA1            ! Enter BOOT command designating the
                               ! TK tape drive as input device; /R5:10
                               ! is the boot flag indicating the
                               ! VDS program.
  (self-test results print)
Loading system software.
                    VAX DIAGNOSTIC SOFTWARE
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                 DIGITAL EQUIPMENT CORPORATION
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DIAGNOSTIC SUPERVISOR. ZZ-ELSAA-11.XX-NNN  23-APR-1989 12:01:45
DS>                            ! System boots VDS and displays banner.
                               ! Run VDS level 3 or 2 programs.
DS> ^P                         ! Enter CTRL/P to exit VDS
>>>                            ! Console prompt returns.
```

Example 2-9: Running Online VDS

```
$                              ! At the operating system prompt, run
$ RUN ELSAA                    ! the VDS program.
  [self-test results and VDS banner print, as in example above]
DS>                            ! VDS prompt appears.
                               ! Run VDS level 2R or 2 programs.
DS> EXIT                       ! Enter EXIT to exit VDS
$                              ! Operating system prompt returns.
```

Table 2-7 describes the levels of VDS programs. Check Table 2-9 for the programs you wish to run, and determine if you will run VDS in stand-alone or online mode.

A VAX system that runs ULTRIX can use VDS only in stand-alone mode (not under VMS). To run VDS in stand-alone mode, insert a TK tape containing the VAX 6200 VDS program into the TK tape drive on the system.[1] At the console prompt, boot VDS from the TK tape using the /R5:10 qualifier:

```
>>> BOOT /R5:10 CSA1
```

where CSA1 is the device name for the TK tape drive, and /R5:10 is the boot flag designating the VDS program. (See Example 2-8). To run VDS in online mode under VMS, you use the RUN command under your operating system (see Example 2-9).

In both stand-alone and online mode, VDS functions the same way. Typically a program running in online mode provides less detailed results than one running in stand-alone mode. For more information on VDS, see the documents listed in Table 2-8.

---

[1] The VAX 6200 Console TK50 tape (part number AQ-FJ77*-ME) ships with every system and contains VDS and the autosizer. DIGITAL field service representatives and licensed self-maintenance customers may use the VAX 6200 CMPLT DIAG SET TK50 tape (part number AQ-FK0Z*-DE) that contains VDS, the autosizer, and a complete set of diagnostics. The nonbootable VAX6200 CMPLT DIAG SET MT tape (part number BB-FK03*-DE) is also available to field service and self-maintenance customers for use on a TU81 tape drive.

2.4.2 Sample VDS Session

When you run the VDS programs, run the system autosizer program EVSBA first. The program, which takes several minutes to execute, will save you time as you proceed with other tests.

Example 2-10: Sample VDS Session

```
>>>                          ! Begin in console mode.
>>> BOOT /R5:10/CSA1         ! Command to load VDS (/R5:10) as stand-alone
                             ! from the system TK tape drive (CSA1).
[self-test results print]
Loading system software.
                    VAX DIAGNOSTIC SOFTWARE
                          PROPERTY OF
                 DIGITAL EQUIPMENT CORPORATION
              ***CONFIDENTIAL AND PROPRIETARY***

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DIAGNOSTIC SUPERVISOR. ZZ-ELSAA-11.XX-NNN  23-APR-1989 09:38:42
DS>
DS> RUN EVSBA                ! Run the autosizer program.

.. Program: EVSBA - AUTOSIZER   level 3   Rev Y6.0, revision 6.0, 3 tests
   at 09:39:24.76.

.. End of run, 0 errors detected, pass count is 1,
   time is 23-APR-1989 09:40:31.16

DS> SHOW DEV
_DWMBA0 DWMBA    HUB     61F00000  XMI node 3 (1,2,3,4,B,C,D,E) =0000000E(X)
BI Node Number (HEX)=00000001(X)
_DUA     KDB50   _XBI0   7C010000  BI Node Number (HEX)=00000008(X)
_DJA1    RA60    _DUA    7C600000
_KA0     KA62A   HUB     61880000  XMI Node ID=00000001(X) FPU Present=Yes
_BLA0    KLESI-B _XBI0   7C00E000  BI Node Number (HEX)=00000007(X)
_MUA0    TU81    _BLA0   7C5FF940  CSR=774500(O) VECTOR=000260(O) BR=5.
_TXA     DMB32   _XBI0   7C004000  BI Node Number (HEX)=00000002(X)
_ETA     DEBNA   _XBI0   7C008000  BI Node Number (HEX)=00000004(X)
_ETA0    LANCE   _ETA    7C500000
_MUA     TBK50   _XBI0   7C00C000  BI Node Number (HEX)=00000006(X)
_MUA0    TK50    _ETB    7C580000

DS> SELECT ALL

DS> RUN ELKMP
.. Program: ELKMP - VAX 6200 MP Exerciser, revision 0,3, 7 tests,
Testing:  _KA0
```

Example 2-10 Cont'd. on next page

Example 2-10 (Cont.): Sample VDS Session

```
Test 1: Memory Interlock Test
Test 2: Interprocessor Interrupt Test
Test 3: Write Error Interrupt Test
Test 4: Cache Invalidate Test
Test 5: XMI Bus Arbitration Test
Test 6: XMI Bus Arbitration Collision Test
Test 7: Multiprocessor Exerciser
******** ELKMP - VAX 6200 MP Exerciser - 0.3 *******
 Pass 1, test 7, subtest 0, error 3, 23-APR-1989 00:00:00.00
 Hard error while testing Unknown device:  WE IVINTR count failure

********  End of Hard error number 3 ********

.. Halt on error at PC 00001FGB(X)
DS>
```

The off-line autosizer program EVSBA identifies hardware on your system and builds a database for the VAX diagnostic supervisor. The autosizer eliminates the need for you to type in the name and characteristics of the hardware you intend to test under VDS with level 3 diagnostic programs.

You can also use the autosizer to print a list of system hardware by running the program EVSBA under VDS and typing the VDS command SHOW DEVICE/BRIEF. The command lists system devices, similar to the SHOW CONFIGURATION command in console mode.

2.4.3 VDS Diagnostics

Table 2–9 lists the VAX diagnostic supervisor tests available for the VAX 6200 system.

Table 2–9: VAX Diagnostic Supervisor Programs

Diagnostic	Level	Diagnostic Title
ELSAA[1]		VAX 6200 Diagnostic Supervisor
ELKAX[1]	3	Manual Tests
ELKMP[1]	3	Multiprocessor Exerciser
EVSBA	3	VAX Stand-Alone Autosizer
		VAX CPU Cluster Exerciser
EVKAQ	2	VAX Basic Instructions Exerciser, Part 1
EVKAR	2	VAX Basic Instructions Exerciser, Part 2
EVKAS	2	VAX Floating-Point Instruction Exerciser, Part 1
EVKAT	2	VAX Floating-Point Instruction Exerciser, Part 2
EVKAU	3	VAX Privileged Architecture Instruction Test, Part 1
EVKAV	3	VAX Privileged Architecture Instruction Test, Part 2
		KDB50 (BDA) Macrodiagnostics
EVRLF	3	UDA50/KDB50 Basic Subsystem Diagnostics
EVRLG	3	UDA50/KDB50 Disk Drive Exerciser
EVRLB	3	VAX RAxx Formatter
EVRLK	3	VAX Bad Block Replace Utility
EVRLL	3	Disk Drive Internal Error Log Utility
EVRAE	2R	VAX Generic MSCP Disk Exerciser

[1]VDS tests starting with EL indicate tests created specifically for the VAX 6200 system and are not transportable across all VAX systems.

Table 2–9 (Cont.): VAX Diagnostic Supervisor Programs

Diagnostic	Level	Diagnostic Title
		DEBNA Macrodiagnostics
EVDYD	2R	DEBNA Online Functional Diagnostics
EVDWC	2R	VAX NI Exerciser
		TBK50 Macrodiagnostics
EVMDA	2R	TK Data Reliability Exerciser
		CIBCA Macrodiagnostics
EVGCA	3	T1015 Repair Level Diagnostic, Part 1
EVGCB	3	T1015 Repair Level Diagnostic, Part 2
EVGCC	3	T1015 Repair Level Diagnostic, Part 3
EVGCD	3	T1015 Repair Level Diagnostic, Part 4
EVGCE	3	T1025 Repair Level Diagnostic
EVGAA	3	CIBCA Functional Diagnostic, Part 1
EVGAB	3	CIBCA Functional Diagnostic, Part 2
EVGDA	3	CIBCA EEPROM Program and Update Utility
EVXCI	1	VAX CI Exerciser
		KLESI-B/TU81 Macrodiagnostics
EVMBA	2R	VAX TU81 Data Reliability
EVMBB	3	VAX Front-End/Host Functional Diagnostics
		DHB32 Macrodiagnostics
EVDAR	3	DHB32 Diagnostics
EVDAS	2R	DHB32 Macrodiagnostics
		DMB32 Macrodiagnostics
EVAAA	2R	VAX Line Printer Diagnostic
EVDAJ	2R	DMB32 Online Asynchronous Port Test

Table 2-9 (Cont.): VAX Diagnostic Supervisor Programs

Diagnostic	Level	Diagnostic Title
		DMB32 Macrodiagnostics
EVDAK	3	DMB32 Stand-Alone Functional Verification
EVDAL	2R	DMB32 Online Synchronous Port Test
EVDAN	2R	DMB32 Online Data Communications Link
		DRB32 Macrodiagnostics
EVDRH	3	DRB32-M, -E Functional Diagnostic
EVDRI	3	DRB32-W Functional Diagnostic
EVDRJ	3	DRB32-C Functional Diagnostic
		UNIBUS Diagnostics
EVCBB	3	VAX DWBUA VAXBI to UNIBUS
EVDRB	2R	VAX DR11W Online Diagnostics
EVDRE	3	VAX DR11W Repair Level Diagnostics
EVDUP	3	DUP11 Repair Level, Part 1
EVDUQ	3	DUP11 Repair Level, Part 2
EVDCA	2R	VAX Synchronous Link Diagnostics
EVAAA	2R	VAX Line Printer Diagnostic (LP11)

Chapter 3
KA62A Processor

This chapter contains the following sections:

- Physical Description and Specifications
- KA62A Configuration Rules
- Functional Description
- Boot Processor
- Power-Up Sequence
- KA62A Self-Test Results: Console Display
- KA62A Self-Test Results: Module LEDs
- ROM-Based Diagnostics
- KA62A Self-Test RBD
- CPU/Memory Test RBD
- Second-Level Cache RBD
- VDS Diagnostics
- Machine Checks
- Console Commands
- How to Replace the Only Processor
- How to Replace the Boot Processor
- How to Add a New Processor or Replace a Secondary Processor
- PATCH EEPROM Command
- PATCH EEPROM Command Error Messages
- KA62A Registers

3.1 KA62A Physical Description and Specifications

The KA62A is a single-module VAX processor based on a single CPU chip and a floating-point accelerator chip. The module designation is T2011. VAX 6200 systems include multiple KA62A processors, which use the 100 Mbyte/second XMI system bus to communicate with memory. For I/O, an adapter connects the XMI to the VAXBI bus. Features of the module are shown in Figure 3-1.

Figure 3-1: KA62A Module

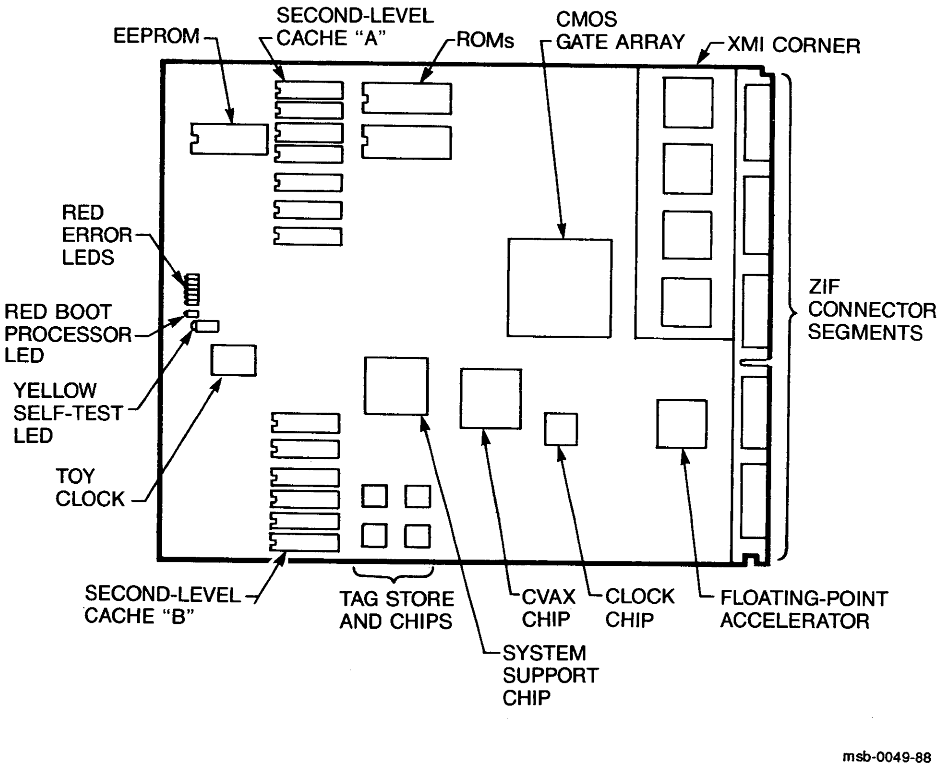


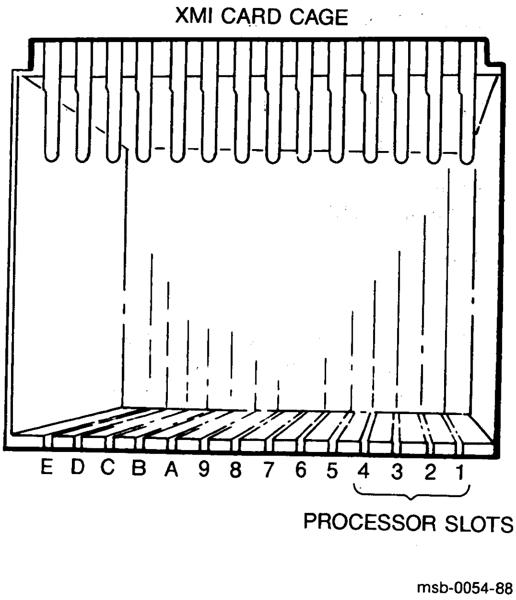
Table 3–1: KA62A Specifications

Parameter	Description
Module Number:	T2011
Dimensions:	23.3 cm (9.2") H x 0.6 cm (0.25") W x 28.0 cm (11.0") D
Temperature:	
Storage Range	-40°C to 66°C (-40°F to 151°F)
Operating Range	5°C to 50°C (41°F to 122°F)
Relative Humidity:	
Storage	10 to 95% noncondensing
Operating	10 to 95% noncondensing
Altitude:	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)
Current:	8A at +5V 0.20A at +5VBB
Power:	41W
Cables:	None
Diagnostics:	ROM-based diagnostics (0, 1, and 4) VDS diagnostics, see Section 3.12.

3.2 KA62A Configuration Rules

There are no explicit rules for placement of KA62A modules; they will operate in any slot. Processors usually go on the right, beginning with slot 1.

Figure 3–2: Typical KA62A Configuration



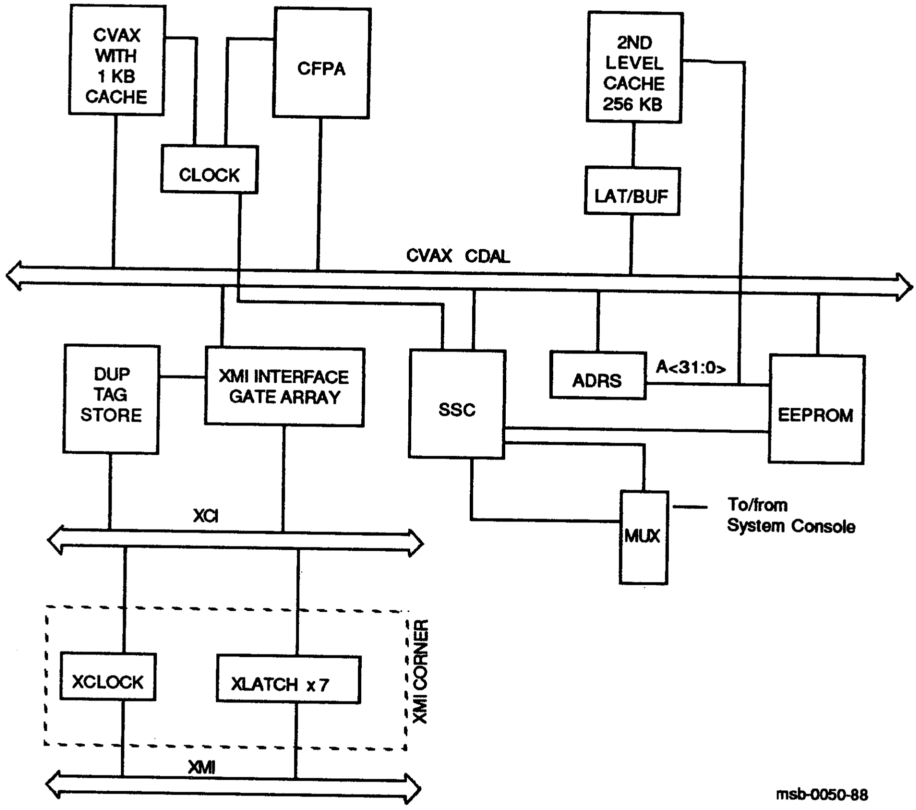
By convention, processors are placed in the right XMI slots, beginning with slot 1. Memories are usually placed in the middle slots, and VAXBI adapters occupy the slots at the left side of the card cage.

A processor module should be replaced if it consistently fails self-test, or if it causes the operating system to crash. However, you can leave the module in the system temporarily if you prevent VMS from using that processor, as follows. Enter console mode. Use the command SET CPU/NOENABLE to remove the processor from the software configuration. Reboot the operating system.

3.3 KA62A Functional Description

The KA62A processor has four functional sections (see Figure 3-3): the CPU section, the second-level cache, the XMI interface, and the console and diagnostics sections.

Figure 3-3: KA62A Block Diagram



The CPU section includes:

- The CVAX processor chip, which supports the MicroVAX subset of the VAX instruction set and data types. It has full VAX memory management including demand paging and 4 Gbytes of virtual memory. The CPU chip includes the first-level cache, for I-stream (instruction) storage only. First-level cache is 1 Kbyte, organized with 128 tags. Cache is write-through, two-way associative, and is filled eight bytes at a time.
- A floating-point accelerator with the MicroVAX subset of the VAX floating-point instruction set. Data types supported by the hardware are D_floating, F_floating, and G_floating.
- The clock chip includes a VAX standard time-of-year (TOY) clock with access to battery backup, an interval timer with 10 ms interrupts, and two programmable timers.

The second-level cache is for both I-stream and D-stream (data) storage. Second-level cache is 256 Kbytes, organized with 4096 tags. Cache is write-through and direct-mapped. If a processor read misses an entry in the cache, or if the entry is invalid, the XMI gate array reads the data from main memory. Cache is filled 32 bytes at a time; the first longword read satisfies the processor's read request.

The XMI interface includes:

- An octaword write buffer that decreases bus and memory controller bandwidth needs by packing writes into larger, more efficient blocks prior to sending them to main memory.
- Hexword cache fill logic that loads the second-level cache with eight longwords of data on each cache miss.
- XMI write monitoring logic that uses a duplicate tag store to detect when another XMI node writes a memory location that is cached on this processor. Then the gate array invalidates the corresponding entry in the second-level cache.
- Full set of error recovery and logging capabilities.

Example 3-1: ROM and EEPROM Version Numbers

```
F   E   D   C   B   A   9   8   7   6   5   4   3   2   1   0   NODE #

    A   A   .   .   M   M   M   M   .   .   P   P   P   P       TYP
    o   o   .   .   +   +   +   +   .   .   +   +   +   +       STF
    .   .   .   .   .   .   .   .   .   .   E   D   E   B       BPD
    .   .   .   .   .   .   .   .   .   .   +   +   +   +       ETF
    .   .   .   .   .   .   .   .   .   .   E   D   E   B       BPD

.   .   .   .   .   .   .   .   .   +   +   .   +   .   +   .   XBI D +
.   .   .   .   .   .   .   .   .   +   .   +   .   +   +   .   XBI E +

    .   .   .   .   A4  A3  A2  A1  .   .   .   .   .   .       ILV
    .   .   .   .   32  32  32  32  .   .   .   .   .   .       128Mb

ROM = 3.0          EEPROM = 2.0/3.1        SN = SG01234567
       1                     2     3
```

The console and diagnostics sections include:

- A console read-only memory (ROM), which contains the code for initialization, executing console commands, and bootstrapping the system. The last line of the self-test display shows the ROM version. In this example, the callout ❶ indicates that the console ROM is version 3.0.
- A diagnostic ROM, which contains the power-up self-test and extended diagnostics. The diagnostic ROM has the same version number as the console ROM ❶.
- An electrically-erasable, programmable ROM (EEPROM), which contains system parameters and boot code. You can modify the parameters with the console SET commands. Patching console and diagnostic code in the ROMs is accomplished by reading the patches into a special area of the EEPROM. The console PATCH EEPROM command is described in Section 3.18.

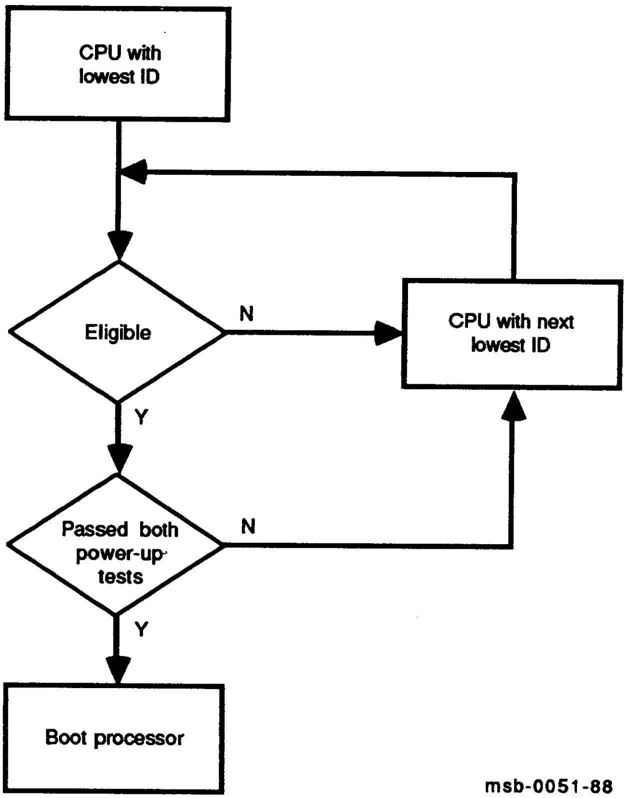
  The last line of the self-test display shows two EEPROM version numbers. The first number ❷ indicates the format version of the EEPROM. This version is changed only when the internal structure of the EEPROM is modified.

  The second number ❸ is the revision of ROM patches that have been applied to the EEPROM. The major number in this revision (before the decimal point) corresponds to the major number of the ROM revision ❶. The minor number indicates the actual patch revision. In this example, the EEPROM has been patched once for console ROM 3.0.
- A system support chip (SSC) contains circuits for writing the EEPROM, controlling the console, and timer support. On the module, the red LED next to the yellow LED is controlled by the SSC. When the power-up tests have completed successfully, the SSC on the boot processor turns off this LED.

3.4 Boot Processor

The VAX 6200 system is designed so that all KA62A processors share system resources equally. Because only one processor can boot the system or use the console at any given time, this processor is designated the primary or boot processor. The others are called secondary processors. The boot processor is selected during the power-up sequence and can change the next time the system powers on.

Figure 3–4: Selection of Boot Processor



Using boot code stored in its EEPROM, the boot processor reads the boot block from a specified device. Booting may be triggered by a command issued to the boot processor from the console, or by a system reset with the bottom key switch in the Auto Start position.

The boot processor also communicates with the system console, using the common console lines on the backplane. When you change system parameters in the EEPROM using SET commands, the boot processor automatically copies the new values to the EEPROMs on the secondary processors. If you swap in a new KA62A module, it should be configured as a secondary processor. Then you can use the UPDATE command to copy the boot processor's entire EEPROM to the new secondary. See the *VAX 6200 Owner's Manual* for a description of the UPDATE command.

Usually the processor with the lowest XMI node number (which is also the lowest slot number) is selected as the boot processor. However, if this processor does not pass all its power-up tests, the next higher-numbered processor is selected. This is one way the boot processor can change.

The user also has control over boot processor selection with the SET CPU command. This command may declare a processor ineligible for selection. SET CPU can also select a boot processor explicitly.

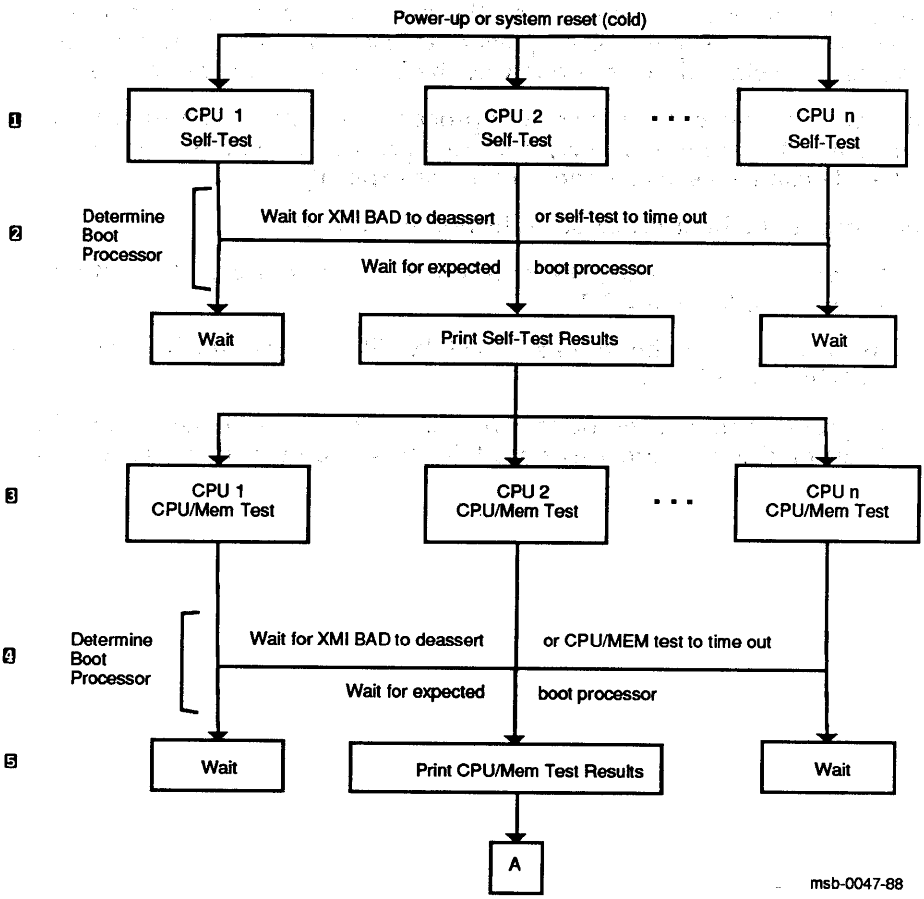
You can see the boot processor selection three ways:

- In the self-test display, the boot processor is indicated by a **B** on the second line labeled **BPD**.
- In console mode, the command SHOW CPU displays the boot processor as "Current primary."
- In program mode, the bottom red LED (next to the larger yellow LED) is off on the boot processor module. It is lit on secondary processors.

3.5 Power-Up Sequence

Figure 3–5 shows the power-up sequence for KA62A processors. All processors execute two phases of self-test, and a boot processor is selected. The boot processor tests the VAXBI adapters and prints the self-test display.

Figure 3–5: KA62A Power-Up Sequence, Part 1 of 2



1. All CPUs execute their on-board self-tests at the beginning of the power-up tests. On line **STF** of the self-test display, a plus sign (+) is shown for every module whose self-test passes (see Section 3.6).

2. The boot processor is determined as described in Section 3.4. On the **first BPD line**, the letter **B** corresponds to the processor selected as boot processor. Because the processors have not yet completed their power-up tests, the designated processor may later be disqualified from being boot processor. For this reason, line BPD appears twice in the self-test display.

3. All CPUs execute an extended self-test using the memories. On line **ETF** of the self-test display, a plus sign (+) is shown for every module that passes extended self-test.

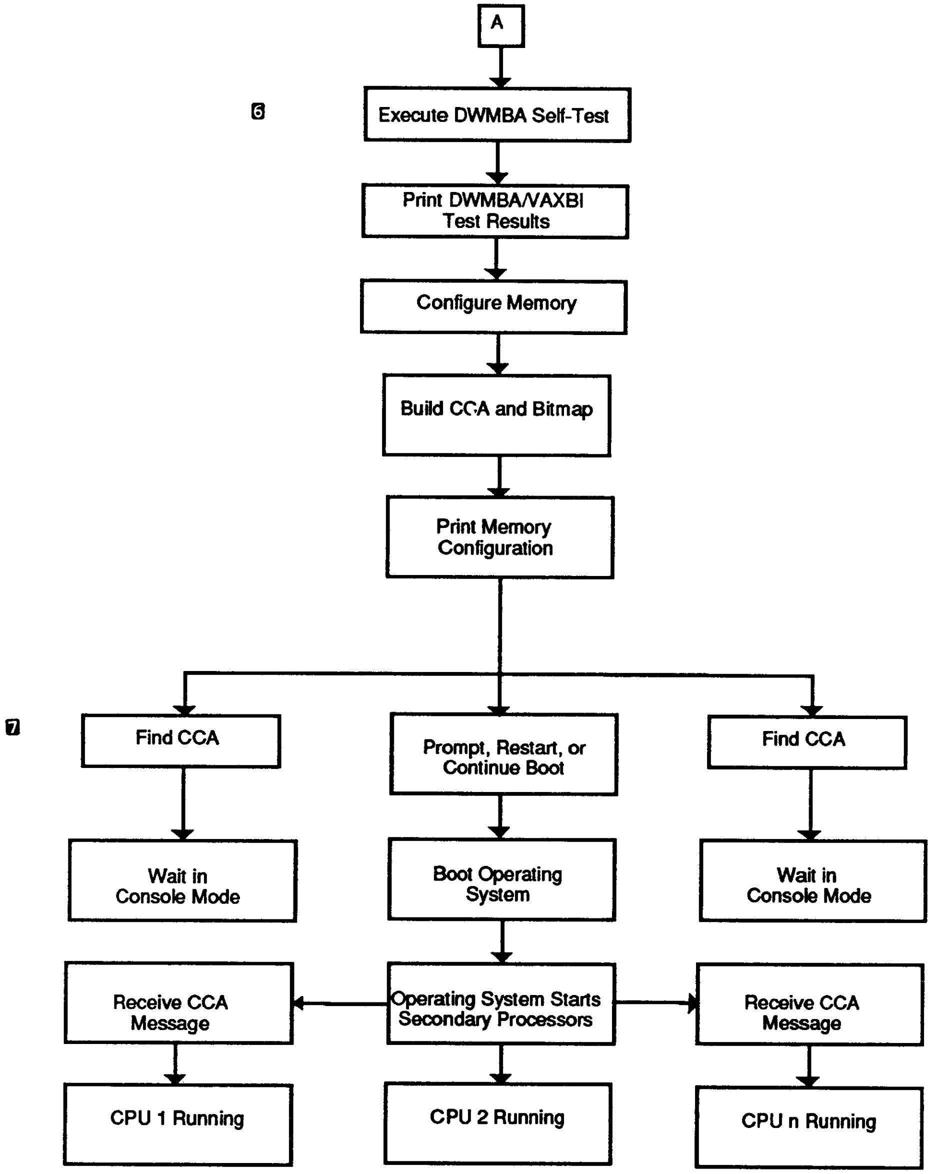
4. If all CPUs pass the extended self-test, the original boot processor selection is still valid. Lines STF and ETF would be identical for all the processors.

   The yellow LED is lit on all processor modules that pass both power-up tests. On the secondary processors, the red LED next to the yellow one is also lit. On the boot processor, this red LED is off (see Figure 3-7).

   If the original boot processor fails the extended test (indicated by a minus sign (-) on line ETF), a new boot processor is selected. On the **second BPD line**, the letter **B** corresponds to the processor finally selected as boot processor.

5. The boot processor prints the self-test display. If none of the processors is successfully selected as the boot processor, no self-test results are displayed and the console hangs. You can identify this hung state by examining the LEDs on the processor modules (see Section 3.7). All yellow lights will be OFF. The group of six red lights will flash two alternate patterns, and in one pattern only the bottom light will be ON.

Figure 3-6: KA62A Power-Up Sequence, Part 2 of 2



msb-0048-88

6 Secondary processors are not involved in the DWMBA and VAXBI adapter testing. The boot processor indicates the test results on the lines labeled XBI on the self-test display. A plus sign (+) at the extreme right means that the adapter test passed; a minus sign (–) means that the test failed.

7 CCA stands for console communications area. The boot processor uses the CCA to communicate with the secondary processors.

3.6 KA62A Self-Test Results: Console Display

You can check KA62A self-test results both in the self-test display and in the lights on the module. Pertinent information in the self-test display is shown in Example 3-2.

Example 3-2: Self-Test Results

```
F   E   D   C   B   A   9   8   7   6   5   4   3   2   1   0    NODE #

    A   A   .   .   M   M   M   M   .   .   P   P   P   P        TYP     1
    o   o   .   .   +   +   +   +   .   .   +   +   +   +        STF     2
    .   .   .   .   .   .   .   .   .   .   E   E   D   B        BPD     3
    .   .   .   .   .   .   .   .   .   .   +   +   +   -        ETF     4
    .   .   .   .   .   .   .   .   .   .   E   B   D   E        BPD     5

.   .   .   .   .   .   .   .   .   +   +   .   +   .   +   .    XBI D +
.   .   .   .   .   .   .   .   .   +   .   +   .   +   +   .    XBI E +

    .   .   .   .  A4  A3  A2  A1   .   .   .   .   .   .        ILV
    .   .   .   .  32  32  32  32   .   .   .   .   .   .        128Mb

ROM = 3.0          EEPROM = 2.0/3.0        SN = SG01234567    6
>>>
```

❶ The second line in the self-test display indicates the type (TYP) of module at each XMI node. Processors are type P. In this example, processors are at nodes 1, 2, 3, and 4.

❷ The third line shows self-test fail status (STF) which are the results of on-board self-test. Possible values for processors are:

+ (pass)
- (fail)
All processors passed self-test in this example.

❸ The BPD line indicates boot processor designation. When the system completes on-board self-test, the processor with the lowest ID number that passes self-test is selected as boot processor — in this example, the processor at node 1.

The results on the BPD line indicate:

- The boot processor (B)
- Processors eligible to become the boot processor (E)
- Processors ineligible to become the boot processor (D)

❹ During extended self-test (ETF) all processors run a longer test, which includes reading and writing memory and using the cache. On line ETF, results are reported for each processor in the same way as on line STF—a plus sign indicates that extended self-test passed and a minus sign that extended self-test failed. In this example, the processor at node 1 (originally selected boot processor) failed the CPU/memory extended self-test.

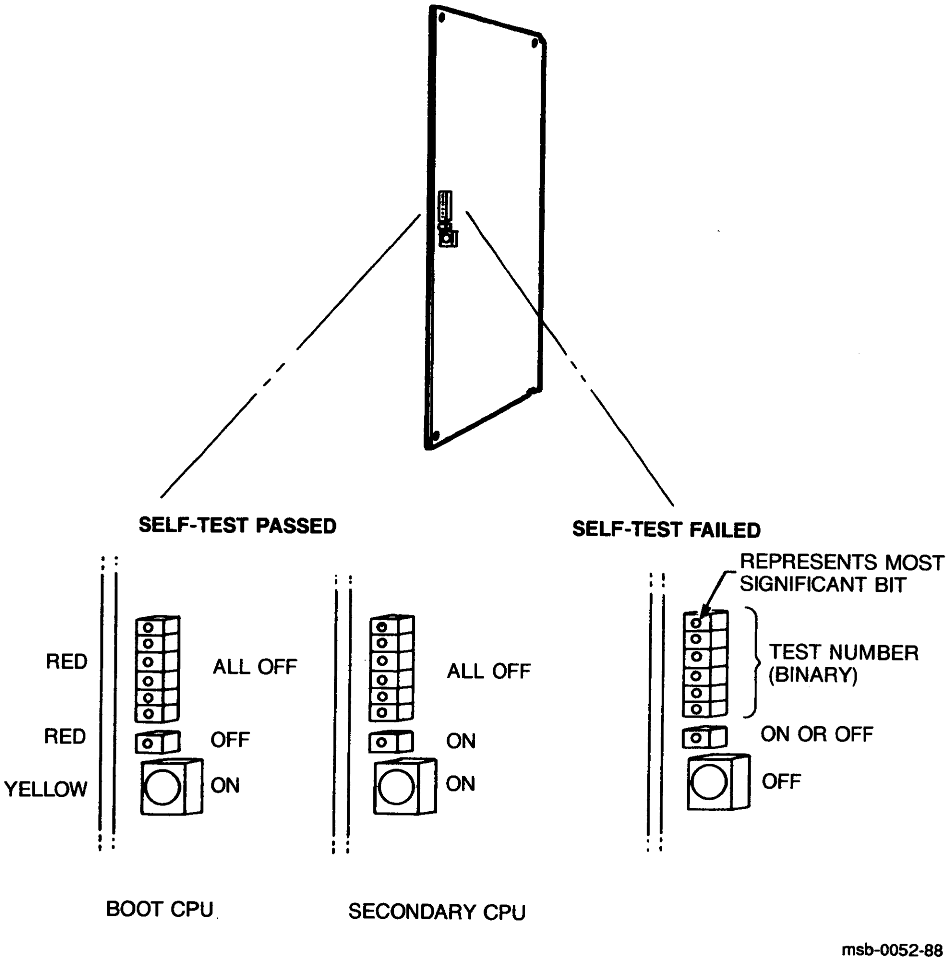
❺ Another BPD line is displayed, because it is possible for a different CPU to be designated boot processor before the system actually boots. This occurs in this example, because the processor at node 1 failed the extended test. The lowest-numbered processor that passed both tests is the processor at node 2. However, a previous SET CPU/NOPRIMARY command has made this processor ineligible to be boot processor (indicated by the designation D on the BPD line). Therefore, the processor at node 3 is designated boot processor.

❻ The bottom line of the self-test display shows the ROM and EEPROM version numbers and the system serial number.

3.7 KA62A Self-Test Results: Module LEDs

You can check KA62A self-test results both in the self-test display and in the lights on the module. As shown in Figure 3–7, if self-test passes, the large yellow LED at the bottom is on.

Figure 3–7: KA62A LEDs After Power-Up Self-Test



The large yellow LED at the bottom of the LEDs is ON if self-test passes and OFF if self-test fails. (Here self-test means both the on-board power-up test and the extended CPU/memory test.)

On the boot processor module, the red LED next to the yellow is OFF. This LED, which is controlled by the SSC chip, is ON on all the secondary processors.

The six red LEDs on top are all OFF if self-test passes. If any of the LEDs is ON, self-test failed and the LEDs contain a binary error code. The error code corresponds to the number of the test that failed. In the six error LEDs, the most significant bit is at the top, but the lights have a reverse interpretation — a bit is ONE if the light is OFF.

For example, assume a processor fails self-test (yellow LED is OFF), has a minus sign (-) on its STF line, and shows the following pattern in its top six LEDs:

