AT&T 3B2 Computer
Maintenance Reference Manual

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Ordering Information

For ordering information on this document or related learning support materials, see "Related Learning Support Materials, in Chapter 1, "Introduction." The ordering number for this document is 305-395.

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3B2 System board addresses.

500/600/700	800		
0x0		(128 KB)	System board firmware
0x20000			End of system firmware
0x20000			Virtual firmware (>>>)
0x40000			End of virtual firmware
0x40000			System board CSRs
	0x00040000	(1 Byte)	Floppy CSR
	0x00041000		Timer
	0x00042000	(2 KB)	NVRAM
	0x00044000	(32 Words)	CSR
	0x00045000		Floppy DMA Page Reg.
	0x00046000		UART A DMA Page Reg.
	0x00047000		UART B DMA Page Reg.
	0x00048000		DMA Controller
	0x00049000		UARTS
	0x0004A000		Floppy Controller
	0x0004B000	(4 KB)	MMU 1
	0x0004C000	(1 Word)	Fault Reg. 1
	0x0004D000	(4 Words)	Fault Reg. 2
	0x0004E000		TOD Clock
	0x0004F000	(4 KB)	MMU 0
0x60000			/* End of system board CSRs */
0x200000			/* 3B2 I/O bus */
	200000	1	
	400000	2	
	600000	3	
	800000	4	
	a00000	5	
	c00000	6	
	e00000	7	
	1000000	8	
	1200000	9	
	1400000	10	
	1600000	11	
	1800000	12	
0x1a00000			/* End of 3B2 I/O bus */
0x1c00000			/* Unbuffered microbus */
0x2000000			/* End of unbuffered microbus*/
	0x01C00000	(2 MBytes)	PBus 1
	0x01E00000	(2 MBytes)	PBus 2
0x2000000			/* Memory */
0x6000000			/* End of (maximum) memory */
0x6000000			/* Buffered microbus */
0x16000000			/* End of buffered microbus */
	0x06000000	(64 Mbytes)	BuBus 0
	0x0A000000	(64 Mbytes)	BuBus 1
	0x0E000000	(64 Mbytes)	BuBus 2
	0x12000000	(64 Mbytes)	Reserved
	0xC0F00000	(1 Mbyte)	Reserved
	0xC1000000	(1 Mbyte)	Reserved for diagnostics0x16

300/310/400

```
0x0              /* System board firmware */
0x10000          /* End of system firmware */
0x20000          /* Virtual firmware */
0x40000          /* End of virtual firmware */
0x40000          /* System board CSRs */
0x60000          /* End of system board CSRs */
0x200000         /* 3B2 1/0 bus */
0x1a00000        /* End of 3B2 1/0 bus */
0x2000000        /* Memory */
0x2400000        /* End of (maximum) memory */
0x2400000        /* End of system board stuff */
```

Chapter 1: Introduction

About This Document

Purpose

The *AT&T 3B2 Computer Maintenance Reference Manual* provides instructions for performing hardware maintenance procedures on all models of the AT&T 3B2 computer. All 3B2 computer core components, subassemblies, feature cards, and peripherals are covered in this document. Procedures are provided for corrective maintenance (repairing, replacing, and troubleshooting), as well as for preventive maintenance. The purpose of this manual is to guide technicians with information and procedures for doing maintenance and repair work on the 3B2 computer.

Intended Audiences

This document is designed primarily for technicians who maintain and repair the 3B2 computer.

Prerequisite Skills and Knowledge

Before performing any maintenance procedures, you should have a basic working knowledge of the 3B2 computer hardware, the UNIX® operating system, and standard computer repair tools. Only qualified maintenance technicians should attempt to repair or replace hardware components. You should be familiar or have experience with the following:

- safety precautions

- use of the computer documentation

- use of the operator (maintenance) console

- use of test equipment

- troubleshooting techniques

- system configuration and equipment locations

- equipment abbreviations

- equipment power-up and power-down procedures

- system and cabinet power structure

- hardware diagnostics

- replacing circuit boards and feature cards

- tape drive operation, including loading and removing magnetic tapes

- disk drive operation, including loading and removing floppy disks

- UNIX System commands and error messages

The 3B2 computer may experience hardware and/or software faults requiring more system knowledge than you are expected to have. Unless you have knowledge of or experience with such faults, it is recommended that you call the local AT&T support organization for assistance. Attempting to correct these faults without proper qualifications could result in severe damage to the 3B2 computer hardware or software.

To obtain general information about AT&T hardware (including spare parts) and software, call the following toll-free numbers: 1-800-247-1212 (in the continental USA), or 1-201-953-7554 (elsewhere).

How to Use This Document

This manual contains nine chapters, four appendices and a floppy diskette containing the 3B2 computer Maintenance Utilities software. A short synopsis of each follows:

Chapter 1   "Introduction," provides a brief explanation of maintenance for the 3B2 computer. This chapter tells about the level of expertise that is expected before attempting maintenance and repair procedures. This chapter also discusses conventions used in this document, and provides an overview of the contents of the manual.

Chapter 2   "3B2 Model Overview," discusses the computer hardware and software components for all models of the 3B2 computer, with a diagram of each model. This chapter includes a discussion of the power supply, I/O backplane, random access memory (RAM) system board, floppy disk drive, and hard disk drive used in the 3B2 computer.

Chapter 3   "3B2 Peripheral Overview," describes the different components that are added to the 3B2 computer, including SCSI modules.

Chapter 4   "Start-up and Initial Testing," describes procedures for initial operation of the 3B2 computer (for example, after some maintenance repair work has been completed and the machine no longer needs to be out-of-service) including normal start-up procedures and a general test for system functionality.

Chapter 5   "System Troubleshooting," describes procedures for isolating problem areas and for using specific firmware and software troubleshooting tools. Also included are ways to restore firmware passwords, and check file systems. Troubleshooting charts that detail common system malfunctions and error conditions are provided. This chapter also contains general troubleshooting techniques for setting up and using peripheral components such as terminals, modems, and printers.

Chapter 6   "3B2 Subassemblies," provides definitions, locations, and replacement procedures for subassemblies on the 3B2 computer. Subassemblies include the system board, power supply, backplane, and internal peripherals.

Chapter 7   "3B2 Peripheral Subassemblies," discusses the locations and replacement procedures for external add-on products, including SCSI modules.

Chapter 8   "I/O Feature Cards," provides a basic understanding of feature card operation in a 3B2 computer, including diagrams for each feature card. Guidelines for installation, initialization, and troubleshooting are also discussed.

Chapter 9   "Preventive Maintenance," describes the preventive maintenance procedures required for 3B2 computers and peripherals.

Appendix A   "Handling Circuit Boards," contains guidelines and cautions for handling circuit boards and feature cards including static electricity cautions, storage and packing guidelines, and general handling instructions.

Appendix B   "Using the Diagnostic Monitor," outlines the set of diagnostics available from the 3B computer hard disk that diagnoses the system board, the attached disks, and all the peripheral cards inserted into the backplane.

Appendix C   "Using 3B2 Computer Maintenance Utilities," tells about the 3B2 computer Maintenance Utilities package that is included with this manual and programs it contains for performing such things as formatting disk drives and running diagnostics from the floppy drive.

Appendix D   "Repair Equipment and Spare Parts," reviews the necessary equipment (hardware and software) that is needed to repair the 3B2 computer. Lists of test equipment, tools, and spare parts for testing and repairing the 3B2 computer appear in this chapter.

Appendix E   "Peripheral Configuration Diagrams," shows the configuration settings and termination for 3B2 peripherals.

Glossary   Defines general terms, and acronyms used in this manual.

Index   The index is included at the end of the manual.

Floppy Diskette   The 3B2 computer Maintenance Utilities floppy diskette included with this manual contains programs for formatting disk drives and running diagnostics from the floppy drive.

Conventions Used in This Document

In addition to Palatino Regular typeface used for body text, three special typefaces are used.

```
This style of type is used to show system-generated responses
displayed on your screen.
```

```
This style of type is used to show inputs entered from your keyboard
that are displayed on your screen,  such as responses to prompts.
```

Italic font is used to show user-defined variables.

1s -**1** *file*

The command name and command option (1s -1) should be entered as shown, and *file* should be replaced by the particular file name.

Table 1-1 describes in more detail some of the special uses of fonts in this document.

Table 1-1. Style Chart

Item	Style	Example
Appendix Titles	Initial Capital	Appendix A
AT&T Special Names	CAPITALIZED	UNIX, NAU, AIC
Book Titles	*Italics*	*User's Guide*
Chapter Titles	Initial Capital	Chapter 1. "Introduction"
File Names	`constant width`	`/etc/inittab`
Firmware Commands	`constant width`	`dgn`
Options	`constant width`	`ph=`
UNIX System Commands	`constant width` with section reference	`sysadm(1M)`
User Input (exact)	`constant width bold`	**`root`**
Variables	*Italics*	*device*

■   When user entries require one or more keystrokes, the keys are displayed in a box
    in running text.

```
This style is used to show special keys and compound keystrokes,
such as: [RETURN], [CTRL-d], [ESC-g] , and [TAB]
```

■   Command lines do not show the [RETURN] key, which should be typed, unless
    otherwise stated. A sample user-input command line is

            mkunix

■   When a command is followed by a number or a number and a letter in
    parentheses, the information in parentheses indicates the section of the document
    where the manual page can be found. An example is

            mkfs (lM)

    The mkfs manual page would be in Section lM.

■   Page numbers are made up of the chapter number, hyphen and page number. For
    example, 1-2 indicates Chapter 1, page 2.

■   Cross-references to other parts of the document are enclosed in quotes, such as
    "Service Contract Options."

NOTE: This document also contains sample terminal displays which will help you understand
the described procedures. The sample displays in this document and the displays on your
terminal screen may differ slightly due to type of terminal or improvements in the product
after the document was finalized. Therefore, use the displays in this document as samples of
the type of data available.

This manual contains information about procedures for repair to the subassembly level for all
models of the AT&T 3B2 computers. Because different models use much of the same
hardware, they share many of the same maintenance procedures. However, some procedures,
especially those for the Small Computer System Interface (SCSI), differ depending on the
model.

Model-specific or component-specific procedures are named as such, when appropriate. If
there is no model specification, you can assume that the information is relevant to all models.
References to Model 400 include information about Model 400S60 unless indicated otherwise.
Information that is specific to Model 400S60 is so identified.

Related Learning Support Materials

This section provides information on related documents, how to order these documents, related training, and how to receive training information.

Related Documents

For additional information about the 3B2 computers, AT&T has developed a complete library of documentation. Some of the manuals supplied with the 3B2 computer have detailed information or outline problems and troubleshooting procedures, such as the *AT&T 3B2 Computer UNIX System V System Administrator's Guide* and *AT&T 3B2 Computer UNIX System V Release Notes.* To get a listing of the available documentation, see the *AT&T 3B2 Computer Documentation Roadmap* (Select Code 305-470).

More information about the 3B2 computer is available in the engineering drawings shown in Table 1-2.

Table 1–2.   Engineering Drawings

Drawing Number	Description
ED-4C492-30	Model 300, Domestic
ED-4C560-30	Model 300, International
ED-4C645-30	Model 310, Domestic
ED-4C646-30	Model 310, International
ED-4C631-30	Model 400, Domestic
ED-4C638-30	Model 400, International
ED-3T043-30	Model 500
ED-3T023-30	Model 600
ED-3T027-30	Model 700
ED-3T061-30	Model 1000
ED-4C580-30	XM, Domestic
ED-4C635-350	XM, International
ED-3T010-30	XM/405S, XM/900S, Domestic
ED-3T027-30	XM/405S, XM/900S, International
ED-3T010-35	XM/405S, XM/900S, Connectorized Cable Assemblies
ED-3T011-30	TM/60S, TM/120S DCM and DM
ED-3T025-30	9-track, Domestic
ED-3T026-30	9-track, International
ED-4C492-35	Model 300 Connectorized Cable Assemblies
ED-4C631-35	Model 400 Connectorized Cable Assemblies
ED-3T043-35	Model 500 Connectorized Cable Assemblies
ED-3T023-35	Model 600/700/1000 Connectorized Cable Assemblies
ED-3T011-35	SCSI Connectorized Cable Assemblies

Related Training

Courses about the 3B2 computer, including maintenance courses, are available from AT&T and are strongly recommended. In the courses on operations and maintenance, you learn how to set up and operate the 3B2 computers. Information is prcscntcd about using system administration menus, performing system diagnostics, using sccurity features, interpreting and responding to error messages, and installing and testing the input/output expansion board. You also learn to install and operate feature cards and utility packages. Anyone responsible for system administration, maintenance, expansion, operation, networking, and troubleshooting of the 3B2 computers can benefit from these classes.

Courses on basic and advanced system administration are also available. The basic system administration class teaches you how to bring up the system, load application software packages, and perform minor alterations to ensure efficient use of the system's resources. In addition, system security, the kernel, the shell, the utility, and the application programs are discussed. This basic class is intended for nontechnical personnel primarily concerned with system administration for software application packages on the 3B2 computer.

The advanced system administration class focuses on the inner working of the AT&T 3B2 computer to enable system administrators to configure a system to particular applications or needs. You learn to use system administrative commands rather than menus to enable optimal control and manipulation of the system. System administrators and service personnel who have a working knowledge of simple administration commands, but need in-depth skills and knowledge about the system, can benefit from this advanced course.

How to Order Documents

Documents and courses that may be helpful are listed in the documentation and training catalogs. To order these documents

- within the continental United States, call 1 (800) 432-6600

- outside the continental United States, call 1 (317) 352-8556

- in Canada, call 1 (800) 255-1242

How to Receive Training Information

The *AT&T Education and Training Catalogue of Courses* and course schedules arc free and can be ordered by contacting your account executive or calling (toll free):

> 1-800-554-6400, extension 7235

Training information can also be accessed electronically through our computerized catalog:

> DIAL: 1-800-662-0662 or 1-614-764-5566
> LOGIN: comcats
> PASSWORD: 88cat

Additional Support and Information

AT&T provides installation, maintenance, and operations support for customers. Customers wanting more information about support packages should contact their AT&T account representative.

To contact a marketing rcpresentative about AT&T hardware (including spare parts) and software, call the following toll-free numbers: 1-800-247-1212 (in the continental USA), or 1-201-953-7554 (elsewhere).

How to Make Comments About This Document

A comment card is in the front of this document. Although wc have tried to make this document fit your needs, we are interested in your suggestions to improve this document.

If the comment cards have been removed from this document, please send your comments to

AT&T
4513 Western Avenue
Lisle, Illinois 60532
Attn: District Manager - Documentation

Chapter 2: 3B2 Model Overview

Introduction

This chapter will introduce you to the various models that make up the 3B2 line of minicomputers. The individual hardware components of the 3B2 will be discussed, along with some compatibility issues dealing with both the hardware and software. For more detail on troubleshooting and repair, refer to the subsequent chapters.

The AT&T 3B2 computer is a desktop stand-alone processor based on the WE 32000, 32100, and 32200 microprocessors that runs the UNIX operating system. The various 3B2 computer models allow support of a wide range of configurations and applications and make it compatible with a variety of environments. Special attention to the user interface makes it a computer that can be used by both the casual user as well as the expert.

This manual partitions the 3B2 line of minicomputers into two basic groups: Version 2 and Version 3. The version number indicates the basic hardware architecture used by the computer. The differences between the two versions will be explained in this chapter.

The following list shows the 3B2 computer models grouped according to their hardware version:

Table 2–1.   3B2 Hardware Versions

Version 2	Version 3
3B2/300	3B2/500
3B2/310	3B2/600
3B2/400	3B2/700
3B2/400S60	3B2/1000

Standard and optional components of the previous hardware are discussed in this chapter. Information on peripheral add-ons is found in Chapter 3, "3B2 Peripheral Overview."

Version 2 Hardware

Figures 2-1 and 2-2 show the 3B2 Models 300, 310, and 400. All 3B2 computers are composed of several major interdependent hardware units, called subassemblies. Figures 2-3 and 2-4 show the major subassembly locations in these Models.
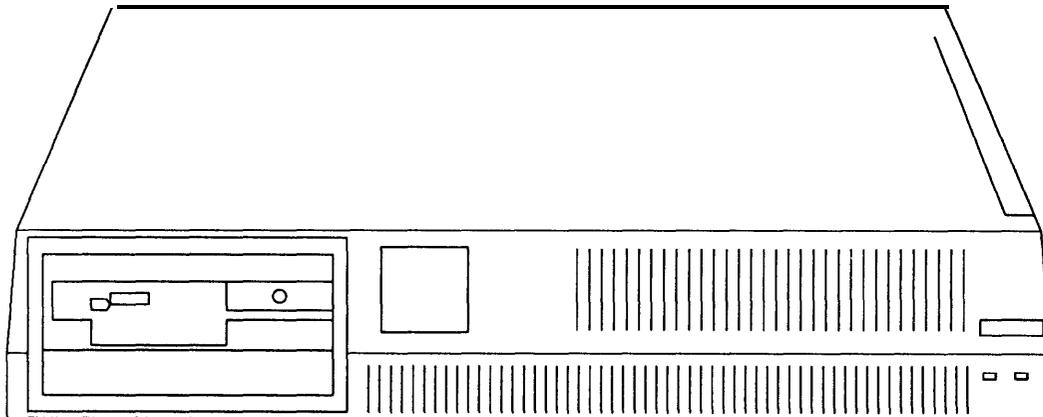
Figure 2–1.   AT&T 3B2 computer, Model 300/310
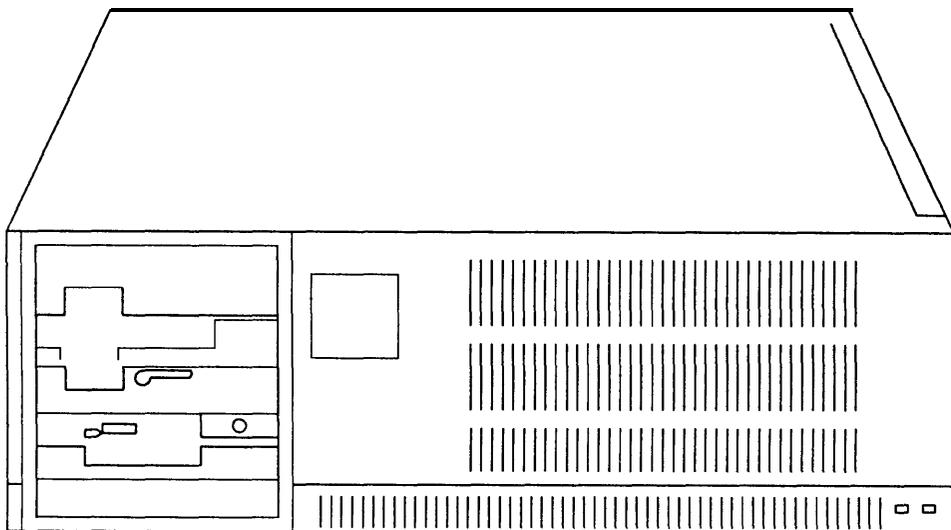
Figure 2–2.   AT&T 3B2 computer, Model 400
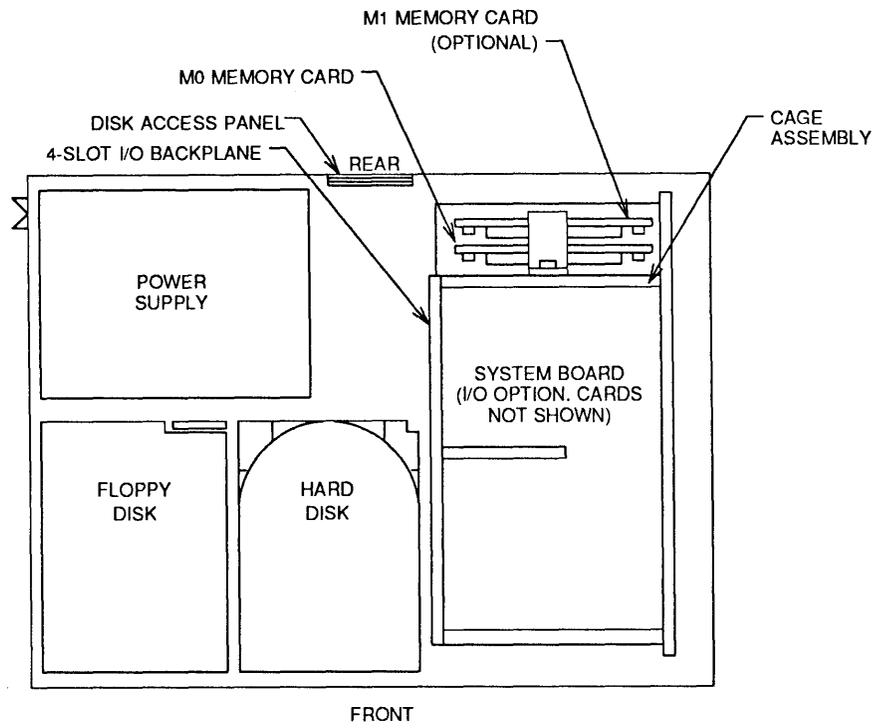
Figure 2-3.   AT&T 3B2/300/310 major subassemblies
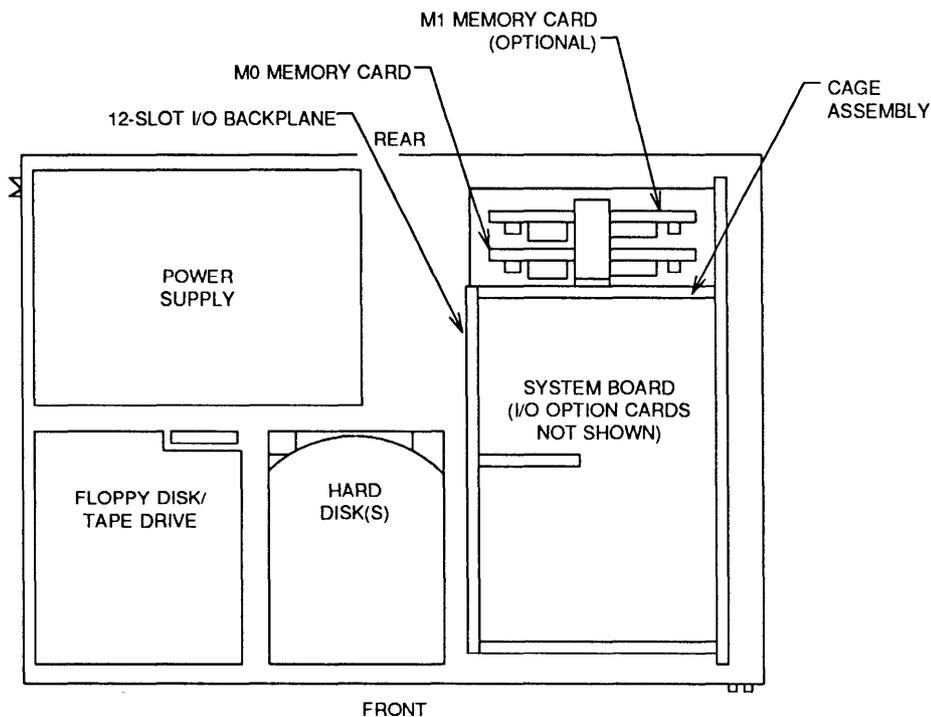
Figure 2–4.   AT&T 3B2/400 major subassemblies

The subassemblies for Version 2 3B2 computers are as follows:

■   power supply

The power supply used in domestic 3B2 computer systems operates off standard 90 to 140 VAC in range one (110 VAC position), 47 to 63 Hz. The international power supply is 180 to 260 VAC in range two (220 VAC position), 47 to 63 Hz. The power supply provides proper power levels to all internal components of 3B2 computers. Internal voltage levels supplied are +5 VDC, +12 VDC, and -12 VDC. Different power supplies are used in the 300/310 and 400; however, the same voltage levels are supplied by all. Also, two different power supplies are available for the 300/310 Models. For more information, see Chapter 6, "3B2 Subassemblies."

■   system board

The system board is the heart of the 3B2 computer. The system board on Models 300, 310, and 400 is the same. Besides the main microprocessor (WE 32000 or 32100 series), the system board contains the read-only memory (ROM) chips, the I/O controller for the console and contty ports, floppy controller, hard disk controller, nonvolatile RAM (NVRAM), and the system time-of-day clock. Integral

memory boards mount to the rear of the system board through edge card connectors. The backplane mounts to the system board with two edge card connectors. See Figure 2-5 for the CM190A system board (based on WE 32000 series), and Figure 2-6 for the ED system board (based on WE 32100 series).
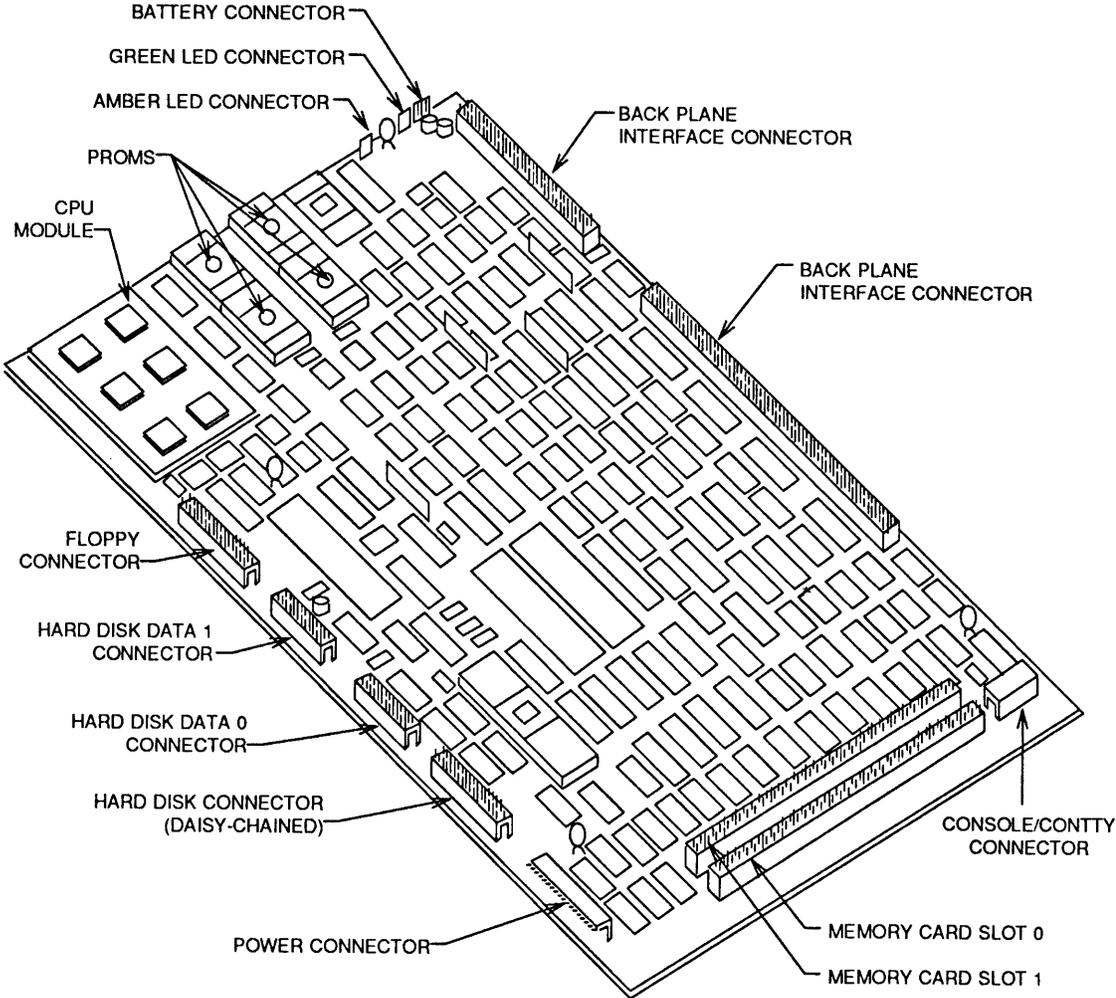
Figure 2–5. WE 32000-based system board CM190A (Model 300 only, earliest version)
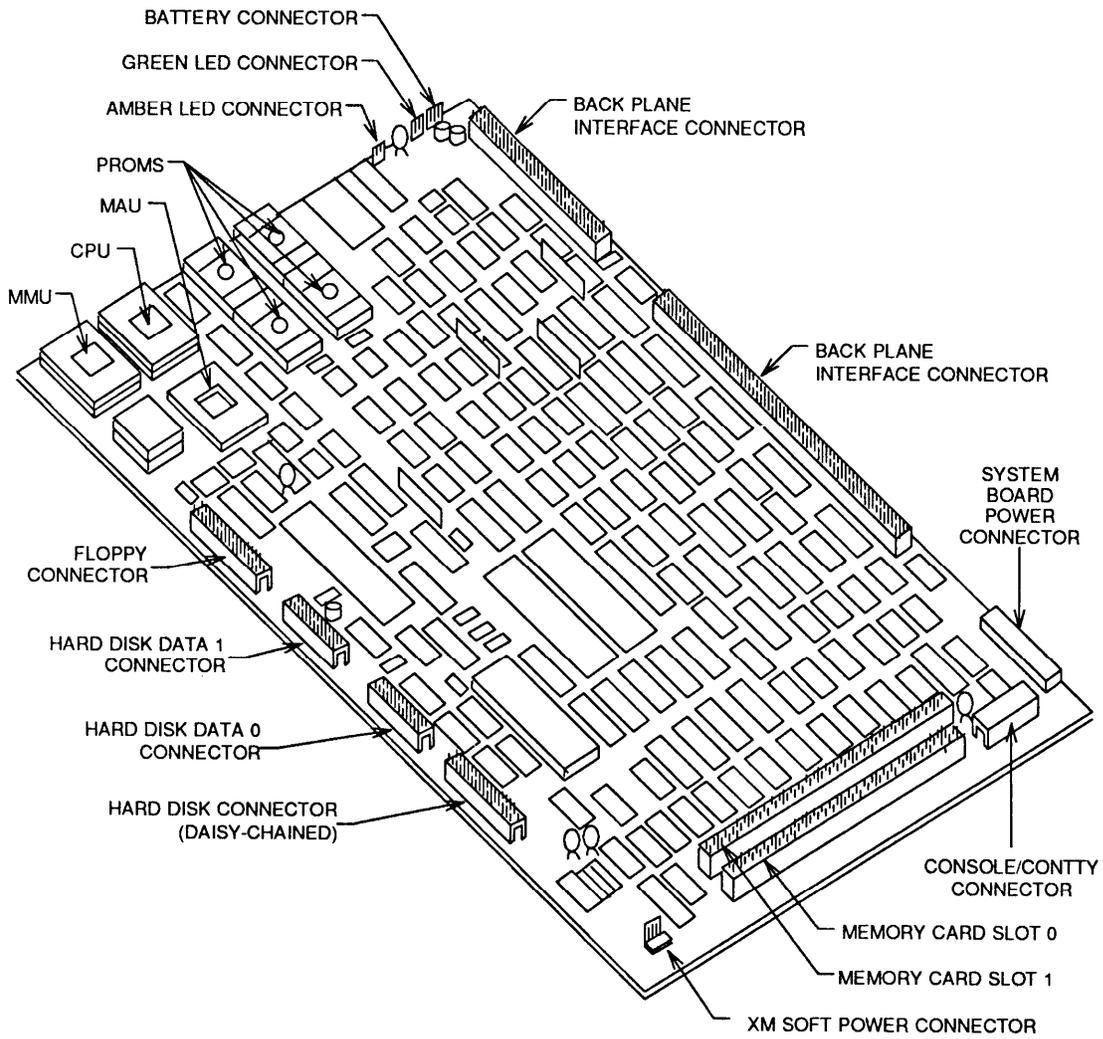
Figure 2–6.   WE 32100-based ED system board (G1-G6) (Models 300/310/400 only)

■ floppy disk drive

The floppy drive is a microprocessor-controlled 5-1/4 inch drive. The standard diskettes used with this drive are double-sided, double-density with 96 TPI (tracks per inch). Each floppy disk is capable of storing 720 kilobytes of formatted data. The same floppy drive comes with all 3B2 computers.

■ hard disk drive

The following three hard disk drive sizes are available:

❑ 10 megabyte (MB) formatted capacity

❑ 30 MB formatted capacity

❑ 72 MB formatted capacity

The hard disk drive used in the Version 2 hardware architecture is a 5-1/4 inch Winchester drive (ST506 interface). The Models 300, and 310 contain one hard disk drive, while the Model 400 contains either one or two hard disk drives. The hard disk media is not removable as the floppy diskettes are. (The 10 MB disk is no longer sold for the 3B2 computer, but is still a maintenance item.) Since the hard disk controller circuitry (located on the system board), is capable of controlling two disks, the Models 300, and 310 allow access to the second port through the disk access panel (see Figure 2-3). This panel provides connections for the addition of a second hard disk through an expansion module (XM).

■ I/O backplane (300/310-4 expansion slots, 400-12 expansion slots)

The I/O backplane provides either 4 or 12 expansion slots for I/O feature cards. For more information on feature cards, see Chapter 8, "I/O Feature Cards."

■ memory

The following three memory sizes are available:

❑   two 1/4 MB random access memory (RAM) memory boards (300 only)

❑ one (or two) 1 MB RAM memory boards (300, 310 or 400)

❑ one (or two) 2 MB RAM memory boards (300, 310, or 400)

Memory options are intermixable. For example, a 1 MB board may be added to a system with a 2 MB board (or vice versa). However, the 2 MB board must be in the first slot, closest to the apparatus case. The 1/4 MB board available on Model 300 cannot be mixed with either the 1 MB board or the 2 MB board. If only one board is used, it must be installed in the first slot.

In addition, one of the following may be present, variable per system configuration:

■ 23 MB cartridge tape drive and cartridge tape controller (CTC) I/O feature card (Model 400).

   NOTE: The 23 MB tape drive manufactured by Wangtek may be used in place of the Cypher model. The Wangtek model appears identical to the SCSI cartridge tape drives.

■ 60 MB SCSI cartridge tape drive and SCSI host adapter (HA) card (Model 400S60).

   NOTE: On the Model 400S60, the 60 MB SCSI cartridge tape drive and the SCSI host adapter card replace the 23 MB cartridge tape drive and the cartridge tape controller card.

Version 3 Hardware

The 3B2 Models 500, 600, 700, and 1000 incorporate several major enhancements to the Version 2 hardware. While these models are comprised of the same major subassemblies as the Models 300, 310, and 400, some of the subassemblies are significantly different, such as the system board, backplane, and the disk/tape subsystems.

Most of these models can have a system board and (sometimes) backplane upgrades that change the model number. For example, a 3B2/500 that has been upgraded to the 22 MHz CM518B system board would be renamed to 3B2/522. (See the following subsystem descriptions and Table 2-2 for more information). Throughout this manual, the base model numbers (i.e., 500, 600, 700, 1000) will be used; the upgraded model numbers will be specified only where needed.

Table 2–2.   Version 3 System Board and Backplane Configurations

3B2 Model	System Board	Backplane
500	CM518A	CM520A
522	CM518B	CM520A
600	CM518A	CM519A
622	CM518B	CM519A
700	CM518B	CM519A
1000-60	CM518B	CM519B
1000-70	CM518B	CM519B
1000-80	CM518C	CM519B

While the 3B2/500 is packaged in the same cabinet as the 3B2/400 (Figure 2-2), the Models 600, 700, and 1000 are packaged in a different cabinet (Figure 2-7). The larger cabinet allows for a larger backplane, more internal hard disks, and larger cooling fans external to the power supply. The 3B2/500 subsystems are located in the same position as the 3B2/400 (Figure 2-4) except for the memory cards that plug into the backplane instead of the system board. See Chapter 6, "3B2 Subassemblies," Figure 6-17 and Figure 6-18, for an example of the internal subsystems for the 3B2 Models 600, 700, and 1000.
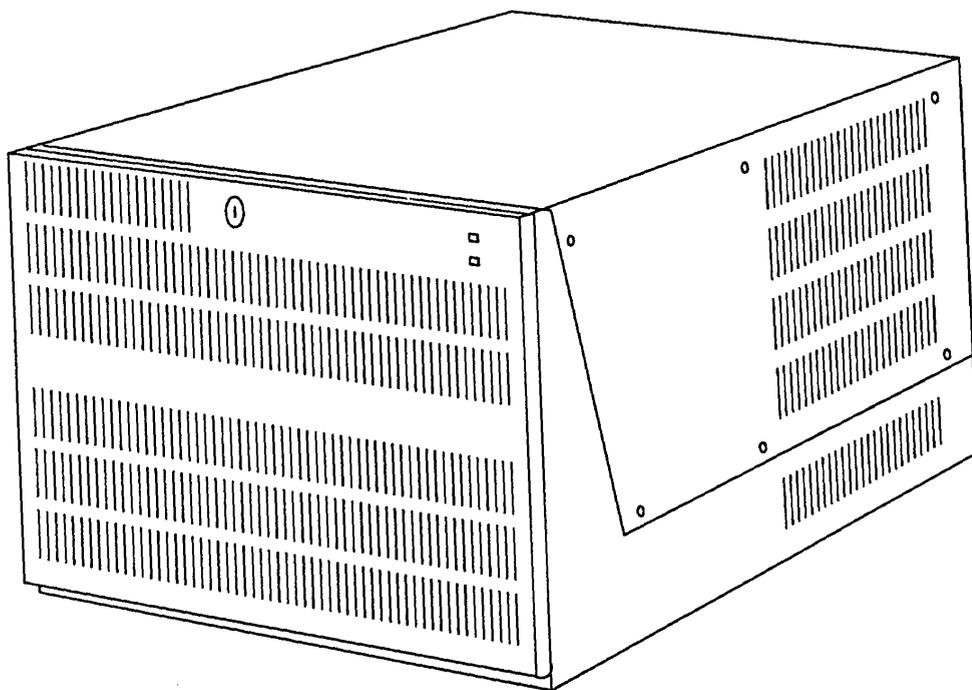
Figure 2–7. **AT&T 3B2 computer, Models 600/700/1000**

The major subassemblies for the Version 3 3B2 computers are as follows:

■   system board

One of three system boards may be installed in a Version 3 computer. Each of these boards contains the main microprocessor (WE 32100 or 32200 series), ROM, NVRAM, console/contty controller, floppy disk controller, and the time of day clock. The system board plugs into the backplane, with all electrical connections to the other subsystems provided through this connection (see Figure 2-8).

The differences between the three system boards are listed below. Also, refer to Tables 2-2 and 2-3 for more information.

CM518A   WE 32100 chipset, 18 MHz clock

Supports one micro-bus (uBus) slot for virtual address cache (Vcache) memory board, one buffered micro-bus (BuBus) slot, and a maximum 16 MB of main memory.

CM518B   WE 32200 chipset, 22 MHz clock

Utilizes four KB physical address cache (Pcache) memory located in memory management unit (MMU) chip on the system board. (The uBus (Vcache) slot is still operational, but will not improve system performance). Supports up to four BuBus slots, and a maximum 64 MB of main memory.

CM518C   WE32200 chipset with two MMU chips, 24 MHz clock

Utilizes eight KB Pcache memory, with the uBus slot no longer available. Supports up to three processor bus (PBus) slots, three BuBus slots, and a maximum 64 MB of main memory.
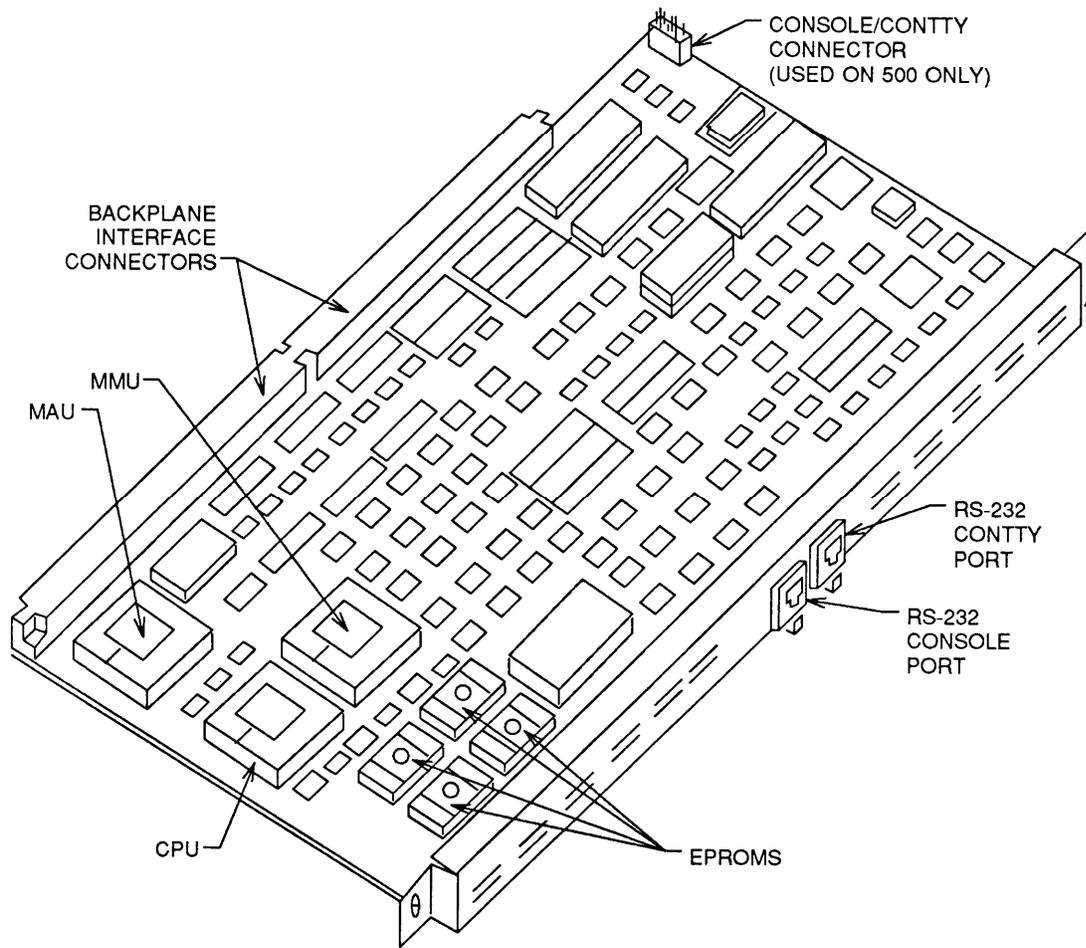
Figure 2–8.   System board CM518A (Models 500/600 only)

■ power supply

The Models 600, 700, and 1000 share the same power supply; the 500 has its own power supply (not the same as used in the 3B2/400). These supplies provide +5, +12, and -12 volts to system components. Features include thermal overload protection and autoranging between 120V and 240V AC power. The power supply has a two-position ON/STANDBY switch, unlike the three position switch on Version 2 models. Having the switch stay in the ON position allows the computer to automatically reboot after a power failure. Also, the Version 3 hardware incorporates an "express shutdown" feature that allows faster shutdown of the computer when pressing the switch to STANDBY.

In Models 600, 700, and 1000 cabinets, the fans and thermal sensor are external to the power supply, but are still controlled and monitored by the power supply.

■ core SCSI bus

All Version 3 models have a core single-ended SCSI bus, meaning that the internal hard disk and cartridge tape peripherals connect to a SCSI bus. (For more information on SCSI, see Chapter 3, "3B2 Peripheral Overview.") All Version 3 models have a SCSI host adapter installed in slot 1 of the I/O bus. A 50-pin ribbon cable runs from this host adapter to the internal peripherals.

Depending on cabinet size and disk type, one, two, or three disk drives maybe installed internal to the 3B2. All the Version 3 models are equipped with one cartridge tape drive.

Hard disk drives	The earlier Version 3 models utilized disk drives with an ESDI interface that required a separate controller card. The later models contain disk drives with embedded SCSI controllers.
Cartridge tape drives	All models are equipped with either a 60 or 120 MB cartridge tape drive. These tape drives contain their own SCSI controller.

■ memory

Version 3 memory cards use error correction code (ECC) instead of simple parity. ECC allows the correction of single-bit errors and the detection of double-bit errors. These memory boards are available in 2, 4, and 16 MB sizes. Instead of plugging into slots on the system board, as on Version 2 models, these memory boards plug into the backplane memory slots. The maximum memory size for each Model depends on the number of memory slots and the type of system board. The 16 MB board will not work with the CM518A system board.

■ enhanced I/O bus (EIO)

The I/O bus provides 7 (500) or 12 (600,700,1000) slots for adding I/O feature cards. See Chapter 8, "I/O Feature Cards," for further information on the cards. The I/O bus was enhanced for the Version 3 computers. Each I/O slot on the backplane was increased in width to provide additional pins for improved data transfer rates. These slots are still compatible with the Models 300, 310, 400 I/O slots.

■ performance buses and cards

The "performance" buses are extensions of the buses on the system board. They allow for additional microprocessors, cache memory, or other hardware to be added to the system that needs to tie in closely with the main processor on the system board. These buses are:

Micro-bus (uBus) 1 slot provided exclusively for the virtual address cache (Vcache) memory card. This bus is supplied only by the CM518A and CM518B system boards, and the CM519A backplane. However, the Vcache card is not necessary if using a CM518B system board, since this system board utilizes the onboard physical address cache Pcache). This bus is replaced by the PBus on the CM518C system board and the CM519B backplane.

Buffered micro-bus (BuBus) Several types of cards can be installed on the BuBus, including the multiprocessor enhancement board (MPB). The CM518A system board supports only 1 BuBus slot, while the CM518B and CM518C system boards support as many slots as the backplane provides.

Processor bus (PBus) Provided only by the CM518C system board and the CM519B backplane. This bus is used exclusively by the processing element (PE) board.

The performance cards plug into the performance buses mentioned previously. These cards are:

Virtual address cache
(Vcache)

Cache memory is a "fast-access" memory device that stores most recently used instructions and data. One µBus slot is provided by the CM520A and CM519A backplanes exclusively for the Vcache card. This card, that supplies 6 KB of cache memory, is standard on the 3B2/600; optional on the 3B2/500. Vcache is not used with the CM518B and CM518C system boards since these boards utilize onboard physical address cache (Pcache). See Figure 2-9 for an example of a Vcache board.

Multiprocessor enhancement
Board (MPB)

The MPB provides an additional WE 32100 series chipset running at 18 MHz. These boards are added to the BuBus slots to increase the computing power of the system. See Figure 2-10 for an example of a MPB board.

Processing element (PE)

The PE board provides an additional WE 32200 series chipset running at 24 MHz. This card is installed in the PBus slots. Both MPB and PE cards require that the Multiprocessor Enhancement (MPE) Utilities be installed. See Figure 2-11 for an example of a PE board.

There are additional cards that may be installed in the BuBus, namely the expansion bus interface (XBI) used in the 3B4000, and the VME bus host adapter. The XBI card will not be covered in this manual, and minimal information on the VME card can be found in the add-on chapters.
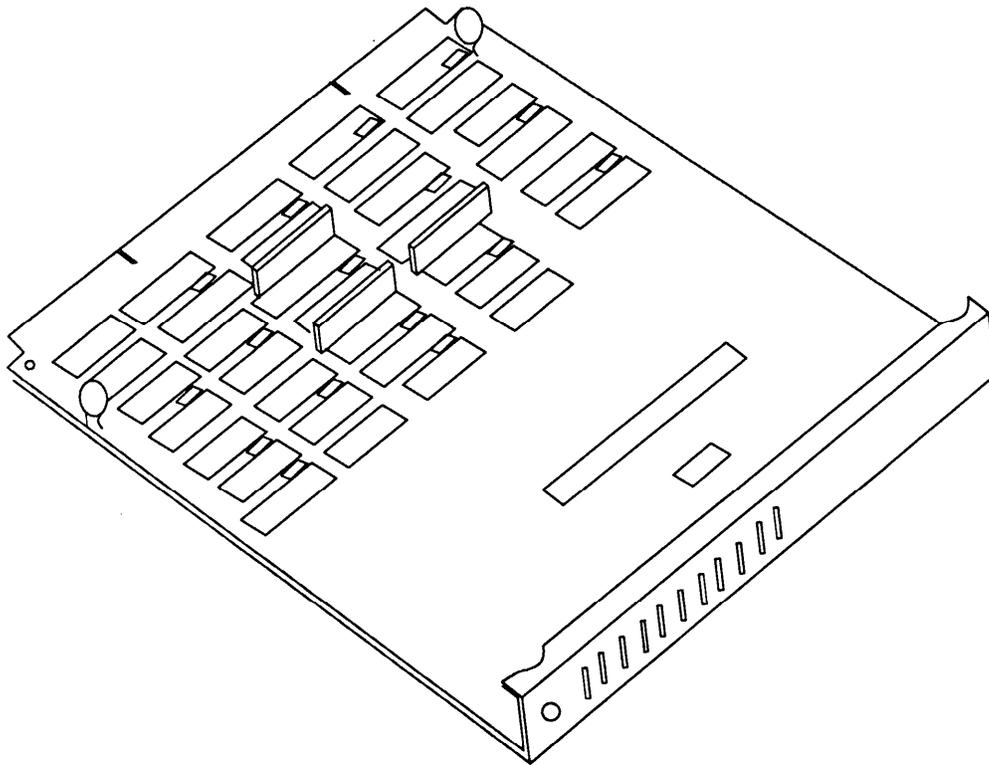
Figure 2-9. Virtual address cache (Vcache) board CM522A.

WE 32100 MICROPROCESSOR
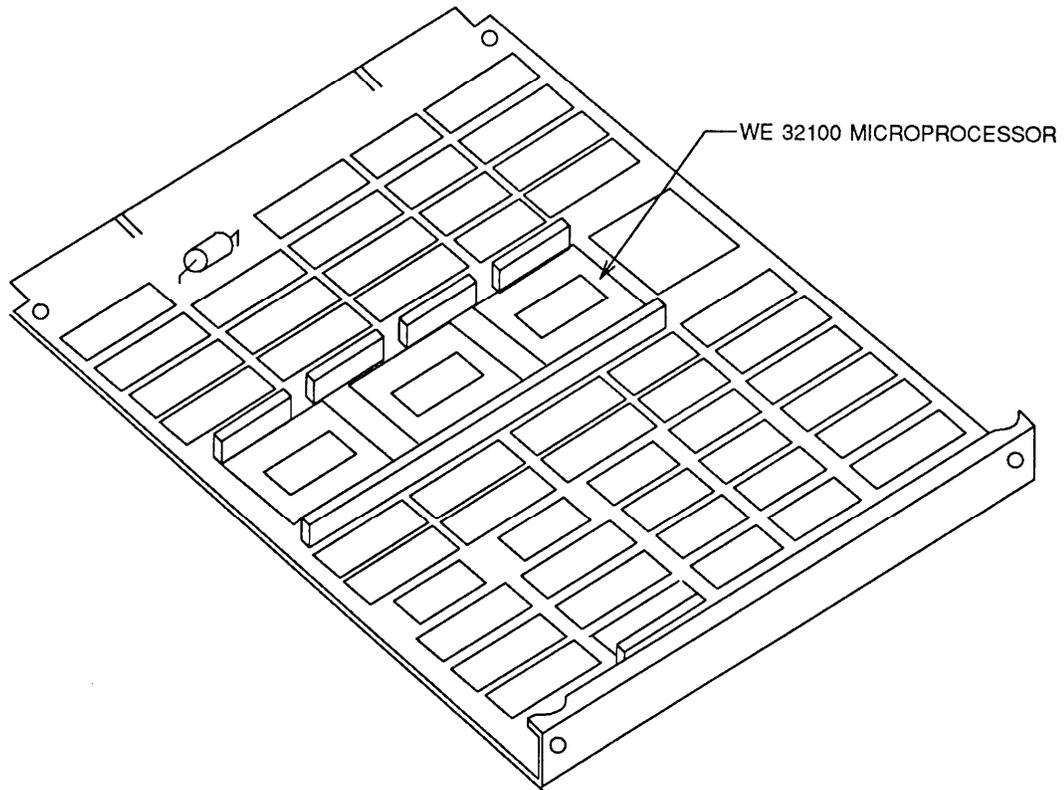
Figure 2–10.   Multiprocessor enhancement board (MPB) CM527A

WE32200 MICROPROCESSOR
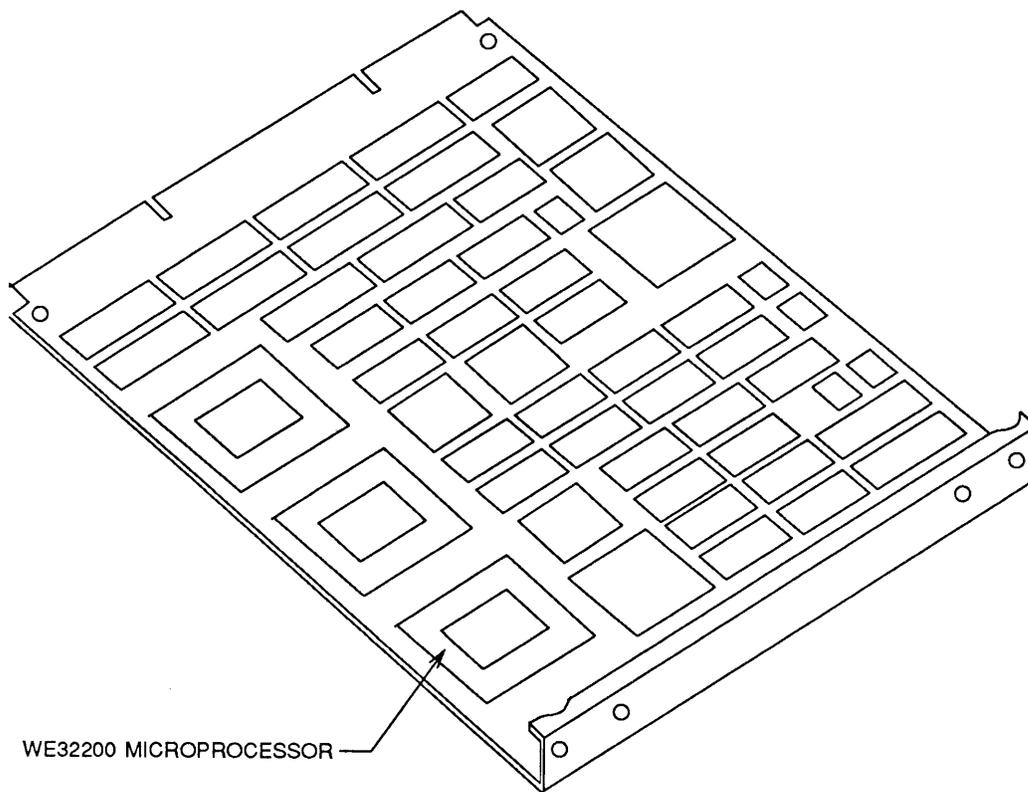
Figure 2–11.   Processing element (PE) board CM524A

■   backplane

The backplane carries all system buses between the system board and the equipped circuit boards. These buses include the I/O bus, the performance buses, and the memory bus. The backplane also carries power to each circuit card (including the system board) and provides connections for the NVRAM battery, floppy disk, and LEDs.

Three backplanes are used in Version 3 computers

CM520A (500)	one system board slot, seven I/O slots, two memory slots, one uBus slot, and two BuBus slots
CM519A (600,700)	one system board slot, 12 I/O slots, four memory slots, one uBus slot, and four BuBus slots
CM519B (1000)	one system board slot, 12 I/O slots, four memory slots, three PBus slots, and three BuBus slots

See Table 2-3 for compatibility with system boards. See the subassembly chapter for diagrams of the bus layouts.

■   floppy disk drive

The same floppy disk drive is used on all 3B2 models (720KB). While the floppy controller remains on the system board, the floppy drive cable connects to the backplane.

Software

The 3B2 computer runs the UNIX operating system. The operating system software controls the hardware and monitors all stored data. The UNIX operating system that runs on the 3B2 computer is the UNIX System V that offers portability with other AT&T 3B computer systems.

The UNIX software and other 3B2 specific software that is important to the basic operation of the computer is bundled together in a package called Essential Utilities. For Version 2 models, the Essential Utilities package comes on floppy diskettes; for Version 3 models, the package comes on a cartridge tape. If the software gets so corrupted that the 3B2 will not boot, either a partial or full restore of the Essential Utilities must be performed. A full restore is also the procedure that initially sets up the 3B2 computer. These operations are described in more detail in the documentation supplied with the 3B2 computer.

In addition to the Essential Utilities, there are other software utility packages supplied with the 3B2. These utilities are supplied on additional diskettes, or are contained on the same tape as the Essential Utilities. An example of these utilities is the Basic Networking Utilities, that adds the software necessary for communicating between computers.

Another utility supplied with every 3B2 is the System Administration Utilities, that contains the system administration (`sysadm` (1M)) commands that maintenance technicians must use for completing many procedures. Many of the administrative tasks on a 3B2 (including installing and removing the additional utilities) can be performed with the `sysadm` command. This command provides a menu driven interface for performing many different tasks on a 3B2, including partitioning hard disks and creating file systems.

NOTE: It is strongly suggested that maintenance personnel have a working knowledge of the UNIX operating system before attempting to troubleshoot a 3B2 computer.

UNIX Releases

The following is a short chronological overview of UNIX System V for the 3B2 computers. The first UNIX operating system on the 3B2 computer was System V Release 1.0. This was followed by Release 2.0. There were several revisions of UNIX System V Release 2, including 2.0, 2.0.2, 2.0.4, and 2.0.5. All of these releases run only on Version 2 hardware, and were "swapping" based operating systems. UNIX System V Release 3.0 was the first official "paging" release available on Version 2 computers (a 2.1 paging release was offered on a limited supply, but these machines should be upgraded). The first revision of Release 3.0 was Release 3.1. System V Release 3.1 was the first porting base for the Version 3 3B2 computers, and is distinguished by adding another digit to the release number. Therefore, the first operating system for the Version 3 models was System V Release 3.1.1. The next revision was Release 3.2 (for Version 2 models) and Release 3.2.1 (for Version 3 models). When the 3B2/1000 Models were introduced, changes were added to Release 3.2.1 to make Release 3.2.2.

Table 2-3 shows the minimum UNIX release for the Version 3 system boards.

Table 2–3.   Version 3 System Board Dependencies

System Board	Backplane*	UNIX Release
CM518A	CM519A or B	3.1.1 or later
CM518B	CM519A or B	3.2.1 or later
CM518C	CM519B	3.2.2 or later

* The 362/500 and 362/522 use the CM520A backplane. A CM518C
system board cannot be used in these models.

Since the Version 3 models have a core SCSI bus, the Essential Utilities contain the portions of the SCSI utilities necessary for basic operation of the system (see the next chapter for detail on the SCSI Utilities). The first UNIX release available for the Version 3 3B2 was System V Release 3.1.1. The 3.1.1 Essential Utilities tape contained Release 1.0 of the SCSI host adapter and disk controller utilities. The cartridge tape utilities is also included on the 3.1.1 tape as a separate installable package. (See the next Section, "Compatibility Issues," for more on the 3.1.1 Essential Utilities.) UNIX System V Releases 3.2.1 and 3.2.2 provide a subset of the SCSI Release 3.0 Utilities as a part of the Essential Utilities.

Table 2–4 shows which UNIX releases are compatible with the two 3B2 hardware versions.

Table 2–4.   UNIX Release Compatibility

UNIX Release	Type	Runs on 3B2 Hardware Version
1.0	swapping	300 only
2.0 - 2.0.5	swapping	2
3.0	paging	2
3.1	paging	2
3.1.1	paging	3
3.2	paging	2
3.2.1	paging	3
3.2.2	paging	3

Compatibility Issues

Any 3B2 computer equipment part, subsystem, or peripheral purchased from AT&T for use with the 3B2 computer system will usually work with any other part. However, the maintenance technician should make note of the following exceptions.

UNIX System V Release 1.0

When the 3B2 computer was originally available, the UNIX release was System V Release 1. (The message on the console terminal would refer to UNIX 5.0.5 ... during powerup.) AT&T provided a free upgrade to System V Release 2 (SVR2) and no machines should be running Release 1. It is possible that some machines may not have been upgraded. Check with your support organization for the procedures to upgrade to SVR2.

UNIX on Version 3 Models

The UNIX operating system for the Version 3 models has hardware specific changes included. For this reason, the UNIX releases for Version 2 models will not run on Version 3 models, and UNIX releases for Version 3 models will not run for Version 2 models. Also, the system boards used in Version 3 models require certain releases of the UNIX software. Table 2-3 shows these dependencies.

Minimum UNIX Release for SCSI

The use of SCSI on 3B2 computers requires UNIX System V Release 2.0.5 or later versions.

3.1.1 and 120 MB Tape Drive

Trying to install UNIX System V Release 3.1.1 on a Version 3 model with an internal 120 MB (versus 60 MB) cartridge tape drive will not work. Since 3.1.1 contains release 1.0 of the SCSI software, and this release of SCSI software does not recognize the 120 MB tape drive, a full restore operation will fail when trying to read the cpio archive from the tape. For this reason, Release 3.2.1 or later of the UNIX operating system must be used with any 3B2 model that dots not have an internal 60 MB cartridge tape drive, even though the 3B2 may have a CM518A system board (see Table 2-3).

3.1.1 and Embedded Controller Disks

The same problem that was previously mentioned happens in Version 3 models with internal embedded SCSI controller hard disk drives (versus ESDI disk drives). Some packages of the 3B2 Models 500 and 600 (CM518A system board) contain disk drives with embedded SCSI controllers. Release 1.0 of the SCSI software recognizes only ESDI disk drives connected to the Emulex disk controller (see Figure 6-21). Therefore, a full restore of the 3.1.1 Essential Utilities will fail. The 3.1.1 Essential Utilities tape was re-released to correct this problem. The comcode for the new cartridge tape is 105654297.

3B2 Computer Maintenance Utilities

The latest issue of the Maintenance Utilities (4.0) contains software for diagnosing the CM518C system board and the PE board. Release 3.0 of the Maintenance Utilities does not contain the diagnostic code for these boards. Release 1.0 of the Maintenance Utilities does not contain the diagnostic code for the CM518B system board or the XBI. See Appendix C, "Using 3B2 Computer Maintenance Utilities," for more information on this utility.

idtools

The integral disk tools (idtools) program, formerly known as DEVTOOLS, on the 3B2 computer Maintenance Utility floppy will only function on a hard disk that is connected to the 3B2 Models 300, 310, 400 system board. This program cannot format XDC or SCSI disks.

72 MB Hard Disk

When initially released, only 10 MB and 30 MB hard disks were supported on the 3B2 computer. A 72 MB hard disk became available at a later time. On the 3B2/300, the 72 MB hard disk will not function with an early version of the system board. The following system boards allow the use of the 72 MB hard disk:

- any ED system board

- any CM190A system board with artmaster 6 (AM6)

- a CM190A system board with AM5, series 27 or later

The AM and series information is stamped on the outside edge of the system board near the memory board connectors. Refer to Figure 2-5 and Figure 2-6 for diagrams of the two types of system boards.

Version 3 System Boards and Backplanes

Refer to the previous overview of Version 3 hardware and Table 2-3 for information on this subject.

Chapter 3: 3B2 Peripheral Overview

Introduction

This chapter describes the different components that make up the peripheral add-ons to the 3B2 computer that include hardware, software and interconnection equipment. This includes the following:

- expansion module (non-SCSI)

- tape module (non-SCSI)

- SCSI components

    - host adapters

    - disk module

    - tape module

    - disk controller module

    - expansion module

    - 9-track tape drives

    - peripheral power control unit (PPCU)

- Versa Modula Europa (VME)

Expansion Module (XM) (non-SCSI)

The AT&T XM is an external storage device that increases the standard data storage capability of the 3B2 computer. The XM normally contains a cartridge tape drive that provides streaming tape backup for the hard disk(s). In addition, it may contain hard and/or floppy disk drives. A maximum of two removable media devices are allowed because of the physical makeup of the XM cabinet. See Figure 3-1 for an illustration of the AT&T XM.

All XM systems contain the following subassembly:

- power supply

In addition, the XM contains one or more of the following units:

- cartridge tape drive

- hard disk drive (two sizes available)

    ❑ 30 MB formatted capacity

    ❑ 72 MB formatted capacity

- floppy disk drive (same as integral floppy)
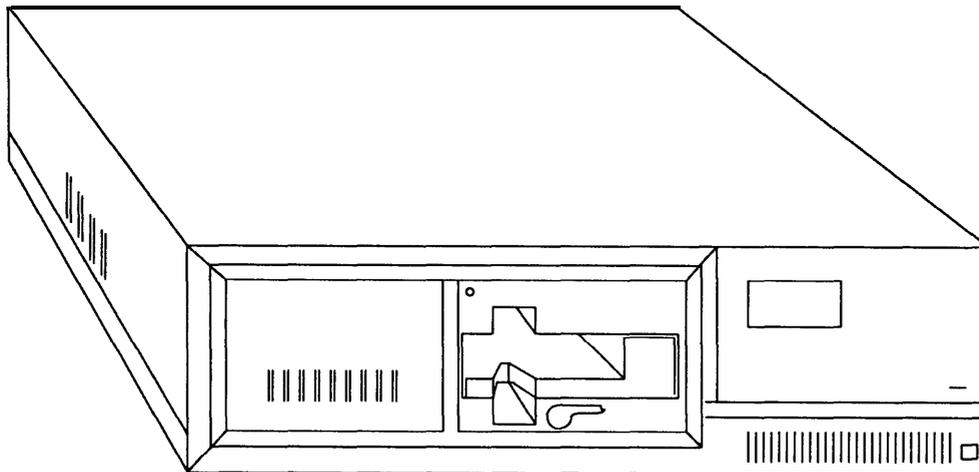
Figure 3–1.   AT&T expansion module (XM)

Expansion Module (XM) Cabling

Cabling to the XM depends on how the XM is equipped.

All XM devices contain the following:

- AC power receptacle

- two soft-power jacks

For hard disk drives, cabling involves the following connectors:

- 34-pin disk control connector

- 20-pin disk data connector

For 23 MB cartridge tape and floppy disk drive, cabling involves the following connector:

- 34-pin connector

Tape Module (TM) (non-SCSI)

The AT&T tape module (TM) offers a less expensive alternative for those customers who do not need the amount of data storage provided by the AT&T XM. The tape module consists of a cabinet (5.04 x 7.85 x 15.38 inches) containing the same cartridge tape drive used in the XM along with an independently controlled power supply. See Figure 3-2 for an illustration of the AT&T TM.

All TM systems consist of the following subassemblies:

- power supply

- fan (physically separated from the power supply)

- cartridge tape drive (23MB)

NOTE: The 23 MB tape drive manufactured by Wangtek may be used in place of the Cypher model. The Wangtek model appears identical to the SCSI cartridge tape drives.

TM Cabling

Cabling to the TM involves the following connectors:

- 34-pin connector

- AC power receptacle
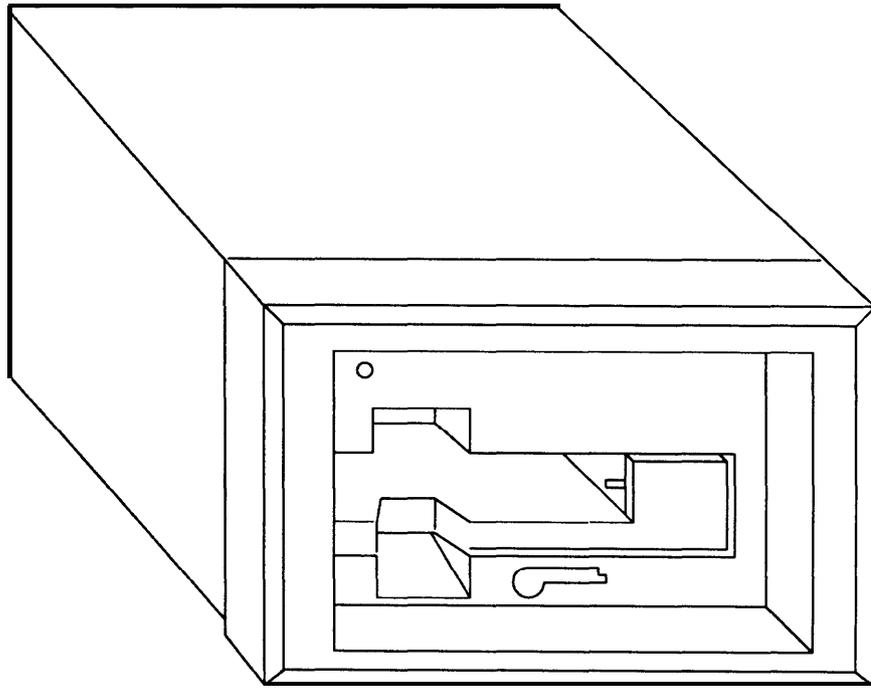
Figure 3–2.   AT&T tape module

SCSI Bus Peripherals

The SCSI bus is an industry standard peripheral bus that interconnects several SCSI components.   The SCSI bus is a daisy-chain originating with a host adapter (HA) board. The bus can connect seven intelligent peripheral controllers.

Naming Conventions

The SCSI peripheral modules follow a standard naming convention that helps you understand what each module contains.

There are two basic types of SCSI modules: SCSI device module (disk module and cartridge tape module) and controller module (disk controller module).

Device Module

The following is an example of the naming convention used for SCSI peripheral device modules:

> DM/300E
>
> where: DM is the device type (disk module)
> 300 is the formatted storage capacity (in megabytes)
> E is the interface type (E-ESDI)

Table 3–1 includes the different naming conventions possible for SCSI peripheral devices.

Table 3–1.   SCSI Peripheral Device Naming Conventions

Device Type	DM - disk module
	TM - tape module
	SCSI XM - expansion module
Storage Capacity	megabytes
(formatted)	
Interface Type	E = ESDI
	S = single-ended SCSI
	DS = differential SCSI

Controller Module

For the SCSI disk controller module that controls up to four disk modules, the maximum number of disk modules connected to the controller is the capacity number.

The following is an example of the naming convention for a SCSI DCM.

> DCM/4E
>
> where: DCM is the disk controller module
> 4 is the maximum disk modules
> E is the interface type (E - ESDI)

Bus Addressing

There can be up to eight controllers on each SCSI bus (including the host adapter). Each controller must have a different SCSI address (0 - 7) that is set by a SCSI ID switch. The SCSI address uniquely identifies each controller and also establishes its priority level. Controller ID 7 has the highest priority. The SCSI ID switch for the host adapter is on the circuit board and is factory-preset to 0. The SCSI ID switches for the peripheral controllers are located on the rear panels of their respective cabinets (the SCSI ID for the 9-track tape drive is set by either a DIP switch setting on the SCSI controller board, or by the front control panel depending on which 9-track drive in being used).

SCSI Bus Terminators

Each SCSI bus requires two bus terminators, one at each end of the bus. Two SCSI terminators are supplied with the host adapter.

⚠ CAUTION
Terminators for single-ended SCSI components are not compatible with differential SCSI components and should not be mixed. Similarly, differential SCSI components are not compatible with single-ended components and should not be mixed.

⚠ WARNING
All connections on a SCSI bus must be made properly. If a SCSI bus cable or bus terminator is connected incorrectly, irreparable damage may occur to the SCSI hardware.

SCSI Hardware Components

The following are the major hardware components for a SCSI subsystem on the 3B2 computer:

- host adapters

- disk controller module

- disk modules

- SCSI expansion module

- SCSI cartridge tape module

- SCSI 9-track tape drive

Figure 3–3 shows that the SCSI components are daisy-chained from the host adapter in the 3B2 computer through the SCSI bus, except for the disk modules, which connect to the disk controller module.

Since the list of SCSI devices will grow as new devices become available, this chapter does not specifically address the individual devices that are currently available, but rather describes the device types (disk module, tape module, and so on). Where appropriate, examples of specific devices are included.
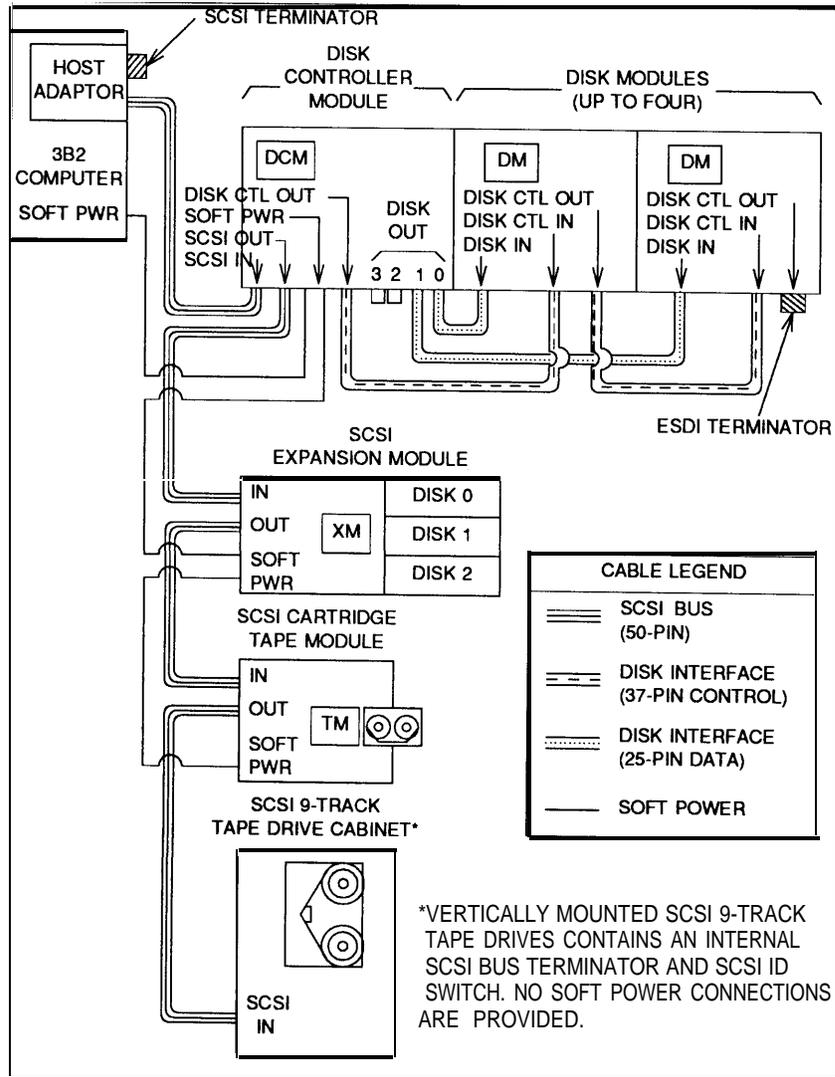
Figure 3–3.   Example layout of a single-ended SCSI bus and devices

SCSI Host Adapter

The 3B2 SCSI host adapter (HA) provides the 3B2 computer with an interface to the SCSI bus. The SCSI HA is equipped with two 50-pin connectors and can support up to seven peripheral controllers. Usually, the SCSI bus cable connects to the right connector on the HA board and an HA bus terminator connects to the left.

The HA is a single-width 3B2 computer feature card that can be inserted in the next available I/O slot. The HA package comes with the circuit board, 50-pin SCSI cable, terminators, and software.

Single-Ended Host Adapter

The single-ended HA card (CM195W) is referred to as HA1, and supports bus lengths of up to six meters (19 feet 8 inches).

Differential Host Adapter

The differential HA card (CM521A) is referred to as HA2, and supports bus lengths of up to 25 meters (82 feet). The HA2 card is supported only in Version 3 hardware (3B2/500 computers or greater) because of power requirements.

Only peripherals supporting the differential SCSI interface may be cabled to the HA2 card, Any existing peripherals on a single-ended bus, HA1, should NOT be cabled to the HA2 card. See Chapter 8, "I/O Feature Cards," for more information about the differential host adapter card.

Shared Peripherals

A significant new feature of the differential SCSI bus is the capability to share peripherals between up to three host computers. This capability should not cause any significant difficulties when troubleshooting a problem on the SCSI bus. A second HA2 card on a SCSI bus appears as another target controller to the first HA2 card. For the second HA2 to be recognized during powerup, the second host computer must be powered on before the `edtgen` program executes on the first host computer (the `edtgen` program follows diagnostics in the powerup sequence). The second host computer does not have to be powered on for proper operation of the SCSI bus; instead, it will not be configured by the first host computer.

If one host on a shared bus is powered down, it may cause a SCSI bus reset. Because of this, any other hosts on the bus should have limited activity on the bus until the host is powered down. For example, if a tape job on a shared bus is currently running on another host, a SCSI bus reset will abort the tape job.

Software

The SCSI Release 3 Host Adapter Utilities contain one software driver for both versions of the host adapter cards. However, two pump files, `scsi1,` and `scsi2,` are installed for the HA1 and HA2 cards, respectively. A new command, `haversion` (1M), can determine which type of host adapter is in a particular I/O slot. The `prtconf` (1M) command can also distinguish between the two types of host adapters.

A new feature of the software allows for shared peripherals when multiple hosts share a SCSI bus (supported on HA2 only). 3B2 computers, as well as 3B4000 computers, may share peripherals on a differential bus. For more information on shared peripherals, see Release 2 of the *SCSI Operations Manual,* 305-012.

Disk Controller Module

The disk controller module (DCM) does the interface conversion between the SCSI bus and the enhanced small disk interface (ESDI) bus of the disk modules. The DCM contains a SCSI target controller, that supports up to four disk modules. The DCM is supported by the AT&T 3B2 SCSI disk Controller Utilities Software (described in the "Software" section of this chapter).

