
VAXstation
4000

digital™

VAXstation 4000 Model 60
Service Information

EK-V466B-SV.001

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Preface

This manual is a support and reference document for Digital Services personnel who perform maintenance work on the VAXstation 4000 Model 60 workstation. It is also intended for Digital customers who have a self-maintenance agreement with Digital.

Manual Organization

This manual is organized in the following way:

- Chapter 1 provides an overview of the Model 60 features, main memory, network interface, and SCSI controller.
- Chapter 2 provides information on diagnostic firmware.
- Chapter 3 provides configuration information on the system box.
- Chapter 4 describes system console commands and using alternate consoles.
- Chapter 5 provides information on diagnostic testing.
- Chapter 6 provides information on how to remove and replace system FRUs.
- Appendix A contains tables listing error codes and error messages.
- Appendix B describes how to read the diagnostic LED codes.
- Appendix C contains troubleshooting information.
- Appendix D contains tables that provide part numbers for Field Replaceable Units (FRUs).

Associated Documentation

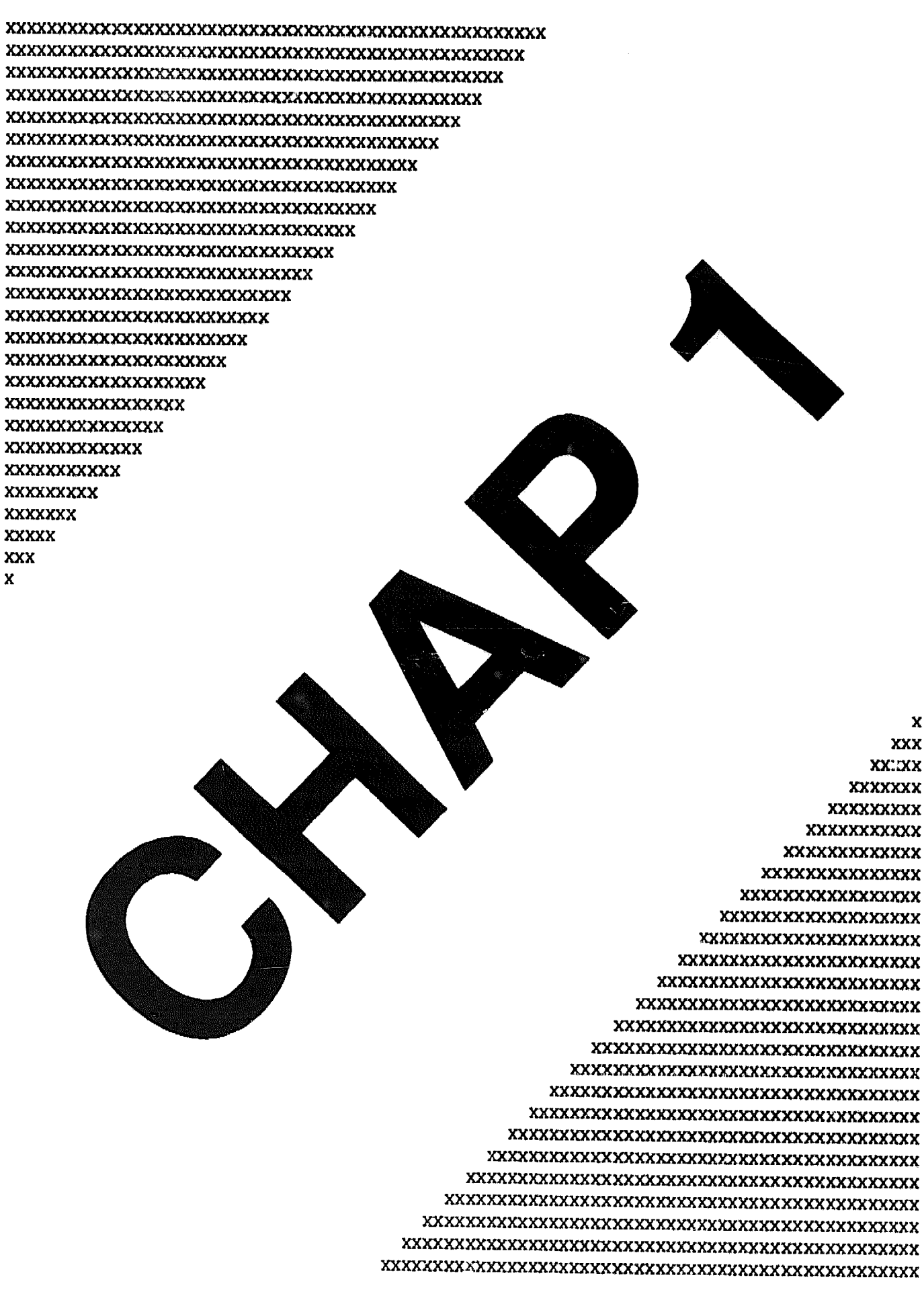
The following documents provide additional information about the VAXstation 4000 Model 60 workstation:

VAXstation 4000 Model 60 Quick Installation Guide	EK-PMARI-IN
VAXstation 4000 Model 60 Options Installation Guide	EK-PMARI-IG
VAXstation 4000 Model 60 Owner's and System Installation Guide	EK-PMARI-OM
VAXstation 4000 Model 60 Service Information Kit Guide	EK-V466H-SV

Conventions

This guide uses the following conventions:

Convention	Description
WARNINGS	Contain important information that relate to personal safety.
CAUTIONS	Contain information to prevent damage to the equipment.
NOTES	Contain general information.
PN	Part number


CHAP 1

1
VAXstation 4000 Model 60 System Module

This chapter describes the features of the VAXstation 4000 Model 60 system module. The topics covered include:

1.1 System Overview

The VAXstation 4000 Model 60 system is a single-user engineering workstation, based on the KA46 system module. The Model 60 includes:

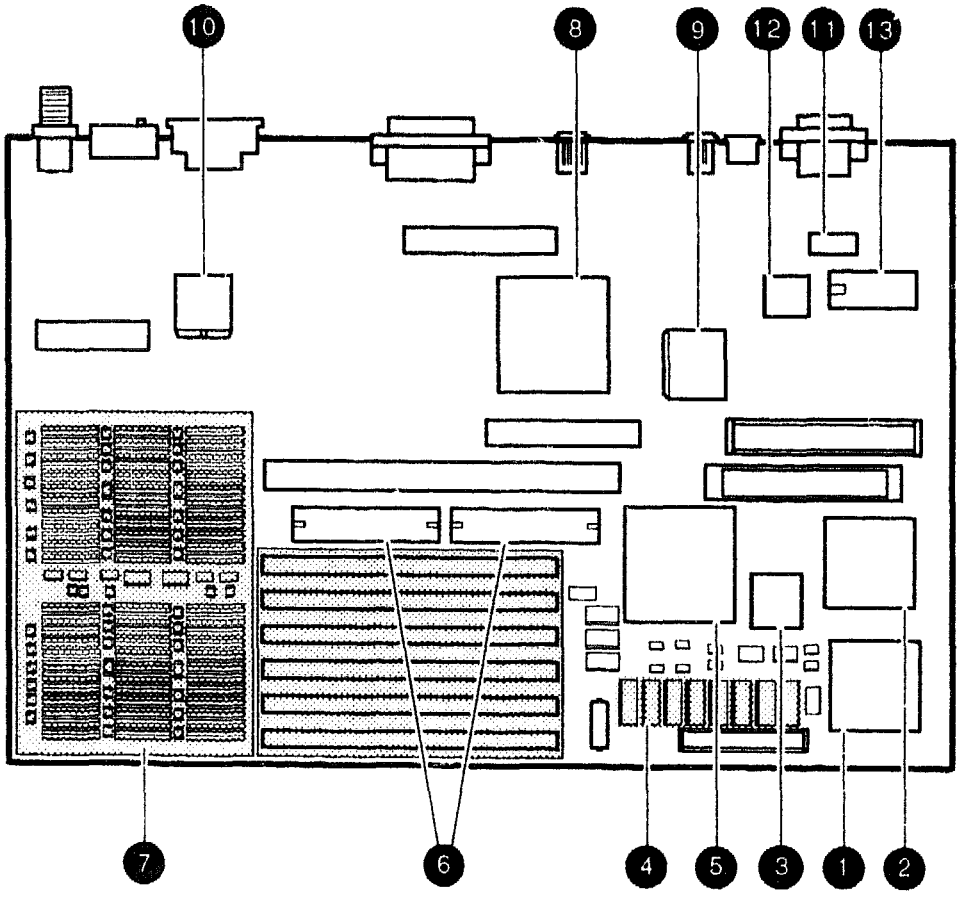
- An LK401 keyboard
- A VSXXX-AA mouse or VSXXX-AB tablet
- A monochrome or color video monitor
- One or more storage devices
- SCSI and Ethernet controllers

Each Model 60 system is housed in a desktop enclosure that contains a KA46 system module and an H7819-AA power supply. Figure 1–1 shows the module layout and other major components that comprise the system module. Figure 1–3 shows a block diagram of the module.

The KA46 system module contains the following list of components. The numbers in this list correspond to the numbers in Figure 1–1.

❶ CPU chip
❷ Floating point unit (FPU) chip
❸ Clock chip
❹ Secondary cache
❺ MARR chip
❻ Base system ROMs
❼ On-board memory
❽ S-chip
❾ SCSI Controller
❿ Ethernet Controller
⓫ Network address ROM
⓬ Sound chip
⓭ Time-of-Year clock

Figure 1–1 KA46 System Module Layout



The KA46 system module includes the following internal connectors, shown in Figure 1–2.

❶ Power supply connector

❷ Memory module connectors (6)

❸ Graphics module connector

❹ Mass storage power connector

❺ Lights and switches module connector

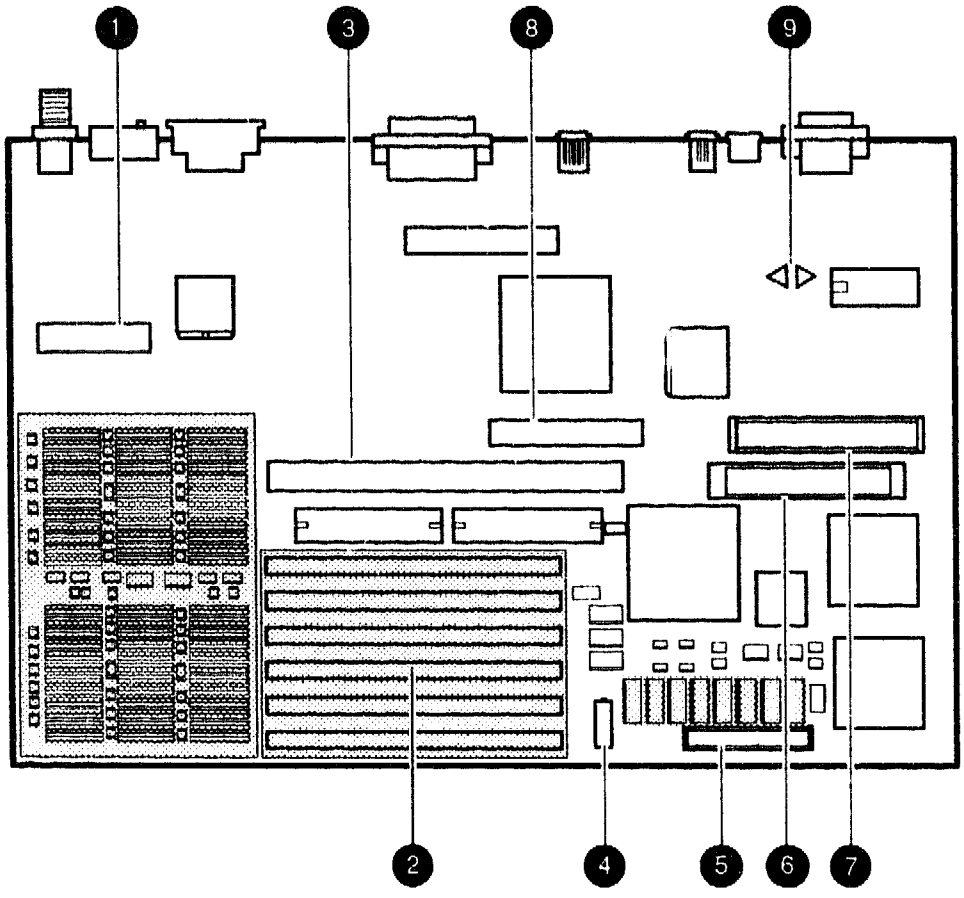
❻ SCSI Connector

❼ Communications option connector

❽ Channel adapter connector

❾ NVR reset etch pad

Figure 1–2 KA46 System Module Internal Connectors

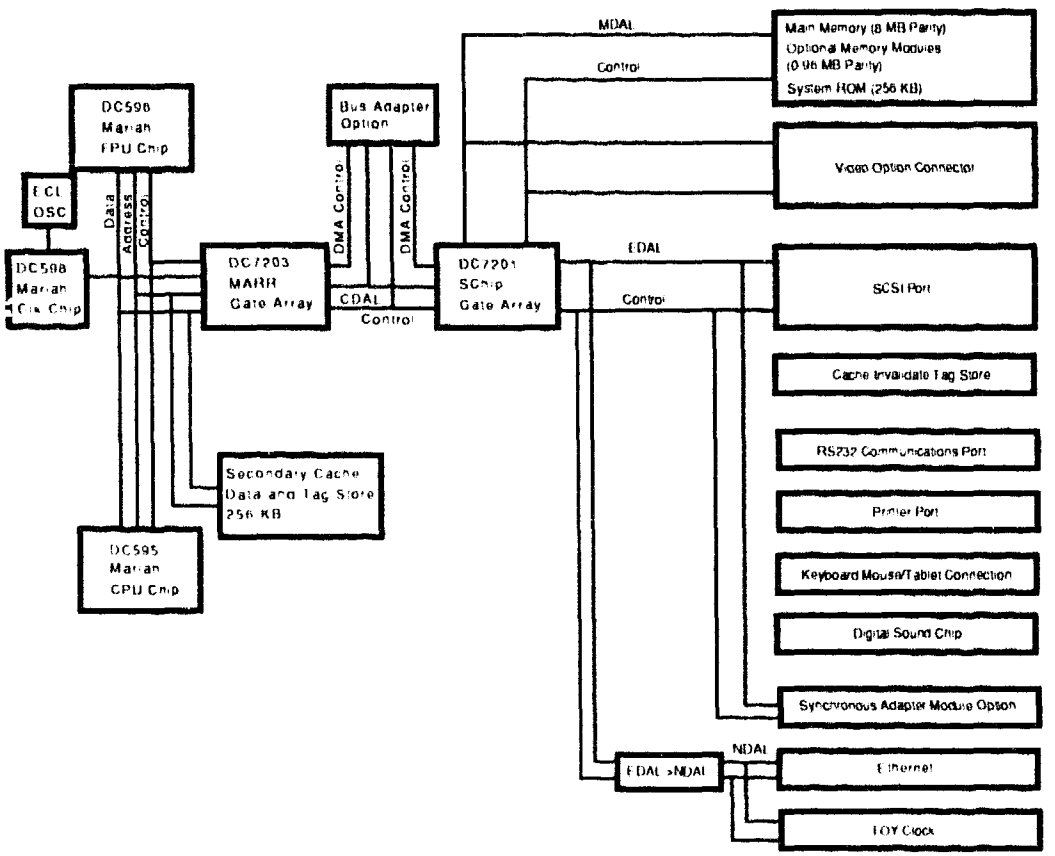


1.2 Central Processor Unit

The Central Processor Unit (CPU) of the KA46 system module supports the MicroVAX computer chip subset (plus six additional string instructions) of the VAX computer instruction set and data types, and full VAX computer memory management. The CPU is implemented as a single VLSI chip. The CPU supports both 30-bit and 32-bit physical addressing. Physical addressing mode is selected by a mode bit in the internal processor register (ACCS).

The CPU chip connects to the floating point accelerator (FPA) chip, the clock chip, the MARR gate array chip, and the secondary cache RAMs only. All other connections to the system are using the MARR gate array. See Figure 1–3.

Figure 1–3 KA46 System Module Block Diagram (Model 60)



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1.2.1 Addressing

In the 30-bit mode, 0.5 Gbytes of program space and 0.5 Gbytes of I/O space are addressable. The actual physical address output by the CPU has address bits <31:29>=000 for program space references and address bits <31:29>=111 for I/O references.

1.2.2 Processor State

The processor state is composed of 16 general purpose registers (GPR), the processor status longword (PSL), and the internal processor registers (IPR).

Non-privileged software can access the GPR and the processor status word (and bits <15:00> of the PSL). The IPR and bits <31:16> of the PSL can be accessed only by privileged software. The IPR is accessible only by the move to processor register (MTPR) and the move from processor register (MFPR) instructions, which can be executed only while running in kernel mode.

1.2.3 Internal Processor Registers

The CPU Internal Processor Registers (IPRs) can be accessed by using the MFPR and MTPR privileged instructions. Table 1–1 lists each of the IPRs with its mnemonic, access type (read or write), scope (CPU-wide or per-process), the chip it is implemented in, whether it is initialized by hardware reset, and its category number.

Table 1–1 KA46 Internal Processor Registers

Register Name	Mnem	Dec	Hex	Type	Scope	Impl	Init	Cat
Kernel stack pointer	KSP	0	0	RW	PROC	DC595		1
Executive stack pointer	ESP	1	1	RW	PROC	DC595		1
Supervisor stack pointer	SSP	2	2	RW	PROC	DC595		1
User stack pointer	USP	3	3	RW	PROC	DC595		1

Table 1–1 (Cont.) KA46 Internal Processor Registers

Register Name	Mnem	Dec	Hex	Type	Scope	Impl	Init	Cat
Interrupt stack pointer	ISP	4	4	RW	CPU	DC595		1
Reserved		5-7	5-7					3
P0 base register	P0BR	8	8	RW	PROC	DC595		1
P0 length register	P0LR	9	9	RW	PROC	DC595		1
P1 base register	P1BR	10	A	RW	PROC	DC595		1
P1 length register	P1LR	11	B	RW	PROC	DC595		1
System base register	SBR	12	C	RW	CPU	DC595		1
System length register	SLR	13	D	RW	CPU	DC595		1
Reserved		14-15	E-F					3
Process control block base	PCBB	16	10	RW	PROC	DC595		1
System control block base	SCBB	17	11	RW	CPU	DC595		1
Interrupt priority level	IPL	18	12	RW	CPU	DC595	Yes	1
AST level	ASTLVL	19	13	RW	PROC	DC595	Yes	1
Software interrupt request register	SIRR	20	14	W	CPU	DC595		1
Software interrupt summary register	SISR	21	15	RW	CPU	DC595	Yes	1

Table 1–1 (Cont.) KA46 Internal Processor Registers

Register Name	Mnem	Dec	Hex	Type	Scope	Impl	Init	Cat
Reserved		22-23	16-17					3
Internal counter control status	ICCS	24	18	RW	CPU	DC595		2
Reserved		25-26	19-1A					3
Time-of-year register	TODR	27	1B	RW	CPU			1
Console storage receiver status	CSRS	28	1C	RW	CPU			5
Console storage receiver data	CSRD	29	1D	R	CPU			5
Console storage transmitter status	CSTS	30	1E	RW	CPU			5
Console storage transmitter data	CSTD	31	1F	W	CPU			5
Console receiver control/status	RXCS	32	20	RW	CPU			2
Console receiver data buffer	RXDB	33	21	R	CPU			2
Console transmitter control/status	TXCS	34	22	RW	CPU			2
Console transmitter data buffer	TXDB	35	23	W				2
Reserved		36-37	24-25					3

Table 1–1 (Cont.) KA46 Internal Processor Registers

Register Name	Mnem	Dec	Hex	Type	Scope	Impl	Init	Cat
Machine check error register	MCESR	38	26	W	CPU	DC595		2
Reserved		39	27					3
Accelerator control & status register	ACCS	40	28	RW	CPU	DC595	Yes	2
Reserved		41	29					3
Console saved PC	SAVPC	42	2A	R	CPU	DC595		2
Console saved PSL	SAVPSL	43	2B	R	CPU	DC595		2
Reserved		44-46	2C-2E					3
Translation buffer tag	TBTAG	47	2F	W	CPU	DC595		2
Reserved		48-54	30-36					3
I/O system reset register	IORESET	55	37	W	CPU			2
Memory management enable	MAPEN	56	38	RW	CPU	DC595	Yes	1
Translation buffer invalidate all	TBIA	57	39	W	CPU	DC595		1
Translation buffer invalidate single	TBIS	58	3A	W	CPU	DC595		1
Translation buffer data	TBDATA	59	3B	W	CPU	DC595		2
Reserved		60-61	3C-3D					3

Table 1–1 (Cont.) KA46 Internal Processor Registers

Register Name	Mnem	Dec	Hex	Type	Scope	Impl	Init	Cat
System identification	SID	62	3E	R	CPU	DC595		1
Translation buffer check	TBCHK	63	3F	W	CPU	DC595		1
Reserved		64-122	40-7A					3
Vector interface error status register	VINTSER	123	7B	RW	CPU			2
Primary cache tag store	PCTAG	124	7C	RW	CPU	DC595		2
Primary cache index register	PCIDX	125	7D	RW	CPU	DC595		2
Primary cache error address register	PCERR	126	7E	RW	CPU	DC595		2
Primary cache status register	PCSTS	127	7F	RW	CPU	DC595	Yes	2
Reserved		128-255	80-FF					3
Reserved		>255	>FF					4

1.2.4 Data Types

The KA46 CPU supports the following subset of the VAX computer data types:

- Byte
- Word
- Longword
- Quadword
- Character string
- Variable length bit field
- Absolute queues
- Self-relative queues
- F-floating
- G-floating
- D-floating

Support for the remaining VAX computer data types is provided by way of macrocode emulation.

1.2.5 Instruction Set

The CPU implements the following subset of the VAX computer instruction set types in microcode:

- Integer arithmetic and logical
- Address
- Variable length bit field
- Control
- Procedure call
- Miscellaneous
- Queue
- Character string (MOVC3, MOVC5, CMPC3, CMPC5, LOCC, SCANC, SKPC, SPANC)
- Operating system support

- F-floating
- G-floating
- D-floating

The CPU chip provides special microcode assistance to aid the macrocode emulation of the following instruction groups:

- Character string (except MOVC3, MOVC5, CMPC3, CMPC5, LOCC, SCANC, SKPC, SPANC)
- Decimal
- CRC
- EDITPC

The following instruction groups are not implemented, but can be emulated by macrocode:

- Octaword
- Compatibility mode instructions

1.3 Interrupt Controller

The interrupt controller section of the S-chip performs two separate functions.

- Receives eight interrupt request signals from the system I/O devices, synchronizes and latches them. The eight latched requests are then masked by individual enable bits and the eight results are read to form a single interrupt. The interrupt is presented to the CPU on IRQ1_L, interrupt priority level 15H.
- Recognizes the CPU interrupt acknowledge cycles for both IPL 14H and IPL 15H.

  For IPL 15H, the controller generates a three bit number from the eight possible interrupt requests. Using a fixed priority encoding, it presents that number to the system ROM as an address from which it retrieves the interrupt vector specific to the highest priority interrupt currently active.

  For IPL 14H, the controller generates a fixed address to the system ROM from which a single interrupt vector is retrieved.

The controller contains three 8-bit registers.

- INT_REQ - Holds the latched interrupt requests received from I/O devices (read-only).
- INT_MSK - Contains a mask that determines which interrupt requests generate a processor interrupt (read/write).
- INT_CLR - Enables a program to selectively reset interrupt request bits in the \INT_REQ register (write-only).

1.3.1 Interrupt Sources and Ranking

There are eight interrupt sources. These sources are listed in Table 1–2. The interrupt numbers 7:0 indicate their bit positions in the registers and their relative priority when more than one request is pending; 7 is the highest priority.

Interrupts 0, 1, 2, 3, 4, and 5 are dedicated to devices on the KA46 system module. Interrupt 7 comes from an optional device.

1.3.2 Interrupt Vector Generation

When the CPU acknowledges an interrupt from the interrupt controller, the interrupt controller causes a vector number to be placed on the CDAL bus that corresponds to the highest priority pending interrupt. The interrupt controller obtains this vector number from a reserved location in the KA46 system module on the board ROM. The conventional vector values established by the ROM firmware for the eight devices are listed in Table 1–2.

Table 1–2 Interrupt Signal Sources and Interrupt Vectors - IPL15h

No	Name	Vector	P	Source
7	SY	02C0	0	VSSYNC controller request for service
6	SO	02C4	0	79C30 request for service
5	AR	0250	0	Asynchronous serial line controller receiver done or silo full
4	AT	0254	0	Asynchronous serial line controller transmit done
3	G1	0244	0	Graphics interrupt 1
2	G0	0248	0	Graphics interrupt 0
1	NI	03F8	0	Network controller
0	SC	03FC	0	Storage controller

1.4 Secondary Cache

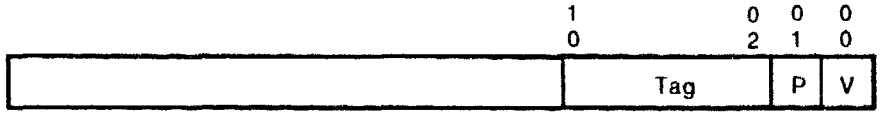
The CPU and floating point accelerator connect to the secondary cache, which is used to reduce the load on main memory. This cache supports a maximum main memory size of 128 Mbytes and has a capacity of 256 Kbytes. The tag store is 32K x 9, plus valid and (odd) parity bits. The data store is 32K x 64 plus eight parity bits, one per byte. The CPU generates and checks the data store parity, and the MARR gate array generates and checks the tag store parity. The cache is organized as single set, quadword line size, direct mapped, write-though.

1.4.1 Diagnostic Mode

The secondary cache tag and data stores can be accessed by way of two ranges of fixed addresses for diagnostic purposes.

Tag Store Diagnostic Access - The address range allocated for diagnostic access to the secondary cache tag store is 2D00.0000 - 2D01.FFFF. The tag store entries are accessed at sequential quadword addresses (address bits <02:00> = 000) using the format shown in Figure 1–4.

Figure 1–4 Tag Store Diagnostic Access



V Tag Valid Bit - ready/write. When accessed via this address range, the Valid bit is directly accessible. Reads of the Tag Store do not cause a Tag comparison as does a normal access.

P Tag Parity Bit - read/write. When accessed via this address range, the Parity bit is directly accessible. Writing wrong parity will not cause a parity error if the subsequent read also occurs via the diagnostic address range.

TAG Cache Tag - read/write.

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Data Store Diagnostic Access - The address range allocated for diagnostic access to the secondary cache data store is 0800.0000 - 0803.FFFF. Use of this address range performs no tag loop, so the entire data store is accessible as 32,768 sequential quadwords. Parity checking is performed by the CPU.

1.5 Main Memory

Main memory consists of 8 Mbytes of DRAM installed on the KA46 system module. Additional memory is added as pairs of memory modules, using 4 Mbyte or 16 Mbyte modules. A maximum of six memory modules may be installed. Memory addressing is adjusted automatically according to the type of memory module installed in each socket to always present a contiguous address range to the CPU, starting at physical address 0 and extending upwards to 67FFFFF.

Each memory module is 32-bits wide, so it has just one DRAM per bit for either the 4 Mbytes or 16 Mbytes variations. Four parity bits are added to each module, one per byte.

The S-chip arbitrates and services requests for main memory cycles from several sources; the Ethernet Controller (NI), Mass Storage Controller (SCSI), Invalidate Filter, CPU, and Graphics Controller (GC) section of the S-chip. To minimize interaction between the requesters, the S-chip has three buses: the CDAL, which connects to the CPU; the EDAL, which connects to the Ethernet controller, storage controller, and the invalidate filter; and the MDAL, which connects to the memory system, including video RAMs.

The S-chip is capable of performing several types of RAM cycles: longword, quadword and octaword. Buffering between the requesters and the memory allows these cycles to make the best use of the available memory bandwidth.

The Ethernet controller and SCSI controller are DMA devices. The graphics controller can generate addresses independently. All three of these devices may attempt to write to memory locations that are currently cached. To maintain cache coherency, the CPU cache is checked and, if necessary, the entry invalidated for writes requested by any of these devices. This could impose a significant load on the CPU to check the potential invalidated entries. For this reason the S-chip controls a separate invalidate filter that maintains a copy of the CPU's cache tags. In this way only those entries that do require a cache invalidate disturb the CPU.

1.5.1 Main Memory Requests

Main memory requests have a fixed priority, as follows (highest to lowest):

- GC - Shift register load
- GC - Cursor buffer load
- Refresh
- NI Controller
- DCXXXX
- Bus adapter controller
- SCSI Controller
- GC Address generator

1.5.2 DMA Mapping

The Ethernet and SCSI controllers access memory by way of a translation table which is stored in main memory. A Map Base Address Register (MAP_BASE) within the S-chip points to this reserved section of memory. The 32,768 longwords extending upwards from MAP_BASE provide translations for the page address supplied by either DMA device.

Each DMA device has a two entry cache of current translations kept in the S-chip. It is the responsibility of the operating system to allocate entries for each DMA device in the translation table.

1.5.3 Translation

Each DMA controller has its own 24-bit address counter for DMA transfers, which has a page field (15 bits) and an address-within-page field (9 bits). When a DMA controller presents an address to the S-chip to perform a DMA cycle to/from main memory, the S-chip translates the address supplied, using MAP_BASE and the translation table contained in main memory as follows:

The bits <23:09> of the address supplied by the DMA controller (the page field) are compared to the address value held in either the read or write translation cache for that DMA device.

If the addresses match and if the entry is marked valid, the associated page address held in a field of the cache entry is connected with the address-within-page field of the supplied address to form the actual address to be used and the DMA cycle proceeds.

If the address match fails, indicating that the DMA transfer is to an address on a different page than the last DMA transfer the device initiated, bits <23:09> of the DMA address supplied are connected with bits <24:17> of MAP_BASE to form a new 23-bit longword aligned map register address. This address is used to retrieve data from the translation table in main memory.

Bits <15:00> of the data that returned from memory are connected with the original address-within-page bits supplied by the controller to form a 25-bit address that is the actual address to be accessed. Bits <15:00> that were retrieved from the translation table are stored as a new value in the appropriate translation cache associated with the DMA device and the valid bit set for the entry.

1.6 ROM Memory

The KA46 system module ROM contains the processor restart, diagnostic, console code, and bootstrap programs. Another small NI ROM is programmed for the system network address.

1.6.1 System ROM

The system ROM data is stored in two 64K by 16 EPROM chips that hold a total of 256 Kbytes of data. The data appears at physical addresses 2004.0000 through 2007.FFFF. The ROM data path is 32 bits wide. Some physical addresses in the ROM have fixed use. These are:

2004.0000	Processor restart address. The processor begins execution at this address in non-mapped mode when a processor restart occurs.
2004.0004	System type register SYS_TYPE. The contents of this longword supplement the internal processor SID register to identify the processor and system type.
2004.0020	Interrupt vector numbers. Eight consecutive longwords starting at this address are automatically referenced by the hardware to supply the interrupt vector numbers for the eight interrupt sources connected to the interrupt controller.

1.6.2 Network Address ROM

A 32-byte ROM on the KA46 system module contains the network address for the system. Information from this ROM is read in the low-order bytes of 32 consecutive longwords at physical addresses 2009.0000 through 2009.007C. The network address occupies the first six bytes (addresses 2009.0000 through 2009.0014). The byte at 2009.0000 is the first byte to be transmitted or received in an address field of an Ethernet packet; its low-order bit is transmitted or received first in the serial bit stream.

1.7 Graphics Controller

The graphics controller is a part of the memory control section of the S-chip. The graphics controller competes for memory cycles as do other devices. However, graphics operations have the lowest priority of all devices requesting memory cycles.

The graphics controller supports both 8 plane and single plane 2D graphics and can execute the most commonly used primitives of DECwindows. The controller draws by way of linear addressing. The types of operations supported are:

- Lines
- One, two, and three operand rasterops
- Text

Rasterops can be:

- Solid colored
- Tiled
- Stippled
- Color expanded
- Plane compacted

All operations can be performed to both the frame buffer and non-displayable main system memory using virtual addressing with multiple clipping rectangles for overlapping window hardware support.

The Model 60 system has no video frame buffer; one of several video option modules can be added to the KA46 system module to provide the frame buffer from which pixels are output to the monitor. The video option modules carry video RAMS, pixel timing, and output digital-to-analog conversion/level shifters. The interface to the KA46 system module is at the "nibble" level, that is one quarter of the pixel rate.

1.7.1 Graphics Controller Screen Formats

The graphics controller supports several formats, which may not be supported by individual video frame buffer modules. The graphics ROM is located on the graphics module. Table 1–3 lists the screen formats supported by the graphics controller.

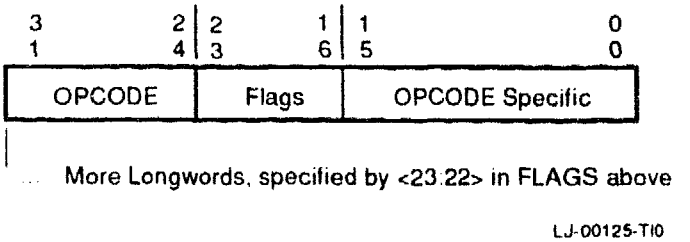
Table 1–3 Graphics Controller Screen Formats

Format	Color	Mono	Refresh Rate
1280 x 1024	Supported	Supported	66 Hz
1024 x 768	Supported	Supported	60 Hz
800 x 600	Supported	Not Supported	60 Hz
1024 x 864	Supported	Supported	60 Hz

1.7.2 Graphics Controller Communication

Commands are passed from the CPU to the graphics controller in the form of variable length packets. The controller accepts the command packet data and, if it is not busy and if the Clip List feature is not enabled, loads the command directly into its registers for execution. If the graphics controller is busy, or the Clip List feature is enabled, the command packet data is written by the controller into a circular buffer area in main memory - the LCG Common FIFO. The size and location of the FIFO are two of the setup parameters required by the graphics controller. Figure 1–5 shows a command packet.

Figure 1–5 General Format of a Command Packet



1.8 Serial Line Controller

The KA46 system module serial line controller handles four asynchronous serial lines. The controller and a 64 entry silo shared by all four receive lines are parts of the S-chip. The four serial lines are numbered 0 through 3, and each has a particular primary use, as listed in Table 1–4:

Table 1–4 Serial Line Usage

Line	Device
0	Keyboard - connected to a 15-pin D-sub connector and to a 4-pin modular jack mounted on KA46 system module. Data leads only. Supports the LK401 Keyboard
1	Pointer - connected to a 15-pin D-sub connector and to a miniature DIN connector mounted KA46 system module. Data leads only. Supports VSXXX-AA mouse or VSXXX-AB Tablet.
2	Communications - connected to a 25-pin D-sub connector mounted on the KA46 system module, RS423 compatible. Data leads plus modem control signals.
3	Printer - connected to a 6-pin MMJ mounted on the KA46 system module. DEC423 data leads only.

Line 3 is normally connected to a printer through a BC16E cable. (If a special jumper is installed in the MMJ on the KA46 system module, a break condition sensed on this line triggers the CPU halt signal, which restarts the system with code 2.)

1.8.1 Serial Line Controller Registers

The serial line controller has eight addressable registers. These registers are listed in Table 1–5, along with their addresses and names.

Table 1–5 Serial Line Controller Register Addresses

Address	Name	Access	Description
200A.0000	SER_CSR	R/W	Control and status register
200A.0004	SER_ RBUF	R	Receiver buffer - oldest data in silo
200A.0004	SER_LPR	W	Line parameter register
200A.0008	SER_TCR	R/W	Transmitter control register
200A.000C	SER_MSR	R	Modem status register
200A.000C	SER_TDR	W	Transmitter data register
200A.0010	DZ_LPR0	R	Line parameter register, line 0
200A.0014	DZ_LPR1	R	Line parameter register, line 1
200A.0018	DZ_LPR2	R	Line parameter register, line 2
200A.001C	DZ_LPR3	R	Line parameter register, line 3

1.9 Time-of-Year Clock

The time-of-year (TOY) clock is a chip that keeps the date and time of day. The clock contains 50 bytes of general purpose RAM storage, and a 32.768 KHz time base oscillator.

1.9.1 Battery Backup

A rechargeable battery powers the clock's chip and oscillator while the system is off. When fully charged, the battery maintains the clock for a minimum of 100 hours. The battery automatically recharges while the system power is on.

1.9.2 TOY Clock Chip Registers

The TOY clock chip contains 64 8-bit registers. Ten of these contain date and time data, four are control and status registers, and the remaining 50 provide general purpose RAM storage. The registers occupy 64 consecutive longwords of address space as shown in Table 1–6.

Each register is accessed using bit <9:> of the longword; bits <31:10> and <1:0> are ignored on writing and undefined on reading.

Table 1–6 TOY Chip Register Addresses

Address	Name	Description
200B.0000	WAT_SEC	Time seconds, 0...59
200B.0004	WAT_ALMS	Alarm seconds (not used)
200B.0008	WAT_MIN	Time minutes, 0...59
200B.000C	WAT_ALMM	Alarm minutes (not used)
200B.0010	WAT_HOUR	Time hours, 0...23
200B.0014	WAT_ALMH	Alarm hours (not used)
200B.0018	WAT_DOW	Day of week, 1...7
200B.001C	WAT_DAY	Day of month, 1...31
200B.0020	WAT_MON	Month of year, 1...12
200B.0024	WAT_YEAR	Year of century, 0...99
200B.0028	WAT_CSRA	Time base divisor
200B.002C	WAT_CSRB	Date mode and format
200B.0030	WAT_CSRC	Interrupt flag (not used)
200B.0034	WAT_CSRD	Valid RAM and time flag
2008.0038		First byte of RAM data
.		
.		
.		
200B.00FC		Last byte of RAM data

NOTE

Because each register spans two bytes on the system bus, only *word* or *longword* instructions can be used to manipulate these registers. Instructions for modifying bits such as BBSS, BBSC, BBCC, and BBCS cannot be used; they generate byte instructions for read-modify-write cycles that corrupt the portion of the register not being accessed.

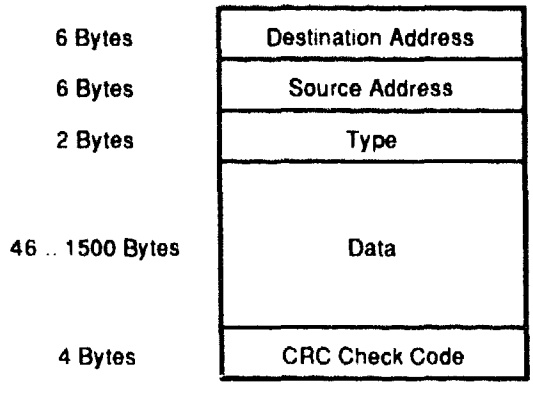
1.10 Network Controller

The network controller enables the Model 60 workstation to be connected to an Ethernet network by way of a ThinWire connection using RG-58 coax cable or a transceiver cable. Either of these connections can be selected by setting a two-position switch at the rear of the Model 60 workstation. The network controller is a part of the KA46 system module and consists of a LANCE Ethernet controller chip, a serial interface adapter, an Ethernet transceiver chip, a BNC connector for the RG-58 cable to the Ethernet, and a 15-pin D-sub connector for the transceiver cable.

1.10.1 Packet Format

Data is passed over the Ethernet at a serial data rate of 10 million bits per second in variable-length packets. Each packet has the format shown in Figure 1–6.

Figure 1–6 Ethernet Packet Format



The minimum size of a packet is 64 bytes. Packets shorter than this are called *runt packets* and are treated as erroneous when received by the network controller.

1.10.2 Network Addresses

Ethernet network addresses are 48 bits (6 bytes) long and are of two types:

- **Physical Address:** The unique address associated with a particular workstation on the Ethernet network, which should be different from the physical address of any other workstation on any other Ethernet network.
- **Multicast Address:** A multi-destination address associated with one or more workstations on a given Ethernet network (also called a logical address). There are two kinds of multicast addresses:
  - — Multicast-Group address: An address associated by higher-level convention with a group of logically related workstations.
  - — Broadcast address: A predefined multicast address which denotes the set of all the workstations on the Ethernet network.

Bit 0 (the least significant bit of the first byte) of an address denotes the type:

- 0 = Physical addresses
- 1 = Multicast addresses

In either case the remaining 47 bits form the address value. A value of 48 ones is always treated as the broadcast address.

The physical address of each Model 60 workstation is determined before the system ships from the factory. The physical address is stored in the Ethernet Address ROM on the KA46 system module.

1.11 SCSI Controller

The controller conforms to the ANSI small computer system interface (SCSI) specification. It has a single port, connecting to devices within the Model 60 workstation system enclosure and allowing for external expansion.

The SCSI controller interface is a single-ended, bi-directional, 8-bit wide bus. When the KA46 system module is connected to the SCSI bus, as many as seven additional devices can be attached to the bus. Devices can be either an initiator or a target. An initator originates an operation by sending a command to a specific target. A target performs an operation which was requested by an initiator. The Model 60 workstation is always the initiator and all other SCSI devices attached to it are targets.

Each device attached to the SCSI bus is identified by a unique device ID. The device IDs of the initiator and targets are both placed on the data bus by asserting the data bits corresponding to the device ID number. This number is controlled by programs that drive the SCSI interface, and is fixed in the Model 60 firmware to ID 6.

The interface consists of 18 signal lines, of which some are driven by initiators and some by targets. The SCSI bus always should be terminated internally and externally. The bus is permanently terminated internally at the SCSI controller end. External termination can take place in one of two locations:

- At the expansion connector on the rear of the system enclosure.
- At the second connector on the last storage expansion unit.

1.11.1 SCSI Bus Signals

SCSI bus signals are described next.

DB7..0 and DBP	Comprise an 8-bit parallal data bus with an associated odd parity bit. The use of the parity bit is optional but strongly encouraged. These lines may be driven by either an initiator or a terminator, depending upon the direction of data transfer.
RST	Signals all devices on the SCSI bus to reset to their initial power-on states. Thereafter, it should be asserted only as a last resort during error recovery since it indiscriminately affects all devices on the bus. An RST signal generated by some other device on the bus causes an internal reset of the 53C94 chip used in this controller and sets the interrupt request bit (INT in register SCS_STATUS)
BSY and SEL	Are used by initiators and targets during the arbitration, selection, and reselection bus phases to establish or resume a logical connection between an initiator and a target. Once the connection is established, the target asserts BSY and the SEL signal is not driven by anyone.
C/D, I/O and MSG	Collectively indicate one of six possible information transfer phases according to the following table. These signals are always driven by the target device.

MSG	C/D	I/O	Phase name	Transfer direction
0	0	0	Data out	To target
0	0	1	Data in	To initiator
0	1	0	Command	To target
0	1	1	Status	To initiator
1	0	0		(reserved)
1	0	1		(reserved)
1	1	0	Message out	To target
1	1	1	Message in	To initiator

ATN — Is used by an initiator to signal a target that it has a message ready. The target can receive the message by entering the "message out" phase. ATN is always driven by an initiator.

REQ and ACK — Are used to synchronize information transfers over the data bus during any of the six information transfer phases. REQ is always driven by the target, ACK is always driven by the initiator.