```
          TOP
on
on
off
off
off
on
          BOTTOM
```

The failing test number decodes to 001110 (hex 0E, decimal 14). If you then ran the ROM-based diagnostic 0 with TRACE ON, the last test number you would see displayed is T0014.

When any of the six red error LEDs is lit, a failure has occurred during the self-test sequence. But system power-up self-test actually comprises three sets of tests: KA62A power-up tests, CPU/memory tests, and VAXBI adapter (DWMBA) tests. Interpretation of the processor board error lights depends on which set of tests was running, as explained below and in Table 3-2.

Processor error LEDs can also indicate failures of memories or VAXBI adapters.

Table 3-2: KA62A Error LEDs

Yellow LED	Error LEDs (hex)	Diagnostic and Test No. (decimal)	Device Failing	Self-Test Line
OFF	1-22	Power-up self-test (equivalent to RBD 0) T0001-T0034 See Table 3-4.	KA62A	STF
OFF	25-38	CPU/memory test - Memory 1 (equivalent to RBD 1) T0001-T0020 See Table 3-5.	MS62A 1 (module with lowest XMI node number)	ETF
OFF	39	CPU/memory test - Memory 2 T0002 (equivalent to ST 1/T=2)	MS62A 2	ETF
OFF	3A	CPU/memory test - Memory 3 T0002 (equivalent to ST 1/T=2)	MS62A 3	ETF
OFF	3B	CPU/memory test - Memory 4 T0002 (equivalent to ST 1/T=2)	MS62A 4	ETF
OFF	3C	CPU/memory test - Memory 5 T0002 (equivalent to ST 1/T=2)	MS62A 5	ETF
OFF	3D	CPU/memory test - Memory 6 T0002 (equivalent to ST 1/T=2)	MS62A 6	ETF
OFF	3E	CPU/memory test - Memory 7 T0002 (equivalent to ST 1/T=2)	MS62A 7	ETF
OFF	3F	CPU/memory test - Memory 8 T0002 (equivalent to ST 1/T=2)	MS62A 8	ETF
ON (boot processor)	1-1A	DWMBA test (equivalent to RBD 2) T0001-T0026 See Table 5-5.	DWMBA	XBI

If a processor's yellow LED is OFF and the six red LEDs show an error code in the range 1–22 (hex), the power-up self-test failed and the processor board is bad. On the self-test console display, the processor shows a minus sign (–) on the STF line.

After the power-up tests, each processor runs the CPU/memory tests. If a test fails, the processor shows a minus sign (–) on the ETF line of the self-test console display. With the first memory, LED error codes are numbered from 25 to 38 (hex), to distinguish them from the power-up tests. For example, assume that a processor fails self-test (yellow LED is OFF) and shows the following pattern in the error LEDs:

```
         TOP
off
on
on
off
off
off
         BOTTOM
```

The failing test number decodes to 100111 (hex 27), which corresponds to the third CPU/memory test. If you then ran the ROM-based diagnostic 1 with TRACE ON, the last test number you would see displayed is T0003.

Each processor, after testing with the first memory, runs the CPU/memory test on every other good memory module. (However, only CPU/memory test T0002 is run.) If a failure occurs, the memory module is probably bad, although the processor's yellow light is OFF and the memory module's yellow light is ON. If several processors fail on the same memory, the memory is certainly bad. Try using SET MEMORY to configure the bad module out of the interleave set. For error codes higher than 38, consult Table 3–2 to determine the failing memory.

The last series is the DWMBA tests. If one fails, the top six LEDs contain an error code, although the processor's yellow self-test LED is ON (because the CPU itself has passed). The failing error code (converted to decimal) corresponds to a test number in Table 5–5. Note that only the boot processor performs the DWMBA tests, so the red LED next to the yellow LED is OFF.

3.8 ROM-Based Diagnostics

The KA62A ROM contains five diagnostics, which you run using the boot processor's RBD monitor program described in Chapter 2. Diagnostics 0, 1, and 4 test the boot processor. Diagnostic 2 tests VAXBI adapters, and diagnostic 3 tests memories.

Table 3–3: ROM-Based Diagnostics

Diagnostic	Test
0	KA62A Power-up test
1	KA62A Extended CPU/memory test
2	DWMBA tests
3	Memory test
4	Second-Level Cache test

Diagnostic 0 is the same as the power-up self-test. It is useful for running several passes when a processor fails self-test intermittently. Section 3.9 shows an example and lists the tests.

Diagnostic 1 is the same as the extended CPU/memory test. It is useful for running several passes when a processor fails self-test intermittently. Section 3.10 shows an example and lists the tests.

Diagnostic 2 is the set of tests that the boot processor runs for each DWMBA VAXBI-to-XMI adapter when the system is powered on. (The DWMBA has no on-board self-test of its own.) The diagnostic reports whether each DWMBA passed and whether each I/O device on that adapter's VAXBI bus passed its own self-test.

Diagnostic 3 is a set of memory tests that tests sizes and runs extended tests on all of memory. Section 4.10 and Section 4.11 show an example of memory RBDs and list the tests.

Diagnostic 4 is a set of exhaustive cache tests. It is not meant to be used frequently—you must explicitly request each test to run. The complete set of seven tests takes over one hour.

For a detailed explanation of the diagnostic printout, see Chapter 2.

3.9 KA62A Self-Test RBD

RBD 0 is equivalent to the KA62A power-up self-tests.

Example 3-3: KA62A Self-Test RBD

```
>>>                          ! Console program prompt.
>>> T/R                      ! Command to enter RBD monitor program.
RBD3>                        ! RBD monitor prompt, where 3 is the hexa-
                             ! decimal node number of the boot processor.
RBD3> START 0 /TRACE/HE      ! Runs the KA62A self-test on boot processor
                             ! Trace prints each test number; halt on error
                             ! Test results written to the console terminal:
;XCPST            0.06

; T0001  T0002  T0003  T0004  T0005  T0006  T0007  T0008  T0009  T0010
; T0011  T0012  T0013  T0014  T0015  T0016  T0017  T0018  T0019  T0020
; T0021 ❶

;        F ❷          3      8001 ❸    1
;       HE XDEV_ERR              1     T0021❶
;       21     00000000 00000001 00000000 00001420 1FFD074C 00040CD0 02
```

In the example above: ❶ test 21 failed, ❷ F indicates failure, and ❸ the diagnostic ran for one pass.

Table 3-4: KA62A Power-Up Test—RBD 0

Test	Function
T0001	KA62A ROM test
T0002	SSC Base Address Register test
T0003	SSC RAM test
T0004	SSC Configuration Register test
T0005	SSC Bus Timeout test
T0006	SSC Programmable Address Decode test
T0007	KA62A CSR1 test
T0008	SSC Output Port test
T0009	KA62A EEPROM test

Table 3-4 (Cont.): KA62A Power-Up Test—RBD 0

Test	Function
T0010	SSC Interval Timer test
T0011	SSC Programmable Timers tests
T0012	SSC Console test
T0013	SSC TOY Clock test
T0014	CVAX Critical Path test
T0015	Cache Data RAM March test
T0016	Cache Mask Write test
T0017	Cache Data Parity RAM March test
T0018	CSR1:CPUD test
T0019	CFPA test
T0020	CFPA Critical Path test
T0021	XDEV Register test
T0022	XBER Register test
T0023	XFADR Register test
T0024	XGPR Register test
T0025	KA62A CSR2 Register test
T0026	XMI High Longword Data test
T0027	Interprocessor IVINTR test
T0028	Write Error IVINTR test
T0029	CNAK Read test
T0030	CNAK Write test
T0031	CNAK IP/WE IVINTR test
T0032	Multiple Interrupt test
T0033	Parity Error CNAK Read test
T0034	Parity Error CNAK Write test

3.10 CPU/Memory Test — RBD 1

RBD 1 is equivalent to the extended CPU/memory test.

Example 3-4: CPU/Memory Test RBD

```
>>>Z 3                          ! This example uses the Z command
                                ! to connect processor 3 to the console
                                ! Note new console program prompt

3>> T/R                         ! Command to enter RBD monitor program

RBD3>                           ! RBD monitor prompt, where 3 is the hexa-
                                ! decimal node number of the processor
                                ! that is currently receiving your input.

RBD3> START 1 /TRACE/HE         ! Runs the CPU/Memory RBD with trace; halt
                                ! on error.  Test results written to the
                                ! console terminal:

;CPUMEM       0.03

; T0001  T0002  T0003  T0004  T0005  T0006  T0007  T0008  T0009  T0010
; T0011  T0012  T0013  T0014  T0015  T0016  T0017  T0018  T0019  T0020

          ❶                            ❷
;         P            3     8001       1
;000000000 00000000 00000000 00000000 00000000 00000000 00000000

RBD3>
```

In the example above:

❶ P means that the diagnostic ran successfully.

❷ One pass was completed.

Table 3–5: Extended CPU/Memory RBD Test—RBD 1

Test	Function
T0001	Cache Disable test
T0002	Cache Invalidate test
T0003	Cache Read Fill test
T0004	Interlock Instruction Cache test
T0005	Longword Write WB0 test
T0006	Octaword Write WB0 test
T0007	WB Switch and Purge test
T0008	Octaword Write WB1 test
T0009	Write Buffer Read Tests
T0010	Hit WB0 test
T0011	Hit WB1 test
T0012	WB Mask Bit Byte Tests
T0013	WB Mask Bit Word Tests
T0014	Intlk Read/Unlck Write WB test
T0015	I/O Space Write WB test
T0016	Node Private Space WB test
T0017	WB Address test
T0018	WB Pending Purge test
T0019	Duplicate Tag Invalidate test
T0020	Duplicate Tag Address test

3.11 Second-Level Cache RBD—RBD 4

RBD 4 tests the second-level cache. Note that no tests are run by default.

Example 3–5: Second-Level Cache Test RBD

```
>>>                                     ! Console program prompt

>>> T/R                                 ! Command to enter RBD monitor program

RBD1>                                   ! RBD monitor prompt, where 1 is the
                                        ! hexadecimal node number of the processor
                                        ! that is currently receiving your input

RBD1> ST4/T=1:2/TR                      ! Specifically asks for tests 1 and 2 to
                                        ! be run with trace enabled

;SLCRBD       0.04

; T0001                                         ! Test 1 started
         1                       3
;        S        1       8001        1         ! Status message for test 1
;       XX SL_CACHE         XX    T0001

;00000000 00040000 00000000 00000000 00000000 00000000 00000000 00000000
                                                ! Print message showing current
                                                ! address and ending address
; T0002                                         ! Test 2 started
         1                       3
;        S        1       8001        1         ! Status message for test 2
;       XX SL_CACHE         XX    T0002

;00000000 01000000 00000000 00000000 00000000 00000000 00000000 00000000
                                                ! Print message showing current
                                                ! address and ending address.
;00000042 00000000 00000000 00000000 00000000 00000000 00000000 00000000
                                                ! Print message showing the
                                                ! number of cache hits
         2                       3
;        P        1       8001        1
;00000000 00000000 00000000 00000000 00000000 00000000 00000000

RBD1> QUIT                                      ! Exit the RBD monitor
```

❶ S denotes status message for individual test.

❷ P means that the entire diagnostic ran successfully.

❸ One pass was completed.

Table 3–6: Second-Level Cache RBD Test — RBD4

Test	Function
T0001	Parity Error Test
T0002	Cache Coherency Test
T0003	Cache Invalidate Test
T0004	Self-invalidate Test
T0005	Invalidate/Self-invalidate Test
T0006	Self-invalidate Scope Test
T0007	Cache Ram Parity Error Test
T0008	Passive Release Test

3.12 VDS Diagnostics

The KA62A software diagnostics that run under the VAX Diagnostic Supervisor (VDS) are listed in Table 3–7. An example follows. See Section 2.4 for instructions on running the supervisor.

Table 3–7: KA62A VDS Diagnostics

Program	Description
EVSBA	VAX Stand-Alone Autosizer
EVKAQ	VAX Basic Instructions Exerciser - Part 1
EVKAR	VAX Basic Instructions Exerciser - Part 2
EVKAS	VAX Floating Point Instruction Exerciser - Part 1
EVKAT	VAX Floating Point Instruction Exerciser - Part 2
EVKAU	VAX Privileged Architecture Instruction Test - Part 1
EVKAV	VAX Privileged Architecture Instruction Test - Part 2
ELKAX	Manual Tests
ELKMP	Multiprocessor Exerciser

Example 3–6: Running Stand-Alone Processor Diagnostics

```
DS> RUN EVSBA   ❶
DS> SEL KA0     ❷
DS> RUN ELKAX   ❸
  [diagnostic messages]
DS> EXIT
>>>
```

❶ Run the Stand-Alone Autosizer; then you do not need to attach devices to the supervisor explicitly. However, if you want to know the Attach command, enter HELP diagnostic_name ATTACH.

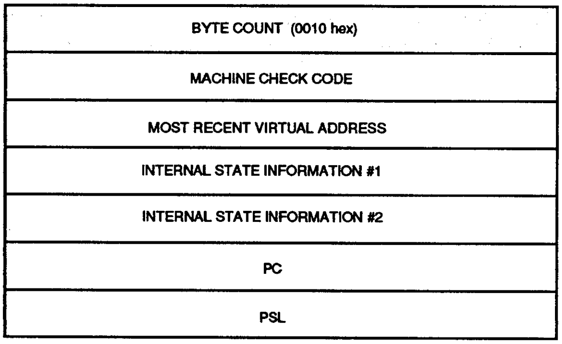
❷ The instruction and manual tests run on the boot processor. If the boot processor is the CPU with the lowest XMI node number (which is usually the case), issue the command to select KA0. The Diagnostic Supervisor numbers the processors consecutively. For example, if the KA62A module with the second-lowest XMI node number were boot processor, you would select KA1.

❸ This example runs the manual tests (ELKAX), which include powerfail, machine check, restart, and EEPROM functions. The diagnostic prints messages, and you must manually intervene using console switches.

3.13 Machine Checks

A machine check is an exception that indicates a processor-detected internal error. Figure 3-8 shows the parameters that are pushed on the stack in response to a machine check. Table 3-8 lists these parameters.

Figure 3-8: The Stack in Response to a Machine Check



msb-0053-88

Table 3-8: Machine Check Parameters

Parameter	Value	Description
Machine check code (hex) (SP+4)	1	Floating-point protocol error
	2	Floating-point reserved instruction
	3	Floating-point unknown error
	4	Floating-point unknown error
	5	Process PTE in P0 space during TB miss flows
	6	Process PTE in P1 space during TB miss flows

Table 3-8 (Cont.): Machine Check Parameters

Parameter	Value	Description
	7	Process PTE in P0 space during M = 0 flows
	8	Process PTE in P1 space during M = 0 flows
	9	Undefined INT.ID value
	A	Undefined MOVCx state
	80	Memory read error
	81	SCB, PCB, or SPTE read error
	82	Memory write error
	83	SCB, PCB, or SPTE write error
Most recent virtual address (SP+8)	<31:0>	Current contents of VAP register
Internal state information #1 (SP+C)	<31:24>	Opcode
	<23:16>	1110, highest priority software interrupt <3:0>
	<15:8>	CADR<7:0>
	<7:0>	MSER<7:0>
Internal state information #2 (SP+10)	<31:24>	Most recent contents of SC register <7:0>
	<23:16>	11, state flags <5:0>
	<15:8>	Restart flag, 111, ALU CC flags <3:0>
	<7:0>	Offset from saved PC to PC at time of machine check
PC (SP+14)	<31:0>	PC at the start of the current instruction
PSL (SP+18)	<31:0>	Current contents of PSL

Machine checks are taken regardless of the current IPL. If the machine check exception vector bits (<1:0>) are not both one, the operation of the processor is undefined. The exception is taken on the interrupt stack and the IPL is raised to 1F (hex).

3.14 Console Commands

Table 3-9 summarizes the console commands. Commands specific to the VAX 6200 include RESTORE EEPROM, SAVE EEPROM, SET BOOT, SET CPU, and Z. The VAX 6200 Owner's Manual gives a full description of each command, its qualifiers, and examples.

Table 3-9: Console Commands

Command	Function
BOOT	Initializes the system, causing a self-test, and begins the boot program.
CONTINUE	Begins processing at the address where processing was interrupted by a CTRL/P console command.
DEPOSIT	Stores data in a specified address.
EXAMINE	Displays the contents of a specified address.
FIND	Searches main memory for a page-aligned 256-Kbyte block of good memory or for a restart parameter block.
HALT	Null command; no action is taken since the processor has already halted in order to enter console mode.
HELP	Prints explanation of console commands; operates like the HELP command in VMS.
INITIALIZE	Performs a system reset, including self-test.
REPEAT	Executes the command passed as its argument.
RESTORE EEPROM	Copies the TK tape's EEPROM contents to the EEPROM of the processor executing the command.
SAVE EEPROM	Copies to the TK tape the contents of the EEPROM of the processor executing the command.
SET BOOT	Stores a boot command by a nickname.
SET CPU	Specifies eligibility of processors to become the boot processor.
SET LANGUAGE	Changes the output of the console error messages between numeric code only (international mode) and code plus explanation (English mode).
SET MEMORY	Designates the method of interleaving the memory modules; supersedes the console program's default interleaving.

Table 3-9 (Cont.): Console Commands

Command	Function
SET TERMINAL	Sets console terminal characteristics.
SHOW ALL	Displays the current value of parameters set.
SHOW BOOT	Displays all boot commands and nicknames that have been saved using SET CPU.
SHOW CONFIGURATION	Displays the hardware device type and revision level for each XMI and VAXBI node and indicates self-test status.
SHOW CPU	Displays the /ENABLED and /PRIMARY values for each node.
SHOW ETHERNET	Locates all Ethernet adapters on the system and displays their addresses.
SHOW MEMORY	Displays the memory lines from the system self-test, showing interleave and memory size.
SHOW TERMINAL	Displays the baud rate and terminal characteristics functioning on the console terminal.
START	Begins execution of an instruction at the address specified in the command string.
STOP	Halts the specified node.
TEST	Passes control to the self-test diagnostics; /RBD qualifier invokes ROM-based diagnostics.
UPDATE	Copies contents of the EEPROM on the processor executing the command to the EEPROM of the processor specified in the command string.
Z	Logically connects the console terminal to another processor on the XMI.
!	Introduces a comment.

3.15 How to Replace the Only Processor

After swapping modules in a single-processor system, you must RESTORE the EEPROM image previously saved on a TK tape.

Example 3–7: Replacing a Single Processor

```
F   E   D   C   B   A   9   8   7   6   5   4   3   2   1   0   NODE #

    A   A   .   .   M   M   .   .   .   .   .   .   .   P       TYP    6
    o   o   .   .   +   +   .   .   .   .   .   .   .   +       STF    7
    .   .   .   .   .   .   .   .   .   .   .   .   .   B       BPD
    .   .   .   .   .   .   .   .   .   .   .   .   .   +       ETF    7
    .   .   .   .   .   .   .   .   .   .   .   .   .   B       BPD

.   .   .   .   .   .   .   .   .   +   +   .   +   .   +   .   XBI D +
.   .   .   .   .   .   .   .   .   +   .   +   .   +   +   .   XBI E +

    .   .   .   .   A2  A1  .   .   .   .   .   .   .   .       ILV
    .   .   .   .   32  32  .   .   .   .   .   .   .   .       64Mb

ROM = 3.0          EEPROM = 2.0/3.0       SN = SG01234567

  >>> RESTORE EEPROM 11

  !optional - may need latest console/diag patches again   12
  >>> PATCH EEPROM

  >>> B  15
```

1. Turn the upper key switch straight up to the Off position (0).
2. Remove the defective KA62A module.
3. Insert the new processor module.
4. Turn the lower key switch to Halt.
5. Turn the upper key switch to Enable.
6. Check the self-test display for the processor, indicated by a P on the TYP line (usually in slot 1). See Example 3-7.
7. If the processor shows a plus sign (+) on both lines STF and ETF, it passed self-test.
8. You will see the following message

   ```
   ?4E System serial number has not been initialized
   ```

9. Turn the lower key switch to Update.
10. Mount the TK cartridge containing the most recent saved image of the old processor's EEPROM.[1]
11. Issue the console command RESTORE EEPROM.
12. If any patches had been issued since the last save, mount the TK cartridge containing the patches. If the EEPROM has already been patched to the latest revision, go to step 14. For more information about the PATCH command, see Section 3.18.
13. Issue the console command PATCH EEPROM. The patch operation takes approximately five minutes.
14. Turn the lower key switch to the Auto Start position.
15. Boot the operating system by issuing the console command B.

---

[1] When the system was originally installed, field service saved the EEPROM on a TK cartridge. The cartridge was left in the care of the customer. Subsequently, the EEPROM might have been changed, then saved, several times. This would normally be the case following a PATCH operation.

If you do not have a tape, set the system serial number in the new processor as follows:

>>>[ESC] [DEL] SET SYSTEM SERIAL [RET]

Enter system serial number? aannnnnnnn [RET]

UPDATE EEPROM? (Y or N) >>> Y [RET]

3.16 How to Replace the Boot Processor

The boot processor is the processor farthest to the right in the XMI card cage—slot 1 in Example 3–8. If the new KA62A module has the same version ROM as the secondary processors, you can update the new processor's EEPROM from one of the secondaries.

Example 3–8: Replacing Boot Processor

```
F  E  D  C  B  A  9  8  7  6  5  4  3  2  1  0   NODE #

   A  A  .  .  M  M  M  M  .  .  P  P  P  P      TYP     6
   o  o  .  .  +  +  +  +  .  .  +  +  +  +      STF     7
   .  .  .  .  .  .  .  .  .  .  E  D  E  B      BPD
   .  .  .  .  .  .  .  .  .  .  +  +  +  +      ETF     7
   .  .  .  .  .  .  .  .  .  .  E  D  E  B      BPD

.  .  .  .  .  .  .  .  .  +  +  .  +  .  +  .   XBI D +
.  .  .  .  .  .  .  .  .  +  .  +  .  +  +  .   XBI E +

   .  .  .  .  A4 A3 A2 A1 .  .  .  .  .  .      ILV
   .  .  .  .  32 32 32 32 .  .  .  .  .  .      128Mb

ROM = 3.0        EEPROM = 2.0/3.1      SN = SG01234567

  >>> !optional - if the new CPU ROM doesn't match
  >>> !then don't let it be boot processor
  >>> SET CPU/NOPRIMARY 1  10
  >>> SHOW CPU

  Current Primary:  1
  /NOENABLED-
  /NOPRIMARY- 1

  >>> SET CPU 2  11
  >>> SHOW CPU

  Current Primary:  2
  /NOENABLED-
  /NOPRIMARY-

  >>> UPDATE 1  13
```

1. Turn the upper key switch straight up to the Off position (0).
2. Remove the defective boot processor module.
3. Insert the new KA62A module.

4. Turn the lower key switch to Halt.
5. Turn the upper key switch to Enable.
6. Check the self-test display for the new processor, indicated by a P on the TYP line (usually in slot 1). See Example 3–8.
7. If the processor shows a plus sign (+) on both lines STF and ETF, it passed self-test.
8. You will see the following message:

   ```
   ?4F System serial number not initialized on primary processor
   ```

9. If you see the following message, the new module will not be able to function as the boot processor:

   ```
   ?51 ROM revision mismatch.  Secondary processor has revision x.y.
   ```

   If you don't see this message, go to step 11.

10. Make the new module ineligible to be boot processor—use the console command SET CPU/NOPRIMARY. The new processor will operate as a secondary processor without problems, but the customer will continue to see messages like the following when the system is powered on:

    ```
    ?2D For Secondary Processor 1
    ?51 ROM revision mismatch.  Secondary processor has revision x.y.
    ?53 EEPROM revision mismatch.  Secondary processor has revision x.y/x.y.
    ```

    As long as its ROM is out of revision, do not issue the command UPDATE to the new module. Go to step 15.

11. Make one of the secondary processors the boot processor temporarily, because the UPDATE command copies the boot processor's EEPROM. Then you can update the new processor. The following command immediately makes the processor at node 2 the boot processor: SET CPU 2.
12. Turn the lower key switch to Update.
13. Now update the EEPROM of the new module from the temporary boot processor, using the UPDATE command.
14. Turn the lower key switch to the Auto Start position.
15. Press the Restart button.

3.17 How to Add a New Processor or Replace a Secondary Processor

Add a new processor in a slot to the left of the boot processor, so that it will be a secondary processor at power-up. Also follow the procedure here if you need to replace a secondary processor. If the new KA62A module has the same version ROM, you can update the new processor's EEPROM from the boot processor.

Example 3-9: Adding or Replacing Secondary Processor

```
F   E   D   C   B   A   9   8   7   6   5   4   3   2   1   0   NODE #

    A   A   .   .   M   M   M   M   .   .   P   P   P   P       TYP    6
    o   o   .   .   +   +   +   +   .   .   +   +   +   +       STF    7
    .   .   .   .   .   .   .   .   .   .   E   D   E   B       BPD
    .   .   .   .   .   .   .   .   .   .   +   +   +   +       ETF    7
    .   .   .   .   .   .   .   .   .   .   E   D   E   B       BPD

.   .   .   .   .   .   .   .   .   +   +   .   +   .   +   .   XBI D +
.   .   .   .   .   .   .   .   .   +   .   +   .   +   +   .   XBI E +

    .   .   .   .  A4  A3  A2  A1   .   .   .   .   .   .       ILV
    .   .   .   .  32  32  32  32   .   .   .   .   .   .       128Mb

ROM = 3.0        EEPROM = 2.0/3.1 10      SN = SG01234567

  >>> !optional - if the new CPU ROM doesn't match
  >>> !then don't let it be boot processor
  >>> SET CPU/NOPRIMARY 3  9
  >>> SHOW CPU

  Current Primary:  1
  /NOENABLED-
  /NOPRIMARY- 3

  >>> UPDATE 3  12
```

1. Turn the upper key switch straight up to the Off position (0).
2. Either remove the defective secondary processor module, or find an empty slot where you can add the new processor.
3. Insert the new KA62A module.
4. Turn the lower key switch to Halt.

5. Turn the upper key switch to Enable.
6. Check the self-test display for the new processor, indicated by a P on the TYP line (in this example: slot 3). (See Example 3-9.)
7. If the processor shows a plus sign (+) on both lines STF and ETF, it passed self-test.
8. If you see the following message, the new module will not be able to function as the boot processor:

```
?2D For Secondary Processor 3
?51 ROM revision mismatch.  Secondary processor has revision x.y.
```

   If you don't see this message, go to step 10.
9. Make the new module ineligible to be boot processor—use the console command SET CPU/NOPRIMARY. The new processor will operate as a secondary processor without problems, but the customer will continue to see messages like the following when the system is powered on:

```
?2D For Secondary Processor 3
?51 ROM revision mismatch.  Secondary processor has revision x.y.
?53 EEPROM revision mismatch.  Secondary processor has revision x.y/x.y.
```

   As long as its ROM is out of revision, do not issue the command UPDATE to the new module. Go to step 14.
10. If you see the following message, compare the EEPROM revision numbers of the secondary processor and boot processor (second number in the EEPROM = X/Y field on the bottom line of self-test display).

```
?2D For Secondary Processor 3
?53 EEPROM revision mismatch.  Secondary processor has revision x.y/x.y.
```

   If the new secondary processor has a *higher* revision number than the boot processor, PATCH the boot processor's EEPROM (see Section 3.18).
11. Turn the lower key switch to Update.
12. Now update the EEPROM of the new module.
13. Turn the lower key switch to the Auto Start position.
14. Press the Restart button.

3.18 PATCH EEPROM Command

The PATCH EEPROM command is a console command used by field service to update console and RBD monitor programs when new revisions are issued.

Example 3-10: PATCH EEPROM Command

```
                                        ! Load the tape cartridge into the tape
                                        ! drive on the upper left corner of the
                                        ! system; queue the tape to the beginning.
                                        !
>>> PATCH EEPROM                        ! Enter the PATCH EEPROM command; wait
                                        ! approximately 5 minutes.
                                        !
>>> UPDATE ALL                          ! The UPDATE command copies the EEPROM
                                        ! patch to all secondary processors.
                                        !
>>> I                                   ! Initialize the system to cause a system
                                        ! reset, and check self-test summary line.
F   E   D   C   B   A   9   8   7   6   5   4   3   2   1   0   NODE #

    A   A   .   .   M   M   M   M   .   .   P   P   P   P       TYP
    o   o   .   .   +   +   +   +   .   .   +   +   +   +       STF
    .   .   .   .   .   .   .   .   .   .   E   D   E   B       BPD
    .   .   .   .   .   .   .   .   .   .   +   +   +   +       ETF
    .   .   .   .   .   .   .   .   .   .   E   D   E   B       BPD

.   .   .   .   .   .   .   .   .   +   +   .   +   .   +   .   XBI D +
.   .   .   .   .   .   .   .   .   +   .   +   .   +   +   .   XBI E +

    .   .   .   .   A4  A3  A2  A1  .   .   .   .   .   .       ILV
    .   .   .   .   32  32  32  32  .   .   .   .   .   .       128Mb

