# FORTUNE SYSTEMS
# 32:16
# FIELD SERVICE MANUAL

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**FORTUNE SYSTEMS 32:16 FIELD SERVICE MANUAL Revision 4/87**

Version 4/87 of the 32:16 Field Service Manual supersedes all previous editions. The revision updates all existing information including that in the Hardware Reference Guide, and in addition, covers the SCSI subsystems and Streaming Tape Controller.

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# CHAPTER 1

## INTRODUCTION

The Fortune 32:16 family of business computer systems is designed to meet the needs of today's serious minded businessmen, with the power of a multi-user, multi-tasking minicomputer operating system, in a simple to operate desttop microcomputer. The systems are designed to allow users to configure office automation system to conform to the particular needs of their businesses, and to allow maximum flexibility as that business grows from a single user word processor to an international network of computer systems.

To meet these needs, the Fortune 32:16 systems have been designed with the following features:

- The Motorola 68ØØØ microprocessor (6MHz or 12MHz).
- The Fortune operating system FOR:PRO, based on the UNIX™ minicomputer operating system originally developed by Bell Laboratories.
- Easy to use menu-driven integrated application software which provides the user with powerful word processing, electronic spread sheet, and business accounting capabilities.
- A comprehensive array of communications capabilities which allow a user to interface with other computer systems to access and use their data bases.
- A modular design of the hardware and software for ease of system maintenance, and expansion.
- A worldwide network of authorized dealers, and service centers to support the 32:16 system hardware and software, insuring that each user has access to the latest technology with which to manage the system.

**FORTUNE 32:16 FAMILY HARDWARE CONFIGURATIONS**

Fortune Systems provides a wide range of products. This manual depicts the 32:16 system family of desk top computers configured to meet the varying needs of a wider range of users. The 32:16 family includes the Basic 32:16, PS, XP, and SX series. The Basic 32:16, PS, and the first XP systems all included a monitor, CPU (Central Processing Unit), and keyboard. The new XP's and SX system consist only of a CPU.

The **System 10** and **System 20** are the basic 32:16 systems. These systems will support up to 1 megabyte of main memory and have 5 I/O slots. There are 2 of the 5 I/O slots are already filled, one slot for the WD controller and one slot for the video controller, leaving three unused slots for expansion of additional users or devices.

The **PS20** and **PS30** systems are limited capability systems. These systems will support up to a half megabyte of main memory and have 3 I/O slots. Two of the 3 I/O slots are already filled, one slot for the Wd controller and one slot for the video controller leaving only one unused slot for expansion of additonal devices.

The **XP30** and **XP45** systems are high performance systems with full expansion capacity, and high-speed 30- or 45-megabyte voice coil hard disk drives for high use multiuser systems where maximum performance is required. These systems will support up to 2 megabytes of main memory and have 5 I/O slots. On the earlier XP systems 2 of the 5 I/O slots are already filled, one slot for the WD controller and one slot for the video controller leaving 3 unused slots for expansion of additional users or devices.

The newer XP systems are referred to as "alternate console" systems. They contain the latest version of the O.S. (1.8 or above) and the newest MOM ROMS (1.8). One of the 5 I/O slots is already filled by the WD controller, leaving four unused slots for expansion of additional users or devices. The need for a video controller is eliminated; any one of the attached terminals can be used as a console. This gives customers the maximum flexibility in configuration.

The **SX45, SX70, SX45T,** and **SX70T** expand the capability of the Fortune 32:16 in three dimensions: processing power, storage capacity, and internal tape backup capability. The heart of the SX series is a 12MHz microprocessor which increases the processing power dramatically, and provides significant performance improvement over the PS and XP series.

The SX45 and SX70 products contain 1 megabyte of main memory, expandable to 3.5 megabytes, and 5 I/O slots available for user-selected option controller boards (the WD controller claims on e of the five slots in the CPU cabinet). The SX45T and SX70T series contain 1 megabyte of main memory, expandable to 3.5 megabytes, and 5 I/O slots available for user-selected optin controller boards (WD controller and PIO Tape controller claim 2 of the 5 slots in the CPU cabinet).

The SX series are configured with the FOR:PRO 2.0 Multi-user operating system which provides the capability of 3.5 MB main memory and an "alternate console". Therefore, the console, deyboard, and CRT controller boards are no longer bundled with the SX products. This feature gives the user a choice between using an FIS 1000 Workstation or a Fortune Basic Workstation as the console for the SX products.

The **SX145T** is the newest addition to the 32:16 product line. The SX145T expands the capability of the Fortune 32:16 in two ways: processing power and storage capacity. The SX145T includes a 5 1/4" Winchester disk drive which provides 145 MB of formatted disk capacity. The disk controller card has changed from a ST506 interface to a SCSI (Small Computer System Interface). A single SCSI controller provides the interface for both the Winchester disk and 60 MB internal tape. The advantage being one more I/O slot is available for other Fortune supported I/O options. Another advantage is the SCSI controller will support up to eight disk and tape devices.

**OPTIONAL HARDWARE**
The Fortune 32:16 system capabilities can be expanded through the use of add-on hardware option boards. The options are designed so that the user can obtain an optimum system configuration to meet immediate computing needs, and yet be assured of increased capacity for future needs.

**Additional memory** is available for the system in 256KB increments, up to 3.5 Megabytes. As the user's system grows, the performance of the system can be improved through additional memory.

**Additional online hard disk storage** of up to three hard disk drives may be added to allow for system expansion when needed.

**Streamer tape cartridge storage** may be added to allow the user quick and easy backup and restoration of system data and software.

**Asynchronous Communications** controller (Comm A) can be installed in 2-, 4-, or 6-port increments. Additional printers, intelligent workstations, or communications links to other systems can be easily added to the system.

**Synchronous Communications** controller (Comm B) can be installed in 2-port increments to communicate with devices using synchronous communications protocols.

# CHAPTER 2

# HARDWARE OPERATION

The Fortune 32:16 hardware has been designed for ease of maintenance. Each system assembly can be easily exchanged, and problems quickly isolated and resolved with a minimum of user downtime. A key to the ease of maintenance is an understanding of the operation of the system hardware. This chapter provides an overview of the system hardware, and how the various subsystems interact with each other. The system block diagram (Figure 2-1) is a representation of the system hardware interface. Refer to it while reading this chapter to help keep the information in perspective.

## CLB DATA BUS

The CLB data bus consists of 16 data paths, and additional bus control paths. The CLB data bus is connected to all major system devices and is used to transfer data between the microprocessor, memory and system devices.

## CLB ADDRESS BUS

The CLB address bus consists of 23 address lines, and additional bus control paths. The CLB address bus is connected to all system devices and is the means by which system devices are addressed.

## MEMORY

The memory is used to store the system programs and data for use by the microprocessor. The information stored in memory is organized in 16-bit words; each word is divided into two 8-bit bytes. Each byte has an individual 24-bit address associated with it, starting with location Ø and continuing through the last location in memory. Each byte of data stored in memory has a parity bit for error detection.

The 32:16 has a minimum memory capacity of 256KB expandable in 256KB increments to a maximum capacity of 3.5 megabytes.

## MEMORY MANAGEMENT UNIT

The Memory Management Unit (MMU) is the interface between the processor address bus (PAB) and the CLB address bus. The MMU under control of the operating system dynamically reallocates system resources as required without time consuming software algorithms or dedicated memory management schemes.

The MMU also allows areas of memory to be write-protected so that important system information cannot be destroyed inadvertently. This feature protects the system from software errors which are difficult to detect or correct, and protects each user's data from damage caused by another user.

## THE MICROPROCESSOR

The Motorola MC68000 microprocessor chip is the heart of the 32:16 computer. The name 32:16 is derived from the internal architecture of the 68000 in that the registers in the chip are 32 bits wide while the data paths are 16 bits wide.

Within the 68000 chip, are eight 32 bit data registers, seven 32 bit address registers, two 32 bit stack pointers, one 32 bit program counter, and one 16 bit status register. The chip is capable of directly addressing up to 16MB of memory, and can move data one or two bytes at a time into or out of its internal registers.

The external connections of the 68000 are shown in Figure 2-2. There are 64 input/output pins on the chip grouped as follows:

- **Address Bus** - 23 unidirectional address bus lines A1 through A23 used to provide a base address to the MMU.
- **Data Bus** - 16 bidirectional data lines D0 through D15 to transfer data into and out of the microprocessor.
- **AS** - Address strobe - indicates that the address currently on the Address bus is valid.
- **R/W** - Read/Write - the microprocessor is reading data from the data bus. When negated, the microprocessor is writing to the data bus.
- **UDS** - Upper Data Strobe - the microprocessor is addressing the upper byte of the word being operated upon. (Bits 8 thru 15).
- **LDS** - Lower Data Strobe - the microprocessor is addressing the lower byte of the word being operated upon. (Bits 0 thru 7).
- **DTACK** - Data Transfer Acknowledge - either data is being transferred into the microprocessor from the addressed device, or data transferred from the microprocessor has been received by the addressed device.
- **BR** - not used.
- **BG** - not used.
- **BGACK** -not used.
- **IPL0,1,2** - Processor Interrupt bits 0,1,and 2, when asserted, indicate the priority level of the device interrupting the microprocesser. The lowest interrupt priority is level 1; the highest is level 7. (See Priority)

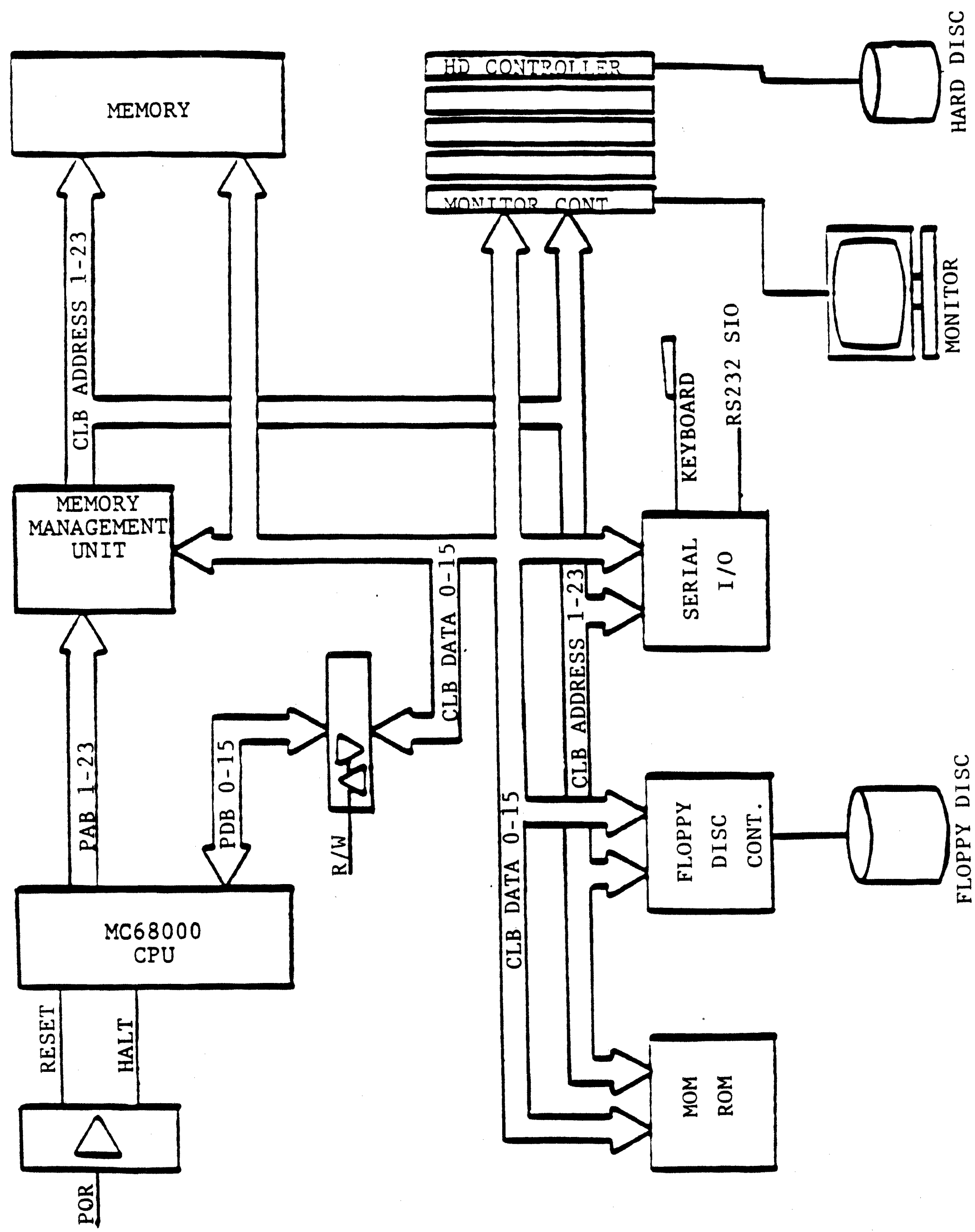


Figure 2-1

System Block Diagram

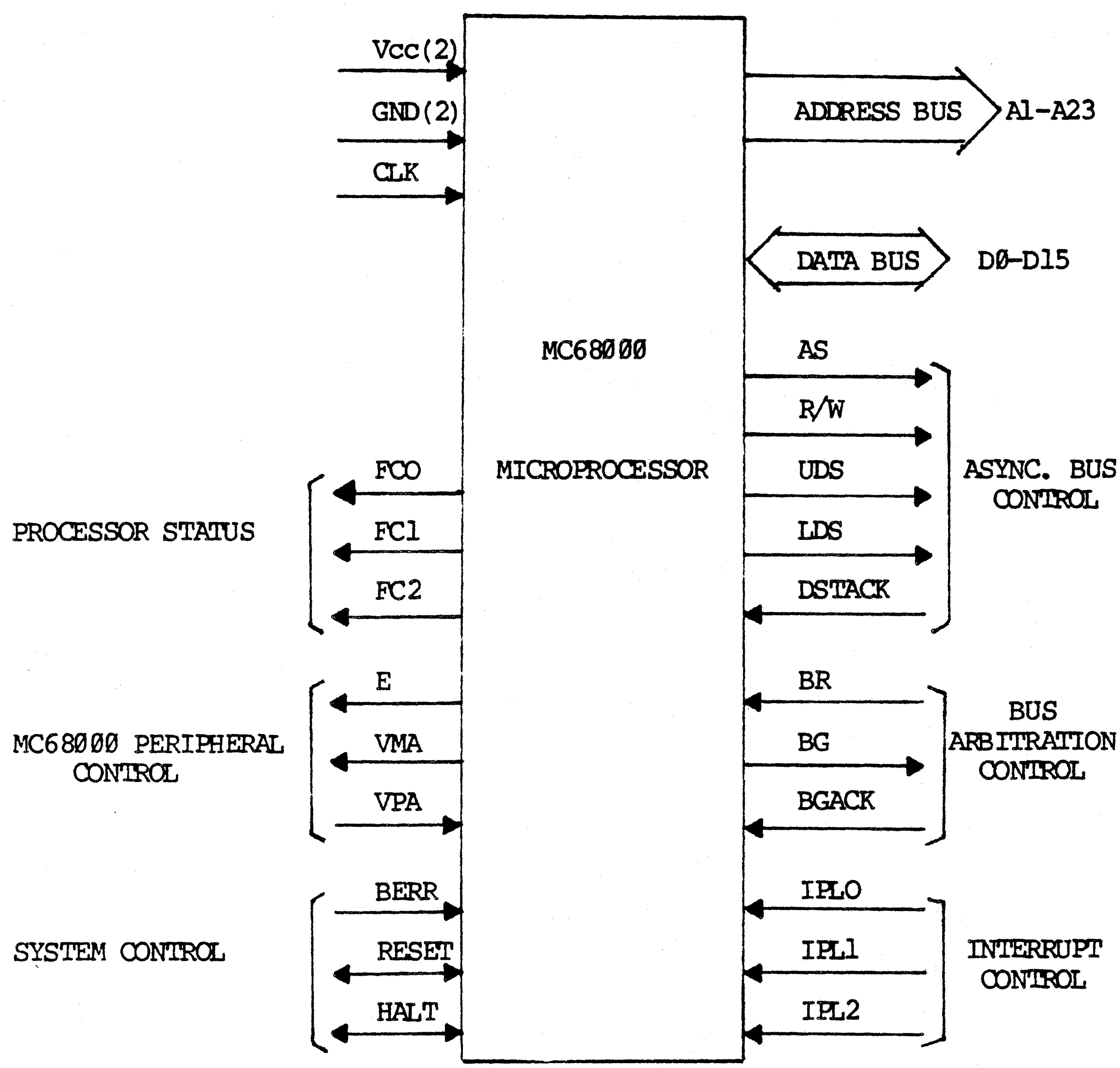


Figure 2-2

68ØØØ Input and Output Signals

- **Halt** - Bidirectional signal that halts the microprocessor (input) or indicates that the processor has executed the Halt command.
- **Reset** - Bidirectional signal that resets the microprocessor (input) or indicates that the processor has executed the Reset command (output).
- **BERR** - Bus Error - when asserted a bus error has been detected by the system. The Bus Error can be caused by either hardware or software errors.
- **VPA** - not used.
- **VMA** - not used.
- **E** - not used.
- **FC Ø,1,2** - Function Code bits Ø,1 and 2 from the Processor Status Word indicate what function the processor is performing and are decoded as follows:

| Binary | Decimal | Function |
|---|---|---|
| FC = ØØØ | (Ø) | Unassigned |
| FC = ØØ1 | (1) | User Data |
| FC = Ø1Ø | (2) | User Program |
| FC = Ø11 | (3) | Unassigned |
| FC = 1ØØ | (4) | Unassigned |
| FC = 1Ø1 | (5) | Supervisor Data |
| FC = 11Ø | (6) | Supervisor Program |
| FC = 111 | (7) | Interrupt Acknowledge |

- **CLK** - 5.5 Megahertz clock (18Ø ns/cycle)
- **GND** - Electrical Ground
- **Vcc** - +5 VDC

## MICROPROCESSOR OPERATION

The microprocessor performs its work by fetching instructions stored in memory and executing those instructions. For example if the instruction were to add two numbers, the processor would address and read in the first number from memory, then the second number, add the two together and store the sum in another memory location.

The process is more complex however. The processor must retrieve a word processing file from a location on the hard disk, load it into an area of memory not being used by any other user, display the information on the proper screen, and at the same time, keep the Multiplan data coming in from another terminal from getting mixed in.

## PRIORITIES

Part of the process which makes the operation of the microprocessor less complex is the assignment of a priority to each device. Since the microprocessor is capable of executing only one instruction at a time, each function must be prioritized so that it can be serviced in a logical sequence.

Generally, priorities are assigned to devices in relation to their data transfer speed and relative importance in the system. Slower devices usually are assigned a lower priority.

The fastest devices, such as the hard disk controller and Comm-6 controller, are capable of transferring data to and from memory directly with their own on board processors, and are called direct memory access or DMA devices. Bus arbitration circuitry on the motherboard determines which DMA device controls the bus, and therefore, has access to memory. The microprocessor is assumed to always want the bus. Whenever the microprocessor and a DMA device contend for the memory, the arbitration circuitry allows both devices to share the bus, each transferring one word at a time.

### Interrupts

Other devices in the system such as the keyboard, and Comm-A controller, are much slower or are not used as often as the DMA devices. It would be uneconomical to provide a dedicated processor for each device, used only to move data to and from memory. The keyboard for example, can move 240 characters a second (2400 baud), while a microprocessor can move over 400,000.

A way has been devised to interrupt the processor and have it execute a service routine to move data between these slower devices and memory. The interrupting device responds to the microprocessor with a "vector number", which is the address of the address of the location of its service routine. The interrupt sequence flow chart (figure 2-3) shows how a typical interrupt is processed.

The processor has the capability of "masking" or not responding to selected interrupts so that when the system is busy with a highter priority interrupt it won't be disturbed by a low priority device. Interrupt masks are set by the system software, and are a part of the processor status word.

With the possibility of several devices interrupting the processor at once, each device is given an interrupt priority. Table 2-1 lists the relative priority of each device in the system.

The highest priority function in the system is memory refresh, because if memory is not refreshed, data is lost. The lowest priority device of the system is the flexible disk. Its input data is stored in a buffer and the system can postpone service to it for relatively long periods of time.

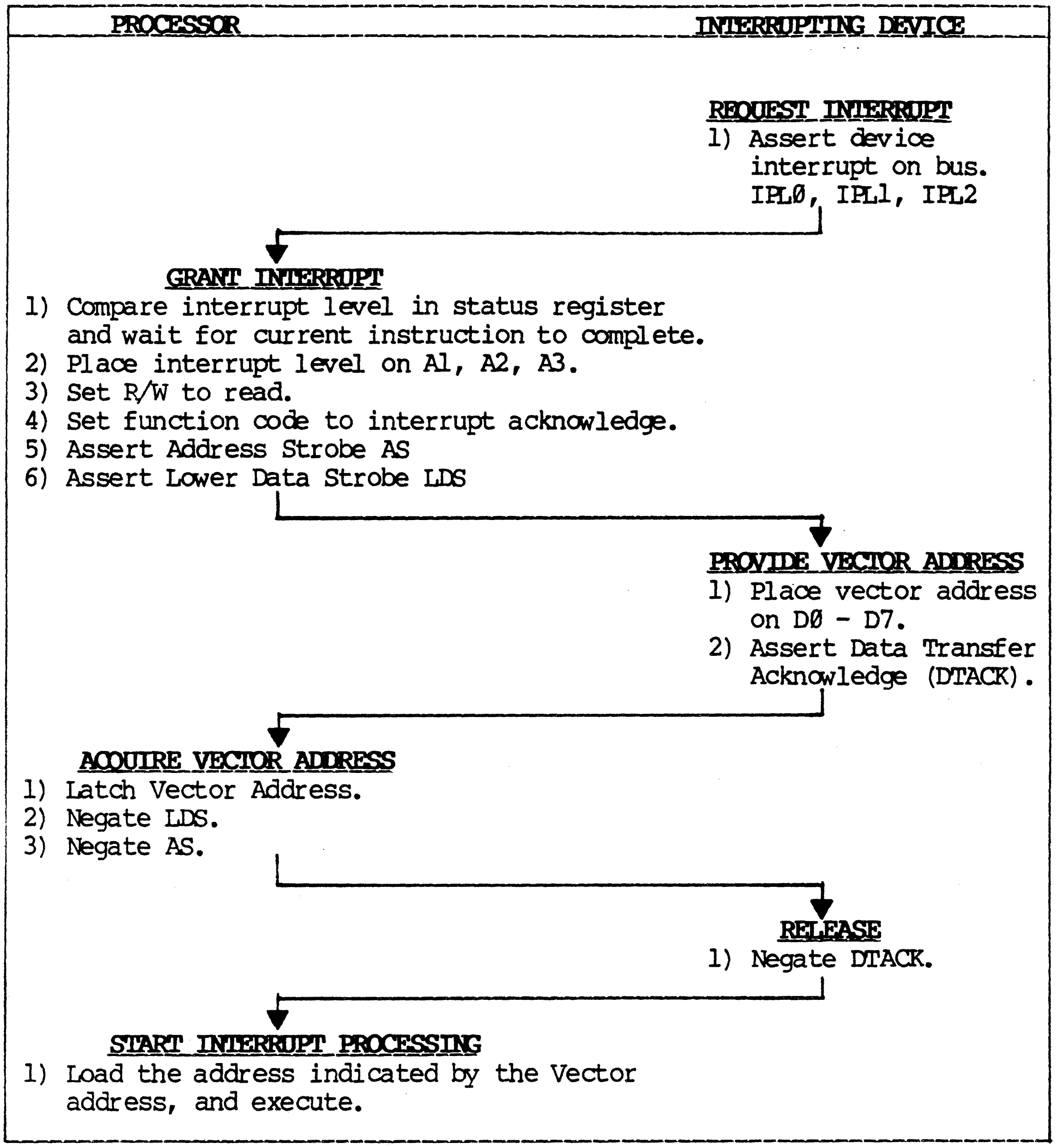


Figure 2-3
Interrupt Sequence Flow Chart

| Priority Level | Devices |
|---|---|
| DMA Devices | Priority for DMA Transfer into memory is established by slot location. Slot A being the lowest, and Slot E being the highest. |
| MPU | The microprocessor has priority if no DMA device is active on the bus. The MPU will alternate bus cycles with active DMA devices. |
| Interrupt Level 7 | Power Failure, Parity Error, Memory Refresh Time Out. Cannot be masked in Processor Word. |
| Interrupt Level 6 | The Central Logic Timer |
| Interrupt Level 5 | Serial I/O Port, Keyboard Port, Comm-6 Board |
| Interrupt Level 4 | Comm A Board, LAN Controller |
| Interrupt Level 3 | Comm A Board, WD Controller, SCSI Controller |
| Interrupt Level 2 | Flexible Disc Controller |
| Interrupt Level 1 | Software Controlled Timer Interrupt |

Table 2-1

Relative Priority by Device

## THE KEYBOARD

The keyboard consists of a standard typewriter keyboard, a ten-key numeric key pad, and an array of special function keys. When a key is pressed, drivers on the keyboard electronics board detect the change and determine the x and y coordinates of an address in the keyboard read only memory chip (ROM). The character code in that location is clocked one bit at a time into the serial I/O logic. The characters transmitted from the keyboard ROM are in ASCII code (American Standard Code for Information Interchange). Characters generated by the function keys and numeric keypad are each prefaced by a CTRL A (Ø1 hex) and followed by a carriage return character (ØD hex). The console keyboard is optional with the latest Fortune O.S., since a Fortune terminal can also act as the system console device.

## THE SIO PORT

Each 32:16 has a serial input and output port (SIO) for communication with such external devices as a printer, modem, or another Fortune system. The SIO port can transmit or receive at speeds up to 19,2ØØ baud, and is an EIA standard RS 232-C, DCE device.

******** C A U T I O N ********

When connecting devices to the SIO Port, refer to chapter 6 for proper cable selection. Failure to use the correct cable can cause improper operation or equipment damage.

## SERIAL I/O LOGIC

The keyboard and SIO port are connected to the processor via the serial I/O logic located on the motherboard. The logic consists of a dual asynchronous receiver transmitter chip (DART), and timing and control circuits. The SIO logic is a priority 5 interrupt device and although it provides a separate vector number for each port of the DART, the interface with the processor is the same.

The DART keyboard port receives data from the keyboard one character at a time and changes it from a serial to a parallel data byte. The character is stored in the SIO logic output buffer and the processor interrupt sequence is initiated to store the byte in the keyboard input buffer in main memory.

## FLEXIBLE DISK SUBSYSTEM

The flexible disk subsystem stores system data and programs on removable magnetic media so that information in the system can be more easily safeguarded and transported. The flexible disk subsystem is the means used to enter the initial system software and to backup and archive both system software and data files.

The flexible disk subsystem consists of a flexible disk controller chip, associated timing and control logic, a 2K buffer RAM, and up to four 8ØØK byte flexible disk drives. Data is transferred to and from the subsystem in 1K byte blocks, one byte at a time.

## HARD DISK SUBSYSTEM

The hard disk subsystem provides the system with a large capacity online storage for system software and data files. The subsystem consists of a microprocessor-controlled DMA disk controller and up to four hard disk drives of 10, 20 or 30 megabytes each.

When the system needs data files or software loaded into memory, the 68000 microprocessor transfers the address of the file it wants, and the location in memory where the file is to be stored to the disk controller. Through the commands from its own microprocessor, the disk controller finds the data on disk, loads it into the designated memory location via a DMA transfer, and notifies the system when the transfer is completed.

## MOM ROM

The system MOM ROMs, located on the motherboard, are two 8KB EPROMs containing software and data used to power up the system. After the microprocessor detects a power on reset, it loads and executes the start up program located within the MOM ROM. The start up program will direct the execution of power on diagnostics, validate system auto configuration, and load the operating system.

## CONSOLE SUBSYSTEM

The console subsystem displays information for the operator. The monitor subsystem consists of a monochrome monitor and a CRT controller board. Data to be displayed is loaded by the microprocessor into RAM on the monitor controller. Characters are read from the RAM by the CRT controller logic as they are displayed on the screen.

Each character consists of a matrix 9 dots wide and 10 dots high. There are 25 lines of 80 columns each displayed on the screen. Each character stored in the RAM consists of one byte of character data, and one byte of character attribute data. The system is capable of displaying character attributes such as reverse video, highlighted video, underline, double-underline, overstrike, and other special attributes.

The console subsystem is optional with the latest Fortune Operating System, since a Fortune Terminal can now act as a system console device.

## RESET SWITCH

The reset switch should be used **only** if the system is running in maintenance mode (i.e. booted from the floppy drive) or is "hung" and will not respond to input from any terminal. Using the reset switch during normal system operation may result in loss of data and/or file system damage. To operate the reset switch insert a thin object into the round hole in the lower left-hand section of the front panel of the machine. A straightened paper clip or a small screwdriver works well for this purpose. Push in lightly and release. The count-up will then start on the console.

# CHAPTER 3

# SOFTWARE OPERATION

## THE OPERATING SYSTEM

The Fortune 32:16 series of computers use the UNIX operating system. Fortune Systems has enhanced UNIX to make it an easy-to-use microcomputer operating system compatible with both the Motorola 68000 microprocessor and the flexible disk environment of an efficient office system.

Fortune Operating System (FOR:PRO) is based on UNIX version 7.0, with additional utilities from the University of California at Berkeley 4.1 UNIX, and the Bell Laboratories UNIX system 3. Complete documentation for all available system utilities and commands is provided as a part of the Software Development Tools. The FOR:PRO Programmer's Manual is also available separately, and is a valuable reference guide for those not interested in the development tools software.

It is assumed that the readers are familiar with the FOR:PRO operating system and the Bourne shell. This chapter is intended to provide information on system utilities not used on a day-to-day basis rather than be an introductory guide to UNIX or FOR:FRO. Those in need of basic understanding of the operating system should refer to the FOR:PRO User's Guide or one of the many introductory books on UNIX.

## SOFTWARE SECURITY

A means has been developed for the Fortune 32:16 system to protect the software from being loaded onto a system for which it has not been licensed. Each Application disk is licensed to operate on only one system. Use of the same software in another system is a violation of the Software License Agreement.

Once a protected software disk has been loaded onto a system, it cannot be used to load that application onto any other system. If an attempt is made to load an application from one system onto another, the system will either not load the application and notify the operator that an "illegal" disk is loaded in the system, or the application will not run when selected from the global menu.

## SOFTWARE MAINTENANCE

The Fortune 32:16 system is capable of holding the total business records and future plans of a good-sized company. Loss of those records and plans, because of a system failure, can be catastrophic to a business.
System management practices to safeguard system software and data should always be taken. Backup copies of the operating system and application software should be made and kept in a safe place. Backup copies of the data files should be made as often as practical so that if trouble arises, the system can be brought up to date as soon as possible. The disks used to copy the operating system, applications, and data files should be certified for a minimum of 96 tracks per inch, 80 tracks per side double-density, double-sided, soft sectored. Tapes used to backup the system must be certified 100% error free.

**The system will not allow installation, removal or duplication of system software unless the operator is logged in as "root" or "manager".**

**'COLD BOOTING' the system (Loading FOR:PRO from flexible to hard disk)**

The cold boot procedure for the Fortune 32:16 is detailed in the Fortune 32:16 Setup Guide. **COLD BOOTING OF THE SYSTEM SHOULD ONLY BE DONE WHEN UNAVOIDABLE AS ALL DATA ON THE HARD DISK IS ERASED DURING COLD BOOT.**

## THE FILE SYSTEM STRUCTURE

The UNIX file system is a disk data structure accessed via block structured I/O (see special files types below). A disk is considered to be a randomly addressable array of 512 byte blocks.

### Disk Data Structure

UNIX divides the disk into at least two partitions. A partition is a group of blocks reserved for a particular purpose. The number of blocks in a partition depends upon the contents or purpose of that partition. The purpose of the first three partitions is as follows:

### Partition Ø

This partition contains the 'Boot program', the 'Spare blocks', and the 'Configuration file'. The boot program searches for and loads the operating system or other "control' program into main memory as specified by the operator. (The operator usually enters this 'boot file name' on the maintenance screen). The configuration file contains special system and device information such as the size and type of disk and the size and starting block number of all partitions. See the entry on "rdconf" in the FOR:PRO Programmer's Manual.

### Partition 1

This partition contains 'Swap space'. Swap space is a number of blocks reserved for use as a temporary 'buffer' area for programs (called processes) awaiting main memory resources.

**NOTE:**
The swap space is only used on one of the physical drives on the system, that drive is usually the 'root device'.

### Partition 2

From the beginning of partition 2 to the end of the disk is space for the files (usually referred to as 'the file system'), the 'Super Block', and the i-nodes. The 'Super Block' contains, among other things, the 'free-list', and the 'i-list' (i stands for index).

The free space on the disk is maintained by a 'linked' list of the available blocks. This list is called the 'free list'. (A linked list is a data structure wherein each element contains the address of the next element, therefore a file can be broken up into segments and does not require contiguous space on the disk. This allows much more efficient use of disk space and much easier maintenance of files).

The i-list is a list or table of addresses of file definitions. Each file on the system has an entry in the i-list which points to another entry called an i-node. The i-node contains a description of the file including:

1. The owner and group id number (uid and gid).
2. The protection mode for that file.
3. The physical address of the file on the disk.
4. The size of the file.
5. Time of creation and last update of the file.
6. Number of links to the file.

Each file on the system has an 'i-number' associated with it just as it has a 'filename' (see Directory Implementation below). This i-number is used to address the i-list to obtain the i-node for that particular file. Armed with the information in the i-node, UNIX is able to physically locate the file on the disk and determine other facts about it. The use of the i-number, i-list, i-node structure also allows us to use different 'filenames' in different directories for the same physical file, and also to use the same 'filename' in different directories for different physical files. The number of directories referencing the same file via the i-number is called the number of 'links' to that file. With the correct options defined the ls (list) command will display the i-number, filename, etc. of each file.

NOTE The area normally used by partition 2 may be divided into more than one partition, in which case partitions 0 and 1 remain the same but partitions 2 thru 7 (maximum) will be separate file systems.

### Directory Implementation

A directory is simply an ordinary file that contains a list of file names and i-numbers. The logical directory hierarchy is imposed by allowing directory entries to reference other directories.

### Removable File Systems

It is not necessary for the entire file system hierarchy to reside on the same physical or logical device. The mount command will 'attach' or link a special file associated with the disk to an existing directory on the current file system. The disk to be 'mounted' must contain a correctly established file system. After the mount there is virtually no difference between files on the removable volume and those on the permanent file system.

The only exception to the rule of identical treatment is no link may exist between one file system hierarchy and another. This is to avoid the massive bookkeeping requirement to assure removal of all links whenever the removable volume is unmounted.

Special File Types

There are two types of special files, the block file (for structured devices), and the character file (for unstructured devices). A special file has an i-node associated with it (as do all files). However, instead of containing physical addresses it contains the internal device name. A device name is actually a pair of numbers representing the device type and subdevice number. These numbers are called the major and minor device numbers.

Block Files

A block or structured device is accessed as blocks of storage 1024 bytes long. The device driver (pointed to by the major device number) provides the buffering software to implement this model in memory. Disks and tapes are an example of block devices.

Character Files

Any device not accessed in blocks of data is associated with a character file. These devices are considered to be strings of characters like ordinary files. Again the device driver implements this model in memory. Examples of character devices are:

Terminals (including the console)
Communication lines
Printers
Main memory

# POWER ON/POWER OFF RECONFIGURATION MENUS

## SETTING UP

Place the computer on a suitable table or desk. Make sure that there is plenty of clearance (at least four inches) to the rear and on all sides of the CPU for sufficient air flow. Do not place the CPU on a cushioned or carpeted surface as it will restrict air flow into the bottom of the CPU and may cause overheating.

If the system console consists of a CRT and keyboard which each plug into the system unit, do the following. Place the monitor on top of the CPU, and plug one end of the coiled cable into the rear of the monitor and the other end into the rear of the monitor controller. Place the keyboard in front of the CPU, and connect the coiled cord to the connector on the lower right front corner of the CPU. Adjust the video level control on the CRT to the center portion of its travel.

If the system console is a Fortune terminal, place the terminal on top of the system unit and connect the terminal power cable to a properly grounded outlet. Plug the keyboard cable into the modular jack on the terminal, and connect the RS232 cable from the SIO port at the center rear of the system unit to the RS232 port at the rear of the terminal marked "HOST". Adjust the video level controls on the terminal to the center portion of their travel.

Connect the power cord into the receptacle in the left rear of the CPU, and make sure that the power switch is turned off. Then, plug the power cord into a properly grounded wall receptacle. If power from the wall is erratic, or a proper earth ground is not provided, the system may not operate properly. If the system is configured to use a Fortune terminal (rather than a keyboard and CRT plugged into the system unit) as the console, power up the terminal which is used and wait about 10 seconds for it to warm up. Turn the system power switch to ON and observe the console screen. During the power on sequence a number from 1 to 9 is displayed as each step in the process is completed. (see table 3-1)

| Phase | printed on screen | system activity |
|---|---|---|
| Test | 1 | Initial diagnostics pass |
| Configure | 2 | Found Boot-Device |
| Load | 3 | Boot program is loaded |
| Boot OS | 4 | Boot starting to load Kernel |
| Boot Complete | 5 | Kernel loaded |
| Kernel Started | 6 | Execute init program |
| System Initialized | 7 | Init complete |
| Execute Command File | 8 | Shell starts command file (/etc/rc) |
| System running | 9 | Power up complete |

Table 3-1
Power on Sequence

### Date and Time

When the system displays a date and time screen, enter the correct information as requested, and <RETURN>. The system will then display the date and time again. If it is not correct, press <RETURN> and reenter the correct information. If it is correct, press <EXECUTE>.

When initially displayed, if the date and time are already correct, select the displayed date and time by pressing the <CANCEL/DEL> key.

After the date and time are entered the system will run the command files contained in the directory **/m/rc.** These command files are used to initialize various hardware and software options installed in the system.

### Login

Log into the system as "manager". The system will then display the global menu (Figure 3-1). This is the master entry point into all the system applications programs and utilities. The system "manager" login is for maintenance of system files and user capabilities, and for installation, removal, duplication, or maintenance of system application software. As such, the system "manager" should never be a user of system applications.

**F O R T U N E   S Y S T E M S   G L O B A L   M E N U**

| **BUSINESS APPLICATIONS** | **PROFESSIONAL TOOLS** | **OFFICE AUTOMATION TOOLS** |
|---|---|---|
| B1 Business Systems | P1 Multiplan | E1 Fortune:Word |
| B2 Business Surveys | P2 | E2 Record Processing |
| B3 Business Graphics | P3 | E3 Automated Calendar |
| B4 | P4 | E4 |
| B5 | P5 | E5 |
| B6 | P6 | E6 |

| **COMMUNICATIONS** | **TRAINING AND EDUCATION** | **SYSTEM TOOLS** |
|---|---|---|
| C1 Async | T1 Topic Introduction | S1 System Utilities |
| C2 Bisync | T2 Amusements | S2 System Management |
| C3 Local Network | T3 Operator Training | S3 Languages |
| C4 X.25 | T4 C.A.I. Training | S4 IDOL |
| C5 SNA/SDLC | T5 Demonstrations | S5 Product Maintenance |
| C6 | T6 | S6 |

**Fortune Systems Corporation** **Press <HELP> For Assistance**
**Enter Selection & Press <RETURN>:**

Figure 3-1
The Global Menu

## POWER OFF

The system **must** be powered off in an organized manner to keep from **destroying system data files** or software. There are three ways to execute the system power off routine. The shutdown procedure may only be done from the system console.

### From the Global Menu

Select "S2" System Management. When the system management menu is displayed, select "30" for shutdown. The system will ask for confirmation, enter <F1> followed by <EXECUTE>. The system will then shutdown the hardware and software, and end with a prompt to turn off the power.

### From the login prompt

At the login prompt type in "shutdown". The system will ask for confirmation, enter <F1> followed by <EXECUTE>. The system will then shutdown the hardware and software, and end with a prompt to turn off the power.

### In FOR:PRO

Login as "root" and enter the command "shutdown" at the number sign (#) prompt. The system will ask for confirmation, enter <F1> followed by <EXECUTE>. Exercise care when entering commands within the operating system as data can easily be destroyed without proper knowledge of the command syntax and operating system structure. If you are unable to shutdown the system from the system prompt, try holding down the control <CTRL> key and press "d". This should return you to the login prompt or a menu, where you can continue to shutdown as described above. If neither of the above works, type in "sync<RETURN>" twice at the number sign (#) prompt, (wait for the prompt after each) and power the system off.

## THE MAINTENANCE MENU

The maintenance menu displays the system configuration parameters information stored in EAROM, e.g. System configuration parameters include: SIO and keyboard port speeds, type of flexible disk drive, location of the system boot program and the name of the file to be booted. To display the maintenance menu, power on or reset the system and hold down <Cancel/del> on the console keyboard until the menu appears. **Important: If the system console is a Fortune Terminal, it must already be powered on at the time when the system is powered on.** Depending on the system logic board firmware revision level one of two menu screens will be displayed. Earlier MOM ROM versions used a text based menu screen which utilized function keys. More recent MOM ROM versions display an icon screen. The function key menu is described first and is shown in figure 3-2.

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| | | |
|---|---|---|
| **F1** | Change front port speed | 2400 |
| **F2** | Change back port speed | 9600 |
| **F3** | Change power-up action | Boot up |
| **F4** | Change boot device | WD Boot, Drive 0 |
| **F5** | Change boot program number | 0 |
| **F6** | Change floppy drive 0 type | Tandon |
| **F7** | Set boot file name | hd02/unix |
| **F8** | Read settings from EAROM | |
| **F9** | Save settings to EAROM | |

**EXECUTE**
**HELP**

Type any highlighted key

EAROM has been changed 4 times

Figure 3-2
The Function Key Maintenance Menu

**Maintenance Menu Field Definitions**

- **F1** Baud rate for the keyboard port. Not changed.
- **F2** Baud rate for the SIO port. Set accordingly.
- **F3** Defines power up action. Not normally changed
- **F4** Defines boot device. Hard or Floppy disk to boot from
- **F5** Defines boot program. Usually 0 not normally changed
- **F6** Type of floppy drive. Tandon - Shugart
- **F7** Defines boot file name. Set accordingly.
- **F8** Reads current settings stored in EAROM.
- **F9** Writes settings on screen into EAROM.

## THE ICON MENU

The Icon menu is displayed on the console and allows the user to change basic system parameters. See Figure 3-2 for an example of what the Icon menu looks like.

The Icon menu may be accessed in 2 ways:

1. To enter the icon menu, a <CANCEL> must be entered during the count-up at **1.** This must be done from the system console.

2. If an error is detected by the MOM ROM during the boot process, the Icon menu will be displayed on the console. See page 3-18 for a listing of error messages.

The Icon menu may be used to change the following system parameters:

- Console baud rate
- Boot device
- Boot program number
- Boot file name

This information may be changed and then stored in the EAROM.

If a system error is being indicated, the error code will appear inside a box at the lower left corner of the screen.

When the Icon is first displayed the cursor is below the currently defined boot device. Two numbers will be displayed. The left is the device number and the right is the boot program number for that device. The boot program number will normally be zero.

The icon menu has two modes. When it is first entered, it is in mode 1.

Mode 1: Allows specification of the **boot device**, the **boot program number**, and the **console baud rate**. The **left** and **right** arrows are used to move the cursor to the desired boot device or console port. Once the cursor is positioned, the space bar may be used to change the secondary information (Boot program number or console baud rate). Press <SHIFT-F1> to store altered values to EAROM, <EXECUTE> to go into mode 2. Pressing <CANCEL> will set values to those in EAROM.

Mode 2: Places the cursor into the terminal part of the Icon, where the **boot file name** may be specified. Use the <RETURN> key to terminate the boot file name, the <EXECUTE> key to continue with boot, or <SHIFT><F1> to store new values in EAROM. Pressing <CANCEL> will set values to those in EAROM, and return the Icon to mode 1.

A summary of Icon control keys:

| | |
|---|---|
| LEFT/RIGHT | Allows cursor movement over boot device and arrows console port fields. |
| <SPACE BAR> | Changes the boot program number or the console baud rate. |
| <SHIFT-F1> | Saves new values in EAROM. |
| <CANCEL> | Redisplays the Icon with EAROM values. |
| <CTRL-L> | Redisplays the current screen. |
| <CTRL-X> | Displays a memory map and configuration information. |
| <EXECUTE> | In mode 1 - Changes to mode 2<br>In mode 2 - Continues the boot process with the values selected. |

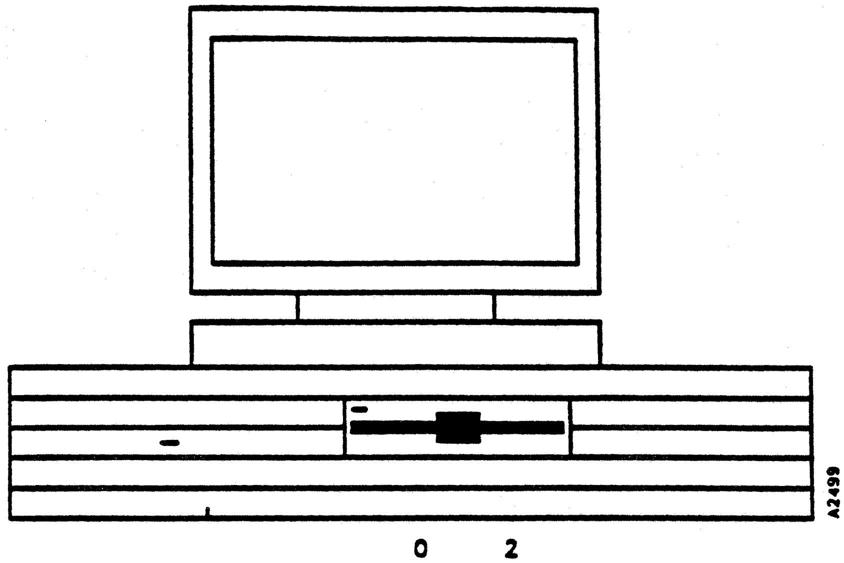



Figure 3-2
The Icon Menu

**THE CONFIGURATION MENU**

The configuration menu defines parameters of the system which normally do not change unless the system configuration is changed. The menu is used during a cold boot of the system to redirect the root and swap areas of the system to the floppy disk. A typical configuration menu is shown in Figure 3-3.

To access the configuration menu from hard disk, hold down the <CANCEL> key on the console while the system is booting. If the count-up goes beyond 1, reset the system from the front panel and press the <CANCEL> key again. The Icon maintenance menu will be displayed. Using the return key, move the cursor so it is below the lefthand section of the 32:16 (i.e. below the hard disk drive). Press <EXECUTE> and enter the boot file name "hd02/sa/reconf" at the Icon maintenance menu, and press <EXECUTE> again to load the program.

To access the menu from flexible disk, load a disk with the /sa/reconf program on it, (cold boot disk 1) select the floppy drive, and enter the boot file name "fd02/sa/reconf" at the maintenance menu, then press <EXECUTE>.

```
                        System Configuration Menu

                                 Used/Total                          Used/Total
        Language = ENGLISH                 Max process size = 512
     Root device = hd02                    Appx. # of users = 1
     Swap device = hd01      456/11560   Set params auto? = YES
       Boot file = hd02/unix                 Number buffers = 200         89
    Boot drive # =  0                         Number inodes = 200    20/ 275
     Boot device = SLOT E                      Number files = 127    12/ 275
  Boot Program # =  0                          Number texts =  15     8/  53
 Power up action = Boot                       Number clists =  50     0/  80
Console location = CRT                     Number processes =  30    16/ 107
    Console type = FT                           Number ptys =   0         40
TTY00 port speed = 2400                            Timezone = PACIFIC
TTY01 port speed = 9600                    Daylight savings = YES
   Flex drive #1 = TEC                       Line frequency = 60
   Flex drive #2 = TEC                      Floating point? = YES
   Flex drive #3 = TEC                           Hex number = FFFF

Total primary storage = 1024K; programs are using 361K of 628K available
                      EAROM has been changed 30 times

   F1 SORE SCREEN DATA IN EAROM        F2 READ CURRENT EAROM SETTINGS
                    F3 EXIT WITHOUT CHANGING EAROM
```

Figure 3-3
Configuration Menu

**Configuration Menu Field Definitions**

**Language** — Language to be used for error messages, the menu system, and multilingual programs.

**Root Device** — The device which contains the root file system. Usually hd02.

**Swap device** — The device which will contain the swap space for the operating system, usually hd01.

**Boot file** — The boot file name. Usually "hd02/unix".

**Boot drive #** — Which drive contains the boot program: 0, 1, 2, or 3.

**Boot Device** — Which device contains the boot program: SLOT E, floppy, etc. Usually SLOT E.

**Boot Program #** — Several boot programs can exist on a specific drive. This parameter defines which program will be used.

| | |
|---|---|
| **Power up action** | The process the machine will perform when it is first powered up. **BOOT** will load the program pointed to by the other boot parameters shown below. **MENU** will display the Icon maintenance menu. **MONITOR** will cause the system to go into MomRom monitor mode. This mode is not used for normal system operation. |
| **Console location** | Which device on the system will receive system error messages. |
| **Console Type** | The type of terminal attached to the console port, usually **FT**. |
| **TTY00 port speed** | The speed of the keyboard port. Set to 2400. |
| **TTY01 port speed** | The speed of SIO port. |
| **Flex Drive #1** | Type of diskette drive #1. |
| **Flex Drive #2** | Type of diskette drive #2. |
| **Flex Drive #3** | Type of diskette drive #3. |
| **Flex Drive #4** | Type of diskette drive #4. |
| **Max process size** | Maximum process size allowed by For:Pro. Must be set to the largest process size required by any application program to be run on the system. |
| **Approximate # of users** | Enter the maximum number of users expected to use the system concurrently |
| **Set params Auto** | If "yes", operating system parameters are set automaticly. |

**Number buffers, number inodes, number files, number clists, number processes, number of ptys**

These parameters define the size and structure of For:Pro operating system tables. Defining these parameters effectively requires an intimate knowledge of FOR:PRO. If these parameters are not set properly, the system may not operate, or will operate inefficiently. If **"set parameters auto"** is yes, these values are calculated from internal variables in the operating system. If **"set parameters auto"** is no, these values may be manually entered.

| | |
|---|---|
| **Timezone** | Pacific, Mountain, Yukon, GMT, etc. |
| **Daylight savings** | Indicate whether daylight savings time is observed. |
| **Line Frequency** | AC power line frequency |
| **Hex Number** | Diagnostic error pointer. Leave at 0. |

## Maintenance Mode Operation of the Fortune 32:16

If for some reason the 32:16 will not boot from the hard disk, the system may be booted from floppy diskette into single-user maintenance mode. An attempt may then be made to salvage data from the hard disk, or repair the damaged files which are causing the problem. Refer to page 3-27 for power-up sequence problems and software related causes.

### Load Procedure

While holding down the <CANCEL/DEL> key, turn on system power or reset the system from the front panel. Within a few seconds, the system will display the Icon Maintenance Screen, (Figure 3-2).

Insert cold boot diskette number one into the flexible drive. Press return until the zeroes are positioned below the diskette drive portion of the icon. The cursor should be located on the right-hand zero.

Press <EXECUTE> and verify that the message displayed on the console icon is "fd02/sa/reconf". Press <EXECUTE> again. The count-up continues to 3, and the system configuration menu is displayed. (Figure 3-3)

```
Cold boot Release 2.0
Select a function key:

<F1>            To completely erase and reload your disk

<F3>            To retry starting up the system as specified
                in the Maintenance Sceen

....            (Anything else typed in will be executed as
                 a maintenance mode command.)
```

Figure 3-4
Cold Boot Menu

Press the <F5> key. The screen will clear, and the system resumes count-up. The cold boot menu is displayed (Figure 3-4). Rather than making a function key selection, type in the following commands:

# **cd /etc** <RETURN>
# **mount /dev/hd02 /h** <RETURN>

You may now proceed to work on files on the hard disk. If the mount command failed, the hard disk may have a damaged configuration block or hardware problems. Refer to page 3-33 for information on rebuilding the configuration block. Hardware diagnostics are detailed in chapter five of this manual.

## System Maintenance
## UNIX commands

Following is an alphabetical list of maintenance related commands along with their arguments and flags. In this list spaces must be entered exactly as they appear and arguments in quotes ('..') indicates an appropriate entry, for example; 'filename' means to enter the name of the file you are working with. The command, exactly as you enter it, is in bold-face print and a RETURN is assumed at the end of the command line. Below each argument is a number. The arguments indicated by the numbers are explained below that. Refer to the FOR:PRO Programmer's Manual for more information about the commands.

**bootcp** Allows one to copy the boot program from the sa directory onto a device (such as a hard disk with a corrupted boot file).

```
bootcp /sa/boot /dev/rhd00 0
  1        2         3     4
```

Where:
1 = Command
2 = Source of the boot program
3 = Device to load boot program on (in this case the hard disk).
4 = The number of the boot program (at this time always 0).

**dd** Allows us to copy and convert files. The following example copies the boot file to floppy partition 0.

```
dd if=/sa/boot of=/dev/fd00 bs=1k seek=10
1      2           3         4      5
```

Where:
1 = Command
2 = The name of the input or source file.
3 = The name of the output or destination file.
4 = Size of the input and output blocks.
5 = Number of blocks to skip before writing the output.

**Note:** The following use of the dd command allows us to read all of the blocks on the hard disk file system and check for read errors. /dev/null is the 'bit bucket', therefore the output goes nowhere, and if errors are encountered reading the input, they will be reported by block number.

**dd if=/dev/hd02 of=/dev/null bs=1k**

**dskselect** Allows us to select a pre-written prototype configuration block. This is the command that is run during 'cold boot' when we are asked which type of disk we have. Reference: Service Notice number 23A.

```
dskselect conf-file N70
    1        2       3
```

Where:
1 = Command
2 = Name of output file to contain configuration block.
3 = Type of disk drive. If not supplied, the user is prompted.

**format** Allows us to format a disk (hard or floppy) or a single track on a disk. Reference; Service Notice number 24A.

**format -c conf-file /dev/hd00**
1 23 4 5

Where:
1 = Command
2 = The '-' indicates that the character following is a flag or modifier.
3 = A flag telling the system to copy a configuration block from an input file when it formats the device.
4 = The name of an input file containing a conf. block.
5 = The device to be formatted.

**fsck** runs a file system check on the specified device. Fsck checks for such things as correct pathnames, correct free-list, correct I-list, etc.

**fsck /dev/hd02**
1 2

Where:
1 = Command
2 = Device to run file system check on.

**mkconf** Allows us to make or alter the configuration block on a device. Reference: Service Notice 23A.

**mkconf -i conf-file /dev/hd00**
1 23 4 5

Where:
1 = Command
2 = The '-' indicates the character following is a flag.
3 = The first flag. The 'i' causes the system to build the configuration block 'interactively', which allows the operator to change entries as the block is being built.
4 = The input file containing a configuration block.
5 = The device upon which the block is to be written.

**NOTE:** If the configuration block on the device is good and you wish only to alter it, i.e. add blocks to the spares table, the following format will read the block from the device, allow you to alter it, then write the altered block back on the device.

**mkconf -i /dev/hd00 /dev/hd00**

**mkfs** is the command used to make a file system on a device.

**mkfs -a /dev/fd02**
1 23 4

Where:
1 = Command
2 = The '-' indicates the character following is a flag.
3 = A flag specifying "automatic" generation of a file system
4 = Device on which the file system is to be made.

**mount** allows us to attach a separate file system under a directory on the current (root) file system.

**mount /dev/fd02 /f**
1 2 3
Where:
1 = Command
2 = The device containing the file system to be mounted or attached.
3 = The directory on the current file system to which the separate file system is to be mounted. (There are, by convention, two empty directories in every file system's root directory which we use to mount separate file systems on. These are 'f' which we use for a floppy disk, and 'h' which we use for a expansion hard disk).

**od** is the octal dump command and may be used to dump a file in octal, ASCII, hexadecimal, or decimal. Reference; FOR:PRO Programmers Manual . (This manual is supplied with the FOR:PRO Development Utilities or may be ordered separately from Fortune Systems Corporation. The part number for the manual is 1002066-01).

**od -ocxd 'filename'**
1 23456 7
Where:
1 = Command
2 = The '-' indicates the characters to follow are flags.
3 = The first flag. The 'o' tells the system to dump the file in octal.
4 = The second flag. The 'c' tells the system to dump the file in ASCII.
5 = The third flag. The 'x' tells the system to dump the file in hexidecimal.
6 = The fourth flag. The 'd' tells the system to dump the file in decimal.
7 = The name of the file to be dumped.

**NOTE:** The flags may be used in any combination although typically only one is used at a time. If no flags are given the output will be in octal.

**rdconf** allows us to read the configuration block of a device.

**rdconf /dev/hd00**
1 2
Where:
1 = Command
2 = The device to read the configuation block from.

**shutdown** is the procedure used to 'gracefully' shutdown FOR:PRO, and it is the only way to shut the system down.

**shutdown**
1
Where:
1 = Command

**NOTE:** Shutdown may be executed in three ways, from UNIX as above, by logging in as shutdown from the login menu, or by selecting "S2" "30" from the global menu. Refer to page 3-4.

**sync** schedules an update of the super-block.

**sync**
1
Where:
1 = Command

**uconf** allows us to access and modify the reconfiguration menu (EAROM). If modifications are made to the reconfiguration menu those changes do not become effective until the system is shutdown and brought up again.

**uconf**
1
Where:
1 = Command

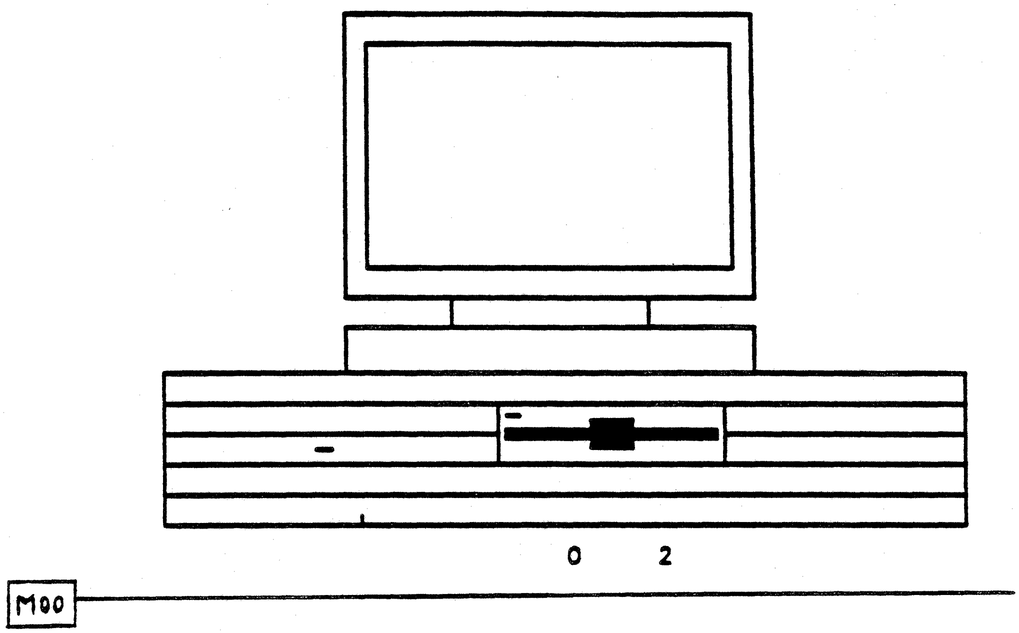
**umount** allows us to unmount an attached file system.

**umount /dev/fd02**
1 2
Where:
1 = Command
2 = The device containing the mounted or attached file system. Please note it is not necessary to specify the directory to which the file system is attached.

## MomRom Error Messages

MomRom Error Format

MomRom error message codes are presented in the lower left hand corner of the Fortune Systems CPU **icon** display (see below).




The above is only an example. 'M' is the error prefix indicating the general category of the problem encountered, and the number identifies the specific problem.

Category prefixes are:

- H - Hard disk
- F - Flexible disk
- E - EAROM
- M - Memory
- T - Traps/Exceptions

**NOTE:** Error codes may be cleared by changing the menu icon or by using the <CTRL>L to redraw the icon.

E00 Several unsuccessful attempts have been made to verify the EAROM. Bring up your system and run program **hd02/sa/reconf** (see **uconf(8)** in FOR:PRO Programmer's Manual). Verify that the fields are correct. This error should not prevent you from powering up or using your system. Nevertheless, report this error to your Fortune Representative.

E01 The EAROM has the Console Location set to "CRT", but there is no CRT controller in any of the five DMA slots. TTY01 is used as the console. If a CRT controller is indeed in a slot, reseat the controller, or try another slot. If reseating or trying another slot also fails, the controller is most likely damaged. If no CRT is present, run the **hd02/sa/reconf** program and change the Console Location to "TTY01".

E02 The EAROM has the Console Location set to an incorrect value. Bring up your system and run the **hd02/sa/reconf** program and change the Console Location to either "CRT" or "TTY01".

E03 The EAROM has the boot device set to an incorrect value. Bring up your system and run the **hd02/sa/reconf** program and change the boot device to a valid selection. Selection is made by placing the cursor on the boot device field and pressing the <**space bar**> until the correct device is displayed.

E04 The EAROM's boot device is set to "TTY01" and the Console Location is also "TTY01." This conflict for the device is not permitted. Bring up your system and run the **hd02/sa/reconf** program and correct the discrepancy.

E05 The EAROM's boot device field is set to a slot on the bus that does not have a valid boot device. The last valid boot device located will be used. Bring up your system and run the **hd02/sa/reconf** program to determine which slot is in question. If a valid boot device is present, reseat the card, or try another slot. If this fails, the card is most likely damaged. If the slot does not have a valid boot device (e.g., WD controller), correct the EAROM's boot device using the **hd02/sa/reconf** program.

E06 Cannot use terminal mode unless console location is set to "CRT." Bring up your system and run the **hd02/sa/reconf** program and change the Console Location field.

E07 Function key F2, used to write changes to the System Configuration menu, was initiated without any changes made.

F01 The MomRom, instructed to boot up using the diskette drive, could not communicate to the selected drive, or the diskette is not formatted or cannot be read. Try removing and reinserting the diskette into the drive. If that fails, try using a backup cold boot diskette or contact your authorized Fortune Representative.

F02 The configuration block identification number on the diskette is incorrect. Verify that a valid Fortune Systems cold boot diskette, Volume 1, is present in the drive and retry.

F03 The selected boot program has a length of zero. Verify that Volume 1 of the cold boot set is inserted in the diskette drive. Check that the boot number displayed with the cold boot icon (number on the right hand side, beneath the drive) is set to zero, or if using the boot menu, verify that entered values are correct.

F04 The selected boot program is not in the proper format. Verify that Volume 1 of the cold boot set is inserted in your diskette drive and try again. If problems still persist, use a backup copy of cold boot Volume 1.

F05 The select boot yram has an igal start address. Verify that Volume 1 of the cold boot set is inserted in the diskette drive and try again. If problems still persist, use a backup copy of cold boot Volume 1.

F06 The diskette drive has failed to locate thstructed block number. Verify that Volume 1 of the cold boot set is being used and that it is not damaged (see **NOTE** below). Put the disk back into the drive and make sure that the drive door is completely closed, retry the procedure. If the prm still persists, try using a backup copy of cold boot Volume 1.

F07 The diskette has a bad block and cannot be read. Verify that Volume 1 of the cold boot set is being used and that it is not damaged. Reinsert the diskette into the drive and make sure that the drive door is completely closed, retry the procedure. If the problem still persists, try using a backup copy of cold boot Volume 1.

H00 No Boot Device

H01 Boot Routine Error

M00 This message is accompanied by repeated beeping of both the TTY01 (alternate console) and TTY00 keyboards. This message means that your system has less than the mandatory 4KB of memory or memory was not found.

M02 A hole in RAM has been detected. Memory locations are not contiguous after the first 256KB of memory. Check that the memory boards are seated properly into their slots and retry the procedure.

T00 Power failure. Check power supply outlet and connections to the CPU.

T01 Unexpected error trap. This is a general message that is displayed if an error condition does not meet one of the above criteria. Power off your system, wait a few seconds and turn the power back on. Run diagnostics, if the condition still persists contact your authorized Fortune Representative.

# Kernel Error Messages

Error messages are presented in different formats depending on what program issues the errors. Thus a kernel error is different in format from a driver error.

Kernel Error Message Format

Each error is ordered by its error code number in parentheses (as defined in <sys/err.h>), followed by its corresponding mnemonic. Other descriptions following the mnemonic are;

a. message string as it appears on the console.
b. source routine that reports this error.
c. cause of the error.
d. comments and recommended user action. If no user action is specified, reboot the system.

Kernel Error List

(1) BLKDEV

a. blkdev
b. bio.c
c. Invalid block device is specified. This error happens when device number is too big.
d. This error is usually caused by the illegal device number in devctl() call. The kernel checks the major device number and gives this message if it is too big. Check reconfiguration table and verify all information.

(2) DEVTAB

a. devtab
b. bio.c
c. Invalid device table entry is specified. This error happens when buffer header pointer for this block device table is not properly initialized.
d. This error is usually caused by the illegal device number in devctl() call. If autoconfig did not initialize the table entry for this device, this error comes out. It is possible to hang the system without error message if minor device number is wrong. User should be very careful in using devctl() routine.

(3) EIOSWAP

a. I/O error in swap
b. bio.c
c. I/O error occurs during swapping
d. Most likely a disk error, run hdtest.

(4) IOCCOM

a. ioccom
b. tty.c or ttynew.c
c. In raw or cbreak mode, the count for canonical input is not zero. This error also could happen when an impossible character is used.
d. Kernel has caught a bug in itself, reset system.

(5) NOFS

a. nofs
b. alloc.c
c. Device name not found in the mount table.
d. Kernel has caught a bug in itself, reset system.

(6) TTOF

a. timeout table overflow
b. clock.c
c. Too many timeouts are specified, so run callout structure.
d. Run with fewer terminals at one time.

(7) NOIMT

a. noimt
b. iget.c
c. Mount table error. No corresponding inode entry is found in the mount table.
d. Kernel has caught a bug in itself, reset.

(8) IINIT

a. iinit
b. main.c
c. Cannot read superblock during initialization.
d. Disk error - run hdtest.

(9) RDPROC

a. Run dead proc
b. slp.c
c. Trying to run a process (or dead) structure. Possibly process table becomes bad.
d. Kernel has caught a bug in itself, reset.

(10) NOPROCS

a. no processes
b. slp.c
c. Trying to create a new process, but process table is full.
d. Kernel has caught a bug in itself, reset.

(12) NOSWAP2

a. Out of swap2 or out of swap3
b. trap.c
c. No more swap space. Swap2 comes from xswap and swap3 from xalloc.
d. Not enough disk space is allocated for swap area. Run with fewer users or fewer background processes, or re-cold boot with more swap space.

(13) ETRAP

a. At PC 0x________ trap
b. trap.c
c. Unexpected trap received.
d. The system detected an interrupt which should not have occurred. It could be caused by electrical interference or by hardware malfunction or kernel bug.

(14) KBAERR

a. AT PC 0x________ Kernel bus/addr error
b. trap.c
c. Bus or address error occurred within the kernel.
d. This is most likely a software problem. Please carefully record what was happening at the time the problem occurred. Kernel may have caught a bug in itself, reset.