CHAP 2

2
Model 60 Firmware

This chapter is an overview of the system firmware. The firmware is located in two EPROMs, which hold a total of 256 Kbytes of data. The system firmware is grouped into the following areas of operation:

Additional topics in this chapter include:

2.1 Power-Up Initialization Code

The initialization code executes when power to system is turned on. The initialization code sequence is as follows:

- The system tests enough memory to allow it to bring up the console for building console and device structures.
- The system checks its configuration for optional devices.
- The system tests the TOY clock and the non-volatile RAM. If this test fails, the test stops.
- The system constructs the Master Configuration Table (MCT), Device Configuration Table (DCT), Driver Descriptor, Shared Console Interface Area, and a blank Page Frame Map.
- The system tests the serial lines. If this test fails, the console terminal is not enabled.

NOTE

If the alternate console switch is set to alternate console, the terminal connected to line three of the serial port is used as the console. If a video option is plugged into the video slot, the system tests that option. If the test passes, the video option becomes the console device. If the test fails or no video option is present, the system defaults to line three of the serial port.

- The system calls up the console device initialization routine.

  The system type and ROM ID are printed out at the console device, followed by the amount of memory, and the Ethernet address.

- The system Test Dispatcher tests the functional blocks of the system. The dispatcher runs the tests in the following order:

  1. Non-Volatile RAM (NVR)
  2. Color graphics (LCG)
  3. Serial line controller (DZ)
  4. CACHE Memory (CACHE)
  5. Memory configuration (MEM)
  6. Floating point unit (FPU)
  7. Interval timer (IT)

8. Miscellaneous system board (checksums, interrupt controller, Ethernet ID ROM) (SYS)
9. Network controller (NI)
10. SCSI Controller (SCSI)
11. Sound chip (AUD)
12. Option board (COMM)

If any device fails during testing, the dispatcher continues to test the remaining devices until all tests are completed.

NOTE

If halts are enabled, the console prompt >>> displays. If not, the system is autobooted using the default device stored in the NVR or the Ethernet if no device is specified.

2.2 Console Overview

The Model 60 system console mode allows operation of a console device, which can be one of the following:

- A workstation video device and LK401 keyboard and mouse
- A terminal connected to line three of the serial port
- A remote system connected using the Ethernet

The console mode can be entered if:

- The HALT parameter is set to halt when power is turned on.
- A severe processor condition occurs (such as an invalid interrupt stack).
- An external HALT is detected (pressing the halt button on the front panel)

In console mode input and output (I/O) routines are used by:

- Self-test
- Extended self-test
- Utilities
- System test
- Virtual memory boot (VMB)

2.3 Extended Self-Test Overview

The extended self-tests are started by entering the TEST command at the console prompt, followed by the test number or numbers you wish to run. The test dispatcher runs the self-test requested until an error occurs or until all tests are completed.
The dispatcher uses the Main Configuration Table (MCT), Device Configuration Table (DCT), and Drive Descriptor data structures when running a self-test. The dispatcher performs the following steps when running self-tests:

- Uses the device number to index into the MCT
- Gets a pointer to the device's DCT from the MCT
- Finds a pointer to the device's directory entries in the DCT
- Scans all the directories for a directory type of the self-test directory (=1)
- Reads the flags field in the DCT to determine if the self-test diagnostic needs to be loaded into RAM

  If the diagnostic needs to be loaded into RAM, the dispatcher allocates memory for loading the diagnostic (moving it from ROM to RAM).
- Reads the flags field in the DCT to determine if the diagnostic uses a shared diagnostic driver.

  If the self-test diagnostic uses a shared diagnostic driver, the dispatcher gets the directory entry and the pointer to the Driver Descriptor from the DCT.

  If the shared driver is not already in RAM, the dispatcher allocates temporary RAM for the shared driver (loading the driver from ROM to RAM) and fills in the driver descriptor data structure to point to the RAM based shared driver.
- Calls the device's self-test interface

2.4 Utilities Test Overview

To start a utility test, at the console prompt enter the command:

```
TEST/UTIL dev_nbr util_nbr op1...opn
```

Where:

- /UTIL - instructs the test dispatcher to run a utility.
- dev_nbr - is the device on which the utility operates.
- util_nbr - is the utility number.
- op1...opn - is one to n optional parameters.

The console mode passes a list of parameters to the test dispatcher. The test then uses the Main Configuration Table (MCT), Device Configuration Table (DCT), and Driver Descriptor data structures when running a utility. The dispatcher performs the following to run a utility:

- Uses the device number to index into the MCT
- Gets a pointer to the device's DCT from the MCT
- Finds a pointer to the device's directory entries in the DCT
- Scans all the directories for a directory type of the utility directory (=3)
- Reads the flags field in the DCT to determine if the utility needs to be loaded into RAM

  If the utility needs to be loaded into RAM, the dispatcher allocates memory for loading the utility (moving it from ROM to RAM).
- Reads the flags field in the DCT to determine if the utility uses a shared diagnostic driver

  If the utility uses a shared diagnostic driver, the dispatcher gets the directory entry and the pointer to the Driver Descriptor from the DCT.

  If the shared driver is not already in RAM, the dispatcher allocates temporary RAM for the shared driver (loading the driver from ROM to RAM) and fills in the driver descriptor data structure in the Driver Descriptor for the shared driver.
- Calls the utility entry point

- Checks the parameters passed. If the parameters are out of range or too many passed, the dispatcher sends out an illegal parameter message
- Prompts the user if more parameters are needed
- Prompts the user if the utility is going to destroy any of the user's data
- Starts the utility

2.5 System Test Overview

The system test testa the device interaction in the system by creating maximum DMA and interrupt activity. The test consists of:

- Modified VAXELN kernel
- System test monitor
- System diagnostics
- Shared drivers (if present)

The system test can be run in three environments, selected by the SET DIAGENV command:

- Customer
- Digital Services
- Manufacturing

CAUTION

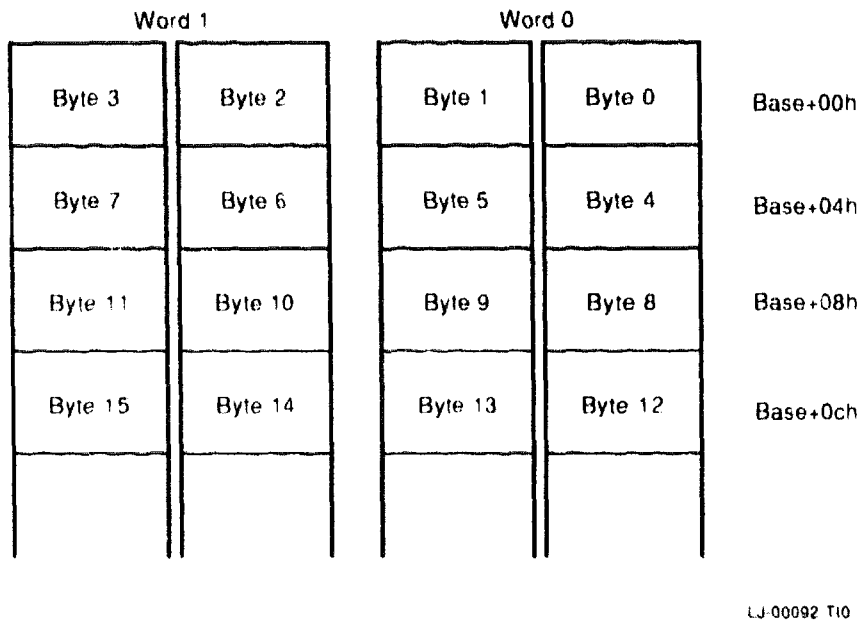
Do not use the manufacturing mode in the field. Manufacturing mode erases customer data on hard disks, excluding the system disk.

Refer to Table 5–7 for more detailed information on running the system test.

2.6 System ROM Overview

The firmware contains 256 Kbytes of ROM split into two 64 Kbytes by sixteen-bit wide ROMs. This provides the 32-bit wide memory data path shown in Figure 2–1.

Figure 2–1 System ROM Format



The system firmware ROMs supply some information on a per byte basis for ease of manufacture and development; other information (software and tables) is supplied by the set of ROM parts.

2.6.1 System ROM Part Format

- Version (word 02h) - contains the low eight bits of the version number of the console code for the Model 60 system firmware.
- ROM byte number (byte 03h) - indicates the position of the byte among the set of ROMs used to implement the firmware. This value is equal to the low two bits of the physical address of the first byte in the ROM part. The value ranges from 0 to 3.

- Manufacturing check data (bytes 04h - 06h) - used for a quick check of the ROM. The data are 55h, AAh, and 33h.
- ROM part length (byte 07h) - indicates the length of the ROM part divided by the data path width in bytes.
- Checksum (last byte) - each ROM byte contains a simple eight-bit add and rotate checksum. In a 16-bit ROM the last two bytes contain a checksum, one checksum for each byte address in the device.

2.6.2 System ROM Set Format

The physical addresses in the system ROM set are fixed.

- 2004.0000 processor restart address - The hardware begins execution at this address when:
  - — Power is turned on
  - — Kernel mode halt instruction executes.
  - — A break signal is received from the console device
  - — The HALT button is depressed
  - — The CPU detects a severe corruption of its operating environment
- 2004.0004 SYS_TYPE - This longword is the System Type Register. The system type value is 0401.0001.
- 2004.0008 reserved for ROM part data - These 24 bytes are reserved for information contained in each ROM byte.
- 2004.0020 interrupt vector numbers - These eight longwords are used by the hardware as part of the interrupt process.
- 2004.0040 console I/O routines - There are eight I/O routines provided in the system ROM. Entry points for these routines are located at longword intervals in the area.
- 2004.0070 reserved - Reserved so all ROM set data that follows it will be in the same relative position.
- 2004.0078 system console firmware revision number - This word contains the system console firmware revision number.
- 2004.007A system diagnostic firmware revision number - This word contains the system diagnostic firmware revision number.

- 2004.007C diagnostic descriptor - This longword contains the physical address of the beginning of the system level diagnostic boot block. A value of zero indicates that there is no system level diagnostic present in the Model 60 system firmware ROM.
- 2004.0080 pointers to keyboard map - These two longwords point to the tables used to translate the LK401 main array keycodes to character codes. The first longword contains the physical address of the beginning of the keyboard tables. The second longword contains the physical address of the beginning of the keyboard mapping tables.

2.7 Option ROM Overview

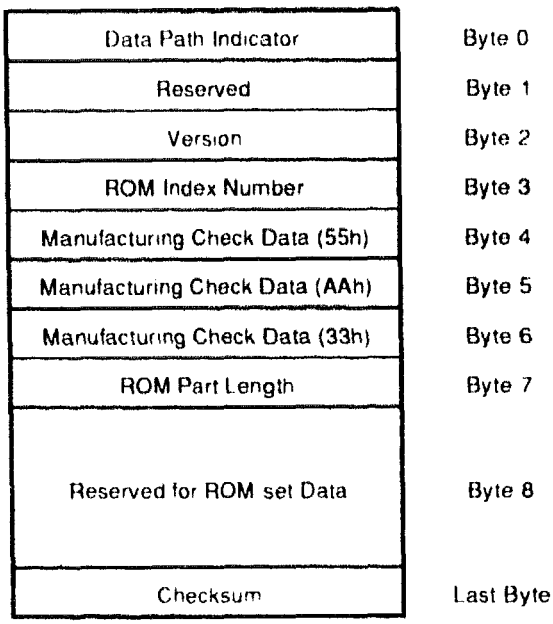
Each option in the Model 60 system has its own ROM firmware. The ROM memory on the option board may be implemented as discussed in the following sections.

2.7.1 Option ROM Part Format

The option ROM part format is provided for each byte in the ROM set. This format is compatible with the system ROM format, with the addition of the data path indicator. Figure 2–2 shows the ROM byte data.

- Data Path Indicator (byte 00h) - indicates the size of the ROM data path. The data path must be one of the following:
  - 1: one byte per longword - Bytes in ROM occupy the low byte of each longword.
  - 2: two bytes per longword - Words in ROM occupy the low two bytes of each longword.
  - 4: four bytes per longword - Longwords in ROM correspond to longwords in the address space.
- Version (byte 02h) - contains the low eight bits of the version number for the option's firmware.
- ROM Byte number (byte 03h) - indicates the position of the byte among the set of ROMs used to implement the firmware. This value is equal to the low two bits of the physical address of the first byte in the ROM set. Note that this value is always less than the data path indicator.

Figure 2–2 Option ROM Byte Data



- Manufacturing check data (bytes 04h through 06h) - these three bytes may be used for a quick verify check of the ROM contents. The data are 55h, AAh, and 33h.
- ROM Part length (byte 07h) - indicates the length of each byte address in the set. It is the number of bytes associated with each byte in the ROM in Kbytes.

NOTE

The number of bytes in the ROM set equals the sum of the number of bytes in each of the ROM parts divided by the data path of each device. Each of the ROM parts on the option board must have the same number of bytes.

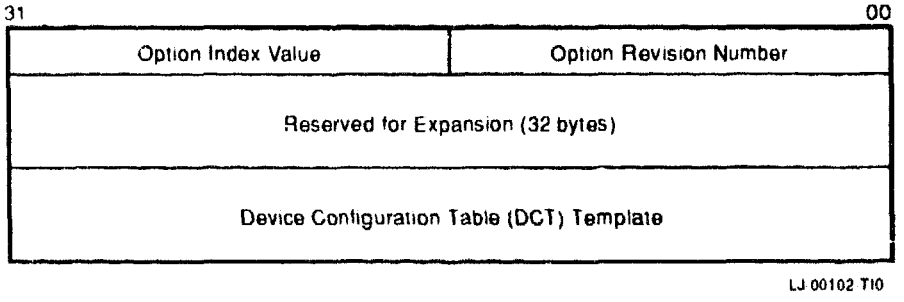
- Reserved for ROM set data - byte 8.
- Checksum (last byte) - each byte in the ROM set has a simple add and rotate checksum in its last byte.

2.7.2 Option ROM Set Format

For options that have a one-byte or two-byte data path, the data from the ROM set must be moved into RAM. Note that a device cannot have both an 8-bit data path and a 16-bit data path. An option with a full 32-bit data path may not have to be moved. Devices with a 16-bit data path are treated as though each byte of the device is a device in itself.

Figure 2–3 shows option ROM set data.

Figure 2–3 Option ROM Set Data

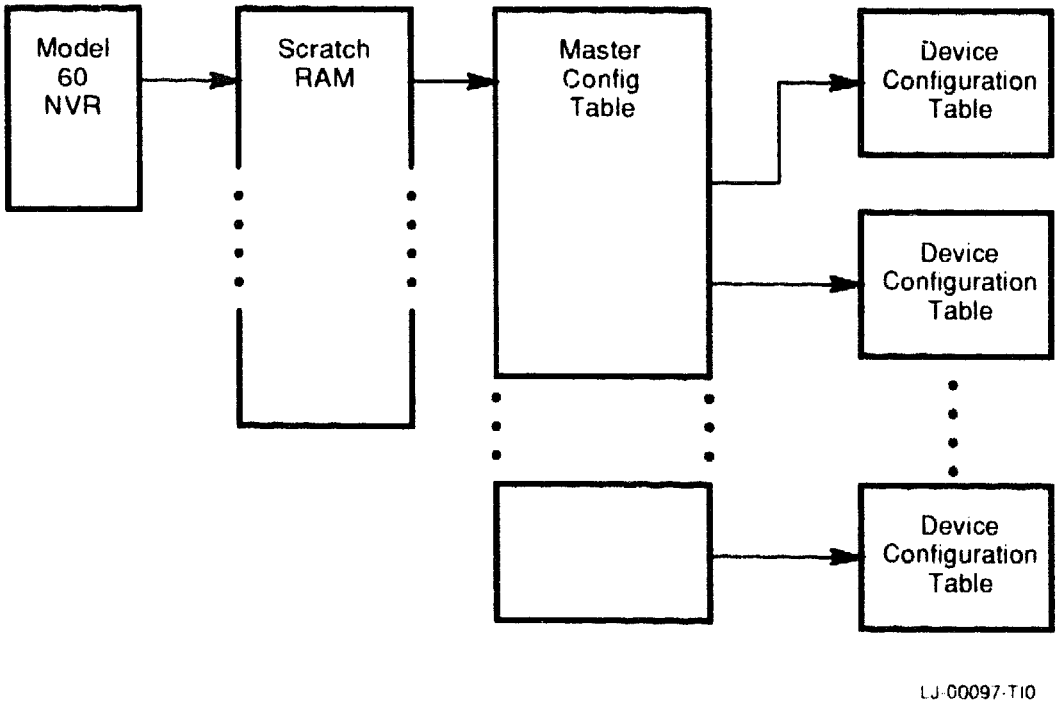


- Option revision - this number controls changes in both the option hardware and firmware.
- Option index value - index value of the last DCT entry. A zero in this field indicates a single DCB for the device, a one indicates two device control blocks for this device. An option that occupies the storage option slot can have the values of zero or one. An option that occupies the video option slot can have the values of zero, one, or two.
- Reserved for expansion - these 32 bytes are reserved.
- Device Configuration Table template - the device implemented by the option must have an associated Device Configuration Table template. The DCT contains static and dynamic data and pointers to code required for the device.

2.8 Configuration Table Overview

Information on the Model 60 devices is saved in the system configuration tables by the power-up initialization code. The code sizes the system by reading the ROM-based Device Configuration Tables (DCT) and builds a memory resident configuration data structure. Figure 2–4 shows how the data structures are linked together.

Figure 2–4 Model 60 Configuration Tables

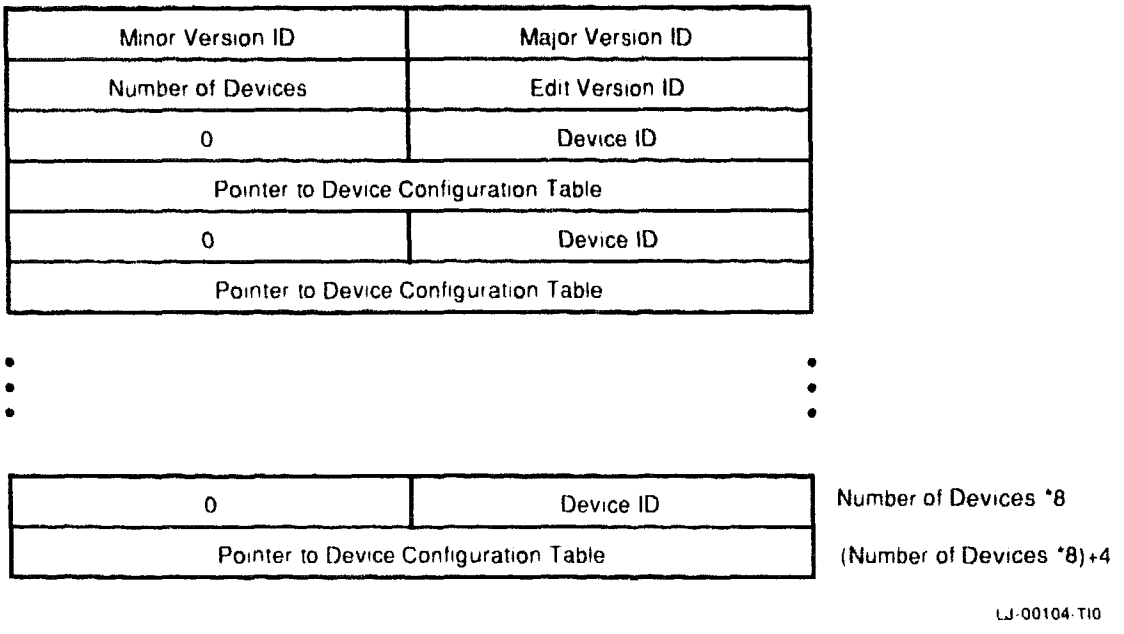


The initialization code saves a pointer to the scratch RAM in the Model 60 NVR in four consecutive bytes. The scratch RAM contains a pointer to the Main Configuration Table (MCT) at its base address. The MCT contains pointers to the DCT.

2.8.1 Main Configuration Table

The Main Configuration Table (MCT) contains a list of the devices in the system and a pointer to the Device Configuration Table for each device. The MCT is built when power is turned on and resides in the diagnostic area in memory. The MCT gives the test dispatcher a single interface into the various components of the system. The MCT is shown in Figure 2–5.

Figure 2–5 Main Configuration Tables



The components of the Main Configuration Table are:

- Major version ID - version number is used to track major changes in the diagnostic interface.
- Minor version ID - version number is used to track minor changes in the diagnostic interface.

- Edit version ID - reserved for use by diagnostic developers.
- Number of devices - the number of entries in the MCT table.

  The next three fields are replicated for each device in the system.
- Device ID - the device ID number
- Must be zero - reserved for future use.
- Pointer to Device Configuration Table - points to the DCT for this particular device.

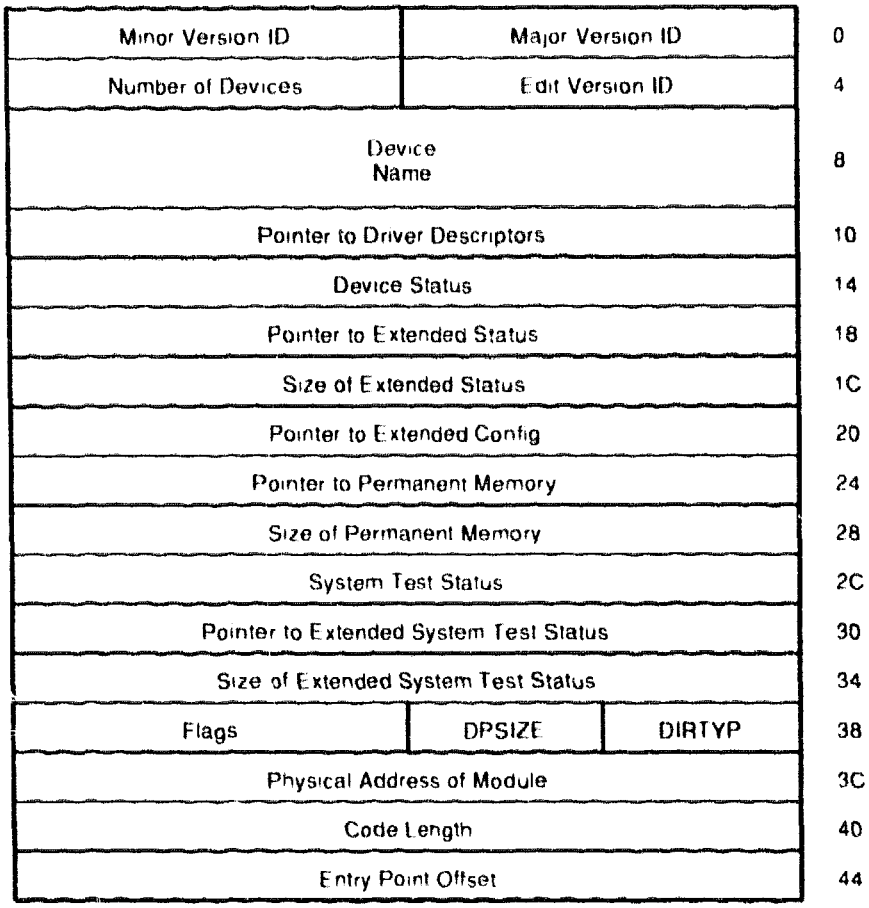
2.8.2 Device Configuration Table

There is a Device Configuration Table (DCT) entry for each device in the Model 60 system. The DCT contains extended information about the device, such as:

- Device name
- Diagnostic code location
- Header information

The test dispatcher and the system test monitor use this data to fetch the appropriate diagnostic code to execute from the ROM or to load into RAM. The DCT is shown in Figure 2–6.

Figure 2–6 Device Configuration Table



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The components of the Device Configuration Table are:

- Major version ID - version number is used to track major changes in the device's diagnostic routines.
- Minor version ID - version number is used to track minor changes in the device's diagnostic routines.
- Device ID - device ID number
- Number of directories - the number of directory entries for the device. A directory entry tells the user where to find a particular component of code for the device.
- Device name - the name of the device is ASCII. This is used by the show configuration utility and the system test to display information about the device.
- Pointer to the driver descriptors - points to the drive descriptor area associated with the device.
- Device status - saved from the last time that self-test was run on the device. The show configuration utility uses this field to display information about the device. The device status is split into two words, the lower word is the error field and the upper word is the Field Replaceable Unit (FRU) thought to be bad.
- Size of extended device status - the length of the extended device status in bytes. The extended device status can be up to 16 longwords of information. The extended status is displayed when the user enters the "SHOW ERRORS" command at the console prompt.
- Pointer to extended device status - points to any extended information that is saved by the device self-test.
- Pointer to extended configuration data - points to extended configuration information about the device. For example, the SCSI self-test code uses this field to save a pointer to information about the devices connected to the SCSI bus. The information is displayed when the user enters the "SHOW CONFIG" command at the console prompt.
- Pointer to permanent memory allocated - points to the permanent memory that has been allocated. The field is filled in by the diagnostic, the first time that it allocates memory.
- Size of permanent memory allocated - the amount of permanent memory (in pages) that has been allocated. This field is filled in by the diagnostic the first time that it allocates memory.

- System test status - the status saved the last time that System Test was ran on this device without doing intervening test commands.
- Pointer to extended system test status - points to any extended information that is saved by the device's self-test. The "SHOW ESTAT" utility uses the extended status to display information about the device.
- Size of extended system test status - the length in bytes of the extended System Test status.
- Directory type - contains the type of directory entry that the previous elements refer to. Table 2–1 lists the directory type.

Table 2–1 Directory Type Definitions

Definition	Meaning
1	Self-test directory entry
2	System test directory entry
3	Utility directory entry
4	Console routine directory entry
5	Unjam routine directory entry
6	Diagnostic driver directory entry

- Data path size - contains the data path size of the ROM in which the piece of code resides. The path size is listed in Table 2–2.

Table 2–2 Data Path Size Definitions

Definition	Meaning
1	ROM Width is one byte wide
2	ROM Width is two bytes wide
4	ROM Width is four bytes wide

- Flags - contains flag data associated with the particular device routine. Table 2–3 lists the flag definitions.

Table 2–3 Flag Definitions

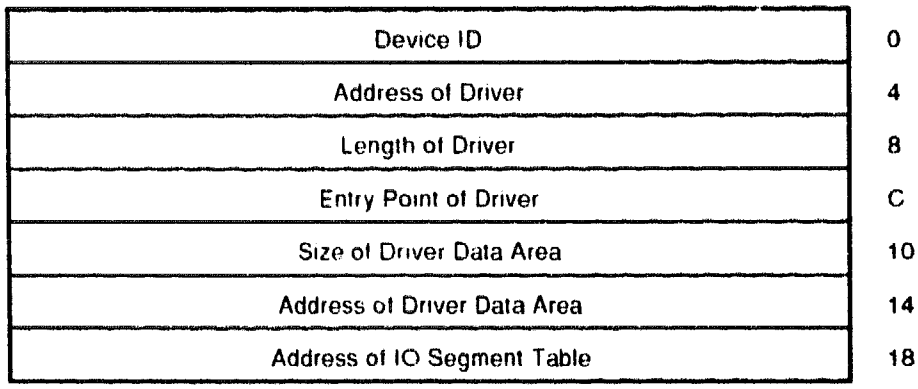
Definition	Meaning
Bit 15=1	Code must be loaded into RAM at power-up and memory marked as unavailable to the operating system.
Bit 14=1	Code must be loaded into RAM to execute. The memory is released after execution is complete.
Bit 13=1	Code has been loaded into RAM at power-up and memory marked as unavailable to the operating system.
Bit 0=1	Code uses shared diagnostic driver.

- Length of code - contains the length of code in bytes.
- Physical address of the module - contains the physical address for this particular component of the code.
- Entry point offset - contains the offset from the beginning of the code to where the entry point is.

2.9 Driver Descriptor Overview

Any device that provides a shared port driver or shared class driver must provide a descriptor that supplies the Model 60 base system firmware, system test monitor, and any other piece of software specific information about the drive. The format for a driver descriptor is shown in Figure 2–7.

Figure 2–7 Driver Descriptor Data Structure



The fields of the driver descriptor are:

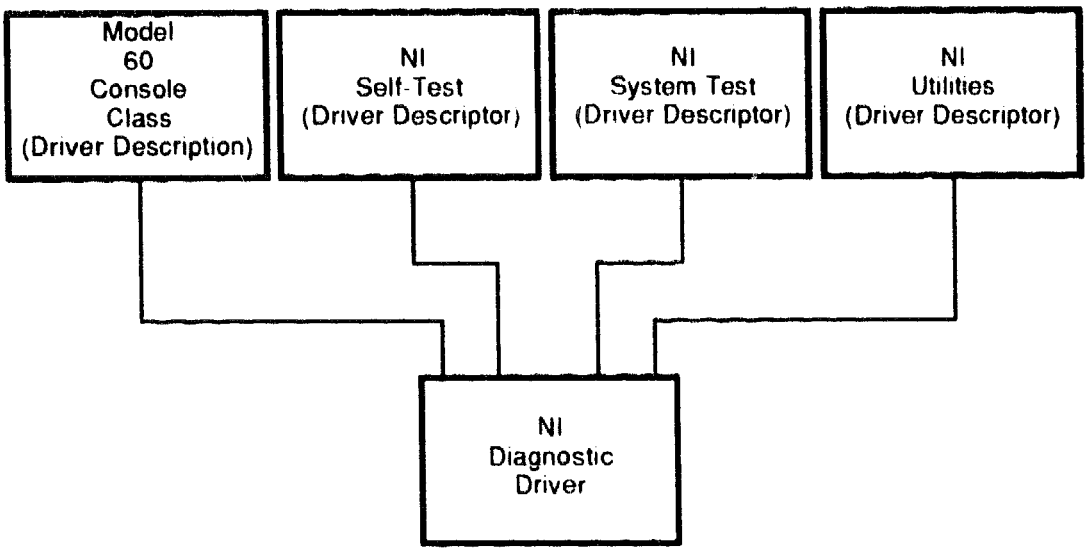
- Device ID - ensures that the driver descriptor ID matches the function block ID. This allows a function the ability to determine if it is being used correctly.
- Address of the driver - contains the address of the Device Driver. This address may be ROM or memory address.
- Length of the driver - contains the length of the Device Driver in bytes. This field is used by both the base system ROM and the system test monitor to determine the amount of code that needs to be loaded into RAM.
- Entry point offset of the driver - contains the number of bytes from the beginning of the device driver to the INIT_DRIVER function.
- Size of driver data area - contains the length in bytes of the amount of memory that a driver needs for its parameters and local data.

- Address of the driver data area - contains the address of the Device Driver data area that is used by the driver to store local data.
- Address of the I/O segment table - contains the address of the I/O segment table.

2.10 Interfacing to Diagnostic Drivers

The network device contains routines to UNJAM the device and to run self-test routines, system test routines, console routines, and a shared diagnostic driver routine. Figure 2–8 shows how these pieces of code relate to each other.

Figure 2–8 Diagnostic Driver Console Support



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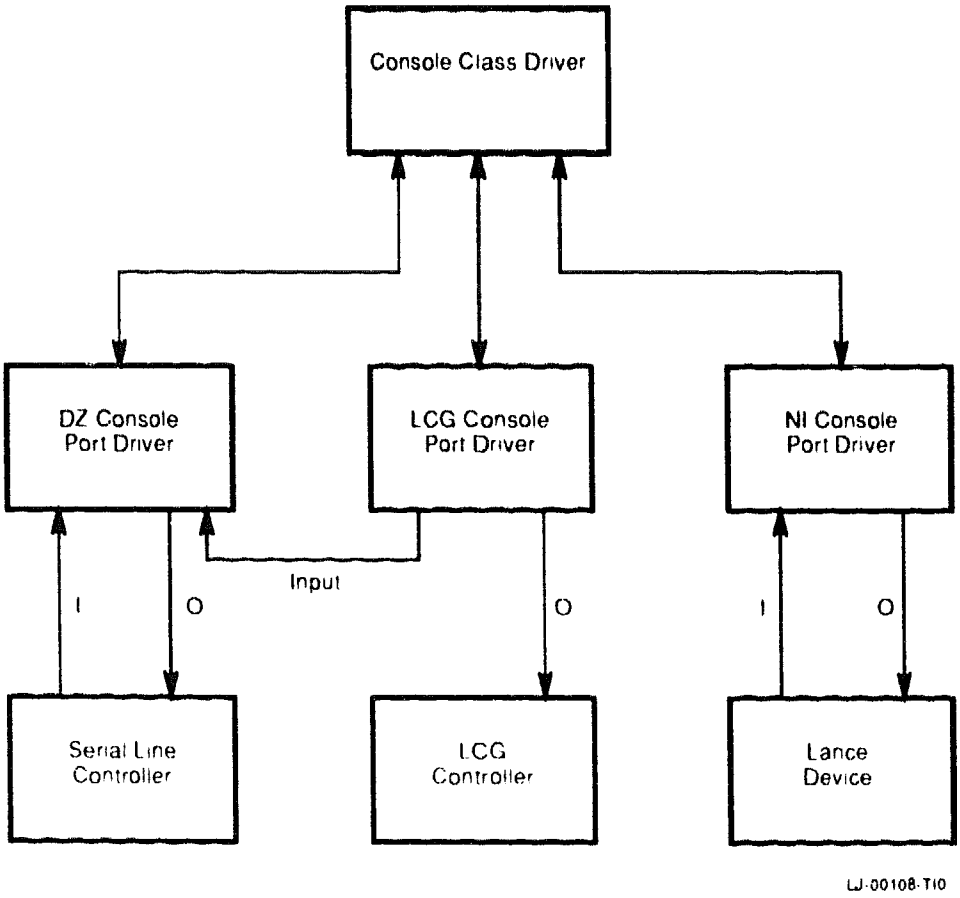
User application performs console input/output to the network by calling the console code, which calls the network diagnostic driver. The console, self test, system test, and UNJAM routines interface to the diagnostic driver in similar ways. All diagnostic routines, utilities, and console routines do the following:

- Allocate memory for the driver data area
- Allocate memory for the diagnostic function block or console function block
- Call the INIT_DRIVER routine with the following parameters:
  - Pointer to the I/O Segment Table
  - Pointer to the Driver Data Area
  - Pointer to the Driver Function Block or Console Function Block
  - Pointer to the Shared Console Interface Area or display zero if this is not a console driver
  - As many as two additional device-specific parameters

2.11 Console Driver Interface

The Model 60 console code is split into a a class/port driver scheme. The class driver contains the main console functions, such as PUT_CHARACTER and GET_CHARACTER. The port drivers contain the device specific code required to support these functions. Figure 2–9 shows the division of the console function.

Figure 2–9 Model 60 Console Structure



The console device can require either one channel or two channels to perform I/O to the console device. If the console device is a graphics terminal with a LK401 keyboard, the console program must interface with the serial line device driver for console input and interface with the graphics device driver for output from the console. If the console device is a terminal connected to a serial line, the console responds to the serial line driver for both input and output.

The console class driver contains the generic routines that interface to the console and user application to perform terminal input and output transactions. The console class driver interfaces with the port driver depending on the current console device.

If the console port driver does not support PUT_CHARACTER or GET_CHARACTER functions, it must interface with the appropriate port driver to perform the needed function.

2.11.1 Shared Console Interface Area

The shared console interface area (SCIA) consists of a console class driver descriptor and three port driver descriptors. The port driver descriptors can be associated with a DZ port driver, a graphics output driver, and a network driver.

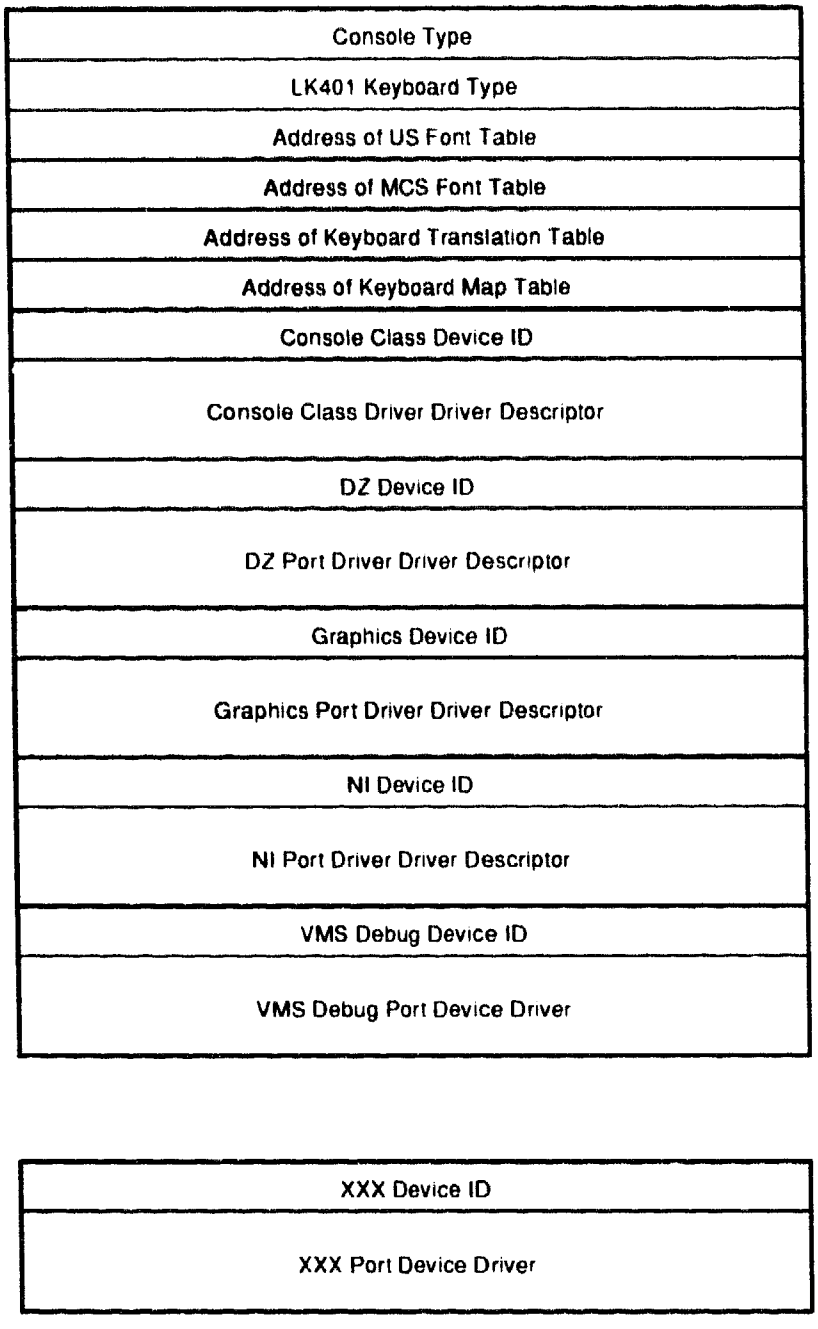
The SCIA provides an interface to the console terminal that isolates the implementation specifics of accessing the console terminal. It is designed so the console drivers can run in both virtual and physical mode.

The SCIA is set up by the initialization code. After the SCIA is set up, the software can use this area to interface with the console class driver routine. The shared console performs the following:

- Raw character I/O to console terminal
- Higher level of I/O functions that handle XON/XOFF flow (ASCII bell character and LK401 keyboard translation are handled by the DZ driver)
- Data structures to allow system software to map all console code and I/O space references into virtual memory as needed

SCIA data structure is shown in Figure 2–10.

Figure 2–10 SCIA Data Structure



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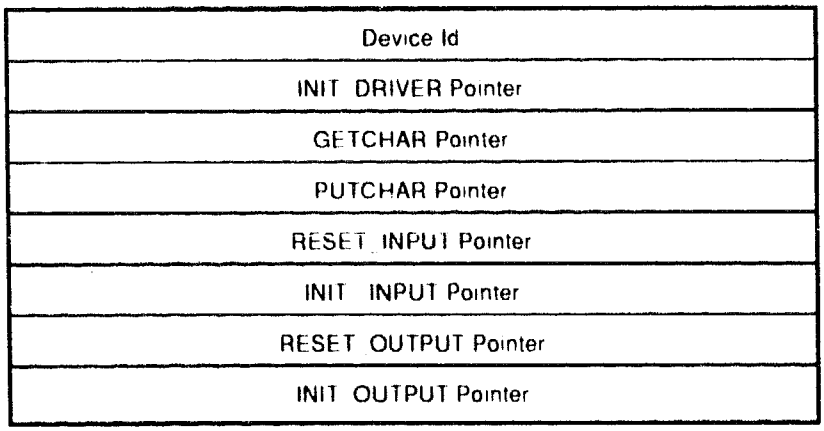
2.11.2 Console Port Driver

The fields of the console port driver's driver descriptor are the same as the console class driver's driver descriptor, except the port driver contains pointers to the console port level routines. The port driver supports all functions whether or not the device supports console output only or console input/output. Figure 2–11 shows the function block of the port driver.

Figure 2–11 Console Port Driver Function Block



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СНАР 3

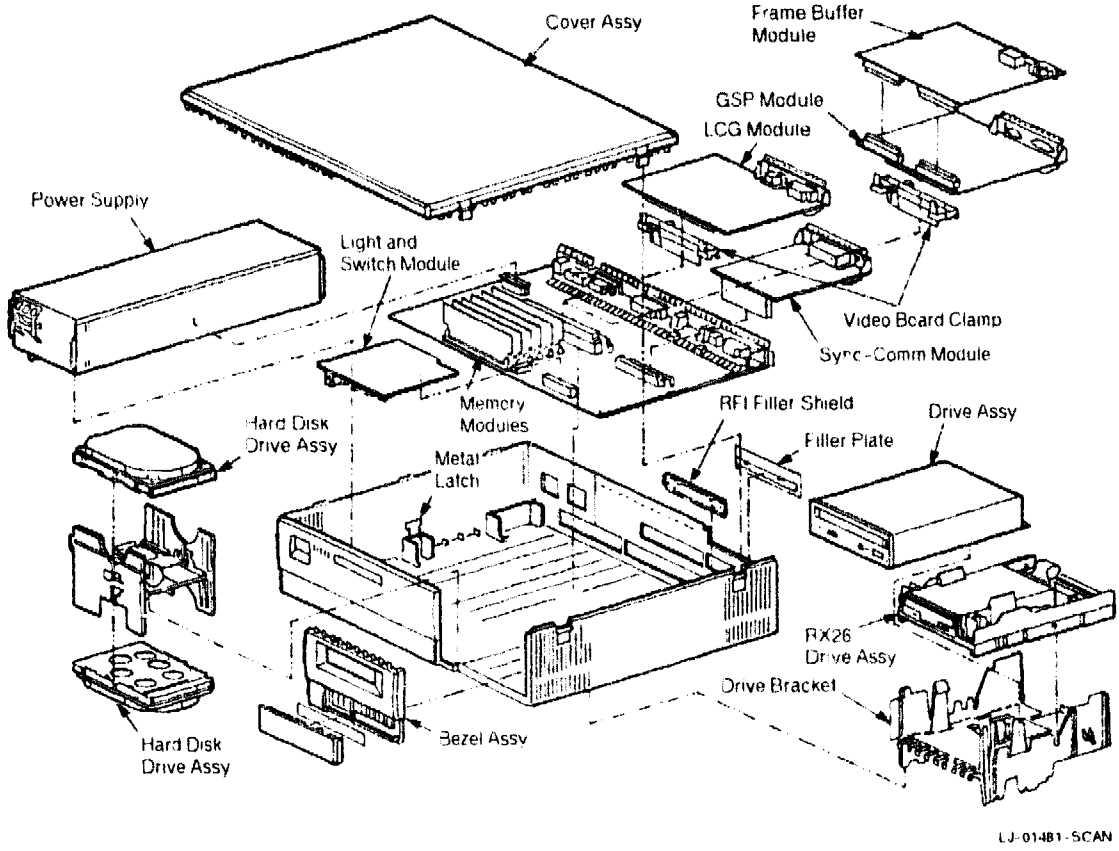
3
System Configuration

This chapter describes the system box used with the VAXstation 4000 Model 60 workstation, and its the components, cabling, and specifications. The topics covered in this chapter are:

3.1 Model 60 System Box

The Model 60 System box is used for desktop and floorstand installation of the VAXstation 4000 Model 60 system. Figure 3–1 shows the system box and its components.

