6104

VS-15 COMPUTER SYSTEM

Customer Engineering
Product Maintenance Manual

741-1404

PREFACE

This document is the First Customer Shipment (FCS) Manual for the VS-15 Computer System. It is organized in accordance with the approved FCS outline established at the Field/Home Office Publications meetings conducted on September 14th and 15th, 1982. Normally, an FCS manual will not include the Introduction, Theory of Operation, Preventive Maintenance or Schematics chapters; however, if available at FCS time, they may be included. The scope of this manual reflects the type of maintenance philosophy selected for this product (swap unit, printed circuit assembly, chip level or any combination thereof).

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with instructions to operate, troubleshoot and repair the at FCS time.

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Wang Laboratories, Inc.
Customer Engineering Documentation
M/S 8237
437 South Union Street
Lawrence, Mass.
01843-9984

Second Edition (February 1985)

This edition of the VS-15 Computer System FCS manual may only be used for the purpose stated in the Preface.

CUSTOMER ENGINEERING

PUBLICATION UPDATE BULLETIN

TITLE: VS-15 COMPUTER SYSTEM

DATE: 12/18/86

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742-1404

CLASS CODE: 6104

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REASON FOR CHANGE:

This PUB provides information pertaining to the External Disk Drive Controllers as related to the VS-15 Computer System. This PUB contains installation, cabling, and operating requirements for the VS-15 External Disk Drive Controller.

INSTRUCTIONS:

Remove and insert attached pages and/or microfiche as follows:

	REMOVE PAGES	INSERT PAGES
1.	ix/x	ix/x
2.	Nothing	Appendix G
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

	REMOVE FICHE	INSERT FICHE
1.	Fiche 1	Fiche 1
2.	Fiche 5	Fiche 5
3.		
4.		

This page constitutes a permanent record of revisions; place it directly following title page.

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CUSTOMER ENGINEERING

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REASON FOR CHANGE:

This PUB provides information pertaining to the Modular Serial I/O Subsystem as related to the VS-15 Computer System. This PUB contains listings of components, installation, operating requirements, diagnostics and trouble-shooting information for the Modular Serial I/O Subsystem

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INSTRUCTIONS:

Remove and insert attached pages and/or microfiche as follows:

	REMOVE PAGES	INSERT PAGES
1.	ix/x	ix/x
2.		Appendix F
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	REMOVE FICHE	INSERT FICHE
1.	Fiche 1	Fiche 1
2.	Fiche 5	Fiche 5
3.	Nothing	Fiche 6
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This PUB: 741-1404-3

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REASON FOR CHANGE:

This PUB adds a description of the Async. Controller (Appendix E) to the VS-15 Product Maintenance Manual.

INSTRUCTIONS:

Remove pages and insert attached pages as follows:

	REMOVE	INSERT
1.	ix/x	ix/x
2.	Nothing	Appendix E
3.		
4.		
5.		
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10.		

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Previous Notice(s):741-1404-1

REASON FOR CHANGE:

This PUB corrects the SMD Disk Device Adapter address jumpers, the main memory RAM chip layout, and Appendix C, the NEC 147-MB Disk Drive.

INSTRUCTIONS:

Remove pages and insert attached pages as follows:

	REMOVE	INSERT
1.	5-19b/20	5-19b/20
2.	8-27/28	8-27/28
3.	C4-7/8	C4-7/8
4.	C4-11/12	C4-11/12
5.	C7-1/2	C7-1/2
6.		
7.		
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9.		
10.		

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Class Code: 6104

Base Document: 741-1404

Previous Notice(s): None

REASON FOR CHANGE:

This PUB provides installation, operation, checkout, and troubleshooting instructions for the internal NEC 147-Megabyte Disk Drive option (Appendix C) and the 2-Megabyte Main Memory Option (Appendix D) for the VS-15 Computer

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INSTRUCTIONS:

Remove pages and insert attached pages as follows:

	REMOVE	INSERT
1.	Cover/ii	Cover/ii
2.	ix/x	ix/x
3.		Appendix C
4.		Appendix D
5.		
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WARNING

```
**************************************************************
*                                                            *
*    DO NOT OPEN THE SWITCHING POWER SUPPLY UNDER ANY        *
*    CIRCUMSTANCE.  EXTREMELY DANGEROUS VOLTAGE AND          *
*    CURRENT LEVELS (IN EXCESS OF 300 VOLTS DC AND UN-       *
*    LIMITED CURRENT) ARE PRESENT WITHIN THE POWER SUPPLY.   *
*                                                            *
*    DO NOT ATTEMPT TO REPAIR THE SWITCHING POWER            *
*    SUPPLY; IT IS FIELD REPLACEABLE ONLY.                   *
*                                                            *
*    AFTER POWERING THE UNIT DOWN AND DISCONNECTING THE AC   *
*    POWER CONNECTOR FROM THE POWER SOURCE RECEPTACLE,       *
*    ALLOW ONE MINUTE BEFORE REMOVING THE POWER SUPPLY TO    *
*    PROVIDE ADEQUATE TIME FOR ANY RESIDUAL VOLTAGE TO       *
*    DRAIN THROUGH THE BLEEDER RESISTORS.                    *
*                                                            *
**************************************************************
```

WARNING

```
*****************************************************************
*                                                               *
*  THIS COMPUTER EQUIPMENT HAS BEEN VERIFIED AS FCC CLASS A.    *
*                                                               *
*****************************************************************
```

IN ORDER TO MAINTAIN COMPLIANCE WITH FCC CLASS A VERIFICATION, THE FOLLOWING CONDITIONS MUST BE ADHERED TO DURING NORMAL OPERATION OF EQUIPMENT.

- ALL COVERS MUST BE ON SYSTEM AND SECURED IN THE PROPER MANNER.
- ALL INTERNAL CABLES MUST BE ROUTED IN THE ORIGINAL MANNER WITHIN THE CABLE CLAMPS PROVIDED FOR THAT PURPOSE.
- THE MAINTENANCE PANEL DOOR MUST BE KEPT CLOSED.
- ALL EXTERNAL CABLING MUST BE SECURED AND THE PROPER CABLE USED TO ENSURE THAT CABLE SHIELDING IS PROPERLY GROUNDED TO THE CABLE CLAMPS PROVIDED.
- MAKE SURE CONTACT FINGER STRIP CLIP-ON (WLI P/N 654-2139) IS IN PLACE AND UNDAMAGED. (CONTACT FINGER STRIP MAY BE ORDERED AND CUT TO PROPER LENGTH).
- ALL HARDWARE MUST BE PROPERLY SECURED.

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INTRODUCTION

CHAPTER 1

INTRODUCTION

Chapter 1 information is not provided as part of the First Customer Shipment (FCS) Manual, but will appear in the Standard Product Maintenance Manual.

CHAPTER 2
THEORY OF OPERATION

CHAPTER 2

THEORY OF OPERATION

Chapter 2 information is not provided as part of the First Customer Shipment (FCS) Manual, but will appear in the Standard Product Maintenance Manual.

CHAPTER 3
OPERATION

CHAPTER 3

OPERATION

3.1 GENERAL

This chapter provides the CE with tables listing all VS-15 main frame switches and indicators, and daily turn-on and normal and emergency shut-down procedures. Included in this chapter are the procedures for using these switches and a brief statement on the purpose of each switch and indicator.

3.2 SWITCHES

Table 3-1 lists the switches found on the VS-15. Locations of the switches are shown in figures 3-1 and 3-3.

Table 3-1. VS-15 Switches

SWITCH NAME/TYPE	LOCATION	PURPOSE
AC POWER ON/OFF Rocker Switch	Power Supply	Applies ac and dc power to the CP main frame when in the 1 position
CONTROL MODE Green Pushbutton	Front Panel	Forces system into Control Mode if Control Mode Microcode is loaded
INITIALIZE Red Pushbutton	Front Panel	Causes system to IPL from selected disk drive and system clock to be reset
BOOT DEVICE Toggle Switch	Front Panel	Selects disk drive (Diskette or Internal fixed) for Standalone Utilities or IPL
LOCAL CONTROL/ REMOTE DIAGS./ REMOTE CONTROL Key Switch	Front Panel	Allows normal local operations. Connects VS15 to modem for remote tests. Reserved for future use.
DISCONNECT Pushbutton	TC Front Panel	Clear Data Terminal Ready signal for TC Device Adapter
CLEAR Pushbutton	TC Front Panel	Generate Power On Reset state for TC Device Adapter
MEMORY SIZE DIP-Switch	7900 Main Memory board	Selects main memory size. Refer to paragraph 3.2.3
BP SOFTWARE DIP-Switch	8358 Bus Processor board	Determines diagnostics mode or normal system operation. Read by the BP 8086 microprocessor. Refer to paragraph 3.2.4
33 MEG WINCH. DA DIP-Switches	8362 Winchester board	Selects disk drive type & maximum number of disk drive heads.
76 MEG SMD DA DIP-Switches	8312 SMD Disk board	Selects disk drive type.

3.2.1 POWER ON/OFF

The ac power On/Off switch is mounted on a bracket on the front of the SPS476E Switching Power Supply. (See figure 3-1.)

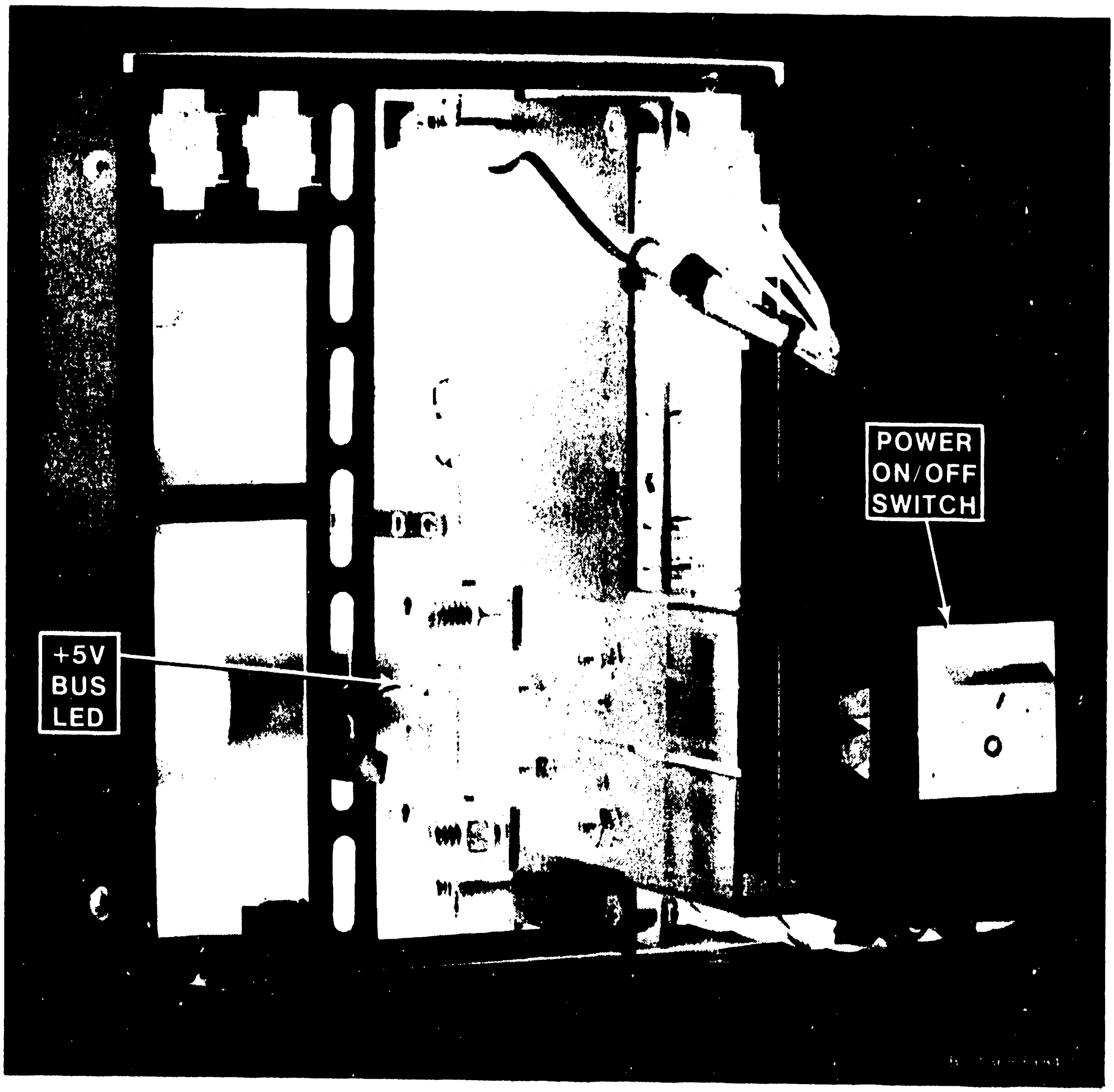


Figure 3-1. Switching Power Supply (Left Side View)

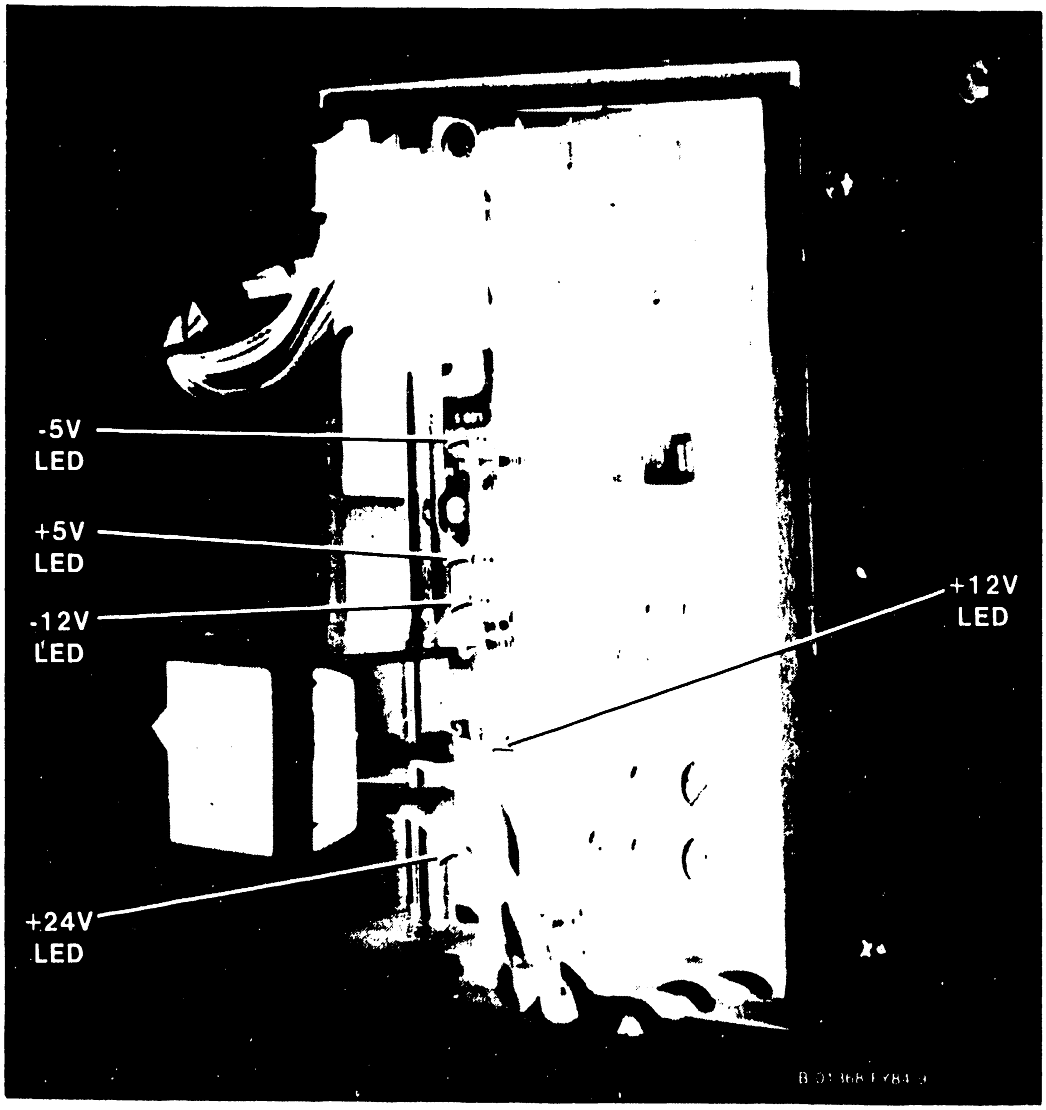


Figure 3-2. Switching Power Supply (Right Side View)

Ac power is applied to the switching power supply directly from the input source. The system is turned on by:

1. Depressing the ac power On/Off switch to the 1 position. Ac power is supplied to the switching power supply, fans, diskette drive, and internal disk drive. The switching power supply turns on and provides dc voltages to the Motherboard and the internal disk drive(s).
2. The Power On LED and the four HEX displays on the Front Panel light. If the LEDs do not light or the HEX displays go on and then go out within two seconds, a system power supply problem exists.

The system is turned off by:

1. Depressing the ac power On/Off switch to the 0 position.

3.2.2 FRONT PANEL

The 210-8613 Front Panel board, located in the right front corner of the main frame, contains several pushbuttons, switches and indicators. These allow the user to force the system into Control Mode, initialize the system, select a disk drive, load system or diagnostic microcode, and display system error status. (See figure 3-3.)

3.2.2.1 CONTROL MODE PUSHBUTTON

Pressing the green Control Mode button sets the Control Mode bit to one, forcing the CP into the Control Mode. The VS-15 Control Mode is identical in operation to the VS-25/45.

3.2.2.2 INITIALIZE PUSHBUTTON

Pressing the red Initialize pushbutton forces the system into the Initialized state. In this state, the system is in the following condition:

1. Main memory, Segment Control Registers (SCRs), and CP Reference and Change Table are all set to zero.
2. Page Table for Segment Zero (Operating System) is loaded into the T-Ram for access by the CP. Remaining T-Ram entries are faulted.
3. System Clock is zeroed and Comparator bits are set to one. As a result, the user must enter the date and time into the system whenever the system is initialized using the Initialize pushbutton.
4. BP-PROM receives control and is ready to start the bootstrap process.
5. BP checks BP Code RAM, BP Data RAM, and IPL disk drive interface. BP then loads microcode into the Data RAM, moves the microcode to Code RAM, and branches to execute the microcode.

3.2.2.3 BOOT DEVICE SWITCH

The three-position Boot Device switch enables the user to select the disk drive for Standalone Utilities or IPL the system. These three positions are:

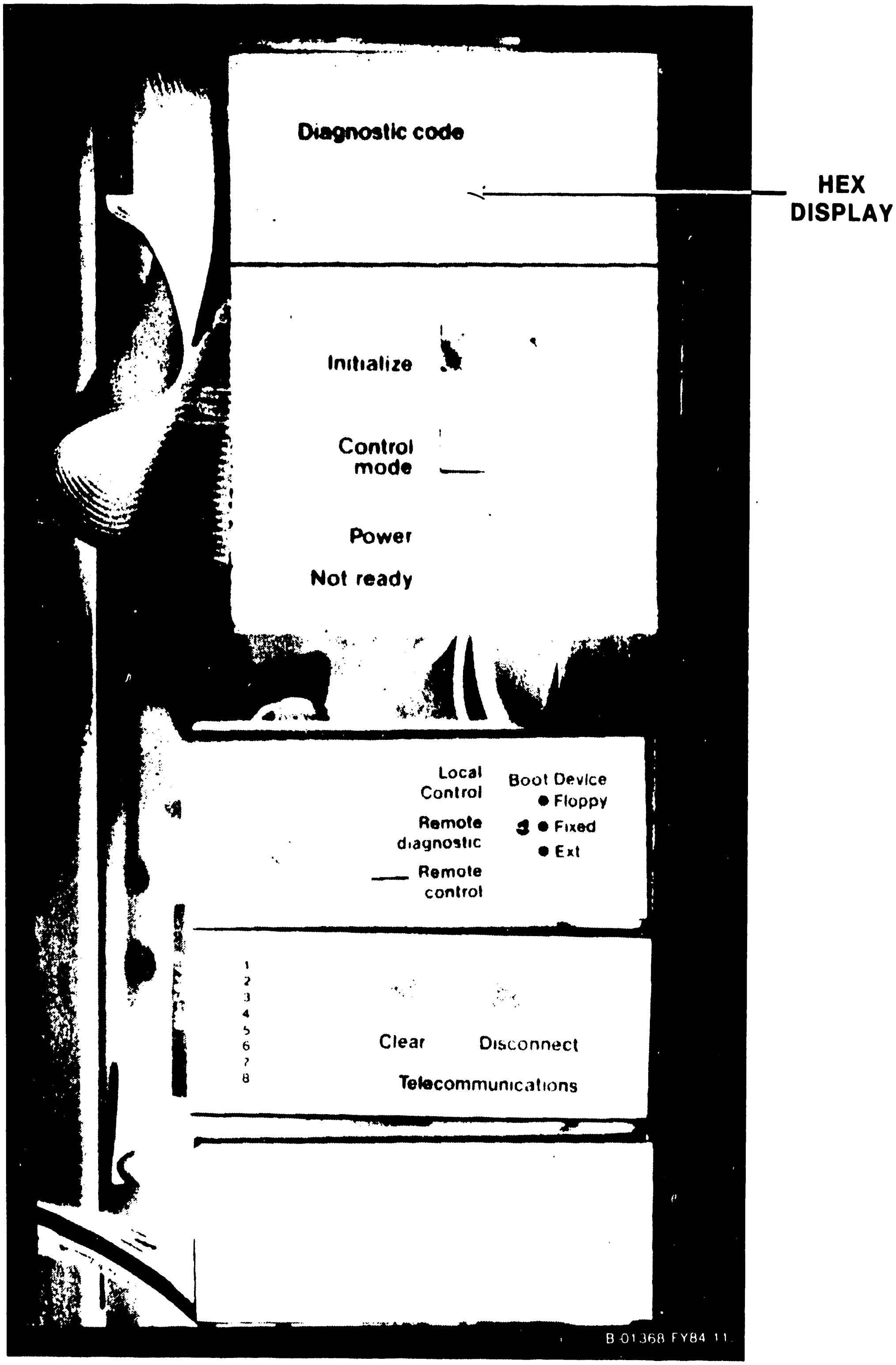


Figure 3-3. Front Panel Switches and Indicators

1. Up - Select the model 2270V-5 diskette drive.
2. Center - Select the system's internal media tolerant disk drive.
3. Down - not used.

3.2.2.4 LOCAL CONTROL/REMOTE DIAGNOSTIC/REMOTE CONTROL SWITCH

When in Local Control, the three-position, key operated Local Control/-Remote Diagnostic/Remote Control switch will allow normal system operation. When in Remote Diagnostic, it will connect the system to the Remote Maintenance Center (RMC), via a modem and telephone line, for remote diagnostic operation. The RMC will be able to read the Nonvolatile RAM or down-line run diagnostic packages already loaded on the system. The Remote Control position is reserved for future use.

If the switch is in the Remote position, the system will not IPL. Turn the switch to the Local Control position and remove the key from the lock.

Because of its function as a diagnostic tool, a detailed description of the Local Control/Remote Diagnostic/Remote Control switch will be included in Chapter 8 of this document.

3.2.2.5 TC DA CONTROL/INDICATOR PANEL

The 25V76-1/2 TC DA Front Control/Indicator Panel is part of the Front Panel (figure 3-3). There is room for four TC DA Front Indicator/Control Panels. Each panel contains 8 LED indicators and two pushbutton switches. The pushbutton switches are described in table 3-1. The TC DA status is indicated by the LEDs as described in tables 3-3 and 3-4.

3.2.3 MEMORY SIZE SELECTION

Minimum memory size is 256K bytes and maximum main memory size is 1 Megabyte (1024K bytes). Memory can be increased in 256K byte increments until maximum memory size is reached.

A 5-position DIP switch (S1), located on the 210-7900 Main Memory board, determines the size of main memory. (See figure 5-5 for the location of the switch.) Table 5-2 provides information for determining switch settings for different memory sizes. Incorrectly altering the switch settings can result in the system refusing to IPL correctly.

The settings of switch S1 on the 210-7900 Main Memory board are compared with the high-order memory address bits (MA17-20) in the comparator chip at location L252. When the SYSGEN procedure is run, it checks the switch and requests the size it reads regardless of whether the size is legitimate.

If the switch setting exceeds 1024K bytes and the address entered during the SYSGEN procedure <u>does not</u> exceed 1024K bytes, the system processes the address normally. If the switch setting <u>does not</u> exceed 1024K bytes and the address entered during the SYSGEN procedure <u>does</u> exceed 1024K bytes, the SYSGEN procedure requests the memory size parameter to be reentered.

However, if the switch settings are higher than the actual physical memory and that size is entered during the SYSGEN procedure, the memory address is accepted as legitimate and the CP attempts to process the address. This will result in the system hanging up during initialization or returning a MACHINE CHECK CODE 001 (not enough memory for IPL) during initialization.

3.2.4 BP SOFTWARE SWITCH SETTINGS

An eight-position DIP switch, located on the 210-8358 BP board, is used by the BP's 8086 microprocessor to determine the type of diagnostics to be run. (See figure 5-7 for the location of the switch.) Table 5-3 provides information for determining switch settings for diagnostic functions.

3.3 INDICATORS

Table 3-2, 3-3, and 3-4 lists the indicators found on the VS-15. Locations of the indicators are shown in figures 3-1, 3-2, and 3-3.

Table 3-2. VS-15 Indicators

INDICATOR NAME/TYPE	LOCATION	PURPOSE
POWER ON LEDS	Power Supply	Indicators for +24V, +12V, -12V, +5V, -5V, and +5V bus dc voltages
POWER ON LED	Front Panel	Indicates dc power is on
NOT READY LED	Front Panel	When ON, power-up diagnostics are running. When OFF, system microcode is running
HEX DISPLAY	Front Panel	Four hexadecimal displays for reporting system errors
TC DISPLAY LEDS	TC Front Panel	Refer to tables 3-3 and 3-4
ISIO DIAGNOSTIC LED	ISIO Device Adapter	Indicates power-up diagnostics for the ISIO DA are running
33 MEG WINCHESTER READY LED	Winchester Device Adapter	When ON, 33 Meg. drive is ready. When OFF, 33 Meg. drive is not ready. When blinking, 33 Meg DA is attempting to communicate with 33 Meg. drive.

Table 3-3. VS-15 TC Device Adapter Front Indicator/ Control Panel (Normal TC Operation)

INDICATOR NAME/TYPE	PURPOSE
LED1	Received Data
LED2	Transmitted Data
LED3	Clear-to-Send
LED4	Request-to-Send
LED5	Carrier Detect
LED6	Data Terminal Ready
LED7	Data Set Ready
LED8	Power On

Table 3-4. VS-15 TC Device Adapter Front Indicator/ Control Panel (Power Up and IPL)

LEDS 1-7 CONDITIONS	LED 8 CONDITIONS	TC DA STATUS
All on	Blinking	Test running
All off	On	Test passed
Some on/some off	Blinking	Test failed

3.3.1 HEX DISPLAY

The Front Panel monitors system error status and provides the user with information concerning the error condition of all I/O devices connected to the main frame as well as data concerning the BP and CP status. The Display Panel has one row of four HEX displays. Because of its function as a diagnostic tool, a detailed description of the HEX Displays is included in Chapter 8 of this document.

3.3.2 POWER ON LED

The Power On LED, located on the Display Panel, indicates whether or not the correct voltages are being applied to the main frame. At initial power-up this LED lights as the voltages are applied to the main frame.

NOTE

Since the Power On LED's normal status is ON, a trouble condition exists when the LED is OFF. However, the LED indicates only that the voltages are present at the power supply. It does not indicate that actual voltages on the Motherboard are within limits.

3.3.3 ISIO DEVICE ADAPTER DIAGNOSTIC LED

A single LED is mounted at the top of the ISIO Device Adapter board. The LED is on when the ISIO DA power-up diagnostics are running and will go out when the diagnostics have completed successfully. If the diagnostics fail, the LED will stay on.

3.3.4 33 MEGABYTE WINCHESTER READY LED

A single LED is mounted at the top of the 33 Megabyte Winchester Device Adapter board. The LED is on when the 33 Megabyte disk drive is ready, off when the disk drive is not ready, and blinking when the Device Adapter is attempting to communicate with the disk drive.

3.4 SUPPORT MATERIALS

No special support materials are necessary for the VS-15 main frame.

3.5 DAILY POWER-UP PROCEDURES

After all peripherals are connected to the main frame, the daily power-up and power-down procedures for the VS-15 system are as follows:

1. Make sure that the main frame power connector is plugged into the power source receptacle.
2. Power up Workstation 0.
3. Depress the main frame ac power On/Off switch to the 1 position.
4. After the PROM-based power-up diagnostics have completed (the NOT READY light on the Display Panel has gone out), position the cursor on W/S 0 next to the IPL volume name and press ENTER. The Self-Test Monitor diagnostics will begin running. (See table 8-2 for diagnostic error code information.)
5. After the IPL Self-Test Monitor diagnostics have completed, enter the name of the configuration file and press ENTER.
6. Enter the date and time and press ENTER.
7. When System Initialization has completed, the VS Operators Console screen will appear and the system is ready for normal operation.

3.6 DAILY VERIFICATION PROCEDURES

Daily verification procedures are as follows:

1. Perform an IPL from the system disk.
2. Log on to a workstation and and run the WSDKTEST diagnostic located in @SYSTST@ library on the system disk.
3. If there are no errors cancel the diagnostic, log off the system, and let the customer resume normal daily operations.

3.7 DAILY POWER-DOWN PROCEDURES

CAUTION

IMPROPERLY POWERING DOWN THE SYSTEM AND/OR ANY DISK DRIVE CAN RESULT IN DAMAGE TO THE VOLUME TABLE OF CONTENTS (VTOC) OF THE DISK DRIVE(S).

1. Make sure all operators have logged off of the system.
   a. Press PF key 13 (WORKSTATIONs) on an operators console to check that the operators have logged off of the system.
   b. Press PF key 7 (NONINTERACTIVE Tasks) on an operators console to check the background tasks on the system. Look under the User column to identify any operator running a background task.
2. Press the green Control Mode button. This prevents any disk I/O command in process from being halted prior to completion.
3. Power down all peripheral devices according to procedures in the applicable documents in Class 3000.
4. Depress the main frame ac power On/Off switch to the 0 position.

3.8 EMERGENCY SHUT-DOWN PROCEDURES

In case of an emergency situation when the normal daily shut-down procedure can not be used, perform the following:

1. Press the green Control Mode button, if possible. This prevents any disk I/O command in process from being halted prior to completion and prevents possible damage to any disk VTOC.
2. Depress the power On/Off switch to the 0 position.
3. Disconnect the main frame power connector from the power source receptacle.

3.9 OPERATOR PREVENTIVE MAINTENANCE

No operator preventive maintenance is necessary on the VS-15 main frame.

CHAPTER 4
INSTALLATION

CHAPTER 4

INSTALLATION

4.1 GENERAL

This chapter describes the procedures for unpacking, inspecting, and installing the VS-15 main frame. Included in this chapter are instructions for system interconnection and initial power-up. Refer to Chapter 3, Operation, and Chapter 5, Preventive and Corrective Maintenance and Removal/Replacement, of this manual for more information needed to complete installation. Actual installation should not begin until the site requirements detailed in the following publications have been met.

DOCUMENT TITLE	WLI P/N
Customer Site Planning Guide	700-5978D
Systems Installation Guide for VS, 2200, and WP/OIS Systems	729-0907
VS Customer Planning and Resource Guide	700-6727

Plus any other pertinent documents in Class 1106.

4.2 INSTALLATION SITE CHECK

Prior to installation, the following conditions must have been met:

1. All site plans must have been approved by both the customer and a Wang service representative.
2. All building alterations must have been completed and inspected.
3. All electrical wiring, air conditioning, and telecommunications modifications must have been installed and tested.
4. If the installation is an upgrade only (CP replacement), the salesperson will make sure that serial peripheral devices replace all parallel peripheral devices.

NOTE

> It is the responsibility of the salesperson to make sure that an upgrade site meets all necessary VS-15 specifications.

5. The CE will perform a preinstallation inspection two weeks prior to delivery. At this time, the CE will check the site for compliance with VS site specifications. The CE will bring any unsatisfactory conditions noted to the attention of the customer for correction.

NOTE

Before installation of a VS-15 can take place, the minimum specifications as described in the previously listed publications should be met. Failure to meet these requirements can be cause for the installing CE to deem a site as unsuitable for the proper functioning of a VS-15 system.

4.2.1 REMOTE DIAGNOSTIC TELECOMMUNICATIONS REQUIREMENTS

The following information is provided to ensure proper installation of telecommunications equipment for remote diagnostic support.

4.2.1.1 Site Preperation for Remote Maintenance

At the preinstallation site check, verify that the customer has ordered the following equipment from the telephone company for connection to a switched line telephone network:

1. Telephone for Remote Diagnostic sessions.
2. Either of the following modular connecting block for the telephone:
   a. RJ11C voice jack for desk top telephones
   b. RJ11W voice jack for flush wall telephones.

Schedule the telephone equipment installation prior to the VS-15 installation to ensure an efficient Remote Diagnostic Certification procedure.

4.2.1.2 Configuration Guideline

1. Command Console (Workstation 0) - within 25 feet of VS-15 CPU.
2. Remote Diagnostic Modem - within 10 feet of VS-15 CPU.
3. Telephone - adjacent to Remote Diagnostic Modem.

4.2.1.3 Wang WA3451 Remote Diagnostic Modem Specifications

NOTE

Domestically, the Wang model WA3451 modem is supplied with the VS-15 system. A 6-pin modular plug (T-connector), WLI P/N 726-8089, is also supplied to connect the modem to the switched line telephone network.

MODEM DIMENSIONS	INCHES	CENTIMETERS
Width	7.0	18
Height	2.5	6
Depth	12.0	30

MODEM POWER REQUIREMENTS	115Vac
Ac Variation	+/-10%
Hertz	47-63
Watts	12

4.2.1.4 FCC Requirements For Switched Line Connection

Federal Communications Commission (FCC) regulations specify that prior to connecting a device such as the WA3451 modem to the switched telephone network, a user must provide the local telephone company with the name of the manufacturer, the model number, FCC registration number, and the ringer equivalence number of the device to be connected. For the WA3451, the information is listed on the bottom of the modem, and is also shown below.

Model Number	Wang WA3451
FCC registration number	AJ 496M-67213-DM-N
Ringer equivalence number	0.9B
Manufacturer (for Wang Labs)	Racal-Vadic, Inc.

NOTE

The WA3451 modem is registered with the FCC as a permissive device for direct connection to a switched telephone line. A Data Access Arrangement (DAA) is not needed.

4.2.1.5 International Site Preparation and Installation

1. Customer must provide a telephone line for both voice and data communications, and a telephone within 20 feet of the VS-15 system.
2. Customer must provide a 1200BPS asynchronous modem conforming to CCITT V.22 recommendations.
   a. Racal-Milgo MPS1222 modem is recommended.
   b. In those countries where the MPS1222 modem is not available, the Postal Telephone/Telegraph (PTT) supplied equivalent is acceptable.
   c. The approval for the V.22 modems and availability of the MPS1222 is Europe is as follows:
      Austria - Not allowed
      Belgium - PTT monopoly, can supply MPS1222
      France - MPS1222 approved
      Ireland - PTT monopoly, can supply MPS1222
      Italy - PTT monopoly, can supply MPS1222
      Luxembourg - MPS1222 approved
      Netherlands - MPS1222 approved
      Sweden - PTT monopoly, can supply MPS1222
      Switzerland - PTT monopoly, can supply V.22
      United Kingdom - PTT monopoly, can supply MPS1222
      West Germany - PTT monopoly, can supply MPS1222
3. Connection of the modem to a switched line telephone network will be performed by the PTT.

4.3 TOOLS AND TEST EQUIPMENT

TOOL DESCRIPTION	WLI P/N
Standard CE Tool Kit	726-9401

TEST EQUIPMENT DESCRIPTION	WLI P/N
Digital Voltmeter - Fluke #8022A	727-0119

4.4 UNPACKING

Before unpacking the VS-15, check all packing slips to make sure that the proper equipment has been delivered. Refer to the serial tag information below. After checking packing slips, inspect all shipping containers for damage (crushed corners, punctures, etc.).

4.4.1 CLAIMS INFORMATION

If damage is discovered during inspection, file an appropriate claim promptly with the carrier involved, and notify:

WLI Distribution Center
Department #90
Quality Assurance Department
Tewksbury, MA. 01876.

State the nature and extent of damage and make arrangements for replacement equipment, if necessary. Make sure to include this information:

WORK ORDER #__________
CUSTOMER NAME__________
CUSTOMER #__________
MODEL #__________
SERIAL #__________

Table 4-1. VS-15 Models

MODEL #	SERIAL TAG #	MEMORY SIZE	MAIN MEMORY P/N	DISK DRIVE
VS15-4A	157/177-7281	256 KB	210-7900-2A	33 MBYTE
VS15-8A	157/177-7282	512 KB	210-7900-3A	33 MBYTE
VS15-16A	157/177-7284	1024 KB	210-7900-5A	33 MBYTE
VS15-8C	157/177-7286	512 KB	210-7900-3A	66 MBYTE
VS15-16C	157/177-7288	1024 KB	210-7900-5A	66 MBYTE
VS15-8AN	157/177-7324	512 KB	210-7900-3A	76 MBYTE
VS15-16AN	157/177-7325	1024 KB	210-7900-5A	76 MBYTE

Part number prefix 157 = 50 cps ac line frequency machines.
Part number prefix 177 = 60 cps ac line frequency machines.

4.4.2 VS-15 CPU UPGRADE KITS

MODEL #	WLI P/N	DESCRIPTION
UJ-3275	205/206-3275	Upgrade from a VS15A to a VS15C
UJ-3276	205/206-3276	Upgrade VS15 from 256KB to 512KB
UJ-3278	205/206-3278	Upgrade VS15 from 256KB to 1024KB
UJ-3280	205/206-3280	Upgrade VS15 from 512KB to 1024KB
UJ-3282	205/206-3282	Upgrade from 1 TC port to 2 TC ports
UJ-3295	205/206-3295	Expander for 10 workstations + tape
UJ-4004	205/206-4004	Upgrade from VS15-16A to VS45-16A
UJ-4005	205/206-4005	Upgrade from VS15-16AN to VS45-16AN

Part number prefix 205 = International systems.
Part number prefix 206 = Domestic systems.

4.4.3 DISK UPGRADE

Upgrade kit UJ-3275, WLI P/N 205/206-3275, to upgrade the VS15A (1-33 MByte Disk Drive) to a VS15C (2-33 MByte Disk Drives) will contain the following components:

COMPONENT DESCRIPTION	QUAN	WLI PART NUMBER
DC Power Cable	1	220-0406
Disk I/O Cable	1	220-3352
5 1/4", 33MByte Disk Drive (Tested)	1	278-4034
6-32 x 1/4" Phillips Screws	4	650-3080
8" Static Ground Cable	1	220-2114

4.4.4 TELECOMMUNICATIONS OPTIONS

4.4.4.1 Single Port TC Option

TC Option, WLI P/N 157/177-7289, to install the 25V76-1A Single Port Telecommunications Device Adapter, will contain the following components:

COMPONENT DESCRIPTION	QUAN	WLI PART NUMBER
Single Port TC Device Adapter	1	210-8337-A
Front Indicator/Control Panel Cable	1	220-3247
Front Indicator/Control Panel	1	270-0959
Rear Cable Connector Panel	1	270-0952
RS-232 & CCITT/V.24 TC Cable (25')	4	220-0333

Internal cables, connecting the TC DA to the Rear Cable Connector Panel, are supplied with the Rear Panel. Part numbers for the cables are listed below.

CABLE DESCRIPTION	QUAN	WLI PART NUMBER
RS-232 & CCITT/V.24	2	220-3244

4.4.4.2 Dual Port TC Option

TC Option WLI P/N 157/177-7290, to install the 25V76-2A Single Port Telecommunications Device Adapter, will contain the following components:

COMPONENT DESCRIPTION	QUAN	WLI PART NUMBER
Dual Port TC Device Adapter	1	210-8637-A
Front Indicator/Control Panel Cable	2	220-3012
Front Indicator/Control Panel	2	270-0959
Rear Cable Connector Panel	1	270-0953
RS-232 & CCITT/V.24 TC Cable (25')	4	220-0333

Internal cables, connecting the TC DA to the Rear Cable Connector Panel, are supplied with the Rear Panel. Part numbers for the cables are listed below.

CABLE DESCRIPTION	QUAN	WLI PART NUMBER
RS-232 & CCITT/V.24	4	220-3244

4.4.4.3 Single Port to Dual Port TC Option

Upgrade kit UJ-3282, WLI P/N 205/206-3282, to upgrade the 25V76-1A Single Port TC DA to a 25V76-2A Dual Port TC DA will contain the following components:

COMPONENT DESCRIPTION	QUAN	WLI PART NUMBER
Dual Port TC Device Adapter	1	210-8637-A
Front Indicator/Control Panel Cable	2	220-3012
Front Indicator/Control Panel	1	270-0959
Rear Cable Connector Panel	1	270-0953
RS-232 & CCITT/V.24 TC Cable (25')	2	220-0333

4.4.5 UNPACKING THE MAIN FRAME

1. Cut the plastic strapping that secures the top cover and carton tube to the pallet. (See figure 4-1.)
2. Remove the top cover, top cushion, and carton tube.
3. Remove the two cushion blocks at the base of the main frame cabinet.
4. Remove the plastic bag covering the main frame cabinet.
5. Remove the two shipping bolts (one front and one rear) securing the main frame cabinet to the pallet.

WARNING

The main frame cabinet weighs approximately 136 pounds (62 Kilograms). Be careful when performing the following steps.

6. While firmly grasping the cabinet, carefully slide the main frame cabinet off pallet.
7. Move the CPU cabinet to its permanent location and remove the top and front covers. (Refer to paragraphs 5.3.2.1 and 5.3.2.2 for disassembly procedures.)
8. Turn the front leveling pad down until it supports the cabinet. Adjust the leveling pad to align the unit with adjacent equipment. Make sure the cabinet is level with no detectable rocking motion,
9. Once the cabinet is in place, check the service clearances as listed below.

SERVICE CLEARANCES	INCHES	CENTIMETERS
Front	36	91.5
Rear	30	76.0
Left	24	61.0
Right	24	61.0
Top	38	96.5

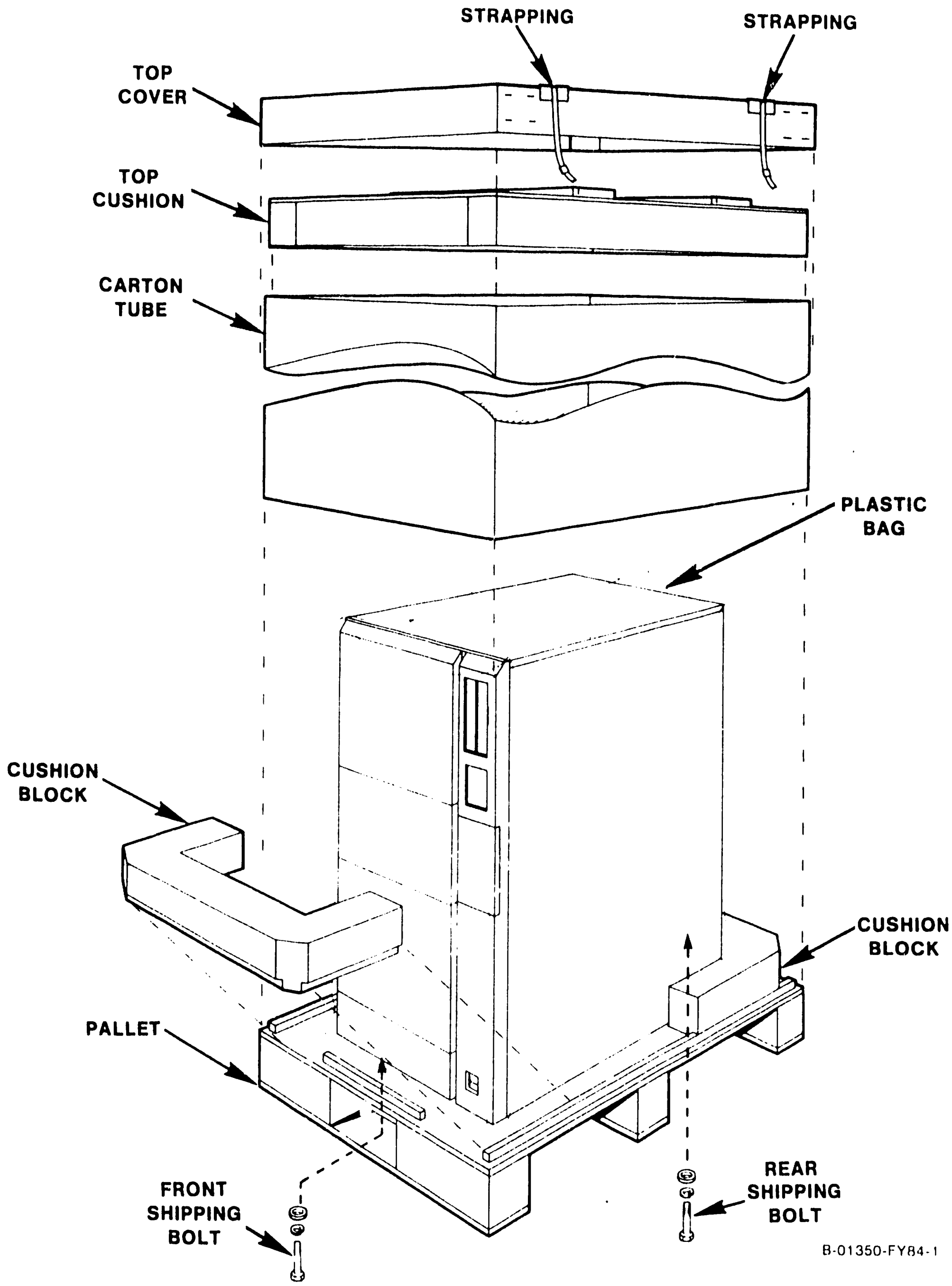


Figure 4-1. VS-15 Shipping Carton

4.4.6 UNPACKING THE PERIPHERALS

Before proceeding, carefully unpack all peripherals according to procedures outlined in applicable maintenance manuals in Class 3000. As each unit is unpacked, check it for any obvious shipping damage.

4.5 MAIN FRAME INSPECTION

NOTE

New quality assurance procedures and tests have shown that VS CPUs arriving on the customer's premises require only visual inspection, voltage checks, software loading, and cabling. Therefore, the following new inspection and installation procedures for all VS CPU products are effective immediately.

DO NOT REMOVE PRINTED CIRCUIT BOARDS FOR INSPECTION

DO NOT CLEAN PRINTED CIRCUIT BOARD CONTACTS WITH AN ERASER

INSPECT CPU MAIN FRAME VISUALLY

REPORT INSTALLATION PROBLEMS ON THE INSTALLATION REPORT AND STATE SPECIFIC CAUSES OF FAILURE

To make sure of the integrity of the equipment, a detailed internal inspection must be performed before final installation of the system. Perform an internal inspection of the main frame, as follows: (See figures 4-2 and 4-2a.)

1. Inspect the interior of the main frame for packing material or such shipping damage as broken connectors and loose fastening hardware.
2. Refer to the shipping list to make sure that the correct circuit boards have been shipped. Refer to paragraph 4.6.1 for the minimum hardware revision levels.
3. Carefully inspect the motherboard and fans for obvious damage or loose connections.
4. Inspect the power supply assembly for damage and loose connections. At this time, make sure that all power supply connections are tight.
5. If necessary, vacuum clean the unit.
6. Do not reassemble the main frame at this time.
7. If damage is discovered at any time during the inspection, follow the reporting procedure in paragraph 4.4.1.

4.5.1 PERIPHERAL INSPECTION

After inspecting the main frame, carefully inspect each peripheral according to procedures outlined in the applicable maintenance manuals in Class 3000. If damage is discovered at any time during the peripheral inspection, follow the reporting procedure in paragraph 4.4.1.

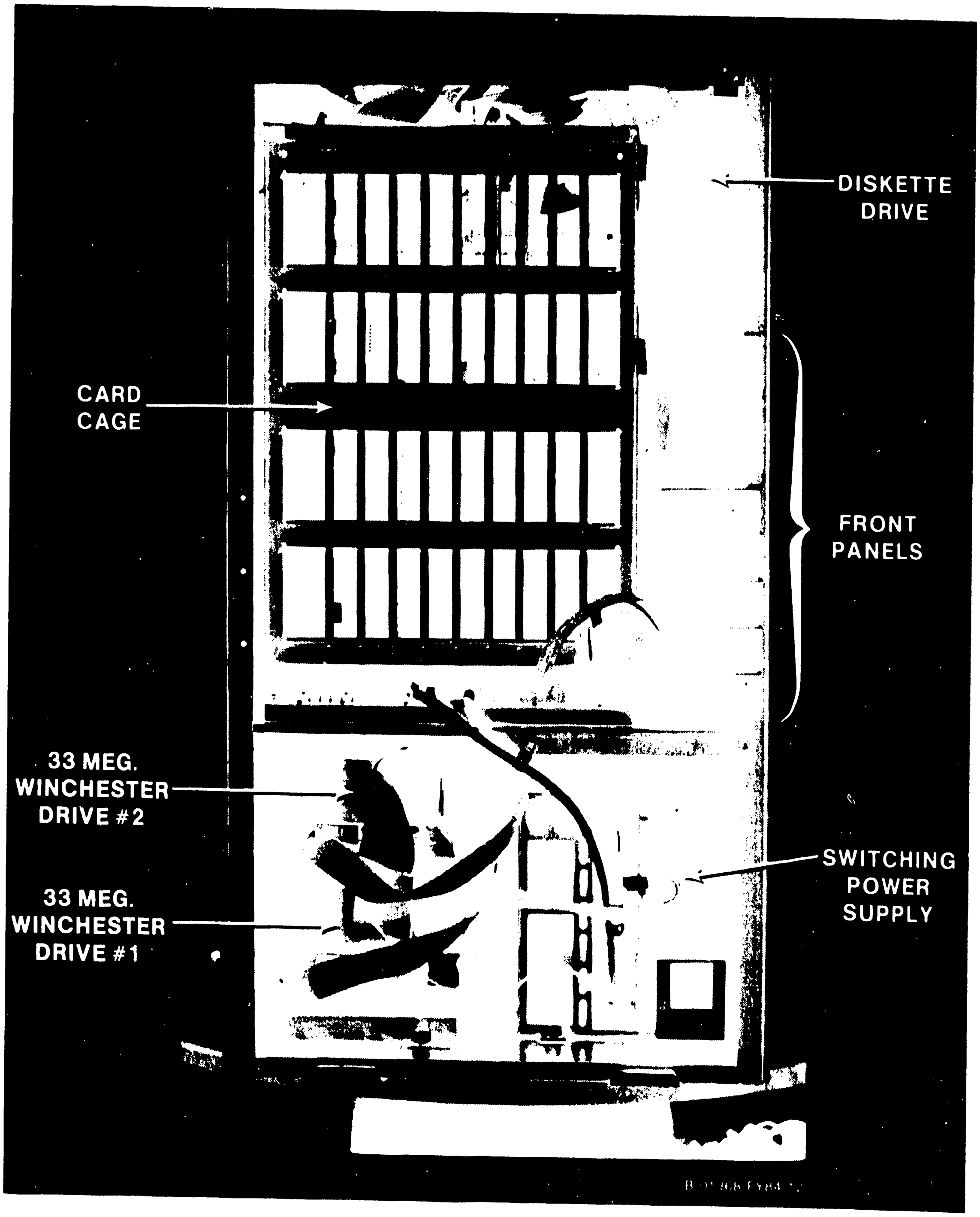


Figure 4-2. VS-15 With 33 Megabyte Disk Drives

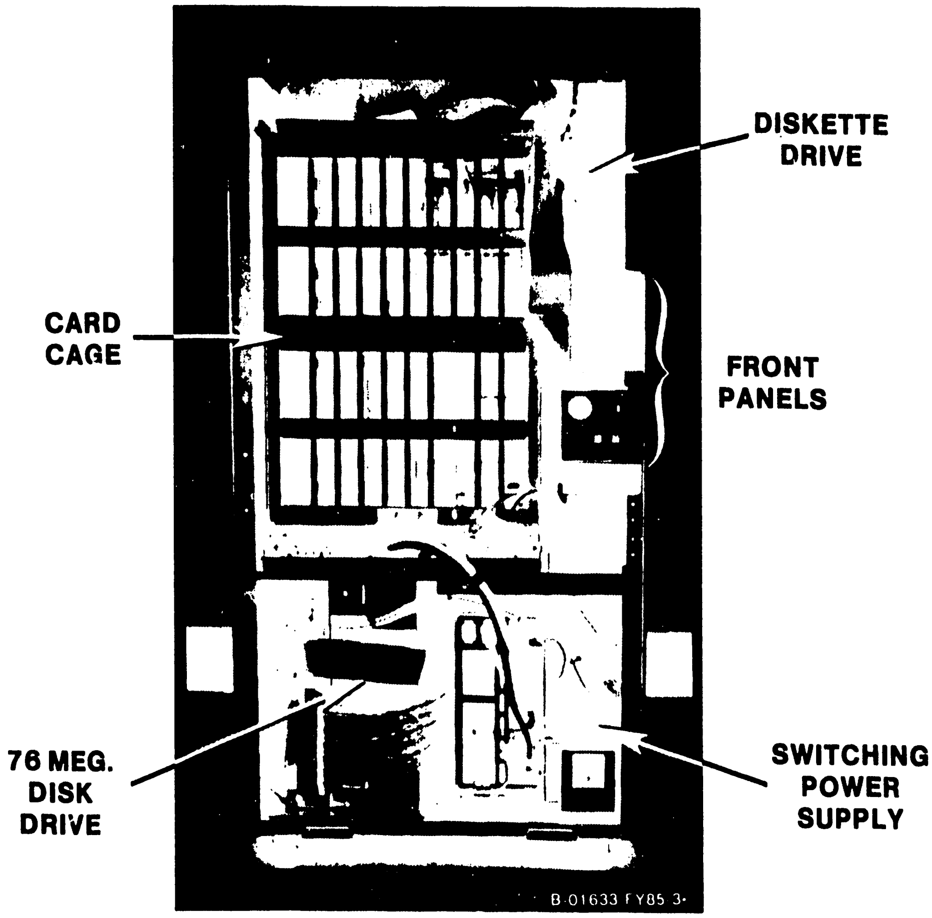


Figure 4-2a. VS-15 With 76 Megabyte Disk Drive

4.6 MINIMUM REQUIREMENTS

4.6.1 HARDWARE

WLI P/N	BOARD DESCRIPTION	E REVISION LEVEL
210-7900-2A	256 Kbyte Main Memory board	2
210-7900-3A	512 Kbyte Main Memory board	2
210-7900-5A	1 Megabyte Main Memory board	2
210-7906	16-Port SIO DA	2
210-8303	CPU board	1
210-8312	1-Port SMD Disk Drive DA	4
210-8337	1-Port Telecommunications DA	2
210-8358	Bus Processor board	4
210-8362	Winchster Drive DA	4
210-8607	Main Frame Motherboard	0
210-8613	Front Panel board	0
210-8616	32-Port ISIO DA	4
210-8637	2-Port Telecommunications DA	3

4.6.2 STANDALONE UTILITIES PACKAGE

Currently the Standalone Utilities (SAU) package, formerly Coldstart package, is available in either diskette or cartridge tape versions.

1. Diskette version, WLI P/N 195-2456-9, contains:

DISKETTE NAME	VERSION	WLI P/N
SAUDK1	7.00.11	735-8028
SAUDK2	7.00.11	735-8029
SYST01	6.20	735-8030
SYST02	6.20	735-8031
SYST03	6.20	735-8032
SYST04	6.20	735-8033
SYST05	6.20	735-8034
SYST06	6.20	735-8035
SYST07	6.20	735-8036
SYST08	6.20	735-8037
SYST09	6.20	735-8038
SYST10	6.20	735-8039
SYST11	6.20	735-8040
SYST12	6.20	735-8041
SYST13	6.20	735-8042
SYST14	6.20	735-8043

1.a. The following system diskettes are not part of the SAU package.

DISKETTE NAME	VERSION	WLI P/N
UTLTY1	6.20	735-8044
UTLTY2	6.20	735-8045
UTLTY3	6.20	735-8046
UTLTY4	6.20	735-8047
UTLTY5	6.20	735-8048
UTLTY6	6.20	735-8049
UTLTY7	6.20	735-8050

DISKETTE NAME	VERSION	WLI P/N
UTLTY8	6.20	735-8051
UTLTY9	6.20	735-8052
UTLTYA	6.20	735-8053
UTLTYB	6.20	735-8054
UTLTYC	6.20	735-8055
UTLTYD	6.20	735-8056
UTLTYE	6.20	735-8057
DIAG1		735-8058
DIAG2		735-8059
DIAG3		735-8060
DIAG4		735-8061
MACLIB1	6.20	735-8062
MACLIB2	6.20	735-8063
MACLIB3	6.20	735-8064
MACLIB4	6.20	735-8065
WSCODE	6.20	735-8066
PRCODE	6.20	735-8067
NVRAM Utilities		195-2452-0

2. Tape cartridge version, WLI P/N 195-2456-12, contains:

DISKETTE NAME	VERSION	WLI P/N
SAUDK1	7.00.11	735-8028
SAUDK2	7.00.11	735-8029

TAPE CARTRIDGE NAME	VERSION	WLI P/N
VS6202	6.20	705-0636

4.6.3 OPERATING SYSTEM VERSIONS

The following are the current operating system component versions:

COMPONENT	VERSION
@OPER@	06.20.00
@PRTTSK@	06.20.00
@SHARER@	06.20.00
@SYS00@	06.20.02
@SYSCPR@	06.20.00
@SYSGEN@	06.20.00
@SYSSVC@	06.20.02
@SYSTSK@	06.20.00
@TSKMGR@	06.20.00
BP CODE	06.01.01
CP CODE	05.11
DEVLIST	06.20.62

4.6.4 SMALL SYSTEM VS DIAGNOSTIC MONITOR PACKAGE

The Small System VS Diagnostic Monitor Packege, WLI P/N 195-2461-0 cantains the following diskettes:

1. Diskette 1 (DIAG1): Testing Disks and Main Memory

TEST ID	TEST NAME	VERSION	DISKETTE P/N
BT3500	5 1/4' Floppy Disk Diagnostic	1410	732-8002
RT1000	5 1/4" Winchester DA Diagnostic	1430	" "
DT1000	CMD/SMD Disk DA Diagnostic	1434	" "
MT1000	Main Memory Test	1412	" "
BT2000	BP/MM DMA Test	1337	" "

2. Diskette 2 (DIAG2): Testing BP and I/O DAs

TEST ID	TEST NAME	VERSION	DISKETTE P/N
BT1000	USART/Modem Diagnostic	1354	732-8003
BT5000	Bus Processor Diagnostic	1354	" "
BT4000	Multitasker	643C	" "
CPTSTR	CPU Tester	145C	" "
ST1000	Dumb 928 Data Link DA	1380	" "
ST2000	Smart 928 (w) Data Link DA	1380	" "
TT1000	T.C. DA 1-Port	1334	" "
TT2000	T.C. DA 2-Port	1380	" "

3. Diskette 3 (DIAG3): Testing CP (Part I)

TEST ID	TEST NAME	VERSION	DISKETTE P/N
CT1000	CP Control Memory	1334	732-8004
CT2000	BP/CP Communication	145C	" "
CT3000	BU Branch Opcode	145C	" "
CT4000	Status, Conditional Branch	145C	" "
CT5000	Subroutine Stack Data	145C	" "
CT6000	Subroutine Stack Addressing	145C	" "

4. Diskette 4 (DIAG4): Testing CP (Part II)

TEST ID	TEST NAME	VERSION	DISKETTE P/N
CT7000	Regs, Immediate Opcodes	145C	732-8005
CT8000	CPU Stack Diagnostic	145C	" "
CT9000	Logical and Shift Opcodes	145C	" "
CTA000	8-Bit and 16-Bit ALU Test	145C	" "
CTB000	MAR, TRAM, and RCT Test	145C	" "
CTC000	BD, IAD, CC, and DSET Test	145C	" "
CTD000	BI Branch Opcode Test	145C	" "

4.6.5 ON-LINE DIAGNOSTICS

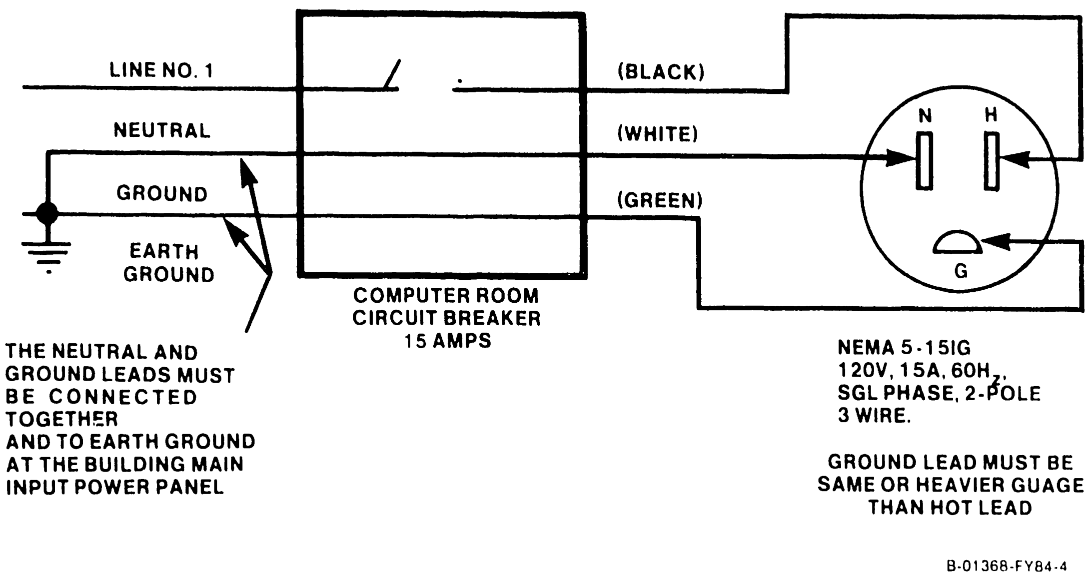
DIAGNOSTIC NAME	VERSION	WLI P/N
FTU On-Line	6434	195-2652-9
VS On Line DTOS Device 2 Package	2430	195 2615-9
VS On Line DTOS Device 3 Package	2344	195-2604-9
VS On Line DTOS Printer 2 Package	2330	195-2535-9
VS On Line DTOS Printer 3 Package	2260	195-2899-9
VS On-line Printer Monitor, Part I	2242	195-XXXX-9
VS On-line Printer Monitor, Part II	2211	195-XXXX-9

4.7 MAIN FRAME SOURCE-POWER CHECK

Before completing main frame reassembly and peripheral equipment installation, check the main frame power source receptacle for proper wiring and service, as defined in figure 4-3 and table 4-2. Perform the following electrical checks to make sure that the receptacle meets all specified requirements before proceeding with the installation.

CAUTION

Failure to perform the following check properly can result in serious damage to main frame circuits and to connected peripherals.



	RECEPTACLE BODY	MATCHING CONNECTOR
NEMA Configuration:	5-15IG	5-15IP

Figure 4-3. Power Service Requirements for VS-15 Main Frame

Table 4-2. DVM Chart For Receptacle Voltage Measurements

TEST POINT LOCATIONS	DMV READINGS
H TO N	115 Vac (+/-10%)
H TO G	115 Vac (+/-10%)
G TO N	+0 Vac

4.7.1 INITIAL MAIN FRAME POWER-UP

1. Make sure that the ac power On/Off switch on the power supply (figure 3-1) is in the 0 position and then plug the main frame power connector into the power source receptacle.
2. Perform the following in the sequence given: (Figures 3-1 and 3-3.)
   a. Set the Front Panel Boot Device switch to the up position (select diskette drive). No diskette should be in the drive.
   b. Depress the ac power On/Off switch to the 1 position.
   c. Make sure the Power On LED on the Front Panel is lit, the main frame cooling fans are turning, the diskette drive motor is running, and the internal Winchester disk drive motor is running. The HEX Display LEDs should also be lit. If the HEX Display LEDs go out after 2 seconds, there is a problem with the dc voltage compare circuit in the power supply.
   d. The HEX display on the Front Panel will begin counting down a series of numbers from FFFF to 0000 and then count up through a series of diagnostic routines (typically 10, 11, 12, 13, 14, 15, and 16) and stop at 9820, Diskette drive not ready. If any number (except 9820) is displayed for more than 15 seconds, the system has failed one of the diagnostics.
   e. At the same time the HEX display on the Front Panel is counting, the TC DA PROM-based power-up diagnostics will be running as shown on the TC DA Front Indicator/Control Panel. (Table 3-4.) The diagnostics will complete successfully in about 12 seconds.

NOTE

If the diagnostics failed and the voltages listed below are correct, refer to Chapter 8, Trouble Shooting, and Appendix B, Self-Test Monitor Diagnostic Error Codes.

3. The following voltages must be checked on the at the motherboard test points (figures 4-4 and 4-5). If the dc voltages are out of operating limits (table 4-3), the switching power supply must be adjusted.
4. With a digital voltmeter, check the voltages at the Motherboard test points.
5. With a nonmetallic adjustment tool, adjust the voltage(s) to within the operating limits. (See figures 4-6 and 4-7 for the locations of the adjustment pots.)
6. After completing the voltage checks, turn to paragraph 4.8.

Table 4-3. DC Test Point Voltages

TEST POINT	VOLTS	OPERATING LIMITS	AC RIPPLE LIMITS
TP1	+/-0	+/-0V	35mV RMS or 50mV Pk-to-Pk
TP2	+5.0	+4.95V to +5.05V	35mV RMS or 50mV Pk-to-Pk
TP3	-5.0	-4.95V to -5.05V	35mV RMS or 50mV Pk-to-Pk
TP4	+12.0	+11.9V to +12.1V	35mV RMS or 50mV Pk-to-Pk
TP5	-12.0	-11.9V to -12.1V	35mV RMS or 50mV Pk-to-Pk

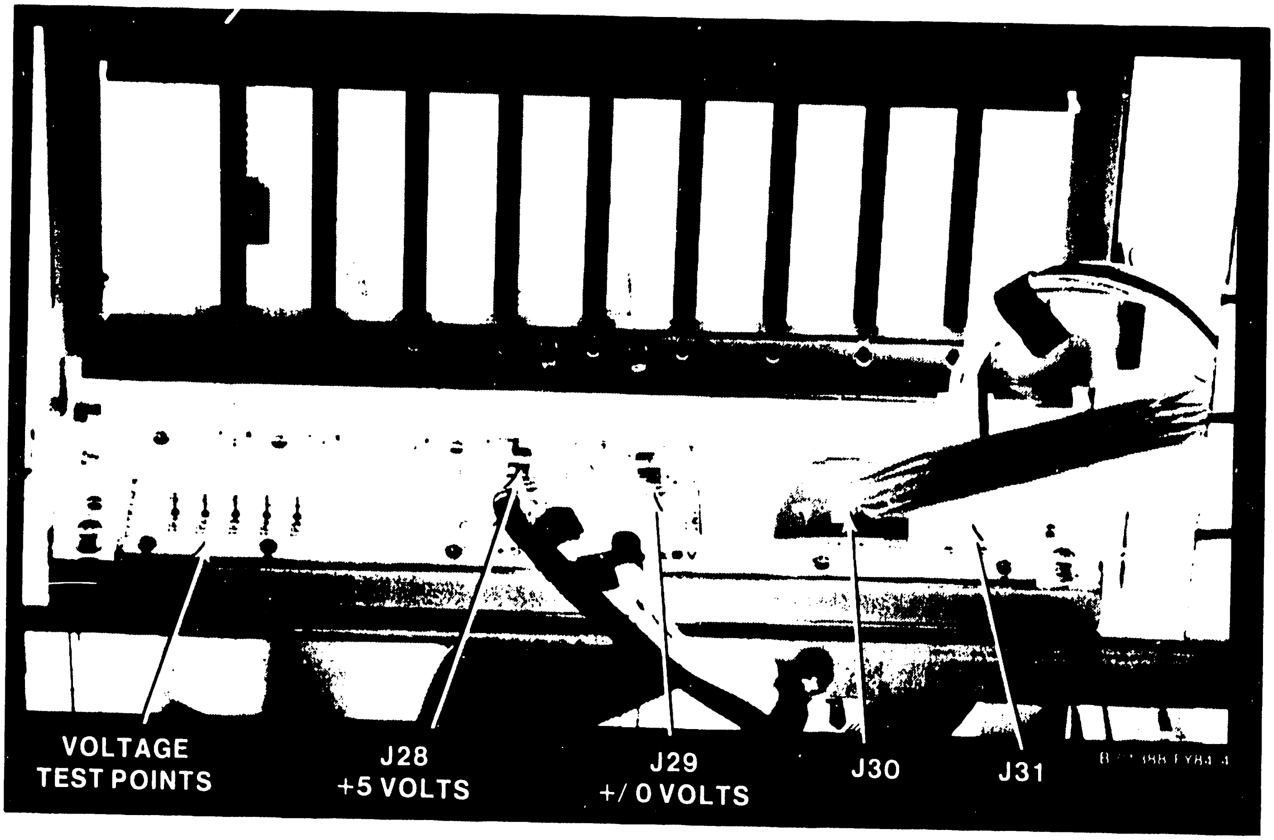


Figure 4-4. Motherboard Power Connectors

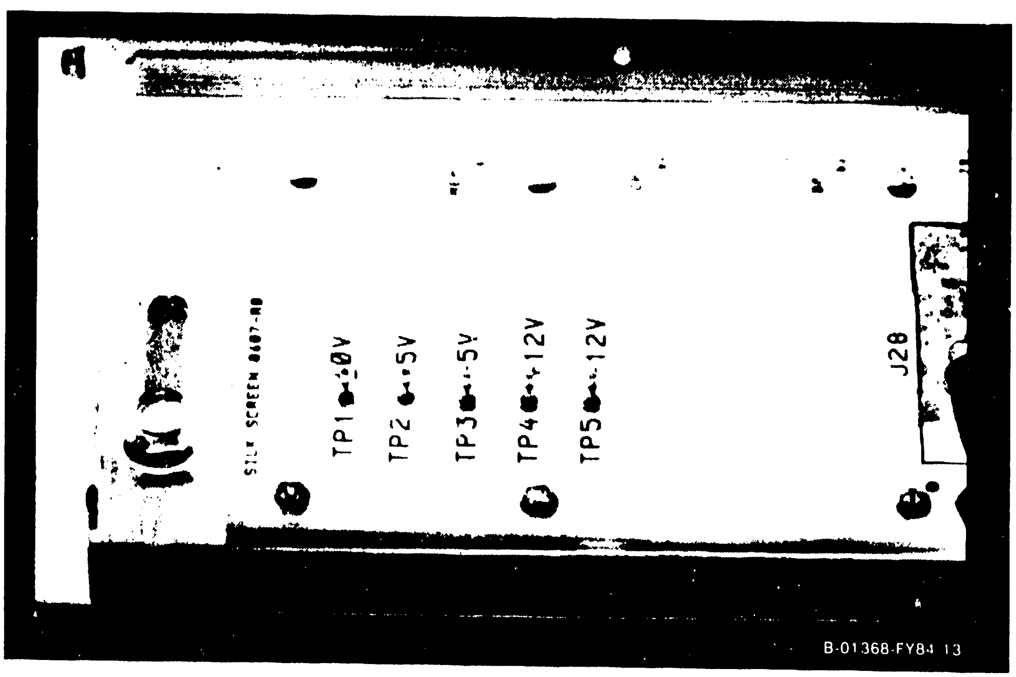


Figure 4-5. Motherboard Voltage Test Points

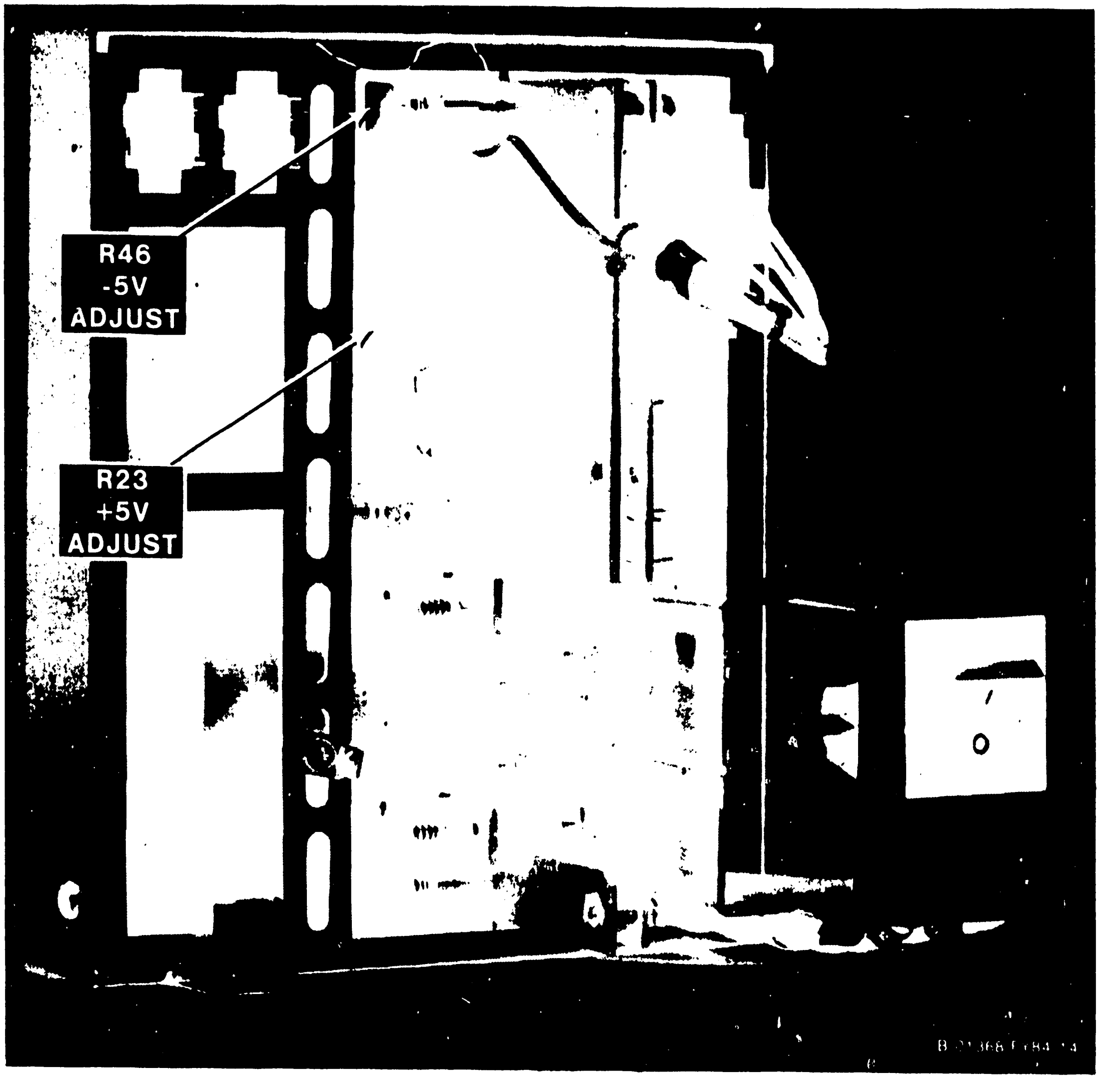


Figure 4-6. Switching Power Supply (Left Side View)

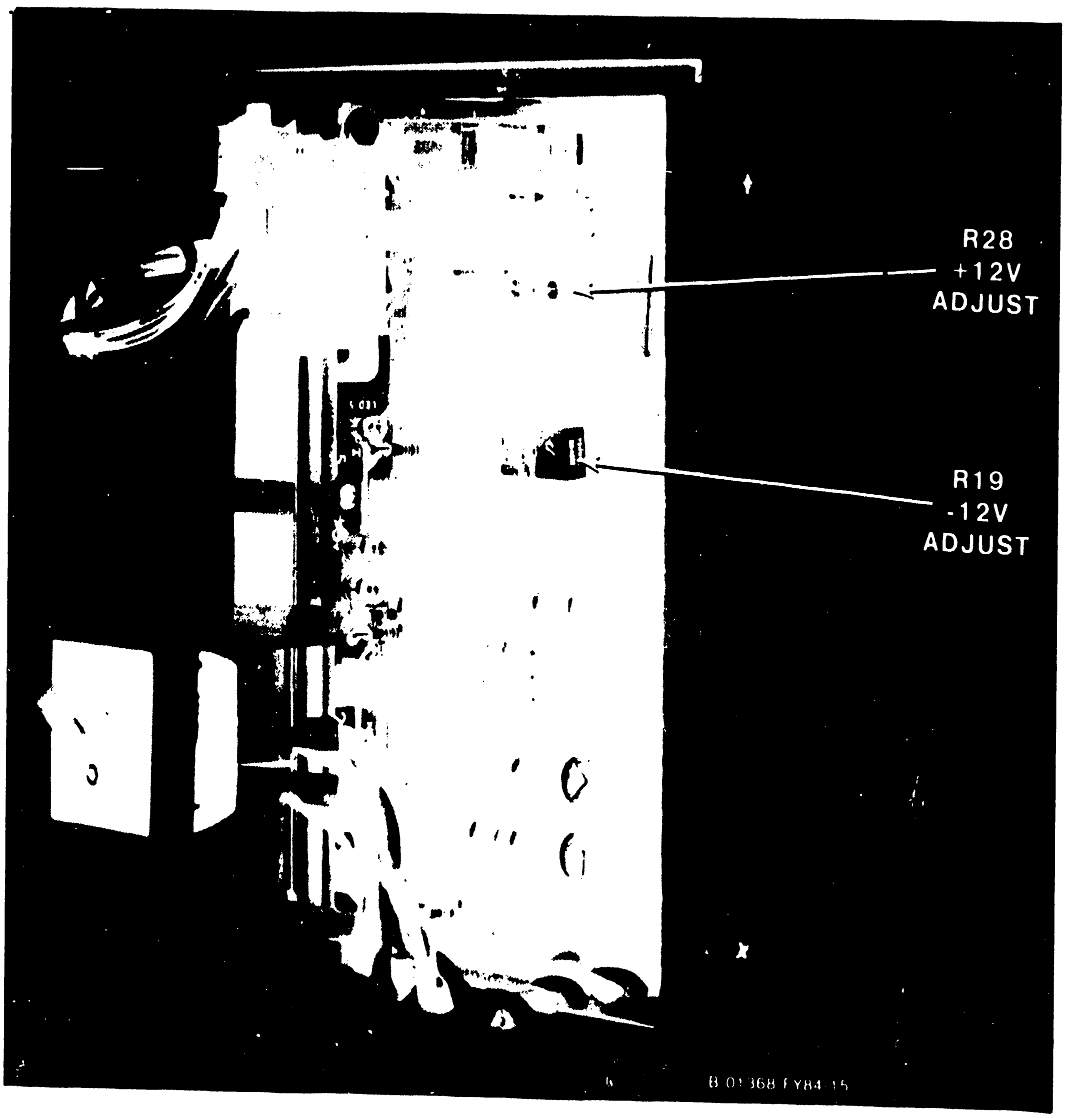


Figure 4-7. Switching Power Supply (Right Side View)

4.8 VERIFY SYSTEM DISK

The VS-15 should be delivered with the internal disk drive(s) formatted and the operating system loaded. Currently there is no method available to verify the disk drive(s), before bringing up the operating system, to be sure the prerecorded system software has not been damaged. If the voltage checks are normal, proceed to paragraph 4.10 and IPL the system. If you can't IPL, or it is known or suspected that the system disk drive contains errors, proceed to paragraph 4.9, Standalone Utilities.

4.9 STANDALONE UTILITIES (SAU)

The basic VS-15 system currently supports only one removable disk media, the 5-1/4" diskette. In order to bring up the VS Operating System on this basic hardware, the fixed disk must be reformatted and then loaded with the necessary operating system files. The SAU, formerly called Coldstart, provides this function.

SAU are IPLed from a media tolerant diskette. The utilities use the 2270V5 diskette drive, (and/or, the 2529V cartridge tape drive if available), the internal drive, and Workstation 0. The utilities copy the OS files from a series of diskettes, or, a tape cartridge. The utilities build a media tolerant VTOC on the fixed disk as it copies the OS files. SAU can also copy the CP and BP code and bootstrap files to the fixed disk, allowing both bootstrapping and IPLing from the fixed disk.

The Standalone Utilities are self-contained. They don't use the normal operating system, nor can the normal operating system use them. The utilities have two modes of operation: the Copy mode and the Backup mode. The Copy mode allows three different ways to copy data from the input diskette or tape to the system volume.

1. Initialize the system volume before copying the data.
2. Reformat the system volume before copying the data.
3. Copy only those files that you want to add to or update the system volume with.

The method selected depends on circumstances. The VS-15 should be delivered with the system disk initialized and loaded. If the disk to be used for the system volume has errors or is not initialized, select the first option. Initializing a 33 megabyte drive takes about 90 minutes; the 76 megabyte drive takes about 2 hours.

The second option, reformatting, can be used to bring up a system when the system volume has been initialized previously. Reformatting clears the volume of existing data and rewrites the VTOC. This option is required if the system volume is not media tolerant. This option will be used if IPLing from the system disk is not successful. Reformatting a 33 megabyte drive takes about 15 seconds; the 76 megabyte drive takes about 20 seconds.

The third option, Copy only, allows loading new system files without rebuilding the entire system. SAU checks for duplicate file names, flags each, and allows you to skip the input file or to rename either the old or the new file.

The Backup method of SAU is useful on single disk systems in the situation where, for some reason, you can read but not IPL from the system disk. By running the Backup mode before reformatting, undamaged data resident on the volume can be preserved. Because it is not normally part of system installation, SAU Backup will not be explained here. For information on SAU Backup, refer to VS-15 Processor Handbook, WLI P/N 800-1152-01.

4.9.1 STANDALONE UTILITIES PROCEDURES

If it is not possible to IPL from the system disk drive, perform the following:

1. Connect Workstation 0 to Port 0 on the Serial I/O Device Adapter, as described in paragraph 4.11.2, and power up workstation 0.
2. If the 2529V Cartridge Tape Drive is available, connect it to an unused port (Ports 1 thru 6) on the Serial I/O Device Adapter and power up the tape drive.
3. Make sure the Local Control/Remote Diagnostic/Remote Control switch (figure 3-3) is in the Local Control position. (The system will not IPL if the switch is in Remote.)
4. Set the Boot Device switch (see figure 3-3) on the Front Panel to the up position to select the diskette drive.
5. Press the green Control Mode button (figure 3-3) on the Front Panel.
6. Insert the first diskette labeled SAUDK1 into the diskette drive and close the door.
7. Press the the red Initialize button.
8. The HEX display on the Front Panel will begin counting down, as described in paragraph 4.7.1, and then go out. (At the same time the HEX display on the Front Panel is counting, the TC DA PROM-based power-up diagnostics will be running as shown on the TC DA Front Indicator/Control Panel.) In about 30 seconds W/S 0 will display the following:

```
            Small System VS Package  Version --------

                    Loading System Micro Code
```

9. After the first diskette has loaded, W/S 0 will display the following:

```
Small System VS Package  Version --------

Please change floppy to continue Loading System Code
```

10. Remove the first diskette and insert the second diskette, SAUDK2. W/S 0 will display the following:

```
Small System VS Package  Version --------

Loading System Micro Code
```

11. After all the diskettes have been loaded, W/S 0 will display the following:

```
Small System VS Package  Version --------

Loading Complete, Beginning System Initialization
```

12. W/S 0 will then display the following:

```
Standalone Utility - Version ------                              Select Function
(C) Copyright 1984, Wang Laboratories, Inc.
________________________________________________________________________________

The primary purpose of the standalone utilities is to bring up a new machine by
formatting the system disk and copying a minimum system to it. These utilities
may also be used for system and disk maintenance.


                 Press PF4 to COPY to system disk, or
                       PF5 to BACKUP the system disk.
```

13. Press PF4, COPY. W/S 0 will display the following:

```
Standalone Utility - Version ------                         Define Input Device
(C) Copyright 1984, Wang Laboratories, Inc.
________________________________________________________________________________


     Please enter the device type and address of the input device.

              Device Type                   -
              Physical Device Address (Hex) -


Device Type  Description                Device Type  Description
________________________________________________________________________________
2260VR       10 Meg F/R Disk (R)        2265V1       75 Meg Rem Disk
2265V2       288 Meg Rem Disk           2270V0       Console Diskette
2280V1R      30 Meg F/R Disk (R)        2280V2R      60 Meg F/R Disk (R)
2280V3R      90 Meg F/R Disk (R)        2270V1       Hard Sector Diskette
2270V2       Soft Sector Diskette       2270V3       Hrd/Sft Sec Diskette
2265V1A      75MB R dual port Dk        2265V2A      288MB R dual port Dk
2270V4       Soft Sector Diskette       2270V5       5-1/4 in SS Diskette
2209V        9-Track, 1600bpi Tape      2209V2       9-Track-DD, 1600bpi
2209V3       7-Track, 800bpi Tape       2219V1       1600/6250bpi, 75ips
2219V2       1600/6250bpi, 125ips       2219V3       Tri-density, 75ips
2219V4       Tri-density, 125ips        2529V        6400bpi Cartridge Tp
2509V        9-Track,1600bpi tape
________________________________________________________________________________
      Press (ENTER) to continue
```

14. At this point, decide which input device will be used.
    a. If it is the 2529V Cartridge Tape Drive, use:
        (1) 2529V for Device Type.
        (2) 2801 thru 2806 for Device Address. (Ports 1-6 on the SI/O DA.)
    b. If it is the 2270V5 Diskette Drive use:
        (1) 2270V5 for Device Type.
        (2) 2000 for Device Address.
    c. Press ENTER.
    d. W/S 0 will display the following:

```
Standalone Utility - Version ------                    Define System Device
(C) Copyright 1984, Wang Laboratories, Inc.
_____________________________________________________________________________

       Please enter the device type and address of the output disk.

               Device Type                     -
               Physical Device Address (Hex)   -

Device Type  Description                  Device Type  Description
_____________________________________________________________________________
2260VR       10 Meg F/R Disk (R)          2260VF       10 Meg F/R Disk (F)
2265V1       75 Meg Rem Disk              2265V2       288 Meg Rem Disk
2280V1R      30 Meg F/R Disk (R)          2280V1F      30 Meg F/R Disk (F)
2280V2R      60 Meg F/R Disk (R)          2280V2F      60 Meg F/R Disk (F)
2280V3R      90 Meg F/R Disk (R)          2280V3F      90 Meg F/R Disk (F)
2265V1A      75MB R dual port Dk          2265V2A      288MB R dual port Dk
2265V3       620 Meg Fixed Disk           Q2040        8 inch Fixed Disk
2265V3A      620Mb Dual Port Disk         2220         8in 75meg fixed disk
D2257        160Mb 8in Fixed Disk         2230         32Mb 5-1/4in Fix Dsk
_____________________________________________________________________________
      Press (ENTER) to continue
```

15. Use:
    a. Device Type:
        (1) 2230 (for 33 megabyte drive)
        (2) 2220 (for 76 megabyte drive)
    b. Device Address:
        (1) 2400 (for 33 megabyte drive #1)
        (2) 2400 (for 76 megabyte drive)
        (3) 2401 (for 33 megabyte drive #2)
    c. Press ENTER.
    d. W/S 0 will display the following:

```
Standalone Utility - Version ------                    Specify Label Handling
(C) Copyright 1984, Wang Laboratories, Inc.

              Press (PF2) to INITIALIZE the system disk,
                    (PF3) to REFORMAT the system disk, or
                    (PF4) to COPY only.

       Or, press (PF1) to return to the mode selection screen.
```

16. Press PF3, REFORMAT, (takes about 15 seconds for the 33MB drive: 20 seconds for the 76MB drive). W/S 0 will display the following:

NOTE

If the first attempt to IPL the system failed, the drive was then REFORMATTED and reloaded and IPL failed again, press PF2 and INITIALIZE and reload the disk drive. (Initializing the 33MB drive takes about 90 minutes: the 76MB drive takes about 2 hours.)

```
Standalone Utility - Version ------                    Specify Volume Label
(C) Copyright 1984, Wang Laboratories, Inc.

                              System Disk

      The following information is required for volume formatting;

 Volume name                 -
 Volume owner                -
 Date (MM/DD/YY)             -   /  /
 VTOC size (in blocks)       - 112  (252 for 2220)
 Fault Tolerance             - MEDIA  (NONE - No fault Tolerance)
                                      (CRASH - Tolerate system halt)
                                      (MEDIA - Tolerate bad media also)

 Please supply the required parameters and press (ENTER) to continue,
 or Press (PF1) to return to mode selection screen.
```

17. Enter the requested information and press ENTER. W/S 0 will display the following:

```
Standalone Utility - Version ------                    Writing Volume Label
(C) Copyright 1984, Wang Laboratories, Inc.
_______________________________________________________________________________


   Formatting of the output disk volume directory is now in progress.
```

18. After REFORMAT is complete, W/S 0 will display the following:

```
Standalone Utility - Version ------         Allocate dump or paging files
(C) Copyright 1984, Wang Laboratories, Inc.
_______________________________________________________________________________

Please specify the size of the preallocated control mode dump file.  The
size of the file should correspond to the size of main memory for any
CPU you intend to use this disk on.  Enter a size of zero (0) if you do
not want to allocate a dump file at this time.

              Size of preallocated dump file      = 00000k

Please specify the size and location of the user paging pool.  The size
of the pool should be based on the number of tasks and their segment 2
sizes which may use this disk for paging.  Enter a zero (0) if you do
not want to allocate a paging pool at this time.

              Size of paging pool                 = 00000k

              Pool location (relative to VTOC)    = 0
                   0 = Nearest VTOC
                   9 = Farthest VTOC

_______________________________________________________________________________
      Press (ENTER) to continue
```

19. Select the defaults (or enter the correct information) and press ENTER. (At this point, either the tape cartridge, or the diskettes will be used for input. For the tape cartridge, refer to paragraph 4.9.1.1. For the diskettes, refer to paragraph 4.9.1.2.)

4.9.1.1 Tape Cartridge Input

1. W/S 0 will display the following:

```
Standalone Utility - Version ------                     Request to Mount
(C) Copyright 1984, Wang Laboratories, Inc.
___________________________________________________________________________

                    Please mount the first tape.
```

2. Insert the tape cartridge into the 2529V Cartridge Tape Drive and press the "Online" pushbutton. The "Online" LED should light and, after the tape rewinds, W/S 0 will display the following:

```
Standalone Utility - Version ------
(C) Copyright 1984, Wang Laboratories, Inc.
___________________________________________________________________________

                         Copy in progress
```

3. The tape will start copying onto the system disk. Currently, copying the tape requires at least 30 minutes.
4. When copying the tape is complete, W/S 0 will display the following:

```
Standalone Utility - Version ------                      Copy Completed
(C) Copyright 1984, Wang Laboratories, Inc.
___________________________________________________________________________

                 Copy completed. IPL when ready.

___________________________________________________________________________
      Or, press PF1 to copy more
```

5. If no more tapes are to be copied press the "Online" pushbutton on the tape drive. The "Online" LED should go out. Remove the tape cartridge and begin the IPL procedure, paragraph 4.10.

4.9.1.2 Diskette Input

1. W/S 0 will display the following:

```
Standalone Utility - Version ------                    Request to Mount
(C) Copyright 1984, Wang Laboratories, Inc.
________________________________________________________________________



                     Please mount the first diskette.



```

2. Insert the first diskette, labeled SYST01, into the diskette drive. W/S 0 will display the following:

```
Standalone Utility - Version ------
(C) Copyright 1984, Wang Laboratories, Inc.
________________________________________________________________________



                           Copy in progress



```

3. The diskette will start copying onto the system disk. Currently, copying all of the diskettes takes about 15 minutes.
4. When the first diskette is copied, W/S 0 will display the following:

```
Standalone Utility - Version ------                    Request to Mount
(C) Copyright 1984, Wang Laboratories, Inc.
______________________________________________________________________

                Please mount the next diskette SYST02
```

5. Insert the diskette labeled SYST02. W/S 0 will again display the "Copy in process" screen.
6. After each diskette has been copied, the next diskette will be called for. Continue inserting the diskettes, in numerical order, until the last diskette (currently SYST14) has been copied.
7. After the last diskette has been copied, W/S 0 will display the following:

```
Standalone Utility - Version ------                    Copy Completed
(C) Copyright 1984, Wang Laboratories, Inc.
______________________________________________________________________

                  Copy completed. IPL when ready.

______________________________________________________________________
      Or, press PF1 to copy more
```

8. Remove the last diskette and begin the IPL procedure, paragraph 4.10.

4.10 BOOTSTRAP PROGRAMS AND IPL PROCESS

Because the VS-15 system does not contain any PROM-based operational microcode, all CP and BP operational microcode must be loaded into the system by the bootstrap programs. (Note that the bootstrap programs cannot coexist with the operational CP and BP code; therefore, no system-level CP/BP functions, such as Control Mode, are available while the bootstrap programs are executing.)

Pressing the Initialize Button starts the bootstrap process from the disk device indicated by the 3-position Boot Device switch. The bootstrap programs perform power-up initialization and diagnostic functions and then uses the Workstation 0 screen to allow the operator to select either "IPL the system" or "Run Off-line Diagnostics" from the selected IPL device.

The VS-15 system functions just like other VS machines once execution of the IPL text has begun. However, since the bootstrap programs do not maintain the Time of Day clock during their power-up and initialization process, the VS-15 will require resetting the clock after every IPL from a power off condition.

4.10.1 IPL PROCEDURE

1. Connect Workstation 0 to Port 0 on the Serial I/O Device Adapter, as described in paragraph 4.11.2, and power up workstation 0.
2. Make sure the Local Control/Remote Diagnostic/Remote Control switch (figure 3-3) is in the Local Control position. (The system will not IPL if the switch is in Remote.)
3. Set the Boot Device switch to the center position to select the internal Winchester drive.
4. Press the Control Mode button on the Front Panel, and then press the Initialize button. (The HEX display on the Front Panel will begin counting down from FFFF.) In about 40 seconds W/S 0 will display the following Menu:

```
     Small System VS Self Test Monitor Package  Version --------
                          IPL Drive Selection
                          Bootstrap Volume =

      Device    Capacity   Type    Volume    Status
      ----------------------------------------------------------
      2270V5    368 kb     Dsket
      2230       33 Mb     Fixed             Media Tolerant

            Position Cursor to Indicate Device and Select:
================================================================

(ENTER) IPL                    (8) STAND ALONE DIAGNOSTIC MONITOR
```

5. Position the cursor next to the system volume and press ENTER.
6. The Self-Test Monitor diagnostics will begin running. (See table 8-2 for diagnostic error code information.)

```
     Small System VS Self Test Monitor Package  Version --------
                        System Hardware Status
                        System Volume =

Status           Diagnostic
________________________________________________________________

Passed           (SIO) Serial Data Link Test
Passed           (BP)  USART Loopback Verification Test
Passed           (CPU) CP Control Memory & CP/BP Test
Passed           (CPU) CP Random Operands Test
Passed           (CPU) CP Integrity Test
Passed           (MM)  Main Memory Integrity Test
Passed           (BP)  BP DMA & MARS Test

      Diagnostics Completed, Beginning System Initialization
```

7. If the Main Memory Integrity test fails, refer to paragraph 8.5.3.3.3 for instructions on running the Main Memory test portion of the Stand-Alone Diagnostic Monitor to locate the failing memory chip.
8. After the Self-Test Monitor diagnostics have completed, the Not Ready LED on the Front Panel will go out and the system will IPL. In about 30 seconds W/S 0 will display the request for information to specify the name of the configuration file.

```
***Message M0001 BY SYSGEN

                         INFORMATION REQUIRED


 Specify the name of the system configuration file and press (ENTER)
                              - or -
          Press (1) to use one workstation and one disk.

                         SYSFILE = @CONFIG@
                         SYSLIB  = @SYSTEM@

  Specify the communications configuration file to be used, if any

                        COMMFILE =
                         COMMLIB  = @SYSTEM@

    Inhibit logons at all workstations?            Logons = NO
```

9. Enter the correct information and press ENTER. The System Generation process will begin.
10. In about 30 seconds, W/S 0 will respond with a request for information required to set date and time.
11. Enter the date and time and press ENTER.

12. System Initialization will begin and in about 30 seconds W/S 0 will display the standard VS Operators Console screen, completing IPL.

NOTE

If the first attempt to IPL failed, refer to paragraph 4.9 and REFORMAT and reload the system disk drive. If the drive was REFORMATTED and IPL still fails, refer to paragraph 4.9 and INITIALIZE and reload the disk drive.

13. Log onto the system as CSG.
14. Run the GENEDIT program (refer to the VS25 Bulletin, WLI P/N 800-6183), verify that all peripherals have been declared, and reIPL.

NOTE

If the system disk was REFORMATTED or INITIALIZED, and the input media was diskette, complete the following steps. If the media was the tape cartridge, the steps are not necessary.

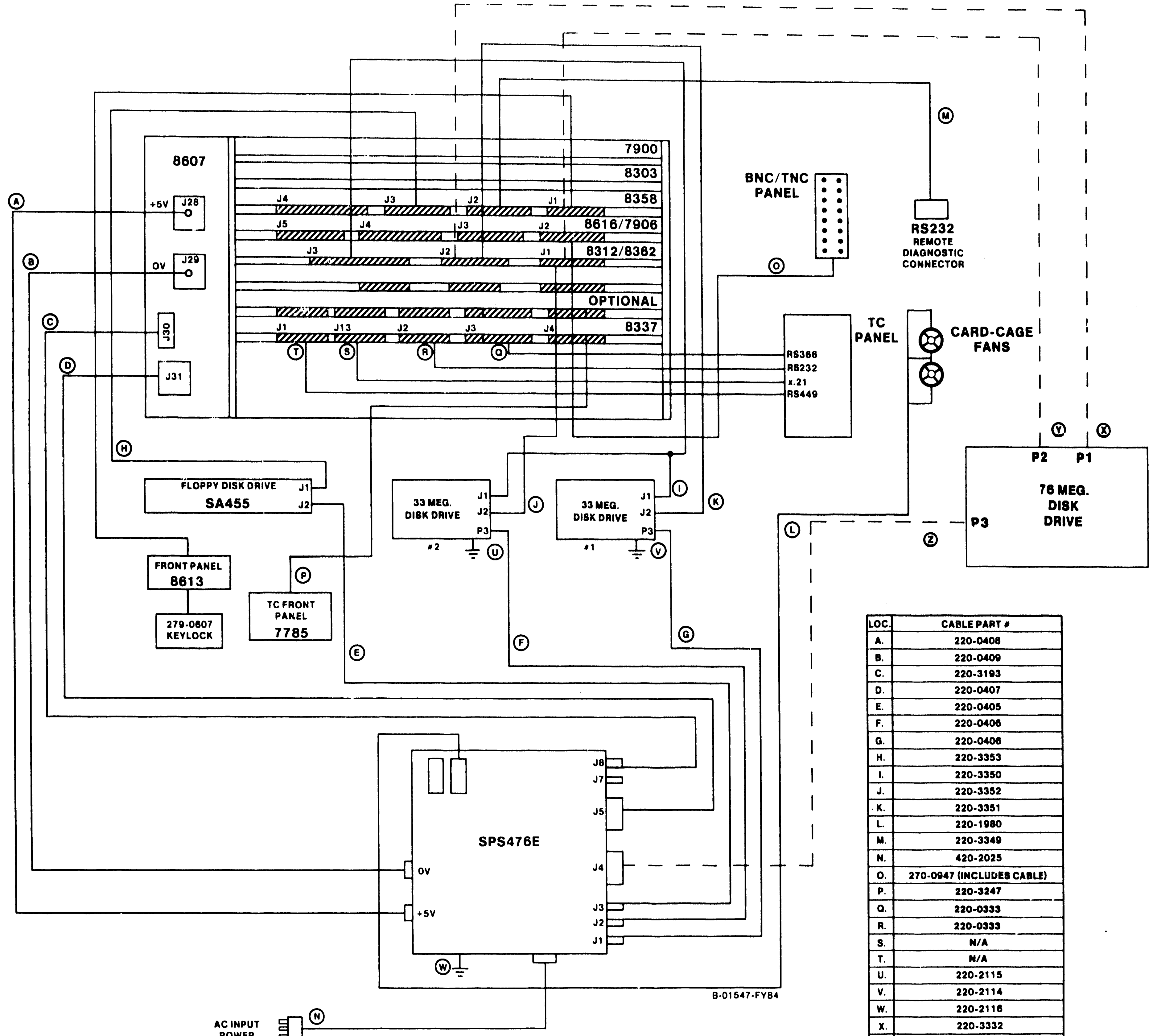
15. Run the BACKUP program, using the RESTORE function, and copy the following diskettes to the system disk: MACLIBs, PRCODE, WSCODE, UTILITIES, and NVRAM.
16. If the message "The WORK file cannot be placed on the output volume. Please respecify." appears, press PF1 to continue.
17. When all diskettes have been copied, the procedure is complete.

4.11 SYSTEM INTERCONNECTION

After microcode is loaded and SYSGEN has been performed, power down the main frame and connect all peripheral devices according to the configuration created during SYSGEN. See figure 4-8, the following paragraphs, and the appropriate documents in Class 3000 for cabling procedures.

4.11.1 CONNECTOR PLATE-TO-I/O DEVICE ADAPTER CABLING

Before installing cables in the connector plates at the rear of the main frame, all cables between the plates and associated device adapters must be installed. Make sure that the cable from the connector plate containing workstation 0 connects to J2 of the Serial I/O Device Adapter assembly in Motherboard slot #4.



LOC.	CABLE PART #
A.	220-0408
B.	220-0409
C.	220-3193
D.	220-0407
E.	220-0405
F.	220-0406
G.	220-0406
H.	220-3353
I.	220-3350
J.	220-3352
K.	220-3351
L.	220-1980
M.	220-3349
N.	420-2025
O.	270-0947 (INCLUDES CABLE)
P.	220-3247
Q.	220-0333
R.	220-0333
S.	N/A
T.	N/A
U.	220-2115
V.	220-2114
W.	220-2116
X.	220-3332
Y.	220-3331
Z.	220-2206

Figure 4-8. VS-15 Interconnection Diagram

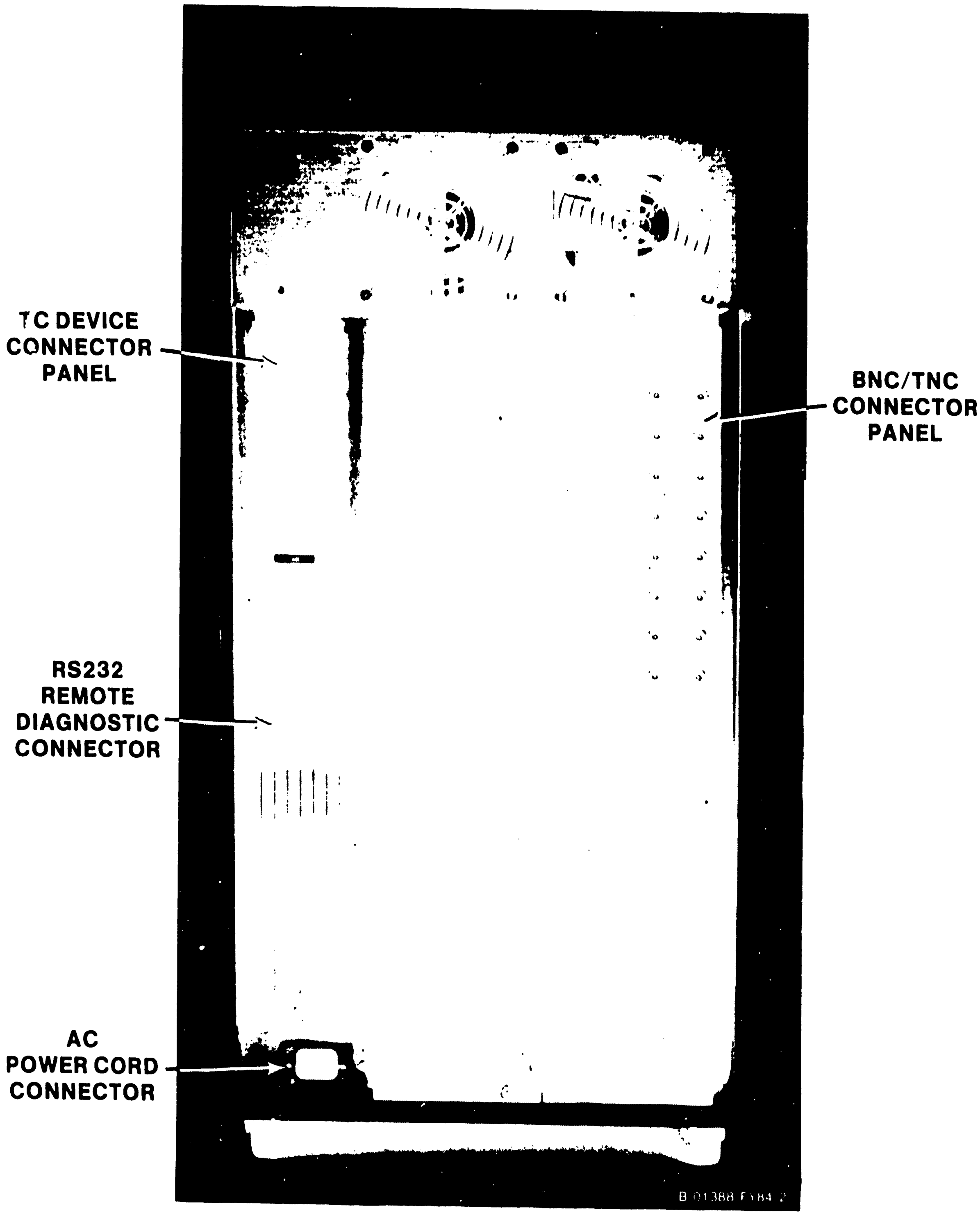


Figure 4-9. VS-15 Rear Panel Connector Plate Locations

4.11.2 BNC/TNC CONNECTORS

Serial I/O devices (workstations, printers, etc.) connect to the main frame by means of standard BNC/TNC connectors mounted on a 16-connector plate (WLI P/N 270-0949). Maximum cable length for these devices is 2000 feet (610 meters). Workstation 0 MUST be connected to Port 0 on the Serial I/O Device Adapter. The connectors for Workstation 0 are located in the upper right corner of the connector plate on the rear of the main frame. See figure 4-10 for details on connector plate and BNC/TNC count for peripherals.

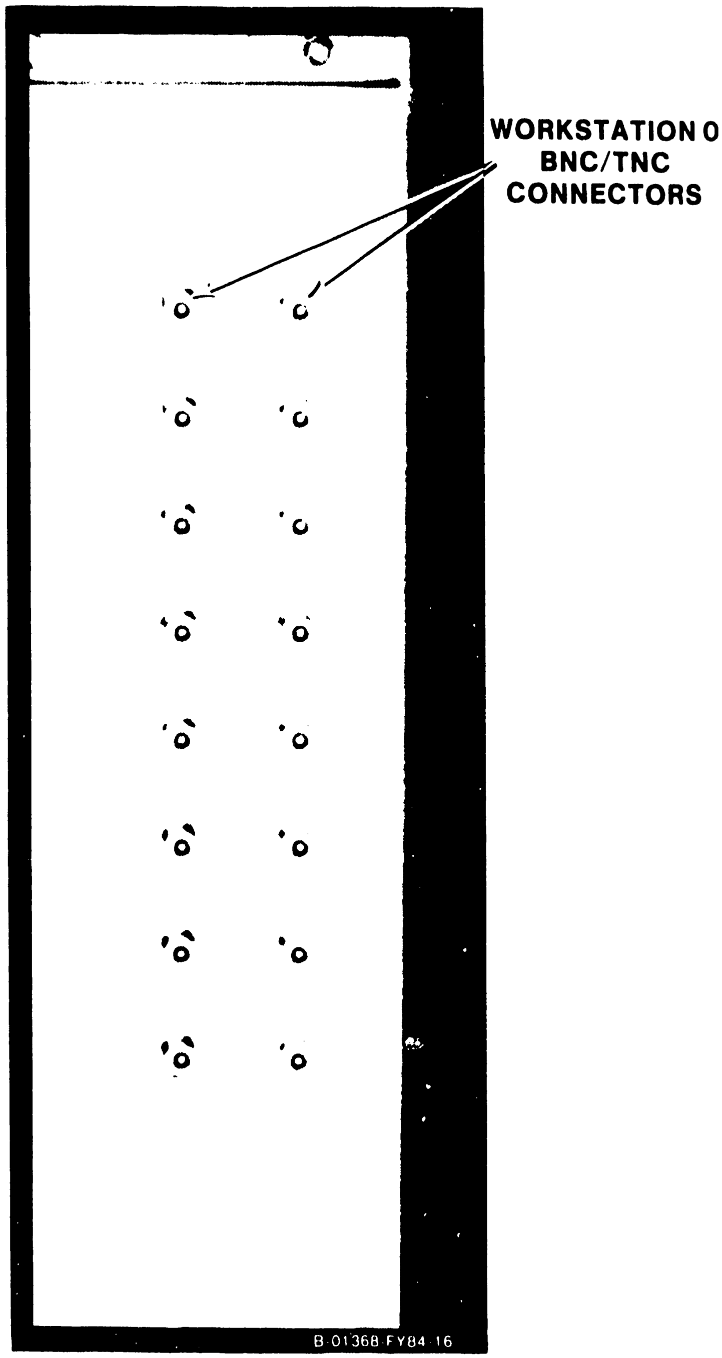


Figure 4-10. WLI P/N 270-0949 BNC/TNC Connector Panel

4.11.3 TELECOMMUNICATION CONNECTORS

The external telecommunications cables (modem to main frame) must be connected to a cable connector panel (WLI P/N 270-0952 for the 1-port TC adapter and WLI P/N 270-0953 for the 2-port TC adapter) at the rear of the main frame. This panel supports three different TC connections, providing plugs for both the modem and Automatic Calling Unit (ACU) cables. This connector panel (figure 4-11) is cabled internally to the 25V76-1A/2A TC DA (figures 5-14 or 5-15).