(16) DBLPARY

a. At PC 0x________ double parity
b. trap.c
c. A memory parity error was detected while processing a parity error. This means that some portion of memory has gone bad.
d. Try powering the system off and then back on again. This may make the problem go away. If not, it is possible that the power-on memory diagnostics will find the problem and allow you to operate with a reduced amount of memory.

(17) REFTIMO

a. At PC 0x_______ Refresh time out
b. trap.c
c. Refresh time out (RTO) error indicates a problem with the memory refresh circuitry. The system may not have been well serviced.
d. Power on and off.

(18) INITNX

a. Can't exec init
b. sysl.c
c. This indicates a problem when the kernel is trying to start up /etc/init at power-up time. The most likely cause is that /etc/init program has gone bad or that a multi-user version of /etc/init is incorrectly installed.
d. Boot from cold boot floppy #1 and copy init file from the floppy to the /etc/directory in the hard disk. Then reboot from the disk.

(19) MFREE

a. map table overflow
b. malloc.c
c. Memory map has overrun during mfree.
d. Run with fewer processes.

(20) ZWCHAN

a. zero wchan
b. slp.c
c. A process is sleeping for nothing.
d. Kernel has caught a bug in itself, reset.

(22) INITD

a. init died
b. sysl.c
c. Init died after being executed from icode.
d. same as (18).

(24) IALLOC

a. ialloc
b. alloc.c
c. File system data structure (filsys) error detected while allocating inodes.
d. Kernel has caught a bug in itself.

(25) TIMNOTING

a. deltimeout not in queue
b. clock.c
c. Timeout structure not found in the queue while deleting.
d. Kernel has caught a bug in itself (driver).

(26) BADSCPAL

a. failure in machine ID PAL
b. (omitted on purpose)
c. Bad checksum in security pal.
d. Protected software is installed on the wrong machine or PAL is bad.

(120) PARITY

a. parity
b. trap.c
c. A memory parity error was detected.
d. same as (16).

(128) ODDERR

a. odd error
b. bio.c
c. Odd address, odd count or wraparound count error detected in raw mode I/O (physio).
d. To recover, try powering off and rebooting.

(129) ENFLE

a. no file
b. fio.c
c. File table full while allocating a user file descriptor and temporarily no more opens can be accepted.
d. Too many I/O-intensive programs are running at one time.

(130) INTOF

a. Inode table O/F
b. iget.c
c. Inode table in the kernel is full.
d. Too many I/O-intensive programs are running at one time.

(131) BADIADD

a. iaddr > 2^24
b. iget.c
c. Disk addresses of plain files and directories are kept in the array (di_addr) packed into 3 bytes each. Non-zero in the 4th byte error is detected while updating inode structure on a disk block.
d. Disk may be corrupted, try rebooting without doing an "orderly shutdown" by waiting 45 seconds and then powering off and back on.

(132) NEGQF

a. neg queue flush
b. prim.c
c. Clist counter becomes negative while flushing.
d. Kernel has caught a bug in itself.

(133) ESTUFF

a. STUFF
b. sig.c
c. Error detected in writing user instruction area. The requester must be an exclusive user on the file to write on.
d. Make sure the parameters in ptrace() call are correct and also check if the text is not shared among users.

(134) USRACC

a. usracc Øx_______
b. sig.c
c. Error detected in writing user instruction area. The requester does not have the access permit for the file.
d. Make sure the parameters in ptrace() call are correct and also check if the text is writable by the current user.

(135) ESUIWD

a. sui word failed
b. sig.c
c. Error detected in writing user instruction area. Writing can not be performed due to the reasons other than (133) or (134).
d. Make sure the parameters in ptrace() call are correct.

(137) ENTXT

a. Out of text
b. text.c
c. Not enough slots in the kernel shared text table. There are too many programs with the save-text bit set, or the text table is just too small for the number of distinct shared-text programs you are trying to run at one time.
d. Reboot and possibly you should increase size of process table.

(138) RANDOM

a. Random interrupt
b. trap.c
c. Unused trap vector generates a trap.
d. Probably a hardware problem. Run diagnostics to determine the bad part.

(139) BADFREE

a. bad free count
b. alloc.c
c. File system error (superblock). The free count in a superblock exceeds the system limit (NIOFREE) while allocating disk blocks.
d. Run fsck on hard disk.

(140) NOSPACE

a. file system full
b. alloc.c
c. You have run out of space on one of your file systems.
d. Recover by deleting some files (possibly archiving them to floppy first).

(141) BADBLK

a. bad block
b. alloc.c
c. Block number is out of range, i.e., it is less than the first block or greater than the last block in the volume.
d. Bad file system on the mounted device. Run fsck.

(142) NOINO

a. file system full (out of inodes)
b. alloc.c
c. Inodes in the mounted device ran out while creating a file.
d. Delete files or remake the file system specifying more inodes than normal.

(143) BADCNT

a. bad free block count
b. alloc.c
c. File system error (superblock). The free block counter is too big (> NICAREE) or the inode counter is too big (>NICINOD).
d. File system is corrupted. Run fsck.

(144) OVERR

a. error
b. prf.c
c. Ran out of spare blocks in the hard disk while saving a bad block.
d. The system may have a bad hard disk. Run hdtest.

## COUNT-UP SEQUENCE PROBLEMS

If the system hangs immediately after displaying any digit we have an indication of what problem is occurring. The following list suggests solutions for problems which may occur at each point of power up:

| HANGS AT | |
|---|---|
| No Display | Check brightness control on console, cabling and that you are working at the console. |
| 1 | Running internal diagnostics. If unsuccessful modify system to run with minimum system components. |
| 2 or 3 | Indicates the conf. block or the boot program is damaged and must be rebuilt. Refer to page 3-33.<br><br>May also happen if another Comm-A was installed and defined but the number of users wasn't increased. |
| 4 | This may mean that /unix is corrupted. Boot up off Cold Boot Set vol. 1 going into the maintenance mode. Refer to page 3-13 for how to get into maintenance mode. Mount the hard disk to /h and copy /unix to /h. Possible MMU error. |
| 5 or 6 | If message "init died" or "software error 18 or 22" is displayed, go into maintenance mode. Mount the hard disk to /h and copy /etc/init to /h/etc. May be caused by a bad comm board on the CLB bus.<br><br>This may happen if the multi-user init program was previously installed on another system. |
| 7 | If message "can't find /bin/sh" is displayed, go into maintenance mode and copy /bin/sh to /h/bin<br><br>/etc/rc and/or /bin/test may be damaged. If so, copy from 1st volume of cold boot set. Note: copy /etc/rc.real on the diskette to /etc/rc on the hard disk. |

| HANGS AT | |
|---|---|
| 8 | Boot up from vol 1 of Cold Boot set and get into maintenance mode. Mount the hard disk to /h and copy /etc/rc.real to /h/etc/rc. You may also want to copy /etc/init to /h/etc.<br><br>A mount or umount file may cause this problem. Recopy [u]mount to /h/etc. |

| Problem | Solution |
|---|---|
| System goes through file system check successfully but loops back to date and time or just hangs. | This may mean that the /etc/devtype file is missing or corrupted. Go into maintenance mode and rebuild the /etc/devtype file. Another possibility is that a control file in /m/rc has been corrupted. Go into maintenance mode and rename all files in /m/rc except menu.rc, to no longer end in ".rc", and bring the system back up. If the system boots properly, reload all applications onto the hard disk. |

## HARD DISK ERROR MESSAGES

Hard errors can be caused by power glitches or an improper shutdown procedure. Hard errors which cannot be corrected by reformatting the drive or track indicate media defects. Media defects must be spared out using the procedures outlined in this chapter.

Hard Disk Error Message Format

The error messages from the disk driver are printed on the console in case of a disk related error. The error message format is as follows:

*** hd error <msg> on drive <n> in state <state>

where:

<state> is an internal state. Generally you will see MOVE, (during reading or writing data)
<n> is the drive number on which the error occurred.
<msg> is one or more of the following:

Command was aborted
The controller will only send a command to the drive if the drive is ready to accept it. This message is seen when the drive does not become ready for a long time.

CRC error in ID field
The computed checksum for the ID does not match the stored checksum. This is a soft error and may also be seen in the case of a power line glitch.

DAM not found
Data address mark not found. Sector address could have been destroyed due to an earlier power failure or due to a hardware error.

ECC error in data field
An uncorrectable ECC error. The controller applies an error correcting code (ECC) to every sector it reads. If the controller cannot correct an error this message is given. This is a hard error.

ID not found
Sector id not found. A sector is identified by its ID. If the ID cannot be found it generally means the track was not formatted, or that the sector ID was destroyed due to power failure hardware malfunction.

Parity error
The controller detected a memory error. If you see this, it means the memory could be defective. Run memory diagnostics (memtest).

Track ØØ error
The drive could not find the very first track. The drive is unusable if this happens. Run hard disk diagnostics (hdtest).

Drive Ø has gone bad, will not accept anymore requests Hd drive status selected, seek complete flushing queue.

This error is caused by the drive ready signal turning false, which may be a problem with the drive or SCSI host adapter. Turn power off, wait 1 minute, power back up. System should boot correctly. If it doesn't, check to see that the hard disk is spinning . If the drive does not become ready when power is applied, this could be caused by:

1) low AC line voltages, or a brown out
2) too much static around the system
3) interference from other electrical equipment
4) a bad controller
5) a bad hard disk

Check data and power cables and the static electricity situation. If all looks fine, then go into maintenance mode (refer to page 3-1Ø) and try to read the hard disk configuration block (/etc/rdconf /dev/hdØ2). If unable to read the configuration block, try rebuilding it and the boot program (refer to page 3-32 to 3-34). If still getting errors persist run hdtest and check for psoft and hard errors. Spare the bad blocks out if any. **If blocks are spared from a partition containing a file system <u>data may be lost</u>.** Refer to pages 3-29 through 3-31 for information on how to salvage data and spare bad blocks.

**BAD BLOCK - DATA SALVATION**

When a bad block is encountered, by either an error message or by running diagnostics the block must be spared out. Before sparing out bad blocks you may want to either backup the entire system, or determine which files reside in the bad block. The latter is only possible if Development Utilities are loaded on the system. If so, do the following:

1. Convert disk physical block number (DPB, the number that shows up in error message or hdtest) to the file system physical block (FSPB) number. To do this subtract the beginning number of the partition that the DPB number resides in from DPB number. The answer will give you the FSPB number.

2. Now take the FSPB number and convert it to the file system logical block number (FSLB). To do this divide the FSPB number by two. The answer will give you the FSLB number.

3. Login as root and type in the highlighted commands:

   # **/etc/icheck -b [FSLB number] /dev/hd02** (hd02 may be different, be sure to check original error message). This command will give you an inode number on the first line of its output.

   # **/etc/ncheck -i [inode number] /dev/hd02**
   The result will give you file name.

This procedure is done so you can determine which files reside in the bad block. Now restore files (after sparing block) from backups. You may also want to do a manual file system check.

If the block is going bad (psoft error), but can still be read, you can retain the data on the block with the following procedure:

1. Convert the DPB number to the FSPB number by subtracting the beginning number of the partition that the DPB number resides in from the DPB number.

   Now do the following logged in as root:

   # **dd if=/dev/rhd02 of=/tmp/[FSPB number] count=1 bs=512 iseek=[FSPB#]**
   The result will be something like;
   1+0 records in
   1+0 records out

2. Now spare out the block, (refer to following section). Next enter:

   # **dd if=/tmp/[FSPB number] of=/dev/rhd02 count=1 bs=512 oseek=[FSPB#]**
   1+0 records in
   1+0 records out

At this point the data is restored!! You can now remove /tmp/[FSPB#] after process is done.

**NOTE:** This procedure may take several tries if the block is marginal.

## SPARING BAD BLOCKS

PROCEDURE: Start a normal 'Cold Boot' bringing the system all the way to the menu that asks you to select F1, F2, or F3 to reload the system. You will note that the last message says that anything else will be treated as a 'maintenance mode' command.
Enter:

**cd /etc <RETURN>**

This will cause the system to change the working directory to /etc and return with the # prompt.
Enter:

**mkconf -i /dev/hd00 /dev/hd00 <RETURN>**

The 'Configuration Block' will be displayed one line at a time on the CRT with '?' prompts. Press the <RETURN> to enter the default value until you get the question 'Number of Spare Blocks = **nn**'? (where **nn** is a default value).
Enter:

**nn <RETURN>**

At this point, start sparing bad blocks. Enter the bad block number followed by <return> at the first spare entry that ends in 'Bad?'. Repeat this for all known bad blocks. After entering all bad block numbers enter:

**done <return>** at the next spare entry.

Now do **rdconf /dev/hd00 <return>** and check the configuration block. It should now show the bad block as being spared out. Enter:

**sync <return>**
**sync <return>**

**NOTE**
Bad blocks may also be spared using the diagnostic program "hdtest"

**REBUILDING CONFIGURATION BLOCK**

Before rebuilding the "Conf block", it is necessary to know two things. The number of swap units the system was set up for and any 'Bad Blocks' that were spared in the original 'Conf Block'. It is advised on systems you sell or service, you do the command **rdconf /dev/hd00** and record the information concerning bad blocks that are spared and the size of the partitions **BEFORE ANY PROBLEMS OCCUR**. Therefore if the following procedures are required you will have all the information you need.

**Only proceed to rebuild the configuration block if you had recorded the bad blocks and number of swap units.**

**NOTE**

In the following write-up, all references to 'disk type' will be 'XYY'. Substitute the correct value for the disk type which is being worked on (e.g. N70, C70, M145, etc....).

PROCEDURE: Start a normal 'Cold Boot' bringing the system all the way to the menu that asks you to select F1, F2, or F3 to reload the system. Note the last message says that anything else will be treated as a 'maintenance mode' command. At this point enter:

**cd /etc <return>**

This will cause the system to change the working directory to /etc and return with the # prompt. At this time enter:

**dskselect XYY <return>**

A menu will appear asking you to select a disk type. Enter the mber tCcorresponds the drive type in your system.

Now enter:

**mkconf -i XYY /dev/hd00 <return>**

The 'Configuration Block' will now begin to appear on the CRT with '?' prompts. Press the <return> to enter the default value until the question 'Number of Spare Blocks = **XX**'? (**XX** is a default value). At this point enter:

**XX <return>**

The system will now be set to spare any known bad blocks, and will return the message 'Spare 0 (Block 3)= free ?' If you have any known bad blocks enter the first bad block number here and hit <RETURN>. Continue to do this for all bad blos. IfMre are no balocks, or when you have entered all known bad blocks, enter **'bad'** for the remainder of the spares entries.

Following the last entry, the system will automatically write the new 'Conf Block' to the rigid disk. The disk now has a 'Conf Block' for a one (1) user system.

If the system was formatted for a 3 or 5 user system, do the following command:

**mkconf -U * /dev/hd00 <return>**

Where * is the number of swap units (i.e. 3 or 5). Check the 'Conf Block' by doing the following command:

**rdconf /dev/hd00 <return>**

If all went well, you should have a working hard disk at this point. Do a file system check to verify file system integrity, enter:

**fsck /dev/hd02 <return>**

The file system check should run error free. If not, you have file damage and a cold boot may be in order. Enter the following commands to prevent writing on the floppy:

**sync <return>**
**sync <return>**

Next rebuild the Boot Program. This should be done to insure proper boot up.

PROCEDURE: Start by typing in the following commands:

**/etc/bootcp /dev/rfd00 /dev/rhd00 0 <return>**

The system will now write the 'Boot' program from floppy to the hard disk and return the # prompt. Then enter:

**sync <return>**
**sync <return>**

Now turn off the system, wait 10 seconds, then power up in the normal fashion or reset the system.

**NOTE**

If when you entered **bootcp......** the system returned the message **bootcp; not found,** enter the following command:

**dd if=/sa/boot of=/dev/hd00 bs=512 seek=* <return>**

Proceed as above. For the * parameter use the starting block number of the boot 0 program. This information is available in the configuration block. The "Boot 0 begins at" message gives the starting block number that should be used for this parameter. To see the configuration block enter:

**rdconf /dev/hd00 <return>**

# CHAPTER 4

# SYSTEM CONFIGURATION

A portion of the power of the 32:16 is derived from the capability to configure the system to meet the specific user needs. Proper configuration has been simplified through the use of configuration software during power on, and a minimum of hardware strapping. The process of notifying the system that a change has been made to the configuration is explained in the sections which follow.

The Fortune 32:16 cabinet contains two sets of expansion bus connectors, the first for system memory, the second for I/O controllers such as the Comm A-4 and IAC (Comm A-6) serial controllers, the PIO tape controller, and the WD hard drive controller. The memory bus is in the rear central portion of the system, the I/O expansion bus is on the right side of the system.

Peripherals and mass-storage devices such as hard drive number one, a diskette drive, and a tape-streamer drive are housed in the 32:16 cabinet. (Older systems didn't allow for the addition of a tape drive in the system cabinet.) The floppy drive connects directly to the SLB, but the tape and hard-disk drives are controlled by the PIO and WD controller, respectively. Also housed in the system cabinet are all system I/O controllers and system memory cards.

Optionally, one or more mass storage expansion cabinets may be attached to the system. Up to four hard disk drives and one tape drive may be accommodated in this manner. The tape drive is interfaced using a 50-pin cable, the additional hard drives are controlled via a 34-pin control cable which daisy-chains from one drive to the next, plus a 20-pin data cable for each individual drive.

In the newer model SX systems, the hard disk drive(s) and tape drive are part of the SCSI system. An external SCSI port (50 pin connector) is provided on the back of the system for expansion cabinets. All SCSI peripherals are connected in parallel to a 50-wire bus which handles data transfer and control functions.

## FORTUNE INTELLIGENT WORK STATION

The Fortune Intelligent Work Station is an additional system terminal when connected to a multi-user Fortune System through the SIO port, Comm-A four port or Comm-A six port communications interface boards. Fortune systems currently supports two different types of terminals (FIS 1000 and Fortune Basic Workstation) which consist of a CRT, logic board, power supply and a keyboard.

**FIS 1000**

The FIS CRT is identical to the CRT used in the monitor assembly (see Figure 4-1) in the system console except that the upper and lower shell assemblies are coated with a conductive coating for decreased EM/RF interference. The operation is identical to that of the system monitor assembly. The contrast adjustment potentiometer is located on the left front side of the logic board and can be adjusted through the cooling vents in the front of the terminal.

The logic assembly contains a Z-80A microprocessor, 8K bytes of RAM, and two Dual Asynchronous Receiver/Transmitter (DART) chips, one port for the keyboard, and three RS-232C serial I/O ports on the rear of the chassis. Figure 4-2 shows the switch settings to control power source type, parity, baud rate, and stop bits.

The keyboard assembly is identical to the main console keyboard.

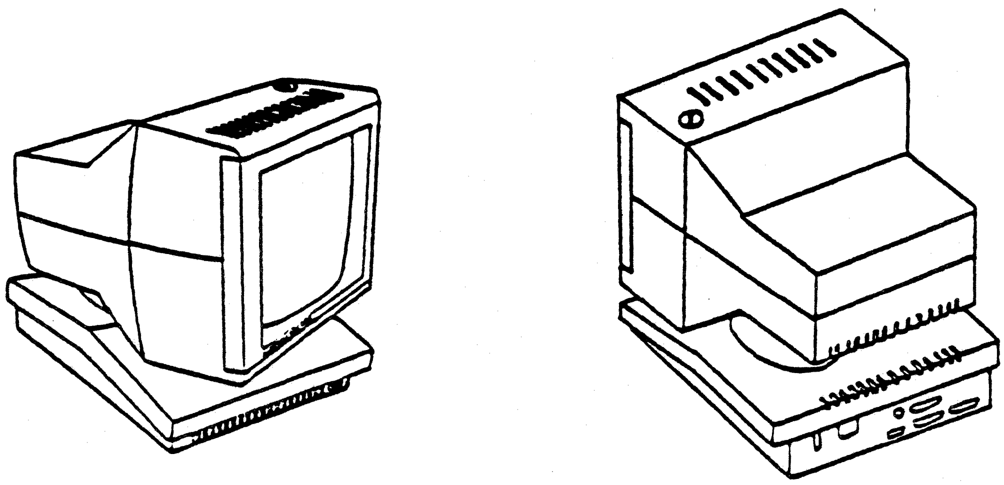
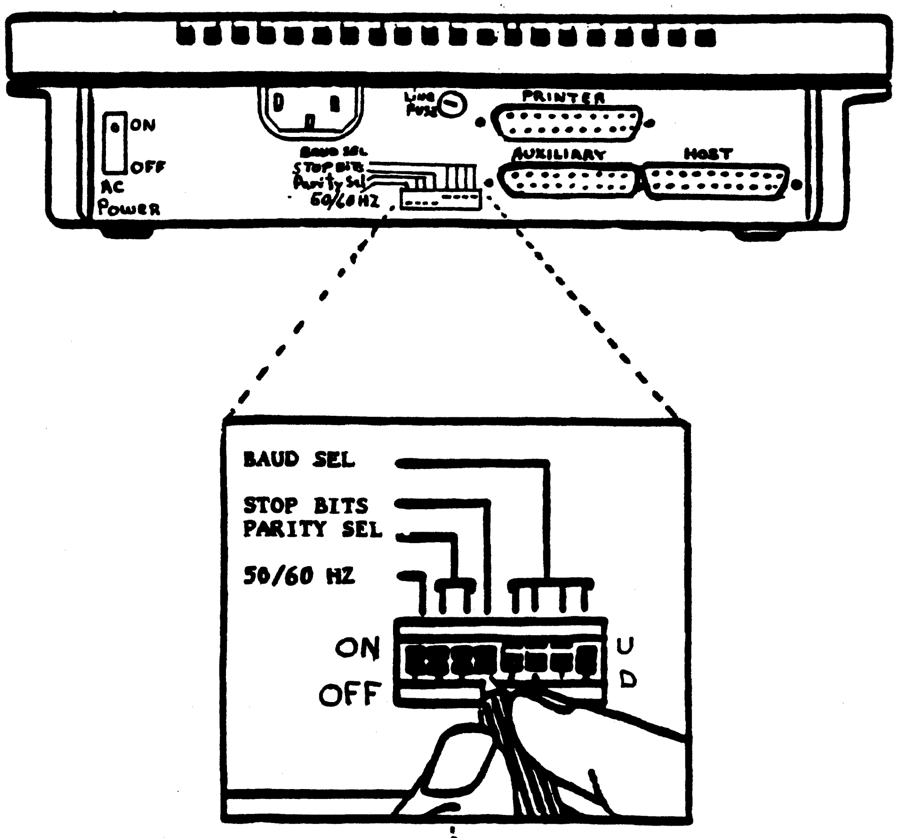


Figure 4-1
FIS 1000

The host processor is connected to the RS-232C port marked "HOST" on the rear of the workstation. The remaining two ports are marked "AUXILIARY" and "PRINTER". Refer to "USING FORTUNE TERMINALS" to see how these ports are accessed.

The workstation power supply provides $\pm$ 12 VDC and +5 VDC to power the terminal. There are no field adjustments for the power supply. The power supply is protected by a 3 amp fuse.




| Switch Number | | | | | | | | Function |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| D | | | | | | | | 60 HZ Power source |
| U | | | | | | | | 50 HZ Power source |
| | D | D | | | | | | No parity (space) |
| | U | D | | | | | | No parity (mark) |
| | D | U | | | | | | Odd parity |
| | U | U | | | | | | Even parity |
| | | | D | | | | | 1 Stop bit |
| | | | U | | | | | 2 Stop bits |
| | | | | D | D | D | D | 50 baud |
| | | | | D | D | D | U | 75 baud |
| | | | | D | D | U | D | 110 baud |
| | | | | D | D | U | U | 134.5 baud |
| | | | | D | U | D | D | 150 baud |
| | | | | D | U | D | U | 300 baud |
| | | | | D | U | U | D | 600 baud |
| | | | | D | U | U | U | 1200 baud |
| | | | | U | D | D | D | 1800 baud |
| | | | | U | D | D | U | 2000 baud |
| | | | | U | D | U | D | 2400 baud |
| | | | | U | D | U | U | 3600 baud |
| | | | | U | U | D | D | 4800 baud |
| | | | | U | U | D | U | 7200 baud |
| | | | | U | U | U | D | 9600 baud |
| | | | | U | U | U | U | 19200 baud |

Figure 4-2

FIS 1000 Switch Settings

## FORTUNE BASIC WORKSTATION

The Fortune Basic Workstation consists of a video display unit and a keyboard (see Figure 4-3). The two are joined by a coiled cable with RJ-11 connections at either end. The Basic Workstation can be used as a terminal on the Fortune 32:16 series or as a monochrome monitor on an IBM PC. The Basic Workstation may also be used in a limited capacity without a central processing unit (CPU).

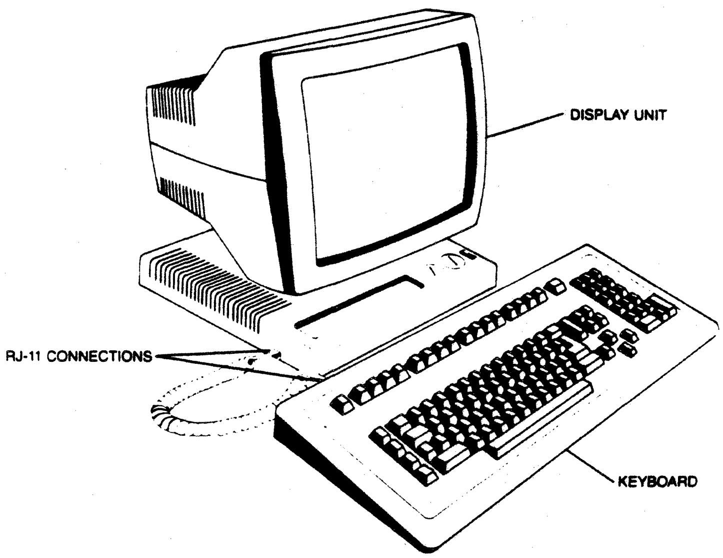



Figure 4-3

Fortune Basic Workstation

The Fortune Basic Workstation features a 14" display with separate controls for contrast and brightness (see Figure 4-4) and is attractively styled with an ergonomic tilt and swivel base. The display is available with either a P-39 green phosphor or P-22 amber phosphor tube.

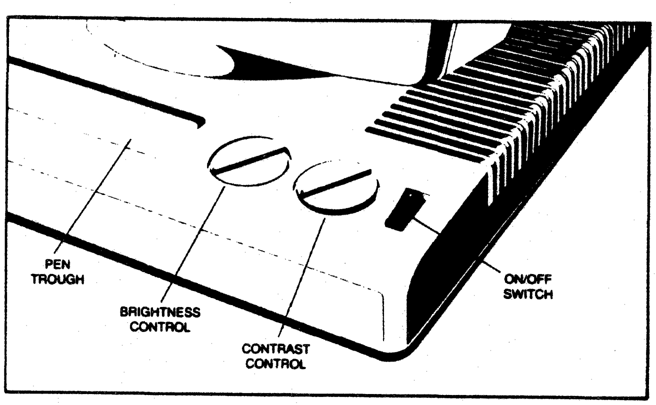



Figure 4-4

Fortune Basic Workstation Controls

The Fortune Basic Workstation is configurable to work with an IBM PC as a monochrome monitor. The rear panel of the Basic Workstation is shown in Figure 4-5. It contains the following:

- AC line input for the power cord.
- Fuse holder containing a 2-ampere 250-volt 3HE (little type) fuse.
- Internal/external video switch. When set to INT. VIDEO the Basic Workstation may be used in Local mode or on a Fortune 32:16 system. When set to EXT. VIDEO it may be used with a IBM PC.
- DB9-D external video input port. When you want to use the Basic Workstation as a monitor on a IBM PC, connect this port to the video port of the PC.
- Two RS-232C ports. The port labeled "AUXILIARY" is wired as data communication equipment (DCE) and can be used to connect peripheral devices, such as a printer. The HOST port is wired as data terminal equipment (DTE) and is used to connect the terminal to a CPU.

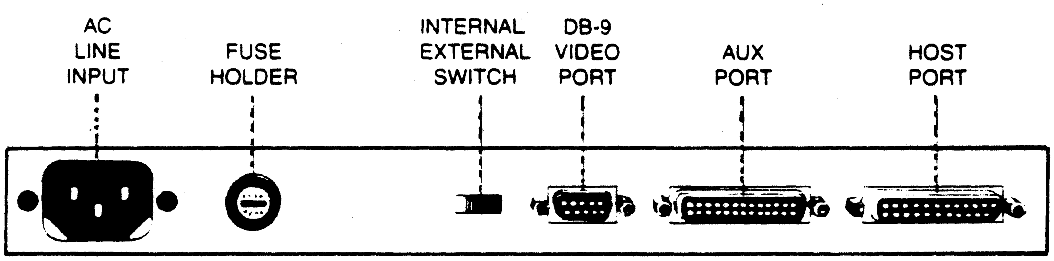



Figure 4-5

Fortune Basic Workstation Rear Panel

## ADDING A FORTUNE BASIC WORKSTATION

Connect the Intelligent Work Station cable (P/N 1000633-xx) to the desired port on the rear of the system. Select 'S2 System Management' from the Global Menu. Select '39 Change Device Connection' from the System Management Menu, the system will display a diagram of the rear panel of the system. Enter the number of the port that the work station is connected to, followed by a <RETURN>. Select or enter the device speed and type, and the system will configure itself to add that device.

## SETUP MENU ON FORTUNE BASIC WORKSTATION

Upon power-up, the screen should display a configuration screen similar to the Setup menu as shown in Figure 4-6. If the Setup menu is not displayed, enter setup mode by pressing the Ctrl, Shift, and Help keys at the same time. The setup menu will then be displayed.

| | | | |
|---|---|---|---|
| 1 | Language | ENGLISH | |
| 2 | Setup | DEFAULT | |
| | | Host | Aux. |
| 3 | Baud Rate | 9600 | 9600 |
| 4 | Data Bits | 7 | 8 |
| 5 | Stop Bits | 1 | 2 |
| 6 | Parity | SPACE | DISABLE |
| 7 | Handshake | XON/XOFF | NONE |
| 8 | Mode | FULL | FULL |
| 9 | Operation | ON LINE | |
| 10 | Scrolling | HARD | |
| 11 | Columns | 80 | |
| 12 | Video | NORMAL | |
| 13 | Cursor | BLOCK | |
| 14 | Cursor Blink | OFF | |
| 15 | Line Wraparound | ON | |
| 16 | Auto Line Feed | OFF | |
| 17 | Screen Saver | ON | |
| 18 | Bell Volume | ON | |
| 19 | Keyclick Volume | ON | |

VERSION 2.3

Figure 4-6

Fortune Basic Workstation Setup Menu

Table 4-1
Serial I/O Port Interface
EIA RS232-C

| | Pin No. | Circuit Name | Signal Function | Direction |
|---|---|---|---|---|
| | 1 | AA | Frame Ground | |
| DTE | 2 | BA | Transmitted Data | To DCE |
| DCE | 3 | BB | Received Data | From DCE |
| DTE | 4 | CA | Request to Send | To DCE |
| DCE | 5 | CB | Clear to Send | From DCE |
| DCE | 6 | CC | Data Set Ready | From DCE |
| | 7 | AB | Signal Ground | |
| DCE | 8 | CF | Data Carrier Detect | From DCE |
| | 9 | - | +12 VDC | |
| | 10 | - | -12 VDC | |
| DTE | 20 | CD | Data Terminal Ready | To DCE |
| | 25 | - | Busy | To DCE |

## PRINTERS

The 32:16 supports printers through software drivers found in the file /etc/printcap. Included with FOR:PRO are drivers for Diablo, NEC, Qume, and IDS printers. To logically connect the printer to the system, select 'S2 System Management' from the Global Menu. Select '39 Change Device Connection' The system will display a diagram of the rear panel of the system. Enter the number of the port that the printer is connected to, the logical printer number it is to be accessed as, and the speed of the printer (i.e., 9600 baud). Most printers can be connected to any system SIO, Comm A-4, or IAC (Comm A-6) port using cable P/N 1000664-XX.

* * * * * * * C A U T I O N * * * * * * *

> Pins 9 and 10 of the SIO and Comm A-4 ports output ± 12 Volts DC. Connecting devices to to the system with these pins active may cause damage to the system and/or the device.

The printer must be configured for 'X-on, X-off' software handshaking, no Parity, serial communications. Refer to the individual manufacturers installation manual to properly configure the printer before connecting the printer to the system.

## PRINTER CABLES

Figure 6-2 is a wiring diagram and use description of the printer cable for the 32:16. Use of any other cable may not work, and can cause system or printer damage.

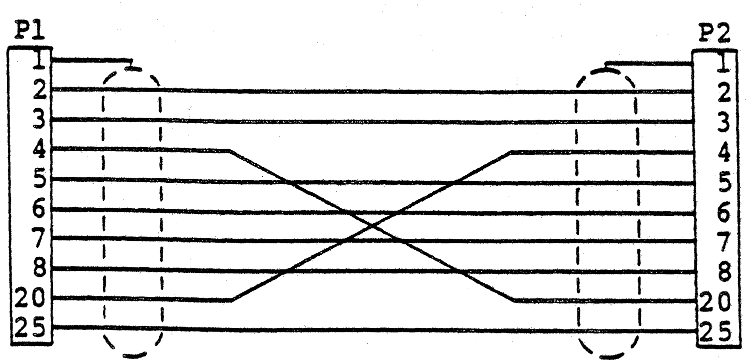


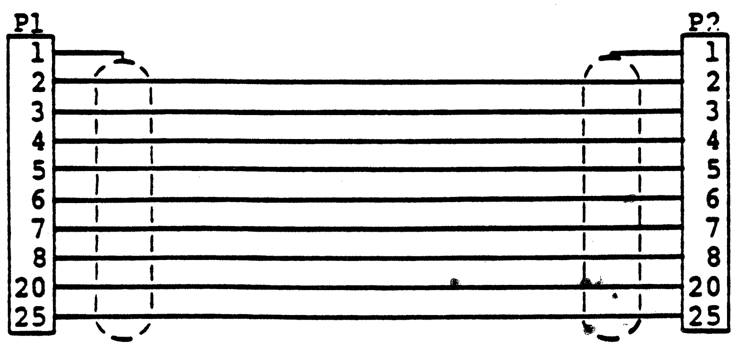

Figure 4-7
Printer Cable

| Part Number | P1 | P2 | type of printer | Length |
|---|---|---|---|---|
| 1000664-01 | Male | Male | Letter Quality | 10 feet |
| 1000664-02 | Male | Male | Letter Quality | 20 feet |
| 1000664-03 | Male | Male | Letter Quality | 50 feet |
| 1000664-04 | Male | Female | Dot Matrix | 10 feet |
| 1000664-05 | Male | Female | Dot Matrix | 20 feet |
| 1000664-06 | Male | Female | Dot Matrix | 50 feet |

Figure 4-7
Printer Cable
continued

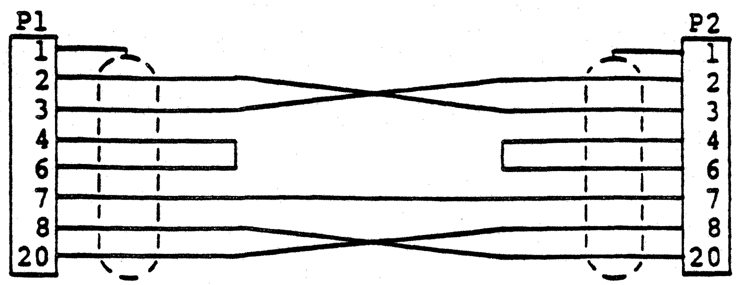
## COMMUNICATION CABLES

Figure 6-3, 6-4, and 6-5 are wiring diagrams and use description of the 10000633-xx communications cables.



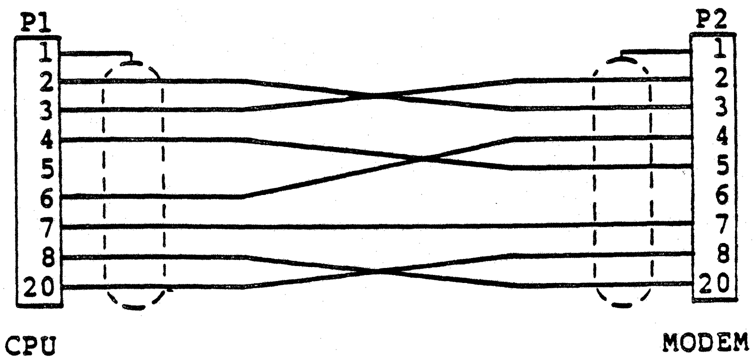

| Part Number | P1 | P2 | Use | Length |
|---|---|---|---|---|
| 1000633-01 | Male | Male | CPU to Workstation | 10 Feet |
| 1000633-02 | Male | Female | Extension Cable | 10 Feet |
| 1000633-03 | Male | Female | Extension Cable | 20 Feet |
| 1000633-04 | Male | Female | Extension Cable | 50 Feet |
| 1000633-08 | Male | Male | CPU to Workstation | 20 Feet |
| 1000633-09 | Male | Male | CPU to Workstation | 50 Feet |

Figure 4-8
Communications Cable




| Part Number | P1 | P2 | Use | Length |
|---|---|---|---|---|
| 1000633-05 | Male | Male | CPU to CPU | 10 Feet |
| 1000633-06 | Male | Male | CPU to CPU | 20 Feet |
| 1000633-07 | Male | Male | CPU to CPU | 50 Feet |

Figure 4-9
Communications cable




| Part Number | P1 | P2 | Use | Length |
|---|---|---|---|---|
| 1000633-10 | Male | Male | CPU to MODEM | 10 Feet |
| 1000633-11 | Male | Male | CPU to MODEM | 20 Feet |
| 1000633-12 | Male | Male | CPU to MODEM | 50 feet |

Figure 4-10
Communications Cable

## OPTIONAL SERIAL I/O PORTS

Groups of six asynchronous serial I/O ports may be added to the Fortune system through the use of the Intelligent Asynchronous Communications board. Also known as the Comm-A-6, the IAC contains its own microprocessor in order to reduce the processing load associated with transmission and reception of RS-232 characters. The ports of a IAC are accessed through the `tty' interface described in the FOR:PRO Programmer's Manual.

The functionality of the IAC ports is provided by Signetics DUART chips. The microprocessor on the board, a Z80b, provides local buffering of characters and port conditions, and performs DMA block transfers of information to and from main memory. IAC ports can operate at the standard Unix speeds, 0-19200 baud, except 50 and 200 baud which are unsupported.

The default baudrates for the ports are determined by values stored in the EAROM for /dev/tty01. [These defaults are usually overriden by other facilities, e.g. getty and login.] The IAC interrupts roughly once per hundred characters output and once per 1/20th of a second when there are input characters to process. Device file names for IAC boards are always a group of six contiguous names such as /dev/tty02 through /dev/tty07; the exact name assignment depends on the placement of boards in the I/O option slots.

IAC boards are configured with six 9-pin male connectors. Most IAC boards are shipped with six one-foot adapter cables, which convert the 9-pin connectors to 25-pin females, which are pin-for-pin compatible with other asynchronous port controllers and cables available for the 32:16. Information given earlier in this chapter concerning cabling serial peripherals applies to the IAC ports equipped with 9-pin to 25-pin adapters.

Pinouts of the 9-pin connector on the IAC board are believed to be one pin short of compatible (DSR is unsupported) with the asynchronous communications controller of the IBM PC/AT. While such compatibility may be useful to many users, no functional compatibility is guaranteed.

Electrically, the ports at either the 9-pin connector on the IAC or the 25-pin connector on the adapter cable conform to RS-232C. (RS-232C is the Electronic Industries Association standard for serial I/O.) The RS232 serial interface world is divided into two kinds of equipment: Data Communication Equipment (DCE), e.g. modems, and Data Terminal Equipment (DTE), e.g. CRT terminals.

You can connect DCE to DTE with a simple, straight-through cable. A special adapter cable known as a "null modem" must be used to connect DTE to DTE, and a "null terminal" adapter cable must be used to connect DCE to DCE. A port on a host computer might be connected to either a DCE or DTE depending on the application, requiring a special cable in one of the two cases.

The serial ports on the computers used for the initial development of UNIX were wired as DTE, and the modem control signals are described in the software and the manual pages as if this were the case (Fortune retains this nomenclature for standardization with UNIX practice).

However, the Fortune RS-232C ports are wired as DCE so that terminals can be connected with a simple, straight-through cable. Therefore, modems must be attached with special adapter cables. All of this can be a little confusing, so be careful to note that when the tty(4) manual page (FOR:PRO Programmer's Manual) talks about DCD, you can think of this as if it were describing the DCD signal at the modem end (In fact, on the host port, it corresponds to the DTR pin.)

In general, therefore, the tty(4) man page nomenclature and the software names for the modem control bits follow the names at the modem end of a modem adapter cable as shown below. The tables below show the correspondence between the DUART signals, RS-232C connector pinouts, and modem cable connections. The pinouts on the the 9-pin board connector and the 25-pin adapter connector look like this:

| DUART SIGNAL | | 9-PIN CONN | 25-PIN CONN | TERMINAL SIGNAL | SIGNAL NAME |
|---|---|---|---|---|---|
| RxD | <- | 2 | 2 | TxD | Transmitted Data |
| TxD | -> | 3 | 3 | RxD | Received Data |
| CTS | <- | 8 | 4 | RTS | Request to Send |
| DTR | -> | 4 | 5 | CTS | Clear to Send |
| RTS | -> | 7 | 6 | DSR | Data Set Ready |
| GND | — | 5 | 7 | GND | Ground |
| DTR | -> | 4 | 8 | DCD | Data Carrier Detect |
| DCD | <- | 1 | 20 | DTR | Data Terminal Ready |
| RI | <- | 9 | 25 | TRB | Trouble |
| -- | — | Shield | 1 | — | Chassis Ground |

Note that the use of pin 25 is not officially defined in the RS-232C specification, but many printers and modems use it to indicate some problem (out of paper, taken off line, etc.). The electrical specification of the 9-to-25 pin adapter cable may be read from the above table.

When a port is to be connected to a modem, yet another adapter cable must be used. (Note that this adapter cable is not the same as a `null modem' adapter NOR is it the 9-to-25 pin adapter described above.) This adapter cable, designed to be attached to the 25-pin end of the 9-to-25 pin adapter, has the following connections:

| DUART SIGNAL | HOST SIGNAL | 25-PIN CONN | | 25-PIN CONN | MODEM SIGNAL | |
|---|---|---|---|---|---|---|
| RxD | TxD | 2 | <- | 3 | RxD | Received Data |
| TxD | RxD | 3 | -> | 2 | TxD | Transmitted Data |
| DTR | CTS | 5 | -> | 20 | DTR | Data Terminal Ready |
| RTS | DSR | 6 | -> | 4 | RTS | Request to Send |
| — | — | 7 | — | 7 | — | Signal Ground |
| DCD | DTR | 20 | <- | 8 | DCD | Data Carrier Detect |
| RI | BUSY | 25 | <- | 6 | DSR | Data Set Ready |
| — | — | 1 | — | 1 | — | Chassis Ground |

The end of the cable that connects to the IAC adapter cable must terminate in a male connector.

**NOTE:** Do not leave a cable attached to a serial port on the CPU which is not plugged into a peripheral device. Noise on the input control lines on pins 4, 20, and 25 can put a heavy interrupt load on the CPU, crippling or even stopping system activity. Therefore, these pins are all pulled to +12 volts through a 15k ohm resistor (inactive logic level), so that if left unconnected, they do not fluctuate from noise.

## MASS STORAGE SUBSYSTEMS

Currently there are two major categories of hard drive subsystems being used by Fortune Systems in the 32:16 product line. The original system used a Western Digital (WD) drive controller in conjunction with ST-506 interfaced hard drives. Configurations with from 5 MB to 210 MB of hard drive storage were offered with the WD/ST-506 subsystem. Tape backup with the WD subsystem is provided for through the PIO tape controller and a tape drive. More recently built systems utilize the SCSI (Small Computer System Interface) mass storage subsystem. Currently SCSI-based SX's with from 45 MB to 435 MB of hard drive storage are available from Fortune Systems. Tape drives are supported directly by the SCSI controller.

### WD subsystem

Up to four hard disk drives can be installed on a system with a WD controller. The disk drives can be any combination of Fortune provided ST-506 type disk drives connected to the WD hard disk controller. While the WD Controller will work in any option slot, the best to use is slot E since there is more airflow for better cooling and more space available in which to route cables. Each disk drive is connected to the same 34-pin control cable. A seperate 20-pin data cable is required for each drive. The hard drives used in this subsystem have the industry standard ST-506 interface, which allows a data transfer rate of up to 5 MBits/second. Only hard drives may be controlled by the WD controller. A seperate controller is required for systems which have a tape drive.

### SCSI subsystem

Up to eight SCSI devices, including both hard disks and tape drives may be controlled by the SCSI Host Adapter. Any combination of SCSI compatible drives provided by Fortune Systems may be used in the SCSI configuration. This may include hybrid setups consisting of both embedded SCSI (Drives with intelligent SCSI controllers built into the drive logic board.) and ST-506 interface hard drives. The ST-506 interface drives require the use of an Adaptec SCSI/ST-506 controller. The Adaptec controller converts SCSI commands to commands which ST-506 drives recognize, and may be used to control one or two drives. The SCSI subsystem will only be found in the latest model SX's (and the Formula series) or in recently upgraded machines. The PIO tape controller is not used in SCSI equipped systems.

### Cabling, Device Select, and Termination Requirements

Cabling and other requirements for the two different subsystem varieties shall be covered next. Included in the discussion of the WD subsystem is information on the PIO tape backup system.

## WD/PIO

The WD control and data signals are carried separately on two or more ribbon cables.

A 34 conductor control cable is connected in a daisy-chain fashion from the WD controller to each hard drive in the system. This control cable must be terminated at the end with a 220/330 ohm resistor network. This is done to assure protection from noise and to maintain signals at their proper level.

Configurations with only 220/330 termination at the physical end of the cable are called "hard terminated", and are found in earlier production systems with 5 to 30 MB hard drives.

The newer systems use a so called "soft termination" scheme in which each drive attached to the WD controller provides a 1000 ohm terminator. This simplifies matters in that the technician does not have to remove or add terminating resistors to drives when replacing or upgrading drives. Soft termination is found only on N70 and M45 type drives provided by Fortune Systems.

**Mixing and matching of "soft"(1000 ohm) and "hard"(220/330 ohm) termination within a system and its associated expansion cabinets is not supported and may cause unreliable performance or the loss of system data.**

Also required for each drive attached to the WD controller is a 20 pin data cable. Each data cable must be attached to its correct logical drive, i.e. the data port number on the WD controller must be the same as the drive select enabled on a particular drive. Drive selection is accomplished through the use of jumpers or switches on each hard drive in the system. See figure 4-11.

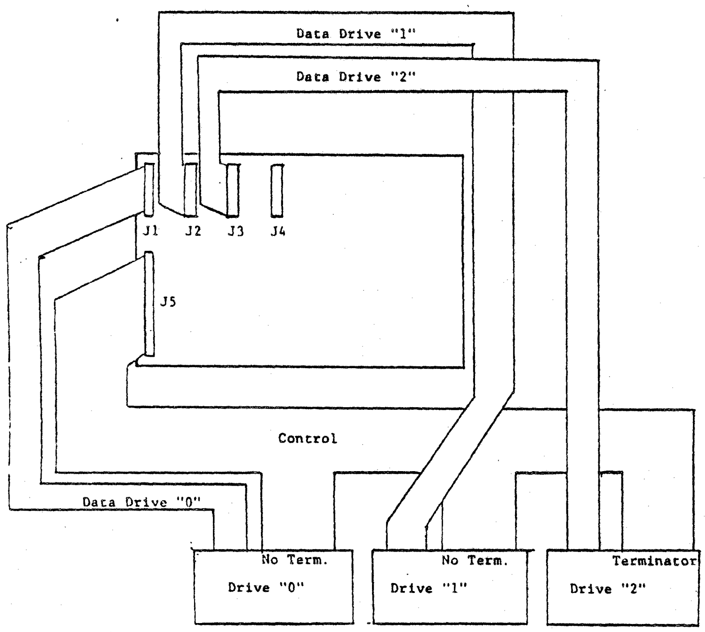



Figure 4-11
WD/Hard Disk Controller Cable
Connection guide

The PIO controller supports the tape drive. The PIO board will support either the older 20 MB or the 60 MB tape drive. A single 50 conductor cable provides control and data transfer functions between the PIO and tape drive. There are no jumpers on either the drive, PIO board, or formatter board which should be altered from factory settings.

## SCSI

The SCSI bus signals are carried on 50 pin ribbon cable that must not exceed 20 feet in length and must not be more than 12 feet from the external port to the last external device. Connection are in daisy-chain fashion with each hard disk or tape drive having a device number. Figure 4-12 shows a typical SCSI configuration.

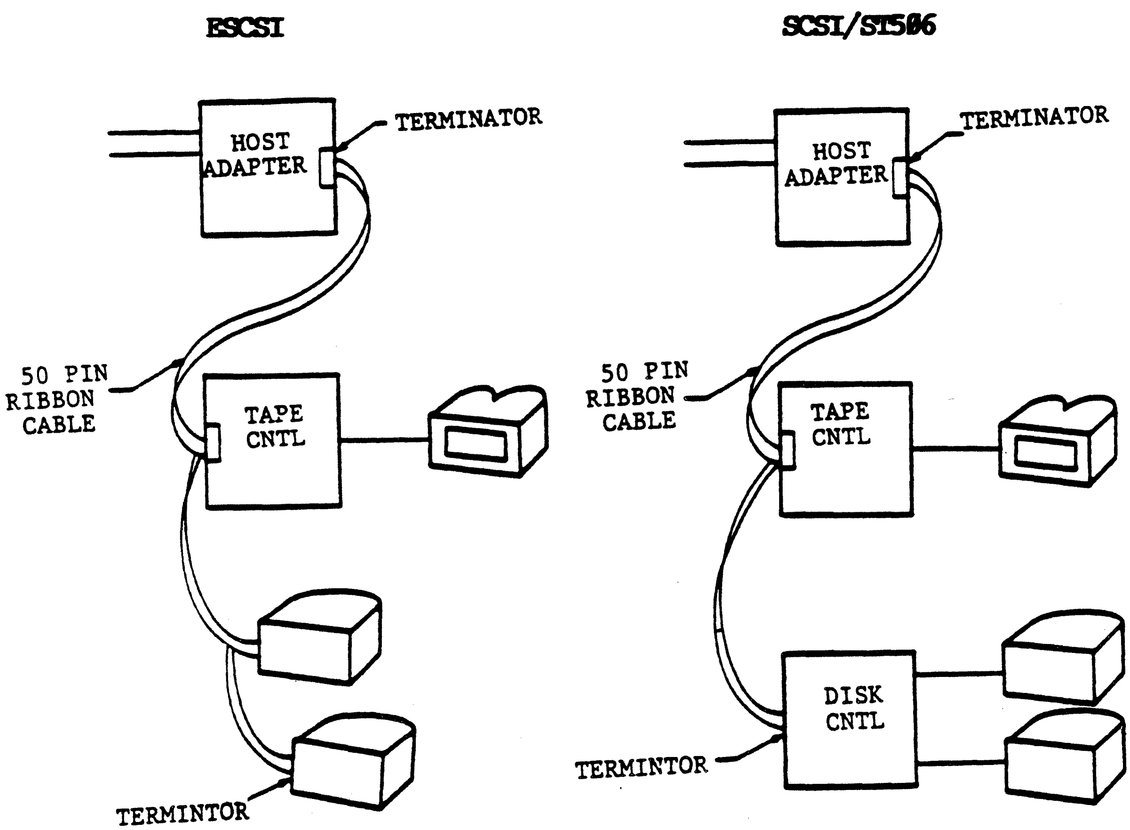



**FIGURE 4-12. Typical ESCSI and SCSI/ST506 Configurations**

The device addresses are assigned as follows:

| Device name | Address |
|---|---|
| ESCSI Drive 0 or ST506 controller | 0 |
| ESCSI Drive 1 | 1 |
| ESCSI Drive 2 | 2 |
| ESCSI Drive 3 | 3 |
| Expansion Dev | 4 - 5 |
| Tape Drive | 6 |
| Host Adaptor | 7 |

The daisy chained cable must be terminated at both ends using 220/330 ohm resistors. On the SCSI SX the SCSI Host Adaptor board and ESCSI drive 0 (or SCSI/ST-506 adapter) are the terminated ends. See figure 4-12. SCSI bus termination consists of 220/330 resistor networks on the host adaptor card and ESCSI drive 0 (or SCSI/ST-506 adapter).

If an external expansion cabinet is used with a SCSI SX system, the terminating networks are removed from the SCSI host adaptor in the system unit. The last physical drive in the expansion cabinet must then have termination since it is at the end of the SCSI bus. Included with the expansion unit is a terminating plug to be used in the external SCSI I/O port (220/330 ohms). If the expansion unit is disconnected from the host system, the terminating plug provided with the expansion disk must be plugged into the SCSI I/O socket of the host system.

ST506 Disk Drive Controller

The ST506 controller is assigned SCSI device address 0. Two ST506 disk drives may be connected to the controller. The last ST506 drive must be terminated with a 1K ohm terminator and have the appropriate drive number selected. See figure 4-13 for cabling information.

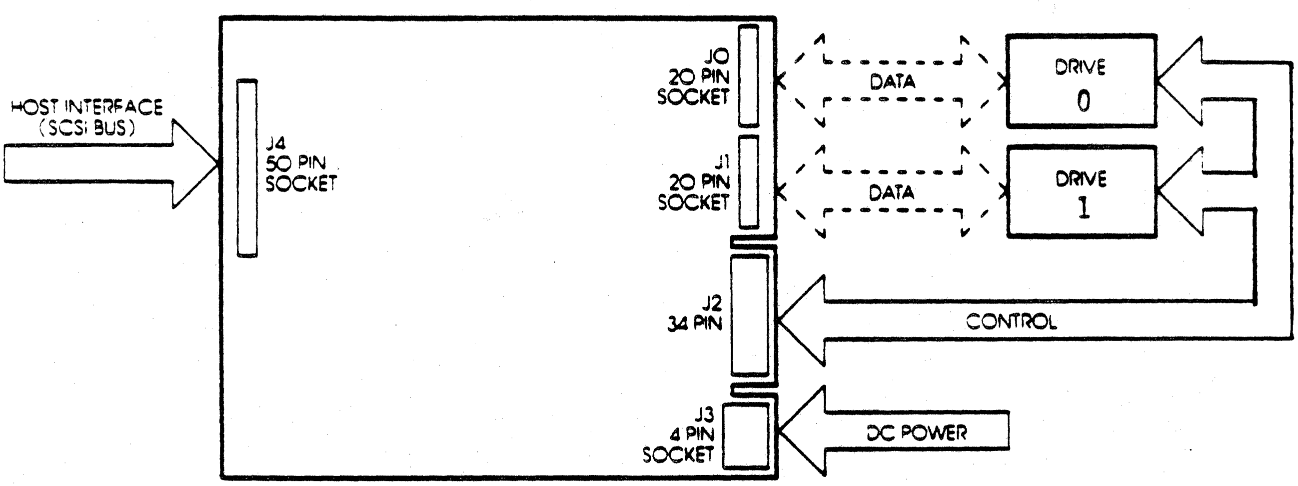



FIGURE 4-13. Controller Cabling

ESCSI Based Systems

Currently available ESCSI drives provide a formatted capacity of 145 Megabytes and come equipped with the control logic embedded within the drive itself. These drives are designed to be attached directly to the SCSI bus with no intermediate controller board. Each ESCSI drive is assigned a SCSI device number and must be jumper selected appropriately.

On an ESCSI drive system the drive in the system unit is assigned device number 0. Since it is the last device in the SCSI daisy chain, it must be terminated by installing 220/330 ohm resistors at locations U20, U32, and U41 and by installing the "TP" jumper on the J4 connector on the drive. See figure 4-14.

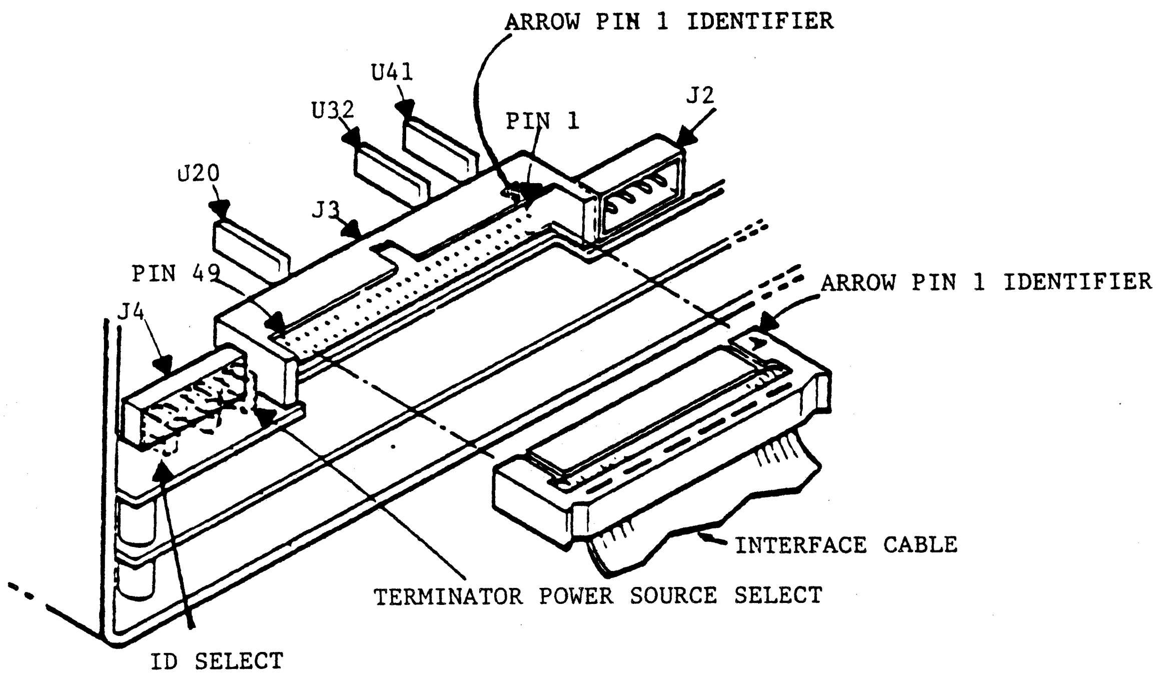
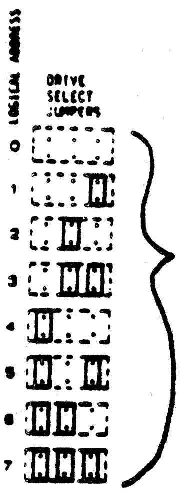



**FIGURE 4-14 ESCSI Termination and cabling**

Device ID Number Selection

The ESCSI disk drive in the main cabinet is assigned logical device address 0. The drive ID is binary coded on jumpers "DRIVE SELECT 2, 1, 0" on J4 jumper. For a logical value of zero, install the TP jumper, but do not install any drive select jumpers. For drive number 1 (expansion cabinet) only install a jumper on drive select 0. See figure 4-15.



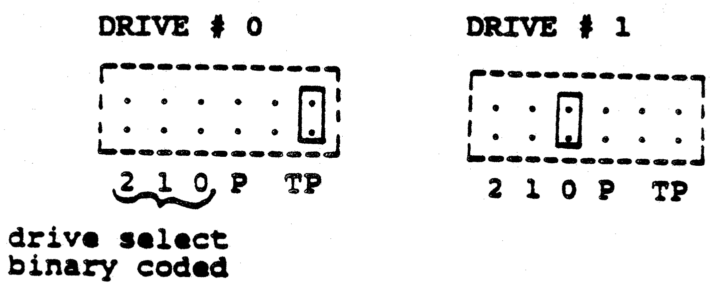




**FIGURE 4-15 ESCSI Drive ID Selection**

## Streaming Tape Controller

The streaming tape controller board is located under the tape drive. Note that this is a different board than that used with the older PIO tape controller. However, the 60 MB tape drive itself is identical to the one used in earlier PIO based tape systems. The controller board interfaces the 1/4" streaming tape drive to the SCSI system. The controller card supports both QIC-24 and QIC-11 media formats. See figure 4-16 for controller connections.

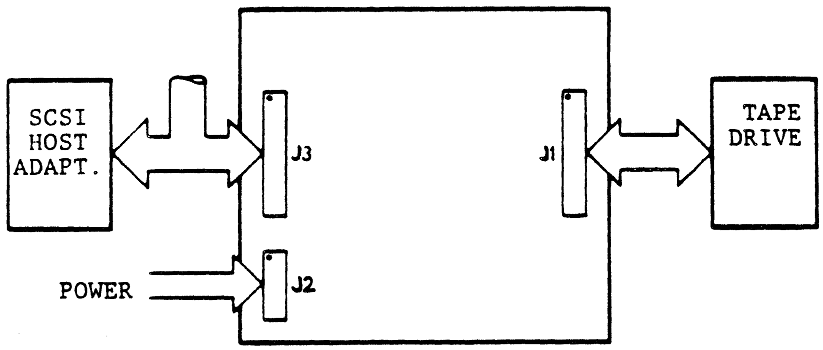



FIGURE 4-16 Tape Controller Connections

The tape controller is assigned SCSI device address 6. The address is encoded on jumpers J6 (lsb), J7, and J8 (msb). See figure 4-17.

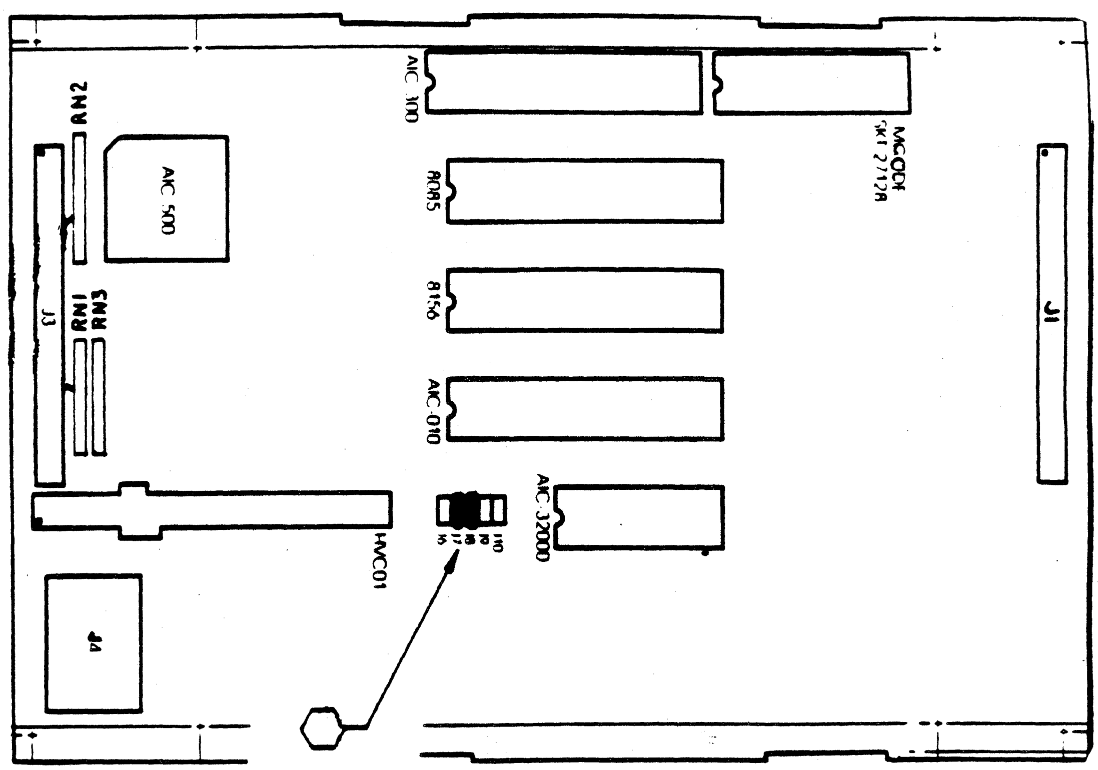



**FIGURE 4-17 Tape Controller**
Selected SCSI address # 6 by installing jumpers J7 & J8.

### Operating System Considerations

To connect multiple hard disk drives to a system, changes must be made to the operating system configuration files, and the drive(s) to be added must be properly setup. Configuration software is included with each upgrade drive or expansion cabinet which allows this to be done through a series of simple menus. Consult the documentation provided with the expansion disk upgrade kit for information.

## MEMORY CONFIGURATION

The system memory can be configured using combinations of four available memory boards: 1MB, 512KB, 256KB, and 128KB. The 128KB board is not compatible with the 1MB or 512KB memory boards, and is not generally in use. In a system which uses one or more 1MB or 512KB boards, the first board is installed in the the wide slot at the rear of the memory bus, and a ribbon cable is daisy-chained to the other 1MB and 512KB boards. This cable carries additional address lines not found in the four narrower memory bus slots. Table 6-2 shows the different memory sizes possible when using only 256KB and 512KB memory cards and the recommended board location for each memory size.

Table 6-2
Memory Configuration

| Memory | CLA Connector | | | | |
|---|---|---|---|---|---|
| Size | PM1 | PM2 | PM3 | PM4 | PEC |
| 256KB | 256KB | | | | |
| 256KB | 128KB | 128KB | | | |
| 384KB | 256KB | 128KB | | | |
| 384KB | 128KB | 128KB | 128KB | | |
| 512KB | 256KB | 256KB | | | |
| 512KB | 128KB | 128KB | 128KB | 128KB | |
| 640KB | 256KB | 256KB | 128KB | | |
| 768KB | 256KB | 256KB | 256KB | | |
| 896KB | 256KB | 256KB | 256KB | 128KB | |
| 1 MB | 256KB | 256KB | 256KB | 256KB | |

**Notes for 1 Meg (and 1/2 Meg) boards**

SLOT
rear
PEC
PM1
PM2
PM3
PM4
front

The system addresses memory starting with the board in slot PM1 then PM2, PM3, PM4, ending with the board in the PEC slot. The 1 Meg board (or 1/2 Meg board) may be installed in systems that already contain one or more 256K boards installed in slots PM1 thru PM4, or may be installed in various combinations with each other.

More recently manufactured boards have different allowable configurations than the older 1 Meg and 1/2 Meg boards. The factor which determines allowable configurations for memory boards is the starting address of each board in the system and the model and revision level of the mother board. Current production SX series mother boards allow for installation of up to 3.5MB of memory, older SX and XP mother boards allow 2MB, and the earliest mother boards allowed the installation of 1MB.

The starting address of each of the 256K boards is determined by its slot location, e.g. PM1 starts at 0K (0x00000), PM2 starts at 256K (0x40000), PM3 starts at 512K (0x80000), PM4 starts at 768K (0xc0000). Starting addresses for 256K boards are therefore not alterable.

Starting addresses for 1 Meg and 1/2 Meg boards are jumper selectable. The 1 Meg board (or 1/2 Meg board) is factory jumpered to be the last board of memory in a 2 (or 1.5) Meg system, i.e. its starting address is set to 1MB (0x100000).