Figure 3-4 shows the front and rear views of a disk controller module (DCM/4E). The front cover of the DCM contains the power switch and recessed label areas for SCSI identification labels. The rear of the DCM contains connections to the SCSI bus, the disk modules, AC power, and the soft-power control.
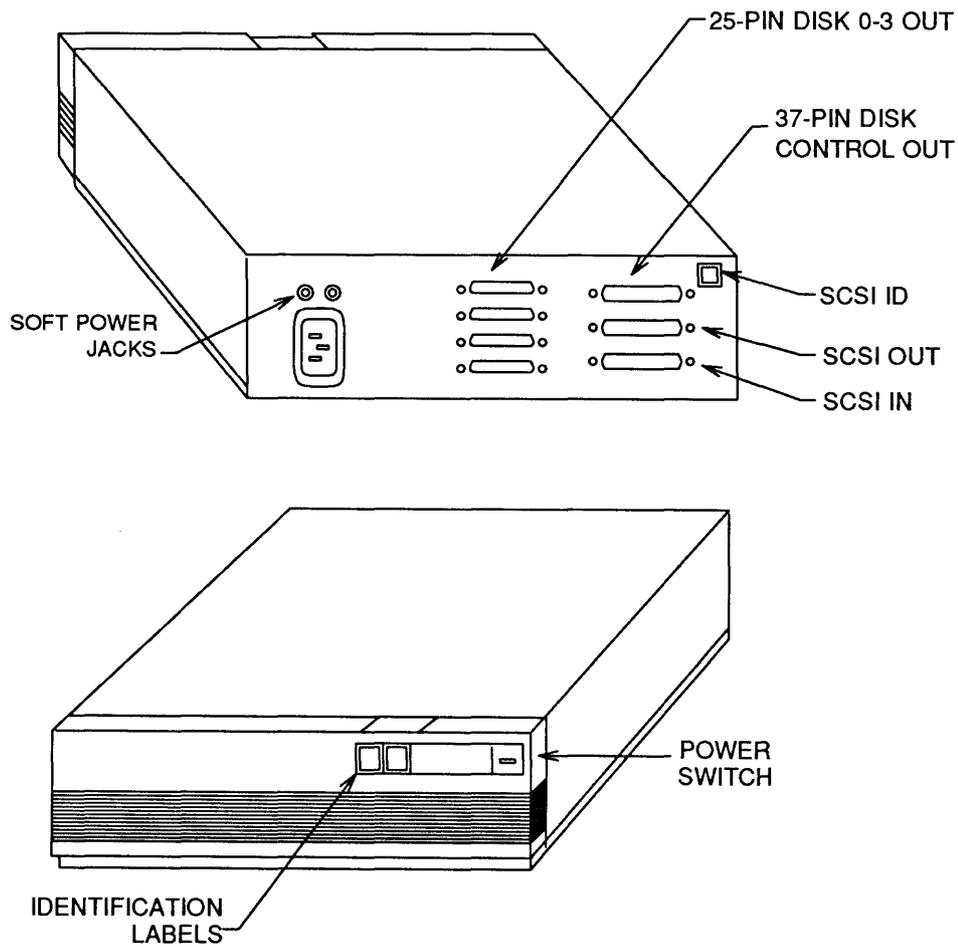
Figure 3-4. SCSI disk controller module.

DCM Cabling

Cabling to the DCM (see Figure 3-4) involves the following connectors:

- two 50-pin connectors (SCSI in and out)

- one 37-pin connector (disk control out)

- four 25-pin connectors (disk out, 0 through 3)

- two soft-power jacks

- AC power receptacle

As shown in Figure 3-3, the SCSI cable from the host adapter connects to the 50-pin SCSI in connector on the DCM. The SCSI out connector on the DCM contains a SCSI bus terminator or a cable to another controller on the SCSI bus.

The 37-pin disk control out connector on the DCM is the ESDI bus control interface for the SCSI disk modules. Up to four disk modules can be daisy-chained from the ESDI bus. The last disk module on the ESDI bus requires an ESDI terminator.

The four 25-pin disk out (0 through 3) connectors on the DCM provide the individual ESDI disk module data interfaces. Each 25-pin connector interfaces a single SCSI disk module. No terminators are required on any of the 25-pin interfaces.

The soft-power jacks provide power control for the DCM from the 3B2 computer. Soft-power control for the disk modules is incorporated in the 37-pin control cable, not through the soft power daisy-chain cable.

DCM SCSI Bus Address

The SCSI ID push-button switch on the rear panel of the DCM should be set to an appropriate setting for a peripheral device controller (1 through 7). It is important that the ID for the DCM not be duplicated anywhere on the SCSI bus.

Disk Module for ESDI Disks (DCM Required)

A disk module (DM), that is normally stacked on top of its respective disk controller module, contains a hard disk drive. Disk module in this section refers to peripherals such as DM/94E, DM/135E, DM/147E and DM/300E that use the ESDI interface.

Figure 3–5 shows the front and rear views of a disk module. The front panel cover of the disk module contains two recessed label areas for device identification stickers and an opening to access the power switch. The rear of the disk module contains the ESDI connectors for cabling to the disk module, the logical unit (LU) ID switch for addressing, and an AC power receptacle.
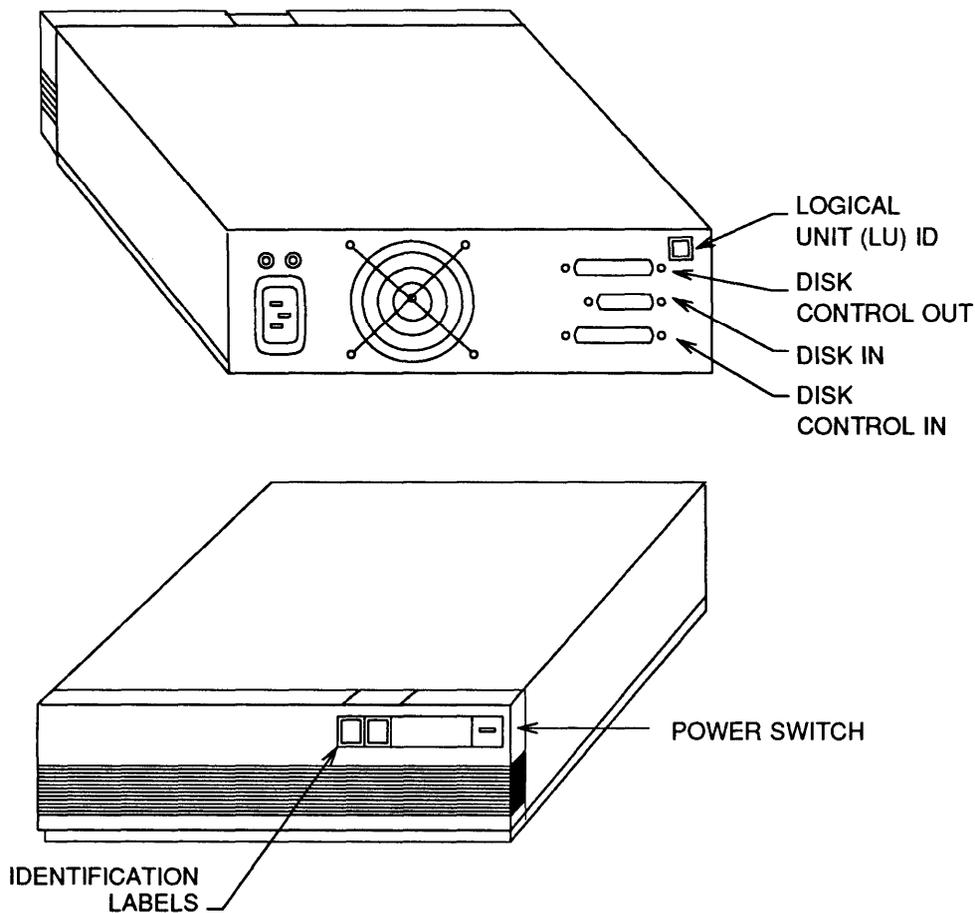
Figure 3–5.   Disk module for ESDI disks

DM Cabling

Cabling to the DM involves the following connectors:

- two 37-pin ESDI control interface connectors (disk control in and disk control out)

- 25-pin ESDI data interface connector (disk in)

- AC power receptacle

- two plugged soft-power jacks

⚠ **WARNING**

Do not remove the plugs from the soft-power jacks. If a soft-power cable is connected to one of these jacks, damage will occur to the 3B2 computer.

The 37-pin ESDI control cable starts at the DCM and is daisy-chained through the disk control in/out connectors of each disk module. The last disk module on the ESDI bus requires a terminator on the disk control out connector.

Each disk module has a separate 25-pin data cable from the DCM to the disk in connector. No terminators are required at either end of the 25-pin cables.

DM Logical Unit Number

The LU ID push-button switch on the rear panel of the DM should be set to match the label (disk x) of the associated 25-pin data connector on the back of the DCM. For example, a disk module connected to the disk 2 out connector on the DCM must have its LU ID switch set to 2.

Disk Module for SCSI Disks with Embedded Controller

The disk module for SCSI disks houses an embedded controller that eliminated the need for a DCM/4E bridge controller. The embedded controller improves reliability in the subsystem, reduces the low end entry cost, and improves performance. The DM/300S disk module houses the 300 MB 5.25 inch embedded SCSI disk drive with the single-ended SCSI bus. The DM/300S disk module houses the 300 MB 5.25 inch embedded SCSI disk drive with the differential SCSI bus.

The DM/300S and DM/300DS packages are similar except for the single-ended or differential options of the disk. Only the disk device itself is different. Both packages consist of a cabinet containing a power supply and a single 5.25 inch form factor embedded SCSI disk drive. The formatted capacity of the drive is 300 MB, the same as the DM/300E. The DM cabinet is about the same as the disk module for ESDI disks (see Figure 3–6).

DM Cabling for SCSI disks

Cabling to the DM⁄300S or the DM⁄300DS involves the following connectors:

- two 50-pin connectors (one labeled SCSI IN and one labeled SCSI OUT)

- two soft-power jacks

- 50-pin SCSI terminator

- AC power receptacle

The DM⁄300S or the DM⁄300DS are connected to the 3B2 SCSI host adapter or another SCSI tap through a 50-pin SCSI external cable. The rear panel of the DM⁄300S and the DM⁄300DS have two 50-pin connectors, one labeled "SCSI IN" and one labeled "SCSI OUT." The 50-pin SCSI terminator is on the last device attached to the SCSI bus. The soft-power cable connects to the rear of the DM from the 3B2 computer or other DMs or XMs.
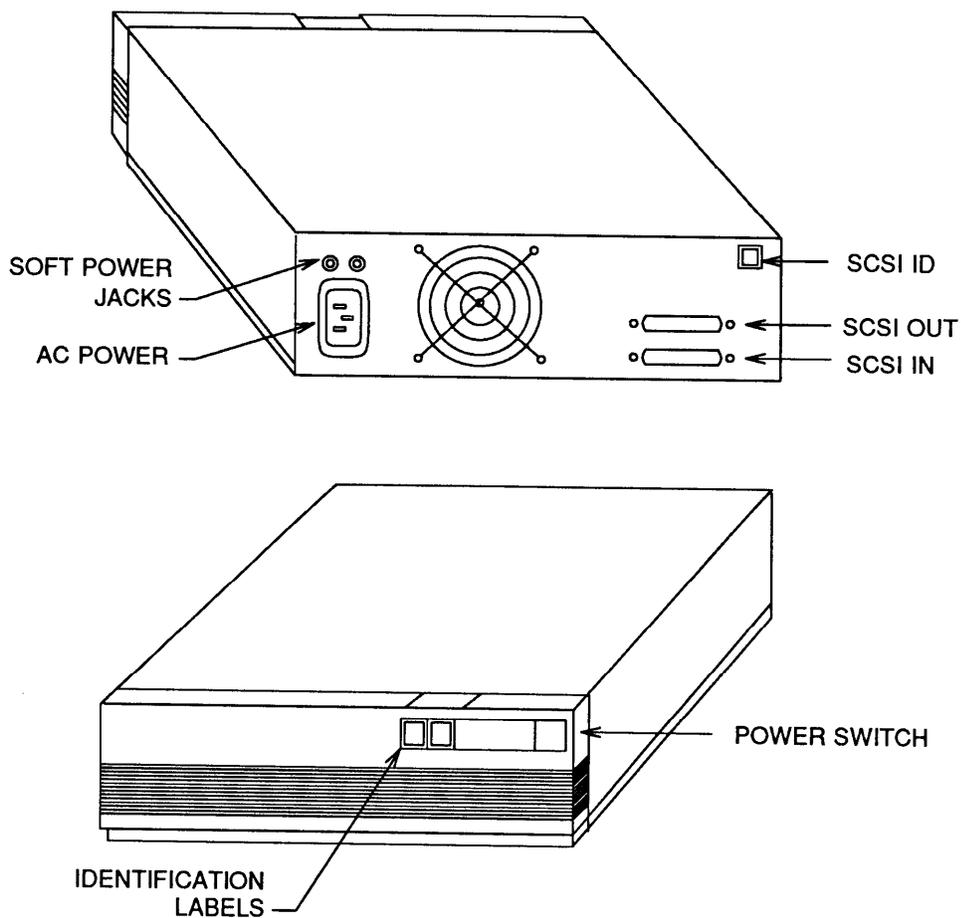
Figure 3-6. **Disk module for SCSI disks with embedded controller**

SCSI Bus Address

The SCSI ID push-button switch on the rear panel of the DM should be set to an appropriate setting for a peripheral device controller (1 through 7). The setting establishes the priority of the DM on the SCSI bus. It is important that the ID for the DM not be duplicated anywhere on the SCSI bus.

SCSI Expansion Module (XM)

SCSI XM is a mass storage SCSI device that contains three hard disk drives in a single cabinet. For example, an XM/900 contains three 300-megabyte drives for a total formatted storage capacity of 900 megabytes. Along with three disk drives, the SCSI XM contains a SCSI target controller. The SCSI XM is supported by the AT&T 3B2 SCSI disk Controller Utilities Software (described in the "Software" section of this chapter).

Figure 3–7 shows the front and rear views of the SCSI XM (XM/900). The front panel contains an area for identification (XM900) and a power indicator. The rear panel of the SCSI XM contains the SCSI connectors, SCSI ID switch, AC power receptacle, and soft-power jacks.

Note that the three drives in the SCSI XM are listed as three separate disks in the System Administration menus (for example: disk2, disk3, disk4).

NOTE: Though physically similar, the SCSI expansion module (SCSI XM) should not be confused with the standard XM cabinet available with the 3B2 computer.
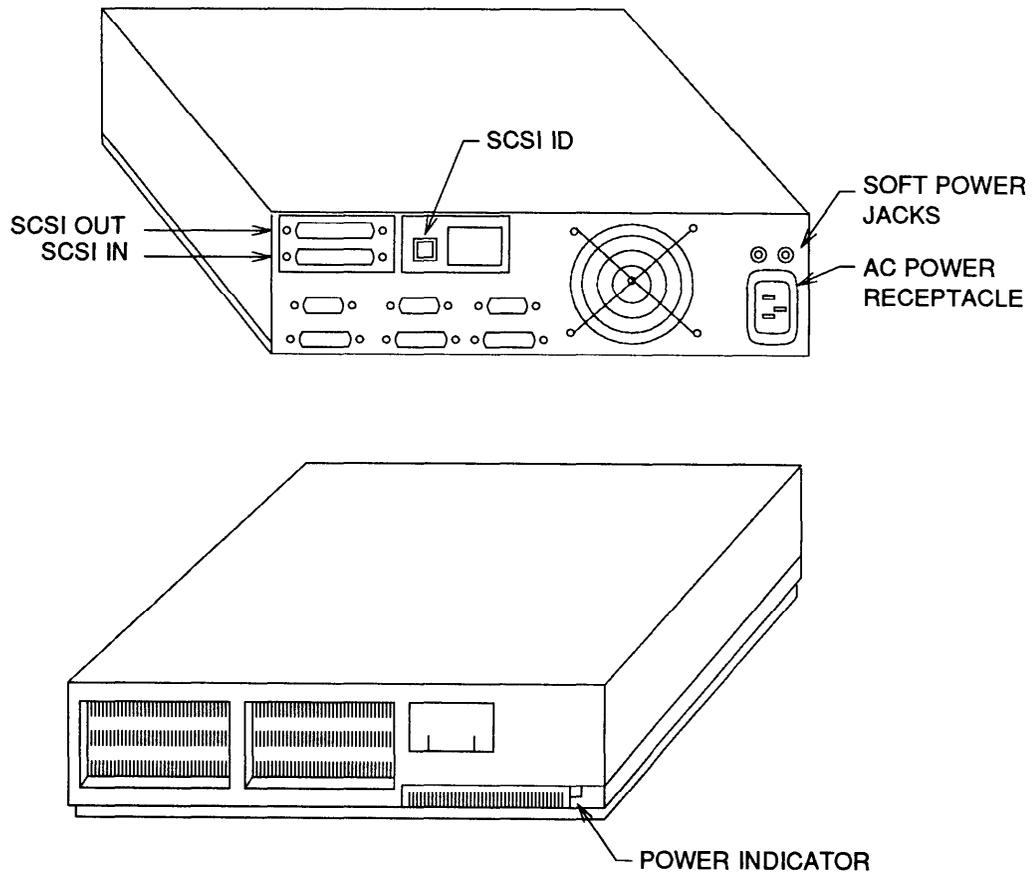
Figure 3–7.   SCSI   expansion   module   (XM/900)

SCSI XM Cabling

Cabling to the SCSI XM (see Figure 3-7) involves the following connectors:

- two 50-pin connectors (SCSI in and out)

- two soft-power jacks

- AC power receptacle

The SCSI bus cable originating at the 3B2 computer host adapter connects to the 50-pin SCSI in connector on the SCSI XM. The SCSI out connector on the SCSI XM contains a SCSI bus terminator or a cable to another device on the SCSI bus.

The soft-power jacks provide power control for the SCSI XM from the 3B2 computer.

Expansion Module SCSI Bus Address

The SCSI ID push-button switch on the rear panel of the SCSI XM should be set to an appropriate setting for a peripheral device controller (1 through 7). This setting establishes the priority of the XM device on the SCSI bus.

SCSI Cartridge Tape Modules (TM/60S and TM/120S)

NOTE. Though physically similar, the SCSI cartridge tape drive should not be confused with the cartridge tape controller (CTC - 23 MB) drive available with the 3B2 computer. The tapes written on these two cartridge tape drives are not compatible and should be kept separate.

⚠ WARNING

If you attempt to write a cartridge tape written on a noncompatible tape drive, you may destroy the information on the tape.

The SCSI cartridge tape module is a mass storage SCSI device that provides removable media capability to the SCSI system by the cartridge tape. The primary purpose of the SCSI cartridge tape module is for backing up and restoring the 3B2 computer file systems.

The SCSI cartridge tape module contains a tape drive, an embedded SCSI controller, and a power supply. The SCSI cartridge tape module is supported by the SCSI Cartridge Tape Utilities.

The TM/60S and TM/120S designate the 60 MB and 120 MB removable media cartridge tape drives, respectively. The TM/120S can read tapes written on the TM/60S. Figure 3–8 shows the front and rear views of the SCSI cartridge tape module (TM/60S - TM120S). The front panel contains recessed label areas for device identification, a tape insertion mechanism, and a power switch. The rear panel of the SCSI cartridge tape module contains the SCSI bus connectors, the SCSI ID switch, an AC power receptacle, and the soft-power jacks.
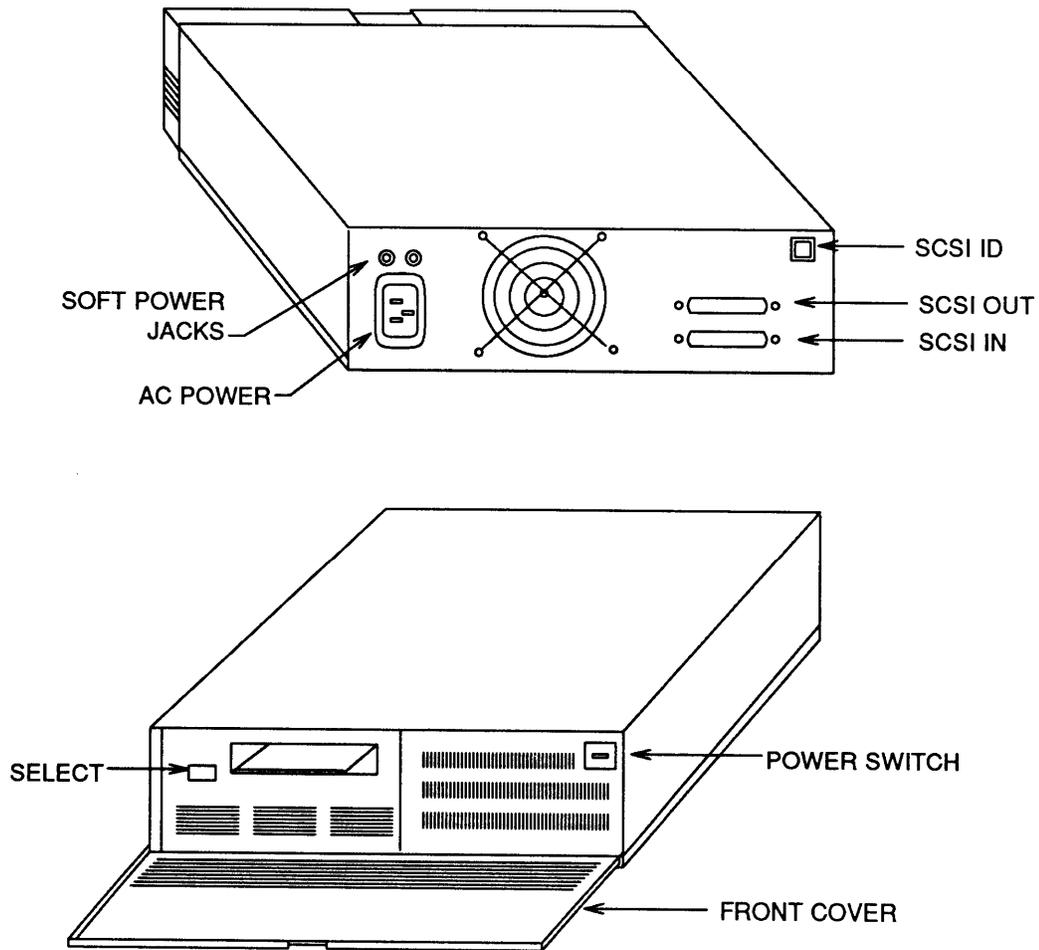
Figure 3–8.   SCSI cartridge tape module (TM/60S and TM/120S)

SCSI Cartridge Tape Cabling

Cabling to the SCSI cartridge tape module (see Figure 3-8) involves the following connectors:

- ■ two 50-pin connectors (SCSI in and out)

- ■ two soft-power jacks

- ■ AC power receptacle

The SCSI bus cable originating at the 3B2 computer host adapter connects to the 50-pin SCSI in connector on the SCSI cartridge tape module. The SCSI out connector contains a SCSI bus terminator or a cable to another device on the SCSI bus.

The soft-power jacks provide power control to the SCSI cartridge tape module from the 3B2 computer.

SCSI Cartridge Tape Module SCSI Bus Address

The SCSI ID push-button switch on the rear panel of the SCSI tape module should be set to an appropriate setting for a peripheral device controller (1 through 7). This setting establishes the priority of this device on the SCSI bus. The SCSI ID for the tape module must not be duplicated anywhere on the SCSI bus.

SCSI Manual 9-Track Tape Drive (KS22762 -KS23113)

The 9-track tape drive is a SCSI mass storage device that provides removable media capability for the 3B2 computer in the form of 1/2-inch magnetic tape reels (maximum tape size is 2400 feet). The 9-track tape drive is installed in a 5-foot floor-standing cabinet. This peripheral device must be the last device on a SCSI bus.

The primary purpose for the 9-track tape drive is to support data transportability with other 3B computers (3B2, 3B5, 3B15, and 3B20) and/or other systems that support an industry standard tape media. This means that data can be written on tape from one 3B computer, and then read back onto the 3B2 computer. A SCSI 9-track tape drive is also used for backing up and restoring file systems.

The 9-track tape drive cabinet contains a tape drive with an embedded SCSI controller. The SCSI 9-track tape drive is supported by the AT&T 3B2 SCSI 9-track Tape Utilities Software (described in the "Software" section of this chapter).

Figure 3-9 shows the front view of the SCSI 9-track tape drive with the front cover open. The front cover shields the magnetic tape and drive mechanism from dust and should be kept closed except when mounting or removing a tape. Controls for the drive can be accessed through the opening in the front cover (see Chapter 7, "3B2 Peripheral Subassemblies").
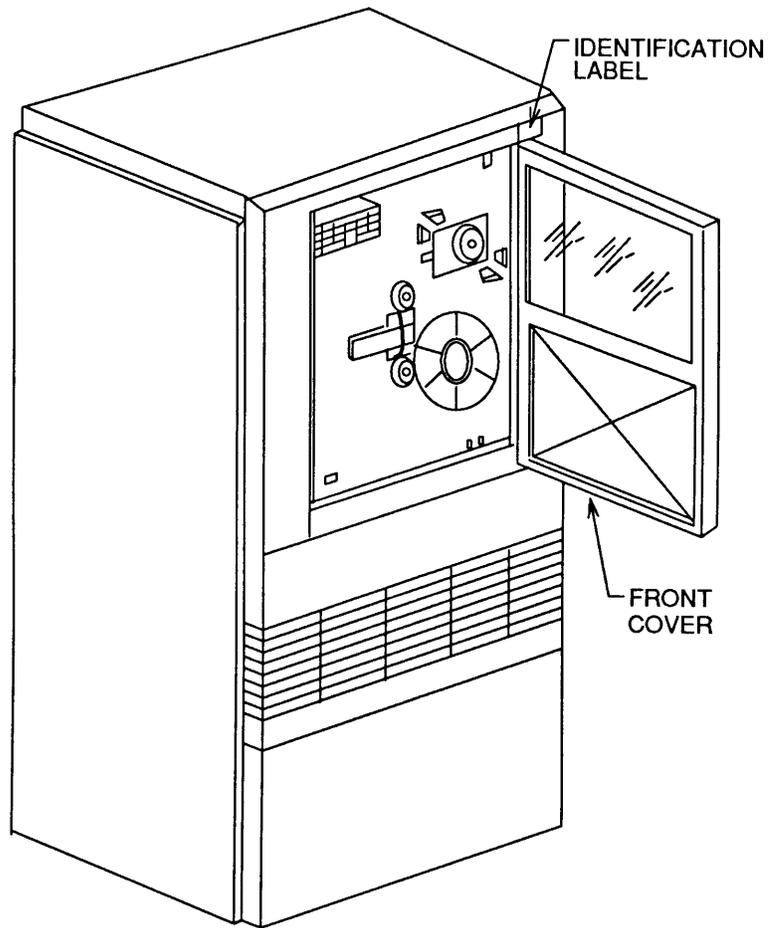
Figure 3–9.   SCSI 9-track tape drive (front view)

Figure 3-10 shows the rear view of the 9-track tape drive. This figure illustrates the location of the SCSI in connector and the AC power cord.
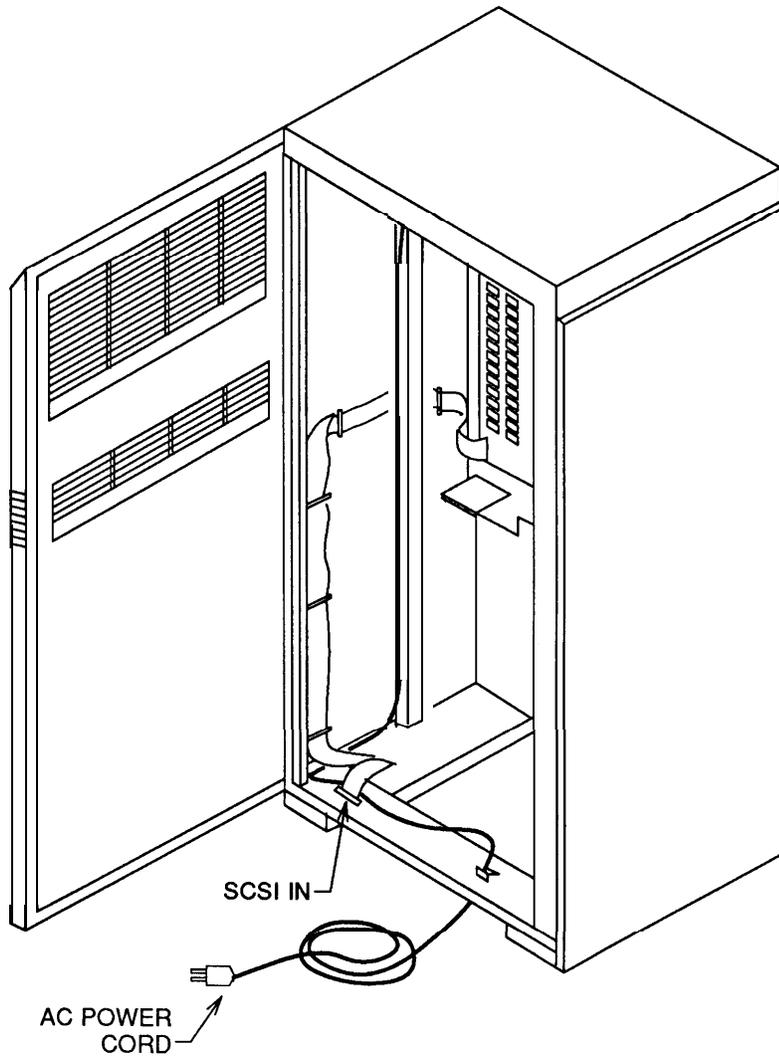
Figure 3–10.   **SCSI 9-track tape drive (rear view)**

9-Track Tape Drive Cabling

Cabling to the 9-track tape drive (Figure 3-10) involves the following connectors:

- one 50-pin connector (SCSI in)

- AC power cord

The SCSI bus cable originating at the 3B2 computer host adapter connects to the 50-pin SCSI in connector on the 9-track tape drive. Since the 9-track tape drive is designed to be the last device on a SCSI bus, a SCSI out connector is not required. The 9-track tape drive has an internal SCSI bus terminator.

9-Track Tape Drive SCSI Bus Address

The SCSI ID of the 9-track tape drive is factory-preset to seven using a DIP switch on the embedded SCSI controller. This ID should not be changed.

Desktop, Autoloading, Dual-Density 9-Track Tape Drive (KS23495)

The desktop, autoloading, dual-density 9-track tape drive can read and write tapes in either 1600 bpi phase encoded (PE) or 6250 bpi group coded recording (GCR) modes with a tape speed of 125 ips. The physical dimensions of the tape unit are 8.75 inches by 19 inches by 26.5 inches and the weight is about 85 pounds (see Figure 3–11). The tape drive is an autoload/autothread device with all setup and control operations performed at the front panel.

Both single-ended and differential SCSI interfaces are offered with the tape drive. The type of interface is determined by the SCSI controller card located at the rear of the cabinet. The interface type is labeled on the rear panel of the tape unit.

9-Track Tape Drive Cabling

Cabling to the 9-track tape drive involves the following connectors:

- 50-pin connector (SCSI IN)

- 50-pin connector (SCSI OUT)

- AC receptacle
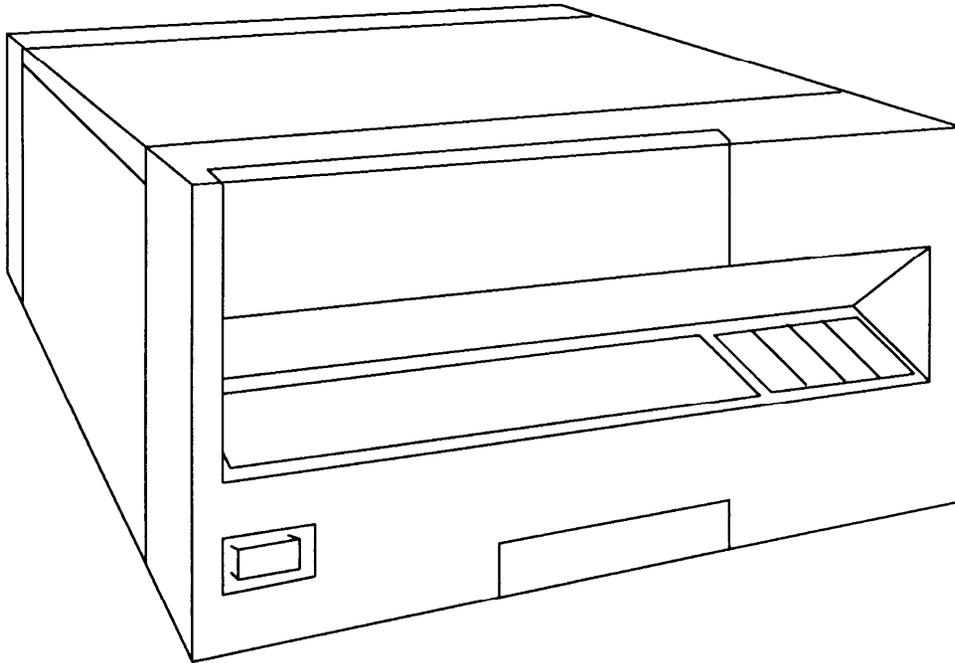
Figure 3–11.   Desk-top autoloading dual density tape drive (KS23495)

SCSI Cables

The SCSI host adapter and all peripheral cabinets are shipped with the appropriate cables and terminators to make connections to the SCSI bus and support devices. The maximum length of the SCSI bus is six meters from terminator to terminator.

⚠ CAUTION

As with any computer data bus, the lengths of the interconnecting cables are critical. Do not make any modifications to or substitutions for the cables that are supplied with SCSI. This may result in data errors, system failure, or equipment damage.

See the *AT&T 3B2 Computer SCSI Installation Manual* for specific cable length information.

If the SCSI bus cables need to be disconnected for any reason, make certain that you reconnect all the cables and terminators properly.

⚠ WARNING

If the connections to the host adapter are not made properly, irreparable equipment damage may occur.

3B2 Computer Peripheral Power Control Unit

The shared peripheral feature of SCSI Release 3 requires soft power control between hosts on a shared bus. This prevents one host computer from controlling all peripheral power, and allows one computer to be shut off without disturbing the power supply of all peripherals.

The peripheral power control unit (PPCU), that is used to distribute power control, is a logical "OR" of multiple soft power inputs (see Figure 3–12). It provides three inputs for 3B2 computer connections and one input for a 3B4000 computer connection. Outputs are provided for 3B2 and 3B4000 computer peripherals. Table 3–2 shows the conditions needed for an active output.

Table 3–2.   PPCU Output

	INPUT		OUTPUT
Front Switch	3B2	304000	
Off	Don't Care	Don't Care	Off
On	Off	Off	Off
On	No cables installed	Don't Care	On
On	Off	On	On
On	On	Off	On
On	On	On	On
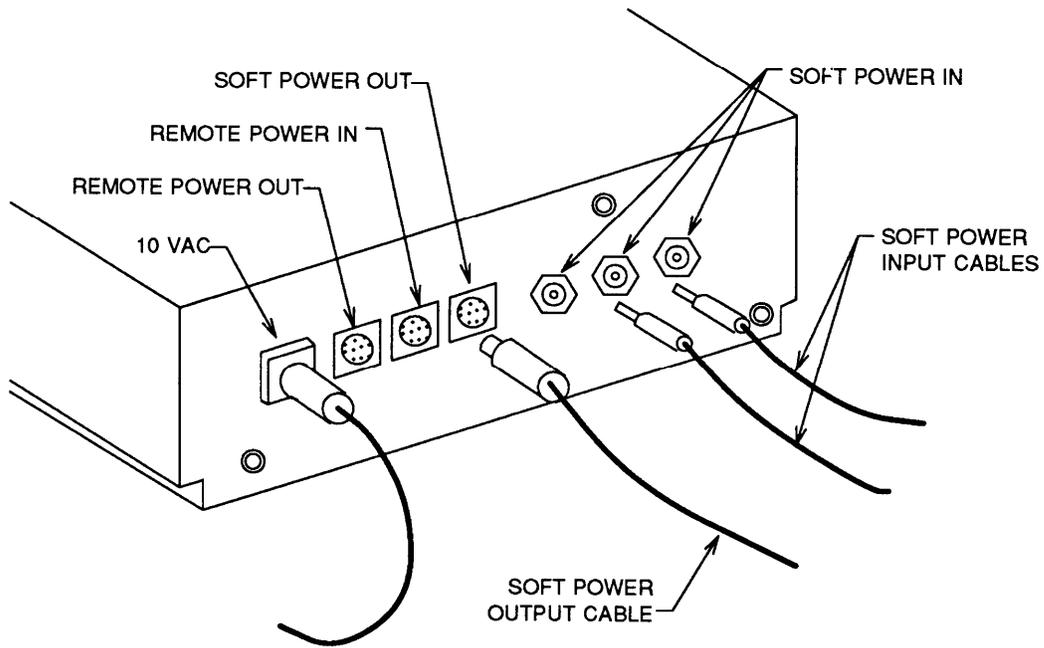
Figure 3–12.   Soft power connections to PPCU

Support Of 3B4000 SCSI Peripherals

Several of the SCSI peripherals for the 3B4000 computer are supported on a 3B2 computer differential SCSI bus. The 570 MB disk drive and the Keystone III® differential 9-track tape drive can be connected to the 3B2 computer HA2 card.

There are some compatibility restrictions with both units depending on their internal firmware version. However, the 3B2 computer supports 570 MB disk drives with firmware revision 8802 or later. The Keystone III 9-track tape drive currently cannot support data transfers with synchronous devices such as the DM/300DS. New firmware may have to be installed in the tape drive to ensure compatibility.

SCSI Software Utilities

Each type of SCSI component comes with the appropriate software to support that component's operation with both UNIX System V and the System Administration menus. New or changed UNIX System V command manual pages are included in the *AT&T 3B2 Computer SCSI Release Notes.* New System Administration commands are discussed in the same document.

Utilities and Dependencies

The use of SCSI on the 3B2 computer requires either UNIX System V Release 2.0.5 (swapping), or UNIX System V Release 3.0 or later (paging) releases. Also, on a Version 2 model, the Extended Core Upgrade Utilities must be installed. These utilities provide the functions necessary to support SCSI self-configuration and other operations.

The SCSI software is comprised of several utilities. Each is used for a particular type of device or peripheral. The following list describes these utilities and some installation dependencies.

Host Adapter Utilities	Provide a communication mechanism between the UNIX operating system and the SCSI host adapter.
Disk Controller Utilities	Support the DCM, SCSI XM, ESDI DM, and SCSI DM external components and the internal disks and disk controller on Version 3 3B2 models. These utilities provide the unique functions required by hard disk drives. Installation requires that the SCSI Host Adapter Utilities be installed first.

Cartridge Tape Utilities

Support the SCSI cartridge tape drives in the SCSI TM units and internal to the Version 3 3B2 models. These utilties provide the specific functions required by the tape drives. They require that the SCSI Host Adapter Utilities be installed first.

9-Track Tape Utilities

Support the SCSI 9-track tape drives. These utilities provide the functions necessary for the 9-track tape drives and embedded controllers. They require that the SCSI Host Adapter Utilities be installed first.

Each utility has gone through several revisions. If possible, the same release of each utility should be installed in the 3B2. Do not, for instance, install release 1.0 of the Host Adapter Utilities with release 3.0 of the Disk Utilities. The hardware supported by each utility also may depend on the release. Release 3.0 or later of the Host Adapter Utilities is needed for the differential SCSI host adapter (HA2). Also, disk drives with embedded SCSI controllers require release 3.0 or later of the Disk Controller Utilities. For more information on compatibility between the hardware and software, refer to the *AT&T 3B2 Computer SCSI Release Notes.*

Power

Each SCSI peripheral module (DCM, DM, TM) is equipped with an intelligent power supply that automatically switches between input voltages of 120 and 240 volts AC for both domestic and international applications. The SCSI XM power supply can be changed through an inspection plate in the top of the supply. The SCSI 9-track tape drive power supply can be changed by reversing a board inside the supply (see the Tape Drive Manual shipped with unit). Both the SCSI XM and 9-track tape drive are ordered with the power supply set to the desired voltage (120 or 240 volts).

As with other peripheral devices, SCSI devices should be connected to a reliable power source.

> ### ⚠ WARNING
> Never remove power from any SCSI device while the system is powered up. This includes removing power by external means or by operating the front-panel power switch. An unexpected loss of power may cause loss of data on a SCSI storage device.

Soft Power

Each of the SCSI hardware components that have soft-power jacks are under power control of the 3B2 computer. This means that when the 3B2 computer is powered up or powered down, the SCSI devices are automatically powered up or down.

Most SCSI devices receive a soft-power signal through rear-panel soft-power jacks that daisy-chain the signals from the 3B2 computer. An exception is the ESDI disk modules, that receives soft-power signals through the 37-pin ESDI control cable from the disk controller module.

> ### ⚠ ' WARNING
> The soft-power jacks on the rear panel of the ESDI disk modules are capped and should not be used. Damage to the 3B2 computer will occur if a soft power cable is connected to a DM/???E.

The SCSI 9-track tape drive cabinet has no soft-power jacks and, therefore, its power supply has to be manually controlled.

Versa Modula Europa (VME)

AT&T offers a Versa Modula Europa (VME) subsystem for the AT&T 3B2 line of computers for sharing peripherals with other compatible machines (see Figure 3–13). The system will only work with the 600, and 700, and 1000 line of the 3B2, because it is a double-width board requiring connection to the buffered microbus (BuBus), that only these machines have. The following is provided by AT&T:

- VME host adapter (HA) that resides in the 3B2.

  This is a double-width card whose left side connects to the BuBus and the right side is used for the additional power requirements of this feature. The HA provides translation between the 3B2's input/output (I/O) bus and the 3B extension bus (XBUS).

- VME system controller (VME SC).

  This board resides in the customer's VME card cage. This card provides translation between the XBUS and the VME bus.

- Installation hardware, ribbon cables, shielded cables, connectors, patch panels, and documentation (see Figure 3-14).

- Software that includes sysadm commands, other UNIX System V commands, and driver software needed to install and operate the VME interface as a subsystem to the host 3B2 computer.

NOTE: The customer is responsible for providing the VME cabinet and card cage. The customer is also responsible for providing the target controllers and support driver software that are to be used in the VME cabinet. For additional information or ordering inquiries, please contact your AT&T account executive, or authorized AT&T representative.

As with other 3B2 add-ons, there are firmware level diagnostics that can be run on the board (through dgmon to try to diagnose any hardware failures with the AT&T supplied hardware).
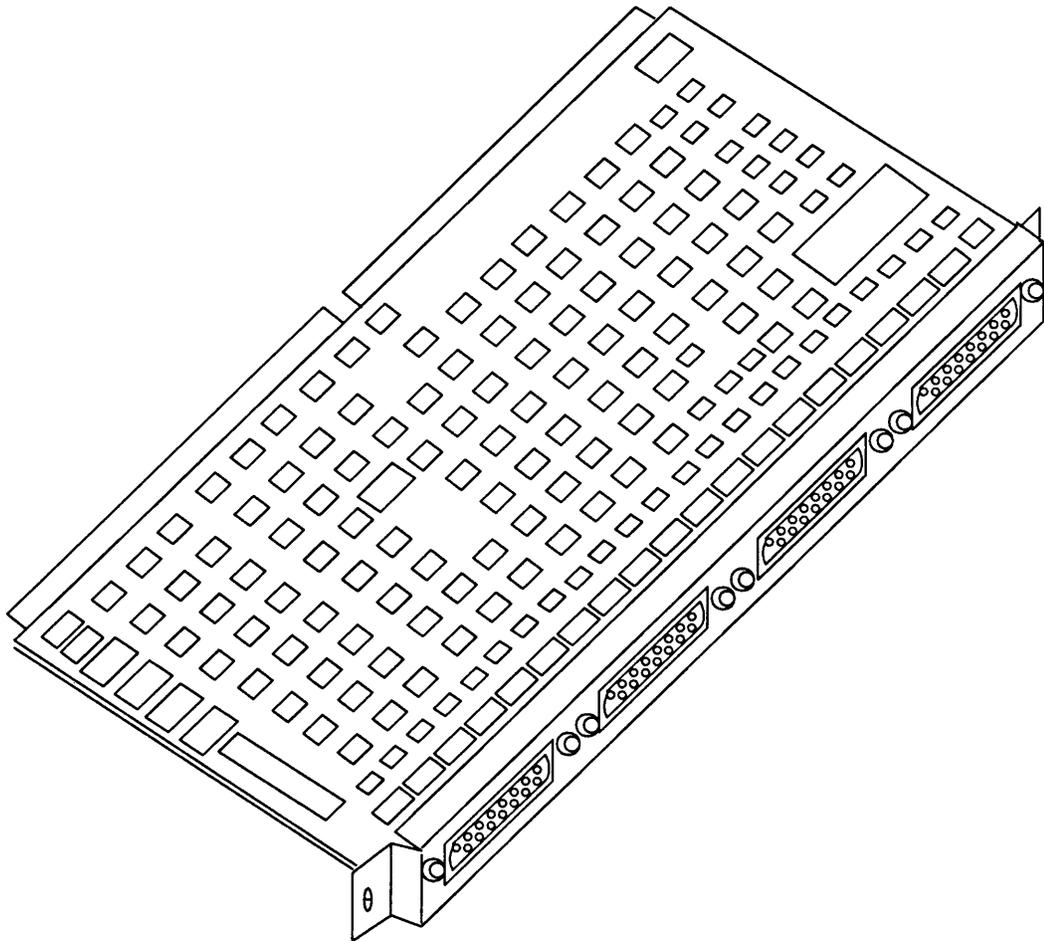
Figure 3-13.   VME host adapter
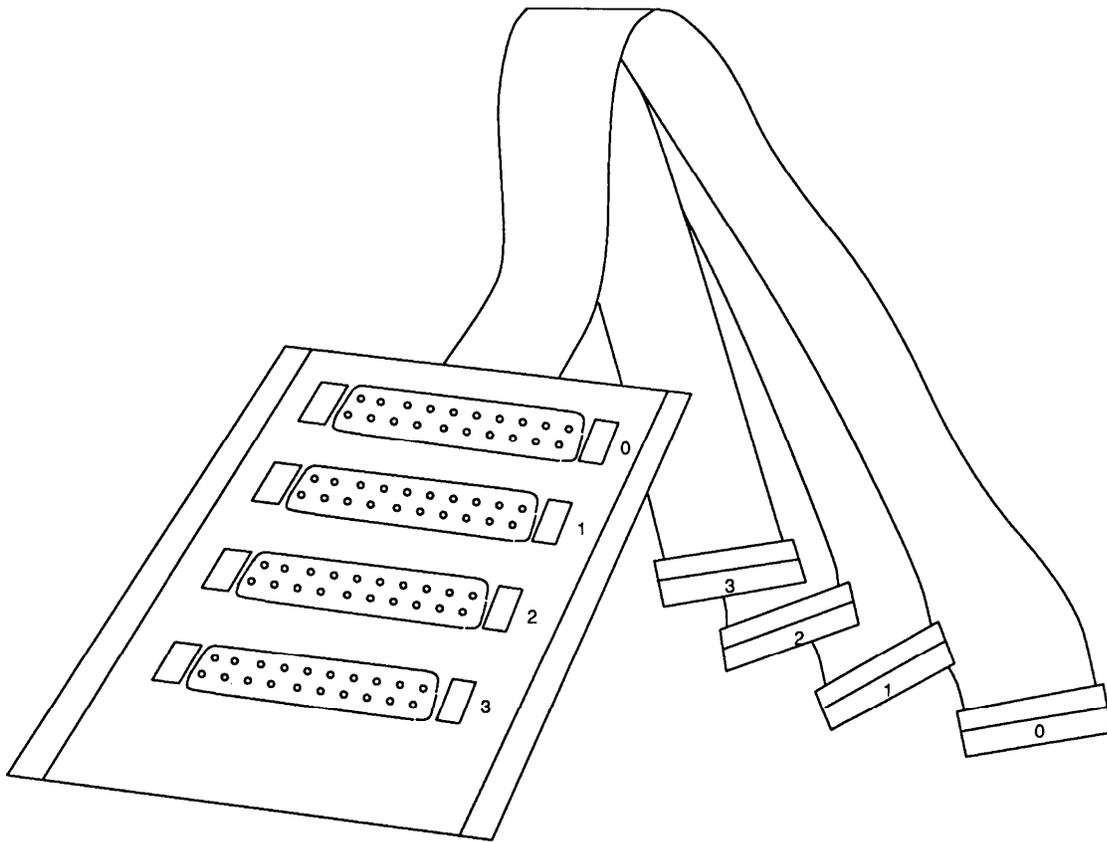
Figure 3−14. **VME patch panel**

Chapter 4: Start-up and Initial Testing

Introduction

This chapter describes procedures for initial operation of the 3B2 computer, including normal set-up procedures and a general test for system functionality.

System Console Set-up

The 3B2 computer is equipped with two modular RS-232-C ports at the rear of the machine. The console set-up procedures are as follows:

1. Connect a terminal/printer connector to one end of a modular cable.

2. Connect the other end of the modular cable to the console jack at the back of the machine.

3. Connect the terminal/printer connector to the back of the console terminal. A gender changer may be required.

4. Set console terminal options to 9600 baud, no parity.

NOTE: The parity setting of the console terminal is important. Parity must be set to "none" or "space." A setting of "even" or "odd" prevents access to firmware mode.

Power-Up and Functionality Check

Execute the following steps for an initial power-up check:

1. Plug the machine into the power source.

2. Power on the console terminal.

3. Located on the rear left side of the cabinet is a momentary contact rocker switch (Models 300, 310, and 400) or on the front, a two-position switch (Model 600, 700, and 1000). The Model 500 has a two position switch on the rear left side. Figure 4-1 shows the 300 and 310 power switch, Figure 4-2 shows the 400 power switch, and Figure 4-3 shows the 600 power switch. Push the switch toward the front of the machine or to the ON position. The computer fan will start, giving audible indication that power has been applied.
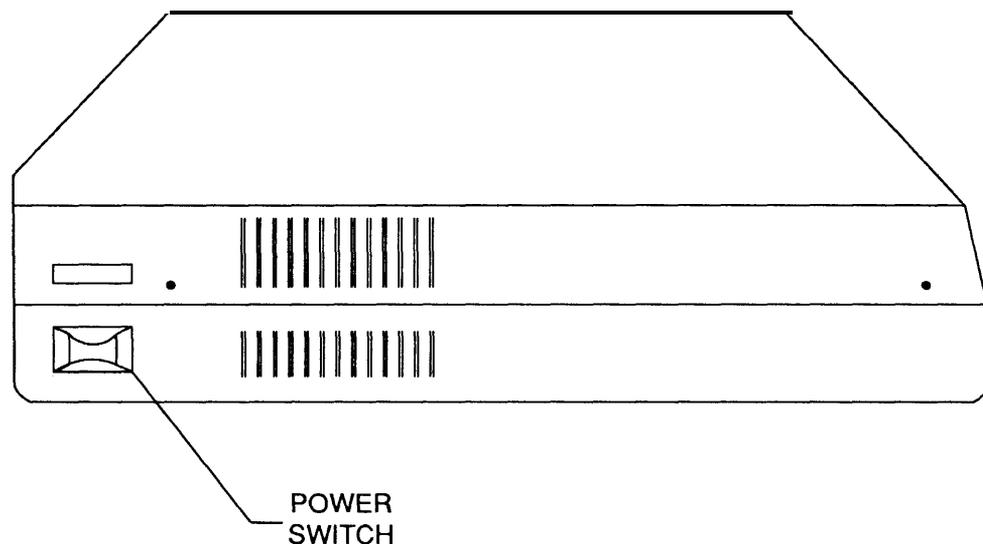
Figure 4–1.   300/310 power switch
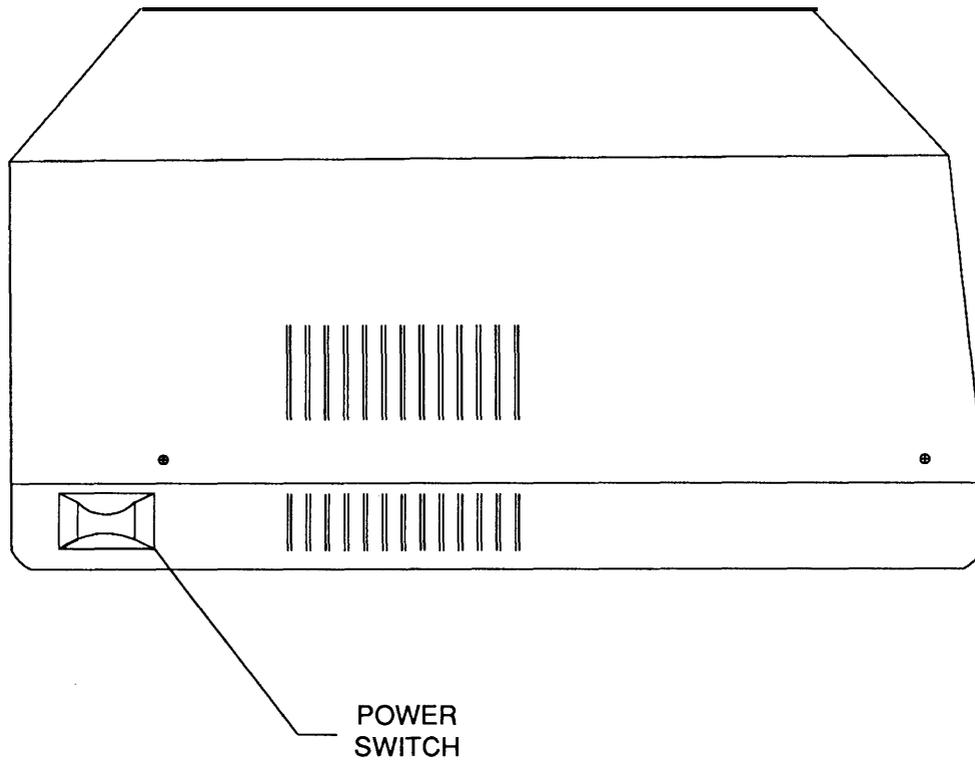
Figure 4-2. 400/500 power switch

RESET SWITCH

On

Standby
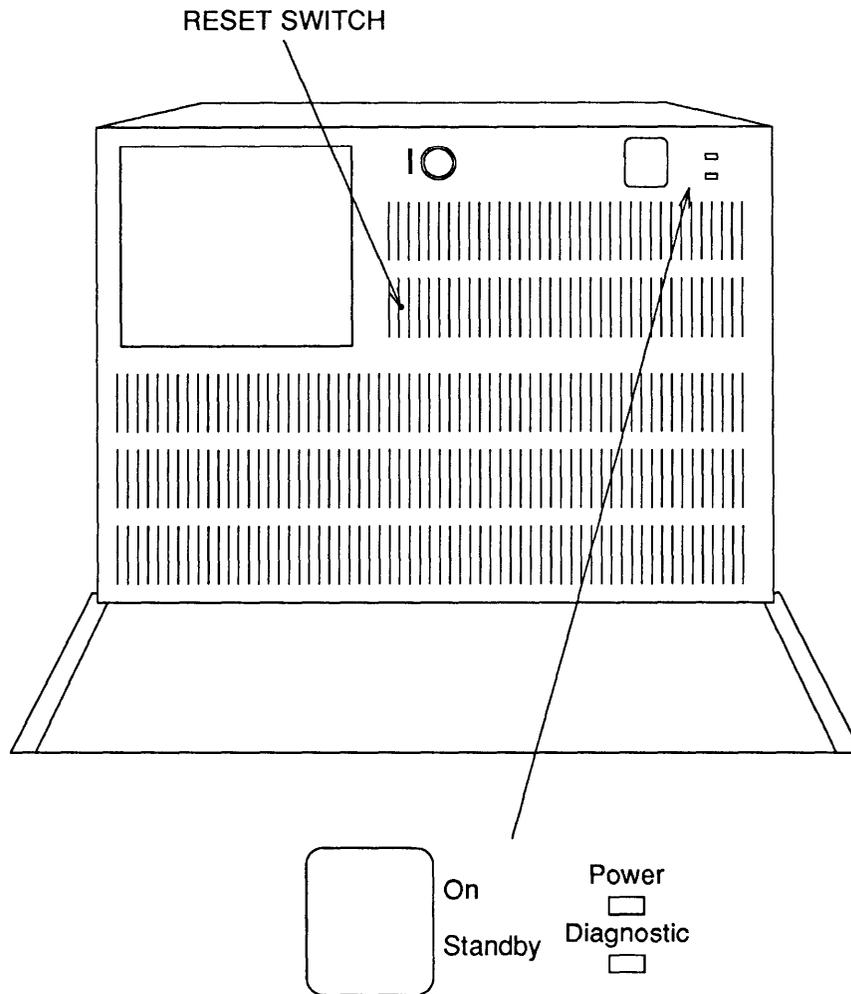
Power

Diagnostic

Figure 4–3.   600/700/1000 power switch

4. A series of messages are reported at the console as the machine goes through its power-up sequence (normal phase diagnostics, sanity checks, disks come up to speed, and booting the UNIX system) and the UNIX system is loaded. The content and length of these messages vary depending on the system configuration. The power-up sequence messages are shown in Figure 4-4.

```
SELF CHECK

DIAGNOSTICS  PASSED
.
.
.
UNIX System V Release ...
.
.
.
The system is coming up. Please wait.
.
.
.
The system is ready.



Console logins.
```

Figure 4–4.   Power-up sequence messages

In response to CONSOLE LOGIN: type in **root.** This completes the power-up check. You can continue with the procedure to check basic system functionality.

5. After logging in as **root** (on the console terminal), move the 8-pin modular (contty port) connector at the back of the machine to the jack adjacent to its present location. From the login prompt, enter any login other than root.

6. After you have successfully logged into each of the ports, you can assume functionality of both system board RS-232-C serial ports.

7. Move the 8-pin modular connector to the original (console) position. Login again as **root.**

The status of the LED indicators and the approximate elapsed time for each system condition during power-up is given in Table 4-1. Deviations from this sequence may indicate problems in system initialization. Larger system configurations may take longer time because of additional hardware. Version 3 Models have the capability to disable "power-up" diagnostics. If disabled, the DIAGNOSTIC. . . PASSED message will not appear.

Table 4-1. LED Indicators (All 3B2 Computer Models)

Elapsed Time(sec)	User Action	Power Light	Diagnostic Light	Console Message(s)	System Condition
<0		OFF	OFF		Power off
0+	Depress POWER switch	ON	ON		Power is on. Disk spin-up begins.
1	—	ON	ON	SELF CHECK	Sanity tests
35	—	ON	ON	DIAGNOSTICS	Diagnostics begun
45	—	ON	OFF	DIAGNOSTICS PASSED	Diagnostics complete; UNIX loading starts.
60	—	ON	OFF	UNIX System V...	UNIX loaded
	—	ON	OFF	The system is ... ...is ready	System coming up
90	—	ON	OFF	Console Login:	System is ready

Utility Floppy Write Check

To check functionality of the floppy drive, execute the following procedures.

1. From the console login prompt, Iogin as **root.**

2. Enter **sysadm** and select the disk management (diskmgmt) menu.

3. Select the format option and follow the prompts to format and verify a floppy diskette. This step is not necessary if a formatted diskette is already available. Make certain the floppy is not write-protected.

4. Select the make file system (makefsys) option and verify the following responses.

    ```
    Insert the medium in the diskette drive.  Press <RETURN> when
    ready.  [q] Enter the label to be put on the medium [?, q]
    ```

5. Enter **test.**

6. The system will respond:

    ```
    Enter the file system name [? q].
    ```

7. Enter **mnt.**

8. The system will respond:

    ```
    Enter the maximum number of files and directories on this
    medium:
             (default 200) [q]:
    ```

9. Press [RETURN] .

10. The system will respond:

    ```
    Building 'mnt' file system on 'test' .  Initializing 'mnt' file
    system.  Do you want to leave '/rent' mounted? [y, n, q, ?]
    ```

11. Enter **y.**

12. The system will respond:

    ```
    Mounted.  DO NOT REMOVE THIS MEDIUM UNTIL IT IS UNMOUNTED!

    Press <RETURN> to see the diskmgmt menu [?, ', q]:
    ```

13. Enter **q** to get back to the root directory.

14. The prompt (#) will appear. Enter **cp unix /rnnt/floptest.** (mnt is the name given to the floppy file system; floptest is the name of the destination file).

Wait for the system to indicate (with the prompt (#) sign) that it has finished copying the file unix.

15. Issue the command **cmp unix /mnt/floptest** to compare what is copied to the floppy and the unix file.

If no hardware or software failures occurred, the computer will print only the prompt sign (#) . If a difference is indicated, then the floppy drive has failed to copy the data exactly. This indicates that the floppy drive failed the write test. Execute the test again. If a second failure occurs, replacement of cables, floppy drive, or system board maybe indicated. Try the floppy drive first.

16. Unmount the floppy by entering **sysadm** and selecting the diskmgmt and umountfsys options.

⚠ WARNING
Never remove a mounted floppy from the floppy drive or damage will result to the diskette.

Chapter 5: System Troubleshooting

Introduction

This chapter describes procedures for isolating problem areas and using firmware and software maintenance tools for all models of the 3B2 computer.

Instructions are given for the following procedures:

- determining system information

- restoring the firmware password

- checking file systems

- restoring the UNIX system from core floppies

- taking a crash dump

In addition, troubleshooting charts are provided for common system malfunctions and error conditions.

System Information

Before you begin any system maintenance work, you should verify information about the 3B2 computer itself. Specifically, you should determine the vintage of the system firmware and software. Although some differences may be inconsequential, others, such as the differences between UNIX system Release 1.0 and 2.0, are significant. For example, the `sysadrn` commands used to accomplish administrative procedures in Release 2.0 are not available in Release 1.0. You may need to determine system information on-site if the customer is unsure of the system's software and hardware. Always try to verify your determination about software and firmware vintage with the customer.

Firmware Mode and Firmware Vintage

To determine firmware vintage, the system must be in the firmware mode. There are several ways to put the 3B2 computer into the firmware mode. Each of the procedures described below depends on the system state at the time that you need to put the system into firmware mode.

1. If the 3B2 computer is just being powered up, the easiest way to enter the firmware mode is to interrupt the power-up sequence before the UNIX system is booted. To do this, wait for the DIAGNOSTICS prompt to appear on the console as the system is coming up. When you see the DIAGNOSTICS prompt, press the [RESET] button immediately. On Models 300,310,400, and 500, the [RESET] button is located at the rear of the computer. On the Models 600, 700, and 1000, the [RESET] button is found through the front grill.

   ⚠ **CAUTION**
   Before pressing the [RESET] button, make sure you know which state the system is in. If UNIX has started booting, file system corruption may occur if the [RESET] button is depressed. Therefore, the only time that the [RESET] button should be used is *immediately* following the DIAGNOSTICS prompt, or when the system is hung and nothing can be initiated at the console.

Press the [RESET] button, and wait for the console to report FIRMWARE MODE. After receiving the FIRMWARE MODE message, enter the appropriate firmware password. The default firmware password is mcp, unless changed by the system administrator. After you enter the firmware password, the system is in the interactive mode, and asks you which program you want to run.

2.   If the system is already running UNIX software, there are two ways to enter firmware mode. In single-user mode, enter init 5. In multi-user mode, enter shutdown –y –g0 –i5. Each of these commands returns the FIRMWARE MODE prompt. After receiving this prompt, enter the appropriate firmware password. The default is mcp. The system will then enter the interactive mode, and ask you which program you want to run.

3.   3. When the system has a problem and the following message appears on the console, you may need to put the system into the firmware mode.

```
SYSTEM FAILURE CONSULT YOUR SYSTEM ADMINISTRATORS GUIDE
```

If you receive this message, enter the appropriate firmware password. The default is mcp. After you enter the firmware password, the system should return to the interactive mode and ask you which program you want to run.

Once the system is in the firmware mode, you can determine the firmware vintage by typing the version command. System information of the following form is reported:

```
CREATED:  (date of creation)
ISSUE:
RELEASE:  (official name for the release)
LOAD:  (development name for the release)
 SERIAL NUMBER:  (unique serial number for this 3B2 computer)
```

Refer to the serial number to determine the firmware vintage. The third digit (from the left) of the serial number is the vintage number. For example, if the serial number 0b1035ff appears, the vintage number is 1. Table 5–1 relates the firmware vintage number to the model of the 3B2 computer for which the firmware is intended.

Table 5-1.   Firmware Vintage

Vintage Number	3B2 Computer Model Number
1	300
3	400/400S60
7	500/600/700/1000
9	310

Software Version

The release number of the UNIX operating system that is running on the 3B2 computer is reported both when the UNIX system is booted, and when users log onto the system. An example is:

```
UNIX System V Release 2 .0.4 3B2 Computer Version 2
```

Once you are logged on, you can recheck the software release of the system using the `uname -a` command.

Disk Partition Information

Information on hard disk partitioning is available on-line. After the UNIX system is booted, use the `harddisk` menu available under `sysadm diskmgmt.` The subcommands in the `harddisk` menu provide functions for using hard disks. For each hard disk, the disk can be partitioned with default partitioning or the current disk partitioning can be displayed.

Trouble Analysis

This section outlines some common system failures and describes possible causes and solutions. Problems related to system power-up, hard disks, flashing LED indicators, and firmware error messages are reviewed.

Troubleshooting Charts

Five troubleshooting charts are presented:

- power-up troubleshooting (Models 300, 310, and 400) (see Figure 5-1)

- power-up troubleshooting (Model 600) (see Figure 5-2)

- general power-up routine (see Figure 5-3)

- firmware messages (see Table 5-2)

- other messages and conditions (see Table 5-3)

⚠ CAUTION
Before handling any circuit board or feature card, see Appendix A, "Handling Circuit Boards," for important safety and operational considerations.

| While applying power, does the system power up? | → | See the power section of this chapter. |

↓ YES

| Is there a console message? | NO → | Check LED on front of unit and resolve using the <u>Error Message information.</u> |

↓ YES

| Is there a "SELF CHECK" message on the console? | NO → | Is there a firmware error message on the console? | NO → | Garbled message. Check terminal settings. |

↓ YES (from firmware error box)

| Look up message in this chapter and repair. |

↓ YES

| Is "DIAGNOSTICS" on the console? | NO → | Is there a firmware error message on the console? | NO → | System hung. Resolve using Error Message information. |

↓ YES (from firmware error box)

| Check message in this chapter and repair. |

↓ YES

| Is "PASSED" printed after "DIAGNOSTICS"? | NO → | Enter DGMON and determine which diagnostic is failing. Check message information in <u>this chapter and repair.</u> |

↓ YES

| Is the UNIX message on the console? | NO → | Firmware error message. Check message information and repair. |

↓ YES

| Is the "CONSOLE LOGIN" message on the console? | NO → | Data Terminal Ready (DTR) is possibly missing from the terminal. |

↓ YES

| Operating System is intact. Basic hardware checks pass. |

Figure 5-1.   Power-up troubleshooting (Models 300/310/400)

After applying power, does the system stay on?	NO →	Does power stay on for over 1 second?	NO →	See the power section of this chapter

YES ↓   YES ↓

Does power stay on for over 1 minute?	NO →	The fan or the thermal sensor is disconnected or defective

YES ↓

Is there a shutdown message on the console?	NO →	Replace the power supply, then the system board

YES ↓

Look up message in this chapter and repair.

Is there a console message?	NO →	Check LED on front of unit and resolve using the Error Message information.

YES ↓

Is there a "SELF CHECK" message on the console?	NO →	Is there a firmware error message on the console?	NO →	Garbled message. Check terminal settings.

YES ↓   YES ↓

Look up message in this chapter and repair.

Is "DIAGNOSTICS" on the console?	NO →	Is there a firmware error message on the console?	NO →	System hung. Resolve using Error Message information.

YES ↓   YES ↓

Look up the message in this chapter and repair.

Is "PASSED" printed after "DIAGNOSTICS"?	NO →	Enter DGMON and resolve the problem.

YES ↓

Is the UNIX message on the console?	NO →	Firmware error message. Look up and repair.

YES ↓

Is the "CONSOLE LOGIN" message on the console?	NO →	Data Terminal Ready (DTR) is possibly missing from the terminal.

YES ↓

Basic hardware checks pass. Essential software is intact.

Figure 5-2.   Power-up troubleshooting (Model 600)

Figure 5-3.   Power-up routine (all models)

Table 5-2. Troubleshooting - Firmware Error Messages

Messages	Problem Symptoms	Possible Causes/Solutions
1-01 NVRAM SANITY FAILURE		Check NVRAM backup battery. If it's not OK, replace it. Run diagnostics phase 9 for NVRAM. If the diagnostic fails, replace the system board.
1-02 DISK SANITY FAILURE		Run fixdisk from 3B2 Computer Maintenance Utilities. Run straight cables from system board to hard disk. (Eliminate disk access panel.) If system works with straight cables, replace disk cables between access panel, SIP, or access panel itself. Run diagnostics from floppy and see if the system board passes any disk tests. Replace system board only if the test for disk controller fails.
1-03 UNEXPECTED FAULT		Try to load a known good floppy to see if the floppy drive is functional. Then try to load diagnostics from floppy to locate the problem. Suspect memory, and exchange first memory board.
1-04 UNEXPECTED INTERRUPT		Try to run diagnostics from floppy to locate the problem (usually caused by system board or memory). Swap memory first, then system board.

(continued)

Table 5-2.   Troubleshooting - Firmware Error Messages *(continued)*

Messages	Problem Symptoms	Possible Causes/Solutions
1-05 SELF CONFIGURATION FAILURE		Use the firmware `edt` command to see if the equipped device table is different from actual system configuration. Remove all cards from backplane and reboot. If system boots, put the cards back in one at a time to determine which card is bad. If no cards are present and system still has trouble, replace backplane or system board.
1-06 BOOT FAILURE (from hard disk boot)		Use diagnostics on floppy to see if the system board and hard disk are functional. If so, try to do a partial restore. If that fails, replace hardware until a partial restore is possible (disk drive, system board, backplane).
(from floppy disk boot)		Try a new diskette. Try to replace the floppy drive and system board until diagnostics on floppy or first core floppy will boot. Hard disk is probably not defective.
1-07 FLOPPY KEY CREATE FAILURE		Check to see if the floppy is write protected or was not formatted properly. Format with the `verify` command. Run floppy diagnostics to test the floppy drive.

(continued)

Table 5-2. Troubleshooting - Firmware Error Messages *(continued)*

Messages	Problem Symptoms	Possible Causes/Solutions
1-08 MEMORY TEST FAILURE		Check the first memory board and replace it. (Check one board at a time.) If the problem recurs, replace the system board.
1-09 DISK FORMAT NOT COMPATIBLE WITH SYSTEM		Formatting of the hard disk with the Release 1.1 3B2 Computer Maintenance Utilities is needed to make the hard disk work with the system. The disk has the old release of the hard disk format and will not work with the current system.
2-01 NVRAM SANITY FAILURE DEFAULT VALUES ASSUMED		Check NVRAM backup battery. if it's not OK, replace it. Run diagnostics phase 9 for NVRAM. If the diagnostic fails, replace the system board.
2-02 NO LOAD DEVICE IN SLOT *n*		Request proper boot device. If the proper device was selected, boot dgmon from a diagnostic floppy or the 3B2 Computer Maintenance Utilities floppy and investigate the problem.
2-03 UNEXPECTED FAULT		Try to load a known good floppy to see if the floppy drive is functional. Then try to load diagnostics from floppy to locate the problem. Suspect memory, and exchange first memory board.

(continued)

Table 5--2. Troubleshooting - Firmware Error Messages *(continued)*

Messages	Problem Symptoms	Possible Causes/Solutions
2-04 UNEXPECTED INTERRUPT		Try to run diagnostics from floppy to locate the problem (usually caused by system board or memory). Swap memory first, then system board.
2-05 SELF-CONFIGURATION FAILURE		Use the firmware `edt` command to see if the equipped device table is different from actual system configuration. Remove all cards from backplane and reboot. If system boots, put the cards back in one at a time to determine which card is bad. If no cards are present and system still has trouble, replace backplane or system board.
2-06 BOOT FAILURE		Use diagnostics on floppy to see if the system board and hard disk are functional. If so, try to do a partial restore. If that fails, replace hardware until a partial restore is possible (disk drive, system board, backplane).
2-07 FLOPPY KEY CREATE FAILURE		Check to see if the floppy is write protected or was not formatted properly. Format with the `verify` command. Run floppy diagnostics to test the floppy drive.

(continued)

Table 5-2. Troubleshooting - Firmware Error Messages *(continued)*

Messages	Problem Symptoms	Possible Causes/Solutions
2-08 MEMORY TEST FAILURE		Check the first memory board and replace it. (Check one board at a time.) If the problem recurs, replace the system board.
2-09 UNEXPECTED SANITY TIME-OUT		A non-maskable interrupt caused by the system Sanity Timer bit in the CSER is being set. Run diagnostics (if possible) to determine the problem. Remove the I/O feature boards, Vcache, and BuBus boards if necessary. If the problem still persists, replace the system board.
2-10 UNEXPECTED ABORT		A non-maskable interrupt was caused by the abort bit being set in the CSER without EDEN proms. Do not use the abort feature without EDEN proms. If the abort feature is not being used, replace the system board, and then the backplane.
2-11 MEMORY CONFIGURATION OF *n* MEGABYTES UNSUPPORTED MAXIMUM IS 16 MEGABYTES		It is currently not possible to exceed 16 megabytes. If larger memory boards are developed in the future, do not exceed this requirement.

Table 5-3. Troubleshooting - Other Errors and Conditions

Messages	Problem Symptoms	Possible Causes/Solutions
FIRMWARE MODE or SYSTEM FAILURE	Forgotten FIRMWARE password	Turn off 3B2 computer, insert floppy key, turn on. Disconnect battery to erase NVRAM contents. Password defaults to `mcp`.
Console login:	Forgotten root password	Do partial restore from firmware.
No Message	System loses time	Replace battery. If problem persists, replace system board.
No Message	System won't power down	Attach a terminal to system console and power terminal on. As last resort, depress reset switch. When FIRMWARE MODE message appears on console, toggle power switch off.
No Message	Amber/red LED pulsing 1 time	Unknown problem. The console may be wired incorrectly or there may be other trouble not revealed by LED pulses. Investigate further using diagnostics and the powerup troubleshooting chart given earlier.
No Message	Amber/red LED pulsing 2 times	Problem with the CPU.
No Message	Amber/red LED pulsing 3 times	Problem with firmware (ROMs).

(continued)

Table 5-3. Troubleshooting - Other Errors and Conditions *(continued)*

Messages	Problem Symptoms	Possible Causes/Solutions
No Message	Amber/red LED pulsing 4 times	Problem with RAM. Possible bent pins in backplane (usually where system boards plug into backplane), defective I/O boards, or any hardware failure that may cause a problem with memory access.
No Message	Amber/red LED pulsing 5 times	Problem with the DUART.
No Message	Both green and amber/red LEDs on	Reseat memory boards, I/O backplane. Remove feature cards. Try to reboot. Disconnect battery and reconnect, then reboot. Swap first memory card.
Possible message	Green LED on, amber/red LED off after short time	Check to see that the console is connected correctly. It should have Term/Printer Adapter hooked to the MODEM port. Terminals other than AT&T Teletype may not supply DTR as a positive 12 volts. Use RS-232-C breakout box to verify, or jumper pins 8 to 20 in the Term/Printer Adapter.
SELF CHECK	System hangs	Reseat all cards and reboot. Remove the cards from the backplane and reboot. Reseat the backplane after cleaning contacts. Swap out first memory card. Disconnect and reconnect battery to clear out NVRAM. Reseat EPROMs.

(continued)

Table 5-3.   Troubleshooting - Other Errors and Conditions *(continued)*

Messages	Problem Symptoms	Possible Causes/Solutions
NOTICE: Hard Disk Errors	Intermittent hard disk errors when booting	Check the SIP on the disk access panel (300/310). Also, the cables for the hard disk should be suspected if the disk drive is believed to be functional. Put in new hard disk and run diagnostics from floppy to test system board and cables.
WARNING: Thermal overload shutdown	System powers down after a maximum of 1 minute.	Internal temperature is >125 degrees F, or the thermal sensor is bad or has become disconnected. The power supply requests an express shutdown from the system board. If the shutdown hasn't completed after 1 minute, power is removed anyway. Check airflow and the thermal sensor.
THERMAL SHUTDOWN	System powers down.	A fan failure has occurred. Check for blade obstruction. Replace fan if defective.
No Message	System powers down after 1 minute.	A fan or the thermal sensor is defective or has become disconnected.
NOTICE: Soft power switch shutdown	System executes a fast, but clean shutdown.	The power switch has moved to the Standby position. This starts an express shutdown. Users are not notified, but file system sanity is maintained.

System Will Not Power-up

The fan and LED indicators should show that the 3B2 computer is receiving line voltage. You may want to check the line voltage to ensure that the required 110 VAC (220 VAC) is present and available as input to the power supply.

All power supply models in the 3B2 computer line operate on the same basic principle. When the power switch is thrown to the ON position, power is supplied to the load for about a half second. During this time, the system board comes on line and supplies +5VDC on the PWRON1 lead, running back to the power supply. This signal latches the power supply to the on position. As long as this signal is present, the power will remain on (unless there is a voltage regulation or thermal problem). If the system board does not supply +5VDC on the PWRON1 lead before the supply times out, power will be removed. Should this occur, the problem could be either a power supply voltage problem, or a bad system board.

The power supply voltages can be checked by the following procedure:

1. Power down the 3B2 computer and remove the cover.

2. Remove the power supply header connector from the system board (Models 300, 310, and 400) or the backplane (Models 500,600,700, and 1000).

3. The PWRON1 lead must be jumped to +5VDC. On Models 300, 310, and 400, use any of pins 12-15 on the same connector. On Models 500, 600, 700, and 1000, use any of the pins on either of the backplane power connectors.

4. Turn the system on. If the power latches on, the voltages can be checked (see proper subassembly chapter for pinouts). If not, replace the power supply.

NOTE: Using this procedure, the fans and thermal sensor must be connected on the 3B2 Models 600, 700, and 1000. If not, the power will be dropped after 1 minute. There must also be a load connected to the supply or the voltages cannot be realistically measured.

LED Announced Sanity Failures

Sanity failures that occur during system initialization are normally indicated through a flashing amber (red on older models) LED on the front panel of the computer. It is possible that a processor sanity error will prevent the LED from flashing, the LED may indicate an error condition that really does not exist, or the system may be incapable of giving an LED indication.

As a first attempt to clear a sanity failure, push down firmly on all socketed components on the system board. Remove the memory board(s), and I/O backplane. Reseat the boards firmly. If the problem recurs, replace the system board. If a different source for the problem is indicated by a firmware error message or diagnostic failure, try to fix that related problem before replacing the system board.

Error Messages

Error messages generated by system firmware and software are primary sources of information about an error or a fault condition. The system console displays various error messages for your information during trouble situations. Types of error messages are as follows:

- firmware error messages

    Firmware error messages are displayed on the console when the system is not running UNIX software. Diagnostic error messages, that are returned directly from the diagnostic monitor control program, are an exception. Firmware error messages are listed and explained in the next section.

- diagnostic monitor error messages

    The diagnostic monitor provides the ability to execute hardware tests on the 3B2 computer. If a problem occurs while using the diagnostic control program, an error message is displayed on the console terminal. See Appendix C, "Using 3B2 Computer Maintenance Utilities," for more information on diagnostic error messages.