Figure 3–1 Model 60 System Box



3.1.1 Mass Storage Device Areas

The system box can hold two half-height drives, 8.9 cm (3.5 in), in the H bracket (front left, Figure 3–1), and one half-height drive, 13.3 cm (5.25 in), in another bracket (front right, Figure 3–1. The bottom drive in the H bracket is mounted upside down. The H bracket releases by a single latch and the other bracket uses two release points.

3.1.2 Power Supply

The system box has space for one power supply, the H7819-AA. The powe supply provides protection against excess voltage, current, and temperature.

The power supply voltage connectors are located at the rear of the unit. The input connector is used to connect to a wall outlet and the output connector connects to the system monitor. The power switch and power OK LED are located on the front of the unit. Inside the power supply is a -9.0 V LED, visible from the outside. The supply also has two 12 V fans for cooling the system.

The power supply has an automatic voltage select (AVS) circuit to automatically select the AC input for 100 to 120 Vac or 220 to 240 Vac mode of operation. The supply is a 163 watt (W) unit. It supplies the following voltages:

Voltage (dc)	Ampere
+5.1	19.52
+3.3	6.39
+12.1	3.82
-12.0	0.69
-9.0	0.17

Power is supplied to the following components:

- System module (which supplies power for option modules installed in the system)
- Mass storage devices
- Cooling fans
- AC power for system monitor

3.1.2.1 Power Supply Specifications

Input Characteristics

Parameter	Specifications	
Line voltage	120 V	240 V
Voltage tolerance	88 V to 132 V	176 V to 264 V
Frequency	60 Hz	50 Hz
Frequency tolerance	47 Hz to 63 Hz	47 Hz to 63 Hz
Input current	2.9 A (max.) PS only 4.0 A (max.) AUX only	1.4 A (max.) PS only 2.0 A (max.) AUX only
Inrush current	45.0 A (max) cold PS only	45.0 A (max) cold PS only
Power consumption (max.)	251 W	251 W

Output Characteristics

Parameter	Specifications		
	Minimum	Typical	Maximum
+5.1 V reg. Short term	4.90 V	5.05 V	5.20 V
+5.1 V reg. Long term	+4.85 V	+5.10 V	+5.25 V
+12.1 V reg. Short term	+11.70 V	+12.10 V	+12.50 V
+12.1 V reg. Long term	+11.50 V	+12.10 V	+12.70 V
-12.0 V reg. Long term	-11.40 V	-12.00 V	-12.60 V

Parameter	Specifications		
	Minimum	Typical	Maximum
-9.0 V (isolated) Long term	-8.55 V	-9.00 V	-9.45 V
+3.3 V Long term	+3.13 V	+3.3 V	+3.46 V
Load range			
+3.3 V	3.20 A		6.39 A
+5.1 V	2.8 A		19.52 A
+12.1 V	0.18 A		3.82 A
-12.0 V	0.26 A		0.69 A
-9.0 V	0.12 A		0.17 A
Ripple and noise 1Hz to 10Hz			
+3.3 V		20.0 mV	30.0 mV
+5.1 V		30.0 mV	50.0 mV
+12.1 V		50.0 mV	70.0 mV
-12.0 V			120.0 mV
-9.0 V			50.0 mV
Ripple and noise (except +5.1 V and +3.3 V) 10 MHz to 50 MHz		1.0%	2.0%
Ripple and noise 10 MHz to 50 MHz			
+5.1 V		30 mV	50 mV
+3.3 V		20 mV	30 mV

Physical Dimensions

Weight	Height	Width	Depth
14.9kg (33 lb)	6.99 cm (2.75 in)	11.18 cm (4.4 in)	38.10 cm (15.0 in)

3.1.3 System Box Internal Cabling

The system box internal cabling is shown in Figure 3–2. Note that there is one SCSI cable and one dc power harness connecting to the drives.

NOTE

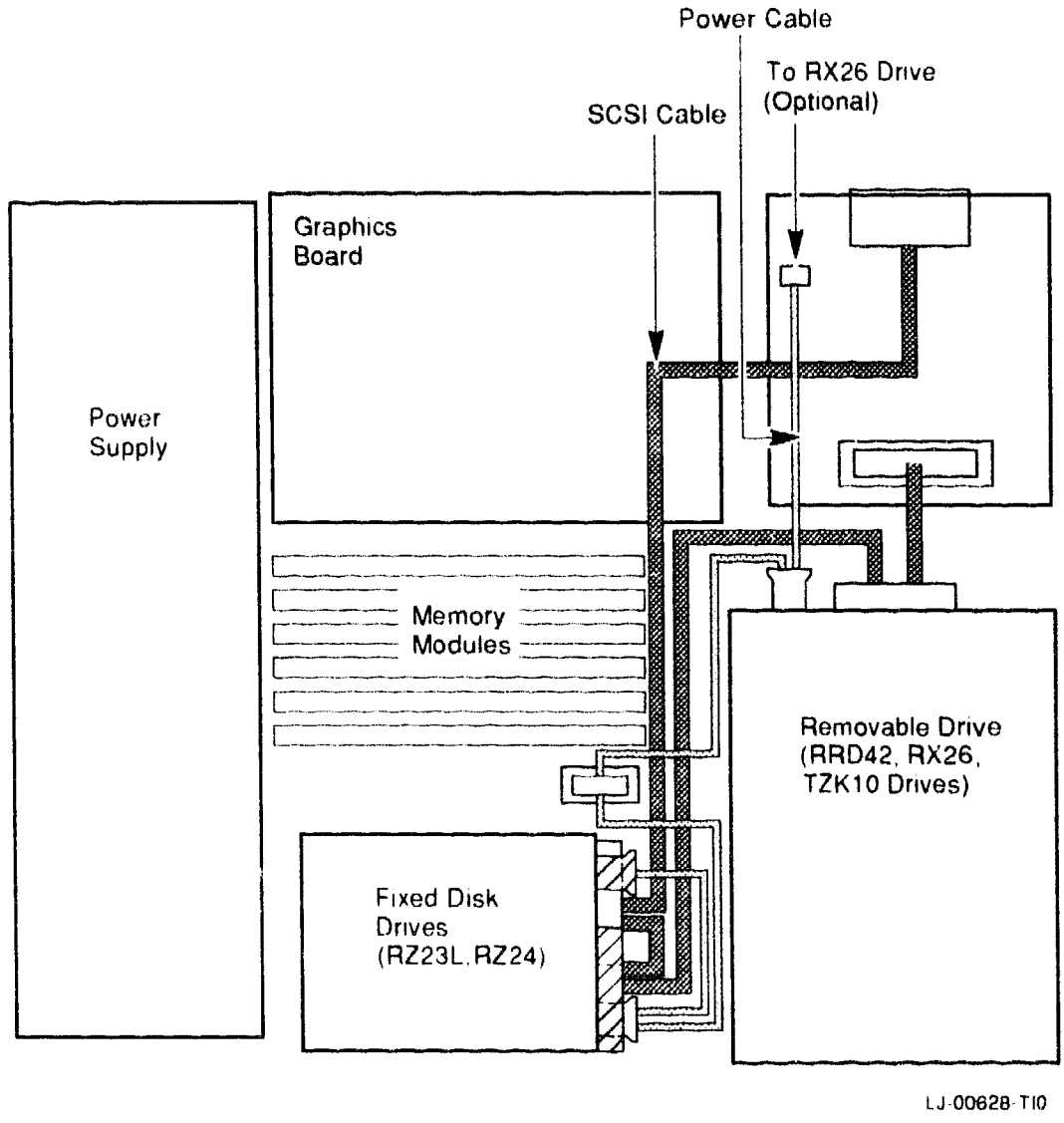
The power cable for half-height drives must be routed above the SCSI cable, as shown in Figure 3–2.

Table 3–1 lists internal system devices and their cable part numbers.

Table 3–1 Internal System Devices and Their Cables

System Device	Cable PN	Descrption
3 SCSI devices	17-02875-01	Three 50-pin IDC to 50-pin champ (external)
SCSI device dc power harness	17-02876-01	Four 4-pin Mat-N-Loks to 4-pin mini

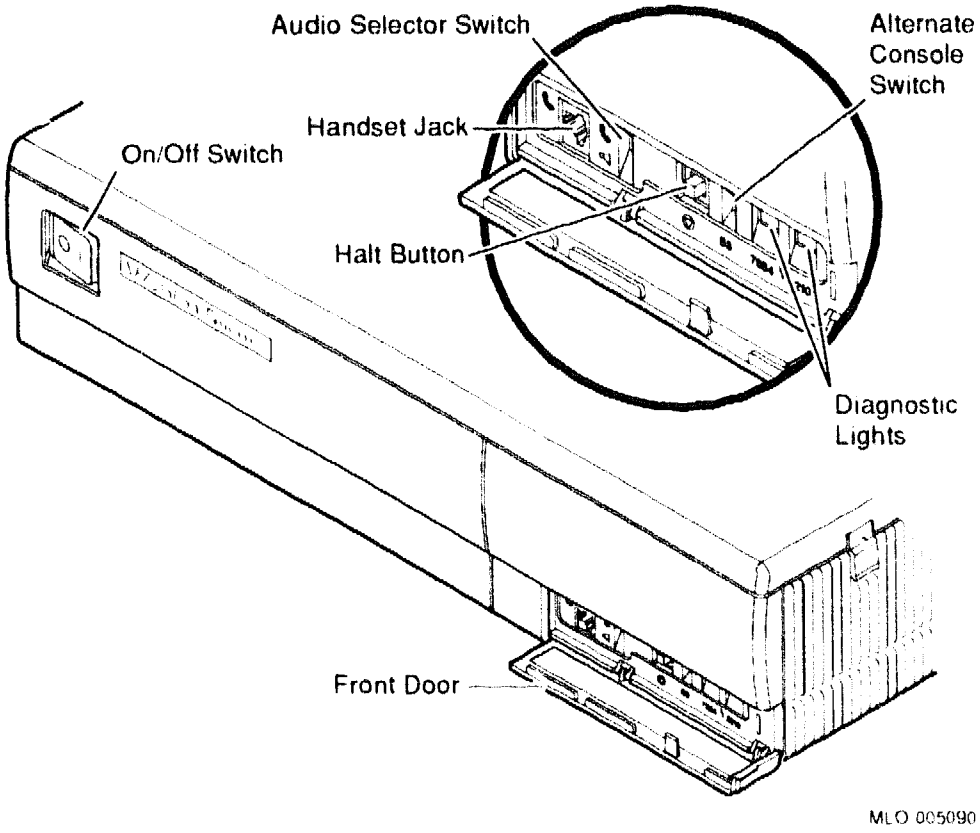
Figure 3–2 Internal Cabling



3.1.4 System Box Control Panel

The controls and indicators for the system box are located behind the flip-down door on the front bezel (Figure 3–3) of the box.

Figure 3–3 System Box Control Panel



AC Power Switch - This switch, located on the upper left side of the front bezel, controls ac power to the H7819-AA power supply. The switch does not affect the ac power outlet provided for add-on peripherals at the rear of the system box.

Power OK LED - This small green indicator is visible on the upper left side of the front bezel. The LED is lit when ac power is applied and the proper output voltage levels are present.

Audio In/Out - This jack is a four-pin MJ-type connector.

Speaker/Headset Switch - This switch selects between speaker output and headset output.

Alternate Console Switch - This switch selects either the graphics terminal or printer/console port to be the system's console.

Halt Console Switch - When actuated, this momentary switch sends a halt signal to the CPU module.

Diagnostic LEDs - These LEDs are located on the right side of the control panel. These LEDs display two binary fields, which represent a two-digit hexadecimal diagnostic code.

3.1.5 I/O Panel

The I/O panel provides connectors to devices external to the system. The system configuration determines which external devices are connected to the panel. The external devices shown in Figure 3–4 are as follows:

❶ Ethernet interface (from left to right: standard Ethernet port, network switch, and ThinWire port)

❷ RS423 communications port

❸ Printer/console port with a DEC423 connector (MMJ)

❹ Keyboard port

❺ Mouse port

❻ Remote keyboard/mouse port

❼ SCSI port

❽ Option port (for the DSW21 communications device)

❾ Monitor video port

❿ Monitor power socket

⓫ AC power socket

Table 3–2 lists external system devices and their cables.

Figure 3–4 Model 60 I/O Panel

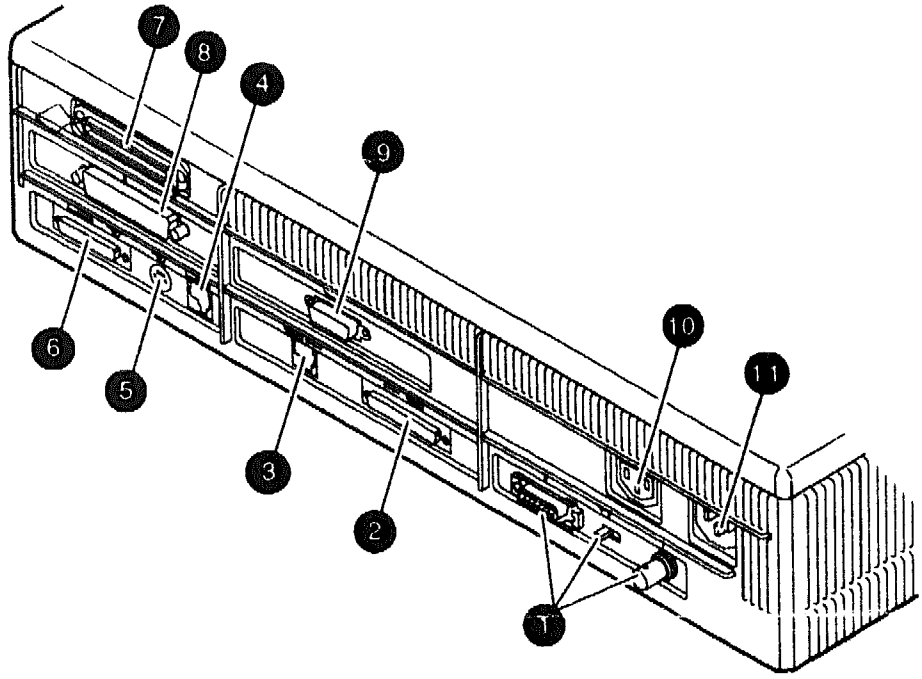


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Table 3–2 External System Devices and Their Cables

System Devices	Cable P/N	Description
System to monitor	BC27R-03	3 coax Dsub. to 3 BNC 39 in (99.1 cm)
System to VRT13		3 row 15-pin Dsub. to 9-pin Dsub. 3 ft (.91 m)
Remote video	BC27R-10	3 coax Dsub. to 3 BNC 10 ft (3.0 m)
Remote LK/VSXXX (mouse/keyboard)	17-02640-01	15-pin Dsub. to LK/VSXXX 10 ft (3.0 m)
DSW21 communications device option	DSW21-AX	50-pin Dsub. to x-pin[1] 2 ft (.61 m)
External SCSI	BC19J-03	50-pin champ to 50-pin champ 3 ft (.91 m)
AC power input (to power supply)	17-00606-10	IEC to 3 prong AC 6 ft (1.83 m)
AC power output (system to monitor)	17-00442-25	IEC to IEC, 39 in (99.1 cm)

[1]x=6, 12, 16, 22, 24, or 26.

3.1.6 System Box Specifications

The system box specifications are listed next. Table 3–3 lists the system box operating conditions and Table 3–4 lists the electrical specifications.

NOTE

The operating clearance is 8.9 cm (3.5 in) minimum on the sides and back of the system box. The service clearance is 15.2 cm (6 in) minimum on all sides of the box.

Table 3–3 System Box Operating Conditions

Temperature range	15° C to 32° C (59° F to 90° F)
Maximum rate of temperature change	11° C (20° F) per hour
Relative humidity	20% to 80% (with disk or tape drive)
Altitude	2400 m at 36° C (8000 ft at 96° F)
Maximum wet bulb temperature	28° C (82° F)
Minimum dew point	2° C (36° F)

Table 3–4 System Box Electrical Specifications

Input voltage	100 VAC to 120 VAC 220 VAC to 240 VAC
Frequency range	47 to 63 Hz


CHAP 4

4
Using the Console

This chapter describes the system console commands and using alternate consoles. Diagnostic commands, used to troubleshoot a system, are described in Chapter 5. The following topics are covered in this chapter:

4.1 System Console

Standard console commands for the VAXstaton 4000 Model 60 are listed by functional groups as follows:

- Additional commands - HELP or ?, LOGIN, and REPEAT
- SET/SHOW Commands - used to set or examine system parameters and configuration.
- Memory commands - include the DEPOSIT and EXAMINE commands.
- Processor control commands - BOOT, CONTINUE, INITIALIZE, START, and UNJAM commands.

4.1.1 Additional console commands

Command	Function
HELP or ?	Lists console commands and syntax.
LOGIN	Enables restricted console commands when PSE and PSWD are set.
REPEAT	Continuously repeats a console command.

4.1.1.1 HELP or ?

The HELP command or question mark (?) lists the console commands and the syntax allowed with each command.

4.1.1.2 LOGIN

The LOGIN command enables restricted console commands when the PSE bit is set. Enter the console password on the line following the LOGIN command.

4.1.1.3 REPEAT

The REPEAT command repeats a console command entered on the same line following REPEAT.

- BOOT, INIT, and UNJAM cannot be repeated.
- The command is terminated by entering the Ctrl C key sequence.

Example:

```
>>> REPEAT TEST MEM   ! Repeats the memory test.
        .
        .
        .
CTRL C                 ! Terminates the test.
>>>
```

4.1.2 SET and SHOW Commands

The SET and SHOW commands are used to set and examine system parameters. Table 4–1 lists the SET/SHOW parameters and their meanings:

Table 4–1 SET/SHOW Parameters

Parameter	Meaning
BFLG	Default bootflag
BOOT	Default boot device
CONFIG	System configuration
DEVICE	Ethernet and SCSI devices information
DIAGENV	Diagnostic environment (mode)
ETHER	Ethernet hardware address
ERROR	Errors from the last system or self-test
ESTAT	Status from the last system test
FBOOT	Power-up memory test flag
HALT	Halt recovery action
KBD	Keyboard language
MEM	Memory address range
MOP	MOP listener
PSE	Password enable
PSWD	Password
SCSI	System SCSI ID
TRIGGER	Enable network console

4.1.2.1 SET and SHOW Command Syntax

The following are the syntax and examples of the SET and SHOW parameters:

Syntax:

```
>>> SHOW parameter
>>> SET parameter value
```

Example:

```
>>> SHOW BOOT
>>> SET BOOT DKA200:
```

4.1.2.2 BFLG

The BFLG parameter is the default bootflag. It is equivalent to R5:xxxxxxxx in the boot command.

- BFLG is normally set to 0.

Example:

```
>>> SET BFLG 00000001     ! Set BLFG to
                             conversational boot
    BFLG = 00000001

>>> SHOW BFLG
    BLFG = 00000001
```

4.1.2.3 BOOT

The BOOT parameter is the default boot device.

- The boot device can be set to a bootable SCSI drive or the network device.
- To see the valid device boot names, type >>> SHOW DEVICE. The first column of the table (VMS/VMB) lists the boot names.

Example:

```
>>> SET BOOT DKA200
    BOOT = DKA200

>>> SHOW BOOT
    BOOT = DKA200
```

4.1.2.4 CONFIG

The CONFIG parameter is used to display the system configuration and device status.

- The SET command does not apply to this parameter.
- Use SHOW DEVICE for more information on SCSI devices.

Example 4–1 shows the information displayed by the SHOW CONFIG command.

Example 4–1 SHOW CONFIG Command

```
>>> SHOW CONFIG

KA46-A BL3-186-B3.1          ! System type and firmware revision
08-00-2B-F3-31-03            ! Ethernet hardware address
16 MB                        ! Total memory

DEVNBR  DEVNAM  INFO
------  ------  ----
    1    NVR    OK                      ! Non-volatile RAM
    2    LCG    OK                      ! 2D high res. color graphics rev 2.7
                 HR - 8 PLN FB - 2.7
    3    DZ     OK                      ! Serial line controller
    4    CACHE  OK                      ! Cache memory
    5    MEM    OK                      ! Memory configuration

                16MB = SY=8MB, S0/S1=8MB, S2/S3=0MB, S4/S5=0MB

    6    FPU    OK                      ! Floating point accelerator
    7     IT    OK                      ! Interval timer
    8    SYS    OK                      ! Other system functions
    9     NI    OK                      ! Ethernet
    10   SCSI   OK                      ! SCSI and drives
                1-RZ23L 6-INITR         ! One RZ23L at ID 1, system at ID 6.
    11   AUD    OK                      ! Sound
    12   COMM   OK                      ! DSW21 communications device
```

4.1.2.5 DEVICE

The DEVICE parameter is used to display SCSI and Ethernet device information.

The SET command does not apply to this parameter.

Example 4–2 shows the information displayed by the the SHOW DEVICE command.

Example 4–2 SHOW DEVICE Command

```
>>> SHOW DEVICE
   VMS/VMB     ADDR        DEVTYPE   NUMBYTES    RM/FX  WP  DEVNAM    REV
   -------     ----        -------   --------    -----  --  ------    ---
   ESA0        08-00-2B-17-EA-FD
   DKA100      A/1/0       DISK      121 MB      FX         RZ23L     1F25
   DKA300      A/3/0       RODISK    594 MB      RM     WP  RRD42     1.1A
   MKA500      A/5/0       TAPE                  RM         TZK10     00AD
  ..HostID..               INITR
   DKA700      A/7/0       DISK      332 MB      FX         RZ55      0900

!Column Meanings:

VMS/VMB    - The VMS device name, and console boot name for the device.
ADDR       - Ethernet hardware address or SCSI device ID.
             The SCSI device ID has the format:

                   A/DEVICE_ID/LOGICAL_ID

             The LOGICAL ID is always 0.

DEVTYPE    - Device type, RODISK is a read-only disk (CDROM).
NUMBYTES   - Drive capacity. Capacity is not be displayed for empty
             removable media drives
RM/FX      - Indicates whether the drive has removable or fixed media.
WP         - Indicates whether the drive is write protected.
DEVNAM     - Device name for the drive.
REV        - Firmware revision level for the drive.
```

4.1.2.6 DIAGENV

The DIAGENV parameter determines the diagnostic environment that the diagnostics run under. Table 4–2 lists the diagnostic environments and their use.

Table 4–2 Diagnostic Environments

Mode	Usage
Customer	No setup is required. Default mode on power-up.
Digital Services	Provides a more thorough test than in customer mode. Some tests require loopback connectors for successful completion.
Manufacturing	Some tests require loopback connectors for successful completion. **Do not use this mode in the field. It can erase customer data.**
Loop on error Digital Services	The system loops on a test when an error occurs. **Do not use this mode in the field. It can erase customer data.**
Loop on error Manufacturing	The system loops on a test when an error occurs.

To set the diagnostic environment, enter a console command from Table 4–3.

Table 4–3 SET DIAGENV Command

Command	Result
SET DIAGENV 1	Resets environment to Customer mode.
SET DIAGENV 2	Sets environment to Digital Services mode.
SET DIAGENV 3	Sets environment to Manufacturing mode.
SET DIAGENV 80000001	Sets environment to loop on error in Digital Services mode.
SET DIAGENV 80000002	Sets environment to loop on error in manufacturing mode.

Example:

```
>>> SET DIAGENV 2

    DIAGENV = 2
>>> SHOW DIAGENV

    DIAGENV = 2
```

4.1.2.7 ERROR

The ERROR parameter displays extended error information about any errors that occur during the last execution of:

- Initialization (power-up) test
- Extended test
- System test

The SET command does not apply.

Example:

```
>>> SHOW ERROR

?? 150 10 SCSI 0032
150 000E 00000005 001D001D 03200000 00000024
(cont.) 00000002 00000000 00000004
```

4.1.2.8 ESTAT

The ESTAT parameter displays status information about the system test.

The SET command does not apply.

The following example shows the information displayed by the SHOW ESTAT command:

```
>>> SHOW ESTAT
```

4.1.2.9 ETHER

The ETHER parameter displays the Ethernet hardware address.

- The SET command does not apply.

Example:

```
>>> SHOW ETHER
ETHERNET = 08-00-2B-1B-48-E3
```

4.1.2.10 FBOOT

The FBOOT (fast boot) parameter determines whether the memory is tested when power is turned on. The test time is reduced when main memory is not tested.

- When FBOOT = 0 the memory is tested on power-up.
- When FBOOT = 1 the memory test is skipped on power-up.
- The setting only affects the power-up test.
- FBOOT should only be set to 1 when troubleshooting requires a number of power cycles, and memory is not the suspected fault.

Example:

```
>>> SET FBOOT 1    ! Enables fast power-up test.
    FBOOT = 1
>>> SHOW FBOOT
    FBOOT = 1
```

4.1.2.11 HALT

The HALT parameter determines the recovery action. The recovery action is the action the system takes after power-up, system crash, or halt. The following table lists the HALT parameter values and their meanings:

Value	Meaning
1	System tries to restart operating system. If restart fails, then the system tries to reboot.
2	System tries to reboot.
3	System halts and enters console mode.

Examples:

```
>>> SET HALT 2
    HALT = 2
```

```
>>> SHOW HALT
    HALT = 2
```

4.1.2.12 KBD

The KBD parameter determines the keyboard language.

- The SHOW KBD command only displays a numeric keyboard code.
- The SET KBD command displays the language choices and the corresponding numeric code.

Example:

```
>>> SHOW KBD

KBD = 4

>>> SET KBD

0) Dansk                          8) Francais (Suisse Romande)
1) Deutsch                        9) Italiano
2) Deutsch (Schweiz)             10) Nederlands
3) English                       11) Norsk
4) English (British/Irish)       12) Portugues
5) Espanol                       13) Suomi
6) Francais                      14) Svenska
7) Francais (Canadian)           15) Vlaams

3 >>> 4              ! Enter numeric code
```

4.1.2.13 MEM

The MEM parameter displays the memory address range and the unavailable memory address range.

- The unavailable range is memory that is used by the console, and memory that is marked unavailable by the diagnostics.
- The SET command does not apply.

Example:

```
>>> SHOW MEM

        MEM_TOP = 01000000
        MEM_BOT = 00000000

          MEM_NOT_AVAIL
        -----------------
        00FC0800:00FFFFFF
```

4.1.2.14 MOP

The MOP bit enables the NI (Ethernet) listener while the system is in console mode. The listener can send and receive messeages on the network.

- The default mode is listener enabled (MOP = 1).

Examples:

```
>>> SET MOP 1
 MOP = 1
```

```
>>> SHOW MOP
    MOP = 1
```

4.1.2.15 PSE and PSWD

The PSE parameter is the enable console password bit. This enables the console password to restrict access to the console.

The PSWD parameter is used to set the console password.

The following are key points to remember about passwords:

- The password must be exactly 16 characters.
- Valid password characters are 0 through 9 and A through F only.
- The password feature is enabled when PSE = 1.
- The password feature is disabled when PSE = 0.
- SHOW PSWD does not apply.

Example:

```
>>> SET PSWD
PSDW0>>> xxxxxxxxxxxxxxxx    ! Old password (only if a
                             password has been
                             previously set)
PSWD1>>> 1234567890ABCDEF    ! New password
PSWD2>>> 1234567890ABCDEF    ! Verify new password

>>> SET PSE 1

PSE = 1
```

NOTE

After PSE is set to 1, type LOGIN at the >>> prompt, and type the password at the PSWD0>>> prompt.

4.1.2.16 SCSI

This parameter is the SCSI ID for the system.

- The system SCSI ID should be set to 6.
- The system SCSI ID should never be changed.

Example:

```
>>> SHOW SCSI
SCSI = 6
```

4.1.2.17 TRIGGER

The TRIGGER bit enables the Entity-Based Module (EMB).

- With EMB and the NI listener enabled (TRIGGER = 1, MOP = 1) you can access the console or boot the system from a remote system.
- Refer to Section 4.2.2 for more information about remote console access.

Example:

```
>>> SHOW TRIGGER
  TRIGGER = 0
>>> SET TRIGGER 1
  TRIGGER = 1
```

4.1.3 Memory Commands

The following table lists console commands that manipulate memory and registers.

Command	Function
DEPOSIT	Enters a value(s) into memory location(s) or register(s).
EXAMINE	Displays the contents of memory location(s) or register(s).

4.1.3.1 DEPOSIT Commands

The DEPOSIT command is used to write to memory locations from the console.

Syntax:

```
DEPOSIT /QUALIFIERS ADDRESS DATA
```

Table 4–4 lists the qualifiers and what each one specifies.

Table 4–4 DEPOSIT Command Qualifiers

Data size	/B - byte (8 bits) /W - word (16 bits) /L - longword (32 bits) /Q - quadword (64 bits)
Address type	/V - virtual address /P - physical address /I - internal processor register /G - general purpose register /M - machine register
Range of addresses	/N:X specifies that the X+1 locations be written with the value specified by DATA.
Protection	/U unprotects a protected memory location. An example of a protected area is the area of memory that the console uses.

The ADDRESS specifies the address (or first address) to be written.

DATA values must be given in hexadecimal.

Example:

```
!This example writes the value 01234567 into 6 longword
!locations starting at address 00100000.
            >>> DEPOSIT/P/N:5 00100000 01234567


              P 00100000 01234567
              P 00100004 01234567
              P 00100008 01234567
              P 0010000C 01234567
              P 00100010 01234567
              P 00100014 01234567
```

4.1.3.2 EXAMINE Commands

The EXAMINE command is used to display specific memory locations from the console.

Syntax:

```
EXAMINE /QUALIFIERS ADDRESS
```

Table 4–5 lists the qualifiers and what each one specifies.

Table 4–5 EXAMINE Command Qualifiers

Data size	/B - byte (8 bits) /W - word (16 bits) /L - longword (32 bits) /Q - quadword (64 bits)
Address type	/V - virtual address /P - physical address /I - internal processor register /G - general purpose register /M - machine register
Range of addresses	/N:X specifies that the X+1 locations be written.
Protection	/U unprotects a protected memory location. An example of a protected area is the area of memory that the console uses.

The ADDRESS specifies the address (or first address) to be read.

Example:

```
!This example reads the Ethernet hardware address.
            >>> EXAMINE/P/N:5 20090000

              P 20090000 0000FF08
              P 20090004 0000FF00
              P 20090008 0000FF2B
              P 2009000C 0000FF1B
              P 20090010 0000FF48
              P 20090014 0000FFE3
```

4.1.4 Processor Control Commands

The following table lists the processor control commands.

Command	Function
BOOT	Bootstraps the operating system.
CONTINUE	Starts the CPU running at the current program counter (PC).
INITIALIZE	Initializes processor registers.
START	Starts the CPU at a given address.
UNJAM	Sets devices to an initial state.

4.1.4.1 BOOT

The boot command starts the bootloader, which loads the operating system and starts it. The boot command causes the system to exit console mode and enter program mode. The boot command has the following syntax:

Syntax:

```
>>> boot /qualifier   device,   second_device
```

Table 4–6 BOOT Command Syntax

Term	Meaning
/qualifier	This optional qualifier sets the value for R5 for the bootloader. It is used to select a boot on the disk, or a conversational boot. The qualifier can be specified in either of the following formats: • /R5:XXXXXXXX • /XXXXXXXX
device,	This optional term is the primary boot device. If no device is specified, the system attempts to boot the default device. You can set the default boot device with the SET BOOT command.
second_device	This optional term is the device the bootloader tries to boot if the primary boot device fails.

Example:

```
>>> BOOT /R5:00000001 DKA200, DKA400
```

The preceding example shows the system performing a conversational boot from DKA200. If the system cannot boot from DKA200, it tries a conversational boot from DKA400.

4.1.4.2 CONTINUE

The CONTINUE command switches the system from console mode to program mode. The CPU starts running at the current Program Counter (PC).

Example:

```
>>> CONTINUE
```

4.1.4.3 INITIALIZE and UNJAM

The INITIALIZE command resets the processor registers. UNJAM resets the system devices. These commands together reset the system. UNJAM should be entered first.

Example:

```
>>>INITIALIZE
>>>UNJAM
```

4.1.4.4 START

The START command is used to set the program counter (PC) and start the CPU. The command causes the system to exit console mode and enter program mode. The syntax for the START command is:

```
>>> START ADDRESS

! ADDRESS is the value loaded into the PC.
```

Example:

```
!This example starts the bootloader.

>>> START 200
```

4.2 Alternate Consoles

The Model 60 provides two ways to use alternate consoles if the graphics subsystem fails. Console commands may be entered on a terminal connected to the printer port of the workstation or from a network connection. The two alternate consoles are described in the following sections.

4.2.1 Printer Port Console

To access the printer port console verify that:

- The baud rate of the terminal connected to the printer port is set at 9600 baud.
- The alternate console switch (S3) located on the front panel is up.

NOTE

The state of the alternate console switch is only read at power up. Changing the switch setting when the system is powering up has no effect until the system box is powered down and then up.

4.2.2 Network Console

The system console can also be accessed from the network. The network console allows you to remotely troubleshoot the system or provide a console when the other consoles are not available.

Some console tests and commands cause the network connection to be terminated because the commands use the network device, or they cause a connection timeout at the remote node.

To access the console you need:

- The hardware Ethernet address of the VAXstation computer.
- Access to a VMS operating system on the same Ethernet segment as the VAXstation 4000 computer (the systems cannot be separated by a bridge or router).
- The following VAXstation 4000 computer parameters must be set:
  - — A console password
  - — MOP, TRIGGER

Once the Model 60 is set up, perform the following steps from the other VMS operating system to connect to the console:

1. Log in to a user account (no special privileges are required).
2. Type the following commands:

Command	Action
$ MC NCP	Enters the Network Control Program (NCP).
NCP> SHOW KNOWN CIRCUITS	Shows available circuits you can connect through.
NCP> CONNECT VIA circuit SERVICE PASSWORD xxxxxxxxxxxxxxxx PHYSICAL ADDRESS 08-00-2B-XX-XX-XX	
	Connects to the console.
>>> console commands	Performs console functions.
>>> CTRL/D	Disconnects console.
NCP> EXIT	Exits NCP.
$ LO	Logs off the system.

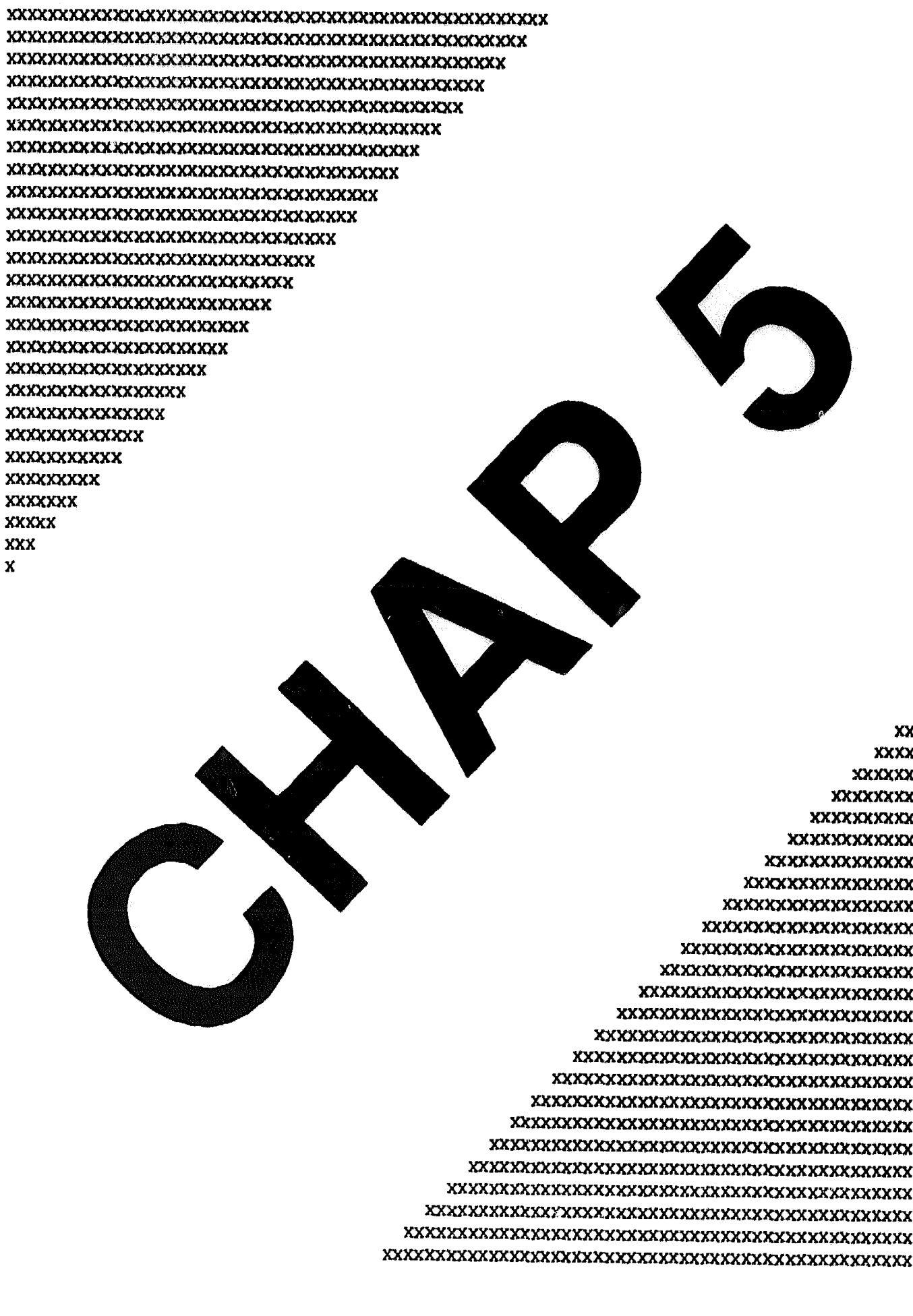
Example 4–3 shows each step involved in the process.

NOTE

Do not run memory test. It causes the console to hang and you will have to power off the system.

Example 4–3 Network Console Session

```
$ MC NCP
NCP>SHOW KNOWN CIRCUITS

Known Circuit Volatile Summary as of 27-MAR-1991 13:50:02

   Circuit          State                    Loopback     Adjacent
                                               Name      Routing Node

  SVA-0             on                                    25.14
NCP>CONNECT VIA SVA-0 SERVICE PASSWORD 111111111111111 -
  PHYSICAL ADDRESS 08-00-2B-1B-48-E3
Console connected (press CTRL/D when finished)
>>>               (At the >>> prompt, type LOGIN and [RETURN] if
                   the PSE was set to 1.  At the PSWD0>>> prompt,
                   type the password.)

>>> SHOW CONFIG

 KA46-A BL3-186-B3.1        ! System type and firmware revision
 08-00-2B-F3-31-03          ! Ethernet hardware address
 16 MB                      ! Total memory

 DEVNBR  DEVNAM  INFO
 ------  ------  ----
     1    NVR    OK                    ! Non-volatile RAM
     2    LCG    OK                    ! 2D high res. color graphics rev
                  HR - 8 PLN FB - 2.7
     3    DZ     OK                    ! Serial line controller
     4    CACHE  OK                    ! Cache memory
     5    MEM    OK                    ! Memory configuration

                 16MB = SY=8MB, S0/S1=8MB, S2/S3=0MB, S4/S5=0MB

     6    FPU    OK                    ! Floating point accelerator
     7     IT    OK                    ! Interval timer
     8    SYS    OK                    ! Other system functions
     9     NI    OK                    ! Ethernet
     10   SCSI   OK                    ! SCSI and drives
                 1-RZ23L 6-INITR       ! One RZ23L at ID 1, system at ID
     11   AUD    OK                    ! Sound
     12   COMM   OK                    ! DSW21 communications device
CTRL/D

NCP> EXIT
$
```


CHAP 5

5
Diagnostic Testing

This chapter describes the diagnostic testing and test commands that are used with the Model 60 system. It includes procedures for setting up the diagnostic environments, running self-tests and system tests, and invoking utilities. The following topics are included in this chapter:

For this troubleshooting process it is assumed that problems are not caused by such things as faulty power cords or loose modules and connectors.

Actual error codes and their meanings are provided in Appendix A.

5.1 Diagnostic Functions

The system firmware provides the diagnostic functions listed in Table 5–1.

Table 5–1 Diagnostic Functions

Function	Description
Power-up test	Tests initialization and all devices.
Extended self-test	Tests devices in the system sequentially with the TEST command.
System test	Test all devices in the system interactively.
Utilities	Functions for visual screen test, mass storage devices, and the network listener.
Error reporting	Displays error messages on the console when errors are found during power-up tests, self-tests, and system tests.

5.2 System Power-up Test

The power-up self-test sequentially tests the devices in the system. This test takes about one minute to complete for an 8MB base system. When the test successfully completes, the console prompt is displayed. Figure 5–1 shows the prompt.

Factors increasing the test time are:

- Additional memory

  Each additional 8 Mbytes adds about eight seconds.

- Additional time is required for SCSI devices.

The time to execute the power-up self-test can be reduced by setting the FBOOT parameter to 1. The system then will not test memory on power-up.

5.2.1 Power-up Sequence

Figure 5–1 and Figure 5–2 show the console screens shown when successful and unsuccessful power-up tests occur.

Refer to Section B.1.2 for a list of the power-up initialization diagnostic LED codes.

The following events summarize the power-up sequence:

- If the system finds a fatal error prior to initializing the console, the error can only be decoded from the eight error LEDs located on the lights and switches board.

  Refer to the error codes in this manual. If all of the error LEDs remain on, the ROM code does not start.

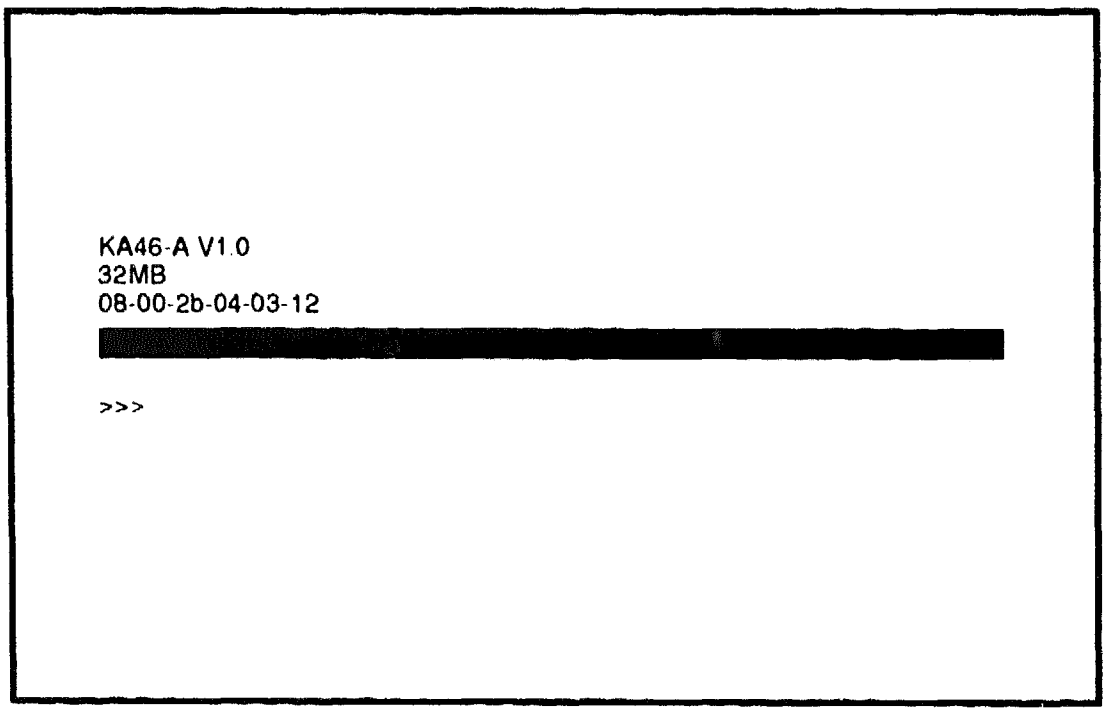
- If the graphics subsystem fails self-test, the system assumes that a console terminal is connected to the console/printer port.

