WANG

5103

OFFICE INFORMATION SYSTEMS

Models:

OIS 140 (Model 6540)
OIS 145 (Model 6545)

Customer Engineering
Product Maintenance Manual

741-0664

PREFACE

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with instructions to operate, troubleshoot and repair Wang Office Information Systems 140 (Model 6540) and 145 (Model 6545).

Third Edition (July 1984)

This reprint of Document 729-0664-A is identified by a new converted document number (741-0664) and incorporates the following: Document 729-0664, Addendums 729-0664-1 through 729-0664-6, Product Service Notices (PSN's) 729-0986 and 729-1111, and Publication Update Bulletin (PUB) 729-0664-A1. The material in this document may be used only for the purpose stated in the Preface. Updates and/or changes to this document will be published as PUB's or subsequent editions.

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CHAPTER 1

INTRODUCTION

1.1 SCOPE AND PURPOSE

This publication concerns the Office Information Systems 140 and 145, (OIS 140/145) and provides field personnel with the information necessary to:

A. Understand the functions of the principle parts of the system and all the relationships and interactions among these parts

B. Unpack and install the system

C. Perform preventive maintenance procedures

D. Perform diagnostic tests

E. Analyze failure indications

F. Replace failed assemblies

A block-level description of the printed circuit boards internal to the Master Unit is presented in Chapter 8, "Theory of Operation". This document also serves as a reference to those publications necessary for the installation and maintenance of optional peripherals and accessories.

This manual is written for Customer Engineering personnel with a background in WANG word processing. Familiarity with OIS 140 and 145 systems and the HAWK, Phoenix, and 300 Meg SMD disk drives is essential for effective use of this manual.

1.2 ORGANIZATION

This manual describes the 140 and 145 Office Information Systems. Throughout this manual, all statements pertaining to both the OIS 140 and 145 systems will be identified as such by references to the collective 'OIS 140/145 System'. In cases where the two systems differ, the references will be qualified to explicitly indicate one system apart from the other. That is to say, whenever the phrase 'OIS 140' or 'OIS 145' stands alone, the ensuing statement applies to that system only.

The OIS 145 is essentially the same as the OIS 140 System, with the exception of the System Disk. The 145 is equipped with a 300 Megabyte Storage Module Drive (300 Meg SMD) as its System Disk, while the 140 System contains a 96 Meg 'Phoenix' Cartridge Module Drive (96 Meg CMD), sold in three different storage capacities.

In accordance with the stated scope and purpose, this manual is arranged into 8 chapters:

CHAPTER 1	INTRODUCTION
CHAPTER 2	SYSTEM DESCRIPTION
CHAPTER 3	INSTALLATION
CHAPTER 4	CONTROLS AND INDICATORS
CHAPTER 5	MAINTENANCE
CHAPTER 6	TROUBLESHOOTING
CHAPTER 7	REPAIR
CHAPTER 8	THEORY OF OPERATION

This manual is further organized and arranged so that all information pertaining to a task or subject is complete on a single page. Obviously, more than one page is required for complicated and difficult subjects. In these instances, all the information written at "page level" is presented on that page; references are given for further details. The referenced material is also organized in the same fashion.

That is to say: when the CE has completed a page, he/she has completed the task described on that page; there is no more to be done. If the CE is not familiar with, or needs detailed information about, some item on that page he/she is referenced to a page which details that item (the details also being complete on one page). This arrangement allows the experienced CE to quickly run through all the steps in a task without being slowed by details with which he/she is already familiar. At the same time, all the details needed by a CE less familiar with the product are also available.

In order to reduce endless paging back-and-forth, the manual is arranged so that once the CE has gone to the detailed portion of the manual, he/she can remain there and proceed from one detailed page to another. Of course, if the CE only needed additional information on one item, he/she is better advised to return to the "higher level" procedures and continue from there.

1.3 RELATED DOCUMENTATION

MISCELLANEOUS

Systems Installation Guide for VS, 2200, WP/OIS Systems	(729-0907)
Site Preparation Guide	(700-5978)
OIS Supervisor Procedures Manual	(700-5562C)
OIS Supervisor Quick Reference Guide	(700-5741C)

CRT WORKSTATION (Models 5536-2,-3,-4)

Models 5536-1/-2/-3/-4 Workstations, WPNL No.81.	(729-0522)
Model 5536 Series Workstation PMM	(729-0522A)

PHOENIX CMD DISK DRIVE (Model 6580)

CDC CMD Hardware Maintenence Manual	(729-0198A)
Wang Cartridge Module Disk Drive Manual	(729-0199)
Cartridge Module Drive (Block Point 4) Manual	(729-1063)
Wang CMD Addendum 2	(729-0199-2)

CDC SMD DISK DRIVES (80 MB, 300 MB)

CDC OEM Service Manual	(729-0210)
CDC SMD Hardware Maintenance Manual	(729-0221)
CDC SMD Hardware Reference Manual	(729-0222)

HAWK CDC DISK DRIVE (Model 6560)

CDC HAWK Field Maintenance Manual	(729-0884)
Wang/CDC HAWK Disk Drive Manual	(729-0181)

SHUGART FLOPPY DISKETTE DRIVE (Model SA901)

Shugart Disk System, Service Bulletin No. 46.2	(729-0115)
PSN-2 Shugart SA901	(729-0122)

OPTIONAL PERIPHERALS

Product Maintenance Manual: Wang Daisy Printers	(729-0372A)
Archiving Workstation - Service Information, WPNL #77	(729-0521)
Mag-Card Reader for WPS, WPNL #78	(729-0545)
Model 61/62 Matrix Printer Maintenance Manual	(729-0339)
Model 44, 48 Phototypesetter	(729-0465)
Image Printer Maintenance Manual	(729-0447)
Model 5538 Twin Sheet Feeder (TSF) Installation & Adjustment Manual	(729-0549)
Envelope Feeder (EF) Product Maintenance Manual	(729-0873)
WISE Model 6550-1 PMM	(729-0906)
TCB-1 TC Controller Self Study Workbook	(729-1057)

1.4 TOOLS AND EQUIPMENT

1.4.1 RECOMMENDED TEST EQUIPMENT / TOOL LIST

OIS installation, repair, and maintenance procedures can be performed using the following tools and test equipment:

A. Customer Engineering Standard Tool Kit (WLI P/N 726-9401) containing the following :

1. Allen Wrench (Hex Key) Set.
2. Small Slotted Screwdriver (insulated shaft) (WL #726-9406) - for voltage adjustments.
3. Medium Phillips Screwdriver (WL #726-9407).
4. Medium Slotted Screwdriver (WL #726-9408).
5. Handle and Assorted Nutdrivers (WL #726-9478, 726-9459 through 9477).
6. Diagonal cutters (WL #726-9416)

B. Digital Voltmeter - (e.g. FLUKE Model 8022A, WL #727-0119).
C. Oscilloscope with two X1 probes and/or two X10 probes. (e.g. Phillips Model 3262, WL# 727-0054, probes - WL# 726-9689; Tektronix Model 465B, WL# 727-0001, probes - WL# 726-9690.)
D. Alcohol Pads (WL #660-0130).
E. Hypot/DC ESD Tester (WL #727-0144) (WL #727-0146 for 230 VAC, 50 Hz).
F. AC Outlet Impedence Tester (WL #727-0143).
G. Dry Air (WL #726-5816).
H. Media Solution (WL #726-8018).

1.4.2 SPECIAL TOOLS AND EQUIPMENT

Special tools and equipment for the Phoenix, Hawk, 300 Meg SMD, and Shugart drives are presented in the associated manuals outlined in section 1.3.

1.4.3 SOFTWARE TOOLS

Software diskettes and documents referenced in this manual are:

TITLE	DISKETTE/DOCUMENT
OIS 140-Class Power Up (PROM)	(702-0042D)
OIS 140 Extended Memory Power Up (PROM)	(702-0123B)
SYSEX40	(702-0117)
SYSEX40X	(702-0135)
OIS 140-Class Master Monitor	(702-0057D)
OIS Online Device Monitor	(702-0174)
OIS Online Printer Part I	(702-0176A, Rev 2422)
OIS Online Printer Part II	(702-0149, Rev 21A0)

CHAPTER 2 SYSTEM DESCRIP-TION

CHAPTER 2

SYSTEM DESCRIPTION

2.1 GENERAL DESCRIPTION OF OIS 140/145

The OIS 140 and the closely-related OIS 145 are two of the continuing series of versatile text processors in Wang Laboratories Office Information Systems (OIS) "family". Masterprocessing and data-storage equipment form the core of these OIS systems; user devices are clustered around this core. Extensive options provide system configurations that are versatile and expandable.

The OIS 140 and 145 systems are the largest text processors in the OIS line. These CRT/disk-based processors are designed for users with large volumes of data input, output or storage requirements. The OIS System 140 is available in three different models (6540-1, 6540-2, and 6540-3). The basic configuration includes one master processor unit possessing a single diskette drive for off-line storage, one or more peripheral devices (workstations, printers, phototypesetters, etc.), and one or more hard disk storage devices (one of which is designated "System Disk"). The customer has three different choices for the size of his System Disk, available through configuration modifications on the unformatted 96 Meg CMD (Phoenix). These choices are reflected in the three different Model numbers of the OIS 140 System:

SYSTEM	MODEL NUMBER	SYSTEM DISK (formatted capacity)
OIS 140-1	6540-1	26.8 Meg
OIS 140-2	6540-2	53.6 Meg
OIS 140-3	6540-3	80.4 Meg

The OIS 145 is essentially the same as the OIS 140 System, with the exception of the System Disk. The 145 is equipped with a 300 Megabyte Storage Module Drive (300 Meg SMD) as its System Disk (formatted capacity = 275 Meg). In fact, up to three 300 Meg SMD units may be attached to the OIS 145, making the total system capable of storing over 334,000 pages of text. An additional 10 Meg HAWK drive is automatically sold with the system for information backup purposes.

Both the 140 and 145 systems utilize standard OIS architecture and software. Both may be expanded to include up to 32 peripherals (maximum of 24 workstations) in many different combinations. The diagrams on the next two pages outline the basic configuration, standard and optional software, and available peripherals for each system.

----------NOTE----------
Throughout the remainder of this manual, statements applicable to both the OIS 140 and 145 systems will be identified as such by references to the 'OIS 140/145 System'. In cases where the two systems differ, the references will be qualified to explicitly indicate one system apart from the other.

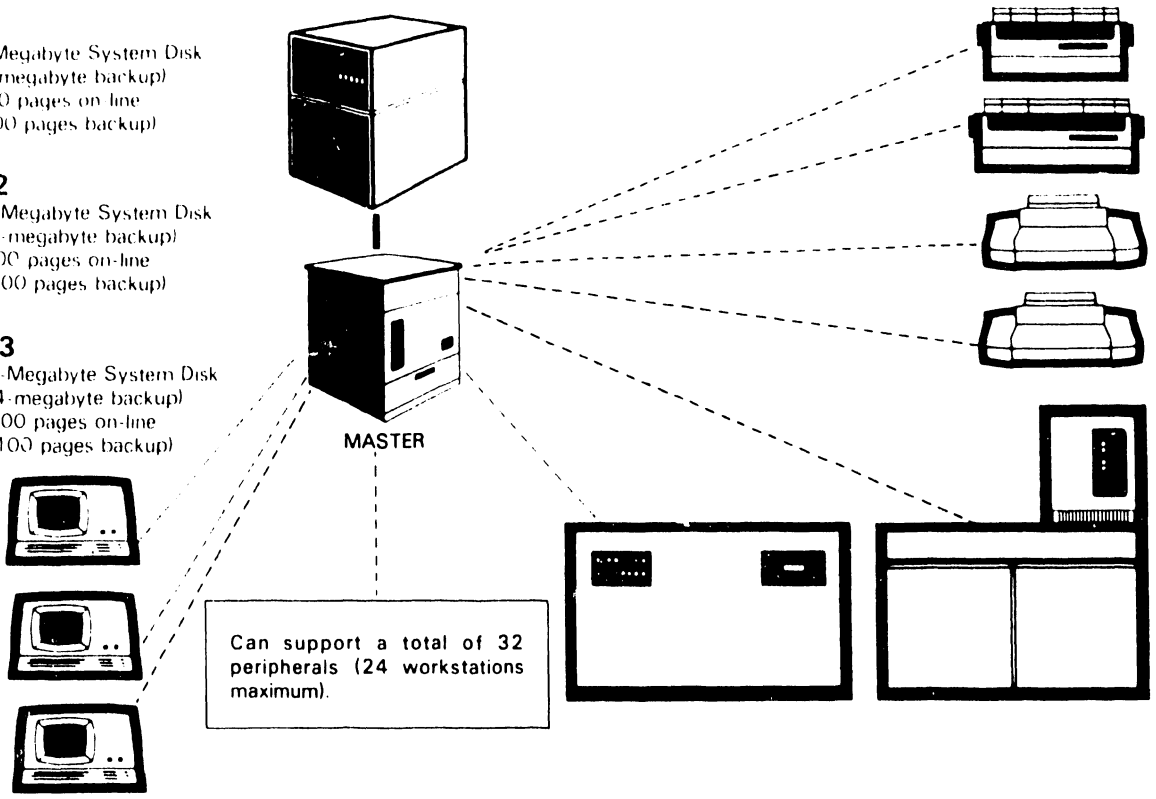
OFFICE INFORMATION SYSTEM 140

Models 140-1, 140-2, 140-3

140-1
26.8-Megabyte System Disk
(26.8-megabyte backup)
10,700 pages on-line
(10,700 pages backup)

140-2
53.6-Megabyte System Disk
(53.6-megabyte backup)
21,400 pages on-line
(21,400 pages backup)

140-3
80.4-Megabyte System Disk
(80.4-megabyte backup)
32,100 pages on-line
(32,100 pages backup)



Basic Configuration:
1 System Master and Archive Diskette
1 System Disk (26.8, 53.6, or 80.4 Megabytes)

Standard Software:
Math Support Package
Sort
System Security
Advanced Functions

Optional Software:
Office BASIC
List Processing

Optional Peripherals:
Archiving Workstation (48K or 64K)
Mag Card Reader
Numeric Keypad
Phototypesetter
Phototypesetter Input Option
Papertape Punch for Telex
Telecommunications
Twin Sheet Feeder
26.8, 53.6, or 80.4-Megabyte Disk
(13.4-Megabyte removable cartridge)
(2) 10-Megabyte Disks
(5-Megabyte removable cartridge)
WISE (Wang Inter-System Exchange)
Workstation (32K, 48K, or 64K)
Envelope Feeder
MAILWAY™
Optical Character Recognition Interface
Bidirectional Forms Tractor
Multilingual Support Package

Printers:
35-CPS Daisy
35-CPS Wide Carriage Daisy
120-CPS Matrix Printer
200-CPS Matrix Printer
425-LPM Line Printer
Intelligent Image Printer
Twin-Head Daisy

Accessories:
Workstation Table
General Work Table
Line Printer Stand
Additional Cable Lengths
(2000' Max.)

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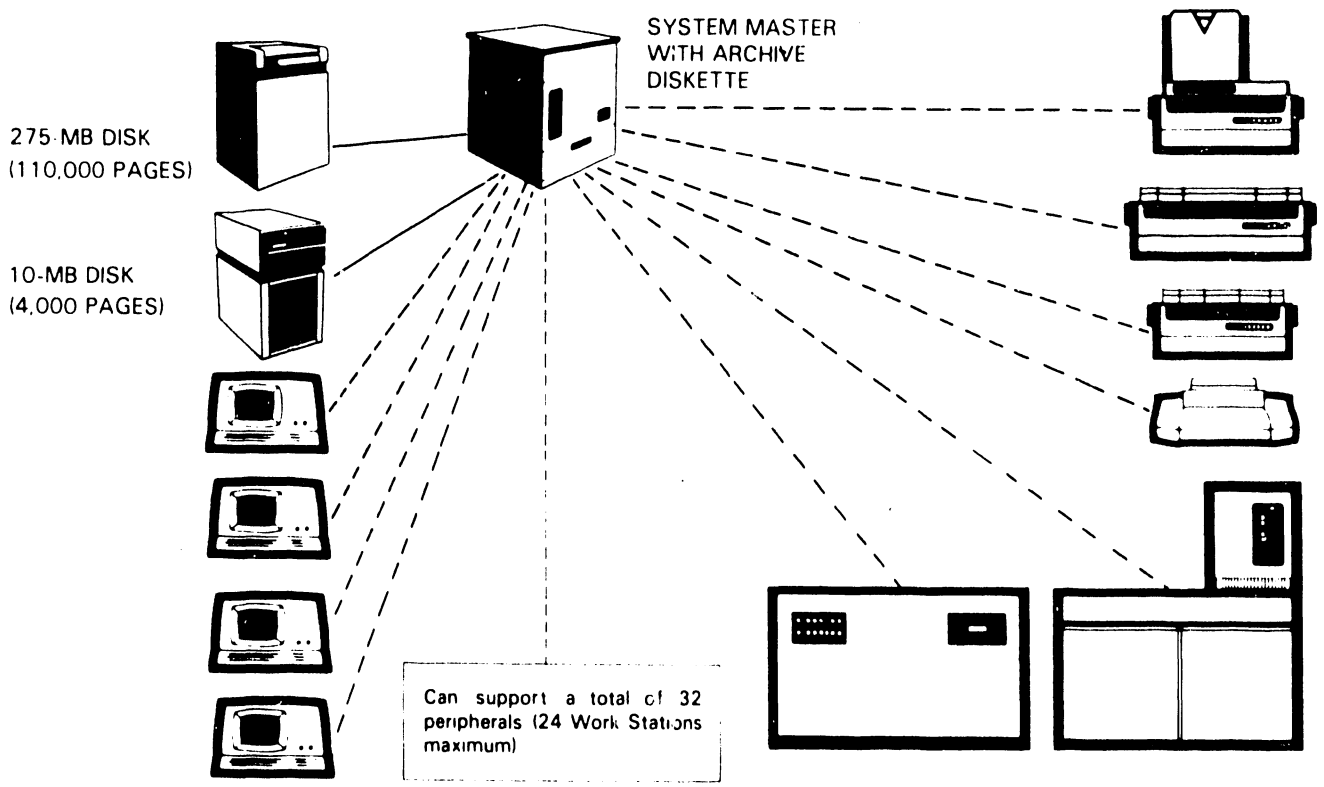
OFFICE INFORMATION SYSTEM 145



Basic Configuration

1 275-Megabyte Disk
1 10-Megabyte Disk
1 Archive Diskette

Standard Software

Math Support Package
Sort
System Security
Advanced Functions

Optional Software

Office Basic
List Processing

Optional Peripherals

Archiving Workstation
Bidirectional Forms Tractor
1 10-MB Disk
1 or 2 275-MB Disk
Envelope Feeder
Mag Card Reader
MAILWAY ™
Numeric Keypad
Optical Character Recognition Interface
Phototypesetter 5548Z
Phototypesetter Input Option
Twin Sheet Feeder
WISE (Wang Inter-System Exchange)
Workstation with Communications

Printers

35-CPS Daisy
35-CPS Wide Carriage Daisy
Twin-Head Daisy Printer
120-CPS Matrix Printer
200-CPS Matrix Printer
425-LPM Line Printer
Intelligent Image Printer

Accessories

Workstation Table
General Work Table
Line Printer Stand
Additional Cable Lengths
(2000' Max.)

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2.2 MASTER UNIT SPECIFICATIONS

A Z-80 based Master CPU is a standard hardware feature of the OIS 140/145. Operating at 4 MHz, it provides this system with a faster transfer rate than previous processing systems. Included on the same circuit board as the Master CPU is a programmable Counter Timer Circuit (CTC), 3K of PROM, 1K of address space devoted to Memory Mapped I/O, and 60K of RAM. If the Extended Memory option is purchased, an additional 3K of PROM and 60K of RAM is available to the customer.

Other features of the Master Unit include thirty-two slave channels and I/O ports, nine Printed Circuit Assemblies (PCAs), a Power Supply Assembly, Front Panel Assembly, and Shugart Floppy Diskette Drive. Refer to Chapter 8, "Theory of Operation", for a block diagram discussion of the PCAs in the Master CPU.

Following is a list of printed circuit boards and chassis assemblies used in the OIS 140/145 Master Unit:

BOARD/CHASSIS #	NAME
210-7501-A	64K CPU/Memory Board
210-7502	Floppy/10 Meg Controller Board
210-7503	Data Link Controller Board
210-7504-A	Data Buffer Board
210-7505	SMD Disk Controller Board #1 (A)
210-7506	SMD Disk Controller Board #2 (B)
210-7507	Motherboard
210-7508	Regulator Board
210-7518	Front Panel PCB
270-0599	Motherboard Chassis
270-0601	Power Supply Chassis (60 Hz)
270-0601-1	Power Supply Chassis (50 Hz)

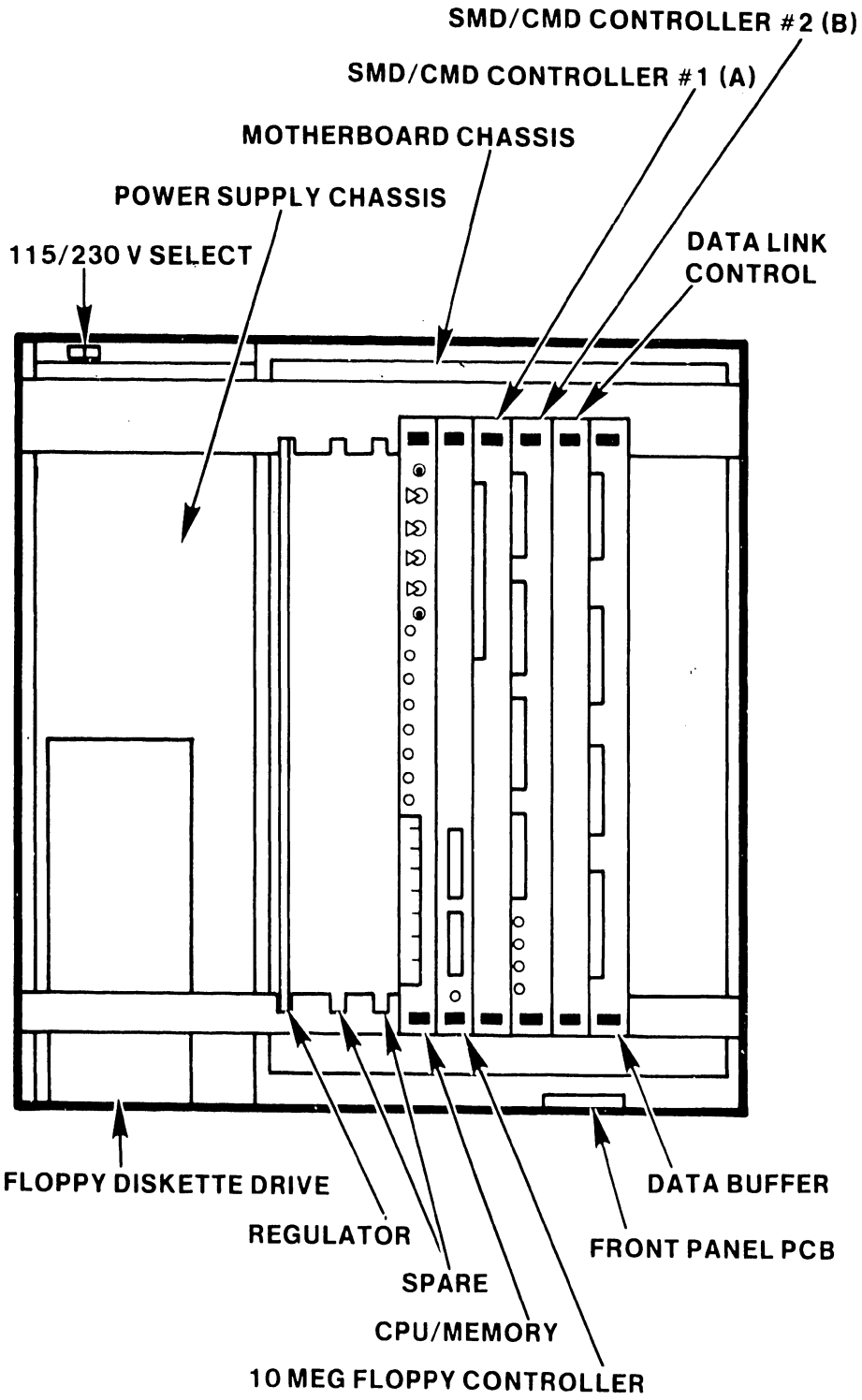


FIGURE 2-1 MASTER UNIT MAJOR COMPONENT LOCATIONS

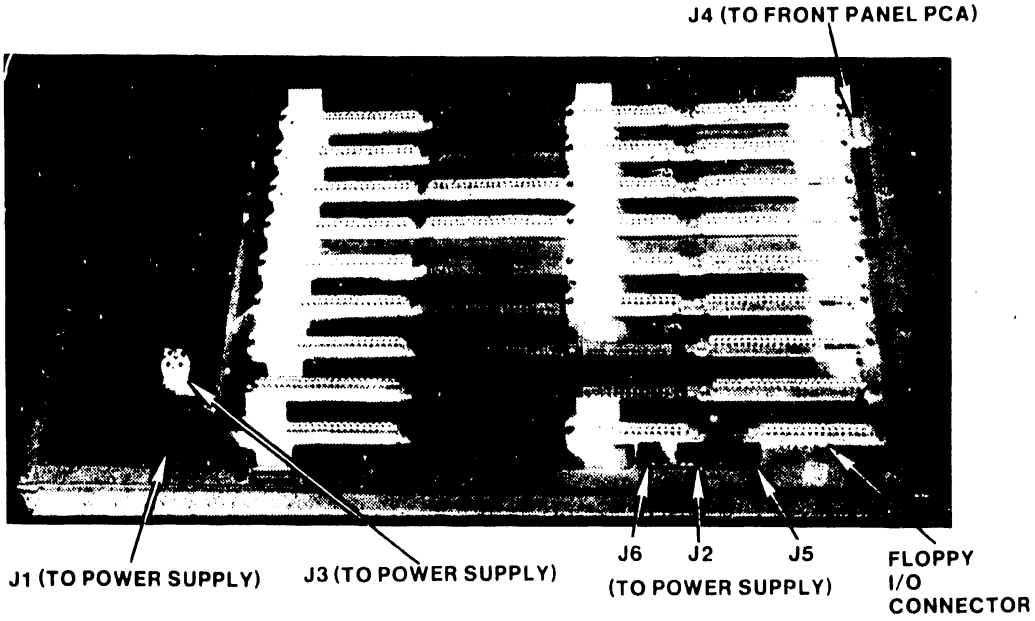


FIGURE 2-2 210-7507 MOTHERBOARD PCB AND CONNECTOR LOCATIONS

Following are the electrical and physical specifications for the Master Unit and Diskette Drive:

Master Unit:	Domestic	International
Height	30 Inches	(76.2 cm)
Width	24 Inches	(60.9 cm)
Depth	30 Inches	(76.2 cm)
Power Requirements	115VAC ± 10%	(230VAC ± 10%)
	60 Hz ± 1 Hz	(50 Hz ± 1 Hz)
	4A @ 115VAC	3A @ 230 VAC
Power Consumed	500 Watts	
Heat Dissipated	1700BTU/Hr	

Diskette Drive: (See fig. 2-3)

Height	12.75 Inches	(32.4 cm)
Width	6.0 Inches	(15.3 cm)
Depth	16.5 inches	(42 cm)

Diskette Drive characteristics:

Diskette Capacity	315,392 Characters
Rotational Speed	360 RPM
Rotational Period	166.72 msec
Average Access Time	424 msec
Average Latency	83 msec
Data Transfer Rate	31,250 Bytes/sec.
Bit Cell Time	4 usec
Track to Track Access Time	10 msec
Head Settling Time	10 msec
Sectors per Track	16
No. of Tracks	77
Total Sectors	1232
Sector Mark Duration	400 usec ± 200 usec
Index Mark Duration	400 usec ± 200 usec
Direction Select Pulse Duration	1 usec minimun
Time Between Head Load and Valid Data	50 msec
Time Between Head Load and step	30 msec

Refer to Service Bulletins 46.2 (729-0115), 46.3 (729-0116), and 46.3A (729-0117) for additional information on the Floppy Diskette.

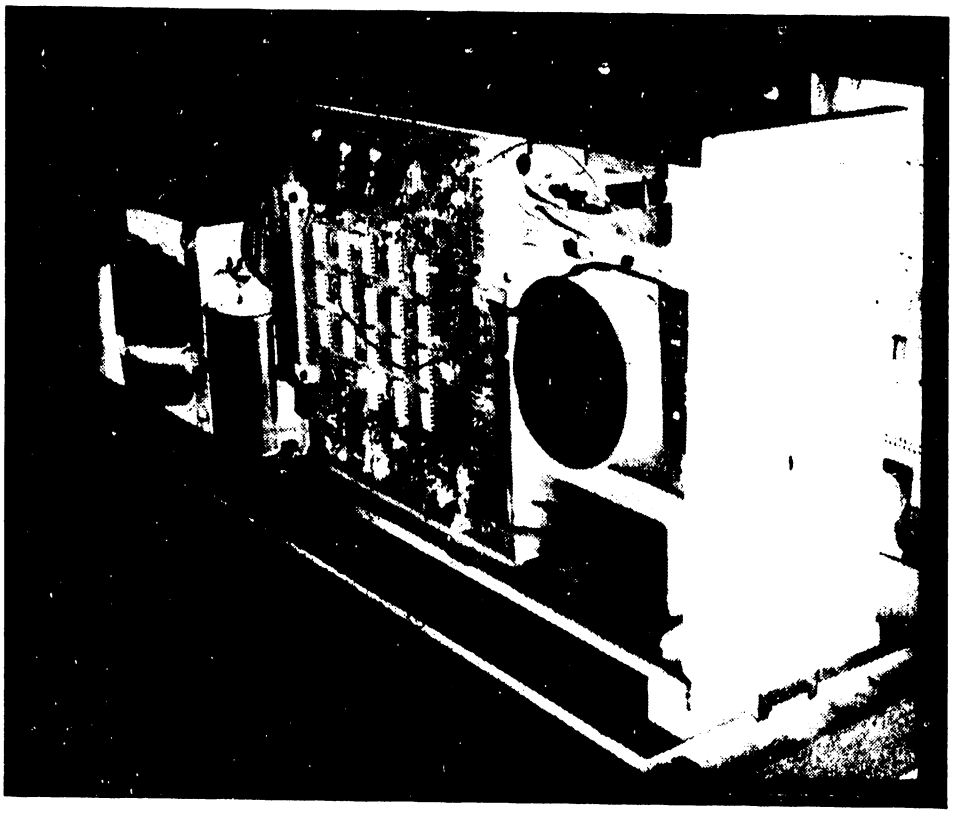


FIGURE 2-3 SHUGART DRIVE MOUNTED ON POWER CHASSIS

2.3 STANDARD/OPTIONAL DISK DRIVES

Two types of disk drives are available to the OIS 140; the Phoenix (6580) Cartridge Module Drive (CMD) standard to the system, and the HAWK (6560) 10 Mbyte Drive (optional). The number of drives on-line depends upon the needs of the end user. Because one Phoenix Drive is standard on the OIS 140, one Phoenix and two Hawk drives may be added to the system. Therefore, the OIS 140 can support a maximum of four drive units providing the user with up to 180 Mbytes (depending on model) of formatted storage. If an additional Phoenix is to be added to the standard system, it must be configured to the same capacity as the original Phoenix.

Two types of disk drives are available to the OIS 145; a 275 Mbyte Storage Module Drive (SMD), (Model 6565), and the HAWK (6560) 10 Mbyte Drive; one of each is sold standard with the system. The SMD unit has an unformatted capacity of 300 Mbytes, and a formatted capacity of 275 Mbytes. For this reason, the unit is often referred to as an 300 Meg SMD. Up to three 300 Meg SMD units may be attached to a 145 System along with two (2) 10-Meg HAWKs. These three SMD units and two CMD HAWK units comprise the maximum configuration for the 145, providing over 840 Mbytes of total formatted storage.

2.3.1 STANDARD DISK DRIVE - OIS 140

As previously stated, the Phoenix (6580) Cartridge Module Drive (CMD) is the standard storage device for the OIS 140 (See Fig. 2-4). The Phoenix CMD is a high performance, random access, mass storage device available in three versions. After formatting, the Model 1 (6580-1) stores a maximum of 26.8 Mbytes, the Model 2 (6580-2) stores a maximum of 53.6 Mbytes, and the Model 3 (6580-3) stores a maximum of 80.4 Mbytes.

A linear positioner, a density of 384 Tracks per Inch (TPI), and a 30 msec average access time give the Phoenix CMD a 9.67 MHz transfer rate.

Following are the electrical/physical characteristics of the Phoenix CMD:

Phoenix Specifications:	Domestic	International
Height	10.5 Inches	(264 mm)
Width	19.0 Inches	(483 mm)
Depth	31.75 Inches	(806 mm)
Weight	170 lbs	(77.1 Kg)
Power Requirements*	115 VAC ± 10% 60Hz ± 1 Hz 8.2A @ 120 VAC .950 KWH	(230VAC ± 10% (50Hz ± 1 Hz) (4A @ 230 VAC)

Phoenix Data Capacity (formatted):

Model 1 (6580-1)	26,836,992 bytes
Model 2 (6580-2)	53,675,984 bytes
Model 3 (6580-3)	80,510,976 bytes

* A separate, 20A (10A Int'l) dedicated line should be provided for the Phoenix.

Phoenix Specifications - continued

Track Density	384 TPI
Maximum Positioning Time	55 ms
Track-to-track Positioning Time	6 ms
Average Access Time	30 ms
Spindle Speed	3600 rpm (+2.5%,-3.5%)
Avg. Latency Time	8.33 ms @ 3600 rpm

----------NOTE----------
Refer to the Wang Cartridge Module Disk Drive Manual (729-0199, 729-0199-1, 729-0199-2) and the Control Data Cartridge Module Hardware Maintenance Manual (729-0198A) for a detailed description of the Phoenix CMD.

2.3.2 STANDARD DISK DRIVE - OIS 145

The 300 megabyte Storage Module Drive unit (300 Meg SMD, Model 6565) is the standard storage device for the OIS 145 System (see Fig. 2-6). The 300 Meg SMD is a high speed, random access, mass storage device having a formatted capacity of 275 megabytes. Like the Phoenix, the 300 Meg SMD has a density of 384 Tracks per Inch (TPI), a 30 msec average access time, and a 9.67 MHz transfer rate.

Following are the electrical and physical characteristics of the 300 megabyte Storage Module Drive:

300 Meg SMD Specifications:	Domestic	International
Height	36 Inches	(920 mm)
Width	36 Inches	(914 mm)
Depth	23 Inches	(584 mm)
Weight	550 lbs	(252 Kg)
Power Requirements*	208 VAC ± 10%, 230 VAC ± 10% 60Hz ± 1Hz 8.0A @ 208 VAC 1300 Watts	(220 VAC ± 10%), (240 VAC ± 10%) (50Hz ± 1 Hz) (9.5A @ 220 VAC)

300 Meg SMD Characteristics:

Track Density	384 TPI
Maximum Positioning Time	55 ms
Track-to-track Positioning Time	6 ms
Average Access Time	30 ms
Spindle Speed	3600 rpm (+2.5%,-3.5%)
Avg. Latency Time	8.33 ms @ 3600 rpm

Data Capacity: 300 Mbytes (unformatted)
275 Mbytes (formatted)

* A separate, 20A dedicated line should be provided for the 300 Meg SMD.

----------NOTE----------

Refer to the CDC SMD Hardware Reference Manual (729-0222) and the CDC Hardware Maintenance Manual (729-0221) for a detailed description of the 300 Meg SMD.

2.3.3 HAWK DISK DRIVE

Available as an option to the OIS 140 and standard on the 145 is the HAWK (6560) 10 Mbyte Cartridge Disk Drive (see Fig. 2-5). The OIS 140/145 can support a maximum of two HAWK drives; however, the HAWK Drive should not stand alone as the only storage device in an OIS 140/145 System.

Following are the electrical and physical characteristics of the HAWK Cartridge Disk Drive:

HAWK Specifications:	Domestic	International
Height	10.3 Inches	(262 mm)
Width	18.9 Inches	(480 mm)
Depth	30.6 Inches	(778 mm)
Weight	150 lbs.	(68.2 kg)
Power Requirements	115VAC ± 10% 60Hz ± 1Hz 4.6A @ 120 VAC 310 Watts	(230VAC ± 10%) (50Hz ± 1 Hz) (2.5A @ 230 VAC)

HAWK Characteristics:	
Track Density	200 TPI
Access Time	60 msec
Average Access Time	35 msec ± 1 msec
Spindle Speed	2400 RPM (± 48 RPM) at + 0.5 -1.0 Hz of input freq. and + 10%, -15% of input voltage.
Avg. Latency Time	12.5 msec (@ 2400 RPM)
Nominal Recording Bit Rate	2.5 MHz
Data Capacity (unformatted)	10 Mbytes

Refer to the Wang/CDC HAWK Disk Drive Manual (729-0181) for additional details.

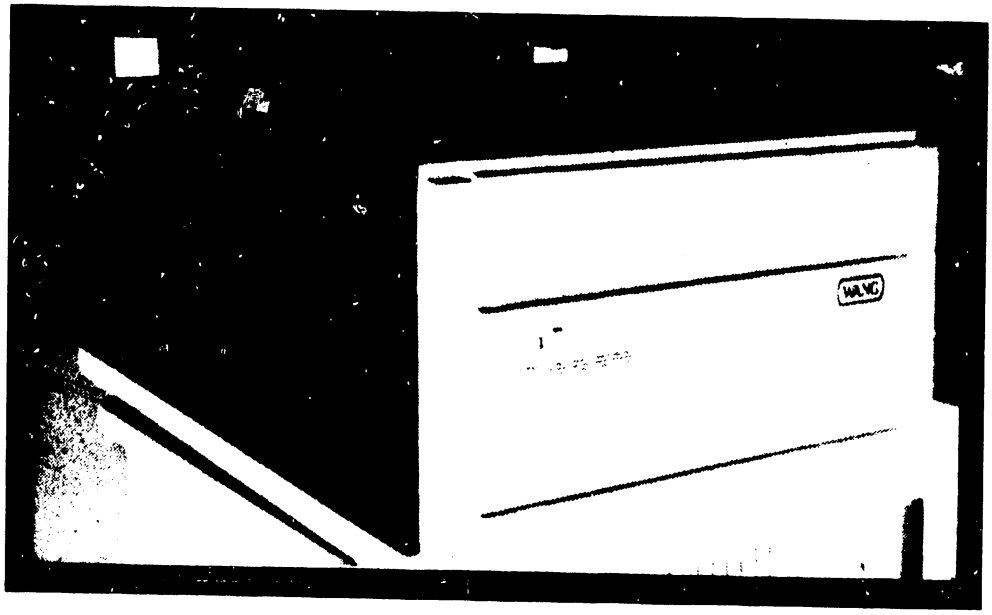


FIGURE 2-4 PHOENIX CMD

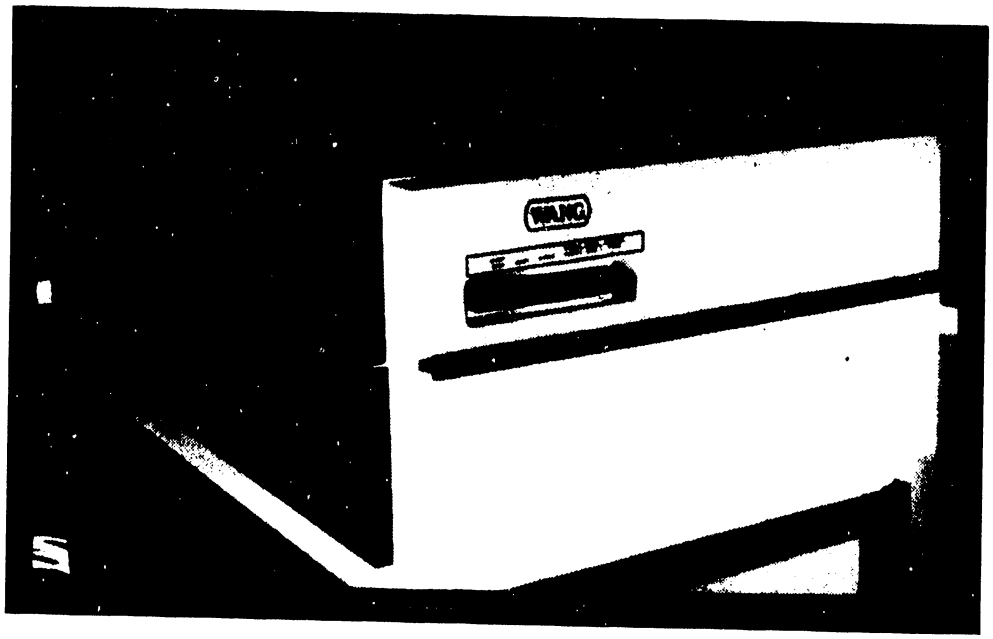
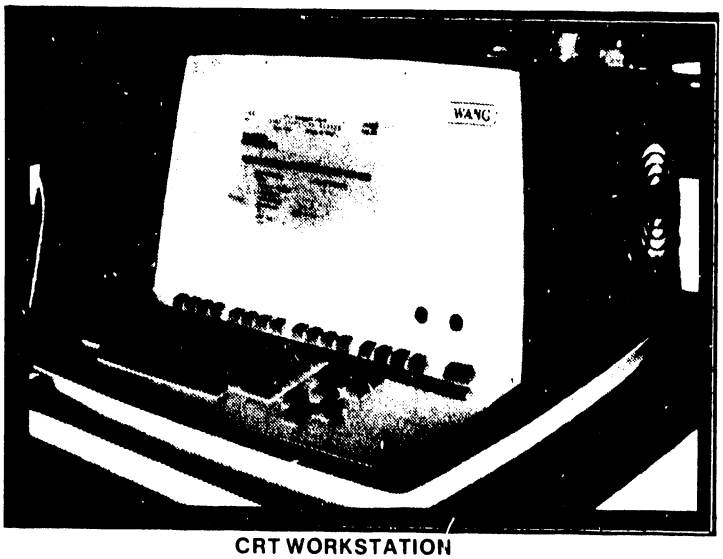
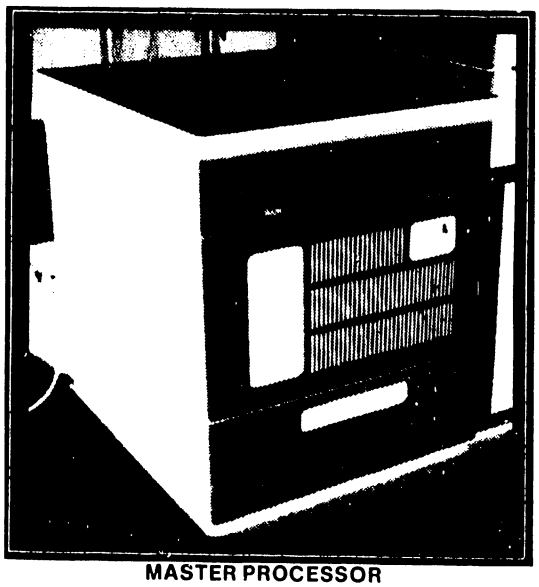


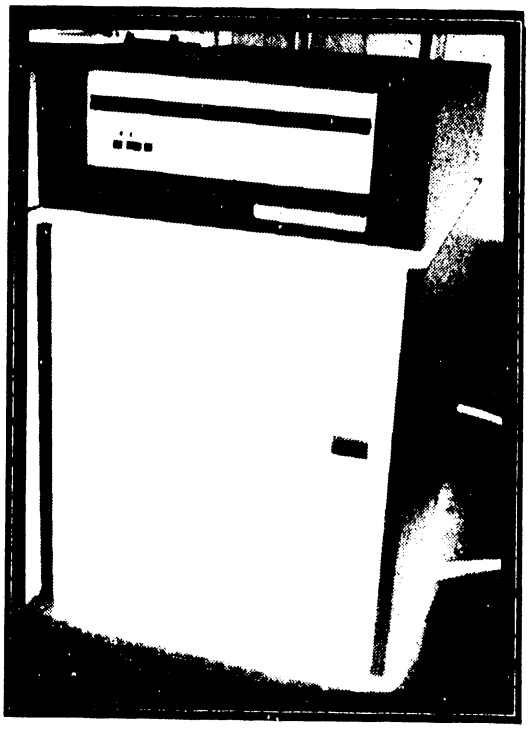
FIGURE 2-5 HAWK DISK DRIVE



CRT WORKSTATION



MASTER PROCESSOR



300 MEG SMD

FIGURE 2-6 300 MEG SMD DISK DRIVE, MASTER PROCESSOR, AND CRT WORKSTATION

2.4 OPTIONAL PERIPHERALS

The basic OIS 140/145 consists of a Master Unit and a System Disk. However, to communicate with the system, peripheral devices such as CRT/Workstations and printers are necessary additions.

Most peripherals available to the system are standard Wang products. These include the Model 5536-2, -3, and -4 CRT/Workstations with 32K, 48K, and 64K of memory, respectively, the 6521 Line Printer with 16K memory, and the 6581W Daisy Printer with 16K memory. A more complete list is provided on pages 2-2 and 2-3.

2.5 ENVIRONMENTAL CHARACTERISTICS

The operating environment is an important consideration when installing a processing system. Although the OIS 140/145 is designed to operate efficiently under less-than-ideal conditions, a dust-free, temperature-controlled environment is recommended.

Adhering to the following system environmental specifications will ensure that maximum operating efficiency is maintained:

1.	Relative Humidity	40% to 60% (non-condensing)
2.	Ambient Temperature	60°F (15°C) to 80°F (28°C)
3.	Temperature Gradient	12°F/Hr (6.7°C/Hr)
4.	Max. Wet Bulb Temp.	75°F (24.5°C)
5.	Maximum Altitude **	10,000 ft (3048m)

** Tape drives above 4000 ft (1200m) and disk drives (removable disks) above 6500 ft (1960m) require high altitude options.

CHAPTER 3 INSTAL-LATION

CHAPTER 3

INSTALLATION

3.1 INTRODUCTION

The configuration addressed in this manual is a minimum configuration and is comprised of a Master Processor with single diskette drive, CRT workstation, and a System Disk. A Model 6580 Phoenix CMD serves as System Disk for the OIS 140 System; a Model 6565 300 Meg SMD, for the OIS 145 System. System control is accomplished at the CRT workstation, while "off-line" data storage is provided by the diskette drive. Since the Model 6560 HAWK Disk Drive is a standard component in OIS 145 Systems, it is considered part of the minimum configuration, and so is addressed in this chapter.

This chapter sets forth a checklist for site preparation and the information necessary to unpack, inspect, make initial adjustments, and power-up the basic system. Specifically, this chapter provides:

ITEM	SECTION
Checklist for site preparation	3.2
Unpacking & initial inspection	3.3
System Interconnections	3.4
Initial Setup, checks, and adjustments	3.5
Power-up Procedure	3.6
Master Unit Power-up Diagnostic	3.7
Power-down procedure	3.8
Software Installation	3.9
System Checkout	3.10
Final Word Processing Check	3.11
Detailed Procedures	3.12

3.2 CHECKLIST FOR SITE PREPARATION

Proper location and site preparation are important for overall operating efficiency. Ideally, the area should be easily accessible, relatively dust free, and temperature and humidity controlled. An adequate number of dedicated, regulated, noise-free AC power outlets should be provided to minimize electromagnetic interference. Additional information is provided in the Systems Installation Guide (729-0907), and the Site Preparation Guide (700-5978).

Selection and preparation of the site should already be completed. The purpose of this checklist in Table 3-1 is to highlight key items, and thereby promote the best operating environment.

TABLE 3-1. SITE PREPARATION CHECKLIST

ITEM	NOTES
Location	Master Processor near the primary user; devices may be as much as 2000 feet from the Master Processor, if necessary.
Space	Easy access by user and service personnel.
Storage	For manuals, materials (ribbon, paper, spare disks), etc.
Environment	An air-conditioned and humidity-controlled environment is recommended (see Table 3-2).
Power Circuits	(1) Separate, noise-free, 3-wire, 20 amp dedicated lines (properly installed in rigid metal conduits that are correctly joined to junction boxes). (2) Branch circuits protected by circuit breakers suitable for motor load application (see Table 3-2).
Grounding	Extremely important that the CPU and all disks be connected to a Grounding Conductor, which is securely attatched to the ground bus in the service panel. The Grounding Conductor is green, green with yellow stripe, or bare. In addition, all outlets used by the system peripherals must be properly grounded.
Dust Free	No noticeable accumulation of dust in a 24-hour period.
Static Electricity	Preferably non-static floor materials.
Access	All doorways and corridors wide enough to allow passage of the system, and sufficient elevator weight-capacity (if used).

TABLE 3-2 ELECTRICAL AND ENVIRONMENTAL REQUIREMENTS *

DEVICE	VOLTAGE REQUIREMENTS	AMPS	BTU/HR (max.)
MASTER UNIT			
Domestic	115 VAC ± 10% (60 Hz ± 1 Hz)	4A	1700
International	230 VAC ± 10% (50 Hz ± 1 Hz)	3A	
96 MEG CMD			
Domestic	115 VAC ± 10% (60 Hz ± 1 Hz)	8.2A	3000
International	230 VAC ± 10% (50 Hz ± 1 Hz)	4A	
300 Meg SMD			
Domestic	208 VAC (+14.6, -29)	8.0A	
	230 VAC (+16.0, -13) (60 Hz ± 1 Hz)	7.2A	4200
International	220 VAC (+15.0, -25)	9.5A	
	240 VAC (+17.0, -27) (50 Hz ± 1 Hz)	8.7A	
5536-2/-3/-4 CRT/WS			
Domestic	115 VAC ± 10% (60 Hz ± 1 Hz)	2.5A	480
International	230 VAC ± 10% (50 Hz ± 1 Hz)	1.5A	

SYSTEM ENVIRONMENTAL SPECIFICATIONS

1.	Relative Humidity	40% to 60% (non-condensing)
2.	Ambient Temperature	60°F (15°C) to 80°F (28°C)
3.	Temperature Gradient	12°F/Hr (6.7°C/Hr)
4.	Max. Wet Bulb Temp.	75°F (24.5°C)
5.	Maximum Altitude **	10,000 ft (3048m)

* All AC outlets used by the system and peripherals must be checked with the AC Outlet Impedence Tester (WL #727-0143) for proper polarity and grounding quality.

----------CAUTION----------

The AC Outlet Impedence Tester, when used on circuits employing a GFI, will cause the GFI to trip. In environments containing extremely important equipment, such as life support equipment, tripping a GFI could spell disaster.

** Tape drives above 4000 ft (1200m) and disk drives (removable disks) above 6500 ft (1960m) require high altitude options.

3.3 UNPACKING & INITIAL INSPECTION

3.3.1 UNPACKING THE MASTER PROCESSOR

---------- CAUTION ----------
Inspect the shipping cartons and report any damage to the carrier. Do not proceed with unpacking until certain that this will not void any claims to the carrier.

Unpacking procedures for the Master Processor comprise 6 steps:

A. Using diagonal cutters (or other suitable tool), cut the two plastic straps securing the shipping carton.
B. Remove the the carton's top cover and the cushion assembly that protects the top of the Master Unit
C. Slide the square cardboard tube off of the unit. (tube should not be stapled to pallet.)
D. Remove the plastic bag surrounding the unit.
E. Remove the four shipping brackets that secure the CPU to its pallet, using the appropriate size nut driver.
F. The Master Unit is now ready to be lifted from the pallet and placed in its assigned location.

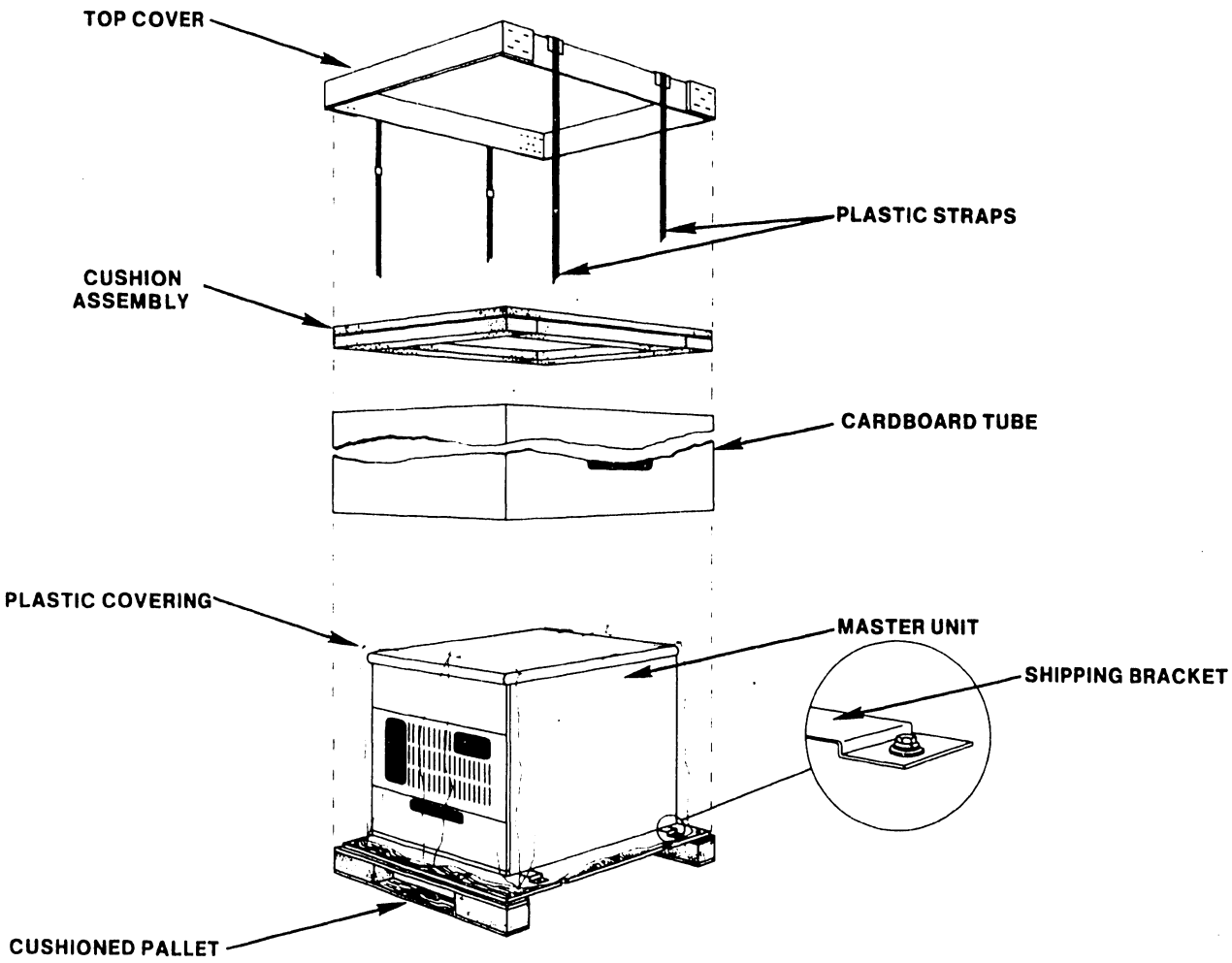


FIGURE 3-1 PACKAGING FOR THE MASTER PROCESSOR

3.3.2 UNPACKING THE CRT WORKSTATION

---------- CAUTION ----------

Inspect the shipping cartons and report any damage to the carrier. Do not proceed with unpacking until certain that this will not void any claims to the carrier.

Unpacking the CRT workstation follows standard procedures for "foam in place" packaging:

A. Cut the sealing tape and open the top of the shipping carton
B. Remove the foam padding at the top and sides of the CRT workstation
C. Carefully, lift the CRT workstation clear of the shipping carton and place it in its designated location.

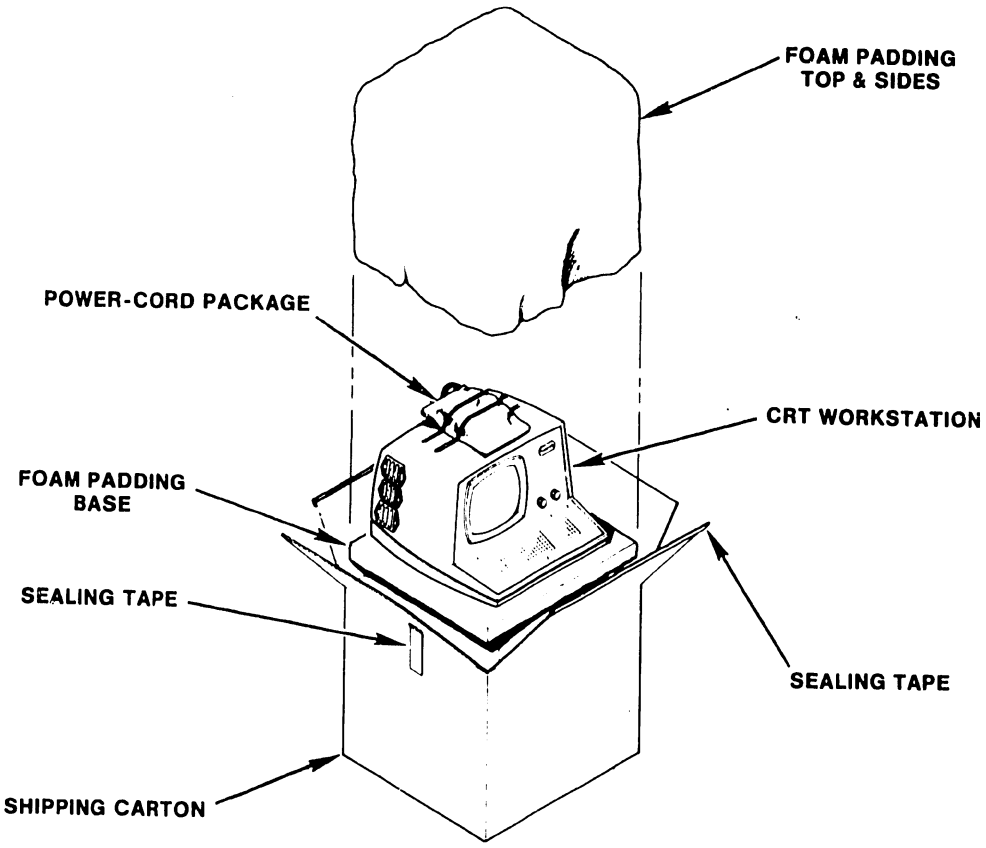


FIGURE 3-2 PACKAGING FOR THE CRT WORKSTATION

3.3.3 UNPACKING THE PHOENIX DISK DRIVE

---------- CAUTION ----------

Inspect the shipping cartons and report any damage to the carrier. Do not proceed with unpacking until certain that this will not void any claims to the carrier.

Unpacking procedures for the Phoenix disk unit comprise 5 steps:

A. Using diagonal cutters (or other suitable tool), cut the two steel straps securing the shipping carton.
B. Open the top of the cardboard carton and remove Instapak that surrounds the drive. Take care not to lose or dispose of the hardware package shipped internally on top of the unit.
C. Remove the staples that secure the cardboard carton to the wooden pallet, then lift off the carton.
D. With the disk drive exposed, remove the four short metal hold-down brackets that secure the disk to the wooden support base.
E. Prior to removing the Phoenix from the wooden pallet, raise one end of the drive at a time just enough to install the round white rubber mounts supplied with the associated hardware. The disk is now ready to mount on its stand.

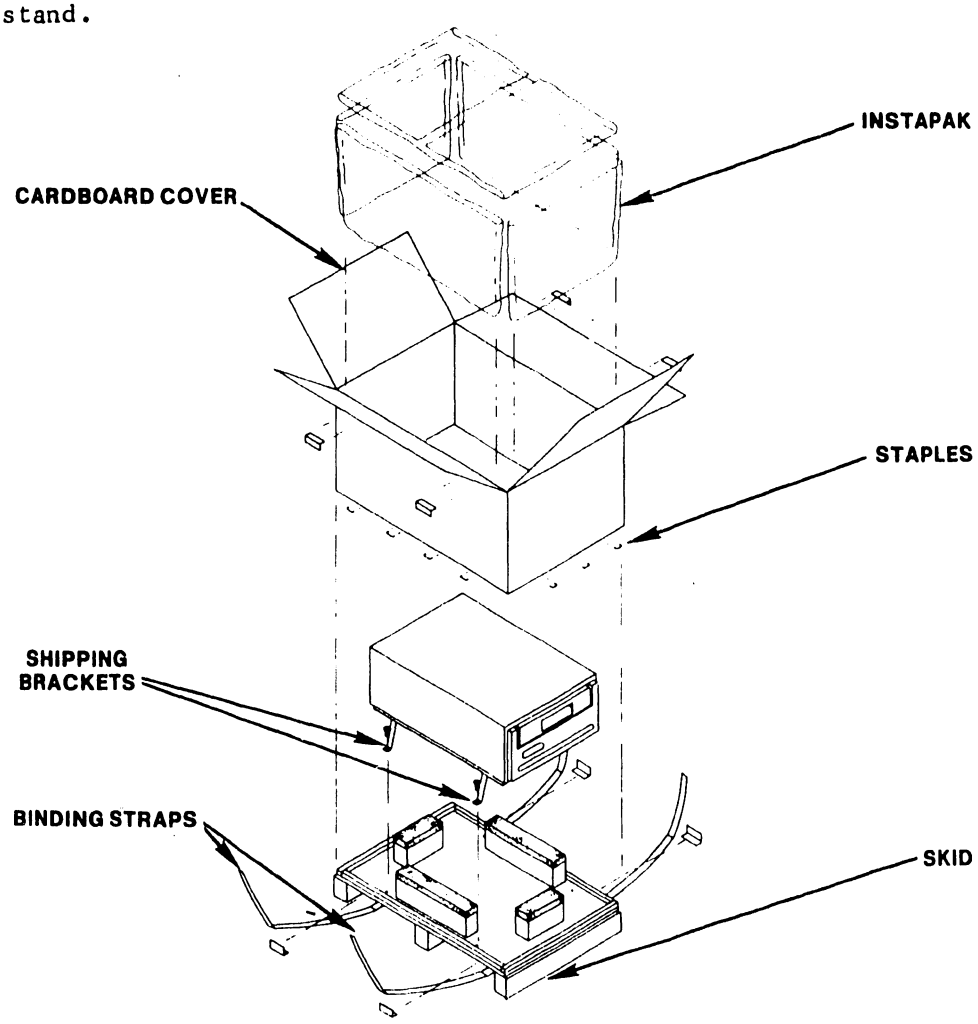


FIGURE 3-3 PACKAGING FOR THE PHOENIX DISK DRIVE

3.3.4 UNPACKING THE 300 MEG SMD DISK DRIVE

---------- CAUTION ----------

Inspect the shipping cartons and report any damage to the carrier. Do not proceed with unpacking until certain that this will not void any claims to the carrier.

Unpacking procedures for the 300 Meg SMD disk unit comprise 5 steps:

A. Using diagonal cutters (or other suitable tool), cut the two straps securing the shipping carton.
B. Remove the the carton's top cover and the cushion assembly that protects the top of the Master Unit.
C. Cut the inner straps that secure the unit to its pallet, then remove the protective plastic covering.
D. Unbolt the shipping brackets and remove the middle and end cushion assemblies from the wooden pallet as shown in the figure below.
E. Raise the four leveling legs as high as possible and slowly roll the unit down off the pallet. The disk is now ready to be placed in its assigned location.

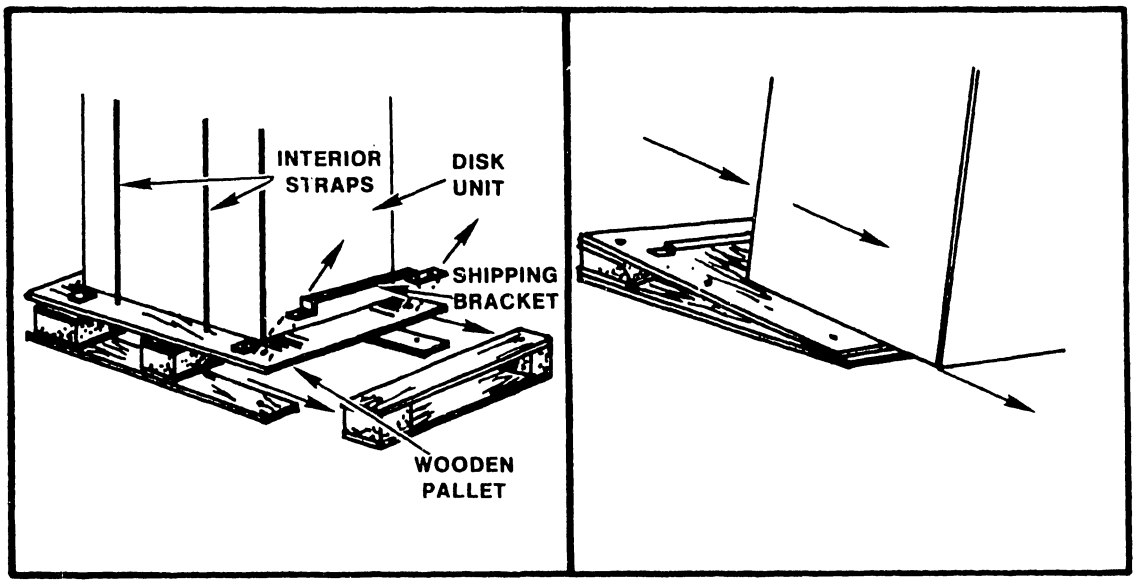


FIGURE 3-4 PACKAGING FOR THE 300 MEG SMD DISK DRIVE

3.3.5 UNPACKING THE HAWK DISK DRIVE

---CAUTION---

Inspect the shipping cartons and report any damage to the carrier. Do not proceed with unpacking until certain that this will not void any claims to the carrier.

The HAWK disk unit is strapped to a cushioned pallet for shipping. A corrugated shipping carton covers the unit and is also strapped down.

Unpacking procedures comprise 6 steps:

A. Using diagonal cutters (or other suitable tool), cut the steel straps securing the shipping carton.
B. Using a slotted screwdriver, remove the staples which attach the carton to the pallet and lift off the carton.
C. Remove any packing material.
D. Cut the steel straps securing the HAWK disk unit.
E. Carefully, lift the HAWK disk unit clear of the pallet and place it on the mounting cabinet.
F. Thoroughly clean the unit of all particles of shipping dust.

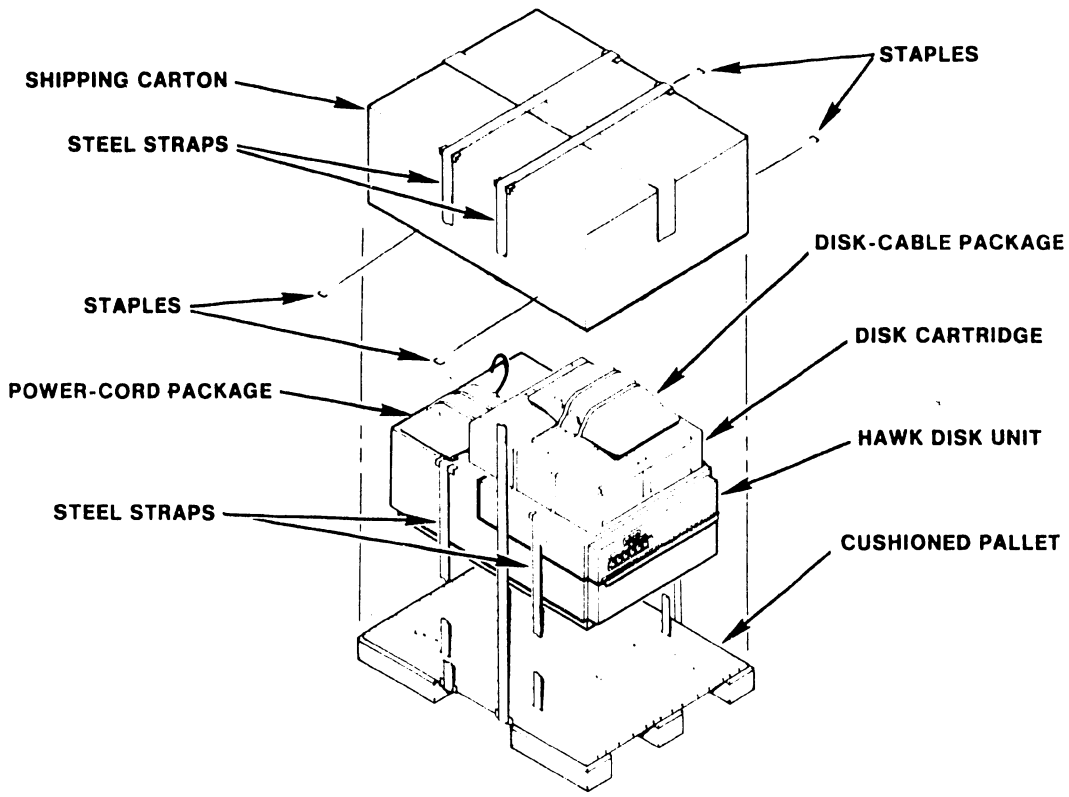


FIGURE 3-5 PACKAGING FOR THE HAWK DISK UNIT

3.3.6 INSPECTING THE MASTER PROCESSOR

A. Ensure that the power-on switch is in the OFF position.
B. Remove the top cover and front panels per Sections 7.3.1 and 7.3.2.
C. Ensure that all connections from the motherboard to the power supply chassis, front panel, and diskette drive are secure and properly oriented per sections 7.3.2 and 7.3.4 (see Figure 3-6).
D. Inspect the inside of the Master Unit, the motherboard, and the power supply chassis for wire clippings, metal shavings, etc.
E. Clean as necessary.
F. Ensure that the two screws located on top of the large capacitor on the power supply chassis are sufficiently tight (see Figure 3-7).
G. Set the voltage selector switch to the correct position (see Figure 3-7). Check fuse to ensure value is correct for line voltage selected. (115 VAC - 4A SLO-BLO, WL# 360-1040-SB; 230 VAC - 3A SLO-BLO, WL# 360-1031-SB.)
H. Check and properly seat all PCAs and connectors per section 7.3.3.
I. Complete, sign, and mail the shipping card enclosed with the unit.
J. The top cover and front panels need not be replaced until the system installation and checkout is complete.

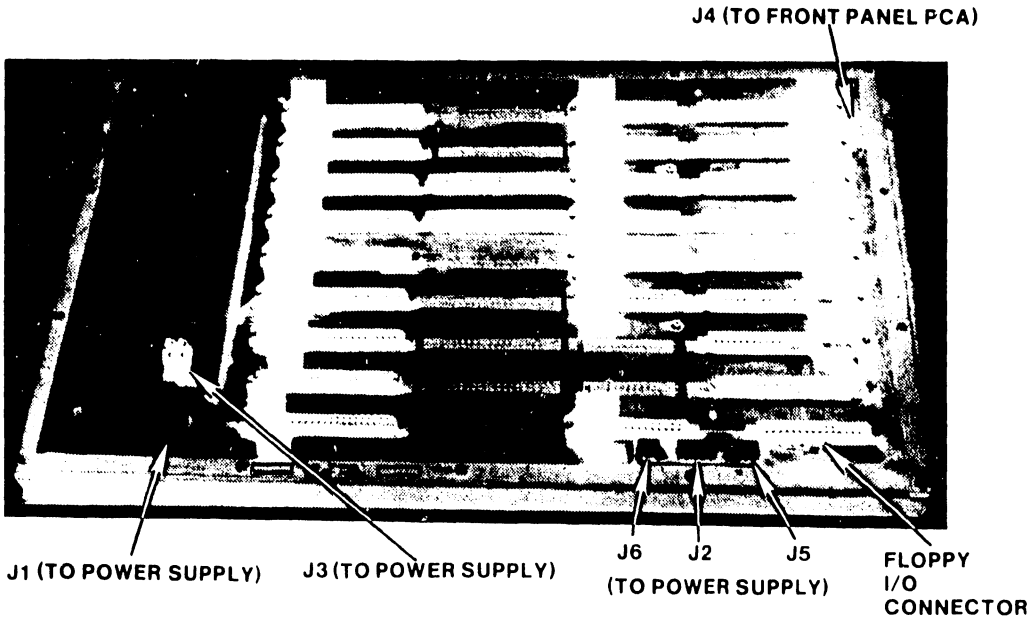


FIGURE 3-6 MOTHERBOARD CONNECTIONS

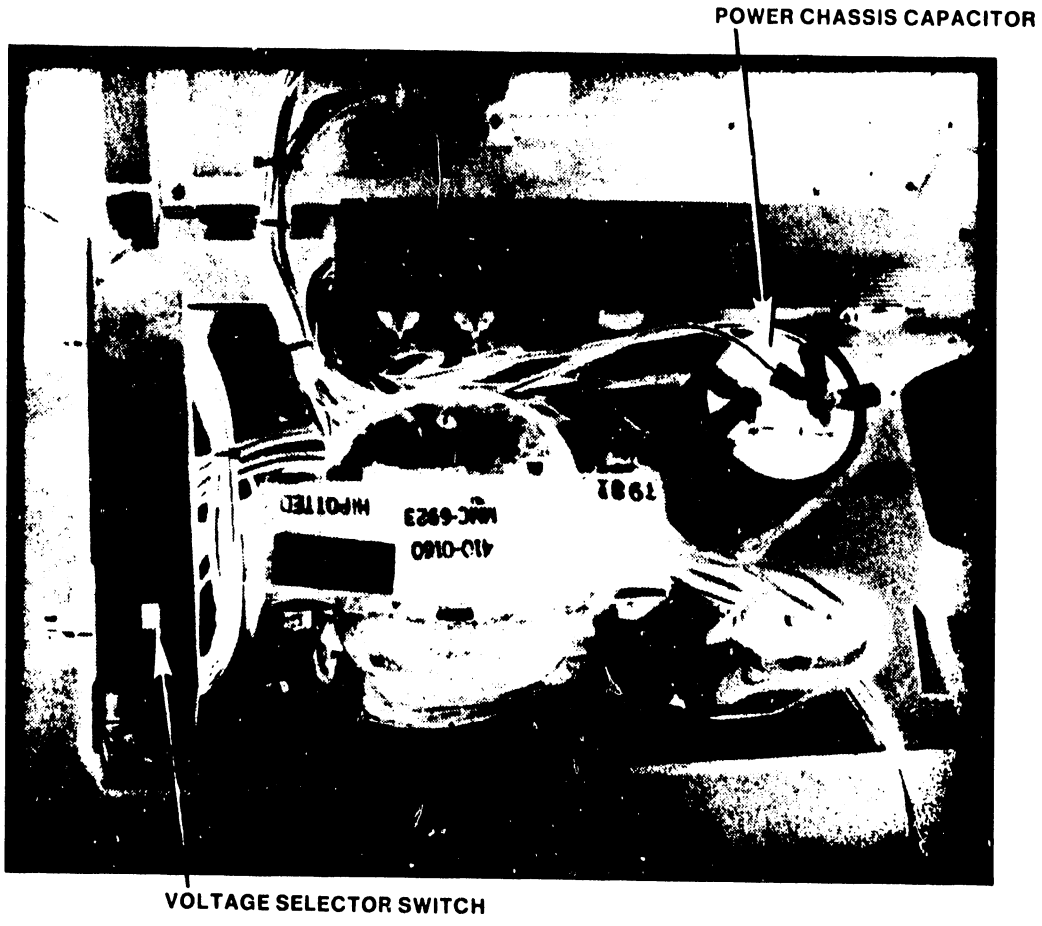


FIGURE 3-7 POWER CHASSIS CAPACITOR CONNECTIONS AND 115/230 VOLTAGE-SELECT SWITCH

3.3.7 INSPECTING THE CRT WORKSTATION

These procedures are detailed in Models 5536-1/-2/-3/-4 Workstations, WPNL No.81 (729-0522) and Model 5536 Series Workstation PMM (729-0522A).

Inspection requires:

A. Removing the keyboard and main covers.
B. Inspecting for wire clippings, metal shavings, etc.
C. Setting the switches
D. Completion and mailing of the shipping card

The covers need not be replaced until the Initial Checks and Adjustments have been completed.

3.3.8 INSPECTING THE PHOENIX DISK DRIVE

The following procedures are detailed in the Wang Cartridge Module Disk Drive Manual (729-0199), and CMD Block Point Four Manual (729-1063):

A. Remove the top dust cover and inspect various items such as circuit boards, carriage assembly, and read/write heads for shipping damage.

B. Remove the Electronic Module Securing Screws.

C. Move the Head Carriage Locking Tool from the 'shipping' position to the 'operating' position.

D. Loosen the Deck Hold Down Bolts and ensure that the Rear Shipping Bolt and spacer are in position before attempting to raise the deck assembly.

E. Check that the unit is clean inside. Raise the base deck assembly to inspect inside the base pan. Note that the Electronic Module must be in maintenance position to open the deck (not applicable to Block Four units).

F. Check/perform the inspection of the following items:

   1. Power supply is securely tightened.
   2. Check the unit for any shipping or packing material that may be in the cartridge receiver area.
   3. Inspect top of unit for loose wires or damaged components.
   4. Check the connectors on the bottom of the Electronics Module while the Deck Base is raised.
   5. Check the Deck Lowered Switch Interlock located under the Electronic Module.

G. Lower the base deck assembly and restore the Electronics Module to its normal position per Section 2.6 of the Wang CMD Disk Drive Manual. Take care not to pinch any cables while lowering the assembly.

H. Tighten the Deck Hold Down Bolts, remove the Rear Shipping Bolt and spacer.

I. When the procedure outlined in Section 2.6 has been completed, restore the top dust cover and complete, sign, and mail the shipping card.

3.3.9 INSPECTING THE 300 MEG SMD DISK DRIVE

The following inspection procedures are detailed in the CDC SMD Hardware Maintenance Manual (729-0221):

1. Inspect drive for possible shipping damage. Any claim for this type of damage should be filed promptly with the transporter involved. If a claim is to be filed, save the original shipping materials.
2. Ensure that all shipping hardware, e.g. shipping bolts, head clamp, etc., have been removed per chapter 1 of the manual cited above.
3. Verify that all logic cards are firmly seated in logic chassis and power supply.
4. Verify that all connectors are firmly seated.
5. Verify that the control panel is firmly seated in its shroud.
6. Verify that all cabling is intact and that there are no broken or damaged wires.
7. Check entire drive for presence of foreign material which could cause an electrical short.
8. Check actuator and pack area for presence of material which could obstruct movement of carriage and heads.
9. Complete, sign, and mail the shipping card.

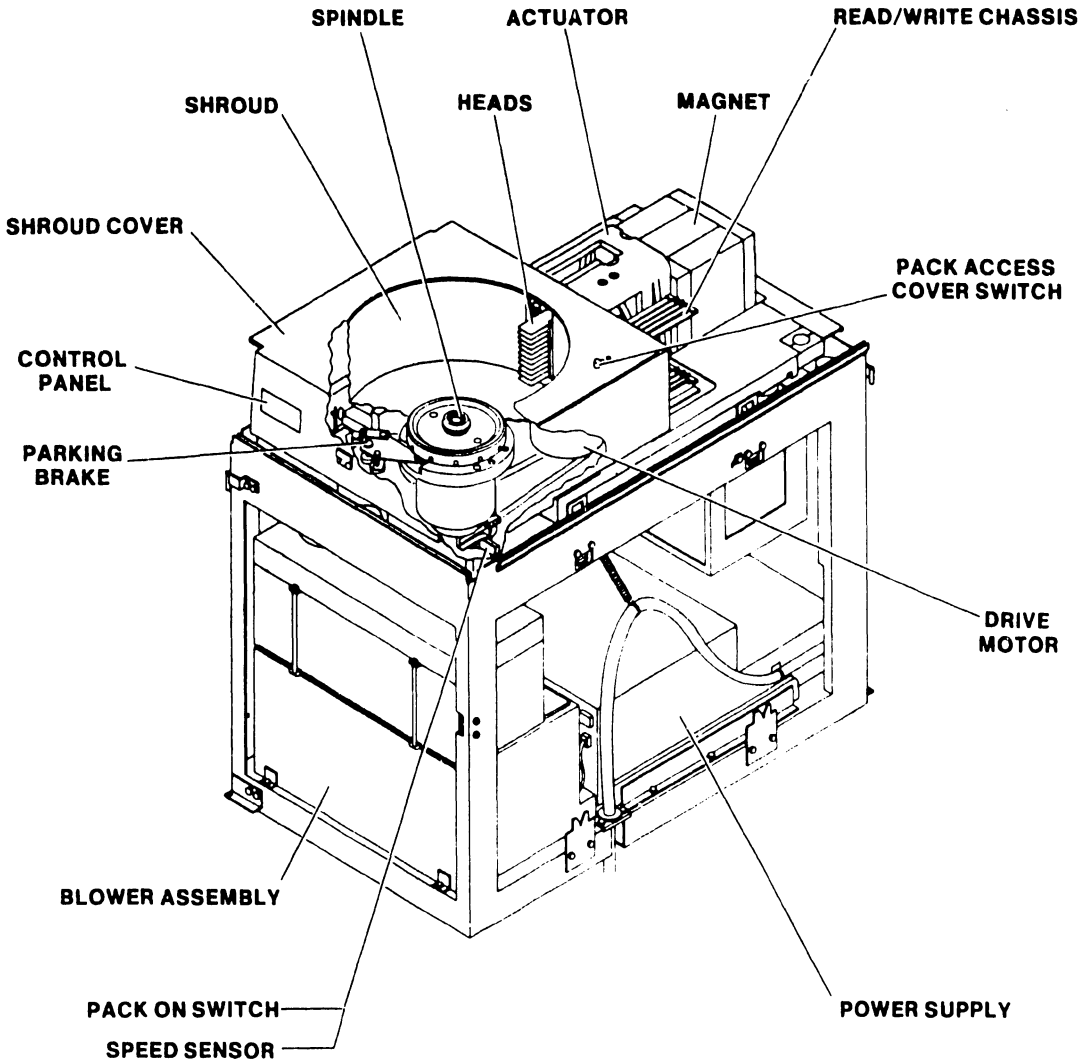


FIGURE 3-8 300 MEG SMD DETAILED LOCATIONS

3.3.10 INSPECTING THE HAWK DISK DRIVE

The following procedures are detailed in the Wang/CDC HAWK Disk Drive Manual (729-0181); refer to this document for further information unless directed otherwise.

A. Remove the electronics cover.
B. Remove the carriage lock pin.
C. Remove the card-cage cover.
D. Verify that all logic cards are firmly seated.
E. Set the option switches per Section 3.12.4.
F. Ensure that the ground straps are properly installed.
G. Complete and mail the shipping card.
H. The electronics covers need not be replaced until the Initial Checks and Adjustments have been completed.

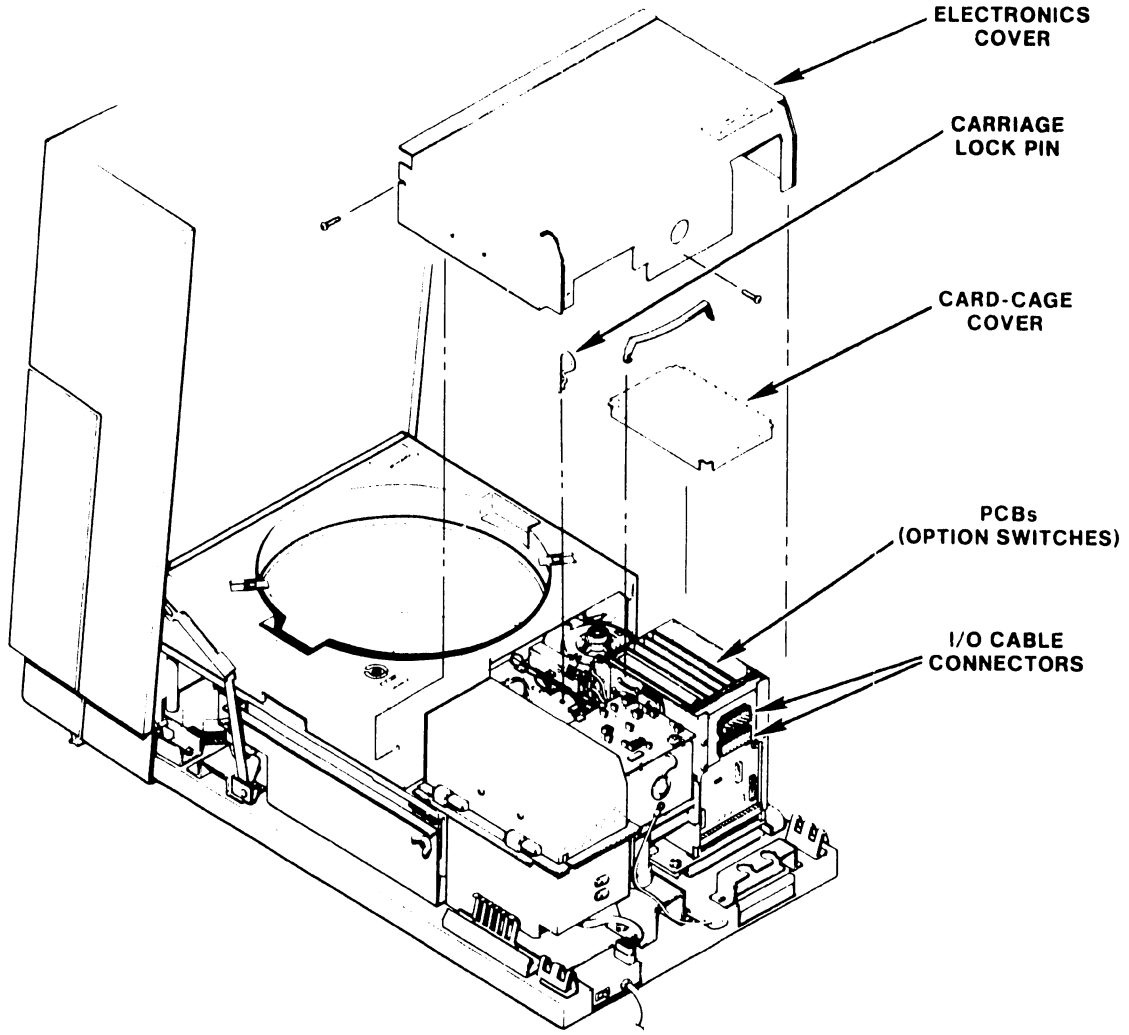


FIGURE 3-9 INSPECTING THE HAWK DISK UNIT

3.4 SYSTEM INTERCONNECTIONS

3.4.1 CABLING

The Master Unit is connected to its various peripherals as follows:

A. Connect all slave devices to the serial connector plates (279-0358) at the rear of the Master Unit. A CRT/Workstation should be close to the master processor to serve as a 'system console' for running Master Monitor Diagnostics and the like.

Be sure to number the coaxial cables at both ends, master and slave. Slave devices can be located up to 2000 feet from the Master Unit.

B. Connect the four ribbon cables from the serial connector plates to the top of the 7504 DATA BUFFER board (See Fig. 3-10). The ribbon cable from adapter plate number one plugs into the J_1 connector, from plate number two, into the J_2 connector, and so on.

C. The cables from the #1 HAWK drive, Phoenix CMDs, (or 300 Meg SMDs) are inserted through clamps at the rear of the main chassis. The J_1 and J_2 plugs of the HAWK cable are inserted into the J_1 and J_2 connectors, respectively, of the 210-7502 PCB. The CMD/SMD "A" cable is plugged into the 7505 board and the CMD/SMD "B" cables are plugged into Ports 0 through 3 (Connectors J1 through J4) of the 7506 board.

----------NOTE----------

Ports 0 through 3 are interchangeable, i.e. any Phoenix (or 300 Meg SMD) drive may be connected to any of the four ports, as long as each drive-type definition switch is set to the appropriate state. For OIS 140/145 Systems employing more than one Phoenix (or 300 Meg SMD), it is recommended that all the drive-type definition switches be set identically. In this way, all four ports may be interchanged at will during troubleshooting without having to modify the drive-type definition switches. See Section 3.12.1 for instructions on how to set the drive-type definition switches.