ROM = 3.0          EEPROM = 2.0/3.1 8       SN = SG01234567
>>>
```

1. Save the current contents of the EEPROM to tape using the SAVE EEPROM command (see Chapter 5 of the *VAX 6200 Owner's Manual*).
2. Halt all processors and enter console mode.
3. Load the new EEPROM patch tape into the TK tape drive.
4. Queue the tape to the beginning by pressing the load/unload pushbutton. (See Appendix A of the *VAX 6200 Owner's Manual* for details on using the TK tape drive.)
5. Enter the PATCH EEPROM command. Wait approximately five minutes for the patch to complete. You receive the console prompt back when the patch is complete.
6. If the system is a multiprocessor system, run UPDATE ALL to copy the new patch information to the secondary processors. The time for UPDATE ALL to execute varies with the number of processors, up to a maximum of 15 minutes for a four-processor system.
7. Reset the system, by pushing the Restart button on the control panel or by entering the INITIALIZE command.
8. Check the summary line of the self-test. The EEPROM information indicates first the starting revision number of the EEPROM for this system, followed by a slash, and the current revision number of the EEPROM for the processors. (See Example 3–10.)
9. If the revision numbers on all processors do not match, the system prints out the most current revision number of the EEPROM data and gives an error message indicating that the EEPROM code does not match. (See Section 3.17.)
10. Instruct the customer to save the updated contents to tape, using the SAVE EEPROM command.

3.19 PATCH EEPROM Command Error Messages

Table 3–10 lists the error messages and probable causes.

Table 3–10: PATCH EEPROM Command Error Messages

Message	Meaning
?39 Console patches are not usable.	The console patch area in EEPROM is corrupted or contains a patch revision that is incompatible with the console ROM.
?3F Key switch must be at "Update" to update EEPROM.	A SET command needs to update the EEPROM, but the key switch is not set to allow updates.
?52 EEPROM header is corrupted.	The EEPROM header has been corrupted. The EEPROM must be reloaded from the TK tape drive.
?53 EEPROM revision mismatch. Secondary processor has revision *x.y*/*x.y*.	A secondary processor has a different revision of EEPROM or has a different set of EEPROM patches installed.
?54 Failed to locate EEPROM area.	The EEPROM did not contain a set of data required by the console. The EEPROM may be corrupted.
?56 EEPROM area checksum error.	A portion of the EEPROM is corrupted. It may be necessary to reload the EEPROM from the TK tape drive.
?5C No such boot spec found.	The specified saved boot specification was not found in the EEPROM.
?5E Major revision mismatch between tape image and EEPROM.	The TK tape contains an EEPROM image with a major revision different from that found in the EEPROM. The image cannot be restored.
?60 EEPROM header or area has bad format.	All or part of the EEPROM contains inconsistent data and is probably corrupted. Reload the EEPROM from the TK tape.
?62 Unable to locate console tape device.	The console could not locate the I/O adapter that controls the TK tape.
?64 Insufficient memory to buffer EEPROM image.	The SAVE, RESTORE, and PATCH EEPROM commands require working memory, but not enough was found.

Table 3-10 (Cont.): PATCH EEPROM Command Error Messages

Message	Meaning
?65 Validation of EEPROM tape image failed.	The image on tape is corrupted or is not the result of a SAVE EEPROM command. The image cannot be restored.
?66 Read of EEPROM image from tape failed.	The EEPROM image was not successfully read from tape.
?67 Validation of local EEPROM failed.	For a PATCH EEPROM operation, the EEPROM must first contain a valid image before it can be patched. For a RESTORE EEPROM operation, the image was written back to EEPROM but could not be read back successfully.
?68 EEPROM not changed.	The EEPROM contents were not changed.
?69 EEPROM changed successfully.	The EEPROM contents were successfully patched or restored.
?6A Error changing EEPROM.	An error occurred in writing to the EEPROM. The EEPROM contents may be corrupted.
?6D EEPROM Revision = *x.x/y.y*.	The EEPROM contents are at revision *x.x* with revision *y.y* patches.
?6E EEPROM header version mismatch.	The primary and a secondary processor have different versions of the EEPROM. The requested operation cannot be performed.
?6F Tape image Revision = *x.x/y.y*.	The EEPROM image on the TK tape is at revision *x.x* with revision *y.y* patches.

3.20 KA62A Registers

The KA62A registers consist of the processor status longword, internal processor registers, KA62A registers in XMI private space, XMI required registers, and 16 general purpose registers.

Table 3-11: KA62A Internal Processor Registers

Register	Mnemonic	Address	Type	Class
Kernel Stack Pointer	KSP	IPR0	R/W	1
Executive Stack Pointer	ESP	IPR1	R/W	1
Supervisor Stack Pointer	SSP	IPR2	R/W	1
User Stack Pointer	USP	IPR3	R/W	1
Interrupt Stack Pointer	ISP	IPR4	R/W	1
Reserved		IPR5-IPR7		3
P0 Base Register	P0BR	IPR8	R/W	1
P0 Length Register	P0LR	IPR9	R/W	1
P1 Base Register	P1BR	IPR10	R/W	1
P1 Length Register	P1LR	IPR11	R/W	1
System Base Register	SBR	IPR12	R/W	1
System Length Register	SLR	IPR13	R/W	1

Key to Types:

R-Read
W-Write
R/W-Read/write

Key to Classes:

1-Implemented by the KA62A (as specified in the *VAX Architecture Reference Manual*).
2-Implemented uniquely by the KA62A.
3-Not implemented. Read as zero; NOP on write.
4-Access not allowed; accesses result in a reserved operand fault.
5-Accessible, but not fully implemented; accesses yield UNPREDICTABLE results.
n I-The register is initialized on KA62A reset (power-up, system reset, and node reset).

Table 3–11 (Cont.): KA62A Internal Processor Registers

Register	Mnemonic	Address	Type	Class
Reserved		IPR14–IPR15		3
Process Control Block Base	PCBB	IPR16	R/W	1
System Control Block Base	SCBB	IPR17	R/W	1
Interrupt Priority Level	IPL	IPR18	R/W	1 I
AST Level	ASTLVL	IPR19	R/W	1 I
Software Interrupt Request	SIRR	IPR20	W	1
Software Interrupt Summary	SISR	IPR21	R/W	1 I
Reserved		IPR22–IPR23		3
Interval Clock Control/Status	ICCS	IPR24	R/W	2 I
Next Interval Count	NICR	IPR25	W	3
Interval Count	ICR	IPR26	R	3
Time-of-Year Clock	TODR	IPR27	R/W	1
Console Storage Receiver Status	CSRS	IPR28	R/W	5 I
Console Storage Receiver Data	CSRD	IPR29	R	5 I
Console Storage Transmitter Status	CSTS	IPR30	R/W	5 I
Console Storage Transmitter Data	CSTD	IPR31	W	5 I
Console Receiver Control/Status	RXCS	IPR32	R/W	2 I
Console Receiver Data Buffer	RXDB	IPR33	R	2 I
Console Transmit Control/Status	TXCS	IPR34	W	2 I
Console Transmit Data Buffer	TXDB	IPR35	W	2 I
Translation Buffer Disable	TBDR	IPR36	R/W	3
Cache Disable	CADR	IPR37	R/W	2 I
Machine Check Error Summary	MCESR	IPR38	R/W	3
Memory System Error	MSER	IPR39	R/W	2 I
Reserved		IPR40–IPR41		3
Console Saved PC	SAVPC	IPR42	R	2
Console Saved PSL	SAVPSL	IPR43	R	2
Reserved		IPR44–IPR47		3

Table 3-11 (Cont.): KA62A Internal Processor Registers

Register	Mnemonic	Address	Type	Class
SBI Fault/Status	SBIFS	IPR48	R/W	3
SBI Silo	SBIS	IPR49	R	3
SBI Silo Comparator	SBISC	IPR50	R/W	3
SBI Maintenance	SBIMT	IPR51	R/W	3
SBI Error	SBIER	IPR52	R/W	3
SBI Timeout Address	SBITA	IPR53	R	3
SBI Quadword Clear	SBIQC	IPR54	W	3
I/O Bus Reset	IORESET	IPR55	W	2
Memory Management Enable	MAPEN	IPR56	R/W	1
Translation Buffer Invalidate All	TBIA	IPR57	W	1
Translation Buffer Invalidate Single	TBIS	IPR58	W	1
Translation Buffer Data	TBDATA	IPR59	R/W	3
Microprogam Break	MBRK	IPR60	R/W	3
Performance Monitor Enable	PMR	IPR61	R/W	3
System Identification	SID	IPR62	R	1
Translation Buffer Check	TBCHK	IPR63	W	1
Reserved		IPR64-IPR127		4

The IPRs are explicitly accessible to software only by the Move To Processor Register (MTPR) and Move From Processor Register (MFPR) instructions, which require kernel mode privileges. From the console, EXAMINE/I and DEPOSIT/I commands read and write the IPRs.

Table 3–12: XMI Registers for the KA62A

Register	Mnemonic	Address
XMI Device	XDEV	BB + 00
XMI Bus Error	XBER	BB + 04
XMI Failing Address	XFADR	BB + 08
XMI XGPR	XGPR	BB + 0C
KA62A Control/Status #2	CSR2	BB + 10

Note: "BB" = base address of a node, which is the address of the first location in nodespace.

Table 3–13: KA62A Registers in XMI Private Space

Register	Mnemonic	Address
KA62A Control/Status #1	CSR1	2000 0000
KA62A ROM	ROM	2004 0000 to 2007 FFFF
KA62A EEPROM	EEPROM	2008 0000 to 2008 7FFF
SSC Base Address	SSCBR	2014 0000
SSC Configuration	SSCCR	2014 0010
CDAL Bus Timeout	CBTCR	2014 0020
Console Select	CONSEL	2014 0030
Timer Control Register 0	TCR0	2014 0100
Timer Interval Register 0	TIR0	2014 0104
Timer Next Interval Register 0	TNIR0	2014 0108
Timer Interrupt Vector Register 0	TIVR0	2014 010C
Timer Control Register 1	TCR1	2014 0110
Timer Interval Register 1	TIR1	2014 0114
Timer Next Interval Register 1	TNIR1	2014 0118
Timer Interrupt Vector Register 1	TIVR1	2014 011C
CSR1 Base Address	CSR1BADR	2014 0130
CSR1 Address Decode Mask	CSR1ADMR	2014 0134
EEPROM Base Address	EEBADR	2014 0140
EEPROM Address Decode Mask	EEADMR	2014 0144
SSC BBU RAM	BBURAM	2014 0400 to 2014 07FF
IP IVINTR Generation	IPIVINTRGEN	2101 0000 to 2101 FFFF
WE IVINTR Generation	WEIVINTRGEN	2102 0000 to 2102 FFFF

Chapter 4
MS62A Memory

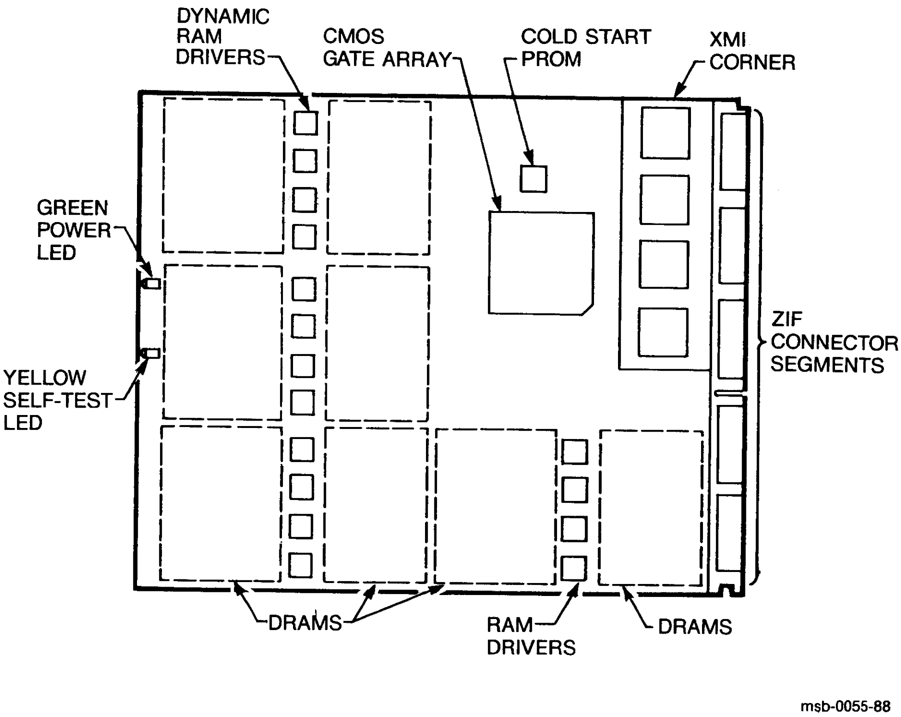
This chapter discusses maintenance of MS62A memory modules. Sections include:

- Description
- MS62A Configuration Rules
- Specifications
- Functional Description
- Interleaving
- Console Commands for Interleaving
- Memory Self-Test
- Memory Self-Test Errors
- Memory RBDs
- Memory RBD Test Examples
- MS62A Control and Status Registers
- MS62A Memory Installation

4.1 MS62A Description

The MS62A is a metal-oxide semiconductor (MOS), dynamic random access memory (DRAM), which provides 32 Mbytes of data storage. The memory module is designed for use with the VAX 6200 system through the primary interconnect known as the XMI.

Figure 4-1: MS62A Module (Side 1)



The 32-Mbyte memory module has the following features:

- The memory module contains MOS dynamic RAM (DRAM) arrays; a CMOS gate array that contains error correction code (ECC) logic and control logic; and an XMI interface known as the XMI Corner.
- Storage arrays are multiple banks of 72 DRAMs with four banks.
- ECC logic detects single-bit and double-bit errors and corrects single-bit errors on 64-bit words.
- Memory self-test checks all RAMs, the data path, and control logic on power-up.
- Quadwords, octawords, and hexwords are read from memory; quadwords and octawords are written to memory.
- Memory is configured by the console program for 1-, 2-, 4-, 8-way or no interleaving.

4.2 MS62A Configuration Rules

Table 4–1 shows how the XMI card cage should be configured. Memory modules are placed in adjoining XMI slots beginning at slot A.

Table 4–1: Memory Configurations for the XMI Backplane

XMI Slot Number	Contents
A	First memory module
9	Second memory module
8	Third memory module
7	Fourth memory module
6	Fifth memory module
5	Sixth memory module
B	Seventh memory module
C	Eighth memory module

NOTE: *Do NOT install memory modules in XMI backplane slots 1 or E.*

Standard configurations include 1, 2, 4, or 8 memory modules. Systems will run with 3, 5, or 7 memory modules; however, system performance may decrease as the number of memory modules increases.

4.3 MS62A Specifications

Table 4–2 gives the MS62A specifications including access and cycle times.

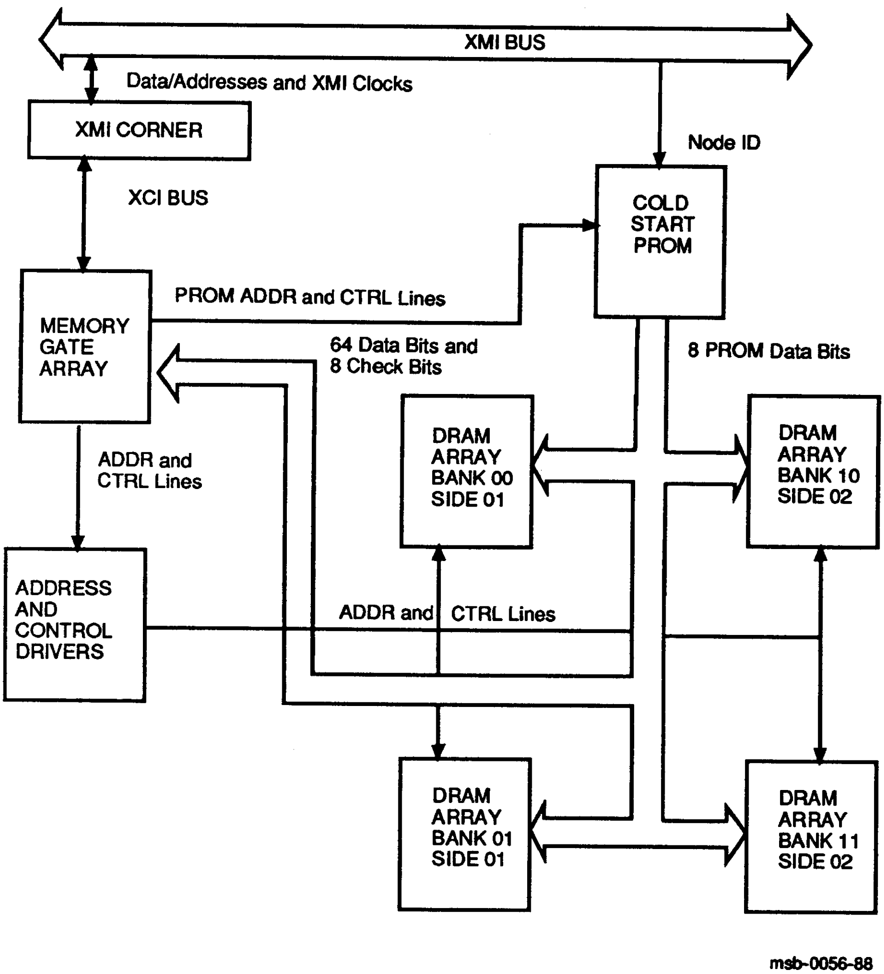
Table 4–2: MS62A Specifications

Parameter	Description
Module Number:	T2014-B
Dimensions:	23.3 cm (9.2") H and 28.0 cm (11.0") D
Addresses:	2-Mbyte boundaries
Starting Address	0 to 510 Mbytes
Ending Address	32 to 512 Mbytes
Technology:	
DRAMS	1 Mbit dynamic RAMs
Gate Arrays	CMOS gate array
Interleave:	1-, 2-, 4-, 8-way or none
Error Correction Code:	Detects single- and double-bit errors and corrects single-bit errors
Temperature:	
Storage Range	-40°C to 66°C (-40°F to 151°F)
Operating Range	5°C to 50°C (41°F to 122°F)
Relative Humidity:	
Storage and Operating	10 to 95% noncondensing
Altitude:	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)
Current:	7.5A active, 2.8A standby, max. at +5VBB
Power:	37.5W active, 14.5W standby, max. at +5VBB
Refresh Request Frequency:	9.8 μsec
Refresh Cycle Duration:	6 cycles

4.4 MS62A Functional Description

The MS62A consists of an XMI Corner, a memory gate array, address and control drivers, DRAM arrays, and a cold start PROM.

Figure 4–2: Simplified Block Diagram



The XMI Corner is located on the MS62A and contains interface logic.

The memory gate array transfers data between the XMI Corner and the DRAMs. The gate array also controls address multiplexing, command decoding, arbitration, and CSR logic functions.

Address and control logic modifies address bits received from the XMI Corner. These modified address bits are used to control the selection of the DRAMs during reading and writing.

Memory is arranged in four banks of DRAMs. Each bank contains 72 DRAMs for a total of 288 DRAMs on each memory module.

The data in the cold start PROM is used to initialize the gate array. After a power-up or system reset, the data in the cold start PROM is loaded into the gate array.

4.5 MS62A Interleaving

Interleaving optimizes memory access time and increases the effective memory transfer rate by operating memory modules in parallel.

Table 4–3: Interleaving

		Interleave Address Bits[1]		
Interleave	Array	<7>	<6>	<5>
1-Way	A1	-	-	-
2-Way	A1	-	-	0
	A2	-	-	1
4-Way	A1	-	0	0
	A2	-	0	1
	A3	-	1	0
	A4	-	1	1
8-Way	A1	0	0	0
	A2	0	0	1
	A3	0	1	0
	A4	0	1	1
	A5	1	0	0
	A6	1	0	1
	A7	1	1	0
	A8	1	1	1

[1]Bits <7>, <6>, and <5> in the Starting and Ending Address Register (SEADR) define which array is interleaved. Bits <29:8> and <4:0> are not used in interleaving.

Memory supports 1-, 2-, 4-, 8-way or no interleaving. Up to eight memory modules of the same size can be interleaved. Interleaving is done on hexword boundaries. Interleaving addresses are set in the Starting and Ending Address Register by the console program.

NOTE: *Memory modules that fail self-test due to multiple bit errors are not included in the interleave set.*

Unless the system requires a specific, dedicated memory use, you should run the default interleave rather than setting interleaving manually. In default, the console program chooses the optimal configuration for the system. Manual interleaving requires more operator attention.

4.6 Interleaving Examples

Figures 4-3 through 4-5 show how memory is set up for each mode of interleaving.

Figure 4–3: 2-Way Interleaving

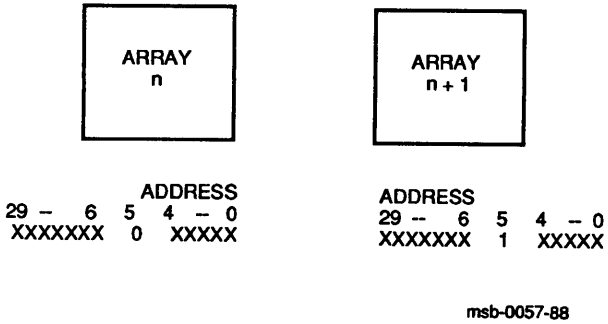


Figure 4–4: 4-Way Interleaving

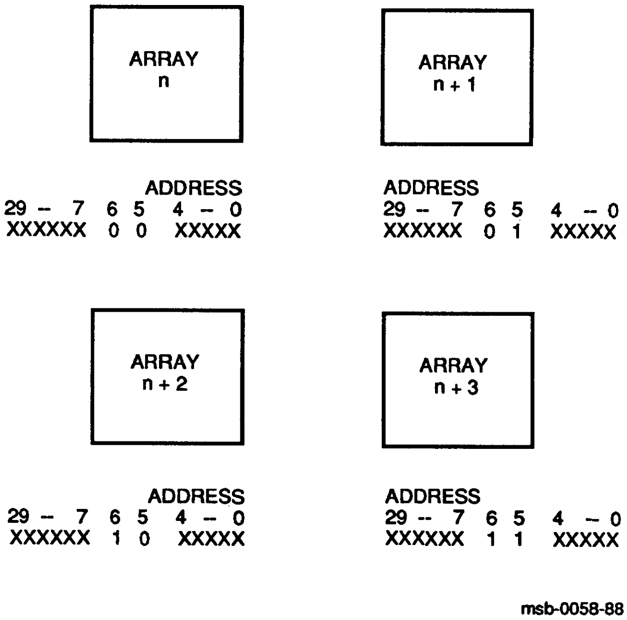
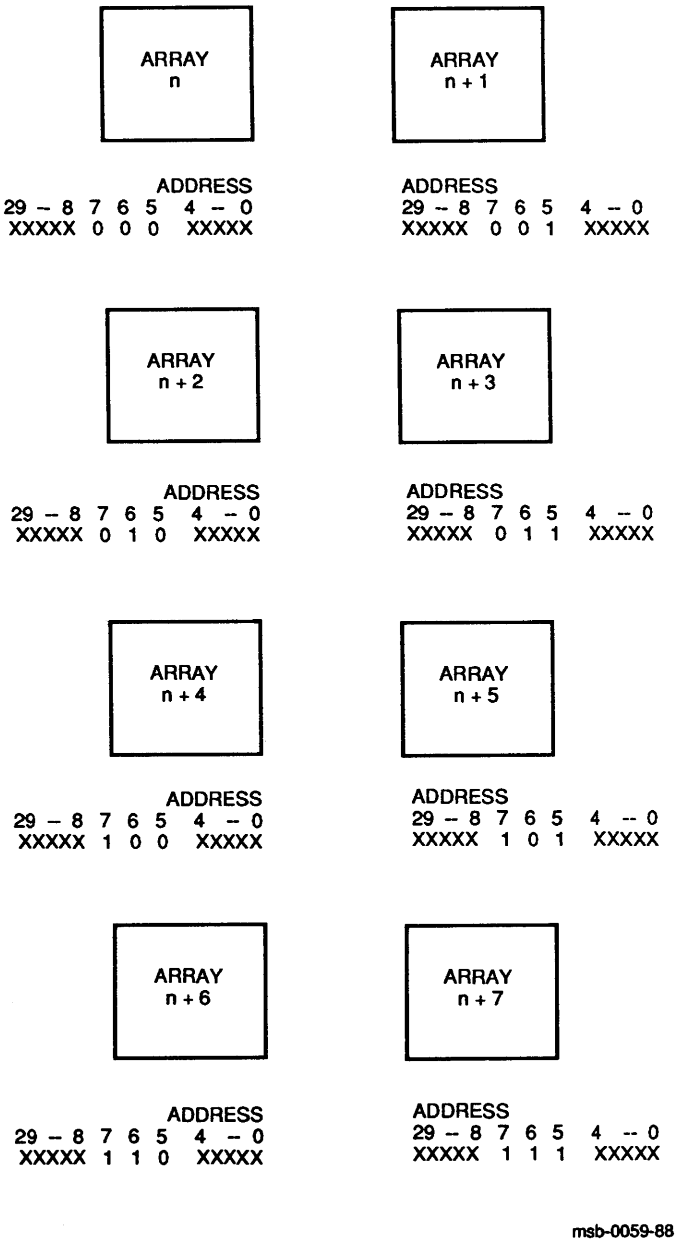


Figure 4–5: 8-Way Interleaving



4.7 Console Commands for Interleaving

The SET MEMORY and SHOW MEMORY commands are useful for setting the interleave to a memory configuration other than the default interleave. This is not usually advisable, but occasional customer use will warrant overriding the original console setting of the interleave. The INITIALIZE command causes the VAX 6200 system to execute MS62A self-tests.

Example 4-1: SET MEMORY and INITIALIZE Commands

```
1 >>> SET MEMORY  /INTERLEAVE:DEFAULT
                          ! For a system with four 32-Mbyte memory
                          ! modules, it creates a 4-way interleave
                          ! of the 32-Mbyte modules. Memory modules
                          ! located at XMI nodes 7, 8, 9, and A.

2 >>> SHOW MEMORY         ! Displays the memory lines from the
                          ! system self-test.

F  E  D  C  B  A   9   8   7   6  5  4  3  2  1  0   NODE #
   .  .  .  .  A4  A3  A2  A1  .  .  .  .  .  .      ILV
   .  .  .  .  32  32  32  32  .  .  .  .  .  .      128Mb

   /INTERLEAVE:DEFAULT

3 >>> SET MEMORY  /INTERLEAVE:(7+8, 9+A)
                          ! Explicitly specifies what is created
                          ! as requested by the user (two 2-way
                          ! interleave sets with modules in nodes
                          ! 7 and 8; 9 and A).

4 >>> SHOW MEMORY       ! Displays the memory lines from the
                          ! system self-test.

F  E  D  C  B  A   9   8   7   6  5  4  3  2  1  0   NODE #
   .  .  .  .  B2  B1  A2  A1  .  .  .  .  .  .      ILV
   .  .  .  .  32  32  32  32  .  .  .  .  .  .      128Mb

   /INTERLEAVE:(7+8, 9+A)

5 >>> INITIALIZE A        ! Initializes node A on the XMI; prompt
                          ! returns following self-test printout.
```

The callouts in Example 4-1 are explained below.

1. Shows the SET MEMORY command that configures interleaving with the console program. This command invokes the default interleaving configuration. If you set a memory configuration and want to revert to the default, use this command.

2. The SHOW MEMORY command displays the node number (node #), interleave (ILV), and total usable memory (xxMb) lines from the self-test results.

3. Shows the SET MEMORY command that creates a 4-way interleave as requested by the user. In this example the user explicitly specified how to interleave the memory modules. Each interleaving set must contain the node number of the memory module. If there is more than one memory module in a set, they are joined by a + sign. Each set of interleaved memory modules must be separated by a comma.

4. The SHOW MEMORY command displays the configuration set in 3.

5. The specified node is initialized, self-test is run, and the >>> prompt returns. To initialize memory, you must know which slots the MS62A modules are located in. If an empty slot is initialized, the following error message is received:

   ```
   ?42 Unable to initialize node.
   ```

   This means that the INITIALIZE command failed to reset the node. Section 4.8 describes the memory self-test and shows test results.

NOTE: *Refer to Chapter 5 of the VAX 6200 Owner's Manual for detailed information on the SET MEMORY and SHOW MEMORY commands.*

When an MS62A module is initialized, it executes a self-test that clears all memory array locations (loads these locations with zeros).

The SET MEMORY command does not change memory interleaving; it just modifies the memory configuration in the EEPROM. The memory configuration specified by the SET MEMORY command takes place when the system is initialized (by a power-up or INITIALIZE command).

4.8 Memory Self-Test

The MS62A performs an initialization and self-test sequence on power-up or when the sequence is requested by a console command. During self-test the array chip is initialized, all memory locations are tested, and the control and status registers are initialized.

Example 4–2: MS62A Memory Module Results in Self-Test

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	NODE #
	A	A	.	.	M	M	M	M	.	.	P	P	P	P		TYP ❶
	o	o	.	.	–	+	+	+	.	.	+	+	+	+		STF ❷
	.	.	.	.	.	.	.	.	.	.	E	D	E	B		BPD
	.	.	.	.	.	.	.	.	.	.	+	+	+	+		ETF
	.	.	.	.	.	.	.	.	.	.	E	D	E	B		BPD
.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	XBI D +
.	.	.	.	.	.	.	.	.	+	+	+	.	+	+	.	XBI E +
	.	.	.	.	C1	B1	A2	A1	.	.	.	.	.	.		ILV ❸
	.	.	.	.	32	32	32	32	.	.	.	.	.	.		128Mb ❹

ROM = 3.0 EEPROM = 2.0/3.0 SN = SG01234567

The callouts in Example 4-2 are explained below.

❶ The **TYP** line shows that memory modules are installed in XMI slots 7 through A as indicated by the M in this row.

❷ The **STF** line shows if memory modules pass self-test, as indicated by the + in this row. If a module fails self-test, a— is indicated, but the console still tests all pages within the module. The failing module is included in the configuration, and the addresses that fail self-test are not used by the system.

❸ The **ILV** line indicates that two memory array modules are 2-way interleaved and the other two modules are interleaved by themselves. That is, memory modules in slots 7 and 8 are two-way interleaved into one interleave set (indicated by all modules beginning with the letter A). Since the memory module in slot A did not pass self-test, it is interleaved by itself (it begins with the letter C). The memory module in slot 9 is interleaved by itself (it begins with the letter B) since it is left alone and cannot be interleaved with A1, A2, or the failing module.

❹ This VAX 6200 system contains a total usable memory of 128 Mbytes (four 32-Mbyte memory modules).

If all MS62A nodes pass self-test, the CPU/Memory test is performed on the MS62A by the CPU. The console executes a simple read/write test to a small portion of memory. Since there are no errors from the self-test, the memory bitmap is set with all pages as good.

4.9 Memory Self-Test Errors

If an MS62A node fails self-test, an explicit memory test is run on the failing module and console error messages are displayed. The failing module is still included in the memory configuration.

Example 4-3: MS62A Memory Module Node Exclusion

```
>>>  SET MEMORY  /INTERLEAVE:(7+8, 9)
>>>  INITIALIZE
>>>  SHOW MEMORY

F   E   D   C   B   A   9   8   7   6   5   4   3   2   1   0   NODE #
    .   .   .   .   -   B1  A2  A1  .   .   .   .   .   .       ILV
    .   .   .   .   .   32  32  32  .   .   .   .   .   .       96Mb

    /INTERLEAVE:(7+8, 9)
```

If an MS62A node fails self-test, then the console executes an explicit memory test during the building of the bitmap. Failing memory modules are included in the configuration, although they are interleaved by themselves. The only way to exclude a memory module from interleaving is to use the SET MEMORY command without designating the node you want to exclude. Example 4-3 shows how to exclude the memory module at node A.

During the explicit memory test, any number of the following console messages might be displayed to aid the field service engineer in diagnosing the problem.

```
?37  Explicit interleave list is bad. Configuring
     all arrays uninterleaved.
```

This means that the explicit set of memory arrays for the explicit interleave includes no nodes that contain memory array. All memory arrays found in the system are unconfigured (the SET MEMORY command may have specified nodes that did not contain memory modules).

```
?45  Memory interleave set is inconsistent: n n ...
```

This means that the listed nodes *(n n)* do not form a valid memory interleave set. One or more of the nodes might not be a memory array or the set contains an invalid number of memory arrays. Each listed memory array that is valid will be configured uninterleaved; any memory array that is not included in the set will not be interleaved.

```
?46  Insufficent working memory for normal operation.
```

This means that less than 256-Kbytes per processor of working memory were found. There may be insufficient memory for the console to function or for the operating system to boot.

```
?47  Uncorrectable memory errors -- long memory test
     must be performed.
```

This means that a memory array contains an unrecoverable error. The console must perform a slow test to locate all the failing locations.

```
?48  Memory not interleaved due to uncorrectable errors.
```

This means that the listed arrays would normally have been interleaved (by default or an explicit request). Because one or more arrays contained unrecoverable errors, this interleave set will not be constructed.

NOTE: *Refer to Appendix B, Console Error Messages, and Section 6.6 in the VAX 6200 Owner's Manual for more information on these errors.*

When all testing is completed, the yellow LED (located at the center of the module's edge farthest from the XMI backplane) lights, indicating that the module has passed self-test. After self-test, starting and ending addresses are set by the boot processor.

4.10 MS62A Memory RBDs

RBD test 3 of the ROM-based diagnostics sizes memory, runs extended memory tests, and shows which test (if any) fail.

Table 4–4: Memory Test — RBD Test 3

Test	Function	Approximate Run Time[1]
T0001[4]	Memory Self-test	12 sec[2]
T0002[3]	CSR Addressability test	3 sec
T0003[3]	CSR Bit Toggling test	3 sec
T0004[3]	Parity Error Detection test	3 sec
T0005[3]	Error Detection and Correction Logic test	3 sec
T0006[3]	Data Path test	3 sec
T0007[3]	Quadword and Octaword Masked Write Logic test	3 sec
T0008[3]	Interlock Lock Logic test	3 sec
T0009[4]	Interleaving and Address Boundary test	22 sec
T0010[4]	ECC RAM March test	7 min
T0011[4]	RAM March test	15 min
T0012[4]	RAM Moving Inversions test	4 hrs

[1]Run times are approximate for one 32-Mbyte module.

[2]If self-test fails, there is a 60 sec timeout.

[3]Tests T0002 through T0008 are run by default.

[4]The /C qualifier is required for these tests.

Tests T0002 through T0008 are run by default. Tests T0010 through T0012 have to be selected by the user. Tests are performed on all MS62As unless the user chooses to test a single MS62A. Parameters specified in the command line (refer to Table 4-5) allow one or all memory modules to be tested. These parameters also allow RBD tests to be run from main memory or ROM for RBD tests T0011 and T0012. The /C (confirm destructive memory test) switch is required with RBD tests T0001, T0009, T0010, T0011 and T0012.

Table 4-5: RBD Test 3 Parameters

Hex[1]	Function
0n	Run tests 11 and 12 from main memory and test all memory modules
1n	Run tests 11 and 12 from main memory and test memory module n only
2n	Run tests 11 and 12 from ROM and test all memory modules
3n	Run tests 11 and 12 from ROM and test memory module n only

[1]where n is the memory module backplane slot (n must be A, 9, 8, 7, 6, 5, B, or C) that has to be specified in hex parameters 1n and 3n.

The CPU/memory test also runs tests that exercise memory. See Chapter 3 for information on this CPU/memory test. See Chapter 2 for more information on running the RBDs.

4.11 Memory RBD Test Examples

RBD memory tests are run with a number of user-selectable switches as shown in Example 4-4 through Example 4-7. Refer to Section 2.3 for more details on how to run RBDs.

Example 4-4: RBD Test on All Modules with Halt on Error

```
>>>                            ! Console program prompt

>>> T/R                        ! Command to enter RBD monitor program

RBD3>                          ! RBD monitor prompt, where 3 is the hexa-
                               ! decimal node number of the processor
                               ! that is currently receiving your input

RBD3> START 3 /TRACE /HE       ! Runs the default MS62A RBD
                               ! test; test results written to the
                               ! console terminal; tests will halt on
                               ! any error found (/HE)

;XMARBD        3.00

; T0002  T0003  T0004  T0005  T0006  T0007  T0008

;       P        3     8001        1
;00000000 00000000 00000000 00000000 00000000 00000000 00000000
```

Example 4-5: RBD Test on Module in Slot A

```
RBD3> START 3 /TRACE 1A        ! Runs the MS62A RBD test
                               ! on memory module in slot A only;
                               ! test results written to the console
                               ! terminal

;XMARBD        3.00

; T0002  T0003  T0004  T0005  T0006  T0007  T0008

;       P        3     8001        1
;00000000 00000000 00000000 00000000 00000000 00000000 00000000
```

Example 4-6: RBD Test with Module Error

```
RBD3> START 3 /TRACE           ! Runs the default MS62A RBD test;
                               ! test results written to the console
                               ! terminal; a hard error is found
                               ! in the memory module in slot 8

;XMARBD        3.00

; T0002  T0003  T0004  T0005  T0006  T0007  T0008

;      F        3      8001        1
;     HE ERRLOGIC       08     T0005
;     00 00000000 00000000 00000000 00000000 20073E32  16

;      F        3      8001        1
;00000000 00000001 00000000 00000000 00000000 00000000 00000000
```

Example 4-7: RBD Test with Confirm Switch

```
RBD3> START 3 /TRACE 3A/ TEST=5:12/ C
                               ! Runs RBD tests T0005 through T0012 on
                               ! memory module in slot A. Confirm
                               ! destructive memory test switch (/C)
                               ! is required on tests T0009 and T0012..
                               ! Tests 0011 and 0012 are run out of ROM.
;XMARBD        3.00

; T0005  T0006  T0007  T0008  T0009  T0010  T0011

;  S            1      8001        1      ! Test status prints out every
; XX          RAM        XX    T0011      ! 60 sec until tests are completed;
                                          ! /DS disables test status printout.
; T0012
;  S            1      8001        1
; XX          RAM        XX    T0012

;      P        3      8001        1
;00000000 00000000 00000000 00000000 00000000 00000000 00000000

RBD3>  QUIT                    ! Exit from RBD monitor program

>>>                            ! Console prompt returns
```

4.12 MS62A Control and Status Registers

The memory contains 24 control and status registers (CSRs) to control the memory and log errors. All CSRs are 32 bits long and respond only to longword read and write transactions. Only full writes are performed to the CSRs. If a parity error occurs during a write operation, the operation is aborted and the contents of the CSRs are unchanged.

The CSRs start at an address dependent upon the node ID. All CSR addresses are designated as BB + *n*, where *n* is the relative offset of the register.

Table 4–6: MS62A Memory Control and Status Registers

CSR Name	Mnemonic	Address
Device Register	XDEV	BB[1] + 00
Bus Error Register	XBER	BB + 04
Starting and Ending Address Register	SEADR	BB + 10
Memory Control Register 1	MCTL1	BB + 14
Memory ECC Error Register	MECER	BB + 18
Memory ECC Error Address Register	MECEA	BB + 1C
Memory Control Register 2	MCTL2	BB + 30
TCY Register	TCY	BB + 34
Interlock Flag Status Registers[2]	IFLG*n*	BB + *n*

[1]"BB" refers to the base address of an XMI node (2180 0000 + (node ID x 8000)).

[2]Refer to Table 4-7 for the relative address of the Interlock Flag Status Registers.

Table 4-7: Interlock Flag Registers

Interlock Flag Register	Mnemonic	Address
Interlock Flag 0 Status Register	IFLG 0	BB + 20
Interlock Flag 1 Status Register	IFLG 1	BB + 24
Interlock Flag 2 Status Register	IFLG 2	BB + 28
Interlock Flag 3 Status Register	IFLG 3	BB + 2C
Interlock Flag 4 Status Register	IFLG 4	BB + 40
Interlock Flag 5 Status Register	IFLG 5	BB + 44
Interlock Flag 6 Status Register	IFLG 6	BB + 48
Interlock Flag 7 Status Register	IFLG 7	BB + 4C
Interlock Flag 8 Status Register	IFLG 8	BB + 80
Interlock Flag 9 Status Register	IFLG 9	BB + 84
Interlock Flag 10 Status Register	IFLG10	BB + 88
Interlock Flag 11 Status Register	IFLG11	BB + 8C
Interlock Flag 12 Status Register	IFLG12	BB + 100
Interlock Flag 13 Status Register	IFLG13	BB + 104
Interlock Flag 14 Status Register	IFLG14	BB + 108
Interlock Flag 15 Status Register	IFLG15	BB + 10C

4.13 MS62A Memory Installation

Use the following procedure when removing or installing a memory module.

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the circuit breaker on the AC power controller to the Off position.
4. Open the front cabinet door.
5. Put on the ground strap.
6. Remove the clear plastic door in front of the XMI cage.

   CAUTION: *You must wear an antistatic wrist strap attached to the cabinet when you handle any modules.*

7. Lift up the lever and remove the memory module from its slot.
8. Install the memory module in empty slots A through C (memory modules should be installed adjacent to each other).
9. Close the lever after you have inserted a new memory module.
10. Replace the clear door.
11. Take off the ground strap.
12. Turn on system power and check that all nodes pass self-test.
13. Complete the installation by running appropriate self-test diagnostics (refer to Section 4.8) and RBDs (refer to Section 4.10).

   NOTE: *See Chapter 7 of the VAX 6200 Installation Guide for complete acceptance instructions.*

Chapter 5

DWMBA XMI-to-VAXBI Adapter

This chapter discusses the DWMBA modules. Sections include:

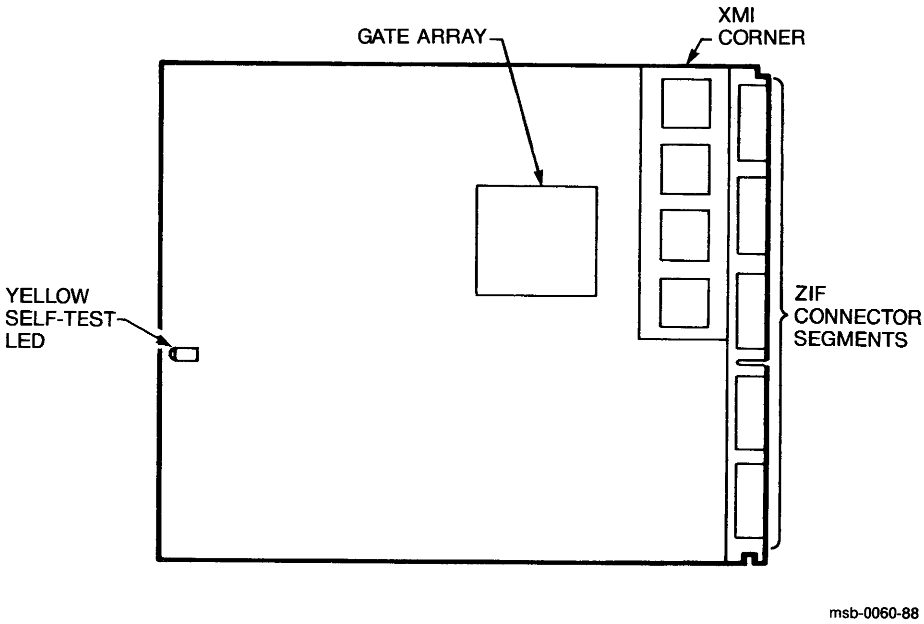
- Physical Description
    - Physical Layout
    - Specifications
- Functional Description
- Configuration Rules
- DWMBA ROM-Based Diagnostics Tests
- DWMBA Registers

5.1 DWMBA Physical Description

5.1.1 Physical Layout

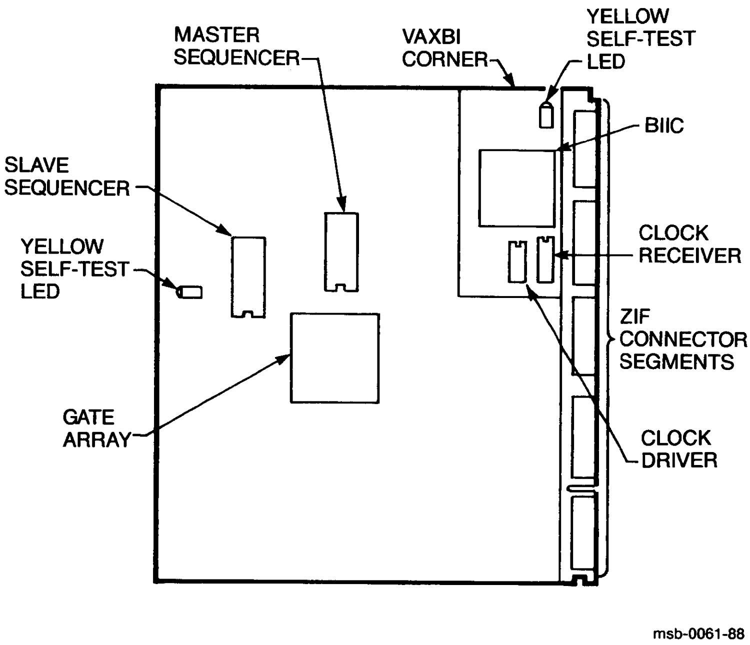
The DWMBA/A is an XMI module with the standard XMI Corner, an XMI self-test OK LED indicator, IBUS drivers/receivers and transceivers, timeout logic, and a gate array which acts as the "brains" of the DWMBA/A. Most of the components on the DWMBA/A are surface-mounted.

Figure 5-1: DWMBA/A XMI Module



The DWMBA/B is a standard VAXBI module with a VAXBI Corner, including a BIIC interface chip, the primary interface between the VAXBI bus and the DWMBA/B node logic, a clock driver, and a clock receiver. The DWMBA/B gate array is used mostly for data path logic. The VAXBI self-test OK LED is on the VAXBI Corner, and the module self-test OK LED is at the module edge opposite the connector edge.

Figure 5–2: DWMBA/B VAXBI Module



5.1.2 DWMBA Specifications

The following specifications apply to the DWMBA modules.

Table 5-1: DWMBA/A XMI Module Specifications

Parameter	Description
Module Number:	T2012
Dimensions:	23.3 cm (9.2") H x 28.0 cm (11.0") D x 0.23 cm (0.093") thick
Temperature:	
Storage Range	-40°C to 66°C (-40°F to 151°F)
Operating Range	5°C to 50°C (41°F to 122°F)
Relative Humidity:	
Storage and operating	10 to 95% noncondensing
Altitude:	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)
Current:	3A at +5V
	200mA at +5VBB
Power:	16W

Table 5–2: DWMBA/B VAXBI Module Specifications

Parameter	Description
Module Number:	T1043
Dimensions:	20.3 cm (8″) H x 23.3 cm (9.2″) D x 0.23 cm (0.093″) thick
Temperature:	
Storage Range	-40°C to 66°C (-40°F to 151°F)
Operating Range	5°C to 50°C (41°F to 122°F)
Relative Humidity:	
Storage and operating	10 to 95% noncondensing
Altitude:	
Storage	Up to 4.8 km (16,000 ft)
Operating	Up to 2.4 km (8000 ft)
Current:	6A at +5V
	10mA at -12V
Power:	30W

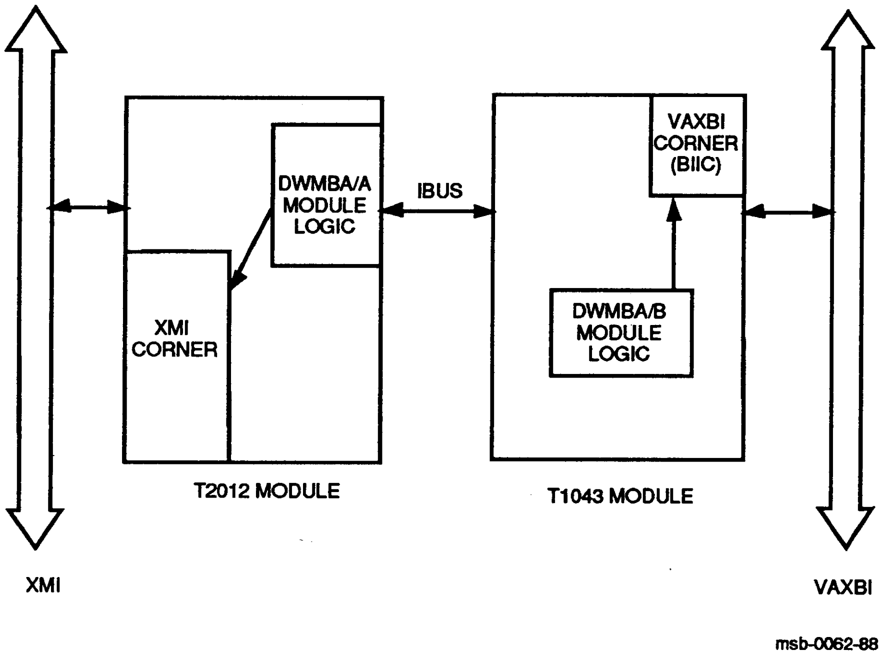
Table 5–3: DWMBA Cables

Part Number	Description
17-00849-08	18″ DWMBA/B to DWMBA/B AC/DC OK cable, from VAXBI cage 2 slot 1 (segment C2) to VAXBI cage 1 slot 1 (segment C1).
17-01897-01	15′ DWMBA cables for expander cabinet, from XMI slots C, B, 1, and 2 as needed (segments D and E) to VAXBI cages 3, 4, 5, and 6 slot 1 (segments D and E). Two per DWMBA.
17-01897-02	7″ DWMBA cables, from XMI slot E (segments D and E) to VAXBI cage 2 slot 1 (segments D and E). Two per DWMBA.
17-01897-03	25″ DWMBA cables, from XMI slot D (segments D and E) to VAXBI cage 1 slot 1 (segments D and E). Two per DWMBA.

5.2 DWMBA Functional Description

The DWMBA adapter provides an information path between the XMI bus and I/O devices on the VAXBI bus. The DWMBA consists of two modules: the DWMBA/A and the DWMBA/B. The DWMBA/A resides on the XMI bus, and the DWMBA/B resides on the VAXBI bus. Four 30-pin cables, which make up the IBUS, connect the two modules.

Figure 5–3: DWMBA XMI-to-VAXBI Adapter Block Diagram



The DWMBA/A contains the XMI Corner, the register files, XMI required registers, DWMBA-specific registers, and the control sequencers for the XMI interface.

The DWMBA/B contains the BIIC interface chip, interconnect drivers, control sequencers to handle the control of the data transfer, status bits to/from the DWMBA/A's register files and the BIIC, DWMBA/B specific registers, decode logic for direct memory access (DMA) operation, and VAXBI clock-generation circuitry.

The DWMBA/A and DWMBA/B are connected by four cables of 30 wires each. These 120 wires make up the IBUS, which transfers data and control information between the two modules.

The DWMBA uses processor and DMA transactions to exchange information. CPU transactions originate from the KA62A(s) and are presented to the DWMBA from the XMI bus with the processor as the XMI commander and the DWMBA as the XMI responder.

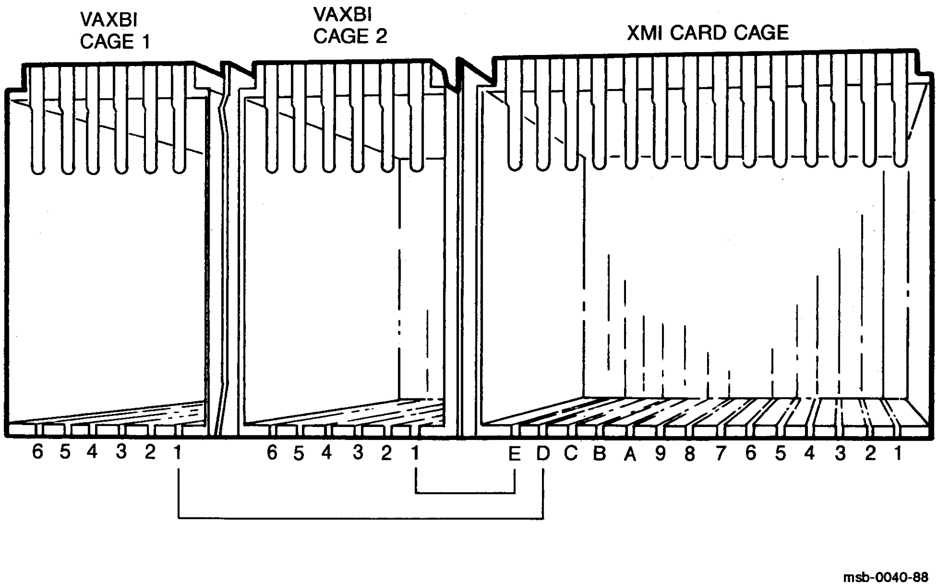
DMA transactions originate from VAXBI nodes that select the DWMBA as the VAXBI slave. These are read or write transactions targeted to XMI memory space or are VAXBI-generated interrupt transactions that target a KA62A. For DMA transactions, the DWMBA is the XMI commander, and the MS62A is the XMI responder.

The VAX 6200 system uses a 30-bit physical address. The DWMBA can be both a master and a slave on the VAXBI. As a master, it carries out transactions requested by its XMI devices. As a slave, it responds to VAXBI transactions that select its node.

5.3 DWMBA Configuration Rules

This section describes the configuration rules for the DWMBA/A modules in the XMI card cage and for the DWMBA/B modules in the system's two 6-slot VAXBI card cages.

Figure 5-4: VAX 6200 Slot Numbers



DWMBA/As are placed in the order shown in the table below:

Table 5–4: DWMBA Configuration

XMI Node No.	VAXBI Cage No.
D	1
E	2
C	3
B	4
1	5
2	6

Configuration rules are as follows:

- The DWMBA/B which corresponds to the DWMBA/A in XMI slot D is placed in VAXBI cage 1, slot 1. The DWMBA/B which corresponds to the DWMBA/A in XMI slot E is placed in VAXBI cage 2, slot 1.
- All additional DWMBA/Bs are placed in slot 1 (rightmost slot) of each card cage in the VAXBI expander cabinets, as shown in Table 5–4.

5.4 DWMBA ROM-Based Diagnostics Tests

Test 2 of the ROM-based diagnostics tests checks functions of both modules. The RBD runs the DWMBA power-up tests and can trace the subtests, pinpointing errors.

The DWMBA has no on-board self-test. The boot processor ROM code tests DWMBAs during additional power-up tests. The boot processor first sizes all DWMBAs and then serially tests each one. VAXBI ROM-based diagnostics can be invoked from the console program and from the RBD monitor.

Example 5–1: DWMBA XMI-to-VAXBI Adapter ROM-Based Diagnostics Tests

```
>>>                           ! Console program prompt

>>> T/R                       ! Command to enter RBD monitor program

RBD1>                         ! RBD monitor prompt, where 1 is the
                              ! hexadecimal node number of the
                              ! processor that is currently receiving
                              ! your input.