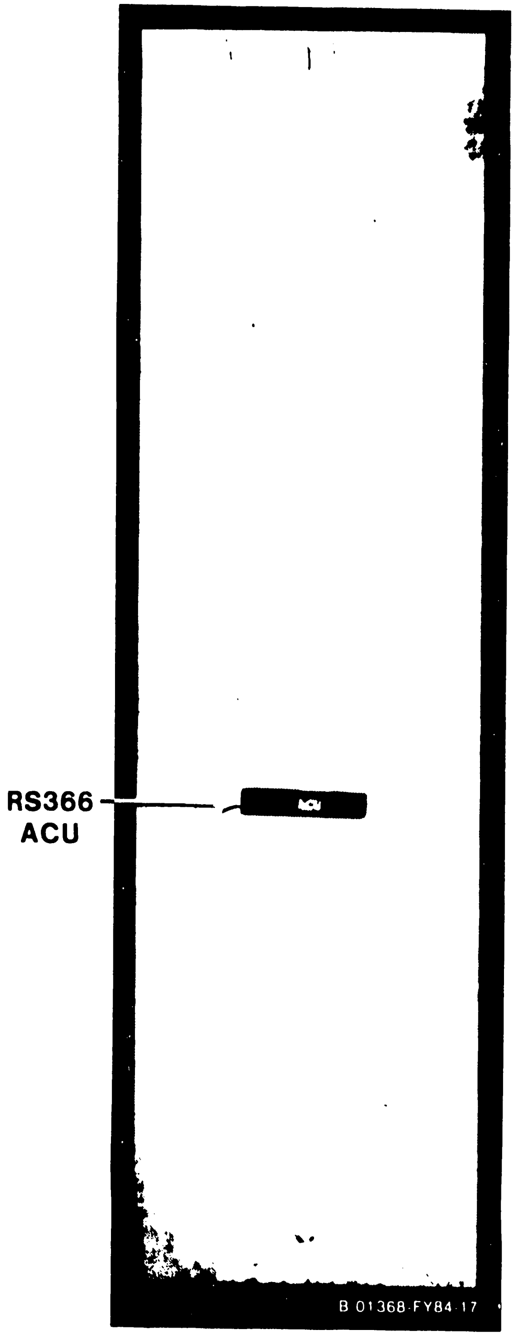


Figure 4-11. 270-0952 Rear Cable Connector Panel For 1-Port Telecommunications Adapter.

4.12 PRELIMINARY SYSTEM CHECKOUT

At this point, all peripherals should be installed, powered off, and connected to their respective device adapters. Before proceeding, perform the following checkout procedure:

1. Visually inspect all main frame circuit boards for correct switch settings and proper cabling configuration.
2. Visually inspect all peripheral devices to make sure that I/O cabling is correctly installed, all switch settings are correct, and all covers and panels are in place.
3. Make sure that all devices are powered off.

4.12.1 DAILY POWER-UP/POWER-DOWN PROCEDURES

After all peripherals are connected to the main frame, the daily power-up and power-down procedures for the VS-15 system are as follows:

1. POWER-UP
   a. Make sure that the main frame power connector is plugged into the power source receptacle.
   b. Power up Workstation 0.
   c. Depress the main frame ac power On/Off switch to the 1 position.
   d. After the PROM-based power-up diagnostics have completed (the NOT READY light Front Panel has gone out), position the cursor on W/S 0 next to the IPL volume name and press ENTER. The Self-Test Monitor diagnostics will begin running. (See table 8-2 for diagnostic error code information.)
   e. After the IPL Self-Test Monitor diagnostics have completed, enter the name of the configuration file and press ENTER.
   f. Enter the date and time and press ENTER.
   g. When System Initialization has completed, the VS Operators Console screen will appear and the system is ready for normal operation.

2. POWER-DOWN
   a. Make sure all operators have logged off of the system.
      1) Press PF13 (WORKSTATIONs) on an operators console to check that the operators have logged off of the system.
      2) Press PF7 (NONINTERACTIVE Tasks) on an operators console to check the background tasks on the system. Look under the User column to identify any operator running a background task.
   b. Press the green Control Mode button. This prevents any disk I/O command in process from being halted prior to completion.
   c. Power down all peripheral devices according to procedures in the applicable documents in Class 3000.
   d. Depress the main frame ac power On/Off switch to the 0 position.

4.13 REMOTE DIAGNOSTIC CERTIFICATION PROCEDURES

Before system turnover, and before any remote diagnostic service sessions can be run, the remote maintenance data link between the VS-15 site and the home office Technical Assistance Center (TAC) must be verified. The procedure requires that the CE work directly with the TAC to establish that the data link is working. It is the responsibility of the on-site CE to troubleshoot and resolve any telecommunications related problem.

Once the data link has been certified, it should not be necessary for the CE to return to the site to participate in the remote diagnostic sessions. The customer will normally be responsible for initiating and coordinating the remote diagnostic session with the TAC.

The following flow charts (figure 4-12) describe the remote diagnostic certification procedures, while figure 4-13 shows the modem and telephone line connections and the modem switch settings.

For more information on the WA3451 Wang Modem, refer to Customer Engineering Documentation Class 7401 and the WA3451 Asychronous/Synchronous Modem User Manual, WLI P/N 700-6975. Also, refer to the following TAC Newsletters:

#30830 - Initialize Nonvolatile RAM
#30830 - Remote Maintenance Implementation
#30920 - VS-25/45 Remote Maintenance Information
#30927 - Nonvolatile RAM

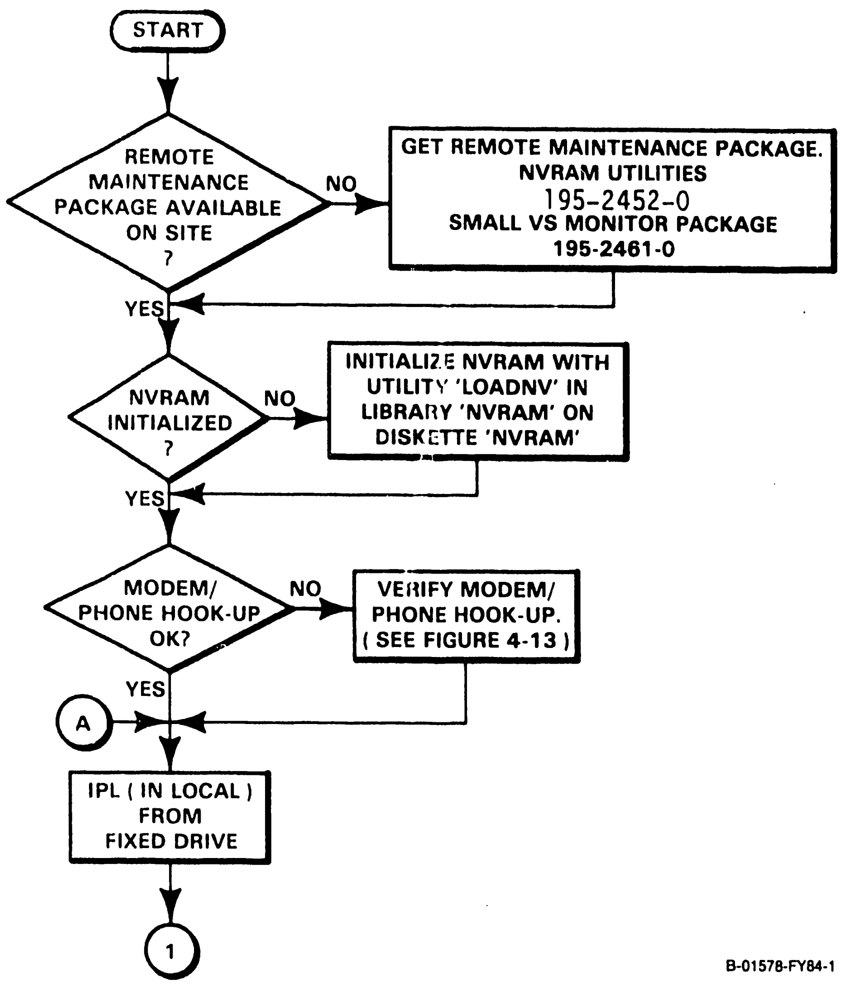


Figure 4-12. Remote Diagnostic Certification Flowchart (1 of 4)

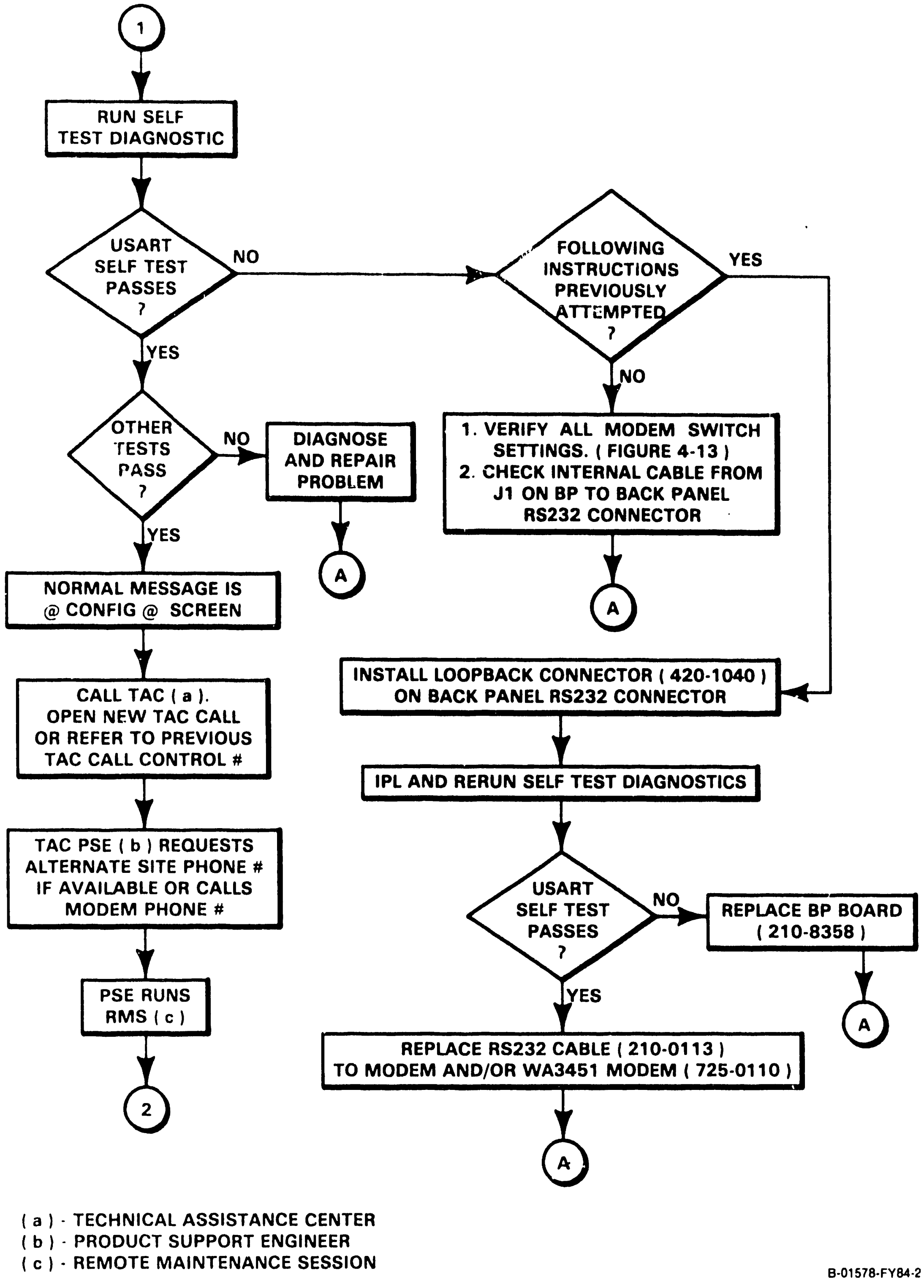


Figure 4-12. Remote Diagnostic Certification Flowchart (2 of 4)

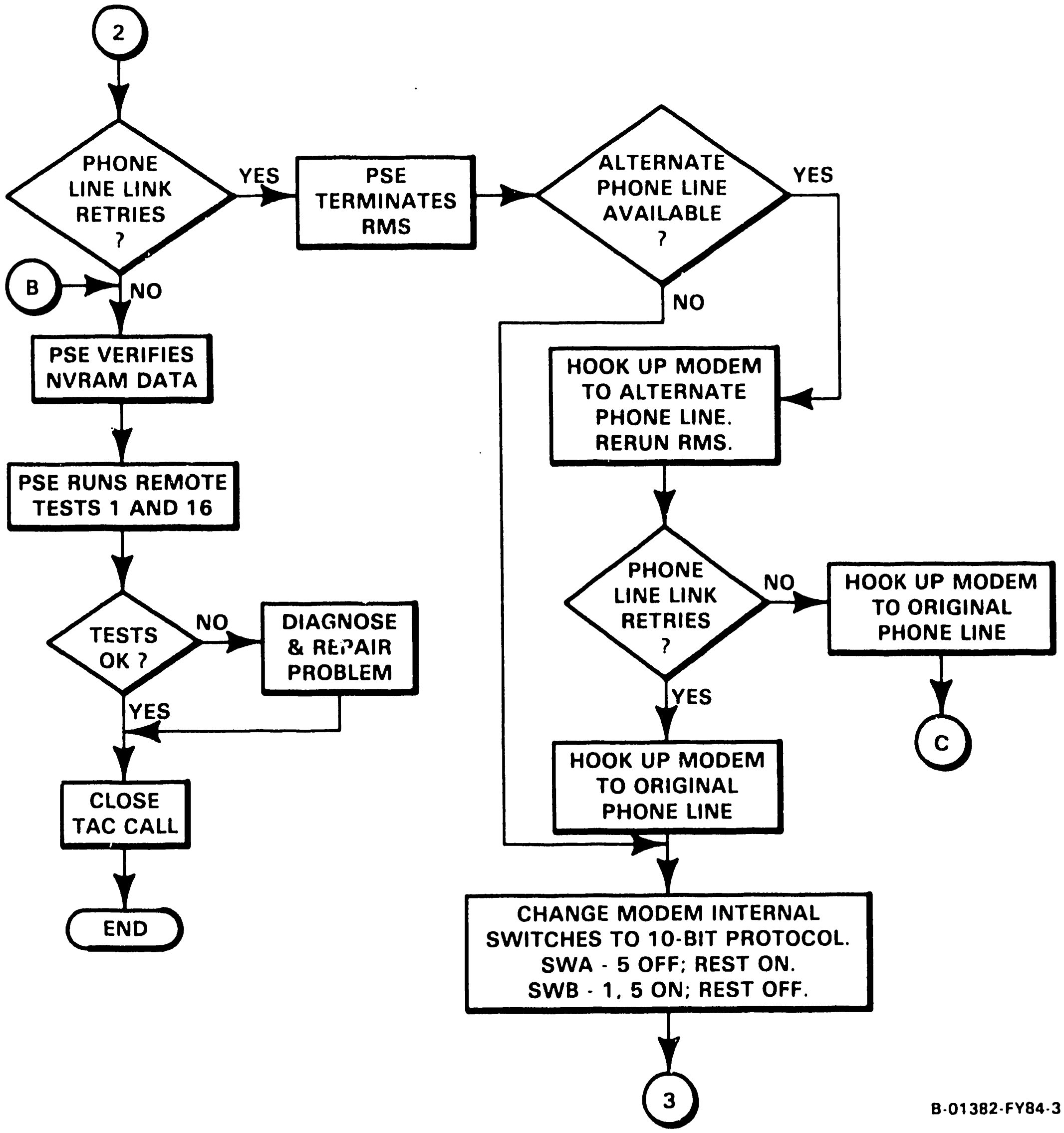


Figure 4-12. Remote Diagnostic Certification Flowchart (3 of 4)

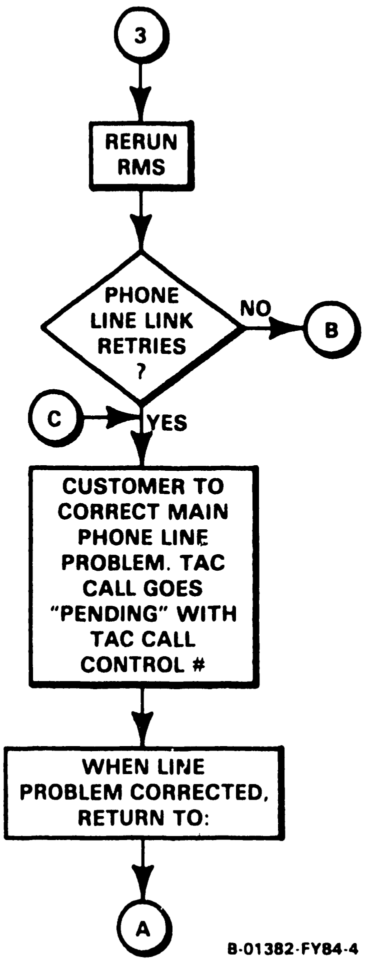
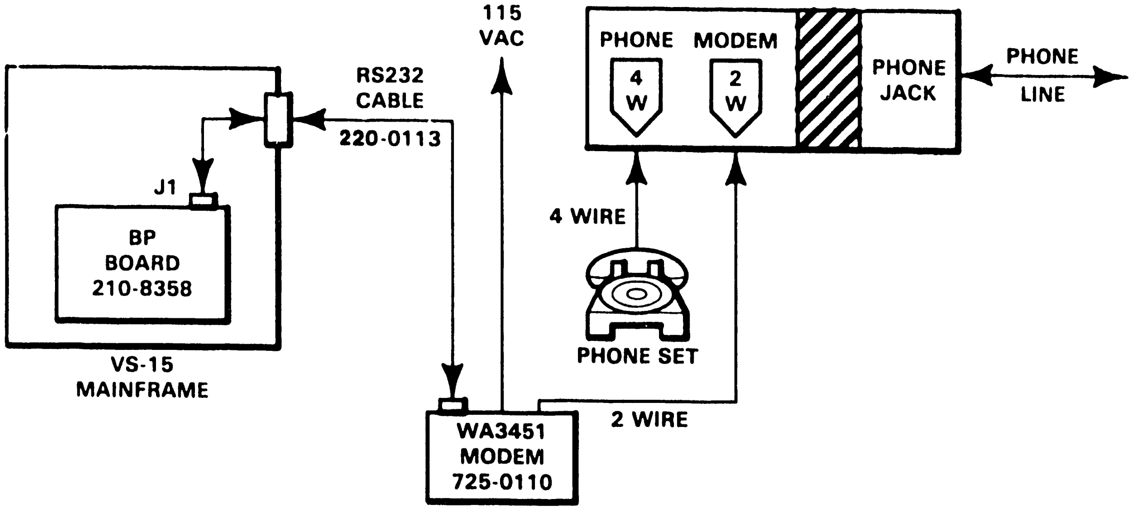
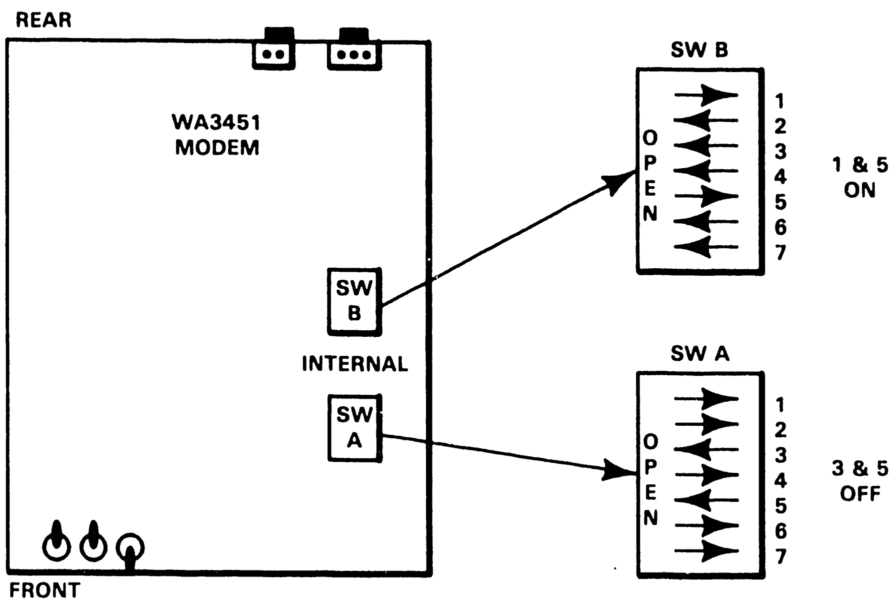


Figure 4-12. Remote Diagnostic Certification Flowchart (4 of 4)



MODEM/PHONE LINE HOOK-UP



MODEM SWITCHES

SW A & SW B NORMAL SETTINGS

B-01578-FY84-3

Figure 4-13. Modem/Phone Connections and Modem Switches

4.14 SYSTEM TURNOVER

1. Remove any scratch or Customer Engineering diskettes from the diskette drive.
2. Perform an IPL from the system disk.
3. Log on to a Workstation.
4. Use the Command Processor display functions to display the files in the @SYSTEM@ library on the customer's operating system disk. Check through the listed files to make sure all customer-purchased options are present.
   If the BASIC compiler was purchased by the customer, for example, the following files should be present in the @SYSTEM@ library:
   a. BASIC
   b. CVBASIC
   If the COBOL compiler was purchased, conversely, the following files should be present:
   a. COBOL
   b. WC1PASS1
   c. WC1PASS2
   If the RPG compiler was purchased, only the following file should be present:
   a. RPGII
5. Delete any of the above compilers not purchased by the customer from the related files using the Command Processor SCRATCH function.
6. Demonstrate to the customer or to the responsible computer operator how the disk initialization procedure is performed using the DISKINIT system utility program.
7. Perform the following Daily Power-Down procedure and explain each step to applicable customer personnel:
   a. Make sure all workstations have been logged-off.
   b. Press the green Control Mode button on the VS-15 Front Panel.
   c. Power down all workstations and printers.
8. Perform the Daily Power-Up procedure and explain each step to applicable customer personnel:
   a. Power on all workstations and press the HELP key at each workstation (a LOG-ON screen should be displayed on each workstation).
   b. Power on all printers.
9. Allow the customer to test the system using his programs. If the customer is satisfied with the operation of the system, officially turn the system over to the customer. This should be a verbal notification given by the CE performing the installation.

CHAPTER 5
PREVENTIVE AND CORRECTIVE MAINTENANCE

CHAPTER 5

PREVENTIVE AND CORRECTIVE MAINTENANCE

5.1 GENERAL

This chapter consists of preventive maintenance requirements, and removal/ replacement procedures for field replaceable components in the VS-15 main frame.

5.2. PREVENTIVE MAINTENANCE

Periodic maintenance is essential to the proper operation of the VS-15 main frame and associated peripherals. Because of its design, the main frame requires a minimum amount of maintenance to ensure continued efficient operation.

5.2.1 TOOLS

TOOL DESCRIPTION	WLI P/N
Standard CE Tool Kit	726-9401

5.2.2 MATERIALS

No special materials are necessary to perform main frame preventive maintenance.

5.2.3 PREVENTIVE MAINTENANCE SCHEDULE

Scheduled maintenance for the main frame (table 5-1) will be performed annually, in conjunction with a service call if no PM has been performed within a year.

Table 5-1. VS-15 Preventive Maintenance

PROCEDURE	ITEM	NOTES
Inspect	Main frame interior	Look for dust & loose hardware. Clean.
Inspect	Main frame fans	Replace damaged fans. Paragraph 5.3.2.22

5.2.4 PERIPHERAL PREVENTIVE MAINTENANCE

Refer to the appropriate documents in Class 3000 for PM procedures for all VS-15 associated peripherals.

5.3 REMOVAL AND REPLACEMENT

These paragraphs describe the steps involved in removing and replacing or reinstalling all major field-replaceable components in the VS-15 main frame.

5.3.1 TOOLS

TOOL DESCRIPTION	WLI P/N
Standard CE Tool Kit	726-9401

5.3.2 TEST EQUIPMENT

TEST EQUIPMENT DESCRIPTION	WLI P/N
Digital Voltmeter - Fluke #8022A	727-0119

5.3.2.1 Top Cover Removal

Remove the top cover as follows: (Figure 5-1.)

1. At the rear of the main frame cabinet, firmly grasp the back edge of the top cover and pull it up and away from the cabinet.

Reinstall the top cover by reversing this procedure.

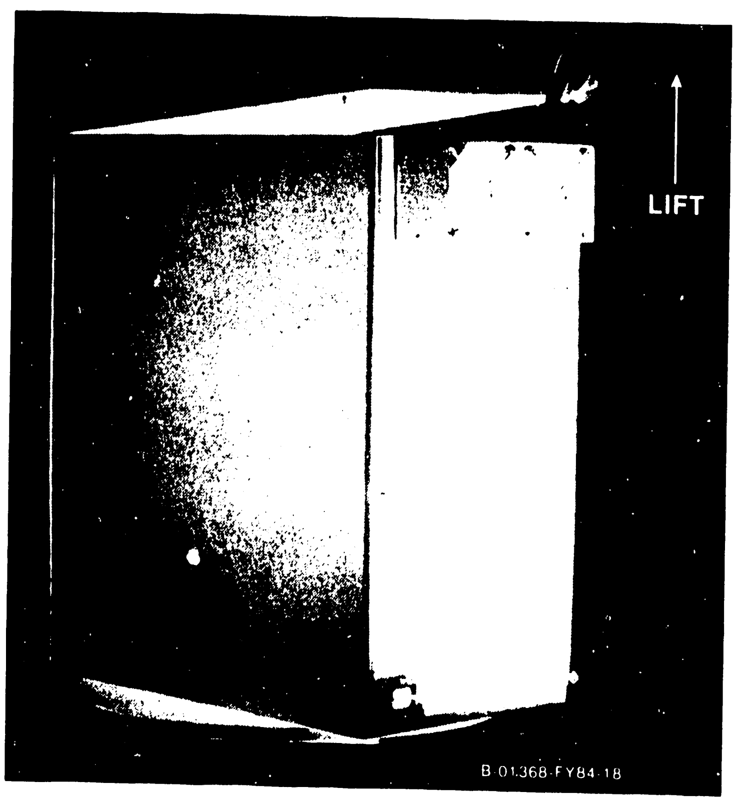


Figure 5-1. Top Cover Removal

5.3.2.2 Front Cover Removal

Remove the front cover as follows: (Figure 5-2.)

1. Remove the top cover as previously described.
2. The top of the front cover is secured to the chassis' top crossbrace by two hex bolts. Loosen the two hex bolts.
3. Tilt the top of the cover out and away from the main frame, lift it up and out of the bottom hinged brackets and away from the cabinet.

Reinstall the front cover by reversing this procedure.

NOTE

If the Front Panel door does not open and close properly, adjust the ball plunger located inside the front cover, above the door cutout.

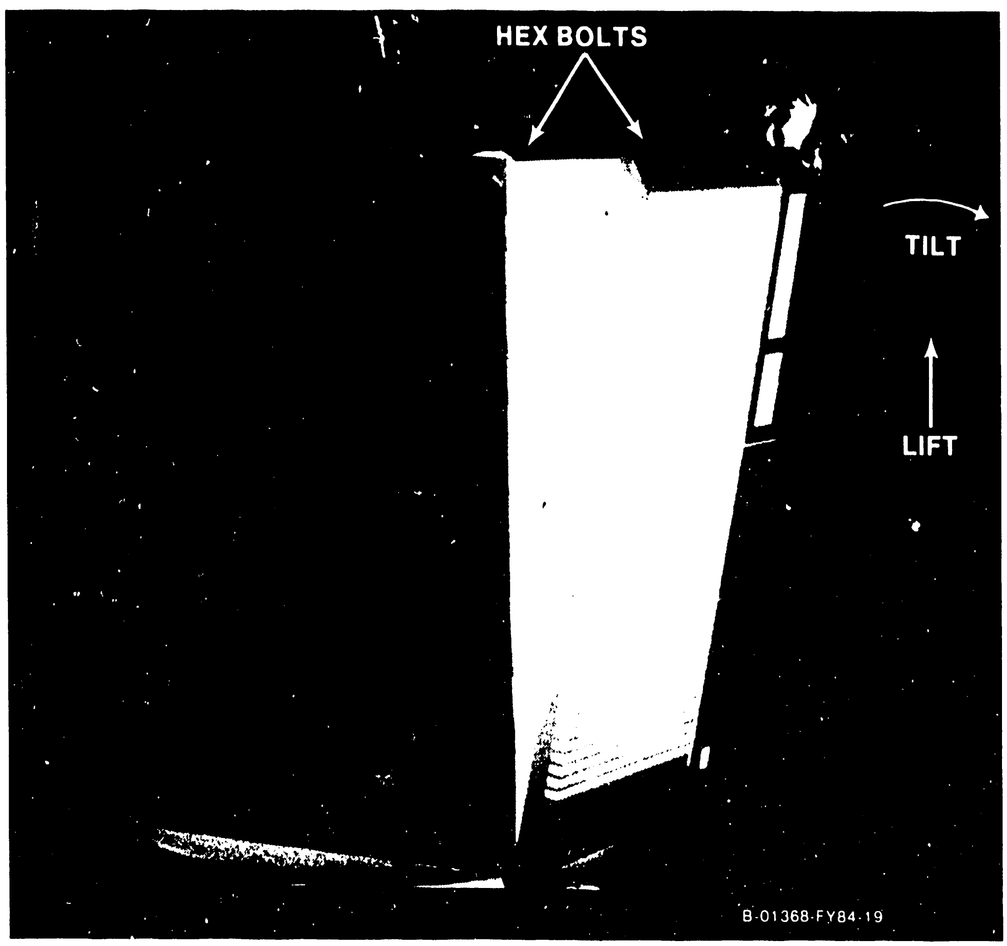


Figure 5-2. Front Cover Removal

5.3.2.3 Side Cover Removal

Remove the side cover(s) as follows: (Figure 5-3.)

1. Remove the top cover as previously described.
2. Firmly grasp the top edge of the side cover and pull it up and away from the cabinet.

Reinstall the side cover by reversing this procedure.

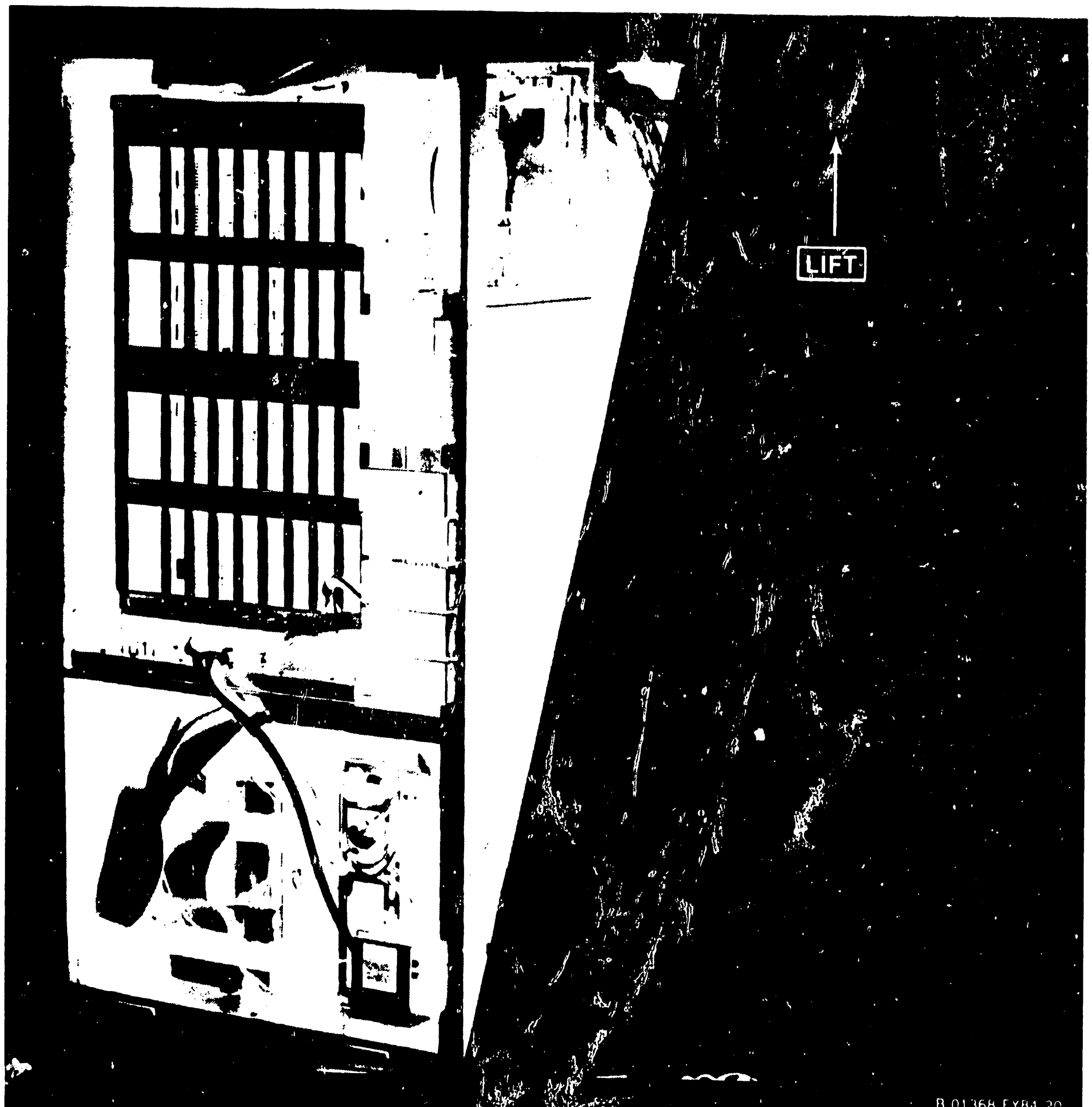


Figure 5-3. Side Cover Removal

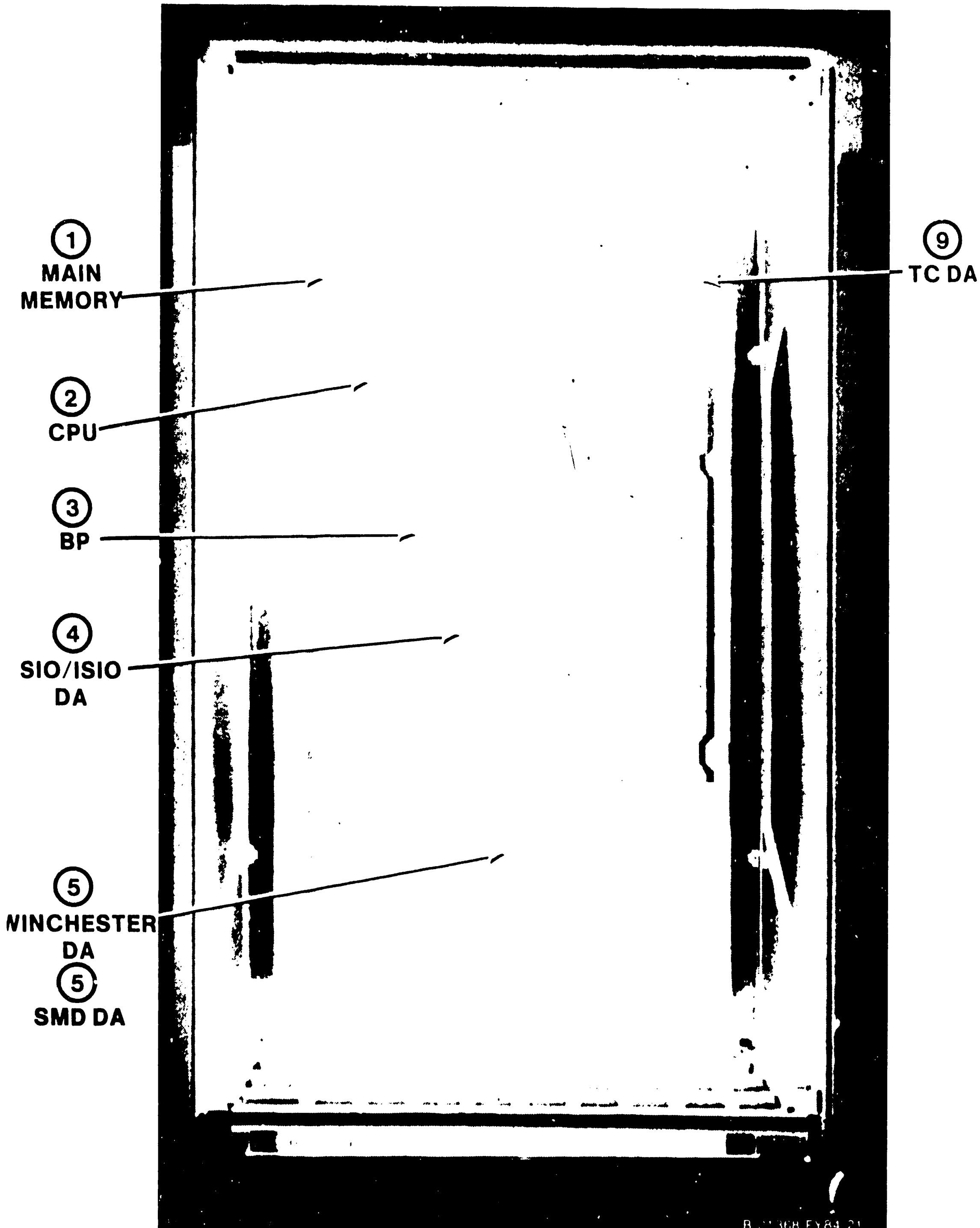


Figure 5-4. VS-15 Motherboard

5.3.2.4 CP Circuit Board Removal and Replacement

There are three different CP boards found in the VS-15. The removal and replacement procedures for the different boards are given in the order in which they are found on the Motherboard. (Figure 5-4.)

CAUTION

Be careful when replacing the large, flexible VS-15 boards. Make sure that all boards are seated properly in the correct Motherboard sockets. Do not damage the sockets when inserting the boards. Make sure all boards have their component sides facing right when viewed from the chassis front.

A board locator label (below) is on the front of the VS-15 board cage.

SLOT #	1	2	3	4	5	6	7	8	9
	MM	CP	BP	I/ODA1	I/ODA2	I/ODA3	I/ODA4	I/ODA5	I/ODA6

5.3.2.4.1 210-7900 Main Memory Board Removal and Replacement

1. Press the green Control Mode button. This prevents any disk I/O command in process from being halted prior to completion.
2. Power down the main frame by depressing the ac power On/Off switch to the 0 position.
3. Remove the top cover as described in paragraph 5.3.2.1.
4. Each circuit board is held in place by two snaplocks. One snaplock tab fits under the top edge of the front board cage assembly rail and the second snaplock tab fits under the top edge of the rear board cage assembly rail.
5. Remove the Main Memory board (figure 5-5) from Motherboard slot #1 by lifting the snaplocks to free the board from the Motherboard connectors. Once the board is free of the connectors, ease it straight up in the board guides and out of the board cage.
6. After checking the memory size switch settings on the new board as shown in table 5-2, insert the Main Memory board in the board guide and lower it to the Motherboard connector.

Table 5-2. VS-15 Main Memory Size Select Switch

SW. NO.	1	2	3	4	MEMORY SIZE (IN BYTES)
	ON	ON	ON	OFF	256K (Min)
	ON	ON	OFF	OFF	512K
	ON	OFF	OFF	OFF	1024K (Max)

NOTE

Switch #5 is not used and is always OFF.

7. Make sure the board edge connectors are lined up with the Motherboard connector slots and the snaplock tabs are under the top rails.
8. Push down on the snaplocks to seat the board in the Motherboard.

CAUTION

DO NOT USE EXCESSIVE FORCE WHEN PUSHING DOWN ON THE SNAPLOCKS.

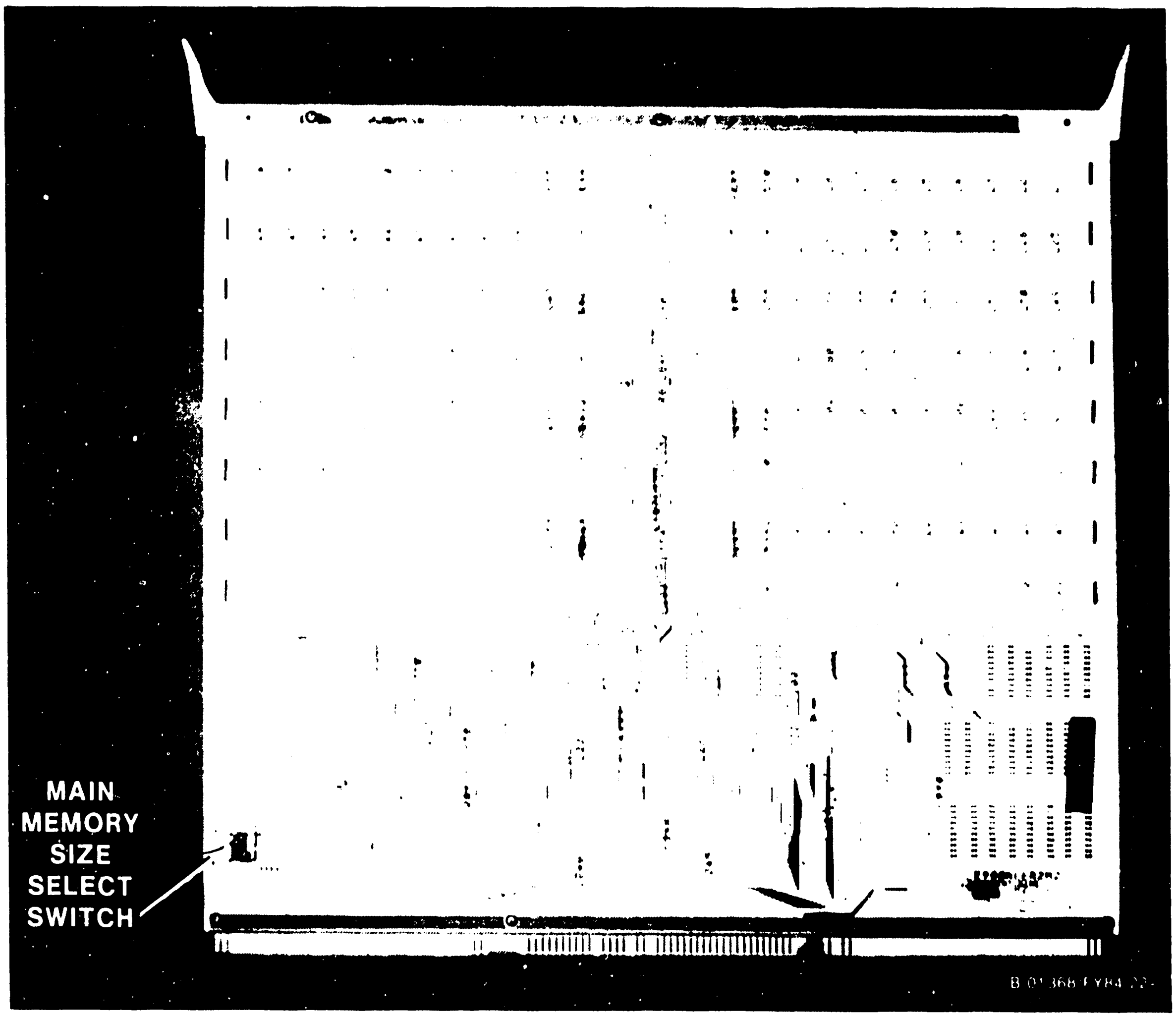


Figure 5-5. 210-7900 Main Memory Board

5.3.2.4.2 210-8303 CPU Board Removal and Replacement

1. Remove the CPU board (figure 5-6) from Motherboard slot #2 as described in 5.3.2.4.1. (Be careful the snaplock tabs don't damage the two top corner chips on the CPU.)
2. Install the new CPU board as described in 5.3.2.4.1.

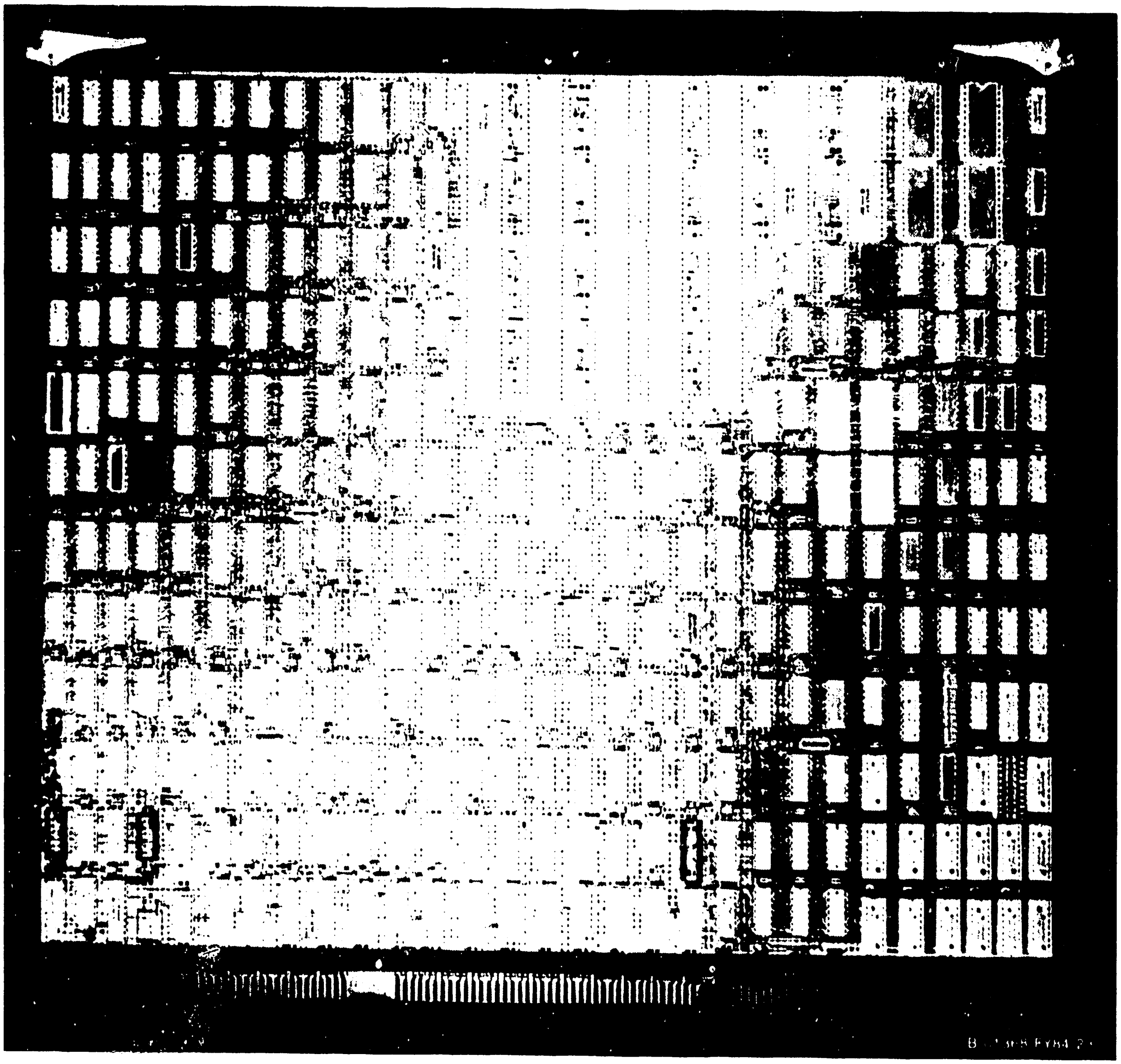


Figure 5-6. 210-8303 CPU Board

5.3.2.4.3 210-8358 BP Board Removal and Replacement

1. Before removing the BP board (figure 5-7) from Motherboard slot #3, disconnect the 34-pin connector from J1 and the 26-pin connector from J2.

CAUTION

The 34-pin connector from J3 of the BP board to the Shugart SA455 Diskette Drive may not be keyed. To avoid damage to the Diskette Drive upon reinstallation of the BP board, make sure of the orientation of the connector (pin 1 toward the front of the main frame) before removing the cable from J3.

2. Remove the board as described in 5.3.2.4.1.
3. Check the jumpers (figure 5-8) on the new BP, make sure that all of the BP Software Switches (figure 5-7 and table 5-3) are in the OFF position and install the board as described in 5.3.2.4.1. All switches must be OFF for normal operation of power-up diagnostics and system initialization.
4. Reconnect all cables. (Refer to table 5-4.) Remember to connect the 34-pin connector to J3 of the BP with pin 1 toward the front of the main frame.

NOTE

Cables for all boards should be reconnected with pin 1 toward the front of the main frame.

Table 5-3. VS-15 BP Software Switch Settings

SWITCH #	PURPOSE (WHEN ON)	NORMAL POSITION
8	Diagnostic mode. ON to read other switches	OFF
7	Bypass Core Diagnostic	OFF
6	Bypass Core Diagnostic & Diagnostic Monitor	OFF
5	Loop on Core Diagnostic	OFF
4	Loop on error	OFF
3	On = 4Mhz clock to 8086 microprocessor Off = 8Mhz clock to 8086 microprocessor	OFF
2	Data RAM clock (fast)	OFF
1	Data RAM clock (slow)	OFF

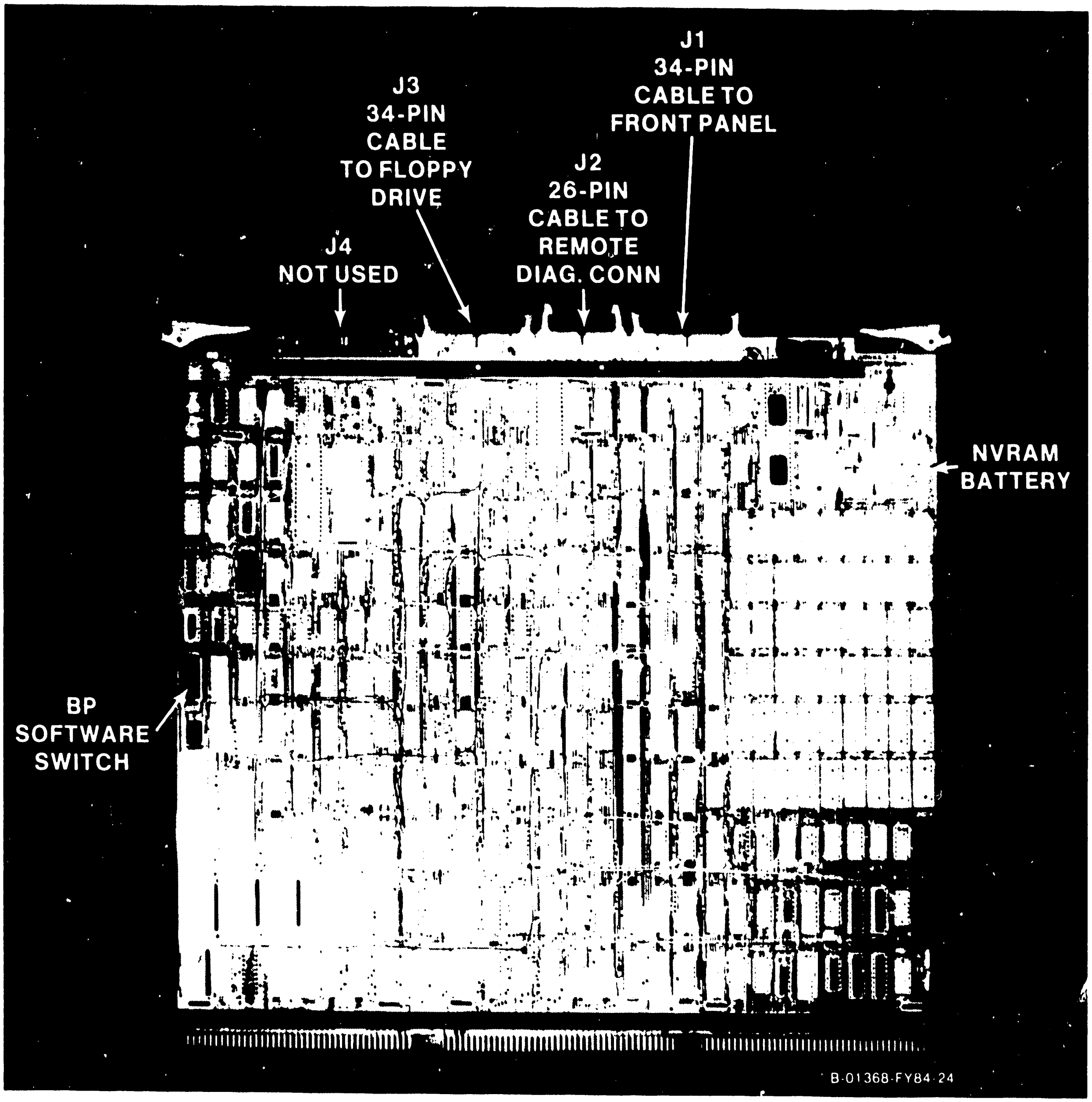


Figure 5-7. 210-8358 Bus Processor Board

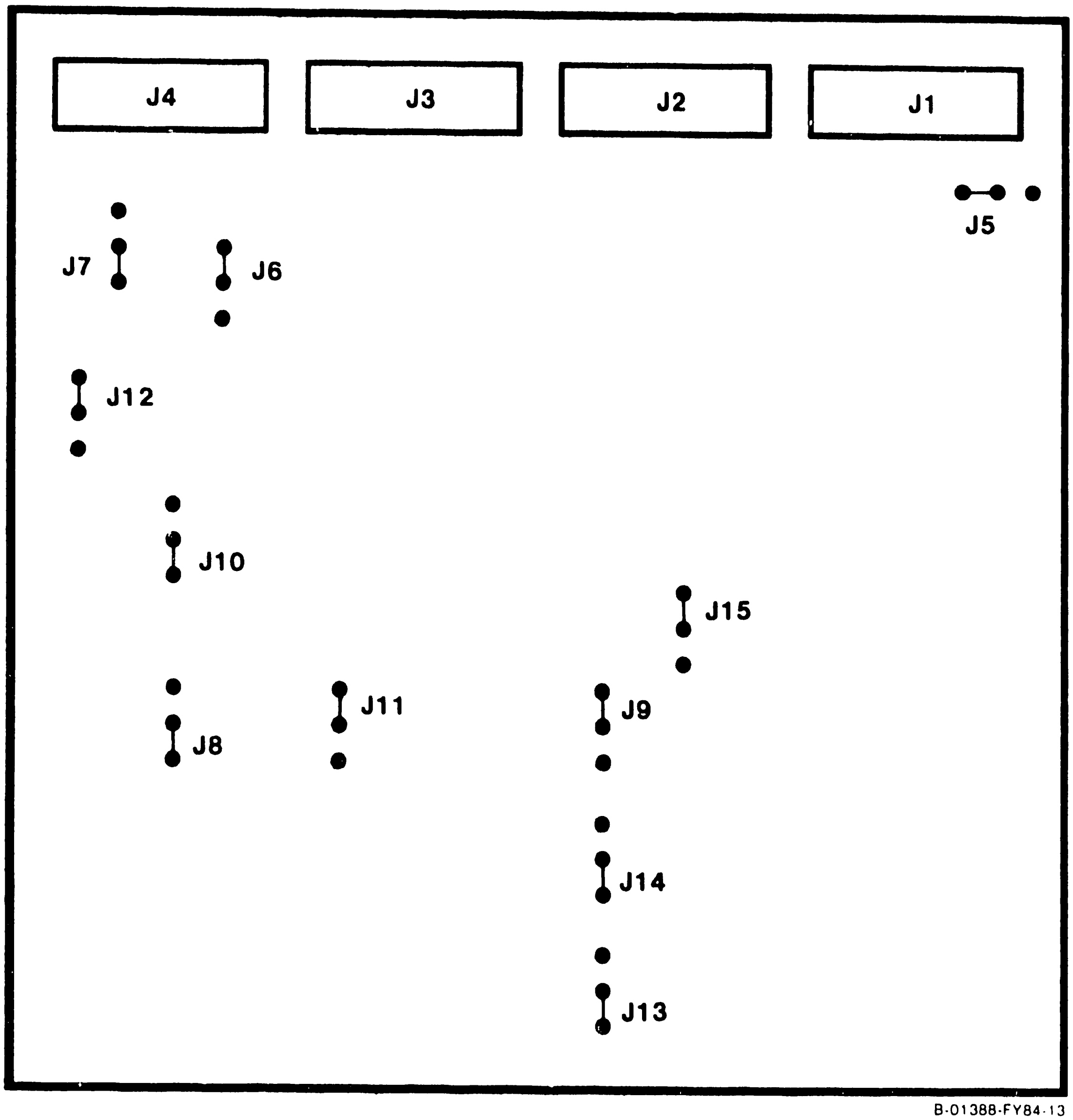


Figure 5-8. 210-8358 Bus Processor
Connector and Jumper Locations

Table 5-4. VS-15 Internal Signal Cable Connections

PC BOARD	CONNECTOR	CONNECTOR TYPE	CONNECTOR	PC BOARD
210-8358	J1	34-pin conn.	J1	210-8613 Front Panel
"	J2	26-pin conn.	RS232	Rear panel
"	J3	34-pin conn.	J1	Diskette Drive
"	J4	50-pin "		Not used
210-7906	J2	34-pin conn.	BNC/TNC	Rear panel
"	J3	" " "	" "	" "
"	J4	" " "	" "	" "
"	J5	" " "	" "	" "
210-8616	J3	34-pin conn.	BNC/TNC	Rear panel
"	J4	" " "	" "	" "
"	J5	" " "	" "	" "
"	J6	" " "	" "	" "
210-8362	J1	20-pin B conn.	J2	33 Meg Dr #2
"	J2	" " B "	J2	" " " #1
	J3	34-pin Daisy A	J1	" " " #2 to #1
210-8312	J1	60-pin A conn.	P1	76 Meg Drive
"	J2	34-pin B "	P2	" " "
210-8337	J1	40-pin conn.	RS449	Rear Panel
"	J13	20-pin conn.	X.21	" "
"	J2	26-pin conn.	RS232	" "
"	J3	" " "	RS366	" "
"	J4	20-pin conn.	Display	TC Front Panel
210-8637	J2A	26-pin conn.	RS232	Rear Panel
"	J3A	" " "	RS366	" "
"	J13A	20-pin conn.	X.21	" "
"	J2B	26-pin conn.	RS232	" "
"	J3B	" " "	RS366	" "
"	J13B	20-pin conn.	X.21	" "
"	S1 & S2	16-pin conn.	Display	TC Front Panel

Table 5-5. VS-15 Internal Power Cable Connections

PC BOARD	CONNECTOR	CONNECTOR TYPE	CONNECTOR	PC BOARD
210-8611 Switching Power Supply	J1, 2, J3	4-pin dc connectors (parallel). Note.	J3	33 Meg Drive(s)
			J2	Diskette Drive
	J4	9-pin dc	P3	76 Meg Drive
	J5	6-pin dc	J31	210-8607 Mthbd.
	J8	10-pin ribbon	J30	210-8607 "
210-8612 Switching P/S	Fan	2-pin ac		Rear fan panel
	5V Bus	Cable, #8 wire, white	J28	210-8607 Mthbd.
	0V Bus	Cable, #8 wire, black	J29	210-8607 "

NOTE

1. Actual switching power supply connections may vary depending on system configurations.
2. Refer to figure 4-8, VS-15 Interconnection Diagram.

5.3.2.5 DA Circuit Board Removal and Replacement

There are five different device adapters (DAs) used in the VS-15. The removal and replacement procedures for the different adapters are given in the order in which they are found in the Motherboard. (Figure 5-4.) DAs are assigned to the Motherboard slots on a priority basis, as follows:

Table 5-6. VS-15 Recommended Adapter Placement

I/ODA#	MOTHERBOARD SLOT	ADAPTER TYPE		WLI P/N
1	4	25V25	SIO	210-7906
1	4	25V37	Intelligent SIO	210-8616
2	5	25V51	33 Meg. Disk	210-8362
2	5	25V50-0	76 Meg. Disk	210-8312
4	7	Optional		
5	8	Optional		
6	9	25V76-1A	Telecomm.	210-8337
6	9	25V76-2A	Telecomm.	210-8637

NOTE

Either the SIO DA or the ISIO DA may be installed in the VS-15, but not both. Also, either the 33 Megabyte Winchester DA or the 76 Megabyte SMD DA may be installed, but not both.

5.3.2.5.1 210-7906 SIO DA Removal and Replacement

1. Press the green Control Mode button. This prevents any disk I/O command in process from being halted prior to completion.
2. Power down the main frame by depressing the ac power On/Off switch to the 0 position.
3. Remove the top cover as described in paragraph 5.3.2.1.
4. Each DA is held in place by two snaplocks. One snaplock tab fits under the top edge of the front board cage assembly rail. The other tab fits under the top edge of the rear board cage assembly rail.
5. Remove all connectors from the top of the Serial I/O Device Adapter (figure 5-9) in Motherboard slot #4 (I/ODA1). Note the position of all connectors for later reassembly.
6. Remove the device adapter from Motherboard slot #4 by lifting the snaplocks to free the adapter from the Motherboard connectors. Once the adapter is free of the connectors, ease it straight up in the board guides and out of the board cage.
7. Check the jumpers (figure 5-10) on the new device adapter and install the adapter in Motherboard slot number #4. Insert the adapter in the board guide and lower it to the Motherboard connector.
8. Make sure the adapter edge connectors are lined up with the Motherboard connector slots and the snaplock tabs are under the top rails.
9. Push down on the snaplocks to seat the adapter in the Motherboard.

CAUTION

DO NOT USE EXCESSIVE FORCE WHEN PUSHING DOWN ON THE SNAPLOCKS.

10. Reconnect all cables.

NOTE

Cables for all boards should be reconnected with pin 1 toward the front of the main frame.

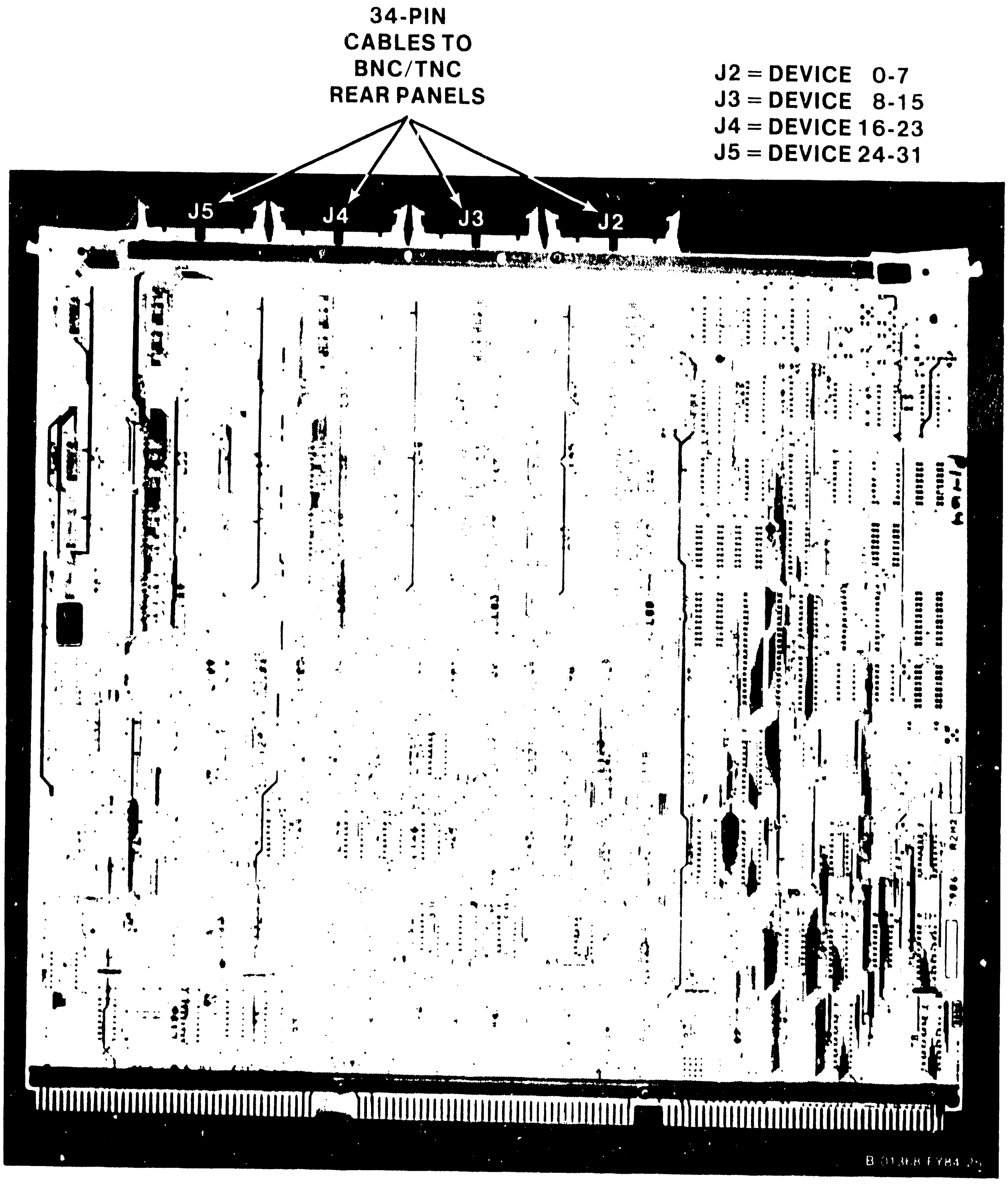


Figure 5-9. 210-7906 Serial I/O Adapter

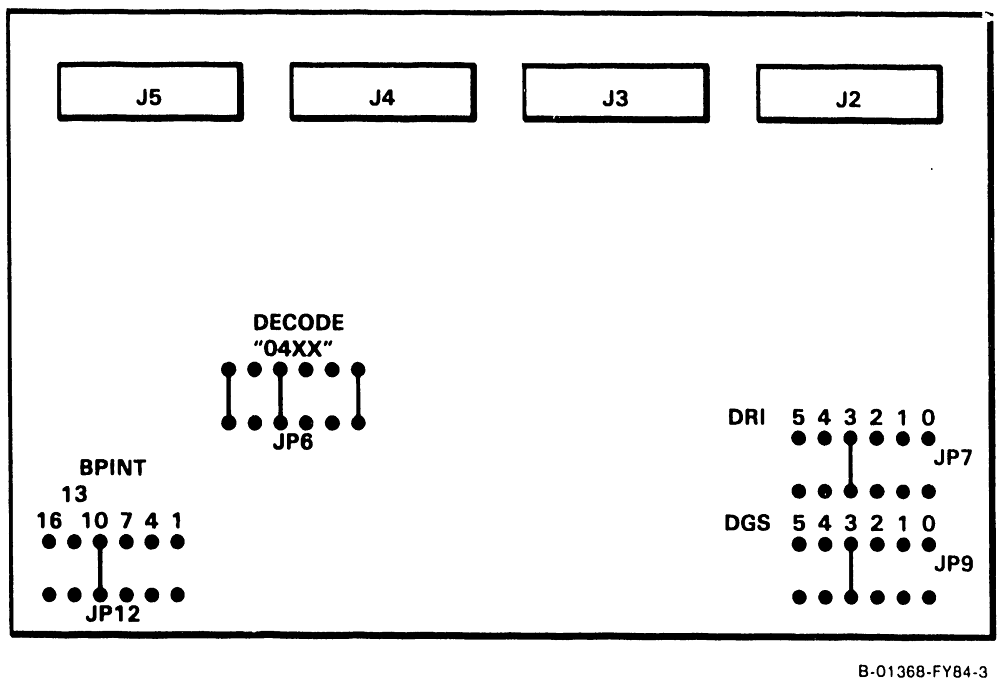


Figure 5-10. 210-7906 Serial I/O Adapter
Connector and Jumper Locations

5.3.2.5.2 210-8616 ISIO DA Removal and Replacement

1. Remove all connectors from the top of the Intelligent Serial I/O Device Adapter (figure 5-11) in Motherboard slot 4 (I/ODA1). Note the position of all connectors for later reassembly.
2. Remove the device adapter as previously described in 5.3.2.5.1.
3. Check the jumpers (figure 5-12) on the device adapter and install the new adapter in Motherboard slot #4 as described in 5.3.2.5.1.
4. Reconnect all cables.

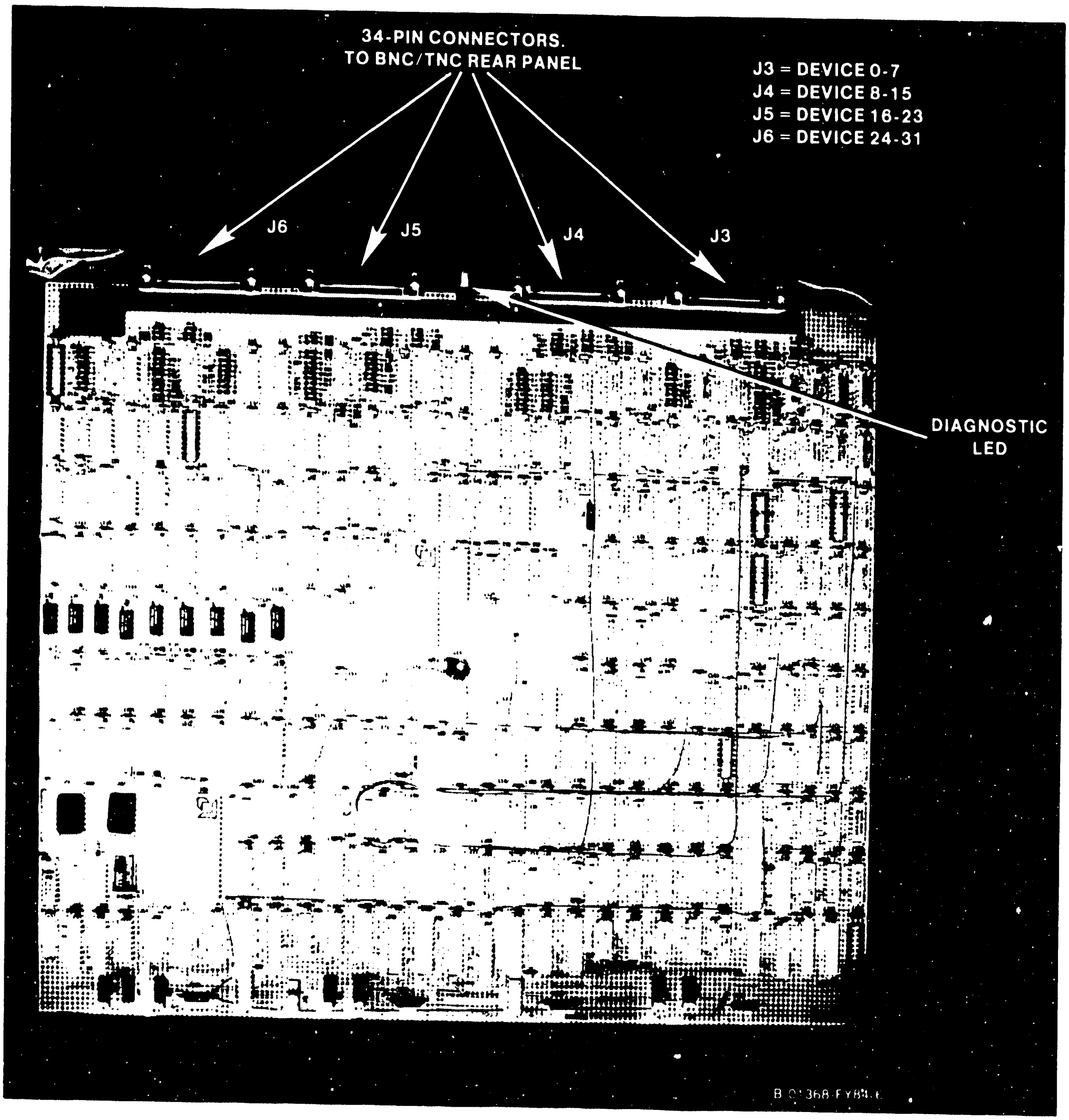
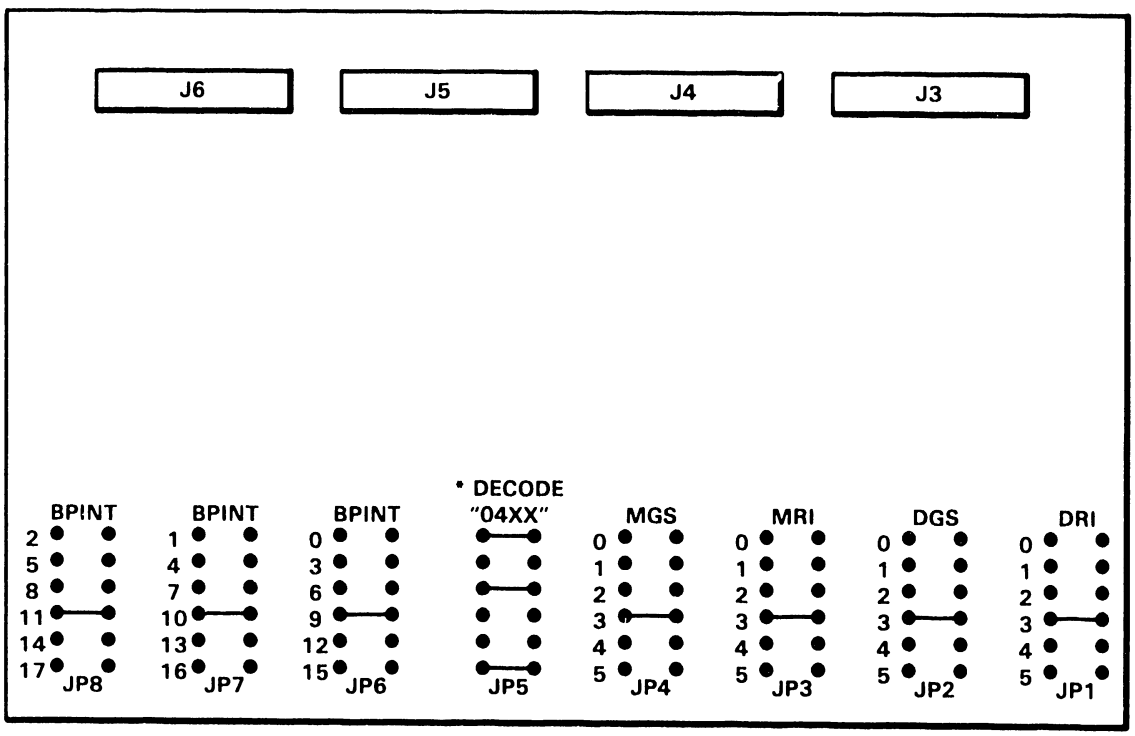
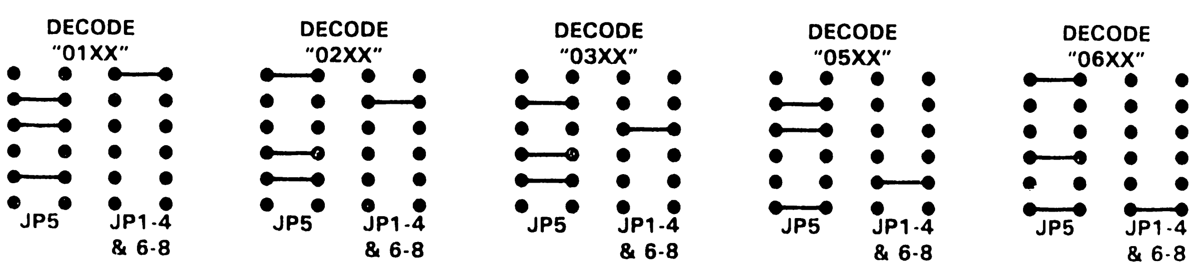


Figure 5-11. 210-8616 Intelligent Serial I/O Adapter



* STANDARD CONFIGURATION. OTHER POSSIBLE CONFIGURATIONS.



B-01368-FY84-2

Figure 5-12. 210-8616 Intelligent Serial I/O Adapter
Connector and Jumper Locations

5.3.2.5.3 210-8362 Winchester DA Removal and Replacement

1. Remove all connectors from the top of the Winchester Device Adapter (figure 5-13) in Motherboard slot #5 (I/ODA2). Note the position of all connectors for later reassembly.
2. Remove the device adapter as previously described in 5.3.2.5.1.
3. Check the disk drive type/maximum number of heads switches SW1 and SW2 (figure 5-13), and jumpers (figure 5-14) on the new device adapter and install the adapter in Motherboard slot #5 as described in 5.3.2.5.1. (Both switches are set identically.)
4. Reconnect all cables.

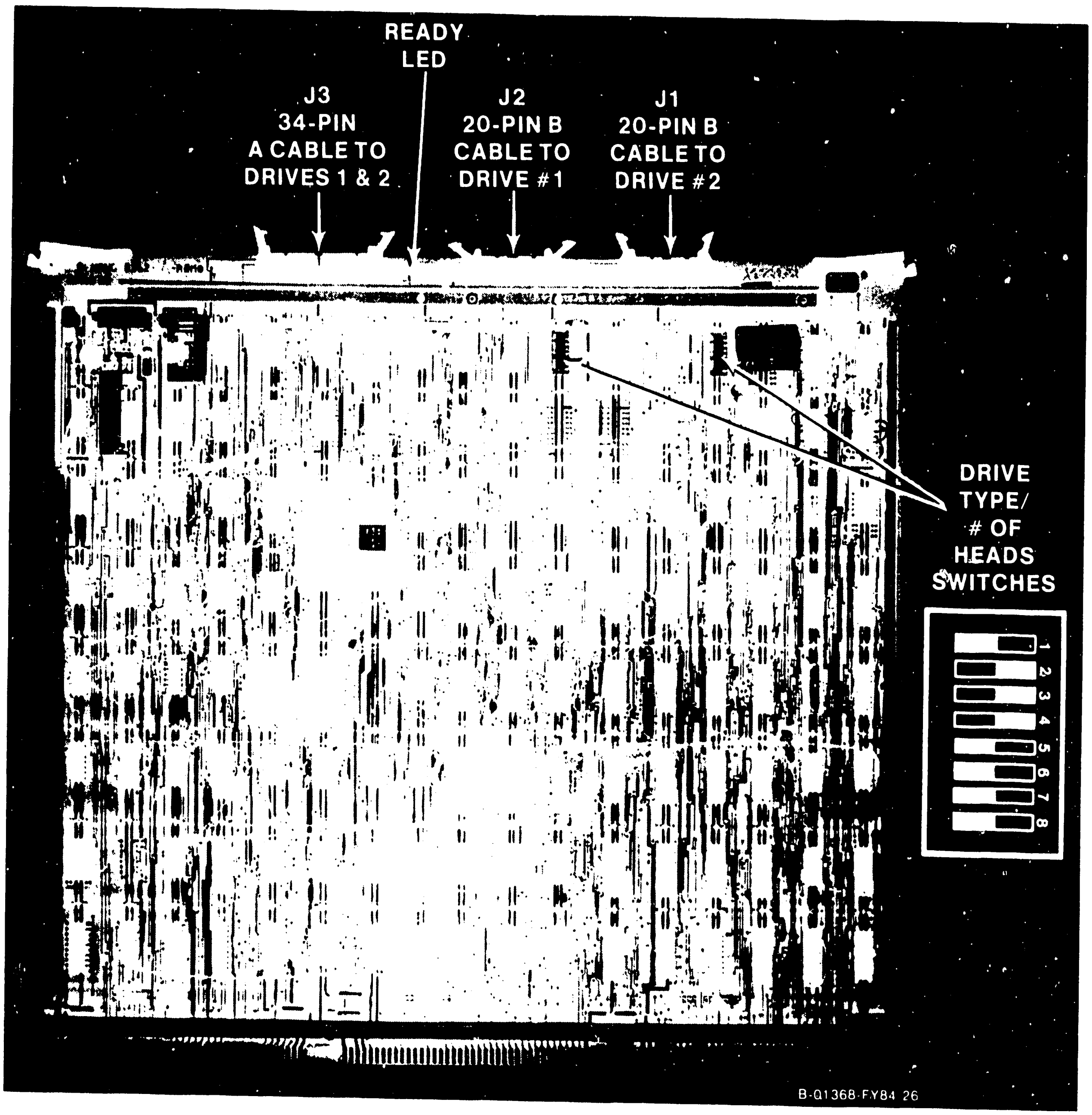
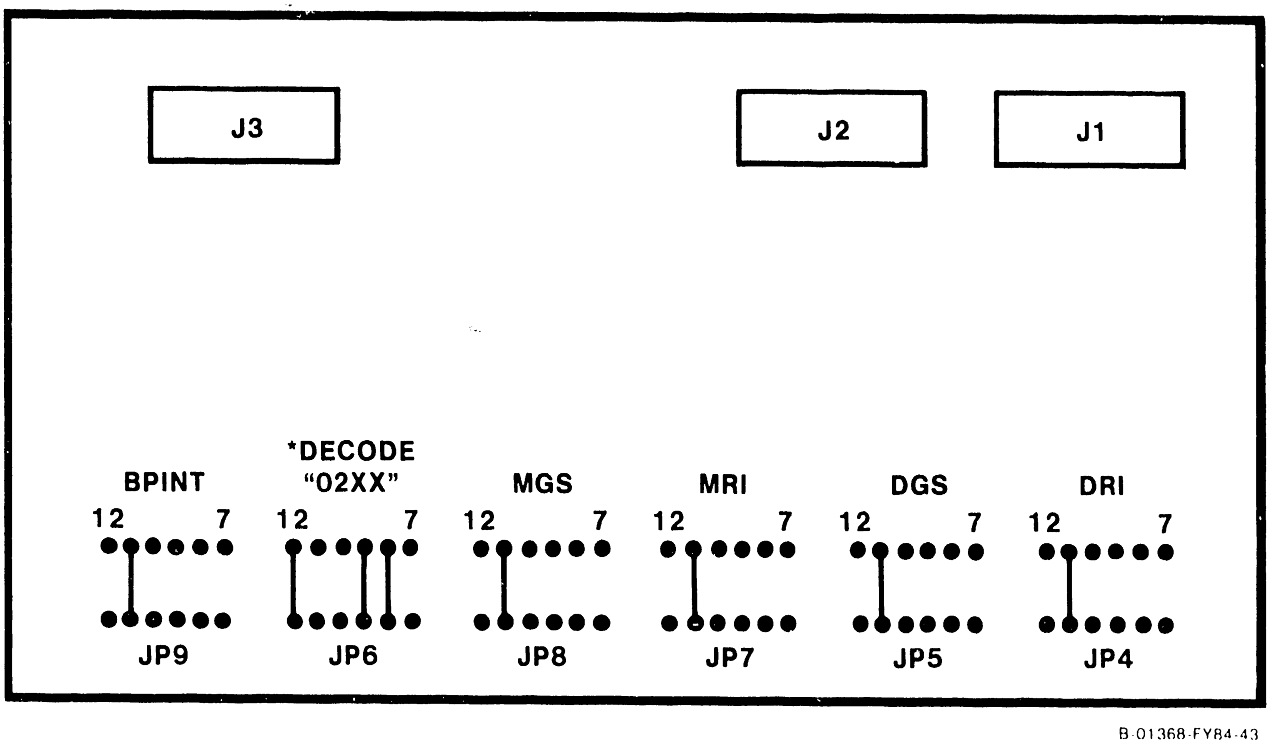


Figure 5-13. 210-8362 Winchester Disk Device Adapter



*STANDARD CONFIGURATION. OTHER OPTIONAL CONFIGURATIONS:

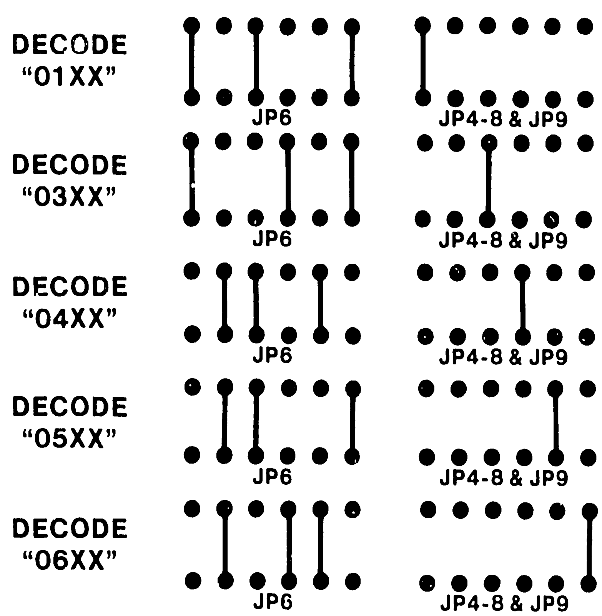


Figure 5-14. 210-8362 Winchester Disk Device Adapter Connector and Jumper Locations

5.3.2.5.3.1 210-8312 SMD DA Removal and Replacement

1. Remove both connectors from the top of the SMD Device Adapter (figure 5-14a) in Motherboard slot #5 (I/ODA2). Note the position of all connectors for later reassembly.
2. Remove the device adapter as previously described in 5.3.2.5.1.
3. Check the disk drive device type switch SW1 (figure 5-14b), and jumpers (figure 5-14c) on the new device adapter and install the adapter in Motherboard slot #5 as described in 5.3.2.5.1.
4. Reconnect all cables.

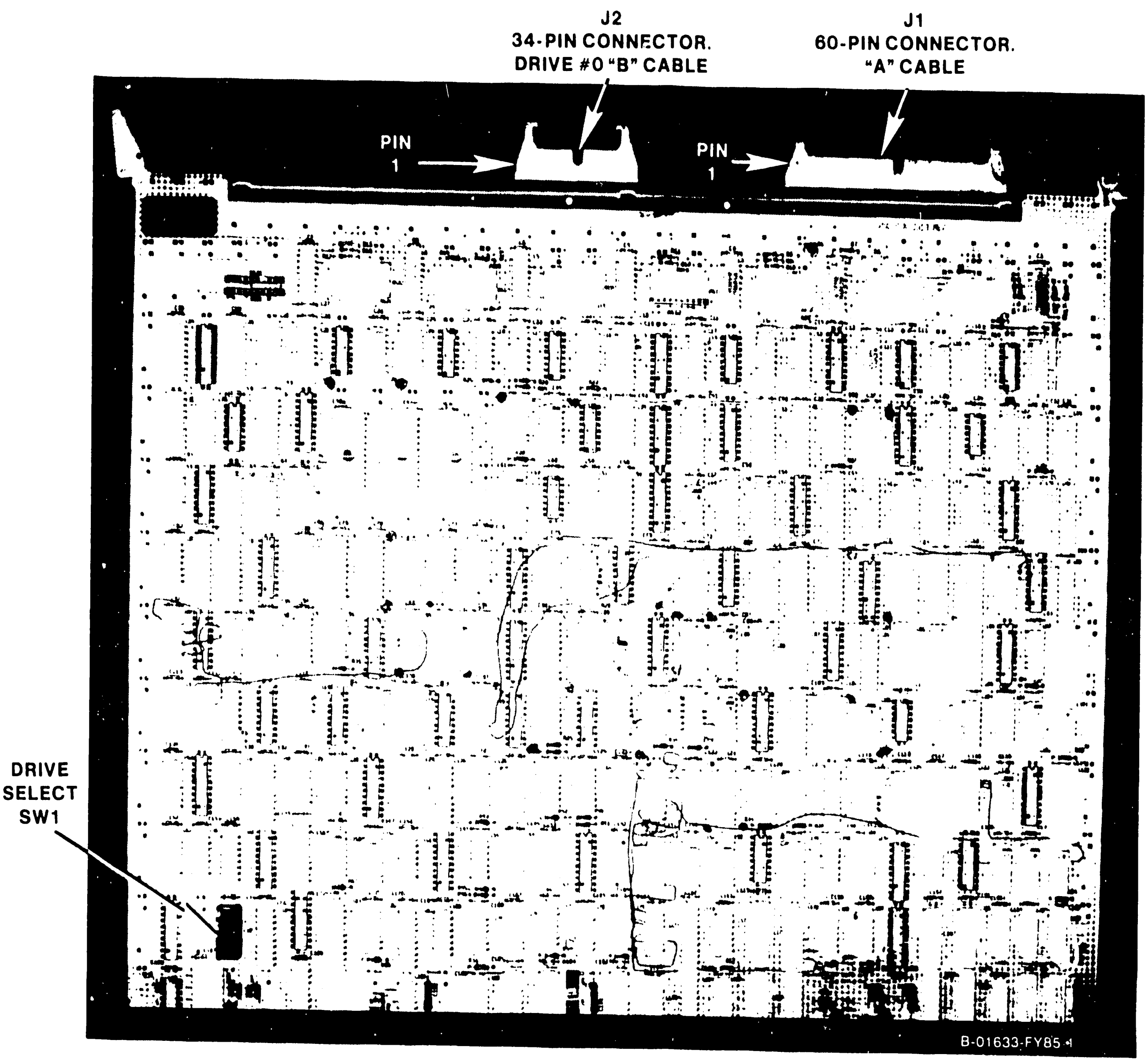


Figure 5-14a. 210-8312 1-Port SMD Disk Device Adapter

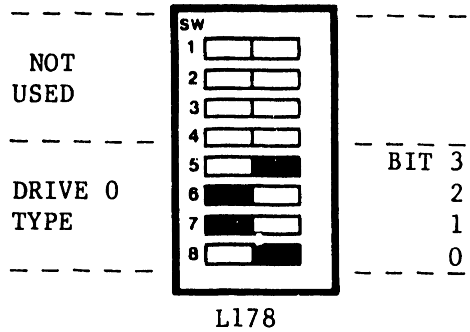


Figure 5-14b. SMD Disk Device Adapter.
Disk Device Type Switch Setting For 76 Megabyte Drive.

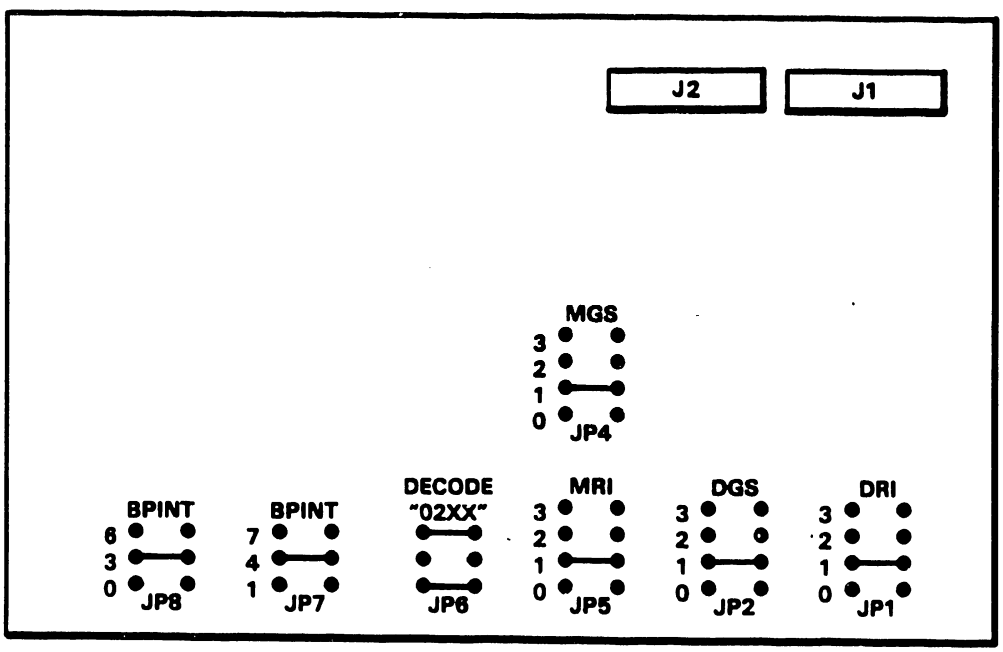


Figure 5-14c. SMD Disk Device Adapter
Connector and Jumper Locations

5.3.2.5.4 210-8337/8637 TC DA Removal and Replacement

1. Remove all connectors from the top of the 1-port 210-8337-A Telecommunications Adapter (figure 5-15) or 2-port 210-8637-A Telecommunications Adapter (figure 5-16) in Motherboard slot #9 (I/ODA6). Note the position of all connectors for later reassembly. (Note the position of all cables on the boards that are already installed in the system. Some of these cables may have to be removed to allow removal and replacement of the Telecommunications Adapter.)
2. Remove the device adapter as previously described in 5.3.2.5.1.
3. Check the settings of the 8-position Address/Status switch(s) SW1 (1-port) and SW1 and SW2 (2-port). (See figures 5-15, 5-16, and 5-17, and table 5-7.)

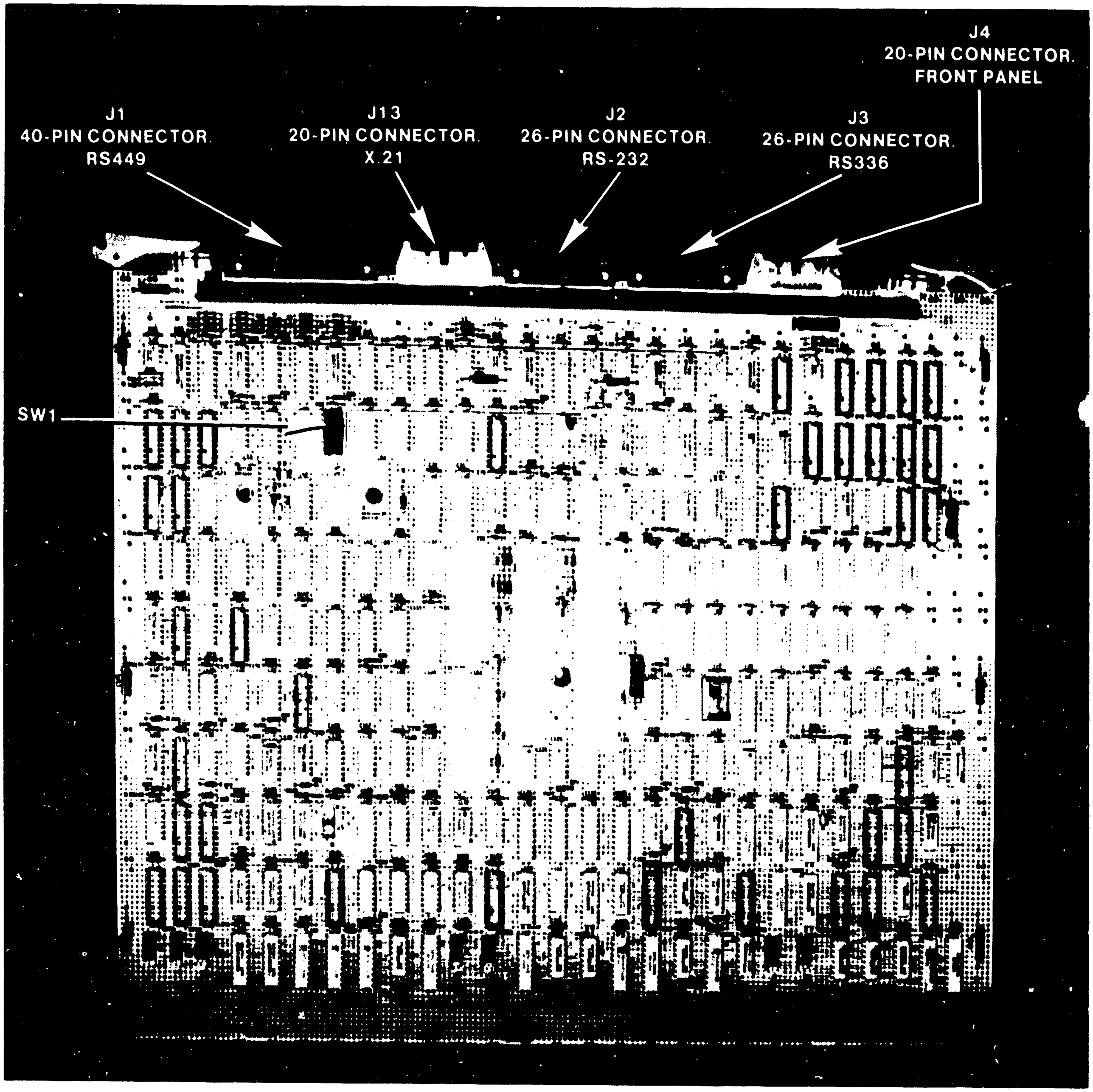


Figure 5-15. 210-8337 1-Port Telecommunications Adapter B-01368-FY84-8

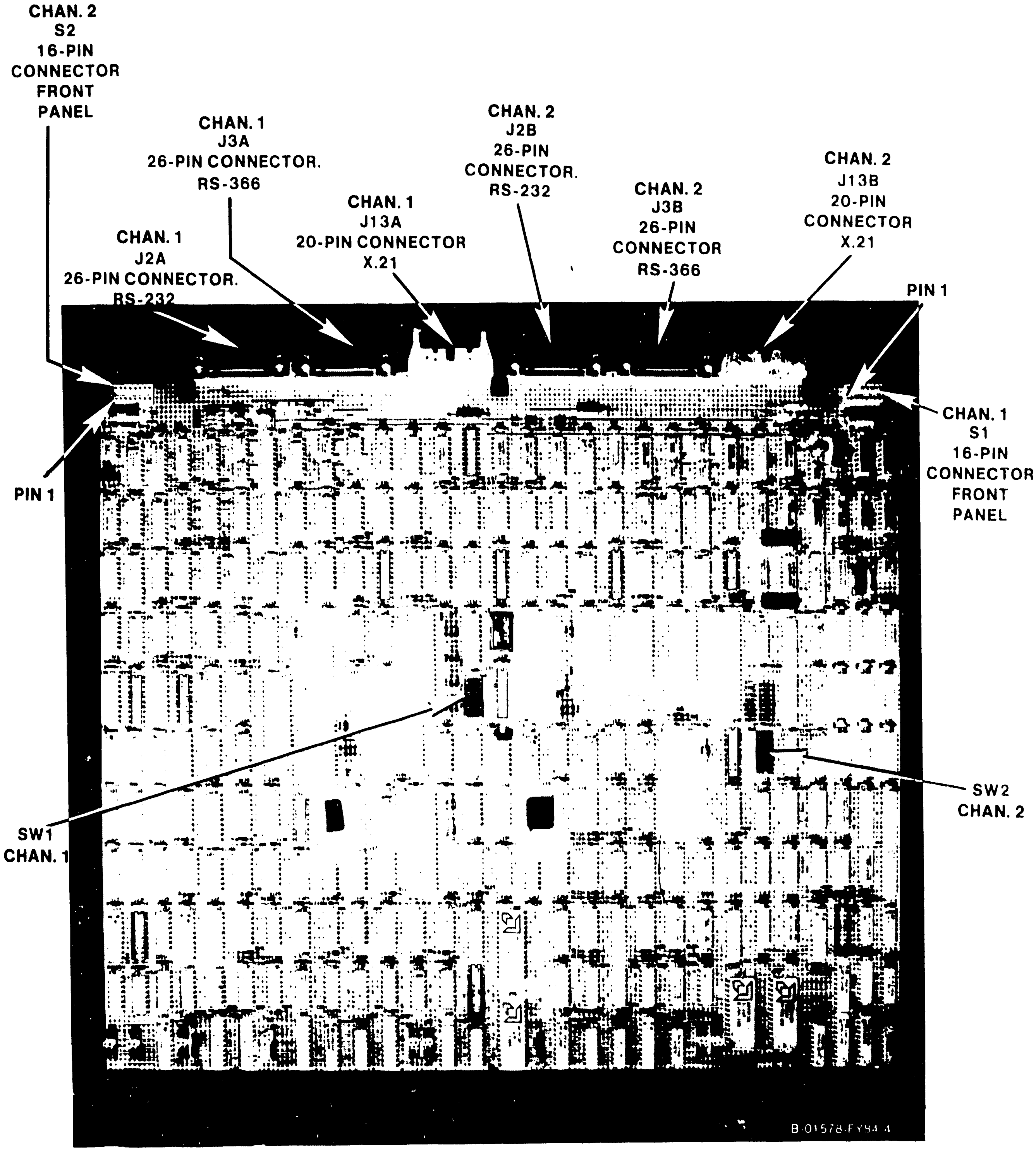


Figure 5-16. 210-8637 2-Port Telecommunications Adapter

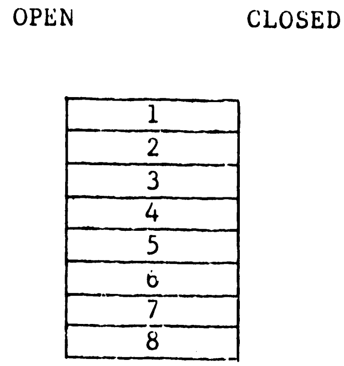


Figure 5-17. 210-8337/8637 Telecommunications Adapter. Address/Status Switch SW1/SW2

NOTES

1. SW1 is for 1-port TC adapter and SW1 and SW2 are for 2-port TC adapter.
2. All switches should be off unless the 64K byte RAM option or the X.21 Interface option have been ordered.

Table 5-7. SW1/SW2 Address/Status Switch Settings

SW#	SWITCH NAME	PURPOSE (WHEN ON)	NORMAL POSITION
1	Loop on Bit	Repeat TC DA test sequence	OPEN (OFF)
2	Ext. Loopback	To support external RS232 loopback connector	OPEN (OFF)
3	Loop on Error	Repeat any test in error	OPEN (OFF)
4	Stop on Error	Holds error code in TC DA LED display. Needs SW3 ON	OPER (OFF)
5	Bypass Power-up	Bypass all power up tests	OPEN (OFF)
6	Loop On Test	Repeat current TC DA test	OPEN (OFF)
7	X.21 Option	Supports X.21 interface	OPEN (OFF)
8	128K Option	Supports 128K byte TC DA memory	OPEN (OFF)

4. Check all address selection jumpers as shown in figures 5-18, 5-19, and 5-19a. Make sure that no TC DA addresses conflict with other DA addresses.

   Device Address for a single TC DA = 06xx.
   Device Address for a second TC DA = 05xx.
   Device Address for a third TC DA = 03xx.