The CMD/SMD "A" and "B" cables, and the HAWK cables are copper clad for shielding purposes. To ensure proper contact with the main chassis, all drive cables must be mounted as follows:

1. Slide plastic sleeve over ground clips ensuring that the copper shield is in contact with the clips. (See Fig. 3-11.)

2. Push cable into clamp until plastic sleeve of cable touches the cable clamp ground clips.

3. Tighten clamps to ensure good contact, do not overtighten as this could damage drive cable.

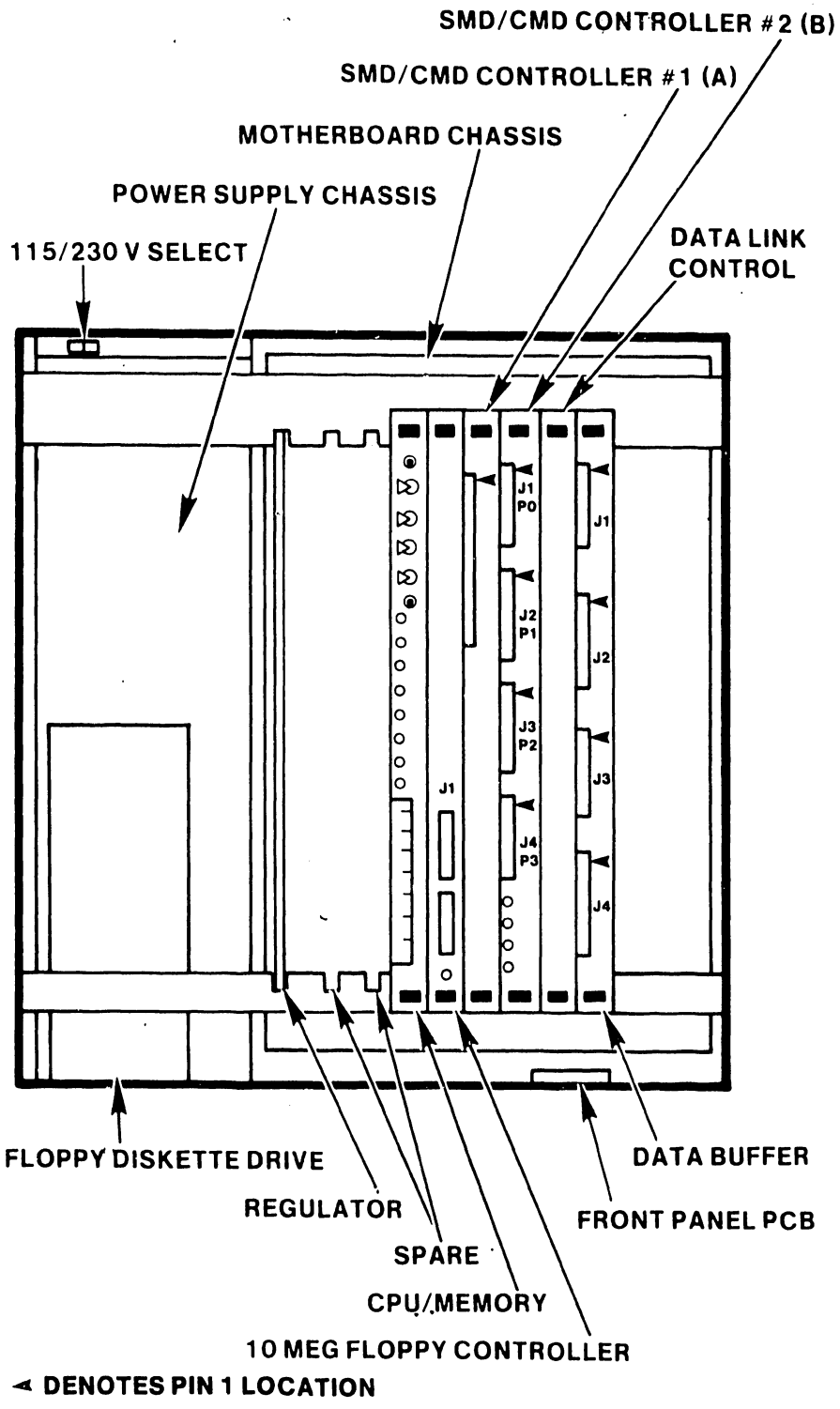


FIGURE 3-10 MASTER UNIT DETAILED LOCATIONS

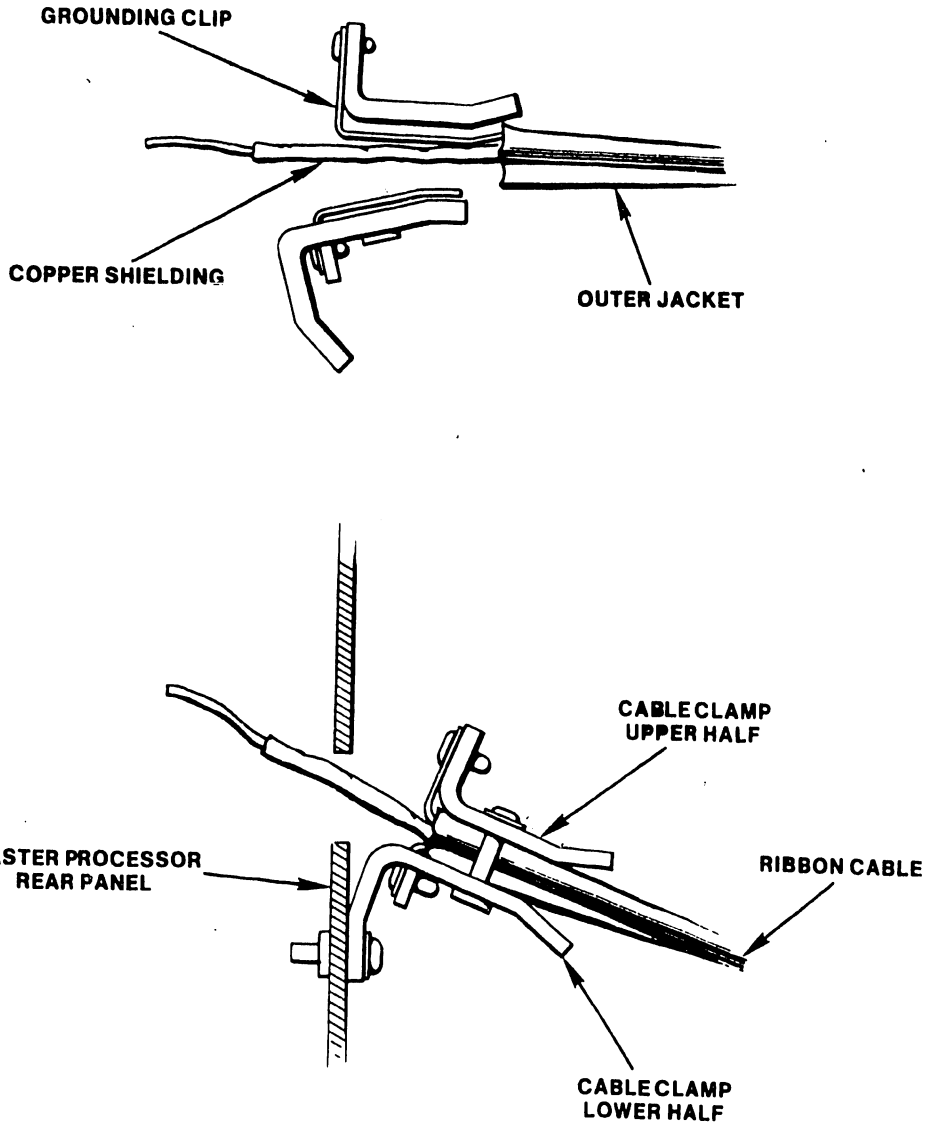


FIGURE 3-11 MASTER UNIT DISK CABLE CLAMP

3.4.2 ELECTRICAL POWER

----------WARNING----------

It is extremely important that all system equipment and all outlets are properly grounded: The Master Unit and all disks must be connected to a Grounding Conductor which is securely attached to the ground bus in the service panel. "The Grounding Conductor shall be...green...or green with yellow stripes, unless it is bare." -- National Electrical Code, Article 210, National Fire Protection Association.

All AC outlets used by the system and peripherals must first be checked with the AC Outlet Impedence Tester (WL #727-0143) for proper polarity and grounding quality.

A. Ensure that all equipment power switches are positioned "OFF" and the Master Processor Voltage Selector switch is positioned correctly (see Figure 3-7).

B. Plug the Master Processor power cable into the outlet provided.

C. Plug all disk drive power cables into the outlets provided.

D. Plug the CRT Workstation power cable into the outlet provided.

3.5 INITIAL SETUP, CHECKS, AND ADJUSTMENTS

3.5.1 INITIAL CHECKS AND ADJUSTMENTS FOR THE MASTER PROCESSOR

----------WARNING----------

Do not touch the heat sink: serious injury could result. The heat sink reaches very high temperatures when the unit is running and the top cover is removed.

A. If applicable, remove the top cover. (See Section 7.3.1.)

B. Check the PC board E-revision level. (See Section 3.12.7)

C. Properly set all switches. (See Section 3.12.1)

D. Position the power switch to "ON".

----------CAUTION----------

Avoid touching bare leads and causing a short circuit: very little clearance is provided for these adjustments.

E. Adjust the voltages on the CPU/MEM board. (See Section 3.12.5)

F. Test the diagnostic LEDs. (See Section 3.12.5)

G. Replace the top cover. (See Section 7.3.1.)

3.5.2 INITIAL CHECKS AND ADJUSTMENTS FOR THE CRT WORKSTATION

These procedures are detailed in Models 5536-1/-2/-3/-4 Workstations, WPNL No.81 (729-0522).

Initial checks and adjustments comprise the following steps.

A. Turn power ON and adjust voltages
B. Turn power OFF and connect video cable
C. Connect fan
D. Connect brightness/contrast cable
E. Replace covers
F. Ensure free rotation of the fan blades
G. Tighten all screws

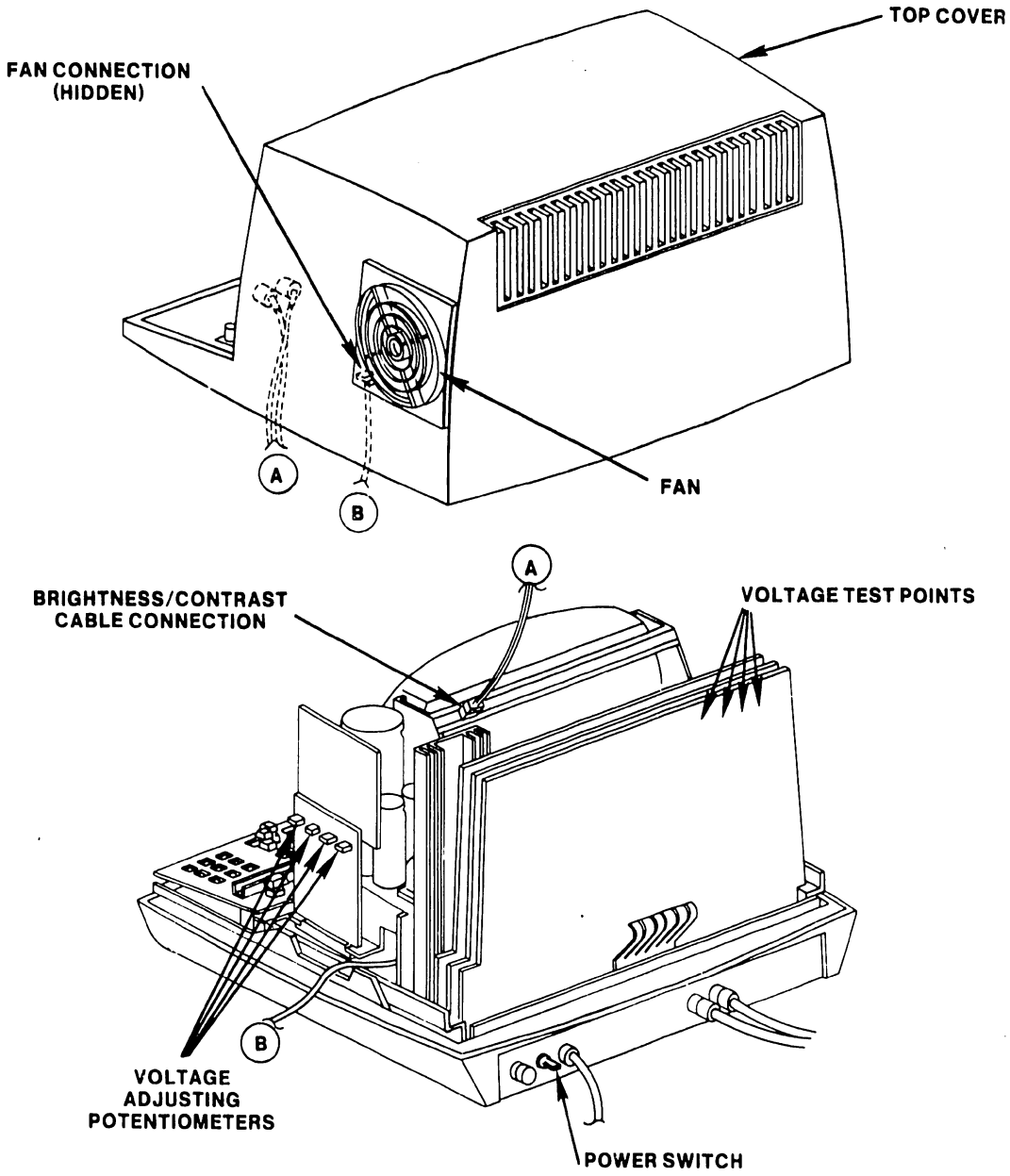


FIGURE 3-12 CRT WORKSTATION CHECKS AND ADJUSTMENTS

3.5.3 INITIAL CHECKS AND ADJUSTMENTS FOR THE PHOENIX DISK DRIVE

The following procedures are detailed in the Wang Cartridge Module Disk Drive Manual (729-0199):

A. Ensure that the Carriage Locking Pin is in the 'operating' position.

B. Verify the following cable connections:

1. "A" Cable to the J1 connector of the I/O board.
2. "B" Cable to the J3 connector of the Control MUX PCB.
3. Terminator to the J2 connector of the I/O board of last drive in chain.
4. If daisy chained, "A" Cable from J1 connector of the I/O board, to J2 connector of the I/O board on "upstream"* drive.

---NOTE---

As viewed from the component side, positioned in the electronics module, the I/O board shows two large connectors. Connector J1 is to the left of J2. On both connectors, pin 1 is located in the upper-left corner.

The J3 connector of the Control MUX PCB, when viewed in the same manner locates pin 1 in the upper-left corner.

C. Make proper switch settings on Servo Coarse PCB. (See Section 3.12.2.)

D. Make proper switch settings on Control MUX PCB. (See Section 3.12.2.)

E. Check/perform Logical Address Plug Installation. (See Section 3.12.6.)

F. Power up and perform voltage checks.

G. Verify/perform correct head alignment.

H. Perform the Heads Loaded Switch Adjustment.

I. Perform the Spin Speed Sensor Test.

J. Perform the Velocity Gain Adjustment.

* In daisy chain, upstream drive is next drive closer to Master Processor.

3.5.4 INITIAL CHECKS AND ADJUSTMENTS FOR THE SMD-300 DISK DRIVE

The following procedures are detailed in the CDC SMD Hardware Maintenance Manual (729-0221):

A. Ensure that the SMD unit is properly grounded according to the Daisy Chain Grounding scheme outlined on page 1-11 of the manual cited above.
B. Verify the following cable connections on the SMD I/O connector panel (see Figures 3-13, 3-14):

1. "B" Cable to connector IJ2.
2. "A" Cable to connector IJ3.
3. Terminator to connector IJ4 of last drive in chain.
4. If daisy chained, "A" Cable from connector IJ3 to connector IJ4 on "upstream"* drive.

C. Make the proper sector switch settings on the LTV card, in logic chassis position A06. (See Section 3.12.3.)
D. Check/perform Logical Address Plug installation. (See Section 3.12.6.)
E. Power up and perform voltage check.
F. Perform Servo System Test and Adjustment and Head Alignment procedures.

* In daisy chain, upstream drive is next drive closer to Master Processor.

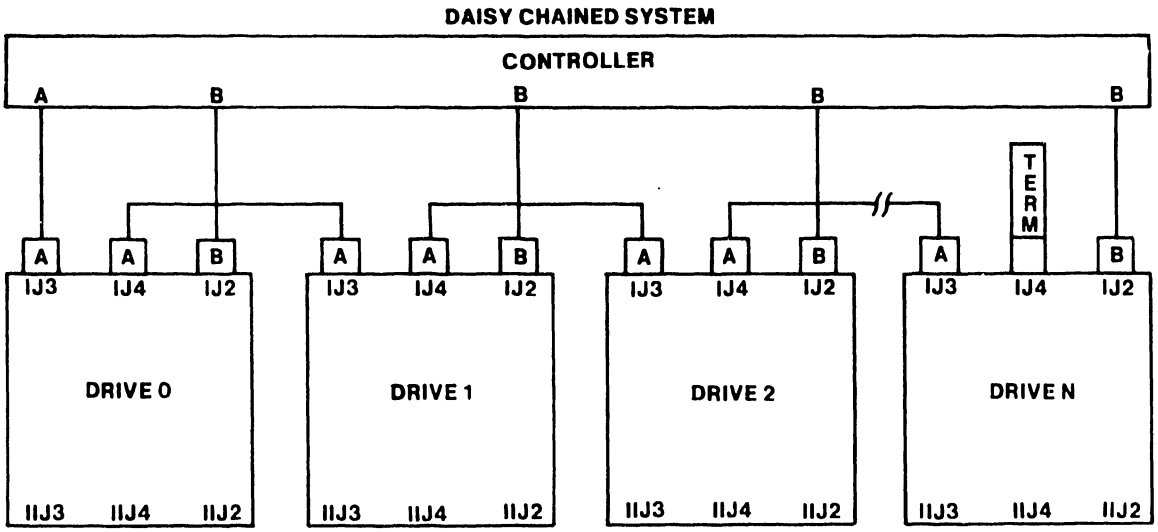
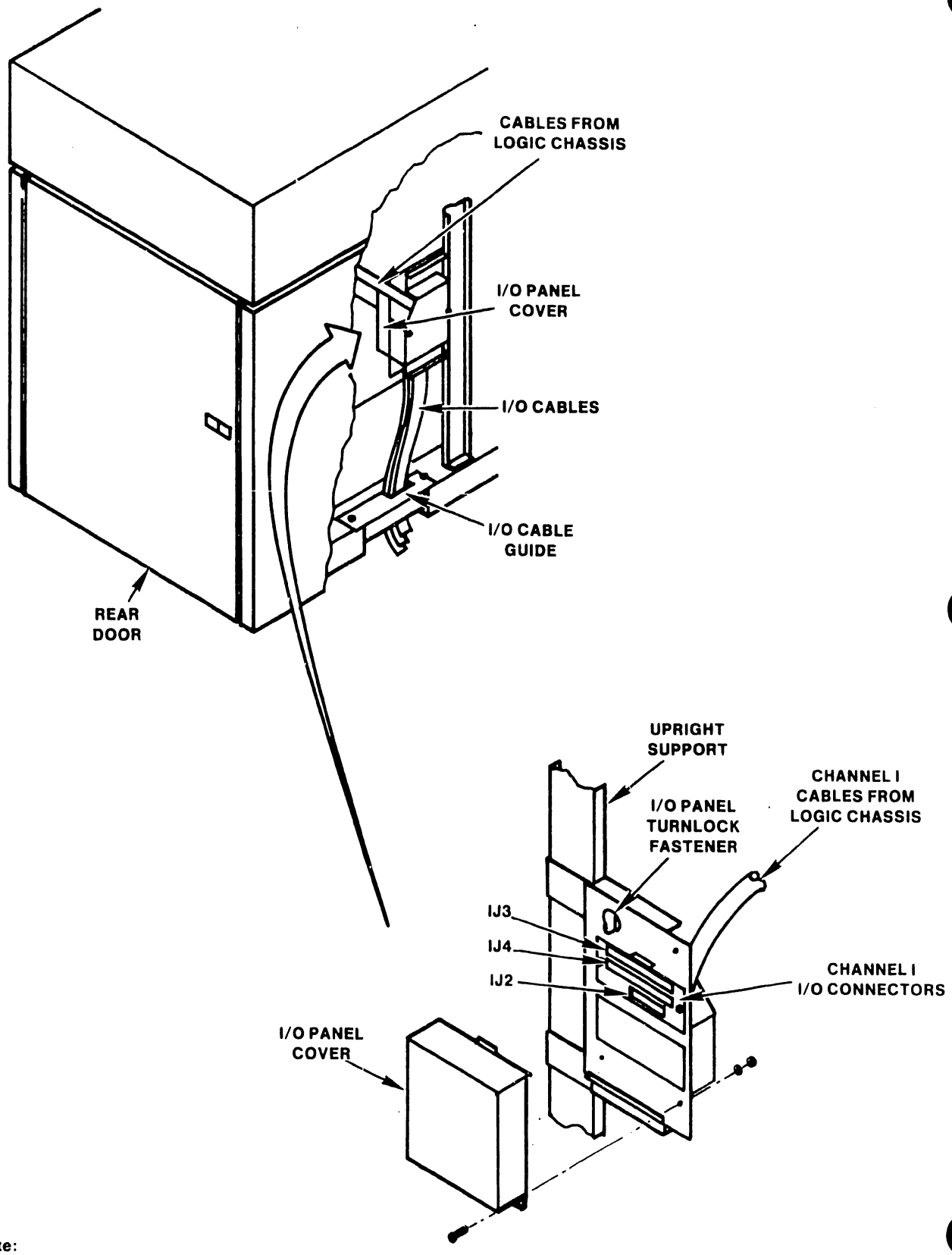


FIGURE 3-13 300 MEG SMD CABLE CONFIGURATIONS



Note:

CONNECTOR PINS ARE LABLED. PIN #1 IS LOCATED AT THE BOTTOM LEFT OF EACH CONNECTOR, AS VIEWED FROM THIS ANGLE

FIGURE 3-14 300 MEG SMD I/O CONNECTOR PANEL

3.5.4.1 INITIAL CHECKS AND ADJUSTMENTS FOR THE 80 MEG SMD DRIVE

The following procedures are detailed in the CDC OEM Service Manual (729-0210):

A. Verify the following cable connections on the SMD I/O connector panel (see Figures 3-14a, 3-14b):

1. "B" Cable to connector IJ2.
2. "A" Cable to connector IJ3.
3. Terminator to connector IJ4 of last drive in chain.
4. If daisy chained, "A" Cable from connector IJ3 to connector IJ4 on "upstream"* drive.

B. Make the proper sector switch settings on the LTV card, in logic chassis position B08. (See Section 3.12.3.)
C. Check/perform Logical Address Plug installation. (See Section 3.12.6.)
D. Power up and perform voltage check.
E. Perform Servo System Test and Adjustment and Head Alignment procedures.

* In daisy chain, upstream drive is next drive closer to Master Processor.

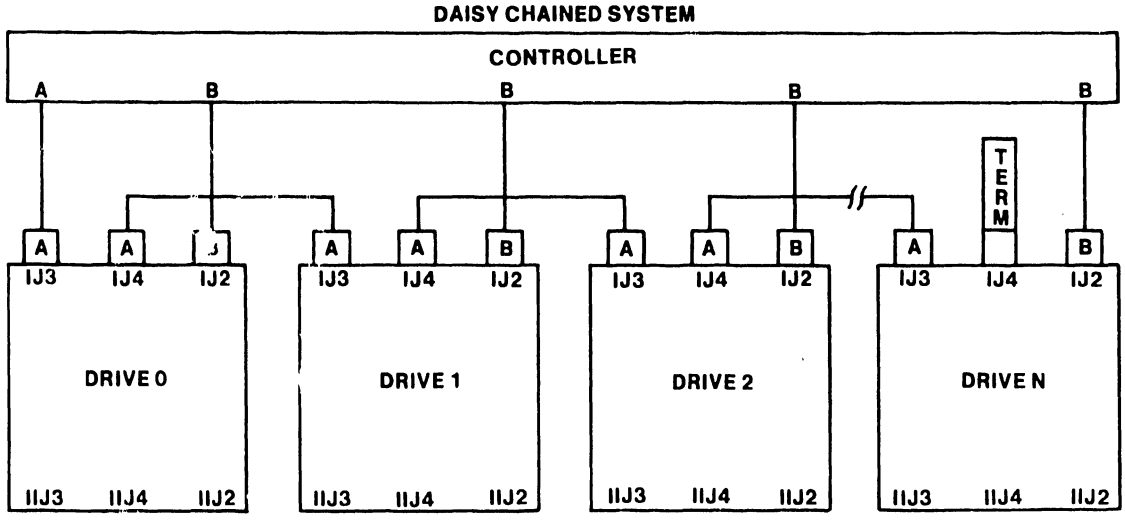


FIGURE 3-14a 80 MEG SMD CABLE CONFIGURATIONS

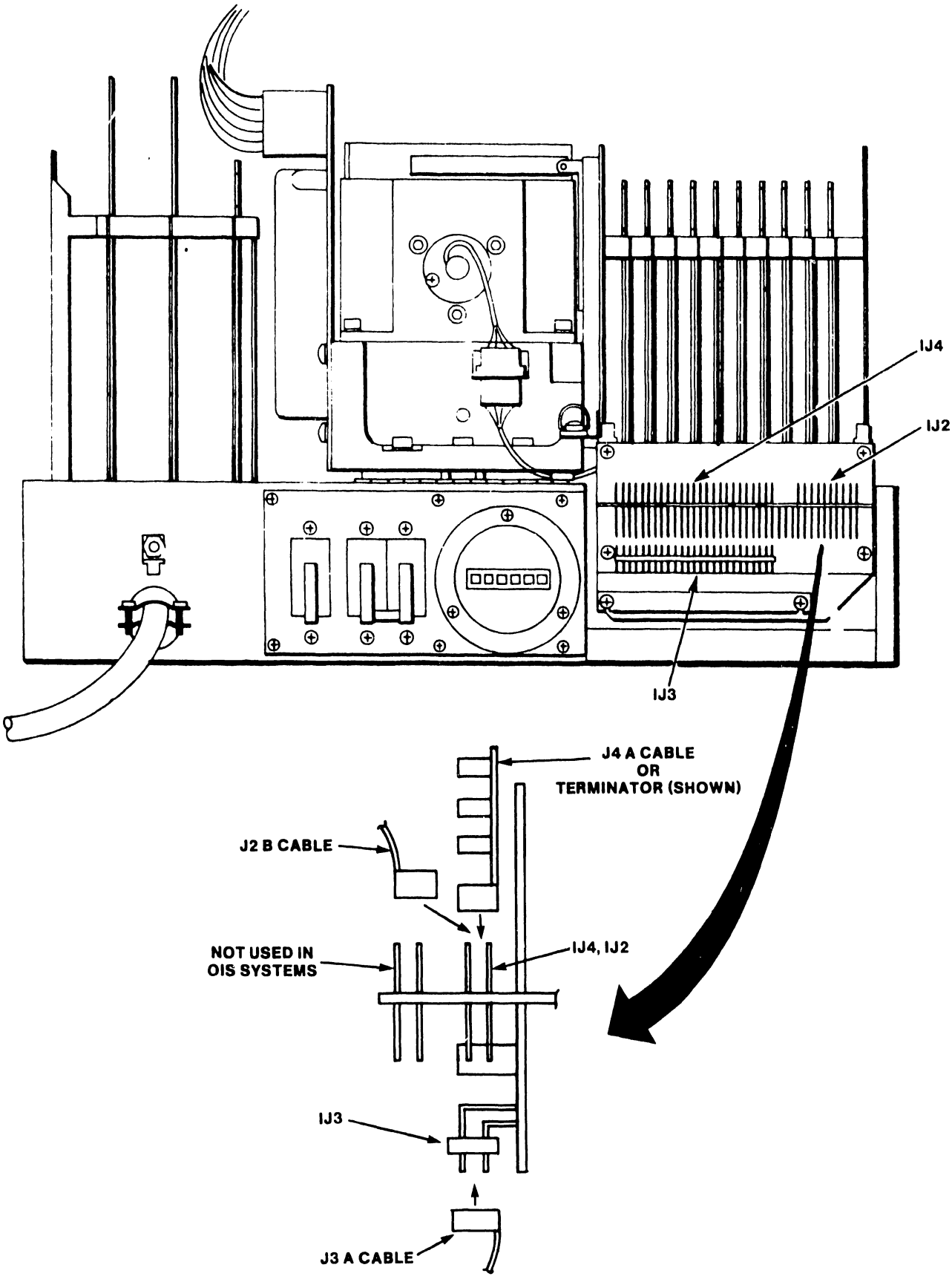


FIGURE 3-14b 80 MEG SMD I/O CONNECTOR PANEL

3.5.5 INITIAL CHECKS AND ADJUSTMENTS FOR THE HAWK DISK DRIVE

The following procedures are detailed in the Wang/CDC HAWK Disk Drive Manual (729-0181); refer to this document for further information unless directed otherwise.

CAUTION

Stop the unit immediately if a pinging or scratching sound (caused by head-to-disk contact) is heard and persists. Also, keep the access door closed to prevent unnecesssary entry of atmospheric dust in order to obtain maximum performance and reliability.

A. Ground the I/O ribbon cable at the rear of the HAWK unit (see Fig. 3-14).

1. Tilt the top cover forward to access the I/O board at the rear of the unit.
2. Feed the cable under the cable clamp, located just below the I/O board.
3. Ensure that the bare shield is in contact with the clamp.
4. Tighten the screws evenly, ensuring good electrical contact between the clamp and copper shield.

B. Connect the ribbon cable to the Winchester I/O board at the rear of the unit (see Fig. 3-15).

1. Plug the ribbon cable from the Master Processor into the upper (male) connector on the Winchester I/O board. If there is only one HAWK in the system configuration, this ribbon cable should include a terminator at its connector, as shown in Figure 3-14.
2. If a second HAWK is to be included in the system, plug the 'daisy chain' ribbon cable into the lower (female) connector on the Winchester I/O board as shown in Figure 3-15. The other end of the 'daisy chain' cable should include a terminator and be connected to the upper (male) connector of the 'downstream'* HAWK.
3. Evenly tighten the securing screws on all connectors.

C. Ensure that the HAWK option switches have been set correctly. (See Section 3.12.4.)

D. Power up the HAWK unit(s).

E. Install the Cartridge Module(s).

F. Perform compatibility alignments as outlined in Section 3 of the manual cited above.

G. Replace all covers.

* Downstream HAWK is unit furthest from Master Processor in daisy chain.

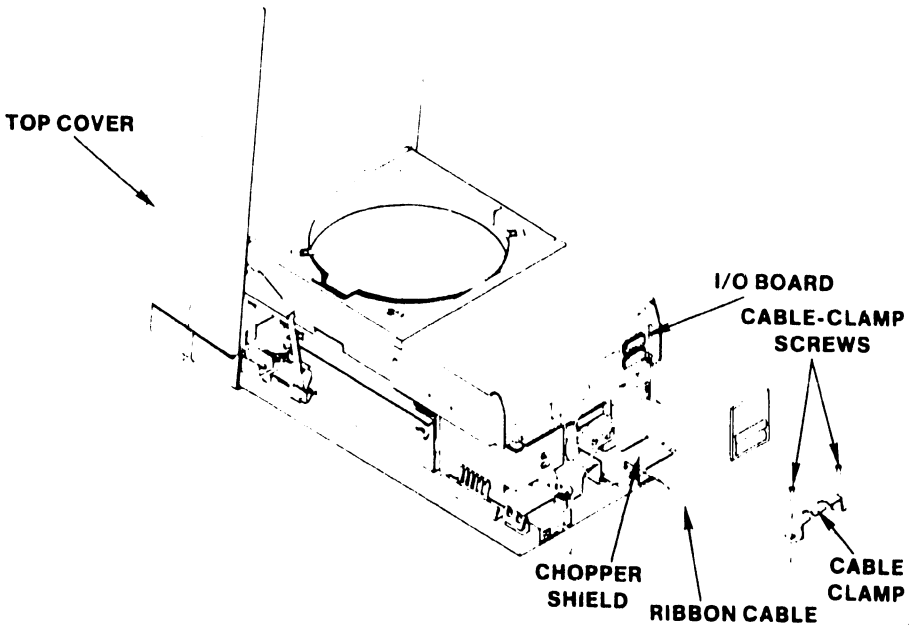


FIGURE 3-15 GROUNDING THE HAWK I/O RIBBON CABLE(S)

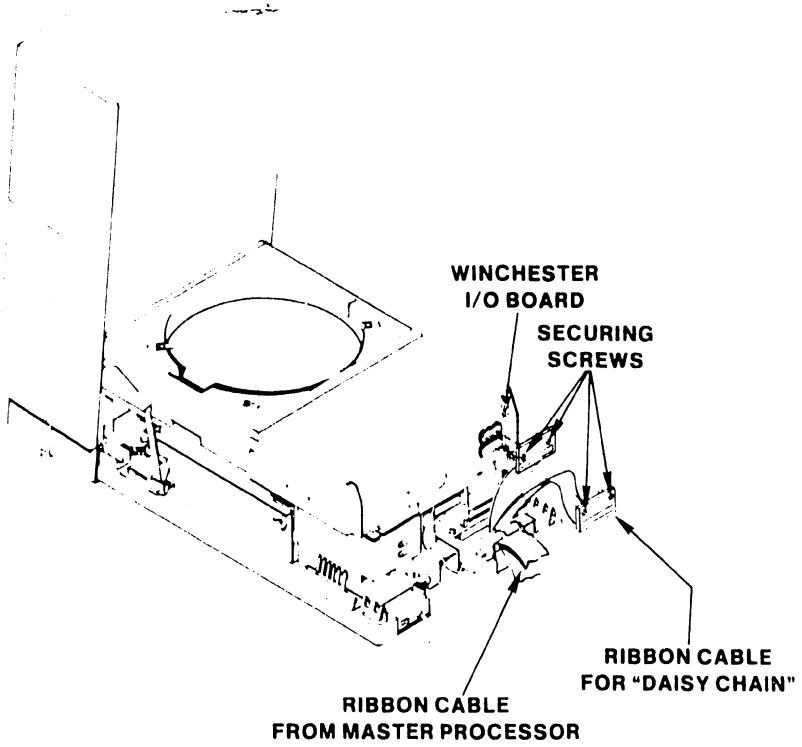


FIGURE 3-16 CONNECTING THE HAWK I/O RIBBON CABLE(S)

3.6 POWER-UP PROCEDURE

Power is applied to the system upon completion of all installation checks and adjustments. The power switches for the HAWK, Phoenix, and 300 Meg SMD drives are located at the rear of each unit. The START/STOP switches for these drives are located on the front panel of each unit. To minimize risk of damage to the system, follow the power-up procedure outlined below:

A. Position the Disk Select Switch on the Master Processor to indicate the location of the System Disk.

B. Position the power switch on the Master Processor to ON.

C. Position the power switches on all the disk units to "ON" and ensure that the blower motors start. (This is the "standby mode".)

---CAUTION---

Do not power-up (or down) any optional drive unit if the system has been IPLed and is operating. Do not activate any drive units simultaneously: allow an interval of at least one minute to avoid overloading circuits. Wait a minimum of 5 minutes (30 minutes if room temperature was below 40°F during shutdown) for the equipment to stabilize before proceeding to activate the disk units.

D. If the optional disk unit is required, activate the unit by pressing the START/STOP pushbutton. (Note that the optional drive may be left in the standby mode if not required for daily operation; when required, activate and mount volume(s) using Disk Control.)

E. Activate the System Disk unit by pressing its START/STOP pushbutton.

F. Power-up all workstations and devices to be used.

G. Press RESET on the Master Processor.

H. Enter correct date and time when the IPL menu is displayed.

3.7 MASTER UNIT POWER-UP DIAGNOSTIC

The Power-Up Diagnostic begins whenever the Master Unit is powered up, IPL'ed, or Reset and the system disk reaches operating speed. The diagnostics take approximately 15 seconds to complete.

Once the Power-Up diagnostic begins, the Power LED starts to flash. If all tests pass, the Power LED ceases flashing and goes to a steady-on state and the DATE/TIME sceen is displayed on the CRT. If an error occurs, an error code is displayed on the Front Panel Error LEDs of the Master Unit and the Power LED continues flashing (See Fig. 3-17). For detailed information concerning the OIS 140/145 Power-Up Diagnostic and is associated error codes, refer to Appendix D for the standard 64K CPU, and Appendix E for the 128K CPU.

3.8 POWER-DOWN PROCEDURE

A. Power down all system devices (excluding the Master Processor and disk units).

B. Press RESET on the Master Processor.

C. Press START/STOP pushbutton on the optional disk unit (if used).

D. Press START/STOP pushbutton on the System Disk unit.

---NOTE---
It is recommended that the drive units be left in standby mode (AC power only, and the blower motors running). This will keep the drive units stabilized and reduce contaminants.

F. Position the power switches on all disk units to OFF.

G. Position the power switches on the Master Processor to OFF.

3.9 SOFTWARE INSTALLATION

Refer to Appendix C, SOFTWARE INSTALLATION PROCEDURES, for detailed information concerning software installation and updates procedures.

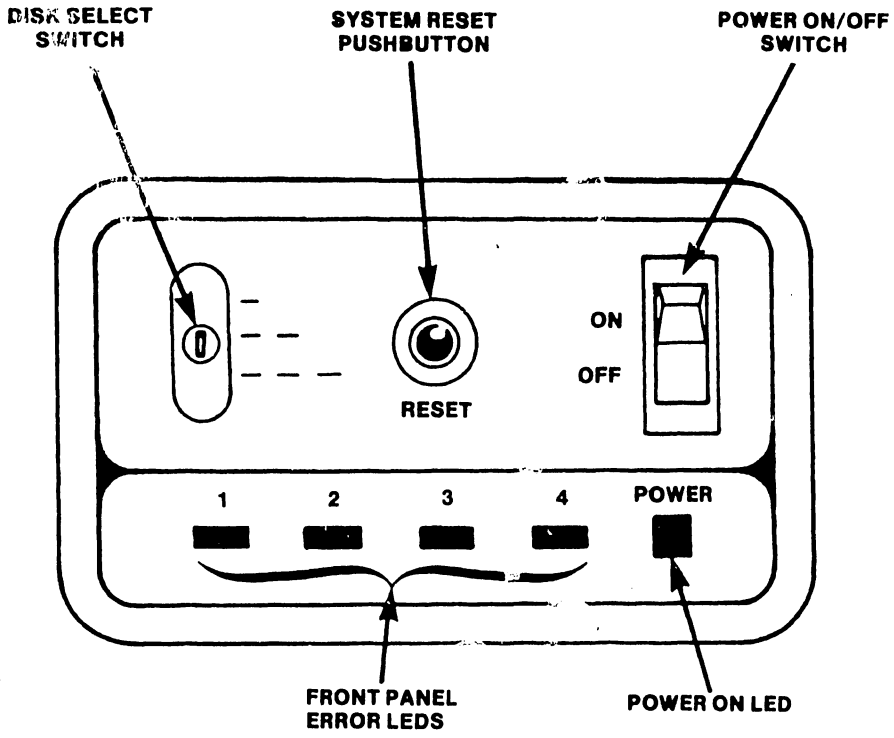


FIGURE 3-17 MASTER UNIT FRONT CONTROL PANEL

3.10 SYSTEM CHECKOUT

System checkout is complete when the items on the following checklist have been accomplished:

A. Verify correct switch settings for all devices. (See Section 3.12)

B. Verify correct head alignment for all disk drives.

C. Set switches on the CMD/SMD "B" CONTROLLER board for the maximum storage capacity. (See Section 3.12.1)

D. Configure the U33 jumper-pack on the Phoenix CONTROL MUX PCB for the maximum storage capacity. (See Section 3.12.2)

E. Exercise the system for a minimum of four hours, using SYSEX40, if available.

F. Exercise the Master Diagnostics Monitor for at least ten passes of each diagnostic program. (See Appendix A.)

G. Reset the switches in the Master Processor and Phoenix to the purchased configurations. (See Section 3.12)

H. Format and initialize the System Disk. (See Appendix C.)

I. Load software packages. (See Appendix C.)

J. Format and initialize all remaining volumes.

K. Run the Single Channel Diagnostic Monitor for all devices (or on-line diagnostic, if available).

L. Verify static immunity for all system components by Hypot testing to 2500 V. (Refer to Chapter 5 of the Systems Installation Guide, WL# 729-0907.)

M. Adjust printers for best print quality.

N. Perform final Word Processing Check. (See Section 3.11)

O. Reinitialize the System Disk. (See Appendix C.)

3.11 FINAL WORD PROCESSING CHECK

Assign a library to each workstation. The libraries should be equally divided among the volumes available to the system. Each workstation should run the glossary listed in Appendix F. This glossary will:

A. Create a New Document

B. Edit a Document by:

1. supercopying text from another document
2. super global replace words contained within the text
3. deleting words within the text

C. File document to archive diskette

D. Retrieve document from archive diskette

E. Delete document from archive diskette

F. Delete document from library

G. Start process all over again

Only archiving workstations and one standard workstation using the central archive drive, can perform steps C, D, and E simultaneously. This checkout should be run over night. Upon completion of this test, documents should be queued to every printer and printed out. At least 2 documents should be printed per printer.

Upon completion of this Final Check-Out, all volumes should be reinitialized and software reloaded. Because loading of the software at this time should be suited to the customer and with purchased software options, the proper loading of the software is the responsibility of the Marketing Support Representative.

3.12 DETAILED PROCEDURES

3.12.1 MASTER PROCESSOR SWITCH SETTINGS

Internal switches of the Master Processor comprise:

SWITCH	LOCATION
Diagnostic switches	CPU/MEM board
Voltage Selector switch	Rear of power supply
Drive Type Definition switch	SMD/CMD Controller "B"
Options switch	CPU/MEM board

A. Verify that the Voltage Selector switch has been set to the correct position (see Figure 3-7).

B. Position all the Diagnostic switches on the CPU/MEM board to OFF (toward the component side of the board). The function of this group of switches is discussed in Appendices D and E.

C. Position the switchpacks SW1 and SW2 on the CPU/MEM board as follows:

SWITCHPACK	SWITCH	POSITION
SW1	ALL	OFF
SW2	1,2,4,5,6,7,8	OFF
SW2	3	ON if BASIC purchased OFF if BASIC not purchased

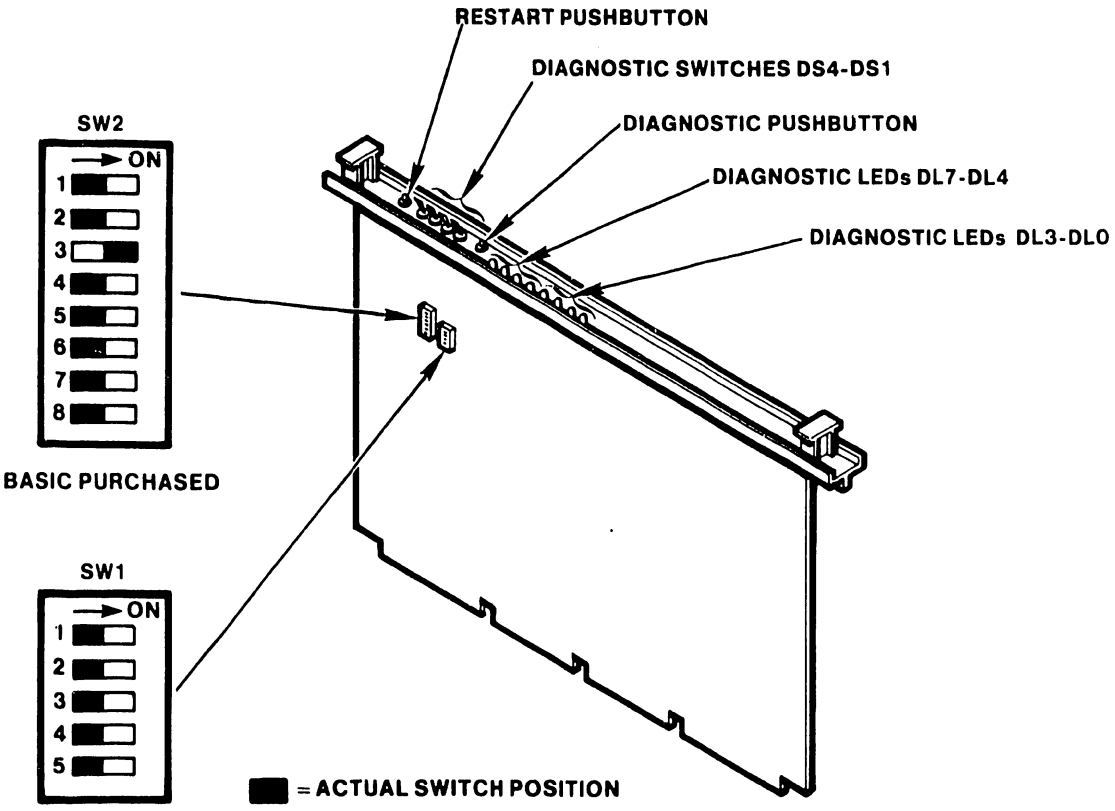


FIGURE 3-18 CPU/MEM DIAGNOSTIC AND OPTION SWITCHES

D. Position the Drive Type Definition switches on the 7506 SMD/CMD "B" CONTROLLER board as shown below:

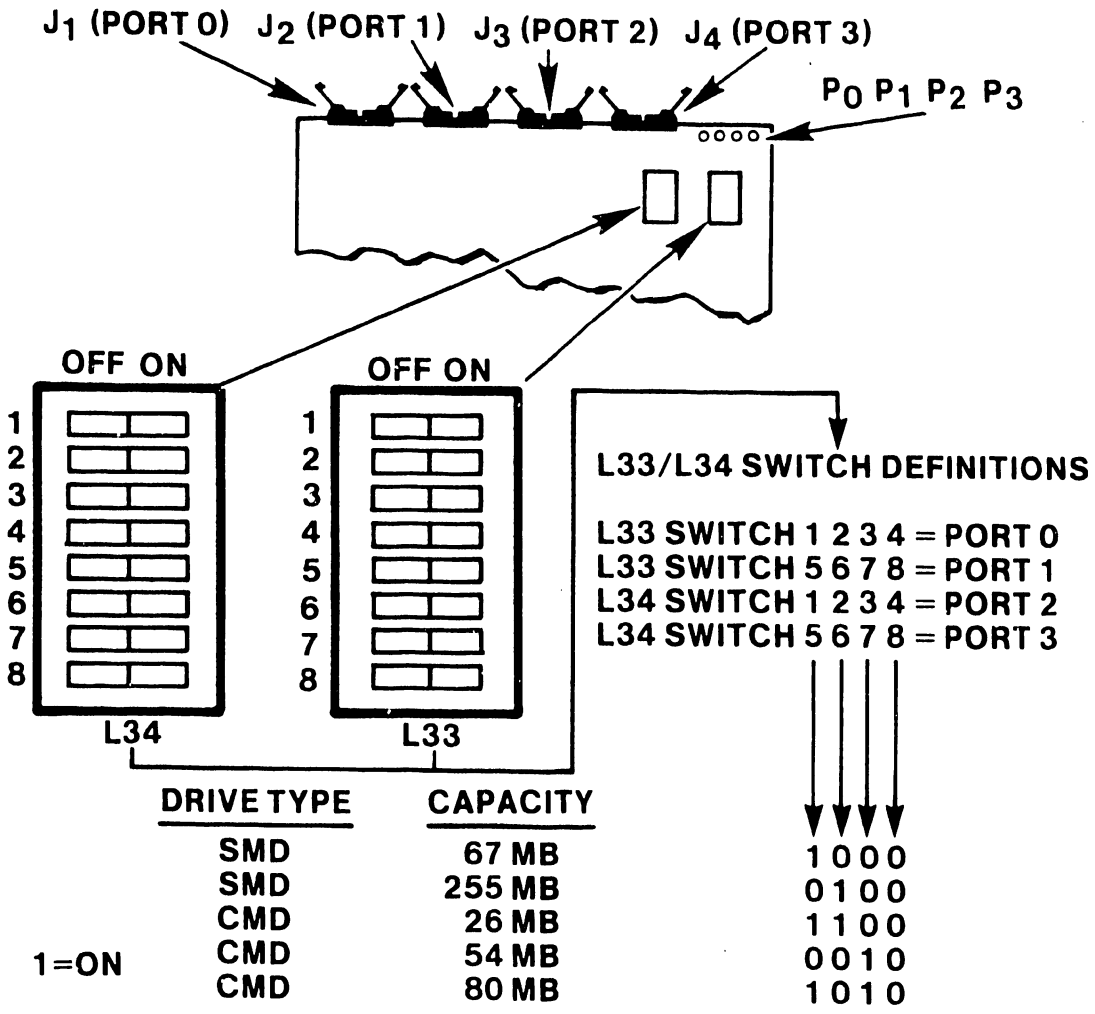


FIGURE 3-19 SWITCH SETTINGS FOR THE SMD/CMD "B" CONTROLLER

3.12.2 SWITCH SETTINGS FOR THE PHOENIX DRIVE

This section discusses only the internal Phoenix Drive switch settings unique to OIS 140 Systems. Additional switch settings are necessary for successful operation of the Phoenix Drive and may be obtained from the Wang CMD Disk Drive Manual (729-0199). Phoenix switch settings unique to OIS 140 Systems comprise:

1. Switchpack S1 on the SERVO-COARSE PCB (726-5780)
2. Switchpack S2 and jumper-pack U33 on the CONTROL MUX PCB (726-5779)

A. Set the Sector Pulse switches (Switchpack S1) on the SERVO-COARSE PCB as shown in Figure 3-20.

B. Set the Switch pack S2 and jumper-pack U33 on the CONTROL MUX PCB as shown in Figure 3-21. (One need not cut the jumper to create an open jumper; simply bend the associated pin out of its socket. In the event a pin breaks, the jumper-pack may be rotated 180 degrees, replaced in its socket, and will still function correctly. For reorder purposes, this jumper-pack has WLI No. 726-5889.

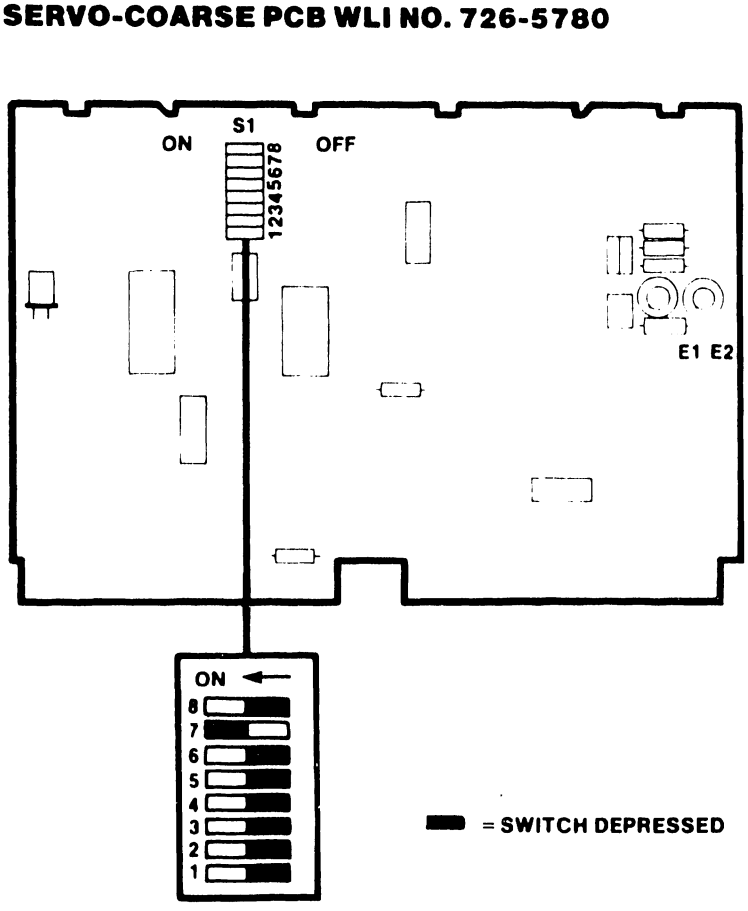
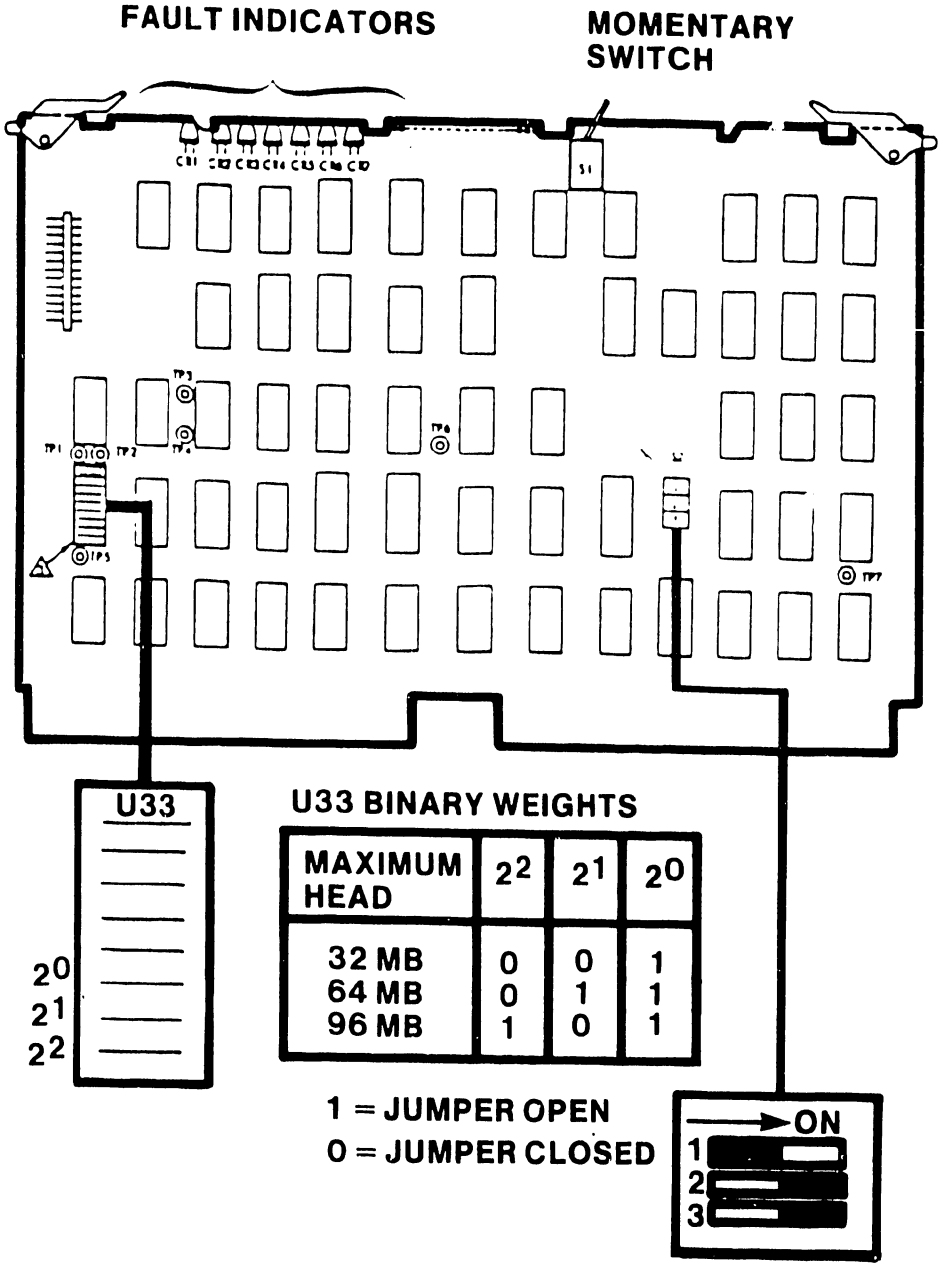


FIGURE 3-20 PHOENIX SWITCH SETTINGS FOR SERVO-COARSE PCB

CONTROL MUX PCB WLI No 726-5779



MAXIMUM HEAD	2^2	2^1	2^0
32 MB	0	0	1
64 MB	0	1	1
96 MB	1	0	1

FIGURE 3-21 PHOENIX SWITCH SETTINGS FOR CONTROL MUX PCB

3.12.3 SWITCH SETTINGS FOR THE SMD-300 DRIVE

This section discusses only the internal 300 Meg SMD Drive switch settings unique to OIS 145 Systems. Additional switch settings are necessary for successful operation of the 300 Meg SMD Drive and may be obtained from the CDC SMD Hardware Maintenance Manual (729-0221). 300 Meg SMD switch settings unique to OIS 145 Systems affect the LTV printed circuit card located in chassis location A06. Figure 3-22 below depicts these settings:

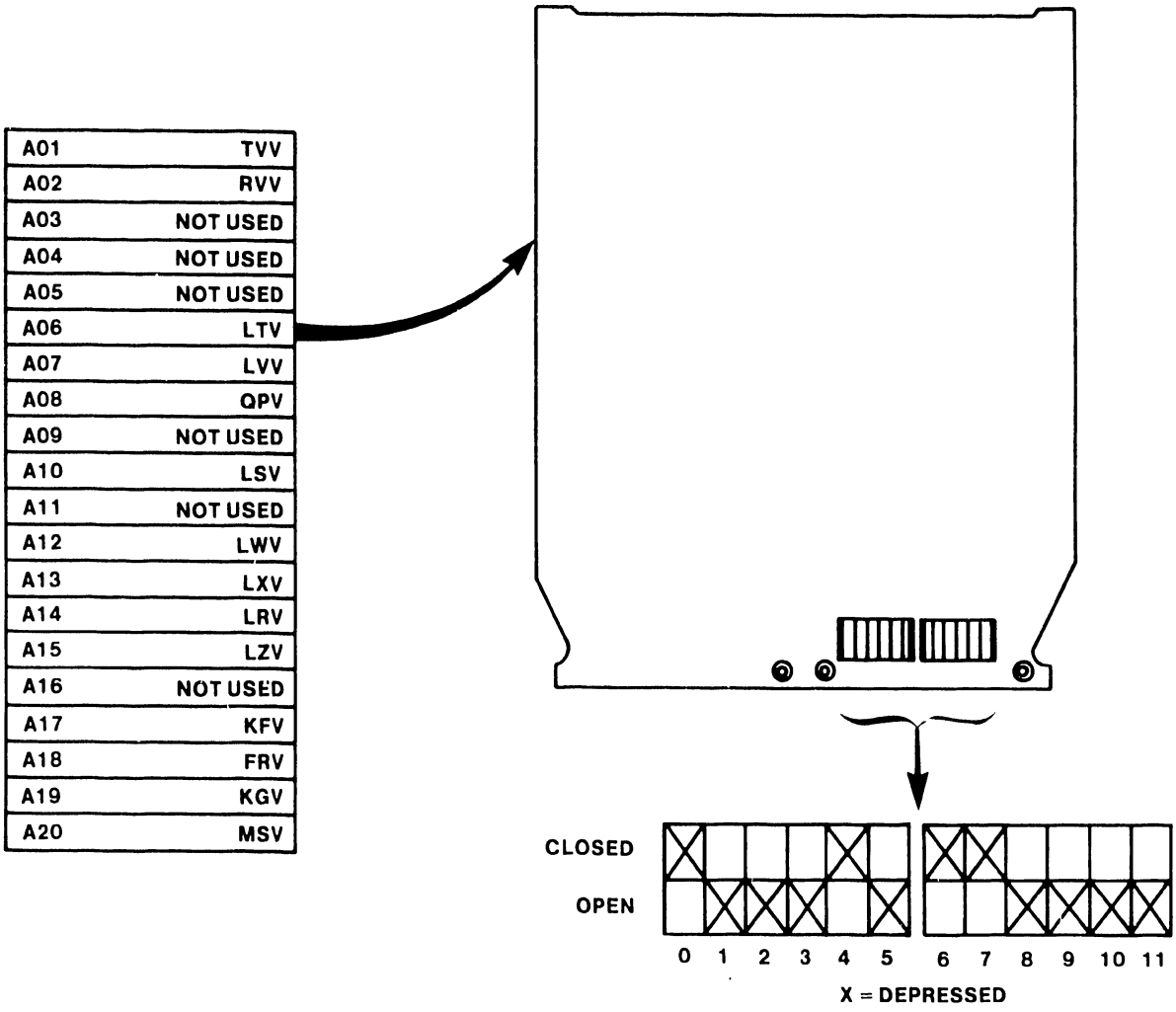


FIGURE 3-22 300 MEG SMD SECTOR SWITCH SETTINGS

3.12.4 SWITCH SETTINGS FOR THE HAWK DRIVE

This section discusses the internal switch settings for the HAWK Disk Drive, which are unique to OIS 140/145 Systems. Additional switch settings are necessary for successful operation of the HAWK Disk Drive and may be obtained from the Wang/CDC HAWK Disk Drive Manual (729-0181). The HAWK switch settings unique to OIS 140/145 Systems affect the Winchester I/O board located in the rear of the HAWK unit. Figure 3-23 below depicts these settings. Banks 1 through 4 on switch-packs S1 and S2 identify the drive unit number. For HAWK Unit 1, Bank 1 on both switch-packs should be 'ON', Banks 2, 3, and 4 should be 'OFF'. For HAWK Unit 2 (if present), Bank 2 should be 'ON', 1, 3, and 4, 'OFF'. Set switch-packs S3, S4, and S5 according to the diagram below.

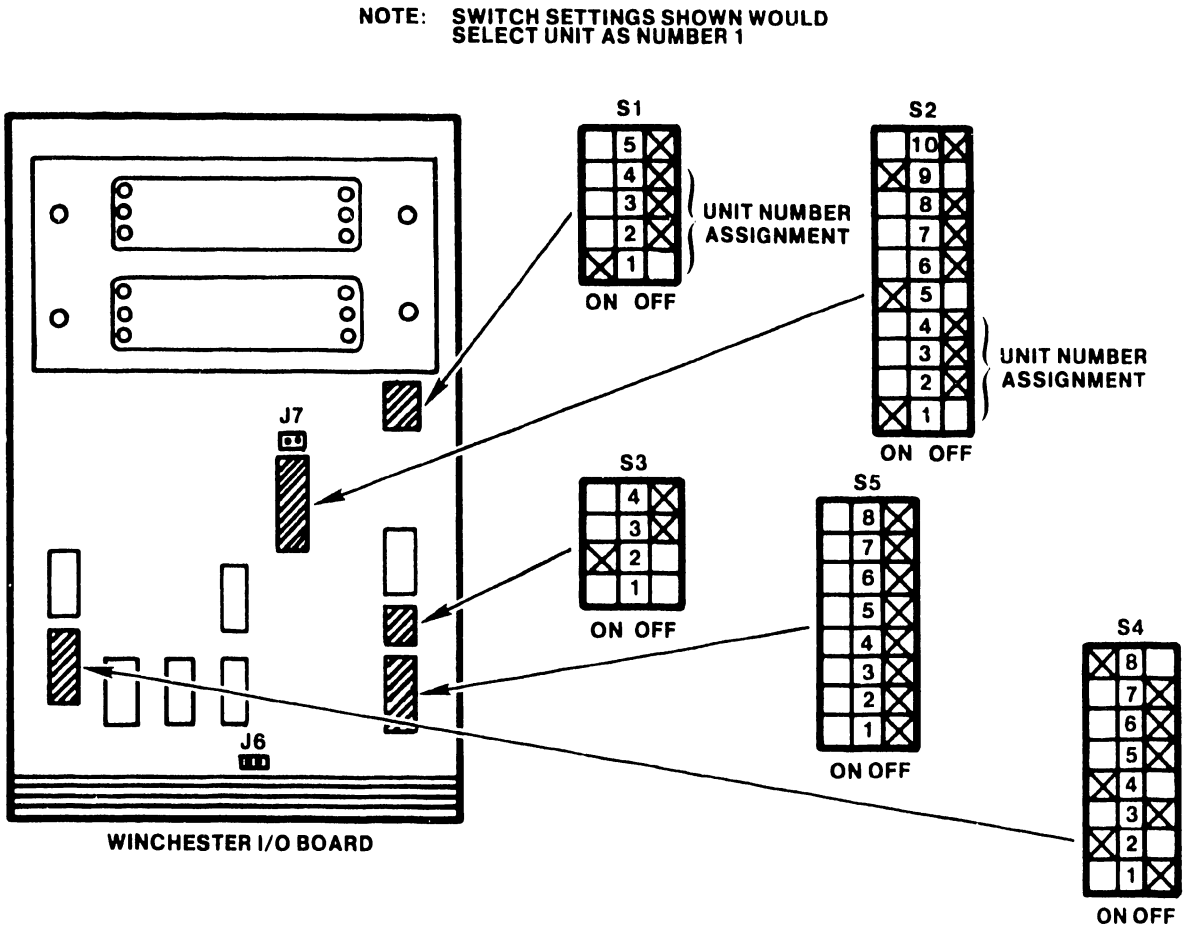


FIGURE 3-23 HAWK SWITCH SETTINGS

3.12.5 VOLTAGE ADJUSTMENTS FOR THE MASTER PROCESSOR

It is important that the following voltage-check procedures be performed to eliminate component failures due to improperly adjusted supply voltages.

A. Ensure that all PCBs are properly seated.

B. Plug in the main power cable from the Master Unit and turn the Master Unit Power switch ON.

C. Using a DVM, measure the DC voltages at the test points on the CPU/MEM board using the GND point as a reference. These test points are located on the CPU/MEM board and are labeled $+5V_1$, $+5V_2$, -5V, +12V, -12V, +24V, respectively. (See Fig. 3-24.)

D. Adjust specific voltages as necessary by trimming the related potentiometers located on the Power Regulator Board (210-7508), a $\pm$2% variation is allowed. There is no adjustment for The -12V supply. This voltage should not be lower than -11.7 VDC. Replace regulator board if voltage is not within limits. (See Fig. 3-24.)

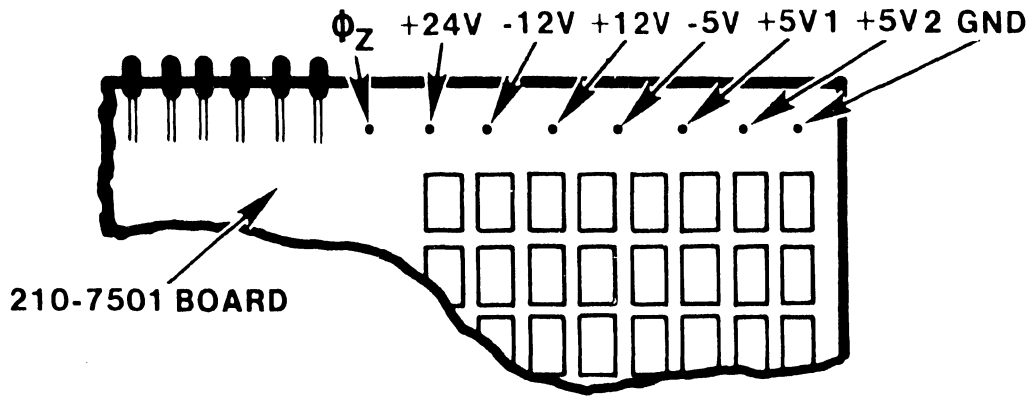
E. Check the system clock, Oz, on the CPU/MEM board with an oscilloscope or DVM. To check with an oscilloscope, set the Volts/Div. to 2V and the SEC/DIV to .1 usec. The resulting display should have a pulse width of 0.25 usec. A reading of approximately +1.9 VDC should be obtained when using a DVM. (See Figure 3-24.)

F. Engage the Diagnostic Pushbutton (DPB) on the CPU/MEM board. While keeping the DPB engaged, push the Reset (IPL) button on the front panel on the Master Unit. Engaging both pushbuttons in the above sequence causes all diagnostic LEDs on the CPU/MEM board and front panel to light, replace any board having an unlit LED. (See Fig. 3-17, 3-18.)

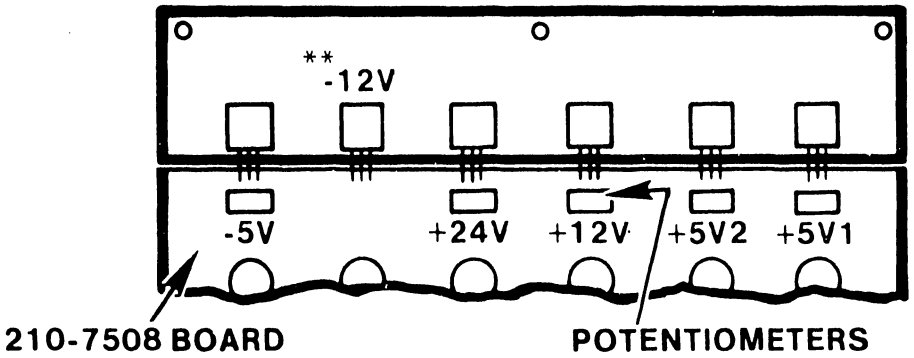
G. Turn the Master Unit Power switch OFF.

Test Point	Limits (Vdc)		Adjustment
+24	+23.5	+24.5	+ pot.
− 5	− 4.9	− 5.1	− pot.
−12	−11.7	−12.3	none
+12	+11.75	+12.25	+ pot.
+ 5V1	+ 4.9	+ 5.1	+ 5V1 pot.
+ 5V2	+ 4.9	+ 5.1	+ 5V2 pot.

USING DVM, MEASURE DC VOLTAGES AT TEST POINTS ON CPU/MEM BOARD USING GND POINT AS A REFERENCE. THESE TEST POINTS ARE LOCATED ON THE 210-7501 BOARD AND ARE LABELED +5V1, +5V2, -5V, +12V, -12V, +24V



ADJUST VOLTAGES AS NECESSARY BY TRIMMING RELATED POTENTIOMETERS LOCATED ON POWER REGULATOR BOARD 210-7508. A ±2% VARIATION IS ALLOWED



**** -12V IS NOT ADJUSTABLE**

FIGURE 3-24 VOLTAGE TEST AND ADJUSTMENT LOCATIONS

3.12.6 INSTALLATION OF THE LOGICAL ADDRESS PLUGS

If more than one Phoenix or 300 Meg SMD drive is present in an OIS 140/145 System, and the drives are in a daisy-chained configuration, it becomes necessary to assign each drive a logical address, in order for the Master Processor to identify the individual drives. This is accomplished through the use of binary-coded Logical Address Plugs inserted into the front control panel of each disk unit. Plug 0 should be installed on the disk unit which serves as the System Disk. Extra plugs for the Phoenix may be ordered using WLI # 726-6550 (contains plugs 1-7), and WLI # 726-6848 (plug 0 only). Extra plugs for the 300 Meg SMD may be ordered using WLI # 726-6849. Note that only plugs with numbers 0 through 3 are valid addresses on the OIS System.

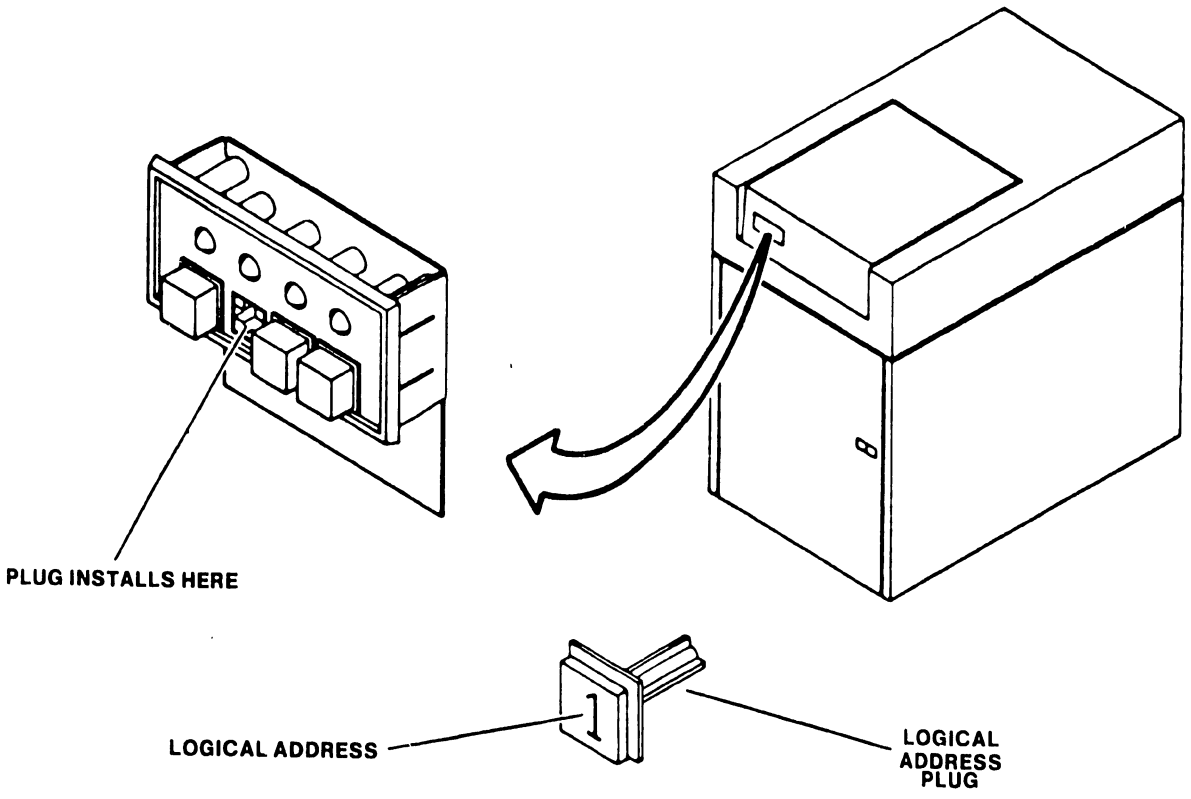


FIGURE 3-25 LOGICAL ADDRESS PLUG FOR THE 300 MEG SMD

3.12.7 CHECKING THE BOARD E-REV LEVELS

The E-revision level is noted on a sticker affixed to the non-component side of each PC board. Note that occasionally the E-revision level is only scratched into the board in the spot where the sticker should be affixed.

A. Remove the PCB retainers.
B. Remove the PCB by pulling up on the board handles.
C. Verify that the board E-revision levels are at or above those listed in Figure 3-26 below.

Board	Revision
7501 CPU & MEMORY	3
7502 10 MEG FLOPPY CNTRL	4
7503 DATA LINK CONTROL	9
7504 DATA BUFFER	1
7505 SMD CONTROLLER A (140/145)	6
7506 SMD CONTROLLER B (140/145)	6
7507 MOTHERBOARD (140/145)	2
7508 REGULATOR (140/145)	3
7650 DISK I/O A (105/115)	6
7653 DISK I/O B (105/115)	5
7887 REGULATOR	3
7649 MOTHERBOARD	0
3025 CPU & MEMORY 128K ASSY	
7684 MOTHER 128K	3
7685 DAUGHTER 128K	2
3014 TCB-1 ASSY	
7762 MOTHER TC	2
7763 DAUGHTER TC	4

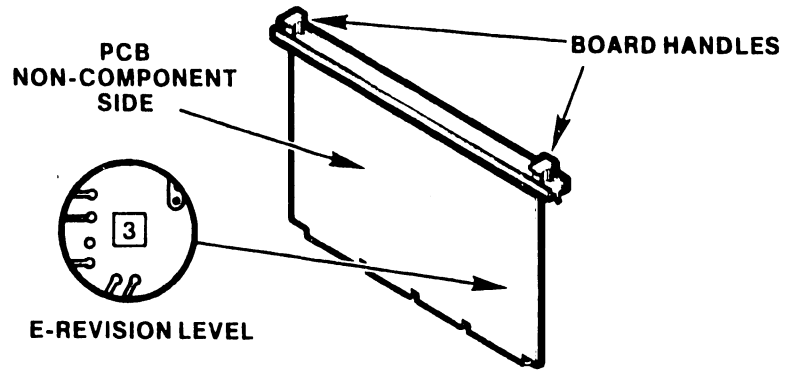


FIGURE 3-26 E-REVISION LEVELS

CHAPTER 4

CONTROLS AND INDICA-TORS

CHAPTER 4

CONTROLS AND INDICATORS

4.1 INTRODUCTION

This chapter describes the main switches, controls, and indicators for the OIS-140/145 Master Processor. Controls and indicators for the CRT workstation, Phoenix, and 300 Meg SMD disk units are referenced.

TABLE 4-1 OIS 140/145 CONTROLS AND INDICATORS

NAME	SECTION
Power Switch	4.2.1
Front (Operator) Panel	4.2.1
Option Switches	4.2.2.1
Diagnostic Switches	4.2.2.1
Diagnostic LEDs	4.2.2.1
10 Meg/Floppy Disk Activity LED	4.2.2.2
CMD/SMD Drive Type Definition switches	4.2.2.3
CMD/SMD Disk Acivity LEDs	4.2.2.3
Voltage Selector Switch	4.2.2.4
Phoenix CMD controls and indicators	4.3
300 Meg SMD controls and indicators	4.4
CRT workstation controls and indicators	4.5

4.2 MASTER-PROCESSOR CONTROLS AND INDICATORS

Controls and indicators for the Master Processor are located on the front panel, the PCBs, and at the rear of the power supply chassis.

4.2.1 MASTER-PROCESSOR FRONT PANEL

The locations of front-panel controls and indicators are called out in Figure 4-1. Their functions and settings are described in the associated Table 4-2.

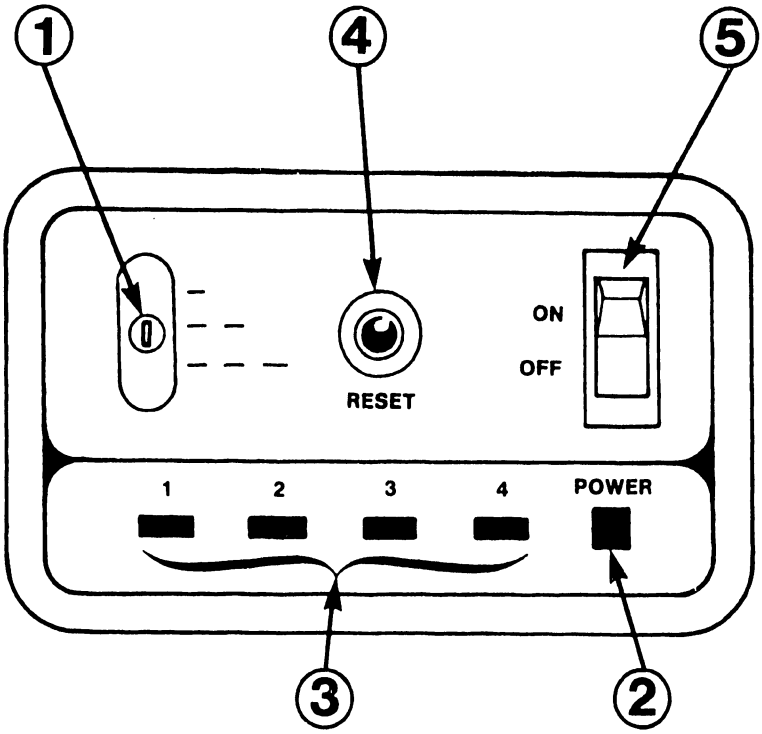


FIGURE 4-1 MASTER PROCESSOR FRONT-PANEL CONTROLS AND INDICATORS

TABLE 4-2 MASTER PROCESSOR FRONT-PANEL CONTROLS AND INDICATORS

ITEM	NAME	TYPE AND FUNCTION
(1)	DISK-SELECT	Three-position toggle switch. Set to System Disk where IPL program is located. IPL program is normally located on the CMD/SMD with Logical Address Plug '0'. UP (-) = Floppy diskette MIDDLE (--) = Hawk disk unit DOWN (---) = Phoenix CMD or 300 Meg SMD
(2)	POWER LED	Indicates AC power applied to Master processor. Flashes during power-up diagnostics and when an error condition is detected. Steadily illuminated while the system is operational.
(3)	ERROR LEDs 1, 2, 3, 4	Error lights; indicate type of error detected during power-up diagnostics. LED 1 indicates a fatal error. LEDs 2, 3, and 4 indicate errors which are correctable by the operator. Refer to Appendices D and E for error descriptions.
(4)	RESET	Red pushbutton; IPL's system by forcing system to address 0000H.
(5)	POWER-ON SWITCH	Rocker-type switch; Energizes Master Unit and forces system into Power-up diagnostics.

4.2.2 MASTER PROCESSOR INTERNAL CONTROLS AND INDICATORS

4.2.2.1 7501 CPU/MEMORY BOARD

Internal controls and indicators located on the 7501-board comprise those used for diagnostics and those used for options. The locations of the controls and indicators are called out in Figure 4-2, their function and use, in Table 4-3.

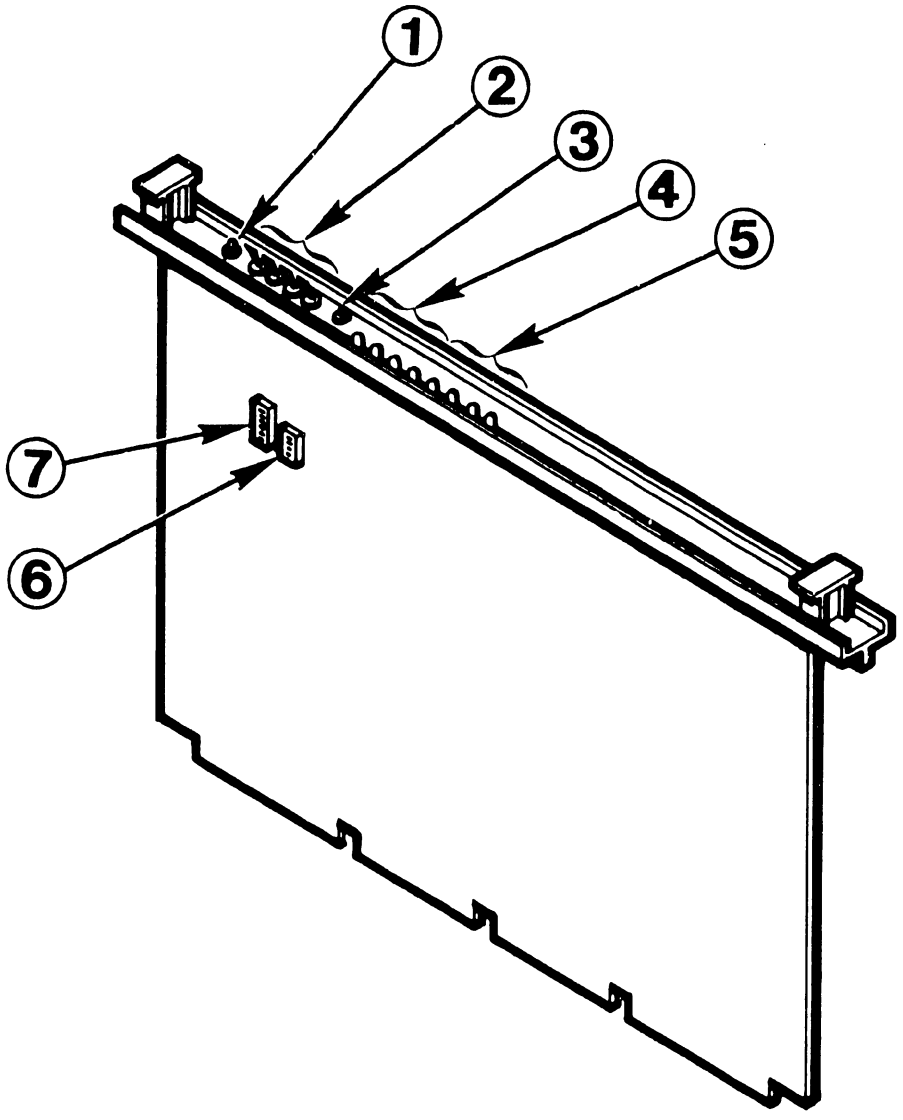


FIGURE 4-2 MASTER PROCESSOR INTERNAL CONTROLS AND INDICATORS
7501 CPU/MEMORY BOARD

TABLE 4-3 MASTER PROCESSOR INTERNAL CONTROLS AND INDICATORS
7501 CPU/MEMORY BOARD

ITEM	NAME	TYPE AND FUNCTION
(1)	RST	Restart pushbutton; forces system to trap at address 0066H; same effect as non-maskable interrupt.
(2)	DS4, DS3, DS2, DS1	Diagnostic switches; used to start diagnostic programs at particular locations. All switches should be positioned OFF for normal operation. Appendices D and E contain information concerning their use.
(3)	DPB	Diagnostic pushbutton; initializes requested diagnostic programs.
(4)	DL7-DL4	Diagnostic LEDs; display fatal "detailed error code" during power-up diagnostics. The detailed error codes do not apply if the error is not fatal. (See Appendices D and E.)
(5)	DL3-DL0	Diagnostic LEDs; display the test number being executed during power-up diagnostics. Also used to display Extended Error information. (See Appendices D and E.)
(6)	SW1	Option switches; 5-bank DIP switch. For future use. Position all switches to OFF.
(7)	SW2	Option switches; 8-bank DIP switch. BASIC purchased, position switch 3 ON BASIC not purchased, position switch 3 OFF Position switches 1, 2, 4, 5, 6, 7, and 8 OFF.

4.2.2.2 7502 - 10 MEG/FLOPPY CONTROLLER BOARD

The activity LED indicates activity on either a Hawk disk drive or on the Shugart floppy diskette drive.

ITEM 1 10 Meg/Floppy Disk Activity LED

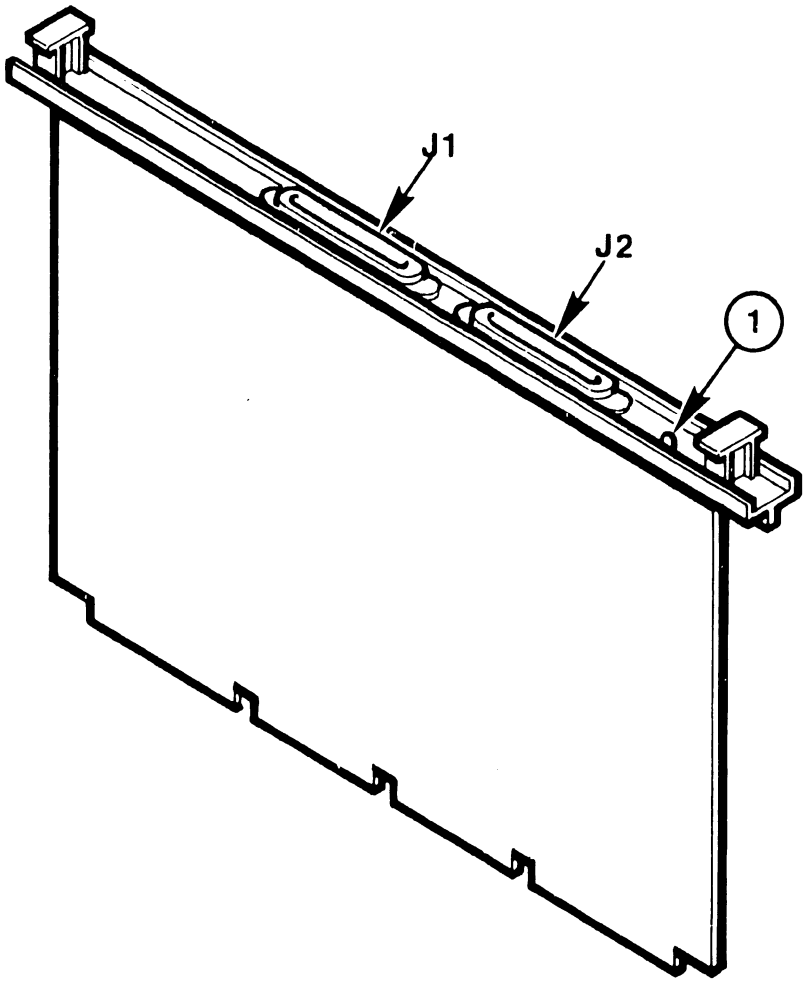


FIGURE 4-3 MASTER PROCESSOR INTERNAL CONTROLS AND INDICATORS
7502 - 10 MEG/FLOPPY CONTROLLER BOARD

4.2.2.3 7506 CMD/SMD "B" CONTROLLER BOARD

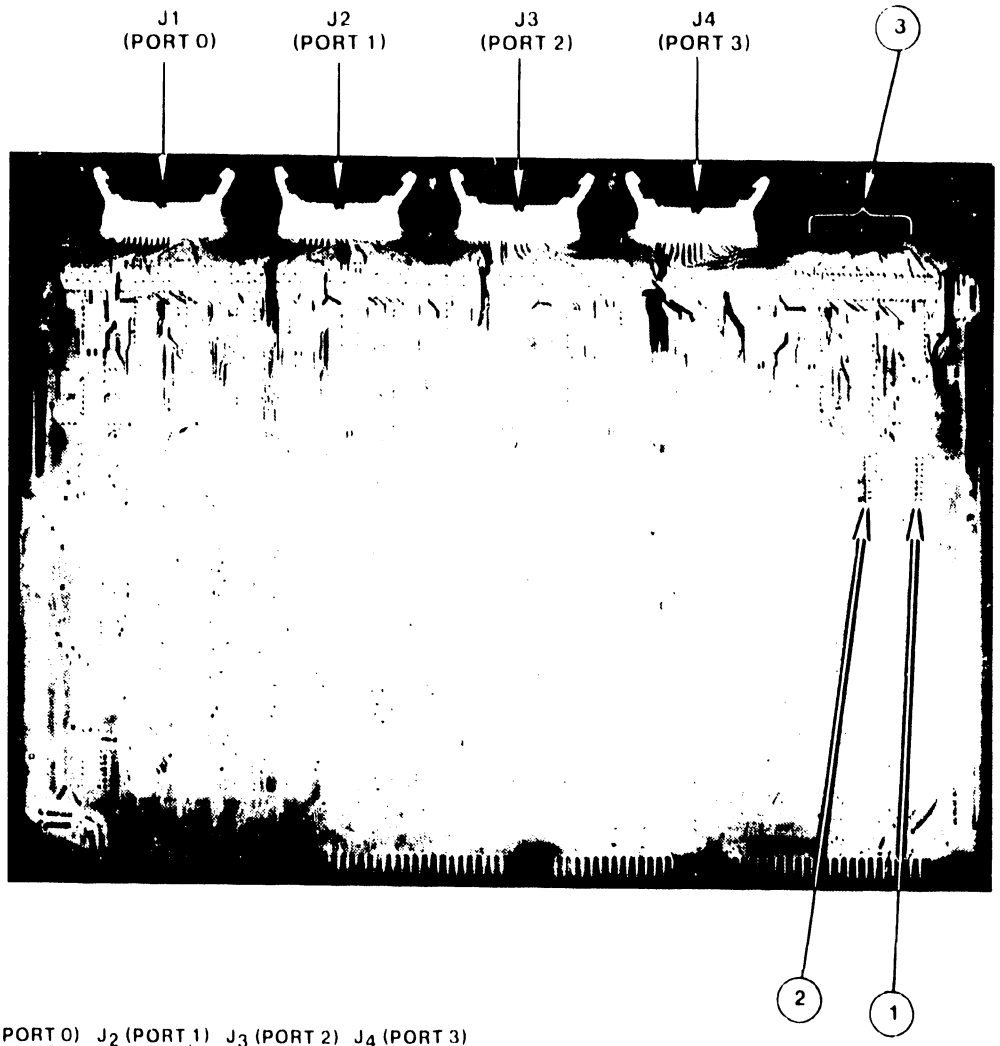
Internal switches and indicators located on the 7506 board comprise two 8-bank DIP switches used to define drive storage capacity and four LEDs to indicate drive activity. The locations of the switches and indicators are called out in Figure 4-4, their function and use, in Table 4-4.

TABLE 4-4 MASTER PROCESSOR INTERNAL CONTROLS AND INDICATORS
7506 CMD/SMD "B" CONTROLLER BOARD

ITEM	NAME	TYPE AND FUNCTION
1	SW1	Drive-type Defininition switch (L33); 8-bank DIP switch. Used to define the type and storage capacity of CMD/SMD connected to each port of the 7506 board. Switches 1 - 4 reference Port 0, switches 5 - 8 reference Port 1. Refer to Figure 4-4 for details.
2	SW2	Drive-type Defininition switch (L34); 8-bank DIP switch. Used to define the type and storage capacity of CMD/SMD connected to each port of the 7506 board. Switches 1 - 4 reference Port 2, switches 5 - 8 reference Port 3. Refer to Figure 4-4 for details.
3	P0 - P3	These LEDs indicate read, write, or seek activity on the associated disk unit (P0 corresponds to the disk connected to Port 0, P1 to Port 1, etc.).