RBD1> START 2 /TRACE D        ! Runs the DWMBA RBD self-test, testing
                              ! the DWMBA at XMI node number 1. Test
                              ! results written to the console
                              ! terminal:

;XBI_SLF      3.0

; T0001  T0005  T0006  T0007  T0008  T0009  T0012  T0013  T0014  T0015
; T0016  T0017  T0018  T0019  T0020  T0021  T0022  T0023  T0024  T0025
; T0026

;        P         1       8001         1
;000000000  00000000  00000000  00000000  00000000  00000000  00000000

RBD1> QUIT

>>>
```

Table 5-5: DWMBA XMI-to-VAXBI Adapter RBD Tests

Test	Function	Default
T0001	DWMBA/A XMI Module CSR test	Yes
T0002	XMI Low Longword Parity Error test	No
T0003	XMI High Longword Parity Error test	No
T0004	XMI Function and ID Parity Error test	No
T0005	DWMBA/B CSR test	Yes
T0006	BIIC VAXBI Loopback Transaction test	Yes
T0007	BIIC VAXBI Transaction test	Yes
T0008	DMA test	Yes
T0009	DMA Buffer test	Yes
T0010	XMI Parity Error Interrupt test	No
T0011	Write Sequence Error Interrupt test	No
T0012	CPU Buffer C/A Fetch Parity Error (Interrupt) test	Yes
T0013	CPU Buffer Data Fetch Parity Error (Interrupt) test	Yes
T0014	DMA Buffer Data Fetch Parity Error (Interrupt) test	Yes
T0015	VAXBI Interlock Read Error (Interrupt) test	Yes
T0016	DMA-A Buffer C/A Load Parity Error (Interrupt) test	Yes
T0017	DMA-A Buffer Data Load Parity Error (IVINTR) test	Yes
T0018	DMA-B Buffer C/A Load Parity Error (Interrupt) test	Yes
T0019	DMA-B Buffer Data Load Parity Error (IVINTR) test	Yes
T0020	CPU Buffer Data Load Parity Error (Interrupt) test	Yes
T0021	BCI Parity Error test	Yes
T0022	Nonexistent Memory (Interrupt) test	Yes
T0023	CRD Error (Interrupt) test	Yes
T0024	VAXBI Interrupt test	Yes
T0025	VAXBI IP Interrupt test	Yes
T0026	No Stall Timeout Test	Yes

5.5 DWMBA Registers

Two sets of registers are used by the DWMBA adapter: VAXBI registers (residing in the BIIC) and DWMBA registers (residing on both modules of the DWMBA). The DWMBA registers include the XMI required registers and DWMBA-specific registers addressed in DWMBA private space.

Table 5-6: VAXBI Registers

Name	Mnemonic	Address[1]
Device Register	DTYPE	bb+00
VAXBI Control and Status Register	VAXBICSR	bb+04
Bus Error Register	BER	bb+08
Error Interrupt Control Register	EINTRSCR	bb+0C
Interrupt Destination Register	INTRDES	bb+10
IPINTR Mask Register	IPINTRMSK	bb+14
Force-Bit IPINTR/STOP Destination Register	FIPSDES	bb+18
IPINTR Source Register	IPINTRSRC	bb+1C
Ending Address Register	EADR	bb+24
BCI Control and Status Register	BCICSR	bb+28
Write Status Register	WSTAT	bb+2C
Force-Bit IPINTR/STOP Command Register	FIPSCMD	bb+30
User Interface Interrupt Control Register	UINTRCSR	bb+40
General Purpose Register 0	GPR0	bb+F0
General Purpose Register 1	GPR1	bb+F4
General Purpose Register 2	GPR2	bb+F8
General Purpose Register 3	GPR3	bb+FC
Slave-Only Status Register	SOSR	bb+100
Receive Console Data Register	RXCD	bb+200

[1]The abbreviation "bb" refers to the base address of a VAXBI node (the address of the first location of nodespace).

Table 5-6 lists the VAXBI registers. The VAXBI registers are described in Chapter 5 of the *VAXBI Options Handbook*. Table 5-7 lists the DWMBA registers.

Table 5-7: DWMBA XMI Registers

Name	Mnemonic[1]	Address[2]
Device Register	XDEV	BB+00
Bus Error Register	XBER	BB+04
Failing Address Register	XFADR	BB+08
Responder Error Address Register	AREAR	BB+0C
Error Summary Register	AESR	BB+10
Interrupt Mask Register	AIMR	BB+14
Implied Vector Destination/Diagnostic Register	AIVINTR	BB+18
Diag 1 Register	ADG1	BB+1C
Control/Status Register	BCSR	BB+40
Error Summary Register	BESR	BB+44
Interrupt Destination Register	BIDR	BB+48
Timeout Address Register	BTIM	BB+4C
Vector Offset Register	BVOR	BB+50
Vector Register	BVR	BB+54
Diagnostic Control Register 1	BDCR1	BB+58
Reserved Register	—	BB+5C

[1]If the first letter of the mnemonic is "X" or "A," it indicates that the register resides on the DWMBA/A; a first letter of "B" indicates that the register resides on the DWMBA/B.

[2]The abbreviation "BB" refers to the base address of an XMI node (the address of the first location of nodespace).

Chapter 6
XMI Card Cage

This chapter describes the XMI card cage. Removal and replacement procedures are detailed, and configuration restrictions are listed. Sections include:

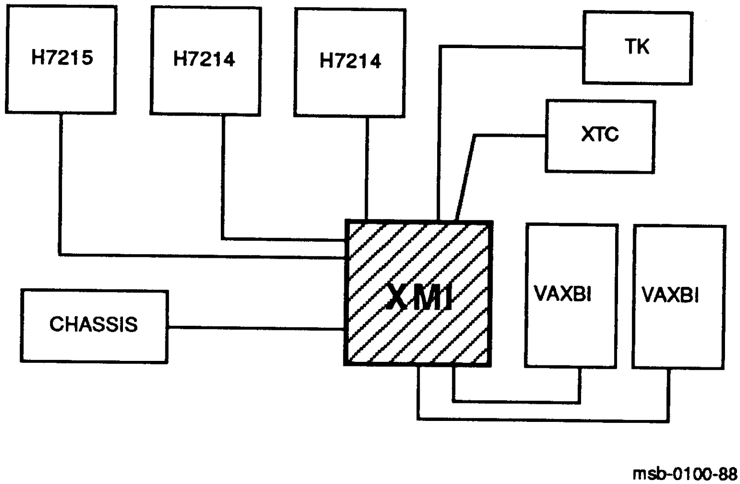
- Description
  - System Use
  - Specifications
- XMI Card Cage Removal
- Switching XMI Card Cages
- XMI Card Cage Replacement
- Installing Modules in the XMI Card Cage
- XMI Troubleshooting

6.1 XMI Card Cage Description

6.1.1 System Use

The XMI card cage provides the high-speed system bus. Figure 6-1 is a simplified block diagram showing physical connections between the XMI card cage and other components in the cabinet.

Figure 6-1: XMI Card Cage Connections



The XMI card cage is a 14-slot cage with zero insertion force (ZIF) connectors. The cage is 3 inches deeper than a VAXBI cage, providing for larger XMI modules. The backplane area extends over three of the five connector segments, which leaves two segments for I/O pins. Mounted in the center rear of the XMI backplane is a daughter card that holds the central arbiter chip. Four slots in the center of the cage have no I/O connectors, so only processor or memory modules may be placed in these slots.

For each VAXBI bus, there must be an XMI-to-VAXBI adapter. This adapter (DWMBA) consists of two modules: a DWMBA/A module in the XMI card cage and a DWMBA/B module in the VAXBI card cage.

6.1.2 XMI Card Cage Specifications

The XMI card cage (see Figure 6–2) is a 14-slot cage. The XMI card cage is located in the upper part of the cabinet, on the right side as you view the system from the front. The field-replaceable unit (70-24373-01) does not include the power bus bar assembly, the two side mounting plates, the daughter card, and three foam air seals.

Figure 6–2: XMI Card Cage

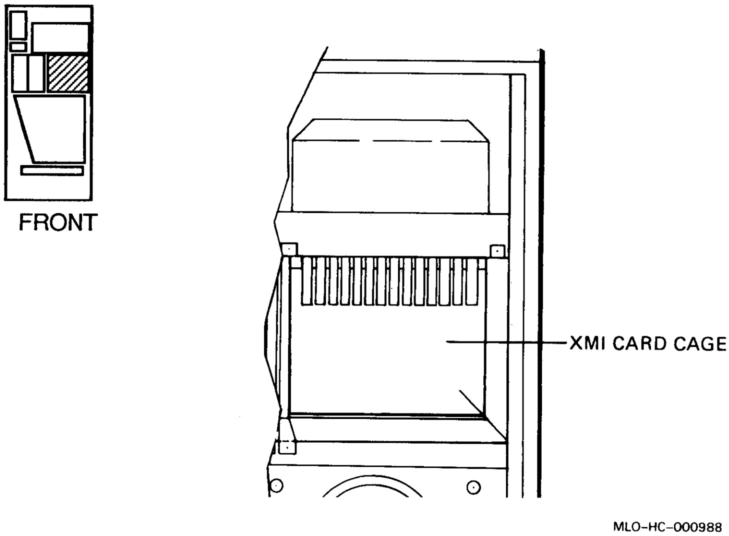


Table 6–1: XMI Card Cage Assembly Specifications

Parameter	Description
Part Number:	70-24373-01, 14-slot cage with no daughter card or bus bars
Location:	Upper right front
Dimensions:	12″ H x 10 1/2″ W x 12 1/4″ L
Weight:	29 lbs
Power:	One H7215 DC regulator and two H7214 DC regulators
Service From:	Front and rear of cabinet

Table 6–2: XMI Card Cage Cables

Item	Part Number	Description
Cables:	17-01525-01	XMI to both H7214s
	17-01566-01	XMI to J3 of H7215
	17-01568-02	XMI to J4 of XTC, 20-pin ribbon
	17-01662-01	XMI ground strap
	17-01812-01	XMI to filter board in system control assembly to power the TK unit
	17-01833-01	Fail safe enable cable, XMI to H7231 battery backup unit and H405
	17-01897-01	15′ DWMBA cables for expander cabinet, from XMI slots C, B, 1, and 2 as needed (segments D and E) to VAXBI cages 3, 4, 5, and 6 slot 1 (segments D and E). Two per DWMBA.
	17-01897-02	7″ DWMBA cables, from XMI slot E (segments D and E) to VAXBI cage 2 slot 1 (segments D and E). Two per DWMBA.
	17-01897-03	25″ DWMBA cables, from XMI slot D (segments D and E) to VAXBI cage 1 slot 1 (segments D and E). Two per DWMBA.
Tools Required:		
VAXBI Tool Kit	A2-M1094-10	Includes a torque screwdriver
	—	Large Phillips and flat screwdrivers
	—	Small Phillips screw-holding screwdriver or one with magnetic tip
	—	11/32″ nutdriver
Subassemblies:		
Daughter Card	54-18172-01	Small module that mounts on XMI backplane
Bus Bar Assembly	12-27676-01 12-27938-01 12-27939-01	+5V/+5VBB/Ground -5.2V XMI bus bars -2V XMI bus bars
Foam Air Seals	74-34536-01 74-34536-03 74-36670-02	Three pieces of foam used for air seals

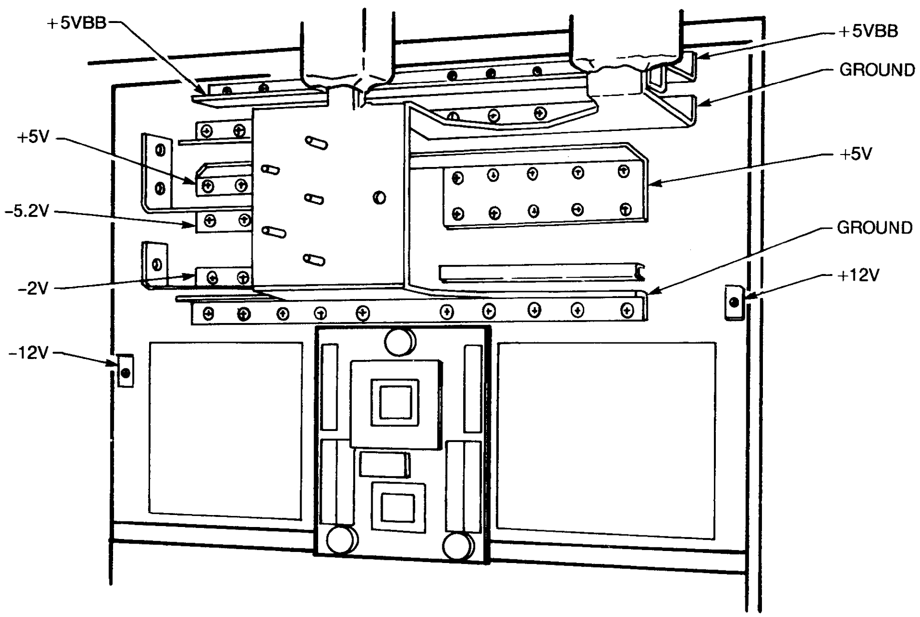
6.2 XMI Card Cage Removal

The XMI card cage is removed from the front of the cabinet after you disconnect connections at the backplane.

6.2.1 Prepare for Removal

Prepare the system for shutdown. Set up a work space nearby where you can store the modules and work on the XMI card cage. Label and disconnect the signal and power connections.

Figure 6–3: XMI Backplane Power Connections



1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the circuit breaker on the AC power controller to the Off position.
4. Unplug the machine.
5. Open the rear cabinet door.
6. Drop the I/O bulkhead tray to expose the card cages.

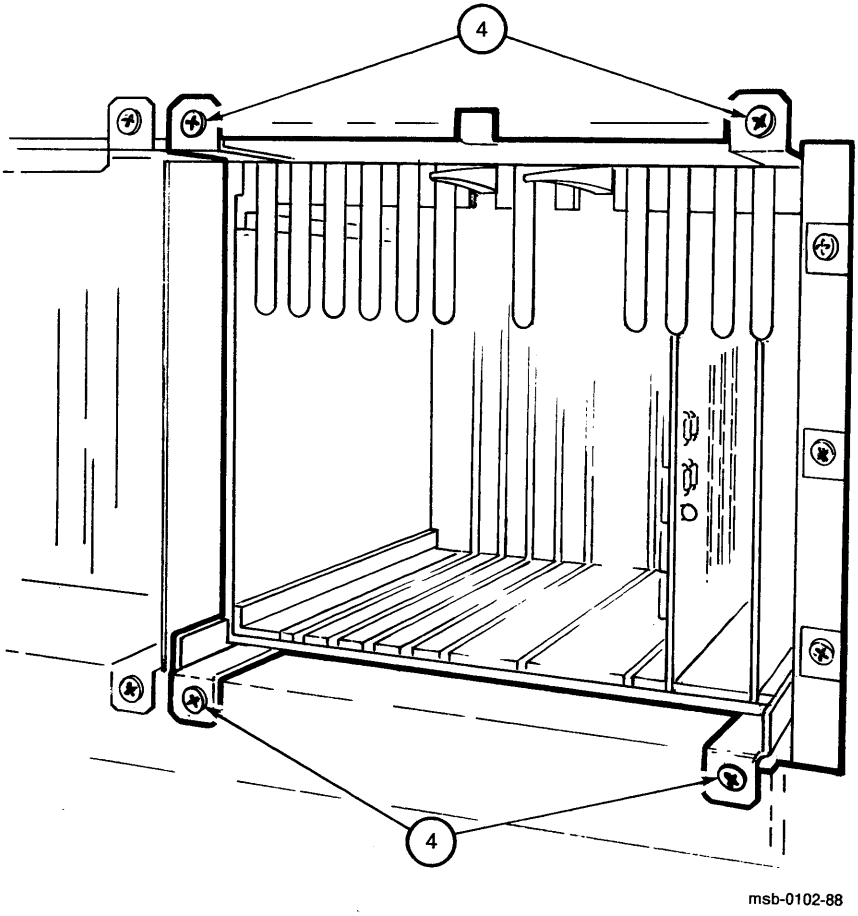
   CAUTION: *You must wear an antistatic wrist strap attached to the cabinet when you handle any modules.*

7. Disconnect all signal cables taking care to note their locations.
   a. Cable to the XTC power sequencer (17-01568-02)
   b. Cables between DWMBA modules (17-01897-02 and -03) from XMI to VAXBI
8. Disconnect only these power connections (see Figure 6–3).
   a. Four wires on the bus bars that go to the TK unit (17-01812-01)
      1. +5V
      2. +12V
      3. Two ground connections. Use 11/32 inch nutdriver.
   b. Fail safe enable cable (17-01833-01)
      1. Connection to +5VBB
      2. Connection to Ground
   c. Cable to the H7215 power regulator (17-01566-01)
      (Remove connector from the regulator.)
   d. Harnesses to the two H7214 power regulators
      (On each regulator, remove the four screws from the leads.)
   e. Lines to the two H7214 regulators (17-01525-01)
      (Remove connector from the regulator.)
   f. Ground strap to the chassis (17-01662-01)
      Remove the screw from the bus bar with a large Phillips screwdriver, and with your free hand catch the nut in back of the bus bar. (See Figure 6–5 for a detailed view of the bus bar assembly.)

6.2.2 Removal of XMI Card Cage from Cabinet

Before removing the cage from the cabinet, remove all modules and set them aside.

Figure 6–4: XMI Card Cage



1. Open the front cabinet door.
2. Remove the clear plastic door in front of the XMI cage.

   CAUTION: *You must wear an antistatic wrist strap attached to the cabinet when you handle any modules.*

3. Lift up the levers and remove modules from the cage. Put them in protective bags and note which slots they had been in.
4. With a flat screwdriver remove and save the four mounting screws that fasten the XMI cage assembly to the chassis (see Figure 6–4 for location of these screws).
5. Pull the cage out of the system cabinet carefully so that you do not damage the power harnesses or bus bars. Push from the back to ease the cage out toward the front of the cabinet.

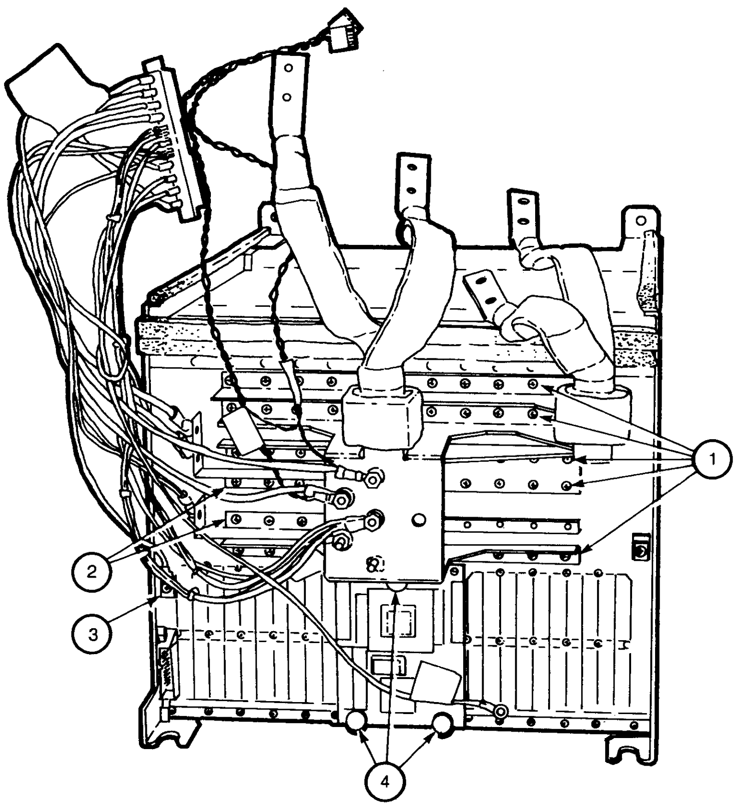
6.3 Switching XMI Card Cages

Some parts must be removed from the XMI cage taken from the system and installed on the new XMI cage.

- The entire bus bar assembly
- The daughter card (static sensitive)
- The two side mounting plates

Three pieces of foam air seal must be installed on the new cage.

Figure 6-5: XMI Bus Bar Assembly and Daughter Card



6.3.1 Removal of Bus Bars and Daughter Card

Remove the bus bars and daughter card as follows:

1. First remove the +5V/+5VBB/Ground bus bar assembly. Keep all screws and note where they came from.
2. Then remove the two smaller bus bars for -5.2V and -2V (see Figure 6-5).
3. Disconnect the blue cable at the far left that goes to -12V.

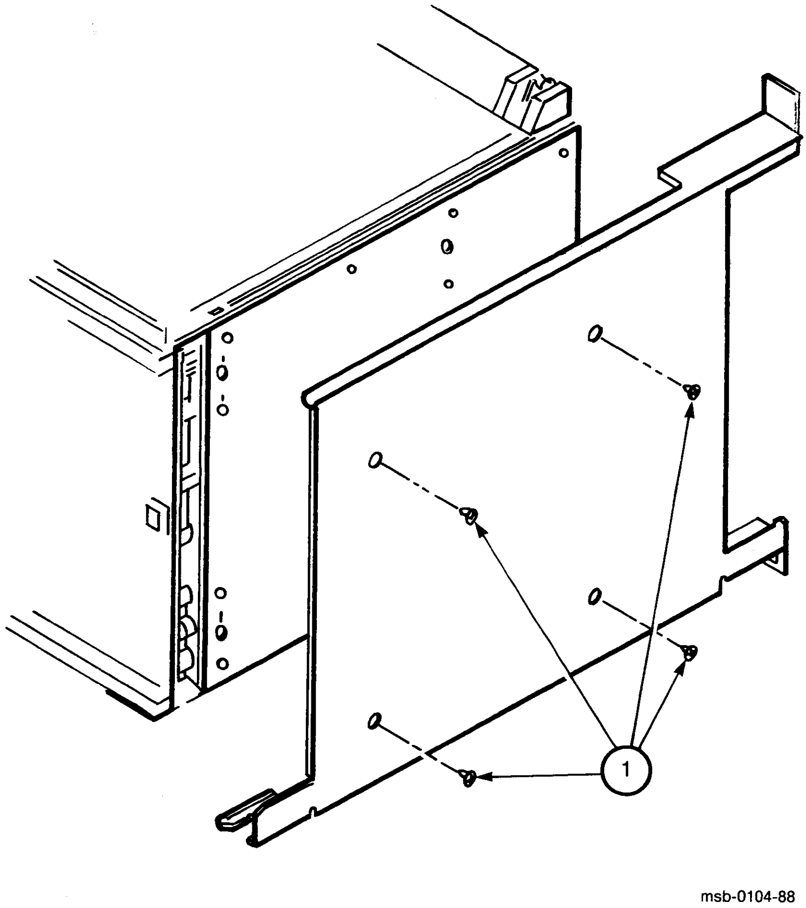
   CAUTION: *The daughter card is static sensitive. You must wear an antistatic wrist strap attached to the cabinet when you handle any modules.*

4. Unscrew the three large thumbscrews that hold the daughter card to the XMI backplane.
5. Pull the daughter card away from the backplane.

6.3.2 Moving XMI Side Mounting Plates and Installation of Parts

Remove the two side mounting plates from the defective cage and install on the new cage (see Figure 6–6). Install on the new cage the bus bars and daughter card that you removed from the old cage. Install the new foam air seals.

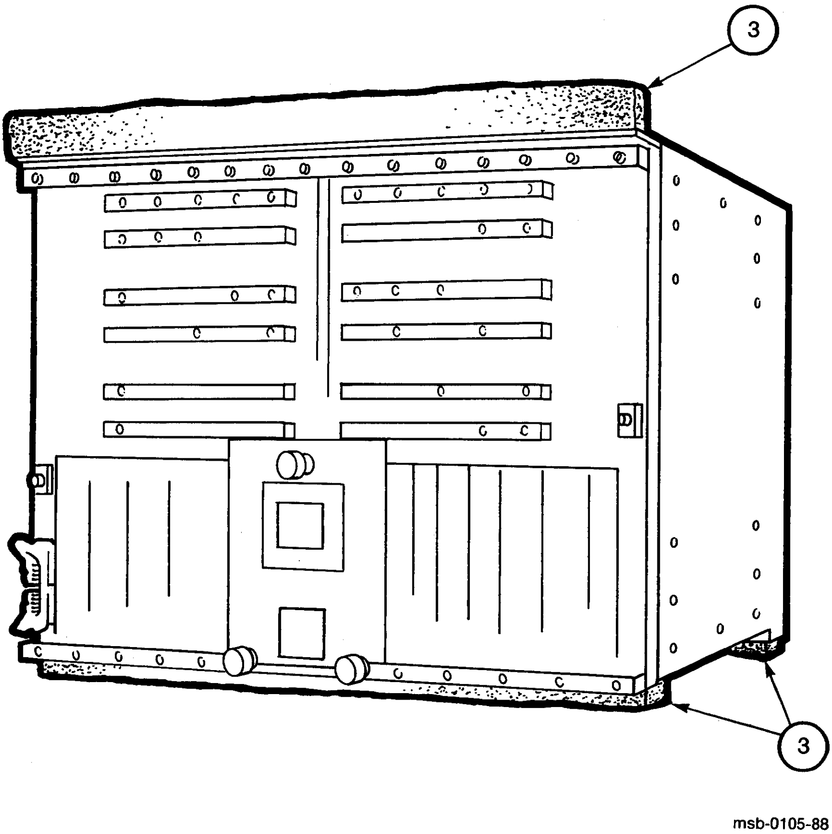
Figure 6–6: XMI Cage Side Mounting Plates



Perform the tasks in the following order:

1. Remove the two side mounting plates by removing the four screws shown in Figure 6–6. (Don't install them on the new cage yet.)
2. On the new cage install the two smaller bus bars and then the +5V/+5VBB/Ground bus bar assembly. Using the torque screwdriver from the VAXBI tool kit, torque screws to 9 (+/–1) inch-pounds.
3. Install the foam air seals in the locations shown in Figure 6–7: at the bottom front and back and at the top of the backplane.
4. Install the side mounting plates.
5. Install the daughter card.

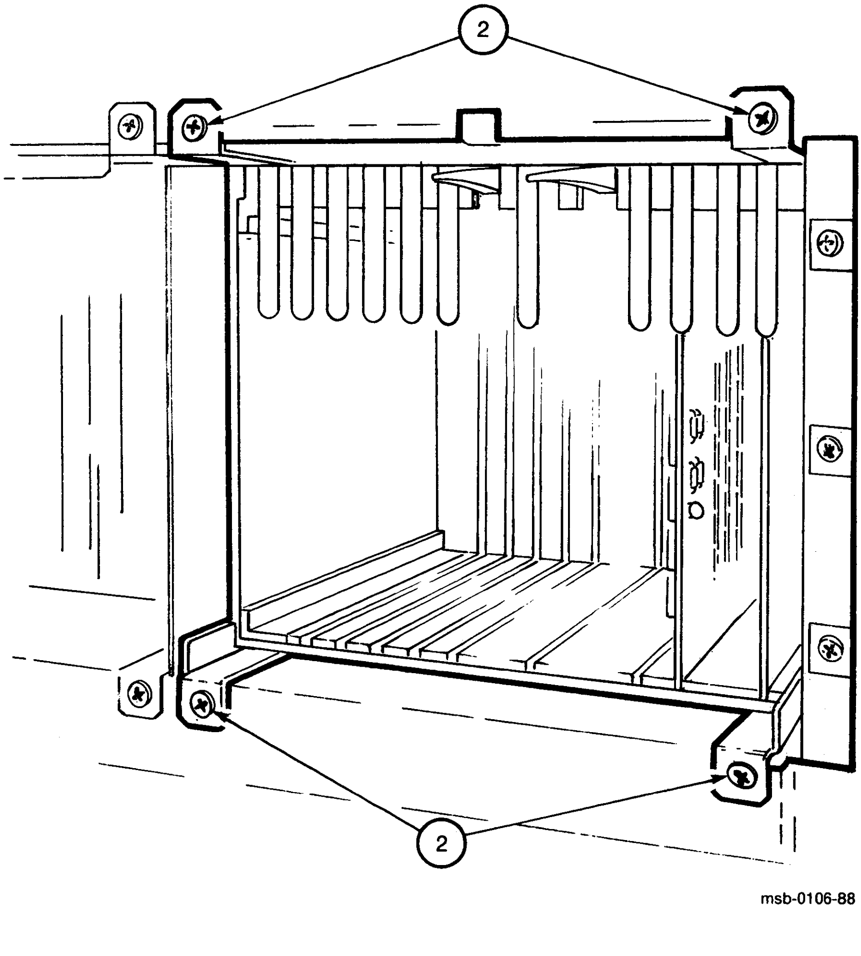
Figure 6–7: Installation of Foam Air Seals



6.4 XMI Card Cage Replacement

Return the new cage to the system cabinet. Reattach all the connections on the backplane, install the screws attaching the cage to the chassis, and then put the modules back into their slots (see Figure 6–8).

Figure 6–8: XMI Card Cage



The new XMI cage should be installed in the cabinet as follows:

1. Slide the XMI card cage into the system cabinet taking care not to damage the power harnesses or bus bars. Push from the front and pull from the rear.
2. Install the four mounting screws that secure the XMI cage assembly to the system cabinet (see Figure 6-8).
3. Reattach the power connections.

   On the H7214 regulators, torque the screws to 27 (+/-5) inch-pounds

   Make sure the two remote sense wires going to the two H7214 regulators go to the correct regulator. If they are switched, the +5V supplies may not turn on.
4. Reattach all signal connections.
5. Put the I/O bulkhead tray back into place at the rear of the cabinet.

   CAUTION: *You must wear an antistatic wrist strap attached to the cabinet when you handle any modules.*
6. Insert the modules into their correct slots.
7. Replace the clear door.
8. Turn on system power and check that all nodes pass self-test.

   NOTE: *See Chapter 7 of the VAX 6200 Installation Guide for complete acceptance instructions.*

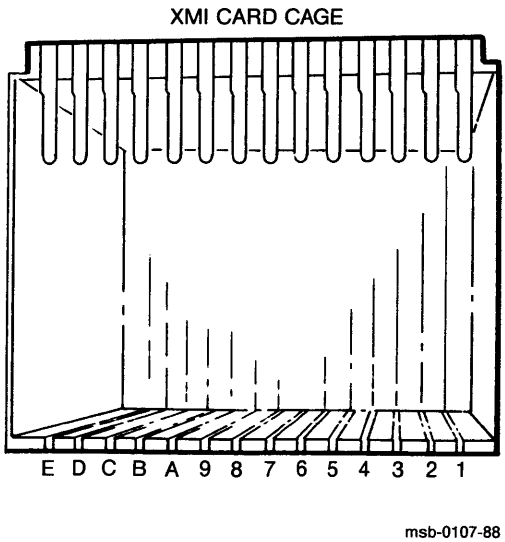
6.5 Installing Modules in the XMI Card Cage

The XMI card cage design and XMI architecture place some restrictions on the use of the slots.

- Either a KA62A or DWMBA module must be in slot 1 or E.
- No memory modules in slots 1 and E.
- No I/O modules in slots 5 through A.

Only XMI modules may be placed in the XMI card cage; installing any other modules may destroy the modules.

Figure 6-9: Numbering of XMI Slots



An XMI node takes its node number from the slot in which it resides. This is unlike the VAXBI bus where the node number assignment derives from node ID plugs inserted into the backplane for each slot.

Figure 6–9 shows the numbering of the slots in the XMI card cage. Slots are numbered in hexadecimal to correspond to the self-test display. Because the daughter card is mounted in the center of the XMI backplane, no I/O cables can be connected to slots 6 through 9. Also, no I/O modules are to go in the two adjoining slots, 5 and A. Another configuration restraint is that either the first or last slot in the cage must house a non-memory module. If no module is in either slot, the XMI shuts down. Memory modules must not be placed in the first and last slots.

Any problems with the XMI cage or modules are indicated in the first three lines of the self-test display (see Section 2.2 for an explanation of these lines).

CAUTION: *Never attempt to insert a VAXBI module into an XMI card cage. The backplane technology for the XMI and VAXBI is similar but incompatible. Inserting a VAXBI module into an XMI card cage can destroy the module. Note that VAXBI modules are shorter than XMI modules.*

6.6 XMI Troubleshooting

When you install modules in the XMI card cage, several items need to be checked. Table 6–3 gives a checklist of items to troubleshoot.

Table 6–3: XMI Troubleshooting Checklist

Symptom	Possible Cause
No power to cages	Clear plastic door not in place or not latched.
Intermittent module response	Poor contact at connector
	Loose cabling at backplane
Module does not appear on self-test results	Loose cabling at the backplane
	System not configured correctly.

The XMI and VAXBI card cages are in back of clear plastic doors.

NOTE: *If these doors are opened when power is still on, a power interlock switch cuts off power from the regulators to either the VAXBI side or to the XMI side, depending on the door opened.*

Before turning power back on, make sure the clear plastic doors are in place and latched. You can then push the reset switch on the H7206 PAL unit (see Figure 9–9) to return power to the system.

The XMI bus requires a non-memory module in slots 1 or E. If both of these slots are empty, the bus will shut down. Also, if a memory module is in either of these slots, the bus will shut down.

If you receive intermittent module response, or the module does not show up on self-test as being present at all, make sure that the module is seated properly, and check the backplane cabling.

Modules may fail self-test because of poor contact at the connector. A thorough cleaning of the gold pads on the module and of the connector in the card cage corrects this contact failure. If the connections seem to be faulty, clean the contact areas of the connector and module. Table 6–4 lists tools and supplies for connector cleaning.

Table 6–4: XMI Connector Cleaning Supplies

Item	Part Number	Function
VAXBI tool kit	A2-M1094-10	Maintaining card cages
Paddle wipe handle	47-00116-01	Holding paddle wipes
Paddle wipes	12-26321-01	Cleaning contact area inside ZIF connectors
Gold-wipes™	49-01603-00	Cleaning module connector contact area
Protective goggles	29-16141-10	Eye protection
Nitrile gloves	29-26403-00	Hand protection

™Gold-wipes is a trademark of TEXWIPE.

Chapter 7

VAXBI Card Cage

This chapter describes the VAXBI card cage and its use in the VAX 6200 system. Removal and replacement procedures are detailed, and configuration restrictions are listed. Sections include:

- VAXBI Card Cage Description

  System Use
  Specifications
  Subassemblies

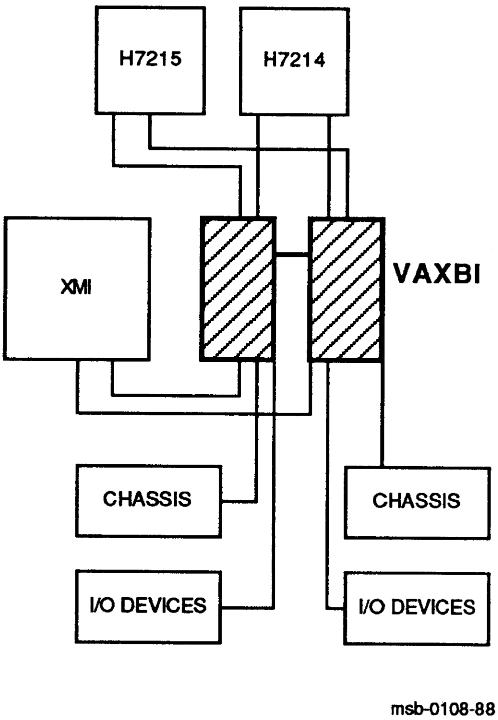
- VAXBI Card Cage Removal
- Switching VAXBI Cages
- VAXBI Card Cage Replacement
- VAXBI Expansion and Configuration Rules
- VAXBI Troubleshooting

7.1 VAXBI Card Cage Description

7.1.1 System Use

The VAXBI card cage serves as the I/O subsystem of the VAX 6200 system. Each processor cabinet has two VAXBI card cages, each providing a separate VAXBI channel. The interface between the VAXBI bus and the XMI bus is the DWMBA option. The DWMBA/B module requires one slot for communication with its companion module, the DWMBA/A, in the XMI card cage. Figure 7-1 is a simplified block diagram showing physical connections between the VAXBI card cages and other components in the cabinet.

Figure 7-1: VAXBI Card Cage Connections



The VAX 6200 system uses the VAXBI bus for input/output. Each system has two VAXBI card cages, which provide two VAXBI channels of six slots each. A VAXBI expander cabinet can also be added, which can hold up to four VAXBI cages.

The VAXBI card cage has zero insertion force (ZIF) connectors. The backplane area extends over two of the five connector segments; the remaining three segments are used for I/O connections. Installed on the cage are I/O transition headers.

Each VAXBI bus has its own XMI-to-VAXBI adapter (DWMBA). The DWMBA/B module of this adapter resides in the VAXBI card cage.