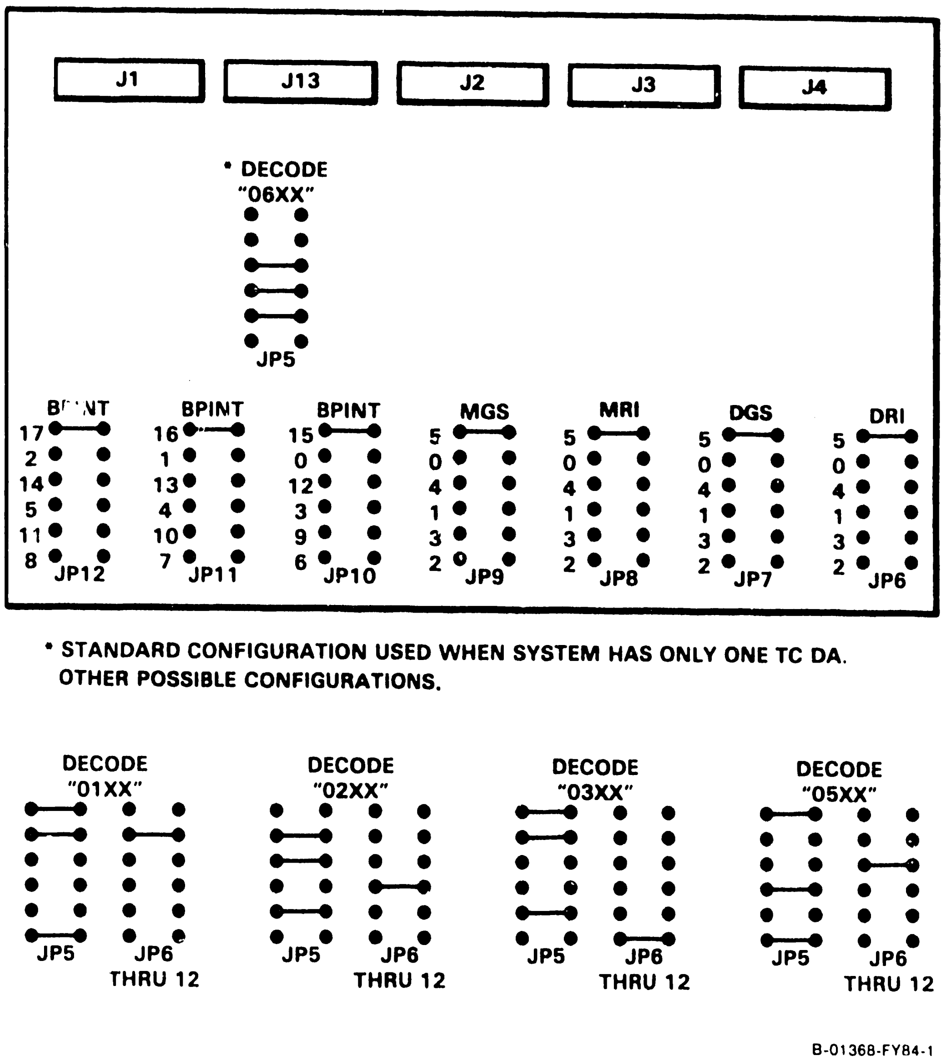


Figure 5-18. 210-8337 1-Port TC Device Adapter Connector and Jumper Locations

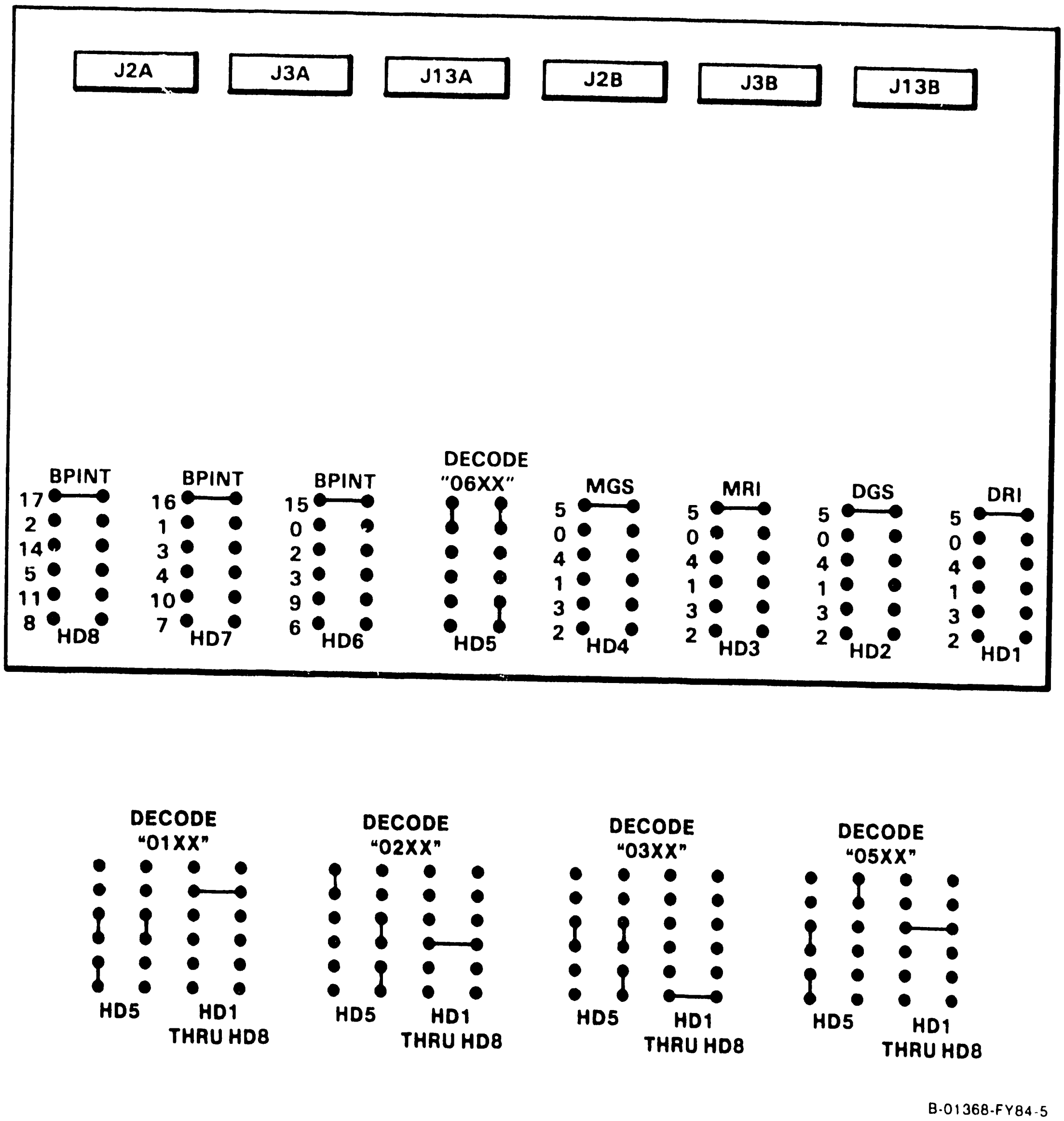


Figure 5-19. 210-8637 2-Port TC Device Adapter
Connector and Jumper Locations (R1 Version)

5. Install the new device adapter in Motherboard slot #9 as described in 5.3.2.5.1.
6. Reconnect all cables.

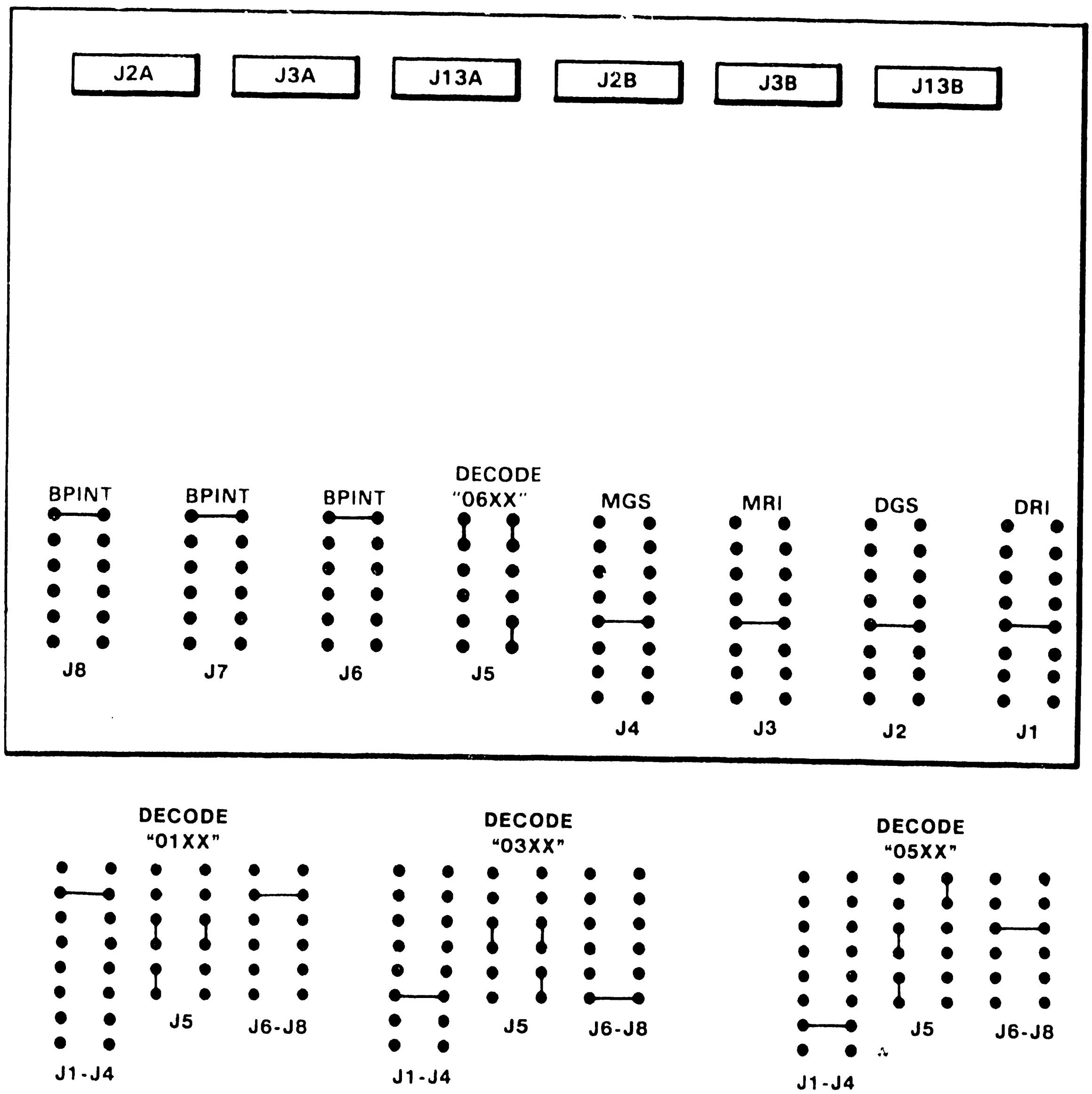


Figure 5-19a. 210-8637 2-Port TC Device Adapter Connector and Jumper Locations (R2 Version)

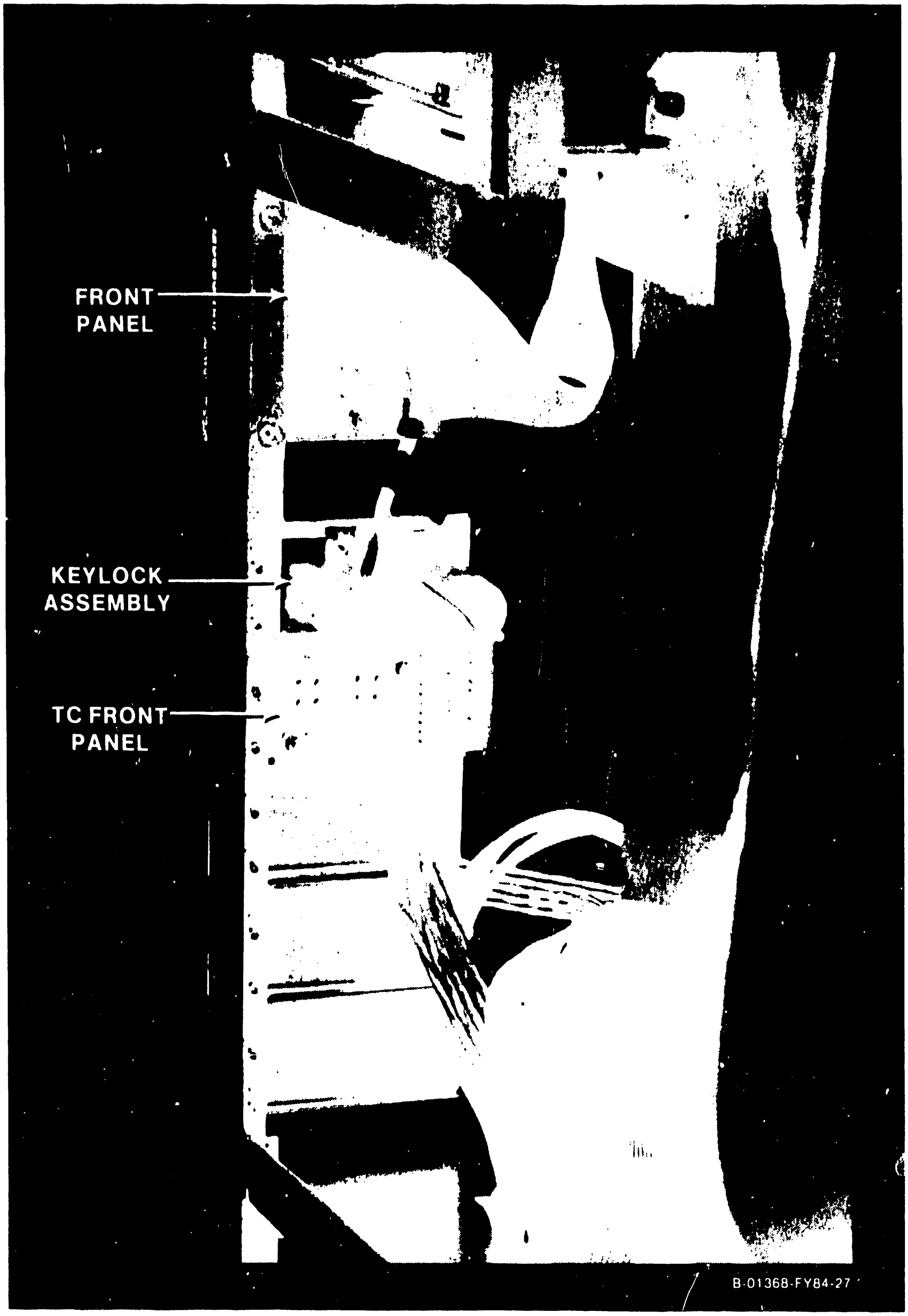


Figure 5-20. Inside view of Front Panels

5.3.2.6 Front Panel Removal

The 210-8613 Front Panel board (figure 5-21) is mounted below the Diskette Drive. To remove the Front Panel board:

1. Power down the main frame by depressing the ac power On/Off switch to the 0 position.
2. Remove the top, front, and side covers (paragraphs 5.3.2.1, 5.3.2.2, and 5.3.2.3).
3. Remove the Front Panel-to-BP cable from J1 of the BP.
4. Remove the 6-pin cable from J2 on the Front Panel.
5. Remove the two nuts holding the panel to the chassis behind the panel.
6. Remove the board.

5.3.2.7 Front Panel Replacement

Reinstall the Front Panel by reversing the above procedures.

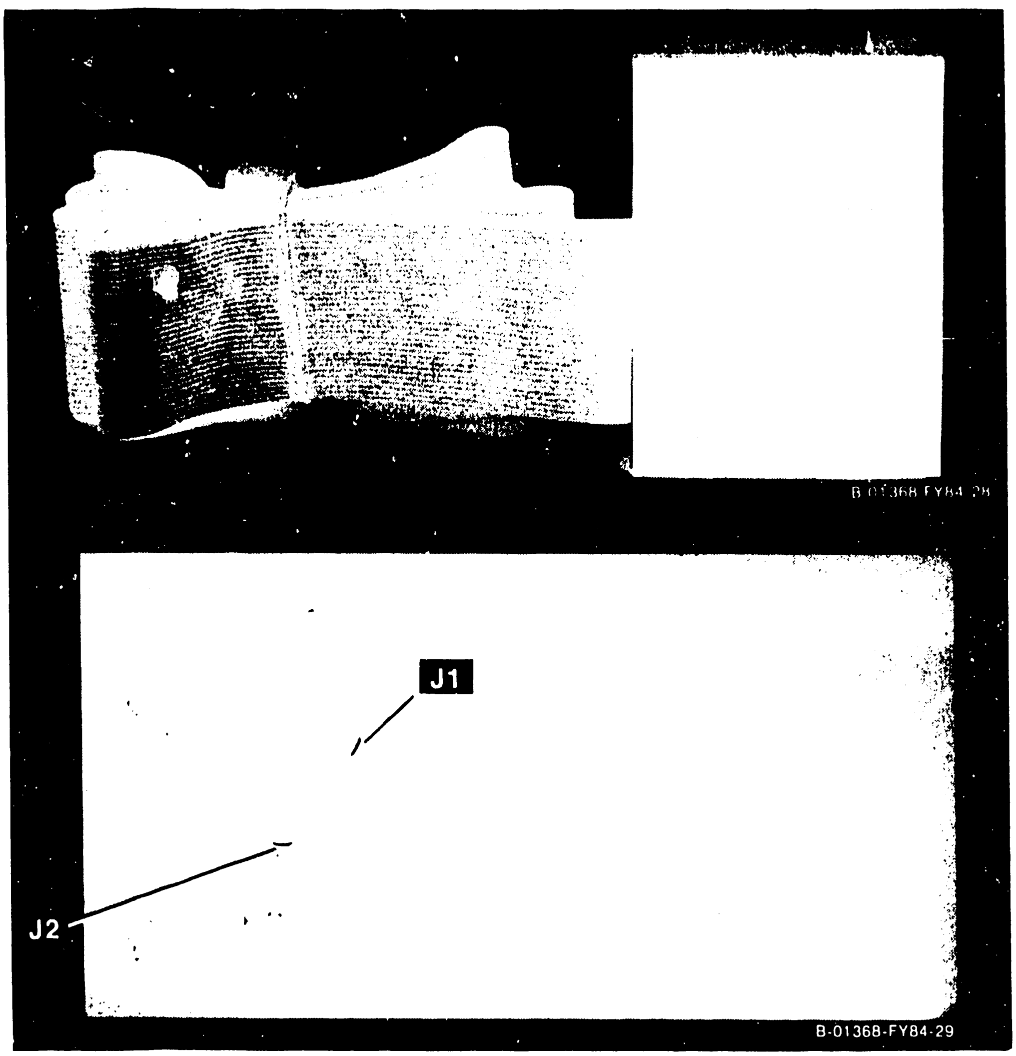


Figure 5-21. Front and Rear View of 210-8613 Front Panel Board

5.3.2.8 Keylock Assembly Removal

The 279-0607 Keylock Assembly (figure 5-22) is mounted below the Front Panel board. To remove the Keylock Assembly:

1. Power down the main frame by depressing the ac power On/Off switch to the 0 position.
2. Remove the top, front, and side covers. (Paragraphs 5.3.2.1, 5.3.2.2, and 5.3.2.3).
3. Remove the 6-pin cable connector from J2 on the Front Panel.
4. Remove the two nuts holding the Keylock Assembly to the chassis from behind the assembly.
5. Remove the assembly.

5.3.2.9 Keylock Assembly Replacement

Reinstall the Keylock Assembly by reversing the above procedures.

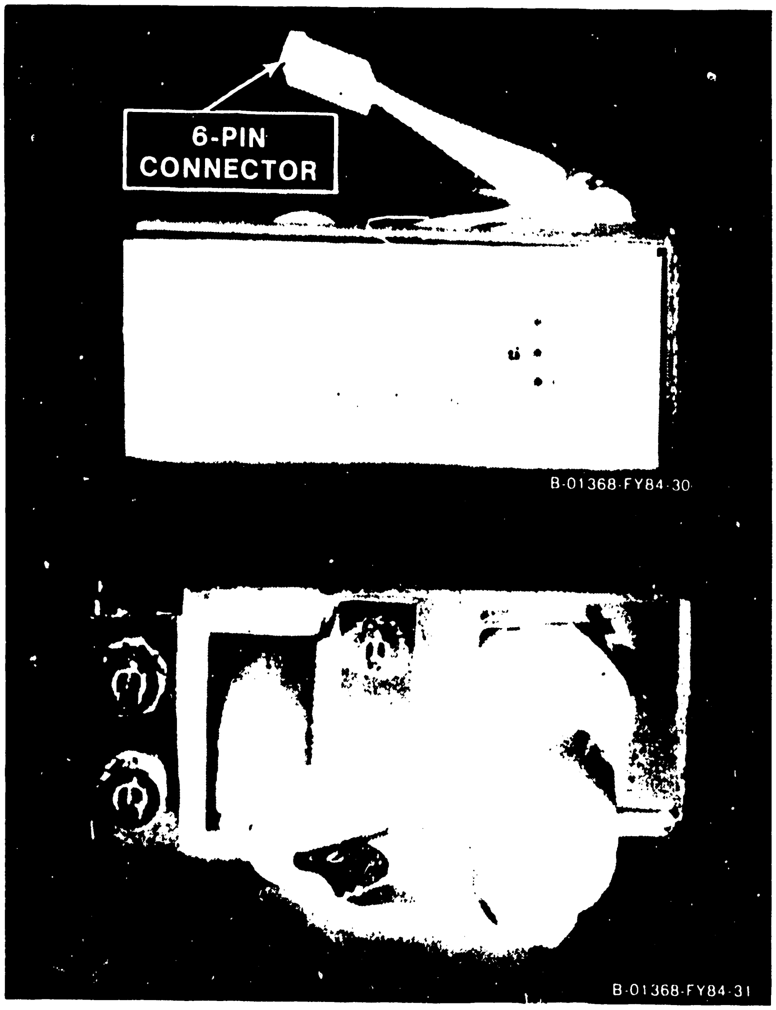


Figure 5-22. Front and Rear View of 279-0607 Keylock Assembly

5.3.2.10 TC DA Front Indicator/Control Panel Removal

The 210-7785 TC DA Front Indicator/Control Panel board (figure 5-23) is mounted beneath the Keylock Assembly. To remove the board:

1. Power down the main frame by depressing the ac power On/Off switch to the 0 position.
2. Remove the top, front, and side covers. (Paragraphs 5.3.2.1, 5.3.2.2, and 5.3.2.3).
3. Remove the 16-pin cable from J1 on the panel.
4. Remove the two nuts holding the panel to the chassis behind the panel.
5. Remove the panel.
6. Remove the board.

5.3.2.11 TC DA Front Indicator/Control Panel Replacement

Reinstall the TC Front Panel by reversing the above procedures.

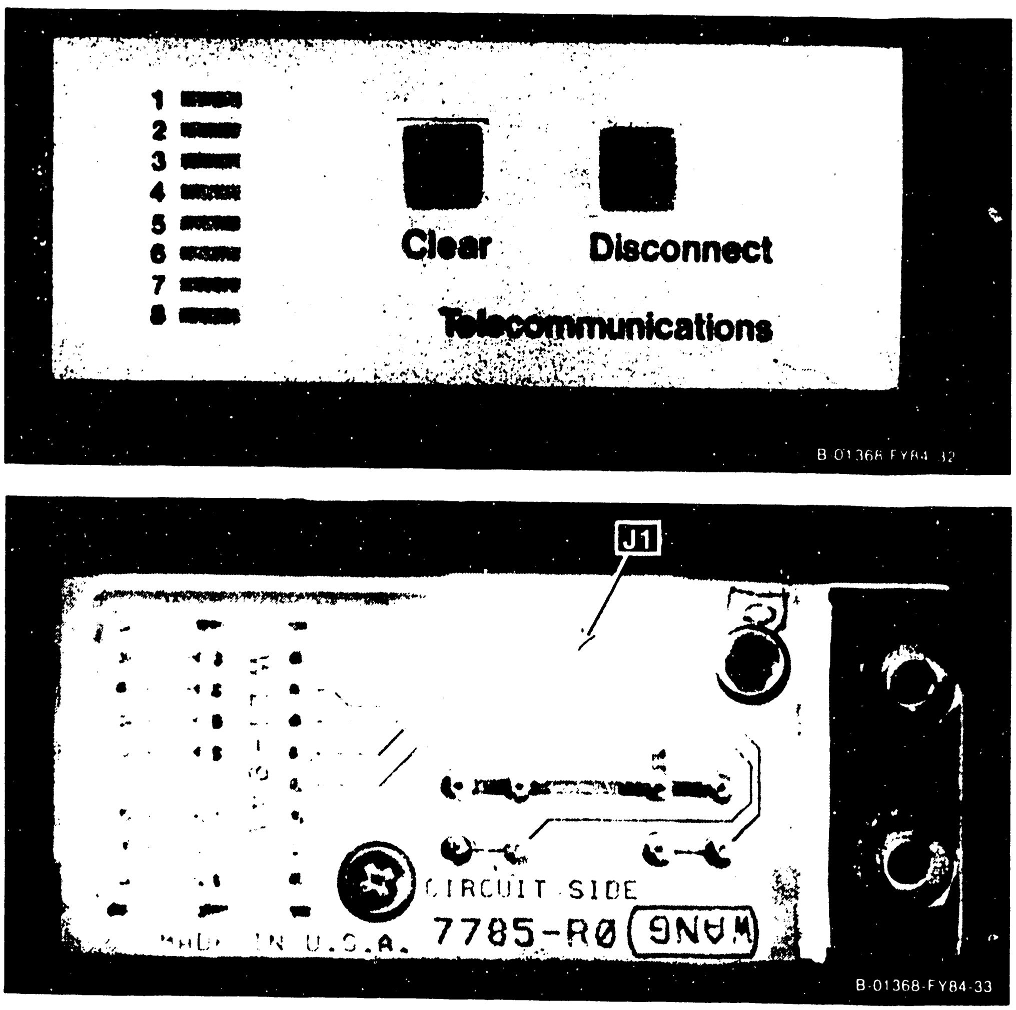


Figure 5-23. Front and Rear View of 210-7785
Telecommunications Adapter Indicator/Control Panel

5.3.2.12 Motherboard Removal

Removal of the 210-8607 CPU Motherboard should be done only if it has been determined conclusively that the problem is in the Motherboard. The following steps describe the procedures involved in removing the VS-15 Motherboard.

CAUTION

When reinstalling the Motherboard, make sure no conductive (metal) parts of the Motherboard come in contact with the frame. This could cause a short to ground on the Motherboard resulting in damage to CPU or I/O boards when power is applied.

To remove the Motherboard: (Figures 5-24 and 5-25.)

1. Press the green Control Mode button. This prevents any disk I/O command in process from being halted prior to completion.
2. Power down the main frame and unplug the power connector from the power source receptacle.
3. Remove the top and front covers (paragraphs 5.3.2.1 and 5.3.2.2).
4. Note the position of all cables on the circuit boards for later re-assembly and then remove all board cables.
5. Remove all circuit boards. (Paragraphs 5.3.2.4 and 5.3.2.5.)
6. Disconnect the 10-pin ribbon cable connector from J30 and the 6-pin dc connector from J31 at the front of the Motherboard. Do not remove the two dc power cables (+5 Volts and +/- 0 Volts) at the front of the Motherboard at this time.
7. Remove the cable clamp securing the +5 Volt cable and +/- 0 Volt cable to the front of the main frame.
8. Remove the two 5/16 inch Whiz Lock bolts that secure the front of the board cage assembly to the frame.

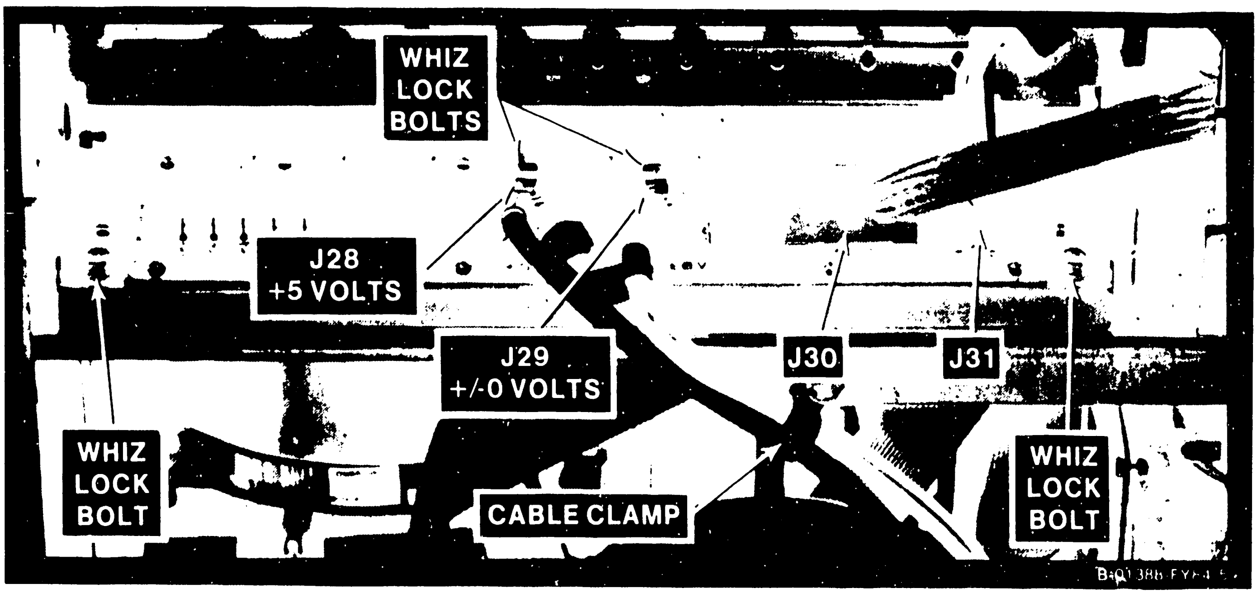


Figure 5-24. Motherboard Power Connectors

9. The rear of the board cage assembly is attached to the frame by two studs seated in slots in the frame. Pull the entire board cage assembly forward slightly and lift up on the rear of the cage to disengage the studs from the slots. Then pull the entire board cage assembly forward about 6 inches.
10. Make sure that the white #8 dc power cable is labeled +5 Volts and the black #8 dc power cable is labeled +/- 0 Volts. Remove the two Whiz Lock bolts securing the +5 Volt cable to J28 and the +/-0 Volt cable to J29 at the front of the Motherboard. The two bolts are secured by Whiz Lock nuts under the Motherboard. Remove the Whiz Lock bolts while holding the Whiz Lock nuts under the Motherboard.
11. With all bolts, nuts, and cables removed, grasp the board cage assembly and pull it forward and out of the main frame.
12. Set the cage assembly out on the floor or on a table.
13. Remove the four hex bolts from the bottom of the right side of the card cage and the four hex bolts from the bottom of the left side of the card cage. Remove the Motherboard and the base plate.
14. Remove the 30 Phillips screws from the top of the motherboard and lift the Motherboard from the base plate.

5.3.2.13 Motherboard Replacement

To replace the Motherboard:

1. To reinstall the Motherboard, reverse the above procedure.
2. Make sure that all screws and nuts are reinstalled in their proper locations, and that all wires and cables are installed correctly.
3. Make sure that no metal part of the Motherboard makes contact with the main frame board cage assembly (see CAUTION above).
4. Reinstall all circuit boards (paragraphs 5.3.2.4 and 5.3.2.5.) as shown in figure 5-4 and make sure that all board cabling is installed correctly.

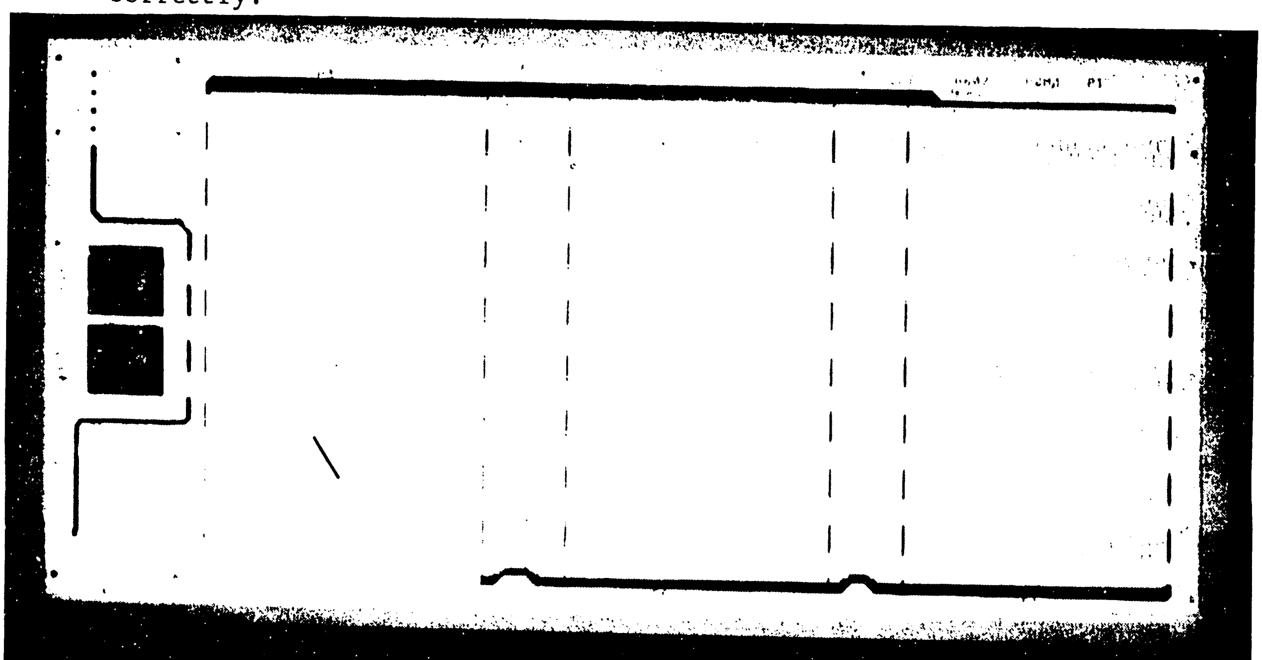


Figure 5-25. Motherboard

5.3.2.14 Power Supply Removal

WARNING

```
************************************************************
*                                                          *
*    DO NOT OPEN THE SWITCHING POWER SUPPLY UNDER ANY      *
*    CIRCUMSTANCE.  EXTREMELY DANGEROUS VOLTAGE AND        *
*     CURRENT LEVELS (IN EXCESS OF 300 VOLTS DC AND UN     *
*    LIMITED CURRENT) ARE PRESENT WITHIN THE POWER SUPPLY. *
*                                                          *
*    DO NOT ATTEMPT TO REPAIR THE SWITCHING POWER          *
*    SUPPLY; IT IS FIELD REPLACEABLE ONLY.                 *
*                                                          *
*    AFTER POWERING THE UNIT DOWN AND DISCONNECTING THE AC *
*    POWER CONNECTOR FROM THE POWER SOURCE RECEPTACLE,     *
*    ALLOW ONE MINUTE BEFORE REMOVING THE POWER SUPPLY TO  *
*    PROVIDE ADEQUATE TIME FOR ANY RESIDUAL VOLTAGE TO     *
*    DRAIN THROUGH THE BLEEDER RESISTORS.                  *
*                                                          *
************************************************************
```

To remove the 279-0608 Switching Power Supply: (Figures 5-26 and 5-27.)

1. The power supply is located to the right of the internal disk drive.
2. Power down the main frame and unplug the power connector from the power source receptacle.
3. Remove the top, front, and right side covers (paragraphs 5.3.2.1, 5.3.2.2, and 5.3.2.3).
4. Remove the ac power input cable at the rear of the main frame.
5. Remove the cable clamp securing the +5 Volt cable and +/- 0 Volt cable to the front of the main frame.
6. Unscrew the spring loaded thumbscrew securing the front of the power supply to the main frame base plate and pull the power supply forward about 4 to 6 inches.
7. Remove the quick-disconnect ground wire from the front of the power supply.
8. Make sure that the white #8 dc power cable is labeled +5 Volts and the black #8 dc power cable is labeled +/- 0 Volts. Remove the +5 Volt and +/- 0 Volt cables from the power busses at the front of the power supply.
9. Remove the following connectors from the front of the power supply. The connectors are keyed to ensure proper reinsertion.
   a. Two-pin fan connector from fan jack.
   b. Ten-pin ribbon connector from J8.
   c. Six-pin dc connector from J5.
   d. Four-pin dc connectors from J1, 2, and 3.

NOTE

Actual connections at J1, J2, and J3 may vary depending on system configurations.

10. Carefully pull the power supply forward and out of the main frame.

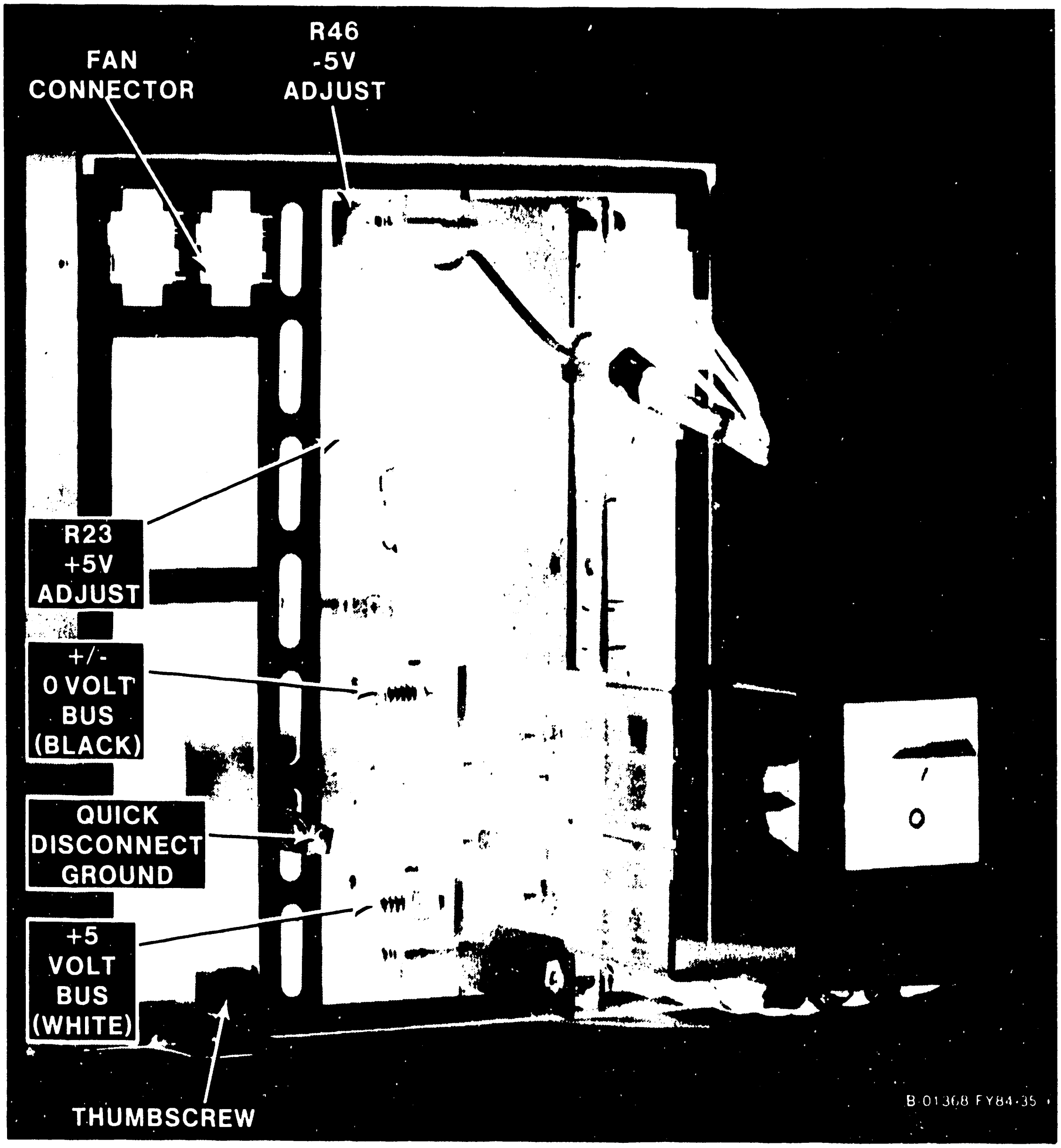


Figure 5-26. Switching Power Supply (Left Side View)

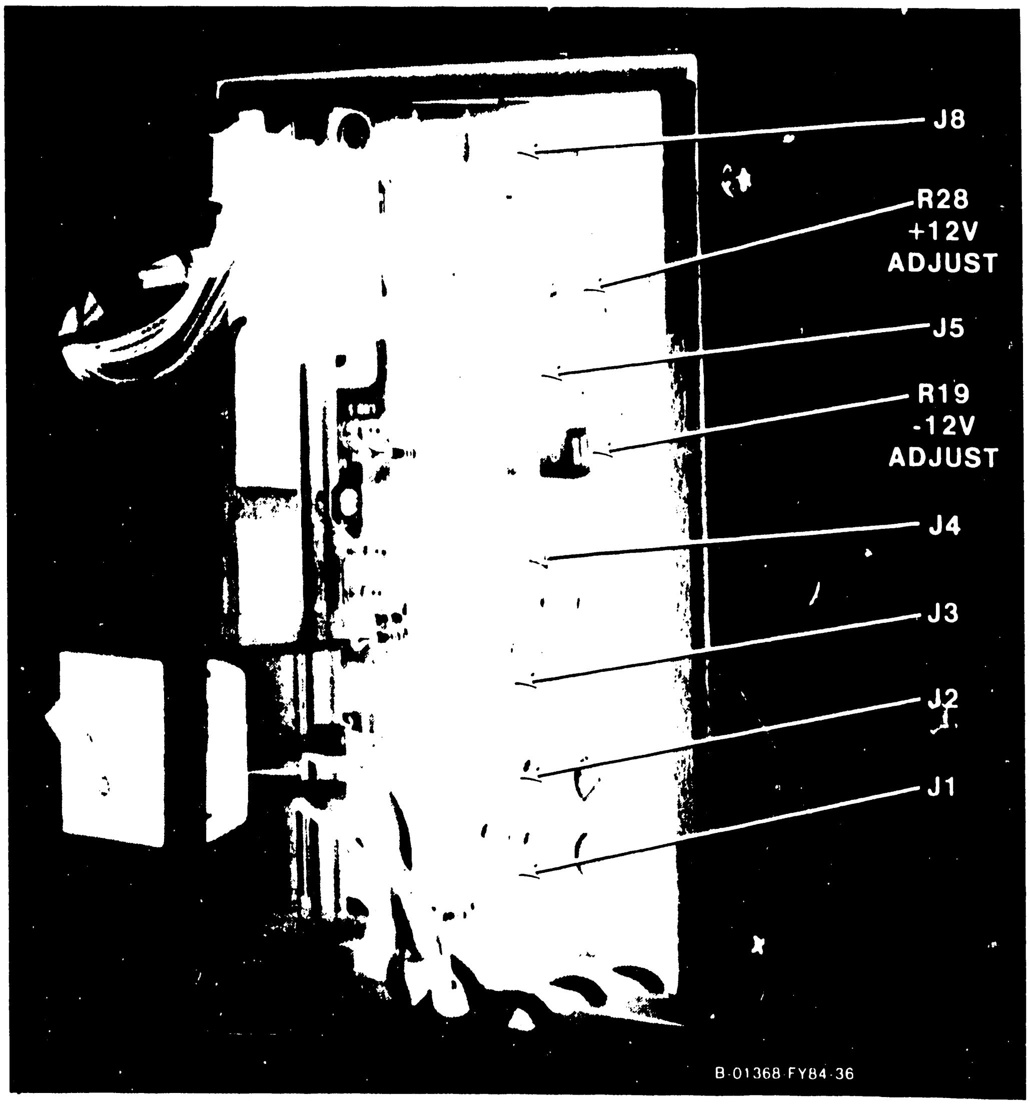


Figure 5-27. Switching Power Supply (Right Side View)

5.3.2.15 Power Supply Replacement

NOTE

After reinstalling the power supply, the dc voltages should be checked. If the dc voltages are not within operating limits (table 5-8), the switching power supply must be adjusted.

1. To reinstall the power supply, reverse the above procedure.
2. After making sure that the ac power On/Off switch is in the 0 position, plug the main frame power connector into the power source receptacle.
3. Perform the following in the sequence given:
   a. Depress the ac power On/Off switch to the 1 position.
   b. Make sure that the fans and the internal disk drive motor are turning. The Power On LED on the Front Panel, and the HEX Display LEDs should also be lit after the ac power ON/OFF switch has been pressed. If the HEX Display LEDs go out after 2 seconds, there is a problem with the dc voltage compare circuit in the power supply.
4. Using a digital voltmeter, check the voltages at the Motherboard test points (figure 5-28).
5. With a nonmetalic adjustment tool, adjust the voltage(s) to within the operating limits. (See figures 5-26 and 5-27 for the locations of the adjustment pots.)

Table 5-8. DC Test Point Voltages

TEST POINT	VOLTS	OPERATING LIMITS	AC RIPPLE LIMITS
TP1	+7-0	+7-0V	35mV RMS or 50mV Pk-to-Pk
TP2	+5.0	+4.95V to +5.05V	35mV RMS or 50mV Pk-to-Pk
TP3	-5.0	-4.95V to -5.05V	35mV RMS or 50mV Pk-to-Pk
TP4	+12.0	+11.9V to +12.1V	35mV RMS or 50mV Pk-to-Pk
TP5	-12.0	-11.9V to -12.1V	35mV RMS or 50mV Pk-to-Pk

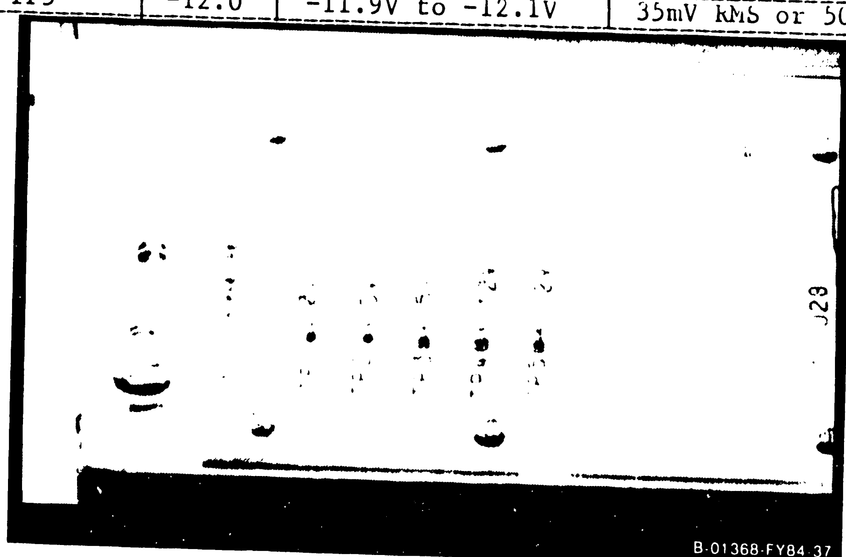


Figure 5-28. Motherboard Voltage Test Points

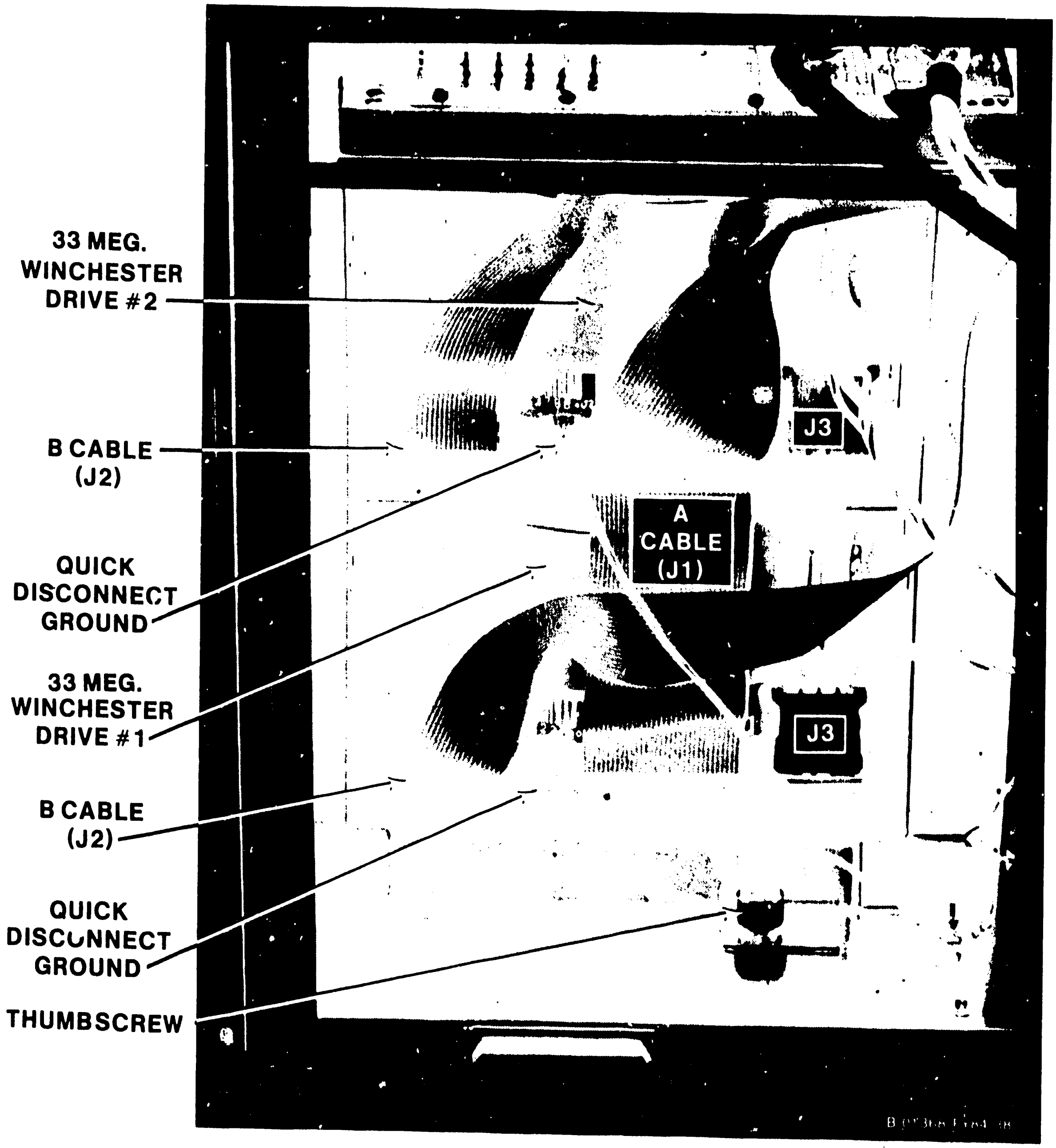
5.3.2.16 33 Megabyte Winchester Disk Drive Removal

To remove a drive:

1. Power down the main frame by depressing the ac power On/Off switch to the 0 position.
2. Remove the top and front covers (paragraphs 5.3.2.1 and 5.3.2.2).
3. Winchester drive #1 is always the bottom drive and drive #2, if installed, is the top drive. The A and B signal cables, dc power cable, and quick-disconnect ground wire are connected to the front of the drive(s). (Figure 5-29.) Note the locations of the connectors for reinstallation and remove the following connectors from the front of the disk drive(s). The connectors are keyed to ensure proper reinsertion.
   a. A signal cable(s) from J1.
   b. B signal cable(s) from J2.
   c. Four-pin dc power cable(s) from J3.
   d. Quick-disconnect ground wire(s) from the ground terminal lug.
4. Unscrew the spring loaded thumbscrew securing the front of the drive(s) chassis to the main frame base plate. Slide the entire chassis forward and out of the cabinet.
5. Remove the four Phillips screws (two on each side) securing the drive to the drive chassis. (Figure 5-30.)
6. Carefully slide the drive out of the chassis.

CAUTION

Be careful when removing the drive from the chassis. The logic PC board is on the bottom of the drive.



NOTE

Pin 1 (red stripe) of the A and B signal cables faces right when viewed from the chassis front.

Figure 5-29. 33 Megabyte Winchester Disk Drives (Front View)

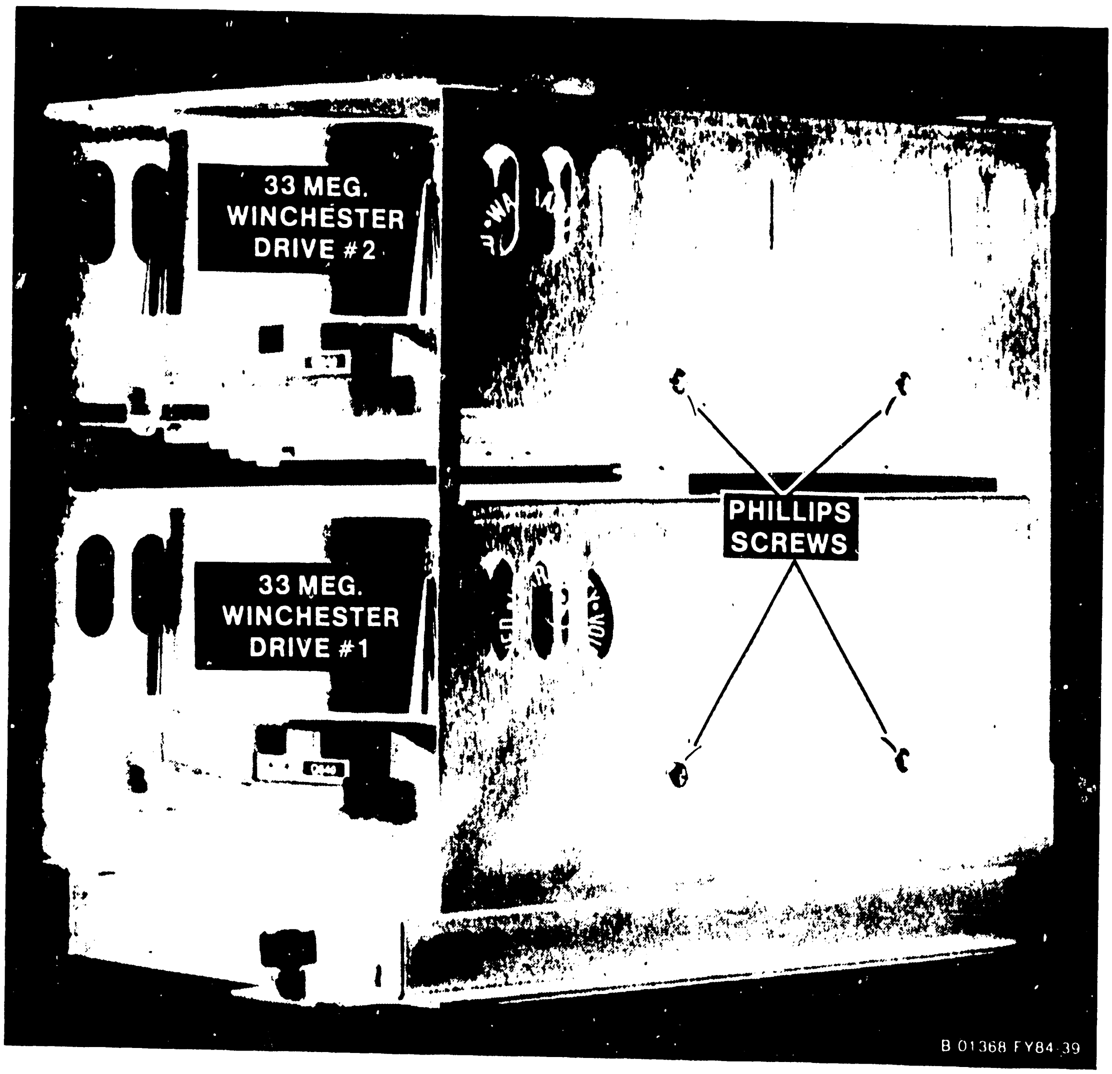


Figure 5-30. 33 Megabyte Winchester Disk Drives (Right Side View)

5.3.2.17 33 Megabyte Winchester Disk Drive Replacement

To replace a drive:

1. Before installing the drive, check the options jumpers and the terminator IC of the Winchester Drive PC board. They should be as follows. (See figure 5-31.)
   a. "Mask Servo Wedge" selected. (Top two pins jumpered at E7.)
   c. Drive Select to the appropriate DS pin. If the drive is to be #1, install the jumper on DS1; if the drive is to be #2, install the jumper on DS2. DO NOT jumper pin A. This will cause the drive to be selected constantly.
   e. A 220/330 ohm terminator pack at location RN3 of last drive in the A cable chain, Drive #1.

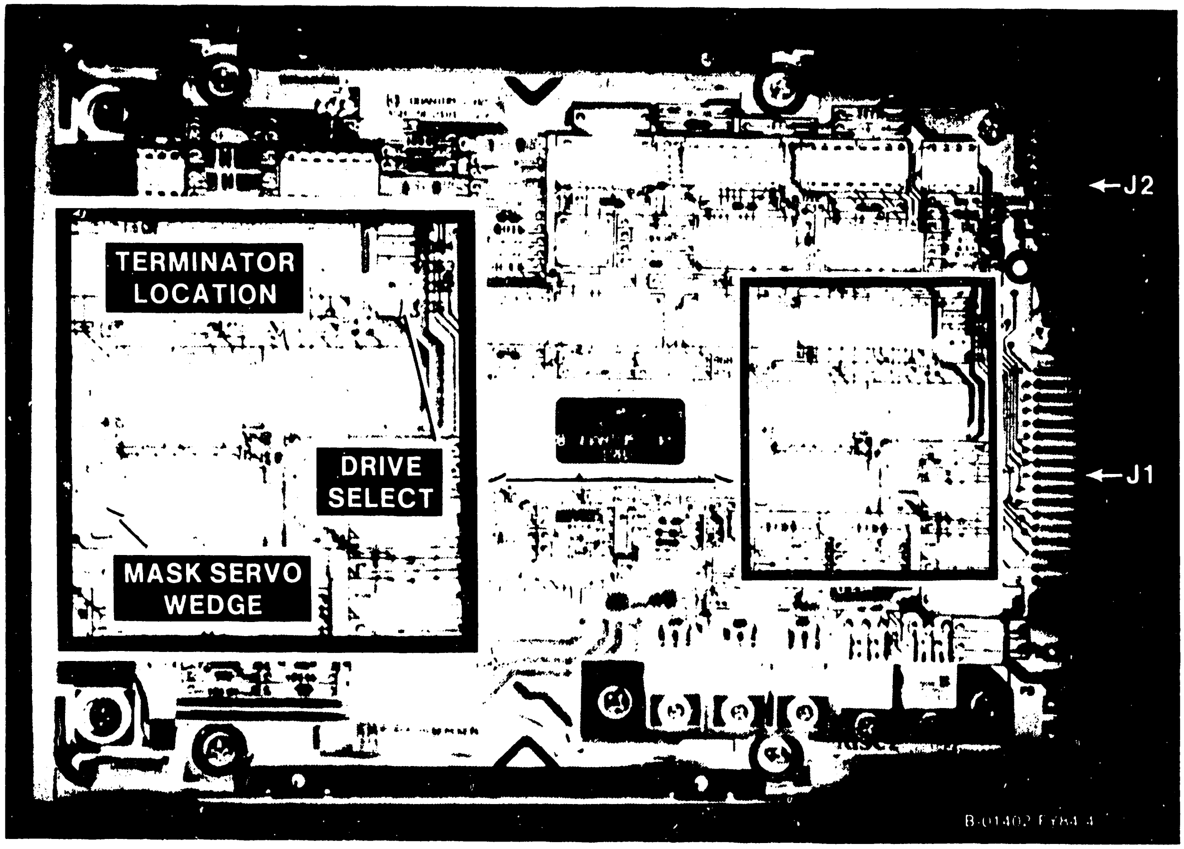


Figure 5-31. 33 Megabyte Winchester Drive Jumper Options

2. Carefully slide the drive into the chassis and reinstall the four Phillips screws.
3. Slide the entire chassis back into the cabinet and secure the spring loaded thumbscrew to the main frame base plate.
4. Reconnect the signal and power cables to the front of the drive as follows: (Refer to tables 5-4 and 5-5.)
   a. For one drive, connect the end of the A cable to J1 of drive #1.
   b. For two drives, the A cable is daisy chained from the 210-8362 DA board to J1 of drive #2 and then to J1 of drive #1.
   c. There is a separate B cable from the DA to J2 of each drive.
   d. Reconnect the quick-disconnect ground wire.

5.3.2.18 76 Megabyte Disk Drive Removal

To remove a drive:

1. Power down the main frame by depressing the ac power On/Off switch to the 0 position.
2. Remove the main frame top and front covers (paragraphs 5.3.2.1 and 5.3.2.2).
3. Make sure the drive has stopped turning, then remove the A and B signal, and dc power cable are from the front of the drive. (Figure 5-32.) Note the orientation of these cables for reinstallation.
4. Unscrew the spring loaded thumbscrew securing the front of the drive to the main frame base plate. Slide the drive forward and out of the cabinet.

CAUTION

The drive weighs approximately 30 pounds (14 kilograms).

5. Lock the spindle and carriage into their shipping position by moving the red Spindle/Carriage Lock Lever on the rear of the drive (figure 5-33) to the right, push it down as far as it will go, and then move it to the left into the Lock position.

NOTE

The 76 megabyte disk drive will be repaired by replacing individual printed circuit board assemblies. (Refer figure 5-36 and the 76 Megabyte NEC Disk Drive Maintenance Manual, WLI P/N 729-1452.) Do not order or replace the complete disk drive.

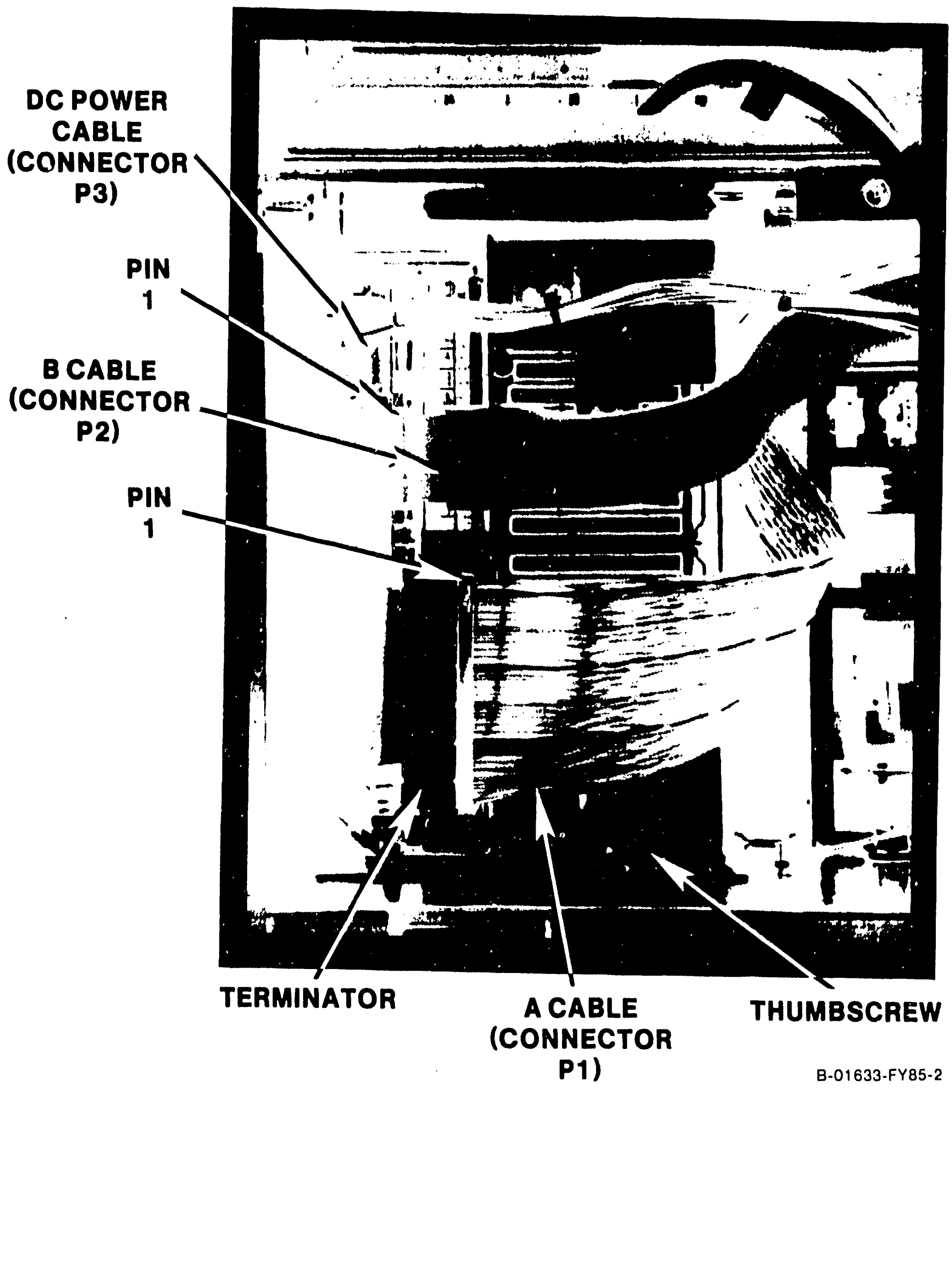


Figure 5-32. 76 Megabyte Disk Drive

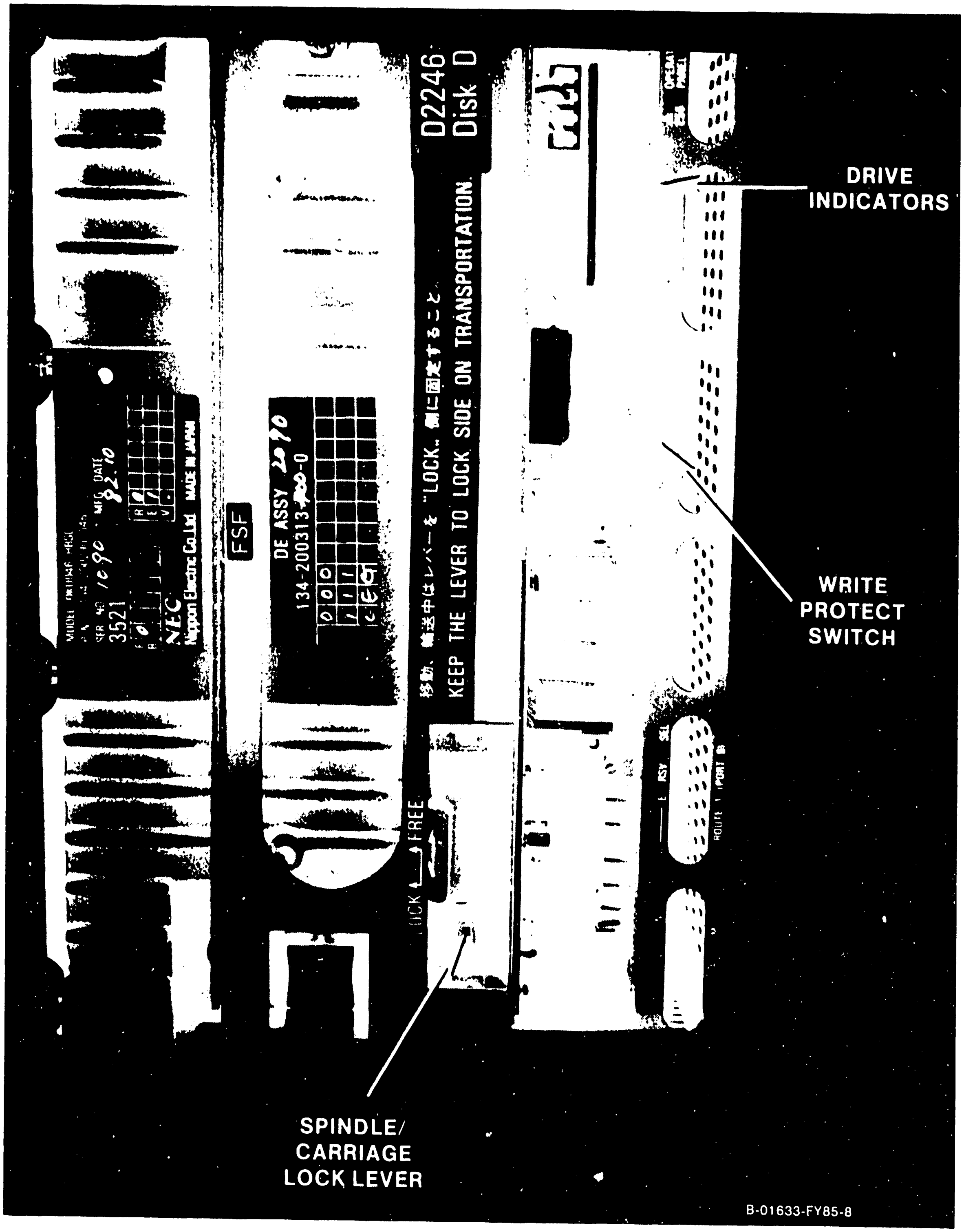


Figure 5-33. 76 Megabyte Disk Drive (Rear View)

5.3.2.19 76 Megabyte Disk Drive Replacement

To replace a drive:

1. If a new drive is been installed, check the terminators, and the Installation Mode, the Control Mode, and the Number of Sectors switches on the Logic/Servo PCB in the drive as follows:
   a. Lay the drive down on its left side, with the red Spindle/Carriage Lock Lever toward the front.
   b. Remove the two Phillips screws (figure 5-34) from the upper right corner and the lower left corner of the right side cover. Carefully lift off the cover.
   c. Remove the three signal cables from P55, P53, and P41 on the top of the Logic/Servo board (figure 5-35). Note the positions of the cables for reinstallation.
   d. Remove the two Phillips screws from the upper left corner and the lower right corner of the board. Carefully tip the board to the left so that the component side is facing up. There is a single ground wire and a 2-wire cable still connected to the board.
   e. Check each of the three switches as shown in figure 5-35. They must be set as shown in the figure. The Number of Sectors and the Control Mode switches have clear plastic covers that must be removed before the switches can be set. Make sure to put the covers back on before reinstalling the board.
   f. Before reinstalling the board, make sure that the four terminators shown in figure 5-35 have been removed.
   g. Carefully tip the board back to its normal position, backplane side up, and reinstall the two Phillips screws. Make sure that the 2-wire cable does not get caught between the board and the upper left board bracket.
   h. Reinstall the three signal cables and the the 9-pin power connector on the board.
   i. Make sure that there are no cables in the way and carefully reinstall the right side cove and the two Phillips screws.
   j. Set the drive back to its normal vertical position with the red Spindle/Carriage Lock Lever facing toward the rear.
2. Unlock the spindle and carriage from their shipping position by moving the red Spindle/Carriage Lock Lever on the front of the drive (figure 5-33) to the right, push it up as far as it will go, and then move it to the left into the Free position.
3. Carefully slide the drive back into the cabinet and secure the spring loaded thumbscrew to the main frame base plate.
4. Reconnect the signal and power cables to the front of the drive. (The dc power cable goes to the 9-pin connector J4 on the switching power supply. Figures 5-27 and 5-36.)

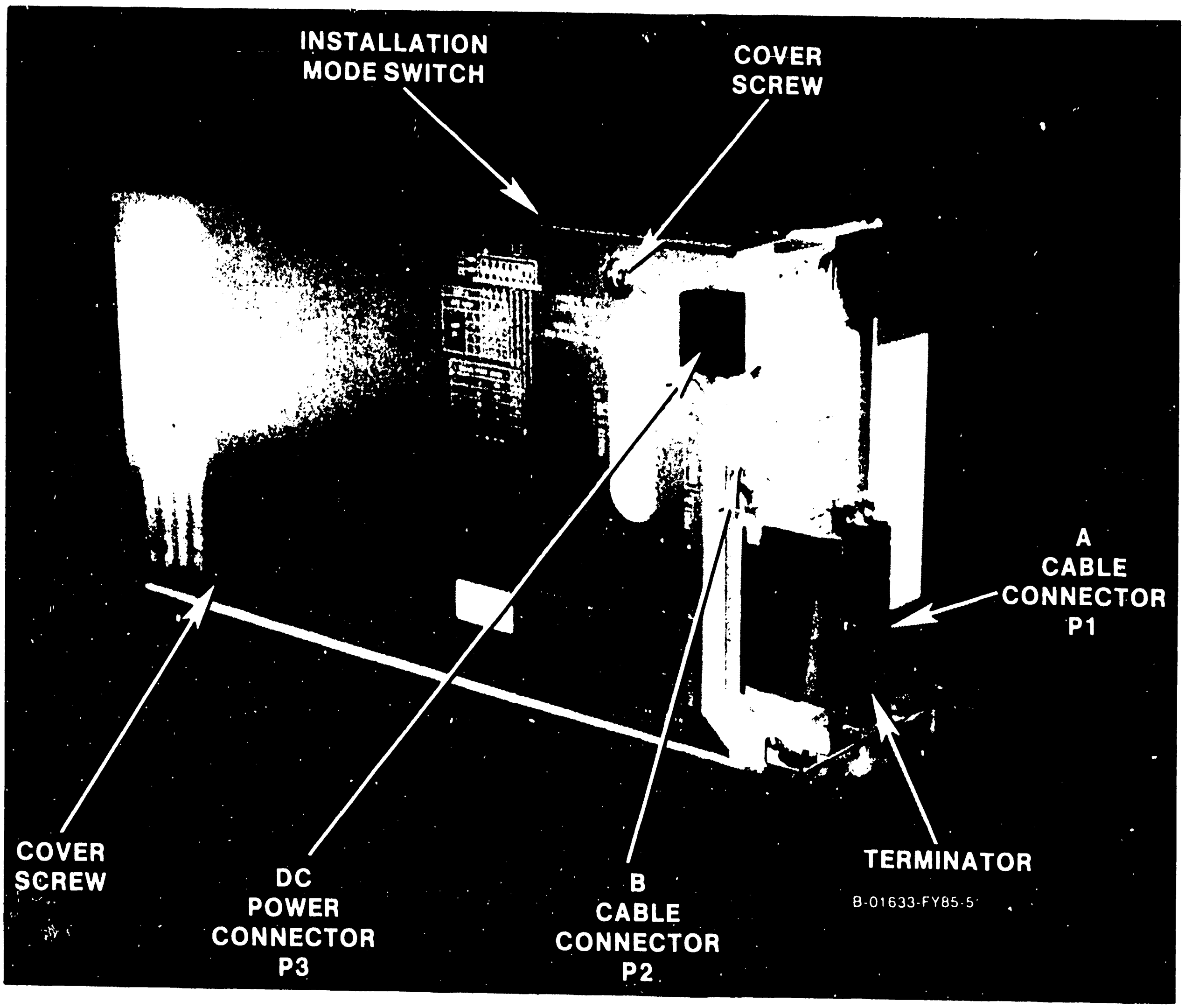


Figure 5-34. 76 Megabyte Drive (Side View)

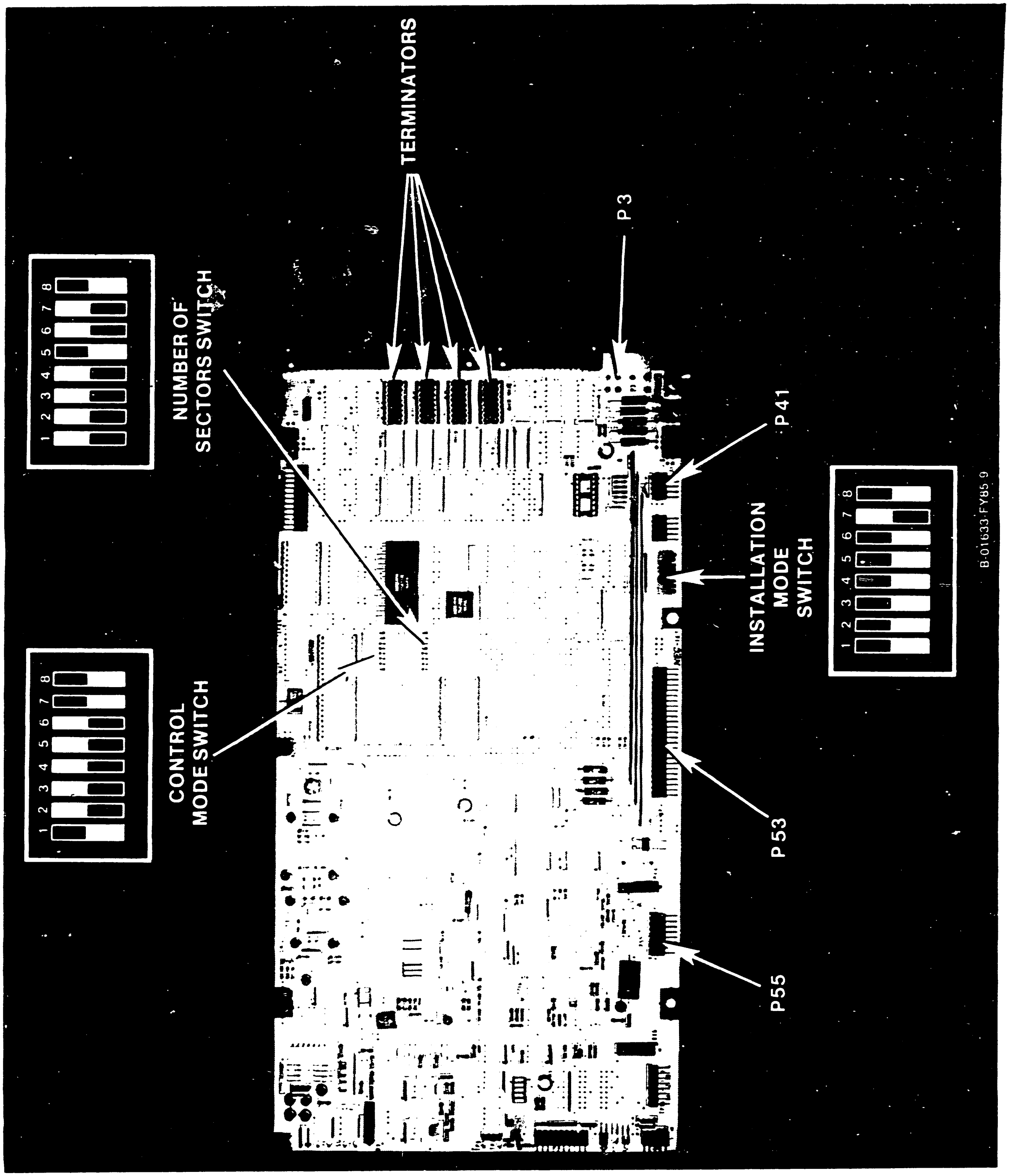


Figure 5-35. Disk Drive Logic and Servo PCB

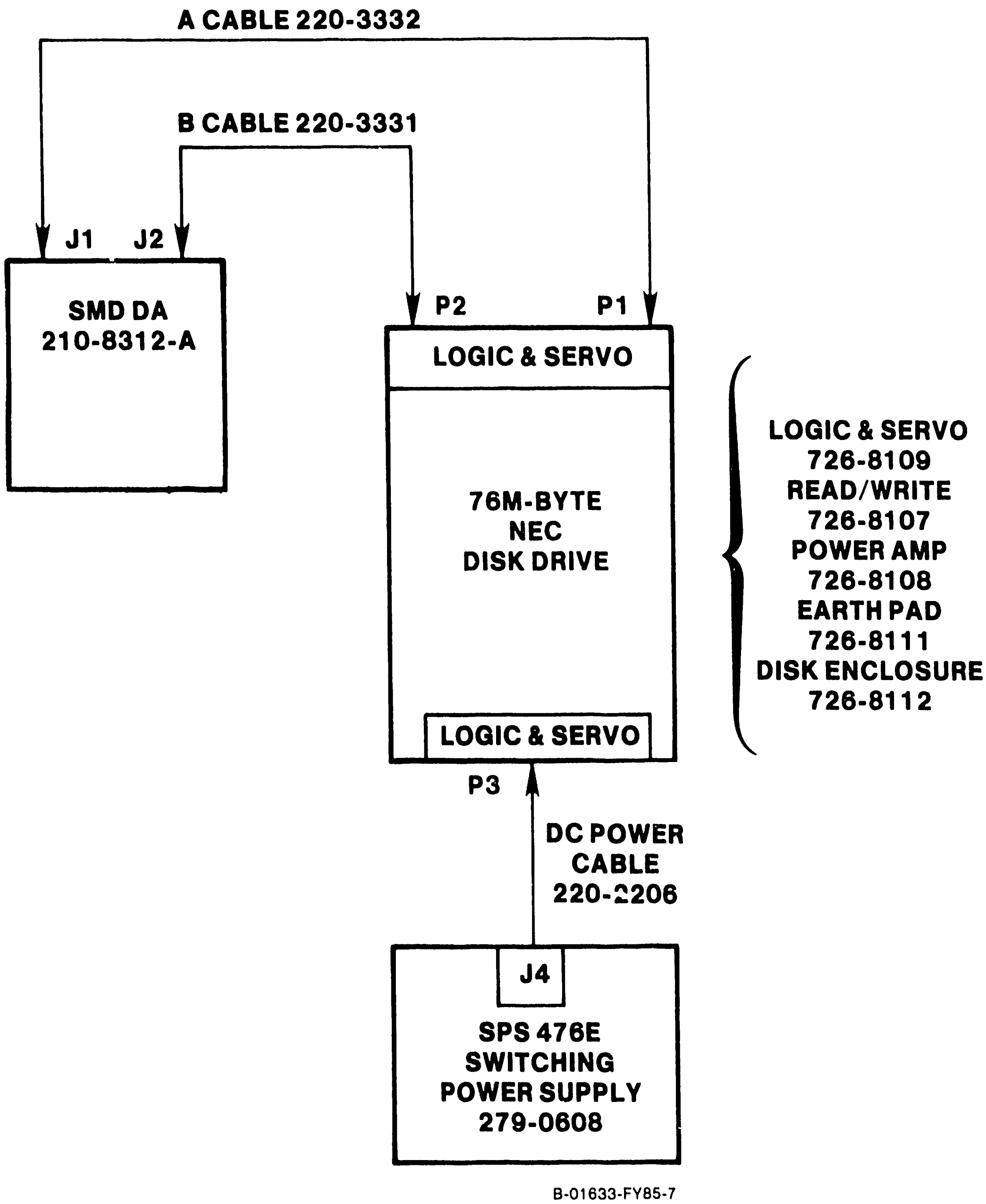


Figure 5-36. 76 Megabyte Disk Drive Cable Interconnections

5.3.2.20 Diskette Drive Removal

The Shugart SA455 Diskette Drive is located at the top right of the main frame chassis. To remove the diskette drive:

1. Power down the main frame by depressing the ac power On/Off switch to the 0 position.
2. Remove the top and front covers (paragraphs 5.3.2.1 and 5.3.2.2).
3. Remove the 34-pin signal connector from J1, and the 5-pin dc connector from J2 on the rear of the drive. (Figure 5-38.) The connectors are keyed to ensure proper reinsertion.
4. Unscrew the spring loaded thumbscrew at the top of the drive that secures the drive to the chassis. (Figure 5-37.)
5. The drive is seated between one top and one bottom rail. Slide the drive straight out the front of the main frame.

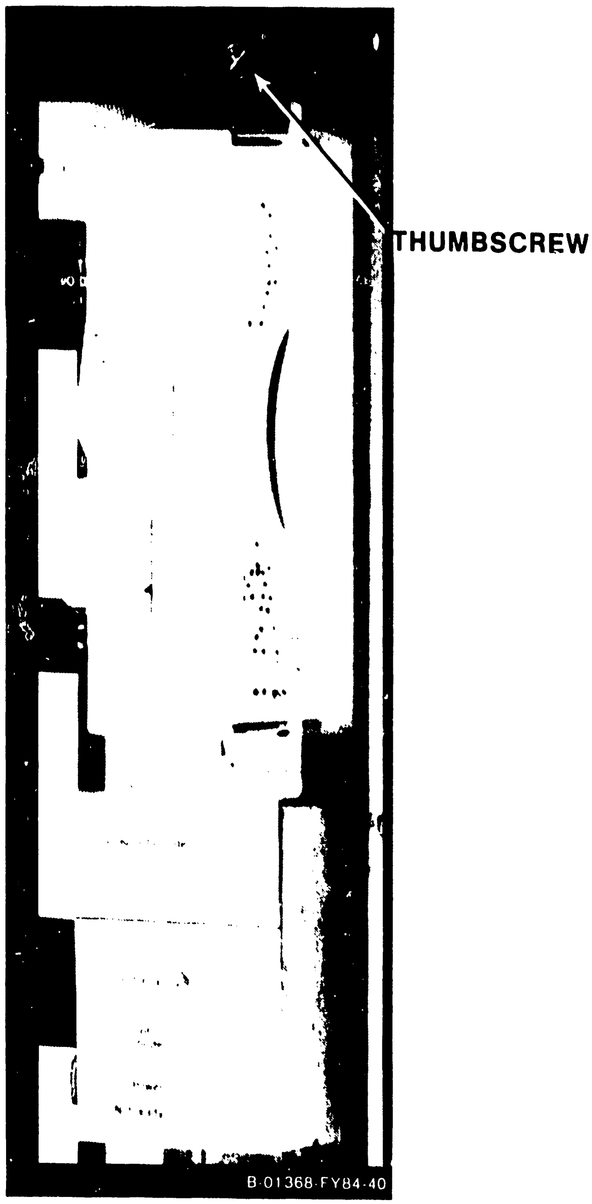


Figure 5-37. SA455 Diskette Drive

5.3.2.21 Diskette Drive Replacement

1. To reinstall the Diskette Drive, reverse the above procedure.
2. Check the jumpers on the component side of the logic PC board of the drive. They should be the same as the drive that was removed, as shown in figures 5-38 and 5-39.

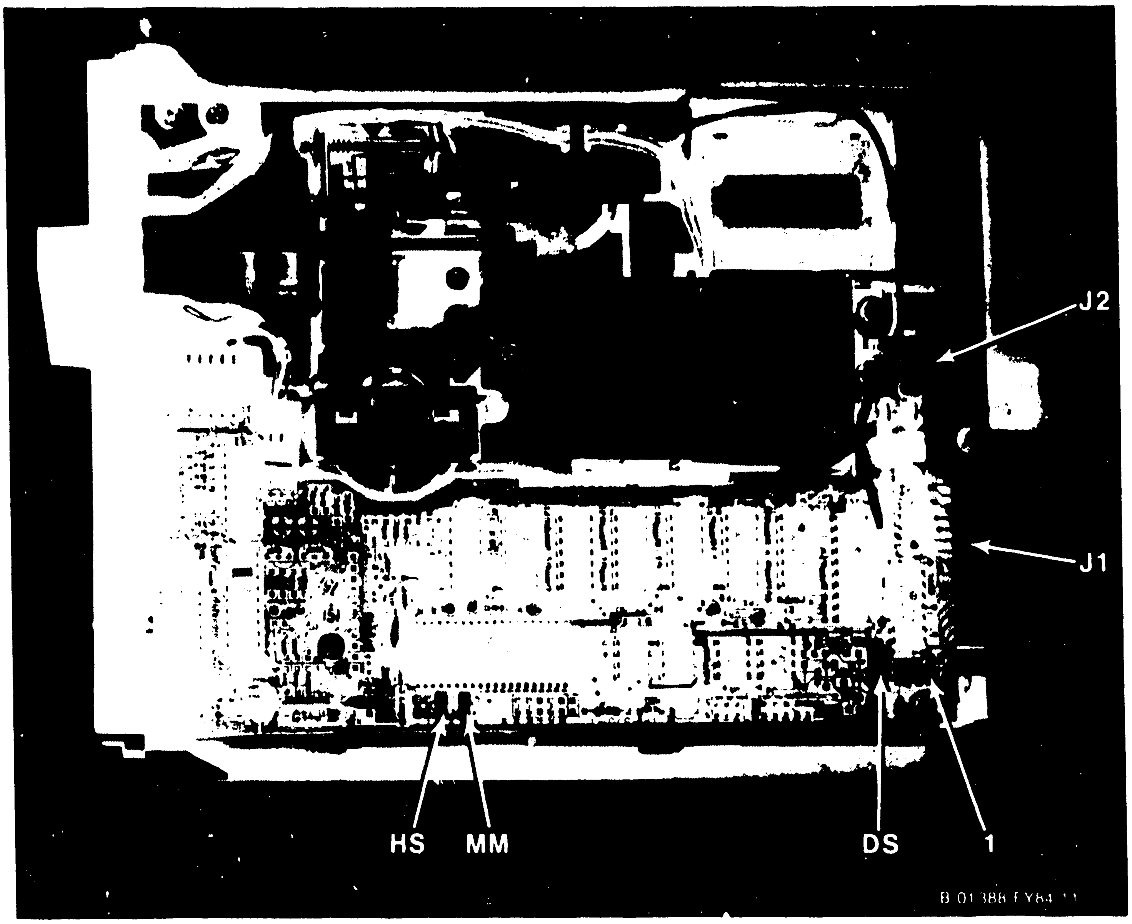


Figure 5-38. SA455 Diskette Drive PC Board Jumpers

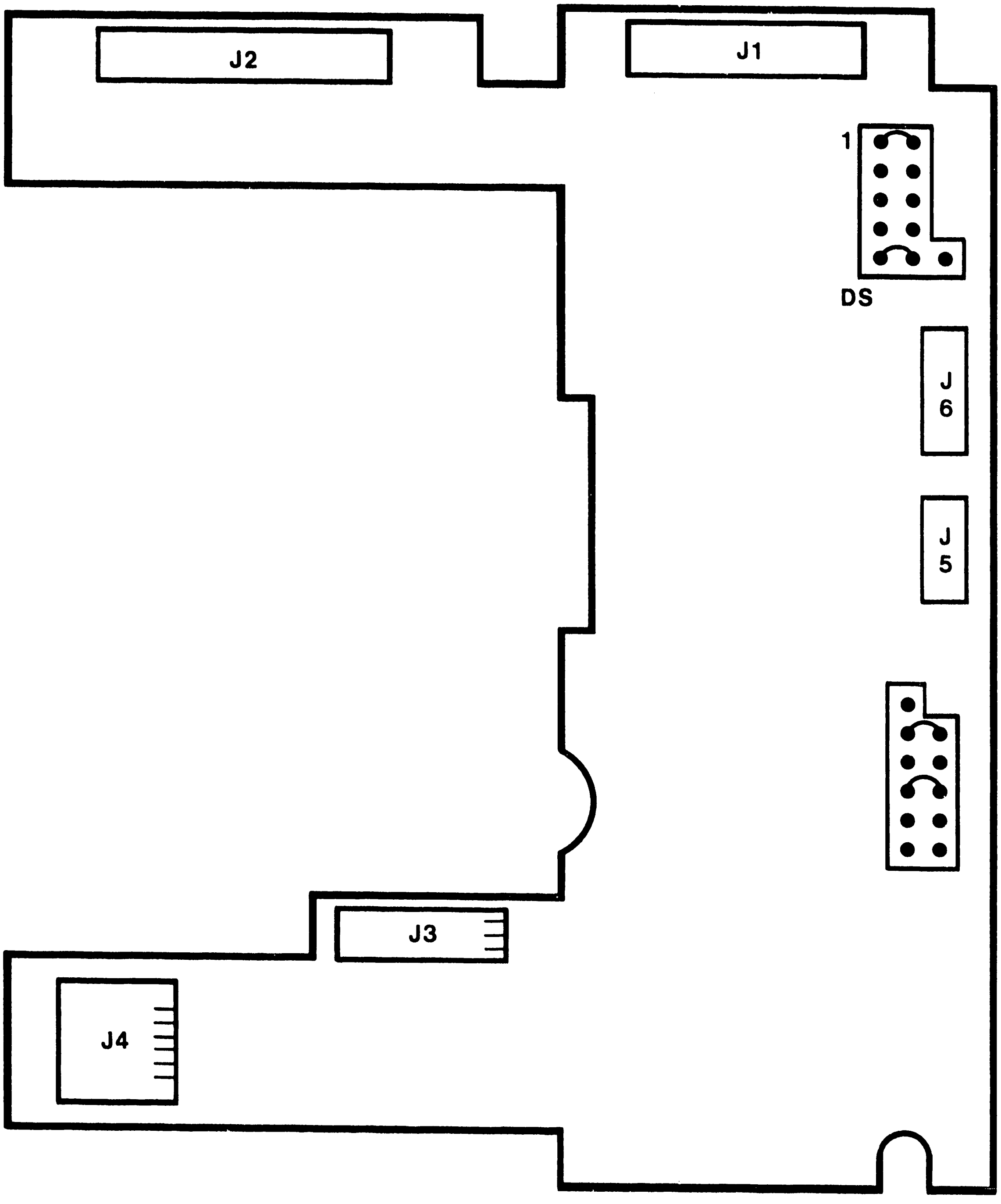


Figure 5-39. SA455 Diskette Drive PC Board Jumpers

5.3.2.22. Fan Removal

The two cooling fans used in the VS-15 main frame cabinet are mounted horizontally on the back panel assembly of the main frame. To remove a fan:

1. Power down the main frame by depressing the ac power On/Off switch to the 0 position and unplug the power connector from the power source receptacle.
2. Remove the top cover (paragraphs 5.3.2.1).
3. a. If the left fan, as seen from the rear, is to be replaced, remove only the four hex head screws securing the left fan screen and fan to the rear panel assembly. (Figure 5-40.)
   b. If the right fan is to be replaced, remove all eight hex head screws securing both of the fan screens and fans to the rear panel assembly.
4. Unscrew the two spring loaded thumbscrews from the inside top of the fan panel.
5. Carefully lower the entire rear panel assembly enough to allow access to the fans. Brace the panel in this position. Be careful of the I/O cables connected to the rear panel assembly.
6. Disconnect the ac power connector(s) at the fan(s). (Figure 5-41.)
7. To replace the right fan, the left fan must be removed first through the cutout in the top of the panel. Then, remove the right fan through the cutout. The left fan can be replaced without having to remove the right fan.

5.3.2.23 Fan Replacement

To install a fan, reverse the above procedure.

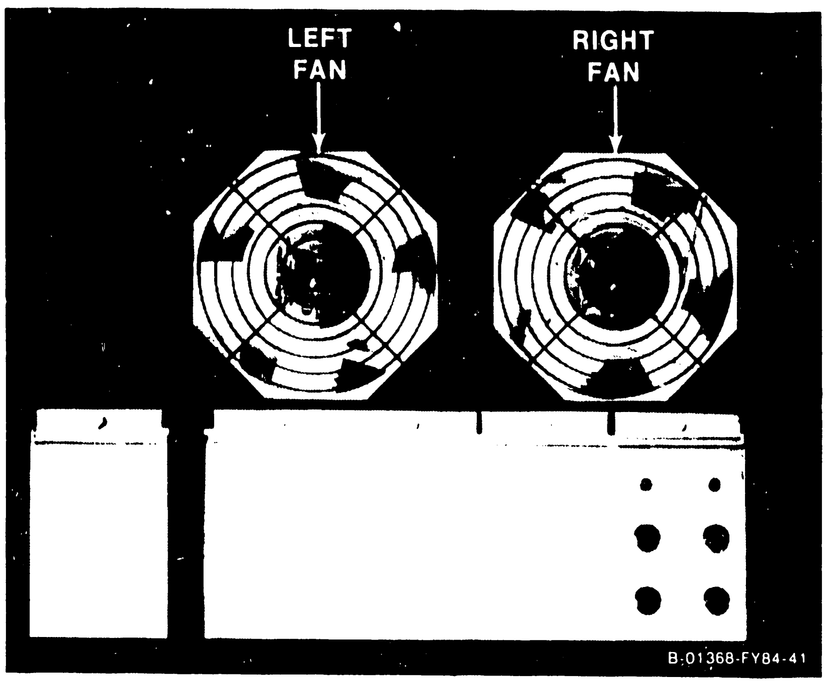


Figure 5-40. Rear View of Fan Panel Assembly

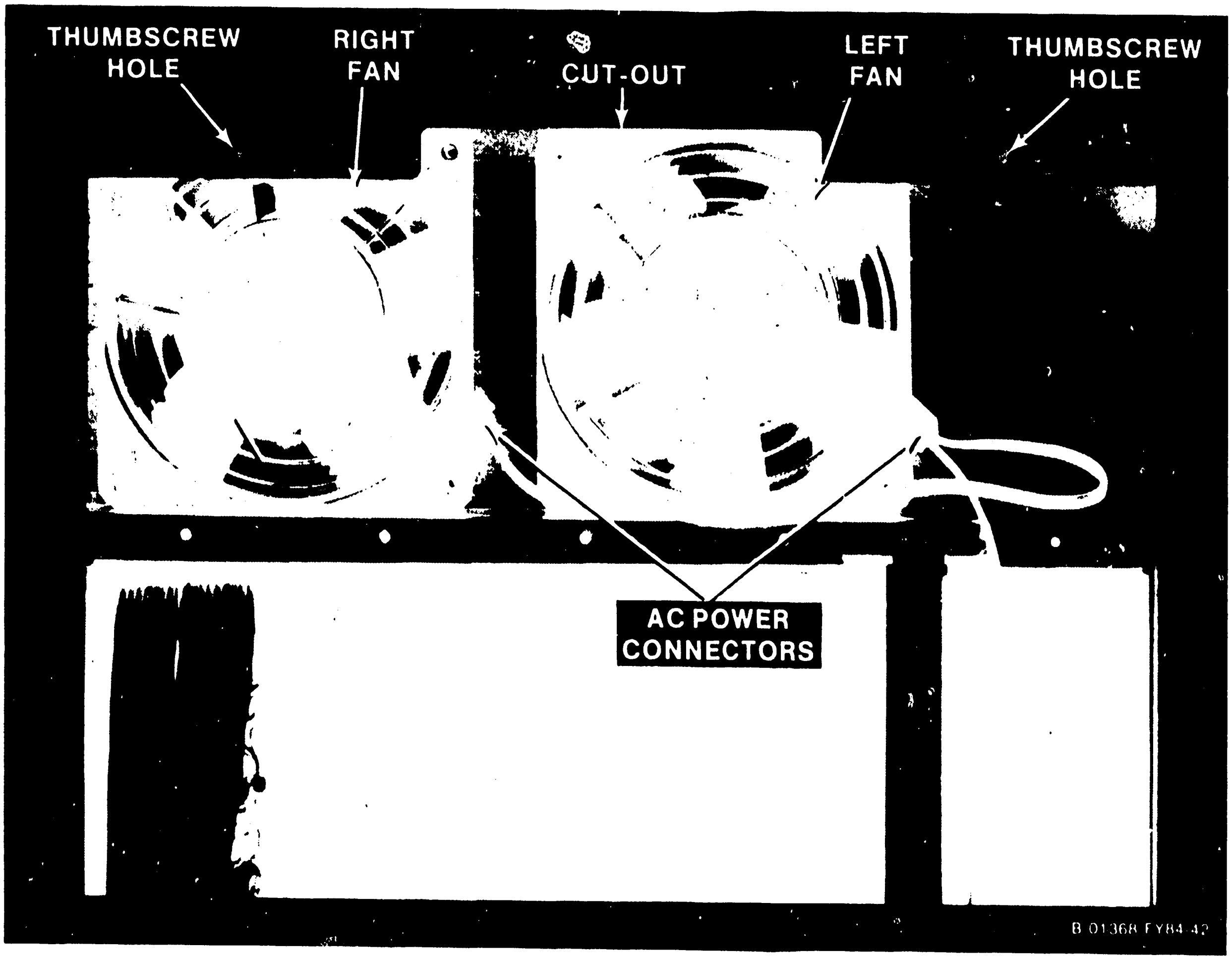


Figure 5-41. Inside View of Fan Panel Assembly

CHAPTER 6 SCHE- MATICS

CHAPTER 6

SCHEMATICS

Schematics are not provided as part of this Standard Manual. The schematics will appear in a combined VS-15/25/45 Computer System Schematics Manual.

CHAPTER
7
ILLUSTRATED
PARTS
BREAKDOWN

CHAPTER 7

ILLUSTRATED PARTS BREAKDOWN

7.1 SCOPE

This chapter contains the illustrated parts breakdown for the VS-15 Computer System. Use this breakdown for part number identification when ordering field-replaceable components.

Internal Signal Cable Part Numbers

FROM PC BOARD	(CONNECTOR)	TO PC BOARD	(CONNECTOR)	PART NUMBER
210-8358	J1	210-8613	J1	Note
"	J2	Rear Panel	RS232	220-3349
"	J3	Diskette Drive	J1	220-3353
210-7906	J2	Rear I/O Panel	BNC/TNC	220-3080
"	J3	" " "	" "	" "
"	J4	" " "	" "	" "
"	J5	" " "	" "	" "
210-8616	J3	Rear I/O Panel	BNC/TNC	220-3080
"	J4	" " "	" "	" "
"	J5	" " "	" "	" "
"	J6	" " "	" "	" "
210-8362	J1	33MB. Dr. #1	J2 (B cable)	220-3352
"	J2	33MB. Dr. #2	J2 (B cable)	220-3351
"	J3	33MB. Dr. #1&2	J1 (A cable)	220-3350
210-8312	J1	76MB. Drive	P1 (A cable)	220-3332
"	J2	" "	P2 (B cable)	220-3331
210-8337	J1	Rear TC Panel	RS449	N/A
"	J13	" " "	X.21	N/A
"	J2	" " "	RS232	220-0333
"	J3	" " "	RS366	220-0333
"	J4	Front TC Panel	Display	220-3247
210-8637	J2A	Rear TC Panel	RS232	220-0333
"	J3A	" " "	RS366	220-0333
"	J13A	" " "	X.21	N/A
"	J2B	" " "	RS232	220-0333
"	J3B	" " "	RS366	220-0333
"	J13B	" " "	X.21	N/A
"	S1 & S2	Front TC Panel	Display	220-3012

NOTE

This cable is part of 210-8613 Front Panel board

Internal Power Cable Part Numbers

FROM PC BOARD	(CONNECTOR)	TO PC BOARD	(CONNECTOR)	PART NUMBER
210-8611 Switching P/S	Ac input		Power source receptacle	420-2025 Power cord
210-8611 Switching P/S	J1, 2, J3 (Note)	33MB. Drive(s)	J3	220-0406
		Diskette Drive	J2	220-0405
	J4	76MB. Drive	P3	220-2206
	J5	210-8607	J31	220-0407
	J8	210-8607	J30	220-3193
210-8612 Switching P/S	Fan	Rear fan panel	Fans	220-1980
	+5V Bus	210-8607	J28 (+5V)	220-0408
	0V Bus	210-8607	J29 (+/-0V)	220-0409

NOTE

J1, J2, and J3 are parallel dc output connectors.