- If the alternate console switch located on the light and switches board is set to alternate console (switch in the up position), the system assumes that a console terminal is connected to the console/printer port.

- At the end of the power-up sequence the system enters console mode as indicated by the >>> prompt if the HALT parameter is set to 3. If the HALT parameter is set to 1 or 2, the system tries to boot the default boot device.

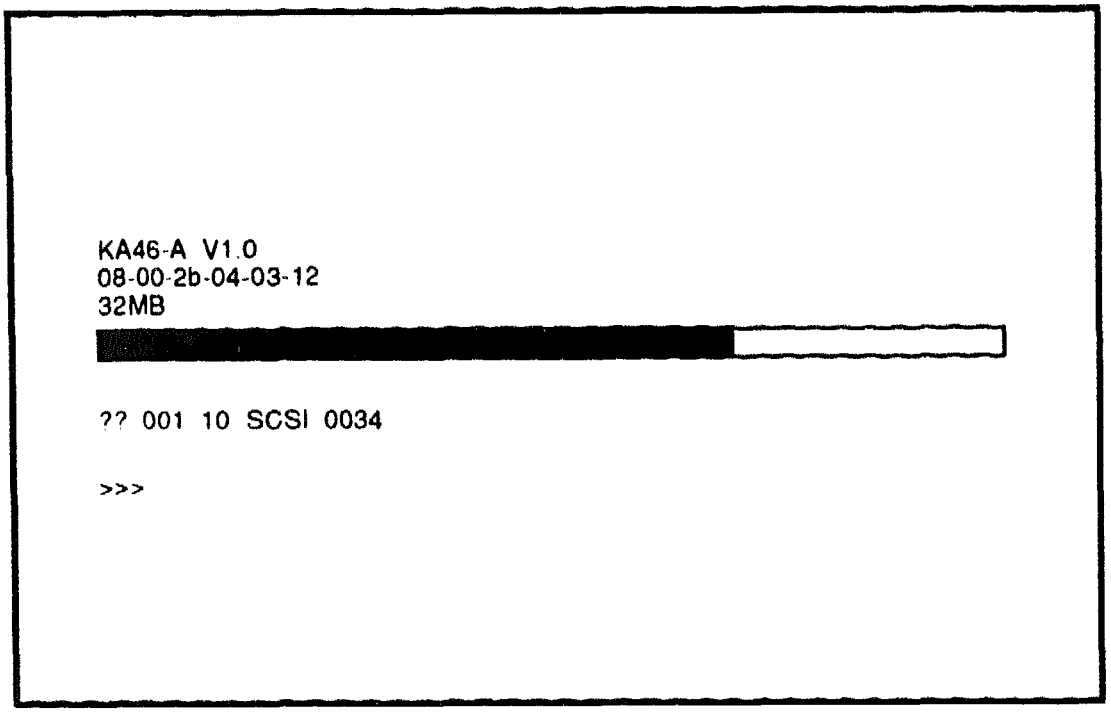
- During initialization, the system is configured by creating the Master Configuration Table (MCT) and the Device Configuration Table (DCT).

Figure 5–1 Successful Power-Up Self-Text



LJ-00112-TI0

Figure 5–2 Unsuccessful Power-Up



LJ-00635-TI0

The general format for error information is:

```
Fru  Dev_nbr  Dev_nam  Err_nbr
```

Where:

- ?? - indicates a fatal error; ? indicates a non-fatal error
- Fru - the field replaceable unit of the device that failed (see Appendix D for a list of FRUs)
- Dev_nbr - the device number of the failing function
- Dev_nam - the device name of of the failing function
- Err_nbr - a decimal number that corresponds to a specific device failure. This error code number indicates the function or the FRU that caused the error. Refer to Appendix A for error code descriptions.

5.3 Displaying System Configuration

The Model 60 firmware provides two configuration commands, SHOW DEVICE and SHOW CONFIG.

SHOW DEVICE determines what type of mass storage devices are included in the system.

SHOW CONFIG determines the overall system configuration.

5.3.1 SHOW DEVICE

To determine the presence of storage devices such as a hard disk, diskette drives, or other drives, at the console prompt enter:

```
>>>  SHOW DEVICE  Return
```

The system shows a display similar to the following:

Example 5–1 Displaying System Configuration

```
>>> SHOW DEVICE
   VMS/VMB     ADDR        DEVTYPE   NUMBYTES    RM/FX   WP   DEVNAM    REV
   -------     ----        -------   --------    -----   --   ------    ---
   ESA0        08-00-2B-17-EA-FD
   DKA100      A/1/0       DISK      121 MB      FX           RZ23L     1F25
   DKA300      A/3/0       RODISK    594 MB      RM      WP   RRD42     1.1A
   MKA500      A/5/0       TAPE                  RM           TZK10     00AD
  ..HostID..               INITR
   DKA700      A/7/0       DISK      332 MB      FX           RZ55      0900
```

VMS/VMB	Is operating system interpretation of what the device is. For example, with a VMS operating system, an RZ23 drive is interpreted as a DKA300.
ADDR	Indicates the location of the device. If the device is an Ethernet device, the ADDR column shows the Ethernet address. If the device is a system device, the first character shown is the bus (A or B); the second character represents the device number (3, 5, 6); the third field (00) is not used.
DEVTYP	Shows the device type.
NUMBYTES	Gives the number of storage bytes
RM/FX	Indicates whether the media device is fixed or removable.
WP	Write protected, yes or no.
DEVNAM	Shows the device name.

5.3.2 SHOW CONFIG

To determine the presence of devices other than internal storage devices, and to determine the quantity of memory in the system, enter:

```
>>>SHOW CONFIG Return
```

The system displays a configuration table similar to the one shown in Example 5–2.

Example 5–2 Configuration Table

```
KA46-A BL3-186-V1.0                ! System type and firmware revision
08-00-2B-F3-31-03                  ! Ethernet hardware address
16 MB                              ! Total memory

DEVNBR   DEVNAM   INFO
------   ------   ----
    1     NVR     OK                          ! Non-volatile RAM
    2     LCG     OK                          ! 2D high res. color graphics rev 2.
                   HR - 8 PLN FB -2.7
    3     DZ      OK                          ! Serial line controller
    4     CACHE   OK                          ! Cache memory
    5     MEM     OK                          ! Memory configuration

                   16MB = SY=8MB, S0/S1=8MB, S2/S3=0MB, S4/S5=0MB
```

Example 5–2 (continued on next page)

Example 5–2 (Cont.) Configuration Table

```
    6     FPU     OK                          ! Floating point accelerator
    7     IT      OK                          ! Interval Timer
    8     SYS     OK                          ! Other system functions
    9     NI      OK                          ! Ethernet
    10    SCSI    OK                          ! SCSI and drives
                  1-RZ23L 6-INITR             ! One RZ23L at ID 1, system at ID 6.
    11    AUD     OK                          ! Sound
    12    COMM    OK                          ! DSW21 communications device
>>>
```

To determine the quantity of memory in the system, note line 5, the MEM line, in the example. This line shows 8 Mbytes for the system board and 8 Mbytes for memory module slots 0 and 1).

5.4 Displaying Additional Error Information

Use the SHOW ERROR utility to obtain detailed error information about any failing device. To determine if an error has occurred on a particular device, type SHOW ERROR followed by the device number. To show all of the system errors, type SHOW ERROR. If errors are present, a display similar to Example 5–3 is shown.

Example 5–3 SHOW ERROR

```
>>> SHOW ERROR

?? 001   03  DZ      0023
         001 0010    00000001 00000001 00003f30 00000001

?? 001   09  NI      0009
         001 0001    200e0000 00005555 00005515

>>>
```

The general format for error information is:

Fru Dev_nbr Dev_nam Err_nbr

Where:

- Fru - is the field replaceable unit of the failed device.
- Dev_nbr - is the number of the failing device.
- Dev_nam - is the name of the failing device.

- Err_nbr - is a decimal number corresponding to a specific device failure. This number is used to reference various error tables when performing problem isolation and repair procedures.

5.5 Setup Required for Self-Tests

You must do the following before running a self-test:

Step	Action	Comment
1	Put the system in console mode.	Shut down the operating system or power up the system if you do not have the console prompt.
2	Select the diagnostic environment.	See Table 5–2.
3	Attach loopbacks if required.	See Table 5–3.

5.5.1 Selecting a Diagnostic Environment

The system diagnostics and utilities can run in one of three environments:

- Customer environment - requires no setup beyond installation of the system. Type SET DIAGENV 1 at the >>> prompt to access.
- Digital Services environment - requires loopbacks and setup, but provides a more comprehensive test. The Key utilities require must be run in this environment. Type SET DIAGENV 2 at the >>> prompt to access.
- Manufacturing environment - for manufacturing use. Type SET DIAGENV 3 at the >>> prompt to access. (**CAUTION: Do not use this environment for customers as it may destroy customer data.**)

To set the diagnostic environment, enter one of the console commands listed in Table 5–2.

Table 5–2 SET DIAGENV Command

Command	Result
SET DIAGENV 1	Resets environment to Customer mode.
SET DIAGENV 2	Sets environment to Digital Services mode.
SET DIAGENV 3	Sets environment to Manufacturing mode.
SET DIAGENV 80000001	Sets environment to loop on error in Digital Services mode.
SET DIAGENV 80000002	Sets environment to loop on error in manufacturing mode.

Example:

Example 5–4 SET DIAGENV

```
>>> SET DIAGENV 2

    DIAGENV = 2
>>> SHOW DIAGENV

    DIAGENV = 2
```

5.6 Device Tests

Table 5–3 lists the device tests and corresponding mnemonics, decimal ID, binary ID, and loopback requirements.

Table 5–3 Device Test IDs and Mnemonics

Device	Mnemonic	Decimal ID	Binary ID	Loopback Required, Digital Services Env.
Non-Volatile RAM	NVR	1	0001	No
2D or other Graphics	LCG or xxx	2	0010	Monitor on low res. 2D
Serial line controller	DZ	3	0011	Yes, on comm. port
Cache system	CACHE	4	0100	No
Memory	MEM	5	0101	No
Floating point accelerator	FPU	6	0110	No
Interval timer	IT	7	0111	No
Other system board hardware	SYS	8	1000	No
Network interface	NI	9	1001	Yes, or connected to a network
SCSI Controller	SCSI	10	1010	No
Sound chip	AUD	11	1011	No
Synchronous comm or other option	COMM or xxx	12	1100	No, but H3199 required for Manufacturing environment.

5.7 Running Self-Tests

This section describes the test command interface used to run the self-test on a device. Table 5–4 shows the general format for running the self-test using the test command.

Table 5–4 Running the Self-Test

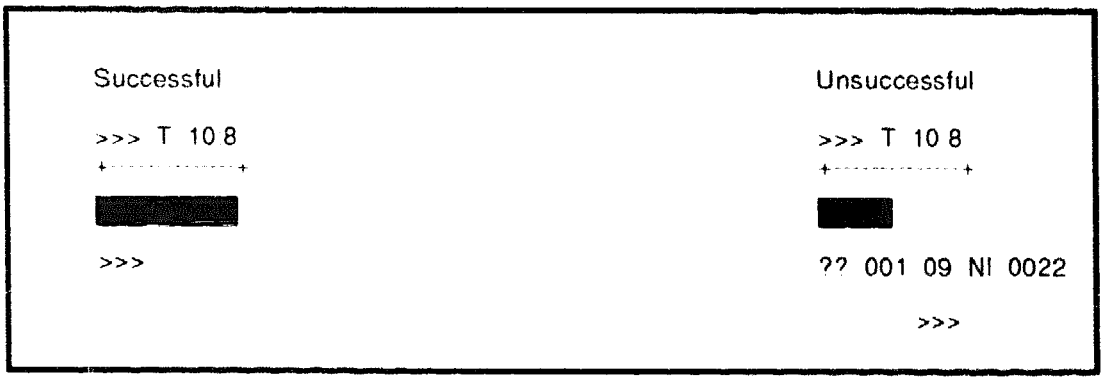
Command	Action
T 1	Run self-test on device number 1
T 1:4	Run self-test on devices numbered 1 through 4
T 1,2	Run self-test on devices 1 and 2

To test a range of devices, separate the device numbers being tested by a colon (:). To separate individual tests or ranges of devices, use a comma or space bar. For example,

T 8:10,6,3:5 tests devices 8 through 10, tests device 6, and then tests devices 3 through 5

Figure 5–3 gives an example of the console display when successful and unsuccessful self-tests have been run.

Figure 5–3 Successful and Unsuccessful Self-Test



The format of the error message is identical to the power-up self-test error message shown in Figure 5–3.

5.7.1 Running a Single Device Self-Test

To run a single device self-test, type the TEST command using the following syntax:

Example 5–5 TEST - Single

```
>>> TEST xxx
```

Where:

xxx is the device mnemonic or ID (decimal) listed in Table 5–3.

Example 5–6 Running a Single Device Test

```
>>> TEST MEM
```

This command tests main memory.

5.7.2 Running Multiple Device Self-Tests

Multiple device self-tests can be specified with the TEST command. The device tests are executed one at a time in the order specified in the command line.

The devices can be specified individually, or as a range using the conventions listed in Table 5–5:

Table 5–5 Multiple Test - Syntax Rules

IDs	Syntax
Individual device IDs	Separate the device IDs with a comma.
A range of device IDs	Separate the range limits with a colon.
Combination ranges and individual IDs	Separate the ranges and individual IDs with a comma.

Table 5–6 lists the formats for running multiple device tests.

Table 5–6 Formats for Running Multiple Tests

Format/Example	Action
TEST xxx,yyy	Execute self-test on devices xxx and yyy.
TEST 1,5	Execute self-test on main memory and the NVR.
TEST xxx:yyy	Execute self-tests on devices xxx through yyy.
TEST 1:4	Execute self-tests on NVR, LCG, DZ and CACHE.
TEST xxx:yyy,zzz	Execute self-tests on devices xxx through yyy and device zzz.
TEST 1:4,6	Execute self-tests on NVR, LCG, DZ, CACHE and FPU.

5.7.3 Running a self-test Continuously

You can run a self-test sequence continuously using the console REPEAT command. The REPEAT command executes a command continuously until you type the Ctrl C key sequence at the console or until an error occurs:

Example 5–7 Running a Self-Test Continuously

```
>>> REPEAT  TEST 1:4
```

In this example, device tests 1 through 4 run continuously until you type the Ctrl C key sequence at the console.

5.8 Descriptions of Self-Tests

This section describes the self-tests that are listed in Table 5–3.

NOTE

The self-tests are arranged by decimal ID. The self-test's decimal ID appears in parentheses.

5.8.1 TOY/NVR Self-Test (1)

Setup Notes

- There are no extended error messages for the NVR test.
- Non-fatal errors (indicated by a single question mark (?)) indicate the time in the NVR has not been set and is not a hardware fault.

The self-test includes the NVR/TOY self-tests.

NVR Test - Checks the NVR for valid data. If the NVR is not initialized, a register test is performed on all of the NVR locations and the NVR is initialized. If the NVR is not initialized, ONLY the temporary locations are tested in the NVR.

TOY Test - Checks to see if time has been set in the TOY. If not, a test of all the TOY registers is performed. This test writes/reads all possible values a TOY register can hold.

Refer to Table 5–4 and Table 5–3 for information on running the TOY /NVR self-test. Refer to Section A.2.1 for a list of the TOY/NVR error codes and Section B.1.3 for a list of the TOY/NVR diagnostic LED codes.

5.8.2 LCG Self-Test (2)

Setup Notes

- This test does not run in customer mode because it clears the console.
- A monitor must be connected to the low resolution graphics board.
- The console only uses the left port on the dual monitor board.
- The LCG test does not run extended tests in customer mode (DIAGENV 1) because it clears the console. Refer to Section 4.1.2.6 for information on DIAGENV parameters.
- DIAGENV = 2 and requires a 29-24795 total loopback connector installed in the communication port.

- The low resolution frame buffer clock jumpers must be installed correctly before power-up.
- The low resolution monitors must be connected during the LCG self-test.
- Only one port can be the console port on a dual head high resolution frame buffer.
- The panel Alternate Console switch must be in the DOWN position for graphics console or in the UP position for the DZ port.

The self-test includes the following tests:

Video Test - Tests the VRAM memory and the communication between the S-chip and VRAM. It initializes the Brooktree and sets up the video screen. It also sets up the video registers in the S-chip.

Register Test - Uses the longword format to read/write test all LCG S-chip registers.

FIFO Test - Creates a FIFO and clip list in the contiguous physical memory and tests set up packets, int/status bits, put/get pointers, FIFO and clip control flags, FIFO status bits; and makes sure that the FIFO can be reset.

AG Test - Calls all of the LCG address generator specific self-test routines. These routines test the drawing functions, logic unit functions and glyph functions.

Virtual Addressing Mode Test - Calls all the LCG virtual drawing specific self-test routines.

Refer to Table 5–4 and Table 5–3 for information on running the LCG self-test. Refer to Section A.2.17 for a list of the LCG self-test error codes and Section B.1.4 for a list of the LCG diagnostic LED codes.

5.8.3 DZ Self-Test (3)

Setup Notes

- The DZ interrupt test fails in the Digital Services or manufacturing environments if no external loopbacks are present on the communication port.
- The mouse test fails if the mouse is not plugged in and the console is a video device.
- The LK401 test fails if the LK401 is not plugged in and the console is a video device.

- A keyboard and pointing device must be plugged in, or an error is reported.
- When you are in the Digital Services or Manufacturing environments, loopbacks must be used on the standard communications port.

The self-test includes the following tests:

Reset Test - Resets the DZ chip and sets up its lines to their default values. An error occurs if the device does not reset or the line parameters do not get set up properly.

Polled Test - Tests each line in the internal loopback mode by using the chip in the polled mode. Characters are transmitted out a line and are expected to be looped back.

Interrupt Test - Tests each line running interrupt driven. If the diagnostic environment is Digital Services or manufacturing, the lines are tested using an external loopback device on the communication port. Interrupts are disabled and characters are sent out the lines not being used by the console device. The characters are expected to be looped back.

LK401 Test - Checks for the presence of an LK401 when the console device is a video device.

Mouse Test - Checks for the presence of a mouse when the console device is a video device.

Refer to Table 5–4 and Table 5–3 for information on running the DZ self-test. Refer to Section A.2.2 for a list of the DZ self-test error codes and Section B.1.5 for a list of the DZ diagnostic LED codes.

5.8.4 CACHE Self-Test (4)

The self-test includes the following tests:

DATA Store Test - Tests the data store in the Model 60 primary cache. A two pass memory test is performed on the data store. This test performs a read/compare/complement/write in both the forward and reverse directions. The data store is accessed through the I/O address space. Only the cache banks enabled in the BEHR are tested.

TAG Store Test - Tests the tag store in the Model 60 primary cache. A two pass memory test is performed on the tag store. This test performs a read/compare/complement/write in both the forward and reverse directions. The tag store is accessed through the I/O address space. Only the cache banks enabled in the BEHR are tested.

Refer to Table 5–4 and Table 5–3 for information on running the CACHE test. Refer to Section A.2.16 for a list of the CACHE test error codes and Section B.1.6 for a list of CACHE test diagnostic LED codes.

5.8.5 Memory Self-Test (5)

Setup Notes

- If memory modules are not configured correctly, the memory test fails, and the memory modules will not be configured. Memory modules must be installed in pairs, with the 16MB modules installed behind the 4 MB modules. Refer to Section 6.5.2 for further information on memory module configuration.

The self-test includes the following tests:

Byte Mask Test - Checks the byte mask signals that are generated by the CPU. This test is performed on each page boundary. Once the test is complete, all free memory is filled with AAh.

Memory Test (forward) - Performs a read/compare/complement/write on the memory in the forward direction. If a page is found to be bad, the appropriate bit in the memory bitmap is cleared.

Memory Test (reverse) - Starts at the last address to be tested and performs a read/compare/complement/write on memory. If a page is found to be bad, the appropriate bit in the memory bitmap is cleared.

Final Parity - Fills all of memory with a pattern of 01h (an odd bit pattern) to verify that the parity bit can be changed. This pattern is read and verified. A parity error occurs if the parity bit is not changed. The pattern 01010101h is the known stat of unused memory after power-up.

Refer to Table 5–4 and Table 5–3 for information on running the LCG test. Refer to Section A.2.3 for a list of the memory test error codes and Section B.1.7 for a list of the memory test diagnostic LED codes.

5.8.6 Floating Point Unit Self-Test (6)

The self-test includes the following tests:

Instruction Tests - These tests are performed on the FPU. A failure occurs if the instruction produces unexpected results or an unexpected exception occurs during the execution of the instruction.

Refer to Table 5–4 and Table 5–3 for information on running the FPU test. Refer to Section A.2.15 for a list of the FPU test error codes.

5.8.7 Interval Timer Self-Test (7)

The Interval timer self-test includes the following tests:

Interrupt Test - Enables the interval timer interrupts. It lowers the IPL for 30 ms and counts the number of interrupts. If there are too few or too many interrupts, an error occurs.

Refer to Table 5–4 and Table 5–3 for information on running the Interval Timer test. Refer to Section A.2.4 for a list of IT test error codes.

5.8.8 System Self-Test (8)

The system self-test includes the following tests:

System ROM - Checks the system ROMs one byte at a time to ensure that they contain the correct manufacturing check data and the correct checksum.

Filter RAM - Makes two passes on the invalidate filter RAMS. The test detects all stuck addressing and data faults.

Refer to Table 5–4 and Table 5–3 for information on running the system test. Refer to Section A.2.5 for a list of the system test error codes and Section B.1.8 for a list of the system test diagnostic LED codes.

5.8.9 Network Interconnect Self-Test (9)

Setup Notes

- You must install an external loopback connector or a network connection (cable) at the selected network port before running a self-test.

The NI self-test includes the following tests.

Refer to Section A.2.22 for a complete list of NI tests and their error codes.

Network Address ROM Test - Verifies the 32 byte network address ROM which contains the unique 6 byte network address along with the 2 byte checksum and test data byte. It checks for a null or multicast address, calculates/compares the checksum, and verifies the test data bytes.

LANCE Register Test - Tests the address and data paths to the LANCE register address port (RAP) and the register data port (RDP) for each of the four Control Status Registers (CSRs).

LANCE Initialization Test - Sets up the LANCE data structures and initializes the LANCE chip, which causes the LANCE to perform a single word DMA read to the system memory.

LANCE Internal Loopback - Verifies the correct operation of the LANCE transmitter and receiver during an internal loopback. It also verifies the burst-mode DMA read and write on non-word-aligned data buffers for packets of different lengths and data patterns.

LANCE Interrupt Test - Enables, forces, and services the LANCE interrupts for initialization, transmission and reception using internal loopback.

LANCE CRC Test - Tests the LANCE CRC generation on transmission. It checks for detection of a bad CRC on reception using internal loopback.

LANCE Receive MISS/BUFF Test - Checks LANCE operation for missed packets and buffer error during reception with internal loopback.

LANCE Collision Test - Verifies collision detection and retry during transmission with internal loopback.

LANCE Address Filtering Test - Tests the LANCE receiver address filtering for broadcast, promiscuous, and null destinations during internal loopback.

Refer to Table 5–4 and Table 5–3 for information on running the NI test. Refer to Section A.2.22 for a list of the NI test error codes and Section B.1.9 for a list of the NI test diagnostic LED codes.

5.8.10 SCSI Self-Test (10)

Setup Notes

- CDROM devices will fail in extended mode if media is not installed in removable media drives.
- If some or all devices do not show up in the configuration display after running the test, make sure all devices have a unique ID number. Make sure power is supplied to all devices and the system module. Check to make sure the SCSI cable is connected to the system module and devices, and that the bus is terminated.
- All expansion boxes must have power supplied BEFORE the system box is powered up, or the expansion box devices will not be configured.

- Common causes of errors or devices missing from the configuration include:

  - SCSI bus is not terminated.
  - All device IDs are not unique.
  - Internal cables to the drives are disconnected.

Refer to Table 5–4 and Table 5–3 for information on running the SCSI test. Refer to Section A.2.6 for a list of SCSI test error codes and to Section B.1.10 for a list of SCSI test diagnostic LED codes.

The self-test includes the following tests:

Register Test - Verifies that the 53C94B controller chip registers are fully functional. All read/write bits that can be written are written to. It also verifies the bits.

Interrupt Test - Verifies the SCSI bits in the interrupt mask register, interrupt request register, and the interrupt clear register. A SCSI interrupt is forced, with the SCSI bit in the interrupt mask first set and then cleared. This is repeated for both a high interrupt priority level and a low priority level.

Data Transfer Test - Verifies SCSI bus communication between the controller and the available peripherals and also the data path of the controller to the S-chip and to memory. A series of four inquiry commands are issued to each device. The commands are issued in the programmed I/O mode, asynchronous mode with DMA, asynchronous mode with the DMA starting on a non-word-aligned boundary and crossing a page boundary, and synchronous mode with DMA.

5.8.11 Audio Self-Test (11)

Refer to Table 5–4 and Table 5–3 for information on running the audio test. Refer to Section A.2.10 for a list of the audio test error codes and to Section B.1.11 for a list of audio test diagnostic LED codes.

The self-test includes the following tests:

Register Tests - Performs a write/read to registers in the 79C30 DSC chip.

Interrupt Test - Enables interrupts, sends and receives an 8-byte packet by way of internal loopback.

Audio Test - Generates and outputs a sequence of eight audible tones.

5.8.12 Synchronous Communication Self-Test (12)

Setup Notes

- If Digital Services environment is used (SET DIAGENV 2), an H3199 loopback should be used.

Refer to Table 5–4 and Table 5–3 for information on running the Synchronous Communication test. Refer to Section A.2.11 for a list of the synchronous communication test error codes and to Section B.1.12 for a list of the synchronous communication test diagnostic LED codes.

Test 1 - Checks the checksum; read 128 Kbyte ROM part and verify checksum.

Test 2 - Checks the static RAM; write, verify, complement, verify 256K RAM.

Test 3 - Performs the MC68302 test.

Test 4 - Checks the RAM dual access; shared RAM bus arbitration.

Test 5 - Checks the EPROM dual access; EPROM bus arbitration.

Test 6 - Checks the host interrupt; verifies option can interrupt the CPU.

Test 7 - Checks the host buffer loopback and interrupt; moves data from the CPU to the communication option, loops it back and waits for an interrupt.

Test 8 - Resets the communication options and waits for an interrupt.

5.9 System Test

The system test is a strenuous test of the workstation. All devices are exercised simultaneously to find system interaction problems. The system test can be used to find faults that only occur when the system interaction is high.

The system test can be run in three environments, which you select with the SET DIAGENV command. Refer to Section 5.5.1 for information on selecting the diagnostic environment.

Important points to note about the system test are:

- Runs under a modified VAXELN kernel which is loaded from ROM.
- Causes a worst case environment in terms of system interaction, using maximum DMA and interrupts.

5.10 System Test Monitor

This section describes the test command interface to be used for running the system test on a device or on the whole system. Table 5–7 shows the general format for running the system test with the test command.

Table 5–7 Running the System Test Using the Test Command

Command	Action
T 100	Run system test in the Customer environment for two passes.
T 101	Run system test in the Digital Services environment for two passes.
T 102	Run system in the Digital Services environment. Type ^C to exit.
T 103[1]	Run system test in the Manufacturing environment. Type Ctrl C to exit.
T 106	Run system test for specific devices. System prompts for specific device. 1=Yes, 0=No.

[1]This test writes over data on hard disks. Do not use in the customer environment; it erases customer data. This test runs the system test in the Manufacturing environment. Type Ctrl C to exit.

NOTE

Make sure that loopback connectors are installed while in the Digital Services environment. SET DIAGENV 2 to run in Digital Services mode. (Table 4–2 and Table 5–2 contain descriptions and commands for the diagnostic environments)

The following examples show the output from system test commands.

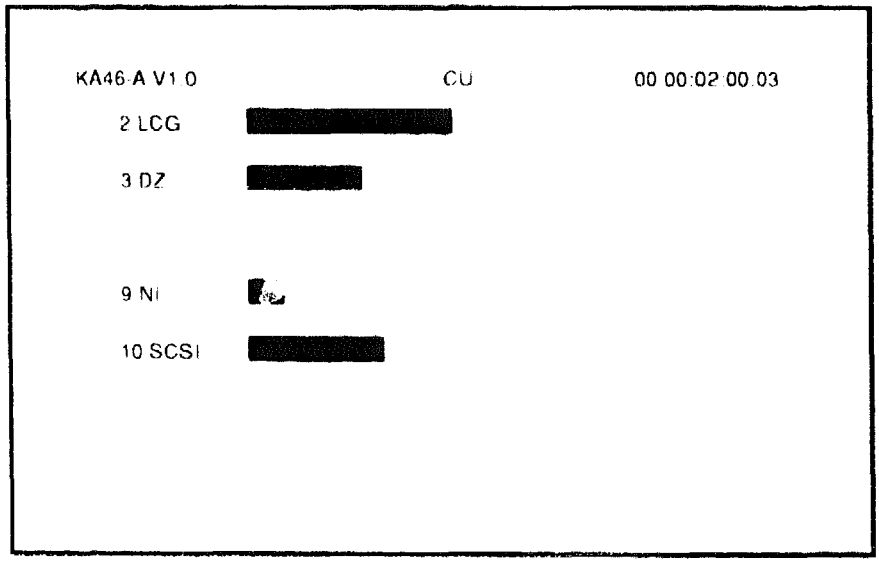
Example 5–8 System Test Commands

```
>>> T 101          !Runs two passes of system
                    test in customer mode.

>>> T 106          !Runs system test for specific
                    devices. System will prompt for
    specific device. 1 = yes; 0 = no.
```

5.10.1 Display from the System Test

Figure 5–4 shows the output from a successful system test.

Figure 5–4 Successful System Test



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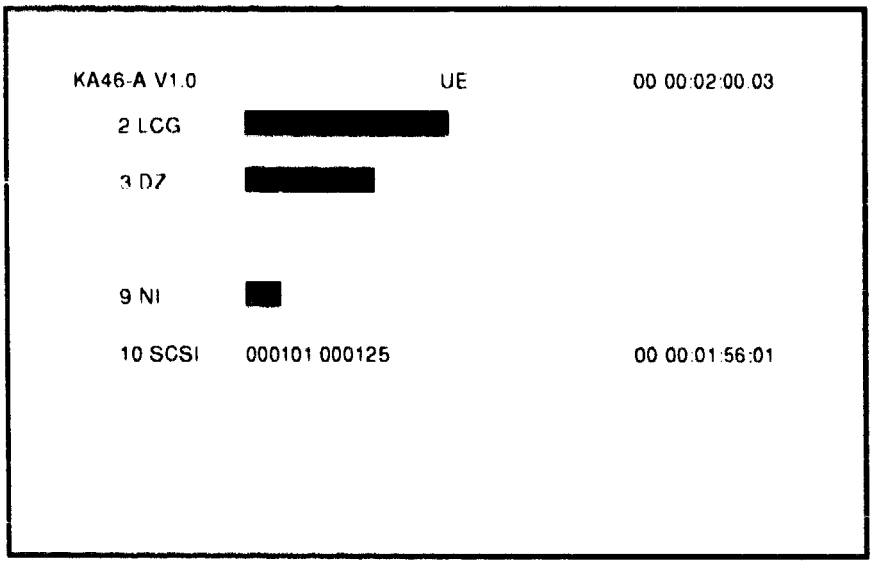
Where:

- KA46-A - is the system module ID.
- V1.0 - is the ROM version.
- CU - is the environment in which the test is running.
- 00 00:02:00.03 - is the CPU time used during testing.

Figure 5–5 shows the display when the system test is unsuccessful.

Figure 5–5 Unsuccessful System Test



When a device fails, the device status line in the display becomes the error message. You can get extended error information using the SHOW ERROR command. Interpretation of the error code is explained in Appendix A.

5.10.2 System Test Summary Screens

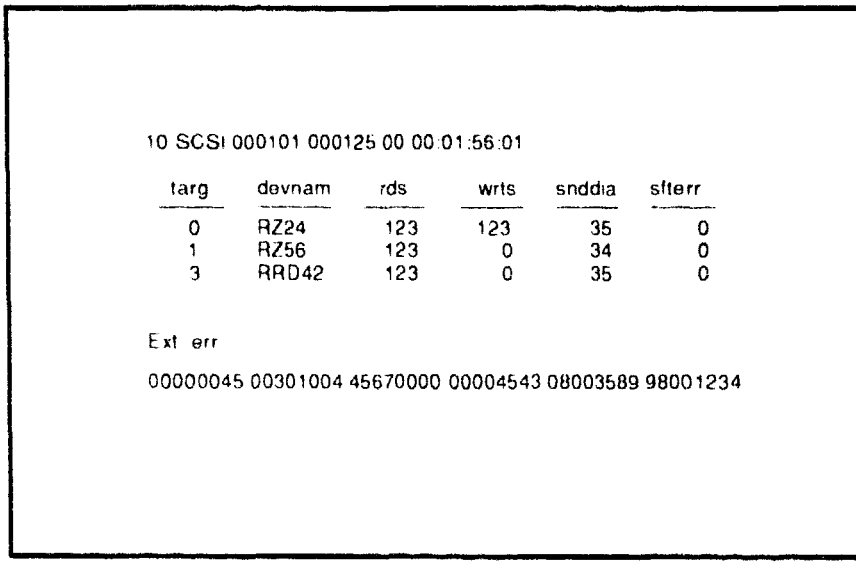
You can get summary information about the most recent system test using either of the following two methods:

- By interrupting system test by entering the Ctrl C key sequence. This stops the system test and displays summary screens for the devices. The display prompts for each summary screen. It can take a few moments after entering Ctrl C to view the summary screens. This time is needed to clean up the interrupted system test.
- By typing >>> SHOW ESTAT from the console prompt. This displays the summary from the most recent system test since power up. The display prompts for each summary screen.

A sample summary screen is in Figure 5–6.

Each system diagnostic is also able to display extended status and error information on its own summary screen. Figure 5–6 shows an example of the summary screen with a SCSI failure.

Figure 5–6 Summary Screen



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5.10.2.1 DZ System Test

NOTE

Be sure that loopback connectors are installed when in the Digital Services environment.

Functional Mode - Tests all the lines other than the lines dedicated to the console. Loopback testing is done in all legal combinations of baud rate, parity, and character width. In Digital Services mode, external loopback testing is performed.

Burst Mode - Performs in the same way as functional mode except the lines are tested at 19.2K baud, 8 bit characters, and parity is odd.

The following is a example of the DZ system test error.

```
?? 001 3 DZ 0220
```

This error code means that not all characters were received on line 1 and line 2.

The following is an example of the DZ system test summary screen:

```
Line L_Param Chr_Xmt Chr_Rec          Error
---- ------- ------- -------   --------------------
0      1fc8      25      25        ***** No Err ***
1      1fc9      25      22        ?? Xfr Timedout
2      1fca      25      24        ?? Xfr Timedout
3      1fcd       0       0       * Not Tstd - Cons
```

The summary screen gives information about the DZ test. The first column lists the serial line number that corresponds to the following devices:

- Line 0 - Keyboard port
- Line 1 - Mouse/Pointing device port
- Line 2 - Communications port
- Line 3 - Printer/Console port

5.10.2.2 Network Interconnect System Test

Setup Notes

- The selected NI port must be connected to a network, or have a loopback installed.
- A more thorough test is done if the system is connected to a live network and MOP is enabled.
- Maximum testing of hardware occurs on a live network with MOP enabled.

The network system test tests the network port using external loopback packets. The packets vary in size from 1 byte of data to 32 bytes of data. The pattern for the packets comes from a set of 8 patterns: AA, 55, 34, CB, 99, 66, 43, and BC.

The following is an example of a network system test error:

Example 5–9 System Test Error - Network

```
?? 9 NI 0001 xxxx 8:15:02
   where xxxx is the error code
```

5.10.2.3 SCSI System Test

CAUTION

Do not use manufacturing mode in the field; this erases customer data on hard disks, excluding the system disk.

Setup Notes

- If some or all devices do not show up in the summary screen after running system test, that all devices have unique ID numbers.
- Make sure the power cable is connected to the devices and the system module.
- Make sure the SCSI cable is connected to the system and the devices terminate and terminate the SCSI bus.
- When in Digital Services or manufacturing mode, media must be present in the removable media drives, otherwise an error occurs.
- When in manufacturing mode, removable media must be write protected when present in the drives, otherwise an error occurs.

- In order for destructive testing to be performed in Digital Services mode, a key pattern must be on the removable media disks and tapes.

The system test includes the following tests:

Inquiries Test - Performs inquiries to find out which devices are connected to the SCSI bus.

Size Bus Test - Spins up all the hard disk drives, makes sure the drives are ready (if not in customer mode), forces disk block sizes to 600 bytes, and obtains the capacity of the drives. This test also checks that removable media are write protected; checks that key pattern is present on removable media in Digital Services mode, and that VMS boot block is present on the hard disk drives when in manufacturing mode.

Data Transfer Test - Verifies SCSI bus communication between the controller and available peripherals. It also verifies the data path of the controller to the S-chip and to memory.

Device Test - Verifies the peripheral devices attached to the SCSI bus, and the DMA data path. Interrupts are enabled.

The following is an example of a successful SCSI system test display:

```
10 SCSI ################## 4
```

The following example shows an unsuccessful (error) SCSI system test display:

```
?? 10 SCSI 150 0076 8:18:41
```

The display shows an error on ID 5.

The following is an example of the SCSI system test summary display.

Example 5–10 System Test Summary Screen - Display

```
ADR  RDS   WRTS   ERR   FRU  CMD  PHS  INF  LBNSTRT  XFERSIZ
---  ---   ----   ---   ---  ---  ---  ---  -------  -------
1/0  10987   0
3/0  5643  5643                          36   1378      119
4/0  28    28     160   150  28    1
-------------------------------------------------------------
4/0 XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX
```

Data is destroyed on hard disks in the manufacturing environment, except for disks with factory installed software.

Data is not be destroyed on hard disks in the Digital Services environment.

All expansion boxes must have power supplied BEFORE the system box is powered up, or the expansion box devices will not be configured.

Common causes of errors or devices missing from the configuration include:

- SCSI bus not terminated.
- All device IDs are not unique.
- Internal cables to the drives are disconnected.

The summary screen lists the test results by device ID.

When in the Digital Services environment, media must be present in all removable media devices.

In order for writes to occur, a key pattern must be installed on writable removable media (floppies and tapes). The key pattern is put on the media via the SCSI utilities. This is described in Section 5.11.6.

5.10.2.4 DSW21 Communication System Test

The system test loads and runs 68302 test/scheduler.

The following shows a DSW21 communication system test error:

```
?? 12 COMM 020 001E 0 00:00:15.00
```

The following is an example of the DSW21 communication system test summary:

Example 5–11 Communication System Test - Display

```
COMM Test Summary Screen....  ....................................
------------------------------ -----------------------------------
SCC1 Tx:          36 Rx:          36 Err:          0 INT-NOCABLE
SCC2 Tx:          36 Rx:          36 Err:          0 EXT-H3199
SCC3 Tx:          36 Rx:          36 Err:          0 INT-NOCABLE
```

Example 5–11 (continued on next page)

Example 5–11 (Cont.) Communication System Test - Display

```
Status Block:
-------------
FRU: 14 FTY: 6
CSR: 30 STA: 1
HWV:  2 SWV: 5
CC1:  F CC2: 0
MOD:  1 CNT: 1
CHN:  2 SEL: 2
PROT: 3 SCM: 9CF
```

5.11 Utilities

TEST commands run or display available utilities. Utilities can either be run with all parameters input at the command line or the utilities prompt for additional input. The format for a utility test that runs completely from the command line is shown below:

>>> T [EST]/UT[ility] dev_nbr util_nbr opt_p1,...,opt_pn

Where:

- dev_nbr - is the number of the device on which you want to run the utility.
- util_nbr - is the number of the utility you want to run. The devices can have more than one utility.
- opt_p1,...,opt_pn - is the optional parameters that could be needed by a utility. For example, a SCSI utility could need to know the target ID of the device on which to run the utility.

If you are not familiar with the utilities a device has available, enter the TEST/UTILITY command followed by a device number or utility mnemonic (such as LCG or SCSI). The utility prompts for additional information, if needed. For example, to run an LCG utility, do the following:

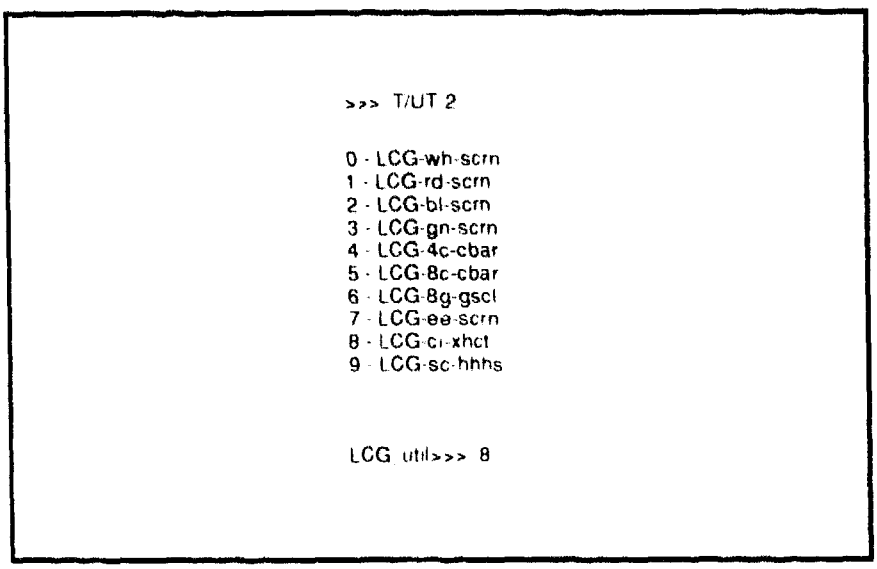
1. Type T/UT 2.

   The LCG's main utility routine displays a list of the available utilities (as shown in Figure 5–7) and then displays the prompt LCG_util>>>.

2. Enter the utility number that you want to run.

In the following example, utility 8 was selected.

Figure 5–7 Utilities List



You may exit the utility from the prompt by pressing Return.

Press the space bar to return to the utility menu after it has run.

Control returns to the console if an invalid utility number is entered.

Enter the Ctrl C key sequence to exit the utility after the test has run.

If you run a utility that will destroy the contents of a mass storage device, the following displays:

```
dev_nam OK ?
```

Where:

- dev_nam - is the device whose contents will be lost.

Enter the letters "OK" followed by Return to start the utility. If any other combination of keys is entered, the control is returned to the console.