The desired starting address for a particular 1 Meg (or 1/2 Meg) board determines the jumper configuration on the 1 Meg board (or 1/2 Meg board) according to the tables below. The jumper pins are labeled **B12C, B12D, B12E,** and are located in the upper left corner of the 1 Meg board (or 1/2 Meg board) on the component side.

**The first table below is for earlier revision 1 Meg and 1/2 Meg boards.** The Fortune Systems part numbers for these two boards are 1003307-03 and 1003307-04 respectively. **The second table is for current production boards,** part number 1003307-05 (1 Meg) and 1003307-06 (1/2 Meg). Note that **older boards have a maximum starting address of 1MB** (0x100000), and that **newer boards may only be set for starting addresses in 1MB or 1/2MB increments.** When configuring system memory boards keep in mind that there may be no "holes" or overlapping in memory address space.

| number of 256 K boards | Starting Address (MB) | Jumper Configuration B12C | B12D | B12E | Address range of 1 Megabyte board | Address for Next Board (megabytes) |
|---|---|---|---|---|---|---|
| 0 | 0.00 | 1-2 | in | 1-3 | 000000 - 0fffff | 1.00 |
| | | | | | **(000000 - 07ffff)** | **(0.50)** |
| 1 | 0.25 | 1-2 | out | 1-3 | 040000 - 13ffff | 1.25 |
| | | | | | **(040000 - 0bffff)** | **(0.75)** |
| 2 | 0.50 | out | out | 1-3 | 080000 - 17ffff | 1.50 |
| | | | | | **(080000 - 0fffff)** | **(1.00)** |
| 3 | 0.75 | out | in | 1-3 | 0c0000 - 1bffff | 1.75 |
| | | | | | **(0c0000 - 13ffff)** | **(1.25)** |
| 4 | 1.0 | out | in | out | 100000 - 1fffff | 2.00 |
| | | | | | **(100000 - 17ffff)** | **(1.50)** |

Table 6-3
1 Meg (and 1/2 Meg) Memory Board Strap Configurations.
Older boards (1003307-03 and 1003307-04)

**Note: 1/2 Meg boards use the same jumper settings as 1 Meg boards shown in column 3. In columns 4 and 5, 1/2 Meg board values are enclosed in parentheses.**

| Starting Address (MB) | Jumper Configuration B12C B12D B12E | Address range of 1 Megabyte board | Address for Next Board (megabytes) |
|---|---|---|---|
| 0.0 | 1-2 in 1-3 | 000000 - 0fffff<br>**(000000 - 07ffff)** | 1.0<br>**(0.5)** |
| 0.5 | 1-2 in out | 080000 - 18ffff<br>**(080000 - 0fffff)** | 1.5<br>**(1.0)** |
| 1.0 | 1-2 out 1-3 | 100000 - 1fffff<br>**(100000 - 07ffff)** | 2.0<br>**(1.5)** |
| 1.5 | 1-2 out out | 180000 - 27ffff<br>**(180000 - 1fffff)** | 2.5<br>**(2.0)** |
| 2.0 | out 1-2 1-3 | 200000 - 2fffff<br>**(200000 - 27ffff)** | 3.0<br>**(2.5)** |
| 2.5 | out in out | 27ffff - 37ffff<br>**(Not Available)** | 3.5<br>**1 Meg Only** |
| 3.0 | out in out | Not Available<br>**(300000 - 37ffff)** | **1/2 Meg Only**<br>**(3.5)** |

Table 6-4
1 Meg (and 1/2 Meg) Memory Board Strap Configurations.
<u>Newer boards (1003307-05 and 1003307-06)</u>

**Note: 1/2 Meg boards use the same jumper settings as 1 Meg boards shown in column 2. In columns 3 and 4, 1/2 Meg board values are enclosed in parentheses. 256K boards may also be used with new model 1 Meg and 1/2 Meg boards, but were not included in the table. Due to address strapping limitations, only 2 or 4 256K boards may be used with the newer boards, and they must be installed sequentially in slots PM1, PM2, PM3, and PM4.**

# CHAPTER 5

# DIAGNOSTICS

## Load Procedure

Turn on system power, or hit reset while holding down the <Cancel/Del> key. Within a few seconds, the system will display the maintenance screen (Figure 5-1), or the front view of the Icon Maintenance Screen (Figure 5-2). If your system displays the maintenance screen continue on this page. If it displays the Icon maintenance screen then proceed to page 5-2.

---

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| | | |
|---|---|---|
| **F1** | Change front port speed | 24ØØ |
| **F2** | Change back port speed | 96ØØ |
| **F3** | Change power-up action | Boot up |
| **F4** | Change boot device | WD Boot,Drive Ø |
| **F5** | Change boot program number | Ø |
| **F6** | Change floppy drive Ø type | Tandon |
| **F7** | Set boot file name | hdØ2/unix |
| **F8** | Read settings from EAROM | |
| **F9** | Save settings from EAROM | |

**EXECUTE**
**HELP**

Type any highlighted key

EAROM has been changed x times

---

Figure 5-1
-Maintenance Screen-

Insert the diagnostic disk into the flexible drive. Press the function key <F4>, and observe that 'Change boot device' is now highlighted. Press the space bar until the boot device is changed to 'Floppy Drive Ø'

Press the function key <F7>, and observe that 'Set boot file name' is highlighted, and that 'hdØ2/unix' is no longer displayed.

Select desired diagnostic by entering one of the file names from table 5-1. and press <RETURN> then <EXECUTE> to load the diagnostic.

## Load Procedure

Turn on system power, or hit reset while holding down the <Cancel/Del> key. Within a few seconds, the system will display the Icon Maintenance Screen (Figure 5-2).

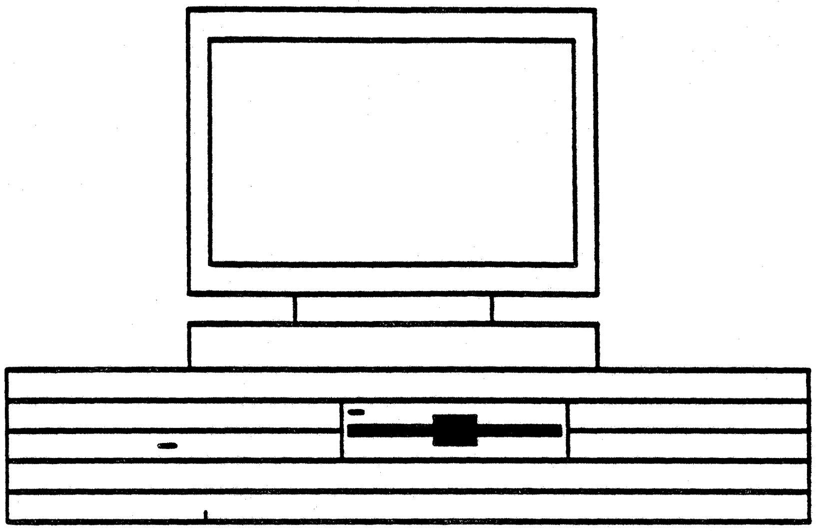


Figure 5-2
Front View of Icon Maintenance Screen

Insert the diagnostic disk into the flexible drive. Press RETURN twice or until the zeroes are positioned under the diskette drive portion of the icon. The cursor should be located on the left-hand zero.

Press EXECUTE and notice the message displayed on the console "fd02/sa/reconf".

Select desired diagnostic by entering one of the file names from table 5-1 and press <RETURN> then <EXECUTE> to load the diagnostic.

Table 5-1
SYSTEM DIAGNOSTICS

| Selections | Diagnostic | Page |
|---|---|---|
| fd02/mem | Memory | 5-4 |
| fd02/memlow | Low Memory | 5-8 |
| fd02/mmu | Memory Management Unit | 5-13 |
| fd02/kbtest | Keyboard and CRT | 5-15 |
| fd02/fdtest | Flexible Disk | 5-17 |
| fd02/hdtest | Hard Disk | 5-21 |
| fd02/coma | COMM-A Controller | 5-39 |
| fd02/comb | COMM-B Controller | 5-46 |
| fd02/bitg | Graphic Board | 5-47 |
| fd02/pio | PIO Board | 5-48 |
| tapediag | Streamer Tape | 5-49 |
| Duplicating Diagnostic Diskettes | | 5-52 |

See documentation for loading instructions for tapediag.

## MEMORY DIAGNOSTICS

The memory diagnostics (mem and memlow) provide a means to test all memory boards in a system. The user-interface is menu driven, however with the exception of the 'use quick test only' and 'check parity' options the tests are run in a predetermined order with no user interaction.

The 'memlow' diagnostic tests memory locations Øx1ØØØ thru Øx4ØØØ, while 'mem' tests memory locations Øx3f58 and above. Memlow tests the area in which the diagnostic program and its data normally reside.

NOTE

> The prefix Øx denotes a hexadecimal number. Numbers not proceded by Øx are interpreted as decimal numbers by the diagnostic. Either decimal or hex numbers may be used, however, all numbers returned by the diagnostic will be in hex.

### Loading 'mem' Diagnostic

Load the diagnostic according to the load procedure on page 5-1 or 5-2, and select file name 'fdØ2/mem'. After a succeessful load the following will appear:

```
mem: Fortune Systems Memory Diagnostic
Version 4.Ø  Made Jul 24 1985 at 11:31

'mem' residees in ram between locations Øx0 and Øx3ab4.
Use 'lowmem' to test ram between these locations.

Do you want to run 'lowmem' or another diagnostic (no)?
```

**Do you want to run 'lowmem' or another diagnostic (no)?** - This line si a query asking the user if he wishes to run 'memlow' or another diagnostic. If the user types a RETURN <cr> only the default will be taken. (The default value is always shown in parenthesis followed by a question mark and is always used if only the <cr> key is hit).

### Running 'mem' tests

See Table 5-3 (Page 5-11) for a description of each test.

After hitting <cr> key in response to the query above, the following prompts will appear one at a time:

```
memory test start location (0x3ab4)?
memory test end location (0xbffff)? [End location is variable]
silent error reporting (yes)?
preform standard test sequence: Q, P, 1-10 (yes)?

The following range of memory locations will now be tested:
start loc = 3afc   end loc = bffff  # bytes = bc504
hit <return> to start test or <DEL> to re-enter parameters:
```

**memory test start location (0x3afc)? -**

This line asks the operator to specify the beginning address of memory locations to be tested. The cursor will be positioned after the question mark (?), and the user may respond with a RETURN <cr> to load the default value, or enter a new hex value as the starting memory location.

Notice that the start location default value is 0x3f58, this prevents the diagnostic program from overwriting itself or its data. The start location may be changed to any value above the default value.

**memory test end location (0xbffff)? -**

This line asks the operator to specify the ending address of memory locations to be tested. The cursor will be positioned after the question mark (?), and the user may respond with a RETURN <cr> to load the default value, or enter a new hex value as the ending memory location.

IMPORTANT:
The default end location should be checked against the actual amount of memory known to be in the system.

EXAMPLE:
Suppose a system has one 1 Meg board and two 256 K boards for a total of 1,572,864 bytes. The default end location should be 0x17FFFF. If the 'mem' diagnostic showed that the default end location was 0x13FFFF right away we know something is wrong.

| | | |
|---|---|---|
| known memory | 1,572,864 dec | 0x17FFFF hex |
| - default end location | 1,310,718 dec | 0x13FFFF hex |
| | 262,144 dec | 0x040000 hex |

the discrepancy is 256 K, this tells us that the last 256K memory board is so bad that the 'mem' diagnostic can't even address it.

The end location displayed is the last valid memory location as determined by the diagnostic. This is accomplished by writing a pattern to location 1ffffc (maximum long word memory address), and issuing a read to that location, if an error is reported the address is decremented by 128k and the above is repeated. This continues until the read is successful. The address of the first successful read is assumed to be the end location of memory.

**IMPORTANT:** Always check the end location to be sure it matches the amount of memory in your particular machine. If the end location differs, the last board (the board in the highest slot) is probably bad. An error of this type may not be detected by the diagnostics or the operating system but will probably cause system degradation (slow operation), or other difficult to analyze problems.

**silent error reporting (yes)?** -The default <CR> should be used.

**perform standard test sequence: Q, P, 1-10 (yes)? -**
The default value (yes) will perform tests Q, P, and 1-10 in succession on the range of memory selected. A (no) response will allow the tests to be selected individually.

**perform Test Q : Quick check.................... (yes)? -**
'Quick test only' is a fast verification of memory. The default value (yes) should usually be used in troubleshooting.

**perform Test P : Parity check................... (yes)? -**
The default value (yes) should be used. Check parity is used to test the parity checker and parity generator on the Motherboard. Bad parity is written to memory, (there is hardware to allow this) then memory is read. If the parity generator and checker are working correctly a parity error (level 7) interrupt will occur, if the interrupt does not occur an error is reported.

See **Table 5-3** for descriptions of tests 1-10

The last message displayed allows the user to verify the diagnostic set up before starting the actual testing.

Upon starting the test the following screen is displayed:

```
mem: Fortune Systems Memory Diagnostic
Version 4.0. Made Jul 24 1985 at 11:31

0        256      512      768      1024     1280     1536     1792     2048
|        |        |        |        |        |        |        |        |
11111111111111111111111111111111111111110000111l****************


pass    1:              test      pass      total
Data errors:             0         0          0
Parity errors:           0         0          0
Latch errors:            0         0          0
Refresh errors:          0         0          0


Q  : Quick check.....................[]
```

Each asterisk '*' represents 32,768 8 bit memory locations, or 32K bytes.

Each one '1' represents a 32K section of memory that is being tested.

Each zero '0' represents a 32K section of memory that has **failed** the diagnostic.

In the above 'screen' memory locations 16,216 (0x3f58) to 1,572,863 (0x17ffff) are being tested. Locations 1,179,648 (0x140000) to 1,441,791 (0x15ffff) have **failed** the diagonstic and are marked by zeros. See **Table 5-2** for address conversions.

EXAMPLE

Following is a sample error report and a discussion on how the technician may wish to set each parameter.

An end user reports that his machine is very intermittently displaying system error message '120' (see table 3-1 on page 3-6) and the address displayed with the message always seems to be 17f02. The technician may wish to exercise that address vigorously to determine if, in fact, the problem is memory. The start address in this case may be set to something like 0x17f00. The address 17f00 was chosen because some of the tests operate on long words (four bytes); therefore, the long word address which includes 17f02 begins at 17f00.

The end location in this case should be set to 0x17f03. Like the choice of the start address above this end address was chosen because it is the end address of the long word which includes 17f02. The smallest recommended address range is four bytes on the following boundaries; 0xXXXX0-0xXXXX3, 0xXXXX4-0xXXXX7, 0xXXXX8-0xXXXXb, 0xXXXXc-0xXXXXf

**Loading 'memlow' diagnostic**

**-NOTE-**

**'Memlow' diagnostic will hang when run in systems using Graphic controller as the console.**

Follow the procedure on 5-1 or 5-2 using 'fd02/memlow' as the boot file name.

**Running 'memlow' tests**

After 'memlow' is successfully loaded the following will appear:

---

```
memlow:   Fortune Systems Low-Memory Diagnostic
Version 4.0. Made Jul 24 1985 at 11:31

  silent error reporting (yes)?
```

---

**silent error reporting (yes)?** - The default <cr> should be used.

The following memory locations on the slot 1 memory card will now be tested: start location = 1000 end location = 4000 # bytes = 3000
hit <return> to start test or <DEL> to re-enter parameters...

**NOTE:** The system MOM-ROMS automatically check locations 0 - 1000 on reset or power-up.

**Stopping the tests**

As the diagnostic runs, the cursor will move left and right on the screen to indicate that the test is running. The speed of the 'heartbeat' will depend on memory size; the larger the memory the slower the heartbeat. As each test is started, the number of each test will be displayed. After each pass the following message will be displayed showing the number of times the diagnostic has been run and the number of errors encountered.

QP 1234567890 Pass n Pass errors = 0 Cum errors =0

The diagnostic cycles continuously until stopped by the user. To stop the testing hit the CANCEL/DEL key. When this key is hit the following message will be displayed:

---

```
  Memory test interrupted.
    interrupted pass n:  pass errors = e,  cum. errors = c

  Do you want to terminate this test (no)?
```

---

Where:

n = Pass number that was running at the time key was hit.

e = Number of errors which had occurred during that pass.

c = Total number of errors encountered from all passes run to that point.

Table 5-3

TEST DESCRIPTION

| | |
|---|---|
| Test Q - | Part 1 - Writes 5555 to memory and checks it, then writes aaaa to memory and checks it. Part 2 - Ones and zeros walked through memory. |
| Test P - | Writes parity errors into locations in memory and tests to see if errors are detected during read cycle |
| Test 1 - | Cambridge pattern ØØ written to even bytes, ff written to odd bytes |
| Test 2 - | Address pattern Least significant byte of address written to memory |
| Test 3 - | Alternate ones and zeros, aa written to each byte |
| Test 4 - | Address inverse pattern logical NOT of test 2 |
| Test 5 - | Alternate zeros and ones, 55 written to each byte |
| Test 6 - | All ones |
| Test 7 - | Inverse Cambridge pattern, logical NOT of test 1 |
| Test 8 - | All zeros |
| Test 9 - | Walking one pattern, one bit is set and written to all even bytes, while its inverse is written to all odd bytes. Eight passes are used, with bit shifting for each pass. |
| Test 1Ø - | Walking zero pattern, logical NOT of test 9 |

## Notes for 1 Meg (and 1/2 Meg) boards

```
SLOT
                 rear
PEC  ===================
PM1         ============
PM2         ============
PM3         ============
PM4         ============
                 front
```

The system addresses memory starting with the board in slot PM1 then PM2, PM3, PM4, ending with the board in the PEC slot. The 1 Meg board (or 1/2 Meg board) may be installed in systems that already contain four 256K boards installed in slots PM1 thru PM4, or may be installed in various combinations with each other.

More recently manufactured boards have different allowable configurations than the older 1 Meg and 1/2 Meg boards. The factor which determines allowable configurations for memory boards is the starting address of each board in the system and the model and revision level of the mother board. Current production SX series mother boards allow for installation of up to 3.5 MB of memory, older SX and XP mother boards allow 2 MB, and the earliest mother boards allowed the installation of 1 MB.

The starting address of each of the 256K boards is determined by its slot location, e.g. PM1 starts at 0K (0x00000), PM2 starts at 256K (0x40000), PM3 starts at 512K (0x80000), PM4 starts at 768K (0xc0000). Starting addresses for 256K boards are therefore not alterable.

Starting addresses for 1 Meg and 1/2 Meg boards are jumper selectable. The 1 Meg board (or 1/2 Meg board) is factory jumpered to be the last board of memory in a 2 (or 1.5) Meg system, i.e. its starting address is set to 1MB (0x100000).

If after running memory diagnostics the technician determines that one or more of the 256K boards is bad, the defective boards should be swapped with good ones.

If, for any reason, the technician cannot acquire good boards to swap, the technician can remove the defective 256K boards and rejumper the 1 Meg board (or 1/2 Meg board) to reflect the decreased amount of memory available. This approach will decrease 'down time' and buy the technician some time to acquire replacement boards.

The desired starting address for a particular 1 Meg (or 1/2 Meg) board determines the jumper configuration on the 1 Meg board (or 1/2 Meg board) according to the tables below. The jumper pins are labeled **B12C, B12D, B12E,** and are located in the upper left corner of the 1 Meg board (or 1/2 Meg board) on the component side.

**The first table below is for earlier revision 1 Meg and 1/2 Meg boards.** The Fortune Systems part numbers for these two boards are 1003307-**03** and 1003307-**04** respectively. **The second table is for current production boards,** part number 1003307-**05** **(1 Meg)** and 1003307-**06** **(1/2 Meg)**. Note that **older boards have a maximum starting address of 1 MB** (0x100000), and that **newer boards may only be set for starting addresses in 1 MB or 1/2 MB increments.** When configuring system memory boards keep in mind that there may be no "holes" or overlapping in memory address space.

| number of 256 K boards | Starting Address (MB) | Jumper Configuration B12C | B12D | B12E | Address range of 1 Megabyte board | Address for Next Board (megabytes) |
|---|---|---|---|---|---|---|
| 0 | 0.00 | 1-2 | in | 1-3 | 000000 - 0fffff | 1.00 |
| | | | | | **(000000 - 07ffff)** | **(0.50)** |
| 1 | 0.25 | 1-2 | out | 1-3 | 040000 - 13ffff | 1.25 |
| | | | | | **(040000 - 0bffff)** | **(0.75)** |
| 2 | 0.50 | out | out | 1-3 | 080000 - 17ffff | 1.50 |
| | | | | | **(080000 - 0fffff)** | **(1.00)** |
| 3 | 0.75 | out | in | 1-3 | 0c0000 - 1bffff | 1.75 |
| | | | | | **(0c0000 - 13ffff)** | **(1.25)** |
| 4 | 1.0 | out | in | out | 100000 - 1fffff | 2.00 |
| | | | | | **(100000 - 17ffff)** | **(1.50)** |

1 Meg (and 1/2 Meg) Memory Board Strap Configurations.
<u>Older boards (1003307-**03** and 1003307-**04**)</u>

**Note:** 1/2 Meg boards use the same jumper settings as 1 Meg boards shown in column 3. In columns 4 and 5, 1/2 Meg board values are enclosed in parentheses.

| Starting Address (MB) | Jumper Configuration B12C | B12D | B12E | Address range of 1 Megabyte board | Address for Next Board (megabytes) |
|---|---|---|---|---|---|
| 0.0 | 1-2 | in | 1-3 | 000000 - 0fffff<br>**(000000 - 07ffff)** | 1.0<br>**(0.5)** |
| 0.5 | 1-2 | in | out | 080000 - 18ffff<br>**(Not Avaialable)** | 1.5<br>**1 Meg Only** |
| 1.0 | 1-2 | out | 1-3 | 100000 - 1fffff<br>**(Not Available)** | 2.0<br>**1 Meg Only** |
| 1.5 | 1-2 | out | out | 180000 - 27ffff<br>**(Not Available)** | 2.5<br>**1 Meg Only** |
| 2.0 | out | 1-2 | 1-3 | 200000 - 2fffff<br>**(Not Available)** | 3.0<br>**1 Meg Only** |
| 2.5 | out | in | out | 0c0000 - 1bffff<br>**(Not Available)** | 3.5<br>**1 Meg Only** |
| 3.0 | out | in | out | Not Available<br>**(100000 - 17ffff)** | **1/2 Meg Only**<br>**(3.5)** |

1 Meg (and 1/2 Meg) Memory Board Strap Configurations.
<u>Newer boards (1003307-05 and 1003307-06)</u>

**Note:** 1/2 Meg boards use the same jumper settings as 1 Meg boards shown in column 2. In columns 3 and 4, 1/2 Meg board values are enclosed in parentheses. 256K boards may also be used with new model 1 Meg and 1/2 Meg boards, but were not included in the table. Due to address strapping limitations, only 2 or 4 256K boards may be used with the newer boards, and they must be installed sequentially in slots PM1, PM2, PM3, and PM4.

## MEMORY MANAGEMENT UNIT

### Loading mmu Diagnostic

Load diagnostic according to the load procedure on page 5-1, or 5-2, by selecting file name 'fd02/mmu'. Refer to Table 5-2 (Page 5-10) to verify that the end location is correct, and press <RETURN>. The diagnostic will then load each memory location with a test pattern, and then check the information it has loaded. Select the default values, and start the test by pressing <RETURN> after each question. The MMU diagnostic takes between 5 and 100 seconds to run, and will display the following message when complete:

```
mmu pass n: total cumulative errors = x
```

The mmu test will run continuously, reporting errors as they occur. At the end of each pass the error statistics are printed in the following format:

```
mmu pass P: total cumulative errors = E
S seg errs: N mapping, N no r/o trap,
                       N r/o trap/write
(Virt addr: and VA, or VO)(Phys: and PA, or PO)
```

As of the end of pass P, there have been E total errors. The second line is repeated for each segment that has had errors, where S is the segment letter, and N is the number of errors of each type. If there have been any mapping errors, the third line will be present, and displays anded values to show bits common to the addresses with errors, while the ored values show all address bits involved with any addresses with errors.

## ERROR MESSAGES

The Error messages in table 5-4 contain the following variables:

| Segment | Address (in Hex) |
|---|---|
| T = Text Segment | VA = Virtual Address |
| D = Data Segment | VD = Data read thru VA |
| S = Stack Segment | PA = Physical Address |
| X = Non-implemented segment | PD = Data read thru PA |

Table 5-4

ERROR MESSAGES

| ERROR MESSAGE | MEANING |
|---|---|
| ERROR--no trap on write to read-only segment (S seg) | A write was attempted to a read only segment and no trap occurred |
| ERROR--trap occurred (S seg, r/o) but write was not suppressed | A write was attempted to a read only segment and a trap was generated, but the hardware did not prevent a write. |
| ERROR--can't restore location PA | After a read-only segment check data was not restored. Rerun the memory diagnostic. |
| S seg PARITY ERROR: Virtual (VA); Physical (PA)=(PD) | A parity error occurred during the test of VA, which corresponds to PA. Data read from PA was PD |
| S seg error: virtual (VA) = VD Physical (PA) = PD | An MMU mapping error occurred. VA should map to PA, and VD should equal PD |
| Trap S seg ERROR: Virtual (VA) (VA) = VD; physical (PA) = PD | An MMU trap occurred where one one should not have happened. |
| No trap S reg ERROR: Virtual (VA) = VD Physical (PA) = PD | An MMU trap did not occur where one should have. |
| Unexpected bus error Hit DEL | An unexpected bus error or parity parity error occurred. Press <CANCEL/DEL> to continue |
| Unexpected parity error pc = PC, location = AA | Parity error occurred at AA. Program Counter = PC |

## KEYBOARD/CRT

### Loading kbtest Diagnostic

Load the diagnostic according to load procedure on page 5-1, or 5-2, by selecting file name 'fd02/kbtest'. This diagnostic is used to verify that the monitor and keyboard sub-assemblies are working properly.

### Running kbtest

### The CRT Scroll Test

The first message after loading the test will ask if you wish to do the CRT Scroll test. If you answer yes (hitting RETURN defaults to yes) the next message will ask you if you have a domestic keyboard, for domestic systems the default is RETURN, if you answer no an international CRT test will run.

The CRT Scroll test displays a line of characters, and then rolls the line up the screen. If there are any bad bits in the monitor controller RAM, the characters will change as they roll up the screen. Improperly displayed characters can be an indication of trouble in the monitor controller, monitor, CLA or interconnecting cabling.

After the scroll test runs the diagnostic will say 'Hit any key to continue'. The next message will ask you if you wish to do the attribute test. Default, (RETURN) causes this test to run.

### The CRT Attribute Test

This test displays the attributes in different combinations to insure that each will operate. When this test finishes you will be asked to hit ESC to continue, then you will be asked if you wish to do the keyboard test.

### Keyboard Test

The first message will ask you to enter the keyboard type. The valid types are listed below:

AM - American
BR - British (U.K.)
SA - South African
FR - Francaise
DE - Deutsch
IT - Italian
SV - Sverige
NO - Norge
SR - Swisse - Romande
CF - Canadian - French
SD - Schweiger - Deutsch
SP - Spanish - Portuguese

If an error is made on this selection, you can exit the keyboard test by hitting SHIFT/NUMERIC KEYPAD RETURN.

An outline of the keyboard will be displayed, as you press a key that location on the outline should change to the letter on the key top.

**NOTE** - Be sure to read the directions at the top of the display.

**-NOTE-**

**When using a fortune 1000 as the remote console the brace key will fail the keyboard diagnostic test.**

**Driver Test**

This test allows you to check the keyboard 'bell'. Each time you hit a key the alarm sounds. Hit ESC key to exit.

**Cursor Positioning Test**

This test places an 'X' in every screen position to test the cursor positioning logic of the monitor controller. This test is also very useful for CRT alignment and focusing.

**Exiting the test**

At the end of the Cursor Positioning Test the 'boot' message will be displayed allowing the user to boot the next program as desired.

## FLEXIBLE DISK DIAGNOSTIC

Load the diagnostic according to load procedures on page 5-1, or 5-2, by selecting file name 'fd02/fdtest'. The following tests will verify that the flexible disk subsystem is operating properly. A default test sequence has been selected for quick diagnosis. Optional tests are listed in Table 5-5, and are for more specific troubleshooting. If an error is encountered during the execution of the following tests, the flexible disk drive, CLA, or cable will usually repair the fault. Always suspect media first.

After the test has been loaded, the following will appear in the upper left corner of your screen.

**fdtest: Fortune Systems Flexible Disk Diagnostic**
**Version 4.0. Made Jul 24 1985 at 11:20**

**Has the diagnostic disk been removed (no)?**

This line is asking if the diagnostic disk has been removed so that it will not be destroyed. The test sequence about to be performed writes to disk (unless it is write protected).

At this point, the diagnostic disk should be removed and a scratch disk inserted. Scratch disks must be certified for 96 tracks per inch, soft sectored, dual density, double sided, 80 tracks per side. Answer 'y' <RETURN>.

**Has a scratch disk been inserted (no)?**

If you have inserted the scratch disk then answer 'y' <RETURN>.

**Specify Drive type (1) TEC, (2) Shugart (1)?**

TEC drives are half-height with a lever type clamping mechanism. They are being built into all new XP systems, thus the reason for the default to (1). Shugart drives are full height with a door tab clamping mechanism. These drives have been installed on 32:16 and older XP systems.

If you have a TEC drive, press <RETURN>.
If you have a Shugart drive type '2' <RETURN>.

**Perform standard test sequence: (init,format,write,read,seek) (yes)?**

Press <RETURN> if yes. Type 'n' <RETURN> for optional commands.

**Use standard parameters ?**
**(Drive 0, 2 Sided, trk 0-79, 2 pass write-cycle, 1 pass read-cycle, 10 pass seek-cycle, 10 tracks used, 3ms step rate) (yes)?**

Press <RETURN> to start test sequence. Type 'n' <RETURN> if other parameters are desired.

```
Current drive selected is 0
initializing: enabling interrupts...recalibrating drive 0...done
initialization complete.
FORMAT DISK: (in process)
.....................................................................
formatting complete.
WRITE CYCLE TEST (in process)
pass 1 (writing)
pass 1 (scanning)
pass 1 cum errors: 0 write (800 tries), 0 scan (800 tries)
pass 2 cum errors: 0 write (800 tries), 0 scan (1600 tries)
READ CYCLE TEST: (in process)
pass 1 (reading)
pass 1 cum errors: write 0 (0), read 0 (800), 0 data
SEEK CYCLE: (in process)
tests complete. Have you read the screen (no)?
```

This test sequence is run only if all the defaults are taken or the command **'auto'** is entered from the fdtest prompt. The fields we are concerned with are 'cum errors' during both passes of the WRITE CYCLE TEST and one pass of the READ CYCLE TEST. These should all be zeros except for the numbers in parenthesis which are the number of tries. All other tests report their own errors. The last line is asking if you have read the screen. The default is no so that the screen data is saved for evaluation. To proceed, type 'y' <RETURN>

```
Block size is set to 1024, operating in interrupt mode with drive 0
selected.
Hit HELP for command assistance
fdtest:
```

If no errors were encountered this may be all the testing that you wish to do. If a heat problem is suspected, longer tests are available in the optional commands section. If format, scan or write errors were detected, try reinserting the disk, using another scratch diskette or reformatting before replacing any parts.

### Interrupting Tests

All testing will be halted by pressing the <CANCEL/DEL> key. The diagnostic returns to asking if standard testing is desired. If you do wish to quit, type 'n' <RETURN> at this prompt.

To quit testing, type 'q' or 'exit' from the fdtest command prompt followed by a <RETURN>. This will exit to the boot prompt. Be sure to remove the scratch diskette before attempting to boot into another test.

### Optional Commands

Commands listed in Table 5-5 are used for more specific testing and where appropriate, are grouped with commands with which they are usually associated.

Table 5-5

Additional Commands

| Command | Comments |
|---|---|
| help | Displays a menu of all possible commands. |
| recalibrate | Relocates the read/write heads to track Ø. |
| information | General information on flexible disk diagnostic operation. |
| auto | Runs initialize, format, write cycle, read cycle, and seek cycle tests sequentially (1 pass only). |
| environment | Provides information on chip status, current drive selected, current block size, mode of operation (polled vs. interrupt). |
| exit | Exit diagnostic and return to boot prompt. |
| specify | Disk head actuator step rate in 2ms increments. Range is from 1 - 15. Select 3. |
| seek | Moves the heads to the track and side specified. |
| read id | Reads the current positof the read/write heads. |
| write | Writes data pattern selected to the specified track, side and sector. |
| read | Reads the track, sector and side specified. |
| write cycle | Writes a test pattern to selected tracks, then reads and compares the data to verify accuracy. Test runs until interrupted by <CANCEL/DEL>. |
| read cycle | Reads all blocks on the diskette and checks for correct 'CRC' characters (data integrity). No data compares are performed. |
| scan cycle | Same as write cycle above. |

Table 5-5 (Continued)

| Command | Comments |
|---|---|
| seek cycle | At the step rate specified, the test moves the heads to designated tracks and side for a selected number of test cycles. Default values are 10 tracks to be tested, for 10 cycles, at a step rate of 13 (26 ms) in the following order:<br><br>track 0, side 0 - track 79, side 1<br>track 10, side 0 - track 70, side 1<br>track 20, side 0 - track 60, side 1<br>track 30, side 0 - track 50, side 1<br>track 40, side 0 - track 41, side 1 |
| drive sense | Display status for selected drive. |
| drive select | Change drive under test (0-3). |
| drive <number> | Current drive selected is (0-3). |
| interrupt mode | Current mode is interrupt or polled. |
| interrupt enable | Selects interrupt mode. |
| interrupt disable | Selects polling mode. |

## HARD DISK DIAGNOSTIC

The hard disk diagnostic provides a means to verify that the hard disk system is working properly. There are two default test for testing the integrity of the hard disk(s). The first default test is the **PROTECT** test. If the protect test is not selected the diagnostic prompts for selection of the second default test which is the **READTST.**

The **protect** test is used to read and write all disk blocks, while ensuring the integrity of customer data stored on the disk. The **read** test also checks data integrity on the hard disk, but does no writes. This test runs much faster than **protect**, and is, therefore, a good quick disk verification test. Both the **protect** and the **read** test default to run in a sequential buffered mode. Sequential means that blocks are tested in order starting from **START BLOCK** to **END BLOCK.** Buffered means that reads and writes of many blocks are done at a time. This decreases the time it takes for the test to complete.

The default **protect** and **read** tests described above are able to locate blocks on the hard disk that are bad. They don't test the capability of the drive to seek to a random cylinder and read a specified block.

It is recomended that the **seek** test be run if the **protect** or **read** tests run error free. The **seek** test can detect problems associated with head settling time, and head movement, better than the **protect** or **read** tests.

### Loading hdtest

Load the diagnostic according to the instructions on page 5-1 or 5-2 and select filename 'fd02/hdtest'.

After a successful load the following will appear:

---

hdtest: Fortune Systems Hard Disc Diagnostic
Version 4.0. Made Jul 24 1985 at 11:14

**Drive 0: M45 - 45 Mega byte**
**Drive 1: "J30 - 30 Mega byte"** — Sample Output
Drive 2: Could not resolve drive type
Drive 3: Not found

Press the <HELP> key for the general command menu.
Test Drive: 0 using 'PROTECT'(YES)? (yes)

---

The display for Drive Ø: thru Drive 3: depends on the drive configuration of the particular system. Drives that are not attached to the system will show up as **"Not found"**. If a drive that is attached to the system shows up as **"Not found"** you should check the drive cabling, drive termination, and the drive select jumper for the proper configuration. The entry **"Could not resolve drive type"** indicates that the drive is present, but the diagnostic could not read the configuration block on the drive. All default values are shown in parentheses and may be entered by pressing **<RETURN>**.

**Running the protect test**

Press **<RETURN>** in response to the following prompt:

    Test Drive: Ø using 'PROTECT'(YES)?  (yes)

The diagnostic will display the following prompt:

    Loop count desired (1)?

Press **<RETURN>** to select 1 loop. The following is displayed:

    Enable ttyØ1 printing (there must be no console connected to ttyØ1)
    (no)?

Press **<RETURN>** to disable ttyØ1 error printing, a response of 'yes' will cause error messages to be routed to a printer attached to ttyØ1 at 96ØØ baud.

The following prompt is displayed:

    Press <RETURN> for testing or <DEL> to re-enter parameters...

A response of **<DEL>** will cause the diagnostic to re-initialize and return to the above screen.

If the response is **<RETURN>** the diagnostic will start testing and display the following screen:

---

```
Sequential/Random Testing                                   TEST MODE = SEQ BUFRD
DRIVE: Ø is being tested                                   START BLOCK = Ø
COMP: PASS:CYL:SEC:HEAD/WD#:WRT:RD/&WRT:&RD                  END BLOCK = 84659
TSFT: BLOCK#/PASS:RETRIES:CYL:SEC:HEAD/STATUS                TEST TYPE = PROTECT
OTHERS: BLOCK#/PASS:CYL:SECTOR:HEAD/STATUS                  LOOP COUNT = 1
STATUS: E R W S:. C . B/BB EC CR ID:PA AB TØ DA


BLK      HARD      SOFT      COMP      WRT      TSOFT
Ø        Ø         Ø         Ø         Ø        Ø
```

---

The entire disk (drive: Ø) will now be tested using the **'PROTECT'** test. The **START BLOCK** is zero and the **END BLOCK** is the last block available on the particular drive. The **LOOP COUNT** is the number of test loops selected. The loop count is decremented as each successive pass is completed.

If any errors exist after all loops have completed the following prompt `is displayed:

**PRESS ANY KEY TO CONTINUE**

After logging these errors press any key to continue the test with the next available logical drive.

If the first drive successfully completes the specified number of test loops without any errors the diagnostic will automatically begin testing the second drive with the indicator **"Drive: 1 is being tested"** displayed.

When all drives have been tested, test statistics will be displayed in the following format:

**Drive: Ø error statistics**

| READS | WRITES | HARD | SOFT | COMP | WRT | TSOFT | ECCF |
|---|---|---|---|---|---|---|---|
| xxxxx | xxxxx | Ø | Ø | Ø | Ø | Ø | Ø |

**Drive: 1 error statistics**

| READS | WRITES | HARD | SOFT | COMP | WRT | TSOFT | ECCF |
|---|---|---|---|---|---|---|---|
| xxxxx | xxxxx | Ø | Ø | Ø | Ø | Ø | Ø |

In this example drive 2 would not automatically be tested since its drive type is unknown.

After displaying the error statistics, the diagnostic will display the following prompt:

press **<HELP>**, **<DEL>** to exit or **<RETURN>** to re-initiate testing...

**<HELP>** will cause the diagnostic to display the general menu, and is explained under **"running the seek test"**.

**<DEL>** will cause the diagnostic to exit and return the user to the "boot:" prompt.

**<RETURN>** will cause the diagnostic to re-initialize.

**Running the "READ" test**

Any time the diagnostic is re-initialized the following screen is displayed:

```
hdtest: Fortune Systems Hard Disc Diagnostic
Version 4.0.  Made Jul 24 1985 at 11:14

Drive 0: M45 - 45 Mega byte
Drive 1: "J30 - 30 Mega byte"
Drive 2: Could not resolve drive type
Drive 3: Not found

Press the <HELP> key for the general command menu.
Test Drive: 0 using 'PROTECT'(YES)?  (yes)
```

The **READ** test is started by entering 'n' for no, followed by **<RETURN>** in response to the "Test Drive: 0 using 'PROTECT'(YES)? (yes)" query.

The following will be displayed:

    Test Drive: 0 using 'READTST'(YES)?  (yes)

Press **<RETURN>** in response to the above prompt.

The diagnostic will display the following prompt:

    Loop count desired (1)?

Press **<RETURN>** to select 1 loop.

The following is displayed:

    Enable tty01 printing (no)?

Press **<RETURN>** to disable tty01 error printing, a response of 'yes' will cause error messages to be routed to a printer attached to tty01 at 9600 baud.

The following prompt is displayed:

    Press <RETURN> for testing or <DEL> to re-enter parameters...

A response of **<DEL>** will cause the diagnostic to re-initialize and return to the above screen.

If the response is **<RETURN>** the diagnostic will start testing and display the following screen:

```
Sequential/Random Testing                                TEST MODE = SEQ BUFRD
DRIVE: Ø is being tested                               START BLOCK = Ø
COMP: PASS:CYL:SEC:HEAD/WD#:WRT:RD/&WRT:&RD              END BLOCK = 84659
TSFT: BLOCK#/PASS:RETRIES:CYL:SEC:HEAD/STATUS            TEST TYPE = READ TEST
OTHERS: BLOCK#/PASS:CYL:SECTOR:HEAD/STATUS              LOOP COUNT = 1
STATUS: E R W S:. C . B/BB EC CR ID:PA AB TØ DA


BLK       HARD      SOFT      COMP      WRT       TSOFT
Ø         Ø         Ø         Ø         Ø         Ø
```

The entire disk (drive: Ø) will now be tested using the '**READ**' test. The **START BLOCK** is zero and the **END BLOCK** is the last block available on the particular drive. The **LOOP COUNT** is the number of test loops selected. The loop count is decremented as each successive pass is completed.

If any errors exist after all loops have completed the following prompt `is displayed:

**PRESS ANY KEY TO CONTINUE**

After logging these errors press any key to continue the test with the next available logical drive.

If the first drive successfully completes the specified number of test loops without any errors the diagnostic will automatically begin testing the second drive with the indicator **"Drive: 1 is being tested"** displayed.

When all drives have been tested, test statictics will be displayed in the following format:

```
Drive: Ø error statistics
READS    WRITES   HARD     SOFT     COMP     WRT      TSOFT    ECCF
xxxxx    xxxxx    Ø        Ø        Ø        Ø        Ø        Ø

Drive: 1 error statistics
READS    WRITES   HARD     SOFT     COMP     WRT      TSOFT    ECCF
xxxxx    xxxxx    Ø        Ø        Ø        Ø        Ø        Ø
```

In this example drive 2 would not automatically be tested since its drive type is unknown.
After displaying the error statistics, the diagnostic will display the following prompt:

press **<HELP>**, **<DEL>** to exit or **<RETURN>** to re-initiate testing...

<HELP> will cause the diagnostic to display the general menu, and is explained under **"running the seek test"**.

<DEL> will cause the diagnostic to exit and return the user to the "boot:" prompt.

<RETURN> will cause the diagnostic to re-initialize.

**Running the "SEEK" test**

Any time the diagnostic is re-initialized the following screen is displayed:

---

```
hdtest: Fortune Systems Hard Disc Diagnostic
Version 4.Ø.  Made Jul 24 1985 at 11:14

Drive Ø: M45 - 45 Mega byte
Drive 1: "J3Ø - 3Ø Mega byte"
Drive 2: Could not resolve drive type
Drive 3: Not found

Press the <HELP> key for the general command menu.
Test Drive: Ø using 'PROTECT'(YES)?  (yes)
```

---

The **SEEK** test is selected from the general command menu, press the <HELP> key. The following general command menu will be displayed:

---

```
Version 4.Ø (Ø2/22/85)                               PARM TYPE = DEC
                                                     DATA TYPE = HEX
                                                     TEST TRAP = RUN
                                                     TRAP TYPE = RUN
                                                       HISTORY = OFF
                                                   HIST UPDATE = ON
                                                     HIST TRAP = RUN
                                                       PRINTER = OFF

                                                          SLOT = E
                                                   TEST DRIVE# = Ø
                                                    DRIVE TYPE = M45
                                                     TEST MULT = OFF
                                                     # OF CYLS = 83Ø
                                                    # OF HEADS = 6
                                                    BLKS/TRACK = 17
                                                    BYTES/BLOCK = 512
                                                    INTERLEAVE = 2
                                                  WPRECOMP CYL = 831

HELP F2   F3    F5   F6  F7  F8   F9   F13  F16      >
HELP FUNC PARMS HIST DEV REP EDIT TEST INIT EXIT
```

---

Press function key <F9> TEST.

The following test selection screen appears:

---

```
Sequential/Random Testing                              TEST MODE = SEQ BUFRD
DRIVE: Ø is being tested                             START BLOCK = Ø
COMP: PASS:CYL:SEC:HEAD/WD#:WRT:RD/&WRT:&RD            END BLOCK = 84659
TSFT: BLOCK#/PASS:RETRIES:CYL:SEC:HEAD/STATUS          TEST TYPE = READ TEST
OTHERS: BLOCK#/PASS:CYL:SECTOR:HEAD/STATUS            LOOP COUNT = 1
STATUS: E R W S:. C . B/BB EC CR ID:PA AB TØ DA



BLK      HARD      SOFT      COMP      WRT      TSOFT
Ø        Ø         Ø         Ø         Ø        Ø
```

---

The cursor will be positioned in the TEST MODE field.

Press the **<down arrow>** key until the cursor is positioned in the TEST TYPE field.

Press the **<right arrow>** or **<left arrow>** key until the TEST TYPE is SEEK.

Press **<EXECUTE>** to begin the SEEK test.

When the SEEK test has completed the following is displayed:

**PRESS ANY KEY ON KEYBOARD TO CONTINUE**

After pressing any key the following is displayed:

---

```
PRESS ANY KEY ON KEYBOARD TO CONTINUE

Drive: Ø error statistics
READS   WRITES   HARD   SOFT   COMP   WRT   TSOFT   ECCF
xxxxx   xxxxx    Ø      Ø      Ø      Ø     Ø       Ø
```

---

Press any key on the keyboard after logging errors if necessary, the diagnostic will return to the general command menu.

**Changing the unit under test**

The default **protect** and **read** tests automatically test all drives attached to the system provided their configuration blocks are readable. Any other test has to have the **TEST DRIVE#** field of the general command menu set to the appropriate value.

From the general command menu press the **<F6>** (DEVice) function key, the cursor will be positioned at the **SLOT** field.

Press the **<down arrow>** key until the cursor is positioned at the **TEST DRIVE#** field.

Press the **<right arrow>** or **<left arrow>** key until the correct drive selection appears.

Press the **<EXECUTE>** key to select the drive and return to the general command menu.

The **SEEK** test can now be run on the selected drive.

**Display bad block list**

From the general command menu select the drive to be listed by following the procedure in the section pertaining to **changing the unit under test.**

At the general command menu prompt '>' enter the following:

sp **<RETURN>** **<EXECUTE>**

The system will display:

```
Version 4.Ø (Ø2/22/85)                       STEP RATE = Ø      PARM TYPE = DEC
Press <RETURN> to enter bad block              ADDRESS = Ø      DATA TYPE = HEX
or <DEL> for command prompt...             BLOCK COUNT = 1      TEST TRAP = RUN
                                            INTERLEAVE = 2      TRAP TYPE = RUN
                                            LOOP COUNT = 1        HISTORY = OFF
                                                              HIST UPDATE = ON
(3)21233 (4)41388                                               HIST TRAP = RUN
                                                                  PRINTER = OFF


                                                                     SLOT = E
                                                              TEST DRIVE# = Ø
                                                               DRIVE TYPE = M45
                                                                TEST MULT = OFF
                                                                # OF CYLS = 83Ø
                                                               # OF HEADS = 6
                                                               BLKS/TRACK = 17
                                                              BYTES/BLOCK = 512
                                                               INTERLEAVE = 2
                                                              WPRECMP CYL = 831

HELP F2   F3    F5   F6  F7  F8   F9   F13  F16        >
HELP FUNC PARMS HIST DEV REP EDIT TEST INIT EXIT
```

The bad block list displayed on the screen reflects the mapped blocks of the hard disk. **Check** the traveller of the hard disk and verify that all the blocks on the traveller are on the screen.

If there are no bad blocks on the traveller there should be no bad blocks displayed on the screen.

Press **<CANCEL/DEL>**, the system will go back to the general command menu.

## Bad Block Sparing

If a block is verified as being a media defect and is to be spared, perform the following:

From the general command menu select the drive on which the block is to be spared by following the procedure in the section pertaining to **changing the unit under test** (page 5-7).

At the general command menu prompt '>' enter the following:

sp **<RETURN>** **<EXECUTE>**

The system will display:

```
Version 4.0 (02/22/85)              STEP RATE = 0        PARM TYPE = DEC
Press <RETURN> to enter bad block     ADDRESS = 0        DATA TYPE = HEX
or <DEL> for command prompt...    BLOCK COUNT = 1        TEST TRAP = RUN
                                   INTERLEAVE = 2        TRAP TYPE = RUN
                                   LOOP COUNT = 1          HISTORY = OFF
                                                       HIST UPDATE = ON
(3)21233 (4)41388                                        HIST TRAP = RUN
                                                           PRINTER = OFF

                                                              SLOT = E
                                                       TEST DRIVE# = 0
                                                        DRIVE TYPE = M45
                                                         TEST MULT = OFF
                                                         # OF CYLS = 830
                                                        # OF HEADS = 6
                                                       BLKS/TRACK = 17
                                                       BYTES/BLOCK = 512
                                                        INTERLEAVE = 2
                                                       WPRECMP CYL = 831

HELP F2   F3    F5   F6  F7  F8   F9   F13  F16        >
HELP FUNC PARMS HIST DEV REP EDIT TEST INIT EXIT
```

**NOTE: The bad block list displayed on the screen reflects the mapped blocks of the hard disk. Check the traveller of the hard disk and verify that all the bad blocks on the traveller are on the screen.**

If there are no bad blocks on the traveller, there will be no display for the bad block list.

Press **<RETURN>**.

The system will display:

```
Version 4.0 (02/22/85)                        STEP RATE = 0      PARM TYPE = DEC
Press <RETURN> to enter bad block               ADDRESS = 0      DATA TYPE = HEX
or <DEL> for command prompt...              BLOCK COUNT = 1      TEST TRAP = RUN
Enter Block Number(2-45):                    INTERLEAVE = 2      TRAP TYPE = RUN
                                             LOOP COUNT = 1        HISTORY = OFF
                                                               HIST UPDATE = ON
(3)21233 (4)41388                                                HIST TRAP = RUN
                                                                   PRINTER = OFF

                                                                      SLOT = E
                                                               TEST DRIVE# = 0
                                                                DRIVE TYPE = M45
                                                                 TEST MULT = OFF
                                                                 # OF CYLS = 830
                                                                # OF HEADS = 6
                                                                BLKS/TRACK = 17
                                                              BYTES/BLOCK = 512
                                                                INTERLEAVE = 2
                                                              WPRECMP CYL = 831

HELP F2   F3    F5   F6  F7  F8   F9   F13  F16        >
HELP FUNC PARMS HIST DEV REP EDIT TEST INIT EXIT
```

1 Enter the next available spare number, in this case, 5, and press **<RETURN>**.

**NOTE:** If the hard disk has no spared blocks at this point, the first available spare is 3.

An extra line will display: **"Enter Bad Block:"**

2 Enter: (bad block number) **<RETURN>**.

If there is more than one block to spare, repeat the sparring procedure until all bad blocks are spared.

Enter: sp **<RETURN> <EXECUTE>**

**Check** that all the blocks logged are now on the bad block list.

Press **<CANCEL/DEL>**.

The diagnostic will return to the general command menu.

**NOTE:** Blocks that have been spared will not be reported during testing.

**Testing an unrecognized drive**

Any time the diagnostic is re-initialized the following screen is displayed:

---

hdtest: Fortune Systems Hard Disc Diagnostic
Version 4.Ø. Made Jul 24 1985 at 11:14

**Drive Ø: M45 - 45 Mega byte**
**Drive 1: "J3Ø - 3Ø Mega byte"**
Drive 2: Could not resolve drive type
Drive 3: Not found

Press the <HELP> key for the general command menu.
Test Drive: Ø using 'PROTECT'(YES)? (yes)

---

The entry for Drive 2: "Could not resolve drive type" signifies that there is a drive attached to the system, but the diagnostic could not read the configuration block of the drive. Because the drive type is unresolved the default **protect** and **read** tests will not automatically test drive 2 in this example.

Press the <HELP> to get to the general command menu.

From the general command menu press the <F6> (DEVice) function key, the cursor will be positioned at the **SLOT** field.

Press the **<down arrow>** key until the cursor is positioned at the **TEST DRIVE#** field.

Press the **<right arrow>** or **<left arrow>** key until the correct drive selection appears.

Press the **<down arrow>** key until the cursor is at the **DRIVE TYPE** field.

Press the **<right arrow>** or **<left arrow>** key until the correct drive type selection appears. If the drive type is not available see the notes below pertaining to **testing other drives.**

Press the <EXECUTE> key to select the drive and return to the general command menu.

If the message **"set other now'** appears at the bottom of the screen, repeat this procedure starting with <F6> (DEVice).

From the general command menu press the <F9> (TEST) function key, the following test selection screen appears:

---

```
Sequential/Random Testing                                TEST MODE = SEQ BUFRD
DRIVE: 2 is being tested                               START BLOCK = Ø
COMP: PASS:CYL:SEC:HEAD/WD#:WRT:RD/&WRT:&RD              END BLOCK = 84659
TSFT: BLOCK#/PASS:RETRIES:CYL:SEC:HEAD/STATUS            TEST TYPE = READ TEST
OTHERS: BLOCK#/PASS:CYL:SECTOR:HEAD/STATUS              LOOP COUNT = 1
STATUS: E R W S:. C . B/BB EC CR ID:PA AB TØ DA



BLK       HARD      SOFT      COMP      WRT       TSOFT
Ø         Ø         Ø         Ø         Ø         Ø
```

---

The cursor will be positioned in the TEST MODE field.

Press the **<down arrow>** key until the cursor is at the **TEST TYPE** field.

Press the **<right arrow>** or **<left arrow>** key until the required test is selected.

***************************************CAUTION***************************

**ONLY THREE TEST TYPES CAN BE RUN WITHOUT DESTROYING DATA ON THE DISK, THEY ARE PROTECT TEST, READ TEST, AND SEEK TEST. THERE IS NO NEED TO RUN OTHER TESTS, THEREFORE THEY ARE NOT EXPLAINED.**

Press **<EXECUTE>**

The selected test will begin and operate as described previously.

**Testing other drives**

In order to test a drive supported by Fortune Systems but not provided for in this release of the diagnostic, the following drive parameters must be known:

number of cylinders
number of heads
number of blocks per track
interleave
the cylinder at which write precompensation takes place

From the general command menu prompt '>', press the **<F6>** (DEVice) function key, the cursor will be positioned at the **SLOT** field.

Press the **<down arrow>** key until the cursor is positioned at the **TEST DRIVE#** field.

Press the **<right arrow>** or **<left arrow>** key until the correct drive selection appears.

Press the **<down arrow>** key until the cursor is at the **DRIVE TYPE** field.

Press the **<right arrow>** or **<left arrow>** key until the drive type selection is **OTHER.**

Press the **<EXECUTE>** key to select the drive and return to the general command menu.

At the general command menu prompt '>' enter the following:

init **<RETURN>**

The system will display:

```
Version 4.0 (02/22/85)                    STEP RATE = 0      PARM TYPE = DEC
                                            ADDRESS = 0      DATA TYPE = HEX
                                        BLOCK COUNT = 1      TEST TRAP = RUN
                                         INTERLEAVE = 2      TRAP TYPE = RUN
                                        BLK / TRACK = 16       HISTORY = OFF
                                         LOOP COUNT = 1    HIST UPDATE = ON
                                          # OF CYLS = 679    HIST TRAP = RUN
                                         # OF HEADS = 5        PRINTER = OFF
                                        WPRECMP CYL = 679

                                                                  SLOT = E
                                                           TEST DRIVE# = 0
                                                            DRIVE TYPE = M45
                                                             TEST MULT = OFF
                                                             # OF CYLS = 830
                                                            # OF HEADS = 6
                                                            BLKS/TRACK = 17
                                                           BYTES/BLOCK = 512
                                                            INTERLEAVE = 2
                                                           WPRECMP CYL = 831

HELP F2   F3    F5   F6  F7  F8   F9   F13  F16        > init
HELP FUNC PARMS HIST DEV REP EDIT TEST INIT EXIT
```

The cursor will be positioned at the **STEP RATE** field.

Set the **STEP RATE** to zero.

Press the **<down arrow>** key until the cursor is at the **ADDRESS** field

Set the **ADDRESS** to zero.

Press the **<down arrow>** key until the cursor is at the **BLOCK COUNT** field

Set the **BLOCK COUNT** to one.

Press the **<down arrow>** key until the cursor is at the **INTERLEAVE** field

Set the **INTERLEAVE** to two.

Press the **<down arrow>** key until the cursor is at the **BLK / TRACK** field

Set the **BLK / TRACK** value to whatever value is required for the particular drive being tested.

Set the rest of the drive parameters to their appropriate values.

Press **<EXECUTE>**, the diagnostic will return to the general command menu.

From the general command menu press the **<F9>** (TEST) function key, the following test selection screen appears:

---

```
Sequential/Random Testing                                  TEST MODE = SEQ BUFRD
DRIVE: 2 is being tested                                 START BLOCK = Ø
COMP: PASS:CYL:SEC:HEAD/WD#:WRT:RD/&WRT:&RD                END BLOCK = 84659
TSFT: BLOCK#/PASS:RETRIES:CYL:SEC:HEAD/STATUS              TEST TYPE = READ TEST
OTHERS: BLOCK#/PASS:CYL:SECTOR:HEAD/STATUS                LOOP COUNT = 1
STATUS: E R W S:. C . B/BB EC CR ID:PA AB TØ DA



BLK       HARD      SOFT      COMP      WRT       TSOFT
Ø         Ø         Ø         Ø         Ø         Ø
```

---

The cursor will be positioned in the TEST MODE field.

Press the **<down arrow>** key until the cursor is at the **END BLOCK** field.

Compute the **END BLOCK** from the following formula:

**END BLOCK** = (Blocks/Track * Cylinders * Heads) -1

Enter the computed value.

Press the **<down arrow>** key until the cursor is at the **TEST TYPE** field.

Press the **<right arrow>** or **<left arrow>** key until the required test is selected.

***************************CAUTION******************************************

**ONLY THREE TEST TYPES CAN BE RUN WITHOUT DESTROYING DATA ON THE DISK, THEY ARE PROTECT TEST, READ TEST, AND SEEK TEST. THERE IS NO NEED TO RUN OTHER TESTS, THEREFORE THEY ARE NOT EXPLAINED.**

Press <**EXECUTE**>.

The selected test will begin and operate as described previously.

Table 5-6

DRIVE TYPE LIST USED BY FORTUNE SYSTEMS CORP.

A1Ø - Seagate 1Ø Megabyte (ST412)
B1Ø - Miniscribe 1Ø Megabyte
C2Ø - Ampex 2Ø Megabyte
J2Ø - CDC 2Ø Megabyte
J3Ø - CDC 3Ø Megabyte
M45 - Micropolis 45 Megabyte
N7Ø - Micropolis 7Ø Megabyte
M145- CDC 145 Megabyte (Embedded SCSI)
OTHER - Use the 'init' command to hand set the drive environment

**NOTE:** To determine which type of drive you have, check for a sticker on the rear panel of your machine. If you upgrade machine (Hard disk drive only) be sure to change this sticker to reflect the new drive type.

**TEST MODE**

There are two modes the tests can be run in;

1. **Sequential** starts at the block number specified in START BLOCK and runs thru the block number specified in END BLOCK.

2. **Random** runs the test in random blocks between the numbers specified in START BLOCK and END BLOCK.

**START BLOCK**

The Start Block may be set to any value between Ø and the last block on your particular drive. To set the Start Block type the number of the block and hit the **DOWN ARROW.** (This number need not be left justified.)

**END BLOCK**

Set in the same manner as the Start Block.

**TEST TYPE**

The three tests may be selected by hitting the **RIGHT ARROW.** A description of each is listed below.

***********************CAUTION***************************

**ONLY THREE TEST TYPES CAN BE RUN WITHOUT DESTROYING DATA ON THE DISK, THEY ARE PROTECT TEST, READ TEST, AND SEEK TEST. THERE IS NO NEED TO RUN OTHER TESTS, THEREFORE THEY ARE NOT EXPLAINED.**

1. **PROTECT TEST** - This test reads the data from the current block, checks the CRC character and stores the data in main memory. It then writes a random pattern into the current block, reads this pattern and compares what it read with what it wrote, this is repeated 16 times. The original data is then written from main memory back to the disk. If you wish to run this test randomly see Loop Count below.

2. **READ TEST** - This test does no writing, it reads the data in the current block and checks the ECC and CRC characters only. It runs much faster than the Protect test. If you wish to run this test randomly see Loop Count below.

3. **SEEK TEST** - This test checks for any head settling or seeking problems on the hard disk. It may be run in sequential or random mode.

**LOOP COUNT**

When in sequential mode the tests will run from the Start Block thru the End Block, then repeats the sequence as many times as specified in the Loop Count

When in random mode each operation decrements the loop count by one, therefore, it should be set to the number of operations you wish to do. If you set the loop count to the same number as the End Block and leave the Start Block at Ø all blocks between start and end will be operated on randomly.

**Exiting hdtest**

If hdtest is running, press <CANCEL/DEL>, and wait for the system to prompt 'Hit any key to continue'. Press any key, and the diagnostic main menu will be displayed, hit F16 (QUIT) and the boot prompt will appear. Do not attempt to power off or reset the system while hdtest is running. Always return to the main menu or the boot prompt. Failure to do so may result in loss of data from the disk.

When hdtest finishes normally the message 'Hit any key to continue' will appear automatically.

**APPROX. RUN TIMES**

SEEK TEST - 1Ø minutes on a 45 Megabyte disk.
SEQUENTIAL PROTECT TEST - 4Ø minutes on a 45 Megabyte disk. SEQUENTIAL READ TEST - 4 minutes on a 45 Megabyte disk.

**NOTE:** Test times will differ depending on disk capacity and access time.

## HDTEST Error Messages

The purpose of hdtest is to verify the integrity of the hard disk subsystem consisting of a winchester disk controller and one or more winchester disk drives. The most serious errors are HARD ERRORS indicating either an ID NOT FOUND or DAM NOT FOUND. Less serious errors are SOFT or TSFT errors indicating that an error was detected but was corrected during one of the retries.

### HARD ERRORS

When a disk is formatted, ID fields are written to each block for identification. If an ID NOT FOUND message is encountered, this means that the ID field cannot be read, therefore, the data in that block cannot be accessed.

For instance: A system in the field that has been working fine for a good number of months when suddenly HD ERROR messages appear. The F.E. arrives at the site and immediately runs hdtest diagnostic. While running SEQ READ (usually the best to start with) HARD ERRORS start appearing randomly on all parts of the disk (ID NOT FOUND). If this is the case, the first thing to do is replace the hard disk controller. Usually disks do not go bad in random areas but rather sequentially or in repeating patterns, the latter referring to a particular head problem. If one block consistently repeats the HARD ERROR message when doing more than one loop count, it should be spared. Refer to page 5-31 for sparing procedure.

If replacing the WD controller does not cure the problem, it is probable that the data is lost and the drive should be replaced.

### SOFT ERRORS

Soft errors are less severe meaning that an error was reported by the WD controller, but was corrected during one of the retries. Usually they are not a problem unless they repeat in multiple loops of testing. If this is the case spare the block according to the procedure on page 5-31.

### Track Format

```
 _____________________________________________________________________
| GAP 3 | 14B | AM | IDENT | CYL | SH | SEC | CRC | 3B |
|__(4E)_|_(00)|(A1)|_______|_LOW_|____|_____|__2B_|(00)|
               |                                  |
_INDEX __      |______________ID FIELD____________|
 |____|

        _____________________________________________
       | 12B | AM | AM | DATA  | ECC | 3B | GAP 4 |
       |_(00)|(A1)|(FB)|_FIELD_|__4B_|(00)|_(4E)__|
             |                       |    |       |
             |_______DATA FIELD______|    |_NOTE 6|
        _____________________________________
    ___|             WRITE GATE              |___
```

**NOTES**

1) 12B indicates field is 12 bytes in length.
2) (ØØ) is the hexadecimal value written.
3) MSB of SH field is the Bad Block mark. When this bit = 1 a bad block is detected. The ID field must be good.
4) IDENT field is used to identify number of cylinders. (5 MB drive = FE, 1Ø MB drive = FF).
5) GAP 3 is 3Ø bytes in length and is written for each sector.
6) GAP 4 is 8ØØ bytes in length and is written only after the last sector on a track.
7) WRITE GATE indicated here assumes a write command to a formatted disk.

**RETRY**

The Western Digital Hard Disk Controller automatically retries most errors. For example, if a CRC error is encountered during a read operation the controller will try 16 times to read the sector. If unsuccessful it will do an auto restore and an auto seek back to the affected track and try up to 16 more times. If still unsuccessful it will set the appropriate bit (or bits) in the Status and Error registers and present an interrupt to the processor.

## Comm-A Diagnostic

### Loading Comm-A diagnostic

**NOTE:** All communication cables must be removed from the device(s) being tested for a valid test.

Load the diagnostic according to the procedure on page 5-1 or 5-2 and select file name 'fd02/coma'. After the diagnostic is loaded, the message 'Fortune Systems Comm-A Diagnostic' will appear in the upper left corner of the screen followed by;

**'COMM-A' Devices with proms found in option slot(s): X**
(if you have a Comm-A board with proms)
**Devices without proms found in buss option slot(s): X**
(if you have a board without proms)

**coma:**

This prompt is displayed whenever the COMM-A diagnostic program is waiting for an operator command.

An upper or lower case H (for Help) or the HELP key from the COMM-A prompt displays the following:

0 = Run tests
1 = Hardware environment
2 = Diagnostic reporting
3 = Test Selections
q = quit Comm-A diagnostics

**Where:**

0 causes all tests selected to execute. (see below)
1 asks about the Hardware environment. (page 5-44)
2 displays the data dump information. (page 5-47)
3 asks which test(s) to run. (page 5-47)
q exits to 'Boot Prompt'.

**Run Command**

A '0' (CR) from the COMM-A prompt will cause all tests, or those tests currently selected, to be executed. (See Test Select Command page 5-47.)

The COMM-A program is intitialized to automatically run all COMM-A tests on devices found. Currently, there are four groups or COMM-A diagnostic tests which test the following hardware functions:

1. Character size logic. Tests 1-4 of group 1. See table 5-8.
2. Stop bit logic. Tests 1-3 of group 2. See table 5-9.
3. Parity logic. Tests 1-12 of group 3. See table 5-10.
4. Baud rate logic. Test 1-13 of group 4. See table 5-11.

**Hardware Environment Command**

A '1' from the COMM-A prompt causes the diagnostic program to display several prompts which query the operator about the Hardware Environment.

The first prompt is:

Which Slots Contain COMM-A Boards? (X) already defined.

NOTE: You need not define slots already found.

Type H (H for help) or press HELP key. The following help prompts will be displayed:

| | |
|---|---|
| ALL | = All slots A,B,C,D,E |
| (S) | = Single slot, Enter (A-E) |
| (S,S) | = Multiple slots separated by commas. |
| (S-S) | = From slot (S) thru slot (S) |

**Where:**

| | |
|---|---|
| ALL | tests slots A-E |
| (S) | single slot entry: 'C' means just run test(s) on COMM-A board in slot C |
| (S,S) | multiple slot entries separated by comas: 'A,D,E' means just slots A, D, and E will be tested. |
| (S-S) | multiple slot entries: 'A,C-E' means slots A,C,D,E contain COMM-A boards. |

The next prompt asks which channels to test:

Which Channels Are To Be Tested? (ALL;A;B;CØ;Cl;#,#-#,ASK)

Type H (H for help) or press HELP key. The following help prompt will be displayed:

**NOTE:** See page 5-5Ø for an explanation of channels, ports, and DART chips.

**Channel Selects:**

| | |
|---|---|
| ALL | = All Channels Ø,1,2,3 |
| A | = Channels Ø,2 |
| B | = Channels 1,3 |
| CØ | = Chip Ø channels Ø,1 |
| Cl | = Chip 1 channels 2,3 |
| (#) | = Single channel, Enter (Ø,1,2, or 3) |
| (#-#) | = From channel (#) thru channel (#) |
| ASK | = Ask above channel selects on a per slot basis |

**Where:**

All means test all COMM-A channels for all DART chips in all slots previously specified.