RAM Replacement Chips

BOARD P/N	DESCRIPTION	WLI RAM P/N	VENDOR	VENDOR P/N
210-8303	CPU C.M.	377-0413	Hitachi	HM6147-3
210-7900	Main Memory	377-0415-X	See Series I/D	

SERIES I/D	VENDOR	VENDOR P/N	WLI P/N
377-0415-X	Texas Inst.	TMS4164C-2	377-0415
377-0415-X	Fujistu	MB8264-20	726-8101-F
377-0415-X	Hitachi	HM48641P-3	726-8101-H
377-0415-X	Intel	D2164-20	726-8101-I
377-0415-X	Motorola	MCM6665AL-20	726-8101-M
377-0415-X	Mostek	MK4560/P-15	726-8101-MX
377-0415-X	NEC	UPD4164C-2	726-8101-N

Switching Power Supply Fuses

FUSE	LOCATION	RATING	WLI PART NUMBER
F1	210-8611	4 Amp/250 Volts SB	360-1040
F1	210-8612	10 Amp/250 Volts FB	360-1100
F2	210-8612	2 Amp/125 Volts (Pico)	360-1155
F3	210-8612	2 Amp/125 Volts (Pico)	360-1155

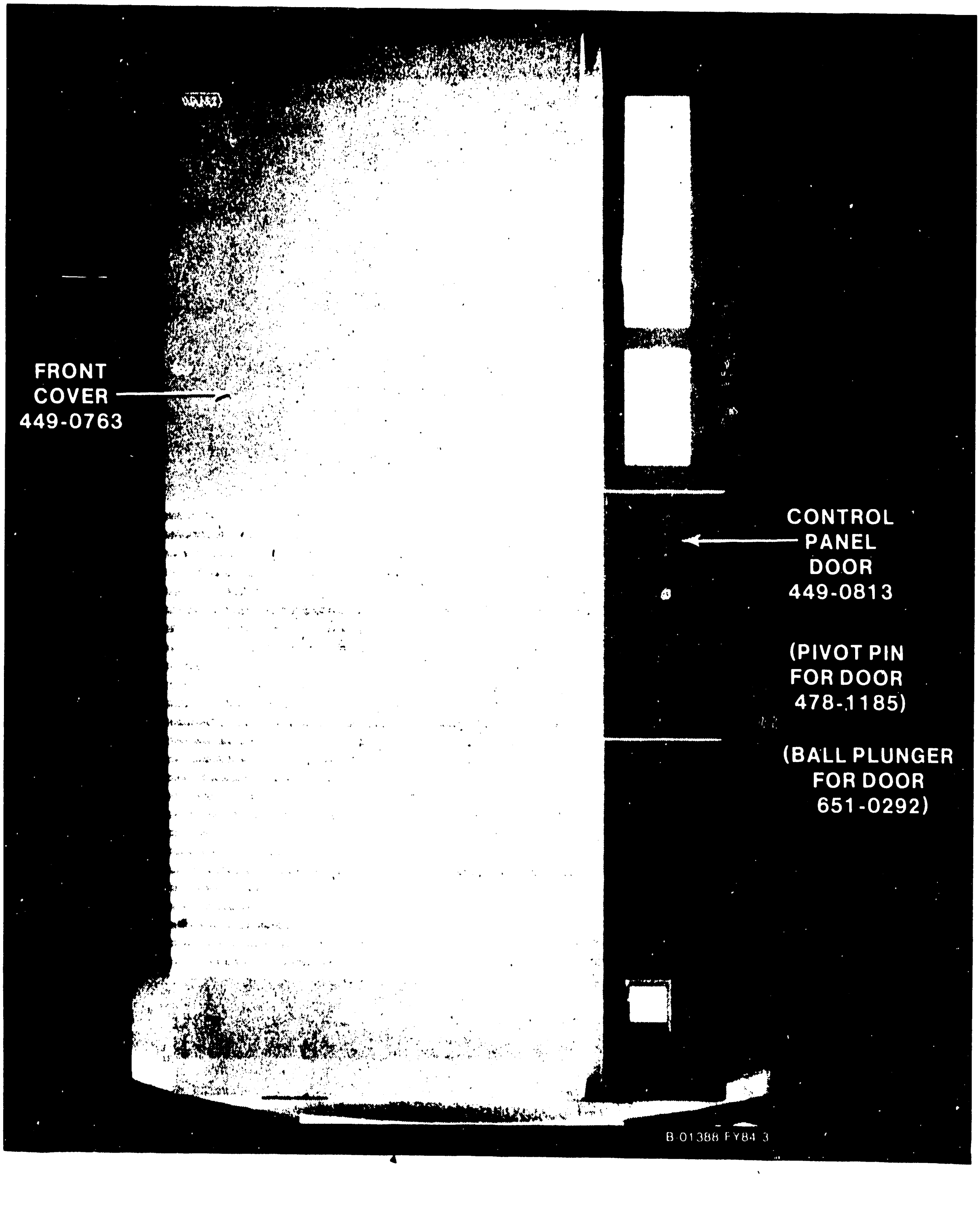


Figure 7-1. VS-15 Front Cover

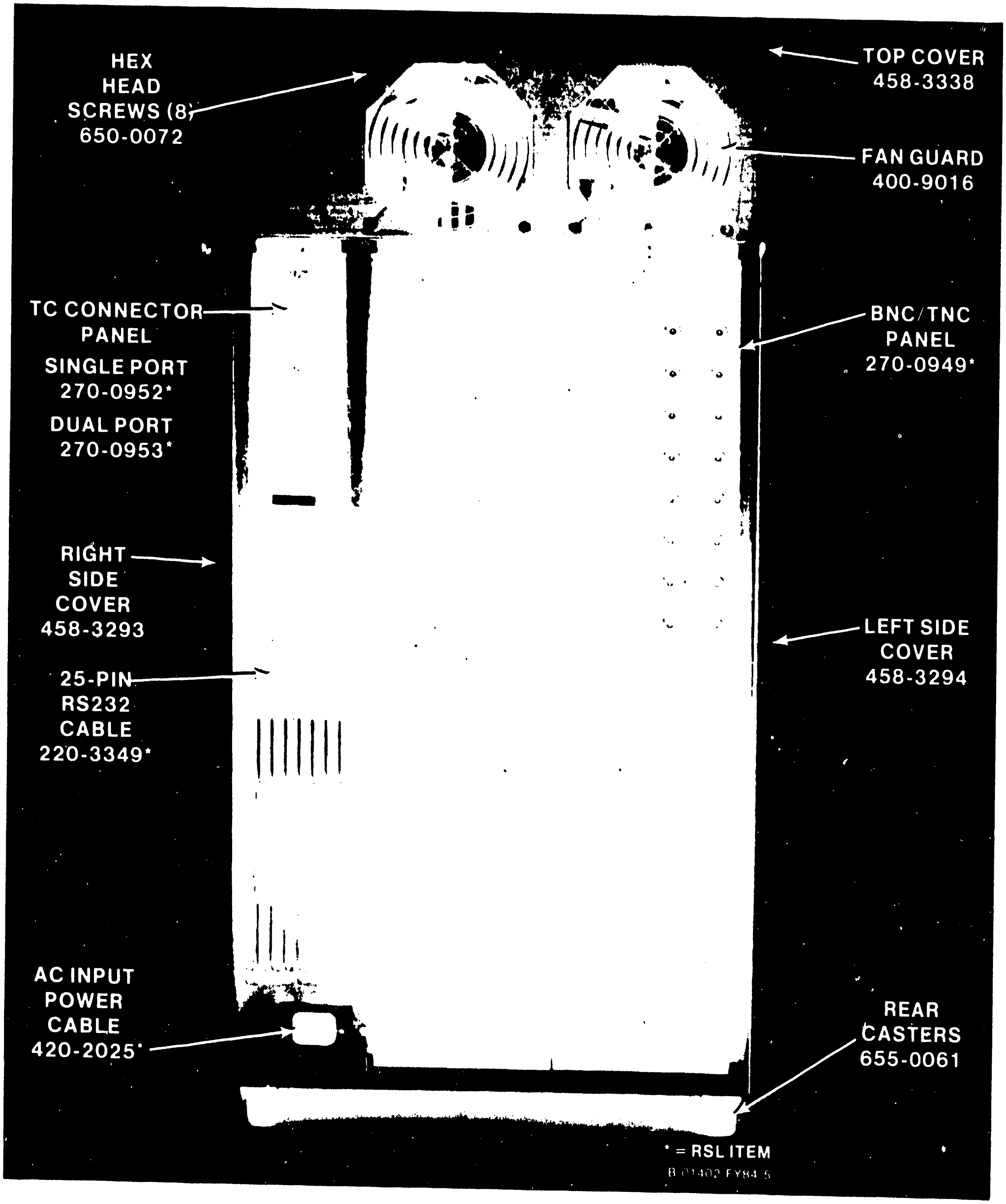


Figure 7-2. VS-15 Rear Panel

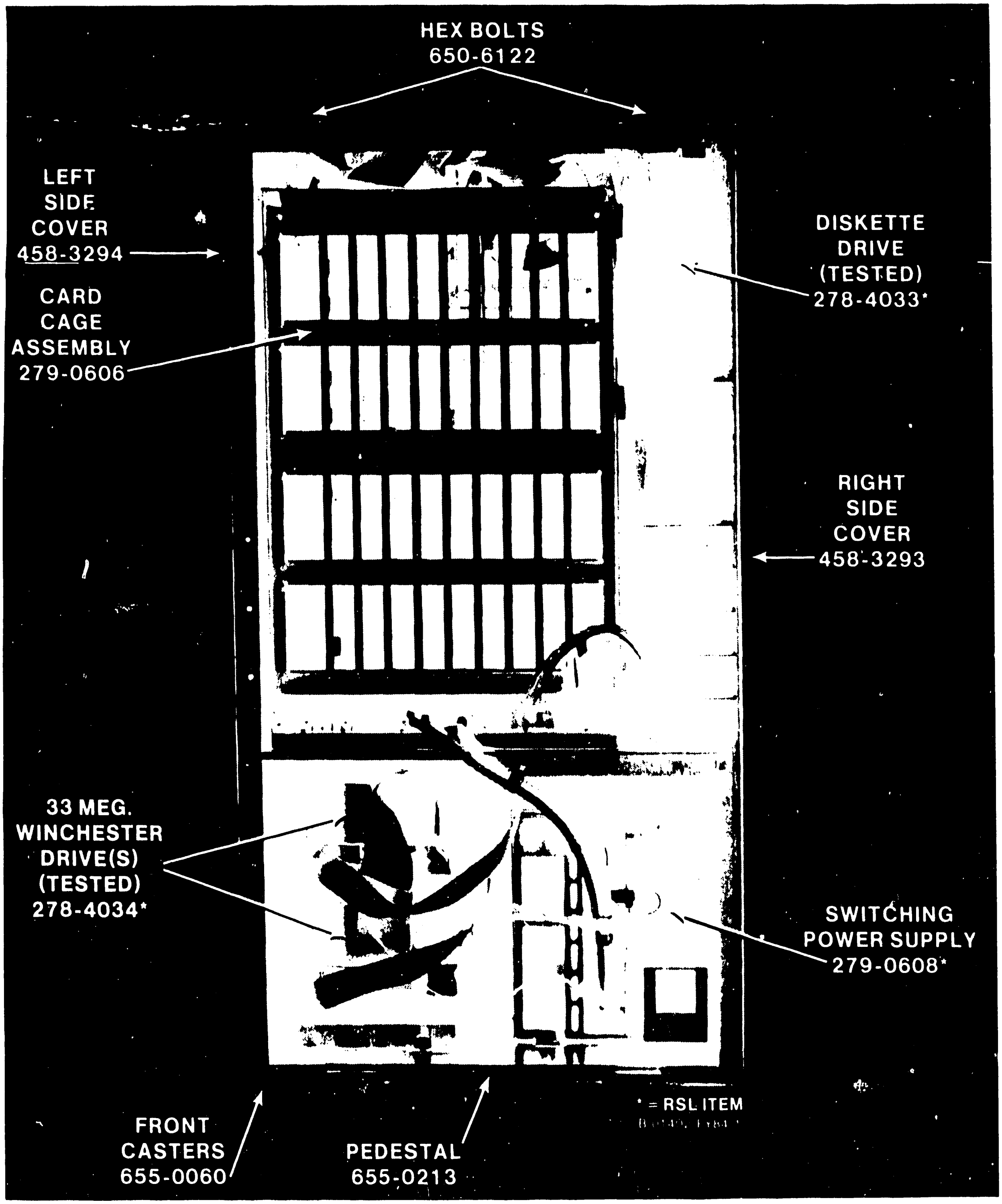


Figure 7-3. VS-15 Front View (Cover Removed)

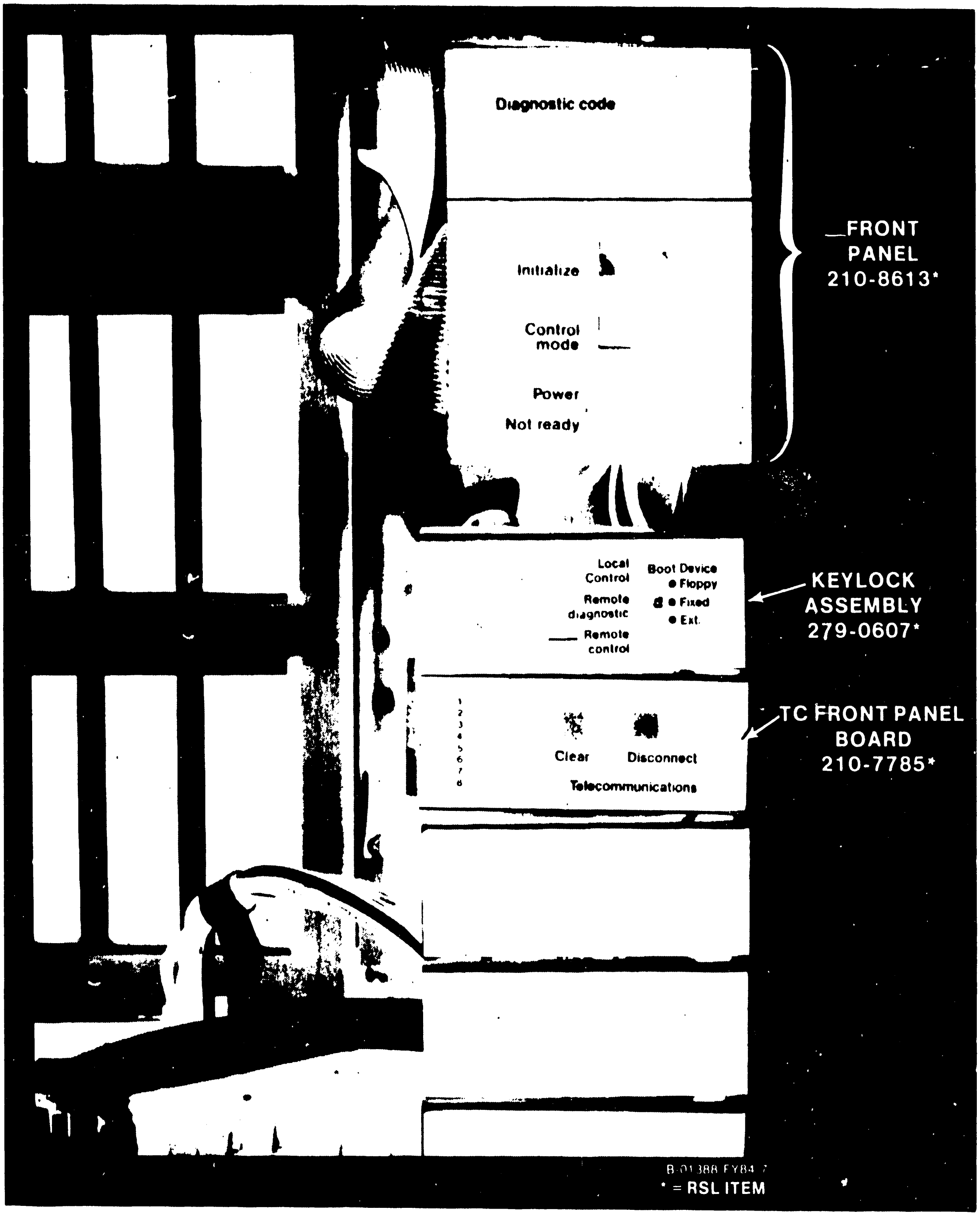


Figure 7-4. VS-15 Front Panel

Figure 7-5. VS-15 Motherboard Power Connectors

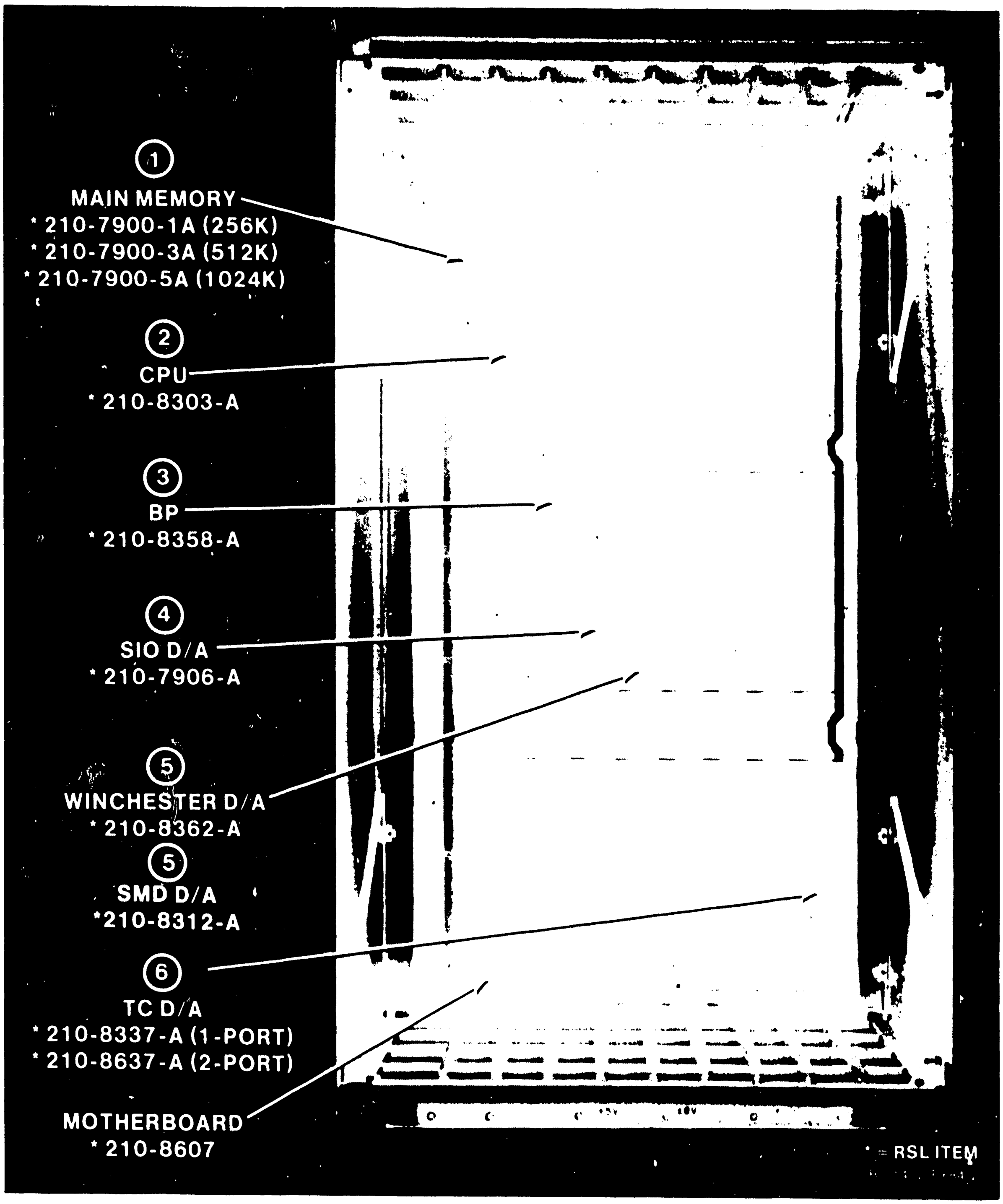


Figure 7-6. VS-15 Motherboard

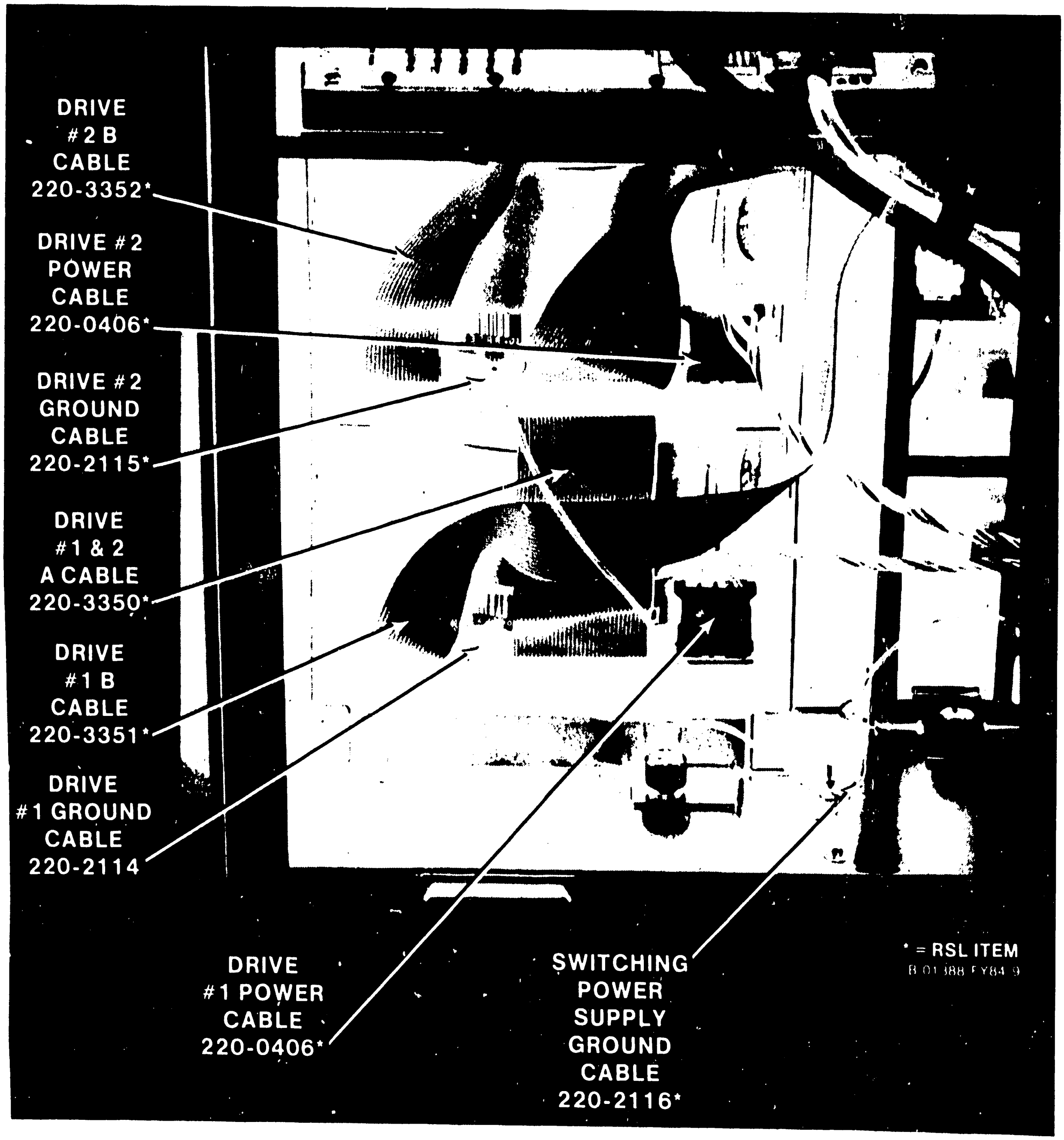


Figure 7-7. 33 Megabyte Winchester Disk Drives

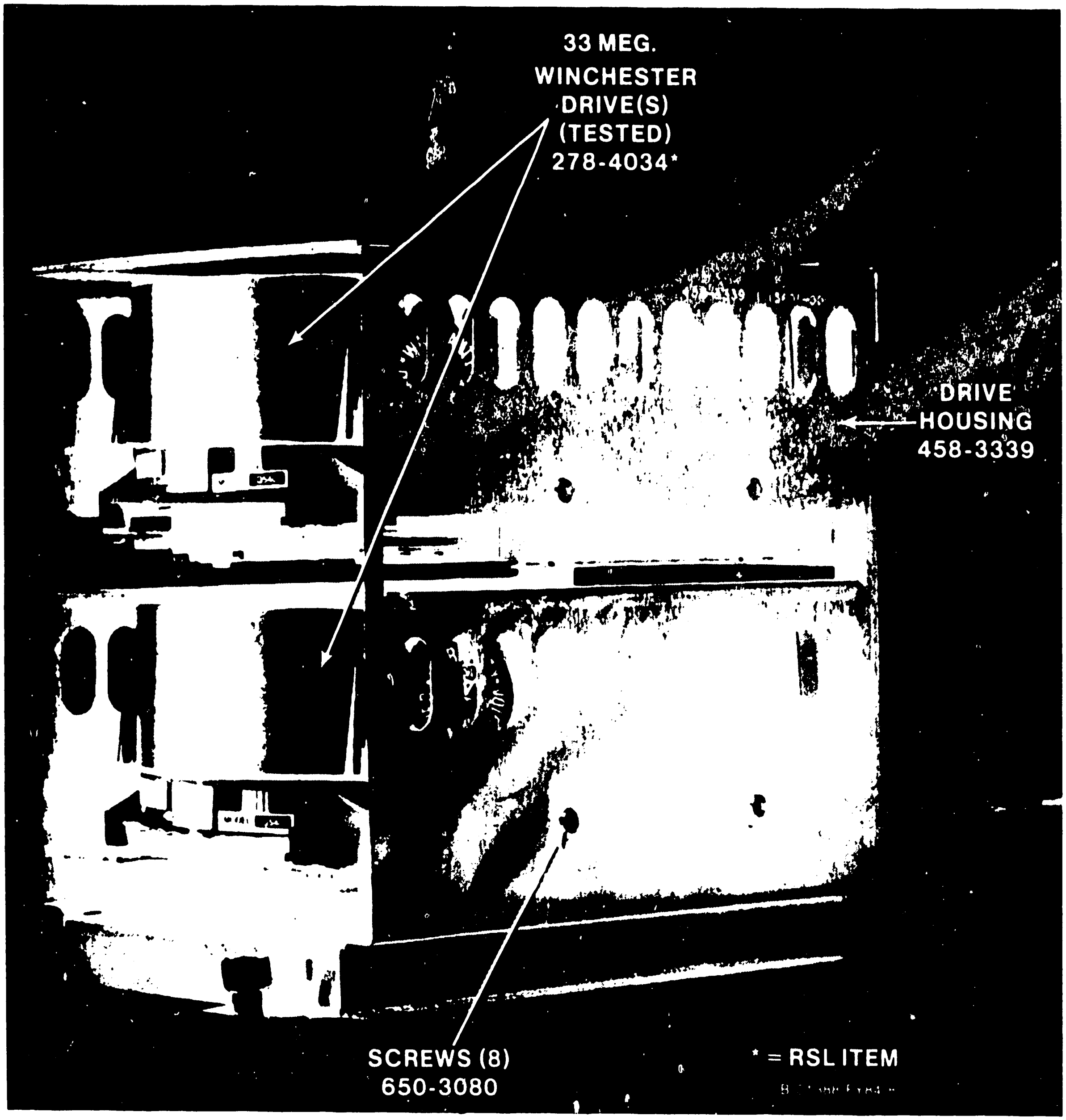


Figure 7-8. 33 Megabyte Winchester Disk Drives (Right Side View)

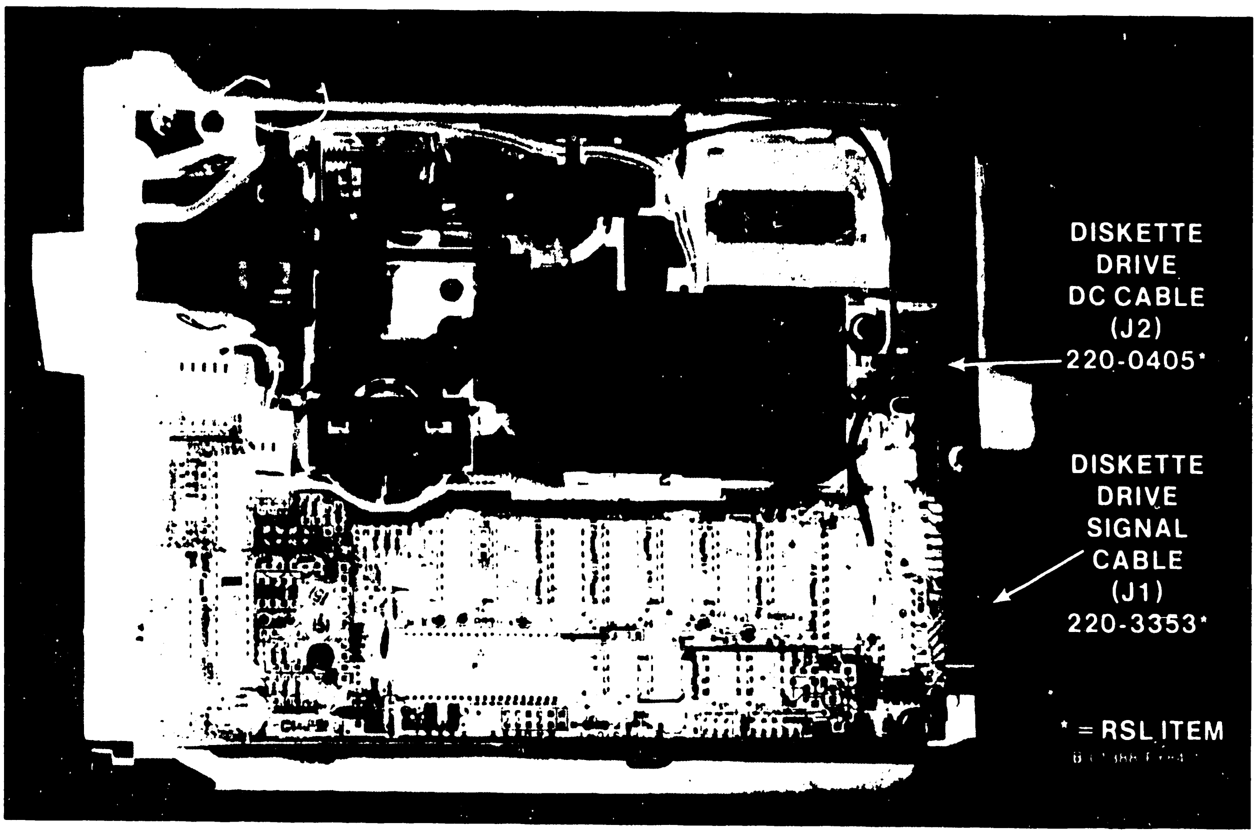
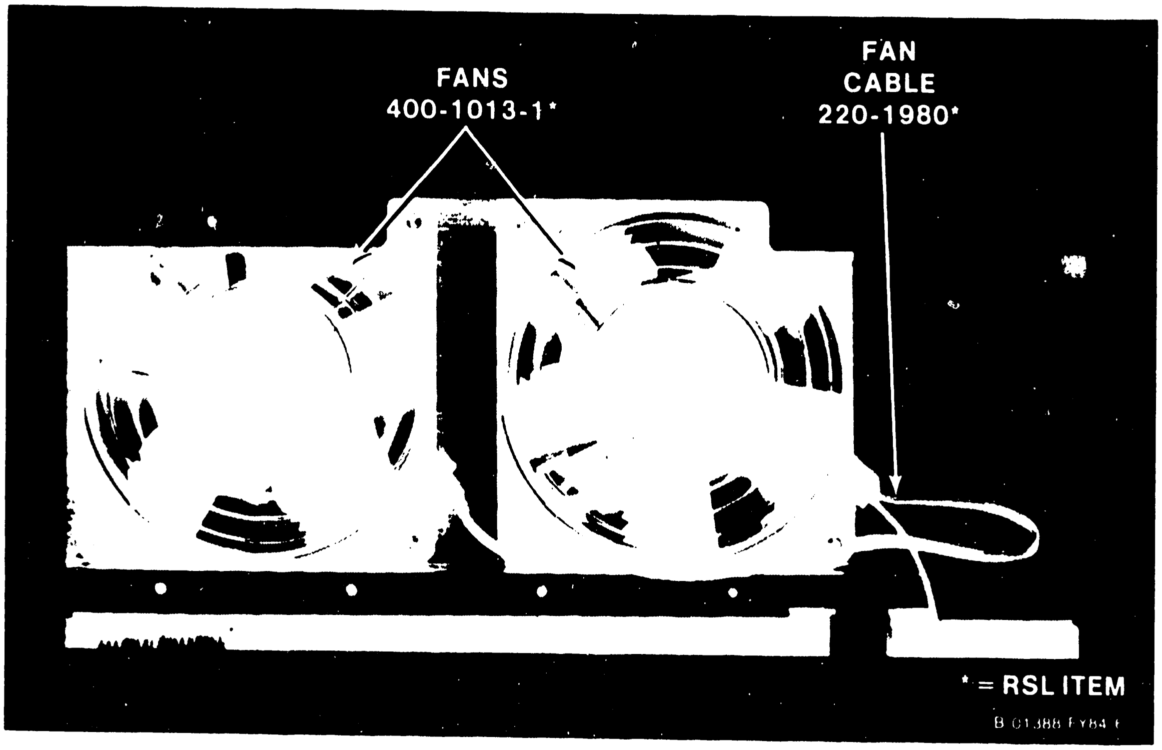


Figure 7-9. SA455 Diskette Drive



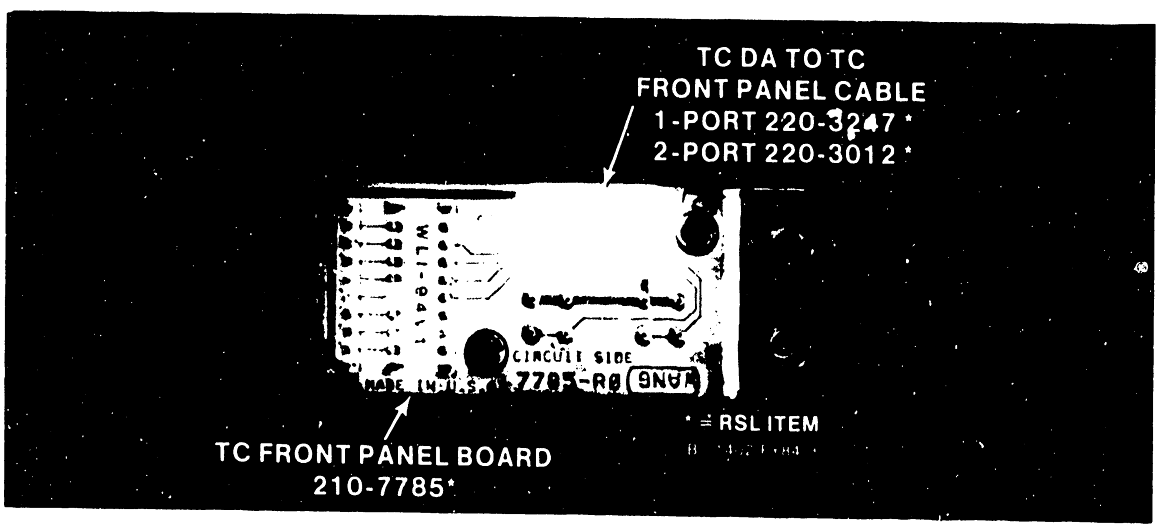


Figure 7-10. VS-15 Fans and TC Front Panel

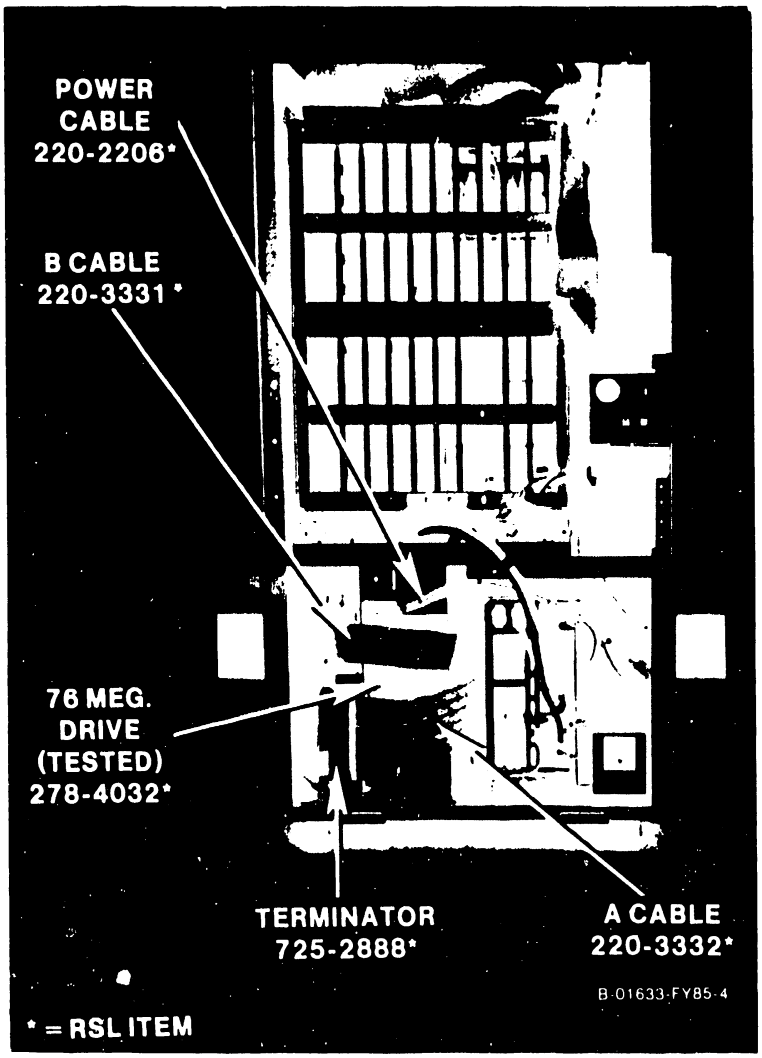


Figure 7-11. 76 Megabyte Disk Drive

CHAPTER 8

TROUBLE-SHOOTING

CHAPTER 8

TROUBLESHOOTING

8.1 GENERAL

This chapter describes the various diagnostic test programs available on the VS-15, and gives guidelines for their use. It also provides guidelines for isolating fault locations of field replaceable (or repairable) units.

The diagnostic programs perform a number of comprehensive tests of the system hardware functionality in a building block manner. They provide multi-level error isolation options so that the user can pursue error situations down to the board, and if necessary, the chip level. The packaging of the programs on the VS-15 mini-floppy diskettes provides for easy access and usage. A description of the diagnostics available, along with a discussion of their usage follows.

8.2 DIAGNOSTIC FACILITIES

The VS-15 system uses the same diagnostic and error reporting concept as the VS-25/45 with some differences in functionality and packaging. Three types of diagnostic facilities are available to the VS-15: Off-line or stand-alone diagnostics (also referred to as inner-level diagnostics); on-line peripheral diagnostics (often referred to as outer-level diagnostics) which are operating system dependent and are under the control of the VS Operating System; and remote diagnostics via a hardware diagnostic telecommunications link to the Remote Maintenance Center. With these diagnostics the CE is able to efficiently isolate and repair most of the problems that occur in the system.

During installation (or after repair), all available off-line diagnostics must be run to check the CPU. In addition, and prior to new system turnover to the customer, the CE must initiate a remote link verification with the TAC VS Support Group to insure operation of the Remote Diagnostic Support mode (refer to section 4.13, Remote Diagnostic Certification Procedures).

Like the VS-25/45, all VS-15 systems have a 2K byte Nonvolatile Random Access Memory (NVRAM). The primary function of the NVRAM is to provide information during a Remote Diagnostic Support session. It contains customer and service log information, system hardware and software configuration, and is maintained by battery backup during any power-off condition.

8.3 OFF-LINE DIAGNOSTICS

The VS-15 system architecture (CPU) and disk drives can be thoroughly tested using an integrated set of off-line (stand-alone) hardware diagnostics running on the 8086 microprocessor controlled Bus Processor (BP). These off-line diagnostic programs provide a sophisticated, yet user-friendly, interface with the CPU.

There are three sets of off-line core diagnostics available on the VS-15.

1. PROM-based: Power-up diagnostics do rudimentary testing and verification of the most basic aspects of a given board. Currently, three boards have PROM-based core diagnostics: the Bus Processor; the Intelligent Serial I/O Device Adapter (ISIO DA); and the Telecommunic ion Device Adapter (TC DA). Each of these boards run concurrent power-up diagnostics.

2. CRAM-Based: Self-Test Monitor (STM) diagnostic package. It is implemented automatically by the Bus Processor upon successful completion of the PROM-based diagnostics when the system is IPLed.

3. CRAM-Based: Optional (or Default if Self-Test failure) 'Stand-Alone' Diagnostic Monitor, implemented on the Bus Processor, provides additional and more sophisticated tests with which the CE can isolate specific faults detected by the Self-Test Monitor.

8.3.1 POWER-UP CORE DIAGNOSTICS (PROM-BASED)

When the VS-15 is turned on (or during re-IPL), the CPU goes through an automatic initialization phase before it allows the operator to interface with the system. CPU PROM-level diagnostic programs are automatically accessed during the normal power-up procedure. CRAM-level diagnostics are bypassed (on all CPU boards) if the BP diagnostic switches are not set to the 'OFF' position (refer to paragraph 8.5.1, page 8-12, and table 5-3, page 5-9).

8.3.1.1 Bus Processor Diagnostics

The PROM-based core diagnostics allow the Bus Processor to verify its internal operation and its interface to the selected bootstrap device prior to loading the first CRAM-based intelligence. Circuitry which requires signals that are not internal to the BP, or used to bootstrap the system are not verified. This includes circuitry such as Main Memory DMA, Remote Diagnostic USART, the Nonvolatile RAM (NVRAM), and the Real-Time-Clock (RTC).

Beginning with the decrementing of the Front Panel's four digit hexadecimal (HEX) display (see paragraph 8.3.1.4), the Bus Processor initiates the loading and/or testing of a number of basic core functions. For example, the BP verifies its PROM (checksum), and loads and verifies the Programmable Interrupt Controllers and Interrupt Timers. It then tests the Code RAM (CRAM) and Data RAM (DRAM) integrity and function, communication with data and addressing lines, and parity error detection. The Wait State Generator is loaded and wait states are verified. The bootstrap device is tested and, when available, its diagnostic space (cylinder) is verified.

The Bus Processor, after successfully completing its PROM-based diagnostics and loading the VTOC handler (@MCBOOT@), reads its diagnostic switches to determine its next operation. If all switches are in the standard operational position, the BP will find and load the Self-Test Monitor, continuing with its diagnostic testing until the IPL selection screen appears.

An additional verification of the functionality of the BP's DRAM and CRAM, is the reading in of the VTOC handler and then the Self-Test Monitor (STM) diagnostic package. Each are read as data into the DRAM and then moved by the

BP to the CRAM. The BP also verifies the Workstation Zero (WS-0) channel (go/no-go only), and if no errors are detected, it then loads and runs the serial I/O controller. The WS-0 code is loaded, and the IPL selection screen is then displayed. This screen allows the selection of the IPL device or the loading of the Stand-Alone Diagnostic Monitor. After all PROM-based diagnostics are successfully completed, the IPL selection screen will appear (in about 40 seconds).

8.3.1.2 Intelligent Serial I/O Device Adapter Diagnostics

Like the BP, the Intelligent Serial I/O DA has PROM-based power-up diagnostics which will run each time the system is powered-up or IPLed. The diagnostics will begin running at the same time as the BP power-up diagnostics and will complete successfully in about 10 seconds.

The ISIO DA verifies as much of its hardware as possible without affecting the workstations. A number of programs, designed to check the ISIO logic, are run during power-up. Upon successful completion of the PROM-based diagnostics, the ISIO will enter into a 'Boot Mode' and indicate to the Bus Processor its 'ready' status.

The BP will begin loading diagnostic (or operational) microcode into the ISIO DA. The ISIO tests for excessive microcode and the 'restart' command from the BP. Once the restart command is received, the ISIO performs a checksum test on all loaded microcode. After passing the checksum test, the ISIO resets its logic and begins execution of the code.

The ISIO DA board indicates failures with a single LED attached to the board. The three possible failures are:

1. A 'Power-up' failure has occurred when the LED stays 'ON' continuously. This indicates that the ISIO board is bad.

2. A 'Boot-Routine' failure has occurred when the LED blinks at a rate of one blink per second. This also indicates a bad ISIO board.

3. Too large of a loadable firmware file, a 'Checksum' failure, or a 'Non-maskable Interrupt' generated from a parity error will result in a slow blink rate with the ISIO being set busy to the BP.

IF an error occurs during the power-up diagnostics and the ISIO LED displays one of the conditions given above, attempt to run the Self-Test Monitor as instructed in paragraph 8.5.2 to verify the error. If the Self-Test Monitor cannot be run, re-initialize the system to clear the error (if possible) and continue with the Self-Test Monitor. If the error is verified, the Self-Test Monitor will report the error on the Front Panel HEX display. In either case (nonfunctional or verifiable error), replacing the Intelligent Serial I/O Device Adapter is required.

8.3.1.3 Telecommunication Device Adapters Diagnostics

The Telecommunication DAs (1 and 2-port) also have PROM-based power-up diagnostics which will run each time the system is powered-up or IPLed. The diagnostics will run at the same time as the BP and ISIO power-up diagnostics and will complete successfully in about 12 seconds.

The LEDs on the TC DAs' Front Indicator/Control Panel (table 3-4) only show that a failure occurred. The type of error is not defined. If an error was indicated during the power-up diagnostics, run the Stand-Alone diagnostics as instructed in paragraph 8.5.3.3 to verify that an error is occurring. Ignore the TC DA's LED display when running the Stand-Alone Diagnostic Monitor. Any errors will be displayed on the WS-0 screen. If the error is verified, replace the Telecommunication Device Adapter.

8.3.1.4 Front Panel Hexadecimal Diagnostic Error Code Display

The Front Panel (figure 3-3) indicates system status error codes in hexadecimal (HEX) format. They are used by the CE, in conjunction with the microcode diagnostics, to troubleshoot the VS-15 CPU. The four digit HEX display is arranged in a single row. The panel provides information concerning BP and CP status as well as the error condition of I/O devices in the IPL path. (For example, WS-0 and the IPL disk drive selected by the Boot Device switch.)

At initial power-up, the HEX displays are decremented as a visual check of their functioning. They will also display, under operator control, the Bus Processor Diagnostic Switch settings prior to power-up diagnostics (with the minimal exceptions of verifying that the 8086 microprocessor is running, the PROM power-on and data check, and that I/O communication is possible).

When a fault is detected by the power-up core diagnostics (either PROM-based or CRAM-based), the results are displayed as a HEX code which indicates which board or unit failed. An error detected by the STM is also displayed on the WS-0 screen. (Refer to table 8-2 for the VS Self-Test Monitor diagnostic error code breakdown of the first two HEX digits, and Appendix B for the VS-15 list of the 4-digit Small System VS Diagnostic Monitor error codes.)

Once the CE has identified the failing board and recorded the error code, the board is sent to a Repair Depot. At the depot, repair personnel will test the defective board using the same diagnostics as the Customer Engineer to verify the observations of the CE. This duplication of the fault conditions aids in a rapid board repair turn-around time while providing a mechanism for the continual verification and upgrading of field-level diagnostics.

8.3.2 POWER-UP CORE DIAGNOSTICS (CRAM-BASED)

An essential diagnostic tool for testing the VS-15 is a series of microcode diagnostic programs executed on the BP. These programs provide diagnostic services for the BP, CP, Main Memory, all VS-15 device adapters, the Remote Diagnostic Telecommunication link, and the ability to communicate with all disk drives. They allow the CE to test all primary system functions, and when used in conjunction with system supplied on-line diagnostics, insure rapid resolution of Customer problems.

Loaded from disk or diskette, these CRAM-based core diagnostic programs use the Workstation Zero (WS-0) screen to allow the operator to select either the Self-Test Monitor (which, after passing the various diagnostic tests, will IPL the system) or the Stand-Alone Diagnostic Monitor. In order to run the CRAM-based Core Diagnostics, the system must first pass all of the PROM-based Core Diagnostics.

8.3.2.1 The Self-Test Monitor Package (@DIAGST@)

The Self-Test Monitor (STM) is loaded from the selected bootstrap device into the BP's Code RAM (CRAM) from library @DIAGST@. It verifies all remaining logic necessary to IPL the system. The CP Control Memory, Data Path to BP, Instructions, and Status Bits; the Main Memory; the Remote Diagnostic link; and the BP's ability to communicate with Workstation Zero (WS-0) are tested by the Self-Test Monitor.

The STM diagnostics are run as part of the Customer's normal daily power-up sequence (refer to paragraph 4.12.1) or at any time the system is initialized (refer to paragraph 4.10.1). The STM diagnostics are maintained in library @DIAGST@ on the System disk and diskette. In order to access the STM diagnostics, the Bus Processor DIP switches (figure 5-7) must all be in the 'OFF' or 'OPEN' position. Table 8-1 is a listing of the Self-Test Monitor Diagnostic Test Programs available on the VS-15.

Table 8-1. Self-Test Monitor Diagnostic Programs

TEST NO.	TEST ID.	TEST NAME
1.1	ST0500	Serial I/O Data Link Self-Test (See Note)
1.2	ST0800	Intelligent SIO / 928W Self-Test (See Note)
2	BT0500	BP USART & Modem Loop-back Self-Test
3	CT0500	BP/CP5 & CP Control Memory Self-Test
4	CT0800	CP5 Random Operands & Operational Self-Test
5	CT0B00	CP5 Integrity Self-Test
6	MT0500	Main Memory Integrity Self-Test
7	BT0800	BP DRAM/MM DMA and DRAM & MM MARs Self-Test

NOTE

Only seven tests are run by the Self-Test Monitor. The Bus Processor will determine which Serial I/O Device Adapter is installed, and will load and run the appropriate test.

Table 8-2 (page 8-6) is a listing of the error code breakdown of the first two HEX digits of the Front Panel HEX display. It reflects the error code indicated on the HEX displays and on the WS-0 screen if the CPU fails any Self-Test Monitor diagnostic. The STM writes error messages and user prompts in the lower half of the WS-0 screen. When successfully completed, the STM will typically complete its testing in less than one minute and begin system IPL.

8.3.2.2 The Stand-Alone Diagnostic Monitor Package (@DIAGMN@)

The Stand-Alone Diagnostic Monitor includes 29 programs, available in

Table 8-[illegible] VS Self-Test Monitor Diagnostic Error Codes
(Error code breakdown of the first two Front Panel HEX display digits)

GENERAL	SPECIFIC	GENERAL ERROR NAME	SPECIFIC ERROR NAME
00		Bus Processor (PROM) and BP Operational Code	
10		BP CRAM & DRAM Tests	
20		BP PE & Wait State Tests	
30		BP Floppy Power-up and Modem Loop-back Tests	
40		STM Bootstrap Loader	
	41		First Boot File (@MCBOOT@)
	42 thru 43		STM Test Files & Overlays
	44		System Loader (@MCIPL@)
	45 thru 49		Diagnostic Monitor & Files
	4A		Not Used
	4B		BP/CP Comm. & CP5 CM Tests
	4C		CP5 Operational Self-Test
	4D		CP5 Integrity Self-Test
	4E		CPU Main Memory Self-Test
	4F		BP/MM DMA and MARs Tests
50		5-1/4" Internal Disk DA	
60		8" Quantum Fixed Disk DA	
70		Serial I/O DA (Note 1) (SIO/ISIO/928W DA)	
80		Floppy Disk Controller	
90		Device Error	
	90		Workstation Zero (WS-0)
	91 thru 94		Not Used
	95		8" Quantum Internal Disk
	96		5-1/4" Internal Disk
	97		Not Used
	98		System Diskette Device
	99 thru 9A		Not Used
	9B		CMD/FMD/SMD Disk Device
	9C thru 9F		Not Used
A0		Motherboard Signals	
	A0 thru A3		Undetermined Error Source
	A4 thru A7		SIO Signal
	A8		8" Quantum Disk Signal
	A9		5-1/4" Intrnl. Disk Signal
	AA thru AB		Not Used
	AC thru AF		CMD/FMD/SMD Disk Signal
B0		Internal SMD Disk DA	
C0		Invalid Error Code	
D0		Hardware Related Error	
	DE	(Note 2)	BP/OS Related Failure
E0 - F0		Reserved for BP Code	

NOTES

1. Error code '7203' (rather than '9011') may occur when Workstation Zero (WS-0) is off or disconnected from the system.

NOTES (Cont'd)

2. There is only one valid error code allowed in the DO category, all others are invalid.

3. For a list of 4-digit VS-15 Self-Test Monitor error codes, refer to Appendix B of this manual.

library @DIAGMN@, designed to test the various components parts (or boards) of VS Small System CPUs. (Only 27 programs are used by the VS-15.) These programs are intended to throughly exercise individual elements of the CPU. It is necessary to run the Stand-Alone Diagnostic Monitor when an error is detected by the Self-Test Monitor, or a new system is being installed. In addition there are two programs designed specifically for the informed user: Program 14, the CPU Tester (which is not a field supported diagnostic program) and Program 29, the Small System VS Multitasker (System Exerciser).

Using the Stand-Alone Diagnostic Monitor programs, located in library @DIAGMN@, the CE loads a diagnostic operating system into the Bus Processor with a menu display of available CPU test programs. The CE then selects and executes the desired program or programs. The customer cannot access the system while these programs are being executed. Currently available diagnostic programs are listed in table 8-3 on page 8-8.

8.3.3 OUTER-LEVEL DIAGNOSTICS (@DIAGSA@)

Presently, the only off-line outer-level diagnostic available on the VS-15 system is FTUA (outlined in table 8-4). (Actually, FTUA is a function tester rather than a diagnostic.) Stand-alone outer-level diagnostics are executed on the CP thus requiring a minimal operating system and the functional exclusion of all other VS system users.

Table 8-4. Outer-Level Off-Line Diagnostics

DIAGNOSTIC	WLI P/N	FUNCTION
FTUA	195-2626-9 (732-0026)	Allows the exercising of disk units still connected to the system. Permits verifying, reading and writing, initializing, positioning heads, and alternate seeks. The following are the device numbers required by the Disk Drive Selection Screen to run FTUA on various VS disk drives: 100 = 5-1/4" System Floppy Diskette Drive. 110 = 5-1/4" (or 8") Internal Fixed Drive. 111 = 5-1/4" Optional Internal Fixed Drive.

In the case of a single disk system, a stand-alone version of FTU, loaded from a floppy diskette, may be the only means of bringing the system up in order to diagnose a possible disk problem. FTUA and future stand-alone outer-level diagnostics are available on floppy diskettes (and system volumes) in library @DIAGSA@. It is selected and loaded using the Stand-Alone Boot Loader (@SYS000@, which must reside in library @SYSTEM@ on the same disk) which allows the diagnostic to function without the VS Operating System.

Table 8-3. Stand-Alone Diagnostic Monitor Programs

PROGRAM	TEST ID.	TEST NAME
1	CT1000	CP5 Control Memory Diagnostic
2	CT2000	BP/CP5 Communications Diagnostic
3	CT3000	CP5 Microsequencer (BU Operation) Diagnostic
4	CT4000	CP5 Branch Conditional and Status Opcodes
5	CT5000	CP5 Subroutine Data Stack Integrity Diagnostic
6	CT6000	CP5 Stack Address Integrity Diagnostic
7	CT7000	CP5 Registers and Immediate Opcodes Diagnostic
8	CT8000	CP5 Stack Data & Address Integrity Diagnostic
9	CT9000	CP5 Logical and Shift Opcodes Diagnostic
10	CTA000	CP5 8-Bit and 16-Bit ALU Test Diagnostic
11	CTB000	CP5 MAR, TRAM, and R & C Table Diagnostic
12	CTC000	CP5 BD, IAD, Cond. Code & DSET Opcode Diagnostic
13	CTD000	CP5 Branch Indirect (BI Opcode) Diagnostic
14	CPTSTR	CP5 CPU Tester (Note 1)
15	MT1000	Main Memory (Comprehensive) Diagnostic
16	BT2000	BP DRAM/MM DMA and DRAM & MM MARs Diagnostic
17	BT3000	8" Floppy FDC Program Monitor (Notes 2 & 3)
18	BT3500	5-1/4" Floppy FDC Program Monitor (Notes 2 & 3)
19	QT1000	8" Quantum Disk DA Diagnostic (Notes 3 & 4)
20	RT1000	5-1/4" Internal Disk DA Diagnostic (Notes 3 & 4)
21	DT1000	Internal CMD/FMD/SMD Disk DA Diagnostic (Note 5)
22	BT1000	BP USART and Modem/Loop-back Diagnostic (Note 6)
23	BT5000	BP NVRAM, Real-Time-Clk, DRAM Clock Diagnostic
24	TT1000	TC Single-Port DA Interface Diagnostic (Note 7)
25	TT2000	TC Dual-Port DA Interface Diagnostic (Note 7)
26	ST1000	Serial I/O (Dumb 928) Data Link DA Diagnostic
27	ST2000	ISIO/928W (Smart 928/W) DA Diagnostic (Note 8)
28	ST3000	Intelligent RS-232 DA Diagnostic (Note 9)
29	BT4000	Multitasker (System Exerciser/Verifier) (Note 10)

NOTES

1. Test 14, the CP5 CPU Tester, is not a Field Supported diagnostic. Its use may damage valuable Customer data on any disk attached to the system (including the SYSTEM disk).

2. 5-1/4" Soft Sector Diskettes must be preformatted (and can be written on the System Floppy Drive using FTU) for this test.

3. The VS-15 does not support the 8" floppy diskette or 8" Quantum disk drive available on VS-25/45.

NOTES (Cont'd)

4. This test must be run to completion or the disk cannot be used as the Bootstrap (SYSTEM) Disk.

5. A VS formatted SCRATCH disk must be used for disk portion of this test. This test will verify the operation of the device adapter.
6. Requires a WA-3451 modem, and cannot be run during a Remote Diagnostic Session. If test fails use loop-back connector to check system hardware.

7. All switches on the Telecommunication DA must be 'OFF' to fully execute this test.

8. Verifies all functions of the ISIO or 928W Device Adapter Interface.

9. Verifies all functions of the Intelligent RS-232 Device Adapter Interface.

10. Disk data is DESTROYED. Refer to Documentation P/N 760-1028 for additional information on the Small System VS Multitasker (System Exerciser) program.

8.4 ON-LINE DIAGNOSTICS (@SYSTST@)

All on-line diagnostics are stored on disk or diskette in library @SYSTST@. They may be executed under operator control, in the standard VS Operating System environment, while the customer is in operation. The majority of on-line diagnostic programs are designed for use with serial peripheral devices. They down-load diagnostic microcode to the serial devices to be tested and usually require a dedicated workstation as test monitor.

These packages include coverage for all serial workstations, serial printers, archiving workstations, twin sheet feeders, envelope feeders, typesetters, special telecommunication devices (TCB/1 & 3), and laser printers.

In addition to on-line diagnostics for serial devices, on-line diagnostics for non-system disk and diskettes are available. Applicable VS-25/45 on-line test routines are available on the VS-15. Diagnostic programs currently available for individual on-line peripherals are given in table 8-5.

8.5 SYSTEM INITIALIZATION AND TEST

When the VS-15 is powered-on or re-IPLed, the system diagnostics are initialized. This process begins with the decrementing of the Front Panel HEX displays and continues until an error is encountered or a system pause is reached. This section describes the procedures required to thoroughly test and bring to an operational state the VS-15 system and its peripherals.

Table 8-5. On-Line Diagnostics

DIAGNOSTIC	WLI P/N.	FUNCTION
FTU (On-Line)	195-2652-9	On-line version of FTU simulator. Supports all current VS disk drives including soft-sector. Allows CE to do most disk read, write, and control functions. CE can do most disk alignment procedures without removing disk drive from system. Requires VS Operating System version 6.20.02 or later.
VS On-Line DTOS Device 2 Package	195-2615-9	Variety of serial device tests including Slave Upper RAM, Z80 Instruction Set, CRT RAM, Display & Keyboard, TC Black Box Diagnostic, Z80 Typesetter Test, TLC4/LS4, I/D Exerciser, Cable Interface Unit, Fixed Frequency Modem.
VS On-Line DTOS Device 3 Package	195-2604-9	Tests include AWS TC, Disk, Soft/Hard Sector Diskette and VCO Adjustment. Mini-Archiver Diskette, 9-Track Tape Controller & Function, Kennedy Tape Drive, Archiving Cartridge Tape Drive.
VS On-Line Printer I Monitor	(195-xxxx-9) 732-0179	Low speed serial printers 5521, 5531, 5535, 5581WD, 6581, 6581W/WC/WD and DW20. 6581 Lamp and Status, 5538 Twin-Sheet Feeder, Envelope Feeder Diag, Matrix Ptr., Lamp & Switch Tests.
VS On-Line DTOS Printer 2 Package	195-2535-9	High speed serial printers, including 5570, 5570, 5573, 5574, 5575, 5577, and 5531W6.
VS On-Line DTOS Printer 3 Package	195-2899-9	Slave Upper RAM, Z80 Instruction Set, LPS12 Laser Printer, and Ziyag Feeder.

8.5.1 POWER-UP PROCEDURE

1. Power-up the necessary workstations, printers, and other peripherals as required.

2. Make sure the three position (LOCAL CONTROL/REMOTE DIAGNOSTICS/REMOTE CONTROL) switch (figure 3-3) is in the LOCAL CONTROL position. (The system will NOT IPL if the switch is in the REMOTE DIAGNOSTICS position.)

3. Set the Front Panel Boot Device switch to the required position (refer to paragraph 3.2.2.3).

4. Power-up the VS-15 CPU. The Front Panel HEX displays will flash 0000 and then begin decrementing from FFFF to 0000.

5. The CE (and likewise, the Customer) must observe carefully the count-down process to insure that each HEX display is indicating all characters correctly.

NOTE

The decrementing of the Front Panel HEX displays is a visual indication of their operation, NOT a test.

6. The four HEX displays will continue the counting sequence with 00FF (all Bus Processor diagnostic switches 'OFF'), pause briefly at 1000, and progress through 1600, until the PROM-based diagnostics are complete, or the system halts due to an error.

NOTE

1. If the HEX displays indicate a diagnostic code other than 00FF, the HEX displays and the BP diagnostic switch settings may be verified by pressing the Control Mode push-button switch during the HEX display countdown. The HEX displays will continue to decrement from FFFF through 0000 and repeat until the Control Mode push-button is pressed a second time. The HEX displays will then halt and indicate the setting of the BP diagnostic switches.

2. The BP diagnostic switches are read from high to low as follows:

   a. 8765 4321, where 1 = 'OFF' and 0 = 'ON'.
   b. 1111 1111, where 4-binary ones = 'F' HEX.
   c. The HEX displays are read left to right, where '00FF' = all switches 'OFF'.
   d. Any combination of 0080 HEX or greater means switch 8 is 'OFF' and the entire set of BP diagnostic switches is deactivated and acceptable for system verification. However, upon completion of system checkout and prior to turn-over to the customer, all BP diagnostic switches must be reset to 'OFF'.

   e. Pressing the Control Mode push-button a third time restores the BP to normal operation and the system diagnostics will continue at 1000 HEX.

3. If any HEX display code halts at a given value for more than 20 seconds (with the exception of Note 2 above), the system is displaying an error code. In this case, refer to the VS-15 Customer Engineering Level Troubleshooting Flow Chart, figure 8-12.

8.5.1 POWER-UP PROCEDURE (Cont'd)

7. After passing the PROM-based diagnostics, the BP will test the Boot Device and then will load the CRAM-based diagnostics. (The Front Panel HEX displays will indicate a device dependent program number: 6000 for the 5-1/4" Internal Disk; 3800 for the Floppy Diskette; or 00B0 for the 76M byte Internal Fixed Disk), then 4000, 4100 and finally go blank.)

8. If the BP diagnostic switches are deactivated, the VS Self-Test Monitor package will display the IPL Drive/Monitor Selection screen (figure 8-1) on Workstation Zero and the system will pause.

```
           Small System VS Self-Test Package  Version Rxxxx
                          IPL Drive Selection
                       Bootstrap Volume = WIN17

      Device      Capacity      Type    Volume         Status
  ------------------------------------------------------------------------
      2270V5      368 Kb        Dsket                  [See Note 3]
   =  2230         33 Mb        Fixed   WIN17          Media Tolerant
      2230         33 Mb        Fixed   WIN18          Media Tolerant


            Position Cursor to Indicate Device and Select:
  ========================================================================
            (ENTER) IPL          (8) STAND-ALONE DIAGNOSTIC MONITOR
```

Figure 8-1. IPL Drive/Monitor Selection Screen

NOTES

1. If switches six and eight are activated ('ON' or 'CLOSED'), the system will bypass the Self-Test and Stand-Alone Diagnostic Monitors (and screens) and begin system initialization (IPL).

2. If switches seven and eight are activated, the system will load the Stand-Alone Diagnostic Monitor (from the SYSTEM disk) immediately and remain in this mode until the switches are deactivated.

NOTES (Cont'd)

3. On the [illegible], the Self-Test Monitor is always entered when the BP DIP switch is disabled (deactivated or turned 'OFF') at IPL. On the VS-15, selecting the floppy drive as the Boot Device causes this process to be bypassed regardless of switch settings. The system will IPL to whichever level of software is present on the 5-1/4" floppy diskette.

8.5.2 SELF-TEST MONITOR PROCEDURE

At the IPL Drive/Monitor Selection screen, the CE (or Customer) can select the IPL (Bootstrap) Volume and continue with the Self-Test diagnostics (and consequent system initialization), or go directly to the Stand-Alone Diagnostic Monitor Program Selection Screen by pressing PF8. If system IPL (from the System Volume) is chosen, the System Hardware Status screen shown in figure 8-2 will appear and the following sequence of events will occur.

1. The BP will systematically load, run, and pass (or fail) each of the seven tests.

2. The System Hardware Status screen will display two types of errors, "Fatal Error" or "Non-Fatal Error".

3. Non-fatal errors (such as a missing Loop-back Plug on Remote TC) will produce a flashing error code display and the 'Non-Fatal Error' statement, and will require acknowledgement by the system operator before testing can continue. By pressing ENTER on WS-0, the STM will continue with the remaining tests. (An example of a fatal error will be given in section 8.5.3.3.3.)

4. A fatal error will produce a flashing error code display and the 'Failed' statement, at which point the system operator must select the Stand-Alone Diagnostic Monitor (PF8), or re-initialize the system (and try again).

5. Upon successful completion of the Self-Test Monitor, a message at the bottom of the screen in figure 8-2 will appear: "Loading System Microcode".

NOTES

1. The diagnostic programs cannot coexist with the operational BP and CP code; therefore, system-level BP/CP functions, with the exception of very limited applications of Control Mode (as in paragraph 8.5.1 and Note 2 following), are not available while the diagnostic programs are executing. (Refer to section 8.7 for additional information on Control Mode.)

NOTES (Cont'd)

2. However, if the Control Mode button is pressed while the STM is running (after the visual HEX display is completed) and no fatal errors are encountered, the STM will display the message "VS Will Enter Control Mode on Completion of Diagnostics" and the system will drop into control mode immediately prior to the system configuration (SYSGEN) screen.

```
           Small System VS Self Test Package  Version Rxxxx
                         System Hardware Status
                         System Volume = WIN17

 Status                Diagnostic
 ------------------------------------------------------------------------
 Passed               (SIO) Serial Data Link Test                (Note 1)
 Non-Fatal Error      (BP)  USART Loop-back Verification Test    (Note 2)
 Passed               (CPU) CP Control Memory & CP/BP Test
 Passed               (CPU) CP Random Operands Test
 Passed               (CPU) CP Integrity Test
 Running              (MM)  Main Memory Integrity Test           (Note 3)
                      (BP)  BP DMA & MARS Test

                              [Non-Fatal Error]
                      [Press ENTER To Continue Testing]


  [Error Code = 3C0A]
```

Figure 8-2. System Hardware Status Screen (Normal Execution of Self-Test Monitor)

NOTES

1. On systems with an Intelligent Serial I/O DA, the ISIO test (ST0800) will be run.

2. This test can be a non-fatal test. The STM screen will display a flashing highlighted message on the screen as shown in brackets. After pressing ENTER, the Error Code will move to the position of (Note 2) above.

   If no errors occur, the screen will continue to display the Passed, Loading, Running status messages and the lower portion of the screen will remain blank.

NOTES (Cont'd)

3. This test takes approximately 30 seconds to complete for 1M byte of memory and will NOT detect ALL possible Main Memory errors.

6. At the completion of the Self-Test Monitor, the screen will display the message "Loading System Microcode".

7. Depending on the Boot Device being used, the message will change in about 15 seconds to "Diagnostics Completed, Beginning System Initialization" and the front panel NOT-READY LED will go out.

8. The Front Panel NOT-READY LED going out indicates that initialization is beginning. (If it does not go out, or the system halts, refer to figure 8-12, VS-15 Customer Engineering Troubleshooting Flow Chart.

9. In approximately 30 seconds, the system configuration (SYSGEN) screen will appear. Normal SYSGEN procedures from this point forward should bring the entire system on-line (refer to section 4.10.1).

8.5.3 STAND-ALONE DIAGNOSTIC MONITOR PROCEDURE

The Stand-Alone Diagnostic Monitor should be used when:

= The system is a new installation.
= A fatal error occurs while running the Self-Test Monitor.
= A non-fatal error occurs and the error code indicated is unclear.
= The system halts under any of the conditions described in the VS-15 Customer Engineering Level Troubleshooting Flow Chart (figure 8-12).

8.5.3.1 Accessing the Diagnostic Monitor's Menus

The VS-15 Stand-Alone Diagnostic Monitor may be accessed:

= During normal power-up procedures by the system operator pressing PF8.
= Immediately after PROM-based diagnostics via the BP's diagnostic switches 7 & 8 ('ON' or 'CLOSED' position).
= By IPLing directly from one of the four Diagnostic Monitor diskettes.

Responsibility for the use of the Diagnostic Monitor must be acknowledged by the system operator prior to access. The system operator may then interface with the Stand-Alone Diagnostic Monitor through two menus, the Program Selection Menu and the Run-Time Menu.

8.5.3.1.1 Diagnostic Monitor Program Selection Menus

The Diagnostic Monitor, when selected from the System Disk displays the Diagnostic Monitor Test Selection Menu shown in figure 8-3. This menu allows the system operator to select one or more of 25 diagnostic test programs (and two non-diagnostic programs) for use with the VS-15, or to initiate an automatic sequence of 15 programs. (Referred to as 'BURN-IN' in figure 8-12.) The Automatic Sequence (which must be run during installation or after CPU repair) includes programs 1-13, and 15 & 16 given previously in table 8-3.

Small System VS Diagnostic Package Version Rxxxx
Test Selection Option

To Select Tests, Position Cursor And Press Any NON-BLANK. Press SPACE or DELETE To Deselect a Test. Press PF8 to Start An Automatic Sequence. Press ENTER to Begin Testing. Press PF16 to Terminate.

Test Name	(Rev.)	Test Name	(Rev.)
▪ 1 CP Control Memory Test	xxxx	▪ 16 BP DMA (and MARs) Diag	xxxx
▪ 2 BP/CP Communication Test	xxxx	▪ 17 8" Floppy Disk Diag	xxxx
▪ 3 BU Branch Opcode Test	xxxx	▪ 18 5-1/4" Floppy Diag	xxxx
▪ 4 Status, Conditional Branch	xxxx	▪ 19 Q2040 Quantum DA Diag	xxxx
▪ 5 Subroutine Stack Data	xxxx	▪ 20 5-1/4" Winchester DA Diag	xxxx
▪ 6 Subroutine Stack Address	xxxx	▪ 21 CMD/FMD/SMD Disk DA Diag	xxxx
▪ 7 Registers, Immed. Opcodes	xxxx	▪ 22 USART/Modem Diag	xxxx
▪ 8 CP Stack Diagnostic Test	xxxx	▪ 23 BP (D-Clk, NVRAM, RTC) Diag	xxxx
▪ 9 Logical and Shift Opcodes	xxxx	▪ 24 TC DA 1-Port	xxxx
▪ 10 8-Bit and 16-Bit ALU Test	xxxx	▪ 25 TC DA 2-Port	xxxx
▪ 11 MAR, TRAM, and RCT Test	xxxx	▪ 26 Dumb 928 Data Link DA	xxxx
▪ 12 BD, IAD, CC, and DSET Test	xxxx	▪ 27 Smart 928/W Data Link DA	xxxx
▪ 13 BI Branch Opcode Test	xxxx	▪ 28 Smart RS-232 Data Link DA	xxxx
▪ 14 CPU Tester [Note 1]	xxxx	▪ 29 Multitasker [Note 2]	xxxx
▪ 15 Main Memory Test	xxxx		

Figure 8-3. System Disk Diagnostic Monitor Program Selection Screen

NOTES

1. The CPU Tester is not a diagnostic and is not included in the Automatic Sequence. It allows an experienced user to load CP5 Control Memory with microcode level instructions using the Bus Processor board.

   Exercise extreme CAUTION when attempting to use this utility. The ability to write to any disk attached to the system (including the SYSTEM disk) is made available via the Bus Processor. Customer data may be damaged.

2. The Multitasker is a system exerciser and verifier. It simultaneously loads, runs, and verifies all hardware at the system configuration level. Refer to Document 760-1028 for detailed information.

The Small System VS Diagnostic Monitor has also been packaged as a set of four stand-alone 5-1/4" floppy diskettes. When the diskette drive is selected as the boot device, each diskette will IPL the system and display its menu of diagnostic programs. The Automatic Sequence will function when using the appropriate 5-1/4" diskettes, or each program may be selected individually. An example of the diskette Selection Menu is given in figure 8-4 and the content of each diskette is shown in Table 8-6 on page 8-18.

```
            Small System VS Diagnostic Package  Version  Rxxxx
                            Test Selection Option
 To Select Tests, Position Cursor And Press Any NON-BLANK. Press SPACE
 or DELETE To Deselect a Test. Press PF8 to Start An Automatic Sequence.
 Press ENTER to Begin Testing. Press PF16 to Terminate.

         Test Name            (Rev.)           Test Name

 -  1 5-1/4" Floppy Disk Diag   xxxx
 -  2 5-1/4" Winchester DA Diag xxxx
 -  3 CMD/FMD/SMD Disk DA Diag  xxxx
 -  4 Main Memory Test          xxxx
 -  5 BP/MM DMA (& MARs) Diag   xxxx
```

Figure 8-4. System Diskette Diagnostic Monitor Program Selection Screen (Floppy Diskette Volume = DIAG 1)

NOTE

When the VS-15 has been initialized from one of the Diagnostic Diskettes (DIAG 1-4), the system will display and run the diagnostics on each diskette without re-initialization. After exiting a given program, the Automatic Sequence (or simply viewing a diskette Diagnostic Program Menu), remove the diskette and insert another. Pressing PF16 will result in either the new menu or the reappearance of the NOTICE screen. Entering a YES response to NOTICE screen will result in the display of the new menu and testing can be continued.

8.5.3.1.2 Diagnostic Monitor Run-Time Menu

The Diagnostic Monitor Run-Time Menu (figure 8-5) is accessed from the Program Selection Menu after the desired program(s) have been selected. It allows the operator to monitor and control the performance of the diagnostic program in operation. Pressing ENTER or PF8 causes the Run-Time Menu to be displayed and the programs or Automatic Sequence selected from figure 8-3 to begin running. (An error message is displayed if PF8 is selected when using the DIAG 2 diskette as the boot device volume.)

Table 8-6. VS-15 Diagnostic Monitor System Diskettes
(Stand-Alone Diagnostic Monitor Package)

DISKETTE NUMBER	DISKETTE NAME	FILE NAME	PROGRAM NUMBER	PROGRAM NAME
1	DIAG 1	@BT3500@	1	5-1/4" Floppy Disk Diag
		@RT1000@	2	5-1/4" Winchester Disk Diag
		@DT1000@	3	CMD/FMD/SMD Disk DA Diag
		@MT1000@	4	Main Memory Test
		@BT2000@	5	BP/MM DMA (and MARs) Diag
2	DIAG 2	@BT1000@	1	BP USART/MODEM Diag
		@BT5000@	2	BP (Clk, NVRAM, & RTC) Diag
		@TT1000@	3	TC 1-Port Interface Test
		@TT2000@	4	TC 2-Port Interface Test
		@ST1000@	5	Dumb 928 (SIO) Data Link DA
		@ST2000@	6	Smart 928/928W Data Link DA
		@ST3000@	7	Smart RS-232 DA Diagnostic
		@BT4000@	8	Multitasker (System Exer.)
		@CPTSTR@	9	CPU Tester
3	DIAG 3	@CT1000@	1	CP Control Memory Test
		@CT2000@	2	BP/CP Communication Test
		@CT3000@	3	BU Branch Opcode Test
		@CT4000@	4	Status, Conditional Branch
		@CT5000@	5	Subroutine Stack Data
		@CT6000@	6	Subroutine Stack Addressing
4	DIAG 4	@CT7000@	1	Registers, Immediate Opcodes
		@CT8000@	2	CP Stack Diagnostic Test
		@CT9000@	3	Logical and Shift Opcodes
		@CTA000@	4	8-Bit and 16-Bit ALU Test
		@CTB000@	5	MAR, TRAM, and RCT Test
		@CTC000@	6	BD, IAD, CC, and DSET Test
		@CTD000@	7	BI Branch Opcode Test

NOTES

1. The VS-15 5-1/4" Diskette version of the Stand-Alone Diagnostic Monitor package does not include the 8" Floppy Diagnostic (@BT3000@) or the 8" Quantum Disk Diagnostic (@QT1000@) as they are not part of the VS-15 system.

2. The Automatic Sequence programs are stored on Diskettes 1, 3 & 4. Diskette 2 (DIAG 2) will respond to the PF8 command with an error message.

The menu shows those commands (PF keys) which can be used for direct operator control of the diagnostic programs; the current diagnostic descriptors; and error messages and user prompts. Stop-on-error is automatically selected for each (or all) programs chosen EXCEPT when using the Automatic Sequence (PF8) selection.

When selected, the Stand-Alone Diagnostic Monitor programs will run in the order that they are shown in table 8-3. If testing is not altered by operator action or by hardware failure, the Monitor automatically cycles on the set of diagnostic programs chosen and the Monitor Pass Count will increment.

```
            Small System VS Diagnostic Package  Version  Rxxxx

 (1) = Error Loop    (4) = Program Loop    (7) = Step          (16) = Exit
 (2) = Routine Loop  (5) = Pause          (10) = Clear all Settings
 (3) = Stop on Error                      (13) = Display Error Log

 Program Name: R1410 VS-15 Winchester DA Diag    Error Count        = 00000
 Routine Name: 00 Initialization & Interrupts -- Routine Loop Count = 00000
 Error Code  =                                   Program Loop Count = 00000
 Program Status: Test In Progress                Monitor Pass Count = 00000

 Messages:
Configuration switch data and corresponding device types
defined by switch position 6 - 8:

Switch 0 data = 70 / unit 0 type (J2) - Quantum Q540 32Mb
Switch 1 data = 70 / unit 1 type (J2) - Quantum Q540 32Mb

Type FF and press [ENTER] if types are correct.
Otherwise, type 00 then [ENTER] for error loop.


FF
```

Figure 8-5. Diagnostic Monitor Run-Time Menu Selection Screen

8.5.3.2 Run-Time Menu Screen Commands and Descriptors

There are nine commands and eight descriptors displayed on the Run-Time Menu Selection screen. The operator uses the Run-Time Menu to monitor test results, and the PF function key commands and alternate-action commands to control test performance. Selecting the command initiates the functioning of the command and highlights the command on the screen. The next time a command is selected, it becomes an alternate-action command and will cause the original command to be deselected. Commands PF1 through PF5 are alternate-action commands. A brief discussion of each command follows.

8.5.3.2.1 Diagnostic Monitor Run-Time Screen Commands

1. ERROR LOOP (PF1) - Loop on routine in which the next failure occurs.

8.5.3.2.1 Diagnostic Monitor Run-Time Screen Commands (Cont'd)

2. ROUTINE LOOP (PF2) - Loop on current test routine.

3. STOP ON ERROR (PF3) - Stop the diagnostic program where the next failure is detected.

4. LOOP ON PROGRAM (PF4) - Loop on current diagnostic program.

5. PAUSE (PF5) - Halt the program prior to the next test routine.

6. STEP (PF7) - Used to Step passed a selected option (PF1 thru PF5). That is, Step through Pause, Program or Routine Loop, or Stop On Error without deselecting the command.

7. CLEAR ALL SETTINGS (PF8) - Resets all other test control commands (PF Keys 1-7).

8. DISPLAY ERROR LOG (PF13) - Displays the 23 most recent errors in an error buffer. ENTER will return the Run-Time screen to the routine in progress.

9. EXIT (PF16) - The Diagnostic Monitor Program is terminated, and the Diagnostic Monitor Test Selection Option screen (figure 8-3) is re-entered after the EXIT command.

8.5.3.2.2 Diagnostic Monitor Run-Time Screen Descriptors

1. PROGRAM NAME - The name of the program currently being executed. A Program consists of one or more test routines.

2. ROUTINE NAME - The name of the test routine currently being performed.

3. ERROR CODE - The code of the most recently detected error.

4. PROGRAM STATUS - The status of the diagnostic currently being performed (e.g. Test in Progress, Stop on Error, Program Pause, etc.).

5. ERROR COUNT - A decimal count of the number of errors which have been detected. The count is cumulative and it is reset only by re-IPLing or returning to the Program Selection menu (PF16).

6. ROUTINE LOOP COUNT - A decimal count of the number of loops which have been made through the diagnostic routine currently being performed. This value is only displayed when the loop-on-routine option is in effect. It is cleared when the loop-on-routine option is deselected.

7. PROGRAM LOOP COUNT - Identical to Routine Loop Count except that this count applies to diagnostic programs rather than to routines.

8.5.3.2.2 Diagnostic Monitor Run-Time Screen Descriptors (Cont'd)

8. MONITOR PASS COUNT - A decimal count of the number of loops which have been made through the set of diagnostic programs. It is cleared by re-IPLing or returning to the Program Selection menu (PF16).

8.5.3.2.3 Error Messages and User Prompts

The current diagnostic program writes error messages and user prompts in the lower half of the screen. If more than one error occurs, only the last error message will be left on display, although the error count and the Diagnostic Monitor Error Log are updated for each error.

8.5.3.3 Running the Stand-Alone Diagnostic Monitor

1. Make sure the three position (LOCAL CONTROL/REMOTE DIAGNOSTICS/REMOTE CONTROL) switch (figure 3-3) is in the LOCAL CONTROL position. (The system will NOT IPL if the switch is in the REMOTE DIAGNOSTICS position.)

2. Set the Front Panel Boot Device switch to the required position. (The Boot Device may be either the SYSTEM disk, or a Stand-Alone Diagnostic Monitor diskette.)

3. Press the Initialize button on the Front Panel (or power-up the system). (The HEX display on the Front Panel will begin counting down from FFFF.) In about 45 seconds WS-0 will display the Menu shown in figure 8-1.

NOTE

When initializing from the System Diskette Drive, the screen display of figure 8-1 will be bypassed as will STEP 4 below. The first screen to appear will be that of STEP 5 following.

4. When the IPL Drive/Monitor Selection Screen appears, the cursor will be positioned next to the default IPL volume. Press PF8 to load the Stand-Alone Diagnostic Monitor. The screen (figure 8-1) will briefly display the message "Loading Diagnostic Monitor Microcode".

NOTE

When loading the SDAM using PF8, the VS-15 will always load from the bootstrap (default) volume (for example, 'WIN17'), an alternate volume cannot be selected.

8.5.3.3 Running the Stand-Alone Diagnostic Monitor (Cont'd)

5. Workstation Zero (WS-0) will display a cautionary notice and request a YES or EXIT response. Enter the YES response.

6. After YES is entered, WS-0 will display the menu shown in figure 8-3 (or figure 8-4 for the 5-1/4" diskette version, DIAG 1).

7. Press PF8 to start the Automatic Sequence. (Note that on the System Volume the Automatic Sequence skips test 14, the CPU Tester. The last test in the Automatic Sequence is test 16, the BP DMA and MARs test. Also note that Stop-On-Error is NOT selected in either case.)

8. Run the Stand-Alone Diagnostic Monitor (figure 8-3) for one complete, error-free pass. This should take about 15 minutes for systems equipped with 1M byte of Main Memory. Check the Monitor Pass Count on the WS-0 screen to determine when one complete pass has been made.

9. If any errors occur, display the Diagnostic Monitor Error Log at the end of one complete pass, using PF13. (Refer to paragraph 8.5.3.3.1) If the Main Memory Integrity test fails, refer to paragraph 8.5.3.3.3 for instructions on how to locate the failing memory chip.

NOTE

When running the SDAM using PF8, more than one error may occur and be listed in the Error Log. Some diagnostic programs will generate multiple errors (for example, @MT1000@) many of which may be repetitive, thus loading the Error Log with similar errors. In this case, replace the multiple error component (or board) first and then repeat the Automatic Sequence (PF8) to view the remaining error(s).

10. If no errors occurred, press PF16 (EXIT) to return to the Diagnostic Monitor Program Selection screen. (When using the four diagnostic diskettes, insert the next diskette, press PF16 and then press PF8 to proceed.) If a test routine is in progress when PF16 is pressed, the routine will complete before the Diagnostic Monitor Program Selection screen occurs. This may take several seconds, depending on the test routine.

11. Press PF16 again to terminate and return to the IPL Drive/Monitor Selection screen. (Occasionally, PF16 may have to be pressed more than once in order to return to the IPL Drive/Monitor screen.)

12. IPL the system.

8.5.3.3.1 Displaying the Diagnostic Monitor Error Log

The Diagnostic Monitor Error Log may be displayed by pressing PF13. The

Error Log Display Screen (figure 8-6) will show up to 23 of the most recent Stand-Alone Diagnostic Monitor errors. These errors are listed as 8-character codes followed by up to 18 HEX characters all on a single line in a 'shorthand' format. The 18 HEX characters are an extraction of all other relevant information from the message portion of the error screen.

```
ME102001 24 00 04 00 0A 00 00 24 10                  (24th error)
ME102002 20 00 00 00 0A 00 00 04 10                  ( 2nd error)
ME102001 20 01 00 01 0A 00 00 24 10
ME102002 20 01 00 01 0A 00 00 24 10
ME102001 20 02 00 02 0A 00 00 24 10
ME102002 20 02 00 02 0A 00 00 24 10
ME102001 20 04 00 04 0A 00 00 24 10
ME102002 20 04 00 04 0A 00 00 24 10
ME102001 20 08 00 08 0A 00 00 24 10
ME102002 20 08 00 08 0A 00 00 24 10
ME102001 20 10 00 10 0A 00 00 24 10
ME102002 20 10 00 10 0A 00 00 24 10
ME102001 20 20 00 20 0A 00 00 24 10
ME102002 20 20 00 20 0A 00 00 24 10
ME102001 20 40 00 40 0A 00 00 24 10
ME102002 20 40 00 40 0A 00 00 24 10
ME102001 20 80 00 80 0A 00 00 24 10
ME102002 20 80 00 80 0A 00 00 24 10
ME102001 21 00 01 00 0A 00 00 24 10
ME102002 21 00 01 00 0A 00 00 24 10
ME102001 22 00 02 00 0A 00 00 24 10
ME102002 22 00 02 00 0A 00 00 24 10
ME102002 24 00 04 00 0A 00 00 24 10                  (23rd error)
                  Press ENTER to Save Log, PF1 to Delete
```

Figure 8-6. Diagnostic Monitor Error Log Display Screen

The first two characters of the 8-character code identify the board (or unit) being tested and the program, routine, or error notation. The second two digits (00-FF HEX) identify the program number; the third two digits (00-FF HEX) identify the test routine within the program; the fourth two digits (00-FF HEX) identify the error within the test routine; and finally the remaining 18 HEX error message codes are displayed.

Although only one error screen can be displayed at a time, relevant data from the most recent 23 screens is saved in the Error Log. For example, the final 18 HEX characters are the Received Data, Expected Data, MAR1 address, and CP Status Register HEX characters from each error message occurring during running of the Main Memory Test example given in figure 8-9.

Error codes are written from left-to-right, top-to-bottom. They wrap around from the bottom to the top and start overlaying when the 23 line Error Log buffer becomes full. For example, the top row of the Error Log Display in figure 8-6 is the 24th error and the bottom row is the 23rd error. The second row (2nd error) will be overwritten by the 25th error.

8.5.3.3.2 Interpreting the Diagnostic Monitor Error Log Display

The CE can select the failing board (or unit) from the 8-character error code and replace (or repair) that unit, using the following example:

1. The USART/Modem Diagnostic portion of the Self-Test Monitor fails (@BT0500@). (Loop-back connector, WLI P/N 420-1040, is installed.)

2. Press PF8 to load the Stand-Alone Diagnostic Monitor.

3. Select program 22, USART/MODEM Diagnostic and press ENTER.

4. Enter 10 (Character Loop-back thru Connector) and press ENTER (the test fails).

5. Deselect Stop-On-Error (PF3) for a few errors, and then press PF3 (or PF5, Pause).

6. Press PF13, Display Error Log and the following is displayed.

```
BE101007 04 01
BE101007 04 02
BE101007 04 03
BE101007 04 04
BE101007 04 05
BE101007 04 06
BE101007 04 07
BE101007 04 08
BE101007 04 09
BE101007 04 0A



                    Press ENTER to Save Log, PF1 to Delete
```

Figure 8-7. USART/Modem Failure During Diagnostic Monitor Execution

7. Observe the 1st error code character as shown in the last entry of Error Log, that is, <u>B</u>E101007 xx xx (where xx means don't care).

8. Use table 8-7 and compare the 1st error code character with the failing unit. In this case, '<u>B</u>' compares with the Bus Processor. As the USART logic is on the BP board, replace the BP board.

9. To return to the last test running after viewing the log, press ENTER to SAVE the Diagnostic Monitor Error Log, or press PF1 to DELETE the Error Log.

Table 8-7. Failing Unit from Error Code Character

1ST ERROR CODE CHARACTER	FAILING UNIT
B	Bus Processor Board failures include 5-1/4" System Diskette & USART/Modem
C	CP5 Central Processor
D	Internal Fixed Disk DA or Disk Drive
M	Main Memory
R	5-1/4" Fixed Disk DA or Disk Drive
S	Serial I/O (SIO/ISIO/928W) or WS-0
T	Telecommunication Device Adapter

8.5.3.3.3 The Main Memory Stand-Alone Diagnostic Program (MT1000)

'hen running the Self-Test Monitor, one of the more common failures is the Main Memory Integrity portion of the Self-Test Monitor (MT0500). If this failure should occur, the Stand-Alone Diagnostic Monitor must be run to determine the location of the failing memory chip. The display shown in figure 8-8 will appear on Workstation Zero (WS-0) screen at the time of the failure and the Self-Test Monitor will halt.

```
             Small System VS Self Test Package  Version Rxxxx
                          System Hardware Status
                          System Volume = WIN 17

Status              Diagnostic
------------------------------------------------------------------

Passed             (SIO) Serial Data Link Test
Passed             (BP)  USART Loop-back Verification Test
Passed             (CPU) CP Control Memory & CP/BP Test
Passed             (CPU) CP Random Operands Test
Passed             (CPU) CP Integrity Test
Failed             (MM)  Main Memory Integrity Test
                   (BP)  BP DMA & MARS Test


  Error Code = 4E20

         Press PF (8) to Load Stand-Alone Diagnostic Monitor
```

Figure 8-8. Main Memory Failure During Self-Test Monitor Execution

Proceed as follows:

1. Press PF8 to load the Stand-Alone Diagnostic Monitor.

2. WS-0 will display the Diagnostic Monitor NOTICE screen. Type YES to continue, and WS-0 will then display figure 8-3, the Diagnostic Monitor Selection screen. (When the boot device is the System Diskette, figure 8-4 will appear.)

8.5.3.3.3 The Main Memory Stand-Alone Diagnostic Program (@MT1000@ - Cont'd)

3. Select the Main Memory Test by positioning the Cursor, pressing any non-blank character, and pressing ENTER. A modified Diagnostic Monitor Run-Time Menu (figure 8-9) will appear.

```
            Small System VS Diagnostic Package  Version  Rxxxx

(1) = Error Loop     (4) = Program Loop     (7) = Step              (16) = Exit
(2) = Routine Loop   (5) = Pause           (10) = Clear all Settings
(3) = Stop on Error                        (13) = Display Error Log

Program Name: R1412 VS Main Memory Diagnostic -- Error Count          = 00000
Routine Name:                                   Routine Loop Count    = 00000
Error Cod_  =                                   Program Loop Count    = 00000
Program Status: Test In Progress                Monitor Pass Count    = 00000

Messages:

                 Enter FF to run MOVING INVERSIONS Tests
                 Else Enter 00

FF
```

Figure 8-9. Main Memory Test Option Screen

4. The Main Memory Test Option Screen (figure 8-9) allows the system operator to choose a short version of the Main Memory Test (@MT1000@). The short MM diagnostic, which takes less than 2 minutes to complete, will detect all Main Memory errors previously detected by the STM. To run the short version , enter 00 in the field provided, then press ENTER. The Diagnostic Monitor Run-Time Menu Selection Screen will appear (figure 8-10).

5. Deselect Stop-On-Error function by pressing PF3 and allow the Stand-Alone Diagnostic Monitor to run until a significant number of Main Memory errors (less than 23) are displayed at the Error Count position or one complete test program occurs. (It will loop automatically.)

6. Press PF3, Stop On Error (or PF5, Pause).

7. Using figure 8-10, look at the Messages portion of WS-0 screen showing (as an example):

   a. RECEIVED DATA NOT EQUAL TO EXPECTED DATA
   b. RECEIVED DATA (MDR) = 20 00
   c. EXPECTED DATA = 00 00
   d. ADDRESS (MAR1) = 0A xx xx

```
            Small System VS Diagnostic Package  Version  Rxxxx

  (1) = Error Loop    (4) = Program Loop    (7) = Step            (16) = Exit
  (2) = Routine Loop  (5) = Pause          (10) = Clear all Settings
  (3) = Stop on Error                      (13) = Display Error Log

  Program Name: R1412 VS Main Memory Diagnostic -- Error Count         = 00002
  Routine Name: 20 Data Buss Test --A/B 50 sec.--  Routine Loop Count = 00000
  Error Code   = ME102001                          Program Loop Count = 00000
  Program Status: Stopped On Error                 Monitor Pass Count = 00000

  Messages:

RECEIVED DATA NOT EQUAL TO EXPECTED DATA
RECEIVED DATA  (MDR)  =  20 00
EXPECTED DATA  =  00 00
ADDRESS (MAR1)  =  A0 00 00
(Status Bit 5 = 1 indicates MM Parity Trap taken)
(Status Bit 12 = 1 indicates Invalid Address Trap taken)
CP Status Register  =  04 10
```

Figure 8-10. Main Memory Error During Stand-Alone Monitor

8. Look at the two high order MAR1 address HEX digits. Using table 8-8, find the LOGICAL ROW number of the defective Main Memory RAM chip.

   a. EXAMPLE: ADDRESS (MAR1) = 0A xx xx (where xx = don't care.)

   b. The failing chip is in LOGICAL ROW five of the VS-15 Main Memory board. (Third row from top of figure 8-11, VS-15 Main Memory Board RAM Chip Layout.)

Table 8-8. Converting MAR Address to Main Memory RAM Chip Row

TWO HIGH ORDER HEX DIGITS	LOGICAL ROW	
0E or 0F	7	(TOP)
0C or 0D	6	
0A or 0B	5	
08 or 09	4	
06 or 07	3	
04 or 05	2	
02 or 03	1	
00 or 01	0	(BOTTOM)

(TOP OF BOARD)

LOGICAL ROW \ DATA BITS	TWO HIGH ORDER HEX DIGITS								TWO LOW ORDER HEX DIGITS							
	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
ROW 7	L24	L23	L22	L21	L20	L19	L18	L17	L8	L7	L6	L5	L4	L3	L2	L1
ROW 6	L48	L47	L46	L45	L44	L43	L42	L41	L32	L31	L30	L29	L28	L27	L26	L25
ROW 5	L72	L71	L70	L69	L68	L67	L66	L65	L56	L55	L54	L53	L52	L51	L50	L49
ROW 4	L96	L95	L94	L93	L92	L91	L90	L89	L80	L79	L78	L77	L76	L75	L74	L73
ROW 3	L120	L119	L118	L117	L116	L115	L114	L113	L104	L103	L102	L101	L100	L99	L98	L97
ROW 2	L144	L143	L142	L141	L140	L139	L138	L137	L128	L127	L126	L125	L124	L123	L122	L121
ROW 1	L168	L167	L166	L165	L164	L163	L162	L161	L152	L151	L150	L149	L148	L147	L146	L145
ROW 0	L192	L191	L190	L189	L188	L187	L186	L185	L176	L175	L174	L173	L172	L171	L170	L169

B-01394-F Y84-10

(BOTTOM OF BOARD)

Figure 8-11. Main Memory Board RAM Chip Layout

8.5.3.3.3 The Main Memory Stand-Alone Diagnostic Program (@MT1000@ - Cont'd)

9. Look at the four MDR data HEX digits (Received Data and Expected Data) and find the correct chip in row five of figure 8-11 using the example and table 8-9 given below.

   a. EXAMPLE: RECEIVED DATA (MDR) = 20 00
      EXPECTED DATA = 00 00

Table 8-9. Bit Chart for Main Memory Chip Locations

DATA HEX DIGITS	TWO HIGH ORDER DIGITS								TWO LOW ORDER DIGITS							
DATA BITS	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
RECEIVED DATA (20 00)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
EXPECTED DATA (00 00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIFFERENCE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

   b. The difference shows that the most significant high order HEX digit picked up the 2-bit.

   c. Looking at figure 8-11, the 2-bit RAM chip of the high order HEX digit in logical row five is L70, the failing chip.

10. Power-down the system, remove the Main Memory board, and replace the failing memory chip. (Refer to Chapter 7, Illustrated Parts Breakdown, for Main Memory RAM chip part numbers.)

11. Power-up the system and run the Automatic Sequence (PF8) of the Stand-Alone Diagnostic Monitor to make sure that there are no other errors.

8.6 ON-LINE DIAGNOSTIC PROCEDURES

With On-Line diagnostics, located in library @SYSTST@, the CE logs on to the system through any workstation and executes a specific test routine, which runs under control of the VS Operating System (while the customer is running). Under VS Operating System Release 6.20.02 level, the standard VS-25/45 on-line diagnostics (listed in table 8-5) and error log features are present. For a more detailed explanation and discussion of each, see the Customer Engineering Diagnostic Handbook P/N 729-1257-A.

8.7 CONTROL MODE

Control Mode is a CP state where normal programming activities (under the control of the VS Operating System) are suspended and certain other facilities (mainly diagnostic and initialization) are made available to the system operator. These facilities are divided into two groups of commands as follows:

1. LOAD Group: Contains commands for initializing the Operating System, loading a Stand-Alone program, loading a diagnostic program, or restarting a program from an initialized state.

2. DEBUG Group: Contains commands for displaying and/or modifying Main Memory, general registers, control registers, or the Program Control Word (PCW). Also included in this group are commands for a single step program execution, a hard copy dump of Main Memory and registers, and a virtual address translation.

Control Mode uses Workstation Zero (WS-0) for communications between the operator and the system. To enter Control Mode, WS-0 must be powered-on. Control Mode uses only the top line of the CRT display (line one); the contents of the line are saved on entry into Control Mode and restored at exit. This makes Control Mode transparent to any program that may be using WS-0.

For a detailed discussion of Control Mode commands, refer to Chapter 6 of the VS Principles of Operation manual (WLI P/N 800-1100PO-04.01). All standard VS-25/45 control mode functions are available on the VS-15.

8.8 REMOTE DIAGNOSTICS

As part of its remote maintenance objectives, Customer Engineering offers remote diagnostic service as a maintenance program to VS-15 customers. The primary goal of the service is to isolate problems remotely so that the CE can bring the correct parts to the customer's site and supply the customer with a responsive and efficient level of service. The VS-15 uses the same remote diagnostic programs as the VS-25/45. Remote diagnostic service is an integral part of first level customer problem resolution.

8.8.1 REMOTE DIAGNOSTIC SUPPORT

The VS-15 hardware supports several features related to remote diagnostic service. These include a basic telecommunication capability, and the microcode required to establish a link with the Remote Maintenance Center. Necessary Customer, System, and Service information is stored and maintained without external system power. And finally, a TC link can be established over ordinary telephone lines and off-line diagnostics can be run remotely.

One of the features supported involves the use of the Nonvolatile RAM (NVRAM) on the Bus Processor board (refer to paragraph 8.9). The NVRAM is maintained by various VS Operating System application programs, operating system hooks and microcode support. The contents of the NVRAM is the first block of data transmitted from the VS-15 during a remote diagnostic session. The data transmitted is made up of the following sections:

1. Customer Information
2. System Configuration
3. Hardware Configuration
4. Service Log

The primary feature involves the Bus Processor's capability to run all off-line diagnostics remotely. Locally resident diagnostic packages, already loaded on the system, can be run from the Remote Maintenance Center. (Refer to paragraphs 3.2.2.4 and 8.8.2). The 8086 microprocessor code necessary to establish the link with the Remote Maintenance Center resides in the BP Code RAM.

In the United States and Canada (except Hawaii), a Remote Diagnostic Modem (WA 3451) is shipped with each VS-15 system. (The modem is to be used for remote diagnostic sessions only and will be removed from the customer's site if the service is not implemented.) Using ordinary telephone lines, the customer can easily establish a remote diagnostic session with the Remote Maintenance Center.

8.8.2 REMOTE DIAGNOSTIC PROCEDURES

It is normally the customer who initiates the remote diagnostic session and coordinates with the Remote Maintenance Center (RMC) during the testing. It is not necessary for the CE to be present at the site during the remote diagnostic session. The basic remote diagnostic procedure is as follows:

1. Experiencing a problem with the system, the customer establishes that the problem is not operator dependent by following the procedure given in the VS-15 Operator (Customer) Level Troubleshooting Flow Chart (figure 8-13), and notifies the Area Call Control Center (CCC).

2. The CCC then calls the home office Technical Assistance Center (TAC).

3. The TAC Remote Maintenance Center (RMC) establishes a telephone line data link between the RMC diagnostic system and the customer's VS-15.

4. The RMC reads and analyzes the information from the VS-15's Nonvolatile Random Access Memory (NVRAM).

5. The RMC runs the diagnostics from the diagnostic diskette inserted by the customer into the diskette drive of the customer's system.

6. The RMC notifies the Area CCC of the test results and which Field Replaceable Unit, if any, failed.

7. The CCC notifies the local Customer Engineer who completes the service call, including updating the NVRAM.

8.9 NONVOLATILE RAM (NVRAM)

All VS-15 systems have a special 2K byte x 8-bit memory area called Nonvolatile Random Access Memory (NVRAM). The NVRAM is physically located on the Bus Processor (BP) board and is logically located within the BP's memory addressing space. A special long-life battery, also located on the BP, provides back-up power to make sure that the NVRAM retains its data (remains nonvolatile) during a power outage or when the system is normally powered-off.

The primary purpose of the NVRAM is to provide a condensed outline of customer information, system configuration, hardware configuration, and service log information for the remote diagnostic facilities. At the beginning of a remote diagnostic session, all the contents of the NVRAM, plus the power-up error codes, will be transmitted to the Remote Maintenance Center. This information will aid the Center in diagnosing the customer's problem.

The NVRAM can be read and written on-site by two utility programs; LOADNV and SHOWNV. The NVRAM initially contains no information until data is entered using the LOADNV utility. From that point on, the contents of the NVRAM may be updated by the Customer Engineer during each service call.

8.9.1 NVRAM UTILITIES

Two applications programs, LOADNV and SHOWNV, are used to manage the NVRAM. These programs run under the VS Operating System and support features which include displaying, modifying, and printing any of the defined NVRAM fields. The LOADNV program also supports backup/restore functions between the physical NVRAM and a disk file. The NVRAM may be viewed using either the LOADNV or the SHOWNV programs, but may be modified only with the LOADNV program. For a complete description of the NVRAM Utilities refer to Documentation WLI P/N 760-1135 (195-2452-0).

The LOADNV and SHOWNV programs display and/or print a formatted view of the NVRAM. This formatted view currently consists of four sections. The following is an overview of the contents of each section:

1. Customer Information Section: This section, loaded at installation time,includes customer identification, service location, system serial number, and information regarding the type of customer service contract.

2. System Configuration Section: The second section includes the VS operating system version, and the CPU and BP microcode versions. It also contains a system-wide ECO map and a system maintenance count. This, along with the Customer Information Section, covers all system-level information.

3. Hardware Configuration Section: The third section is segmented by Device Adapter (DA) with each DA's devices being tracked by their I/O Device Addresses (IODAs). Serial number, ECO-level, and error counts (maintained dynamically by the CPU and BP microcode) are stored separately for each device. The CE can view and alter devices as a group (eg: all serial devices) or individually.

4. Service Log Section: This last section contains one entry per service call. An entry includes call report number, and repair and subunit codes. A maximum of 12 entries can be stored, after which the oldest entry is discarded.

8.9.1.1 LOADNV Utility

The LOADNV program provides flexible read and optional modify control to all NVRAM sections. The program supports loading the NVRAM at installation time, generating backup disk files of the NVRAM data, and entering service call report information.

After running LOADNV, a check can be made of hard copy output to verify the changes. If any errors are detected, the program can be rerun recalling the output just generated. The CE can select only the particular field(s) within a section which need correction. These field(s) can be easily modified and the newly updated data replaced.

The program also allows a prototype disk file to be generated. This file can be initialized for a general VS-15 I/O device configuration. The prototype file can then be used as a standard starting point file for on-site running of LOADNV at system installation time. The operation of the LOADNV utility is divided into three distinct processes:

1. Selection of Input Data: The initial screen of the LOADNV program is used to define the input data to be used by the utility. One of the three input options may be selected. The three input options and their most common uses are:

   a. Disk File Input: Provides the LOADNV utility with a preformatted NVRAM image file from a disk, at which time further updates may be made.

   b. Default Input: Used when generating an NVRAM image from scratch, such as for a new VS-15 system installation.

   c. Direct NVRAM Input: Uses the actual data in the NVRAM as input for the utility. It would be most commonly used to update the service log section.

2. Processing and modification of the selected input data using the Section Selection Menu:

   a. Once the input data is defined by selecting one of the three input options, the LOADNV program then allows this data to be processed or modified.

   b. Data is accessed by logical NVRAM section name (customer information section, system configuration section, hardware configuration section, and service log section). As many sections as may be required can be accessed and modified.

   c. All modifications are made to the input data and held within the LOADNV program. The final disposition of the updated data is determined by the output options.

3. Selection of the destination of the processed or modified data: After modifying the desired section(s), the LOADNV program displays the output options. One of three output options may be selected.

   a. Create NVRAM Image File: Allows the NVRAM data to be written to a user-specified disk file. Useful for saving NVRAM data to be used later.

   b. Load Data Into NVRAM: Allows NVRAM data to be written directly into the physical NVRAM, destroying the previous contents. This option would be most commonly used to update the service log section.

   c. Load NVRAM and Create NVRAM Image File: Combines both of the previous options, also destroying the existing contents of the NVRAM.

After the output section is chosen, the LOADNV program performs the selected function and also generates a formatted NVRAM print file. The print file is generated and placed in the system print queue on HOLD.

8.9.1.2 SHOWNV Utility

The SHOWNV program allows either examining the physical NVRAM without any possibility of accidentally modifying the current data, or examining an NVRAM image file. It will also generate hard copy printouts of either.

1. Selection of Input Data: The initial screen of the SHOWNV program is used to define the input data to be used by the utility. One of two input options may be selected, as follows:

   a. Use an existing NVRAM image file: Provides the SHOWNV utility with a preformatted or backup NVRAM image file from disk. Uses the 2K NVRAM disk image file as input to the utility.

   b. Use NVRAM native: Allows current NVRAM data to be used as input by the utility. Commonly used to examine service call information. No data modifications may be made.

2. Processing Functions: Once the input data is defined, the SHOWNV program generates a formatted print file of the NVRAM or Image File data, whichever is selected as input.

3. Display Function: The print file is displayed via a link to the VS DISPLAY utility. Data is displayed in a format identical to the print format used by the LOADNV utility. All processing functions within the DISPLAY utility are available to manage the print file.