The console firmware provides the following utilities:

Utility Group	Functions
LCG	Provides colored screens and geometric patterns.
NI	Set and show commands for: • MOP - NI listener • Trigger - Entity-Based Module (EMB)
SCSI	Key utilities, floppy formatter, and disk eraser

5.11.1 LCG Utilities

The LCG Utilities provide ten screens of color bars and geometric programs. The following table describes how to use and exit the LCG Utility:

Action	Command
Enter the LCG Utility	>>> TEST/UTIL LCG
Display a screen	Enter a command number at the LCG_util >>> prompt.
Go back to the LCG menu	Press the space bar
Go back to the LCG menu and clear the screen	Enter the Ctrl C key sequence.
Exit the LCG utility	Enter the Ctrl Y key sequence while a pattern is active

5.11.2 LCG Utility Menu

The following example shows the LCG Utilities menu:

Example 5–12 LCG Utilities Menu

```
0 - LCG-wh-scrn          !White screen
1 - LCG-rd-scrn          !Red screen
2 - LCG-bl-scrn          !Blue screen
3 - LCG-gr-scrn          !Green screen
4 - LCG-4c-cbar          !4 color bars
5 - LCG-8c-cbar          !8 color bars
6 - LCG-8g-gscl          !8 gray scale bars
7 - LCG-ee-scrn          !Screen of EEs
8 - LCG-ci-xhct          !Cross hatch with circle
9 - LCG-sc-hhhs          !Screen of scrolling HHs

LCG_util >>>             !LCG utility prompt
```

5.11.3 NI Utilities

The NI utilities are invoked by SET or SHOW commands, not by the TEST/UTIL command. The NI utility functions are:

- SET/SHOW MOP - enable/disable NI listener
- SET/SHOW TRIGGER - enable/Disable EMB

5.11.4 NI Listener

The NI listener can send and receive messages while the system is in console mode. The operation of the NI listener is transparent to the console, and NI listener errors are not reported. Listener failure can only be detected with the use of a network monitor device. The default is NI listener enabled.

To enable the listener, type the following:

Example 5–13 Enabling Listener

```
>>> SET MOP 1
```

To disable the listener, type the following:

Example 5–14 Disabling Listener

```
>>> SET MOP 0
```

5.11.5 EMB

The EMB (Entity-Based Module) is used to enable the remote console and remote boot. Remote boot allows another system to send a boot message to the workstation to start the bootloader. The remote console is presented in Section 4.2.2.

To enable the MOP boot type the following:

Example 5–15 Enabling MOP

```
>>> SET TRIGGER 1
```

To disable the MOP boot type the following:

Example 5–16 Disable MOP

```
>>> SET TRIGGER 0
```

5.11.6 SCSI Utilities

The SCSI utilities are as follows:

SHOW DEVICE	This is a console command that displays information about the Ethernet controller and the SCSI drives attached to the system. This is described in Section 4.1.2.5.
Floppy Key Utility	This utility is used in Digital Services mode. The key utility writes a key on block 0 of the floppy media. The key is used by System Test in Digital Services mode. If the key is found on the media, the System Test writes to the media during the test. If the key is not found during the system test, only reads are done to the media.
Tape Key Utility	This utility is used in Digital Services mode. The key utility writes a key at the beginning of the tape media. The key is used by the system test in Digital Services mode. If the key is found on the media, the System Test writes to the media. If the key is not found, only reads are done to the media.
Hard Disk Erase Utility	This utility erases all data from a hard disk. The pattern AA (hexadecimal) is written to all bytes on the disk. Any bad blocks are revectored.
Floppy Formatter Utility	This utility formats a floppy disk and erases it.

5.11.7 Invoking SCSI Utilities

To invoke the SCSI utilities, perform the following steps:

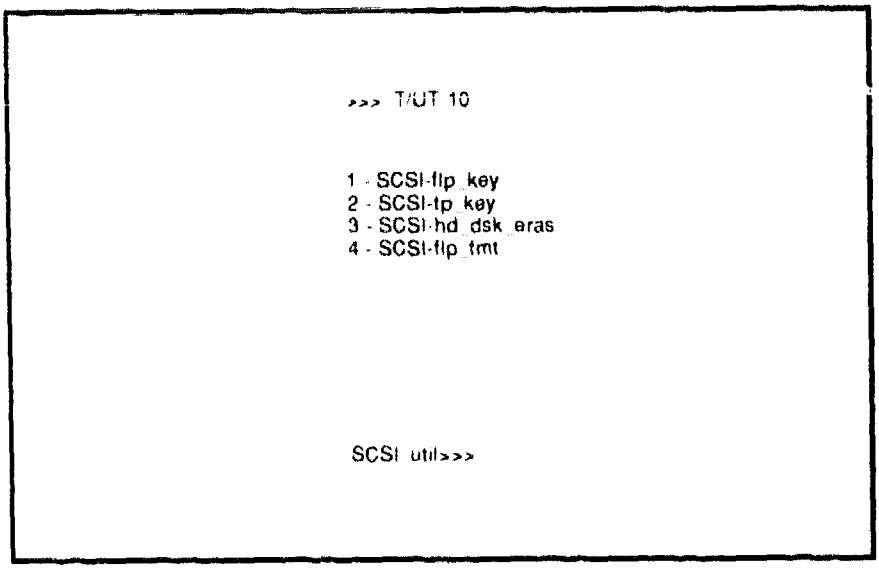
Step	Action	Result
1	Enter TEST/UTIL SCSI command.	Displays the SCSI Utility Menu
2	Enter utility number	Selects the utility.
3	Enter SCSI ID	Selects the drive.
4	Enter SCSI LUN (always 0)	Logical unit number (LUN)
5	Enter OK if requested	Verifies action for formatter and erases utilities.

5.11.8 SCSI Utility Menu

Example 5–17 SCSI Utilities Sample Session

```
>>> T/UT 10                  ! Type in this command (or T/UT SCSI)

1 - SCSI-flp_key             ! Floppy key utility.
2 - SCSI-tp_key              ! Tape key utility.
3 - SCSI-hd_dis_eras         ! Hard disk erase.
4 - SCSI-flp_fmt             ! Floppy formatter.

SCSI_util>>> 3               ! Type in utility number
SCSI_id(0-7)>>> 5            ! Type in SCSI device ID
SCSI_lun(0-7)>>> 0           ! Type SCSI logical unit
                               number (always 0).

 SCSI HD_DSK_ERAS_UTIL

DKA500 OK ? ok               ! Confirm the action.

##############               ! Progress banner on ERASE
                               and FORMAT only.

SCSI_util_succ               ! Utility finished.
```

Figure 5–8 SCSI Utilities Display



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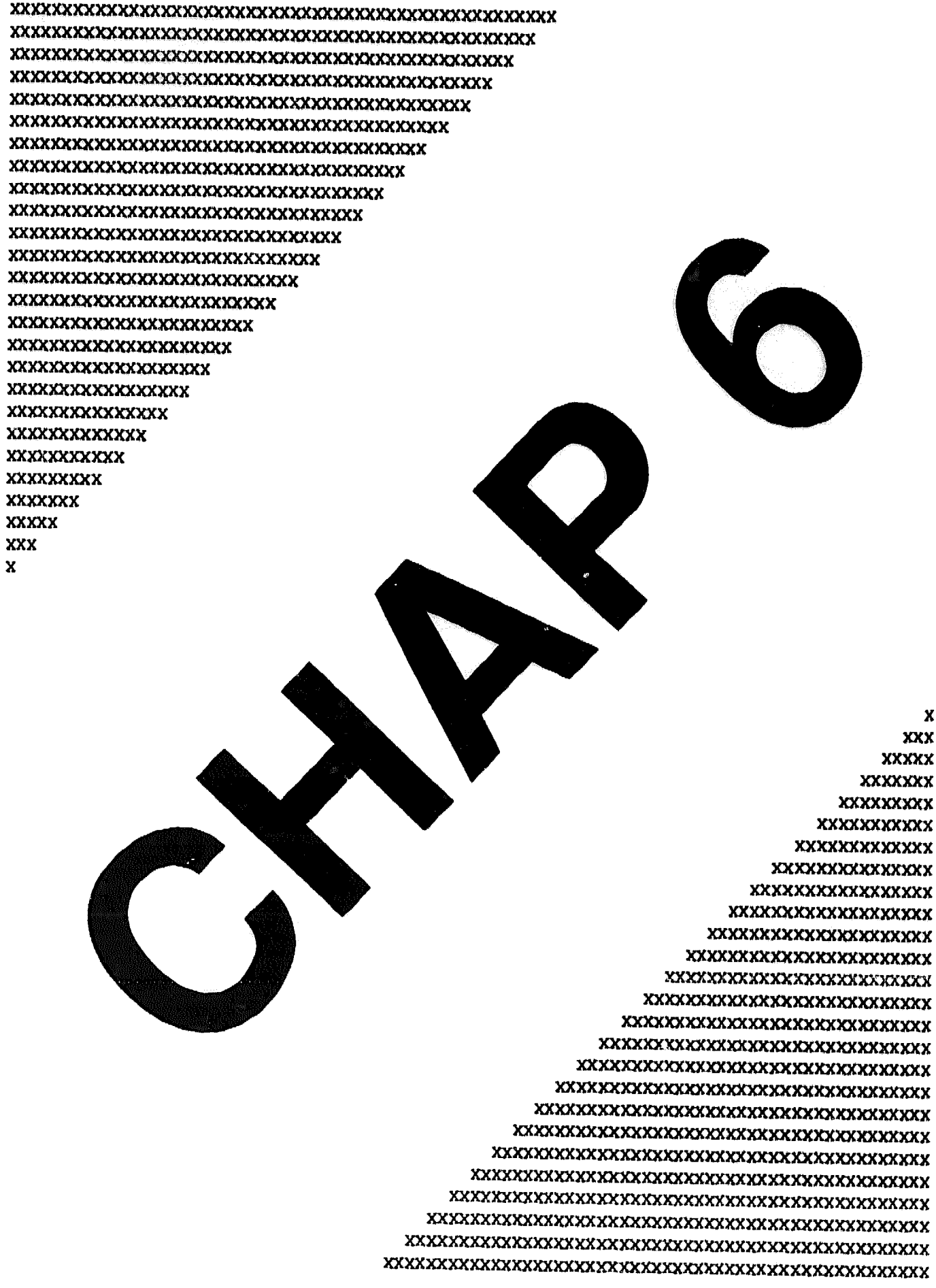
5.11.9 SCSI Utility Notes

Follow these guidelines about the SCSI utilities:

- The key utilities can only be run from Digital Services mode. An error code of 181 displays if you run the key utilities from Customer mode.
- Never run a SCSI utility on the Host ID (ID = 6).
- An error mnemonic of SCSI_E_type indicates you cannot perform the utility on the specified device, for example, running the tape key utility on a fixed disk.
- On the formatter and erase utilities, you must type OK at the DKAxxx OK prompt, or an error appears.
- An error occurs if an invalid device ID and logical unit number (always 0) are entered. Type SHOW DEVICE from the console prompt for the correct IDs.
- If a drive is not listed in the SHOW DEVICE table, check SCSI and power connections, and for duplicate device IDs.


CHAP 6

6

FRUs Removal and Replacement

This chapter describes how to remove and replace the field replaceable units (FRUs) in the Model 60 system box. Appendix D lists the Model 60 FRUs and their part numbers.

Each section describes the removal procedure for the FRU. Unless otherwise specified, you can install a FRU by reversing the steps in the removal procedure. The topics covered in this chapter are:

6.1 Precautions

Only qualified service personnel should remove or install FRUs.

NOTE

It is the customer's responsibility to back up the software before Digital Services personnel arrive at the site. This is important to ensure that data is not lost during the service process. The customer should also shut down the workstation software. Before performing any maintenance work, Digital Services personnel must confirm that the customer has completed both of these tasks.

CAUTION

Electrostatic discharge (ESD) can damage integrated circuits. Always use a grounded wrist strap (part number 29-11762-00) and work-surface-to-earth ground when working with the internal parts of the workstation.

6.1.1 System FRU Removal

Perform these preliminary steps before removing and replacing a FRU.

- Verify that the symptom is not caused by improper configuration or a loose cable.
- Confirm with the customer that data has been backed up. If not, the data could be lost (when a hard disk is at fault).
- Be sure that the operating system is shut down before turning off the sytem or halting the CPU.
- Use the SHOW CONFIG command and write down the following information:
  - — System ROM version
  - — Graphics type
  - — Memory configuration.

    Make sure this configuration agrees with the amount and type of memory modules present. If the configuration does not agree, check that the memory modules are installed correctly.

— SCSI devices and IDs

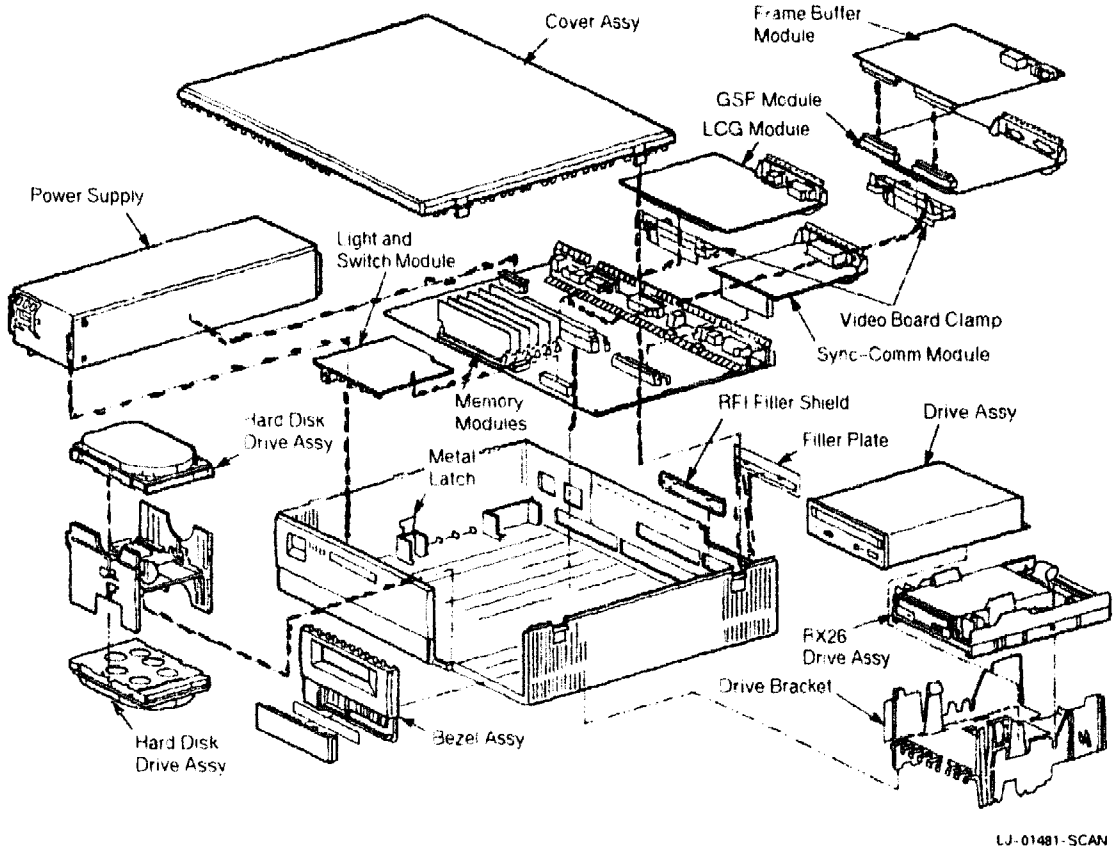
Make sure this configuration agrees with the actual hardware. If the configuration does not agree, make sure the following are true:

SCSI IDs are all unique.
Cables are correctly installed.
The expansion box power is turned on first.

— Wait three minutes after turning off a monitor before you move or service it.

Figure 6–1 shows the location of the system FRUs.

Figure 6–1 System FRU Locations

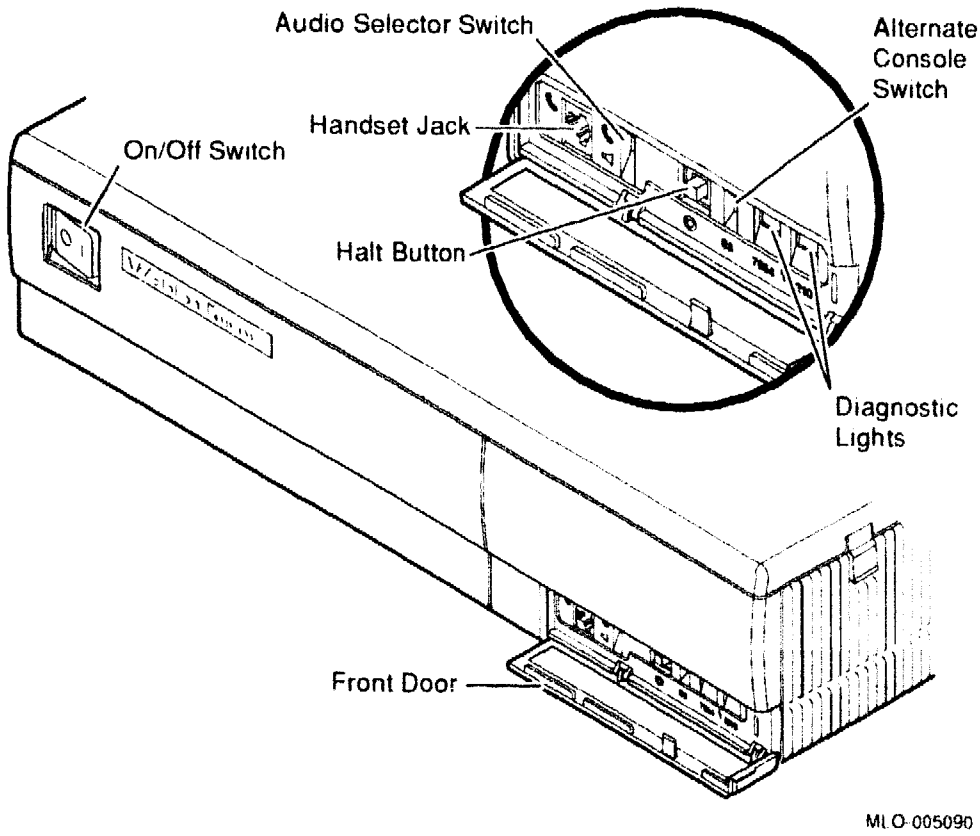


6.2 System Preparation

Prepare the system for removing or replacing FRUs by following these next steps.

1. Shut down the operating system.
2. Put the system into console mode by pressing the halt button (Figure 6–2) on the front of the system box (behind the door on the lower right).

Figure 6–2 Halt Button



3. At the console prompt, set the system to halt on future power-ups. Self tests are completed by typing:

```
>>> SET HALT 3 Return
>>>
```

NOTE

After adding the new device or module, halt the system when you first turn it on. Use the diagnostic tests described in Chapter 5 to determine if the new device or module is connected correctly.

4. Before adding a new device or module, review the current system configuration. Record the current system configuration information for reference. After adding the new device or module, compare the new configuration with the previous one to help verify that all devices are present and functioning correctly.

   To determine the presence of devices, test status, and to determine the quantity of memory inside the system, enter the following command:

```
>>>SHOW CONFIG Return
```

   A configuration display similar to the following appears:

```
KA46-A BL3-186-B3.1                ! System type and firmware revision
08-00-2B-F3-31-03                  ! Ethernet hardware address
16 MB                              ! Total memory

DEVNBR   DEVNAM   INFO
------   ------   ----
     1     NVR     OK                          ! Non-volatile RAM
     2     LCG     OK
                    HR - 8 PLN FB - 2.7        ! 2D high res. color graphics rev 2
     3     DZ      OK                          ! Serial line controller
     4     CACHE   OK                          ! Cache memory
     5     MEM     OK                          ! Memory configuration
                     16MB = SY=8MB, S0/S1=8MB, S2/S3=0MB, S4/S5=0MB
     6     FPU     OK                          ! Floating point accelerator
     7     IT      OK                          ! Interval Timer
     8     SYS     OK                          ! Other system functions
     9     NI      OK                          ! Ethernet
     10    SCSI    OK                          ! SCSI and drives
                    1-RZ23L 6-INITR             ! ONE RZ23L AT ID 1, SYSTEM AT ID
     11    AUD     OK                          ! SOUND
     12    COMM    OK                          ! DSW21 communications device
```

To determine the quantity of memory in the system, look at the MEM line. The memory line (line 5) shows that there are 16MB of memory. There are 8MB of memory on the system board and 8MB of memory in memory module slots 0 and 1 (4MB in each slot).

5. Turn power to the system off (0).
6. Disconnect the system power cord from the wall outlet and then from the system.

WARNING

Turn the monitor power off for at least three minutes before removing the power cord. Remove the power cord before moving the monitor.

The monitor is heavy and may require two people to lift it.

7. Remove the monitor from the top of the system and set it aside.
8. Remove the system cover by gently pulling out on the tabs on right side of the cover, and lift the cover up and away (Figure 6–1).

6.3 Mass Storage Drive Removal

This section describes how to remove mass storage devices from the VAXstation 4000 Model 60 workstation.

Mass storage devices installed in the system share the same SCSI and dc power cable. Each device has its own connector on the power cable.

NOTE

Refer Section 6.2 before removing or replacing a device or module.

6.3.1 Hard Disk Drive Removal

This section describes how to remove a hard disk drive from its bracket. Figure 6–1 shows the mounting areas for drives.

To remove a hard disk drive, perform the following steps:

1. Pull the colored tab on the drive bracket toward the front of the system. The tab is located at the upper left corner of the bracket.
2. Lift the drive(s) and bracket from the system box.
3. Disconnect both the SCSI and dc power cable from the drive(s).
4. Push down on the plastic tab at the end of the bracket (opposite to where the SCSI and power cables connect to the drive).

5. Slide the drive over the plastic tab until the metal peg on each side of the drive is aligned with the verical slot on the bracket.
6. Lift the drive from the bracket.
7. Match the SCSI ID with the error code to verify that the failed drive was removed. Figure 6–3 and Figure 6–4 show the disk drive ID jumper locations. Table 6–1 contains the SCSI jumper settings.
8. Remove the drive mounting plate.
9. Remove the second hard disk drive from the bracket if one is present.

6.3.1.1 Hard Disk Drive Replacement

Use the following procedure to replace hard disk drives in the system box:

1. Verify the SCSI ID setting on the drive.

   The SCSI jumpers allow you to select a distinct ID number for each SCSI device. It is essential that each device have a unique SCSI ID (0-7). Figure 6–3 shows the location of the RZ23L hard disk drive SCSI ID jumpers (ID number 4 selected). Figure 6–4 shows the location of the RZ24 disk drive SCSI ID jumpers.

Figure 6–3 RZ23L Disk Drive SCSI ID Jumper Location

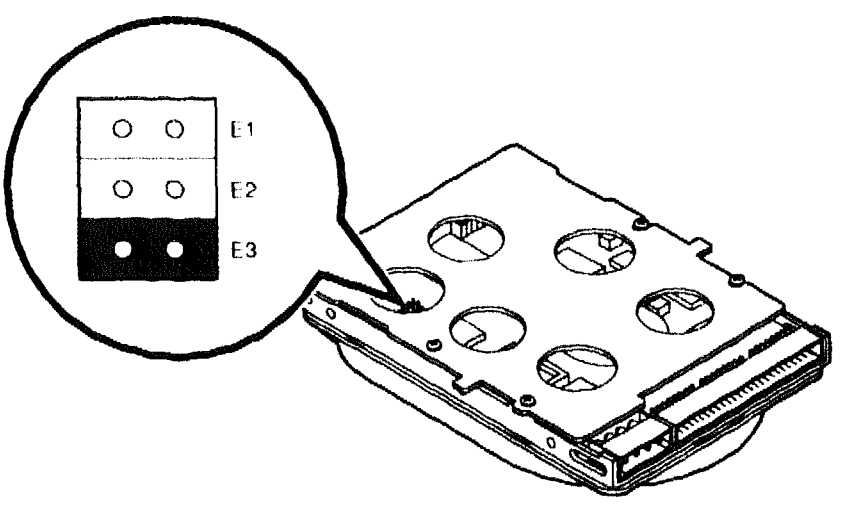
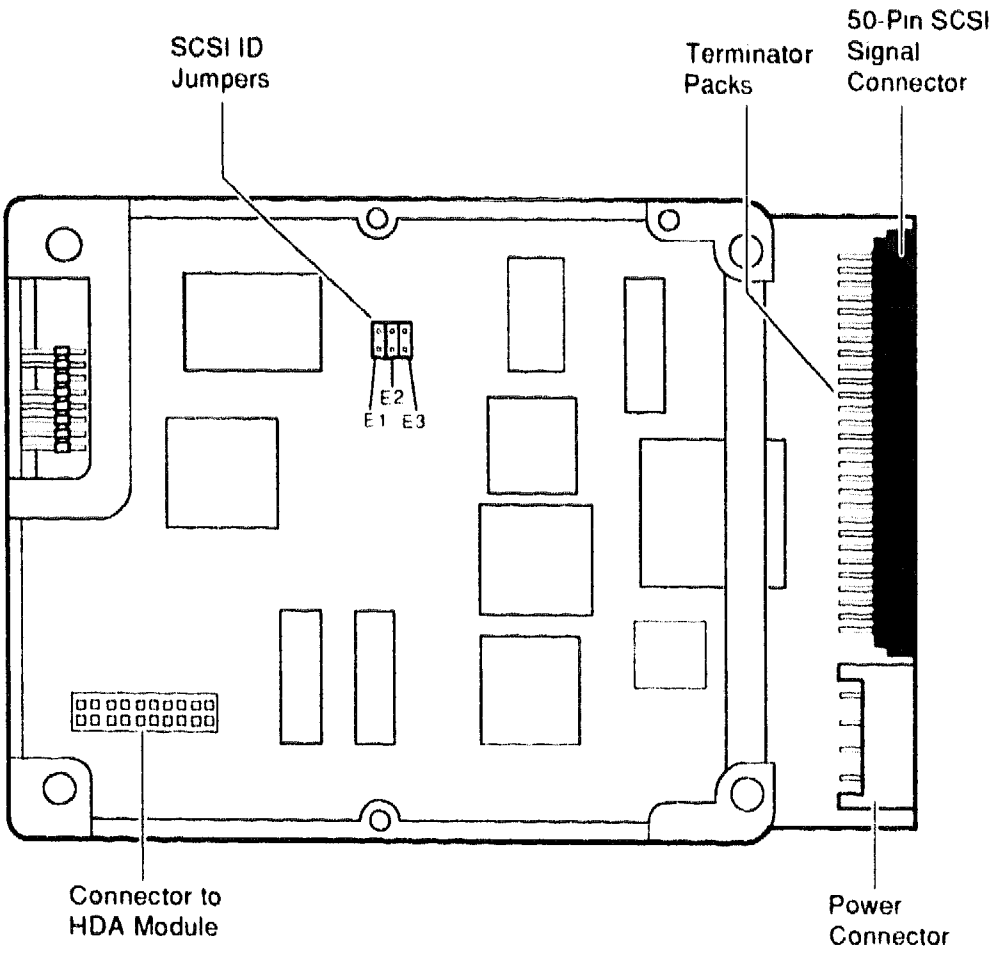


Figure 6–4 RZ24 Disk Drive SCSI ID Jumper Location



2. Set the SCSI ID jumpers of the top disk drive as specified in Table 6–1. The jumpers are used in the following manner:
   - Install the jumper for IN
   - Remove the jumper for OUT

Table 6–1 Hard Disk Drive SCSI Jumper Settings

SCSI ID	E1	E2	E3	Comment
0	Out	Out	Out	
1	In	Out	Out	
2	Out	In	Out	
3	In	In	Out	
4	Out	Out	In	
5	In	Out	In	
6	Out	In	In	Usually reserved for SCSI controller
7	In	In	In	

The following is a table for standard ID numbers for the SCSI devices.

Table 6–2 Standard IDs for SCSI Devices

ID Number	Device Type	Example
0 through 3	Hard disk	RZ23L, RZ24, RZ5x
4	CDROM	RRD42
5	Tape or floppy	RX26, TLZ04, TZK10
6	Reserved for the system	KA46 SCSI controller
7	Any drive	2nd tape or floppy

3. Install a new drive in its bracket by reversing the steps in Section 6.3.1.

NOTE

When installing a drive into the bracket, you must apply pressure on the drive for it to seat properly.

6.3.2 RRD42 CDROM Drive Removal

This section describes how to remove a RRD42 CDROM drive. Figure 6–1 shows the RRD42 CDROM drive.

To remove the drive, perform the following steps:

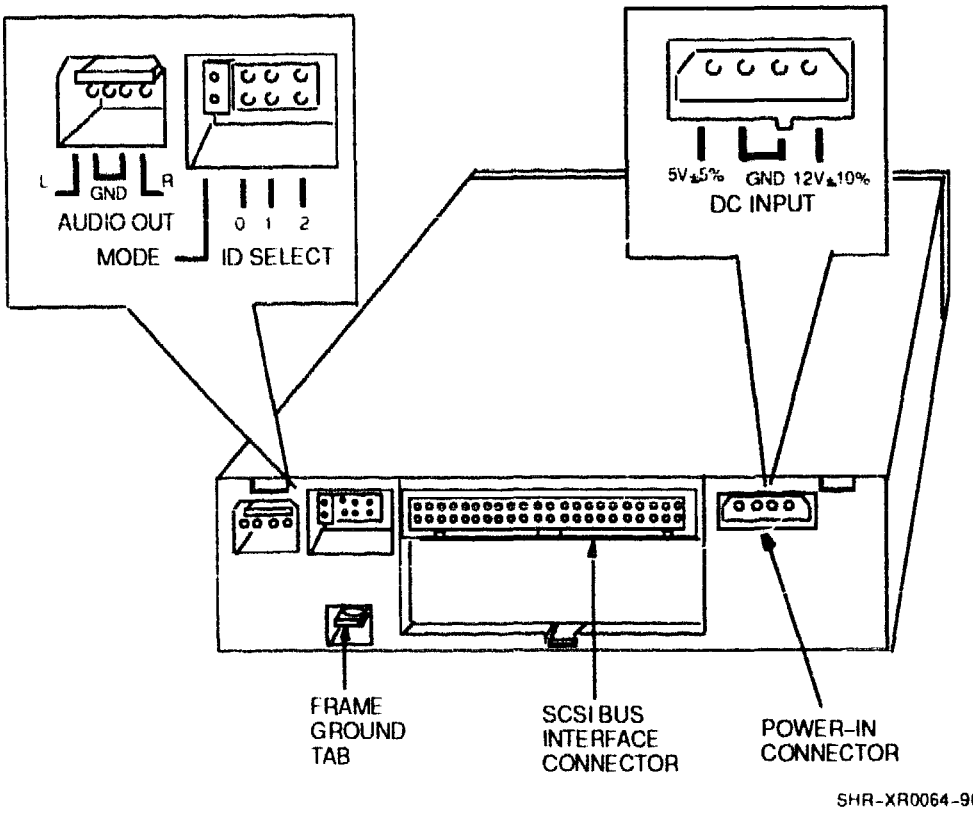
1. Push the colored tab at the right upper front of the bracket toward the power supply, and the tab behind the screw hole at the bottom left center of the bracket to the right.
2. Lift the drive and drive bracket from the system box.
3. Disconnect the SCSI and dc power cables from the drive.
4. Remove the drive from the bracket by releasing the colored latches on each side of the bracket and lifting the drive from the bracket.
5. Match up the SCSI ID with the error code to verify that the failed drive was removed. Refer to Figure 6–3 and Figure 6–4 for the disk drive ID jumper locations. Refer to Table 6–1 for the SCSI jumper settings.
6. Remove the drive mounting plate.

6.3.2.1 RRD42 CDROM Drive Replacement

Before installing the new drive, verify the SCSI ID setting on the drive. Use the following procedure to verify or set the SCSI ID jumpers on the drive:

1. Locate the set of SCSI ID jumpers 0, 1, and 2 at the rear of the drive. The jumpers should be to the left side of the drive as shown in Figure 6–5.

Figure 6–5 RRD42 (CDROM) Jumper Settings



The jumpers are removable electrical connectors on the ID settings.

2. The SCSI ID jumpers should be in the factory set positions for SCSI ID 4. This is the default SCSI ID setting for the drive. Verify that the jumpers are set to the following positions (left to right) for SCSI ID 4: OFF, OFF, ON.

   To set the SCSI ID jumper in the OFF position, remove the jumper from its seating. To set a jumper in the ON position, leave the jumper in place.

NOTE

Never set two devices to the same SCSI ID; the system cannot service devices with identical IDs.

To install a new drive, reverse the steps in Section 6.3.2. You do not need to push the tabs to insert the bracket. The bracket snaps into place if positioned properly.

6.3.3 RX26 (Diskette) Drive Removal

This section describes how to remove the diskette drive. Figure 6–1 shows the drive location.

To remove the drive, perform the following steps:

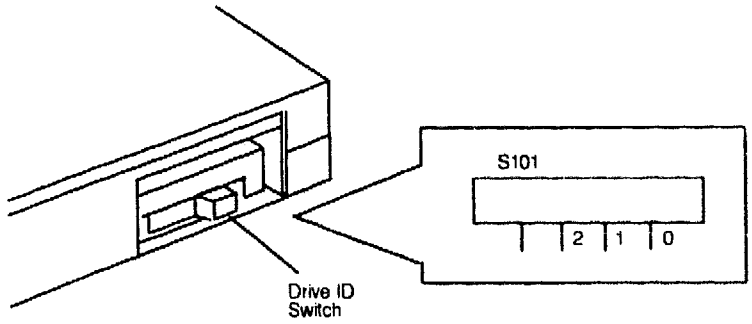
1. Pull the colored tab on the drive bracket toward the front of the system. The tab is located at the upper front right corner of the bracket.
2. Push the colored tab at the lower front of the bracket and the tab behind the screw hole at the bottom left center of the bracket to the right.
3. Lift the drive and drive bracket from the system box.
4. Disconnect the SCSI and dc power cable from the drive.
5. Remove the drive from the removable media bracket by releasing the colored latches on each side of the bracket. Lift the drive and secondary bracket (RX26 bracket) from the bracket.

6.3.3.1 RX26 (Diskette) Drive Replacement

Before installing the new drive, verify the drive type number setting on the drive. Figure 6–6 shows the drive type switch location for the diskette drive. Use the following procedure to verify or set the drive type number switches.

1. Locate the ID number switches 0, 1, and 2 on the drive, as shown in Figure 6–6.

Figure 6–6 Setting the RX26 (Diskette) Drive ID Number



2. The SCSI ID switches should be in the factory set positions for SCSI ID 5. This is the default SCSI ID setting for the drive. Verify that the switches are set to the following positions (left to right) for SCSI ID 5: 2 = IN, 1 = OUT, 0 = IN.

   To set the SCSI ID switch in the OFF position, remove the switch from its seating. To set a switch to the ON position, leave the switch in place.

3. Use a pen or small pointed object to move the switches side to side. The switch should be set to 0.

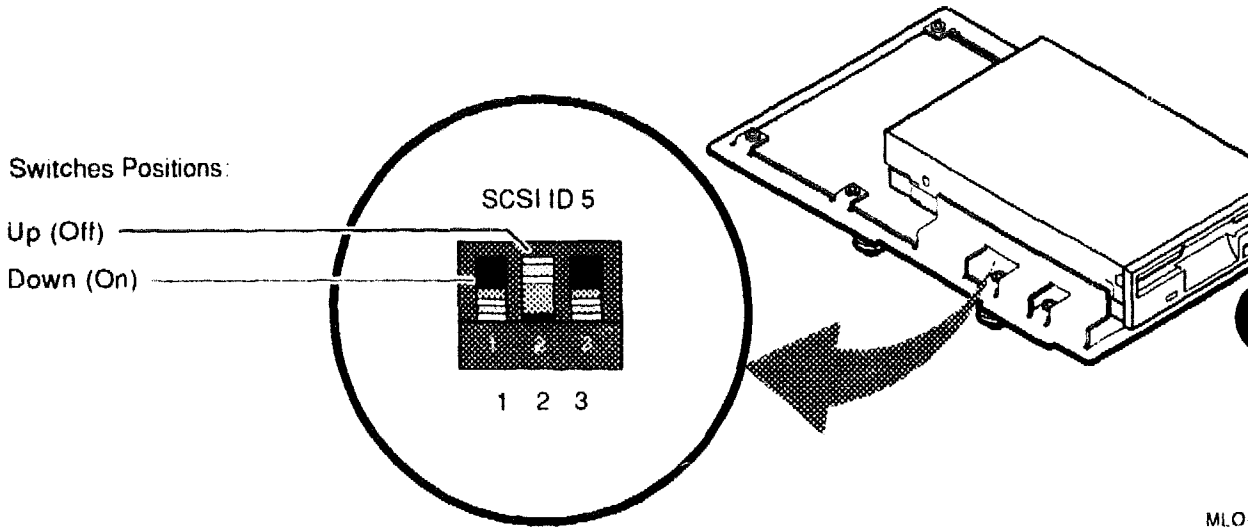
CAUTION

Do not use a pencil. Graphite particles can damage the switches.

Figure 6–7 shows the SCSI ID switch location for an RX26 drive,

To install a new drive, reverse the steps in Section 6.3.3. You do not need to push the tabs to insert the bracket. The bracket snaps into place if positioned properly.

Figure 6–7 RX26 (Diskette) Drive SCSI ID Switch Location



6.3.4 TLZ04 Cassette Tape Drive Removal

To remove the TLZ04 drive, do the following:

1. Disconnect the SCSI cable and dc power cable from the drive.
2. Remove the screws that secure the drive bracket to the bottom of the box.
3. Lift the bracket and drive from the box.
4. Remove the drive from the bracket by removing the screws that secure the drive to the bracket. The screws are located to the side of the bracket.
5. Lift the drive from the bracket.

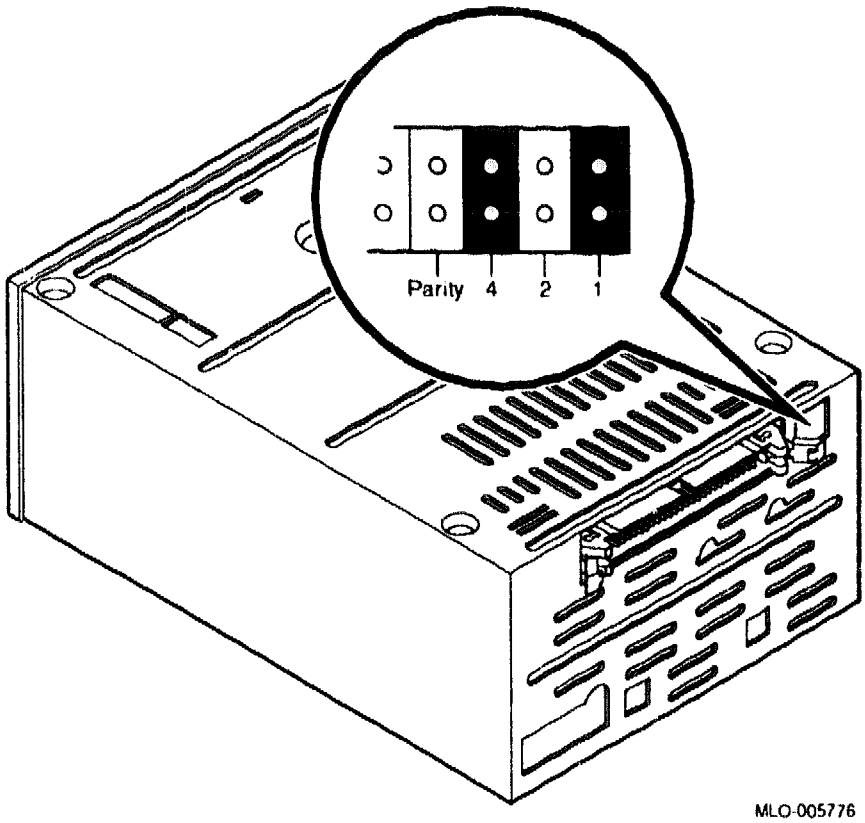
6.3.4.1 TLZ04 Cassette Tape Drive Replacement

When replacing the TLZ04 drive, make sure you do the following:

1. Verify the SCSI ID jumper settings for the TLZ04 drive before you replace it in the system box.
2. Locate the SCSI ID jumpers P, 4, 2, and 1, which are on the back of the drive, on the left. See Figure 6–8.
3. Make sure the jumpers are set to the following positions (right to left) for SCSI ID 5: ON, OFF, ON, OFF. Parity is always set to 0.

4. Reverse the removal steps in Section 6.3.4 to replace the TLZ04 drive in the system box.

Figure 6–8 TLZ04 Tape Drive SCSI ID Jumper Location



NOTE

Never set two devices to the same SCSI ID; the system cannot service devices with identical IDs.

6.3.5 TZK10 QIC Tape Drive Removal

This section describes how to remove the TZK10 tape drive. Figure 6–1 shows the drive location.

To remove the drive, perform the following steps:

1. Push the colored tab at the lower front of the bracket and the tab behind the screw hole at the bottom left center of the bracket to the right.
2. Lift the drive and drive bracket from the system box.
3. Disconnect the SCSI and dc power cable from the drive.
4. Remove the drive from the removable media bracket by releasing the colored latches on each side of the bracket. Lift the drive from the bracket.

6.3.5.1 TZK10 (Tape) Drive Replacement

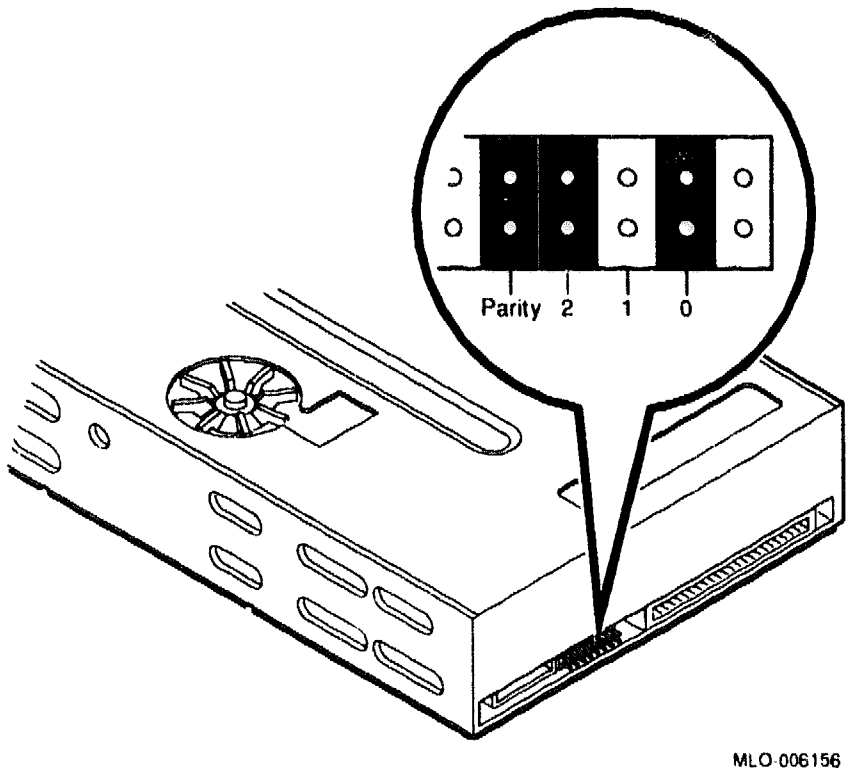
Before installing the new drive, verify the drive ID number setting on the drive. Figure 6–9 shows the drive type switch location for the tape drive. Use the following procedure to verify or set the drive type number switches.