- boot error messages

    Boot firmware provides the ability to execute a number of disk-resident programs, including the diagnostic monitor, the UNIX operating system, and other utilities. Boot errors may appear on the console while attempting to execute these programs. Boot errors are not covered in the document. For descriptions of and corrective actions for boot error messages, see the *AT&T 3B2 Computer Error Message Reference Manual.*

- autopump error messages

    Autopump is a feature that detects and automatically downloads firmware to feature cards mounted in the 3B2 computer backplane slots during the power up sequence. Autopump error messages appear on the console terminal when a phase in the autopump sequence fails. Although these errors are not fatal to the entire system, the affected card will not be operational. Therefore, normal

services provided by the device will not be accessible. Autopump error messages are not covered in this document. For descriptions of and corrective actions for autopump error messages, see the *AT&T 3B2 Computer Error Message Reference Manual.*

■   UNIX system error messages

UNIX system error messages are divided into three severity classes: NOTICE, WARNING, and PANIC. When an error message is displayed, its severity class is also displayed. A description of each severity class is given below.

NOTICE: Error messages provide information on system status. If these messages are monitored, they can sometimes be used to anticipate and prevent problems before they occur.

WARNING: Error messages indicate that the UNIX system may stop functioning if corrective action is not taken.

PANIC: Error messages indicate that if a particular PANIC error message occurs repeatedly (or predictably), contact software support personnel.

Error messages indicate a problem severe enough that the UNIX system must stop. The cause is usually a hardware problem or a kernel software problem. The UNIX system generally restarts itself with no user intervention required, although any programs running when the PANIC occurred will be lost. Some file systems may also be corrupted, but the UNIX system will check and possibly correct this when it restarts.

Hard Disk Problems (Models 300/310 Only)

Hard disk failures are frequently caused by cabling problems. The cables from the hard disk to the system board should be suspected. Use a test set that runs above the card cage in place of the suspected cables. You can verify that errors are eliminated by removing the expansion module cables and the disk access panel from the system. Disconnect the cables from the hard disk. Disconnect the 20- and 34-pin cables that go to the hard disk from the system board. Connect the test cables between the system board and the hard disk. If the hard disk is now functional, try to determine if the cables, the access panel, or the terminating SIP is bad by swapping them one at a time.

The XM terminating SIP is located on the interface panel. If this is in the wrong socket, it causes intermittent hard drive errors. Looking from the top, the terminating resistor must be in the right-hand (side) socket if there is no XM with hard disk, and on the left if there is one. (The left socket is simply a "holder," see Figure 5-4).

The terminating SIP should be suspected if the drive is functional with the test cables in place. If a new SIP does not resolve the problem, replace the disk access panel. Finally, the cables should be swapped.

If the second hard disk is suspected of being defective, test it in the 3B2 computer by using the test cables. It can be hooked to the system board as drive 0. Remember to change the drive ID plug to 0 before testing and back to 1 when testing is completed.
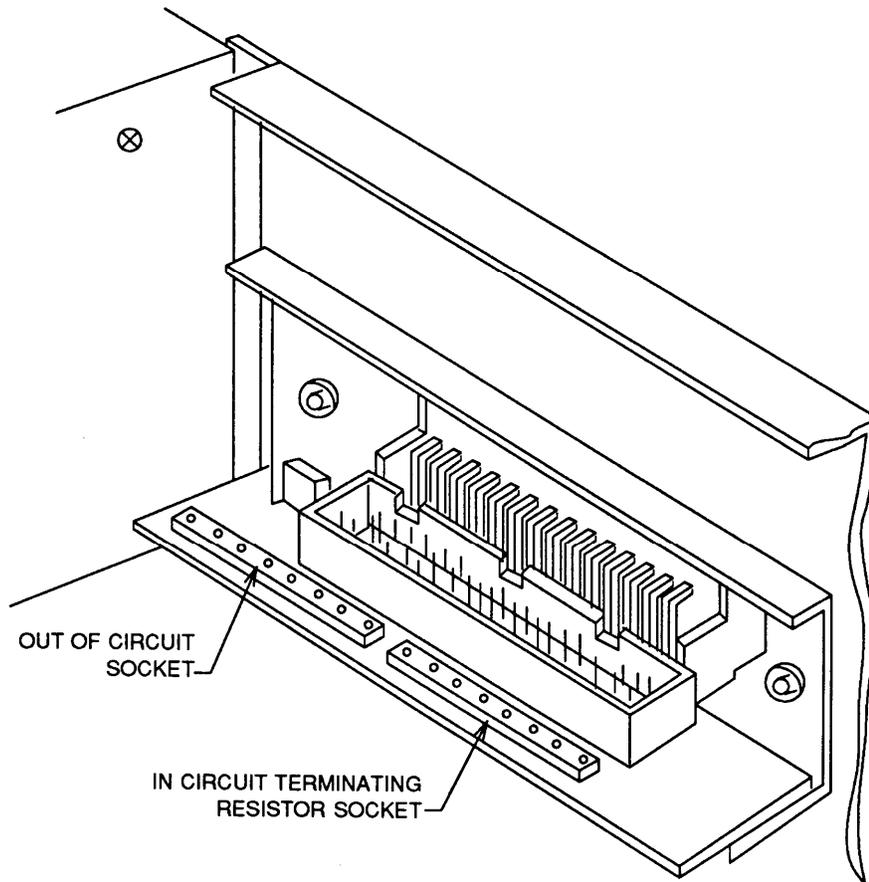
Figure 5-4. **Disk access panel terminating SIP resistor**

Software Troubleshooting

Although software troubleshooting is largely done by system administrators and programmers, there are times when maintenance personnel may need to determine or fix software problems. For example, if you suspect that a maintenance procedure has caused software corruption, you may need to manually check file systems using the `fsck` (1M) command. If the system begins to crash frequently with panic error messages, you may want to initiate a crash dump so that a software expert can examine the operating system contents.

File System Checks

The `fsck(1M)` command can be used to check for file system damage. This command can be run on any file system (`root`, `/usr`, and all other User file systems). The `fsck` command can also correct many file system problems that may be preventing proper file system operation. Use the following procedure to run a file system check:

1. Enter **shutdown** **-y -g0 -i1.**

   This procedure brings the system to the single-user state.

2. Enter **fsck -b fsdevice.**

   where `fsdevice` is the name of the special device file associated with the file system to be checked. Cat the file `/etc/fstab` for the names of the available file systems. In these entries, replace `dsk` with `rdsk`.

3. If no corruption is found, you can return the system to the multi-user mode (`init 2`) after the `fsck` is complete.

4. If corruption is detected, the system will prompt you to make changes, for example, it may ask you: RECONNECT?.

A check of a hard disk file system should run straight through and return the UNIX prompt (#) at completion. The system will respond with several reports as it checks various characteristics of a hard disk file system.

If a file system has suffered major darnage, the most obvious solution is to restore it from backup. Always check with the customer first, and be sure that the most recent backups are used. If the `root` or `/usr` file systems are corrupted, you may need to restore them from the core UNIX system floppies. Always be sure to recheck file systems after any restore procedure.

Restoring Core UNIX System

The following procedure explains how to restore the core UNIX system from the Essential Utilities:

1. Use the `sysadm firmware` command to put the system into the firmware mode. The `shutdown -y -i5 -g0` command can also be used.

2. Type in the firmware password. The default is `mcp`.

3. When prompted for ENTER NAME OF PROGRAM TO EXECUTE, enter **unix.**

4. Place the first core UNIX diskette in the floppy. For Version 3 models, skip to step 9.

5. When prompted for ENTER LOAD DEVICE, select the floppy disk. Use the proper numerical designation.

6. The next option is for choosing the type of restore: partial or full. Full restore returns the disk to its original distribution state. Partial restore leaves files added to /usr intact. If the files are backed up and software corruption looks extensive, a full restore may be necessary.

7. Follow the screen prompts for all five diskettes.

8. The backed-up data may then be restored by following the `sysadm softwaremgmt` menus. For Models 300, 310, 400, and 400S60, stop here.

9. For Version 3 models, insert the core UNIX tape into the cartridge tape drive.

10. When prompted for ENTER LOAD DEVICE, select **SCSI.**

11. When prompted for SPECIFIC SCSI DEVICE, select **tape.**

12. The next option is for choosing the type of restore: partial or full. Full restore returns the system to its basic operating state. Partial restore leaves files added to /usr intact. If the files are backed up and software corruption looks extensive, full restore is recommended.

13. Follow the screen prompts until the tape is loaded.

14. The backed-up data may then be restored by following the `sysadm softwaremgmt` menus.

For a more detailed description of file system checks, see the *AT&T 3B2 Computer UNIX System V System Administrator's Guide.*

Crash Dumps

When the 3B2 computer experiences several panic error messages, a crash dump should be done to dump the operating system image to floppy disks for subsequent analysis. The `sysdump` command executes from the firmware level. This program writes the system image to one or more floppy disks. Three formatted floppy disks are needed to dump the contents of a 2-megabyte memory. Six formatted floppy disks are needed to dump the contents of a 4-megabyte memory. Existing floppy disks may be used, but their contents will be overwritten. The time required to dump the system image is about five to six minutes per floppy disk.

If a system dump is to be executed after a crash, enter the firmware mode and immediately execute the `sysdump` program. Rebooting the system or executing another program will overwrite the system image, making subsequent crash analysis a futile effort. Note also that you should make a copy of the `/unix` file that was running at the time. If you reboot the system from `/unix,` this file will be the same. If you boot from `/etc/system,` the resulting `/unix` file may not match the previous version. Save the crash dump floppies and the copy of the `/unix` for the support person who will do the crash analysis work. If `/unix` is not bootable, this procedure will not work.

NOTE: In Models 500, 600, 700 and 1000, there is the option of having a crash partition on the integral hard drive (normally `cltld0s3)` that is chosed at the time the system is loaded.

If the system is configured in this fashion, and the autodump tunable parameter is set, the system, on a panic will dump a copy of core to this partition for later analysis. When making configurations at the time of loading, make this partition as large as the current available memory. Making the partition larger than you need is a waste of space. Making it too small may result in lack of information when the system has a problem.

Figure 5–5 illustrates how to run sysdump on a system with 2 MB of memory:

NOTE: The Version 3 models automatically perform a sysdump to partition 3 on hard disk 0 after each panic.

```
FIRMWARE MODE
mcp

Enter name of program to execute [ ] : sysdump

Do you want to dump the system image to the floppy diskette?
Enter 'c' to continue, 'q' to quit: c

 Insert first sysdump floppy.
Enter 'c' to continue, 'q' to quit: c

Dumping mainstore
.........................................................
.........................................................
If you wish to dump more of mainstore,
insert new floppy.

Enter 'c' to continue, 'q' to quit: c

Dumping more mainstore
.........................................................
.........................................................
If you wish to dump more of mainstore,
insert new floppy.

Enter 'cl to continue, 'q' to quit: c

Dumping more mainstore
.........................................................
.....................................................
Dump completed.
Three floppies written

Returning to firmware

SELF-CHECK

FIRMWARE MODE
```

Figure 5-5. sysdump

Restoration of Firmware Passwords

The floppy key diskette can be used to restore a forgotten firmware password to the default value of `mcp` by following this procedure:

1. Turn off the 3B2 computer.

2. Insert the floppy key diskette made when the system was first powered up.

3. Turn on the power.

4. The message `NVRAM SANITY FALIURE` will appear on the console. Ignore the message.

If the floppy key diskette is unavailable, the firmware password can be easily returned to the default value of `mcp` by momentarily interrupting power to NVRAM by disconnecting the battery. Execute the following procedure:

1. Turn off the 3B2 computer.

2. Detach the battery power connector at the system board (Models 300, 310, and 400), or reseat the system board (Models 500, 600, 700, and 1000).

3. NVRAM is now restored to its default settings.

4. During the next power-up sequence, the message `NVRAM SANITY FAILURE` will appear on the console. Ignore the message.

General Troubleshooting Techniques

When a 3B2 computer malfunctions, get the system into the simplest configuration possible, and then test each subcomponent.

The simplest configuration possible includes the system board, at least one memory board, power supply, backplane, and the connected floppy. With this configuration, and a copy of `idtools,` the diagnosis of the system board and memory can begin. If these components can not be diagnosed, then the system board, power supply, backplane, or memory board may not be working properly. Try the red diagnostic LED or a voltmeter to diagnose the power supply.

If all tests pass, then reconnect the hard disk drives. With Models 300 and 310, install the internal disk, and run `dgmon` diagnostics. If this test passes, run `edt` from firmware to check if the ID is as expected (drive 0). If the ID number and terminating resistor are installed correctly, and the operating system is loaded on the disk drive, then try to boot the system. With the 3B2/400, install drive 0 and run the same test outlined above. If the tests pass, then a second disk may be added. If the second disk tests well, then you may try the other boards that were installed.

For the 3B2 Models 500, 600, 700, 1000, troubleshooting techniques are more complicated. In all these models, the one I/O slot is occupied by the SCSI host adapter. If the first 16 phases of the SCSI diagnostic `(dgmon)` pass, then the host adapter is functional.

The most common cause of failure in the SCSI subsystem is the ribbon cable that runs from the host adapter to the other internal components.

> ⚠ **CAUTION**
> When removing the ribbon cables, take EXTREME care. DO NOT pull on the
> ribbon cable itself; instead, pull on the header directly. If you pull on the outside
> edges of the cable, the contacts on either end of the connector will open up.

If one or more of the peripherals are still not recognized, the peripheral itself maybe at fault (as with the tape drive), or a tap on the target controller may have failed. You can change the ID of the drive in question to 0,1,2, or 3, but not the ID number of any other functioning drives on that target controller. Then move the cable to the tap corresponding to the new ID. Use the EDT program from firmware, or Phase 17 of the SCSI diagnostics to see if the system recognizes the new ID number. If the drive is recognized, then the target controller is suspect. If the system still does not recognize the drive, then the drive maybe the problem.

Now the system is a sane state with a basic configuration of a system board, memory, and the integral peripherals. If the operating is on drive 0, then the machine can be booted, if not then a full restore must be done to reload the operating system.

If the system is Version 3 (Models 500, 600, 700, 1000) and running UNIX 3.1.1 or greater, two files in the `/use/adm` directory that may help in system troubleshooting, `errlog` and `0errlog`. Type the command `errint -t` along with either the `errlog` or `0errlog` command. The system should then show you all the previous NOTICE and WARNING that it has experienced. As the `errlog` file grows, the information is moved to the `0errlog` file. The dates of different trouble occurrences in the `0errlog` file can be used to determine which message may be relevant to the most recent problem. This may be helpful in diagnosing trouble patterns with a particular system.

Now I/O boards can be reinstalled and tested separately to determine their functionality.

Troubleshooting Techniques for Peripherals

Terminals and Modems

In setting up a terminal or a modem on the 3B2 computer, follow the instructions in the manufacturer's manual. If you run into problems, consider the following possibilities.

If the terminal you are trying to hook up doesn't work at first, try another terminal on that port, try a different cable, or try a different term/printer connector. If these items seem to work and you're still having problems, it may be that your terminal is not giving the system the necessary signals.

The 3B2 computer needs to see DATA TERMINAL READY from the terminal at +12 volts before the getty process will issue the "login" prompt. Also, some terminals must have REQUEST TO SEND (pin 4) at +12 volts. If this is the case, it is possible to jumper pins 4 and 5 at the terminal to get the terminal to send all the time.

Note that the AT&T male term/printer connectors connect pin 20 to pin 6. This connection maybe required for terminals needing the DATA SET READY signal to be at +12 volts. Refer to the on-line message at the bottom left side of the screen. If the message is not there, you might have a faulty connector.

If you want your terminal to utilize hardware flow control, it must be connected to an EPORTS card. EPORTS is the only feature card that has hardware flow control capability. See Chapter 8, "I/O Feature Cards," for more information about the EPORTS card.

When hooking up a 3B2 computer to a standard modem, the ACU modem connector should work, without modifications. The only thing you might have to do is to change some of the switch settings on your modem. For example, the carrier line (pin 8) should follow the terminal ready line (pin 20), but some modems don't have this capability. If it is not possible to set a switch on your modem accordingly, then install a jumper between connector pins 8 and 20.

Printers

The 3B2 computer supports a variety of printers (for example, dot matrix, laser, and daisy wheel). Some general troubleshooting techniques and tips for printers follow.

One of the first things you should do in setting up a printer is to refer to the appropriate line printer spooler documentation. Direct your attention to the discussion of the line printer spooler utility. Most of the information that you need to set up the 3B2 computer for the use of printers is described in this section.

In addition, make sure that the port is operating correctly. To determine this, perform diagnostic tests using the `dgmon` command as described in this manual. You may also want to set up a terminal to the port in question to see if it works, or try to send some data to the port from a known working device. If these tests pass, then check the printer.

Most printers have a self-check mode. In the self-check mode, a printer can print several types of fonts to prove that it is functional. If the printer still does not work after using the line printer spooling software, following the instructions in the appropriate line printer spooler documentation. If the port and the printer are operational, there is probably a problem with the printer's internal configuration or with the cable between the 3B2 computer and the printer. The DIP switches on the printer maybe set incorrectly, or other types of software configurations may be incorrect. Refer to the instructions in the manufacturer's manual for the printer you are using, and also check the appropriate sections of this manual for the pinouts for the 3B2 computer.

Chapter 6: 3B2 Subassemblies

Introduction

This chapter reviews definitions, locations, and replacement procedures for subassemblies on the 3B2 computer models. You should be familiar with the information in Chapter 2, "3B2 Model Overview," before reading this chapter. Peripheral subassembly including external SCSI definitions, locations, and replacement procedures are in Chapter 7, "3B2 Peripheral Subassemblies." This chapter is divided into three sections covering Version 2, Version 3, and the 3B2/500.

Whenever a subassembly is replaced, certain information should be recorded. At a minimum, the serial number of the 3B2 computer or peripheral and the serial number of the defective or replaced subassemblies must be noted. This information must accompany the defective part when it is returned to AT&T for repair or replacement.

> ⚠ **CAUTION**
> Before replacing any hardware boards, see Appendix A, "Handling Circuit Boards," for information on proper handling of circuit boards and feature cards. The information in Appendix A, "Handling Circuit Boards," applies equally to defective and replacement boards. Defective boards must be examined to determine failed components for potential problem areas. New failures should not be introduced because of improper handling procedures.

> ⚠ **WARNING**
> Before working on any peripheral cabinet, shut down the computer and unplug the AC power cord to avoid the chances of injury or equipment damage.

Version 2

The level of repair addressed in this section is limited to replacement of the following internal subassemblies:

- power supply (including fans and thermal sensor, where applicable)

- 5 1/4-inch floppy disk drive (720 kilobyte)

- cartridge tape drive (23 MB)

- SCSI cartridge tape drive (60 MB)

- hard disk drive

- backplane/card cage

- I/O expansion cards

- memory cards

- system board

- math accelerator unit (MAU)

- PROMS

- battery

While not considered major subassemblies, the internal cabling is also considered a replaceable part and is reviewed in this chapter.

Removing the Cover

Access to all subassemblies in the Models 300, 310, and 400 require removal of the cabinet cover. The cover of the Models 300, and 310 must also be removed for installation or removal of the I/O feature cards. This may not be necessary for the 3B2/400.

The cabinet cover is attached by four screws on the sides of the cabinet. To remove the cover, remove the four screws and lift the lid straight up.

Power Supply

The shielded power supply occupies the left rear corner of the cabinet. Model-specific information about power supplies follows.

Model 300/310

A bundle of 23 wires from the power supply divides into three destination cable-connector assemblies that connect to the system board, floppy drive, and hard disk drive. Pinouts for the cables are given in Table 6-1. The connectors for the disk drives are of the same type for both units.

NOTE: Two Model 300 and 310 power supplies are available, one supplying 20 A maximum and the other 22.5 A maximum. They are easily differentiated by the color of the power switch (red on the 20 A and black on the 22.5 A). The larger capacity power supply maybe needed when using the intelligent serial controller (ISC) cards. This is because of the higher power consumption of the ISC card versus other I/O feature cards. Table 6-2 shows which power supply is needed for all configurations with ISC cards.

Table 6-1.   Model 3001310/400 Power Supply Pinouts

System Board Connector	
Pin #	**Description**
1	Reset Switch
2	Reset Switch
3	+12 VDC
4	-12 VDC
5	12 VDC Return
6	Soft Power (PWRDN 0
7	Soft Power (PWRON 1)
8 through 11	Return
12 through 15	+5 VDC
Peripheral Device Connectors	
Pin #	**Description**
1	+12 VDC
2 and 3	Return
4	+5 VDC

In Table 6-2, OK means that either power supply (20 A or 22.5 A) maybe used, RU stands for "requires upgrade" of power supply (22.5 A), and NA means "not applicable."

Table 6-2. Configuration Rules for 300/310 Power Supplies

Model 300/310 Configurations Supported with up to 2 MB of RAM

ISC Cards	Other Feature Cards				
	0	1	2	3	4
No ISC Cards	OK	OK	OK	OK	OK
One ISC Card	OK	OK	OK	OK	NA
Two ISC Cards	OK	OK	OK	NA	NA
Three ISC Cards	OK	RU	NA	NA	NA
Four ISC Cards	RU	NA	NA	NA	NA

Model 300/310 Configurations Supported with 3 MB of RAM

ISC Cards	Other Feature Cards				
	0	1	2	3	4
No ISC Cards	OK	OK	OK	OK	OK
One ISC Card	OK	OK	OK	OK	NA
Two ISC Cards	OK	OK	RU	NA	NA
Three ISC Cards	OK	RU	NA	NA	NA
Four ISC Cards	RU	NA	NA	NA	NA

Model 300/310 Configurations Supported with 4 MB of RAM

ISC Cards	Other Feature Cards				
	0	1	2	3	4
No ISC Cards	OK	OK	OK	OK	OK
0ne ISC Card	OK	OK	OK	RU	NA
Two ISC Cards	OK	OK	RU	NA	NA˙
Three ISC Cards	OK	RU	NA	NA	NA
Four ISC Cards	RU	NA	NA	NA	NA

Model 400

A bundle of 47 wires from the power supply divides into six destination cable-connector assemblies. These connect to the floppy drive, cartridge tape drive, (one or two) hard disk drive(s), system board, and I/O backplane (see Figure 6-l).
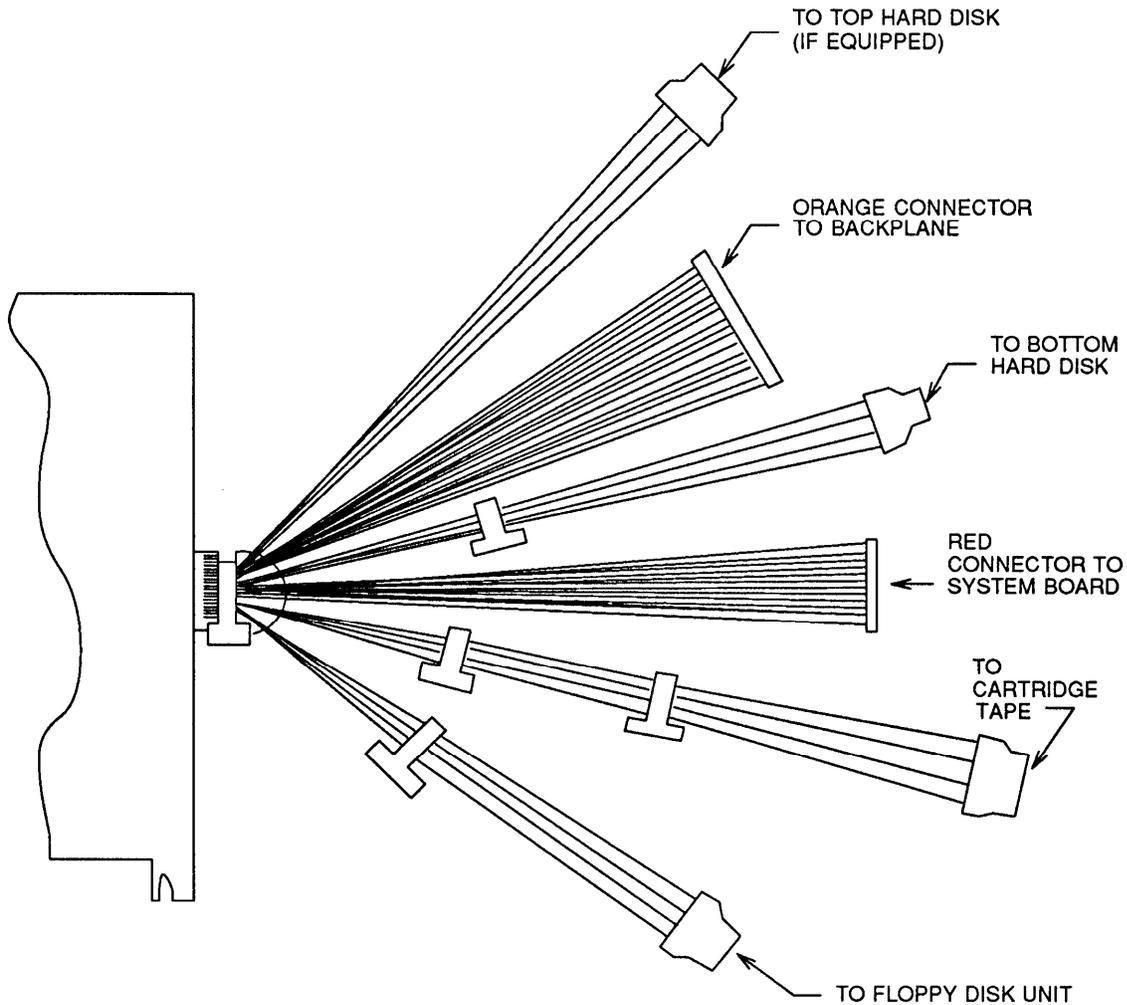
Figure 6-1.   3B2/400 power cable connectors

Power Supply Requirements

The integral power supply provides the system board operating voltage, power for the internal disk drives and expansion cards, and the necessary voltages for RS-232-C communications (-12 VDC, +12 VDC).

The cooling fan is a part of the power supply. If the fan malfunctions, the entire power supply must be replaced.

Voltage ripple over a 10 MHz bandwidth may not exceed 75m VDC on +5 and +12 VDC lines and 100m VDC on -12 VDC lines. Variations on the +5 and +12 VDC lines may not exceed 5 percent and variation on the -12 VDC line is limited to 20 percent. All percentage figures are + or -.

The power supply for Model 400 is a larger version of the Model 300 power supply. The voltage requirements for each individual subassembly are the same, but the Model 400 supply can provide voltages to more subassemblies. Another difference is that the Model 400 power supply also provides voltage directly to the I/O backplane. The Model 300 backplane draws power from the system board.

Floppy Disk

The floppy drive is located in the left front corner of the cabinet, in front of the power supply. The drive itself is equipped with two connectors: a 34-pin system board interface and a 4-pin power supply connector. A terminating resistor must always be installed in a drive inside the 3B2 computer. See Appendix E, "Peripheral Configuration Figures," for a diagram of the floppy drive.

The floppy disk is attached to the system board (see Chapter 2, "3B2 Model Overview," Figures 2-3 and 2-6,) with a single cable that connects to the header nearest the front of the system board. Four screws hold the drive bracket to the cabinet on the 300 and 310. On the 400, the floppy and cartridge tapes are mounted together in a bracket that is released by upward pressure with a screwdriver in a slot on the underside of the cabinet. Cable orientation for the floppy drive is the same as for the hard disk drive. There is also a connector from the power supply similar to that on the hard disk. See the "Hard Disk" section later in this chapter.

Cartridge Tape Drive (23 MB)

The 23 MB cartridge tape drives are (KS-23165,L1) present in the Model 400 and the XM/TM only. The drive is mounted on top of the floppy drive in the 400, and inside the same bracket with the floppy. The tape drive has a 4-pin power connector and a 34-pin cable that comes off the cartridge tape controller card in the I/O expansion slots, usually slot 1.

Cartridge Tape Drive (60 MB)

The 3B2/400S60 contains a 60 MB SCSI cartridge tape drive (KS-23417) and host adapter board. These items replace the 23 MB cartridge tape drive and the cartridge tape controller card in the basic 400 cabinet. The SCSI tape drive mounts in the same housing as the floppy drive. This tape drive is the same drive used in the 3B2/500, 3B2/600 and in the TM/60S, except that it requires SCSI bus terminating resistors. Since replacement drives may not contain terminating resistors, you must remove the resistor DIPs from the defective unit and install them in the new unit. For further information see Appendix E, "Peripheral Configuration Figures."

Hard Disk

3B2 Version 2 models contain hard disk drives with the ST-506 interface. This 5-1/4 inch hard disk drive is located in the front center of the cabinet, to the right of the floppy drive. The 3B2/400 may have two disk drives, one installed on the top of the other.

The ST-506 interface is made up of two cables: a 20-pin data cable and a 34-pin control cable. These cables connect the disk drive to the controller located on the system board. This controller is capable of controlling up to two disk drives. Since the Models 300 and 310 have room for only one disk, the second port of the controller is cabled to the rear disk access panel to allow the connection of an additional disk in an expansion module (XM). The system board (see Chapter 2, "3B2 Model Overview," Figures 2-5 and 2-6,), provides one 34-pin connector for the control cable that is daisy-chained from disk to disk, and two 20-pin connectors for the data cables, one for each disk. Figure 6-2 shows a logical diagram of this interface. These disks also have a 4-pin power connector, a jumper field for setting the ID, and a terminating resistor socket. See Appendix E, "Peripheral Configuration Figures," for locations of these iterns on the various disk models.
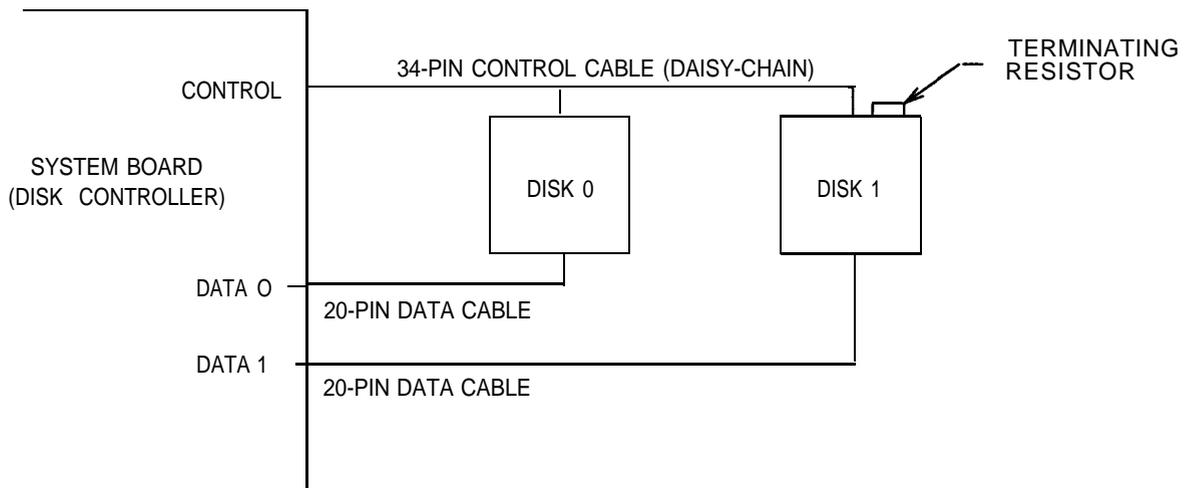
Figure 6-2. **ST-506 interface**

Care must be taken when replacing a disk drive to ensure that the ribbon cables are reconnected properly. In the ModEls 300 and 310, the control cable routes from the system board, to the internal disk, and on to the disk access panel (see Figure 6-4). The data cable form the data 0 connector on the system board connects to the internal disk. The data cable from the data 1 connector goes to the disk access panel. In a 3B2/400 equipped with two disks, the control cable is daisy-chained to both disks, and data cables 0 and 1 go to disks 0 and 1, respectively.

The placement of the terminating resistor is also important. A terminator resistor must be present in any configuration. Its purpose is to terminate the signals on the control (daisy-chained) cable. In Models 300 and 310, the disk access panel contains two single-inline sockets, and one single-inline terminating pack (SIP). This resistor must be in the right-hand socket, viewed from the front of the machine, if a second disk is NOT present. If an XM disk is connected, simply move this terminator to the left-hand slot, that is just a holder. In this situation, the second disk must contain a terminating resistor. In the Model 400, the last disk on the control cable must have a terminating resistor installed. See Appendix E, "Peripheral Configuration Figures," for the location of the terminating resistor socket. These resistors are called dual-inline packages (DIP).

The ID of the disk should be set to either 0 or 1. The ID must match the data cable. For example, if the data 0 port on the system is cabled to the disk, its ID must also be set to 0. If only one disk in configured, it should be set to 0.

Removal

In the Model 300 and 310, the hard disk is secured to the bottom of the cabinet by four screws. In the 3B2/400, the disk drive(s) are located in a metal housing similar to the floppy and cartridge tape drives. To remove the hard disk, insert a screwdriver in the slot on the underside of the cabinet and press upward. Then slide the housing towards the rear of the machine.

If the cables need to be replaced, the card cage and system board must be removed first. On some models, a shield is located underneath the system board to protect the cables from the sharp pins of the system board. On models without this shield, be careful not to put tension on the cable as it runs under the system board. See Figures 6-3 and 6-4 for the location of the hard disk drive connectors, and cables.
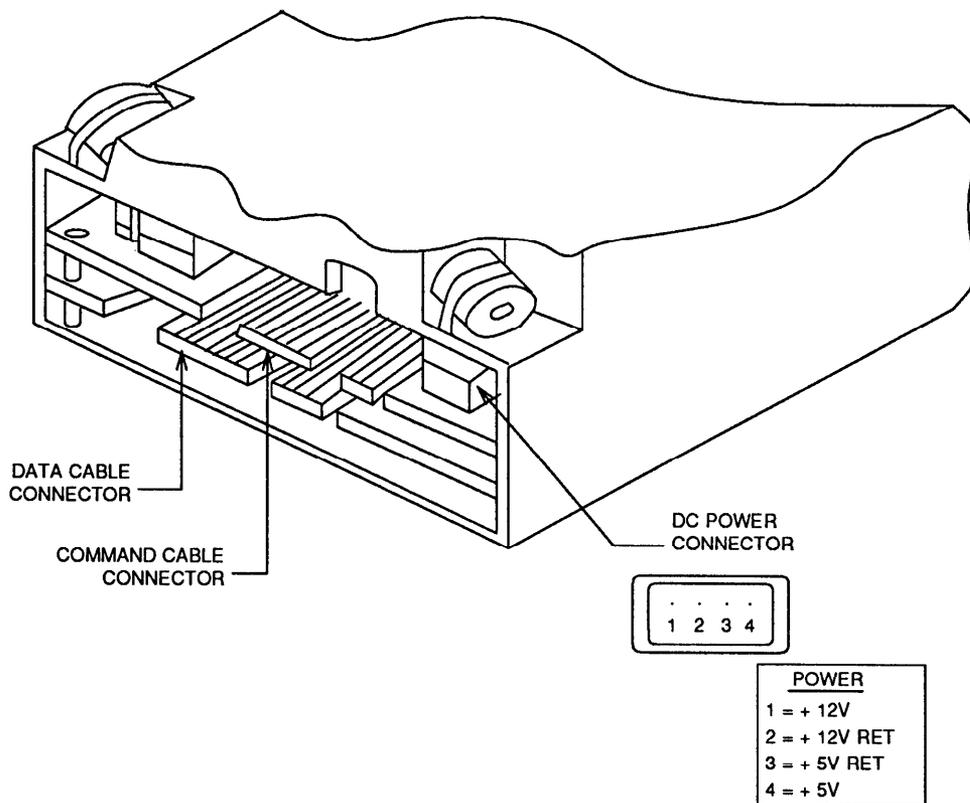
Figure 6-3.   Hard disk drive connectors

HARD DISK

PIN 1

ONE END OF
THE J1
POWER CABLE

RETRO FIT J1
POWER CABLE

20-PIN DATA CABLE
DISK 0

34-PIN COMMAND CABLE

REAR DISK
ACCESS
PANEL

20-PIN DATA CABLE
DISK 1
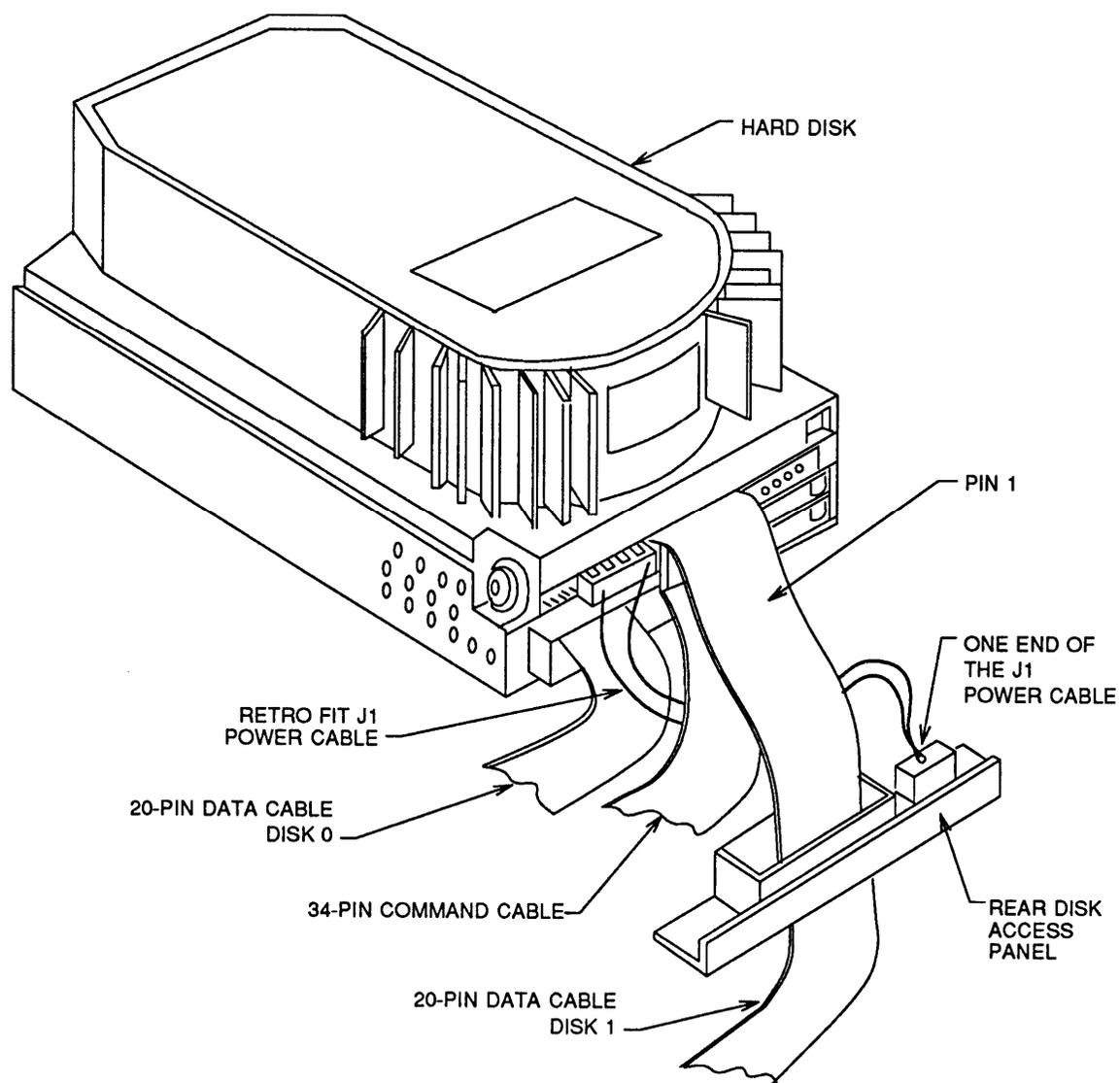
Figure 6-4.   Hard disk drive cabling

Notes

Because of limited clearance, the hard disk cables must be attached to the drive prior to mounting in the cabinet.

When installing a new hard drive, the terminating resistor DIP must be removed, if present (unless it is the second drive in the daisy-chain in a 3B2/400). If removed, place it on the defective drive to be returned. If the system board is a CM190A, the XM soft power cable connects to the DIP socket (see Figure 6-4 for the retrofit J1 power cable). If the system board is an ED board, nothing will connect to the DIP socket.

If the system board is a CM190A, the 72 MB hard disk will not operate unless the system board is an Artmaster 5 Series 27 (or higher) or any Artmaster 6. (AM5 Ser. XX or AM6 Ser. XX will be printed on the system board on the edge near the memory board connectors.)

Most hard disk drives currently shipped with the 3B2 computer have electronic locking heads that lock automatically. A manually operated lock is present only on the 30 MB drive. It is not necessary to engage the lock for transportation of the 3B2 computer. The manually operated lock is engaged only on those units that are shipped overseas. Replacement ("loose ship") drives may have the locking mechanism engaged. Refer to Figure 6-5 for the location of the locked drive heads position.

LOCKING ARM

F
R
O
N
T

O
F

D
R
I
V
E

LOCKED

.75 INCH (2 CM)

UNLOCKED

TOP VIEW

NOTE: A PAPER CLIP CAN ALSO BE USED TO UNLOCK
         THE DISKS SIMPLY LOOP THE CLIP IN THE
         LOCKING ARM GROOVE AND PULL.
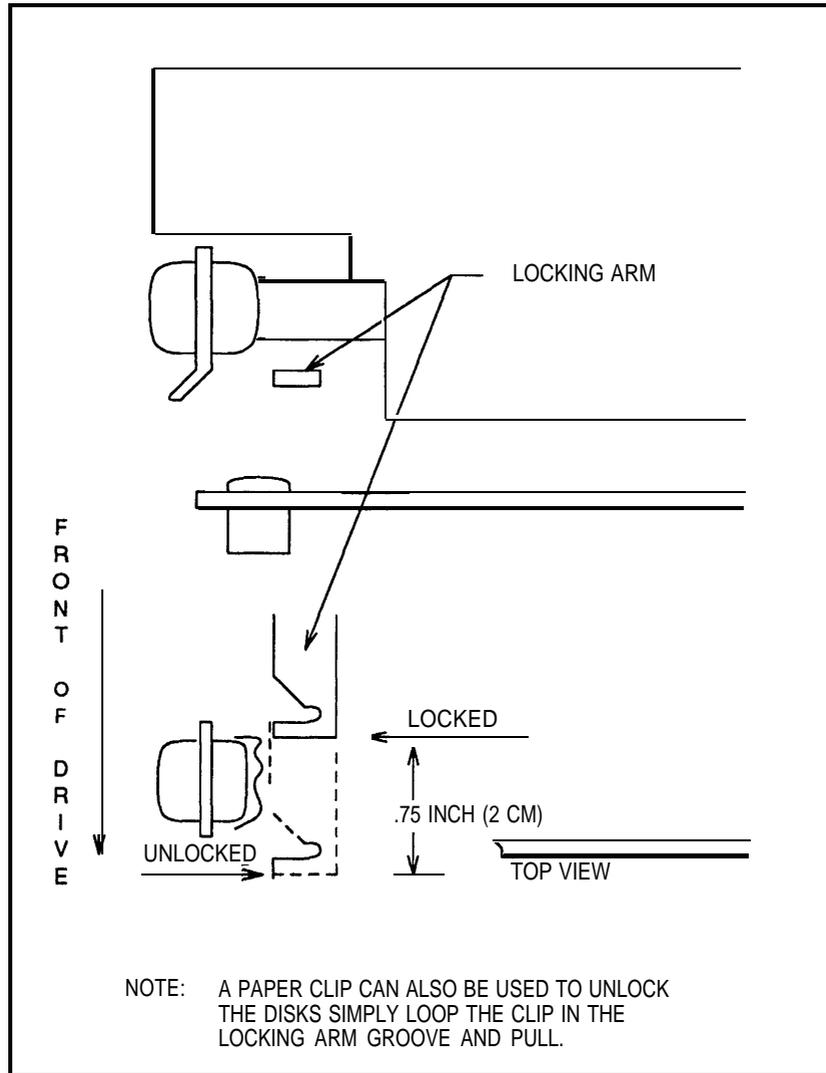
Figure 6--5.   30 MB CDC mechanical head locking mechanism

I/O Backplane

The I/O backplane is situated on top of the left side of the system board. It is attached to the system board by two edge card connectors (one 100-pin and one 60-pin). The I/O backplane is mounted parallel to the side of the cabinet and is attached to the apparatus cage that houses the expansion cards. The apparatus cage is held down with two screws in the front, one on the left side toward the rear, and one through the back of the cabinet at the right rear corner two through the back on the Model 400). Figure 6-6 shows how to remove the Model 300 and 310 apparatus cage.
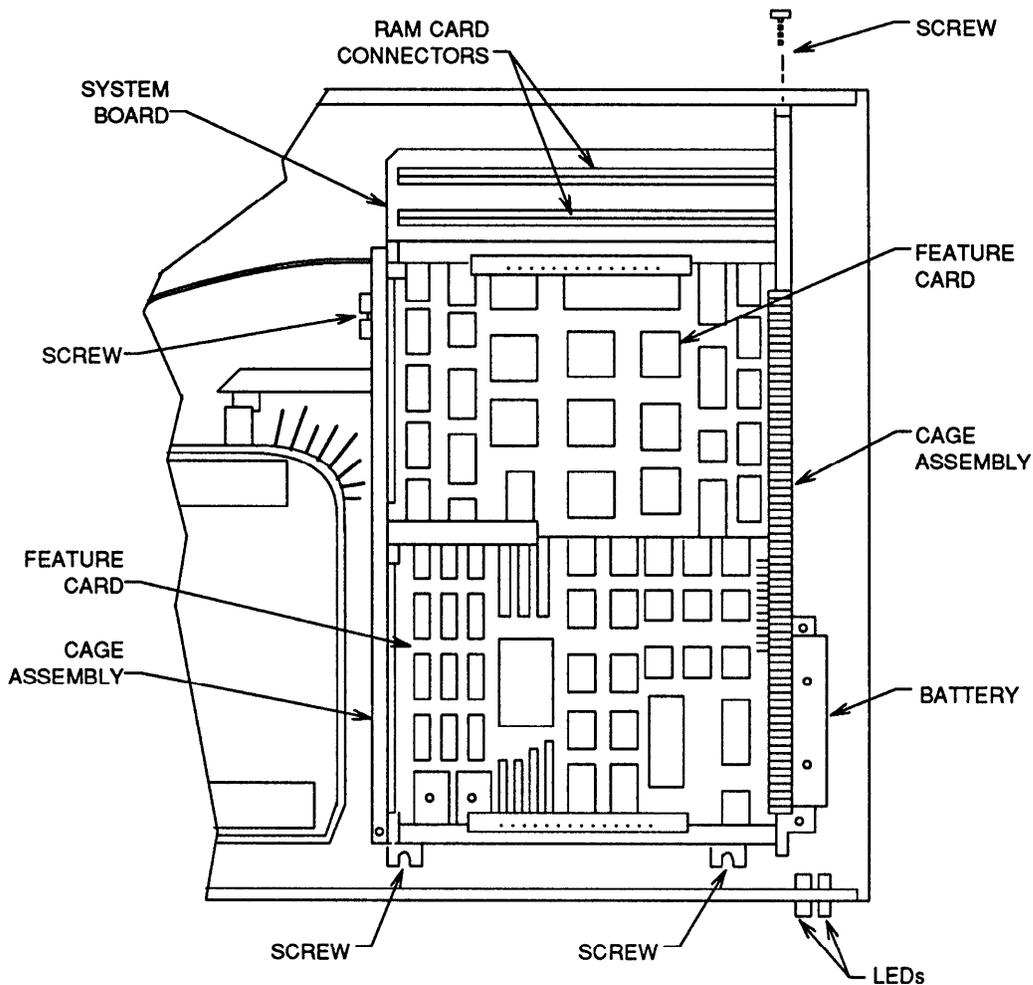
Figure 6-6.   Removing the Model 300/310 apparatus cage

All the I/O expansion cards mount horizontally in the cabinet a plug into the I/O backplane. All slots must be filled in sequential order. Do not skip any slots. See Figure 6-7 and Figure 6-8 for the numbering of backplane slots on Models 300, 310, and 400.
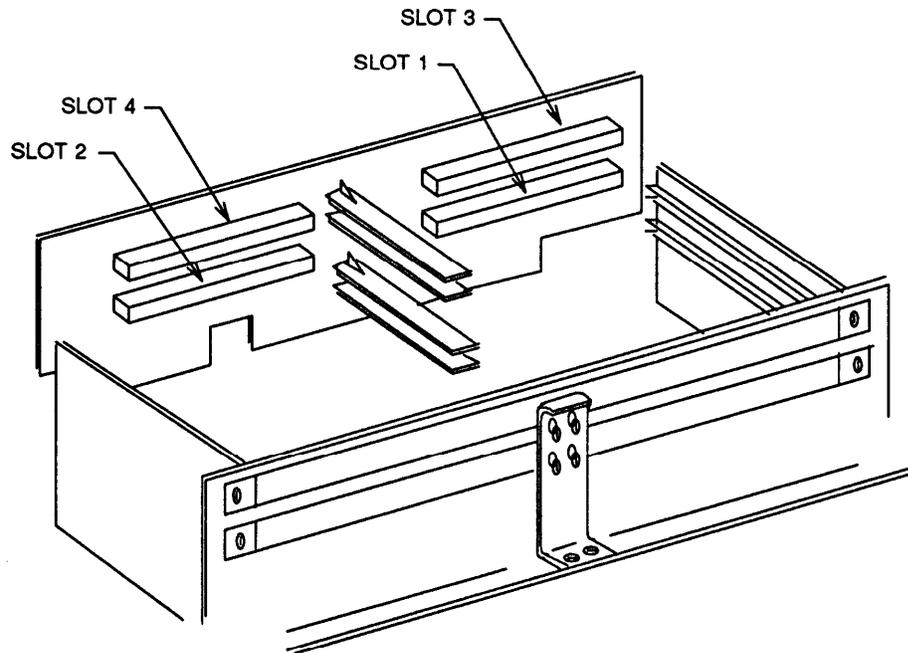
Figure 6-7.   Backplane slots - Models 300/310
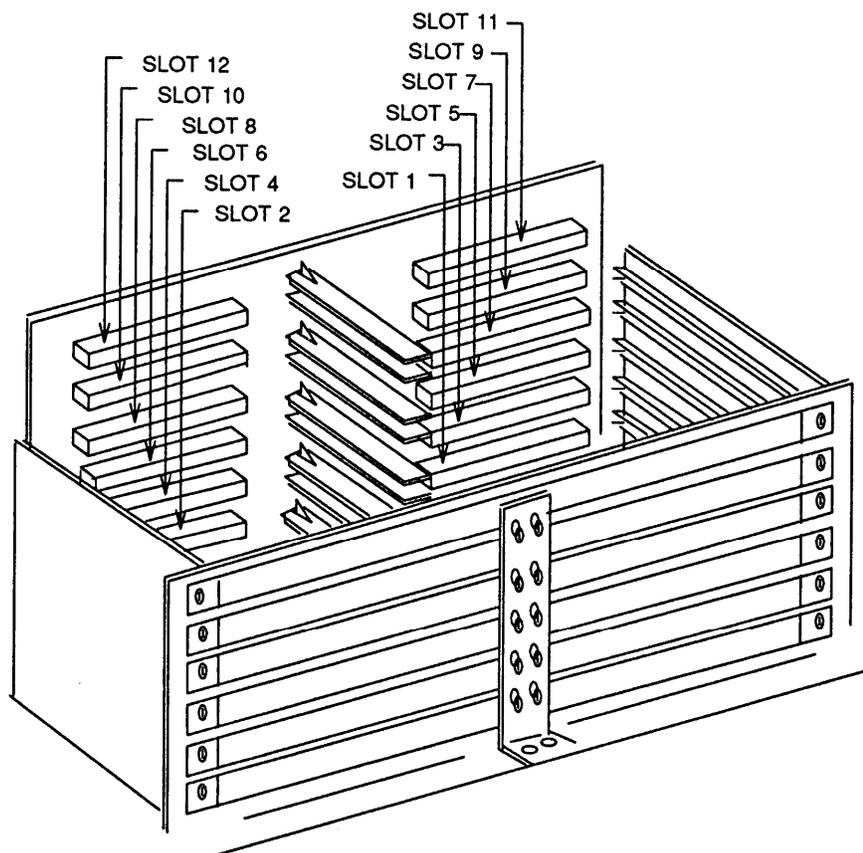
Figure 6-8.   Backplane slots - Model 400/400S60

On the 3B2/400 computer, expansion cards can be installed and removed without opening the entire cabinet. The cover of the Model 300 and 310 must be removed. The expansion cards slide in horizontally through the access door on the right side of the cabinet. There is a grounding strap in the center of the opening that must be removed. Filler plates must also be removed for initial installation. Figure 6-9 illustrates the filler plates on the 300 and 310.

Filler plates can be broken in half as necessary (see Figure 6-10). These should be retained if the feature card for the slot is removed and not replaced. No "open" spaces should exist to assure proper air flow. The grounding strap and grounding clips must be replaced after feature card replacement.
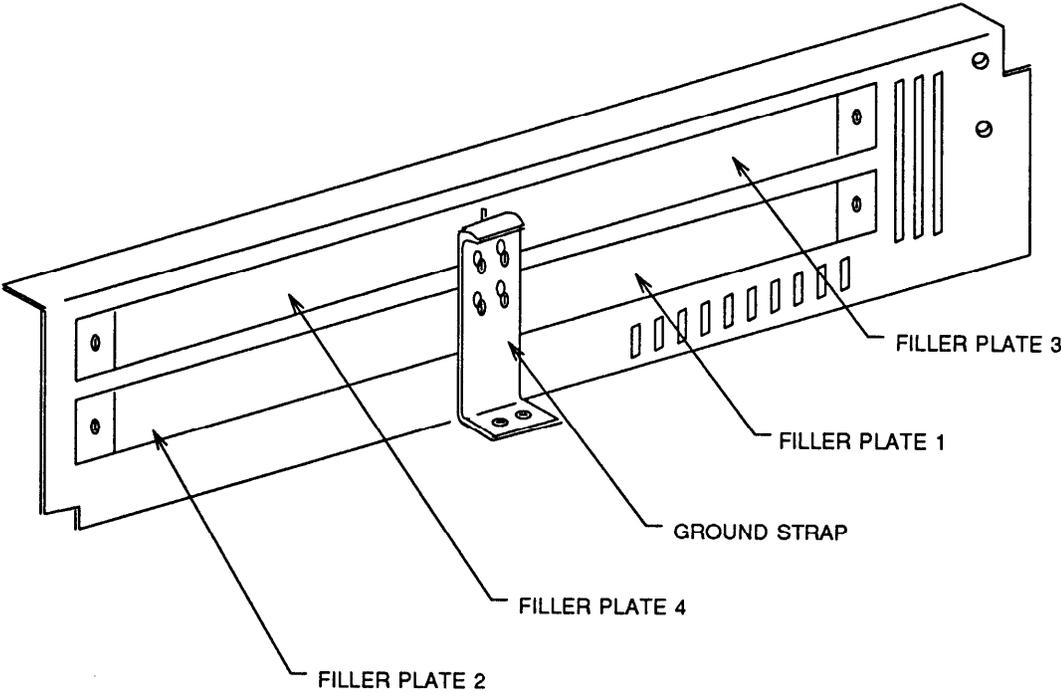
Figure 6–9.   Filler plates
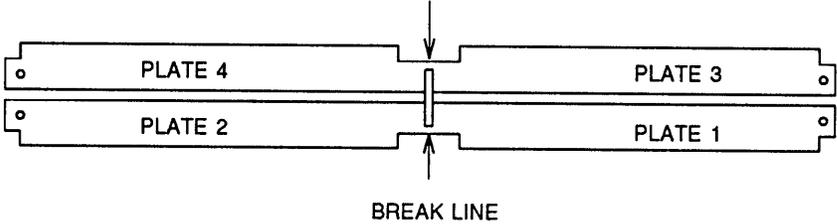
Figure 6-10.   Breaking filler plates

Memory Boards

Memory boards are located in the right rear corner of the cabinet at the rear of the system board. Each board is held down by a clip on the back of the apparatus cage. The boards are connected to the system board with edge-card connectors (72-pin). The component side faces toward the front of the system.

On the 1-MB (CM191B) board, a "191B" label is stamped on the back of the memory card (see Figure 6-11). The 2-MB board is twice as high and cannot be mistaken for a 256K or 1-MB board. A 2-MB half-height board (CM191D) is also available. It is readily distinguished from other memory boards because it has surface mount technology with chips on both sides of the board. On the 2-MB half-height board, the front of the board is marked "FRONT."

Memory options are intermixable. For example, a 1-MB board may be added to a system with a 2-MB board (or vice versa). However, the 2-MB board must be in the first slot, closest to the apparatus case. There is an exception for a 1/4-MB board: it may not be mixed with the 1-MB board or either of the 2-MB boards. If only one memory board is used, it must be inserted in the first slot (slot closest to the card cage).

To remove the memory boards, unscrew the clamp on the apparatus cage that holds the board(s) down, and apply upward force on both sides of the board at the same time. A slight rocking motion may make removal easier. Reverse the procedure for replacement.
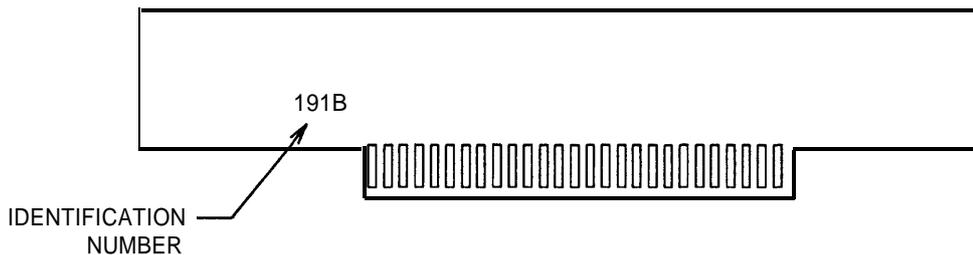
Figure 6-11.   Location of the memory card identification number

System Board

The system board is the heart of the 3B2 computer. Unlike other subassemblies whose failure can sometimes be circumvented or ignored, if the system board fails, the 3B2 computer will not function properly and may not be testable.

The system board is located in the right half of the cabinet and is mounted underneath the apparatus cage. The two types of system boards used in Version 2 models are the CM190A (WE 32000) and the ED (WE32100) series. The CM190A is only functional on the Model 300. The ED board will function on any of the three models, although there are several functional differences between the 300 ED board and the 310 and 400 ED boards. The 310 and 400 boards are identical except for the PROMs. For the ED system board configurations, see Table 6-3.

Table 6-3.   ED Series System Board Configurations

Group Number	System	Configuration
G1	300	With PROMS, Without MAU
G2	400	With PROMS, Without MAU
G3	310	With PROMS, Without MAU
G4	310	With PROMS, With MAU
G5	400	With PROMS, With MAU
G6*	310/400	Without PROMS, Without MAU

* This board is usually supplied as a replacement. The proms and MAU must be removed from the defective board and installed on the new one.

Electrical Connections

There are a total of ten (or nine, depending on system board vintage) cables that make up the electrical interface to the system board. These are as follows:

- back-up battery cable

- LED indicator cables (2)

- dual UART cable

- floppy interface cable

- hard disk interface cables (3)

■ power supply cable assembly

■ XM soft power cable (J1)

Depending on the vintage of the system board, this cable maybe attached to the hard drive. This is true for all CM190A system boards. On all 190A system boards, +5 volts for the XM soft power is drawn from the hard disk terminating resistor socket. The ED board has a separate +5 volt power connection for soft power.

System Board Mounting

The Model 300 and 310 system board is mechanically mounted to the cabinet with six machine screws that are threaded through spacers and the bottom of the cabinet. The apparatus cage must be removed in order to access the system board. The Model 400 system board is mounted on a steel plate. The disk drive/power cables are routed under this plate.

Replaceable Components - 3B2/300

When replacing the Model 300 system board on a 3B2 computer used in a 3BNET application, EPROMs should be swapped so that the system retains the old soft serial number. If this is not possible for some reason (for example, bad EPROMs), the customer must inform other computers on the network of the new ID. Where EPROMs are not swapped, the customer must always make a new floppy key. The PROM replacement procedures for all models follow.

Replaceable Components - 3B2/310/400/400S60

When replacing the Models 310, 400 and 400S60 system boards, the EPROMs and MAU (if installed) must be carried over to the new system board. Replacement boards for the 310 and 400 do not have any EPROMs or MAU. Follow the MAU and PROM replacement procedures.

IC Replacement Precautions

The following precautions must be observed when performing any integrated circuit replacements (see Appendix A, "Handling Circuit Boards.")

- Use a grounding strap to prevent static shock of the chips.

- Do not pry chips. Use an IC puller (or the chip removal tool supplied with the MAU).

- Be careful when inserting IC chips to prevent accidental bending of the pins.

MAU Replacement Procedure

The MAU is a single chip located on the front half of the system board (Model 310 and 400) next to the WE 32100 (series) microprocessor (see Figure 6-12). The MAU should be removed and the system board tested before removing the firmware to determine whether or not the system is still failing. This next procedure must be followed when replacing the system board or the MAU.

1. Use the MAU removal tool to remove the MAU. Figure 6-13 shows the removal of the MAU.

2. Work back and forth across the chip. Do not attempt to pry out one corner or you could damage the chip.

3. With the MAU removed, determine if the system is still failing.

4. If the system does not fail, install a new MAU on the old system board.

5. If a failure still occurs, replace the system board and transfer the old firmware to the new board.

6. Verify that the system is up. Reinstall the original MAU on the new system board.

7. Place the MAU on the socket with the "A1" corner positioned towards the socket orientation notch. See Figure 6-13.

   ### ⚠ WARNING
   It is possible to install the MAU chip backwards. Permanent damage will result if the MAU is installed backwards and power is applied. Verify placement before completing step 7.
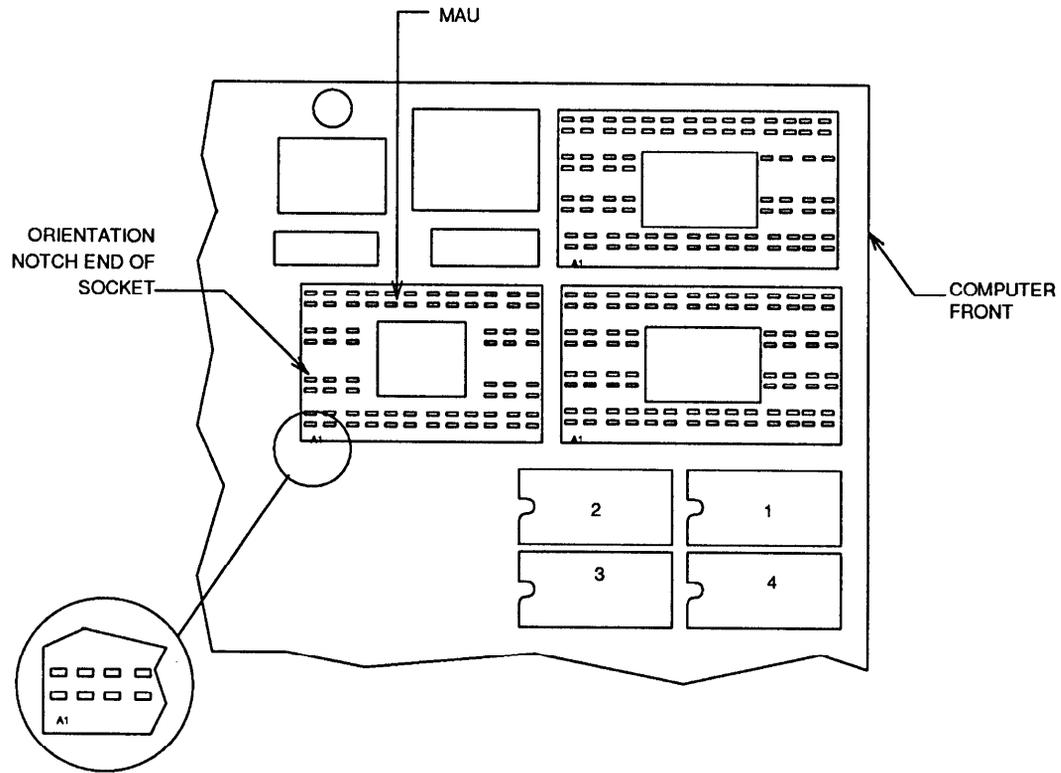
Figure 6-12.   MAU and PROM locations (ED board)
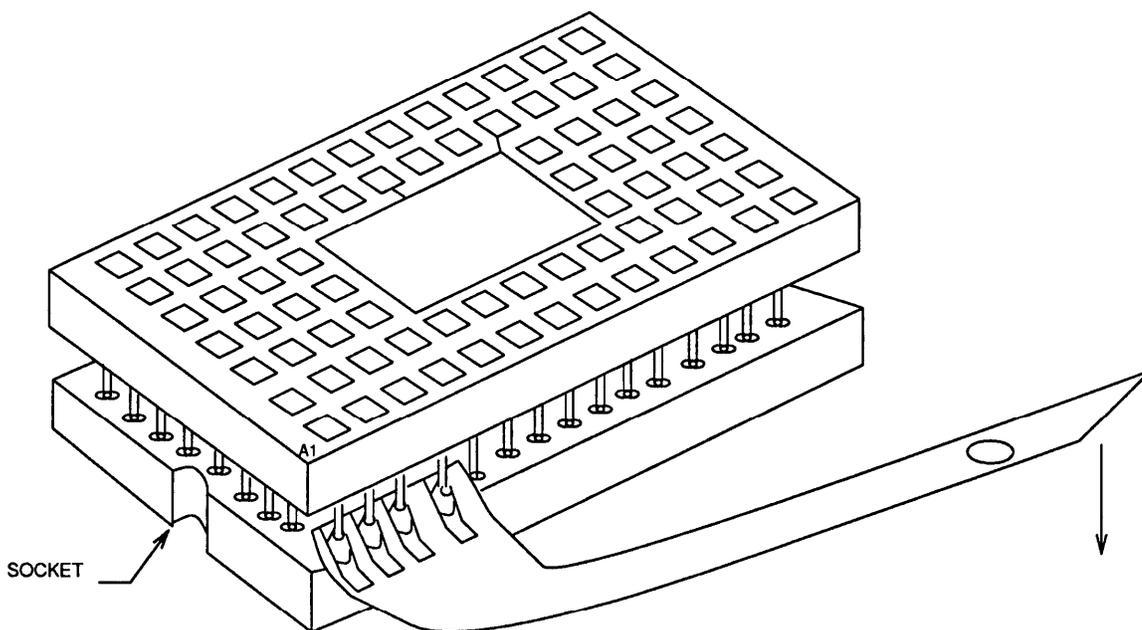
Figure 6-13. Removal of the MAU

PROM Replacement Procedure

On 3B2 computer systems with NI cards, it is necessary to transfer the old system firmware to the replacement system board. The transfer operation causes less inconvenience to the customer when the repaired system is installed on the local area network (LAN).

The system board firmware contains a unique identification number that is used as an address for the 3BNET network node. Replacing the system board without retaining the old address creates the problem of having to modify an address file on each of the systems on the network. Adopting the practice of replacing the firmware on the system makes system board replacement transparent to customers running 3BNET. Other networking products that utilize the NI card may not depend on this firmware serial number.

The firmware is contained on four socketed chips (PROMs) located on the front half of the system board next to the microprocessor (see Figures 6-12 and 6-14). Execute the following procedures when replacing the system board:

1. Use a PROM puller to pull and replace the chips. Figure 6-14 shows the correct coding sequence for the release 1.1 PROMs on a CM190A.

2. The PROMs from the replacement board (if any) must be installed on the defective board so a complete board can be returned for credit.

   NOTE: The CM190A and the ED-4C637-30, G1 arc functionally equivalent, and may be freely interchanged. The exception to this is that a machine that has a 72 MB disk drive must have one of the following:

   ❑ ED-4C637-30 or ED-4C637-32, G1

   ❑ CM190A--AM6

   ❑ CM190A--AM5 Ser. 27 (or higher)
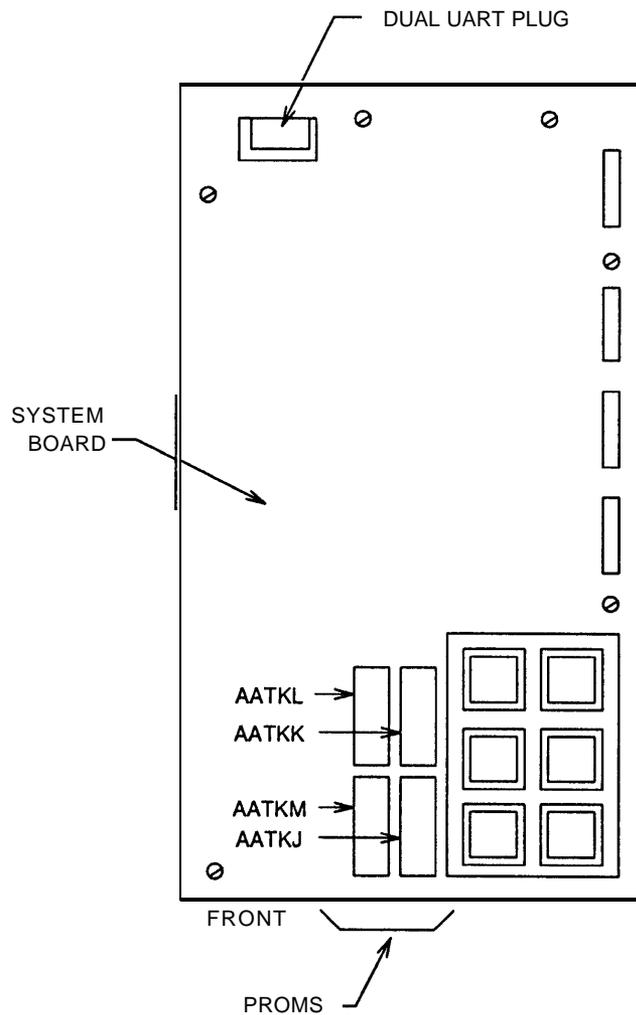
Figure 6-14.   PROM locations (CM4190A)

Counting the PROMS

In Figure 6-14, the PROMS are labeled with four letters AATK, followed by a fifth letter. The fifth letter on each PROM is in an alphabetic sequence from PROM to PROM. For example, in Figure 6-14, the fifth letter on the lower right-hand PROM is J, on the upper right-hand PROM, it's a K, on the upper left-hand PROM, it's an L, and on the lower left-hand PROM, it's an M. In this example, the PROM whose fifth letter is a J is counted as PROM number one, the PROM whose fifth letter is a K is counted as PROM number two, the PROM whose fifth letter is an L is counted as PROM number three, and the PROM whose fifth letter is an M is counted as PROM number four. Of these four PROMS, PROM number four contains information about the type of machine for which all four PROMS are intended.

On the fourth PROM (the one whose fifth letter represents the last letter in the alphabetic sequence for that set of chips), there is also one single digit number stamped on the chip. To determine the type of machine that all four chips are intended to be on, see Table 6-4.

Table 6-4. PROM Identification

Number on Chip	Type of Machine
3	300
4	400/400S60
5	310

Battery

A lithium battery is located in the right-front corner of the cabinet immediately behind the LED indicators. It connects to the system board with a two-conductor cable.

The older style battery is mounted underneath a metal cover. The cover is mounted to the base of the cabinet with two screws. The battery holder is attached to the underside of the cover. The electrical connection is a standard AA type battery connection. The battery pushes into the holder. Note the polarity.

The newer style battery assembly comes complete with cables and a velcro fastener. It is mounted directly on the cabinet base, with the other half of the velcro fastener held to the cabinet by double-faced tape.

Version 3

This section discusses definitions, locations, and replacement procedures for subassemblies on Version 3 Models 600, 700, and 1000. For subassembly information on the 3B2/500, see the next section in this chapter, "3B2/500 Subassemblies." For information about external SCSI subassemblies, see Chapter 7, "3B2 Peripheral Subassemblies."

Definitions, locations, and replacement procedures for the following subassemblies are included in this chapter. For the following subassemblies, cover removal is NOT required:

- system board
- SCSI host adapter
- other I/O feature boards
- memory boards
- microbus boards
- buffered microbus boards

In addition, definitions, locations, and replacement procedures for the following subassemblies are included in this chapter. For the following subassemblies, cover removal IS required:

- battery
- thermal shutdown sensor
- power supply
- fans
- SCSI peripherals
    - hard disks, disk bridge controller
    - cartridge tape drive
- floppy disk drive
- backplane

⚠ WARNING

For subassembly replacement procedures that require that the cover be removed, it is important to reinstall the cover after the procedure and before testing. The cover ensures proper cooling. Without it, the computer will not function properly.

System Board

The system board is located behind the large faceplate, containing the console jack, in the back of the computer. The system board is held in place by two locking screws, one on each end of the faceplate. To remove the board, turn each screw counterclockwise one half turn. This will unseat the board from the backplane. When this is done, the board will slide out easily. See Figure 6-15 for a rear view of the 3B2/600 computer.

When replacing the system board, carefully place it in the card guides and slide it into place. Make sure that the fingers on the locking screws pass through the slotted holes in the card cage. Push the system board in until it makes contact with the pins in the backplane. Then turn the locking screws one half turn clockwise to seat the connector. DO NOT FORCE THE LOCKING SCREWS. If excessive pressure is placed on the screws, the fingers will break off.

NOTE: Removing the system board from the backplane disconnects the NVRAM battery. As a result, the first boot after this action will result in an NVRAM SANITY FAILURE message. This is a normal condition under these circumstances. Ignore the message.

Some models may have EMI shielding on the cards directIy below the system board. To facilitate removal and installation, loosen the two screws on each shield and slide the shield down.
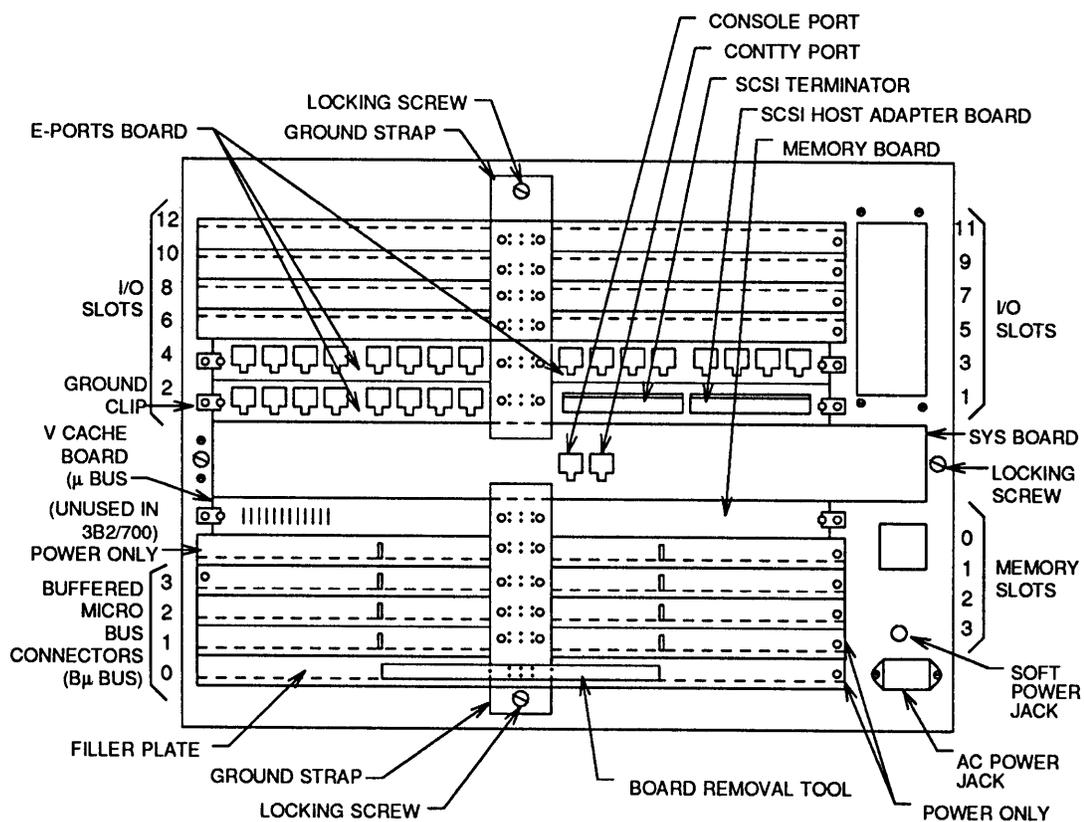
Figure 6-15.   3B2 600/700 computer, rear view

SCSI Host Adapter Board Removal

The SCSI host adapter board (CM195W) in slot 1 is the interface between the system board and the SCSI disks and tape drives. Because of the special cable routing involved, this board is discussed separately. If you are removing a second host adapter board, or any other I/O feature board, proceed to the section on removing I/O feature boards in the next section. Execute the following steps to remove the SCSI host adapter board:

1. To remove the host adapter in slot 1, remove the internal SCSI bus cable from the header connector in the faceplate of the board.

2. After the cable is disconnected, remove the 12 screws in the upper ground strap. The ground strap can then be removed by turning the locking screw at the top one quarter turn counterclockwise.

3. Loosen both screws on the grounding clip on the right edge of the host adapter faceplate and slide the clip all the way to the right. Tighten the rightmost screw to hold the clip in place. Make sure that the clip clears the faceplate.

4. Remove the two screws securing the board removal tool on the bottom filler plate. Insert the tool around the edges of the host adapter faceplate. Push the tool in until the stops prevent it from going in any further. The tool should be locked in place.

5. Carefully unseat the board by pulling straight back on the removal tool. Do this slowly to prevent the board from coming completely out of the card cage. If the board comes out of the card cage, it will darnage the SCSI bus cable.

6. Hold the SCSI bus cable up and out of the way as you gently remove the board from the card cage. It maybe helpful to remove the circuit card or filler plate directly above the host adapter.

When reinstalling a host adapter in slot 1, pull the SCSI bus cable out the back of the card cage about two inches. Holding it up and out of the way, slide the board in until it contacts the backplane connector. Make sure that both edges of the board are resting in the card guides. Apply even pressure on both sides of the faceplate as you press the board into the connector. After the board is in place, reinstall the SCSI bus cable on the right side header connector.

⚠ WARNING

Some of the early vintage host adapter faceplates allowed the cable to be skewed by one column in either direction. Do not allow this to happen. The HA will be damaged if the cable is not correctly seated.

NOTE: If the 3B2 contains hard disk drives with embedded SCSI controllers, (the Emulex bridge controller is not preset) be sure to use a host adapter (HA1) with Artmaster 4, series 8 or greater. This later vintage board has a separate comcode.

I/O Feature Cards

The following procedure can be used on all I/O feature cards except a SCSI host adapter board installed in slot 1. To remove this board, see the previous section, "SCSI Host Adapter Board Removal."