---NOTE---

Ports 0 through 3 are interchangeable, i.e. any Phoenix (or 300 Meg SMD) drive may be connected to any of the four ports, as long as the associated drive-type definition switch is set to the appropriate state. For OIS 140/145 Systems employing multiple CMD or SMD drives, it is recommended that all the drive-type definition switches be set identically. In this way, all four ports may be interchanged at will during troubleshooting without having to modify the drive-type definition switches. (This recommendation assumes that all the CMD/SMD units in the particular system have identical storage capacity.)



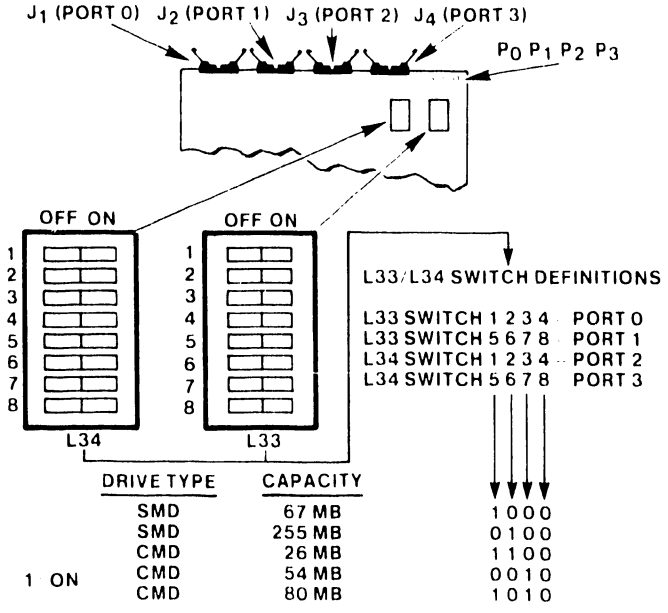


FIGURE 4-4 MASTER PROCESSOR INTERNAL CONTROLS AND INDICATORS
7506 CMD/SMD "B" CONTROLLER BOARD

4.2.2.4 VOLTAGE-SELECTOR SWITCH

The voltage-selector switch, located at the rear of the power-supply chassis, is used to select 115 Vac or 230 Vac according to the line voltage available. Changes in operating frequency (50/60 Hz) require a complete change of power supply and floppy diskette. The part numbers necessary to make such a change may be found in the IPB of Appendix G.

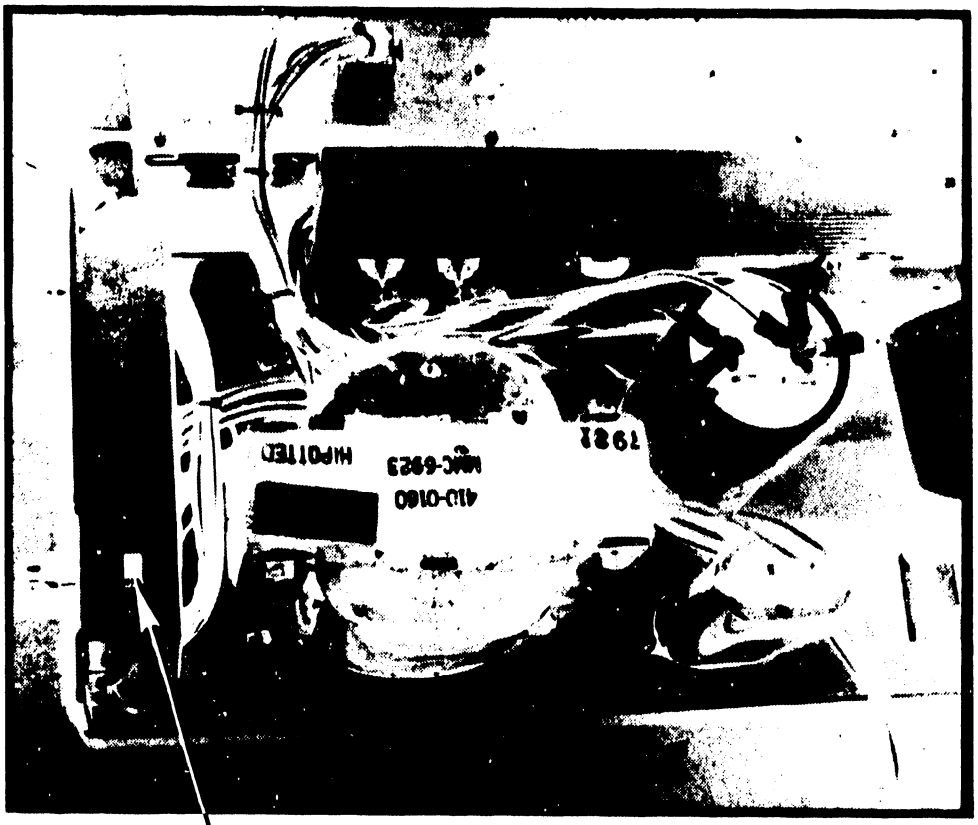


FIGURE 4-5 MASTER PROCESSOR INTERNAL CONTROLS AND INDICATORS
POWER SUPPLY CHASSIS

4.3 PHOENIX DISK UNIT

Operator controls and indicators for the Phoenix disk unit are described in the Wang Cartridge Module Disk Drive Manual (729-0199); refer to this document for further information. The locations of the controls and indicators are called out in Figure 4-6, their function and use, in Table 4-5.

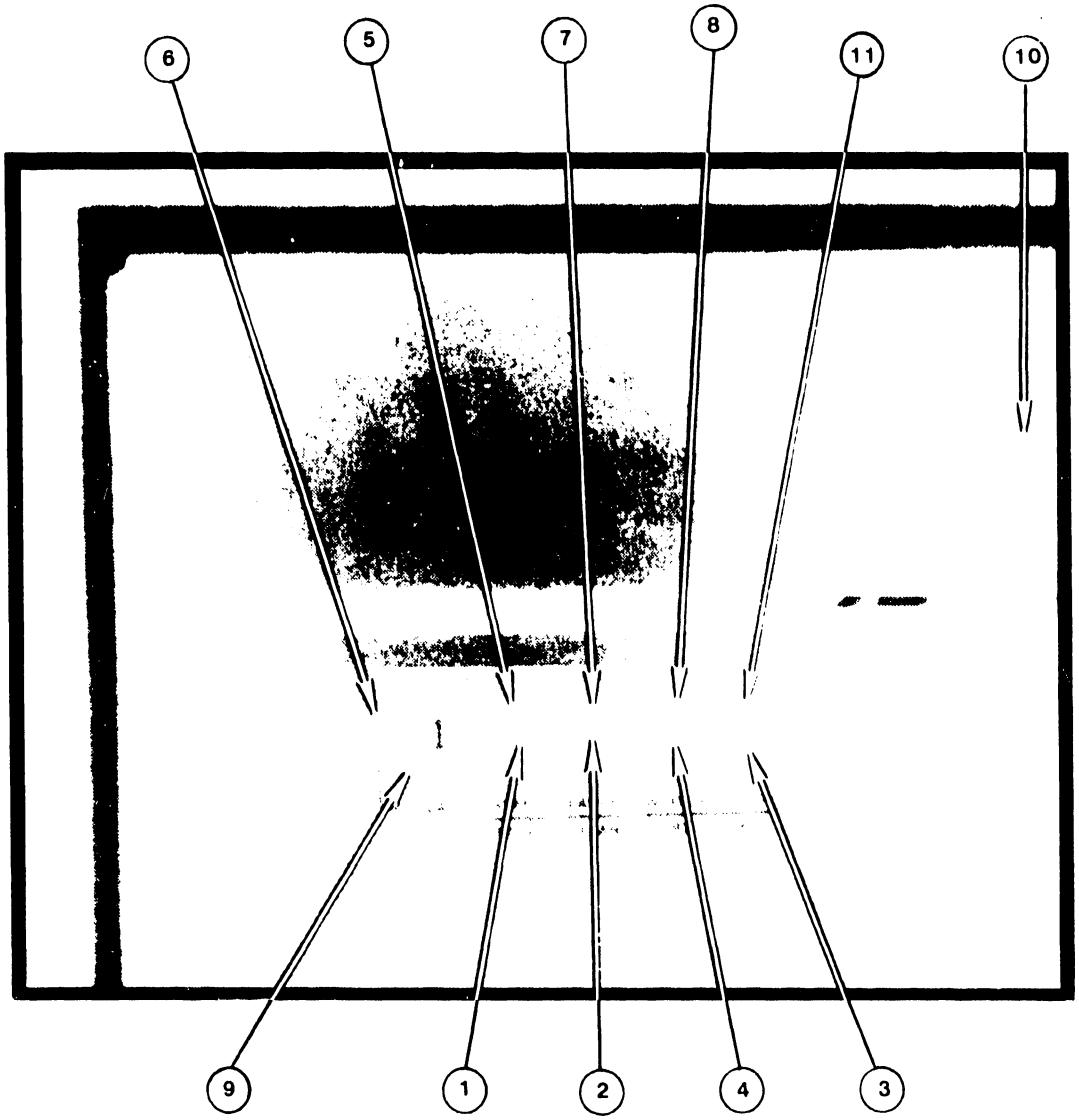


FIGURE 4-6 PHOENIX CMD CONTROLS AND INDICATORS

TABLE 4-5 PHOENIX CMD CONTROLS AND INDICATORS

ITEM	NAME	FUNCTION
(1)	START/STOP SWITCH	Energizes spindle motor and initiates the first seek mode, provided the following conditions are met: 1) The AC circuit breaker is ON. 2) The disk cartridge loading door is closed and latched with cartridge in place. (Deck in lowered position) 3) FAULT indicator LED is OFF. 4) Ground on HOLD line for LOCAL start mode. Releasing the switch when the drive is in powered-up state (disk pack spinning) initiates power-down sequence.
(2)	FAULT SWITCH	Clears certain fault conditions when operated. Start/Stop switch may have to be released to clear some fault indicators.
(3)	PROTECT FIXED SWITCH	Disables write driver for fixed media; disabled in Wang Systems.
(4)	PROTECT CART-RIDGE SWITCH	Disables write driver for removable cartridge; disabled in Wang Systems.
(5)	START/STOP INDICATOR LED	Located within the START/STOP switch, lights when the START/STOP switch is activated, turns off when switch is released. Not all units have a START indicator.
(6)	READY INDICATOR LED	When lit this LED indicates unit ready status. The READY indicator is lit whenever unit is up to speed, heads are loaded, and no fault requiring manual intervention exists within the unit. The READY light will blink throughout the spindle start and stop procedure.

TABLE 4-5 (continued)

ITEM	NAME	FUNCTION
(7)	FAULT INDICATOR LED	Located on the FAULT switch*. Indicates a fault condition when lit. Turns OFF when the fault condition is cleared by operating the FAULT switch.
(8)	PROTECT CARTRIDGE INDICATOR LED	Indicates that the removable volume cartridge of the drive is write protected.
(9)	LOGICAL ADDRESS PLUG	Plastic plug; generates the logical unit address when inserted into the socket. This is done by closing the coded switch contacts in the Logical Address socket. The plug is marked (0, 1, 2, 3 ...) to represent the unit number selected.
(10)	DISK PACK ACCESS DOOR LATCH	The Disk Pack Access Door is opened by lifting the latch located under the lip of the access door. The latch will not open the door until after the spindle motor has stopped rotating and the START/STOP switch is in the OFF position. This causes the interlock solenoid to release the catch. In the event of an AC power loss, the interlock solenoid will not release the catch. This is done to prevent damage to the cartridge.
(11)	PROTECT FIXED INDICATOR LED	Indicates that the fixed volume media of the drive is write protected.

* Does not indicate Seek error.

4.4 300 MEG SMD UNIT

Operator controls and indicators for the 300 Meg SMD are described in the CDC SMD Hardware Maintenance Manual (729-0221); refer to this document for further information. The locations of the controls and indicators are called out in Figure 4-7, their function and use, in Table 4-6.

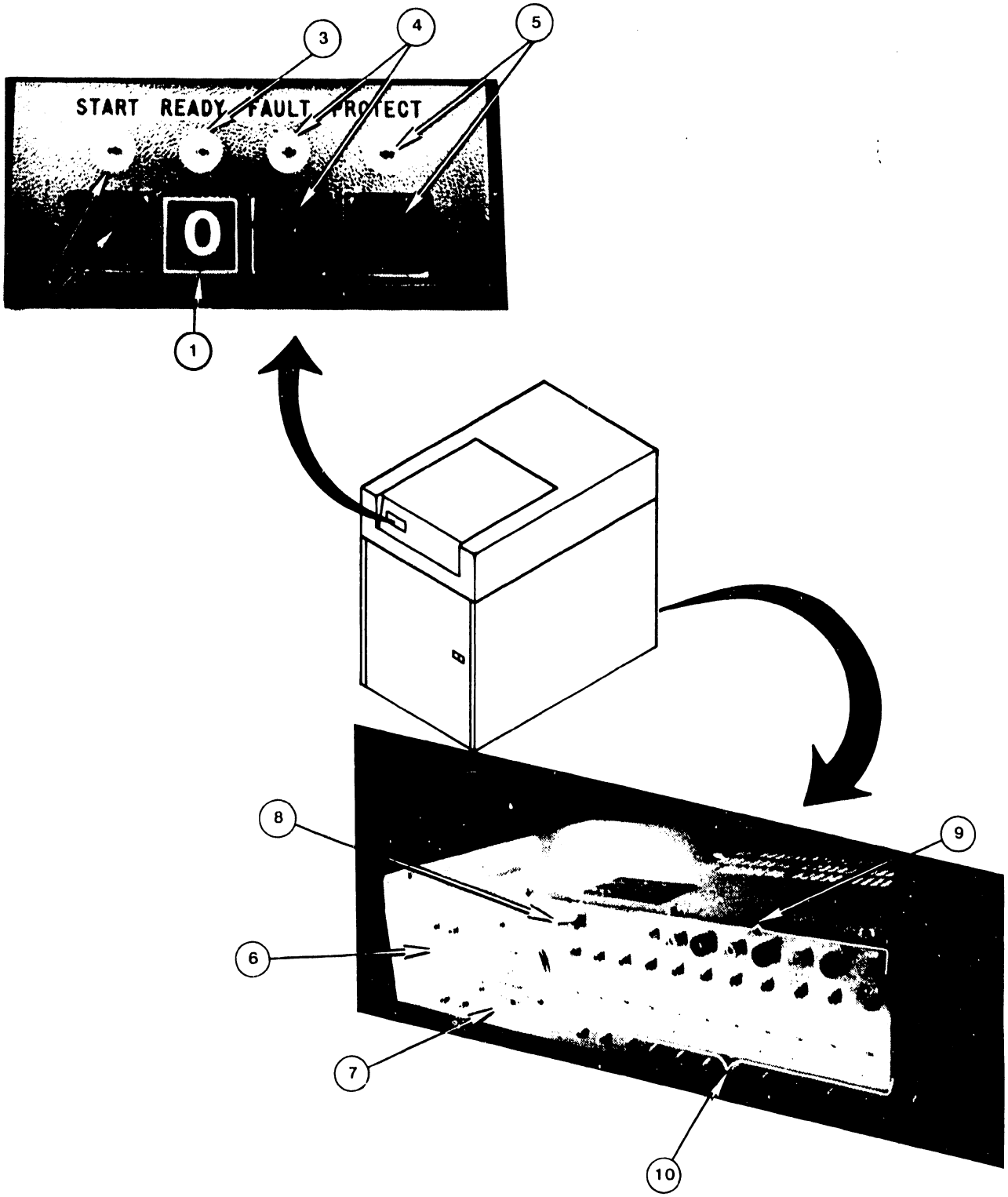


FIGURE 4-7 300 MEG SMD CONTROLS AND INDICATORS

TABLE 4-6 300 MEG SMD CONTROLS AND INDICATORS

ITEM	NAME	FUNCTION
(1)	LOGICAL ADDRESS PLUG	Determines logical address of drive. In OIS 145 Systems, this address may be 0, 1, or 2 (a maximum of 3 SMDs are allowed). 'Zero' plug must reside on System Disk.
(2)	START SWITCH/ INDICATOR	Pressing button when drive is in power-off condition (disk pack not spinning) lights indicator and starts power-on sequence, provided the following conditions are met: 1. Disk pack is installed 2. Pack access cover is closed 3. All power supply circuit breakers are on Pressing the indicator when drive is in power-on condition (disk pack spinning), extinguishes indicator and starts power-off sequence.
(3)	READY INDICATOR	Lights when unit is up to speed, the heads are loaded, and no fault conditions exist.
(4)	FAULT SWITCH/ INDICATOR	Lights if a fault condition exists within the drive. It is extiguished by either of the following: 1. Pressing fault switch on indicator control panel 2. Maintenance Fault Clear switch on fault card in logic chassis location A17
(5)	WRITE PROTECT SWITCH/INDICATOR	Pressing switch lights indicator and disables the driver write circuits, preventing data from being written on the pack. Pressing the switch to extinguish the indicator removes the disable from the write circuits.
(6)	MAIN AC CIRCUIT BREAKER	Controls application of site AC power to drive. Closing this breaker applies power to blower and elapsed time meter.

TABLE 4-6 (continued)

	NAME	FUNCTION
(7)	HOURS ELAPSED TIME METER	Records accumulated AC power-on time. Meter starts when Main AC Circuit Breaker is closed.
(8)	LOCAL/REMOTE SWITCH	Controls whether drive can be powered-up from drive, (LOCAL) or controller (REMOTE). The OIS System uses the LOCAL position, and drive power-on sequence starts when START switch is pressed.
(9)	GRD, +46, -46, +9.7, -9.7, +20 -20, +28 TEST POINTS	Provide means of checking the associated DC voltages.
(10)	+20V, MOTOR, +46, -46, +9.7, -9.7, +20, -20, +28 SWITCHES	Control application of associated voltages to drive and also provide overload protection.

4.5 CRT WORKSTATION

The CRT workstation is described in Models 5536-1/-2/-3/-4 Workstations, WPNL No.81 (729-0522). For more information on these controls and indicators, and the internal controls, refer to this WPNL.

TABLE 4-7 WORKSTATION CONTROLS AND INDICATORS

ITEM	NAME	TYPE AND FUNCTION
(1)	DISPLAY	CRT screen; displays input and output data.
(2)	CONTRAST	Potentiometer; adjusts contrast of "highlights".
(3)	BRIGHTNESS	Potentiometer; adjusts brightness of display.
(4)	KEYBOARD	"Typewriter" keys; input data.
(5)	CONNECTORS	BNC & TNC connectors; connects Master Processor.
(6)	POWER SWITCH	Toggle switch; energizes the workstation.
(7)	FUSE	2.5A Slow-Blow fuse; protection for all circuits.
(8)	TONE	Potentiometer; adjusts volume of "beep".
(9)	CLICKER	Potentiometer; adjusts volume of "clicker".

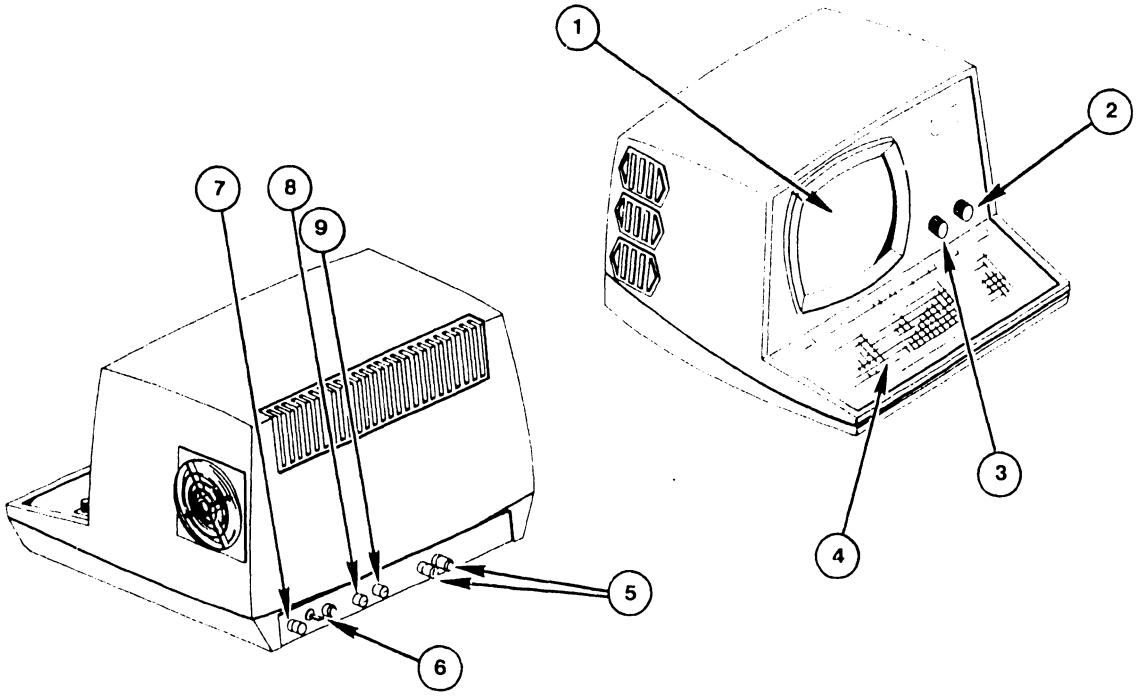


FIGURE 4-8 CRT WORKSTATION CONTROLS AND INDICATORS

CHAPTER 5 MAINT-ENANCE

CHAPTER 5

MAINTENANCE

5.1 GENERAL

This chapter contains a preventive maintenance schedule along with required materials and detailed maintenance procedures for the OIS 140/145 Master Unit. Proper and timely implementation of the information contained in this chapter is necessary to ensure maximum operating efficiency of the OIS 140/145 System.

Preventive maintenance procedures for the system's disk drives and CRT workstations do not fall within the scope of this manual. PM schedules and procedures for these peripheral devices may be found in the following documents:

A. PHOENIX CMD:

PM schedules and procedures for the Phoenix drive can be found in Chapter 6 of the CDC CMD Hardware Maintenence Manual (729-0198A).

B. 300 MEG SMD DRIVE:

PM schedules and procedures for the 300 Meg SMD drive are found in chapter 2 of the CDC SMD Hardware Maintenance Manual (729-0221).

C. HAWK DRIVE:

PM schedules and procedures for the HAWK drive are found in section 4 of the Wang/CDC HAWK Disk Drive Manual (729-0181).

D. CRT/WORKSTATION: (5536-2,-3,-4)

For information on maintenance procedures for the CRT workstation consult section 4 of Word Processing Newsletter No. 81 (729-0522).

5.2 MATERIALS REQUIRED

Materials required to perform a thorough and efficient job of preventive maintenance on OIS 140/145 Systems include:

1. Cleaning agents for use on the system cabinetry and special cleaning agents for use on heads, contacts, etc.

2. Dusting tools and aids such as assorted brushes, swabs, a vacuum, and aerosol can filled with compressed air.

3. Materials for cleaning electrical contacts.

4. Touchup paints.

5. CE tool kit.

6. Oscilloscope.

7. Diagnostics -- OIS 140-Class Power Up (PROM) (702-0042D)
OIS 140 Extended Memory Power Up (PROM) (702-0123B)
SYSEX40 (702-0117)
SYSEX40X (702-0135)
OIS 140-Class Master Monitor (702-0057D)
OIS Online Device Monitor (702-0174)
OIS Online Printer Part I (702-0176A, Rev 2422)
OIS Online Printer Part II (702-0149, Rev 21A0)

8. Manuals -- OIS 140/145 Product Maintenance Manual (729-0664A),
CDC CMD Hardware Maintenence Manual (729-0198A),
CDC SMD Hardware Maintenance Manual (729-0221),
Cartride Module Drive (Block Point 4) (729-1063)
Wang/CDC HAWK Disk Drive Manual (729-0181),
CDC Hawk Field Maintenance Manual (729-0884)
Word Processing Newsletter No. 81 (729-0522)

5.3 PM SCHEDULES FOR THE MASTER PROCESSOR

ACTION / FREQUENCY	WEEKLY	6 MONTHS	12 MONTHS	SECTION
Equipment operational check (IPL)	X			5.4.1
Clean exterior		X		5.4.2
Clean interior		X		5.4.2
Inspect		X		5.4.3
Align/Adjust		X		5.4.4
Diagnostic check		X		
Clean contacts and connectors			X	5.4.2
Apply ECN's			X	
Replace parts			X	
Repair scratches and blemishes			X	

5.4 DETAILED PROCEDURES

5.4.1 EQUIPMENT OPERATIONAL CHECK

It is recommended that the customer perform an equipment operational test at least once weekly. This test constitutes running the Power-Up Diagnostic and checking the front panel Diagnostic LEDs for possible error codes. The test takes approximately 15 seconds to complete and is activated when the customer re-IPL's the system.

5.4.2 CLEANING

A. Exterior:

1. Remove excess dust and debris from exterior with cloth and vacuum.
2. Apply general cleaning agent to soft cloth or towel and wipe case clean.

B. Interior:

1. Remove top cover, dust, then vacuum dust and debris from interior.
2. Clean fan blades with cloth and cleaning agent.

C. Contacts and Connectors:

1. Remove all PCB assemblies and clean contacts if necessary, also brush and vacuum dust accumulated on PCBs.
2. Clean PCB and I/O cable connector.

D. Shugart Floppy:

1. Using brush and vacuum cleaner, remove dust and debris from drive.
2. Inspect the head load pad and head for dirt and/or damage. The head should be cleaned if it has an oxide build-up that is visible to the naked eye. Cleaning methods and materials other than those listed can permanently damage the head and should be avoided.

    a. Lightly dampen a piece of clean, lintless tissue with isopropyl alcohol (use sparingly).
    b. Lift the load arm off the head, being careful not to touch the load button (see Fig. 5-1). Note: Do not bend back the head load arm more than 90^{o}.
    c. Gently wipe the head with the moistened portion of the tissue.
    d. After the alcohol has evaporated, gently polish the head with a clean, dry piece of lintless tissue.
    e. Carefully lower the load arm onto the head. DO NOT let it snap back.

5.4.3 INSPECTION

A. Inspect for loose, missing, or damaged parts.

1. Replace, if part on hand.
2. Order for next PM, or call.

B. Check PCB E-Rev, and PROM Rev levels.

1. Update, if parts available.
2. Order parts for update on next PM, or call.

C. Check PCB and I/O cable security.

D. Clean and check fan operation.

E. Inspect covers for scratches or blemishes.

F. Check controller address switch setting for correctness.

G. Inspect the Shugart floppy disk drive as follows:

1. Check for and correct any loose connections.

2. Check for excessive noise from spindle or head movement motors.

3. Inspect drive belt for worn, frayed, or weak spots.

NOTE: Hands and fingers should be clean, free of oil and grease when handling drive.

4. Check spindle lock nut for tightness. Do not take apart spindle and lubricate it.

5.4.4 ALIGNMENTS/ADJUSTMENTS

A. Mechanical: None required.

B. Voltage:

Adjust voltages per section 3.12.5 and Figure 3-24, using test points located on CPU/MEM board and adjusting potentiometers located on the Power Supply Regulator board.

----------CAUTION----------

Avoid touching bare leads and causing a short circuit: very little clearance is provided for these adjustments. If possible, insulate the shank of the adjusting screwdriver or use an insulated alignment tool. All PCBs must be inserted and the system drive connected for these adjustments.

C. Shugart Floppy:

Check and/or replace worn read/write head load pad buttons to prevent excessive wear on the diskette (see Fig. 5-1).

1. To remove the button, hold the load arm out away from the head (not more than 90°), squeeze the locking tabs together with a pair of needle-nosed pliers and press forward.
2. To install the button, press the button into the head load arm and it will snap into place.
3. Check integrity of floppy door and door locking mechanism. Adjust as necessary.

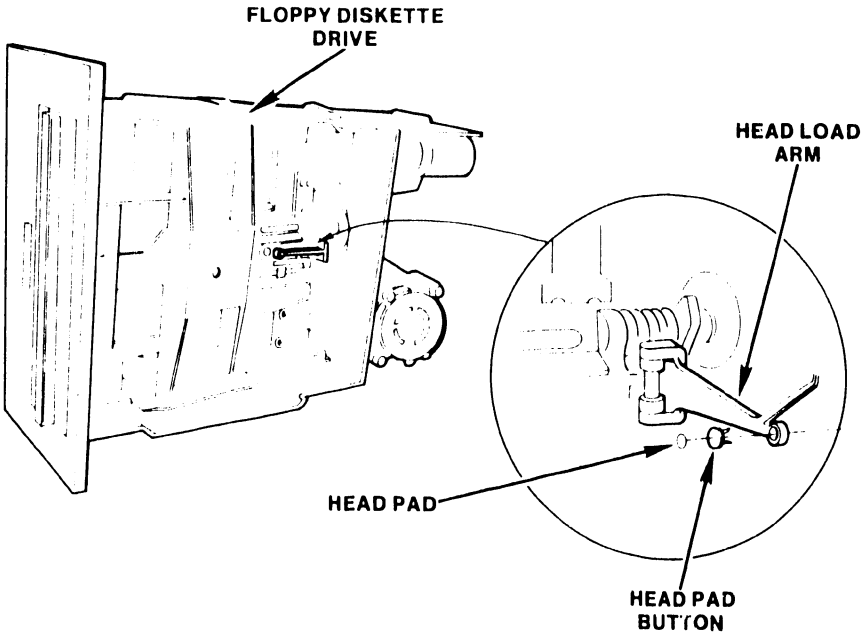


FIGURE 5-1 CHECKING/REPLACING THE DISKETTE DRIVE HEAD PAD

CHAPTER 6 TROUBLE-SHOOTING

CHAPTER 6

TROUBLESHOOTING

6.1 GENERAL

Efficient troubleshooting depends primarily upon three factors:

1. Knowledge of design, operation, and potential malfunctions of the equipment.
2. "Common-sense" reasoning.
3. Proper test equipment and knowledge of its application.

Item 1 has been discussed in the preceeding chapters and, most especially, in the OIS training course. For greatest proficiency, however, this knowledge must be supplemented by practical experience. Item 2 is a prime ingredient which makes the difference between first-rate Field Service and that which is just mediocre. Item 3 is also important, but it should be remembered that many problems can be resolved using very simple test equipment, or, in many cases, no test equipment at all.

The proficient Field Service Technician evaluates all the evidence available; he/she then proceeds from the most obvious to the less obvious causes until the disorder is located. There are 3 methods for collecting the necessary evidence -- observation of the equipment, diagnostic aids, and test measurements.

Fortunately, observation usually provides enough information to allow the trouble to be isolated at least to a unit of equipment. The value of observation cannot be overstressed: often simple observations will identify the trouble at once; resulting in a quick service call without involved investigation at the customer s site. For example, the distinctive smell of melted transformer wax, varnish, or other component odors is familiar to the experienced technician and may pinpoint the defective component as well as the unit of equipment.

Extensive diagnostic aids are provided for the OIS systems. Fault-lights, diagnostic switches, and semi-automated tests furnish the Field Service Technician with detailed evidence. PROM-based diagnostics are exercised whenever the system is powered-on or IPLed. These usually provide sufficiently detailed evidence to isolate the trouble to a field-replaceable unit. More evidence, if needed, is available via the Master Monitor Diagnostic and Online Device Monitor.

Sometimes measurements are needed to make adjustments or actually test the defective component. Extensive diagnostic measurements at the customer's site, however, should be kept to a minimum.

1. Obtain the customer's full story of the complaint.
2. Observe the equipment, cabling, panel indicators, cabinetry, and CRT-screen for obvious indications (CRT prompts, poor power-plug connection, etc.).
3. Check all controls and switches.

4. Analyze the evidence from all sources to localize the trouble to an item of equipment (Master Processor, workstation, disk drive unit, etc.).
5. Utilize the diagnostic aids to further localize the trouble to a replaceable assembly.

6.2 LEVEL OF REPAIR

Repair of the OIS 140/145 is at the "board-replacement-level"; i.e., only major assemblies will be replaced at the customer's site. Those assemblies designed for field replacement are listed in Table 7-1.

6.3 TROUBLESHOOTING AIDS FOR THE MASTER PROCESSOR

6.3.1 POWER-UP (PROM) DIAGNOSTIC

The Power-up diagnostic resides in PROM and checks the system integrity each time the Master Processor is powered-up or reset. This diagnostic takes approximately 15 seconds to complete. The primary use of this Power-Up diagnostic at the field level is for the isolation of board failures within the OIS Master Unit. Fault isolation is accomplished through the use of error codes displayed on the Master Unit's front panel LEDs. These error codes are either termed "non-fatal", indicating faulty operating conditions, or "fatal", indicating faulty circuit boards. Corrections or repairs, if required, may be performed by Customer Engineering personnel.

This diagnostic also provides both Detailed and Expanded Error information via error codes displayed on the eight LED indicators present on the CPU/MEM board. This additional error information can be used in the field to aid in the isolation of those problems that are not readily resolved by direct replacement of suspected faulty board(s).

Fault isolation beyond board level is possible in the case of the CPU/MEM board. With the use of diagnostic switches on the top of this board, Expanded Error information is available to correct CPU/MEM board problems by isolating faulty memory chips.

A complete guide for the proper use of the OIS 140-Class Power-Up Diagnostic is presented in Appendix D. This Appendix discusses the 64K CPU version, while Appendix E describes the differences associated with the 128K Extended Memory Power-Up Diagnostic.

6.3.2 OPERATING SYSTEM ERROR MESSAGES

The Operating System will display 4 types of error messages on the CRT screen:

1. Screen Package DEBUG error messages
2. Word Processing Error Handler messages
3. Request Control Block (RCB) error messages.
4. Additional error and warning messages.

These CRT error messages are explained in detail in Appendix B.

6.3.3 MASTER DIAGNOSTIC MONITOR

The OIS 140-Class Master Diagnostic Monitor (702-0057D) is completely contained on a single floppy diskette. General use of this diagnostic at the field level is anticipated for situations where the PROM-based Power-Up Diagnostics fail to isolate a board or assembly failure; this is especially true in the case of a suspected intermittent failure. In addition, this diagnostic can be used for confidence testing, quickly establishing that all device components operate properly. Test routines included in the Master Diagnostics Monitor are:

MASTER LOWER RAM TEST
MASTER UPPER RAM TEST
MASTER DATA LINK
10-MEG DISK CONTROL
SLAVE LOWER RAM TEST
CMD/SMD DISK CONTROL
Z80 INSTRUCTION TEST
FIELD TEST UNIT SIMULATOR
SLAVE DATA LINK EXERCISER
I/D MODE EXERCISER
WINCHESTER CONTROLLER

Once the Master Diagnostic Monitor diskette is IPLed via the Master Processor floppy diskette drive, the operator can select, execute, control, and monitor desired combinations of the test programs listed above.

Appendix A presents a complete guide for the software-related tasks required to perform the OIS 140-Class Master Diagnostics Monitor package.

6.3.4 SYSEX40 AND SYSEX40X

SYSEX40 (702-0117) and SYSEX40X (702-0132) are diskette-based system exercisers which allow simultaneous exercising of each major logic board in the master processor plus some logic in attached slaves. SYSEX40 is used on systems with the standard 64K CPU memory while SYSEX40X is used with the 128K CPU memory option. Both generate a large amount of random activity on selected disk drives. They are very useful for system checkout, as slave memory may be used to perform some of the read, write, or random read operations.

6.3.5 SOFTWARE PROCEDURES

Appendix C presents a complete guide for the software-related tasks required to perform the OIS 140/145 Software Initialization and Post-Installation Software updates.

Software Installation is normally a Customer Service Representative function. The procedure is included in this manual for cases where it has been determined that Customer Engineering should perform this task.

6.4 TROUBLESHOOTING FLOWCHARTS

The troubleshooting flowcharts provided on the following pages are intended to aid in the systematic investigation, diagnosis, and repair of failures common to all OIS 140/145 Master Processors.

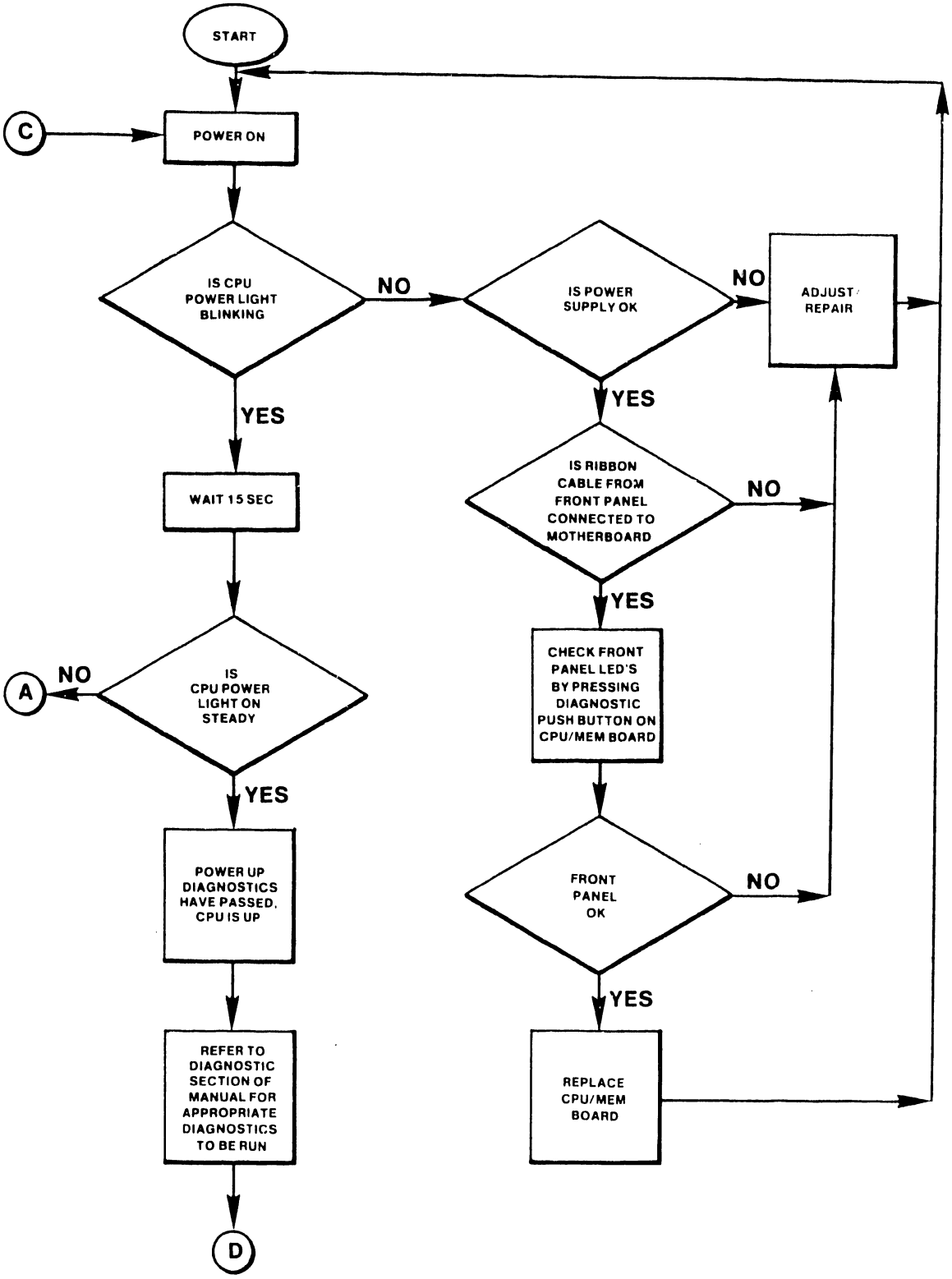


FIGURE 6-1 TROUBLESHOOTING FLOWCHART FOR MASTER UNIT COMMON FAILURES

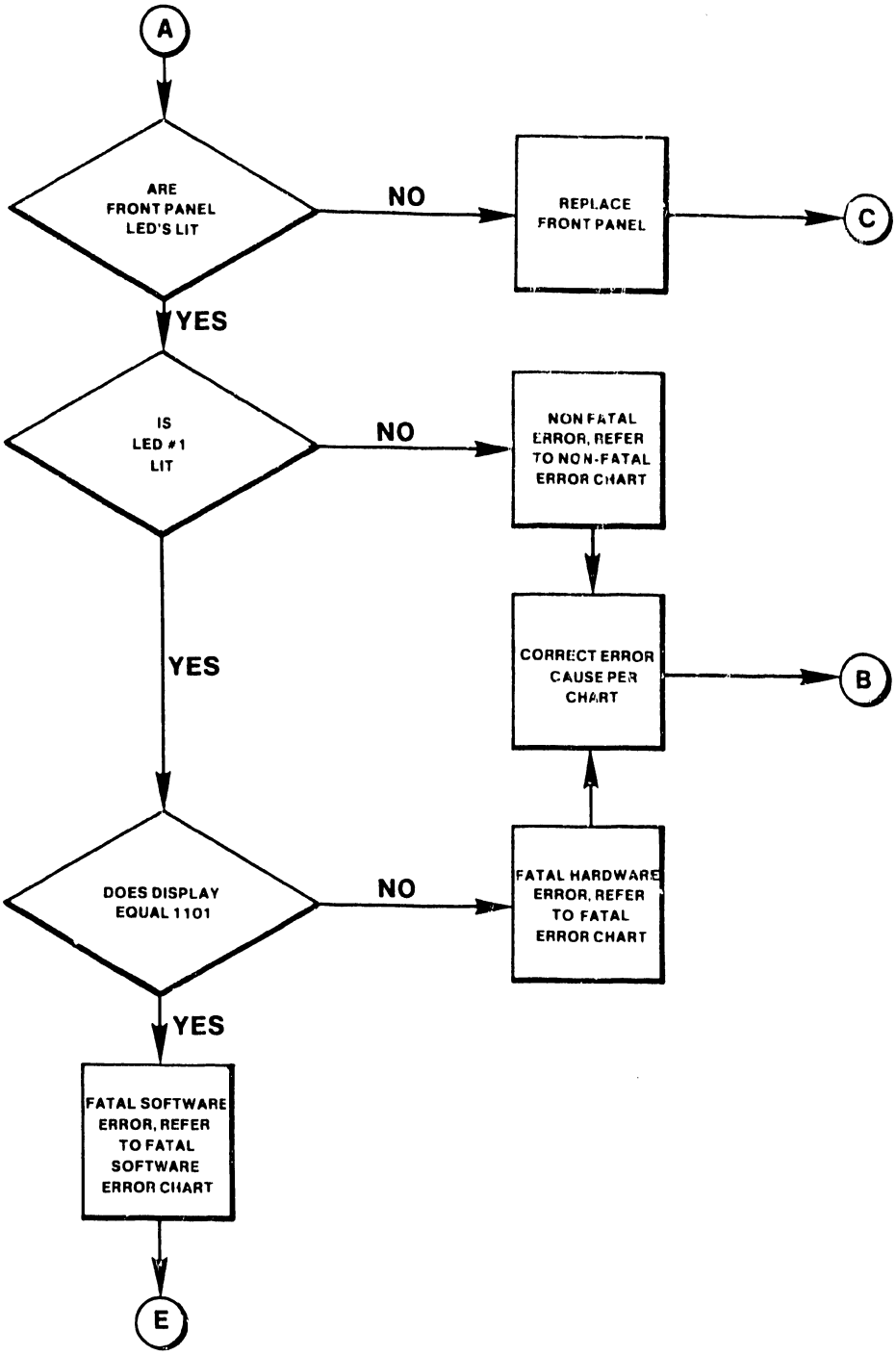


FIGURE 6-1 continued

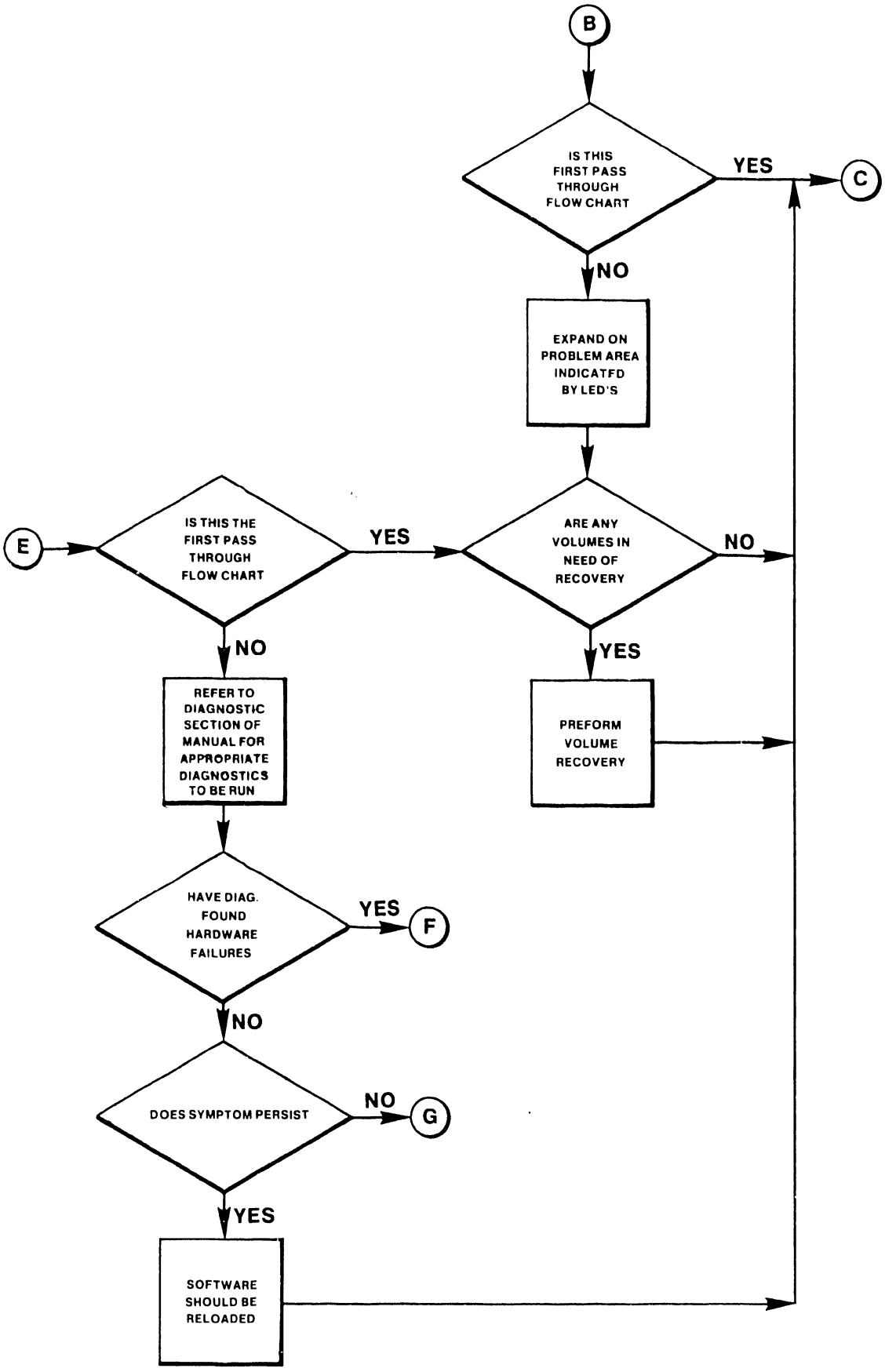


FIGURE 6-1 continued

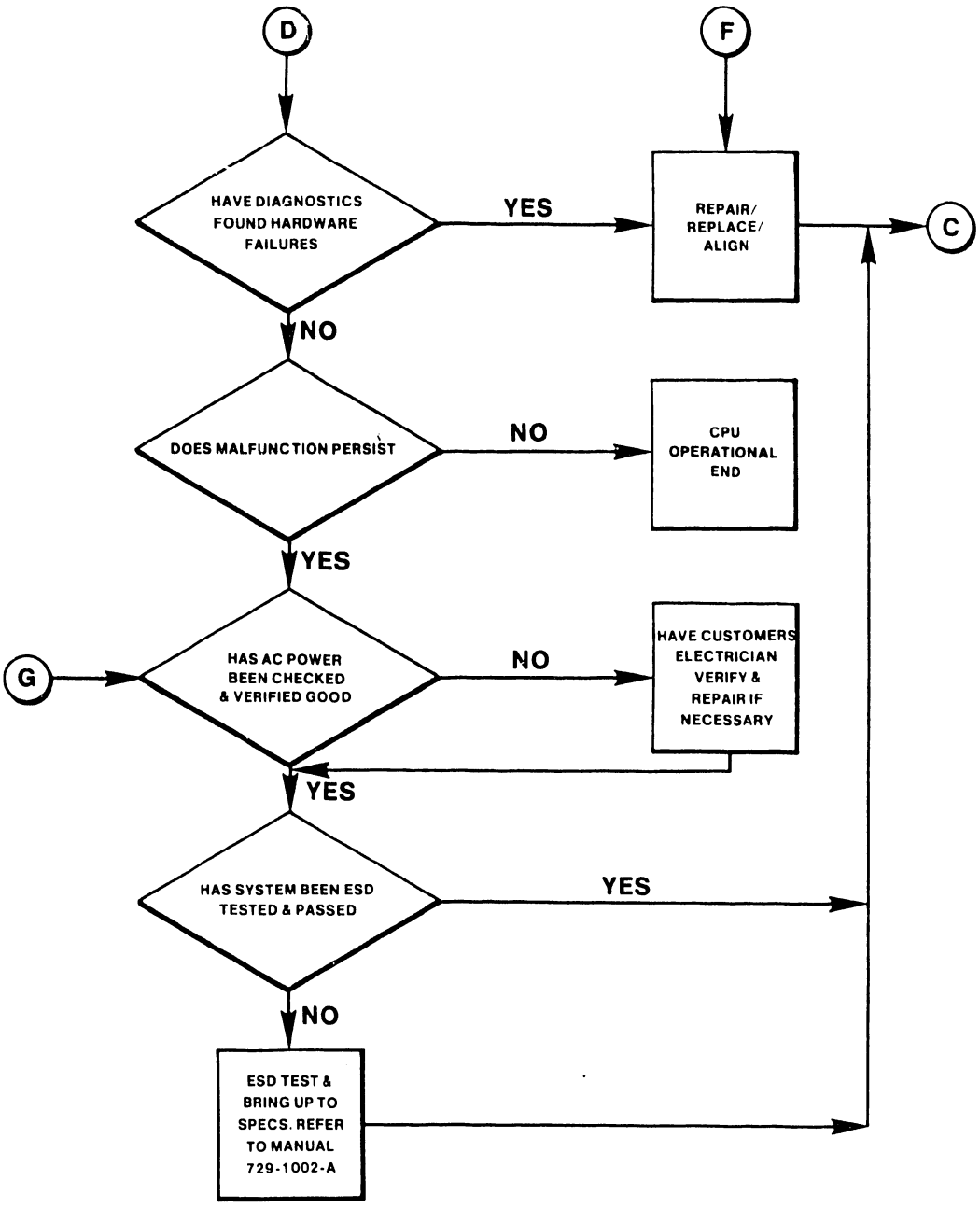


FIGURE 6-1 continued

CHAPTER 7

REPAIR

CHAPTER 7

REPAIR

7.1 GENERAL

This chapter provides the information necessary to remove and replace VIS 140/145 parts and assemblies. In general, most parts and assemblies are accessed with the top cover and front panels of the Master Processor removed. Thus procedures for removing and replacing these items are discussed first and are subsequently referenced by most of the following repair procedures.

7.2 TABLE OF FIELD-REPLACEABLE ITEMS

TABLE 7-1 FIELD-REPLACEABLE ITEMS

NAME	WLI PART NUMBER
PCA CPU & (64K) MEMORY	210-7501-A
PCA 10 MEG/FLOPPY CNTLR	210-7502
PCA DATA LINK CONTROL	210-7503
PCA DATA BUFFER	210-7504-A
PCA SMD CONTROLLER #1	210-7505
PCA SMD CONTROLLER #2	210-7506
PCA REGULATOR	210-7508
CABLE SMD B 15'	220-3033-18
CABLE SMD A 15'	220-3041-6
FLOPPY DISK DRIVE (60 Hz)	278-4003-M
FLOPPY DISK DRIVE (50 Hz)	278-4003-1M*
FUSE 3 AMP 250V	360-1031-SB
FUSE 4 AMP 250	360-1040-SB
FAN MUFFIN	400-1003
FLOPPY DOOR LOCK KIT	725-0053-93
CABLE 10 MEG CHAIN DRIVE 1	220-0169-1
CABLE 10 MEG CHAIN DRIVE 2	220-0187-1
CABLE 10 MEG	220-0236
FLOPPY DISK CABLE	220-3011
FRONT PANEL RIBBON CABLE	220-3020
30 PR FLAT A CABLE	220-3031-1
26 COND SHIELDED FLAT CABLE	220-3033-19
MOTHERBOARD ASSEMBLY	270-0599
HEAT SINK ASSEMBLY	270-0600
POWER SUPPLY CHASSIS (60 Hz)	270-0601
POWER SUPPLY CHASSIS (50 Hz)	270-0601-1*
FRONT PANEL ASSEMBLY	270-0605
SERIAL CONNECTOR PLATE	279-0358

* International only

7.3 REMOVAL/REPLACEMENT PROCEDURES FOR THE MASTER PROCESSOR

The physical layout of the OIS 140/145 Master Unit chassis allows the field technician easy access to all major parts and assemblies internal to the Master Unit. This easy access simplifies removal and replacement of major parts and assemblies in comparison to previous systems. The following sections describe the procedures to be used to remove and replace major parts and assemblies.

----------CAUTION----------
DISCONNECT AC POWER CORD BEFORE REMOVING ANY PCBs OR INTERNAL ASSEMBLIES.

7.3.1 TOP COVER REMOVAL/REPLACEMENT PROCEDURE

The top cover of the OIS 140 Master Unit is removed as follows (See Fig. 7-1):

A. Remove the machine screw at the rear of the main chassis. This screw is used to secure the top cover to the main chassis.
B. Push the cover to the rear of the unit to disengage the tab on the front edge of the cover from the front of the main chassis.
C. Lift the cover up and away from the main chassis.

Reinstall the top cover by aligning the guides to the top cover with the main chassis, then perform the above procedure in reverse order.

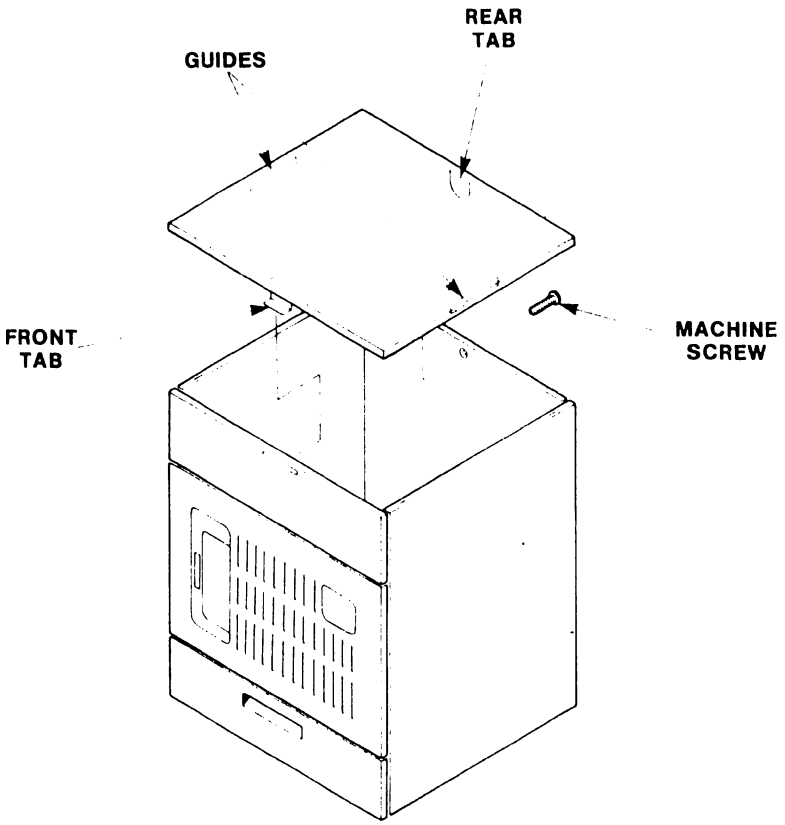


FIGURE 7-1 MASTER UNIT TOP COVER REMOVAL

7.3.2 FRONT PANELS REMOVAL/REPLACEMENT PROCEDURES

Two panels and a storage drawer are located on the front of the Master Unit. The panels consist of a small upper front panel and a larger lower front panel on which the control panel PCB is mounted. The upper panel is removed as follows (See Figs. 7-2, 7-3):

A. Lift the panel upward disengaging the four tabs mounted on it from the slots located on the chassis.
B. Pull the panel away from the unit.
C. Reinstall the upper panel by reversing the above procedure.

The lower front panel is removed as follows:

A. Disconnect the AC Molex connector, then the Front Panel ribbon cable at the motherboard. Note the orientation of both connectors.
B. The lower front panel is then removed and replaced in the same manner as the upper front panel. Ensure that both cables are re-connected.

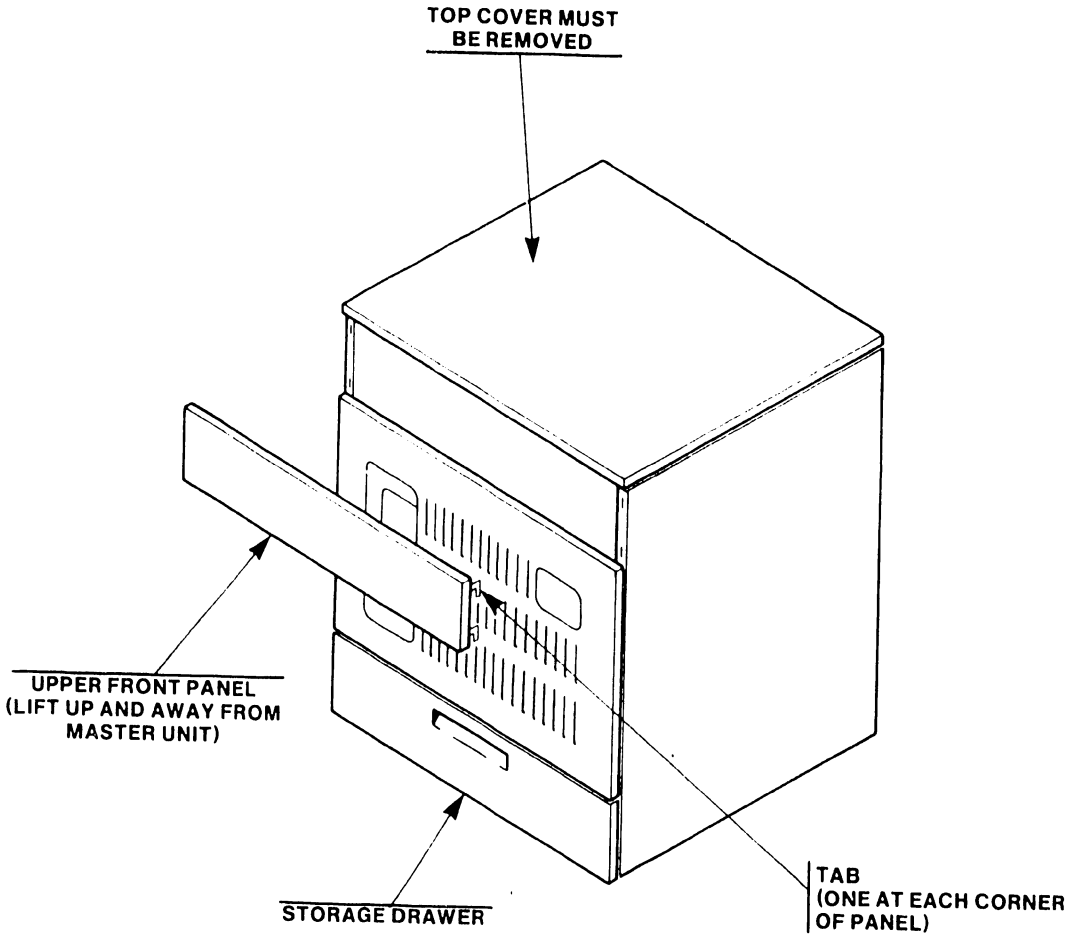


FIGURE 7-2 REMOVING MASTER UNIT UPPER FRONT PANEL

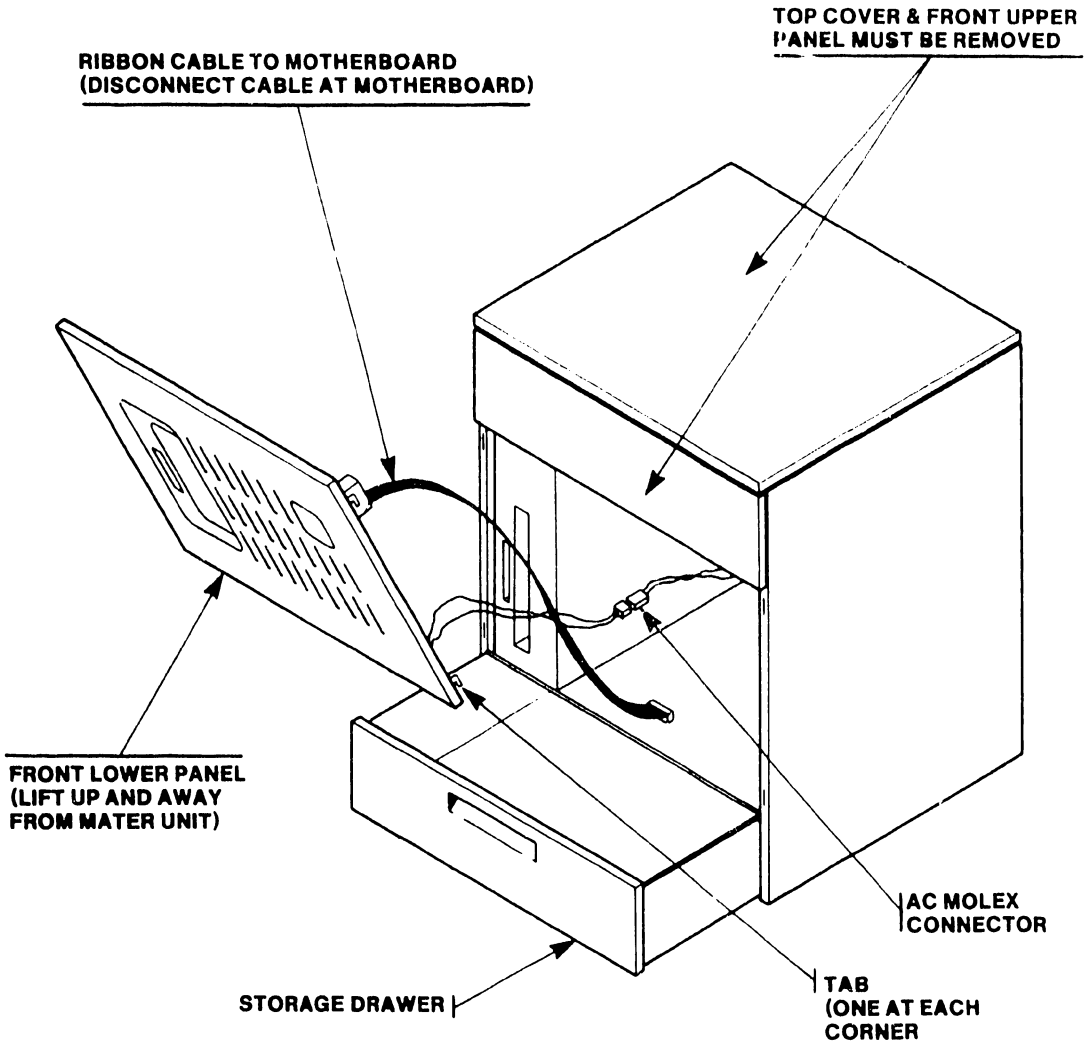


FIGURE 7-3 REMOVING MASTER UNIT LOWER FRONT PANEL

7.3.3 PCB REMOVAL/REPLACEMENT PROCEDURES

ITEM	WLI PART NUMBER
PCA CPU & (64K) MEMORY	210-7501-A
PCA 10 MEG/FLOPPY CNTLR	210-7502
PCA DATA LINK CONTROL	210-7503
PCA DATA BUFFER	210-7504-A
PCA SMD CONTROLLER #1	210-7505
PCA SMD CONTROLLER #2	210-7506
PCA REGULATOR	210-7508

These seven PCBs are secured by two board retainers. Each retainer is secured by a single Phillips screw and a tab. PCB removal has been greatly simplified in comparison with previous systems. To remove a PCB, perform the following procedures:

A. Disconnect AC power.
B. Remove the top cover per section 7.3.1.
C. Remove the two board retainers (each secured by a Phillips screw and a Tab).
D. Ensure that all cables are disconnected from the PCBs to be removed.
E. Grasp the black handles mounted on the PCA faceplate and lift with a slow steady force.

To reinstall or replace a PCB, insert the PCB into the Master Unit using the plastic card guides on the motherboard to keep the PCB aligned with its connectors. Once the PCB is properly aligned, use a steady downward pressure to seat the PCB securely in place (see Fig. 2-1).

7.3.4 DISKETTE DRIVE REMOVAL/REPLACEMENT PROCEDURE **

The top cover and front panels of the Master Unit must be removed in order to remove the diskette drive.

Remove and replace the diskette drive as follows (See Fig. 7-4):

A. After noting its orientation, disconnect the Floppy I/O cable from motherboard.
B. Disconnect AC power cord from rear of drive.
C. Pull storage drawer located beneath lower front panel part-way out, insert hand into drawer under drive and remove wing screw securing drive to main and power chassis.
D. Use appropriate-sized nut driver to remove the two bolts that secure the floppy drive mounting bracket to the top of the floppy drive.
E. Pull drive forward and out of chassis.
F. To reinstall drive, reverse the above procedure. See Figure 7-4 for orientation of Floppy I/O cable.

** NOTE: OIS systems require Door Lock Kit be installed on all floppy drives. refer to PSN-2 Shugart SA901 (729-0122) for removal/replacement procedure.

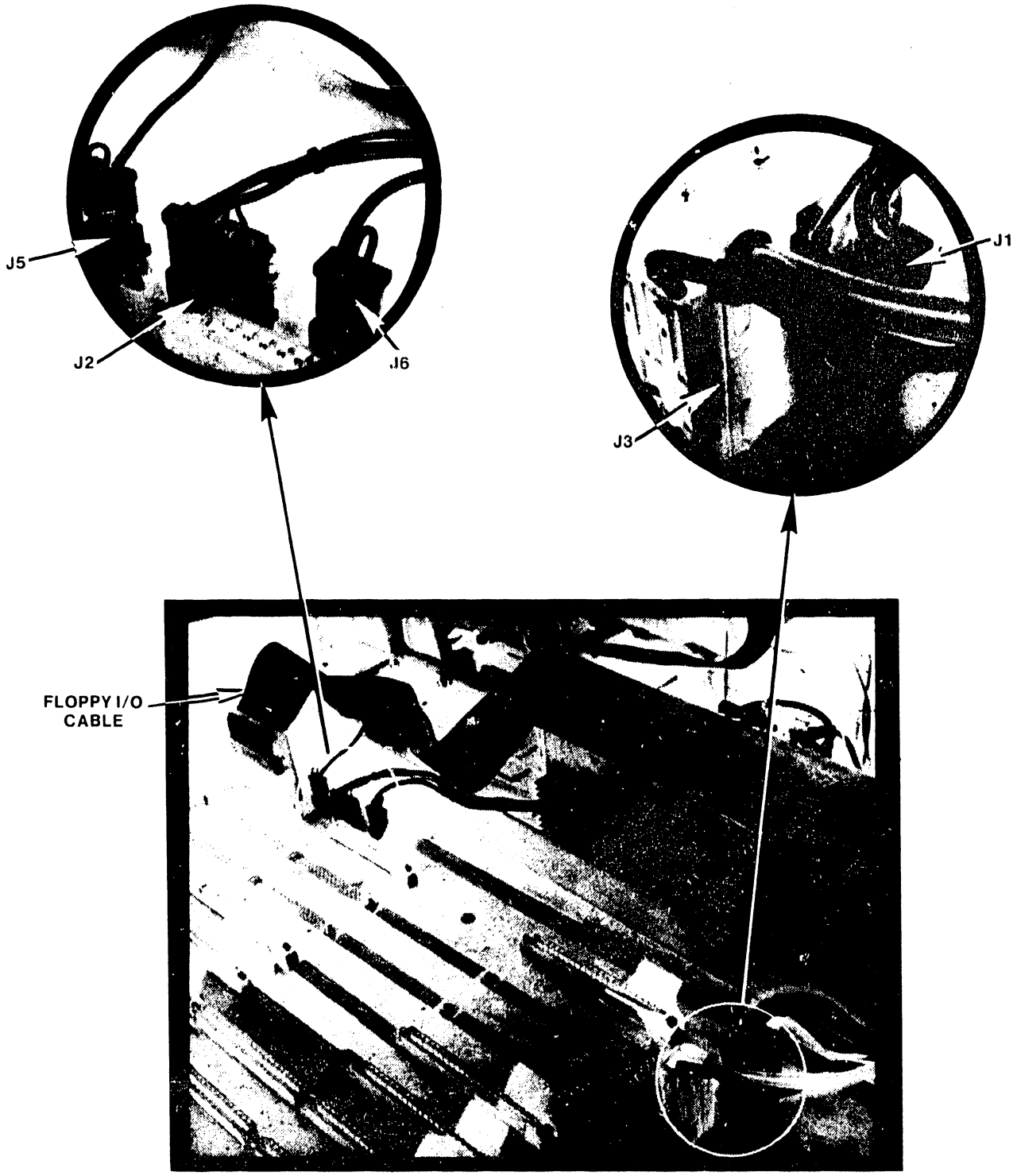


FIGURE 7-4 DISKETTE DRIVE, POWER CHASSIS, AND MOTHERBOARD CONNECTIONS

7.3.5 POWER CHASSIS REMOVAL/REPLACEMENT PROCEDURES

Before removing the power chassis, unplug the main AC power cord. Remove the diskette drive as described in section 7.3.3. Once the drive is removed proceed as follows (See Fig. 7-4):

A. Disconnect the five (J_1, J_2, J_3, J_5, J_6) connectors from the power chassis to the motherboard. Remove these connectors by pulling them straight up, do not move them from side-to-side as this could damage the connectors.
B. Using a $7/16^{ths}$ inch nut driver, remove the two bolts at the front of the power chassis.
C. Using a Philips screwdriver, remove the two screws securing the power chassis to the rear of the main chassis.
D. Disconnect the fan leads at the rear of the power chassis.
E. Pull the power chassis forward and out of the main chassis. Keep the AC power cord from tangling in rear of main chassis.

To reinstall or replace the power chassis, reverse the above procedure. When placing the power chassis into the main chassis feed the AC power cord through the back of the main chassis and align the fuse holder at the rear of the power chassis with the appropriate hole in the main chassis.

7.3.6 MOTHERBOARD REMOVAL/REPLACEMENT PROCEDURES

The motherboard for the OIS 140 is removed and replaced or reinstalled as follows (See Fig. 7-4):

A. Remove all data buffer and disk drive cables from PCBs. Note location of cables to aid in reinstallation.
B. Remove all PCBs mounted on the motherboard per Section 7.3.3.
C. Remove the five connectors coming from the power chassis (Section 7.3.5, Step A)
D. Using a $7/16^{ths}$ nut driver, remove the two bolts at the front of the motherboard.
E. Grasp the front of the motherboard and lift upward slightly.
F. Pull motherboard out from Master Unit while moving board from side-to-side (requires firm steady pressure). This is done to disengage the two tabs at the rear of the motherboard from the two slots on the main chassis.

To reinstall or replace the motherboard, reverse the above procedure. Ensure that all connections are correct and are firmly in place.

7.3.7 REMOVING/REPLACING THE FAN MUFFINS

Both Master Unit fan muffins may be removed using the following procedure:

A. Disconnect AC power.
B. Remove the top cover per section 7.3.1.
C. Disconnect the fan AC power lead from the top of the fan assembly.
D. Remove the four Phillips screws and nuts that secure the fan muffin to the Master Unit rear panel.
E. Remove the fan.

To replace the fan:

A. Align fan, fan guard, and screw holes.
B. Install and finger-tighten the four Phillips screws and nuts.
C. Tighten the screws with a Phillips screwdriver.
D. Connect the fan AC power lead at the top of the fan assembly.
E. Replace the top cover per section 7.3.1.

7.3.8 REMOVING/REPLACING THE SERIAL CONNECTOR PLATES

Each serial connector plate may be removed as follows:

A. Disconnect the dual coaxial cables from the serial connector plate.
B. Disconnect the ribbon cable from the Data Buffer board.
C. Remove the four Phillips screws that connect the serial connector plate to the back panel (two at the top and two at the bottom).
D. Remove the serial connector plate.

To replace:

A. Insert the serial connector plate and align the screw holes.
B. Finger-tighten all four Phillips screws (two at the top, two at the bottom).
C. Tighten the screws with a Phillips screwdriver. Ensure that the serial connector plate makes good contact with the chassis so that the coaxial cables will be properly grounded.
D. Connect the ribbon cable to the Data Buffer board per section 3.4.1.
E. Connect the dual coaxial cables to the serial connector plate.

7.4 REMOVAL/REPLACEMENT PROCEDURES FOR OIS 140/145 PERIPHERALS

A detailed discussion of removal/replacement procedures for all OIS 140/145 peripheral devices is beyond the scope of this manual. However, the following paragraphs provide document re-order numbers and specific chapters containing removal/replacement procedures for 140/145 disk drives and CRT workstations:

A. PHOENIX CMD:

Removal/replacement procedures for the Phoenix drive can be found in Chapter 6 of the CDC CMD Hardware Maintenance Manual (729-0198A).

B. 300 MEG SMD DRIVE:

Removal/replacement procedures for the 300 Meg SMD drive are found in chapter 2 of the CDC SMD Hardware Maintenance Manual (729-0221).

C. HAWK DRIVE:

Removal/replacement procedures for the HAWK drive are found in section 4 of the Wang/CDC HAWK Disk Drive Manual (729-0181).

D. CRT/WORKSTATION: (5536-2,-3,-4)

For information on removal/replacement procedures for the CRT workstation consult section 4 of Word Processing Newsletter No. 81 (729-0522).

CHAPTER 8

THEORY OF OPERATION

CHAPTER 8

THEORY OF OPERATION

8.1 GENERAL

The Master CPU can be functionally divided into four components; the CPU/MEMORY board, TEN MEG/FLOPPY CONTROLLER, SMD CONTROLLER, and the DATA LINK CONTROLLER. The SMD Control Logic resides on two boards, SMD CONTROLLER "A" (#1), and SMD CONTROLLER "B" (#2). Similarly, the Data Link Control Logic also consists of two boards - the DATA LINK CONTROL board and the DATA BUFFER board. Figure 8-1 presents a simplified block diagram of the OIS 140/145 Master Unit.

8.2 THE CPU/MEMORY BOARD

The heart of the Master Unit is its 7501 CPU/MEMORY board, which includes a Z80A Microprocessor operating at 4 Megahertz. In addition to the Z80A and its associated timing and control logic, this board contains:

1. 3K of PROM
2. 1K of Memory-Mapped I/O allocations
3. a Counter/Timer Circuit (CTC)
4. parity generation and checking
5. a priority interrupt structure
6. 60K of RAM memory (expandable to 120K with Expanded Memory option).

The PROM portion of memory occupies the bottom 3K of addressable locations, 0000 to 0BFF Hex. The first 1K of PROM contains the "Bootstrap Loader" program while the remaining 2K contains the "Power-up Diagnostics". At power-up, the Bootstrap Loader gains program control briefly before passing it on to the Power-up Diagnostics. The diagnostics then test all basic system functions before allowing the system to proceed any further. If not satisfied with the state of the system , the Power-u Diagnostic program posts error codes on the Master Unit front panel indicators and the CPU/Memory board's diagnostic LEDs. The power-on light on the unit's front panel is set flashing and the system remains in this state until corrective measures are taken. When the Power-up Diagnostics program has determined the system to be operational, Z80A program control is passed back to the Bootstrap Loader program which then commences to Initial Program Load (IPL) the system.

The CPU/MEMORY board contains 64K bytes of Dynamic RAM memory, which must be continually refreshed in order to maintain its data. The Z80A provides a refresh pulse to serve this purpose. Because the PROM and Memory-Mapped I/O take up the lower 4K of memory addresses, only the upper 60K of RAM is addressable by the Z80A CPU. This 60K of RAM is referred to as "Master Memory". When the system is IPL'ed, the system operating software is loaded into Master Memory from the System Disk. The System Disk may reside in any one of three drives (floppy, Hawk, or SMD/CMD); its location is revealed to the CPU via the three-position switch on the Master Unit's front panel.

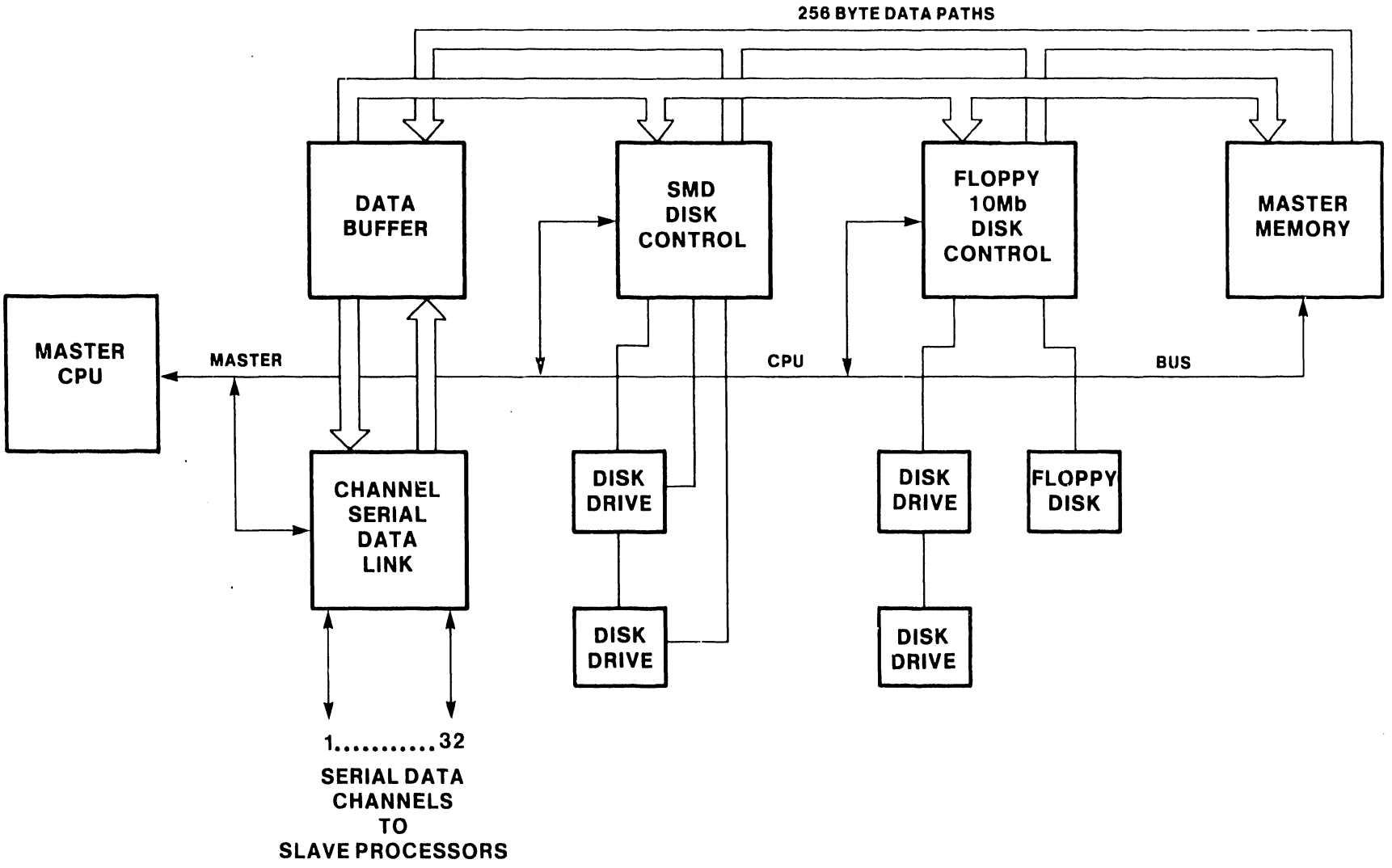


FIGURE 8-1 OIS 140/145 SYSTEM SIMPLIFIED BLOCK DIAGRAM

The CPU/MEMORY logic uses a Memory-Mapped I/O technique (MMI/O) to transfer all I/O commands. In MMI/O, I/O devices pose as memory devices, and as long as they respond like memory devices, the CPU can not tell the difference. By using MMI/O, one is able to take advantage of the larger Z80A instruction set that references memory address space. It permits direct arithmetic and logical operations on port data as well as transfers between any of the Z80A internal registers and the I/O port. Conventional I/O interfacing methods do not offer this versatility. Blocks of memory addresses are assigned to each of the system I/O devices and when specific locations are addressed they are decoded into commands on the associated device controllers. In the OIS 140/145 systems, memory address locations 0C00 to 0FFF Hex are reserved for Memory-Mapped I/O, sandwiched between 3K of PROM (0000 to 0BFF Hex) and 60K of RAM (1000 to FFFF Hex). Although 1000 bytes are available for this purpose, only 256 bytes are needed at present.

8.3 MEMORY-MAPPED I/O DEVICE ADDRESSES

The I/O devices referred to are the TEN MEG/FLOPPY CONTROLLER, SMD CONTROLLER, DATA LINK CONTROLLER, and the CPU/MEMORY board itself. Each is assigned MMI/O address space according to the following table:

DEVICE TYPE	DEVICE NUMBER	ADDRESS SPACE (Hex)
CPU/MEM BOARD	0	0C00 to 0C3F
10 MEG/FLOPPY CONT.	1	0C40 to 0C7F
SMD CONTROLLER BD.	2	0C80 to 0CBF
DATA LINK CONT. BD.	3	0CC0 to 0CFF

The Master CPU's Z-80A is designed with an address bus of 16 bits for address selection (A_{15}-A_0). These address bits break down as follows for I/O operations:

1. Address bits A_{15}- A_{12} are used to select either a RAM memory bank or PROM.

2. Address bits A_{11}-A_{10} are used to select one of the four 1K memory locations within PROM. (The fourth 1K of PROM is Memory Mapped In/Out (MMI/O).

3. Address bits A_9-A_6 are used for Device selection (MCPU, 10 Megabyte and Floppy Disk controller, Data Link Control or SMD disk controller). See table above.

4. Address bits A_5-A_0 are used for one of sixty-four command selections.

For example, when the CPU Address Bus holds address ($OCCO_H$ = 0000 1100 1100 0000), an OCCO MMI/O command is generated on device 03, the DATA LINK CONTROLLER Board, as follows:

$A_{15} - A_{12}$	$A_{11} - A_{10}$	$A_9 - A_6$	$A_5 - A_0$
0 0 0 0	1 1	0 0 1 1	0 0 0 0 0 0
1 of 16 MEMORY BANK SELECTIONS	1 of 4 PROM SELECTIONS	1 of 16 DEVICE SELECTIONS	1 of 64 COMMAND SELECTIONS
0000 SELECTS PROM	11 SELECTS MMI/O	0011 SELECTS DATA LINK CONTROLLER	000000 SELECTS 1-BYTE STATUS COMMAND

8.4 MASTER UNIT DATA FLOW

Data Flow in the OIS 140/145 system can be divided into eight functional categories:

1. DISK WRITE TO MASTER MEMORY

   256-Byte Sectors are read from a Disk and written into Master 'RAM' Memory, a sector at a time. This is how the Initial Program Load, (IPL) is accomplished.

2. DISK READ FROM MASTER MEMORY

   256 Byte 'Pages' are read from Master 'RAM' Memory and written to the Disk, a Sector at a time. This is how Volume Label information is written to the disk.

3. INPUT SLAVE STATUS

   The Master CPU commands a specified 'Slave' Work Station or Printer to send its current status to the CPU. The 4 status conditions are:

   a. Power On (PO) - Slave power on or off.

   b. Memory Parity Error (MPE) - A parity error occurred in the Slave's memory.

   c. Channel Parity Error (CPE) - The slave data channel logic detected a parity error on one or more of the previously received characters.

   d. Initial Program Load State (IPL) - The slave device has been powered on but is not running because it:

      1. is waiting for an "IPL" from the Master.
      2. is waiting on a RESTART command from the Master.
      3. has had a hard failure.

4. SLAVE RESTART

The Master CPU commands a specified 'Slave' Work Station or Printer to do a 'Restart' due to a reported error from that unit or because that unit was just powered up.

5. ONE-BYTE WRITE

The Master CPU sends a 1 Byte Function Code, Slave Code, Drive Status or Function Release to a specific address in the selected slave's memory.

6. ONE-BYTE READ

The Master CPU commands a Slave to send it a One Byte Function code, Data Address (2 Bytes), or Slave Code from a specified address in that Slave's memory.

7. BLOCK WRITE TO SLAVE

A 256 Byte Sector is read from a Disk sector specified by the CPU and written to a specified page of a selected Slave Memory under Master CPU control.

8. BLOCK READ FROM SLAVE

A 256 Byte 'Page' is read from a selected Slave Memory and written to a specified disk sector under Master CPU control.

8.5 AUTOMATIC STATUS OPERATION (ASOP)

The OIS 140/145 System data link expands on the basic slave protocol by performing an Automatic Status Operation (ASOP) after each transfer operation except for the STATUS transfer command. The ASOP automatic slave STATUS read always reflects the slave's evaluation of the last transfer command. This relieves the Master software of the task of queueing a STATUS request following each command while other requests for the data link are backed up.

In addition, the received slave status error type bits are OR'ed together and presented in the master status word allowing the controlling software to see the result of each transfer as seen at both ends of the cable, by just examining one location.

8.6 THE DATA LINK CONTROLLER

The DATA LINK CONTROL board (210-7503) combined with the DATA BUFFER board (210-7504) provide the interface between the Master CPU and all peripheral devices. Together the two boards are referred to as the CHANNEL SERIAL DATA LINK (CSDL). The CSDL logic can be divided into five functional blocks, one of which is the 7504 DATA BUFFER. The other four blocks, located on the DATA LINK CONTROL board, are:

1. Master CPU (MCPU) command and Status interface
2. Slave channel selection logic
3. Serial data transmitting and receiving logic
4. Line protocol command transmission and timing logic

The DATA LINK CONTROL board provides the communication interface between the Master CPU and slave devices such as workstations and printers. It interprets and executes CPU MMI/O commands to control the flow and direction of communications between the master and its slaves. In addition, it resolves conflicting line use requests and provides the neccessary control signals to the DATA BUFFER board.

The 7504 DATA BUFFER board serves as an intermediate storage area for data transfers between Master Memory and slave devices. It contains 256 bytes of Static RAM FIFO in addition to a 32 channel coaxial transmitter/receiver section. The data transfer is set up by a few commands from the CPU to the DATA LINK CONTROL board and one of the Disk Drive Controller boards. Then the hardware on the respective boards execute the transfer, leaving the CPU free to perform other tasks as needed. Four different types of data transfer involve the Data Buffer board. They are:

1. Block Read from Slave
2. Block Write to Slave
3. Disk Read from Master Memory (DMA READ)
4. Disk Write to Master Memory (DMA WRITE)

The DATA BUFFER board services a maximum of 32 lines, 24 of which may be CRT workstations. Each line (or channel) is a coaxial cable pair that can be up to 2000 feet long. The 32 channels are labeled CH01 through CH32 with CH00 (Channel Zero) being reserved for Master Memory. The CSDL logic remains in the transmit state except when actually receiving data from a selected slave. All slaves remain in the receive state except when individually selected and commanded by the master to transmit.

The CSDL logic (DATA BUFFER plus DATA LINK CONTROL board) is the only controller capable of executing a DMA block transfer. A DMA block is 256 bytes of data to be transferred between Master Memory and the DATA BUFFER (in either direction). The DMA transfer is initiated by the Z80A CPU when it issues a string of MMI/O commands to the DATA LINK CONTROL board. This board decodes these commands into either a Block Read from Master Memory, or a Block Write to Master Memory. The DATA LINK CONTROL board then generates a CBUSREQ signal which causes the Z80A on the CPU/MEM board

to enter a WAIT state. In addition, the CPU Address, Data, and Control Busses are tri-stated so that the DMA transfer logic can use the busses to access Master Memory. The DATA LINK CONTROLLER then provides the proper address and control signals to execute the transfer.

8.7 THE DISK DRIVE CONTROLLERS

The 7502 TEN MEG/FLOPPY DISK CONTROLLER interfaces the OIS Master to a 300 kilobyte Shugart type Floppy Diskette drive and one or two 10 Megabyte HAWK hard disk drives. The 7505/7506 SMD DISK CONTROLLER interfaces the OIS Master to up to four CMD or SMD hard disk drives, in any combination. The CMD/SMD drives range from 26.8 to 275 Megabyte capacity and are generally used to store the system operating software as well as all active document files. The floppy diskette drive is used for archiving and for loading diagnostics and operating software into the system.

All disk operations are controlled by a series of MMI/O commands issued by the MCPU and all the data transfers occur in 256 byte blocks between the DATA BUFFER and the particular disk controller. When writing to a disk, a disk controller converts the parallel data from the DATA BUFFER to serial data for transfer to the disk drive. Similarly, when reading from a disk, the controller will convert the serial data obtained into parallel data to be supplied to the DATA BUFFER.

8.7.1 THE SMD CONTROLLER

The 7505/7506 SMD CONTROLLER serves as an interpreter between the MCPU and the disk drive. It consists of two boards, SMD CONTROLLER BOARD "A" (210-7505), and SMD CONTROLLER BOARD "B" (210-7506). A maximum of four disk drives in any combination of SMD's and CMD's may be operated through these boards. The 7505/7506 SMD CONTROLLER contains the electronics neccessary to position, read, and write the disk in a format suitable for the system operating software.