7.1.2 VAXBI Card Cage Specifications

The VAXBI card cage (see Figure 7-2) is a 6-slot cage. The VAXBI card cages are located in the upper part of the cabinet, on the left as you view the system from the front. The field-replaceable unit [H9400-AA] does not include the power bus bar assembly, the node ID plugs, and the terminators. Two cages configured as two separate VAXBI channels are in each system cabinet.

Figure 7–2: VAXBI Card Cages

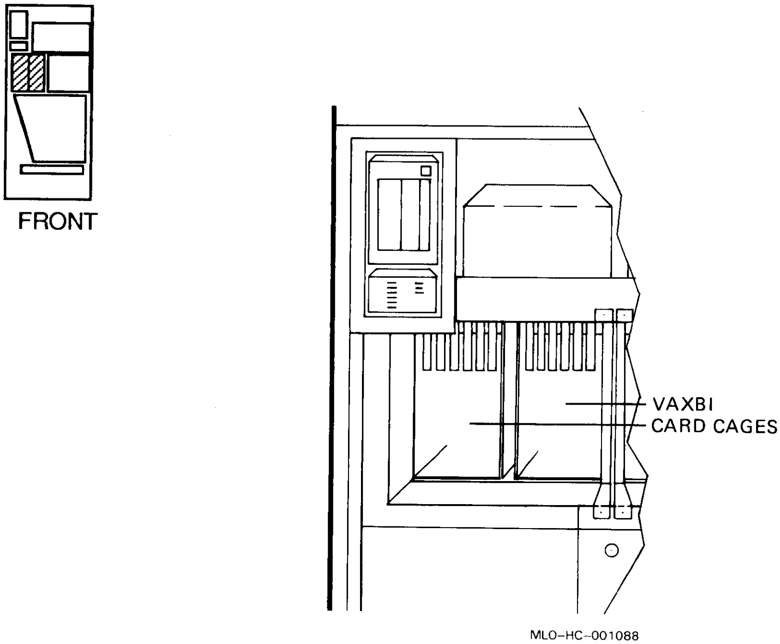


Table 7–1: VAXBI Card Cage Assembly Specifications

Parameter	Description
VAXBI Card Cage	H9400-AA, one 6-slot cage with no terminators or bus bars; includes transition headers
Location:	Upper left front
Dimensions:	12.5" W x 9.5" D x 10" L
Weight:	26 lbs (2-cage assembly)
Power:	One H7215 DC regulator and one H7214 DC regulator supply power to the 2-cage assembly.
Service From:	Front and rear

Table 7–2: VAXBI Card Cage Cables

Part Number	Description
17-00849-08	18" DWMBA/B to DWMBA/B AC/DC OK cable, from VAXBI cage 2 slot 1 (segment C2) to VAXBI cage 1 slot 1 (segment C1).
17-01149-01	Boot enable jumper (on Ethernet adapter slot, slot 6, segment E1)
17-01458-02	VAXBI ground strap
17-01496-01	Ethernet (from slot 6, segment E2, to H7214 (+13V) and to Ethernet port)
17-01523-01	VAXBI +/-12V to J3 on H7215
17-01569-01	DWMBA, from slot 1, segment C1, to J11 of H7206
17-01897-01	15' DWMBA cables for expander cabinet, from XMI slots C, B, 1, and 2 as needed (segments D and E) to VAXBI cages 3, 4, 5, and 6 slot 1 (segments D and E). Two per DWMBA.
17-01897-02	7" DWMBA cables, from XMI slot E (segments D and E) to VAXBI cage 2 slot 1 (segments D and E). Two per DWMBA.
17-01897-03	25" DWMBA cables, from XMI slot D (segments D and E) to VAXBI cage 1 slot 1 (segments D and E). Two per DWMBA.
17-01920-01	AC/DC OK cable, from VAXBI slot 1, segment C1. Installed in system to provide for expansion to VAXBI expander cabinet.

7.1.3 VAXBI Card Cage Subassemblies

Table 7-3 lists the part numbers for FRUs of the VAXBI card cage assembly in the VAX 6200 system.

Figure 7-3: VAXBI Card Cage Subassemblies

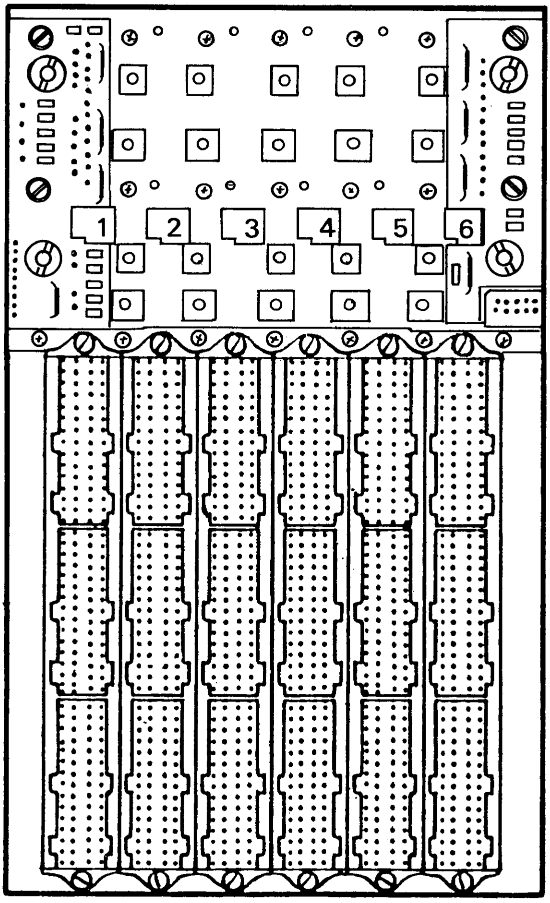


Table 7-3: VAXBI Subassemblies and Tools Required

Item	Part Number	Description
Subassemblies:		
Bus Bar Assembly	12-28508-01	+5V/+5VBB/Ground VAXBI bus bars
	12-28342-01	-5.2V VAXBI bus bars
	12-28345-01	-2V VAXBI bus bars
Terminators	20-24486-01	Near end (GIF)
	20-24487-01	Far end (GOM)
VAXBI Node IDs	12-23701-17	Set of 16
Transition Header	12-22246-01	Three-segment I/O header
Foam Air Seals	74-34536-01	Three pieces of foam used for air seals
	74-34536-02	
	74-34536-03	
Tools Required:		
VAXBI Tool Kit	A2-M1094-10	Includes a torque screwdriver
Screwdrivers	—	Offset ratchet screwdriver
	—	Large and small Phillips screwdrivers
	—	Small Phillips screw-holding screwdriver or one with magnetic tip
	—	Flat screwdriver

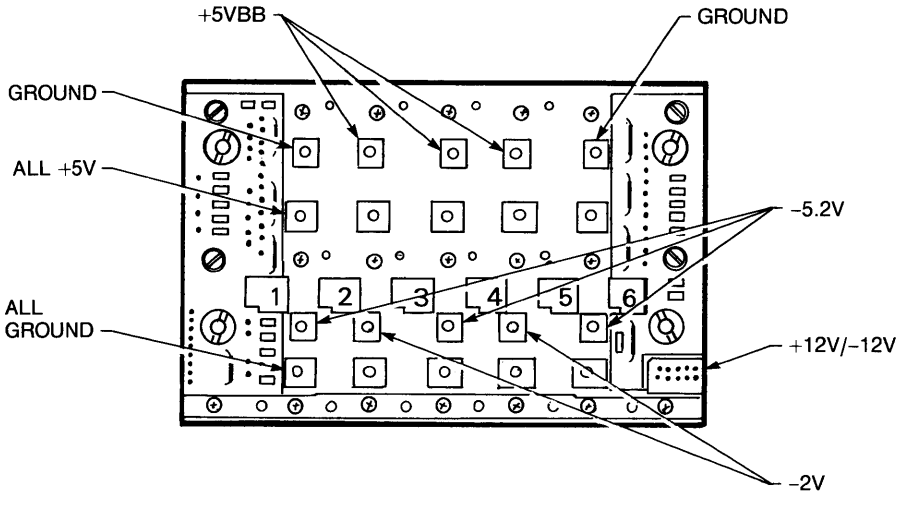
7.2 VAXBI Card Cage Removal

The two VAXBI card cages are bolted together and must be removed as a unit. They are removed from the front of the cabinet after you disconnect connections at the backplane. You must first remove the system control assembly before you can remove the VAXBI card cage assembly (see Chapter 8 for instructions).

7.2.1 Prepare for Removal

Prepare the system for shutdown. Set up a work space nearby where you can store the modules and work on the VAXBI card cages. Label and disconnect the signal and power connections.

Figure 7-4: VAXBI Backplane Power Connections



The VAXBI card cage assembly, which contains both cages, slides out the front of the system cabinet. Before attempting to remove the assembly, detach cables from other system components that go to the backplanes of both cages.

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the circuit breaker on the AC power controller to the Off position.
4. Unplug the machine.

   NOTE: *You must first remove the system control assembly; see Chapter 8 for instructions for the removal procedure.*

5. Open the rear cabinet door.
6. Drop the I/O panel to expose the card cages.

   CAUTION: *Put on the antistatic wrist strap that is attached to the cabinet.*

7. Label and disconnect all signal cables.

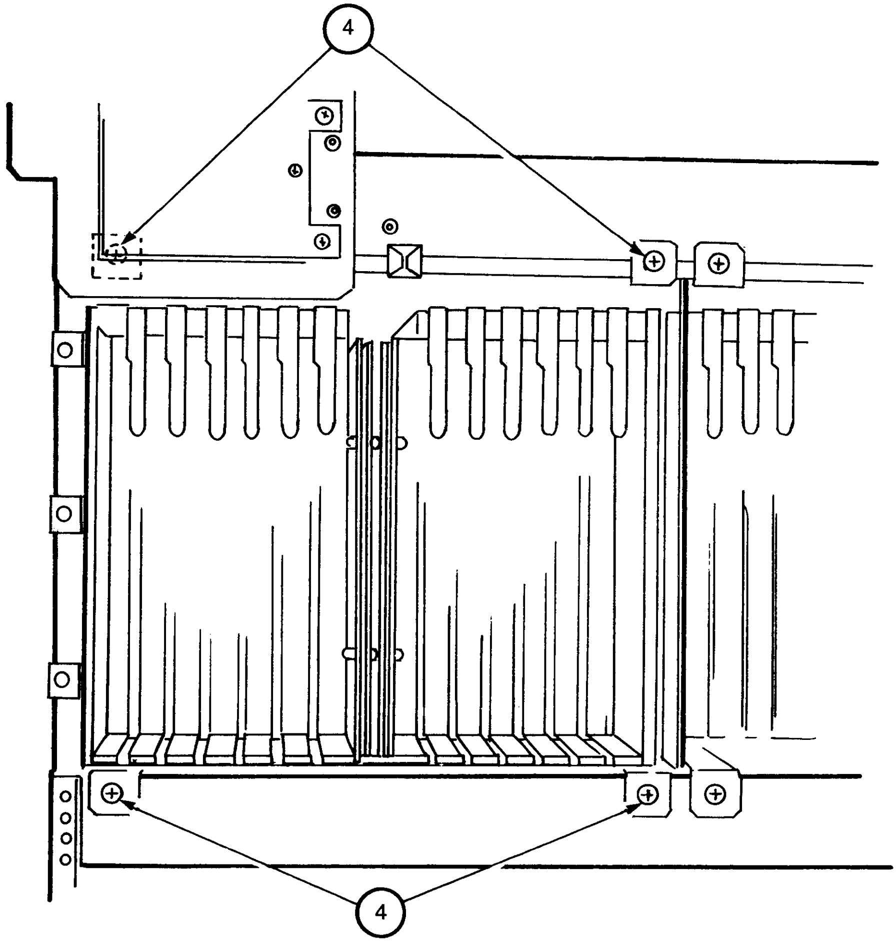
   Remove the connectors from the transition headers. Note that the CIBCA and KDB50 transition headers must be removed from the card cage, since the I/O segment is a permanent part of the transition header.

8. Disconnect all power connections (see Figure 7–4).
   a. Cable to the H7215 power regulator (17-01523-01)
      (Remove connector from the regulator.)
   b. Harness to the H7214 power regulator
      (On the regulator, remove the four screws that fasten the harness to the regulator.)
   c. Ethernet line to the H7214 regulator (17-01525-01) from each cage with a DEBNA adapter
      (Remove connector from the regulator.)
   d. Ground strap from each cage to the chassis (17-01458-02)

7.2.2 Removal of VAXBI Card Cages from Cabinet

Before removing the cages from the cabinet, remove all modules and set them aside.

Figure 7-5: VAXBI Card Cages



1. Open the front cabinet door and lift it from its hinges to provide more clearance.
2. Remove the clear plastic door in front of the VAXBI cage area.

   CAUTION: *You must wear an antistatic wrist strap attached to the cabinet when you handle any modules.*

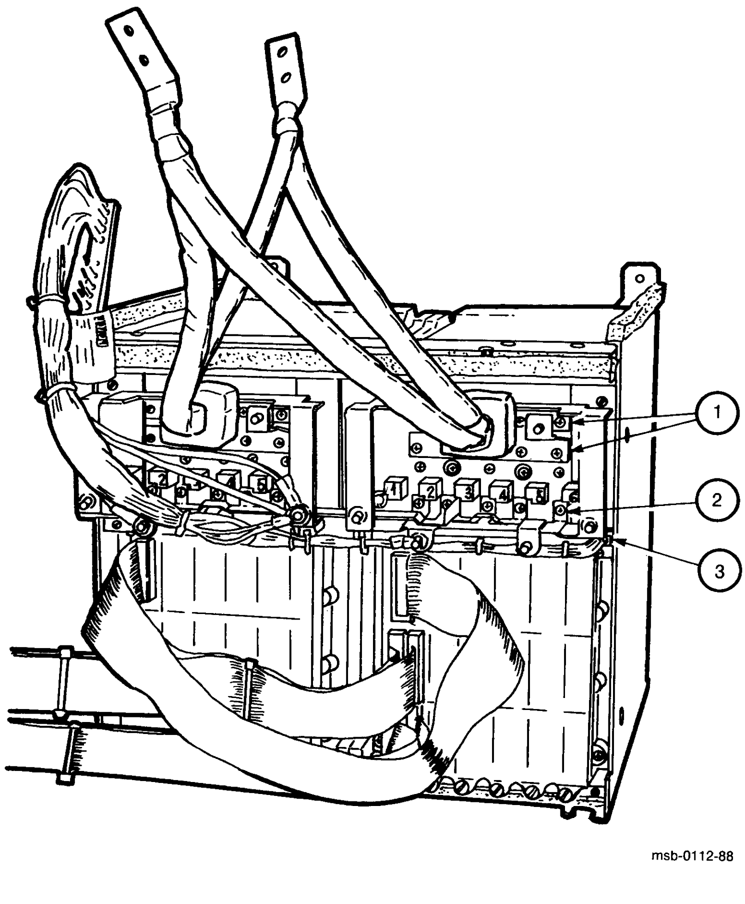
3. Lift up the levers to remove modules. Put them in protective bags and note which slots they had been in.
4. Remove and save the four mounting screws that fasten the VAXBI assembly to the chassis (see Figure 7-5 for location of these screws).
5. Pull the cages out of the system cabinet carefully so that you do not damage the power harnesses or bus bars.

7.3 Switching VAXBI Cages

The following is an overview of what you must do to switch a cage:

Remove the bus bar assembly from the defective cage leaving the bus bars in place for the second cage and attach the bus bars to the new cage. Remove the node ID plugs and insert them on the replacement cage at the same slot location. Remove the terminators from the old cage and install them on the new one. Unbolt the side and inner mounting plates from the original assembly so that you can replace the defective VAXBI card cage.

Figure 7-6: VAXBI Bus Bar Assembly



7.3.1 Removal of VAXBI Bus Bars

On ONLY the cage that needs to be swapped out of the two-cage assembly, remove the bus bars in the following order:

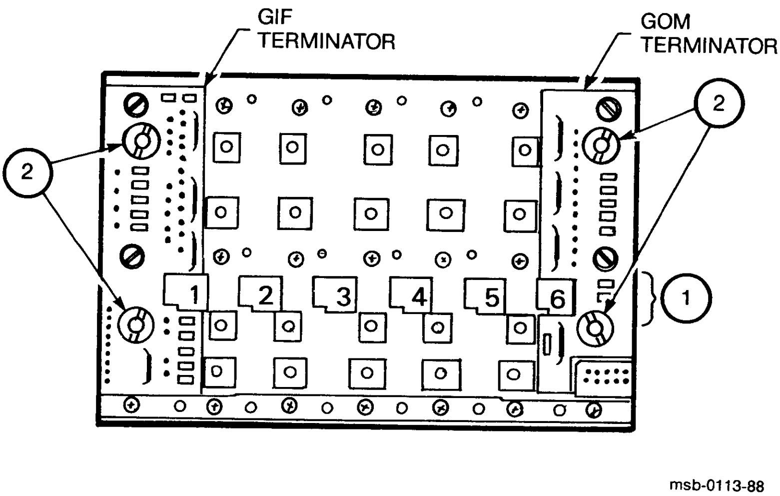
1. First remove the +5V/+5VBB/Ground bus bar assembly (12-28508-01), 14 screws.
2. Next remove the -5.2V and -2V bus bars (5 screws into the power cubes).
3. Disconnect the +/-12V connection (17-01523-01) to the H7215 regulator.

Use a small Phillips screwdriver (#6-32 screws). See Figure 7-6 for a detailed view of the VAXBI bus bar assembly.

7.3.2 Removal of Other VAXBI Parts

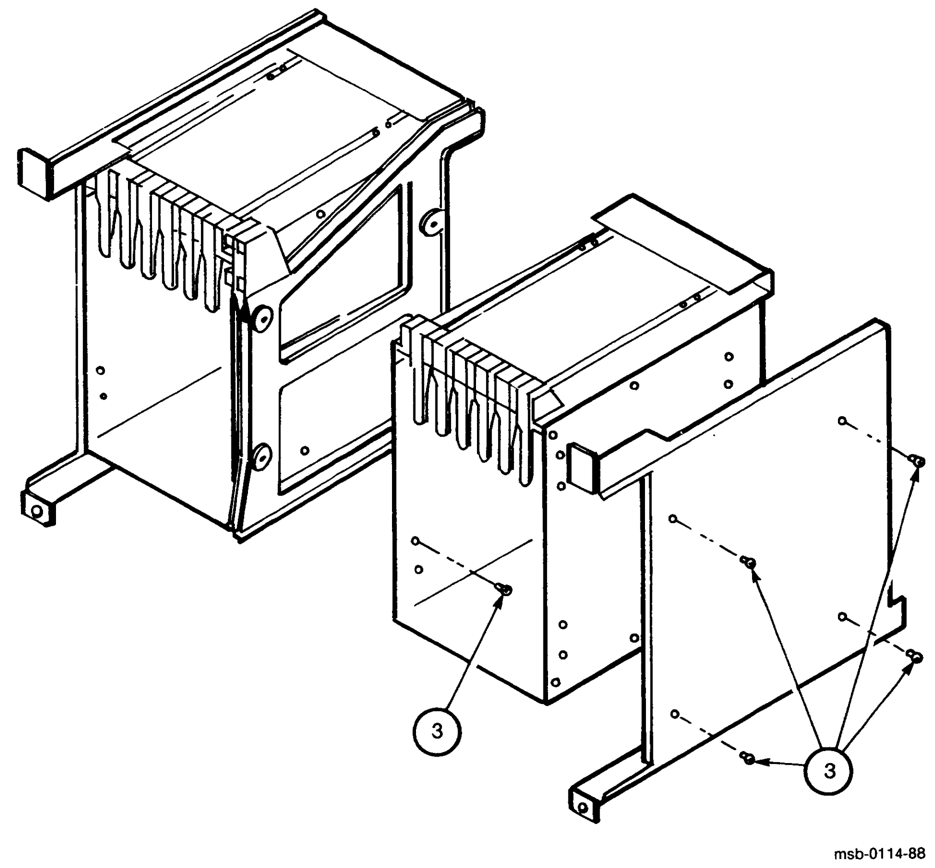
Remove the node ID plugs, the terminators, and the mounting plates from the old cage (see Figure 7-7 for their locations).

Figure 7-7: VAXBI Backplane Components



1. Remove the node ID plugs.
2. Remove the terminators by removing the two screws with a flat screwdriver (see Figure 7-7).
3. Remove the side and inner mounting plate so that you can slide the defective cage away from the remaining cage. For the inside plate, remove the innermost screws with an offset ratchet screwdriver (see Figure 7-8).

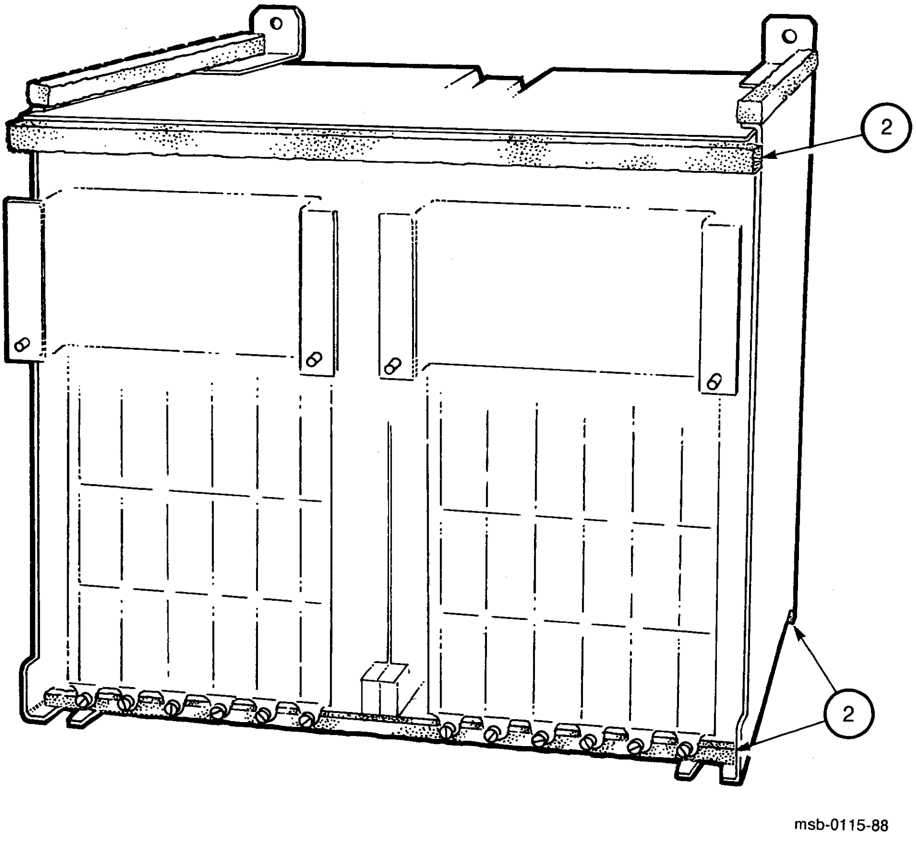
Figure 7-8: VAXBI Cage Mounting Plates



7.3.3 Installation of VAXBI Parts

Install the terminators, node ID plugs, and bus bar assembly taken from the old cage. Attach the side and inner mounting plates. Finally, install new foam air seals.

Figure 7-9: Installation of Foam Air Seals

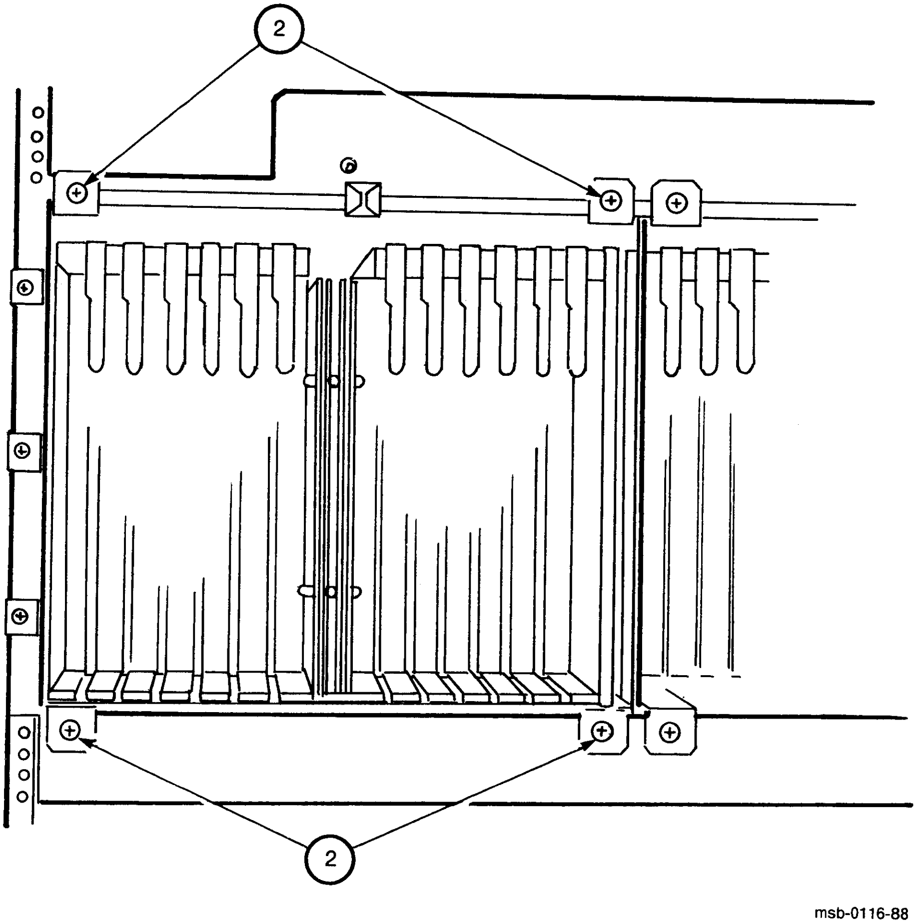


1. On the replacement cage, install the parts that you removed from the defective VAXBI card cage:
   - Terminators
   - Node ID plugs
   - Bus bar assembly, in the reverse order of the removal. Torque screws to 9 (+/-1) inch-pounds.
   - Side and inner mounting plates
2. Three foam air seals need replacement, as shown in Figure 7-9: the top front of the backplane and the bottom surfaces of the cages, back and front.
3. The new cage, the H9400-AA, is shipped with six transition headers installed. For the slots that are to hold the CIBCA and KDB50 options, remove the transition headers.

7.4 VAXBI Card Cage Replacement

Return the two-cage assembly to the system. Reattach all the connections on the backplane, install the screws attaching the cage to the chassis, and then put the modules back into their slots (see Figure 7-10).

Figure 7-10: VAXBI Card Cages



The VAXBI cage assembly should be installed in the cabinet as follows:

1. Slide the VAXBI card cages into the system cabinet taking care not to damage the power harnesses or bus bars. You will also need to pull the cages from the back.
2. Install the four mounting screws that secure the VAXBI cage assembly to the system cabinet.
3. Reinstall the system control assembly (see Chapter 8 for instructions).
4. Screw on the transition headers containing the CIBCA and KDB50 cables. Tighten the screws in stages: do not tighten one completely before tightening the other. Torque both screws to 6 (+/-1) inch-pounds, using the torque screwdriver.
5. Attach the other signal connections in the I/O area.
6. Reattach the power connections.

   At the H7214 regulator, torque screws to 27 (+/-5) inch-pounds.

   On the bus bars torque screws to 9 (+/-1) inch-pounds.
7. Put the I/O bulkhead tray back into place at the rear of the cabinet.

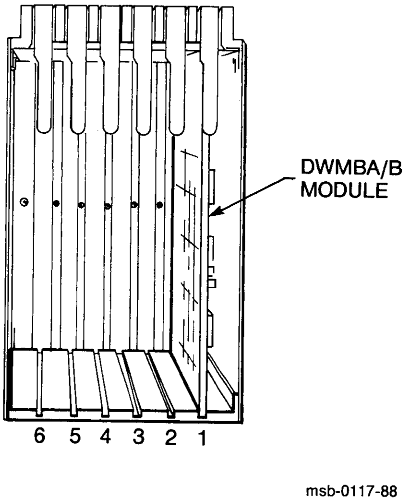
   CAUTION: *You must wear an antistatic wrist strap attached to the cabinet when you handle any modules.*
8. Insert the modules into the VAXBI card cages.
9. Replace the clear door.
10. Turn on system power and check that all nodes pass self-test.
11. Rehang the front cabinet door.

    NOTE: *See Chapter 7 of the VAX 6200 Installation Guide for complete acceptance instructions.*

7.5 VAXBI Expansion and Configuration Rules

The system cabinet has two VAXBI cages configured to provide two VAXBI channels for I/O. One of the six slots holds the XMI-to VAXBI adapter module, leaving five slots for I/O modules. Four more cages can be installed in a VAXBI expander cabinet to provide four additional VAXBI channels. A total of 30 slots are available for I/O.

Figure 7-11: Numbering of VAXBI Slots



The cage and backplane were designed so that any module or node can reside in any slot (except slot 1). On the VAXBI bus, the module that drives the clock must reside in the first slot (see Figure 7–11 for the numbering of VAXBI slots). In the VAX 6200 system the DWMBA/B module of the XMI-to-VAXBI adapter drives the clock and therefore must reside in slot 1.

VAXBI node numbers derive from node ID plugs that plug into the backplane. A node, which can be more than one module, is assigned the node number of the plug that is inserted into the slot of the module with the VAXBI Corner. Multimodule nodes must be in adjacent slots.

Constraints on adding VAXBI options include:

- Power requirements for the options
- Memory latency time needed to access MS62A memory

See the *VAX Systems and Options Catalog* for VAXBI option configurations in VAX 6200 systems. See Appendix B of the *VAXBI Options Handbook* for power requirements of various options. The DWMBA/B module requires 6 amps.

7.6 VAXBI Troubleshooting

When you install modules in the VAXBI card cages, several items need to be checked. Table 7-4 gives a checklist of items to troubleshoot.

Table 7-4: VAXBI Troubleshooting Checklist

Symptom	Possible Cause
No power to cages	Clear plastic door not in place or not latched.
Intermittent module response	Poor contact at connector
	Loose cabling at backplane
Module does not appear on self-test results	Loose cabling at backplane
	System not configured correctly

The XMI and VAXBI card cages are in back of clear plastic doors.

NOTE: *If these doors are opened when power is still on, a power interlock switch cuts off power from the regulators to either the VAXBI side or to the XMI side, depending on the door opened.*

Before turning power back on, make sure the clear plastic doors are in place and latched. You can then push the reset switch on the H7206 PAL unit (see Figure 9–9) to return power to the system.

The XMI bus requires a non-memory module in slots 1 or E. If both of these slots are empty, the bus will shut down. Also, if a memory module is in either of these slots, the bus will shut down.

If you receive intermittent module response, or the module does not show up on self-test as being present at all, make sure that the module is seated properly, and check the backplane cabling.

Modules may fail self-test because of poor contact at the connector. A thorough cleaning of the gold pads on the module and of the connector in the card cage corrects this contact failure. If the connections seem to be faulty, clean the contact areas of the connector and module. Table 7–5 lists tools and supplies for connector cleaning.

Table 7–5: VAXBI Connector Cleaning Supplies

Item	Part Number	Function
VAXBI tool kit	A2-M1094-10	Maintaining card cages
Paddle wipe handle	47-00116-01	Holding paddle wipes
Paddle wipes	12-26321-01	Cleaning contact area inside ZIF connectors
Gold-wipes™	49-01603-00	Cleaning module connector contact area
Protective goggles	29-16141-10	Eye protection
Nitrile gloves	29-26403-00	Hand protection

™Gold-wipes is a trademark of TEXWIPE.

Chapter 8
Control Subsystem Assemblies

This chapter describes the specifications and maintenance of the system control assembly and its subassemblies. Sections include:

- System Control Assembly Specifications
- System Control Assembly Removal and Replacement
- XTC Power Sequencer Specifications
- XTC Removal and Replacement
- Control Panel Assembly Specifications
- Control Panel Assembly Removal and Replacement
- TK Tape Drive Specifications
- TK Tape Drive Removal and Replacement
- Filter Board and TOY Clock Battery Specifications
- Filter Board and TOY Clock Battery Removal and Replacement

8.1 System Control Assembly Specifications

The system control assembly is located in the upper left front corner of the cabinet. It houses the separate FRUs of the control panel, TK tape drive, the XTC, and the battery powering the TOY clock. The system control assembly's part number is 70-24903-01.

Figure 8-1: System Control Assembly

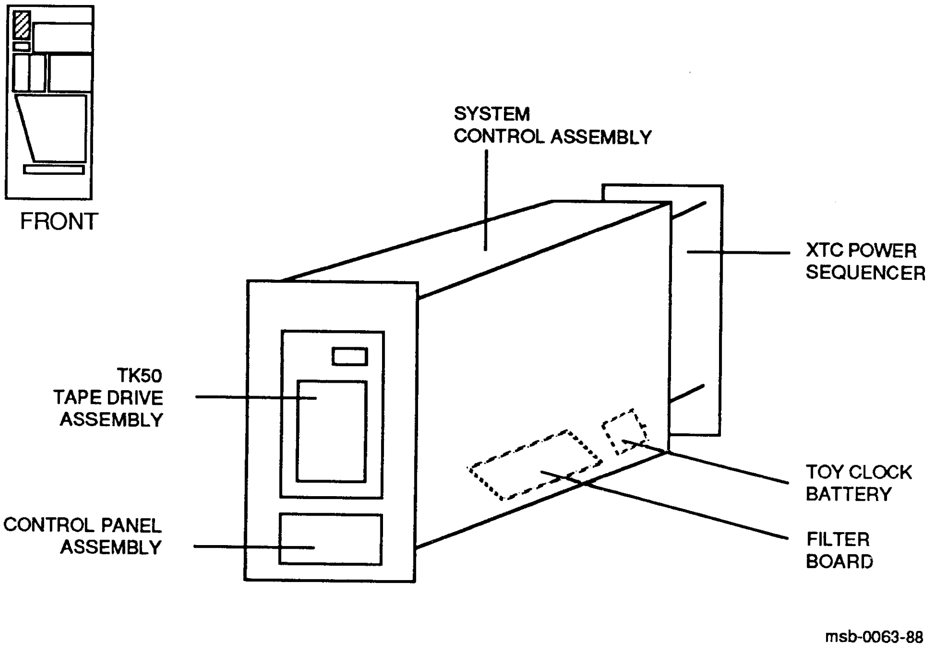


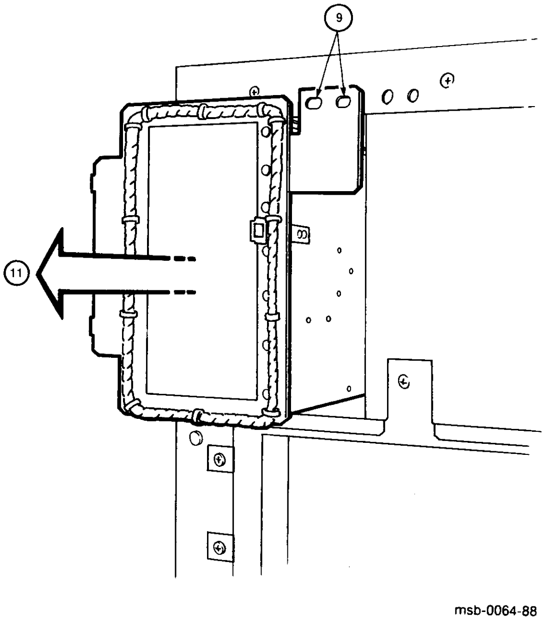
Table 8–1: System Control Assembly Specifications

Parameter	Description
Part Number:	70-24903-01
Location:	Upper left front
Dimensions:	11.25″ H x 8.5″ W x 17.5″ D
Weight:	18 lbs, with TK and control panel installed
Signal Cables:	17-01814-01 from the control assembly shield leading to the TBK50 adapter's slot at VAXBI backplane segment D
Service From:	Front and rear of cabinet, front door removed
Tools Required:	Large and small Phillips screwdrivers
Subassemblies:	Control panel assembly (54-16574-01) XTC power sequencer (54-17243-01 or 20-29176-01) TK tape drive (TK50-AA) TOY 3-cell battery (12-19245-02)
Diagnostics:	Control panel assembly lights will light when the control assembly is correctly installed.

8.2 System Control Assembly Removal and Replacement

Working mainly from the front of the cabinet, remove or replace the system control assembly using a large and small Phillips screwdriver. The assembly has four screws on the front of the assembly, two screws on the back of the assembly, and one cable.

Figure 8–2: System Control Assembly Removal



REMOVAL

1. Perform an orderly shutdown of the system.
2. Turn the control panel upper key switch to the Off position.
3. Pull the circuit breaker switch and unplug the machine.
4. Open and remove the front door. (See Section 10.1.) Open the rear door.

5. Remove the four power cords (orange, black, red, and black) from the back of the console assembly using a large Phillips screwdriver. (See Section 6.2.)
6. Remove the four screws from the corners of the XTC power sequencer module (see Section 8.4), and lay the XTC down with all of its connections in place.
7. Remove signal cable 17-01814-01 from the upper right corner of the back of the console assembly. This cable is the control from the TK to VAXBI backplane segment D, at the slot housing the TK's TBK50 adapter.
8. Working from the rear of the cabinet, loosen the two #10-32 screws with a large Phillips screwdriver.
9. Move to the front of the cabinet. Remove the two #10-32 screws on the left side of the console assembly using a large Phillips screwdriver. Remove one of the two screws on the upper right support panel. Loosen the remaining screw.
10. Supporting the control assembly with one hand, remove the last loosened screw with your hand.
11. Using both hands, carefully pull the control assembly forward and out of the cabinet.

REPLACEMENT

1. Install the XTC and the control panel assembly (see Section 8.4 and Section 8.6).
2. As you guide the control assembly into the front of the cabinet, push the control assembly all the way to the left. This will align the screws with their holes in the structure. If you have trouble closing the cabinet door, check the assembly alignment.
3. Reverse steps 1 through 8 in the Removal section above.

8.3 XTC Power Sequencer Specifications

The XTC power sequencer is mounted on the back of the system control assembly. It is wired to the XMI backplane, the console terminal, the TK tape drive, and the H7214 power regulator.

Figure 8-3: XTC Power Sequencer

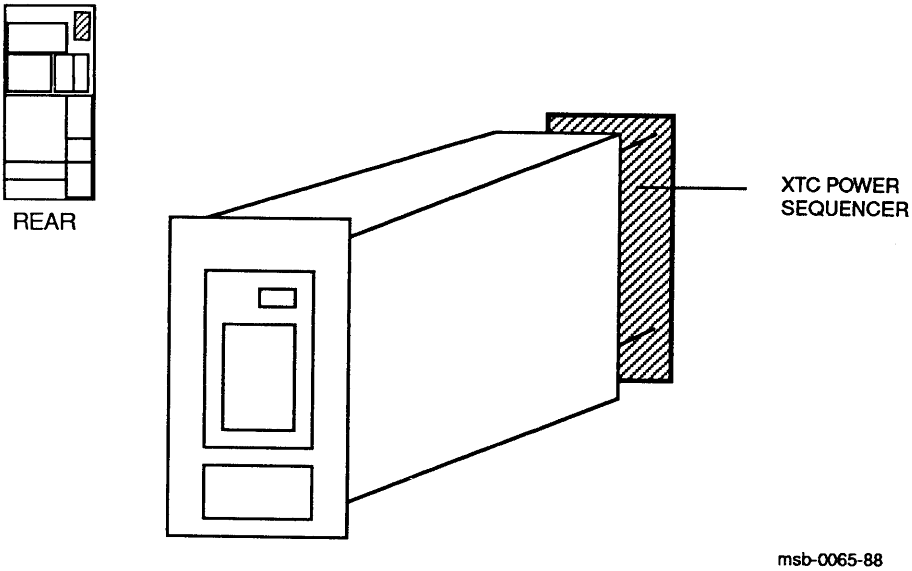


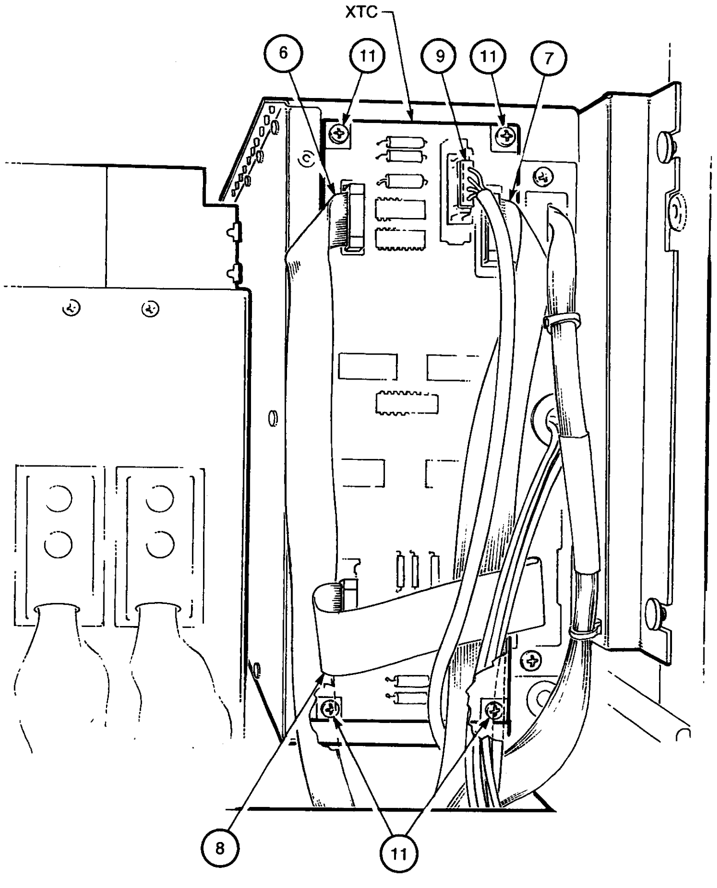
Table 8–2: XTC Power Sequencer Specifications

Parameter	Description
Part Number:	54-17243-01 or 20-29176-01
Location:	Upper right rear, mounted on the back of the system control assembly
Dimensions:	2.5" W x 8" H x .06" D
Weight:	Less than 1 lb
Power:	+5VBB at 0.6 amps +12V at 1.0 amps -12V at 0.1 amps
Cables:	Four ribbon cables and one TOY clock battery cable: 12-19245-02 battery cable, J1 connector with red plug end 17-01498-01 XTC to H7206, J3 14-pin connector 17-01567-01 XTC to console port, J5 10-pin connector 17-01568-02 XMI to XTC, J4 20-pin connector, 56" long 17-01816-01 XTC to control panel, J2 connector
Service From:	Rear of cabinet, door removed
Tools Required:	Large Phillips screwdriver
Subassemblies:	None
Diagnostics:	Power indicator lights on the control panel will light and the control panel key switches will turn when the XTC power sequencer is correctly installed.

8.4 XTC Removal and Replacement

Working from the rear of the machine, you remove or replace the XTC power sequencer using a large Phillips screwdriver. The XTC has four #6–32 screws, four ribbon cables, and one TOY clock battery cable.

Figure 8–4: XTC Power Sequencer Removal



REMOVAL

1. Execute an orderly shutdown of the system.
2. Turn the control panel upper key switch to the Off position.
3. Pull the circuit breaker switch.
4. Unplug the system.