I/O feature boards reside in the twelve slots above the system board. The backplane and the feature boards are keyed so that it is impossible to insert an I/O feature board in any other slot. To remove the I/O feature board, follow these steps:

1. Before removing any board, label and remove all cables from the board to be removed. Remove the 12 screws from the upper ground strap. The ground strap can then be removed by turning the locking screw at the top one quarter turn counterclockwise.

2. Loosen both screws on the grounding clip on the edge of the feature board faceplate and slide the clip away from the faceplate. Tighten the clip screw to hold it in place. Make sure that it is clear of the feature board faceplate. If the board is double width, there will be a grounding clip on both ends.

3. Remove the two screws securing the board removal tool on the bottom filler plate. Insert the tool around the edges of the feature board faceplate. Push the tool in until the stops on the tool prevent it from going in any further. The tool should now be locked in place.

    NOTE: If the board is double width, the removal tool will not work. You will have to remove any filler plates or feature cards that are in the slots directly above the board, and unseat the board by hand.

4. Carefully unseat the board by pulling straight back on the removal tool. Make sure that you do not develop enough momentum to pull the board completely out of the card cage. Remove the tool and complete the job by hand.

When reinstalling a feature card, carefully place it into the edge guides. Gently slide it in until it touches the backplane connector. Make sure that both edges of the board are resting in the card guides. Apply even pressure on both sides of the faceplate as you press the board into the connector.

Memory Boards

Memory boards are available in sizes of 2, 4, and 16 MB. There are four slots available for memory boards. Slot 0 is on the right, directly under the system board. Slots 1-3 follow sequentially, continuing down under slot 0. These slots are keyed so that only a memory board will fit into the backplane connector. Board sizes may be mixed in any order.

NOTE: The 16MB memory board requires a CM518B or CM581C system board.

To remove a memory board, follow these procedures:

1. Remove the 12 screws from the lower ground strap. The ground strap is then removed by turning the bottom locking screw one quarter turn counterclockwise.

   ### ⚠ WARNING
   Most memory boards have components on the top and bottom. This causes interference with the faceplate of the board (or the filler plate) directly underneath. Therefore, always remove memory boards from the bottom up, starting with the filler plate directly under the lowest board.

2. Remove the filler plate directly under the lowest memory board. Loosen both screws on the grounding clip on the right edge of the memory board to be removed, and also on every board underneath it. Slide the clip(s) away from the faceplate(s). Tighten the clip screw(s) to prevent any interference with the memory board faceplate(s).

3. Remove the two screws securing the board removal tool on the bottom filler plate. Insert the tool around the edges of the lowest memory board faceplate. Push the tool in until the stops on the tool prevent it from going in any further. The tool should now be locked in place.

4. Carefully unseat the board by pulling straight back on the removal tool. Make sure that you do not develop enough momentum to pull the board completely out of the card cage. Remove the tool and complete the job by hand.

5. Repeat this procedure until you have removed the defective memory board.

Reinstall memory boards from the top down. Repeat the installation procedure until all boards have been replaced. Then replace the filler plate under the last board.

To install a memory board, carefully place the board into the edge guides. Gently slide it in until it touches the backplane connector. Make sure that both edges of the board are resting in the card guides. Apply even pressure on both sides of the faceplate as you press the board into the connector.

Microbus (uBus) Boards

There is only one uBus connector in the 3B2/600 backplane (CM519A) located on the left hand side, directly underneath the system board. This connector provides unbuffered access to the CPU bus. This slot is used exclusively by the virtual address cache (Vcache, CM522A) board. The Vcache is a fast access memory that stores the most frequently used instructions and data, thereby improving the performance of the 3B2.

All 3B2/600 computers come equipped with a Vcache board. The board is not, however, required for system operation. If the Vcache board is defective, it maybe removed until a replacement board is available. The system will run slower, but it will continue to function properly.

NOTE: The 3B2/500 may also use the Vcache board. See the 3B2/500 section in this chapter for more information.

3B2 models containing the CM518B system board and any backplane except the CM519B will have an operable uBus slot. However, since this system board contains on-board physical address cache (Pcache) memory, the Vcache board is not needed. If a Vcache board is installed in one of these models, it will "override" the system board Pcache. The 3B2 will function properly, but may operate slightly slower.

To remove the Vcache board, follow these steps:

1. Remove the lower ground strap by removing the twelve screws from the strap. Then remove the board removal tool from the bottom filler plate. Release the locking screw at the bottom of the strap by turning it one quarter turn counterclockwise.

2. Loosen the two grounding clip screws on the left side of the Vcache board and slide the clip all the way to the left. Tighten the leftmost screw to hold the clip clear of the Vcache faceplate.

3. Insert the board removal tool around the edges of the Vcache faceplate and push inward until the stops on the tool prevent any further movement. The tool should now be locked in place. Carefully pull straight back on the tool to unseat the board from the backplane connector. Disconnect the tool and remove the board from the card cage by hand.

When installing a Vcache board, place the edges of the board into the card guides and gently push it in until contact is made with the backplane connector. Make sure that both edges are resting in the guides. Seat the board into the connector by applying even force on each side of the faceplate until it snaps into place.

Buffered Microbus (BuBus) Boards

The CM519A and CM519B backplanes have four and three buffered microbus (BuBus) connectors, respectively. These are the bottom connectors on the left side of the backplane. They are numbered from the bottom up, starting with zero.

The bottom two slots can accommodate double-width boards without interfering with any memory slots. The top one or two slots can also support double-width boards but require the loss of a memory slot.

NOTE: The CM518A system board supports only the bottom connector. The CM518B system board supports all three or four connectors (depending on the backplane).

More than one type of board maybe installed in the BuBus slots. The only one that will be discussed here is the multiprocessor enhancement board (MPB). Two other boards that may be installed in this bus are the VME bus host adapter and the expansion bus interface (XBI). See Chapter 3, "3B2 Peripheral Overview," for more information on the VME bus host adapter and the XBI. The XBI is used only in the 3B4000, so refer to the appropriate documentation for more information.

The MPB (CM527A) is an optional board for Version 3 models. Multiple MPB boards maybe added to the system, limited only by the number of operable BuBus slots available (the CM518A system board supports only one slot). If more than one MPB is installed in a 3B2, Release 2 or later of the multiprocessor enhancement (MPE) software must be installed.

To remove a BuBus board follow these procedures:

1. Label and remove all cables from the board to be removed. Remove the 12 screws from the lower ground strap. The ground strap can then be removed by turning the locking screw at the bottom one quarter turn counterclockwise.

2. Loosen both screws on the grounding clip on the left edge of the board faceplate and slide the clip away from the faceplate. Tighten the clip screw to hold it in place, making sure that it is clear of the faceplate. If the board is double width, there will be a grounding clip on both ends.

3. Insert the board removal tool around the edges of the board faceplate. Push the tool in until the stops on the tool prevent it from going in any further. The tool should now be locked in place.

   NOTE: If the board is double width, the removal tool will not work. You will have to remove any filler plates or boards that are in the slots directly above the board to be removed. Remove the board by hand.

4. Carefully unseat the board by pulling straight back on the removal tool. Make sure that you do not develop enough momentum to pull the board completely out of the card cage. Remove the tool and complete the job by hand.

When reinstalling a BuBus board, carefully place it into the edge guides. Gently slide it in until it touches the backplane connector. Make sure that both edges of the board are resting in the card guides. Apply even pressure on both sides of the faceplate as you press the board into the connector.

Processor Bus (PBus) Boards

The CM518C system board and CM519B backplane provide the processor bus (PBus) in place of the uBus. The PBus occupies the three slots on the left hand side of the backplane, directly underneath the system board. These slots are numbered from top down, starting with zero. Since the PBus borrowed one slot from the BuBus, only three BuBus slots are provided by this backplane. See Figure 6-16 for layouts of the backplanes.

The PBus, like the uBus, provides unbuffered access to the CPU bus on the system board. This bus is used exclusively by the processing clement (PE) boards.

The PE board (CM524A) works only in conjunction with a CM518C system board. Also, Release 2 of the multiprocessor enhancement (MPE) software must be installed (the same package used for the MPB board). A 3B2/1000 Model 80 comes equipped with one PE board. This board is not required for system operation. If it is defective, it may be removed until a replacement board is available. The system will run slower without the PE installed.

Although this board is named differently from the MPB, the 3B2 identifies either board by the same name, namely, mph. For instance, the output of the `prtconf` command will show mpb for either an MPB board in a BuBus slot or a PE board in a PBus slot. The output will show, however, on which bus the board is located. The same thing is true for the equipped device table (EDT). The EDT will also show the slot number and occurrence (count) for each mph.

When running diagnostics on either an MPB board or PE board, the device name supplied should be `mph`. To run diagnostics on a single board when more than one is installed, it is necessary to supply the number of the mpb board. The system will number the MPB and PE boards starting with the BuBus slots 0-2, and then the PBus slots 0-2. Figure 6-16 shows an example. In this example, if the first PE board (the one in slot 0 of the PBus) is to be diagnosed, the command would be: dgn mpb=l. Specific phases may also be specified.
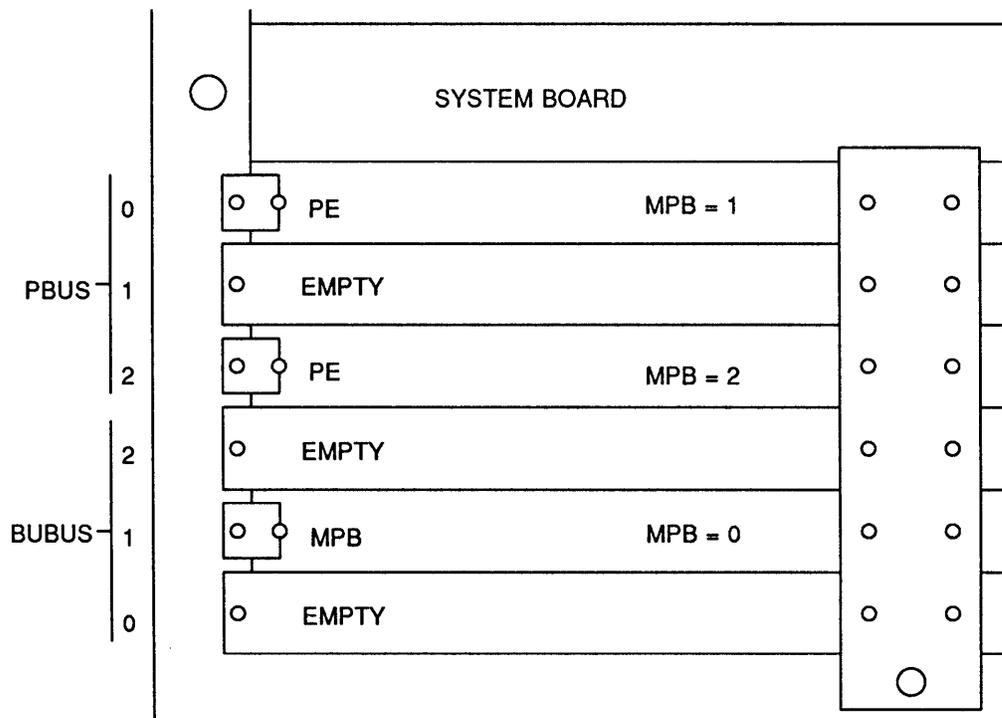
Figure 6-16.   MPB and PE board numbering example in CM519B backplane

Installation and removal procedures of a PE board are identical to those for the Vcache.

Removing the Cover

The cover on the 3B2 Models 600, 700 and 1000 does not interfere with removing boards from the backplane. Therefore, for procedures that simply require backplane activity, it is not necessary to remove the cover. The following procedures, however, do require that the cover be removed.

The cover is secured by 12 Phillips screws. Remove these and slide the cover back and lift it off. When replacing the cover, make sure not to catch any cables that are dressed along the sides of the cabinet.

See Figure 6-17 and Figure 6-18 for locations of the following subassemblies:

- battery

- thermal sensor

- disk bridge controller board (not on all models)

- power supply

- fan

- peripheral cage

- backplane

Battery

The battery assembly on the 3B2/600, 700, and 1000 computers is the same as the battery available for the other models of the 3B2 computer. The battery is attached to the right side (looking from the rear) of the card cage using a velcro fastener. The battery cable connects to the backplane between the top two I/O connectors on the right side (slots 9 and 11).

The battery cable can be disconnected without removing any other assemblies. To reconnect the cable, you may need to remove the I/O board in slot 11 (if one is present). To remove the I/O board, see the section on removing I/O boards.

NOTE: If the battery has been disconnected, the contents of the NVRAM on the system board (and any I/O board that makes use of the battery) will be lost. The next time the computer is turned on, an NVRAM SANITY FAILURE message will be displayed on the console. This is normal for these circumstances. Ignore the message.

Thermal Sensor

The 3B2/600, 700, and 1000 has a thermal sensor attached to the left side (looking from the rear) of the card cage. If the internal temperature reaches 125 degrees Fahrenheit, the message `WARNING: thermal overload shutdown` will appear on the console and the system will begin an express powerdown. If this occurs, the system will remain off until the power switch is reset or the AC power is interrupted.

The sensor has two leads attached to it. One connects to frame ground, and the other goes back to the power supply. Under normal conditions, the sensor provides a short to ground. When the sensor is tripped, the ground path is broken.

The sensor is attached to the card cage by two screws. To remove the sensor, first remove the lead running back to the power supply. Then remove the screws to release the sensor.

When installing a sensor, make sure that the attached lead is grounded. Do not forget to attach the lead from the power supply. If the lead from the power supply is not connected, or the sensor is open, the power supply will run for one minute and then shut itself off.

To bypass the sensor for troubleshooting purposes, simply ground the lead from the power supply.
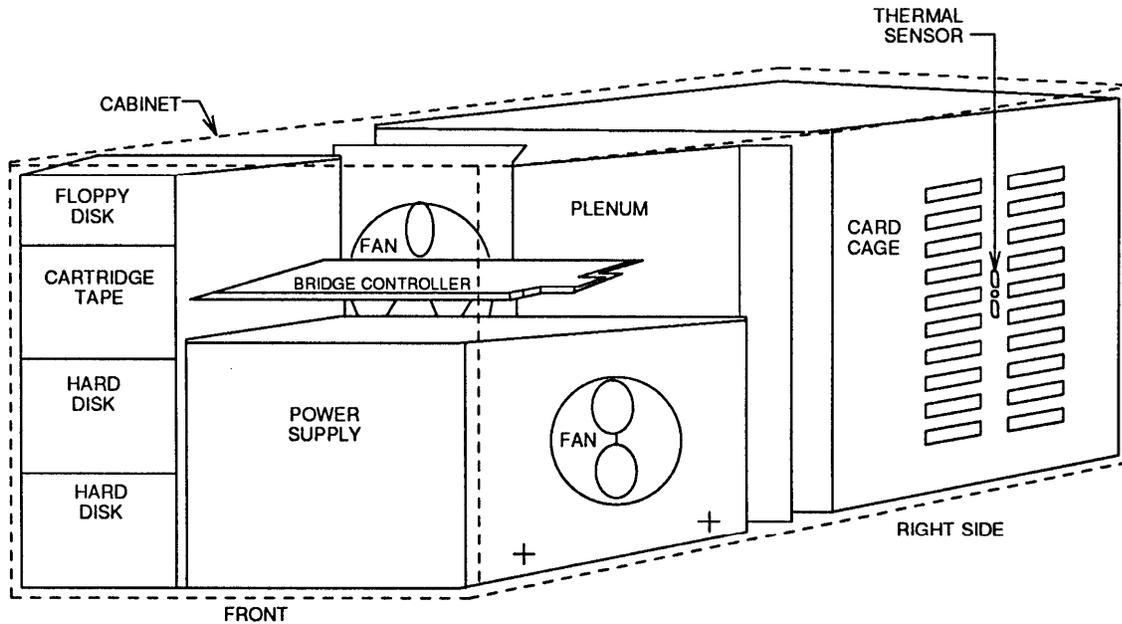
Figure 6-17.   3B2/600 suassemblies (ESDI disk drives)

PERIPHERAL
CAGE
HANDLE

FAN

SOFT POWER
CABLE

AC POWER
JACK

BATTERY

PERIPHERAL
CAGE

LOCKING
BRACKET

POWER
SUPPLY

DISK OR
DISK BRIDGE
CONTROLLER
MOUNTING

CARD
CAGE

FRONT
DOOR

POWER SUPPLY
HEADER
CONNECTORS

+5 VDC
POWER FEEDER
HARNESSES

FAN

THERMAL
SENSOR

BACKPLANE
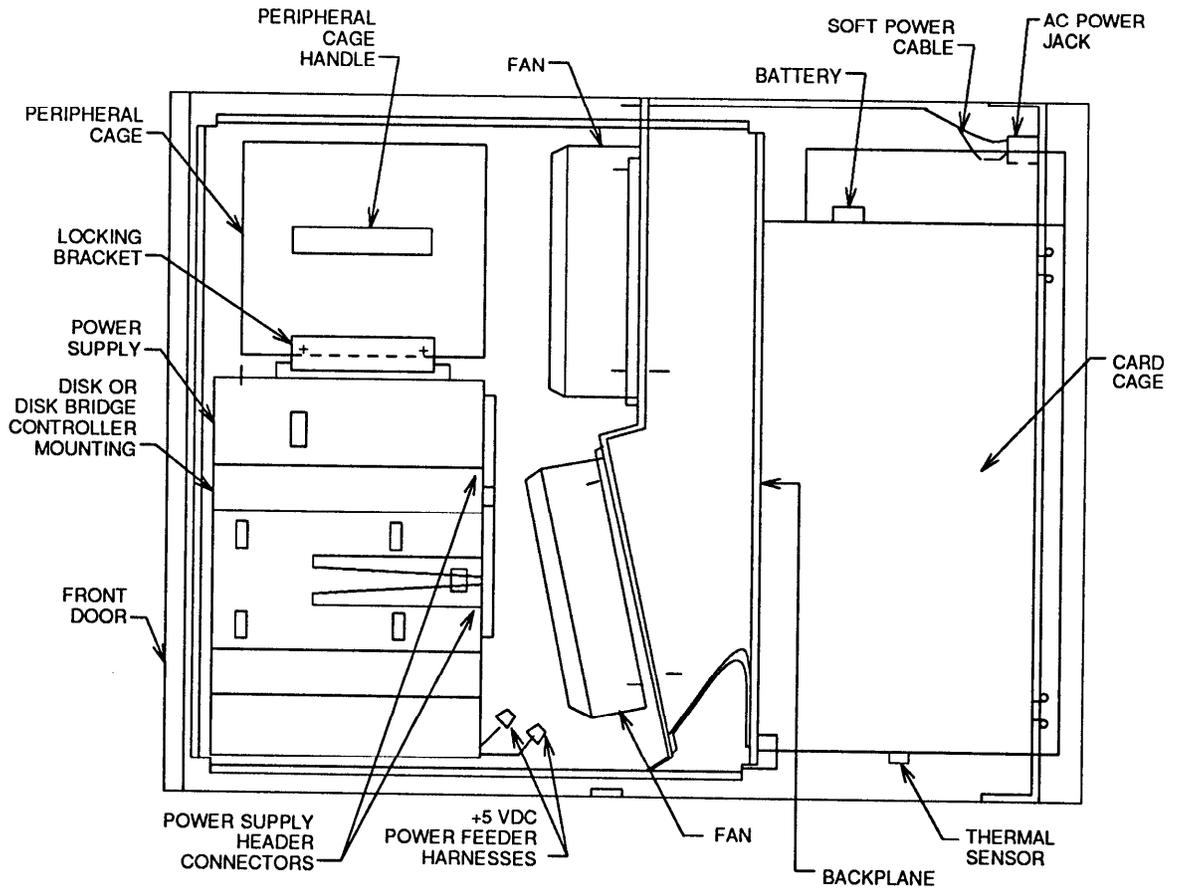
Figure 6-18. **3B2/600 computer, top view**

Fans

There are two 12 VDC fans in the 3B2/600, 700 and 1000 computers. The fans are attached to a carrier that secures to the fan plenum. The bottom of the carrier has two tabs that insert through matching slots in the plenum. The top of the carrier is secured by screws, snap fasteners, or both, depending on the vintage of the machine.

To remove a fan, follow this procedure:

1 . Cut the cable tie (if present) holding other cables to the fan. Trace the fan cable back to the power supply and disconnect it.

2 . Remove the screw(s) from the top of the carrier (if present) and tilt the carrier toward the front of the machine.

3 . Lift the assembly up and out of the cabinet.

When replacing a fan, be sure to secure any cables that were tied to the fan before it was removed. Loose cables may interfere with fan operation.

NOTE: The fan cables carry a failure signal back to the power supply. If a fan is connected but the blade is not rotating, the message THERMAL SHUTDOWN will appear on the console and the power will be removed. If one or both fans is disconnected, the system will fail powerup diagnostics and shut itself off.

Power Supply

The power supply is in the right front (looking from the front) of the 3B2/600 cabinet. There are six cable connections to the power supply.

The right side header connector supplies the +5 and +12VDC for the peripherals (disk, tape, and floppy) and the disk bridge controller. All the peripheral connectors supply the same voltages (red=+5, yellow=+12, blue=ground).

The left side header is split into three separate cables. The two on the right power the fans and are interchangeable. The leftmost cable supplies the backplane with control signals along with positive and negative 12 VDC. This cable also runs to the power switch, the thermal sensor, and the soft power jack.

The two large cable harnesses from the bottom of the supply carry +5 VDC and ground to the backplane. These two cables are interchangeable.

To remove the power supply, execute the following steps:

1. Remove the leads from the power switch and the LEDs and place them out of the way.

2. Remove the cables from the disk bridge controller. The bridge controller is attached to a removable chassis that is latched onto the top of the power supply. Remove this chassis by lifting up on the locking tab that protrudes from the rear, and sliding the chassis backward (toward the fans). Place the chassis out of the way.

3. Remove the four header connectors from the power supply and disconnect the two +5 V harnesses. The power supply is held inside a cage that is secured to the bottom of the cabinet, and to the peripheral cage. Remove the two screws and the bracket holding the peripheral cage to the power supply cage.

4. Insert a screwdriver through the round hole in the bottom of the front face of the cabinet (underneath the power supply). Apply downward pressure on the screwdriver to lift the locking tab that holds the power supply cage in place. When the tab is released, the cage will slide backward toward the fans. Lift the cage out and remove the supply from the cage. See Figure 6-19 for pinouts on the power supply.

Pin 1	------- Pin 1	--	+5V
		--	+5V Return
		--	+12V Return
		--	+12V
PERIPHERAL		--	+5V
POWER		--	+5V Return
CONNECTOR		--	+12V Return
		--	+12V
		--	+5V
		--	+5V Return POWER
		--	+12V Return SUPPLY
		--	+12V
		--	+5V
		--	+5V Return
		--	+12V Return
		--	+12V
		--	+5V
		--	+5V Return
		--	+12V Return
Pin 20	------- Pin 20	--	+12V

Pin 1	------- Pin 1	--	1 Logic+ (fan 1 logic power - +12V)
Fan 1		--	1 Fanfail0 (fan 1 failure)
Connector		--	1 Motor+ (fan 1 motor power - +12V Max.)
		--	1 Logic Return
		--	1 Motor Return
Pin 1	------- Pin **6**	--	2Logic+ (fan 2 logic power - +12V)
Fan 2		--	2Fanfail0 (fan 2 failure)
Connector		--	2Motor+ (fan 2 motor power - +12V Max.)
		--	2Logic Return
		--	2Motor Return
		--	XM soft power Return
Discrete		--	On/Standby switch
Wires		--	XM soft power (+5V)
		--	On/Standby switch return
		--	Thermal sensor

Pin 1	------- Pin 16	--	+12V
		--	+12V
		--	Return
BACKPLANE		--	Return
CONNECTOR		--	-12V
		--	RRST0 (request reset)
		--	PWRON1 (power on)
		--	EXTPWR1 (external power on)
		--	THSDN0 (thermal shutdown)
Pin 10	------- Pin 25	--	PDWNRQ0 (power down request)

Figure 6-19.   Power supply header connectors, top view

SCSI Subsystem - Hard Disks and Cartridge Tape

Version 3 models contain a "core" single-ended SCSI bus that connects one or more integral hard disk drives and one integral cartridge tape drive to a host adapter (HA1) in slot 1 of the I/O bus.

Core SCSI Bus Physical Configuration

Since some 3B2 models contain disks with an ESDI interface, a SCSI-to-ESDI bridge controller is required. This controller is the same one that is used in the DCM/4E, XM/405S, and XM/900S. Other 3B2 models contain disks with embedded SCSI controllers, thus eliminating the need for the bridge controller. This also allows room for an additional disk inside the 3B2 cabinet. The cartridge tape drive always contains its own SCSI controller.

The peripheral cage located in the front left corner of the cabinet houses the cartridge tape drive, one or two hard disk drives, and the floppy disk drive. (The floppy drive is not a part of the SCSI subsystem.) To replace any of these devices, the entire cage must be removed from the cabinet. The space above the power supply may contain either a SCSI bridge controller or a SCSI disk drive (see Figure 6-20).

The internal SCSI bus is a 50-pin ribbon cable that connects the SCSI host adapter board in slot 1 of the I/O bus to the internal peripherals. There are several different cables that are used, depending on the type of hard disks (SCSI or ESDI), and the number and placement of disks (if equipped with SCSI disks). The following cables can be identified by the number of connectors, or taps, on the cable.

3 connector cable   This cable, used in models with ESDI disk drives and a SCSI bridge controller, provides three taps on the SCSI bus: the host adapter, cartridge tape drive, and SCSI bridge controller. The ESDI hard disk drives are connected to the bridge controller through another cable.

4 connector cable   If the 3B2 contains one or two SCSI disk drives, and these drives are located in the peripheral cage, this cable is used. Since SCSI disk drives connect directly to the SCSI bus, a connector is provided for each disk. If only one disk is equipped, the extra connector can be left empty.

5 connector cable   This cable must be used when the 3B2 contains SCSI disk drives, and
                     one of the drives is located on top of the power supply. This cable
                     provides three taps for SCSI disk drives. One or both of the taps in the
                     peripheral cage may be left empty.

⚠ WARNING

Extreme care must be taken when disconnecting the 50-pin
ribbon cable from the internal peripherals. Do NOT pull on
the cable during removal from a peripheral, as this will lead
to internal breakage of the cable conductors.

NOTE: As seen in Figure 6-20, the last controller on the bus is terminated. Similarly, in a
configuration with ESDI disks, the last disk on the ESDI command cable must be terminated.
The ESDI cabling between the bridge controller and the ESDI disks is not shown in
Figure 6-20.
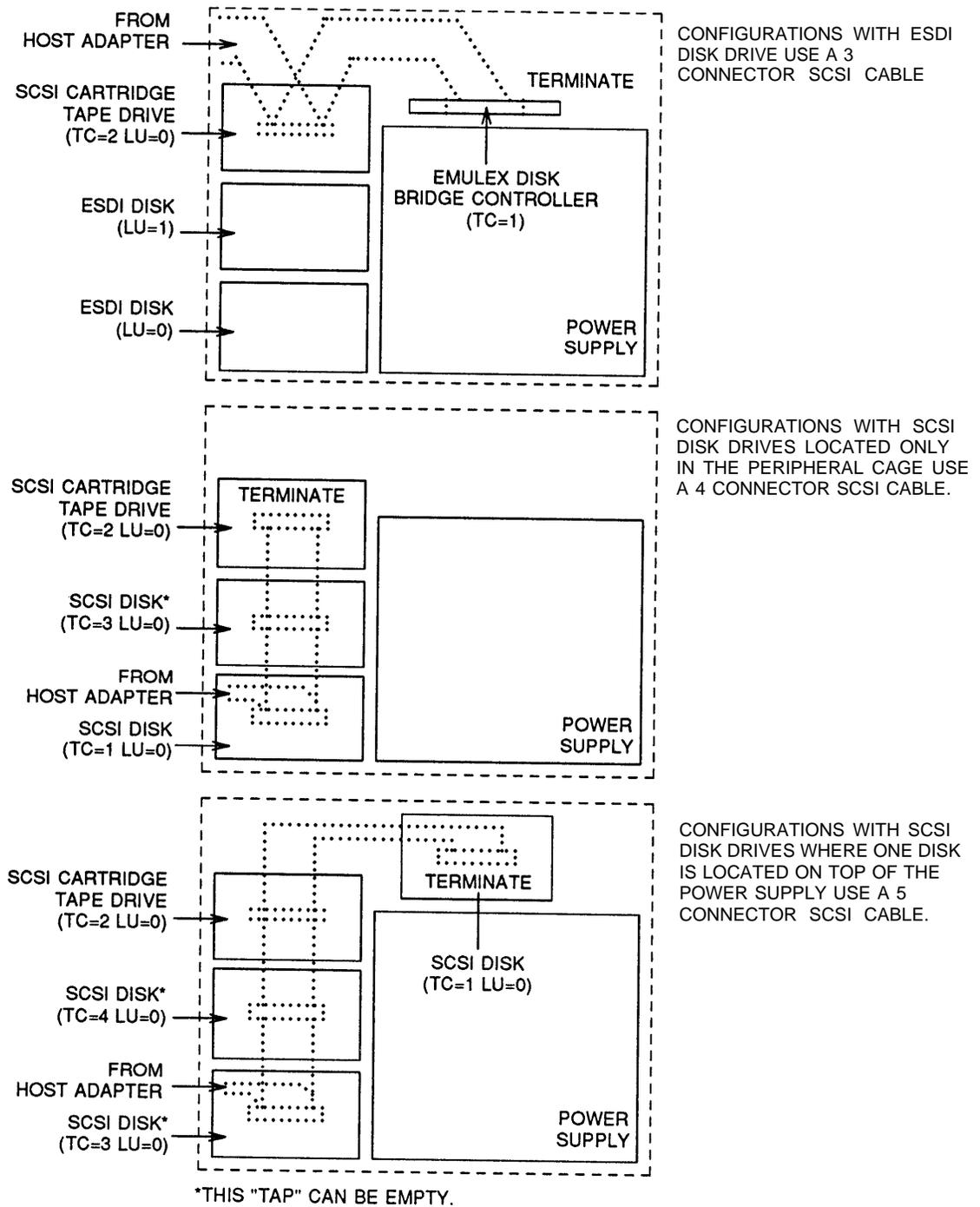
Figure 6-20.   Internal hard disk and SCSI cable configurations

SCSI Disk Bridge Controller

If the hard disks inside the 3B2 have an ESDI interface, a SCSI-to-ESDI disk bridge controller board is present (see Figure 6-21). The bridge controller is located on top of the power supply.

To remove the bridge controller board, you must first remove the power, SCSI, and ESDI cables from the board. The board is secured to a removable chassis by four snap mounts. The board is released by gently applying upward pressure at each snap.

When installing a disk bridge controller, check the following items:

- Switch 1 on the DIP switch should be on. All others should be off. The SCSI target ID of this controller is expected to be 1. It cannot be set externally, so the DIP switch is used.

- The two SCSI bus terminating resistors must be installed since this is the last controller on the bus.

- The ESDI data cables should be on the connectors labeled DRV 0 and DRV 1.

To secure the board to the snap mounts, position the holes over the mounting studs. Apply gentle downward pressure over each stud until the board snaps
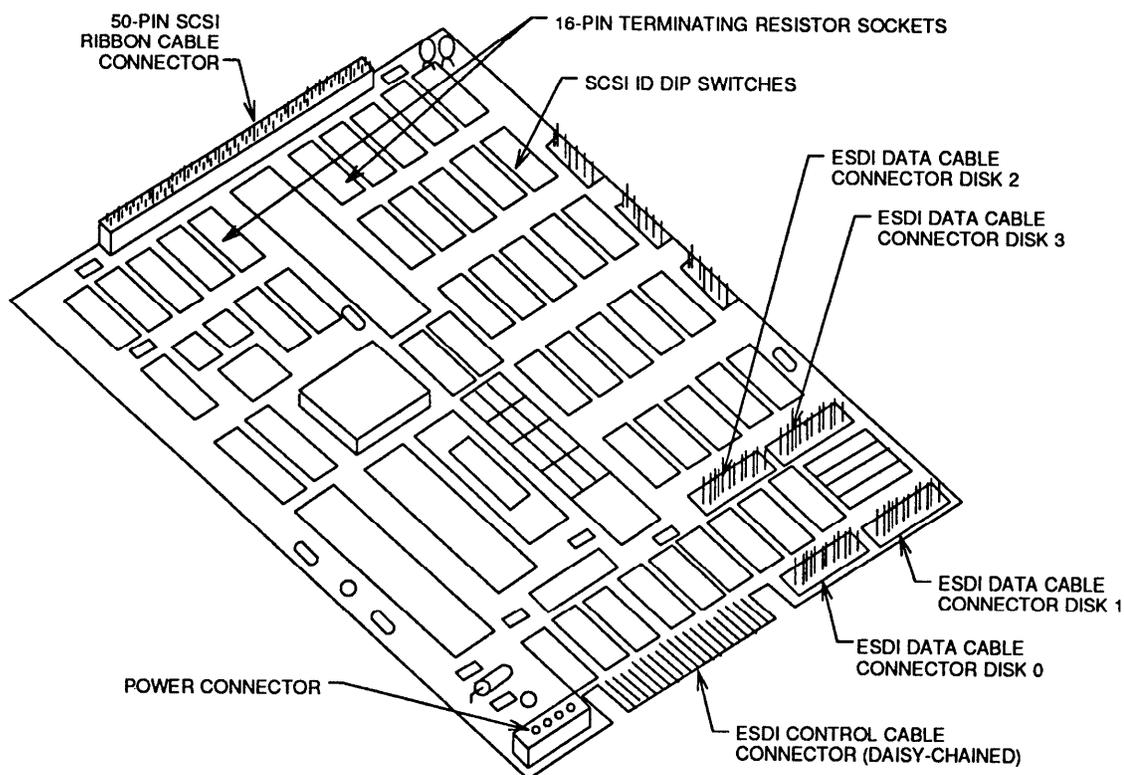
Figure 6-21. **Emulex SCSI-to-ESDI disk bridge controller**

Removing the Hard Disk Drive

If the disk drive is mounted on top of the power supply, it is secured to a removable chassis. Disconnect all cable connections to the disk, release the latch at the rear of the chassis, and slide the chassis to the rear. Then loosen the screws securing the disk drive and remove it from the chassis.

For disk drives located in the peripheral cage, the cage must be removed. Refer to the following section for this procedure.

When replacing a disk, the ID must be set to match the defective unit. On ESDI disks, the ID sets the logical unit (LU) number; on SCSI disks, the ID sets the target controller (TC) number. Also, the last disk on the bus must be terminated. For ESDI disk drives, disk 0 (the bottom disk in the peripheral cage) should be terminated. For SCSI disks, the last disk on the 50-pin SCSI ribbon cable should be terminated. Appendix E, "Peripheral Configuration Diagrams," shows the ID and termination locations for all peripherals.

NOTE: ESDI and SCSI hard disks are not interchangeable with those used with the expansion disk controller (XDC), or those connected to a Model 300, 310, or 400 system board.

Removing the Cartridge Tape Drive

The tape drive is the same drive used in the SCSI tape modules. It can be either a 60 or 120 MB unit. The tape drive connects directly to the SCSI bus (50-pin ribbon cable). By default, the internal tape drive always has a SCSI ID of 2. Also, the tape drive should not contain terminating resistors unless it is the last device on the 50-pin ribbon cable.

To remove the tape drive, the peripheral cage must be removed. See the next Section, "Removing the Peripheral Cage," for this procedure.

> ⚠ **WARNING**
> When reinstalling the SCSI bus cable on the tape drive, make sure that it is not skewed one or more columns in either direction. This will cause damage to the tape drive and possibly other target controllers.

Removing the Peripheral Cage

To replace one peripheral storage device in the peripheral cage, the entire peripheral cage must be removed. This cage is held to the power supply by a bracket with two screws and to the cabinet floor by a locking tab.

To remove the peripheral cage, do the following:

1. Remove the fan located behind the cage.

2. Carefully remove the cables from all storage devices.

   > ⚠ **WARNING**
   > Extreme care must be taken when disconnecting the 50-pin ribbon cable from the internal peripherals. Do NOT pull on the cable during removal from a peripheral, as this will lead to internal breakage of the cable conductors.

3. Remove the screws and bracket holding the top of the cage to the power supply cage.

4. Insert a screwdriver through the round hole in the bottom of the cabinet front (under the peripheral cage). Apply pressure on the screwdriver (to raise the locking tab) and slide the cage toward the fans. Use the handle on top of the cage to lift it out of the cabinet.

     5. The storage devices are independently held in the cage with four screws each. Remove the screws from the defective device and slide it out of the cage.

Backplane

The backplane is housed inside the card cage and is the most difficult assembly to remove. Several other subassemblies must be removed before the backplane can be accessed. Verify that the backplane is defective before attempting to remove it.

To remove the backplane, see the Section, "Backplane," in this chapter. Then remove the subassemblies in the following order:

     1. Remove the system board.

     2. Remove the top and bottom grounding straps and all filler plates.

     3. Remove all I/O, memory, uBus, and BuBus boards.

     4. Disconnect all cables from the top of the backplane.

     5. Disconnect the battery cable.

     6. Disconnect the thermal sensor cable from the sensor assembly.

After these subassemblies are removed and/or disconnected, the entire backplane should be visible. Remove the three screws securing the fan plenum to the top of the card cage. Remove the two screws from the locking bracket at the bottom rear of the card cage. Remove the bracket.

The card cage is now free to move. Rotate the cage 90 degrees counterclockwise. Be careful not to damage the AC or soft power cords. Remove the 12 screws that secure the center guide posts to the card cage. Remove the 15 screws that secure the backplane to the card cage. Rotate the backplane 45 degrees and lift it out of the card cage. (This step may not have to be performed if the new backplane is already assembled in a new card cage).

Floppy Disk Drive

The floppy drive is the same drive used on the other models of the 3B2 computer (720 KB). This drive is located in the top of the peripheral cage. To remove the floppy, this cage must be removed. For this procedure, see the previous section on the SCSI subsystem.

When replacing the floppy drive, none of the switches or jumpers should be changed. The floppy drive is connected through the backplane to the system board.

3B2/500 Subassemblies

Introduction

Since the 3B2/500 is a cross between a Version 2 cabinet and the Version 3 architecture, it does not fit nicely into the preceding sections of this chapter. The 3B2/500 is a scaled-down version of the 3B2/600 housed in a 3B2/400 cabinet. Most of the hardware is identical to the 600. The Model 500 uses the same system and memory boards as the 600, as well as having the capability to use the Vcache and multi-processor enhancement boards. The 500 also utilizes an internal SCSI subsystem that contains one or two hard disk drives and a cartridge tape drive. These peripherals, as in the larger Models 600, 700, and 1000, connect to a SCSI host adapter (HA) board in 1/O slot 1. The standard 720 KB floppy disk drive is also packaged in the 3B2/500.

The main subassemblies that are unique to the 3B2/500 are the power supply and the backplane. These subassemblies will be covered in this section, as well as some points on the physical configuration. The following items are included in this section:

- backplane

- power supply

- miscellaneous notes

    - memory boards

    - system board

    - buffered microbus (BuBus)

    - SCSI subsystem

Backplane

The 3B2/500 backplane provides seven I/O expansion slots, two memory slots, one uBus (Vcache) slot, two BuBus slots, and the system board slot. All the slots in the backplane are keyed so that a feature board can only be installed in an appropriate slot. Figure 6-22 shows the layout of the backplane.

To remove the backplane, the card cage assembly must be removed. Disconnect all cable connections to the backplane, the cable between the system board and the console/contty assembly, and the SCSI ribbon cable from the host adapter board. There are 4 screws holding the cage to the bottom of the cabinet, and two screws securing it to the back panel.

I/O SLOT 7	I/O SLOT 6	
I/O SLOT 5	I/O SLOT 4	
I/O SLOT 3	I/O SLOT 2	
BuBus 1 *	I/O SLOT 1 (HA)	I/O SLOTS
BuBus 0	MEMORY 1	PERFORMANCE SLOTS
uBus (Vcache)	MEMORY 0	
SYSTEM BOARD		
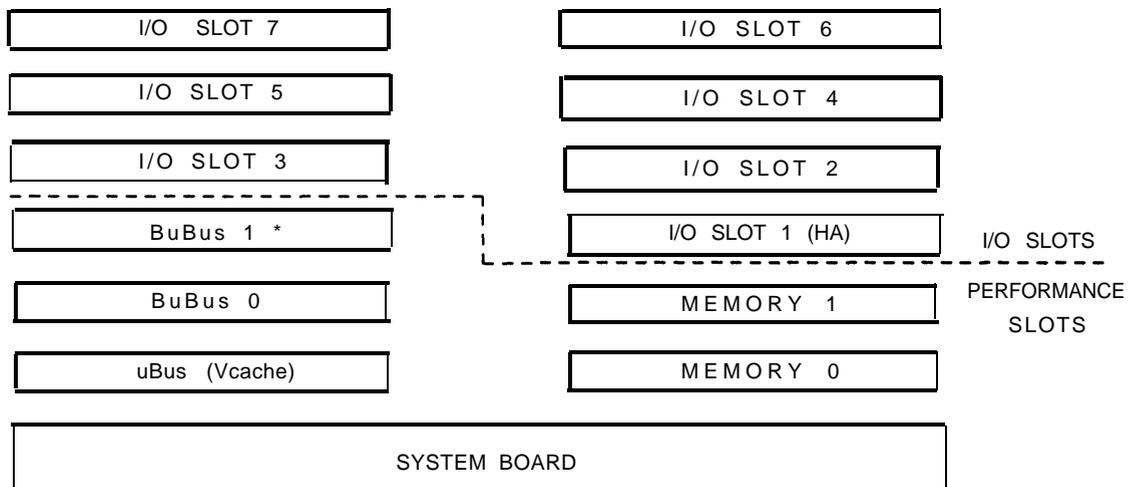
* OPERABLE ONLY WITH CM518B SYSTEM BOARD

Figure 6-22.   3B2/500 backplane layout

Power Supply

The power supply is located in the left-rear corner of the cabinet. This supply is auto-ranging. It supplies positive 5 and 12 volts and negative 12 volts to the internal components. The power supply has a two-position switch that operates in the same way as on the Models 600, 700, and 1000. Pressing the switch to the standby position causes an express shutdown. The power supply is also equipped with a recessed reset button on the rear panel. This button, as always, should only be used to recover from a 'hung' state after first trying the power switch.

There are three cable assemblies/connections to the power supply. Coming out of the front of the supply are the cables carrying +5 and +12 volts to the peripherals. The connector on the right side supplies +5 volts and ground to the backplane. The header connector in the front at the top-right corner supplies control signals and positive and negative 12 volts. These pins, numbered starting from the left side, are shown in Table 6-5.

Table 6-5. 3B2/500 Power Supply Pinouts

Pin #	Function
1	RQRST0 (request reset)
2	Gnd
3	+12V
4	-12V
5	Gnd
6	PDWNRQ0 (power down request)
7	PWRON1 (power on)
8	Gnd
9	Gnd
10-15	Not Used
16	THSDN0 (thermal shutdown)
17-18	Not Used

This power supply also contains a fan and thermal sensor. A soft power jack is supplied at the rear panel. These components are built into the supply and are not replaceable.

To remove the power supply, disconnect all power cables, remove two screws holding the front of the supply to the bottom of the cabinet, and remove four screws attaching the supply to the rear panel.

Miscellaneous Notes

Memory Boards

The 3B2/500 computer comes equipped with one 4 MB memory board. An additional memory board can be installed in the second slot. The first memory slot must not be skipped. When installing a memory board in the second slot, the chips on the bottom of the board (if any) will contact the faceplate of the memory board in the first slot. Therefore, the memory board in the first slot must first be removed and then reinstalled after the other board has been installed in the second slot.

The 16 MB memory board maybe used only if a CM518B system board is installed (3B2/522).

System Board

Either a CM518A (500) or CM518B (522) system board may be equipped. Although the system board plugs into the backplane, the entire card cage must be removed to replace the system board.

The console and contty ports, located on the back of the cabinet, are connected by a ribbon cable to the jack on the left-rear corner of the system board. The console and contty ports located on the system board should not be used.

BuBus Slots

If a CM518A system board is installed, only one BuBus slots will be operational (BuBus 0). A CM518B system board allows both slots to be used.

SCSI Subsystem

The 3B2/500 computer may have either one ESDI hard disk drive with a SCSI bridge controller board, one SCSI hard disk drive, or two SCSI hard disk drives. Replacement of the bridge controller is identical to the Models 600, 700 and 1000. The hard disks are contained in a metal housing. This housing can be removed by pressing up on the tab underneath the cabinet and sliding the housing towards the rear.

One of two internal 50-pin ribbon cables maybe used for connecting the SCSI peripherals to the host adapter. One is the 3-connector cable used when a bridge controller is present, and the other is a 4-connector cable used when SCSI disks are equipped (one connector may be left empty when only one SCSI disk is installed).

Chapter 7: 3B2 Peripheral Subassemblies

Introduction

This chapter reviews definitions, locations and replacement procedures for the external peripheral modules of the 3B2 computer. The external peripherals are listed as follows:

- Expansion module (XM) (non-SCSI)

- Tape module (TM) (non-SCSI)

- SCSI subassemblies

  - Disk controller module (DCM)

  - Disk module (DM)

  - Tape module (TM)

  - Expansion module (XM)

  - 9-Track tape drives

⚠ WARNING

Before working on any peripheral cabinet, shut down the computer and unplug the AC power cord to avoid the chances of injury or equipment damage.

Expansion Module (XM) (non-SCSI)

To release the cover from the expansion module (XM), remove the single screw on the back panel of the cabinet. This screw is located at the top, in the center of the cabinet (see Figure 7-1). Once the screw is removed, the cabinet lid must be pulled forward and lifted up. The top and bottom sides are slotted to fit together.

There are three 4-pin connectors present for up to three devices inside the XM cabinet. The XM power supply provides the same drive voltage to all three connectors. See Table 7-1 for pinouts of connectors. The twin lead LED is powered directly from the power supply.

Table 7–1.   Pinout Numbers

PIN NO.	DESCRIPTION
1	+12VDC
2	Return
3	Return
4	+5VDC
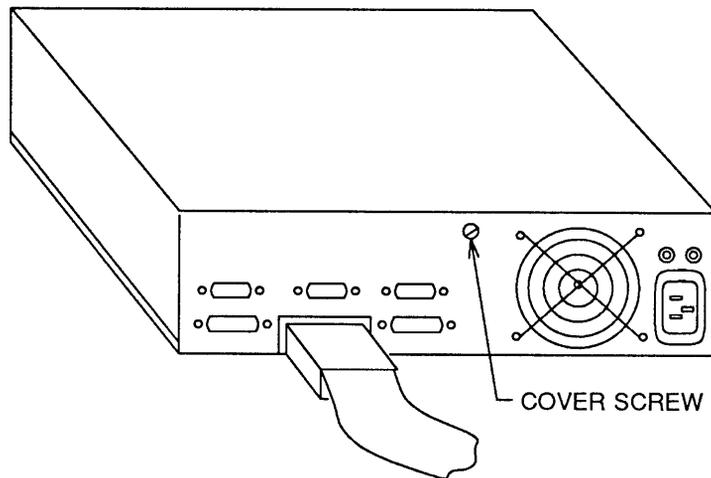
Figure 7–1.   Removal of XM cabinet cover

Cartridge Tape Drive (23 MB)

The 23 MB cartridge tape drives (KS-23165) are present in the Model 400 and the XM/TM only. The cartridge tape drive is located on top of the floppy drive in the Model 400, and in either the center or the far left in the XM. The drive is mounted on top of the floppy drive in the 400, and inside the same bracket with the floppy. In the XM, there is a slotted adapter plate that is released from the cabinet base by depressing a metal tab at the back of the drive. This same tab releases all drives that are present in the XM. Figures 7-2 and 7-3 show the XM device adapter plate and the mounting/release tabs. The TM has four screws through the bottom of the chassis that mount the tape drive to the chassis. These screws are only visible after removing the XM cover. The cartridge tape drive also contains a terminating resistor that should be in place or removed depending on cabling placement (see Figure 7-4). The tape drive has a 4-pin power connector and a 34-pin cable that connects to the cartridge tape controller (CTC) card in an I/O expansion slots.
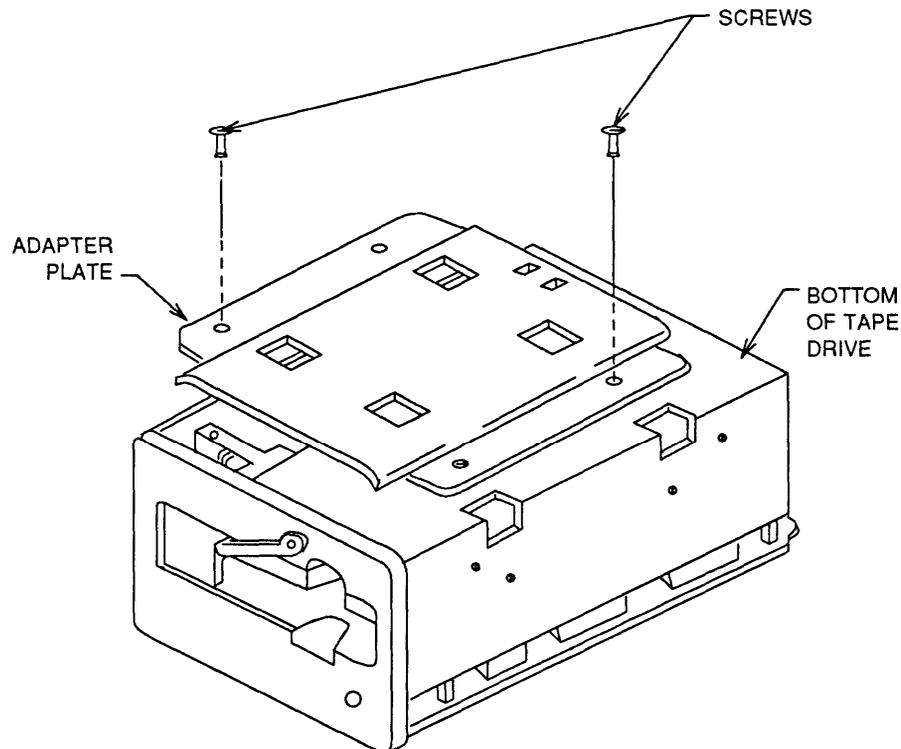
Figure 7–2.   XM drive adapter plate
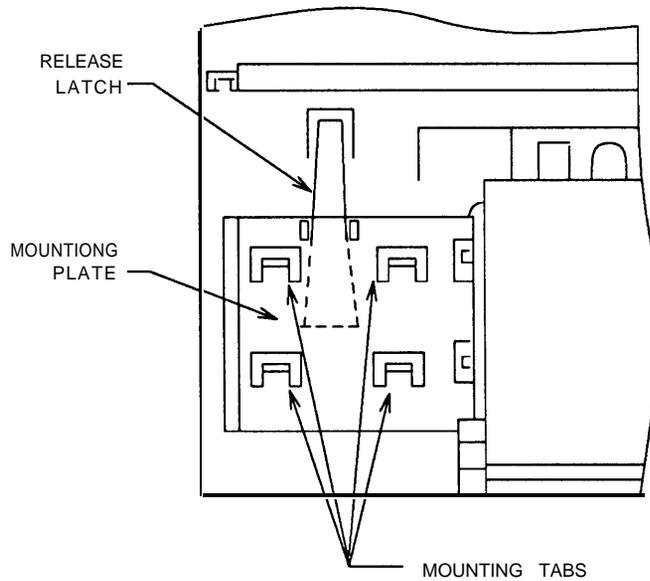
Figure 7–3. XM adapter plate mounting release
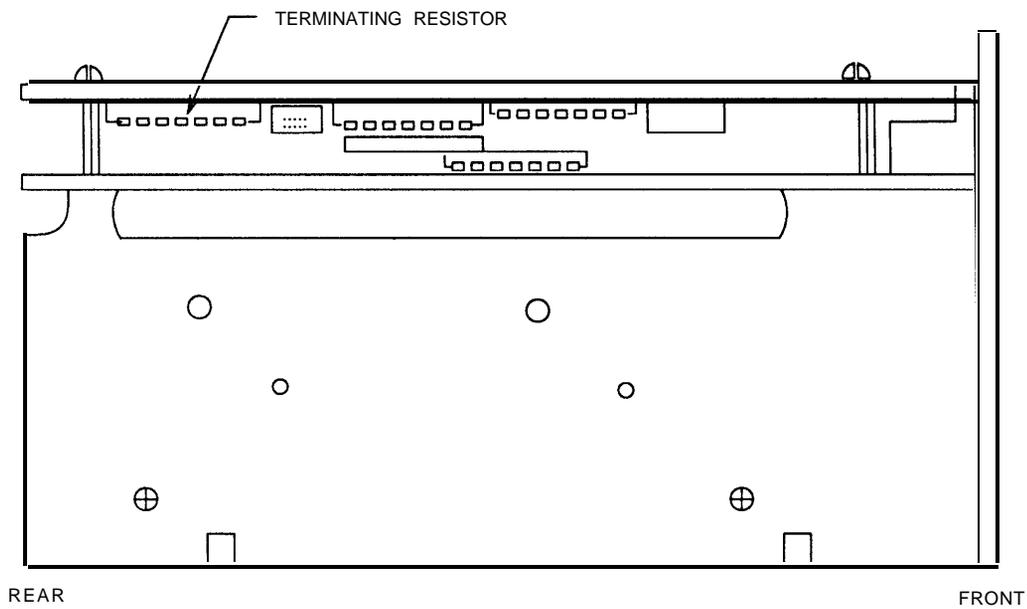
Figure 7-4.   23 MB cartridge tape drive terminating resistor

Hard Disk

There are two ST-506 interface hard disk drives that are supported in the XM. They include

- KS23054, L1 32MB

- KS23054, L2 72MB

The hard disk in the XM is located in the right front corner of the cabinet. It is possible for the XM to have more than one hard disk, in which case the second drive is in the front center and the third is at the far left. The interface is composed of at least three connectors: a 34-pin and a 20-pin provided as links to the system board, and a 4-pin power connector. Figure 7-5 shows the hard disk drive connectors. Refer to Appendix A, "Handling Circuit Boards," for drive ID and termination information.
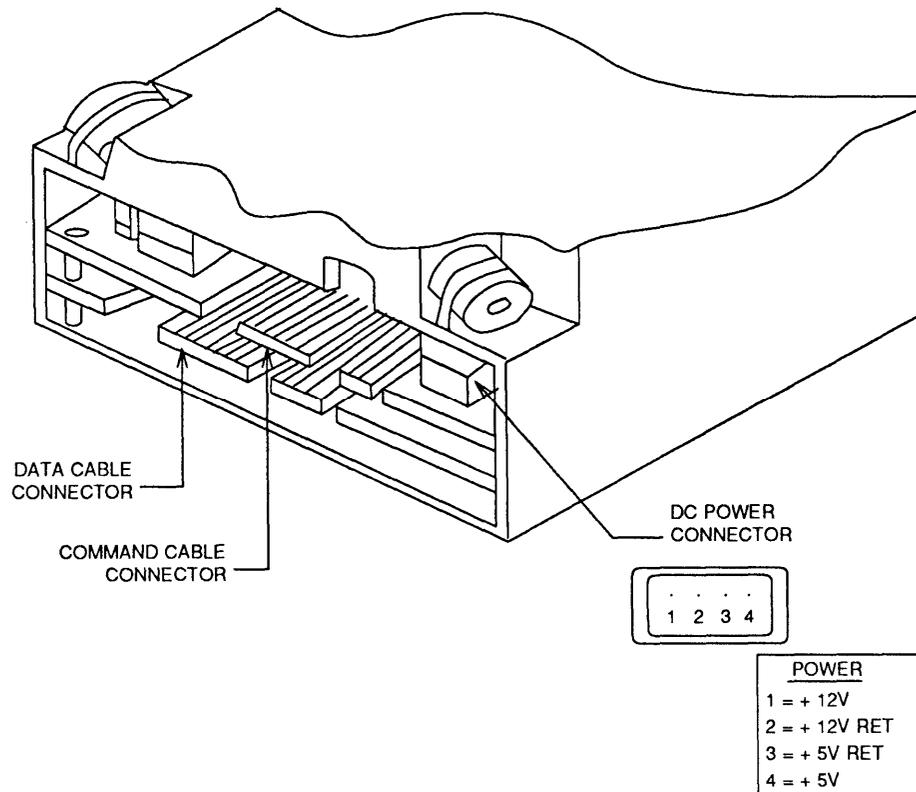
Figure 7–5.   Hard disk drive connectors

Floppy Disk

Most XMs do not have a floppy drive present. If one is present, it is located in an adapter cage. Release the adapter cage by depressing the tab in back. See the Section, "Cartridge Tape Drive," in this chapter.   If you are installing a floppy for the first time or replacing a defective one, make certain of the terminating resistor status on the drive. See Figure 7-6 for the location of the terminating resistor. If the drive is at the end of the cabling inside the XM, the resistor should be left in place (see Figure 7-7). If the cabling is such that the floppy is in the middle, remove the resistor pack (see Figure 7-8).
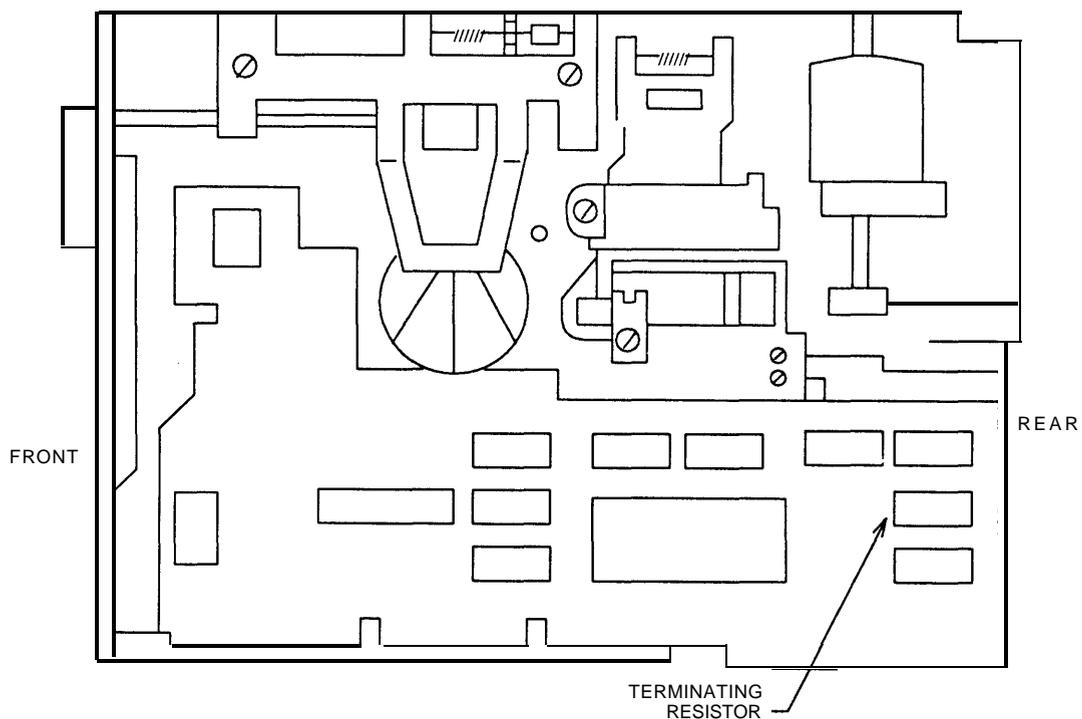
Figure 7–6.   Floppy drive terminating resistor, top view
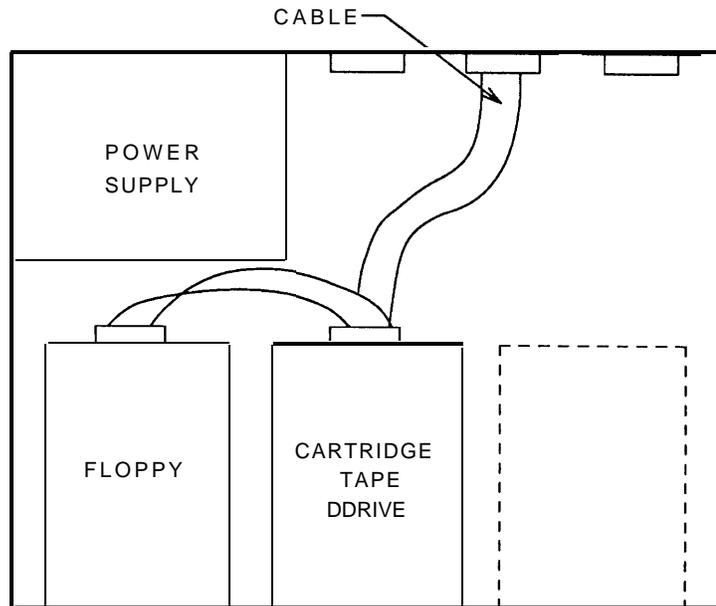
Figure 7-7. Cable routing number 1
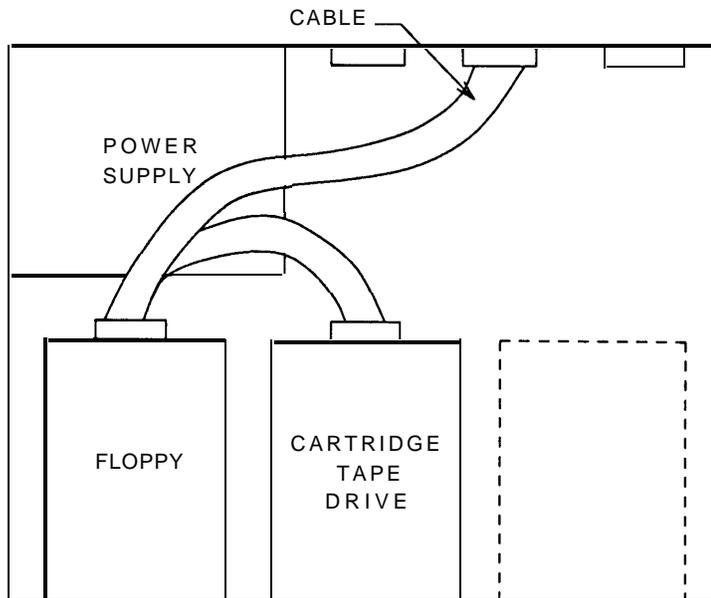
Figure 7–8. Cable routing number 2

Tape Module (TM) (non-SCSI)

To take off the housing lid, two screws from the lower corners of the rear panel have to be removed. Slide the housing cover forward and away.

One 4-pin connector runs from the power supply to the tape drive. To simplify removal of the tape module (TM) power supply, release all the connectors. The power supply sits on four stand-off posts. Depress the tabs back into the stand-off posts and lift up (see Figure 7-9).
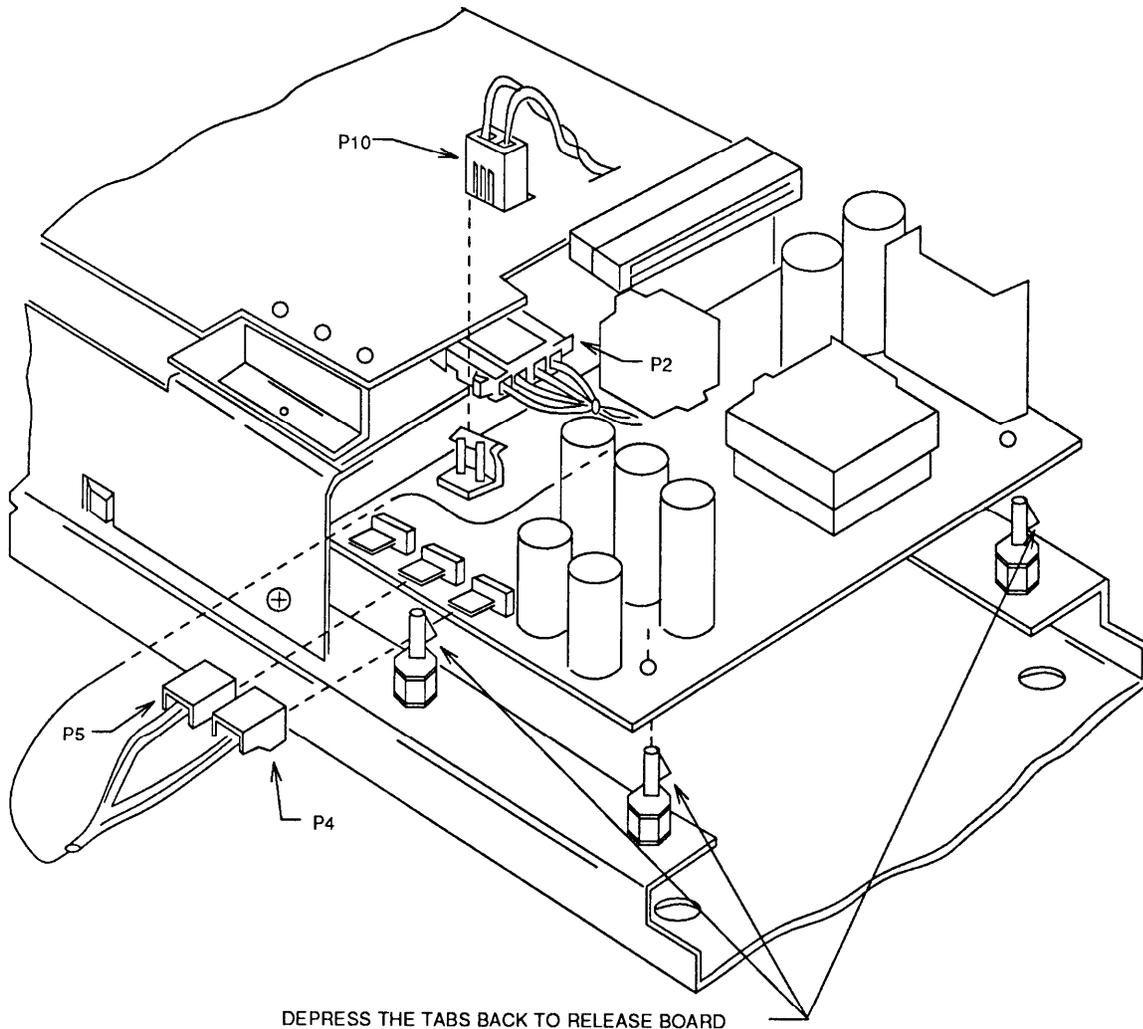
Figure 7–9.   Removal of TM power supply

SCSI Subassemblies

This section discusses definitions, locations, and replacement procedures for external SCSI subassemblies. For information about system subassemblies, see Chapter 6, "3B2 Subassemblies."

In this section, the phrase "controller on the SCSI bus" is used. Cabinets of this type are equipped with a SCSI target controller ID switch (0-7) on the back panel.

The 9-track tape drive is also a controller, but its ID is set through a DIP switch on the Keystone tape drives or by the front control panel on the HP autoloading tape drive. The SCSI IDs are set at the factory for both host adapter boards and 9-track tape drives. The host adapter board is set to ID 0, and the 9-track tape drive is set to ID 7. ID numbers 1-6 may be used by any other controller. Be sure that no ID number is duplicated on a SCSI bus.

Disk Controller Module (DCM)

The DCM/4E acts as a bridge between the SCSI bus and the enhanced small disk interface (ESDI) bus (see Figure 7-10). The disk bridge controller in this module is capable of driving four ESDI disks of varying capacity. The ESDI bus consists of one daisy-chained control cable and four discrete data cables. The data connectors are labeled from 0-3 on both the bridge controller and the back panel of the DCM/4E. The control out connector cables to the first disk module. The SCSI in and out connectors are used to daisy-chain the SCSI bus.

If the DCM is the last controller on the SCSI bus, the SCSI out connector must be terminated with a SCSI bus terminator. The SCSI bus target controller ID (0-7) is set by the rotary switch on the back panel. The ID can also be set using positions 1-3 on the DIP switch on the controller. This is a binary ID where position 1 is the least significant bit. This switch should never be used (all switches off) in the DCM/4E unless there is a problem with the rotary switch or a cable between the rotary switch and the controller. The DCM package contains a bridge controller board, a fan, and a power supply. The power supply is auto-ranging and operates on either 110 or 220 VAC.

Figure 7–l0.   Disk control module, top view

Removing the Cover

Remove the plastic front door. Open the door until it is horizontal, then press down on the hinges. The door will snap free. There are two types of covers on the DCM/4E. The first is held in place by a single screw on the top center of the back panel. Remove this screw and the cover will slide forward and lift off. The second type of cover is secured by four screws, two on each side of the bottom of the cover. Remove these screws and lift the cover.

Removing the Bridge Controller Board

The bridge controller is secured to a removable chassis by snap connectors. All cables should be removed from the controller board first. Then apply upward pressure at each snap location to release the board. When reinstalling the controller board, secure it onto the snap connectors first, then connect the cables. Make sure that port 0 on the controller is connected to port 0 on the back panel, and so on. There are two sockets for terminating resistors on this board. No terminating resistors should be installed. All switches on the DIP should be in the OFF position.

Removing the Rotary ID Switch

The ID switch snaps into place through a hole in the back panel. Remove the cable connecting the switch to the bridge controller, then remove the switch by applying pressure to both sides and pushing towards the back. The switch should snap free.

Removing the Fan

The fan is screwed to the bridge controller chassis. Disconnect the fan from the power supply, then remove the fan. When installing a new fan, make sure that the cable is connected properly. The fan will not operate if the cable is on backwards. You must also check to see that the airflow is directed towards the bridge controller.

Removing the Power Supply

To remove the power supply, remove the back panel. The back panel is held in place by screws in the lower-right and upper-left corners. Remove all cables from the controller board and power supply, then remove the back panel. The power supply is secured to the base of the cabinet by a locking tab. Release the tab by applying upward pressure through the hole in the bottom front of the cabinet, underneath the power supply. When the tab is released, slide the power supply back and lift up.

Disk Module (DM)

There are two types of disk modules (DM). One type contains ESDI drives and is identified with the "E" suffix (DM/300E). This disk module requires a disk controller module (DCM). The other type contains SCSI drives and is identified with the "S" suffix (DM/300S). This type does not require the disk controller module (DCM). Both these types of drives are described in this chapter.

Disk Module for ESDI Disks

The disk module (DM) contains a 5.25 inch ESDI hard disk, a rotary disk ID (logical unit 0-3) switch, a power supply, and a fan (see Figure 7–11). The number in the name DM/300E reflects the formatted storage capacity (300 MB) of the disk. The suffix "E" after the number indicates that this is an ESDI disk. When larger disks are introduced, the package names will change accordingly.

There are four ESDI disk drives that are available for the DM.

- 94 MB

- 135 MB

- 147 MB

- 300 MB

The DM has three cable connections on the back panel. There are two for the daisy-chained control cable (control in, and control out) and one for the data cable. The last DM on the chain must have an ESDI terminator installed in the control out connector. Soft-power is supplied to the DM through the control cable from the DCM/4E.

Disk modules are shipped from the factory with plugs in the soft power jacks. Do not remove these plugs.

⚠ WARNING
Do not connect a soft-power cable to a disk module. This will cause damage to the 3B2 computer.

When replacing a hard disk drive in a DM, two things must be checked: the disk ID and termination. The disk ID setting should be set between 1 and 4 corresponding to the logical unit (LU) number 0-3 on the DCM. When installing a disk in a DM, a disk ID cable is used instead of jumpers. See Table 7-2 for the proper ID cable. The terminating resistor must be removed when installing a new hard disk in a DM. An external terminator is used for the DM at the end of the daisy-chain. See Appendix E, "Peripheral Configuration Diagrams," for the location of terminators and the ID pins of the different disk drives.

⚠ **WARNING**

Never change any jumpers or switch settings other than the ID on a hard disk drive. All other settings are set by the manufacturer to match the specific characteristics of the disk drive.
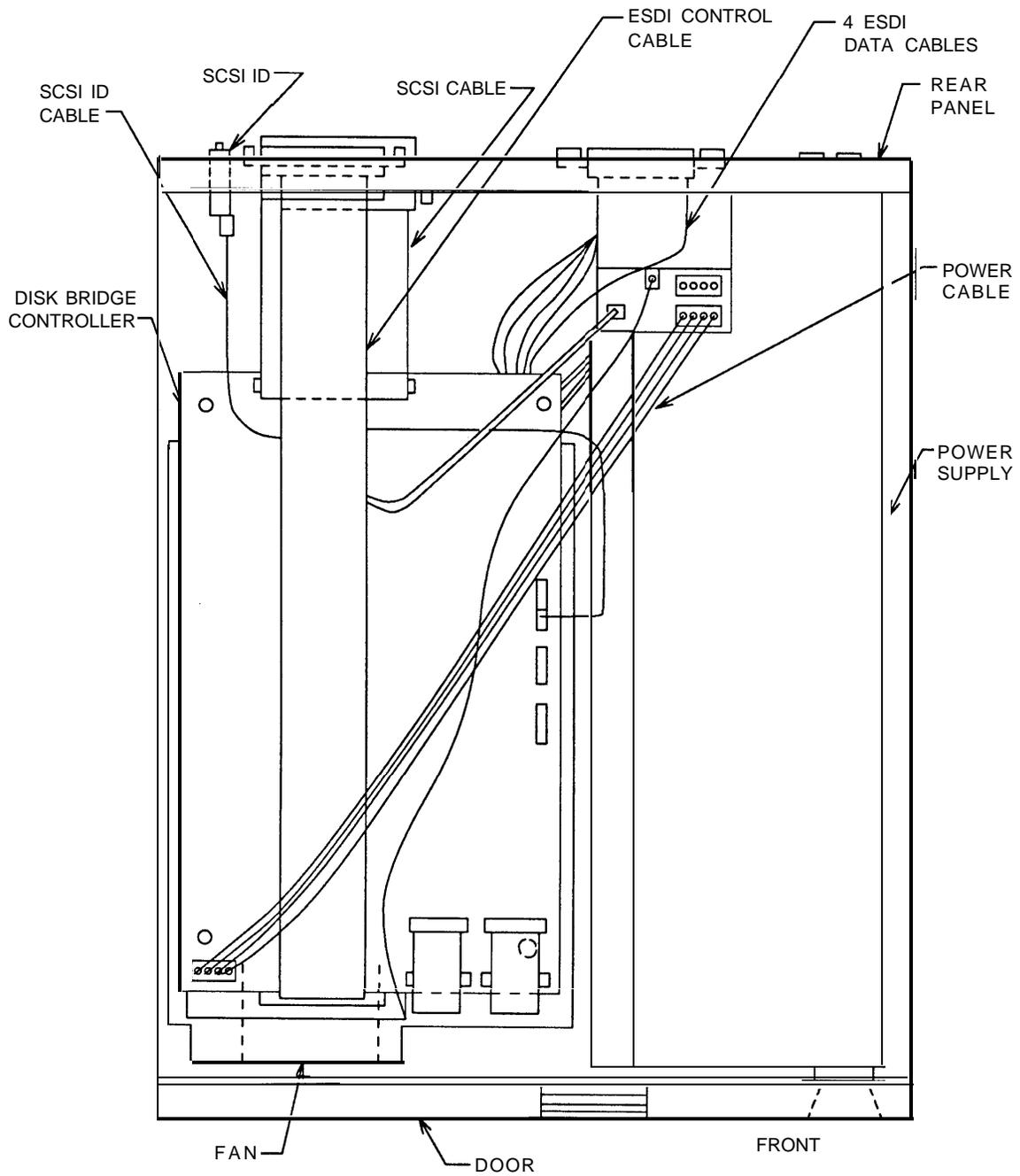
Removing the Cover

Remove the plastic front door. Open the door until it is horizontal, then press down on the hinges. The door will snap free. There are two types of covers on disk modules. The first is held in place by a single screw on the top center of the back panel. Remove this screw and the cover will slide forward and lift off. The second type of cover is secured by four screws, two on each side of the bottom of the cover. Remove these screws and lift the cover.

Removing the Hard Disk

Remove the control and data cables from the disk. Then remove the disk ID cable. If the cable is attached to the back of the disk drive, remove it from the drive. If the cable runs underneath the disk drive, remove it from the rotary switch in the back panel. The disk is held in place by a locking tab.

To release the tab, apply upward pressure through the hole in the bottom front of the cabinet (underneath the disk drive), then slide the drive toward the back and lift up. Remove the locking plate from the bottom of the disk.

⚠ **WARNING**

When installing a new disk in a DM, do NOT change any jumpers to match the old drive. Depending on the manufacturer, jumpers may be used to tune the drive to meet certain specifications. Changing these jumpers could result in a malfunctioning disk drive.

Figure 7–11.   ESDI Disk module, top view

Removing the Rotary ID Switch

The ID switch snaps into place through a hole in the back panel. Remove the cable connecting the switch to the disk drive, then remove the switch by applying pressure to both sides and pushing towards the back. The switch should snap free.

Removing the Fan

The fan is screwed to the back panel. Disconnect the fan from the power supply. Then remove it. When installing a new fan, make sure that the cable is connected properly. The fan will not operate if the cable is on backwards. Also, ensure that the airflow is directed out the back of the cabinet.

Removing the Power Supply

To remove the power supply, remove the back panel. This is held in place by screws in the lower-right and upper-left corners. Remove all cables from the disk drive and power supply, then remove the back panel. The power supply is secured to the base of the cabinet by a locking tab. The tab is released by applying upward pressure through the hole in the bottom front of the cabinet, underneath the power supply. When the tab is released, slide the power supply back and lift up.

Disk Module for SCSI Disks with Embedded Controller

The SCSI disk module can be identified by the "S" or "DS" suffix (DM/300S has the single-ended SCSI interface while the DM/300DS has the differential SCSI interface). These DM's eliminate the need to use the disk controller module (DCM) and connect directly to the SCSI bus. The disk module uses the same cabinet and power supply as other disk modules but have new internal cabling. See Appendix D, "Equipment and Spare Parts List," for the list of spare parts. Refer to Appendix E, "Peripheral Configuration Diagrams," for the location of the terminator and ID pins of the disk drives.

Replacement procedures for the SCSI disk modules are the same as the replacement procedures for the ESDI disk modules. Refer to the sections under ESDI disk modules for any replacement procedures.

Soft Power for SCSI Disks with Embedded Controller

Soft-power for the DM/300S and DM/300DS connects directly to the soft power connector behind the disk module (DM).

Tape Module (TM)

The 3B2 computer SCSI bus supports the following two SCSI cartridge tape drives:

- 60 MB SCSI cartridge tape drive

- 120 MB SCSI cartridge tape drive

The original 60 MB drive and the new 120MB drives look identical except for the identification stamps appearing on the faceplates. The faceplate of the 60 MB drive is labeled "60." Similarly, the faceplate of the 120 MB drive is labeled "120." Both drives use the same cartridge tapes (DC600A) as the non-SCSI CTC tape subsystem. The 120 MB drive can read but not write a 60 MB tape. The 60 MB drive can neither read nor write a 120 MB tape. Figure 7-12 shows a TM/60S that contains a KS-23417,L1 tape drive.