For example:

If slot C & D were selected, then channels Ø-3 of slot C and channels Ø-3 of slot D will be tested.

'A' means test only the A channels of both DART chips for all boards specified. There are currently 2 DART chips per board.

'B' means test only the B channels of both DART chips for all board specified.

'CØ' means test only the channels of the first DART chip for all boards specified.

'C1' means test only the channels of the second DART chip for all boards specified.

'#' means the channel number from Ø thru 3
'Ø' means channel A of first DART chip.
'1' means channel B of first DART chip.
'2' means channel A of second DART chip.
'3' means channel B of second DART chip.
'#-#'means test channels # thru channel #.

For example:

'Ø,2-3' means test channel A of first DART chip and both channels of second DART chip.

**NOTE:** A mixture of 'Ø,C1' is illegal.

'ASK' means ask the above channel prompt on a per slot basis. If ASK is entered, then the following prompt is displayed:

Which Channels of Slot X Are To Be Tested? (ALL;A;B;CØ;C1;#,#-#)

**Where:**

X is the slot (A,B,C,D,E).

The above definitions are the same but only on a per slot basis.

For Example:

If slots C,D were selected to be tested and ASK is entered from the channel prompt, then the following prompts will be displayed:

```
Which Channels of Slot c Are To Be Tested? (ALL;A;B;CØ;C1;#,#-#)
ALL:A
Which Channels of Slot d Are To Be Tested? (ALL;A;B;CØ;C1;#,#-#)
ALL:Ø,3
```

The Operator chose to test only channel A of both DART's in Slot c. From the Slot d prompt channel A of the first DART was selected and channel B of the second DART.

**NOTE:** The current channel selections are automatically displayed on the next line terminating with ':'. If a CR is entered, these default values are used.

The COMM-A program is initialized to test both channels of both DART chips of the COMM-A board in slot c.

The next prompt asks, whether external jumper(s) is (are) used.

External Jumper(s) used?

If external jumpers are used, type a y (for yes).

**NOTE:** 'External jumper' refers to jumpering pin two to pin three of the port(s) to be tested. Any type of jumper may be used, and allows the data driver and receiver to be tested.

**Diagnostic reporting Command**

A '2' from the COMM-A prompt causes a prompt to be displayed which allows the operator to alter the dump information. The following prompt is displayed:

```
S = ???   start of dump (Ø - -1)    (currently  Ø)
L = ???   length of dump       (currently 32)
D = ?     dump select (Ø-sil,1-err,2-comp,3-rcvd) (currently  1)
P = ?     pass/fail select (Ø-sil,1-fail,2-pass,3-both)(currently  3)
R = y/n   run tests continuously    (currently  n)
CR = continues or directly enter option
```

**NOTE:** This command is not necessary for normal 'in the field' troubleshooting.

**Test Selections Command**

A '3' from the COMM-A prompt causes the following display to appear:

RUN TESTS? (ALL;G,ALL; G,#; G,#-#)

**Where:**

ALL executes all COMM-A diagnostic tests.
G,ALL executes all tests in group G.
G,# executes test '#' in group G.
G,#-# executes test '#' thru test '#' in group G.

**PASS/FAIL Message**

A PASS/FAIL message is displayed after each test completes. A brief description of the test is also included in the message. The format of the PASS/FAIL message is as follows:

Test N of group G, PASSED. D-----------D.

**Where:**

N - is the test number
G - is the group number
D - is up to 35 characters of test description.

**TRANSMIT/RECEIVE Error Message**

If the number of characters transmitted or received does not agree with the expected number, then the following error message is displayed:

Channel C of Slot S: Transmitted T, received R, expecting E characters

**Where:**

C - is the channel in error
S - is the slot in error.
T - is the actual number of characters transmitted this test
R - is the actual number of characters received this test
E - is the number of characters expected to be transmitted/received

The following tables contain the values used in each test. These tables are for Character Size Tests, Stop Bit Tests, Parity Tests and Baud Rate Tests.

TABLE 5-8
Character Size Tests

| Group | Test Number | Stop Bits | Character Size | Baud Rate | Parity |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 5 | 19200 | odd |
| 1 | 2 | 1 | 6 | 19200 | odd |
| 1 | 3 | 1 | 7 | 19200 | odd |
| 1 | 4 | 1 | 8 | 19200 | odd |

TABLE 5-9
Stop Bits Tests

| Group | Test Number | Stop Bits | Character Size | Baud Rate | Parity |
|---|---|---|---|---|---|
| 2 | 1 | 1 | 8 | 19200 | odd |
| 2 | 2 | 1.5 | 8 | 19200 | odd |
| 2 | 3 | 2 | 8 | 19200 | odd |

TABLE 5-10
Parity Tests

| Group | Test Number | Stop Bits | Character Size | Baud Rate | Parity |
|---|---|---|---|---|---|
| 3 | 1 | 1 | 5 | 19200 | odd |
| 3 | 2 | 1 | 5 | 19200 | even |
| 3 | 3 | 1 | 5 | 19200 | none |
| 3 | 4 | 1 | 6 | 19200 | odd |
| 3 | 5 | 1 | 6 | 19200 | even |
| 3 | 6 | 1 | 6 | 19200 | none |
| 3 | 7 | 1 | 7 | 19200 | odd |
| 3 | 8 | 1 | 7 | 19200 | even |
| 3 | 9 | 1 | 7 | 19200 | none |
| 3 | 10 | 1 | 8 | 19200 | odd |
| 3 | 11 | 1 | 8 | 19200 | even |
| 3 | 12 | 1 | 8 | 19200 | none |

TABLE 5-11
Baud Rate Tests

| Group | Test Number | Stop Bits | Character Size | Baud Rate | Parity |
|---|---|---|---|---|---|
| 4 | 1 | 1 | 8 | 50 | odd |
| 4 | 2 | 1 | 8 | 75 | odd |
| 4 | 3 | 1 | 8 | 110.2 | odd |
| 4 | 4 | 1 | 8 | 134.5 | odd |
| 4 | 5 | 1 | 8 | 150 | odd |
| 4 | 6 | 1 | 8 | 300 | odd |
| 4 | 7 | 1 | 8 | 600 | odd |
| 4 | 8 | 1 | 8 | 1200 | odd |
| 4 | 9 | 1 | 8 | 1800 | odd |
| 4 | 10 | 1 | 8 | 2400 | odd |
| 4 | 11 | 1 | 8 | 4800 | odd |
| 4 | 12 | 1 | 8 | 9600 | odd |
| 4 | 13 | 1 | 8 | 19200 | odd |

## Comm-A Board Layout

There are two types of Comm-A boards, two port and four port. On a two port board there is one DART (dual asynchronous receiver/transmitter) chip, and on a four port board there are two DARTs. Each DART consists of two communications channels which are usually referred to as channel A and channel B. The DARTs on a board are referred to as chip Ø (or the first DART chip) and chip 1 (or the second DART chip). (A two port Comm-A board, of course, only has chip Ø or the first DART chip). The plugs on the back of the board into which we plug peripherals are referred to as ports and the ports are numbered Ø and 1 (for a two port board) or Ø thru 3 (for a four port board). Below is a chart of this DART, channel, port concept as used by the COMM-A diagnostic.

**Four Port Comm-A**
Rear view

```
 ______________________________________
|                                      |
|     CHIP  Ø          CHIP  1         |
|    |       \        |       \        |
|    |   P    |       |   P    |       |
|    |   O    |       |   O    |       |
|    |   R    |       |   R    |       |
|    |   T    |       |   T    |       |
|    |        |       |        |       |
|    |   Ø    |       |   2    |       |
|    |_______/        |_______/        |
|     CHAN   A         CHAN   A        |
|                                      |
|     CHIP  Ø          CHIP  1         |
|    |       \        |       \        |
|    |   P    |       |   P    |       |
|    |   O    |       |   O    |       |
|    |   R    |       |   R    |       |
|    |   T    |       |   T    |       |
|    |        |       |        |       |
|    |   1    |       |   3    |       |
|    |_______/        |_______/        |
|     CHAN   B         CHAN   B        |
|                                      |
|                                      |
|______________________________________|
```

**NOTE:** A two port board is the same as this except chip 1 (both channel A and B) or ports 2 & 3 are missing.

## Comm-B Diagnostic

### Loading comb diagnostics

Load the comb diagnostic according to the instructions on page 5-1 or 5-2, and select 'fd02/comb'. After the diagnostic has loaded the following menu will appear:

```
    comb: Fortune Systems Comm - B Diagnostic
    Version 4.0.  Made Jul 24 1985 at 10:31

    General command format is: <cmd> [arg1] [arg2];<cmd> ... <cr>
    Use 'HELP'.....to reprint this summary
    Use 'DEL'......to terminate testing after the current test
    a(ddr).........arg1-arg5 are the option slots to test: abcde
    c(ount)........arg1 is the number of times to repeat each test
    d(isplay)......prints all currently selected options
    e(xternal).....loopback testing selected for test 'd'
    -e(external)...test 'd' reverts to internal loopback SIO testing
    g(o)...........executes selected tests
    l(oop).........if arg1 is 'e', sets test to loop on first error
                   'a' sets selected test(s) to loop till killed
                   'f' arg sets selected test(s) to loop till first error
    -l(oop)........turns off loop mode
    p(ause)........on any error until the space bar is pressed
    -p(ause).......turns off pause on error mode
    q(uit).........exits to boot prompt ':'
    r(ange)........arg1, are starting, ending word address' for test 6
                   missing arg(s) default to top and/or bottom of memory
    t(est).........arg(s) or arg-arg select test(s) tests to be run
'comm-b' device found in buss option slot(s): C
```

### Running comb diagnostic

It is recommended that all tests be run with all cables to the Comm-B board disconnected. To do this it is only necessary to type 'g'<RETURN>. If all tests run successfully it is recommended that pins 2 and 3 be jumpered together and test 'd' be run. To run test 'd' in loopback mode type 'p;e;t d;g' <RETURN>. ('p' sets pause on error, 'e' sets loopback mode 't d' selects test 'd', and 'g' causes the test to run).

### Error Messages

Each test returns its own error messages and if any test fails the Comm-B board should be replaced.

## Bitg Diagnostic

### Loading bitg diagnostics

Load the bitg diagnostic according to the instructions on page 5-1 or 5-2, and select 'fd02/bitg'. After the diagnostic has loaded the following menu will appear:

---

```
bitg: Fortune Systems Monochrome Graphics Diagnostic
Version 4.0. Made Jul 24 1985 09:57

    General command format is: <cmd> [arg1] [arg2];<cmd> ... <cr>
    Use 'HELP' key to reprint this summary.
    Use 'DEL' to terminate testing.
    a(ddr).........arg(s) are the optin slots to test (abcde).
                    Without arg(s) each bitmap board found is
                   displayed and will be tested.
    c(ount)........arg1 is the number of passes to perform.
    d(isplay)......prints all currently selected options
    g(o)...........executes selected tests.
    l(oop).........arg1= 'e' loop on first error.
                   arg1= 'a' loop until terminated by 'DEL'.
    -l(oop)........turns off loop mode.
    p(ause)........on any error until <SPACE> is pressed.
    -p(ause).......turns off pause mode.
    q(uit).........exits to boot prompt 'Boot:'.
    t(est).........args are the tests to run each pass. With no
                    args, each test is enabled and a description of
                    it is displayed.  Use arg-arg to specify range of
                   tests to be enabled.

'Graphics' devices found in buss option slot(s); A
```

---

### Running bitg diagnostic

To run bitg diagnostic, type 'g' <RETURN>. To select other parameters, see menu above.

**NOTE:** When using graphics coprocessor as CONSOLE, bitg diagnostic will NOT run. You must have an alternate console.(available with 1.8 MOM ROMS). It is not recommended to use two display terminals from the same 12 volt buss. (i.e. both out the back of the system without external power). This causes undue stress on the system power supply.

There MUST be a monitor connected to the graphics card to run the diagnostics as there are tests that utilize the graphics display device.

### Error Messages

Each test returns its own error messages and if any test fails the Graphics board should be replaced. Use interaction required for test 'g'.

## PIO Diagnostic

### Loading pio diagnostics

Load the pio diagnostic according to the instructions on page 5-1 or 5-2, and select 'fd02/pio'. After the diagnostic has loaded the following menu will appear:

```
pio: Fortune Systems Parallel I/O Diagnostic
Version 4.0 Made Jul 24 1985 at 12:00

command format: <cmd [arg1] [arg2]; <cmd> ... <cr>
Use 'HELP'......to reprint this summary
Use 'DEL' ......to interrupt testing.
a(ddr)..........arg(s) are the option slots to test (abcde).
c(ount).........arg1 is the number of passes to perform.
d(isplay).......prints all currently selected options
e(nable)........enables parallel port testing.
-e(nable).......disables parallel port testing.
g(o)...........executes selected tests
l(oop).........arg1 = 'e' test to be repeated if it failed.
                  'a' test(s) to loop until terminated be DEL.
                  'f' test(s) to loop until first error.
-l(oop)........turns off loop mode
p(ause)........on any error until <SPACE> is pressed.
-p(ause).......turns off pause mode
q(uit).........exits to boot prompt 'BOOT:'.
t(est).........arg(s) are the tests to run each pass.  With no
               args, each test is enabled and a description of
               it is displayed.  Use arg-arg to specify a range
               of tests to be enabled.
'PIO' devices found in buss option slot(s): D
pio:
```

### Running pio diagnostic

To run pio diagnostic, type 'g' <RETURN>. To select other parameters, see menu above.

### Error Messages

Each test returns its own error messages and if any test fails the PIO board should be replaced.

## Streamer Tape Diagnostic

### Loading the Streamer Tape diagnostics

The **Streamer Tape** diagnostic is not a stand-alone program, and therefore, cannot be loaded in the same manner as, for example, the **hdtest** and **mem** test are loaded.

The **Streamer Tape** diagnostic is called **tapediag**. This name should be used for loading the diagnostic.

Log in to the system as **root.**

The system should return a pound sign (#) prompt.

Insert the diagnostic diskette into the diskette drive and mount the filesystem on the /f directory with the following command:

**mount /dev/fd02 /f** followed by **<RETURN>**.

**NOTE: After running the diagnostic, remember to unmount the diagnostic diskette before attempting to remove it from the diskette drive.** The unmount command should be as follows:

**umount /dev/fd02** followed by **<RETURN>**.

**NOTE: Before loading the tapediag program be sure that a scratch tape is in the drive.**

Load the **tapediag** program with the following command:

**/f/tapediag** followed by **<RETURN>**.

After pressing **<RETURN>** the following screen will appear:

```
tapediag: Fortune Systems Tape Streamer Diagnostic
Version 4.0.  Made Jul 24 1985 at 12:06

general command format is: <cmd> [arg1] [arg2];<cmd>...<cr>
'HELP' or '?'..displays this command menu.
'DEL'.........terminates executing test and returns to command mode.
c(ount)........[##] is the number of times to repeat each test.
d(isplay)......displays all currently selected test(s).
e(rase)........erase the entire tape.
g(o)...........executes the selected test(s).
h(istory)......display status file. [p] print file. [c] clear file.
i(nitialize)...reset and restart PIO daemon.
l(oop).........loop control. [e] causes failing tests to be repeated.
               [f] tests are repeated until the first failure. [a] tests
               are repeated until 'DEL'. -l(oop) disables loop mode.
p(ause)........pause on error until <SPACE> is hit. -p(ause) disables it.
q(uit).........exit diagnostic.
r(ead).........read entire tape. [b ###] read ### blocks. [l] read label.
s(ilent).......enables silent error reporting. -s(ilent) disables it.
t(est).........[#-#] selects test(s) to run.
v(erbose)......enables verbose reporting. -v(erbose) disables it.
w(rite)........write entire tape. [f] write file mark. [b ###] write
               ### blocks. [l] write label.
tapediag:
```

[At this point we are ready to enter a command].

---

If **'t'** is entered after the **:** (colon) the following test description screen is displayed:

---

```
Test 1 - Detect Tape presence
Test 2 - Detect Write-protected tape
Test 3 - Detect LED confirmation of drive online
Test 4 - Write/read 1 sector (512 bytes/sector)
Test 5 - Write/read 1 file of 10 sectors
Test 6 - Write/read 3 files of 10 sectors each
Test 7 - Write/read entire tape, 200 sectors at a time
Test 8 - Retension Test
tapediag:
```

---

**running 'tapediag'**

The following procedure is recommended for testing the **Streamer Tape** system.

Load the **'tapediag'** diagnostic as described above.

From the general command menu select **t 4-8** (to run tests 4-8)

Press **<RETURN>**.

Select the **g**(o) command to begin test execution.

Press **<RETURN>**

The diagnostic will cycle thru the non-interactive tests #'s 4-8.

The diagnostic will display error messages which are self explanatory.

If the **Streamer Tape** system fails the diagnostic the following is suggested:

Try different media (tape) as the tape itself is the weakest link in the system.

Try a different PIO controller.

Try a different tape drive.

## Duplicating Diagnostic Disks

The following procedure will enable you to duplicate your diagnostic disk. That portion of the following list that is in boldface type is data you must enter. All of the inputs are made after you login as '**root**'. After you login you should see the pound sign prompt (#). Begin entry of commands below from this prompt. That portion of the list that is **not** in boldface type are messages returned to you by the operating system. Diagnostics are for your use only, and are not to be given to anyone else.

Insert your master diagnostics disk copy into the flexible disk drive and proceed.

\# **mount /dev/fd02 /f<RETURN>**<br>
\# **mkdir diag<RETURN>**<br>
\# **cd diag<RETURN>**<br>
\# **cp -rVsot /f/* .<RETURN>**

copy /f/README to ./README<br>
copy /f/bitg to ./bitg<br>
copy /f/coma to ./coma<br>
copy /f/comb to ./comb<br>
copy /f/eastart to ./eastart<br>
copy /f/fdtest to ./fdtest<br>
copy /f/hdtest to ./hdtest<br>
copy /f/kbtest to ./kbtest<br>
copy /f/mem to ./mem<br>
copy /f/memlow to ./memlow<br>
copy /f/mmu to ./mmu<br>
copy /f/pio to ./pio<br>
copy /f/tapediag to ./tapediag<br>
copy /f/reconf to ./reconf<br>
--examine directory /f/sa<br>
--make directory ./sa<br>
cp: copy /f/sa/reconf to ./sa/reconf linked to ./reconf

\# **bootcp /dev/rfd00 boot 0<RETURN>**

```
# rdconf -b /dev/rfd00 > conf<RETURN>
# umount /dev/fd02<RETURN>
```

* * * * * * * * * * N O T E * * * * * * * * * * *

**Remove the master disk from the drive, and insert a blank disk.**

* * * * * * * * * * * * * * * * * * * * * * * *

```
# /etc/format -c conf /dev/rfd00<RETURN>
# bootcp boot /dev/rfd00 0<RETURN>
# /etc/mkfs -a /dev/rfd02 <RETURN>
file system size = 740
isize=224
m/n = 1 10

# mount /dev/fd02 /f<RETURN>
# rm boot conf<RETURN>
# cp -rVsot * /f<RETURN>
copy README to /f/README
copy bitg to /f/bitg
copy coma to /f/coma
copy comb to /f/comb
copy eastart to /f/eastart
copy fdtest to /f/fdtest
copy hdtest to /f/hdtest
copy kbdtest to /f/kbdtest
copy mem to /f/mem
copy memlow to /f/memlow
copy mmu to /f/mmu
copy pio to /f/pio
copy tapediag to /f/tapediag
copy reconf to /f/reconf
--examine directory sa
--make directory /f/sa
cp: copy sa/reconf to /f/sa/reconf linked to /f/reconf
```

```
# ll /f<RETURN
total 188
-rw-r--r-- 1 root       301 Aug 18 09:28   README
-r--r--r-- 1 root     39908 Jul 10 09:15   bitg
-r--r--r-- 1 root     31640 Jul 10 09:15   coma
-r--r--r-- 1 root     77404 Jul 10 09:15   comb
-r--r--r-- 1 root      7320 Jul 10 09:15   eastart
-r--r--r-- 1 root     24316 Jul 10 09:15   fdtest
-r--r--r-- 1 root     69476 Jul 10 09:15   hdtest
-r--r--r-- 1 root     29000 Jul 10 09:15   kbtest
-r--r--r-- 1 root     10692 Jul 10 09:15   mem
-r--r--r-- 1 root     13768 Jul 10 09:15   memlow
-r--r--r-- 1 root      9852 Jul 10 09:15   mmu
-r--r--r-- 1 root     40196 Jul 10 09:15   pio
-rwxrwxr-x 1 root     30372 jul 16 13:03   tapediag
-r--r--r-- 1 root     18068 Jul 10 09:15   reconf
drwxrwxrwx 1 root        48 Jul 10 09:15   sa
```

*** * * * * * * * N O T E * * * * * * * * * * ***
*** Dates times and numbers may be different ***
*** on your files. ***
*** * * * * * * * * * * * * * * * * * * * * ***

```
# umount /dev/fd02<RETURN>
# fsck /dev/fd02<RETURN>

/dev/fd02
**Checking /dev/fd02
**Phase 1 Check Blocks and Sizes
**Phase 2 Check Pathnames
**Phase 3 Check Connectivity
**Phase 4 Check Reference Counts
**Phase 5 Check Free List
13 files 196 blocks 513 free

# cd /<RETURN>
# rm -r diag<RETURN>
# <CONTROL D>  will return you to the login prompt
```

At this time you are finished making and checking a duplicate disk, remove your new disk and **put a write protect tab on it.**

# CHAPTER 6

## MODULE REMOVAL AND REPLACEMENT

Maintenance of the system has been simplified by designing modules so that they are easy to replace when a malfunction does occur. The system can be disassembled and re-assembled in a very short time, so that user downtime due to hardware malfunction is reduced.

The fasteners used in the system are removed with a standard size phillips or common blade screwdriver. The monitors are removed with a standard size phillips, common blade screwdriver or an allen wrench. Screws should be tightened to approximately 30 inch pounds of torque. Excessive torque will cause threads to strip.

It should never be necessary to force or pry components apart. If it becomes difficult to remove a component, re-check that all fasteners have been removed, then carefully work the components apart.

References to direction in this chapter, such as "right" or "left", are those as seen by an operator facing the system during normal operation.

Reference Parts Chapter for blown up view of components if necessary.

Re-assembly of the system is the reverse of disassembly procedure unless noted.

All removal and replacement procedures are performed on systems with the power cord removed.

**Required Tools**

1. Flat-blade screwdriver
2. Phillips screwdriver
3. Needle nose pliers
4. Allen Wrench (5/32")

* * * * * * * W A R N I N G * * * * * * *

Always remove the power cord from the rear of the system before removing any cover, module, or cable. Hazardous voltages are present within the cabinet when power is applied which can damage system components, and injure anyone working on the system with power applied.

The following procedures should always be done before disassembling any system:

1. Disconnect the AC power cord from the CPU.
2. Disconnect the keyboard and the monitor from the CPU.
3. Make a note of the port to which each device (such as printers, terminals, or modems) is connected to on the CPU.
4. Disconnect all devices connected to controllers.
5. At this point we are ready to begin with the removal of the cover.

## TOP COVER DISASSEMBLY

This section describes, in detail the procedures for removing the system top cover. There are actually two types of top covers on the 32:16 models, the Soft Tooled Skin (STS) and the Hard Tooled Skin (HTS). The difference is that the STS are painted and the HTS have the color and texture molded into the plastic. The way to determine an HTS CPU or Keyboard from an STS CPU or Keyboard is to measure the length. The HTS CPU or Keyboard is twenty-three inches long and the STS CPU or Keyboard is twenty-two inches long.

**NOTE:** Do not turn the CPU assembly on end or upside down when removing or replacing the covers. The assembly can be easily dropped or excessively flexed possibly causing damage.

The CPU assembly should always be set on a suitable work surface, such as a desk top or workbench.

### STS Top Cover Disassembly

STS top cover is held in place by six screws which are accessible from the bottom of each side and one screw which is accessible from the top of the WD controller I/O back panel (this screw may or may not be there).

1. Position the CPU or Expansion Cabinet so that one end extends beyond the edge of the work surface approximately one inch. Loosen the three captive screws in that end .
2. Extend the opposite end of the CPU off the edge of the work surface approximately one inch and loosen the three captive screws on that end.
3. When all screws have been loosened carefully reposition the CPU or Expansion Cabinet assembly on the work surface, and lift off the top cover and set it aside. Removal is now complete.

### HTS Top Cover Disassembly

HTS top cover is held in place by eight screws which are accessible from the bottom of the unit. Three screws are located at each end and two screws are located in the back. One screw, accessible from the top of the WD controller I/O back panel, will also have to be loosened.

1. Position the CPU so that one end extends beyond the edge of the work surface approximately one inch. Loosen the three captive screws in that end.
2. Extend the opposite end of the CPU off the edge of the work surface approximately one inch and loosen the three captive screws on that end.
3. Reposition the CPU so that the back edge is extended over the edge approximately one inch and loosen the screws there.
4. When all screws have been loosened, carefully reposition the CPU on the work surface, and lift off the top cover and set it aside. Removal is now complete.

## FRONT PANEL DISASSEMBLY

This section describes in detail the procedures for removing the system front panel. There are actually two types of front panels on the 32:16 models, the Soft Tooled Skin (STS) and the Hard Tooled Skin (HTS).

### STS Front Panel Disassembly

The front panel is held in place by two retainer straps. These straps are held by two screws which are accessible from the front bottom of the system.

1. Remove top cover (refer to Top Cover Removal).
2. Position the CPU so that the front extends beyond the edge of the work surface approximately one inch. Loosen the two screws at each corner of the base plate approximately eight turns each.
3. Slip the retainer straps off each end of the front panel, open the flexible disk door, and lift the front panel out and away from the base plate.
4. Disconnect the in-line connectors on the wires to the light-emitting diodes (LED lights), and set the front panel aside. Removal is now complete.

### HTS Front Panel Disassembly

The front panel is held in place by two alignment tabs that clip to the base of the CPU and one screw located in the center top of the front panel.

1. Remove top cover (refer to Top Cover Removal).
2. Position the CPU so that it is stable.
3. Remove the floppy drive latch by using a small phillips screwdriver.
4. Remove center screw on front panel.
5. Remove front panel by pushing in the sides and pulling upwards.
6. Disconnect the in-line connectors on the wires to the light-emitting diodes (LED lights), and set the front panel aside. Removal is now complete.

## REAR PANEL DISASSEMBLY

This section describes in detail the procedures for removing the system rear panel. There are actually two types of rear panels on the 32:16 models, the Soft Tooled Skin (STS) and the Hard Tooled Skin (HTS).

### STS Rear Panel Disassembly

The rear panel is held in place by three alignement tabs which slip into the CPU.

1. Remove top cover (refer to Top Cover Removal).
2. Position the CPU so that the back is facing you.
3. Gently lift the rear panel by the left end. While rotating it toward yourself disengage the panel from the base and from around the power supply (it may be necessary to loosen the power supply screws to allow enough clearance to remove the rear panel).
4. Remove the AC power plug from the fan, and slip off the ground wire from the fan assembly.
5. Removal is now complete.

### HTS Rear Panel Disassembly

The rear panel is held in place by three alignement tabs which slip into the CPU and the two screws which hold the top cover in place. WD controller will have to be removed to get the rear panel off.

1. Remove top cover (refer to Top Cover Removal).
2. Position the CPU so that the back extends beyond the edge of the work surface approximately one inch.
3. Remove the two screws that go through the back panel, which are used to secure the top cover.
4. Loosen the two screws that are on the back of the WD controller I/O back plate and removal.
5. Loosen the two screws holding the memory board grill and remove the grill.
6. Gently lift the rear panel by the left end. While rotating it toward yourself disengage the panel from the base and from around the power supply (it may be necessary to loosen the power supply screws to allow enough clearance to remove the rear panel).
7. Remove the AC power plug from the fan, and slip off the ground wire from the fan assembly.
8. Removal is now complete.

## FAN DISASSEMBLY

This section describes in detail the procedures for removing the fan from the rear panel. There are two types of fans to be concerned with. The STS system fan and the HTS system fan (quiet fan).

### STS Fan Disassembly

The fan is held in place by four screws which are accessible once the rear panel has been removed.

1. Remove rear panel (refer to Rear Panel Removal).
2. Place rear panel on a suitable work surface.
3. Take note of where the memory alignement piece and ground connection are located.
4. Remove the four screws and gently lift the fan from rear panel.
5. Removal is now complete.

### HTS Fan Disassembly (Quite Fan)

The fan is held in place by four screws which are accessible once the rear panel has been removed.

1. Remove rear panel (refer to Rear Panel Removal).
2. Place rear panel on a suitable work surface.
3. Take note of where the memory alignement piece and ground connection are located.
4. Remove the four screws and gently lift the fan from rear panel.
5. Removal is now complete.

## POWER SUPPLY DISASSEMBLY

This section describes in detail the procedures for removing the power supply. The power supplies we will be concerned with are the Zenith (22 & 28 amp), Western Electric (32 amp), Digi Power (37.5 amp) and the Kyosan (located in Expansion Cabinet).

Even though there are several types of systems, the power supplies are all held in place by two screws. Therefore there will only be one description given. If removing power supply from an Expansion Cabinet, skip step 4.

### Power Supply Disassembly

The power supply is held in place by two screws which are only accessible once the cover has been removed.

1. Remove top cover.
2. Remove connectors from fan.
3. Remove the power supply connectors from the back of drives and from the load resistor on expansion cabinet fan.
4. Remove the main connector from central logic assembly by pinching the connector at each end and pulling up while holding the motherboard down.
5. Take a long phillips screw driver (at least 6 inches in length) and remove the two screws holding the power supply.
6. Lift the power supply up and out.
7. Set power supply to side and removal is complete.

## FIELD REPLACEABLE UNITS DISASSEMBLY

This section describes in detail the procedures for removing the memory boards, mother board, controller boards (pio, WD, video, SCSI, ect.), floppy drive, hard drive and disk drive mounting chassis. As in the previous removal procedures, there are basically two types of Field Replaceable Unit configurations. We will call the older configuration STS and the newer configuration HTS.

### STS FRU Disassembly

At this point, it is assumed that the top cover, front panel, rear panel and power supply are already removed from system. The following procedures assume that you are facing the front of the system.

1. Remove the memory card(s) by lifting the card(s) first on the left side then the right side gently working the card(s) out of the slot. Set card(s) aside out of the way.
2. Remove all cables from both disk drives. Be sure to note the polarity of the cables so that they can be reinserted properly.
3. Remove each circuit card from their option slots, by loosening the captive thumb screw on the rear of each option card, and lifting the card from the back then the front working board out of slot. When re-assembling the system, make sure that the option cards are returned to their original positions.

STS FRU Disassembly (continued)

4. Remove four screws that hold the disk bracket assembly, and carefully lift it out of the CPU assembly. The disk drives should be handled with care as they can be damaged by rough handling.
5. Turn the disk bracket assembly upside down and place on a suitable work surface.
6. Remove the screws which secure the drives (floppy and hard) to the bracket assembly. Be sure to mark the holes where screws were removed to prevent confusion. Remove the disk drives and set them aside.
7. Remove the flexible disk drive ribbon cable from the motherboard, and set it aside.
8. Remove the six screws holding the motherboard to the base.
9. Disconnect the keyboard harness from the motherboard.
10. Lift the motherboard out from the base and set it aside. At this point the system is now completely disassembled.

**NOTE**

Whenever the motherboard is exchanged, the Serial PAL (location 7D on older systems and 14A on newer systems) must be removed from the old board and reinstalled on the new motherboard.

## HTS FRU Disassembly

At this point, it is assumed that the top cover, front panel, rear panel and power supply are already removed from system. The following procedures assume that you are facing the front of the system.

1. Remove the memory card(s) by lifting the card(s) first on the left side then the right side gently working the card(s) out of the slot. Set card(s) aside out of the way.
2. Remove each circuit card from their option slots, by loosening the captive thumb screw on the rear of each option card, and lifting the card from the back then the front working board out of slot. When re-assembling the system, make sure that the option cards are returned to their original positions.
3. Remove the eight screws holding the bracket shielding over the drives and then remove the shielding.
4. Remove all cables from both disk drives. Be sure to note the polarity of the cables so that they can be reinserted properly.
5. Remove three (maybe two on new SX and SCSI systems) screws, located between both drive assemblies, that hold the tape/floppy drive assembly and hard drive assembly together.
6. Remove the two additional screws located on the right side of the tape/floppy drives. Carefully lift out the tape/floppy assembly and set to the side.

HTS FRU Disassembly (continued)

7. Remove two screws on left side of hard drive assembly and carefully lift out. The disk drives should be handled with care as they can be damaged by rough handling.
7. Remove the flexible disk drive ribbon cable from the motherboard, and set it aside.
8. Remove the six screws holding the motherboard to the base.
9. Disconnect the keyboard harness from the motherboard.
10. Lift the motherboard out from the base and set it aside. At this point the system is now completely disassembled.

**NOTE**

Whenever the motherboard is exchanged, the Serial PAL (location 7D on older systems and 14A on newer systems) must be removed from the old board and reinstalled on the new motherboard.

## KEYBOARD DISASSEMBLY

This section describes the procedure to disassemble an STS Keyboard and an HTS Keyboard. The Low Profile Keyboard is not mentioned due to the fact that the whole keyboard unit must be returned for repair on either an RMA (under warranty) or to PDC.

### STS Keyboard Disassembly

The Keyboard is held in place by four phillips screws accessed from bottom of keyboard.

1. Remove coil cable from back left side of keyboard.
2. Place the keyboard assembly face down on a suitable work surface, and loosen the four screws in the base.
3. Turn the assembly face up and lift off the top cover and set aside. Also collect and set aside the four screws from the base.
4. Disconnect the ribbon cable from the keyboard electronics assembly. Lift the key-switch assembly out and put aside.
5. Disconnect the cable from between the keyboard electronics assembly and the key-click volume control.
6. Remove the three screws securing the keyboard electronics assembly to the base, and remove the assembly. Disassembly is now complete.

### HTS Keyboard Disassembly

The Keyboard is held in place by four phillips screws accessed from bottom of keyboard.

1. Remove coil cable from back left side of keyboard.
2. Place the keyboard assembly face down on a suitable work surface, and loosen the four screws in the base.
3. Turn the assembly face up and lift off the top cover and set aside. Also collect and set aside the four screws from the base.
4. Disconnect the keyboard harness located on the left side of keyboard.
5. Disconnect the cable from between the keyboard electronics assembly and the key-click volume control (located on the right side of keyboard assembly).
6. Lift out keyboard electronics and disassembly is complete.

## VIDEO MONITOR DISASSEMBLY

This section will cover the disassembly of the Monitor, FIS 1000, and the Fortune 1000 Terminals.

*** * * W A R N I N G * * ***

**Exercise caution when handling the Terminals. If a terminal is dropped or broken, there could be a violent implosion, and danger of injury from flying glass. Only proceed if you are thoroughly familiar with all safety precautions that should be observed when servicing CRT equipment.**

### BASIC MONITOR DISASSEMBLY

Upper Shell Disassembly

The upper assembly is held together by two screws accessed from the bottom half of upper assembly.

1. Disconnect coil cable from monitor assembly.
2. Turn monitor upside down and place on a suitable work surface. Loosen the two captive screws holding the monitor shells together.
3. Once screws are loose, turn monitor back to original position. Slide the upper shell up and off of the left and right CRT mounting brackets.
4. Separate the cable to the brightness knob at the in-line connector and set the top shell aside.
5. Follow the in-line connector to electronics board and remove red connector from electronics board (located underneath center of yoke.
6. Remove the four screws holding the monitor board and Flyback transformer to the lower shell.
7. Slide the CRT and bezel assembly up and out of the lower shell, and place face down on a clean work surface.
8. Remove the four screws that hold the bezel to the CRT, and remove the bezel. Disassembly is now complete

BASIC MONITOR DISASSEMBLY (cont.)

Base Disassembly

The lower assembly is held together by four screws accessed from bottom of base assembly.

1. Place monitor face down on suitable work surface.
2. Remove four screws that hold base assembly together and place bottom of base to the side.
3. If any repair to terminal block or wire harness is needed reference figure F-6 (Video Monitor Lower Shell and Upper Pedestal) in the parts chapter.
4. Disassembly is now complete.

### FIS 1000 DISASSEMBLY

Upper Shell Disassembly

The FIS 1000 upper shell assembly is held in place by two phillips screws accessed from bottom of lower shell.

1. Disconnect coil cable from monitor assembly.
2. Turn monitor upside down and place on a suitable work surface. Loosen the two captive screws holding the monitor shells together.
3. Once screws are loose, turn monitor back to original position. Slide the upper shell up and off of the left and right CRT mounting brackets.

FIS 1000 DISASSEMBLY (cont.)

Upper Shell Disassembly (cont.)

4. Separate the cable to the brightness knob at the in-line connector and set the top shell aside.
5. Follow the in-line connector to electronics board and remove red connector from electronics board (located underneath center of yoke.
6. Remove the four screws holding the monitor board and Flyback transformer to the lower shell.
7. Slide the CRT and bezel assembly up and out of the lower shell, and place face down on a clean work surface.
8. Remove the four screws that hold the bezel to the CRT, and remove the bezel. Disassembly is now complete.

Base Disassembly

The lower assembly is held together by four screws accessed from bottom sides of base assembly.

1. Place monitor face down on suitable work surface.
2. Remove four screws that hold base assembly together and two screws directly under back base panel.
3. Lower bottom of base assembly so that it sits flat on table with PWA board exposed.
4. With rear base panel facing you, remove keyboard harness and wire assembly connector from PWA board.
5. To remove PWA assembly, remove two screws from top of back panel, two screws from power supply assembly and three screws from the PWA board.
6. Lift PWA assembly up and out. Base disassembly is now complete. Parts chapter, figure F-12 can be referenced if needed.

**FORTUNE BASIC DISASSEMBLY**

Upper Shell Disassembly

Due to the changes done on the Fortune Basic Workstation Electronics assembly, it would be best to refer to Service Notice 93 (Fortune Basic Workstation CRT Electronics Replacement) and Service Notice 95 (Replacing the first release CRT Electronics with the new NCE CRT Electronics) for electronics disassembly.

Base Disassembly

Due to changes done on the Fortune Basic Workstation base assembly, it would be best to refer to Service Notice 94 (Fortune Basick Workstation Base Assembly Replacement) for base disassembly instructions.

# CHAPTER 7

## PARTS

This chapter illustrates units of the Fortune system that are field replaceable. Fortune Systems Corporation has phased in new skins for the CPU, Video Monitor, FIS1000 and Keyboard. They are no longer painted but have the color and texture molded into the plastic. The new keyboard and CPU skins are one inch longer than the old painted ones. The old painted skins will be referred to as STS (soft tooled skins). The new skins will be referred to as HTS (hard tooled skins). HTS and STS parts are not interchangeable.

## INDEX

## KEYBOARD

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-1 | | Keyboard Assemblies | 1000016-01 | Domestic |
| F-1 | | | 1001132-01 | French |
| F-1 | | | 1001132-02 | German |
| F-1 | | | 1001132-03 | UK |
| F-1 | | | 1001132-05 | Fr/Sws |
| F-1 | | | 1001132-06 | Ger/Sws |
| F-1 | | | 1001132-07 | Swed/Fin |
| F-1 | | | 1001132-08 | Nor/Dan |
| F-1 | | | 1001132-09 | Italian |
| F-1 | | | 1001132-10 | Span/Port |
| F-1 | | | 1001132-11 | Can/Fr |
| F-1 | | | 1001132-12 | Dutch |
| F-1 | | | 1001132-13 | So.Africa |
| F-1 | 1 | Keyboard Base | 1001072-01 | HTS |
| F-1 | 1 | Keyboard Base | 1001221-01 | STS |
| F-1 | 2 | Keyboard Cover | 1000120-01 | STS |
| F-1 | 2 | Keyboard Cover | 1001073-01 | HTS |
| F-1 | 3 | Keyboard Electronics | 2001174-01 | See Note F-1 |

FOR INTERNATIONAL KEYBOARD ELECTRONICS, USE 1001195-XX. XX REFERS TO DASH # OF KEYBOARD ASSEMBLIES ABOVE

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-1 | 4 | Keyclick Harness | 1000122-02 | |
| F-1 | 5 | Keyclick Knob | 1000128-01 | |
| F-1 | 6 | Rubber Feet | 1000129-01 | 4 Places |
| F-1 | 7 | Keyboard Harness | 1000048-01 | |
| F-1 | 8 | Screw | 1001283-02 | HTS |
| F-1 | 8 | Screw | 1000118-01 | STS |
| F-1 | 9 | Clip, Knob | 1000137-01 | |
| F-1 | 10 | Screw | 1003057-02 | HTS |
| F-1 | 10 | Screw | 1000118-01 | STS |
| F-1 | 13 | Nut | 1001297-01 | |
| F-1 | 14 | Washer | 1001231-03 | |

**NOTE:** The replacement parts for the old two piece keyboard electronics are, 1001174-01 (one piece keyboard electronics) and 1000048-01 (keyboard harness).

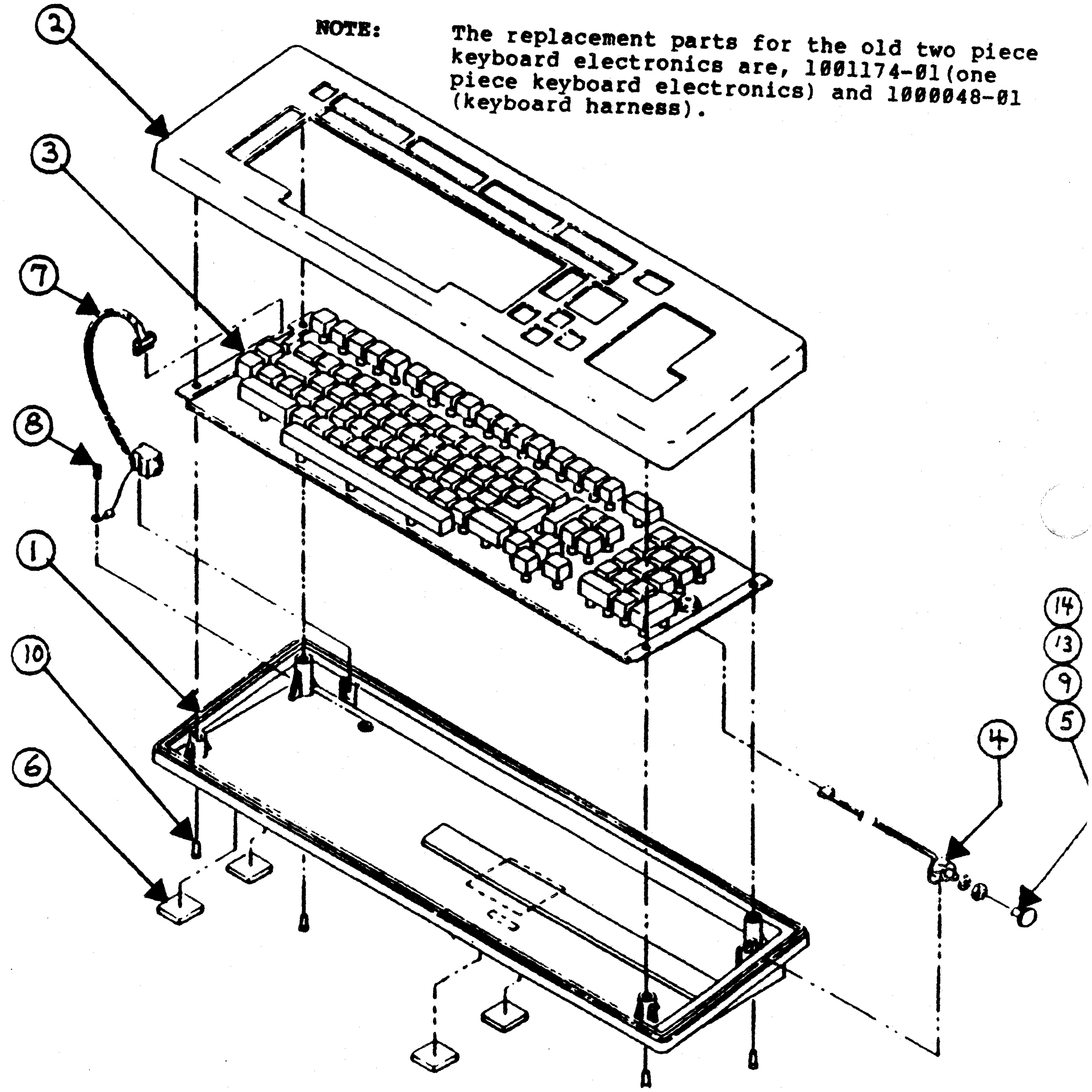



Figure F-1

KEYBOARD

## FORTUNE BASIC WORKSTATION HIGH PROFILE KEYBOARD
(Modified FIS 1000 Keyboard)

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-2 | -- | Assy, Keyboard | 1003474-01 | F/1000 Only |
| F- | 1 | Keyboard Base | 1001657-01 | |
| F-2 | 2 | Keyboard Cover | 1001073-01 | |
| F-2 | 3 | Keyboard Electronics | 2003632-01 | F/1000 Only |
| F-2 | 6 | Foot, Rubber | 1000129-01 | 4 Places |
| F-2 | 7 | Keyboard Harness | 1000048-05 | |
| F-2 | 8 | Screw | 1001283-02 | |
| F-2 | 10 | Screw | 1003057-02 | |

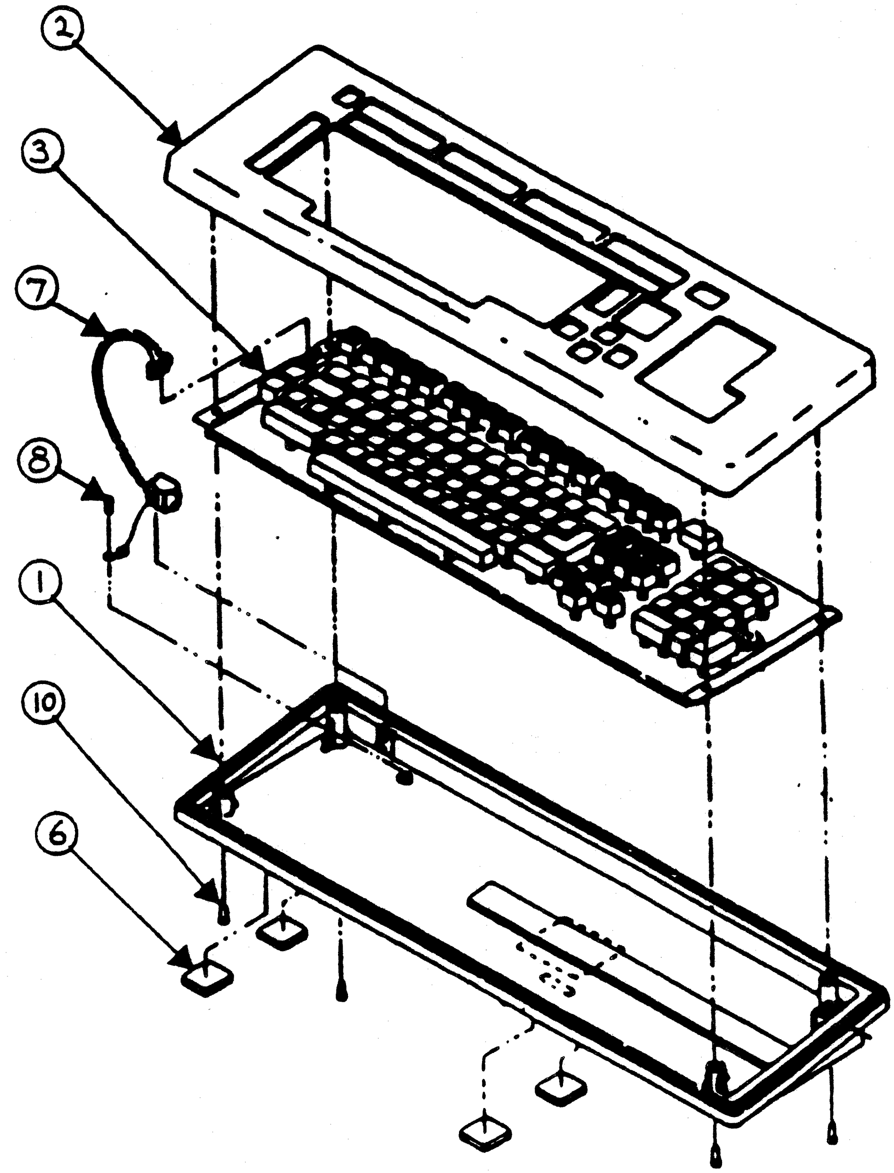



Figure F-2

FORTUNE BASIC WORKSTATION HIGH PROFILE KEYBOARD

## FORTUNE BASIC WORKSTATION LOW PROFILE KEYBOARD

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-3 | -- | Assy, Keyboard | 1003384-01 | F/1000 Only |
| F-3 | 1 | Keyboard Cover | 1003820-01 | |
| F-3 | 2 | Keyboard Base | 1003725-01 | |

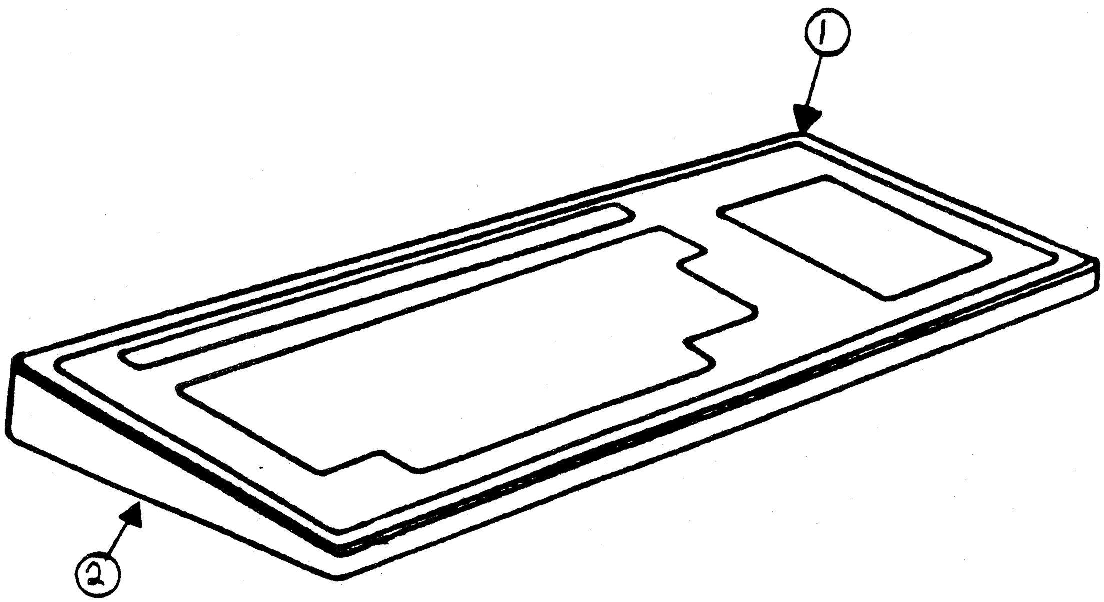



Figure F-3

FORTUNE BASIC WORKSTATION LOW PROFILE KEYBOARD

## VIDEO MONITOR

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-4 | --- | Video Monitor Assy | 1000019-01 | |
| F-4 | 1 | Assy, Pedestal | 1000041-01 | STS |
| F-4 | 1 | Assy, Pedestal | 1001065-01 | HTS |
| F-4 | 2 | Assy, Upper Shell | 1000133-01 | STS |
| F-4 | 2 | Assy, Upper Shell | 1001063-01 | HTS |
| F-4 | 3 | Assy, CRT/Bezel | 1001166-01 | STS |
| F-4 | 3 | Assy, CRT/Bezel | 1001616-01 | HTS |
| F-4 | 4 | Assy, Base | 1000020-01 | STS |
| F-4 | 4 | Assy, Base | 1001068-01 | HTS |
| F-4 | 5 | Screw | 1000118-01 | 2 places |
| | ITEM 5 USED WITH ZENITH CRT ASSY ONLY | | | |
| F-4 | 6 | Screw | 1000118-08 | 4 places |
| F-4 | 8 | Insert | 1001239-01 | HTS only |
| F-4 | 9 | Screw | 1000118-07 | STS |
| F-4 | 9 | Screw | 1003057-01 | HTS |

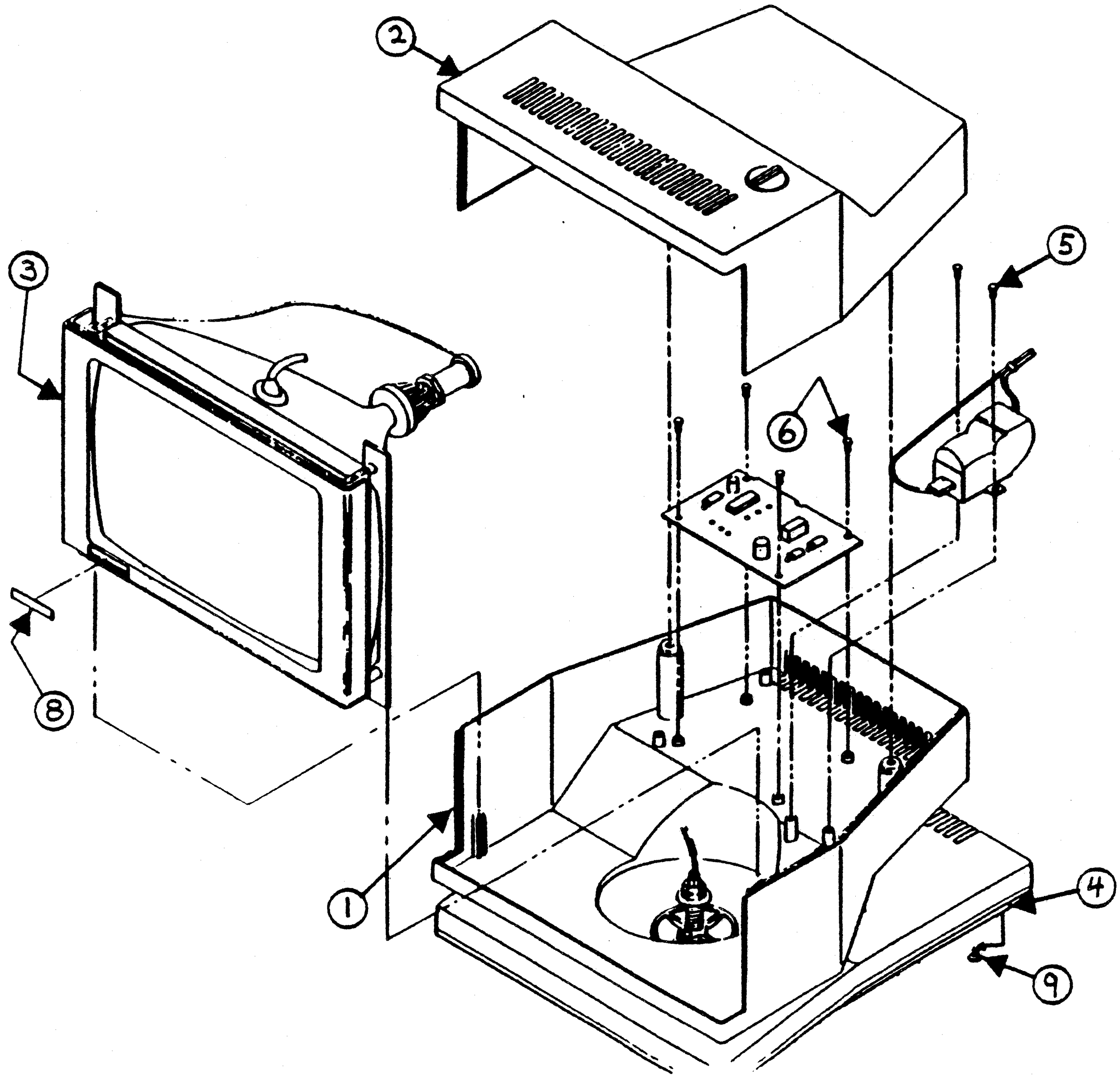



Figure F-4

VIDEO MONITOR

## VIDEO MONITOR UPPER SHELL

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-5 | -- | Assy, Upper Shell | 1000133-01 | STS |
| F-5 | -- | Assy, Upper Shell | 1001063-01 | HTS |
| F-5 | 1 | Upper Shell | 1000134-01 | STS |
| F-5 | 1 | Upper Shell | 1001064-01 | HTS |
| F-5 | 2 | Cable Assy | 1000131-01 | |
| F-5 | 3 | Knob | 1001110-01 | |
| F-5 | 4 | Clip | 1000137-01 | |

**VIDEO MONITOR UPPER SHELL**

**HTS & STS**

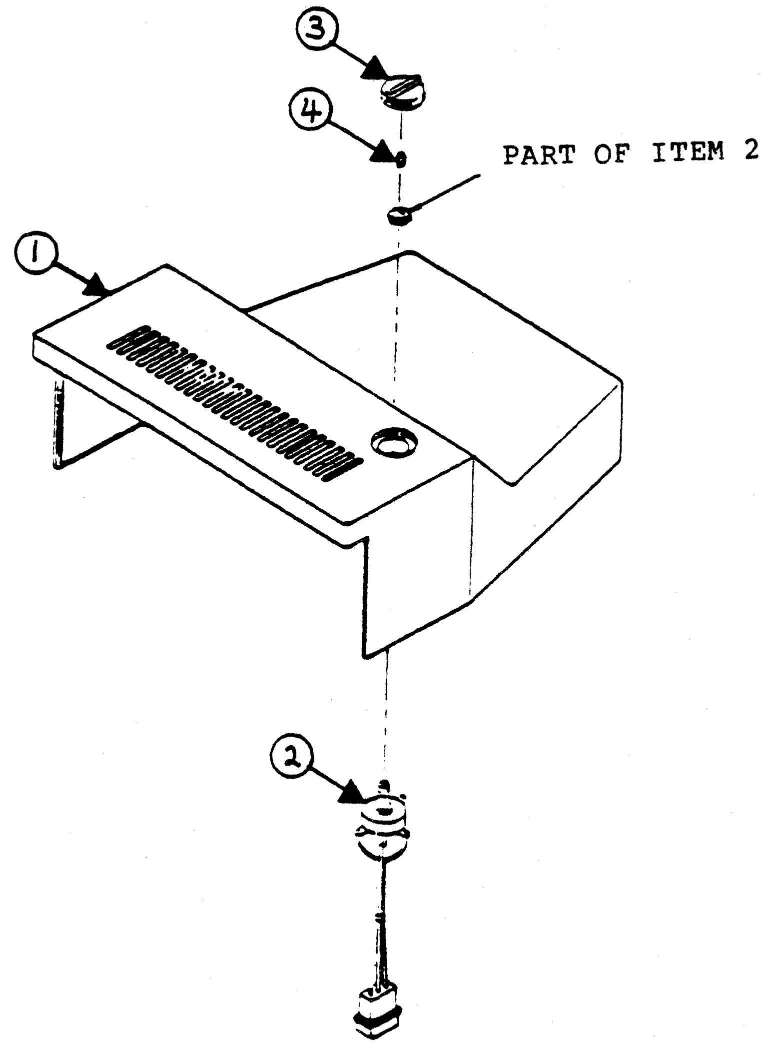



Figure F-5

UPPER SHELL

## VIDEO MONITOR LOWER SHELL AND UPPER PEDESTAL

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-6 | -- | Assy, Pedestal | 1000041-01 | STS |
| F-6 | -- | Assy, Pedestal | 1001065-01 | HTS |
| F-6 | 1 | Wire Harness | 1000043-01 | |
| F-6 | 2 | Pedestal, upper | 1000132-01 | STS |
| F-6 | 2 | Pedestal, upper | 1001066-01 | HTS |
| F-6 | 3 | Wiring Harness | 1000468-01 | |
| F-6 | 4 | Terminal Block | 1000636-01 | |
| F-6 | 6 | Tape, double sided | 1000637-01 | |
| F-6 | 8 | Screw | 1000139-03 | |
| F-6 | 9 | Plate | 1000140-01 | |
| F-6 | 10 | Spring | 1000141-01 | |
| F-6 | 11 | Nipple | 1000142-01 | |
| F-6 | 12 | Washer | 1000138-38 | |
| F-6 | 13 | Washer | 1001231-01 | |
| F-6 | 14 | Glide Button | 1001681-01 | 3 places |
| F-6 | 15 | Brass Nut | 1000143-01 | 4 places |
| F-6 | 16 | Lower Shell | 1000149-01 | STS |
| F-6 | 16 | Lower Shell | 1001067-01 | HTS |

# VIDEO MONITOR LOWER SHELL AND UPPER PEDESTAL

## HTS & STS

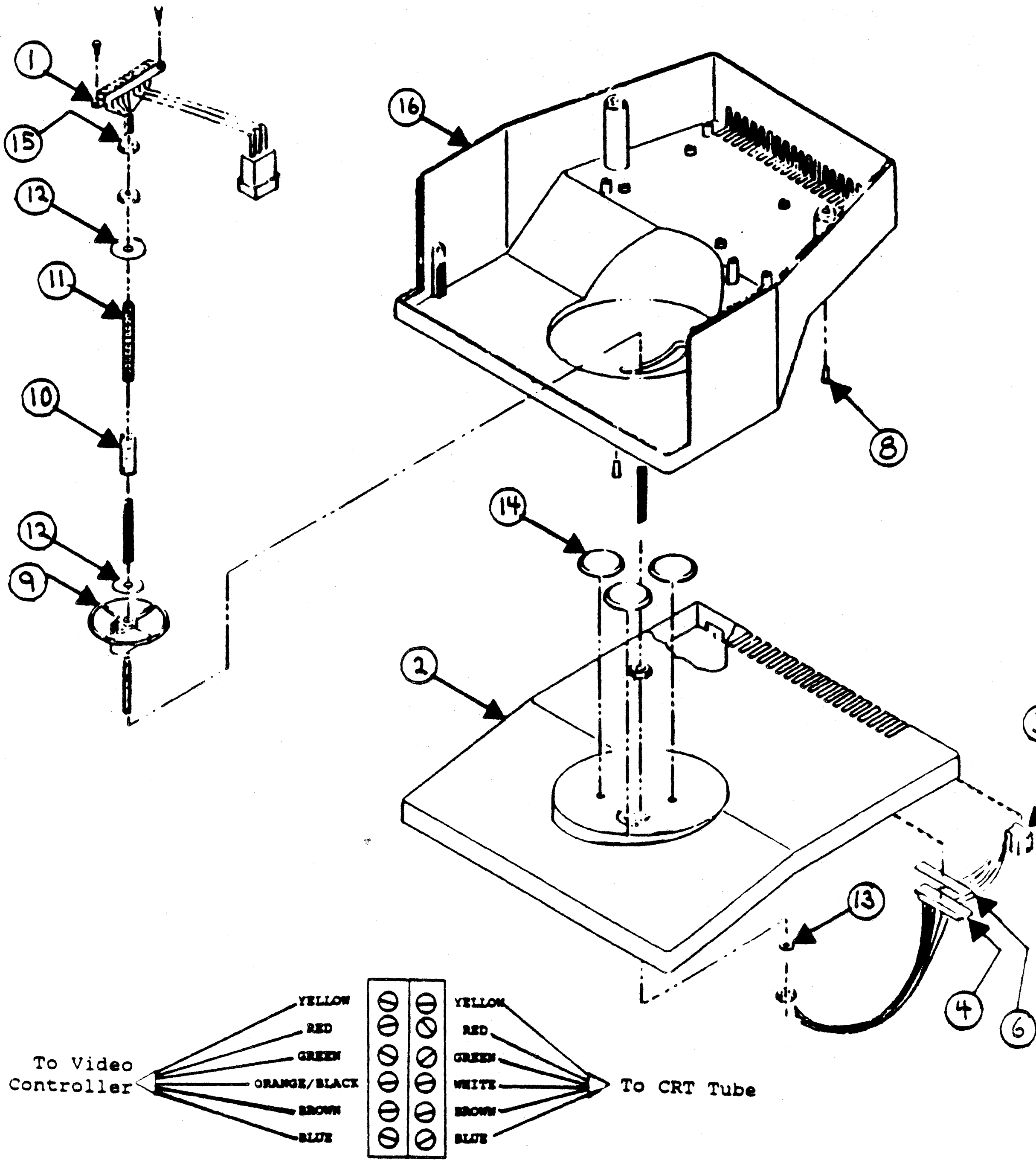



Figure F-6

LOWER SHELL & UPPER PEDESTAL

## VIDEO MONITOR BASE

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-7 | -- | Assy, Base | 1000020-01 | STS |
| F-7 | -- | Assy, Base | 1001068-01 | HTS |
| F-7 | 1 | Monitor Base | 1000130-01 | STS |
| F-7 | 1 | Monitor Base | 1001069-01 | HTS |
| F-7 | 2 | Rubber Feet | 1000129-01 | 4 places |
| F-7 | 3 | Screw | 1000118-08 | |
| F-7 | 4 | Shield | 1001023-01 | |