5. Open the front and rear doors.
6. Wearing a ground strap, disconnect the 17–01568–02 ribbon cable at J4 which is a 20-pin connector 56 inch leading to the XMI.
7. Disconnect the 17–01498–01 ribbon cable at J3 which is a 14-pin connector cable leading to the H7206 power and logic box.
8. Disconnect the 17–01567–02 ribbon cable at J5 which is a 10-pin connector cable leading to the console port.
9. Disconnect the 17–01816–01 ribbon cable at J2 which leads to the control panel on the system control assembly.
10. Disconnect the 12–19245–02 lead with a red plug end at the J1 connector; the cable leads to the TOY clock battery in the system control assembly.
11. Use a large Phillips screwdriver to remove the four #6–32 screws located on each corner of the XTC power sequencer.
12. Pull the XTC toward you and remove.

REPLACEMENT

Reverse steps 1 through 12 in the Removal section above.

8.5 Control Panel Assembly Specifications

The control panel assembly is in the upper left front of the cabinet, and is a subassembly within the system control assembly. It is part number 54–16574–01.

Figure 8–5: Control Panel Assembly

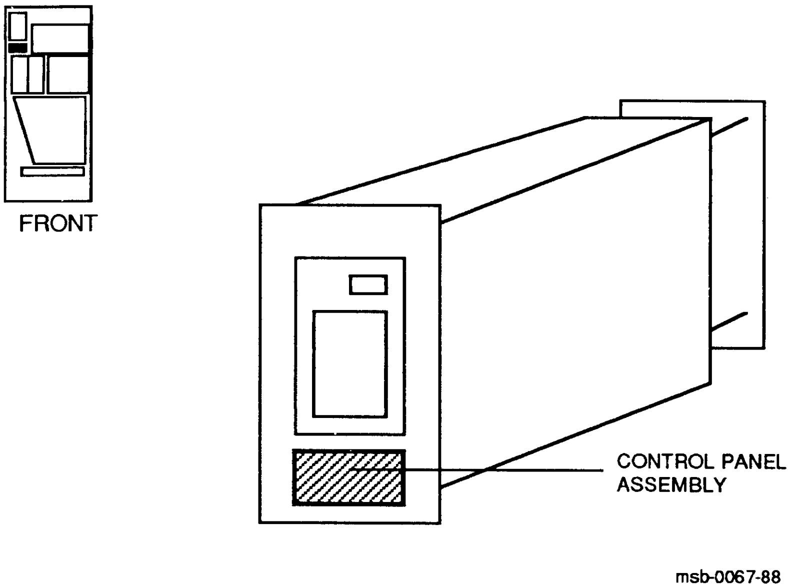


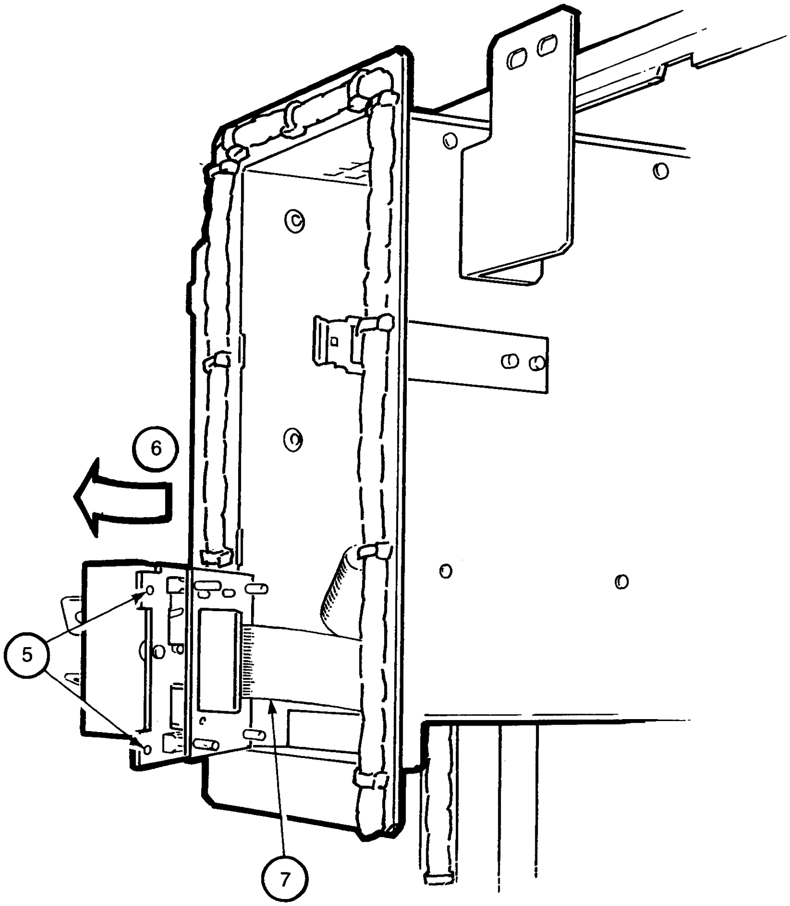
Table 8–3: Control Panel Assembly Specifications

Parameter	Description
Part Number:	54-16574-01
Location:	Front upper left corner
Dimensions:	4.25″ W x 2.75″ H x 1.75″ D
Weight:	Less than 5 lbs
Cables:	17-01818-01 cable from the J1 20-pin connector to the assembly bulkhead
Service From:	Front of cabinet, door open
Tools Required:	Large Phillips screwdriver
Subassemblies:	None
Diagnostics:	Control panel assembly lights light when power is turned on by the control panel key switch.

8.6 Control Panel Assembly Removal and Replacement

Working from the front of the cabinet, remove the control panel assembly using a large Phillips screwdriver. The panel assembly has one cable, 17-01818-01.

Figure 8-6: Control Panel Assembly Removal



msb-0068-88

REMOVAL

1. Conduct an orderly shutdown of the system.
2. Turn the control panel upper key switch to the Off position.
3. Pull the circuit breaker switch.
4. Unplug the machine. Open the front door.
5. Using a large Phillips screwdriver, remove the two #6-32 screws on the right side of the panel.
6. Swing the unit out and to the left, and pull it toward you.
7. Disconnect cable 17-01818-01 at the J1 20-pin connector.

REPLACEMENT

1. Connect the power cord to J1. The connection is not keyed, so look at the pins and the receptacle and align them carefully as you connect the cord.
2. Place the tabs on the left edge of the control panel in the slots on the control assembly.
3. With the tabs inserted, swing the module into the opening.
4. Using a large Phillips screwdriver, insert and tighten two #6-32 screws.
5. Close the front door.

8.7 TK Tape Drive Specifications

The TK tape drive is located in the system control assembly in the upper left front of the cabinet, part number TK50-AA.

Figure 8–7: TK Tape Drive

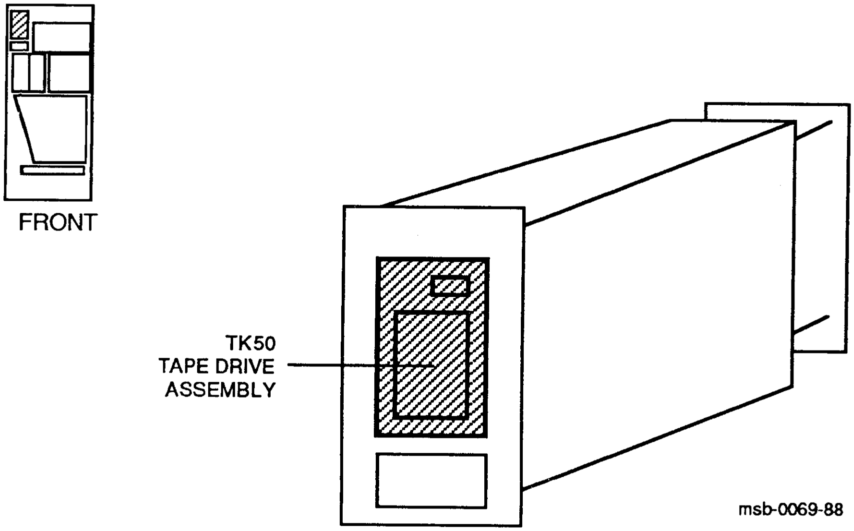


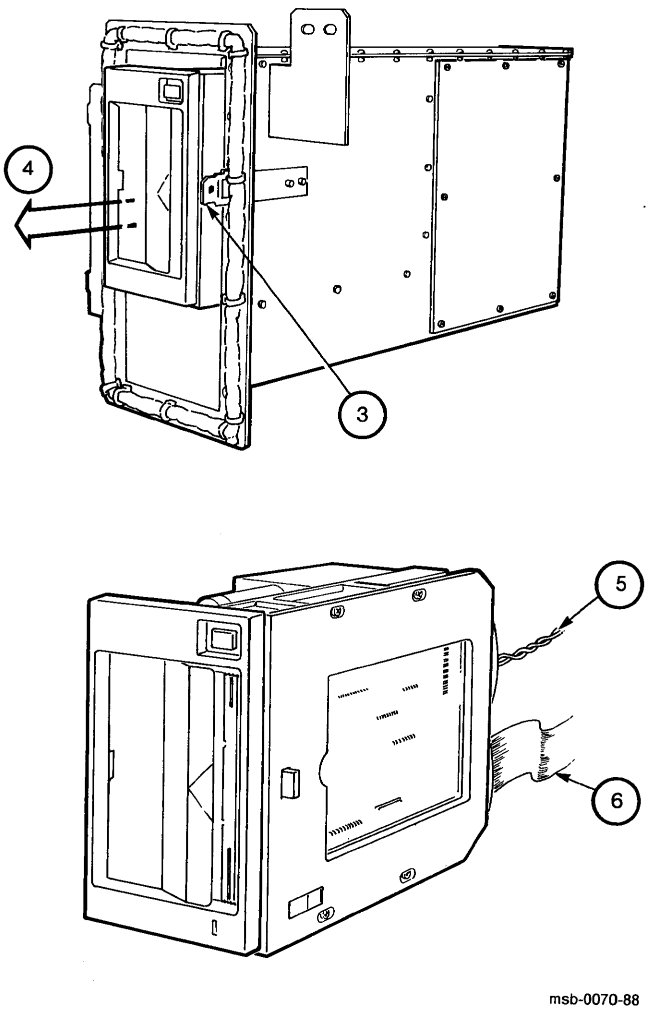
Table 8-4: TK Tape Drive Assembly Specifications

Parameter	Description
Part Number:	TK50-AA
Location:	Upper left front, housed in the system control assembly
Dimensions:	3.75" W x 6.25" H x 8.25" D
Weight:	5 lbs
Power:	One power cord 17-01817-01 to the system control assembly, which connects to 17-01814-01 leading to the TBK50 adapter in the VAXBI
Cable:	One signal cord 17-01813-01 from connector J7 to the filter board
Service From:	Front of cabinet, door removed
Tools Required:	None
Subassemblies:	None
Diagnostics:	Load light on TK50 lights (red)

8.8 TK Tape Drive Removal and Replacement

Working from the front of the cabinet, remove or replace the TK using the spring clip attached to the control assembly unit on the right. The TK has one power and one signal cable.

Figure 8-8: TK Tape Drive Removal



REMOVAL

1. Turn the control panel upper key switch to the Off position.
2. Open the front door.
3. Push the spring clip to the right (see Figure 8–8).
4. Pull the TK out toward you.
5. Holding the unit in your hand, disconnect power cord 17–01817–01 labeled P1.
6. Disconnect the signal cable 17–01813–01 at J7 on the TK50.

REPLACEMENT

- Reverse steps 1 through 6 above, being careful not to twist the signal cable.
- As you push the unit in, hold the signal cable flush to the left side of the unit so that the service loop remains untangled and is installed smoothly. Tuck the end loop in if it protrudes when the TK unit is installed.

8.9 Filter Board and TOY Clock Battery Specifications

The filter board and TOY clock battery are located on the inside floor of the control assembly in the upper left front of the cabinet. The battery is a 3-cell TOY clock battery, part number 12–19245–02, and it powers the time-of-year clock on the XTC power sequencer module. The filter board part number is 54–18547–01.

Figure 8–9: Filter Board and TOY Clock Battery

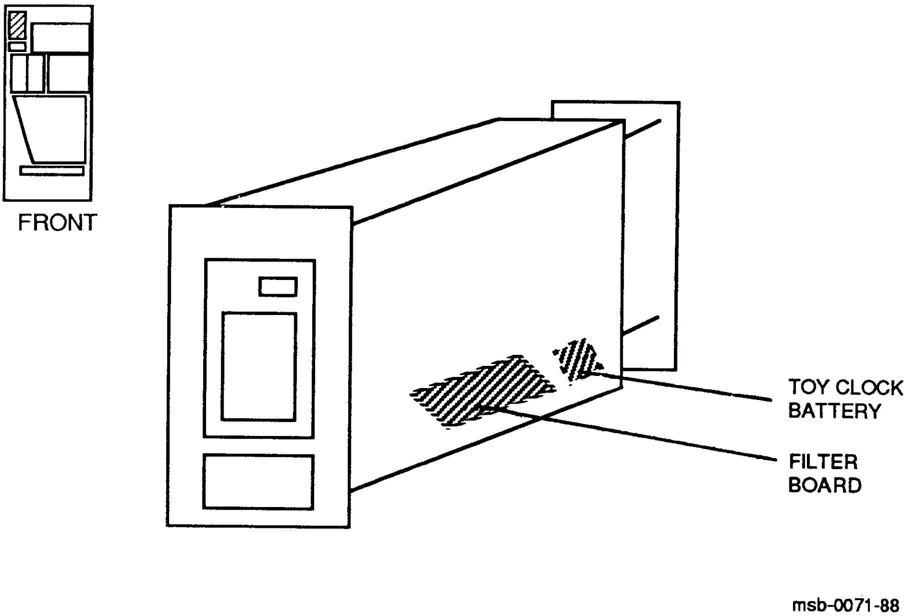


Table 8-5: Filter Board Specifications

Parameter	Description
Part Number:	54-18547-01
Location:	Inside of system control assembly
Dimensions:	3 1/4" x 5 1/4"
Weight:	Less than 1 lb
Cable:	17-01812-01 to XMI backplane 17-01813-01 to the TK50 tape drive
Service From:	Inside of system control assembly
Tools Required:	Large Phillips screwdriver
Diagnostics:	TK lights

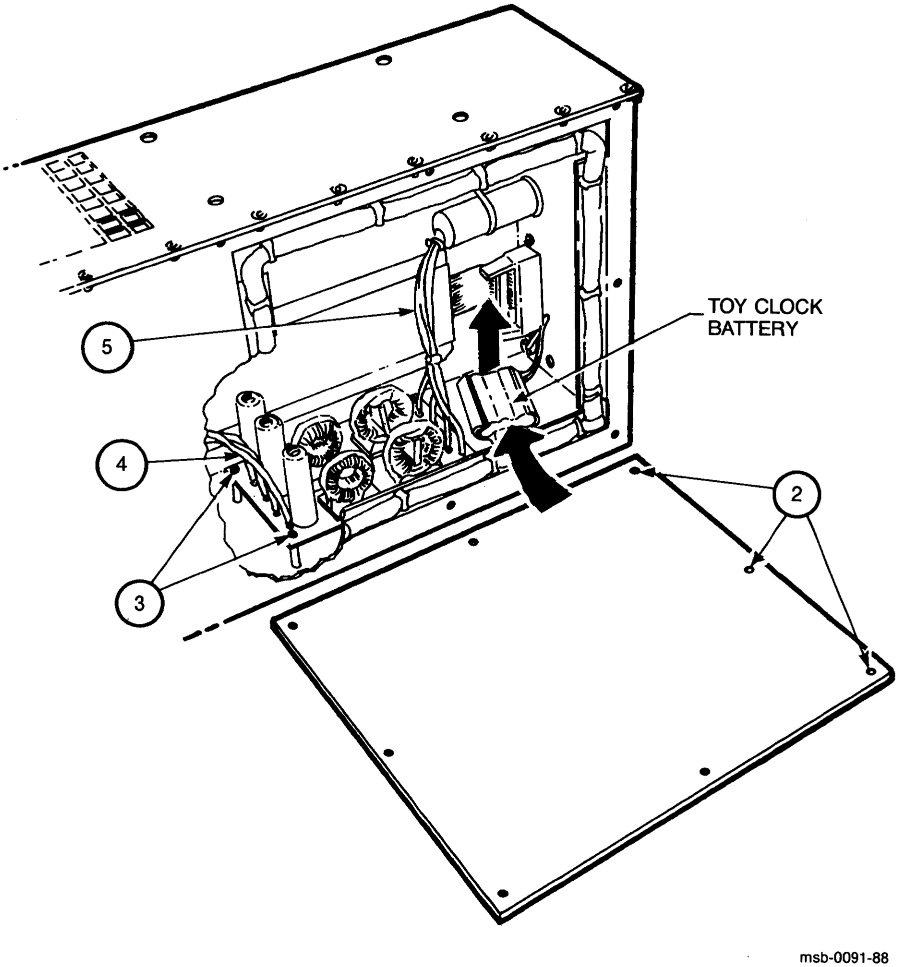
Table 8-6: TOY Clock Battery Specifications

Parameter	Description
Part Number:	12-19245-02
Location:	Inside of system control assembly
Dimensions:	1 3/4" x 1 1/2"
Weight:	Less than 1 lb
Power:	3-cell, 3.75V, .18mA
Cable:	Lead to XTC power sequencer
Service From:	Front of cabinet, door removed
Tools Required:	None
Diagnostics:	Time-of-year clock works

8.10 Filter Board and TOY Clock Battery Removal and Replacement

To remove or replace the filter board or the 3-cell time-of-year clock battery, first remove the system control assembly (see Section 8.2). Then remove the side panel of the system control assembly.

Figure 8-10: Filter Board and TOY Clock Battery Removal



REMOVAL

1. Remove the system control assembly (see Section 8.2).
2. Using a large screwdriver, unscrew the side panel of the system control assembly (see Figure 8-8).
3. Remove the screw from each corner of the filter board, using a large screwdriver.
4. Disconnect cable 17-01813-01 from J7 at the back of the TK50 tape drive.
5. Disconnect cable 17-01812-01 which leads to the XMI backplane. Working from the inside of the system control assembly, gently pull the cable through the ferrite bead at the rear of the system control assembly.
6. Lift the filter board up and out of the system control assembly.

REPLACEMENT

- Remove the system control assembly (see Section 8.2).
- Reverse steps 2 through 6 above.

To remove the battery, disconnect the 2-pin battery lead at J1 on the XTC power sequencer. Push the battery up and out of the plastic holder, pulling the lead through the system control assembly shielding.

To replace the battery, snap it into the holder and connect the lead at J1 on the XTC power sequencer.

Chapter 9
Power Subsystem

This chapter gives specifications and removal and replacement procedures for the power modules. Figure 9–1 shows a block diagram of the power subsystem design.

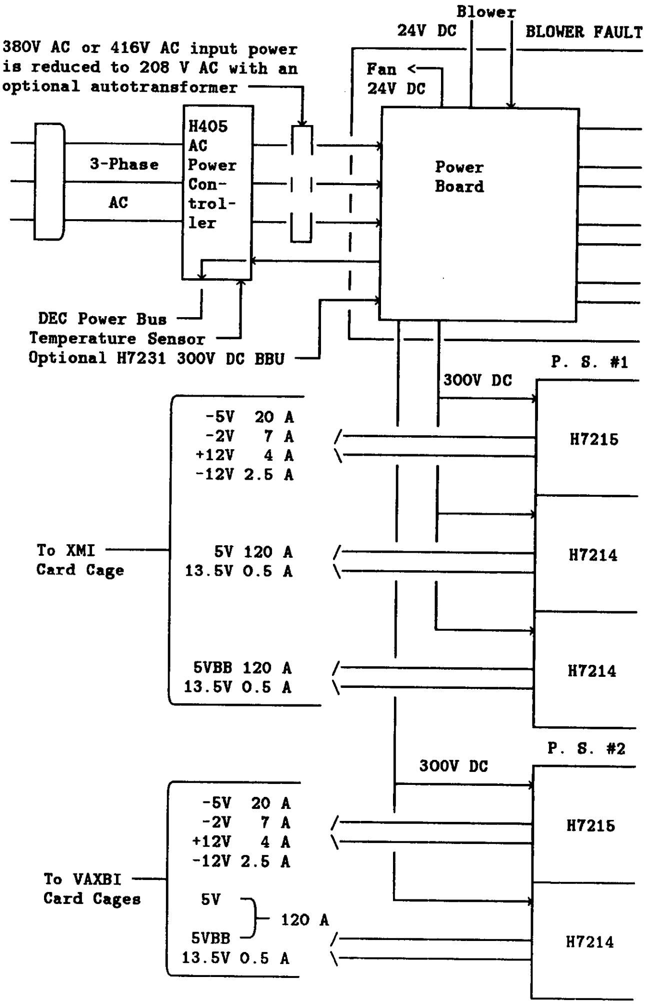
Sections in this chapter include:

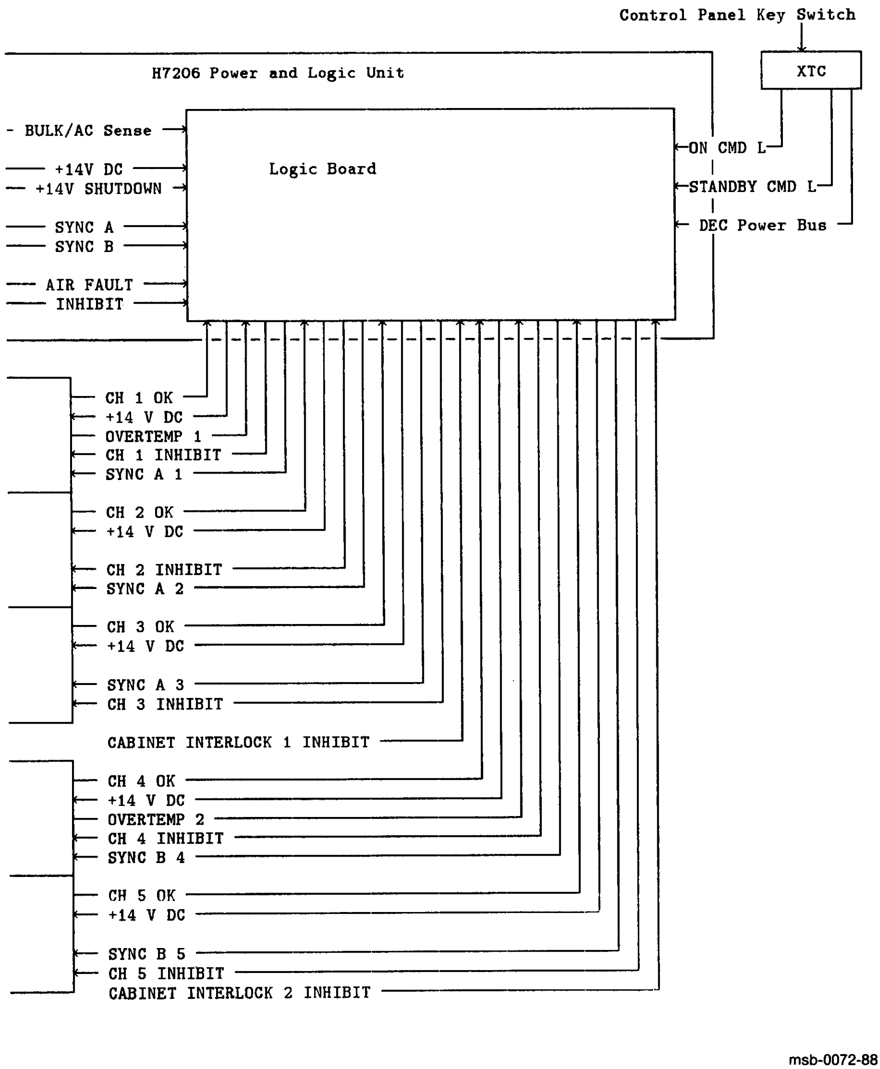
- Power Subsystem Design
- Power Specifications
- Power Modules
- H7214 Power Regulator
- H7214 Power Regulator Removal and Replacement
- H7215 Power Regulator
- H7215 Power Regulator Removal and Replacement
- H7206 Power and Logic Unit
- H7206 Power and Logic Unit Removal and Replacement
- H7206 Fan Removal and Replacement
- H405 AC Power Controller
- H405 AC Power Controller Removal and Replacement
- 50 Hz Transformer
- 50 Hz Transformer Removal and Replacement
- H7231–N Battery Backup Unit
- H7231–N Battery Backup Unit Removal and Replacement
- H7231–N Battery Backup Unit Installation

9.1 Power Subsystem Design

Figure 9–1 is a block diagram of the VAX 6200 power subsystem.

Figure 9–1: Power Subsystem Design




Control Panel Key Switch
XTC
H7206 Power and Logic Unit
Logic Board
- BULK/AC Sense
+14V DC
+14V SHUTDOWN
SYNC A
SYNC B
AIR FAULT
INHIBIT
ON CMD L
STANDBY CMD L
DEC Power Bus
CH 1 OK
+14 V DC
OVERTEMP 1
CH 1 INHIBIT
SYNC A 1
CH 2 OK
+14 V DC
CH 2 INHIBIT
SYNC A 2
CH 3 OK
+14 V DC
SYNC A 3
CH 3 INHIBIT
CABINET INTERLOCK 1 INHIBIT
CH 4 OK
+14 V DC
OVERTEMP 2
CH 4 INHIBIT
SYNC B 4
CH 5 OK
+14 V DC
SYNC B 5
CH 5 INHIBIT
CABINET INTERLOCK 2 INHIBIT
msb-0072-88

9.2 Power Specifications

Figure 9–2 shows the physical arrangement of the power regulators in the cabinet. Table 9–1 and Table 9–2 list the DC output voltages the power regulators supply to the XMI and VAXBI card cages. AC output specifications are listed in Table 9–3.

Figure 9–2: DC Power Regulators in Cabinet (Rear View)

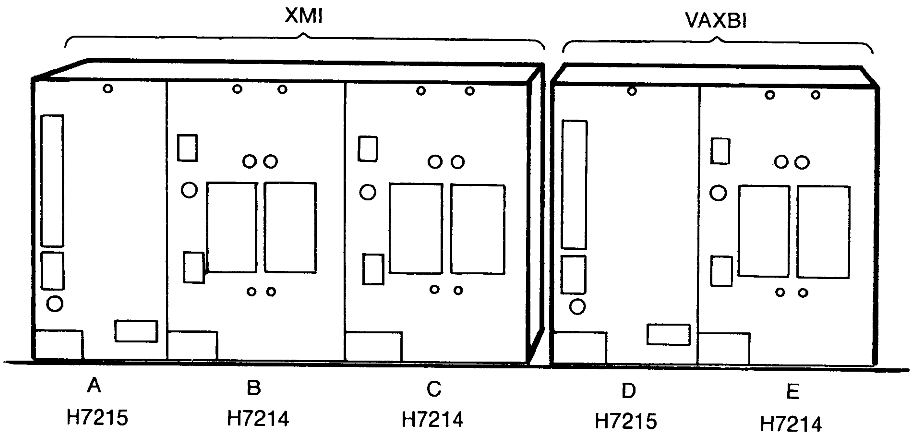


Table 9–1: XMI Side—DC Output Specifications

DC Voltage	Current	For:	From Regulator(s):
+12V	4 A	RS-232 and TK tape drive supply	A
-12V	2.5 A	RS-232 supply	A
-5V	20 A	ECL logic	A
-2V	7 A	ECL logic	A
+5V	120 A	Logic supply	B
+13.5V	0.5 A	Ethernet transceiver B	B
+5VBB	120 A	Memory supply	C
+13.5V	0.5 A	Ethernet transceiver C	C

Table 9-2: VAXBI Side—DC Output Specifications

DC Voltage [1]	Current	For:	From Regulator(s):
+12V	4 A	RS-232 and TK tape drive supply	D
-12V	2.5 A	RS-232 supply	D
-5V	20 A	ECL logic	D
-2V	7 A	ECL logic	D
+5V	120 A	Logic supply	E
+5VBB	120 A	Memory supply	E
+13.5V	0.5 A	Ethernet transceiver E	E

[1]The H7206 power and logic unit supplies 24VDC at 0-4 amps to the blowers and airflow sensor.

Table 9-3: AC Output Specifications

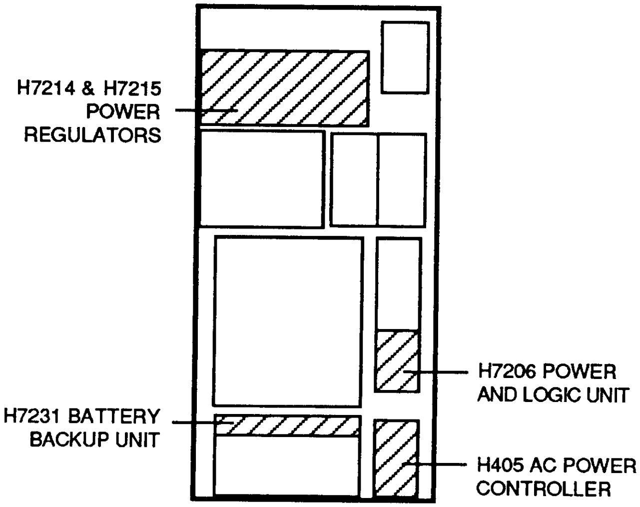
Type	For:
Two switched external IEC 320 receptacles fused at 10 amps [1]	Reserved
One unswitched internal IEC 320 receptacle fused at 2 amps	H7231-N battery backup option

[1]These receptacles are not included on some systems.

9.3 Power Modules

Most of the power modules can be seen from the rear of the cabinet.

Figure 9–3: Location of Power Modules (Rear View)



Power modules are listed in Table 9-4.

Table 9–4: Power Modules

Part Number	Module	Quantity	60 Hz System	50 Hz System
H7214	Power regulator	3	X	X
H7215	Power regulator	2	X	X
H7206	Power and logic unit	1	X	X
H7231-N	Battery backup unit	1	X	X
H405-E	AC power controller	1	X	-
H405-F	AC power controller	1	-	X
16-28393-01	50 Hz transformer	1	-	X

9.4 H7214 Power Regulator

The system has three H7214 power regulators; two supply power to the XMI backplane and one supplies power to the VAXBI backplane. Each power regulator can also supply +13.5V to an Ethernet transceiver. The regulators are located in the upper part of the cabinet.

Figure 9–4: H7214 Power Regulators

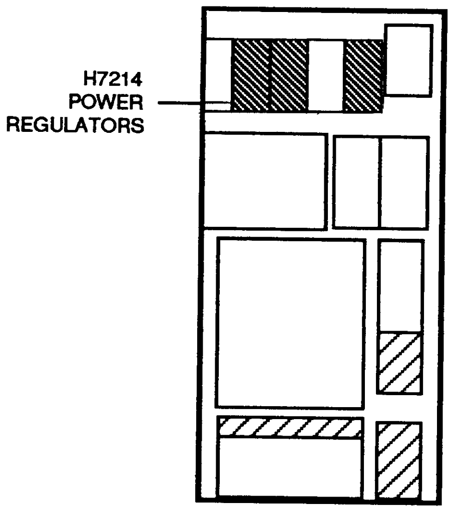


Table 9–5: H7214 Power Regulator Specifications

Parameter	Description
Part Number:	H7214
Location:	Upper part of cabinet
Dimensions:	6″ H x 4.5″ W x 12″ D
Weight:	8 lbs
Cables for XMI:	17-01497-02 control/status cable, 34-pin connector 17-01446-01 bulk power cable 17-01525-01 remote sense cable +13.5V output cable, 2-pin connector (part of Ethernet cable 17-01496-01) +5VDC and -5VDC leads attached to XMI bus bar assembly
Cables for VAXBI:	17-01666-01 control/status cable, 24-pin connector, to H7206 power and logic unit 17-01447-01 bulk power cable to H7206 power and logic unit 17-01525-01 remote sense cable to VAXBI bus bar +13.5V output cable, 2-pin Mate-N-Lok connector (part of 17-01496-01 Ethernet cable) +5VDC and -5VDC leads attached to VAXBI bus bar assembly
Service From:	Front and rear of cabinet, doors open
Tools Required:	Flat screwdriver
Diagnostics:	Green LED lights when +5V output is within regulation

The H7214 power regulator develops two regulated DC outputs: +5V used to power system logic and memory loads, and the +13.5V, available for an Ethernet transceiver.

Each H7214 has one green LED that is visible from the rear of cabinet. The LED lights to indicate that the +5V output is properly regulated.

NOTE: *The green LED does not indicate the status of the +13.5V Ethernet output.*

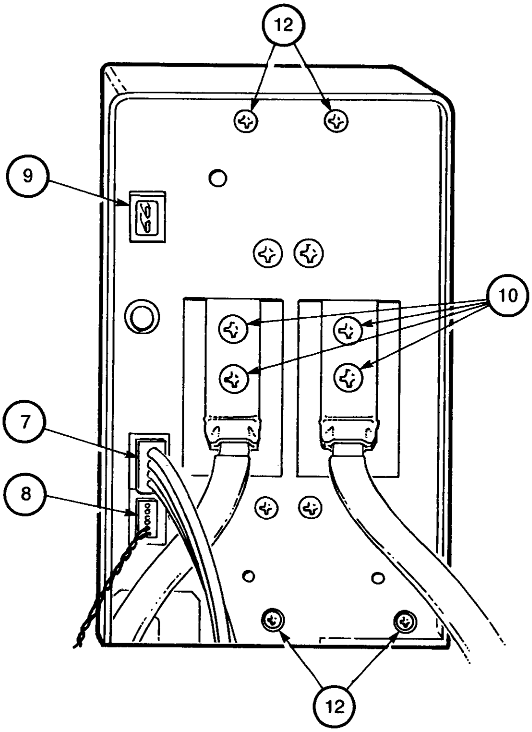
The power regulator consists of a single printed circuit board mounted on a right-angle bracket. The bracket has guiding edges for use when inserting the regulator into the cabinet.

9.5 H7214 Power Regulator Removal and Replacement

Working mainly from the rear of the cabinet, remove or replace the H7214 power regulator using a flat screwdriver. The assembly has five screws, one control/status cable, one remote sense cable, and two power bus bar leads.

WARNING: *High voltages are present in the H7214 power regulator. After power has been removed, wait at least 2 minutes before working on the unit.*

Figure 9–5: H7214 Power Regulator Removal



REMOVAL

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the main circuit breaker on the AC power controller to the Off position.
4. Open the front and rear doors.
5. At the front of the cabinet, disconnect the bulk power cord by releasing the fastener clip and pulling. On the XMI side, cable 17-01446-01 is disconnected from J3. On the VAXBI side, cable 17-01447-01 is disconnected from J3.
6. At the front of the cabinet, loosen the one captive screw securing the regulator.
7. At the rear of the cabinet, disconnect the control/status cable by releasing the fastener clip and pulling (see Figure 9-5). On the XMI side, cable 17-01497-02 is disconnected from J1. On the VAXBI side, cable 17-01666-01 is disconnected from J1.
8. Disconnect the 17-01525-01 remote sense cable from J4 .
9. Disconnect the +13.5V cord [part of 17-01496-01] from J2 (if Ethernet connection is present).
10. Disconnect the bus bar leads by removing the four screws.
11. Work the bus bar leads down into the XMI service area.
12. Using a flat screwdriver, loosen the four slotted screws.
13. Support the bottom of the H7214 as you pull it from the cabinet.

REPLACEMENT

- Reverse steps 1 through 13 above.

NOTE: *Make sure that the lugs connecting the bus bar leads do not contact the sheet metal bracket around the mounting points.*

The H7214 ground reference wire is connected to the regulator's circuit board and return bus bar by a screw and washer. Make sure the wire is intact and properly connected. Tuck the wire out of the way when inserting the regulator into the machine.

9.6 H7215 Power Regulator

The system has two H7215 power regulators, one for the XMI card cage and one for the VAXBI card cages. They are located in the upper part of the cabinet, along with the H7214 power regulators.

Figure 9–6: H7215 Power Regulators

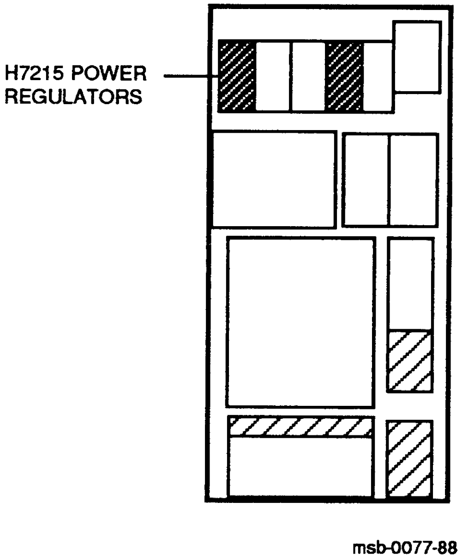


Table 9-6: H7215 Power Regulator Specifications

Parameter	Description
Part Number:	H7215
Location:	Upper part of cabinet
Dimensions:	6″ H x 3.5″ W x 12″ D
Weight:	5 lbs
Cables for XMI:	17-01446-01 bulk power cable from H7206, 3-pin connector 17-01497-02 control/status cable from H7206, 10-pin connector for signals and 2-pin Mate-N-Lok connector for interlock switch 17-01566-01 power distribution cable to XMI, 32-pin connector
Cables for VAXBI:	17-01447-01 bulk power cable for H7206, 3-pin connector 17-01666-01 control/status cable from H7206, 10-pin connector for signals and 2-pin Mate-N-Lok connector for the interlock switch 17-01523-01 power distribution cable to VAXBI, 32-pin connector
Service From:	Front and rear of cabinet, doors open
Tools Required:	Flat screwdriver
Diagnostics:	Green LED lights when voltages are in regulation

The H7215 develops four regulated DC output voltages: -5V and -2V for ECL devices and +12V and -12V for communications devices and the TK tape drive.

The H7215 has a thermal sensor. If the H7215 overheats on the XMI side, an OVER TEMP signal is sent to the H7206 logic board. The H7206 will then inhibit all regulator outputs to the XMI. The same is true for the regulators on the VAXBI side.

Each regulator has a green LED that lights to indicate when all four output voltages are in regulation. The LEDs are visible from the rear of the cabinet.

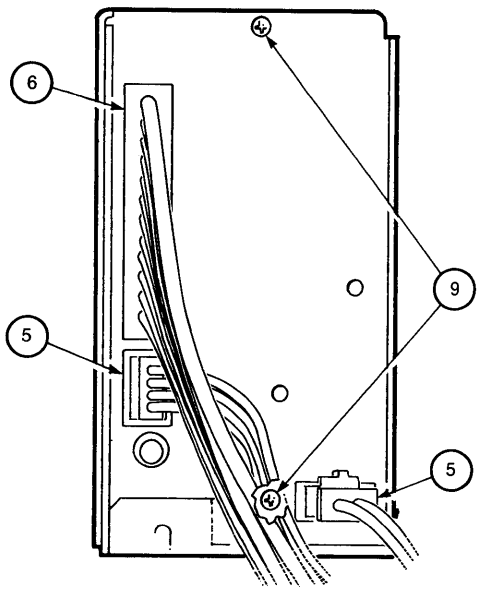
The power regulator consists of a single printed circuit board mounted on a right-angle bracket. The bracket has guiding edges for use when inserting the regulator into the system.

9.7 H7215 Power Regulator Removal and Replacement

Working mainly from the rear of the cabinet, remove or replace the H7215 power regulator using a flat screwdriver. The assembly has three captive screws, one control/status cable, and two power cables.

WARNING: *High voltages are present in the H7215 power regulator. After power has been removed, wait at least 2 minutes before working on the unit.*

Figure 9–7: H7215 Power Regulator Removal



REMOVAL

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the main circuit breaker on the AC power controller to the Off position.
4. Open the front and rear doors.
5. Working from the rear of the cabinet, disconnect the control/status cable by pulling out the 10-pin connector at J2 and the 2-pin Mate-N-Lok connector at INTERLOCK. On the XMI side, cable 17-01497-02 is disconnected. On the VAXBI side, cable 17-01666-01 is disconnected.
6. Remove the cable retainer and disconnect the power distribution cable from J3. (Note that this 32-pin connector is keyed.) On the XMI side, cable 17-01566-01 is disconnected. On the VAXBI side, cable 17-01523-01 is disconnected.
7. At the front of the cabinet, disconnect the bulk power cable from J1. This cable has a 3-pin Mate-N-Lok connector. On the XMI side, cable 17-01446-01 is disconnected. On the VAXBI side, cable 17-01447-01 is disconnected.
8. At the front of the cabinet, loosen the one captive screw securing the H7215.
9. At the rear of the cabinet, use a flat screwdriver to loosen the screws at the top and bottom of the power regulator.
10. Support the bottom of the H7215 as you pull it out of the cabinet.

REPLACEMENT

- Reverse steps 1 through 10 above.
- Be sure to position the power regulator on the guide rail when you insert it into the cage.
- Note the gray dot on the control/status cable connector. When installing this cable, make sure the dot is on the top side.

9.8 H7206 Power and Logic Unit

9.8.1 Specifications

The H7206 power and logic unit is located in the lower right rear of the cabinet, just above the H405 AC power controller.

NOTE: *The early version of the H7206 power and logic unit does not support battery backup operation.*

Figure 9–8: H7206 Power and Logic Unit

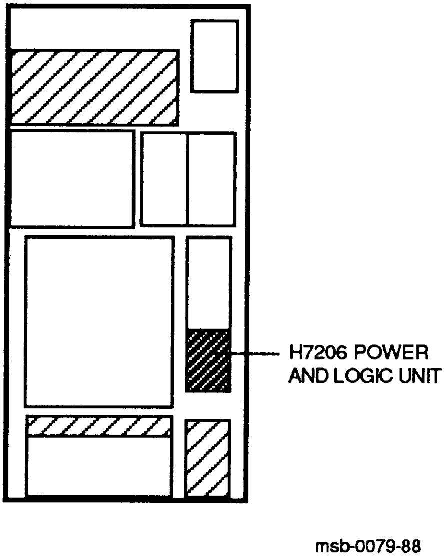


Table 9-7: H7206 Power and Logic Unit Specifications

Parameter	Description
Part Number:	H7206
Location:	Lower right rear of cabinet, just above the H405 AC power controller
Dimensions:	5″ H x 5″ W x 20.5″ D
Weight:	13 lbs
Cables:	17-00962-01 to battery backup unit 70-20369-2F to battery backup unit 17-01498-01 to XTC module 17-01549-01 DEC power bus cable to H405 AC power controller 17-01569-01 AC/DC OK to DWMBA/B module 17-01666-01 control/status to regulators on VAXBI side 17-01497-02 control/status to regulators on XMI side 17-01447-01 bulk power to regulators on VAXBI side 17-01446-01 bulk power to regulators on XMI side 17-01570-01 power to front and rear blowers 17-01501-01 input from AC power controller