Unlike the CTC drives, the SCSI cartridge tape drives support only character mode sequential access. This means that there is no file system capability, and that no formatting of tapes is required. There is no automatic retention pass when a tape is inserted, and the tape is not locked in the drive when the drive is selected. The green select indicator (on the faceplate) lights when the unit is powered on. Depending on the firmware version, this light may stay on until a tape is inserted into the drive. After a tape has been inserted into the drive, the light remains on while the drive is selected and extinguishes when the drive is released.

Removing the Cover

Remove the plastic front door by opening the door until it is horizontal, then pressing down on the hinges. The door will snap free. There are two types of covers on tape modules. The first is held in place by a single screw on the top center of the back panel. Remove this screw and the cover will slide forward and lift off. The second type of cover is secured by four screws, two on each side of the bottom of the cover. Remove these screws and the cover will lift off.

Removing the Tape Drive

Remove the SCSI bus, target controller ID, and power cables from the tape drive first. The tape drive is held in place by a locking tab. To release the tab, apply upward pressure through the hole in the bottom front of the cabinet (underneath the tape drive), then slide the drive toward the back and lift up. Remove the locking chassis from the bottom of the tape drive.

When replacing a tape drive, make sure that there are no SCSI bus terminating resistors installed on the target controller board. For more information see Appendix E, "Peripheral Configuration Figures." These DIPs should only be used when the tape drive is the last device on the bus inside of a 3B2 computer.
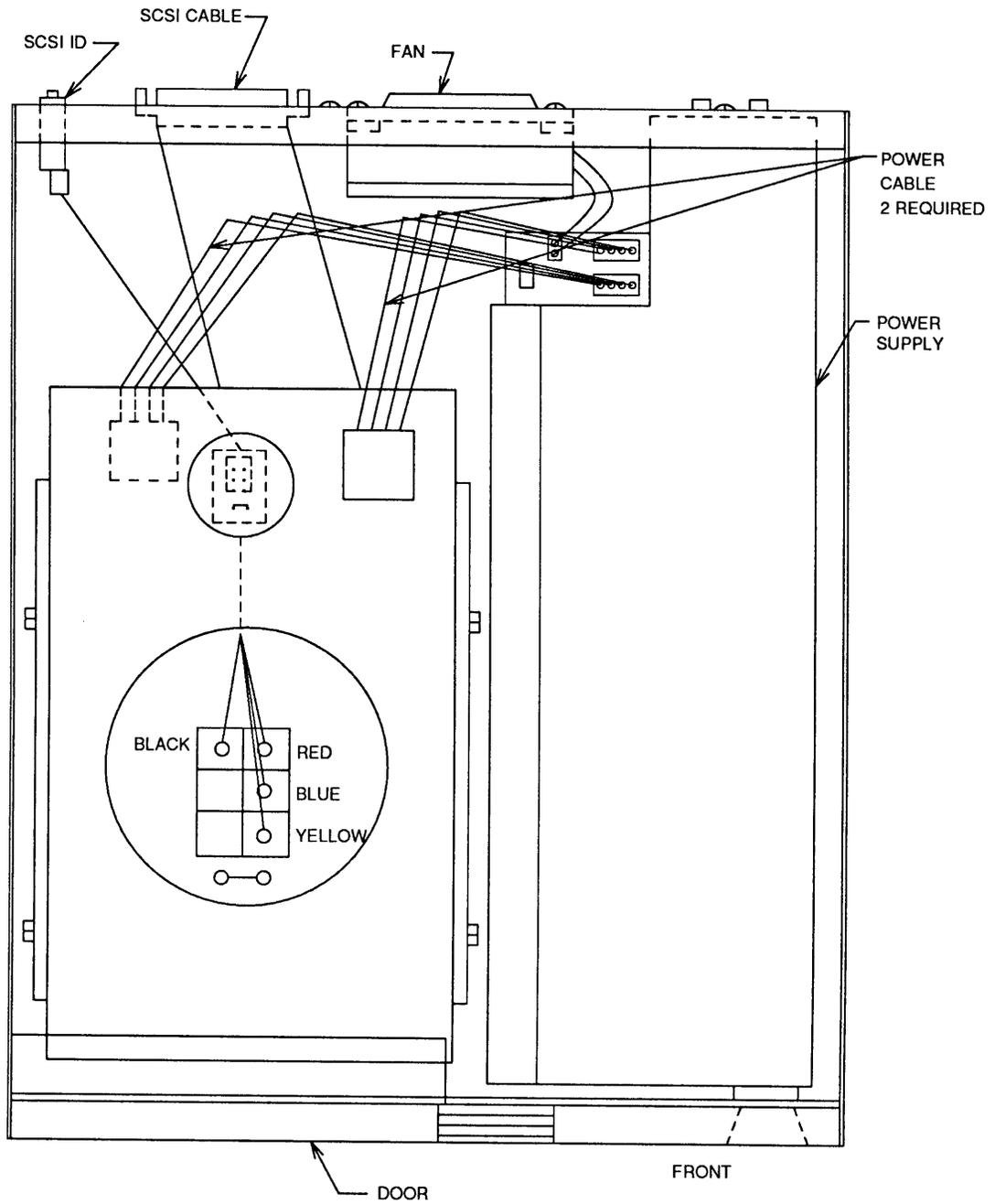
Figure 7–12.   TM/60S tape module, top view
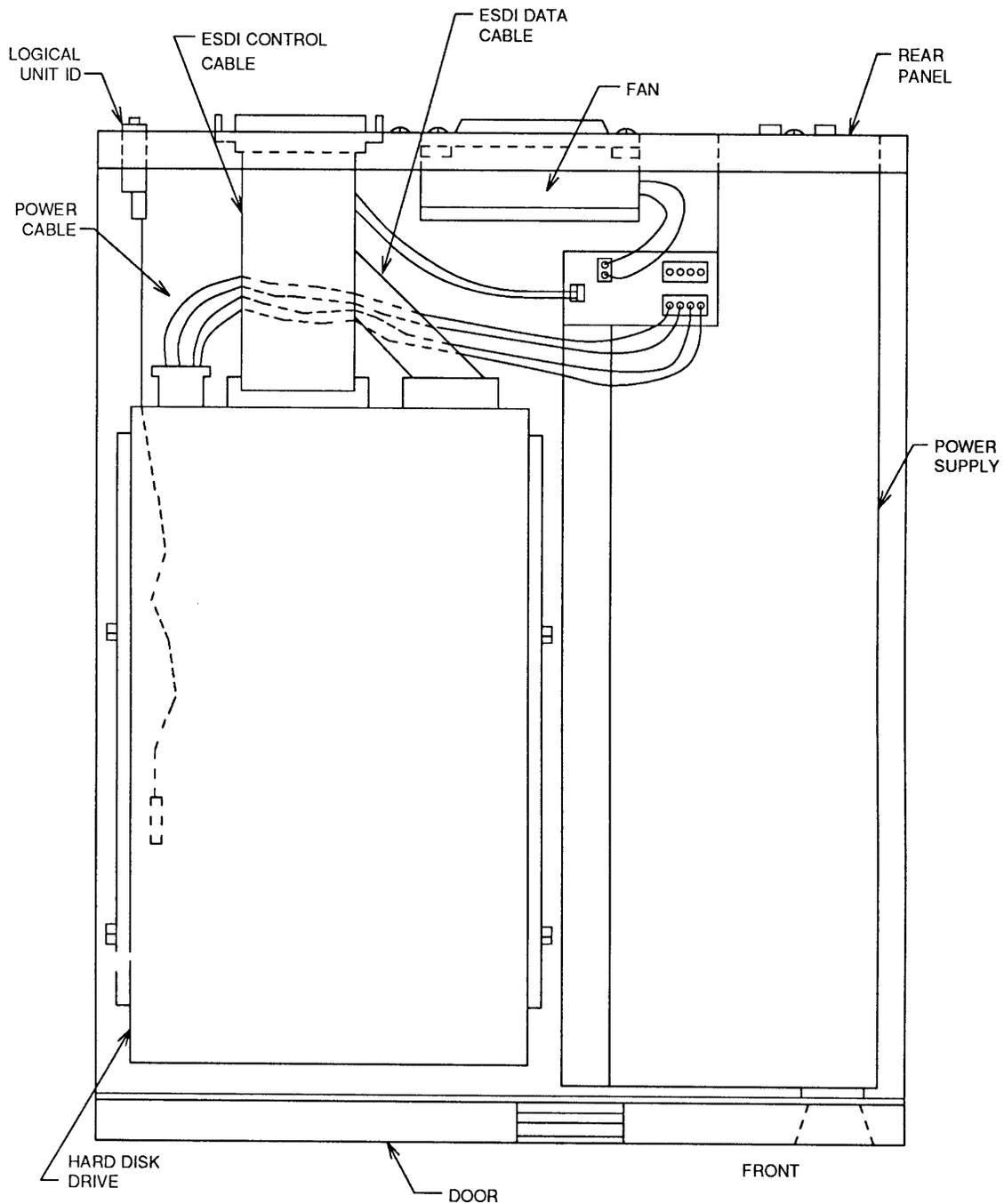
Removing the Rotary ID Switch

The ID switch snaps into place through a hole in the back panel. Remove the cable connecting the switch to the disk drive, and then remove the switch by applying pressure to both sides and pushing towards the back. The switch should snap free.

NOTE: See Table E-2 in Appendix E, "Peripheral Configuration Diagrams," for the correct ID cable to use with the tape drive.

Removing the Fan

The fan is screwed to the back panel. Disconnect the fan from the power supply, then remove it. When installing a new fan, make sure that the cable is connected properly. The fan will not operate if the cable is on backwards. Check to see that the airflow is directed out the back of the cabinet.

Removing the Power Supply

To remove the power supply, remove the back panel. This is held in place by screws in the lower-right and upper-left corners. Remove the SCSI bus and ID cables from the tape drive. Remove the two power cables from the power supply. Remove the back panel. The power supply is secured to the base of the cabinet by a locking tab. The tab is released by applying upward pressure through the hole in the bottom front of the cabinet, underneath the power supply. When the tab is released, slide the power supply back and lift up.

Expansion Module (XM)

The SCSI expansion module contains three ESDI 5.25 inch hard disk drives, a bridge controller board, a SCSI target controller ID switch, and a power supply (see Figure 7–13). The power supply can be changed from 110 to 220 VAC through an inspection plate in the top of the supply. There are two cable connections on the back of the XM (a SCSI in and a SCSI out) and two soft-power jacks. If the XM is the last controller on the SCSI bus, the SCSI out connector must be terminated.

The formatted size of each disk is normally the capacity of the XM divided by 3 (405/3=135). As disk capacities increase, the package name changes accordingly. It is possible that a smaller older drive will be discontinued and replaced by a new larger drive. The XM might not always contain three identical disks.

Removing the Cover

The cover is secured by a single screw in the top center of the back of the cabinet. Remove the screw, slide the cover forward, and lift off.

Removing the Bridge Controller Board

The bridge controller is secured to snap connectors. All cables should be removed from the controller board first. After this, apply upward pressure at each snap location to release the board. Some of the early vintage machines may have the controller board held down with four screws. When reinstalling the controller board, secure it onto the snap connectors first, and then connect the cables. Make sure that port 0 on the controller is connected to disk 0 and so on. The disk IDs are set with jumpers. Disk 0 is normally on the left when looking from the front. All switches on the DIP should be in the OFF position. Although there are two sockets for terminating resistors on the controller board, no resistors should be installed.
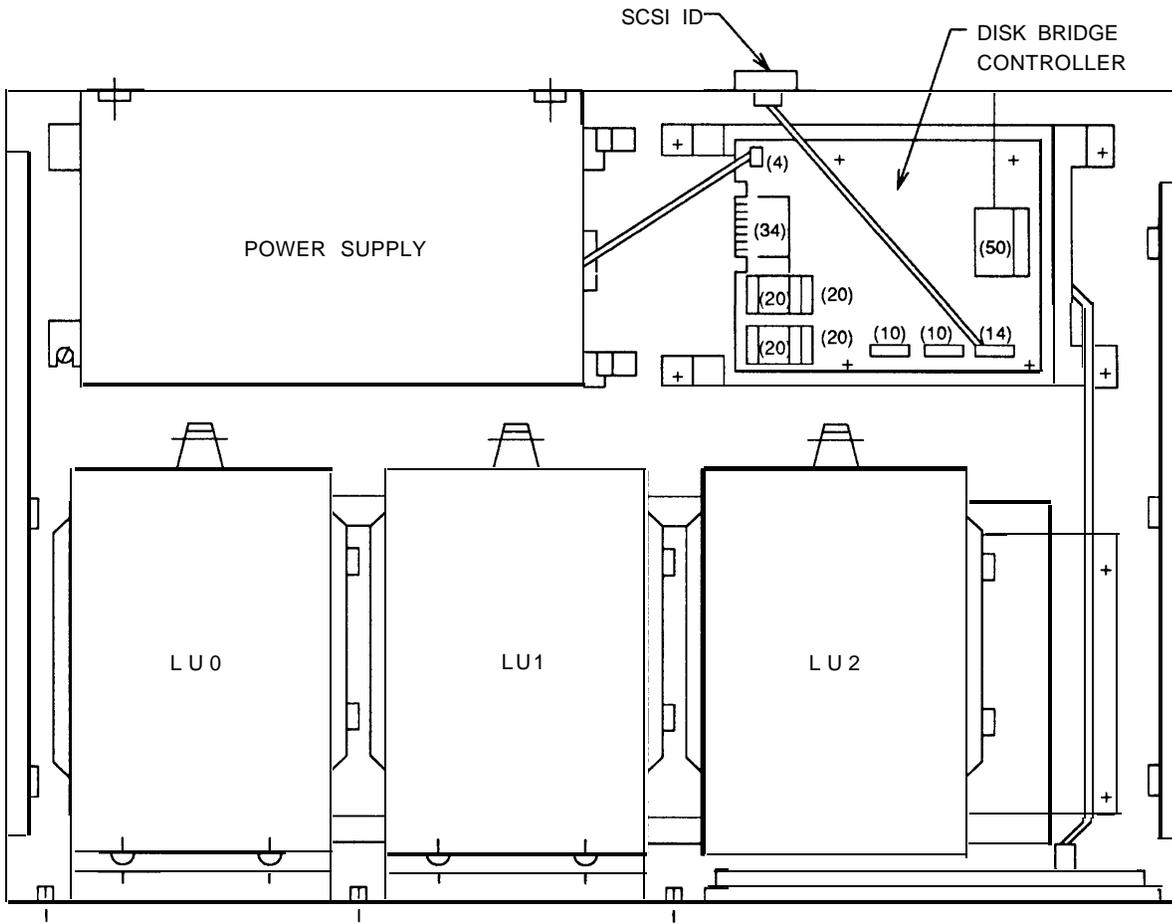
Figure 7–13.   XM405S ‑ XM900S expansion module, top front view

Removing the Disk Drives

Remove the ESDI control and data cables, and the power cable from the disk drive first. The disk drive is held in place by a locking tab. To release the tab, apply downward pressure on the tab that extends from underneath the rear of the drive. Slide the drive toward the rear and lift up. Remove the locking chassis from the bottom of the disk drive. When replacing a disk drive in an XM, the disk ID (logical unit 0-3) must be set to match the defective drive. For Hitachi disks, the ID is set with jumpers on the bottom of the drive. The ID is binary coded (1-4), using three jumper positions. Port 0 on the controller connects to disk 1, port 1 to disk 2, and so on.

> ## ⚠ WARNING
>
> There are several other jumpers on the Hitachi disk drive. These are used to tune the disk to meet specifications and are set by the manufacturer. Do NOT move any of these jumpers to match the defective disk.

For CDC disks, the ID is set with a single jumper on the back of the drive. ID 0 is the left-most column when looking at the rear of the drive. ID 1 is the next column. See Appendix E, "Peripheral Configuration Figures," for the location and setting of IDs for each of the various drives.

Removing the Rotary ID Switch

The ID switch snaps into place through a hole in the back panel. Remove the cable connecting the switch to the bridge controller board, and then remove the switch by applying pressure to both sides and pushing towards the back. The switch should snap free.

Removing the Power Supply

To remove the power supply, disconnect the power cables from the bridge controller board, the disk drives, and the power LED. The power supply is held in place by two screws in the upper-rear of the cabinet, and one screw inside the cabinet. Remove the screws and lift the supply.

9-Track Tape Drives

Currently the following three types of tape drives are supported on the 3B2 computer SCSI bus.

- 1600 bpi SCSI 9-track tape drive (Keystone II KS22762)

- 1600/6250 bpi SCSI 9-track tape drive (Keystone III KS23113)

- 1600/6250 bpi SCSI autoloading 9-track tape (HP KS23495)

Subassembly replacement procedures described here do not address repairing the tape drive itself. See the manufacturer's documentation for that information. Spare parts for the tape drives are included in the spare parts list in Appendix D, "Repair Equipment and Spare Parts."

1600 bpi SCSI 9-track Tape Drive (Keystone II - KS22762)

The 9-track cabinet contains a 1600 bpi reel-to-reel tape drive. This is the same tape drive (Keystone II) used on other AT&T 3B computers, with a SCSI bridge controller added to the back. The tape drives are shipped with documentation from the manufacturer. Subassembly replacement procedures described here do not address repairing the tape drive itself. See the manufacturer's documentation for that information. Spare parts for the tape drive are included in the spare parts list in Appendix D, "Repair Equipment and Spare Parts."

The SCSI in connector (located inside the rear door on the floor) is the only cable connection to the tape cabinet. This design conserves bus length. Since there is no SCSI out connector, the cabinet must always be the last controller on the SCSI bus. The bus termination consists of two 16-pin DIP resistors on the bridge controller board. No other termination is required.

There is no soft-power control for the tape cabinet. The main tape drive power and the logic power must be turned on before the 3B2 computer is turned on.

The power supply in the tape drive is set to operate on 110 VAC. By reversing a circuit board in the power supply, it can be set for 220 VAC.

Opening the Rear Door

The rear door of the cabinet is secured by three locking screws. Depending on the vintage of the cabinet, these screws will have a hex head or a slotted head. The appropriate tool is provided with the cabinet. In either case, release the door by turning the screws counterclockwise.

Removing the Bridge Controller Board

Remove all the cables from the controller board. Remtove the screws securing the board to the back of the tape drive, and remove the board.

When replacing a 9-track bridge controller, be sure that the SCSI ID is set to the same value as the original controller. The ID (normally 7) is set using the DIP switch on the left edge of the board. The ID is a 3-bit binary code, using positions 1-3 on the switch. Table 7–2 shows the possible switch settings and their corresponding SCSI ID values (FS=factory setting).
Figure 7–14 shows the location of the SCSI bridge controller on the 9-track tape drive. See Figure 7-15 for a depiction of the SCSI bridge controller itself.

Troubleshooting

Diagnostic tests can be run on the 9-track tape drive from either the 3B2 computer or the tape drive itself. On the 3B2 computer, SCSI diagnostic phase 21 provides tests for tape drives. This phase performs several read/write tests to a scratch tape.

Typically, if an error occurs during phases 17 through 19 of 3B2 computer diagnostics, a problem lies somewhere between the host adapter card and the target controller card for the tape drive. Cable connections, termination, and ID settings should be verified. If these phases pass but phase 21 fails, the problem, most likely, is the tape drive. The tape drives internal diagnostics should be executed to determine the failing component.

Internal diagnostic tests on the 9-track tape drive are too extensive to describe in detail in this document. However, a comprehensive test is provided which runs an assortment of other tests. A blank write-enabled tape is needed for this test. To run the comprehensive test, follow these steps:

1 . Take the drive off-line.

2 . A write-enabled scratch tape should be threaded, but NOT loaded (unpensioned).

3. Press [TEST] on the control panel. The two-digit display should read 01.

4. Press [EXECUTE] on the control panel. Internal diagnostics should start. This test could take up to ten minutes.

If test 01 returns a two-digit code of 00, it is a good indication that the tape drive is operational. If test 01 displays other than a code of 00, further troubleshooting is necessary. Refer to vendor maintenance manual under the structured analysis method (SAM) tables for corrective action.

Table 7–2.   DIP Switch and SCSI ID Settings

Position 1	Position 2	Position 3	SCSI ID
OPEN	OPEN	OPEN	0
OPEN	OPEN	CLOSED	1
OPEN	CLOSED	OPEN	2
OPEN	CLOSED	CLOSED	3
CLOSED	OPEN	OPEN	4
CLOSED	OPEN	CLOSED	5
CLOSED	CLOSED	OPEN	6
CLOSED	CLOSED	CLOSED	7 (FS)

POWER AMPLIFIER

FORMATTER/CONTROL

READ/WRITE/SERVO

SCSI BRIDGE CONTROLLER
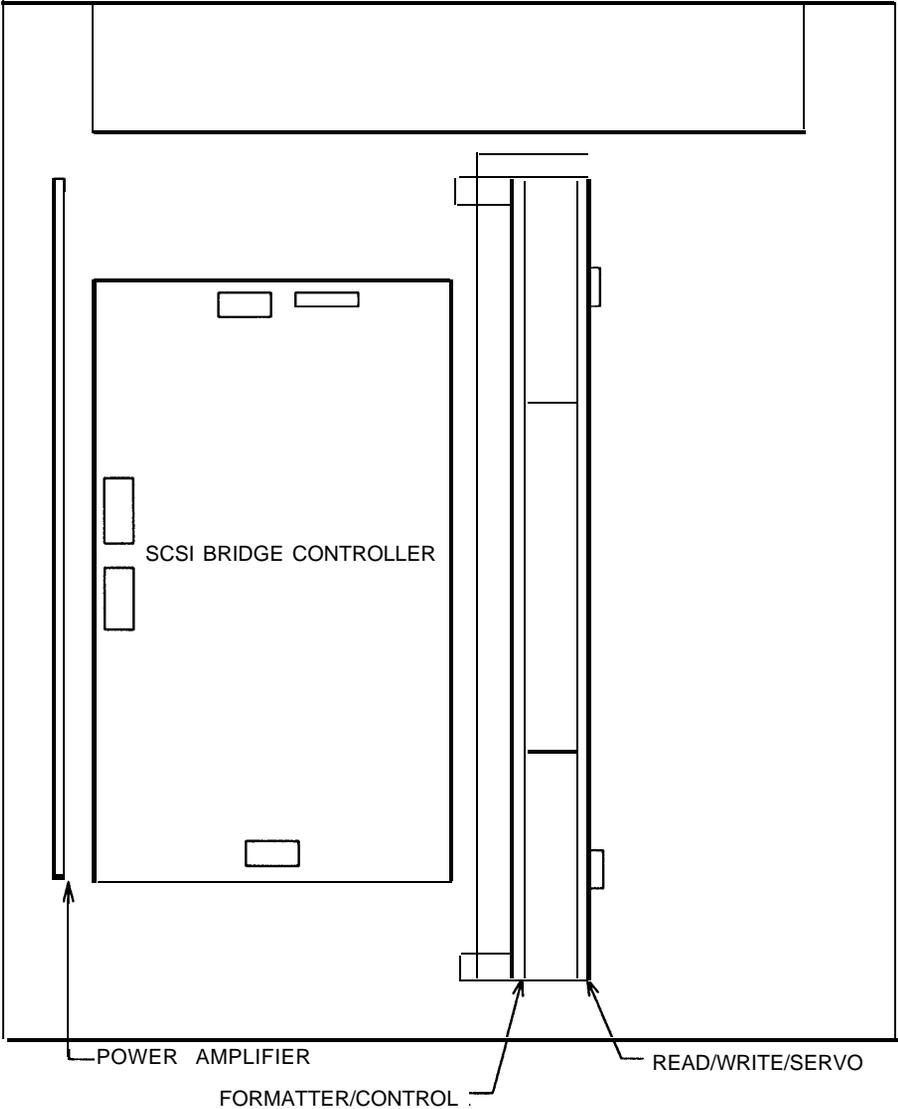
Figure 7–14.   SCSI bridge controller 9-track tape drive (Keystone II), rear view
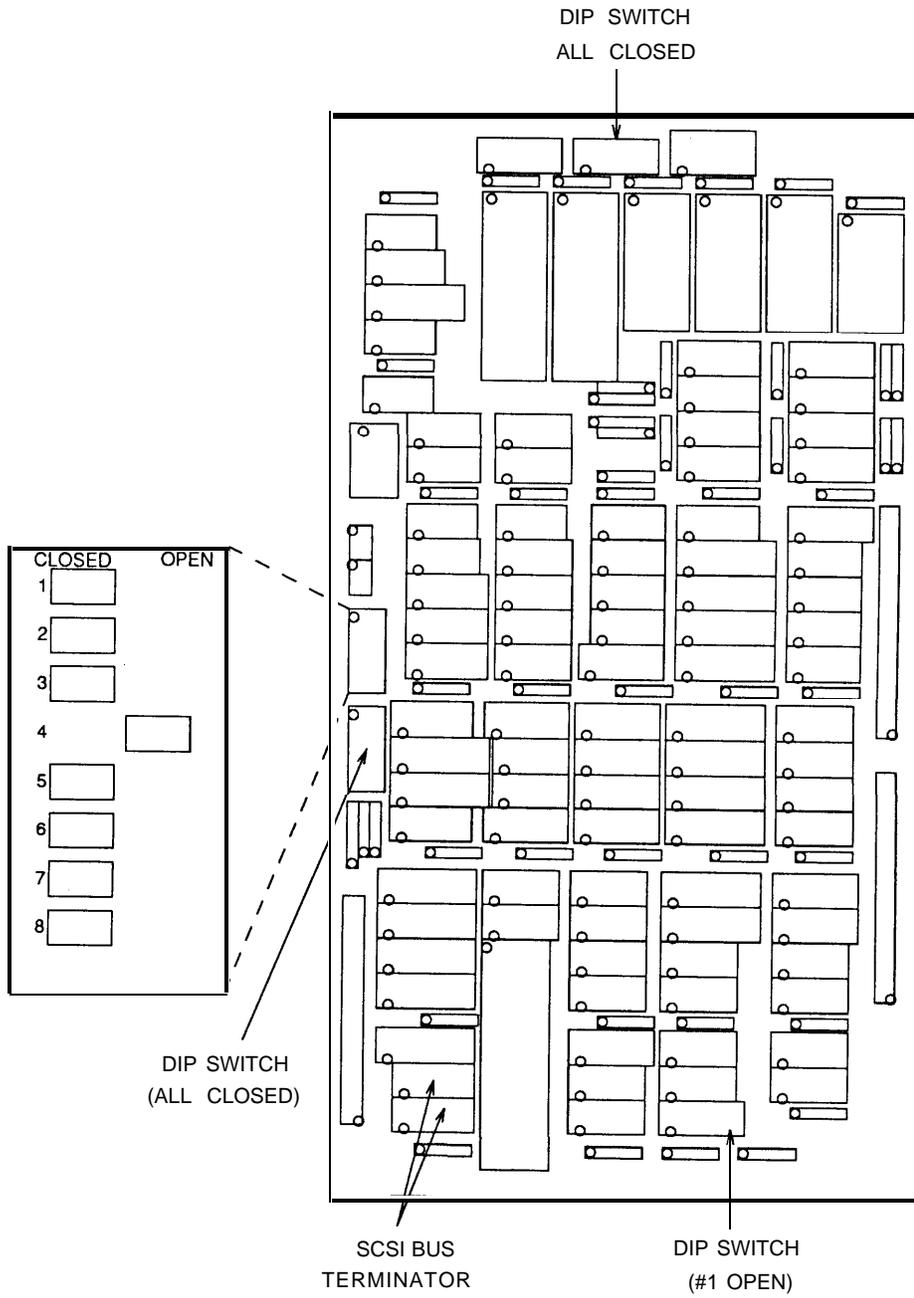
Figure 7–15.   SCSI bridge controller

1600/6250 bpi SCSI 9-track Tape Drive (Keystone III - KS23113)

This section reviews the hardware components of the 1600 ⁄ 6250 bpi tape drive. Specifications for the 1600 bpi tape drive are given for comparison purposes only.

The SCSI 9-track tape drives supported on the 3B2 computer are the same as the tape drives supported on the 3B5 and 3B15 computers, except for the SCSI interface board. The 1600 ⁄ 6250 bpi tape drive can be easily distinguished from a 1600 bpi tape drive by the HIGH DENSITY indicator on the front panel of the 1600 ⁄ 6250 bpi tape drive. (The 1600 bpi tape drive features a SELECT indicator on the front panel. See Figure 7–16.) Table 7–3 reviews the operational specifications for both types of drives.

Table 7–3.   Specifications for SCSI 9-Track Tape Drives

	1600 bpi 9-track tape drive	**1600/6250 bpi 9-track tape drive**
comcode	405218611	405206848
KS number	KS22762 L10	KS22113 L40
recording mode	Phase Encoded (PE)	PE (1600 bpi) Group Coded Recording (GCR) (6250 bpi)
transfer rate (streaming)	160 KB/sec	160 KB/sec (1600 bpi) 468 KB/sec (6250 bpi)
model	Keystone II	Keystone III
tape speed start/stop streaming	 25 ips 100 ips	 75 ips

NOTE: The total capacity of the 1600 ⁄ 6250 bpi 9-track tape drive is 160 MB. However, the backup utility restricts it to 145 MB.
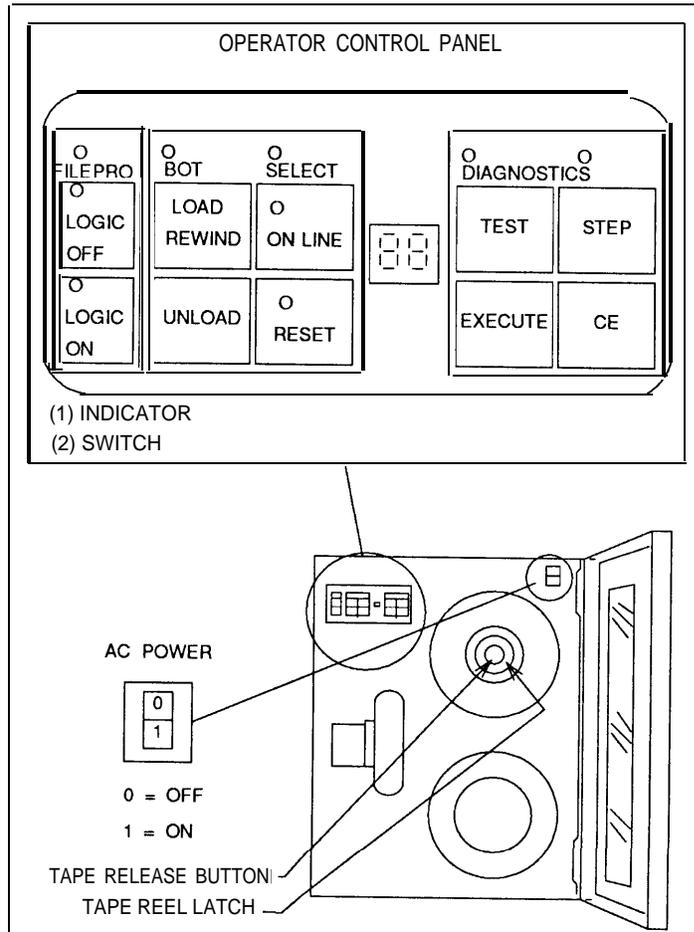
Figure 7−16. **1600 SCSI 9-track tape drive - control panel**

Hardware of the 1600/6250 bpi SCSI 9-Track Tape Drive

Table 7–4 lists the circuit boards used with the SCSI 9-track tape drives and their respective comcodes. The 1600/6250 bpi 9-track tape drive no longer uses the formatter/control board (Pertec interface) coupled to the SCSI bridge controller. Instead, the drive interface on the SCSI bridge controller is embedded into the board.

Table 7–4. Circuit Boards Used with the SCSI 9-Track Tape Drives

1600 bpi drive	1600/6250 bpi drive
SCSI bridge controller (405218868)	SCSI bridge controller (405209172)
formatter/control (4038361 09)	formatter/read (405508508)
read/write/servo (403836125)	formatter/write (405508490)
	servo control (405286261)
	read amplifier (403836141)
	write driver (403836158)

The reel motors and certain components on the front of the drive are the only interchangeable parts on the 1600/6250 bpi drive. The manufacturer's manuals that are supplied with the drives provide information about switch settings for both drives. These manuals are included with each tape drive or can be purchased separately from the Control Data Corporation. Switches S6, S7, and S8 on the SCSI board used with the 1600/6250 bpi 9-track tape drive set the SCSI controller ID. Table 7–5 shows how to set these switches. See Figure 7-17 for location of the SCSI bridge controller. Other switch settings for the SCSI board used with the 1600/6250 bpi 9-track tape drive (single-ended) are shown in Table 7-6. (These switch settings are taken from the manufacturer's manual, document number 49762900.)

Table 7–5.   SCSI ID Switch Settings, 1600/6250 bpi 9-Track Tape Drive

SCSI ID	Switch Location F9		
	S 6	S 7	S 8
0	0	0	0
1	C	0	0
2	0	C	0
3	C	C	0
4	0	0	C
5	C	0	C
6	0	C	C
7	C	C	C

Table 7–6. **Embedded SCSI Controller Switch Settings, 1600/6250 bpi 9-Track Tape Drive**

Location of Switch	Switch Number	Position
F9	S1	CLOSED
	S2	CLOSED
	S3	CLOSED
	S4	CLOSED
	S5	OPEN
	S6	ID SWITCH
	S7	ID SWITCH
	S8	ID SWITCH
A7	S1	CLOSED
	S2	CLOSED
	S3	CLOSED
	S4	CLOSED
	S5	CLOSED
	S6	CLOSED
	S7	CLOSED
	S8	CLOSED
H9	S1	OPEN
	S2	OPEN
	S3	OPEN
	S4	OPEN
	S5	CLOSED
	S6	CLOSED
	S7	OPEN
	S8	OPEN
D1	S1	CLOSED
	S2	CLOSED
	S5	CLOSED
	S7	CLOSED
	S5	CLOSED
	S6	CLOSED
	S7	OPEN
	S8	OPEN
E1	S1	CLOSED
	S2	CLOSED
	S3	CLOSED
	S4	CLOSED
	S5	CLOSED
	S6	CLOSED
	S7	CLOSED
	S8	CLOSED

Troubleshooting

Diagnostic tests can be run on the 9-track tape drive from either the 3B2 computer or the tape drive itself. On the 3B2 computer, SCSI diagnostic phase 21 provides tests for tape drives. This phase performs several read/write tests to a scratch tape.

Typically, if an error occurs during phases 17 through 19 of 3B2 computer diagnostics, a problem lies somewhere between the host adapter card and the target controller card for the tape drive. Cable connections, termination, and ID settings should be verified. If these phases pass but phase 21 fails, the problem, most likely, is the tape drive. The tape drives internal diagnostics should be executed to determine the failing component.

Internal diagnostic tests on the 9-track tape drive are too extensive to describe in detail in this document. However, a comprehensive test is provided which runs an assortment of other tests. A blank write-enabled tape is needed for this test. To run the comprehensive test, follow these steps:

1. Take the drive off-line.

2. Press the [OPTION] key.

3. Press [TEST] on the control panel. The two digit display should read 01.

4. Press [EXECUTE] on the control panel. Internal diagnostics should start. This test could take up to 10 minutes.

If test 01 returns a two-digit code of 00, this is a good indication that the tape drive is operational. If test 01 displays other than a code of 00, further troubleshooting is necessary. See the vendor maintenance manual under the structured analysis method (SAM) tables for corrective action.
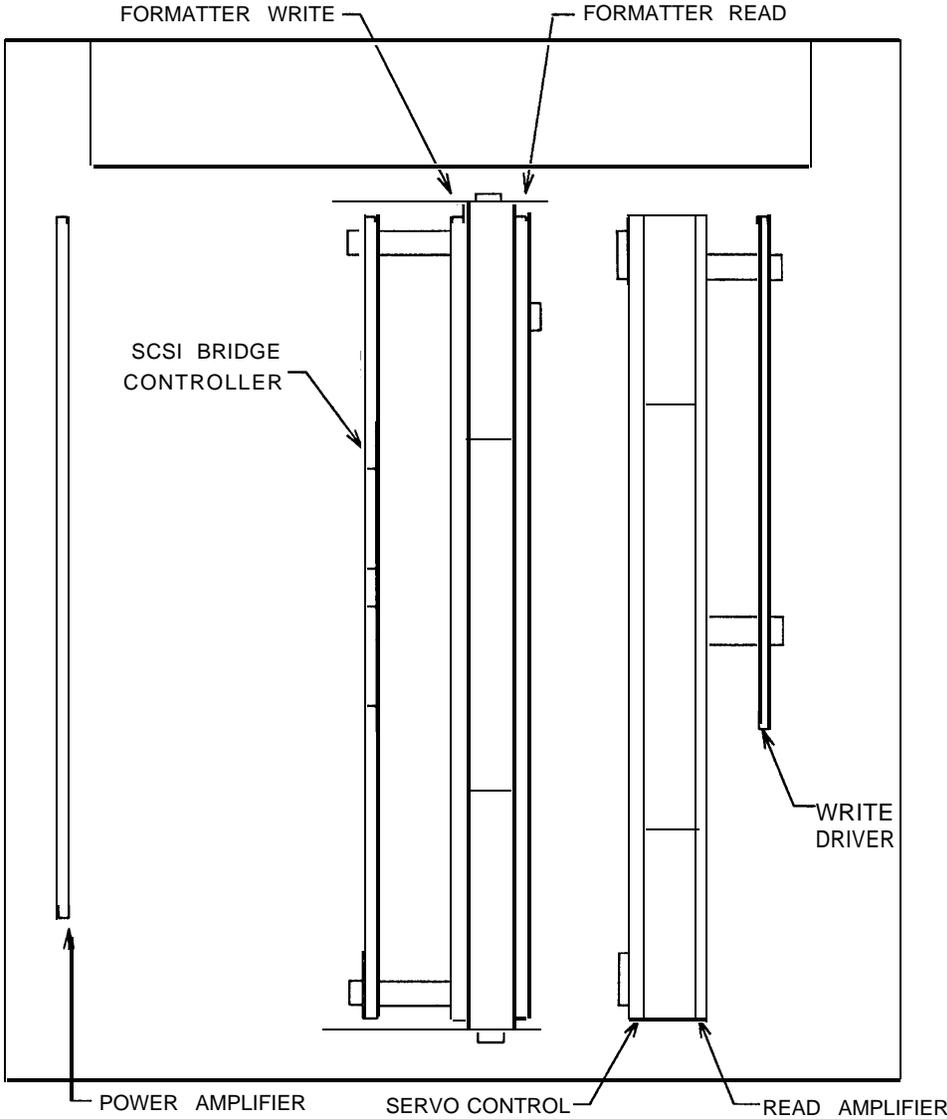
Figure 7–17.   Keystone III (KS23113) tape drive, rear view

Desktop, Autoloading, Dual-Density 9-Track Tape Drive (KS23495)

The desktop, autoloading, dual-density 9-track tape drive can read and write tapes in either 1600 bpi phase encoded (PE) or 6250 bpi group coded recording (GCR) modes with a tape speed of 125 ips. The physical dimensions of the tape unit are 8.75 inches by 19 inches by 26.5 inches and the weight is about 85 pounds (see Figure 7-18). The tape drive is a front loading, autoload/autothread device with all setup and control operations performed at the front panel.

Both single-ended and differential SCSI interfaces are offered with the tape drive. The type of interface is determined by the SCSI controller card located at the rear of the cabinet. The interface type is labeled on the rear panel of the tape unit.

Setup and Configuration

Connection of the 9-track tape drive is the same as for any other SCSI tape device. Connect the SCSI bus cable to a D type connectors on the SCSI interface board at the rear of the tape drive. If another SCSI device is to be added on the bus after the tape drive, connect another cable to the other D type connector. If the tape drive is the last device on the bus, a SCSI bus terminator must be installed on the unused connector. The single-ended interface board has an additional 50-pin double in-line connector, which is not used.

To set the SCSI ID, or check the configuration options, the tape unit must be powered on. The tape unit performs a series of internal diagnostics during the powerup sequence. After the diagnostics finish, the drive checks for the presence of a tape, and tries to autoload the tape if one is inserted. After the tape is loaded, the drive is in an idle state.

> ### ⚠ CAUTION
> Do NOT try to force open the tape door. Press the [UNLOAD] key on the front panel to open the tape door.
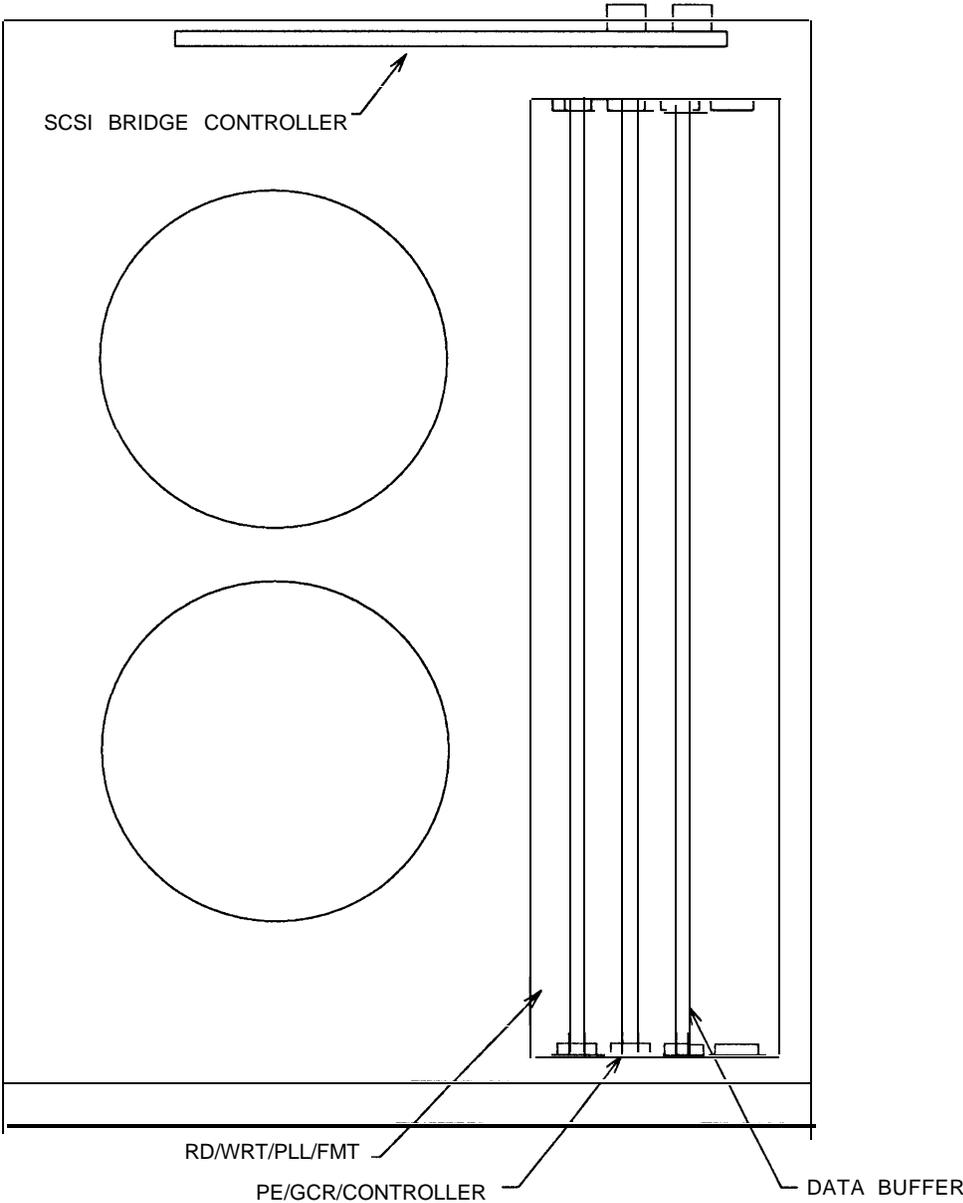
Figure 7–18.   Desktop autoloading dual density tape drive (KS23495), top view
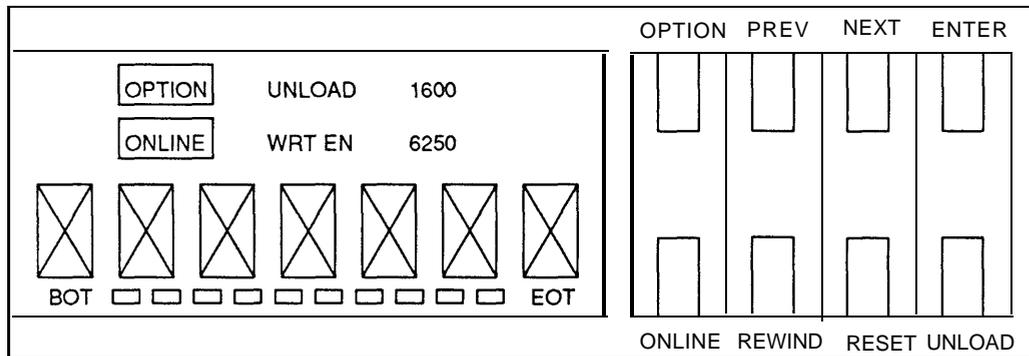
Figure 7–19. **9-track status control panel layout**

To set the SCSI ID, use the front panel option keys (see Figure 7-19) in the following procedure:

1 . If the drive is on-line, press the [ONLINE] key to take it off-line.

2 . Press the [OPTION] key to enter option mode. TEST* will appear in the display,

3 . Press the [NEXT] key until ID* appears in the display.

4 . Press [ENTER] to select the addressing option.

5 . Use the [NEXT] or [PREV] keys to set the ID to the desired number (or press [ENTER] to keep the same value).

6 . Press [ENTER] to save the new defined ID. The message SET#, where # is the ID number selected, appears momentarily.

7 . Press [OPTION] or [RESET] to exit the option mode.

All other configuration parameters are preset and should not have to be changed. Because all configuration information is stored in nonvolatile RAM, a power cycle will not destroy any of the settings.

It maybe necessary at times to check or change the configuration options of the 9-track tape drive. The following is must be done before any options can be viewed or changed.

1. Take the drive off-line.

2. Press [OPTION] .

3. Press [NEXT] until CONF* appears.

4. Press [ENTER] .

5. Press [UNLOAD] to increment by 10's, until 100 appears (the NEXT and PREV keys increment/decrement by 1, the UNLOAD and ONLINE keys increment/decrement by 10).

6. Press [ENTER] , OFF should appear.

7. Press [UNLOAD] , [NEXT] , and/or [PREV] keys to show 48 .

8. Press [ENTER] , SET 100 appears briefly, then back to CONF * .

9. Press [ENTER] , CONF 100 appears.

10. Press [NEXT] , CONF 101 appears.

11. Press [ENTER] , OFF should appear. Use keys to go to 76 .

12. Press [ENTER] , SET 101 appears briefly, then back to CONF * .

The passwords are now entered, allowing access to the configurations. If you only want to view the configurations, enter the configuration number. However, if you need to change a configuration, you must first go to CONF 40 and set it to ON. This will allow any changes to be stored in NVRAM.

After any checks or changes have been made, configurations 40, 100 and 101 should be returned to 0 (off).

Table 7–7 shows a list of options for the Hewlett-Packard 9-track tape drive. The AT&T configuration is shown, along with the default for each option. Since AT&T sets some of the options differently from the default, these should be checked whenever working with a Hewlett-Packard 9-track tape drive.

Table 7–7.   Hewlett-Packard 9-track Tape Drive Options

Configuration number	Description	AT&T Configuration	Default Configuration
40	Enable Front Panel Change	off	same
41	Automatic On-line	on	off
42	Allow Media Removal	on	same
44	Enable Archival Rewind	REW (off)	same
45	Operator Select Archive	off	same
46	Default Density	6250	same
47	Operator Select Density	OPEN	same
48	Language	0 (English)	same
49	Recovered Error Report	OFF	ON
50	Write, Immediate Response	ON	same
51	Write, TM to disable IR	OFF	same
52	Write Retry Count	17	same
53	1600 PE Gap Size	6	same
54	6250 CGR Gap Size	4	same
55	Stop at EOT	OFF	same
56	Write Holdoff Time	5 (sec)	same
57	Write Startup Point	2 (2/8 of buf)	same
60	Readahead Enable	ON	same
61	TM to terminate RA	2	same
62	Read Retry Count	6	same
63	Trailing Buffer	0	same
64	Read Startup Point	2 (2/8 of buf)	same
75	Front Panel Gauge Usage	0 (rel. pos.)	same
76	No Break On Failure	OFF	same
77	Command Activity Indicator	OFF	same
81	Block Length	3 (512)	0
82	Bus Inactivity Limit	9 (immediate)	0
83	Disconnect Time Limit	0 (0.1 ms)	same
84	Disconnect Length	7 (64K)	0
85	Inquiry Field Byte	0	same
86	Reset Method	ON	same
87	Report EOM	OFF	ON
88	SCSI II Compatible	OFF	same
100	Password 1	OFF	same
101	Password 2	OFF	same

Troubleshooting

Diagnostic tests can be run on the 9-track tape drive from either the 3B2 computer or the tape drive itself. On the 3B2 computer, SCSI diagnostic phase 21 provides tests for tape drives. This phase performs several read/ write tests to a scratch tape.

Typically, if an error occurs during phases 17 through 19 of 3B2 computer diagnostics, a problem lies somewhere between the host adapter card and the target controller card for the tape drive. Cable connections, termination, and ID settings should be verified. If these phases pass but phase 21 fails, the problem, most likely, is the tape drive. The tape drive internal diagnostics should be executed to determine the failing component.

Internal diagnostic tests on the 9-track tape drive are too extensive to describe in detail in this document. However, a comprehensive test is provided which runs an assortment of other tests. A blank write-enabled tape is needed for this test. To run the comprehensive test, follow these steps:

1. Take the drive off-line.

2. Press the [OPTION] key.

3. Press the [ENTER] key to enter test mode.

4. Press the [NEXT] or [PREV] keys until 1 shows in the display.

5. Press [ENTER] twice to execute the test.

If test 1 passes, this indicates that the tape drive is operational. If test 1 fails, further troubleshooting is necessary. Refer to the service manual (305-681) and handbook (305-694) which are orderable through the AT&T Customer Information Center in Indianapolis, Indiana (1 800 432-6600). Both of these documents thoroughly describe diagnostic execution, diagnostic listings, error logs, and configuration setup for the 9-track tape drive.

Peripheral Power Control Unit (PPCU)

The peripheral power control unit (PPCU) contains a circuit board (CFW-1), a cable assembly and power switch and soft power cable assembly. The power is supplied by an external transformer (WP91689) (see Figure 7-20). There are seven cable connections on the back panel. Three are soft power in, one is soft power out, one is remote power in, one is remote power out and one is transformer connection.

Removing the Cover

Remove the plastic front door. Open the door until it is horizontal, then press down on the hinges. The door will snap free. There are five screws that have to be removed before the cover can be removed, two on each side of the cabinet and one in the upper center of the back panel. Slide cover forward and up to remove.

Removing the Circuit Board

There are two cable connectors that must be removed from the board first. The circuit board can be removed by removing the two screws from the back panel. It is also secured by four snap mounts. After the screws are removed, gently apply upward pressure at each snap to release the board.

SOFT POWER IN
CABLE ASSEMBLY

CIRCUIT BOARD

POWER SWITCH
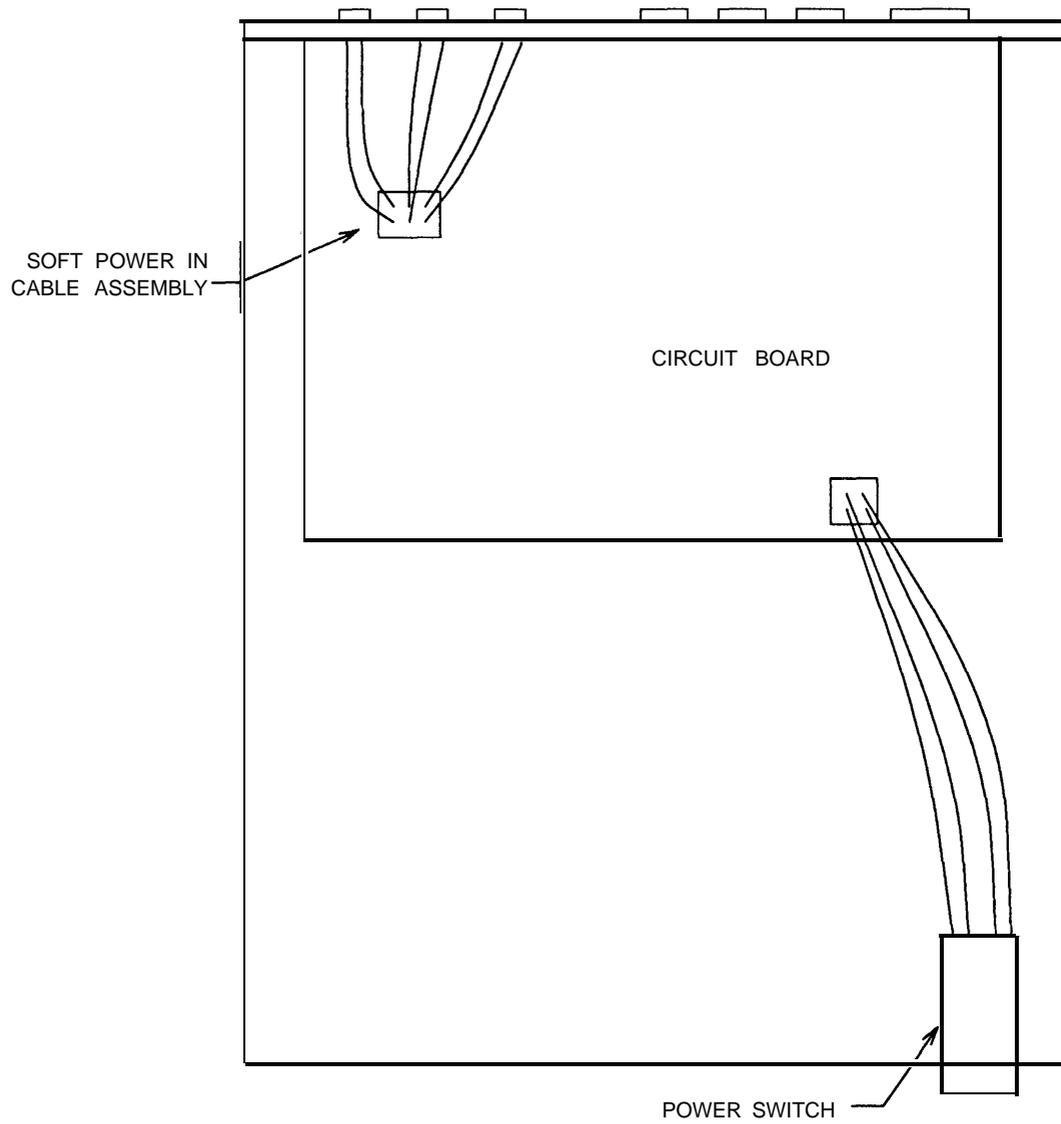
Figure 7-20. Peripheral power control unit (PPCU)

Chapter 8: I/O Feature Cards

Introduction

This chapter provides a basic understanding of feature card operation in a 3B2 computer. Guidelines for installation, initialization, and troubleshooting are also discussed. Figures of each feature card and of the system boards for each model of the 3B2 computer are included.

Installation of Feature Cards

Each feature card is supplied with a set of installation instructions that should be followed. Remember that a backplane slot may never be empty between two feature cards, and that the first card must be installed in slot number one. Also, make sure that the card is properly inserted in the card guides on both sides.

Initialization of Feature Cards

When the 3B2 computer is first powered up, some basic sanity and hardware checks are made on the core hardware. A reset signal is then sent to all feature cards on the I/O bus. This procedure signals the card to initialize itself, and then wait to be identified by the system board. The system board then polls each I/O backplane slot and expects an identification (ID) code in return. Each type of feature card is assigned a unique ID code. Table 8-1 provides a partial list of devices and subdevices and their respective ID codes.

Table 8-1.   Partial List of Device and Subdevice ID Codes

Device	ID Code
System board	0x0001
Network interface	0x0002
Expanded ports	0x0003
Cartridge tape controller	0x0005
Network access unit	0x0006
SCSI host adapter	0x0100
Alarm interface circuit	0x0101
Enhanced ports	0x0102
Intelligent serial controller	0x0201
Expansion disk controller	0x0204
Multiprocessor enhancement board	0xFF00
Math accelerator unit	0xFD00
Vcache	0xFE00
Multiprocessor enhancement board (PE)	0xFE01
Datakit	0x0308
Subdevice	**ID Code**
NULL	0x0000
Floppy disk	0x0001
10 MB hard disk	0x0002
30 MB hard disk	0x0003
23 MB cartridge Tape	0x0004
72 MB hard disk (CDC WREN II)	0x0005
72 MB hard disk (Fujitsu)	0x0008
SCSI disk controller	0x0100
SCSI cartridge tape controller (60 MB cartridge and 9-track)	0x0101
Processor	0x0103

After each backplane slot is polled and every I/O feature card returns its respective ID code, the system builds the basic equipped device table (EDT) in memory. The EDT contains the slot numbers and corresponding ID codes. If a card does not respond, or if a backplane slot is skipped, then the 3B2 computer will most likely "hang." If this occurs, run diagnostics and check the I/O bus configuration.

After identifying the feature cards, the main processor attempts to access the default boot device (the name of that is stored in NVRAM). After establishing hard disk communication, the `filledt` command is loaded and executed. When filling the EDT, the main processor looks at the ID codes (Table 8-1), extracts additional information for each ID code from the file `/dgn/edt_data,` and adds the new information to the EDT.

To inspect the data in the EDT, use the `edt` command if you are in firmware mode. If you are in the diagnostic monitor, use the s command. The following is an example of partial output of these commands for the ports card:

```
03 – device name = PORTS, occurrence = 1, slot = 03, ID code = 0x03
     boot device = n, board width = single, word width = 2 byte(s),
     req Q size = 0x03, comp Q size = 0x23, console ability = y pump file = y
```

In the above example, `occurrence = 1` represents the second ports card. (The first ports card would appear as `occurrence = 0)`. The slot number of the card is identified by `slot = 03` (in this case, slot number three). The ID code returned by the card is represented by `ID code = 0x03`.

After executing the `filledt` command, the system loads `dgmon` from the hard disk to run normal diagnostics on all equipped devices. The `dgmon` program looks for support files under the `/dgn` directory. For example, a ports card would have a `/dgn/PORTS` file containing information on the diagnostic phases, and a `/dgn/X.PORTS` file containing the executable diagnostic code. This executable diagnostic code is downloaded to the ports card when it is being diagnosed.

After the `dgmon` program terminates, and if all diagnostics pass, the system boots the UNIX operating system. However, if there has been a change in the hardware configuration (such as the installation of a new feature card), the system will automatically perform a self-configuration. During the self-configuration process, the associated software drivers are loaded for any new feature cards. This is done by looking in the `/boot` directory for a file name that corresponds to the device name in the EDT. After all the needed drivers are linked to the kernel, the new kernel is booted and then saved in the `/unix` file.

If the system is booting to multi-user mode, the feature cards are pumped with the executable code (if any) supplied with the feature card. Each feature card begins executing its own code and normal operation begins.

NOTE: If an error occurs during the boot sequence, the system enters the interactive mode of the maintenance and control program (MCP), more commonly known as FIRMWARE MODE. From this point, you should run diagnostics to try to pinpoint the problem. If the error occurred before a console terminal link was established, the LEDs on the front panel must be used to identify the problem. For information about the meaning of the LEDs on the front panel, refer to Chapter 5, "System Troubleshooting."

Troubleshooting Feature Cards

The following are five of the most common errors that can occur with feature cards during the boot process, and troubleshooting techniques for solving each of these problems.

■ Reseating a card

Some errors can occur because of a bad connection between a feature card and the backplane. Generally speaking, before you assume that a card is defective, power off the 3B2 computer and reseat the card. To reseat the card, gently pull it out and reinstall it. Use a pencil eraser to clean the card's contacts before reinstalling the card.

■ Swapping slots

Occasionally, a slot in the backplane is defective. To test for this, move the feature card to another slot and see if the error follows the card. If two cards of the same type are in the machine, they should be swapped. This swapping minimizes reconfiguration of the software when rebooting.

■ Unknown ID code

If the 3B2 computer encounters an ID code that it does not know, (for example, the code is not in the `edt_data` file), it prints a message about an unknown ID code and lists the slot number where the unknown ID code was encountered. Most of the time, this is not a problem if the software for the associated feature card has not yet been installed. However, if the software has been installed, the card still could be returning the wrong code. This error may mean that either there is a bad connection between the feature card and the backplane, or that the feature card (or the backplane) is defective.

■ `NULL` ID code

If a feature card controls subdeviccs, the EDT will show `NULL` or nothing if the subdevices are not responding properly. This output indicates several possible types of trouble with the subdevices: not powered on, not connected, improperly connected, or defective.

■ Cannot pump card

If the 3B2 computer cannot pump a feature card, reseat the card and try again.

Feature Cards

The following describes the feature cards that can be purchased as options for the 3B2 computer. Additional information can be obtained from the manuals that accompany each feature card.

Expanded Ports Card

The ports card is designated as the CM195B board, and the later version is designated as the CM195BA board. The ports card provides four additional eight-pin modular jacks for RS-232-C interface, and one CENTRONICS-type parallel interface. The CM195BA board is identified by an "HPP" stamping on its faceplate, between the fourth serial port and the parallel port. The only other difference between the two versions is in the internal operation of the hardware. Diagnostics and pinouts are identical for both versions. Figure 8-1 represents the expanded ports card.

There is also a ports software package called the ports utilities. If the Ports Utilities are not installed, the CM195BA board has the same performance as the CM195B board. However, if the Ports Utilities are installed, the performance of the CM195BA board is increased considerably. The CM195B board is still functional with the Ports Utilities installed, but without the improved performance of the CM195BA board. The Ports Utilities package is standard on all UNIX Releases 3.1 and later.

Figure 8-1. Expanded ports card CM195BA
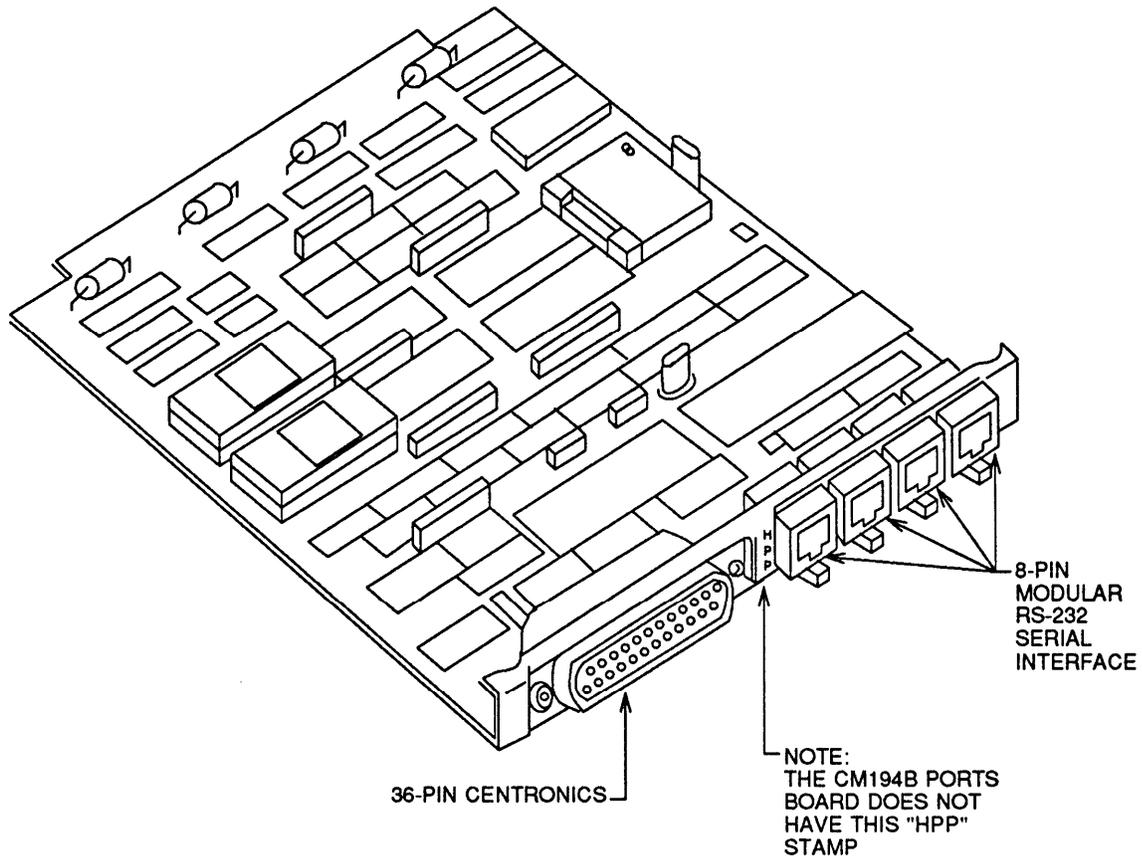
Diagnostics

Normal diagnostics are run for the ports card each time the 3B2 computer is powered up. A complete set of diagnostics (normal and demand) can be requested in the same fashion as all other diagnostics (dgn ports ph=*). Special loop-around connectors are necessary to execute the demand diagnostic phases for the printer CSR register and the DUART external loop.

Failures in the ports diagnostics are typically caused by the following

- defective ports card

- defective I/O backplane slot

- defective system board

- bad diagnostic code

If the only evident problem is the ports card itself, it is unlikely that the diagnostic code is bad or that the system board is defective. If there are two equipped devices, a quick check of defective slots rather than defective cards is to change locations and see if the fault follows the slot or the card.

NOTE: The software entries will be different if the exchange of cards involves a ports and a network interface (or other) card. This will be done automatically, but it requires two boots to clear up errors.

Software Problems

Problems with ports cards may be caused by improper loading of software. The relevant files to check are /dev and /etc/inittab. The /dev entries should look like:

```
crw--w--w-  1 (owner) (owner) slot, port Nov 28 15:46 tty??,
```

where *owner* is the last owner (uid and gid), slot is the backplane slot, and port is the connector number on the card (0-4). The ?? (in tty??) also refers to the backplane slot and card connector number (1-5). The /etc/inittab entries should look like:

```
??:2:respawn:/etc/getty tty?? baud #card? port?
```

where baud will be a number like 9600, 1200, and so on. Additional sample entries are given in the *AT&T 3B2 Computer Expanded Input/Output Capability Manual (305-452).* If changes are required, use the sysadm and ttymgrnt commands. For those more experienced with the UNIX system, the proper entries can be made using the standard UNIX commands. See the *AT&T 3B2 Computer System Administrator's Guide* for procedures for creating or changing /dev and /etc/inittab entries.

Pinouts

The pinouts for serial ports are identical to those for the integral console and contty ports on the back of the 3B2 computer. These pinouts are shown in Figure 8-2. Table 8–2 provides pinout definitions for the eight-pin modular connectors, and can be used in conjunction with Figure 8-2 for clarification. The term/printer adapter utilizes a null-modem connection; the automatic calling unit (ACU) modem adapter does not. On the term/printer adapter, the transmit data goes to receive data. This means that the line that transmits data out of the 3B2 computer goes into the line that receives data on the terminal, and the line that transmits data from the terminal goes to receive data on the 3B2 computer.

Table 8-2. Eight-Pin Modular Jacks

Pin	Lead	Direction	Explanation
1	PROT GRD		Ground.
2	Reserved		Not connected.
3	TXD0	Out	Transmit data.
4	DTR0	Out	Data terminal ready. This signal, when active, connects the modem to the telephone line, or denotes to a terminal or printer that the expansion port is ready to begin sending or receiving data.
5	RXD0	In	Receive data.
6	DCD0	In	Data carrier detect. This signal is active when the modem detects a signal capable of being demodulated, or the terminal/printer is ready to accept or transmit data.
7	SIG GRD		Ground.
8	Reserved		Not connected.

8-PIN MODULAR JACK	25-PIN RS-232-C JACK OR PLUG FOR PRINTER OR TERMINAL	25-PIN RS-232-C PLUG FOR AUTOMATIC DIAL MODEM

*1 PROT
2 RESERVED
3 TXD0
4 DTR0
5 RXD0
6 DCD0
	1 FRAME GROUND
	4 RESERVED
	3 TRANSMIT DATA
	B DATA TERMINAL READY
	2 RECEIVE DATA
	20 DATA CARRIER DETECT*
	6 DATA SET READY
	*NOTE:
	  ON THE JACK ONLY, PIN 20 IS
	  JUMPERED TO PIN 6.
		1 FRAME GROUND
		5 RESERVED
		2 TRANSMIT DATA
		20 DATA TERMINAL READY
		3 RECEIVE DATA
		8 DATA CARRIER DETECT

7 SIGNAL GROUND 8 RESERVED	7 SIGNAL GROUND 8 RESERVED	7 SIGNAL GROUND 8 RESERVED

SEE PIN DIAGRAM BELOW

RS-232-C CONNECTOR

1   13
14   25

FRONT

PIN 8 ——   —— PIN 1

PLUG WHICH GOES INTO 3B2 COMPUTER

GROUND LEAD (PIN 1)

PIN 1 ——   —— PIN 8

PLUG WHICH GOES INTO CONNECTOR

PIN 8 ——   —— PIN 1

MODULAR JACK 3B2 COMPUTER

PIN 1 ——   —— PIN 8

PLUG WHICH GOES IN 8-PIN-TO-25-PIN CONNECTOR

---
* Pin 1 on ports board is not used.

Figure 8-2. Serial ports pinouts

Use Figure 8–3 to construct the loop-around connectors for the demand diagnostic phases testing the DUART external loop. Pin 3 is strapped to pin 5. Pin 4 is strapped to pin 6. The DGMON command 1 ports lists the phase numbers that test the DUART external loop.

Two serial loop-around connectors must be used for each phase. In the first phase, you must install the loop-around connectors in the first and second serial ports. In the second phase, you must install the loop-around connectors in the third and fourth serial ports.

PIN #

3   TXD
4   DTR
5   RXD
6   DCD

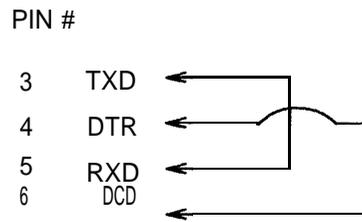**Figure 8-3.   Serial ports loop-around connector**

The pinouts for the parallel (CENTRONICS-type) interface are shown in Figure 8-4. The parallel port loop-around connector is shown in Figure 8-5. To construct the loop-around connector for the parallel port, strap pin 2 to 11, pin 3 to 12, pin 4 to 13, and pin 5 to 32. This loop-around is for the demand diagnostic phase that tests the printer CSR register.

PIN	DESCRIPTION	DESIGNATION
1	DATA STROBE	PRSTB0
2	DATA BIT 1	PRPA01
3	DATA BIT 2	PRP002
4	DATA BIT 3	PRPA03
5	DATA BIT 4	PRPA04
6	DATA BIT 5	PRPA05
7	DATA BIT 6	PRPA06
8	DATA BIT 7	PRPA07
9	DATA BIT 8	PRPA08
10	NO CONNECTION	NC
11	BUSY	PRBUSY1
12	PRINTER ERROR	PRPE1
13	SELECT	PRSEL1
14	±VOLTS	GRD
15	NO CONNECTION	NC
16	GROUND	GRD
17	FRAME GROUND	FRAME GROUND
18	NO CONNECTION	NC
19-29	GROUND	GRD
30	GROUND	GRD
31	INPUT PRIME	PRREST0
32	FAULT	PRFALT0
33	GROUND	GRD
34	NO CONNECTION	NC
35	NO CONNECTION	NC
36	NO CONNECTION	NC
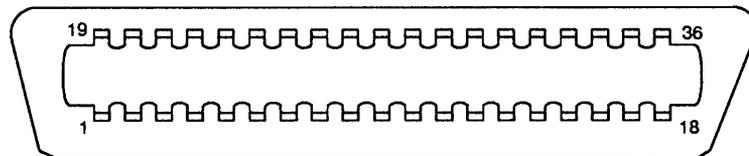
Figure 8-4. Parallel port pinouts (CENTRONICS)

36-PIN PLUG

PIN #

2	PRPA01
3	PRPA02
4	PRPA03
5	PRPA04
11	PRBUSY1
12	PRPE1
13	PRSEL1
32	PRFALT0
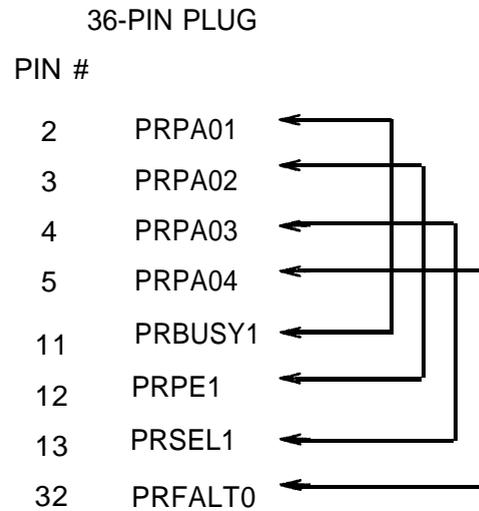
Figure 8-5.   Parallel port loop-around connector

Enhanced Ports Card

The enhanced ports card is commonly called the EPORTS card. It is designated as CM195Y.
A later version of the EPORTS card in the CM195AY. These two boards are functionally
equivalent and can be intermixed. There is a difference, however in the external diagnostic
loop-around cable. The enhanced ports card provides eight 8-pin modular jacks for serial RS-
232-C interface. In addition to all the features provided by the expanded ports card, this card
offers higher throughput, support of 38400 baud, and the capability of hardware flow control.
Figure 8–6 represents the enhanced ports (EPORTS) card.

Pinouts of the eight-pin jacks are identical to those for the expanded ports card, with the
exception of pin 2 clear to send (CT'S) and pin 8 request to send (RTS). See Table 8-3 for
more information about the EPORTS eight-pin modular jacks.

8-PIN MODULAR
RS-232 SERIAL
INTERFACE

Figure 8-6.   Enhanced ports (EPORTS) card CM195Y

Table 8-3.   EPORTS Eight-Pin Modular Jacks

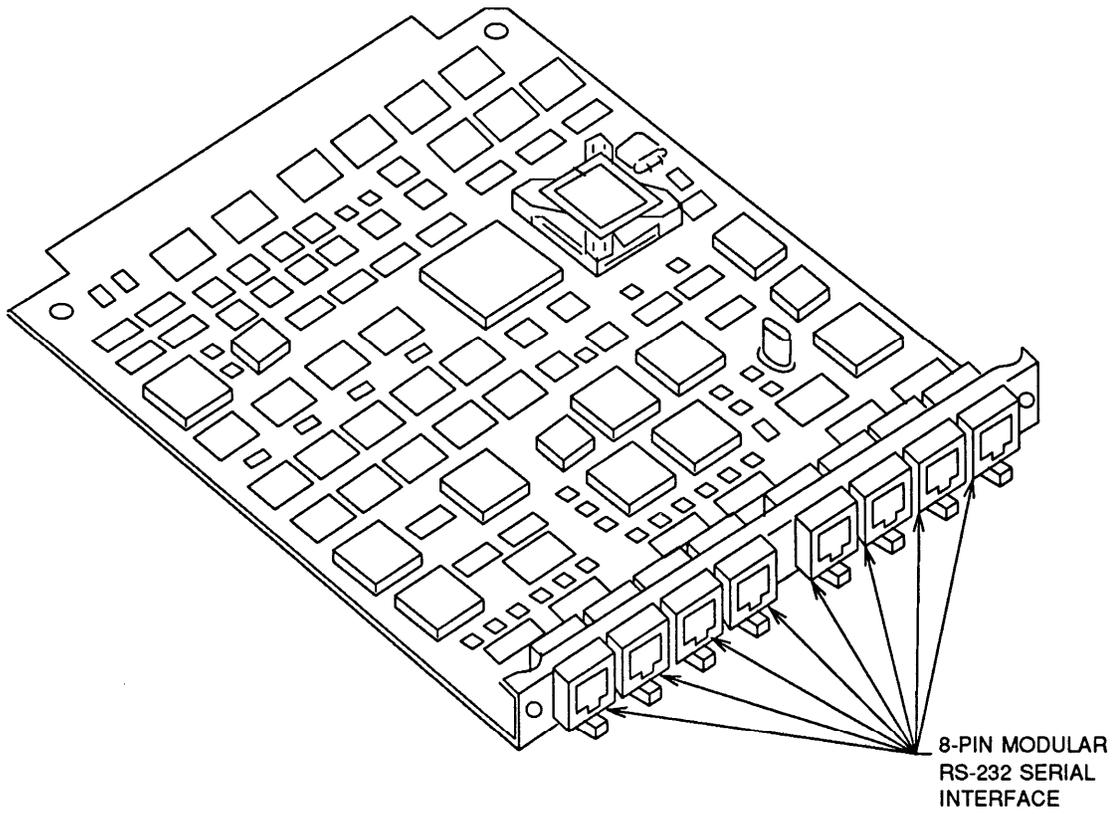| Pin	Lead	Direction	Explanation
1			Reserved.
2	CTS	Out	Clear to send.
3	TXD0	Out	Transmit data.
4	DTR0	Out	Data terminal ready. This signal, when active, connects the modem to the telephone line, or denotes to a terminal or printer that the expansion port is ready to begin sending or receiving data.
5	RXD0	In	Receive data.
6	DCD0	In	Data carrier detect. This signal is active when the modem detects a signal capable of being demodulated, or the terminal/printer is ready to accept or transmit data.
7	SIG GRD		Signal ground.
8	RTS	In	Request to send.
Spade plug	PROT GND		Ground.

Standard software flow control (DC1, DC3) is supported by EPORTS. EPORTS also supports two methods of hardware flow control. In one method of hardware control, the receiving device must use the RTS and CTS signals for flow control. In the other method, the receiving device must use the DTR signal. For applications not using DTR hardware flow control, standard term/printer and ACU/modem connectors may be used. However, if DTR hardware flow control is used, a special connector must also be used. The wiring for this connector is shown in Figure 8-7. See the *AT&T 3B2 Computer Enhanced Ports Manual* for more information on flow control. For a complete listing of the pinouts for the term/printer and ACU modem connectors, see Figure 8-2.