Figure 8-2 presents a simplified block diagram of the 7505/7506 SMD CONTROLLER. There are four major functional interfaces to this controller. The "A" Cable Interface daisy chains to all connected drives and handles command/status information between the controller and the drives. Under control of the 7505 board, it provides the signals neccessary to select and address one out of several thousand sectors available on each drive. The "B" Cable Interface handles the read data, write data, synchronizing clocks, and format information for each disk drive up to a maximum of four. The Data Buffer Interface extracts parallel data from the DATA BUFFER during disk writes, and loads parallel data into the DATA BUFFER during disk reads. Lastly, the Master CPU Interface allows the CPU to check drive and controller status and diagnose errors and faults through MMI/O commands. The collection of logic blocks between the four interface blocks converts parallel data to serial and serial to parallel at a 9.67 MHZ serial rate. It also generates and checks a 35 bit error check character, performs header writing and checking, write check/read compare tests, and other functions necessary to position and control the disk drives.

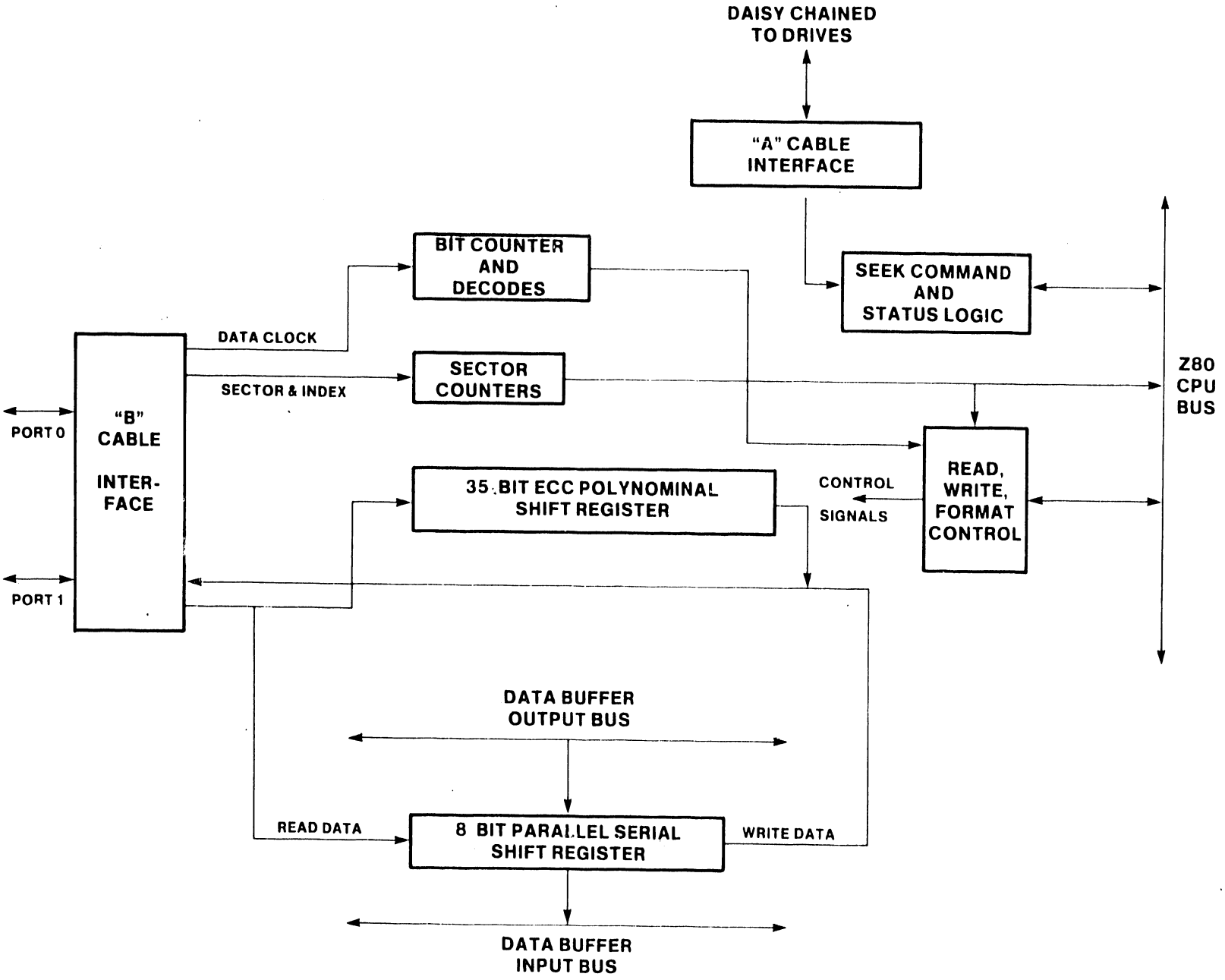


FIGURE 8-2 7505/7506 SMD CONTROLLER SIMPLIFIED BLOCK DIAGRAM

8.7.2 THE 10 MEG/FLOPPY CONTROLLER

The 10-Megabyte (Hard Disk Drive) and Floppy disk controller board 7502 is the interface between the MCPU and the selected disk drive (Floppy or 10 Megabyte/Hard Disk drives). Both the Floppy and Hard Disk Drives are controlled by a series of Memory Mapped Input/Output (MMI/O) commands issued by the MCPU which permits the selected disk to read or write data to or from any selected bank of memory. The data transfers are always via the Processor Communication Channel (DMA). The commands for both the floppy and hard disk drives are general enough to permit both types of drives to operate with the 7502 controller.

The operating commands controlled by the disk controller and performed by the disk drives are the "READ", "WRITE" and "FORMAT" operations. The Read and Write operations are 256-byte transfers from a selected disk to a selected slave or master memory bank or from a selected slave or master memory bank to a selected disk. The Format is an operation that prepares the disk by loading the preamble and identifying each sector with the Header bytes for a specific Track and Sector address for the controller to identify.

The time required to transfer data internally to or from the disk drives depends on the type of disk drive selected. The Hard disk can Read and Write data at ten times the rate of the Floppy drive. This situation requires the controller to be capable of processing the data at a higher rate. The A and B clock generator is designed to operate at these two rates; generating clocks that will fill the requirements.

The 10 Meg/Floppy controller board is addressed as DEVICE TYPE 01 and will use PROM Memory Mapped I/O addresses $0C40_H$ to $0C7F_H$ for operating commands. The controller board will always be attached to a Floppy drive. In addition the controller will support a maximum of two 10-megabyte CDC HAWK (Model 6560) disk drives.

8.7.3 FLOPPY DISK FORMAT

The single floppy disk has 77 tracks (cylinders) and each track is divided into 32 equal sector marks. The present specifications require a sector to be 256 data bytes long, therefore, it was necessary to use two sector marks for each 256-byte formatted sector. Each track is divided then into 16 sectors allowing a time of 10.42 ms for each sector to be written into or read from. The following diagram illustrates the sector organization.

FLOPPY DISK SECTOR FORMAT

PREAMBLE	SYNC 1	HEADER	GAP	SYNC 2	DATA FIELD	CRC	POSTAMBLE

PREAMBLE

This field is created during a format operation. It starts at the leading edge of the sector mark and consists of 20 bytes. The first nineteen bytes are 0 (all clock bits), the first 6 bits of the twentieth byte are 0 and the last two bits are two ones '11'.
This field is used to switch the head to read the SYNC 1 character during WRITE, READ and READ/VERIFY operations.

SYNC 1

This field is contained in the PREAMBLE. It consists of two bits (11). The interface detects a (11) and prepares to read the header.

HEADER

This section contains information identifying the sector as track and actual sector address (one byte each). It is created as a result of the FORMAT command. It is read and compared for WRITE and READ operations.

The following diagram describes the 16 bits of the header:

FLOPPY DISK SECTOR HEADER FORMAT

HEADER

FIRST BYTE	SECOND BYTE
0 64 32 16 8 4 2 1	0 0 0 0 8 4 2 1
Track Address	Sector Address
Valid binary values 0000 0000 through 0100 1100	Valid binary values 0000 0000 through 0000 1111

GAP

The gap is composed of all clock bits (zeros) but for the last two bits which are '11'. This field serves as a preamble to the data field. The gap is used as a delay for header comparison time and allow for switching of the heads in the case of a write command.

SYNC 2

The SYNC 2 character is the last 2 bits of the GAP (11). These bits are created during a Write operation. For Read operation, these bits designate the start of the data field.

DATA FIELD

This field contains 256 bytes of data.

CRC

(Cyclic Redundancy Check) - This check is a two byte character created from the SYNC 2 character and the 256 bytes of the data field.

POSTAMBLE

This section is composed of all clock (zero) bits.

DISKETTE SECTOR TIMING AND SIZE

FIELD	LENGTH	APPROXIMATE BYTES
PREAMBLE & SYNC 1	640us	20
HEADER 1	32us	1
HEADER 2	32us	1
GAP & SYNC 2	640us	20
DATA FIELD	8192us	256
CRC 1	32us	1
CRC 2	32us	1
POSTAMBLE	820us	25
TOTAL	10420us	325

APPENDIX A

MASTER DIAG-NOSTICS MONITOR

APPENDIX A

MASTER DIAGNOSTICS MONITOR

A.1 INTRODUCTION

This appendix presents a quick reference guide for the software-related tasks required to perform the OIS-140/145 Master Diagnostics Monitor package.

General use of these diagnostic test programs at the field level is anticipated for situations where the PROM-based Power-Up Diagnostics fail to identify/isolate a board/assembly failure; this is especially true in the case of a suspected intermittent failure.

In addition, these diagnostic test programs can be used for confidence testing, quickly establishing that all device components operate properly.

---NOTE---

The information contained within this appendix is based on Release 2242 of the Master Monitor. Later releases may contain changes that are not reflected here. Refer to the documentation accompanying the monitor package for complete detailed instructions and error code interpretation.

A.2 GENERAL DESCRIPTION

This package is completely contained on a single floppy diskette. In addition to the monitor, the following diagnostic test programs are supplied on the diskette:

MASTER LOWER RAM TEST
MASTER UPPER RAM TEST
MASTER DATA LINK
10-MEG DISK CONTROL
SLAVE LOWER RAM TEST
CMD/SMD DISK CONTROL
Z80 INSTRUCTION TEST
FIELD TEST UNIT SIMULATOR
SLAVE DATA LINK EXERCISER
I/D MODE EXERCISER
WINCHESTER CONTROLLER

Once the Master Diagnostic Monitor diskette is IPLed via the Master Processor floppy diskette drive, the operator can select, execute, control, and monitor desired combinations of the test programs listed above.

Operation of the diagnostic test programs on this diskette requires, as a minimum, that the following equipment be on-line.

* The Master Processor
* One operable (32k or greater) workstation (to be used as the Test Display Console (TDC)).
* One other serial device.

A.3 MASTER MONITOR COMMANDS

A.3.1 OVERVIEW

The diagnostic test programs are selected at the PROGRAM SELECTION MENU (see A.4.3). Testing begins with an EXECUTE command causing the selected diagnostic programs to run automatically in the order listed on the PROGRAM SELECTION MENU. This test sequence repeats automatically until the operator ends the test cycle.

The Stop On Error function (automatically enabled after EXECUTE) will cause the program sequence to halt on the first error detected.

During testing, the test program and the test routine in progress and other data are presented on the current RUN-TIME MENU.

Testing can be controlled via TDC key entries at anytime during run-time operation. The following types of test control are provided:

PROGRAM FUNCTION	FUNCTION KEY
Pause	FORMAT
Loop on program	DECTAB
Loop on routine	PAGE
Stop on error	CENTER
Loop on error	INDENT
Loop on next error	MERGE
Display Error Log	COMMAND
Clear all settings	STOP

The test program in progress is ended with the CANCEL commmand. CANCEL also ends the test sequence and causes the PROGRAM SELECT MENU to be re-displayed after a short delay.

A.3.2 PROGRAM SELECTION MENU FUNCTIONS

The uses of the individual diagnostic test programs are described below:

1. MASTER LOWER RAM - Tests Master Memory including data and address busses, and parity circuitry. Both Addressing and data faults are detected. The memory that is not occupied by the monitor and this diagnostic will be tested. The Lower Ram diagnostic tests memory locations 1000 to 8FFF.

2. MASTER UPPER RAM - Used to check master memory address and data functions, as well as parity circuitry. This program should be selected whenever one of the MASTER DATA LINK test programs is selected. The Upper Ram diagnostic tests memory locations 6000 to FFFF.

3. MASTER DATA LINK - Used to check the performance of the Data Link Controller and Data Buffer boards (7503 and 7504). Also included are tests of the channel select logic and all channel drivers to on-line devices.

4. 10-MEG/FLOPPY DISK CONTROL - This diagnostic locates faults in the 10-MEG/Floppy Controller board (7502) and the HAWK Disk Drive(s).

   ---------- NOTE ----------
   This diagnostic does not perform a comprehensive media test.
   ---

5. SLAVE LOWER RAM - Used to isolate faults in the data link and/or lower 12k of RAM of an on-line device.

6. CMD/SMD DISK CONTROL - Used to check SMD/CMD Controller and attached SMD/CMD disk drives.

   ---------- NOTE ----------
   This diagnostic does not perform a comprehensive media test.
   ---

7. Z80 INSTRUCTION SET - Used to verify the correct execution of all Z-80 CPU chip instructions on the Master CPU board.

8. FIELD TEST UNIT SIMULATOR - This program is not a diagnostic, but will display an error message on the occurance of a disk drive error. This program is used to simulate the Hardware Field Test Unit; thus, allowing disk drive alignment and adjustments to be performed.

9. SLAVE DATA LINK EXERCISER- Designed to test Slave Data Link functions including Status, Restart, Byte Read, Byte Write, Block Read, and Block Write. The lower 12K of slave memory is tested for data faults, and all of the slave memory can be tested for addressing faults. Addressing of both the slave CPU and the Slave Data Link is tested.

10. WINCHESTER DISK CONTROLLER - This program is only used to test OIS 105/115 systems. It verifies the correct operation of the two Winchester Controller boards in these systems, and the attached Winchester drive.

    ---------- NOTE ----------
    This diagnostic does not perform a comprehensive media test.

----------NOTE----------

Along with the programs on the preceding page, ten additional programs are made available when running on an expanded memory master. These ten programs are identical to the ten listed on the preceding page, except that they run in the second 64K of master memory, known as D space (D Sp). The ten on the preceding page run in the first 64K of memory, known as I space.

The D space programs are listed below:

11. MASTER LOWER RAM - D SPACE
12. MASTER UPPER RAM - D SPACE
13. MASTER DATA LINK - D SPACE
14. 10 MEG/FLOPPY DISK CONTROL - D SPACE
15. SLAVE LOWER RAM - D SPACE
16. SMD/CMD DISK CONTROLLER - D SPACE
17. Z80 INSTRUCTION TEST - D SPACE
18. FTU SIMULATOR - D SPACE
19. SLAVE DATA LINK EXERCISER - D SPACE
20 WINCHESTER CONTROLLER - D SPACE

One more program exists to test the operation of the Extended Memory Master. Its description follows:

21. I/D MODE EXERCISER - Used only with OIS Expanded Memory Master, this diagnostic tests the 7684/7685 128K CPU/MEMORY boards, specifically the circuitry responsible for I/D mode functions. This includes total verification of 2K of firmware located on the 7685 board.

A.3.3 RUN-TIME CONTROLS

These commands are entered in the form of single-key entries to configure testing.

1. Pause (FORMAT) - Press FORMAT to interrupt the diagnostic program in progress. If the Monitor is between programs when FORMAT is keyed, the next program will come up in the Pause state. A second FORMAT key closure will restart the program from the interruption point.

2. Loop On Program (DECTAB) - DECTAB causes the diagnostic program in progress to be repeated continuously until the next DECTAB key closure. The number of loops performed is recorded by the Program Loop Counter. This counter is reset when the loop is exited.

3. Loop On Routine (PAGE) - PAGE causes the diagnostic program routine in progress to be repeated continuously until the next PAGE key closure. The number of loops performed is recorded by the Routine Loop Counter. This counter is reset when the loop is exited.

4. Stop On Error (CENTER) - CENTER causes the diagnostic program to stop when a hardware failure is detected. Testing is resumed when CENTER is re-keyed, and will not stop again on any subsequent failures (unless CENTER is selected again).

5. Loop On Error (INDENT) - INDENT causes a segment of the test routine in progress to loop when a hardware failure is detected. The segment repeated consists of all test routine code necessary to generate, detect, and report the error.

Non-intermittent errors are reported at a constant rate. If the error is intermittent, any remaining test routine code following the point of termination is performed, then the test routine begins again. Thus, the entire test routine is executed repeatedly until an error is detected (causing segment looping) or until the error loop is deselected with an INDENT key closure.

Deselection causes the diagnostic program:

A. to continue from the interruption point, and
B. to not loop on any subsequent failure (until INDENT is selected again), and
C. to clear the Error Loop Counter.

6. Scope Loop (MERGE) - MERGE causes the same response as Loop On Error except that error reporting is disabled after the first error is detected. This feature is convenient when the error is to be traced with an oscilloscope as the time required to format and display error information may be very long compared to the time required to generate and test for the error.

7. Clear All Settings (STOP) - Press STOP to reset all diagnostic control commands currently set (e.g., stop looping if looping, or resume testing if halted).

8. Error Log (COMMAND) - COMMAND causes the error log to be displayed on the TDC screen in place of the Run-Time menu. The error log screen shows the most recent errors, up to the time when the command is invoked. See section A.3.5 for more details.

A.3.4 CURRENT TEST DESCRIPTOR MESSAGES

In addition to the RUN-TIME control commands described in A.3.3, the RUN-TIME MENU displays the following user prompts and messages

PROGRAM = Name of test program currently in progress.

TEST(RTN) = Name of test routine currently in progress.

ERROR CODE = Identifies the last hardware failure. (See Sect. A.5.)

ERROR COUNT = A cummulative count (decimal) of detected errors since returning to the PROGRAM SELECTION MENU or IPLing.

PROGRAM STATUS = Status of the current test program (Test in Progress, Program Pause, Stop On Error, etc,).

PROGRAM LOOP COUNT = The number of consecutive loops (decimal) which have occured during a current Loop On Program function.

PROGRAM SET LOOP COUNT = A cummulative count (decimal) of the loops made through the selected program(s) set since returning to the PROGRAM SELECTION MENU or IPLing.

ROUTINE LOOP COUNT= The number of consecutive loops (decimal) which have been made during a current Loop On Routine function.

ERROR MESSAGES = English language descriptions and commands associated with the test routine currently in progress.

For details concerning error messages and user prompts see the individual diagnostic programs described in Section A.5.

A.3.5 ERROR LOG

The Error Log mode is entered by pressing the COMMAND key, causing testing to be interrupted until the Error Log mode is exited. There are two exit commands:

NEXT SCRN clears the Error Log and restarts program execution at the interrupt point.

PREV SCRN saves the error codes while restarting the program at the interrupt point.

The Error Log shown below consists of a field of 8 characters arranged in a matrix of 22 rows and 8 columns. Thus, there are 176 entries displayed simultaneously. The error codes are displayed from left to right starting at the first row. The 177th error code writes over the first error code at row 1, column 1. In this way the matrix always displays the last 176 detected errors.

Each 8-character field is sub-divided into four 2-character codes as shown below:

aabbccdd

where: aa = Channel Number of the failing device (ex. 00)
bb = Program Number failed (ex. 07)
cc = Test Routine Number failed (ex. 2D)
dd = Error within the Test Routine (ex. 23)

(See Section A.5 for details concerning these codes)

```
00072D23  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
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00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
          "NEXT SCREEN" CLEARS ERROR LOG   "PREV SCREEN" SAVES ERROR LOG
```

A.4 DISKETTE LOAD/UNLOAD PROCEDURES

A.4.1 DISKETTE LOAD PROCEDURE

1. Position the Master Processor DISK-SELECT switch to "-" (up = floppy drive).

2. Insert the Master Diagnostic Monitor diskette into the Master Processor floppy drive.

CAUTION

Leave the diagnostic diskette in the drive for the entire test duration.

---

3. Press the Master Processor RESET switch.

NOTE

At this time the PROM-based Power-Up Diagnostics are performed, and are followed by Monitor status checks of the system's devices and an initial Monitor test of each device's memory.

---

4. To terminate a test program at any time, press CANCEL and do the A.4.2 Diagnostic Diskette Removal procedure.

A.4.2 DISKETTE REMOVAL PROCEDURE

Perform the following steps to discontinue testing and to enable normal system operation conditions:

1. Once testing is completed, set the Master Processor DISK-SELECT switch to the desired position.

2. Press and hold the Master Processor RESET pushbutton until the Master Diagnostic Monitor diskette is removed from the floppy drive.

3. The Master Diagnostic Monitor is now completed.

4. Return the system to desired operating conditions.

A.4.3 PROGRAM SELECT MENU

With this screen displayed perform the following steps for program selection:

1. Select the diagnostic program(s) to be run by positioning the cursor (using the spacebar= down, backspace = up, or the North/South arrows) and selecting/deselecting using the INSERT/DELETE keys.
2. With the desired program(s) selected, press EXECUTE.
3. The next screen displayed will indicate the first program selected (see the PROGRAM = prompt on the TDC display).

---------- NOTE ----------
The CENTER = STOP ON ERROR test command is selected by default upon entering the first test program and remains in force until the first error is detected or the CENTER command is reset. Thus, program execution is automatically halted at the detection of the first error unless this function is reset.
---

4. Whenever end of testing is desired, press CANCEL to return to the PROGRAM SELECT MENU and then do the A.4.2 Diskette Removal procedure.

```
140 MASTER RESIDENT DIAGNOSTIC MONITOR REV:  X.X

     POSITION CURSOR ON TEST YOU WANT SELECTED
AND USE INSERT OR DELETE TO SELECT/DESELECT A TEST.
          USE EXECUTE TO START TESTS.

   TEST NAME                          TEST NAME

_ MASTER UPPER RAM TST  REV. XXX
_ MASTER DATA LINK      REV. XXX
_ 10-MEG DISK CONTROL   REV. XXX
_ SLAVE LOWER RAM TST   REV. XXX
_ CMD/SMD DISK CONTROL  REV. XXX
_ Z80 INSTRUCTION TST   REV. XXX
_ SLAVE DATA LINK EX    REV. XXX
_ FTU SIMULATOR         REV. XXX
_ WINCHESTER CONTRL     REV. XXX
```

----------NOTE----------
If an Extended Memory Master is being tested, the D-space counterparts of the above tests will appear as choices, along with the I/D Mode Exerciser, on the right side of the screen.

A.5 ERROR CODES

This section presents the diagnostic program error codes for detected faults for each of the pertinent OIS-140/145 diagnostic program routines. The error codes are presented as a two-character hexidecimal number. Error Codes for the following test programs are presented in this section:

DIAGNOSTIC TEST	SECTION
MASTER LOWER/UPPER RAM	A.5.1
MASTER DATA LINK	A.5.2
10 MEG DISK CONTROL	A.5.3
SLAVE LOWER RAM TEST	A.5.4
CMD/SMD DISK CONTROL	A.5.5
Z80 INSTRUCTION TEST	A.5.6
SLAVE DATA LINK EXERCISER	A.5.7
I/D MODE EXERCISER	A.5.8

----------NOTE----------

For systems employing Extended Memory, error code interpretation is the same whether the diagnostic is runnung in I space or D space.

A.5.1 MASTER UPPER/LOWER RAM

The following information is intended as a guide in interpreting and making use of the error messages for the MASTER UPPER and MASTER LOWER RAM Diagnostics. The suggested repair actions provided are meant for use in burn-in or at a customers site, not for board repair.

It is more economical to repair a unit by replacing a faulty memory chip than to replace the entire memory board. In cases where it is likely that the fault is with a single memory chip, enough information will be supplied to isolate that chip. In some cases it should be replaced, in others it should be checked for proper insertion (no bent pins that fail to make contact with socket).

All error messages with the exception of parity errors will begin in this form:

```
(type of error) at  (loc.)
Rec. data = xx Exp. data = yy  Xor data = zz
```

The important details of this message are the (loc.), the address at which the fault was detected, and the Xor data, which represents the discrepancy between the received and expected data, i.e. the failing chip. From the address received in the message, the operator must determine which bank of memory chips contains the fault. To aid in this task, a table of address boundaries has been provided.

Bank #	Address Range
0	1000-4FFF
1	5000-8FFF
2	9000-CFFF
3	D000-FFFF

----------NOTE----------

With Extended Memory systems, the operator should note whether the Master Upper/Lower RAM test is running in I-space or D-space. If in I-space, the faulty chip is located on the 7684A CPU motherboard; if in D-space, the chip is located on the 7685A daughterboard.

Once the bank has been located, the failing chip must be identified. This is accomplished with the Xor data. If in the case of a 1-bit data error, where we wrote 'FF' to a location and read back '7F', the Xor data would equal '80' hex. This indicates that the failing chip is at bit D07, which can usually be located through markings on the PC board.

In the case of addressing errors, the failing address line or lines are identified in hex., along with what the problem appears to be, two shorted address lines, an address line stuck high or low, or an open address line. In many cases these faults cannot be repaired by replacing a single memory chip. The one exception to this is the open address line. The open address line looks just like a stuck address lines except that the Xor data contains only one bit, i.e. only one chip is being affected.

As mentioned before, parity errors do not follow this message format. The message form for parity errors will be:

Parity error occurred while testing memory from X000 to XFFF.

Note: In reference to the following table, the first error message received is always the most important one.

ERROR CODE	ERROR TYPE	SUGGESTED FIELD REPAIR
01	Data error	Replace memory chip(s) Replace memory board
02	Addressing error	For address shorts or stucks, replace memory board. For open address lines, and parity chip open address lines, check for faulty chip insertion, try replacing chip.
04	Parity error	Replace parity chip in appropriate bank.
05	Bank address error	If the Xor data = FF, the problem is affecting the entire bank, replace CPU bd. If the Xor is not FF, it might be the memory board, try replacing chips.
06	Parity chip open address line	Check parity chip of bank specified for proper insertion, try replacing it.
07 08 09	Parity generator errors	Replace CPU board.

A.5.2 MASTER DATA LINK

The error codes for the MASTER DATA LINK Diagnostic are listed below:

TEST	SCREEN NAME	ERROR CODE	FAILING MODULE
11	D-LINK R/W TEST	01,02,03,04	7503
12	OCDO IF AND DIAG	05,06	7503
13	OCCE/OCC1 LGO CHK	07	7503
14	OCDO BLK BSY CHK	08,09,0A,0B	7503, 7504
15	OCCE MSTR AND LGO	07,16,17 18,19	7503, 7504
16	OCCO VLDST TCG CMDT	12,13	7503, 7504
17	OCCE STXD STATUS BIT, BIT 7	14,15	7503, 7504
18	NDTO PULSE WIDTH	0D	7503, 7504
19	DLNB INTERRUPT	0C,29	7503
1A	OCCO OP COMP CHK	0F,10,11	7503, 7504
1B	DIAG MODE CMND	1A, 1B	7503
1C	DIAG MODE ADRS	1C	7503
1D/ 1E	DIAG MODE BLK XFER (1D), DIAG MODE XFER BAD PARITY (1E)	20,21,22 23,24,25 26,27,28	7503, 7504
1F	DIAG MODE BOSS	1D,1E,1F	7503,7504
20	MSTR-D BUFF TEST	2A,2B,36 37,38,39 3A,3B,3C,3D	7503, 7504
21	D-BUFF ADR TEST	38,39,3F,3F	7503, 7504
22	D-BUFF DATA TEST	38,39,40,41	7503, 7504
23	D-BUFF PARITY TEST	38,39,42	7503, 7504

TEST	SCREEN NAME	ERROR CODE	FAILING MODULE
24	RST: BK RD/WT TST	3D,44,45,46 47,48,49,50	7503, 7504
25	BK RD/WT	4A,4B,4C, 4D,4E	7503, 7504
26	BK RD/WT LOGIC	4A,4C,4D,4F	7503, 7504
27	BK ADR LOGIC	4A,4C,4D,4F	7503, 7504
28	SELCT LOGIC TEST	4A,4C,4D, 4F,51,56	7503, 7504
29	SELCT MUX TEST	38,39,52, 53,54,55	7503, 7504
2A	BYT NDTO BIT TST	57,58	7503, 7504
2B	BYTE READ TEST	4F,59,5A	7503, 7504
2C	BYTE WRITE TEST	4A,5B,5C	7503, 7504
2D	DATA XFER XRCISER	2D,56,59,5B, 5E,5F,60,61, 62,67,68,69	7503, 7504

A.5.3 10 MEG DISK CONTROLLER

The error codes for the 10-MEG DISK CONTROL Diagnostic are listed below:

TEST	SCREEN NAME	ERROR CODE	FAILING MODULE
00	STATIC REGISTER	01	7502
02	STATUS REG INTEG	01,02	7502
04	CONFIGURATION	00	7502
06	SECTOR REG. CHNG	01	7502, Drive
08	SECTOR REG. VAL.	01,02,04	7502, Drive
0A	ROT'L PERIOD	01,02	Drive Motor
0C	SECTOR PUL INTR	01,02,03	7502
0E	FIRST RESTORE	01,02,03, 04,05,06	7502, Drive
10	SEEK INTERRUPT	01,02,03, 04,05,06, 07,08,09	7502, Drive
12	CYLINDER ADRS	01,02,03, 04,05	7502, Drive
14	SEQ. FWD. SEEK	01,02,03,04, 05,06,07	7502, Drive
16	SEQ. BKD. SEEK	01,02,03, 04,05,08	7502, Drive
18	HEAD SELECT	01	7502, Drive
1A	READ DECODE	01,02,03, 04,05	7502
1C	FIRST READ	01,02,03	7502
1E	READ INTERRUPT	01,02	7502
20	FORMAT DECODE	01,02,03	7502
22	FIRST FORMAT	01,02,03	7502
24	FORMAT INTERRUPT	01	7502

TEST	SCREEN NAME	ERROR CODE	FAILING MODULE
26	HDR CHK ERR T1	01	7502
28	HDR CHK ERR T2	01	7502
2A	HDR CHK ERR T3	01	7502
2C	HEAD ADDRESSING	01,04 02,03	Drive 7502, Drive
2E	WRITE DECODE	01,02,03	7502
30	FIRST WRITE	01,02,03	7502
32	WRITE INTERRUPT	01	7502
34	WRITE ALL F'S	01	7502
36	WRITE ALL 0'S	01	7502
38	WRITE INCR'L PAT	01	7502
3A	PARITY CHECK	01, 02	7502
3C	WRITE FLT 0'S	01	7502
3E	WRITE FLT 1'S	01	7502
40	DB INP CTR CLR	01	7502
42	DB OUTPT CTR CLR	01	7502
44	CRC T1 (GOOD CRC)	01	7502
46	CRC T2 (BAD CRC)	01,02	7502
48	OVERLAPPING SEEKS	01,02,04	7502

A.5.4 SLAVE LOWER RAM TEST

The error codes for the SLAVE LOWER RAM are listed below:

TEST	SCREEN NAME	ERROR CODE	FAILING MODULE
01	GET SLAVE STATUS	01	7503 or device
02	SLAVE RESTART	02	coax
		04	coax
		05	coax or device
03	DATA BUS TEST	05	coax or device
04	PARITY GEN	06	7503, 7504, or device
05	BANK ADDRESS	0A	7503 or 7504
		08	7503 Or 7504
06	ADDRESS BUS	08	7503 or 7504
		0B	7503 or 7504
07	ADRESS LINE	05	7503 or 7504
		07	7503 or 7504
08	DMA/CPU ADDRESS	05	7503 or 7504
		07	7503 or 7504
		08	7503 or 7504
09	MOVING INVRSN	05	7503 or 7504
0A	MEMORY PARITY	06	7503 or 7504
0B	BLOCK WT/BYTE RD	08	7503 or 7504
		09	7503 or 7504
0C	BLCK WT/BLCK RD	05	7503 or 7504
		09	7503 or 7504
0D	REFRESH TST	05	7503 or 7504
		09	7503 or 7504

A.5.5 CMD/SMD DISK CONTROLLER

The following table presents the complete set of error messages for the CMD/SMD DISK CONTROLLER diagnostic.

TEST	SCREEN NAME	ERROR CODES	FAILING MODULE
01	CUBSY TIMEOUT	1,2,4	7505
02	CONFIGURATION	1,2,7,8,9 4,5,6	7505 7506
04	CLEAR ERROR REG	1,2,5,7,9	7506, DRIVE
06	CNTRL UNIT INPT	4,01,02	7505
08	SEEK INTERRUPT	2,4,5,6,7,8	7505,DRIVE
0A	SEQ FWD SEEK	1,2,4,5,6,7,8	7505,7506 DRIVE
0C	SEQ BKWD SEEK	1,2,4,5,6,9,A,B	DRIVE
0E	SECTOR REG. CHANGE	1	7506, DRIVE
10	SECTOR REG. VAL.	1,2,4	7506, OR DRIVE SWITCHES SET WRONG
12	ROT'L PERIOD	1	DRIVE MOTOR
14	FIRST READ	4,5,6	
16	READ RESET	1,2	
18	TAG 3 (READ)	1,2,4,5 7,9,A 6	 7505 7505, DRIVE
1A	SCTR ADFS/CMPRTR	1,2,4,5	7506
1C	READ CONTROL	1,2,4	7506
1E	OFFSET SIGNALS	1,2,4,5,6,7,8,9 A,B,C,D,E	7505
20	FIRST FORMAT	1,2	7506
22	FORMA SIGNALS	1,2,3,4,5 6,8,9,A	7505,7506, DRIVE 7506, DRIVE
24	HDR CHK PRP T1	1 2,4	7506 7505,7506, DRIVE

TEST	SCREEN NAMES	ERROR CODES	FAILING MODULE
26	HDR CHK PRR T2	1,2	7506
28	HRD CHK ERR T3	1,2	7506
2A	CONFIG/HEAD ADRS		
2C	FMT CYL, X'0336'	1	7506, DRIVE, PACK
2E	FIRST WRITE	1,2	
30	TAG 3 (WRITE)	1,2,4,5, 6,7,8,9,A	7505 7505, DRIVE
32	WRITE CONTROL	1,2,4	7506
34	READ END	1 2,4,5	7506
36	HDR CLK NOISE	1	7505
38	HEADER INTEGRITY	1	7505, DRIVE
3A	WRITE ALL F's	1,4 2	7506 7505,DRIVE,PACK
3C	WRITE ALL 0's	1,4 2	7506 7506,DRIVE,PACK
3E	WRITE INCR'L PAT	1,4 2	7506 7506,DRIVE,PACK
40	PARITY CHECK	1,2	7506
42	WRITE-CHK F's	1 2,4	7505 7506
44	WRITE-CHK FLT 0	1,2	7506
48	WRITE-CHK 0's	7506 4	
4A	WRITE-CHK INCR'L	2	7506
4C	CLR MSK/ADR (WR)	1 2	7506 7505,7506
4E	CLR MSK/ADR (RD)	1 2	7506 7505,7506
50	DIAG RD FRC FCC	1,2,4,5	7505,7506

TEST	SCREEN NAMES	ERROR CODES	FAILING MODULE
52	ECC 1-BIT DETECT	1,2,4	7506
54	ECC ADRS CTR T1	1,2	7505
56	ECC ADRS CTR T2	1	7505
58	ECC ADRS CTR T3	1	7505
5A	ECC ADRS CTR T4	1,2	7505
5C	ECC ADRS FLT 1,0	1,2,4,5,6	7505,7506
5E	ECC MULT BIT ERR	1,2,4,5,6,7	7506,7505
60	DB INP CTR CLR	1	7506
62	DB OUTPT CTR CLR	1	7506
64	OVERLAPPING SEEK	1,2,4	DRIVE,7505

A.5.6 Z80 INSTRUCTION TEST

The following table describes a list of error codes for the Z80 CPU INSTRUCTION TEST Diagnostic. Each error code denotes a faulty 7501 CPU board.

ERROR CODE	DESCRIPTION
01	AND, OR, XOR COMMAND FAILURE
02	ACCUMULATOR FAILURE
04	8-BIT REGISTER FAILURE
05	RL RR COMMAND FAILURE
06	RLC RRC COMMAND FAILURE
07	SLA SRA COMMAND FAILURE
08	SRL COMMAND FAILURE
09	RLD RRD COMMAND FAILURE
0A	HL, BC, DE REGISTER FAILURE
0B	EX DE, HL OR EXX COMMAND FAILURE
0C	IX, IY, OR SP REGISTER FAILURE
0D	PUSH OR POP ERROR
0E	CCF OR SCF COMMAND FAILURE
0F	8-BIT ADC COMMAND FAILURE
10	16-BIT ADC COMMAND FAILURE
11	8-BIT ADD COMMAND FAILURE
12	16-BIT ADD COMMAND FAILURE
13	SUBTRACT CMD FAILURE
14	DAA COMMAND FAILURE
15	BIT TEST FAILING
16	RES CMD FAILURE
17	SET CMD FAILURE
18	CPI CMD FAILURE
19	CPD CMD FAILURE
1A	CPDR CMD FAILURE
1B	CPIR CMD FAILURE
1C	LDI CMD FAILURE
1D	LDD CND FAILURE
1E	LDIR CMD FAILURE
1F	LDDR CMD FAILURE
20	CALL OR RET CMD FAILURE
21	INDEXED ADDRESSING FAILURE

A.5.7 SLAVE DATA LINK EXERCISER

This section presents a list of error codes and a summary of the error messages reported in the SLAVE DATA LINK EXERCISER.

TEST	SCREEN NAME	ERROR CODE	DESCRIPTION
01	GET SLAVE STATUS	01	Bad Status Returns on Hardware Status Request.
		0D	Device Type Changing.
		0E	Intermittent NDTO returned on -Hardware Status Request-.
		0F	No slave on line for -Hardware Status Request-.
02	SLAVE RESTART	^2	Bad status Returned on -Slave Restart-.
		10	Bad Status Returned on -Byte Read-.
		11	Bad Status Returned on -Byte Write-.
		12	Restart is not executing the program loaded.
		13	Restart is working intermittently.
03	DATA BUS/PARITY	05	Data Error.
		06	Parity Error.
04	ADDRESS LINE	0B	Slave CPU addressing Error.
		11	Bad Status Returned on -Byte Write-.
		02	Bad status returned on -Slave Restart-.
		05	Data error.
		06	Parity error.
		11	Bad status returned on -Byte Write-.
		0B	Slave CPU addressing error.
		22	Stuck address line to slave memory.
05	BYTE LOW ADDRESS		
		02	Bad Status Returned on -Slave Restart-.
		05	Data Error.
		10	Bad Status Returned on -Byte Read-.
		11	Bad Status Returned on -Byte Write-.
06	BYTE HIGH ADDRESS	02	Bad Status Returned on -Slave Restart-.
		05	Data Error.
		10	Bad Status Returned on -Byte Read-.
		11	Bad Status Returned on -Byte Write-.
07	DMA/CPU ADDRESS TEST	05	Data Error.
		07	Slave CPU Address Lines and DMA Address line did not meet at location XXXX Bad Status Returned on -Byte Write-.
08	MOV-INVRSN/PARITY	05	Data Error.
		11	Bad Status Returned on -Byte Write-.
		10	Bad status returned on -Byte Read-.

TEST	SCREEN NAME	ERROR CODE	DESCRIPTION
09	BLOCK WRT/BYTE READ	05	Data Error.
		08	Bad Status returned on byte transfer.
		09	Bad Status returned on Block Transfer.
0B	BLOCK LOW ADDRESS	02	Bad Status returned on -Slave Restart-.
		11	Bad Status returned on -Byte Write-.
		18	Bad Status on Block Transfer to Data Buffer.
		19	Bad Status on Block Transfer from Data Buffer.
		1A	Data error on block transfer.
0C	BLOCK HIGH ADDRESS	02	Bad Status returned on -Slave Restart-.
		18	Bad Status on Block Transfer to Data Buffer.
		19	Bad Status on Block Transfer from Data Buffer.
		1A	Data Error on Block Transfer Operation.
0D	CPE Test	14	CPE bit not set after receiving bad parity byte.
		15	Slave did not terminate the data Xfer at the point of bad parity data.
		16	Data Error on Xfer of block with single byte of bad parity data: at byte XX.
		17	Data Error on Xfer of single byte of bad parity data; CPE failed to inhibit slave memory write at XX.
0E	Refresh Test	05	Data Error.
		09	Refresh Error while attempting to write a block of data to the slave.
		0A	Refresh Error while attempting to read a block of data from the slave.
0F	Power on Test	01	Bad status return on -Hardware Status Request-.
		1B	Power-on bit not set.
		1C	IPL bit not set.
		1D	CPE bit not reset.
		1E	MPE bit not reset.
		1F	Didn't receive bad parity from slave.
		11	Bad status return after -Byte Write-.
		0F	No slave on line.
		20	Could not detect bad parity. MPE bit not set.
		21	Restart didn't reset slave bad parity.

A.5.8 I/D MODE EXERCISER

Error codes for the I/D MODE EXERCISER used with expanded Memory CPU/MEM boards are presented in the two tables that follow. Replace the CPU/MEM board if failure is indicated.

ERROR CODE	DESCRIPTION
	I TO D DMA TEST
01	BAD DMA Transfer from I space page AO to D space page BO
02	BAD DMA Transfer from D space page BO to I space page CO
	NON MEMORY ACCESS INSTRUCTION
03	NMI DID NOT OCCUR AFTER OCOE.
04	JP (C3) INSTRUCTION DID NOT EXECUTE.
05	JP NZ (C2) EXECUTED WITH Z SET.
06	JP M (FA) EXECUTED WITH S SET.
07	JP C (DA) EXECUTED WITH C RESET.
08	JP Z (CA) NOT EXECUTED WITH Z SET.
09	JP P (F2) NOT EXECUTED WITH S SET.
OA	JP NC (D2) NOT EXECUTED WITH C RESET.
OB	JP Z (CA) EXECUTED WITH Z RESET.
OC	JP P (F2) EXECUTED WITH S RESET.
OD	JP NC (D2) EXECUTED WITH C SET.
OE	JP NZ (C2) NOT EXECUTED WITH Z RESET.
OF	JP M (FA) NOT EXECUTED WITH S RESET.
10	JP C (DA) NOT EXECUTED WITH C RESET.
11	JR (18) NO EXECUTED.
12	JP PO (E2) EXECUTED WITH P/V RESET.
13	JP PE (EA) NOT EXECUTED WITH P/V SET.
14	JP PE (EA) EXECUTED WITH P/V SET.
15	JP PO (E2) NOT EXECUTED WITH P/V RESET.
16	JR NZ (20) EXECUTED WITH Z SET.
17	JR Z (28) NOT EXECUTED WITH P/V RESET.
18	JR Z (28) EXECUTED WITH Z RESET.
19	JR NZ (20) NOT EXECUTED WITH Z RESET.
1A	JR NC EXECUTING WITH C SET
1B	JR C NOT EXECUTING WITH C SET
1C	JR C EXECUTING WITH C RESET
1D	JR NC NOT EXECUTING WITH C RESET
1E	DJNZ NOT EXECUTING CORRECTLY.
Note:	Z= Zero Flag C= Carry Flag S= Sign Flag P/V= Parity/Overflow Flag

CODE	FAILED INSTRUCTION	CODE	FAILED INSTRUCTION
	MEMORY ACCESS INSTRUCTIONS		
1F	PUSH AF	20	PUSH BC
21	PUSH DE	22	PUSH HL
23	PUSH IX	24	PUSH IY
25	JP (HL)	26	JP (IX)
27	JP (IY)	28	CALL NZ
29	CALL M	2A	CALL C
2B	CALL P	2C	CALL Z
2D	CALL NC	2E	CALL Z
2F	CALL P	30	CALL NC
31	CALL M	32	CALL NZ
35	CALL PE	36	CALL PE
37	CALL PO	38	LD (BC) ,A
39	LD (DE) ,A	3A	LD (HL) ,A
3B	LD (HL) ,B	3C	LD (HL) ,C
3D	LD (HL) ,D	3E	LD (HL) ,E
3F	LD (HL) ,H	40	LD (HL) ,L
41	LD (HL) ,NN	42	LD (IX) ,A
43	LD (IX) ,B	44	LD (IX) ,C
45	LD (IX) ,D	46	LD (IX) ,E
47	LD (IX) ,H	48	LD (IX) ,L
49	LD (IX) ,NN	4A	LD (IY) ,A
4B	LD (IY) ,B	4C	LD (IY) ,C
4D	LD (IY) ,D	4E	LD (IY) ,E
4F	LD (IY) ,H	50	LD (IY) ,L
51	LD (IY) ,NN	52	LD (NN) ,A
53	LD (NN) ,BC	54	LD (NN) ,DE
55	LD (NN) ,HL	56	LD (NN) ,IX
57	LD (NN) ,IY	58	LD (NN) ,SP
59	RETN	5A	RETI
5B	RET Z	5C	RET NZ
5D	RET C	5E	RET NC
5F	RET M	60	RET P
61	RET PE	62	RET PO

APPENDIX B
SYSTEM ERROR MESSAGES

APPENDIX B
SYSTEM ERROR MESSAGES

B.1 INTRODUCTION

The OIS Operating System presents error messages on the CRT in one of the following 4 types:

1. Screen Package DEBUG error messages. (Table B-1.)
2. Word Processing Error Handler messages. (Table B-2.)
3. Request Control Block (RCB) error messages. (Table B-3.)
4. Additional error and warning messages. (Table B-4.)

B.2 SCREEN PACKAGE DEBUG ERROR MESSAGES

---------- NOTE ----------
At present, these error messages are being revised.

TABLE B-1. SCREEN PACKAGE DEBUG ERROR MESSAGES

ERROR CODE	MEANING
A	Message row invalid
B	Message column invalid
C	Message will not fit on the screen
D	Buffer data larger than display area
E	Msgnr* does not start with stx**
F	Invalid character in msgnr message
G	Invalid character in buffer area
H	Cannot load message module
I	Screen clear request invalid
J	Invalid Link Table
K	Invalid offset or choice pointer value
L	More than 16 error messages (stack overflow)
M	Invalid date mask

* Message number
** Start of message text flag

B.3 WORD PROCESSING ERROR HANDLER MESSAGES

Table B-2 explains the messages and suggested methods for recovery.

TABLE B-2. ERROR HANDLER MESSAGES

ERROR MESSAGE	MEANING
File access conflict	A workstation is tying up a file which is necessary to Word Processing. Since this may be only a momentary problem, first simply retry the whole operation from scratch. Request that all the workstations return to the main WP menu and retry the operation. If that fails, try entering SHIFT-CANCEL at each workstation. (If it is possible to isolate the workstation which is tying up the file, then it may be necessary to IPL only that workstation.) Only as a last resort should the Master Processor be IPLed.
Master Processor overload	This message indicates that there are too many files open. Try the same procedure indicated for a "File access conflict".
Lock-out on shared files	This is similar to "file access conflict". The same procedure is recommended.
File not found on volume	A file necessary to Word Processing is missing. If it is one which is copied to the WPS during installation, it may be possible to retrieve it from the Installation Disk. If it is a document, check to see if the volume for that library has been changed. Otherwise this should be considered a software error.
Volume not found	Word Processing i expecting a particular volume to be mounted, and cannot find it. (In most cases the volume name will be contained within the file name displayed.) Check all the drives to be sure that the correct volumes are mounted, then retry the operation.
No disk in drive	This indicates almost the same problem as above, although it refers to operations usually performed on floppy disks. Check all the drives to be sure that the disks are mounted properly.
System residence volume space exhausted	The "system" volume is full of files. Archiving documents from libraries found on the system volume will remedy this.

TABLE B-2 (continued). ERROR HANDLER MESSAGES

ERROR MESSAGE	MEANING
Volume space exhausted	This is the same problem as above, but the disk is not the "System" volume. If the volume is a floppy disk, it will be necessary to delete documents (files); otherwise the procedures described above are recommended.
Drive not ready	Ensure that all the drives are powered up properly.
Drive write protected	Check to see that the buttons on the front panel of the regular disk drives are not set to "write protect", and that the write-enabling tab is in place on any floppy disks being used.
Data transmission error	This indicates a true hardware error.
Disk format error	This could be either a software or a hardware error.
Equipment malfunction	This indicates a true hardware error.
Slave parity error	A parity error occurred when writing to the workstation memory. This is a hardware error.
Data link	A parity error occurred when writing to the workstation memory. This is a hardware error.
Parameter error	This is a programming error.
Drive dropped ready	Ensure that the disks are correctly powered-up and that the Fault light (on disk drive) is not on.
All others	Consider to be fatal errors.

B.4 REQUEST CONTROL BLOCK ERROR MESSAGES

If the error is so disabling that the Word Processing Error Handler cannot be invoked, then the following message format is displayed on the CRT screen.

---------- NOTE ----------
Copy the message before touching any key: touching any key causes the message to be erased.

```
Fatal I/O Error   RCB=(xxyy0000  00000000  00zz0000  00000000)  Press Any Key

          Request Code                Hardware Error Code if status code = X'08'.
                       Status Code
```

The error message while in WP Mode has the form:

*** xx *** yy zz, or System error codes : xxyyzz

Explanations of these codes are presented in Tables B-3, 4, and 5.

TABLE B-3. REQUEST CODES

CODE xx	MEANING
00	OPEN--open file
01	READ--read sectors from a file
02	WRITE--write sectors to a file
03	CATALOG--change name of a file
04	CLOSE--terminates access to a file
05	OPEN CAT--provides scratch file containing information of a chosen subtree of a catalog
06	READ-LOCK--read lock sectors from a file opened with shared access
07	SET-EOF--reset the end of a file opened for read/write access
08	REOPEN--access to a file which is open may be changed without closeing-read only-read/write-shared
09	OPEN-DC--open drive for direct control
0A	DIRECT I/O--enables slave to perform any physical operation on the disk*
0B	LOCK--locks sectors from a file open with shared access so a write operation can be performed*
0C	GET-FILE-NAME--allows sequential steping through names of files on a volume
0D	FILE-LOCK--locks the entire file for exclusive use by the requesting slave*
0E	FILE-UNLOCK--unlocks the file from exclusive use*
0F	ASSIGN-PASSWORD--used to place/replace or remove passwords on nodes of the catalog
10	OPEN-DCS (Model 40 & XMM only)**--slave direct access to the memory of another slave as well as control of the slave

* Receives no hardware I/O error

** Model 40 includes OIS-105, OIS-115, OIS-125A, OIS-130A, OIS-140, and OIS-145. XMM refers to Extended Memory Master.

TABLE B-4. STATUS CODES

CODE yy	MEANING
01	Reference Number not valid, or Name node not found on volume.
02	Buffer not on page boundary, or Name string indicates a file-Access conflict, or Address drive is not available, or End of catalog.
03	File not open with write access, read/write access, shared acesss, or Volume not mounted, or No disk in drive, or Slave not open for direct control, or RN not for direct control disk, or Slave not available.
04	Invalid file segment specified (out of bounds), or Name string format error, or Insufficient space on volume to increase file size to that request, or Password string format error.
05	Lock-out (shared files only), or Tree structure error, or File not open for shared read/write access.
06	Segment not previously lock (shared file only), or Buffer not on page boundary, or Password incorerect or not provided.
07	Volume name is incorrect, or Master processor overloaded, or Invalid new password.
08	Permanent I/O error.
09	Invalid request option specified.
0A	Catalog damaged.
0B	VAU Map damaged.
0C	Insufficient space on volume to create file prologue sector.
0D*	System not found (WISE systems only).
0E*	File source connection broken (External File Source software option only).
80	Successful.
81	Successful, less than requested sectors read/written (System Residence Volume space exhausted, end-of-file encountered).

TABLE B-5. HARDWARE ERROR CODES

CODE zz	MEANING
01	Drive not ready
02	Drive is write protected
03	CRC or non-correctable ECC error
04	Format error/header error
05	Equipment malfunction error
06	Parity error (reading slave memory)
07	Data-link error (writing slave memory)
08	Programming error
09	Drive dropped power during operation
0A	Slave not available
0B	Slave dropped power during operation or Master Data Link error
0C	Write-check compare error (Model 40 & XMM only)**

* Applies to Operation Systems 4.4, 5.1, or above.

** Model 40 includes OIS-105, OIS-115, OIS-125A, OIS-130A, OIS-140, and OIS-145. XMM refers to Extended Memory Master.

B.5 ADDITIONAL ERROR AND WARNING MESSAGES

Table B-6 includes some of the ERROR and WARNING messages the operator will encounter during the DOS software implementation and operations contained in this document.

TABLE B-6. ADDITIONAL ERROR AND WARNING MESSAGES

ERROR MESSAGE	MEANING
Access Conflict, Input File	Displayed next to the file name if the file is in use during during a Copy Mode. These file names should be noted and the file copied later.
Answer all Questions	Before the system will accept the EXECUTE command, all fields on the menu must be completed.
Cannot Make Copy-- Insufficient Space	The Volume is full, delete files to continue.
Cannot Read Catalog File	The system cannot access the catalog file; the system disk is full. Archive or delete documents/files from the system.
Cannot Read Print Job File	The system cannot print the file because it has been deleted or it is in use.
Cannot Reserve Requested Drive	The drive is being accessed from another workstation and it is not available for mounting or dismounting a disk at this time.
Catalog Damaged	The system disk has been damaged and cannot be cataloged. Try Volume Recovery procedures through the Volume Utilities.
Could Not Cancel Active Job	The job is being processed at another device.
Disk I/O Error	Indicates a system error. Reset the system.
Drive is Not Available	Indicates that the drive is in use and cannot be accessed at this time.
Error Found When Opening Catalog	The Input Name String has been entered incorrectly. Reenter it, using the correct syntax.
Error Initializing Disk	Indicates a Format error, or a bad sector on the disk. Try the process again, if the same message appears, try another disk.

TABLE B-6 (continued). ADDITIONAL ERROR AND WARNING MESSAGES

ERROR MESSAGE	MEANING
File Not Found	The system has searched and has not found the named file on the Volume. Check to see that the name string has been entered correctly and that it's Volume is logically mounted.
Invalid Character in Field	Letters and Numbers Only Volume names, library names and passwords cannot contain any symbol other than uppercase letters, lower case letters or numbers 0-9.
Invalid Key, Ignored	A typographical error or illegal response has been entered. Reenter and press EXECUTE.
Invalid Page	The Print Thru Page number entered in the Print Document field does not exist in the document; this number cannot be higher than the last page of the document.
Invalid Partial File Name	The input name has been entered incorrectly. Check that it is in the correct DOS name string syntax and that it is a partial file name (volume and/or library only).
Named Mode Not Found on Volume	Indicates that the file has been deleted, the file name entered incorrectly, or the wrong volume has been accessed.
Name String Format Error	The name string has not been entered in the correct name string syntax: VOLUME1:DOCUMENT.A.12.34.
No Disk in Drive	The system does not recognize any volume at the designated address. Check to see if disk is mounted.
Prototype Document	This message means that the library prototype does not exist. It can be created using the Create Library Function.
Password Error	An error was made entering the password. Try again, or check that the Volume being requested is correct.
Unable to Rename File	Error in the Input Name String such as the wrong number of nodes or an illegal character.
Volume Not Mounted	Volume cannot be accessed until it is logically mounted. Mount the volume using the Volume Utility Mount/Dismount function.

APPENDIX
C
SOFTWARE INSTALLATION PROCEDURES

APPENDIX C

SOFTWARE INSTALLATION PROCEDURES

C.1 INTRODUCTION

This appendix presents a complete guide for the software-related tasks required to perform the OIS 140/145 Software Initialization (Section C.2) and the Post-Installation Software Updates Procedures (Section C.3) .

To properly utilize this appendix, address Section C.2 when performing system start-up during site installation.

Section C.3 provides the step-by-step procedures required to up-date or add on software to a previously installed system.

Further information on Software Loading and Operation is available in the OIS Supervisor Procedures Manual (700-5562C).

C.2 SOFTWARE INITIALIZATION AND INSTALLATION PROCEDURE

The procedures in Section C.2 provide a complete guide for performing software-related tasks during an initial installation of the OIS-140/145 systems. This section is divided into three areas:

C.2.1 System Disk Initialization (Screens 1 through 14)

C.2.2 System Configuration (Screens 15 through 18)

C.2.3 Software Installation (Screens 19 through 27)

---------- NOTE ----------
Software Installation is normally a Customer Support Analyst function. The procedure is provided here for cases where it has been determined that Customer Engineering should perform this task.

C.2 SYSTEM DISK INITIALIZATION PROCEDURE

This procedure formats the system disk and loads the "STARTER" DOS system and "SYSTEM GENERATION" software packages.

C.2.1 SCREEN 1

1. Ensure that the switch settings on the CPU/MEM board conform to the configuration desired:

   Position 3 of SW2 ON if BASIC is to be installed.
   Position 4 of SW2 ON if the ALLIANCE software option is used.

2. Ensure that the switch settings on the 7506-board (SMD/CMD Controller "B") conform to the configuration desired (See section 3.12.1).

3. Perform the system Power-Up procedure described in section 3.6 of this manual.

4. Position the Master Processor DISK-SELECT switch to "-" (up=floppy drive).

5. Insert the STARTER diskette into the Master Processor diskette drive.

6. Press the Master Processor RESET pushbutton to access SCREEN 1.

```
Unit XX              Office Information System              Type XXX
                  I N I T I A L  P R O G R A M  L O A D
                    Release X.X   System is "STARTER"


 Enter Date and Time, Press EXECUTE


                  Enter Date:  mm/dd/yy:  __/__/__

                  Enter time:   hh:mm  :  __:__
```

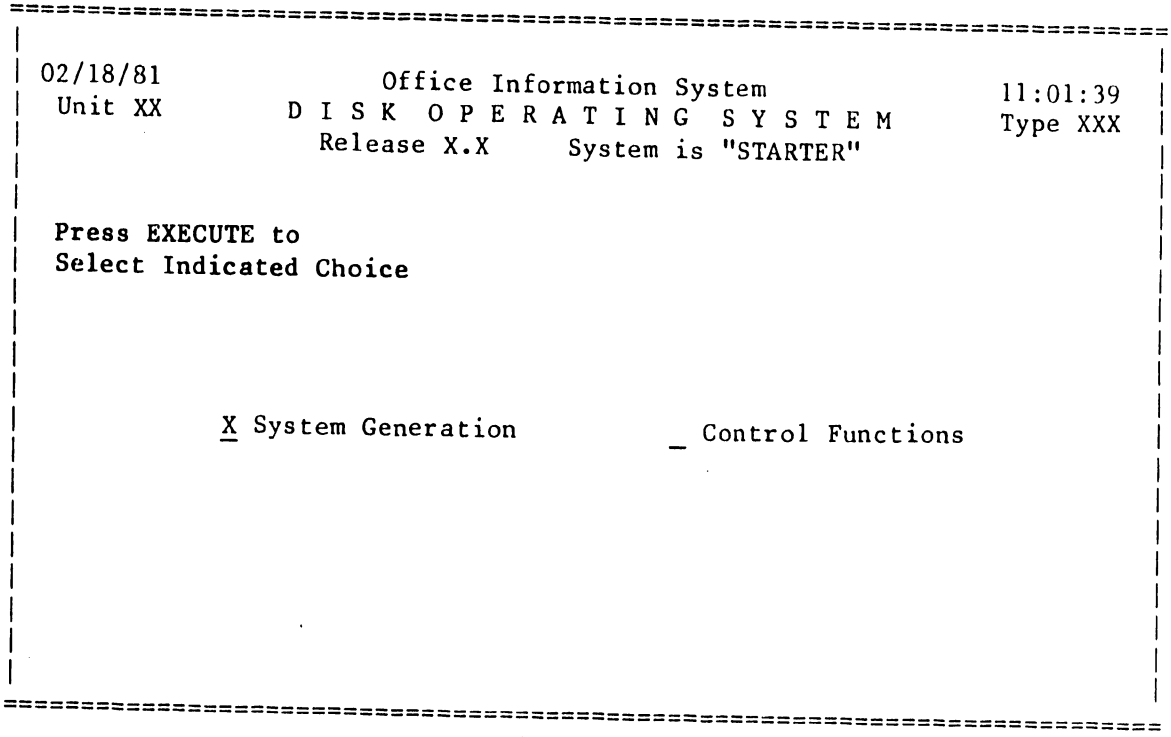
SCREEN 1

7. At the workstation, enter the Date on SCREEN 1 and press RETURN.

8. Enter the Time and press EXECUTE twice to access the next screen. (CANCEL would terminate this installation procedure.) After a short delay SCREEN 2 will appear on the Workstation CRT.

C.2.1 SCREEN 2

1. Select 'System Generation' (using the spacebar) at SCREEN 2.
2. Press EXECUTE to access SCREEN 3.



SCREEN 2

C.2.1 SCREEN 3

```
Office Information System - System Generation
S Y S G E N  F U N C T I O N  S E L E C T I O N

Select Function and Disk Type
Press EXECUTE or CANCEL

X Initialize System Disk          _ Hawk-5
_ Update System software          _ Hawk-2
_ Configure System                _ Winc-3
                                  _ Winc-4
                                  _ Winc-8
                                  _ Winc-20
                                  _ Winc-40
                                  _ CMD-32
                                  _ CMD-64
                                  X CMD-96
                                  _ SMD-80
                                  _ SMD-300
```

SCREEN 3

1. Select 'Initialize System Disk' and press RETURN at SCREEN 3. Notice that the cursor moves to the right-hand column.

---------- NOTE ----------
In step 2, select one of the following for OIS 140/145:

CMD-32 for OIS 140-1
CMD-64 for OIS 140-2
CMD-96 for OIS 140-3
SMD-300 for OIS 145

---

2. Select the appropriate system disk drive (using the space bar) and press EXECUTE.

---------- NOTE ----------
If this system has not been initialized previously, SCREEN 4 will appear on the CRT, proceed with C.2.1, SCREEN 4.
If this system has been initialized previously, SCREEN 9 will appear; in this case, proceed with C.2.1, SCREEN 9.

C.2.1 SCREEN 4

```
Office Information System - System Generation
        I N I T I A L I Z E  S Y S T E M  D I S K

Fill in all fields
Press EXECUTE or CANCEL

     Initialize xxxxxx Disk on Drive nn

     Formatting is Required

     New Volume Name: _____

     New Password: _____

     New Sectors Per VAU: ___
```

SCREEN 4

1. For **xxxxxxx**, the system will enter the name of the disk selected on the previous menu. For Disk on Drive **nn**, the system will enter the disk hardware address. (In this example xxxxxxx = CMD-96, nn = 50.)**

2. With SCREEN 4 on the CRT, Enter the volume name, up to eight alphanumeric characters. Press RETURN.

3. Enter a password in the appropriate field and press RETURN.

   ---------- NOTE ----------

   In step 4, suggested VAU's (Volume Allocation Units) are as follows:

   32 for CMD-32
   32 for CMD-64
   64 for CMD-96
   64 for SMD-300

   ---

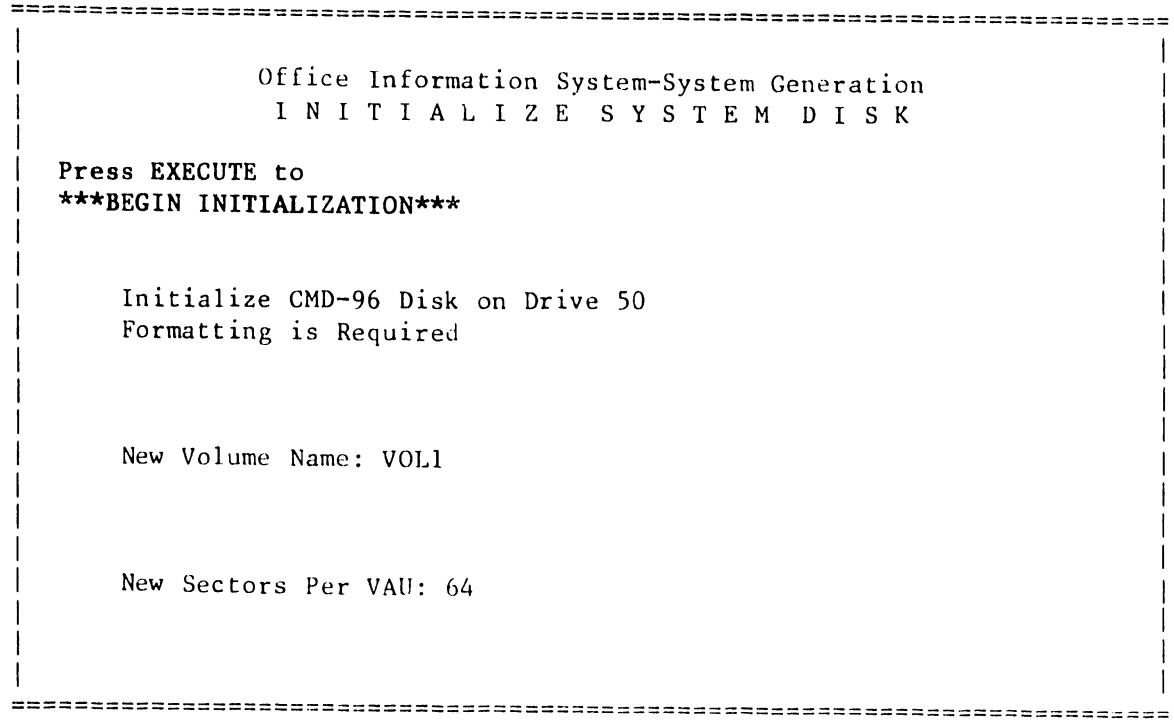
4. Fill in the appropriate New Sectors Per VAU.

5. Press EXECUTE and note that SCREEN 5 appears on the CRT.

** NOTE: For drive addresses, i.e. nn = 50, the first digit is the value of the port setting on the 7506 board, and the second digit is the LAP (Logical Address Plug) number of the drive.

C.2.1 SCREEN 5

1. With SCREEN 5 displayed on the CRT, press EXECUTE. SCREEN 6 will appear on the CRT and Formatting will begin automatically.



SCREEN 5

C.2.1 SCREEN 6

1. SCREEN 6 (Formatting) will continue for anywhere from 10 to 105 minutes (depending on system model). This time will increase dramatically if retries are performed by the Disk Unit. At the conclusion of Formatting, SCREEN 7 will automatically appear.

---------- NOTE ----------

It's possible that at the end of Formatting, the CRT screen will display the following to indicate that bad sectors were found:

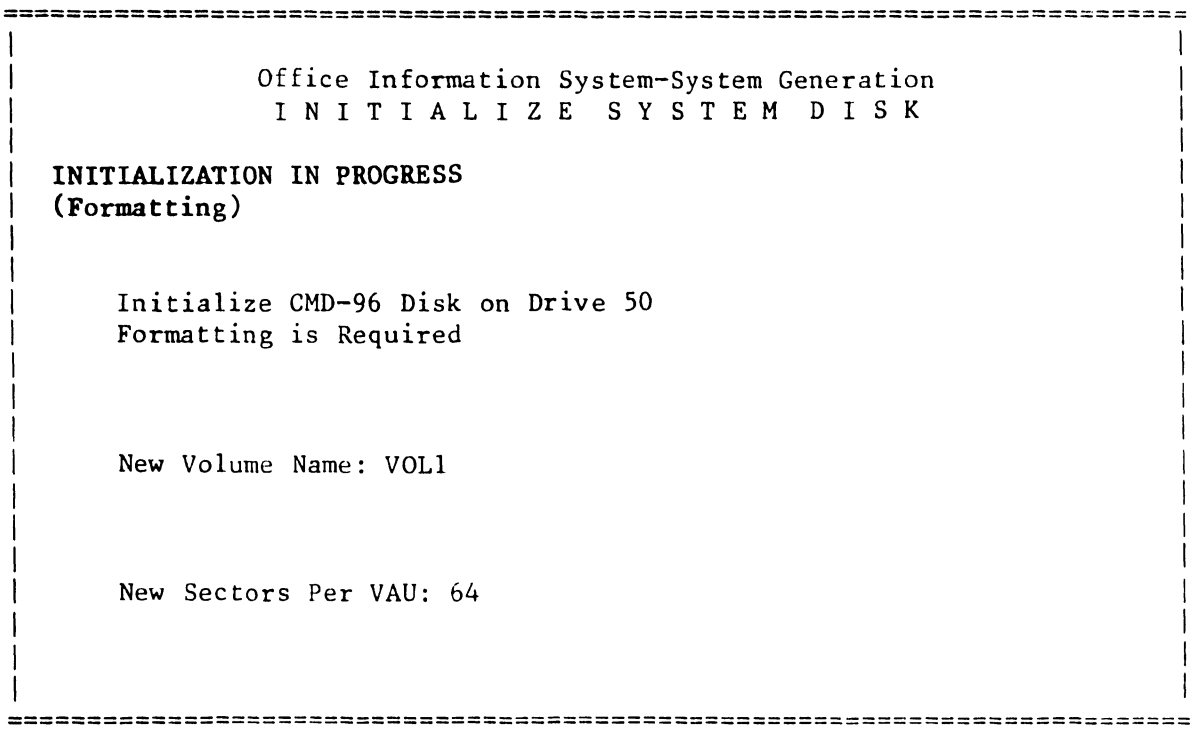
Disk Contains XX Bad Sector(s)
Press EXECUTE to continue

XX indicates the number of bad sectors. The sector(s) could have either a SOFT or a HARD (damaged surface) error. EXECUTE must be pressed at this time as an acknowledgement before the procedure may continue. With EXECUTE as an acknowledgement, the system will flag the bad sector(s); indicating that they are not to be used, insuring that they will not effect normal disk operation.

If the number of bad sectors exceeds 85, the following prompt will be displayed:

Too Many Bad Sectors, Unable to continue
please press cancel

The Initialization Procedure should then be canceled and the source of the problem located and repaired.



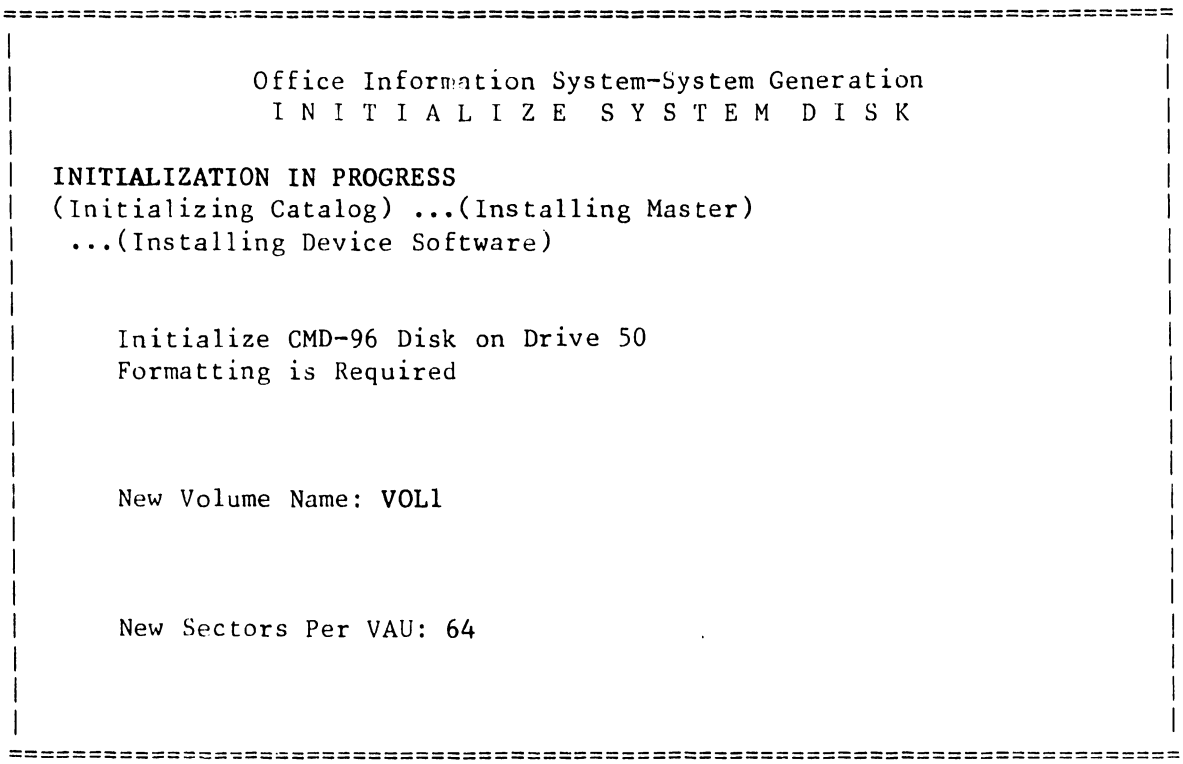
SCREEN 6

C.2.1 SCREEN 7

1. When SCREEN 7 automatically replaces SCREEN 6 (after Formatting is complete), the word 'Formatting' will be sequentially replaced by 'Initializing Catalog', then 'Installing Master', and finally 'Installing Device Software'.

---------- NOTE ----------

All three operations combined will last approximately 2-1/2 minutes, after which SCREEN 8 will automatically replace SCREEN 7.



SCREEN 7

C.2.1 SCREEN 8

1. When SCREEN 8 appears, press CANCEL (SCREEN 15 will appear on the CRT). Continue by performing the C.2.2, System Configuration Procedure

```
Office Information System-System Generation
I N I T I A L I Z E  S Y S T E M  D I S K

Initialization Complete
Please Press CANCEL

    Initialize CMD-96 Disk on Drive 50
    Formatting is Required

    New Volume Name: VOL1

    New Sectors Per VAU:  64
```

SCREEN 8

C.2.1 SCREEN 9

---------- NOTE ----------

SCREEN 9 will appear if this system has been initialized in the past (e.g., at the factory), a password will have already been entered. Thus, the password is requested before the System Disk Initialization Procedure may continue. Manufacturing and shipping use the volume name 'VOL1' and the password (vol1) when initializing system disks.

---

1. Enter the required password and press EXECUTE. SCREEN 10 will appear on the CRT.

```
Office Information System-System Generation
        I N I T I A L I Z E  S Y S T E M  D I S K

Press EXECUTE to Continue
or CANCEL for Previous Menu


     VOLUME "VOL1" on Drive 50

     Password Required _____
```

SCREEN 9

C.2.1 SCREEN 10

1. Since the disk has been previously initialized, the existing volume name, password, and sectors per VAU are displayed. These may be modified if so desired. Press RETURN until the cursor is positioned in the right hand field.

---------- NOTE ----------

Suggested sectors per VAU are as follows:

32 for CMD-32
32 for CMD-64
64 for CMD-96
64 for SMD-300

---

2. If during the previous step, the VAU size was modified, reformatting is required. Select Format and Initialize using the spacebar. If circumstances dictate, select 'Reinitialize' instead.

3. Press EXECUTE and note that SCREEN 11 appears on the CRT.

```
Office Information System-System Generation
I N I T I A L I Z E  S Y S T E M  D I S K

Fill in all fields
Press EXECUTE or CANCEL


     Initialize CMD-96 Disk on Drive 50
     Disk has Volume Name: VOL1

                                        Initialization Operation

                                        X Format and Initialize
     New Volume Name: VOL1              _ Reinitialize

     New Password: voll

     New Sectors Per VAU: 64
```

SCREEN 10

C.2.1 SCREEN 11

1. With SCREEN 11 displayed on the CRT, press EXECUTE. SCREEN 12 will appear on the CRT and Formatting will begin automatically.

```
Office Information System-System Generation
I N I T I A L I Z E  S Y S T E M  D I S K

Press EXECUTE to
***BEGIN INITIALIZATION***

    Initialize CMD-96 Disk on Drive 50
    Disk has Volume Name: VOL1

                                        Initialization Operation

                                        X Format and Initialize
    New Volume Name: VOL1               _ Reinitialize


    New Sectors Per VAU: 64
```

SCREEN 11

C.2.1 SCREEN 12

1. SCREEN 12 (Formatting) will continue for anywhere from 10 to 105 minutes (depending on system model). This time will increase dramatically if retries are performed by the Disk Unit. At the conclusion of Formatting, SCREEN 13 will automatically appear.

---------- NOTE ----------

It's possible that at the end of Formatting, the CRT screen will display the following to indicate that bad sectors were found:

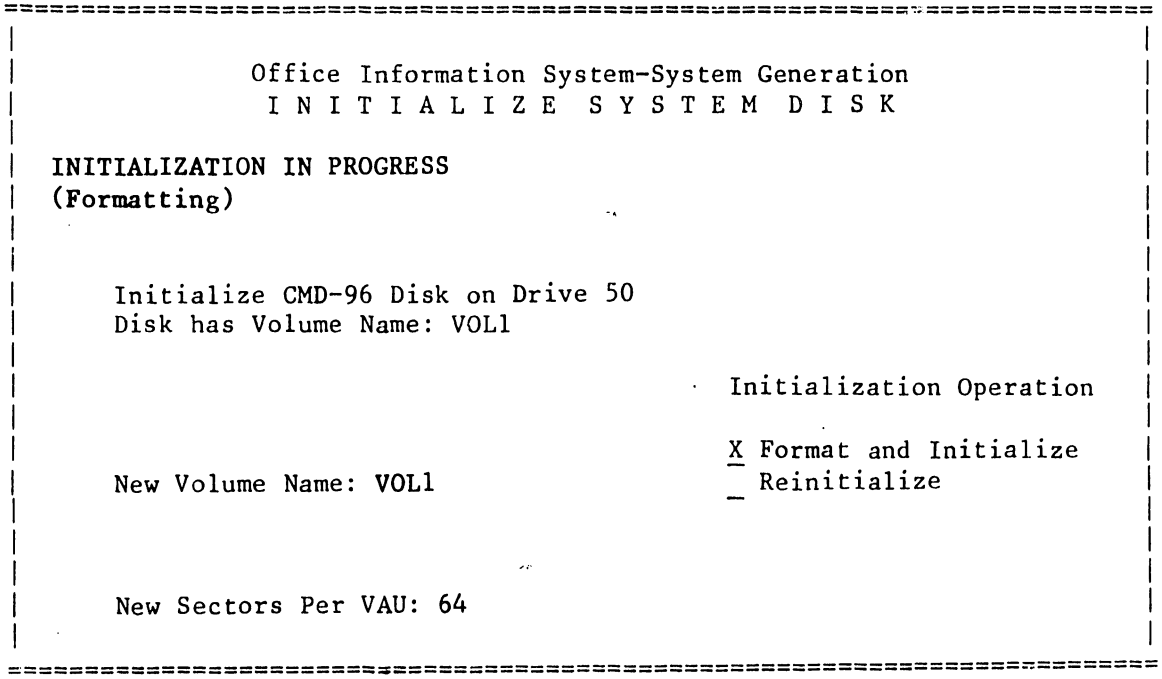
Disk Contains XX Bad Sector(s)
Press EXECUTE to continue

XX indicates the number of bad sectors. The sector(s) could have either a SOFT or a HARD (damaged surface) error. EXECUTE must be pressed at this time as an acknowledgement before the procedure may continue. With EXECUTE as an acknowledgement, the system will flag the bad sector(s); indicating that they are not to be used, insuring that they will not effect normal disk operation.

If the number of bad sectors exceeds 85, the following prompt will be displayed:

Too Many Bad Sectors, Unable to continue
please press cancel

The Initialization Procedure should then be canceled and the source of the problem located and repaired.



SCREEN 12

C.2.1 SCREEN 13

1. When SCREEN 13 automatically replaces SCREEN 12 , the word 'Formatting' will be sequentially replaced by 'Initializing Catalog', then 'Installing Master', and finally 'Installing Device Software'.

---------- NOTE ----------

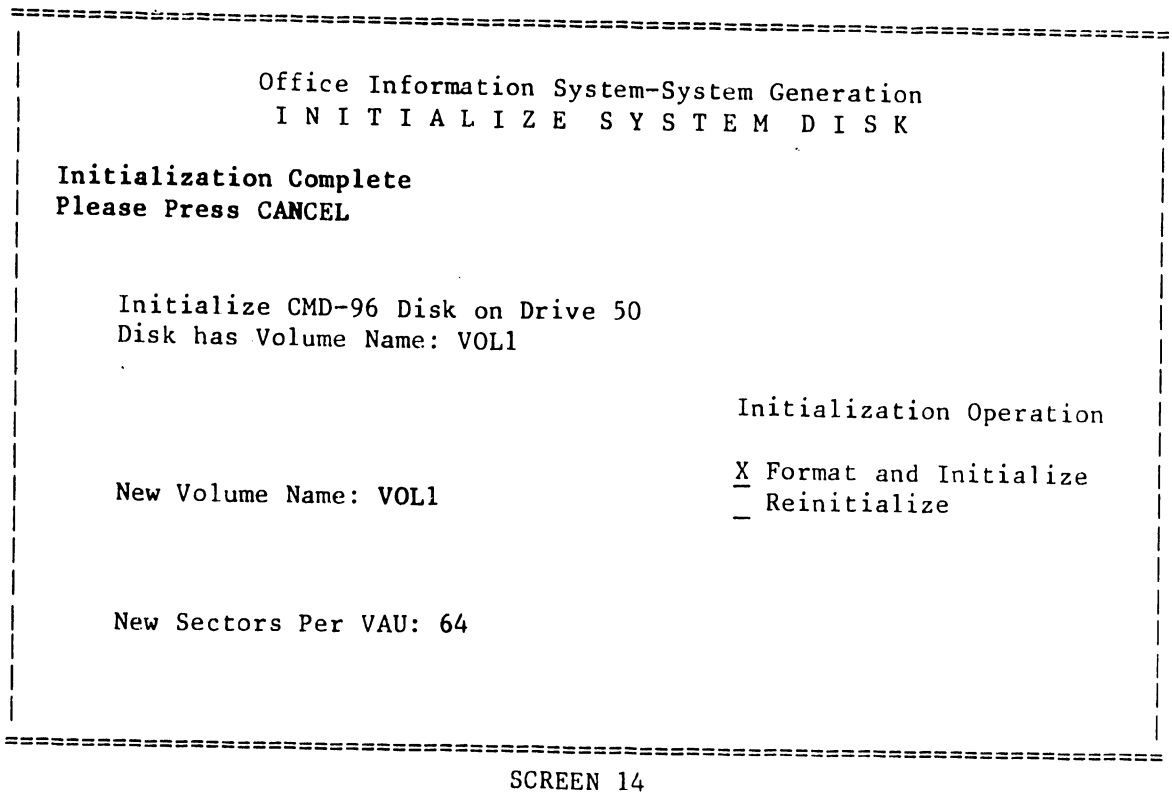
All three operations combined will last approximately 2-1/2 minutes, after which SCREEN 14 will automatically replace SCREEN 13.

```
Office Information System-System Generation
I N I T I A L I Z E  S Y S T E M  D I S K

INITIALIZATION IN PROGRESS
(Initializirg Catalog) ...(Installing Master)
 ...(Installing Device Software)


   Initialize CMD-96 Disk on Drive 50
   Disk has Volume Name: VOL1

                                    Initialization Operation

                                    X Format and Initialize
   New Volume Name: VOL1            _ Reinitialize


   New Sectors Per VAU: 64
```

SCREEN 13

C.2.1 SCREEN 14

1. When SCREEN 14 appears, press CANCEL (SCREEN 15 will appear on the CRT). Continue by performing C.2.2, System Configuration Procedure



SCREEN 14

C.2.2 SYSTEM CONFIGURATION PROCEDURE

This procedure enters system hardware configuration information onto the system disk.

C.2.2 SCREEN 15

1. With SCREEN 15 on the CRT as a result of completing the C.2.1, System Disk Initialization Procedure, select 'Configure System' using the spacebar and press RETURN.

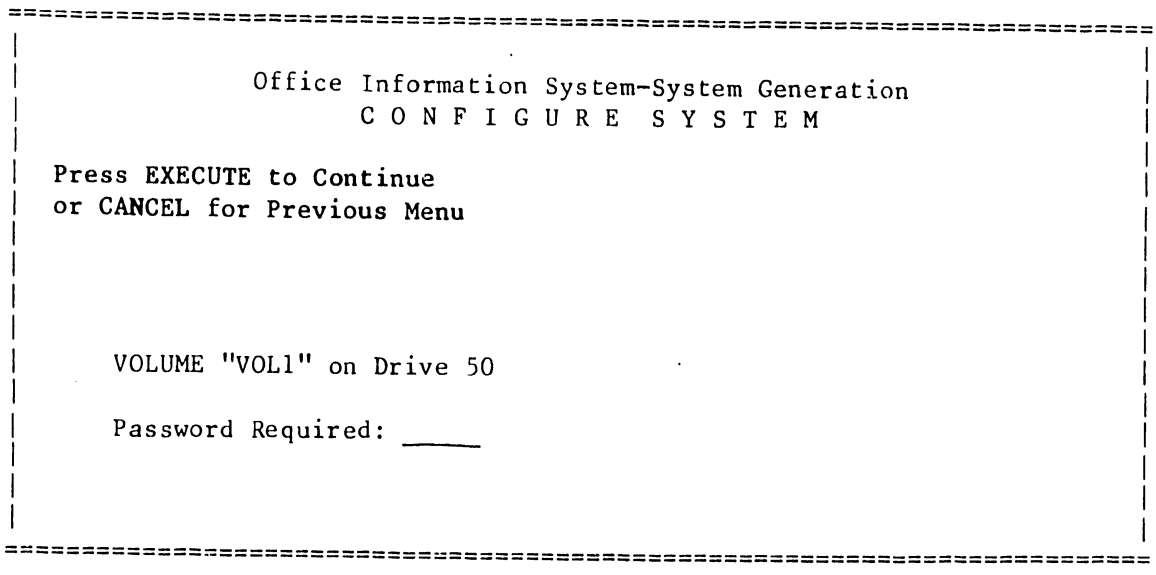
2. Identify the appropriate system drive model (must be the same as the one selected in C.2.1, SCREEN 3 of the System Disk Initialization Procedure) using the spacebar and press EXECUTE. SCREEN 16 will appear on the CRT.

```
Office Information System-System Generation
S Y S G E N  F U N C T I O N  S E L E C T I O N

Select Function and Disk Type
Press EXECUTE or CANCEL

_ Initialize System Disk          _ Hawk-5
_ Update System software          _ Hawk-2
X Configure System                _ Winc-3
                                  _ Winc-4
                                  _ Winc-8
                                  _ Winc-20
                                  _ Winc-40
                                  _ CMD-32
                                  _ CMD-64
                                  X CMD-96
                                  _ SMD-80
                                  _ SMD-300
```

SCREEN 15

C.2.2 SCREEN 16

1. With SCREEN 16 displayed on the CRT, enter the password (same as the one used during C.2.1, SCREEN 4 or C.2.1, SCREEN 10 of the System Disk Initialization Procedure) and press EXECUTE. SCREEN 17 will appear.



SCREEN 16

C.2.2 SCREEN 17

1. Make selections as explained below and press EXECUTE. SCREEN 18 will appear.

   Enter the number of disk drives (of each type) to be supported by the system.

   a. Floppy drive should be 1.
   b. Hawk Units* may be 0, 1 or 2.
   c. SM may be 1, 2, 3. This digit indicates the number of CMD or SMD units which are supported by the operating system.

   Devices - Set for the total number of devices supported by the system (example 140/145 = 32 devices).

   Non-Wise Devices - On systems not using WISE, this number should be the same as that set for "Devices". On systems using WISE, if the WISE box is on port 1, this number should be 1 less than the number set for "Devices"; if the WISE box is on port 2, it should be 2 less than the number set for "Devices".

   External File Source - This must be set as "Supported" for all systems using WISE, 3270, or RCF (Remote cluster facility). Set this selection as "Not Supported" for all other systems.

   Extended Memory Master - This must be set as "Supported" for all systems containing the Extended Memory Option (128K). Set this selection as "Not Supported" for systems with the 64K master.

* Note that a unit is different from a drive in that a unit may contain one or more drives (volumes). A Hawk Disk Unit contains two Hawk drives. A CMD Disk Unit contains two CMD drives, and an SMD Disk Unit contains one SMD drive.

```
Office Information System-System Generation
C O N F I G U R E  S Y S T E M

Modify Configuration
Press EXECUTE or CANCEL

  Configure CMD-96 Disk on Drive 50   Software Release X.X
  Disk has Volume Name: VOL1          Last IPLed on: 03/05/81

  Floppy Drives: 1                    Devices (Dec): 32
  Hawk Units : 2                      Non-WISE Devices (Dec): 32
  SM/Winc Units: 4
  External File Source                Extended Memory Master

  _X_ Non-Supported                   _X_ Non-Supported
  ___ Supported                       ___ Supported
```

SCREEN 17

C.2.2 SCREEN 18

1. With SCREEN 18 on the CRT, press EXECUTE again. When the operation is complete, the message 'New Configuration Written to Disk' will appear on the screen. press CANCEL to return to the main menu.

2. On the Master Processor set the Disk Select switch to the bottom "---" position.

3. Press the Master Processor RESET pushbutton while removing the STARTER diskette from the floppy disk drive. Once the diskette is removed, release the RESET pushbutton. SCREEN 19 will appear on the CRT, after the system has been initialized from the System Disk.

4. The system is now ready for installation of software. Proceed to C.2.3, Software Installation.

NOTE

The following screen shows a system configuration of one floppy, zero Hawks, and two CMD units, with 128K Extended Memory and a WISE unit on port 3.

Office Information System-System Generation
C O N F I G U R E S Y S T E M

Modify Configuration
Press EXECUTE to write to disk

Configure CMD-96 Disk on Drive 50	Software Release X.X
Disk has Volume Name: VOL1	Last IPLed on: 03/05/81
Floppy Drives: 1	Devices (Dec): 32
Hawk Units : 0	Non-WISE Devices (Dec): 29
SM/Winc Units: 2	
External File Source	Extended Memory Master
___Non-Supported	___Non-Supported
_X_Supported	_X_Supported

SCREEN 18

C.2.3 SOFTWARE INSTALLATION PROCEDURE

This procedure is used to enter software packages onto the system disk. The software packages are distributed on separate floppy diskettes.

If installation of software is required, perform the following procedure (having completed the C.2.1, System Disk Initialization and C.2.2, System Configuration Procedures).