VS-15 CUSTOMER ENGINEERING LEVEL
TROUBLESHOOTING FLOW CHART (1 OF 5)

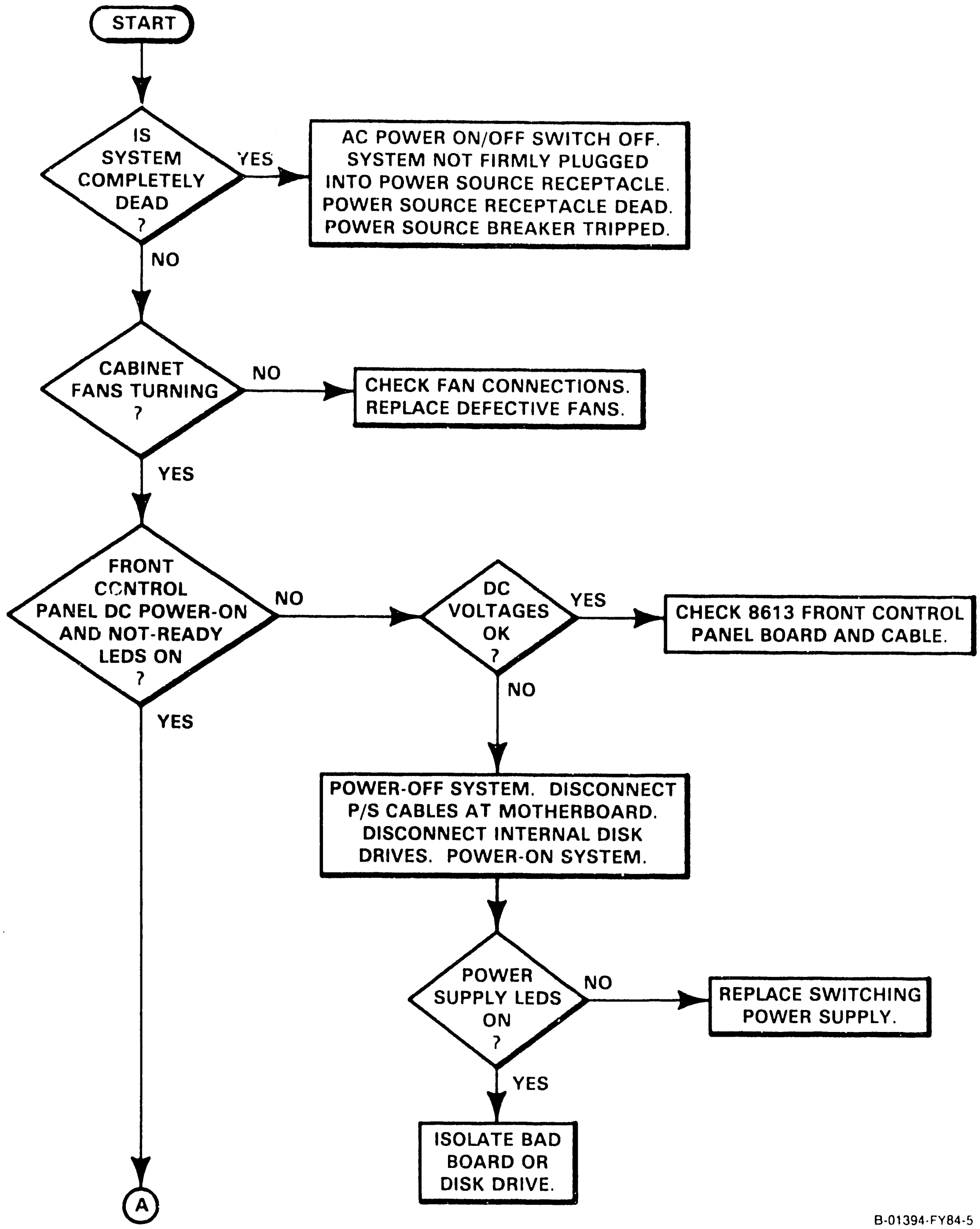


Figure 8-12A. Customer Engineering Level Troubleshooting Flow Chart

VS-15 CUSTOMER ENGINEERING LEVEL TROUBLESHOOTING FLOW CHART (2 OF 5)

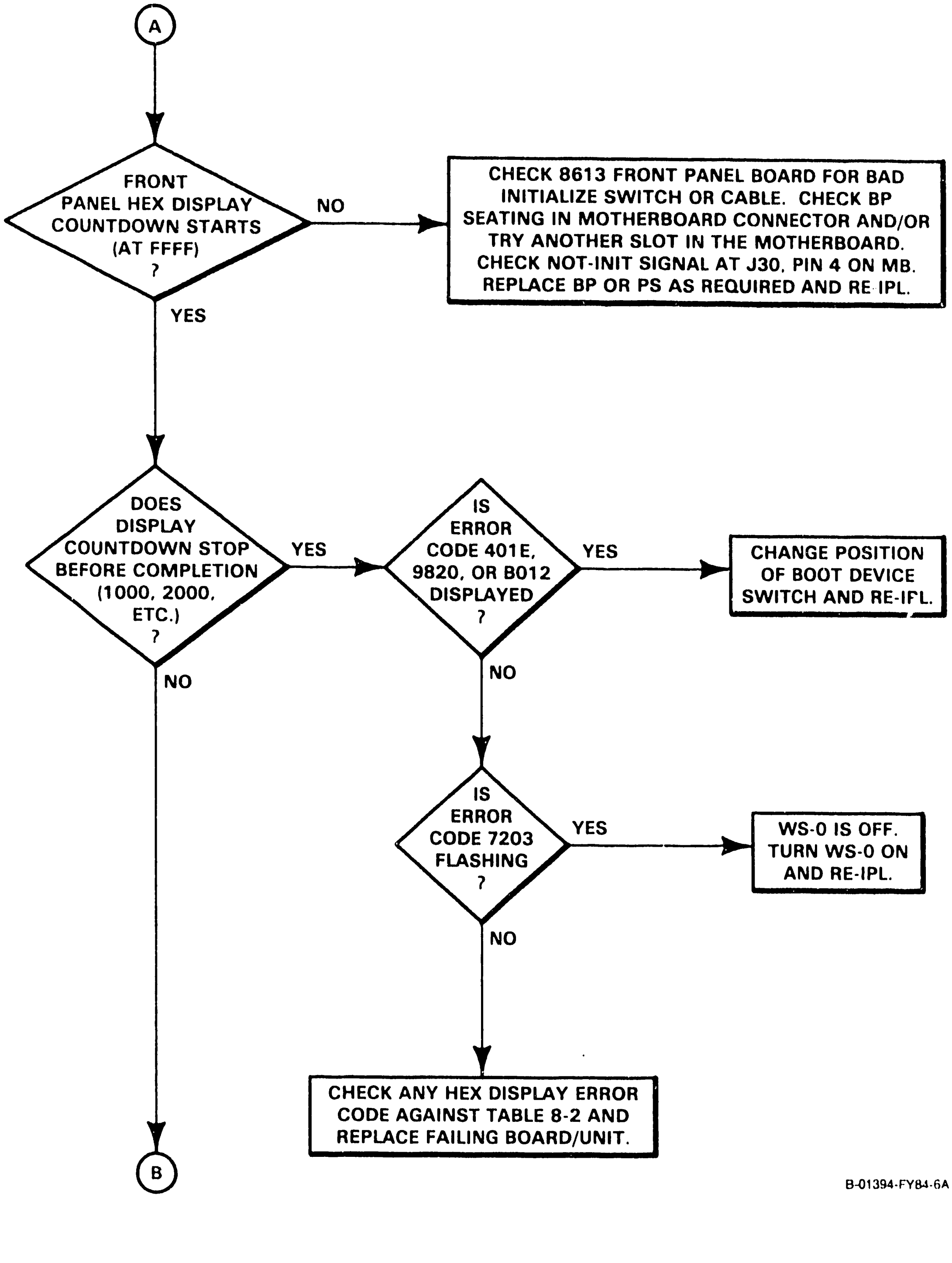


Figure 8-12B. Customer Engineering Level Troubleshooting Flow Chart

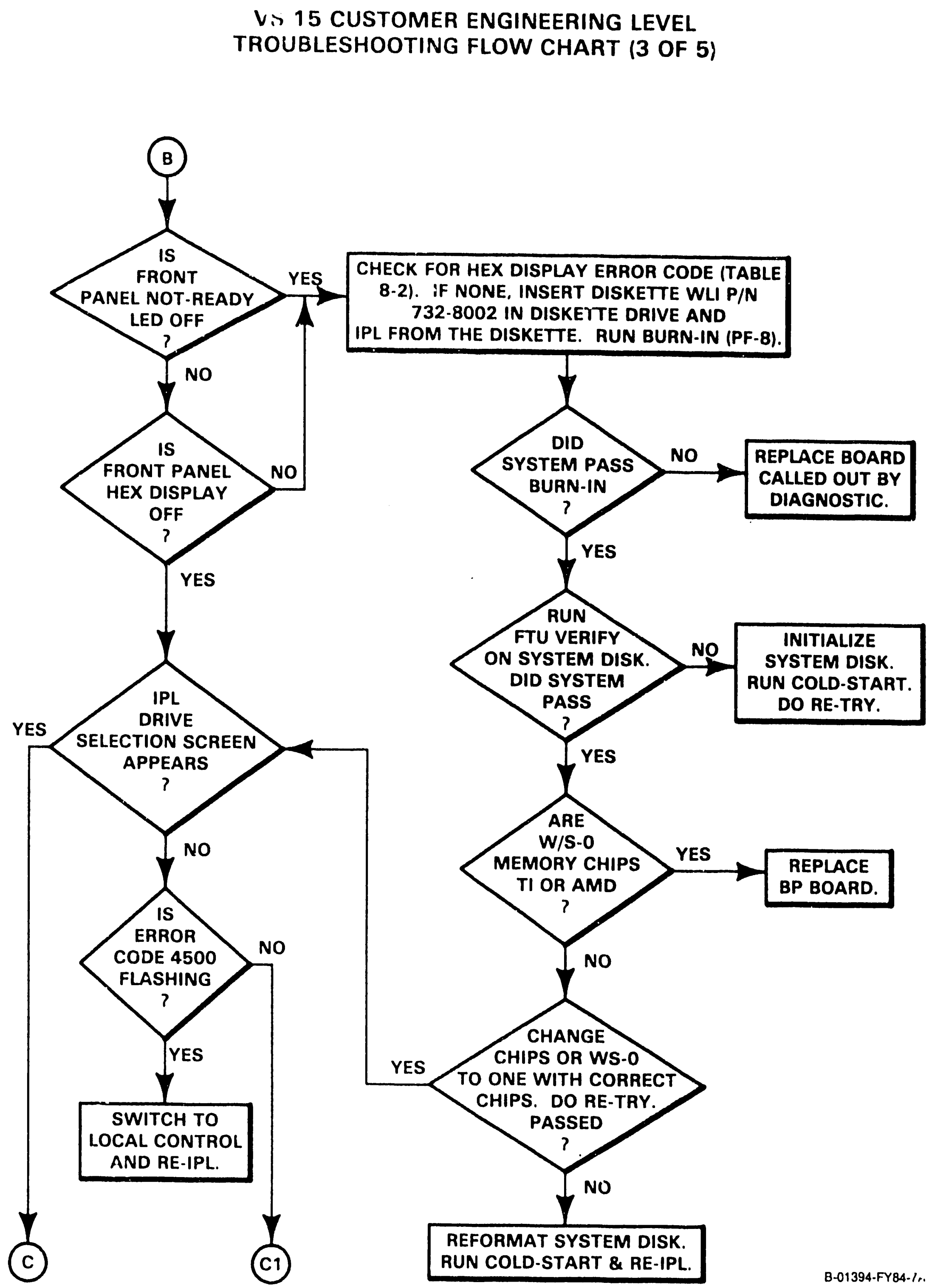


Figure 8-12C. Customer Engineering Level Troubleshooting Flow Chart

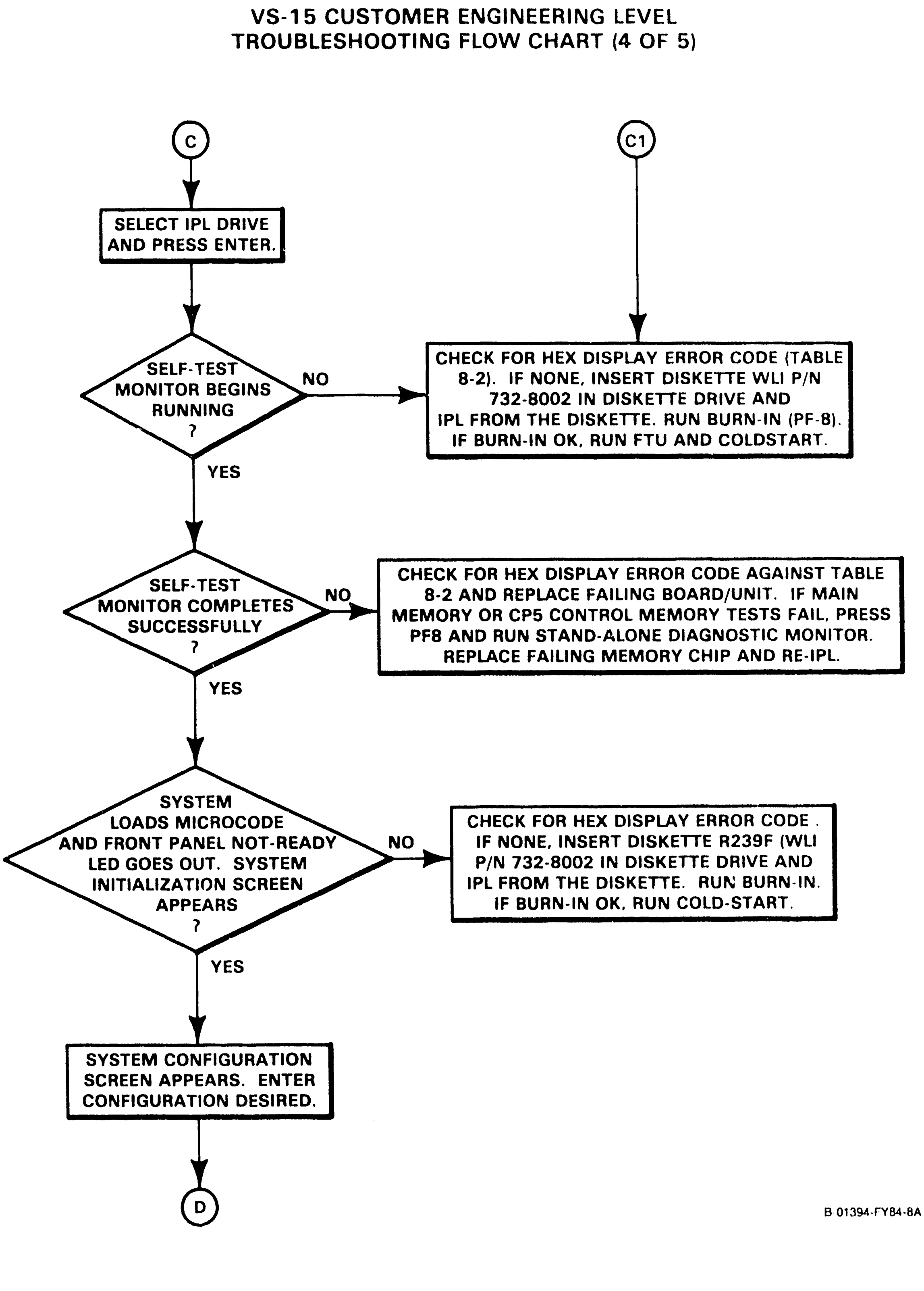


Figure 8-12D. Customer Engineering Level Troubleshooting Flow Chart

VS-15 CUSTOMER ENGINEERING LEVEL TROUBLESHOOTING FLOW CHART (5 OF 5)

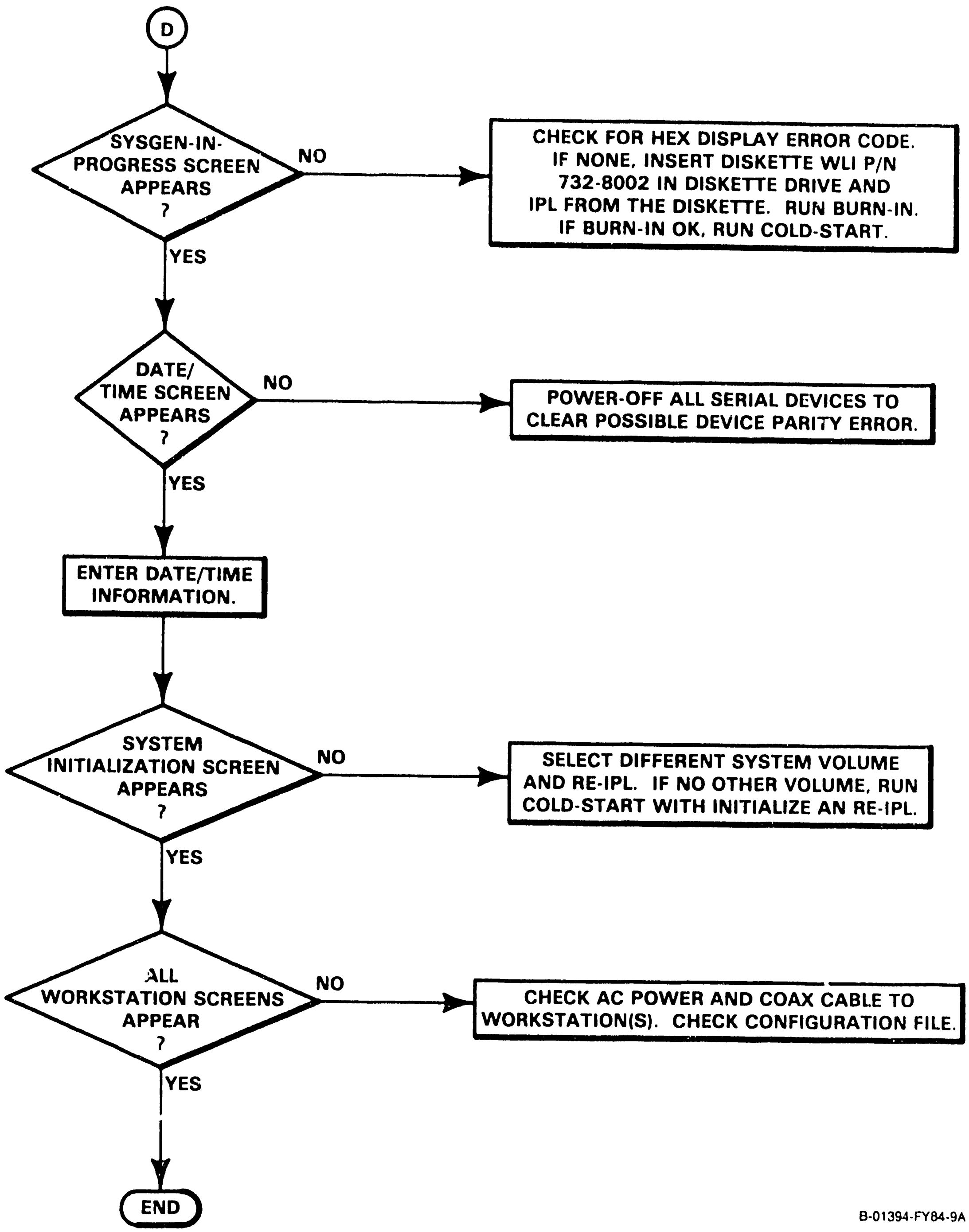


Figure 8-12E. Customer Engineering Level Troubleshooting Flow Chart

VS-15 OPERATOR (CUSTOMER) LEVEL TROUBLESHOOTING FLOW CHART (1 OF 4)

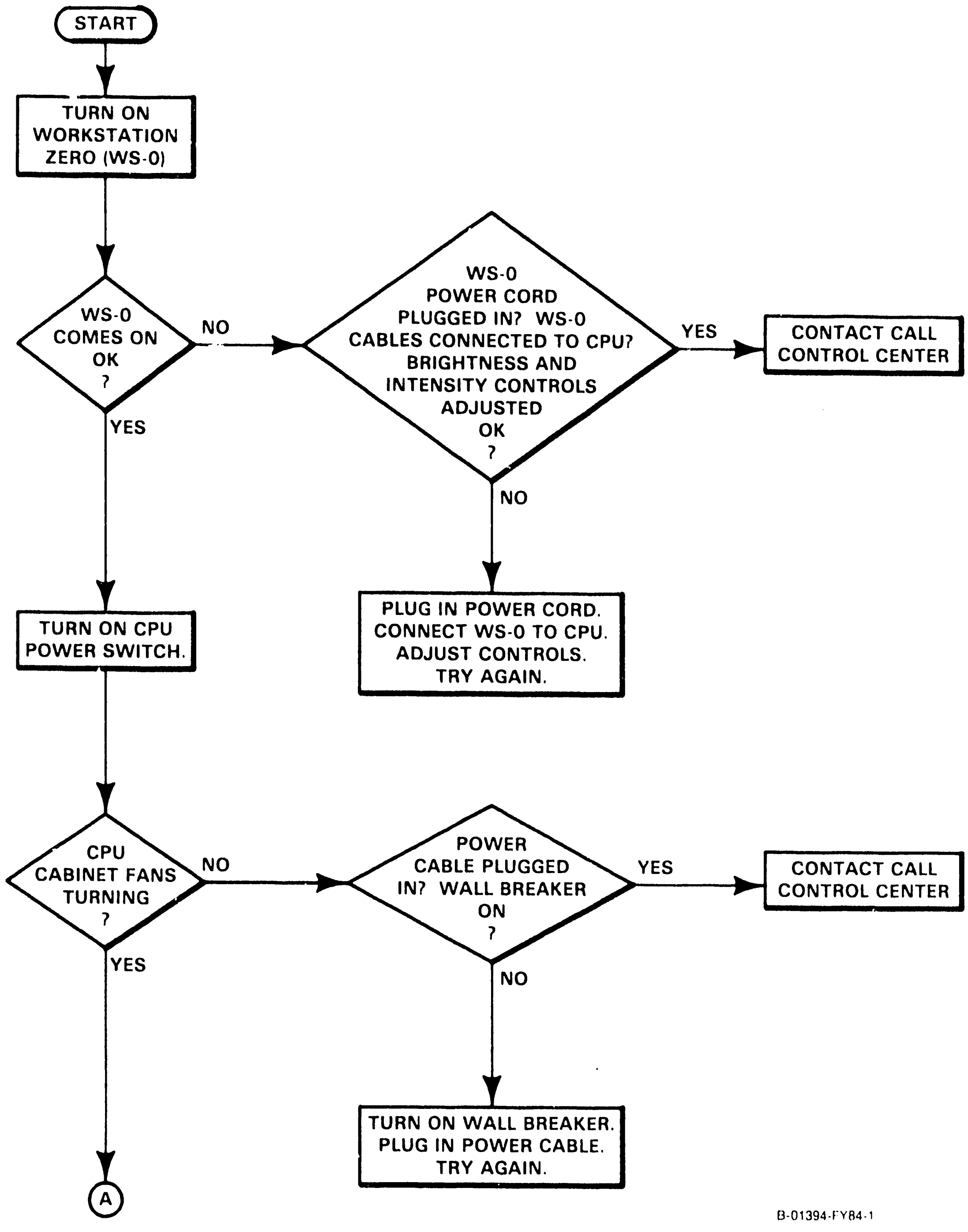


Figure 8-13A. Operator (Customer) Level Troubleshooting Flow Chart

VS-15 OPERATOR (CUSTOMER) LEVEL TROUBLESHOOTING FLOW CHART (2 OF 4)

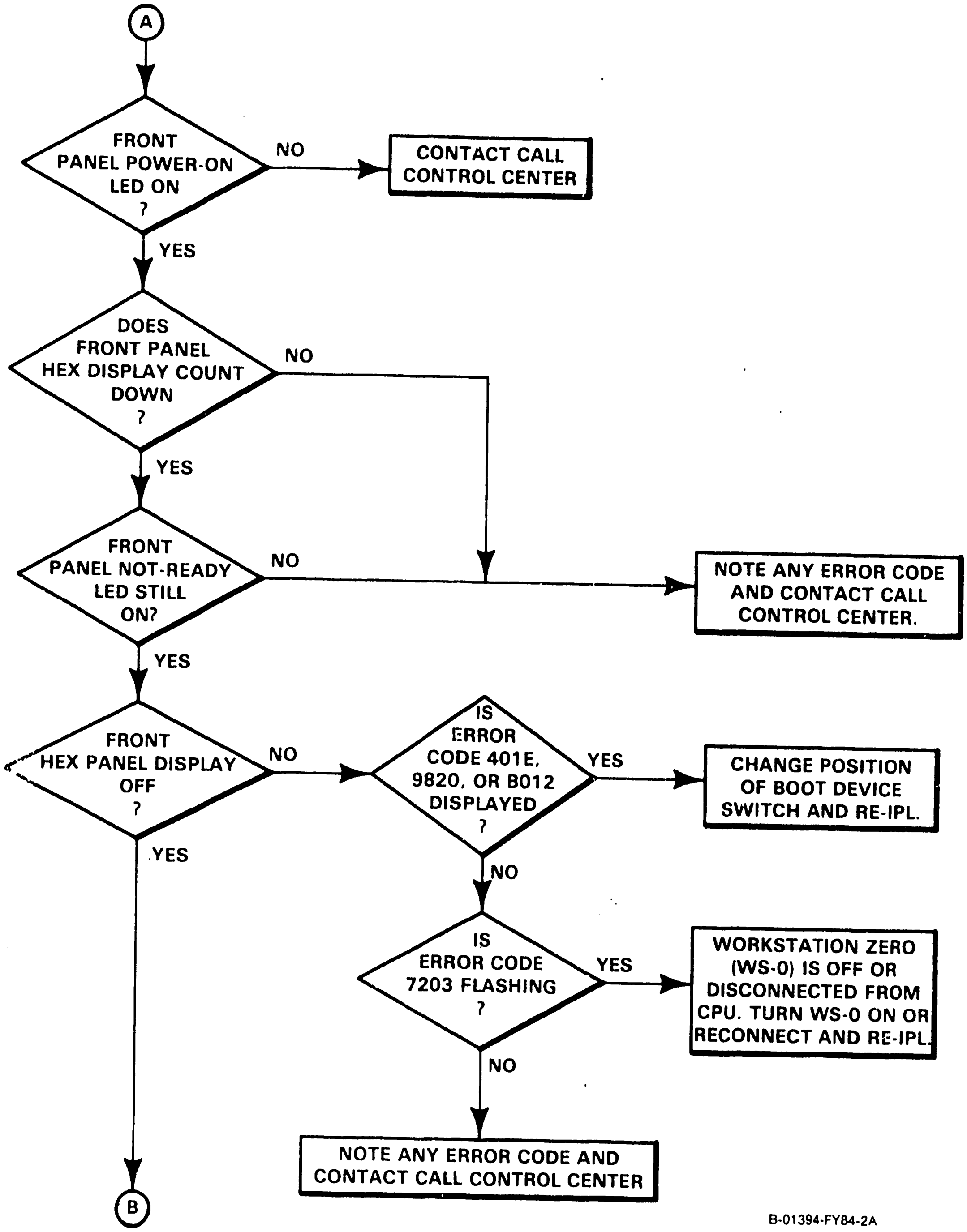


Figure 8-13B. Operator (Customer) Level Troubleshooting Flow Chart

VS-15 OPERATOR (CUSTOMER) LEVEL TROUBLESHOOTING FLOW CHART (3 OF 4)

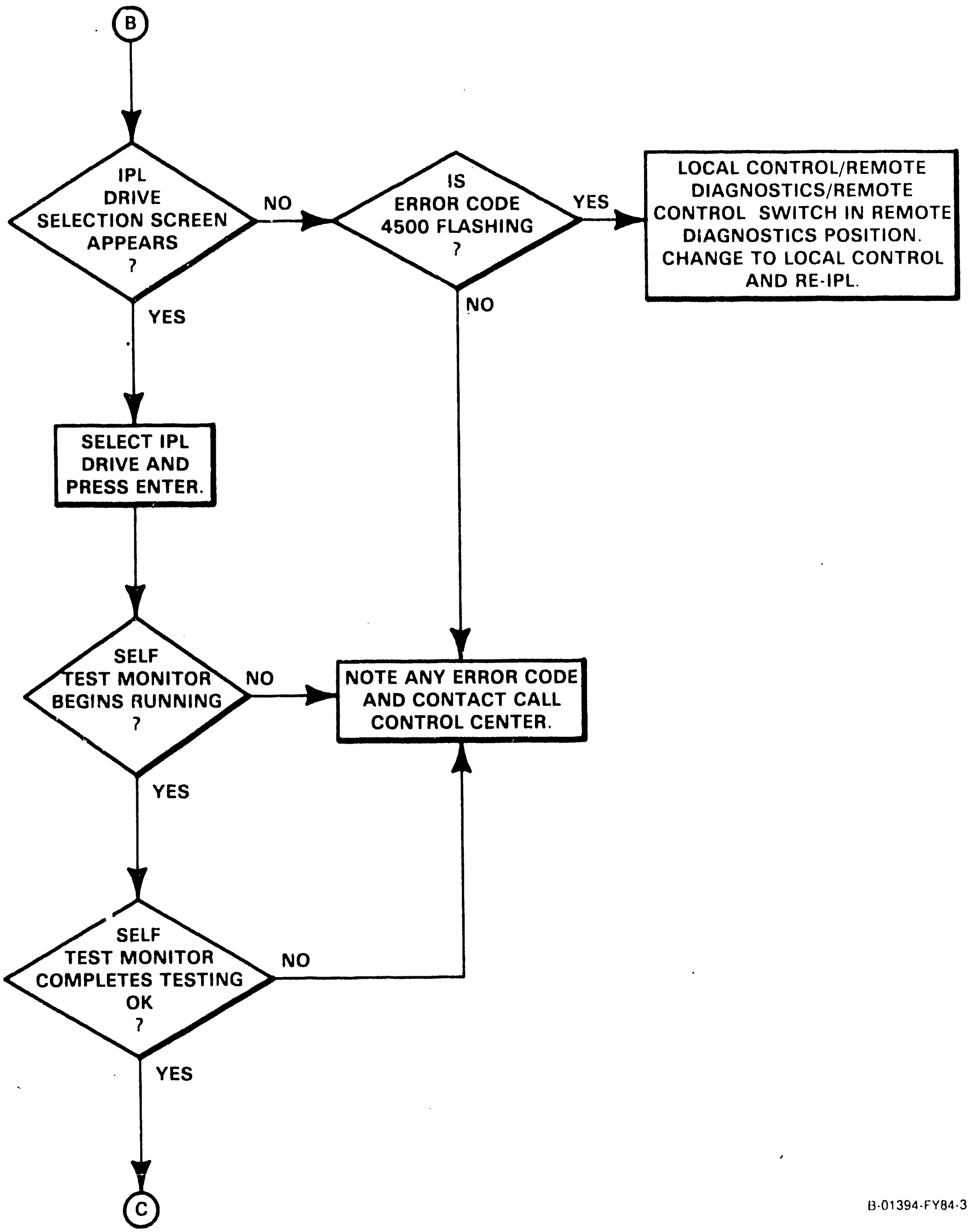


Figure 8-13C. Operator (Customer) Level Troubleshooting Flow Chart

VS-15 OPERATOR (CUSTOMER) LEVEL
TROUBLESHOOTING FLOW CHART (4 OF 4)

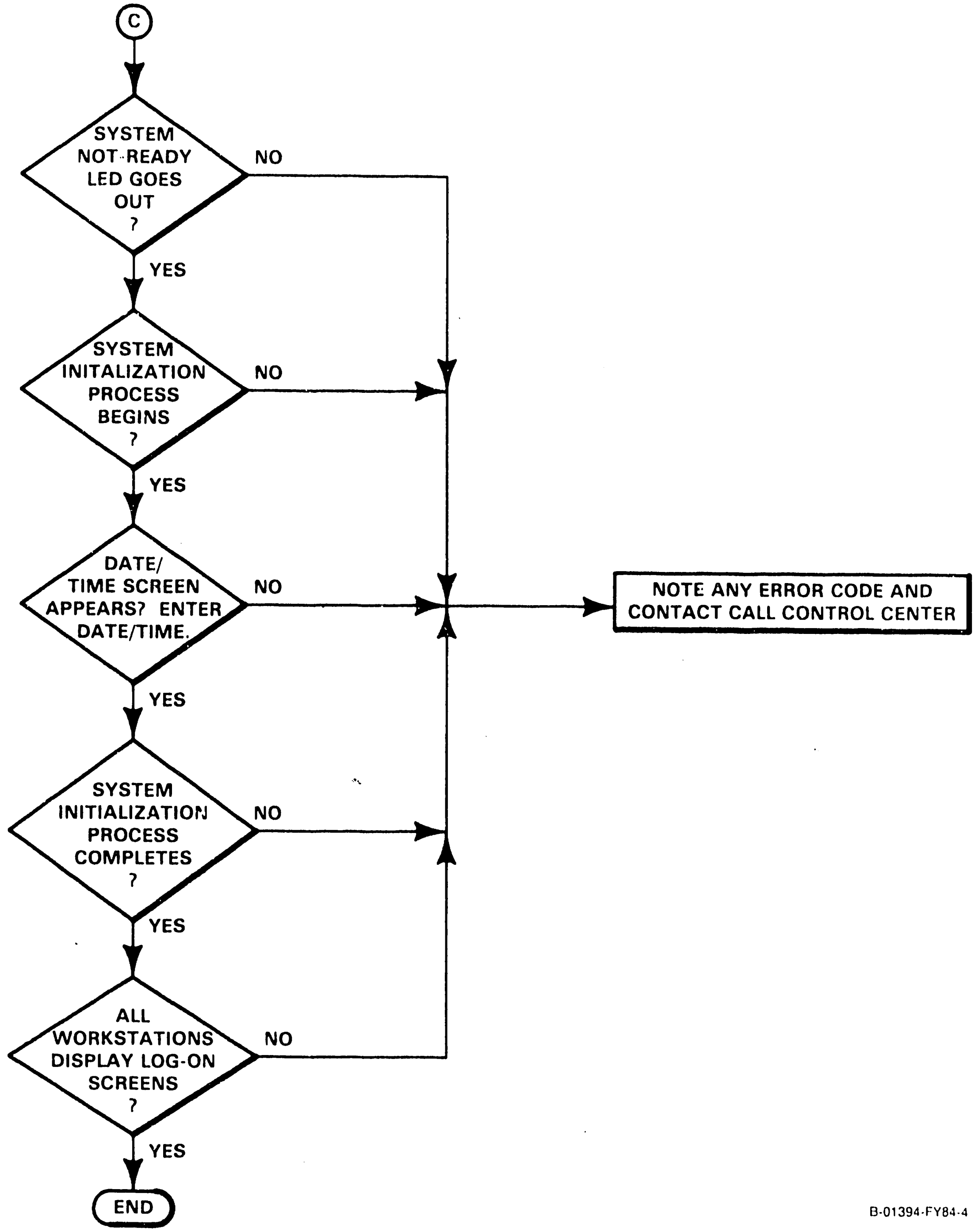


Figure 8-13D. Operator (Customer) Level Troubleshooting Flow Chart

APPENDIX A

APPENDIX A

MNEMONICS, WORDS/PHRASES, MICROINSTRUCTIONS, & MISCELLANEOUS HARDWARE RELATED FUNCTIONS

DEFINITIONS FOR VS-15 SIGNAL-NAME (TRUE) MNEMONICS

MNEMONIC	DEFINITION	SOURCE	DESTINATION	DESCRIPTION
BPA0-19	BP Addresses	BP	CP, DA's	Addresses to load CPU CM RAM
BPD0-15	BP Data	BP	CP, DA's	Data for CPU CM RAM
BPINT0-15	BP Interrupts	BP	BP	Interrupts from 8253 PIT to 8259A PIC
BR0-15	B Register	CP	Cp	B Register data output
CB0-31	C Bus Data	CP	CP	C Bus output data
CM0-39	Control Memory	CP	CP	Microinstruction Data Bits
CN0-7	BALU	CP	CP	8-bit BALU output
DA0-15	Data RAM Addresses	DA's	BP	One word of address for BP Data RAM addressing
DD0-15	Data RAM Data	BP,DA's	DA's,BP	One word of data to or from BP/DA's
DN0-7	DALU	CP	CP	8-bit DALU output
MA0-20	Memory Address	CP,BP DA's	MM	CP/BP/DA memory addresses for main memory
MAR0-23	Memory Add Reg	CP	CP	MAR output addresses
MD0-15	Memory Data	MM	CP,BP,DA's	CP/BP/DA memory data to/from main memory
MDR0-15	Memory Data Reg	CP	CP	MDR output data
MCB0-2	Main Memory Control Bits	CP,BP, DA's	MM	Command bits for MM
MGS0-7	Memory Grant Strobe	MM	CP,BP, DA's	Main Memory Access granted
MRI0-7	Memory Request In Strobe	CP,BA, DA's	BAP	Request to main memory for access
MSB0-1	Main Memory Status Bits	MM	CP,BP, DA's	Status bits from the MM
PMR0-7	Program Mask Register	CP	CP	Program Mask Reg data output

MNEMONIC	DEFINITION	SOURCE	DESTINATION	DESCRIPTION
PT0-15	Page Table	CP	CP	Page Table output from T-RAM
SD0-15	Stack Data	CP	CP	Data from CP Stack
U0-15	BALU	CP	CP	16-bit BALU output

VS-15 MNEMONICS

MNEMONIC	HARDWARE ORIENTATED DEFINITION
A-Register Source Selector	Selects 1 of 4 inputs for A-Register
ALLOW PE	Allow code RAM parity error
ALU	Arithmetic-Logical Unit
ALU Input Selector	Output to 8-bit Decimal ALU/Binary ALU
ALU Level 1	All ALU operations
ALU Level 2	Most ALU operations
ALU Level 3	Move operations
AMX0-2	Input select bits for A-Register Source Selector. From Process Field Decoder
AR0-15	A-Register data
Auxiliary Registers	Work or spare CP Stack registers
BALU	Binary Arithmetic Logic Unit(s) (8 and 16-bit)
BCD	Binary coded decimal
BIU	Bus Interface Unit
BMDS	Memory Data Strobe
BP	Bus Processor
BP-DSB	BP status bit. ECC failure encountered during BP access of Data RAM
BP-TR1	BP status bit. Initialize button pressed
BP-TR2	BP status bit. Reset button pressed
BPA0-19	BP Addresses
BPD0-15	BP Data
BR0-15	B Register Data
BRCK	B Register Clock
C-Bus Selector	Selects 1 of 4 inputs for C-Bus
CA	Carry Bit
CAS	Column Address Strobe
CB0-15	C-Bus Data
CBT	Change bit
CCS0-1	Condition Code bits
CDLI	Control Device Level Interface
CIO	Control I/O
CM	Control Memory
CM	Control Mode
CNT0-1	Used to address Process Field Decoder PROMs. Generated by counter clocked by master clock
CP5	VS-15 Central Processor
CPDEN	CP Data Enable
CRAM	Code RAM
CRYSTAL	Crystal clock speed for Data RAM
CSEL	CM bit 12. Selects high or low order byte of CP Stack data for 8-bit ALUs
DA	Data RAM Address
DALU	Decimal Arithmetic Logic Unit (8-bit)
DD	Data RAM Data
DEC	Status bit set for Invalid Decimal digit found in A or B Bus Operand for Decimal Add/Subtract with Carry
DEF	Dual Error (Memory)

MNEMONIC	HARDWARE ORIENTATED DEFINITION
DGS	Data Grant Strobe
DIGS	Data In Grant Strobe
DMA	Direct Memory Access
DRAM	Data Random Access Memory
DRI	Data Request In
ECC	Error Correction Code
ECNT	Error Count
ENO-2	BP address bits 1 and 2 used to enable Control Memory bus transceiver
EU	Execution Unit
FAST	Fast clock speed for Data RAM
FDC	Diskette Drive Controller
Fault bit	T-RAM invalid virtual address
General Registers	Outer program General Registers
HOB	High Order Bit
I/O	Input/Output
IA2-12	Addressing for Control Memory RAMs (IA2-12) from Instruction Counter Register
IC	Instruction Counter
IC Source Selector	Selects address source for Control Memory RAM
ICO-1	Chip select for Control Memory RAMs
INVA	Invalid physical memory address
IO3	Interrupt to let BP know when current I/O-Interrupt has been accepted by CP
IO4B	Interrupt bit providing interlock so CP does not overwrite current command before BP can process it
IODEN	I/O Data Enable
IODTR	I/O Data Transmit/Receive
IORD	I/O Read
IOWR	I/O Write
IPL	Initial program loading
IREG	Instruction Register
IREG	Indirect Register
Immediate/Stack Data Selector	Selects input to 8-Bit Binary/8-Bit Decimal ALU
Instruction Counter Register	Addressing for Control Memory RAM
Instruction Length Code	Indicates length of current machine language instruction. Used by specialized microinstructions to support outer-level machine language
LDBR	Load B-Register
LDSO-2	Load strobes
LOOPBACK	Loop necessary signals back to test UART
MA	Memory Address
MAO-12	Memory address bits
MAO-20	Memory address lines
MA11-20	Memory Address Output Buffer Data
MAR1	Memory Address Register #1
MAR2	Memory Address Register #2
MCB	Memory Control Bit
MD	Memory Data
MDR	Memory Data Register

MNEMONIC	HARDWARE ORIENTATED DEFINITION
MDRH	Memory Data Register High
MDRL	Memory Data Register Low
MDS	Memory Data Strobe
MG	Memory Grant
MGS	Memory Grant Strobe
MM-DSB	BP status bit. ECC during MM DMA access of Data RAM
MSB0	Invalid main memory address
MSB1	ECC Error
MOP	Memory operation field (Control Memory bits 18-22)
MPAR	Memory Parity Error
MRI	Memory Request In
MSB	Memory Status Bit
MSEL	Trap 0003/0006. MAR in use when trap taken
Main Memory ECC	Error Correction Code
Memory Address Output Selector	Concatenates 13 bits of T-RAM addresses with low order 11 bits of virtual address to form 24-bit physical Main Memory address
MAR Input Selector	Selects high input order bits for MAR from C Bus or T-RAM
PA	Physical Main Memory address
PMR	Program Mask Register
PROM	Programmable Read Only Memory
Process Field Decoder	Control signals stored in PROMs
R/W	Read/Write
RAM	Random Access Memory
RAS	Row Address Strobe
RBT	Reference bit
RCT	Page Frame Reference And Change Table
RDE	Read
REF	Refresh
RMW	Read modified write
Read and Write Protect Bit	Protects page against being read or over-written.
Ripple operation	Increment/decrement MAR
SD0-15	CP Stack Data
SEF	Main memory single bit error
SHBR	Shift B-Register
SID	System Identification Number
SIO DA	Serial I/O Device Adapter
SLOW	Slow clock speed for Data RAM
SMX0-7	Generated from Process Field Decoder to select Stack Address Multiplexor for CP Stack Addressing
SRD0-12	Source of address of next microopcode to be executed. From Subroutine Return Register
Snn(0-15)	CP Status bits
Stack	Local RAM area used for temporary storage by CP
Stack Address Multiplexor	Selects Stack Address source
Stack Byte Selector	Select high/low order byte of CP Stack data for 8-bit ALUs
Stack File Registers	Work registers for CP microprogram

MNEMONIC	HARDWARE ORIENTATED DEFINITION
State	System/User State
Subroutine Return Register	Contains next microinstruction address, to be used for Conditional Subroutine Return
System Mask bits	PMR2-5. Enables/ disables various interrupts
System Registers	Outer program Control/ Floating Point Registers
T-RAM	Translation RAM (PT0-15)
TALIGN	Alignment Trap
TBI	Pagespan Trap
TC	Telecommunications
TCC	BOP Trap
TIM	Real-time clock tick
TRAP03	Translation Trap (T-RAM Fault)
TRAP04	Protection Trap (Page Table 1/2)
Traps	Interrupts to CP microprogram
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
VA	Virtual memory address
VCO	Voltage Controlled Oscillator
WP	Write Pulse
WT0-2	Write enable for Control Memory RAM. From IOWR-IO Write
Work Registers	128 16-bit CP Stack registers used in relation to translation operations
XD0-15	Control Memory data bus transceiver data
XDR0-15	Input from BP to IC Source Selector as source for address of the next microopcode to be executed

MNEMONIC	SOFTWARE ORIENTATED DEFINITION
BOP	Branch field of CP microinstruction
FLUB	File Length and User Block
INVA	Invalid Address
IO	Input/Output
IOCA	I/O Command Address
IOCW	I/O Control Word
IOSW	I/O Status Word
LRU	Least Recently Used
MMPFT	Main Memory Page Frame Table
MOP	Memory Operation field of CP microinstruction
NOP	No Operation
OS	Operating System
OVF	Overflow
PA	Physical Address
PCW	Program Control Word
PF	Page Frame
PFN	Page Frame Number
POP	Process field of CP microinstruction
PT	Page Table
PTA	Page Table Address
PTE	Page Table Entry
R/C	Reference and Change status bits
RP	Read Protect
RS	Reset State
Segment 0	512 Kbytes of supervisory routines/data for Op System
Segment 1	512 Kbytes for user program
Segment 2	4K to 512 Kbytes (in 4K increments) for user data
SIO	Start I/O
SQB	Status Qualifier Byte
VA	Virtual Address
WP	Write Protect

VS-15 WORDS/PHRASES

WORD/PHRASE	DEFINITION
Background Processing	Automatic execution of batched lower priority programs by Operating System whenever no higher priority programs are being handled.
Base Address	Starting address of a page frame.
Byte Index	A value, when added to a base address, that results in true physical address of a byte in main memory.
Command Processor	Special program used to call up all system functions.
Concatenated	Linked together in a series.
Current PCW	The "active" or "controlling" PCW - the one that pertains to instruction that is currently being executed.
Data Base Management System	Process (program) that allows multiple users to access common data files.
Demand Paging	Memory management feature where portions of a program are called into memory as they are needed.
Displacement	See Byte Index.
Distributed Processing	Technique of sharing a Central Processor among more than one user.
Dynamic Access Mode	Technique which lets program switch back and forth between sequential access and random access in same data file.
File	Logical unit of data records.
Indexed Filing	Technique which stores data records in the order of specified key values.
Interactive	Process to allow users to communicate directly with a system (eg; from a workstation).
Locality Of Reference	Quality of a program prepared for maximum execution speed by means of remaining on one page frame as long as possible before branching elsewhere.
Macro	Named routine that is called up for processing whenever the corresponding name is specified as part of a high level instruction.
Linking	Connecting or tying together.

WORD/PHRASE	DEFINITION
Macro (Inner-layer type)	Series of microinstructions which, when executed, accomplish the purpose of the Macro equivalent to a machine instruction, IBM instruction, or Assembler instruction).
Macro (outer-layer type)	An instruction which, when executed, calls up a sequence of instructions (a subroutine) for execution, and then branches back to the original program.
Macroassembler	Computer having the capability to process defined macros.
Macroinstruction	Name of a routine, prepared in Assembler language, that gets called up for execution whenever the name is used as part of a high level instruction.
Menu	Generally, a list of available options displayed on the CRT when the system is turned on or after an operation has been completed. The term menu should be used to define the presence (existing or desired) of a list of two or more program branching possibilities OR parameter identification inputs that the system must solicit from the operator.
Multiprogramming	Quality of a computer to process more than one program simultaneously.
Outboard Side	External to (away from) the CP.
Page	Block of 2,048 contiguous one-byte virtual memory locations that begin at an address of zero, 2048, or some multiple of 2048.
Page Fault	Indication that a particular page is not in main memory.
Page Fault Exception	Error condition indicating that a page is invalid.
Page Frame	2K blocks of contiguous one-byte physical memory locations that begin at a physical (main) memory address of zero, 2048, or some multiple of 2048.
Page In	Read from disk into main memory.
Page Out	Write to disk from main memory.
Page Table	An entry into Translation RAM containing the starting address of a physical page boundary.

WORD/PHRASE	DEFINITION
Paging Task	That portion of the operating system that controls paging.
Print File	Disk file that is to be printed by a specific printer at the convenience of the Operating System and/or the System Console operator.
Print Queue	Collection of print file records pertaining to one or more printers (also, the sequence list identifying those records and the order in which they are to be printed).
Print Spooling	Temporarily storing print jobs on disk until a printer is available.
Procedure (Language)	Language used to create special text functions to perform operations normally executed interactively at a workstation.
Program Interrupt	Break in the normal sequence of instruction execution because of an error or request for assistance. The supervisory system seizes control to take action.
Prompt	Name of a message (usually a one-liner) directing the operator to perform some action.
Relocatability	Capability of a program to be initiated at any page frame and to randomly occupy any number of additional page frames as a consequence of a linkage of its subsequent parts by an address pointer.
Segment	Block of contiguous one-byte virtual memory locations, with the block beginning on a decimal value virtual address of zero, 1,048,576, or some multiple of that value.
Segment Control Register	CP register containing the page table virtual address and the page table length.
Sequential Filing	Technique which stores data records in the order in which they are written or entered.
Stack	Local RAM area used for temporary storage by the CP.
Swapped Into	When an entire program is brought into main memory and allowed to run for a certain amount of time.
Swapped Out	When an entire program is replaced in main memory by another program which is allowed to run for a certain amount of time.

WORD/PHRASE	DEFINITION
System Console	Workstation that additionally or alternatively controls special functions not available to other, "regular" workstations of the system.
Thrashing	Phenomenon of excessively moving pages back and forth between memory and secondary storage" (particularly because of "removing a page from memory and then immediately needing it again due to a page fault referencing that page").
Virtual Address	Disk address containing the location of a page. The disk address will be translated to a physical main memory address by the CP so the page will be read into the correct main memory location for a particular user.

VS-15 MICROINSTRUCTIONS

MNEMONIC	OPCODE	MICROINSTRUCTION ORIENTATED DEFINITION
A	0A	Add (CA in=0; no CA out)
AC	02	Add with Carry
ACM	3C	Add with carry
ACO	06	Add with Carry (CA in = 1)
ACP	0B	Add for Pagespan Check
ACV	07	Add with Carry (Overflow bit set)
ACZ	03	Add with Carry (CA in = 0)
AND	08	Logical AND
ANDI	20	Logical AND Immediate
ANDM	39	Logical AND
BD	37	Generate Base Displacement Address
CCS1	2C	Set CC based on ALU, CA, and S1
CCS2	2D	Set CC directly (from S14 and S15)
CCSET	2E	Set Explicitly (immediate)
CIO	2A	Communication operation (CP - BP)
CSGN	2F	Set CC based on register sign and value
DACM	3E	Decimal add with Carry
DGC	38	Disable ECC generation
DSCM	3F	Decimal subtract with Carry
DSET	2B	Setup for decode
IAD	36	Instruction Address Update
LTRAM	16	Load T-RAM entry (16 bits from MDR)
MMI	30	Move MDR Indirect
MMI+1	31	Move MDR Indirect +1
MMI-1	32	Move MDR Indirect -1
MMR	18	Move MDR
MMR8	1C	Move MDRH
MMS	1A	Move MDR to System Register
MMS8	1E	Move MDRH to System
MRM	19	Move Register
MRM8	1D	Move Register
MSI	33	Move Stack Indirect
MSI+1	35	Move Stack Indirect +1
MSI-1	34	Move Stack Indirect -1
MSM	1B	Move System Register
MSM8	1F	Move System Register
MV	0D	Move
MVI	24	Move Immediate
MVS	0E	Move System Register
MVSI	0F	Move System Register
NANDI	21	AND Immediate (no result)
NOP	27	No operation
NXORI	23	XOR Immediate (no result)
OR	09	Logical OR
ORI	22	Logical OR Immediate
ORM	3A	Logical OR
RTRAN	28	Translate for read address
SC	00	Subtract with Carry (B-A)
SCI	05	Subtract Inverted (A-B)
SCO	01	Subtract with Carry (CA in = 1)
SCOM	3D	Subtract with Carry (CA in=1)

MNEMONIC	OPCODE	MICROINSTRUCTION ORIENTATED DEFINITION
SCV	04	Subtract with Carry (OVF set)
SHL	14	Shift left 1 bit
SHL4	10	Shift left 4 bits
SHL4Z	12	Shift left 4 bits (bits in = 0)
SHR	15	Shift right 1 bit
SHR4	11	Shift right 4 bits
SHRZ4	13	Shift right 4 bits (bits in = 0)
STRAM	17	Store T-RAM entry (16 bits to MDR)
TMAR	25	Transfer MAR
TSTK	26	Transfer Stack pair
WTRAN	29	Translate for write address
XOR	0C	Logical XOR
XORM	3B	Logical exclusive OR

VS-15 MICROINSTRUCTION FIELDS

39 BIT MICROINSTRUCTION (CONTROL MEMORY BITS)		
PROCESS FIELD (POP)	MEMORY FIELD (MOP)	BRANCH FIELD (BOP)
CM0	CM18	CM23 — CM38

PROCESS FIELD FORMAT		
MICRO-OPCODE	A-OPERAND	B-OPERAND
CM0	CM6	CM12 — CM17

Process field (CM0-CM17)
1. Microopcode field
2. A-operand field
3. B-operand field

MEMORY FIELD FORMAT		
MAR SELECT	MEMORY OPERATION	MAR RIPPLE
CM18	CM19	CM21 — CM22

Memory field (CM18-CM22)
1. Memory Address Register (MAR) select
2. Memory operation
3. MAR ripple

MEMORY ADDRESS REGISTER (MAR) SELECT FIELD	
CM18	MAR REGISTER SELECTED
0	MAR1
1	MAR2

MEMORY OPERATIONS FIELD		
CM19	CM20	MEMORY OPERATION
0	0	NO OPERATION (NOP)
0	1	READ TWO BYTES
1	0	WRITE TWO BYTES
1	1	WRITE ONE BYTE

VS-15 MICROINSTRUCTION FIELDS

MEMORY MAR RIPPLE FIELD		
CM21	CM22	RIPPLE
0	0	RIPPLE +1
0	1	RIPPLE +2
1	0	RIPPLE -1
1	1	NO RIPPLE

BRANCH FIELD FORMAT 1 - FULL-ADDRESS BRANCH	
BRANCH OPCODE	MICRO-ADDRESS (13 BITS)
CM23	CM26 … CM38

BRANCH FIELD FORMAT 2 - CONDITIONAL BRANCH		
BRANCH OPCODE	STATUS SELECT	MICRO-ADDRESS (6 LOW BITS)
CM23	CM26	CM33 … CM38

BRANCH FIELD FORMAT 3 - STATUS BIT MANIPULATION			
BRANCH OPCODE	STATUS SELECT A-SELECT	STATUS OPCODE	STATUS BIT B-SELECT
CM23	CM26	CM30	CM33 … CM37 CM38

BRANCH FIELD FORMAT 4 - ALIGNMENT TRAP				
BRANCH OPCODE		A1	A2	A3
CM23	CM26	CM36	CM37	CM38

Branch field (CM23-CM38)
1. Branch operation field
2. Microaddress (or other operands)

VS-15 Stack Organization and Register Location

STACK ADDRESS	16 BITS WIDE
00 – 1F	FILE REGISTERS (32)
20 – 3F	SYSTEM REGISTERS (32)
40 – 5F	AUXILIARY REGISTERS (32)
60 – 7F	GENERAL REGISTERS (32)
80 – FF	WORK AREA (128)

VS-15 CP Memory Operation Decoding (Memory Control)

REQUEST FOR MEMORY OPERATIONS			
MCB0	MCB1	MCB2	OPERATION
0	0	0	WRITE 8 (LOW BYTE) DISABLE ECC
0	0	1	WRITE 8 (LOW BYTE) ENABLE ECC
0	1	0	READ 16 DISABLE ECC
0	1	1	READ 16 ENABLE ECC
1	0	0	WRITE 16 DISABLE ECC
1	0	1	WRITE 16 ENABLE ECC
1	1	0	WRITE 8 (HIGH EYTE) DISABLE ECC
1	1	1	WRITE 8 (HIGH BYTE) ENABLE ECC

CP commands decoded into following memory instructions

1. Write 8 - Write byte. Write the low order byte of MDR to memory
2. Write 8 - Write byte. Write the high order byte of MDR to memory
3. Write 16 - Write word from MDR
4. Read 16 - Read word into MDR

VS-15 CP Memory Status Bits

RESULTS OF MEMORY OPERATIONS		
MSB0	MSB1	STATUS
0	0	OPERATION OK
1	0	INVALID MEMORY ADDRESS
0	1	ECC (PARITY) ERROR
1	1	NOT DEFINED

VS-15 CPU Status Bits

BIT	NAME	CONDITION
S0	CA	Carry Bit. Carry In/Out for Decimal/Binary Operations.
S1	SPARE	
S2	ALU	0 Or Non-0 result for 8/16 Bit Move or Arithmetic Operations.
S3	PAGE	Set/Reset when MAR Rippled. Carry-out of MAR13. (New Page)
S4	STATE	Protection Checking. Indicates System or User State.
S5	DEC	Set for Invalid Decimal digit found in A or B Bus Operand for Decimal Add/Subtract with Carry.
S6	MSEL	From Trap 0003/0006. MAR in use when Trap taken.
S7	SPARE	
S8	DEBUG	
S9	CM	Control Mode. CP Control Mode button.
S10	IO3	Set by BP. BP has stored I/O Status Word in memory.
S11	TIM	Real-time clock tick. Set from AC line frequency cycle.
S12	OVF	Overflow from 2's compliment arithmetic. From Add with Carry/Subtract with Carry instructions.
S13	IO4	Receive bit IO4B when CIO 0 issued.
S14		From Reset Reference/Change Entry for Reference/Change value.
S15		From Reset Reference/Change Entry for Reference/Change value.

VS-15 Memory Register Data Bit To Memory Address Line Values

MAR BIT	MA LINE BIT
MAR 23	MA0
MAR 22	MA1
MAR 21	MA2
MAR 20	MA3
MAR 19	MA4
MAR 18	MA5
MAR 17	MA6
MAR 16	MA7
MAR 15	MA8
MAR 14	MA9
MAR 13	MA10
MAR 12	MA11
MAR 11	MA12
MAR 10	MA13
MAR 9	MA14
MAR 8	MA15
MAR 7	MA16
MAR 6	MA17
MAR 5	MA18
MAR 4	MA19
MAR 3	MA20

VS-15 CP Microtraps

TRAP ADDRESS	TRAP NAME	CONDITION
0003	TRAP03	Translation Trap (T-RAM Fault) (Set Status Register Bit S6)
0004	TRAP04	Protection Trap
0005	INVA	Memory Trap (Invalid Physical Address)
0006	MPAR	Memory Parity Error (Bit S6 set = MAR in use on MPAR trap
0007	TALIGN	Alignment Trap (BOP = TRP ALIGNx)
0008	TBI	Pagespan Trap (Page = 0 when BOP = BI)
0009	TCC	Trap for BOP = TRP CC/MASK

VS-15 Read/Write Protection Bits

RP	WP	RESULT
0	0	No Protection
0	1	No Write Allowed In User State
1	0	No Read, Write, Or Execute Allowed In User State
1	1	No Write Allowed In System Or User State

VS-15 Set Condition Code Bits

CC SET TO	CONDITIONS
00	If ALU = 0 and Status Bit S1 = 0
01	CARRY bit = 0
10	CARRY bit = 1

CC SET TO	CONDITIONS
00	If ALU = 0 and Status Bit S1 = 0
01	HIGH ORDER BIT = 1
10	HIGH ORDER BIT = 0

VS-15 Condition Code Check With Trap

IF CC =	THEN TRAP IF
00	IREG bit 0 = 0
01	IREG bit 1 = 0
10	IREG bit 2 = 0
11	IREG bit 3 = 0

VS-15 Main Memory Addresses

MA BIT	HEX	MEMORY CAPACITY	COMMENT
MA 20	0	1MEG BYTES	MODULE SELECT
MA 19	F	512K BYTES	64K WORD SELECT
MA 18		256K BYTES	64K WORD SELECT
MA 17		128K BYTES	64K WORD SELECT
MA 16		64K BYTES	COLUMN ADDRESS
MA 15	F	32K BYTES	COLUMN ADDRESS
MA 14		16K BYTES	COLUMN ADDRESS
MA 13		8K BYTES	COLUMN ADDRESS
MA 12		4K BYTES	COLUMN ADDRESS
MA 11	F	2K BYTES	COLUMN ADDRESS
MA 10		1K BYTES	COLUMN ADDRESS
MA 9		512 BYTES	COLUMN ADDRESS
MA 8		256 BYTES	ROW ADDRESS
MA 7	F	128 BYTES	ROW ADDRESS
MA 6		64 BYTES	ROW ADDRESS
MA 5		32 BYTES	ROW ADDRESS
MA 4		16 BYTES	ROW ADDRESS
MA 3	F	8 BYTES	ROW ADDRESS
MA 2		4 BYTES	ROW ADDRESS
MA 1		2 BYTES	ROW ADDRESS
MA 0			BYTE SWAP SELECT

VS-15 Main Memory Size Select Switch

SW. #	1	2	3	4	MEMORY SIZE
	ON	ON	OFF	OFF	512 KB
	ON	OFF	ON	ON	640 KB
	ON	OFF	ON	OFF	768 KB
	ON	OFF	OFF	ON	896 KB
	ON	OFF	OFF	OFF	1024 KB

Note: Switch #5 is not used and is always OFF.

APPENDIX B

APPENDIX B

VS-15 SELF-TEST MONITOR ERROR CODES
(LIST OF 4-DIGIT TEST/ERROR CODE NUMBERS)

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
0000	SYSTEM DEFAULT STATE AT POWER-UP
000C	8086 Microprocessor on Bus Processor Board is not operational.
00xx	8086 BUS PROCESSOR INTERNAL (CRAM-BASED) MICROCODE
00E0	Unable to load microcode to Workstation Zero (WS-0). (Attempt to clear condition by powering WS-0 OFF then ON.)
00E1	Main Memory parity error occurred during a Code RAM DMA.
00E2	Main Memory DMA attempted to access a nonexistent address.
00E3	Bus Processor Data RAM parity error has occurred.
00E4	Front Panel Boot Device switch in wrong position.
00E5	Pascal exception of unknown origin occurred.
00E6	Invalid device adapter type has been detected.
00E7	DMA operation between Data RAM and Main Memory timed-out.
00E8	Central Processor set an illegal command out area code.
00E9	Repeated DMA attempts for command out area failed. Bus Processor initiates entry into Control Mode.
00EA	Repeated DMA attempts for processor interrupt area failed. Bus Processor initiates entry into Control Mode.
00EB	SIO/CIO raced with Error Completion (EC) or Normal Completion (NC) IOSW (possible Operating System failure). Bus Processor initiates entry into Control Mode.
00EC	Intervention Required (IRQ)/Data Area Early Release (DAR) raced with EC or NC IOSW (possible Operating System failure). Bus Processor initiates entry into Control Mode.
00ED	Main Memory error correction count exceeded its limit of one. Bus Processor initiates entry into Control Mode.
00F4	IPL device returned damaged status (hardware error).
00F5	IPL device was not ready (IRQ - Intervention Required).
00F6	BP memory or disk address error while accessing IPL device.
00FE	Bus Processor parity error.
01	PROM POWER-ON CHECK (PROM-BASED)
0100	Bus Processor code hung on jump to routine start.
0101	Bus Processor code hung on segment register load.
0102	Bus Processor code hung when wait state generator set.
02	PROM CHECKSUM CHECK (PROM-BASED)
0201	Bus Processor PROM Checksum error.
04	INPUT/OUTPUT (I/O) COMMUNICATION CHECK (PROM-BASED)
0401	Bus Processor cannot access I/O address 4 (Data RAM MAR - DMAR).

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
05	FRONT PANEL CHECK (PROM-BASED)
0501	Control Mode Status Bit cannot be reset.
0502	Control Mode Latch not cleared after being set.
05xx	The value '00xx' is equal to the Bus Processor Diagnostic switch settings (in HEX) which are continuously displayed. (Depress Control Mode button to continue normal power-up testing.)
06	PROGRAMMABLE INTERRUPT CONTROLLERS (PIC 0-4) - (PROM-BASED)
0600	Bus Processor routine halted, unknown cause.
0601	BP 8259 mask not readable on Master. The value of the Source Index (SI) register (a register found in the 8086 microprocessor chip) is equal to the mask pattern.
0602	BP 8259 mask not readable on Slave 4: SI is equal to mask pattern.
0603	BP 8259 mask not readable on Slave 3: SI is equal to mask pattern.
0604	BP 8259 mask not readable on Slave 2: SI is equal to mask pattern.
0605	BP 8259 mask not readable on Slave 1: SI is equal to mask pattern.
08	PROGRAMMABLE INTERVAL TIMER #1 (PIT-0) - (PROM-BASED)
0800	Bus Processor routine halted, unknown cause.
0801	BP data miscompare on PIT count read: SI equals the expected value (Expd); DI (Destination Index register) equals the received value (Rcvd). (The DI register is found in the 8086 microprocessor chip.)
0802	Bus Processor PIT Counter 0 incorrect.
0803	Bus Processor PIT Counter 1 incorrect.
0805	No Bus Processor PIT interrupt request.
0806	Bus Processor PIT interrupt level incorrect.
09	PROGRAMMABLE INTERVAL TIMER #2 (PIT-1) - (PROM-BASED)
0900	Bus Processor routine halted, unknown cause.
0901	BP data miscompare on PIT count read: SI = Expd; DI = Rcvd.
0902	Bus Processor PIT Counter 0 incorrect.
0903	Bus Processor PIT Counter 1 incorrect.
0904	Bus Processor PIT Counter 2 incorrect.
0905	No Bus Processor PIT interrupt request.
0906	Bus Processor PIT interrupt level incorrect.
0A	DATA RAM COMMUNICATION CHECK (PROM-BASED)
0A01	Bus Processor Data RAM parity error cannot be cleared.
0A02	Bus Processor DRAM address 'zero' cannot be accessed.
0A03	Bus Processor DRAM low-byte parity error cannot be forced.
0A04	Bus Processor DRAM high-byte parity error cannot be forced.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
0A	DATA RAM COMMUNICATION CHECK - (Cont'd)
0A05	Bus Processor DRAM not available: BX equals DRAM status. (BX - A general purpose data register found in the 8086 chip).
0A06	Bus Processor DRAM low-byte parity error cannot be cleared.
0A07	Bus Processor DRAM high-byte parity error cannot be cleared.
0C	RAM and PARITY RAM DATA LINE TEST (PROM-BASED)
0C00	Bus Processor routine halted, unknown cause.
0C01	Bus Processor RAM data miscompare.
0C02	Unexpected Bus Processor parity error.
0C03	Bus Processor RAM data miscompare.
0C04	Forced Bus Processor parity error not detected.
0E	RAM ADDRESS LINES TEST (PROM-BASED)
0E00	Bus Processor routine halted, unknown cause.
0E01	Bus Processor RAM data miscompare.
0E02	Unexpected Bus Processor parity error.
0E03	Bus Processor RAM chip addressing error.
0E04	Bus Processor parity RAM chip addressing error.
0F	BANK ADDRESSING TEST (PROM-BASED)
0F01	Data error Bank Address read.
0F02	Parity error Bank Address read.
0F03	Data error Bank Address read.
0F04	Parity error Bank Address read.
10	RAM INTEGRITY TEST, HALFWORD OPERATIONS (PROM-BASED)
1000	Bus Processor routine halted, unknown cause.
1001	Bus Processor RAM data miscompare, pattern B6DB HEX.
1002	Unexpected Bus Processor parity error, pattern B6DB HEX.
11	RAM INTEGRITY TEST, HALFWORD OPERATIONS (PROM-BASED)
1101	Bus Processor RAM data miscompare, pattern B6DB HEX.
1102	Unexpected Bus Processor parity error, pattern B6D6 HEX.
1103	Bus Processor RAM data miscompare, pattern B6D6 HEX, first read.
1104	Forced Bus Processor parity error low byte not detected.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
12	RAM INTEGRITY TEST, LOW BYTE OPERATIONS (PROM-BASED)
1201	Bus Processor RAM data miscompare, pattern 6C HEX, low byte.
1202	Unexpected Bus Processor parity error, pattern 6C HEX, low byte.
13	RAM INTEGRITY TEST, HIGH BYTE OPERATIONS (PROM-BASED)
1301	Bus Processor RAM data miscompare, pattern DB HEX, high byte.
1302	Forced BP parity error not detected, pattern DB HEX, high byte.
14	RAM BLOCK MOVE OPERATIONS and NOISE SENSITIVITY TEST (PROM-BASED)
1403	BP RAM data miscompare, '0' in bank of '1's, low address.
1404	BP RAM data miscompare, '0' in bank of '1's, high address.
15	CODE RAM DATA INVERSION (PROM-BASED)
1501	Bus Processor Code RAM (CRAM) parity error.
16	CODE RAM REFRESH TEST (PROM-BASED)
1601	Data error on initial write/read.
1602	Parity error on initial write/read.
1603	Data error on read after refresh.
1604	Parity error on read after refresh.
17	CRAM ODD/EVEN HALFWORD/BYTE OPERATIONS (PROM-BASED)
1701	Data error at address 001FE HEX.
1702	Data error at address 1FE00 HEX.
1703	Data error after write halfword string to an odd address.
1704	Data error after write halfword string to an even address.
1705	Data error after write byte string to an odd address.
1706	Data error after write byte string to an even address.
1707	Data error after write halfword to an odd address.
1708	Data error after write halfword to an even address.
1709	Data error after write byte to an odd address.
170A	Data error after write byte to an even address.
18	DMA LOGIC TEST (PROM-BASED)
1801	DMA chip status register not 'zero' after Master clear.
1802	Cannot access address register 'zero'.
1803	Address data not returning properly.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
18	DMA LOGIC TEST - (Cont'd)
1804	Internal addressing on DMA chip bad.
1805	Data error after memory to memory DMA.
1806	No Terminal Count interrupt when doing memory to memory DMA.
20	PARITY ERROR INTERRUPT ROUTINE (PROM-BASED)
2000	Bus Processor routine halted, unknown cause.
2001	Bus Processor Code RAM parity error interrupt not detected.
2002	Bus Processor Data RAM parity error interrupt not detected.
22	WAIT STATE GENERATOR TEST (PROM-BASED)
2200	Bus Processor routine halted, unknown cause.
2201	Bus Processor Code RAM wait states cannot be changed.
2202	Bus Processor PROM, I/O wait states cannot be changed.
38	DISKETTE POWER-UP TEST (PROM-BASED) - (SEE ALSO 98xx)
3800	Hung on floppy test entry.
380A	Floppy Disk Controller (FDC) not ready for commands after reset.
380B	FDC error on sense drive status command.
3C	MODEM LOOP-BACK SELF-TEST (CRAM-BASED)
3C01	USART (8251), or USART input line failure.
3C02	USART, C/D or data line, clock, or modem failure. (Status bit 7 not set, status not equal to 'OFF' HEX.)
3C03	I/O decode logic, or inverter failure. (Status bit 7 not set, status not equal to '085' HEX.)
3C04	USART, or modem failure.

NOTE

Whenever a failure occurs and the error sources listed include the modem, replace the modem with a loop-back connector to isolate failing unit.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
3C05	USART failure. ('RxRdy' not set).
3C06	USART, buffer or modem failure. ('TxE' not set.)
3C07	USART, buffer or modem failure. ('TxRdy' not set.)
3C08	USART, buffer or modem failure. (Overrun error detected.)
3C09	USART, buffer or modem failure. ('TxE' not reset.)

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
3C	MODEM LOOP-BACK SELF-TEST (CRAM-BASED) - (Cont'd)
3C0A	USART, modem failure. ('RxRdy' not set.)
3C0B	USART failure. ('FE' not set.)
3C0C	USART, modem failure. ('PE' not set.)
3C0D	USART failure. (Rcvd character did not equal current character.)
3C2C	Local Control/Remote Control switch or buffer failure.
3E	UNEXPECTED INTERRUPT HANDLER (PROM-BASED)
3Exx	Unexpected BP interrupt, where 'xx' equals interrupt type serviced.
3EFF	Unexpected BP interrupt. The interrupt type is unknown.
40	LOAD BOOTSTRAP FILE HARDWARE/SOFTWARE FAILURE (PROM-BASED BOOTSTRAP LOADER SEQUENCE)
4000	Hung during Bootstrap operation.
401E	Device adapter not present in system. (Also indicates 'Boot Device switch in EXT position'.)
4020	Diskette error on volume label read or unlabeled volume.
4021	Diskette (boot device) media error.
4022	Diskette hardware (controller) error.
4024	Diskette drive not ready.
4028	Diskette program (parameter) error or Bus Processor failure.
402A	Diskette selected is nonbootstrap volume.
402C	Diskette checksum failure on bootstrap file.
4030	Internal disk error on volume label read or unlabeled volume.
4031	Internal disk (boot device) media error.
4032	Internal disk hardware error on device adapter.
4034	Internal disk drive not ready.
4038	Internal disk program (parameter) error or Bus Processor failure.
403A	Internal disk selected is nonbootstrap volume.
403C	Internal disk checksum failure on bootstrap file.
403E	Internal disk device adapter not present in system.
4040	Internal (fixed SMD) disk error on volume label read or unlabeled volume found.
4041	Internal (fixed SMD) disk (boot device) media error.
4042	Internal (fixed SMD) disk hardware error on device adapter.
4044	Internal (fixed SMD) disk drive not ready.
4048	Internal (fixed SMD) disk program (parameter) error or Bus Processor failure.
404A	Internal (fixed SMD) disk selected is nonbootstrap volume.
404C	Internal (fixed SMD) disk checksum failure on bootstrap file.
404E	Internal (fixed SMD) disk device adapter not present in system.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
40	LOAD BOOTSTRAP FILE HARDWARE/SOFTWARE FAILURE (PROM-BASED BOOTSTRAP LOADER SEQUENCE) - (Cont'd)
40A0	Diskette error on volume label read or unlabeled volume.
40A1	Diskette media error during bootstrap file read.
40A2	Diskette hardware (controller) error during file read.
40A4	Diskette drive not ready for file read.
40A8	Diskette program (parameter) error or Bus Processor failure.
40AA	Diskette selected is nonbootstrap volume.
40AC	Diskette checksum failure on bootstrap file read.
40B0	Internal disk error on volume label read or unlabeled volume.
40B1	Internal disk media error during bootstrap file read.
40B2	Internal disk hardware error on device adapter during file read.
40B4	Internal disk drive not ready for file read.
40B8	Internal disk program (parameter) error or Bus Processor failure.
40BA	Internal disk selected is nonbootstrap volume.
40BC	Internal disk checksum failure on bootstrap file read.
40BE	Internal disk device adapter not present in system.
40C0	Internal (fixed SMD) disk error on volume label read or unlabeled volume found.
40C1	Internal (fixed SMD) disk media error during bootstrap file read.
40C2	Internal (fixed SMD) disk hardware error on device adapter during file read.
40C4	Internal (fixed SMD) disk drive not ready for file read.
40C8	Internal (fixed SMD) disk program (parameter) error or BP failure.
40CA	Internal (fixed SMD) disk selected is nonbootstrap volume.
40CC	Internal (fixed SMD) disk checksum failure on bootstrap file read.
40CE	Internal (fixed SMD) disk device adapter not present in system.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
41	BOOTSTRAP LOADER FILE HARDWARE FAILURE (LOAD @MCBOOT@ from @SYSTEM@)	
4110	Unlabeled volume (VOL1 missing).	Volume Label
4111	Media error.	Volume Label
4112	Controller hardware error.	Volume Label
4114	Drive not ready.	Volume Label
4116	Program error (divide).	Volume Label
4118	Program error (bad data).	Volume Label

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
41	BOOTSTRAP LOADER FILE HARDWARE FAILURE (LOAD @MCBOOT@ from @SYSTEM@) - (Cont'd)	
4119	Media error.	Bit map
411A	Controller hardware error.	Bit map
411C	Drive not ready.	Bit map
411E	Program error (divide).	Bit map
4120	Program error (bad data).	Bit map
4121	Media error.	VTOC
4122	Controller hardware error.	VTOC
4124	Drive not ready.	VTOC
4126	Program error (divide).	VTOC
4128	Program error (bad data).	VTOC
412A	FDX1 ID does not match.	VTOC
412B	FDX2 ID does not match.	VTOC
412C	FDR1 ID does not match.	VTOC
4131	Media error.	Self-Test Monitor
4132	Controller hardware error.	Self-Test Monitor
4133	Checksum does not match.	Self-Test Monitor
4134	Drive not ready.	Self-Test Monitor
4136	Program error (divide).	Self-Test Monitor
4138	Program error (bad data).	Self-Test Monitor
413A	Library not found.	Self-Test Monitor
413B	File not found.	Self-Test Monitor
413C	FDR1 not found.	Self-Test Monitor
413E	Extents greater than three.	Self-Test Monitor
4141	Media error.	Diagnostic Monitor
4142	Controller hardware error.	Diagnostic Monitor
4143	Checksum does not match.	Diagnostic Monitor
4144	Drive not ready.	Diagnostic Monitor
4146	Program error (divide).	Diagnostic Monitor
4148	Program error (bad data).	Diagnostic Monitor
414A	Library not found.	Diagnostic Monitor
414B	File not found.	Diagnostic Monitor
414C	FDR1 not found.	Diagnostic Monitor
414E	Extents greater than three.	Diagnostic Monitor
4151	Media error.	System Loader
4152	Controller hardware error.	System Loader
4153	Checksum does not match.	System Loader
4154	Drive not ready.	System Loader
4156	Program error (divide).	System Loader
4158	Program error (bad data).	System Loader
415A	Library not found.	System Loader
415B	File not found.	System Loader
415C	FDR1 not found.	System Loader
415E	Extents greater than three.	System Loader

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
41E-41F	MISCELLANEOUS SERIAL DEVICE HARDWARE FAILURES (LOAD @MCBOOT@ from @SYSTEM@)	
41F3	Invalid hardware configuration.	
41F4	Diskette status error.	
41FD	Bus Processor Data RAM parity error.	
41FE	Bus Processor Code RAM parity error.	
41FF	Unknown interrupt on the Bus Processor.	
420-422	SELF-TEST MONITOR BOOT DEVICE and/or IPL DEVICE FAILURE (LOAD @NORMAL@ from @DIAGST@)	
420F	Incompatible version of Self-Test code.	
4210	Unlabeled volume (VOL1 missing).	Volume Label
4211	Media error.	Volume Label
4212	Controller hardware error.	Volume Label
4214	Drive not ready.	Volume Label
4216	Program error (divide).	Volume Label
4218	Program error (bad data).	Volume Label
4219	Media error.	Bit map
421A	Controller hardware error.	Bit map
421C	Drive not ready.	Bit map
421E	Program error (divide).	Bit map
4220	Program error (bad data).	Bit map
4221	Media error.	VTOC
4222	Controller hardware error.	VTOC
4224	Drive not ready.	VTOC
4226	Program error (divide).	VTOC
4228	Program error (bad data).	VTOC
422A	FDX1 ID does not match.	VTOC
422B	FDX2 ID does not match.	VTOC
422C	FDR1 ID does not match.	VTOC
423	WORKSTATION ZERO LOADER FAILURE (WS-0 File = @SLFWS0@ from @DIAGST@)	
4231	Media error.	WS-0 File
4232	Controller hardware error.	WS-0 File
4233	Checksum does not match.	WS-0 File
4234	Drive not ready.	WS-0 File
4236	Program error (divide).	WS-0 File
4238	Program error (bad data).	WS-0 File
423A	Library not found.	WS-0 File
423B	File not found.	WS-0 File
423C	FDR1 not found.	WS-0 File
423E	Extents greater than three.	WS-0 File

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
424	INTELLIGENT SERIAL I/O LOADER FAILURE (ISIO File = @MONISIO@ from @DIAGST@)	
4241	Media error.	ISIO File
4242	Controller hardware error.	ISIO File
4243	Checksum does not match.	ISIO File
4244	Drive not ready.	ISIO File
4246	Program error (divide).	ISIO File
4248	Program error (bad data).	ISIO File
424A	Library not found.	ISIO File
424B	File not found.	ISIO File
424C	FDR1 not found.	ISIO File
424E	Extents greater than three.	ISIO File
426	BUS PROCESSOR USART/MODEM LOOP-BACK LOADER FAILURE (Diag. Test 2 = @BT0500@ from @DIAGST@)	
4261	Media error.	Diag. Test 2
4262	Controller hardware error.	Diag. Test 2
4263	Controller hardware error.	Diag. Test 2
4264	Drive not ready.	Diag. Test 2
4266	Program error (divide).	Diag. Test 2
4268	Program error (bad data).	Diag. Test 2
426A	Library not found.	Diag. Test 2
426B	File not found.	Diag. Test 2
426C	FDR1 not found.	Diag. Test 2
426E	Extents greater than three.	Diag. Test 2
427	CP CONTROL MEMORY or CP/BP COMMUNICATION LOADER FAILURE (Diag. Test 3 = @CT0500@ from @DIAGST@)	
4271	Media error.	Diag. Test 3
4272	Controller hardware error.	Diag. Test 3
4273	Controller hardware error.	Diag. Test 3
4274	Drive not ready.	Diag. Test 3
4276	Program error (divide).	Diag. Test 3
4278	Program error (bad data).	Diag. Test 3
427A	Library not found.	Diag. Test 3
427B	File not found.	Diag. Test 3
427C	FDR1 not found.	Diag. Test 3
427E	Extents greater than three.	Diag. Test 3
428	CENTRAL PROCESSOR RANDOM OPERANDS LOADER FAILURE (Diag. Test 4 = @CT0800@ from @DIAGST@)	
4281	Media error.	Diag. Test 4
4282	Controller hardware error.	Diag. Test 4

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
428	CENTRAL PROCESSOR RANDOM OPERANDS LOADER FAILURE (Diag. Test 4 = @CT0800@ from @DIAGST@) - (Cont'd)	
4283	Controller hardware error.	Diag. Test 4
4284	Drive not ready.	Diag. Test 4
4286	Program error (divide).	Diag. Test 4
4288	Program error (bad data).	Diag. Test 4
428A	Library not found.	Diag. Test 4
428B	File not found.	Diag. Test 4
428C	FDR1 not found.	Diag. Test 4
428E	Extents greater than three.	Diag. Test 4
429	CENTRAL PROCESSOR INTEGRITY LOADER FAILURE (Diag. Test 5 = @CTOBOO@ from @DIAGST@)	
4291	Media error.	Diag. Test 5
4292	Controller hardware error.	Diag. Test 5
4293	Controller hardware error.	Diag. Test 5
4294	Drive not ready.	Diag. Test 5
4296	Program error (divide).	Diag. Test 5
4298	Program error (bad data).	Diag. Test 5
429A	Library not found.	Diag. Test 5
429B	File not found.	Diag. Test 5
429C	FDR1 not found.	Diag. Test 5
429E	Extents greater than three.	Diag. Test 5
42A	MAIN MEMORY INTEGRITY LOADER FAILURE (Diag. Test 6 = @MT0500@ from @DIAGST@)	
42A1	Media error.	Diag. Test 6
42A2	Controller hardware error.	Diag. Test 6
42A3	Controller hardware error.	Diag. Test 6
42A4	Drive not ready.	Diag. Test 6
42A6	Program error (divide).	Diag. Test 6
42A8	Program error (bad data).	Diag. Test 6
42AA	Library not found.	Diag. Test 6
42AB	File not found.	Diag. Test 6
42AC	FDR1 not found.	Diag. Test 6
42AE	Extents greater than three.	Diag. Test 6
42B	BUS PROCESSOR DMA and MARs LOADER FAILURE (Diag. Test 7 = @BT0800@ from @DIAGST@)	
42B1	Media error.	Diag. Test 7
42B2	Controller hardware error.	Diag. Test 7
42B3	Controller hardware error.	Diag. Test 7
42B4	Drive not ready.	Diag. Test 7

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
42B	BUS PROCESSOR DMA and MARs LOADER FAILURE (Diag. Test 7 = @BT0800@ from @DIAGST@) - (Cont'd)	
42B6	Program error (divide).	Diag. Test 7
42B8	Program error (bad data).	Diag. Test 7
42BA	Library not found.	Diag. Test 7
42BB	File not found.	Diag. Test 7
42BC	FDR1 not found.	Diag. Test 7
42BE	Extents greater than three.	Diag. Test 7
42E-42F	MISCELLANEOUS SERIAL DEVICE HARDWARE FAILURES (BOOTSTRAP LOADER: @MCBOOT@ EXECUTION)	
42E0	SIO timeout.	
42E1	SIO overrun.	
42E2	SIO Data RAM parity error.	
42E3	SIO serial parity error.	
42E4	ISIO timeout.	
42E5	ISIO memory parity error.	
42E6	ISIO Data RAM parity error.	
42E7	ISIO serial parity error.	
42E8	ISIO data link timeout.	
42E9	ISIO FIFO parity error.	
42EA	Workstation powered-off.	
42EB	Workstation coaxial parity error.	
42EC	Workstation memory parity error.	
42ED	Workstation has incorrect microcode.	
42EE	Workstation status invalid.	
42F3	Invalid hardware configuration.	
42F4	Diskette status error.	
42F5	No terminal ID byte found.	
435	SERIAL INPUT/OUTPUT (SIO) DEVICE ADAPTER LOADER FAILURE (Diag. Test 1.1 = @ST0500@ from @DIAGST@)	
4351	Media error.	Diag. Test 1.1
4352	Controller hardware error.	Diag. Test 1.1
4353	Controller hardware error.	Diag. Test 1.1
4354	Drive not ready.	Diag. Test 1.1
4356	Program error (divide).	Diag. Test 1.1
4358	Program error (bad data).	Diag. Test 1.1
435A	Library not found.	Diag. Test 1.1
435B	File not found.	Diag. Test 1.1
435C	FDR1 not found.	Diag. Test 1.1
435E	Extents greater than three.	Diag. Test 1.1

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
436	INTELLIGENT SERIAL INPUT/OUTPUT DEVICE ADAPTER LOADER FAILURE - (Diag. Test 1.2 = @ST0800@ from @DIAGST@)	
4361	Media error.	Diag. Test 1.2
4362	Controller hardware error.	Diag. Test 1.2
4363	Controller hardware error.	Diag. Test 1.2
4364	Drive not ready.	Diag. Test 1.2
4366	Program error (divide).	Diag. Test 1.2
4368	Program error (bad data).	Diag. Test 1.2
436A	Library not found.	Diag. Test 1.2
436B	File not found.	Diag. Test 1.2
436C	FDR1 not found.	Diag. Test 1.2
436E	Extents greater than three.	Diag. Test 1.2
438	CENTRAL PROCESSOR RANDOM OPERANDS OVERLAY LOADER FAILURE - (Overlay 4 = @CM0800@ from @DIAGST@)	
4381	Media error.	Overlay 4
4382	Controller hardware error.	Overlay 4
4383	Controller hardware error.	Overlay 4
4384	Drive not ready.	Overlay 4
4386	Program error (divide).	Overlay 4
4388	Program error (bad data).	Overlay 4
438A	Library not found.	Overlay 4
438B	File not found.	Overlay 4
438C	FDR1 not found.	Overlay 4
438E	Extents greater than three.	Overlay 4
439	CENTRAL PROCESSOR INTEGRITY OVERLAY LOADER FAILURE - (Overlay 5 = @CM0B00@ from @DIAGST@)	
4391	Media error.	Overlay 5
4392	Controller hardware error.	Overlay 5
4393	Controller hardware error.	Overlay 5
4394	Drive not ready.	Overlay 5
4396	Program error (divide).	Overlay 5
4398	Program error (bad data).	Overlay 5
439A	Library not found.	Overlay 5
439B	File not found.	Overlay 5
439C	FDR1 not found.	Overlay 5
439E	Extents greater than three.	Overlay 5
43A	MAIN MEMORY INTEGRITY OVERLAY LOADER FAILURE (Overlay 6 = @MM0500@ from @DIAGST@)	
43A1	Media error.	Overlay 6
43A2	Controller hardware error.	Overlay 6

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
43A3	Controller hardware error.	Overlay 6
43A4	Drive not ready.	Overlay 6
43A6	Program error (divide).	Overlay 6
43A8	Program error (bad data).	Overlay 6
43AA	Library not found.	Overlay 6
43AB	File not found.	Overlay 6
43AC	FDR1 not found.	Overlay 6
43AE	Extents greater than three.	Overlay 6
44	SYSTEM IPL DEVICE FAILURE (LOAD @MCIPL@ from @SYSTEM@)	
440F	Incompatible version of IPL code.	
4410	Unlabeled volume (VOL1 missing).	Volume Label
4411	Media error.	Volume Label
4412	Controller hardware error.	Volume Label
4414	Drive not ready.	Volume Label
4416	Program error (divide).	Volume Label
4418	Program error (bad data).	Volume Label
4419	Media error.	Bit map
441A	Controller hardware error.	Bit map
441C	Drive not ready.	Bit map
441E	Program error (divide).	Bit map
4420	Program error (bad data).	Bit map
4421	Media error.	VTOC
4422	Controller hardware error.	VTOC
4424	Drive not ready.	VTOC
4426	Program error (divide).	VTOC
4428	Program error (bad data).	VTOC
442A	FDX1 ID does not match.	VTOC
442B	FDX2 ID does not match.	VTOC
442C	FDR1 ID does not match.	VTOC
443-44C	SYSTEM IPL DEVICE FAILURE (LOAD DEVICE FILE from @SYSTEM@)	
4431	Media error.	W. S. File
4432	Controller hardware error.	W. S. File
4433	Checksum does not match.	W. S. File
4434	Drive not ready.	W. S. File
4436	Program error (divide).	W. S. File
4438	Program error (bad data).	W. S. File
443A	Library not found.	W. S. File
443B	File not found.	W. S. File
443C	FDR1 not found.	W. S. File
443E	Extents greater than three.	W. S. File

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
443-44C	SYSTEM IPL DEVICE FAILURE (LOAD DEVICE FILE from @SYSTEM@) - (Cont'd)	
4461	Media error.	@MCCP@ File
4462	Controller hardware error.	@MCCP@ File
4463	Controller hardware error.	@MCCP@ File
4464	Drive not ready.	@MCCP@ File
4466	Program error (divide).	@MCCP@ File
4468	Program error (bad data).	@MCCP@ File
446A	Library not found.	@MCCP@ File
446B	File not found.	@MCCP@ File
446C	FDR1 not found.	@MCCP@ File
446E	Extents greater than three.	@MCCP@ File
44C1	Media error.	@MCBP1@ File
44C2	Controller hardware error.	@MCBP1@ File
44C3	Controller hardware error.	@MCBP1@ File
44C4	Drive not ready.	@MCBP1@ File
44C6	Program error (divide).	@MCBP1@ File
44C8	Program error (bad data).	@MCBP1@ File
44CA	Library not found.	@MCBP1@ File
44CB	File not found.	@MCBP1@ File
44CC	FDR1 not found.	@MCBP1@ File
44CE	Extents greater than three.	@MCBP1@ File
44E-44F	MISCELLANEOUS SERIAL DEVICE HARDWARE FAILURES	
44E0	SIO timeout.	
44E1	SIO overrun.	
44E2	SIO Data RAM parity error.	
44E3	SIO serial parity error.	
44E4	ISIO timeout.	
44E5	ISIO overrun.	
44E6	ISIO Data RAM parity error.	
44E7	ISIO serial parity error.	
44E8	ISIO data link timeout.	
44E9	ISIO FIFO parity error.	
44EA	Workstation powered off.	
44EB	Workstation coaxial parity error.	
44EC	Workstation memory parity error.	
44ED	Workstation has no code.	
44EE	Workstation invalid status.	
44EF	Invalid 'Burn-In' table. (Also indicates Automatic Sequence function [PF8] not available.)	

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
44F0	DMA timeout.	
44F1	DMA failure.	
44F2	Central Processor failure.	
44F3	Invalid hardware configuration.	
44F4	Diskette status error.	
45	STAND-ALONE DIAGNOSTIC MONITOR DEVICE FAILURE (LOAD @MONITOR from @DIAGMN@)	
4500	Monitor attempting to run remotely. (Also indicates LOCAL/REMOTE DIAGNOSTICS/REMOTE CONTROL switch is in REMOTE DIAGNOSTICS position.)	
4505	Monitor message buffer overflow.	
450F	Incompatible version of Diagnostic Monitor	
4510	Unlabeled volume (VOL1 missing).	Volume Label
4511	Media error.	Volume Label
4512	Controller hardware error.	Volume Label
4514	Drive not ready.	Volume Label
4516	Program error (divide).	Volume Label
4518	Program error (bad data).	Volume Label
4519	Media error.	Bit map
451A	Controller hardware error.	Bit map
451C	Drive not ready.	Bit map
451E	Program error (divide).	Bit map
4520	Program error (bad data).	Bit map
4521	Media error.	VTOC
4522	Controller hardware error.	VTOC
4524	Drive not ready.	VTOC
4526	Program error (divide).	VTOC
4528	Program error (bad data).	VTOC
452A	FDX1 ID does not match.	VTOC
452B	FDX2 ID does not match.	VTOC
452C	FDR1 ID does not match.	VTOC
4531	Media error.	Test Table
4532	Controller hardware error.	Test Table
4533	Controller hardware error.	Test Table
4534	Drive not ready.	Test Table
4536	Program error (divide).	Test Table
4538	Program error (bad data).	Test Table
453A	Library not found.	Test Table
453B	File not found.	Test Table
453C	FDR1 not found.	Test Table
453E	Extents greater than three.	Test Table

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
45	STAND-ALONE DIAGNOSTIC MONITOR DEVICE FAILURE (LOAD @MONITOR from @DIAGMN@) - (Cont'd)	
4541	Media error.	WS File
4542	Controller hardware error.	WS File
4543	Checksum does not match.	WS File
4544	Drive not ready.	WS File
4546	Program error (divide).	WS File
4548	Program error (bad data).	WS File
454A	Library not found.	WS File
454B	File not found.	WS File
454C	FDR1 not found.	WS File
454E	Extents greater than three.	WS File
4551	Media error.	ISIO File
4552	Controller hardware error.	ISIO File
4553	Checksum does not match.	ISIO File
4554	Drive not ready.	ISIO File
4556	Program error (divide).	ISIO File
4558	Program error (bad data).	ISIO File
455A	Library not found.	ISIO File
455B	File not found.	ISIO File
455C	FDR1 not found.	ISIO File
455E	Extents greater than three.	ISIO File
45E-45F	MISCELLANEOUS SERIAL DEVICE HARDWARE FAILURES	
45E0	SIO timeout.	
45E1	SIO overrun.	
45E2	SIO Data RAM parity error.	
45E3	SIO serial parity error.	
45E4	ISIO timeout.	
45E5	ISIO memory parity error.	
45E6	ISIO Data RAM parity error.	
45E7	ISIO serial parity error.	
45E8	ISIO data link timeout.	
45E9	ISIO FIFO parity error.	
45EA	Workstation powered off.	
45EB	Workstation coaxial parity error.	
45EC	Workstation memory parity error.	
45ED	Workstation has no code.	
45EE	Workstation status invalid.	
45EF	Invalid 'Burn-In' table. (Also indicates Automatic Sequence function [PF8] not available.)	

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	(LOCATION or OTHER COMMENTS)
45F0	DMA timeout.	
45F1	DMA failure.	
45F2	Central Processor failure.	
45F3	Invalid hardware configuration.	
45F4	Diskette status error.	
45F5	No terminal device adapter found.	
45FA	Lost Data Set Ready.	
45FB	Transmit data error.	
45FC	Receive data error.	
46x-49x	DIAGNOSTIC MONITOR TEST FILE FAILURE	
46x1	Media error.	Test File x
46x2	Controller hardware error.	Test File x
46x3	Controller hardware error.	Test File x
46x4	Drive not ready.	Test File x
46x6	Program error (divide).	Test File x
46x8	Program error (bad data).	Test File x
46xA	Library not found.	Test File x
46xB	File not found.	Test File x
46xC	FDR1 not found.	Test File x
46xE	Extents greater than three.	Test File x

NOTE

The value of 'x' is determined by the LOGICAL file number of the Test (or Overlay) Program described in table 8-3 (Stand-Alone Diagnostic Monitor Programs, page 8-8 of this manual). Error codes '46x' and '47x' are reserved for the diagnostic test programs while error codes '48x' and '49x' are reserved for the diagnostic overlay programs.

For example, an error code of 46EB indicates that diagnostic program number E (HEX) was not found in library @DIAGMN@. Program 'E' converts to Program 15 (14 logical) which is the Main Memory Test (@MT1000@). If, however, the error code was 48EB, this would indicate that diagnostic overlay program 15 @MM1000@ was not found.

47x1	Media error.	Test File x
47x2	Controller hardware error.	Test File x
47x3	Controller hardware error.	Test File x
47x4	Drive not ready.	Test File x
47x6	Program error (divide).	Test File x

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION	[illegible] OTHER COMMENT
46x-49x	DIAGNOSTIC MONITOR TEST FILE FAILURE - (Cont'd)	
47x8	Program error (bad data).	Test File x
47xA	Library not found.	Test File x
47xB	File not found.	Test File x
47xC	FDR1 not found.	Test File x
47xE	Extents greater than three.	Test File x
48x1	Media error.	Test File x
48x2	Controller hardware error.	Test File x
48x3	Controller hardware error.	Test File x
48x4	Drive not ready.	Test File x
48x6	Program error (divide).	Test File x
48x8	Program error (bad data).	Test File x
48xA	Library not found.	Test File x
48xB	File not found.	Test File x
48xC	FDR1 not found.	Test File x
48xE	Extents greater than three.	Test File x
49x1	Media error.	Test File x
49x2	Controller hardware error.	Test File x
49x3	Controller hardware error.	Test File x
49x4	Drive not ready.	Test File x
49x6	Program error (divide).	Test File x
49x8	Program error (bad data).	Test File x
49xA	Library not found.	Test File x
49xB	File not found.	Test File x
49xC	FDR1 not found.	Test File x
49xE	Extents greater than three.	Test File x

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ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
4B	CENTRAL PROCESSOR CONTROL MEMORY and CP/BP COMMUNICATION SELF-TEST - (@CT0500@ from @DIAGST@ EXECUTION)
4B01	CP Microinstruction Counter (MIC) cannot be set to 'zero'.
4B02	Data error during write/read Control Memory operation.
4B03	Data error during Control Memory read/write/read sequence.
4B04	Central Processor hardware status register error: Bit 2 not reset after setting Central Processor into Step mode.
4B05	Central Processor hardware status register error: Bit 2 not set after setting Central Processor into Run mode.
4B06	Central Processor hardware status register error: Bit 2 not reset after setting Central Processor into Step mode after Run mode.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
4B07	Central Processor hardware status register error: Bit 3 not reset after disabling Central Processor address comparator.
4B08	Central Processor hardware status register error: Bit 3 not set after enabling Central Processor address comparator.
4B09	Central Processor hardware status register error: Bit 4 not set after enabling Central Processor address comparator and setting compare address equal to value in MIC.
4B0A	Central Processor hardware status register error: Bit 4 not reset after enabling Central Processor address comparator and setting compare address not equal to value in MIC.
4B0B	Central Processor hardware status register error: Bit 3, 4, or 5 not reset after disabling Central Processor address comparator.
4B0C	Central Processor hardware status register error: Bit 3, 4, or 5 not reset after disabling Central Processor address comparator, with compare address set equal to value in MIC.
4B0D	Central Processor hardware status register error: Bit 3, or 4 not set after enabling Central Processor address comparator, with compare address set equal to value in MIC.
4B0E	Sync interrupt not detected.
4B0F	Central Processor hardware status register error: Bit 3, or 4 not reset after disabling Central Processor address comparator, with compare address set equal to value in MIC.
4B10	Central Processor hardware status register error: Central Processor CIO 7 status bit set after execution of a NOP instruction.
4B11	CP Halted interrupt not detected on a step in Step mode.
4B12	CP hardware status register error: Central Processor CIO 7 status bit not set after execution of a CIO 7 instruction.
4B13	Central Processor Halted interrupt not detected when a CIO 7 instruction executed.
4B14	Central Processor hardware status register error: CP CIO 7 status bit not reset after execution of a NOP instruction.
4B15	CP Halted interrupt not detected when a NOP instruction executed.
4B16	Central Processor SYNC interrupt not detected.
4B17	Central Processor hardware status register error: Bit 7 not set or Bit 3 not reset after setting nanoinstruction step mode.
4B18	Incorrect MIC after executing Enable IO3.
4B19	Incorrect MIC after executing Clear IO3.
4B1A	CP IO3 status bit not cleared by Clear IO3 Instruction.
4B1B	Bus Processor IO3 status bit not set by Clear IO3 Instruction.
4B1C	Incorrect MIC after executing Clear IO4 instruction.
4B1D	Central Processor IO4 bit not cleared by Clear IO4 instruction.
4B1E	Incorrect MIC after executing Clear IO4B instruction.
4B1F	BP IO4B status bit not set after executing Clear IO4B instruction.
4B20	Incorrect MIC after executing Move IO4B to IO4.
4B21	Central Processor IO4 status bit not clear after moving IO4B to IO4.
4B22	Incorrect MIC after executing Move IO4B to IO4.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
4B	CP CONTROL MEMORY and CP/BP COMMUNICATION SELF-TEST (@CT0500@ from @DIAGST@ EXECUTION) - (Cont'd)
4B23	Bus Processor IO3 status bit not reset after Set IO3 instruction.
4B24	BP IO4B status bit not reset after Set IO4B instruction.
4B25	Central Processor IO4 not set 'ter Set IO4B, and Move IO4B TO IO4 instruction executed.
4B26	CP IO3 status bit not set after Set IO3 instruction executed.
4B27	Incorrect MIC after Clear IO3 instruction executed.
4B28	CP IO3 status bit not reset after Clear IO3 instruction executed.
4B29	BP IO3 status bit not set after executing Clear IO3 instruction.
4B2A	IO3 interrupt not detected when IO3 cleared.
4B2B	Incorrect MIC after executing Clear IO4B instruction.
4B2C	BP IO4B status bit not set after executing Clear IO4B instruction.
4B2D	IO4B interrupt not detected when IO4B cleared.
4B2E	Incorrect MIC after executing Clear IO4B instruction.
4B2F	CP IO4 status bit cleared after executing Clear IO4B instruction.
4B30	Incorrect MIC after executing Disable IO3.
4B31	CP IO3 status bit not clear when setting IO3 after disabling IO3.
4B32	Incorrect MIC after executing Enable IO3.
4B33	Central Processor IO3 bit not set after enabling IO3.
4B34	Central Processor nanocode error.
4C	CENTRAL PROCESSOR RANDOM OPERANDS SELF-TEST (@CT0800@ from @DIAGST@ EXECUTION)
4C10	Timeout.
4C20	Central Processor detected error.
4C30	Central Processor parity error.
4D	CENTRAL PROCESSOR INTEGRITY SELF-TEST (@CTOB00@ from @DIAGST@ EXECUTION)
4D10	Timeout.
4D20	Central Processor detected error.
4D30	Central Processor parity error.
4E	MAIN MEMORY SELF-TEST (@MT0500@ from @DIAGST@ EXECUTION)
4E10	Timeout.
4E20	Central Processor detected Main Memory error.
4E30	Central Processor parity error.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
4F	BUS PROCESSOR DMA and MARs SELF-TEST (@BT0800@ from @DIAGST@ EXECUTION)
4F01	Continuous Main Memory error correction count interrupt.
4F02	Continuous Bus Processor/Main Memory DMA interrupt.
4F03	Continuous Central Processor sync interrupt.
4F11	DRAM MAR data compare failure.
4F21	DRAM MAR changed after diagnostic ripple with ripple controls equal to 'zero'.
4F22	DRAM MAR incorrect value after diagnostic ripple with ripple controls equal to 'one'.
4F23	DRAM MAR incorrect value after diagnostic ripple with ripple controls equal to 'two'.
4F31	Main Memory MAR low data compare failure.
4F32	Main Memory MAR high data compare failure.
4F41	Main Memory MAR low incorrect value after diagnostic ripple.
4F42	Main Memory MAR high incorrect value after diagnostic ripple.
4F81	No DMA completion interrupt on transfer from DRAM to Main Memory address 'zero'.
4F82	No DMA completion interrupt on transfer from Main Memory address 'zero' to DRAM address displayed.
4F83	No data transferred on DMA from Main Memory address 'zero' to DRAM address displayed.
4F84	DRAM addressing failure: Actual address of transfer displayed not equal to Expected address.
4F91	No DMA completion interrupt on transfer from DRAM to Main Memory address 'zero'.
4F92	No DMA completion interrupt on transfer from Main Memory to DRAM address 'zero'.
4F93	Data bus failure: Received data not equal to expected data.
4F94	Bus Processor DMA error status bits set on transfer from DRAM to Main Memory address 'zero'. (Bus Processor status displayed.)
4F95	Bus Processor DMA error status bits set on transfer from MM to DRAM address 'zero'. (Bus Processor status displayed.)
4FA1	No DMA completion interrupt on transfer from DRAM to Main Memory address 'zero'.
4FA2	Bus Processor DMA error status bits set on transfer from DRAM to MM address 'zero'. (Bus Processor status displayed.)
4FA3	No DMA completion interrupt on transfer from Main Memory to DRAM address 'zero'.
4FA4	BP DMA error status bits set on transfer from DRAM to Main Memory address 'zero'.
4FA5	Data received from Main Memory did not match expected data.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
4F	BUS PROCESSOR DMA and MARs SELF-TEST (@BT0800@ from @DIAGST@ EXECUTION) - (Cont'd)
4FA6	No DMA completion interrupt on transfer from DRAM address 'zero' to Main Memory address displayed.
4FA7	BP DMA error status bits set on transfer from DRAM address 'zero' to Main Memory address displayed.
4FA8	Main Memory Invalid Memory Address (IMA) status bit set on access to valid Main Memory location.
4FA9	DRAM data altered on Main Memory IMA fault.
4FAA	No DMA completion interrupt on transfer from DRAM address 'zero' to Main Memory scan address displayed.
4FAB	Bus Processor DMA error status bits set on transfer from DRAM address 'zero' to Main Memory scan address displayed.
4FAC	Main Memory addressing failure: Data received from Main Memory scan location did not match expected data.
4FAD	Main Memory addressing failure: Data received from Main Memory test location did not match expected data.
4FAE	DRAM data altered by DMA to Main Memory test location.
4FAF	Access to Main Memory address greater than Lowest Word Address (LWA) set by Central Processor; sizing did not generate IMA fault.
4FD8	No DMA completion interrupt on multiword transfer from DRAM to Main Memory with MAR ripple equal to one.
4FD9	DMA register count fault: Rcvd count did not equal Expd count.
4FE1	Unexpected interrupt from Main Memory ECC logging counter after initial programming.
4FE2	No DMA completion interrupt on 2K halfword transfer from DRAM to Main Memory.
4FE3	Bus Processor DMA error status bits set on 2K halfword transfer from DRAM to Main Memory.
4FE4	Unexpected interrupt from ECC logging counter on 2K halfword transfer from DRAM to Main Memory.
4FE5	No DMA completion interrupt on 2K halfword transfer from DRAM to Main Memory while operating in the non-ECC mode.
4FE6	Bus Processor DMA error status bits set on 2K halfword transfer from DRAM to Main Memory while operating in the non-ECC mode.
4FE7	Unexpected interrupt from ECC logging counter on 2K halfword transfer from DRAM to Main Memory while operating in the non-ECC mode.
4FE8	No DMA completion interrupt on 2K halfword transfer to DRAM from MM.
4FE9	Bus Processor DMA error status bits set on 2K halfword transfer to DRAM from Main Memory.
4FEA	Single-bit Main Memory error not corrected on 2K DMA transfer.
4FEB	Incorrect number or error corrections logged on 2K DMA transfer.
4FEC	No DMA completion interrupt on 2K halfword transfer from DRAM to Main Memory while operating in the non-ECC mode.
4FED	Bus Processor DMA error status bits set on 2K halfword transfer from DRAM to Main Memory while operating in the non-ECC mode.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
4FEE	Unexpected interrupt from ECC logging counter on 2K halfword transfer from DRAM to Main Memory while operating in the non-ECC mode.
4FEF	No DMA completion interrupt on attempted 2K halfword transfer to DRAM from Main Memory with uncorrectable data.
4FF0	BP Main Memory ECC status bit not set after Main Memory read of uncorrectable data.
4FF1	Correctable ECC logging interrupt did not occur with limit count equal to transfer length and single-bit error correction attempted.
4FF2	DMA operation did not abort on Main Memory uncorrectable ECC error.
4FF3	No DMA completion interrupt on attempted transfer from Main Memory address 100000 HEX to DRAM.
4FF4	Bus Processor Main Memory Invalid Memory Address (IMA) status bit not set after attempted access to Main Memory location 100000 HEX.
4FF5	DMA operation did not abort on Main Memory IMA error.
4FF6	No DMA completion interrupt on attempted 2K halfword DRAM to Main Memory transfer with bad DRAM parity.
4FF7	Bus Processor Main Memory DSB status bit not set after attempted read of DRAM with bad parity.
4FF8	DMA operation did not abort on DRAM parity error.
4FF9	No DMA completion interrupt on DRAM to Main Memory transfer after correcting DRAM parity.
4FFA	Bus Processor DMA error status bits set on DRAM to Main Memory transfer after correcting DRAM parity.
4FFB	Unexpected interrupt from ECC logging counter on DRAM to Main Memory transfer after correcting DRAM parity.
4FFC	No DMA completion interrupt on two-halfword transfer to DRAM form Main Memory to start PIT clock.
4FFD	No DMA completion interrupt on two-halfword transfer from DRAM to Main Memory rewrite "bad" data.
4FFE	Bus Processor DMA error status bits set on two-halfword transfer from DRAM to Main Memory.
50-54	5-1/4" INTERNAL DISK SELF-TEST (PROM-BASED)
5000	Hung on entry to Internal Disk Self-Test.
510	5-1/4" INTERNAL DISK RECALIBRATION TEST ROUTINE (PROM-BASED)
5102	Uncorrectable data ECC error.
5104	No device adapter ID found.
5106	No interrupt on recalibration operation.
5108	Controller error on recalibration operation.
510A	No interrupt on seek operation.
510C	Controller error on seek operation.
510E	No seek complete from drive on seek operation.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
510	5-1/4" INTERNAL DISK RECALIBRATION TEST ROUTINE - (Cont'd)
5110	No completion interrupt on read operation.
5112	Controller/DMA error on Read operation.
5114	Requested drive not ready.
5116	Invalid unit number.
5118	Head address exceeds unit maximum.
511A	Starting block number out of range.
511C	Block count exceeds track limit.
511E	Starting transfer address exceeds DRAM last address.
5120	Transfer length exceeds DRAM last address.
5122	No track 'zero' on recalibration/seek operation.
520	5-1/4" INTERNAL DISK SEEK-MAXIMUM-CYLINDER TEST ROUTINE (PROM-BASED)
5202	Uncorrectable data ECC error.
5204	No device adapter ID found.
5206	No interrupt on recalibration operation.
5208	Controller error on recalibration operation.
520A	No interrupt on seek operation.
520C	Controller error on seek operation.
520E	No seek complete from drive on seek operation.
5210	No completion interrupt on read operation.
5212	Controller/DMA error on Read operation.
5214	Requested drive not ready.
5216	Invalid unit number.
5218	Head address exceeds unit maximum.
521A	Starting block number out of range.
521C	Block count exceeds track limit.
521E	Starting transfer address exceeds DRAM last address.
5220	Transfer length exceeds DRAM last address.
5222	No track 'zero' on recalibration/seek operation.
530	5-1/4" INTERNAL DISK SEEK-MINIMUM-CYLINDER TEST ROUTINE (PROM-BASED)
5302	Uncorrectable data ECC error.
5304	No device adapter ID found.
5306	No interrupt on recalibration operation.
5308	Controller error on recalibration operation.
530A	No interrupt on seek operation.
530C	Controller error on seek operation.
530E	No seek complete from drive on seek operation.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
5310	No completion interrupt on read operation.
5312	Controller/DMA error on Read operation.
5314	Requested drive not ready.
5316	Invalid unit number.
5318	Head address exceeds unit maximum.
531A	Starting block number out of range.
531C	Block count exceeds track limit.
531E	Starting transfer address exceeds DRAM last address.
5320	Transfer length exceeds DRAM last address.
5322	No track 'zero' on recalibration/seek operation.
540	5-1/4" INTERNAL DISK TRACK-ZERO-READ TEST ROUTINE (PROM-BASED)
5402	Uncorrectable data ECC error.
5404	No device adapter ID found.
5406	No interrupt on recalibration operation.
5408	Controller error on recalibration operation.
540A	No interrupt on seek operation.
540C	Controller error on seek operation.
540E	No seek complete from drive on seek operation.
5410	No completion interrupt on read operation.
5412	Controller/DMA error on Read operation.
5414	Requested drive not ready.
5416	Invalid unit number.
5418	Head address exceeds unit maximum.
541A	Starting block number out of range.
541C	Block count exceeds track limit.
541E	Starting transfer address exceeds DRAM last address.
5420	Transfer length exceeds DRAM last address.
5422	No track 'zero' on recalibration/seek operation.
70-76	INTELLIGENT SERIAL INPUT/OUTPUT DEVICE ADAPTER SELF-TEST DIAGNOSTIC - (@ST0800@ from @DIAGST@ EXECUTION)
7010	ISIO (or 928W) Device Adapter ID not found on system.
7011	Device adapter ready bit failed to be set, software status register indicates that the internal power-up failed. (Software status register has not been tested at this time.)
7012	Device adapter ready bit failed to be set.
7013	Device adapter ready bit failed to be reset.
7014	Device adapter request bit failed to be set.
7016	Device adapter request interrupt failed to be detected.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
70-76	INTELLIGENT SERIAL INPUT/OUTPUT DEVICE ADAPTER SELF-TEST DIAGNOSTIC - (Cont'd)
7017	Illegal interrupt detected (DA request interrupt expected).
7018	Device adapter request bit failed to be reset.
701A	Device adapter request failed to be set.
701C	Device adapter ready interrupt failed to be detected.
701D	Illegal interrupt detected (DA ready interrupt was expected).
701E	Software status register failed walking ones pattern.
7020	Local DMA Controller Buffer Full (LDCBF), Flip-Flop (F/F) failed to be reset.
7021	LDCBF, F/F failed to be set.
7022	ISIO (or 928W) failed to internally detect a completion interrupt.
7023	Local DMA Controller Byte Counter (LDCBC) F/F failed to be reset.
7024	ISIO (or 928W) failed to internally detect LDCBC F/F being reset.
7025	Static RAM Byte Cou r (SRBC) F/F failed to be reset.
7026	SRBC F/F failed to be set.
7027	Device adapter completion interrupt failed to be detected.
7028	Illegal interrupt detected. (Only device adapter completion interrupt was expected.)
7029	ISIO (or 928W) failed to internally detect a completion interrupt.
702A	SRBC F/F failed to be reset.
702B	ISIO (or 928W) failed to detect SRBC F/F being reset.
702C	Loading of LDCBC (with control register equal to SR/DR) failed to reset LDCBC F/F.
702D	Loading of SRBC (with control register equal to 0) failed to prevent SRBC F/F from resetting.
702E	Loading of SRBC (with control register equal to 0) failed to reset SRBC F/F.
702F	ISIO (or 928W) failed to set up for DMA operations.
703C	ISIO (or 928W) failed to select Static RAM (SR) Bank 1.
7042	Dynamic RAM (DR) to SR Bank 1 (SRB-1) DMA: completion interrupt failed to be detected.
7044	DR to SRB-1 DMA: ready interrupt failed to be detected.
7046	DR to SRB-1 DMA: request interrupt failed to be detected.
7048	DR to SRB-1 DMA: hardware status bits failed.
704A	DR to SRB-1 DMA: software status bits failed.
7052	Dynamic RAM to Z80 and SRB-1 to Main Memory concurrent DMAs: completion interrupt failed to be detected.
7058	DR to Z80 and SRB-1 to Main Memory concurrent DMAs: hardware status bits failed.
705A	DR to Z80 and SRB-1 to Main Memory concurrent DMAs: software status bits failed.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
705E	DR to Z80 and SRB-1 to Main Memory concurrent DMAs: interrupts failed (expected one completion, two readys, and two requests.
706C	ISIO (or 928W) failed to select SR Bank 2 (SRB-2).
7072	Z80 to DR and Main Memory to SRB-2 concurrent DMAs: completion interrupt failed to be detected.
7078	Z80 to DR and Main Memory to SRB-2 concurrent DMAs: hardware status bits failed.
707A	Z80 to DR and Main Memory to SRB-2 concurrent DMAs: software status bits failed.
707E	Z80 to DR and Main Memory to SRB-2 concurrent DMAs: interrupts failed (expected one completion, two readys, and two requests.
7082	SR Bank 2 to DR DMA: completion interrupt failed to be detected.
7084	SRB-2 to DR DMA: ready interrupt failed to be detected.
7086	SRB-2 to DR DMA: request interrupt failed to be detected.
7088	SRB-2 to DR DMA: hardware status bits failed.
708A	SRB-2 to DR DMA: software status bits failed.
7090	Data transfer failure.
70B0	Failure to enable microcode loading step 1.
70B2	Failure to enable microcode loading step 2.
70B4	Failure to enable microcode loading step 3.
70B6	Failure to enable microcode loading step 4.
70FD	Unexpected trap.
70FE	Unexpected SIO interrupt.
70FF	Get control of workstation failure.
7101	Address latch integrity error.
71FE	Unexpected SIO interrupt.
7201	Write byte completion interrupt failure.
7202	Read byte completion interrupt failure.
7203	Read and test data. (Also indicates 'Workstation Zero inoperable'.)
7204	SIO status error.
7205	Static RAM MAR (SMAR) ripple failure.
72FF	Get control of workstation failure.
7301	Write 256 completion interrupt failure.
7302	Read 256 completion interrupt failure.
7303	Read and test data.
7304	SIO status error.
7305	SMAR ripple failure.
73FF	Get control of workstation failure.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
70-76	INTELLIGENT SERIAL INPUT/OUTPUT DEVICE ADAPTER SELF-TEST DIAGNOSTIC - (Cont'd)
7601	Give status completion interrupt failure.
7602	Status unchanged.
7603	Valid status.
7604	Valid device type.
76FF	Get control of workstation failure.
90	SERIAL INPUT/OUTPUT DEVICE ADAPTER SELF-TEST (@ST0500@ from @DIAGST@ EXECUTION)
9011	Workstation powered-off (or disconnected) status.
9015	Coaxial parity, parity, or not running status.
96	5-1/4" INTERNAL DISK SELF-TEST (PROM-BASED)
9614	5-1/4" internal disk device not ready, timeout.
98	DISKETTE DEVICE SELF-TEST (PROM-BASED)
9820	Diskette drive not ready. (Also indicates 'No floppy in IPL/Boot Device'.)
9821	Failure on initial Diskette recalibration.
9822	Failure on Diskette seek to maximum track (track 77).
9823	Failure on Diskette seek to track 00.
A4	SERIAL INPUT/OUTPUT (SIO) and WORKSTATION ZERO SELF-TEST (CRAM-BASED) - (ST0100 from @DIAGST@ EXECUTION)
A400	SIO or WS-0 hung on self-test entry.
A401	SIO or WS-0 ID not found.
A402	SMAR data integrity failure.
A4FD	Unexpected trap.
A4FE	Unexpected SIO interrupt.
A4FF	Get control of workstation failure.
A9	5-1/4" INTERNAL DISK SELF-TEST (PROM-BASED)
A910	No 5-1/4" Internal Disk device ID in system.
B0	INTERNAL SMD DEVICE ADAPTER SELF-TEST (PROM-BASED)
B000	Hung on entry to internal SMD device self-test.