VIDEO MONITOR BASE

HTS & STS

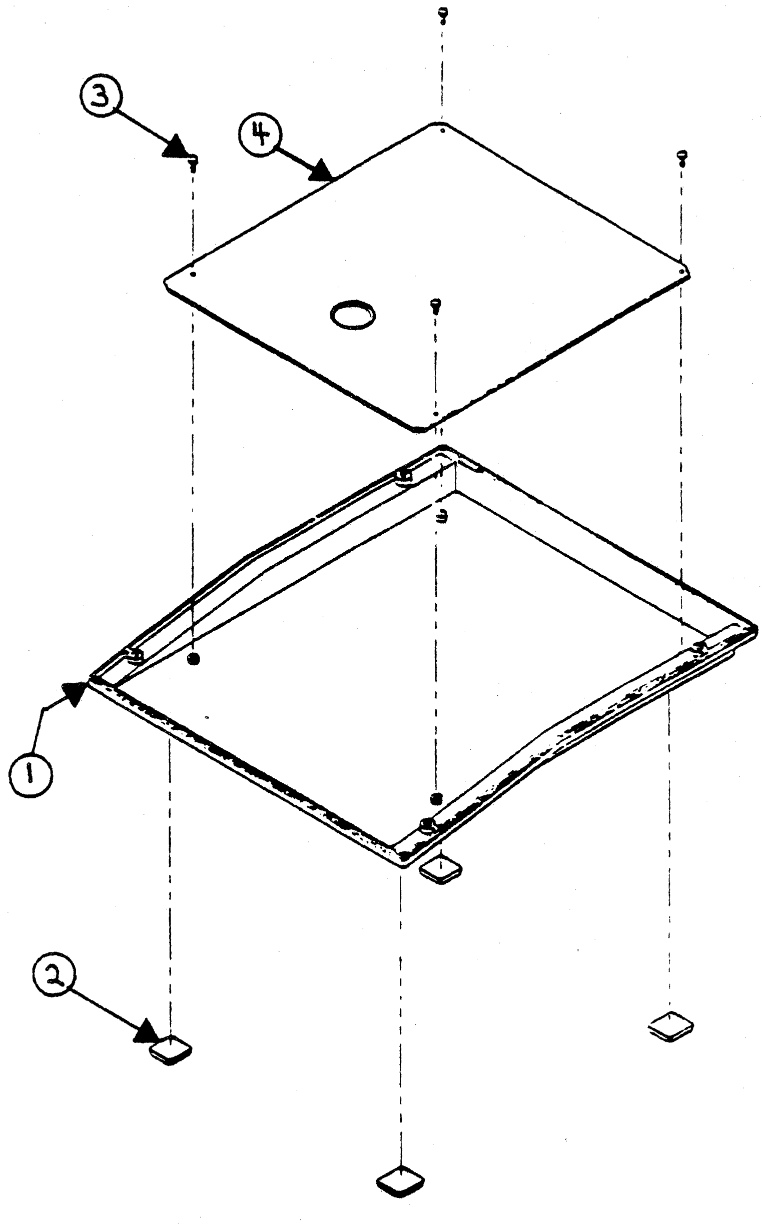



Figure F-7

VIDEO MONITOR BASE

## VIDEO MONITOR & FIS 1000 CRT/BEZEL ASSEMBLY

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-8 | -- | Assy, CRT/Bezel | 1001166-01 | STS |
| F-8 | -- | Assy, CRT/Bezel | 1001616-01 | HTS |
| F-8 | 1 | Bezel, CRT | 1000148-01 | STS |
| F-8 | 1 | Bezel, CRT | 1001070-01 | HTS |
| F-8 | 3 | Bracket, CRT | 1000135-01 | STS |
| F-8 | 3 | Bracket, CRT | 1001645-01 | HTS |
| F-8 | 4 | CRT Electronics | 2000042-01 | Includes CRT & Circuit Bd. |
| F-8 | 5 | Washer | 1000138-05 | |
| F-8 | 6 | Screw | 1000118-01 | STS |
| F-8 | 6 | Screw | 1000118-07 | HTS |

# VIDEO MONITOR & FIS 1000 CRT/BEZEL ASSEMBLY

## HTS & STS

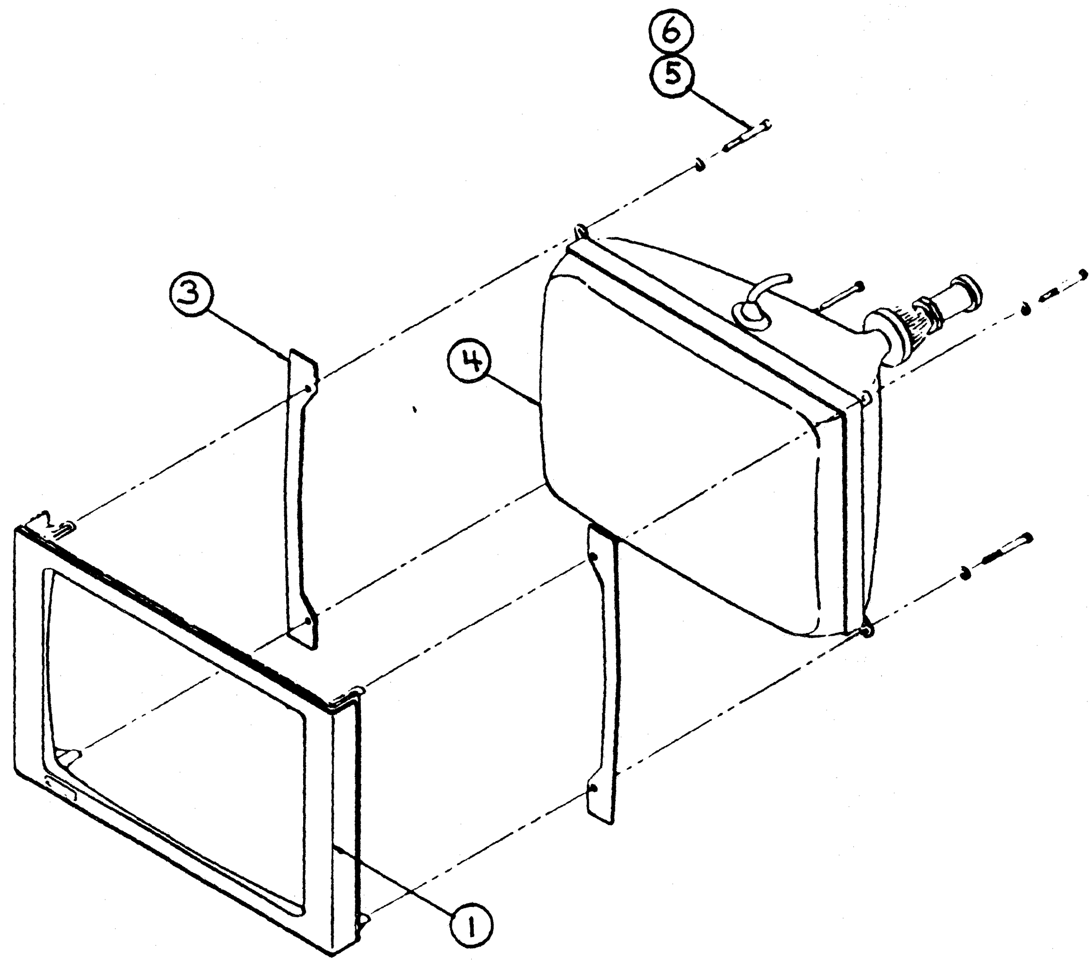



Figure F-8

CRT/BEZEL

FIS 1000

HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-9 | -- | FIS 1000 Terminal | 1000092-01 | |
| F-9 | 1 | Assy, Base | 1001696-01 | STS |
| F-9 | 1 | Assy, Base | 1001619-01 | HTS |
| F-9 | 2 | Screw | 1000118-07 | STS |
| F-9 | 2 | Screw | 1003057-01 | HTS |
| F-9 | 3 | Assy, CRT/Bezel | 1001166-01 | STS |
| F-9 | 3 | Assy, CRT/Bezel | 1001616-01 | HTS |
| | SEE FIGURE 10-7 FOR BREAKDOWN OF CRT/BEZEL ASSY | | | |
| F-9 | 7 | Assy, Upper Shell | 1000133-02 | STS |
| F-9 | 7 | Assy, Upper Shell | 1001063-03 | HTS |
| F-9 | 8 | Assy, Pedestal | 1000095-01 | STS |
| F-9 | 8 | Assy, Pedestal | 1001621-01 | HTS |
| F-9 | 15 | Insert | 1001239-01 | HTS Only |

SEE FIGURE 10-3 FOR CRT ELECTRONICS MOUNTING HARDWARE

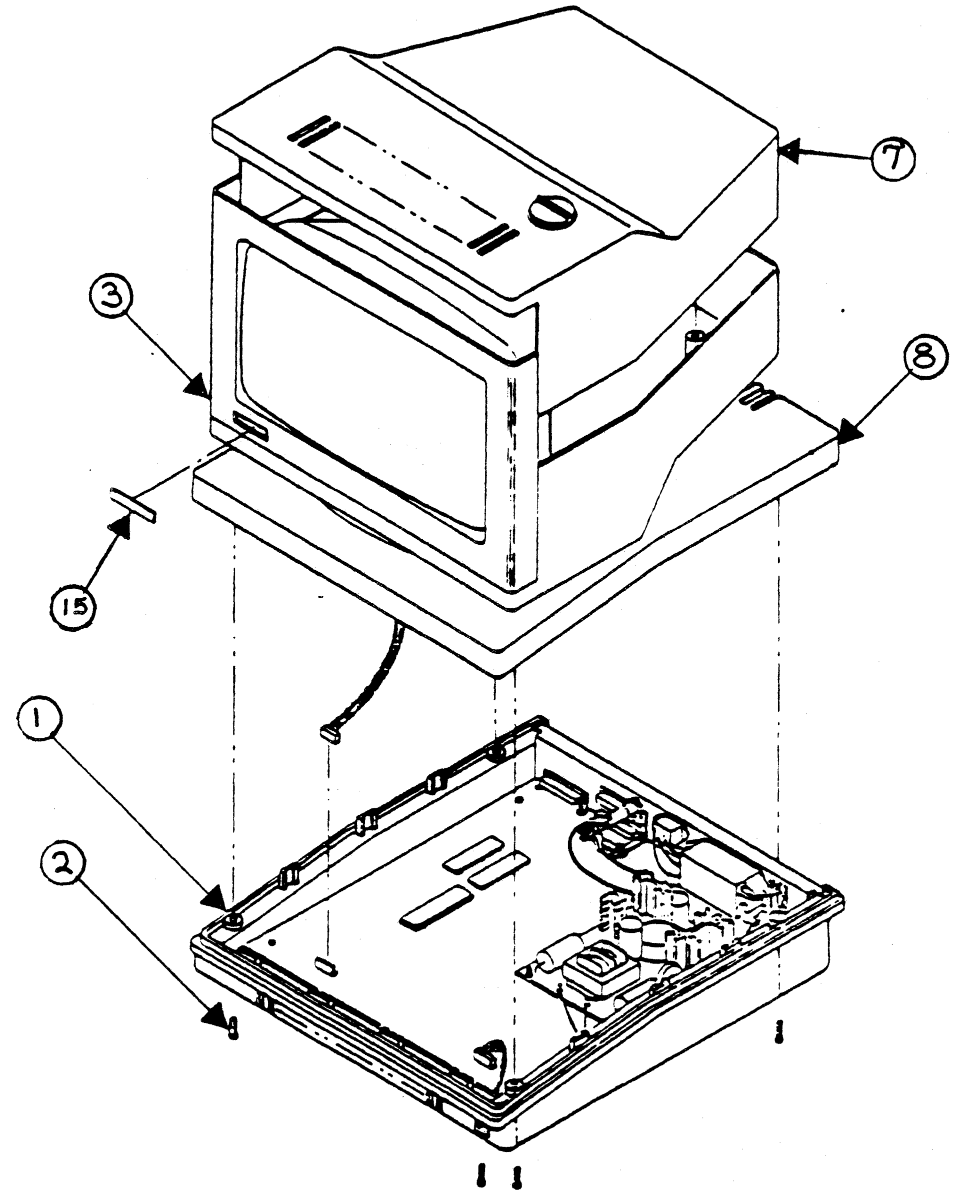



Figure F-9

FTS 1000

## FIS 1000 UPPER SHELL

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-10 | -- | Assy, Upper Shell | 1000133-02 | STS |
| F-10 | -- | Assy, Upper Shell | 1001063-03 | HTS |
| F-10 | 1 | Upper Shell | 1000134-02 | STS |
| F-10 | 1 | Upper Shell | 1001064-03 | HTS |
| F-10 | 2 | Brightness Cable | 1000131-01 | |
| F-10 | 3 | Brightness Knob | 1001110-01 | |
| F-10 | 4 | Knob Clip | 1000137-01 | |

## FIS 1000 UPPER SHELL

## HTS & STS

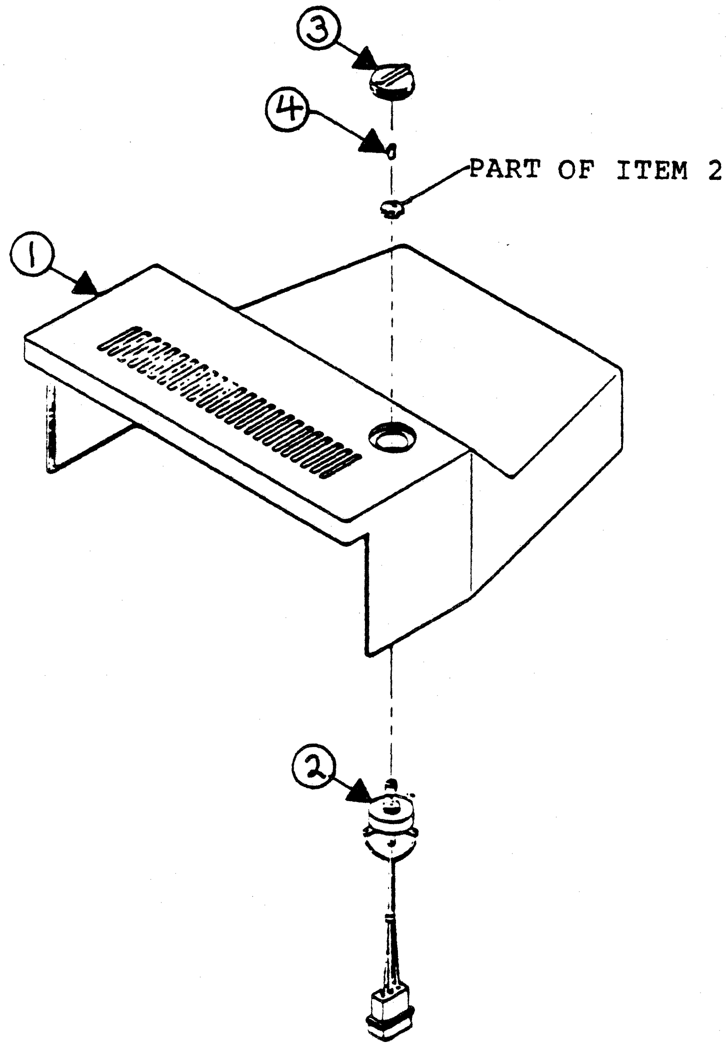



Figure F-10

FIS 1000 UPPER SHELL

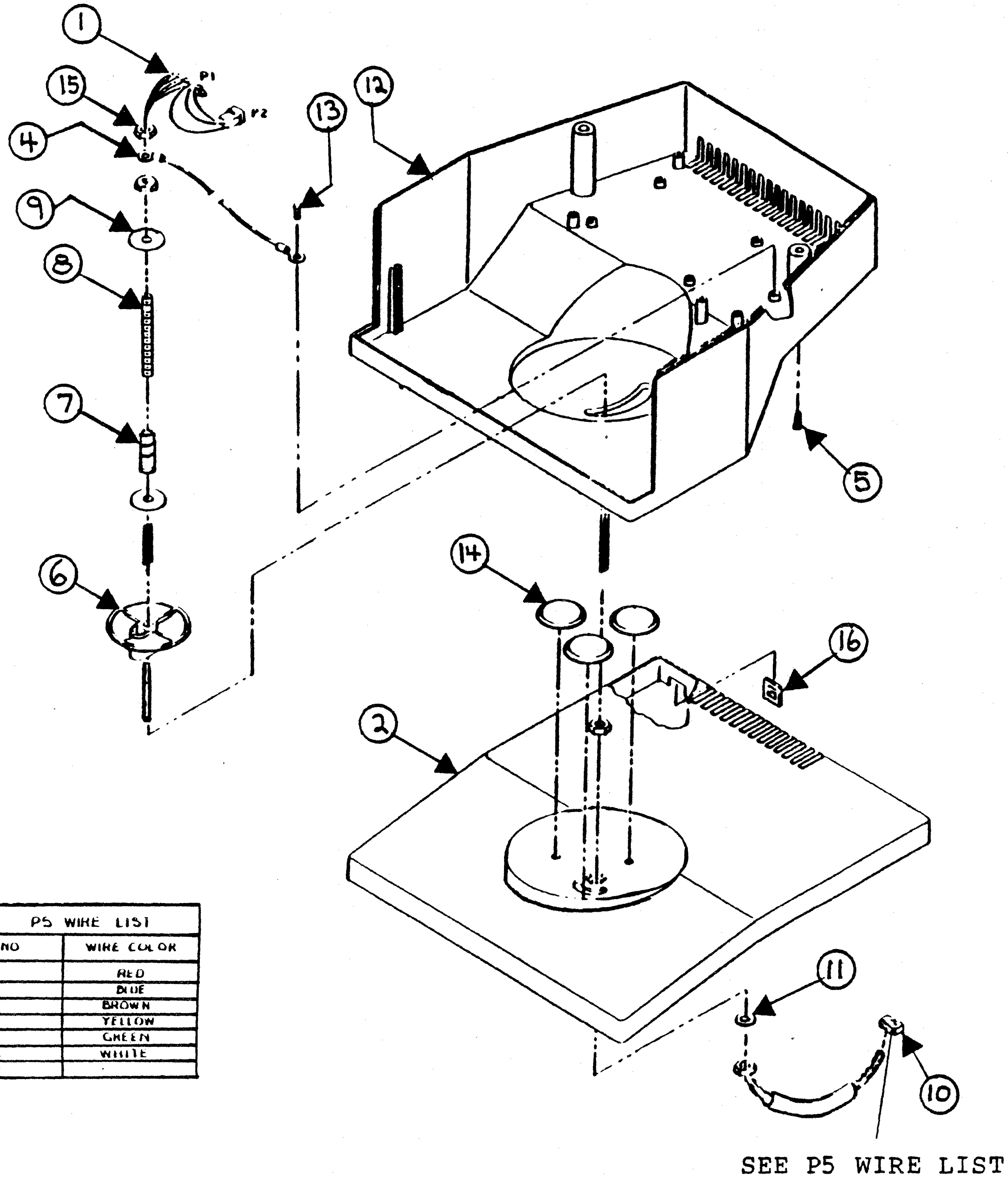
## FIS 1000 LOWER SHELL AND UPPER PEDESTAL

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-11 | -- | Assy, Pedestal | 1000095-01 | STS |
| F-11 | -- | Assy, Pedestal | 1001621-01 | HTS |
| F-11 | 1 | Wiring Assembly | 1000043-01 | |
| F-11 | 2 | Pedestal Upper | 1000132-02 | STS |
| F-11 | 2 | Pedestal Upper | 1001682-01 | HTS |
| F-11 | 4 | Ground Cable | 1001113-01 | |
| F-11 | 5 | Captive Screw | 1000139-03 | |
| F-11 | 6 | Load Distribution Plate | 1000140-01 | |
| F-11 | 7 | Compression Spring | 1000141-01 | |
| F-11 | 8 | Nipple | 1000142-01 | |
| F-11 | 9 | Flat Washer | 1000138-38 | |
| F-11 | 10 | 7 POS Connector | 1000604-01 | |
| F-11 | 11 | Split Washer | 1001231-01 | |
| F-11 | 12 | Lower Shell | 1000149-02 | STS |
| F-11 | 12 | Lower Shell | 1001067-03 | HTS |
| F-11 | 13 | Screw | 1000118-08 | |
| F-11 | 14 | Glide Button | 1001681-01 | |
| F-11 | 15 | Brass Nut | 1000143-01 | |
| F-11 | 16 | Plug | 1001704-01 | HTS Only |
| F-11 | NS | Vent Screw | 1001111-02 | STS Only |

## FIS 1ØØØ LOWER SHELL AND UPPER PEDESTAL

## HTS & STS




| P5 WIRE LIST | |
|---|---|
| PIN NO | WIRE COLOR |
| 1 | RED |
| 2 | BLUE |
| 3 | BROWN |
| 4 | YELLOW |
| 5 | GREEN |
| 6 | WHITE |
| 7 | |

Figure F-11

FIS 1ØØØ LOWER SHELL AND PEDESTAL

# FIS 1000 BASE

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-12 | -- | Assy, Base FIS | 1001696-01 | STS |
| F-12 | -- | Assy, Base FIS | 1001619-01 | HTS |
| F-12 | 1 | FIS PWA | 2001246-02 | |
| F-12 | 2 | Power Supply 115 Volts | 2000666-01 | |
| F-12 | 2 | Power Supply 230 Volts | 2000666-02 | |
| F-12 | 3 | Back Panel 230 Volts | 1001695-02 | STS |
| F-12 | 3 | Back Panel 230 Volts | 1001620-03 | HTS |
| F-12 | 3 | Back Panel 115 Volts | 1001695-01 | STS |
| F-12 | 3 | Back Panel 115 Volts | 1001620-01 | HTS |
| F-12 | 4 | Fastener | 1001644-01 | HTS Only |
| F-12 | 6 | Keyboard Harness | 1000048-02 | |
| F-12 | 7 | Rubber Feet | 1000129-01 | |
| F-12 | 8 | Screw | 1000303-02 | STS |
| F-12 | 8 | Screw | 1001283-03 | HTS |
| F-12 | 9 | Flat Washer | 1000138-01 | |
| F-12 | 10 | Molded Base | 1000611-01 | STS |
| F-12 | 10 | Molded Base | 1001216-01 | HTS |
| F-12 | 13 | Support | 1000463-01 | |
| F-12 | 14 | Screw | 1000303-05 | STS |
| F-12 | 14 | Screw | 1001283-12 | HTS |
| F-12 | 15 | Gasket | 1001751-03 | HTS Only |
| F-12 | 18 | Screw | 1000373-01 | HTS Only |
| F-12 | 20 | Switch, 115V | 1001009-01 | |
| F-12 | 20 | Switch, 230V | 1001009-02 | |
| F-12 | 22 | Filter | 1001095-01 | |
| F-12 | 23 | Fuse, 115V, 2 Amp | 1000617-01 | |
| F-12 | 23 | Fuse, 230V, 1 Amp | 1000617-03 | |

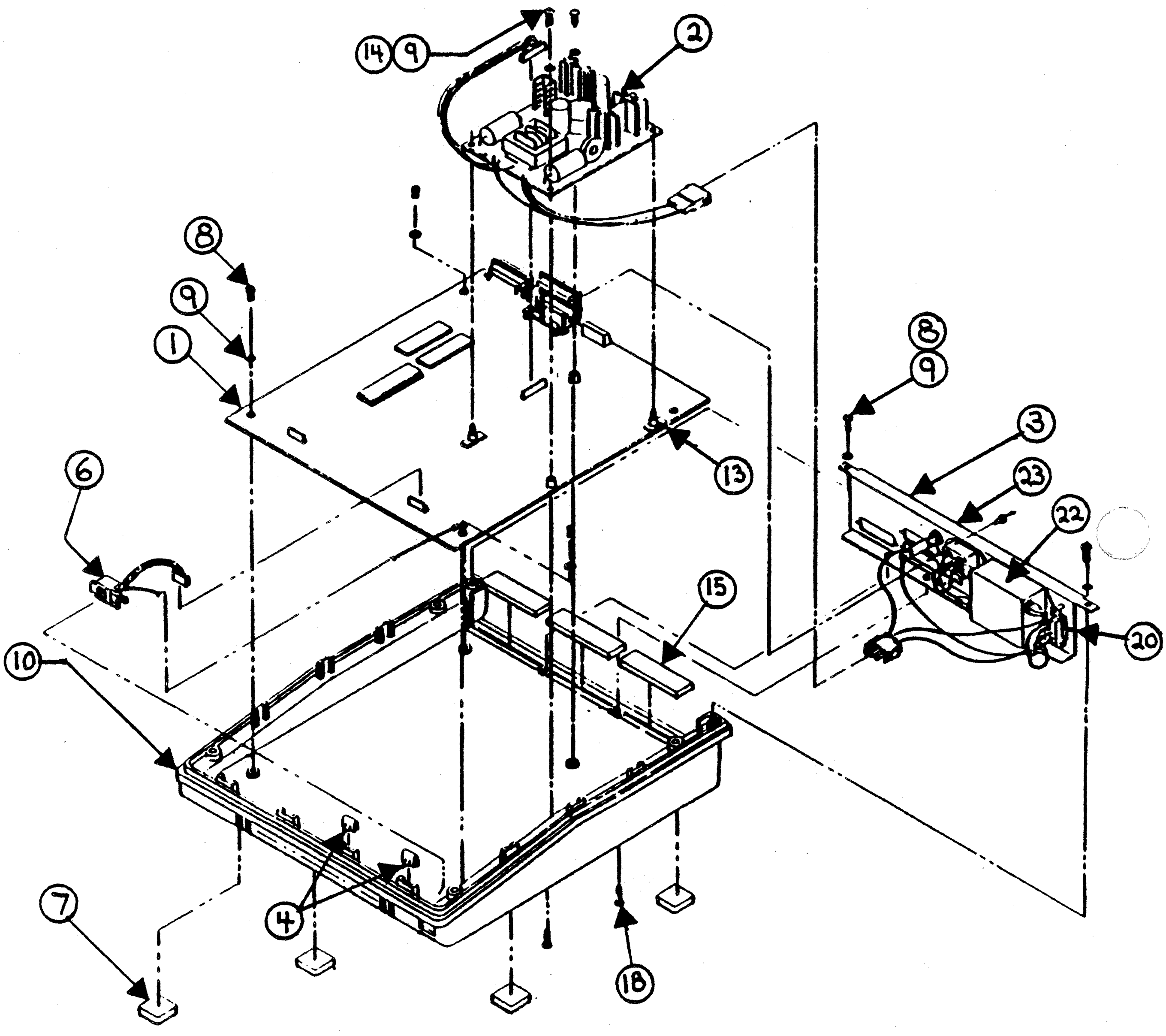



Figure F-12

FIS 1ØØØ BASE

## FORTUNE BASIC WORKSTATION

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-13 | 1 | Display, Green | 1003385-01 | 115V |
| F-13 | 1 | Display, Amber | 1003385-03 | 115V |
| F-13 | 1 | Display, Green | 1003385-02 | 230V |
| F-13 | 1 | Display, Amber | 1003385-04 | 230V |
| F-13 | 2 | Keyboard, Domestic | 1003374-01 | |
| F-13 | 3 | Keyboard Coil Cord | 1003406-01 | |
| F-13 | NS | Power Cord | 1001003-01 | |

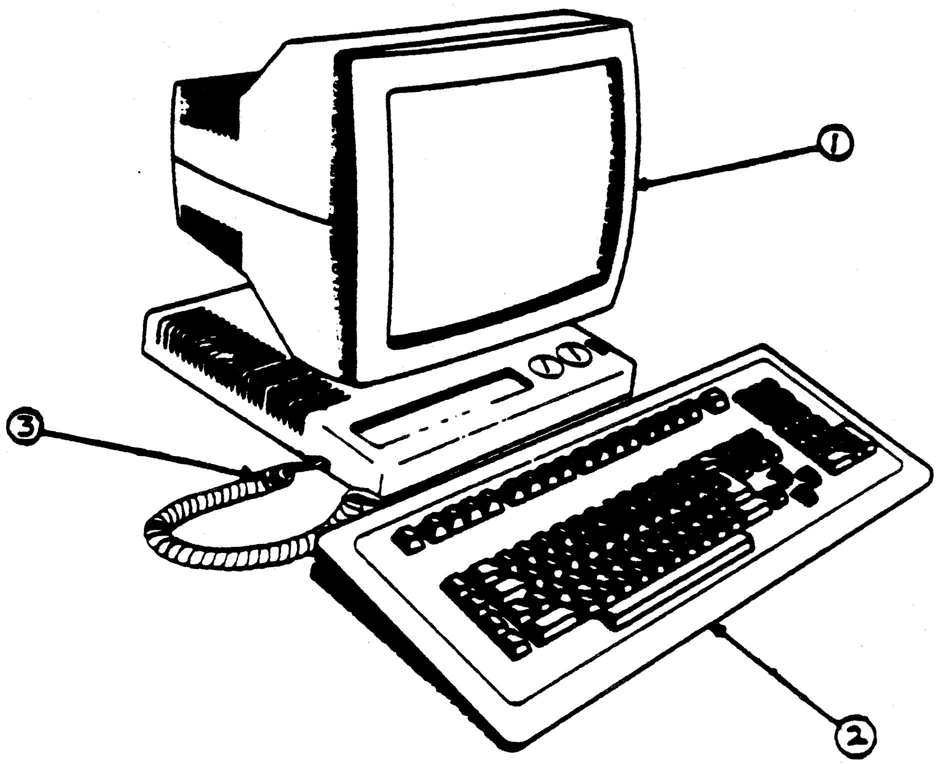



Figure F-13

FORTUNE BASIC WORKSTATION

## FORTUNE BASIC WORKSTATION DISPLAY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-14 | -- | Display, Green | 1003385-01 | 115V |
| F-14 | -- | Display, Amber | 1003385-03 | 115V |
| F-14 | -- | Display, Green | 1003385-02 | 230V |
| F-14 | -- | Display, Amber | 1003385-04 | 230V |
| F-14 | 1 | Ped/Shell Assy | 1003482-01 | Skins Only |
| F-14 | 2 | Bezel/CRT Assy. Green | 1003517-01 | |
| F-14 | | Bezel/CRT Assy. Amber | 1003517-02 | |
| F-14 | 14 | Top/Screen Assembly | 1003537-01 | Skins Only |
| F-14 | 10 | Washer, Flat #10 | 1003587-01 | |
| F-14 | 5 | Screw, Allen | 1003559-01 | |
| F-14 | 7 | Dial Knob | 1003498-01 | |
| F-14 | 8 | Clip, Dial Knob | 1000137-01 | |
| F-14 | 9 | Bottom Shell Assembly | 1003482-01 | |
| F-14 | 19 | Insert | 1003499-01 | |
| F-14 | 20 | Base Assembly | 1003481-01 | |
| F-14 | NS | Fuse 2amp/250 | 1000617-01 | |
| F-14 | NS | Contrast Harness Assy. | 1003550-01 | |
| F-14 | NS | Interconnect Harn/Assy. | 1003507-01 | |

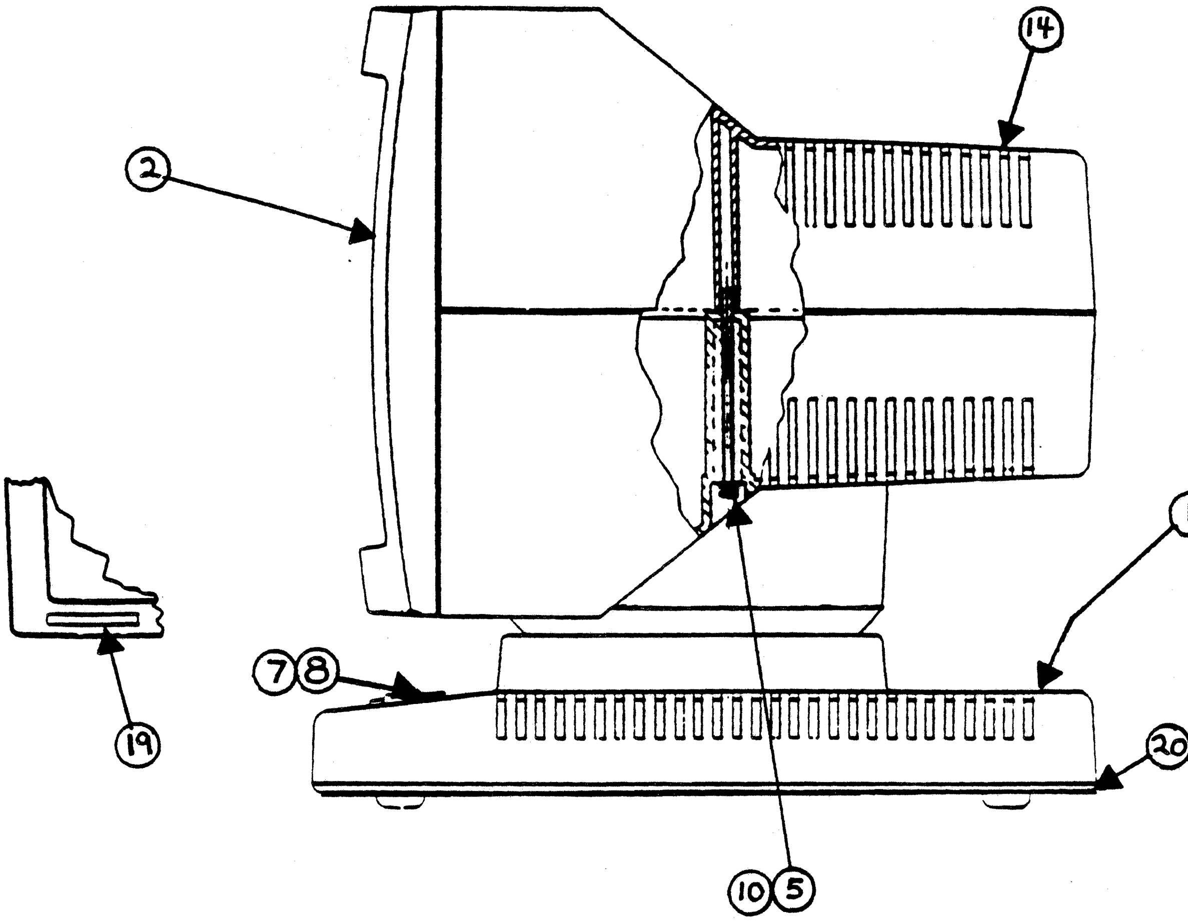



Figure F-14

FORTUNE BASIC WORKSTATION DISPLAY

## FORTUNE BASIC WORKSTATION DISPLAY CRT/BEZEL ASSY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-15 | -- | Assy, CRT/Bezel Green | 1003517-01 | 115V |
| F-15 | -- | Assy, CRT/Bezel Amber | 1003517-02 | 115V |
| F-15 | -- | Assy, CRT/Bezel Green | 1003517-01 | 230V |
| F-15 | -- | Assy, CRT/Bezel Amber | 1003517-02 | 230V |
| F-15 | 1 | Bezel | 1003495-01 | |
| F-15 | 2 | CRT Elect/Green NCE | 1003691-01 | |
| F-15 | 2 | CRT Elect/Amber NCE | 1003691-02 | |
| F-15 | 4 | Spacer | 1003511-01 | 4 each |
| F-15 | 5 | Screw, Sems | 1001284-06 | |
| F-15 | 6 | Washer, Flat | 1003587-01 | 12 each |
| F-15 | 9 | Bracket, CRT Mtg. | 1003490-01 | |

**-NOTE-**

The CRT Electronics Assembly listed in Index 2 above is the new style CRT Electronics Assembly as shown in F-16, Page 7-34.

The old style CRT Electronics Assembly part number is 2003479-01 for a green tube and electronics board or part number 2003479-02 for an amber tube and electronics board. With the old style CRT electronics, the power supply is separate and that part number is 2003509-01.

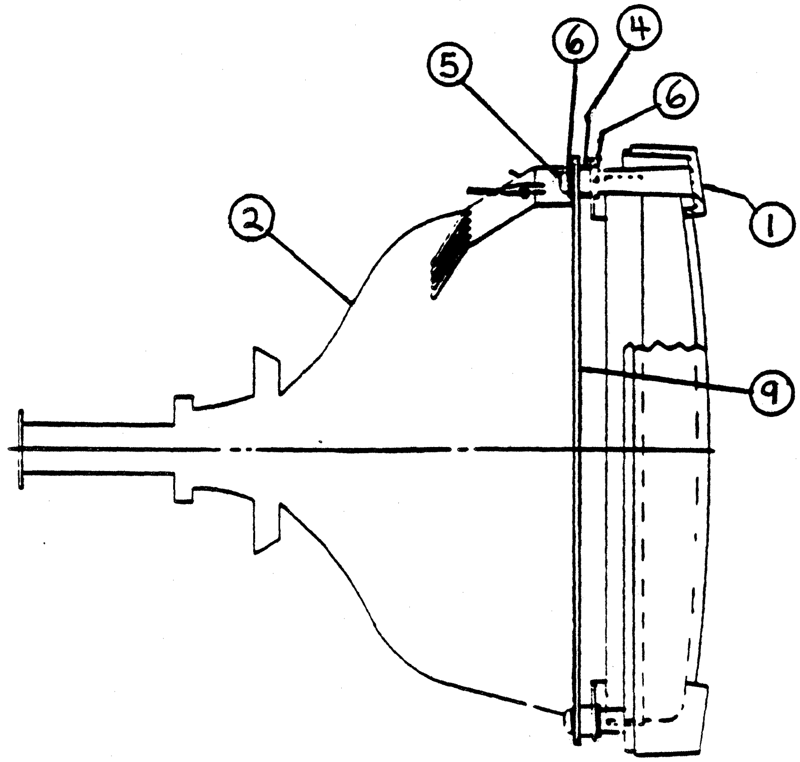



Figure F-15

CRT/BEZEL ASSEMBLY

## CRT ELECTRONICS ASSEMBLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-16 | -- | CRT El/Assy. Green NCE | 1003691-01 | 115V |
| F-16 | -- | CRT El/Assy. Amber NCE | 1003691-03 | 115V |
| F-16 | -- | CRT El/Assy. Green NCE | 1003691-02 | 230V |
| F-16 | -- | CRT El/Assy. Amber NCE | 1003691-04 | 230V |
| F-16 | 1 | CRT Tube, Green NCE | 2000002-01 | |
| F-16 | 1 | CRT Tube, Amber NCE | 2000002-05 | |
| F-16 | 2 | Power Supply, NCE | 2000002-02 | |
| F-16 | 3 | PWA Electronics, NCE | 2000002-03 | |
| F-16 | 4 | Flyback Trans, NCE | 2000002-04 | |

*See note on Page 7-31 concerning different style CRT Electronics.

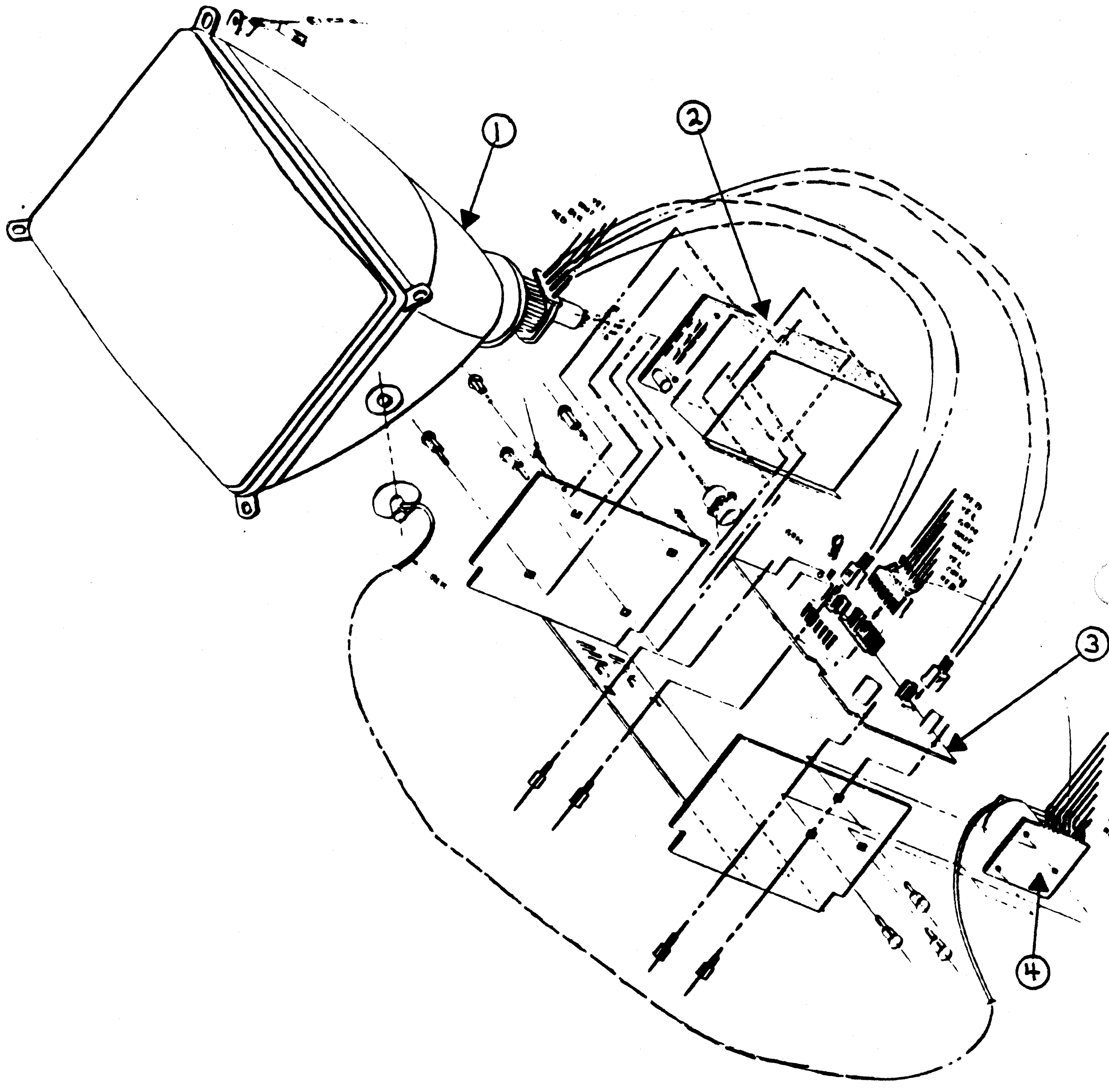



Figure F-16

FORTUNE 1000
CRT ELECTRONICS ASSEMBLY

## FORTUNE BASIC WORKSTATION DISPLAY BASE ASSEMBLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-17 | -- | Assy, Base, | 1003481-01 | |
| F-17 | 1 | Base Plate, metal | 1003491-01 | |
| F-17 | 2 | Assy, Logic Board | 1003503-01 | |
| F-17 | 3 | Fuse Holder | 1001108-02 | |
| F-17 | 4 | Standoffs, Threaded | 1003514-03 | 2 each |
| F-17 | 5 | Harness Assembly, Keybd | 1003646-01 | |
| F-17 | 6 | Rubber Foot | 1000129-01 | |
| F-17 | 7 | Screws, Sems | 1001283-01 | |
| F-17 | 8 | Speaker Assy | 1003505-01 | |
| F-17 | 9 | Support | 1000463-04 | |
| F-17 | 11 | Standoff | 1003513-01 | |
| F-17 | 12 | Standoff | 1003513-02 | |
| F-17 | 13 | Standoff | 1003514-01 | |
| F-17 | 16 | Screw, Sems | 1001282-01 | |
| F-17 | 18 | Screw, Sems | 1001283-03 | |
| F-17 | 19 | Screw | 1001107-03 | |
| F-17 | 21 | Washer | 1003584-01 | |
| F-17 | 22 | Washer | 1000667-01 | |
| F-17 | 23 | Nut 6-32 | 1001094-01 | |
| F-17 | 24 | Nut 8-32 | 1000374-02 | |
| F-17 | 25 | Cable Tie | 1000421-01 | |
| F-17 | 28 | Jack Post | 1003510-01 | |
| F-17 | 29 | Label | 1003489-01 | |
| F-17 | 30 | Screw, Sems | 1001283-05 | |
| F-17 | 32 | DC Harness Assy | 1003549-01 | |
| F-17 | 33 | AC Harness Assy | 1003508-01 | |
| F-17 | 35 | Shield, Logic Bd | 1003557-02 | |
| F-17 | 37 | Mount, Cable Tie | 1003573-01 | |
| F-17 | 38 | Shield Support | 1003558-01 | |
| F-17 | 44 | Ground Wire | 1003592-01 | |

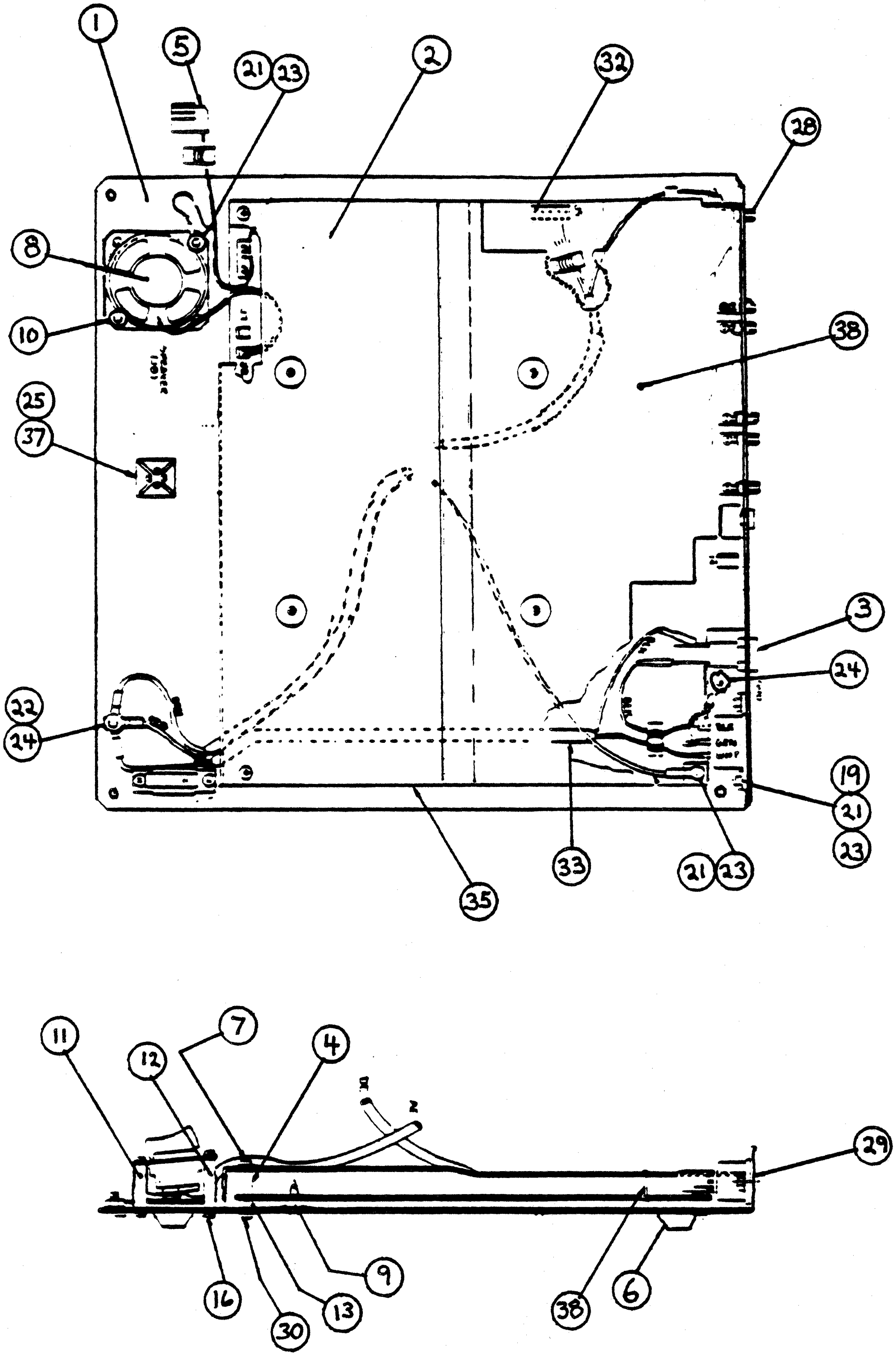



Figure F-17

DISPLAY BASE ASSEMBLY

# CENTRAL PROCESSING UNIT

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-18 | -- | XP30:1MBC | 1001974-05 | 115V |
| F-18 | -- | XP30:1MBC | 1001974-06 | 230V |
| F-18 | -- | XP45:2MBC | 1003869-01 | 115V |
| F-18 | -- | XP45:2MBC | 1003869-02 | 230V |
| F-18 | -- | XP45T:2MBC | 1008390-01 | 115V |
| F-18 | -- | XP45T:2MBC | 1008390-02 | 230V |
| F-18 | 9 | Clip, Right | 1001158-01 | STS Only |
| F-18 | 10 | Clip, Left | 1001158-02 | STS Only |
| F-18 | 11 | Screw | 1000373-02 | STS Only |

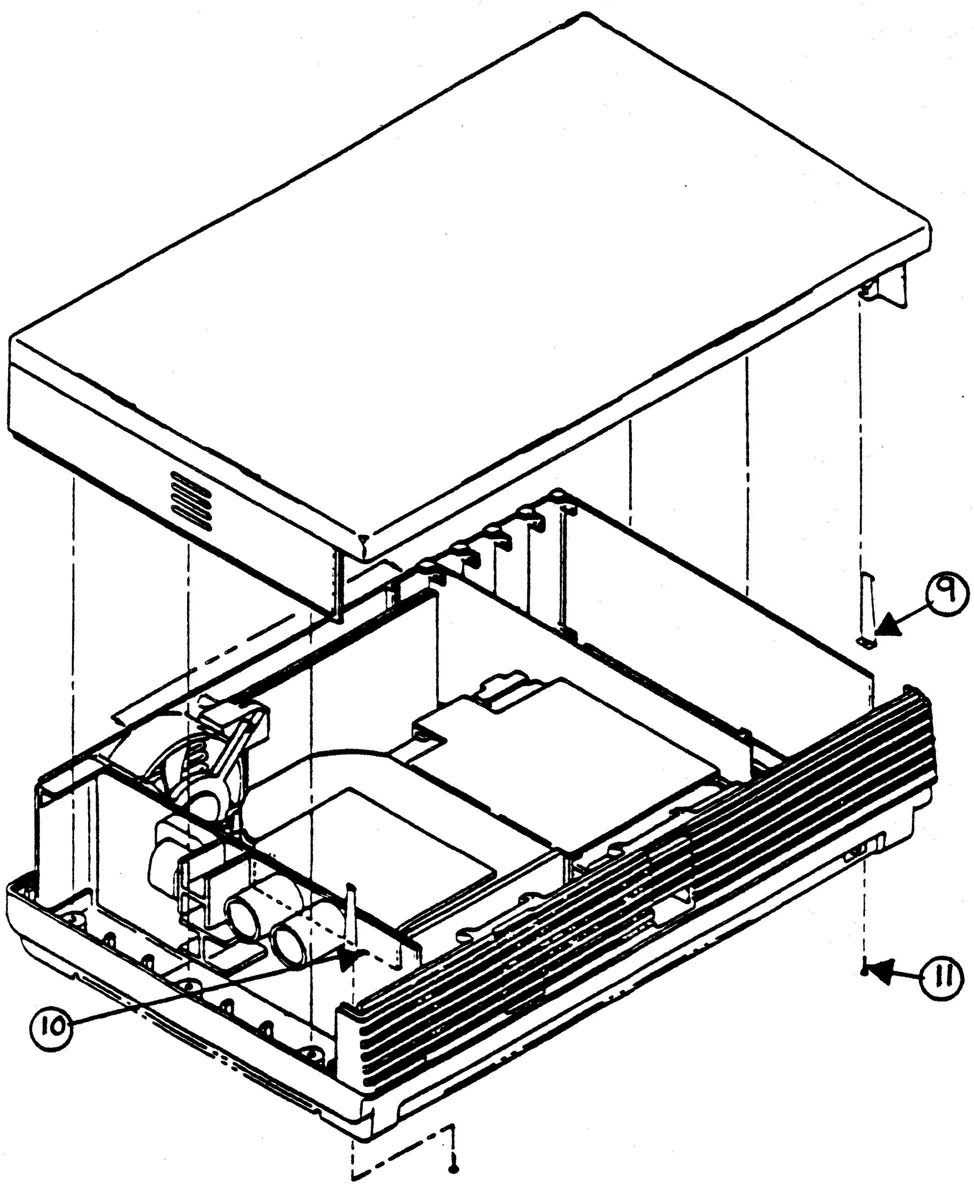
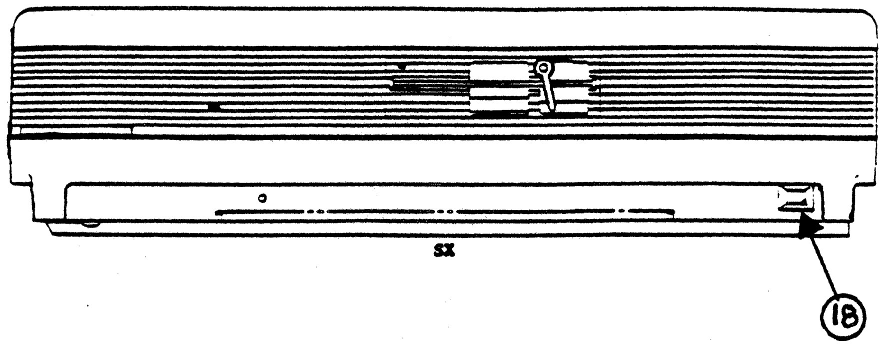



Figure F-18

CENTRAL PROCESSING UNIT

## SX CENTRAL PROCESSING UNITS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-19 | -- | SX45:3.5MBC | 1003434-01 | 115V |
| F-19 | -- | SX45:3.5MBC | 1003434-02 | 230V |
| F-19 | -- | SX45T:3.5MBC | 1003446-01 | 115V |
| F-19 | -- | SX45T:3.5MBC | 1003446-02 | 230V |
| F-19 | -- | SX70:3.5MBC | 1003617-01 | 115V |
| F-19 | -- | SX70:3.5MBC | 1003617-02 | 230V |
| F-19 | -- | SX70T:3.5MBC | 1003661-01 | 115V |
| F-19 | -- | SX70T:3.5MBC | 1003661-02 | 230V |
| F-19 | -- | SX145:3.5MBC | 1008236-01 | 115V |
| F-19 | -- | SX145:3.5MBC | 1008236-02 | 230V |
| F-19 | -- | SX145T:3.5MBC | 1008238-01 | 115V |
| F-19 | -- | SX145T:3.5MBC | 1008238-02 | 230V |
| F-19 | 17 | Screw 6-32x3/8" | 1001283-03 | |
| F-19 | 18 | Plug | 1001704-01 | |
| F-19 | 21 | Screw 6-32x5/16" | 1001283-02 | |



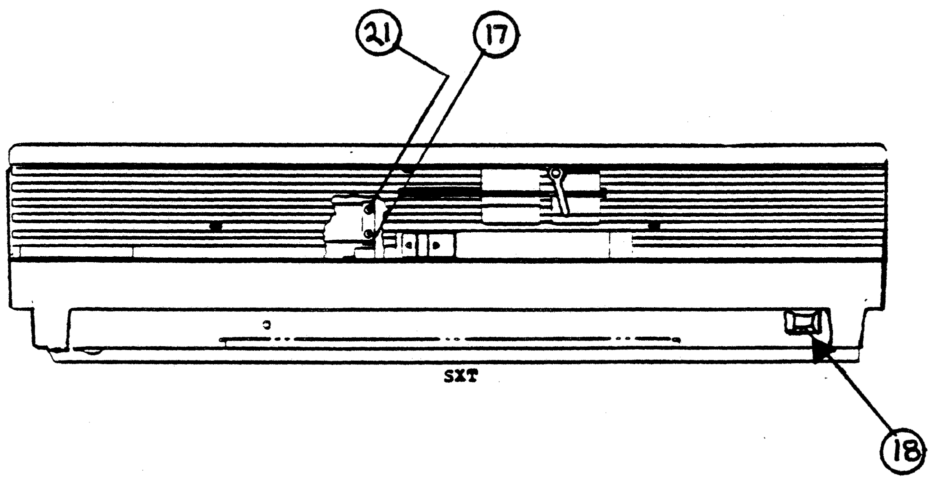




Figure F-19

SX & SX SCSI
CENTRAL PROCESSING UNIT

## TOP COVER

## STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-2Ø | -- | Assy, Top Cover | 1ØØØ155-Ø1 | |
| F-2Ø | 1 | Side Panel | 1ØØØ156-Ø1 | 2 Places |
| F-2Ø | 2 | Top Cover | 1ØØØ157-Ø1 | |
| F-2Ø | 3 | Screw | 1ØØØ118-Ø7 | 6 Places |
| F-2Ø | 4 | Clip | 1ØØØ325-Ø1 | 6 Places |
| F-2Ø | 5 | Washer | 1ØØØ326-Ø1 | 6 Places |
| F-2Ø | 6 | Rubber Pad | 1ØØØ454-Ø2 | |
| F-2Ø | 7 | Rubber Pad | 1ØØØ454-Ø1 | |
| F-2Ø | 14 | Insulator | 1ØØ3Ø65-Ø1 | |

INSULATOR TO BE USED WITH WESTERN ELECTRIC POWER SUPPLIES

TOP COVER

STS

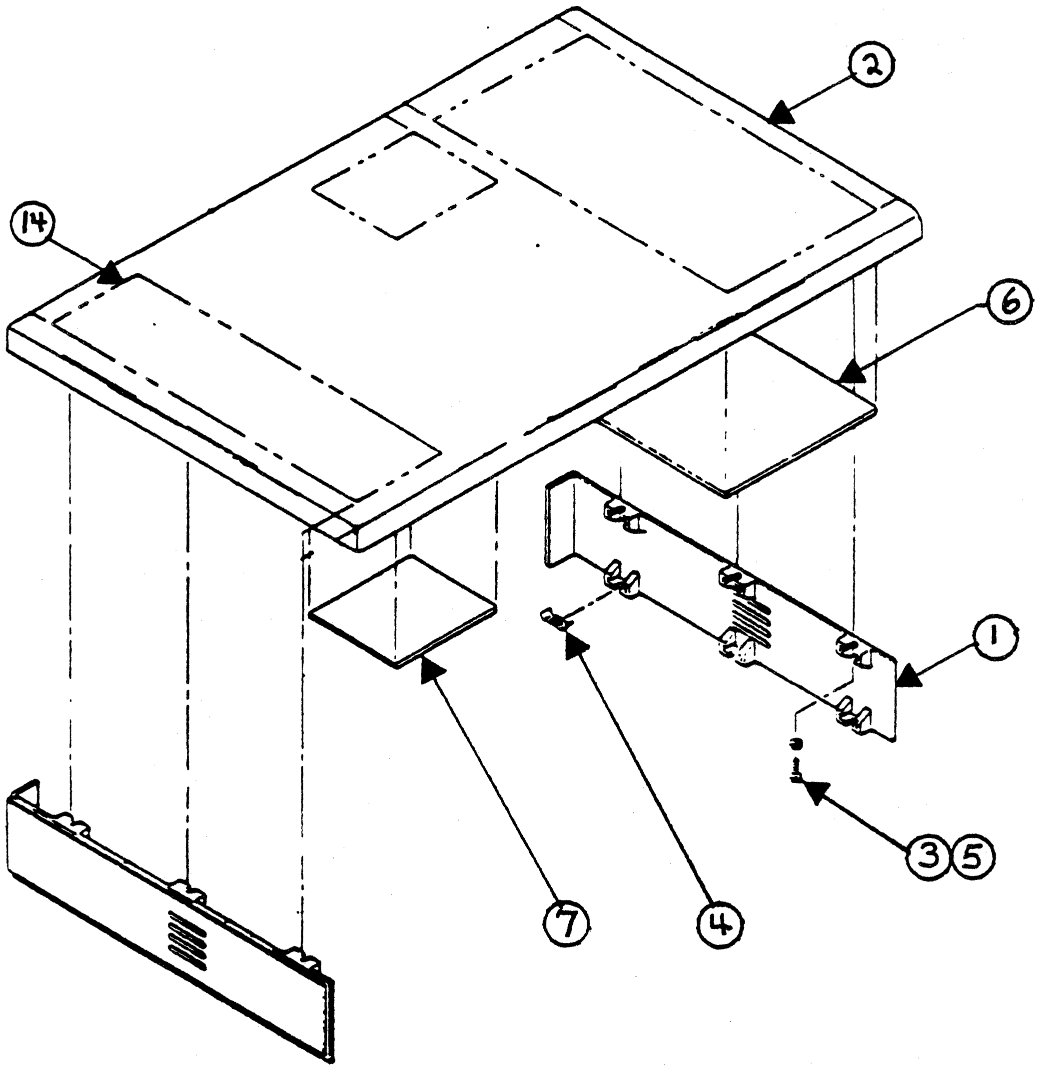



Figure F-2Ø

TOP COVER (STS)

## TOP COVER

## HTS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-21 | -- | Assy, Top Cover | 1001080-01 | |
| F-21 | 1 | CPU Top Cover | 1001678-01 | |
| F-21 | 3 | Fastener | 1001644-01 | |
| F-21 | 4 | Pad, Pressure | 1001885-01 | |
| F-21 | 5 | Gasket | 1001683-01 | |

TOP COVER

HTS

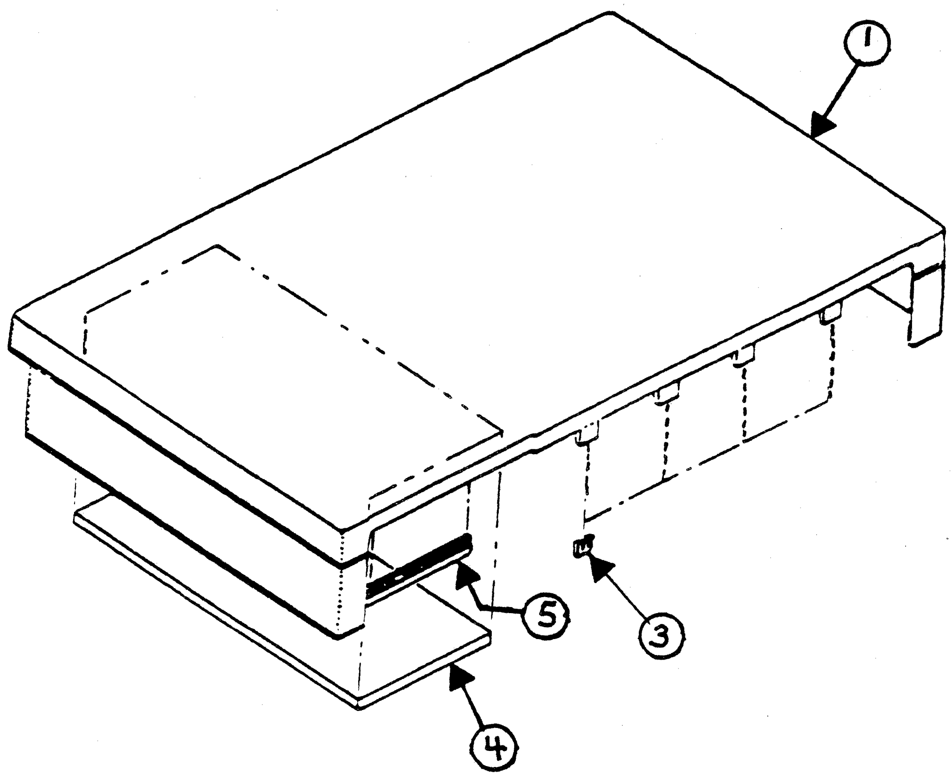



Figure F-21

TOP COVER (HTS)

## SX & SX SCSI

## TOP COVER

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-22 | -- | Assy, Top Cover | 1001080-01 | |
| F-22 | 1 | CPU Top Cover | 1001678-01 | |
| F-22 | 3 | Fastener | 1001644-01 | |
| F-22 | 4 | Pad, Pressure | 1001885-01 | |
| F-22 | 5 | Gasket | 1001683-01 | |

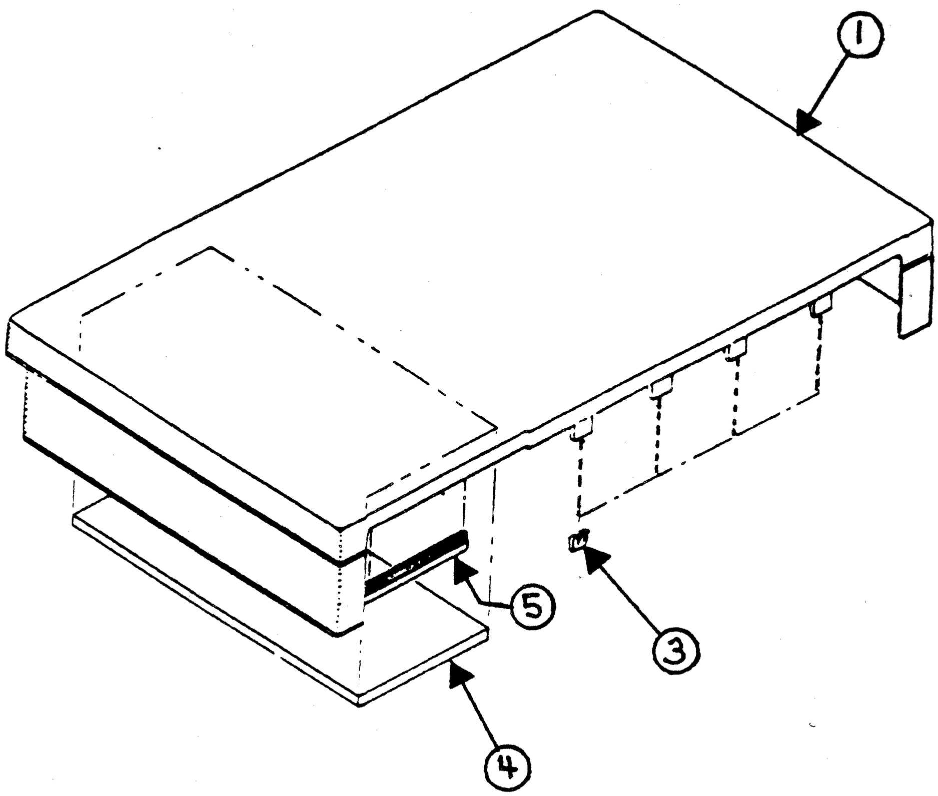



Figure F-22

SX & SX SCSI
TOP COVER

## CPU BASE ASSEMBLY

## STS

OLD STYLE

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-23 | -- | Assy, Base | 1000055-01 | |
| F-23 | 1 | Base | 1000154-01 | |
| F-23 | 2 | Rubber Ft 1/2" | 1000129-02 | |
| F-23 | 3 | Bracket | 1000164-01 | |
| F-23 | 5 | Screw | 1000118-04 | 3 Places |
| F-23 | | Scr,Captive | 1000139-03 | |
| F-23 | 7 | Insulator | 1000301-01 | |
| F-23 | 9 | Screen | 1001112-01 | |
| F-23 | 11 | Screenn | 1001111-01 | |
| F-23 | 14 | Gasket, Copper | 1001168-01 | |