1. Verify the ID number switches on the rear of the drive, as shown in Figure 6–9.
2. Use a pen or small pointed object to move the switches from side to side. The drive should be set to 5.

CAUTION

Do not use a pencil. Graphite particles can damage the switches.

Figure 6–9 TZK10 (QIC) Tape Drive SCSI ID Jumper Location



To install a new drive, reverse the steps in Section 6.3.5.

6.4 Power Supply Removal

NOTE

Refer to Section 6.2 before removing or replacing a device or module.

This section describes how to remove the system power supply (H7819-AA) from the system box. Figure 6–1 shows the system power supply.

WARNING

Do not attempt to open the power supply. There are dangerous voltages inside the power supply, and there are no user-serviceable parts.

To remove the power supply, perform the following steps:

1. Disconnect the power cords (monitor and power supply) from the two ac connectors at the rear of the unit.
2. Perform the steps in Section 6.3.1.
3. Remove the bracket for the RZ drives to gain access to the power supply tab.
4. Pull forward on the blue tab (on the right, toward the front of the box) just under the supply and lift the front of the supply slightly.
5. Lift the rear of the power supply and remove the supply from the system box.

6.4.1 Power Supply Replacement

To install a new power supply, reverse the steps in Section 6.4. Installation is the reverse of Section 6.4 with the exception of pulling the tabs.

When replacing the power supply, ensure that you do the following:

1. Install an H7819-AA power supply.
2. Align the two guides (one on the right front of the supply, and one on the right rear) with the slots on the system box.
3. Push the supply down into place. The power supply snaps into place if positioned properly.

6.5 Module Removal

NOTE

Refer to Section 6.2 before removing or replacing a device or module.

The following sections describe how to remove and replace the VAXstation 4000 Model 60 system modules.

CAUTION

Wear an anti-static wrist strap and place modules on an anti-static mat when removing and replacing system modules.

6.5.1 Light and Switches Module Removal

This section describes how to remove the light and switches module from the system.

NOTE

Refer to Section 6.2 before removing or replacing a device or module.

To remove the light and switches module, perform the following steps:

1. Perform the steps in Section 6.3.1 (Hard Disk Drive Removal) and Section 6.3.2 (RRD42 Disk Removal) or Section 6.3.3 (RX26 Drive Removal) and Section 6.3.5 (TZK10 Drive Removal).
2. Disconnect the module connector from the system module by lifting up on the module where it overlaps the system module.
3. Lift the module away from the front of the system.

6.5.1.1 Light and Switches Module Replacement

To replace the light and switches module, perform the following steps:

1. Align the switches with their respective holes in the front bezel.
2. Align the connector on the lower side of the module with the connector on the system module and seat the connector.

NOTE

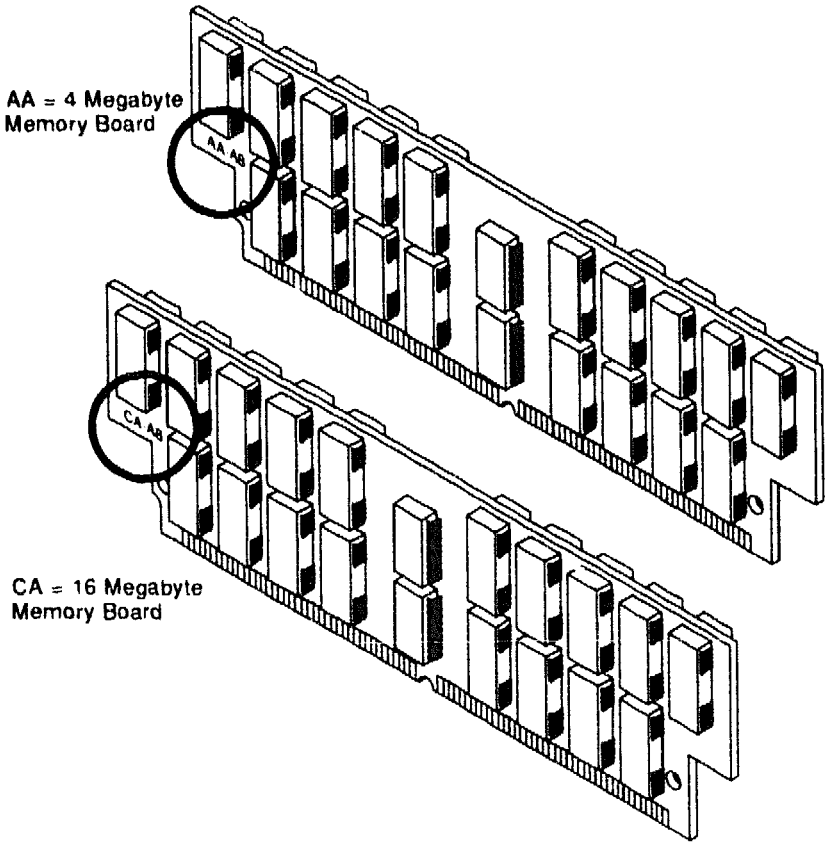
When installing a new module, be sure to align the module jacks and switches with the cutouts in the front panel.

6.5.2 Memory Module Identification

Three types of memory modules are available: 4 Mbyte (MS44-AA), 4 Mbyte Reduced Cost (MS44L), and 16 Mbyte (MS44-CA). The VAXstation 4000 Model 60 can use any of the three memory modules. Memory modules must be installed in pairs of two, 4 Mbyte modules or two, 16 Mbyte modules.

Make sure that you have the correct memory module before installation. To identify a memory module, locate the etch on the left side of the memory module. The 4 Mbyte modules have AA or AL on the etch board, and the 16 Mbyte modules have CA on the etch board. Figure 6–10 shows the location of the memory module ID number.

Figure 6–10 Memory Module Identification



6.5.3 MS44 Memory Module Removal

This section describes how to remove the MS44 memory modules from the system.

NOTE

The MS44 memory modules are an option for the VAXstation 4000 Model 60 system. These modules are not installed in all systems. Installation depends on configuration ordered and system upgrades.

CAUTION

Memory components are easily damaged with static electricity. An antistatic wrist strap should always be worn when installing or removing memory components.

CAUTION

The memory modules are keyed and should be installed in only one direction. Excessive force applied to the modules when they are not properly aligned with the connector can cause permanent damage to either the modules or to the connector.

NOTE

Memory modules must always be removed starting from the rear of the system. For example, to replace the module at the front of the system board, you must remove any modules at the back of the board and work toward the front. Memory modules are numbered on the right edge of the memory connectors located on the system board.

The location of the memory modules is shown in Figure 6–1.

To remove the MS44 memory modules, perform the following steps:

1. Release the two metal retainers at each end of the memory module connector.
2. Rotate the module back approximately 55 degrees to the rear of the unit and lift it out of the slot.

CAUTION

Failure to release the two module retainers will permanently damage the module connector located on the system board.

6.5.3.1 MS44 Memory Module Replacement

NOTE

When installing both 4 Mbyte and 16 Mbyte memory module pairs, install the 4 Mbyte pairs (MS44-AA or MS44-AL) in the first slots, toward the front of the system box. The 16 Mbyte module pairs (MS44-CA) must be installed behind the last pair of MS44-AA or MS44L memory modules.

To install a new MS44 memory module, perform the following steps:

1. Place the memory module in the connector and lean the module approximately 55 degrees backwards. Make sure the double notched lower corner of the memory module is toward the power supply.
2. Pivot the memory module upward until the metal tabs connect with the memory module.

6.5.4 Graphics Module Removal

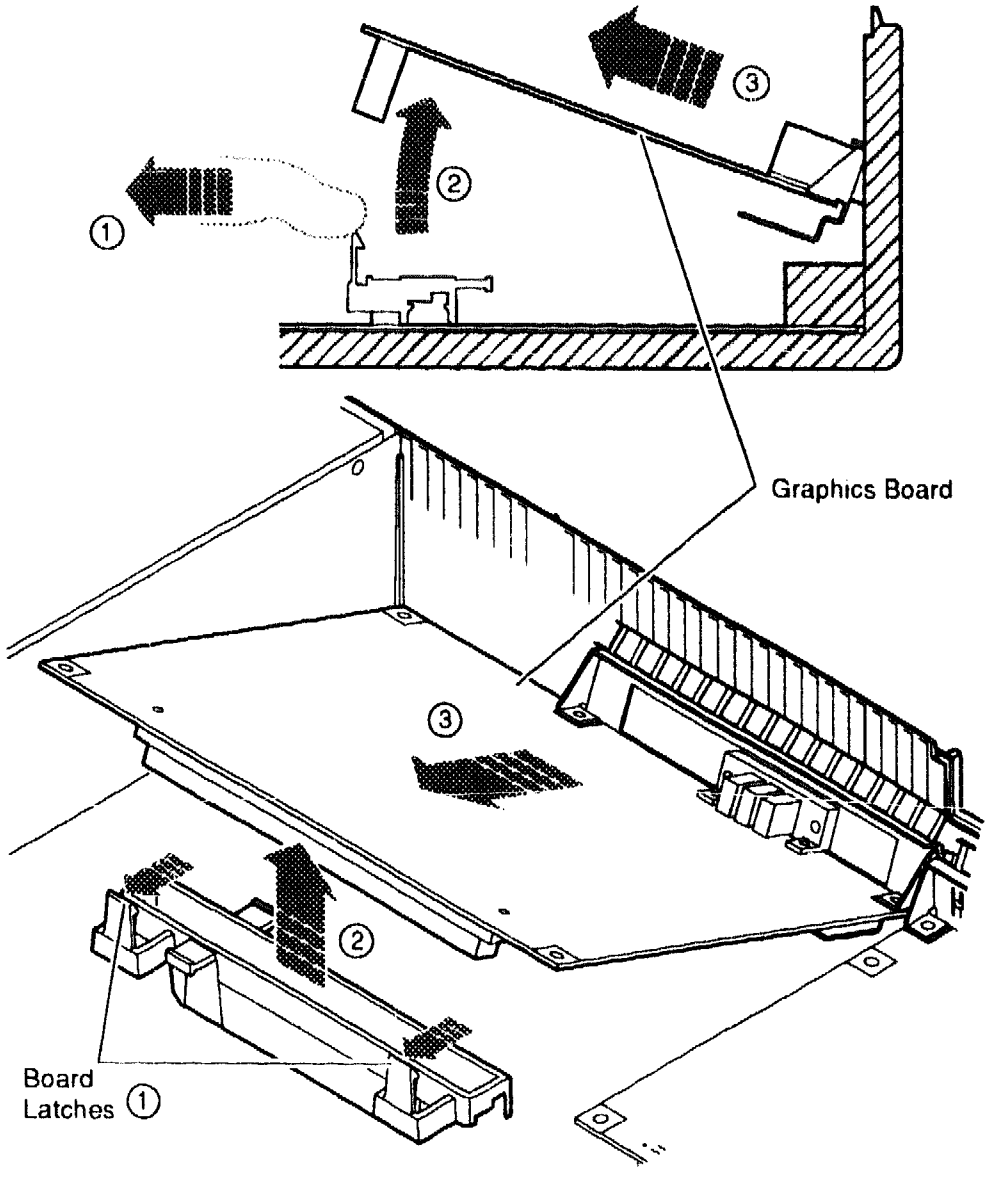
CAUTION

Wear an antistatic wrist strap and place an antistatic mat under the system when removing and replacing any modules.

The LCG graphics module is located at the rear of the system box, next to the power supply. Figure 6–1 shows its location in the system box. To remove it from the system box, use the following procedure:

1. Remove any external cable that is attached to the graphics port on the rear of the system unit.
2. Remove the existing board by releasing the two tabs, as shown in Figure 6–11, and lifting the board out.

Figure 6–11 Removing the LCG Graphics Module

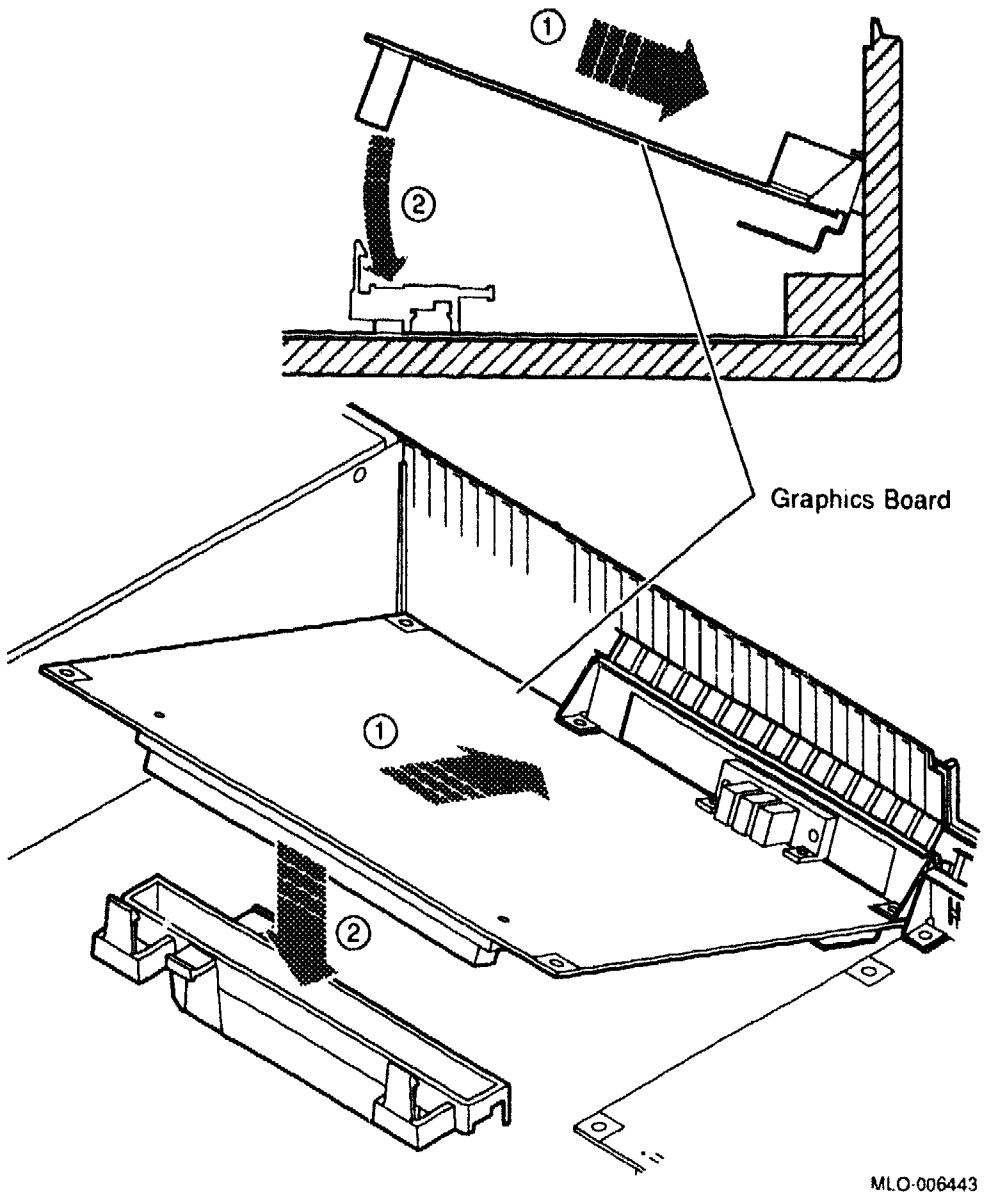


6.5.5 Replacing the LCG Graphics Module

1. Place the new graphics module in the system box, as shown in Figure 6–12. Press down firmly on the edge of the board until it latches.

2. Reconnect any cable that you removed from the graphics port.

Figure 6–12 Replacing the LCG Graphics Module



6.5.6 System Module (CPU) Removal

This section describes how to remove the system module from the system.

CAUTION

Wear an antistatic wrist strap and place an antistatic mat under the system when removing and replacing any modules.

To remove the system module (CPU), perform the following steps:

1. Disconnect the cables attached to the module at the rear of the system.
2. Remove the MS44 memory modules.
3. Remove the optional graphics module (if applicable).
4. Remove the optional synchronous communications module (if applicable).
5. Remove the removable edia bracket, with drives. Refer to Section 6.3.2 or Sectior .3.
6. Remove the lights and itches module. Refer to Section 6.5.1.
7. Remove the hard disk bracket, with drives. Refer to Section 6.3.1.
8. Remove the power supply. Refer to Section 6.4.
9. Remove the system module (CPU) by lifting it slightly, so that it clears the two guides at the front right and left of the module.
10. Using the large center connector, pull module toward the front of the system box and lift it out.

NOTE

When the system module is replaced, the Ethernet ROM must be removed and installed on the new system module.

NVR settings are lost on system module replacement.

6.5.6.1 System Module (CPU) Replacement

To install a new system module (CPU), reverse the steps in Section 6.5.6. Make sure the 5 slots in the module are aligned with the 5 latches on the base of the system box.

6.6 DSW21 Communications Device Removal

To remove the DSW21 from the system box, perform the following steps:

1. Remove the system box cover.
2. Disconnect the SCSI cable, located directly in front of the DSW21.
3. Disconnect the communications cable or terminator from the back of the system box.
4. Lift the DSW21 (directly in front of the SCSI connector), front end first.

6.6.1 DSW21 Communications Device Replacement

NOTE

Before replacing the DSW21, make sure the SCSI and communications cables have been disconnected.

1. Place the DSW21 in the right rear corner of the system box.
2. Apply pressure to the connector underneath the DSW21 and push the DSW21 down toward the rear of the system box until it clears the SCSI cable connector and lines up with the communications connector on the system module.
3. Reconnect the SCSI cable in the SCSI connector.
4. Reconnect the communications cable.

6.7 Bezel Removal

Do the following to remove the system bezel. Figure 6–1 shows the bezel location:

1. Remove the cover.
2. Remove the removable media bracket, with drives. Refer to Section 6.3.2 or Section 6.3.3.
3. Remove the lights and switches module (Section 6.5.1).
4. Slide the bezel up out of its guides.

6.7.1 Bezel Replacement

To install a new bezel, reverse the steps in Section 6.7.

6.8 Clearing System Password

NOTE

Power to the system must be off to perform this procedure.

To clear the system password, ground the two triangles on the system module with a screwdriver. The triangles are located to the rear left of the memory module connectors. Figure 1–1 shows the location of the triangles.

6.9 Testing the VAXstation 4000 Model 60 System

This section describes how to test the system after completing the removal or replacement process.

6.9.1 Restore the System

Before you can test the system, you must restore the system to its previous operating state. To restore the system, perform the following steps:

1. Replace the system cover. Align the teeth of the cover with the teeth on the side of the system enclosure and lower the cover until it clicks into place.
2. If you disconnected cables at the rear of the system, reconnect them.
3. Plug the system power cord into the wall outlet.
4. Reconnect the monitor.
5. Power up the system.

6.9.2 Testing the System

Test the system to confirm that all devices and modules are connected correctly. You can verify system operation by running any tests or procedures that exhibited the failure symptoms. In the course of testing the system, do the following:

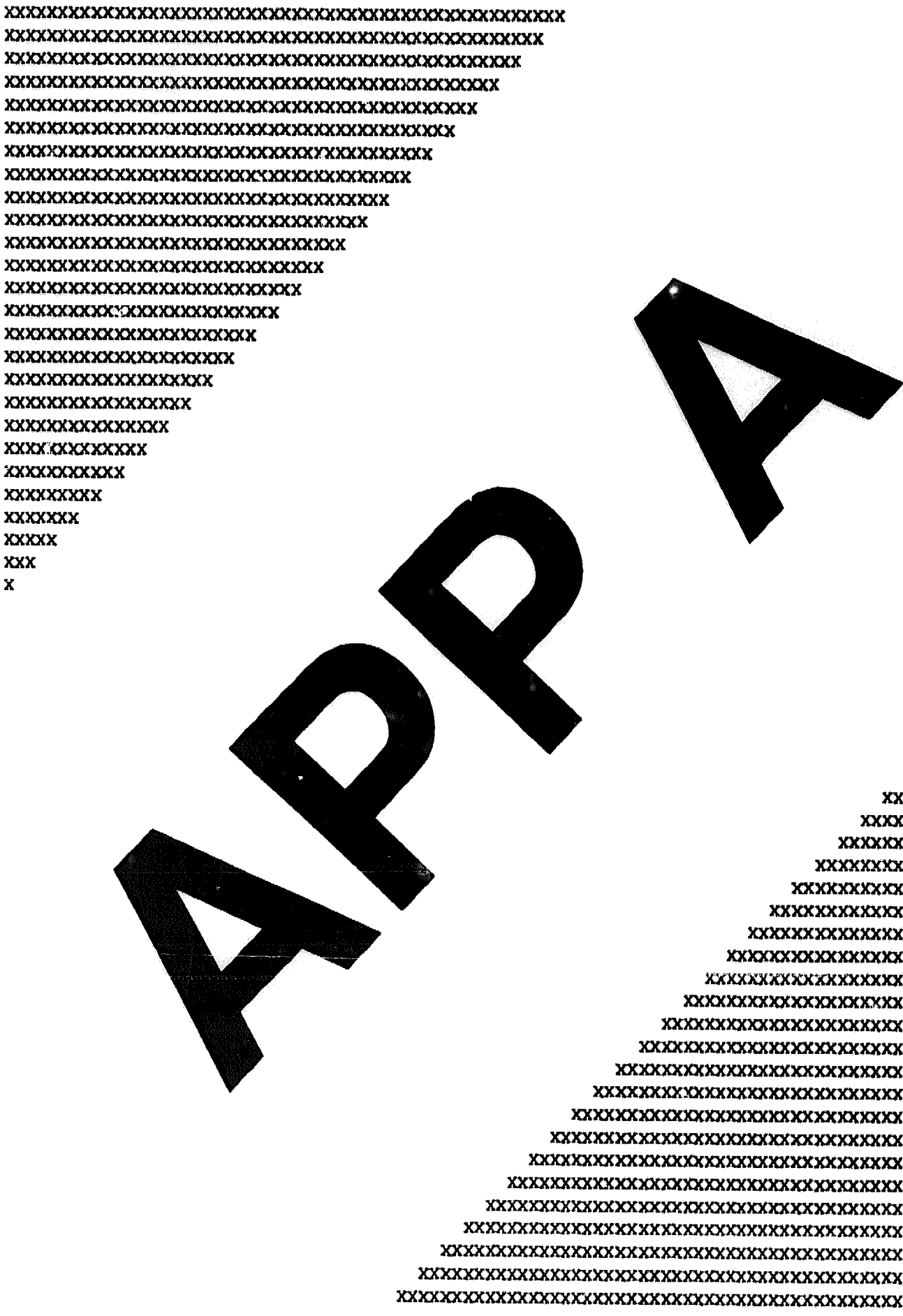
1. Note any power-up error or status messages on the monitor screen.
2. Display the system device configuration by using the SHOW CONFIG command. (See Section 6.2.) Compare the latest configuration display with the configuration display you viewed during system preparation. You should see the new device and the other devices present in the system. Verify that no error messages appear on the monitor screen.
3. Verify that all devices are interacting properly by using the TEST 100 command to run the system exerciser.

NOTE

A loopback connector is needed on the communication port to run TEST 100.

4. Verify that drives are set to the correct SCSI IDs using the SHOW DEVICE command.
5. If problems occur, be sure that:

   All cables inside and outside the system are connected.
   All modules are fully seated in their connectors.
   SCSI IDs are set correctly. There should not be any duplicate SCSI IDs. Refer to Table 6–2 for standard SCSI ID settings.


APP A

A
Interpreting Error Codes

The system firmware always tries to report any detected hardware errors to the console device and to the LEDs located on the front of the system box. Errors are reported as a result of failures during the powerup tests or during user initiated tests. The error codes identify the device and the test that failed. This chapter covers the following topics:

A.1 Error Messages

The console reports two types of errors.

- Immediate error message

  Errors displayed immediately after running a test without additional user intervention.

- Extended error display

  These errors display more error information in a different format. To get the extended error information, enter the SHOW ERROR command at the console prompt (>>>).

Immediate Error Message Format

The following example shows the format for immediate error messages:

```
?? 150 10 SCSI 0050
```

Where:

- ?? - indicates whether the failure is fatal or non-fatal.
  - — A double question mark (??) indicates a fatal error.
  - — A single question mark (?) indicates a non-fatal error.
- 150 - Field replaceable unit (FRU). See Table A–1. In this case it is a SCSI drive with the device ID set to 5.
- 10 - Device identification (decimal). This value corresponds to the left bank of four LEDs (hexadecimal). This ID also corresponds to the mnemonic (next field). Use Table 5–3 to correlate the error code to a device.
- SCSI - Mnemonic of device ID.
- 50 - The error code displayed following the test is in decimal. The extended message error codes have a hexadecimal format. When you look up an error code in the error code tables, be sure you know whether the code is in hexadecimal or decimal.

A.1.1 Extended Error Message

You can display the extended error messages by entering the SHOW ERROR command at the console prompt following the completion of a test. The extended error display has two lines.

- An error line similar to the immediate error code. The error code (last field of the first line) is in hexadecimal.
- A second line with up to eight longwords of error information.

Extended Error Message Format

The extended error messages appear in the following format:

```
?? 150 10 SCSI 0032
150 000E 00000005 001D001D 03200000 00000024
  (cont.) 00000002 00000000 00000004
```

Where:

First line of error message

?? Indicates whether the failure is fatal or non-fatal.

- A double question mark (??) indicates a fatal error.
- A single question mark (?) indicates a non-fatal error.

150 Field replaceable unit (FRU). See Table A–1.

10 Device identification (Value is given in decimal. Translates to SCSI)

SCSI Mnemonic of failed module

32 Error Code in hexadecimal

Second line of error message

150 Field Replaceable Unit (FRU)

000E Error code format. The format dictates the meaning of the remaining longwords of error information. This remaining information is not normally required for service.

A.1.2 FRU Codes

The FRU code identifies the field replaceable unit that failed. FRU codes and names are listed in the following table.

Table A–1 FRU Codes

FRU Code	FRU
001	System module. The mnemonic identifies the device.
002	Keyboard
003	Mouse
004	Monitor #1
005	Monitor #2
010-019	Graphics modules
020-029	COMM options
030-039	BUS adapters

Memory Module Codes 040-049	
FRU Code	**Module Location**
040	J25
041	J24
042	J23
043	J22
044	J21
045	J20

Table A–1 (Cont.) FRU Codes

FRU Code	FRU
	SCSI Drive Codes 100-199
FRU Code	**Drive with ID**
100	0
110	1
120	2
130	3
140	4
150	5
160	6
170	7

A.2 Self-Test Error Codes

The system reports two kinds of self-test errors. Those that displays on the console immediately after running the self test and extended test errors. The first type of error consists of one or two question marks to indicate a nonfatal or fatal error, the failing FRU, the device that failed, and a general error code. The second type of error message (extended), displays more detailed information. To view an extended error message, enter the SHOW ERROR command at the console prompt, after the test has reported an error.

A.2.1 TOY/NVR Self-Test Error Messages

The TOY/NVR self-test produces the error messages in the following table:

Table A–2 TOY/NVR Test Error Messages

Error		
Decimal	**Hexadecimal**	**Meaning**
4	4	Battery was found to be bad
8	8	NVR register test has failed
12	C	Battery down and NVR register test has failed
16	10	TOY register test has failed
32	20	Valid RAM and time bit have failed to set
36	24	VRT bit failure and battery was found to be bad
44	2C	Battery down, VRT failure, and NVR test has failed
48	30	TOY register test and VRT have failed
64	40	Battery check test has failed; hard error
65	41	Battery check test has failed; soft error
72	48	Battery check test and NVR register test have failed
96	60	VRT bit failure and battery check test has failed
104	68	Battery check, VRT, and NVR test have failed
128	80	Update in progress has failed to clear; hard error
129	81	Update in progress has failed to clear; soft error
160	A0	Update in progress has failed and VRT bit failure

A.2.2 DZ Self-Test Error Codes

Table A–3 DZ Self-Test error codes

Error		
Decimal	**Hexadecimal**	**Meaning**
16	10	DZ reset test has failed
32	20	DZ read LPR test has failed
48	30	DZ modem test has failed
64	40	DZ polled test has failed
80	50	DZ interrupt driver transfer test has failed
96	60	DZ LK401 test has failed
112	70	DZ mouse test has failed
128	80	DZ INIT DRIVER has failed
144	90	No memory to use for data area

The DZ self-test does not display extended error information when an error occurs. Enter the SHOW ERROR command to view the extended error information. The extended error code format is shown in the following example.

Extended Error Format:

This extended error message is returned by the DZ read LPR test or if a character comparison error occurs in the other DZ tests. The second field (4-digit field) is the extended error format.

```
001 000a ssssssss cccccccc lprlprlp llllllll rrrrrrrr eeeeeeee
```

Where:

- ssssssss - is the suberror code
- cccccccc - is the value of the DZ CSR
- lprlprlp - is the contents of the line parameter register
- llllllll - is the line number
- rrrrrrrr - is the data read back
- eeeeeeee - is the expected data

The extended error code returned by polled and interrupt test when a transfer times out is in the following format:

```
001 000b ssssssss cccccccc lprlprlp llllllll xxxxxxxx tttttttt
```

Where:

- ssssssss - is the suberror code
- cccccccc - is the value of the DZ CSR
- lprlprlp - is the contents of the line parameter register
- llllllll - is the line number
- xxxxxxxx - is the number of characters transmitted
- tttttttt - is the value of the DZ transmit control register

The suberror codes reported by the DZ self-test are as follows:

Table A–4 DZ suberror codes

Suberror-hexadecimal	Meaning
21	Read LPR baud rate is incorrectly set
22	Read LPR character width is incorrectly set
23	Read LPR parity bit is incorrectly set
24	Read LPR receiver on bit is incorrectly set
31	DZ modem test - failed RTS <-> CTS loopback
32	DZ modem test - failed DSRS <-> DSR & CD loopback
33	DZ modem test - failed LLBK <-> SPDMI loopback
34	DZ modem test - failed DTR <-> RI loopback
41	DZ polled test - transfer has timed out
42	DZ polled test - data is not valid
43	DZ polled test - parity error
44	DZ polled test - framing error
45	DZ polled test - overrun error
46	DZ polled test - character received != character transmitted
51	DZ interrupt test - transfer has timed out
52	DZ interrupt test - data is not valid
53	DZ interrupt test - parity error
54	DZ interrupt test - framing error
55	DZ interrupt test - overrun error
56	DZ interrupt test - character received != character transmitted
61	DZ LK401 test - transfer has timed out
62	DZ LK401 test - LK0401 has failed self-test
71	DZ mouse test - transfer has timed out
72	DZ mouse test - mouse has failed self-test

The following are error codes for the system test DZ module:

```
?? DZ    0      ABCD      0 00:00:00.00
```

ABCD are the four DZ lines. The error codes are identical for each line.

- A (line 3) printer port
- B (line 2) 25-pin connector
- C (line 1) mouse
- D (line 0) keyboard

There are eight error codes possible for each line.

- 1 - not all characters transmitted
- 2 - first character not received
- 3 - timeout
- 4 - more characters received than expected
- 5 - parity error
- 6 - framing error
- 7 - overrun error
- 8 - data compare error

These errors are translated by the summary screen. The summary screen for the DZ module uses the following format for each line:

```
Line     L_Param      Chr_Xmt      Chr_Rec              Error
```

Where:

- Line - is the line number
- L_Param - are the line parameters
- Chr_Xmt - is the last character transmitted
- Chr_Rec - is the last character received
- Error - text message for error code from main screen for this line.

A.2.3 Memory Test Error Codes

Table A–5 Memory Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
64	40H	A 16 Mbyte memory module and a 4 Mbyte memory module are plugged in as a pair
66	42H	A gap was found between memory module pairs
70	46H	4 Mbyte memory modules found after 16 Mbyte memory modules
72	48H	Memory modules not plugged in as pairs
256	100H	Failure has occurred in the byte mask test
260	104H	A parity error occurred during the byte mask test
514	202H	A data compare error occurred during the forward pass
516	204H	A parity error occurred during the forward pass
770	302H	A data compare error occurred during the reverse pass
772	304H	A parity error occurred during the reverse pass
1028	404H	A parity error occurred during parity test 1
1288	504H	A parity error occurred during parity test 2

The memory test does not display extended error information when an error occurs. Enter the SHOW ERROR command to view the extended error information. The extended error code format is shown next.

Extended Error Format:

```
xxx 4 MEM yyyy
xxx 00a bbbbbbbb cccccccc dddddddd eeeeeeee
```

Where:

- xxx - is the FRU that failed
- yyyy - is the error code in hexadecimal
- 00a - is the extended error information format type

- bbbbbbbb - is the contents of the memory system error register (MSER)
- cccccccc - is the failing address
- dddddddd - is the expected data
- eeeeeeee - is the data that was read

Table A–6 MEM Memory Module FRU Values

FRU	Module	Bank
040	1	0
041	2	0
042	1	1
043	2	1
044	1	2
045	2	2

A.2.4 Interval Timer Test Error Codes

Table A–7 Interval Timer Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
2	2	Interval timer is not interrupting at the correct rate

A.2.5 System Device Self-Test Error Codes

Table A–8 System Device Self-Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
128	80	Invalidate filter RAM error
256	100	ROM illegal data path value
512	200	ROM checksum error
768	300	ROM manufacturing check data error
1024	400	ROM index number did not agree with address

If the invalidate filter RAM error occurs, an extended error message displays. The extended error code format is shown in the next example.

Extended Error Format:

This format displays when there is an invalidate filter RAM error.

```
001 0010 aaaaaaaa rrrrrrrr eeeeeeee
```

Where:

- 001 - is the FRU number (system board)
- 0010 - is the format number
- aaaaaaaa - is the failing invalidate filter address
- rrrrrrrr - is the data read
- eeeeeeee - is the data expected

A.2.6 SCSI Self-Test Error Codes

Table A–9 SCSI Self-Test Error Codes

Error Decimal	Error Hexadecimal	Meaning
2	2	SCSI reset register test has failed
4	4	SCSI configuration registers test has failed
6	6	SCSI FIFO register test has failed
8	8	SCSI transfer count registers test has failed
		SCSI Interrupt Test Failures
10	10	Status registers test has failed
20	14	No cause has failed
22	16	High I pl, mask disabled has failed
24	18	High I pl, mask enabled has failed
26	1A	Low I pl, mask disabled has failed
28	1C	Low I pl, mask enabled has failed

Table A–9 (Cont.) SCSI Self-Test Error Codes

Error Decimal	Hexadecimal	Meaning
		SCSI Data Transfer Test Failures
30	1E	PROM function has failed
32	20	DMA mapping has failed
34	22	Non-DMA inquiry has failed
36	24	Not enough data returned failure
38	26	DMA inquiry has failed
40	28	Non-DMA/DMA miscompare
42	2A	DMA inquiry nonaligned has failed
44	2C	Non-DMA/DMA nonaligned miscompare
46	2E	Synchronous inquiry has failed
48	30	Non-DMA/synchronous miscompare
50	32	SCSI minimal device test has failed
		SCSI Map Error Test Failures
60	3C	DMA mapping has failed
62	3E	DMA inquiry has failed
64	40	Map error will not clear
66	42	Map error will not set
68	44	Parity error will not clear
70	46	PROM function has failed
80	50	SCSI PROM function has failed
82	52	SCSI INIT driver has failed

The SCSI test does not display extended error information when an error occurs. Enter the SHOW ERROR command to view the extended error information. The extended error code is shown in the following example:

Extended Error Format 0001:

This format is used by the register test.

```
001 0001 aaaaaaaa bbbbbbbb cccccccc dddddddd
```

Where:

- aaaaaaaa - is the error code
- bbbbbbbb - is the address of the register or location being accessed
- cccccccc - is the expected data or data written
- dddddddd - is the actual data or data read

Extended Error Format 000B:

This format is used by the register test.

```
001 000B aaaaaaaa bbbbbbbb cccccccc
```

Where:

- aaaaaaaa - is the error code
- bbbbbbbb - is the address of the register or location being accessed
- cccccccc - is information about the error

Extended Error Format 000C:

This format is used by the interrupt test.

```
001 000C aaaaaaaa bbbbbbbb cccccccc dddddddd eeeeeeee ffffffff
```

Where:

- aaaaaaaa - is the error code
- bbbbbbbb - is information about the error
- cccccccc - is contents of interrupt mask register
- dddddddd - is contents of interrupt request register
- eeeeeeee - is contents of controller status register
- ffffffff - is contents of the controller interrupt register

Extended Error Format 000D:

This format is used when not enough data are returned to the self-test after a SCSI command is executed.

```
aaa 000D bbbbcccc ddddeeee ffffgggg hhhhhhhh
```

Where:

- aaa - is the FRU
- bbbb - is the logical unit number
- cccc - is the device ID
- dddd - is the actual command opcode
- eeee - is the current command opcode
- ffff - is the error code
- gggg - is the mode of operation
- hhhhhhhh - is the number of data bytes received

Extended Error Format 000E:

This format is used when execution of a SCSI command fails.

```
aaa 000E bbbbcccc ddddeeee ffffgggg hhhhiiii jjjjjjjj kkkkllll mmmmmmmm
```

Where:

- aaa - is the FRU
- bbbb - is the logical unit number
- cccc - is the device ID
- dddd - is the actual command opcode
- eeee - is the current command opcode
- ffff - is the error code
- gggg - is the mode of operation
- hhhh - is byte 14 of the request sense packet (device FRU)
- iiii - is information about the error
- jjjjjjjj - is SCSI bus phase at the time of the error
- kkkk - is the contents of the controller status register at the time of the error

- llll - is the contents of the controller interrupt register at the time of the error
- mmmmmmmm - is the request sense key

Extended Error Format 000F:

This format is used when the status phase returns a bad status, or when a bad sense key is seen after a request sense.

```
aaa 000F bbbbcccc ddddeeee ffffgggg hhhhiiii jjjjjjjj kkkkkkkk
```

Where:

- aaa - is the FRU
- bbbb - is the logical unit number
- cccc - is the device ID
- dddd - is the actual command opcode
- eeee - is the current command opcode
- ffff - is the error code
- gggg - is the mode of operation
- hhhh - is byte 14 of the request sense packet (device FRU)
- iiii - is information about the error
- jjjjjjjj - is the status byte returned in the status phase
- kkkkkkkk - is the request sense key

Extended Error Format 0010:

This format is used when a request sense command is executed, but not enough sense bytes are received.

```
aaa 0010 bbbbcccc ddddeeee ffffgggg hhhhiiii jjjjjjjj kkkkkkkk
```

Where:

- aaa - is the FRU
- bbbb - is the logical unit number
- cccc - is the device ID
- dddd - is the actual command opcode
- eeee - is the current command opcode

- ffff - is the error code
- gggg - is the mode of operation
- hhhh - is byte 14 of the request sense packet (device FRU)
- iiii - is information about the error
- jjjjjjjj - is the number of bytes of sense data returned from the request sense
- kkkkkkkk - is the request sense key

Extended Error Format 0011:

This format is used when the data out phase sends fewer bytes than expected.

```
aaa 0011 bbbbcccc ddddeeee ffffgggg hhhhiiii jjjjkkkk llllllll mmmmmmmm
```

Where:

- aaa - is the FRU
- bbbb - is the logical unit number
- cccc - is the device ID
- dddd - is the actual command opcode
- eeee - is the current command opcode
- ffff - is the error code
- gggg - is the mode of operation
- hhhh - is byte 14 of the request sense packet (device FRU)
- iiii - is information about the error
- jjjj - is the contents of the controller status register at the time of the error
- kkkk - is the contents of the controller interrupt register at the time of the error
- llllllll - is the number of bytes actually sent in the data in/out phase
- mmmmmmmm - is the number of bytes that should have been sent in the data in/out phase

Extended Error Format 0012:

This format is used when an unsupported message is seen.

```
aaa 0012 bbbbcccc ddddeeee ffffgggg hhhhiiii jjjjjjjj kkkkllll mmmmmmmm
```

Where:

- aaa - is the FRU
- bbbb - is the logical unit number
- cccc - is the device ID
- dddd - is the actual command opcode
- eeee - is the current command opcode
- ffff - is the error code
- gggg - is the mode of operation
- hhhh - is byte 14 of the request sense packet (device FRU)
- iiii - is information about the error
- jjjjjjjj - is the first message byte of the message in the phase that the error occurred
- kkkk - is the contents of the controller interrupt register at the time of the error
- llll - is the contents of the controller status register at the time of the error
- mmmmmmmm - is the request sense key

Extended Error Format 0013:

This format is used by the map error test.

```
aaa 0013 bbbbcccc dddddddd eeeeeeee ffffffff gggggggg hhhhhhhh iiiiiii
```

Where:

- aaa - is the FRU
- bbbb - is the logical unit number
- cccc - is the device ID
- dddddddd - is the DMA address where the SCSI command is located
- eeeeeeee - is the DMA address where the SCSI data is located
- ffffffff - is the contents of the parity control register
- gggggggg - is the map register address
- hhhhhhhh - is the contents of the map register
- iiiiiii - is the error code

Extended Error Format 0014:

This format is used by the data transfer test when the numbers received from two transfers are different.

```
aaa 0014 bbbbbbbb cccccccc dddddddd
```

Where:

- aaa - is the FRU
- bbbbbbbb - is the first number of the bytes
- cccccccc - is the second number of the bytes
- dddddddd - is the error code

Extended Error Format 0015:

This format is used by the data transfer test when the data bytes received from two transfers are compared and found to be different.

```
aaa 0015 bbbbbbbb cccccccc
```

Where:

- aaa - is the FRU
- bbbbbbbb - is the number of the byte that failed
- cccccccc - is the error code

The FRU reported by all error formats is either 1 for the system board FRU, or (100 + device_id*10 + logical unit number).