⚠ CAUTION
The DTR hardware flow control connector should not be used as a standard terminal connector. If it is used as a terminal connector, users must explicitly log off from the UNIX operating system environment. Turning the power off to the terminal will not ensure that complete log-off procedures have occurred.
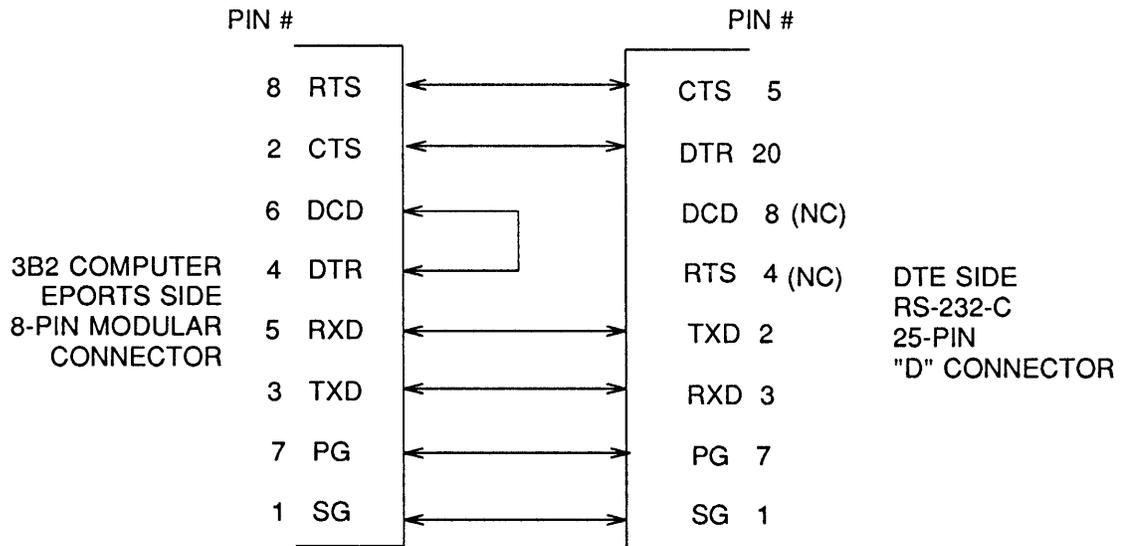
```
        PIN #                              PIN #

        8   RTS    ◄─────────►     CTS    5

        2   CTS    ◄─────────►     DTR   20

        6   DCD    ◄────┐          DCD    8 (NC)
3B2 COMPUTER                  │
  EPORTS SIDE  4   DTR    ◄────┘          RTS    4 (NC)    DTE SIDE
8-PIN MODULAR                                             RS-232-C
  CONNECTOR   5   RXD    ◄─────────►     TXD    2         25-PIN
                                                          "D" CONNECTOR
        3   TXD    ◄─────────►     RXD    3

        7   PG     ◄─────────►     PG     7

        1   SG     ◄─────────►     SG     1
```

Figure 8-7.   Pinouts for DTR hardware flow control connector (845754118)

Software

The EPORTS package includes software that must be installed before the hardware can be recognized by the system. The software consists of the following:

- diagnostic programs

- enhanced ports driver

- simple administration menus

- support files

If the Ports Utilities package is installed after EPORTS has been installed, the EPORTS software must be reinstalled to ensure proper operation.

Diagnostics

The diagnostic programs for EPORTS include external loop-around phases that requires four special loop-around cables. See Figures 8-8 and 8-9 for wiring instructions for the loop-around connector.

To run a loop-around diagnostic phase, use the cables to connect the jacks on the EPORTS card as follows. Connect jack 1 to jack 4, jack 2 to jack 3, jack 5 to jack 8, and jack 6 to jack 7.
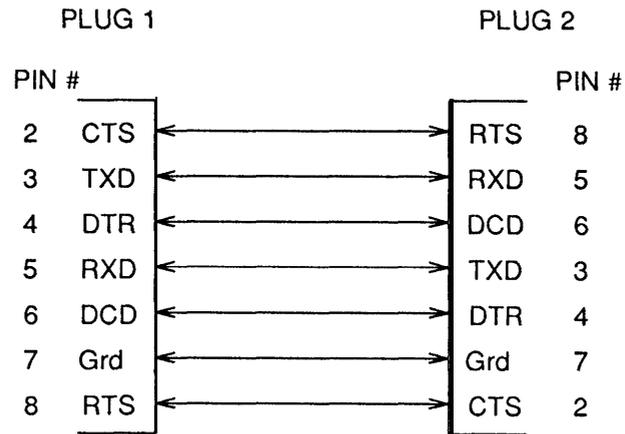
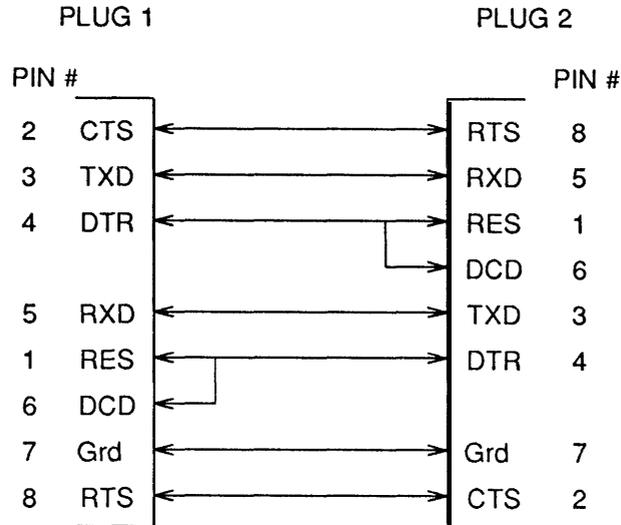**Figure 8-8. Loop-around cable wiring (CM195Y)**

Figure 8–9. Loop-around cable wiring (CM195AY)

Network Interface Card

The network interface (NI) card is designated as a CM195A and allows the 3B2 computer to be interconnected with other 3B2 computers running 3BNET, TCP/IP, or 10 MB STARLAN applications. Figure 8–10 represents the NI card.

Like any other peripheral card, the NI card affects the automatic diagnostics that take place during system power-up. The application software must be installed before the NI card can be recognized by the 3B2 computer. Once the software is in place, diagnostics expect to find a fully terminated network on the NI card. If an NI card is installed without such a network, the phases that test the external loop will fail. These phases require that the NI card be connected, through a drop cable, to a terminated transceiver. The termination may be accomplished by either placing terminators on both ends of the transceiver, or by adding on to an existing terminated network. Both of these configurations allow diagnostics on the NI card to complete successfully.
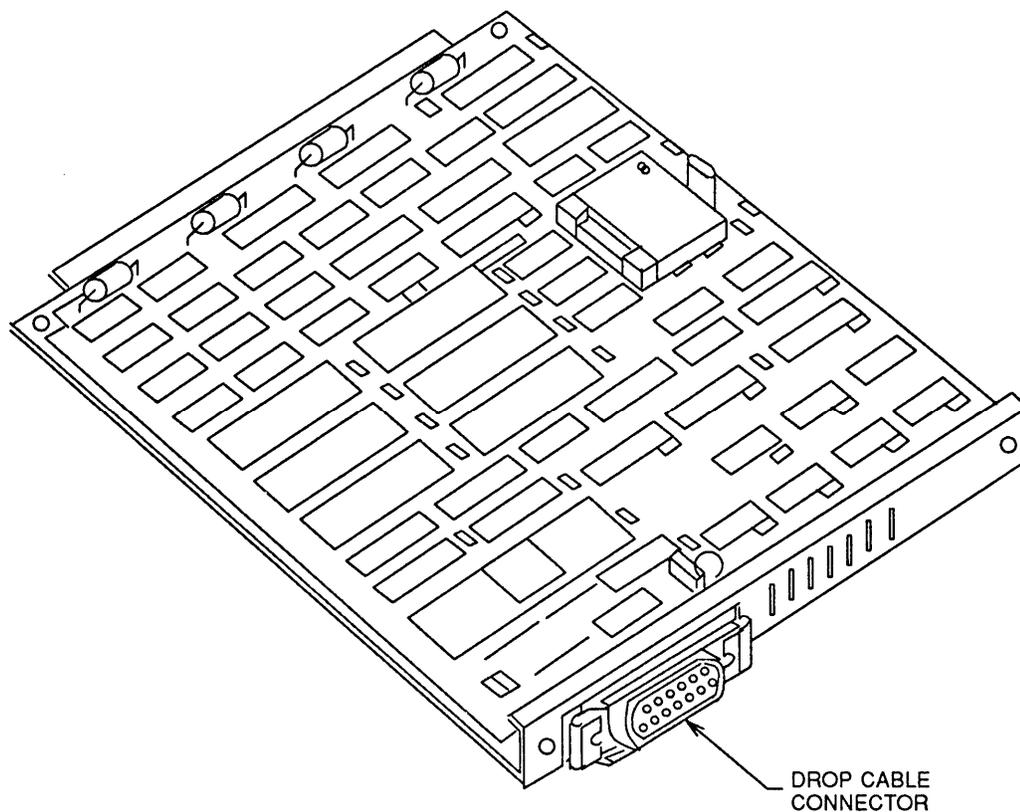

DROP CABLE
CONNECTOR

Figure 8-10.   Network interface (NI) card CM195A

If any of the other phases fail, the NI card should probably be changcd. The failure of the external loop phases indicates a problem in the network outside of the 3B2 computer. The best way to approach this problem is to terminate both sides of the transceiver. This either corrects the problem, indicates that there is an "open" somewhere in the existing network, or limits the failure to the terminators, the transceiver, the drop cable, or the NI card itself. If the drop cable causing the problem has never been used before, the following three items should be checked:

- The right angle connector must be attached so that the drop cable runs straight out the back of the cable trough.

- The cable must be shielded, and must contain four twisted pairs. Continuity must exist straight through on pins 1, 2, 3, 5, 6, 9, 10, 12, and 13.

- The twisted pairs must be on pins 2-9, 3-10, 5-12, and 6-13. If these pairs are intertwined, crosstalk will result.

If an NI application is installed and a fully terminated network is not available, the NI card should be removed. This allows system diagnostics to pass without removing the complete application utility.

If the following limits are exceeded for the NI, errors may occur.

- The maximum cable lengths are (must be a multiple of 2.5 meters):

  - drop cable - 50 meters

  - coax cable - 500 meters (between terminators)

- The maximum number of nodes on the network are

  - "3B2 computer only" network - 100

  - all others - 30

NOTE: On all models, if the system board is replaced in a machine that contains a 3BNET application, the PROMS should be moved from the old system board to the new system board. If this is not done for some reason (for example, bad PROMS), the 3BNET node address will change and you must inform other computers on the network of the new ID.

Remote Management Package/Alarm Interface Circuit

The remote management package/alarm interface circuit (RMP/AIC) is designated as CM195AA. Figure 8–11 represents the AIC card. Troubleshooting the RMP/AIC card in most cases requires additional knowledge about the customer's unique use of the card. Each installation has peculiarities that require specialized attention. The proper use of the I/O ports on the RMP/AIC card can be determined from the specifications in Table 8-4.

As shown in Table 8-4,

    ∇ represents an absolute maximum rating over a free-air temperature range of 0 to 70 degrees C

    **   means that closure across these pins results in a major alarm (accepts either TTL or closure)

    +   means that closure across these pins results in a minor alarm (accepts either TTL or closure)

    #   represents major alarm outputs (intended for activating an external alarm processing unit)

    $ represents minor alarm outputs (intended for activating an external alarm processing unit)

    **   means that P1 is on the right and P4 is on the left of each modular jack, referenced with the component side up and the faceplate toward you

Table 8--4.   RMP/AIC Application Interface Specifications

Port Labels					
		ALM	**UPS**	**EXT2**	**EXT1**
Direction		outputs	Inputs	inputs	Inputs
Current		Sink 35 ma max	Source 2 ma max	Source 2 ma max	Source 2 ma max
Voltage		VCE: 1.0 v at 35 ma 0.8 v at 10 ma 0.7 v at 5 ma VCE: 30 v max VEC: 7 v max	VIL = 0.8 v max VIH = 2.0 v min VIH = 7.0 v max ∇	VIL = 0.8 v max VIH = 2.0 v min VIH = 7.0 v max ∇	VIL + 0.8 v max VIH = 2.0 v min VIH = 7.0 v max ∇
Active State		Conducts	Logic Low "0"	Logic Low "0"	Logic Low "0"
Signal Duration		127 ms min	20 ns min (low)	20 ns min (low)	20 ns min (low)
Pin **	P1	Darlington Emitter# (MJOUT1)	Ground	Ground*	Ground+
	P2	Darlington Collector# (MAJORIN1)	AC FAILURE (ACFSET0)	EXTERNAL ITL* (EXT2IN0)	EXTERNAL ITL+ (EXT1IN0)
Signals	P3	Darlington Emitter$ (MINOUT1)	Ground	Ground	Ground
	P4	Darlington Collector$ (MININ1)	LOW BATTERY (LOWBSET0)	Reserved	Reserved

CONNECTION
TO THE 3B2
COMPUTER
CONSOLE
PORT

ALARM
OUTPUT
JACK

REMOTE
CONSOLE
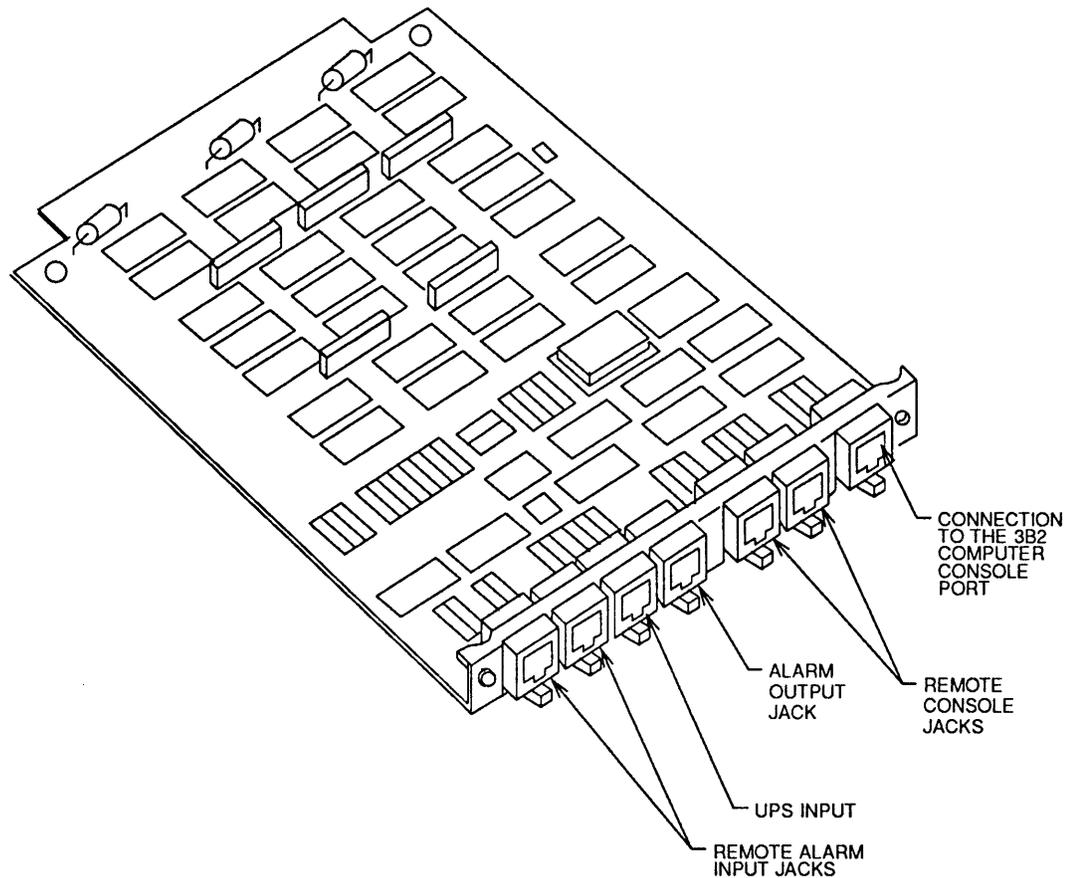JACKS

UPS INPUT

REMOTE ALARM
INPUT JACKS

Figure 8-11.   Alarm interface circuit (AIC) CM195AA

Diagnostics for the RMP/AIC

The RMP/AIC card has its own set of diagnostics that are executed as any other feature card diagnostics by the diagnostic monitor. The designation for the remote management package in the equipped device table (EDT) is RMP.   All the diagnostics, with the exception of one, can be executed without additional hardware. The loop-around phase requires the use of a special loop-around cable that is constructed from the included diagram (see Figure 8-12). Successful completion of all the diagnostic phases for the RMP/AIC card provides sufficient evidence that the card is functional.
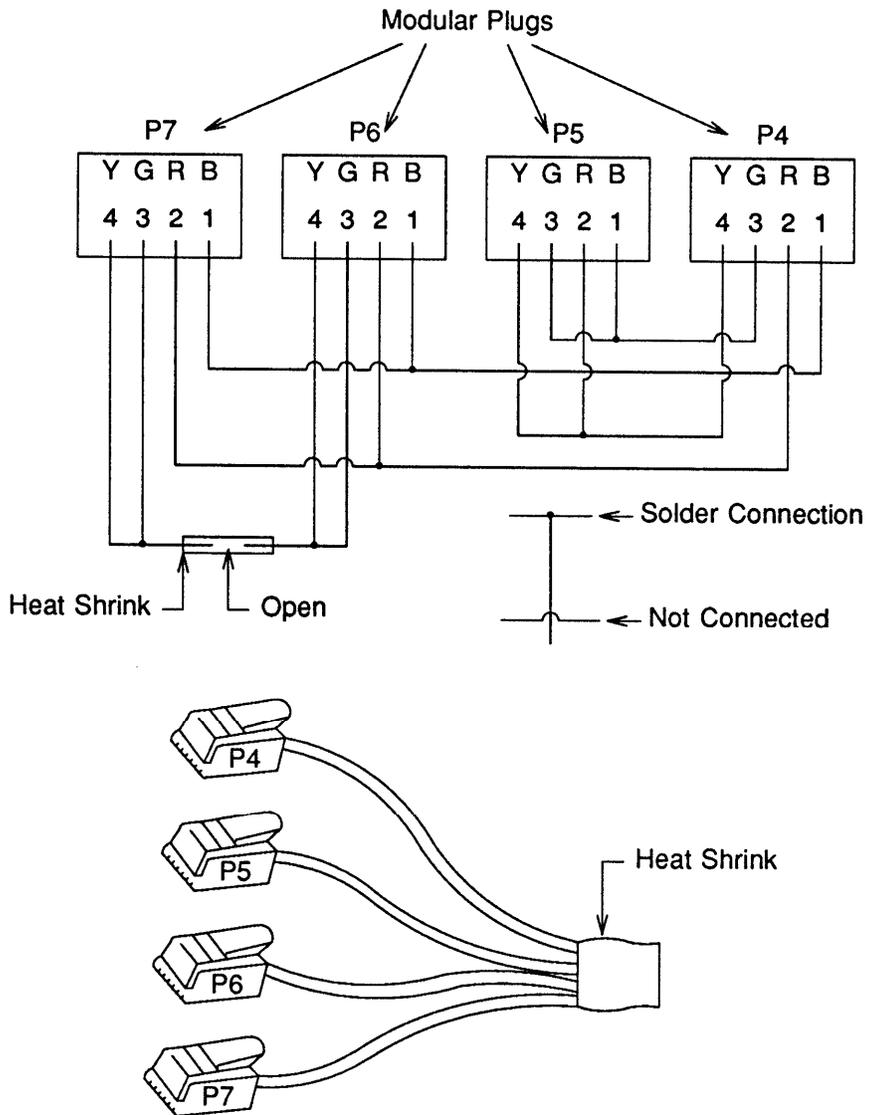
Figure 8-12.   Special test cable for RMP/AIC

Typical Connections to the RMP/AIC Dialer

The external alarm processing unit (dialer) is intended to be specified by the customer. A typical connection of an alarm processor is a Silent Knight, Model 1450 five-channel digital dialer. The following option selections and wiring apply to the Model 1450 dialer.

- Remove jumper 6. For channel 1, select the latched mode.

- Remove jumper 8. For channel 3, select the latched mode.

- Place a jumper wire between terminals 3 and 4 (Channel 1).

- Place a jumper wire between terminals 9 and 10 (Channel 3).

- Place a 15K resistor across terminals 6 and 11. (This resistor is supplied with the dialer.)

- Connect the four conductor modular to the spade lug telephone cable to the dialer.

    ❏ Connect the yellow wire in the cable to terminal 4 on the dialer.

    ❏ Connect the red wire in the cable to terminal 10 on the dialer.

    ❏ Connect the black and green wires in the cable to terminal 11 on the dialer.

- Connect the telephone line to terminals 14 (Tip) and 13 (Ring) on the dialer.

- Connect the modem telephone line to terminals 16 (Tip) and 15 (Ring) on the dialer.

The cable's modular plug should line up with the AIC ALM modular jack so that yellow is pin 1, green is pin 2, red is pin 3, and black is pin 4. Pin 1 is on the right and pin 4 is on the left of each AIC modular jack, referenced with the component side up and the faceplate towards you.

Channel 1 of the dialer is now associated with major alarms. Channel 3 of the dialer is now associated with minor alarms. The remote console link of the host site modem shares the telephone line with the dialer. The dialer takes priority. If the dialer must report an alarm and the modem is using the line, the dialer will force the modem off-line. A second telephone line is required if this presents a problem. Table 8-5 shows priority and data paths for the two console ports.

Table 8-5. Remote Console Priorities

Input State		Result			
State of DCD		Serial data transmitted/received from/to SBD integral UART			
TRM1 (J1)	TRM2 (J2)	TRM1 (J1)		TRM2 (J2)	
		TXD	RXD	TXD	RXD
off	off	no	no	no	yes
on	off	yes	yes	no	no
off	on	no	no	yes	yes
on	on	yes	yes	yes	no

Network Access Unit

The network access unit (NAU) is designated as CM195U. This feature card allows a 3B2 computer to be connected to an AT&T STARLAN network. The STARLAN software must be installed before the card can be operational. Follow the instructions supplied with the card for installation of the card and connection to the network. Figure 8-13 represents the network access unit (NAU) card.
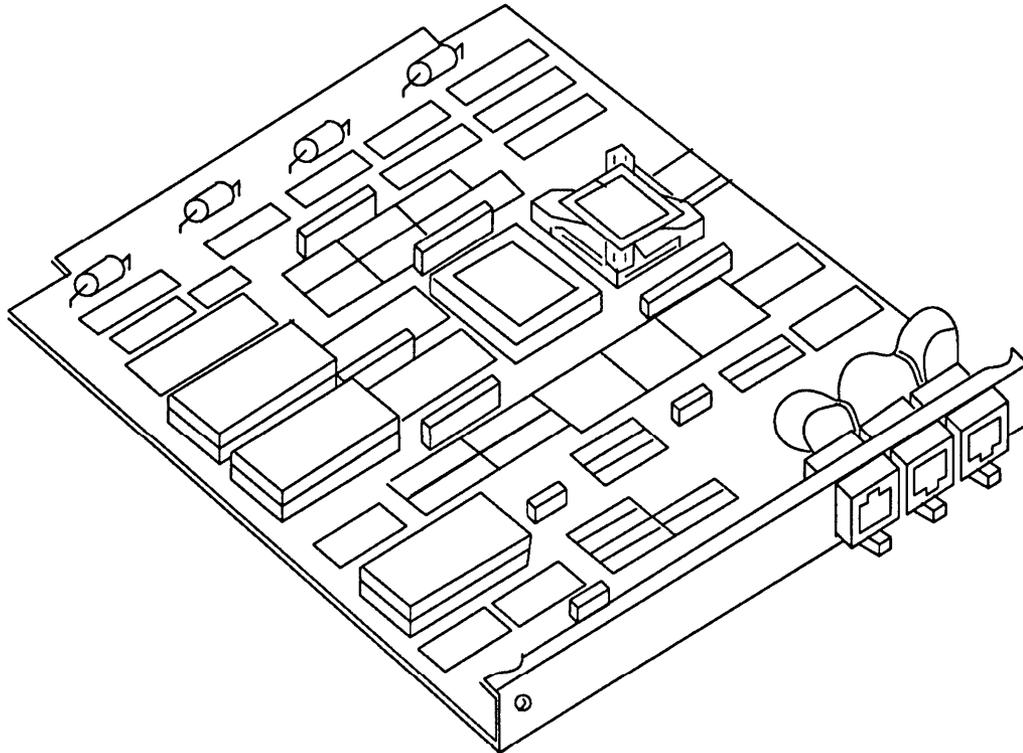
Figure 8-13.   Network access unit (NAU) card CM195U

The following procedures help to determine if an NAU card is defective, but they will not help locate a problem with the network to which the 3B2 computer is connected.

The diagnostics supplied with the software should be used to troubleshoot problems with the NAU. If there is a question as to whether the problem lies with the NAU or with the network, completely disconnect the NAU from the network. Then, run diagnostics. For disconnect procedures, see the installation guide provided with the NAU.

Ensure that the STARLAN cable is disconnected at the NAU jacks. The jacks loop-around automatically when a cable is not plugged in so that the external diagnostics work. If the diagnostics pass with this configuration, connect the NAU to the network and run the external diagnostics again. If the diagnostics fail, the problem lies elsewhere in the network. Refer to the *STARLAN User's Manual* for information about troubleshooting network problems.

NOTE: When you are connected to the AT&T STARLAN network, the network must be operational for diagnostics to pass.

Cartridge Tape Controller Card

The cartridge tape controller (CTC) card is designated as CM195H. It is only installed in 3B2 computer systems using a cartridge tape drive. Only the 3B2/400, the AT&T expansion module (XM), and the AT&T tape module (TM) have such drives. The CTC card controls the cartridge tape drive, or a floppy drive, if one is present in the XM. Figure 8-14 represents the cartridge tape controller (CTC) card.
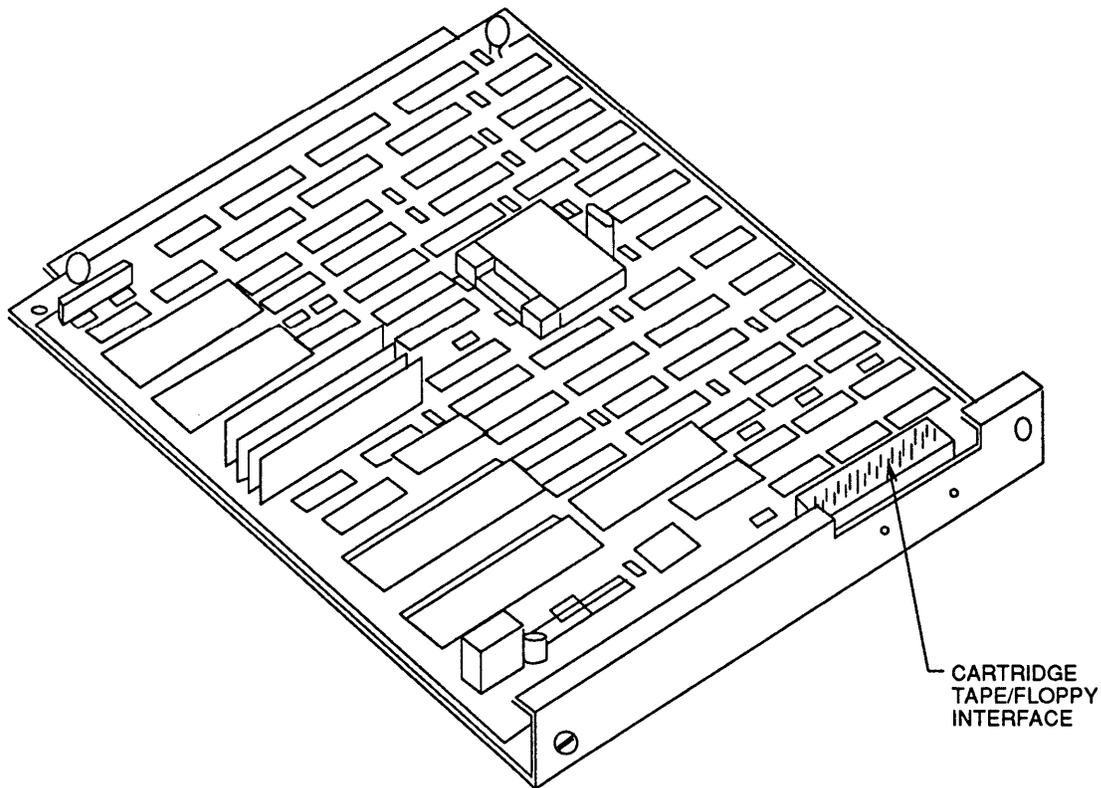

Figure 8-14. **Cartridge tape controller (CTC) card CM195H**

Installation of CTC Board

Two software floppy disks must be installed before the CTC card is placed in the 3B2 computer. Use the standard `sysadm installpkg` routines to install and load the CTC soft ware.

In any 3B2 computer with SCSI 9-track Tape Drive Utilities where a CTC card is also being installed, the 9-Track Tape Drive Utilities must be reinstalled after the CTC Utilities.

Diagnostics

Diagnostics for the CTC are run like the diagnostics for any other feature card. As noted for other cards, failures in the diagnostics are probably caused by a defective card, but it is possible that other factors may be the cause (defective slot, improper connections, and so on).

Intelligent Serial Controller Card

The intelligent serial controller (ISC) card is designated CM195T and provides a synchronous interface for an IBM 3270-type emulator. Figure 8-15 represents the ISC card. Since it is equipped with only one jack, a synchronous RS-232-C Y cable provides the two channels A and B to which a modem is connected (see Figure 8-16). A second modem is connected to the mainframe. The ISC application (SNA/SDLC, BI-SYNC, or X.25) is determined by the software that is loaded into the 3B2 computer system. The UNIX operating system will not recognize the ISC card unless the application software is loaded before the 3B2 computer is booted.
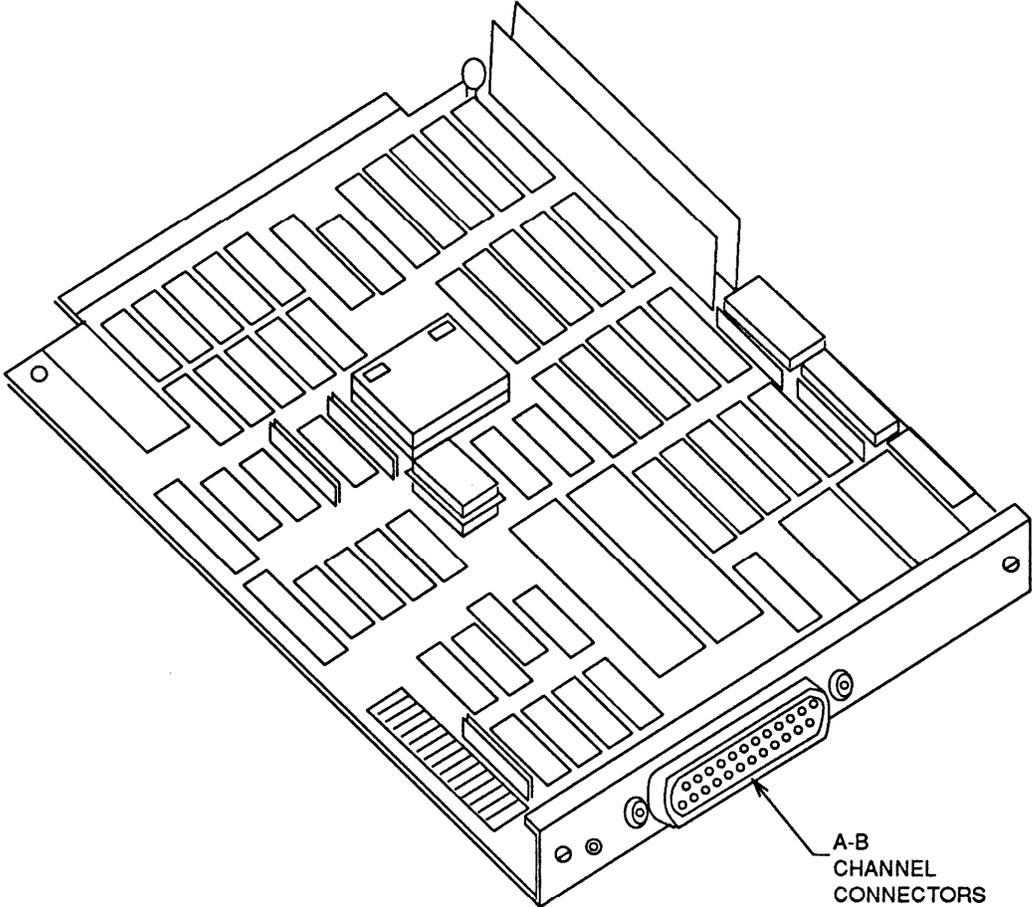
A-B
CHANNEL
CONNECTORS

Figure 8-15.   Intelligent serial controller (ISC) card CM195T
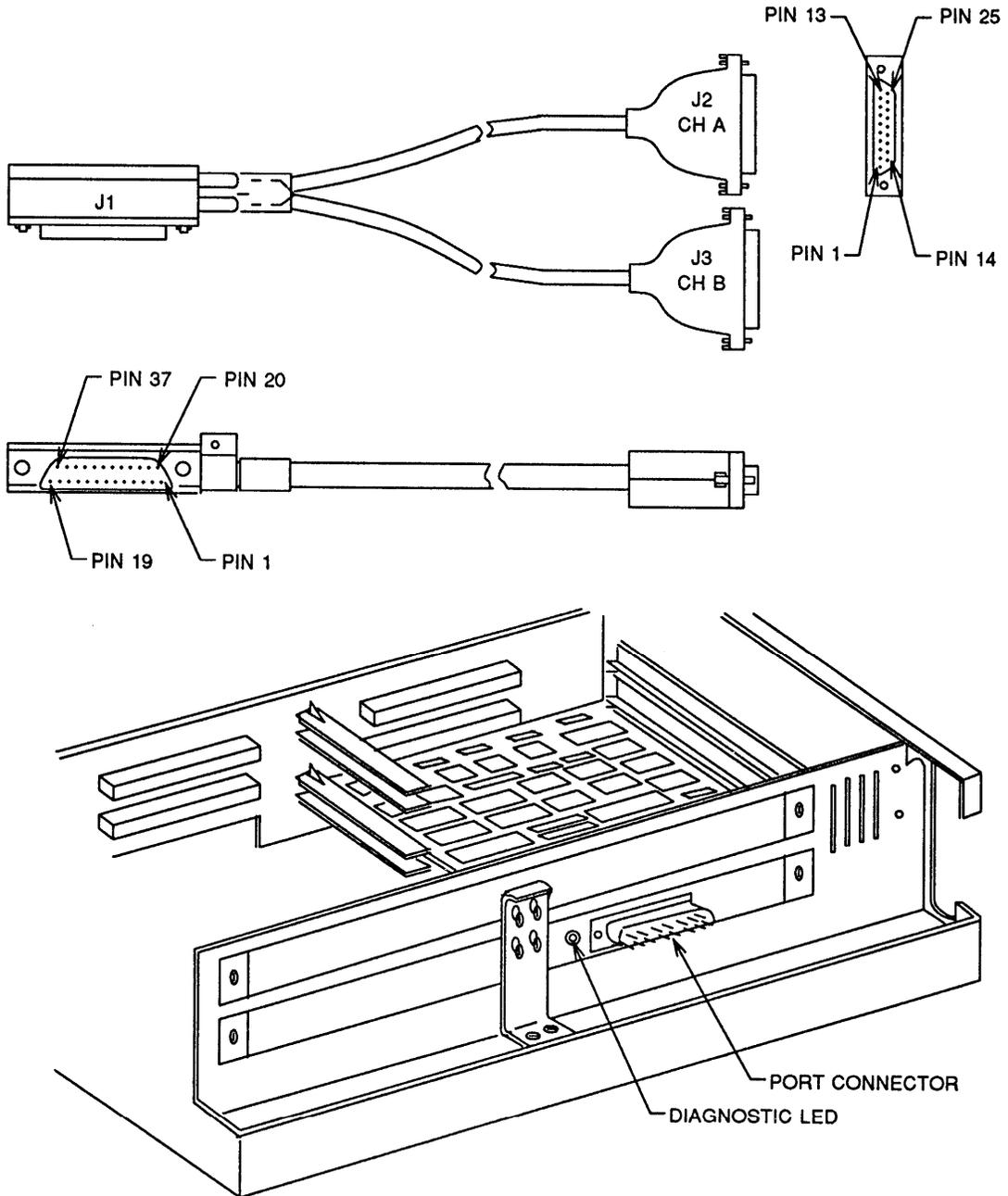
Figure 8-16. Synchronous RS-232-C Y cable and installed ISC card

Diagnostics

Diagnostics for the ISC card include normal, demand, and interactive phases. Phase 1 is the only normal phase. Phases 2 through 13 are demand phases. Phases 14 through 18 are interactive. The diagnostics for the ISC card must be loaded via a floppy disk using the standard `sysadm installpkg` menu. (Some applications software may contain a copy of the diagnostics.)

If any phase from 1 through 13 fails, the card probably needs replacing. If the replacement card fails, the failure is probably because of a defective backplane or system board. See Table 8–6 for a description of off-board diagnostic failures and phases and associated failed components. Loopback cables and an external clock source are required in order to run phases 15 through 18. See Figure 8-17 and Figure 8-18 for descriptions of the pin configurations for the loopback connectors.

An additional fault check is provided by an LED located on the left of the cable jack at the front of the card (see Figure 8-16). If this light is illuminated, the card is defective.

NOTES: The RS-232-C cable has a maximum recommended length of 50 feet. See Figures 8-19 and 8-20 for the pinout specifications.

The external clock must be provided by a terminal or modem.

The 80186 microprocessor on the ISC card is normally capable of supporting total throughput of 64 kilobaud. However, while it is a component of the ISC card, its total throughput is only 19.2 kilobaud.

The application software packages produced for the ISC (SNA/SDLC and BI-SYNC) only allow access to channel A. As a result, channel B is totally inoperative. This is standard to these software packages, and no fix is planned.

Table 8-6. ISC Diagnostic Failures and Phases

Failed Component	Corresponding Diagnostic Phase	
3B2 computer I/O bus interface acknowledge circuitry and I/O bus interface	Phase	1
ISC card*	Phases	2
		⋮
		⋮
		18
Synchronous RS-232-C "Y" cable**	Phases	15
		⋮
		⋮
		18

* Phase 14 is not a true diagnostic test, but rather a software development utility that requires special connections.

**Diagnostic phases 15 through 18 require a loopback cable and an external clock source.

```
ISC              DB-25
SIGNAL           PIN

  TD               2
  RD               3

  DTR             20
  DSR              6

  RTS              4
  CTS              5
  DCD              6

  TXC             15
  RXC             17
```

THESE INPUTS MUST BE DRIVEN BY AN EXTERNAL
SOURCE WHICH CAN PROVIDE A SQUARE WAVE FROM
-12V TO +12V AT A FREQUENCY OF ABOUT 9.6 Khz
THIS WAVEFORM REPRESENTS A 1X CLOCK OF 9600
BAUD AT 4S-232 SIGNAL LEVELS
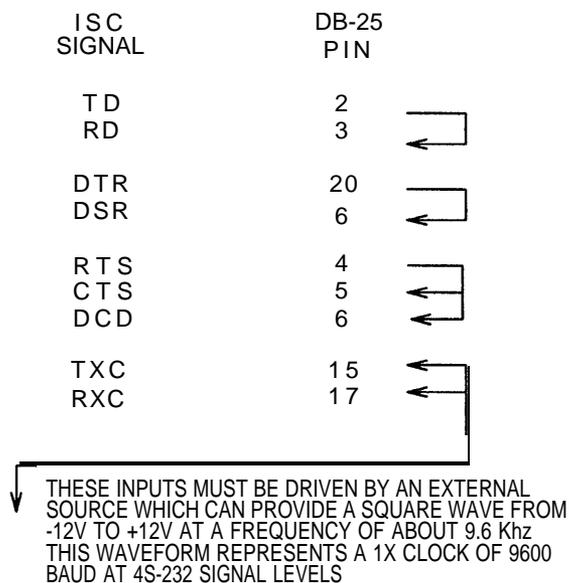
Figure 8-17.   ISC loopback connection for phases 15 and 16

ISC CHANNEL A	DB-25 PIN		DB-25 PIN	ISC CHANNEL A
TD	2	→	3	TD
RD	3	←	2	RD
DTR	20	→	6	DTR
DSR	6	←	20	DSR
RTS	4	→	8	RTS
CTS	5	←		CTS
DCD	8	←	4	DCD
			5	
TXC	15	→	17	TXC
RXC	17	→	15	RXC

THESE INPUTS MUST BE DRIVEN BY AN EXTERNAL
SOURCE WHICH CAN PROVIDE A SQUARE WAVE FROM
-12V TO +12V AT A FREQUENCY OF ABOUT 9.6 Khz
THIS WAVEFORM REPRESENTS A 1X CLOCK OF 9600
BAUD AT RS-232 SIGNAL LEVELS.
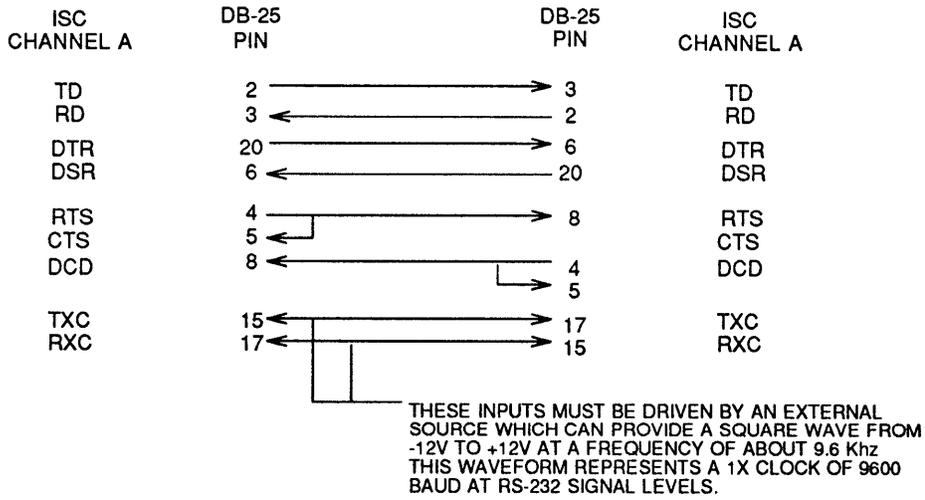
Figure 8-18.   ISC loopback connection for phases 17 and 18

PIN	SIGNAL	FUNCTION
1	SIGNAL GD	SIGNAL GROUND
2	ARXC	A CHANNEL, RECEIVE CLOCK
3	ATXD	A CHANNEL, TRANSMIT DATA
4	ATXCI	A CHANNEL, TRANSMIT CLOCK INPUT
5	ARXD	A CHANNEL, RECEIVE DATA
6	- - -	
7	ARTS	A CHANNEL, REQUEST TO SEND
8	- - -	
9	ACTS	A CHANNEL, CLEAR TO SEND
10	- - -	
11	SIGNAL GD	SIGNAL GROUND
12	- - -	
13	ADCB	ACHANNEL, DATA CARRIER DETECT
14	- - -	
15	ADTR	ACHANNEL, DATA TERMINAL READY
16	ARI	ACHANNEL, RING INDICATOR
17	ADSR	ACHANNEL, DATA SET READY
18	ATXCO	ACHANNEL, TRANSMIT CLOCK READY
19	- - -	
20	- - -	
21	BTXD	BCHANNEL,TRANSMIT DATA
22	BRXC	BCHANNEL, RECEIVE CLOCK
23	BRXD	BCHANNEL, RECEIVE DATA
24	BTXCI	BCHANNEL,TRANSMIT TO CLOCK INPUT
25	BRTS	BCHANNEL, REQUEST TO SEND
26	- - -	
27	BCTS	BCHANNEL, CLEAR TO SEND
28	SIGNAL GD	SIGNAL GROUND
29	SIGNAL GD	SIGNAL GROUND
30	- - -	
31	BDCD	BCHANNEL, DATA CARRIER DETECT
32	- - -	
33	BDTR	BCHANNEL, DATA TERMINAL READY
34	- - -	
35	BDSR	BCHANNEL, DATA SET READY
36	BTXCO	BCHANNEL, TRANSMIT CLOCK READY
37	BRI	BCHANNEL, RING INDICATOR

Figure 8-19.   Pinout of Jl serial port connector

PIN	SIGNAL	FUNCTION
1	GND	SIGNAL GROUND
2	TXD	TRANSMIT DATA
3	RXD	RECEIVE DATA
4	RTS	REQUEST TO SEND
5	CTS	CLEAR TO SEND
6	DSR	DATA SET READY
7	GND	SIGNAL GROUND
8	DCD	DATA CARRIER DETECT
9		
10		
11		
12		
13		
14		
15	TXCI	TRANSMIT CLOCK INPUT
16		
17	RXC	RECEIVE CLOCK
18		
19		
20	DTR	DATA TERMINAL READY
21		
22	RI	RING INDICATOR
23		
24	TXCO	TRANSMIT CLOCK OUTPUT
25		

FRONT

Figure 8-20.   Pinout of J2 or J3 serial port connector

Expansion Disk Controller Card

The expansion disk controller (XDC) is an I/O expansion card that allows up to two additional hard disks to be added to the system. The XDC is designated CM195K and uses the same hard disk controller chip as the system board, allowing any drives available as integral disks to be connected as expansion disks. The supported growth limits are two XIX cards in the 300/310 and four XDC cards in the 400, with a maximum of 6 and 10 hard disk drives, respectively. Figure 8–21 represents the XDC card.
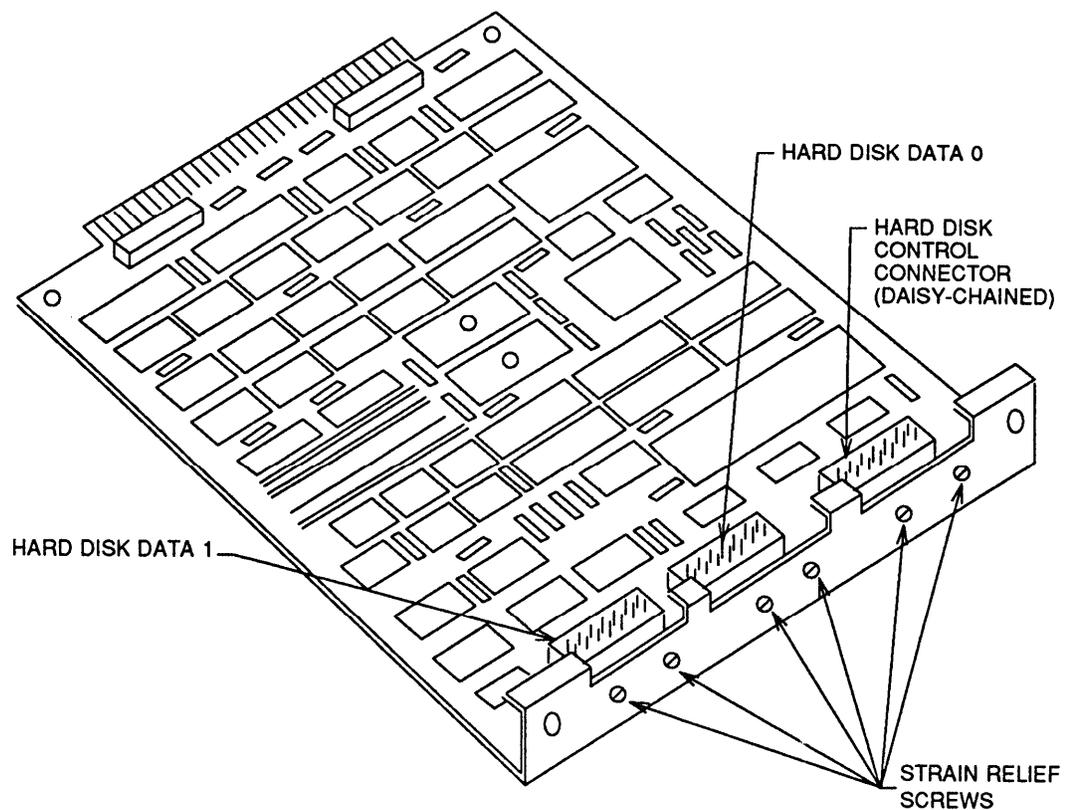

Figure 8-21.   Expansion disk controller (XDC) card CM195K

Installation

The cabling of the XDC card is identical to that of the system board. There are two 20-pin data cables and one 34-pin control cable per board. The 20-pin connector closest to the 34-pin connector is for drive 0 (same as the system board). Figure 8-21 shows 20-pin and 34-pin cable connectors to the XDC card. The hardware disk IDs are 0 and 1 for disks on each XDC card. The software actually refers to integral disk 0 as disk 1. Every disk added is numbered sequentially; disk 2, disk 3, and so on. There is no correlation between a given disk and its software "disk" number other than the order of installation. The software names that correlate with a specific disk are the special device nodes /dev/rdsk/ *c?d?s?* and /dev/dsk/ *c?d?s?,* where *c* is the controller number, *d* is the hardware disk ID (0 or 1), and *s* is the slice (partition) number.

The controller number is 1 for the integral hard disks. For XDC disks, the controller number is the I/O slot number of the XDC card (1-4 or 1-12) plus one.

NOTE: The directory for character devices is rdsk and dsk is the directory for block devices. Both types can be used for I/O, but only block devices can be mounted.

Refer to the *AT&T 3B2 Computer XM Manual* (305-538) for additional information.

General Purpose Synchronous Controller (GPSC) Card

The general purpose synchronous controller (GPSC) card (see Figure 8-22) contains the following features: two physical half/full-duplex synchronous ports, serial communication at up to 64 K bits per second, and support for several electrical and communication protocols.

Installation for this feature card is the same as other I/O cards in the 3B2 computer. The GPSC is installed in the next available slot in the backplane. The software is then loaded and the machine is rebooted.
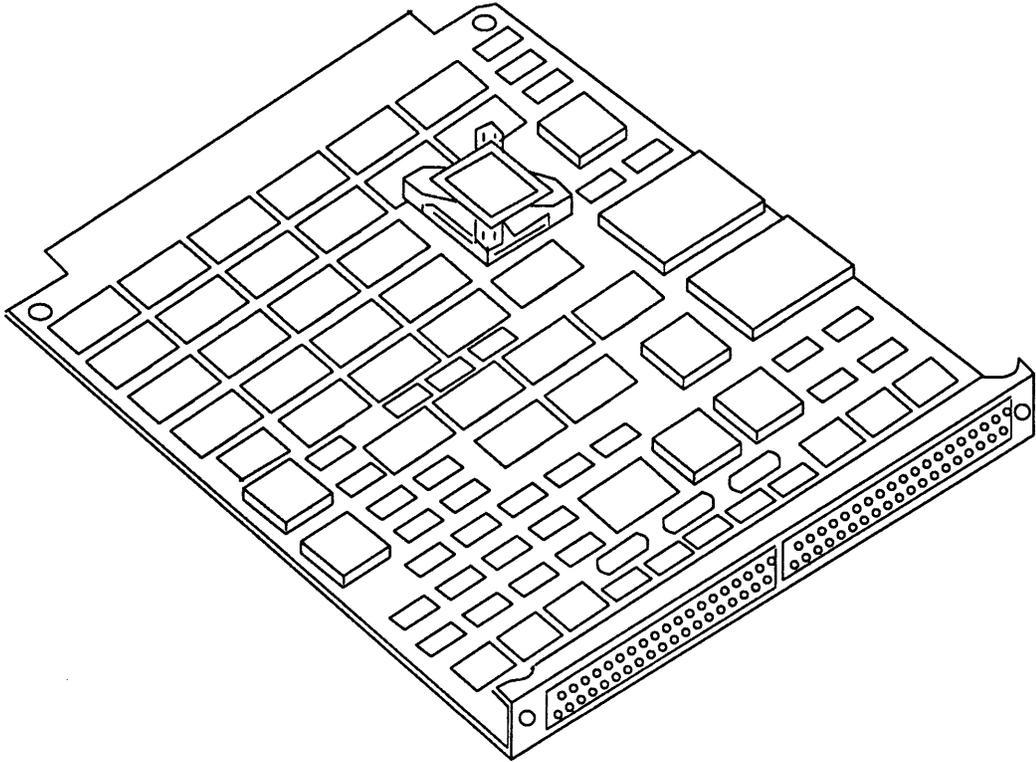
Figure 8-22.   General purpose synchronous controller (GPSC) card CM195AE

To run the loop-around test, the RS-232 cable is used with the null modem cable. Using cables other than the RS-232 and the null modem will cause the diagnostic tests not to run (see Figure 8-23 and Figure 8-24).
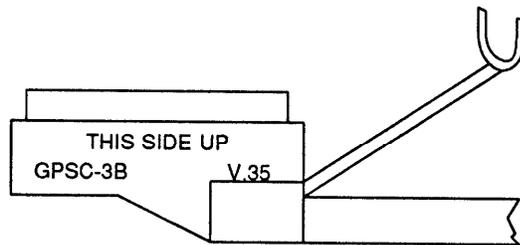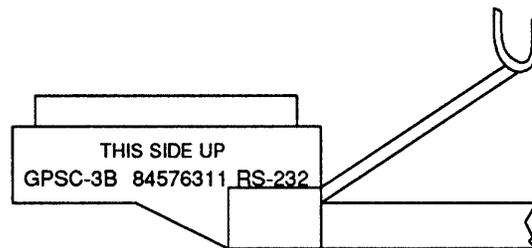

Figure 8–23.   V.35 serial port connector cable

Figure 8-24.   RS-232-C serial port connector cable

SCSI Host Adapter Card

The Small Computer System Interface (SCSI) is an industry-wide standard bus for connecting peripheral devices. These devices include hard disk drives, cartridge tape drives, and 9-track tape drives. A daisy-chain cabling configuration connects all SCSI devices together. A total of eight controllers may occupy a single bus. Each controller, or target controller, has a unique ID between 0 and 7 on the SCSI bus. These controllers use one of the following types of drivers or receivers

- Single-ended— allows total bus length of 6 meters (19 feet 8 inches).

- Differential (double-ended)— allows total bus length of 25 meters (82 feet).

All controllers on a bus must use the same type of driver or receiver.

The SCSI host adapter card is the interface between the 3B2 I/O bus and the SCSI bus. The host adapter is a target controller on the bus, and usually has an ID of 0. There are two host adapter cards available. The single-ended card, CM195W, is called HA1 and the differential card, CM521A, is called HA2 (see Figures 8-27 and 8-28). The 3B2 supports any combination of up to eight HA1 and HA2 cards. Because of power requirements, the HA2 card is only supported in Version 3 Models. If more than one host adapter is configured in a system, they can both have an ID of 0 since they reside on separate SCSI buses.

Differential SCSI supports the feature of shared peripherals. This feature allows more than one host adapter on the 3B2 to reside on the same SCSI bus. This means that several 3B2 computers can share a common peripheral, such as a 9-track tape drive. This feature does not allow dynamic sharing of a single file system and should not be used for concurrent access to any peripherals on the bus. When more than one 3B2 is connected to a SCSI bus, the host adapter IDs must be changed to be unique.

Since the SCSI bus is a daisy-chain configuration, each end of the bus must be terminated. The host adapter card is equipped with two 50-pin connectors. Usually the host adapter is at one end of the daisy chain, so the unused connector contains a terminator. Figure 8-26 shows a host adapter cable and terminator.

The SCSI cables are the only items that may be used on either single-ended or differential buses. The terminators can not be intermixed. The type is stamped on the terminator shell. If not designated, the type is single-ended.

Refer to Chapter 3, "3B2 Peripheral Overview," and Chapter 7, "3B2 Peripheral Subassemblies," for more information on SCSI peripherals. For more information on SCSI features and operations, refer to the SCSI *Operations Manual* (305-012).

SCSI Software

The SCSI Release 3 Host Adapter Utilities contains a single software driver for both versions of the host adapter cards. However, two pump files will be installed, `scsi1` and `scsi2`, for the HA1 and HA2 cards, respectively. Previous releases of the Host Adapter Utilities support only the single-ended bus. The command `haversion` determines which type of host adapter is in a particular slot. The `prtconf` command also helps to distinguish between the two types.

Shared Peripherals

The significant new feature of the differential SCSI bus allows the bus to share peripherals between up to three host computers. This capability should not cause any significant difficulties when troubleshooting a problem on the SCSI bus, and will make it easier to pinpoint the problem. A second HA2 card on a SCSI bus looks just like another target controller the first HA2 card. For the second HA2 to be recognized during the power up sequence, the second host computer must be powered on before the `edtgen` program executes on the first host computer (`edtgen` follows diagnostics in the power-up sequence). The second host computer does not have to be powered on for proper operation of the SCSI bus, it will just not be configured by the first host.

If a host on a shared bus is powered down, a SCSI bus reset may result. Therefore, limit the activity of the other host on the bus until the host is powered down. If a tape job on a shared bus is currently running on another host, a SCSI bus reset will abort the job.

The `prtconf` command is very useful in verifying proper system configuration. Figure 8-25 shows a sample output from this command.

```
# prtconf
AT&T 3B2 SYSTEM CONFIGURATION:

Memory size:  40 Megabytes
System Peripherals:


Device Name      Subdevices       Extended  Subdevices

SBD
                 Floppy disk
SCSI
 (S. E. BUS ID0)
                 SD01 IDl
                                  317 Megabyte Disk ID0
                                  317 Megabyte Disk ID1
                 SD01 ID2
                                  Tape ID0
                 SD01 ID4
                                  322 Megabyte Disk ID0
NAU
 SCSI
 (DIF.BUS ID0)
                 SH00 ID1
                                  Processor ID0
                 SD01 ID2
                                  322 Megabyte Disk ID0
                 ST00 ID5
                                  Tape ID0
```

Figure 8-25. Output from the prtconf command

This output shows that there are two SCSI buses installed on this 3B2. The first bus is
identified as S.E. BUS ID0, indicating that it is a single-ended bus and that the HA1 card
has an ID of 0. The second bus is identified as DIF. BUS ID0, indicating that it is a
differential bus and that the HA2 card also has an ID of 0. SH00 ID1 shows that another
host is connected to this bus and that its host adapter has an ID of 1.
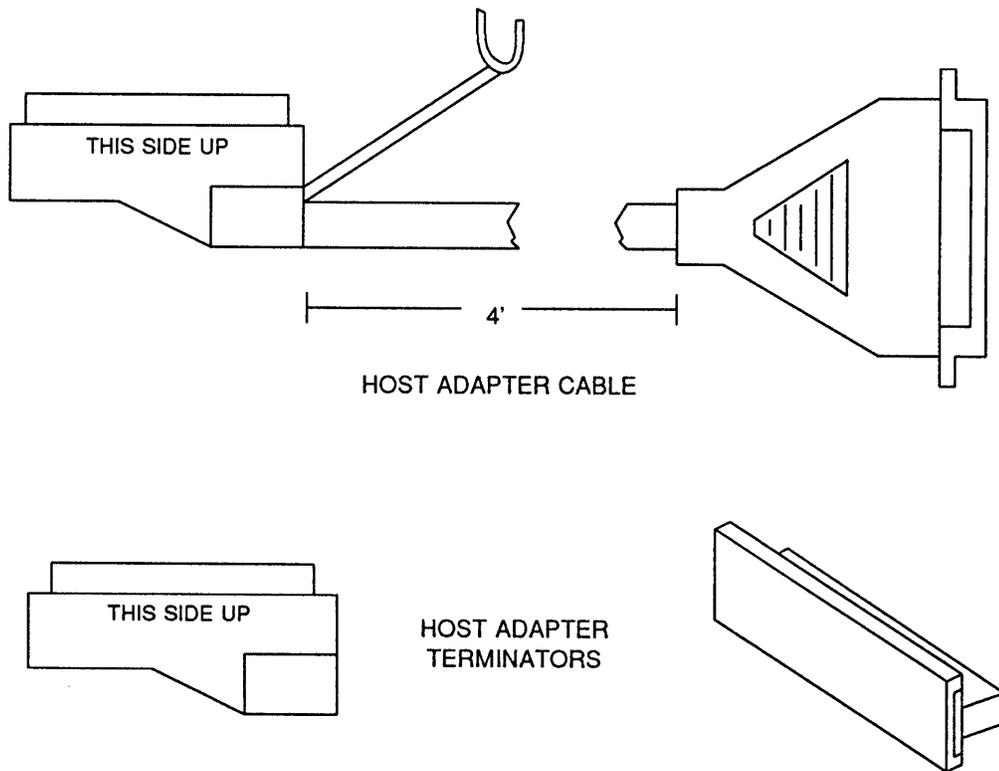
THIS SIDE UP

4'

HOST ADAPTER CABLE

THIS SIDE UP

HOST ADAPTER
TERMINATORS

Figure 8-26. HA SCSI bus cable and HA SCSI bus terminator
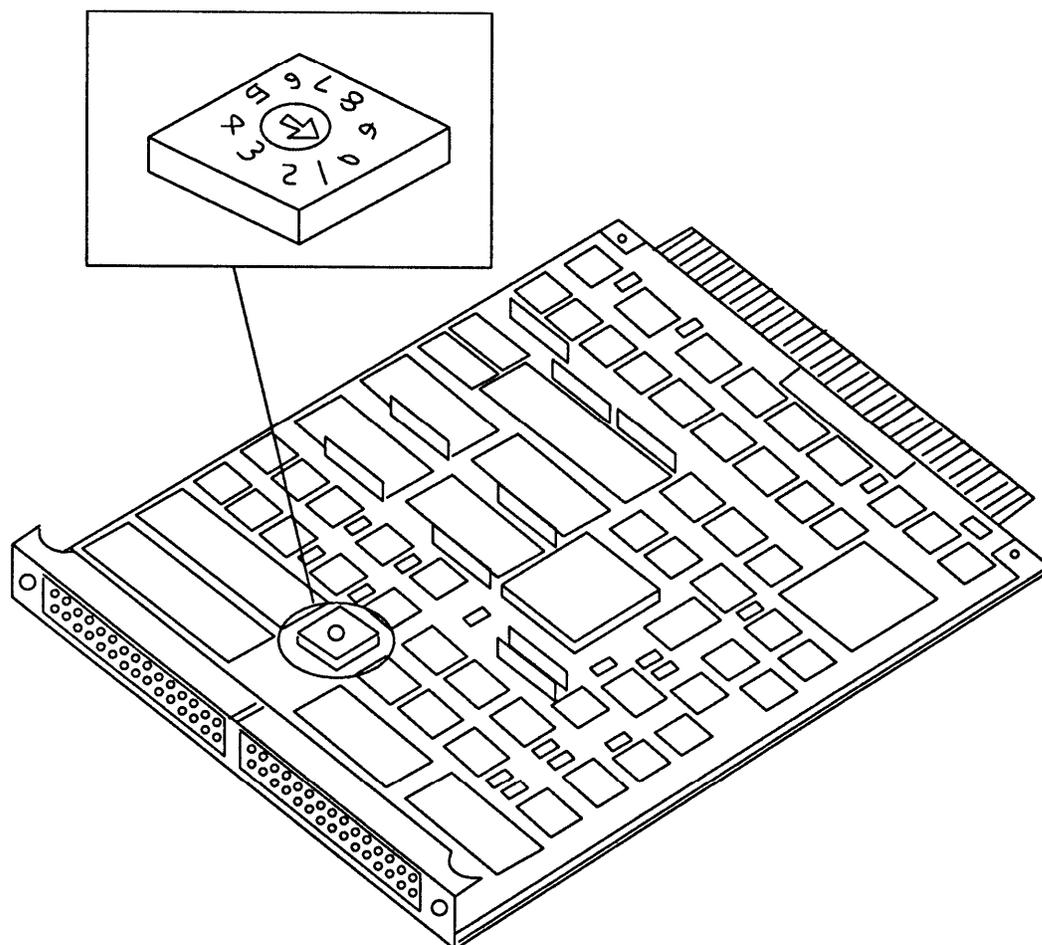
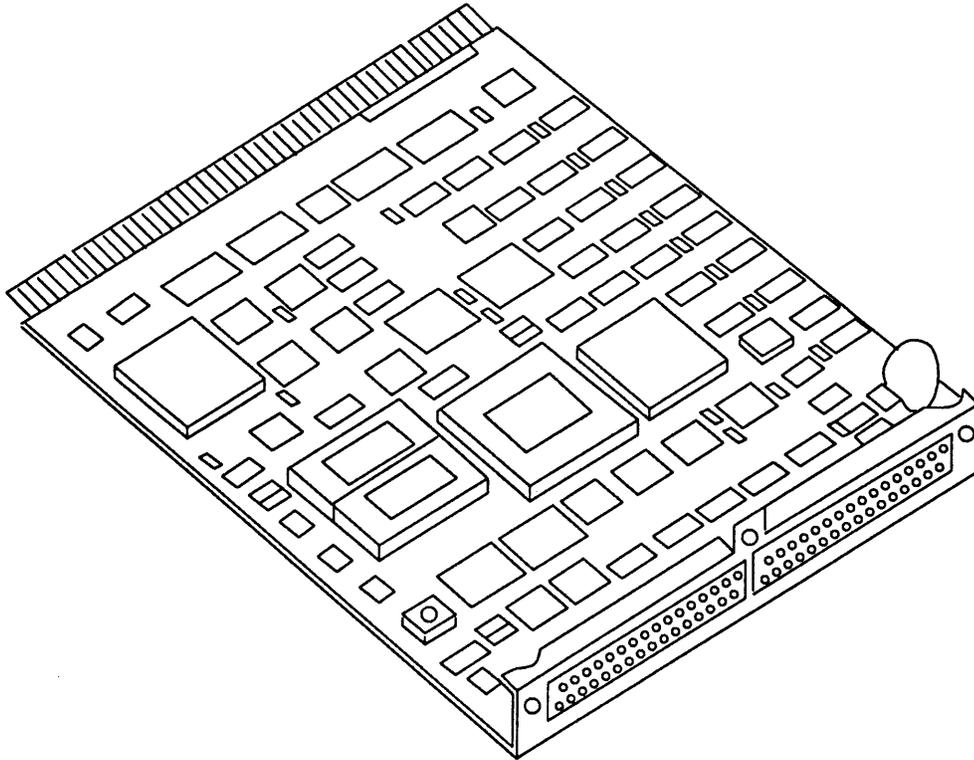**Figure 8-27.   SCSI host adapter card (HA1) CM195W and ID switch setting**

Figure 8-28. **Differential host adapter card (HA2) CM521A**

SCSI Device File Names

SCSI device files are located under the `/dev` directory. The following is an example of a device file for a SCSI hard disk:

> `/dev/dsk/c1t1d0s6`

> where: `dsk` refers to the type of device
> `c1` refers to the slot location of the host adapter
> `t1` refers to the target controller SCSI ID setting
> `d0` refers to the device logical unit number (LU ID)
> `s6` refers to the partition on the device

The following is an example of a device file for a SCSI cartridge tape drive:

> `dev/rmt/c?t*d0s0n`

> where: *?* refers to the slot number for the host adapter
> *** refers to the target controller SCSI ID
> *n* refers to no rewind (optional)

The following is an example of a device file for a SCSI 9-track tape drive:

> `/dev/mt/c?t*d0&n` or `/dev/rmt/c?t*d0&n`

> where: *?* refers to the slot number for the host adapter
> *** refers to the target controller SCSI ID
> *&* refers to m,h (tape density)
> *n* refers to no rewind (optional)

The device names used by the System Administration `(sysadm)` Utilities are a bit different (this will be obvious when you use `sysadm` utilities for SCSI devices). However, most messages reported to the console use the above format to define storage devices.

Diagn ostics

SCSI diagnostic phases 1-16 test only the circuitry on the host adapter card. Phases 17-24 actually test the devices on the bus. Phase 17 issues a bus reset and prints the bus configuration. This phase is the single most useful tool in debugging SCSI bus problems. If the configuration printed in phase 17 does not match the physical hardware layout, there is either a bus termination or cabling problem, an ID problem, a defective unit, or a defective host adapter card. Figure 8-29 is an example of a phase 17 printout from a 3B2/600 computer.

```
DGMON > dgn scsi ph 17

    <<< DIAGNOSTIC MODE >>>

Phase # 17
Test: SCSI Reset Test
Tests : 4                The : 60 seconds
Configuration:
 ID# 0   host adapter
 lD# 1 Disk Controller LU0 LU1
 ID# 2 Tape Controller LU0
 ID# 3 Disk Controller LU0 LU1 LU2
*** phase - ATP ***


     SCSI O (IN SLOT 1) DIAGNOSTICS PASSED

 DGMON>
```

Figure 8-29.   3B2/600 computer - phase 17 printout

In Figure 8-29, `ID# 1 Disk Controller LU0 LU1`, and `ID# 2 Tape Controller LU0` represent the internal peripherals, `ID# 3 Disk Controller LU0 LU1 LU2` represents the disks and controller contained in a XM/405S.

Datakit Card

The Datakit® feature card is actually comprised of two circuit cards, the CM195AC and the CM195AD. These feature allow a 3B2 computer to connect to a Datakit or ISN network through fiber optic cable. The CM195AD card, that supplies the fiber connections, is mounted on top of the CM195AC card. A ribbon cable assembly connects the two boards electrically. Early versions of the CM195AC contained two modular 8-pin jacks on the faceplate. Later versions (Artmaster 4 or later) do not contain these jacks (see Figure 8-30).

Since the CM195AD only draws power from the backplane slot, the slot between the two cards does not have to be filled. For instance, if the Datakit boards are installed in slots 4 and 6 of the I/O backplane, slot 5 does not have to be populated for the 3B2 to function normally (of course slots 1 through 3 must be populated).

Diagnostics for the Datakit feature may differ depending on the application software package installed. A diagnostic floppy diskette supplied with the cards contains diagnostic code only. These diagnostics will require a loop-around fiber cable to connect the transmit connector to the receive connector. Diagnostics supplied with the application software may require that the 3B2 be connected to the network. If any of the loop-around phases fail, try both of these connections before deciding that the cards are defective.

The diagnostics for this feature are run by using `dkit` as the device name in `dgmon`. For instance, `dgn dkit ph=*` will run all the phases of the Datakit diagnostics.
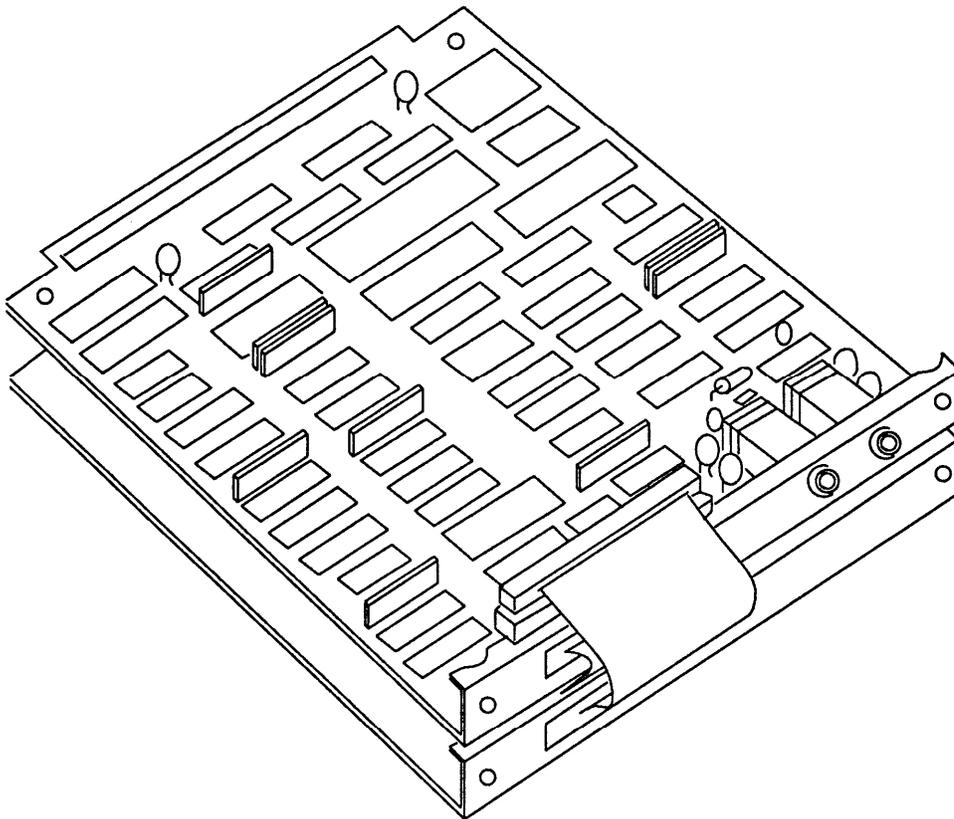

Figure 8-30.   Datakit cards (DKIT) CM195AC and CM195AD

Chapter 9: Preventive Maintenance

Introduction

In general, no preventive maintenance is required for a 3B2 computer system. The tape drives and the air filter in Models 600, 700, and 1000 are the exception. Tape drives and air filters require periodic cleaning for proper operation. These procedures are easily done and may be performed by the system administrator.

Air Filter Maintenance (600/700/1000)

On 3B2 models with a front door, an air filter is housed in the door assembly. This air filter should be inspected every 60 days. When the air filter becomes dirty, wash it in water with a mild dishwashing detergent. Rinse in cool water and allow to dry before reinstalling it.

Replacement filters can be ordered by comcode 845755610.

Cartridge Tape Maintenance

This section details the preventive maintenance procedure for 1/4" cartridge tape drives used with 3B2 computers. This includes both the 23 MB tape drive used with the cartridge tape controller (CTC), and the tape drives used with the SCSI bus.

23 MB Tape Drives (Non-SCSI)

The cartridge tape drive (23 MB) requires cleaning after 20 hours of use. The cartridge tape subsystem automatically tells the user when 20 hours has elapsed since the last cleaning.

> ⚠ **CAUTION**
> If the system administrator has not changed the permissions on the `sysadm resetusage` command, it is possible for anyone with login permission to reset the drive usage to 0 hours. While it is not probable that a normal user will have done this, the repair technician should be aware of this possibility.

When at a customer site (even for an unrelated problem), the repair technician should check the drive usage if there is a cartridge tape drive on the system. If it is close to the time to clean the drive, clean it. Check the drive usage as follows, either as `root` or with `sysadm` permissions.

1. Enter the command `sysadm info.`

> The system will return the information in Figure 9-1.

```
Running sucommand 'info' from menu 'tapemgmt.'
TAPE MANAGEMENT

Available information:

    v - vtoc (volume table of contents)
    d - device type
    . -    ...
    . -    ...
    u - tape drive usage
    . -    ...
    . -    ...
    . -    ...

Enter the letter(s) corresponding to the kind(s) of
information you wish displayed.  If more than one
letter is given, use blank spaces to separate them.
Enter q to quit:
```

Figure 9-l.   sysadm info response

2. Enter **u** for tape drive usage.

> The system will return the message in Figure 9-2.

```
Tape Drive Usage:
        10 hours 15 minutes since last cleaning
        9 hours 44 minutes until next cleaning

Enter <REETURN> to return to info menu, q to quit:
```

Figure 9-2.   Tape drive usage response

3. Enter **q** to quit.

NOTE: The previous hours will total close to but not necessarily exactly 20 hours, as in Figure 9-2.

Cleaning the Tape Drive

The following items are necessary for cleaning the tape drive:

■ a lint-free cleaning swab that will not scratch the tape head or leave residue or fibers behind; standard cotton swabs will not do

■ Freon degreaser (type TF)

The steps for cleaning the tape drive are as follow:

1. If power is on, power down the system. Use the sysadm powerdown or shutdown commands, or the ON-OFF switch. With a TM, powerdown the system, then shut off the TM power switch.

2. Locate the capstan roller and head assembly.

3. Moisten the swab with the Freon cleaner.

⚠ CAUTION
Do not use a dirty swab. If the swab gets dirty while cleaning, it should be discarded and replaced with a new one before finishing.

4. Carefully clean the head assembly with the moistened swab.

5. Use the swab to rotate and clean the capstan roller.

6. Clean the tape pathway of any debris.

7. Power up the system.

8. Reset the drive usage count as follows:

❑ As root or with sysadm permissions, enter the command **sysadm resetusage.**

❑ The system will return the message in Figure 9-3.

```
Ruining command 'resetusage' from menu 'tapemgmt',
TAPE MANAGEMENT

Tape Drive Usage:
    0 hours 0 minutes since last cleaning
    20 hours 0 minutes until next cleaning
```

Figure 9–3.   sysadm resetusage response

The tape drive is now clean and the usage counter reset. Maintenance will not be necessary for another 20 hours of drive usage.

SCSI Cartridge Tape Maintenance

The following is a list of suggested preventive maintenance activities that apply to the SCSI cartridge tape drive and associated tapes. Figure 9–4 shows the SCSI cartridge tape.
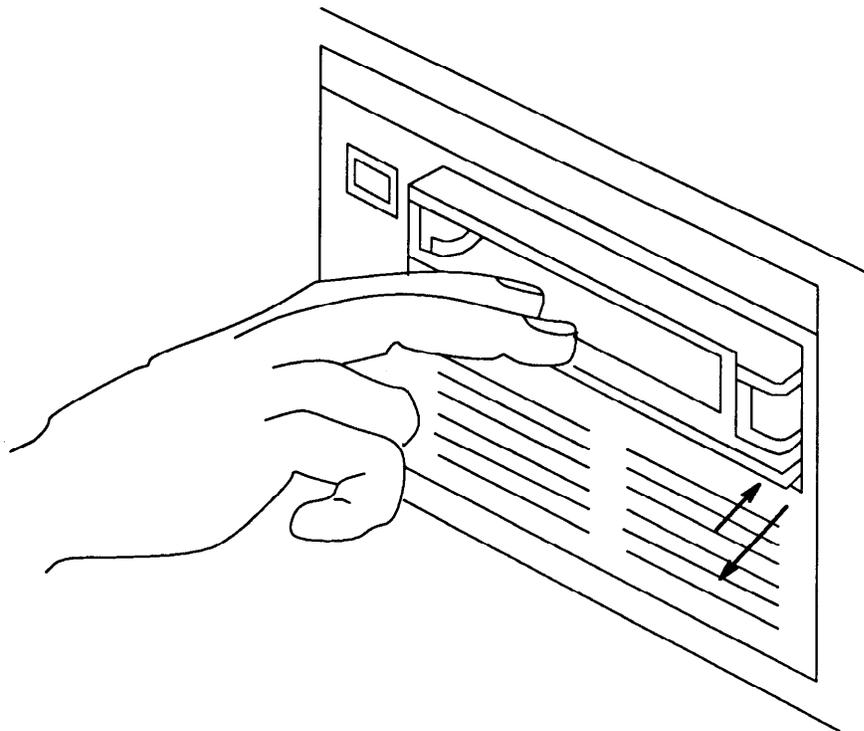

Figure 9–4.   SCSI cartridge tape

Tape Drive Care

- Keep the front cover, if applicable, always closed except when inserting or removing tapes.