**BASE ASSEMBLY**

**STS**

OLD STYLE

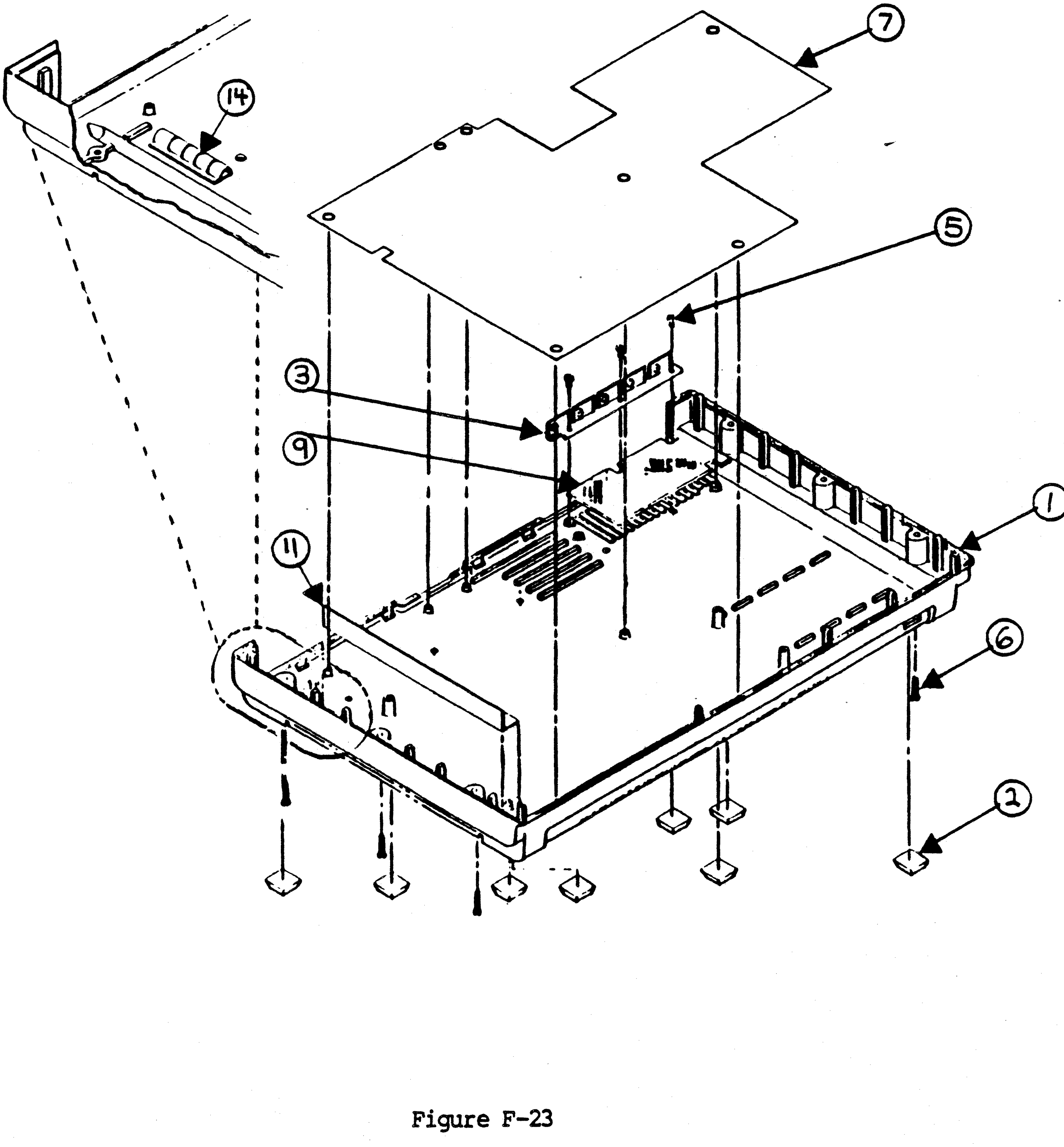



Figure F-23

CPU BASE ASSEMBLY (STS)

# CPU BASE ASSEMBLY

## HTS

NEW STYLE

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-24 | — | Assy, Base | 1001079-01 | |
| F-24 | 1 | Base | 1003273-01 | Old 1001685-01 |
| F-24 | 2 | Foot | 1000129-02 | |
| F-24 | 3 | Screw | 1001283-02 | |
| F-24 | 4 | Screw, Captive | 1000139-03 | 6 each |
| F-24 | 5 | Plate | 1001624-01 | |
| F-24 | 7 | Gasket | 1001167-01 | |
| F-24 | NS | Screw, Captive 6" | 1001227-01 | 2 each |

**BASE ASSEMBLY**

**HTS**

NEW STYLE

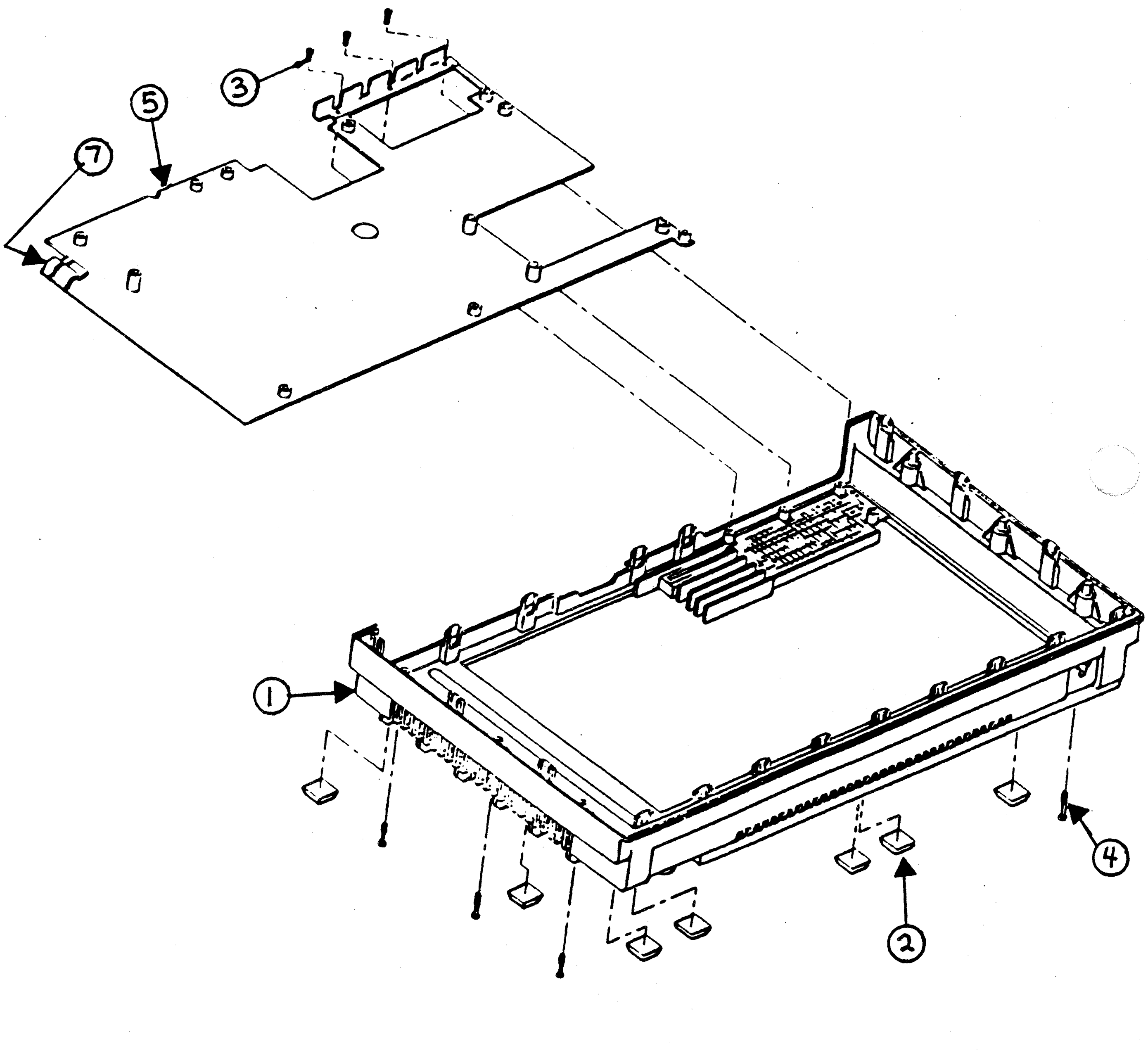



Figure F-24

CPU BASE ASSEMBLY (HTS)

## SX & SXT

## CPU BASE ASSEMBLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-25 | -- | Base Assembly | 1003437-01 | |
| F-25 | 1 | Base | 1001635-03 | |
| F-25 | 2 | Rubber Foot | 1000129-02 | 7 Places |
| F-25 | 3 | Screw:6-32x5/16" | 1001283-02 | 3 Places |
| F-25 | 4 | Screw:8-32x7/8" | 1000139-03 | 6 Places |
| F-25 | 5 | Conductive Plate | 1001624-02 | |
| F-25 | 7 | Shielding Gasket | 1001168-01 | |
| F-25 | 8 | Plastic Round Plugs | 1003170-01 | 2 places |
| F-25 | 9 | Insulator:Fish Paper | 1003279-02 | |
| F-25 | 10 | Block Spacer | 1003375-01 | |
| F-25 | 11 | Screw:6-19x1/2" | 1000118-01 | |

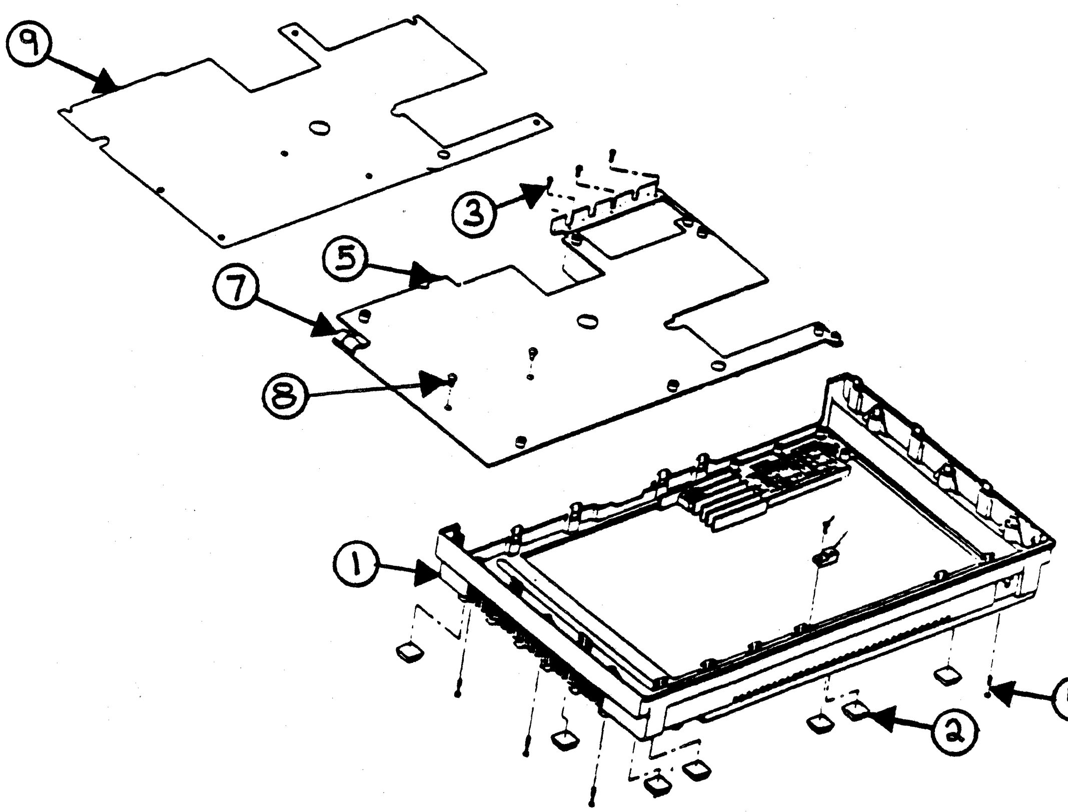



Figure F-25

SX & SX SCSI
CPU BASE ASSEMBLY

## CIRCUIT BOARDS & INTERNAL CABLES

### HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-26 | 4 | Zenith | 2000050-03 | 115V |
| F-26 | 4 | Zenith | 2000050-04 | 230V |
| F-26 | 4 | Western Electric | 2003177-01 | 115V |
| F-26 | 4 | Western Electric | 2003177-02 | 230V |
| F-26 | 5 | Power Supply Screw | 1000302-01 | STS |
| F-26 | 5 | Power Supply Screw | 1001284-02 | HTS |
| F-26 | 10 | Screw | 1000118-04 | STS |
| F-26 | 10 | Screw | 1000118-01 | HTS |
| F-26 | 23 | Screw, Captive | 1001283-01 | HTS |
| F-26 | 23 | Screw | 1000118-02 | STS |
| F-26 | 27 | Screw, Captive | 1000139-03 | HTS Only |
| F-26 | 12 | Motherboard (XP):1MBC | 2001177-01 | Old 1000497-03 |
| F-26 | 12 | Motherboard (XP) 2MBC | 2001177-03 | |
| F-26 | 19 | Keyboard Harness | 1000048-02 | |
| F-26 | 20 | Blank I/O Plate,2 Screws | 1000165-10 | |
| F-26 | 20 | Blank I/O Plate,1 screw | 1000165-01 | |
| F-26 | 20 | HD I/O Panel for Exp.Cab | 1001717-01 | |
| F-26 | 20 | I/O Plate,Video Cont. | 1000165-03 | |
| F-26 | 20 | PIO/Tape I/O Panel | 1000165-40 | |
| F-26 | 20 | I/O Plate | 1000165-04 | 4 Port Comm A |
| F-26 | 20 | I/O Plate | 1000165-15 | 2 Port Comm A |
| F-26 | 20 | I/O Plate | 1000165-42 | 6 Port Comm A |
| F-26 | 18 | WD Disk Ctr. | 2000079-06 | |
| F-26 | 30 | Video Controller | 2000444-03 | |
| F-26 | NS | Graphics Coprocessor | 2003077-01 | |
| F-26 | NS | ArcNet Controller | 1003335-01 | |
| F-26 | NS | PIO Controller | 1001672-01 | Tape Streamer Interface Only |
| F-26 | NS | Comm B Board | 2001652-02 | 2 Port |
| F-26 | NS | Comm A Board | 2000171-03 | 4 Port |
| F-26 | NS | Comm A Board | 2000014-03 | 2 Port |
| F-26 | NS | Comm A Board | 2003461-01 | 2 Port |
| F-26 | 14 | Retainer, MEM | 1001626-01 | HTS Only |
| F-26 | NS | 128KB Memory Board | 2000034-01 | |
| F-26 | NS | 256KB Memory Board | 2000031-01 | |
| F-26 | NS | 512KB Memory Board | 2003307-04 | |
| F-26 | NS | 1 Meg Memory Board | 2003307-03 | |
| F-26 | NS | Cable, Floppy | 1000059-01 | |
| F-26 | NS | Cable, HD Data, 20 Pin | 1000082-01 | |
| F-26 | NS | Cable, HD Control,34 Pin | 1000083-01 | |
| F-26 | NS | Cable, HD Control,34 Pin | 1001812-01 | For Exp.Cab. |
| F-26 | NS | Cable, HD Data, 20 Pin | 1001813-02 | For Exp.Cab. |
| F-26 | NS | Cable/PIO 50 Pin | 1001811-01 | For Exp.Cab. |
| F-26 | NS | PIO w/Cable & I/O Panel | 2003054-01 | |

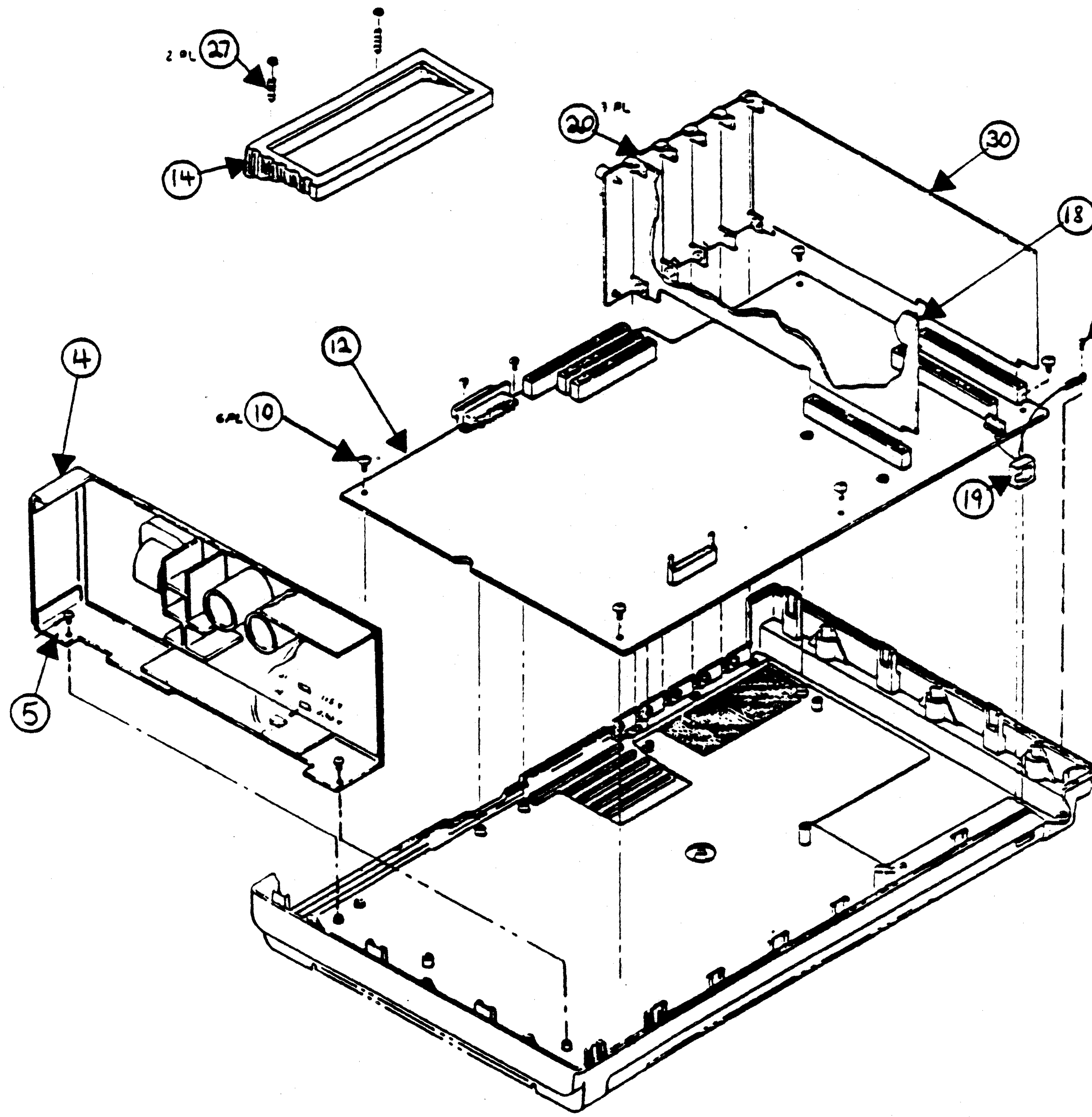



Figure F-26

CIRCUIT BOARDS & CABLES

## SX & SXT

## CIRCUIT BOARDS & CABLES

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-27 | 4 | Western Electric | 2003177-01 | 115V |
| F-27 | 4 | Western Electric | 2003177-02 | 230V |
| F-27 | 4 | Digipower:300W | 2003922-01 | 115V |
| F-27 | 4 | Western Electric | 2003177-02 | 230V |
| F-27 | 5 | Screw:8-32x5/16" | 1001284-02 | 2 Places |
| F-27 | 7 | Hd/Flp/Tape Cover | 1003324-01 | |
| F-27 | 9 | Screw:6-19x1/2" | 1000118-01 | 6 Places |
| F-27 | 12 | Motherboard:(SX):2MBC | 2001177-07 | OLD |
| F-27 | 12 | Motherboard:(SX):3.5MBC | 2003396-01 | NEW |
| F-27 | 12 | Memory Retainer | 1001626-01 | |
| F-27 | 13 | Cable, HD Data, 20 Pin | 1000082-01 | |
| F-27 | 13 | Cable, HD Control, 34P | 1000083-01 | |
| F-27 | 15 | 256KB Memory Board | 2000031-01 | |
| F-27 | NS | 512KB Memory Board | 2003307-06 | |
| F-27 | NS | 1 MEG Memory Board | 2003307-01 | |
| F-27 | 16 | WD Controller | 2000079-06 | |
| F-27 | 19 | Blank I/O Plate | 1000165-04 | 1 Screw |
| F-27 | 20 | Screw:4-20x1/2" | 1000640-03 | |
| F-27 | 21 | Screw:6-32x5/16" | 1001283-02 | |
| F-27 | 23 | PIO to Tape Cable | 1003388-01 | |
| F-27 | 24 | Floppy Cable | 1000059-01 | |
| F-27 | 25 | Screw:8-32x7/8" | 1000139-03 | 2 Places |
| F-27 | 26 | Hold down Screw | 1001227-01 | 2 Places |
| F-27 | 28 | PIO:W/O I/O Plate | 2001672-01 | |
| F-27 | 29 | Blank Plate Assembly | 1000165-10 | 2 Screws |
| F-27 | NS | Lan Card | 2003704-02 | |
| F-27 | NS | Graphics Card | 2003077-01 | |
| F-27 | NS | Comm B Board:2 port | 2001652-02 | |
| F-27 | NS | Comm A Board:4 port | 2000171-03 | |
| F-27 | NS | Comm A Board:2 port | 2000014-03 | |
| F-27 | NS | Comm A Board:6 port | 2003461-01 | |

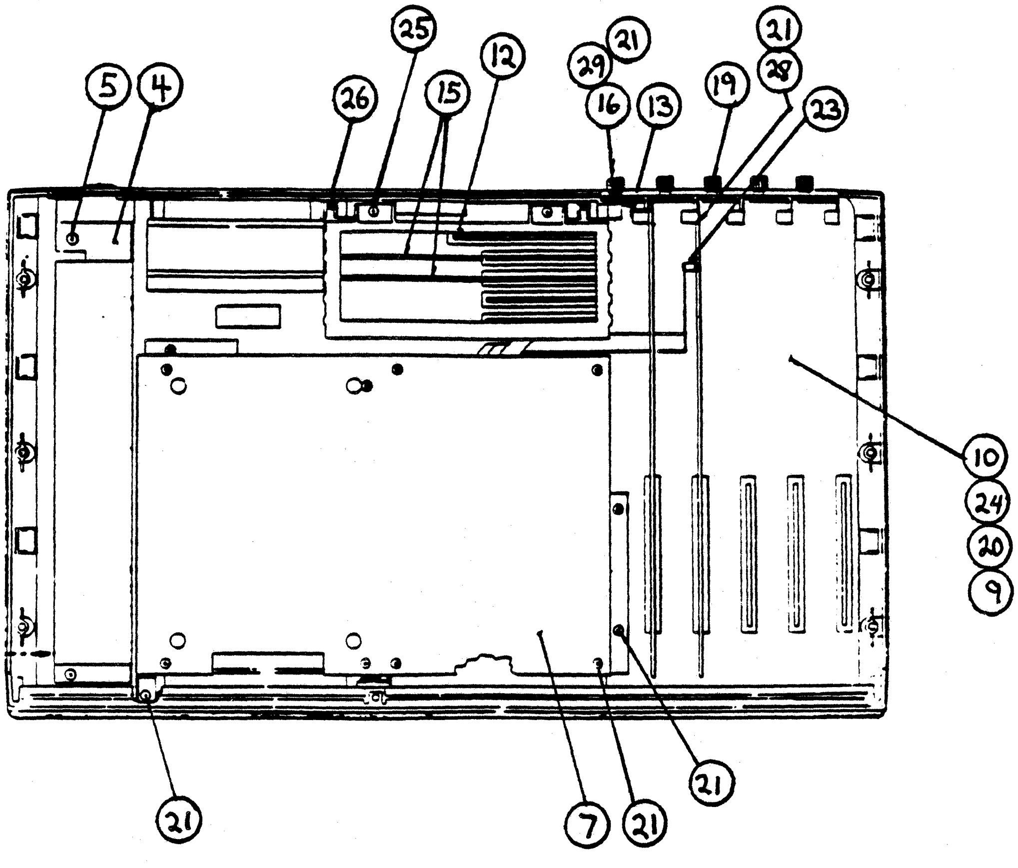



Figure F-27

SX & SXT
CIRCUIT BOARDS & CABLES

## SX SCSI

## CIRCUIT BOARDS & CABLES

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-28 | 1 | Digipower:300W | 2003922-01 | 115V |
| F-28 | 1 | Digipower:300W | 2003922-02 | 230V |
| F-28 | NS | Screw:8-32x5/16" | 1001284-02 | 2 Places |
| F-28 | NS | Motherboard:(SX):3.5MBC | 2003396-01 | |
| F-28 | 2 | Memory Cable Assy:3.5M | 1008106-01 | |
| F-28 | 3 | 512KB Memory Board | 2003307-06 | |
| F-28 | 3 | 1 MEG Memory Board | 2003307-05 | |
| F-28 | 4 | Memory Retainer | 1001626-01 | |
| F-28 | 5 | Blank I/O Plate | 1000165-04 | 1 Screw |
| F-28 | 6 | SCSI Host Adptr | 1003800-01 | |
| F-28 | 7 | Screw:6-32x5/16" | 1001283-02 | |
| F-28 | 9 | Blank Plate Assembly | 1000165-10 | 2 Screws |
| F-28 | 10 | Brkt:Shld:SCSI:Hd Drive | 1003324-02 | |
| F-28 | 11 | SCSI Cable Assy. | 1008174-01 | |
| F-28 | NS | Lan Card | 2003704-02 | |
| F-28 | NS | Comm B Board:2 port | 2001652-02 | |
| F-28 | NS | Comm A Board:4 port | 2000171-03 | |
| F-28 | NS | Comm A Board:6 port | 2003461-01 | |

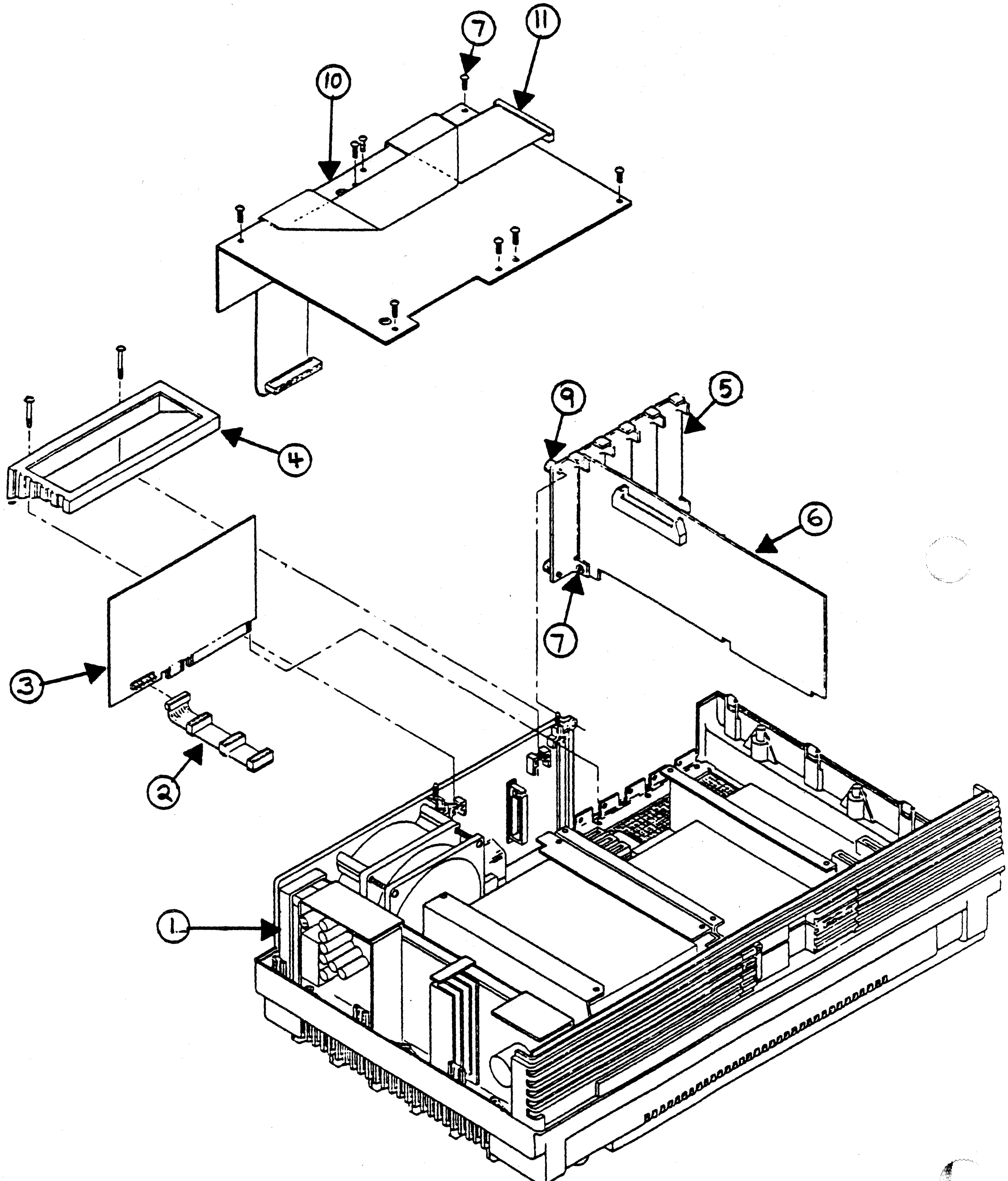



Figure F-28

SX SCSI
CIRCUIT BOARDS & CABLES

# 32:16 & PS DISK DRIVE STORAGE ASSEMBLY

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-29 | 1 | Disk Bracket | 1000380-01 | |
| F-29 | 4 | Disk Door Shugart | 1000645-03 | |
| F-29 | 6 | Floppy Disk Drive | 2000058-02 | W/OutShLD |
| F-29 | 7 | 20M Hard Disk | 2001980-01 | |
| F-29 | 7 | 30M Hard Disk | 2001980-02 | |
| F-29 | 11 | Insulator | 1001806-01 | STS Only |
| F-29 | 12 | Hard Disk Shield Ext. | 1001172-01 | |
| F-29 | 13 | Screw | 1000303-07 | |
| F-29 | 14 | Screw | 1001107-01 | |
| F-29 | 15 | Lock Washer | 1000667-02 | HTS Only |
| F-29 | 16 | Screw | 1000303-02 | |
| F-29 | 17 | Pad, HD Shield | 1000454-03 | |
| F-29 | 18 | Shield | 1000448-03 | |
| F-29 | 19 | Screw | 1001283-03 | |
| F-29 | 20 | I/O Plate Insulating Washer | 1000601-04 | |
| F-29 | 21 | Floppy Disk Shield | 1000448-01 | |

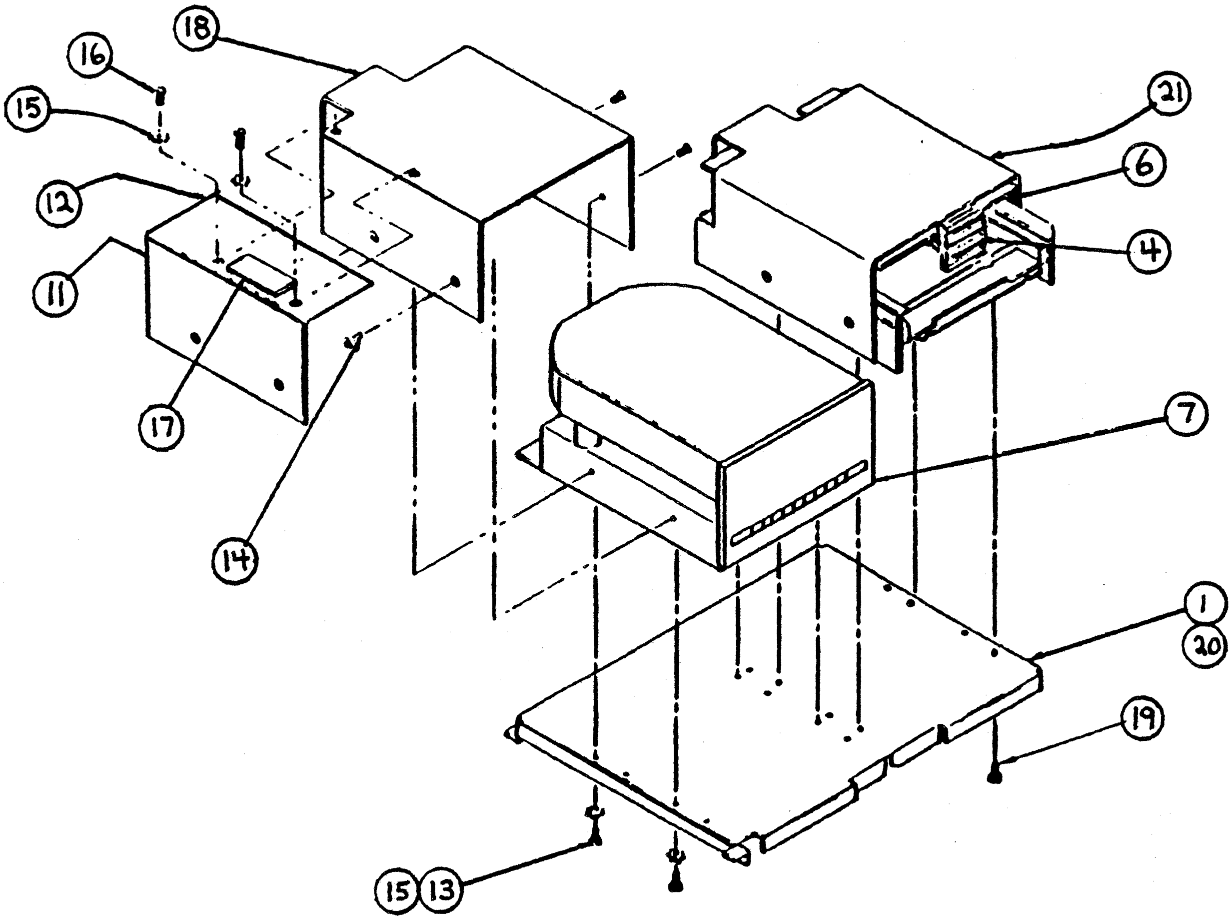



Figure F-29

32:16/PS DISK DRIVE ASSEMBLY

## XP DISK DRIVE STORAGE ASSEMBLY

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-30 | 4 | XP20 Drive | 2001980-01 | |
| F-30 | 4 | XP30 Drive | 2001980-02 | |
| F-30 | 4 | XP45 Drive | 2003241-01 | |
| F-30 | 6 | Floppy Disk Drive | 2000058-02 | No Shield |
| F-30 | 6 | 1/2 High Floppy Drive | 2003213-01 | |
| F-30 | 7 | Disk Drive Mounting Chassis | 1001745-01 | |
| F-30 | 8 | Screw | 1001283-01 | |
| F-30 | 9 | Insulator | 1001806-01 | STS Only |
| F-30 | 10 | I/O Plate Insulating Washer | 1000601-04 | |
| F-30 | 11 | Cover, Disk Drives | 1001748-01 | |
| F-30 | 23 | Screw, Cover | 1001283-01 | 4 Places |
| F-30 | NS | Rubber Pad, Top Cover | 1000454-01 | STS Only |
| F-30 | NS | DC Cable Extender for 45 Meg Drive | 1003280-01 | HST Only |

XP DISK DRIVE STORAGE ASSEMBLY

HTS & STS

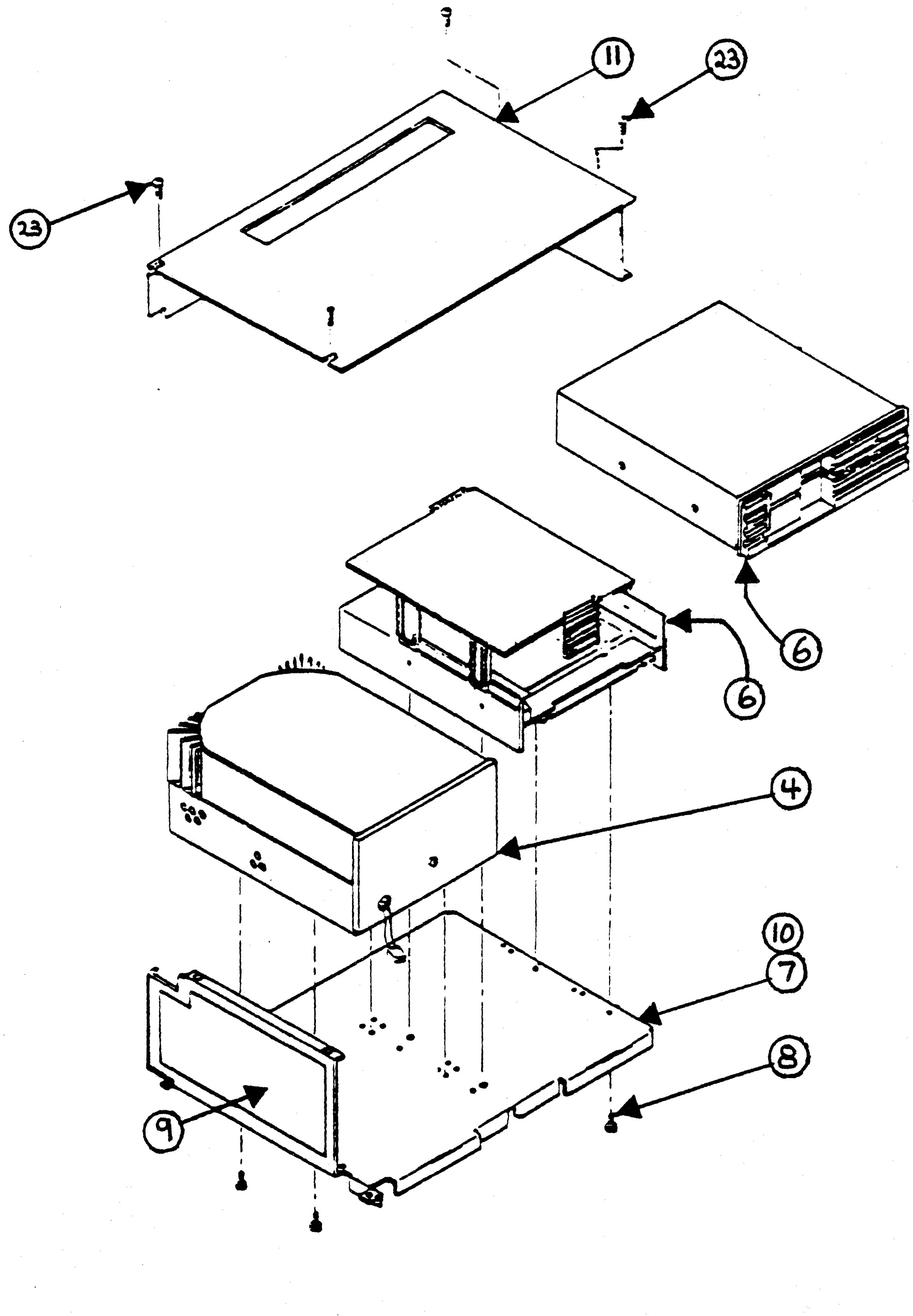


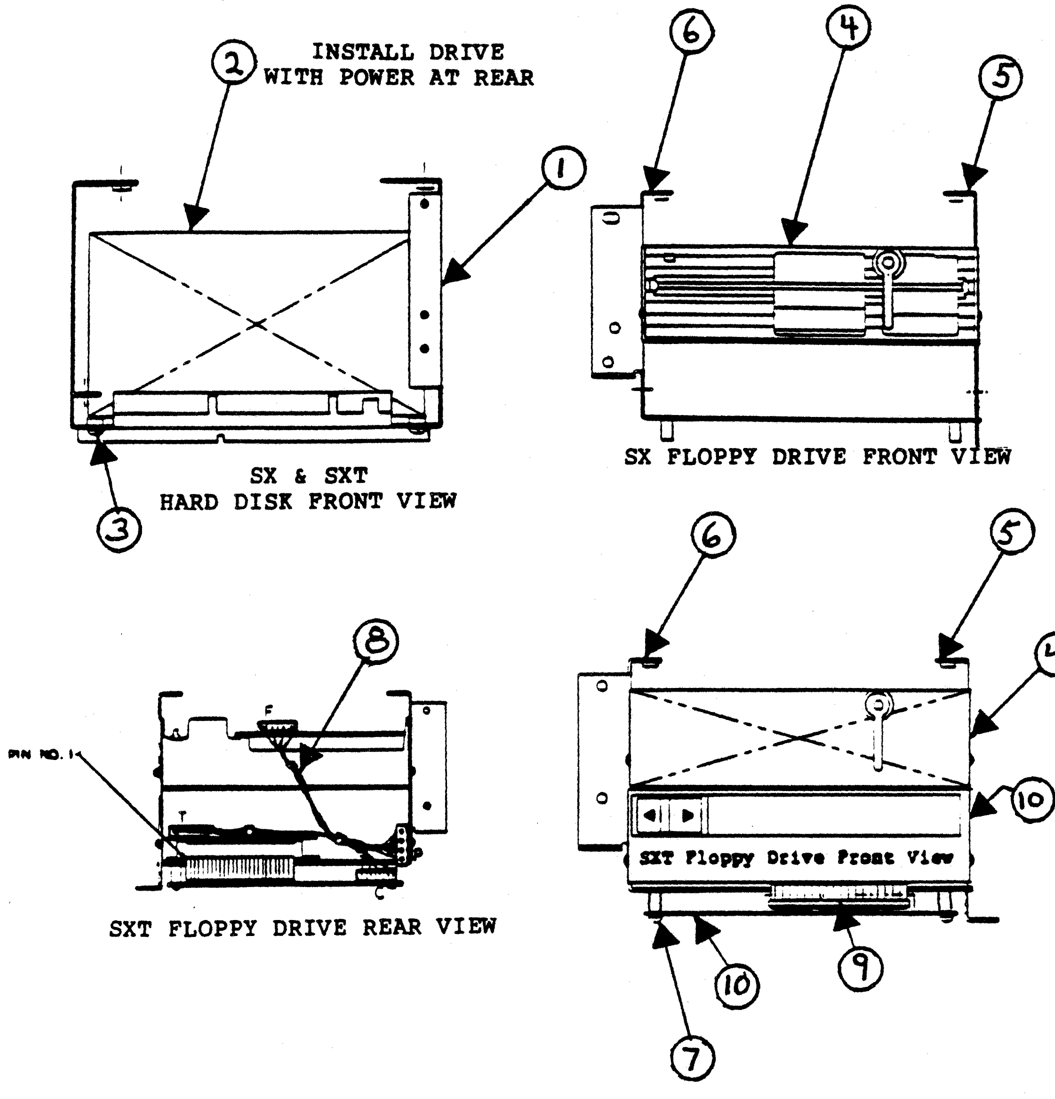

Figure F-30

XP DISK DRIVE ASSEMBLY

## SX & SXT

## DISK DRIVE ASSEMBLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-31 | 1 | Hard Disk Bracket | 1003321-01 | |
| F-31 | 2 | Hard Disk | 2003241-02 | 45 MEG |
| F-31 | 2 | Hard Disk | 2003241-03 | 70 MEG |
| F-31 | 2 | Hard Disk | 2008234-02 | 145 MEG |
| F-31 | 3 | Screw:6-32x3/8" | 1001283-03 | |
| F-31 | 4 | Floppy Disk:1/2HT | 2003213-01 | |
| F-31 | 5 | Brkt:Suppt:Right | 1003323-01 | |
| F-31 | 6 | Brkt:Suppt:Left | 1003322-01 | |
| F-31 | 7 | Screws:6-32x1/2" | 1001283-05 | |
| F-31 | 8 | Cable Assembly | 1003387-01 | |
| F-31 | 9 | Tape Ribbon Cable | 1003701-01 | Cable between Formatter bd. and Tape Dr. |
| F-31 | 10 | Tape Drive Assembly | 2003626-01 | Both Tape Dr. and Formatter board are one unit. |




**-NOTE 1-**
To install or remove SXT Front Panel, slide the Tape lever all the way to the left.

**-NOTE 2-**
To install a new Floppy drive into the SXT, first remove the lock lever, then remove the Front Panel from the new Floppy drive.

Figure F-31

SX & SX SCSI
DISK DRIVE ASSEMBLY

## FRONT PANEL

## HTS & STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-32 | -- | Front Panel Assembly | 1000151-01 | 32:16 Sys STS |
| F-32 | -- | Front Panel Assembly | 1000151-02 | XP System STS |
| F-32 | -- | Front Panel Assembly | 1001078-01 | XP System HTS |
| F-32 | -- | Front Panel Assembly | 1000151-03 | PS System STS |
| F-32 | -- | Front Panel Assembly | 1003248-01 | Half High Flp System HTS |
| F-32 | 1 | Front Panel | 1000152-01 | 32:16 Sys STS |
| F-32 | 1 | Front Panel | 1000152-05 | XP System STS |
| F-32 | 1 | Front Panel | 1000152-06 | PS System STS |
| F-32 | 1 | Front Panel | 1001082-01 | XP System HTS |
| F-32 | 1 | Front Panel | 1003208-01 | Half High Flp Sys HTS |
| F-32 | 2 | LED Harness | 1000205-01 | 2 Places |
| F-32 | 11 | Ersatz Door | 1000161-03 | |
| F-32 | NS | Insert Fortune 32:16 | 1001238-01 | HTS Only |
| F-32 | NS | Insert Fortune 32:16 PS | 1001238-04 | HTS Only |
| F-32 | NS | Insert Fortune XP | 1001238-06 | HTS Only |
| F-32 | NS | Insert Fortune | 1001238-05 | HTS Only |
| F-32 | NS | Insert Fortune Systems | 1001238-08 | HTS Only |

FRONT PANEL

HTS & STS

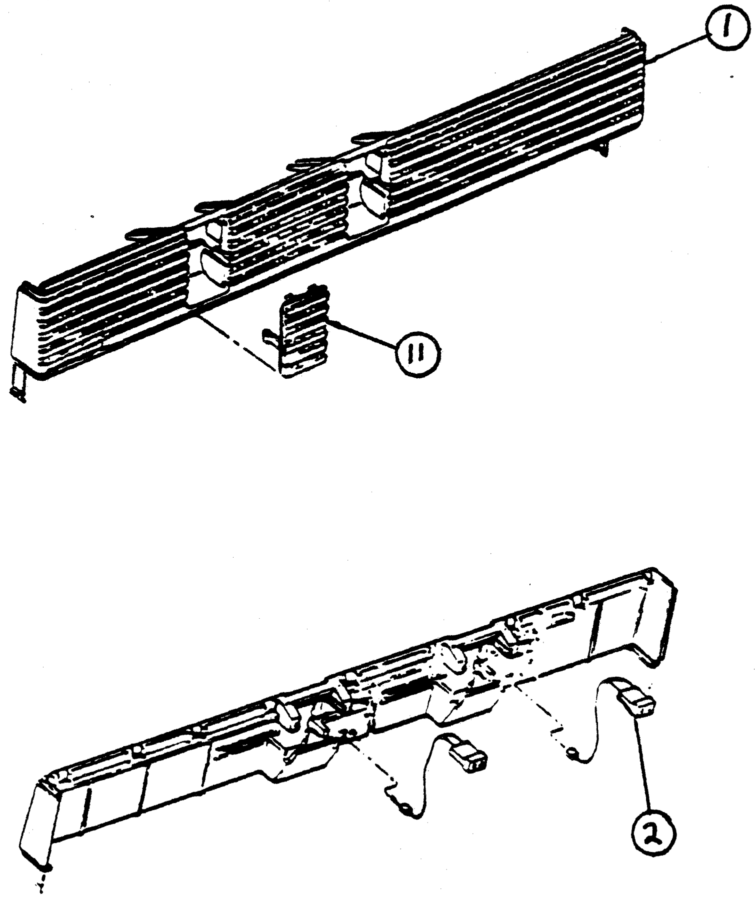


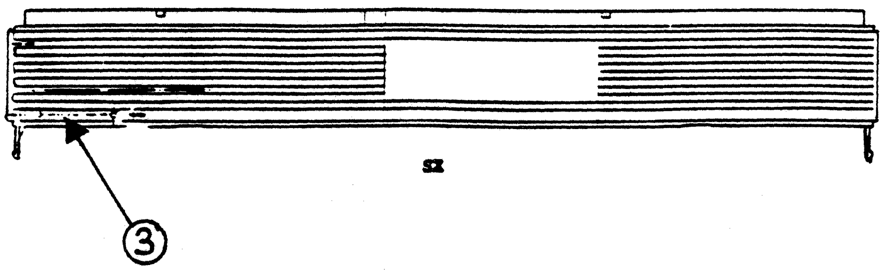

Figure F-32

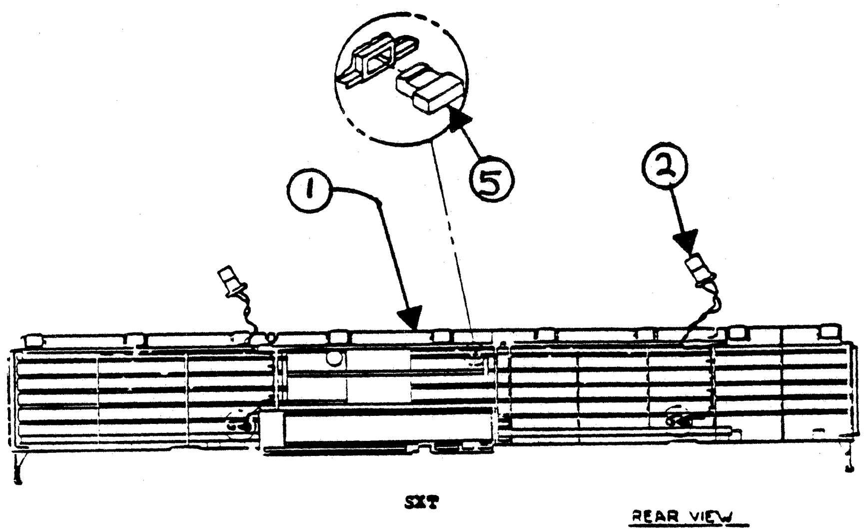
FRONT PANEL

## SX & SXT

## FRONT PANEL

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-33 | -- | Front Panel Assembly | 1003248-01 | SX |
| F-33 | -- | Front Panel Assembly | 1003332-01 | SXT |
| F-33 | 1 | Front Panel | 1003208-01 | SX |
| F-33 | 1 | Front Panel | 1003369-01 | SXT |
| F-33 | 2 | LED Harness | 1000205-01 | |
| F-33 | 3 | Insert Fortune 32:16SX | 1001238-12 | |
| F-33 | 5 | Light Pipe | 1003377-01 | SXT |




**-NOTE 1-**
To install or remove SXT Front Panel, slide the Tape lever all the way to the left.

**-NOTE 2-**
To install a new Floppy drive into the SXT, first remove the lock lever, then remove the Front Panel from the new Floppy drive.

Figure F-33

SX & SX SCSI
FRONT PANEL

## REAR PANEL

## STS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-34 | -- | Assy, Rear Panel | 1000150-01 | |
| F-34 | 1 | Fan 115 VAC | 2000054-01 | |
| F-34 | 1 | Fan 230 VAC | 2000054-02 | |
| F-34 | 2 | Screw | 1000118-05 | 4 Places |
| F-34 | 3 | Spacer | 1000146-03 | 4 Places |
| F-34 | 4 | Rear Panel | 1000145-01 | |
| F-34 | 5 | Washer | 1000138-01 | 4 Places |
| F-34 | 6 | Block, Card Guide | 1001160-01 | |
| F-34 | 7 | Lug, Ground | 1000660-01 | |

REAR PANEL

STS

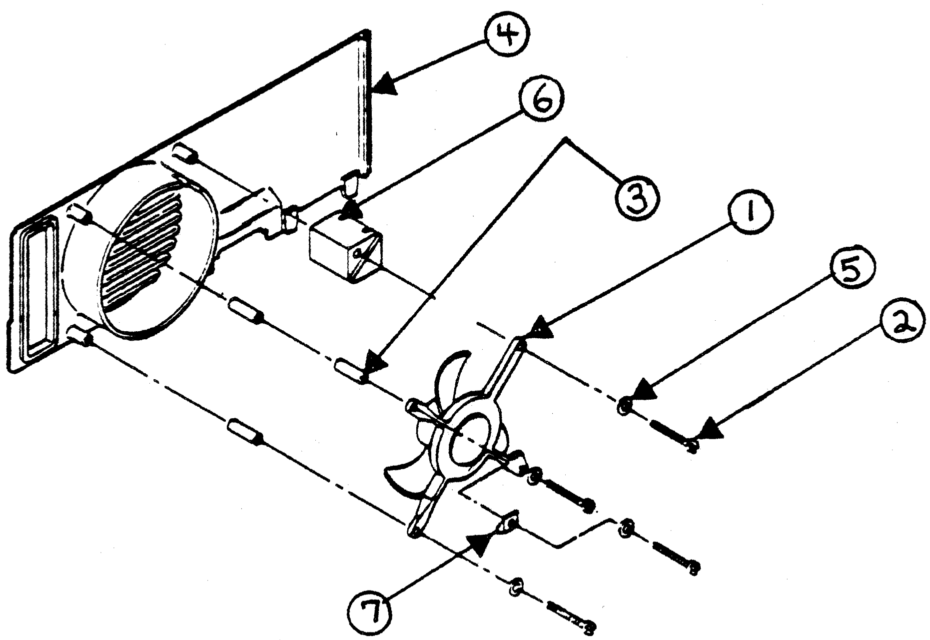



Figure F-34

REAR PANEL (STS)

## REAR PANEL

## HTS

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-35 | -- | Assy, Rear Panel | 1001077-01 | |
| F-35 | 1 | Fan, 115 VAC | 2000054-01 | |
| F-35 | 1 | Fan, 230 VAC | 2000054-02 | |
| F-35 | 2 | Screw | 1000118-01 | |
| F-35 | 3 | Panel, Rear | 1001081-01 | |
| F-35 | 4 | Washer | 1000326-01 | |
| F-35 | 5 | Lug, Ground | 1000660-01 | |
| F-35 | 6 | Clip | 1000325-01 | |

**REAR PANEL**

**HTS**

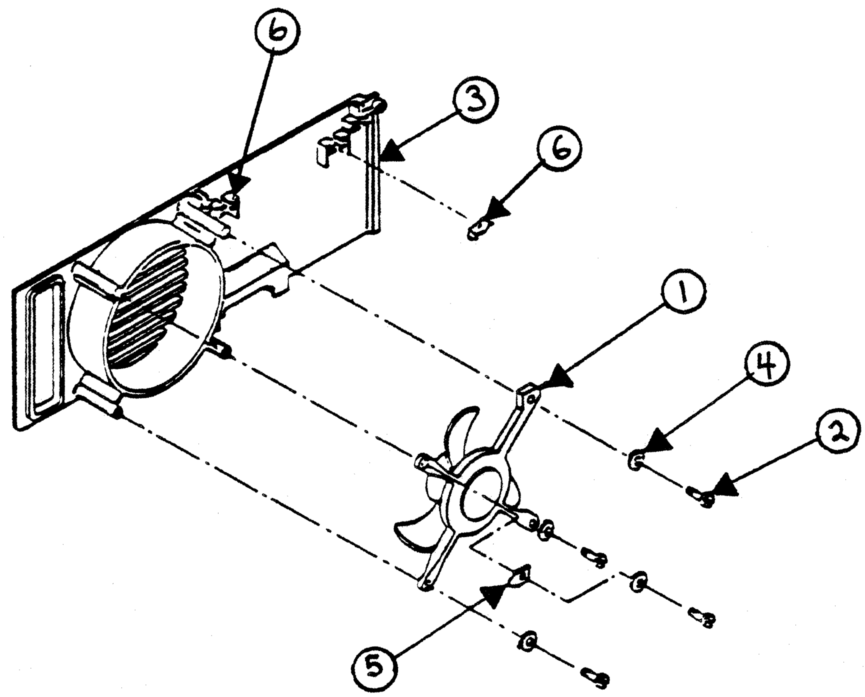



Figure F-35

REAR PANEL (HTS)

## SX & SXT

## REAR PANEL

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-36 | -- | Rear Panel Assy | 1001077-05 | 115V |
| F-36 | -- | Rear Panel Assy | 1001077-06 | 230V |
| F-36 | 5 | Ground Lug | 1000660-01 | |
| F-36 | 6 | Clip | 1000325-01 | 4 Places |
| F-36 | 9 | Quiet Fan | 2000054-03 | 115V |
| F-36 | 9 | Quiet Fan | 2000054-04 | 230V |
| F-36 | 10 | Rear Panel | 1003315-01 | |
| F-36 | 11 | Screw:6-19x1.75" | 1000118-11 | Self-Tap |
| F-36 | 12 | Lock Washer | 1000667-02 | |
| F-36 | NS | Ribbon Cable Clips | 1001721-01 | |

## SX & SX SCSI

## REAR PANEL

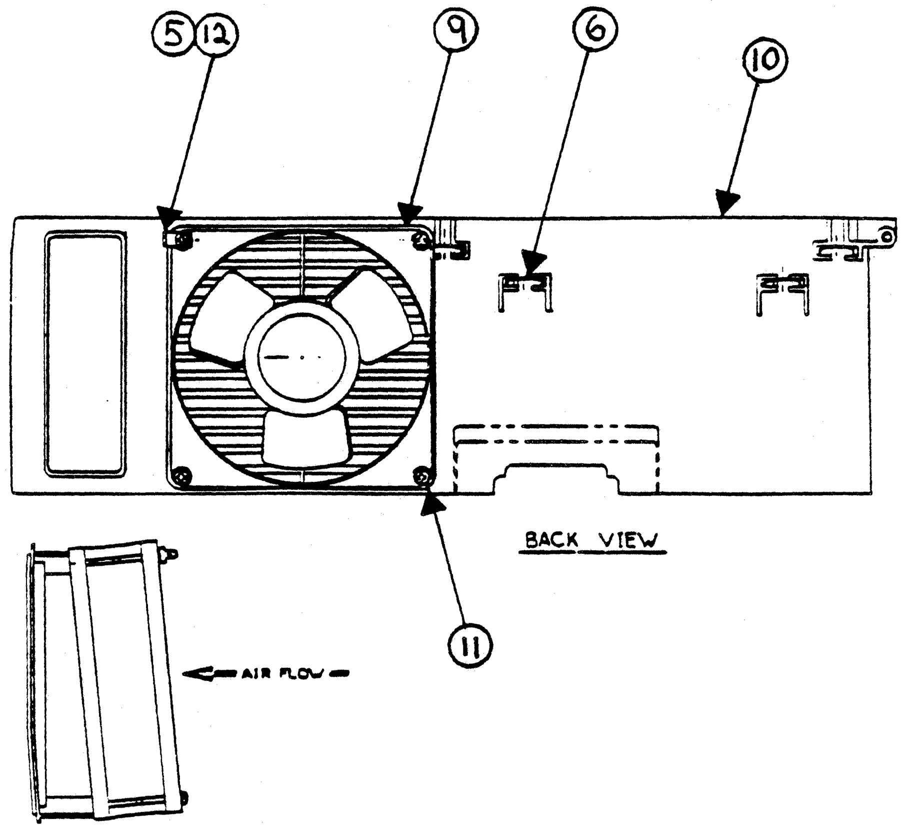



Figure F-36

SX & SX SCSI
REAR PANEL

## EXPANSION CABINET ASSEMBLY

## STS ONLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-37 | -- | Tape Only | 1003030-01 | |
| F-37 | -- | 30 Disk Only | 1003035-01 | |
| F-37 | -- | 45 Disk Only | 1003285-01 | |
| F-37 | -- | 30 Tape & Disk | 1003034-01 | |
| F-37 | -- | 45 Tape & Disk | 1003284-01 | |
| F-37 | 1 | Tape Cartridge Drive | 2001755-01 | |
| F-37 | 1A | Upper PWA | None | Part of Index 1 |
| F-37 | 1B | Lower PWA | None | Part of Index 1 |
| F-37 | 2 | 30Meg Hard Drive | 1001980-02 | |
| F-37 | 2 | 45Meg Hard Drive | 1003241-01 | |
| F-37 | 3 | Bracket | 1001744-02 | |
| F-37 | 4 | Power Supply 115V | 2001791-01 | Exp.Cab Only |
| F-37 | 4 | Power Supply 230V | 2001791-02 | Exp.Cab Only |
| F-37 | 5 | Hard Drive I/O Panel | 1001717-01 | |
| F-37 | 6 | Rear Panel Assy. | 1000150-03 | |
| F-37 | 7 | Front Panel Assy. | 1001770-01 | Exp.Cab Only |
| F-37 | 9 | Bracket/Support | 1001792-01 | For PWA Bds. |
| F-37 | 10 | I/O Panels | 1000165-01 | |
| F-37 | 13 | Screw 6-32 x 1/4 | 1001283-01 | |
| F-37 | 15 | Screw 8-32 x 5/16 | 1001284-02 | For Power Supp. |
| F-37 | 16 | Tape Drive I/O Panel | 1001769-01 | |
| F-37 | 27 | Base Plate Assy. | 1001853-01 | |
| F-37 | NS | Capacitor Assy, HD | 1001612-01 | 45Meg Only |
| F-37 | NS | Clamp, Cap.Assy, HD | 1001614-01 | 45Meg Only |
| F-37 | NS | Jumper, P/S Strapping | 1001787-06 | |
| F-37 | NS | Tape Cleaning Kit | 1003138-01 | |

## EXPANSION CABINET ASSEMBLY

## STS ONLY

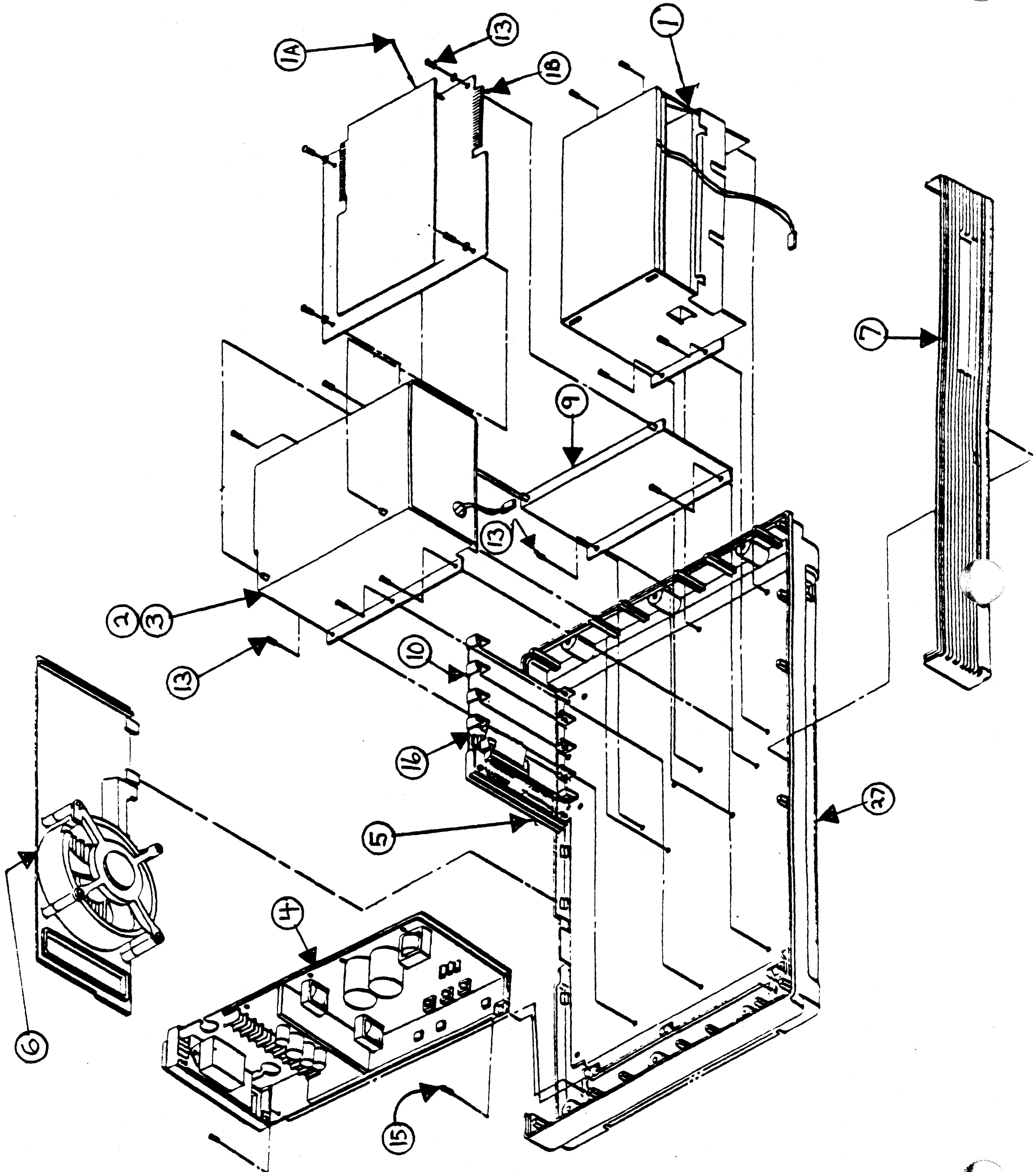



Figure F-37

EXPANSION CABINET

## CABLE CONFIGURATION EXPANSION CABINET

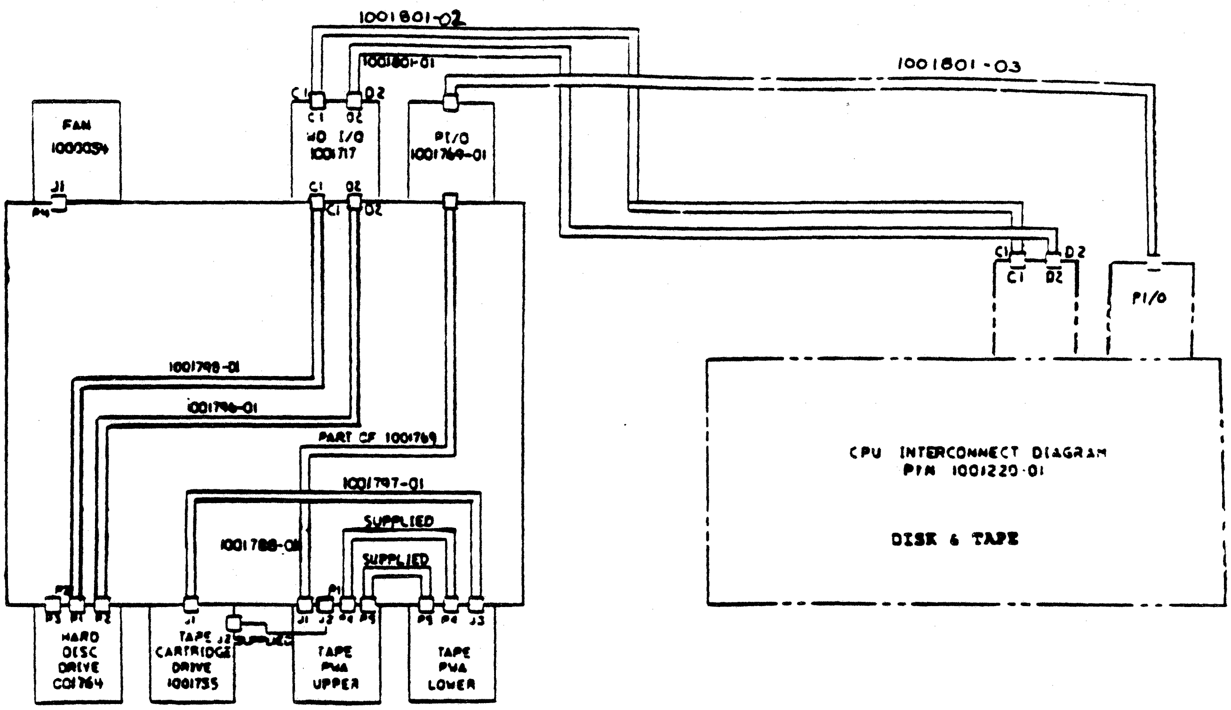
External Cables

| Figure | Cable Name | Part Number |
|---|---|---|
| F-38 | Tape Cartridge Drive I/O, 5Ø Pin | 1ØØ18Ø1-Ø3 |
| F-38 | Hard Disk Control I/O, 4Ø Pin | 1ØØ18Ø1-Ø2 |
| f-38 | Hard Disk Data I/O, 2Ø Pin | 1ØØ18Ø1-Ø1 |