ERROR CODE	TEST TITLE or ERROR CODE DESCRIPTION
B0	INTERNAL SMD DEVICE ADAPTER SELF-TEST (PROM-BASED) - (Cont'd)
B004	Ready status bit failed to set.
B012	Internal SMD device adapter not found on the system.
B014	Internal SMD device adapter port specified does not exist.
B016	Internal SMD device adapter at an illegal address (0400 HEX, 0500 HEX, or 0600 HEX).
B022	Internal SMD device adapter could not be properly reset.
B032	Disk drive could not be selected.
B034	Drive Fault could not be cleared.
B042	Seek interrupt not detected after a restore (RTZ - Return to Track Zero) operation.
B048	Seek interrupt not detected after a seek to track operation.
B052	ECC error could not be corrected.
B062	Operation complete interrupt not detected after a read operation.
B068	Operation complete interrupt not detected after an ECC correction operation.
B082	Drive status error after restore (RTZ) operation.
B084	Drive status error after seek operation.
B086	Drive status error after read operation.
B092	Read sector operation failed (HCE - Header Check Error).
B094	Read sector operation failed.
D0	HARDWARE RELATED FAILURE
DEAD	Program trap for attempted execution from nonexistent memory space. (CRAM address branch leads to address in 8086 PROM.)

APPENDIX
C

APPENDIX C

147-MEGABYTE DISK DRIVE OPTION

PREFACE

This document is an addendum to the First Customer Shipment (FCS) Manual for the VS-15 Computer System. The purpose of this addendum is to provide the Wang-trained Customer Engineer (CE) with instructions to install, operate, checkout, and troubleshoot the internal NEC 147-Megabyte Disk Drive. This addendum will be updated as required.

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LIST OF ILLUSTRATIONS

CHAPTER C1

INTRODUCTION

C1.1 SCOPE AND PURPOSE

This addendum to the VS-15 Computer System FCS manual provides instructions to upgrade the present VS-15 system for operation with an internal NEC 147-Megabyte (formatted) Disk Drive. The hardware for this upgrade is provided in the form of two upgrade (UJ) kits.

C1.2 UPGRADE (UJ) KITS

Kit UJ-3298 is required when upgrading from the present 76-megabyte (formatted) disk drive. This UJ kit contains the new 147-megabyte drive along with a new 5-volt dc power cable. No other hardware is required since the new drive utilizes the mounting bracket from the old drive to ensure correct mounting within the VS-15. The original SMD controller (8312, 8313, 8314, or 8315) that supports the 76-megabyte drive will also support the 147-megabyte drive by simply changing switch settings.

Kit UJ-3299 is required when upgrading from the 33-megabyte disk drive(s) to the 147-megabyte disk drive. Additional hardware and a new SMD Controller (210-8312-A) is provided to facilitate this more extensive upgrade procedure.

C1.3 SOFTWARE REQUIREMENTS

Software Operating System release 6.30 is required to support operation of the NEC 147-Megabyte Disk Drive. The current CP5 CPU-microprogram (version 5.12.01) is adequate to support operation of the drive.

C1.4 APPLICABLE DOCUMENTATION

This section lists CE documentation relating to the NEC 147-Megabyte Disk Drive. A complete listing of technical documentation is presented in the Technical Documentation Catalog/Index (742-0000). Other product documentation is identified in the Corporate Resource Catalog (700-7647).

Orders for documentation may be submitted by sending a printed or a MAILWAY order to the Supplies Division. Directions for ordering documentation can be obtained from your branch manager or by requesting the Order/Distribution Kit from the Supplies Division.

NOTE

Only base documentation part numbers are provided in this section. To order the latest revision and applicable PUB's, refer to the Technical Documentation Catalog/Index (742-0000). Failure to do so may result in receiving outdated information.

The Base Document Number and Title are given for the related document below. Use the Technical Documentation Catalog/Index (742-0000) to determine the latest version of the document listed.

Base Document Number	Title
729-1503	NEC Information Systems Incorporated, Winchester Disk Drive Maintenance Guide, Model D2257

CHAPTER C2

THEORY OF OPERATION

Theory of operation for the SMD Device Adapter used with the disk drive is not provided as part of this First Customer Shipment (FCS) addendum. It will be included in the VS-15 Illustrated Manual (IM) scheduled for completion at a later date.

A functional block diagram description for the NEC 147-Megabyte Disk Drive is found in the NEC Information Systems Incorporated, Winchester Disk Drive Maintenance Guide, Model D2257 (729-1503).

CHAPTER C3

OPERATION

The NEC 147-Megabyte Fixed Disk Drive does not require any special instructions for operation in the VS-15 Computer System.

CHAPTER C4

INSTALLATION

C4.1 GENERAL

This chapter presents information for unpacking, inspecting and installing the NEC 147-Megabyte Fixed Disk Drive into the VS-15 Computer System. Information pertaining to the removal of the existing drive(s) prior to installation of the new 147-megabyte drive is also provided. General information concerning VS-15 installation is found in Chapter 4 of the VS-15 Computer System Product Maintenance Manual.

C4.2 UNPACKING/PACKING

NOTE

Failure to adhere to the following procedure could result in voiding the warranty

The NEC 147-Megabyte Fixed Disk Drive is packed in a shipping carton as shown in figure C4-1. Refer to figure C4-1 while performing the procedure given below.

Unpacking:

1. Before unpacking the disk drive, inspect the shipping container for damage. If any damage is noticed, notify the carrier immediately. Do not open the container until the carriers' representative is present. If there is no apparent damage to the shipping container, proceed to step 2.

2. Carefully open the container and save all packaging material for reshipping.

3. Check all items against the shipping bill to ensure that none are missing or damaged.

4. Inspect the disk drive for shipping damage. Any damage claims should be handled as specified in section 4 of the VS-15 Computer System manual.

Packing

The NEC 147-Megabyte Fixed Disk Drive can be repackaged for shipment by reversing the steps given above.

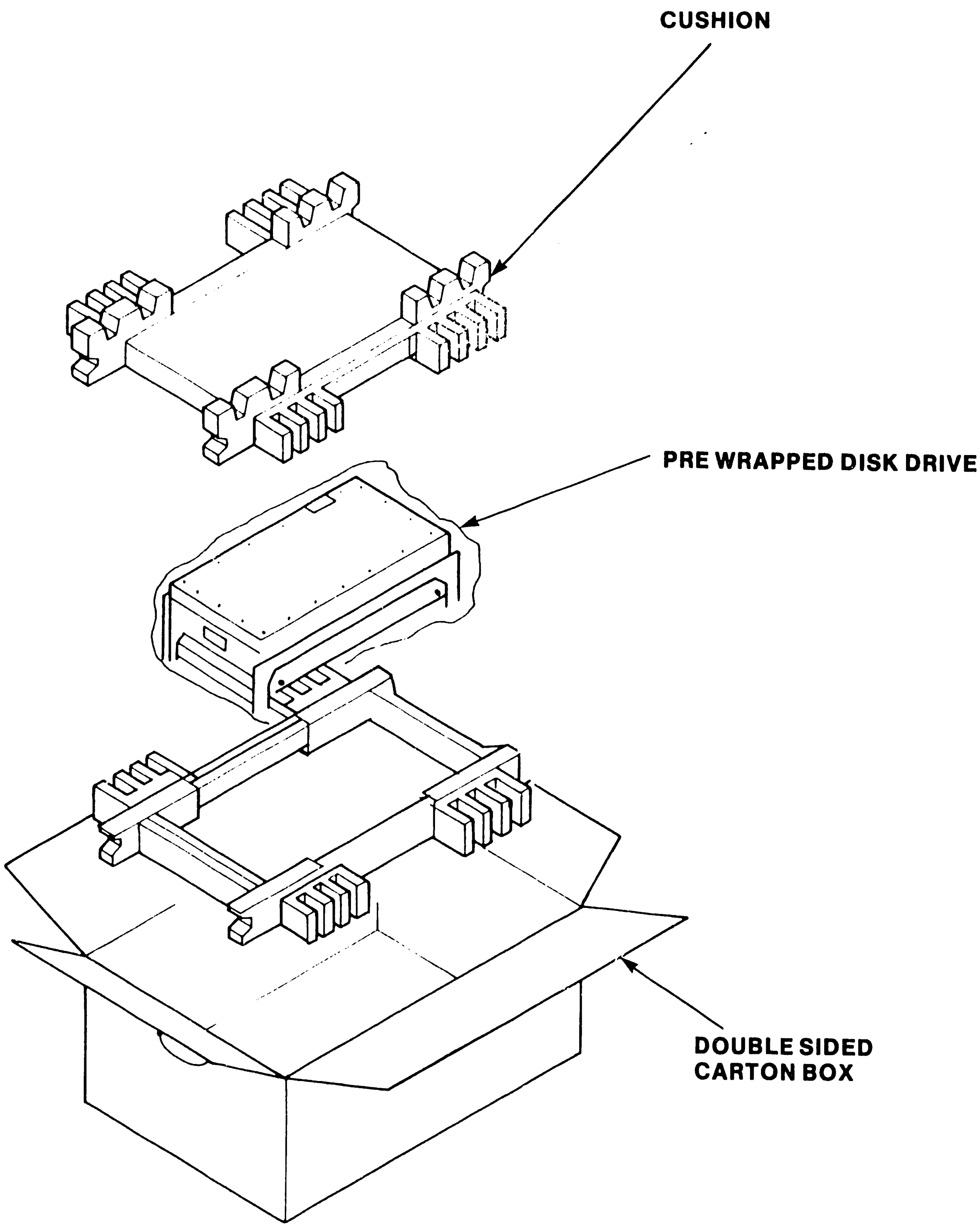


Figure C4-1 Unpacking the 147-Megabyte Disk Drive

C4.3 REMOVAL OF EXISTING DRIVE

This section presents detailed instructions for removing the existing 33-megabyte drive(s) or 76-megabyte drive from the VS-15 Computer System and installing the new 147-megabyte disk drive. Instructions are also provided for replacing the SMD Device Adapter board when upgrading from a 33-megabyte drive. If upgrading from a 76-megabyte drive, the only changes involve new device adapter switch settings.

C4.3.1 33-Megabyte Disk Drive Removal

1. Power down main frame by depressing ac power on/off rocker switch to the 0 position.

2. Remove top, front, and left side covers per instructions in sections 5.3.2.1, 5.3.2.2, and 5.3.2.3.

3. While referring to figure 5-29 in the VS-15 manual, remove following from existing 33-megabyte drive(s): "A" cable from J1, "B" cable from J2, 4-pin dc power cable from J3, and quick-disconnect ground wire from ground terminal lug.

4. Unscrew spring-loaded thumbscrew (figure 5-29) securing front of drive chassis to main frame base plate.

CAUTION

Be careful when removing drive from chassis. The logic PCB is located on bottom of drive.

5. Slide entire drive forward and out of cabinet.

6. Remove Quantum device adapter PCB from CPU. Remove "B" cable(s) and "A" cable.

7. Install new SMD Device Adapter (section C4.4).

8. Install new 147-megabyte disk drive (section C4.5).

9. Return 33-megabyte drive(s) and Quantum device adapter PCB to stock.

C4.3.2 76-Megabyte Disk Drive Removal

1. Power down main frame by pressing ac power on/off rocker switch to the 0 position.

2. Remove ac power cable from its connector.

3. Remove top, front, and left side covers per instructions in sections 5.3.2.1, 5.3.2.2, and 5.3.2.3.

4. Lock drive spindle carriage (figure C4-2) by moving lever to the right, moving it down as far as it will go, and then moving it to the left (LOCK position).

5. Disconnect dc power cable from P3; "A"cable from P1; and "B" cable from P2 (figure 5-32).

6. Remove ground lead from "fast-on" terminal (figure C4-4).

7. Loosen thumbscrew (figure 5-32).

CAUTION

The drive weighs approximately 30 pounds (14 kilograms)

8. Slide Drive out of cabinet.

9. Disconnect "A" interconnect cable from drive by pulling on white nylon tab located to the left of the terminator shown on figure C4-4.

10. Remove bracket (figure C4-2) by removing four bracket screws. Save for use later.

11. Proceed to section C4.5 for instructions to install new 147-megabyte disk drive.

12. Return 76-megabyte drive to stock

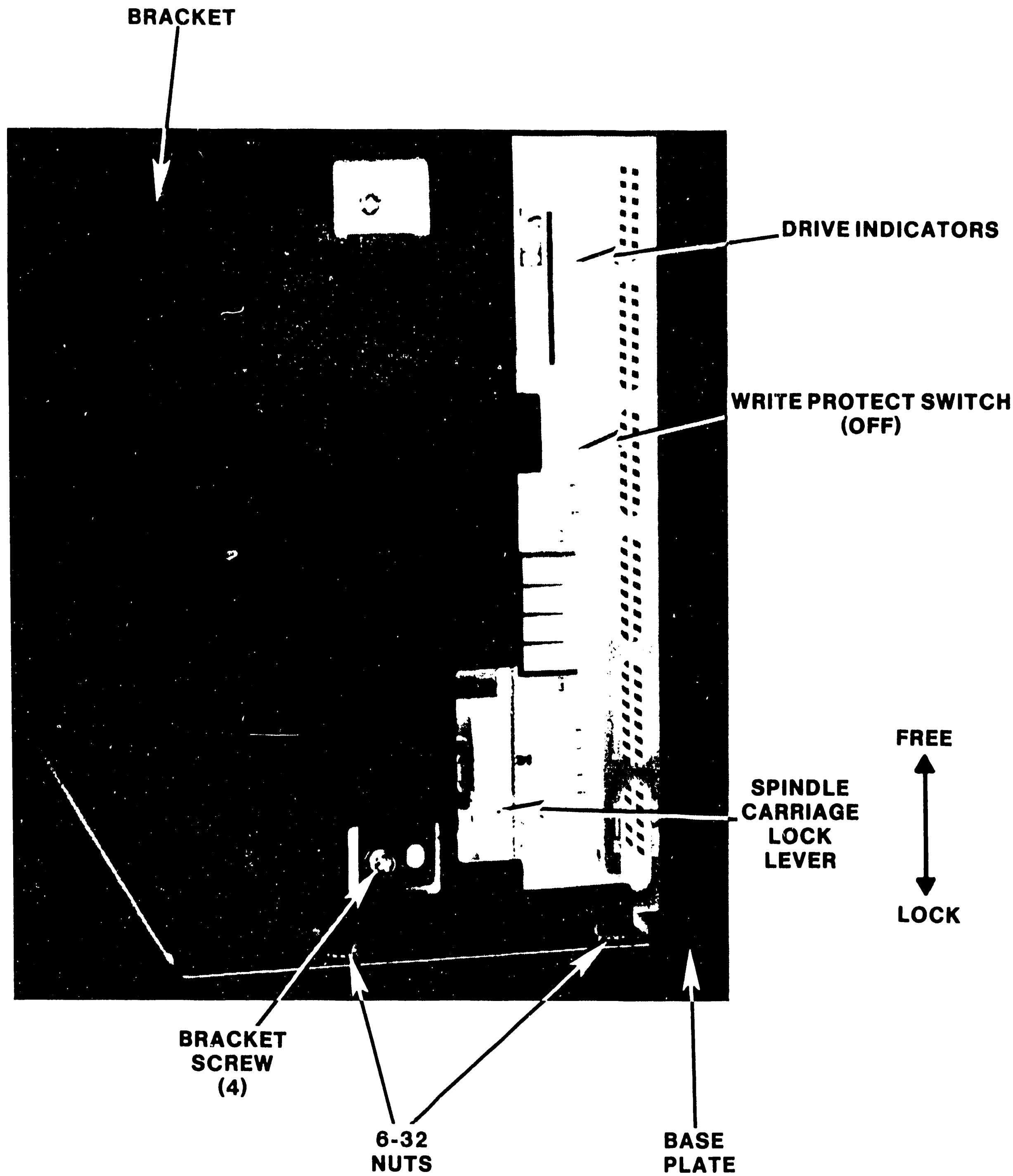


Figure C4-2   76-Megabyte Disk Drive Bracket Removal

C4.4 SMD DEVICE ADAPTER INSTALLATION

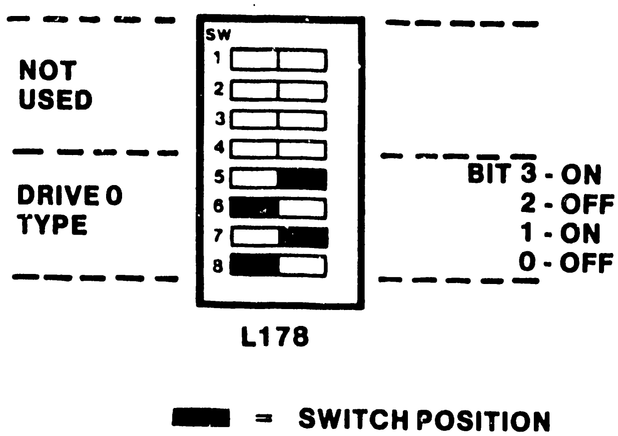
The SMD Device Adapter IOP (figure 5-14a) is the interface between the CPU and the disk drive. If the present VS-15 Computer System is being upgraded from a single or double 33-megabyte disk drive system to the new 147-megabyte disk drive, proceed to section C4.4.1. If the VS-15 is being upgraded from a 76-megabyte drive to the new 147-megabyte drive, proceed to section C4.4.2.

C4.4.1 33-Megabyte Disk Drive to 147-Megabyte Disk Drive

1. Remove all cables from original SMD Device Adapter PCB and remove PCB from the VS-15.
2. Set switches and configure jumpers on new SMD Device Adapter PCB as shown in figure C4-3.
3. Install new SMD Device Adapter PCB into VS-15.
4. Proceed to section C4.5 to install new 147-Megabyte Disk Drive.

C4.4.2 76-Megabyte Disk Drive to 147-Megabyte Disk Drive

1. Remove all cables from original SMD Device Adapter PCB and remove PCB from the VS-15.
2. Verify that jumpers on original SMD Device Adapter PCB are configured as shown in figure C4-3.
3. Change switch settings on original SMD Device Adapter PCB to those shown in figure C4-3.
4. Re-install original SMD Device Adapter PCB back into VS-15.
5. Proceed to section C4.5 to install new 147-Megabyte Disk Drive.



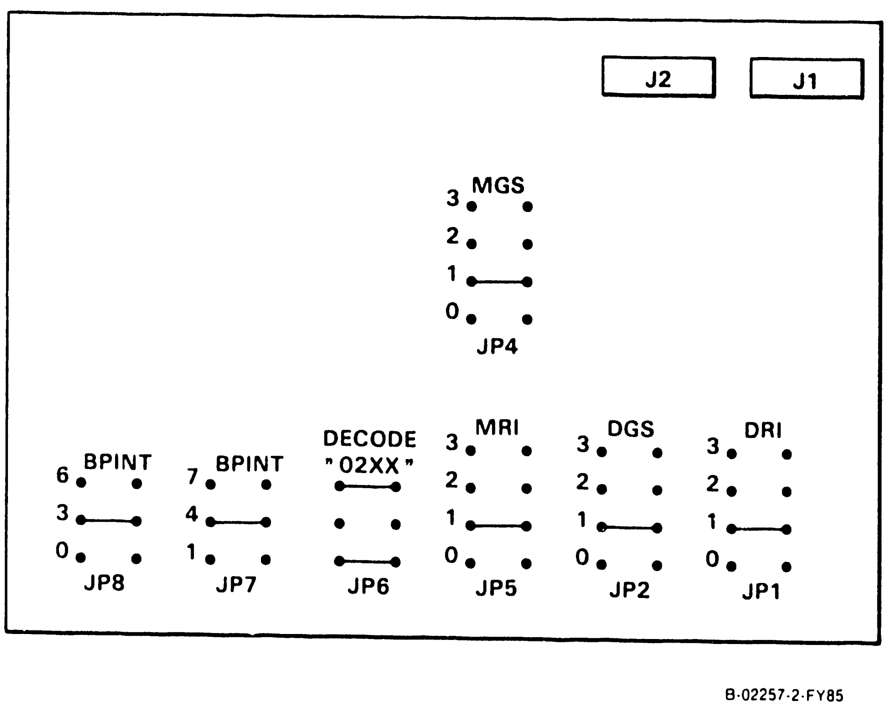


Figure C4-3 Device Adapter Switch and Jumper Settings

C4.5 147-MEGABYTE DISK DRIVE INSTALLATION

1. Power down the VS-15 by pressing the ac power on/off rocker switch to the 0 position. Remove ac power cable from its outlet.
2. Verify 147-megabyte drive switch settings (figure C4-5).
3. Remove original NEC Drive bracket (figure C4-6) by removing four Phillips-head screws.
4. Install new bracket (figure C4-2). Secure using four bracket screws removed in previous step; or use new screws.
5. Install base plate and secure with four 6-32 nuts (figure C4-2).
6. Slide drive into cabinet and position it as shown in figure C4-4.
7. Secure drive using spring-loaded knurled thumbscrew (figure C4-4).
8. Install "Fast-on" terminal (figure C4-4) onto mounting stud.
9. Secure "A" interconnect cable to terminator bracket using 4-40 pan-head screws (figure C4-4).
10. Plug "A" interconnect cable into logic and servo board connector P1 on the drive.

    NOTE
    Pin 1 of the connector should be on top

11. Insert "A" cable into right-side connector on terminator bracket.
12. Insert other end of "A" cable into J1 on the SMD drive adapter PCB.
13. Connect "B" cable between P2 on SMD drive adapter PCB and P1 on drive logic and servo board.
14. Insert terminator into left-side connector on terminator bracket.
15. Connect new 5-volt dc cable between P3 on the drive logic and servo board and J4 located behind three LED's on the switching power supply.
16. Verify overall disk drive cabling per figure C4-7.
17. Unlock drive spindle carriage (figure C4-2) by moving lever to the right, moving it up as far as it will go, and then moving it to the left (FREE position).
18. Reinstall cabinet covers (see sections 5.3.2.1, 5.3.2.2, and 5.3.2.3).)
19. Insert ac power cable into its outlet. Power up the CPU by depressing the ac power on/off rocker switch to the 1 position.
20. Run Diagnostics (chapter 8) to verify correct disk drive operation.

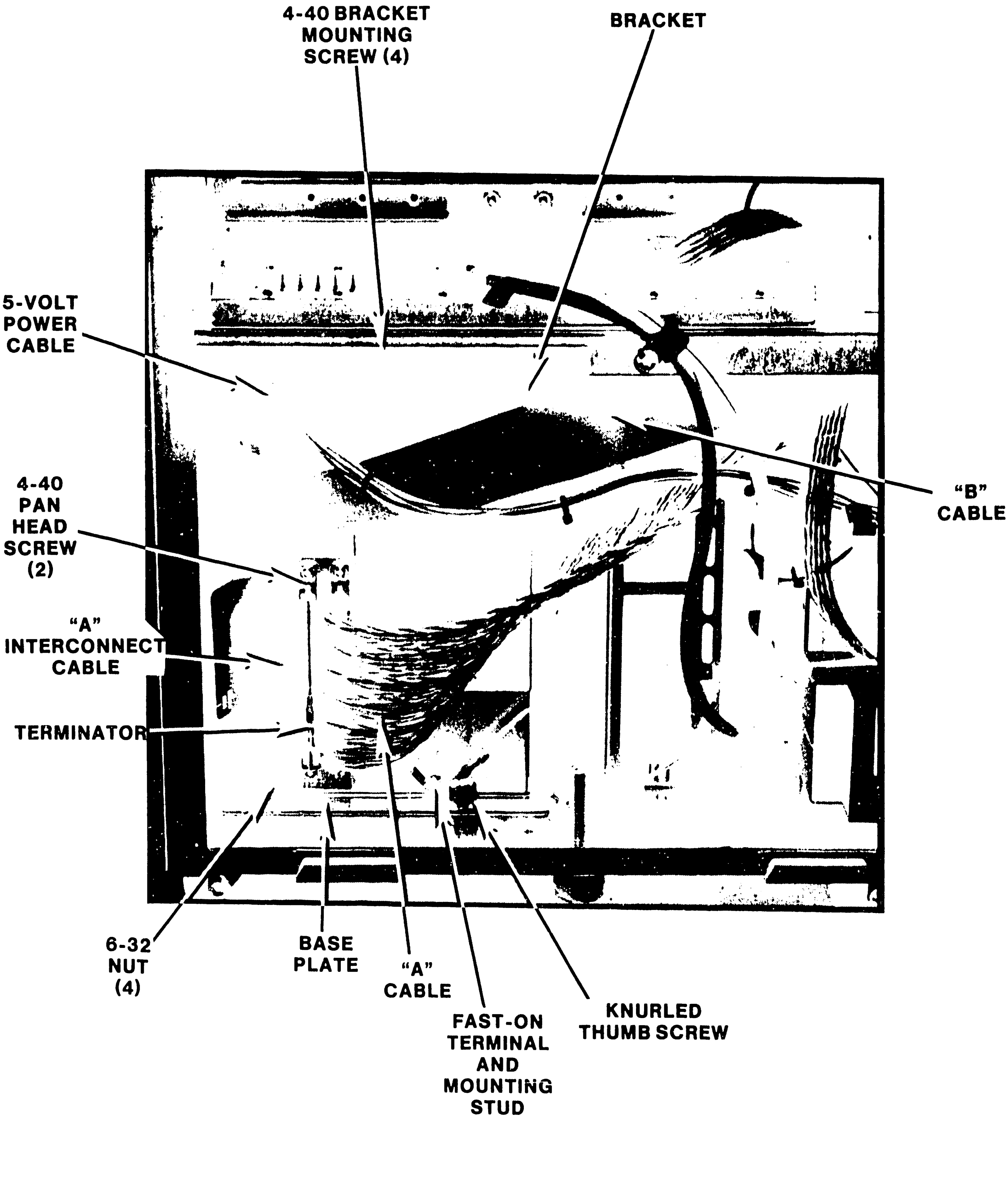


Figure C4-4 147-Megabyte Disk Drive Installed in VS-15 Computer

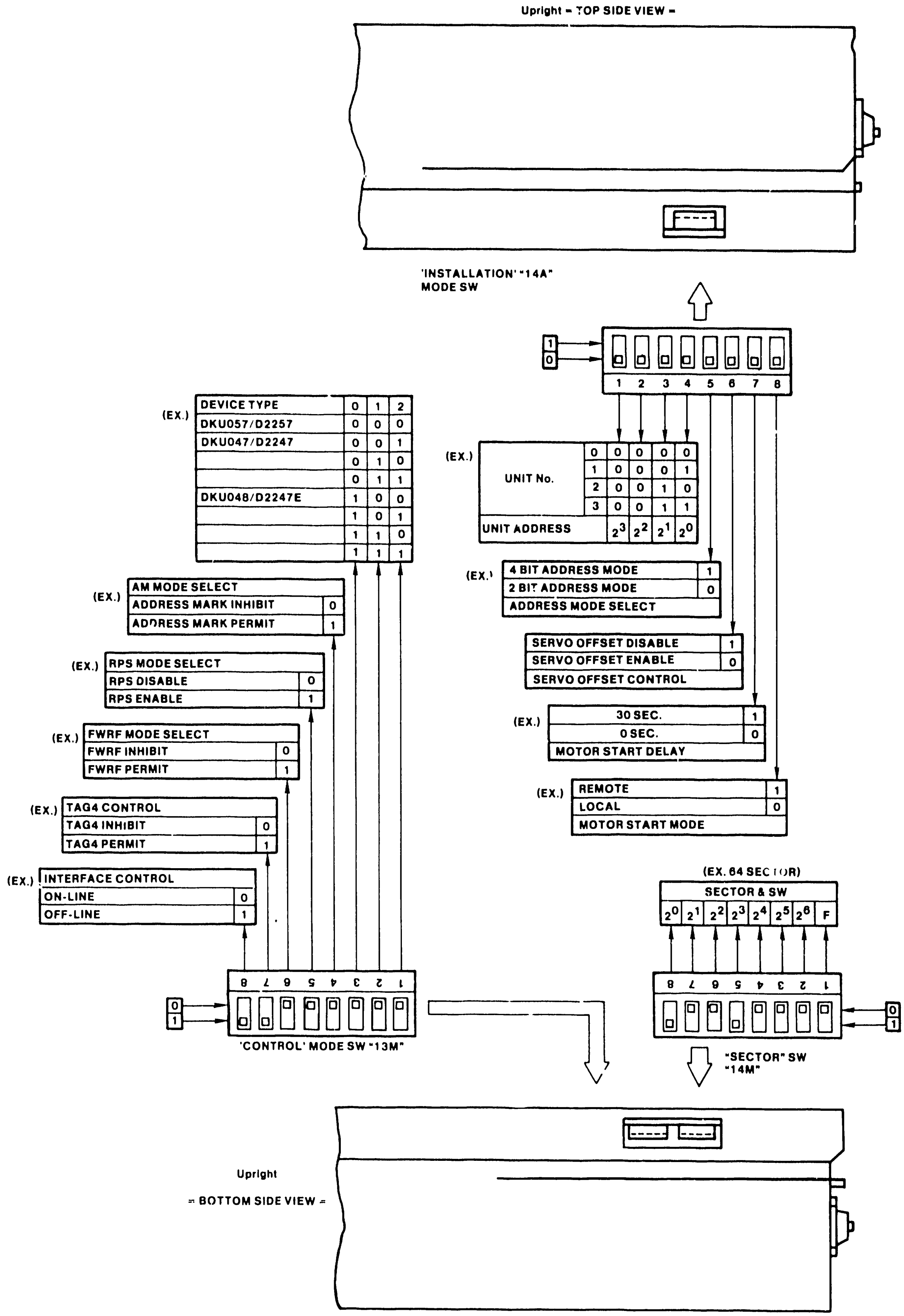


Figure C4-5 147-Megabyte Disk Drive Switch Settings

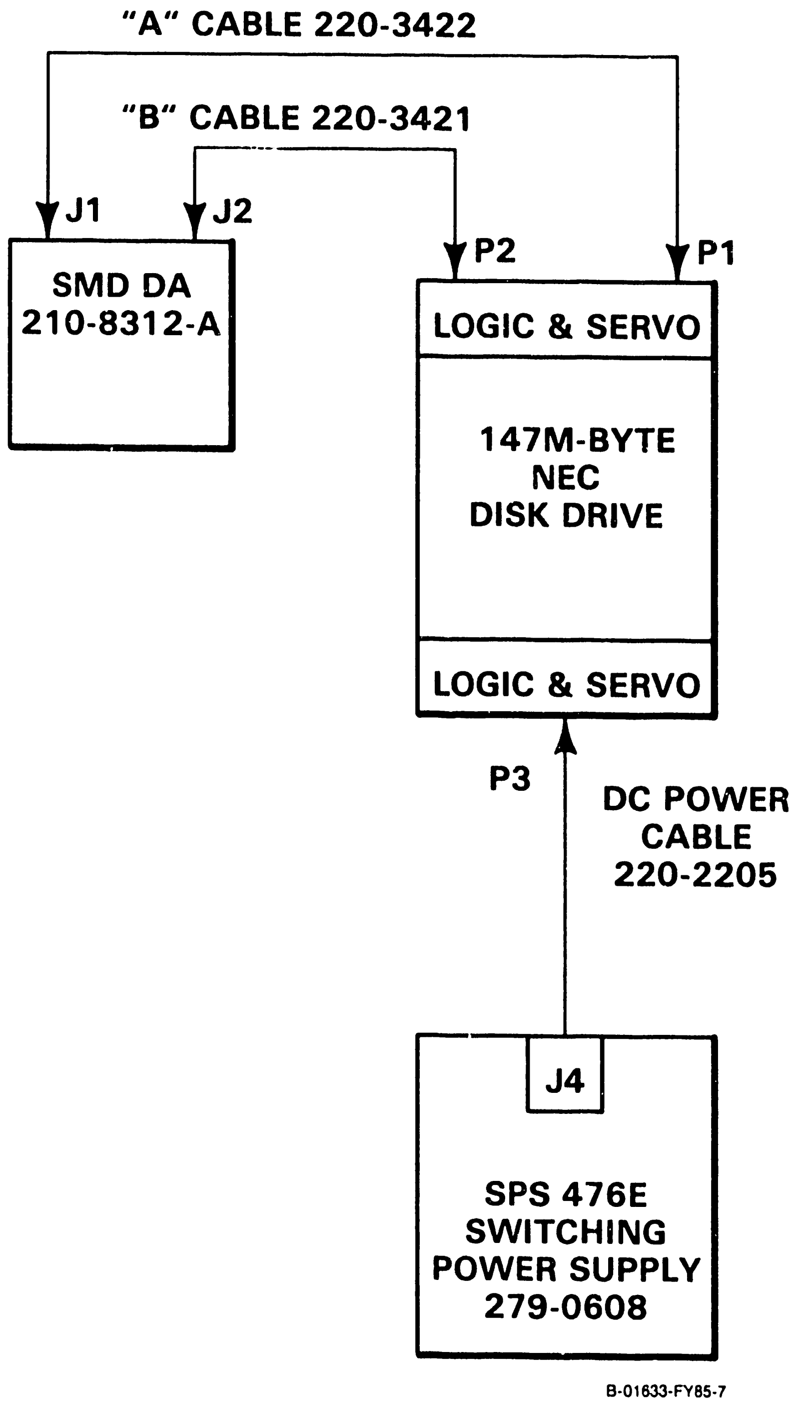


Figure C4-7 147-Megabyte Disk Drive Cable Interconnections

CHAPTER C5

PREVENTIVE AND CORRECTIVE MAINTENANCE

C5.1 GENERAL

Preventive and corrective maintenance for the NEC 147-megabyte disk drive is described in the NEC Information Systems Incorporated, Winchester Disk Drive Maintenance Guide, Model D2257 (729-1503).

C5.2 147-MEGABYTE DISK DRIVE REMOVAL

The 147-Megabyte Disk Drive is removed from the VS-15 Computer System for inspection and/or servicing as follows:

1. Power down the VS-15 by pressing the ac power on/off rocker switch to the 0 position.
2. Disconnect VS-15 ac power cable from its outlet.
3. Remove cabinet covers (sections 5.3.2.1, 5.3.2.2, and 5.3.2.3.
4. Lock drive spindle carriage (figure C4-2) by moving lever to the right, moving it down as far as it will go, and then moving it to the left (LOCK position).
5. Note location of all disk drive cables. Disconnect all cables from the disk drive.
6. Disengage disk drive from CPU cabinet by loosening knurled thumbscrew (figure C4-4).
7. Slide disk drive out of CPU cabinet.
8. Remove "A" cable from disk drive (figure C4-4).
9. Remove four 4-40 bracket mounting screws (figure C4-2).

CHAPTER C6

SCHEMATICS

C6.1 GENERAL

This section contains the related schematics for the SMD Device Adapter PCB required with the NEC 147-Megabyte Fixed Disk Drive.

CHAPTER C7

ILLUSTRATED PARTS BREAKDOWN (IPB)

C7.1 GENERAL

Figure C7-1 illustrates the replaceable components for the 147-Megabyte Fixed Disk Drive installation.

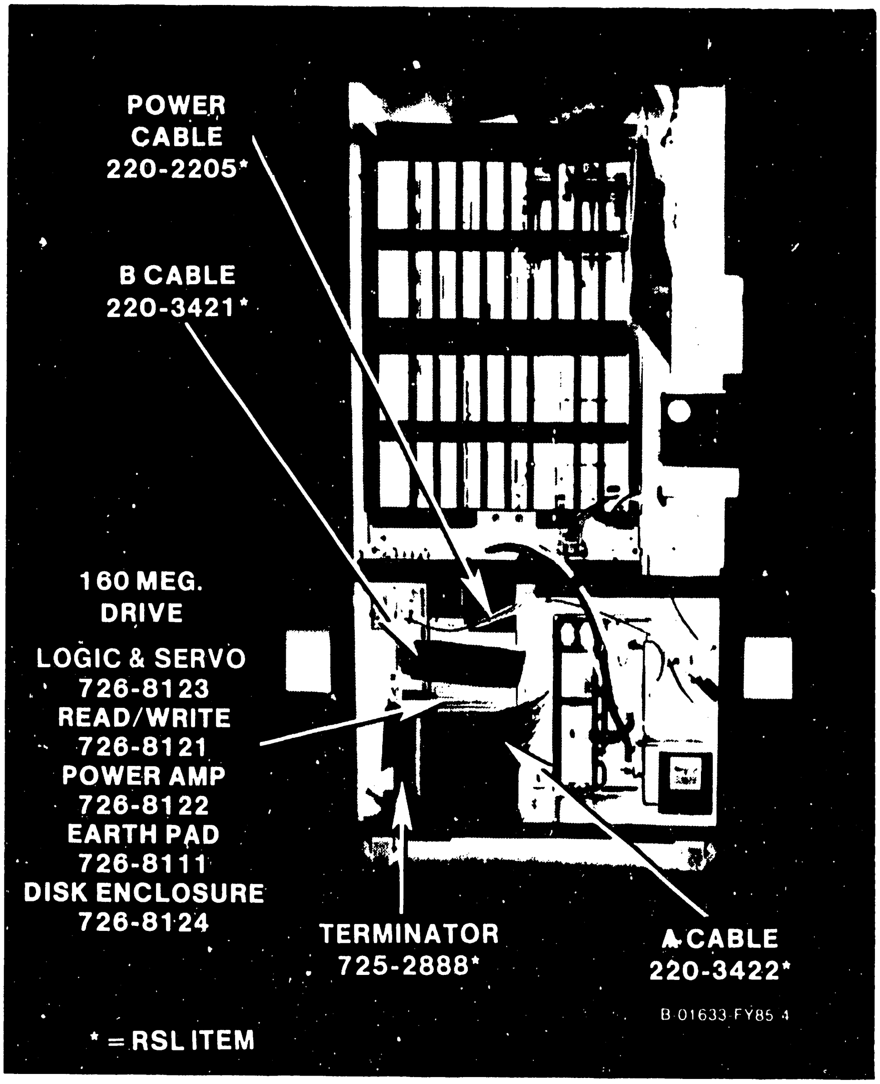


Figure C7-1 147-Megabyte Disk Drive, Illustrated Parts Breakdown

CHAPTER C8

TROUBLESHOOTING

C8.1 GENERAL

The NEC 147-megabyte disk drive is repaired by replacement of individual PCB assemblies. Refer to the diagnostics specified below and also refer to the applicable documentation specified in section C1.4.

NOTE

Do not order or replace the complete disk drive if a malfunction is detected

C7.2 DIAGNOSTICS

Disk Drive malfunctions are detected and analyzed by running the FTU Diagnostic Program on the VS-15 Computer System.

APPENDIX D

APPENDIX D

2-MEGABYTE MAIN MEMORY OPTION

PREFACE

This document is an addendum to the First Customer Shipment (FCS) Manual for the VS-15 Computer System and to the Standard (STD) Manual for VS-25/45 Computer Systems.

The purpose of this addendum is to provide the Wang-trained Customer Engineer (CE) with instructions to install, operate, checkout, and troubleshoot the 2-Megabyte Main Memory option. This addendum will be updated (or incorporated into the respective base manual) on a regular schedule.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

CHAPTER D1

INTRODUCTION

D1.1 SCOPE AND PURPOSE

This addendum to the VS-15 Computer System FCS manual and to the VS-25/45 Computer Systems manual provides instructions to increase the main memory capacity of the present VS-15/25/45 to either 256K, 512K, 1M, or 2M by replacing the original main memory board with a new 210-9300 Main Memory Board.

D1.2 MODEL DESCRIPTION

The 210-9300 PCB is very similar to the existing 210-7900 PCB thereby facilitating ease of installation. Because of hardware limitations, present VS-15/25/45 Systems can only support a maximum main memory size of 2-megabytes. As a result, hardware invalid memory address (IMA) detection is not supported at 2-megabytes; it simply wraps around to address zero. IMA detection is supported for the smaller sizes however.

The model structure for the main memory option is as follows:

MODEL	SIZE
210-9300-A	256K
210-9300-1A	512K
210-9300-2A	1MEG
210-9300-B	2MEG

D1.3 SOFTWARE REQUIREMENTS

Software Operating System release 6.30 is required to support operation of the 2-Megabyte Main Memory Board. The current CP5 CPU-microporgram (version 5.12.01) is adequate to support operation of the new memory board.

CHAPTER D2

THEORY OF OPERATION

Theory of operation for the 2-megabyte main memory board is not provided as part of this addendum.

CHAPTER D3

OPERATION

The 2-megabyte main memory does not require any special instructions for operation in the VS-15/25/45 Computer System.

CHAPTER D4

INSTALLATION

D4.1 GENERAL

This chapter presents information for unpacking, inspecting and installing the 2-megabyte main memory board into the VS-15/25/45 Computer System. General information concerning VS-15/25/45 installation is found in Chapter 4 of this Product Maintenance Manual.

D4.2 UNPACKING/PACKING

The 2-megabyte main memory board is packed in a shipping carton as shown in figure D4-1. Refer to figure D4-1 while performing the procedure given below.

Unpacking:

1. Before unpacking the 2-megabyte main memory board, inspect the shipping carton for damage. If any damage is noticed, notify the carrier immediately. Do not open the carton until the carriers' representative is present. If there is no apparent damage to the shipping carton, proceed to step 2.

2. Using a sharp knife, carefully cut the shipping tape used to secure the carton. Carefully open the carton and save all packaging material for reshipment, if necessary.

3. Check the contents against the shipping bill to ensure that nothing is missing or damaged.

4. Inspect the 2-megabyte main memory board for shipping damage. Any damage claims should be handled as specified in section 4 of the VS-15/25/45 Computer System manuals.

Packing

The 2-megabyte main memory board can be repackaged for shipment by reversing the steps given above.

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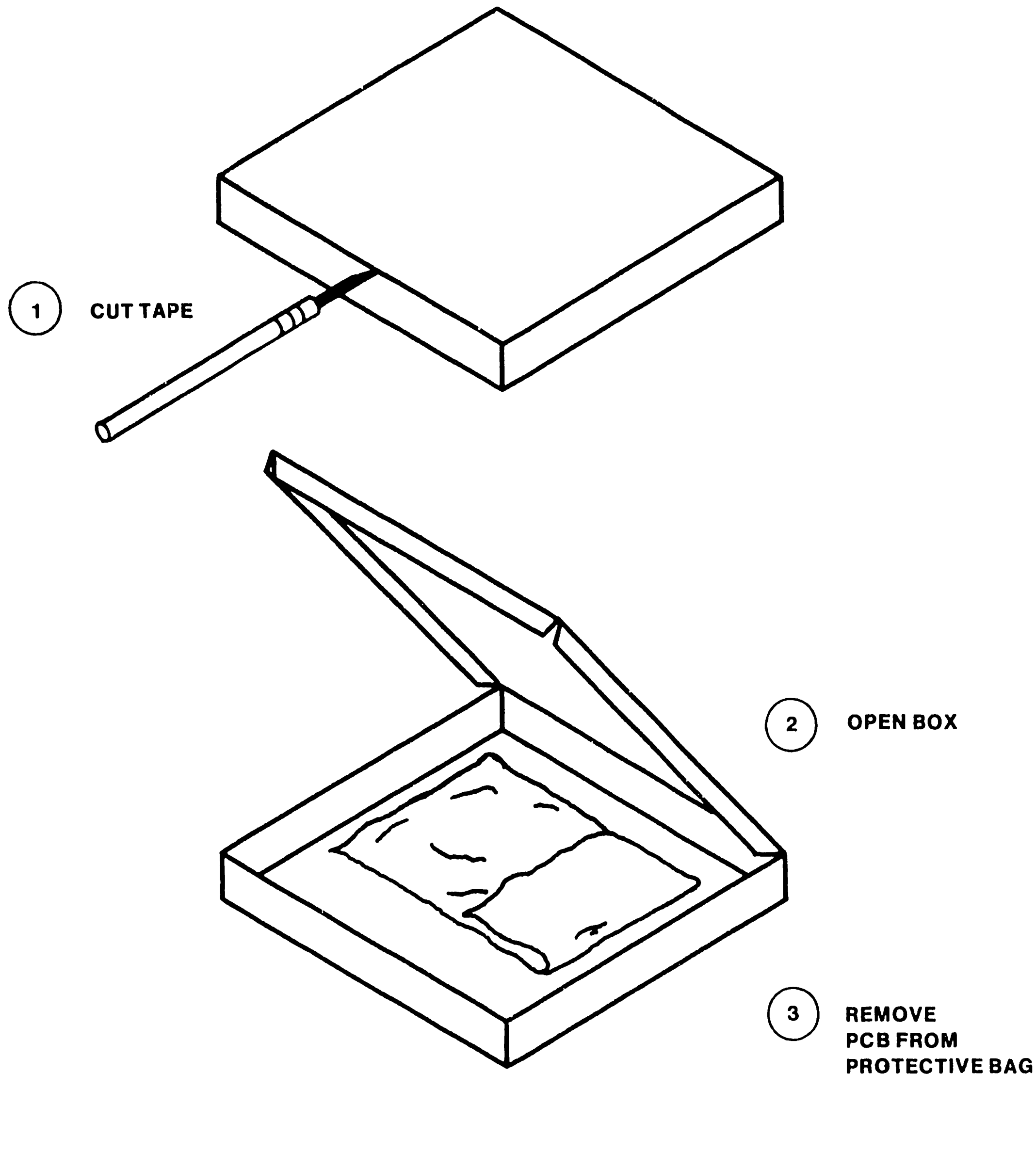


Figure D4-1 Unpacking the 2-Megabyte Main Memory Board

D4.3 SWITCH SETTINGS AND JUMPER CONFIGURATIONS

The 2-megabyte main memory board is programmed for operation via switch SW1 and jumpers JP1-JP4. SW1 defines the memory size and JP1-JP4 specify whether 64K or 256K RAM chips are used. Figure 4-2, in addition to showing the location of switch SW1 and jumpers JP1-JP4, defines memory chip loading and associated chip part numbers. Instructions for setting up the board are given below.

D4.3.1 Switch SW1

1. Verify that the correct chips are in the specified locations corresponding to the maximum memory size (see memory chip loading chart on figure 4-2).

2. Set the five switches of SW1 to define maximum memory size.

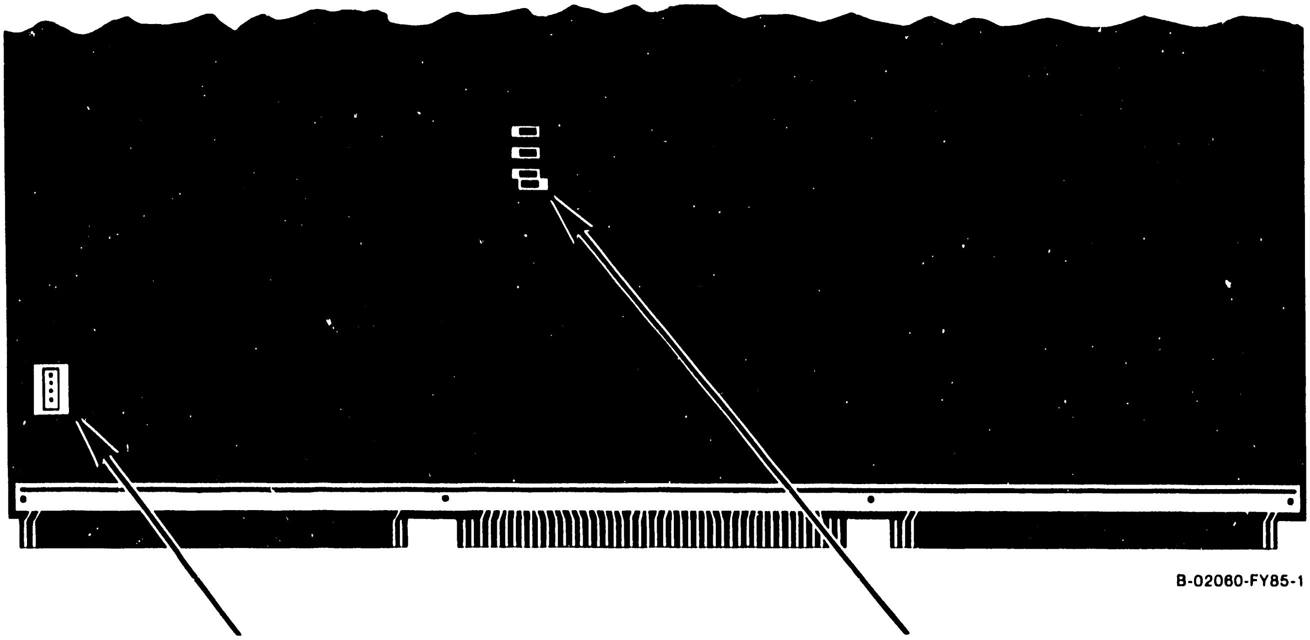
D4.3.2 Jumpers JP1-JP4

Each of the four jumpers JP1-JP4 contains three pins. Pin 1 is on the left, pin 2 in the center, and pin 3 on the right. The respective shorting plug for each jumper can be installed either between pins 1 and 2 (left) or between pins 2 and three (right). In no case is the shorting plug completely removed. Instructions for setting up jumpers JP1-JP4 are presented below.

1. Refer to the memory chip loading chart presented in figure 4-2 and determine that the memory board contains either 64K RAM chips (P/N 377-0415) or 256K RAM chips (P/N 377-0589).

2. If the board contains 64K RAM chips, connect the shorting plug for jumpers JP1, JP2, and JP3 between pins 1 and 2 (left). If the board contains 256K RAM chips, connect the shorting plug for jumpers JP1, JP2, and JP3 between pins 2 and 3 (right).

3. Install the shorting plug for jumper JP4 between pins 1 and 2 (left) for all RAM configurations.



SW1 SWITCH SETTINGS

MODEL	SIZE	1	2	3	4	5
9300-A	256K	ON	ON	ON	ON	OFF
9300-1A	512K	ON	ON	ON	OFF	OFF
9300-2A	1M	ON	ON	OFF	OFF	ON
9300-B	2M	ON	OFF	OFF	OFF	ON

JUMPER CONFIGURATIONS

JUMPER	64K RAMS	256K RAMS
JP1	PINS 1 & 2	PINS 2 & 3
JP2	PINS 1 & 2	PINS 2 & 3
JP3	PINS 1 & 2	PINS 2 & 3

JP4 IS ALWAYS JUMPERED BETWEEN PINS 1 & 2

MEMORY CHIP LOADING*

9300-A (256K) 377-0415 CHIPS IN L145-155, 158-179, 182-192

9300-1A (512K) 377-0415 CHIPS IN L97-107, 110-131, 134-155, 158-179, 182-192

9300-2A (1M) 377-0415 CHIPS IN L1-11, 14-35, 38-59, 62-83, 86-107, 110-131, 134-155, 158-179, 182-192

9300-B (2M) 377-0589 CHIPS IN L97-107, 110-131, 134-155, 158-179, 182-192

*ALL CONFIGURATIONS REQUIRE A 377-0416 CHIP IN LOCATION L220

CHIP TYPES: 377-0415 = 64K X 1
377-0416 = 16-BIT PARITY ERROR GENERATOR
377-0589 = 256K X 1

Figure D4-2 Memory Board Switch Settings and Jumper Configurations

D4.4 2-MEGABYTE MAIN MEMORY BOARD INSTALLATION

1. Power down the VS-15/25/45 by pressing the ac power on/off rocker switch to the 0 position.
2. Remove ac power cable from its outlet.
3. Remove top cover (see section 5).
4. Carefully remove the old memory board from slot 1 of the card cage (see section 5).
5. Verify new memory board switch settings and jumper configurations per section D4.3.
6. Carefully install new main memory board into slot 1 of the card cage.
7. Reinstall top cover.
8. Insert ac power cable into its outlet. Power up the CPU by depressing the ac power on/off rocker switch to the 1 position.
9. Run Diagnostics (chapter 8) to verify correct system operation.
10. Return old memory board to stock.

CHAPTER D5

PREVENTIVE AND CORRECTIVE MAINTENANCE

D5.1 GENERAL

The 2-megabyte main memory board does not require any preventive maintenance or inspection. Corrective maintenance entails running memory diagnostics and swapout replacement of the board, if defective.

CHAPTER D6

SCHEMATICS

D6.1 GENERAL

This section contains the related schematics for the 2-megabyte main memory board.

CHAPTER D7

ILLUSTRATED PARTS BREAKDOWN (IPB)

D7.1 GENERAL

If defective, the entire 2-megabyte main memory board should be swapped out and replaced as a complete unit by re-ordering under the correct part number as follows:

MODEL	SIZE
210-9300-A	256K
210-9300-1A	512K
210-9300-2A	1MEG
210-9300-B	2MEG

NOTE

The exact model number of the board to be replaced can be determined by matching up memory chip type and loading as specified in figure D4-2.

CHAPTER D8

TROUBLESHOOTING

D8.1 GENERAL

The 2-megabyte main memory board is not repaired in the field. If found defective after running system and memory diagnostics, the board is swapped out and replaced with a new one.

APPENDIX
E

Appendix E

Async. Controller
25V36A

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

List of Tables

CHAPTER 1

INTRODUCTION

Chapter 1 information is not provided as part of the First Customer Shipment (FCS) Manual, but will appear in the Standard Product Maintenance Manual.

CHAPTER 2

THEORY OF OPERATION

Chapter 2 information is not provided as part of the First Customer Shipment (FCS) Manual, but will appear in the Standard Product Maintenance Manual.

CHAPTER 3

OPERATION

3.1 GENERAL

This chapter provides the CE with a daily verification procedure. Only sections which directly apply to the Async. Controller have been included in this chapter. If further information is required, refer to the VS-15 Computer System Product Maintenance Manual.

3.6 DAILY VERIFICATION PROCEDURES

1. Power on workstation 0.
2. Place the VS-15 AC On/Off switch in the "On" position.
3. Upon completion of the Power-up diagnostics (ref. Chapter 8 of the VS-15 Manual), fill in the configuration, and time/date fields, and verify that the screen on any workstation configured through the Async. Controller appears as follows in Figure E3-1.

```
                     ***Wang VS Logon***

Workstation    1             3:29 pm    Thursday   January 17, 1985


                        Hello new user
                     Welcome to the WANG VS

       Please identify yourself by supplying the following information

                     Your userid   = ■■■
                      Your password =

                    and press (ENTER) to logon

            or press (PF11) to enter operator mode immediately
```

Figure E3-1 Workstation Screen

5. Using a previously defined password ensure that log-on is possible from the workstation.
6. If there are no errors, log off the system, and let the customer resume normal daily operation.

CHAPTER 4

INSTALLATION

4.1 GENERAL

This chapter describes the procedures for unpacking, inspecting, and installing the VS-15 Async. Controller. Included in this chapter are instructions for jumper setting, interconnection, and initial power-up. Refer to Chapter 3, Operation, and Chapter 5, Preventive and Corrective Maintenance and Removal/Replacement, of this manual for more information needed to complete installation. Actual installation should not begin until the site requirements detailed in the VS-15 Maintenance Manual have been met. Only sections which directly apply to the Async. Controller have been included in this chapter. If further information is required, refer to the VS-15 Computer System Product Maintenance Manual.

4.4 UNPACKING

1. Before unpacking the Controller Board and associated boards, check all packing slips to make sure that the proper equipment has been delivered.
2. After checking packing slips, inspect all shipping containers for damage (crushed corners, punctures, etc.).
3. Open the boxes and remove the PC Boards as shown in Fig. E4-1.

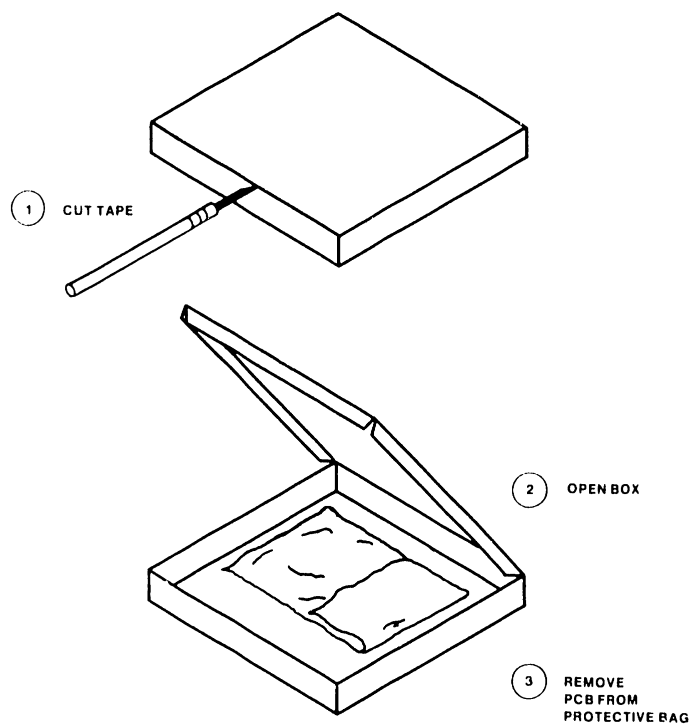


Figure E4-1 Unpacking the Async. Controller Board

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4.4.5 INSPECTION

1. Inspect the Async Controller and associated circuit boards for packing material or such shipping damage as broken connectors.
2. If damage is discovered during the inspection, follow the reporting procedure in section 4.4 of the VS-15 Maintenance Manual.

4.6 MINIMUM REQUIREMENTS

4.6.1 HARDWARE

Minimum requirements for hardware are listed in section 4.6 of the VS-15 Maintenance Manual.

4.6.2 SOFTWARE

Operating software revision 6.4X.XX is required for operation of the Async. Controller. Refer to the proper software release notice for software configuration instructions.

4.9 HARDWARE CONFIGURATION

1. There are 12 Jumpers which must be set for proper operation of the Async. Controller (ref. Fig. E4-2). J6 through J15 provide I/O addressing information to the system. Table E4-1 gives a listing of the possible address configurations and jumper settings. Verify the system address configuration, and set the jumpers accordingly.
2. J16 selects the type of memory chips used on the Async. Controller Board. Presently, only 64K RAM chips are supported. Verify the memory size and set J16 as shown in Fig. E4-3.
3. J17 selects the clock frequency currently being used by the Controller. Presently, only a 8 MHZ clock is supported. Insure that J17 is set as shown in Fig. E4-4.
4. With the system power off, insert the Controller Board into an available I/O Device Adapter slot by Placing it in the board guides and lowering it to the Motherboard connector.
5. Make sure the board edge connectors are lined up with the motherboard connector slots and the snaplock tabs are under the top rails.
6. Push down on the snaplocks to seat the board in the motherboard.

CAUTION
DO NOT USE EXCESSIVE FORCE WHEN PUSHING DOWN ON THE SNAPLOCKS

7. Remove the blank "break out" panel in the rear of the machine (ref. Fig. E4-5), and using the hardware provided, attach the async. rear panel assy..

8. Connect the Ribbon Cables as shown in Figure E4-6.

9. Attach async. peripherals to the rear panel as required.

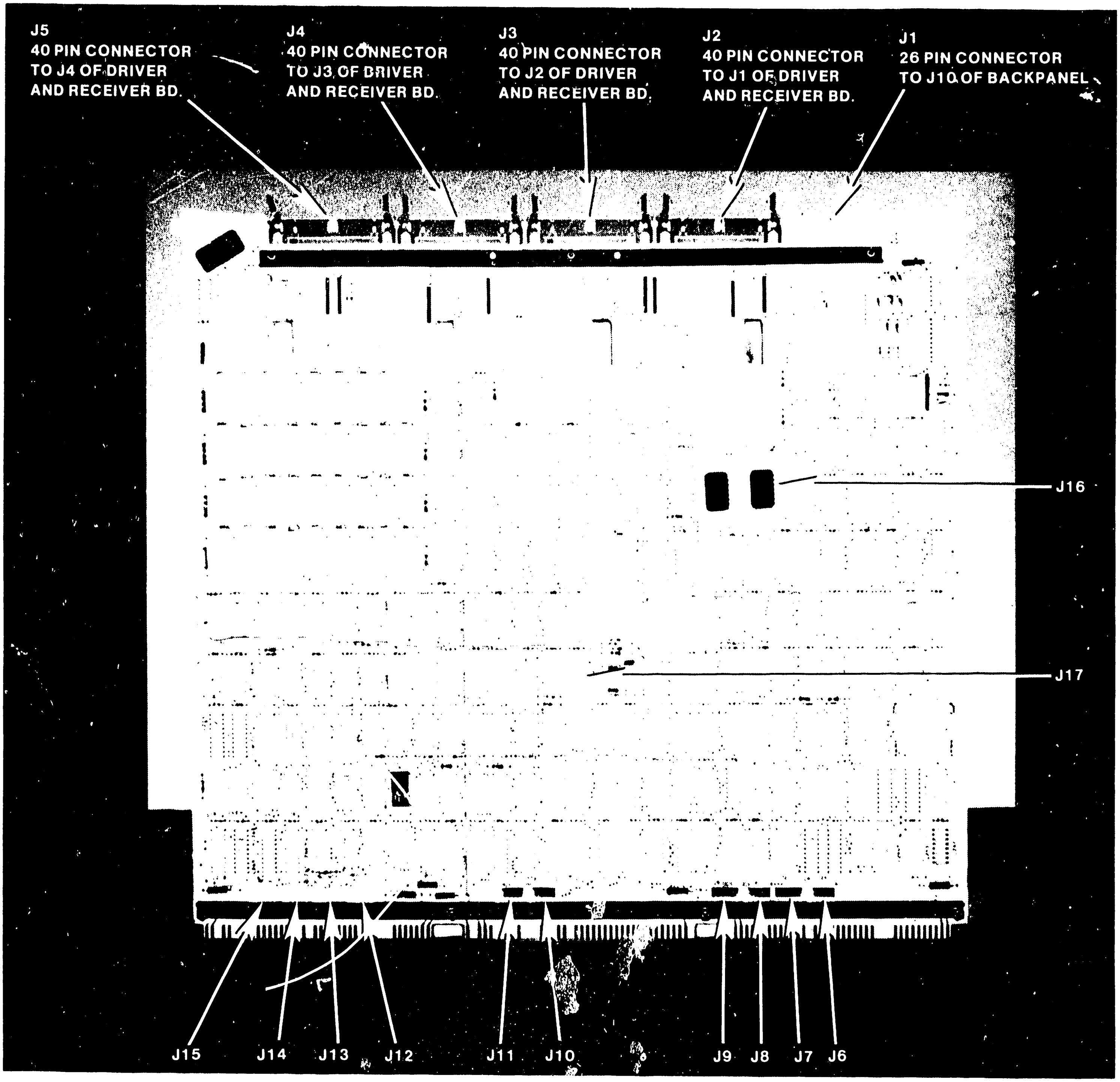
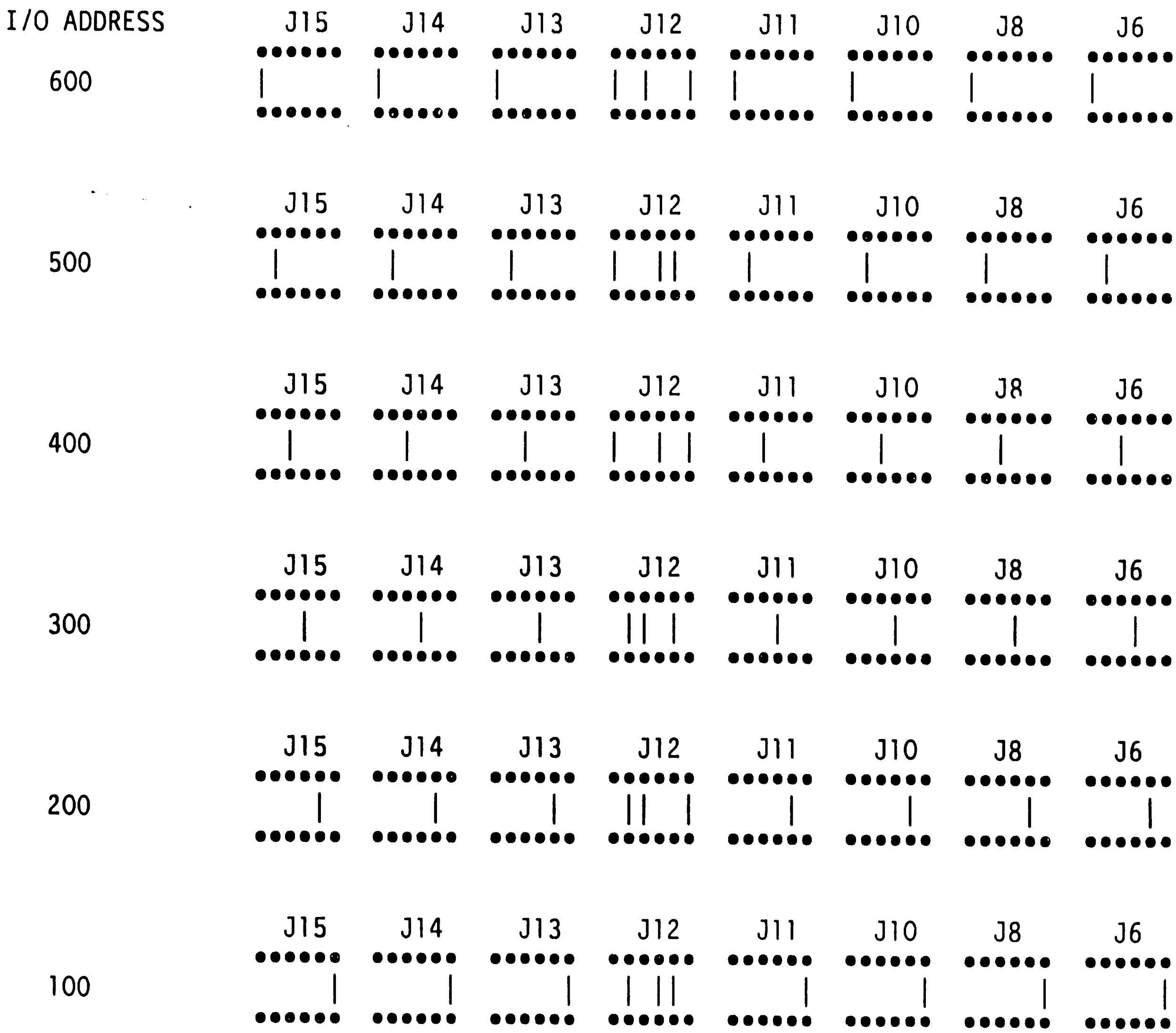


Figure E4-2 Async. Controller Board 25V36A

Table E4-1 Jumper Configurations



NOTE: Remove all jumpers from J7 and J9.
These are not used at this time.

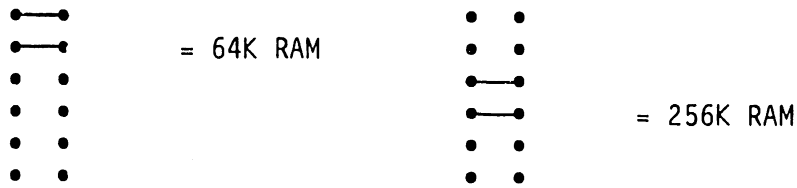


Fig. E4-3 J16 Memory Jumper Settings

Fig. E4-4 J17 Clock Jumper Settings

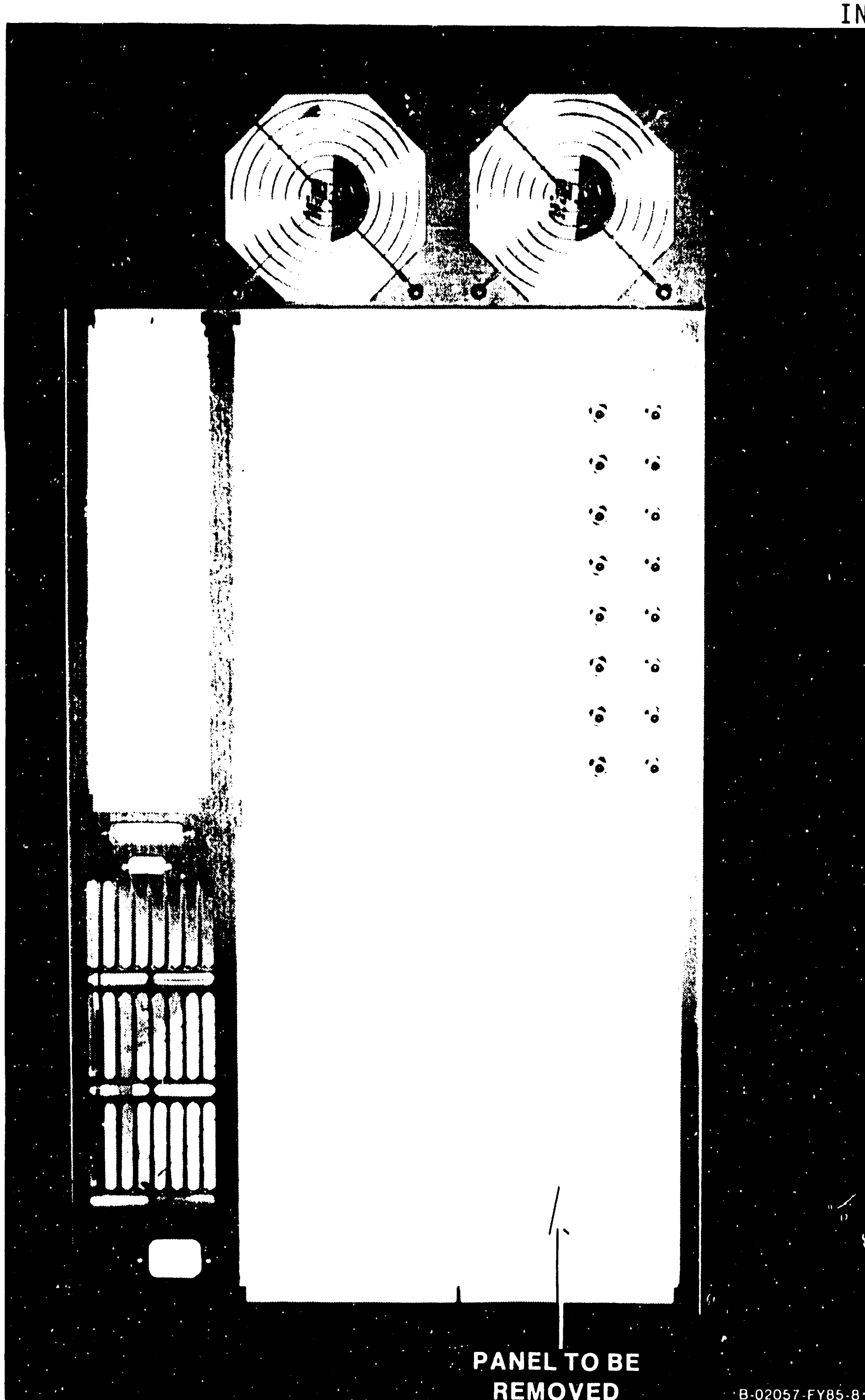
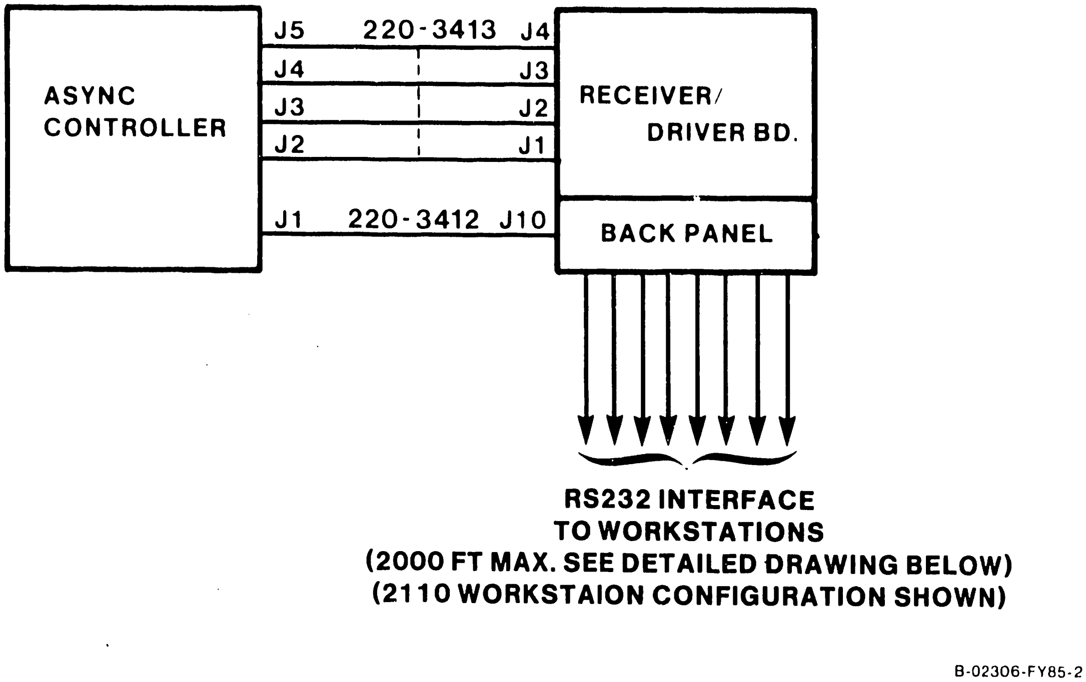


Figure E4-5 VS-15 Breakout Panel



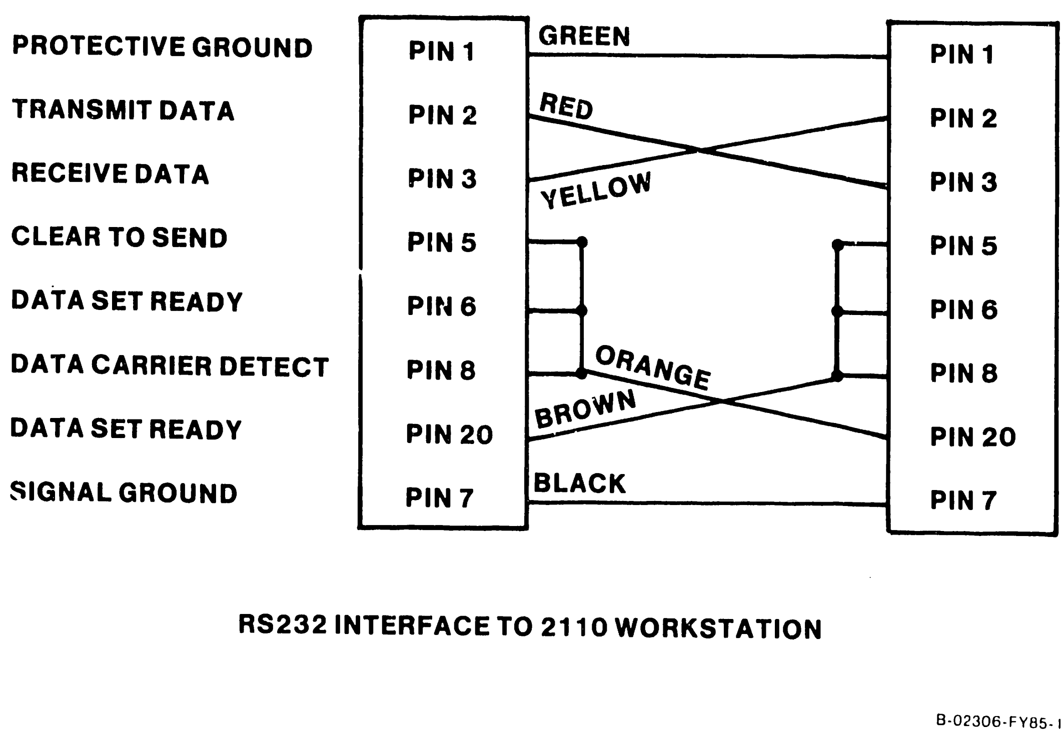


Figure E4-6 Cable Connections

4.10 PRELIMINARY SYSTEM CHECKOUT

1. Power on all workstations currently configured into the system.
2. Place the VS-15 AC On/Off switch in the "On" position.
3. Upon completion of the inbuilt diagnostics (see Chapter 8 of the VS-15 Manual), fill in the configuration, and the time/date fields, and verify that the screen on the workstations configured through the Async. Controller appear as follows in Figure E4-7.
4. Using a previously defined password ensure that log-on is possible from each workstation.
5. If there are no errors, log off, and turn the system over to the Customer.

```
                    ***Wang VS Logon***

Workstation    1            3:29 pm    Thursday   January 17, 1985

                       Hello new user
                    Welcome to the WANG VS

     Please identify yourself by supplying the following information

                    Your userid   = ■■■
                     Your password =

                   and press (ENTER) to logon

          or press (PF11) to enter operator mode immediately
```

Figure E4-7 Workstation Screen

CHAPTER 5

PREVENTIVE AND CORRECTIVE MAINTENANCE

5.1 GENERAL

This chapter describes the procedures for the removal and replacement of the Async. Controller Board, the Line Driver and Receiver Board, and its associated Back Panel. Only sections which directly apply to the Async. Controller have been included in this chapter. If further information is required, refer to the VS-15 Computer System Product Maintenance Manual.

5.2 REMOVAL AND REPLACEMENT

NOTE

If the Async. Controller Bd. or the Line Driver/Receiver Daughter Bd. have been removed from the system for maintenance reasons, the contacts of the PCB's may be cleaned with an alcohol pad. Do not use an eraser.

5.2.1 Async. Controller Board Removal and Replacement

1. Insure that all users have logged off the system.
2. Press the green Control Mode Button on the VS. This prevents any disk I/O command in process from being halted prior to completion.
3. Power down the main frame by depressing the AC Power On/Off switch to the 0 position.
4. Remove all cabling from the Controller Board.
5. The Async. Controller Board is held in place by two snaplocks. One snaplock tab fits under the top edge of the front board cage assembly rail and the second snaplock tab fits under the top edge of the rear board cage assembly rail.
6. Remove the Controller Board from its Motherboard slot by lifting the snaplocks to free the board from its Motherboard connectors. Once the board is free of the connectors, ease it straight up in the board guides and out of the board cage.
7. To replace the Controller Board, insert it into the board guides and lower it to the Motherboard connector.
8. Make sure the board edge connectors are lined up with the Motherboard connector slots and the snaplock tabs are under the top rails.
9. Push down on the snaplocks to seat the board in the Motherboard.
10. Reconnect all cables. (Ref. Figure E4-6.)

5.2.2 Line Driver/Receiver Daughter Board Removal and Replacement

1. Insure that all users have logged off the system.
2. Press the green Control Mode Button on the VS. This prevents any disk I/O command in process from being halted prior to completion.
3. Power down the main frame by depressing the AC Power On/Off switch to the 0 position.
4. Remove all cables from the Line Driver/Receiver Daughter Board.
5. To remove the board, squeeze the locking pins in the upper corners, (ref. Fig E5-1) and lift forward and straight up.
6. To replace the board, insert it back into its motherboard connector, and gently push the board onto the locking pins such that the pins go through the holes on the board and lock into place.
7. Reconnect all cables. (Ref. Figure E4-6.)

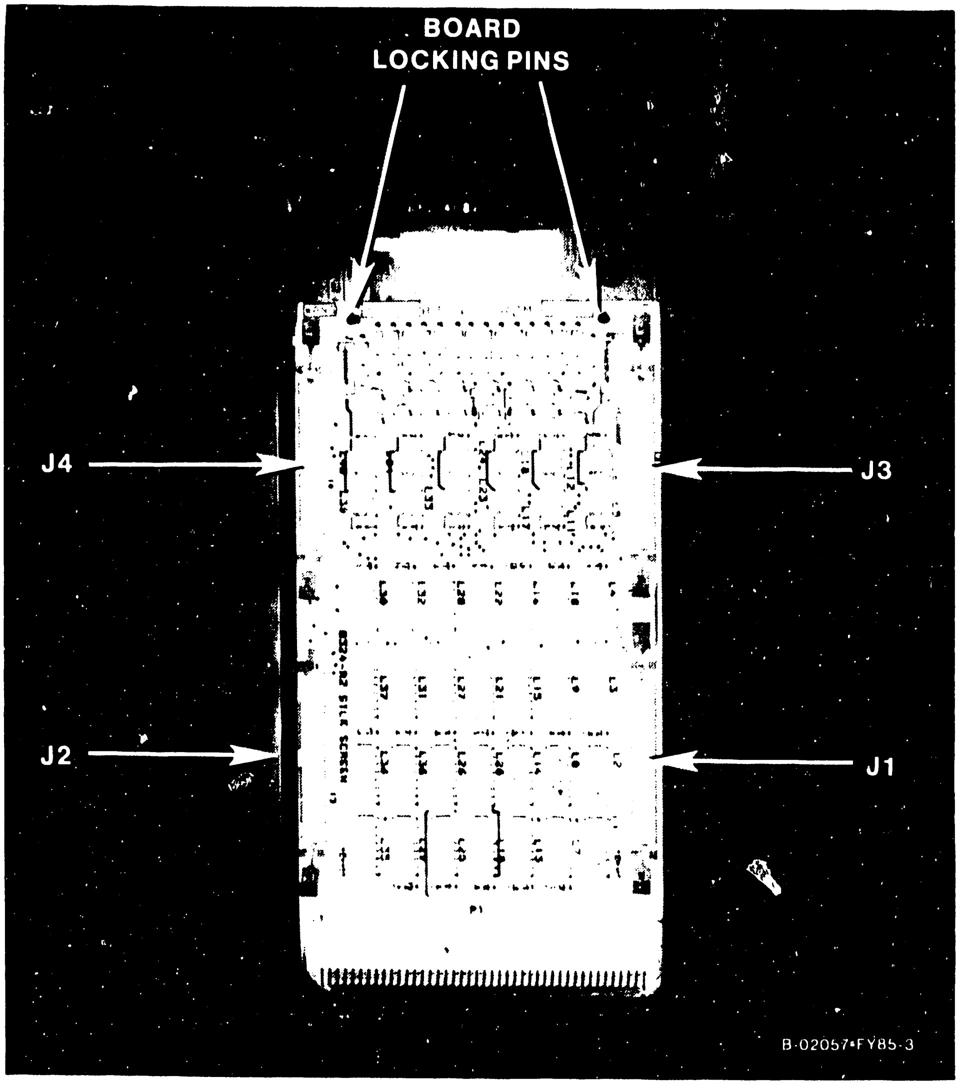


Figure E5-1 Line Driver/Receiver Daughter Board

5.2.3 Back Panel Removal and Replacement

1. Insure that all users have logged off the system.
2. Press the green Control Mode Button on the VS.
3. Power down the main frame by depressing the AC On/Off switch to the 0 position.
4. Remove all cables from the Line Driver/Receiver Motherboard.
5. Remove and save all hardware holding the back panel in place.
6. Carefully lift the back panel and Motherboard out of the system.
7. To replace the back panel, insert it into the system and secure with the hardware saved in step 4.
8. Reconnect all cables. (Ref. Figure E4-6.)

CHAPTER 6

ILLUSTRATED PARTS BREAKDOWN

6.1 SCOPE

This chapter contains the illustrated parts breakdown for the VS-15 Async. Controller. Use this breakdown for part number identification when ordering field-replaceable components.

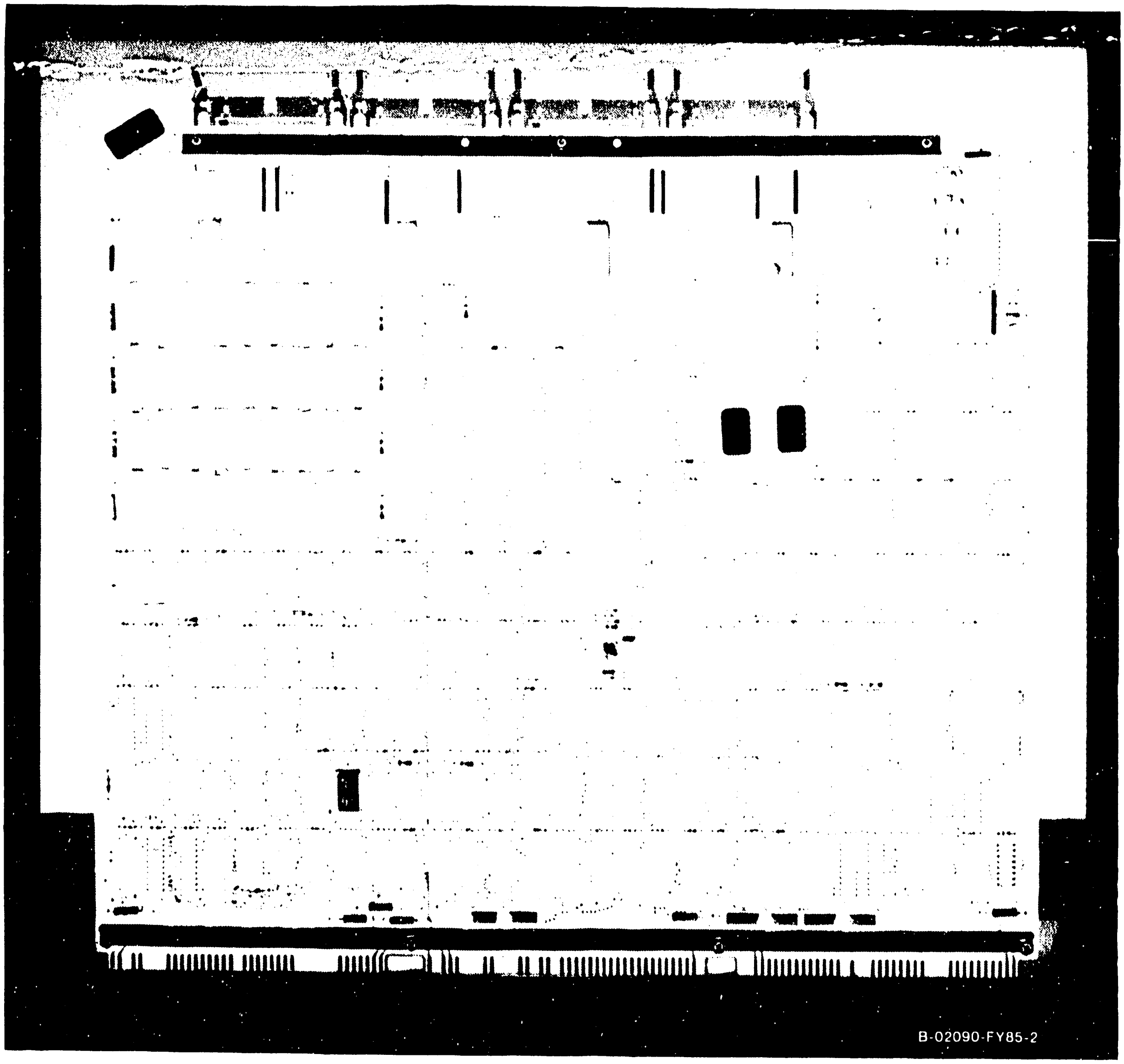


Figure E6-1 VS-15 Async. Controller Board
210-8155

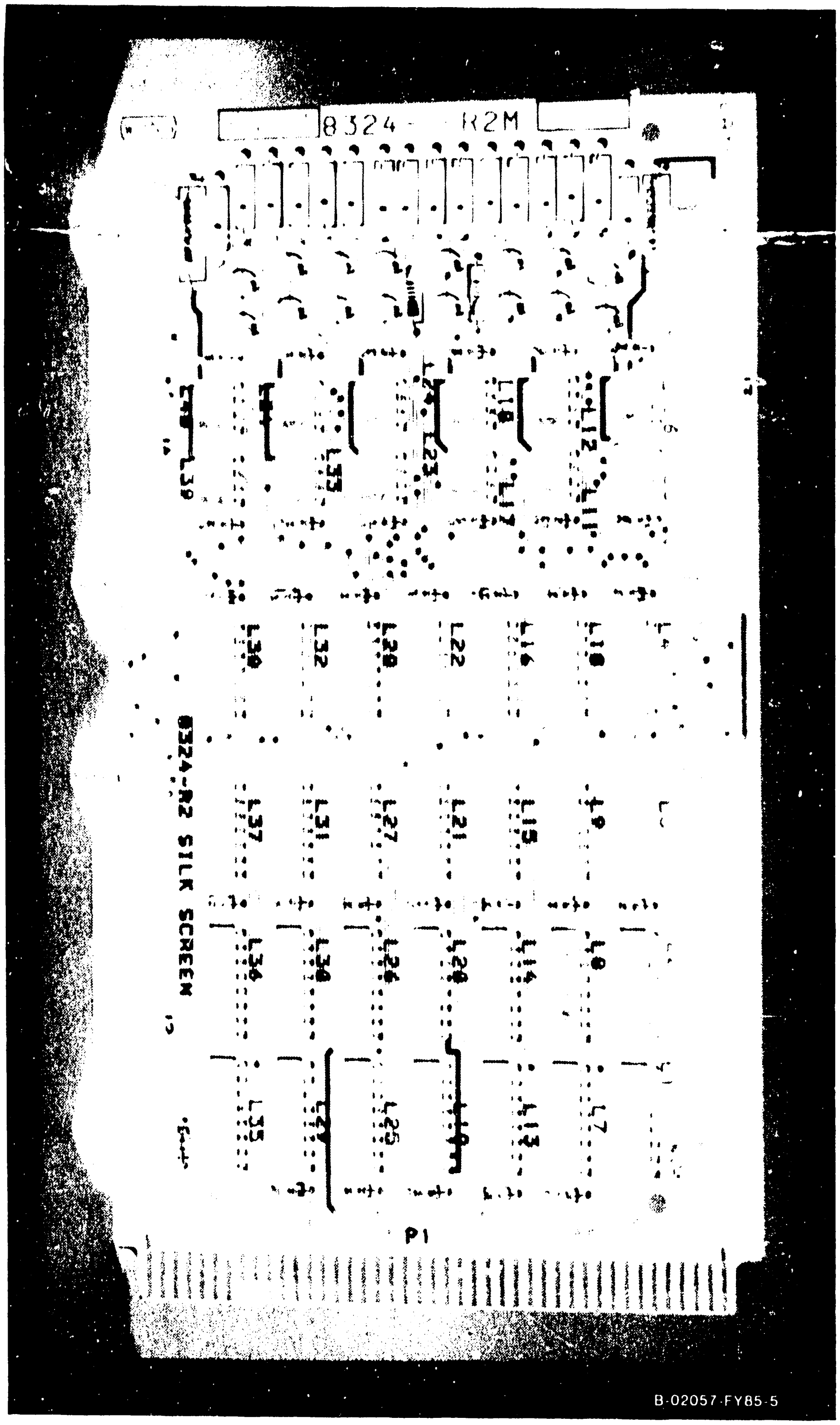


Figure E6-2 Line Driver/Receiver Daughter Board
210-8324

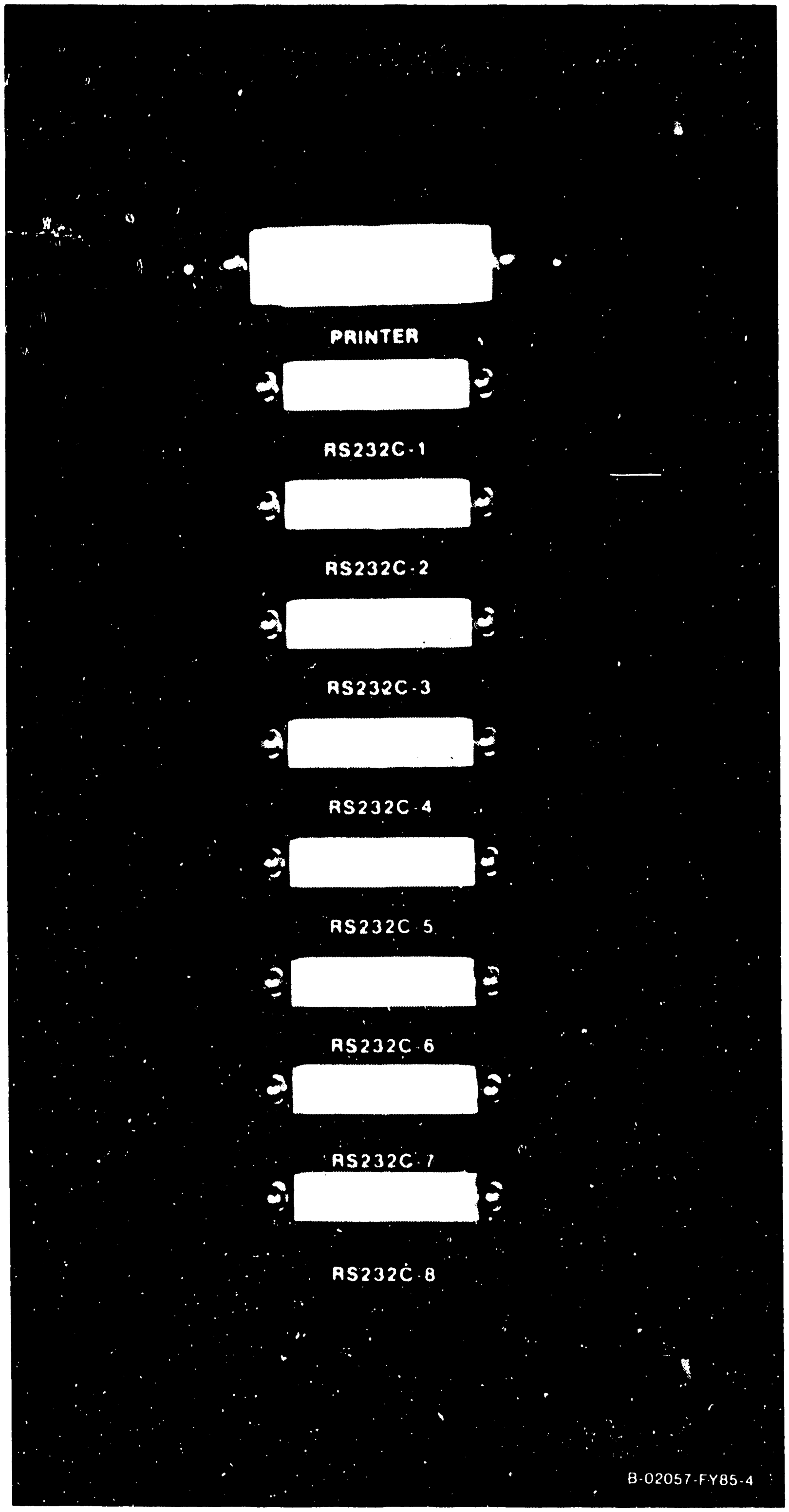


Figure E6-3 Async. Rear Panel (Includes 210-8324 Assy.)
272-0043

RECOMMENDED SPARE PARTS FOR FIELD REPLACEMENT

ITEM	PART NUMBER	DESCRIPTION
1.	210-8155	Async. Controller Board
2.	272-0043	Async. Rear Panel
3.	210-8324	Driver/Receiver Board
4.	220-3413	Forty pin ribbon cable
5.	220-3412	Twenty-six pin ribbon cable

CABLING PART NUMBERS

2110 WORKSTATION CABLES

FEET	PART NUMBER
25	220-0521
50	120-2381-01
100	120-2381-02
500	120-2381-03
1000	120-2381-04
2000	120-2381-05

RS 232-C TC CABLING

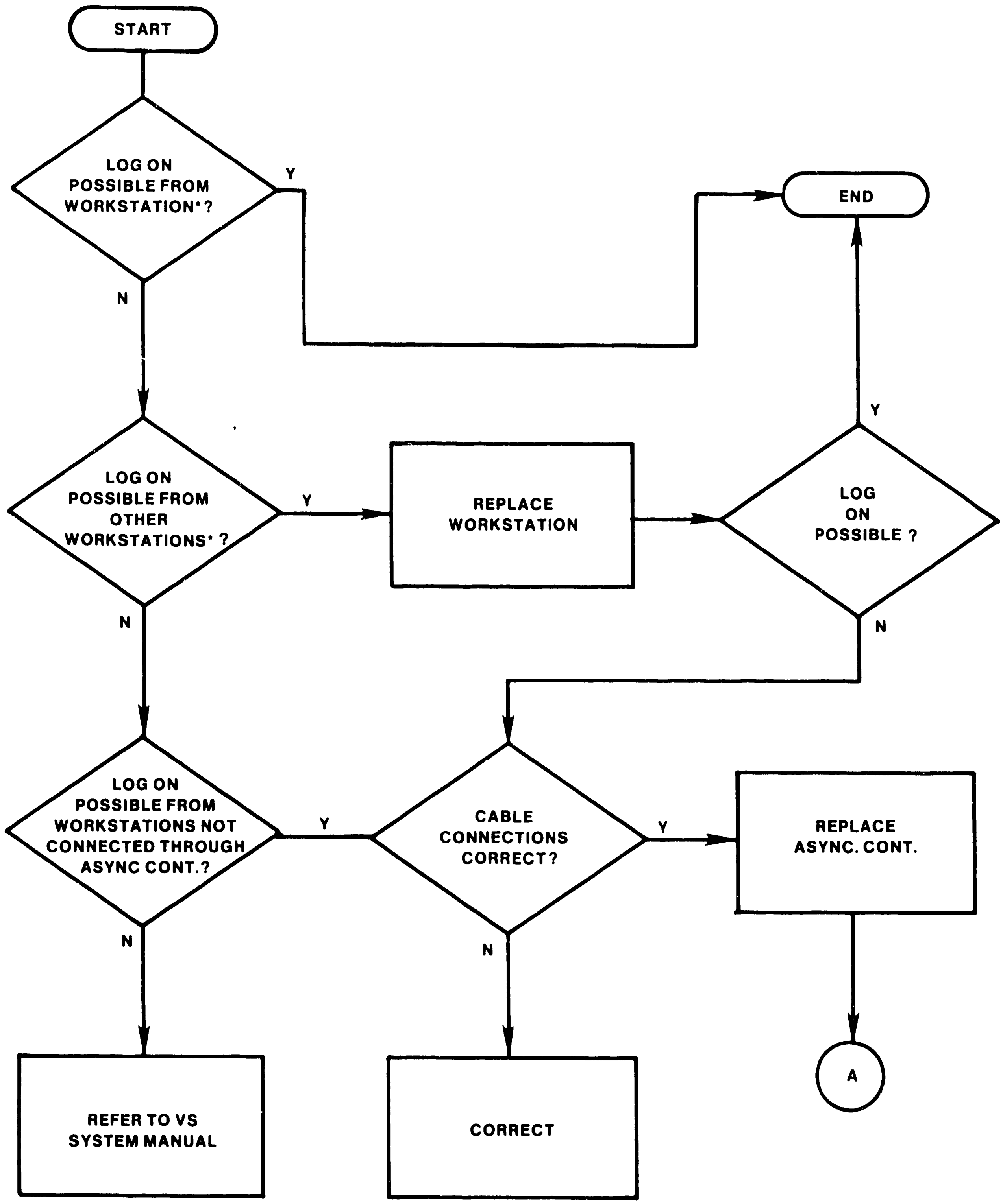
FEET	PART NUMBER
12	220-0113
25	220-0219
50	220-0220

CHAPTER 7

TROUBLESHOOTING

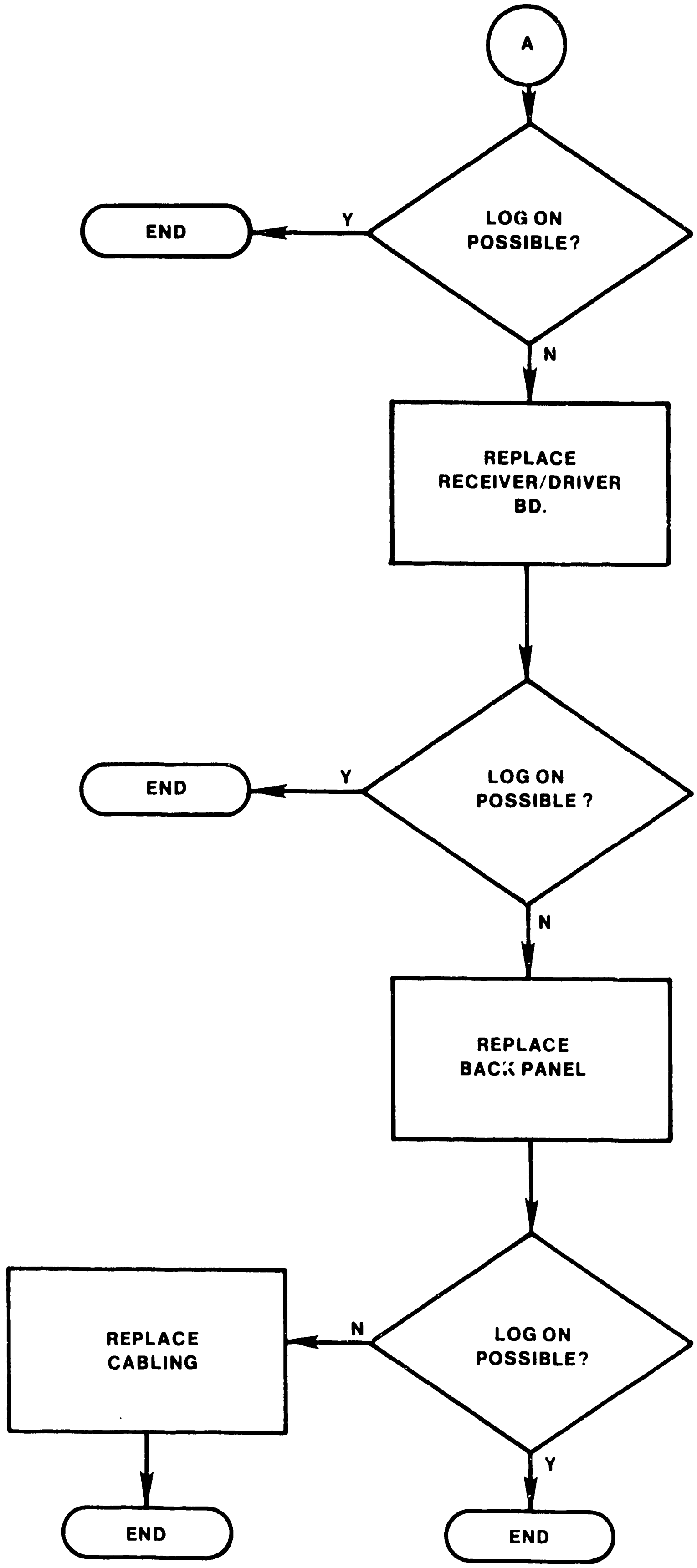
7.1 GENERAL

This chapter provides guidelines, in flowchart form, for isolating fault locations of field replaceable (or repairable) units.



*** DENOTES DEVICE CONFIGURED THROUGH THE ASYNC CONTROLLER**

B-02315-FY85-1


A
LOG ON
POSSIBLE?
Y
END
N
REPLACE
RECEIVER/DRIVER
BD.
LOG ON
POSSIBLE ?
Y
END
N
REPLACE
BACK PANEL
LOG ON
POSSIBLE?
N
REPLACE
CABLING
END
Y
END

APPENDIX F

MODULAR SERIAL INPUT/OUTPUT SUBSYSTEM

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MODULAR SERIAL INPUT/OUTPUT SUBSYSTEM

(UISIO DEVICE ADAPTER/CONTROLLER)

F.1 INTRODUCTION

This appendix contains the necessary information to allow the addition of the Wang Modular Serial Input/Output Subsystem to the VS-15 Computer System. The key component of the modular subsystem is the Universal Intelligent Serial Input/Output Device Adapter/Controller (UISIO DAC) with its newly configured System Bus Interface (MuxBus). The modular subsystem approach allows the addition of peripheral band (P-Band) WangNet service to existing systems using Wang's master data link serial technology.

Serial, FiberWay and/or P-Band devices may be connected in any combination on the controller as determined by the modular components installed in the system and the physical space available on the Rear Panel Assembly (RPA) of the VS-15. With the addition of the VS Small System Cable Concentrator, options requiring RPA mounting space not available on the VS-15 mainframe may be installed. The controller and options described allow the VS-15 system to be configured with up to 16 workstations and a total of 32 logical serial devices.

Instructions are provided for the installation of the UISIO DAC and the related subsystem components with which it interfaces. The effect of its installation upon the original VS-15 configuration is discussed. Descriptions, specifications, installation and removal procedures, and diagnostic information for the modular subsystem components are included.

F.1.1 APPLICABLE DOCUMENTATION

Documentation related to the application and/or use of the modular subsystem may be found under the appropriate Class Code(s) in the Wang Technical Documentation Catalog/Index (WLI P/N 742-0000). The index gives a complete listing of Customer Engineering technical documentation. The Wang Corporate Resource Catalog (WLI P/N 700-7647) identifies additional product documentation. -

F.1.2 UNIVERSAL INTELLIGENT SERIAL I/O DEVICE ADAPTER/CONTROLLER

The VS-15 UISIO DAC (figure F-1) incorporates the processing functions of the existing ISIO Master Data Link device adapter and the 928W WangNet interface board on a single Printed Circuit Assembly (PCA). The UISIO DAC (25V67) provides local interconnection of peripherals through the use of Electrically Active Port Assemblies (EAPA) and remote device support using FiberWay Panels (FWAPA) and a 19-channel global modem interface to WangNet. The controller provides both the interface and power to the 19-channel peripheral band global modem.

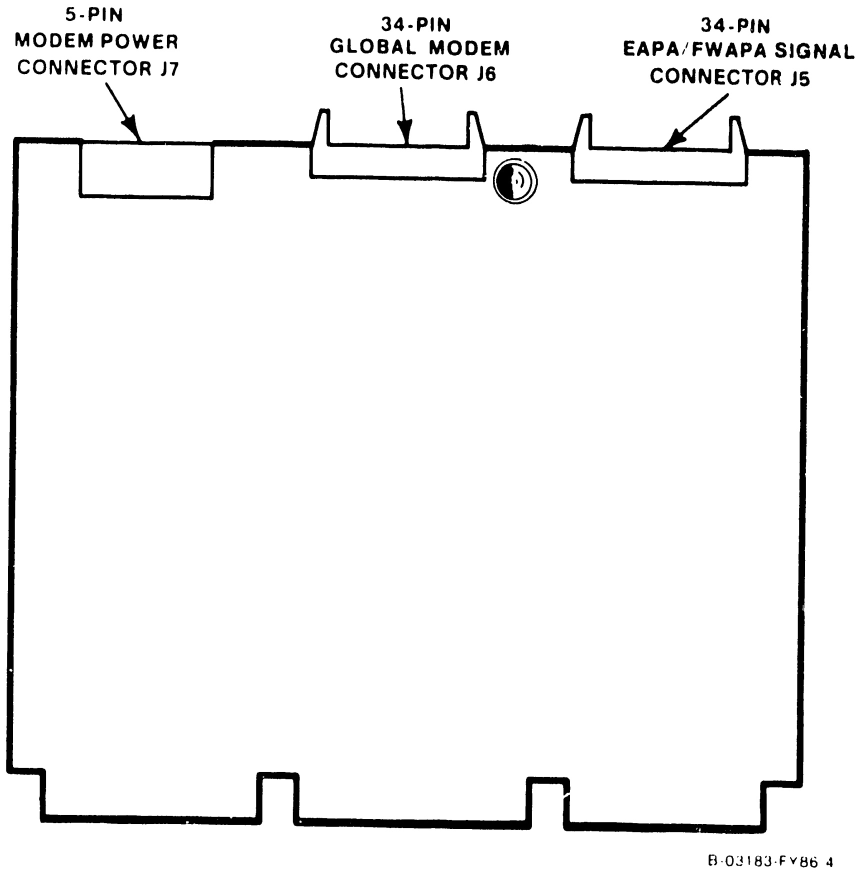


Figure F-1. Universal ISIO Device Adapter/Controller PCA

By supporting the MuxBus interface to the Electrical Active Port Assembly (EAPA) panels, the UISIO allows the use of standard BNC/TNC connectors for local peripheral devices. By supporting the MuxBus interface to the FiberWay Active Port Assembly (FWAPA) panels, the UISIO allows the use of fiber optic datalinks (via a dual fiber optic cable connected to a Remote Cluster Switch [RCS]) to remote peripheral devices located up to 7000 feet from the host.

A maximum of 32 discrete (logical) devices may be connected at one time to a single UISIO. With the addition of the Modular Serial I/O Subsystem, the VS-15 now allows concurrent support of the standard serial I/O (SIO) device adapter, or a second UISIO DAC. A single UISIO DAC supports the following features:

1. Up to 32 (currently supported) serial devices in any combination.

2. Up to four dual coaxial EAPA panels for direct connection of local peripherals. Note EAPA Panels must be mounted in adjacent panel locations thus limiting the number of panels installed to four.

3. Up to four FiberWay panels for connection to remote peripherals.

4. The System Bus Interface (MuxBus).

5. The WangNet Peripheral Band using a global modem capable of transmitting and receiving on any one of 19 peripheral band channels.