- Clean the outside of the unit with mild soap and water.

- Ensure that the tape drive receives adequate air-flow for cooling.

- Clean the tape head and tape cleaner once every two hours if using new tapes, every 24 hours thereafter. Use the cleaning procedure in this section.

  NOTE: The tape head may need cleaning more frequently if new tapes are being used.

- Inspect the tape head for any buildup or wear that could cause tape damage.

  NOTE: Demagnetizing of the tape head and associated tape path is not required on this unit.

Cartridge Tape Care

To care for the SCSI cartridge tape, the following maintenance activities are suggested:

- Store the cartridge tape in its container when it's not being used.

- Keep cartridge tapes clean.

- Keep written tapes away from strong magnetic fields, such as large motors or microwave ovens.

Cleaning the Tape Head

Periodic cleaning of the head assembly is the only preventive maintenance required on the SCSI cartridge tape drive. The head needs to be cleaned after every 24 hours of tape operation. However, you may need to clean the head more often if the read/write errors increase abnormally fast, or if the number of errors varies greatly from pass to pass. When a new tape is used, the head should be cleaned after the first two hours of use.

Establishing a Cleaning Schedule

Since the SCSI cartridge tape drive will be used primarily as a backup device, the cleaning schedule should be based on the amount of time the tape module is used during backup and how often backup is performed.

For example, assume a 3B2 computer has six file systems. Each file system takes about 15 minutes to backup each time and backup is performed twice a week. This means the SCSI tape module would be used three hours each week. The head should be cleaned every eight weeks.

If a new tape is used for each file system in the above example, then the head should be cleaned in the first week and every eight weeks thereafter.

Cleaning Procedure

The following materials are required to clean the head assembly:

- lintless cotton swab

- Freon TF tape cleaner

⚠ WARNING

Clean only the tape head and tape cleaner blades with the Freon cleaner. NEVER clean the capstan with the head cleaning solution. Severe damage may result.

NOTE: If the proper cleaner is not available, isopropyl alcohol may be used, but it is not recommended.

To clean the tape drive, follow these steps and refer to Figure 9-5:

1. If a cartridge tape is in the tape drive, remove the cartridge.

2. Turn off the 3B2 computer.

3. Push the carriage plate forward until the tape load latch triggers.

4. Locate the head assembly (see Figure 9-5).

5. Slightly moisten a swab with the cleaning solution and rub the swab up and down across the surface of the head.

6. Rub the swab along the white nylon tape blade on both sides of the head.

7. If the capstan roller needs cleaning, use a clean cotton swab. Moisten the swab with water only.

8. Wait about ten seconds for the wet surface to dry.

9. Push the carriage plate in until it stops and the latch is released.

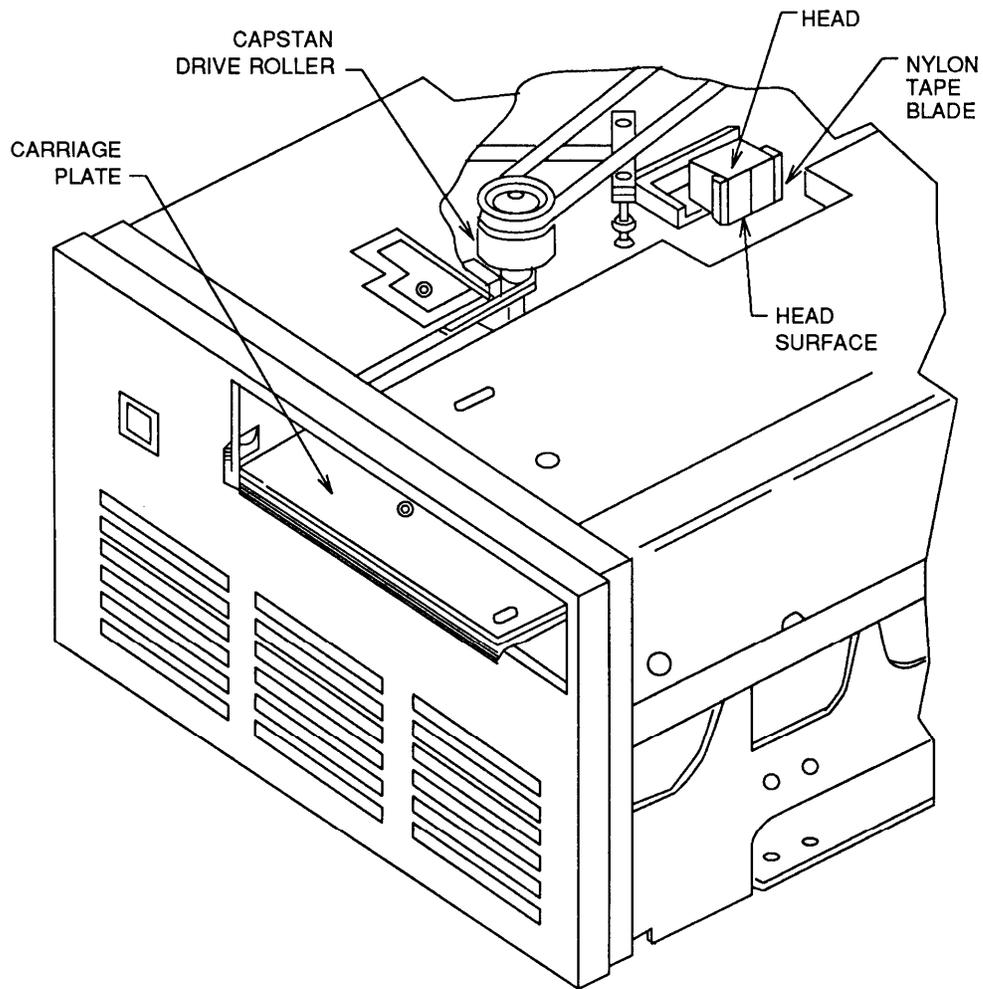**10.** Turn the 3B2 computer back on.

Figure 9-5. Wangtek SCSI cartridge tape drive

9-Track Tape Drive Maintenance

The 9-track tape drives used with the 3B2 computer requires only periodic cleaning for proper operation. The following sections describe the correct cleaning procedure for the two basic styles of tape drives used on the 3B2 computer.

Desktop Autoloading, Dual Density 9-Track Tape Drive

Only liquid Freon TF (trichlorotrifluoroethane) is recommended as a cleaning agent for this tape drive. Non-abrasive, lint-free swabs should be used to clean the following components (see Figure 9-6).
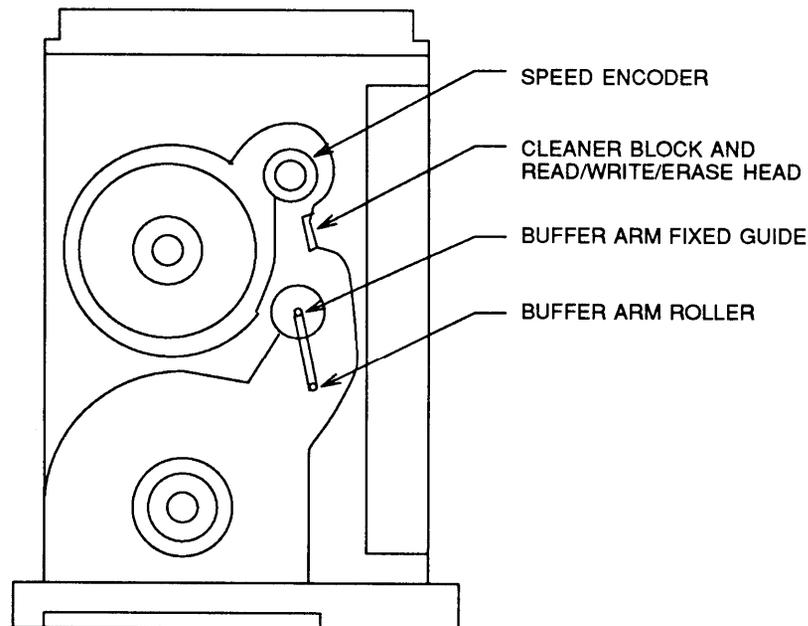

Figure 9–6.   Tape drive cleaning components

More detailed cleaning procedures as well as a cleaning schedule are found in the *HP 88780A Tape Drive Service Manual* (305-681) or the *Customer Engineer Handbook* (305-694).

Keystone II (KS22762) and Keystone III (KS23113) Preventive Maintenance

This section covers information on the preventive maintenance required to keep the 9-track tape drives operating properly. Included are the following:

■ maintenance schedule

■ maintenance procedures

Maintenance Schedule

Table 9-1 provides a preventive maintenance schedule for the Keystone II and Keystone III tape drives.

Table 9–1. Maintenance Schedule for Keystone Tape Drives

Procedure	Schedule
Clean magnetic tape head, tape cleaner, air bearing, and guides.	Every 8 hours of operation.
Clean tape path hub and take-up reel.	Every 3 months.

Maintenance Procedures

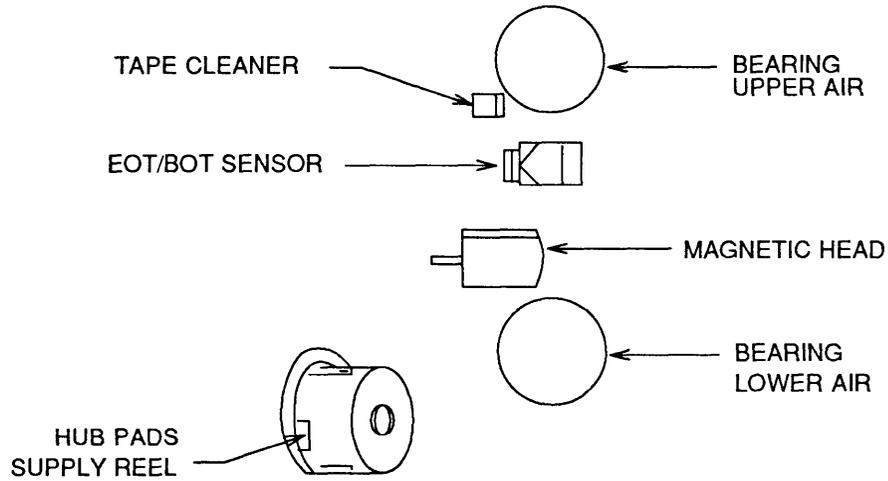Refer to Table 9-2 for the procedure on cleaning the tape drive, and Figure 9-7 for component cleaning locations.

Figure 9–7.   Component cleaning locations

⚠ **CAUTION**

Do not use cleaning solvent in a confined or poorly ventilated area. Avoid prolonged breathing of vapor and contact with skin or clothing. Use disposable gloves to avoid prolonged contact with skin. Adhere to any other precautions on the container of the cleaning solvent.

Table 9–2. Tape Drive Cleaning Procedure

Step	Action
1	Power the tape unit off.
2	Remove the 2-part head assembly dust cover.
3	Clean magnetic head recording surface with soft, lint-free cloth moistened with tape unit cleaner. Wipe recording surface in same direction that tape moves across the head.
4	Clean EOT/BOT assembly using soft, lint-free cloth moistened with tape unit cleaner. Remove dirt or oxide from sensor surfaces, reflective strip and tape cleaner blades.
5	Clean tape cleaner using a lint-free swab moistened with tape unit cleaner. Remove dirt or oxide from tape cleaner blades.
6	Clean both air bearings with a soft, lint-free cloth moistened with tape unit cleaner. Do not soak cloth with cleaner. Ensure foil area, guide springs and both tape guides are cleared of any dirt or oxide buildup.
7	Clean both parts of head assembly dust cover. Do not allow dust or dirt to accumulate on the inside cover.
8	Clean the 3 hub pads with a cloth moistened with tape unit cleaner. Do not soak cloth with cleaner.

Appendix A: Handling Circuit Boards

Introduction

Although AT&T circuit boards are well constructed and durable, they require care in handling to avoid damage. Circuit boards for the 3B2 computer include the system board, memory boards, and feature or option cards. Memory boards mount to the system board. Feature cards mount to the I/O backplane, which mounts to the system board. This appendix provides the following guidelines and cautions for handling circuit boards:

- static electricity cautions

- storage and packing guidelines

- general handling instructions

Static Electricity Cautions

Circuit boards must be handled carefully to prevent damage from electrostatic discharges. Most circuit board IC (integrated circuit) damage can be attributed to a discharge of static electricity. Static charges can come from an ungrounded person, common plastics, or improper packaging. To avoid static electricity damage to circuit boards, be sure you

- ARE GROUNDED.

    When working on circuit boards, wear grounded wrist straps. If you are not wearing wrist straps, always touch grounded (exposed) metal before handling a circuit board. If you move around, you must touch metal again to ensure that you are not going to discharge your static through the circuit board.

- NEVER PASS A CIRCUIT BOARD TO AN UNGROUNDED PERSON.

- KEEP WORK AREA CLEAR OF PLASTICS.

    Common plastics are a major source of static electricity. To protect the circuit boards keep such things as Styrofoam packing containers, clear plastic bags, plastic drinking cups, food wrappers, and notebooks away from your work area.

- PACKAGE CIRCUIT BOARDS PROPERLY.

    Keep circuit boards in their sealed shipping package until you are ready to install them. When you remove a circuit board, replace it in its original packaging or in an antistatic bag.

When you are working on circuit boards, use an antistatic work surface with ground and wrist straps. If you are soldering both the soldering iron and the work surface must be grounded.

It is difficult to identify electrostatic discharge damage. Once exposed to a charge, a circuit board may be unaffected, may wear out faster, may function erratically, or may not function at all.

Storage and Packing Guidelines

Circuit boards are shipped from the factory in containers specially designed to prevent static buildup. Do not break the seal on this packing until you are ready to use the circuit board. When you are returning a circuit board, even a defective one, place it in the original shipping material. If the packing material is not available, use an antistatic shipping bag.

General Handling Guidelines

Circuit boards can also be damaged by mistreatment, dropping, dust, and dirt. Avoid any unnecessary removal or handling of circuit boards, and work in a dust and smoke-free environment. If a circuit board is dropped, visually inspect and test it to make certain it works properly before installing it.

When installing or replacing circuit boards, follow these steps:

- **TURN OFF THE POWER.**

  Power should be out unless otherwise specified by the test requirements.

- **DO NOT TOUCH COMPONENTS.**

  Handle circuit boards by the faceplate and by the sides, except the side with the edge card connector.

- **REMOVE CAREFULLY.**

  To avoid damaging the connector pins, pull the circuit board straight out. (The 3B2/400 comes with a removal tool to facilitate removal of circuit boards. See Figure A-1.)

- **INSPECT FIRST.**

  To prevent backplane pin damage, inspect the connectors and associated backplane slot for damage or foreign matter before installing the circuit board. Do not attempt to install a circuit board if the connector pins are bent or the backplane slots are blocked.

- **INSERT CAREFULLY.**

  Verify that the circuit board is aligned with the guide in the backplane. Then insert, using both hands to apply equal pressure at both sides of the circuit board.

- **DO NOT FORCE.**

  If unusual resistance is felt, stop, and determine the cause before inserting the circuit board.
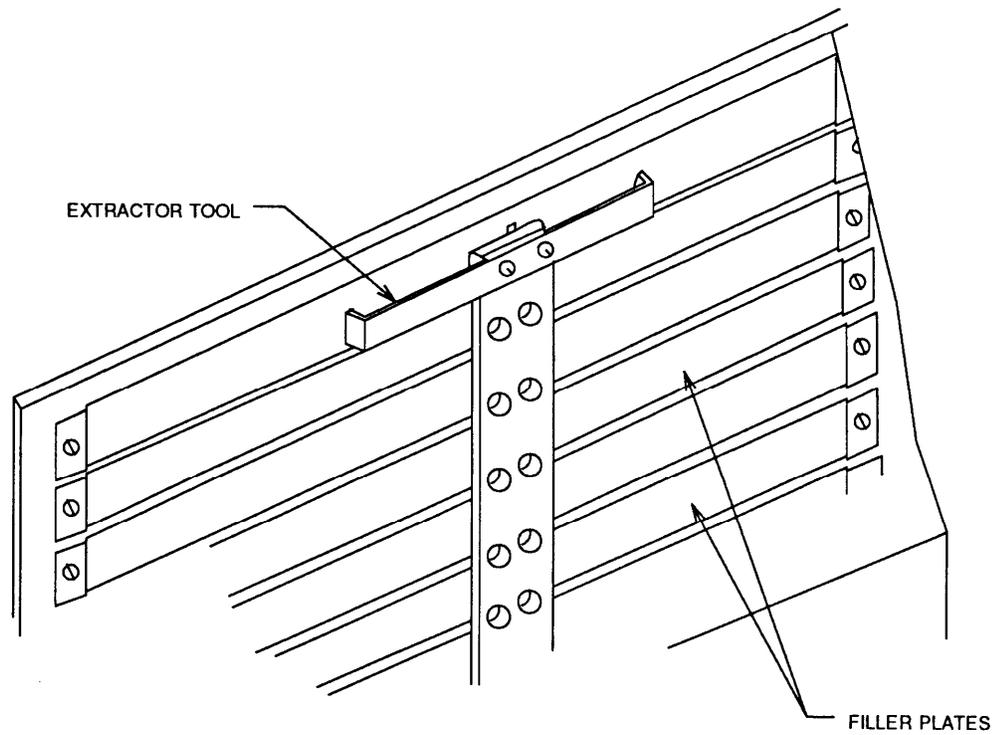
EXTRACTOR TOOL

FILLER PLATES

Figure A–1. **3B2/400 feature card removal tool**

Appendix B: Using the Diagnostic Monitor

Introduction

The set of diagnostics available from the 3B computer hard disk diagnose the system board, the attached disks, and the peripheral cards inserted into the backplane. Since this document deals only with repair at the subassembly level, failure of any of the system board diagnostics, except for the floppy and hard disk (and possibly NVRAM) phases, indicate that the system board must be replaced. Failure of the floppy and hard disk diagnostics could result from problems in the drives themselves. NVRAM failures could be caused by a defective battery. Failure of any phases relating to a peripheral card requires replacement of that card to fix the problem.

It is possible that a defective I/O backplane could cause peripheral card or system board failures; however, the backplane has a long mean time between failure (MTBF).

NOTE: Although diagnostics should detect at least 80 percent of system faults, diagnostic results are valid only if the diagnostic code is not corrupted. If a machine exhibits problems, the results cannot be guaranteed using the diagnostics resident on the hard disk. Use of a known good bootable diagnostics diskette, such as the *3B2 Maintenance Utilities,* is recommended to ensure valid diagnostic results.

Entering the Diagnostic Monitor

To enter the diagnostic monitor control program from multi-user mode, follow these procedures:

1. Use the `sysadm firmware` command to put the system in firmware mode (the command `shutdown -y -i5 -g0` can also be used). The system will respond with the FIRMWARE MODE prompt.

2. At the FIRMWARE MODE prompt, enter the firmware password to access the diagnostic monitor. The default password is **mcp.** The system will respond:

   ```
   Enter name of program to execute [ ] :
   ```

3. Type in **edt.** The system will report the equipped device table (EDT). Verify this with the actual configuration. If a device is missing, run the **filledt** command and check again. The system will then respond:

   ```
   Enter name of program to execute [ ] :
   ```

4. Type in **dgmon.** The system will respond as shown in Figure B-1.

```
Possible load devices are:

Option Number    Slot  Name

       0           0     FD5
       1           0     HD72
       2           0     HD72
       3           2     SCSI
       4           3     SCSI


Enter Load Device Option Number [1 (HD72)] : 1
```

Figure B–1.   **dgmon response**

5. Enter **1** to select the default hard drive.

6. The 3B2 computer will load the diagnostic monitor program and return the `DGMON >` prompt.

Diagnostic Monitor Commands

To obtain a list of the available 3B2 computer diagnostic commands, enter **h** (the help command) after the diagnostic monitor prompt:

>   DGMON > **h**

A complete menu of the commands, options, and descriptions is shown in Table B-1.

Table B–1.   3B2 Computer Diagnostic Commands, Options, and Descriptions

3B2 Computer Diagnostic Commands	Options	Description
DGN UCL I SOAK]]	[DEVICE [DEVICE # I REP=? I PH=?-? I	DIAGNOSE DEVICES
H(ELP)	(NONE)	PRINT HELP MENU
L(IST)	DEVICE	LIST DEVICE PHASE TABLE
Q(UIT)	(NONE)	EXIT DGMON
S(HOW)	(NONE)	SHOW EDT

The dgn command is used to request diagnostics. The h command is used to obtain the help menu shown above. The l (list) command prints diagnostic phase tables for the circuit boards loaded in the 3B2 computer. For example, to print a diagnostic phase table for the ports board, enter:

>   DGMON > **l$ports**

The response to this request is the phase table for the ports board, an example of which is shown in Table B-2.

Table B–2.   Sample Diagnostic Phase Table

Phase #	Phase Type	Phase Description
1	NORMAL	Phase 1 - CIO & Peripheral Sanity
2	DEMAND	Phase 2 - PCSR Read/Write
3	DEMAND	Phase 3 - Upper RAM Verification
4	DEMAND	Phase 4 - Lower RAM Verification
5	DEMAND	Phase 5 - ROM Checksum
6	DEMAND	Phase 6 - Upper Chip Select Registers
7	DEMAND	Phase 7 - DMA Control Registers
8	DEMAND	Phase 8 - CPU Writable Registers
9	DEMAND	Phase 9 - Interrupt Control Registers
10	DEMAND	Phase 10 - Lower Chip Select Register
11	DEMAND	Phase 11 - PIO Byte Transfers
12	DEMAND	Phase 12 - PIO Word Transfers
13	DEMAND	Phase 13 - DMA Byte Transfer
14	DEMAND	Phase 14 - DMA Word Transfer
15	INTERACTIVE	Phase 15 - Printer Data Register
16	INTERACTIVE	Phase 16 - Printer CSR Register
17	DEMAND	Phase 17 - Duart 0 Internal Loop
18	DEMAND	Phase 18 - Duart 1 Internal Loop
19	INTERACTIVE	Phase 19 - Duart 0 External Loop
20	INTERACTIVE	Phase 20 - Duart 1 External Loop
21	NORMAL	Phase 21 - Duart 0 Loop Sanity
22	NORMAL	Phase 22 - Duart 1 Loop Sanity

Similar phase tables are kept for each circuit board and are readable from the 1 command.
Simply enter 1 and the name of the board, which can be obtained by using the show(s)
command.

The s command prints on the console a copy of the EDT. The EDT is created whenever the
3B2 computer is powered up or reset. The EDT lists the current configuration of the 3B2
computer, including complete specifications about the type of device loaded in each 3B2
computer I/O slot. To see the current equipped device table, enter **s** after the diagnostic
monitor prompt:

```
DGMON > s
```

Figure B–2 shows sample output.

```
Current System Configuration

System Board memory size: 1 megabyte(s)

00 - device name = SBD       , occurrence = 0, slot = 00, ID code = 0x01
     boot device = y, board width = double, word width = 2 byte(s),
     req Q size = 0x00, comp Q size = 0x00, console ability = y, pump file = n
     subdevice(s)
     #00 = FD 5       , ID code = 0x01, #01 = HD30       , ID code = 0x03

Press any key to continue

01 - device name = NI        , occurrence = 0, slot = 01, ID code = 0x200
     boot device = n, board width = single, word width = 2 byte(s),
     req Q size = 0x0a, comp Q size = 0x19, console ability = n

Press any key to continue
```

Figure B–2.   show output

Similar configuration lists print for each device loaded in your 3B2 computer. If the system
board cannot identify a device, it lists that device as *VOID* in the EDT. As indicated in
Figure B-4, entering any keyboard character causes the EDT list to continue printing on the
console. The EDT is also accessible while in the firmware mode through the edt command.
Simply enter **edt** as the name of the program to execute. See Chapter 8, ''Feature Cards,' for
more information on the edt command.

The q (quit) command is used to exit from the diagnostics monitor program.

The dgn command is used to run diagnostics. It has the following format.

> dgn *[device[device#* | rep= *?* | ph= *?-?* | us1 | soak *]]*

The following explains the options:

device	Specifies the abbreviated name of the circuit board on which you want the diagnostics to run.
deuice$#	Gives you the option of running diagnostic phases on a certain device.
rep= *?*	Specifies the number of times you want the phase(s) to run.
ph= *?-?*	Gives you the option of running a specific phase or a string of phases.
ucl	Gives you the option of running the phases in the unconditional ucl mode.
soak	Gives you the option of running the diagnostic phases continuously, and storing a record of the failures until testing is completed.

Requesting System Board Diagnostics

In response to the `DGMON >` prompt, request the complete set of SBD diagnostic phases (normal and demand) as outlined below. (A formatted floppy diskette is required for the floppy disk diagnostics.)

1. Issue the `dgn sbd ph=*` command.

   NOTE: Release-specific exceptions might require a change in the way diagnostics are called. See Product Updates or Release Notes, if applicable.

2. Follow any special instructions printed with the Interactive phases. The system responds with a series of diagnostic reports as the phases are run. If no failures occur, the final message will include the message `SBD 0 DIAGNOSTICS PASSED`. If there is a problem in the hardware, the diagnostic monitor will return a message `SBD 0 DIAGNOSTICS FAILED` and cease execution at the failing phase. Repeat the phase. Note the specific diagnostic that was being run at the time that the failure occurred. Each phase runs several different tests.

   The diagnostic phases report a series of numbers as the diagnostics are executing. These numbers are the test numbers of the individual tests run within each phase. The last test number printed before the failure message identifies the test that was executing at the time of failure. For a complete listing of all diagnostic phases and tests, see the *AT&T 3B2 Computer Off-Line Diagnostics Manual.*

3. Some system board diagnostics test the hard and floppy disk drives, as well as their system board interface components. When executing the floppy diagnostic, a pre-formatted diskette that is not write-protected must be used. The hard disk diagnostic phases of the 3B2 computer require the drive to have the correct software written on it, and all interface connectors to be in place. For more information about system board diagnostics, refer to the *AT&T 3B2 Computer Off-Line Diagnostics Manual.*

   NOTE: On some earlier releases of the UNIX system, system board diagnostic phase #20 failed if the system was equipped with a 72 MB hard disk drive. This has been fixed in UNIX System V Release 2.0 Version 2 and later releases.

   Also, if the system board is a CM190A, the 72 MB hard disk will not operate unless the system board is an artmaster 5 series 27 (or higher) or any artmaster 6. AM5 Ser. XX or AM6 Ser. XX is printed on the system board on the edge near the memory board connectors.

4. To exit the diagnostic monitor, enter `q` in response to the `DGMON >` prompt.

For additional information on how to use the diagnostic monitor, see the *AT&T 3B2 Computer Owner/Operator Manual* or the *AT&T 3B2 Computer Off-Line Diagnostics Manual.*

Feature Card Diagnostics

Feature card and peripheral diagnostics are requested in the same way as system board diagnostics. Use the s command to print a list of all diagnosable devices. Appropriate device names for the various feature cards are displayed, and should be used in the diagnostics command line. For example, if a ports card were equipped in the system, the device table would indicate `ports #,` where # is the number of the ports card inserted (beginning with 0). Diagnostic requests should begin with `dgn` followed by the device name, device number, phase number, and any options.

For systems with the CM519A backplane, the BuBus slots are numbered from 0 to 3, starting from the bottom and going up. For systems with the CM519B backplane, the BuBus slots are numbered from 0 to 2 also starting from the bottom. The PBus slots are on the same side starting from the slot just below the system board and are numbered 0 to 2 and go down.

Diagnostic Error Messages

Below is a list of the most common error message numbers that maybe returned from the diagnostic monitor:

- 1-00, file system is inaccessible.

  This error indicates that a possible problem exists in the diagnostic cylinder of the hard disk. If reproducible, restore software, reformat the disk, or (as a last resort) replace the disk drive unit.

- 1-01, error occurred during system configuration.

  This error is produced while polling of the I/O backplane slots occurs during system initialization. If a fault other than an I/O timeout has occurred, this message will be displayed. Check the EDT for nonsensical entries using the s command from the DGMON > prompt, or by entering **edt** when prompted to ENTER NAME OF PROGRAM TO EXECUTE. If this error occurs on a second attempt at booting, exchange a good board for the one having the garbled entry in the EDT. If this action is unsuccessful, suspect the I/O backplane or the system board.

- 1-02, 1-03, 1-06++, probable typographical errors.

  You can clear the majority of these diagnostic monitor errors. To do so, reenter the diagnostic request command string.

- 1-04, 1-05, should be treated as FIRMWARE ERROR counterpart.

Table B-3 is a complete table of all diagnostic error messages for the Models 300, 310, and 400.

Table B–3. Diagnostic Control Program Error Messages

Number	Message	Action
1-00	File system is inaccessible	Retry the request. If it fails again, there is a possible problem with the protected disk cylinder where diagnostics reside. (See the the above list.)
1-01	Error occurred during system configuration	Check the EDT table. The device entry is incorrect. See the 3B2 computer Basic Firmware Utilities.
1-02	Cannot find diagnostic file: 'filename'	See the above list.
1-03	Cannot load diagnostic file: 'filename'	See the above list.
1-04	Unexpected diagnostic exception	See the above list.
1-05	Unexpected diagnostic interrupt	See the above list.
1-06	Non-existent unit; equipped unit types are:	Retry the request.
1-07	Invalid unit number; equipped unit types are:	Retry the request.
1-08	Unrecognizable diagnostic request	Check the request syntax and re-enter.
1-09	Invalid repeat value	Re-enter the request using a value between 1 and 6536.
1-10	Invalid phase(s) requested	Check the requested phase table and retry.
1-11	Redundant diagnostic request option	Re-enter the request.

Appendix C: Using 3B2 Computer Maintenance Utilities

Introduction

The 3B2 computer Maintenance Utilities floppy diskette (included with this manual) contains programs that are useful for troubleshooting a 3B2 that is unable to boot from a hard disk. These programs are `filledt`, `dgmon`, and `idtools`. A short description of each program follows. For more details, refer to the subsequent sections.

`filledt`   Similar to the `filledt` command that is installed on hard disk by the Essential Utilities. Only hardware components essential to the boot process will be recognized. Therefore, most feature cards such as `Eports` will show as VOID in the edt after executing this command.

`dgmon`   The same as the dgmon command that is installed on hard disk by the Essential Utilities. As with `filledt`, `dgmon` will only recognize critical components such as the system board and SCSI host adapter.

`idtools`   Formerly known as `devtools`. `idtools` provides several tools for maintenance procedures on 3B2 Models 300/310/400 integral hard disks (ST-506 interface). These tools will not work with SCSI disks or with ST-506 disks connected to an expansion disk controller (XDC) feature card.

This appendix provides instructions for the use of these utilities. For detailed instructions on the use of the diagnostic monitor (dgmon) refer to Appendix B, "Using the Diagnostic Monitor."

NOTE: If the 3B2 computer Maintenance Utilities floppy diskette is not available, a bootable diagnostic diskette can be created by following the procedures in Figure C-1. This example is for a machine running UNIX System V Release 2.0.4. Note that `idtools` will not be available.

```
# fmtflop -v /dev/rdsk/c0d0s6<CR>
# newboot /lib/olboot /lib/mboot /dev/rdsk/c0d0s7<CR>
newboot: confirm request to write boot programs to /dev/rdsk/c0a0s7:y<CR>
# mkfs /dev/dsk/c0d0s5 1404 1 18<CR>
Mkfs:  /dev/dsk/c0d0s5?
 (DEL if wrong)
bytes per logical block = 1024
total logical blocks = 702
total inodes = 160
gap (physical blocks) = 1
cylinder size (physical blocks) = 18
mkfs: Available blocks = 689
# labelit /dev/rdsk/c0d0s5 dgn 2042<CR>
Current fsname:  , Current volname: , Blocks: 1404, Inodes: 160
FS Units: lKb, Date last mounted: Thu Mar 28 14:19:08 1985
NEW fsname = dgn, NEW volname = 2042 -- DEL if wrong!!
# mount /dev/dsk/c0d0s5 /mnt<CR>
mount: warning! <dgn> mounted as </mnt>
# find /dgmon /dgn /filledt -print |cpio -pdumv /mnt<CR>
/mnt/dgmon
/mnt/dgn/edt_data
/mnt/dgn/SBD
/mnt/dgn/X.SBD
/mnt/dgn/PORTS
/mnt/dgn/X.PORTS
/mnt/dgn/CTC
/mnt/dgn/X.CTC
/mnt/filledt
442 blocks
# umount /dev/dsk/c0d0s5<CR>
```

Figure C–1.   Creating a Diagnostics Floppy Diskette

3B2 Computer Maintenance Utilities Usage

The diskette must be in FIRMWARE MODE to boot any of the programs on the 3B2 computer Maintenance Utilities. The following steps explain how to access FIRMWARE MODE. When the 3B2 computer is in multiuser mode, execute the following procedures:

1. Login as `root`.

2. `cd /.`

3. `shutdown -y -i5 -g0.`

   This brings the machine down to FIRMWARE MODE.

4. Insert the 3B2 computer Maintenance Utilities floppy into the floppy disk drive.

5. The system will respond:

   ```
   SELF-CHECK

   FIRMWARE  MODE
   ```

6. Enter the firmware password. The default password is **mcp.** It is possible that this password may have been changed. If mcp does not work, contact the system administrator for the correct password.

7. The system will respond:

   ```
   Enter name of program to execute [ ]:
   ```

8. Enter **idtools, dgmon,** or **filledt.**

9. The system will respond as shown in Figure C–2.

```
Possible load devices are:

Option Number Slot Name
───────────────────
      0          0      FD5
      1          0      HDX

Enter Load Device Option Number [1 (HDX)]:
```

Figure C–2.   Program to execute response

10. In Figure C-2, x will be replaced with the ID number of the integral hard disk. In a Version 3 model, option 1 is "SCSI." Enter 0, specifying the floppy disk drive as the boot device.

11. The system will then boot the selected program. Both **dgmon** and `filledt` function the same here as they do when booted from the hard disk, but on a limited scale.

Fill Equipped Device Table (filledt)

The `filledt` command is provided on the 3B2 Maintenance Utilities diskette for instances when it cannot be executed from the hard disk. When this occurs, it will be necessary to execute `filledt` from floppy disk before further diagnostic actions (such as running `dgmon`) can be performed.

When `filledt` is executed, it looks at the devices ID codes in the edt (built in main memory during system initialization) and looks for a match in the file `/dgn/edt_data` on the floppy disk. If the ID number is found, then additional information on the ID (including the name of the board) is "filled" into the edt. Only those devices that have diagnostic code on the 3B2 Maintenance Utilities diskette are recognized by `filledt.` These devices are listed in Table C-1.

Table C–1.   Version 2 and Version 3 Devices

Version 2 Models	Version 3 Models
system board (sbd)	system board (sbd)
SCSI host adapter (scsi)	SCSI host adapter (scsi)
	math accelerator unit (mau)
	virtual address cache (Vcache)
	multiprocessor enhancement board (mph)
	processing element (mph)
	expansion bus interface (xbi)*

* Used in 3B4000 ACP application.

When examining the edt after executing `filledt,` all I/O feature cards other than SCSI host adapters will appear as "VOID." This condition is normal because of the absence of their ID codes on the 3B2 Maintenance Utilities floppy.

Diagnostic Monitor (dgmon)

The dgmon program is provided for assistance in determining the failing component when the 3B2 is unable to access the "boot" hard disk. Because of space limitations on the floppy diskette, diagnostic code for all 3B2 components is not included. Refer to the filledt section for a list of components that are diagnosed by the 3B2 Maintenance Utilities.

The diagnostic monitor provided by the 3B2 Maintenance Utilities functions identically to the hard disk version. See Appendix C, "3B2 Computer Maintenance Utilities," for complete instructions on the dgmon command. Remember that only a subset of hardware components can be diagnosed from this floppy diskette.

Integral Disk Tools (idtools)

The `idtools` utility is a set of commands for performing various tasks on integral disks on Version 2 3B2 Models (300/310/400). These commands do NOT work with SCSI disks or with ST-506 disks connected to an expansion disk controller (XDC) feature card.

The `idtools` utility provides nine commands:

- `formflop` – formats floppy diskettes

- `formhard` – formats ST-506 integral disk drives

- `verify` – verifies hard disk format

- `ddhs` – disk-to-disk high-speed copies

- `dd` – disk-to-disk copy by sectors

- `d-m` – disk-to-memory copies

- `defect` – hard disk defect table builder

- `fixdisk` – writes hard disk sanity track

- `chgboot` – changes default booting information

Figure C-3 is referred to as the `idtools` menu screen throughout the rest of this appendix. This menu is provided after booting `idtools` from FIRMWARE MODE. The following sections present each of `idtools` commands in more detail.

```
                         Integral Disk Tools

     AT&T 3B2/PC Computer Installation and Systems Support Engineering

                           <date of issue>

---------------------------- IDTOOLS ----------------------------

   Floppy diskette formatter - type formflop
        Hard disk formatter - type formhard
           Hard disk verify - type verify
 Disk to disk copy high speed - type ddhs
  Disk to disk copy by sector - type dd
          Disk <--> mem copy - type d-m
        Defect table builder - type defect
          Write sanity track - type fixdisk
         Change boot defaults - type chgboot
                        Quit - type q

Comnand?
```

Figure C-3.   Integral disk tools

Floppy Diskette Formatter

Floppy diskettes can be formatted in FIRMWARE (or multiuser) MODE. The idtools program contains the formflop command that formats and optionally verifies floppy diskettes from the FIRMWARE MODE.

Floppy Diskette Formatter Usage

The following steps show how to format and verify a floppy diskette:

1. From the idtools menu screen, enter **formflop.**

2. The program will respond:

   ```
   FLOPPY DISK FORMATTER

   Verify format? (n)
   ```

3. To verify the format, enter **y.** If no verification of format is necessary (default is no verify), enter **<cr>.**

4. The program will respond:

   ```
   Insert Floppy to be formatted,
   type go when ready (q to quit) ...
   ```

5. When the floppy diskette is installed in the floppy disk drive, enter **go.**

6. The program will respond as shown in Figure C–4.

```
Cvlinders  formatted
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
78 79

< if you answered yes to verify>

Verifying cylinders formatted
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
78 79
Writing defect map to floppy

DONE

<idtools menu screen>
```

Figure C–4.   go response

The floppy diskette formatting is now complete. A file system can be built on the diskette or it can be used as a raw media device.

NOTE: The same fomatting capability is available from simple administration.

Floppy Diskette Formatter Error Messages

The floppy diskette formatter program contains 14 error messages. Each message is identified and explained below. (Error messages shown that contain an X will have an actual value in place of the X.)

■   Floppy does NOT have defect mapping capabilities!

This shows that the floppy does not have error mapping capabilities. This error message results from a bad format or from verifying a floppy that was formatted on a SVR1 system. This message should not appear because it is only given when verifying a previously formatted floppy.

■   FLOPPY NOT FORMATTED CORRECTLY!

This error message occurs from a bad format and appears whenever the format fails.

- `FORMFLOP: Unable to format disk, cannot recalibrate floppy drive!`

  This shows that the floppy drive or floppy disk controller has a hardware problem. Replace the floppy drive before replacing the system board.

- `FORMFLOP: Unable to format disk, write protected!`

  Remove the write protect tab.

- `FORMFLOP: Unable to format track = X, side 0`

  This signifies that sector ''X,'' side 0 of the floppy could not be formatted. Try reformatting. If this fails, discard the diskette.

- `FORMFLOP: Unable to format track = X, side 1`

  This reveals that sector "X," side 1 of the floppy could not be fomatted. Try reformatting. If this fails, discard the diskette.

- `write track X error`

  This shows the track where a write error has occurred and usually follows the error messages; `FORMFLOP: Unable to format track = X, side 0` and `FORMFLOP : Unable to format track = X, side 1`.

- `FORMFLOP: Unable to verify disk, cannot recalibrate floppy drive!`

  This shows that the floppy drive or floppy disk controller has a hardware problem. Replace the floppy drive before replacing the system board.

- `home during seek retry failed`

  This states that an error occurred during a seek and indicates a hardware problem (usually loose cables or a bad floppy disk drive).

- `track X seek failed`

  This states that an error occurred during a seek and indicates a hardware problem (usually loose cables or a bad floppy disk drive).

- `home during read retry failed`

  This states that a read error occurred during a seek to sector 0 and indicates a hardware problem (usually loose cables or a bad floppy disk drive).

■   `side X, sector X failed`

This states the particular side and sector that failed during the verification pass. Try reformatting. If this fails, discard the diskette.

■   `write of defect map failed`

This states that the defect table could not be written to the diskette. This error message should never appear if the verify pass completes.

■   `write of pdsector failed`

This states that the disk drive physical description sector write failed. This error message should never appear if the verify pass completes.

Hard Disk Formatter

Integral hard disks can only be formatted from FIRMWARE MODE. Formatting a disk removes all user data on the disk. Only the sanity track and defect maps remain. The `formhard` command automatically maps in the defect table builder program `defect` to ensure that the hard disk contains the proper defect map and that the sanity track program `fixdisk` is able to write the sanity track. The formatter will format, build the defect table, and install the sanity pattern on the diagnostic cylinder.

Hard Disk Formatter Usage

The following steps disclose the formatting of hard disk number 1 (CDC 30 MB WREN). The back-up defect table and defect map should have been built. If it has not, see the information in "Defect Table Builder Usage" before continuing.

1. From the `idtools` screen menu enter **formhard.**

2. The program will respond:

```
Format which disk [0 or 1] (0)?
```

3. Disk drive number 1 is being accessed. Enter **1.**

4. The program will respond:

```
A list of current config and defect table values will be
printed.  To keep the current value, enter <return>, to
change, type the new value.  Current config table values:

                     Drive Id: 3 - ?
```

5. If the disk drives physical ID is correct, enter **<cr>.** If not, enter the correct value.

6. The program will respond:

```
Number cylinders: 697 - ?
```

7. If the number of cylinders is correct, enter **<cr>.** If not, enter the correct value.

8. The program will respond:

```
Number tracks/cyl: 5 - ?
```

9. If the number of tracks per cylinder is correct, enter **<cr>.** If not, enter the correct
value.

10. The program will respond:

```
Number sectors/track: 18 - ?
```

11. If the number of sectors per track is correct, enter **<cr>.** If not, enter the correct
value.

12. The program will respond:

```
Number bytes/sector: 512 - ?
```

13. If the number of bytes per sector is correct, enter **<cr>.** If not, enter the correct
value.

NOTE: As of the date of publication of this manual, these numbers
(18 sectors/track, 512 bytes/sector) are correct for all drives used by AT&T.

14. The program will respond as shown in Figure C–5.

```
The following items finish describing the disk.
They correspond to the sizing information just entered.

      Logical start of disk: 90
 Backup defect map location: 1
     Backup defect map size: 512
         Defect map location: 2
             Defect map size: 512
         Error log location: 89
             Error log size: 512
 Number of relocation areas: 1
      Relocation area start: 3
       Relocation area size: 86


defect map read ok
back-up defect table read ok

The back-up defect table is placed on KS-spec disks by the disk
manufacturer.
If this disk is a KS-spec disk, the table should be present
and left untouched by idtools.
If the table is not present (Whether destroyed on a KS-spec
disk or the disk is pre-KS) the back-up defect table
can be modified as defects are newly entered or edited below.

Modify back-up defect table? [yes or no] (no)
```

Figure C–5.   Bytes per second response

15. It is not necessary to modify the back-up defect table because it has already been built. Enter **<cr>.**

16. The program will respond as shown in Figure C–6.

```
If the back-up defect table is on this disk, you may choose to force
the defect map to agree with it by having 3B2 computer Maintenance Utilities
automatically regenerate the defect map from the back-up table.
This will remove any NEW defects that the formatter or bad block handling
found, but will put the defect map in the initial state.

Re-create defect map? [yes or no] (no)
```

Figure C-6.   Back-up defect table response

17. Since the defect map is already built, enter **<cr>.**

18. The program will respond as shown in Figure C-7.

```
Current defects are:

       BACK-UP                  MAPPED
cyl head byte length _ _ bad _ _ _ _ good _
0:   back-up empty      00b5020f – 00000003
1:   back-up enpty      00b50210 - 00000004

Next relocation sector is 5

Type 'new' to enter ALL defects,
       'edit' to modify current defects,
       <cr> to keep current list:
```

Figure C-7.   Defect map response

19. This defect map display should look like the one built in the defect table builder
usage example, excluding the backup empty messages that are given instead of the
cylinder, head, byte, and length counts. If there are discrepancies in the mapped
display, correct the error before continuing. Enter **<cr>.**

20. The program will respond:

```
Format entire disk - type 1
Format single track - type 2
Format from selected track to end - type 3

Select type of format [1, 2, or 3] (1) ?
```

If type l is selected, the system will respond as shown in Figure C–8.

```
Cylinders Formatted:
O 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 115 120
125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210
215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 300 305
310 315 320 325 330 345 350 355 360 365 270 375 380 385 390 395 400 405
410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495
500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585
590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675
680 685 690 695

Cylinders Verified:
O 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 115 120
125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210
215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 300 305
310 315 320 325 330 345 350 355 360 365 270 375 380 385 390 395 400 405
410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495
500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585
590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675
680 685 690 695

Writing format information.
Writing sanity pattern
Disk 1 correctly formatted
DONE

<idtools menu>
```

Figure C–8.   Type 1 response

21. The format program prints a message for every five (and the last five) cylinders
that it formats. This output can be used as a debugging tool.

If format types 2 or 3 had been selected, you would have been prompted for the
starting track (identified by cylinder and head). The resulting output is similar to
that of format type 1.

The format is now complete, and the sanity track is in place. Load the 3B2
computer core UNIX package or use the partition commands in `sysadm` if this
will be used as a second disk drive.

Format Hard Disk Error Messages

The hard disk format program has 16 error messages associated with it. Each is identified and explained below. In the following error messages, D = disk drive number, C = cylinder number, H = head number, S = sector number, and T = track number.

- `Invalid disk number, D!`

  This error message appears when an unknown disk number is entered. Only 0 and 1 are supported.

- `FORMHARD: invalid disk info`

  This signifies that a corrupted physical description file is read. Verify that the physical description information is correct.

- `FORMHARD: Could not format disk`

  This appears when the format program reaches the maximum retry limit and exits. This error message usually indicates major problems. First, try executing some of the more simple programs (for example, `fixdisk` or `defect`).

- `FORMHARD: Could not respecify controller`

  This states that the driver and disk controller are not communicating. This is usually a result of a bad system board or crossed disk drive cables.

- `FORMHARD: Could not verify disk`

  This is printed when the `verify` program reaches the maximum retry limit and exits.

- `FORMHARD: unable to write format info`

  This appears when the driver cannot talk to the disk drive. There are no acknowledgements from the disk drive. Check the disk drive cable connections.

- `FORMHARD: Sanity pattern write failed`

  This states that the sanity track write failed. Try the `fixdisk` program to double check the sanity track.

- `FORMHARD: Sanity pattern readback failed`

  This states that the sanity track readback failed. Try the `fixdisk` program to verify the sanity track.

- `FORMHARD: Seek to cylinder C failed`

  This is printed when a seek fails. Verify that the physical description information is correct. If this error reoccurs, replace the disk.

■ `FORMHARD: Format Write of track T of cylinder C failed`

This reports the locations of errors as they occur. These locations should be written down and entered into the defect map (error message 11 will correct these).

■ `FORMHARD: Verify Read of cylinder C head H failed due to`
`failing sector S.`
`Add to defect maps [y, n, q(uit)] (y) ?`

This allows modification of the defect map with the information found during the verify readback.

⚠ CAUTION

If more than one or two errors occur, the format has usually failed. Reformat before entering data into the defect map or you will run out of defect entries.

■ `Aborting verify!!!`

This is printed when the verify program fails and exits. Reformat until the verify passes. If it will not pass, replace the disk.

■ `SAVE: Could not recall drive D`

This indicates a communication problem between the driver and disk. This is probably a disk drive or loose cable problem.

■ `SAVE: Could not write manufacturer defect table`

This states that the back-up defect table file could not be written back out to the disk after the formatting was completed.

■ `SAVE: Could not write defect table`

This states that the defect table could not be written back out to the disk after the formatting was completed.

■ `SAVE: Could not write physical info table`

This states that the physical information file could not be written back out to the disk after the formatting was completed.

If error messages; `SAVE: Could not write manufacturer defect table`, `SAVE: Could not write defect table`, `SAVE: Could not write physical info table`, are output, execute the following procedures:

      1. Rebuild the physical information file and the backup defect table.

      2. Force the building of the default map.

      3. Execute the format one more time.

If the error messages recur, the disk may be bad.

Hard Disk Verify

Integral hard disks can only be verified from FIRMWARE MODE. Performing a verify pass on a disk does not effect user 'data on the disk. The `verify` command automatically prints the disk configuration information.

Hard Disk Verify Usage

The following steps disclose the verify pass of hard disk number 1 (CDC 30 MB WREN).

      1. From the `idtools` screen menu enter **verify.**

      2. The program will respond:

```
Verify pass ONLY (no formatting)

Which disk [0 or 1] (0)?
```

      3. Disk drive number 1 is being accessed. Enter **1.**

4. The program will respond as shown in Figure C–9.

```
Current config table values:

                Drive Id:   3
          Number cylinders:   697
          Number tracks/cyl:   5
        Number sectors/track:   18
         Number bytes/sector:   512
        Logical start of disk:   90
   Backup defect map location:   1
       Backup defect map size:   512
          Defect map location:   2
              Defect map size:   512
            Error log location:   89
                Error log size:   512
     Number of relocation areas:   1
          Relocation area start:   3
           Relocation area size:    86


defect map read ok
back-up defect table read ok


Hit RETURN to continue, q to quit -
```

Figure C–9.   Drive number 1 response

5. Enter **`<cr>.`**

The program will respond as shown in Figure C– 10.

```
Cylinders Verified:
O 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 115 120
125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210
215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 300 305
310 315 320 325 330 345 350 355 360 365 270 375 380 385 390 395 400 405
410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495
500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585
590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675
680 685 690 695

Disk 1 correctly formatted
DONE

<idtools menu>
```

Figure C–10.   Cylinders verified response

Disk-to-Disk High-Speed Copy

Disk-to-disk copies can be rapidly completed while in the FIRMWARE MODE. The default values for this command copy the entire disk except for the first cylinder from disk drive 0 (WREN 30 MB) to disk drive 1 (WREN 30 MB). This is extremely useful for making exact disk copies for use in multiple 3B2 computers.

Disk-to-Disk High-Speed Usage

In the following steps, the default values hard disk 0 copied to hard disk 1 are used. The default values begin on track 5 and continue until the drive's own characteristics are reached (track 0, sector 5). This excludes the physical information, back-up defect table, and the defect map. These are not to be written over. The procedure is as follows:

1. From the `idtools` menu screen enter `ddhs`.

2. The program will respond as shown in Figure C–11.

```
HIGH SPEED HARD DISK TO HARD DISK TRACK COPY

WARNING, This routine assumes a defect table on disk
If none exists, use defect /format to create it before proceeding

Tracks containing defects will be transferred a sector at a time.
Source disk [0 for id0, 1 for id1] (0):
```

Figure C–11.   ddhs response

3. Default (0) is being used. Enter **<cr>.**

4. The program will respond:

```
source start track (5):
```

5. Default (5) is being used. Enter **<cr>.**

6. The program will respond:

```
destination disk [0 for id0, 1 for idl] (1):
```

7. Default (1) is being used. Enter **<cr>.**

8. The program will respond:

   ```
   destination start track (5):
   ```

9. Default (5) is being used. Enter **<cr>.**

10. The program will respond:

    ```
    number of tracks (3480):
    ```

11. Default (3480) is being used. Enter **<cr>.**

12. The program will respond as shown in Figure C–12.

```
sr = sector read, sw = sector write, rr = re-read track, rw = re-write track

Tracks Transferred:
25 50 75 100 125 150 175 200 sr-211 225 250 275 300 325 350 sr-369 375 sr-399
400 425 450 475 500 525 550 575 600 625 650 675 700 725 750 775 800 sr-812
825 850 875 900 sw-907925 950 975 1000 1025 1050 1075 1100 sr-1455 1475
1500 1525 1550 1575 1600 1625 sr-1633 1650 1675 1700 1725 1750 1775 1800
sr-1820 1825 1850 1875 1900 1925 1950 1975 2000 2125 sr-2146 2150 2175
2200 2225 2250 2275 2300 2325 2350 2375 2400

2425 2450 2475 2500 2525 2550 2575 2600 2626 2650 2675 2700 2725 2750 2775
2800 2825 2850 2875 2900 2925 2950 2975 3000 3025 3050 3075 3100 3125
3150 3175 3200 3225 3250 3275 3300 sr-3318 3325 sr-3333 3350 sr-3373 3375
3400 3425 3450 3475
DONE with 1 total retries

<idtools menu>
```

Figure C–12.   Number of tracks response

The program reports on its activity by printing the sector number after every 25 sectors transferred. Whenever a sector with mapped defects is encountered, the program prints the sector it is currently reading (`sr`) or writing (`sw`). If it is necessary to retry a read (`rr`) or write (`rw`), the track number is printed. When completed, the program reports the total number of retries made during the disk copy.

Disk-to-Disk High-Speed Copy Error Messages

The `ddhs` command has 15 associated error messages. Each is identified and discussed below. In the following error messages, X = disk drive number, C = cylinder, H = head, S = sector, and T = track.

- ■ `DDHS: invalid source disk number`

  This error message reports that an invalid source disk number has been specified. Only 0 and 1 are supported.

- ■ `DDHS: invalid destination disk number`

  This reports that an invalid destination disk number has been specified. Only 0 and 1 are supported.

- ■ `Converting Destination disk from 1.0 to 1.1 format`

  This states that the destination disk drive is being converted from 1.0 (SVR1) format to 1.1 (SVR2) format.

- ■ `DDHS: Unreadable to convert disk X`

  This error message appears when the 1.0 (SVR1) to 1.1 (SVR2) conversion fails. Usually, the source disk cannot be read or there are too many defects listed in the destination disk defect table for this program to handle. This disk will have to be formatted manually with the `formhard` command.

- ■ `DDHS: Unreadable/Invalid Phys Info on Disk X`

  This signifies that the physical information cannot be read or has been corrupted. Use the defect program to correct this problem.

- ■ `DDHS: Unreadable/Invalid Defect Info on Disk X`

  This shows that the defect tables could either not be read, or that they have been corrupted. Use the defect program to correct these problems.

- ■ `DDHS: Unreadable Maps on Disk X`

  This states that the defect tables could not be read. Use the defect program to fix these problems. Verify that the disk drive giving this error is properly formatted.

- ■ `DDHS: Read Track T Failed (cyl = C, head = H)`

  This a read failure and reports the location of the error.

■ DDHS: Write Track T Failed (cyl = C, head = H)

   This reports a write failure and the location of the error.

■ GET_PUTTRK: Seek to S failed

   This states that a seek error has occurred and reports the failed sector number.

■ GET_PUTTRK: DMA setup failure

   This signifies that the DMA setup has failed. This problem usually indicates a bad
   system board.

■ Failed all retries

   This states that every retry has failed. When this error message appears, the
   program will usually terminate.

■ CONV_DISK: read old sector 0 failed

   This reports that a sector 0 read failed. Verify that the disk contains the correct
   physical information with the defect program. This message is only given when
   converting 1.0 (SVR1) disk to 1.1 (SVR2) format. Try the format with the
   formhard program..

■ CONV_DISK: write new sector 0 failed

   This reports that a sector 0 write has failed. Verify that the disk contains the
   correct physical information with the defect program. This message is only
   given when converting a 1.0 (SVR1) disk to 1.1 (SVR2) format. Try the format with
   the formhard program.

■ CONV_DISK: write of new defect map failed

   This shows that the new defect map write has failed. Use the format program to
   manually update the disk to 1.1 (SVR2). Then do the copy.

Disk-to-Disk Copy by Sector

Disk-to-disk copies by sector are possible with the dd command. This utility can be used for
disk transfers between hard disks or floppy disks, by specifying source and destination
locations. This command assumes that both disks have a defect table and are formatted.

Disk-to-Disk Copy by Sector Usage

A step-by-step example that copies sectors 200 through 1000 from integral hard disk 0 to integral hard disk 1 follows:

1. From the `idtools` menu screen enter **dd.**

2. The program will respond:

```
WARNING, This routine assumes a defect table on disk. If
none exists, use defect/format to create it before
proceeding

source disk [id or if] (id) :
```

3. The first message warns of an unformatted disk drive. Verify that both disks are formatted before continuing. To copy from integral hard disk 0, enter **<cr>.**

4. The program will respond:

```
which [0 or 1] (0) :
```

5. Disk 0 is the source. Enter **<cr>.**

6. The program will respond:

```
source start block:
```

7. Begin copying at block 200. Enter **200.**

8. The program will respond:

```
destination disk [id or if] (id) :
```

9. To specify integral hard disk 1, enter **<cr>.**

10. The program will respond:

```
which [0 or 1] (0) :
```

11. Disk 1 is desired. Enter **1.**

12. The program will respond:

```
destination start block:
```

13. Put the blocks in the same location on the second disk drive. Enter **200.**

14. The program will respond:

        number of sectors:

15. Copy 200 through 1000 to the second disk. Enter **800.**

16. The program will respond as shown in Figure C–13.

```
Sectors Transferred:
200 218 236 254 272 290 308 328 344 362 380 398 416 434 452
470 488 506 524 542 560 478 596 614 632 650 668 686 704 722
740 758 776 794 812 830 848 866 884 902 920 938 956 974

DONE

<idtools menu>.
```

Figure C-13.   Sectors transferred response

The program prints a message for every 18 sectors copied to the destination location. When complete, DONE is printed and the `idtools` menu screen is returned.

Disk-to-Disk Copy by Sector Error Messages

The `dd` comrnand has five associated error messages. Each is identified and described below.

■   `DD: Floppy Defect Map Check Failed`

     This error message reports that the floppy defect map is not in place. Format the floppy diskette.

●   `DD: Invalid Hard Disk Number`

     This is printed when an invalid hard disk number is entered. Only 0 and 1 are supported.

■   `DD: Invalid Disk`

     This is printed when an invalid disk type is entered. Only id (integral hard disk) and if (integral floppy disk) are supported.

- ■ `D-M or DD: Floppy Defect Map Invalidation Failed`

    This states that the floppy diskette defect map could not be invalidated. The write to the floppy diskette failed.

- ■ `DACS: R/W sector S fail`

    This shows that a read or write to the disk has failed (R = read, W = write, and S = sector number). If it is a read failure, verify that the disk is formatted. If it is a write failure, verify that the diskette is not write protected. For a hard disk write failure, verify that it is formatted properly. Run the format program that reports read and write errors along with the actual address.

Disk-to-Memory Copy

The `d-m` command copies data from floppy disk drive or one of the integral hard disks (0 or 1) to main memory. At this time it is not possible to copy from memory to disk; 512 byte chunks, by sectors, must be copied. The `d-m` command is useful during development stages for loading information into main memory. For example, use the `d-m` command to load a boot program.

Disk-to-Memory Copy Usage

In the following steps, sector 0 is copied from the integral hard disk 0 to main memory. (This example is used for demonstration purposes only.)

1. From the `idtools` menu screen, enter **d-m**

2. The program will respond as shown in Figure C–14.

```
Disk to Memory Copy
WARNING, This routine expects maps to be in place on disk
If they are not, use defect/format to build them

Writable memory starts at (beginning address) and ends at (ending address)

 (beginning and ending addresses are automatically computed for each machine)

read from disk, write to disk, or quit? [r,w,q] (r) :
```

Figure C-14.   Disk-to-memory response

3. If the disk has no defect maps and has not been formatted, do `formhard` before continuing. In the following example, the first sector of integral hard disk drive 0 will be read into memory. The prompt: `read from disk, write to disk, or quit` defaults to `read (r)`. Enter **<cr>.**

4. The program will respond:

> `disk [if or id] (if) :`

5. The default is the integral floppy disk. The first sector of the integral hard disk 0 is being read. Enter **id.**

6. The program will respond:

> `which [0 or 1] (0) :`

7. The default is integral hard disk 0. Enter **<cr>.**

8. The program will respond:

> `Enter the starting block (0) :`

9. The default is the beginning of the device, sector 0. Enter **<cr>.**

10. The program will respond:

> `Enter the memory address : 0x`

11. The beginning address (in main memory) hexadecimal physical location is requested. The default starting address is calculated for each machine. Enter **<cr>.**

12. The program will respond:

```
Enter the number of blocks
[1 - (max number that will fit in memory)] :
```

13. Only one block is to recopied. Enter **1.**

14. The program will respond as shown in Figure C–15.

```
Memory copy begins at address (beginning address)
Sectors copied:
0

Memory copy complete at address (ending address)

DONE

<idtools  menu>
```

Figure C-15.   Blocks to be copied response

Sector numbers are printed on the screen as they are copied to main memory. If 100 sectors are copied, it would count to 100.

Disk-to-Memory Copy Error Messages

There are six error messages associated with the `disk to memory copy` command. Each is identified and explained below. (Error messages shown that contain an x will have an actual value in place of the `X`.)

■   `Invalid Disk!`

This error message appears when an invalid disk identification number is entered. The only valid entries are 0 or 1.

■ D-M: Floppy Defect Map Invalidate Failed

This only pertains to the integral floppy disk drive. The driver does not know how the diskette is partitioned. Use a different floppy or format the floppy diskette with `formflop`.

■ D-M: Floppy Defect Map Check Failed

This only pertains to the integral floppy disk drive. The driver could not read the defect map. Use a different floppy or format the floppy diskette with `formflop`.

■ D-M: Unreadable/Invalid Phys Info on Disk X

This states that physical description table for disk drive X could not be read, or contained invalid information. If this is a hard disk unit, use the `defect` program to repair the physical description table. If this is a floppy unit, use `formflop`.

■ D-M: Unreadable Maps on Disk X

This signifies that the defect maps on hard disk drive X could not be read. Use the defect program to rebuild the defect tables.

■ idX CRC error at disk address 0xY (Z retries)

This error message shows that hard disk drive X had a CRC error at disk address 0xY and tried Z times to correct it. The disk drive is probably bad. Try to map out this location and reformat before replacing the disk drive. If this is a boot device (integral hard disk 0) and the error is coming from the boot block area, install this drive as drive 1 and replace the boot block with the `newboot` command.

Defect Table Builder

The defect table builder, the `defect` command, is invaluable for building defect maps and reading the factory defect map. Now, this is the only tool for building defect maps on supported disk drives, ST-506 interface.

NOTE: Use edit mode if you need to add blocks to an existing map. The editor is a valuable tool for adding defects to an existing table. Use of the editor is encouraged.

Defect Map Builder Usage

Each type of disk drive has a specific identification number associated with it. Now, AT&T supports four integral disk drives, each described in Table C–2.

Table C–2.   Disk Drive Specifications

Manufacturer	Model	size	ID	Cylinders	Tracks/Cylinder	Sector/Track	Bytes/Sector
Seagate	ST-412	10M	2	306	4	18	512
CDC	Wren	30M	3	697	5	18	512
CDC	Wren II	72M	5	925	9	18	512
Fujitsu	M2243AS	72M	8	754	11	18	512

Use the information from Table C-2 to answer defect program questions. The following steps shows the values for a CDC Wren 30M disk drive.

NOTE: If the defect table cannot be read, the `defect` program defaults to Seagate values.

1. From the `idtools` menu screen, enter **defect.**

2. The defect program will respond:

   ```
   Building defect table ONLY (no formatting)

   Which disk [0 or 1] (0)
   ```

3. Reply with the disk drive number needed to display or modify the defect table. For this example, use drive number 1. Enter 1.

4. The program will respond:

   ```
   A list of current config and defect table values will be
   printed.   To keep the current value, enter <return>, to
   change, type the new value.

   Current config table values :         Drive Id: 2 – ?
   ```

5. Enter the drive id number if it is different from the number indicated. Enter **3.**

6. The program will respond:

   ```
   Number cylinders : 306 - ?
   ```

7. Enter the number of cylinders if the disk drive is different from the displayed value. Enter **697.**

8. The program will respond:

```
Number tracks /cyl : 4 - ?
```

9. Enter the number of tracks per cylinder if they are different from the displayed value. Enter **5.**

10. The program will respond:

```
Number sectors/track: 18 - ?
```

11. Enter the number of sectors per track if they are different from displayed.
Enter **<cr>.**

12. The program will respond

```
Number bytes/sector: 512 - ?
```

13. Enter the number of bytes per sector if they are different from displayed value.
Enter **<cr>.**

14. The program will respond as shown in Figure C-16.

```
The following items finish describing the disk.
They correspond to the sizing information just entered.

      Logical start of disk: 90
Back-up defect map location: 1
    Back-up defect map size: 512
        Defect map location: 2
            Defect map size: 512
         Error log location: 89
             Error log size: 512
 Number of relocation areas: 1
      Relocation area start: 3
       Relocation area size: 86

defect map read ok
back-up defect table read ok

The back-up defect table is placed on KS-spec disks by the disk
manufacturer.  If this disk is a KS-spec disk, the table should be present
and left untouched by idtools.  If the table is not present (Whether
destroyed on a KS-spec disk or the disk is pre-KS) the back-up defect table
can be modified as defects are newly entered or edited below.

Modify back-up defect table? [yes or no] (no)
```

Figure C-16.   Bytes per sector response

15. In this example, construct the back-up defect table to experience working with a
bad disk. Enter `yes.`

16. The program will respond as shown in Figure C–17.

```
Current defects are:


        BACK-UP              MAPPED
cyl head byte length │ bad        good
─────────────────────│───────────────
                     │
                     │
Next relocation sector is 3

Type 'new' to enter ALL defects,
      'edit' to modify current defects,
      <cr> to keep current list:
```

Figure C–17.   Back-up defect table response

17. In this example, the map is presently empty. It is necessary to enter all disk drive defects. Enter **new.**

18. The program will respond:

Enter type of defect byte count, [bc or bc/48] (be) ?

19. Enter defect locations by byte count or byte count/48. The defect list is provided by the manufacturer, usually typed on a sticker located on the disk drive, and is in byte count values. For bc mode, enter **<cr>.**

20. The program will respond:

Enter defective sectors one per line, as cylinder
head byte count length. Defect length defaults to
1 if not entered! End with 'q' , restart with 'new'
bad sector = ?

21. Enter the defect locations as follows:

   ❑ first, enter the cylinder number

   ❑ second, enter the head number

   ❑ third, enter the byte count, length in bytes from the beginning of the track

   ❑ fourth, enter the length of defective area, defaults to 1 if no value is entered

   Enter the defects for the drive used in this example. Program prompts and defect information are displayed together.

22. An interactive display is shown in Figure C–18.

```
bad  sector = ? 181 2 9114
Bad sector 00b5020f maps to good sector 00000003 (defect 1)
Bad sector 00b50210 maps to good sector 00000004 (defect 2)
bad sector = ? q

Current defects are:



              BACK-UP                        MAPPED
Cyl       head   byte    length  bad                good
O:   181  2      9114       1     00b5020f  -   00000003
1:                               00b50210  -   00000004


Next relocation sector is 5

Type 'new' to enter ALL defects,
        'edit' to modify current defects,
        <cr> to keep current list:
```

Figure C–18.   Interactive display

23. This drive has only one defect. It is on a border so two locations are mapped out. To keep this map and write it to disk, enter **<cr>.**

24. The program will respond:

```
Writing format information.

<idtools menu>
```

25. The back-up defect table or manufacturer defect table has been built. Next, construct the defect table that will be used to format the disk drive. Enter **defect.**

26. The program will respond:

```
Building defect table ONLY (no formatting)

Which disk [0 or 1] (0)
```

27. Use drive number 1. Enter **1.**

28. The program will respond:

```
A list of current config and defect table values
will be printed.  To keep the current value, enter
<return>, to change, type the new value.  Current
config table values:

        Drive Id: 3 - ?
```

29. The disk drive physical ID is now correct. Enter **<cr>.**

30. The program will respond:

```
Number cylinders: 697 - ?
```

31. The number of cylinders is now correct. Enter **<cr>.**

32. The program will respond:

```
Number tracks/cyl: 5 - ?
```

33. The number of tracks per cylinder is now correct. Enter **<cr>.**

34. The program will respond:

```
Number sectors/track: 18 - ?
```

35. The number of sectors per track is now correct. Enter **<cr>.**

36. The program will respond:

```
              Number bytes/sector: 512 - ?
```

37. The number of bytes per sector is now correct. Enter **<cr>.**

38. The program will respond as shown in Figure C–19.

```
The following items finish describing the disk.
They correspond to the sizing information just entered.

      Logical start of disk: 90
Back-up defect map location: 1
    Back-up defect map size: 512
        Defect map location: 2
            Defect map size: 512
          Error log location: 89
             Error log size: 512
 Number of relocation areas: 1
      Relocation area start: 3
       Relocation area size: 86

defect map read ok
back-up defect table read ok

The back-up defect table is placed on KS-spec disks by the disk
manufacturer.  If this disk is a KS-spec disk, the table should be present
and left untouched by idtools.  If the table is not present (Whether
destroyed on a KS-spec disk or the disk is pre-KS) the back-up defect table
can be modified as defects are newly entered or edited below.

Modify back-up defect table? [yes or no] (no)
```

Figure C-19.   Bytes per sector response

39. Do not modify the back-up defect table because it is already built. Enter **<cr>.**

40. The program will respond as shown in Figure C–20.

```
If the back-up defect table is on this disk, you may choose to
force the defect map to agree with it by having idtools automatically
regenerate the defect map from the back-up table.  This will remove any
NEW defects that the formatter or bad block handling found, but will put
the defect map in the initial state.

Re-create defect map? [yes or no] (no)
```

Figure C–20.   Modify back-up defect table response

41. Since anew back-up defect table has been modified (built), force the rebuilding of
the defect rnap. Enter **yes.**

42. The program will respond as shown in Figure C-21.

```
Automatically reconstructing defect map from back-up map
Bad sector 00b5020f mps to good sector 00000003 (defect 1)
Bad sector 00b50210 maps to good sector 00000004 (defect 2)

Current defects are:



            BACK-UP                      MAPPED
Cyl      head   byte    length  bad            good
O:  I8I  2      9II4 ---- I ---- 00b5020f = 00000003
1:                              00b50210 –  00000004


Next relocation sector is 5

Type 'new' to enter ALL defects,
       'edit' to modify current defects,
       <cr> to keep current list:
```

Figure C-21.   Rebuild defect map response

43. The automatic reconstruction has built anew defect map identical to the present
back-up map. If the answer had been no, the old defect map would have been
displayed. If the drive can read the old defect map, read it. You may find new
defects that are not listed on the manufacturer's defect list (if the drive has
discovered any). If these defects are not correct, go back through the original steps
and correct them. Enter **<cr>.**

44. The program will respond:

```
Next relocation sector is 5

Writing format information.

<idtools menu>
```

45. This shows that the next relocation sector is sector 5. Use this location to map out the next defect. The information needed to format the disk is now in place. Use `formhard` to finish constructing a usable disk drive.

Defect Map Builder Error Messages

The defect map builder has 13 associated error messages. Each is identified and discussed below.

- `Invalid disk number`

  This states that the entered disk number is invalid. Only 0 and 1 are supported.

- `FORMHARD: Could not read physical info on disk X`

  This states that the driver could not read the physical description file on disk drive X. If repairing the disk, ignore this the first time it is output. Continue through the defect entry procedure and the message should not appear the next time the defect program is entered. If the error reappears a second time, try replacing the disk.

- `FORMHARD: Invalid physical info on disk X`

  This states that the physical information for disk x is invalid. Some part of the description is invalid, (for example, 10000 tracks per cylinder). Go through the defect procedure and rebuild the physical information table. If the error message reoccurs, replace the disk.

- `Assuming default values for physical info`

  This shows that the defect map was unreadable and that the default values are being assumed (Seagate 10 MB values). Step through the defect mapping procedure and enter the proper disk information. This error message should not be output a second time. If it does reappear, try formatting the drive and building the defect table. Go back and format the disk again, since the defect map was empty during the first format.

■   `defect map unreadable`

This signifies that the defect map is unreadable. Step through the defect mapping procedure. If the error message appears a second time, try formatting the drive and then building the defect table. Go back and format the disk again, since the defect map was empty during the first format.

■   `WARNING: Manual reconstructing of defect map REQUIRED`

This states that the defect map has been corrupted and must be rebuilt. The back-up defect table may be still be operable. If it is functioning, check the back-up table and force a rebuild of the defect map. If the back-up defect table has been corrupted, rebuild it before forcing the automatic reconstruction of the defect map.

■   `back-up defect table unreadable`

This indicates that the back-up defect table is unreadable. Rebuild it.

■   `D:  backup empty      |XXXXXXXX - YYYYYYYY`

This is printed when the hard disk error logger `hdefix` or `hdeadd` commands have made an entry into the defect map. "X" denotes the actual bad block number and "Y" becomes the new location block. The manufacture defect table does not have this entry. Add this to the manufacture defect table if it is a true error location.

■   `D: CYL HEAD BYTE LENGTH  |map empty`

This states that a defect entry has been lost. The cylinder (CYL), head (HEAD), beginning byte (BYTE), and byte length (LENGTH) are known but not mapped out. Use the editor and rebuild the entry. This will map the bad block to a good block.

■   `D:  no backup location     |XXXXXXXX - XXXXXXXX`

This signifies that the manufacturer defect table and defect table are missing defect information, but have mapped out a location. This could result from corruption or from hard disk error logger command entries. For safety, remap this entry. If not familiar with the disk layout, remove the entry and let the hard disk error logger find it. Then reenter the error location.

■   `D:0       |second sector missing in defect map`

This states that the defect map has been corrupted, and the second sector is missing. The bad sector (1) is known, but the replacement sector (2) is unknown. Rebuild the defect map leaving this out and let the hard disk error logger find the bad sector. Then reenter the defect.

■ `D: CYL HEAD BYTE LENGTH │no mapped sector!`

This shows that a defect entry has no mapped sector. The cylinder (CYL), head (HEAD), beginning byte (BYTE), and byte length (LENGTH) are known but have not been mapped out. Use the editor and rebuild the entry. This will map the bad block to a good block.

■ `D:  incorrectly mapped  │XXXXXXXX - YYYYYYYY`

This is printed when a bad entry is made in the defect map. x denotes the actual bad block number and Y the new location block. If this is a known bad sector, remove this entry and reenter it.

Writing Sanity Track

The `fixdisk` command rewrites the sanity track on integral hard disk 0 or 1.

Writing Sanity Track Usage

The following steps show how to fix the sanity track on integral hard disk 0.

1. From the `idtools` menu screen enter **fixdisk.**

2. The program will respond:

>   Which disk? [0 or 1] (0)

3. Fix drive 0. Enter **<cr>.**

4. The program will respond:

```
FIXING SANITY TRACK ON DISK X

Sanity pattern is in place on disk X
DONE

<idtools menu>
```

In the above statements, x = disk identification number. If a `<cr>` is input, the default value (0) is used. The sanity track is now in place.

Writing Sanity Track Error Messages

The `fixdisk` command has four possible associated error messages.

- `FIXDISK: Could not respecify controller`

  This states that the driver is having a problem with the disk controller. This could be a system board problem or the disk's data/control cables might not be installed correctly.

- `FIXDISK: Sanity pattern readback failed`

  This shows that the driver could not read the sanity track. Try to rewrite the sanity track. If this fails, replace the disk drive.

- `FIXDISK: Sanity pattern write failed`

  This signifies that the sanity track could not be written to the diagnostic cylinder. Format the disk before trying again, because the format may have been corrupted.

- `1-02 DISK SANITY FAILURE`

  This error message is given by the firmware diagnostics. Install a sanity pattern before replacing the disk drive. This message may also be given, if the boot block has been destroyed on integral disk drive 0. See the information in "Disk-to-Disk High-Speed Copy" in this chapter for directions on replacing the boot block.

Change Boot Defaults

The `chgboot` command is used to change the default boot parameters. These default values are stored in NVRAM.

Change Boot Default Usage

The default boot values designate the integral floppy disk 0 as the booting device. `/unix` becomes the boot file and disk section 1 the save device. These values are set when the power is removed from NVRAM.

In the following steps, the default parameters are changed to make integral hard disk O the automatic boot device.

1. From the `idtools` menu screen, enter **chgboot.**

2. The program will respond:

        new boot device slot number [0-12] (0) :

3. Indicate the slot number of the boot device. This should always be 0 (system board).

   If you are using a SCSI disk, enter the slot number of the SCSI host adapter board. If you are using an XDC disk, enter the slot number of the XDC controller board, that is the I/O slot number of the XDC board (1-4 or 1-12) plus one. Enter **<cr>.**

4. The program will respond:

        new boot device subdevice number [0-15] (0) :

5. This requests the subdevice number 0 for integral floppy disk drive, and 1 for integral hard disk drive 0. Other numbers are used as growth devices are added (such as a second hard disk). For the integral hard disk 0, enter **1.**

6. The program will respond:

        save device: 01 ?

7. Reply with a 'y' or the value will not be written to NVRAM. Enter **y.**

8. The program will respond:

        new boot file name (unix) :

9. This requests the name of the file to be executed (leave as `/unix`). The 3B2 computer can boot any executable file (the file name is limited to eight characters). Enter **<cr>** or **filename.**

10. The program will respond:

        save name: unix ?

11. A `y` must be given or the value will not be written to NVRAM. Enter **y.**

12. The program will respond:

        <idtools menu>

The boot defaults are now modified. If these defaults are not correct, or the name of the boot file cannot be found, the machine will go into FIRMWARE MODE during the power-up sequence and display:

```
SYSTEM FAILURE : CONSULT YOUR SYSTEM ADMINISTRATION UTILITIES GUIDE
```

Change Boot Error Messages

The chgboot command has one error message:

■   CHGBOOT: device write failed

If this message is output, NVRAM cannot be written. Consult the service representative or try again. The battery must be connected and have minimum power requirements. Make sure the battery is not dead before reexecuting.

Appendix D: Repair Equipment and Spare Parts

Introduction

This chapter provides a spare parts list of equipment (hardware and software) that is needed to repair the 3B2 computer. The spare parts list also includes comcodes and part descriptions for the various pieces of equipment.

Spare Parts

A list of orderable spare parts for all Models of the 3B2 computer, the XM (both SCSI and non-SCSI), the TM (non_SCSI), and all SCSI modules follows. Note that this list does not include cabinet parts, screws, and other similar small items. These types of iterns may be referenced through the ED drawings listed in Chapter 1, "Introduction." For ordering information, contact your account executive or call AT&T Information Systems at the following toll-free number: 1-800-247-1212. Comcodes and descriptions are provided in Table D-1.