**Internal Cables**

| Figure | Cable Name | Part Number |
|---|---|---|
| F-38 | Tape Cartridge Drive Interface | 1ØØ1769-Ø1 |
| F-38 | Cable Only for Above | 1ØØ1795-Ø1 |
| F-38 | Hard Disk Data Interface, 2Ø Pin | 1ØØ1796-Ø1 |
| F-38 | Hard Disk Control Interface, 34 Pin | 1ØØ1798-Ø1 |
| F-38 | Tape Cartridge Servo/Electronics | 1ØØ1797-Ø1 |
| F-38 | Control, Daisy Chain | 1ØØ1992-Ø1 |
| F-38 | Data, 2nd Drive | 1ØØ1991-Ø1 |

# CABLE CONFIGURATION EXPANSION CABINET



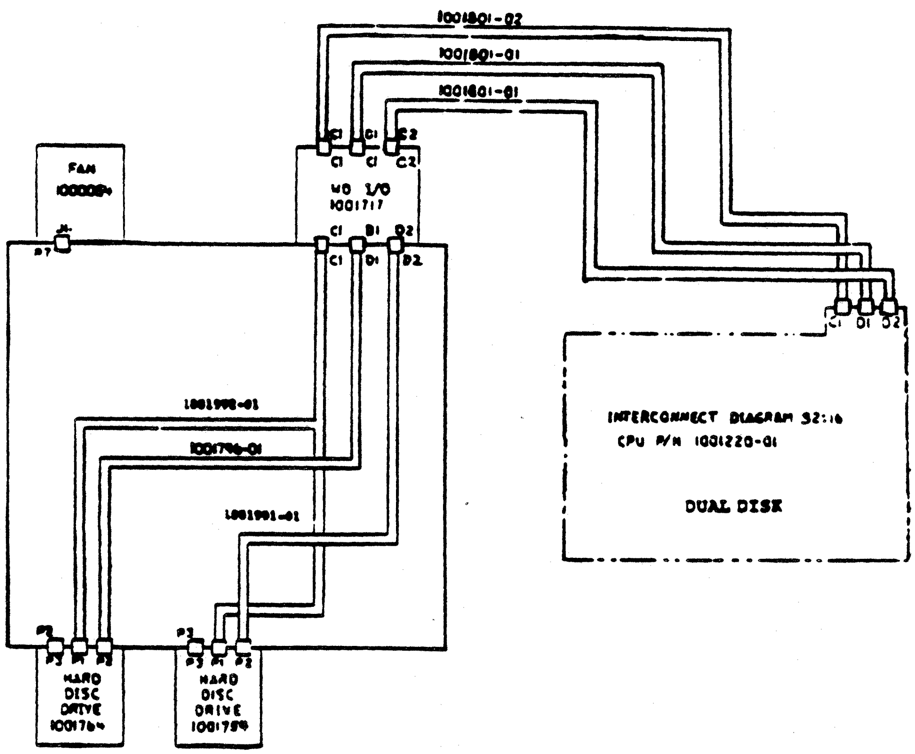




Figure F-38

EXPANSION CABINET CABLES

## 60 MEG TAPE EXPANSION CABINET ASSEMBLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-39 | -- | Tape Only (No Drives) | 1008152-01 | 115V |
| F-39 | -- | Tape Only (No Drives) | 1008152-02 | 230V |
| F-39 | 1 | Base Plate Assy. | 1008154-01 | |
| F-39 | 2 | Tape Drive: 9-TRK | 1003311-01 | |
| F-39 | 3 | Rear Panel Assy | 2001077-05 | 115V |
| F-39 | 3 | Rear Panel Assy | 2001077-06 | 230V |
| F-39 | 4 | Power Supply 115V | 2008189-01 | Exp. Cab. Only |
| F-39 | 4 | Power Supply 115V | 2008189-02 | Exp. Cab. Only |
| F-39 | 5 | Quiet Pan | 2000054-03 | |
| F-39 | 5 | Quiet Pan | 2000054-04 | |
| F-39 | 6 | Blank Plate Assy. | 1000165-10 | |
| F-39 | 7 | Blank Plate Assy. | 10001675-01 | |
| F-39 | 8 | Tape Drive I/O | 1001769-01 | |
| F-39 | 9 | Hold Down Screw | 1001227-01 | |
| F-39 | 10 | Screw 8-32x5.16 | 1001284-02 | |
| F-39 | 11 | Screw 6-32x3/8 | 1001283-03 | |
| F-39 | 12 | Shld:Flpy/Tape/Hd:3inl | 1003324-01 | |
| F-39 | 13 | Scr:Captive:6x32x3.10 | 1003326-01 | |
| F-39 | 14 | Front Panel:Tape Exp. | 1003248-01 | |

2003626-01 $2995.00

$2036.60

# 60 MEG TAPE EXPANSION CABINET ASSEMBLY

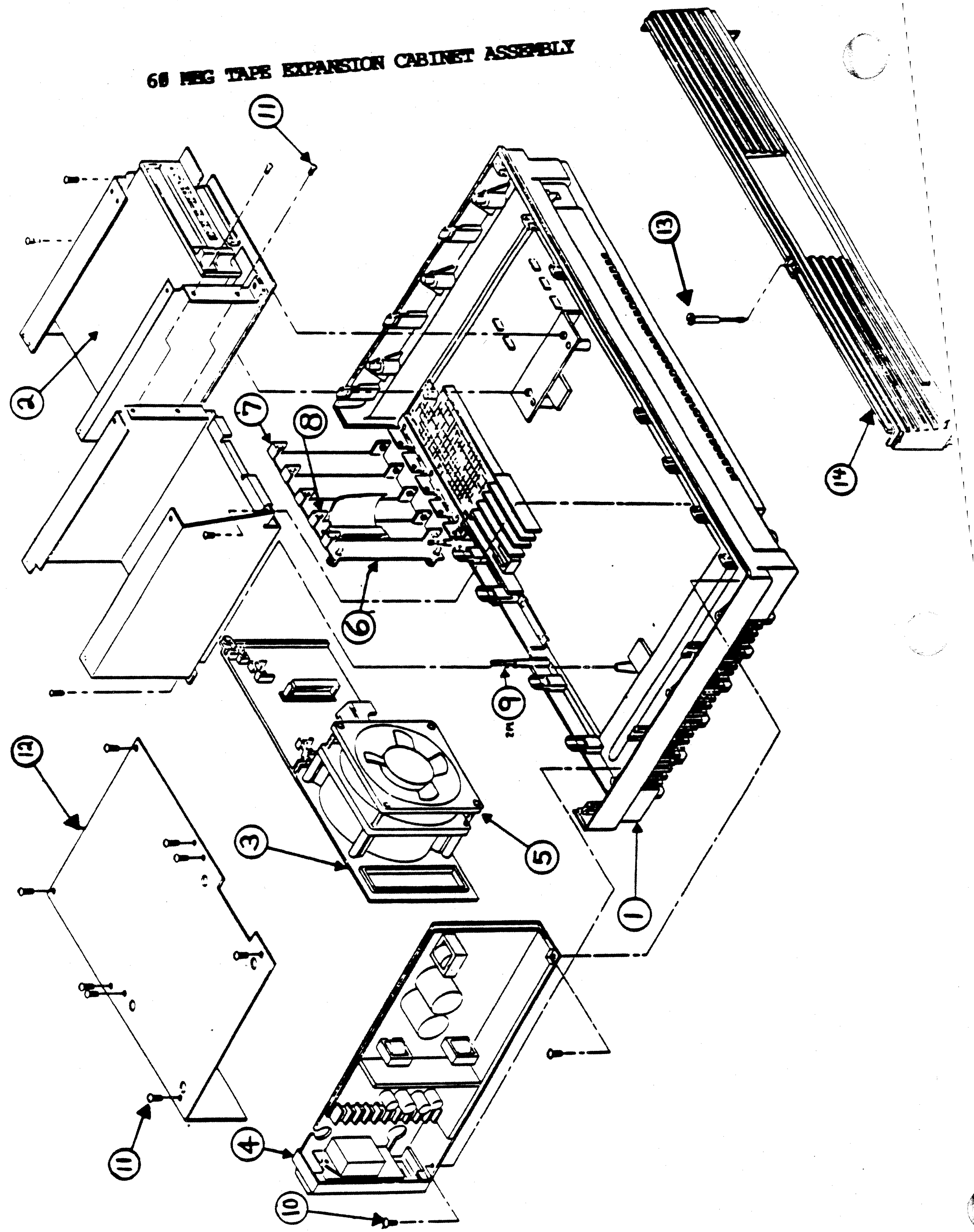



Figure F-39

60 MEG TAPE EXPANSION CABINET ASSEMBLY

## 60 MEG TAPE/BRACKET ASSEMBLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-40 | 1 | Base Plate Assy. | 1008159-01 | |
| F-40 | 2 | Tape Drive Mech. | 1003643-01 | |
| F-40 | 3 | Cable Assy. | 1003701-01 | |
| F-40 | 4 | Chass. Side Plate | 1008158-01 | |
| F-40 | 5 | Scr:Sems:6-32x3/8 | 1001283-03 | |
| F-40 | 6 | PWA:Tape Formatter | 1003644-01 | |

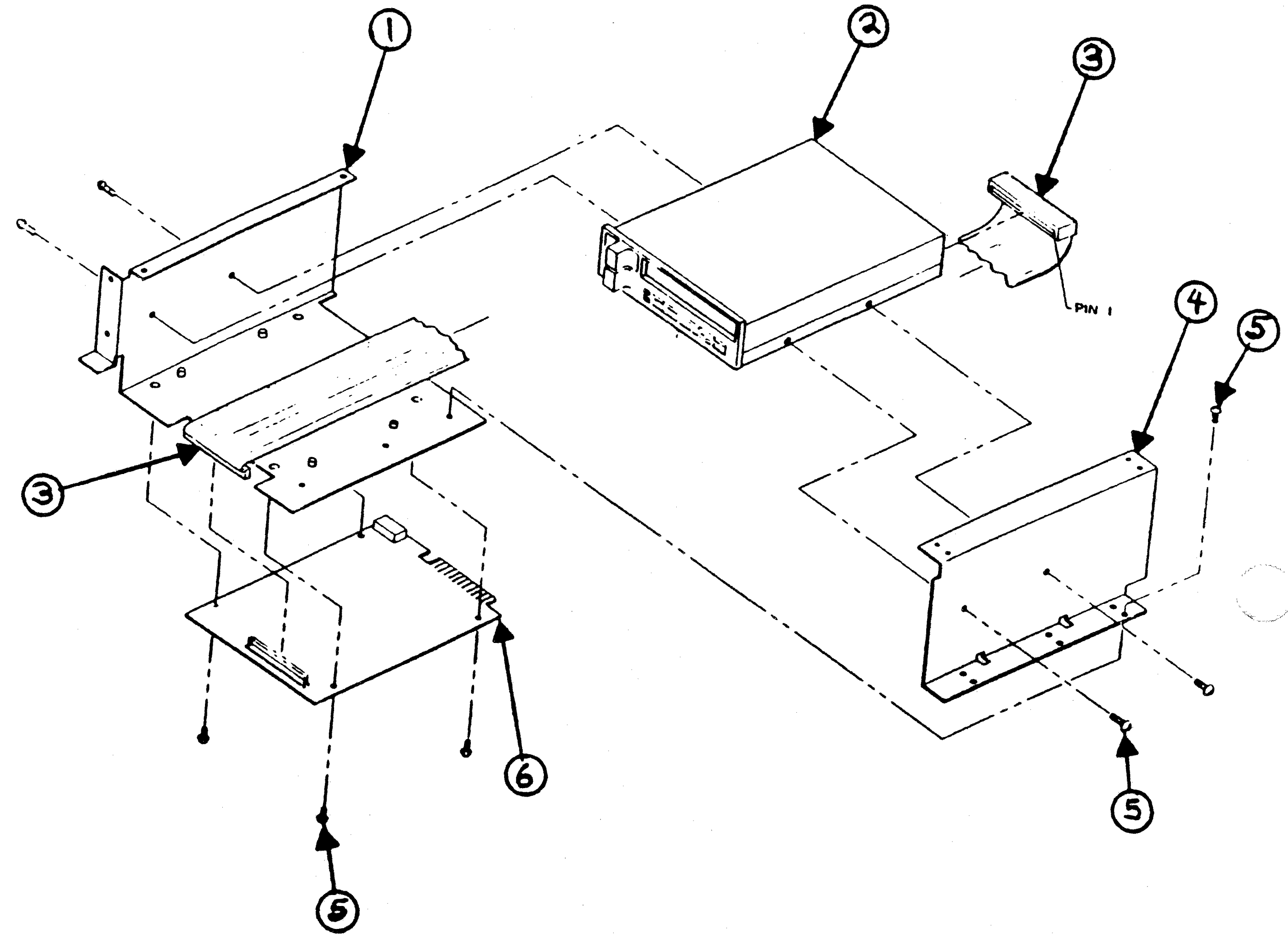



Figure F-4Ø

6Ø MEG TAPE/BRACKET ASSEMBLY

## DRIVE EXPANSION CABINET ASSEMBLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-41 | -- | Drive Only (No Tape) | 1008162-01 | 115V |
| F-41 | -- | Drive Only (No Tape) | 1008162-02 | 230V |
| F-41 | 1 | 30 MB Hard Disk | 1003241-03 | |
| F-41 | 2 | HD Chass/Shld Assy. | 1003327-03 | |
| F-41 | 3 | Resistor Assy. | 1003717-01 | |
| F-41 | 4 | WD I/O Panel Assy. | 1001717-01 | |
| F-41 | 5 | Scr:Plastite:4-20x1/4 | 1000640-02 | |
| F-41 | 6 | Scr:Captive:6-32x3.10 | 1003326-01 | |
| F-41 | 7 | Plug:Tape Drive Slot | 1008160-01 | |
| F-41 | 8 | Front Panel:Drive Exp. | 1008161-01 | |

## DRIVE EXPANSION CABINET ASSEMBLY

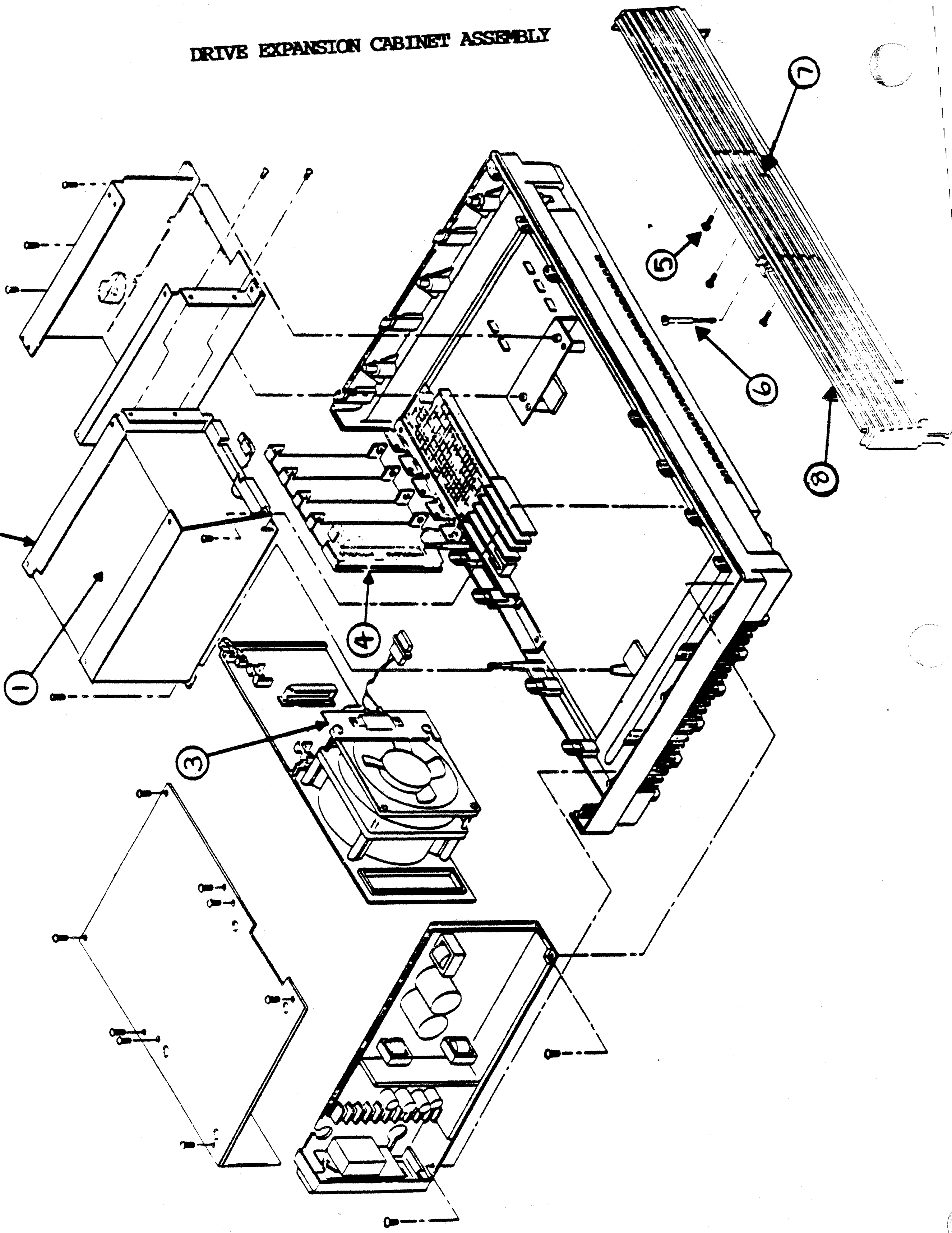



Figure F-41

DRIVE EXPANSION CABINET ASSEMBLY

## SCSI EXPANSION CABINET ASSEMBLY

| Figure | Index | Part Name | Part Number | Comments |
|---|---|---|---|---|
| F-42 | -- | 70MB Exp. Cab. Assy. | 1008246-01 | 115V |
| F-42 | -- | 70MB Exp. Cab. Assy. | 1008246-02 | 230V |
| F-42 | -- | 145MB Exp. Cab. Assy. | 1008246-13 | 115V |
| F-42 | -- | 145MB Exp. Cab. Assy. | 1008246-14 | 230V |
| F-42 | NS | Top Cover | 1001080-01 | HTS |
| F-42 | 1 | Base Assy. | 1008154-01 | |
| F-42 | 3 | Rear Panel | 1001077-05 | 115V |
| F-42 | 3 | Rear Panel | 1001077-06 | 230V |
| F-42 | 4 | Power Supply | 1008189-01 | 115V |
| F-42 | 4 | Power Supply | 1008189-02 | 230V |
| F-42 | 5 | Front Panel | 1008161-01 | |
| F-42 | 6 | Plug:Tape Slot | 1008160-01 | |
| F-42 | 7 | I/O Panels | 1000165-01 | |
| F-42 | 8 | Side Plate:TP Drive | 1008158-01 | |
| F-42 | 9 | Base Plate:TP Drive | 1008159-01 | |
| F-42 | 10 | Shield Assy. | 1008173-04 | |
| F-42 | 12 | Brkt. Shld:TP/HD Drive | 1003324-02 | |
| F-42 | 15 | Cable:SCSI/ESCSI | 1008326-01 | |
| F-42 | 16 | Resistor Assembly | 1003717-01 | |
| F-42 | 17 | Cable Retainer | 1001098-01 | |
| F-42 | 19 | Scr:Plast:4-20x1/4" | 1000640-02 | |
| F-42 | 20 | Scr:Sems:8-32x5/16" | 1001284-02 | |
| F-42 | 21 | Scr:Hold Down | 1001227-01 | |
| F-42 | 22 | Scr:Sems:6-32x3/8" | 1001283-03 | |
| F-42 | 23 | Scr:Cap:6-32x3.10" | 1003326-01 | |

## SCSI EXPANSION CABINET ASSEMBLY

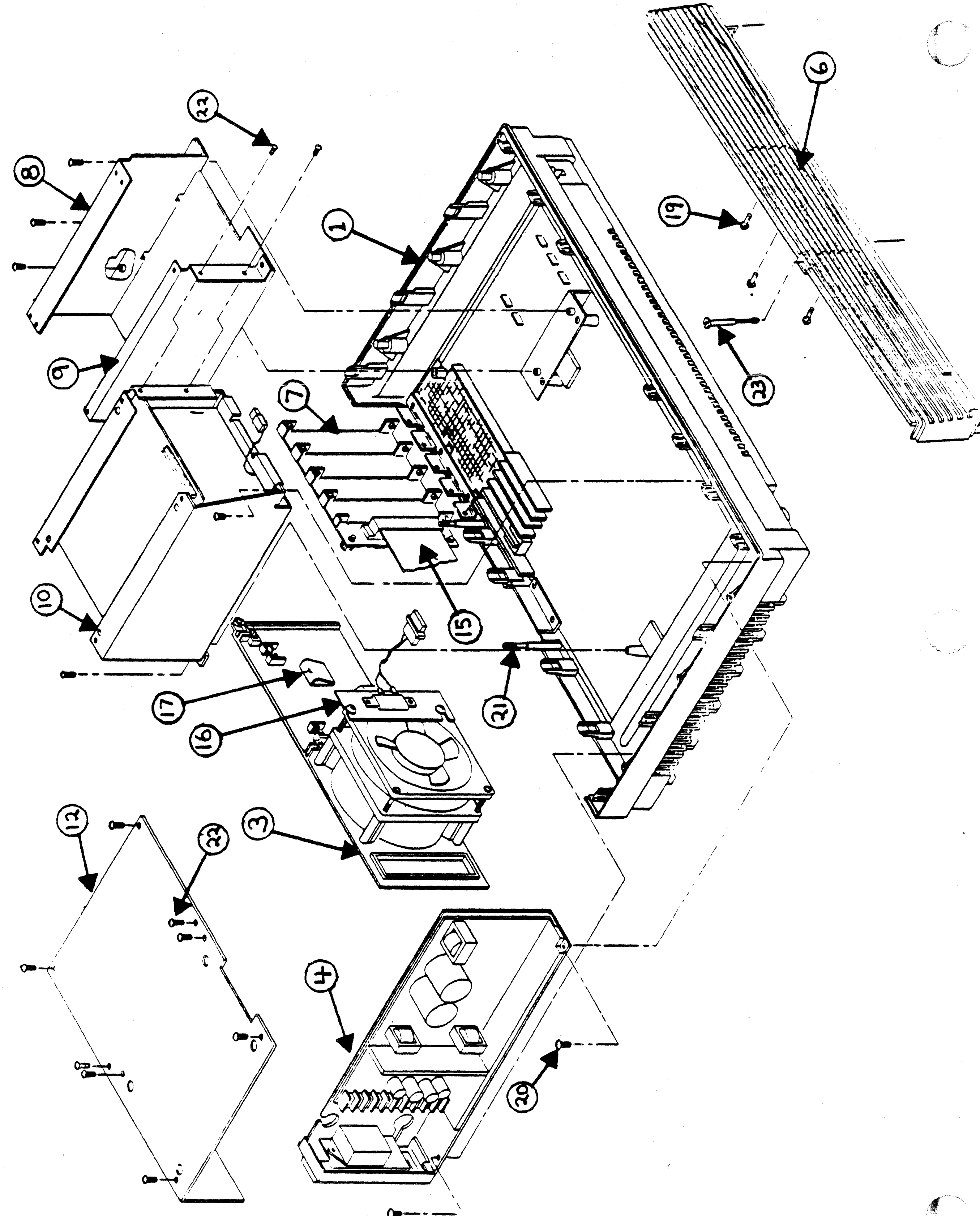



Figure F-42

SCSI EXPANSION CABINET ASSEMBLY

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# APPENDIX A

# HARDWARE REFERENCE GUIDE

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

# S Y S T E M S

**SUPPORTED SYSTEMS:** 32:16 (5, 10, 20), PS10, PS20, XP30, XP45, SX45, SX70, SX45T, SX70T.

***********

When the system is booted up, it normally displays the digits 1 through 9. Each digit is displayed after the computer has completed a distinct task. These tasks are listed below according to the number;

| Screen Display | Meaning |
|---|---|
| 1 | No errors in initial hardware diagnostics. (Momrom prints out 1) |
| 1 2 | Boot file found on device specified in EAROM. (Momrom prints out 2) |
| 1 2 3 | Boot file loaded into memory and successfully initiated. (Boot program prints out 3) |
| 1 2 3 4 | Boot program has found kernel and that file is being loaded into memory (**/hd02/unix**). (Boot program prints out 4) |
| 1 2 3 4 5 | The kernel (the part of FOR:PRO that is always resident in main memory) has loaded and executed auto configuration. (Kernel prints out 5) |
| 1 2 3 4 5 6 | The kernel is ready to execute /etc/init program. (Kernel prints out 6) |
| 1 2 3 4 5 6 7 | The /etc/init program has started successfully. (/etc/init prints out 7) |
| 1 2 3 4 5 6 7 8 | The shell has started the /etc/rc file. (/etc/rc prints out 8) |
| 1 2 3 4 5 6 7 8 9 | Mkdevs and other device configuration programs have finished and start to execute pstat, fsck, and login programs. (/etc/rc prints out 9) |

**General Information Needed:**

When having problems with a Fortune System, it may be a good idea to know the answers to the following questions:

1) When was this problem first noticed? Was something major just changed, added or updated? If an identical problem occurred previously, how was it solved?

2) How long has the system been in use?

3) What is current operating system revision or level?

4) Is this a single-user or multi-user system?

5) Is system a "Alternate Console" system?

6) What make of power supply (zenith, western electric or digipower)?

7) What type of hard disk (C20, J20, J30, M45 OR N70)?

8) How much memory does the system have (512, 1024, 1536 OR 2048)?

9) Is the system fully loaded? (Are all slots filled?) (what is the configuration?)

```
ECC ===========         ||     ||     ||     ||     ||
PM1         =======   PE||   PD||   PC||   PB||   PA||
PM2         =======     ||     ||     ||     ||     ||
PM3         =======     ||     ||     ||     ||     ||
PM4         =======     ||     ||     ||     ||     ||
                        ||     ||     ||     ||     ||
```

10) How many users is the system configured for? How many people normally use the system? How many people are using each application at any one time?

11) Is this an intermittent problem, does it occur regularly or is it a solid failure? Can problem be reproduced?

12) What software is loaded on system?

13) Are any communications packages being used?

14) What has been done to resolve the problem?

```
 ____________________| IMPORTANT |____________________
| Before swapping any part always:                    |
|                                                     |
|           1) Reseat all boards and cables           |
|           2) Test the power supply voltages         |
|_____________________________________________________|
```

If the system hangs immediately after displaying any digit we have an indication of what problem is occurring. The following list suggests solutions for problems which may occur at each point of power up:

<u>HANGS AT</u>

| | |
|---|---|
| 1 | Booting up diagnostics, if successful run all tests. If unsuccessful modify system to run with minimum system components. |

***********

| | |
|---|---|
| 2 or 3 | Indicates the conf. block or the boot program is damaged and must be rebuilt. (refer to Appendix B)<br><br>Make sure the hard drive is spinning up to speed. Do this by listening to the whining noise coming from drive upon power-up. If no whining sound is heard drive is not spinning up. In this case the drive is the problem and must be swapped out.<br><br>May also happen if another Comm A was installed and defined but number of users wasn't increased.<br><br>If the above procedures do not allow the system to proceed past 3, run hdtest. If when loading hdtest the drive is found but cannot read configuration block then the conf. block must be rebuilt. If the drive is not found then reseat the WD controller and ribbon cables. If still unable to find the problem, start swapping or checking parts in this order:<br><br>1. WD Controller<br>2. HD Ribbon Cables<br>3. Hard Disk<br>4. Memory Boards<br>5. Power Supply<br>6. IC's at Motherboard locations 9F, 19E, 22J. |

HANGS AT

| HANGS AT | |
|---|---|
| 4 | This may mean that unix is corrupt. Boot up off Cold Boot Set vol. 1 going into the maintenance mode (refer to Appendix A). Mount the hard disk to /h and copy /unix to /h<br><br>If not fixed, run hdtest and memtest. Then try swapping in the following order:<br><br>1. Memory Boards<br>2. WD Controller<br>3. Hard Disk<br>4. Floppy Controller (9F Mother Bd.)<br>5. IC's at Motherboard locations 19E, 22J. |

***********

| | |
|---|---|
| 5 or 6 | If message "init died" or "software error 18 or 22" is displayed (refer to Appendix A). Mount the hard disk to /h and copy /etc/init to /h/etc<br><br>This may happen if the multi-user init program was previously installed on another system.<br><br>A bad memory board or any defective board in the DMA slots can cause system to hang here. Always suspect memory first.<br><br>If won't boot from floppy EAROMs may be corrupt (location D-15 on Mother board.) |

***********

| | |
|---|---|
| 7 | If message "can't find /bin/sh" is displayed, boot up off of 1st volume of cold boot set (refer to Appendix A) and copy /bin/sh to /h/bin |

7 /etc/rc and/or /bin/test may be damaged, if so than copy from 1st volume of cold boot set.

If the above doesn't fix then run diagnostics on all hardware.

***********

8 Boot up off vol 1 of Cold Boot set and get into maintenance mode. Mount the hard disk to /h and copy /etc/rc.real to /h/etc/rc. You may also want to copy /etc/init to /h/etc.

A mount or umount file may cause this problem. Recopy [u]mount to /h/etc.

***********

9 Have never seen a system hang at this point. If system does hang here suspect the rc file.

The following is a list of problems and solutions that may arise once the system is up and running.

| <u>Problem</u> | <u>Solution</u> |
|---|---|
| System silent hang. This is when a system hangs intermitently for no apparent reason. | Check to see how much memory is being recognized.<br><br>Make sure you are getting proper readings from power supply.<br><br>You may want to backup and do a cold boot after system is warm. |

***********

| | |
|---|---|
| System hangs during shutdown when Tape Streamer is attached. | Tape Streamer must be shutdown before CPU. Enter shell and type the following<br># st shutdown <cr><br># shutdown <cr><br><br>You may get this problem also if tape software is installed but no tape hardware exists. |

***********

| | |
|---|---|
| Turn on system, goes to 2 and straight into the maintenance menu. But after resetting the system a couple of times it boots up fine. | If this happens, the drive is trying to send a signal to the WD controller but is not succeeding. This could be caused by either the WD controller, ribbon cables, or the drive itself. Swap out Swap out WD controller if this doesn't fix the problem then try swapping out the ribbon cables and then the hard drive. |

***********

| | |
|---|---|
| Message "Something wrong start over". | Drive not coming ready or bad WD controller. This message may mean that there is a bad configuration block or boot program. Verify problem by running hdtest of the diagnostics. |

| Problem | Solution |
| --- | --- |
| When going into the maintenance menu, there is a message flashing at bottom of screen "EAROM MAY NOT WORK". | This problem can usually be fixed by making a change to the menu and then saving it by pressing the F9 key. At this point the flashing message should disappear. |

**********

| Problem | Solution |
| --- | --- |
| System goes through file system check successfully but loops back to date and time or just hangs. | This may mean that the /etc/devtype file is missing or corrupted. Boot up off of vol. 1 of cold boot set and get into maintenance mode (Appendix A). Now type;<br><br># cd /etc<br># mount /dev/hd02 /h<br># cd /h/m/fos1/flop3/etc<br># cp devtype /h/etc<br># /h/bin/sync; /h/bin/sync<br># cd /<br># umount /dev/hd02<br>Now reset and check for proper boot operation. |

***********

| Problem | Solution |
| --- | --- |
| System runs very slow and may even hang. | Check to make sure that ports aren't defined for an absent commA board (eg.tty06 if only 1 CommA). Also check to make sure that unused ports on the CommA are not defined as login (i.e. terminals). If so, disable the ports.<br><br>Do a vmstat to check for interrupts. |

**Problem**

**During the cold boot of 1.8 system loops endlessly between the question "Is floppy #1 replaced with #2 yet (y or N)? You have inserted the wrong volume. Please insert floppy #2.**

If sync is not found then proceed to the next step.

**Solution**

From the message:
"Is floppy #1 replaced with etc.......

type:
**single**

The system will respond with...
Going into maintenance mode.

type:
**cp /etc/rc.hd /etc/rc** <RETURN>
**ed /etc/rc.pass2** <RETURN>

The editor will respond with ...
2803 (number may differ)

type:
**11,41d** <RETURN>
**w /etc/rc.pass2.run** <RETURN>

The editor will respond with...
1994 (number may differ)

type:
**q** <RETURN>

The editor will return to the Bourne shell. At the '#' prompt, type:
**sync** <RETURN>
**sync** <RETURN>

Wait 30 seconds and reset the system (or power off and back on). After power up sequence number 9, the system will immediately display the prompt:

Is floppy #1 replaced with #2 yet (y/n)?

type:
**y** <RETURN>

The system should respond with the following message:
copying files from floppy #2 . . . .

Complete the cold boot procedure. If the same error message occurs, contact Technical Support.

# Kernel Error Messages

Error messages are presented in different formats depending on who issues the errors. Thus a kernel error is different in format from a driver error. It is intended that each error be described as it is, not as it should be.

Kernel Error Message Format

Each error is ordered by its error code number in parentheses , followed by its corresponding mnemonic. Other descriptions following the mnemonic are;

a. message string as it appears on the monitor.
b. source routine that reports this error.
c. cause of the error.
d. comments and recommended user action. If no user action is specified, reboot the system.

Kernel Error List

(1) BLKDEV
- a. blkdev
- b. bio.c
- c. Invalid block device is specified. This error happens when device number is too big.
- d. This error is usually caused by the illegal device number in devctl() call. The kernel checks the major device number and gives this message if it is too big. Check reconfiguration table and verify all information.

(2) DEVTAB
- a. devtab
- b. bio.c
- c. Invalid device table entry is specified. This error happens when buffer header pointer for this block device table is not properly initialized.
- d. This error is usually caused by the illegal device number in devctl() call. If autoconfig did not initialize the table entry for this device, this error comes out. It is possible to hang the system without error message if minor device number is wrong. User should be very careful in using devctl() routine.

(3) EIOSWAP
- a. I/O error in swap
- b. bio.c
- c. I/O error occurs during swapping
- d. Most likely a disk error, run hdtest.

(4) IOCCOM
- a. ioccom
- b. tty.c or ttynew.c
- c. In raw or cbreak mode, the count for canonical input is not zero. This error also could happen when an impossible rub character is used.
- d. Kernel has caught a bug in itself, reset system.

(5) NOFS

a. nofs
b. alloc.c
c. Device name not found in the mount table.
d. Kernel has caught a bug in itself, reset system.

(6) TTOF

a. timeout table overflow
b. clock.c
c. Too many timeouts are specified, so run callout structure.
d. Run with fewer terminals at one time.

(7) NOIMT

a. noimt
b. iget.c
c. Mount table error. No corresponding inode entry is found in the mount table.
d. Kernel has caught a bug in itself, reset.

(8) IINIT

a. iinit
b. main.c
c. Cannot read superblock during initialization.
d. Disk error - run hdtest.

(9) RDPROC

a. Run dead proc
b. slp.c
c. Trying to run a process (or dead) structure. Possibly process table becomes bad.
d. Kernel has caught a bug in itself, reset.

(10) NOPROCS

a. no processes
b. slp.c
c. Trying to create a new process, but process table is full.
d. Kernel has caught a bug in itself, reset.

(12) NOSWAP2

a. Out of swap2 or out of swap3
b. trap.c
c. No more swap space. Swap2 comes from xswap and swap3 from xalloc.
d. Not enough disk space is allocated for swap area. Run with fewer users or fewer background processes, or re-cold boot with more swap space.

(13) ETRAP

a. At PC 0x________ trap
b. trap.c
c. Unexpected trap received.
d. The system detected an interrupt which should not have occurred. It could be caused by electrical interference or by hardware malfunction or kernel bug.

(14) KBAERR

a. AT PC 0x________ Kernel bus/addr error
b. trap.c
c. Bus or address error occurred within the kernel.
d. This is most likely a software problem. Please carefully record what was happening at the time the problem occurred. Kernel may have caught a bug in itself, reset.

(16) DBLPARY

a. At PC 0x________ double parity
b. trap.c
c. A memory parity error was detected while processing a parity error. This means that some portion of memory has gone bad.
d. Try powering the system off and then back on again. This may make the problem go away. If not, it is possible that the power-on memory diagnostics will find the problem and allow you to operate with a reduced amount of memory.

(17) REFTIMO

a. At PC 0x________ Refresh time out
b. trap.c
c. Refresh time out (RTO) error indicates a problem with the memory refresh circuitry. The system may not have been well serviced.
d. Power on and off.

(18) INITNX

a. Can't exec init
b. sysl.c
c. This indicates a problem when the kernel is trying to start up /etc/init at power-up time. The most likely cause is that /etc/init program is gone bad or that a multi-user version of /etc/init is incorrectly installed.
d. Boot from cold boot floppy #1 and copy init file from the floppy to the /etc/directory in the hard disk. Then reboot from the disk.

(19) MFREE
- a. map table overflow
- b. malloc.c
- c. Memory map has overrun during mfree.
- d. Run with fewer processes.

(20) ZWCHAN
- a. zero wchan
- b. slp.c
- c. A process is sleeping for nothing.
- d. Kernel has caught a bug in itself, reset.

(22) INITD
- a. init died
- b. sysl.c
- c. Init died after being executed from icode.
- d. same as (18).

(24) IALLOC
- a. ialloc
- b. alloc.c
- c. File system data structure (filsys) error detected while allocating inodes.
- d. Kernel has caught a bug in itself.

(25) TIMNOTING
- a. deltimeout not in queue
- b. clock.c
- c. Timeout structure not found in the queue while deleting.
- d. Kernel has caught a bug in itself (driver).

(26) BADSCPAL
- a. failure in machine ID PAL
- b. (omitted on purpose)
- c. Bad checksum in security pal.
- d. Protected software is installed on the wrong machine or PAL is bad.

(120) PARITY
- a. parity
- b. trap.c
- c. A memory parity error was detected.
- d. same as (16).

(128) ODDERR
- a. odd error
- b. bio.c
- c. Odd address, odd count or wraparound count error detected in raw mode I/O (physio).
- d. To recover, try powering off and rebooting.

(129) ENFLE

a. no file
b. fio.c
c. File table full while allocating a user file descriptor and temporarily no more opens can be accepted.
d. Too many I/O-intensive programs are running at one time.

(130) INTOF

a. Inode table O/F
b. iget.c
c. Inode table in the kernel is full.
d. Too many I/O-intensive programs are running at one time.

(131) BADIADD

a. iaddr > 2^24
b. iget.c
c. Disk addresses of plain files and directories are kept in the array (di_addr) packed into 3 bytes each. Non-zero in the 4th byte error is detected while updating inode structure on a disk block.
d. Disk may be corrupted, try rebooting without doing an "orderly shutdown" by waiting 45 seconds and then powering off and back on.

(132) NEGQF

a. neg queue flush
b. prim.c
c. Clist counter becomes negative while flushing.
d. Kernel has caught a bug in itself.

(133) ESTUFF

a. STUFF
b. sig.c
c. Error detected in writing user instruction area. The requester must be an exclusive user on the file to write on.
d. Make sure the parameters in ptrace() call are correct and also check if the text is not shared among users.

(134) USRACC

a. usracc 0x________
b. sig.c
c. Error detected in writing user instruction area. The requester does not have the access permit for the file.
d. Make sure the parameters in ptrace() call are correct and also check if the text is writable by the current user.

(135) ESUIWD

a. sui word failed
b. sig.c
c. Error detected in writing user instruction area. Writing can not be performed due to the reasons other than (133) or (134).
d. Make sure the parameters in ptrace() call are correct.

(137) ENTXT

a. Out of text
b. text.c
c. Not enough slots in the kernel shared text table. There are too many programs with the save-text bit set, or the text table is just too small for the number of distinct shared-text programs you are trying to run at one time.
d. Reboot and possibly you should increase size of process table.

(138) RANDOM

a. Random interrupt
b. trap.c
c. Unused trap vector generates a trap.
d. Probably a hardware problem. Run diagnostics to determine the bad part.

(139) BADFREE

a. bad free count
b. alloc.c
c. File system error (superblock). The free count in a superblock exceeds the system limit (NIOFREE) while allocating disk blocks.
d. Try running fsck on hard disk.

(140) NOSPACE

a. file system full
b. alloc.c
c. You have run out of space on one of your file systems.
d. Recover by deleting some files (possibly archiving them to floppy first).

(141) BADBLK

a. bad block
b. alloc.c
c. Block number is out of range, i.e., it is less than the first block or greater than the last block in the volume.
d. Bad file system on the mounted device. Run fsck.

(142)NOINO

- a. file system full (out of inodes)
- b. alloc.c
- c. Inodes in the mounted device ran out while creating a file.
- d. Delete files or remake the file system specifying more inodes than normal.

(143)BADCNT

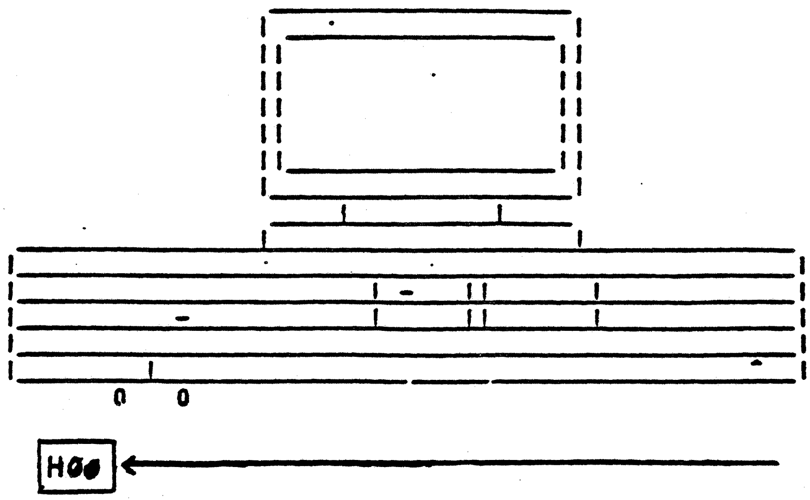
- a. bad free block count
- b. alloc,c
- c. File system error (superblock). The free block counter is too big( > NICAREE) or the inode counter is too big ( >NICINOD).
- d. File system is corrupted. Run fsck.

(144)OVERR

- a. error
- b. prf.c
- c. Ran out of spare blocks in the hard disk while saving a bad block.
- d. The system may have a bad hard disk. Run hdtest.

MomRom Error Format

**MomRom** error message codes are presented in the lower left hand corner of **the** Fortune Systems CPU **icon** display (see below).




The above is only an example. 'H' is the error prefix indicating the general category of the problem encountered, and the number identifies the specific problem.

Category prefixes are:

| | |
|---|---|
| E - EAROM | M - Memory |
| F - Flexible disk | T - Traps/Exceptions |
| H - Hard disk | U - User error |

**NOTE:** Error codes may be cleared by changing the menu icon or by using the <CTRL>L to redraw the icon.

EØØ Several unsuccessful attempts have been made to verify the EAROM. Bring up your system and run program **hdØ2/sa/reconf** (see **uconf(8)** in FOR:PRO Programmer's Manual). Verify that the fields are correct. This error should not prevent you from powering up or using your system. Nevertheless, report this error to your Fortune Representative.

EØ1 The EAROM has the Console Location set to "CRT", but there is no CRT controller in any of the five DMA slots. TTYØ1 is used as the console. If a CRT controller is indeed in a slot, reseat the controller, or try another slot. If reseating or trying another slot also fails, the controller is most likely damaged. If no CRT is present, run the **hdØ2/sa/reconf** program and change the Console Location to "TTYØ1".

EØ2 The EAROM has the Console Location set to an incorrect value. Bring up your system and run the **hdØ2/sa/reconf** program and change the Console Location to either "CRT" or "TTYØ1".

E03 The EAROM has the boot device set to an incorrect value. Bring up your system and run the **hd02/sa/reconf** program and change the boot device to a valid selection. Selection is made by placing the cursor on the boot device field and pressing the <**space bar**> until the correct device is displayed.

E04 The EAROM's boot device is set to "TTY01" and the Console Location is also "TTY01." This conflict for the device is not permitted. Bring up your system and run the **hd02/sa/reconf** program and correct the discrepancy.

E05 The EAROM's boot device field is set to a slot on the bus that does not have a valid boot device. The last valid boot device located will be used. Bring up your system and run the **hd02/sa/reconf** program to determine which slot is in question. If a valid boot device is present, reseat the card, or try another slot. If this fails, the card is most likely damaged. If the slot does not have a valid boot device (e.g., WD controller), correct the EAROM's boot device using the **hd02/sa/reconf** program.

E06 Cannot use terminal mode unless console location is set to "CRT." Bring up your system and run the **hd02/sa/reconf** program and change the Console Location field.

E07 Function key F2, used to write changes to the System Configuration menu, was initiated without any changes made.

F01 The MomRom, instructed to boot up using the diskette drive, could not communicate to the selected drive, or the diskette is not formatted or cannot be read. Try removing and reinserting the diskette into the drive. If that fails, try using a backup cold boot diskette or contact your authorized Fortune Representative.

F02 The configuration block identification number on the diskette is incorrect. Verify that a valid Fortune Systems cold boot diskette, Volume 1, is present in the drive and retry.

F03 The selected boot program has a length of zero. Verify that Volume 1 of the cold boot set is inserted in the diskette drive. Check that the boot number displayed with the cold boot icon (number on the right hand side, beneath the drive) is set to zero, or if using the boot menu, verify that entered values are correct.

F04 The selected boot program is not in the proper format. Verify that Volume 1 of the cold boot set is inserted in your diskette drive and try again. If problems still persist, use a backup copy of cold boot Volume 1.

F05 The selected boot program has an illegal start address. Verify that Volume 1 of the cold boot set is inserted in the diskette drive and try again. If problems still persist, use a backup copy of cold boot Volume 1.

F06 The diskette drive has failed to locate the instructed block number. Verify that Volume 1 of the cold boot set is being used and that it is not damaged (see **NOTE** below). Put the disk back into the drive and make sure that the drive door is completely closed, retry the procedure. If the problem still persists, try using a backup copy of cold boot Volume 1.

The diskette has a bad block and cannot be read. Verify that Volume 1 of the cold boot set is being used and that it is not damaged. Reinsert the diskette into the drive and make sure that the drive door is completely closed, retry the procedure. If the problem still persists, try using a backup copy of cold boot Volume 1.

H00 No Boot Device

H01 Boot Routine Error

M00 This message is accompanied by repeated beeping of both the TTY01 (alternate console) and TTY00 keyboards. This message means that your system has less than the mandatory 4KB of memory or memory was not found.

M02 A hole in RAM has been detected. Memory locations are not contiguous after the first 256KB of memory. Check that the memory boards are seated properly into their slots and retry the procedure.

T00 Power failure. Check power supply outlet and connections to the CPU.

T01 Unexpected error trap. This is a general message that is displayed if an error condition does not meet one of the above criteria. Power off your system, wait a few seconds and turn the power back on. Run diagnostics, if the condition still persists contact your authorized Fortune Representative.

**NOTE**

Remove diskette. Center diskette within envelope without touching the magnetic surface of the diskette, rotate the diskette within the envelope. The diskette should move freely. Check that the envelope is not damaged or creased. The diskette surface, as viewed through the access slot should show no signs of wear. Check the center hole for any sign of deformation.

## Software Release Levels

To determine the current release levels of software on your system, the what command will have to be used. Login as root and at the # prompt type the following command for the appropriate product you are trying to verify;

| Command | Product |
|---|---|
| what /etc/init | Operating System |
| what /bin/od | Development Utilities |
| what /m/wp2/wp | Fortune Word |
| what /m/mp/mp | Multiplan |
| what /usr/bin/gw | Graphwriter |
| what /usr/bin/makedb | Rubix |
| what /b/basic.psd | Basic |
| what /usr/bin/cc | C compiler |
| what /usr/bin/cbas | CBasic |
| what /usr/lib/fcoml | Fortran77 |
| what /usr/lib/cobol/rts5 | Micro-Focus Cobol |
| what /usr/bin/pc | Pascal |
| what /usr/bin/rmcobol | RM Cobol |
| what /usr/bin/ld | Language Dev. Tools |
| what /bin/cu | ITE |
| what /usr/lib/uucp/uucico | FFCP |
| what /usr/bin/vte | VTE |
| what /m/WPS/WPS.rbte | Doc. Conversion |
| what /b/BAS/CAP/CAPDAØ | Accounts Payable |
| what /b/BAS/CAR/CARDAØ | Accounts Receivable |
| what /b/BAS/CGL/CGLDAØ | General Ledger |
| what /b/BAS/CGL/CGLUDO | Fixed Assets |
| what /b/BAS/CPO/CPODAØ | Purchase Orders |
| what /b/BAS/CBI/CBIDAØ | Order processing |
| what /b/BAS/CPR/CRPDBØ | Payroll |
| what /b/IDOL/CUT/CUTUJB | IDOL |

**Supported Expansion Cabinets:** Expansion Cabinet with 30meg, 45meg and 70meg hard disk. Expansion Cabinets with 20meg or 60meg tape streamer (drives and tapes are optional in either type of Expansion Cabinet).

Any Fortune System running FOR:PRO (1.7 or later) which has at least one open I/O slot can be upgraded to support the Tape Streamer.

| Problem | Solution |
|---|---|
| Adding expansion cab. to cpu and now system goes straight to maintenance menu. | Check all cables making sure they are placed in properly and are secure. If that doesn't fix it, disconnect cables and try to boot cpu as a stand alone system. If still down, try to rebuild configuration block. If this isn't possible, run hdtest. Then try swapping in the following order:<br>1. WD controller<br>2. Ribbon cables and external cables<br>3. Hard Disk |

***********

| Problem | Solution |
|---|---|
| Running Diagnostics on the PIO Board. | There is already a diagnostic test on the Diagnostic disk labeled 4.0. To access test type fd02/pio. This test resembles the CommA test.<br><br>Make sure that PIO external cable is disconnected from cpu. This will cause complications if connected. |

***********

| Problem | Solution |
|---|---|
| System hangs at 5 during boot up with PIO board in system; | Remove PIO board to verify that it is causing system to hang. If not PIO board then maybe CommA, WD controller or video controller board. May actually be any board in the DMA slots |

# C E N T R A L   L O G I C   A S S E M B L Y
(MOTHERBOARD)

The Central Logic Assembly (CLA) data bus consists of 16 data paths, and additional bus control paths. The CLA data bus is connected to all major system devices and is used to transfer data between the microprocessor, memory and system devices.

The Central Logic Assembly address bus consists of 23 address lines, and additional bus control paths. The CLA data address bus is connected to all system devices, and is the means by which system devices are addressed.

| Problem | Solution |
|---|---|
| Security Pal Location | On most 32:16 models - D-7. On PS, XP, SX, and SXT systems, Motherboard location A-14. |

***********

| | |
|---|---|
| Security Pal Chip damaged or defective will generate an Hardware #26. | To order pal chip call PDC with the systems serial number. |

***********

Problems with resetting can be caused by;

1. Video controller (Same screen appears after a reset)
2. Power supply (High pitched whine, lines on screen)
3. WD controller
4. Hard disk (Spun down)
5. Reset switch stuck
6. Memory bd. in 1st slot (same symptom as number 2)

***********

| | |
|---|---|
| On maintenance menu Boot device (F4) does not recognize the WD Boot, drive #Ø. On ICON screen this may show the error HDØØ. | This can be caused by a defective mother bd or a bad WD controller. Try moving the WD Controller to another slot. If that fixes it check slot E connector on the mother board (where WD used to be) for bent pins. If no change, replace WD controller. |

The hard disk subsystem provides the system with large capacity on-line storage for system software and data files. The subsystem consists of a microprocessor controlled DMA disk (WD) controller or a SCSI controller.

**Supported Hard Drives in /etc/disktab and /etc/sdisktab:**

**ST506 Interface Type Drives**

| Manufact. | Model | Name | Sec/Trk. | Hds | Cyls | Wrcc | Wpc | Size | A/A/T |
|---|---|---|---|---|---|---|---|---|---|
| Seagate | ST412 | A10 | 17 | 4 | 306 | 306 | 128 | 10 MB | 85ms |
| Seagate | ST506 | Z5 | 17 | 4 | 153 | 128 | 128 | 5 MB | 85ms |
| Miniscribe | 2012 | B10 | 17 | 4 | 306 | 306 | 0 | 10 MB | 85ms |
| Miniscribe | 6085 | B70 | 17 | 8 | 1024 | 512 | 512 | 70 MB | 28ms |
| Ampex | PYXIS27 | C20 | 17 | 8 | 320 | 132 | 132 | 20 MB | 90ms |
| CDC | 94155 | C45 | 17 | 6 | 925 | 0 | 0 | 45 MB | 35ms |
| Disctron | D-526 | I20 | 17 | 8 | 308 | 128 | 128 | 20 MB | 85ms |
| CDC | Spec9415-5 | J20 | 16 | 5 | 500 | 500 | 0 | 20 MB | 35ms |
| CDC | 9415-5 | J30 | 16 | 5 | 697 | 697 | 0 | 28.5 MB | 35ms |
| Micropolis | 1304 | M45 | 17 | 6 | 830 | 831 | 831 | 45 MB | 30ms |
| Micropolis | 1323 | N30 | 17 | 4 | 1024 | 1025 | 1025 | 30 MB | 28ms |
| Micropolis | 1325 | N70 | 17 | 8 | 1024 | 1025 | 1025 | 70 MB | 28ms |
| Rodime | R0204 | R20 | 17 | 8 | 320 | 132 | 132 | 20 MB | 90ms |
| NEC | D5126 | N20 | 17 | 4 | 615 | 625 | 128 | 20 MB | 85ms |
| NEC | D5146 | N40 | 17 | 8 | 615 | 625 | 128 | 40 MB | 85ms |
| ESCSI | 145MB | M145 | 35 | 8 | 1018 | 1019 | 1019 | 145 MB | 28ms |
| ESCSI | 145MB | C145 | 34 | 9 | 967 | 1000 | 1000 | 145 MB | 20ms |

**NOTE:** The WD controller does not support disk drives with more than 8 heads.

## Hard Disk Errors

Hard errors can be caused by power glitches or improper shutdown procedure. Hard errors which cannot be corrected by reformatting the drive indicate media defects. Media defects must be spared out.

Hard Disk Error Message Format

The error messages from the disk driver are printed on the console in case of a disk related error. The error message format is as follows:

*** hd error <msg> or drive <n> in state <state>

where
<state> is an internal state. Generally you will see MOVE, (during reading or writing data)
<n> is the drive number on which the error occurred.
<msg> is one or more of the following:

Command was aborted

The controller will only send a command to the drive if the drive is ready to accept it. This message is seen when the drive did not become ready for a long time.

CRC error in ID field

The computed checksum for the ID does not match the stored checksum. The driver will attempt to spare the sector. This is a soft error and may also be seen the in case of a power supply glitch.

DAM not found

Data address mark not found. Could have been destroyed due to an earlier power failure or due to a hardware error. The driver will attempt to spare the track.

ECC error in data field

An incorrectable ECC error. The controller applies an error correcting code (ECC) to every sector it reads. If the controller can not correct an error this message is given. This is a hard error.

ID not found

Sector id not found. A sector is identified by its id. If the id cannot be found it generally means the track was not formatted or that the track was destroyed due to power failure. The driver will attempt to spare the track.

Parity error

The controller detected memory read error. If you see this, it means the memory could be defective. Run memory diagnostics (memtest).

Track 00 error

The drive could not find the very first track. The drive is unusable if this happens. Run hard disk diagnostics (hdtest).

Drives are usually configured for 3 partitions, but can be configured for up to 8 (0-7).

Partition 0 = Boot and conf. block
1 = Swap space
2 = File System

***********

Hard Disk Error:

hd error: <msg> on drive <#> in state <state> (see below for meaning of message in < >)
<msg> message given
<#> is the drive number on which the error occurred
<state> is an internal state

This error is usually a bad block indication and needs to be spared out. To spare out bad block refer to Appendix B (page 64). If sparing the block does not cure the problem, further diagnose by running hdtest.

Drive 0 has gone bad, will not accept anymore requests Hd drive status selected, seek complete flushing queue.

This error is caused by drive ready signal turning false, whether it be in the drive or WD controller. Turn system power off wait 1 minute, power back up. System should boot correctly. If it doesn't, check to see if hard disk is spinning (J20, J30 and C45 drives LED will constantly flash if a problem exists). If the drive does not become ready when power is applied, this could be caused by: 1) a power failure, or brown out; 2) too much static around the system; 3) an undedicated wall socket; 4) a bad WD controller or 5) a bad hard disk. First, check to make sure that WD controller is part number 100079-06, older revision controllers are the most common reason for this error to occur. Second, check cables and the static electricity situation. If all looks fine, then go into maintenance mode (refer to Appendix A) and try to read the hard disk configuration block (rdconf /dev/hd02). If unable to read the configuration block then try rebuilding it and the boot program (refer to Appendix B). If still getting errors, run hdtest and check for psoft and hard errors. If any, spare them out.

Rodime/Ampex (C2Ø) Disk Drives that experience intermittent hard disk errors or system locks for no apparent reason (drive actually spins down).

Drive may have wrong revision programmable microprocessor. These drives require a hardware modification. The proper Microprocessor will have to be installed. The correct levels of firmware are as follows:

Old Style Stepper Motor (Thick Black Band) is; **6Ø52-13B**

New Style Stepper Motor (Thin Black Band) is; **61Ø9-2.** Refer to Field Service Notice 74 for further information.

When a bad block is encountered, (by either an error message or by running diagnostics) the block must be spared out. Before sparing out bad blocks you may want to either backup the entire system or find out what files reside in the bad block. The only way this is possible is to have Development Utilities loaded on your system. Then do the following:

1. Convert disk physical block number (DPB, the number that shows up in error message or hdtest) to the file system physical block (FSPB) number. To do this subtract the beginning number of the partition that the DPB number resides in from DPB number . The answer will give you the FSPB number.

2. Now take the FSPB number and convert it to the file system logical block number (FSLB). To do this divide the FSPB number by two. The answer will give you the FSLB number.

3. Login as root and type in the highlighted commands:

   **# /etc/icheck -b [FSLB number] /dev/hd02** <cr> (hd02 may be different, be sure to check original error message). This command will give you an INODE NUMBER!

   **# /etc/ncheck -i [inode number] [file system]**
   The result will give you file name.

This procedure is done so you can determine what files did reside in the bad block. Now restore files (after sparing block) from backups. You may also want to do a manual file system check.

***********

If the block is going bad (psoft error), but can still be read, you can retain the data on the block with the following procedure:

1. Convert the DPB number to the FSPB number by subtracting the beginning number of the partition that the DPB number resides in from the DPB number.
   Now do the following logged in as root:

   **# dd if=/dev/rhd02 of=/tmp/[FSPB number] count=1 bs=512 iseek=[FSPB#]**
   The result will be something like;
   1+0 records in
   1+0 records out

2. Now spare out the block, (refer to Appendix B). Next enter:

   **# dd if=/tmp/[FSPB number] of=/dev/rhd02 count=1 bs=512 oseek=[FSPB#]**
   1+0 records in
   1+0 records out

   At this point the data is restored!! You can now remove /tmp/[FSPB#] after process is done.

**NOTE:** This procedure may take several tries if the block is marginal.

## ADDING PARTITIONS TO A SECOND DRIVE

Adding partitions can be done through expansion disk software or by doing the following procedure.

PROCEDURE: Power the system up in maintenance mode, login as root.
From the prompt (#) enter:

**cd /etc <RETURN>**

This will cause the system to change the working directory to /etc and return with the # prompt. Now check to see that no other file systems are mounted during the procedure.
Enter:

**mount <RETURN>** (if any file systems are mounted, unmount them before proceeding)

Making Configuration Block

Enter:

**mkconf -i /dev/hdl0 /dev/hdl0 <RETURN>**

The configuration block will now begin to appear on the CRT with '?' prompts. Press the <RETURN> to enter the default value until you get the question,

Number of partitions = 3?

Enter the number of partitions you would like for this drive, and press return.

**NOTE:** Partition 0 is for your conf block, partitions 1 thru 7 may be used for file systems.

Press <RETURN> until you get the question,

Size of partition 1 = (some#)?

Now you begin to enter the value for the size of the partitions.

**NOTE:** Partitions must break on even cylinder boundaries. To compute for even boundaries, the partition size should be made evenly divisible by (Sectors/track times Number of heads). See the example for location of values assigned to Sectors/track and Number of heads. When complete, the total of the partitions should be equal to Capacity in blocks.

Now enter starting block for this partition.

**NOTE:** This value is previous partition size + previous starting block.

Continue entering partition sizes and starting blocks for each partition.

Press <RETURN> until you get the question, Spare 0 (block 3) = diag ?
Now enter:

**done <RETURN>**

(Continue on next page)

Making a file system

When the prompt (#) returns, make a file system on each partition.
For partition 2 on drive 1 enter:

**mkfs -a /dev/hdl2**

For partition 3 enter:

**mkfs -a /dev/hdl3**

and so on for each additional partition.

Making lost+found

You must make a lost+found directory for each partition.
Enter:

cd /h

**mount /dev/hdlx /h**
**sh mklost+found /h** (where x is partition number)
**umount /dev/hdlx**

Repeat for each partition.

Making a directory

You must make a directory for each partition to be mounted on, or use existing directories such as /u or /b.
To make a directory use the mkdir command. (ie. mkdir /ul)

If you intend to use either /u or /b, make a full backup of the directory.

Example if you intend to use existing /u or /b directories:

**NOTE:** Check integrity of /u (perform an fsck on /dev/hd02) before continuing.

**mount /dev/hdl2 /h**
**cp -rost /u/. /h**
**umount /dev/hdl2**

**(HIGHLY RECOMMENDED THAT /u OR /b BE BACKED UP TO TAPE OR FLOPPY DISK BEFORE CONTINUING.)**

**NOTE:** Check integrity of /h (perform an fsck on /dev/hdl2) before continuing.

Now enter:

**rm -rf /u**
**mkdir /u**

Repeat, starting at Making a directory for each partition.

(Continue on next page)

## Editing /etc/fstab

If you want the operating system to automatically mount the file systems, you need to edit the /etc/fstab file and enter similar lines of text as this, one line per partition:

**/dev/hdlx:dir:rw:1:#** (for more information see fstab(5) in the For:Pro Programmers Manual)

Replace **x** with partition number.
Replace **dir** with the full path name of the directory it is to be mounted on.
Replace **#** with a unique number, file systems on same drive must have distinct numbers.

PROCEDURE IS NOW COMPLETE

The following is an example on how to add additional partitions to a second drive. You must first get into maintenance mode (refer to Appendix A).

The highlighted commands are the commands to be concerned with;

```
# cd /etc
# mkconf -i /dev/hdl0 /dev/hdl0
Sysid = 0
Volume ID = 474728192
Modification date = Wed Jan 16 04:56:32 1985
Media type = 2?
Sectors/track = 16?
Number of heads = 5?
Number of cylinders = 697?
Capacity in blocks = 55760   <-- Capacity in blocks
Write reduce = 697?
Write precomp = 0?
Drive attributes = 0?
Block size = 512?
Software interlace = 1?
Hardware interlace = 2?
System interlace = 3?
Disk identification = "J30 - 28.5 Mega byte"?
Disk type = "J30"?
Number of partitions = 3? 5             Sizes
   Size of partition 0 = 240?            <--
      Starting block = 0?
      Read only (no)?
   Size of partition 1 = 1920?           <--                 240
      Starting block = 240?                                1920
      Read only (no)?                                  13440
   Size of partition 2 = 53600? 13440    <--               13360
      Starting block = 2160?                              26800
      Read only (no)?                                  ------
   Size of partition 3 = 0? 13360        <--               55760
      Starting block = 0? 15600
      Read only (no)?                            (total sizes of partitions
   Size of partition 4 = 0? 26800        <--        = Capacity in blocks)
      Starting block = 0? 28960
      Read only (no)?
Number of boots = 0?
Number of spare blocks = 46?
Enter map for spares (#, bad, 0 or free, or done):
   Spare 0 (block 3) = diag ? done
#
```

WD CONTROLLER:

The WD Controller will support all 32:16, PS's, XP's, SX's and Expansion Cabinets. WD Controller must be part #1000079-06 on all Fortune Systems.

When the system needs data files or software loaded into memory, the 68000 microprocessor transfers the address of the file it wants and the location in memory where the file is to be stored to the WD controller. The WD controller, through commands from its own microprocessor, finds the data on the disk, loads it into the designated memory location via a DMA transfer, and notifies the system when the transfer is completed.

If a defective controller writes garbage to the disk, it usually overwrites the I.D. fields on one whole track. A good WD will still report these blocks as being hard errors. The only way to restore the I.D. fields is to do a format track (ft) using diagnostics, passing the first block in the list of successive bad blocks (I.D. not found) as the address to start. Any data in these blocks is gone.

The flexible disk stores data and programs on removable magnetic media (floppy disk) so that information in the system can be more easily safeguarded and transported. The flexible disk subsystem is the means used to enter the initial system software, and to backup and archive both system software and data files.

## Description

The flexible disk subsystem consists of a flexible disk controller chip, associated timing and control logic, a 2K buffer RAM, and one 800K byte flexible disk drive. Data is transferred to and from the subsystem in 1K byte blocks, one byte at a time.

Fortune Systems has used drives manufactured by Tandon, Shugart and Tec. Most Fortune Systems contain Shugart drives which can be distinguished by the tongue which hangs from the top of the drive door. The exception to that is the XP30, XP45, SX45, SXT45, SX70, and SXT70 systems which use a TEC half-height floppy.

***********

| | |
|---|---|
| Drive transfer rate; | 250 kilobytes per second |
| Average access time ; | 120 milliseconds |

***********

| | |
|---|---|
| Flexible disk requirements; | Double sided/Double density<br>Soft sectored<br>77/80 tracks per side<br>100/96 tracks per inch |

***********

To Format floppy Disk enter;

```
# /etc/format -c /etc/disk/flop.conf /dev/fd00 <cr>
# /etc/mkfs /dev/fd02 790 2 10
              OR
# /m/sysutil/bin/format
```

***********

To check floppy disk for I/O status or bad blocks, enter the following;

```
# dd if=/dev/fd02 of=/dev/null bs=1k <cr>
```

Result should be: read I/O error
790 records in
790 records out

**NOTE:** MOST FLOPPY DRIVE PROBLEMS ARE CAUSED BY LOW QUALITY MEDIA OR MIS HANDLING

# Floppy Disk Errors

The floppy driver error messages are shown on the monitor only if a user sets the system debug flag using the chlog command. Each message starts with the upper case identifier (except "Floppy drivers") message followed by a colon. The first id is the procedure name in the floppy driver, which should be ignored by users. Most of the error messages also print out the unit number, cylinder number, track and sector numbers whenever appropriate.

Supported Floppy Drives
Tandon, Shugart, Qume, CDC, Tec, Other B or Other C. If the floppy driver can not figure out the type, it will print "*****"

CHKSPARES: out of spare blocks for unit____
Tried to spare a bad block, but ran out of spare blocks

CMDONE: pending C 0
An interrupt is received from the currently executing command, but the driver does not know what the command was.

FDICMD: failed after three tries
Failure in sending a command to the FDC chip even after 3 tries.

FDICMD: timeout on RQM = ____ and DIG = ____
Timeout error in reading from the FDC chip.

FDBEGIN: impossible state ____ for unit ____
The floppy driver is in a unknown state. Probably the floppy driver has a bug.