The informaton values reported by some extended SCSI self-test errors are as follows (hexadecimal values are used for self-test):

Table A–10 SCSI Information Values

Information		
Decimal	**Hexadecimal**	**Meaning**
1	1	Valid group code bit clear in controller status register
2	2	Valid group code bit set in controller status register
3	3	Terminal count bit clear in controller status register
4	4	Terminal count bit set in controller status register
5	5	Parity error bit clear in controller status register
6	6	Parity error bit set in controller status register
7	7	Gross error bit clear in controller status register
8	8	Gross error bit set in controller status register
9	9	Interrupt bit clear in controller status register
10	A	Interrupt bit set in controller status register
11	B	Selected bit clear in controller interrupt register

Table A–10 (Cont.) SCSI Information Values

Information		
Decimal	**Hexadecimal**	**Meaning**
12	C	Selected bit clear in controller interrupt register
13	D	Select with attention bit clear in controller interrupt register
14	E	Select with attention bit set in controller interrupt register
15	F	Reselected bit clear in controller interrupt register
16	10	Reselected bit set in controller interrupt register
17	11	Function complete bit clear in controller interrupt register
18	12	Function complete bit set in controller interrupt register
19	13	Bus service bit clear in controller interrupt register
20	14	Bus service bit set in controller interrupt register
21	15	Disconnect bit clear in controller interrupt register
22	16	Disconnect bit set in controller interrupt register
23	17	Illegal command bit clear in controller interrupt register
24	18	Illegal command bit set in controller interrupt register
25	19	SCSI reset bit clear in controller interrupt register
26	1A	SCSI reset bit set in controller interrupt register
27	1B	Arbitration not won
28	1C	Selection timeout
29	1D	Invalid sequence in sequence step register

Table A–10 (Cont.) SCSI Information Values

Information		
Decimal	**Hexadecimal**	**Meaning**
30	1E	FIFO flags are not clear
31	1F	FIFO flags are clear
32	20	Unexpected ISR hit
33	21	SCSI interrupt request set in system interrupt request register
34	22	SCSI bit set unexpectedly in controller status register
35	23	Interrupt service routine was not entered
36	24	No SCSI interrupt request was seen
37	25	Interrupt bit in controller status register will not clear
38	26	SCSI bit in system interrupt request register will not clear
39	27	Bad request sense key
40	28	Bad status returned from status phase
41	29	Not enough sense data returned from a request sense command
42	2A	Phase did not go to command phase
43	2B	Phase did not go to message out phase
44	2C	Phase did not go to message in phase
45	2D	Command phase changed too soon
46	2E	Data out phase changed too soon
47	2F	Message in phase changed too soon
48	30	Message out phase changed too soon
49	31	Stuck in command phase
50	32	Stuck in message in phase
51	33	Stuck in message out phase
52	34	Stuck in data out phase

Table A–10 (Cont.) SCSI Information Values

Information		
Decimal	**Hexadecimal**	**Meaning**
53	35	Stuck in data in phase
54	36	Should not be in message out phase
55	37	No interrupt after sending SCSI command
56	38	No interrupt after sending command complete
57	39	No interrupt after sending message accepted
58	3A	No interrupt after sending transfer information
59	3B	All data out bytes were not sent
60	3C	Command complete message was sent but device did not drop off bus
61	3D	Unexpected message reject from device
62	3E	FIFO flag count is wrong
63	3F	Message is unsupported
64	40	Bus device reset was sent, but device did not drop off bus
65	41	Illegal phase
66	42	Should not be in data in phase
67	43	Problem with a device trying to reconnect
68	44	Unexpected disconnect message received
69	45	Device not seen before trying to reconnect
70	46	Bad identify message received on reconnection
71	47	Out of re-tries for this command
72	48	Too many bytes sent in data out phase
73	49	Too many bytes sent in data in phase
74	4A	Reconnection timeout
75	4B	SCSI parity error
76	4C	SCSI map error

The mode values reported by some extended SCSI self-test errors are as follows:

Table A–11 SCSI Mode Values

Mode - Hexadecimal	Meaning
0	Asynchronous mode with programmed I/O
1	Asynchronous mode with DMA
2	Synchronous mode with DMA

A.2.7 SCSI Utilities Messages

The following table describes error messages returned by a SCSI utility. All SCSI utility errors appear in the format *text_message informaiton_value*.

Table A–12 Text Messages for SCSI Utilities

Text	Meaning
SCSI_E_badparam	Bad parameter entered by the user
SCSI_E_err	Generic utility error
SCSI_E_devtyp	Wrong device type for this utility
SCSI_E_media	Problem with the media
SCSI_E_lun	Logical unit is not present
SCSI_E_inq_err	Error in inquiry command
SCSI_E_modsns_err	Error in mode sense command
SCSI_E_modsel_err	Error in mode select command
SCSI_E_tur_err	Error in test unit ready command
SCSI_E_rwnd_err	Error in rewind command
SCSI_E_wrt_err	Error in write command
SCSI_E_rd_err	Error in read command
SCSI_E_rdcap_err	Error in read capacity command
SCSI_E_st_unt_err	Error in start unit command

Table A–12 (Cont.) Text Messages for SCSI Utilities

Text	Meaning
SCSI_E_ver_	Error in verify command
SCSI_E_fmt_unt_err	Error in format unit command
SCSI_E_reass_err	Error in reassign command

In addition to the information values reported by the extended SCSI self test errors, there are the following information values reported in decimal.

Table A–13 Additional SCSI Information Values for Utilities

Information Decimal	Meaning
176	Bad utility number received from the user
177	Bad device number received from the user
178	Bad logical unit number received from the user
180	Device number entered by the user is the same as the controller
181	Utility cannot be executed in this mode of operation
182	Not enough data was returned from a SCSI command
183	Device is not a disk
184	Device is not a tape
185	Media is not removable
186	Media is removable
187	Media is write-protected
188	Device is not ready
189	Wrong data read back from a SCSI command
190	Logical unit is not present
191	Initialize driver failed
192	Error in format page

Table A–13 (Cont.) Additional SCSI Information Values for Utilities

Information Decimal	Meaning
193	Error in flexible page
194	PROM function error
195	Disk capacity is too small
196	Error receiving character from console
197	Illegal floppy drive
198	Illegal floppy media

A.2.8 SCSI System Test Error Codes

The following error codes are returned by the SCSI system test:

Table A–14 SCSI System Test Error Codes

Error Decimal	Hexadecimal	Meaning
90	5A	WST call failed
92	5C	ELN call failed
100	64	Inquiry failed when sizing bus
102	66	Not enough inquirey data returned when sizing bus
104	68	Start unit failed when sizing bus
106	6A	Test unit ready failed when sizing bus
108	6C	Mode select failed when sizing bus
110	6E	Read capacity failed when sizing bus
112	70	Mode sense failed when sizing bus
114	72	Media is write-protected in manufacturing mode

Table A–14 (Cont.) SCSI System Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
116	74	Not enough mode sense data returned when sizing bus
118	76	Read failed when sizing bus
120	78	Not enough read data when sizing bus
122	7A	Verify failed when sizing bus
130	82	Read failed when checking for key
132	84	Rewind failed when checking for key
134	86	Wrong number bytes read when checking for boot block
140	8C	Read failed when checking for boot block
142	8E	Wrong number bytes read when checking for boot block
150	96	Non-DMA inquiry failed in data transfer test
152	98	Synchronous DMA inquiry failed in data transfer test
154	9A	Number bytes miscompare in data transfer test
156	9C	Data miscompare in data transfer test
160	A0	Device test failed
162	A2	Wrong number bytes read in device test
164	A4	Wrong number bytes written in device test
166	A6	Data miscompare in device test
168	A8	Reselection timeout in device test

A.2.9 SCSI System Test Summary Screen

The SCSI summary screen displays the following information:

```
ADR RDS WRTS ERR FRU CMD PHS INF LBNSTRT XFERSIZ
```

Where:

- ADR - is ID and lun
- RDS - is number of reads performed on this device (decimal)
- WRTS - is number of writes performed on this device (decimal)
- ERR - is the error code (hexadecimal)
- FRU - is the Field Replaceable Unit (hexadecimal if FRU received from request sense packet)
- CMD - is the SCSI command that failed (hexadecimal)
- PHS - is the SCSI bus phase at time of error
- INF - is informational value (same as those reported by the self-test; hexadecimal)
- LBNSTRT - is the starting logical block number of failed transfer (hexadecimal)
- XFERSIZ - is the transfer size in blocks of failed transfer (hexadecimal)

A.2.10 Audio Test Error Codes

The audio self-test (AUD) is divided into three main sections.

- Register tests
- Audio tests
- Interrupt tests

Registers are tested by writing data, then reading back the data, or reading the read_only registers.

The audio test generates a sequence of eight tones and sends them to the speaker. It also does an internal digital loopback through the MAP. This tests the three MUX channels and corresponds to the three AUD$MAP_DIGITAL_LOOPBACK errors.

The interrupt test generates interrupts by loading eight bytes into the D-channel transmit buffer and reading them back through the receiver buffer (eight interrupts are generated).

Table A–15 Audio Self-Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
2	2	AUD$LIU_LSR_SAE register test has failed
4	4	AUD$LIU_LPR_SAE register test has failed
6	6	AUD$LIU_LPR_NZE register test has failed
8	8	AUD$LIU_LMR1_SAE register test has failed
10	A	AUD$LIU_LMR2_SAE register test has failed
16	10	AUD$MUX_MCR1_SAE register test has failed
18	12	AUD$MUX_MCR2_SAE register test has failed
20	14	AUD$MUX_MCR3_SAE register test has failed
32	20	AUD$MAP_MMR1_SAE register test has failed
34	22	AUD$MAP_MMR2_SAE register test has failed
36	24	AUD$MAP_DIGITAL_LOOPBACK1 test has failed
38	26	AUD$MAP_DIGITAL_LOOPBACK2 test has failed
40	28	AUD$MAP_DIGITAL_LOOPBACK3 test has failed
48	30	AUD$INTR_RECEIVE_BYTE_AVAILABLE test has failed
50	32	AUD$INTR_BAD_DLC_LOOPBACK_DATA test has failed
52	34	AUD$INTR_TIME_OUT test has failed
56	36	AUD$INTR_INVALID_IR_VALUE test has failed
58	38	AUD$INTR_NO_INT_GENERATED test has failed
60	3A	AUD$INTR_NOT_ALL_INTS_RCVD test has failed
62	3C	AUD$INTR_NOT_DISABLED test has failed

The AUD test does not display extended error information in decimal when an error occurs. Enter the SHOW ERROR command to view the extended error information in hexadecimal. The extended error codes can be of several types as shown in the following examples.

Extended Error Format 0010:

This format is used by all the audio register tests.

```
aaa 0010 bbbbbbbb cccccccc dddddddd
```

Where:

- aaa - is the FRU
- bbbbbbbb - is the error number
- cccccccc - is the contents of the data register (DR)
- dddddddd - TBS

Extended Error Format 0011:

This format is used by all the audio register tests.

```
aaa 0011 bbbbbbbb cccccccc dddddddd
```

Where:

- aaa - is the FRU
- bbbbbbbb - is the error number
- cccccccc - is the contents of D channel status register 2 (DSR2)
- dddddddd - TBS

Extended Error Format 0012:

This format is used by all the audio register tests.

```
aaa 0012 bbbbbbbb cccccccc dddddddd
```

Where:

- aaa - is the FRU
- bbbbbbbb - is the error number
- cccccccc - 0
- dddddddd - TBS

A.2.11 DSW21 Communications Device Test Error Codes

Table A–16 DSW21 Device Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
1	1	Self-test was unsuccessful
2	2	Transmit underflow
4	4	Transmitter busy
6	6	Receiver busy
8	8	Transmitter error
10	A	Carrier detect loss

Table A–16 (Cont.) DSW21 Device Test Error Codes

Error Decimal	Error Hexadecimal	Meaning
		Sync Comm Receive Failures
12	C	Receive overflow
14	E	Receive CRC error
16	10	Receive abort
18	12	Receive non-octet aligned
20	14	Receive parity error
22	16	Receive frame error
24	18	Receive length too large
26	1C	Receive DLE follow
30	1E	No external loopback connector
32	20	Invalid test specified
34	22	PVAX timeout waiting for response
36	24	Comm module timeout waiting
38	26	PVAX invalid test

Table A–16 (Cont.) DSW21 Device Test Error Codes

Error Decimal	Hexadecimal	Meaning
		DSW21 Comm. Device Failures
40	28	Comm option test failure
42	2A	Comm option copy to RAM failed
44	2C	Comm option RAM test failed
46	2E	Comm option dual RAM access test
48	30	Comm option interrupt test
50	32	Comm option reset test
52	34	Comm option internal loopback
54	36	Comm option external loopback
56	38	Comm option modem signal test
58	3A	Comm option H3199 failure
60	3C	Comm option H3248 failure
62	3E	Comm option H3250 failure
64	40	Comm option H3047 failure
66	42	Comm option host internal buffer failure
68	44	Comm option external buffer loop
70	46	Data compare error

Table A–16 (Cont.) DSW21 Device Test Error Codes

Error Decimal	Hexadecimal	Meaning
		DSW21 Comm. IMP Failures
128	80	IMP IDMA timeout
130	82	IMP SCC transmit timeout
132	84	IMP SCC receive timeout
134	86	IMP command timeout
136	88	IMP ERR timeout
138	8A	IMP PB8 timeout
140	8C	IMP SMC2 timeout
142	8E	IMP SMC1 timeout

Table A–16 (Cont.) DSW21 Device Test Error Codes

Error Decimal	Error Hexadecimal	Meaning
		DSW21 Comm. IMP Failures
144	90	IMP watchdog timeout
146	92	IMP SCP timeout
148	94	IMP timer 2 timeout
150	96	IMP SCC3 timeout
152	98	IMP PB9 timeout
154	9A	IMP timer 1 timeout
156	9C	IMP SCC2 timeout
158	9E	IMP IDMA timeout
160	A0	IMP SDMA timeout
162	A2	IMP SCC1 timeout
164	A4	IMP PB10 timeout
166	A6	IMP PB11 timeout
168	A8	IMP internal loopback system test
170	AA	IMP external loopback system test
172	AC	IMP timer 1 timeout
174	AE	IMP timer 2 timeout
176	B0	IMP transmit ready timeout

Table A–16 (Cont.) DSW21 Device Test Error Codes

Error Decimal	Error Hexadecimal	Meaning
		DSW21 Comm. IMP Failures
178	B2	IMP receive ready timeout
180	B4	IMP invalid SCC channel
182	B6	PVAX data compare error
184	B8	IMP carrier detect asset timeout
186	BA	IMP carrier detect deassert timeout
188	BC	IMP CTS assert timeout
190	BE	IMP CTS deassert timeout
192	C0	IMP IDL assert timeout
194	C2	IMP IDL deassert timeout
196	C4	IMP invalid cable attached
198	C6	IMP no test indicator
200	C8	IMP no data set ready
202	CA	IMP no ring indicator
204	CC	IMP no speed indicator
206	CE	IMP no carrier detect
208	D0	IMP no clear to send
210	D4	IMP power up block initialization
212	D6	IMP DSR assert timeout
214	D6	IMP DSR deassert timeout
216	D8	IMP reset error
218	DA	IMP mode initialization error
220	DC	PVAX memory allocation error
222	DE	PVAX memory free error
224	E0	UTIL invalid utility number

Table A–16 (Cont.) DSW21 Device Test Error Codes

Error Decimal	Error Hexadecimal	Meaning
226	E2	UTIL invalid cable code
		DSW21 Comm. Timeout Failures
228	E4	Timeout comm option set response RA
230	E6	Timeout comm option clear command CA
232	E8	Timeout comm option set scheduler run SR
234	EA	Timeout comm option set transmit ready TR
236	EC	Timeout comm option set receive ready RR
238	EE	Comm option exception occurred
240	F0	Comm option command register timeout
242	F2	Comm option transmit clear to send lost
244	F4	PVAX test memory allocation error
246	F6	PVAX test memory free error
248	F8	Comm option reported invalid configuration
250	FA	PVAX ROM test
252	FC	PVAX ROM checksum error
254	FE	PVAX control C entered at console
256	100	Comm option receive error-CRC follow error
258	102	Comm option MC68302 component is not REV B
260	104	Test request sequence error

Table A–16 (Cont.) DSW21 Device Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
262	106	IMP timeout waiting for host to clear RA
264	108	IMP timeout waiting for host to clear SR
266	10A	ROM test error
268	10C	FBUG secure error-reserved operation
270	10E	Port PB3 signal stuck high
272	110	Timer 3 not counting
274	112	Comm option diagnostics did not complete
276	114	Comm option SDMA bus error occurred
278	116	Timeout waiting for IRQ assertion
280	118	Transmit restart of 10 exceeded

A.2.12 DSW21 Communications Device Test Numbers

Table A–17 lists the test sequence numbers reported by the DSW21 during self-test. The sequence number is reported in location 2C02F604 of the status block. The table also lists the test routines in addition to those of the M68302.

Table A–17 DSW21 Communications Self-Test Sequence Numbers

Test Number			
Decimal	**Hexadecimal**	**Routine**	**Description**
01	01	imp_exc	Exception vector initialization
02	02	imp_vec	User interrupt vector initialization
03	03	imp_rdb	Local register RDB initialization

Table A–17 (Cont.) DSW21 Communications Self-Test Sequence Numbers

Test Number			
Decimal	**Hexadecimal**	**Routine**	**Description**
04	04	imp_pub_init	Up block initialization
05	05	imp_op_init	Option register initialization
06	06	imp_br_init	Base register initialization
07	07	imp_cs_ switch	Power-up switch initialization
08	08	imp_cfg	Get hardware configuration
09	09	imp_scr_init	System control register initialization
10	0A	imp_core	MC68302 core confidence test
11	0B	imp_dwcn	Watchdog timer counter clear
12	0C	imp_aport_ init	Port A initialization
13	0D	imp_bport_ init	Port B initialization
14	0E	imp_cisdn	ISDN configuration
15	0F	imp_loc_init	Local scratch RAM SCR initialization
16	10	imp_idb_init	Interrupt data block initialization
17	11	imp_pcb_init	Process control block initialization
18	12	imp_ic_init	Interrupt controller initialization
19	13	imp_cable_ code	Read cable code
20	14	imp_dma_test	IDMA transfers test

Table A–17 (Cont.) DSW21 Communications Self-Test Sequence Numbers

Test Number			
Decimal	**Hexadecimal**	**Routine**	**Description**
21	15	imp_rings	Initialize rings
22	16	imp_s1_inte	SCC1 ISR enable
23	17	imp_s2_inte	SCC2 ISR enable
24	18	imp_s3_inte	SCC3 ISR enable
25	19	imp_it1_test	Timer 1 test
26	1A	imp_it2_test	Timer 2 test
27	1B	imp_imode	Initialize mode
28	1C	imp_reset	Initialize CP
29	1D	imp_ilb_test	SCC internal loop
30	1E	imp_modem_ test	Modem signal test
31	1F	imp_elb_test	SCC external loop
32	20	imp_isdn_test	ISDN test
33	21	imp_rdb	Runtime register RDB initialization
34	22	imp_loc_init	Runtime SCR RAM initialization
35	23	imp_cable_ code	Runtime read adapter cable cod
36	24	imp_ic_init	Runtime interrupt controller initialization
37	25	imp_idb_init	Runtime IDB initialization
38	26	imp_pcb_init	Runtime PCB initialization
39	27	imp_reset	Runtime communication processor initialization
40	28	imp_rings	Runtime initialize transmit and receive rings

Table A–17 (Cont.) DSW21 Communications Self-Test Sequence Numbers

Test Number			
Decimal	**Hexadecimal**	**Routine**	**Description**
41	29	imp_s1_inte	Runtime SCC1 ISR
42	2A	imp_s2_inte	Runtime SCC2 ISR
43	2B	imp_s3_inte	Runtime SCC3 ISR
44	2C	imp_t1_start	Runtime timer 1 start
45	2D	imp_t2_start	Runtime timer 2 start
46	2E	imp_t3_start	Runtime timer 3 start
47	2F	imp_dainit	Runtime RAM dual access initialization
48	30	imp_xvec	Runtime transfer vector initialization

The DSW21 communications device test does not display extended error information in decimal when an error occurs. Enter the SHOW ERROR command to view the extended error information in hexadecimal. The extended error codes can be of several types as shown in the following example.

Extended Error Format 0001:

This format is used by the synchronous communication option RAM test.

```
0020 0001 aaaa0000 00000000 00000000 00000000 bbbb0000 ccccdddd eeeeff
```

Where:

- 0014 - is the FRU for the communications option.
- 0001 - is the format type for the RAM test.
- aaaa - is the test status.
- bbbb - is the data size (1=byte access, 2=word access, 4=long access).
- cccc - is address low.
- dddd - is address high.
- eeee - is the actual data.

- ffff - is the expected data.

Extended Error Format 0002:

This format is used by the DSW21 communications device self-tests.

```
 0020 0002 aaaabbbb ccddeeff gghhiijj kkkkllll mmmmnnnn oooopppp
qqqqrrrr
```

Where:

- 0020 - is the FRU for the communications option.
- 0002 - is the format type for the test.
- aaaa - is the test status.
- bbbb - is the MC68302 diagnostic test number.
- cc - is the cable code for channel 1 SCC1.
- dd - is the cable code for channel 2 SCC2.
- ee - is the current hardware revision.
- ff - is the current software revision.
- gg - is the current channel under test (1, 2, 3).
- hh - is the current electrical interface.
- ii - is the internal loopback mode (0=internal, 1=external).
- jj - is the external channel count.
- kkkk - is the current SCC mode.
- llll - is the current protocol.
- mmmm - is the data size.
- nnnn - is the current channel speed.
- oooo - is address low.
- pppp - is address high.
- qqqq - is the expected data.
- rrrr - is the actual data.

Extended Error Format 0003:

This format is used by the DSW21 communications device dual access tests.

```
0020 0003 aaaabbbb ccddeeff gghhiijj kkkkllll mmmmnnnn ooooppppp qqqqrrr
```

Where:

- 0020 - is the FRU for the DSW21 communications device.
- 0003 - is the format type for the test.
- aaaa - is the test status.
- bbbb - is the MC68302 diagnostic test number.
- cc - is the cable code for channel 1 SCC1.
- dd - is the cable code for channel 2 SCC2.
- ee - is the current hardware revision.
- ff - is the current software revision.
- gg - is the current channel under test (1, 2, 3).
- hh - is the current electrical interface.
- ii - is the internal loopback mode (0=internal, 1=external).
- jj - is the external channel count.
- kkkk - is the current SCC mode.
- llll - is the current protocol.
- mmmm - is the data size.
- nnnn - is the current channel speed.
- oooo - is address low.
- pppp - is address high.
- qqqq - is the expected data.
- rrrr - is the actual data.

Extended Error Format 0004:

This format is used by the DSW21 communications device interrupt test.

```
0020 0004 aaaabbbb ccddeeff gghhiijj kkkkllll mmmmnnnn ooooppppp qqqqrr
```

Where:

- 0020 - is the FRU for the DSW21 communications device.
- 0004 - is the format type for the self-test.
- aaaa - is the test status.
- bbbb - is the MC68302 diagnostic test number.
- cc - is the cable code for channel 1 SCC1.
- dd - is the cable code for channel 2 SCC2.
- ee - is the current hardware revision.
- ff - is the current software revision.
- gg - is the current channel under test (1, 2, 3).
- hh - is the current electrical interface.
- ii - is the internal loopback mode (0=internal, 1=external).
- jj - is the external channel count.
- kkkk - is the current SCC mode.
- llll - is the current protocol.
- mmmm - is the data size.
- nnnn - is the current channel speed.
- oooo - is address low.
- pppp - is address high.
- qqqq - is the expected data.
- rrrr - is the actual data.

Extended Error Format 0005:

This format is used by the DSW21 communications device modem signal tests.

```
0020 0005 aaaabbbb ccddeeff gghhiijj kkkkllll mmmmnnnn oooopppp qqqqrr
```

Where:

- 0020 - is the FRU for the DSW21 communications device.
- 0005 - is the format type for the test.
- aaaa - is the test status.
- bbbb - is the MC68302 diagnostic test number.
- cc - is the cable code for channel 1 SCC1.
- dd - is the cable code for channel 2 SCC2.
- ee - is the current hardware revision.
- ff - is the current software revision.
- gg - is the current channel under test (1, 2, 3).
- hh - is the current electrical interface.
- ii - is the internal loopback mode (0=internal, 1=external).
- jj - is the external channel count.
- kkkk - is the current SCC mode.
- llll - is the current protocol.
- mmmm - is the data size.
- nnnn - is the current channel speed.
- oooo - is address low.
- pppp - is address high.
- qqqq - is the expected data.
- rrrr - is the actual data.

Extended Error Format 0006:

This format is used by the DSW21 communications device loopback tests.

```
0020 0006 aaaabbbb ccddeeff gghhiijj kkkkllll mmmmnnnn oooopppp qqqqrr
```

Where:

- 0020 - is the FRU for the DSW21 communications device.
- 0006 - is the format type for the self-test.
- aaaa - is the test status.
- bbbb - is the MC68302 diagnostic test number.
- cc - is the cable code for channel 1 SCC1.
- dd - is the cable code for channel 2 SCC2.
- ee - is the current hardware revision.
- ff - is the current software revision.
- gg - is the current channel under test (1, 2, 3).
- hh - is the current electrical interface.
- ii - is the internal loopback mode (0=internal, 1=external).
- jj - is the external channel count.
- kkkk - is the current SCC mode.
- llll - is the current protocol.
- mmmm - is the data size.
- nnnn - is the current channel speed.
- oooo - is address low.
- pppp - is address high.
- qqqq - is the expected data.
- rrrr - is the actual data.

Extended Error Format 0007:

This format is used by the DSW21 communications device reset test. The reset test only returns a timeout status if it does not get a posted interrupt controller.

```
0020 0007 00070000 00000000 00000000 00000000 00000000 00000000 000000000
```

Where:

- 0020 - is the FRU for the DSW21 communications device.
- 0007 - is the format type.

- 0007 - currently running reset test.

Extended Error Format 0008:

This format is used by the synchronous communication option null request.

```
0020 0008 0008 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000
```

Where:

- 0020 - is the FRU for the DSW21 communications device.
- 0008 - is the format type.
- 0008 - currently running null request.

Extended Error Format 0009:

This format is used by the DSW21 communications device when an exception occurs.

```
0020 0009 00EEaaaa bbbbcccc dddd0000 00000000 0000eeee ffffgggg 000000
```

Where:

- 0020 - is the FRU for the DSW21 communications device.
- 0009 - is the format type.
- aaaa - is the command status register.
- bbbb - is the stack pointer high.
- cccc - is the exception vector
- dddd - is the stack pointer low.
- eeee - is the status register.
- ffff - is the PC low.
- gggg - is the PC high.

Extended Error Format 10:

This format is used by the DSW21 communications device when it first executes code, and is used to verify that the 68K is executing instructions.

```
 0020 000A 00040003 00060005 00080007 00100009 00120011 00140013
00160015
```

Where:

- 0020 - is the FRU for the DSW21 communications device.
- 000A - is the format type.

A.2.13 DSW21 Communications Utilities Error Codes

Table A–18 DSW21 Communications Utilities Error Codes

224	E0	Invalid utility request
226	E2	Invalid test request
255	FF	Control C entered

A.2.14 DSW21 Communications Device System Test Error Codes

Errors reported for the system test are the same as reported for the extended test, in addition to errors that may be reported by the VAXeln kernel service.

A.2.15 Floating Point Unit (FPU) Test Error Codes

Table A–19 FPU Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
258	102	MOVF instruction test has failed
260	104	Unexpected exception has occurred during MOVF test
514	202	MNEGF instruction test has failed
516	204	Unexpected exception has occurred during MNEGF test
770	302	ACBF instruction test has failed
772	304	Unexpected exception has occurred during ACBF test
1026	402	ADDF2/ADDF3 instruction test has failed
1028	404	Unexpected exception has occurred during ADDFx test
1282	502	CMPF instruction test has failed
1284	504	Unexpected exception has occurred during CMPF test
1538	602	CVTFD/CVTFG instruction test has failed
1540	604	Unexpected exception has occurred during CVTFD or CVTFG test
1794	702	CVTFx instruction test has failed
1796	704	Unexpected exception has occurred during CVTFx test
2050	802	CVTFx instruction test has failed
2052	804	Unexpected exception has occurred during CVTFx test
2306	902	DIVF2/DIVF3 instruction test has failed
2308	904	Unexpected exception has occurred during DIVFx test
2562	A02	EMODF instruction test has failed

Table A–19 (Cont.) FPU Test Error Codes

Error Decimal	Error Hexadecimal	Meaning
2564	A04	Unexpected exception has occurred during EMODF test
2818	B02	MULF2/MULF3 instruction test has failed
2820	B04	Unexpected exception has occurred during MULFx test
3074	C02	POLYF instruction test has failed
3076	C04	Unexpected exception has occurred during POLYF test
3330	D02	SUBF2/SUBF3 instruction test has failed
3332	D04	Unexpected exception has occurred during SUBFx test
3586	E02	TSTF instruction test has failed
3588	E04	Unexpected exception has occurred during TSTF test

The FPU test does not display extended error information when an error occurs. Enter the SHOW ERROR command to view the extended error information. The extended error code formats are shown in the following examples.

Extended Error Format:

This format is used by the FPU test when it receives an exception while running one of the floating point tests.

```
001 000 VVVVVVVV EEEEEEEE EEEEEEEE EEEEEEEE EEEEEEEE EEEEEEEE EEEEEEEE
```

Where:

- VVVVVVVV - is the vector of the unexpected interrupt.
- EEEEEEEE - is other exception data and is ONLY printed out on machine checks and arithmetic traps.

The following table lists the vectors that the floating point test detects during unexpected interrupts.

Table A–20 FP Exception Vectors

Vector	Description
004	Machine check vector number
010	Privileged instruction vector
014	Customer reserved instruction vector
018	Reserved operand vector
01c	Reserved addressing mode vector
034	Arithmetic trap vector

A.2.16 CACHE Test Error Codes

Table A–21 CACHE Test Error Codes

Error-decimal	Error-hexadecimal	Meaning
512	200	Error in write/read to the DATA store
768	300	Error in write/read to the TAG store
1024	400	Valid bit is not set when it should be
1280	500	TAG does not contain TAG for diagnostic space
1536	600	Unexpected TAG parity error
1792	700	Cache did not provide expected data during a cache hit
2048	800	Cache DATA parity error
2304	900	Tag not valid during cache hit testing
2560	A00	Data not valid during cache hit testing
2816	B00	Cache data write through test failed because of invalid data in the cache data store
3072	C00	Cache data write through test failed because of invalid data in memory

The CACHE test does not display extended error information when an error occurs. Enter the SHOW ERROR command to view the extended error information. The extended error format is shown in the following example:

Extended Error Format:

This format is use by the CACHE test.

```
001 000a aaaaaaaa eeeeeeee rrrrrrrr
```

Where:

- aaaaaaaa - is the address within the DATA or TAG store that failed
- eeeeeeee - is the expected value of the data pattern
- rrrrrrrr - is the data that was read from the failing address

A.2.17 LCG Self-Test Error Codes

The following table contains the error codes returned by the LCG self-test. Note that the error first displayed at the console are in decimal. If the extended error message display when you enter the SHOW ERROR command, the error number displays in hexadecimal. Both numbers are listed in the table. (0 indicates LED off; 1 indicates LED on.)

Table A–22 LCG Self-Test Error Codes

Error Decimal	Hexadecimal	LCG Code	Meaning
2	2	0010 0010	LCG register test has failed
		LCG FIFO Test Failures	
16	10	0010 0100	FIFO status bits error
18	12	0010 0100	FIFO setup packet error
20	14	0010 0100	FIFO interrupt status bit error
22	16	0010 0100	FIFO control status bit error
24	18	0010 0100	FIFO memory pointers error
26	1A	0010 0100	FIFO data flow error
28	1C	0010 0100	FIFO clip list pointers error

Table A–22 (Cont.) LCG Self-Test Error Codes

Error Decimal	Hexadecimal	LCG Code	Meaning
		LCG Interrupt Test Failures	
32	20	0010 1000	Write protect not set
34	22	0010 1000	Write protect not cleared
36	24	0010 1000	Bad opcode interrupt not set
38	26	0010 1000	Bad opcode interrupt not cleared
40	28	0010 1000	Clip list wrap interrupt not set
42	2A	0010 1000	Clip list wrap interrupt not cleared
44	2C	0010 1000	Packet breakpoint interrupt not set
46	2E	0010 1000	Packet breakpoint interrupt not cleared
48	30	0010 1000	Packet breakpoint single step
50	32	0010 1000	Address breakpoint not set
52	34	0010 1000	Address breakpoint not cleared
54	36	0010 1000	Address breakpoint not cancelled
56	38	0010 1000	Access breakpoint not set
58	3A	0010 1000	Access breakpoint not cleared
60	3C	0010 1000	Access breakpoint single step
62	3E	0010 1000	Nop interrupt not set
64	40	0010 1000	Nop interrupt not cleared
66	42	0010 1000	Halt interrupt not set
68	44	0010 1000	Halt interrupt not cleared
70	46	0010 1000	LCG interrupt line
72	48	0010 1000	LCG memory error interrupt

Table A–22 (Cont.) LCG Self-Test Error Codes

Error Decimal	Hexadecimal	LCG Code	Meaning
Video Option Board VRAM Test Failures			
80	50	0010 0001	Pass 1 failed
82	52	0010 0001	Pass 2 failed
84	54	0010 0001	Pass 3 failed
86	56	0010 0001	Address pass test failed
Video Option Board Brooktree Test Failures			
88	58	0010 0001	BT read mask register
90	5A	0010 0001	BT blink mask register
92	5C	0010 0001	BT command register
94	5E	0010 0001	BT test register
96	60	0010 0001	BT pallette red entry
98	62	0010 0001	BT pallette green entry
100	64	0010 0001	BT pallette blue entry
102	66	0010 0001	BT overlay red entry
104	68	0010 0001	BT overlay green entry
106	6A	0010 0001	BT overlay blue entry
108	6C	0010 0001	Video option board of unknown type
110	6E	0010 0001	Video option board video readback test failed
	6F	0010 0001	This is a soft error, same as 6E
LCG Video Timing Test Failures			
112	70	0010 0001	Vertical retrace never detected
114	72	0010 0001	LCG video counters not counting
116	74	0010 0001	LCG video timing test has failed - VSTATE or HSTATE not changing

Table A–22 (Cont.) LCG Self-Test Error Codes

Error Decimal	Hexadecimal	LCG Code	Meaning
118	76	0010 0001	LCG plane mask test has failed - LCG plane mask error
160	A0	0010 0001	BT463 cursor color error
162	A2	0010 0001	BT463 ID REG error - wrong part
164	A4	0010 0001	BT463 command REG error
166	A6	0010 0001	BT463 blink mask REG error
168	A9	0010 0001	BT463 test REG error
170	AA	0010 0001	BT463 revision REG error - wrong part rev.
172	AC	0010 0001	BT463 window type REG error
174	AE	0010 0001	BT463 color palette error
		LCG Virtual Drawing Test Failures	
128	80	0010 1010	Virtual status bits error
130	82	0010 1010	Virtual translation error
132	84	0010 1010	Virtual rasterop error
134	86	0010 1010	Virtual fault error
136	88	0010 1010	Virtual invalidate error
		LCG Physical Drawing Test Failures	
144	90	0010 1001	Physical rasterop error
146	92	0010 1001	Logical function error
148	94	0010 1001	Action code error

The LCG test does not display extended error information when an error occurs. Enter the SHOW ERROR command to view the extended error information. The extended error codes can be displayed in the following formats. For all formats, the first field is the field replaceable unit, either 001 for the system board or 10 (hexadecimal) for the frame buffer board. The next field is the extended error format, one of the seven formats listed in the following examples.

Extended Error Format 0001:

This format is used by the LCG register test, LCG FIFO test, LCG video test, and the LCG virtual test.

```
xxx 0001 aaaaaaaa bbbbbbbb cccccccc dddddddd
```

Where:

- xxx - is the FRU
- aaaaaaaa - is the error code
- bbbbbbbb - is the address of the register or location being accessed
- cccccccc - is the expected data or data written
- dddddddd - is the actual data or data read

Extended Error Format 000B:

This format is used by the LCG FIFO test.

```
001 000B aaaaaaaa bbbbbbbb cccccccc dddddddd eeeeeeee
```

Where:

- 001 - is the FRU
- aaaaaaaa - is the error code
- bbbbbbbb - is the FIFO control flag being tested
- cccccccc - is the address of the register
- dddddddd - is the expected register content
- eeeeeeee - is the register content

Extended Error Format 000C:

This format is used by the LCG FIFO test.

```
001 000C aaaaaaaa bbbbbbbb cccccccc dddddddd eeeeeeee
```

Where:

- 001 - is the FRU
- aaaaaaaa - is the error code
- bbbbbbbb - is the LCG command packet being tested
- cccccccc - is the address of the register

- ddddddddd - is the expected register content
- eeeeeeee - is the register content

Extended Error Format 000D:

This format is used by the LCG FIFO test, LCG interrupt test, LCG video test, and the LCG virtual drawing test.

```
xxx 000D aaaaaaaa bbbbbbbb cccccccc ddddddddd
```

Where:

- xxx - is the FRU
- aaaaaaaa - is the error code
- bbbbbbbb - are the LCG status bits of interest
- cccccccc - is the address of the LCG status register
- ddddddddd - is the LCG status register content

Extended Error Format 000E:

This format is used by the LCG FIFO test and the LCG virtual drawing test.

```
001 000E aaaaaaaa bbbbbbbb cccccccc ddddddddd eeeeeeee fffffffff
```

Where:

- 001 - is the FRU
- aaaaaaaa - is the error code
- bbbbbbbb - are the LCG FIFO control flags
- cccccccc - are the LCG status bits
- ddddddddd - is the LCG status register address
- eeeeeeee - is the LCG status register contents
- fffffffff - is the expected state of status bits

Extended Error Format 000F:

This format is used by the video option board readback test for four and eight plane modules.

```
xxx 000F aaaaaaaa bbbbbbbb cccccccc ddddddddd eeeeeeee
```

Where:

- xxx - is the FRU
- aaaaaaaa - is the error code
- bbbbbbbb - is the color the Brooktree is programmed
- cccccccc - is the value of the video option board readback register
- dddddddd - is the expected value of the video board readback register
- eeeeeeee - head/failure (10-16 for one head, 21-23 for two heads)

Table A–23 Color Compare Failures - One Head

Error #	Description
10	red > blue
11	red <= blue
12	blue > green
13	blue <= green
14	green > red
15	green <= red
16	sync < green

Table A–24 Color Compare Failures - Two Heads

Error #	Description
20	blue > green
21	blue <= green
22	green > red
23	green <= red

Extended Error Format 000F:

This format is used by the video option board readback test for 24 plane modules.

```
xxx 000F aaaaaaaa bbbbbbbb cccccccc dddddddd eeeeeeee
```

Where:

- xxx - is the FRU
- aaaaaaaa - is the programmed test mode, colors
- bbbbbbbb - is the result read from the Brooktree test reg
- cccccccc - is the expected value of the Brooktree test reg
- dddddddd - 0

Extended Error Format 0010:

This format is used by the LCG virtual drawing test and the LCG physical drawing test.

```
001 0010 aaaaaaaa bbbbbbbb cccccccc dddddddd eeeeeeee ffffffff
```

Where:

- 001 - is the FRU
- aaaaaaaa - LCG (31:24) op_code, (23:16) flags
- bbbbbbbb - is the physical address for opration
- cccccccc - are the expected pixel values
- dddddddd - are the pixel values read
- eeeeeeee - is the LCG-LU function
- ffffffff - is the LCG-action code (ag_test), op_setup (_virtual tests)

A.2.18 LCG Utilities

LCG utilities can be used for visual verification of some functions of the graphics subsystem. No tests are performed. The utilities allow a user to verify screen alignment and adjust or verify screen colors and gray scales.

Table A–25 LCG Utilities

Utility #	Description
0	White screen
1	Red screen
2	Blue screen
3	Green screen
4	Four color bars
5	Eight color bars
6	Eight gray scale bars
7	Screen of EEs
8	Cross hatch with circle
9	Screen of scrolling HHs

A.2.18.1 LCG Utility Commands

The following table lists the LCG utility commands.

Table A–26 LCG Utility Commands

Command	Meaning
T/UT LCG	Start the utility in menu mode
T/UT LCG # # #...	Start the utility specified by the first number, then execute the next utility number when the space bar is pressed, loop on the list.
Control C	Exit the utility and erase the screen
Control Y	Exit the utility

A.2.19 LCG System Test Overview

The LCG system test sets up the LCG to execute drawing commands from the LCG FIFO and clip list command buffers. The first pass draws a checkerboard on the screen by copying a "box" from main memory to each of the 24 box locations in the checkerboard, inverting every other box. Subsequent passes copy each box from the next box, and the last box from the first box on each pass. After 50 passes, the pattern is checked a byte at a time. The first error is flagged and testing stops.

A.2.20 LCG System Test Error Codes

The following table lists possible error codes that can be generated by the LCG system test.

Table A–27 LCG System Test Error Codes

F001	Initialize the test module, set up communication links with the monitor
F002	MAP VRAM 1 memory for checkerboard
F003	MAP LUT in VRAM 1 0x21800000
F004	MAP VRAM 2 memory for checkerboard
F005	MAP LUT in VRAM 2 0x21800000
F006	MAP VRAM 3 memory for checkerboard
F007	MAP LUT in VRAM 3 0x21800000
F008	MAP VRAM 4 memory for checkerboard
F009	MAP LUT in VRAM 4 0x21800000
F00A	Creat the video device
F00B	Time out, no interrupt occurred
F00C	Allocate system memory space for the drawing source
F00D	Allocate space in main memory for drawing the checkerboard
F00E	Error WST$_SEND_SUMMARY
F00F	Error WST$_CHECK
F010	De-allocate space for the drawing source
F011	FIFO BAD_OPCODE
F012	MAP the LCG FIFO registers

Table A–27 (Cont.) LCG System Test Error Codes

F013	MAP the LCG int registers
F014	MAP the interrupt registers
F015	MAP the LCG go register
F016	MAP the FIFO I/O range
F017	MAP the EDAL addresses
F018	MAP the video_ref_base reg 0x20100e34
F019	MAP the configuration and test reg 20020000
F0F0	Check checkerboard error, bad read from the VRAM 1
F0F1	Check checkerboard error, bad read from the VRAM 2
F1F1	Check checkerboard error, bad read from the main memory

A.2.21 LCG System Test Summary Screen

```
********** FST EXT_ERRPT   2LCG      0 00:12:30 **********
   LCG error summary -       Pass count =  0000002B
   ------------------------------------------------------
   error code        no error
   ------------------------------------------------------
   checker board    address  expect  read
   ------------------------------------------------------
   main mem error
   vram error

   checker board start in main mem = 00180000
   vram offset to checker board    = 000A6000
   box width                       = 000000A0
   box height                      = 000000A5
   FIFO start                      = 00140000
   CLIP start                      = 00160000
   Graphics int status             =
```

To find the error on the screen, note that VRAM on_screen memory starts at 21800000 (or 22800000) for head 1. Each additional head is offset by 200000.

22800000 - head 1
22A00000 - head 2
22C00000 - head 3
22D00000 - head 4

The "vram offset to checker board" is added to the VRAM start to find the beginning of the checkerboard.

Each block begins one "box width" after the previous one.

A.2.22 NI Self-Test Error Codes

The following tables contain error codes returned by the Network Interface (NI) self-test. If an NI error occurs, first verify that a loopback connector is installed on the selected network port on the back of the system box or that the network cable is firmly connected. Re-execute the NI self-test if necessary.