C.2.3 SCREEN 19

1. With SCREEN 19 on the Workstation CRT as the result of IPL'ing from the System Disk, enter the Date and press RETURN.

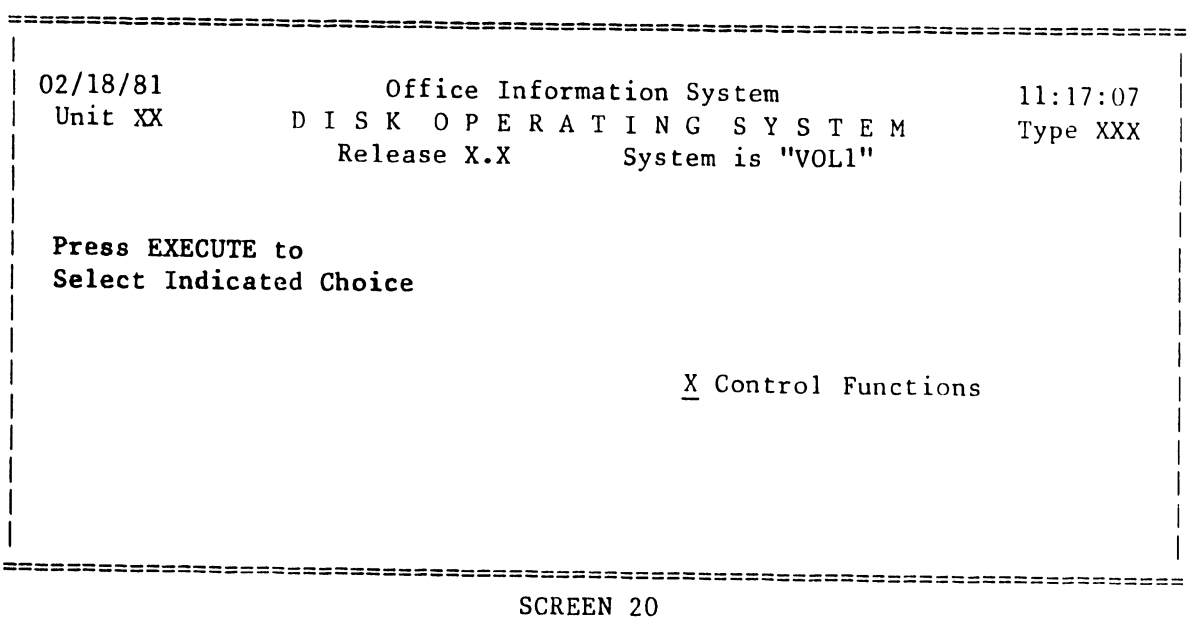
2. Enter Time and press EXECUTE twice. SCREEN 20 will appear on the CRT.

```
Unit XX              Office Information System              Type XXX
                  I N I T I A L  P R O G R A M  L O A D
                    Release X.X      System is "VOL1"

Fill in fields,
Then press EXECUTE

                  Enter Date:  mm/dd/yy:  __/__/__

                  Enter time:   hh:mm  :  __:__
```

SCREEN 19

C.2.3 SCREEN 20

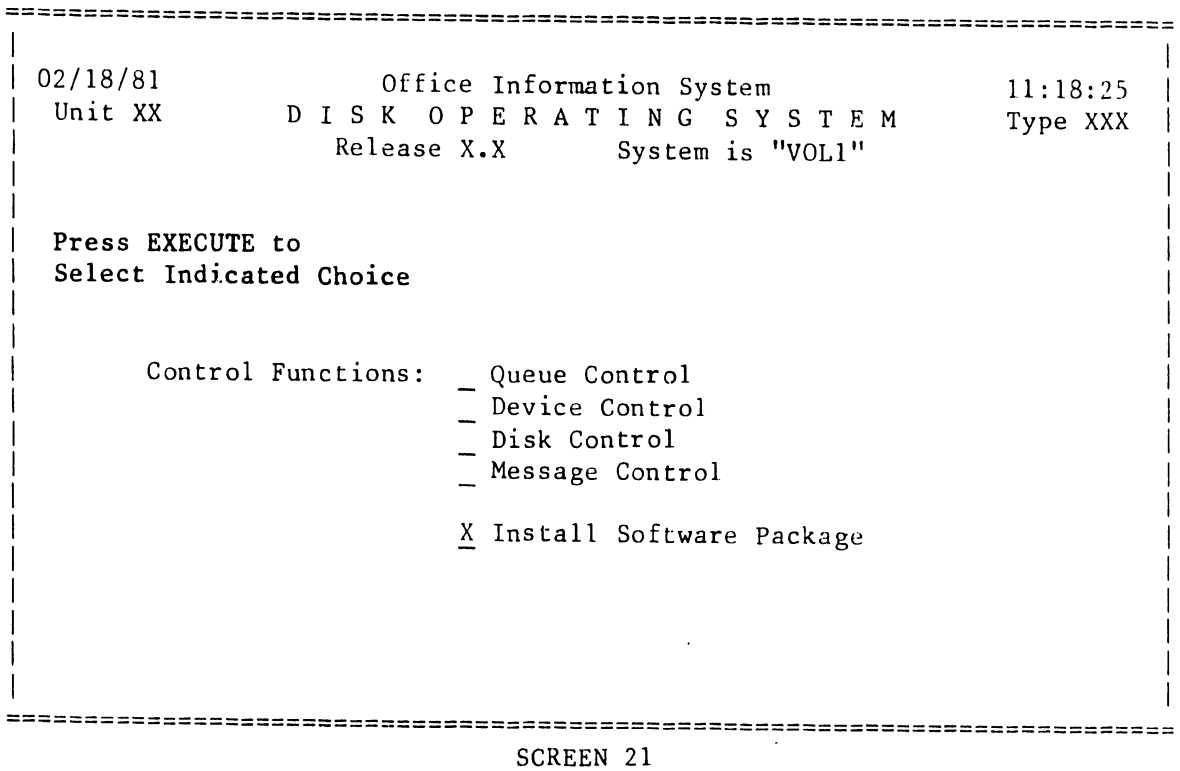
1. With SCREEN 20 on the CRT, press EXECUTE. SCREEN 21 will appear.



SCREEN 20

C.2.3 SCREEN 21

1. With SCREEN 21 on the CRT, select 'Install Software Package' and press EXECUTE. SCREEN 22 will appear.



SCREEN 21

C.2.3 SCREEN 22

---------- CAUTION ----------

BEFORE PROCEEDING TO LOAD ANY SOFTWARE DISKETTES INTO THE SYSTEM, READ ALL MATERIAL IN THE RELEASE DOCUMENTATION ACCOMPANYING THE DISKETTES.

---

1. With SCREEN 22 on the CRT, mount the appropriate diskette (according to the sequence presented in the release documentation) into the Master Processor floppy disk drive.

2. Press EXECUTE to start the diskette installation process. Type in Destination Volume if different. When prompted, press EXECUTE again. SCREEN 23 will appear. (Some utilities packages will display a selection menu like SCREEN 22A.)

```
Office Information System
I N S T A L L  S O F T W A R E  P A C K A G E

Mount Installation Disk in
Drive 01 and Press EXECUTE


      Destination Volume: "VOL1"
```

SCREEN 22

C.2.3 SCREEN 22A

1. With SCREEN 22A on the CRT or some other similiar menu depending on the utility being installed, select each of the entries this system is to support. Use the INSERT key for selection, and the DELETE key for deselection. Then press EXECUTE. Answer all prompts if any occur. SCREEN 23 will appear.

```
Office Information System
S O F T W A R E  S E L E C T I O N  O P T I O N

Make Software Selection
Press EXECUTE to Begin

                        X  Library Catalog
                        X  Document Compare
                        X  Document Recover
                        X  Duplicate Diskette
                        X  Recover Diskette
                        X  Sort Document
```

SCREEN 22A

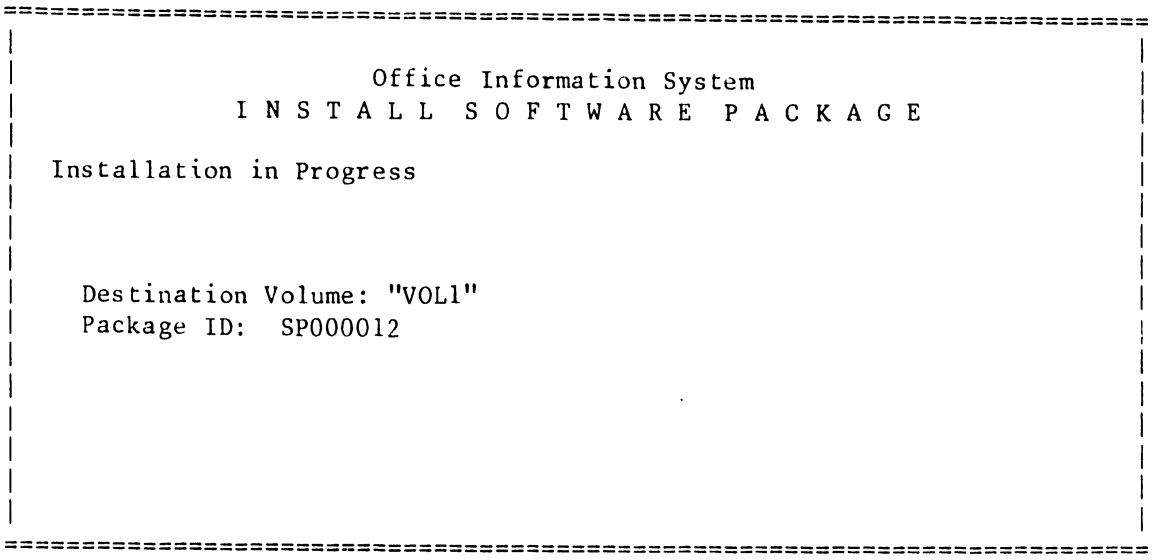
C.2.3 SCREEN 23

---------- NOTE ----------

The 'Package ID' of the diskette currently being installed will be displayed automatically on SCREENS 23 and 24.

---

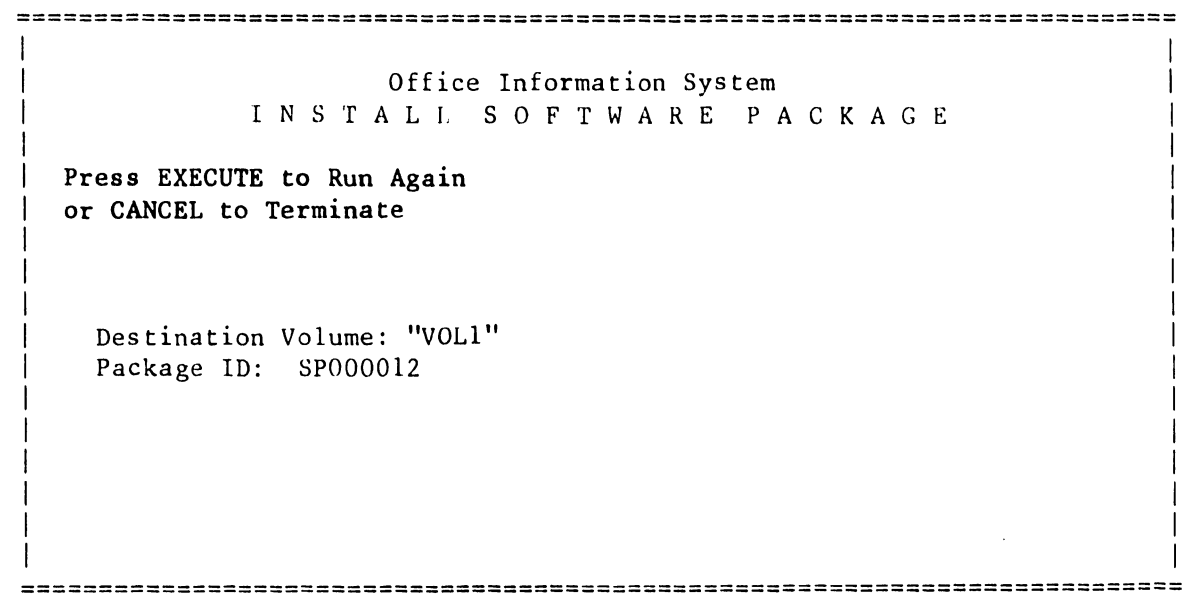
1. With diskette installation in progress, SCREEN 23 will be present until the installation of the current package is complete. When each diskette installation is completed, SCREEN 24 will automatically appear on the CRT.



SCREEN 23

C.2.3 SCREEN 24

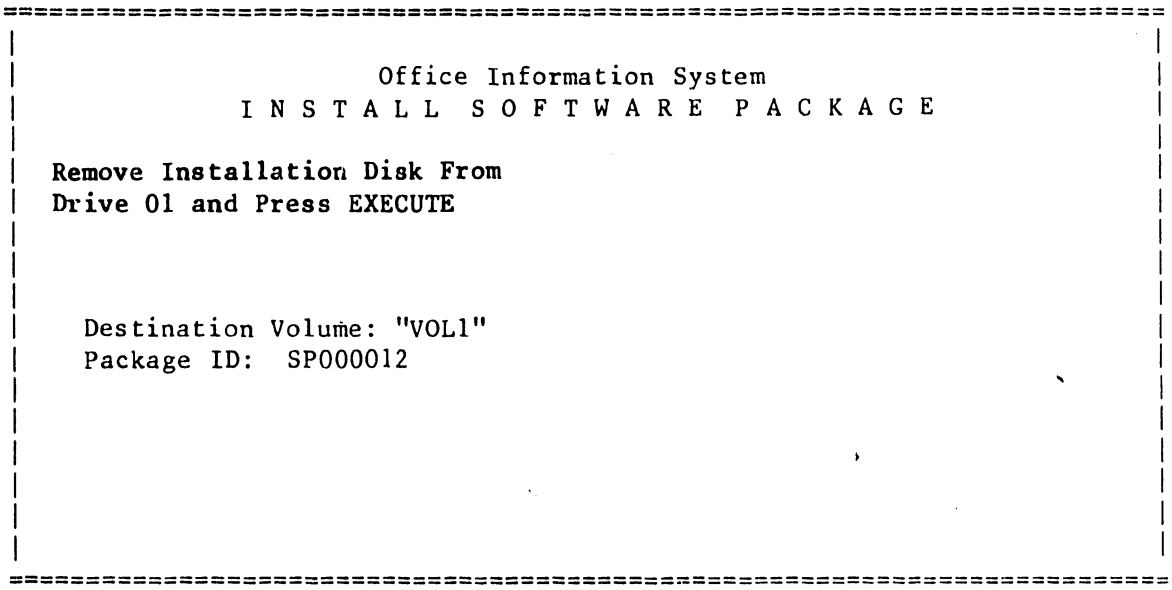
1. If there are more software packages (diskettes) to install when SCREEN 24 appears, press EXECUTE and return to C.2.3, SCREEN 22 where you will repeat the procedure and install another package. If, however, the last package has been installed, press CANCEL (SCREEN 25 will appear). Proceed with C.2.3, SCREEN 25.



SCREEN 24

C.2.3 SCREEN 25

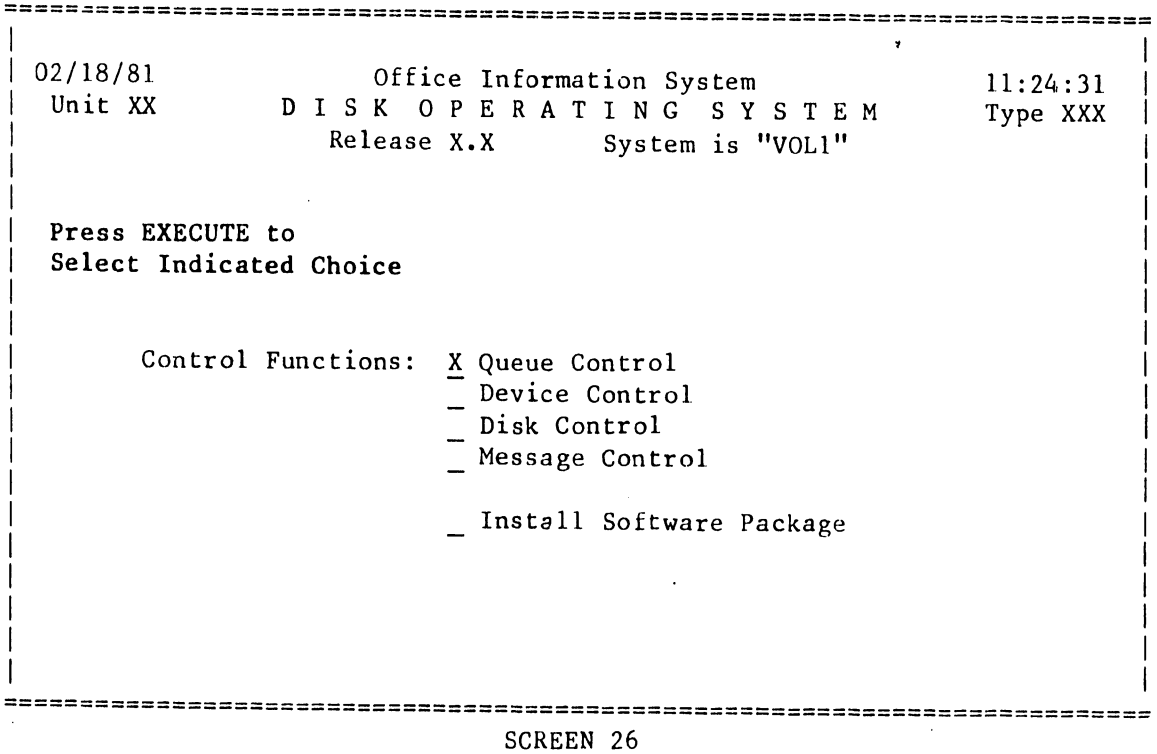
1. With SCREEN 25 on the CRT, first remove diskette and then press EXECUTE. SCREEN 26 will appear on the CRT.



SCREEN 25

C.2.3 SCREEN 26

1. With SCREEN 26 on the CRT, press CANCEL. The main DOS menu (SCREEN 27) will appear.



SCREEN 26

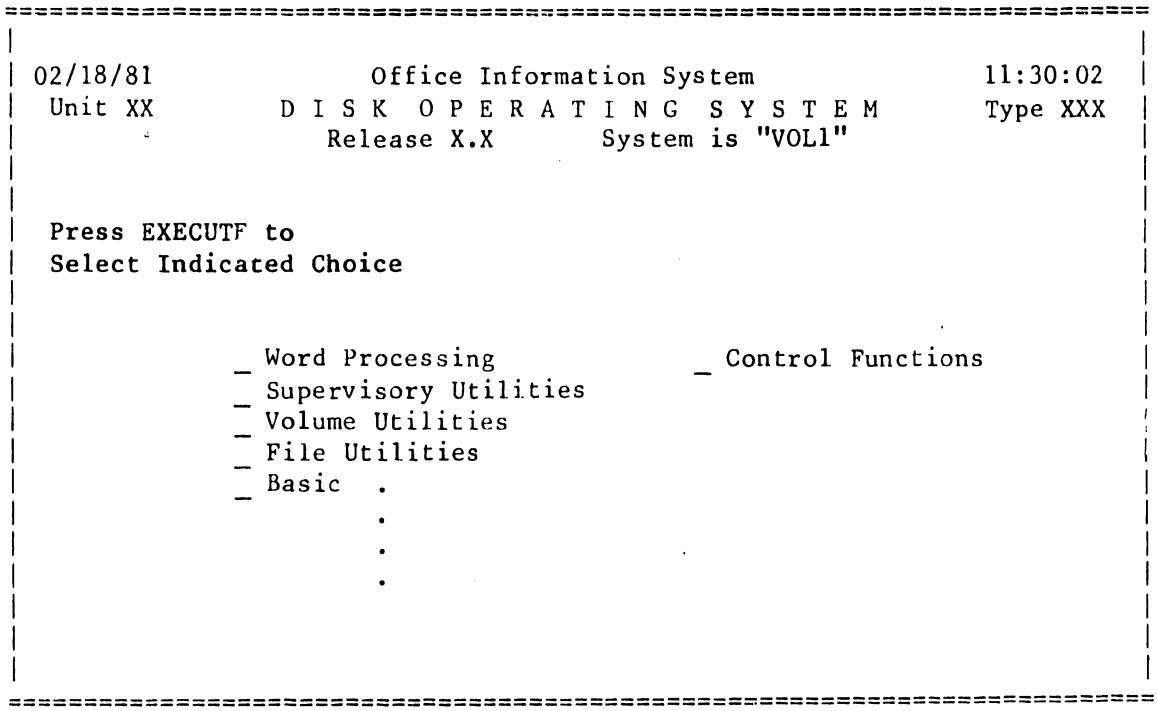
C.2.3 SCREEN 27

1. With the main DOS menu displayed, Software Initialization is complete.

---------- NOTE ----------
The DOS menu will only display the names of the software packages that have been installed in this section.
---

2. The Customer Support Analyst and/or the customer will now be able to initialize other volumes using Volume Utilities.

---------- NOTE ----------
For information on operating the Disk Operating System functions, refer to Word Processing Newsletter 76 or 76.1.



SCREEN 27

C.3 POST-INSTALLATION SOFTWARE UPDATES

The procedures in Section C.3 provide a complete guide for performing software-related tasks during software modification of the OIS 140/145 systems. This section is divided into three areas:

C.3.1	Updating System Software	(Screens 28 through 34)
C.3.2	System Re-Configuration	(Screens 35 through 40)
C.3.3	Updating Software Packages	(Screens 41 through 49)

In one case, a new STARTER will be installed (Updating System Software) and the system will be re-configured (System Re-Configuration), if the Hardware configuration has changed. In the other case, where a new STARTER is not involved; the software resident within the system is IPL'd to control updating (Updating Software Packages).

In either case, installation of updated software is normally a Customer Support Analyst function. Customer Engineering should carry out such procedures only if a need is specifically indicated.

When software packages are available to update a customer's system and a new STARTER package release is not involved, perform the procedure under paragraph C.3.3 (Updating Software Packages) in this section. In this case, IPL from the system drive to obtain C.3.3, SCREEN 41.

C.3.1 UPDATING SYSTEM SOFTWARE

Perform the following procedure when software updating includes the reinstallation of new Operating System Software. This procedure will require the reinstallation of all Wang System Software

C.3.1 SCREEN 28

---------- NOTE ----------
Word Processing documents and/or files are not normally affected by this procedure, therefore they do not need to be archived. However, read the Release Documentation distributed with the software for restrictions, and use your own discretion when especially important documents or files may be involved. This procedure is not recommended except for unique circumstances.
---

1. Position the Master Processor DISK-SELECT switch to "-" (up=floppy drive).

2. Insert the STARTER diskette into the Master Processor diskette drive.

3. Press the Master Processor RESET pushbutton to access SCREEN 28.

---------- CAUTION ----------
FOLLOW THE STEP-BY-STEP PROCEDURES IN THIS APPENDIX: IGNORE PROMPTS ON THE CRT SCREEN. Make keyboard entries to fill in requested information and make appropriate selections only as directed by this procedure.
---

4. Enter the Date and press RETURN.

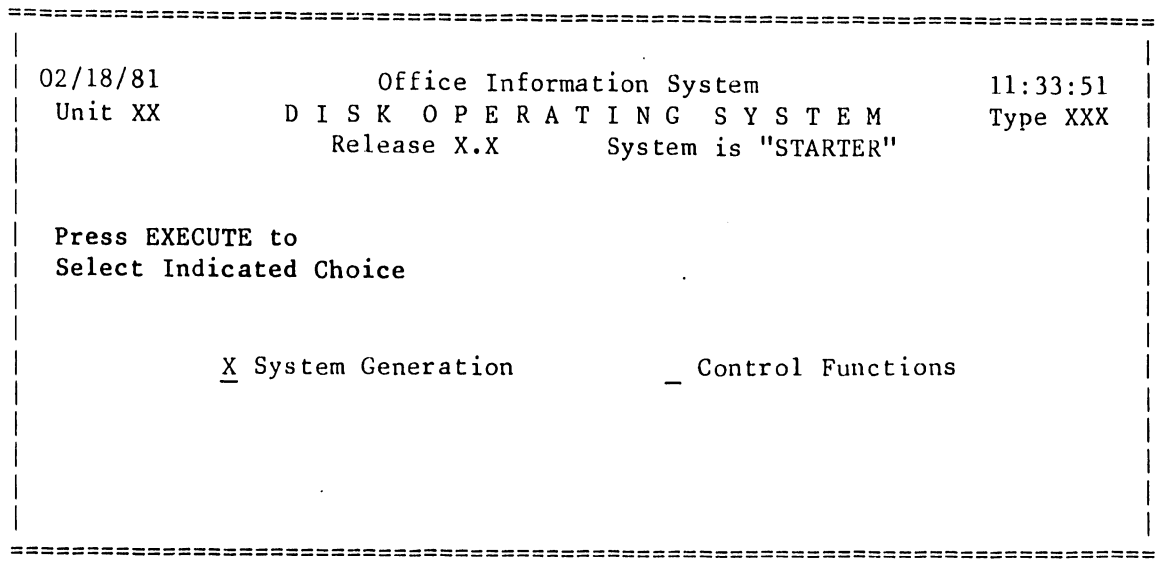
5. Enter Time and press EXECUTE twice to access the next screen. (CANCEL would terminate this software updating procedure.) After a short delay, SCREEN 29 will appear on the Workstation CRT.

```
Unit XX              Office Information System              Type XXX
                  I N I T I A L  P R O G R A M  L O A D
                    Release X.X      System is "STARTER"


Fill in fields,
Then press EXECUTE


                  Enter Date:  mm/dd/yy:  __/__/__

                  Enter time:   hh:mm  :  __:__
```

SCREEN 28

C.3.1 SCREEN 29

1. Select 'System Generation' at SCREEN 29.
2. Press EXECUTE to access SCREEN 30.



SCREEN 29

C.3.1 SCREEN 30

1. With SCREEN 30 on the CRT, select 'Update System Software' (using the spacebar) and press RETURN.

---------- NOTE ----------
In step 2, select the drive as follows:

CMD-32 for OIS 140-1
CMD-64 for OIS 140-2
CMD-96 for OIS 140-3
SMD-300 for OIS 145

---

2. Select the appropriate system disk drive (using the space bar) and press EXECUTE. SCREEN 31 will appear on the CRT.

Office Information System-System Generation
S Y S G E N F U N C T I O N S E L E C T I O N

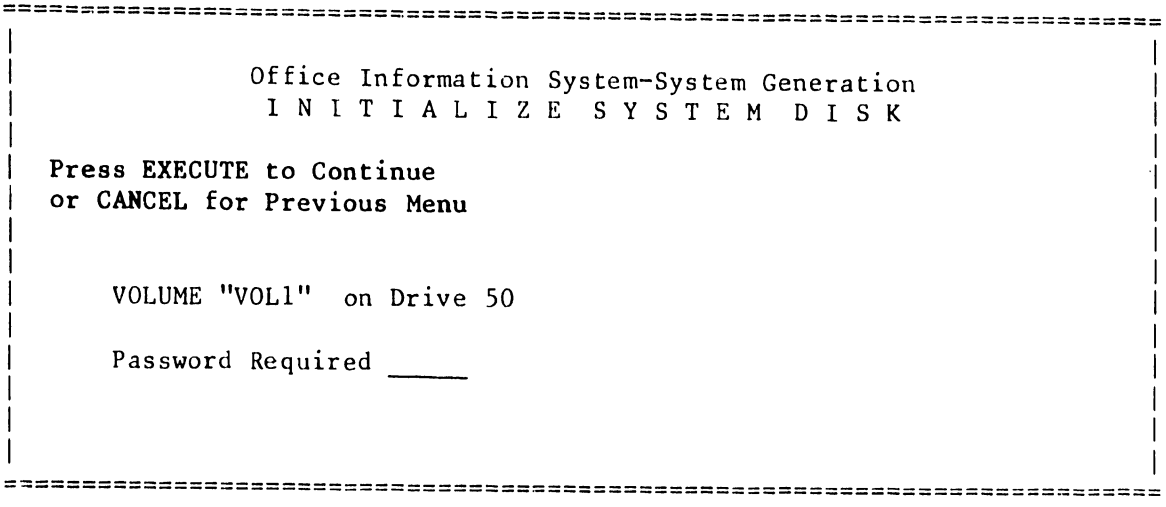
Select Function and Disk Type
Press EXECUTE or CANCEL

_ Initialize System Disk	_ Hawk-5
X Update System software	_ Hawk-2
_ Configure System	_ Winc-3
	_ Winc-4
	_ Winc-8
	_ Winc-20
	_ Winc-40
	_ CMD-32
	_ CMD-64
	X CMD-96
	_ SMD-80
	_ SMD-300

SCREEN 30

C.3.1 SCREEN 31

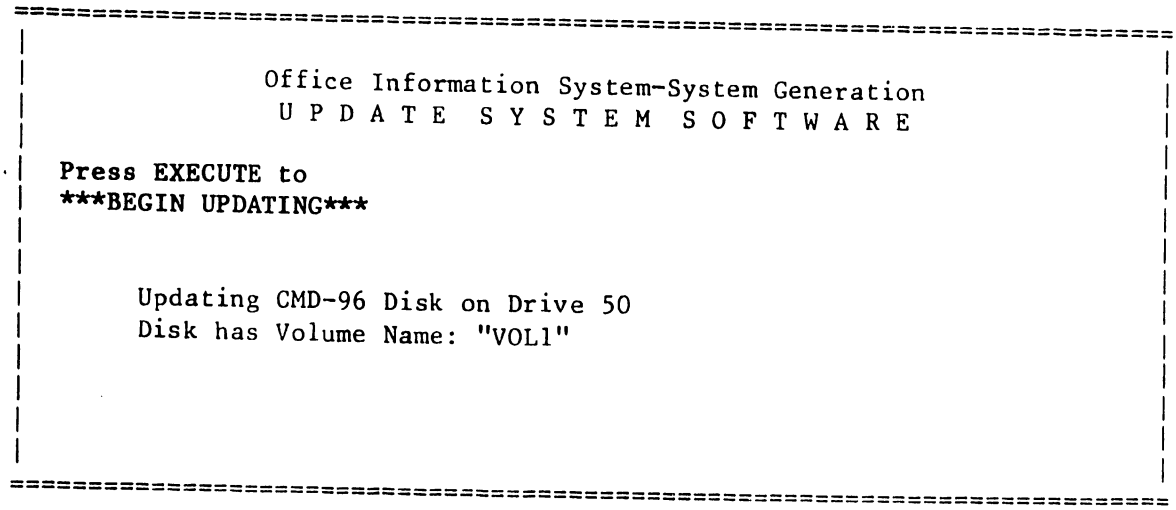
1. Enter the required password and press EXECUTE. SCREEN 32 will appear on the CRT.



SCREEN 31

C.3.1 SCREEN 32

1. With SCREEN 32 displayed on the CRT, press EXECUTE. SCREEN 33 will appear on the CRT and updating will begin automatically.

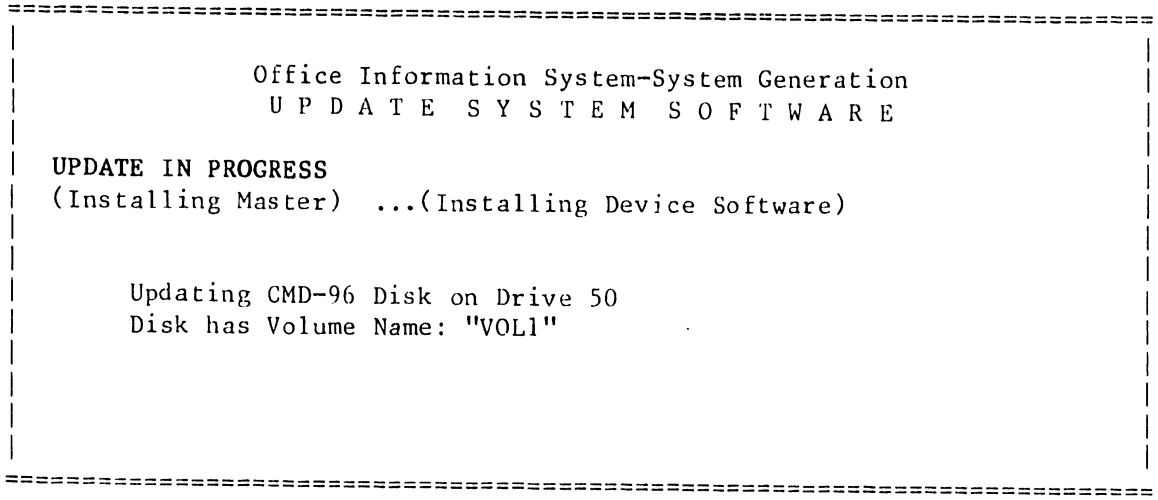


SCREEN 32

C.3.1 SCREEN 33

1. 'Installing Master' then 'Installing Device Software' will appear on SCREEN 33 as updating takes place.

---------- NOTE ----------
At the end of updating, SCREEN 34 will automatically replace SCREEN 33.



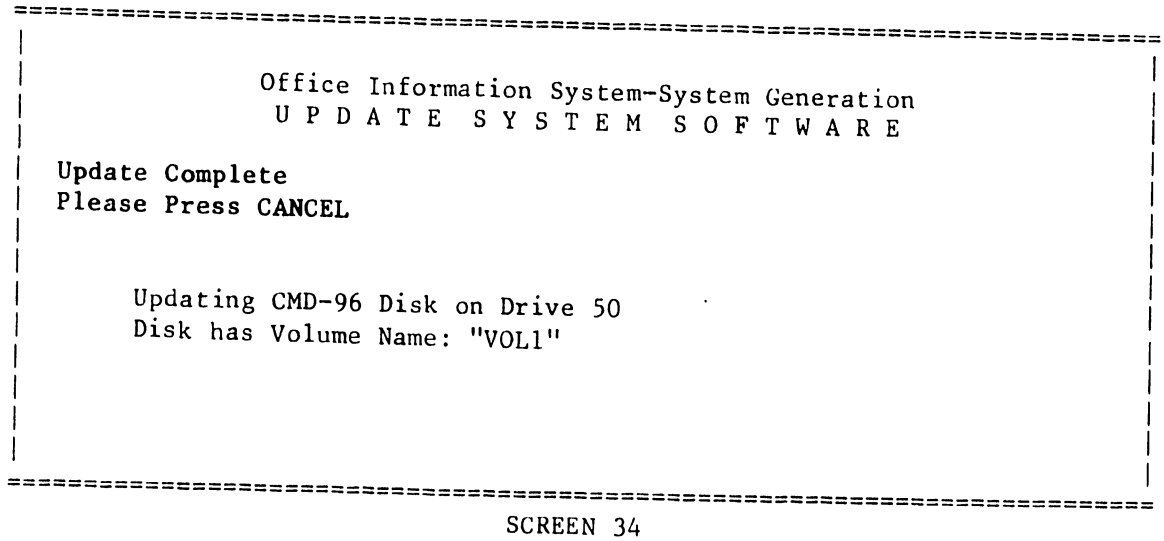
SCREEN 33

C.3.1 SCREEN 34

1. When SCREEN 34 appears, press CANCEL (SCREEN 35 will appear on the CRT).

2. With SCREEN 35 on the CRT, this Updating System Software Procedure is completed.

3. Continue by performing the C.3.2, System Re-Configuration Procedure, if the Hardware Configuration has changed. Otherwise continue with Section C.2.3..



SCREEN 34

C.3.2 SYSTEM RE-CONFIGURATION

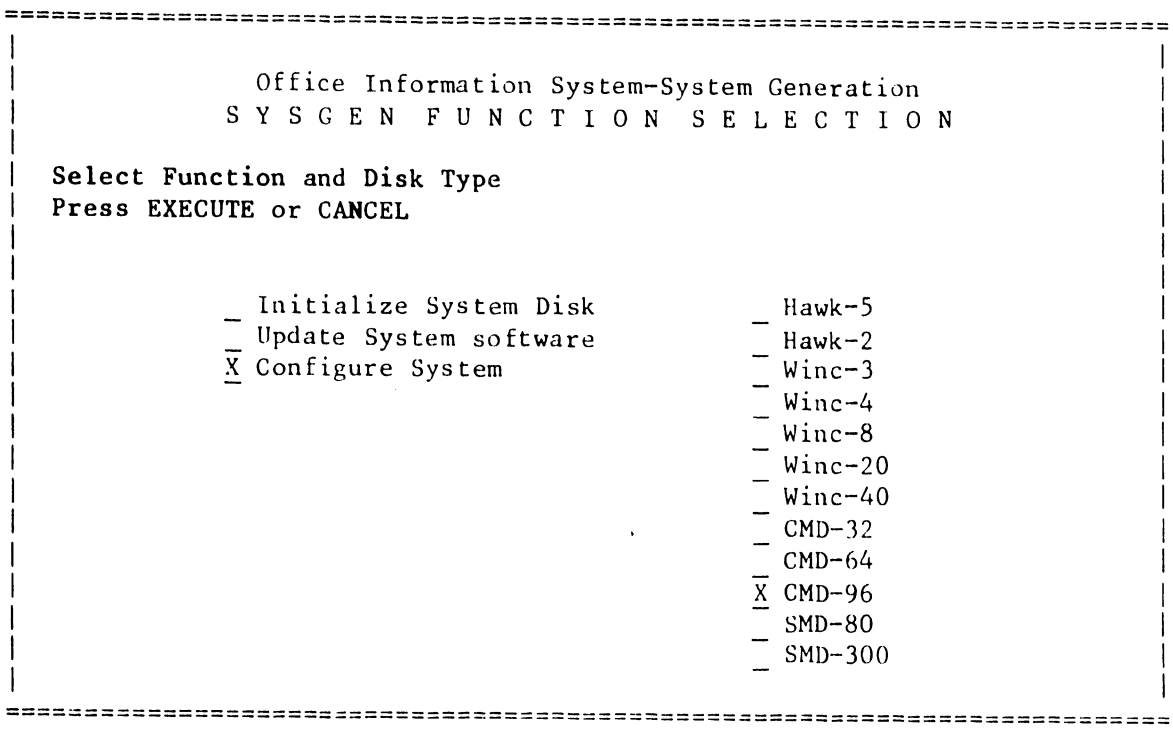
Perform the following procedure only if the disk has been formatted, and loaded with new operating software; or if the hardware configuration has changed.

---------- NOTE ----------
Reconfiguration is not required after updating unless updating included the addition of a WISE option or an optional drive
---

C.3.2 SCREEN 35

1. IPL the System from the STARTER diskette, and select System Generation. With SCREEN 35 on the CRT , select 'Configure System' and press RETURN.

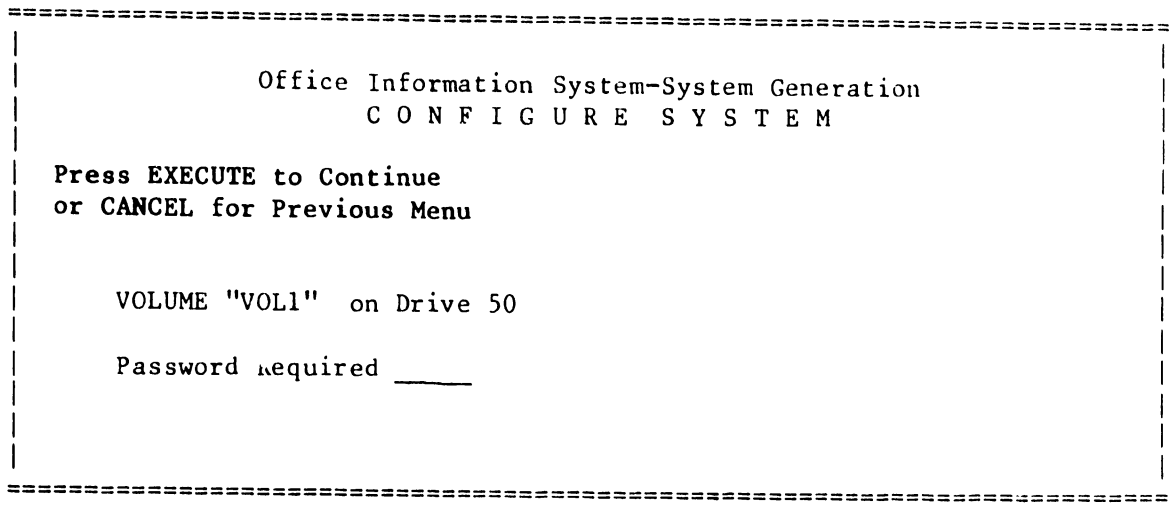
2. Select the appropriate system drive model (the same as the one selected in C.3.1, SCREEN 30) and press EXECUTE. SCREEN 36 will appear on the CRT.



SCREEN 35

C.3.2 SCREEN 36

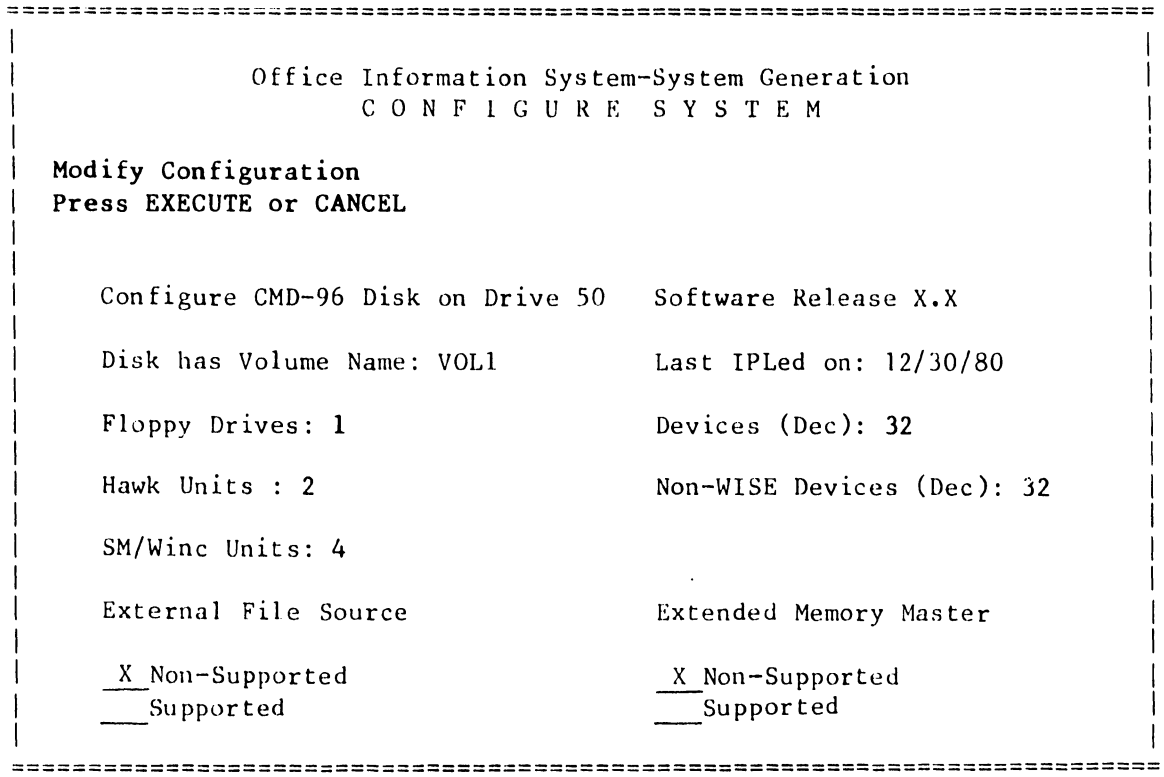
1. Enter the password (the same one used in C.3.1, SCREEN 31) and press EXECUTE. SCREEN 37 will appear.



SCREEN 36

C.3.2 SCREEN 37

1. Change the information on SCREEN 37 to reflect the configuration of the system and press EXECUTE, press EXECUTE, then press CANCEL. SCREEN 38 will appear on the CRT.



SCREEN 37

C.3.2 SCREEN 38

1. With SCREEN 38 on the CRT, System Re-configuration is complete.

2. On the Master Processor set the DISK SELECT switch to the "- - -" (bottom=CMD/SMD) position.

3. Press and hold the Master Processor RESET pushbutton while removing the STARTER diskette from the floppy disk drive. Once the diskette is released from the drive, release the RESET pushbutton. SCREEN 39 will appear on the CRT.

4. The system is now ready for updating of other software packages.

5. Proceed to C.3.3, Updating Software Packages.

```
Office Information System-System Generation
S Y S G E N  F U N C T I O N  S E L E C T I O N

Select Function and Disk Type
Press EXECUTE or CANCEL

_ Initialize System Disk          _ Hawk-5
_ Update System software          _ Hawk-2
_ Configure System                _ Winc-3
                                  _ Winc-4
                                  _ Winc-8
                                  _ Winc-20
                                  _ Winc-40
                                  _ CMD-32
                                  _ CMD-64
                                  _ CMD-96
                                  _ SMD-80
                                  _ SMD-300
```

SCREEN 38

C.3.3 UPDATING SOFTWARE PACKAGES

Perform the following procedure to update software packages. This procedure can be entered in two ways:

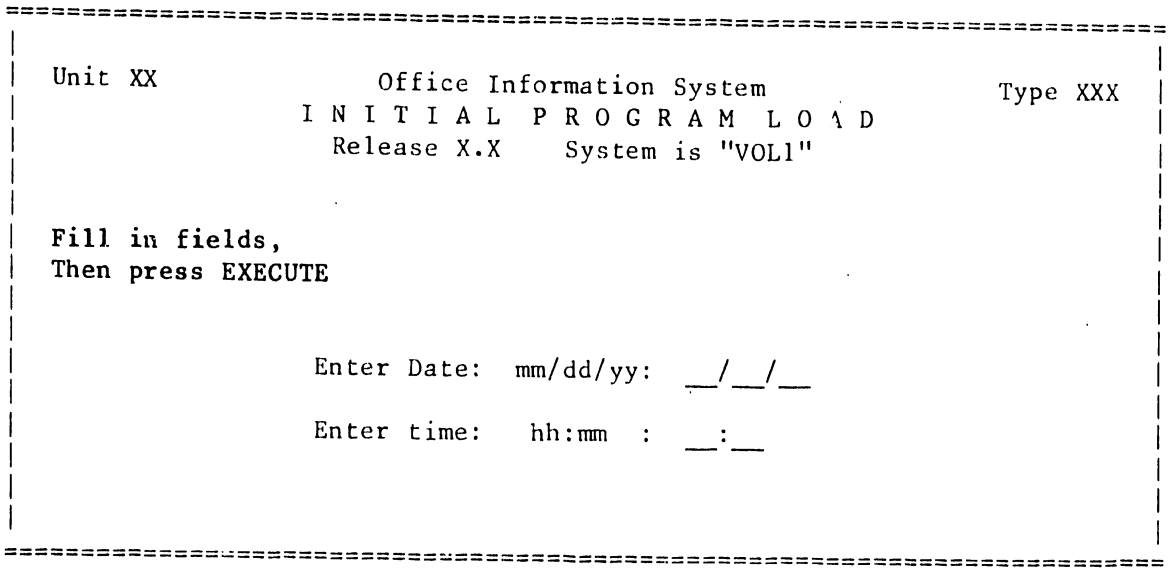
1. By performing the UPDATE SYSTEM SOFTWARE procedure (C.3.1) in this section, Or,

2. By simply IPLing from the system disk for the case when the STARTER was not updated.

C.3.3 SCREEN 39

1. With SCREEN 39 on the CRT, enter Date and press RETURN.

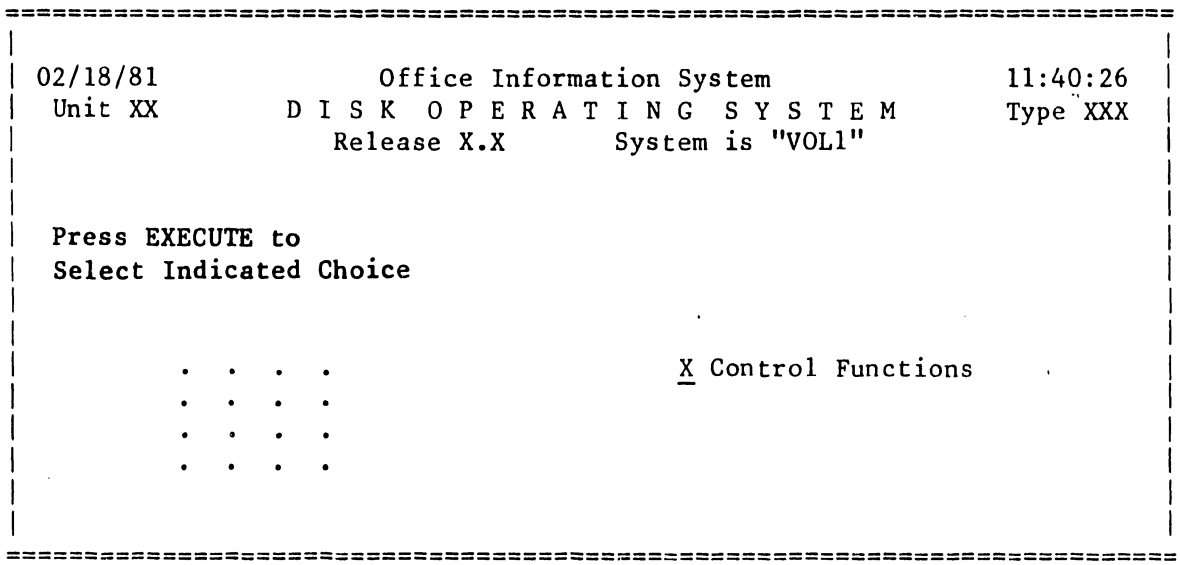
2. Enter Time and press EXECUTE twice. SCREEN 40 will appear on the CRT.



SCREEN 39

C.3.3 SCREEN 40

1. With SCREEN 40 displayed, press EXECUTE. SCREEN 41 will appear.

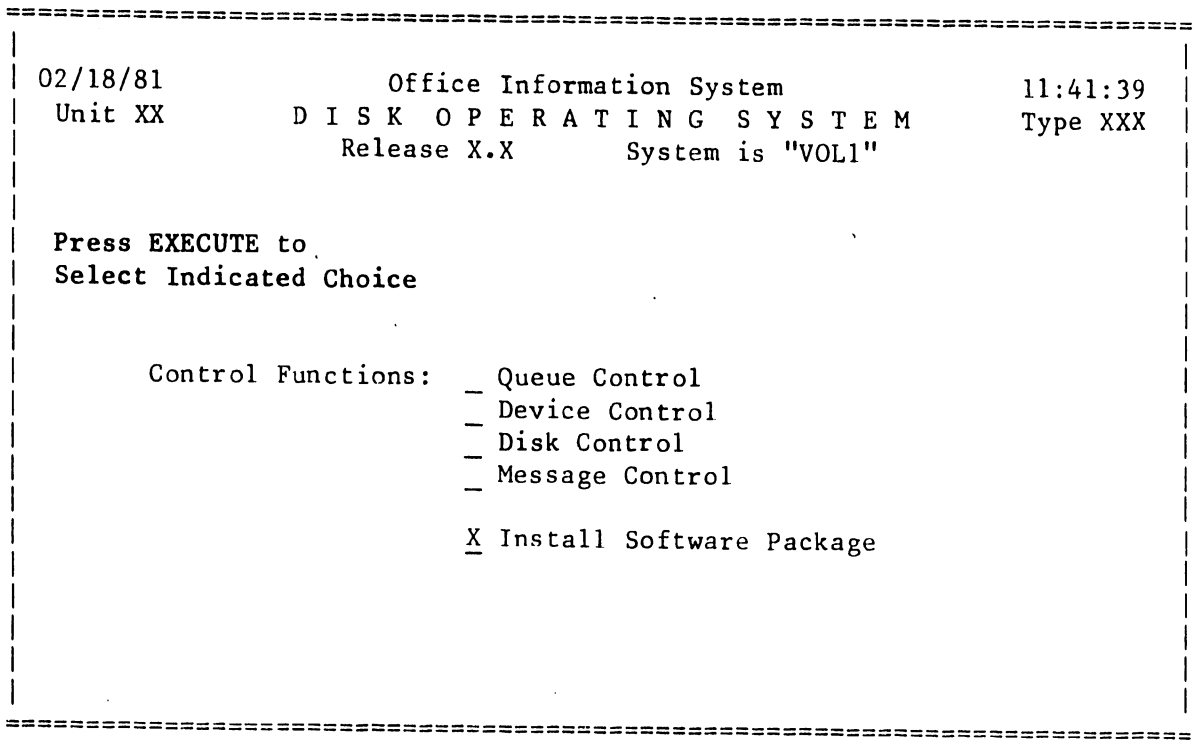


SCREEN 40

C.3.3 SCREEN 41

1. At SCREEN 41, select 'Install Software Package'.

2. Press EXECUTE, SCREEN 42 will appear.



SCREEN 41

C.2.3 SCREEN 42

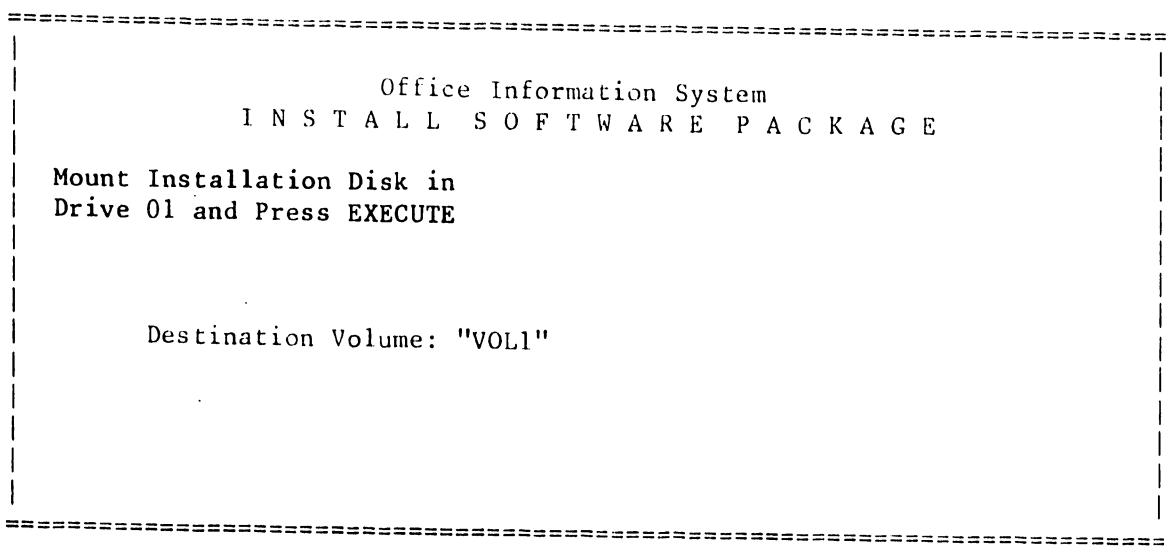
---------- CAUTION ----------

BEFORE PROCEEDING TO LOAD ANY SOFTWARE DISKETTES INTO THE SYSTEM, READ ALL MATERIAL IN THE RELEASE DOCUMENTATION ACCOMPANYING THE DISKETTES.

---

1. With SCREEN 42 on the CRT, mount the appropriate diskette (according to the sequence presented in the release documentation) into the Master Processor floppy disk drive.

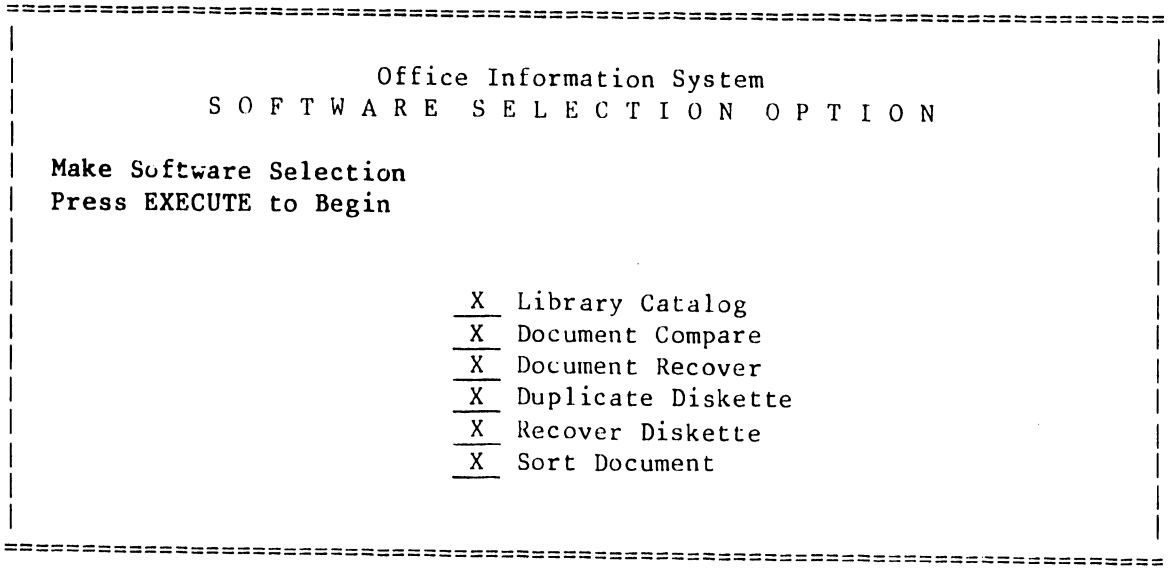
2. Press EXECUTE to start the diskette installation process. Type in Destination Volume if different. When prompted, press EXECUTE again. SCREEN 43 will appear. (Some utilities packages will display a selection menu like SCREEN 42A.)



SCREEN 42

C.3.3 SCREEN 42A

1. With SCREEN 42A on the CRT or some other similiar menu depending on the utility being installed, select each of the entries this system is to support. Use the INSERT key for selection and the delete key for deselection. Then press EXECUTE. Answer all prompts if any occur. SCREEN 43 will then appear.



SCREEN 42A

C.3.3 SCREEN 43

---------- NOTE ----------

The 'Package ID' of the diskette currently being updated will be displayed automatically on SCREENS 43 and 44.

---

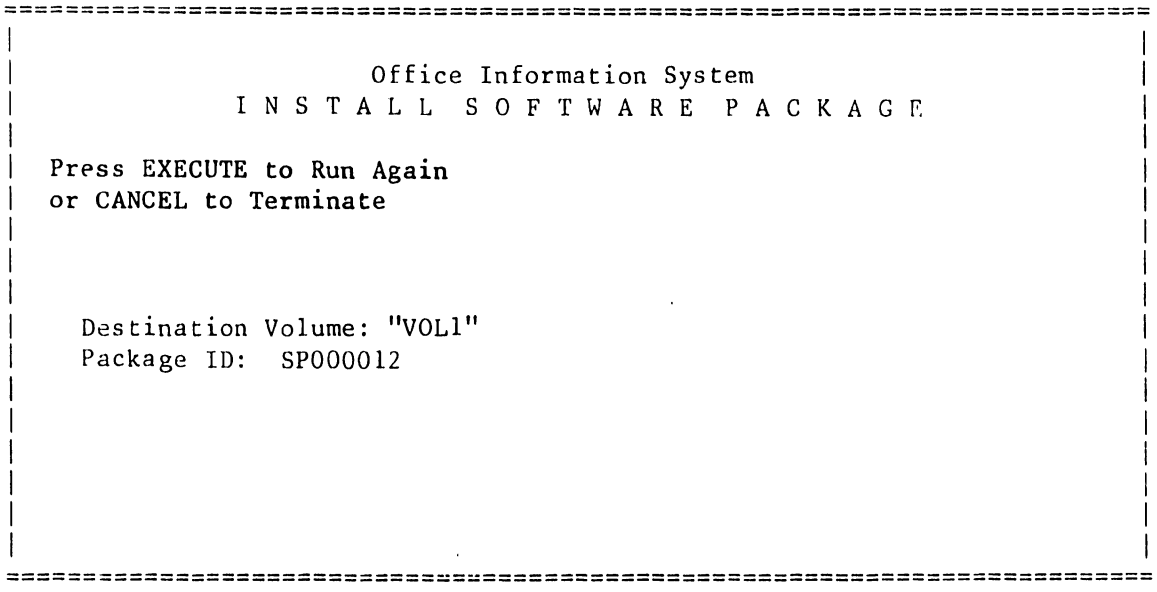
1. With installation in progress, SCREEN 43 will be present until the update of the current package is complete. When each diskette installation is completed, SCREEN 44 will appear on the CRT.

```
Office Information System
I N S T A L L  S O F T W A R E  P A C K A G E

Installation in Progress


  Destination Volume: "VOL1"
  Package ID:  SP000012
```

SCREEN 43

C.3.3 SCREEN 44

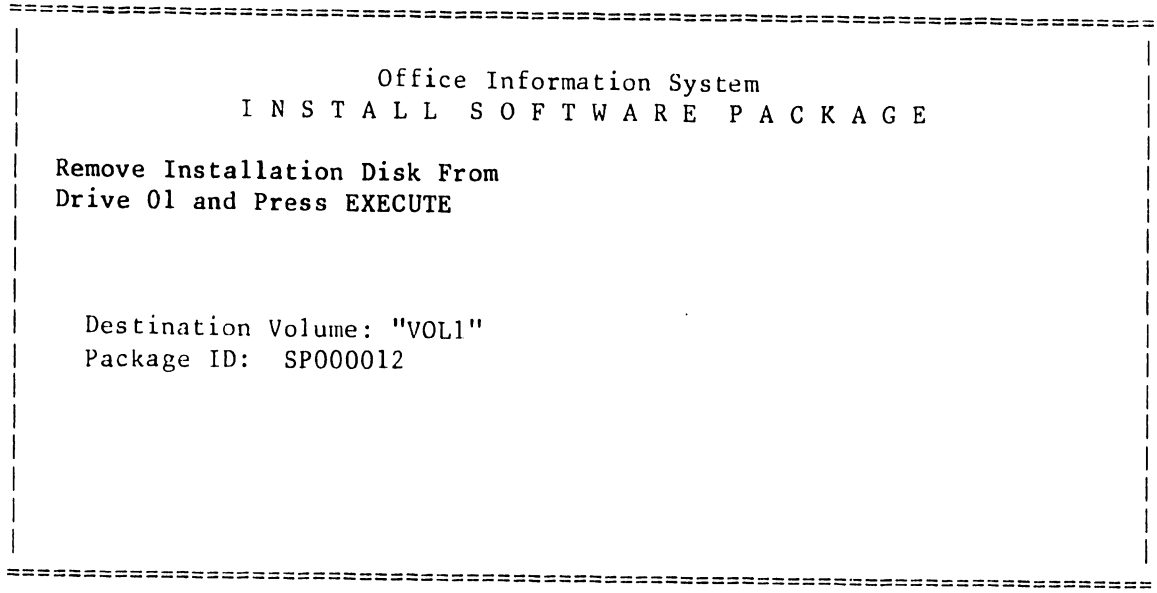
1. If there are more software packages (diskettes) to install when SCREEN 44 appears, press EXECUTE and return to C.3.3, SCREEN 42 where you will repeat the procedure by installing another package. If, however, the last package has been installed, press CANCEL and proceed with C.3.3, SCREEN 45.



SCREEN 44

C.3.3 SCREEN 45

1. With SCREEN 45 on the CRT, first remove diskette (DO NOT RESET) and then press EXECUTE. SCREEN 46 will appear on the CRT.



SCREEN 45

C.3.3 SCREEN 46

1. With SCREEN 46 on the CRT, press CANCEL. The main DOS menu (SCREEN 47) will appear.

```
02/18/81              Office Information System              11:44:09
 Unit XX        D I S K  C P E R A T I N G  S Y S T E M      Type XXX
                   Release X.X       System is "VOL1"


 Press EXECUTE to
 Select Indicated Choice


       Control Functions:  X Queue Control
                           _ Device Control
                           _ Disk Control
                           _ Message Control

                           _ Install Software Package
```

SCREEN 46

C.3.3 SCREEN 47

1. With SCREEN 47 displayed, Software Updating is complete.

---------- NOTE ----------
The DOS menu will display the software packages that have been installed by this section (C.3.3) and also those previously installed during the original Software Initialization procedure.
---

2. The Customer Support Analyst and/or the customer will now be able to initialize other volumes using Volume Utilities (if required).

```
02/18/81              Office Information System              11:45:57
 Unit XX         D I S K  O P E R A T I N G  S Y S T E M      Type XXX
                    Release X.X       System is "VOL1"

 Press EXECUTE to
 Select Indicated Choice

            x Word Processing              _ Control Functions
            _ Supervisory Utilities
            _ Volume Utilities
            _ File Utilities
            _ Basic
            _ Demonstration
            .   .
            .   .
```

SCREEN 47

APPENDIX
D
OIS 140 - CLASS POWER-UP (PROM) DIAGNOSTIC

APPENDIX D

OIS 140-CLASS POWER-UP (PROM) DIAGNOSTIC

D.1 INTRODUCTION

This appendix contains the complete guide for the proper use of the PROM-based OIS 140-Class Power-Up Diagnostic (Revision 5.0 at this printing). This Appendix discusses the 64K CPU version, with Appendix E describing the differences associated with the 128K Extended Memory Power-Up Diagnostic. The diagnostic is automatically initiated when the system is powered up or alternatively, when the front panel RESET button is depressed.

The primary use of this Power-Up diagnostic at the field level is for the isolation of board failures within the OIS Master Unit. Fault isolation is accomplished through the use of error codes displayed on the Master Unit's front panel LEDs. These error codes are either termed "non-fatal", indicating faulty operating conditions, or "fatal", indicating faulty circuit boards. Corrections or repairs, if required, may be performed by Customer Engineering personnel.

This diagnostic also provides both Detailed and Expanded Error information via error codes displayed on the eight LED indicators present on the CPU/MEM board. This additional error information can be used in the field to aid in the isolation of those problems that are not readily resolved by direct replacement of suspected faulty board(s).

Fault isolation beyond board level is possible in the case of the CPU/MEM board. With the use of diagnostic switches on the top of this board, Expanded Error information is available to correct CPU/MEM board problems by isolating faulty memory chips.

---NOTE---

It should be noted that passing the Power-Up Diagnostic DOES NOT NECESSARILY MEAN the Master Unit is trouble-free. For example, write operations are not performed by the Power-Up Diagnostic, in order to avoid damaging customer documents on system disk. Thus, the system will still pass the Power-Up Diagnostic test even though write cicuitry in either the disk drive or the disk controller may be faulty.

D.2 CONFIGURATION REQUIREMENTS

This diagnostic program verifies correct operation of the OIS 140-Class** Operating System as well as correct operation of the following types of OIS-140-Class Master Unit PCBs:

7501	E Rev. 3	CPU/MEMORY
7502	E Rev. 4	10 MEG/FLOPPY CONTROLLER
7503/7504	E Rev. 5/1	DATA LINK CONTROLLER
7505/7506	E Rev. 6/6	SMD/CMD CONTROLLER
7650/7653	E Rev. 2/1	WINCHESTER CONTROLLER

** Masters in the 140-Class incude Models 105, 115, 125A, 130A, 130B/E, 140, and 145.

In order to operate the Power-Up Diagnostics, the following conditions must be met:

a. One slave (of any type except WISE) must be connected and powered on (if not available, the test will hang with appropriate error code).

b. The System Disk must be on line and READY (if not, the test will hang with appropriate error code).

c. The Initial Bootstrap Chip (IBC) must be present in the 7501 CPU/MEM board.

d. The System Disk must already be designated by the three-level Disk Select Switch on the front panel BEFORE powering-up or resetting the Master. The switch designates the System Disk to both the Power-Up Diagnostic and Operating System Software.

D.3 MAJOR CHARACTERISTICS

The major characteristics of the OIS 140-Class Power-Up Diagnostic are as follows:

1. The Diagnostic is PROM-loaded, residing in two 1K 2708 EPROMs found on the CPU/MEM board (memory locations 0400 to 0BFF).

   PROM 1 (L101), 378-2666R5

   PROM 2 (L102), 378-2667R5

2. The program is written in Z80 Assembly Language and attains control whenever the system is powered on or reset.

3. At the beginning of the test, the program controls the following events:

   a. It erases all four diagnostic LEDs on the front panel (they are automatically turned on by reset or power on).

   b. It sets a hardware register bit (X'0C0B') to direct any parity error to the diagnostic parity handler.

4. The test reads only the IPL sector data (Track 0, Sector 1) from the System Disk. The System Disk is selected by the three-level pointer switch on the front panel as follows:

Level -	:	diskette
Level --	:	10 Meg disk drive (Model 6560)
Level ---	:	80 Meg, 300 Meg SMD disk drive (Model 6565), 32-, 64-, or 96-Meg CMD disk drive (Model 6580).

   During the test, no disk write operations take place.

5. In the event of an error, a four bit error code will be displayed on the front panel.

6. If the System Disk is not on line (i.e., not powered up or not up to speed), the test will hang in a loop and display an error code on the front panel. When the disk comes on line the error code is erased and the test continues.

7. The OIS 140/145 may include up to 32 peripherals (slaves). The test will IPL the first slave encountered while scanning through all the channels from 1 to 32. If there is no slave powered on, the test will hang in a loop and display an error code on the front panel. When one of the channels comes on line, the error code is erased and the test continues.

8. If an error condition causes the system to halt, it may still be IPLed with the OIS 140 Master Monitor diskette (see section D.12 for instructions).

D.4 USER INTERFACE

The Power-Up Diagnostic is initiated when the user powers up the system via the front panel ON/OFF switch (1/0 on some OIS 140-Class Masters). Alternatively, if the system is already powered up, the user may press the front panel RESET button to re-IPL the system and initiate the diagnostic test.

There are two sets of LEDs used for diagnostic purposes. Four of these are located on the Master Unit's front panel, while the remaining eight reside on the 7501 CPU/MEM board. The four front panel LEDs indicate that either a fatal or non-fatal error has occurred, according to the error codes explained in Table D-1, Section D.6. The front panel LED labled POWER is used to indicate that the Power-Up Diagnostic is executing (blinking mode), or that the system software is executing (solid-on mode). Figures D-1 and D-2 show the OIS 140-Class front panel controls and indicators.

The eight LEDs residing on the CPU/MEM board provide Detailed Error information when a fatal error has occurred (figure D-3). LEDs DL3 through DL0 indicate the number of the last test in process when the fault was encounterred. (Section D.7 lists and numbers the various tests comprising the Power-Up Diagnostic.) All eight LEDs, when read together, provide the two-digit Hex code for Detailed Error analysis. Detailed Error codes are explained in sections D.8 and D.9.

There are four switches and two push buttons on the CPU/MEM board that are used for diagnostics. These controls are used to obtain Expanded Error information (section D.10), or perform special diagnostic functions as explained in section D.12.

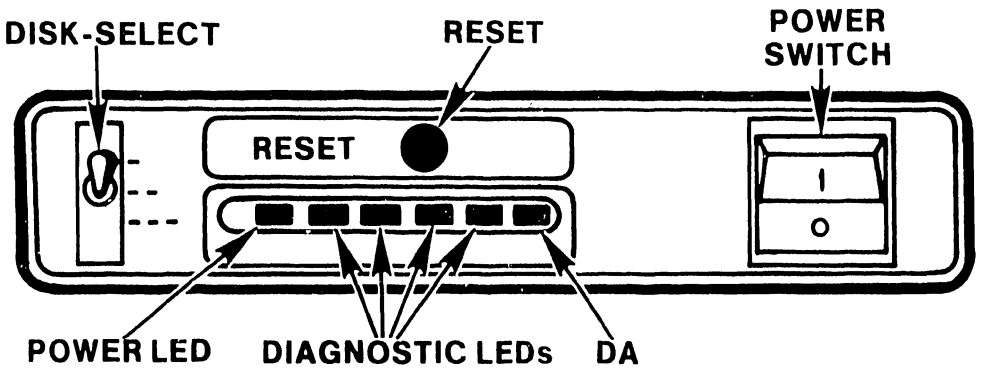


Figure D-1 Front Panel Controls -- OIS 105, 115, 125A, 130A/B/C

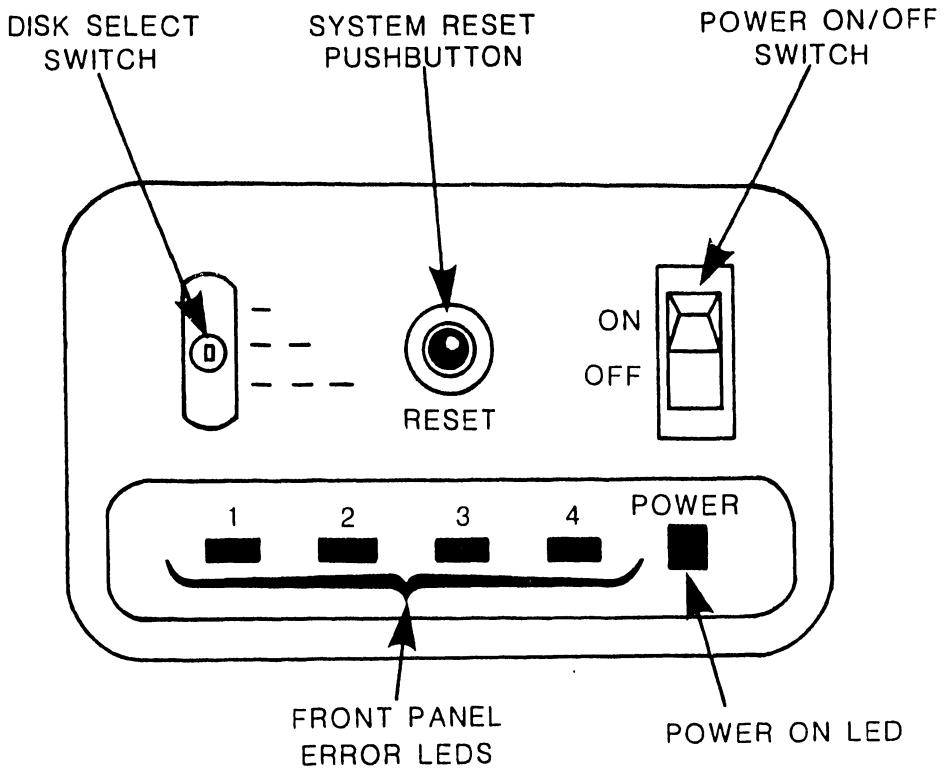


Figure D-2 Front Panel Controls -- OIS 140/145

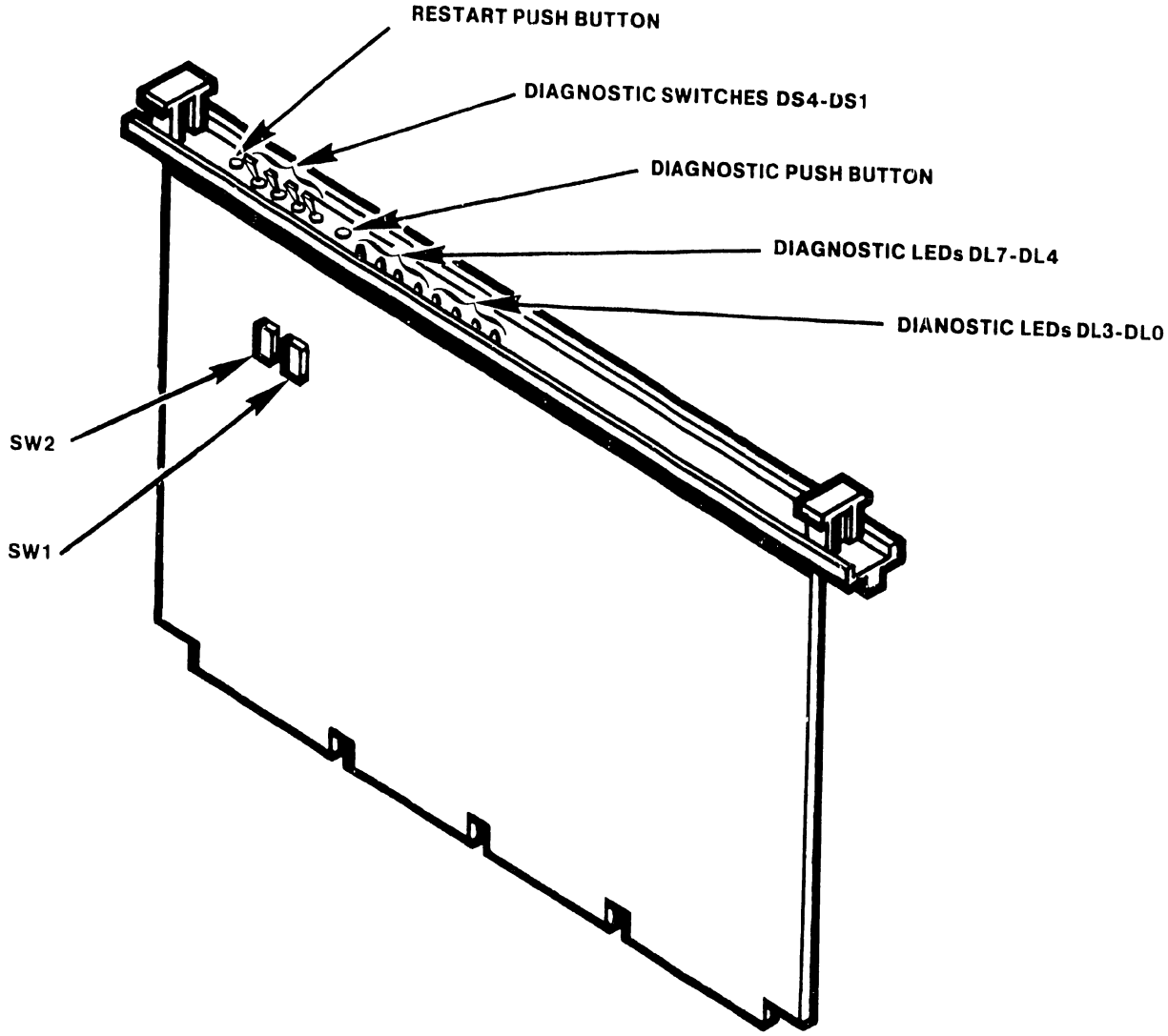


Figure D-3 CPU/MEM Board Diagnostic Controls and indicators

D.5 OPERATING PROCEDURE

The Power-up (PROM) diagnostics start whenever the Master Processor is powered-up or reset and take approximately 15 seconds to be performed.

1. Press RESET on the Master Processor Front Panel. If the system is powered-down, simply set the power switch to 1 (ON).

2. The Power LED will blink while the diagnostics are running.

   A. When all tests pass, the Power LED stops blinking (goes to steady-on) and the IPL menu is displayed at the CRT workstation.

   B. If an error is detected, the Power LED will continue to blink while the Front Panel LEDs display an error code. See sections D.6 through D.10 for error code interpretation. Take action as specified.

3. Enter correct Date and Time when the IPL menu is displayed.

D.6 MASTER UNIT FRONT PANEL ERRROR CODES

Table D-1 explains the error codes displayed by the four front panel diagnostic LEDs. There are two major types of errors: non-fatal and fatal. Non-fatal errors are operator correctable, while fatal errors, which may be either hardware or software faults, require system servicing. Fatal errors are distinguishable by the presence of front panel LED #1 in the "on" state.

TABLE D-1 FRONT PANEL ERROR INDICATIONS

LED ERROR CODE 1 2 3 4	PROBLEM
	NON-FATAL ERROR INDICATIONS
0 0 0 1	No external devices on line: ... Turn on a workstation.
0 0 1 0	Floppy diskette not on line: ... Check position of Disk Select Switch, insert a diskette, or close floppy door.
0 0 1 1	System CMD, SMD, or Winchester not on line: ... Check ready light on drive.
0 1 0 0	HAWK 10-Meg disk unit not on line: ... Check ready light on HAWK.
0 1 0 1	Run-time error: ... Record CPU/MEM LED status and Re-IPL.

TABLE D-1 FRONT PANEL ERROR INDICATIONS
(continued)

LED ERROR CODE 1 2 3 4	PROBLEM
	FATAL ERROR INDICATIONS
1 0 0 0	7501 CPU/MEM board: ... Check CPU/MEM LEDs and Table D-3.
1 0 0 1	7503 DATA LINK CONTROL board or 7504 DATA BUFFER board: ... Replace. (see Table D-4)
1 0 1 0	7502 10-MEG/FLOPPY CONTROLLER board: ... Replace. (see Table D-5)
1 1 0 0	7505/7506 SMD/CMD CONTROLLER board(s) or 7650/7653 WINCHESTER CONTROLLER board(s): ... Replace. (see Table D-6)
1 1 0 1	Software error: ... Check CPU/MEM LEDs and Table D-7.

D.7 DIAGNOSTIC TEST NUMBER IDENTIFICATION

The Diagnostic LEDs DL3 through DL0 on the top of the CPU/MEM board display the Power-Up Diagnostic test number currently in process. Table D-2 identifies the various tests comprising this diagnostic.

TABLE D-2 TEST IDENTIFICATION AND DESCRIPTIONS

CPU/MEM BOARD LED INDICATORS DL3	DL2	DL1	DL0	TEST NUMBER	TEST NAME
0	0	0	0	0	Data Bus/Parity Gen/Marching 1's and 0's
0	0	0	1	1	Not Used
0	0	1	0	2	Not Used
0	0	1	1	3	Not Used
0	1	0	0	4	Interrupt structure
0	1	0	1	5	CTC Timing/Priority
0	1	1	0	6	Data Link Function
0	1	1	1	7	Diskette Controller
1	0	0	0	8	10-Meg Controller
1	0	0	1	9	SMD/CMD Controller
1	1	1	0	E	Winchester Controller

The normal sequence of test execution is 00, 04, 05, and 06. Note that test 06 will be skipped if a WISE is the only slave on-line. Only one of tests 07, 08, 09, or 0E will be executed next, depending on which drive is selected by the three-level front panel Disk Select switch. If the Winchester Drive is present (not applicable to OIS 140/145) and it is not the System Disk, it will be initialized and positioned at sector 00 before passing execution to the Initial Bootstrap Chip.

D.8 DETAILED HARDWARE ERROR CODES

The Diagnostic LEDs DL7 through DL0 on the top of the CPU/MEM board display detailed hardware error code when a fatal error has occurred. Tables D-3 through D-6 decipher these codes. Each table corresponds to one of four hardware Front Panel Error Codes, presenting detailed error information for that particular code.

TABLE D-3 CPU/MEM ERRORS
(FRONT PANEL ERROR = 1000)

HEX	DL7-DL4	DL3-DL0	PROBLEM
10*	0001	0000	Data Bus Error
20	0010	0000	MPE bit (0C06) does not flag bad parity
30	0011	0000	NMI does not flag parity errors
40*	0100	0000	MAIN MEMORY PARITY ERROR
50*	0101	0000	Memory error: first read of a READ/WRITE/READ sequence
65	0110	0101	CTC Time Out Occurred
75*	0111	0101	CTC Priority Error
80*	1000	0000	Memory error: second read of a READ/WRITE/READ sequence
94*	1001	0100	Incorrect interrupt vector generated by 0C0F
A4	1010	0100	No interrupts generated by 0C0F
B4*	1011	0100	Incorrect number of interrupts generated by 0C0F
C0	1100	0000	ILLEGAL PROM ADDRESS ERROR

* Error codes notated with asterisks refer to those codes that may be expanded using Diagnostic Switch DS2 on the CPU/MEM board. (See paragraph D.10 for details concerning expanded error information.)

TABLE D-4 DATA LINK CONTROL ERRORS
(FRONT PANEL ERROR = 1001)

HEX	DL7-DL4	DL3-DL0	PROBLEM
16*	0001	0110	Read/Write Control Registers Error
26	0010	0110	Not used
36	0011	0110	CANNOT SELECT A SLAVE
46	0100	0110	CANNOT IPL A SLAVE
56	0101	0110	ONE BYTE SLAVE READ ERROR
66	0110	0110	Not used
76*	0111	0110	DATA LINK BUSY TIME OUT DOING BLOCK TRANSFER
86*	1000	0110	DATA LINK BUSY INT DID NOT OCCUR DOING BLOCK TRANSFER
96*	1001	0110	DATA LINK DATA BUFFER PARITY ERROR ON BLOCK TRANSFER
A6*	1010	0110	Incorrect Data found after Block Transfer

TABLE D-5 10-MEG/FLOPPY ERRORS
(FRONT PANEL ERROR = 1010)

HEX	DL7-DL4	DL3-DL0	PROBLEM
17*	0001	0111	READ/WRITE Control Register Error (Floppy)
27	0010	0111	IPL from Floppy Status Error
47	0100	0111	Floppy: Cannot find track 00
77	0111	0111	No Sector Pulse Interrupt
97	1001	0111	Sector Counter Never Indicates Sector 00
18*	0001	1000	READ/WRITE Control Register Error (10-Meg)
38	0011	1000	Drive Select Register Error
48	0100	1000	10-MEG: Drive Does Not Restore
58	0101	1000	Restore Takes Greater Than 500 Milliseconds
68	0110	1000	No Interrupt On Seek Complete.
78	0111	1000	No Sector Pulse Interrupt.
88	1000	1000	IPL from 10-MEG Status Error.
98	1001	1000	Sector counter never indicates sector 00

TABLE D-6 SMD/CMD OR WINCHESTER CONTROLLER ERRORS
(FRONT PANEL ERROR = 1100)

HEX	DL7-DL4	DL3-DL0	PROBLEM
			SMD/CMD CONTROLLER
19*	0001	1001	READ/WRITE CONTROL REGISTER ERROR
29	0010	1001	Seek Operation Failed To Cause Interrupt
39	0011	1001	Seek Operation Returned Bad Status
49	0100	1001	Incorrect Interrupt Vector On Seek
59	0101	1001	Read Operation Failed To Cause Interrupt
69	0110	1001	Read IPL Sector Returned Bad Status (includes an ECC error)
			WINCHESTER CONTROLLER
1E*	0001	1110	READ/WRITE CONTROL REGISTER ERROR
2E	0010	1110	DRIVE DOES NOT BECOME READY
3E	0011	1110	NO SEEK INTERRUPT ON RTZ
4E	0100	1110	TKO NOT SET AFTER RTZ
5E	0101	1110	TIMEOUT ON IPL READ
6E	0110	1110	STATUS ERROR ON IPL READ
7E	0111	1110	CANNOT FIND SECTOR ZERO
8E	1000	1110	READ/SELECT FORCED READ ERROR

D.9 DETAILED SOFTWARE ERROR CODES

When the four front panel LEDs indicate a fatal software error, additional information concerning the error may be obtained by analyzing DL7 through DL0 on the CPU/MEM board, according to the table that follows:

TABLE D-7 DETAILED SOFTWARE ERROR CODES
(FRONT PANEL ERROR = 1101)

HEX	DL7-DL4	DL3-DL0	PROBLEM
E0	1110	0000	IPLed Disk has an invalid Volume Label
E1	1110	0001	IPLed Disk is not a System Disk
E2	1110	0010	Bad Configuration: too little Master Memory
E3	1110	0011	Bad Configuration: IPLed Disk excluded
E4	1110	0100	Insufficient Memory for Control Blocks TCB
E5	1110	0101	Insufficient Memory for Control Blocks VCB
E6	1110	0110	Insufficient Memory for Control Blocks DCB
E7	1110	0111	Insufficient Memory for Control Blocks FCB
E8	1110	1000	Bad Configuration: Unsupported Disk Type
E9	1110	1001	Insufficient Memory for Buffers (VAU Map)
EA	1110	1010	Insufficient Memory for Buffers (Catalog)
EB	1110	1011	Incorrect PROM Revision Installed
EC	1110	1100	Unsupported Timer Interval
ED	1110	1101	Cannot Mount System Disk
FA	1111	1010	Invalid IPL Sector Hash Code
FB	1111	1011	Error Reading Master or Volume Label
FC	1111	1100	Hard Debug
FD	1111	1101	Soft Debug
FE	1111	1110	Restart Button Depressed
FF	1111	1111	Parity Error

D.10 EXPANDED HARDWARE ERROR INFORMATION

The detailed hardware error codes marked with an asterisk in Tables D-3 through D-6 can be expanded by positioning Diagnostic Switch DS2 on the CPU/MEM board to its opposite position. Valid additional information exists at the CPU/MEM board LEDs for error codes marked with an asterisk after DS2 has been toggled. The first change of the position of DS2 will cause the first byte of additional error information to be presented at the CPU/MEM board LEDs. Record the data displayed at the LEDs, then toggle DS2 a second time to obtain the second byte of expanded hardware error information.

For the detailed hardware error codes 10, 40, 50, and 80, (See Table D-3) the first byte of information is the high byte of the memory location in error. The second byte of information is the exclusive-or (XOR) of the data read with the data written. Refer to Section D.11 to use these error codes to locate and replace faulty memory chip(s).

For errors 94 and B4 the first byte of information displayed is hexidecimal B0 (x'B0'). The second byte of expanded information for error 94 is the XOR of the low byte interrupt vector received and the one expected. The second byte of error B4 is the number of interrupts that were generated.

The first byte for error 75 is not applicable, the second byte is the XOR of the CTC channel expected to interrupt and the one that did the interrupting.

The first byte for errors 76, 86, 96, and A6, is not applicable. The second byte for each of these errors is the slave selected during the block transfer. Slave select value 00 implies the operation was master to master. Non-zero implies master to slave.

The first byte for errors 16, 17, 18, 19, and 1E (the READ/WRITE Register Test errors) has the low order byte of the Memory Mapped I/O (MMIO) location in error.

TABLE D-8 EXPANDED HARDWARE ERROR CODES

HEX	DL7-DL4	DL3-DL0	FIRST BYTE	SECOND BYTE
** 10	0001	0000	High Byte of Bad Mem Loc.	XOR of data read and data written
** 40	0100	0000	"	"
** 50	0101	0000	"	"
** 80	1000	0000	"	"
94	1001	0100	x'B0'	XOR INTERRUPT
B4	1011	0100	x'B0'	Number of Interrupts
75	0111	0101	N/A	XOR CTC Channel Number
76	0111	0110	N/A	Slave Selected During block Transfer
86	1000	0110	N/A	"
96	1001	0110	N/A	"
A6	1010	0110	N/A	"
16	0001	0110	LO BYTE MMIO	N/A
17	0001	0111	"	N/A
18	0001	1000	"	N/A
19	0001	1001	"	N/A
1E	0001	1110	"	N/A

** See Section D.11 for isolation of faulty memory chips.

D.11 ISOLATION OF FAULTY MEMORY CHIPS

Additional memory error information is available via the CPU/MEM board LEDs. If any of the error codes listed below occur, it may be possible to correct the problem by replacing a memory chip. There are two bytes of additional error information associated with these memory error codes. (Refer to section D.10 for instructions on obtaining expanded error information.) The first byte of information is the high byte of the location where the error occured. The second byte is the exclusive or of the data written to that location and the data subsequently read from the location.