FDINIT: unit ____ recalibrated
This informative message comes out when the driver check if a drive is attached to the system. If successful, it prints "and exits". If not, it prints "and failed, no track zero".

FDINTR: Recalibrate error on ____ (unit)
Recalibrating on the floppy failed after 2 tries.

FDINTR: error formatting track on unit ____, cyl=____ sec=____
Formatting a track failed. The message shows the unit number, cylinder number and sector number where formatting fails.

FDINTR: fatal seek error on ____, cyl = ____
If the seek failed try doing a recalibrate once and then reseeking to the correct track. If it fails a second time this error comes out.

FDINTR: spurious floppy interrupt, unit ____
The driver is interrupted while it is idle.

## Floppy Disk Errors

**FDINTR:** unit ____ interrupted, but does not exist

An interrupt is caused by an attached drive. Please ignore this message.

**FDINTR:** unknown state:_____

The driver has a bug.

**FDSTAT:** timeout on RQM

Reading from the FDC chip failed within a giver time.

**FINDBAD:** no more spares

Find the next available spare block in the configuration block, but none was found.

**FLOPPY DEBUGGING DISABLED:**

Chlog debug flag enabled for floppy error message printing.

**NEWBAD:** block ____, spared to ____ on unit

This message is just for your information. A new bad block is entered in the bad block map table.

**NEWBAD:** table full, no room for ____, spared to ____

A new bad block is being entered in the bad block map table, but no entry is available in the table. This message must follow the previous message.

**SOFTERR:** hard error on ____, cyl = ____, sec ____

Retries have failed after soft error. The driver will try to spare the hard error blocks.

**SOFTERR:** off of cylinder on unit ____

Soft error detected. The driver will retry to correct the soft errors.

**SOFTERR:** no more spares on unit ____

Tried to spare the block which has a hard error, but it cannot be spared since the error was in the critical area (configuration block, spare block area) or run out of spare blocks.

# M E M O R Y   B O A R D

The memory is used to store the system programs and data for use by the microprocessor. The information stored in memory is organized in 16-bit words; each word is divided into two 8-bit bytes. Each byte has an individual 24-bit address associated with it, starting with location Ø and continuing through the last location in memory. Each byte of data stored in memory has a parity bit for error detection.

The 32:16 has a minimum memory capacity of 512KB expandable in 256KB increments to a maximum capacity of 3.5 megabytes.

**MEMORY BOARDS:** Date code (located on top of chips).

| | |
|---|---|
| Memory cycle time | 4 cycles at 18Ø nanoseconds for a total of 72Ø N/S |

| Symptoms | Solutions |
|---|---|
| Panic Parity err. mesg. At PC Øx_____double parity | When this error is detected refer to PC# To determine what memory board is bad. (Refer to Field Service Manual page 7-1Ø). Run memtest of diagnostics. |
| Pre-1.7.4.2, various kernel error messages (such as parity and double parity) may be errors in user's program | If swapping memory bd. does not resolve problems then refer to the number in the brackets ([]). If the number is [ØxA,1 or 2 ] then more than likely the problem is a memory board. If number is [Øx3] then the problem is coming from I/O ports. If number is [Øx4 or 5 ] then the motherboard may be bad. Running diagnostics will help pinpoint problem. |
| Falsely reported as crashes. | As you can see, this error can be caused by many things and will take diagnosing as well as troubleshooting. |

***********

| | |
|---|---|
| Single user system is running very slow. Also lots of processes running simultaneously. | Suspect a bad memory board. Run memory diagnostic and replace defective memory board if defective. |

***********

| | |
|---|---|
| No boot: High pitched noise, screen full of green lines. | Possible bad memory in slot 1. Run memory diagnostic. |

# VIDEO CONTROLLER BOARD

Video controller is usually located in slot A of DMA slots.

Contrast adjustment is a blue trim potentiometer on the top of video controller.

************

| Symptom | Solutions |
|---|---|
| Hangs intermittently. After reset same screen appears. No keyboard input. | Try swapping out video controller board, may be defective. |

# CommA BOARD

CommA without proms (located at A7 and A9) must always go in DMA slot PB on mother board.

CommA with proms can go in any DMA slot.

Comm6 may also go in any DMA slot.

***********

| Symptom | Solutions |
| --- | --- |
| Will not run 4.Ø diagnostics. | External loopback connector is required for port under test. 'External jumper' refers to jumpering pintwo to pin three of the port(s) to be tested. Any type of jumper may be used, and allows the data driver and receiver to be tested. |
| Replace CommA four port with Comm6 board and system freezes. | Check memory boards to be sure that there is at least 1meg. Firmware may be down-loaded on Comm6, CommA 4 port will not do this. |

# P R I N T E R S

## Fortune Supported Printer:

NEC 7710 tractor feed
NEC 7710 with single bin sheet feeder
NEC 7710 with dual bin sheet feeder

NEC 3510 tractor feed
NEC 3510 with single bin sheet feeder
NEC 3510 with dual bin sheet feeder

NEC 3510R tractor feed
NEC 3510R with single bin sheet feeder
NEC 3510R with dual bin sheet feeder

IDS PRISM 132
IDS PRISM 80

DIABLO 630 HPR05 tractor feed
DIABLO 630 HPR05 with single bin sheet feeder

HP LASER JET (interface software only)

**Fortune Compatible Printers (not supported)**

EPSON
TOSHIBA 1350
PRIMAGE (emulates DIABLO 630)
OKIDATA PACEMARK 2410
GENICOM 3404
MANNESMAN TALLY

# ASCII AND CONSOLE

Zenith and Elston CRT's

***********

| | |
|---|---|
| Current drawn from ascii; | 24 amps. or 120 watts |

***********

Baud rates are designated by letters when setting up the device table;

i = 1200
j = 2400
k = 4600
l = 4800
m = 9600
n = 19200

***********

When hooking up terminal or printer over 50 feet.

It is advised to use a short haul modem or a signal booster every 50 feet. You may also adjust the baud rate to match the length of cable (see below).

| Cable | Baud Rate |
|---|---|
| 50' | 19200 |
| 100' | 9600 |
| 150' | 4800 |

```
[=- _
[=   -_     yoke
[=     -_     |  coil
[=       -_   | /
[=         -_ |/          *  *
[=          -I==I-[-]****#__#_______
[=           I==I [ ]    #  #       }}
[=           I==I-[-]****#--#-------
[=         _-       /     *  *
[=       _-        /       \
[=    _-          /         \___Screen
[=-              /           \   Control
     Rotating Adj.            \
          /                    \
 _______________________     _______________________
[                       ]   [|        ^         |   ]
[                       ]   [|        |         |   ]
[     /_________\       ]   [|        |         |   ]
[    ^           ^      ]   [|<---         --->|   ]
[    |           |      ]   [|        |         |   ]
[    v           v      ]   [|        v         |   ]
[     \_________/       ]   [|__________________|   ]
[_______________________]   [_______________________]

           (A)                         (B)
```

(A) If screen is slanted and out of alignment, you would make an adjustment here. When turning adjustment knob, screen moves in the same direction that you are twisting!

(B) If screen seems to be out of alignment, and off in one direction, you would use this adjustment. This is done by moving the two levers towards each other or in opposition to each other. If there is another set of levers, they are for finer tuning of alignment!

**CAUTION HIGH VOLTAGE!!**

Zenith and Western Electric Pin Identification for Mother Board Connector

```
                                    Top View
                               _______________
                              [               ]
                              [ O(15)-----(16)O ] <-- Black wires are all
THIS SIDE IS FACING           [       |         ]     ground. (11, 12, 13,
THE DRIVES.                   [ O(13)-----(14)O ]     14, and 15)
                              [       |         ]
                              [ O(11)-----(12)O ]
                              [                 ]
   Blue = Power Fail          [ O(9)      (10)O ] <-- White = +12v reg.
                              [                 ]
   Orange = Reset             [ O(7)       (8)O ] <-- Purple = -12v
                              [                 ]
                              [ O(5)---    (6)O ] <-- Yellow = +12v
When 9 or 7 are               [       |         ]
active, reading               [ O(3)--|----(4)O ] <-- Red wires are all
is low.  When                 [       |         ]     +5 volts. (1, 2, 3,
inactive high (+5)            [ O(1)-------(2)O ]     4, and 5)
                              [_________________]
                                      |
                                   _______
                                    _____
                                     ___
                                      _
```

| | MIN | MAX |
|---|---|---|
| +5 | 4.90 | 5.25 |
| +12 | 11.40 | 12.60 |
| -12 | 11.40 | 12.60 |
| +12 REG | 12.00 | 13.20 |

## ELECTRICAL PARAMETERS OF FORTUNE UNITS

When the system is turned on, the AC current drawn may exceed the normal operating current. The surge current entry in column nine of chart below, gives the typical power-on current requirements for common system components.

| UNIT | LINE VOLTAGE (VAC) | | | LINE FREQUENCY (HZ) | | | CURRENT (AMPS) | |
|---|---|---|---|---|---|---|---|---|
| | LOW | NOMINAL | HIGH | LOW | NOMINAL | HIGH | NORMAL | SURGE |
| CPU | 90 | 120 | 130 | 47 | 60 | 63 | 4.0 | 30 |
| EXPANSION CABINET | 90 | 120 | 130 | 47 | 60 | 63 | 1.5 | 30 |
| FIS | 90 | 120 | 130 | 47 | 60 | 63 | 0.5 | 1.5 |
| NEC 3510 | 90.75 | 120 | 132.25 | 45/48 | 50/60 | 75/90 | 2.5 | |
| NEC 7710 | 97.75 | 120 | 132.25 | 45/48 | 50/60 | 75/90 | 3.5 | |
| GE 3404 | 97.78 | 120 | 132.25 | 48 | 60 | 65 | 2.0 | |

Surge, or in-rush, currents can exceed maximum ratings by a factor of ten or more. The time rate of change of in-rush current is the quantity of importance here. For example, some circuit breakers are more sensitive to in-rush rates than others, so that one installation may find circuit breaker tripping when two CPUs are turned on simultaneously, while another site with equivalent equipment may not.

## Update

The forward edge of the Western Electric Power Supply was covered with a plastic solution to protect the 12 volt line. The front end of top cover made contact with the power supply.

## Caution

The power supply must be checked with a sufficient load. All connectors should be connected to the device (motherboard, hard drive and floppy) before voltage checks are made at the connector end or power supply.

## P O W E R   S U P P L Y   R E Q U I R E M E N T S

| POWER SUPPLY VENDOR/MODEL NUMBER | POWER SUPPLY PART NUMBER | POWER (WATTS) | CURRENT AVAILABLE (AMP) | | | |
|---|---|---|---|---|---|---|
| | | | +5V | +12V | -12V | +12VR |
| DIGIPOWER MODEL | 1003922-01 &-02 | 300 | 35.0 | 7.0 | 1.0 | 1.5 |
| WESTERN ELECTRIC MODEL CS 720A | 1001851-01 &-02 | 250 | 32.0 | 5.0 | 1.0 | 1.5 |
| ZENITH MODEL 12-1 | 1000050-03 &-04 | 218 | 28.0 | 4.0 | 1.0 | 1.5 |
| ZENITH MODEL 12 | 1000050-01 &-02 | 188 | 22.0 | 4.0 | 1.0 | 1.5 |

POWER SUPPLY (Western Electric or Zenith)

Current shutdown (5 volt line) occurs at 32 amps in a running state.

Shutdown (5 volt line) occurs if DC voltage is greater than or equal to 5.75 - 6.0 volts DC in a running state.

Zenith Power supply only- PFL will catch a missing cycle or low level AC voltage.

Minimum Holdup Time:

@ 115 VAC - approximately 20 MSEC from the time power went off.

@ 90 VAC - 5 MSEC.

AC inrush current will no exceed 30 amps AC for two cycles or less.

## CURRENT REQUIREMENTS AND HEAT DISSIPATION OF POWER SUPPLIES

| A | B | C | D | E |
|---|---|---|---|---|
| ITEM | SUBASSEMBLY | I/O SLOT USED | CURRENT +5V | HEAT BTU/HR |
| 1. | Mother Board | | | |
| | PS or XP | --- | 8.65 A | 225 |
| | SX | --- | 8.45 A | 220 |
| 2. | R A M Board \| Memory Size | --- | --- | |
| a. | 256K | --- | 1.70 A | 45 |
| b. | 512K | --- | .70 A | 20 |
| c. | 1MEG | --- | .90 A | 23 |
| 3. | Video Monitor | --- | .25 A | 62 |
| 4. | Key Board | --- | .20 A | 5 |
| 5. | Hard Disk Dr. \| Vendor \| Dr.Type | --- | --- | |
| | Seagate \| A5/A10 | --- | 1.20 A | 126 |
| | Miniscribe \| B5/10/20 | --- | 1.23 A | 126 |
| | Ampex \| C5/10/20 | --- | 1.06 A | 145 |
| | Disctron \| I20 | --- | 1.06 A | 159 |
| | CDC \| J20/30 | --- | .60 A | 120 |
| | Micropolis \| M45/N70 | --- | .75 A | 167 |
| | Rodime \| R5/10/20 | --- | 1.06 A | 145 |
| 6. | Floppy Disk Drive | | | |
| | Tandon (Full Height) | --- | .65 A | 64 |
| | Shugart (Full Height) | --- | .65 A | 64 |
| | TEC (Half Height) | --- | .40 A | 41 |
| 7. | Tape Unit (Half Height) | --- | 2.05 | 151 |
| 8. | Comm-A Controller | 1 | .75 A | 20 |
| 9. | Intl. Async. Controller (6 port) | 1 | 1.85 A | 120 |
| 10. | Comm B Controler (Bisync) | 1 | 2.65 A | 60 |
| 11. | Monochrome Graphics Controller | 1 | 5.00 A | 185 |
| 12. | Video Controller | 1 | 1.80 A | 46 |
| 13. | Local Area Network Controller | 1 | 2.50 A | 55 |
| 14. | PI/O Controller (Tape Expansion) | 1 | 2.95 A | 76 |
| 15. | Hard Disk Controller (WD) | 1 | 3.45 A | 89 |
| 16. | SCSI H/A Controller | 1 | 3.20 A | N/A |
| 17. | SCSI ST506 Controller | | 1.35 A | N/A |
| 18. | SCSI QIC36 Controller | | 1.85 A | N/A |

# UNINTERRUPTIBLE POWER SUPPLY REQUIREMENTS

## U P S

Output rating: 35Ø watts or 35Ø VA (System capacity; minimal)
Backup time: 1Ø minutes
Transfer time from line to backup battery: < 8 MSEC. (must not trip Power Fail).
Output voltage: 12Ø VAC

**NOTE:** Output Rating- The watts are for the CPU only, the ASCII terminals and printers are not included.

Backup Time- This is a minimum period of time.

Transfer Time- Naturally, the faster the UPS kicks in, the better. The time here is within a 1/2 cycle (Zenith) 1 cycle (Western Electric).

## LINE CONDITIONER

| | |
|---|---|
| Load Rating | 5 amps minute |
| Output Voltage | 12Ø VAC |
| Load & Line Regulator | 1Ø9Ø |
| Minimum Line Input | 85 VAC |

| | |
|---|---|
| It is advised when hooking up an uninterruptible power supply that it be a certain voltage. | Must be between 5ØØ and 6ØØ watts. Kilo-volt amps. .5 |

***********

## SURGE SUPPRESSOR

Clamping level, 2ØØ volts, peak energy dissipation, 13.5 peak pulse power typical switching time, $\leq$ 5 nanoseconds. U.L. listed.

**MEASUREMENTS**

| Unit | Length (inches) | Width (inches) | Height (inches) | Weight (pounds) |
|---|---|---|---|---|
| HTS CPU | 23 | 14 | 7 | 30 |
| STS CPU | 22 | 14 | 6 | 30 |
| Expansion | 22 | 14 | 6 | 30 |
| High Profile Keyboard | 22 | 6 | 2 | 6 |
| Low Profile Keyboard | 22 | 8 | 2 | - |
| Monitor | 12 | 14 | 13 | 12 |
| FIS | 12 | 14 | 13 | 15 |
| NEC 3510 | 24 | 16 | 9 | 38 |
| NEC 7710 | 25 | 19 | 9 | 46 |
| GENICOM 3404 | 24 | 16 | 5 | 45 |
| HP Laser | 19 | 28 | 12 | 71 |

Notes: Table entries are rounded up to nearest inches and pounds.

# ENVIRONMENT

| Unit | Temperature (operating) | Temperature (storage) | Humidity (%relative) | Maximum Alt. (feet) above sea level (oper.) | (stor.) |
|---|---|---|---|---|---|
| CPU | 50 to 104 F | 14 to 140 F | 20 to 80 | 10,000 | 39,000 |
| EXPANSION CABINET | 50 to 104 | 14 to 140 F | 20 to 80 | 10,000 | 39,000 |
| MONITOR | 50 to 104 F | 14 to 140 F | 20 to 80 | 10,000 | 39,000 |
| FIS | 50 to 104 F | 14 to 140 F | 20 to 80 | 10,000 | 39,000 |
| NEC 3510 | 40 TO 100 F | -22 to 158 F | 20 to 80 | 10,000 | 25,000 |
| NEC 7710 | 40 to 100 F | -22 to 158 F | 10 to 85 | 10,000 | 25,000 |
| GENICOM 3404 | 40 to 100 F | -40 to 71 F | 20 to 80 | 10,000 | 25,000 |

<u>ABSOLUTE LOADER</u>
A program that contains the instructions necessary to allow the system processor to load the operating system into memory.

<u>ACCESS TIME</u>
The time required to retrieve information from the computer.

<u>ADDRESS</u>
A number specifying where a unit of information is stored in the computer's memory.

<u>BAUD</u>
A unit of signaling speed equal to the number of code elements per second. For practical purposes it is now used interchangeably with "bits per second" as the unit of measure of data flow.

<u>BIT</u>
An abbreviation of binary digit. The smallest unit of information that the computer recognizes, a bit is represented by the presence or absence of an electronic pulse, Ø or 1.

<u>BLOCK</u>
Is a data grouping whose size varies depending on the usage. A program may arbitrarily choose a block size. In reference to a disk device the block size will usually be a multiple of the physical sector length.

Use care when referencing to block number, that everyone uses the same definition. Do not confuse block numbers reported by higher layers of program (kernel for example), they may not be the same.

<u>BOOTSTRAP LOADER</u>
Contains the instructions necessary for the system to access and read the absolute loader from permanent storage media. Also contains diagnostic routines executed during IPL.

<u>BUFFER</u>
An area reserved for the temporary storage of data.

<u>BUG</u>
Any mechanical, electrical, or electronic defect that interferes with the operation of the computer. May also be a defect in the coding of a program.

BYTE

A group of adjacent bits, such as 4, 6 or 8 bits, operating as a unit. For example, a six-bit byte may be used to specify a letter of the alphabet, and and eight-bit byte may be used to specify an instruction or an address. Normally shorter than a word. Unless otherwise indicated a byte is normally assumed to be 8 bits long.

CABLE

A collection of wires bound together in a protective sheath with a connector at each end used to carry a signal from one place to another.

CHARACTER

The term "character" refers to the signals that a terminal keyboard can produce. Blanks or numbers or special symbols are all "characters". Shifted and unshifted keys and control keys are all different characters, e.g., H, h, and ^H are three different characters produced using the H key. Characters are also commonly referred to as "bytes".

CHARACTERS PER SECOND (CPS)

Used as a rating speed for printers.

CHIP

A thin silicon wafer on which electronic components are deposited in the form of **integrated circuits.** Technologically, the key to the microelectronic revolution in computers.

COMPILER

A program that translates the high-level-language statements of a program into machine-readable form.

COMPUTER SYSTEM

A computer system is an arrangement of hardware and software designed to do a particular job or set of jobs. Computer systems are "configured" (component parts are selected and arranged) to serve a particular set of users' needs. Some computer systems are designed to serve hundreds of people simultaneously. What services are provided by a particular computer system depends on what features the designer decided were necessary.

CONFIGURATION BLOCK

The layout of hardware that makes up any particular computer system. Also the area defining the type of disk drive being accessed and spares available.

CONTROL UNIT

Includes system logic, memory device interfaces, and storage capability in the form of hard disk or flexible disk drives.

CONTROLLER BOARD
A printed circuit board (found in option slots on motherboard) responsible for decoding and transmitting commands from the system to I/O devices as well as reporting status of the I/O device to the system.

CPU (Central Processing Unit)
The part of the computer that controls the interpretation and execution of the processing instructions.

CRASH
Sometimes called a head crash. This is when the read/write head that "floats" above the surface of the hard disk comes into physical contact with the disk due to some electrical or physical disturbance.

CRT
Often used as a short form of "CRT terminal". CRT stands for "cathode ray tube", and refers to the television-like screen used to display typed characters. CRT-type terminals are very fast and very quiet compared to printer terminals.

DAM NOT FOUND
The I.D. field is followed by a user (Fortune) supplied data field. A typical track format is based on 16 or 17 sectors per track, each having 512 bytes of user data. The data address mark is a unique MFM (Modified Frequency Modulation) encoded data pattern to signify the start of a data field, plus establish byte synchronization.

DATA
The raw information within a computer system.

DATA BASE
A collection of interrelated data that is organized for ease of update and retrieval. For example, a personnel database would include information such as employee names and Social Security numbers.

DATA SEPARATION
The I.D. plo sync fields of all zeros required by Fortune's WD controller. Phase locked oscillator/data separator to become phase and frequency synchronized with MFM (Modified Frequency Modulation) recorded data (flux referrals on the media).

DEBUG
To locate and correct any errors in a computer program, and/or to detect and correct malfunctions in the computer itself.

DIAGNOSTICS
Programs for detecting and isolating a malfunction or mistake in the computer system; features that allow systems or equipment to self-test for flaws.

DIRECTORY
"Directory" is a UNIX term referring to a file that contains other files. It is used to cluster files that belong together for some reason.

DISK (or: Magnetic Disk)
A "disk" is a storage place for files. Disks rotate like a phonograph records and store files (streams of characters) as magnetic patterns on the disk surface. Storing a file on a disk is called "writing the file to disk".

DISK DRIVE
A piece of hardware that houses several magnetic disks and keeps them spinning so that information can be read from or stored on the disks.

DISKETTE (Floppy Disk)
A removable magnetic media that stores data and programs so that information in the system can be more easily safeguarded and transported.

DOWNTIME
The period during which a computer is not operating or is malfunctioning because of a machine fault or failure. Downtime consists of repair delay time, repair time, and machine-spoiled work time, as opposed to available, idle, or standby time, in which the system is functional.

DYNAMIC SPARING
The controller sends the status register to the host indicating the bad block bit is on. The operating system records the bad block to the configuration block, moves the data to another block, and returns status to the controller indicating the new block number of the data. This is transparent to the user. The Fortune system does this only if configuration table is set to free (we suggest that you spare a block manually) since there are 16 or 17 sectors per track, Fortune can spare a sector and/or all the entire track; each sector has 512 bytes per.

EAPROM
Electrically alterable programmable read only memory. Often used as a synonym for EPROM.

EAROM
Electrically alterable read only memory. Often used as a synonym for EEROM.

ECC ERROR (Error Correction Code)
Although the implementation of error detection and correction is quite complex, the concept is simple. According to F. Beruekamp "error correcting codes enable a system to achieve a high degree of reliability despite the presence of noise." Correction bytes are calculated and appended to each data field written to hard disk. An ECC Error indicates that an incorrectable ECC Error was encountered in a data field during a read sector command.

ECHO
The system usually "echos" typed characters on your terminal screen, so you can see what you typed. In certain cases, however (e.g., when you type your password), the system may judiciously refuse to echo the characters you type.

EEROM
Electrically erasable read only memory. Read only memory which can be erased by passing an electrical current through it and then reused, ie new data entered. Often used as a synonym for EAROM.

EPROM
Erasable programmable read-only memory. PROM which can be erased for reprogramming.

EXECUTE (or Executing)
The term "execute" is used in the computer community to mean "perform" or "make it happen". The phrase "the currently executing program" means "the program that is currently in operation". When you issue a command to UNIX, you request the execution of a program whose name is the first word you gave. For example, if you issue a "cal" command to obtain a calendar, you are "executing the cal program".

FACILITY
A program or set of routines loaded into memory to assist the operating system during certain functions. An example of a facility is the COBOL interpreter.

FIELD
A specified area of a record used for a particular category of data, e.g., an area of a format designated for wages.

FILE
A "file" is an arbitrarily long sequence of characters. A file on a computer system is equivalent to a file-folder in a manual filing system, and like a file folder, a file can be empty or it can contain enormous quantities of text. Files are often stored on magnetic disks.

FILE CONTROL BLOCK (FCB)
An area of memory set aside for the storage of FID information while a file is being accessed.

FILE IDENTIFIER (FID)
The 64-byte disk file directory entry for individual disk or disk or diskette files. The FID contains the filename, its beginning and ending addresses, the locations of various file pointers, the format and length of records, and other information to control use of the file.

FIRMWARE
A chip or group of chips containing nonvolatile program instructions and/or routines that are extended by a processor.

FLOATING POINT
Refers to the position of the decimal point in numbers stored in a computer. For example, instead of storing 111.23 and 1112.3 in this form, they may be stored as 1.1123x1Ø and 1.1123x1Ø.

HARDWARE CONFIGURATION
That collection of hardware that makes up any particular system.

HARD DISK
The 5 1/4" Winchester disk drive. The hard drive is a rotating memory, mass storage unit with non-removable media.

HARD ERROR

When reading a block of data, if the data cannot be read on the very first try, a bit is posted into the status/error registers. The disk will attempt to read the data again and again for a total of 16 times. If unsuccessful, the disk will recalibrate its heads to track position, by homing to track Ø and then returning to the track it just came from to then attempt another 16 read operations on the problem block of data. If still unsuccessful, the WD controller will post an additional bit to its status/error registers (bad block bit to the kernel) and no further attempts will be made to read the data. This is the extreme case of complete failure to read data and will result in a hard error. This will cause the Fortune System to halt.

I.D. Not Found
The disk storage format is of a soft sectored type, which means that the beginning of each sector is defined by a pre-written identification (I.D.) field, which contains the logical sector address, plus cylinder and head information. I.D. Not Found is the error that occurs when the I. D. field is not readable.

INITIALIZE
The process of establishing hard disk and flexible disk parameters according to a specific format.

INTEGRATED CIRCUIT
A macroscopic multi-layered silicon construction which duplicates the function of several to several hundred components, encased in a protective shell with wire connectors for mounting in a printed circuit board.

INTELLIGENT CONTROLLER
A controller board which contains a microprocessor capable of executing firmware programs contained in integrated circuits on the same printed circuit board.

INTERFACE
The juncture at which two computer entities meet and interact with each other; the process of causing two computer entities to intersect.

I/O
Abbreviation for input/output. The process of transferring information from an external source to the computer or from the computer to an external source.

I/O BUFFER
An area used for temporary storage of data being transferred between disk and peripheral devices and memory.

K
Computerese for the quantity 1,024.

KERNEL
That part of other operating system that is always available for use by any program and is in memory at all times.

LOGICAL BLOCK
Data organized the same as a block but referenced differently.

LOGICAL MEMORY
That portion of memory that at any one particular moment can be accessed by the processor.

LOGICAL SECTOR
The same as a physical sector but references the physical start of the track, and may be interleaved in relation to the physical sector.

MACHINE CODE
The symbols that designate a basic computer operation to be performed.

MAGNETIC TAPE DRIVE
The mechanism that moves magnetic tape past sensing and recording heads and associated electronic and electrical equipment. Most tape drives provide for tape to be wound and stored on reels.

MAINFRAME
A large computer, as opposed to minicomputers and microcomputers.

MAPPING
Procedure used to specify logical memory area partition for each job out of the available physical memory.

MEGABYTE
Abbreviated mb; represents 1 million bytes of data.

MEMORY
The section of the computer where instructions and data are stored.

MEMORY CAPACITY
The maximum number of storage positions in a computer's memory. Typically, a microcomputer can have up to 64K bytes of memory.

MICROCOMPUTER
A small computer in which the CPU is an integrated circuit deposited on a silicon chip.

MICROPROCESSOR
A single integrated circuit containing timing, instruction decoding, interrupt decoding, several accumulators, arithmetic logic unit, and data and address bus connections. Functions in a manner similar to a discrete component computer.

MINICOMPUTER
A computer that is usually larger, more powerful, and costlier than a microcomputer but is not comparable to a mainframe in terms of productivity and range of functions.

MODEM
A telephone hookup device that converts computer signals so that they can be sent over telephone lines; this allows microcomputers to communicate with larger systems, such as time-sharing networks.

MOTHERBOARD
A printed **circuit** board with mounted connectors that serves as a connection point for **several** other printed circuit boards.

MULTI-USER SYSTEM
A computer system designed to be used by more than one person at a time. Contrast with: "single-user systems" or "personal computer".

MULTI-TASKING
A system running more than one process at any given time. For example Fortune Windows runs multi-tasking.

OPERATING SYSTEM
A series of programs, generally provided by the computer manufacturer as part of the computer system that controls the physical operations of the computer, such as printing and accepting input from the keyboard.

OUTPUT
Output is a general term applying to any situation in which the computer system supplies text or information to you (a user). Paper printout produced by a line printer is called "output"; the display resulting from a CAL (calendar) command is also called "output".

OUTPUT DEVICE
Any device capable of receiving information from a central processor. It may be some form of backing storage, or a peripheral unit which 'translates' information into another medium , eg a line printer or VDU.

PAL
Phase Alternate Line. This refers to one of two European standards for colour television broadcasting (the other is SECAM). It is also used in Australia and South Africa.

PARTITION
A collection of blocks of physical memory.

PASSWORD
A secret code associated with each username on a computer system. Usually only the user and one other person (the system owner or account manager) know the password for a particular account.

PERIPHERAL
A device, such as a video display screen, a printer used for displaying data, or for entering data into or retrieving it from the computer system.

PERMANENTLY ADDRESSABLE MEMORY
The portion of memory that is addressable at all times.

PHYSICAL ADDRESS
The drive is organized into physical groups of data:

1. Byte: Byte refers to an 8-bit data representation. A disk cannot usually address this small an element directly but manufacturer can specify a byte count, usually referenced from the start of index or start of a sector.

2. Sector: smallest uniquely addressable data group.

3. Track: A string of sectors on one surface which rotate under a single head.

4. Cylinder: A group of tracks. The maximum amount of data which can be accessed without seeking.

5. Head: Each surface has a dedicated device called a head, which is used to write and read the recorded data.

PHYSICAL MEMORY
The memory that is available to the system via the use of mapping techniques.

PHYSICAL MEMORY BLOCK
An area of physical memory that is 2K in length. The smallest area of memory that can be "mapped in".

PORT
The entry channel to a processor through which one or more devices capable of communication with the processor may be physically attached.

PORTABLE
This describes software that can be moved from one computer to another. Usually refers to source compatibility.

PRINTED CIRCUIT BOARD
A nonconductive construction that usually has conductive runs or wire attached to it or laminated on it, which may be drilled to facilitate the mounting of various electronic components.

PRINTER
Peripheral device available for output; produces "hardcopy" (printed paper copy) of information.

PROCESSOR
A device capable of receiving and manipulating data according to an externally or internally stored program.

PROM (Programmable Read-Only Memory)
Used to store program instruction routines that are used repeatedly by the processor (i.e., do not change).

PSOFT ERROR
A correctable error was found in the sector indicated during the first read. The test aborts and goes immediately to the next sector.

RAM (Random Access Memory)
An integrated circuit device capable of storing data or instructions.

REALTIME
A term referring to a system in which data is processed as soon as it is entered into the computer.

REGISTER
A term used to describe a unit of memory available for storing a group of bits or characters.

ROM (Read-Only Memory)
An integrated circuit that permanently stores program instructions.

RMA
Returned Materials Authorization. A form which allows a replacement for a damaged part or system to be sent before the customer has returned any merchandise.

SECTOR
Represents an area on the hard disk or flexible disk.

SEMICONDUCTOR
A material with a conductivity between that of a metal and an insulator; for example, silicon. It is used in the manufacture of solid-state devices such as diodes, transistors, and the complex integrated circuits that make up computer logic circuits.

<u>SESSION</u> (or On-line Session)
The term "session" is used to refer to any period of time spent interacting with a computer system.

<u>SHELL</u> (or The Shell)
"The Shell" is the name of the UNIX "command interpreter". The shell is a program that accepts commands from you and tries to act on them (interpret them).

<u>STAND-ALONE</u>
This describes software that can perform a certain function without the support of another program. For example, a payroll package may be described as stand-alone when it runs independently of a general-ledger package.

<u>SOFT ERROR</u>
Arrived at by the Fortune diagnostics (hd test). This means the WD controller recovered the data with ECC. This is actually a hard but recoverable error.

<u>TERMINAL</u>
A peripheral device through which information is entered into or extracted from the computer.

<u>TERMINATOR</u>
A 220/330 ohm resistor pack or 1k for drives w/expansion cabinet. The last drive in a daisy chain must be terminated with a 220/330 ohm resistor pack.

<u>TRACK ZERO</u>
The driver will always attempt to maintain the heads over the recording zone of the media (i.e., at or between track 0 and maximum track) in Fortune's case, track 0.

<u>THROUGHPUT</u>
A measure of the amount of work that can be accomplished by the computer during a given period of time.

<u>TIMESHARING</u>
A method for more than one person to use the computer simultaneously at separate terminals within a given period of time.

<u>TRACK</u>
An area on the hard disk or flexible disk, divided into sectors.

TRAILER BYTES
Two-byte overhead applied to the end of each record, used in conjunction with a two-byte header to indicate record length, delete, and lock status, and other record information. In order for the system to successfully read a record the header and trailer bytes must correspond.

TSOFT
A "True" soft error as defined by industry usage ie. The error did not occur upon retry.

TURNAROUND TIME
The measure of time between the initiation of a job and its completion by the computer.

WORKAROUND
An acceptable patch to an individual subassembly to ensure system reliability or a procedure to alleviate an error (i.e. Don't Do...)

WRITE CURRENT (CDC)
A logical 1 of the write gate signal enables the write driver and initiates recording of the contents of the write data lines onto the media.

## BOOTING UP MAINTENANCE MODE FROM FLOPPY

This procedure details the steps required to enter maintenance mode on volume 1 of the Single User FOR:PRO floppy disk set. This procedure assumes the hardware is functioning properly and that Volume 1 of the Single User FOR:PRO floppy disk set is not damaged.

This procedure is identical to the cold boot procedure up the step where the Cold Boot Menu (Press <F1> to erase the hard disk, etc.) is displayed.

The primary reason for booting into maintenance mode on the floppy disk is because the system is unable to boot up normally on the hard disk. In maintenance mode, many software problems preventing normal boot up can be diagnosed and overcome without cold booting, which can save time and data.

**Procedure:** There are two types of Maintenance Menus. The type in the machine you will be working with is determined by the level of MOMROMs installed in the 32:16. If the 32:16 has MOMROMs prior to the 1.8 level you will be presented with the old text style Menu (do all Section 1). If the computer has 1.8 or greater MOMROMs installed, you will see the new ICON Menu (do all Section 2).

### Section 1

1. Insert Volume 1 of the Single User FOR:PRO floppy disk set into the floppy disk drive, and close the door. Make sure a write protect tab is not present.

2. While holding down the <CANCEL/DEL> key, turn the power on or press the recessed hardware reset button on the front of the CPU. Continue to hold down the <CANCEL/DEL> key until the Maintenance Menu appears, then release the key. If the power-up count reaches the number 2, the Maintenance Menu has been passed, and this step must be repeated.

3. Once in Maintenance Menu, depress F4 and press the space bar four times or until "Floppy, Drive #Ø" is displayed, then press F7 and type in **"fdØ2/sa/reconf"**, press <RETURN> then <EXECUTE>. The system will resume counting (1 2 3) for a few seconds, and then display the Configuration Menu.

4. **The** Configuration Menu consists of fields and their related **values.** An incorrect entry in the following fields could cause problems with the operating system. They should be set as follows:

   **Max process size:** 256

   **Set params auto?:** YES

   **Appx. # of users:** This field must be set to the number of terminals (including the console) that are connected to the system. A modem used for outside users to dial up the system is the same as a terminal.

   If these settings are acceptable then proceed to step 5. Otherwise, press <RETURN> until the cursor is in the proper field and make the appropriate changes. Once the settings are correct, press the <F1> function key to permanently store these changes and continue on with the rest of this procedure.

5. Press <RETURN> to move the cursor down to the **Root device** field, and type:

   **fd02** <RETURN>

6. Press <RETURN> to move the cursor down to the **Swap device** field, and type:

   **fd01** <RETURN>

7. Press <RETURN> until the cursor is in the **Appx. # of users** field. You must temporarily set this field to '1'. This will speed up the execution of this procedure.

8. Press <F3>. This will make the system power-up with the screen values without altering the desired normal settings which reside in the EAROM.

9. The screen will clear, and display the prompt "boot:" (or something similar) in the upper left hand corner. Type:

   **fd02/unix** <RETURN>

10. The power-up count sequence will resume, until the Cold Boot Menu appears (see below). This is where this procedure deviates from the normal Cold Boot procedure.

    **Cold boot Release 1.8**
    **Select a function key:**

    | | |
    |---|---|
    | **<F1>** | **To completely erase and reload you disk** |
    | **<F3>** | **To retry starting up the system as specified in Maintenance Screen** |
    | **....** | **(Anything typed in will be executed as a maintenance mode command)** |

    **Select:**

    *NOTE*
    DO NOT PRESS THE <F1>KEY

11. Pressing the <F1> key will completely erase the hard disk. Instead, type:

    **cd /etc** <RETURN>

    This will drop you into Maintenance Mode, running the Bourne shell, which will prompt you with a '#'. You now reside in the directory which contains the 'mount' and 'umount' commands, used for accessing information on a floppy disk.

    It is further suggested that no maintenance mode commands be entered until a hard disk file system check has been performed. Refer to Appendix D, for explanation of the 'fsck' command used to perform the file system check.

    At this point, a variety of diagnostic and corrective procedures can be done.

    After completion of your work, proceed to next step.

12. Be sure to unmount any filesystems that you may have mounted. For example, /dev/hd02 on /h. Then type:

    **sync** <RETURN>
    **sync** <RETURN>

    This command will write any recently updated information to the hard disk. Wait 10 seconds and reset system. Be sure that you reset before you remove floppy disk. If everything went well the system will proceed normally, booting off the hard disk.

    Procedure is now complete!

## Section 2

1. Insert Volume 1 of the Single User FOR:PRO floppy disk set into the floppy disk drive, and close the door. Make sure a write protect tab is not present.

2. While holding down the <CANCEL/DEL> key, turn the power on or press the recessed hardware reset button on the front of the CPU. Continue to hold down the <CANCEL/DEL> key until the ICON Menu appears, then release the key. If the power-up count reaches the number 2, the ICON Menu has been passed, and this step must be repeated.

3. Once in ICON Maintenance Menu, press <RETURN> twice until the two zero's are located underneath the diskette drive portion of the ICON. Press <EXECUTE> and **"fd02/sa/reconf"** will appear on ICON screen. If for some reason "fd02/sa/reconf" is not shown, type **"fd02/sa/reconf"** and press <EXECUTE>. The system will resume counting (1 2 3) for a few seconds, and then display the Configuration Menu.

4. The Configuration Menu consists of fields and their related values. An incorrect entry in the following fields could cause problems with the operating system. They should be set as follows:

   **Max process size:** 256

   **Set params auto?:** YES

   **Appx. # of users:** This field must be set to the number of terminals (including the console) that are connected to the system. A modem used for outside users to dial up the system is the same as a terminal.

If these settings are acceptable, press the <F5> function key. This will set the Configuration Menu to boot from the flexible disk. Otherwise, press <RETURN> until the cursor is in the proper field and make the appropriate changes. Once the settings are correct, press the <F1> function key to permanently store these changes, then press the <F5> function key.

5. The power-up count sequence will resume, until the Cold Boot Menu appears (see below). This is where this procedure deviates from the normal Cold Boot procedure.

**Cold boot Release 1.8**
**Select a function key:**

| | |
|---|---|
| **<F1>** | **To completely erase and reload you disk** |
| **<F3>** | **To retry starting up the system as specified in Maintenance Screen** |
| **....** | **(Anything typed in will be executed as a maintenance mode command)** |

**Select:**

*NOTE*
DO NOT PRESS THE <F1>KEY

6. Pressing the <F1> key will completely erase the hard disk. Instead, type:

**cd /etc** <RETURN>

This will drop you into Maintenance Mode, running the Bourne shell, which will prompt you with a '#'. You now reside in the directory which contains the 'mount' and 'umount' commands, used for accessing information on a floppy disk.

It is further suggested that no maintenance mode commands be entered until a hard disk file system check has been performed. Refer to Appendix D, for explanation of the 'fsck' command used to perform the file system check.

At this point, a variety of diagnostic and corrective procedures can be done.

After completion of your work, proceed to next step.

7. Be sure to leave filesystem mounted and type full path name from hard disk. For example type:

**/h/bin/sync** <RETURN>
**/h/bin/sync** <RETURN>

This command will write any recently updated information to the hard disk. Now unmount the filesystem, wait 10 seconds and reset system. Be sure that you reset, before you remove floppy disk. If everything went well the system will proceed normally, booting off the hard disk.

Procedure is now complete!

## Rebuilding Configuration Block

There are two things you need to know before rebuilding the 'Conf Block'. The number of swap units the system was set up for and any 'Bad Blocks' that were spared in the original 'Conf Block'. It is advised that on any systems you sell or do **service** on, you do the command **rdconf /dev/hd00** and record the information concerning bad blocks that are spared and the size of the partitions **BEFORE ANY PROBLEMS OCCUR**, so that if the following procedures are required you will have all the information you need.

**Only proceed to rebuild the configuration block if you had recorded the bad blocks and number of swap units.**

**NOTE**

In the following write-up, all references to 'disk type' will be 'XYY'. You should now substitute the correct value for the disk type you are working with (i.e. C20, J20, J30, M45, etc....).

PROCEDURE: Start a normal 'Cold Boot' (see Appendix A), bringing the system all the way to the menu that asks you to select F1, F2, or F3 to reload the system. You will note that the last message says that anything else will be treated as a 'maintenance mode' command. At this point enter:
**cd /etc <return>**

This will cause the system to change the working directory to /etc and return with the # prompt. At this time enter:
**dskselect XYY <return>** Example: Use C20 for XYY if you have a 20meg system.

A menu will appear asking you to select a disk type. Enter the number that corresponds to the drive type in your system. Example: **10 <return>** for a C20 system.
You will now enter:
**mkconf -i XYY /dev/hd00 <return>**

The 'Configuration Block' will now begin to appear on the CRT with '?' prompts. Press the <return> to enter the default value until you get the question 'Number of Spare Blocks = 0'?, at this point enter:
**46 <return>**

The system will respond with:
**Enter map for spares (#, bad, diag, free or done):**

**Spare 0 (block 3) = diag?**
**Spare 1 (block 4) = diag?**
**Spare 2 (block 5) = diag?**
**Spare 3 (block 6) = bad?**

The system will now be set to spare any known bad blocks, and will return the message 'Spare 0 (Block 3)= free ?' At this point enter **diag** for the first three entries (Spare 0, 1, 2). If you have any known bad blocks you would enter the **first** bad block number at 'Spare 3 (block 6) = ?' and hit <return>. You would continue to do this for all bad blocks. If there are no bad blocks or when you have entered all known bad blocks, you will enter '**bad**' for the remainder of the spares entries. When you make the last entry, the system will automatically write the new 'Conf Block' to the rigid disk. The disk now has a 'Conf Block' for a one (1) user system.

If the system was formatted for a 3 or 5 user system, do the following command:
**mkconf -U * /dev/hd00 <return>**

Where * is the number of swap units (i.e. 3 or 5). You should now check the 'Conf Block' by doing the following command:
**rdconf /dev/hd00 <return>**

If all went well, you should have a working hard disk at this point. Do a file system check to verify system file integrity, enter:
**fsck /dev/hd02 <return>**

The file system check should run error free. If not, you have file damage and a cold boot may be in order. Enter the following commands to prevent writing on the floppy:

**sync <return>** If sync is not found then wait 30 seconds before
**sync <return>** you continue.

Next rebuild the Boot Program. This should be done to insure proper boot up.

**NOTE: THE FOLLOWING COMMAND IS DONE TWO DIFFERENT WAYS DEPENDING ON THE OPERATING SYSTEM BEING USED. THE FIRST WILL BE FOR PRE-1.8.1.1 O.S. AND THE SECOND WILL BE FOR 1.8.1.1 AND UP.**

PROCEDURE: Start by typing in the following commands:
**bootcp /sa/boot /dev/rhd00 0 <return>** (PRE-1.8)
or
**bootcp /dev/rfd00 /dev/rhd00 0 <return>**(1.8 and Up)

The system will now write the 'Boot' program from floppy to the hard disk and return the # prompt. You will then enter:

**sync <return>** If sync is not found, wait 30 second before you
**sync <return>**

Now you may turn off the system, wait 10 seconds, then power up in the normal fashion or push the reset button.

**NOTE**

If when you entered **bootcp......** the system returned the message **bootcp; not found,** enter the following command:
**dd if=/sa/boot of=/dev/hd00 bs=512 seek=* <return>**
Then proceed as above. For the * parameter use the starting block number of the boot 0 program. This information is available in the configuration block. The "Boot 0 begins at" message gives the starting block number that should be used for this parameter. To see the configuration block enter:
**rdconf /dev/hd00 <return>**

## Sparing Bad Block

PROCEDURE: Start a normal 'Cold Boot' bringing the system all the way to the menu that asks you to select F1, F2, or F3 to reload the system. You will note that the last message says that anything else will be treated as a 'maintenance mode' command. At this point enter:
**cd /etc <return>**

This will cause the system to change the working directory to /etc and return with the # prompt. At this time enter:
**mkconf -i /dev/hd00 /dev/hd00 <return>**

The 'Configuration Block' will now begin to appear on the CRT with '?' prompts. Press the <return> to enter the default value until you get the question 'Number of Spare Blocks = 46'?, at this point enter:
**46 <return>**

The system will respond with:
**Enter map for spares (#, bad, diag, free or done):**

```
        Spare 0 (block 3) = diag?
        Spare 1 (block 4) = diag?
        Spare 2 (block 5) = diag?
        Spare 3 (block 6) = bad?
```

At this point we can start sparing bad blocks. Enter the bad block number followed by <return> at the first spare entry that ends in 'Bad?'. Repeat this for all known bad blocks. After entering all bad block numbers enter:
**done <return>** at the next spare entry.

Now do **rdconf /dev/hd00 <return>** and check the configuration block. It should now show the bad block as being spared out. Enter:

| | |
|---|---|
| **sync <return>** | If sync is not found then wait 30 seconds before |
| **sync <return>** | you continue. |

**NOTE**
You can also spare bad block using hdtest of diagnostics.

# FSCK ERROR CONDITIONS
(copy of appendix to AT&T Bell Labs FSCK document)

## CONVENTIONS

Fsck is a multi-pass file system check program. Each file system pass invokes a different phase of the fsck program. After the initial setup, fsck performs successive phases over each file system, checking blocks and sizes, path-names, connectivity, reference counts, and the free-block list (possibly rebuilding it), and performs some cleanup.

When an inconsistency is detected, fsck reports the error condition to the operator. If a response is required, fsck prints a prompt message and waits for a response. This document explains the meaning of each error condition, the possible responses, and the related error conditions.

The error conditions are organized by the phase of the fsck program in which they can occur. The error conditions that may occur in more than one phase will be discussed in initialization.

## INITIALIZATION

Before a file system check can be performed, certain tables have to be set up and certain files opened. This section concerns itself with the opening of files and the initialization of tables. This section lists error conditions resulting from command line options, memory requests, opening of files, status of files, file system size checks, and creation of the scratch file.

**C option ?**

C is not a legal option to fsck; legal options are -y, -n, -s, -S, and -t. Fsck terminates on this error condition.

**Bad -t option**

The -t option is not followed by a file name. Fsck terminates on this error condition.

**Invalid -s argument, defaults assumed**

The -s option is not suffixed by 3, 4, or blocks-per-cylinder and blocks-to skip. Fsck assumes a default value of 400 blocks-per cylinder and 9 blocks-to-skip.

**Incompatible options -n and -s**

It is not possible to salvage the free-block list without modifying the file system. Fsck terminates on this error condition.

**Can't get memory**

Fsck's request for memory, for its virtual memory tables failed. This should never happen. Fsck terminates on this error condition.

**Can't open checklist file: F**

The default file system checklist, file F (usually /etc/checklist) cannot be opened for reading. Fsck terminates on this error condition. Check access modes of F.

**Can't stat root**

Fsck's request for statistics about the root directory "/" failed. This should never happen. Fsck terminates on this error condition.

**Can't stat F**

Fsck's request for statistics about the file system F failed. It ignores this file system and continues checking the next file system given. Check access modes of F.

**F is not a block or character device; (OK)**

You have given fsck a regular file name by mistake. It ignores this file system and continues checking the next file system given. Check the file type of F.

**Can't open F**

The file system F cannot be opened for reading. It ignores this file system and continues checking the next file system given. Check access modes of F.

**Size check: fsize X isize Y**

More blocks are used for the inode list Y than there are blocks in the file system X, or there are more than 65,535 inodes in the file system. It ignores this file system and continues checking the next file system given.

**Can't create F**

Fsck's request to create a scratch file F failed. It ignores this file system and continues checking the next file system given. Check access modes of F.

**CAN NOT SEEK: BLK B (CONTINUE)**

Fscks's request for moving to a specified block number B in the file system failed. This should never happen.

Possible responses to the CONTINUE prompt are:

<F1> = YES Attempt to continue to run the file system check. Often, however the problem will persist. This error condition will not allow a complete check of the file system. A second run of fsck should be made to recheck this file system. If the block was part of the virtual memory buffer cache, fsck will terminate with the message "Fatal I/O error".
<F2> = YES Terminate the program.

**CAN NOT READ: BLK B (CONTINUE)**

Fscks's request for reading a specified block number B in the file system failed. This should never happen.

Possible responses to the CONTINUE prompt are:

<F1> = YES Attempt to continue to run the file system check. Often, however the problem will persist. This error condition will not allow a complete check of the file system. A second run of fsck should be made to recheck this file system. If the block was part of the virtual memory buffer cache, fsck will terminate with the message "Fatal I/O error".
<F2> = NO Terminate the program.

**CAN NOT WRITE: BLK B (CONTINUE)**

Fscks's request for writing a specified block number B in the file system failed. The disk may be write-protected.

Possible responses to the CONTINUE prompt are:

<F1> = YES Attempt to continue to run the file system check. Often, however the problem will persist. This error condition will not allow a complete check of the file system. A second run of fsck should be made to recheck this file system. If the block was part of the virtual memory buffer cache, fsck will terminate with the message "Fatal I/O error".
<F2> = NO Terminate the program.

## PHASE 1: CHECK BLOCKS AND SIZES

This phase concerns itself with the inode list. This section lists error conditions resulting from checking inode types, setting up the zero-link-count table, examining inode block numbers for bad or duplicate blocks, checking inode size, and checking inode format.

**UNKNOWN FILE TYPE I=I (CLEAR)**

The mode word of the inode I indicates that the inode is not a special block inode, special character inode, regular inode, or directory inode.

Possible responses to the CLEAR prompt are:

<F1> = YES    De-allocate inode I by zeroing its contents. This will always invoke the UNALLOCATED error condition in phase 2 for each directory entry pointing to this inode.
<F2> = NO    Ignore this error condition.

**LINK COUNT TABLE OVERFLOW (CONTINUE)**

An internal table for fsck containing allocated inodes with a link count of zero has no more room.

Possible responses to the CONTINUE prompt are:

<F1> = YES    Continue with the program. This error condition will not allow a complete check of the file system. A second run of fsck should be made to recheck this file system. If another allocated inode with a zero link count is found, this error condition is repeated.
<F2> = NO    Terminate the program.

**B BAD I=I**

Inode I contains block number B with a number lower than the number of the first data block in the system or greater than the number of the last block in the file system. This error condition may invoke the EXCESSIVE BAD BLKS error condition in phase 1 if inode I has too many block numbers outside the file system range. This error condition will always invoke the BAD/DUP error condition in phase 2 and phase 4.

**EXCESSIVE BAD BLKS I=I (CONTINUE)**

There is more than a tolerable number (usually 10) of blocks with a number lower than the number of the first data block in the system or greater than the number of the last block in the file system associated with inode I.

Possible responses to the CONTINUE prompt are:

<F1> = YES — Ignore the rest of the blocks in this inode and continue checking with the next inode in the file system. This error condition will not allow a complete check of the file system. A second run of fsck should be made to recheck this file system.
<F2> = NO — Terminate the program.

**B DUP I=I**

Inode I contains block number B which is already claimed by another inode. This error condition may invoke th EXCESSIVE DUP BLKS error condition in Phase 1 if inode I has too many block numbers claimed by other invokes. This error condition will always invoke Phase 1b and the BAD/DUP error condition in Phase 2 and Phase 4.

**EXCESSIVE DUP BLKS I=I (CONTINUE)**

There is more than a tolerable number (usually 10) of blocks claimed by other inodes.

Possible responses to the CONTINUE prompt are:

<F1> = YES — Ignore the rest of the blocks in this inode and continue checking with the next inode in the file system. This error condition will not allow a complete check of the file system. A second run of fsck should be made to recheck this file system.
<F2> = NO — Terminate the program.

**DUP TABLE OVERFLOW (CONTINUE)**

An internal table in fsck containing duplicate block numbers has no more room.

Possible responses to the CONTINUE prompt are:

<F1> = YES — Continue with the program. This error condition will not allow a complete check of the file system. A second run of fsck should be make to recheck this file system. If another allocated inode with a zero link count is found, this error condition is repeated.
<F2> = NO — Terminate the program.

**POSSIBLE FILE SIZE ERROR I=I**

The inode I size does not match the actual number of blocks used by the inode. This is only a warning.

**DIRECTORY MISALIGNED I=I**

The size of a directory inode is not a multiple of the size of a directory entry (usually 16). This is only a warning.

**PARTIALLY ALLOCATED INODE I=I (CLEAR)**

Inode I is neither allocated nor unallocated.

Possible responses to the CLEAR prompt are:

| | |
|---|---|
| <F1> = YES | De-allocate inode I by zeroing its contents. |
| <F2> = NO | Ignore this error condition. |

**PHASE 1B: RESCAN FOR MORE DUPS**

When a duplicate block is found in the file system, the file system is rescanned to find the inode which previously claimed that block. This section lists the error condition when the duplicate block is found.

**B DUP I=I**

Inode I contains block number B which is already claimed by another inode. This error condition will always invoke the BAD/DUP error condition in phase 2. You can determine which inodes have overlapping blocks by examining this error condition and the DUP error condition in phase 1.

**PHASE 2: CHECK PATH NAMES**

This phase concerns itself with removing directory entries pointing to error conditioned inodes from phase 1 and phase 1b. This section lists error conditions resulting from root inode mode status, directory inode pointers in range, and directory entries pointing to bad inodes.

**ROOT INODE UNALLOCATED. TERMINATING.**

The root inode (usually inode number 2) has no allocate mode bits. This should never happen. The program will terminate.

**ROOT INODE NOT DIRECTORY (FIX)**

The root inode (usually inode number 2) is not directory inode type.

Possible responses to the FIX prompt are:

<F1> = YES Replace the root inode's type to be directory blocks. If the root inode's data blocks are not directory blocks, a very large number of error conditions will be produced.
<F2> = NO Terminate the program.

**DUPS/BAD IN ROOT INODE (CONTINUE)**

Phase 1 or phase 1b have found duplicate blocks or bad blocks in the root inode (usually inode number 2) for the file system.
Possible responses to the CONTINUE prompt are:

<F1> = YES Ignore the DUPS/BAD error condition in the root inode and attempt to continue to run the file system check. If the root inode is not correct, then this may result in a large number of other error conditions.
<F2> = NO Terminate the program.

**I OUT OF RANGE I=I NAME=F (REMOVE)**

A directory entry F has an inode number I which is greater than the end of the inode list.

Possible responses to the REMOVE prompt are:

<F1> = YES The directory entry F in removed.
<F2> = NO Ignore this error condition.

**UNALLOCATED I=I OWNER=O MODE=M SIZE=S MTIME=T NAME=F (REMOVE)**

A directory entry F has an inode I without allocate mode bits. The owner O, mode M, size S, modify time T, and file name F are printed.

Possible responses to the REMOVE prompt are:

<F1> = YES The directory entry F in removed.
<F2> = NO Ignore this error condition.

**DUP/BAD I=I OWNER=O MODE=M SIZE=S MTIME=T DIR=F (REMOVE)**

Phase 1 or phase 1b have found duplicate blocks or bad blocks associated with directory entry F, directory inode I. The owner O, mode M, size S, modify time T, and directory name F are printed.

Possible responses to the REMOVE prompt are:

<F1> = YES  The directory entry F in removed.
<F2> = NO  Ignore this error condition.

**DUP/BAD I=I OWNER=O MODE=M SIZE=S MTIME=T FILE=F (REMOVE)**

Phase 1 or phase 1b have found duplicate blocks or bad blocks associated with directory entry F, inode I. The owner O, mode M, size S, modify time T, and file name F are printed.

Possible responses to the REMOVE prompt are:

<F1> = YES  The directory entry F in removed.
<F2> = NO  Ignore this error condition.

**PHASE 3: CHECK CONNECTIVITY**

This phase concerns itself with the directory connectivity seen in phase 2. The section lists error conditions resulting from unreferenced directories, and missing or full lost+found directories.

**UNREF DIR I=I OWNER=O MODE=M SIZE=S MTIME=T (RECONNECT)**

The directory inode I was not connected to a directory entry when the file system was traversed. The owner O, mode M, size S, and modify time T of directory inode I are printed.

Possible responses to the RECONNECT prompt are:

<F1> = YES  Reconnect directory inode I to the file system in the directory for lost files (usually lost+found). This may invoke the connecting directory inode I to lost+found. This may also invoke the CONNECTED error condition in phase 3 if the link was successful.
<F2> = NO  Ignore this error condition. This will always invoke the UNREF error condition in Phase 4.

**SORRY. NO lost+found DIRECTORY**

There is no lost+found directory in the root directory of the file system. Fsck ignores the request to link a directory in lost+found. This will always invoke the UNREF error condition in phase 4. Check access modes of lost+found.

**SORRY. NO SPACE IN lost+found DIRECTORY**

There is no space to add another entry to the lost+found directory in the root directory of the file system; fsck ignores the request to link a directory in lost+found. This will always invoke the UNREF error condition in Phase 4. Clean out unnecessary entries in lost+found directory.

**DIR I=I1 CONNECTED. PARENT WAS I=I2**

This is an advisory message indicating a directory inode I1 was successfully connected to the lost+found directory. The parent inode I2 of the directory inode I1 is replaced by the inode number of the lost+found directory.

**PHASE 4:CHECK REFERENCE COUNTS**

This phase concerns itself with the link count information seen in phase 2 and Phase 3. This section lists error conditions resulting from unreferenced files, missing or full lost+found directory, incorrect link count for files, directories or special files, unreferenced files and directories, bad and duplicate blocks in files and directories, and incorrect total free-inode counts.

**UNREF FILE I=I OWNER=O MODE=M SIZE=S MTIME=T (RECONNECT)**

Inode I was not connected to a directory entry when the file system was traversed. The owner O, mode M, size S, modify time T of inode I are printed.

Possible responses to the RECONNECT prompt are:

<F1> = YES Reconnect inode I to the file system in the directory for lost files (usually lost+found). This may invoke the lost+found error condition in phase 4 if there are problems connecting inode I to lost+found.

<F2> = NO Ignore this error condition. This will always invoke the CLEAR error condition in phase 4.

**SORRY. NO lost+found DIRECTORY**

There is no lost+found directory in the root directory of the file system. Fsck ignores the request to link a directory in lost+found. This will always invoke the UNREF error condition in phase 4. Check access modes of lost+found.

**SORRY. NO SPACE IN lost+found DIRECTORY**

There is no space to add another entry to the lost+found directory in the root directory of the file system; fsck ignores the request to link a file in lost+found. This will always invoke the CLEAR error condition in Phase 4. Check size and contents of lost+found.

**(CLEAR)**

The inode mentioned in the immediately previous error condition can not be reconnected.

Possible responses to the CLEAR prompt are:

<F1> = YES   De-allocate the inode mentioned in the immediately previous error condition by zeroing its contents.
<F2> = NO   Ignore this error condition.

**LINK COUNT FILE I=I OWNER=O MODE=M SIZE=S MTIME=T COUNT=X SHOULD BE Y (ADJUST)**

The link count for inode I which is a file, is X but should be Y. The owner O, mode M, size S, and modify time T are printed.

Possible responses to the ADJUST prompt are:

<F1> = YES   Replace the link count of file inode I with Y.
<F2> = No   Ignore this error condition.

**LINK COUNT DIR I=I OWNER=O MODE=M SIZE=S MTIME=T COUNT=X SHOULD BE Y (ADJUST)**

The link count for inode I which is a directory, is X but should be Y. The owner O, mode M, size S, and modify time T are printed.

Possible responses to the ADJUST prompt are:

<F1> = YES   Replace the link count of directory inode I with Y.
<F2> = No   Ignore this error condition.

**LINK COUNT F I=I OWNER=O MODE=M SIZE=S MTIME=T COUNT=X SHOULD BE Y (ADJUST)**

The link count for F inode I which is X but should be Y. The name F, owner O, mode M, size S, and modify time T are printed.

Possible responses to the ADJUST prompt are:

<F1> = YES    Replace the link count of directory inode I with Y.

<F2> = No    Ignore this error condition.

**UNREF FILE I=I OWNER=O MODE=M SIZE=S MTIME=T (CLEAR)**

Inode I which is a file, was not connected to a directory entry when the file system was traversed. The owner O, mode M, size S, and modify time T of inode I are printed.

Possible responses to the CLEAR prompt are:

<F1> = YES    De-allocate inode I by zeroing its contents

<F2> = No    Ignore this error condition.

**UNREF DIR I=I OWNER=O MODE=M SIZE=S MTIME=T (CLEAR)**

Inode I which is a directory, was not connected to a directory entry when the file system was traversed. The owner O, mode M, size S, and modify time T of inode I are printed.

Possible responses to the CLEAR prompt are:

<F1> = YES    De-allocate inode I by zeroing its contents

<F2> = No    Ignore this error condition.

**BAD/DUP FILE I=I OWNER=O MODE=M SIZE=S MTIME=T (CLEAR)**

Phase 1 or phase 1b have found duplicate blocks or bad blocks associated with file inode I. The owner O, mode M, size S, and modify time T of inode I are printed.

Possible responses to the CLEAR prompt are:

<F1> = YES    De-allocate inode I by zeroing its contents

<F2> = No    Ignore this error condition.

**BAD/DUP DIR I=I OWNER=O MODE=M SIZE=S MTIME=T (CLEAR)**

**Phase** 1 or phase 1b have found duplicate blocks or bad blocks associated with directory inode I. The owner O, mode M, size S, and modify time T of inode I are printed.

Possible responses to the CLEAR prompt are:

| | |
|---|---|
| <F1> = YES | De-allocate inode I by zeroing its contents |
| <F2> = No | Ignore this error condition. |

**FREE INODE COUNT WRONG IN SUPERBLOCK (FIX)**

The actual count of free inodes does not match the count in the super-block of the file system.

Possible responses to the FIX prompt are:

| | |
|---|---|
| <F1> = YES | Replace the count in the super-block by the actual count. |
| <F2> = NO | Ignore this error condition. |

**PHASE 5: CHECK FREE LIST**

This phase concerns itself with the free-block list. This section lists error conditions resulting from bad blocks in the free-block list, bad free-blocks count, duplicate blocks in the free-block list, unused blocks from the file system not in the free-block list, and the total free-block count incorrect.

**EXCESSIVE BAD BLKS IN FREE LIST (CONTINUE)**

The free-block list contains more than a tolerable number (usually 10) of blocks with a value less than the first data block in the file system or greater than the last block in the file system.

Possible responses to the CONTINUE prompt are:

| | |
|---|---|
| <F1> = YES | Ignore the rest of the free-block list and continue the execution of fsck. This error condition will always invoke the BAD BLKS IN FREE LIST error condition in Phase 5. |
| <F2> = NO | Terminate the program. |

**EXCESSIVE DUP BLKS IN FREE LIST (CONTINUE)**

The free-block list contains more than a tolerable number (usually 10) of blocks claimed by inodes or earlier parts of the free-block list.

Possible responses to the CONTINUE prompt are:

<F1> = YES    Ignore the rest of the free-block list and continue the execution of fsck. This error condition will always invoke the DUP BLKS IN FREE LIST error condition in Phase 5.
<F2> = NO    Terminate the program.

**BAD FREEBLK COUNT**

The count of free blocks in a free-list block is greater than 50 or less than zero. This error condition will always invoke the BAD FREE LIST condition in Phase 5.

**X BAD BLKS IN FREE LIST**

X blocks in the free-block list have a block number lower than the first data block in the file system or greater than the last block in the file system. This error condition will always invoke the BAD FREE LIST condition in Phase 5.

**X DUP BLKS IN FREE LIST**

X blocks claimed by inodes or earlier parts of the free-list block were found in the free- block list. This error condition will always invoke the DUP FREE LIST CONDITION IN PHASE 5.

**X BLK(S) MISSING**

X blocks unused by the file system were not found in the free-block list. This error condition will always invoke the BAD FREE LIST condition in Phase 5.

**FREE BLK COUNT WRONG IN SUPERBLOCK (FIX)**

The actual count of free blocks does not match the count in the super-block of the file system.

Possible responses to the FIX prompt are:

<F1> = YES    Replace the count in the super-block by the actual count.
<F2> = NO    Ignore this error condition.

**BAD FREE LIST (SALVAGE)**

Phase 5 has found bad blocks in the free-block list, duplicate blocks in the free-block list, or blocks missing from the file system.

Possible responses to the SALVAGE prompt are:

| | |
|---|---|
| <F1> = YES | Replace the actual free-block list with a new free-block list. The new free-block list will be ordered to reduce time spent by the disk waiting for the disk to rotate into position. |
| <F2> = NO | Ignore this error condition. |

**PHASE 6: SALVAGE FREE LIST**

This phase concerns itself with the free-block list reconstruction. This section lists error conditions resulting from the blocks-to-skip and blocks-per-cylinder values.

**Default free-block list spacing assumed**

This is an advisory message indicating the blocks-to-skip is greater than the blocks-per-cylinder, the blocks-to-skip is less than one, the blocks-per-cylinder is less than one, or the blocks-per-cylinder is greater then 500. The default values of 9 blocks-to-skip and 400 blocks-per-cylinder are used.

**CLEANUP**

Once a file system has been checked, a few cleanup functions are performed. This section lists advisory messages about the file system and modify status of the file system.

**X files Y blocks Z free**

This is an advisory message indicating that the file system checked contained X files using Y blocks leaving Z blocks free in the file system.

******* BOOT UNIX (NO SYNC!) *******

This is an advisory message indicating that a mounted file system or the root file system has been modified by fsck. If UNIX is not rebooted immediately, the work done by fsck may be undone by the in-core copies of tables UNIX keeps.

******* FILE SYSTEM WAS MODIFIED *******

This is an advisory message indicating that the current file system was modified by fsck. If this file system is mounted or is the current root file system, fsck should be halted and UNIX rebooted immediately, the work done by fsck may be undone by the in-core copies of tables UNIX keeps.