Service From:	Rear of cabinet, door open
Tools Required:	Flat screwdriver
Diagnostics:	AC input and power regulator indicator lights will light

The H7206 power and logic unit contains the fan/power and logic modules.

The fan/power module functions are:

- AC to 300VDC conversion
- 24VDC to blowers
- DEC power bus logic
- Control panel key switch interface

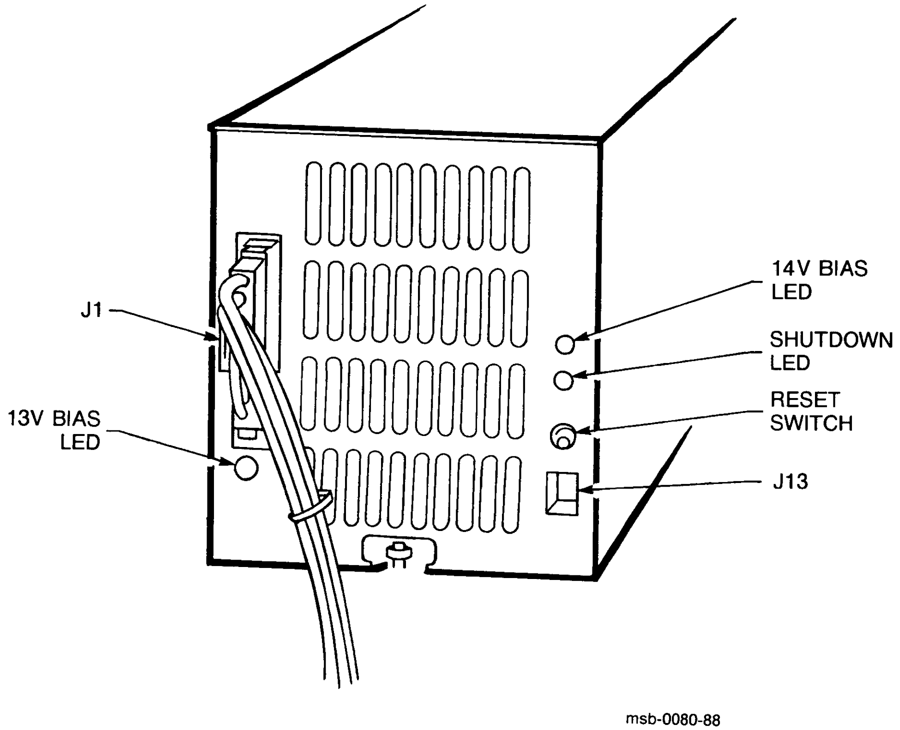
The logic module functions are:

- AC OK and DC OK control for system
- Battery backup unit control logic
- Door interlock logic

9.8.2 H7206 Power and Logic Unit Switches and Indicators

The H7206 power and logic unit has three indicators and one reset switch, visible from the front of the cabinet.

Figure 9–9: H7206 Power and Logic Unit Switches and Indicators



The power and logic unit consists of an AC to DC rectifier and filter, a fan/power module, and a logic module. The unit has three indicator LEDs and one reset switch.

The green +13V bias LED lights to indicate when the bias supply on the fan/power module is working.

WARNING: *When the +13V bias LED is unlit, do not assume that the 300V bulk supply is deenergized. This LED does not indicate the presence or absence of the 300V bulk supply.*

The green +14V bias LED lights to indicate that the bias supply is available to the logic board.

When lit, the red shutdown LED indicates a partial or complete power shutdown. Power shutdowns occur when there is an overtemperature condition, the VAXBI or XMI access door is open, or airflow in the cabinet is inadequate.

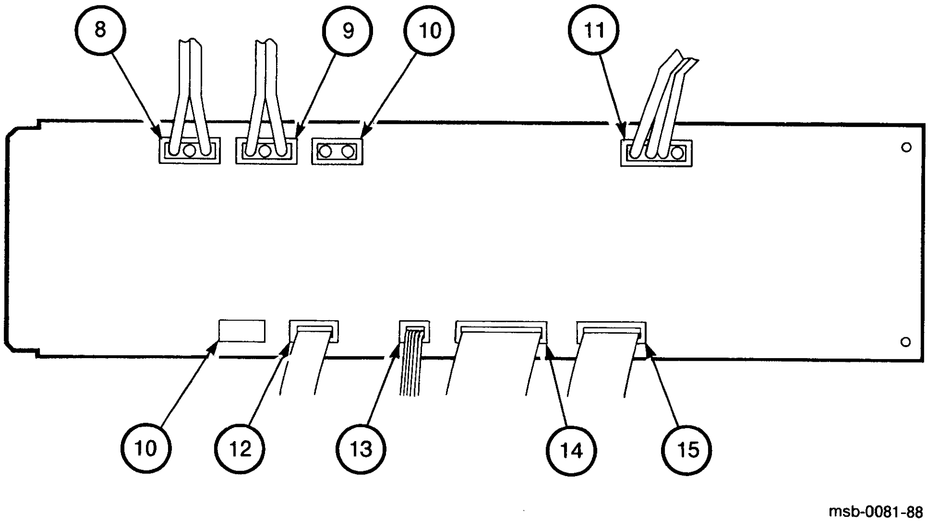
After determining the cause of the power shutdown, restart the system using the front control panel. The red shutdown LED should go off when the system is restarted.

9.9 H7206 Power and Logic Unit Removal and Replacement

Remove or replace the H7206 power and logic unit using a flat screwdriver. The assembly is held in place by six hex screws. There are 11 cables. You may want to mark the cables when removing them to simplify reconnection. If you cannot disconnect some cables from the front of the machine, remove the plenum to access the connectors (see Section 10.7).

WARNING: *High voltages are present in the H7206 power and logic unit. After power has been removed, wait at least 2 minutes before working on the unit.*

Figure 9–10: H7206 Power and Logic Unit Removal (Top View)



REMOVAL

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the main circuit breaker on the AC power controller to the Off position.
4. Unplug the machine.
5. Open the front and rear doors.
6. Working from the front of the cabinet, disconnect the 17-01501-01 AC input cable from J1 (see Figure 9–9).
7. Disconnect the 17-01549-01 DEC power bus cable from J13.
8. Disconnect the 17-01447-01 bulk power cable from J3 (see Figure 9–10).
9. Disconnect the 17-01446-01 bulk power cable from J4.
10. If the system has a H7231–N battery backup unit, disconnect the 70-20396-2F cable from J6 and the 17-00962-01 cable from J12.
11. Disconnect the 17-01570-01 blower cable from J2.
12. Disconnect the 17-01498-01 XTC cable from J16.
13. Disconnect the 17-01569-01 AC/DC OK cable from J11.
14. Disconnect the 17-01666-01 control/status cable from J9.
15. Disconnect the 17-01497-02 control/status cable from J14.
16. Working from the rear of the cabinet, use a flat screwdriver to remove the six hex screws.
17. Slide the unit out of the cabinet.

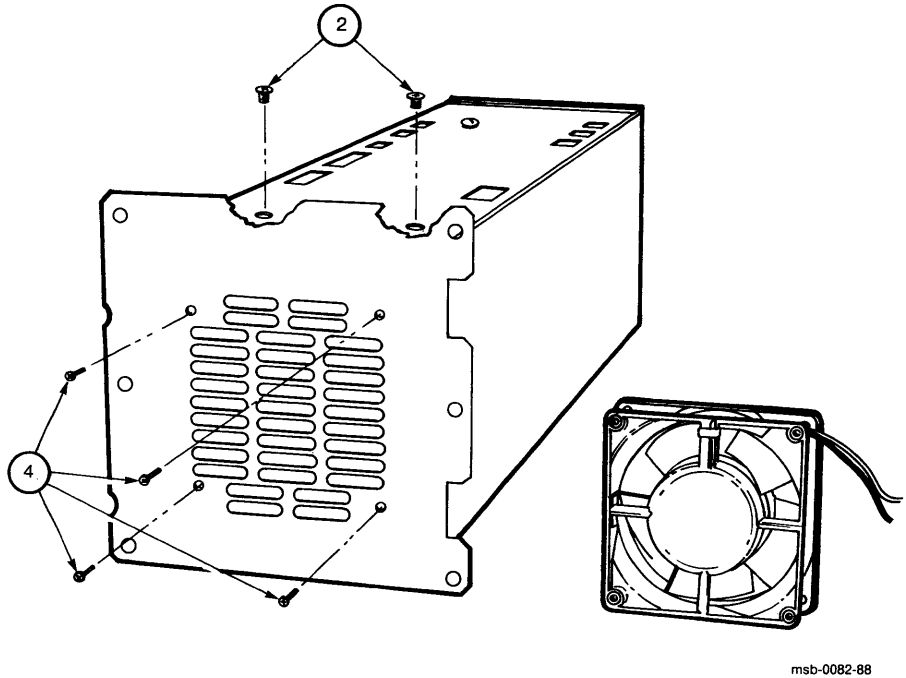
REPLACEMENT

- Reverse steps 1 through 17 above.
- When reinstalling the unit, make sure the locating tang on the front end of the unit engages the locating stud on the front shelf.

9.10 H7206 Fan Removal and Replacement

Remove the H7206 power and logic unit's top cover to access the fan (part number 12-24701-06). There are six screws and one cable. Use a flat screwdriver and a small Phillips screwdriver to remove the fan.

Figure 9-11: H7206 Fan Removal



REMOVAL

1. Remove the power and logic unit from the cabinet (see Section 9.9).
2. Using a flat screwdriver, remove the top cover by removing two screws (see Figure 9–11).
3. Disconnect the fan cable from J8 on the power/fan module by pulling out the 2-pin connector.
4. Using a small Phillips screwdriver, remove the four screws that attach the fan to the rear panel of the power and logic unit.
5. Remove the fan.

REPLACEMENT

Reverse steps 1 through 5 above.

The fan is powered by the same +24VDC used to run the main system blowers. There is no fault indication if the fan stops.

When the cabinet doors are open, the power and logic unit depends entirely on its internal fan for cooling. When working on the machine, make visual checks to see if the fan is operating.

9.11 H405 AC Power Controller

The H405 AC power controller is located in the right lower rear corner of the cabinet. The assembly comes in two models: the H405–E for 60 Hz systems and the H405–F for 50 Hz systems.

Figure 9–12: H405 AC Power Controller

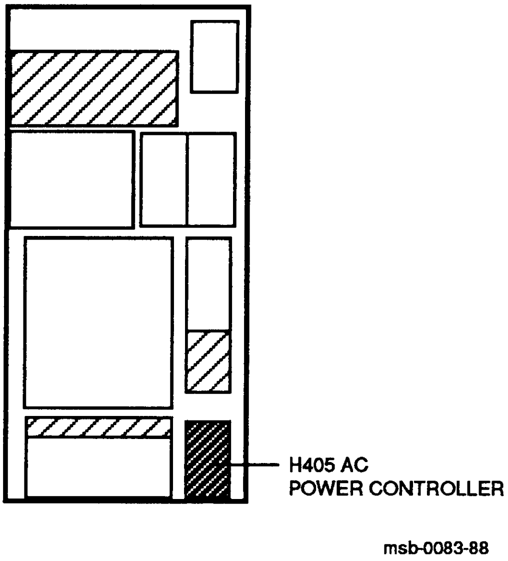


Table 9-8: H405 AC Power Controller Specifications

Parameter	Description
Part Number:	H405-E (60 Hz) H405-F (50 Hz)
Location:	Lower right rear corner of cabinet
Dimensions:	12.0 in. H x 7.5 in. W x 15 in. D
Weight:	34 lbs
Cables:	17-01501-01 AC input to power and logic unit 17-01549-01 DEC power bus to H7206 power and logic unit 17-01815-01 to 50 Hz transformer 17-00365-03 to battery backup unit 17-00365-03 to disks 17-01844-01 to temperature sensor
Service From:	Rear of cabinet, door open
Tools Required:	Large Phillips and flat screwdrivers
Diagnostics:	Three power phase indicator lights on the H405-E will light to indicate that three-phase power is present at power-up

In 60 Hz systems, the H405-E AC power controller routes 3-phase, 208VAC power to the output connector J2, used to connect power to the H7206 power and logic unit. For 50 Hz systems, the same output is first routed to the transformer (part number 16-28393-01) which lowers the phase voltages to the required input range of the H7206.

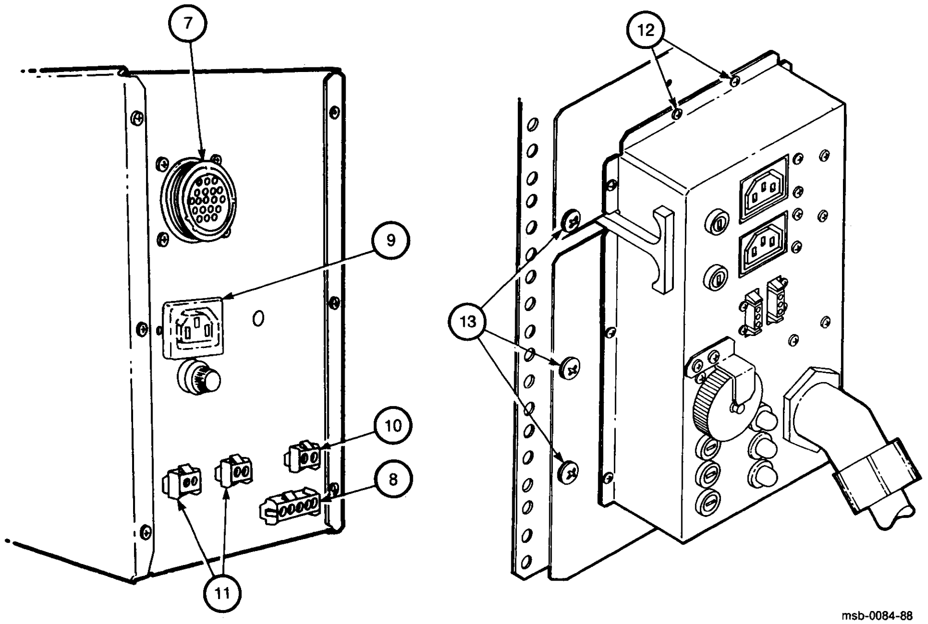
The H405 AC power controller monitors the state of the cabinet thermostat mounted at the top of the cabinet. The thermostat is a normally closed thermal switch. The H405 also monitors the sense switch integral to the main circuit breaker. The sense switch is normally closed when the circuit breaker is in the On position.

If the thermal switch opens (overtemperature condition) or the sense switch opens (main circuit breaker is Off), the H405 removes power from the cabinet by open circuiting its output signal, Fail Safe Enable. The battery backup unit, if included, is also disabled from delivering its 250VDC source to the H7206 power and logic unit.

9.12 H405 AC Power Controller Removal and Replacement

Working mainly from the rear of the cabinet, remove or replace the H405 AC power controller using a large Phillips screwdriver. The assembly has six captive screws and seven cables.

Figure 9–13: H405 AC Power Controller Removal



WARNING: *The H405 AC power controller is heavy. Exercise caution in lifting and moving this unit.*

REMOVAL

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the main circuit breaker on the AC power controller to the Off position.
4. Unplug the machine.
5. Push in the main circuit breaker and then pull it to the Off position to remove any residual current.
6. Open the front and rear doors.
7. Working from the front of the cabinet, disconnect the 17-01501-01 AC input cable from J2 by twisting the black connector ring counterclockwise. If the system has a 50 Hz transformer, disconnect the 17-01815-01 cable from J2 (see Figure 9–13).
8. Disconnect the 17-01549-01 DEC power bus cable from J1.
9. If the power system includes an H7231-N battery backup unit, disconnect the 17-00365-03 cable from J5.
10. Disconnect the 17-01844-01 temperature sensor cable from J9.
11. Disconnect the 17-01833-01 fail safe enable cable from J6 and J7.
12. At the rear of the cabinet, use a flat screwdriver to remove the two hex screws at the top of the subassembly.
13. Using a large Phillips screwdriver, remove the six screws that hold the AC power controller in place.
14. Pull the AC power controller toward you and remove it.

REPLACEMENT

- Reverse steps 1 through 14 above.

NOTE: *Route the 17-01844-01 and 17-01833-01 cables away from the transformer (50 Hz systems only).*

9.13 50 Hz Transformer

A transformer is required for 50 Hz systems. The transformer is located on the floor of the cabinet, directly below the power and logic unit.

Figure 9–14: 50 Hz Transformer (Front View)

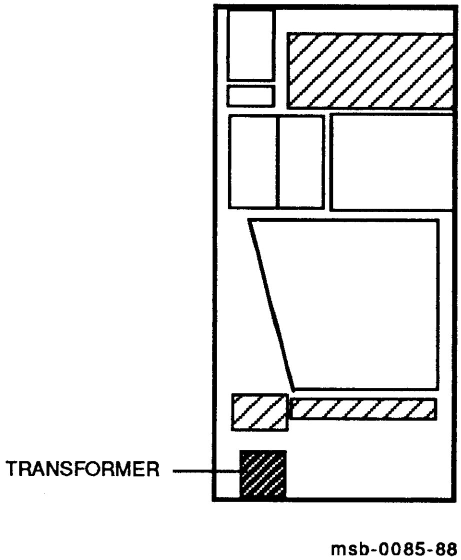


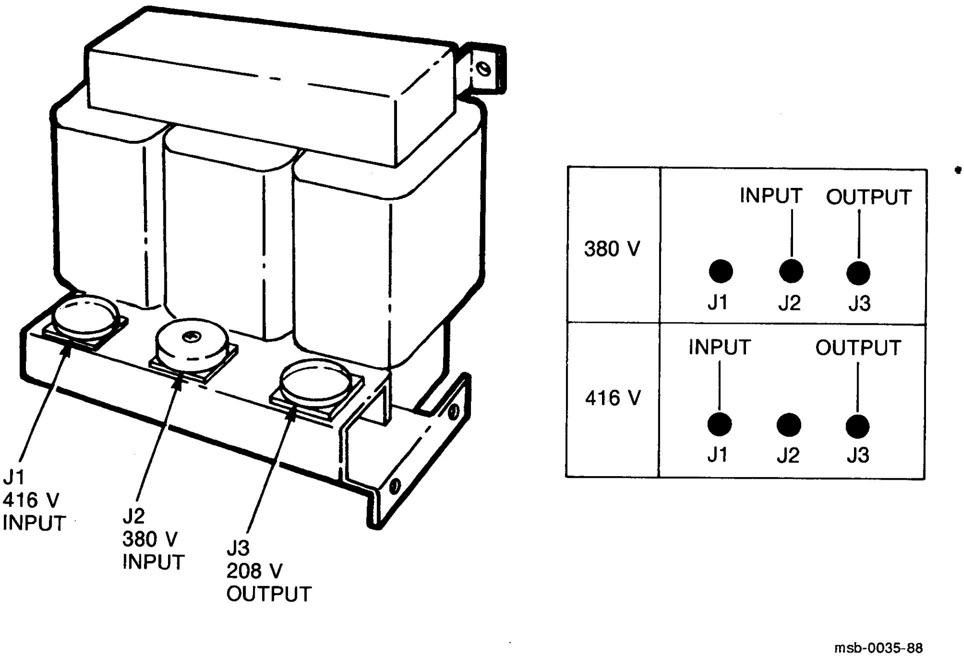
Table 9–9: 50 Hz Transformer Specifications

Parameter	Description
Part Number:	16-28393-01
Location:	Lower left front of cabinet
Dimensions:	6.5″ H x 6″ W x 10″ D
Weight:	40 lbs
Cables:	18-01815-01 to H405-F AC power controller 17-01501-01 to H7206 power and logic unit
Service From:	Front of cabinet, door open
Tools Required:	Flat screwdriver

9.14 50 Hz Transformer Removal and Replacement

Working from the front of the cabinet, remove the transformer using a flat screwdriver. The transformer has six screws and two power cables.

Figure 9–15: 50 Hz Transformer Removal



WARNING: *To avoid high voltage shock, a round, threaded cap is provided to cover the unused inlet connector. When replacing, rewiring, or reconnecting the transformer, make sure that the cap is properly installed. The cap fits onto either the 380V (J2) or the 416V (J1) inlet connector.*

REMOVAL

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the main circuit breaker on the AC power controller to the Off position.
4. Unplug the machine.
5. At the front of the cabinet, use a flat screwdriver to remove the six #10-32 screws securing the sheet metal panel. This panel is located below the power and logic unit.
6. Disconnect the 17-01815-01 power input cable from J1 (416V) or J2 (380V). See Figure 9–15.
7. Disconnect the 17-01501-01 power output cable from J3.
8. Remove the six screws that attach the transformer to the cabinet rails.
9. Remove the transformer.

REPLACEMENT

- Reverse steps 1 through 9 above.

9.15 H7231–N Battery Backup Unit

The optional H7231–N battery backup unit supplies 300V power to the system upon power failure. It is located in the horizontal mounting space just below the system blower, and to the left of the power and logic unit as viewed from the rear of the cabinet.

Figure 9–16: H7231–N Battery Backup Unit

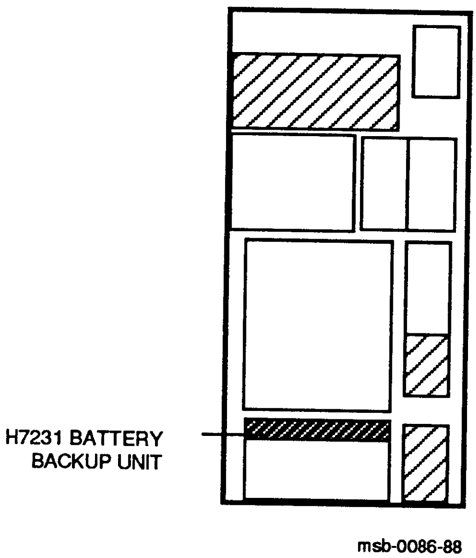


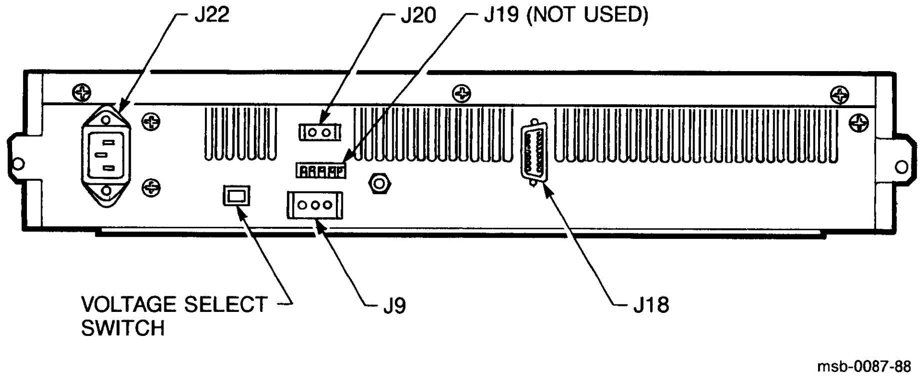
Table 9–10: H7231-N Battery Backup Unit Specifications

Parameter	Description
Part Number:	H7231-N
Location:	Lower third of cabinet, just below the system blower and next to the H7206 power and logic unit
Dimensions:	3″ H x 17″ W x 15″ D
Weight:	35 lbs
Cables:	17-00962-01 control /status cable to power and logic unit 17-01833-01 fail safe enable cable to AC power controller 70-20396-2F power cable to power and logic unit 17-00365-03 AC line to AC power controller
Service From:	Front and rear of cabinet, doors open
Tools Required:	3/8″ nutdriver, flat screwdriver, pliers

9.16 H7231–N Battery Backup Unit Removal and Replacement

Working from the front and rear of the cabinet, remove or replace the H7231–N battery backup unit using a flat screwdriver. The assembly has two screws and four cables.

Figure 9–17: H7231–N Battery Backup Unit Removal



WARNING: *The H7231-N battery backup unit is heavy. Exercise caution when lifting or moving this unit.*

REMOVAL

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the main circuit breaker on the AC power controller to the Off position.
4. Unplug the machine.
5. Push in the main circuit breaker and then pull it to the Off position again to remove any residual current.
6. Open the front and rear doors.
7. If necessary, remove the air intake grill and plenum to access the cable connections (see Section 10.7).
8. Using a flat screwdriver, remove the two screws that attach the 17-00962-01 control/status cable to J18.
9. Disconnect the 70-20396-2F power cable from J9. Using a 3/8 inch nutdriver, disconnect the ground strap.
10. Disconnect the 17-00365-03 AC line cable from J22.
11. Disconnect the 17-01833-01 fail safe enable cable from J20.
12. At the front of the cabinet, use a 3/8 inch nutdriver to remove the two nuts that secure the battery backup unit in its mounting bracket.
13. Slide the battery backup unit toward you and lift it out of the mounting bracket.

REPLACEMENT

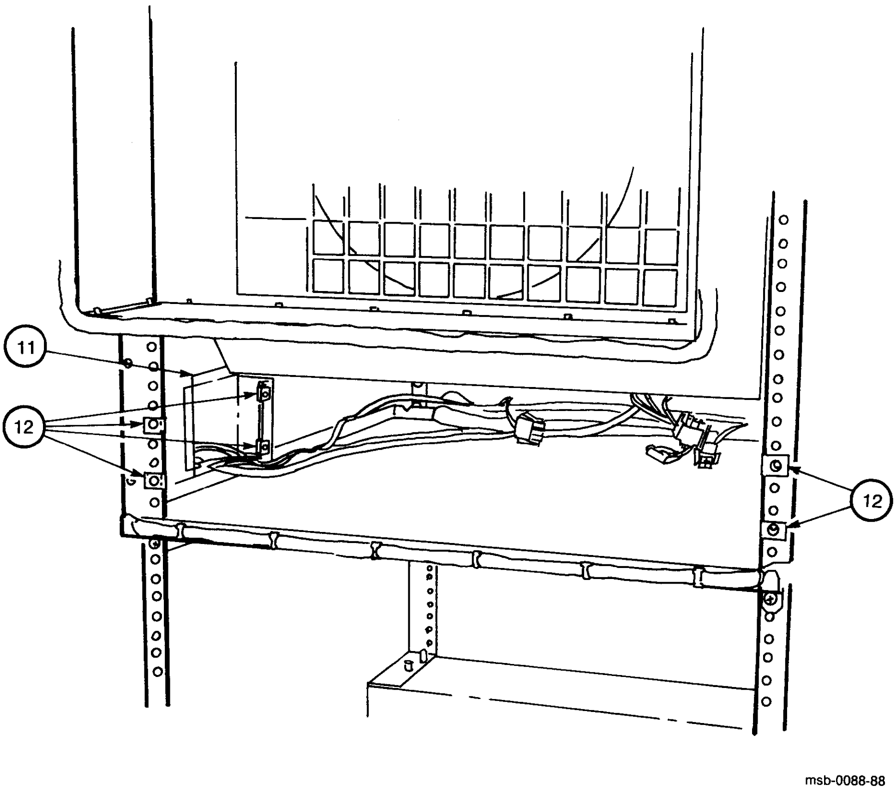
- Reverse steps 1 through 13 above.

9.17 H7231-N Battery Backup Unit Installation

The H7231-N battery backup unit is a field-installable option. The unit, mounting bracket, hardware, and cables are included in the H7231-P Installation Kit. First connect and route the four cables. Then install the mounting bracket. Finally, install the battery backup unit and set the two voltage select switches.

NOTE: *Before installing the battery backup unit, verify that the system's H7206 power and logic unit supports battery backup operation by checking the unit's revision level. The revision level should be E6 or above.*

Figure 9-18: Battery Backup Unit Cable Installation



9.17.1 Install the Battery Backup Unit Cables

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the main circuit breaker on the AC power controller to the Off position.
4. Unplug the machine.
5. Push in the main circuit breaker and then pull it toward you to remove any residual current.
6. Open the front and rear doors.
7. Connect the 17-00365-03 AC input cable to J5 on the H405 AC power controller (see Figure 9–13).
8. Connect the 17-00962-01 cable to J12 on the H7206 power and logic unit.
9. Connect the 70-20396-2F cable to J6 on the H7206 power and logic unit.

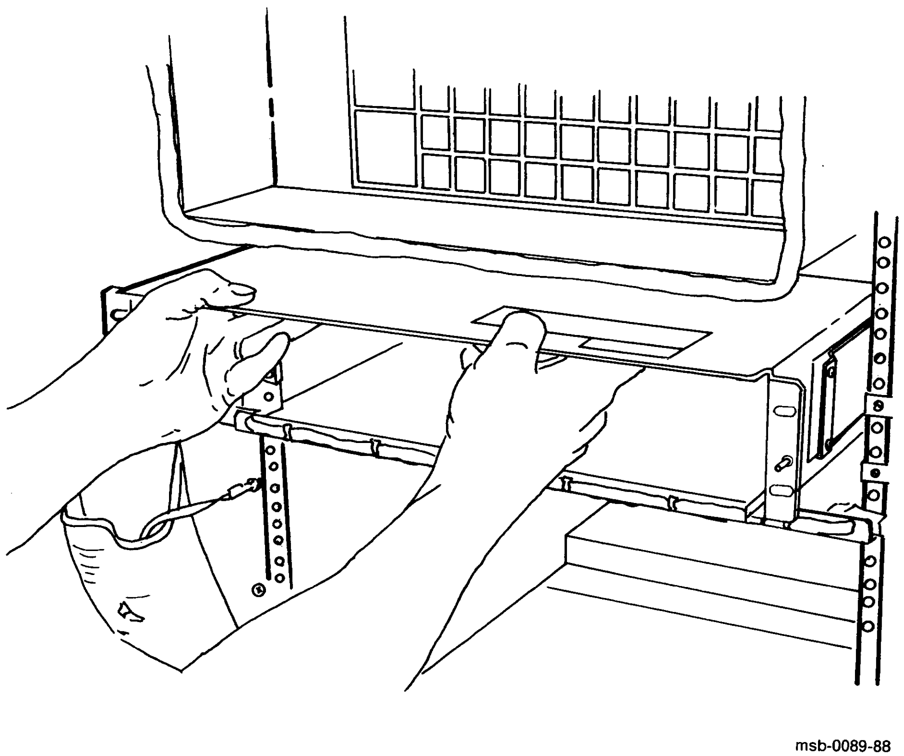
   NOTE: *Be sure that this cable is never connected to any unit other than the H7206 or the battery backup unit.*

10. Find the fail safe enable cable. It is shipped with the system and is located underneath the H405 AC power controller. Connect the 17-01833-01 fail safe enable cable to J6 and J7 on the H405 AC power controller.
11. Route the cables through the clearance space at the right of the H7206 power and logic unit (see Figure 9–18).
12. Install the 8 Tinnerman nuts as shown in Figure 9–18. Four nuts are installed on the front rails, two nuts on each side rail.

9.17.2 Install the Mounting Bracket

1. At the front of the cabinet, slide in the mounting bracket (see Figure 9–19).
2. Secure the mounting bracket by installing four Phillips screws into the Tinnerman nuts on the front rails. Do not tighten.
3. Install the two long Phillips screws on the left side rail.
4. At the rear of the cabinet, install the two spacers and two flathead screws behind the right side rail. Use pliers to line the spacer up behind the rail so that you can install the flathead screw through the spacer, rail, and Tinnerman nut. Then tighten all screws.

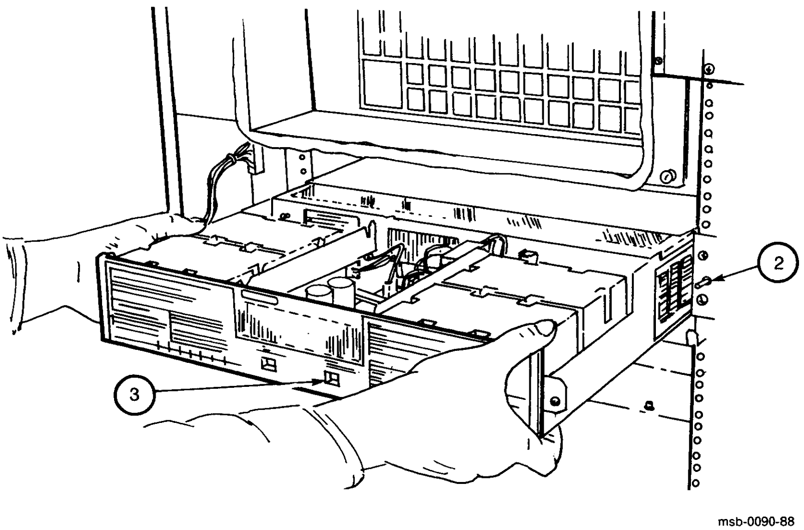
Figure 9–19: Mounting Bracket Installation



9.17.3 Install the Unit

1. At the front of the cabinet, slide the battery backup unit into the mounting bracket (see Figure 9–20).
2. Using a 3/8 inch nutdriver, install the two nuts on the mounting bracket studs to secure the unit.
3. Set the voltage select switch. For 60 Hz systems, set the switch to the right (115V). For 50 Hz systems, set the switch to the left (230V).
4. At the rear of the cabinet, remove the plenum (see Section 10.7).
5. Using a flat screwdriver, install the two screws that attach the 17-00962-01 cable to J18 (see Figure 9–17).
6. Connect the 70-20396-2F cable to J9. Using a 3/8 inch nutdriver, connect the cable's ground strap.
7. Connect the 17-00365-03 cable to J22.
8. Connect the 17-01833-01 cable to J20.
9. Set the voltage select switch as in step 3.
10. Replace the plenum.
11. Shut the doors.

Figure 9–20: Battery Backup Unit Installation



Chapter 10
Cabinet and Airflow Subsystem

This chapter describes the field-replaceable units of the cabinet and units that monitor and control the interior environment of the cabinet. Sections include:

- Door and Filter Removal and Replacement (Front)
- Door and Filter Removal and Replacement (Rear)
- Airflow Sensor Removal and Replacement
- Temperature Sensor Removal and Replacement
- Blower Assembly Specifications
- Blower Assembly, Front and Rear
- Blower Assembly Removal and Replacement
- Side Panel Removal

10.1 Door and Filter Removal and Replacement (Front)

Both the front and rear doors have air filters that need to be replaced periodically. Figure 10–1 shows the inside of the front door.

Figure 10–1: Front Door (Inside View)

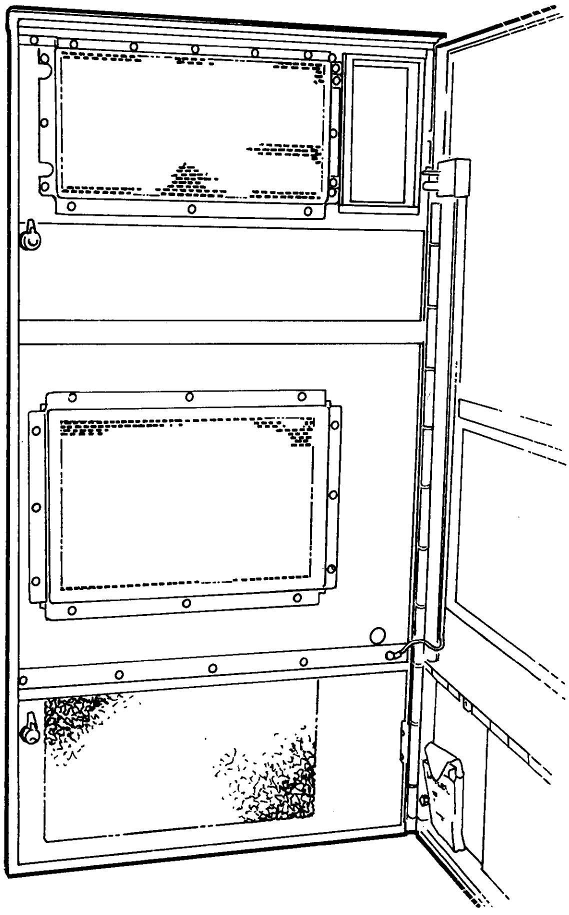


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Table 10–1: Front Cabinet Door and Air Filter Specifications

Parameter	Description
Front Door:	70-24623-01
Dimensions:	28.25″ W x 56″ D
Weight:	31 lbs
Air Filters:	12-11255-23 — 17.5″ W x 9″ D 12-11255-24 — 18.5″ W x 12.5″ D (air intake) 12-11255-25 — 18.5″ W x 10″ D
Tools Required:	3/8″ and 11/32″ nutdrivers

REMOVAL OF DOORS

1. Remove the ground strap, which is attached to the front door, using a 3/8 inch nutdriver.
2. Pull up the pin in the top hinge and lock in place.
3. Pull up and hold the pin in the bottom hinge as you lift the door up to remove it from the cabinet.

REPLACEMENT OF DOORS

1. Put the door into position at the hinges and then release the lock holding the top pin.
2. Pull up the bottom pin and release it to secure the door.

REMOVAL AND REPLACEMENT OF AIR FILTERS

It is especially important that the filters in the center of the front door and at the bottom of the rear door be clean. These filters cover the air intake area.

Three filters are covered with a grill that must be removed to replace the air filter.

1. Use an 11/32 inch nutdriver to remove the grill.
2. Pull off the old filter and stick on the new one.
3. Reinstall the grills (they protect against electromagnetic interference).

10.2 Door and Filter Removal and Replacement (Rear)

Figure 10–2 shows the inside of the rear door.

Figure 10–2: Rear Door (Inside View)

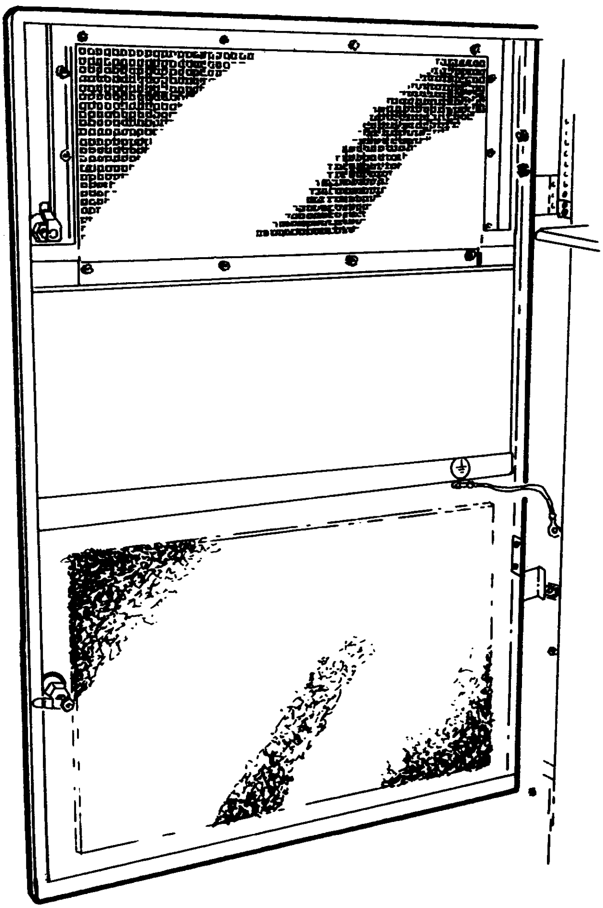

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Table 10–2: Rear Cabinet Door and Air Filter Specifications

Parameter	Description
Rear Door:	70-24124-01
Dimensions:	28″ W x 41.5″ D
Weight:	20 lbs
Air Filters:	12-11255-17 — 26″ W x 15.5″ D (air intake) 12-11255-22 — 22″ W x 9.5″ D
Tools Required:	3/8″ and 11/32″ nutdrivers

For the removal and replacement procedures for the rear door and filters, see Section 10.1.

10.3 Airflow Sensor Removal and Replacement

The airflow sensor (see Figure 10-3) is mounted inside the cabinet above the XMI power regulators, to the left of the temperature sensor. The airflow sensor regulates the two blowers and shuts down the power regulators if the airflow in the cabinet is inadequate.