DETAILED ERROR CODES (FRONT PANEL ERROR = 1000)

10, 40, 50, 80

Use the two bytes of expanded error information in conjunction with the table below in order to locate the faulty memory chip.

TABLE D-9 MEMORY CHIP ISOLATION

SECOND BYTE	FIRST BYTE 10-4F	50-8F	90-CF	D0-FF
00	L01	L19	L35	L52
01	L09	L27	L43	L60
02	L08	L26	L42	L59
04	L07	L25	L41	L58
08	L06	L24	L40	L57
10	L05	L23	L39	L56
20	L04	L22	L38	L55
40	L03	L21	L37	L54
80	L02	L20	L36	L53

D.12 SPECIAL DIAGNOSTIC FUNCTIONS

D.12.1 BOOTING A DIAGNOSTIC DISKETTE AFTER A FATAL ERROR

If, during execution of the power-up, a fatal error is detected, it is still possible to IPL a diskette-based diagnostic such as the OIS 140-class Master Monitor Diagnostic package (WLI No. 702-0057).

1. Set the CPU/MEM board Diagnostic Switches to hexidecimal 'D' (i.e., DS4, DS3, and DS1 to 'ON', and DS2 to 'OFF').

2. Press the CPU/MEM Diagnostic Push Button (DPB). See figure D-3.

This will cause the Power-Up Diagnostic PROM to pass control to the Initial Bootstrap Chip and attempt to boot up the selected diskette.

D.12.2 LAMP TEST EXECUTION

Perform the following procedure to test all Front Panel and CPU/MEM Board LEDs.

1. Set the CPU/MEM Diagnostic Switches to the OFF position.
2. Press and hold the Diagnostic Push Button (DPB) on the CPU/MEM board.
3. Press and release the Front Panel RESET switch.

This should cause all of the Diagnostic LEDs (except DA on Systems with Winchester System Disks) to light. To continue with the diagnostic just release the DPB.

D.12.3 CPU/MEMORY BOARD TEST AND LOOP MODE

There is an option to continuously run only the CPU/MEM board diagnostic tests. To select this function perform the following procedure:

1. Set the four CPU/MEM board diagnostic switches to the 'ON' state.
2. Press and hold the CPU/MEM board Diagnostic Push Button (DPB).
3. Press and release the Front Panel RESET button, then release the DPB.

This action will set a flag directing the diagnostic to execute only CPU/MEM board functions in a continuous loop. Errors will be reported in the usual manner. To exit this mode and execute a normal Power-Up, simply reset the system via the Front Panel RESET button.

D.13 REFERENCE

At the time of this printing the OIS 140-Class Power-Up Diagnostic exists at the Revision 5161 level. Should this level change, as it often does, the latest version of the Power-Up Diagnostic documentation may be obtained by ordering WLI Number 702-0042 from the Diagnostic Distribution Group.

APPENDIX
E
OIS 140-CLASS EXTENDED MEMORY POWER-UP DIAGNOSTICS

APPENDIX E

OIS 140-CLASS EXTENDED MEMORY POWER-UP DIAGNOSTIC

E.1 INTRODUCTION

This appendix is designed to serve as a supplement to Appendix D, outlining the differences between the normal power-up diagnostic and its Extended Memory counterpart. For the most part, Appendix D is directly applicable to Extended Memory systems. The exceptions are explicitly stated in the paragraphs that follow. The addition of the 7684/7685 Mother/Daughterboard set affects the normal 140-Class Power-Up Diagnostic in the following ways:

1. An additional code has been included in the set of front panel error codes, in order to indicate occurance of a fatal error in the 7685A Daughterboard.

2. An additional set of detailed error codes associated with the daughterboard has been included.

3. Additional extended (two-byte) error information has been included, in order to isolate faulty Daughterboard memory chips.

4. Three additional test modules have been included to test Daughterboard circuitry.

E.2 CONFIGURATION REQUIREMENTS

This diagnostic program verifies correct operation of the OIS 140-Class** Operating System as well as correct operation of the following types of OIS 140-Class Master Unit PCBs:

7684A/7685A	E Rev. 1/1	CPU/MEMORY (MOTHER/DAUGHTER)
7502	E Rev. 4	10 MEG/FLOPPY CONTROLLER
7503/7504	E Rev. 5/1	DATA LINK CONTROLLER
7505/7506	E Rev. 6/6	SMD/CMD CONTROLLER
7650/7653	E Rev. 2/1	WINCHESTER CONTROLLER

** Masters in the 140-Class incude Models 105, 115, 125A, 130A, 130B/E, 140, and 145.

E.3 PROM SPECIFICATIONS

	PCB	LOCATION	TYPE	WLI No.
PROM 1	7684A	L110	2716 EPROM	378-5002R2
PROM 2	7684A	L111	2716 EPROM	378-5003R2

E.4 128K EXTENDED MEMORY CHARACTERISTICS

The 128K Extended Memory (EM-OIS) is a two board option providing additional memory for OIS 140-Class systems. The option is available for Office Information Systems 140/145, as well as models 105/115/125A/130A/130B/130C. The option adds 60K of user RAM memory to the existing 60K user RAM. An OIS system with this option has 120K of user RAM, 2K of non-user RAM, and 6K of ROM for the Initial Bootstrap and Power-up diagnostics.

The option is installed by removing the existing 7501 CPU/MEMORY board and replacing it with the new two board combination of CPU/Memory and Extended Memory. The option is a piggyback arrangement of motherboard (210-7684A) and daughterboard (210-7685A) maintained as a unit (P/N 212-3025). It plugs into the single (4 section) connector where the previous CPU/MEMORY board was installed.

This 128K memory option allows future software enhancements of all OIS 140-Class systems. It is normally required when an OIS System is connected in a Wang Inter-System Exchange (WISE) network operating with Level 2 software. The Wise network, an intelligent interconnection system, functions as a high speed communication path between OIS systems. The WISE unit is a self-contained assembly with a single CPU and Memory board and up to four Data Link boards (1 per channel). It connects as a slave unit for a designated OIS Master. The EM-OIS 128K option increases the number of files than can be opened concurrently in a WISE network.

E.4.1 INSTALLATION

To install the EM-OIS 128K option on any OIS 140-Class system;

Turn off all power
Remove the top cover of the cabinet
Remove the existing 7501 CPU/Memory board
Plug new piggyback combination (212-3025) into same location
Return power to the system
Reconfigure for "supported Extended Memory Master" using starter diskette

In OIS systems, both the Initial Bootstrap and the Power-up diagnostics are PROM resident. Returning power to the system resets the system, bootstraps it, and runs the diagnostics. The power-up diagnostic takes about 7 seconds to run if successful. It stops and displays error codes for any failed module or memory chip.

E.4.2 MODIFIED HARDWARE

The mother/daughter board combination has a memory address space of 64K, shared by two banks of memory. An address space of 3k is shared by 6K of Eraseable PROM (EPROM). An address space of 60K is shared by 60K of RAM Instruction (I) memory and 60K of RAM Data (D) memory. Memory Mapped I/O (MMIO) uses 1K of unshared RAM. The 128K option boards retain circuits for parity generation and checking and Input and Output (I/O) decoding. The option boards also retain the Counter Timer Circuit (CTC) and the priority interrupt (INT) structure.

The hardware design provides five software-controlled memory modes for the operating system. These modes are as follows:

Mode 1 Instruction (or I) space
Mode 2 Instruction/Data (or I/D) space
Mode 3 Data (or D) space
Mode 4 DMA transfers
Mode 5 Data/Instruction (or D/I) space.

The five memory modes are described below.

1. MODE 1 is defined as Instruction, or I, space. In Mode 1, the system functions as a normal 140 class master ignoring the additional memory. It is the default mode after Reset or Power-up. Mode 1 loads all IPL code into Instruction (I) memory at power up time. After the IPL loading, software selects any of the five memory modes.

2. MODE 2 is a defined as I/D space, an Instruction/Data memory organization. This mode is the most powerful because it enables the additional 60K of RAM and its control circuitry. Mode 2 is selected only after the IPL code is loaded into (I) memory. It is initialized when an OIS 140 class system is in a WISE network with Level 2 software.

Two 60K banks of memory are active in the system with Mode 2. One array, or bank, is Instruction RAM (I space), and the second is Data RAM (D space). The memory banks share the same addressing space. Because they share address space, the bottom 4K of memory address space is masked. This space is used as adresses for 3K of ROM and 1K for Memory Mapped IN/OUT (MMIO)

Ideally, all instruction code is loaded into (I) space, while Stacks, Tables and File Control Blocks (FCBs) reside in (D) space.

The control circuitry, located on the daughterboard, does an OPCODE DECODE when the system is in the I/D mode. this decoding technique is a steering mechanism for memory, allowing convenient alternate addressing between the two 60K memory banks of RAM.

3. MODE 3 is defined as Data, or D, space. It is similar to Mode 1 except that the additional 60K of memory (D) space is the only memory array accessed by the system. This mode is useful for diagnostics.

4. MODE 4 is defined as DMA transfer space. The modified CPU is designed for software-controlled DMA transfers between data buffers and either (I) or (D) space. Software directs the normal flow of the Master Memory/Data Buffer transfers to I space by clearing bit 2 of the Program Control Register (PCR). DMA transfers to or from D space are enabled when bit 2 of the PCR is set.

5. MODE 5 is defined as D/I space. It is the opposite of Mode 2 and follows the same conventions as Mode 2 except that memory is structured in a (D/I) configuration.

Memory organization is software-controlled through the PCR. Software selects the memory mode operation by controlling four bits in the PCR.

E.5 MASTER UNIT FRONT PANEL ERROR CODES

Table E-1 explains the error codes displayed by the four front panel diagnostic LEDs. Note that this table differs from Table D-1 due to the addition of error code 1110, which indicates a fatal error involving the 7685A CPU/MEM Daughterboard.

TABLE E-1 FRONT PANEL ERROR INDICATIONS

LED ERROR CODE 1 2 3 4	PROBLEM
	NON-FATAL ERROR INDICATIONS
0 0 0 1	No external devices on line: ... Turn on a workstation.
0 0 1 0	Floppy diskette not on line: ... Check position of Disk Select Switch, insert a diskette, or close floppy door.
0 0 1 1	System CMD, SMD, or Winchester not on line: ... Check ready light on drive.
0 1 0 0	HAWK 10-Meg disk unit not on line: ... Check ready light on HAWK.
0 1 0 1	Run-time error: ... Record CPU/MEM LED status and Re-IPL.
	FATAL ERROR INDICATIONS
1 0 0 0	7684 CPU/MEM board: ... Check CPU/MEM LEDs and section E.7.
1 0 0 1	7503 DATA LINK CONTROL board or 7504 DATA BUFFER board: ... Replace. (See Table D-4.)
1 0 1 0	7502 10-MEG/FLOPPY CONTROLLER board: ... Replace. (See Table D-5.)
1 1 0 0	7505/7506 SMD/CMD CONTROLLER board(s) or 7650/7653 WINCHESTER CONTROLLER board(s): ... Replace. (See Table D-6.)
1 1 0 1	Software error: ... Check CPU/MEM LEDs and Table D-7.
1 1 1 0	7685 EXPANDED MEMORY DAUGHTERBOARD: ... See section E.7

E.6 DIAGNOSTIC TEST NUMBER IDENTIFICATION

The Diagnostic LEDs DL3 through DL0 on the top of the CPU/MEM board display the Power-Up Diagnostic test number currently in process. Table E-2 identifies the various tests comprising this diagnostic.

TABLE E-2 TEST IDENTIFICATION AND DESCRIPTIONS

CPU/MEM BOARD LED INDICATORS				TEST	TEST NAME
DL3	DL2	DL1	DL0	NUMBER	
0	0	0	0	00	Data Bus/Parity Gen/Marching 1's and 0's
0	0	0	1	01	Not Used
0	0	1	0	02	Not Used
0	0	1	1	03	Not Used
0	1	0	0	04	Interrupt structure
0	1	0	1	05	CTC Timing/Priority
0	1	1	0	06	Data Link Function
1	0	1	0	0A	Test 00 applied to Daughterboard
1	0	1	1	0B	ROM Decoding Tests (Daughterboard)
1	1	0	0	0C	I/D Interrupt Structure (Test 04 in I/D mode)
0	1	1	1	07	Diskette Controller
1	0	0	0	08	10-Meg Controller
1	0	0	1	09	SMD/CMD Controller
1	1	1	0	0E	Winchester Controller

The normal sequence of test execution is 00, 04, 05, and 06. Note that Test 06 will be skipped if a WISE is the only slave on-line. After Test 06 is completed, Tests 0A through 0C will be executed if and only if the 7685 Expanded Memory board is present. Only one of Tests 07, 08, 09, or 0E will be executed next, depending on which drive is selected by the three-level front panel Disk Select switch. If the Winchester Drive is present (not applicable to OIS 140/145) and it is not the System Disk, it will be initialized and positioned at sector 00 before passing execution to the Initial Bootstrap Chip.

E.7 DETAILED ERROR CODES

Tables D-4 through D-7 in the preceding appendix are still applicable to Expanded Memory operation. The Expanded Memory Power-Up Diagnostic provides an additional set of detailed error codes which are associated with the 7684 Motherboard and the 7685 Daughterboard. These are presented in Tables E-3 and E-4 on the next two pages.

TABLE E-3 128K MOTHER MODULE
(FRONT PANEL ERROR = 1000)

HEX	DL7-DL4	DL3-DL0	PROBLEM
10*	0001	0000	Data Bus Error
20	0010	0000	MPE bit (0C06) does not flag bad parity
30	0011	0000	NMI does not flag parity errors
40*	0100	0000	MAIN MEMORY PARITY ERROR
50*	0101	0000	Memory error: first read of a READ/WRITE/READ sequence
65	0110	0101	CTC time out occurred
75	0111	0101	CTC priority error
80*	1000	0000	Memory error: second read of a READ/WRITE/READ sequence
94	1001	0100	Incorrect interrupt vector generated by 0C0F
A4	1010	0100	No interrupts generated by 0C0F
B4	1011	0100	Incorrect number of interrupts generated by 0C0F
C0	1100	0000	ILLEGAL PROM ADDRESS ERROR

* See section E.8 for Expanded Error Code information.

TABLE E-4 120K DAUGHTER MODULE
(FRONT PANEL ERROR = 1110)

HEX	DL7-DL4	DL3-DL0	PROBLEM
1A	0001	1010	Can not access other side of PROMs
2A	0010	1010	D Space not being accessed
3A	0011	1010	No NMI generated after parity error, or OC22
4A*	0100	1010	Data Bus Error
5A	0101	1010	MPE Bit not set on parity error
6A*	0110	1010	Parity error on Daughterboard
7A	0111	1010	Illegal PROM address error
8A*	1000	1010	Memory error on first READ of READ/WRITE/READ
9A*	1001	1010	Memory error on second READ of READ/WRITE/READ
1B	0001	1011	IPA Bit not set after OC22 WRITE
2B	0010	1011	Table ROM Checksum error ROM 1
3B	0011	1011	Table ROM Checksum error ROM 2
4B	0100	1011	No NMI when illegal PROM address is generated
5B	0101	1011	I/D problem, page 0, PROM 1 (CB Instruction)
6B	0110	1011	I/D problem, page 1, PROM 1 (ED Instruction)
7B	0111	1011	I/D problem, page 2, PROM 1 (DD Instruction)
8B	1000	1011	I/D problem, page 3, PROM 1 (FD Instruction)
9B	1001	1011	D/I Mode not reflected in OC20
AB	1010	1011	D/I does not execute MRD from I Space
BB	1011	1011	DMA BLOCK XFER from I to D bad
CB	1100	1011	DMA BLOCK XFER from D to I bad
DB	1101	1011	M1 from D Space while in I/D Mode
EB	1110	1011	Can not return to continue PUP
1C*	0001	1100	Incorrect interrupt vector generated
2C	0010	1100	No interrupts occurred
3C*	0011	1100	Incorrect number of interrupts occurred

* See section E.8 for Expanded Error Code information.

E.8 EXPANDED HARDWARE ERROR INFORMATION

The detailed hardware error codes marked with an asterisk in Tables E-3 and E-4, can be expanded by positioning Diagnostic Switch DS2 on the CPU/MEM board to its opposite position. Valid additional information exists at the CPU/MEM board LEDs for error codes marked with an asterisk after DS2 has been toggled. The first change of the position of DS2 will cause the first byte of additional error information to be presented at the CPU/MEM board LEDs. Record the data displayed at the LEDs, then toggle DS2 a second time to obtain the second byte of expanded hardware error information. See Section D-10 for additional information.

TABLE E-5 EXPANDED HARDWARE ERROR CODES

HEX	DL7-DL4	DL3-DL0	FIRST BYTE	SECOND BYTE
10	0001	0000	High Byte of Bad Mem Loc.	XOR of data read and data written
40	0100	0000	"	"
50	0101	0000	"	"
80	1000	0000	"	"
4A			High Byte of Bad Mem Loc.	XOR of data read and data written
6A			"	"
8A			"	"
9A			"	"
1C			x'B0'	XOR INTERRUPT
3C			x'Bo'	Number of Interrupts

E.9 ISOLATION OF FAULTY MEMORY CHIPS

Additional memory error information is available via the CPU/MEM board LEDs. If any of the error codes listed below occur, it may be possible to correct the problem by replacing a memory chip. There are two bytes of additional error information associated with these memory error codes. (Refer to section E.8 for instructions on obtaining expanded error information.) The first byte of information is the high byte of the location where the error occured. The second byte is the exclusive or of the data written to that location and the data subsequently read from the location.

DETAILED ERROR CODES (FRONT PANEL ERROR = 1000)

10, 40, 50, 80

DETAILED ERROR CODES (FRONT PANEL ERROR = 1110)

4A, 6A, 8A, 9A

Use the two bytes of expanded error information in conjunction with the tables E-5 and E-6 in order to locate the faulty memory chip.

TABLE E-6 MEMORY CHIP ISOLATION
FRONT PANEL = 1000 (7684 PCB)

SECOND BYTE	FIRST BYTE 10-4F	50-8F	90-CF	D0-FF
00	L09	L30	L50	L69
01	L08	L29	L49	L68
02	L07	L28	L48	L67
04	L06	L27	L47	L66
08	L05	L26	L46	L65
10	L04	L25	L45	L64
20	L03	L24	L44	L63
40	L02	L23	L43	L62
80	L01	L22	L42	L61

TABLE E-7 MEMORY CHIP ISOLATION
FRONT PANEL = 1110 (7685 PCB)

SECOND BYTE	FIRST BYTE 10-4F	50-8F	90-CF	D0-FF
00	L07	L24	L41	L58
01	L15	L32	L49	L66
02	L14	L31	L48	L65
04	L13	L30	L47	L64
08	L12	L29	L46	L63
10	L11	L28	L45	L62
20	L10	L27	L44	L61
40	L09	L26	L43	L60
80	L08	L25	L42	L59

E.10 REFERENCE

At the time of this printing the OIS 140-Class Extended Memory Power-Up Diagnostic exists at the Revision 5161 level. Should this level change, as it often does, the latest documentation on the Power-Up Diagnostic may be obtained by ordering WLI Number 702-0123 from the Diagnostic Distribution Group.

APPENDIX F

FINAL WORD PROCES-SING CHECK

APPENDIX F
FINAL WORD PROCESSING CHECK

F.1 DESCRIPTION

Final Word Processing Checkout for an OIS system consists of the following items:

Select Word Processing	Delete words in the text
Create a New Document	Insert words into the text
Select Edit a Document	File to archive diskette
Create text	Retrieve from archive diskette
Globally replace words in the text	Delete from archive diskette

This sequence of tests is to be run overnight on all workstations. After running these tests overnight, a document is to be queued to the printers, printed, and the document deleted from library.

A Glossary of the Final Word Processing Checkout has been prepared and this Glossary is included in this appendix. The glossary accounts for differences in tests for standard and archiving workstations. It is suggested that the Field Service Technician archive this Glossary onto his own diskette in order to expedite checkout of OIS systems.

The Final Word Processing Checkout glossary is exercised as follows:

1. Retrieve glossary from diskette (or enter the glossary on the keyboard).
2. Mount initialized diskettes in all archiving workstations and the central archiver.
3. Attach the glossary to all workstations.
4. Exercise Glossary "1" on all archiving workstations and one standard workstation (to test the central archiver).
5. Exercise Glossary "2" on all standard workstations.
6. Cancel the glossary when finished; the glossary will loop upon itself until cancelled.

F.2 GLOSSARY OF FINAL WORD PROCESSING CHECKOUT

---------- Page 1 of Glossary ----------

(1)

(-RETURN-)(-PROMPT-)Enter Library(-EXECUTE-)(-1-KEY-)(-PROMPT-)(-EXECUTE-)
(-GO-TO-GL-)A

---------- Page 2 of Glossary ----------

(A)

(-GL-)a
(-GL-)b
(-GO-TO-GL-)A

---------- Page 3 of Glossary ----------

(2)

(-RETURN-)(-PROMPT-)Enter Library(-EXECUTE-)(-1-KEY-)(-PROMPT-)(-EXECUTE-)
(-GO-TO-GL-)B

```
----------------------------- Page 4 of Glossary -----------------------------

(B)

(-GL-)a
(-GL-)c
(-GO-TO-GL-)B

----------------------------- Page 5 of Glossary -----------------------------

(a)
 (-EXECUTE-)Test Document(-EXECUTE-)
This is a test.  This is only a test.(-RETURN-)
(-GO-TO-PAGE-)(-NORTH-)(-COPY-)(-GO-TO-PAGE-)(-SOUTH-)(-EXECUTE-)(-EXECUTE-)
(-GO-TO-PAGE-)(-NORTH-)(-COPY-)(-GO-TO-PAGE-)(-SOUTH-)(-EXECUTE-)(-EXECUTE-)
(-GO-TO-PAGE-)(-NORTH-)(-COPY-)(-GO-TO-PAGE-)(-SOUTH-)(-EXECUTE-)(-EXECUTE-)
(-GO-TO-PAGE-)(-NORTH-)(-COPY-)(-GO-TO-PAGE-)(-SOUTH-)(-EXECUTE-)(-EXECUTE-)
(-GO-TO-PAGE-)(-NORTH-)(-COPY-)(-GO-TO-PAGE-)(-SOUTH-)(-EXECUTE-)(-EXECUTE-)
(-GO-TO-PAGE-)(-SOUTH-)(-PAGE-)
(-GO-TO-PAGE-)1(-EXECUTE-)(-COPY-)(-GO-TO-PAGE-)99(-EXECUTE-)(-EXECUTE-)(-EXECUT
E-)
(-GO-TO-PAGE-)1(-EXECUTE-)(-SEARCH-)test(-CANCEL-)
(-GLOBL-REPLC-)(-EAST-)(-EAST-)(-EAST-)(-EXECUTE-)
TEST OF REPLACE(-EXECUTE-)(-GLOBL-REPLC-)
(-GO-TO-PAGE-)1(-EXECUTE-)
(-SOUTH-)(-SOUTH-)(-SOUTH-)(-SOUTH-)(-SOUTH-)
(-DELETE-)(-SOUTH-)(-SOUTH-)(-SOUTH-)(-SOUTH-)(-SOUTH-)(-RETURN-)(-EXECUTE-)
(-INSERT-)
This is a test INSERT(-RETURN-)
This is a test INSERT(-RETURN-)
This is a test INSERT(-RETURN-)
This is a test INSERT(-RETURN-)
This is a test INSERT(-RETURN-)
(-EXECUTE-)
(-CANCEL-)(-EXECUTE-)

----------------------------- Page 6 of Glossary -----------------------------

(b)

      (-EXECUTE-)
  (-EXECUTE-)(-EXECUTE-)(-EXECUTE-)(-EXECUTE-)(-EXECUTE-)
   (-EXECUTE-)(-EXECUTE-)(-EXECUTE-)(-EXECUTE-)
     (-EXECUTE-)(-EXECUTE-)(-EXECUTE-)(-EXECUTE-)
    (-EXECUTE-)(-EXECUTE-)(-EXECUTE-)
(-CANCEL-)

----------------------------- Page 7 of Glossary -----------------------------

(c)

      (-EXECUTE-)
    (-EXECUTE-)(-EXECUTE-)(-EXECUTE-)
(-CANCEL-)
```

APPENDIX
G
ILLUSTRATED
PARTS
BREAKDOWN

APPENDIX G

ILLUSTRATED PARTS BREAKDOWN

The Illustrated Parts Breakdown for the OIS 140/145 Master Unit is presented in this appendix as follows:

TABLE G-1 IPB INDEX

DESCRIPTION	ILLUSTRATION	PARTS LIST
Master Unit Overview	Figure G-1	-------
Rear Panel Assembly	Figure G-2	Table G-2
Frames Assembly	Figure G-3	Table G-3
Rack-Mounted Sub Assembly	Figure G-4	Table G-4
Control Panel Assembly	Figure G-5	Table G-5
Motherboard Assembly	Figure G-6	Table G-6
Chassis Assembly	Figure G-7	Table G-7

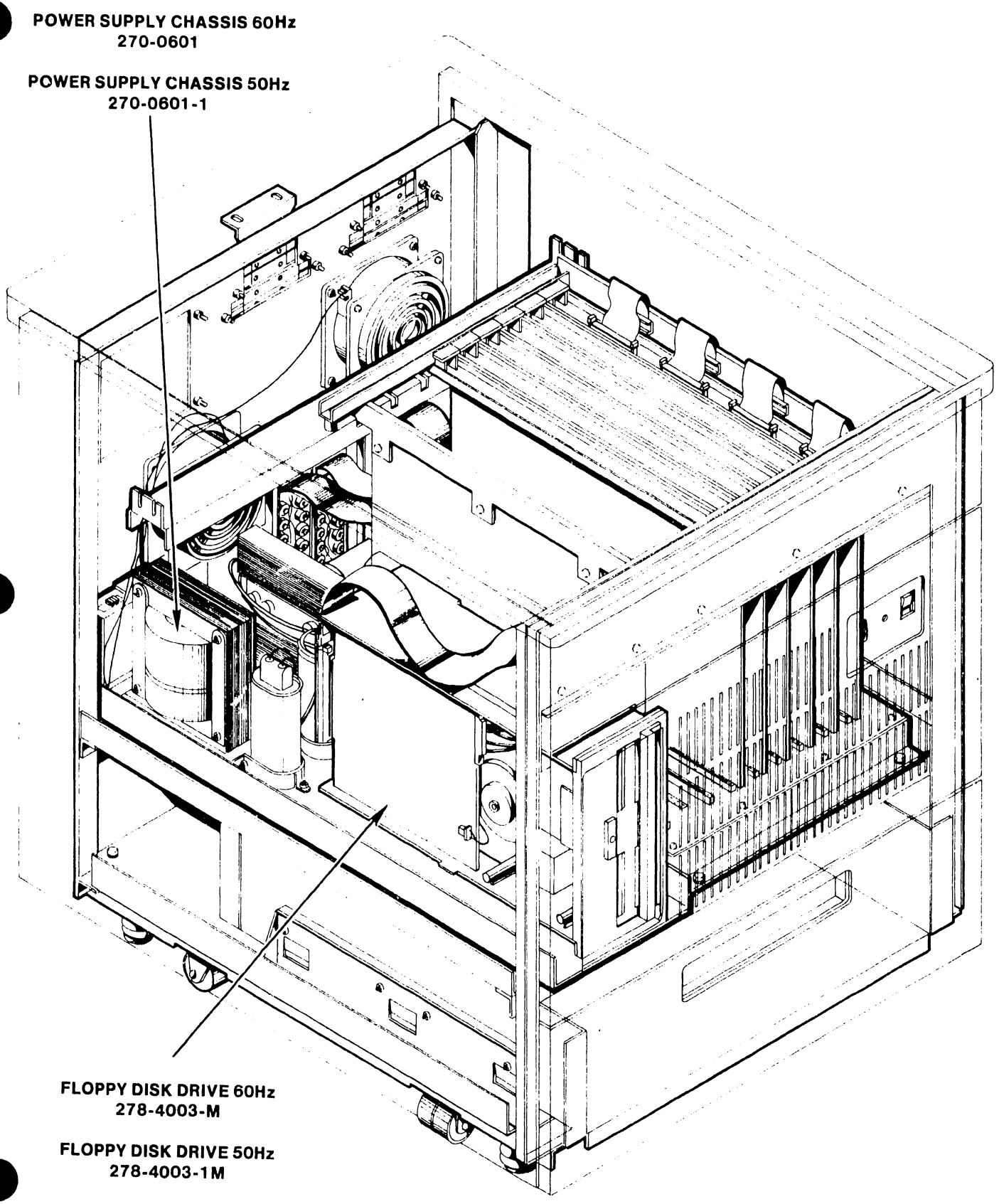


FIGURE G-1 MASTER UNIT OVERVIEW

TABLE G-2 REAR PANEL ASSEMBLY

ITEM		PART NO.	DESCRIPTION
1		451-2277	REAR PANEL COVER
2		458-0784	WIDE CABLE CLAMP RETAINER
3		458-0782	WIDE RIBBON RETAINER
4		458-0785	CABLE CLAMP RETAINER
5		458-0783	NARROW RIBBON RETAINER
6	*	458-0787	NARROW CABLE CLAMP GROUND STRAP
7	*	458-0786	WIDE CABLE CLAMP GROUND STRAP
8	*	400-1003	TUBEAXIAL FAN
9	*	449-0101	FAN GUARD
10	*	652-0032	6-32 LOCK-NUT KEPS
11	*	650-3160	6-32 1/2 PAN HD PHILP SCREW
12	*	279-0358	SERIAL CONNECTOR PLATE ASSY
13	*	452-2618	CLAMP, CABLE
14	*	654-1011	GROUND LUG, 3/8 INCH
15	*	350-1036	BNC BULKHEAD CONNECTOR
16	*	350-2078	TNC BULKHEAD CONNECTOR
17		451-2290	COVER PLATE, REAR
18	*	650-4240	8-32 x 3/4 PAN HD. PHIL SCREW

* Indicates Part Is Stocked

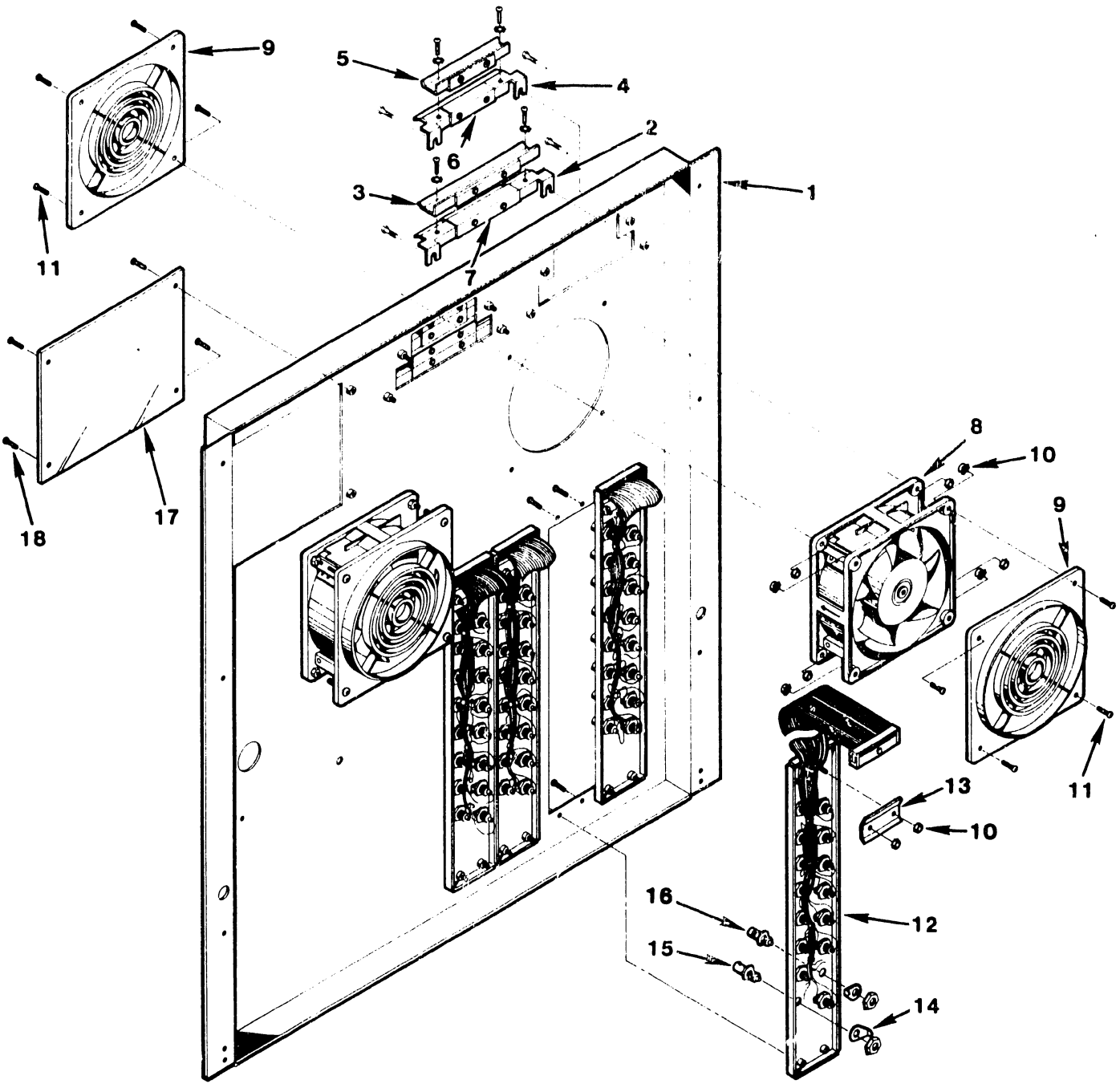


FIGURE G-2 REAR PANEL ASSEMBLY

TABLE G-3 FRAMES ASSEMBLY

ITEM		PART NO.	DESCRIPTION
1		451-2277	REAR PANEL COVER
2	*	451-0144	TABLE TOP
3		451-4874	BRACKET GUIDE, TOP
4	*	650-3160	6-32 X 1/2 PAN HD. EL. SCREW
5		451-4872	BRACKET LOCATOR, TOP
6		452-2628	FACE PLATE CLAMP
7		651-4120	8-32 X 3/8 PAN HD. PHIL. SCREW
8		451-4871	REAR FACE PLATE GUIDE
9		478-0571	SPACER, FACE PLATE
10		452-2629	STUD, FACE PLATE CLAMP
11		451-3089	FRONT PANEL (TOP)
12		458-0749	RH SIDE WELDMENT
13		451-4882	BRACKET DAGGER, RH
14		451-3091	FRONT PANEL (MIDDLE)
15		451-3093	FRONT PANEL (BOTTOM)
16	*	652-0032	6-32 LOCK-NUT KEPS
17		451-4881	BRACKET DAGGER, LH
18		458-0750	LH SIDE WELDMENT
19	*	400-1003	TUBEAXIAL FAN
20		451-4873	BRACKET STOP, TOP

* Indicates Part Is Stocked

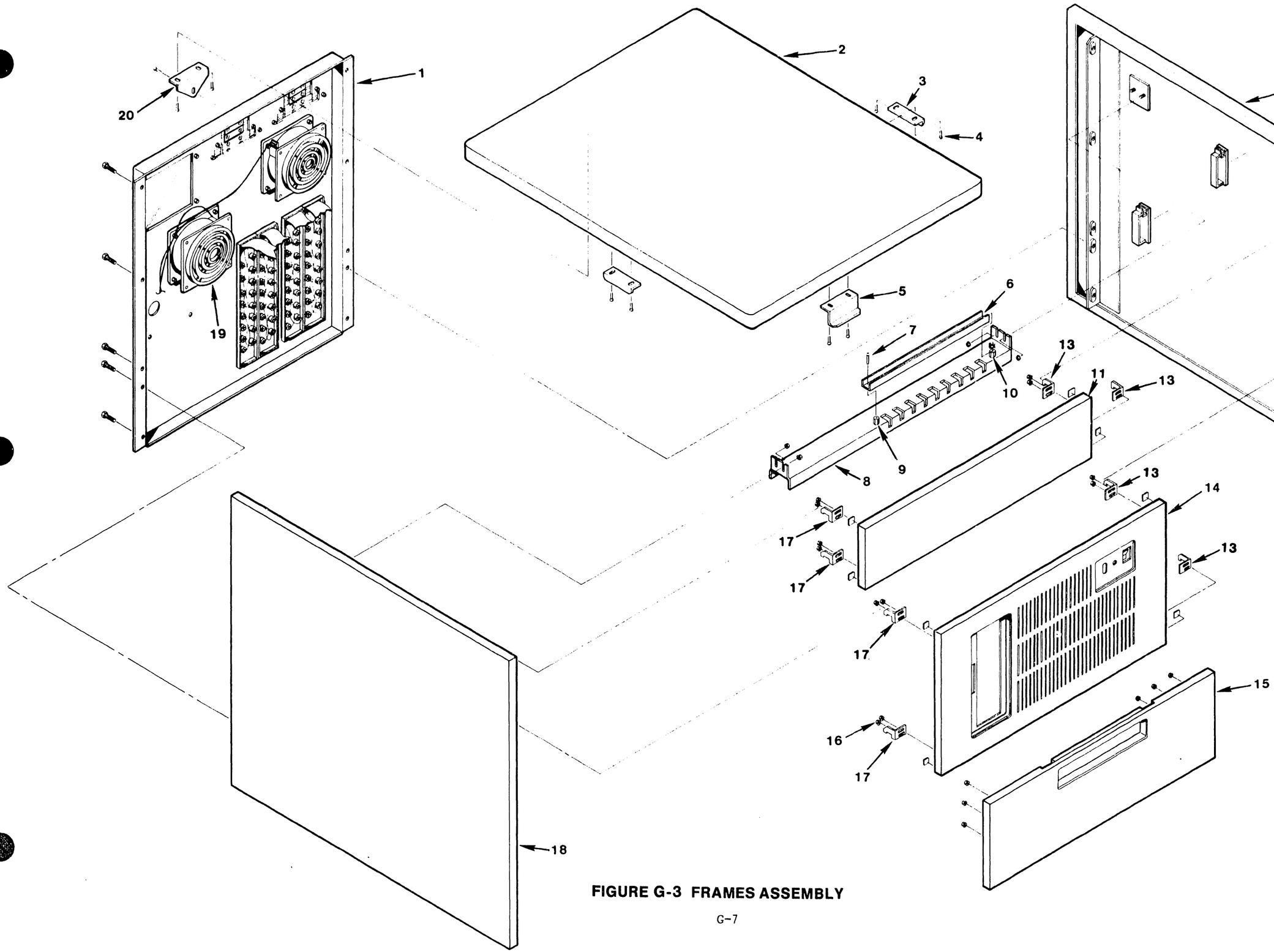


FIGURE G-3 FRAMES ASSEMBLY

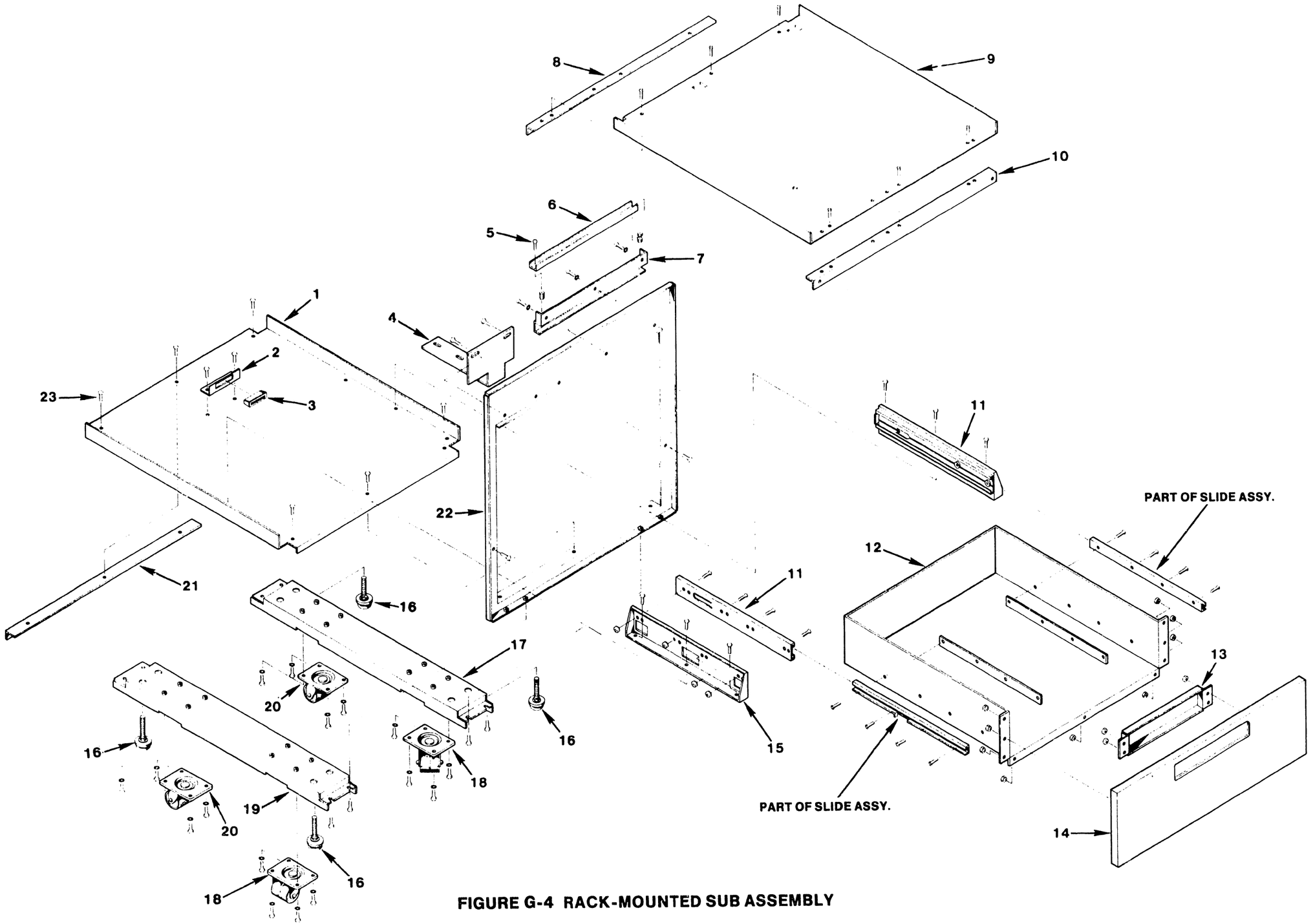


FIGURE G-4 RACK-MOUNTED SUB ASSEMBLY

TABLE G-4 RACK MOUNTED SUB-ASSEMBLY

ITEM		PART NO.	DESCRIPTION
1		458-0752	CABINET BOTTOM WELDMENT
2		451-4561	MAGNET CATCH BRACKET
3		655-0017	MAGNET CATCH
4		451-4885	FLOPPY SUPPORT BRACKET
5	*	650-3160	6-32 X 1/2 PAN HD. PHIL SCREW
6		452-2628	FACE PLATE CLAMP
7		451-4875	FRONT FACE PLATE GUIDE
8		451-4883	REAR BRACKET
9		458-0754	MOTHERBOARD FRAME WELDMENT
10		451-4870	FRONT BRACKET
11		451-1947	SLIDE ASSEMBLY
12		451-6000	DRAWER
13		451-2273	COVER, DRAWER OPENING
14		451-3093	FRONT PANEL (BOTTOM)
15		451-4878	SLIDE BRACKET
16	*	655-0016	LEVELING GUIDES
17		451-4880	BRACKET LEVELER, R.H.
18	*	655-0020	SWIVEL CASTOR
19		451-4879	BRACKET LEVELER, L.H.
20		655-0190	NONSWIVEL CASTOR
21		451-4877	BOTTOM REAR BRACKET
22		458-0748	FRONT SUPPORT
23		650-9024	SCRS/16-18 3/4 HEX HD SCREW

* Indicates Part Is Stocked

TABLE G-5 CONTROL PANEL ASSEMBLY

ITEM		PART NO.	DESCRIPTION
---	*	270-0605	OIS 140 FRONT CONTROL PANEL ASSY
1	*	210-7518	PCA 140 FRONT PANEL BOARD
2	*	325-0009	SPDT TOGGLE SWITCH
3		325-3094	RESET PUSH BUTTON
4	*	370-0031	RED RECTANGULAR LED CM4-264
5		451-2278	SWITCH COVER
6	*	652-2005	4-40 LOCK-NUT KEPS
7	*	462-0274	SPACER, 6-32
8		451-4876	CONTROL PANEL BRACKET WELDMENT
9	*	325-0021	ROCKER SWITCH, SPST
10	*	451-3092	FRONT PANEL SILK SCREEN
11		220-1382	FRONT PANEL SWITCH CABLE ASSY
12	*	650-3080	6-32 x 1/4 PAN HD. PHIL. SCREW
13	*	653-3000	WASHER
14	*	451-3091	FRONT PANEL (MIDDLE)
15	*	220-3020	14 PIN RIBBON CABLE
16		451-3090	FRONT PANEL FLOPPY WELDMENT

* Indicates Part Is Stocked

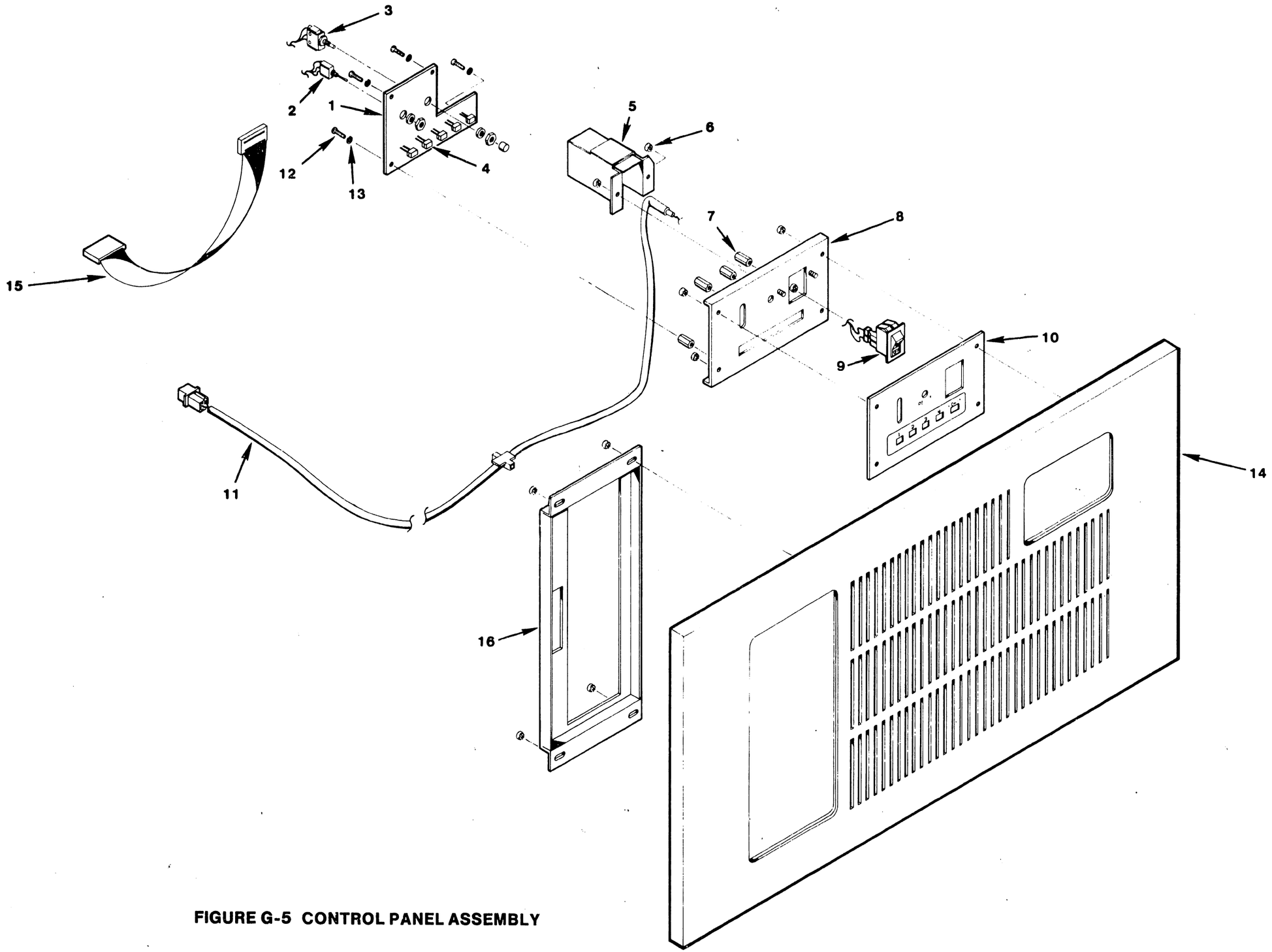


FIGURE G-5 CONTROL PANEL ASSEMBLY

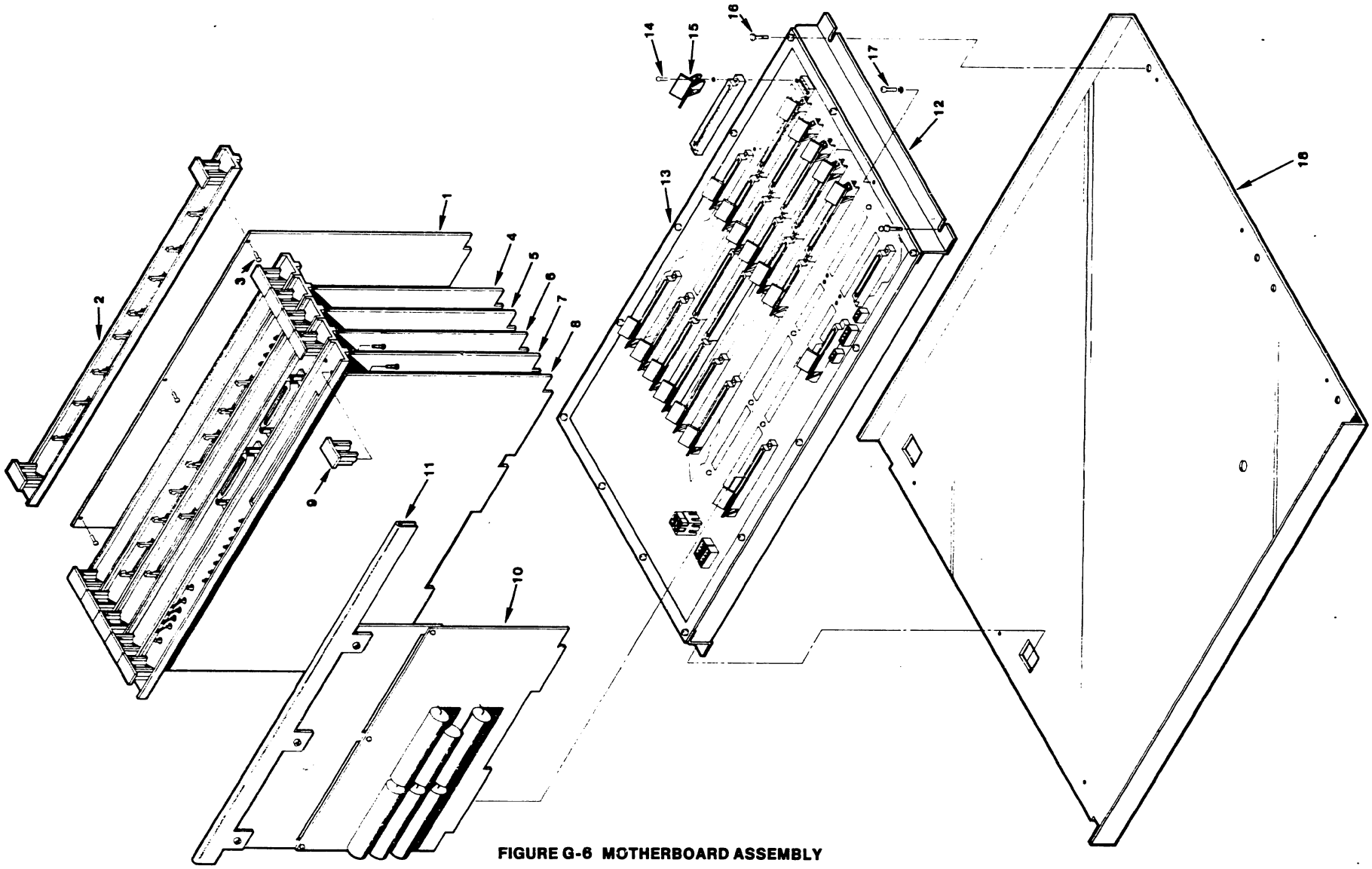


FIGURE G-6 MOTHERBOARD ASSEMBLY

TABLE G-6 MOTHERBOARD ASSEMBLY

ITEM		PART NO.	DESCRIPTION
1	*	210-7504-A	PCA DATA BUFFER
2		452-2095-23	FACE PLATE, 7504 BOARD
3	*	650-2120	4-40 X 3/8 PAN HD SCREW
4	*	210-7503	PCA DATA LINK CONTROL
5	*	210-7506	PCA CMD/SMD CONTROLLER "B"
6	*	210-7505	PCA CMD/SMD CONTROLLER "A"
7	*	210-7502	PCA 10 MEG/FLOPPY CONTROLLER
8	*	210-7501-A	PCA CPU & MEMORY
9		449-0247	FACE PLATE HANDLE
10	*	210-7508	PCA 140 REGULATOR
11		452-2095-40	REGULATOR FACE PLATE
12	*	270-0599	MOTHERBOARD CHASSIS ASSY
13	*	210-7507	PCA MOTHERBOARD
14	*	650-2200	4-40 X 5/8 PAN HD PHIL SCREW
15	*	449-0253	PC CARD GUIDE
16		652-0053	1/4 X 7/16 HEX NUT HD SCREW
17	*	650-3120	6-32 X 3/8 PAN HD PHIL SCREW
18		458-0754	MOTHERBOARD FRAME WLDMT

* Indicates Part Is Stocked

TABLE G-7 CHASSIS ASSEMBLY

ITEM		PART NO.	DESCRIPTION
1	*	270-0601	POWER SUPPLY CHASSIS ASSY 60 HZ
	*	270-0601-1	POWER SUPPLY CHASSIS ASSY 50 HZ
2		420-1022	AC CORD
3		654-1214	GROMMET, HEYCO 6P3-4
4	*	380-5001	VARISTOR, 250V
5	*	410-2005	LINE FILTER
6		300-9024	CAPACITOR BOOT
7	*	300-3203	CAPACITOR, 4 UF, 660 VAC
8		300-9026	CAPACITOR CLAMP, OVAL
9	*	300-3087	CAPACITOR, 161K UF 10V
10	*	300-9006	CAPACITOR CLAMP, 2 1/2 INCH.
11	*	270-0600	HEATSINK ASSEMBLY
12		270-3149	HEATSINK HARNESS ASSY
13		220-1365	115 VAC CABLE
14		420-1021	FLOPPY DISK POWER CORD ASSY
15		451-2274	FILTER COVER
16	*	420-1005	ROTRON FAN CORD
17	*	360-9002	HEX NUT
18	*	360-9003	LOCK WASHER
19	*	360-0000	FUSE HOLDER
20	*	360-1040-SB	4.0 AMP FUSE, 3AG, SB (125 VAC PWR)
		360-1031-SB	3.0 AMP FUSE, 3AG, SB (250 VAC PWR)
21		270-3150	TRANSFORMER/HARNESS ASSY 60 HZ
		270-3151	TRANSFORMER/HARNESS ASSY 50 HZ
22	*	220-3011	FLOPPY DISK CABLE ASSY
23	*	278-4003-M	FLOPPY DISK DRIVE ASSY, 60 HZ
		278-4003-1M	FLOPPY DISK DRIVE ASSY, 50 HZ
24		458-0754	MOTHERBOARD FRAME WELDMENT

* Indicates Part Is Stocked

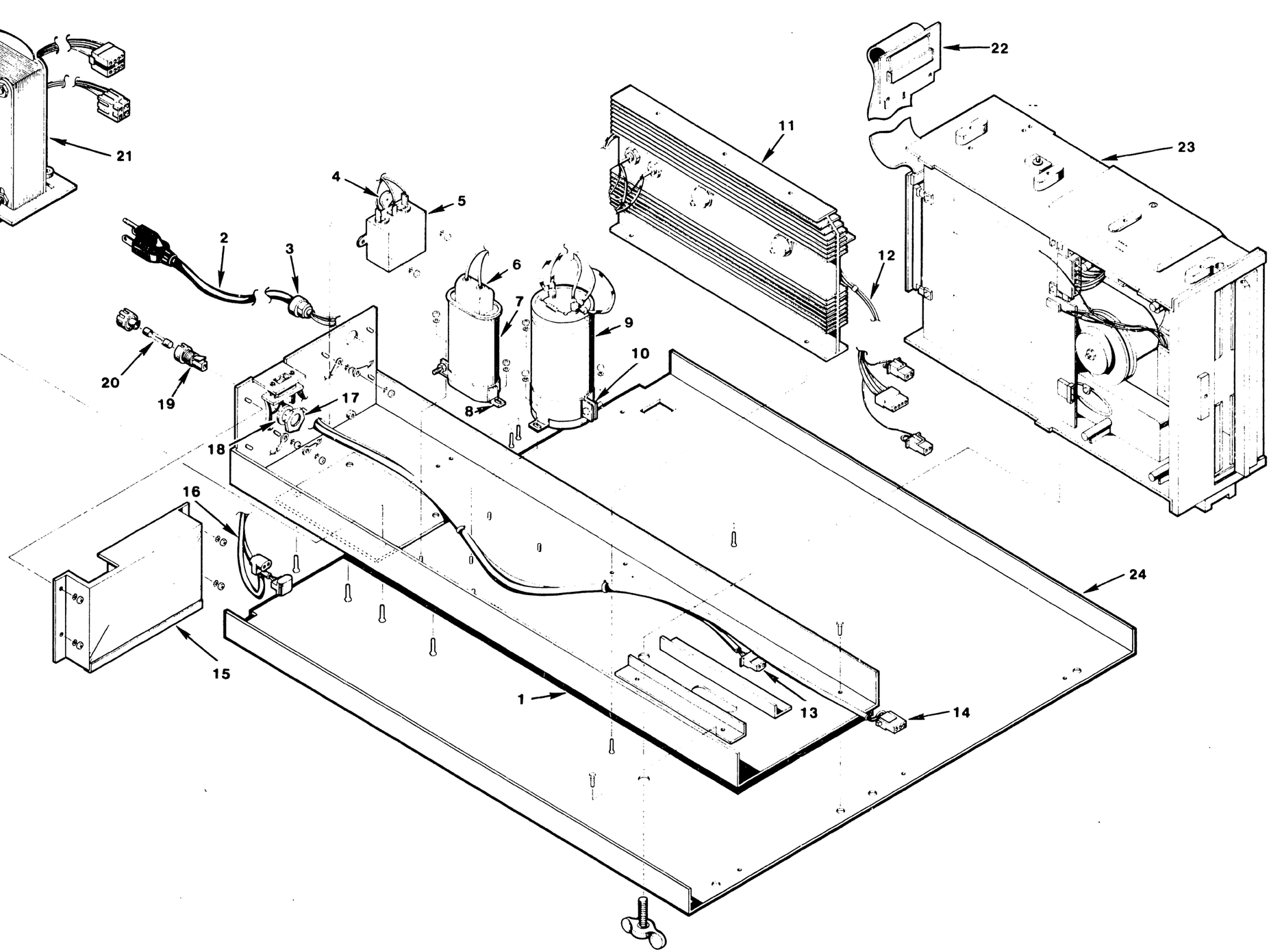


FIGURE G-7 CHASSIS ASSEMBLY

APPENDIX H SCHE-MATICS

APPENDIX H

SCHEMATICS

This appendix provides electrical schematics for the following printed circuit boards:

WLI #	DESCRIPTION	# PAGES
210-7501	CPU/MEMORY	6
210-7502	10 MEG/FLOPPY CONTROLLER	6
210-7503	DATA LINK CONTROLLER	8
210-7504	DATA BUFFER	7
210-7505	CMD/SMD CONTROLLER "A"	6
210-7506	CMD/SMD CONTROLLER "B"	8
210-7507	MOTHERBOARD	4
210-7507-900	INTERCONNECTION DIAGRAM	1
210-7508	POWER SUPPLY REGULATOR	3
210-7684	128K EXTENDED MEM CPU	9
210-7685	128K EXTENDED MEM DAUGHTER	4

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DO NOT SCALE

L92 Z80ACPU

* HAND WIRED PER ECN# 14794.

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY	DATE
	DWN ALB 11-11	10-79	E ENGR	
	CHK		M ENGR	
			MFG ENGR	
MATERIAL	MODEL NO. 140	TITLE: CPU AND MEMORY		
	SEE ENGRG SPECIFICATIONS No.			
FINISH	TOL EX AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH	SEE CHART	D	7501	21
	SCALE	SHT 1 OF 6	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

REVISION — SEE SHEET 6

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DO NOT SCALE

MI (1D7)

PARIN 71

PARIN (4B4)

(1P2) BK3 (1E2) IEO

(1E3) RD

IOR (1C7)

+5VR

R67 2.2K

R68 2.2K

R59 2.2K

L75 L78 L79 7425

L78 7474

L104 7411

CL1 (2C7) CL2 (2E7) CL3 (2C7) CL4 (2D7) CL5 (2D7) CL6 (2D7) CL7 (2C7) CL8 (2C7)

L11C L1K L11K L11C L11B L11B L11B L11B 7408

C159 C165 C155 C156 C158 C157 C160 C161 47 PF

L104 L70 L84 L94 L108 7474

RG6 R77 R83 R82 R79 R78 R88 R89 2.2K

CUBSV (U4) DLNB (T4) SCSM#1 (16A) SCSM#2 (17A) SCSM#3 (18A) SCSM#4 (V4) SCNDA#1 (15A) SCNDA#2 (5A)

L81 7404

L113 74125

SET INT (1C3)

MREQ

L80 7408

L97 74S244

L96 74148

L98 7442

CL (2611) CL2 (2F11) CL3 (2E11) CL4 (2E11) CL5 (2D11) CL6 (2C11) CL7 (C11) CL8 (2B11)

R90 2.2K

L95 74S244

D4 D6 D7 D0 D3 D2 D1

OC

±0V

L14 7408

L15 7474

OCO9 (1D4)

L67 74S280

D0 D1 D2 D3 D4 D5 D6 D7

L65 7432

L33 74125

R75 2.2K

CARRY (4F11)

RTN1AB (1D7)

MREQ (2B7)

L74 7409

L31 7408

OCOE (1C4)

OCOE (1D4)

L33 74125

PAROUT (4B8)

DSD (W4) DSC (R4)

R43 2.2K

R44 2.2K

ME (1F11)

MR (1B10)

L80 7408

(1D4) OCO7

OCO5 (1D4)

SW2

L69 74LS244

L68 74LS240

SW1

R38 2.2K R39 2.2K R40 2.2K

R41 2.2K R42 2.2K

WDI (4C4)

OCO4 (1D4)

D-BUS (1A5) (4D4) (4B7)

R30 R31 R32 R33 R34 R35 R36 R37 2.2K

SW8 DPB PUSH BUTTON

SW6 (DS1) SW5 (DS2) SW4 (DS3) SW3 (DS4)

R91 2.2K

L17 74367

OCOC (1C4)

L75 74S04

(1E2) REFSH (1C7) M1 (1D1) ΦA1

L13 74S11

L12 7474

R93 2.2K

MREQ (1A9)

MREQ (4B8)

M1 WAIT (1F11)

R92 2.2K

DEVO (1C5)

L30 7450B

L64 74S02

MMIO (1B5) ΦA (1C1)

L48 7474

R72 2.2K

MMI/OWAIT (1G11)

TEST POINT LUGS

R102 R101 R100 R97 R99 4.7K R130 220Ω R103 4.7K

+5VR1 -5V +12V -12V +24V ±0V ΦV (1B1) +5VR2

OCOD (1C4)

L51 7404

AUTO RESET (1D11)

L34 7432

L18 74LS373

R110 R109 R108 R107 R106 R105 R104 R103 150Ω (8 PW)

E-REV 3

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
MATERIAL	MODEL NO. 140 SEE ENGRG. SPECIFICATIONS	DWN MPM	10-79	E ENGR	
		CHK		M ENGR	
				MFG ENGR	
FINISH	TOL EX AS NOTED .XX ± .XXX ± FRAC ± ANG ± FINISH √	TITLE CPU AND MEMORY			
	SCALE SHT 2 OF 6	SEE CHART	D	7501	21
		WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

7501

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DO NOT SCALE

D8MI(9A8) D7MI(9A7) D6MI(9A7) D5MI(9A7) D4MI(9A7) D3MI(9A7) D2MI(9A7) D1MI(9A7) D0MI(9A7)

(1G1) A0:A15

74S04 L75

A15 A12 A13 A14 ±0V

L63 74S138 → (1D7) PROM(4B9)

74S30 L62 74S00 L10 R111 56Ω 5%

74S30 L45 74S00 L10 R112 56Ω 5%

L46 74S138

74S20 L29

74S30 L11 74S00 L10 R113 56Ω 5%

RFSH (1C7)

RAS(4F7) 74S00 L10 R114 56Ω 5%

A0 A7 A1 A8 A2 A9 A3 A10 ±0V

L44 74S157 R118 A0/7M R119 A1/8M R120 A2/9M R117 A3/10M 22Ω(4)

BK4 (4EG)

A4 A11 A5 A12 A6 A13 ±0V

L61 74S157 R19 A4/11M R15 A5/12M R20 A6/13M 22Ω(3)

WRITE (4F5)

CAS 4E7

L1 L2 L3 L4 L5 L6 L7 L8 L9

L19 L20 L21 L22 L23 L24 L25 L26 L27

L35 L36 L37 L38 L39 L40 L41 L42 L43

L52 L53 L54 L55 L56 L57 L58 L59 L60

A0 A1 A2 A3 A4 A5 A6 DIN DO RAS WRITE CAS VDD VBB VCC VSS

C90 C91 C92 C93 C94 C95 C96 C97 C98 C99 C100 C101 C102 C103 C104 C105 C106 C107

C108 C109 C110 C111 C112 C113 C114 C115 C116 C117 C118 C119 C120 C121 C122 C123 C124 C125 C126

C127 C128 C129 C130 C131 C132 C133 C134 C135 C136 C137 C138 C139 C140 C141 C142 C143 C144

C145 C146 C147 C148 C149 C150 C151 C152 C153

±0V +12V -5V +5VR

D8MO D7MO D6MO D5MO D4MO D3MO D2MO D1MO D0MO

D0MO - D8MO (4A5)

REVISION SEE SHEET 6

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY	DATE
DWN ADM	10-79		E ENGR	
CHK			M ENGR	
MATERIAL	MODEL NO. 140		MFG ENGR	
FINISH	SEE ENGRG SPECIFICATIONS No.	TITLE CPU AND MEMORY		
	TOL EX AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √	SCALE	SHT 3 OF 6	
	SEE CHART	D	7501	21
	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

D 7501

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DO NOT SCALE

TP1

+5VR R61 2.2K

74S02 L64 L76

74S32 L90

74S08 L89

L77 74S74

L47 7474

R73 2.2K +5VR

R71 2.2K +5VR

DMAMREQ

M1 (1E2)

MREQ(2B6)

CRQAK (1D5) (2F5)

74S11 L13

RFSH (1C7)

RAS (3D10)

R95 2.2K +5VR

L26 74S74

R116 22Ω 5%

WRITE (3B8)

$\overline{A_1}$ (1D1)

L31 L30 74S08

74S08 L30

74S32 L90

74S11 L13

ϕ_2 4MHZ $\overline{\phi_A}$

ϕ_1½(1B4)

L28 74S74

R115 22Ω 5%

CAS (3B8)

L12 74S74

(3C10)BK4

74S08 L31

L74 7404

ϕ_2(1B1) $\overline{\phi_A}$(1C1)

R94 2.2K +5VR

L51 7404

C89 .01μF

NE555 L33A

R131 33M

R127 5.6M

C88 .1μF MYLAR

PWR LED

CBURST (1C11)

BUSAK (1A9)

74S08 L64

74S00 L76

74S08 L89

74S32 L90

74S08 L89

L74 7404

$\overline{\phi_2}$(1B2)

RD(1A8)

(1A9) MREQ

74S00 L76

PROM (3F10)

74S32 L86

PROM (1D7)

74125 L85

74S20 L88

CRQAK (1E4)

CRQAK (12)

ST DATA (N1)

(2F1) PAR OUT

D-BUS (2E1) (1A7)

LS244 L71

R17 56Ω 5%

D0MI (3G7)

R15 R13 R11 R9 R10 R12 R19 R16 56Ω (8) 5%

D0MI (3G11) D1MI (3G2) D2MI (3G9) D3MI (3G4) D4MI (3G5) D5MI (3G3) D6MI (3G6) D7MI (3G7)

D7MI D6MI D5MI D4MI D3MI D2MI D1MI D0MI

LS373 L72

R8 R7 R6 R5 R4 R3 R2 R1 10K (8) +5VR

D0MI-D7MI (3A9)

L87

74125 L85

PAR IN(2G8)

R21 10K +5VR

L50A/S174

$\overline{MR}$ (1B10)

OCOB (1C3)

WDI (2D2)

H+ P+ 13+ 14+

$\overline{FPL_4}$ $\overline{FPL_3}$ $\overline{FPL_2}$ $\overline{FPL_1}$

SEE SHEET 6

REVISION

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN ADMcDuffie	10-79	E ENGR	
		CHK		M ENGR	
MATERIAL	MODEL NO. 140			MFG ENGR	
	SEE ENGRG SPECIFICATIONS No.	TITLE	CPU AND MEMORY		
FINISH	TOL ES AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √	SEE CHART	D	750'	21
	SCALE SHT 4 OF 6	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

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DO NOT SCALE

LED7 LED6 LED5 LED4 LED3 LED2 LED1 LED0

RESTART SW7 SW3 SW4 SW5 SW6 SW8 DPB

32 +24V -12V +12V -5V +5V1 +5V2 GND

7501 R3

SPARE L33A

SPARE L88A

SW2 SW1

Y1

Q1

L1 L2 L3 L4 L5 L6 L7 L8 L9 L10 L11 L12 L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27 L28 L29 L30 L31 L32 L33 L34 L35 L36 L37 L38 L39 L40 L41 L42 L43 L44 L45 L46 L47 L48 L49 L50 L50A L51 L52 L53 L54 L55 L56 L57 L58 L59 L60 L61 L62 L63 L64 L65 L66 L67 L68 L69 L70 L71 L72 L73 L74 L75 L76 L77 L78 L79 L80 L81 L82 L83 L84 L85 L86 L87 L88 L89 L90 L91 L92 L93 L94 L95 L96 L97 L98 L99 L100 L101 L102 L103 L104 L105 L106 L107 L108 L109 L110 L111 L112 L113 L114 L115 L116 L117 L118 L119 L120

C1 C2 C3 C4 C5 C6 C7 C8 C79 C80 C81 C82 C83 C78

R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17

R97 R98

REVISION	BY	DATE
SEE SH 6		

	BY	DATE	APPROVED BY	DATE
	DWN/M Manville	10/79	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL	MODEL NO. 140	TITLE CPU AND MEMORY	
	SEE ENGRG SPECIFICATIONS No.		
FINISH	TOL ER AS NOTED XX ± FRAC ± XXX ± ANG ± FINISH √	SEE CHART	D 7501 21
	SCALE NF SHT 5 OF 6	WANG PART NUMBER	SIZE DRAWING NUMBER REV

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COMPONENT	TYPE	W.L.I #
Q1	SPS6551	375-1050
SW1	SWITCH, 5 Pos.	325-1501
SW2	SWITCH, 8 Pos.	325-1503
SW3-6	SWITCH, TOG	325-0040
SW7,8	SWITCH, P.B.	325-0041

COMPONENT	TYPE	W.L.I #
R1-8,21-29,128	10K ¼W 10%	330-4010
R9-17,[illegible]-114	560Ω ¼W 5%	330-1057
R16-[illegible] 118-120 124	220Ω ¼W 5%	330-1023
[illegible] 86, 132	2.2K ¼W 10%	330-3022
R97-103	4.7K ¼W 10%	330-3047
R103-113	15KΩ ¼W 10%	330-2015
R121-123	330Ω ¼W 10%	330-2033
R125	1K ¼W 10%	330-3010
R126	12Ω ¼W 10%	330-1012
R127	5.6MΩ ¼W 10%	330-6056
R129	390Ω ¼W 10%	330-2039
R130	2.2KΩ ¼W 10%	330-2022
R131	3.3MΩ ¼W 10%	330-6033
C1-8,77-83	15uf 20V	300-4022
C9-76	.047UF, 50V	300-1966
C84-87,90-121,123-154,166	.1uF 50V	300-1930
C88	.1uf, 50V (M)	300-2213
C89	.01uF, 25V	300-1903
C155-161,165	47PF 500V	300-1047
C162	680PF 500V	300-1680
C163	18 PF, 500V	300-1018
C164	150PF 500V	300-1150
C167	3.3uf 15V (T)	300-4016
LED0-7	MV5024 (RED)	370-0026
Y1	15.9744 MHz	321-0022

LOCATION	TYPE	SPARE
L30	74S08	1
L33, L85	74125	2,1
L34, L65	7432	3,2
L48	74LS74	1
L49, L87	7474	2,1
L51	7407	3
L64	74S02	1
L75	74S04	2
L76, L117	74S00	2,1
L79	7425	1
L82	74S37	3
L83	7420	1
L88	74S20	1
L103	7408	1
L107	74S04	2
L112	7404	4
L114	74S11	2
L119	74S74	1
L120	7437	1

LOCATION	W.L. PART NO.	TYPE
L1-5,19-27,35-43,52-60	376-9002	16 PIN SKT
L16,100-102	376-9003	24 PIN SKT
L92	376-9011	40 PIN SKT
L94	376-9015	28 PIN SKT

LOCATION	W.L PART NO	TYPE
L1-9,19-27,35-43,52-60	SEE CHART	MK4116
L10,76,117	376-0228	74S00
L11,45,62	376-0198	74S30
L12,28,48,77,116,119	376-0202	74S74
L13,114	376-0237	74S11
L14,31,80,103,110,118	376-0081	7408
L15,47,70,78,89,108,109	376-0006	7474
L16	376-0090	74154
L17	376-0176	74367
L18,72,91	376-0310	74LS373
L29,88	376-0230	74S20
L30,89,107	376-0200	74S08
L32,66,79	376-0092	7425
L33,85,113	376-0324	74125
L33A	376-0126	NE555
L34,65,86	376-0093	7432
L44,61	376-0217	74S157
L46,63,99	376-0298	74S138
L49	376-0139	7414
L50	376-0003	7410
L50A	376-0247	74S174
L51,74,81,112	376-0010	7404
L64	376-0199	74S02
L67	376-0242	74LS280
L68,69	376-0297	74LS240
L71,73,93,95,105	376-0288	74LS244
L75	376-0197	74S04
L82	376-0296	74S37
L83	376-0004	7420
L87	376-0013	7475
L90	376-0205	74S32
L92	SEE CHART	Z80ACPU
L94	SEE CHART	Z80A-CTC
L96	376-0171	7414-B
L97	376-0286	74LS374
L98	376-0008	7442
L100-102	SEE CHART	2708
L104	376-0194	7411
L106	376-0285	74LS245
L111	376-0104	9602
L115	376-0045	74H04
L120	376-0068	7437

CONN 1

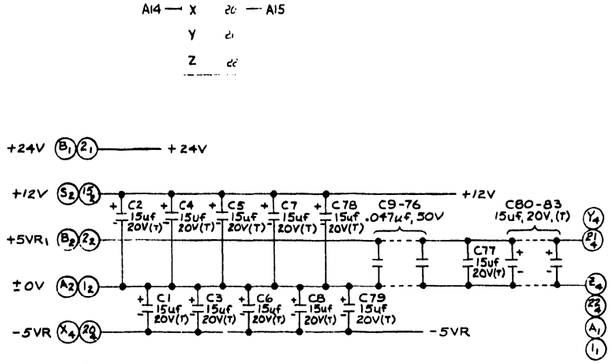
±0V	A 1	1	±0V
+24V	B 2	2	+24V
+5VR2	C 3	3	+5VR2
	D	4	
	E	5	— DLMMI/O
MMI/O	F	6	
PAROUT	H	7	— PARIN
	J	8	
	K	9	
	L	10	
	M	11	
STDATA	N	12	— CRQAK
A0	P	13	— A1
A2	R	14	— A3
A4	S	15	— A5
A6	T	16	— A7
A8	U	17	— A9
A10	V	18	— A11
A12	W	19	— A13
A14	X	20	— A15
	Y	21	
	Z	22	

CONN 8

±0V	A 1	1	±0V
+5VR1	B 2	2	+5VR1
D7	C 3	3	D8
D6	D 4	4	D1
D5	E 5	5	D2
D4	F 6	6	D3
	H 7	7	
CBUSRQ	J 8	8	
	K 9	9	
	L 10	10	
	M 11	11	
AUTO RESET	N 12	12	
DMAMREQ	P 13	13	— BUSAK
-12V	R 14	14	— -12V
+12V	S 15	15	— +12V

CONN 4

IORQ	A 1	1	— MREQ
WR	B 2	2	— RD0
RFSH	C 3	3	
M1	D 4	4	— MR
WAIT	E 5	5	
	F 6	6	
FPL4	H 7	7	
	J 8	8	
ΦC	K 9	9	
ΦAC	L 10	10	
½ ΦC	M 11	11	
	N 12	12	
FPL3	P 13	13	— FPL2
DSU	R 14	14	— FPL1
SCHDA2	S 15	15	— SCHDA1
DLNB	T 16	16	— SCSM1
CUBSY	U 17	17	— SCSM2
SCSM4	V 18	18	— SCSM3
DSD	W 19	19	— PWR LED
-5V	X 20	20	— -5V
+5VR	Y 21	21	— +5VR1
±0V	Z 22	22	— ±0V



MNEMONIC	COORD.
A0-A15	(1F1)
AUTO RESET	(1E11)
BUSAK	(1A9)
CBUSRQ	(1C11)
CRQAK	(4A11)
CUBSY	(4G11)
D0-D7	(1A7)
DLMMI/O	(1A5)
DLNB	(4F11)
DMAMREQ	(4G11)
DSD	(4G2)
DSU	(4G2)
FPL1-FPL4	(4B3)
ΦAC	(1C1)
ΦC	(1C1)
½ ΦC	(1C1)

MNEMONIC	COORD.
IORQ	(1A7)
M1	(1A8)
MMI/O	(1A5)
MR	(1A10)
MREQ	(1A9)
PARIN	(4G8)
PAROUT	(4F1)
PWR LED	(4E1)
RD0	(1A10)
RFSH	(1A8)
SCHDA1, SCHDA2	(4B11)
SCSM1-SCSM4	(4D11)
STDATA	(4A9)
WAIT	(1G11)
WR	(1A8)

REVISION	BY	DATE	NO.
ORIGD. PER DWR # 8595 APP	RLL	10-79	1
REVISED PER E/N 1ST APPD	RLL	10-79	2
REVISED PER ECO # 12776 APP.	RLL	10-79	3
REVISED PER ECO # 12767 APP.	RLL	10-79	4
REVISED ECN # 13072 APP'D: 3/1/80 ET	PEE	11-8-79	5/2
REVISED PER ECN'S # 13389 - 13390 APP'D: 3/11/80 TT	PEE	11-16-79	6/2
REVISED PER ECN # 13378 APP'D: 3/11/80 TT	PEE	12-12-79	7/2
REVISED PER ECN # 13054, 13355, 13953 APP'D: 3/5/80 RLL	PEE	2-23-80	8/2
REVISED PER ECN # 14126 APP'D: 3/12/80 RLL	PEE	3-12-80	9/2
REVISED PER ECN # 14238 APP'D: 3/12/80 RLL	PEE	4-30-80	9/3
REVISED PER ECN # 14790 APP'D: 3/12/80 RLL	PEE	4-30-80	9/4

REVISION	BY	DATE	NO.
REVISED PER ECN # 12776 APP.	RLL	10-79	1/3
REVISED PER ECO # 12767 APP.	RLL	10-79	1/3
REVISED PER ECN # 12701 APP.	RLL	10-79	2/3
REVISED PER ECO # 13057 APP'D: 3/11/80 RLL	PEE	12-7-79	1/4
REVISED PER ECO # 17057 APP'D: 3/11/80 RLL	PEE	5-23-80	1/5
REVISED PER ECN # 17427 APP'D: 6/27/80 RLL	PEE	6-27-80	1/6
REVISED PER ECN # 17790 APP'D: 7/31/80 RLL	PEE	7-31-80	1/7

210	209	L1-9,19-27,35-43,52-60	L92	L94	L100	L101	L102
7501-A	7501	377-0345	377-0368	377-0371	378-3048-R4	378-2666-R5	378-2667-R5
DATA LINK	7501	377-0345	——	377-0371	378-2492-R1	378-2493-R1	378-2494-R1
WAIT, DMA [illegible]	7501	377-0345	——	377-0371	378-2495-R1	378-2496-R1	378-2497-R1
[illegible] BOOTSTRAP	7501	377-0345	——	377-0371	378-3047-R5	378-[illegible]-R5	378-[illegible]-R5

210 = 209 + 378 or 377

E-REV 3

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
MATERIAL	MODEL NO 140	DWN Hewlett	10-79	E ENGR PEP	6/30/80
	SEE ENGRG SPECIFICATIONS No.	CHK RLL	10-79	M ENGR	
FINISH	TOL EX AS NOTED .XX ± .XXX ± ANG ± FINISH √	SCALE NONE	SHT 6 OF 6	MFG ENGR	
		TITLE CPU AND MEMORY			
		WANG PART NUMBER LEE-HART	SIZE D	DRAWING NUMBER 7501	REV 21

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF AND ARE PROPRIETARY TO, WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

DO NOT SCALE

WANG LABORATORIES INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN	8/21/77	E ENGR PEP	9/6/77
		CHK	10/11/77	M ENGR	
MATERIAL	MODEL NO. 140 SEE ENGRG SPECIFICATIONS No.			MFG ENGR	
		TITLE 10 MEG 5" FLOPPY CONTROLLER			
FINISH	TOL EX AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √	210-7502	D	7502	10
	SCALE NONE SHT 1 OF 6	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV.

D 7502

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF, AND ARE PROPRIETARY TO, WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

WANG LABORATORIES, INC.
LOWELL, MASS. U.S.A.

	BY	DATE	APPROVED BY	DATE
DWN			E ENGR P.E.P	
CHK	KUA	10/11/79	M ENGR	
			MFG ENGR	

MATERIAL

MODEL NO. 140

SEE ENGRG SPECIFICATIONS
No.

TITLE
[illegible]

FINISH

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH ✓

SCALE SHT 2 OF 6

WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
210-7502	D	7502	10

"SAID DRAWING AND THE DATA SHOWN THERE ON ARE THE CONFIDENTIAL PROPERTY OF, AND ARE PROPRIETARY TO, WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

DO NOT SCALE

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	
MATERIAL	MODEL NO. 140
	SEE ENGRG SPECIFICATIONS No.
FINISH	TOL EX AS NOTED XX ± FRAC ± XXX ± ANG ± FINISH √
SCALE	SHT 3 OF 6

	BY	DATE	APPROVED BY	DATE
DWN		8/	E ENGR PEP	11/
CHK		10/11/74	M ENGR	
			MFG ENGR	

TITLE: 10 MEG & FLOPPY CONTROLLER

210-7502 | D | 7502 | 10

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

REVISION

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF, AND ARE PROPRIETARY TO, WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

DO NOT SCALE

BCK(2C1)> RFD (2F8)

RSAC(2D3)

(31) HDRDG

BK10 (3A6)

INITE(3C4) (2G5)

INITE1(4D6)(3D9)(3E4)(3C6)

INITE3(3D8)(2C5)(4B9)

+0V

INITE (3C8)

SINK (3D1)

OC4C (1E9)

WTG(3E9)>

+0V

WCS(3E11)

BK13(3G10)>

BK18(3E7)(3C2)

RGA(3E4) (3F9)

C160 (2C3)

C160(2B3)>

RCS

RSA

TP2

RBL 2.2K +5IR

SSR(2F9)

DCC(2G5)(3E2)

ACK(2C1)>

WGA(3B5)>

WRGA(3G4)

DOS(3E6)(3C8)(2B8)

CISY

OC4B (1E9)

SPP(1E4)>

SPPD

INITE1(4F4)

DOS

BK11(3D6)(3D3)

C2208 (2B3)>

RCS

SD0-SD2(2G6)>

+5V

R83 2.2K

+5VR

R81 2.2K

*P3

R82 2.2K +5VR

C7 (2D4)>

SIE

SIE(3E7)(3D6)

SCD

EDBIB(2G6)(2A7)

BCK(2C1)>

BK6 (2C5)

SIE (3D8) (3C5) (3A5)

INITE3(4F4)>

CISY(3E5)

SHC

SHC(3F-)

DOS

C16(2C4)>

	BY	DATE	APPROVED BY	DATE
DWN	[illegible]	8/31/79	E ENGR P.E.P.	9/4/79
CHK	[illegible]	10/11/79	M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140

SEE ENGRG SPECIFICATIONS No.

FINISH

TOL EX AS NOTED

XX ± FRAC ± ANG ± FINISH √

SCALE — SHT 4 OF 6

TITLE 10 MEG 5¼ FLOPPY CONTROLLER

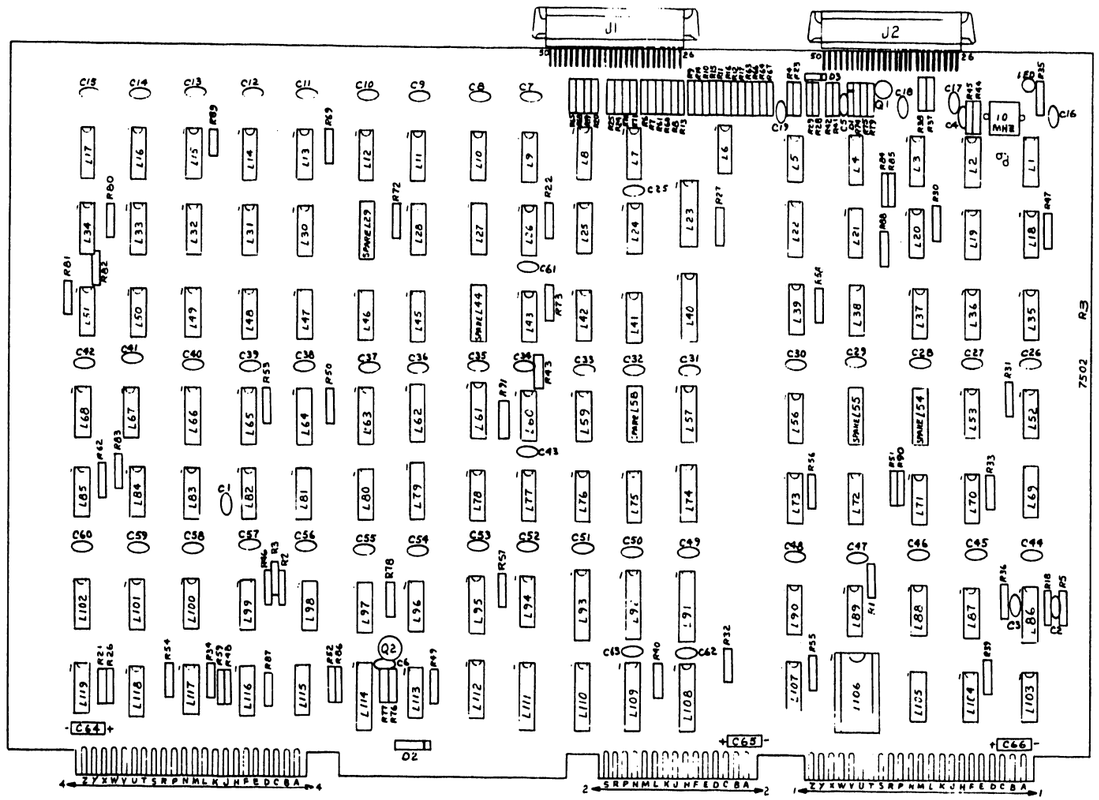
216-7502 | D | 1502 | 10

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

REVISION BY DATE NO

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF AND ARE PROPRIETARY TO, WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

DO NOT SCALE



COMPONENT LAYOUT

BY	DATE	APPROVED BY	DATE
DWN CK	8/31/79	E ENGR VEP	10/5/79
CHK WGK	9/11/79	M ENGR	
		MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140
SEE ENGRG SPECIFICATIONS
No.