6. Full Duplex operation in Diagnostic Mode using Wang 928 Master Data Link circuitry.

7. The VS Small System Cable Concentrator (Model VS-SM-CC).

F.1.3 MODULAR SUBSYSTEM COMPONENTS - DESCRIPTION AND SPECIFICATIONS

The Modular Serial Input/Output Subsystem can be configured in a variety of ways. The subsystem can be equipped with one UISIO DACs, or one SIO DA and one UISIO DAC, or two UISIO DACs if one UISIO replaces the SIO DA. Each UISIO DAC may be configured with just the WangNet peripheral band global modem, or up to four EAPA rear cable connector panels, or up to four FiberWay panels, or a combination of the three.

The number of logical devices connected to the UISIO determines the number of actual physical ports which may be used. (For example, archiving workstations or MultiStation configurations reduce the number of actual physical ports.) Subsystem model configurations are given in the following paragraphs.

F.1.3.1 Model 25V67 - Universal ISIO Device Adapter/Controller

The 25V67 UISIO Device Adapter/Controller (figure F-1) is an intelligent (microprocessor controlled) device adapter subassembly. The UISIO supports 8 MuxBus channel devices consisting of either EAPA or FiberWay panels. Each FiberWay panel uses two MuxBus channels, one channel for each fiber optic datalink. Each EAPA uses one MuxBus channel. The 25V67 provides local and remote electrical interconnection of 32 peripheral devices using EAPA panels, FiberWay Panels or a combination of both. The 25V67 includes an 928 MuxBus terminator PCA used to terminate the last signal-out connector on the last EAPA/FiberWay panel installed.

F.1.3.2 Model VS-PA-8C - Electrical Active Port Assembly

Model VS-PA-8C Electrically Active Port Assembly panel contains one EAPA panel and the cabling required to daisy-chain power and signals to adjacent EAPA/FiberWay panels. Each EAPA panel allows the addition of up to 8 logical devices. A total of four EAPA panels can be installed on the VS-15 backpanel due to the cabling restrictions that require EAPA and FiberWay panels be mounted adjacent to each other. In order to support up to 16 workstations and 32 logical serial devices, concurrent use of one UISIO DAC and one standard SIO device adapter, or two UISIO DACs is required.

All EAPA panels for an individual UISIO must be daisy-chained together, connected to the MuxBus interface cable at one end and the MuxBus terminator at the other. EAPAs installed on the VS-15 mainframe use dc power from an existing jack (J7) on the SPS-476E Switching Power Supply.

When the optional global modem is part of the configuration, space limitations may restrict the number of EAPAs that can be installed on the mainframe, the addition of the VS Small System Cable Concentrator may be required.

Model VS-PA-8C contains the following components:

Component	Qty	Description
270-0975	1	8-Port EAPA
220-2346	1	Power Jumper Cable, 4 in. 3 Pos Plug-Plug EAPA Power Daisy Chain. EAPAs must be adjacent.
220-3234	1	Signal Cable Assembly, 4 inch, 34 Pos Soc-Soc Connects APA signal-out connector to adjacent APA signal-in connector (J1).

F.1.3.3 Model VS-WN-19C - WangNet Serial I/O Peripheral Band Modem

The VS-WN-19C WangNet 19-Channel P-Band Global Modem can be added as a separate subsystem component for attachment to the Model 25V67 UISIO DAC. The UISIO DAC supports one P-Band modem, if an additional modem is required a second UISIO DAC must be installed. The 'P-Band' modem supports up to 32 serial devices via a NetMux connected to the WangNet bus. Due to the modem's size, it can only be mounted in rear panel location 0 in the VS-15 mainframe. A second global modem (if required) will be mounted in the cable concentrator.

Model VS-WN-19C contains the following:

Component	Qty	.Description
279-5305	1	19-Channel Global Modem
452-4757	1	Modem Mounting Panel
452-0379	1	Modem Mounting Plate

F.1.3.4 Model FW-APA-2S - FiberWay Active Port Assembly

NOTE

WORKSTATION 0 MUST BE CONNECTED TO EAPA0. THE FIBER-WAY LINK IS ESTABLISHED DURING THE IPL PROCESS.

The FiberWay panel assembly provides two optical transmit ports and two optical receive ports that support up to 32 serial devices (16 devices per port via a Wang Remote Cluster Switch). (Refer to the Remote Cluster Switch maintenance manual [Class Code 7101] for information pertaining to FiberWay panel maintenance and adjustments.) A total of four FiberWay panels can be installed providing a maximum of 128 serial device ports (only 32 logical devices can be supported per UISIO). It is required that Workstation 0 (operators console) be attached to an EAPA.

FiberWay provides additional benefits that include:

- Reduces the number of cables to be installed by a factor of 16 to 1.
- Provides for a fiber optic cable length of 5000 feet (1.5 km) from the backpanel mounted FiberWay panel to a Remote Cluster Switch.
- Provides interference-free transmission in electrically hostile environments.
- No peripheral modification is required.

The following restrictions apply to FiberWay installation:

- Workstation 0 (the system IPL console) must be connected to an APA panel. (The FiberWay link is established during the IPL process.)
- FiberWay requires a UISIO DAC be installed in the mainframe.
- The last APA (FiberWay or EAPA) signal-out connector must be terminated using the 928 MuxBus Terminator.

Model FW-APA-2S contains the following components:

Component	Qty	Description
279-0727	1	FiberWay Active Port Assembly (FWAPA)
220-2105	1	Power Jumper Cable, 4 in. 4 Pos Plug-Plug FWAPA Power Daisy Chain. FiberWay panels must be adjacent.
220-3234	1	Signal Cable Assembly, 4 inch, 34 Pos Soc-Soc Interconnects adjacent APA panels (FWAPA and EAPA) signal-in connector to adjacent APA panel signal-out connector.

F.1.3.5 Modular Subsystem Cable Kits

The cabling required to install the first subsystem panel (EAPA, FiberWay, or Modem) on the VS-15 rear panel assembly are contained in individual cable kits. When an option panel is to be installed, the corresponding cable kit must be ordered. These kits are defined as follows:

- KIT-PA-CP7 EAPA Cable Kit

  220-3396 - 34-pin Signal Cable 44 in., UISIO Connector J5 to first EAPA
  220-2202 - 3-pin Power Cable 38 in., SPS Connector J7 to first EAPA

- KIT-WN-CP7 WangNet Modem Cable Kit

  220-3236 - 34-pin Signal Cable 36 in., UISIO Connector J6 to Modem Signal
  220-2060 - 5-pin Power Cable in., UISIO Connector J7 to Modem Power
  220-0294 - Signal Cable 10 feet, Modem to WangNet Users Outlet

- KIT-FW-CP7 FiberWay Cable Kit

  220-3396 - 34-pin Signal Cable 44 in., UISIO Connector J5 to first FWAPA
  220-2503 - 5-pin to 4-pin power cable, Power Adapter 5-Pin Connector to first FWAPA Power Connector
  220-2495 - Power Supply Cable Assembly Adapter

F.1.3.6 Additional UISIO Support Features

The VS Small System Cable Concentrator is a separate cabinet with its own power supply, a rear panel configured for up to four half panels (two panels over two panels), and a strain relief panel containing two shield-mounting strain-relief cable clamps. Using the MuxBus interface, up to four EAPAs or four FWAPAs or any combination of EAPAs and FWAPA panels can be mounted in the cabinet. The VS Small cable Concentrator supports two technologies at a time due to concentrator power cabling requirements. Refer to the VS Small Cable Concentrator manual (Class Code 6100) for information pertaining to panel installation, cabling, and other requirements.

F.1.4 SOFTWARE REQUIREMENTS

VSOS Software release 6.41.00 or higher is required to support the UISIO and corresponding subassemblies. The microcode software versions required to operate the Modular SIO Subsystem are 7.02.05 (@MC25V67), and 7.04.01 (@MCBP1@) or later. Auto-enclosed with CEI's 157/177-5697/7362 is MEI 291-0427, which includes the necessary software and documentation. Refer to the correct software release notice for software configuration instructions.

F.2 THEORY OF OPERATION

The theory of operation for the UISIO DAC is not provided as part of this Appendix.

F.3 OPERATION

Operation of the VS-15 Computer System equipped with the UISIO Device Adapter/Controller is transparent to the user. A general discussion of VS-15 operation may be found in Chapter 3 of the maintenance manual. Minor changes in operation are given in the following paragraphs.

F.3.1 OPERATOR CONTROLS AND INDICATORS

No special operator controls or indicators are used with the addition of the UISIO DAC. Information on status and error conditions is displayed in the usual manner using the Front Panel HEX displays and LED indicators.

F.3.2 SERVICE CONTROLS AND STATUS INDICATORS

The status of the UISIO device adapter/controller is determined by a LED located at the upper center of the printed circuit assembly (figure F-2). The LED will light during power-up diagnostics and then go out when the diagnostics have completed successfully. If the LED stays on, diagnostics have failed and the PCA may be defective. Refer to paragraph F.4.6.3.

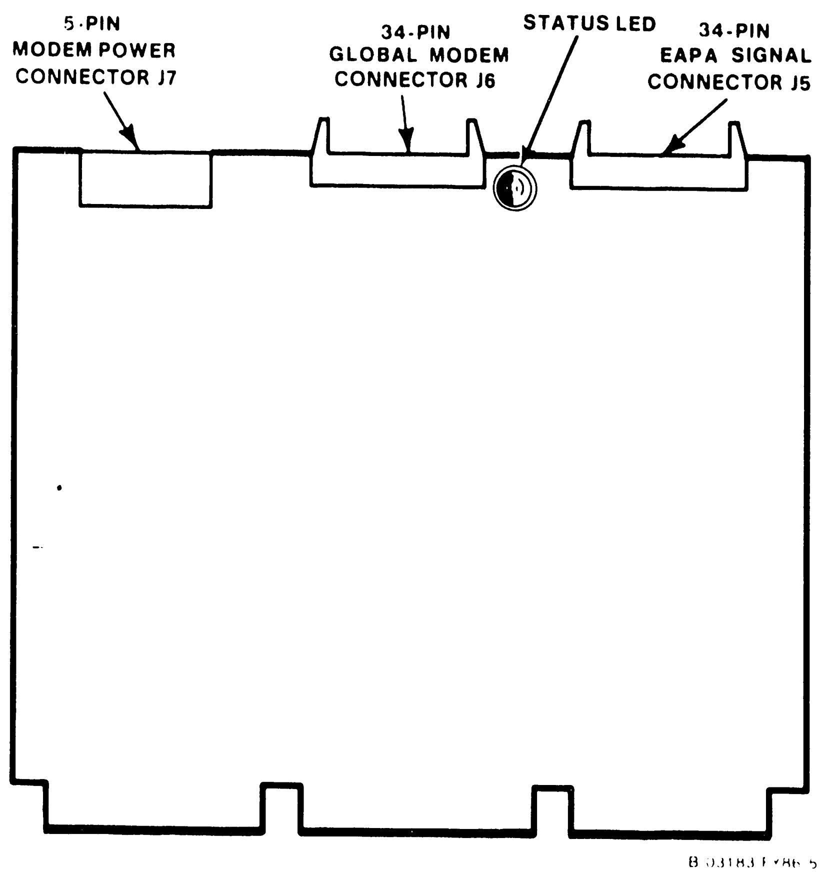


Figure F-2. UISIO Status LED Location

F.3.3 OPERATING PROCEDURES

Prior to installation of the Modular SIO Subsystem hardware, ensure the mainframe is fully operational. If necessary, perform power-up and verification procedures as outlined in the maintenance manual.

F.4 INSTALLATION

This section includes information for unpacking, inspecting and installing the components of the Modular Serial I/O Subsystem in the mainframe. General information concerning mainframe installation is found in the Installation chapter of this manual.

F.4.1 UNPACKING

Before unpacking the Modular Serial I/O Subsystems perform a visual inspection as given below. If damage is noted, follow the reporting procedures given in Chapter 4.

1. Inspect the shipping containers for any visible signs of damage. If no damage is apparent, proceed with unpacking the UISIO DAC and associated subassemblies.

2. Inspect the contents of each shipping container for any sign of loss of integrity, or other signs of damaged, loose, or missing components.

3. Check all items against the shipping bill(s)/packing list(s) to ensure the correct items where shipped and that none are missing.

4. Unpack the various components and inspect for shipping damage. Any damage claims should be handled as specified in Chapter 4.

F.4.2 PREINSTALLATION SOFTWARE AND HARDWARE VERIFICATION

Perform the verification procedures outlined below to ensure correct system operation after installation. If required, refer to paragraph 4.10 in the Maintenance Manual for the complete IPL procedure.

F.4.2.1 VS Operating System Software Verification Procedure

1. From the Operator's Console Menu, verify that the operating system software is the correct versions needed to install the Modular SIO Subsystem hardware. Press PF14, SYSTEM OPTIONS, then PF7, Display SYSTEM VERSIONS, and verify the minimum VSOS Nucleus (@SYSGEN@ is 06.41.00), and BP (07.04.01) and CP (07.02.03) microcode versions.

2. If the BP, CP, or Nucleus are incorrect, be sure the correct VSOS software is available for installation with the hardware before installing the Modular Serial I/O Subsystem.

F.4.2.2 Hardware Configuration Verification Procedure

To ensure optimum performance, installation of the Modular SIO Subsystem requires the utilization of the highest available priority I/O Address Decode. Determine the I/O Address Decode, and if necessary, assist the customer in generating a new system configuration file, using the following procedure:

1. Log onto the system using any appropriate LOG-ON allowed by the customer.

2. Prior to any changes in either software or hardware, be sure that the customer has performed any system back-up required.

3. If the customer has created a new configuration file in advance, proceed with step 5 and verify the I/O Address Decode priority.

4. Run the program COPY and create a NEW system configuration file in library @SYSTEM@. Name the new file (such as @NEWFIG@) and copy the customer's system configuration file into the new file.

5. Run GENEDIT and call up the newly created system configuration file, and configure the system to support the UISIO DAC using the 25V67 model number. If an existing SIO (25V37) is being replaced, changing the 25V37 to the 25V67 will automatically set your baseband ports to the original configuration. Use PF10 and PF11 to check and/or set the baseband and peripheral band (broadband) ports.

6. If the UISIO is being installed in addition to the 25V37, select the highest I/O Address Decode ('Jumper Address') available and configure the baseband and broadband ports to meet customer requirements.

7. SAVE the new configuration file and EXIT the GENEDIT program.

8. Before installing an updated software package, rename any old files (such as @MCBP1@ to @MCBPOLD) first, then COPY the new files onto the system disk.

F.4.3 UISIO DEVICE ADAPTER/CONTROLLER HARDWARE CONFIGURATION

There are eight shunt (jumpers) connector blocks on the UISIO PCA (refer to figure F-3) which must be correctly jumpered for proper controller operation. Each block has six pairs of pins, and one pair on each block must be jumpered with the exception of JP9. JP9 sets the 'I/O Decode Address' and requires three jumpers as shown. JP1-JP3 sets BPINT, JP8 sets DRI, JP4 sets DGS, JP11 sets MRI, and JP10 sets MGS.

I/O Address Decodes are listed in numerical order in table F-1. The UISIO jumpers may be set to any of the six I/O address decodes given, and should be configured for the highest available priority decode. However, some addresses are reserved for specific peripherals which results in a recommended decode ranking as shown in the table. Figure F-3 shows the UISIO DAC jumpers set for address 03xx 'Second SIO DA'. Alternate decode priority configurations for the UISIO DAC are given in figure F-4. Set the jumpers on the UISIO PCA as required by the new system configuration.

CAUTION

POWERING THE SYSTEM AND/OR ANY EXTERNAL DISK DRIVE DOWN IMPROPERLY MAY RESULT IN DAMAGE TO THE VOLUME TABLE OF CONTENTS (VTOC) OF THE DISK DRIVE(S).

Table F-1. Input/Output (I/O) Address Decode Priority Reservations

I/O ADDRESS DECODE	I/O ADDRESS RESERVED FOR DEVICE ADAPTER/CONTROLLER FUNCTION		
	PRIMARY FUNCTION	ADDITIONAL FUNCTIONS	EXCLUDED FUNCTIONS
"01xx"	External Disk Drs	All except 25V50-0	Int Disk (25V50-0)
"02xx"	Int/Ext. Disk Drs	Includes 25V50-0	None
"03xx"	Second SIO DA	All Other Serial DAs	25V50 and 25V50-0
"04xx"	SIO DAs Only	None	All Other DAs
"05xx"	All Optional DAs	Includes Ext Disk DA	25V50-0
"06xx"	TC Device Adapter	All Except Disk Drs	25V50 and 25V50-0

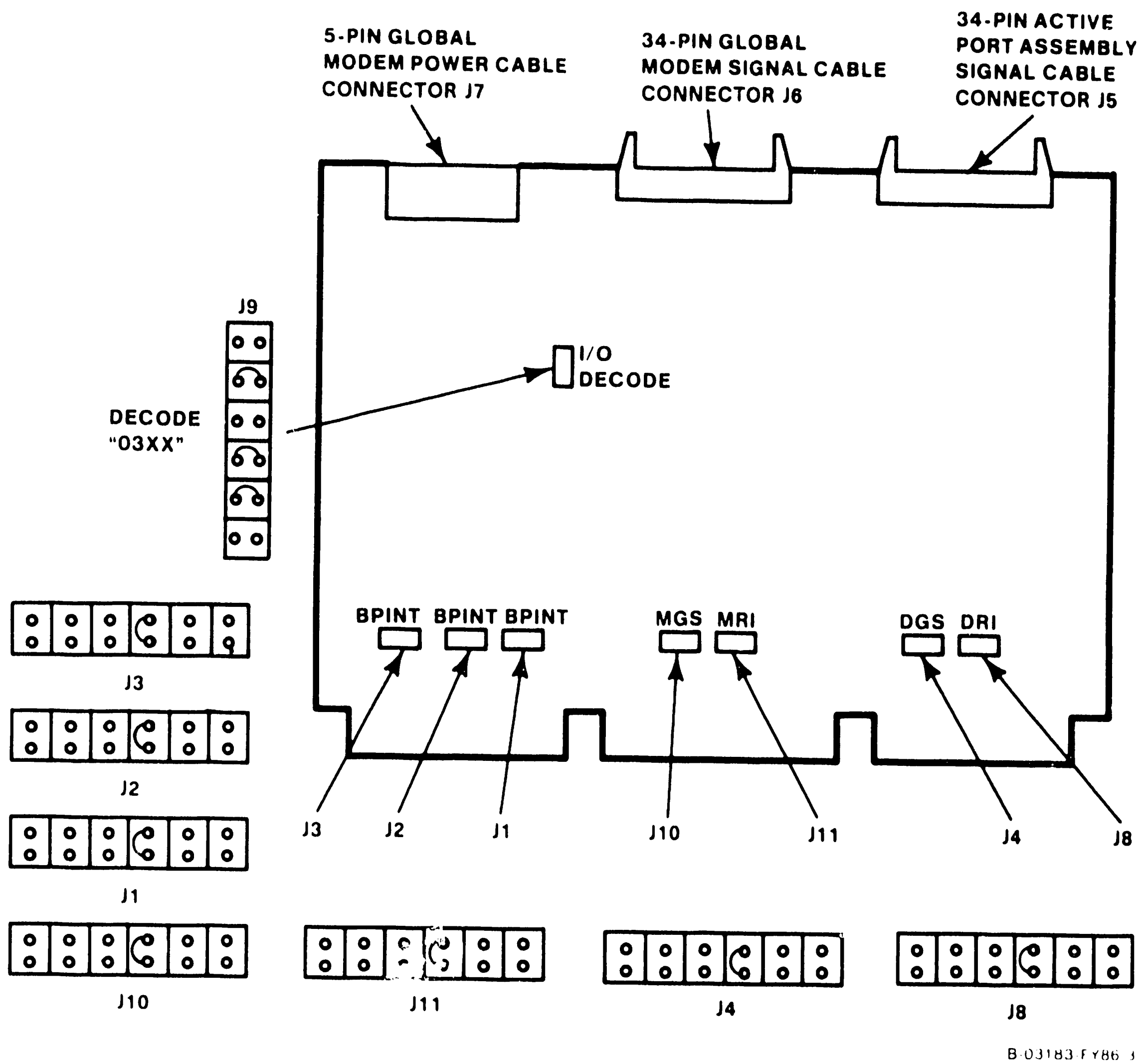


Figure F-3. UISIO Device Adapter/Controller (210-8489) Jumper Locations

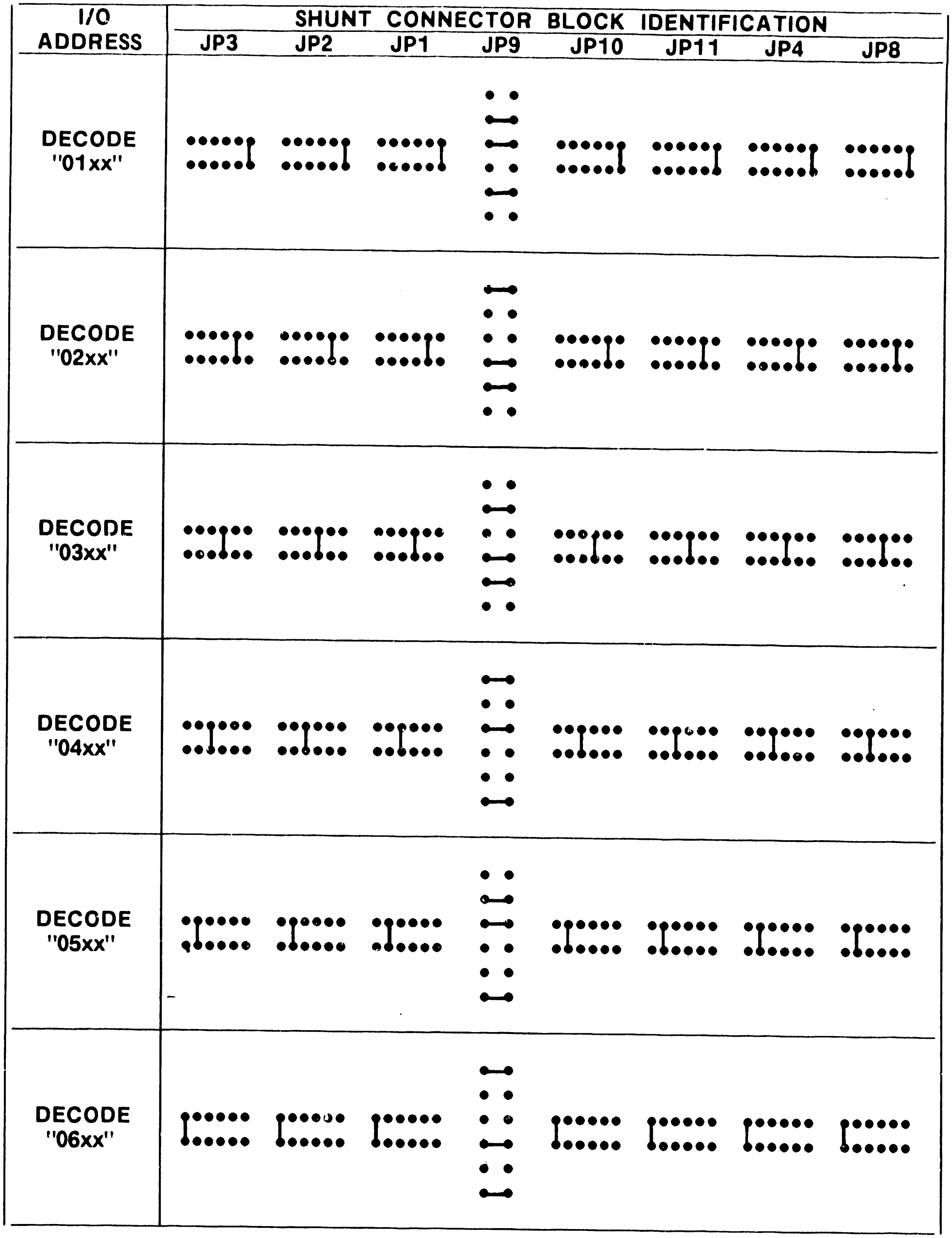


Figure F-4. Alternate "Jumper Address" Configurations

F.4.4 UISIO PCA INSTALLATION PROCEDURES

The general removal and replacement procedures given in the Maintenance Manual should be followed whenever a printed circuit assembly (PCA) is to be removed or installed. If difficulty is encountered, refer to Removal and Replacement procedures in Chapter 5 of the manual. Power-down the system as follows:

1. After verifying all users have logged off and all background tasks are completed, press the green Control Mode button.

2. Power-down the mainframe and peripherals. Refer to Operations chapter of this manual if additional power-down information is required.

3. Remove the top cover as described in paragraph 5.3.2.1 of the manual.

NOTE

> The physical location of any PCA in the MotherBoard is transparent to mainframe operation. However, it is recommended that the PCA I/O Address Decode corresponds to the I/ODAx Motherboard slot.

4. Set the UISIO jumpers to address '03xx' and install the PCA into motherboard connector I/ODA3. If another decode address is required, install the UISIO PCA in the motherboard slot number corresponding to the address selected.

5. If the system configuration requires the removal of the standard SIO DA, the UISIO DAC MUST be installed with its I/O address decode set to "04xx" and the system MUST have at least one EAPA installed. WS-0 MUST be attached to the first BNC/TNC connector pair on an EAPA.

6. If a two UISIO PCA configuration is used (standard SIO removed), set the first PCA address to '03xx' and set the second PCA address to the next available address.

7. Figure F-5 illustrates the PCA locator label mounted on the front of the motherboard card cage assembly. For ease of I/O address decode identification by PCA, the device adapters may be installed in the I/O DAx slot which corresponds with I/O Decode Address assigned.

SLOT NO.	1	2	3	4	5	6	7	8	9
PRINTED CIRCUIT ASSEMBLY	MM	CP	BP	I/ODA1	I/ODA2	I/ODA3	I/ODA4	I/ODA5	I/ODA6

Figure F-5. Card Cage Assembly PCA Locator Label

F.4.5 MODULAR SIO SUBSYSTEM INSTALLATION PROCEDURES

This section presents guidelines and instructions for removing, installing, and/or relocating the various Rear Panel Assembly (RPA) connector panels as may be required when installing the Modular Serial I/O Subsystem (figure F-6). For detailed connector panel removal/replacement refer to Chapter 5 of this manual.

This section contains the following subsystem configurations:

- F.4.5.1 General Rear Panel Removal/Replacement Guide Lines
- F.4.5.2 EAPA Panel Installation/Cabling
- F.4.5.3 Global Modem Installation/Cabling
- F.4.5.4 FiberWay Panel Installation/Cabling
- F.4.5.5 Combination EAPA/FiberWay Panel and Global Modem Installation

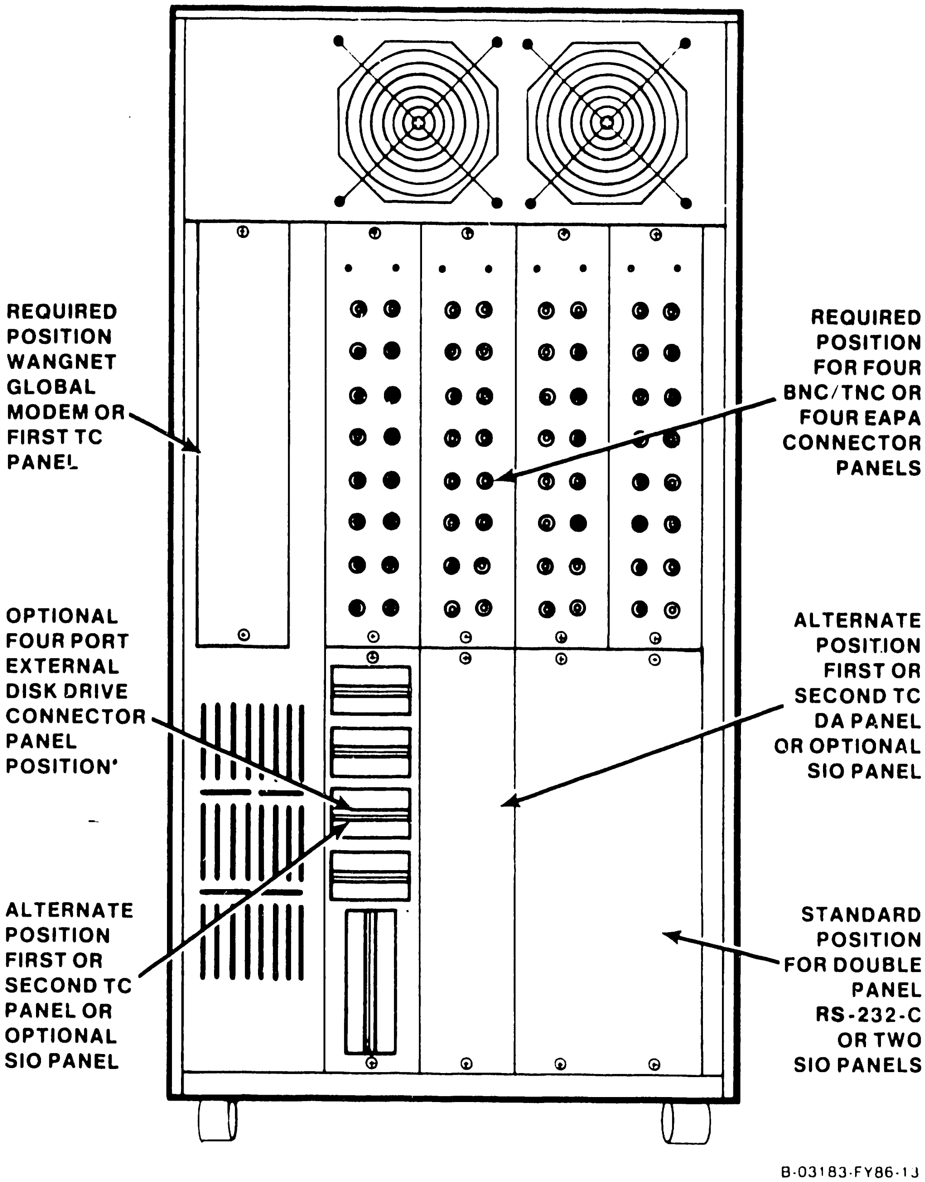


Figure F-6. Mainframe Rear Panel Assembly Connector Panel Locations

F.4.5.1 General Rear Panel Guide Lines

1. If the global modem is part of the installation, remove the blank panel (or the TC panel if so equipped) from the upper left side of the RPA. The global modem can ONLY be mounted in this position on the mainframe. An existing TC panel MUST be relocated on the RPA.

2. All APA (FiberWay and EAPA) panels, connected to a individual UISIO, must be installed in the same row on the Rear Panel Assembly. Remove the required panels from the RPA of the mainframe to allow relocation of any affected device panels. The standard BNC/TNC connector panels which are connected to the SIO DA may be mounted in any available position on the RPA.

3. If the system is equipped with an external drive panel, and/or a TC panel, the external drive and telecommunication panels should be mounted in the standard positions as shown in figure F-6.

4. If the VS-15 is equipped with an internal disk drive only, the APA panels will then be mounted in the lower four rear panel positions leaving the standard SIO connector panel configuration in place.

F.4.5.2 Installing the Electrical Active Port Assembly Panels

EAPA panel installation requires the following modular components:

Model 25V67	UISIO PCA includes 928 MuxBus Terminator
Model VS-PA-8C	Single EAPA panel with signal and power cables
Model KIT-PA-CP7	Cabling required for first EAPA panel installation

NOTE

Daisy-chain signal and power cables shipped with model VS-PA-8C are not used for single panel installation.

1. Ensure the required modular subsystems are available (i.e. for a two EAPA panel installation, two model VS-PA-8C, one model KIT-PA-CP7, and one model 25V67 are required).

2. **EAPA panels must be installed in adjacent backpanel locations.** If adjacent backpanel space is not available, mounting the EAPA panels in the VS Small Cable Concentrator should be considered.

3. It is recommended that standard connectors panels remain in the upper four panel locations. If backpanel space is available, install EAPA panels in the lower four panel positions. If lower panel positions are occupied (TC panels, disk panels, etc.), rearrange the option panels to provide the required number of adjacent backpanel locations.

4. Unscrew the two spring loaded thumbscrews on the inside top of the Rear Panel Assembly (RPA). Carefully lower the entire RPA enough to allow access to the required panel locations. Brace the RPA in the partially lowered position.

5. Install the EAPAs in adjacent lower backpanel locations.

6. Install EAPA Power Cable (P/N 220-2202) to J3 of the first EAPA and connect the other end to Switching Power Supply connector J7 located on PCA 210-8611 (figure F-7).

7. Daisy-chain the EAPA power interconnect cables (P/N 220-2346) from J4 of the first EAPA to J3 of the second EAPA. Perform the cabling sequence for each adjacent EAPA panel.

8. Install MuxBus Interface Cable (P/N 220-3396) between J1 (signal-in) of the first EAPA to the UISIO PCA connector J5.

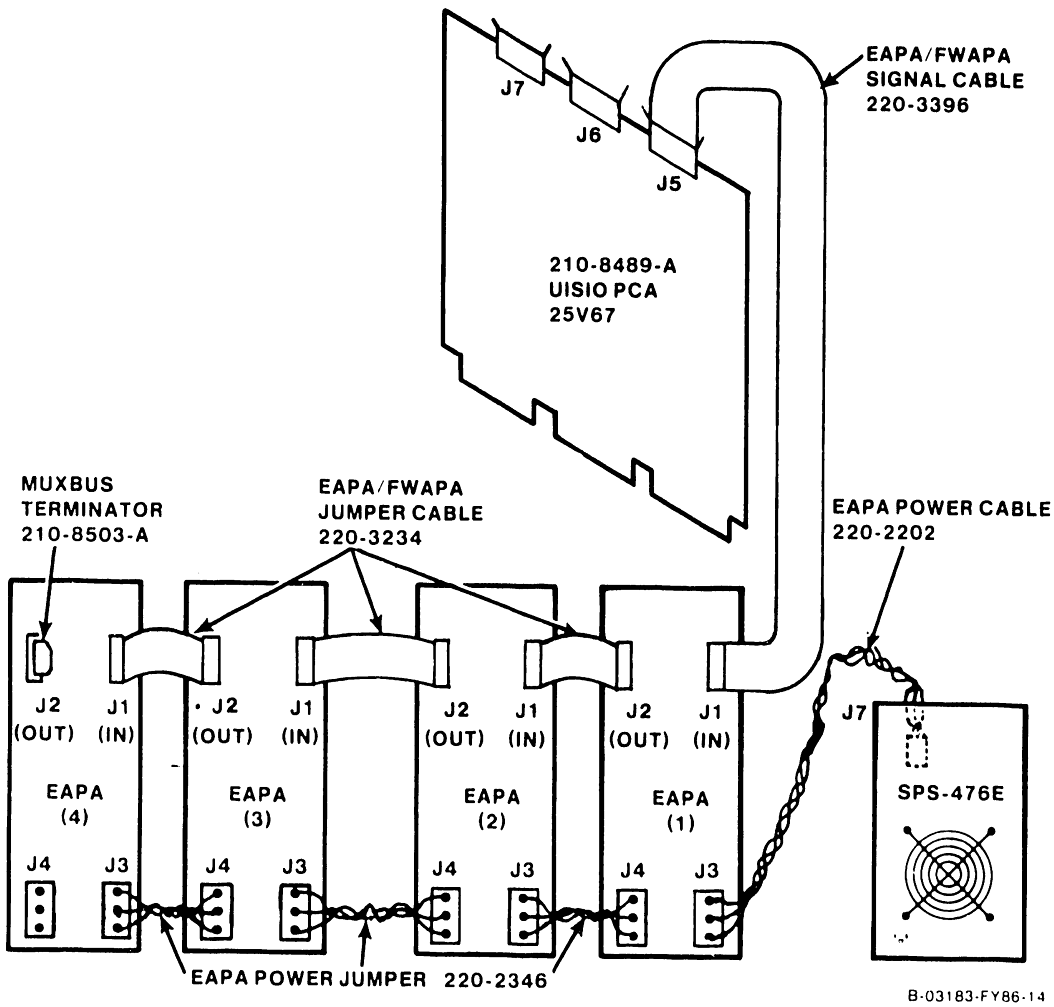


Figure F-7. EAPA Panels Internal Cabling Diagram

NOTE

EAPA panels are mounted in reverse order with respect to standard SIO BNC/TNC panels. Facing the rear of the mainframe, Logical Device Zero (Device Number One) is located on the upper left side of the EAPA panels.

9. Daisy-chain the MuxBus interconnect cables (P/N 220-3234) from J2 of the first EAPA to J1 of the second EAPA. Perform the cabling sequence for each adjacent EAPA panel.

10. Install the MuxBus Terminator in J2 of the last EAPA. Position the terminator such that the terminator PCA is over the EAPA PCA.

12. Reattach the Rear Panel Assembly to the VS-15 mainframe.

F.4.5.3 Installing the WangNet 19-Channel Global Modem Assembly

WangNet panel installation requires the following modular components:

Model 25V67	UISIO PCA includes 928 MuxBus Terminator
Model VS-WN-19C	Single WangNet Peripheral Band Modem
Model KIT-WN-CP7	Cabling required for modem installation

The WangNet 19-Channel Global Modem Assembly includes the modem, mounting plate and panel, and should be received preassembled for installation in the VS-15 mainframe. Install the global modem assembly as follows:

1. Ensure the modem mounting plate and panel screws are secure. Install the global modem assembly into the telecommunication panel/modem slot with the modem 34-pin connector (J1) facing upward (backpanel RX connector will be at the top of the panel).

NOTE

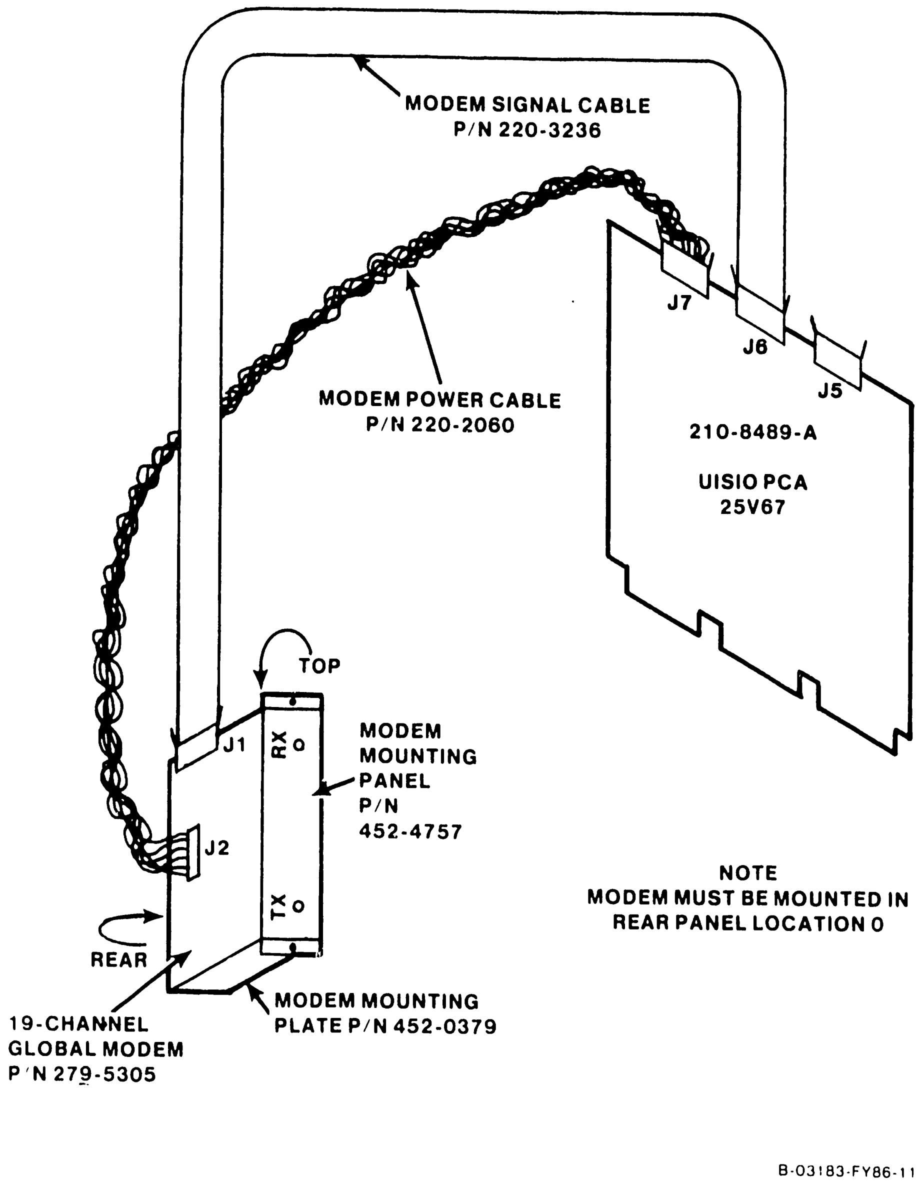
When installing modem, the inserted flange edge of the modem mounting panel must be on the left side of the Rear Panel Assembly.

2. Minimal clearance is available for positioning the mounting panel. Move (rotate) the rear of the modem assembly toward the card cage until the mounting panel flange slides under the edge of the Rear Panel Assembly.

3. Rotate the modem assembly back to its normal position. The mounting panel flange should move securely into the slot. Insert the panel mounting screws and tighten firmly in place.

4. Install modem power cable (P/N 220-2060) to modem connector J2 and UISIO connector J7 (figure F-8).

5. Install the modem signal cable (P/N 220-3236) to modem connector J1 and UISIO connector J6.



NOTE

The WangNet Global Modem Can Only Be Mounted In VS Cabinet Rear Panel Location 0.

Figure F-8. WangNet Modem Panel Internal Cabling Diagram

F.4.5.4 Installing the FiberWay Active Port Assembly Panels

FiberWay panel installation requires the following modular components:

Model 25V67	UISIO PCA includes 928 MuxBus Terminator
Model FW-APA-2S	Single FWAPA panel includes signal and power cables
Model KIT-FW-CP7	Cabling required for first FWAPA panel installation

NOTE

Daisy-chain signal and power cables shipped with model FW-APA-2S are not used for single panel installation.

1. Ensure the required modular subsystems are available (i.e. for a two FWAPA panel installation, two model FW-APA-2S, one model KIT-FW-CP7, and one model 25V67 are required).

2. **FWAPA panels must be installed in adjacent backpanel locations.** If adjacent backpanel space is not available, mounting the FWAPA panels in the VS Small Cable Concentrator should be considered.

NOTE

Workstation 0 (WS0) MUST BE attached to an EAPA or APA panel.

3. It is recommended that the standard connectors panels remain in the upper four panel locations. If backpanel space is available, install the FWAPA panels in the lower four panel positions. If lower panel positions are occupied (TC panels, disk panels, etc.), rearrange the option panels in order to provide the required number of adjacent backpanel locations.

4. Unscrew the two spring loaded thumbscrews on the inside top of the Rear Panel Assembly. Carefully lower the entire RPA enough to allow access to the required panel locations. Brace the RPA in the partially.lowered position.

5. Install the FWAPAs in adjacent lower backpanel locations.

6. Disconnect power cable (220-0407) from power supply connector J5 and motherboard connector J31 and remove. Disconnect any cable connected to power supply connector J7.

7. Install Power Adapter Cable (P/N 220-2495) as follows (refer to figure F-9):

   a. Install the six-pin plug affixed to the long cable portion of the adapter cable to motherboard connector J31.

   b. Install the six-pin plug affixed to the 'Y' cable portion of the adapter cable to power supply connector J5.

   c. Install the 3-pin plug to power supply connector J7.

   d. Connect the five-pin connector (FWAPA power) to the five-pin plug on cable (220-2503).

   e. If EAPA panels are installed, connect the three-pin connector to the EAPA power cable (220-2202) removed in step 6. If EAPA panels are not used, this connector will be left open.

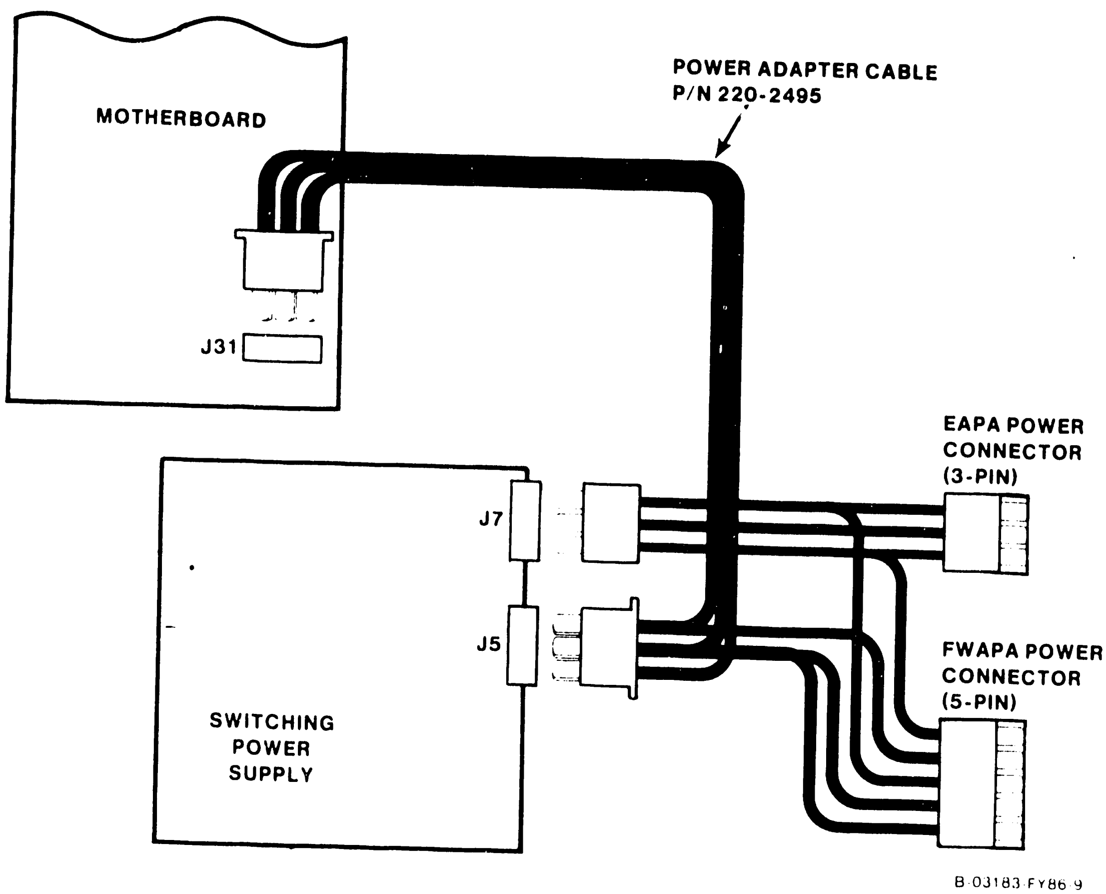


Figure F-8A. Power Supply Cable Adapter Assembly Connections

8. Install FWAPA Power Cable (P/N 220-2503) 4-pin plug to the first FWAPA panel upper power connector.

9. Daisy-chain power interconnect cable (P/N 220-2105) from FWAPA (1) lower power connector to FWAPA (2) lower power connector. Daisy-chain FWAPA (2) upper power connector to FWAPA (3) upper power connector and Daisy-chain FWAPA (3) lower power connector to FWAPA (4) lower power connector.

10. Install MuxBus Interface Cable (P/N 220-3396) between J6 (signal-in) of the first FWAPA to the UISIO PCA connector J5.

11. Daisy-chain MuxBus interconnect cables (P/N 220-3234) from J1 (signal-out) of the first FWAPA to J6 (signal-in) of the second FWAPA. Perform the cabling sequence for each adjacent FWAPA panel.

12. Install the MuxBus Terminator in J1 of the last FWAPA. The terminator should be positioned so the terminator's PCA is over the FWAPA's PCA.

13. Reattach the Rear Panel Assembly to the VS-15 mainframe.

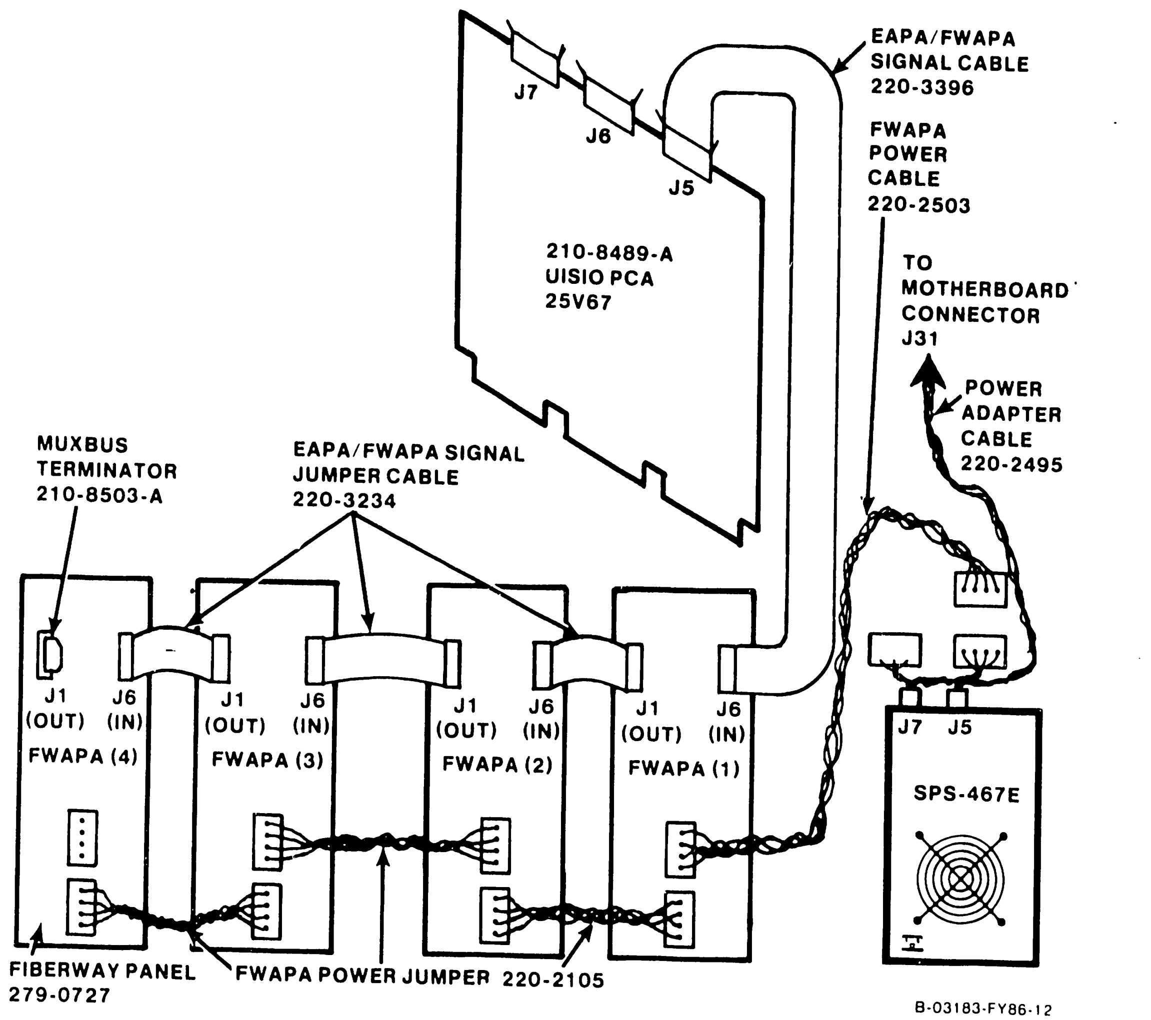


Figure F-9. FWAPA Panels Internal Cabling Diagram

F.4.5.5 Combination EAPA/FiberWay Panel and Global Modem Installation

A combination of EAPA/FiberWay panels (4 panels total) and a Global Modem can be connected to a single UISIO PCA. The example used is configured with two EAPAs, two FWAPAs, and a global modem. This configuration requires the following modular components:

Qty	Model	Description
1	25V67	UISIO PCA includes 928 MuxBus Terminator
2	FW-APA-2S	Single FWAPA panel includes signal and power cables
1	KIT-FW-CP7	Cabling required for first FWAPA panel installation
1	VS-WN-19C	Single WangNet Peripheral Band Modem
1	KIT-WN-CP7	Cabling required for modem installation
2	VS-PA-8C	Single EAPA panel with 4 in. signal and power cable
1	KIT-PA-CP7	Cabling required for first EAPA panel installation

For panel installation and cabling procedures refer to the associated panel installation procedures discussed in the preceding paragraphs.

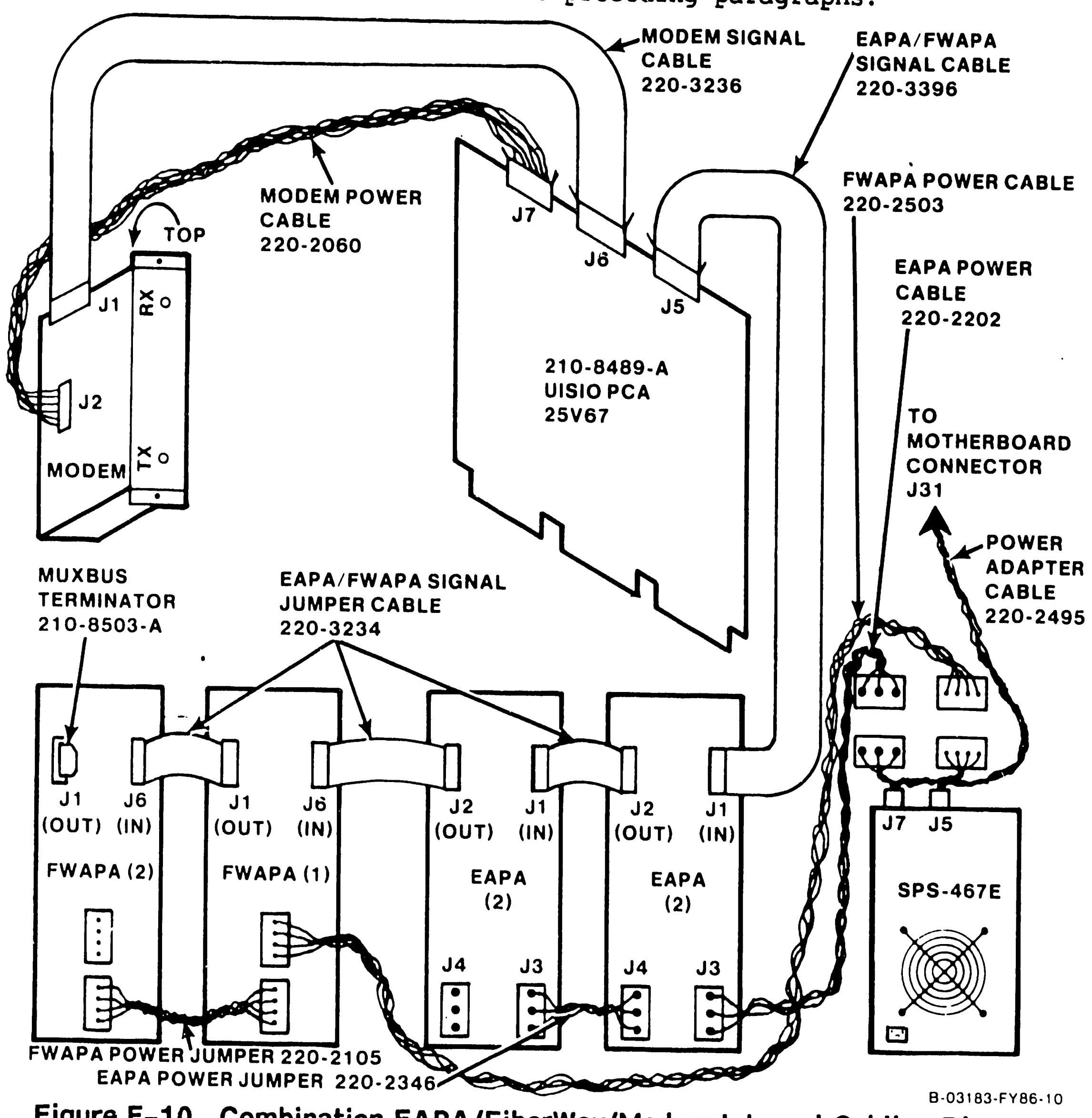


Figure F-10. Combination EAPA/FiberWay/Modem Internal Cabling Diagram

F.4.6 MAINFRAME POWER-UP AND TESTING

When the installation and/or replacement of the affected device adapters is completed, any device adapter cables removed must be reconnected. Power is applied to the mainframe and power supply voltages tested using the procedures in the maintenance manual and the following:

F.4.6.1 Device Adapter and Power Cable Connections

1. Reconnect any device adapter cables removed.

2. Return each cable to its respective cable holder while routing all new cables in a like manner along the mainframe. Refer to the maintenance manual for interconnection of original device adapter panels.

CAUTION

1. RETURNING CABLES TO THEIR CORRECT POSITIONS AND ROUTING ADDITIONAL CABLES CORRECTLY IS IMPORTANT TO ENSURE COMPLIANCE WITH FCC REGULATIONS.

2. BEFORE POWER-UP, ENSURE THE PCAs COMPONENT SIDES ARE FACING RIGHT WHEN VIEWED FROM FRONT OF THE CHASSIS.

F.4.6.2 Mainframe DC Voltage and UISIO PCA Power-Up Verification

1. Set the Boot Device switch on the Operational Control Panel to the DISKETTE (UP) position during initial power-up. There should NOT be a diskette in the drive.

2. Power-up the mainframe using the standard power-up procedures as given in Chapter 4 of the maintenance manual.

3. After installation of a new and/or additional device adapter, the dc power supply voltages must be checked at the Motherboard test points. If the dc voltages at the Motherboard are outside the operating limits as contained in table F-2, the switching power supply voltages must be adjusted. Refer to paragraph 4.7.3 of the maintenance manual.

Table F-2. Direct Current (DC) Test Point Voltages

TEST POINT	DC VOLTS	DC OPERATING VOLTAGE LIMITS	AC RIPPLE VOLTAGE LIMITS
TP1	+/-0.0	- 0.05 to + 0.05	35mV RMS or 50mV Pk-to-Pk
TP2	+ 5.0	+ 4.95 to + 5.05	
TP3	- 5.0	- 4.95 to - 5.05	
TP4	+ 12.0	+11.9 to +12.1	
TP5	- 12.0	-11.9 to -12.1	
SPS	+ 24.0	+21.6 to +26.4	

4. Verify that the UISIO DAC is operational using the Built-In-Test (BIT) power-up diagnostics. The UISIO PCA power-up diagnostic LED (LED1) should light for seven to ten seconds and then go out.

NOTE

UISIO power-up diagnostics only tests the UISIO PCA. Modular Components (EAPA, FWAPA, and Modem) attached to the UISIO PCA are not tested.

5. If the LED remains ON, the UISIO has failed the power-up diagnostics. Proceed with paragraph F.4.6.3, UISIO DAC BIT failure.

6. After successfully completing the power-up diagnostics, voltage checks, and/or adjustments, continue with paragraph F.4.6.5.

F.4.6.3 Universal ISIO Device Adapter/Controller BIT Failure

Whenever power is applied to the system or the INITIALIZE pushbutton is pressed, the UISIO DAC power-up diagnostics will begin running concurrently with the other VS-15 system power-up diagnostics. If the UISIO DAC power-up diagnostics fail (LED remains ON), before replacing the PCA perform the following procedures:

1. Check the Front Panel HEX display for error codes 7010 through 7012. The UISIO DAC may not have set or reset a particular bit on power-up.

2. Re-IPL the system, thus resetting and restarting the BIT. If power-up diagnostics are successful continue to paragraph F.4.6.4.

   If the LED remains ON, Power-down the mainframe and remove the UISIO PCA. Examine the PCA for damaged, loose or improperly seated components. Check the DIPs and sockets for missing or misaligned contacts. Press down firmly and carefully on each of the DIPs to ensure each is properly seated.

3. Reinstall the UISIO DAC in a different slot, ensuring that the PCA is seated properly and rerun the power-up diagnostics. If the BIT fails again, the PCA is defective and should be returned. Refer to paragraph F.5 for removal and replacement procedures. Power-down the system.

F.4.6.4 Modular SIO Subsystem Diagnostic Procedure

1. Insert the Small Systems VS Diagnostic Monitor diskette (DIAG2 - P/N 732-8031) in the diskette drive and press the INITIALIZE pushbutton. The diskette is included in diagnostic package P/N 195-2458-0, Rev 2561. (The package includes multimedia software and documentation.)

2. At the end of the power-up diagnostics, the Diagnostic Diskette will begin the stand-alone IPL process and the standard disclaimer screen will appear. A 'YES' response will continue the diagnostic process.

3. A 40db loop-back device is required to test the 19-channel global modem. Refer to paragraph F.7.3.2 for modem loop-back troubleshooting and loopback device set-up.

4. When the Test Selection Option screen appears, run the UISIO DAC diagnostic test (UT1000) on DIAG2. If the stand-alone diagnostic fails, UISIO PCA replacement is required. Refer to paragraph F.5.

5. Upon successful completion of the stand-alone diagnostics, re-IPL the the system and proceed with paragraph F.4.6.5.

F.4.6.5 Mainframe Power-up Procedures

1. While the power-up diagnostics are running, change the Boot Device switch to the appropriate position allowing the mainframe to IPL from the system drive, and remove the DIAG2 diskette.

2. Run the Self-Test Monitor diagnostics. Enter the Date and Time when requested and press ENTER.

3. Enter the name of the new configuration file and press ENTER. The System Initialization screen will appear.

4. Verify that the VSOS Nucleus and @SYSGEN@ version's agree.

5. When system IPL is complete, log onto the system using the CSG LOG-ON.

6. Verify that all peripherals have been correctly declared and are functioning properly. If not, modify the new configuration file as required by the customer. Re-IPL and verify the system.

7. Run the NVRAM utility and enter the necessary information in the various sections of the NVRAM files. When the NVRAM is updated and the system is verified, the procedure is complete.

F.5. REMOVAL AND REPLACEMENT PROCEDURES

The general removal and replacement procedures given in the maintenance manual should be followed whenever a printed circuit assembly (PCA) or option panel is to be removed or installed. In the event the WangNet Modem must be replaced refer to paragraph F.5.1.

F.5.1 WangNet Modem Assembly Removal and Replacement

When replacing the WangNet 19-Channel Global Modem (P/N 279-5305), the mounting plate and mounting panel are NOT supplied with the modem. The Modem Mounting Panel (P/N 452-0379) and the Modem Mounting Plate (P/N 452-4757) must be removed from the defective modem and installed on the replacement modem prior to replacement installation.

1. Remove the signal and power cables from the modem assembly.

2. Support the modem assembly and remove the modem panel mounting screws.

3. Rotate the modem assembly toward the card cage enough to slip the mounting panel flange out from behind the RPA and free the modem assembly. Return the modem to its normal position and remove.

4. Hold modem assembly upright and remove the four screws (figure F-11) which secure the Modem Mounting Panel to the Modem Mounting Plate. Remove the mounting panel.

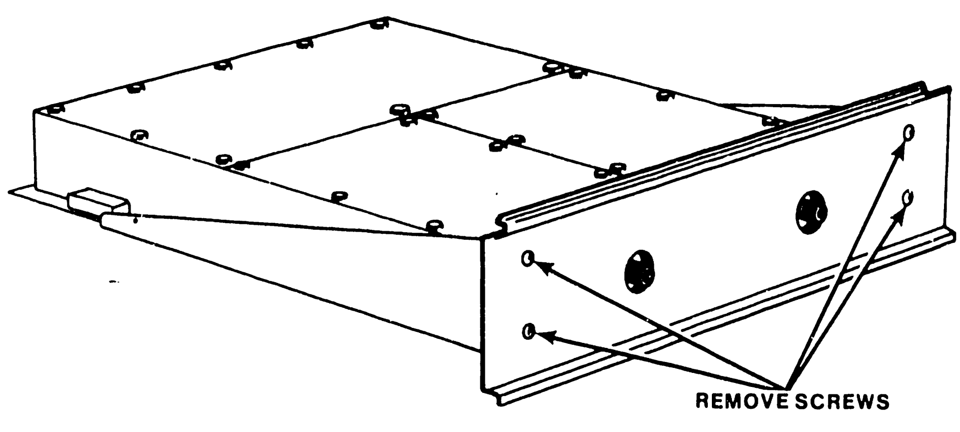


Figure F-11. Modem Mounting Panel Removal

5. Turn the modem and mounting plate over so that the 4.27 MHz label is upside-down (figure F-12).

6. Remove the six screws which secure the mounting plate to the modem and remove the mounting plate.

7. To assembly modem mounting plates, reverse procedures listed above.

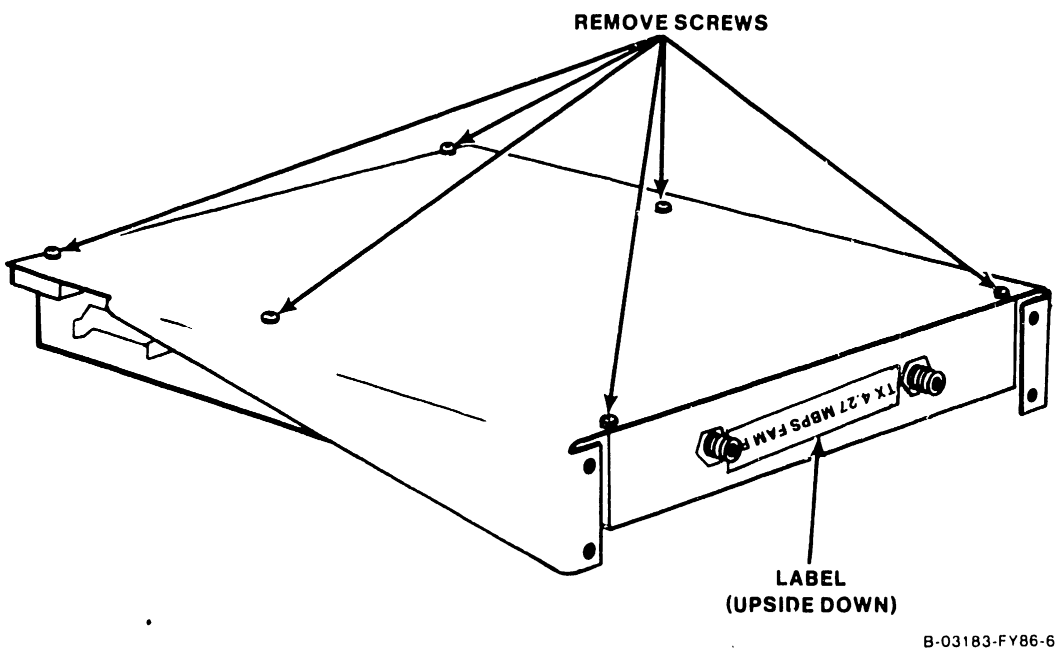


Figure F-12. Modem Mounting Plate Removal

F.6 ILLUSTRATED PARTS BREAKDOWN

This section contains the Illustrated Parts Breakdown (IPB) and power and signal cable part numbers for the Modular Serial Input/Output Subsystem. Use this breakdown for part number identification when ordering Field Replaceable Units (FRUs).

F.6.1 FIELD REPLACEABLE UNITS

Table F-3 lists the Field Replaceable Units of the Modular I/O subsystem.

Table F-3. Field Replaceable Units

PART NUMBER	ITEM DESCRIPTION
210-8489-A	PCA, Universal SIO Device Adapter/Controller
210-8503-A	PCA, 928 MC MuxBus Terminator
270-0975	ASSY, 8-Port EAPA (BNC/TNC) Panel
279-5305	ASSY, 19-Channel, 4.27 MHz WangNet Global Modem (SEE NOTE)
279-0727	ASSY, 2-Channel FiberWay Panel
220-2060	CBL, UISIO-to-WangNet Global Modem Power
220-2346	CBL, 4-Inch, 3-Pos Plug-Plug EAPA-to-EAPA Power Jumper
220-2202	CBL, 38-Inch, 3-Pos Plug-Plug First EAPA-to-Power Supply (J7)
220-3234	CBL, 4-Inch, 34-Pos Soc-Soc APA-to-APA Signal Jumper (FW/EAPA)
220-3236	CBL, 36-Inch, 34-Pos Soc-Soc UISIO (J6)-to-Modem Signal (J1)
220-3396	CBL, 44-Inch, UISIO (J5) to First APA MuxBus Signal (FW/EAPA)
220-2105	CBL, 4-Inch, 4-Pos Plug-Plug FWAPA Power Jumper
220-2503	CBL, 5-Pos to 4-Pos Plug First FWAPA Power
220-2495	CBL, Power Adapter, SPS-to-Motherboard, EAPA/FWAPA Power
220-0294	CBL, 10 Feet, Modem-to-WangNet User Outlet

NOTE

The WangNet Global Modem Assembly requires the disassembly of the mounting hardware prior to replacement. Refer to paragraph F.5.1 for mounting hardware removal and replacement procedures.

F.6.2 MODULAR SIO SUBSYSTEM POWER CABLES

Modular SIO Subsystem power cables part numbers and interconnection with system subassemblies are given in the table below. The power cable interface connector pin-outs are contained in figure F-13.

Table F-4. Modular SIO Subsystem Power Cable Part Numbers

CABLE P/N	SOURCE	DESTINATION
220-2202	SPS Connector J7 or Power Adapter Cable 3-Pos Plug	First EAPA Power Connector (J3)
220-2346	Prev. EAPA Power Connector J4	Adjacent EAPA Power Connector J3
220-2060	UISIO Connector J7	Modem Power Connector J2
220-2495	SPS Connector J7 and J5	Motherboard Connector J31, First EAPA Power Cable (220-2202) and First FWAPA Power Cable (220-2503)
220-2503	Power Adapter Cable 5-Pos Plug	First FWAPA Power Connector
220-2105	Prev. FWAPA Power Connector	Adjacent FWAPA Power Connector

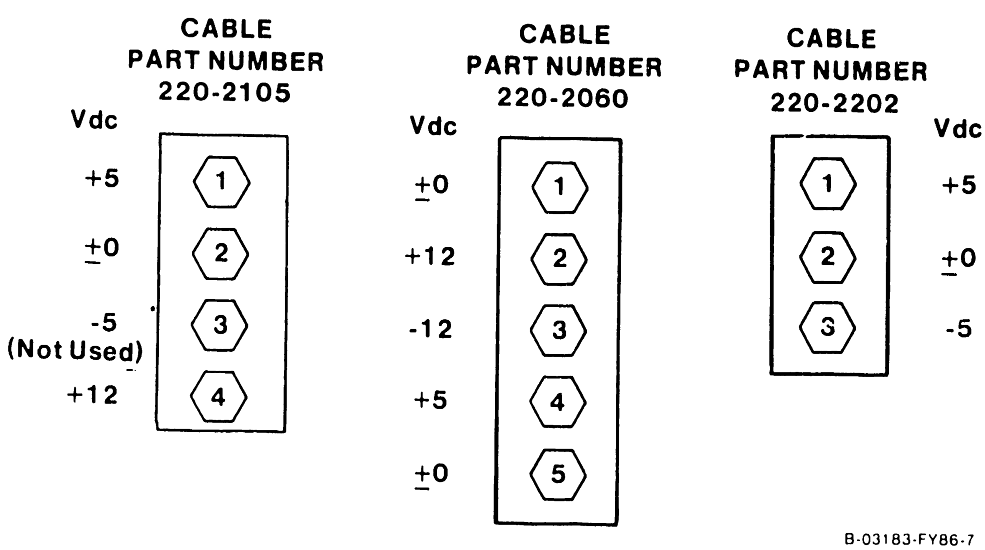


Figure F-13. Modular SIO Subsystem Power Cable Connectors

F.6.3 MODULAR SIO SUBSYSTEM SIGNAL CABLES

Modular SIO Subsystem signal cables part numbers and interconnection with system subassemblies are given in the table below. The signal cable connector pin-outs are contained in figure F-14.

Table F-5. Modular SIO Subsystem Signal Cable Part Numbers

CABLE P/N	SOURCE	DESTINATION
220-3396	UISIO PCA Connector J5	First APA Panel Signal-In Connector (EAPA J1, FWAPA J6)
220-3236	UISIO PCA Connector J6	WangNet Modem Assembly Connector J1
220-3234	Previous APA Signal-Out Connector (EAPA J2, FWAPA J1)	Adjacent APA Signal-In Connector (EAPA J1, FWAPA J6)

NOTE

The Modular Subsystem uses the RS-422 interface. TTL signals asserted low are barred.

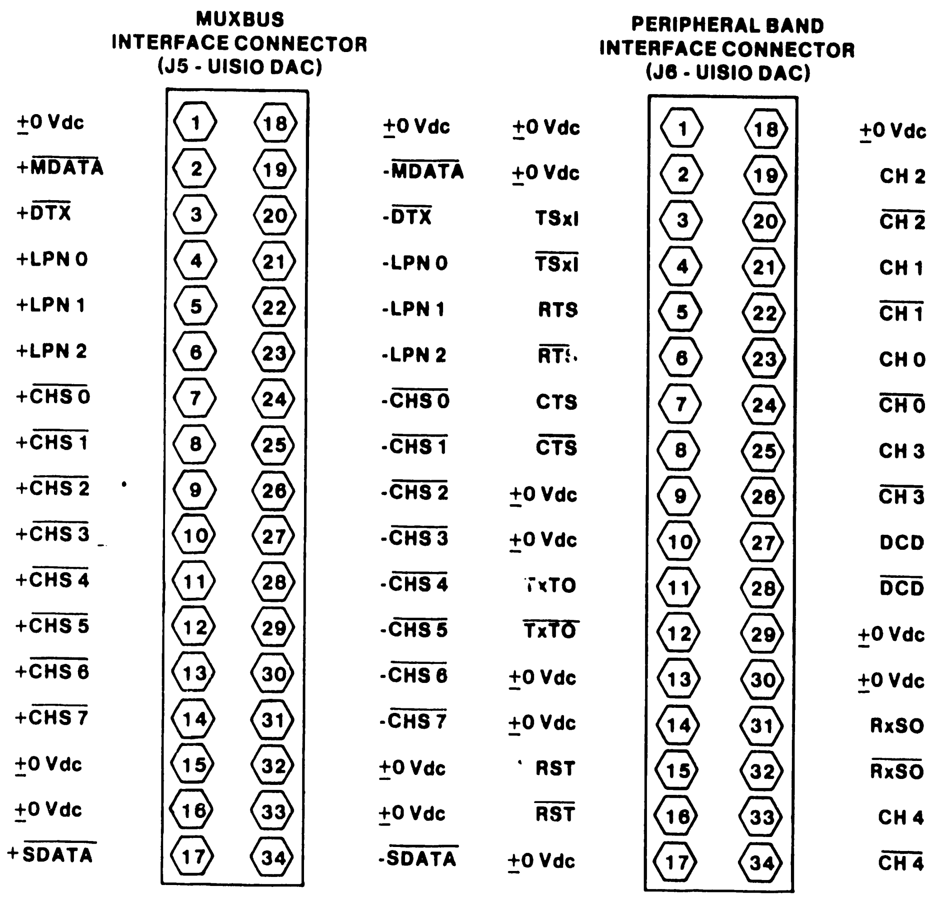


Figure F-14. UISIO Interface Connector Signals

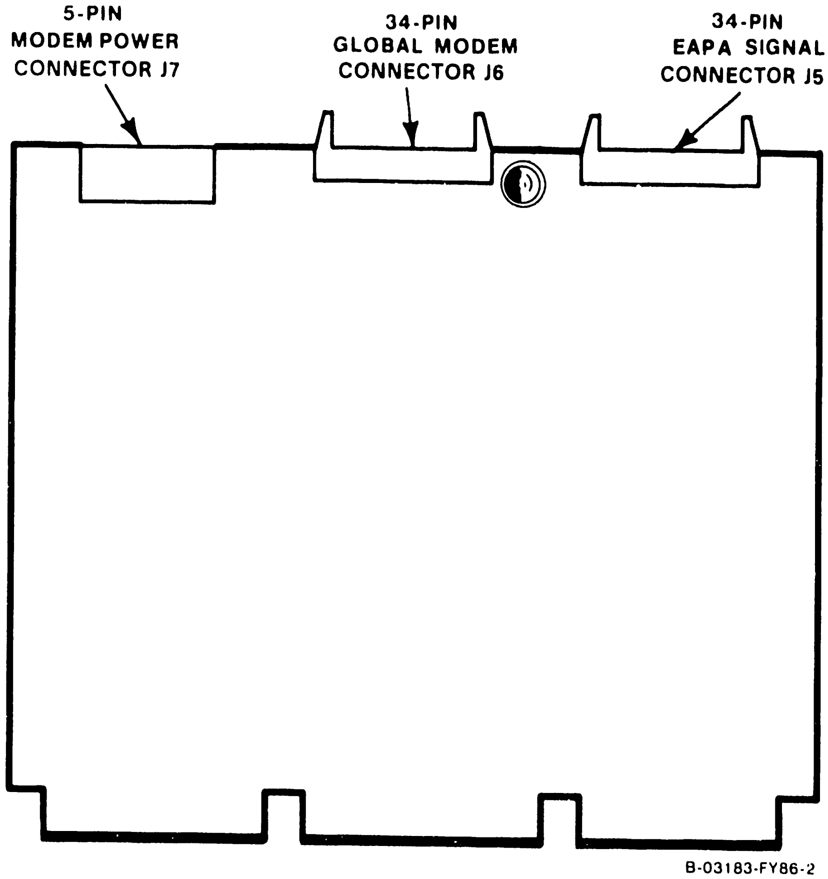


Figure F-15. UISIO PCA (210-8489-A)

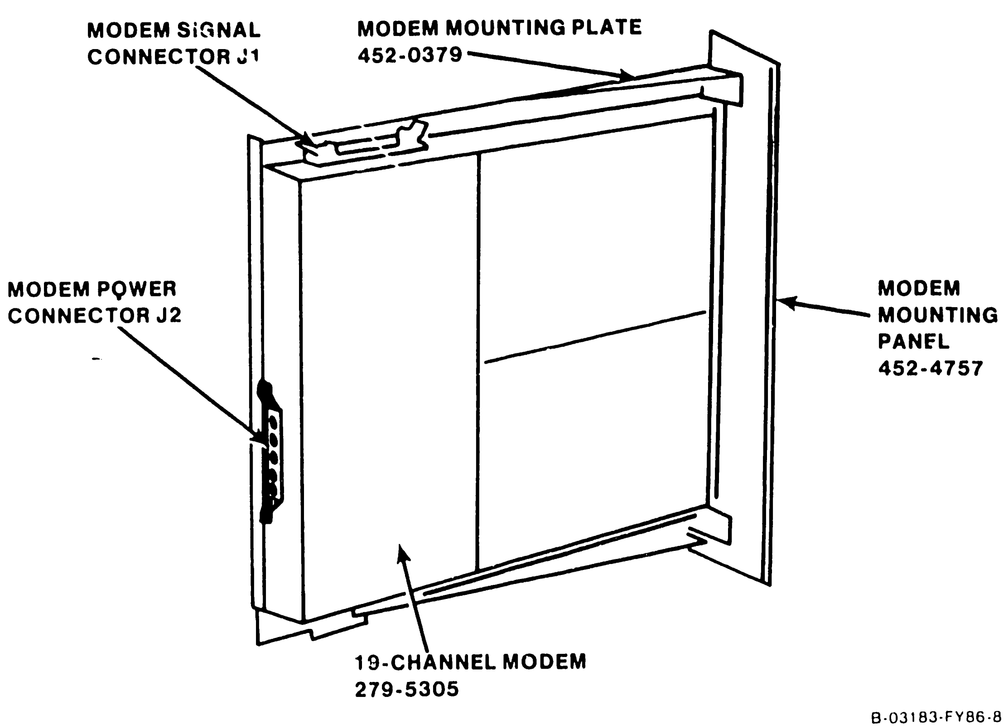
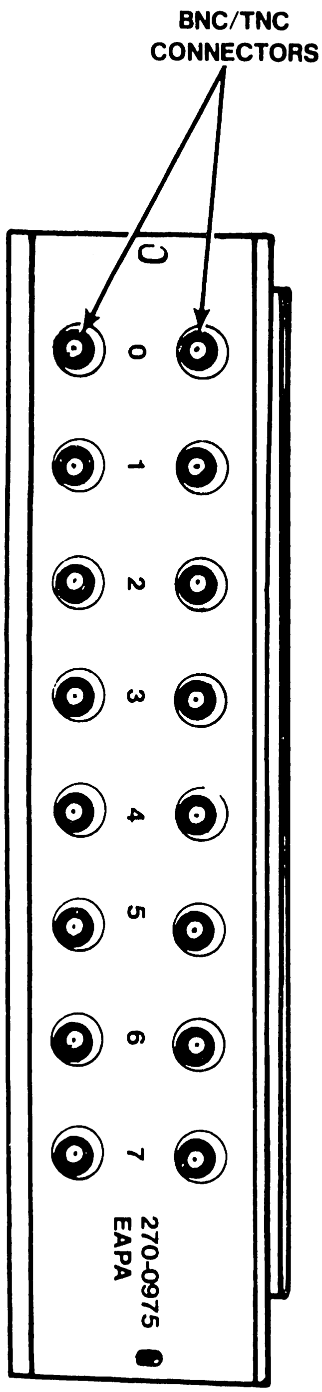


Figure F-16. WangNet 19-Channel Global Modem Assembly (270-1020)



B-02820-FY86-45

Figure F-17. Model VS-PA-8C EAPA Panel (270-0975)

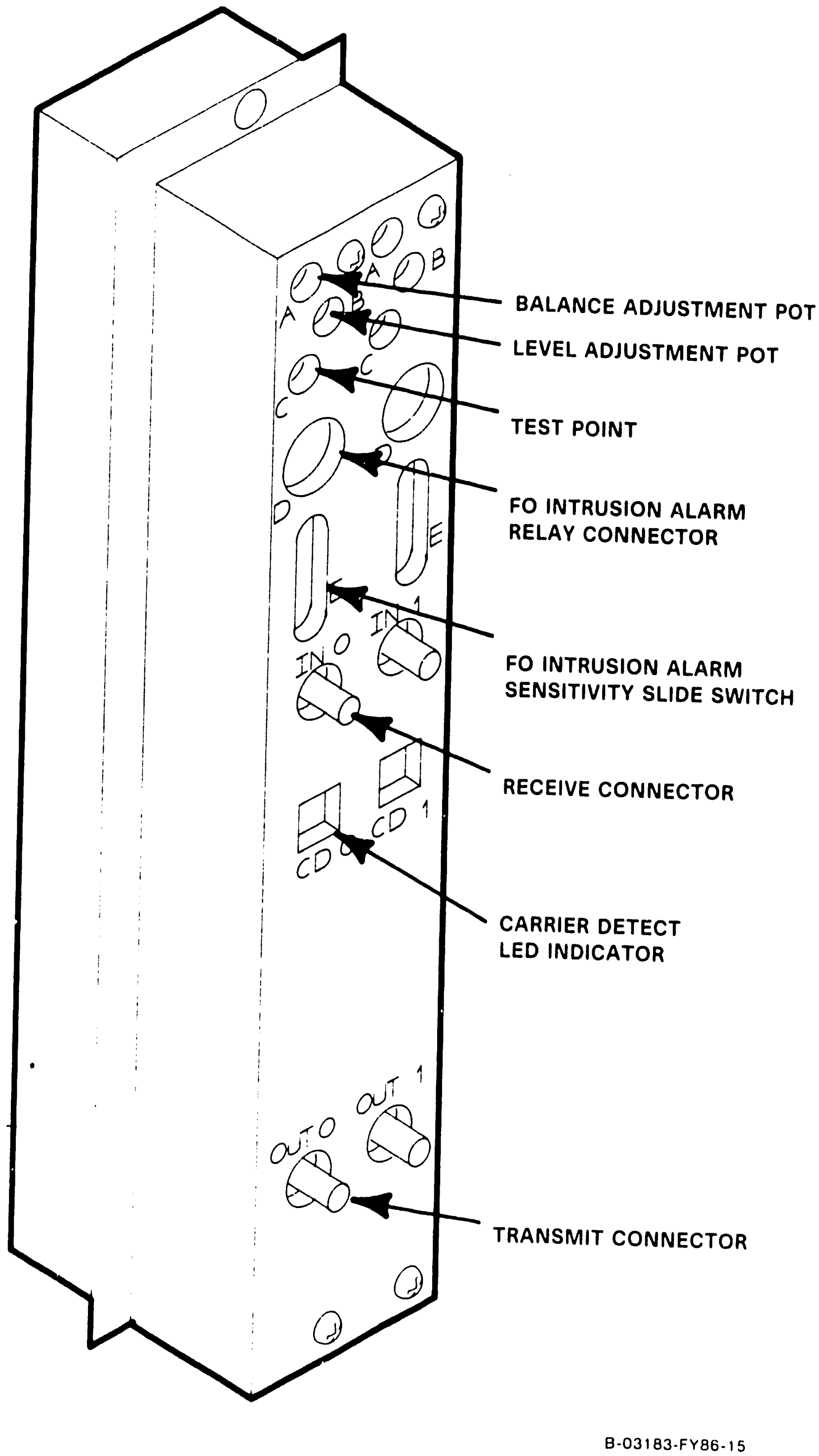


Figure F-18. Model VS-APA-2S FiberWay Panel Assembly (279-0727)

F.7 TROUBLESHOOTING

This section discusses the diagnostics available for the Modular SIO Subsystem. The diagnostic programs provide comprehensive testing of the UISIO PCA, EAPAs in conjunction with an operational workstation and UISIO, FWAPAs in conjunction with an operational workstation and UISIO, and the 19-channel global modem and UISIO using the loop-back device.

F.7.1 DIAGNOSTIC FACILITIES

The Modular SIO Subsystem uses the same diagnostic facilities available to other intelligent PCAs on the VS Computer System. PROM encoded power-up core diagnostics are used to test the internal operation of the UISIO DAF.

Off-line diagnostics controlled by the Bus Processor are used to test the operation and interfacing of the UISIO with other system subassemblies. The Self-Test Monitor (STM) has been modified to include the UISIO DAC when the UISIO is the primary serial I/O device adapter (decode address 0400). The STM performs additional subsystem tests immediately after power-up and whenever the system is initialized.

The VS Diagnostic Monitor is available in on-line and off-line versions. Normally, the on-line Diagnostic Monitor will be used to test the subsystem at installation and whenever an error is indicated by the system. Off-line diagnostics are found on diskette DIAG2 (WLI P/N 732-8031) of the CP7 Stand-Alone Diagnostic Monitor Package.

F.7.2 UISIO DAC SELF-TEST MONITOR DIAGNOSTICS (@ST0800@)

The Self-Test Monitor Diagnostics for the UISIO are functionally identical to those of the VS-15/25/45 Intelligent Serial I/O Device Adapter. The disk-based STM has been modified to recognize the UISIO (928W) hardware, the new CP7 and 80286 BP, and the timing differences found on the VS-15 Computer System.

The STM routine calls up program @ST0800@ when the UISIO is the primary serial I/O device. Workstation Zero must be attached (as logic device zero) via an EAPA and the UISIO must be set for Physical Device Address (PDA) 0400.

If the UISIO is configured as the second SIO on the system, the STM program (@ST0800@) will not test the second SIO device adapter; testing must be accomplished using either the on-line or off-line Diagnostic Monitor Package.

F.7.2.1 Self-Test Monitor Diagnostic Error Codes

The STM Diagnostic Error Codes for the Modular SIO Subsystem are identical to the error codes for the VS-15 ISIO Device Adapter. When a UISIO failure occurs while running the STM, the 70xx error code series will be activated and displayed. This condition may be corrected by re-IPLing the system. Refer to Appendix B of the VS-15 PMM for the STM Error Codes.

F.7.3 SMALL SYSTEM VS DIAGNOSTIC MONITOR PACKAGE

The Small System VS Diagnostic Monitor Package for the VS-15 has been released under WLI P/N 195-2458-0, Rev. 2561. The package includes on-line and off-line versions, documentation, and 8 inch and 5-1/4 inch floppies for documentation and software.

In addition, the package includes the latest version of the Self-Test Monitor software discussed above. VS-15 Computer Systems with VSOS 6.41.00 or higher should be updated to the most recent version.

F.7.3.1 Modular SIO Subsystem Diagnostic Monitor Program

The Diagnostic Monitor should be used when installing a new Modular SIO Subsystem or when replacing subsystem components. If a failure occurs while running the Self-Test Monitor, the system will default to the monitor and must be re-IPLed to clear the monitor access screen.

F.7.3.2 Accessing the Diagnostic Monitor's Menus

The on-line Diagnostic Monitor may be accessed during normal power-up procedures by pressing PF8 at the IPL Selection screen or by IPLing directly from the off-line Diagnostic Monitor diskette DIAG2.

Once the Diagnostic Monitor is accessed, the initial screen displayed on Workstation Zero will be the Cautionary Notice screen. Responsibility for the use of the Diagnostic Monitor must be acknowledged prior to access. The operator may then interface with the Diagnostic Monitor through three menus: the Program Selection Menu, the 928 Device Adapter Address Selection Menu, and the Modular SIO Subsystem Subassembly Test Selection Menu.

```
           Small System VS Diagnostic Package  Version  R2561
                         Test Selection Option

 To Select Tests, Position Cursor And Press Any NON-BLANK. Press SPACE
 or DELETE To Deselect a Test. Press PF8 to Start An Automatic Sequence.
 Press ENTER to Begin Testing. Press PF16 to Terminate.

           Test Name

□  1  USART/Modem/RIPL Diag
□  2  Bus Processor Diag
□  3  T.C. DA 1-Port
□  4  T.C. DA 2-Port
□  5  Dumb 928 Data Link DA
■  6  Universal Smart SIO DA
□  7  8-Port RS232 DA Diag
```

Figure F-19. Diagnostic Monitor Program Selection Screen (Floppy Diskette Volume: DIAG2)

If a 19 channel global modem is to be tested, a 40db loop-back device is required. Attach the attenuators to each other and to the modem's silver (Rx) connector. Attach the appropriate ends of the coaxial cable to the attenuators and to the modem's gold (Tx) connector. Refer to figure F-20.

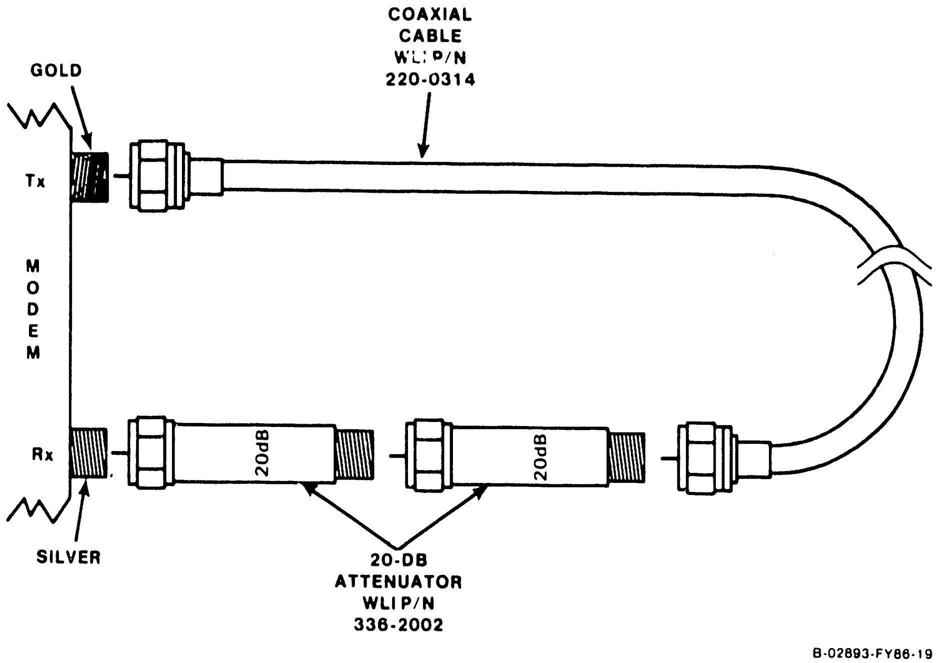


Figure F-20. Global Modem Loop-back Test Equipment

```
            Small System VS Diagnostic Package  Version  R2561

(1) = Error Loop    (4) = Program Loop    (7) = Step          (16) = Exit
(2) = Routine Loop  (5) = Pause          (10) = Clear all Settings
(3) = Stop on Error                      (13) = Display Error Log
Program Name: R14A4 928 DA Interface Diagnostic  Error Count          = 00000
Routine Name:                                    Routine Loop Count = 00000
Error Code  =-                                   Program Loop Count = 00000
Program Status: Test In Progress                 Monitor Pass Count = 00000

Messages:
A 928 Device Adapter has been located on the system at the address
displayed below.  Press ENTER to use the address displayed or if a
second 928 is to be tested, type in its address and then press ENTER.

(Valid DA Address: 0100, 0200, 0300, 0400, 0500, & 0600)

 00
```

Figure F-21. Diagnostic Monitor UISIO 928 DA Address Selection Screen

```
           Small System VS Diagnostic Package  Version  R2561

(1) = Error Loop    (4) = Program Loop     (7) = Step           (16) = Exit
(2) = Routine Loop  (5) = Pause           (10) = Clear all Settings
(3) = Stop on Error                       (13) = Display Error Log

Program Name: R148C VS-15 Fixed Disk DA Diag    Error Count          = 00000
Routine Name: 00 Initialization & Interrupts -- Routine Loop Count = 00000
Error Code  =                                   Program Loop Count = 00000
Program Status: Test In Progress                Monitor Pass Count = 00000

Messages:
TYPE in the Test number in HEX to be executed, then press "ENTER".

00  BR & Refresh Test
01  BR & Modem Loop-back (Ch 0-5)
02  BR & Modem Loop-back (Ch 0-5, 13-1F)
03  BR & Modem Loop-back (User Selectable)
04  BR & Loop-back Connector #1 tests
05  BR & Loop-back Connector #2 tests
06  BR & Baseband tests (Electric, User Selectable)
07  BR & Baseband tests (Fiber-Optic, User Selectable)

00
```

Figure F-22. Modular SIO Subsystem Subassembly Test Selection Screen

After successfully testing the Modular Serial I/O, be sure to enter the required information in NVRAM System Configuration, Hardware Configuration, and Service Log fields.

APPENDIX G
EXTERNAL DISK CONTROLLER

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SECTION G

EXTERNAL DISK DRIVE OPTION

G.1 INTRODUCTION

This appendix contains the necessary information to allow the addition of external disk drive(s) to the VS-15 Computer System using the 25V50 Disk Drive Device Adapter with its related hardware and software. The appendix provides instructions for upgrading the system's on-line storage allowing the support of up to six Wang disk drives and two controllers (including the Wang Small Data Storage Cabinet).

The device adapter is supplied in two upgrade kit configurations based on the number of disk drives to be supported. Instructions are provided for the removal and installation of the related subassembly components. Descriptions, specifications, and diagnostic information for the device adapter and upgrade kits are also included.

G.1.1 APPLICABLE DOCUMENTATION

Documentation related to the Wang supported external disk drives may be found under the appropriate Class Codes in the Wang Technical Documentation Catalog/Index (WLI P/N 742-0000). The Wang Corporate Resource Catalog (WLI P/N 700-7647) identifies additional product documentation.

G.1.2 EXTERNAL DISK DRIVE DEVICE ADAPTER DESCRIPTION

The 25V50 External Disk Drive Device Adapter is currently offered in two versions, 2-port and 4-port, allowing the use of up to four single port disk drives or two dual port disk drives per 4-port controller. Each version of the device adapter supports:

- Up to 64 sectors per track.
- Sector sizes of 256 and/or 2048 bytes.
- Multi-sector operations without Bus Processor intervention.
- Rotation optimization.
- A First-In-First-Out (FIFO) buffer.
- Error Correction.
- Write, then Read, ECC diagnostic modes.

G.1.3 EXTERNAL DISK DRIVES SUPPORTED

The External Disk Drive controller will control any combination of disk drives limited only by the number of ports. The external disk drives supported, including the Small Data Storage Cabinets (SDSCs), are listed in table G-1. (A customer supplied drive must be one of the drives listed.)

Table G-1. Disk Drive Types and Data Storage Combinations

MODEL NUMBER	CAPACITY (FORMATTED)	DISK DRIVE TYPE(S) AND COMBINATIONS
2265-V1	75 Megabytes	STORAGE MODULE DRIVE (REMOVABLE)
2265-V2	288 Megabytes	STORAGE MODULE DRIVE (REMOVABLE)
2265-V3	620 Megabytes	FIXED MODULE DRIVE
2267-V1	76 Megabytes	REMOVABLE STORAGE DRIVE
2268-V1	76 Megabytes	FIXED DISK DRIVE
2268-V2	147 Megabytes	FIXED DISK DRIVE
2268-V3	314 Megabytes	FIXED DISK DRIVE (Large Cabinet Only)
2280-V3	90 Megabytes	15 MB REMOVABLE AND 75 MB FIXED DISK DRIVES
2293V-C1	76 Megabytes	SMALL DATA STORAGE CABINET (REMOVABLE DISK)
2293V-C3	223 Megabytes	SDSC (76 MB REMOVABLE AND 147 MB FIXED)

The SDSCs have two pairs of 'A' and 'B' cable connectors (Drives-0 and 1) mounted on the lower left of the rear cover. When equipped with two drives, the drives are daisy-chained internally. The second external 'A' connector is used for the terminator or to daisy-chain another external drive cabinet.

G.1.4 EXTERNAL DISK DRIVE DEVICE ADAPTERS AND UPGRADE (UJ) KITS

The addition of an external disk drive to a VS-15 requires the installation of a rear cable connector panel, along with the addition or changing of the disk drive device adapter. The two types of kits available for the VS-15 mainframe include all necessary hardware to complete the installation.

When installing an external drive to a VS-15 equipped with only an internal fixed disk drive(s), an External Disk Drive Controller and a rear cable connector panel are required. The Rear Connector Panel provides 'A' and 'B' cable clamps to ground the cable shields and to secure the external drive cables in place. No other hardware is required when installing a new drive.

Table G-2. External Disk Drive Panel Subassembly Kit Descriptions

SUBASSEMBLY DESCRIPTION	SUBASSEMBLY CEI NUMBER	DA MODEL NUMBER	DA PART NUMBER	REAR CONNECTOR PANEL WLI P/N
2-PORT DA	157/177-7346	25V50-2A/2B	210-8313/9313	270-0981
4-PORT DA	157/177-7348	25V50-4A/4B	210-8315/9315	270-0981

'A' and 'B' cables are ordered separately. Three 'A' and 'B' cable lengths are available and one daisy-chain 'A' (drive-to-drive) cable, as follows:

PART NUMBER	DESCRIPTION AND LENGTH
220-3358	'A' Cable, 15 feet
220-3359	'A' Cable, 25 feet
220-3360	'A' Cable, 50 feet
220-3355	'B' Cable, 15 feet
220-3356	'B' Cable, 25 feet
220-3357	'B' Cable, 50 feet
220-3361	'A' Daisy-chain Cable, 10 feet

G.1.4.1 External Disk Drive Upgrade Kits

Upgrade kits for the VS-15 allow the incremental addition of external disk drives to a VS-15 previously equipped with an external disk drive, or the addition of a second device adapter and external disk drives to an internal drive system. A description of the upgrade kits and their part numbers are listed in table G-3.

Table G-3. External Disk Drive Upgrade Kit Descriptions

UJ MODEL NUMBER	DISK DRIVE UPGRADE KIT DESCRIPTION
UJ-3305	25V50-1A to 25V50-2A, 1-Port to 2-Port
UJ-3307	25V50-1A to 25V50-4A, 1-Port to 4-Port
UJ-3309	25V50-2A to 25V50-4A, 2-Port to 4-Port
UJ-3310	25V50-3A to 25V50-4A, 3-Port to 4-Port

G.1.5 SOFTWARE REQUIREMENTS

VS Operating System Software release 6.30 or later (6.43 required for 2268-V3 FSD Drive) is required to support operation of the External Disk Drive Device Adapter and corresponding disk drives. The microcode software versions required to operate the EDD DA are 5.12.01 (@MCCP@), 4.02.05 (@MC25V50), and 5.04.01 (@MCBP1@) or later. Refer to the correct software release notice for software configuration instructions.

G.2 (INTENTIONALLY LEFT BLANK)

G.3 OPERATION

Operation of the VS-15 Computer System equipped with external disk drives does not require any special controls or indicators. The standard VS-15 configuration includes the necessary facilities for the user to control, operate, diagnosis, and IPL from an external disk drive. Minor changes in operation of the VS-15 are given in the following paragraphs.

G.3.1 OPERATOR CONTROLS AND INDICATORS

No special operator controls or indicators are used with the addition of external disk drive(s). Information on status and error conditions is displayed using the Front Panel HEX displays and LED indicators.

Depending on the disk drive configuration, the Boot Device Switch, may now become operational in all three positions. When the Boot Device switch is placed in the EXT. (External) position, the system will IPL from the external drive. Later (or upgraded) versions of the VS-15, equipped with a NEC Internal Disk Drive, will require two 25V50 DAs (25V50-0 for the NEC) and will IPL from either the FIXED or EXT. Boot Device switch position.

G.3.2 SERVICE CONTROLS AND INDICATORS

Service controls and indicators applicable to the installation of the External Disk Drive device adapter are discussed in paragraph G.4.3 of this appendix.

G.3.3 OPERATING PROCEDURES

Prior to installation of the external disk drive optional hardware, ensure the VS-15 Computer System is fully operational. If necessary, perform the power-up and verification procedures as outlined in paragraph 3.5 in the VS-15 manual.

G.4 INSTALLATION

This section includes information for unpacking, inspecting and installing the components of the external disk drive subassembly and/or upgrade kit into the VS-15 Mainframe. General information concerning VS-15 installation is found in Chapter 4 of the VS-15 Computer System manual.

G.4.1 UNPACKING

Before unpacking the subassembly and/or upgrade kit and disk drive(s), refer to paragraphs 4.4 and 4.5 in VS-15 manual. Proceed with the unpacking and inspection as given below. If damage is noticed, follow the procedures given in Chapter 4.

1. Inspect the shipping containers for any visible signs of damage.

2. Inspect the contents of each shipping container for any signs of loss of integrity, or other signs of damaged, lose, or missing components.

3. Check all items against the shipping bill(s) to ensure that the correct items where shipped and that none are missing.

4. If any damage is noted, notify your service manager.

G.4.2 PREINSTALLATION SOFTWARE AND HARDWARE VERIFICATION

Perform the verification procedures outlined below to ensure correct system operation prior to installation. If required, refer to paragraph 4.10 in the VS-15 maintenance manual for the complete IPL procedure.

G.4.2.1 VS Operating System Software Verification Procedure

Verify the VS Operating System (VSOS) microcode files as follows:

1. From the Operator's Console Menu, verify that the operating system software is the correct versions needed to install the external disk drive option. Press PF14, SYSTEM OPTIONS, then PF7, Display SYSTEM VERSIONS, and verify that the VSOS Nucleus (@SYSGEN@) is 06.30.00 or later. If the VSOS Nucleus is 6.40.00 or later, no further verification of microcode is required); otherwise, for 6.30.xx, the BP and CP microcode versions must be 05.04.01 and 05.12.01 or later respectively.

2. If the BP, CP, or Nucleus are incorrect, be sure that the correct VSOS software is available for installation. Earlier VSOS versions will NOT recognize the device adapter during system generation.

G.4.2.2 Hardware Configuration Verification Procedure

Installation of the external disk drive option requires the utilization of priority I/O Address Decode "0100". Determine the I/O Address Decodes in use, and if necessary, assist the customer in generating a new system configuration file, using the following procedure:

1. Log onto the system using any appropriate LOG-ON allowed by the customer.

2. Prior to any changes in either software or hardware, be sure that the customer has performed any system back-up required.

3. If the customer has created a new configuration file in advance, proceed with step 5 and verify the I/O Address Decode priority.

4. Run the program COPY and create a NEW system configuration file in library @SYSTEM@. Name the new file (such as @NEWFIG@) and copy the customer's system configuration file into the new file.

5. Run program GENEDIT and call up the newly created system configuration file, and configure the system to support the External Disk Drive Controller using the 25V50 model number.

6. If the system has a 25V50 installed for the internal drive (the I/O Decode "Jumper Address" should be "0200"), the second 25V50 must be configured for a "Jumper Address" of "0100" in order to be recognized when the Boot Device Switch is in the EXT. position.

7. When installing an additional external drive, the system configuration file will only require adding the new drive model number in the correct 25V50 port position of the original configuration file.

8. SAVE the new configuration file and EXIT the GENEDIT program.

9. Before installing an updated software package, rename any old files (such as @MCBP1@ to @MCBPOLD, or @MCCP@ to @MCCPOLD) first, then COPY the new files onto the system disk.

G.4.3 EXTERNAL DISK DRIVE DEVICE ADAPTER CONFIGURATIONS

The initial external disk drive option included four different configurations of the device adapter. The device adapter supplied with the upgrade kit was determined by the number of external drives being supported. The four models available required changing the device adapter each time a drive was added to the system. There are one, two, and four-megabyte memory addressable versions in the field. (See table G-4 for a brief description and the WLI P/N for each version.) The most recent versions now are the two or four-port models. The installation procedures and cabling requirements are virtually the same for all models. For this appendix, only the 2-Port and 4-Port models are discussed.

Table G-4. Disk Drive Device Adapter

WLI PART NUMBER	BOARD DESCRIPTION	MINIMUM E. REV. LEVEL
210-8312-A	One-Port Disk Drive DA PCA	4
210-8313-A	Two-Port Disk Drive DA PCA	4
210-8314-A	Three-Port Disk Drive DA PCA	4
210-8315-A	Four-Port Disk Drive DA PCA	4
210-9313-A	Two-Port Disk Drive DA PCA (4-MB)	0
210-9315-A	Four-Port Disk Drive DA PCA (4-MB)	0

G.4.4 EXTERNAL DISK CONTROLLER INSTALLATION PROCEDURES

The general removal and replacement procedures given in paragraphs 5.3 of the VS-15 FCS manual should be followed whenever a printed circuit assembly (PCA) is to be removed.

1. Press the green Control Mode button. This prevents any disk I/O command in process from being halted prior to completion.

2. Observing all necessary precautions and power-down the mainframe and peripherals as required (refer to paragraph 3.7).

3. Remove the top cover as described in paragraph 5.3.2.1.

NOTES

1. If Quantum Drive(s) are the internal Drive(s), the Internal Drive Controller PCA Must Be installed in Slot 5 (I/O DA2) and CAN NOT BE interchanged with the 2-Port or 4-Port SMD Controller.

2. If internal drive(s) are either NEC 76MB or 147MB, the Internal Drive Controller can be replaced with a 2-Port or 4-Port SMD Controller depending on configuration requirements. In the event the SMD controller is replaced, the internal drive must be cabled to SMD Controller Port 0.

3. The Boot Device Selection Switch is I/O Address Decode dependent. FIXED will only function with the PCA Jumper Address set for '0200' and EXT. with the PCA Jumper Address set to '0100'.

INTERNAL DRIVE CONTROLLER REPLACEMENT

4. If NEC drives (147MB or 76MB) are installed and the SMD Controller is to be replaced perform the procedures listed below.

   a) Remove 'A' Cable and 'B' Cable from the Internal Drive Controller.

   b) Remove Drive Controller from the Motherboard by lifting the snap-locks to free it from the Motherboard connectors. Once the DA is free, lift it straight up the board guides and out of the cardcage.

   c) Set the address jumpers on the replacement SMD Controller (figure G-1 - G-4) to address '0200' (FIXED). Set Drive-Type switch setting (figure G-5) for Port 0 for the internal drive used (76MB or 147MB NEC).

d) Install the PCA in Motherboard slot number 5 (I/O DA2) by inserting the DA into the card cage guides and lowering it to the Motherboard connectors. Make sure the controller's edge connectors are in-line with the Motherboard connector slots and the snap-lock tabs are under the top rails. Carefully press down the snap-locks to seat the device adapter in the Motherboard.

e) Reconnect all cables with pin 1 toward the front of the mainframe. Return each cable to its respective cable holder by routing it along the mainframe as previously noted.

EXTERNAL DRIVE CONTROLLER INSTALLATION

5. To install an External Drive Controller perform the following:

   a) Set the address jumpers on the SMD Controller used (figure G-1 - G-4) to address '0100' (EXT). Set Drive-Type switch settings for the external drive(s) used or to No Drive (figure G-5).

   b) Note cable position and remove any cables that prevents installation of the SMD Controller.

   c) Install the PCA in Motherboard by inserting the DA into the card cage guides and lowering it to the Motherboard connectors. Make sure the controller's edge connectors are in-line with Motherboard connector slots and the snap-lock tabs are under the top rails. Carefully press down the snap-locks to seat the device adapter in the Motherboard.

   d) Replace cables removed in step b.