Table A–28 NI Self-Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
	Network Address ROM Test Failure	
16	10	Read access failed
18	12	Null address failure
20	14	Bad group address
22	16	Bad checksum
24	18	Bad group 2
26	1A	Bad group 3
28	1C	Bad test patterns
32	20	LANCE register address port read/write error
32	20	LANCE register address port R/W error

Table A–28 (Cont.) NI Self-Test Error Codes

Error Decimal	Hexadecimal	Meaning
		LANCE CSR Test Failures
34	22	LANCE CSR0 read/write error
36	24	LANCE CSR1 read/write error
38	26	LANCE CSR2 read/write error
40	28	LANCE CSR3 read/write error
		LANCE Initialization Test Failures
48	30	Initialization failed
50	32	Receiver disabled
52	34	Transmitter disabled
54	36	Receiver enabled
56	38	Transmitter enabled
		LANCE Internal Loopback/DMA Test Failures
64	40	Initialization failed
66	42	Transmit failed
68	44	Receive failed
70	46	Packet comparsion failed
72	48	Initialization DMA error
74	4A	Transmit DMA error
76	4C	Receive DMA error
78	4E	Unknown tx of rx error

Table A–28 (Cont.) NI Self-Test Error Codes

Error Decimal	Error Hexadecimal	Meaning
		LANCE Interrupt Test Failures
80	50	Initialization failed
82	52	Transmit failed
84	54	Receive failed
86	56	Packet comparison failed
88	58	NI bit in INT_REQ register not set
90	5A	NI bit in INT_REQ register not clear
92	5C	NI ISR not entered
94	5E	NI ISR entered multiple times
		LANCE CRC Test Failures
96	60	Initialization failed
98	62	Transmit failed
100	64	Receive failed
102	66	Packet comparison failed
104	68	LANCE generated bad CRC
106	6A	LANCE rejected good CRC
108	6C	LANCE accepted bad CRC
110	6E	Other error

Table A–28 (Cont.) NI Self-Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
	LANCE rx MISS/BUFF Test Failures	
112	70	Initialization failed
114	72	Transmit failed
116	74	Unknown receive error
118	76	MISS error not flagged
120	78	BUFF error not flagged
	LANCE Collision Test Failures	
128	80	Initialization failed
130	82	Unknown transmit error
132	84	RETRY not flagged
134	86	Transmitter disabled
	LANCE Address Filtering Test Failures	
144	90	Initialization failed
146	92	Transmit failed
148	94	Receive failed
150	96	Packet comparison failed
152	98	Broadcast filtering failed
154	9A	Promiscuous mode failed
156	9C	Null destination accepted
158	9E	Good logical address rejected

Table A–28 (Cont.) NI Self-Test Error Codes

Error		
Decimal	**Hexadecimal**	**Meaning**
	LANCE External Loopback Test Failures	
160	A0	Initialization failed
162	A2	Transmit failed
164	A4	Receive failed
166	A6	Packet comparison failed
168	A8	Unknown transmit error
170	AA	Unknown receive error
172	AC	Check NI port loopback connector
	LANCE tx BUFF Test Failures	
176	B0	Initialization failed
178	B2	BUFF error not flagged
180	B4	Transmitter enabled
182	B6	Unknown transmit error
	DMA Registers Test Failures	
208	D0	MAP_BASE register error
210	D2	I/O write access to map registers failed
212	D4	I/O read access to map registers failed
214	D6	Parity error not flagged

Table A–28 (Cont.) NI Self-Test Error Codes

Error Decimal	Hexadecimal	Meaning
		LANCE DMA Test Failures
224	E0	Non-existent DMA not flagged
226	E2	Invalid DMA not flagged
228	E4	Valid DMA failed
230	E6	DMA failed during initialization
232	E8	DMA failed during transmit
234	EA	DMA failed during receive

The NI test does not display extended error information when an error occurs. Enter the SHOW ERROR command to view the extended error information. The extended error code is shown in the following example.

Extended Error Format 0001:

This format is used by the register test.

```
0001 0001 aaaaaaaa bbbbbbbb cccccccc
```

Where:

- aaaaaaaa - is the register address
- bbbbbbbb - is the expected data or data written
- cccccccc - is the actual data or data read

Extended Error Format 0002:

This format is used when a DMA error occurs.

```
0001 0002 0000aaaa bbbbbbbb cccccccc dddddddd eeeeeeee ffffffff
```

Where:

- aaaa - is the actual value of the LANCE CSR0
- bbbbbbbb - is the contents of the parity control (PAR_CTL) register
- cccccccc - is the device DMA address (24 bits)
- dddddddd - is the map register physical address

- eeeeeeee - is the map register contents
- ffffffff - is the interrupt register contents

Extended Error Format 000B:

This format is used when there is a network address ROM address group error.

```
0001 000B aaaaaaaa bbbbbbbb cccccccc 0000dddd
```

Where:

- aaaaaaaa - is the base address of the network address ROM
- bbbbbbbb - are the first four bytes of the network address
- cccccccc - are the next two bytes of the network address and the two byte checksum
- dddd - is the calculated checksum

Extended Error Format 000C:

This format is used when there is a network address ROM test pattern error.

```
0001 000C aaaaaaaa bbbbbbbb cccccccc
```

Where:

- aaaaaaaa - is the base address of the network address ROM test pattern
- bbbbbbbb - are the first four bytes of the test patterns
- cccccccc - are the last four bytes of the test patterns

Extended Error Format 000D:

This format is used when there is an initialization error.

```
0001 000D 0000aaaa bbbbbbbb 0000cccc dddddddd eeeeeeee
```

Where:

- aaaa - is the actual value of the LANCE CSR0
- bbbbbbbb - is the physical address of the initialization block
- cccc - is the initialization block mode
- dddddddd - is the upper longword of the logical address filter

- eeeeeeee - is the lower longword of the logical address filter

Extended Error Format 000E:

This format is used when there is a transmit error.

```
0001 000E 0000aaaa bbbbbbbb cccccccc dddddddd
```

Where:

- aaaa - is the actual value of LANCE CSR0
- bbbbbbbb - is the physical address of the current transmit descriptor
- cccccccc - is the first longword of the transmit descriptor
- dddddddd - is the second longword of the transmit descriptor

Extended Error Format 000F:

This format is used when there is a receive error.

```
0001 000F 0000aaaa bbbbbbbb cccccccc dddddddd
```

Where:

- aaaa - is the actual value of LANCE CSR0
- bbbbbbbb - is the physical address of the current receive descriptor
- cccccccc - is the first longword of the receive descriptor
- dddddddd - is the second longword of the receive descriptor

Extended Error Format 0010:

This format is used when there is a packet error.

```
0001 0010 0000aaaa bbbbbbbb cccccccc dddddddd
```

Where:

- aaaa - is the actual value of LANCE CSR0
- bbbbbbbb - is the packet length
- cccccccc - is the packet pattern or packet index
- dddddddd - is the packet CRC

Extended Error Format 0011:

This format is used when there is an interrupt error.

```
0001 0011 0000aaaa bbbbbbbb cccccccc
```

Where:

- aaaa - is the actual value of LANCE CSR0
- bbbbbbbb - is the contents of the interrupt mask (INT_MSK) register
- cccccccc - is the contents of the interrupt request (INT_REQ) register

A.2.23 NI System Test Error Codes

The following example and table explain and list NI system test error messages.

```
?? 9 NI       X      00YY          0 00:00:00.00
```

In the example, X is the source of the error:

- 1 - Test
- 2 - System test monitor
- 3 - Device driver
- 4 - VAXELN
- 5 - System

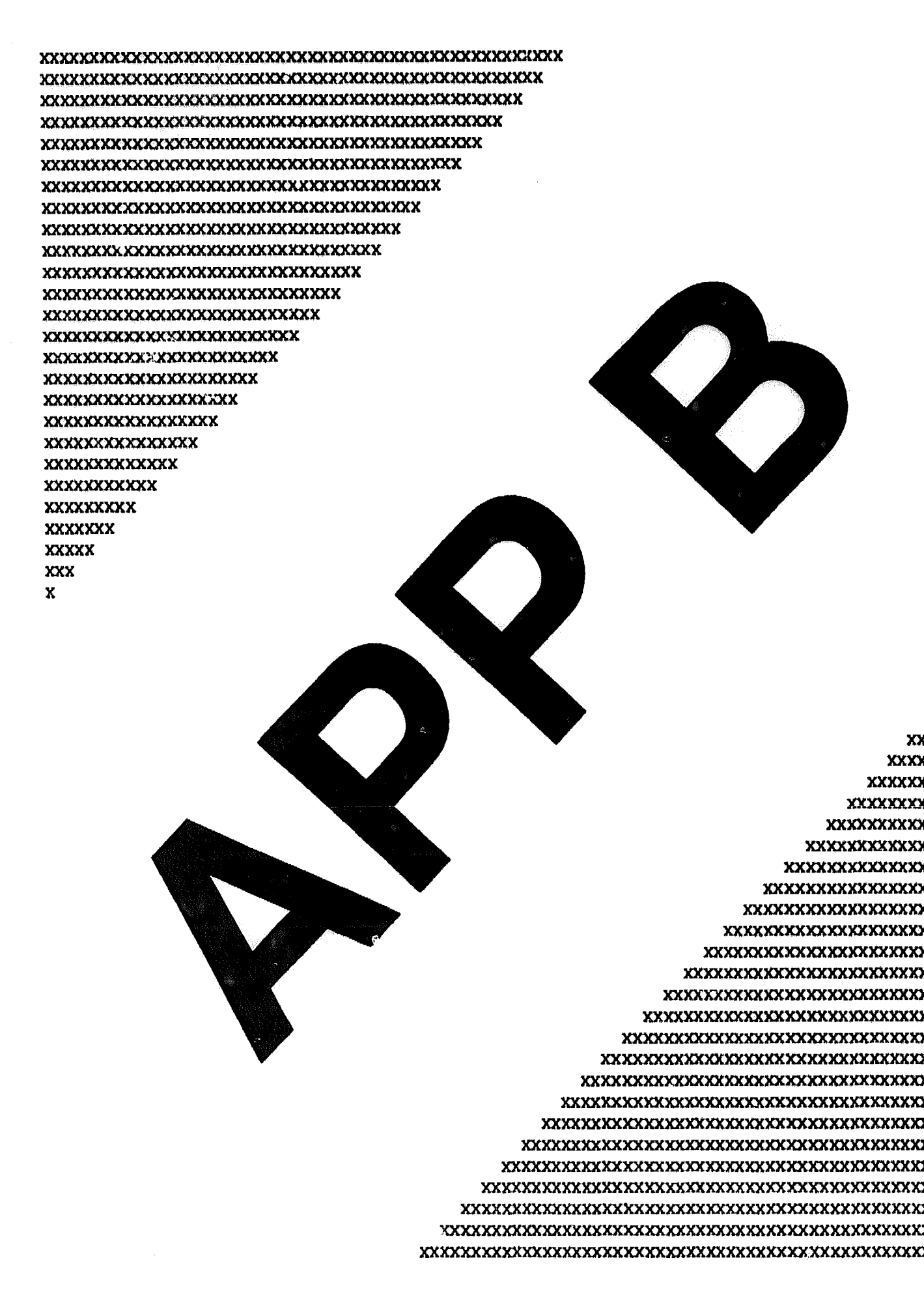
YY indicates the specific error code (shown in Table A–29).

Table A–29 NI System Test Error Codes

Error Source (X)	Error Code (YY)	Meaning
1	02	Initialization failed
1	04	LANCE underflow reported
1	06	DMA transmit failed
1	08	Unknown transmit error
1	0A	Receive failed
1	12	DMA receive failed
1	14	Unknown receive error
1	16	Data compare error
2	02	WST$INIT failed
4	02	Bad memory allocation

Table A–29 (Cont.) NI System Test Error Codes

Error Source (X)	Error Code (YY)	Meaning
4	04	Create device failed
4	06	Create area failed
5	02	Unknown transmit error
5	04	Bad transmit status
5	06	Transmit own bit says LANCE
5	08	Bad receive status from LANCE
5	0A	Timeout waiting for receive interrupt
5	0C	Memory error on initialization
5	0E	BABL error on initialization
5	10	MISS error on initialization
5	12	Parity error on initialization
5	14	MAP error on initialization
5	16	Memory error on receive
5	18	BABL error on receive
5	1A	MISS error on receive
5	1C	Parity error on receive
5	1E	MAP error on receive
5	20	Memory error on transmit
5	22	BABL error on transmit
5	24	MISS error on transmit
5	26	Parity error on transmit
5	28	MAP error on transmit


APP B

B

Reading the Diagnostic LED Codes

This chapter describes how to interpret the diagnostic LEDs on the console control panel. The LED codes covered in this chapter are:

B.1 Diagnostic LED Codes

The system uses the eight LEDs on the control panel to indicate the currently executing test. When power is turned on, all the LEDs light (LED code is FF(h)), and then display different codes as the devices are tested.

The LED codes are divided into two fields. The left-most four LEDs represent the device number and the right-most four LEDs represent a substate that the device test is currently in. LED codes E0h - FFh are reserved for the console.

The system LED codes are listed in the following tables.

B.1.1 LED Error Codes

The eight LEDs on the lights and switches board can be translated into two hexadecimal or binary digits of the form:

X X X X Y Y Y Y

Where:

- X X X X is the device number (binary) currently under test. Use Table 5–3 to match the code from the LEDs to a device.
- Y Y Y Y is the subtest at which the diagnostic hung.

The LEDs can be used for troubleshooting when the console device is inoperable.

B.1.2 Power-up/Initialization LED Codes

Table B–1 Power-up and Initialization LED Codes (1111 XXXX)

LED Depiction[1]	LED Code	Description	FRU
1111 1111	FFh	Power has been applied but no instruction has been run	System module
1111 1110	FEh	ROM has been entered and initialization and testing have started	System module
1111 1101	FDh	Waiting for memory to initialize	System module, Memory modules
1111 1100	FCh	Sizing memory in the system	System module, Memory modules
1111 1011	FBh	Running a byte mask test on the memory needed by the console	System module, Memory modules
1111 1010	FAh	A full memory data path test is being performed on the memory needed by the console	System module, Memory modules
1111 1001	F9h	Initializing the console data structures	System module
1111 1000	F8h	Performing auto configuration on the machine	System module
1111 0111	F7h	Testing the NVR device	System module
1111 0110	F6h	Testing the DZ device	System module, Mouse, Keyboard

[1] In this column, 1 indicates the LED is on; 0 indicates the LED is off; X indicates either 1 or 0.

Table B–1 (Cont.) Power-up and Initialization LED Codes (1111 XXXX)

LED Depiction[1]	LED Code	Description	FRU
1111 0101	F5h	Testing the graphics output device	System module, Graphics
1111 0100	F4h	Initializing the console device	System module, Graphics
1111 0011	F3h	Entering the console program	System module

[1]In this column, 1 indicates the LED is on; 0 indicates the LED is off; X indicates either 1 or 0.

B.1.3 TOY/NVR LED Codes

Table B–2 TOY and NVR LED Codes (0001 XXXX)

LED Depiction	LED Code	Description	FRU
0001 0000	10h	TOY and NVR clock test has failed	System module
0001 0001	11h	TOY and NVR test has failed	System module

B.1.4 LCG LED Codes

Table B–3 LCG LED Codes (0010 XXXX)

LED Depiction	LED Code	Description	FRU
0010 0000	20h	LCG test has been entered	System module, Graphics
0010 0001	21h	LCG video RAM test has failed	System module, Graphics
0010 0010	22h	LCG register test has failed	System module, Graphics
0010 0011	23h	LCG FIFO test has failed	System module, Graphics
0010 0100	24h	LCG interrupt test has failed	System module, Graphics
0010 0101	25h	LCG address generator test has failed	System module, Graphics
0010 0110	26h	LCG virtual test has failed	System module, Graphics

If the graphics option fails, the system may not give you a console error message. In this case you must use the error LEDs on the lights and switches module to isolate the fault.

B.1.5 DZ LED Codes

Table B–4 DZ LED Codes (0011 XXXX)

LED Depiction	LED Code	Description	FRU
0011 0000	30h	DZ test has been entered	System module
0011 0001	31h	DZ reset test has failed	System module
0011 0010	32h	DZ modem test has failed	System module
0011 0011	33h	DZ polled test has failed	System module
0011 0010	34h	DZ interrupt test has failed	System module
0011 0101	35h	LK401 test has failed	Keyboard, System module
0011 0110	36h	Mouse test has failed	Keyboard, System module

B.1.6 CACHE LED Codes

Table B–5 Cache LED Codes (0100 XXXX)

LED Depiction	LED Code	Description	FRU
0100 0001	41h	Error in the data store read/write	System module
0100 0010	42h	Error in the read /write to the tag area	System module
0100 0011	43h	The cache did not contain the proper state of the valid bit	System module
0100 0100	44h	Error during the cache tag validation	System module
0100 0101	45h	Unelpected TAG parity error	System module
0100 0110	46h	Cache did not provide the elpected data during cache hit testing	System module
0100 0111	47h	Parity not what was elpected	System module
0100 1000	48h	Tag not valid during cache hit test	System module
0100 1001	49h	Data not elpected during cache hit test	System module
0100 1010	4Ah	Cache write through test failed. The information in the data store did not agree with the information it was to receive.	System module

Table B–5 (Cont.) Cache LED Codes (0100 XXXX)

LED Depiction	LED Code	Description	FRU
0100 1011	4Bh	Cache write through test failed. The information in the memory did not agree with the information it was to receive.	System module
0100 1011	4Ch	Write miss failed	System module

B.1.7 Memory LED Codes

Table B–6 Memory FRU LED Codes (0101 XXXX)

LED Depiction	LED Code	Description	FRU
0101 0000	50h	Memory byte mask test has failed	System module or memory modules
0101 0001	51h	Memory error occurred in the forward pass	System module or memory modules
0101 0010	52h	Memory error occurred in the reverse pass	System module or memory modules
0101 0011	53h	Memory error in parity test 1	System module or memory modules
0101 0100	54h	Memory error in parity test 2	System module or memory modules

B.1.8 System Device LED Codes

Table B–7 System Device LED Codes (1000 XXXX)

LED Depiction	LED Code	Description	FRU
1000 0000	80h	ROM verify test has failed	System module
1000 0001	81h	Interrupt controller test has failed	System module
1000 0010	82h	Invalidate filter test has failed	System module

B.1.9 NI Device LED Codes

Table B–8 NI LED Codes (1001 XXXX)

LED Depiction	LED Code	Description	FRU
1001 0000	90h	NI test has been entered	System module
1001 0001	91h	Network address test has failed	System module
1001 0010	92h	NI register test has failed	System module
1001 0011	93h	NI initialization test has failed	System module
1001 0100	94h	NI internal loopback/DMA test has failed	System module
1001 0101	95h	NI interrupt test has failed	System module
1001 0110	96h	NI CRC test has failed	System module
1001 0111	97h	NI receive MISS /BUFFER test has failed	System module
1001 1000	98h	NI collision test has failed	System module
1010 1001	99h	NI address filtering test has failed	System module
1001 1010	9Ah	NI elternal loopback test has failed	Network, Loopback, System module
1001 1011	9Bh	NI transmit buffer test has failed	System module

B.1.10 SCSI Device FRU LED Codes

Table B–9 SCSI Device LED Codes (1010 XXXX)

LED Depiction	LED Code	Description	FRU
1010 0000	A0h	SCSI test has been entered	System module
1010 0001	A1h	SCSI register test has failed	System module
1010 0010	A2h	SCSI interrupt test has failed	System module
1010 0011	A3h	SCSI data transfer test has failed	System module
1010 0100	A4h	SCSI map error test has failed	System module
1010 0101	A5h	SCSI minimal device test has failed	Device, System module

B.1.11 Audio Device LED Codes

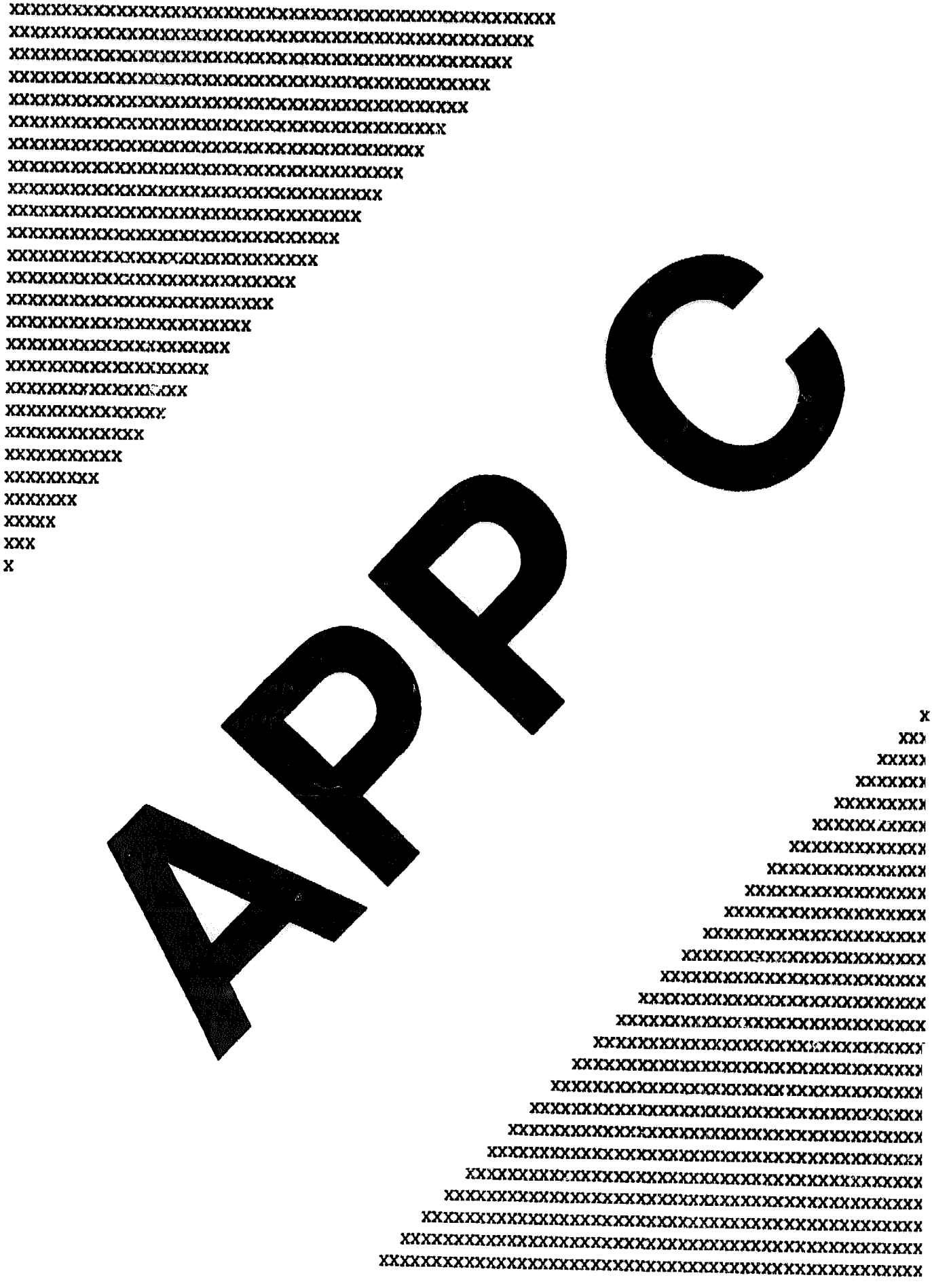
Table B–10 Audio Device LED Codes (1011 XXXX)

LED Depiction	LED Code	Description
1011 0000	B0h	Audio test has been entered
1011 0001	B1h	Audio LIU test has failed
1011 0010	B2h	Audio MU1 register test has failed
1011 0011	B3h	Audio MAP register test has failed
1011 0100	B4h	Audio DLC register test has failed
1011 0101	B5h	Audio test generating an interrupt
1011 0110	B6h	Audio test verifying interrupts
1011 0111	B7h	Audio test disabling interrupts
1011 1000	B8h	Audio internal loopback test has failed
1011 1001	B9h	Audio test is sending out an audio signal
1011 1010	BAh	Audio test is evaluating audio input

B.1.12 DSW21 Communications Device LED Codes

Table B–11 DSW21 Communication Device LED Codes (1100 XXXX)

LED Depiction	LED Code	Description	FRU
1100 0000	C0h	Comm option code entered	DSW21, System module
1100 0001	C1h	Comm option ROM test has failed	DSW21, System module
1100 0010	C2h	Comm option RAM test has failed	DSW21, System module
1100 0011	C3h	Comm option self-test has failed	DSW21, System module
1100 0100	C4h	Comm option dual RAM access test has failed	DSW21, System module
1100 0101	C5h	Comm option dual ROM_RAM access test has failed	DSW21, System module
1100 0110	C6h	Comm option interrupt test has failed	DSW21, System module
1100 0111	C7h	Comm option integrated loopback test has failed	DSW21, System module
1100 1000	C8h	Comm option reset test has failed	DSW21, System module


APPC

C
Troubleshooting

This chapter contains a troubleshooting table that lists symptoms, possible causes, and corrective actions for the following components:

- System
- Monitor
- Mouse/Tablet
- Keyboard
- Drives
- Network
- Audio
- Expansion Box

C.1 Troubleshooting Overview

Troubleshooting is the process of isolating and diagnosing problems with the system. When the system does not operate as described in the *VAXstation 4000 Model 60 Owner's Guide* (EK-PVAX2-OM), use the information in this section to help diagnose the problem.

If the power-up tests complete, you can use the console error messages to identify the failed FRU, or you can run the self-test, system test, and utility tests in Digital Services mode to help isolate the failing FRU. The console error messages are interpreted in Appendix A.

Use the diagnostic LEDs (listed in Appendix B) on the front of the system to help diagnose problems when the system is unable to set up the console.

The troubleshooting techniques described in Table C–1 do not identify all possible problems with the system, nor do the suggested corrective actions remedy all problems.

Table C–1 Symptoms, Causes, and Action

Symptom	Possible Cause	Corrective Action
System Problems		
System fan is off	Power cord is not connected.	Check the power cord connections at both ends.
	Faulty power cord.	Replace power cord.
	Power supply fan has failed.	Replace the power supply.
Power light is off.	Power cord is not connected.	Check the power cord connections at both ends.
	Wall socket may not be operative.	Try a different wall socket, or try an electrical device that you know works in the wall socket.
		Turn the system off for 10 seconds and then back on. Turn the system off. Unplug the video cable, communication cable, and printer. Then plug all cables back in and turn the system on.
	Defective power supply.	Replace the power supply.
Power-up display does not show after two minutes.	Monitor is not turned on.	Turn on the monitor.
	Monitor brightness and contrast controls are too dark to see the screen display.	Adjust the monitor brightness and contrast controls. Verify that the monitor power switch is on (1).
	Monitor cable or video cable is not connected.	Check that the monitor cable and video cable are plugged in at both ends.

Table C–1 (Cont.) Symptoms, Causes, and Action

Symptom	Possible Cause	Corrective Action
System Problems		
	Alternate console switch is in wrong position.	Turn the power off. Change alternate console switch to down (off) position. Use a small pointed object. Do NOT use a pencil to set the switch. Turn the power back on.
	Monitor fuse is blown.	See the monitor guide for fuse replacement instructions.
	Wall socket may not be operative.	Try a different wall socket, or try an electrical device that you know works in the wall socket.
		Check the diagnostic LED code. Compare the code to the LED error code tables in *VAXstation 4000 Service Information Kit Model 60 Base System*. Replace monitor failed FRU. Refer to the monitor service manual for instructions on how to replace the FRU.
	Color monitor is installed, but the color graphics board is not installed.	Check the graphic module part number, check to see that the monitor is designed to work with that graphics module.
Power-up display contains an error message.	Possible system error.	Do the "SHOW ERROR" command. Refer to the error code tables in the *VAXstation 4000 Service Information Kit Model 60 Base System* to interpret the error code.

Table C–1 (Cont.) Symptoms, Causes, and Action

Symptom	Possible Cause	Corrective Action
System Problems		
		Interpret the diagnostic LEDs at the front of the system. Refer to the LED error code tables in *VAXstation 4000 Service Information Kit Model 60 Base System* for the diagnostic LED error code meanings.
System does not boot on power-up.	Software is not installed.	Install the system software. Refer to the software documentation for installation instructions.
	Default recovery action is set to halt.	Change the default recovery action to boot the system from the system disk.
	Incorrect boot device was specified.	Change the default recovery action to boot the system from the system disk.
	Expansion boxes were not powered on first.	Turn the system box off, make sure the expansion boxes are on, and then turn on the system box.
	Boot device is not properly configured.	Do the "SHOW DEVICE" command and check to see that all devices are configured properly. If not, check SCSI IDs and SCSI cables
	Faulty boot device.	Run system exerciser, replace drive if defective.
	Unable to boot off the network (ESA0).	Refer to the network section of this table.

Table C–1 (Cont.) Symptoms, Causes, and Action

Symptom	Possible Cause	Corrective Action
Monitor Problems		
No display appears on the monitor screen.	Monitor is not turned on.	Check the monitor on/off switch. Check that the monitor power cord is connected at both ends.
	Contrast and brightness controls are too dark to see the screen display.	Adjust the contrast and brightness controls. Refer to the monitor guide for more information.
	Alternate console switch is not set correctly.	Power down the system. Change the alternate console switch to the down (off) position. Use a small pointed object. Do NOT use a pencil to set the switch. Power up the system. Turn on the system box last.
	System board or graphics board failure.	Use the diagnostics LEDs on the front to interpret the error code and identify the failed FRU.
Mouse/Tablet Problems		
System boots but mouse or optional tablet pointer does not appear on the screen, or monitor does not respond to pointing device commands.	Pointing device cable is installed incorrectly or is loose.	Turn off the system. Unplug and then replug the cable to rest the device. Turn on the system.
	The system is halted; no pointer appears on the screen.	Reboot the system.
	Pointing device is faulty.	Replace the pointing device.

Table C–1 (Cont.) Symptoms, Causes, and Action

Symptom	Possible Cause	Corrective Action
Keyboard Problems		
Keys do not work.	Hold Screen key is active. Hold screen light is on.	Press the Hold Screen key to release hold on screen.
	Keyboard cable is loose or not connected.	Check the keyboard cable at both ends.
	Keyboard has failed.	Replace the keyboard.

Table C–1 (Cont.) Symptoms, Causes, and Action

Symptom	Possible Cause	Corrective Action
Drive Problems		
Software does not work from the diskette drive, or a diskette read or write error message is displayed.	No diskette is in the diskette drive.	Insert a diskette with software. Use the instruction in the software documentation.
	Diskette was inserted incorrectly.	Check that the write-protect notch on the diskette is to your left when you insert the diskette and that the label is up.
	Diskette is damaged or does not contain software.	Try another diskette that contains software.
	Two SCSI identifiers are set to the same ID number.	Reset the SCSI IDs to a unique number.
	Loose cables.	Check to make sure all cables are connected.
	Defective drive.	Run diagnostics to isolate fault. Replace FRU.
Drive does not work.	Two SCSI identifiers are set to the same IN number.	Reset the SCSI IDs to a unique number.
	Loose cables.	Check to make sure all cables are connected.
	Defective drive.	Run diagnostics to isolate fault. Replace FRU.

Table C–1 (Cont.) Symptoms, Causes, and Action

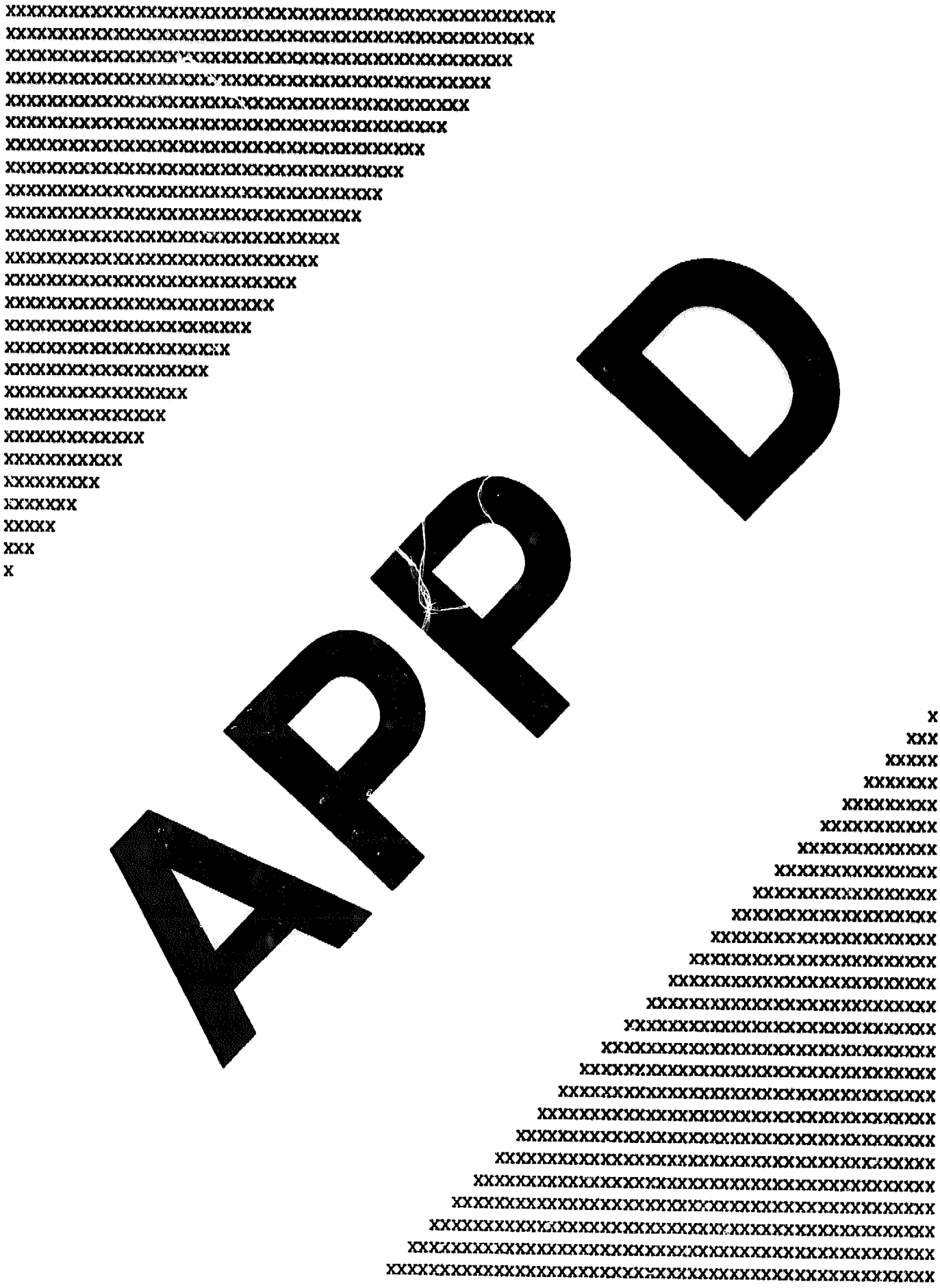
Symptom	Possible Cause	Corrective Action
Network Problems		
NI error message is displayed when verifying Ethernet.	No ThinWire or ThickWire terminator or cable was installed.	Attach a ThinWire or Standard Ethernet terminator.
	Network switch is not set properly.	If Ethernet is not being used, move the network switch to the left, toward standard Ethernet.
	Terminator is missing from network.	Check to see if a ThinWire cable was removed. If so, replace the cable with a terminator.
	Cable connection is loose.	Check that all connections on the Ethernet segment are secure.
	Power supply failure.	Replace the power supply.
Lights 7,4,3, and 0 on the front of the system are on.	T-connector is disconnected.	Make sure that the T-connector is disconnected to an operating ThinWire Ethernet segment.
Cannot boot from the network.	Local network problem.	Problem is most likely caused by the customer server system or the network.
	Defective NI interface.	Run diagnostics (TEST NI command) with terminators attached. Replace faulty FRU if test fails.

Table C–1 (Cont.) Symptoms, Causes, and Action

Symptom	Possible Cause	Corrective Action
Audio Problems		
No audio tone (beep) when the system is turned on.	Speaker is turned off.	Turn on speaker using the switch located on the front of the system box.
	Audio speaker is not working.	Turn off the system. Plug in the headset and turn the system on. If you hear an audio tone from the headset, then there is a problem with the speaker. Replace the lights and switches module.
	Defective sound chip.	Run diagnostics. Replace failed FRU.
Expansion Box Problems		
Expansion box fan is off.	Power cord is not connected.	Check the power cord connections at both ends.
	Faulty power cord.	Replace power cord.
	Power supply fan has failed.	Replace the power supply.
Power light is off.	Power cord is not connected.	Check the power cord connections at both ends.
	Wall socket may not be operative.	Try a different wall socket, or try an electrical device that you know works in the wall socket..
		Turn the system off for 10 seconds and then back on. Turn the system off.
	Defective power supply.	Replace the power supply.
Drive does not work.	Loose cables.	Make sure all cables are connected.

Table C–1 (Cont.) Symptoms, Causes, and Action

Symptom	Possible Cause	Corrective Action
Expansion Box Problems		
	Two SCSI identifiers are set to the same ID number.	Reset the SCSI IDs to a unique number. (See *BA46 Storage Expansion Box Owner's Guide* for SCSI settings.)
	Defective drive.	Run diagnostics to isolate fault. Replace FRU.


APP D

D
FRU Part Numbers

The tables in this chapter provide the names and part numbers for the Field Replaceable Units (FRUs) for the Model 60 system box. The tables in this chapter are organized as follows:

Table D–1	Model 60 System Box FRUs
Table D–2	Model 60 System Box Miscellaneous Hardware
Table D–3	System and Expansion Box Cables and Terminators
Table D–5	External System Devices and Their Cables
Table D–4	Internal System Devices and Their Cables
Table D–6	Expansion Box FRUs
Table D–7	Monitor and Graphic Module Cross Reference

Refer to Chapter 6 for instructions on removing and replacing FRUs.

D.1 Precautions

- Only qualified service personnel should remove or install FRUs.
- **Electrostatic discharge (ESD)** can damage integrated circuits. Always use a grounded wrist strap (part number 29-11762-00) and grounded work surface when working with the internal parts of the workstation.

NOTE

It is the customer's responsibility to back up the software before Digital Services personnel arrive at the site. This is important to ensure that data is not lost during the service process. The customer should also shut down the workstation software. Before performing any maintenance work, Digital Services personnel must confirm that the customer has completed both of these tasks.

Refer to Figure 6–1 for the location of the system FRUs.

D.2 Model 60 System Box FRUs

Table D–1 contains the part numbers for the Model 60 FRUs. These FRUs may be ordered through Digital Services.

Table D–1 Model 60 System Box FRUs

FRU	Part Number
Model 60 Power Supply	H7819-AA
14" Monochrome	PC4XV-A2
19" Monochrome	VR262
19" Color	VR299
13" Color	VRT13-DA,D3,D4
16" Color	VRT16-DA,D4
19" Monochrome	VR319-DA,D4
19" Color	VR320-CA,C4
19" Color	VRT19-DA,D3,D4
17" Color	VRM17-AA,A3,A4
VS4000 Model 60 System Module (KA46)	54-20346-01

Table D–1 (Cont.) Model 60 System Box FRUs

FRU	Part Number
Lights and Switches Module	54-20377-01
DSW21 Communications Module	54-20377-01
Memory, 4MB Module (MS44-AA)	54-19103-AA
Memory, 4MB Reduced Cost Module (MS44L-AL)	
Memory, 16MB Module (MS44-CA)	54-19103-CA
Monochrome Graphics Module	54-20361-01
LCG Low Resolution Module Monochrome	54-20363-01
LCG High Resolution Frame Buffer Color	54-20365-01
LCG High Resolution Frame Buffer Monochrome	54-20365-03
SCSI-FDI Controller w/RX26 Support	54-20764-01
RX26 Diskette Drive	54-20764-02
RX26 Diskette Drive Assembly	70-28100-01
RZ23L 100MB Drive	70-28115-01
RZ24 200MB Drive	70-28115-02
RRD42 CDROM Reader	RRD42-AA
RRD42 CDROM Drive	RRD42-AD
TZ30 Tape Drive	TZ30-AX
TZK10 QIC Tape Drive	TZK10-AA
TLZ04 Cassette Tape Drive RDAT	TLZ04-AA
Bracket, 3.5 Disk Storage	74-40429-01
Bracket, 5.25 in Mounting	74-40430-01
Bracket, 3.5 Dual	74-40431-01
Bracket, RX26 Half-height Removable Media and FDI Module	74-41127-01

Table D–2 lists miscellaneous hardware, which may be ordered through manufacturing.

Table D–2 Model 60 System Box Miscellaneous Hardware

FRU	Part Number
Multiple Box Stand	H9855-AA
SCSI Bracket Assembly	70-28097-01
Front Bezel Blank	70-28099-01
Front Bezel for 3 1/2 in drive	70-28099-03
Front Bezel for 5 1/4 in drive	70-28099-02
Base Plastic Assembly	70-28096-01
Top Plastic Cover, I/O (CPU)	70-28107-01
Shield, I/O (KA46)	74-40964-02
Bracket, I/O (CPU)	74-40967-01
LK401 Keyboard	LK401-AA
Tablet	VSXXX-AB
Logictech Mouse	VSXXX-AA
Rear Opening Filler	74-41472-01
Rear Opening RFI Shield Filler	74-41473-01

Table D–3 System and Expansion Box Cables and Terminators

FRU	Part Number
Ethernet Terminator (ThickWire)	12-22196-01/02
Ethernet Terminator (ThinWire)	12-25869-01
SCSI System and Expansion Box Terminator	12-30552-01
Cable High Resolution 3' Cable	17-02720-02
Cable High Resolution 10' Cable	17-02720-01
Internal Power Cable	17-02906-01
Internal SCSI Data Cable	70-28108-01
Expansion Box Internal SCSI Data Cable	70-28109-01
Expansion Box SCSI ID Select Cable	17-02445-01
Expansion Box Internal Power Harness Cable	17-02876-02

Table D–4 Internal System Devices and Their Cables

System Device	Cable P/N	Descrption
3 SCSI devices	17-02875-01	Three 50-pin IDC to 50-pin champ (external)
SCSI device dc power harness	17-02876-01	Four 4-pin Mat-N-Loks to 4-pin mini

Table D–5 External System Devices and Their Cables

System Devices	Cable P/N	Description
System to monitor	BC27R-03	3 coax Dsub. to 3 BNC 39 in (99.1 cm)
System to VRT13		3 row 15-pin Dsub. to 9-pin Dsub. 3 ft (.91 m)
Remote video	BC27R-10	3 coax Dsub. to 3 BNC 10 ft (3.0 m)
Remote LK/VSXXX (mouse/keyboard)	17-02640-01	15-pin Dsub. to LK/VSXXX 10 ft (3.0 m)
Synchronous comm. option		50-pin Dsub. to ??-pin 2 ft (.61 m)
External SCSI	BC19J-03	50-pin champ to 50-pin champ 3 ft (.91 m)
AC power input (to power supply)	17-00606-10	IEC to 3 prong AC 6 ft (1.83 m)
AC power output (system to monitor)	17-00442-25	IEC to IEC, 39 in (99.1 cm)

Table D–6 Expansion Box FRUs

FRU	Part Number
Expansion Box SCSI ID Select Switch Module	54-19325-02
Expansion Box Load Module	54-20422-01
RRD42	74-40961-02
Bracket, Dual Half-height for TZK10 and RRD42	74-41175-01

Table D–7 contains a cross reference for each monitor and graphic module available for the Model 60.

Table D–7 Monitor and Graphic Module Cross Reference

Monitor	Graphic Module
Monochrome 4 Plane Greyscale Graphic Systems	
19" Monitor (VR319)	PV631-B3/BD/BE
Color 8 Plane Graphic Systems	
16" Trinitron Monitor (VRT16)	PV631-DK/DL/DM
19" Trinitron Monitor (VRT19)	PV631-DN/DP/DR
SPXG 8 Plane Color 3D Graphic Systems	
19" Trinitron Monitor (VRT19)	PV630-RN/RP/RR
Monochrome 4 Plane Greyscale Graphic Systems	
17" Monitor (VRM17)	PV61A-BE/BF/BH
19" Monitor (VR319)	PV61A-AA/AB/AC
Color 8 Plane Graphic Systems	
16" Trinitron Monitor (VRT16)	PV61A-AD/AE/AF
19" Monitor (VR320)	PV61A-AX/AY/BA
19" Trinitron Monitor (VRT19)	PV61A-AH/AJ/AK
SPXG 8 Plane Color 3D Graphic Systems	
16" Trinitron Monitor (VRT16)	PV61A-AL/AM/AN
19" Trinitron Monitor (VRT19)	PV61A-AP/AR/AS
SPXGT 24 Plane Color 3D Graphic Systems	
19" Trinitron Monitor (VRT19)	PV61A-AT/AV/AW
Dual Color Screen Graphic System	
One 19" Trinitron Monitor (VRT19)	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