FINISH

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH √
SCALE: 1/1 SHT 5 OF 6

TITLE 10MEG 5" FLOPPY CONTROLLER

210-7502 | D | 7502 | 10
WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

REVISION

NO.	BY
D	
C	
B	
A	

"THIS DRAWING AND THE DATA SHOWN THERE ON ARE THE CONFIDENTIAL PROPERTY OF AND ARE PROPRIETARY TO, WANG LABORATORIES INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

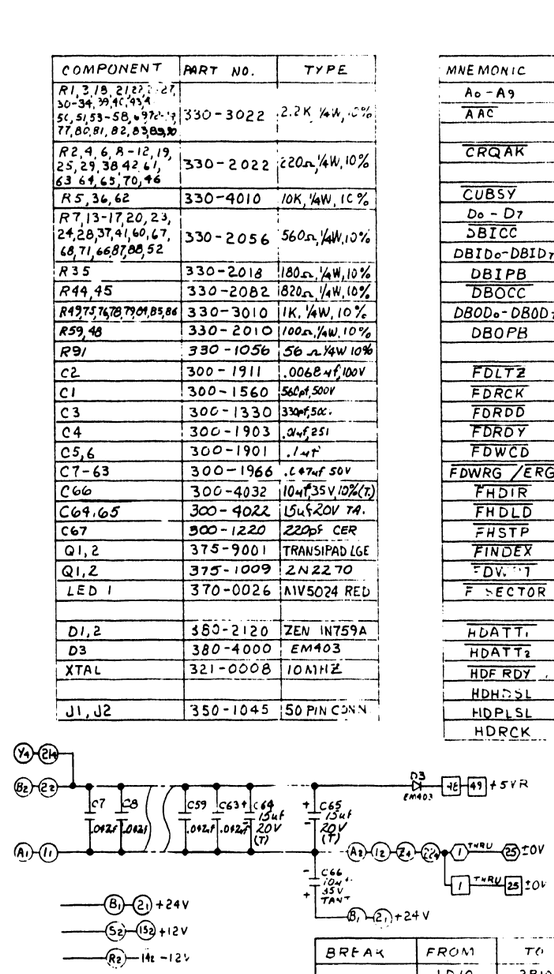
DO NOT SCALE

LOCATION	TYPE	PART NO.
L1,12,15,20,28,34,37,39,42,45,51,52,60,62,67,70,73,84,98,104,107,71	7474	376-0006
L2,10	74H04	376-0045
L3,5,8,9,24,25,118	7438	376-0128
L11,17,26,35,48,97,117	7400	376-0002
L6,30,47,49,77,80,101	7411	376-0194
L7,33,38,59,69,75,76,90,116,119	7432	376-0093
L13,32	7420	376-0004
L14,16, 27,36,43,53,68,72,78,81,82,87	7408	376-0081
L18,64,65,66	74161	376-0094
L19,50,100	7402	376-0016
L22,57,74	74175	376-0119
L23	74LS240	376-0297
L31,46,63,102	7410	376-0003
L40,92,110	74LS374	376-0286
L41	7493	376-0011
L56,105	74125	376-0324
L61	7442	376-0008
L91,93,109,111,114	74LS244	376-0288
L79	74367	376-0176
L83,88,103,99	7404	376-0010
L85	9401	376-0440
L86	9602	376-0104
L89	7425	376-0092
L94	74LS280	376-0242
L95,112	74195	376-0097
L96,113	8242	376-0040
L106	74154	376-0090
L108	74LS245	376-0285
L29	SPARE	
L44	SPARE	
L54	SPARE	
L55	SPARE	
L58	SPARE	
L21,115	7409	376-0085
L9	74132	376-0266

COMPONENT	PART NO.	TYPE
R1,3,18,21,22,27,30-34,39,40,43,54,55,51,53-58,96,97,76-78,80,81,82,83,89,90	330-3022	2.2K 1/4W, 10%
R2,4,6,8-12,19,25,29,38,42,61,63,64,65,70,96	330-2022	220Ω 1/4W, 10%
R5,36,62	330-4010	10K, 1/4W, 10%
R7,13-17,20,23,24,28,37,41,60,67,68,71,66,87,88,52	330-2056	560Ω 1/4W, 10%
R35	330-2018	180Ω, 1/4W, 10%
R44,45	330-2082	820Ω, 1/4W, 10%
R49,75,76,78,79,81,85,86	330-3010	1K, 1/4W, 10%
R59,48	330-2010	100Ω, 1/4W, 10%
R91	330-1056	56 Ω 1/4W 10%
C2	300-1911	.0068 mf, 100V
C1	300-1560	560pf, 50V
C3	300-1330	330pf, 50V.
C4	300-1903	.047 mf 25V
C5,6	300-1901	.1 mf
C7-63	300-1966	.047 mf 50V
C66	300-4032	10 mf 35V 10% (T)
C69,65	300-9022	15 uf 20V TA.
C67	300-1220	220pf CER
Q1,2	375-9001	TRANSIPAD LGE
Q1,2	375-1009	2N2270
LED 1	370-0026	MV5024 RED
D1,2	380-2120	ZEN IN759A
D3	380-4000	EM403
XTAL	321-0008	10 MHZ
J1, J2	350-1045	50 PIN CONN

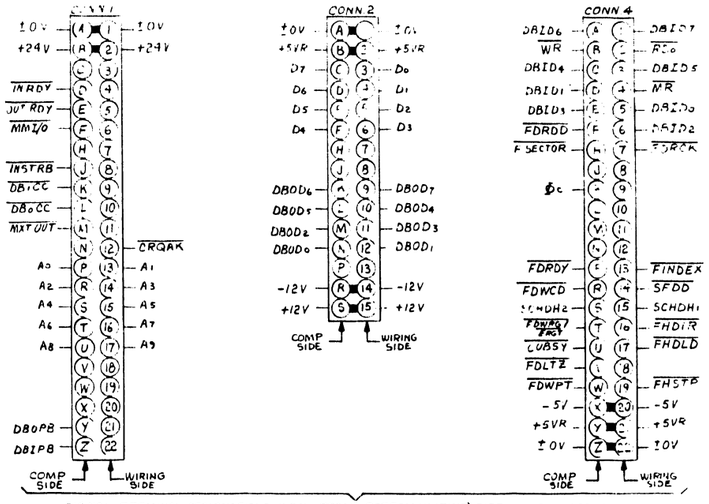
MNEMONIC	COORD.
A0 - A9	1F11
AAC	1D11
CRQAK	1F11
CUBSY	1A4
D0 - D7	1D11
SBICC	1A10
DBID0-DBID7	2A6
DBIPB	2A8
DBOCC	1A10
DBOD0-DBOD7	2D11
DBOPB	2B11
FDLT2	1G5
FDRCK	3G11
FDRDD	3F11
FDRDY	1G7
FDWCD	3D1
FDWRG/ERGT	3B1
FHDIR	1A7
FHDLD	1A7
FHSTP	1A7
FINDEX	3G
FDWPT	3G
F SECTOR	1G7
HDATT1	1A8
HDATT2	1A8
HDFRDY	1G6
HDHDSL	1C1
HDPLSL	1D1
HDRCK	3F11

MNEMONIC	COORD.
HDRDD	3F11
HDRSTR	1A7
HDRDG	4F1
HDSRW	1G6
HDST	1A7
HDT0 - HDT8	2G1
HDWCD	3D1
HDWRGT/ERGT	3A5
HD WRT STAT	1G5
INRDY	1G6
INSTRB	1A4
φc	2B11
LAI	3G5
MMIO	1G11
MR	1D11
MXT OUT	1A4
OUT RDY	1G7
RDO	1E11
S1 - S5	1G4
SCHDH1	1A8
SCHDH2	1A9
SFDD	1G1
SHD1	1A8
SHD2	1A8
SIE	3G6
SPPH	1G4
WCE	3G6
WR	1B11

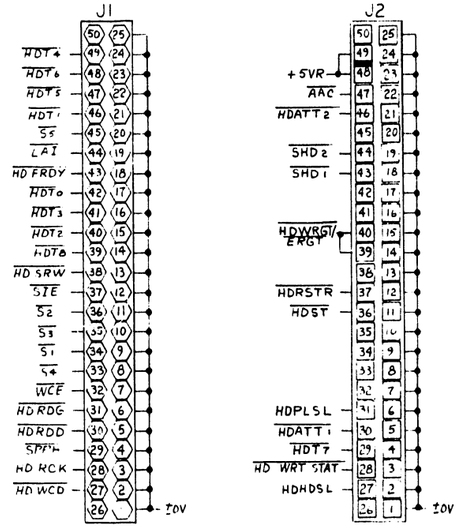


BREAK	FROM	TO
	1D10	2B10
2	1C3	1B4
3	1C3	1B9
4	1B9	1C4 1E5
5	1B9	1C3, 1E5
6	4B6	2C5
7	1E3	1D5
8	1E3	1C5
9	2C9	2E11
10	3A6	4F5
11	4D2	3D3,3D6
12	3C1	3F8
13	4E6	3G10
14	3C-	3E10
15	1E8	2E1
16	1F2	1E5

LOCATION	TYPE	SPARES
L2	74H04	2
L4	74132	1
L5	7438	1
L7	7432	1
L19	7402	3
L25	7438	1
L35	7400	2
L50	7402	1
L52	7474	1
L56	74125	2
L69	7432	3
L79	74367	3
L83	7404	1
L100	7402	1
L103	7404	1
L118	7438	2



SIGNAL - TERMINAL DESIGNATIONS VIEW FROM BOTTOM (WIRING) SIDE OF CONNECTOR



E-REV 4

NO.	REVISION	BY	DATE
9	ORIGINATED PER ECO# 22772 APP'D WH 11-77	WH	9-30-77
10	REVISED PER ECN# 10569 APP'D: WH 11-77	WH	8-31-78
10	REVISED PER ECN# 10709 APP'D: WH 11-77	WH	8-31-78
11	REVISED PER ECN# 11675 APP'D: WH 11-77	WH	9-1-78
12	REVISED PER ECN# 11950 APP'D: WH 11-77	WH	10-26-78
12	REVISED PER ECN# 12154 APP'D: SAL 11-8-78	SAL	11-8-78
13	REVISED PER ECN# 13020 APP'D: SAL 11-8-78	SAL	11-20-78
13	REVISED PER ECN# 13953 APP'D: SAL 2-1-79	SAL	2-1-79
14	REVISED PER ECN# 15186 APP'D: SAL 5-4-79	SAL	5-4-79
14	REVISED PER ECO# 22772-A APP'D: SAL 6-27-79	SAL	6-27-79
15	REVISED PER ECO# 22772 APP'D: SAL 4-14-80	SAL	4-14-80

	BY	DATE	APPROVED BY	DATE
DWN	[illegible]	9/[illegible]/77	E ENGR P.E.P	10/4/77
CHK	LDG	10/4/77	M ENGR	
			MFG ENGR	

WANG LABORATORIES INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140

SEE ENGRG SPECIFICATIONS No.

FINISH

TOL EX AS NOTED XX ± FRAC ± XXX ± ANG ± FINISH √

SCALE NONE SHT 6 OF 6

TITLE 10 MEG 5¼ FLOPPY CONTROLLER

210-7502 WANG PART NUMBER | D SIZE | 7502 DRAWING NUMBER | 10 REV

D 7502

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DO NOT SCALE

A_0- A_9 (3C1) >

LS244 L112 — LS240 L110 — LS244 L109 — LS244 L107

C92 220pf — R45 150Ω — ±0V — RDo (3A6) >

CBUSRQ (3A7) — ST DATA (Hj) — $\overline{\Phi C}$ (Kg) — PAR OUT (Hj) — D7 (6A5) >

→ BSRQ (3E8) — → MMPS (3C10) — → TSC (3F10) — → $\overline{ZBWPB}$ (4F10) — → $\overline{BD7}$ (5G11)

C85 220 pf — R49 120Ω — R46 470Ω — R47 330Ω — +5VR — ±0V

DLMMIO (5j) — MR (Hg) — BUSAK (Hz) — PARIN (7J) — CLK (5BB) >

→ $\overline{BRD}$ (2C4)(3C11) — → $\overline{BMR}$ (6D9)(3G6) — → ACKNLG (3E7) — → TCS (3D8)

C93 22pf — ±0V — ICLK (4j)

BA0 BA1 BA2 BA3 BA4 BA5 — L81 S138 — $\overline{OCC0}$ (6D11) — $\overline{OCC1}$ (6E10) — $\overline{OCC2}$ (4F11)(4D2) — $\overline{OCC3}$ (4E6) — $\overline{OCC4}$ — $\overline{OCC6}$ (5C2) — $\overline{OCC7}$

C91 220pf — ±0V

BA0 BA1 BA2 BA3 BA4 BA5 — L82 S138 — $\overline{OCCE}$ (6F11) (5B11) — $\overline{OCCF}$ (2C4)(3D11)

BA0 BA1 BA2 BA3 BA4 BA5 — L81 S138 — $\overline{OCD0}$ (6C11)(3B11) — $\overline{OCD1}$ (6C10) — $\overline{OCD3}$ (4G6) — $\overline{OCD4}$ — $\overline{OCD5}$ (3F7) — $\overline{OCD6}$ (5B2)

$\overline{DEV03}$ — L138 502 — L20 574 — DATO (3G4)

+5VR R6 2.2K — L20 574 — $\overline{DATE}$ (6B11)

+5VR R7 2.2K — L37 574 — $\overline{DATOS}$ (3B11)(3F7)(4F11)(5B11)(6D10)

$\overline{DLOPCP}$ (2C1) >

K1 — $\overline{DBICC}$ — L28 125 — L48 125 — $\overline{DBOCC}$

+5VR R1 2.2K — L42 L574 — BLK (4B8) >

$\overline{SLCT00}$ (Sa) — L61 L500 — BLK BSY (3A10)(6C11)

+5VR R3 2.2K — L20 L500 — OBCMD (3D11) — CLR DLW (2B2)

$\overline{CLR\ RD}$ (4D9) — L11 L574 — $\overline{OBRD}$ (5D3) — OBRD (2C9) (4B10)

$\overline{CLR\ WR}$ (2E4) — L4 L574 — $\overline{BWRA}$ (2F8) — BWRA (4C10)

L11 L574 — $\overline{OBRE}$ (5E2)

+5VR R4 2.2K — L42 L502 — BLK RD P (3D11)

L13 L502 — BLK WP (3D11)

L46 L502 — DI00 (3F9)

$\overline{DIAG}$ (3C10) — L25 S10 — +5VR R2 2.2K — L27 L574 — $\overline{DL\ WAIT}$ (3F11) — DL WAIT (2D4)(3F9) — L28 125 — (Kj) $\overline{WAIT}$

L30 S27 — BD7 (3F1) — L32 L574 — STAT (2C11)(4C7)

L25 S10 — RDCMD (2D11) — BD6 (3F1) — L3 L574 — $\overline{RST}$ (2F8) — RST (4C9)

BLKP (3D9) — L4 L574 — $\overline{BLK\ AUTO}$ (2B8) (5B5) — BLK AUTO (2B8)

L155 S74 — $\overline{BLK\ RD}$ (3C1) (5F4) — BLK RD (2C11) (4B10) (5E5) (3B7)

L37 574 — $\overline{BLK\ WR}$ (2G8) (5D4) — BLK WR (2E11) (3F7) (4B10) (5G8)

R5 2.2K — +5VR

$\overline{ASCMD}$ (2E4) — L55 S74 — $\overline{BGN}$ (2F3)(4B7) — C BGN (3E7) — BSWISE111 (4D9) (2E8)

$\overline{SB3\ CLR}$ (5D8) >

ECO NO. 24294 PENDING 9-6-82

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN		E ENGR	
		CHK		M ENGR	
MATERIAL	MODEL NO. 140			MFG ENGR	
	SEE ENGRG. SPECIFICATIONS No.	TITLE			
FINISH	TOL EX. AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √	210-7XX	D	7503	4
	SCALE — SHT 7 OF 15	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

REVISION — SEE SHT 8

D7503

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DO NOT SCALE

OTRG (3G5)
±0V
BLKWR (1C1)
NXT OUT (3E9)
NXT OUT
LSTWRD (3G6)
SOTS (3G5)
DBOLW
+5VR
BWRA (1E3)
RST (1F1)
ASOP (+E10)(6F11)
ASOP (5D4)
SBO CLR (5D8)
BLKWR (1C1)
SRSL (5F6)
STHBT (5E8)
BGN (1B1)
SRCA (5C5)
ASCMD (1C2)
CLR WR (1E4)(4D11)(5G8)
TCG (4E9)(5E8)
BGN (1C1)
TCG (5E11)(6E11)
RD BGN (+D11)
RD BSN (5D11)
CMDSR (4C3)
CMDT (4A6)
KDCMD (1F2)
RXSTP (5E8)
RXDG (5G11)(6F11)(5D3)
RXDS (5C6)
BKSRC (3D7)
OBSRC (3E9)
BNDTO (6D11)
DLWAIT (1F3)
OBNDTO (6E11)
RID
RCD (5E3)
RCD (3F3)
GMMDS (3C9)
DIAG (3C9)
BK, (3F9)
MINIMUM
INRY (3C8)
OBRD (1E3)
BUSGTD (3E5)
STAT (1F1)
BLKRD (1D1)
RDS (5C5)
BLK AUTO (1E1)
STCLK (3F11)(5C2)
BLK AUTO (1E1)
BLKSTCLK (5B2)(3G10)
BRDC (3A9)(5F4)
DBICO
DBICO (3F5)
BMR (1B10)
OCCF (1E7)
MWD (3F4)
MRD (3F9)
CLR DLW (3A10)(5D7)
CLR DLW (5D9)(1F5)(3F8)
DLDPCP (1D7)(2E8)(4A7)(5C11)(6E4)
TXI (6F11)(4E10)
TXI

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
MATERIAL	MODEL NO.	DWN		E ENGR	
	SEE ENGRG. SPECIFICATIONS No.	CHK		M ENGR	
FINISH	TOL. EX. AS NOTED .XX ± FRAC. ± .XXX ± ANG. ± FINISH √			MFG ENGR	
	SCALE NONE SHT 2 OF 8	TITLE			
		WANG PART NUMBER	SIZE D	DRAWING NUMBER 7503	REV.

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DO NOT SCALE

BKSRC (3D9)

RXPD1 – RXPD3 (5E2)

BLK STCLK (2B7)

BLK OSS (6D11)

OBOSS (6F11)

STCLK (2C7)

DL WAIT (1G3)

OPCOMP (6E11)

TSC (1E10)

DL WAIT (1F3)

DI00 (1C5)

BK1 (2D6)

CLRDLW (2B2)

MSTR (6D9)

BLK (4B7)

CBGN (1B2)

OUTRDY

OTRDY (6G11)

GOTS (2G10)

OTRQ (2G9)

CLK (5B8)

LST WRD (2G10)

OCD5 (1C7)

DATO5 (1A7)

OTRDY

BLK WR (1C1)

D0 – D7 (6A4)

DATO (1B7)

RCD (2C9)

PBT (5E6)

BLKRD (1D1)

DBICO (2B9)

MRD (2C4)

MWD (2C4)

DLDL (6D11)

BK3 (3B4)

NXT OUT (2G7)

DIAG (3C10)

BD0 – BD7 (4A9)

BD0 – BD5 (6E10)

BD6 (1E2)(3B11)

BD7 (1F2)

BAHC (4F5)

A15

A14

A13

A12

A11

A10

A9

A8

DLOPCP (2B1)

MSTR (6E4)

BSRQ (1E10)

ACKNLG (1B10)

BUSGTD (2C9)

TCS (1B10)

OBSRC (2D4)(5B3)

OBCMD (1F5)

BK3 (5F3)

BLK WP (1C4)

BLKP (1E2)

BLK RDP (1C2)

BKSRC (2D6)(5C3)(3G10)

CCCF (1E7)

BMR (1B10)

MMDS (1E10)

SMMDS (2C8)

IN RDY

INRY (2C11) (2G11)

BD0 (3G1)

DIAG (1E4)(2D7)(5F11) (3E9)

DIAG (1B10)(6B2)(6D11)

OCD0 (1D7)

DATO5 (1A7)

BD6 (3F2)

IE (6C11)

CLR DLW (2B3)

BLK BSY (1G5)

DLNB

BRDC (2B9)

CBUSRQ (1E11)

RD0 (1E11)

BLK RD (1D1)

INSTRB

DMAMREQ

BK2 (3F9)

CBUSRQ

WTMME

RFMME

RD0

MDMARS

MMWRS

	BY	DATE	APPROVED BY	DATE
DWN			E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 175

SEE ENGR SPECIFICATIONS

FINISH

TOL. EX. AS NOTED

SCALE NONE SHT 3 OF 8

TITLE

210-7503 D 7503 REV

WANG PART NUMBER SIZE DRAWING NUMBER REV

REVISION

SEE SHT 8

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DO NOT SCALE

BD0 - BD7 (2F1)

OCD3 (1D7)

ZEWPB (1E10)

DATCS (1A7)

CCCC (1G7)

TXI (2A9)

ASOP (2F6)

TCG (2G2)

BSRCK (5C5)

BGN (1B1)

CLR WR (6E4)

RD BGN (2E2)

CLR RD (1F4)

BWRA (1E3)

STAT (1F1)

RST (1E1)

BLK WR (1C1)

OBRD (1E3)

BLK RD (1D1)

WRCMD

BLK (3E9)

BLK (1G7)(6E4)

BGN (1C1)

STPBT (5E8)

SRCK (5C5)

DLOPCP (2C1)

CMDT (2D11)(5G8)

CMDT (5D4)(6E11)

BHC (3E2)

CMD SR3 (2E10)

RXPD10 (5F3)

STXD (6F11)

TD0 - TD7 (6B1)

CCC2 (1G7)

+5VR

+10V

±5V

±0V

	BY	DATE	APPROVED BY	DATE
DWN	A		E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 145

SEE ENGRG SPECIFICATIONS

No.

FINISH

TOL EX. AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH √

SCALE SHT 4 OF 7

TITLE DATA LINK CONTROL

WANG PART NUMBER D 7523 SIZE DRAWING NUMBER REV

REVISION NO. SEE SHT 8

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WANG LABORATORIES, INC.
LOWELL, MASS. U.S.A.

BY	DATE	APPROVED BY	DATE
DWN [illegible]	[illegible]	E ENGR	
CHK		M ENGR	
		MFG ENGR	

MATERIAL

MODEL NO. 4J

SEE ENGRG SPECIFICATIONS
No. ____

TITLE DATA LINK CONTROL

FINISH

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH ✓

WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
J-7503	D	7503	H

SCALE — SHT 5 OF 8

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DO NOT SCALE

TD₀ - TD₇ (5B1)

OTRDY (3C6)
INRY (3C8)
LG₀ (6E1)
ASOP (2F6)
RXDG (2D7)
TXI (2A9)
STXD (4B3)
OCCE (1E7)
CMDT (4A5)
TCG (2F2)
STPBT (5E8)
VLDST (5D8)
OBOSS (3F9)
OBNDTO (2D3)
ORXPE (5B2)
OPCOMP (3E9)
OCCO (1A7)
DIAG (3B9)
BLKOSS (3G9)
DLDL (3G4)
DBPE (5D2)
BNDTO (2D5)
BRXPE (5C2)
IF (3B9)
BLK BSY (1G5)
OCDO (1C7)

BD₀ - BD₇ (3F1)
OCCI (1G7)
DATOS (1A7)
OCDI (1C7)
BMR (1B10)
+5V
OBSSR₀ OBSSR₁ OBSSR₂ OBSSR₃ OBSSR₄ OBSSR₅
BSSR₀ BSSR₁ BSSR₂ BSSR₃ BSSR₄ BSSR₅
DLOPCP (2C1)
BLK (4B8)
MSTR (5E3) (3D8)
MSTR (3E9) (5D4)
1 or
STB
SEL
DIAG (3B9)
+5VR
R3 2.2K
±0V
R3 2.2K
+5VR
LG₀ (EGH)
LG₁ LG₂ LG₃ LG₄ LG₅ LG₆ LG₇
TDO TD1 TD2 TD3 TD4 TD5 TD6 TD7
DATI (1B7)
D₀ - D₇ (3G4)
D₇ (1D11)
D₀ D₁ D₂ D₃ D₄ D₅ D₆ D₇

	BY	DATE	APPROVED BY	DATE
DWN			E ENGR	
CHK			M ENGR	
			MFG ENGR	

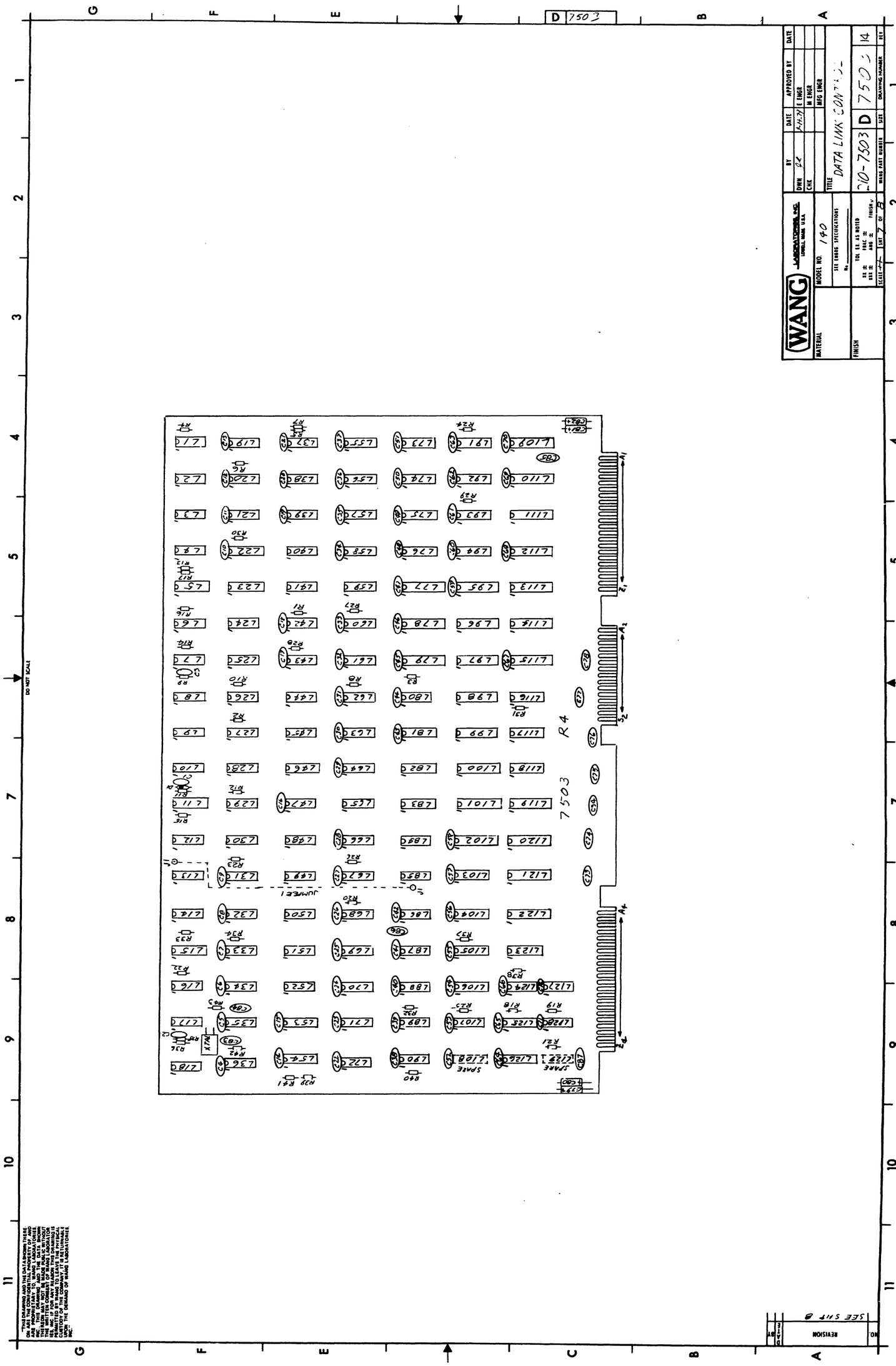
WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL
MODEL NO. 140
SEE ENGRG. SPECIFICATIONS
No.
FINISH
TOL. EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH √
SCALE — SHT 6 OF 9

TITLE DATA LINK CONTROL
WANG PART NUMBER 210-7507 | SIZE D | DRAWING NUMBER 7503 | REV 4

REVISION
SEE SHT 8

D 7503


D 7503
WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.
DWN BY
CHK
ENGR
MFG ENGR
DATE
APPROVED BY
TITLE DATA LINK CONTROL
MODEL NO. 140
SEE OTHER SPECIFICATIONS
No.
MATERIAL
FINISH
TOL. XX ±.03 NOTED
XXX ±.010 ANG ±1°
FINISH
SCALE FULL SHT 2 OF 2
WANG PART NUMBER 110-7503 D
DRAWING NUMBER 7503 14
REV
REVISION
DATE
BY
SEE SHT 2
DO NOT SCALE
7503 R4
JUMPER
SPARE
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DO NOT SCALE

CONN 4

$\overline{RD_0}$	A 1	MDMARS
DBICO	B 2	$DBID_6$
$\overline{DBOLW}$	C 3	
$\overline{LG_0}$	D 4	$\overline{LG_6}$
$\overline{LG_7}$	E 5	$\overline{LG_3}$
$\overline{LG_6}$	F 6	$\overline{LG_2}$
$\overline{LG_5}$	H 7	$\overline{LG_4}$
	J 8	$\overline{SLD}$
ϕ C	K 9	$DBID_0$
	L 10	$DBID_5$
$DBID_4$	M 11	$DBID_3$
$DBID_2$	N 12	$DBID_1$
MMWRS	P 13	SS_0
	R 14	SS_1
$\overline{SCLTOO}$	S 15	SS_2
DLNB	T 16	$\overline{WAIT}$
	U 17	$\overline{MR}$
$\overline{WTMME}$	V 18	$DBID_7$
$\overline{RFMME}$	W 19	
	X 20	
+5VR	Y 21	+5VR
±0V	Z 22	±0V

CONN 2

±0V	A 1	±0V
+5VR	B 2	+5VR
D_7	C 3	D_0
D_6	D 4	D_1
D_5	E 5	D_2
D_4	F 6	D_3
	H 7	
$\overline{CBUSRQ}$	J 8	$\overline{TXT}$
$DBOD_6$	K 9	$DBOD_7$
$DBOD_5$	L 10	$DBOD_4$
$DBOD_2$	M 11	$DBOD_3$
$DBOD_0$	N 12	$DBOD_1$
DMAM REQ	P 13	BUSAK
	R 14	
	S 15	

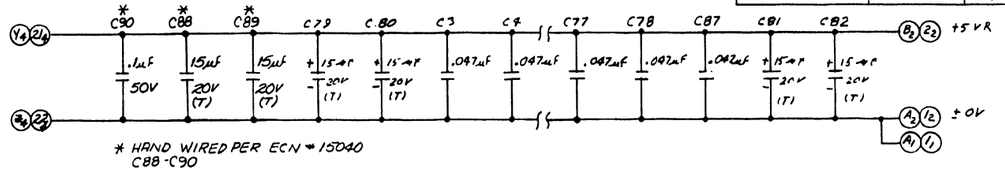
CONN 1

±0V	A 1	±0V
	B 2	
	C 3	
$\overline{INRDY}$	D 4	ICLK
$\overline{OUTRDY}$	E 5	DLMMYIO
	F 6	
PAR OUT	H 7	PAR IN
$\overline{INSTRB}$	J 8	
$\overline{DBICC}$	K 9	
$\overline{DBOCC}$	L 10	
$\overline{NXTOUT}$	M 11	
$\overline{ST\ DATA}$	N 12	
A_0	P 13	A_1
A_2	R 14	A_3
A_4	S 15	A_5
A_6	T 16	A_7
A_8	U 17	A_9
A_{10}	V 18	A_{11}
A_{12}	W 19	A_{13}
A_{14}	X 20	A_{15}
DBOPB	Y 21	$\overline{STXD}$
DBIPB	Z 22	

SIGNAL - TERMINAL DESIGNATIONS, VIEW FROM BOTTOM (WIRING) SIDE OF CONNECTOR

I.C. TYPE	LOC.	SPARES
74LS00	L34	1
	L63	1
7402	L72	1
	L3	1
74LS02	L19	1
	L121	1
74LS04	L73	3
74LS08	L12	1
	L64	1
74S10	L53	2
74S11	L87	1
74S20	L80	1
7427	L2	2
74LS32	L59	1
74S37	L7	2
74LS17	L89	1
7476	L46	1
74123	L90	1
74125	L52	1

COMPONENT	WANG PART NO.	TYPE
R46	330-2047	470Ω 1/4W 10%
R1-10, 12, 14, 17-29, 32, 38	330-3022	2.2K 1/4W 10%
R11	330-4028	27K 1/4W 5%
R15	330-3052	5.1K 1/4W 5%
R16, 39, 40, 41, 43	330-4010	10K 1/4W 10%
R35, 36, 47	330-2033	330Ω 1/4W 10%
R93, 94	330-2022	220Ω 1/4W 10%
R42	330-1022	22Ω 1/4W 10%
R45	330-2015	150Ω 1/4W 10%
C3-78, 84, 87, 94	300-1966	.047μF 50V 20% CER
C79-82, 88, 89	300-4022	15μF 20V (T)
C83, 85, 91, 92	300-1220	220pF 500V CER
C86	300-1082	82pF 500V 10% C
C1	300-1915	.0056μF 500V CER
C90	300-1930	.1μF 50V CER
C2	300-1150	150pF 500V CER
D1	380-1001	SIL. DIODE
XTAL	321-0018	17.1 MHZ
C93	300-1022	22pf



* HAND WIRED PER ECN # 15040
C88-C90

I.C. LOCATION	WL PART No	TYPE
L1, 3, 4, 29, 31, 42, 43, 62, 66, 67, 121, 127, 128	376-0155	74LS74
L2	376-0125	7427
L5, 11, 54, 90	376-0088	74123
L6	376-0198	74S30
L7	376-0296	74S37
L8, 20, 21, 26, 27, 32, 37, 50, 55, 68, 70	376-0202	74S74
L9, 19, 41, 72, 124	376-0208	74L302
L10, 36, 49, 65, 35	376-0304	74LS73
L12, 58, 61, 64	376-0153	74LS08
L13, 34, 40, 63	376-0207	74LS00
L14	376-0102	74164
L15, 22	376-0221	745194
L16, 56	376-0228	74S00
L17	376-0045	74H04
L18	376-0184	74S51
L23, 75, 76, 93, 94	376-0109	74166
L24, 25, 69	376-0038	74S10
L28, 48, 52, 60	376-0324	74125
L30, 74, 86	376-0245	74LS27
L33	376-0271	74S86
L85	376-0010	7404
L38, 45, 51	376-0199	74S02
L39, 44	376-0200	74S08
L46	376-0007	7476
L108, 109		SPARE
L57	376-0205	74S32
L59	376-0211	74LS32
L71, 73	376-0180	74LS04
L72,	376-0016	7402
L77, 95, 96, 113, 119-122	376-0286	74LS374
L78, 79, 97, 98, 99, 101, 102, 109, 111, 112, 115	376-0288	74LS244
L80	376-0230	74S20
L81, 82, 83	376-0298	74S138
L84, 53	376-0207	74LS10
L87	376-0237	74S11
L88	376-0206	74S260
L91, 92, 125, 126	376-0233	74LS161
L100, 110	376-0297	74LS240
L103, 104	376-0098	74174
L105, 106	376-0082	74157
L116, 117, 118	376-0221	745194
L123	376-0298	74S138
L114	376-0310	74LS373

MNEMONIC	COORDINATE
$A_0 - A_{15}$	3E1
BUSAK	1B11
$\overline{CBUSRQ}$	3A7
$D_0 - D_7$	6A5
$\overline{DBICC}$	1A5
DBICO	2B11
$DBID_0 - DBID_7$	5G1
DBIPB	5F1
$\overline{DBOCC}$	1A6
$DBOD_0 - DBOD_7$	5G5
$\overline{DBOLW}$	5F1
DBOPB	5G7
DLNB	3A7
$\overline{DLMMIO}$	1C11
$\overline{DMAM\ REQ}$	3B1
ICLK	1A10
$\overline{INRDY}$	3C11
$\overline{INSTRB}$	3C1
$\overline{LG_0} - \overline{LG_7}$	6E1
MDMARS	3A5
MMWRS	3A5
$\overline{MR}$	1B11
$\overline{NXTOUT}$	2G1
$\overline{OUTRDY}$	3G7
PAR IN	1B11
PAR OUT	1E11
$\overline{RD_0}$	3A6
$\overline{RFMME}$	3A6
$\overline{SCLTOO}$	1G5
$\overline{SLD}$	5A11
SS_0, SS_1, SS_2	6F1
$\overline{ST\ DATA}$	1E11
$\overline{STXD}$	4B1
$\overline{TXT}$	2A10
$\overline{WAIT}$	1G1
$\overline{WTMME}$	3A6
ϕ C	1E11

E-KEY
9

REVISION	BY	DATE	APPROVED BY	DATE
A 9/6 SRC PER UWR # EC29 APPD: [illegible] 9-19-79	DWN JC	7-17-79	ENGR A. DESKUR	10-15-79
B 1/0 REVISED PER ECN # 13225 APP [illegible] 9-19-79	CHK [illegible]	10-15-79	M ENGR	
C 2/0 REVISED PER ECN # 12736 APP [illegible] 9-19-79			MFG ENGR	
D 3/1 REVISED PER ECN # 13020 APPD: [illegible] 11-8-79				
E 4/2 REVISED PER ECN # 13533 APPD: [illegible] 12-14-79				
F 5/2 REVISED PER ECN # 13955 APPD: [illegible] 2-16-80				
G 6/3 REVISED PER ECN # 13987 APP D: [illegible] 2-16-80				
H 7/4 REVISED PER ECN # 13940 APP D: [illegible] 5-6-80				
J 8/5 REVISED PER ECN # 13990 APP D: [illegible] 5-6-80				
K 9/6 REVISED PER ECO # 14877 APP D: UNREL-181 6-24-81 JEP				
L 10/7 REVISED PER ECO # 20870 APP D: [illegible] 11-3-81 JEP				
M 11/8 REVISED PER ECN # 21712 APPD [illegible] 5-6-82 PGD				
N 12/8 REVISED PER ECO # 22772 APPD [illegible] 5-6-82 PGD				
P 13/8 REVISED PER ECO # 22866 APPD [illegible] 5-6-82 PGD				
R 14/9 REVISED PER ECO # 23511 APP D: [illegible] 5-16-82 MP				

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		
MATERIAL	MODEL NO. 170	TITLE DATA [illegible] CONTROL
	SEE ENGRG SPECIFICATIONS No.	
FINISH	TOL EX AS NOTED XX ± FRAC ± XXX ± ANG ± FINISH √	210-7503 / D / [illegible] / 14
	SCA [illegible] SHT 2 OF 8	WANG PART NUMBER / SIZE / DRAWING NUMBER / REV

D 7503

CHANNEL Ø3 | CHANNEL Ø2 | CHANNEL Ø1 | CHANNEL 32 | CHANNEL Ø4 | CHANNEL Ø5 | CHANNEL Ø6 | CHANNEL Ø7

TXI

STXD

$\overline{STXD}$ (2G8)(3G8)(4G8)

$\overline{TXI}$ (2G10)(3G10)(4G10)

SLCT32 (1A10)

SLCTØ7 SLCTØ6 SLCTØ5 SLCTØ4 SLCTØ3 SLCTØ2 SLCTØ1

L52 L34 L53 L35 L50 L32 L51 L33 — 75113

L16 L17 L19 L15 — 75107

RXD01 RXD02 RXD03 RXD04 RXD05 RXD06 RXD07

RXD32

L54 — 74251

L36 — 74S138

L18 — 74251

SSo-SS2 (2F11) (3F11) (4F11)

SLD (2A7)(3A7)(4A7)

SLD (2A7) (3A7) (4A7)

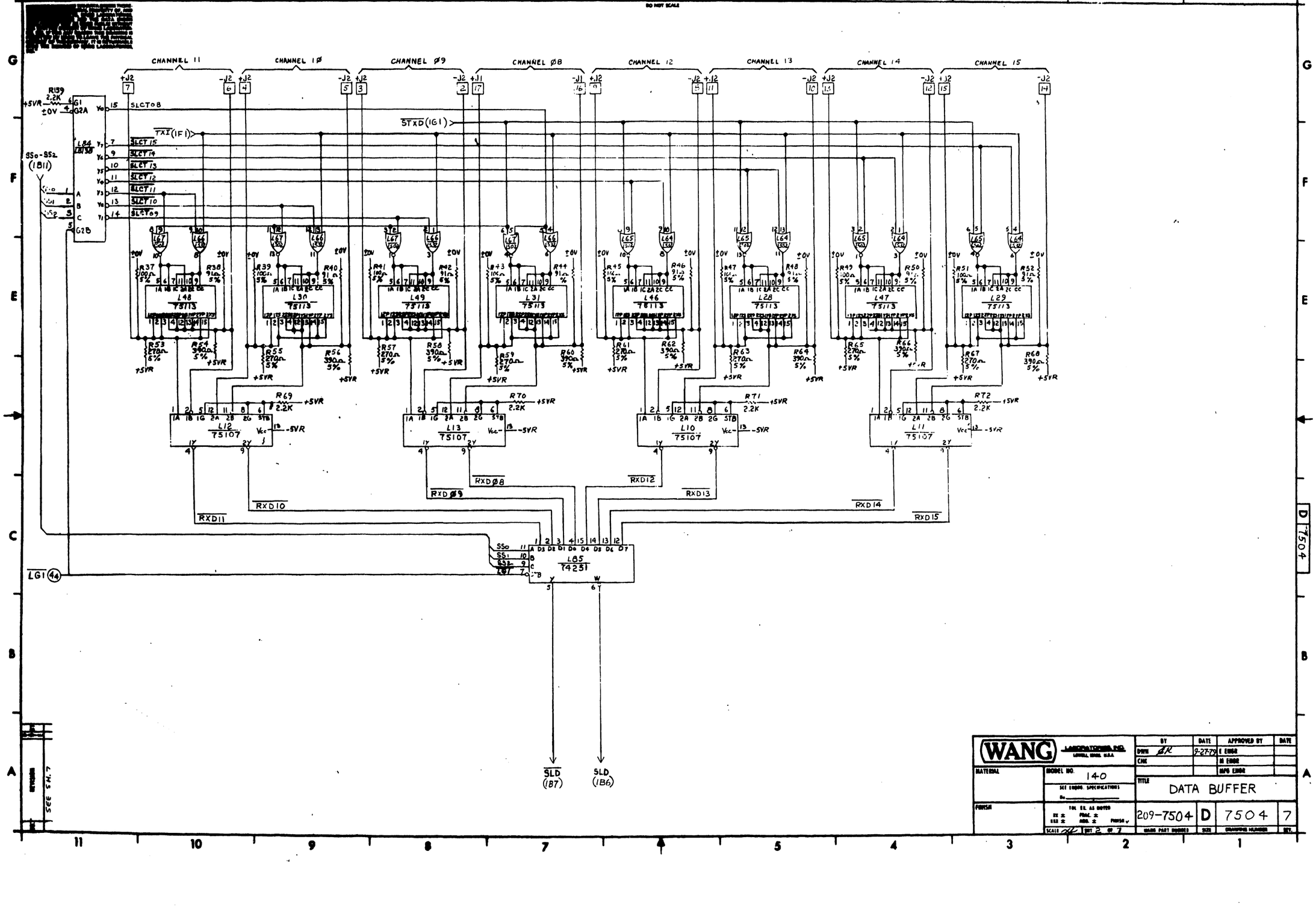
SLCTØØ

SLCT32 (1F7)

SEE SH. 7

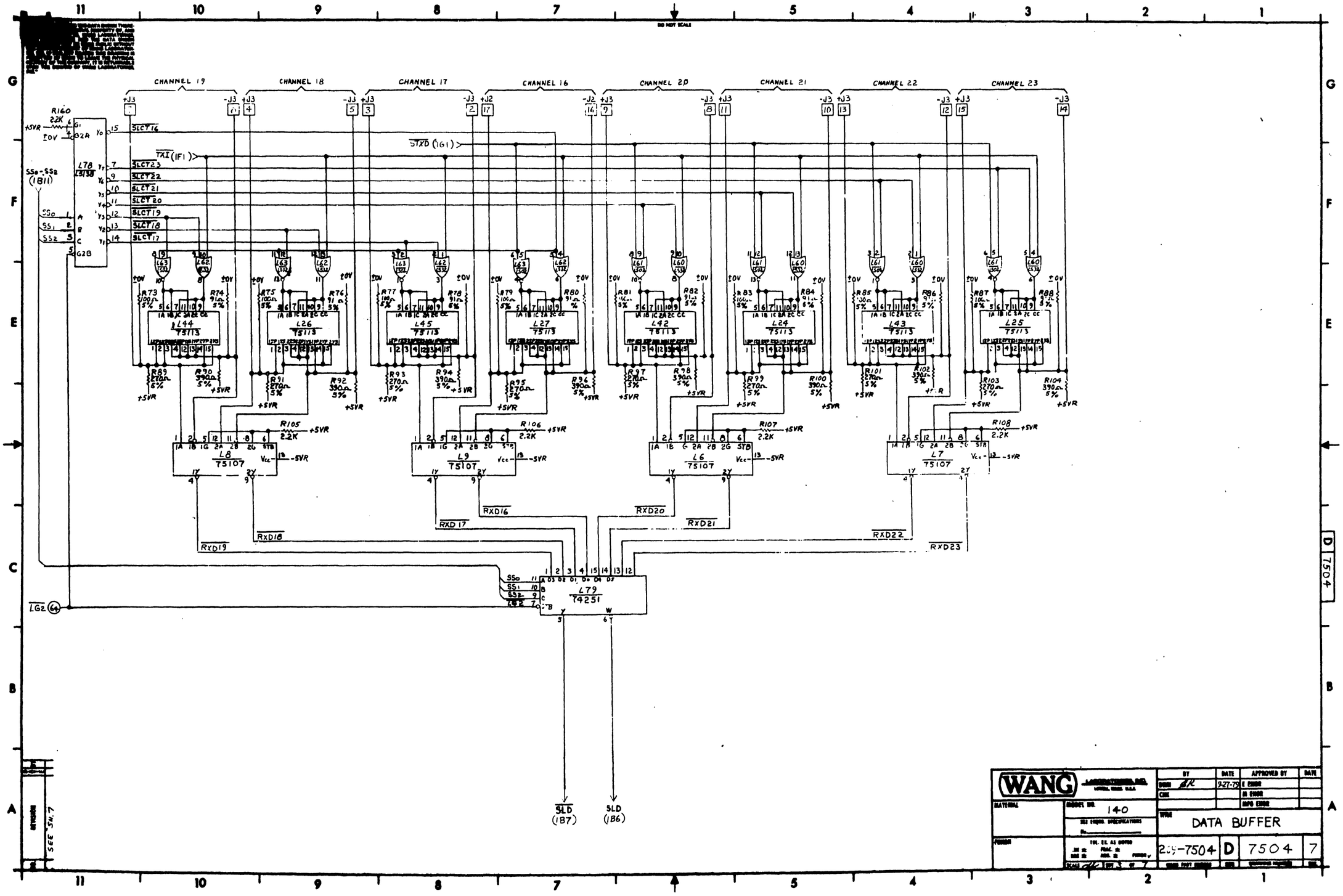
WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN BR	9-27-79	ENGR	
		CHK		MFG ENGR	
MATERIAL	MODEL NO. 140				
	SEE ENGRG. SPECIFICATIONS	TITLE DATA BUFFER			
FINISH	TOL. EX. AS NOTED .XX ± .XXX ± ANGL ± FINISH √	209-7504	D	7504	7
	SCALE NONE WT / SHT 7	MADE FROM PART NUMBER	SIZE	DRAWING NUMBER	REV

D 7504



WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN BR	9-27-79	E ENGR	
		CHK		M ENGR	
MATERIAL	MODEL NO. 140			MFG ENGR	
	SEE ENGRG. SPECIFICATIONS	TITLE DATA BUFFER			
FINISH	TOL EX. AS NOTED .XX ± .FRAC. ± .XXX ± .ANG. ± FINISH √	209-7504	D	7504	7
	SCALE NONE SHT 2 OF 7	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV.

D 7504



WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN AR	3-27-75	E ENGR	
		CHK		M ENGR	
				MFG ENGR	
MATERIAL	SHEET NO. 140	TITLE DATA BUFFER			
FINISH	TOL. EX. AS NOTED	2[illegible]-7504	D	7504	7

[redacted] THIS DATA SHEET CONTAINS [redacted] PROPRIETARY INFORMATION OF WANG LABORATORIES, INC. SUCH DATA SHEET IS LOANED SUBJECT TO [redacted] AGREEMENT THAT NEITHER IT NOR THE [redacted] CONTAINED THEREIN WILL BE COPIED, REPRODUCED OR DISCLOSED TO OTHERS OR USED IN MANUFACTURE OF ANYTHING EXCEPT UNDER A CONTRACT WITH WANG LABORATORIES, INC. IF YOU DO NOT AGREE TO THESE CONDITIONS, YOU ARE REQUESTED TO RETURN THIS DATA SHEET IMMEDIATELY WITH YOUR NAME AND ADDRESS TO WANG LABORATORIES, INC., ATTENTION: CONTRACTS ADMINISTRATION, ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851.

DO NOT SCALE

CHANNEL 27 | CHANNEL 26 | CHANNEL 25 | CHANNEL 24 | CHANNEL 28 | CHANNEL 29 | CHANNEL 30 | CHANNEL 31

R161 2.2K +5VR; ±0V

SS0-SS2 (B11)

L55 74138

SLCT24 SLCT31 SLCT30 SLCT29 SLCT28 SLCT27 SLCT26 SLCT25

TXI (1F1)

STXD (1G1)

L59 L58 L57 L56 L59 L58 L57 L56

R109–R124 100Ω 5%

L40 L22 L41 L23 L38 L20 L39 L21 75113

R125–R132 270Ω 5%; R133–R140 390Ω 5%

R141–R144 2.2K +5VR

L4 L5 L2 L3 75107 Vcc 13 -5VR

RDX27 RDX26 RDX25 RDX24 RXD28 RXD29 RXD30 RXD31

L37 T4251

LG3 (54)

SLD (1B7) SLD (1B6)

D 7504

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
MATERIAL	MODEL NO. 140	DWN AR	9-27-79	E ENGR	
	SEE ENGR SPECIFICATIONS	CHK		M ENGR	
FINISH	TOL ±.XX AS NOTED			MFG ENGR	
	.XX ± FRAC. ± .XXX ± ANGL. ± FINISH √	TITLE DATA BUFFER			
	SCALE NONE SHT 4 OF 7	209-7504	D	7504	7
	WORK PART NUMBER	DATE		DRAWING NUMBER	REV.

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DO NOT SCALE

ICLK (4₁) · INSTRB (J₁) · NXTOUT (M₁) · MR (14₄) · RDCYL (5E7) · DBOCC (L₁) · DBICC (K₁)

BK1 (5E6) · BK2 (5E2) · BK3 (5D10)

CLK · INREQ · IOV · DBRW · DBORS · BMR1 · BTR1 · BTR2 · BTR3 · PU1

RFMME (W₄) · PARIN (T₁) · MDMARS (14) · MMWRS (P₄)

INREQ (5D8) · UNREQ (5F10) · RDCYL (9D11) · BK1 (5E10) · BK3(5F7) · BK2(5G4)

DBADRS · DBA0 · DBA1 · DBA2 · DBA3 · DBA4 · DBA5 · DBA6 · DBA7

DBOD0 · DBOD1 · DBOD2 · DBOD3 · DBOD4 · DBOD5 · DBOD6 · DBOD7

DBOPB (Y₁) · DBOLW (C₄) · DBOCO (3₄) · DBICO (8₄) · OUTRDY (E₁) · INRDY (D₁) · DPIPB (E₂) · PARJUT (H₁) · WTMME (V₄)

DBID0 (9₄) · DBID1 (12₄) · DBID2 (N₄) · DBID3 (11₄) · DBID4 (M₄) · DBID5 (10₄) · DBID6 (2₄) · DBID7 (8₄)

Do - D7 (5B1) · Do - DT (5G3)

R145 1K · R146 2.2K · R147 1K · R148 2.2K · R149 2.2K · R150 2.2K · R151 2.2K · R152 2.2K · R153 2.2K · R154 2.2K · R155 1K · R156 1K · R157 2.2K · +5VR

L74/500 · L75/504 · L76/574 · L77/S11 · L73/574 · L91/04 · L92/LS74 · L93/S174 · L95/S51 · L102/LS374 · L80/LS74 · L101/LS374 · L104/LS74 · L86/S04 · L89/LS161 · L88/LS161 · L87/157 · L107/LS161 · L106/LS161 · L105/157 · L103/125 · L78/LS374 · L99/2101A-2 · L81/2102A-2 · L96/574 · L97/LS374 · L196/574

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

	BY	DATE	APPROVED BY	DATE
DWN	GR	9-27-79	E ENGR	
CHK			M ENGR	
			MFG ENGR	

MATERIAL · MODEL NO. · SEE ENGRG SPECIFICATIONS Rev · FINISH · TOL EX AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √ · SCALE · SHT 5 OF 7

TITLE: DATA BUFFER

WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
209-7504	D	7504	7

D 7504

REVISION · NO

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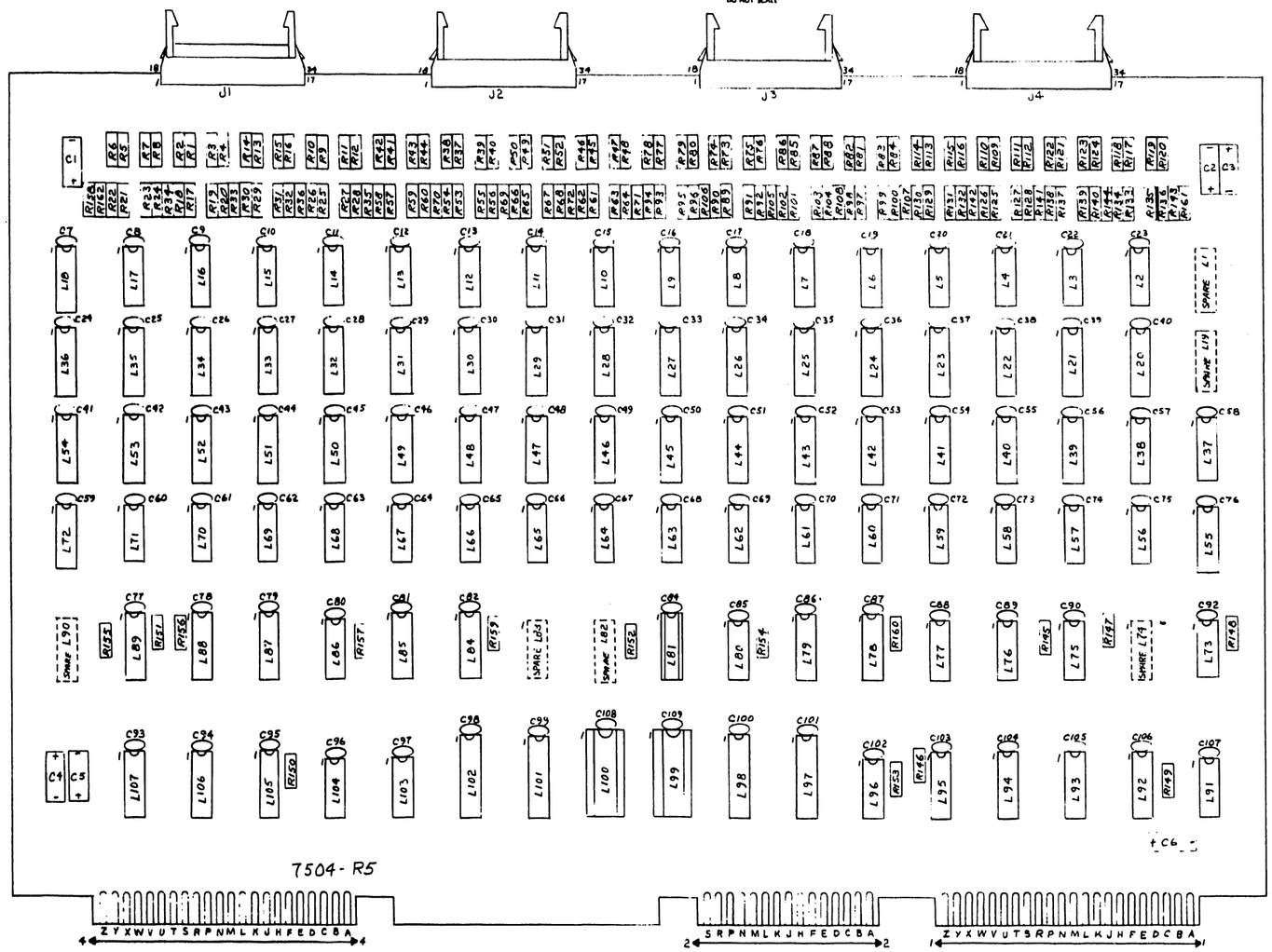
DO NOT SCALE



COMPONENT LAYOUT

	BY	DATE	APPROVED BY	DATE
DWN	ER	3-27-79	E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140
SEE ENGRG SPECIFICATIONS
No.

FINISH

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH √

SCALE NONE SHT 6 OF 7

TITLE: DATA BUFFER

WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
209-7504	D	7504	7

D 7504

REVISION

NO.

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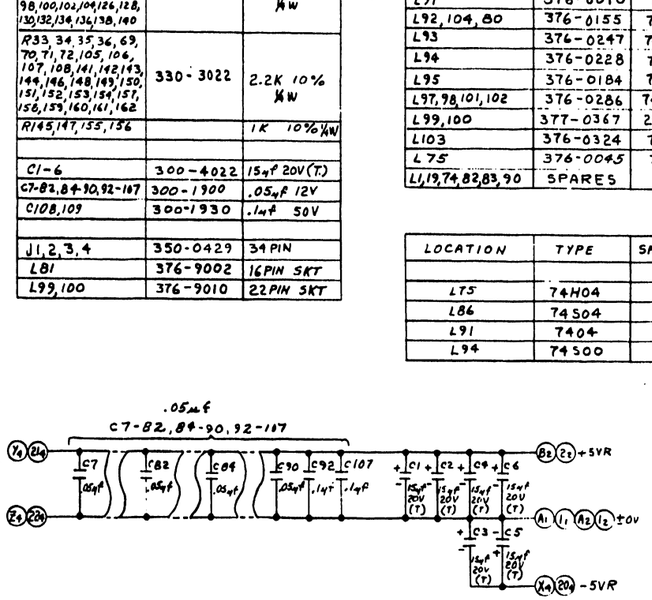
DO NOT SCALE

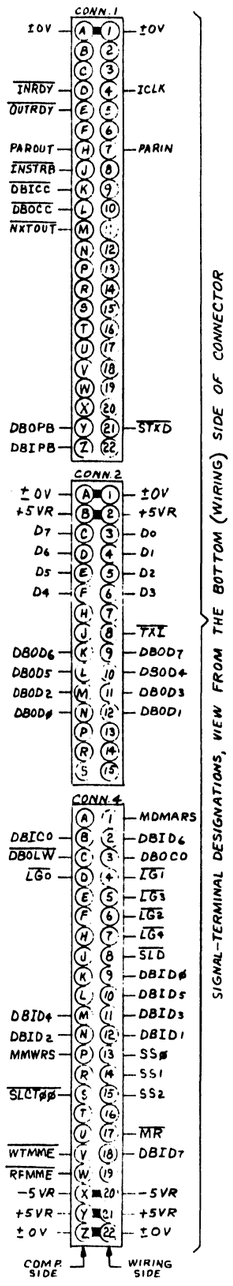
COMPONENT	W.L. PART NO.	TYPE
R1,3,5,7,9,11,13,15,37,39,41,43,45,47,49,51,73,75,77,79,81,83,85,87,109,111,113,115,117,119,121,123	330-2011	100Ω 5% ¼W
R2,4,6,8,10,12,14,16,38,40,42,44,46,48,50,52,74,76,78,80,82,84,86,88,110,112,114,116,118,120,122,124	330-1092	91Ω 5% ¼W
R17,19,21,23,25,27,29,31,53,55,57,59,61,63,65,67,89,91,93,95,97,99,101,103,125,127,129,131,133,135,137,139	330-2028	270Ω 5% ¼W
R18,20,22,24,26,28,30,32,54,56,58,60,62,64,66,68,90,92,94,96,98,100,102,104,126,128,130,132,134,136,138,140	330-2040	390Ω 5% ¼W
R33,34,35,36,69,70,71,72,105,106,107,108,141,142,143,144,146,148,149,150,151,152,153,154,157,158,159,160,161,162	330-3022	2.2K 10% ¼W
R145,147,155,156		1K 10% ¼W
C1-6	300-4022	15μF 20V(T)
C7-82,84-90,92-107	300-1900	.05μF 12V
C108,109	300-1930	.1μF 50V
J1,2,3,4	350-0429	34 PIN
L81	376-9002	16PIN SKT
L99,100	376-9010	22PIN SKT

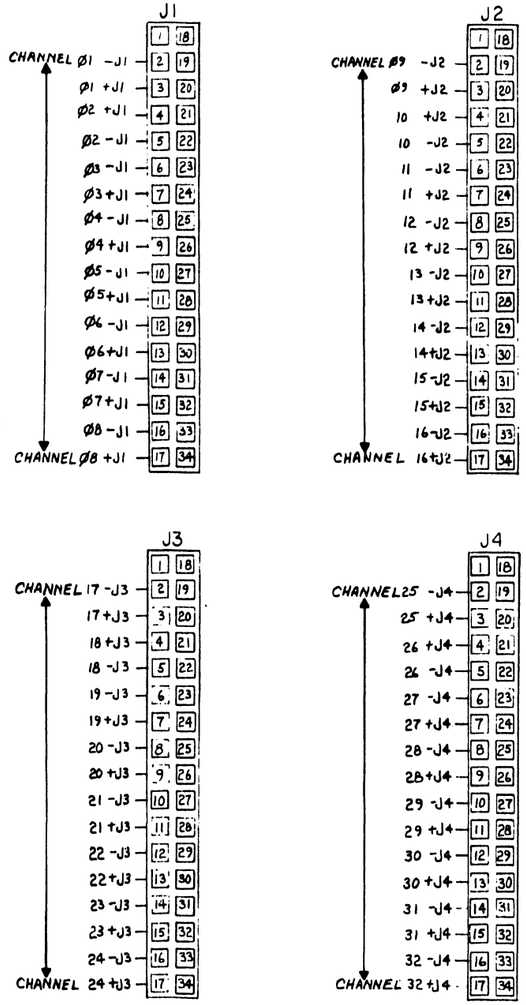
LOCATION	W.L. PART NO.	TYPE
L2-17	376-0146	75107
L18,37,54,79,85	376-0272	74251
L20-35,38-53	376-0256	75113
L36,55,72,78,84	376-0294	74LS138
L56,58,60,62,64,66,68,70	376-0211	74LS32
L57,59,61,63,65,67,69,71	376-0208	74LS02
L73,76,96	376-0202	74S74
L86	376-0197	74S04
L77	376-0225	74LS11
L81	377-0363	2102A-2
L87,105	376-0082	74137
L88,89,106,107	376-0233	74LS161
L91	376-0010	7404
L92,104,80	376-0155	74LS74
L93	376-0247	745174
L94	376-0228	74500
L95	376-0184	74S51
L97,98,101,102	376-0286	74LS374
L99,100	377-0367	2101A-2
L103	376-0324	74125
L75	376-0045	74H04
L1,19,74,82,83,90	SPARES	

LOCATION	TYPE	SPARES
L75	74H04	1
L86	74S04	4
L91	7404	2
L94	74S00	3

MNEMONIC	COORDINATE
D_0-D_7	5B2
$\overline{DBICC}$	5C11
DBICO	5A7
$DBID_0$-$DBID_7$	5E1
$\overline{DBOCC}$	5C11
DBOCO	5A8
$DBOD_0$-$DBOD_7$	5A5
$\overline{DBOLW}$	5A9
DBOPB	5A3
DPIPB	5F1
ICLK	5G11
$\overline{INRDY}$	5F1
$\overline{INSTRB}$	5F11
$\overline{LG0}$	1F11
$\overline{LG1}$	2C11
$\overline{LG2}$	3C11
$\overline{LG3}$	4C11
$\overline{LG4}$	1B11
MMWRS	5G1
MDMARS	5G3
$\overline{MR}$	5D11
$\overline{NXTOUT}$	5E11
$\overline{OUTRDY}$	5A10
PARIN	5G4
PAROUT	5C1
$\overline{RFMME}$	5G4
$\overline{SLCT\#\#}$	1A11
$\overline{SLCT3Z}$	1A10
$\overline{SLD}$	1A7
SS0-SS2	1F11
STXD	1G7
$\overline{TXI}$	1G10
$\overline{WTMME}$	5C1
CHAN.1-7,32	1G3-10
CHAN. 8-15	2G3-10
CHAN. 16-23	3G3-10
CHAN. 24-31	4G3-10





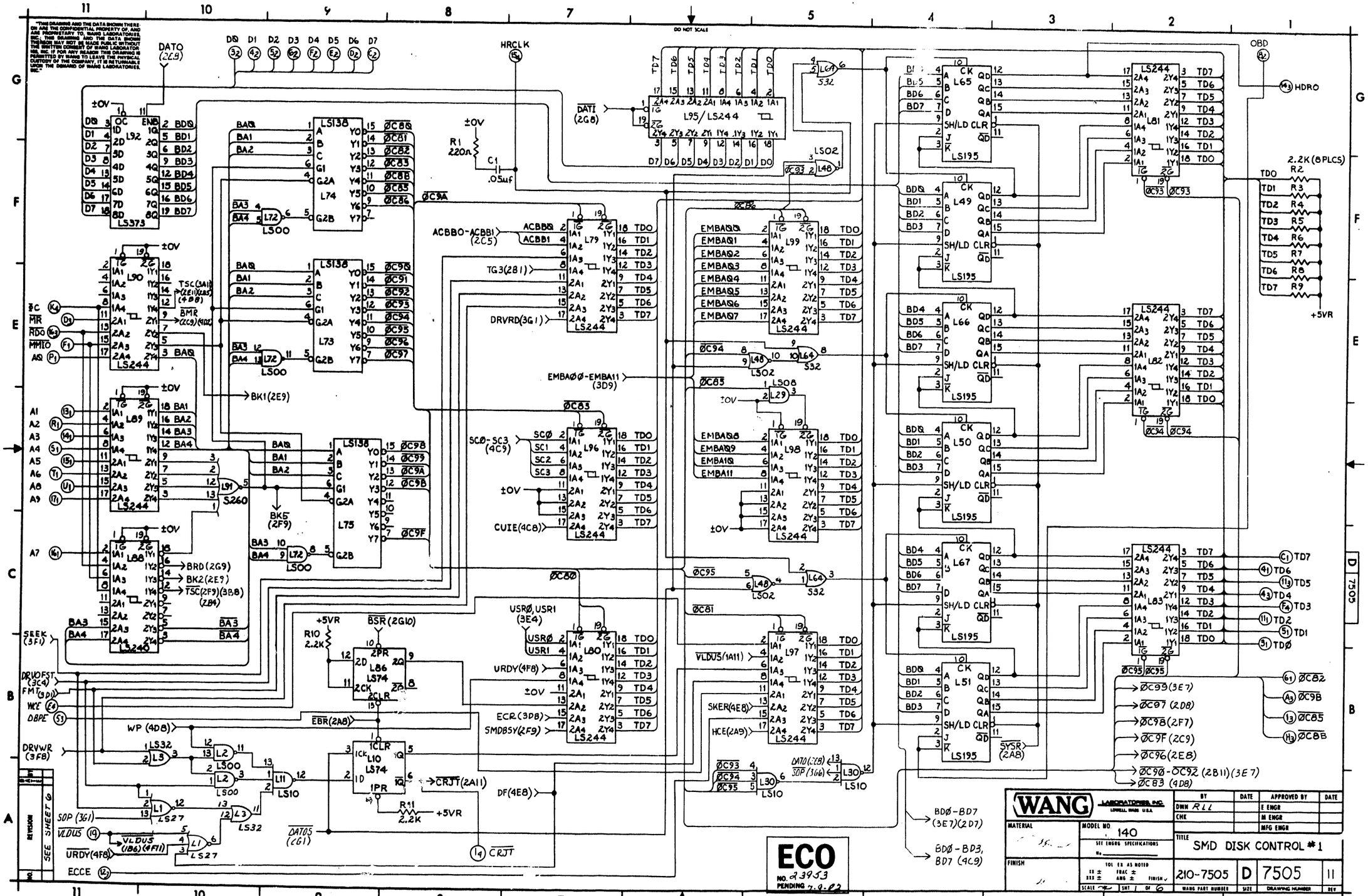


NO.	REVISION	BY	DATE	APPROVED
0	ORIGINATED PER DWR E638	GR	9-27-78	
½	REVISED PER ECN #11715 ADDED 11HS-11	GR	10-13-78	
1	REVISED PER ECN #12138 ADDED 11HS-11	GR	11-17-78	
2	REVISED PER ECN #12330 ADDED 11HS-11	GR	12-21-78	
3	REVISED PER ECN #12 ADDED 11HS-11	GR	1-11-79	
4	REVISED PER ECN #13277 APPD. 11HS-11	GR	2-7-80	
5	REVISED PER ECN #13933 APPD. 11HS-11	GR	4-24-80	
6	REVISED PER ECN# 14053 APPD. 11HS-11	GR	6-4-80	
7	REVISED PER ECN# 14380 APPD. 11HS-11	GR	7-30-80	

E-REV 0

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN GR	9-27-78	E ENGR A. DES KURN	11-15-78
		CHK J.L.L.	10-15-78	M ENGR	
				MFG ENGR	
MATERIAL	MODEL NO. 140	TITLE DATA BUFFER			
	SEE ENGRG. SPECIFICATIONS No.				
FINISH	TOL EX AS NOTED .XX ± .XXX ± FRAC ± ANG ± FINISH √	209-7504	D	7504	7
	SCALE NONE SHT 7 OF 7	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

D 7504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DO NOT SCALE
DATO (2C8)
D0 D1 D2 D3 D4 D5 D6 D7
HRCLK
DATI (2G8)
OBD
HDRO
2.2K (8PLCS)
+5VR
ECO NO. 23953 PENDING 7-9-82
WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.
MODEL NO. 140
SMD DISK CONTROL #1
210-7505 D 7505 11

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF, AND ARE PROPRIETARY TO, WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

DO NOT SCALE

*1: PULSE WIDTH 30ms. MIN.
*2: PULSE WIDTH 1.5μs MIN.

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY	DATE
	DWN RLL	10-17-79	E ENGR	
	CHK		M ENGR	
MATERIAL	MODEL NO. 140		MFG ENGR	
	SEE ENGRG SPECIFICATIONS No.	TITLE	SMD DISK CONTROL #1	
FINISH	TOL EX AS NOTED .XX ± .XXX ± FRAC ± ANG ± FINISH √	210-7505	D 7505	11
	SCALE	SHT 2 OF 6	WANG PART NUMBER	SIZE DRAWING NUMBER REV

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DO NOT SCALE

RDCWD (3C1) WRCMD (3E1) FMT (3D1)

SOP (185)(2C2)

DATOS (2G1) DWRT (3D1) WRCK (3D1) WRCK (3D1)

CMDP (2B9) SYSR (2C9) BDQ-BD7 (1A4) EBR (2A8)

DRVWR (1B11)(2A10)

USRQ USR1 USRO, USR1 (1C7)(4G7)

CRS (2E5)

ECCCC (2A11) ECR (1B7)

ØC9Ø-ØC92, ØC99 (1B2) ØC91 ØC92 ØC9Ø ØC99

DATI (2G8) REGR (2A7)

OFSCMD (2C1) OFSCMD (2F11) OFSM (2G7) DRVOFST (1B11)(2C2) OFSP (2G7)

BD2 BD1 BDQ

EMBAØØ-EMBA11 (1E7)

EMBA11 EMBA10 EMBA9 EMBA08 EMBA07 EMBA06 EMBA05 EMBA04 EMBA03 EMBA02 EMBA01 EMBA00

AEC (3F1) TSC (1C10) TSC (1E10) S (9)

SYSR (2AB)

SMDBSY (2B9) BK3(4G9) BK4 (2D2)

*3: PULSE WIDTH 40NS MINS.
*4: PULSE WIDTH 4MS MINS.

CUE (4C8) CUBSY

(71) SOP (1A11) (134) DRVRD DRVRD (1E7) (21) SADRC (61) PSRCP

BD3 BD4 BD5 BD6 BD7

CLF (2F7) CLF (2C5) RTZ (2C7) RTZ (2C9) SEEK (2F5)(2G11)(1B11) ACC (3B9)

(10) WRCMD (15) WRCMD WRCMD (3G8) (8) WRCK WRCK (3G8) (41) FMT (1B11) (74) DWRT (64) DWRT

(54) RDCMD (42) RDCMD RDCMD (3G8) (R4) DIAGRD

EDS (2C7) LDS (2C7)

PSRCE DRVWR PTLE

WANG LABORATORIES, INC. LOWELL, MASS U.S.A.		BY	DATE	APPROVED BY / DATE
MATERIAL	MODEL NO. 140	DWN RLL	10-19-79	E ENGR
	SEE ENGRG SPECIFICATIONS No.	CHK		M ENGR
FINISH	TOL EX AS NOTED XX ± FRAC ± XXX ± ANG ± FINISH	SCALE	SHT 3 OF 6	MFG ENGR
TITLE	SMD DISK CONTROL #1			
	210-7505	D	7505	11
	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

REVISION NO. SEE SHEET 6

7505

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF AND ARE PROPRIETARY TO WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

DO NOT SCALE

UNIT READY
ON CYL
VLDUS(1A11)
FAULT
SEEK ERROR
WRITE PROT
BUSY
P2 SEND
P0 SEND
P1 SEND
P3 SEND
SHEET 6
SEE

* HANDWIRED PER ECN # 13648 "R125-R129, C84-C88"

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY	DATE
	DWN RLL	10-19-79	E ENGR	
	CHK		M ENGR	
			MFG ENGR	
MATERIAL	MODEL NO. 140		TITLE SMD DISK CONTROL #1	
FINISH	SEE ENGRG SPECIFICATIONS No.			
	TOL EX AS NOTED .XX ± .XXX ± ANG ± FINISH √	210-7505	D 7505	11
	SCALE —	SHT 6 OF 6	DRAWING NUMBER	REV
	MANF PART NUMBER	SIZE		

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF, AND ARE PROPRIETARY TO, WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE PRIOR WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

DO NOT SCALE

7505 - R3

J1 31 1 60 30

L55 SPARE

SPARE L103

Z4 A4 Z3 A3 S2 A2 Z1 A1

SEE SHEET 6

REVISION

	BY	DATE	APPROVED BY	DATE
DWN	[illegible]	10.10.79	E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL MASS. U.S.A.

MATERIAL

FINISH

MODEL NO. 140

SEE ENGRG SPECIFICATIONS

No.

TOL. EX. AS NOTED

XX ± FRAC ±

XXX ± ANG ± FINISH √

SCALE NONE SHT 5 OF 6

TITLE SMD DISK CONTROL #1

210-7505 | D | 7505 | 11

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

D 7505

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF AND ARE PROPRIETARY TO WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES INC."

DO NOT SCALE

I.C.LOCATION	TYPE	W. L. NO.
L1	74LS27	376-0245
L2,12,63,72,87	74LS00	376-0207
L3	74LS32	376-0211
L4,7,10,37,38,45, 46,68,76,86,94	74LS74	376-0155
L53	7473	376-0005
L8,9,24	75107A	376-0146
L11,30	74LS10	376-0209
L13,28,48,69, 70,78	74LS02	376-0208
L14	74LS04	376-0180
L15,71	74LS20	376-0210
L16-23	75110A	376-0255
L25,36	74123	376-0080
L26,35	7404	376-0010
L27	74LS139	376-0226
L29	74LS08	376-0153
L31,34	74LS367A	376-0192
L32,33	74LS374	376-0286
L39	74LS174	376-0159
L40	7400	376-0002
L41,42,44,54	74175	376-0119
L43	74S10	376-0238
L47,60	74S02	376-0199
L49-51,65-67	74LS195	376-0248
L52	7402	376-0016
L56	74S08	376-0200
L57,58	74S74	376-0202
L59	74S00	376-0228
L61	74S04	376-0197
L62	7403	376-0028
L64,	74S32	376-0205
L73-75	74LS138	376-0294
L77	7476	376-0007
L79-83,89,90 95-99	74LS244	376-0288
L5,6,84,85, 100-102	74LS161A	376-0233
L88	74LS240	376-0297
L91	74S260	376-0206
L92	74LS373	376-0310
L93	7430	376-0031
L104	NE555	376-0126

COMPONENT	TYPE	W.L.NO.
R1	220Ω 1/4W 10%	330-2022
R2-13,16-27,50, 61-63,68,73,78-80,85-87,92-94, 99-101,106-108, 123,124,130	2.2K 1/4W 10%	330-3022
R14	390K 1/4W 10%	330-5039
R15,31	27K 1/4W 5%	330-4028
R28,29	1K 1/4W 10%	330-3010
R30	5.1K 1/4W 5%	330-3052
R32,33.59,60	100K 1/4W 10%	330-5010
R34,37,38,41, 42,45,46,49, 51,54,55,58, 64-67,69-72, 74-77,81-84, 88-91,95-98, 102-105,109-113, 116,119,122	56Ω 1/4W 5%	330-1057
R35,36,39,40, 43,44,47,48, 52,53,56,57,114, 115,118,121	470Ω 1/4W 10%	330-2047
R117	270Ω 1/4W 5%	330-2028
R120	100Ω 1/4W 10%	330-2010
R125-129	22Ω 1/4W 10%	330-1022
C1,6-17,19-81, 89	.047μF 50V	300-1966
C2	.1μf 50V	300-1930
C3	.01μf 25V	300-1903
C4	820pf 500V	300-1820
C5	.68μf 35V (T)	300-4011
C18,82,83,84	15μf 20V (T)	300-4022
C85-88,90	470pf 500V	300-1470
D1,2	SIL	380-1001
Q1,2	2N3725	375-1027
J1	60 PIN	350-0057

I.C.LOCATION	TYPE	SPARES
L1	74LS27	1
L52	7402	3
L3	74LS32	1
L14	74LS04	3
L15	74LS20	1
L26	7404	2
L40	7400	3
L43	74S10	2
L47	74S02	3
L55,103	SPARE	
L56	74S08	1
L59	74S00	1
L61	74S04	1
L62	7403	2
L64	74S32	1
L69	74LS02	1
L70		2
L71	74LS20	1
L35	7404	1
L2	74L500	1
L63		1
L87		3

MNEMONIC	COORD.
AØ-A9	(1D11)
BITØ-BIT9	(4B2)(4F1)
BSR	(2G11)
BUSY	(4C11)
CRJT	(1A8)
CUBSY	(3B1)
D0-D7	(1G9)
DATOS	(2G1)
DATOS	(2G1)
DBPE	(1B11)
DIAGRD	(3B1)
DRVRD	(3G1)
DRVWR	(3A7)
DWRT	(3D1)
DWRT	(3D1)
EBR	(2A8)
ECCE	(1A11)
FMT	(3D1)
FMTT	(2E11)
FAULT	(4E11)
HCE	(2A11)
HDRO	(1G1)
HRCLK	(1G7)
MMIO	(1E11)
MR	(1E11)
NSPOT	(2A11)
OBD	(1G1)
ØC8B	(1B1)
ØC82	(1B1)
ØC85	(1B1)
ØC9B	(1B1)
ONCYL	(4F11)
OPEN CABLE DETECT	(4C1)
OPEND	(2D11)
PØ SEND, P2 SEND	(4B11)
PICKHOLD	(4B1)
PSRCE	(3A7)
PSRCP	(3G1)
PTIE	(3A6)
RBO	(1E11)
RDCMD	(3C1)
RDGATE	(2G7)
S	(3A11)
SAC	(2A7)
SADRC	(3G1)
SCSM1 - SCSM4	(4A7)
SEEK ERROR	(4E11)
SMP	(2C11)
SOP	(3G1)
STSR	(2A8)
TAG1 - TAG3	(4A5)
TDØ-TD7	(1C1)
UNIT READY	(4G11)
UNIT SLCTS - UNIT SLCT3	(4A4)(4C1)
UNIT SLCT TAG	(4A4)
VLDUS	(1A11)
WC	(1E11)
RDCMD	(3C1)
P1 SEND, P3 SEND	(4A11)

CONN.3

ØC9B	A 1	ØC85
	B 2	NSPOT
SAC	C 3	DATOS
MR	D 4	TD4
BSR	E 5	DBPE
SYSR	F 6	PSRCP
OCBR	H 7	SOP
	J 8	
P3SEND	K 9	EBR
P2SEND	L 10	WRCMD
P1SEND	M 11	TD5
PØSEND	N 12	ECCE
	P 13	SMP
	R 14	HDRO
	S 15	WRCMD
	T 16	RDO
	U 17	
PSRCE	V 18	
	W 19	
	X 20	
	Y 21	
	Z 22	

CONN.1

±0V	A 1	±0V
	B 2	
TD7	C 3	TDØ
	D 4	TD6
	E 5	TD1
MMIO	F 6	ØC82
	H 7	
	J 8	WRCK
	K 9	5
	L 10	VLDUS
	M 11	TD2
	N 12	
AØ	P 13	A1
A2	R 14	A3
A4	S 15	A5
A6	T 16	A7
A8	U 17	A9
	V 18	
	W 19	
	X 20	
	Y 21	SADRC
	Z 22	PTIE

CONN.4

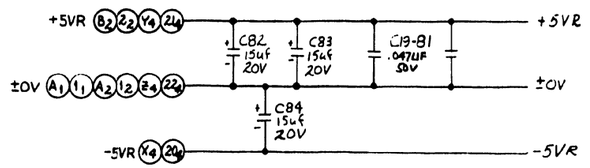
	A 1	CRJT
	B 2	
	C 3	
DRVWR	D 4	FMT
WCE	E 5	RDCMD
TD3	F 6	DWRT
FMTT	H 7	DWRT
	J 8	
Φc	K 9	
	L 10	
	M 11	
	N 12	
RDGATE	P 13	DRVRD
DIAGRD	R 14	HCE
DATOS	S 15	HRCLK
WRTGATE	T 16	SCSM1
CUBSY	U 17	SCSM2
SCSM4	V 18	SCSM3
	W 19	
-5VR	X 20	-5VR
+5VR	Y 21	+5VR
±0V	Z 22	±0V

CONN.2

±0V	A 1	±0V
+5VR	B 2	+5VR
D7	C 3	DØ
D6	D 4	D1
D5	E 5	D2
D4	F 6	D3
RDCMD	H 7	OPEND
	J 8	OBD
	K 9	
	L 10	
	M 11	
	N 12	
	P 13	
	R 14	
	S 15	

J1

TAG1	1	31	TAG 1
TAG2	2	32	TAG 2
TAG3	3	33	TAG 3
BIT 0	4	34	BIT 0
BIT 1	5	35	BIT 1
BIT 2	6	36	BIT 2
BIT 3	7	37	BIT 3
BIT 4	8	38	BIT 4
BIT 5	9	39	BIT 5
BIT 6	10	40	BIT 6
BIT 7	11	41	BIT 7
BIT 8	12	42	BIT 8
BIT 9	13	43	BIT 9
OPEN CABLE DETECT	14	44	OPEN CABLE DETECT
FAULT	15	45	FAULT
SEEK ERROR	16	46	SEEK ERROR
ONCYL	17	47	ONCYL
	18	48	
UNIT READY	19	49	UNIT READY
	20	50	
BUSY	21	51	BUSY
UNIT SLCT TAG	22	52	UNIT SLCT TAG
UNIT SLCT Ø	23	53	UNIT SLCT Ø
UNIT SLCT 1	24	54	UNIT SLCT 1
	25	55	
UNIT SLCT 2	26	56	UNIT SLCT 2
UNIT SLCT 3	27	57	UNIT SLCT 3
WRITE PROT	28	58	WRITE PROT
PICK HOLD	29	59	PICK HOLD
	30	60	



MNEMONIC	COORD.
WCE	(1B11)
WRCK	(3D1)
WRCMD	(3E1)
WRCMD	(3E1)
WRTGATE	(2G7)
WRITE PROT	(4D11)

E-REV
6

REVISION	BY	DATE	APPROVED BY	DATE
0 ORIGINATED PER ECN # 1264 APP'D:	DWN		E ENGR. E. MARTELLO	10-25-79
1 REVISED PER ECN # 11863 APP'D:	CHK		M ENGR	
2 REVISED PER ECN # 12735 APP'D:			MFG ENGR	
3 REVISED PER ECN # 13069 APP'D:				
4 REVISED PER ECN # 13291 APP'D:				
5 REVISED PER ECN # 13648 APP'D:				
6 REVISED PER ECN # 13959 APP'D:				
7 REVISED PER ECN # 14290 APP'D:				

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

FINISH

MODEL NO. 140 — SEE ENGRG SPECIFICATIONS

TOL EX AS NOTED ± FRAC ± ANG ± FINISH √

SCALE — SHT 6 OF 6

TITLE: SMD DISK CONTROL #1

210-7505 | D | 7505 | 11

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

D 7505

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DO NOT SCALE

READ DATA
READ CLOCK
SERVO CLOCK
INDEX PULSE
SECTOR PULSE
SEEK END
UNIT SLCTD
WRITE CLOCK
WRITE DATA

$\overline{POSRD}$ (4G11)
$\overline{PORDC}$ (4F11)
$\overline{POSVDC}$ (4E11)
$\overline{P1SVDC}$ (4E11)
$\overline{POIP}$ (3G9) (3E11)
$\overline{POSP}$ (3G9) (3E11)
POSEND (6C7)
$\overline{POUSLCTD}$ (3C11)
POUSLCTD (6C4)
PO SEND

$\overline{P1SRD}$ (4G11)
$\overline{P1RDC}$ (4F11)
$\overline{P1IP}$ (3E11) (3G6)
$\overline{P1SP}$ (3E11) (3G6)
Y1SEND (6C3)
P1 SEND
$\overline{P1USLCTD}$ (3C11)
P1USLCTO (6C4)
$\overline{SRSC}$ (4E7)
SWD (5B2)

L16 L32 L13 L14 — 75107A
L12 L9 L10 — 75107A
L11 — 75110A
L15 — 75110A
L98 04

DWN	BY	DATE	APPROVED BY / DATE
CHK			E ENGR
			M ENGR
			MFG ENGR

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL
MODEL NO. 140
SEE ENGRG SPECIFICATIONS No.
FINISH
TOL ES AS NOTED
SCALE NONE SHT 1 OF 2
TITLE SMD DISK CONTROL #2
210-7506 | D | 7506 | 10
WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

REVISION NO. SEE SHT 8

2 0 7 5 0 7

"THIS DRAWING AND THE DATA SHOWN THEREON ARE THE CONFIDENTIAL PROPERTY OF AND ARE PROPRIETARY TO WANG LABORATORIES, INC. THIS DRAWING AND THE DATA SHOWN THEREON MAY NOT BE MADE PUBLIC WITHOUT THE WRITTEN CONSENT OF WANG LABORATORIES, INC. IF FOR ANY REASON THIS DRAWING IS PERMITTED BY WANG TO LEAVE THE PHYSICAL CUSTODY OF THE COMPANY, IT IS RETURNABLE UPON THE DEMAND OF WANG LABORATORIES, INC."

DO NOT SCALE

READ DATA
READ CLOCK
SERVO CLOCK
SERVO CLOCK
INDEX PULSE
SECTOR PULSE
SEEK END
UNIT SLCTD

L8 L7 L20 L5 L6 — 75107A

$\overline{P2SRD}$ (4G11)
$\overline{P2RDC}$ (4F11)
$\overline{P2SVDC}$ (4E11)
$\overline{P3SVDC}$ (4E11)
$\overline{P2IP}$ (3G8) (3E11)
$\overline{P2SP}$ (3G8) (3E11)
$\overline{P2SEND}$ (6D3)
$\overline{P2USLCTD}$ (3C11)
P2USLCTD (6C9)
P2 SEND

READ DATA — L4 — 75107A — $\overline{P3SRD}$ (4G11), $\overline{P3RDC}$ (4F11)
INDEX PULSE, SECTOR PULSE — L1 — 75107A — $\overline{P3IP}$ (3G10) (3E11), $\overline{P3SP}$ (3G10) (3E11)
SEEK END, UNIT SLCTD — L2 — 75107A — P3 SEND (6D3)

P3 SEND (K3)
$\overline{P3USLCTD}$ (3D11)
P3USLCTD (6D5)
$\overline{SR5C}$ (4E7)
SWD (5B2)

L3 — 75110A — WRITE CLOCK, WRITE DATA

L7 — 75110A — WRITE CLOCK, WRITE DATA

L72/09

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
	DWN			E ENGR	
	CHK			M ENGR	
				MFG ENGR	
MATERIAL	MODEL NO. 170	TITLE SMD DISK CONTROL #2			
	SEE ENGRG SPECIFICATIONS No.				
FINISH	TOL EX AS NOTED .XX ± .XXX ± FRAC ± ANG ± FINISH	210-7506	D	7506	10
	SCALE — SHT 2 OF 3	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

REVISION: SEE SHT 8

D 7506

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DO NOT SCALE

P3SP (2E5) P3IP (2E6) P2SP (2C9) P2IP (2D9) P1SP (1E5) P1IP (1E6) POSP (1C9) POIP (1D9)

SYSR SADRC D_F D_E D_D D_C D_B D_A D_9 D_8

R183 R184 R185 R186 2.2K

L21 L22 L24 L25 L27 L28 L30 L31 197 CNT/LD

L55 LS174

PT3SC6 PT3SC4 PT3SC3 PT3SC2 PT3SC1 PT3SC0 PT2SC6 PT2SC4 PT2SC3 PT2SC2 PT2SC1 PT2SC0 PT1SC6 PT1SC4 PT1SC3 PT1SC2 PT1SC1 PT1SC0 POSC6 POSC4 POSC3 POSC2 POSC1 POSC0

+5V R187 1.5K 5%

L29 L26 L23 LS153

L38 LS266 L37 LS266

SAC SAC (3D8)

POSP (1C9) P2SP (1E5) P2SP (2C9) P3SP (2E5) POIP (1D9) P1IP (1E6) P2IP (2D9) P3IP (2E6)

L40 153

PTIE

BC4 (4C8) L72 04

L74 LS74 156 74

SOP (5E10) BCR (4C10) BCE (4D10) BONS (4B6) ONS (6F3)(4D2)

SAC (3E1)

R188 R189 R190 1K 2.2K

L39 537 L50 500

P3USLCTD (2E3) P2USLCTD (2B9) P1USLCTD (1E3) POUSLCTD (1B9)

L36 00 L36 02 L37 LS266 R191 R192 2.2K

VLDUS

SW1 SW2 L7A L50A LS244

L51 LS240

R193 R194 R195 R196 2.2K

BSR SMP

L54 LS244

TD_0 TD_1 TD_2 TD_3 TD_4 TD_5 TD_6 TD_7

$TD_0 - TD_7$ (6E3)

OCB2

SEE SHT 8

REVISION	BY	DATE	APPROVED BY	DATE
	DWN	1/21/76	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140

SEE ENGR SPECIFICATIONS No.