NOTE: Comcodes apply only to subassemblies. Only the part listed is included with the designated comcode. The comcode for the MAU is one exception. It includes a wrist strap and a chip removal tool as well as the MAU chip. Other exceptions are noted in the parts list.

A "+" indicates a part that is common to more than one subassembly.

Parts for a 3B2 400S60, 522, 622, etc., are assumed to be the same as the base product (i.e., 400, 500, and 600, respectively) unless otherwise indicated. Some of the abbreviations used in this list are explained below.

V3	Version 3 hardware (any 3B2 Model 500 or greater)
CTC-TM	23 MB cartridge tape module (non-SCSI)
TM	SCSI cartridge tape module
DCM	SCSI disk control module
DM	SCSI disk module
XM	Expansion module for 23 MB cartridge tape drive, floppy disk drive, and/or ST-506 hard disk drives.
XM/405S/900S	Expansion module containing 3 ESDI disk drives and a bridge controller.

Table D–1.   3B2 Computer Spare Parts

Comcode	Description	Part Number
Power Supplies (110 V unless indicated)		
403580525	Power Supply, 300/310 (20 A)	TRW #095-10001
403668023	Power Supply, 300/310 (22.5 A)	TRW #095-10011-XX1
403693864	Power Supply, 400	TRW #095-10035-XX1
104408315	Power Supply, 500 (110/220 V)	
105747737	Power Supply, 600/700/1000 (110/220 V)	ACS782A-0 Ser. 5
403758089	Power Supply, XM	TRW #095-10040-XX1
405862939	Power Supply, XM/405S/900S (domestic)	TRW #095-10064-02
405862087	Power Supply, XM/405S/900S (international)	TRW #095-10073-02
405083155	Power Supply, CTC-TM	
404077950	Fan,CTC-TM	
406025577	Power Supply, SCSIModules(DCM/DM/TM)	095-10065-07
System Boards		
103828547	System Board, 300	CM190A
104256524	System Board, 300	ED-4C637-30, G1
104299573	System Board, 310/400, w/o PROMs orMAU	ED-4C637-30, G6
103984225	System Board, 500/600	CM518A
103984233	System Board, 522/622/700/1000	CM518B
103984241	System Board, 1000	CM518C
845327287	PROM Kit, 300, ED board only	
845327295	PROMKit, 310	
845327303	PROM Kit, 400	
105005391	MAU Upgrade Kit, 310/400	
900817586	MAU Chip Set Extraction Tool	
Memory Boards		
103828554	1/4 M Memory, 300	CM191A
103828562	1 M Memory, 300/310/400	CM191B
103983458	1 M Memory, 300/310/400	CM191C
103983466	2 M Memory, 1/2 height, 300/310/400	CM191D
103828588	2 M Memory, 400	CM192B

(continued)

Table D–1. 3B2 Computer Spare Parts *(continued)*

Comcode	Description	Part Number
Memory Boards *(continued)*		
103984605	2 M ECC Memory, V3	CM523B
103984597	4 M ECC Memory, V3	CM523A
105547772	4 M ECC Memory, V3	CM523AA
103984621	16 M ECC Memory, V3	CM523D
Backplanes		
104030564	Backplane, 300/310	CM193B
104052634	Backplane, 400	CM194B
103984308	Backplane, 500	CM520A
103984266	Backplane, 600/700	CM519A
105539928	Backplane Assembly, 1000 (CM519B)	ED3T059-30
Hard Disks		
403375496	10 MB ST-506, Seagate	KS23034,L1
403392616	32 MB ST-506, Control Data	KS23054,L1
403765209	72 MB ST-506, Control Data	KS23054,L2
403765209	72 MB ST-506, Fujitsu	KS23054,L2
405188616	94 MB ESDI, Hitachi	KS23371,L7
405188608	135 MB ESDI, Hiitachi	KS23371,L13
405209552	147 MB ESDI, Control Data	KS23371,L17
405428129	300 MB ESDI, Micropolis	KS23371,L31
405781428	155 MB SCSI Single Ended, Imprimis	KS23483,L25
405723040	300 MB SCSI Single Ended, HP	KS23483,L1B
405723057	300 MB SCSI Differential, HP	KS23483,L11B
405675489	300 MB SCSI Single Ended, Imprimis	KS23483,L3
405675455	300 MB SCSI Differential, Imprimis	KS23483,L13
Removable Media Drives		
403960875	720 KB Floppy Disk Drive	KS23114,L4
403754393	23 MB Cartridge Tape Drive	KS23165,L1
405283524	60 MB SCSI Cart. Tape Drive	KS23417,L1
105690416	60 MB SCSI Cart. Tape Drive (includes 105458053 SCSI ID cable)	KS23417,L3

(continued)

Table D–1. 3B2 Computer Spare Parts *(continued)*

Comcode	Description	Part Number
Removable Media Drives *(continued)*		
405577933	120 MB SCSI Cart. Tape Drive	KS23465,L1A
405805905	120 MB SCSI Cart. Tape Drive	KS23465,L31
105984694	120 MB SCSI Cart. Tape Drive (includes 105458053 SCSI ID cable)	KS23465,L51
Batteries and LEDs		
403811185	Battery Assembly, all 3B2 Models	TL5242
405718396	Battery, 3V Lithium, Desktop 9-Track	1420-0314
403812431	LED, Orange	
403812449	LED, Green	
403403793	LED, Mounting Hardware	
300/310 Internal Components		
103933990	Cable, DUART	ED-4C492-35,G5
103934006	Cable, LED	ED-4C492-35,G6
104217138	Composite Disk Cable	ED-4C492-35,G10
104298575	Disk Access Panel	ED-4C632-13,G1
403790793	Disk Terminating Resistor SIP	
104217153	Retrofit J1 Power Cable (disk to panel)	ED-4C492-35,G9
103934006	J1 Power Cable (sys bd. to panel)	ED-4C492-35,G6
400 Internal Components		
104217104	Cable, DUART	ED-4C631-35,G2
103934006	Cable, LED	ED-4C492-35,G6
104217062	Composite Disk Cable	ED-4C631-35,G1
104217088	Cable, CTC to Tape, 400	ED-4C631-35,G3
104217096	Cable, HA to Tape Controller, 400S60	ED-4C631-35,G4
104217070	Cable, Power Splitter for Tape, 400S60	ED-4C631-35,G5
500 Internal Components		
405533894	Emulex SCSI-to-ESDI Bridge Controller	WP91205L3
105336515	Cable, Power, right side of power supply	ED-3T043-35,G1
105336523	Cable, Power, front of power supply	ED-3T043-35,G2
105336606	Cable, LED	ED-3T043-35,G3

(continued)

Table D–1. 3B2 Computer Spare Parts *(continued)*

Comcode	Description	Part Number
500 Internal Components *(continued)*		
105336531	Cable, Floppy Drive	ED-3T043-35,G4
105336549	Cable, SCSI 50-pin - 3 connectors	ED-3T043-35,G5
105336564	Cable, SCSI 50-pin - 4 connectors	ED-3T043-35,G7
105336556	Cable Assembly, Disk Controller to Disk	ED-3T043-35,G6
105336572	Dual Connector (DUC) Board and cable (console/contty assembly)	ED-3T043-35,G8
600/700/1000 Internal Components		
405291592	Fan Assembly	
845755610	Air Filter	
405280496	Power Switch	
405296971	Thermodisc Switch, 600,700,1000	36T21X86307
405533894	Emulex SCSI-to-ESDI Bridge Controller	WP91205L3
105259329	Cable, Power Supply to Peripheral	ED-3T023-35,G1
105259337	Cable, Power Supply to Backplane	ED-3T023-35,G2
105259345	Cable, Power Supply to Backplane	ED-3T023-35,G3
105259352	Cable, Backplane to LED	ED-3T023-35,G4
105259378	Cable, Back Panel - AC Power	ED-3T023-35,G6
105421366	Cable, Back Panel-AC Power	ED-3T023-35,G7
105259386	Cable, SCSI 50-pin - 3 connectors	ED-3T023-35,G10
105562193	Cable, SCSI 50-pin - 4 connectors	ED-3T023-35,G14
105517486	Cable, SCSI 50-pin - 5 connectors	ED-3T023-35,G13
105259394	Cable, 34-Pin Backplane to Floppy	ED-3T023-35,G11
105259402	Cable Assembly, Disk cont. to 2 Disks	ED-3T023-35,G12
Miscellaneous Boards		
103984472	Vcache, V3	CM522A
103984985	Multiprocessor Board, V3	CM527A
105516470	Processing Element Package, 1000	CM524A
104166525	Host Adapter - single-ended (HA1)	CM195W
105642060	HA1, Artmaster 4, Series 8 or greater	CM195W
103984340	Host Adapter - differential (HA2)	CM521A
105653000	HA2, Artmaster 2, Series 14 or greater	CM521A
103828612	Network Interface (NI)	CM195A
104166442	Alarm Interface Circuit (AIC)	CM195AA
103984696	Datakit Board	CM 195AC

(continued)

Table D–1.   3B2 Computer Spare Parts *(continued)*

Comcode	Description	Part Number
Miscellaneous Boards (continued)		
105629802	Datakit Board, Artmaster 4	CM195AC
103984704	Datakit Board	CM195AD
105278691	Datakit Assembly, includes both boards	
103984712	Gen. Purpose Synchronous Controller (GPSC-3B)	CM195AE
103828620	Expanded Ports (Ports)	CM195B
103985362	Expanded Ports (HPP)	CM195BA
104166533	Enhanced Ports (Eports)	CM195Y
105424360	Enhanced Ports (Eports)	CM195AY
103828687	Cartridge Tape Controller (CTC)	CM195H
103828703	Expansion Disk Controller (XDC)	CM195K
403775935	Intelligent Serial Controller (ISC)	CM195T
104166517	Network Access Unit (NAU)	CM195U
Miscellaneous Cables, Connectors, etc.		
104217187	Cable, Internal 34-Pin Disk Control, XM	ED-4C580-35,G1
104217195	Cable, Internal 20-Pin Disk Data, XM	ED-4C580-35,G2
104217203	Cable, External 34-Pin CTC or XDC to XM	ED-4C580-35,G3
104217211	Cable, External 34-Pin Disk Control, XM	ED-4C580-35,G4
104316740	Cable, External Disk Daisy Chain, XM	ED-4C580-35,G4A
104224191	Cable, External 20-Pin Disk Data, XM	ED-4C580-35,G5
104224209	Cable, internal Cartridge Tape,XM	ED-4C580-35,G6
104310867	Cable, External 20-Pin XDC to XM	ED-4C580-35,G7
601005671	Cable, Internal Disk Daisy Chain, XM	ED-4C580-35,G9
405067034	Cable, External CTC to TM	KS-23356,L3
403872674	Cable, ISC	
845756329	Cable assembly, V.35	- GPSC-3B
845756311	Cable assembly, RS232	- GPSC-3B
845186766	Cable, 10-Meter Drop, NI	
845186774	Cable, 30-Meter Drop, NI	
845186782	Cable, 50-Meter Drop, NI	
403354475	Transceiver, NI	
403247703	Transceiver Terminator, NI	
403837057	Cable, 2' RS232 Modular, AIC (console)	
403600968	Cable, 7' RS232 Modular	
403600976	Cable, 14' RS232 Modular	
403600984	Cable, 25' RS232 Modular	
403600992	Cable, 50' RS232 Modular	

(continued)

Table D–1.   3B2 Computer Spare Parts *(continued)*

Comcode	Description	Part Number
Miscellaneous Cables, Connectors, etc. *(continued)*		
403602717	Connector, Terminal/Printer - Male	
403417512	Connector, Terminal/Printer - Female	
403417538	Connector, ACU/Modem - Male	
845754118	Connector, DTR Hardware Flow Control, Eports	
403682693	Cable, Daisy Parallel Printer	
403682701	Cable, 7' Daisy Serial Printer	
403682719	Cable, 14' Daisy Serial Printer	
403682727	Cable, 25' Daisy Serial Printer	
403682735	Cable, 50' Daisy Serial Printer	
403752272	Cable, GP Centronix Parallel	
103895645	10-ft DW8ADEStarlan cable	
103730321	25-ft DW8ADEStarlan cable	
103730339	50-ft DW8ADEStarlan cable	
103730347	75-ft DW8ADEStarlan cable	
103895652	100-ft DW8ADE Starlan cable	
103736146	150-ft DW8ADE StarIan cable	
103736153	200-ft DW8ADEStarlan cable	
103935797	10-ft DP8BDEStarlan plenum cable	
103935805	25-ft DP8BDEStarlan plenum cable	
103935813	50-ft DP8BDEStarlan plenum cable	
103935821	75-ft DP8BDEStarian plenum cable	
103935839	100-ft DP8BDEStarlan plenum cable	
103935847	150-ft DP8BDEStarlan plenum cable	
103935854	200-ft DP8BDEStarlan plenum cable	
SCSI		
405533894	Emulex SCSI-to-ESDI Bridge Controller	WP91205L3
845588391	Terminator, Single-Ended HA	
845588383	Terminator, Single-Ended D-Type	
105458129	Terminator, Differential HA	
105458137	Terminator, Differential D-Type	
845588417	Terminator, ESDI External D-Type	
405209628	Fan,DCM/DM/TM	WP90572,L1
845589282	Door, Front Panel, DCM/DM/TM	
845588425	Cord, 3B2SCSI Soft Power	

(continued]

Table D–1. 3B2 Computer Spare Parts *(continued)*

Comcode	Description	Part Number
SCSI *(continued)*		
845588532	Cable, Internal 4-Pin Power, DM TM	
845757426	Cable, 4' Host Adapter External	
845588375	Cable, 1' External 50-Pin SCSI	
845588524	Cable, 2' External 50-Pin SCSI	
845588508	Cable, 4' External 50-Pin SCSI	
845755917	Cable, 10' External 50-Pin SCSI	
405290651	Coupler, External cable	
845588458	Cable, SCSI Internal 50-Pin, DCM	
845588516	Cable, SCSI Internal 50-Pin, TM DM/300(S/DS)	
105167431	Cable, SCSI Internal 50-Pin, XM	
845588466	Cable, ESDI lnterna137-Pin, DCM	
845588474	Cable, ESDI Internal 20-Pin, DCM	
845588482	Cable, ESDI lnterna137-Pin, DM	
845588490	Cable, ESDI Internal 20-Pin, DM	
845588367	Cable, ESDI External 37-Pin, DCM to DM	
845588359	Cable, ESDI External 25-Pin, DCM to DM	
105167324	Cable Assembly, ESDI Internal Control and Data Harness, XM	
845588433	Cable Assembly, Controller ID,DCM/XM	
105458053	Cable Assembly, Controller ID,DM/300(S/DS)	
845754977	Cable Assembly, Controller ID,TM	
845588441	Cable Assembly, Logical Unit ID DM/94E DM/135E DM/300E	
405192071	Switch, Cont.ID, DCM/XM/TM DM/300(S/DS)	
405205923	Switch, Logical Unit ID, DM/94/135E DM/300E	
845755701	Cable and Switch, Logical Unit ID,DM/147E	
Peripheral Power Control Unit		
405644113	Transformer	WP91689
846020865	Circuit Board	CFW-1
105458061	Cable Assembly, Power Switch	ED3T011-35,G2
105458079	Cable Assembly, Internal Soft Power	ED3T011-35,G3
105458202	Cable, 10' 3B2 Soft Power Output Cable	ED3T011-35,G8
105458087	Cable, 25' 3B2 Soft Power Input Cable	ED3T011-35,G6

(continued)

Table D–1. 3B2 Computer Spare Parts *(continued)*

Comcode	Description	Part Number
Keystone II and III		
405218611	1600 Keystone ll	KS-22762,L10
403219306	Blower	
403836109	Board, Formatter Control	
403836117	Board, Power Amp	
403377054	Board, Power Supply Control	
403377054	Board, PowerSupply	
403836125	Board, Read/VVrite Servo	
405218868	Board, SCSI single ended	
845755560	Cable, SCSI 50-pin 80 in.	
405295668	Cable, Power	
403836505	Compressor 60 Hz	
403836364	Cap, Alum 50V DC	
403210529	EOT/BOT Assembly Housing	
403833155	Hub Assembly, Supply	
403210578	Kit, Air Bearing	
403210735	Kit, Magnetic Head	
403290802	Motor, Take-up/Supply	
403236961	Panel, Operator	
403790124	Power Supply 60 Hz	
403210552	Reel, Take-up	
403035827	Sensor, File Protect	
403033251	Switch, Door interlock	
900724386	Tape Cleaner Assembly	
405206848	1600/6250 Keystone III	KS-23113,L40
403219306	Blower	
403836133	Board, Format Read	
403836174	Board, Format Write	
403836117	Board, Power Amp	
403836141	Board, Read Amp	
405209172	Board, SCSI Single Ended	
403836166	Board, Servo Control	
403836158	Board, Write Driver	
845586551	Cable, SCSI 50-pin 80 in.	
105347348	Cable, SCSI Tape Unit Extension	

(continued)

Table D–1. 3B2 Computer Spare Parts *(continue)*

Comcode	Description	Part Number
Keystone II and III *(continued)*		
403836364	Cap, Alum 50V DC	
403836505	Compressor 60 Hz	
403210529	EOT/BOT Assembly	
403833155	Hub Assembly, Supply	
403210578	Kit, Air Bearing	
403833163	Kit, Magnetic Head	
403290802	Motor, Take-up/Supply	
403831431	Panel, Operator	
403924921	Power Supply 60 Hz	
403210552	Reel, Take-up	
403035827	Sensor, File Protect	
403033251	Switch, Door Interlock	
900724386	Tape Cleaner Assembly	
Desktop, AutoLoad, Dual-Density 9-Track Tape Drive		
405693854	SCSI Interface Board (Single Ended)	88780-60015
405764358	Assembly, SCSI S.E.	88754A
405693813	SCSI Interface Board (Differential)	88780-60016
405764366	Assembly, SCSI Diff.	88755A
405695503	Rd/Wrl/Pll/Fmt Circuit Pack	07980-60021
405695362	PE/GCR Controller Circuit Pack	07980-60003
405695412	Data Buffer Circuit Pack	07980-60004
405695461	MTR/PWR Circuit Board	07980-60005
405718842	Motherboard	07980-60000
405718875	Front Panel Display Circuit Board	07980-60008
405718412	Tape Sensor Assembly	07980-60009
405718438	Speed Sensor Assembly	07980-60041
405718420	BOT/EOT Sensor Assembly	07980-60040
405718446	Head Plate Assembly	07980-60042
405718768	Tape Displacement Unit	07980-60051
405718818	Buffer Arm Assembly	07980-60045
405718263	Reel Motor	07980-60050
405718479	Blower	07980-86500
405718081	Power Module	07980-67919
405718370	Power Switch Assembly (On/Stdby)	07980-61616
405718628	Fan	07980-60043
405718321	Micro Switch	3101-2923

(continued)

Table D-1.   3B2 Computer Spare Parts *(continued)*

Comcode	Description	Part Number
Desktop, Autoload, Dual-Density 9-Track Tape Drive *(continued)*		
405718305	Hub, Supply	07980-60053
405718271	Hub, Takeup	07980-60052
405719436	Hub Lock Assembly	07980-60144
405718669	Door Latch	07980-65000
402613509	Fuse, 6A250V, Little Fuse	312006
405719733	Cable, Speed Sensor	07980-60062
405719717	Cable, Front Panel	07980-60064
405718404	Cable, Motor Control	07980-60065
405718388	Cable, Interface	07980-60067
405719691	Cable, Harness	07980-60070
405719683	Cable, Read Head	07980-60071
405719675	Cable, Write Head	07980-60072
405718784	Button, Standby Switch	07980-44111
405718107	Latch, Cover	1390-0776
405718115	Hinge, Cover	3110-0178
405718594	Front Bezel Assembly, white & dark gray	88780-68103
405765207	AT&T Front Bezel Insert	88780-49304
405718248	Firmware Kit, SCSI	88780-60290
Miscellaneous		
105285878	UNIX System V Release 3.1.1 Tape	
105654297	Newer 3.1.1 Tape for Embedded Drives	
403385230	Power Cord	
405303827	Power Cord (North America)	
403654411	Power Cord (International)	
403886922	DC600A Cartridge Tape	
405802570	DC600XTD Cartridge Tape	
405802596	DEI Cartridge Tape	
405902453	DC5150 Cartridge Tape	
403275795	KS Cartridge Tape	
403446511	Diskettes, Floppy	

Appendix E: Peripheral Configuration Diagrams

Introduction

The following diagrams detail the configuration settings and termination for 3B2 peripherals. Usually, the only jumper or switch settings that should be changed are the ID. Any other settings should NOT be changed. Terminating the peripheral depends on how it is configured into the system. See Chapter 6, "3B2 Subassemblies," and Chapter 7, "3B2 Peripheral Subassemblies," for more information. The following diagrams are listed in the order in which they appear:

Cartridge tape drives

60	MB	Wangtek	KS-23417, L1
120	MB	Wangtek	KS-23465, L1
60	MB	Wangtek	KS-23417, L3
120	MB	Wangtek	KS-23465, L1A/31/51

Hard disk drives

30 MB	CDC	(ST-506)
72 MB	CDC	(W-506)
72 MB	Fujitsu	(ST-506)
94 MB	Hitachi	(ESDI)
135 MB	Hitachi	(ESDI)
155 MB	CDC	(ESDI)
317 MB	Micropolis	(ESDI)
155 MB	CDC	(SCSI)
327 MB	CDC	(SCSI)
322 MB	HP	(SCSI)

Table E–1.   Terminating Resistor Information

PERIPHERAL TYPE	MANUFACTURER	TERMINATOR TYPE	PINS	MANUFACTURERS MARKINGS
KS-23054, L1		220/330 DIP	14	82826700-1M7
KS-23054, L2		220/330DIP	14	BECKMAN 899-5
HARD DISK	CDC	220/330DIP	14	4114R-003
KS-23054, L2		220/330DIP	16	RM37
HARD DISK	FUJITSU	220/330DIP	16	914C131X2TR
		150 DIP	14	914C151X2PE
		150 DIP	14	14-2-151
KS-23371, L17 HARD DISK	CDC	150 DIP	14	CTS 8317 760-1-R150
KS-23371, L9 KS-23371, L13 HARD DISK	HITACHI	220/330DIP	16	BI 898-5
KS-23371, L31 HARD DISK	MICROPOLIS	150 DIP	14	MDP1401-151G
KS-23483, L1B HARD DISK	HEWLETT PACKARD	180 SIP (3)	8	1810-1176
KS-23483, L3 HARD DISK	CDC	220/330 DIP (3)	14	4114R-003
KS-23483, L25 HARD DISK	CDC	220/330DIP	20	4120-003

PERIPHERAL TYPE	MANUFACTURER	TERMINATOR TYPE	PINS	MANUFACTURERS MARKINGS
KS-23417, L1/2		220/330DIP	14	14-3-221/331
KS-23465, L1/2		220/330DIP	14	4114R-003
TAPE DRIVE	WANGTEK	220/330DIP	14	BI 899-5
		220/330SIP	10	431OR-104
KS-23465, L1A		CONTAINS BOTH SIP AND DIP TERMINATORS		
TAPE DRIVE	WANGTEK	220/330DIP	16	4116R-003

NOTE: Several terminators are listed for some of the peripherals shown above for use
as alternate terminator selections as authorized by each manufacturer.
Manufacturers markings are listed for reference. Other terminators will work, if
they are the correct value of resistance as indicated.

Table E–2.   SCSI Module ID Cables

SCSI MODULE	TC or LU SWITCH [1]	ID CABLE
DM94E DM135E DM300E	LU	845588441
DM/147E [2]	LU	845755701
DM/155(S) DM/300(S/DS)	TC	105458053
DCM XM/405S XM/900S	TC	845588433
TM/60S TM/120S	TC	845754977 [3]

[1] ESDI peripherals use a logical unit (LU) switch.
Devices with SCSI controllers use a target
controller (TC) switch.

[2] The DM/147E uses its own ID cable which also
comes with the LU switch.

[3] Newer cartridge tape drives (KS-23417,L3 and later
or KS-23465,L51 and later) use the same ID cable
as the embedded controller disk drives (105458053).

Diagrams

SIDE VIEW
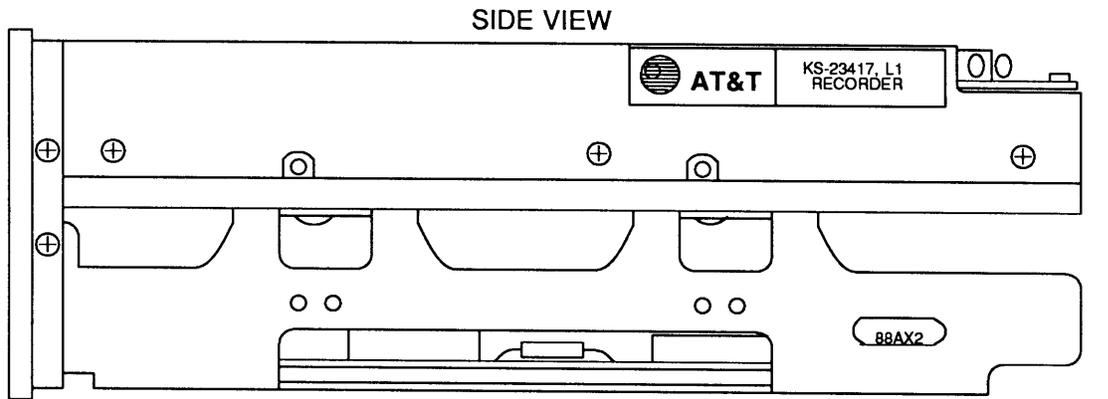
TOP VIEW - CUTAWAY DETAIL OF CONTROLLER BOARD
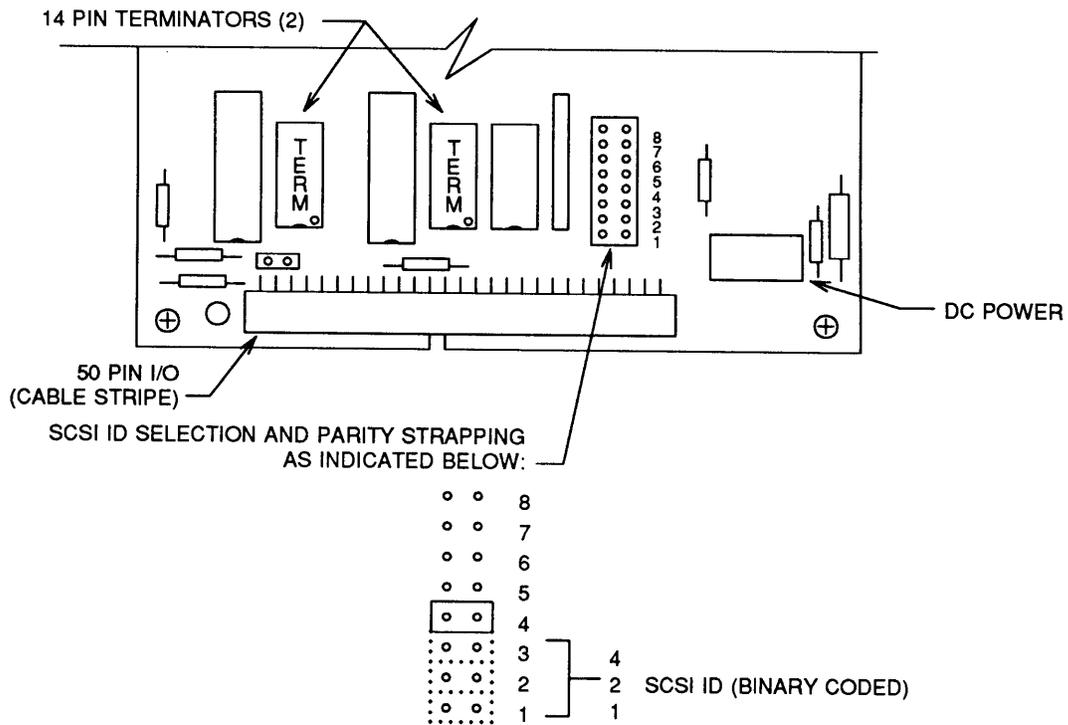
Figure E–1. KS-23417, L1 - 60 MB tape drive, Wangtek

SIDE VIEW

TOP VIEW - CUTAWAY DETAIL OF CONTROLLER BOARD

14 PIN TERMINATORS (2)

DC POWER

50 PIN I/O
(CABLE STRIPE)

SCSI ID SELECTION STRAPPING
AS INDICATED BELOW:

8
7
6
5
4
3 ⌐ 4
2 ┤ 2 SCSI ID (BINARY CODED)
1 ⌐ 1
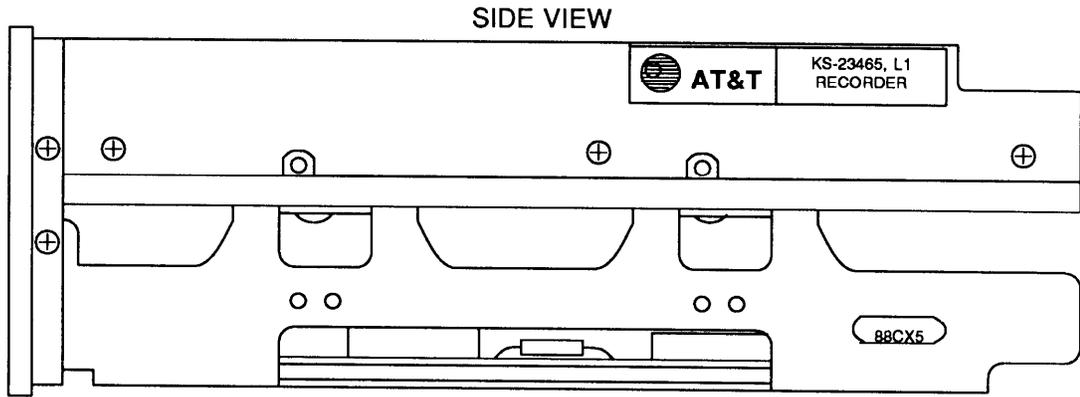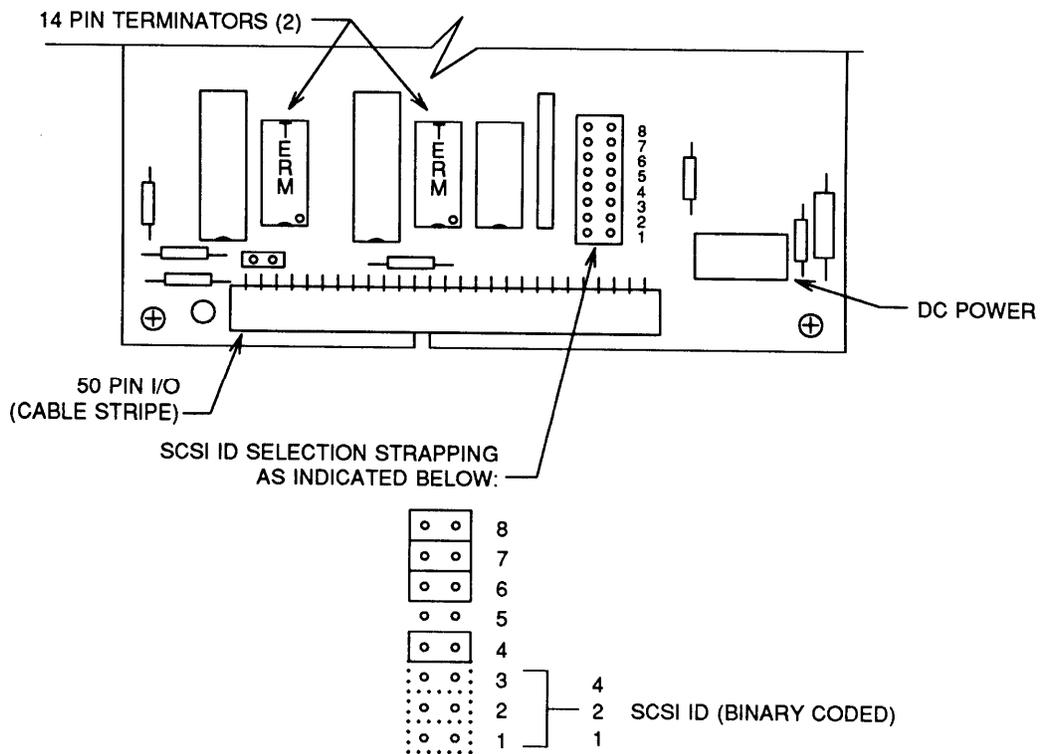
Figure E–2.   KS-23465, L1 - 120 MB tape drive, Wangtek

SIDE VIEW

BOTTOM VIEW

TERMINATORS (2) *

50 PIN I/O
(CABLE STRIPE)

SCSI ID
4 2 1

DC POWER
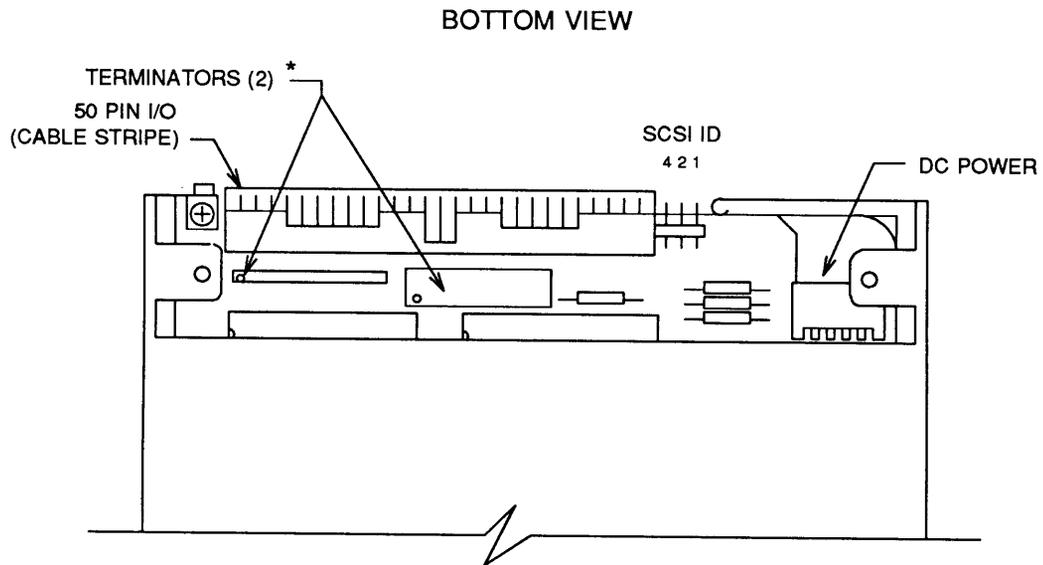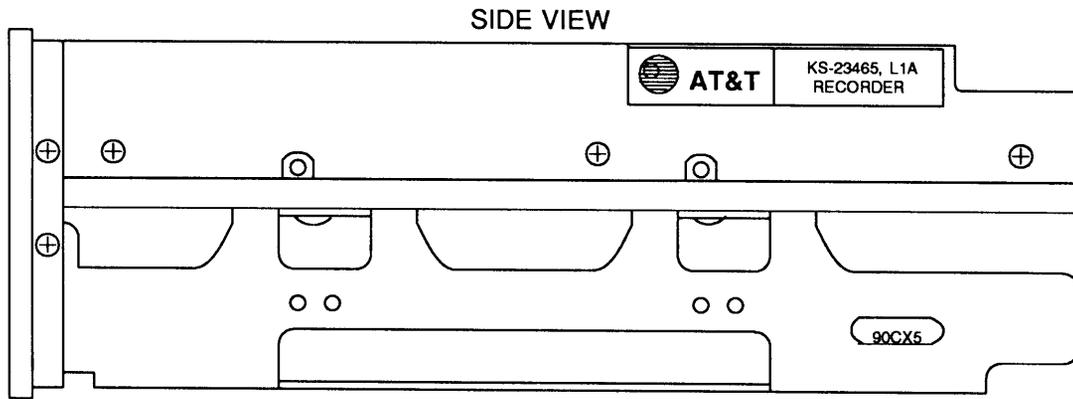
* Both terminators, 10 pin SIP, and 16 pin DIP, must be installed or removed, depending on the application.

SCSI ID SELECTION:
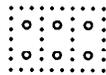
4 2 1

(BINARY CODED)

Figure E–3.   KS-23471, L3 (60 MB) and KS-23465, L1A/31/51 (120 MB) tape drive, Wangtek

SIDE VIEW

AT&T

KS-23054, LIST 1
36 MEGABYTE, 5.25 INCH
WINCHESTER DISK DRIVE

WARRANTY VOID IF
SEAL IS BROKEN

REAR VIEW

DC POWER

UNIT SELECT
AS INDICATED

14 PIN TERMINATOR
PIN 1

DRIVE 0

DRIVE 1
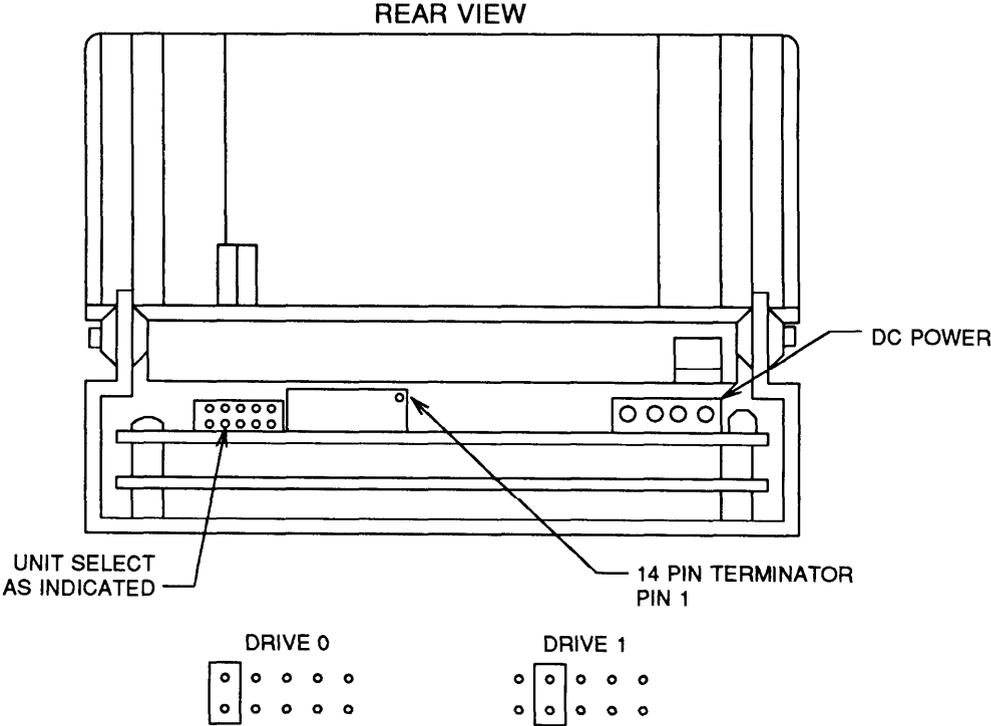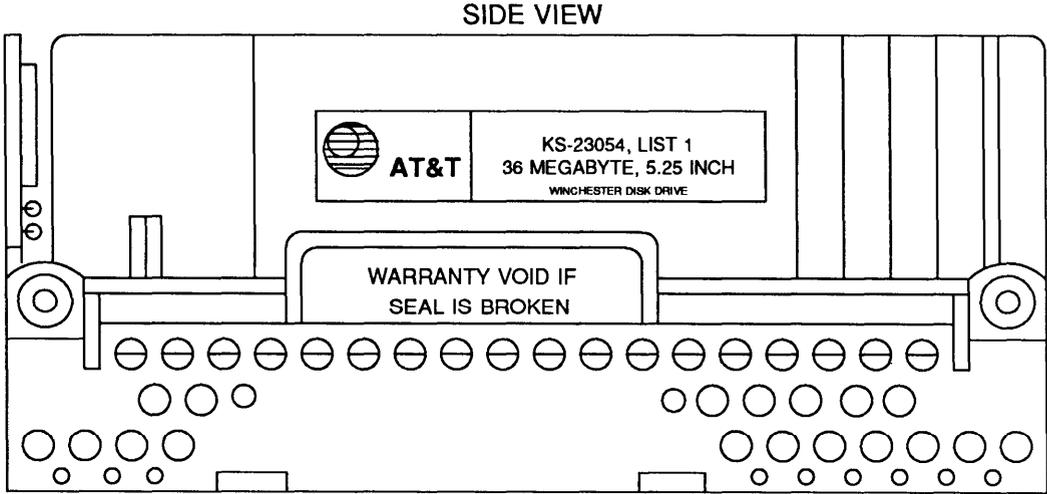
Figure E-4. KS-23054, L1 - 30 MB hard disk, CDC (ST-506)

SIDE VIEW

5A1234567891235

REAR VIEW

DC Power

UNIT SELECT
AS INDICATED

14 PIN TERMINATOR
PIN 1

DRIVE 0

DRIVE 1
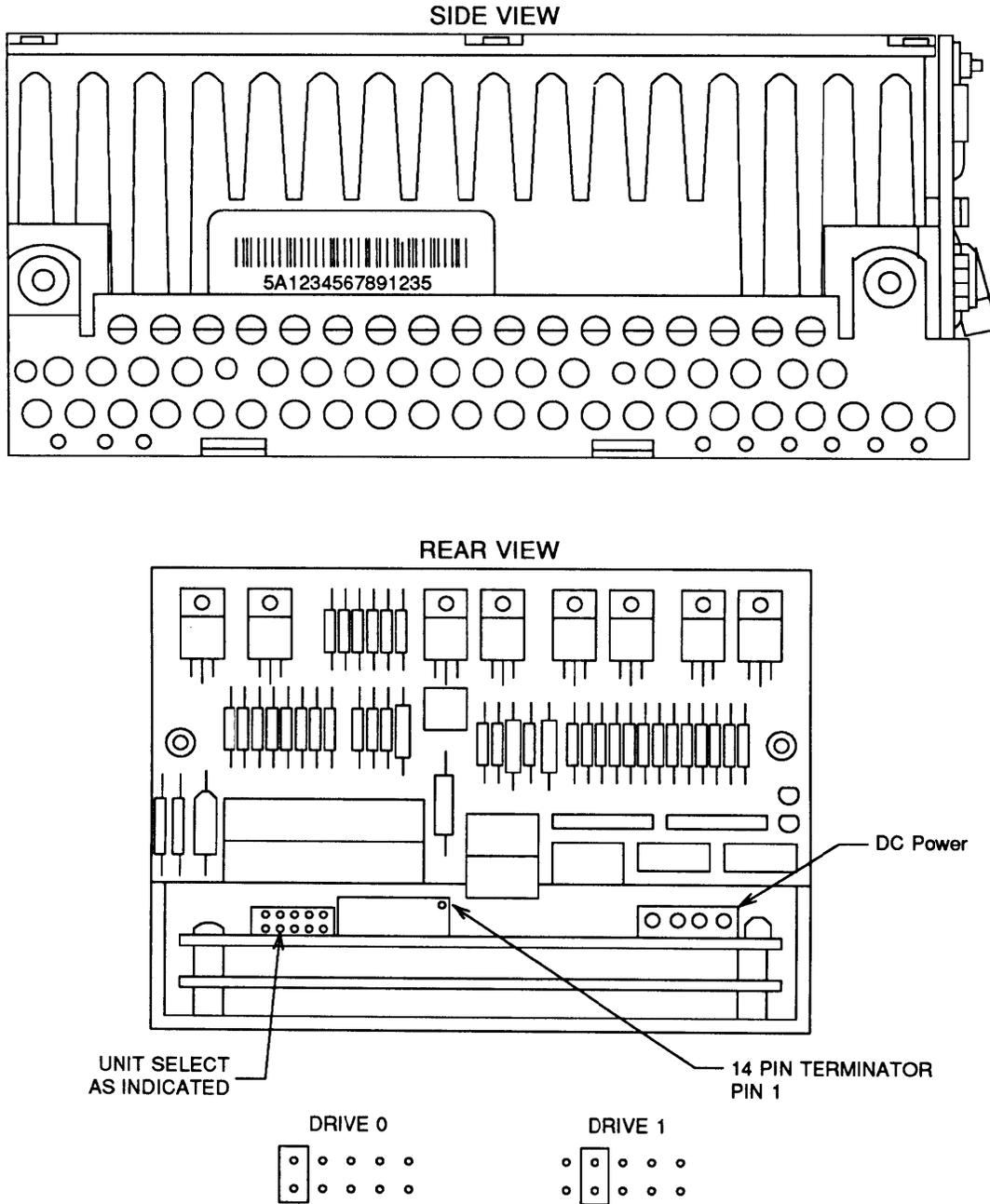
Figure E–5.   KS-23054, L2 - 72 MB hard disk, CDC (ST-506)

SIDE VIEW

PART NO.	B03B-4805-B003A#NT
SER. NO.	111032 DATE 1985-6
RATING	+12V, +5V
REV. NO.	B 0 1 2 3 4 5 6 7 8 9

KS 23054 L2

86 Megabyte Memory

BOTTOM VIEW

DRIVE 0

ON
1
2
3
4
5
6
7
8

DRIVE 1

ON
1
2
3
4
5
6
7
8

DRIVE ID
SELECTION:

16 PIN TERMINATOR
PIN 1
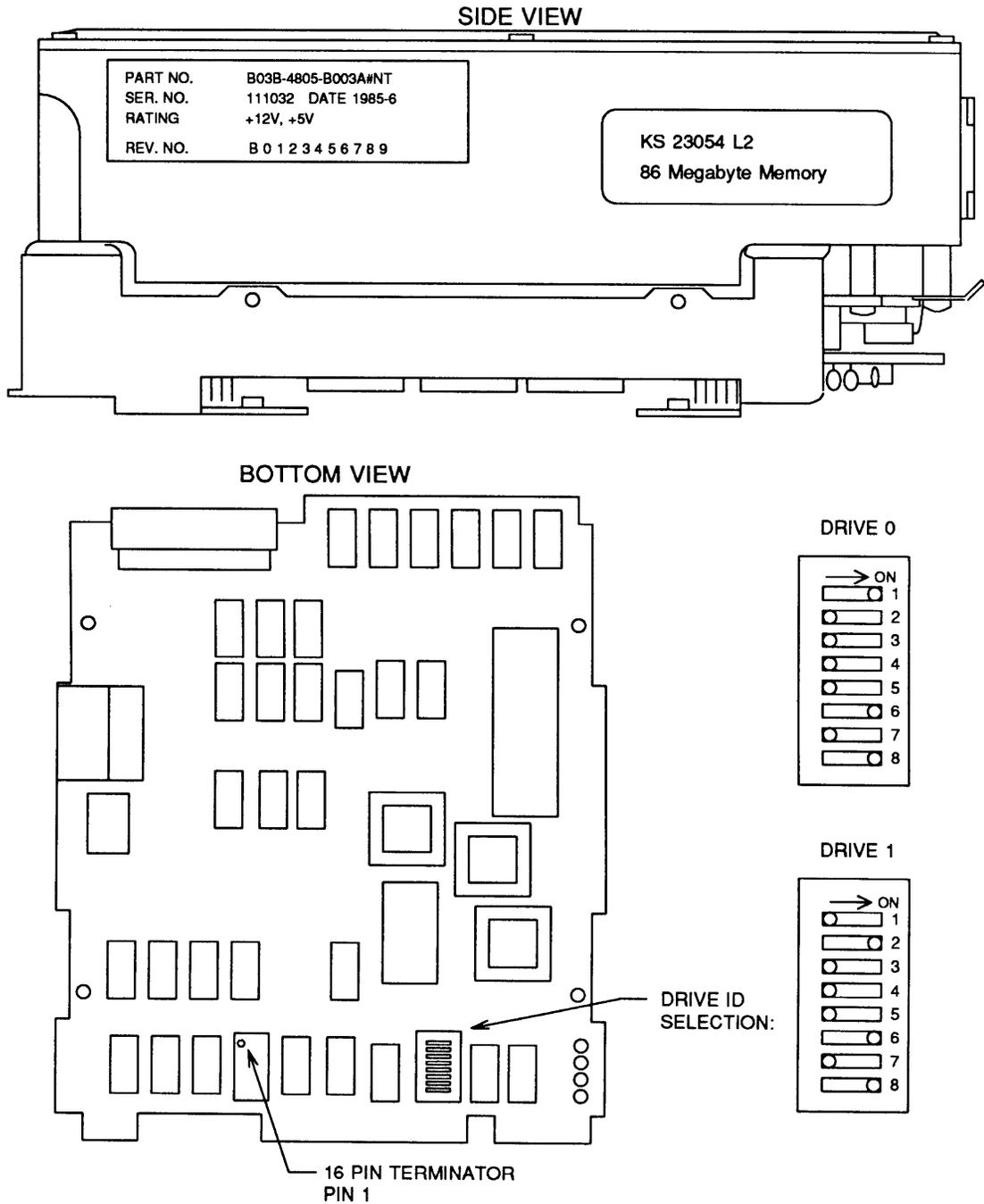
Figure E–6.   KS-23054, L2 - 72 MB hard disk, Fujitsu (ST-506)

SIDE VIEW

AT&T

KS-23371 List 13
5.25 inch ESDI
WINCHESTER DISK DRIVE

BOTTOM VIEW

LOGICAL UNIT ID
(BINARY CODED)

1
2
4

16 Pin TERMINATOR
PIN 1
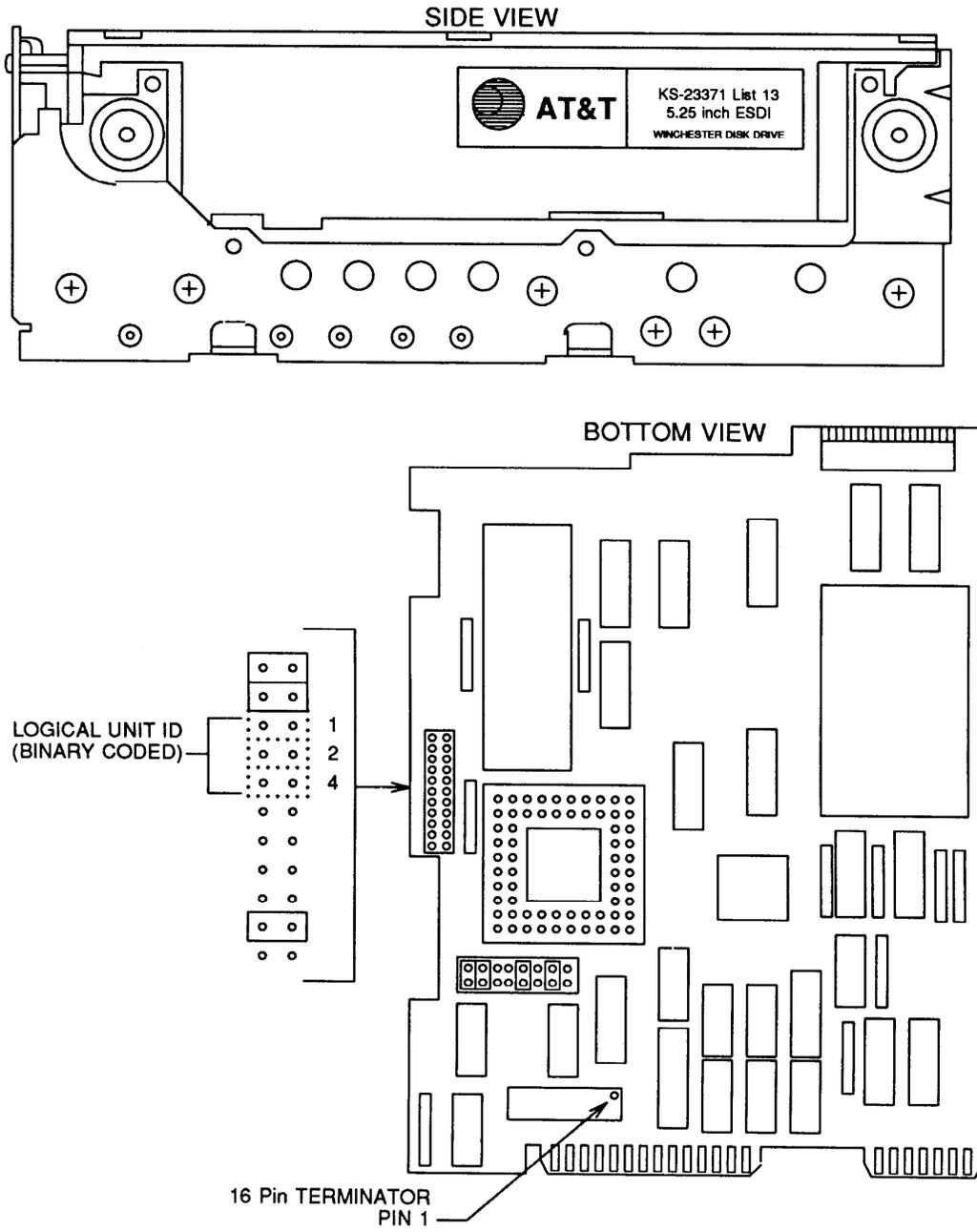
Figure E-7. KS-23471, L7/13 - 94/135 MB hard disk. Hitachi (ESDI)

SIDE VIEW

5A1234567891235

AT&T

KS 23371 LIST 17
5.25 INCH ESDI
WINCHESTER DISK DRIVE

REAR VIEW

SWITCH PACK
ON FRONT

up up down up

DC
POWER

UNIT SELECT
AS FOLLOWS:

14 PIN TERMINATOR
PIN 1

LOGICAL UNIT 0

LOGICAL UNIT 1

LOGICAL UNIT 2

LOGICAL UNIT 3
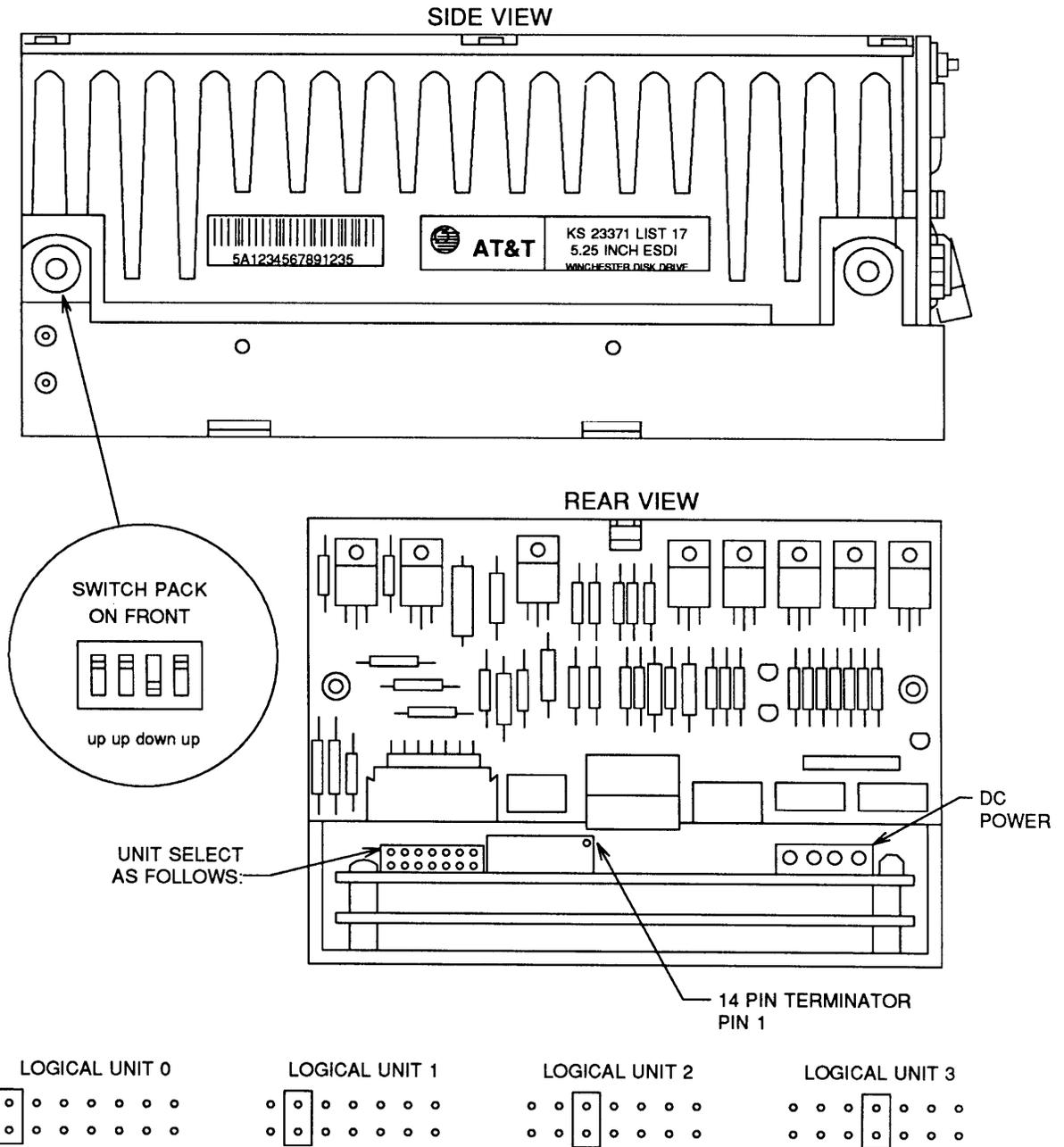
Figure E-8. KS-23471, L17 - 155 MB hard disk, CDC (ESDI)

SIDE VIEW

KS-23371, LIST 31
5.25 INCH ESDI
WINCHESTER DISK DRIVE

AT&T

BOTTOM VIEW

LOGICAL UNIT ID
(BINARY CODED)

4
2
1

14 PIN TERMINATOR, PIN 1
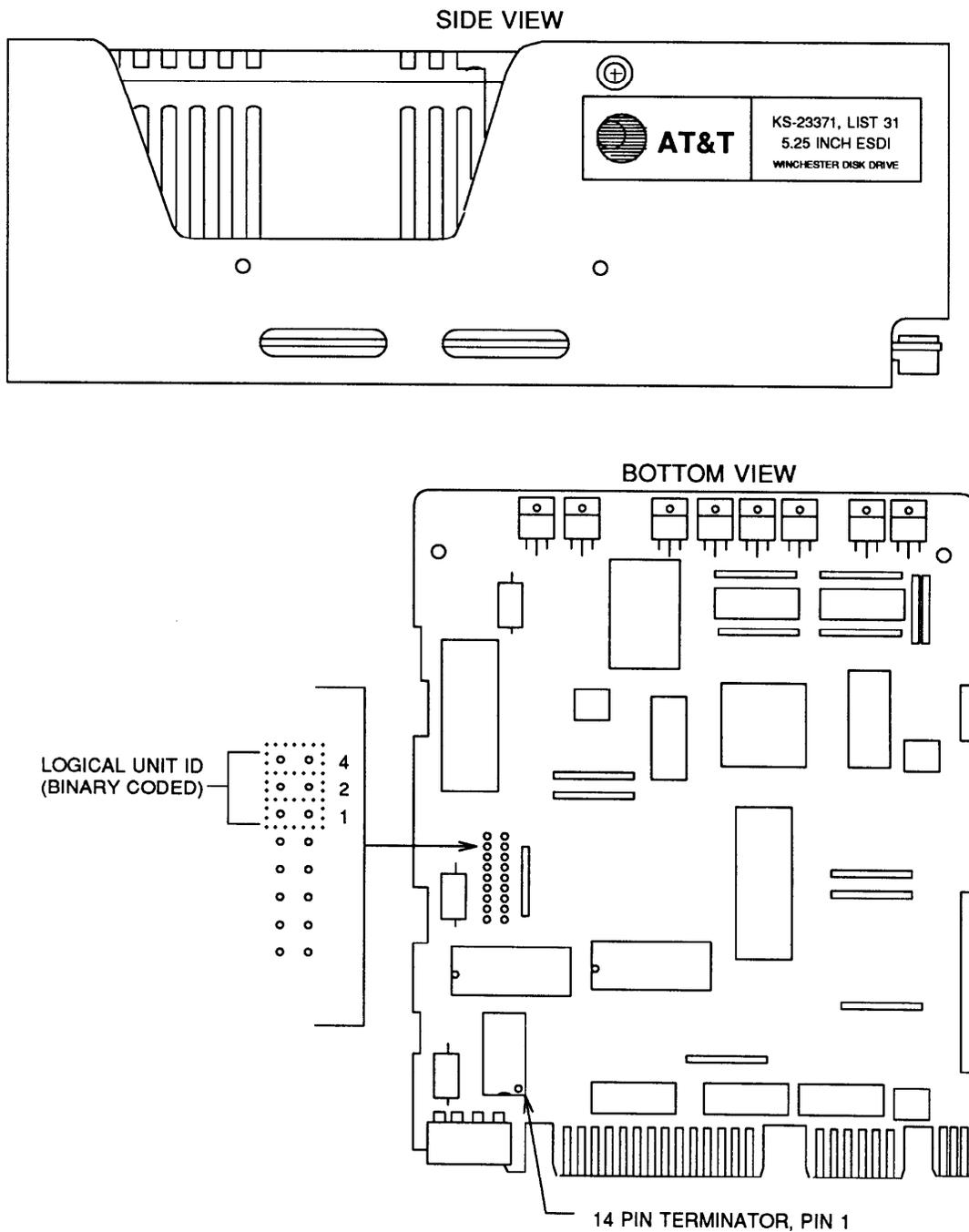
Figure E–9. KS-23371, L31 - 317 MB hard disk, Micropolis (ESDI)

SIDE VIEW

* CFAX123456 *

AT&T KS 23483, LIST 25
5.25 INCH SCSI
WINCHESTER DISK DRIVE

REAR VIEW

SCSI ID SELECT
AS FOLLOWS:

4 2 1
SCSI ID
(BINARY CODED)

50 PIN I/O
(CABLE STRIPE)

DC POWER

20 PIN TERMINATOR
PIN 1
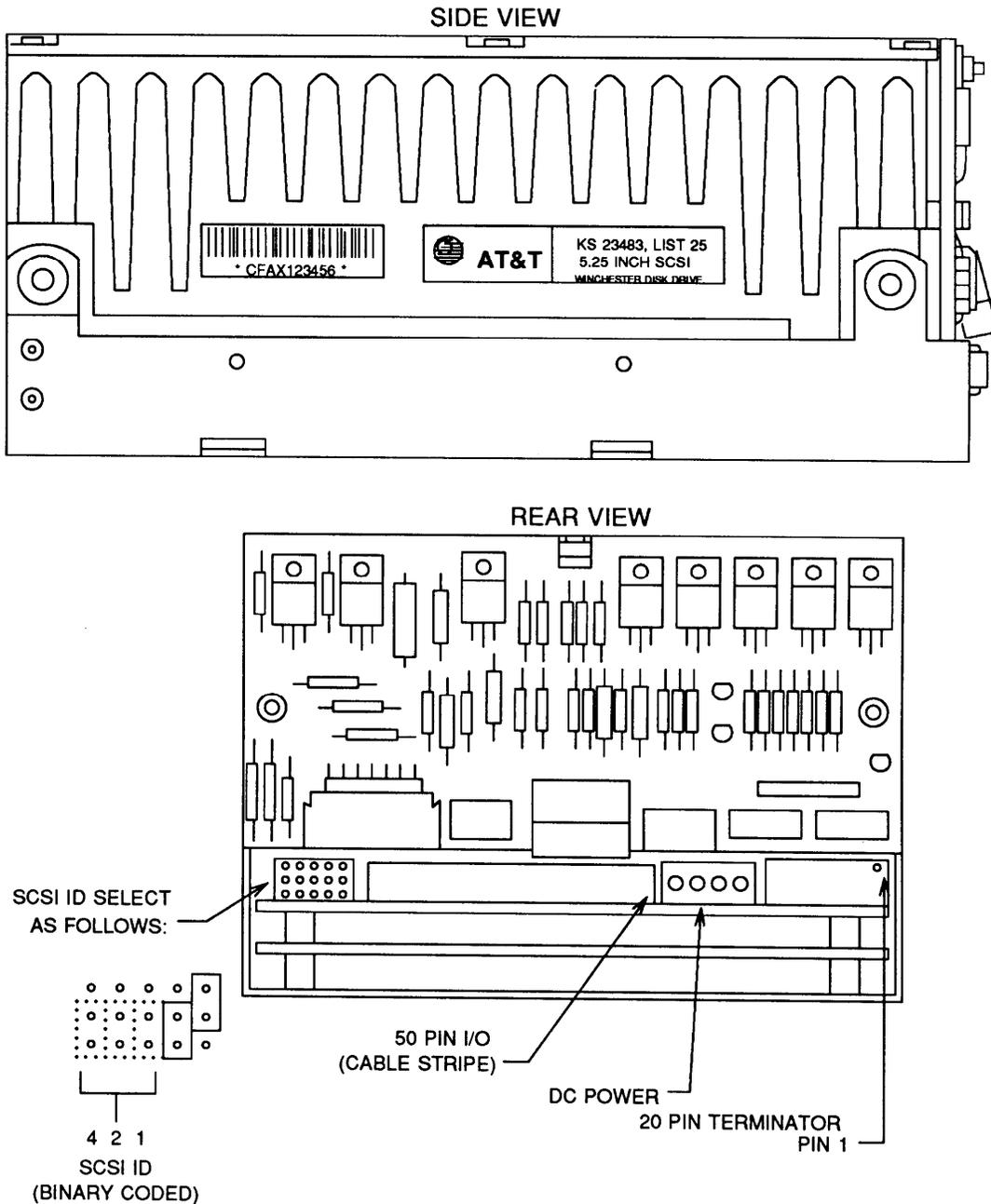
Figure E-10. KS-23483, L25 - 155 MB hard disk, CDC (SCSI)

SIDE VIEW

REAR VIEW

SCSI ID SELECT
AS FOLLOWS:

4 2 1

SCSI ID
(BINARY CODED)

14 PIN TERMINATOR
PIN 1

50 PIN I/O
PIN 1
(CABLE STRIPE)

JUMPER HORIZONTAL
ON LOWER SET OF PINS

DC
POWER

14 PIN TERMINATOR
PIN 1

Figure E-11. KS-23483, L3 - 327 MB hard disk, CDC (SCSI)

SIDE VIEW

REAR VIEW

DC Power

SCSI ID
SELECTION:

8 Pin TERMINATORs (3 SIPs)
Pin 1
(not present on differential drives)

50 Pin I/O
(cable stripe)

(early versions, lists 1 and 11, have only 5 pairs of jumpers)

4 2 1
SCSI ID
(Binary Coded)

Figure E-12.   KS-23483, L1B/11B - 322 MB hard disk, HP (SCSI)

Glossary

Introduction

The following terms and acronyms are used in the *AT&T 3B2 Computer Maintenance Reference Manual* and are related to the UNIX System and the 3B2 computers.

Terms

3B2 Maintenance Utilities Utility Program — A software modification mechanism that provides the means of formatting disks, displaying and modifying the bad tracks on a disk, and of copying information disk-to-disk or disk-to-memory.

3BNET — A local network interface that interconnects up to 30 3B computers over a common interconnection medium. *See also* **network interface.**

ACU — automatic calling unit.

AIC — alarm interface circuit.

ANSI — American National Standard Institute.

AOT — absence of tape.

ATP — all tests passed.

ASCII Code — American Standard Code for Information Interchange. An interface standard that allows eight-bit coded data to be transmitted between computers or between a computer and a terminal.

asynchronous terminal — A terminal that operates at a speed not associated with any particular portion of the computer to which it is connected.

baud — Data transmission speed (frequently equivalent to bits per second).

bit — One binary digit (0 or 1).

bits per second (BPS) — Data transmission speed.

block — One or more bytes treated as a unit for reading and writing data.

boot — The loading of a program or set of instructions from a peripheral device.

BOT — beginning of tape.

BPI — bits per inch.

BPS — *See* bits per second.

byte — eight bits - the equivalent of one character of text. *See* **Kbyte; Mbyte.**

cartridge tape — A cartridge containing magnetic tape used for storing information.

cartridge tape controller (CTC) card — An I/O card providing interface circuitry for cartridge tape drives.

cartridge tape drive (CTD) — A peripheral tape device using tape media packaged in 5 1/4" cartridges.

cathode ray tube (CRT) — A television-like display screen used extensively within the computer industry.

command line — A set of commands and arguments to perform one or more processing tasks. Commands always begin immediately after the shell prompt, and are separated by semicolons. They can continue for several (terminal) lines; up to 256 characters.

command — A word or string of letters and/or special characters that tells the computer what to do.

console — The main terminal from which your 3B2 computer is controlled. The console terminal connects to the console port.

contty — The name of the unlabeled serial port (next to the console port) that comes with a 3B2 computer.

CPU — central processor unit.

CRT — *See* **cathode ray tube.**

CTC — cartridge tape controller card.

CTD — cartridge tape drive.

CTS — clear to send.

DCM — SCSI disk controller module.

DB-**25** pin interface — An interface of 25 pins in a "D" shaped shell housing.

DGMON — diagnostics monitor.

diagnostic monitor (DGMON) — An on-line diagnostic tool that self-tests the 3B2 computer. A minimum of 80% of existing faults can be detected through use of the DGMON. Diagnostics can be normal, demand, and interactive phases.

diagnostics — A series of tests that your 3B2 computer performs to check its own operation.

DIP — dual in-line package.

directory — A special type of file containing the names of other files (including other directories) and a pointer to the control block used to access these files.

disk — Magnetic data storage device consisting of several round plates similar to phonograph records. Disks store large amounts of data and allow quick access to any piece of data.

DM — SCSI disk module.

DMA — direct memory access.

DTR — data terminal ready signal.

dual universal asynchronous receiver-transmitter-transmitter (DUART) — Two integrated circuits, perform serial-to-parallel and parallel-to-serial conversion of digital data.

DUART — dual universal asynchronous receiver-transmitter.

ED system board — In 3B2 computers, an ED system board has WE 32100 series chips.

EDT — equipped device table.

EIA — Electronic Industries Association.

Electronic Industries Association (EIA) — An organization that maintains standards for the electronic industry.

encryption of data — To encode data so that it cannot be read by someone not having knowledge of a special password or key.

enhanced ports card — An intelligent I/O card that provides eight RS-232-C ports.

EOT — end of tape.

EPROM — *See* **erasable programmable read-only memory.**

erasable programmable read-only memory (EPROM) — A programmable read-only memory that is erasable by exposure to ultraviolet light (or other special techniques), allowing it to be reprogrammed. *See also* **read-only memory.**

ESDI — enhanced small disk interface.

expanded I/O ports card — An intelligent I/O card that provides four RC-232-C ports and one CENTRONICS port.

expansion disk controller (XDC) card — This expansion card allows as many as two additional hard disks to be added to the system. Any drives (except 10 MB drives) available as integral disks may be added as expansion disks.

expansion module (XM) — An external storage device comprising several interdependent subassembly units that increase mass storage and/or I/O capability. The XM contains a cartridge tape drive that provides streaming tape back-up for 3B2 Models 300 and 310. It may also contain hard and/or floppy disk drives.

feature card — A circuit board that provides a hardware interface to connect peripherals to a 3B2 computer, or to expand its network communication capabilities (also known as an option card).

file system — A file arrangement on a segment of hard disk that can be mounted or unmounted for access by the operating system and/or users.

file — A collected body of data that has a discrete name.

FIRMWARE MODE — A special mode of the 3B2 computer that allows you to format floppy disks, make floppy keys, run diagnostics, and boot programs from hard or floppy disks.

firmware — Microprograms, usually on read-only memories. *See also* **hardware; software.**

firmware state — The operating state of the 3B2/600 computer that allows you to make a floppy key, run diagnostics, change the firmware password, dump the system image to a floppy diskette, test hardware and firmware, and display the system generic version.

floppy disk drive — A device that allows a 3B2 computer to read and write information to and from floppy disks.

floppy disk — A flat, flexible disk used as a removable storage media for saving or retrieving programs and data. *See also* **hard disk.**

floppy key — A floppy disk that allows you to enter the FIRMWARE MODE if you forget your firmware password. Restores NVRAM to default values.

formatted floppy — A floppy disk that has been subdivided by a computer program, so that data can be read from and written to specific areas on the disk.

full duplex terminal — A terminal that can send and receive data independently and simultaneously.

full restore — A complete reversion of the disk to its virgin state. A full restore of a corrupted disk is recommended if corruption is likely to be extensive and back-up files are available. *See also* **partial restore.**

GCR — group coded recording.

HA — host adapter.

hard disk drive — A disk storage device enclosed inside a 3B2 computer (or XM) used to store or access large amounts of data in a short time.

hardware — The physical components of a 3B2 computer. *See also* **software; firmware.**

ICACHE — internal cache.

input/output (I/O) — Path by which information enters a computer system (input) and leaves the system (output). An input device that you may use is the

keyboard. An output device might be a terminal or printer.

I/O — input /output.

I/O backplane — An input/output backplane that provides outside interface to the system's input /output bus.

ix "Intelligent serial controller card (ISC)" "" intelligent serial controller card (ISC) — Allows synchronous interface with IBM 3270 mainframe computers. Applications software must be loaded before the machine is initialized or the UNIX operating system will not recognize the ISC card.

ISC — intelligent serial controller.

K (or KB) — An abbreviation for "kilo" - 1,000 (with reference to memory, actually, 2 to the power of 10, or 1024). For example, one kilobyte equals 1 Kbyte, or 1024 bytes. *See also* **M.**

KB — kilobyte.

LAN — local area network.

login — A string of letters and/or numbers, unique to each system user, that allows the 3B2 computer to identify with whom it is communicating.

LU — logical unit.

M (or MB) — An abbreviation for "mega" - 1,000,000 (actually, in computer terms, 1,048,576, or 2 to the 20th power). One megabyte equals 1024 kilobytes. (With the introduction of SCSI Release 3.0, the definition was changed to equal 10 to the 6th power). *See also* **K.**

math accelerator unit (MAU) — A floating point hardware chip.

MAU — math accelerator unit.

MB — megabyte.

modem — A device (modulator-demodulator) used to transmit digital data over voice telephone lines, allowing one computer to "talk' with another, or a terminal to communicate with a distant computer.

modular connector — An RS-232-C serial interface that uses an 8-pin modular telephone jack or plug.

mouse — A special, hand-held input device that moves a cursor or enters commands.

MPB — multiprocessor enhancement board.

MTBF — mean time between failure.

multi-user state — The operating state of the 3B2 computer that allows more than one person to use the computer simultaneously. Also called "run level 2."

network interface (NI) card — Also known as 3BNET, this local network interface allows interconnection of up to 30 other AT&T 3B and/or other computers. The NI card uses the ETHERNET protocol. (See **3BNET.**)

NAU — network access unit.

NI — network interface card.

nonvolatile random access memory (NVRAM) — Small section of RAM that contains essential information to boot system that is normally lost when power is interrupted.

NVRAM — *See* **nonvolatile random access memory.**

operating state — An "environment" (defined internally by the computer) in which the computer must be running for specified functions to be performed. The 3B2/600 computer has seven operating states (0-6): powerdown state (0), single-user state (1), multi-user state (2), two-unassigned states (3 and 4), firmware state (5), and reboot state (6). Also called "run levels."

parallel — The ability to transmit data more than one bit at a time. *See also* **serial.**

parity — A method of detecting certain data transmission errors.

partial restore — A software restoration from core UNIX floppy diskettes following corruption. A partial restore returns all system files to their original state, but does not erase any added */usr* files. *See also* **full restore.**

partitioning — A way of dividing a large memory range into more management pieces to facilitate structuring of a device. Device partitions are applicable to floppy diskettes, cartridge tapes, and hard disks (NOT main memory).

password — Any combination of alphanumeric and special characters, unique to each system user. A password must be entered before files can be accessed. Passwords are encrypted by the system to provide an extra measure of security.

Pcache — physical address cache.

PE — processing element.

PROM — programmable read-only memory.

peripheral device — Auxiliary devices under the control of the main computer, used mostly for input, output, and storage functions. Some examples include terminals, printers, and disk drives.

port — A connection between a computer and an input/output device through which the data is transferred.

programmable read-only memory (PROM) — A type of read-only memory that can be programmed. *See also* **read-only memory.**

PROM — *See* **programmable read-only memory.**

prompt — A symbol or string of characters that lets the user know when a new command can be entered. "$" is the UNIX System shell default prompt.

queue — A sequential list of items (for example, processes) that are awaiting execution.

RAM — *See* **random access memory.**

random access memory (RAM) — A type of memory that you can use to directly access any location in memory, and is both written into or read from. *See also* **read-only memory.**

read-only memory (ROM) — A type of memory chip that has information "built in" during its manufacture that cannot be subsequently modified by the user. *See also* **random access memory; erasable programmable read-only memory.**

ROM — *See* **read-only memory.**

root directory — The highest ranked directory in the UNIX System file structure. Root is the directory from which a file system is built. It is also referred to by the symbol /.

root login — The login ID that allows you to be super-user to do administration work.

RS-232-C — The standard serial interface adopted by the Electronics Industry Association.

RTS — request to send sanity — A term that refers to basic processor functionality.

SBD — system board.

SCSI — Small Computer System Interface.

SCSI — *See* **Small Computer System Interface.**

SCSI HA — SCSI host adapter.

serial — Transmission of data more than one bit at a time. *See also* **parallel.**

SIP — single in-line package.

software — The programs that are available to make your 3B2 computer perform its functions. *See also* **hardware; firmware.**

spooling — The process of controlling jobs (through scheduling, queuing, etc.) to be done by the computer.

SSI — standard serial interface.

streaming — A mode of tape drive operation where data is written to tape in a continuous fashion.

super-user — *See* **root login.**

system administration menus — A special set of menus listing interactive commands that help you perform system administration tasks on a 3B2 computer.

system board — The circuit card that contains the main logic circuits comprising the processing center of a 3B2 computer.

tape module (TM) — An AT&T device that allows tape back-up of hard disk data. The most common example of this is a CRT and a typewriter-like keyboard. The keyboard provides input capability.

terminal — A device that provides the human I/O interface for a computer system. The program output is displayed on the monitor screen.

TM — *See* **tape module.**

TPI — tracks per inch.

UART — universal asynchronous receiver transmitter.

Vcache — virtual address cache.

VOM — volt ohmmeter.

VTOC — volume table of contents.

XBI — expansion bus interface.

XDC — expansion disk controller.

UNIX operating system — General-purpose, multiuser, interactive, time-sharing operating system for the 3B2 (and other) computers. It is a disk-oriented system that features software and text-developing utilities.

XM — *See* **expansion module.**

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