Figure 10-3: Airflow Sensor (Front View)

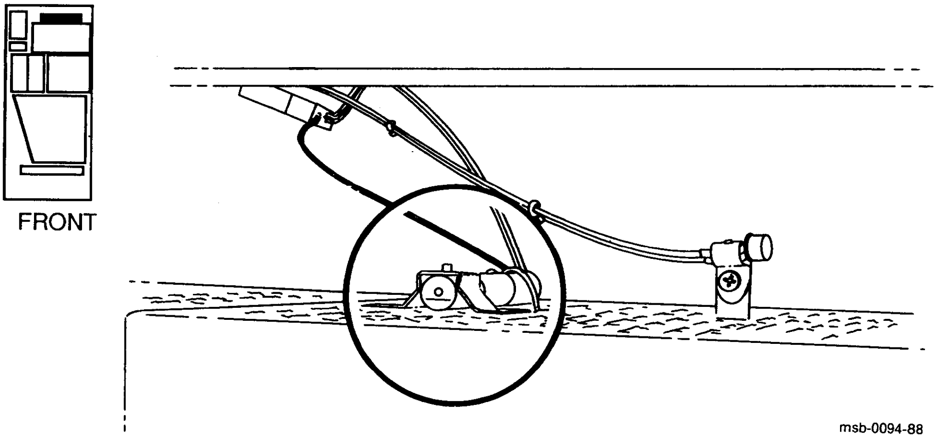


Table 10-3: Airflow Sensor Specifications

Parameter	Description
Part Number:	12-25024-11
Location:	From the front, the sensor is above the outlet grill of the XMI power regulators and to the left of the temperature sensor.
Signal Cable:	17-01570-01, to both blowers and to the H7206 PAL unit
Power:	+24 V (common to main blowers)
Service From:	Front of the cabinet, doors open
Tools Required:	Large and small Phillips screwdrivers Wire clipper

OPERATION

If the airflow sensor detects inadequate airflow, it signals the H7206 power and logic (PAL) unit. After 30 seconds the H7206 unit asserts the Interlock Inhibit signals to the XMI and VAXBI power regulators. The red LED on the H7206 PAL unit lights. The AC power is not affected.

Turn the system off at the control panel as you investigate the cause of the problem. To restart the system, use the front control panel. If the red LED on the H7206 stays on when one side of the system powers up, the problem may be an Interlock switch or the overtemperature switch in the H7215 regulator. If, however, both sides stay down, check the bias LEDs. If they are lit, check the airflow sensor signal. If it is low, indicating normal operating conditions, the H7206 PAL unit is the problem and needs to be replaced.

REMOVAL

1. Unplug at the connector.
2. Clip and remove the tiewrap around the sensor.
3. Push down on top of the metal bracket to pop out one side so that you can remove the sensor. Leave the bracket in the grillwork or mark the exact location so that the new sensor is placed in the same spot.

REPLACEMENT

1. Slip the new sensor in under the bracket and push the end of the bracket back into the grill.
2. Secure in place with a tiewrap (90-07031-00).
3. Reattach at the connector.

10.4 Temperature Sensor Removal and Replacement

The temperature sensor (see Figure 10–4) is mounted inside the cabinet above the XMI power regulators, to the right of the airflow sensor. When the system overheats, the sensor signals the H405 AC power controller to shut down the system.

Figure 10–4: Temperature Sensor (Front View)

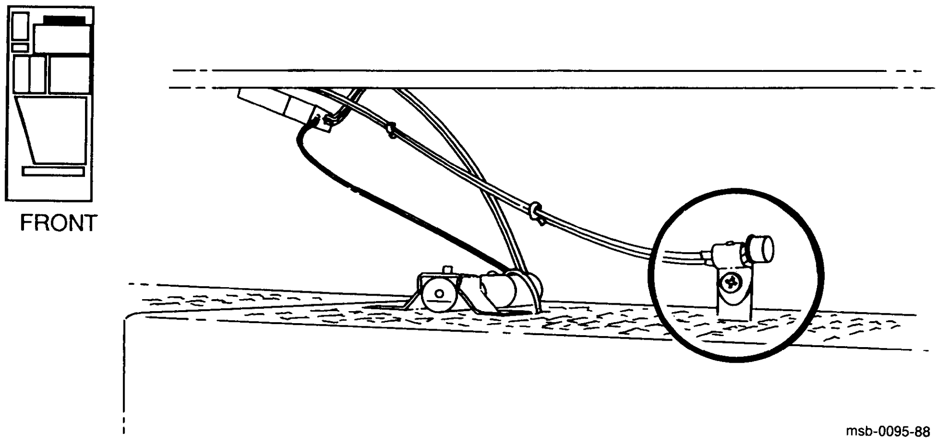


Table 10-4: Temperature Sensor Specifications

Parameter	Description
Part Number:	17-01844-01, sensor and cable to J9 on the H405 power controller
Location:	From the front, the sensor is above the outlet grill of the XMI power regulators and to the right of the airflow sensor.
Power:	H405 power controller
Service From:	Inside the rear door
Tools Required:	Small Phillips screwdriver

OPERATION

When the temperature sensor reaches its threshold, it signals the H405 AC power controller to cut off all power. When the sensor cools down, the power is restored automatically.

REMOVAL AND REPLACEMENT

The temperature sensor is permanently attached to the cable that goes to the power controller.

To remove a temperature sensor:

1. Unplug the cable at J9 on the H405 power controller.
2. Pull the cable up through the system.
3. With a Phillips screwdriver remove the screw from the bracket that holds the sensor.

Install the new sensor in the same place.

10.5 Blower Assembly Specifications

Two blowers are located in the center of the cabinet, just below the XMI and VAXBI card cages. The blowers draw the air into the cabinet and direct it up through the card cages and the power regulators. The mounting plate with the four captive screws (see Figure 10-5) is part of the blower assembly (12-27848-01).

Figure 10-5: Blower Assembly

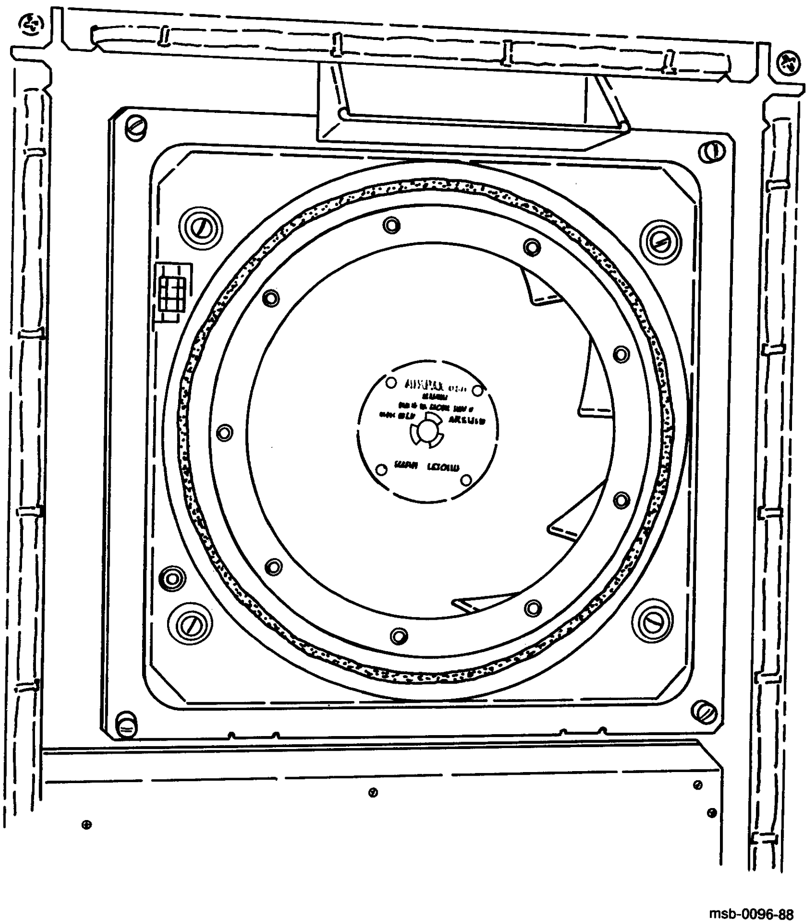


Table 10-5: Blower Assembly Specifications

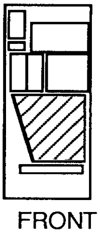
Parameter	Description
Part Number:	12-27848-01; two used
Location:	Front and rear of the lower cabinet area
Dimensions:	15″ x 15″
Weight:	9 lbs
Power:	+24 V
Signal Cable:	17-01570-01, to the H7206 PAL unit and to the airflow sensor
Service From:	Front and rear of cabinet, doors open
Tools Required:	Large Phillips and 1/4″ flat screwdrivers

Each system has two blowers to provide the required airflow within the cabinet. If the airflow sensor detects inadequate airflow, it signals the H7206 power and logic (PAL) unit. After 30 seconds the H7206 unit asserts the Interlock Inhibit signals to the XMI and VAXBI power regulators. The red LED on the H7206 PAL unit lights. The AC power is not affected.

10.6 Blower Assembly, Front and Rear

Figure 10–6 and Figure 10–7 show the two blowers, each with their protective grillwork in place. Although the mounting of the two units is somewhat different, once you remove the protective grillwork from the rear blower assembly the same removal procedures apply to both blowers.

Figure 10–6: Front Blower



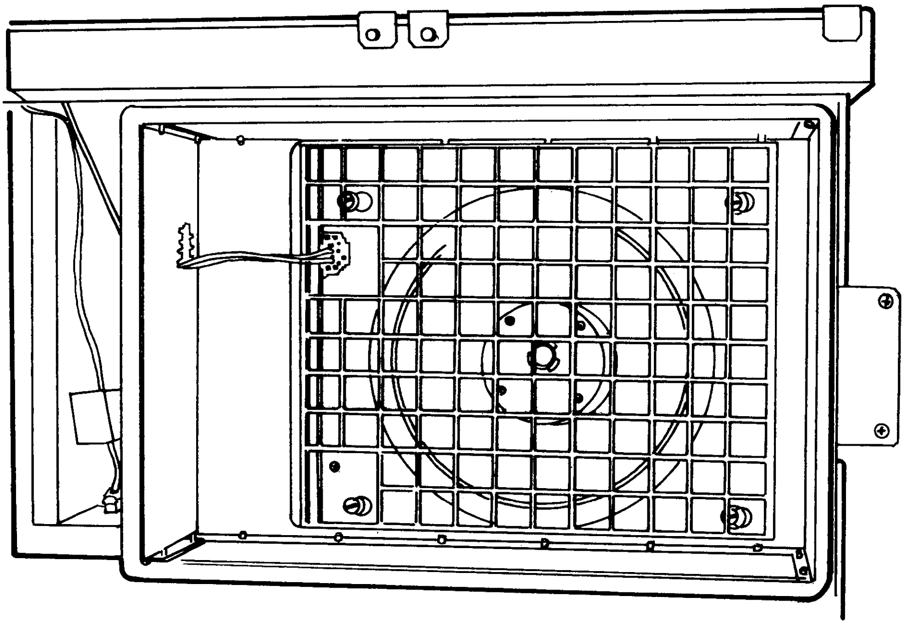


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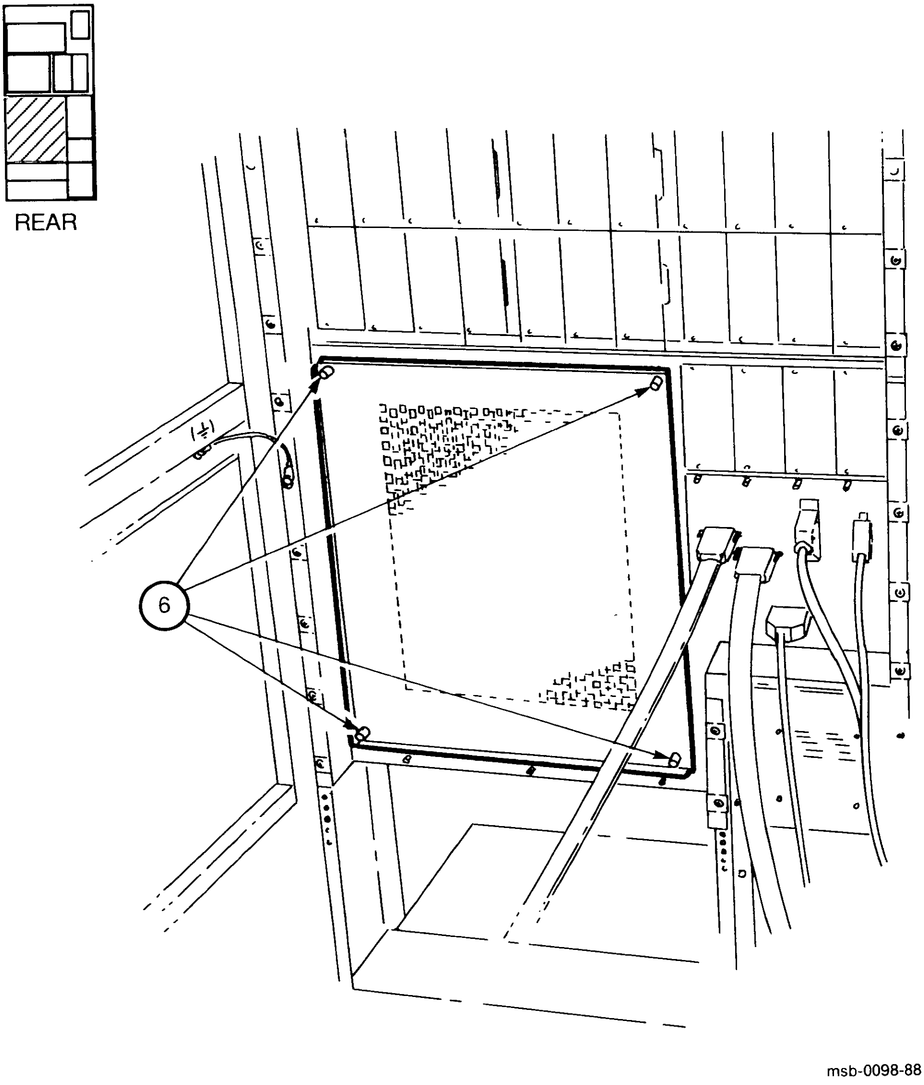
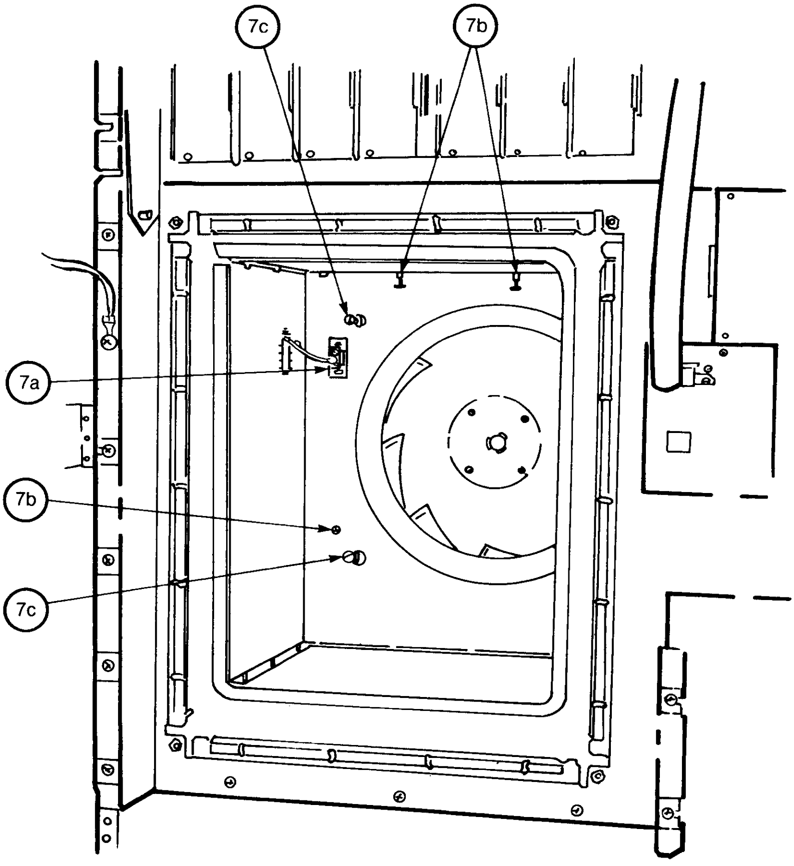
Figure 10-7: Rear Blower



10.7 Blower Assembly Removal and Replacement

To remove the rear blower, you must first remove the protective grillwork. You do not need to remove the grillwork from in front of the blower in front, as it can be lifted off with the plenum. You next remove the plenum; then you can remove the blower.

Figure 10–8: Blower Assembly Removal



REMOVAL

1. Perform an orderly shutdown of the system.
2. Turn the upper key switch on the front control panel to the Off position.
3. Pull the circuit breaker on the AC power controller to the Off position.
4. Unplug the machine.
5. Open the front or rear door to access the blower to be replaced.
6. Figure 10–7 shows the four captive screws that must be loosened to lift off the metal grill in front of the rear blower. Figure 10–8 shows the rear blower with the metal grill removed.
7. The plenum must now be lifted off away from the blower.
   a. Unplug the power cord and push it through the hole on the left panel.
   b. Remove the two #10-32 screws inside the top panel and one screw at the left on the panel at the back of the plenum.
   c. Shift the plenum to the left and lift it off from the four screws.

REPLACEMENT

To replace the blower, reverse the steps above. Note that the blower has two metal tabs at the bottom that slide into slots in the cabinet.

10.8 Side Panel Removal

The left side panel of the system cabinet is detachable, so that the cabinet can be bolted to an expander cabinet (see Figure 10–9).

Figure 10–9: Side Panel Removal

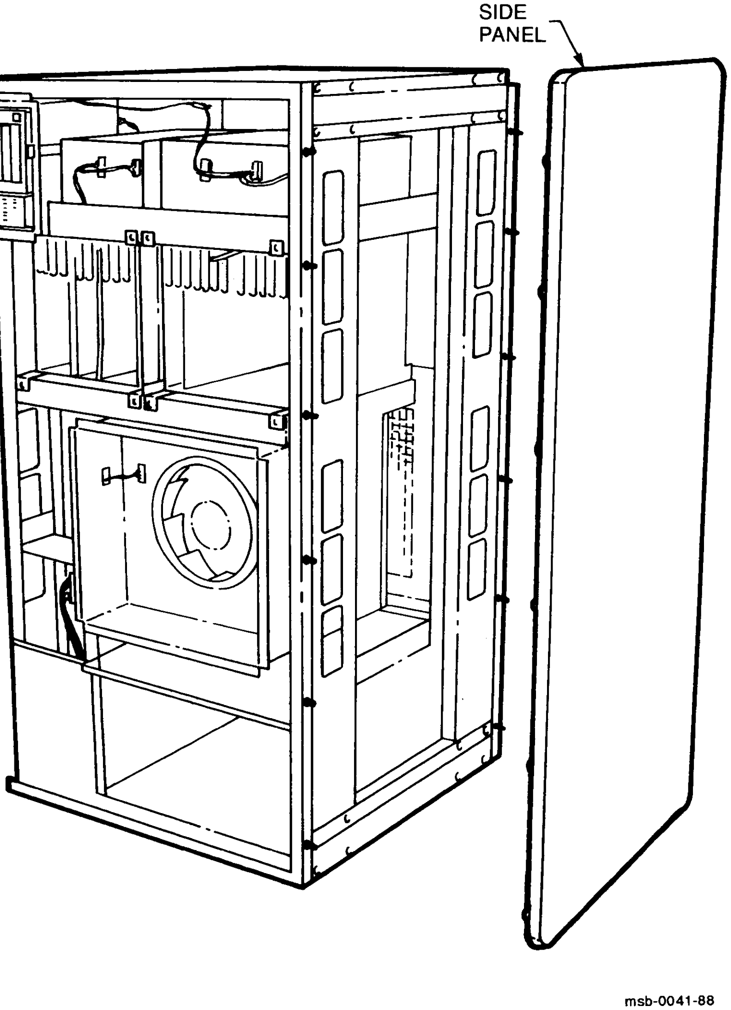


Table 10-6: Side Panel Specifications

Parameter	Description
Part Number:	70-19485-00
Location:	From the front, the panel on the right side is removable.
Dimensions:	30" W x 57" H x 3/4" D
Weight:	34.25 lbs
Service From:	Right side of cabinet, as viewed from the front
Tools Required:	7/16" socket wrench

For most configurations, expansion will be to the right of the system cabinet. To prepare for expansion, remove the side panel of the system cabinet as follows:

1. Open the front and rear doors of the system cabinet and remove the doors by lifting them off their hinges.
2. Using a 7/16 inch socket wrench, remove the system cabinet's side panel by removing the 12 kepnuts (see Figure 10-9). Carefully lift the panel when removing it so as not to damage the threaded bolts. Do not remove the bolts.
3. Before attaching another cabinet, make sure the braided RFI shielding and securing clips are not damaged or missing. Check that any flexible spring-strip type RFI gaskets are present in all the mounting holes.

The *VAX 6200 Installation Guide* describes how to attach the system cabinet to a VAXBI expander cabinet.

Appendix A
Cable List

The following table lists the replaceable cables in the system.

Table A–1: Cable List

Part Number	Qty	Description
17-00365-03	1	H405 to battery backup unit and disks
17-00849-08	2	18″ DWMBA/B to DWMBA/B AC/DC OK
17-00962-01	1	H7206 to H7231 battery backup unit (optional)
17-01149-01	1	Boot enable jumper for DEBNA module
17-01445-01	1	Power to logic board internal to H7206
17-01446-01	1	H7206 to three regulators' jumps (XMI side)
17-01447-01	1	H7206 to two regulators' jumps (VAXBI side)
17-01458-02	2	VAXBI ground strap
17-01496-01	1	VAXBI to Ethernet port and H7214
17-01497-02	1	H7206 to XMI H7215 and H7214, 72 in. long
17-01498-01	1	XTC to H7206 signal, 14-pin
17-01499-01	2	Interlock cable
17-01501-01	1	H405 to H7206
17-01523-01	1	H7215 regulator to VAXBIs ±12V
17-01525-01	3	H7214 regulator to bus bars (+5V remote sense)
17-01549-01	1	H7206 to H405 DEC power bus
17-01566-01	1	H7215 regulator to the XMI
17-01567-01	1	XTC to console port, 10-pin ribbon
17-01568-02	1	XMI to XTC (XTC power) 20-pin ribbon, 56 in. long

Table A-1 (Cont.): Cable List

Part Number	Qty	Description
17-01569-01	1	DWMBA to H7206 power OK signals
17-01570-01	1	H7206 to both blowers and airflow sensor
17-01661-01	3	Jumper assembly (on H7214 regulator output)
17-01662-02	1	XMI ground strap
17-01663-01	3	Fuse cable (H7214 BTO)
17-01666-01	1	H7206 to VAXBI regulators' signal, 60 in. long
17-01812-01	1	XMI to filter board in system control assembly
17-01813-01	1	TBK50 board to system control asembly TK signal swapper
17-01815-01	2	H405 to transformer cable (240V systems only)
17-01816-01	1	XMI to system control assembly 20- to 26-pin
17-01817-01	1	TK to system control assembly 26-pin ribbon
17-01833-01	1	Fail safe enable cable, H7231 battery backup unit to H405 and the XMI
17-01844-01	1	Temperature sensor cable, to H405
17-01897-01	2	15' DWMBA/A to DWMBA/B connector, system VAXBI to VAXBI expander cabinet
17-01897-02	2	7" DWMBA/A to DWMBA/B cables, from XMI slot E
17-01897-03	2	25" DWMBA/A to DWMBA/B cables, from XMI slot D
17-01920-01	1	AC/DC OK cable, system VAXBI to VAXBI expander cabinet
70-20369-2F	1	H7206 to battery backup unit

Appendix B

Troubleshooting the System

Table B–1 gives a checklist for troubleshooting a system that will not power-up and boot. For additional information on troubleshooting, see the following:

- Chapter 2, Diagnostics
- Section 3.6, KA62A Self-Test Results: Console Display
- Section 3.7, KA62A Self-Test Results: Module LEDs
- Section 3.8, ROM-Based Diagnostics
- Section 3.9, KA62A Self-Test RBD
- Section 3.10, CPU/Memory Test — RBD 1
- Section 3.12, VDS Diagnostics
- Section 4.2, MS62A Configuration Rules
- Section 4.8, Memory Self-Test
- Section 4.9, Memory Self-Test Errors
- Section 4.10, Memory RBDs
- Section 4.13, MS62A Memory Installation
- Section 5.4, DWMBA ROM-Based Diagnostics Tests
- Section 6.6, XMI Troubleshooting
- Section 7.6, VAXBI Troubleshooting
- *VAX 6200 Owner's Manual*
  Chapter 3, Controls and Indicators
  Chapter 6, Troubleshooting
  Appendix B, Console Error Messages

Table B-1: Tr

Check
Control Panel I
1 Check the AC po
2 Check the circuit
3 Check the H7206
4 Check the green tors.
System Shuts O 30 Seconds Afte
1 Check the airflow
2 Check the blower

Cold start

An attempt by the primary processor to boot a new co system.

Console Communications Area (CCA)

Segment of system main memory reserved by the cons

Console mode

A mode of operation allowing a console terminal opera with nodes on the XMI bus.

DEBNA

VAXBI adapter; Ethernet port interface.

DHB32

VAXBI adapter communication device; supports up to 1

DMB32

VAXBI adapter interface for 8-channel asynchronous c terminals with one synchronous channel for a line print

DRB32

VAXBI adapter; parallel port.

DWMBA

The XMI-to-VAXBI adapter, a 2-module adapter; al from VAXBI to the XMI, with total effective throughp DWMBA/A is the module in the XMI card cage, and VAXBI module. Every VAXBI on the VAX 6200 system m adapter.

Interleaving memory

See Memory interleaving.

KDB50

VAXBI adapter for DSA disks; enables connection to di:

Memory interleaving

Method to optimize memory access time; VAX 620(automatically interleaves the memories in the system ı access time, unless the SET MEMORY command is us(interleave or no interleave (which would result in se memory module). Interleaving causes an even nu memories to operate in parallel.

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  Chapter 3, Controls and Indicators
  Chapter 6, Troubleshooting
  Appendix B, Console Error Messages

Table B-1: Troubleshooting Power in the System

	Check	Comment	See also
	Control Panel Lights Don't Work		
1	Check the AC power.	Check lights on the AC power controller; check that the system is plugged in and power is present.	Section 9.11
2	Check the circuit breaker.	If the circuit breaker is tripped, your system may have experienced an AC overcurrent.	Sections 9.11 and 9.12
3	Check the H7206 LEDs.	The LEDs should be green, green, no red.	Section 9.8.2
		If red is lit, check the card cage doors and check for an overtemperature condition.	Sections 6.6, 7.6, and 10.4
4	Check the green LEDs on the regulators.	If the LEDs are not lit, you may have a bad regulator or power cabling problem.	Sections 9.4 and 9.6
	System Shuts Off 30 Seconds After Power-Up		
1	Check the airflow sensor.		Section 10.3
2	Check the blowers.	Look for obstructed or no motion. Check blower power and cable connections.	Sections 10.6 and 10.7

Table B–1 (Cont.): Troubleshooting Power in the System

	Check	Comment	See also
	No Output on Console, Control Panel Fault LED Is On		
1	Check the XMI and VAXBI LEDs.		Section 3.16
2	Check the processors.	Use self-test and RBD diagnostics.	Sections 3.7 to 3.10
3	Check your configuration.	XMI node 1 or E must be populated; neither can house a memory.	Sections 3.13, 4.1, and 5.3
4	Force a boot processor.		Owner's Manual, Chapter 6
5	Check the H7206 power and logic unit.	LEDs should be lit.	Section 9.8.2
	No Output on Console, Control Panel Fault LED Is Off		
1	Check baud rate.	Hit BREAK on the console terminal keyboard.	Owner's Manual, Chapter 5
2	Check the cabling to the console.		Terminal owner's manual
3	Check the console terminal.		Terminal owner's manual

Glossary

Adapter
A node that interfaces other buses, communication lines, or peripheral devices to the VAXBI bus or the XMI bus.

Address space
The 1 Gbyte of physical address space supported by the VAXBI bus or the XMI bus.

Bandwidth
The data transfer rate measured in information units transferred per unit of time (for example, Mbytes per second).

Boot device
Contains the bootblock and typically also contains the virtual memory boot program (VMB). The VAX 6200 can be booted from one of four boot devices: the TK tape drive, a local system disk connected through the KDB50, a disk connected to the system through a VAXcluster, or a disk connected to the system through the Ethernet.

Boot primitives
Small programs stored in ROM on each processor with the console program. Boot primitives read the bootblock from boot devices. There is one boot primitive for each type of boot device (tape, local disk, and disk on a VAXcluster).

Bootblock
Block zero on the system disk; it contains the block number where the virtual memory boot (VMB) program is located on the system disk and contains a program that, with the boot primitive, reads VMB from the system load device into memory.

CIBCA
VAXBI VAXcluster port interface; connects a system to a VAXcluster.

Cold start
An attempt by the primary processor to boot a new copy of the operating system.

Console Communications Area (CCA)
Segment of system main memory reserved by the console program.

Console mode
A mode of operation allowing a console terminal operator to communicate with nodes on the XMI bus.

DEBNA
VAXBI adapter; Ethernet port interface.

DHB32
VAXBI adapter communication device; supports up to 16 terminals.

DMB32
VAXBI adapter interface for 8-channel asynchronous communications for terminals with one synchronous channel for a line printer.

DRB32
VAXBI adapter; parallel port.

DWMBA
The XMI-to-VAXBI adapter, a 2-module adapter; allows data transfer from VAXBI to the XMI, with total effective throughput of 10 Mbytes/s; DWMBA/A is the module in the XMI card cage, and DWMBA/B is the VAXBI module. Every VAXBI on the VAX 6200 system must have a DWMBA adapter.

Interleaving memory
See Memory interleaving.

KDB50
VAXBI adapter for DSA disks; enables connection to disk drives.

Memory interleaving
Method to optimize memory access time; VAX 6200 console program automatically interleaves the memories in the system for fastest memory access time, unless the SET MEMORY command is used to set a specific interleave or no interleave (which would result in serial access to each memory module). Interleaving causes an even number of like-sized memories to operate in parallel.

Memory node

Also called the MS62A. Memory is a global resource equally accessible by any processors on the XMI. Each memory module has 32 Mbytes of memory, with MOS dynamic RAMs, ECC logic, and control logic.

Module

A single VAXBI or XMI card that is housed in a single slot in its respective card cage. XMI modules (11.02" x 9.18") are larger than VAXBI modules (8.0" x 9.18").

MS62A

XMI memory array; a memory subsystem of the XMI; memory is a global resource equally accessible by any processors on the XMI. Each memory module has 32 Mbytes of memory, with 1-Mbit MOS dynamic RAMs, ECC logic, and control logic; see also *Memory node*.

Node

An XMI node is a single module that occupies one of the 14 logical and physical slots on the XMI bus. A VAXBI node consists of one or more VAXBI modules that form a single functional unit.

Node ID

A hexadecimal number that identifies the node location. On the XMI bus, the node ID is the same as the physical location. On the VAXBI, the source of the node ID is an ID plug attached to the backplane.

Processor node

Also called a KA62A; a single-board VAX processor that contains a central processor unit (CPU), executes instructions, and manipulates data contained in memory.

RBD

ROM-based diagnostics.

Secured terminal

Console terminal in program mode while the machine is processing.

Shadow set

Two disks functioning as one disk, each shadowing the information contained on the other, controlled by an HSC controller under the VMS operating system.

TBK50

VAXBI adapter connecting the TK tape drive to the system.

TU81E

VAXBI adapter; TU81 controller; local (nonclustered) tape subsystem.

VAXBI bus

The 200-ns bus used by the system for I/O.

VAXBI corner

The portion of a VAXBI module that connects to the backplane and provides an electrically identical interface for every VAXBI node.

VAX Diagnostic Supervisor (VDS)

Software that loads and runs diagnostic and utility programs.

VMB

The virtual memory boot (VMB) program (VMB.EXE) that boots the operating system. VMB is the primary bootstrap program and is stored on the system disk. The goal of VAX 6200 booting is to read VMB from the boot device.

XMI

The VAX 6200 internal high-speed system bus; it is a 64-bit bus, whereas the VAXBI bus, which is used for I/O, is a 32-bit bus.

XMI corner

The portion of an XMI module that connects to the backplane and provides an electrically identical interface for every XMI node.

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