FINISH

TOL EX. AS NOTED

TITLE SMD DISK CONTROL #2

210-7506 | D | 7506 | 10

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

SCALE SHT 3 OF 8

D7506

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DO NOT SCALE

$\overline{P0SRD}$ (1G9) $\overline{P1SRD}$ (1EB) $\overline{P2SRD}$ (2G9) $\overline{P3SRD}$ (2EB) → L48 → L74 → SRSD (5E11)

$\overline{P0RDC}$ (1F9) $\overline{P1RDC}$ (1EB) $\overline{P2RDC}$ (2F9) $\overline{P3RDC}$ (2E7) → L49 → L158 → L139 → $SRSC_1$ (5E11) (6D11)

ECCEND (4G4) DRVRD (4F4) → L48 → L157 → L139 → $SRSC_0$ (4F1) (5E5)

RDGATE(4B1) $\overline{P0SVDC}$ (1F9) $\overline{P1SVDC}$ (1E9) $\overline{P2SVDC}$ (2E9) $\overline{P3SVDC}$ (2E9) → L48 → L158 → L139 → $\overline{SRSC}$ (1D4) (2D4) (5E7)

+5VR R199 1K

DRVRD (5F5) (4F4)

OBD (5A7) → L157 → L175 → $\overline{CRJT}$ (4)

+5VR R201 1K

BCE (3E7) → L163 → CO_0 (4E3)

$\overline{BCR}$ (3E7) → L44 → L163

SC_1 (4C1) → L44 → L163

SC_2 (4E4) → L45 → L163

+0V

BC1 BC2 BC4 BC8 → L43 → L110 → $\overline{BCD_7}$ (4F2) → L93 → BCD_7 (5C10)

BC2 (3D9) → L111 → BCD_0 (5F7)

BC_4 (3F9)

BC16 BC32 BC64 BC128 → L44

RDEND(4G4) → L00 → L73 → L10

BC256 BC2048 → L45

FMT(5C4) → FMT (4)

$\overline{NSOPT}$ (3)

BC2 BC4 BC8 BC16 BC32 BC64 BC128 BC256 BC2048 → L62 → L78 → L77 → L79 → L73 → L63 → L10

BC64 → L63

BONS(3D7) → L48

DO NOT SCALE

BC2 BC8 → L62 → L76 → RDEND (4C8)

R197 1K +5VR

BC1 BC2 BC128 → L62 → L76 → ECCEND (4E11)

BC32 BC64 BC256 BC2048 → L62 → L77 → DRVRD (4E11)

BC8 BC16 BC64 BC256 → L62 → L78 → SC_2 (4B11) (5D9)

DRVRD (5F3)

DRVWR(5F6) C19 120 pf ±0V

BC8 BC16 BC64 BC128 → L62 → L78

BC64 → L63

$\overline{WRS}$ (5B11) → L79

BONS(3D7) → L48

DWRT (4) RDCMD (5) DWRT (7)

L81 → L90 → L62 → L20

ECCW (6F11) (5B5) +5VR R198 2.2K → L87 → L49A → L74 → PSRCW (6D11)

$SRSC_0$ (4E7) → L65 → L74 → DROP (5G5)

DFW (5E7)

$\overline{BCD_7}$ (4D7)

L80 → L02

CO_0 (4D9) → L32 → L20 → $\overline{SSOB}$ (5C10) (6G10)

BC1 BC2 → L60 → L46 → WRT GATE (4)

WRT GATE (6D5)

ONS (3D7) +5VR R200 1K → L64 → HT (6D5)

L62 → FMTT (4)

L63 → $\overline{F50B}$ (5B5)

L63 → SC_1 (4C11)

L64 → RD GATE (5)

RD GATE (4E11) (6D5)

$\overline{FMT}$ (5D4) → L64

L48 → RGA (6F2)

REVISION	BY	DATE	APPROVED BY	DATE
SEE SHT 8	DWN		E ENGR	
	CHK		M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL | MODEL NO. 140 | TITLE SMD DISK CONTROL #2

FINISH | TOL EX AS NOTED FRAC ± ANG ± FINISH | 210-7506 | D | 7506 | 10

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

SHT 7 OF 8

D 7506

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DO NOT SCALE

HDRO (H4) EBR (J3) WRCMD (L3) DBOPB (Y1) DRV WR (D4) INRDY (D1)

DBOD0 (H2) DBOD1 (J4) DBOD2 (M1) DBOD3 (L1) DBOD4 (K2) DBOD5 (L2) DBOD6 (K1) DBOD7 (J2)

L105 195 L106 195 — DBOD0-7 → SR0-SR7, SH/LD

SOP (73) → SOP(5C2)(3E9)

SRSC1 (4F7) SRSD (4G8) → L66A 74 → PBRI (6G10)

R204 2.2K +5VR; R205 2.2K +5VR; R206 2.2K +5VR; R207 2.2K +5VR; R208 10K +5VR

WRCK (B1) SC2 (4E4) WRCMD WRS (4C4) DBOLW (C4) OUT RDY (F1) DATOS (J3) RDCMD (H2)

L57 574 — BCD7 (4D7) S50B (4E2)

L113 123 — *1: PULSE WIDTH, 50 NS MIN, 150 NS MAX

DBICC (K1)

L107 5280 — SR0-SR7 → ΣE

EBR (6E2)

DRV WR (4E4)

C118 47pf EPOXY DIP

BCD0 (4C7) DFW (4F2) SRSC (4D7)

L93 504

L89 1473 — +5VR

L66A 74 — DBOCC (L4) NXTOUT (M1) HDRDTA (B2) WCE (E4)

DROP (4F1) → L72 04

L91 574 — L90 7473 — +5VR

DRVRD (4E4)(6E6)

DRVIRC (4G11)

L108 LS374 — OBD(4D11)

INSTRB (J1) DBID0 (22) DBID1 (23) DBID2 (17) DBID3 (16) DBID4 (13) DBID5 (14) DBID6 (15) DBID7 (18) DBIPE (5) DBIPB (4)

SRSC0 (4E7) — L112 7473 — +5VR

WR CLK (14) HCE (12)

FMT (4B2)

HT (4D1)

FMT (4A10)

X34 (6B7) ECCW (4G2) F50B (4C1)

SOP (5E10) — L146 574 — SWD(1D3)(2,3)(6F3)

R209 1K +5VR; R210 1K +5VR

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY / DATE
	DWN		E ENGR
	CHK		M ENGR
			MFG ENGR
MATERIAL	MODEL NO. 170	TITLE	SMD DISK CONTROL #2
	SEE ENGRG SPECIFICATIONS No.		
FINISH	TOL EX AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √	210-7506	D 7506 .C
	SCALE 1/1 SHT 5 OF 8	WANG PART NUMBER	SIZE DRAWING NUMBER REV

D 7506

REVISION — SEE SHT 8

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DO NOT SCALE

PSRI(5E7)
+5VR
R211 2.2K
S50B (4E2)
! REGR (R4)
ECCW (4G2)
PRSCP (K3)
PSRCW (4F1)
SRSCA (4F1)
PSRCE (V3)
ϕAC (L4)
C21 47Pf
C120 220Pf
±0V
R217 33Ω
* HAND WIRE PER ECN# 15042

LS273 L83 L99 L86 L102 L104
LS175
R216 2.2K
X_{34} (5B5)

OPEND (Z2)
OCB4 (H3)
OCB5 (I3)
OCB9 (K3)
LS244 L53 L52
SWD (5D2)
RDEND(4G4)
RGA (4B2)
ONS (3D7)
TD0-TD7 (3B1)
EBR (5F8)
LS74 L89
ECCE (I3)
DRVRD(5F3)

WRT GATE(4E1)
RD GATE(4B1)
P3USLCTD (2D4)
P2USLCTD (2C8)
P1USLCTD (1D4)
P0USLCTD (1C8)
P3 SEND(2E4)
P2 SEND(2C9)
P1 SEND(1E4)
P0 SEND(1C9)
LS240 L17
LED4 LED3 LED2 LED1
R212 220Ω
R213 220Ω
R214 220Ω
R215 220Ω

SEE SHT 8

REVISION	BY	DATE	APPROVED BY	DATE
	DWN WB	11/20/74	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140
SEE ENGRG SPECIFICATIONS
No.

FINISH

TOL ER AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH

TITLE: SMD DISK CONTROL PC 2

210-7506 | D | 7506 | 1

SCALE: 4 | SHT 6 OF 8 | WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

D 7506

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DO NOT SCALE

J1 J2 J3 J4

LED0 P0 LED2 P1 LED3 P2 LED4 P3

SPARE

SPARE

7506 R4

REVISION	BY	DATE
SEE SHT 8		

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

	BY	DATE	APPROVED BY	DATE
	DWN GO	9/27/78	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

MATERIAL

MODEL NO. 140

SEE ENGRG SPECIFICATIONS: No.

TITLE SMD DISK CONTROL #2

FINISH

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG. ± FINISH √

210-7506	D	7506	
WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

SCALE 1/1 SHT 2 OF 8

D7506

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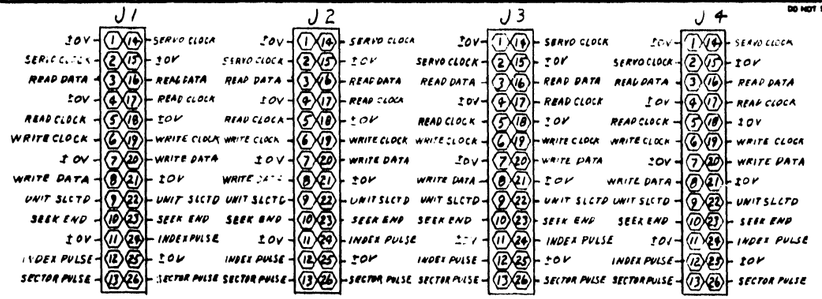
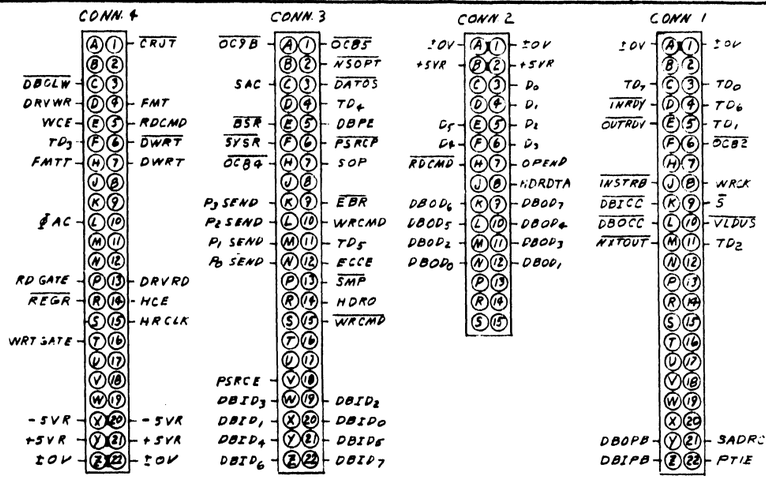
DO NOT SCALE





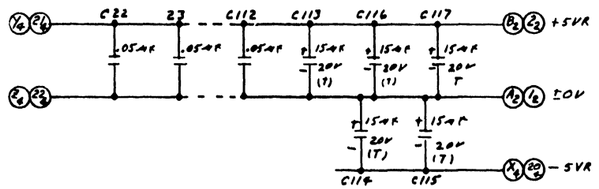
MNEMONIC	COORDINATE
BSR	3A5
CRUT	4D11
Do-D5	3G2
DATOS	5B11
DBIPB	5A10
DBOD0-DBOD7	5G1
DBOPB	5E1
DBOCC	5F11
DBOD0-DBOD7	5AB
DBOPB	5F11
DBPE	5G7
	5E1
DRVRD	4E11
DRVWR	5G6
DWRT	4G2
DWRT	4G3
EBR	5G8
ECCE	6E1
FMT	4A11
FMTT	4C1
HCE	5E1
HDRDTA	5A6
HDRO	5G8
HRCLK	5E1
INDEX PULSE	(1D11)(16G) (2D11)(26G)
INRDY	5G6
INSTRB	5G1
NSOPT	4A7
NXTOUT	5A7
OCIB	6G2
OCB2	3A11
OCB4	6G3
OCB9	6G2
OPEND	6G4
OUTRDY	5C11
Po SEND	1A9
P1 SEND	1F1
P2 SEND	3A9
P3 SEND	2F1
PSRCE	6D11
PSRCP	6F11
PTIE	3D11
RDCMD	4G2
RDCMD	5A11
RQ GATE	3B1
READ CLOCK	(1F11)(16G) (2F11)(26G)
READ DATA	(1G11)(16B) (2G11)(26B)
RECR	6G11
S	6A6
SAC	7E1
SADRC	7G3
SECTOR PULSE	(1C11)(16E) (2C11)(26E)
SEEK END	(2C11)(16A) (2C11)(26A)
SERVO CLOCK	(1F11)(16E) (2F11)(26E)
SMP	3A4
SOP	5E11
SYSR	3G5

I.C. TYPE	LOC	SPARES
74S00	L73	1
74S60	L69	1
74LS02	L70	1
74S03	L109	2
74S04	L48	1
74S04	L93	2
74S08	L74	1
74S10	L81	1
74S10	L65A	2
74LS11	L66	2
74S20	L42	1
74LS27	L111	1
74S74	L49A	1
	L88	1
74S86	L67	1
74LS86	L87	1
74123	L113	1
74LS240	L17	1

I.C. LOCATION	W.L. PART No	TYPE
L1, 2, 4, 5, 6, 8, 9, 10, 12, 13, 14, 16, 20, 32	376-0196	75107A
L3, 7, 11, 15	376-0155	75110A
L17A, 50A, 52, 53, 54	376-0288	74LS244
L17, 51	376-0222	74LS240
L18, 19	376-0207	74LS00
L21, 22, 24, 25, 27, 28, 30, 31	376-0083	74197
L23, 26, 29	376-0156	74LS153
L35, 73	376-0002	7400
L36	376-0016	7402
L37, 38	376-0148	74LS266
L39	376-0196	74S37
L40	376-0048	74153
L41, 42, 61, 62	376-0130	74S20
L43, 44, 45	376-0233	74S163
L46, 47A, 56, 57, 58, 63, 76, 77, 78, 79	376-0202	74S74
L47	376-0237	74S11
L48, 72	376-0117	7404
L49	376-0211	74LS32
L50, 65, 69	376-0238	74S00
L52	376-0159	74LS174
L59, 80	376-0139	74S02
L60, 66	376-0215	74LS11
L64, 64A, 81, 110	376-0238	74S10
L66A	376-0006	7474
L67	376-0211	74S86
L68, 97	376-0051	7430
L70	376-0208	74LS02
L71	376-0200	74S08
L75,	376-0158	74LS174
L77, 79, 89, 90, 112	376-0003	7473
L81A, 97A		SPARE
L82, 87, 98, 101	376-0231	74LS86
L83, 86, 99, 102	376-0302	74LS273
L84, 85, 100, 103, 111	376-0145	74LS27
L92	376-0234	74125
L93	376-0177	74S04
L96	376-0135	7427
L95	376-0009	7420
L96	376-0209	74LS10
L104	376-0160	74LS175
L105, 106	376-0097	74193
L107	376-0246	74S280
L108	376-0296	74LS374
L109	376-0028	7403
L113	376-0080	74123
L71	376-0210	74LS20

COMPONENT	W.L. PART No	TYPE
R1-16, 48-59, 82-85, 88-103, 139-150, 173-176, 179-182	330-1082	82Ω ¼W 10%
R17-32, 60-71, 108-123, 151-162	330-2048	470Ω ¼W 5%
R33, 35, 36-39, 41-44, 46, 47, 72, 73, 75-78, 80, 81, 124, 125, 127-130, 132-135, 137, 138, 163, 164, 166-169, 171, 172	330-4056	56K ¼W 10%
R35, 40, 45, 74, 79, 126, 131, 136, 165, 170, 183-186, 190-196, 198, 202-207, 86, 87, 211, 216, 177, 178	330-3022	2.2K ¼W 10%
R187	330-3016	1.5K ¼W 5%
R188, 189, 197, 199, 200, 201, 209, 210	330-3010	1K ¼W 10%
R208	330-4010	10K ¼W 10%
R212-215	330-2022	220Ω ¼W 10%
R217	330-1033	33Ω ¼W 10%
C1-18, 22-112	300-1900	.05MF 12V (CER)
C19	300-1120	120PF (CER)
C119, 120	300-1220	220PF 500V (CER)
C21	300-1047	47 PF 500V (CER)
C113-117	300-4022	15MF 20V (T)
C118	300-2602	47 PF 5% 10% 500V
LED1-4	370-0026	LED RED
J1, 2, 3, 4	350-0058	26 PIN CONN
SW1, 2	325-1503	8 BANK ROC. SW.
SW1, 2	325-9047	SW COVER

MNEMONIC	COORDINATE
TDo-TD7	6F1
UNIT SLCTD	(1B11)(16B) (2B11)(26B)
VLDUS	3A9
WCE	5A6
WRCK	5D11
WRCMD	3B11
WRCMD	5G8
WRITE CLOCK	(1A7)(1D1) (2A7)(2D1)
WRITE DATA	(1A7)(1D1) (2A7)(2D1)
WRT GATE	1D1
$AC	6D11



E- REV

5

REVISION	BY	DATE	APPROVED
0	ORG. PER DWR #E633 APPROVED:	10-15-79	
1	REVISED PER ECN #11862 APPROVED:	10-15-79	
2	REVISED PER ECN #12026 APP:	10-22-79	
3	REVISED PER ECN #12328 APP:	10-29-79	
4	REVISED PER ECN #13011 APPROVED:	11-9-79	
5	REVISED PER ECN #13400 APPROVED:	11-9-79	
6	REVISED PER ECN #13748 APPD:	11-1-80	
7	REVISED PER ECN #13953 APPD:	3-6-80	
8	REVISED PER ECN #13962 APPD:	5-16-80	
9	REVISED PER ECN #14135 APPD:	10-27-80	
A	REVISED PER ECO #2170 ADDED:	11-6-82	

	BY	DATE	APPROVED BY	DATE
DWN		10-15-79	E ENGR A. DESKUR	10-30-79
CHK		10-30-79	M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140

SEE ENGRG SPECIFICATIONS No.

FINISH

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ±
FINISH √

SCALE FULL SHT 8 OF 8

TITLE SMD DISK CONTROL #2

210-7506 | D | 7506 | 10

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

7506

NO.	REVISION	DATE	BY
	SEE SHEET 4		

SIGNAL	DATA LINK DRIVER	DATA LINK CONTROLLER	SMD CONTROLLER	SMD DRIVER	FLOPPY/ IOMEG	CPU/ MEMORY	SPARE	SPARE	FLOPPY CONN	REGULATOR	J1	J2	J3	J4	J5	J6
A0	P1	P1	P1	P1	P1	P1										
A1	13₁	13₁	13₁	13₁	13₁	13₁										
A2	R1	R1	R1	R1	R1	R1										
A3	14₁	14₁	14₁	14₁	14₁	14₁										
A4	S1	S1	S1	S1	S1	S1										
A5	15₁	15₁	15₁	15₁	15₁	15₁										
A6	T1	T1	T1	T1	T1	T1										
A7	16₁	16₁	16₁	16₁	16₁	16₁										
A8	U1	U1	U1	U1	U1	U1										
A9	17₁	17₁	17₁	17₁	17₁	17₁										
A10	V1	V1	V1	V1	V1	V1										
A11	18₁	18₁	18₁	18₁	18₁	18₁										
A12	W1	W1	W1	W1	W1	W1										
A13	19₁	19₁	19₁	19₁	19₁	19₁										
A14	X1	X1	X1	X1	X1	X1										
A15	20₁	20₁	20₁	20₁	20₁	20₁										
AUTORESET						N2				12₂						
BUSAK	13₂	13₂	13₂	13₂	13₂	13₂										
BSR			E3	E3												
CBUSRQ	J2	J2	J2	J2	J2	J2										
CPLFS1					9₁	9₁										
CPLFS2					22₁	22₁										
CPLFS3					4₁	4₁										
CPLFS4					7₂	7₂										
CPLFS5					H2	H2										
CPLFS6					8₂	8₂										
CPLFS7					21₁	21₁										
CPLFS8					11₁	11₁										
CPLFS9					10₁	10₁										
CPLFS10					8₁	8₁										
CPLFS11					6₁	6₁										
CRJT			14	14												
CUBSY	U4	U4	U4	U4	U4	U4										
CRQAK	12₁	12₁	12₁	12₁	12₁	12₁										
D0	3₂	3₂	3₂	3₂	3₂	3₂										
D1	4₂	4₂	4₂	4₂	4₂	4₂										
D2	5₂	5₂	5₂	5₂	5₂	5₂										
D3	6₂	6₂	6₂	6₂	6₂	6₂										
D4	F2	F2	F2	F2	F2	F2										
D5	E2	E2	E2	E2	E2	E2										
D6	D2	D2	D2	D2	D2	D2										
D7	C2	C2	C2	C2	C2	C2										
DATOS			33	33												
DATOS			S4	S4												
DBICC	K1	K1	K1	K1	K1											
DBICo	B4	B4	B4	B4												
DBOCC	L1	L1	L1	L1	L1											
DBOCO	34	34	34	34												
DBODo	N2	N2	N2	N2	N2											
DBOD1	12₂	12₂	12₂	12₂	12₂											
DBOD2	M2	M2	M2	M2	M2											
DBOD3	11₂	11₂	11₂	11₂	11₂											
DBOD4	10₂	10₂	10₂	10₂	10₂											
DBOD5	L2	L2	L2	L2	L2											
DBOD6	K2	K2	K2	K2	K2											
DBOD7	9₂	9₂	9₂	9₂	9₂											
DBIDo	20₃/9₄	20₃/9₄	20₃	20₃	20₃/5₄	20₃										
DBID1	X3/12₄	X3/12₄	X3	X3	X3/D4	X3										
DBID2	19₃/N4	19₃/N4	19₃	19₃	19₃/6₄	19₃										
DBID3	W3/11₄	W3/11₄	W3	W3	W3/E4	W3										
DBID4	Y3/M4	Y3/M4	Y3	Y3	Y3/C4	Y3										
DBID5	21₃/10₄	21₃/10₄	21₃	21₃	21₃/3₄	21₃										
DBID6	Z3/2₄	Z3/2₄	Z3	Z3	Z3/A4	Z3										
DBID7	22₃/18₄	22₃/18₄	22₃	22₃	22₃/1₄	22₃										
DBIPB	Z1	Z1	Z1	Z1	Z1											
DBOLW	C4	C4	C4	C4												
DBOPB	Y1	Y1	Y1	Y1	Y1											
DBPE			53	53												
DIAGRD			R4	R4												
DLCS1	R4	R4														
DLCS2	F1	F1														
DLCS3	H3	H3														
DLCS5	L3	L3														
DLCS6	11₃	11₃														
DLCS7	7₃	7₃														
DLCS8	1₃	1₃														
DLCS9	7₂	7₂														
DLCS10	H2	H2														
DLCS11	10₁	10₁														
DLCS12	3₁	3₁														
DLCS13	C1	C1														
DLCS14	8₁	8₁														
DLCS15	22₁	22₁														
DLCS16	14₃	14₃														
DLCS17	13₃	13₃														
DLCS18	5₃	5₃														
DLCS19	4₃	4₃														
DLCS20	2₃	2₃														
DLCS23	19₄	19₄														
DLCS24	10₃	10₃														
DLCS25	9₃	9₃														
DLCS26	F3	F3														
DLCS27	E3	E3														
DLCS28	C3	C3														
DLCS29	A3	A3														
DLCS30	6₁	6₁														
DLCS31	9₁	9₁														
DLCS32	11₁	11₁														
DLCS33	3₃	3₃														
DLCS34	6₃	6₃														
DLCS35	12₃	12₃														

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DO NOT SCALE

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		DRWN	BY		
		CHK			
				DATE	APPROVED BY
		M ENGR		12-2-79	P.E.P.
		MFG ENGR			
SIZE	DRAWING NUMBER				REV
D	7507				S

TITLE: MOTHERBOARD

210-7507

140

NO	REVISION	DATE	BY
	SEE SHEET 4		

SIGNAL	DATA LINE DRIVER	DATA LINE CONTROLLER	SMD CONTROLLER	SMD DRIVER	FLOPPY/ IOMEG	CPU/ MEMORY	SPARE	SPARE	FLOPPY CONN.	REGULATOR	J1	J2	J3	J4	J5	J6
DLCS 36	15 3	15 3														
DLCS 37	V3	V3														
DLCS 38	M3	M3														
DLCS39	K3	K3														
DLMMI/O	5,	5,				5,										
DLNB	T4	T4				T4										
DMAMREQ	P2	P2	P2	P2	P2	P2										
DRVRD			134	134												
DRVWR			D4	D4												
DSU						W4								12		
DSU						R4								10		
DWRT			74	74												
DWRT			64	64												
EBR			93	93												
ECCE			123	123												
FDLTZ					V4				P							
FDRCK					74				F							
FDRDD					F4				H							
FDRDY					P4				R							
FDWCD					R4				E							
FDWPT					W4				K							
FDWRGT/ERGT					T4				D							
FHDIR					164				C							
FHDLD					174				M							
FHSTP					194				B							
FINDEX					134				J							
FMT			44	44												
FMTT			H4	H4												
FPL1						144								11		
FPL2						134								9		
FPL3						P4								3		
FPL4						H4								4		
FSECTOR					H4				L							
FSPARE					184				S							
HCE			144	144												
HDRO			143	143												
HRCLK			154	154												
ICLK	4,	4,														
INRDY	D,	D,	D,	D,	D,											
INSTRB	J,	J,	J,	J,	J,											
IORQ	U3	U3	U3	U3	U3	U3/4										
LG0	D4	D4														
LG1	44	44														
LG2	64	64														
LG3	54	54														
LG4	74	74														
LG5	H4	H4														
LG6	F4	F4														
LG7	E4	E4														
M1	R3	R3	R3	R3	R3	R3/D4										
MDMARS	14	14														
MMI/O			F,	F,	F,	F,										
MMWRS	B3/P4	B3/P4														
MR	D3/174	D3/174	D3	D3	D3/44	D3/44										
MREQ0	173	173	173	173	173	173/14										
NSOPT			23	23												
NU1			114	114	114	114										
NU2			104	104	104	104										
NU3			94	94	94	94										
NU4			84	84	84	84										
NU5			124	124	124	124										
NU6	J4	J4	J4	J4	J4	J4										
NU7			N4	N4	N4	N4										
NU8	183	183	183	183	183	183										
NXTOUT	M,	M,	M,	M,	M,											
ØAC	L4	L4	L4	L4	L4	L4										
ØC	K4	K4	K4	K4	K4	K4										
ØBD			82	82												
ØC9B			A3	A3												
ØC82			6,	6,												
ØC84			H3	H3												
ØC85			13	13												
OPEND			72	72												
OUTRDY	E,	E,	E,	E,	E,											
½ØC			M4	M4	M4	M4										
PARIN	7,	7,	7,	7,	7,	7,										
PAROUT	H,	H,	H,	H,	H,	H,										
PRMS										F2				2		
PSRCE			V3	V3												
PSRCP			63	63												
PTIE			22,	22,												
PWRLED						194								13		
P0 SEND			N3	N3												
P1 SEND			M3	M3												
P2 SEND			L3	L3												
P3 SEND			K3	K3												

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DO NOT SCALE

WANG	LABORATORIES, INC.		
DRWN BY	DATE	APPROVED BY	DATE
CHK'D	02-27	ENGR P.E.P	9/25/75
	6/XX/75	MFG ENGR	
SIZE	DRAWING NUMBER	REV	
D	7507	S	
NEXT ASSY	USED ON	APPLICATION	
140			
TITLE	MOTHERBOARD		
PROPRIETARY AND CONFIDENTIAL			

D 7507

NO.	REVISION	DATE	BY
	SEE SHEET 4		

SIGNAL	DATA LINK DRIVER	DATA LINK CONTROLLER	SMD CONTROLLER	SMD DRIVER	FLOPPY/ IOMEG	CPU/ MEMORY	SPARE	SPARE	FLOPPY CONN.	REGULATOR	J1	J2	J3	J4	J5	J6
$\overline{RD_0}$	16₃/A₄	16₃/A₄	16₃	16₃	16₃/2₄	16₃/2₄										
RDCMD			5₄	5₄												
$\overline{RDCMP}$			H₂	H₂												
RDGATE			P₄	P₄												
$\overline{RFSH}$	S₃	S₃	S₃	S₃	S₃	S₃/C₄										
$\overline{RFMME}$	N₃/W₄	N₃/W₄														
$\overline{S}$			9₁	9₁												
SAC			C₃	C₃												
SARC			21₁	21₁												
SCHDA1					15₄	15₄										
SCHDA2					S₄	S₄										
SCSM1			16₄	16₄		16₄										
SCSM2			17₄	17₄		17₄										
SCSM3			18₄	18₄		18₄										
SCSM4			V₄	V₄		V₄										
$\overline{SFDD}$					14₄				N							
SLCTØØ	S₄	S₄														
$\overline{SLD}$	8₄/J₃	8₄/J₃														
$SMDS_1$			A₄	A₄												
$SMDS_2$			2₄	2₄												
$SMDS_3$			B₃	B₃												
$SMDS_4$			8₃	8₃												
$SMDS_5$			J₃	J₃												
$\overline{SMP}$			13₃	13₃												
SOP			T₃	T₃												
SS_0	13₄	13₄														
SS_1	14₄	14₄														
SS_2	15₄	15₄														
$\overline{STDATA}$	N₁	N₁	N₁	N₁	N₁	N₁										
$\overline{STXD}$	21₁	21₁														
$\overline{SYSR}$			F₃	F₃												
TD_0			3₁	3₁												
TD_1			5₁	5₁												
TD_2			11₁	11₁												
TD_3			F₄	F₄												
TD_4			4₃	4₃												
TD_5			11₃	11₃												
TD_6			4₁	4₁												
TD_7			C₁	C₁												
$\overline{TXI}$	8₂	8₂														
VLDUS			10₁	10₁												
$\overline{WAIT}$	P₃/16₄	P₃/16₄	P₃	P₃	P₃	P₃/E₄										
WCE			E₄	E₄												
$\overline{WR}$	T₃	T₃	T₃	T₃	T₃/8₄	T₃/B₄										
WRCK			8₁	8₁												
WRCMD			C₃	10₃												
$\overline{WRCMD}$			15₃	15₃												
WRGATE			T₄	T₄												
$\overline{WTMME}$	V₄/8₃	V₄/8₃														
6.5VACT1											X₄/20₄	2				
6.5VACT2											Z₄/22₄	1				
11.5VACT1											B₄/2₄	7				
11.5VACT2											D₄/4₄	8				
17VACT1											T₄/16₄	3				
17VACT2											V₄/18₄	4				
27VACT1											F₄/6₄	5				
27VACT2											J₄/8₄	6				
+5 REG1											B₂/2₂		1			
+5 REG2											C₂/32		2			
+5VR1S											12		3			
+5VR2S											A2		4			
+24VR	B₁/2₁	B₁/2₁	B₁/2₁	B₁/2₁	B₁/2₁	B₁/2₁			14		H₂/7₂					
+12V	S₂/15₂	S₂/15₂	S₂/15₂	S₂/15₂	S₂/15₂	S₂/15₂	S₂/15₂ Z₂/22₁	S₂/15₂ Z₂/22₁			S₂/15₂					
−12V	R₂/14₂	R2/14₂	R₂/14₂	R₂/14₂	R₂/14₂	R₂/14₂	R2/19₂ Y₁/21₁	R2/19₂ Y₁/21₁			R₂/14₂					
−5V	X₄/20₄	X₄/20₄	X₄/20₄	X₄/20₄	X₄/20₄	X₄/20₄	X₄/20₄	X₄/20₄	13		A₄/14					
+5VR1					Y₄/21₄	Y₄/21₄	Y₄/21₄	Y₄/21₄	15		4 2			1	1	
					B₂/2₂	B₂/2₂	B2/2₂ C₁/3₁	B2/2₂ C₁/3₁						14		
+5VR2	Y₄/21₄ B₄/2₂	Y₄/21₄ B₄/2₂	Y₄/21₄ B₄/2₂	Y₄/21₄ B₄/2₂		C₁/3₁					D2					2
±0V	Z₄/22₄	Z₄/22₄	Z₄/22₄	Z₄/22₄	Z₄/22₄	Z₄/22₄	Z₄/22₄	Z₄/22₄	A, 1, 2, 3		J₂/8₂			1	7	
	A2/12	A2/12	A2/12	A2/12	A2/12	A2/12	A2/12	A2/12	4, 5, 6,		K₂/9₂			2	8	
	A₁/1₁	A₁/1₁	A₁/1₁	A₁/1₁	A₁/1₁	A₁/1₁	A₁/1₁	A₁/1₁	7, 8, 9,		L2/10₂			3		
									10, 11, 12		L4/10₄			4		
											M₄/11₄					
											N₄/12₄					
											P₄/13₄					
											R₄/19₄					

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DO NOT SCALE

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.			
DRWN'L NO. 140	BY	DATE	APPROVED BY
MFG. DRWG. SPECIFICATION	DRWN SK	10-2-79	ENGR PE P
	CHK.		MFG ENGR
TITLE MOTHERBOARD			
BOARD PART NUMBER 210-7507	SIZE D	DRAWING NUMBER 7507	REV. 5

7507

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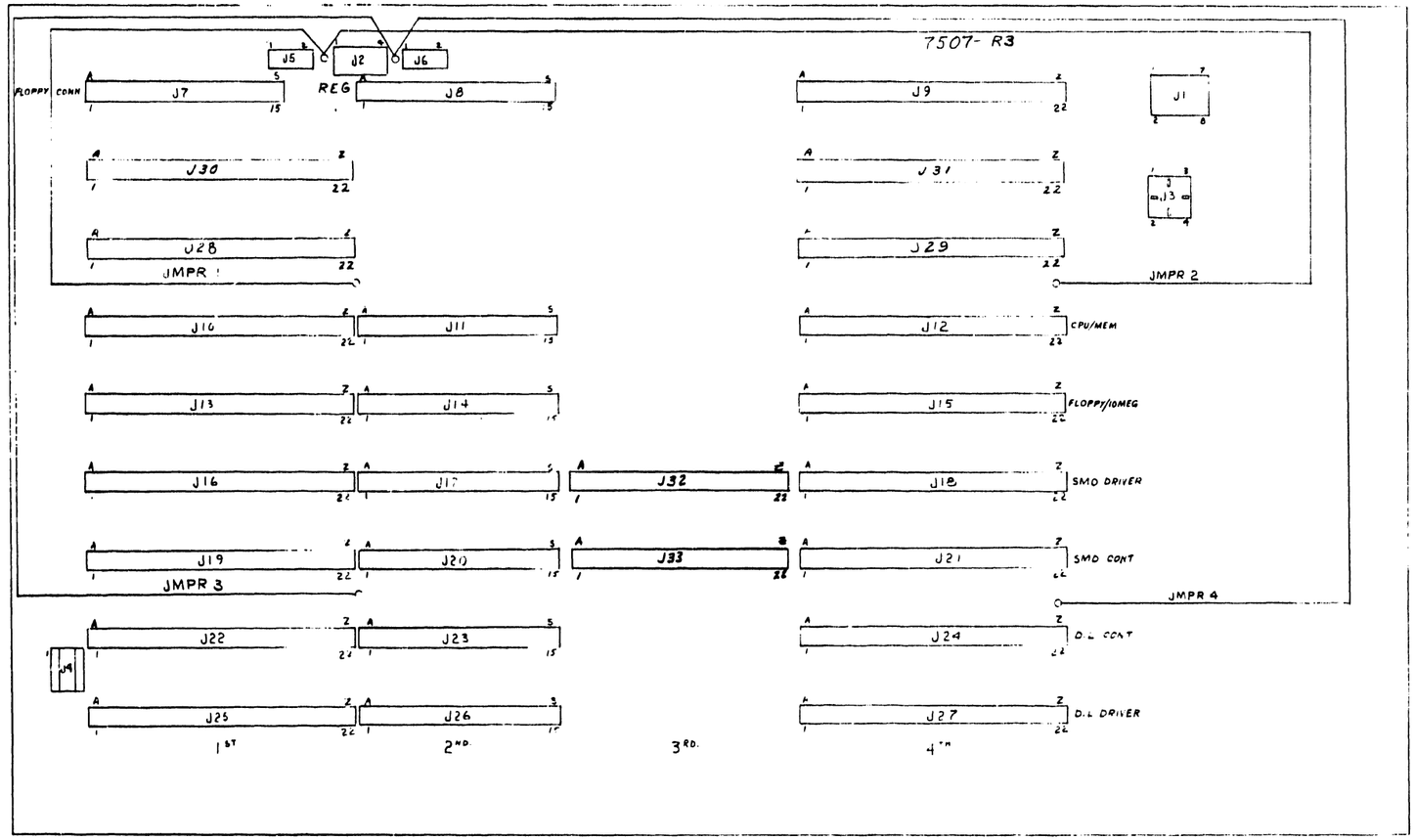
DO NOT SCALE



COMPONENT LAYOUT

COMPONENT	W.L. PART NO.	TYPE
J1	654-1190	8 POS. PIN HEADER
J2	654-1194	4 POS. P.C. HEADER
J4	376-9212	14 PIN CAMBION
J5,6	654-1198	2 POS. PIN HEADER
J9,10,12,13,15,16,18,19,21,22,24,25,27,28-31	350-0021	44 PIN CONN.
J7,8,11,14,17,20,23,26	350-0011	30 PIN CONN.
J32,33	350-0039	44 PIN CONN.
J3	654-3001	4 MALE CONTACT
	654-2073	CONN. HOUSING

NO.	REVISION	BY	DATE	E.S.S.	E.M.S.P.
1	ORIGINATED PER ENGR # ESS DWR: 8 SHTS	LR	12-7-79		
1/1	REVISED PER ENGR # ESS DWR: 8 SHTS	LR	12-7-79		
1/2	REVISED PER ECN = 13107 APPROVED: 8 SHTS	RD	10-30-79		
2	REVISED PER ECN = 13172 APPROVED: 8 SHTS	RD	11-9-79	11-21-79	11-29-79
3	REVISED PER ECN = 13172 APPROVED: 8 SHTS	RD	12-20-79	1-11-80	1-23-80
M 1/2	REVISED PER ECO # 5152 APPROVED: 8 SHTS				
M 1/2	REVISED PER ECO # 5152 APPROVED: 8 SHTS				
M 2	REVISED PER ECO # 5152 APPROVED: 8 SHTS				

	BY	DATE	APPROVED BY	DATE
DWN	LR	10-2-79	E ENGR P.E.P.	10-9-79
CHK	RD	10-16-79	M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL MASS. U.S.A.

MATERIAL

MODEL NO. 140

SEE ENGRG SPECIFICATIONS No.

FINISH

TOL ES AS NOTED XX ± FRAC ± XXX ± ANG ± FINISH

TITLE MOTHERBOARD

SCALE 1/4 SHT 4 OF 4

210-7507 | D | 7507 | 5

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

E-REV 2

D 7507

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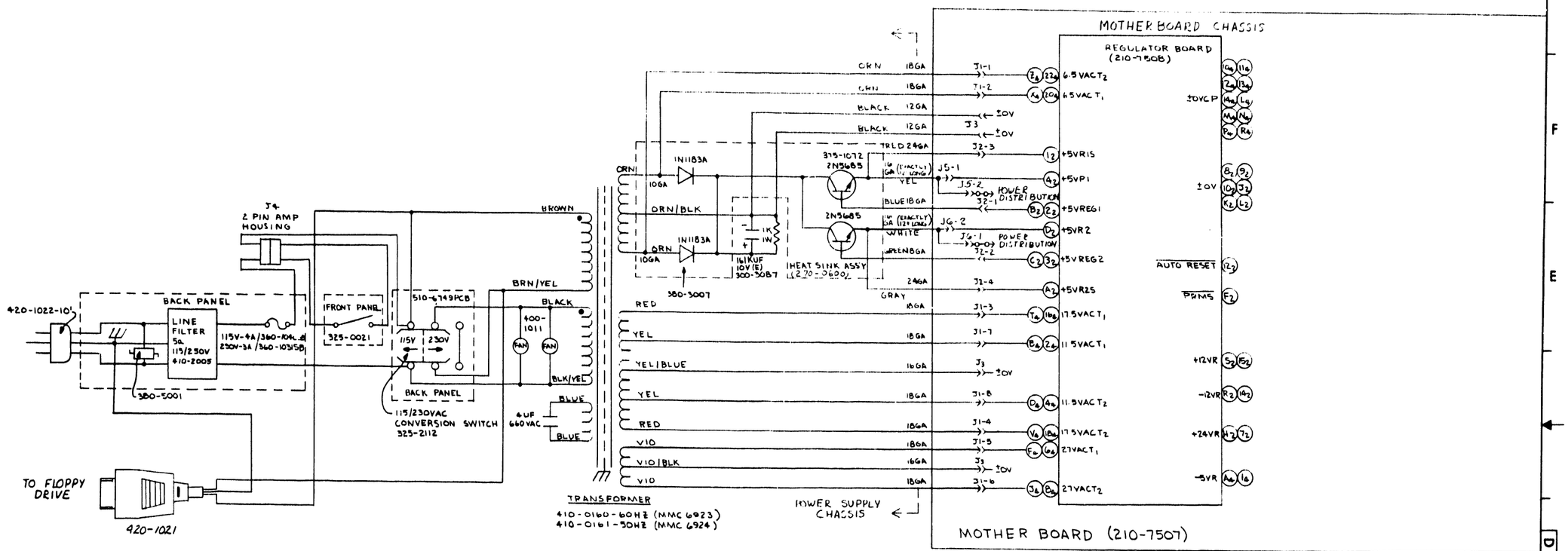
DO NOT SCALE



CHASSIS ASSEMBLIES:
MOTHERBOARD - 270-0599
POWER SUPPLIES -
60HZ - 270-0601
50HZ - 270-0601-1

CONNECTORS
J1 - 8 PIN HOUSING - 654-1189
8 PIN HEADER - 654-1190
J2 - 4 PIN HOUSING - 654-1193
4 PIN HEADER - 654-1194
J3 - HOUSING - 654-2073
PC PIN - 654-3001
CONTACT - 654-3000R
J4 - 2 PIN HOUSING - 654-1147
SOCKET HOUSING (2 PIN) - 654-1148
J5+J6 - 2 PIN HEADER - 654-1198
SOCKET HOUSING (2 PIN) - 654-1148

NO	REVISION	BY	DATE
0	ORIGINATED PER DWR #E692 APPD: [illegible]	LDB 6.27.79	7.0 10.30.79
1	REVISED PER ECN# 1182.3 APPD: [illegible]	7.0 11.30.79	7.0 12.4.79
2	REVISED PER ECN# 1498 APPD: [illegible]	7.0 1.23.80	7.0 1.24.80

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

	BY	DATE	APPROVED BY	DATE
	DWN L.D.B.	6.27.79	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

MATERIAL —

MODEL NO 140
SEE ENGRG SPECIFICATIONS
No. —

TITLE 140 PS INTERCONNECTION SCHMATIC

FINISH —

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH √

SCALE -0- | SHT 1 OF 1 | WANG PART NUMBER | SIZE D | DRAWING NUMBER 7507-900 | REV 2

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DO NOT SCALE

27 VAC T1 (F4) (G4)
27 VAC T2 (J4) (B4)
D1 A15A
D2 A15A
C1 8.2K uf 25V
C2 8.2K uf 25V
±0VCP
C3 .1uf 50V
R1 1K 1W
R2 680Ω 1/2 W
+27V
Q4 RCA B203A
E
B
C
C6 .1uf
R14 220Ω
R3 1K
R4 2.2K ± 5%
R5 27.K ± 5%
C4 .047uf
LM 725
D3 1N4743A 13V ZEN
±0V
R7 680Ω
R8 .050Ω 3W 3%
C5 .05uf
L7 LM339
R6 6.8K
R9 120K
-7V
+24VR (H2) (J2)
R10 18K
R11 1K
R12 2.2K ± 5%
R13 10K
D4 SIL
D5 SIL

PRMS (F2)
+27V
R18 1.2K 1W
R17 100Ω
+5VR2
L9 LM339
D6 1N5230C 4.7V ZEN
R16 4.7K
+12VR
D7 SIL
R66 10K
L7 LM339
C7 10uf 35V
R20 1.5K 1W
D8 1N5230C 4.7V ZEN
R67 100Ω
R19 4.7K
D9 1N283 GER
-5VR

D10 1N4372A 3.0V ZEN
R15 1.2K 1W
L8 LM339
(J2) AUTO RESET

R68 470Ω
R21 2.2K 1/2 W
R22 820Ω 1W
D11 1N5241C 11V ZEN
L9 LM339

R23 1.2K 1W
R24 100Ω
+5VR1
D12 1N5230C 4.7V ZEN
R25 4.7K

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN [illegible]	2 Oct 79	E ENGR	
		CHK		M ENGR	
				MFG ENGR	
MATERIAL	MODEL NO. 140	TITLE REGULATOR			
	SEE ENGRG SPECIFICATIONS No.				
FINISH	TOL ER AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √	210-7508	D	7508	8
	SCALE SHT 1 OF 3	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

REVISION | NO | DATE | BY

7508

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DO NOT SCALE

+12VR

+5VR1

+5VR2

+5VREG1

±0V

-.7V

-12VR

-5VR

+5VR1 (42)

+5VR2 (12)

17.5 VAC T2 (V8, 15)

17.5 VAC T1 (T4, V2)

±0VCP (R4, V4, L4, M4, N4, P4, 1N, 12, 13, 14)

11.5 VAC T2 (D4, 4)

11.5 VAC T1 (B4, 14)

+5VR2 (D2)

+5VR2S (A2)

6.5 VAC T2 (K4, 10)

6.5 VAC T1 (Z4, 24)

+12VR (52, 152)

+5VREG1 (33, 23)

-5VR (A8, 18)

±0V (B2, 92, 102, J2, K2, L2)

R26 2.2K

R27 1K 1/2W

R28 1K 1/2W

R29 1K 1/2W

R30 1K 1/2W

R31 2.2K

R32 120K

R33 390Ω 2W

R34 120K

R35 1K

R36 1.5K

R37 3.3K

R38 120K

R39 3.3K

R40 1K

R41 1.5K

R42 3.3K

R43 100K

R44 2.2K

R45 1K

R46 .050Ω 3W 3%

R47 680Ω

R48 1K

R49 1.5K

R50 3.3K

R51 1.5K

R52 2K

R53 2.2K

R54 7.5K

R55 1.5K

R57 100Ω

R58 33K

R59 120K

R60 .020Ω 3W 3%

R61 820Ω

R62 680Ω

R63 270Ω

R64 270Ω

C8 .05μF

C9 8.2KμF 25V

C10 9KμF 30V

C11 6.2KμF 25V

C12 8.2KμF 25V

C13 .05μF

C15 2.2μF 20V TANT

C16 18μF 15V TANT

C17 1μF 15V TANT

C18 .15μF

C19 .05μF

C20 .001μF

C21 .1μF MYLAR

C22 .05μF

C23 .05μF

C24 15μF 20V

C25 .047μF

C26 .05μF

C27 15μF 20V TANT

C28 15μF 20V TANT

C29 .047μF

C30 .047μF

C14 .33μF 35V TANT

D13 N5A

D14 N5A

D15 N5A

D16 N5A

D17 N5A

D18 N5A

D19 N5A

D20 N5A

D21 SIL

D22 SIL

D23 SIL

D24 IN4372A 3.3V ZEN

D25 SIL

D26 SIL

D27 SIL

LB LM339

LA LM723

LC 741C

LD 7912

LE LM304

Q1 2N3637

Q2 RCA 8203A

Q3 2N6387

Q7 2N3906A

	BY	DATE	APPROVED BY	DATE
DWN		9/68	E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140

SEE ENGRG SPECIFICATIONS No.

FINISH

TOL. EX. AS NOTED

SCALE SHT 2 OF 3

TITLE: REGULATOR

210-7508 | D | 7508 | 8

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

REVISION NO.

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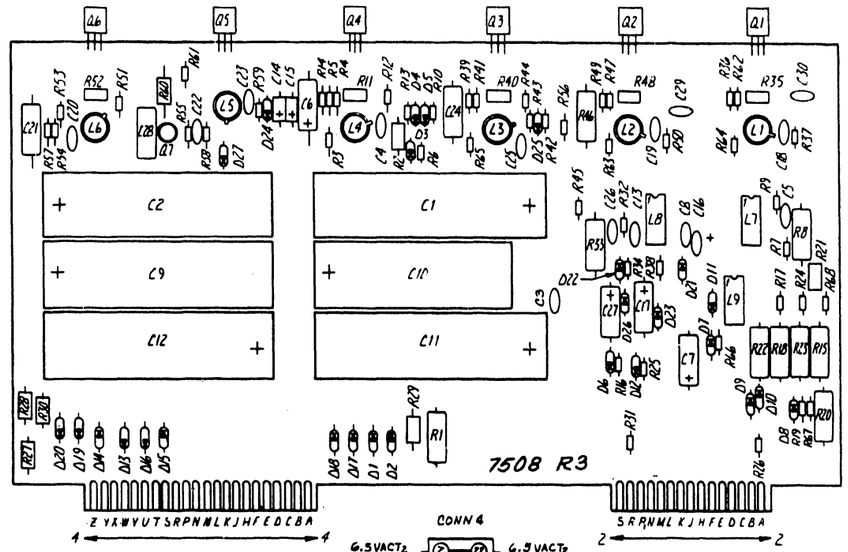
DO NOT SCALE



CONN 4

6.3 VAC T2	Z	24	6.3 VAC T2
6.3 VAC T1	Y	23	6.3 VAC T1
17.5 VAC T2	W	22	17.5 VAC T2
17.5 VAC T1	V	21	17.5 VAC T1
±OVCP	U	20	±OVCP
±OVCP	T	19	±OVCP
±OVCP	R	18	±OVCP
±OVCP	P	17	±OVCP
±OVCP	N	16	±OVCP
27 VAC T2	M	15	27 VAC T2
27 VAC T1	L	14	27 VAC T1
11.5 VAC T2	K	13	11.5 VAC T2
11.5 VAC T1	J	12	11.5 VAC T1
-5VR	H	11	-5VR

CONN 2

+12 VR	S	8	+12 VR
-12 VR	R	M	-12 VR
	P	13	
	N	12	AUTO RESET
	M	11	
±0V	L	10	±0V
±0V	K	9	±0V
±0V	J	8	±0V
+24 VR	H	7	+24 VR
PRMS	F	6	
	E	5	
+5VR2	D	4	+5VR1
+5VREG2	C	3	+5VREG2
+5VREG1	B	2	+5VREG1
+5VR2S	A	1	+5VR1S

I C LOCATION	TYPE	W.L NO.
L1,2,3,4	723	376-0066
L5	741C	376-0074
L6	LM304	376-0134
L7,8,9	LM339	376-0240

COMPONENT	TYPE	W.L. PARTNO
C1,2,9,11,12	8.2K uf 25V ELEC	300-3068
C3	.1uf 50V CER.	300-1930
C4 5,8,13,18,19, 22,23,25 26,29,30	.047uF CER	300-1966
C6 21	.1uf 50V MYLAR	300-2213
C7	10uf 35V TANT.	300-4032
C10	4 K uf 30V ELEC.	300-3080
C14	.33uf 35V TANT.	300-4008
C15	2.2 uf 20V TANT.	300-4014
C16,17	18uf 15V TANT.	300-4018
C20	.001uf 500V CER	320-1906
C24,27,28	15uf 20 V TANT.	300-4022
D1,2,13,14,15,16, 17,18,19,20	AISA RECTIFIER	380-3008
D3	IN4743 ZEN.	380-2113
D4 5,7,21,22,23, 25,26,27	SIL. DIODE	380-1001
D6,8,12	IN5230C ZEN.	380-2048
D9	IN283 GER.	380-0001
D10,24	IN4372A ZEN	380-2129
D11	IN5241C ZEN	380-2111
R1	1K 10% 1W	332-3010
R2	680Ω 10% 1/2 W	331-2068
R3,45	1K 10% 1/4 W	330-3010
R4 12	2.2K 5% 1/4 W	330-3023
R26,31,44,53	2.2K 10% 1/4 W	330-3022
R5	2.7K 5% 1/4 W	330-3028
R6	6.8K 10% 1/4 W	330-3068
R7,47,62	680Ω 10% 1/4 W	330-2068
R8,46	.050Ω 3% 3W	324-0033
R9,32,34,38,59	120K 1/4 W	330-5012
R10	18K 1/4 W 5%	330-4019

COMPONENT	TYPE	W.L. NO
R11,35,40,48	1K VAR	336-1014
R13,66	10K 10% 1/4 W	330-4010
R14	220Ω 10% 1/4 W	330-2022
R15,18,23	1.2K 10% 1W	332-3012
R16,19,25	4.7K 10% 1/4 W	330-3047
R17,24,57,67	100Ω 10% 1/4W	330-2010
R20	1.5K 10% 1W	332-3015
R21	2.2K 10% 1/2 W	331-3022
R22	820Ω 10% 1W	332-2082
R27,28,29,30	1K 10% 1/2 W	331-3010
R33	390Ω 10% 2W	337-2039
R36,41,49,51,55	1.5K 10% 1/4 W	330-3015
R37,39,42,50	3.3K 10% 1/4 W	330-3033
R43	100K 10% 1/4W	330-5010
R52	2K VAR	336-1022
R54	27Ω 10% 1/4 W	330-1027
R56	1.8K 5% 1/4 W	330-3019
R58	33K 10% 1/4 W	330-4033
R61	.020Ω 3% 3W	334-0032
R61	820Ω 10% 1/4 W	330-2082
R63,64	270Ω 10% 1/4 W	330-2027
R65 66	470Ω 10% 1/4 W	330-2047
Q1,2,3	2N6387	375-1052
Q4,6	RCA B203A	375-1053
Q5	7912 I C REG.	374-0503
Q7	2N2906A	375-1017
L1-L6	INSULATOR	375-9016
Q7	TRANSIPAD TO-18	375-9004

MNEMONIC	COORDINATE
AUTO RESET	1D1
PRMS	1G6
27 VAC T1	1F11
27 VAC T2	1F11
+24 V R	1C11
17.5 VAC T1	2E11
17.5 VAC T2	2E11
+12 VR	2G1
11.5 VAC T1	2D11
11.5 VAC T2	2D11
6.5 VAC T1	2B11
6.5 VAC T2	2B11
+5VREG1	2F1
+5VREG2	2B1
+5VR1S	2F11
+5VR2S	2B11
+5VR1	2F11
+5VR2	2C11
±OVCP	2D11
±0V	2A1
-5VR	2B1
-12VR	2A9

NO.	REVISION	BY	DATE
14	INITIATED PER DWG # ECO: ADDED [illegible]		
13	REVISED PER ECN # 11485 ADDED [illegible]		
12	REVISED PER ECN # 11506 ADDED [illegible]		
11	REVISED PER ECN # 11585 ADDED [illegible]		
10	REVISED PER ECN # 12377 ADDED [illegible]		
9	REVISED PER ECN # 13308 ADDED: [illegible]	JRL	11-19-79
8	REVISED PER ECN # 13979 ADDED: [illegible]	JRL	3-6-80
7	REVISED PER ECN # 15989 ADDED: [illegible]	OCP	10-3-80
6	REVISED PER ECO # 22332 ADDED: [illegible]	PGD	2-29-82

E-REV 3

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.		BY	DATE	APPROVED BY	DATE
		DWB	11-4-79	E ENGR P.E.P.	1/20/82
		CHK LJ	11-6-79	M ENGR	
				MFG ENGR	
MATERIAL	MODEL NO. 140	TITLE	REGULATOR		
	SEE ENGRG SPECIFICATIONS No.				
FINISH	TOL ES AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH	210-7508	D	7508	8
	SCALE ~ SHT 1 OF 1	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

7508

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DO NOT SCALE

MASKABLE INTERRUPT CONTROL LOGIC

PARITY GENERATOR/ CHECKER LOGIC

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY / DATE
MATERIAL —	DWN RD		E ENGR
MODEL NO. SEE ENGRG SPECIFICATIONS No.	CHK		M ENGR
			MFG ENGR
FINISH —	TOL ER AS NOTED .XX ± — FRAC ± — .XXX ± — ANG ± — FINISH √	TITLE CPU/ MEMORY	
	SCALE — SHT / OF	SEE CHART / WANG PART NUMBER	D / SIZE / 7684 / DRAWING NUMBER / 13 / REV

REVISION — SEE SHT 9

D 7684

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DO NOT SCALE

MTD EXTERNAL DISK POINTER SWITCH

CPU LEDS

DIAGNOSTIC SWITCHES

DIAGNOSTIC PUSH BUTTON

REVISION	BY	DATE	APPROVED BY	DATE
	DWN JD	11/24/80	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL — MODEL NO. SEE ENGRG SPECIFICATIONS No.

FINISH — TOL EX AS NOTED .XX ± — FRAC ± — .XXX ± — ANG ± — FINISH √

TITLE: CPU / MEMORY

SCALE — SHT 2 OF 5 — WANG PART NUMBER: SEE CHART — SIZE: D — DRAWING NUMBER: 7684 — REV: 13

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DO NOT SCALE

RESTART

Y1 15.9744 MHz

R121 330Ω R122 330Ω R107 2.2K R106 2.2K C121 680PF

L117 HO4 L118 S00 L90 32 L101 08 L102 S04 L79 04 L80 10 L59 08

M1 (4C2) RD (4B2) IORQ (4C2) RD (1F7) M1 (2F2) BK2 (3D5) BK5 (5G4) BK8 (5F2)

SWB ±0V R48 2.2K R55 2.2K +5VR R45 2.2K ME (1D1)

R69 10K C114 150PF CLR1 L95 9602 Q1 Q1 6.400NS

DBSAD (J3) CBUSRQ (J2) R70 2.2K R113 2.2K CBUSRQ (2C7) L96 03 L101 08

(4) RESET (6) NMI

R71 2.2K

L119 S74 L128 S74 L119 S74 ICLR

R127 2.2K R105 2.2K L120 S08 E.7 220Ω 5.P. (2B5) ±2

ΦA (2C4) ΦE (2A7) (2F3) ½ Hz (2B4)

TP4 TP2 TP3

R108 2.2K C150 18PF R123 1K R124 2.2K

R174 33Ω 5% Q1 SPS6551 R125 330Ω R126 12Ω

L120 S08 L125 37 L129 37 L128 37

L117 HO4

L102 S04 MREQ (4C2) MREQ (1D6) (2D2) L103 S11 L104 S74 L76 S02 MMIO (5C6)

R101 2.2K R102 2.2K

MMI/OWAIT MIWAIT

WAIT (E8) AUTO RESET (4B) R54 2.2K R100 390Ω L79 04 AUTO RESET (2G10)

RFSH (4B2) DEVO (5E5) ΦZC

M8 ½ΦC K8 ΦC L8 ΦAC

±0V +5VR

GND VCC

CTC Z80A

RD IORQ IEI L100 M1 Φ CE RESET CS0 CS1 CK/TR0 CK/TR1 CK/TR2 CK/TR3 ZC/TO0 ZC/TO1 ZC/TO2 D0 D1 D2 D3 D4 D5 D6 D7 IEO INT

BK1 (5F1) 1=A TO B 0=B TO A L114 L245 DIR

D0-D7 (4E5) BK3 (1C4) IEO (1G7) R99 10K L101 08

D0Z D1Z D2Z D3Z D4Z D5Z D6Z D7Z

RB0 2.2K RB4 2.2K RB1 2.2K RB5 2.2K RB2 2.2K RB6 2.2K RB3 2.2K RB7 2.2K

L99 Z80A CPU

D0Z D1Z D2Z D3Z D4Z D5Z D6Z D7Z

WAIT INT RESET Φ M1 (4D5) RFSH (4D5) WR (4D5) RD (4D5) IORQ (4D5) MREQ (4D5) BUSAK

BK6 (4D2) L116 04

A0-A15 (4G11) A0-A11 (5G10)

A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15

ZA0 ZA1 ZA2 ZA3 ZA4 ZA5 ZA6 ZA7 ZA8 ZA9 ZA10 ZA11 ZA12 ZA13 ZA14 ZA15

L98 LS244 L97 LS373

BUSAK (4C4) (5F2) BUSAK (1/2 5)

RG8 10K C115 3.3μF (TYP) L95 9602 CLR2 Q2 10MS L94 08 L77 125

(3E3) MR (1G4) (2C11) (2E1) (1G11) (1) (4) MR

REVISION	BY	DATE	APPROVED BY	DATE
SEE SHT 9	DWN RD	11/29/80	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL — MODEL NO. — SEE ENGRG SPECIFICATIONS — No.

FINISH — TOL EX AS NOTED .XX ± .XXX ± FRAC ± ANG ± FINISH — SCALE — SHT 3 OF 5

TITLE CPU/MEMORY (

SEE CHART | D | 7684 | 1.3

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

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DO NOT SCALE

A0-A15 (3F1)

UPS (2B10)

+5VR

0V

C133 .1μf

C131 .1μf

C129 .1μf

L111 2516 PROM3

L110 2516 PROM2

L109 2516 PROM1

Y2 (5F8)

Y1 (5F8)

Yφ (5F8)

R40 2.2K

DREN (2G2)

DREN (2E2)

L37 32

MREQ (4C2)

L76 S02

SWMUX (2C1)

L112 LS244

BK7 (5D5)

D0-D7 (2G11) (3D5)

L115 LS244

R95 10K R94 10K R93 10K R98 10K R97 10K R96 10K

WR' (3C3)

MREQ' (3C3)

IORQ' (3C3)

RFSH' (3D3)

RD' (3C3)

M1' (3D3)

R116 2.2K R118 2.2K R120 2.2K R119 2.2K R115 2.2K R114 2.2K

MREQ (5F3) (3C2)

BUSAK (3C1)

L116 04

L105 125

BUSAK (2C7)

R117 2.2K

IORQ (1F7) (3F9)

M1 (1G7) (3G8)

MREQ (3C9)(2G4, (4D10)(1D3)

RD (1B2) (3G8, (2G2)

RFSH (2D2) (3B8) (5F10)

RDO RD RFSH M1 IORQ MREQ WR

A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15

D0 D1 D2 D3 D4 D5 D6 D7

SEL L51 S157 STB

R35 33Ω 5% A4/11M

R37 33Ω 5% A5/12M

R38 33Ω 5% A1/8M

R36 33Ω 5% A2/9M

SEL L31 S157 STB

R33 33Ω 5% A3/10M

R34 33Ω 5% A0/7M

R28 33Ω 5% A6/13M

RFSH

A0/7M-A6/13M (6G11)

ADDRESS MUXES

L102 S04

L32 L72 S138

PROM (5F10)(2F2)

L12 L11 L52 S30

L10 S10

R29 56Ω 5% RAS1 (6F11)

R30 56Ω 5% RAS2 (6E11)

R31 56Ω 5% RAS3 (6C11)

R32 56Ω 5% RAS4 (6B11)

RAS (2D1)

L70 S20

BANK SELECT LOGIC

PROM (5F10)

BS0

BS1, BS2, BS3

* ADD JUMPER AND CUT ETCH PER ECO # 21314.

A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 D0 D1 D2 D3 D4 D5 D6 D7

REVISION	BY	DATE	APPROVED BY	DATE
SEE SHT 9	DWN RD	11/29/80	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL — MODEL NO. SEE ENGRG SPECIFICATIONS No.

TITLE CPU/MEMORY

FINISH — TOLERANCES AS NOTED .X ± — FRAC ± — .XX ± — ANG ± — FINISH

SCALE — SHT 4 OF 9

WANG PART NUMBER SEE CHART | SIZE D | DRAWING NUMBER 7684 | REV 13

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DO NOT SCALE

A0-A11 (3F1)

PROM DECODER

L124 S138

A10, A11, ±0V

Y0 (4E7) Y1 (4E9) Y2 (4E10)

RFSH (4B2)

PROM (4D7)

BK6 (4D2)

L116 04

PROM (1E2) (2F1)

L90 32

+5VR

R44 2.2K

A4, A5, CRQAK (2A4)

L56 25

L57 04

+5VR

R39 2.2K

A9, A8, A7, A6

L36 25

DEVO (3A8)

L57 04

L58 154

A0, A1, A2, A3

G1, G2

$\overline{OCO0}$ $\overline{OCO1}$ $\overline{OCO2}$ $\overline{OCO3}$ L39 20

$\overline{OCO4}$ (2G7)

$\overline{OCO5}$ (1B5)

$\overline{OCO6}$ (1C1)

$\overline{OCO8}$ (3B6)

$\overline{OCO9}$ (1G2)

$\overline{OCOA}$ (1F4)

$\overline{OCOB}$ (2B11)

$\overline{OCOC}$ (2C7)

$\overline{OCOD}$ (2G10)

$\overline{OCOE}$ (1C1)

CPU MEMORY MAPPED I/O DECODER

BK5 (3F5) L79 04

+5VR R46 2.2K

L59 08

L60 25

BUSAK (3C1)

L79 04

BK1 (3F5)

L38 04

BKB (3F7)

$\overline{OCO6}$ (1C1)

$\overline{OCO7}$ (1E5)

L57 04

L124 37

SET INT (1F10)

CRQAK (2C5)

L126 S20

BK7 (4E5)

RD (3G6)

MMI/O (3C6)

DLMMI/O

MMI/O

REVISION	BY	DATE	APPROVED BY	DATE
SEE SHEET 3				

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY	DATE
	DWN RD	11/2??	E ENGR	
	CHK		M ENGR	
			MFG ENGR	
MATERIAL	MODEL NO. 2200 SEE ENGRG SPECIFICATIONS No.		TITLE CPU/MEMORY	
FINISH	TOL EX AS NOTED .XX ± — FRAC ± — .XXX ± — ANG ± — FINISH √		SEE CHART	D 7684 13
	SCALE — SHT 5 OF 13		WANG PART NUMBER	SIZE DRAWING NUMBER REV

D 7684

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DO NOT SCALE

COMI-DEMI (2E4, 4B9)

A0/7M-A6/13M (4B9)

RAS1 (4C5)

CAS (2A1)

WRITE (2C1)

RAS2 (4C4)

RAS3 (4E4)

RAS4 (4A4)

DØMI-DØMI (2E5)

- 5VR, +5VR, +12V
- C27 15UF 20V(T) ±ØV
- C28 15UF 20V(T) ±ØV
- C39 15UF 20V(T) ±ØV
- C40 15UF 20V(T) ±ØV
- C63 15UF 20V(T) ±ØV
- C64 15UF 20V(T) ±ØV
- C76 15UF 20V(T) ±ØV
- C77 15UF 20V(T) ±ØV
- C16 .1uF ±ØV

MK4116 L9, L1, L2, L3, L4, L5, L6, L7, L8

MK4116 L30, L22, L23, L24, L25, L26, L27, L28, L29

MK4116 L50, L42, L43, L44, L45, L46, L47, L48, L49

MK4116 L69, L61, L62, L63, L64, L65, L66, L67, L68

D8MO, D7MO, D6MO, D5MO, D4MO, D3MO, D2MO, D1MO, DØMO

REVISION	BY	DATE
SEE SHT 3		

WANG LABORATORIES, INC. LOWELL, MASS U.S.A.	BY	DATE	APPROVED BY	DATE
	DWN JP	11/23/82	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

MATERIAL	MODEL NO.	TITLE
	SEE ENGRG SPECIFICATIONS No.	CPU/MEMORY
FINISH	TOL EX AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √	SEE CHART / D / 7684 / 13
	SCALE SHT 6 OF 6	WANG PART NUMBER / SIZE / DRAWING NUMBER / REV

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SWITCHES SW3-SW8 MOUNT ON FAR SIDE

DO NOT SCALE

WANG 7684- -R2

COMPONENT SIDE

CONN. 350-0009
2 PLACES
MOUNT FAR SIDE

REVISION	BY	DATE
ECO 6 JAN 25		

	BY	DATE	APPROVED BY	DATE
DWN	JB	2-11-81	E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL MASS USA

MATERIAL

FINISH

MODEL NO 015

SEE ENGRG SPECIFICATIONS No

TOL EX AS NOTED
XX = FRAC =
XXX = ANG =

SCALE SHT 7 OF 9

TITLE CPU / MEMORY (64K)

SEE CHART | D | 7684 | 13

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

D 7684

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DO NOT SCALE

210 • 209 • 377 OR 378							
210	209	L1-9, 23-30, 42-50, 61-69	L109	L99	L100	L110	L111
7684-A	7684	377-0345	378-5001-R6	377-0368	377-0371	378-5002-R2	378-5003-R2

REVISION	BY	DATE
INIT. RELEASE		

WANG LABORATORIES, INC. LOWELL, MASS U.S.A.	BY	DATE	APPROVED BY	DATE
	DWN JEP	6/81	E ENGR	
	CHK		M ENGR	
			MFG ENGR	
MATERIAL	MODEL NO. [illegible]		TITLE CPU MEMORY	
	SEE ENGRG SPECIFICATIONS No.			
FINISH	TOL ER AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH √	SEE CHART	D	7684	13
	SCALE — UNIT B OF 9	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

D 7684

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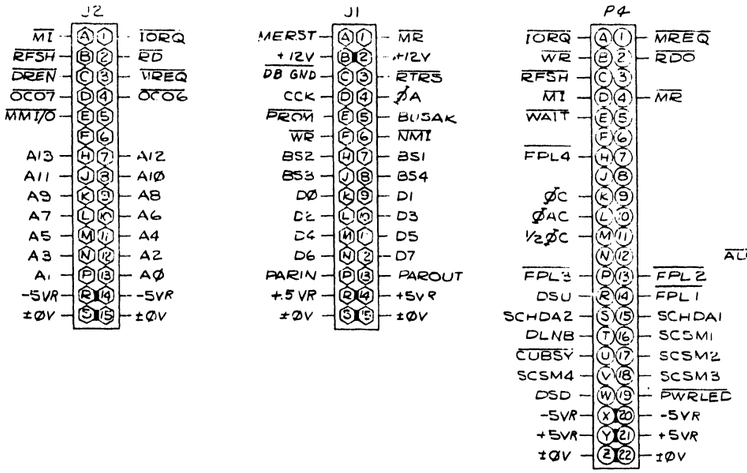
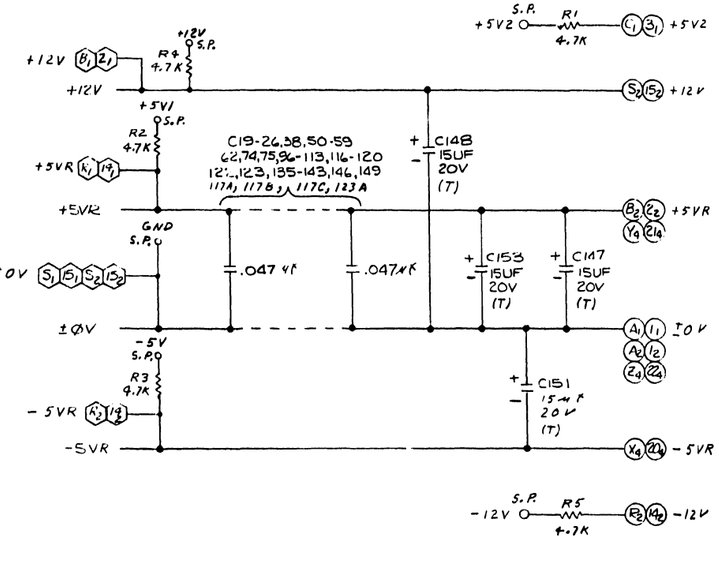
DO NOT SCALE





I.C. LOCATION	W.L. PART No	TYPE
L1-9, 22-30, 42-50, 61-69	SEE CHART	MK4116
L10, 11	376-0238	74S10
L11, 12, 52	376-0178	74S30
L13, 83, 97	376-0310	74LS373
L14	376-0176	74367
L15-21, 41, 125		SPARE
L31, 51	376-0217	74S157
L32, 72, 124	376-0298	74S138
L33, 53, 73, 104, 119, 128	376-0202	74S74
L34, 59, 91, 94, 101, 121, 130	376-0081	7408
L35, 103	376-0237	74811
L36, 56, 60	376-0092	7425
L37, 90	376-0093	7432
L38, 57, 116	376-0010	7404
L39	376-0004	7420
L40	376-0126	555
L54, 55, 120	376-0200	74S08
L58	376-0090	74154
L70, 126	376-0230	74S20
L74, 78, 92, 93, 122, 123, 131, 132	376-0006	7474
L75, 89	376-0205	74S32
L76	376-0199	74S02
L77, 84, 105	376-0324	74125
L79	376-0010	7404
L80	376-0003	7410
L81, 113	376-0297	74LS240
L82, 87, 98, 112, 115	376-0288	74LS244
L86	376-0242	74LS280
L88	376-0247	74S174
L95	376-0104	9602
L96	376-0028	7403
L99	SEE CHART	Z80A-CPU
L100	SEE CHART	Z80-CTC
L102	376-0197	74S04
L106	376-0008	7442
L107	376-0171	74148
L108	376-0286	74LS374
L109-111	SEE CHART	2516
L114	376-0285	74LS245
L117	376-0043	74H04
L118	376-0228	74S00
L127	326-0068	2437
L85	376-0013	7475
L1-9, 22-30, 42-50, 61-69	376-9002	SKT, 16 PIN
L99	376-9011	SKT, 40 PIN
L100	376-9015	SKT, 28 PIN
L58, 109-111	376-9003	SKT, 24 PIN

I.C. TYPE	LOC	SPARES
74S00	L118	1
7403	L76	3
7404	L38	1
	L116	1
74S04	L102	2
7408	L34	1
	L59	1
74S08	L54	2
	L120	1
74S10	L71	1
74S11	L33	1
	L103	1
7420	L39	1
7425	L36	1
7432	L37	2
74S32	L89	2
7474	L78	1
74S74	L53	1
	L118	1
7475	L85	1
74125	L77	1
	L84	1
	L105	1

COMPONENT	W.L. PART No.	TYPE
R1-6	330-3047	4.7K ¼W 10%
R7	330-2022	220Ω ¼W 10%
R8-16, 68, 69, 93-99	330-4010	10K ¼W 10%
R17-24	330-2015	150Ω ¼W 10%
R25, 39, 40, 43-55, 65-67, 70-92, 101-120, 127-134	330-3022	2.2K ¼W 10%
R26-28, 33-38, 124	330-1034	33Ω ¼W 5%
R41	330-6056	5.6M ¼W 10%
R42	330-6033	3.3M ¼W 10%
R29-32, 56-64	330-1037	56Ω ¼W 5%
R100	330-2039	330Ω ¼W 10%
R121, 122, 125	330-2033	330Ω ¼W 10%
R123	330-3010	1K ¼W 10%
R126	330-1012	12Ω ¼W 10%
C1-18, 29-37, 41-49, 65-73, 78-95, 129, 131, 139	300-1930	.1MF 50V
C19-26, 38, 50-59, 62, 74, 75, 96-113, 116-120, 117A, 117B, 117C, 122, 123, 123A, 135-143, 146, 149	300-1966	.047MF 50V
C27, 28, 39, 40, 63, 64, 76, 77, 147, 148, 151, 153	300-4022	15MF 20V (T)
C60	300-1903	.01MF 25V
C61	300-2373	.1MF 50V MYLAR
C114	300-1150	150PF 500V
C115	300-4016	3.3MF 15V (T)
C121	300-1680	680PF 500V
C124-128, 144, 145, 152	300-1047	47PF 500V
C150	300-1018	18PF
LED1-8	370-0026	MV5024 (RED)
Y1	321-0022	15.9744 MHz
SW1	325-1501	SPST, 5 POS
SW2	325-1503	SPST, 8 POS
SW3, 8	325-0041	SPDT, MOM, 90°
SW4-7	325-0040	SPDT, TOG, 90°
Q1	375-1050	SPS6551
J12	330-0009	CONN. 90°

MNEMONICS	COORD
AØ-A15	4E1
AUTO RESET	3B11
BS1	4A6
BS2	4A6
BS3	4A6
BS4	4A7
BUSAK	3C1
CBUSREQ	3G2
CCK	2B2
CRQAK	2A5
CUBSY	1F11
DBGND	3G3
DØ-D7	4C1
DLNB	1E11
DLMMI/O	5B7
DMAMREQ	2G2
DREN	4E11
DSD	2G7
DSU	2G7
FPL1	2A9
FPL2	2A9
FPL3	2A9
FPL4	2A9
IORQ	4B2
MERST	3G1
MI	4B3
MMI/O	5B7
MR	3B1
MREQ	4B2
NMI	3F1
OCO6	5F1
OCO7	5E1
PARIN	2B2
PAROUT	1E1
PROM	4A7
PWRLED	2A8
RD	4B3
RDO	4B3
RFSH	4B3
RTRS	2E1
SCHDA1	1C11
SCHDA2	1B11
SCSM1	1D11
SCSM2	1C11
SCSM3	1F11
SCSM4	1E11
STDATA	2B1
WAIT	3B11
WR	4B2
ØA	2B1
ØC	3A9
ØAC	3A9
½ØC	3A10

E-REV 9

NO	REVISION	BY	DATE	APPROVED
Ø	ORIG. PER ECO # 8962 APP'D: [illegible]	JT	11-25-80	7-18-80
1	REVISED PER ECO # 13578 APP'D: [illegible]	JEP	3-23-81	4-27-81
2	REVISED PER ECO # 18767 APP'D: [illegible]	LDB	4-27-81	
3	REVISED PER ECO # 18958D APP'D: [illegible]	LDB	4-27-81	6-1-81
4	REVISED PER ECO # 19105 APP'D: [illegible]	JEP	6-1-81	
5	REVISED PER ECO # 19744 APP'D: [illegible]	JEP	7-9-81	
6	REVISED PER ECO # 19983, 19984 APP'D: [illegible]	JEP	7-9-81	
7	REVISED PER ECO # 20399 APP'D: [illegible]	JEP	9-28-81	
8	REVISED PER ECO # 21319 APP'D: [illegible]	JEP	12-21-81	
9	REVISED PER ECO # 22578 APP'D: [illegible]	LMR	1-14-82	4-16-82
10	REVISED PER ECO # 24780 APP'D: [illegible]	KM	4-16-82	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY	DATE
	DWN JT	11/22/80	E ENGR [illegible]	7/9/81
	CHK [illegible]	5/26/81	M ENGR	
MATERIAL	MODEL NO.		MFG ENGR	
	SEE ENGRG SPECIFICATIONS No.		TITLE CPU MEMORY (	
FINISH	TOL IS AS NOTED .XX ± FRAC ± .XXX ± ANG ± FINISH		SEE CHART	D 7684 12
	SCALE	SHT 5 OF 9	WANG PART NUMBER	SIZE DRAWING NUMBER REV

D 7684

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DO NOT SCALE

INPUT BUFFER

MEMORY OUTPUT LATCH

MEMORY INPUT BUFFER

ADDRESS MUXES

	BY	DATE	APPROVED BY	DATE
DWN	A. Lin	12/23/80	E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140

SEE ENGRG SPECIFICATIONS No.

FINISH

TOL ES AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH √

TITLE EXTENDED MEMORY (128K)

SCALE | SHT 1 OF 4 | SEE CHART | D | 7685 | 9

WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

D 7685

REVISION | SEE SHEET 4

DRAWING 40 5353

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DO NOT SCALE

PROM2

PROM1

OPCODE DATA LATCH

INPUT BUFFERS

MM10 DECODER

PROM / PAGE SELECT LOGIC

BIT SHIFTER

PCR

DCR

DATA IN (2E7)

DO-D7 (2E11)

NMI

DREN (1E10)

MRP (1A4)

CAS (1D11)

WRITE (1G9)

A9P0 (2E8)

MRF (1F10)

DIAG (2G10)(2G4)

DAB (2G4)

DA9 (2G4)

* NOT LOADED

** REVISED PER ECO #24395

MATERIAL	MODEL NO. 140	TITLE	EXTENDED MEMORY (128K)
FINISH	SEE ENGRG SPECIFICATIONS	SEE CHART	D 7685 9

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

	BY	DATE	APPROVED BY	DATE
DWN	A Bradley	12/29/76	E ENGR	
CHK			M ENGR	
			MFG ENGR	

WANG PART NUMBER — SIZE — DRAWING NUMBER — REV

SCALE — SHT 2 OF 4

REVISION — SEE SHT 4

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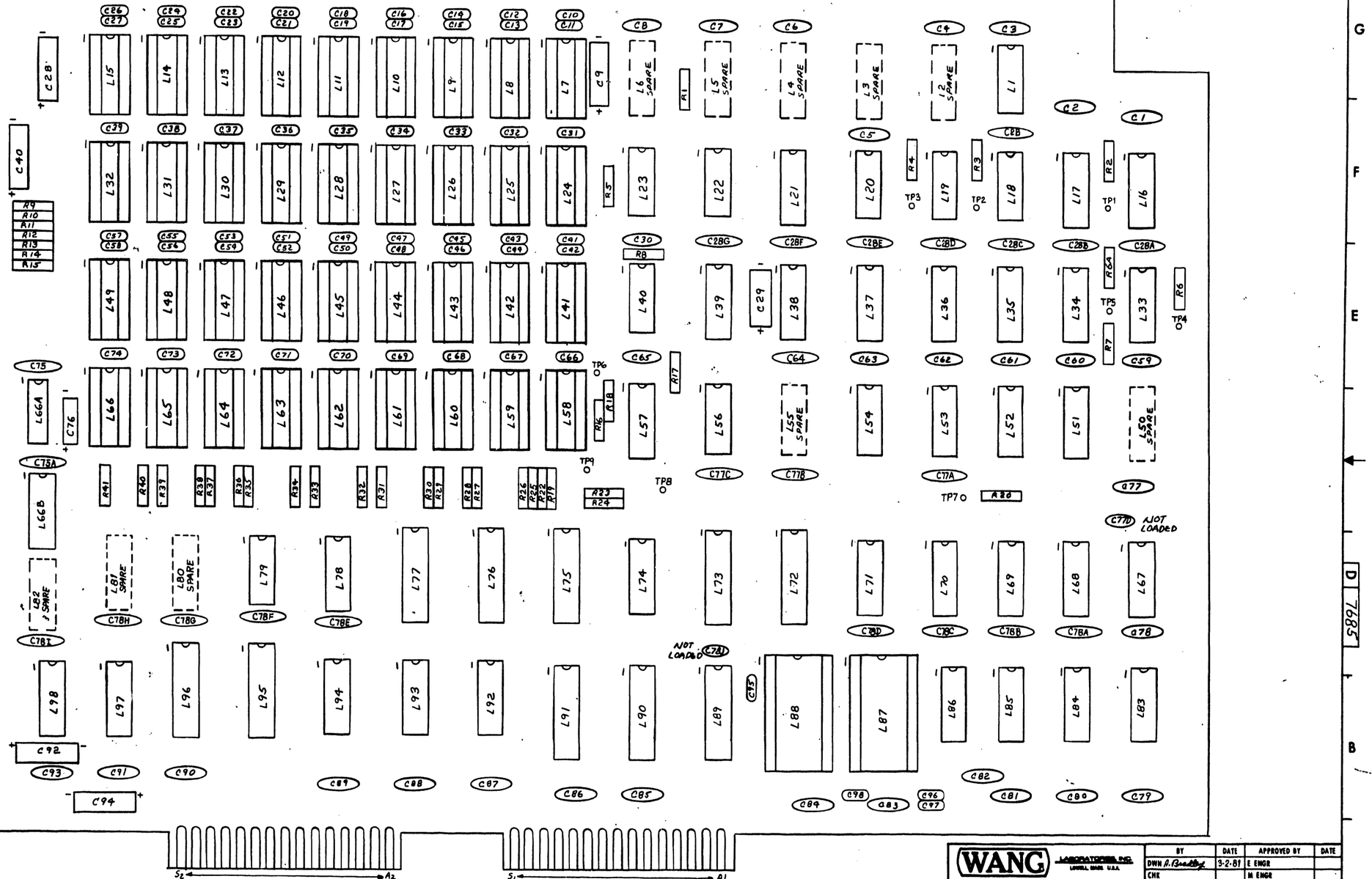
DO NOT SCALE

7685 R3



REVISION	BY	DATE	APPROVED BY	DATE
SEE SHT 4	DWN R. Bradley	3-2-81	E ENGR	
	CHK		M ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL	MODEL NO. 140	TITLE EXTENDED MEMORY (128K)
	SEE ENGRG SPECIFICATIONS No.	
FINISH	TOL XX AS NOTED .XX ± FRAC ± .XXX ± ANG. ± FINISH √	SEE CHART / D / 7685 / 9
	SCALE SHT 3 OF 4	WANG PART NUMBER / SIZE / DRAWING NUMBER / REV

7685

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DO NOT SCALE

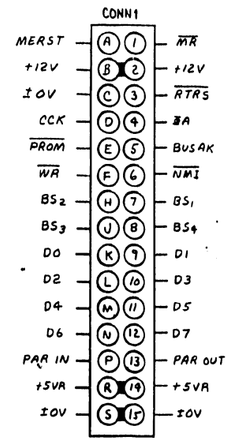
IC LOCATION	TYPE	WL. PART NO.
L1,92	74125	376-0324
L2-6, 50, 82, 80, 81	SPARE	
L7-15, 24-32, 41-49, 58-66	MK4116	SEE CHART
L16,17,19,20, 33,34, 70	7474	376-0006
L18,69	7402	376-0016
L21	7400	376-0002
L22	7403	376-0028
L23,40	74S10	376-0238
L35,67, 71,98	7432	376-0093
L36,37	7427	376-0125
L68	7408	376-0081
L39	74174	376-0098
L51	74S11	376-0237
L52	7486	376-0036
L53,79	7404	376-0010
L54, 85, 38	74S08	376-0200
L56	7405	376-0029
L57,74	74S74	376-0202
L72,73,75,77, 89,90,96	74LS244	376-0288
L76,91	74LS373	376-0310
L78	7475	376-0013
L66A, 66B	74S157	376-0217
L83,93	74S32	376-0205
L84	74175	376-0119
L86	74195	376-0097
L87, 88	TMS 2708	SEE CHART
L94	7420	376-0004
L95	74LS240	376-0297
L97	74LS138	376-0294
L7-15, 24-32, 41-49, 58-66	16 PIN SKT.	376-9002
L87, 88	24 PIN SKT.	376-9003

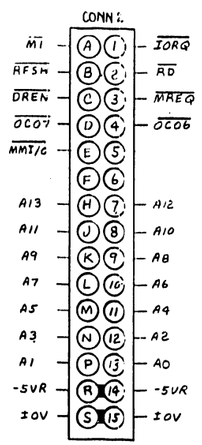
COMPONENT	TYPE	WL PART NO
R1,5,8,17,25, 27,29,31,33 35,37,39,41	56Ω 1/4W 5%	330-1057
R2-4,6,64,7,16, 20,23,24	2.2K 1/4W 10%	330-3022
R9-15,18,22	33Ω 1/4W 5%	330-1034
R19,26,28,30, 32,34,36,38, 40	10K 1/4W 10%	330-4010
C1-8,28,28A-28G, 30,59-65,75,75A, 77,77A-77C,78, 78A-78I,79-91,93	.047μF, 50V	300-1966
C10-27, 31-39, 41-58,66-74, 95-98	.1μF 50V	300-1930
C9,28,29,40, 76,92,94	15μF 20V(T)	300-4022
C77D	120PF	NOT LOADED
C78J	220PF 500V	NOT LOADED

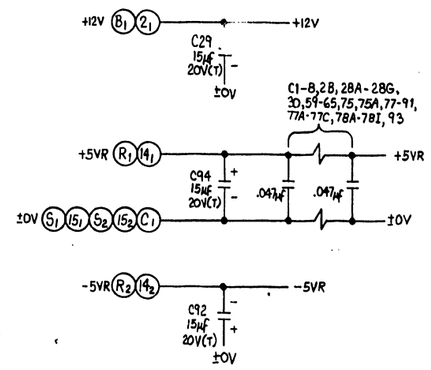
TYPE	IC LOCATION	SPARES
7400	L21	3
7402	L18	2
7403	L22	2
74S04	L79	3
7405	L56	4
74S08	L84	3
74S10	L23	1
	L40	1
7474	L70	1
	L55	1
7486	L52	2
7427	L36	1
7432	L98	2
74S32	L83	3
	L93	1
7475	L78	1
74125	L1	3
	L92	2

MNEMONICS	COORD.
A0-A5	2B11
A6-A13	2C11
BS1-BS4	1F11
BUSAK	2D11
CCK	1F11
DREN	2F1
D0-D7	2F11
ΦA	1F11
IORQ	1F11
MERST	2D11
MMI/O	2B11
MR	2B11
MREQ	2D11
MI	1G11
NMI	2E1
OCO6	2D11
OCO7	2D11
PAR IN	1A9
PAR OUT	1A11
PROM	2C11
RD	2D11
RFSH	2D11
RTRS	2C11
WR	2D11

210 = 209 + 377 OR 378				
210	209	L7-15, 24-32, 41-49, 58-66	L87	L88
7685-A	7685	377-0345	378-3064	378-3065







E REV
5

NO	REVISION	BY	DATE	APPD
0	ORIGINATED PER DWR E/W 3 APP'D: [illegible]	DWR	2-23-81	
1	REVISED PER ECO# 13727 APP'D: [illegible]	DWR	2-23-81	
2	REVISED PER ECO# 18753 APP'D: [illegible]	BCV	5/26/81	
3	REVISED PER ECO# 18766 APP'D: [illegible]	BCV	5/26/81	
4	REVISED PER ECO# 19278 APP'D: [illegible]	BCV	7-17-81	
5	REVISED PER ECO # 20305 APP'D: [illegible]	HJD	10-9-81	
6	REVISED PER ECO # 21003 APP'D [illegible]	JEP	11-19-81	
7	REVISED PER ECO # 21092 APP'D: [illegible]	RMH	2/24/82	
8	REVISED PER ECO # 24237 APP'D: [illegible]	RMH	8/6/82	
9	REVISED PER ECO#24395 APP'D: [illegible]	JEP	9/15/82	

	BY	DATE	APPROVED BY	DATE
	DWN A Bradley	2-23-81	E ENGR [illegible]	3/6/81
	CHK [illegible]	6-26-81	M. ENGR	
			MFG ENGR	

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

MATERIAL

MODEL NO. 140
SEE ENGRG SPECIFICATIONS
No.

FINISH

TOL EX AS NOTED
XX ± FRAC ±
XXX ± ANG ± FINISH √
SCALE SHT 4 OF 4

TITLE EXTENDED MEMORY (128K)

SEE CHART | D | 7685 | 9
WANG PART NUMBER | SIZE | DRAWING NUMBER | REV

D 7685

END