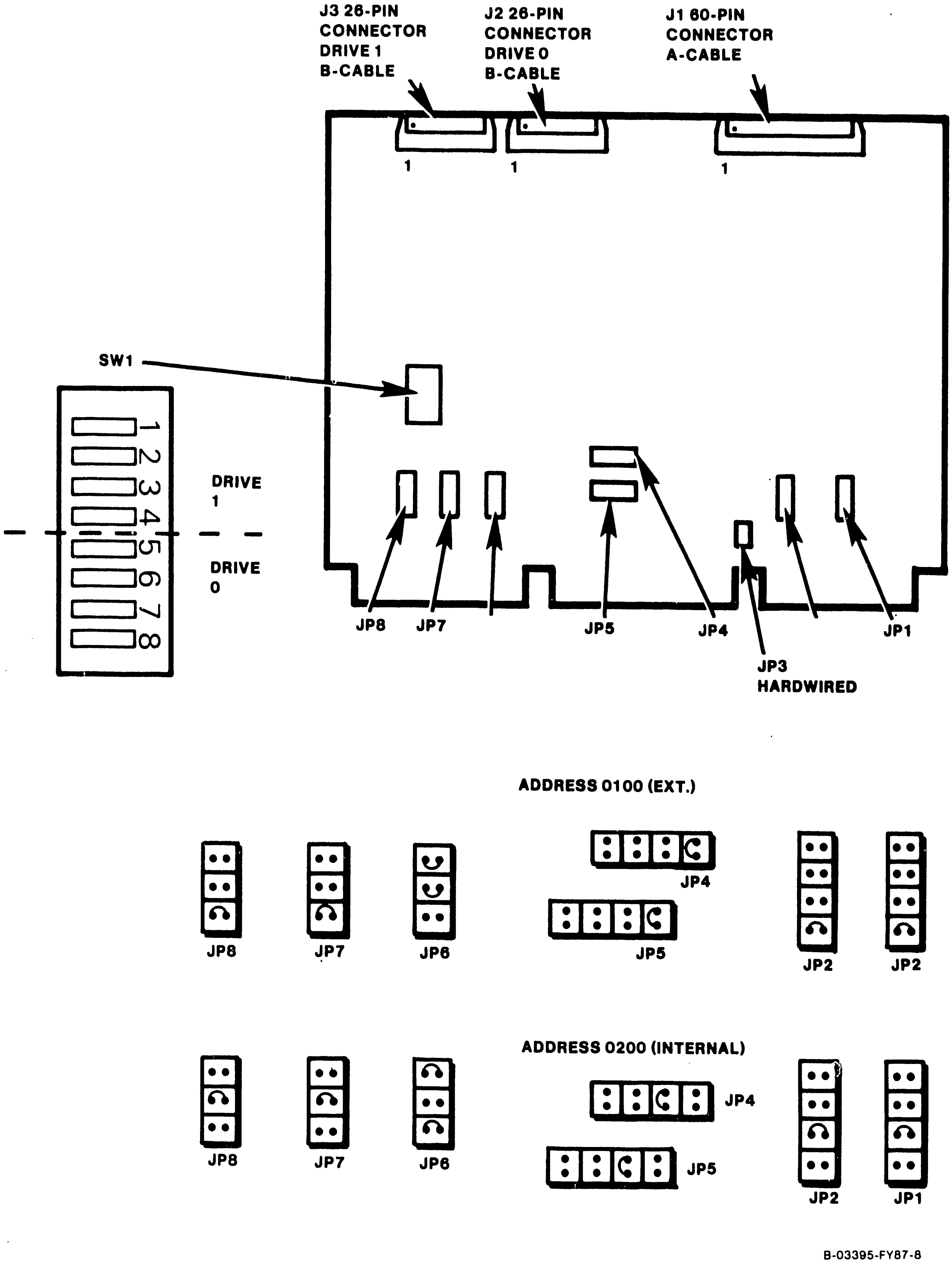


Figure G-1. 2-Port SMD DA Jumper and Switch Locations (P/N 210-8313)

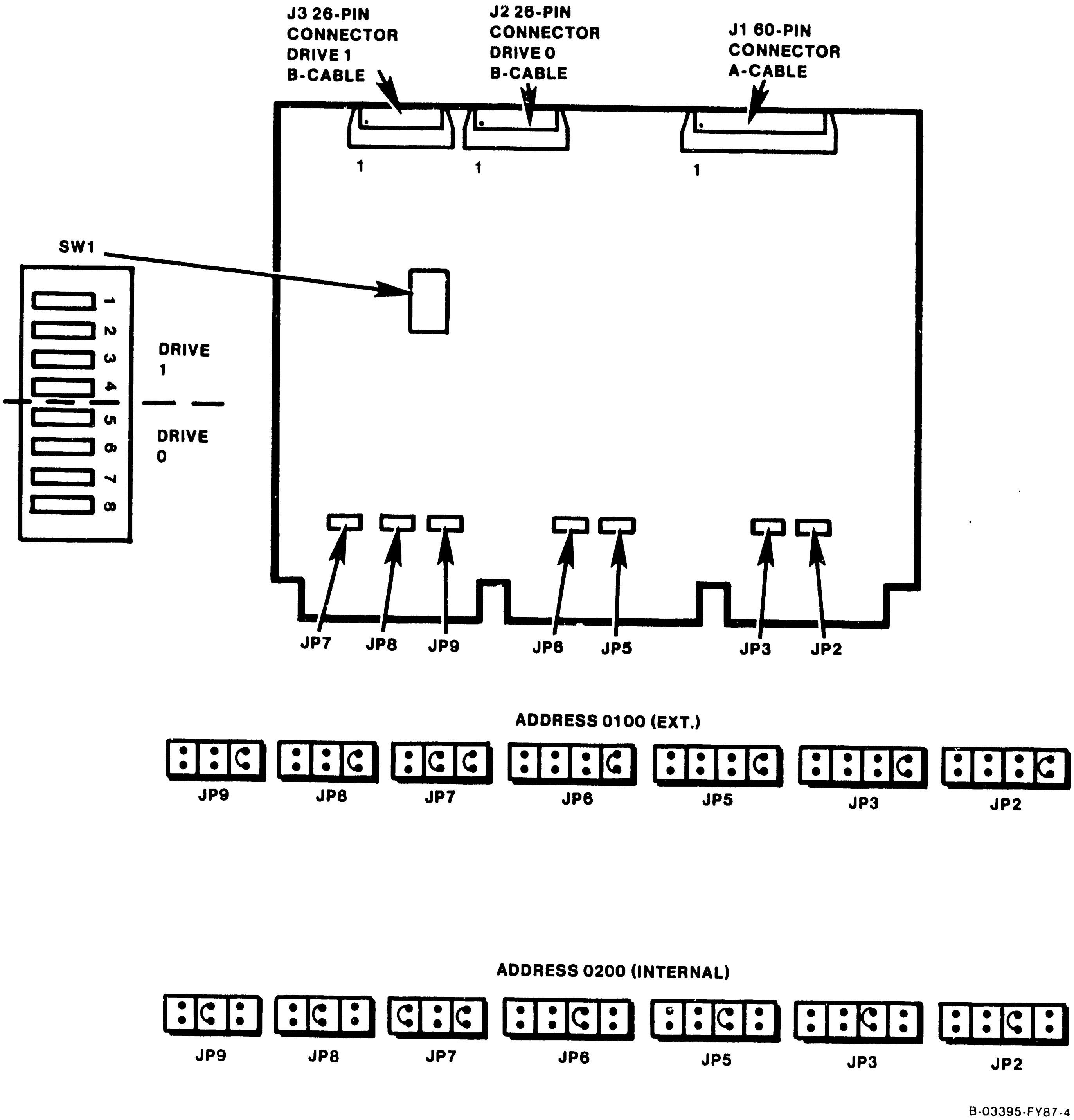


Figure G-2. 2-Port SMD DA Jumper and Switch Locations (P/N 210-9313)

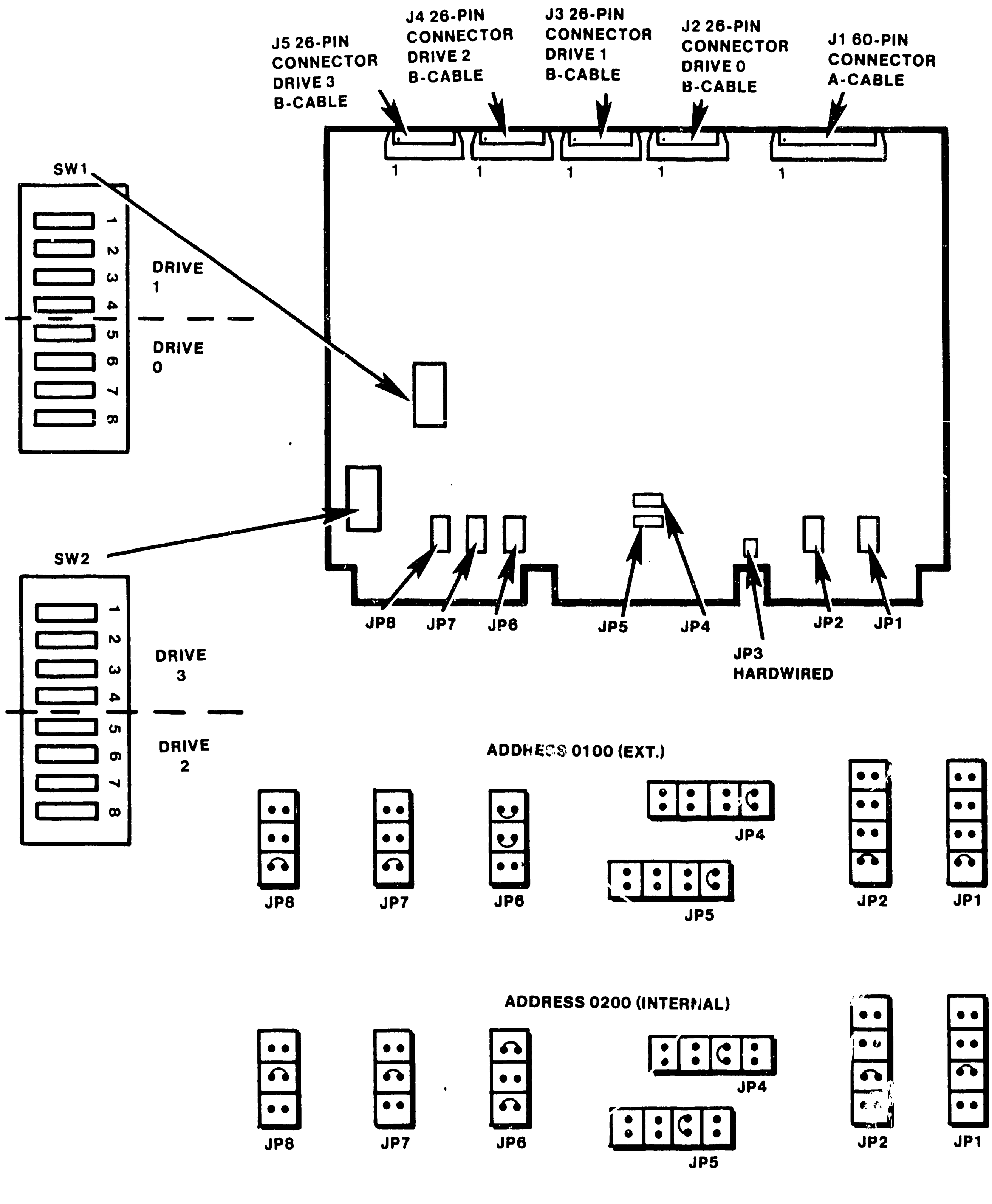


Figure G-3. 4-Port SMD DA Jumper and Switch Locations (P/N 210-8315)

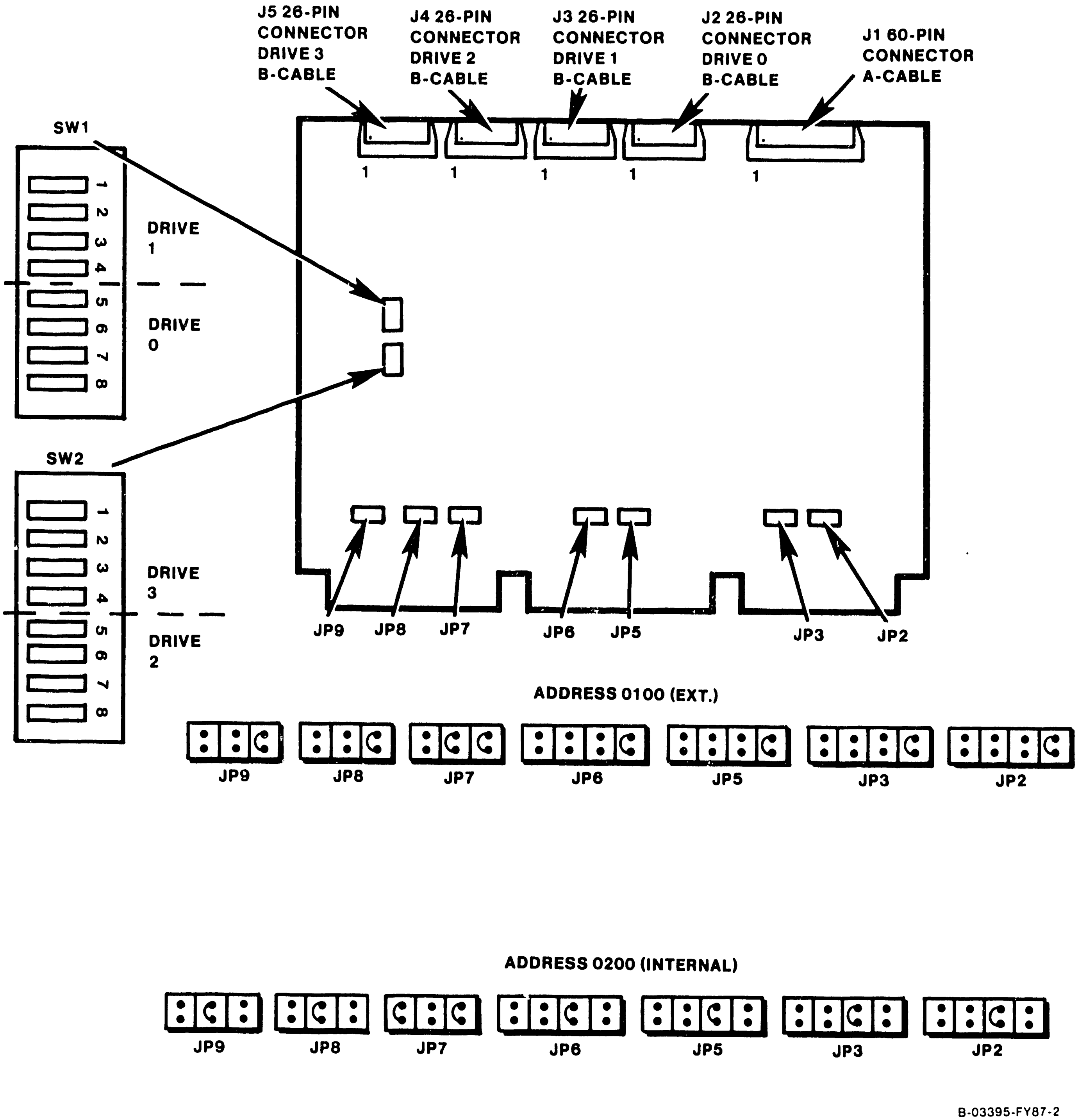


Figure G-4. 4-Port SMD DA Jumper and Switch Locations (P/N 210-9315)

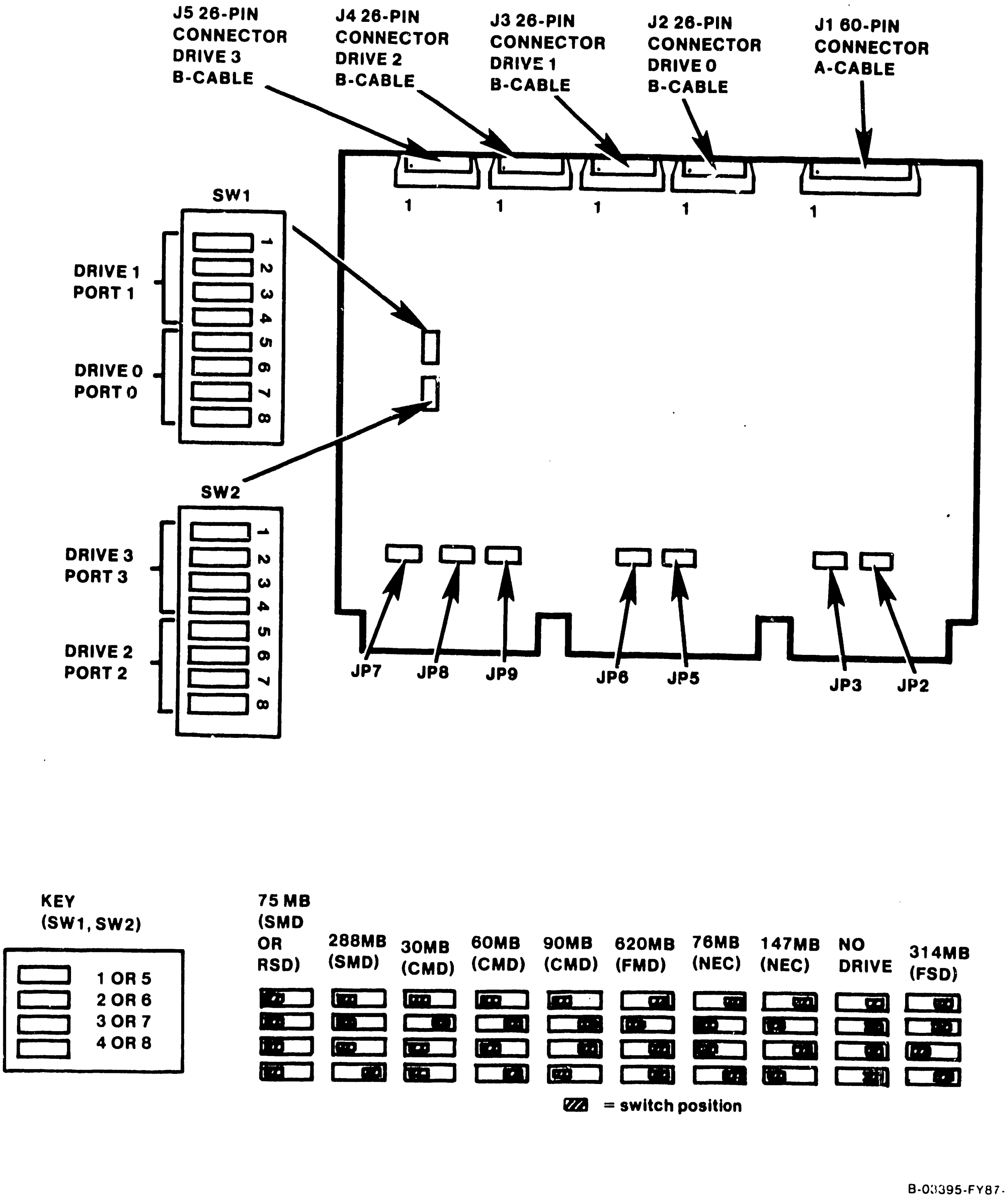


Figure G-5. SMD DA Switch Settings (210-9315 PCA Used in Example)

G.4.5 DISK DRIVE 'A' And 'B' CABLE INSTALLATION

The external disk drive cables (disk drive to mainframe) must be connected through the Disk Drive Cable Connector Panel (WLI P/N 270-0981) located on the Rear Panel Assembly. Two sizes of cable clamps are located on the connector panel; four narrow clamps that secure the B-cables and one wide clamp that secures the A-cable.

G.4.5.1 External Disk Drive Cable Connector Half-Panel Installation

Install the Disk Drive Cable Connector half-panel in the lower left rear half-panel location of the VS-15 cabinet as follows:

1. The half-panels interlock on the right side of each panel (see inset). The half-panel adjacent to the panel being removed/replaced must be removed to allow half-panel insertion. Loosen half-panel mounting screws of the two right-most lower half-panels and slide panels to the right. Remove the screws from the left-most two panels and remove.

2. Install the cable connector panel first, then install the adjacent panel and secure in place with the mounting screws. Reposition the right-most half-panels and secure in place.

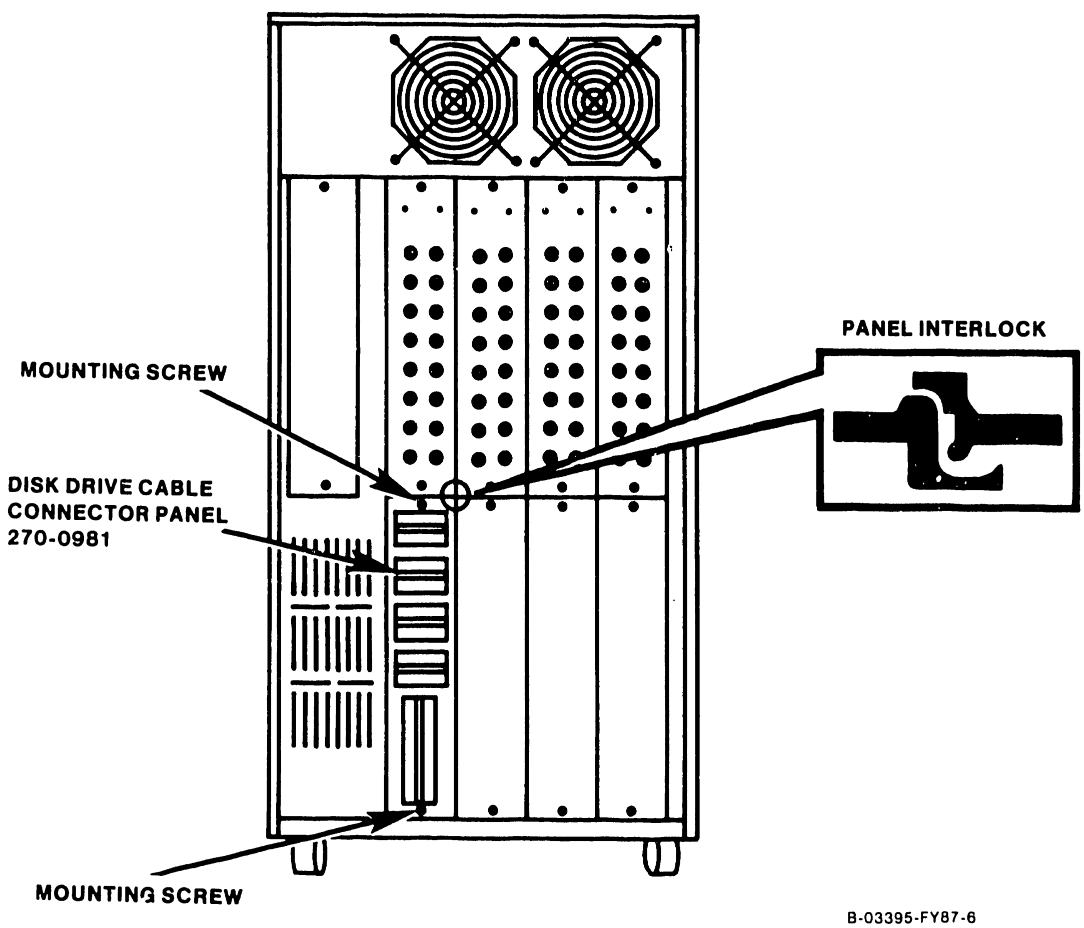


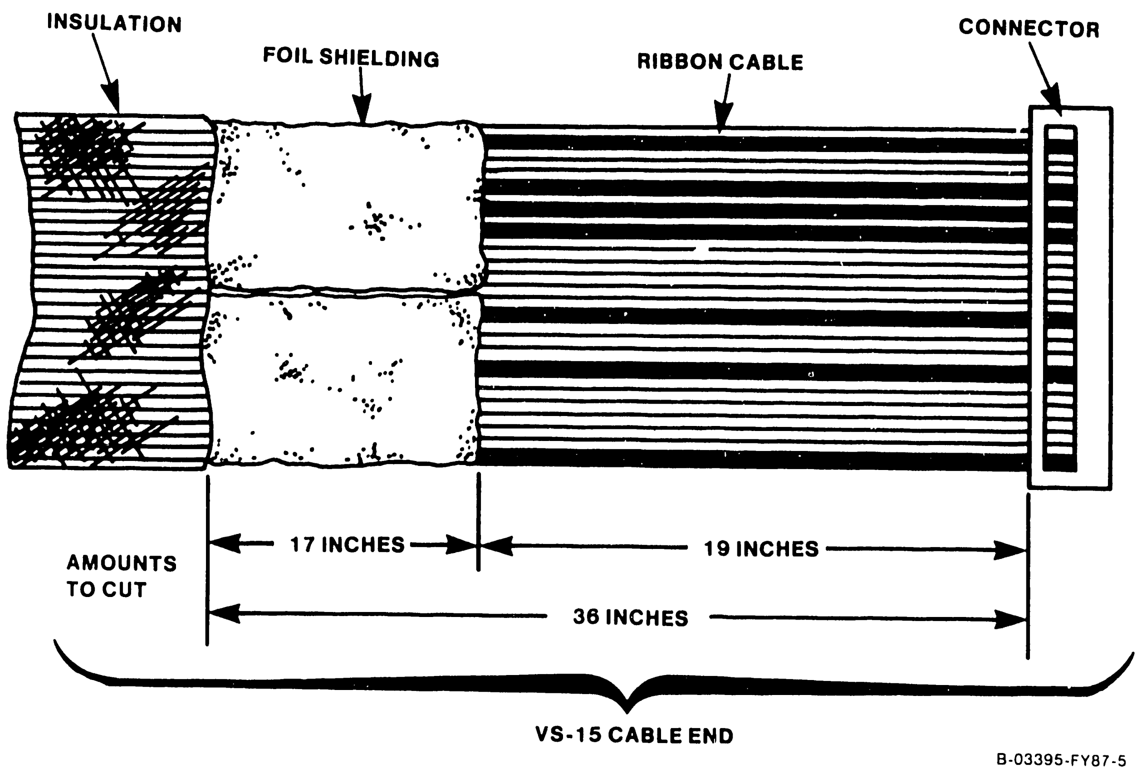
Figure G-6. Disk Cable Clamp Panel Installation

G.4.5.2 External Disk Drive Cable Preparation

When connecting an external disk drive, the cables must be prepared to ensure correct installation at the mainframe. Cables received with the disk drive(s) should be pre-stripped for installation. If not, proceed as follows:

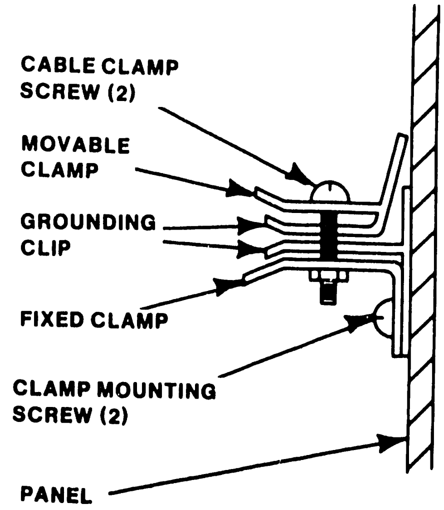
1. Remove approximately 36 inches of plastic insulation sheathing from the cable end being installed at the mainframe. The length removed depends upon the distance required from the connector panel to connection point.

2. Peel back the foil shielding approximately 19 inches to allow the cable to be routed from the device adapter port along the cable channel to the cable clamp connector panel without stressing it.



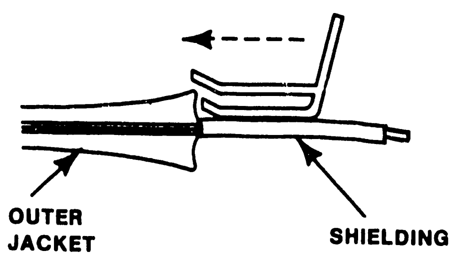
G.4.5.3 Disk Cable Connector Panel Cabling

1. Remove the movable side of the cable clamp ('A' and 'B') by removing the Phillips screws on movable side of clamp.

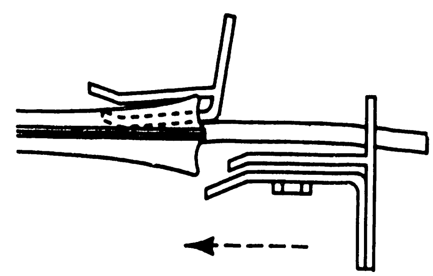


2. Feed disk cables and shields through the cable clamps and route exposed cable along its proper channel into the mainframe cabinet.

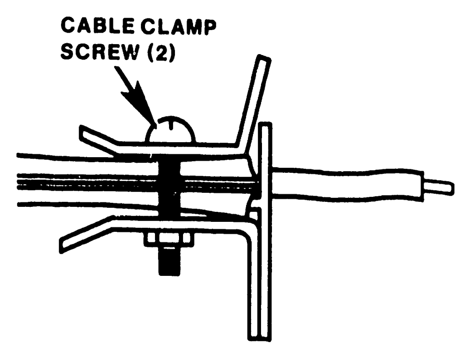
3. On the movable side of the clamp, position cable grounding shield between the cable clamp grounding clip and the outside plastic cover.



4. On the fixed side of the clamp, position cable clamp grounding shield between the cable clamp grounding clip and the outside plastic cover.



5. Be sure cable is properly position to avoid pinching and reassemble cable clamp's movable side to the fixed side and secure with the two cable clamp screws.



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G.4.6 MAINFRAME POWER-UP AND TESTING

After installation of the new device adapter perform the following:

1. Position the Local Control/Remote Diagnostic/Remote Control switch to the Local Control position.

2. Select the diskette drive by setting the Boot Device switch to the UP (Floppy) position. No diskette should be in the drive.

3. Press the ac power On/Off switch to the one '1' position.

4. The Power-On, Not-Ready LEDs, diskette drive Activity LED and the four HEX Displays should light. The fans, internal disk drive motor, and diskette drive motor (briefly) should be running.

5. The Front Panel HEX display will flash 0000 and then begin decrementing from FFFF to 0000 and then count up from 00FF through a series of diagnostic routines (starting at 1000, 1100, through 1600) and stop at 9820, Diskette drive not ready. If any number (except 9820) is displayed for more than 20 seconds, the system has failed one of the diagnostics. Refer to paragraph 8.5.1 in the VS-15 manual for a complete diagnostic power-up discussion.

6. Perform a voltage check at the motherboard test points (paragraph 4.7.1). If the dc voltages are out of tolerance, adjust the voltages to within the operating limits.

7. Observed all power-down precautions and power down the mainframe as described in chapter 3 paragraph 3.7 of the VS-15 manual.

8. Replace all main frame covers removed for the SMD Controller board installation and cabling.

G.4.6.1 Mainframe IPL Procedure

1. Power-Up external disk drive(s). The disk drive(s) should be in the 'Not Ready' state.

2. Set the Local Control/Remote Diagnostic/Remote Control switch to the Local Control position.

3. Set Boot Device switch to select appropriate IPL drive:

   Up = Floppy
   Center = Fixed Drive connected to Disk DA address 0200 Port G.
   Down = EXT. Drive connected to Disk DA address 0100 Port G.

4. Power-On the mainframe by positioning the ac power switch to the On (1) position.

5. Make Ready the external drive(s).

6. The HEX display on the Front Panel will begin counting down from FFFF. In about 45 seconds, the power-up diagnostics will complete and WS-0 will display the Self-Test Monitor screen.

```
              Small System VS Self Test Package Version R2xxx
                           IPL Drive Selection
                        Bootstrap Volume = SYSTEM

 Device       Capacity       Type      Volume        Status

 2270V5        360 Kb        Dsket
■ 2268V1       76 Mb         Fixed      SYSTEM
 2268V1        76 Mb         Fixed      DATA

 Position Cursor to Indicated Device and Select:

(ENTER) Test & IPL                      (PF8) Stand-Alone Diagnostic Monitor
```

Figure G-7. Self Test Monitor and IPL Drive Select Screen

7. Position the cursor next to the IPL volume name and press ENTER. The Self-Test Monitor diagnostics will begin running (figure G-8).

```
        Small System VS  Self Test Monitor Package Version R2620
                         System hardware Status
                         System Volume = SYSTEM

Status              Diagnostic

Passed              (SIO) Serial Data Link test
Passed              (BP) BP UART Loopback Verification Test
Running             (CPU) CPU CP Control & CP/BP Test
                    (CPU) CPU Random Operand Test
                    (CPU) CPU CP Integrity Test
                    (MM) Main Memory Integrity Test
                    (MM) Main Memory Integrity test
```

Figure G-8. System Hardware Self-Test Screen

8) This screen indicates that the VS-15 is testing system components. The results of each test is displayed with the message sequence: 'Loading', 'Running", 'Passed', 'Non-Fatal Error', 'Fatal Error'. If the status is 'Passed', the system is ready to begin initialization.

   A Non-Fatal Error message and Fatal Error Message will display an error code of the failure. Refer to Appendix B for error code definition.

   Press 'ENTER' to continue the IPL sequence. The prompt "Loading System Microcode" is displayed and system initialization begins. In about 10 seconds, the message 'Diagnostics Complete, Beginning System Initialization' appears on WS0 and the Not Ready LED turns off.

9) The SYSGEN screen appears. The SYSGEN screen displays the name of the configuration file last used (SYSFILE Field). NOTE: During Initial IPL, the SYSGEN configuration screen does not display a default value for the name of the communications configuration file. The default system configuration file name @CONFIG@ in @SYSTEM@ should be entered.

*** MESSAGE M001 BY SYSGEN

INFORMATION REQUIRED

Specify the name of the system configuration file and press (ENTER)

SYSFILE = @CONFIG@
SYSLIB = @SYSTEM@

Specify the communications configuration file to be used, if any

COMMFILE = [redacted]
COMMLIB = @SYSTEM@

Inhibit Logons at all workstations? LOGONS = NO

Figure G-9. SYSGEN Screen

10) Enter another valid configuration file name in the filed 'SYSFILE' and press 'ENTER' or press 'ENTER' to select the configuration file displayed.

11) If the system is using communications, specify the communications configuration file name and library.

12) Respond to the prompt 'Inhibit Logons at all workstations? Logons = NO' If YES is selected, only WS0 can be logged on to the system after the IPL is complete. NO is the default value.

13) Press 'ENTER'. The Date and Time Screen will be displayed.

*** MESSAGE WN3 BY IPL

INFORMATION REQUIRED

SET DATE AND TIME

Year = YY	Month = MM	DAY = DD
HOUR = HH	MINUTE = MM	SECOND = SS

Figure G-10. Date and Time Screen

14) Enter date and time in the format provided (use 24 hour clock time for hours) and press ENTER. In about 5 seconds, the IPL screen will appear.

```
      *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
     *                                                                     *
    *  WWWW        WWWW        AAA       NNN        NNN     GGGGGG          *
   *    WW          WW        AA AA       NNN        NN    GG     GG         *
  *     WW          WW       AA   AA      NN  N      NN   GG        GG        *
  *     WW    WW    WW      AA     AA     NN    N    NN   GG                  *
  *     WW    WW    WW      AAAAAAAAA     NN      N  NN   GG      GGGG        *
  *      WW  WWWW  WW       AA     AA     NN       N NN   GG        GG        *
   *      WWWW  WWWW        AA     AA     NN        NNN    GG     GG         *
    *      WW    WW        AAAA   AAAA   NNN        NNN     GGGGGG          *
     *                                                                     *
      *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *

                  © Copyright Wang Laboratories, Inc. 1986

                           Initial Program Load
                            VS Operating System
                          Nucleus Version 06.xx.xx
                       01024K physical memory available

        01:01:01  System Generation                      complete
        01:02:01  I/O System Initialization              in progress
        01:03:01  System Task Initialization             pending
```

Figure G-11. Initial Program Load (IPL) Screen

15) The IPL screen shows the version of the VS Operating System being used in the IPL process, the physical memory size of the system, and the status of the three phases of IPL. These phases are; complete, in progress, and pending. If during the IPL sequence the system detects any critical operating system components are obsolete or incompatible, the Version Warning Screen will be displayed. In the event this occurs refer to chapter 6 of this manual.

16) When the system initialization is completed successfully (approximately 2 minutes), the Operator's console screen is displayed.

```
                  ***  Wang VS Operator's Console  ***
             2:12 PM        Tuesday        March 22, 1986

Position to (*) and Press (ENTER) to Provide Immediate Operator Service:

Mount Volume FLOPPY on Disk 11, . . . . . . . . . . . . . . 12:40
*Assistance Required for Printer 3 . . . . . . . . . . . . . 13:32
*I/O Error Log Queued for Printing . . . . . . . . . . . . . 13:55

                   Press (1) to Return to User Mode
                                - or -
                   Use the Function Keys to Manage:

          2)  PRINT Queue                    9)  PRINTERs
          3)  PROCEDURE Queue               10)  DISKs
          4)  TRANSMIT Queue                11)  TAPEs
          5)  RETRIEVE Queue                12)  TELECOMMUNICATIONs
                                            13)  WORKSTATIONs
          6)  INTERACTIVE Tasks
          7)  NON-INTERACTIVE Tasks         14)  SYSTEM Options

Press (HELP) at Any Time to Return to the Operator Console Menu
```

Figure G-12. Operator Console Screen

17) When the message 'Queue Verification Routine Complete' appears (approx. 20 to 30 seconds), press PF1 to enter user mode. Workstation 0 is now in user mode and any VS function can now be performed. The VS Logon Screen will be displayed.

```
                     ***  Wang VS Logon   ***

  Workstation 0              2:12 PM       Tuesday  March 22, 1986

                         Hello new user
                         Welcome to

Please identify yourself by supplying the following information

                        Your userid   =
                        Your password =

                      and press (ENTER) to Logon

            or press (PF11) to enter operator mode immediately
```

Figure G-13. VS Logon Screen

18) Enter a valid user ID and press ENTER. The command processor screen will be displayed. Once displayed, the system is in user mode and performed a successful IPL.

```
                  ***  WANG VS COMMAND PROCESSOR  ***

Workstation 0 Ready            11:32 PM          Monday  March 22, 1985

                               Hello
                       Welcome to the Wang VS

   Press (HELP) at any time to interrupt your program or to stop processing
   of the current command.

        Use function keys to select a command:

   (1)  RUN Program or Procedure
   (2)  Set USAGE Constraints                  (11)  Enter OPERATOR Mode
   (3)  Show PROGRAM Completion Report         (12)  Submit PROCEDURE

   (4)  Manage QUEUS                           (13)  Send MESSAGE to Operator
   (5)  Manage FILES/Libraries                 (15)  PRINT Command Screen
   (6)  Manage DEVICES                         (16)  LOGOFF
```

Figure G-14. Command Processor Menu

4.7 DIAGNOSTIC TESTING

4.7.1 Power-Up B.I.T.

Power-up B.I.T. diagnostics (PROM-Based) runs concurrently with the BP Power-Up B.I.T. test and verifies external Disk (SMD) controller integrity. If an error condition occurs, the error code is reported to the front panel LED display via the Bus Processor under B0XX, 40XX or 41XX series error codes.

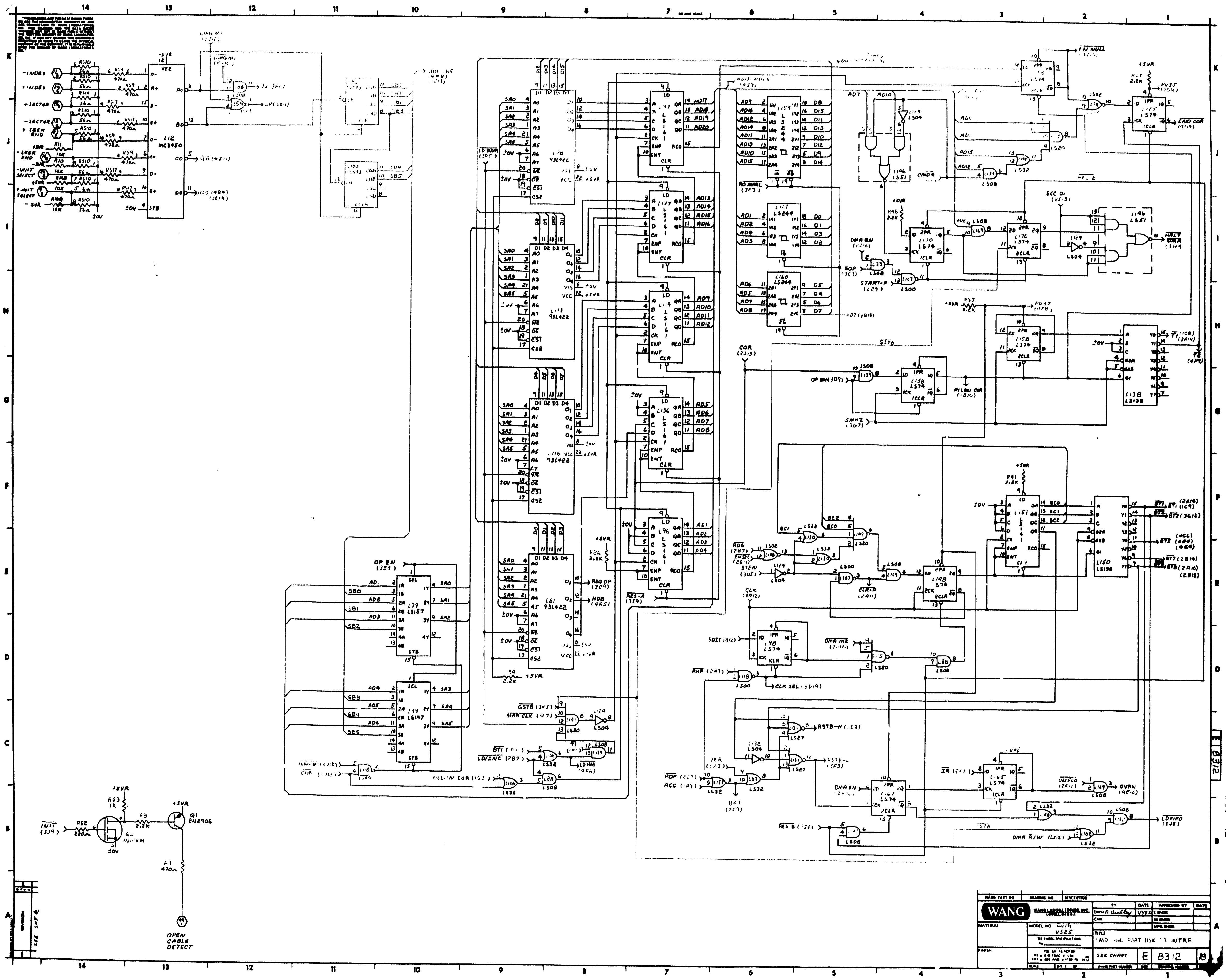
In the event two SMD controllers are installed, the Power-Up B.I.T diagnostics runs on both controllers but, the BP only interacts with the SMD Controller that is defined as the default drive as selected by the Boot Device Select Switch.

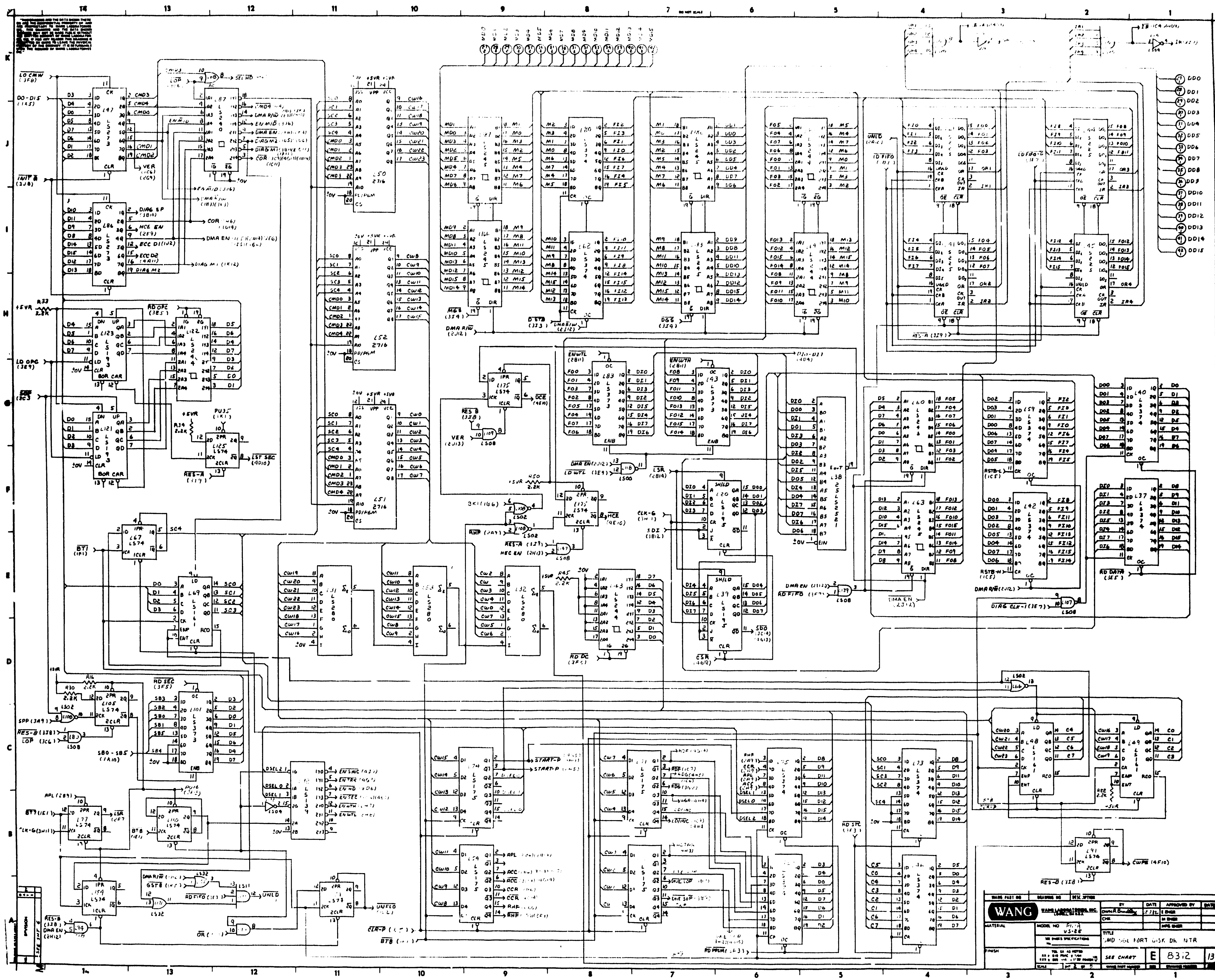
4.7.2 Small System VS Diagnostic Monitor Package

The Small System VS Diagnostic Monitor Package for the VS-15 part number 195-2458-0, Rev 2561 includes test 'DT1000 - Small VS SMD/CMD/FMD Disk Controller DA Diagnostic' which can be run to fully test the integrity of the SMD controller and the disk drive. Refer to the documentation included with this package for Disk controller testing and result interpretation.

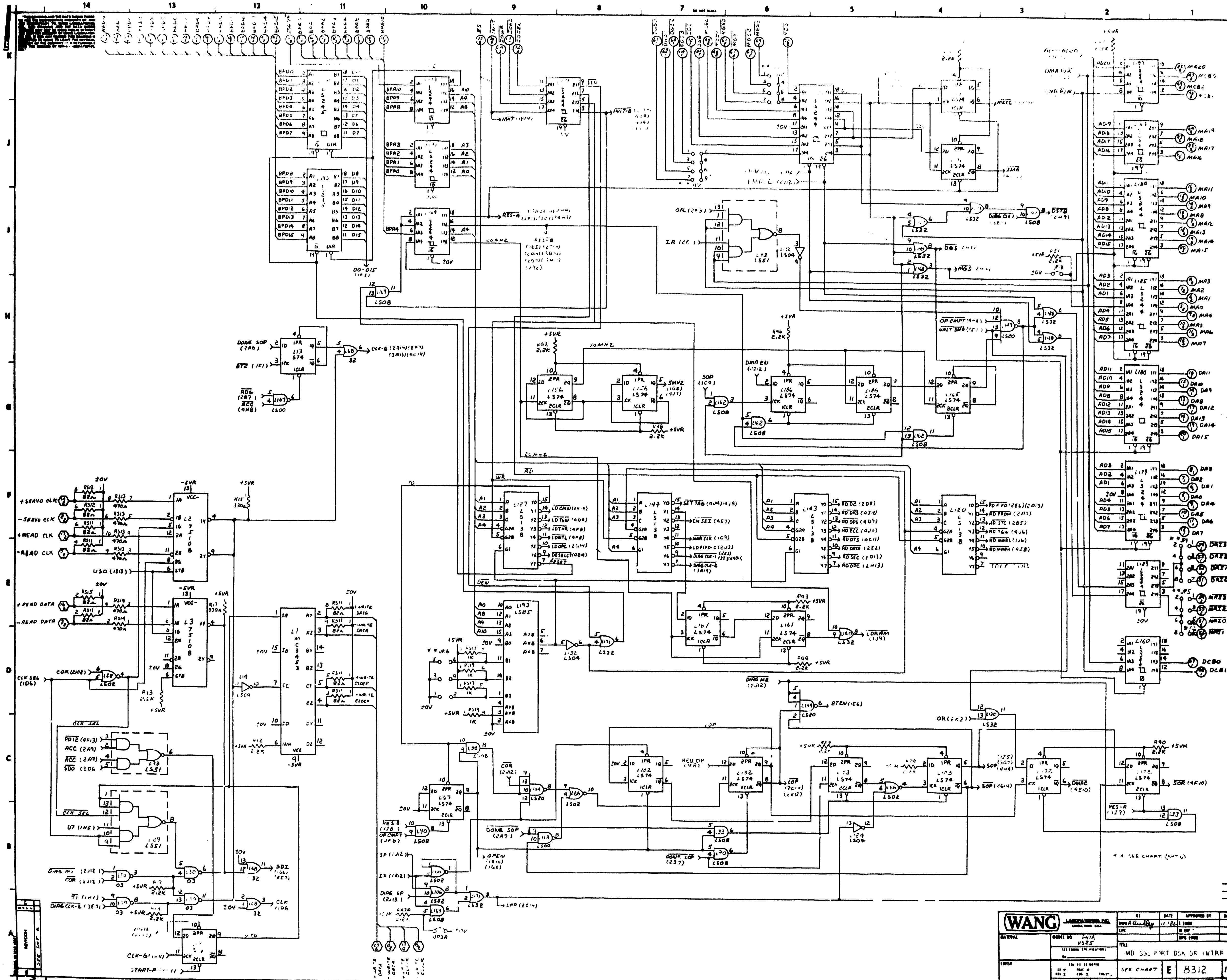
APPENDIX C

SCHE-
MATICS

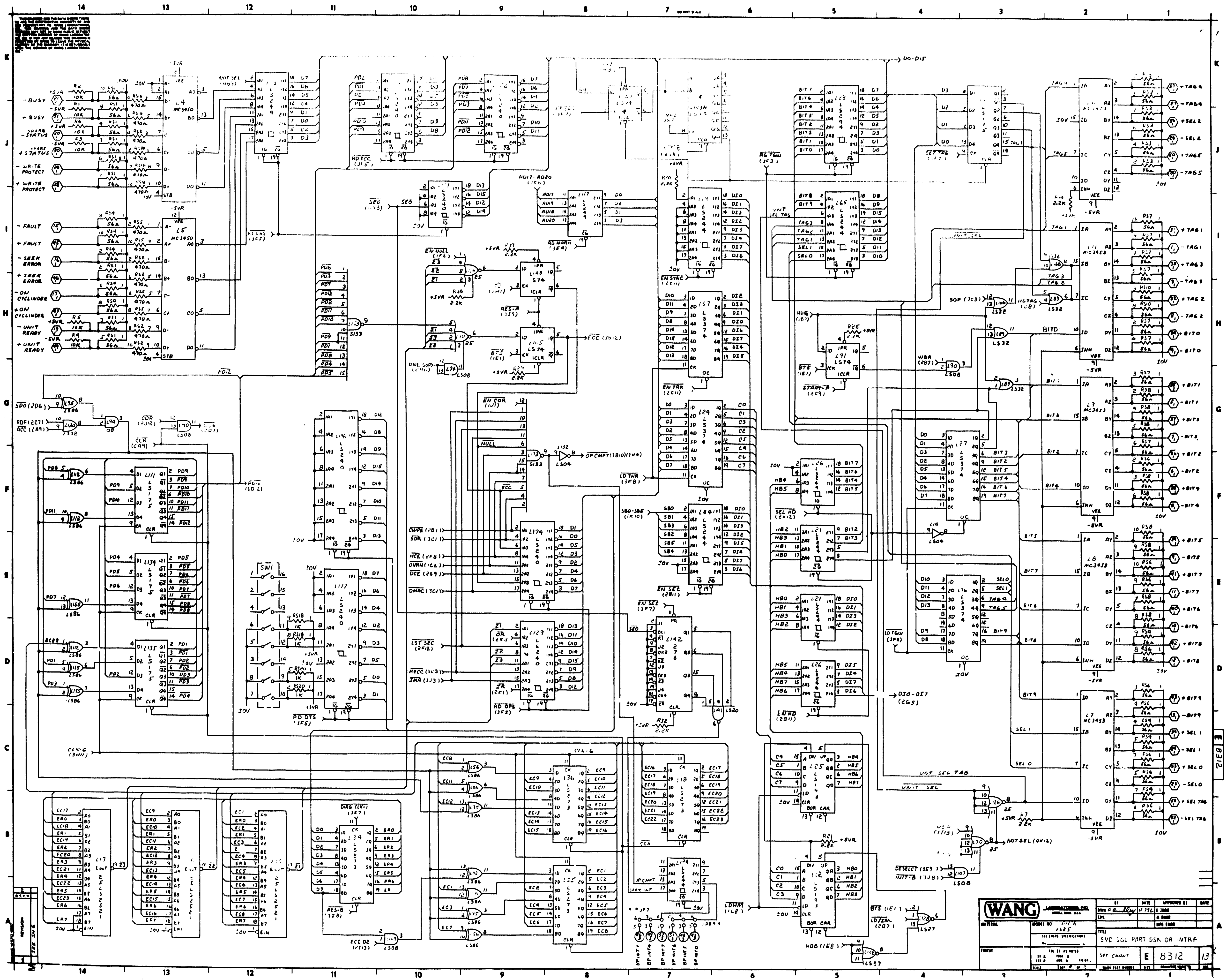

WANG
WANG LABORATORIES, INC.
MODEL NO
VS25
TITLE
MD PORT DSK INTRF
SEE CHART
E
8312
B
OPEN CABLE DETECT

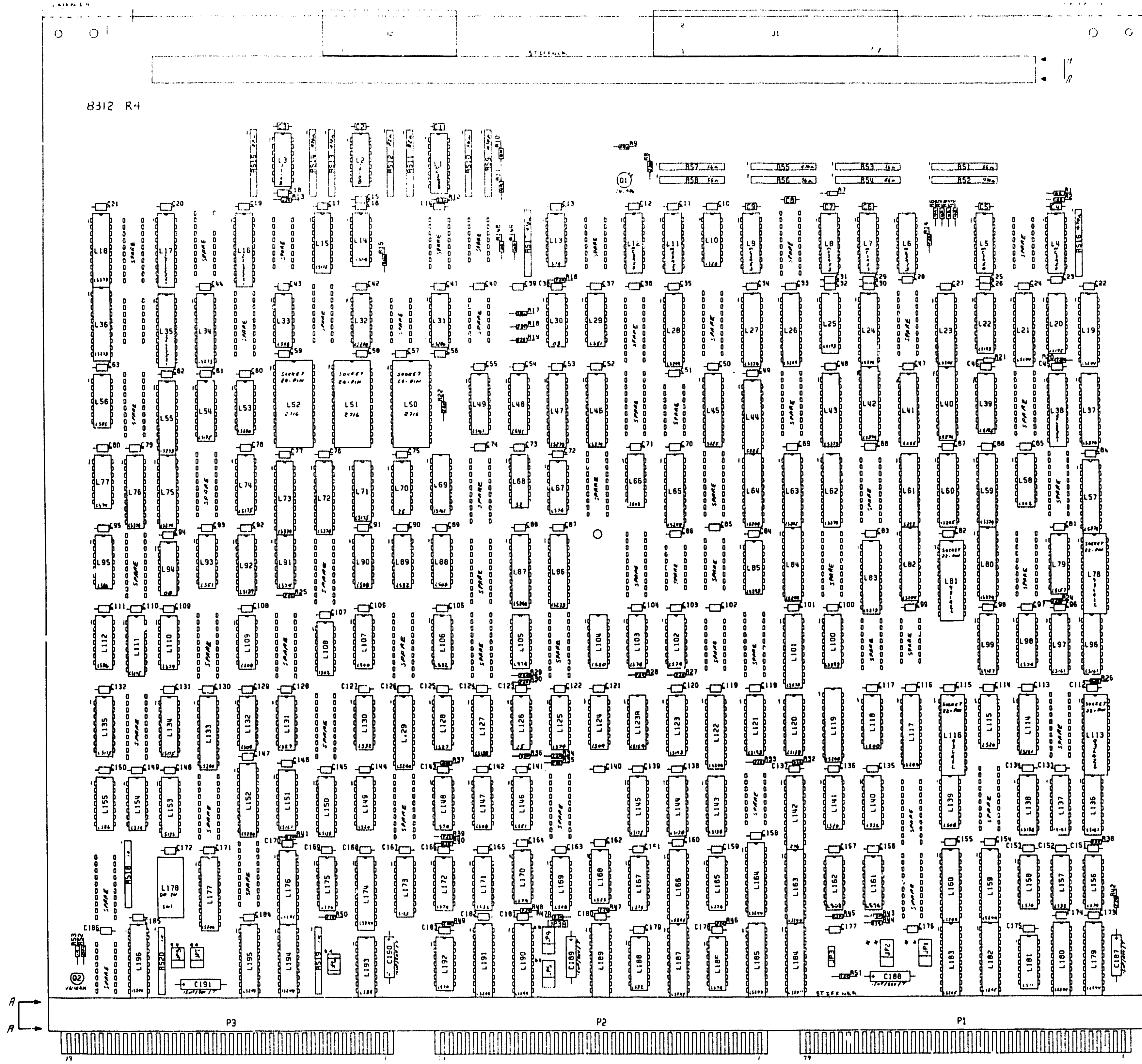


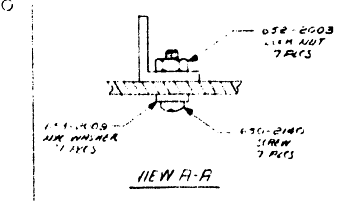
WANG
WANG LABORATORIES, INC.
MODEL NO
VS-26
TITLE
SMD SGL PORT DISK DR NTR
SEE CHART
E
8312
13



* # SEE CHART, (SHT 6)
WANG
BY
DATE
APPROVED BY
DATE
12.7.82
MATERIAL
MODEL NO
VS25
TITLE
MD 55L PORT DSK DR INTRF
FINISH
SEE CHART
E
8312
13


WANG
MODEL NO VS25
TITLE
SMD SGL PORT DSK DR INTRF
SEE CHART
E
8312
13
NOT SEL (4K12)
D0-D15
D10-D17 (2G5)
OP CMPT (3B10)(3H4)
ECC (3H12)

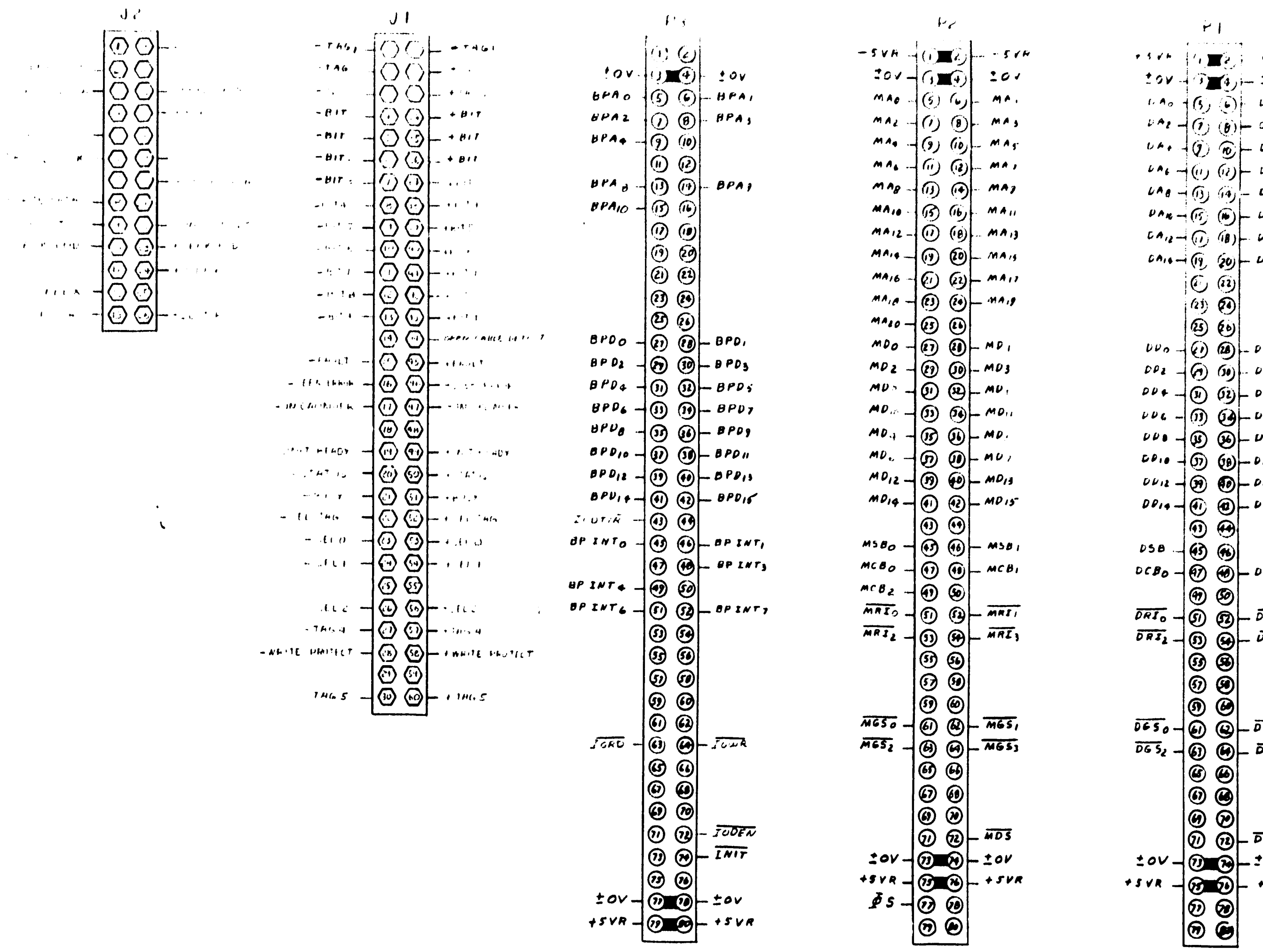


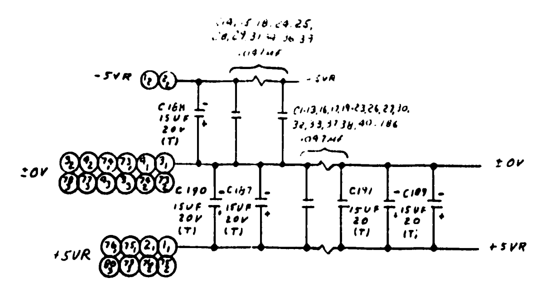


* SEE CHART (SHT 6)

NOTE: 1) ALL UNMARKED CAPS ARE .047UF
2) LOAD JP3 JP3A WITH 24 GA BUS (600-9001)
3) ALL TRANS PAD TO Q1 (375-7004)

WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.	BY	DATE	APPROVED BY	DATE
	DWN A. Bradley	5/11/83	E ENGR	
	CHK		M ENGR	
MATERIAL	MODEL NO 2HIA VS-25		MFG ENGR	
	TITLE SMD SGL PORT DISK INTRF			
FINISH	SEE CHART	E	8312	13
	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV





I.C. COMPONENT	TYPE	W.L PART NO.
L1,6,7,8,9,11	[illegible]	376-0274
L2,3	[illegible]	376-0089
L4,5,12	MC 3450	376-0215
L10,109,115,141,149	74LS20	376-0210
L13,148	74S74	376-0202
L14,124,132	74LS04	376-0180
L15,54,71,74,111,134,135,145	74LS175	376-0160
L16,17,35,38	25LS2521	376-0317
L18,34,36,47,55,86	74LS273	376-0302
L20,39	74LS195	376-0298
L21,23,26,28,64,65,82,89,117,122,159,160,163,164,178,180,184,185,189,190,191,194,19	74LS244	376-0288
L22,25,121,123	74LS193	376-0220
L24,27,37,40,42,46,57,59,62,72,73,75,76,80	74LS374	376-0286
L29,93,146	74LS51	376-0213
L30	7403	376-0028
L31,32,53	74LS280	376-0292
L33,88,90,109,139,147,162,169	74LS08	376-0153
L41,44,45,61	74S225	376-0323
L48,49,69,96,97,114,136,137,151	74LS161	376-0233
L50,51,52	2716	SEE CHART
L56,95,112,155	74LS86	376-0281
L58,66,108	74LS02	376-0208
L60,63,166,176,182,183,187,195	74LS245	376-0286
L67,77,91,98,102,103,105,110,125,154,156,158,161,165,167,170,172,175,186,192	74LS74	376-0155
L89,106,130,140,157,168,171,188	74LS32	376-0211
L70,126	7425	376-0092
L78,113,116,81	93L422	SEE CHART
L79,99	74LS157	376-0216
L83,101,43	74LS373	376-0310
L85,100	74LS393	376-0307
L68	7432	376-0093
L87,119,129,133,152,174,177,196	74LS240	376-0297
L92	74LS139	376-0226
L107,118	74LS00	376-0207
L120,127,138,143,149,150	74LS138	376-0294
L128,131	74LS27	376-0245
L142	74276	376-0318
L153,173	74S133	376-0276
L181	74LS11	376-0225
L193	74LS85	376-0218
L123A	74LS164	376-0236
L50,51,52	24PIN SKT	376-9003
L78,113,116,81	22PIN SKT	376-9010
L94	7408	376-0081

COMPONENT	TYPE	W.L PART NO.	QTY
R1-6,10,11 MAHB	10K 1/4W 5%	[illegible]	
R7,8,12,9,16,18-22,29-33,42-51,47A	2.2K 1/4W 5%		
R9	[illegible] 1/4W 5%	[illegible]	
R15,17	330Ω 1/4W 5%	[illegible]	
R52	[illegible] 1/4W 5%	[illegible]	
R53	1K 1/4W 5%	[illegible]	
RS1 3,4,6-8,10	56Ω SIP	[illegible]	
RS2,5,7,[illegible],14,16,17	[illegible] SIP	333-0803	
RS11 [illegible]	22Ω SIP	333-3809	
RS18,19,20	1K SIP	333-[illegible]	
JP1,2,4,5	8 PIN CONN	350-[illegible]	
JP6-8	3 PIN HDR.	659-0104	
JP1,2,4-8	SHUNT	350-[illegible]	
C1-186	.047UF 50V	300-1066	
C187-191	15UF 20V T	300-4022	
Q1	2N2906	375-1017	
Q2	1N100KM	375-[illegible]	
SW1	8POS SPST	325-1503	
J1	60 PIN CONN	350-[illegible]57	
J2	26 PIN CONN	350-[illegible]58	
Q1	TRANSIPAL	375-9004	QTY
	LOWER STIFF.	452-2707	1
	UPPER STIFF.	452-2708	1
	EXTRACTORS	465-1239	2
	SCR 4-40×7/16	650-2140	7
	LOCK NUT 4-40	652-2003	7
	24GA BUSS	600-9007	
	WASHER NK	653-2009	7

\# SEE NOTE

** SEE CHART

MNEMONICS	CONN'D
+BIT₀ - +BIT9	4F1
-BIT₀ - -BIT9	4F1
BPA₀ - BPA9	3K11
BPA8 - BPA10	3K11
BPD₀ - BPD15	3K13
BPINT₀ - BPINT7	4A7
+BUSY	4J14
-BUSY	4J14
DA₀ - DA15	3F1
DCB0	3D1
DCB1	3D1
DD₀ - DD15	2J1
DDS	3K7
DGS₀ - DGS₃	3K7
DRI₀ - DRI₃	3E1
DSB	3K7
+FAULT	4I14
-FAULT	4I14
+INDEX	1K14
-INDEX	1K14
INIT	3K9
IODEN	3K9
IOD T/R	3K12
IORD	3K9
IOWR	3K9
MA₀ - MA20	3I1
MCB₀ - MCB₂	3K1
MD₀ - MD15	2K8
MDS	3K6
MGS₀ - MGS₃	3K6
MRI₀ - MRI₃	3E1
MSB0	3K7
MSB1	3K7
+ON CYCLINDER	4H14
-ON CYCLINDER	4H14
OPEN CABLE DETECT	1A13
+READ CLK	3F14
-READ CLK	3E14
+READ DATA	3E14
-READ DATA	3E14

MNEMONICS	CONN'D
+SECTOR	1J14
-SECTOR	1J14
+SEEK ERROR	4H14
-SEEK ERROR	4I14
+SEEK END	1J14
-SEEK END	1J14
+SEL0	4C1
-SEL0	4C1
+SEL1	4C1
-SEL1	4C1
+SEL2	4J1
-SEL2	4J1
+SEL TAG	4B1
-SEL TAG	4B1
+SERVO CLK	3F14
-SERVO CLK	3F14
+STATUS	4J14
-STATUS	4J14
+TAG1	4I1
-TAG1	4I1
+TAG2	4H1
-TAG2	4H1
+TAG3	4I1
-TAG3	4I1
+TAG4	4K1
-TAG4	4K1
+TAG5	4J1
-TAG5	4J1
+UNIT READY	4H14
-UNIT READY	4H14
+UNIT SELECT	1I14
-UNIT SELECT	1J14
+WRITE PROTECT	4J14
-WRITE PROTECT	4J14
ϕS	3K9
+WRITE DATA	3A11
-WRITE DATA	3A10
-WRITE CLOCK	3A10
+WRITE CLOCK	3A10

I.C. TYPE	LOCATION	SPARES
74LS02	L58	1
74LS04	L14	2
	L124	1
	L132	1
7408	L94	1
74LS11	L181	2
74LS27	L131	1
74LS32	L140	2
	L157	1
	L168	1
74LS51	L29	1
74LS74	L77	1
	L110	1
74LS86	L155	1
74LS240	L119	1
74LS393	L85	1
	L100	1
74LS08		
	L109	1
74LS27	L128	1
74LS86	L95	1
	L51	2

NOTE
\# EACH HEADER IS MADE UP OF (2)3 PIN HEADERS

210 = 209 + 377 OR 378					
210	209	L50	L51	L52	L78,113,116,81
8312A	8312	378-5138 R1	378-5140 R1	378-5139 A	377-0384

**

VARIATIONS CHART FOR SHUNTS, ADDRESS 01XX						
JP1	JP2	JP4	JP5	JP6	JP7	JP8
DRI0	DGS0	MGS0	MRI0	01XX	BP INT 1	BP INT 0

**

VARIATIONS CHART FOR SHUNTS, ADDRESS 02XX						
JP1	JP2	JP4	JP5	JP6	JP7	JP8
DRI1	DGS1	MGS1	MRI1	02XX	BP INT 4	BP INT 3

E-REV
4

WANG LABORATORIES, INC.

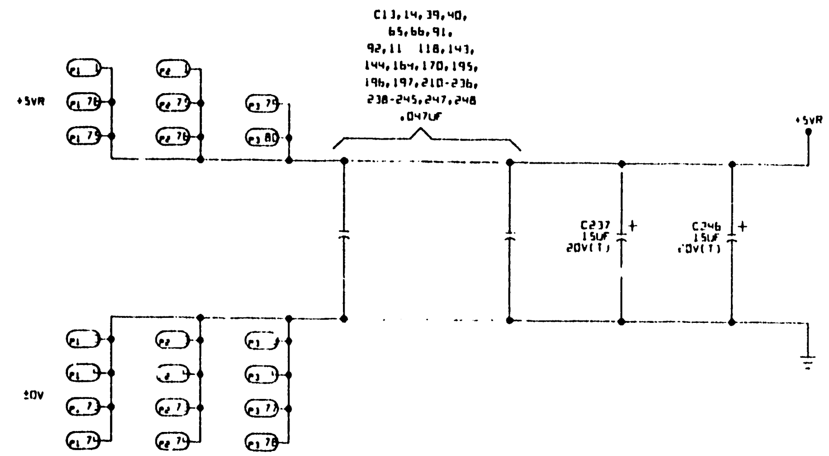
BY	DWN A [illegible]
DATE	12/6/81
MODEL NO	2414 1525
TITLE	SMD [illegible] PORT DISK DR INTRF
WANG PART NUMBER	SEE CHART
SIZE	E
DRAWING NUMBER	8312
REV	13

APPENDIX
D

SCHE-
MATICS

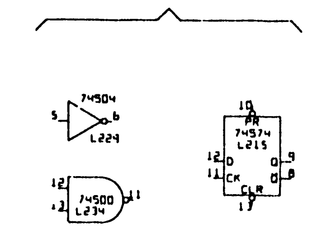
NOTES

1. ALL RESISTOR VALUES IN OHMS.
2. ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE INDICATED.
3. ALL RESISTORS 1/4W 5% UNLESS OTHERWISE INDICATED.



MNEMONICS	COORD.
ECNT	2A7
BS	2H14
MA0	2C14
MA1-MA16	3J14
MA17	3H14
MA18-MA21	2D14
MCB0-MCB2	2C14
MDS	2A7
MD0-MD3	3B14
MD4-MD7	3C14
MD8-MD11	3D14
MD12-MD15	3F14
MGS0-MGS7	2K1
MR 0-MR17	2J14
MSB0	2A8
MSB1	2A7
NEXT	2A8

SPARES



210 • 209 + 377 OR 378																		
210	209	L1-11, 14-24	L25-35, 38-48	L49-59, 62-72	L73-83, 86-96	L97-107, 110-120	L121-131, 134-144	L145-155, 158-168	L169-179, 182-192	L220	C2-12, 15-25	C28-38, 41-51	C54-64, 67-77	C80-90, 93-103	C106-116, 119-129	C132-142, 145-155	C158-168, 171-181	C184-194, 198-208
9300-- (256K)	9300							377-0415	377-0415	377-0416							300-1833	300-1833
9300-1A (512K)	9300-1					377-0415	377-0415	377-0415	377-0415	377-0416					300-1833	300-1833	300-1833	300-1833
9300-2A (1M)	9300-2	377-0415	377-0415	377-0415	377-0415	377-0415	377-0415	377-0415	377-0415	377-0416	300-1833	300-1833	300-1833	300-1833	300-1833	300-1833	300-1833	300-1833
9300-B (2M)	9300-3					377-0589	377-0589	377-0589	377-0589	377-0416					300-1833	300-1833	[illegible]-1833	300-1833

BY	JSH	JSH	A.A.B
DATE	7-24-84	8-27-84	12-3-84
REVISION	ORIGINATED PER DWR NO. E2292 APPR	REVISED PER DCR NO. D0477 DCR-R NO. D0210 CHKR	REVISED PER ECO NO. 33990D CHKR
NO	A /	0 / 0	1 / C

C REV 0 N

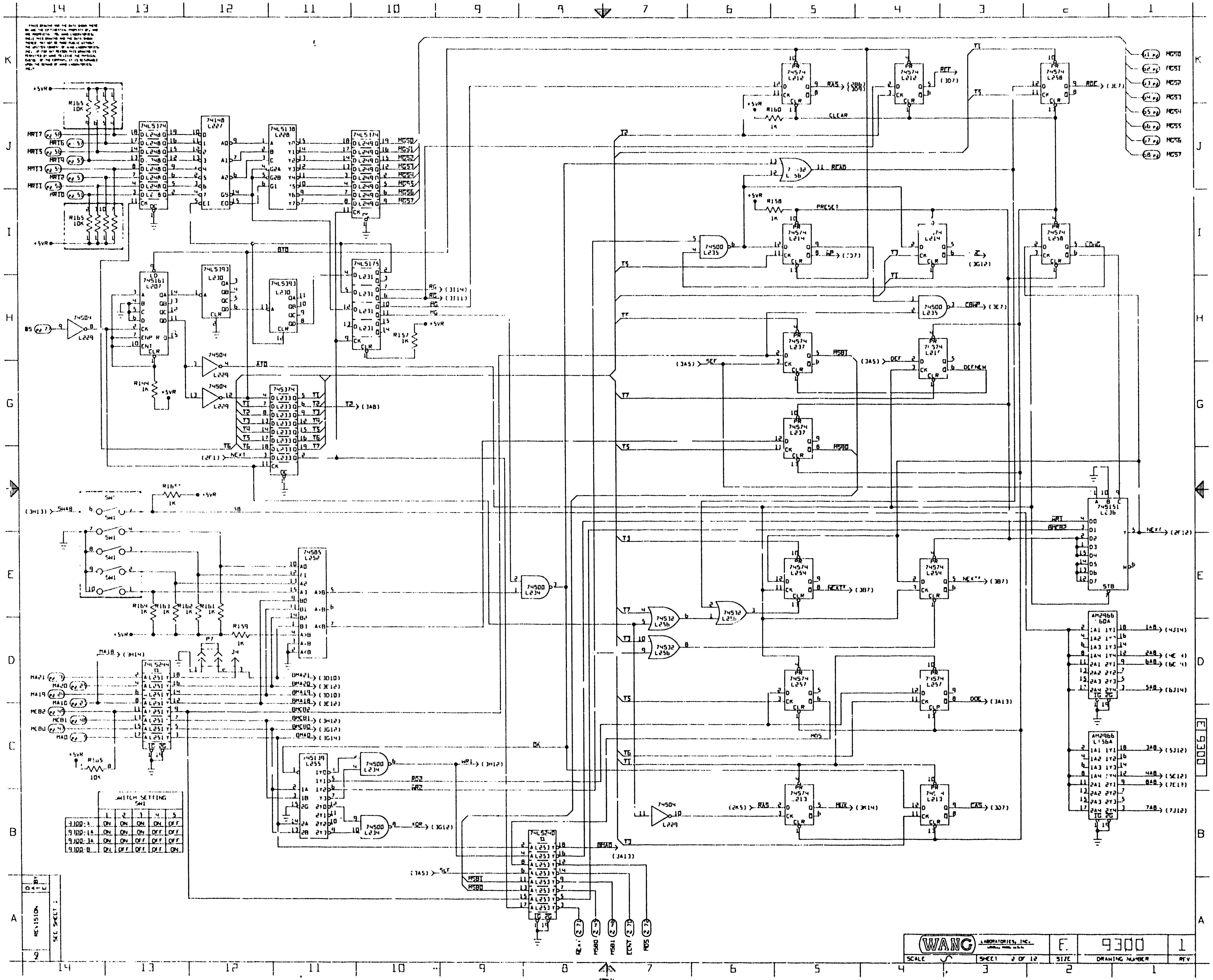
WANG LABORATORIES, INC.

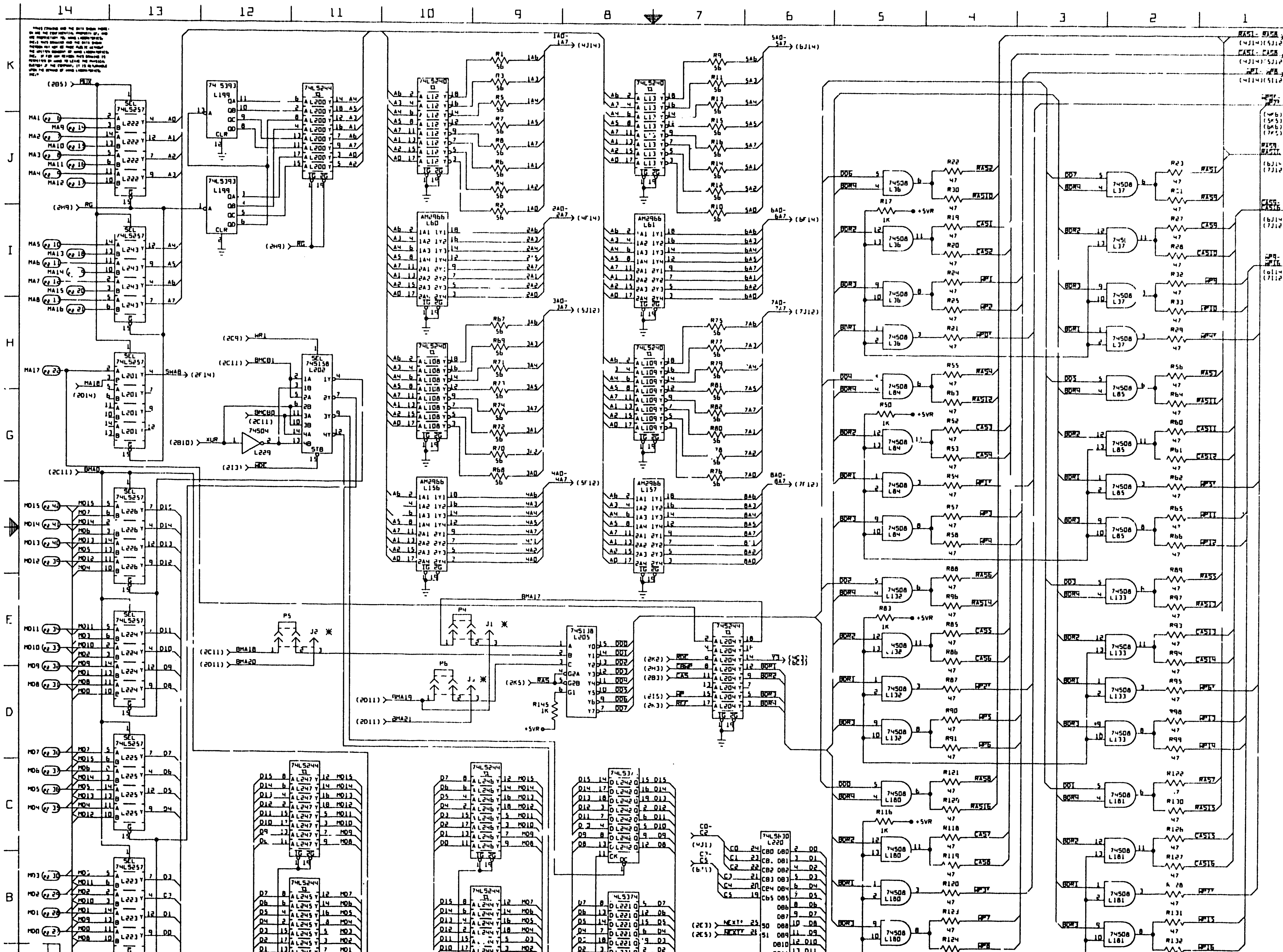
SCHEMATIC DIAGRAM

TITLE 4 MEG BYTE MEMORY M/L

MODEL NUMBER	VS 25	WANG PART NUMBER	210-9300
DWN JSH	CHK	ENG JP	DIR
SIZE E	DRAWING NUMBER 9300	REV 1	SHEET 1 1 .2

E 9300


SWITCH SETTING SW1
1 2 3 4 5
9100-A ON ON ON ON OFF
9100-1A ON ON ON OFF OFF
9100-3A ON ON OFF OFF OFF
9100-B ON OFF OFF OFF ON
WANG LABORATORIES, INC.
E 9300 1
SCALE
SHEET 2 OF 12
SIZE
DRAWING NUMBER
REV



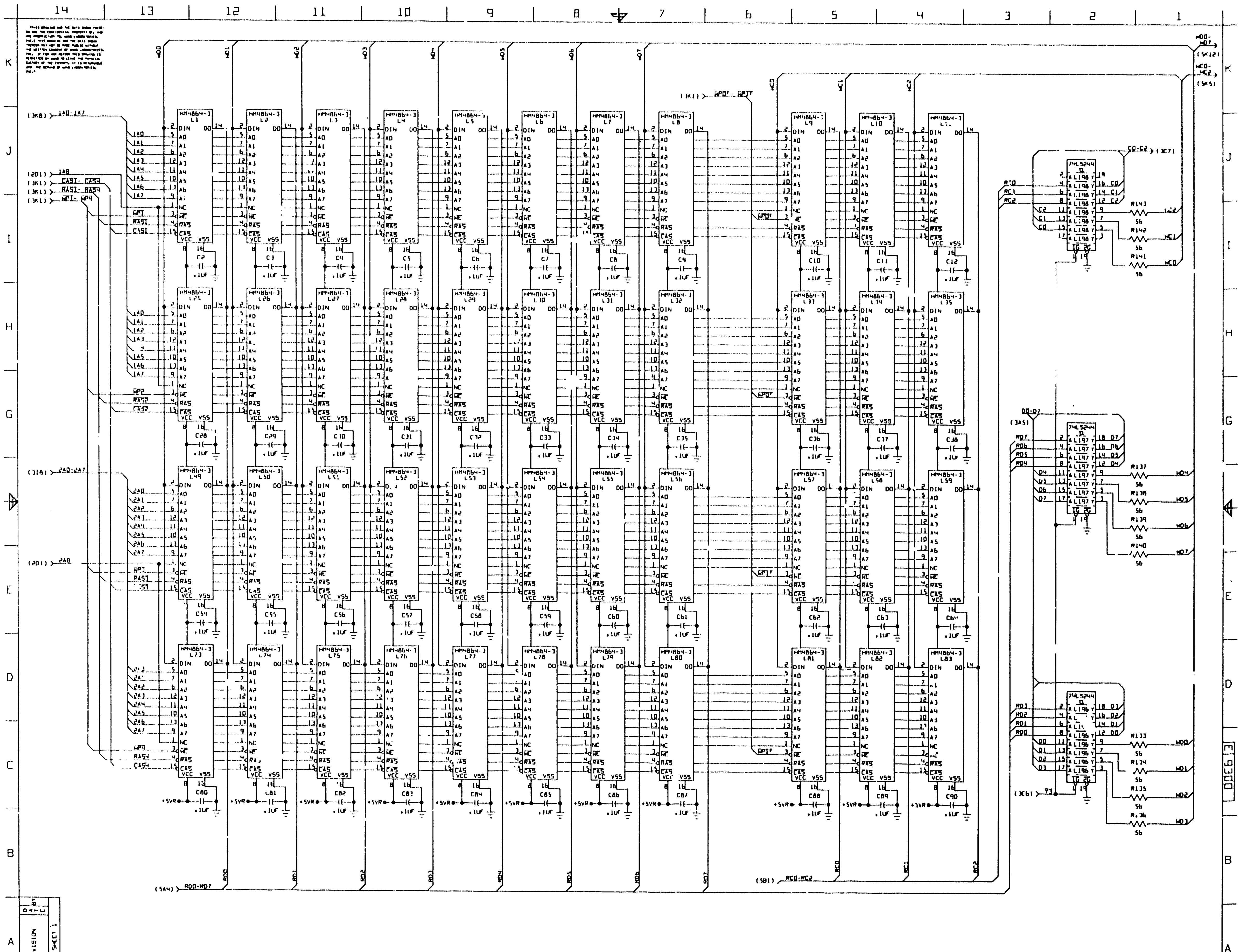
**	M.M. SIZE	2M. OR LESS	OVER 2M.
	J4	PINS 1 & 2	PINS 2 & 3

* JUMPER CHART

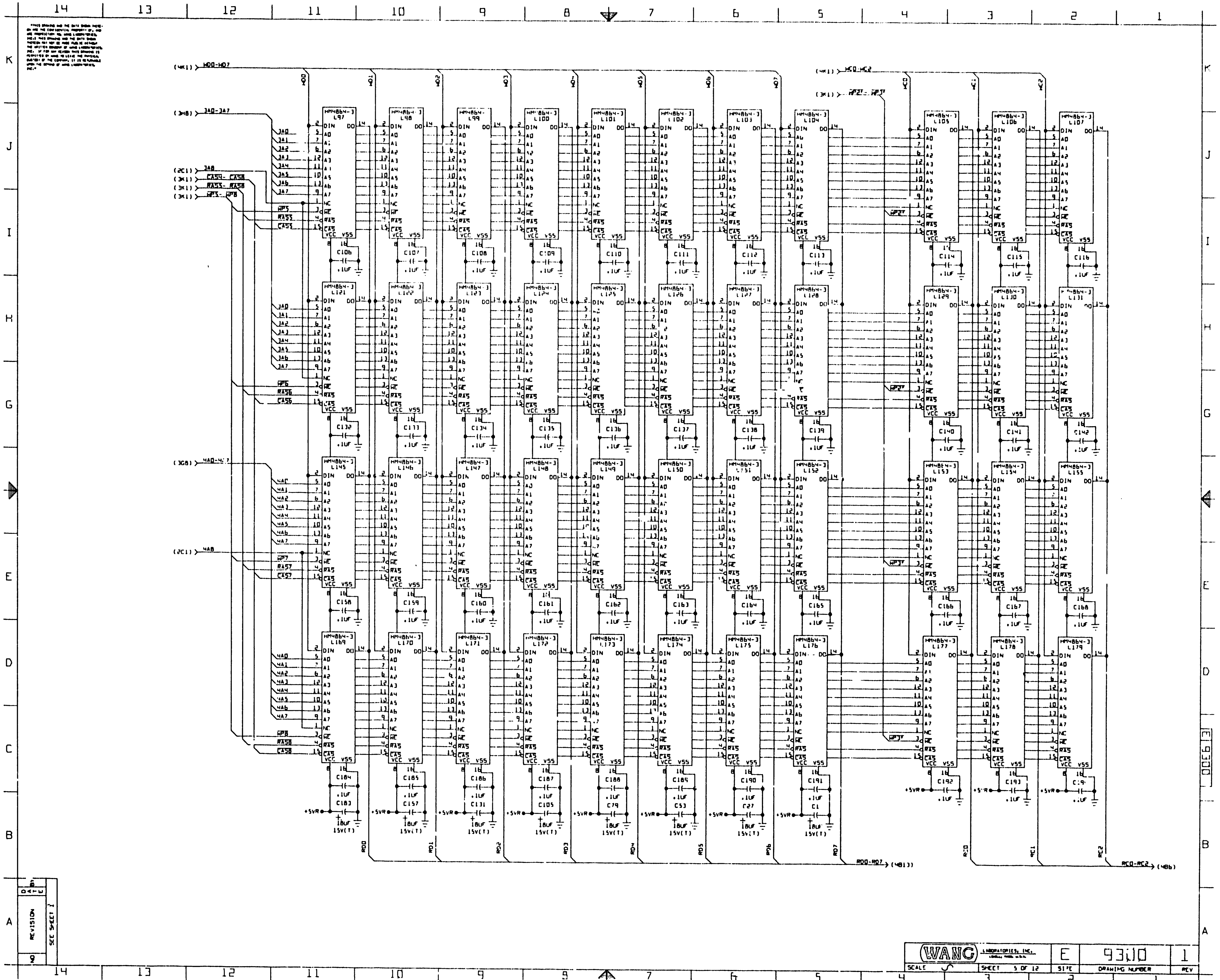
	64K RAMS	256K RAMS
J1	PINS 1 & 2	PINS 2 & 3
J2	PINS 1 & 2	PINS 2 & 3
J3	PINS 1 & 2	PINS 2 & 3

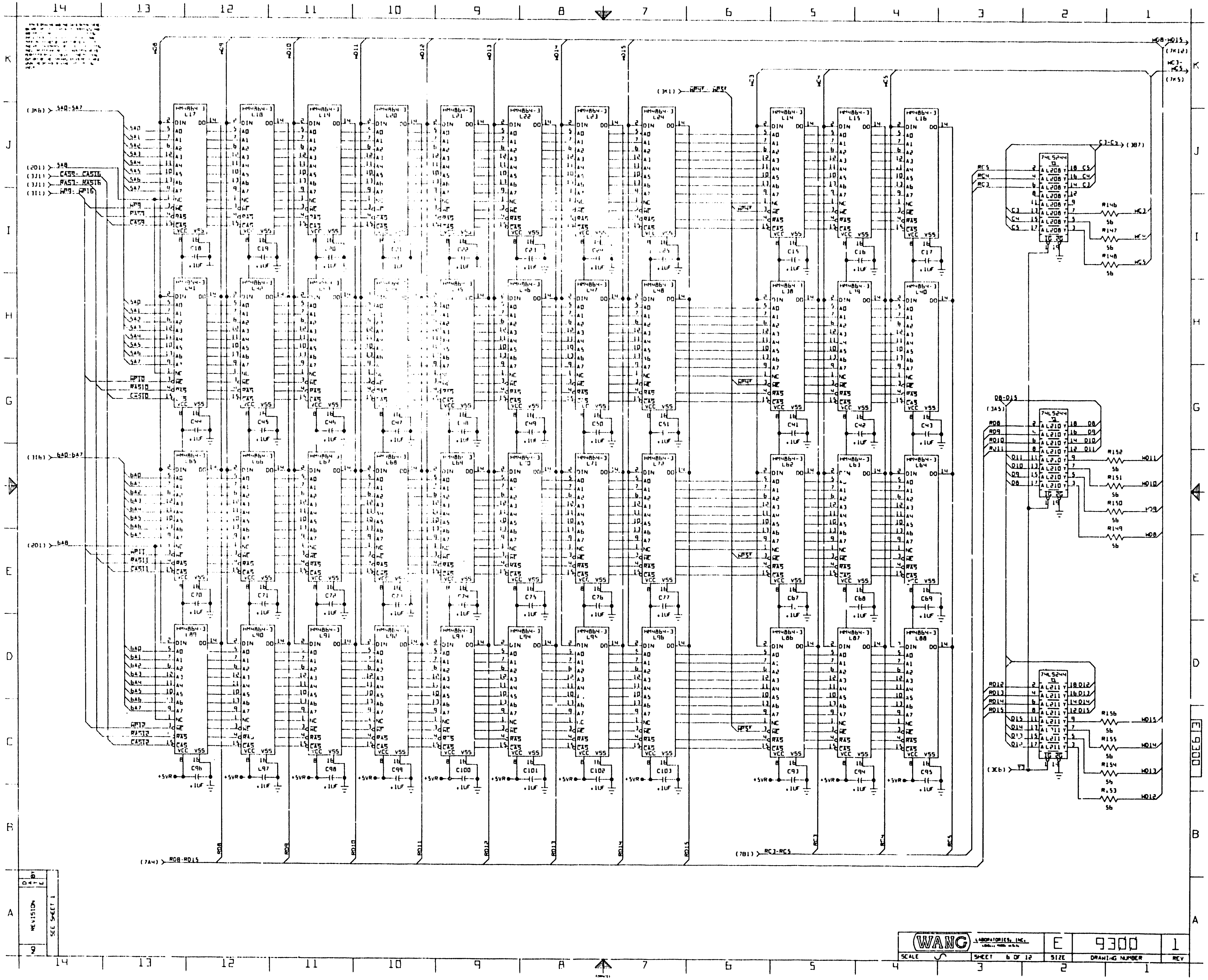
WANG LABORATORIES, INC. LOWELL, MASS. U.S.A.

SCALE	SHEET 3 OF 12	SIZE E	DRAWING NUMBER 9300	REV 1

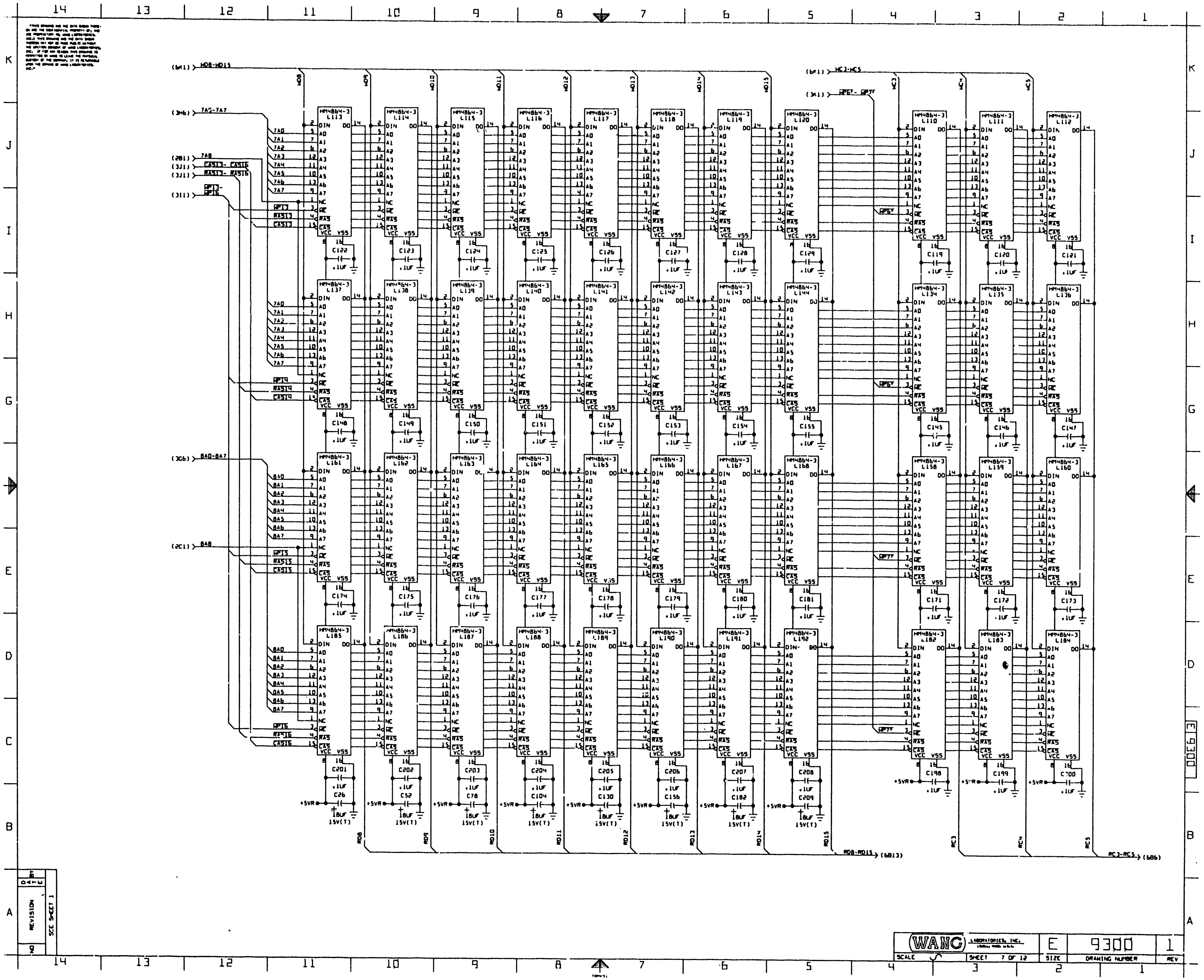


WANG LABORATORIES, INC.	E	9300	1
SCALE — SHEET 4 OF 12	SIZE	DRAWING NUMBER	REV


HM4864-3
DIN DO
VCC VSS
.1UF
+5VR
15V(T)
RD0-RD7
RC0-RC2
REVISION
SEE SHEET 1
WANG LABORATORIES, INC.
E
9310
1
SCALE
SHEET 5 OF 12
SIZE
DRAWING NUMBER
REV



WANG
LABORATORIES, INC.
E
9300
1
SCALE
SHEET 6 OF 12
SIZE
DRAWING NUMBER
REV
REVISION
SEE SHEET 1
E 9300


WANG
E
9300
1
SHEET 7 OF 12
SIZE
DRAWING NUMBER
REV
REVISION
SCE SHEET 1

WANG LABORATORIES, INC. RUN DATE: 12/17/84 14:43

»»» ELECTRICAL PARTS LIST ««« SHEET OF PAGE 1

(FINAL PARTS LIST)

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L
ASSEMBLY LEVEL & TITLE: 209 PCA VS [illegible] SYS [illegible]
PARTS LIST REVISION (P): 1
ARTWORK REVISION (R): 00
ASSEMBLY REVISION (A): 01
SCHEMATIC REVISION (S): 01
DWR OR MOST RECENT ECO: 33990D

CREATED: 07/12/84 14:58
LAST MODIFIED: 12/17/84 14:02 BY: RS
EDITING REVISION: 12

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
C159 - C168	300-1833-	.1U	CAP CERAMIC MONO AXIAL LEADED +80%-20% 50V Z5U		44
C171 - C181					
C184 - C194					
C198 - C208					
C13 - C14	300-1966-	.047U	CAP CERAMIC MONO AXIAL +80 -20% 50V Z5U		54
C39 - C40					
C65 - C66					
C91 - C92					
C117 - C118					
C143 - C144					
C169 - C170					
C195 - C197					
C210 - C236					
C238 - C245					
C247 - C248					
C1	300-4018-	18U	CAP TANT AXIAL 10% 15V		16
C26 - C27					
C52 - C53					
C78 - C79					
C104 - C105					
C130 - C131					
C156 - C157					
C182 - C183					
C209					
C237	300-4022-	15U	CAP TANT AXIAL 10% 20V		2
C246					
SW1	325-1501-	SWITCH	SLIDE SPST 5 POS		1
R19 - R25	330-1048-	47.000	RES FIXED METAL FILM 1/4W 5% 200PPM		56
R27 - R33					
R52 - R58					
R60 - R66					
R85 - R91					
R93 - R99					
R118 - R124					
R126 - R132					
R1 - R16	330-1057-	56.000	RES FIXED METAL FILM 1/4W 5% 200PPM		34
R67 - R82					

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L SCHEMATIC REVISION (S): 01 SHEET OF PAGE 2

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
R133 - R143					
R146 - R156					
R17	330-3011-	1K	RES FIXED METAL FILM 1/4W 5% 200PPM		13
R[illegible]					
R83					
R116					
R144 - R145					
R157 - R164					
R165A					
R165	333-0809-	10.000KΩ	RESISTOR NETWORK TYPE: 10/09/C/SS		1
P4 - P7	350-4506-	2 CONT	CONN SHUNT .100 CTR		4
L231	376-0160-	74LS175	IC QUAD D-TYPE FLIP-FLOP		1
L227	376-0171-	74148	IC 8-LINE-TO-3-LINE OCTAL PRIORITY ENCODER		1
L229	376-0197-	74S04	IC HEX INVERTER		1
L36 - L37	376-0200-	74S08	IC QUAD 2 INPUT POSITIVE AND GATES		8
L84 - L85					
L132 - L133					
L180 - L181					
L212 - L218	376-0202-	74S74	IC DUAL D-TYPE POS EDGE TRIGRD F/F W/PRESET/C		8
L237					
L254					
L257 - L258					
L201	376-0204-	74LS257	IC QUAD 2-LINE TO 1-LINE DATA SEL/MUX		7
L222 - L226					
L243					
L256	376-0205-	74S32	IC QUAD 2-INPUT OR GATE		1
L2[illegible]4 - L235	376-0228-	74S00	IC QUAD 2-INPUT NAND GATE		2
L252	376-0259-	74S85	IC 4-BIT MAGNITUDE COMPARATOR		1
L207	376-0278-	74S161	IC SYN 4-BIT BINARY COUNTER W/DIRECT CLEAR		1
L221	376-02[illegible]6-	74LS374	IC OCTAL D-TYPE FLIP-FLOP TRI-STATE		4
L242					
L248 - L249					
L196 - L198	376-0288-	74LS244	IC OCTAL BUFFER/LINE DRIVER W/[illegible] STATE		12
L200					
L208					
L210 - L211					
L244 - L247					
L251					
L228	376-0294-	74LS138	IC 3-LINE TO 8-LINE DECODER/MULTIPLEXER		1
L12 - L13	376-0297-	74LS240	IC OCTAL BUFFER/LINE DRIVER/LINE RECEIVER		5
L108 - L109					
L253					
L205	376-0298-	74S138	IC 3-LINE TO 8-LINE DECODER/MULTIPLEXER		1
L202	376-0301-	74S158	IC QUAD 2 TO 1-LINE DATA SELECTOR/MUX INVERT		1
L233	376-0305-	74S374	IC OCTAL D-TYPE EDGE-TRIG F/F TRI-STATE		1
L199	376-0307-	74LS393	IC DUAL 4-BIT BINARY COUNTER		2
L230					
L255	376-0333-	74S139	IC 2 TO 4-LINE DECODER/MULTIPLEXER		1
L236	376-0336-	74S151	IC 1-OF-8 DATA SEL/MUX		1
L204	376-0338-	74S244	IC OCTAL BUFFER/LINE DRIVER/RECEIVER TRI-STATE		1

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L SCHEMATIC REVISION (S): 01 SHEET OF PAGE 3

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
L60	376-0553-	AM2966	IC OCTAL DYN MEM DRIVER W/3-ST OUT		6
L60A					
L61					
L156					
L156A					
L157					
L220	376-9015-	SKT 28	IC SOCKET 28 PIN DIL MOUNT		1
L145 - L155	377-0415-	4164	IC 64KX1 DRAM 200NS RFF REQUIRE 4MS/256 ROW		44
L158 - L179					
L182 - L192					
Ø3	452-2707-	STIFFN	STIFFENER LOWER		1
Ø2	452-2708-	STIFFN	STIFFENER UPPER		1
Ø26 - Ø27	465-1238-	EXTRCTOR	EXTRACTUR		2
Ø1	510-9300-		PCB		1
Ø4 - Ø10	650-2083-	SCREW	SCREW		7
Ø18 - Ø24	652-2004-	NUT	NUT		7
Ø11 - Ø17	653-2009-	WASHER	WASHER		7
J1 - J4	654-0104-	3 CONT	CONN PC HEADER SINGLE ROW .100		4
Ø25	660-0341-	L.T.	LOCK TITE (QTY FOR THIS A/R)		1

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L SCHEMATIC REVISION (S): 01 SHEET OF PAGE 4

(CAUTION - THE FOLLOWING PARTS/COMPONENTS CONTAINED IN THIS B.O.M. ARE NOT RECOMMENDED FOR NEW DESIGNS)

	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
	376-0197-	74S04	IC HEX INVERTER		1
	376-0200-	74S08	IC QUAD 2 INPUT POSITIVE AND GATES		8
	376-0202-	74S74	IC DUAL D-TYPE POS EDGE TRIGRD F/F W/PRESET/C		8
	376-0205-	74S32	IC QUAD 2-INPUT OR GATE		1
	376-0228-	74S00	IC QUAD 2-INPUT NAND GATE		2
	376-0298-	74S138	IC 3-LINE TO 8-LINE DECODER/MULTIPLEXER		1
	376-0301-	74S158	IC QUAD 2 TO 1-LINE DATA SELECTOR/MUX INVERT		1
	376-0305-	74S374	IC OCTAL D-TYPE EDGE-TRIG F/F TRI-STATE		1
	376-0333-	74S139	IC 2 TO 4-LINE DECODER/MULTIPLEXER		1
	376-0336-	74S151	IC 1-OF-8 DATA SEL/MUX		1
	376-0338-	74S244	IC OCTAL BUFFER/LINE DRIVER/RECEIVER TRI-STATE		1

*** END-OF-REPORT ***

WANG
WANG LABORATORIES, INC.
LOWELL, MA U.S.A.

BY	DATE	APPROVED BY	DATE
DWN		E ENGR	
CHK		M ENGR	
		MFG ENGR	

MATERIAL

MODEL NO.

SEE ENGRG SPECIFICATIONS No.

FINISH

TITLE: 4 MEG BYTE, MEMORY

WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
210-9300	C	9300	1

SCALE SHT [illegible] OF 12

WANG LABORATORIES, INC. RUN DATE: 12/17/84 14:48

»»» ELECTRICAL PARTS LIST ««« SHEET OF PAGE 1

(FINAL PARTS LIST)

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L
ASSEMBLY LEVEL & TITLE: 209-1 PCA VS SM SYS 512K MEM ML
PARTS LIST REVISION (P): 1
ARTWORK REVISION (R): 00
ASSEMBLY REVISION (A): 01
SCHEMATIC REVISION (S): 01
DWR OR MOST RECENT ECO: 339900

CREATED: 07/12/84 14:58
LAST MODIFIED: 12/17/84 14:02 BY: MS
EDITING REVISION: 12

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
C106 - C116	300-1833-	.1U	CAP CERAMIC MONO AXIAL LEADED +80%-20% 50V Z5U		88
C119 - C129					
C132 - C142					
C145 - C155					
C158 - C168					
C171 - C181					
C184 - C194					
C198 - C208					
C13 - C14	300-1966-	.047U	CAP CERAMIC MONO AXIAL +80 -20% 50V Z5U		54
C39 - C40					
C65 - C66					
C91 - C92					
C117 - C118					
C143 - C144					
C169 - C170					
C195 - C197					
C210 - C236					
C238 - C245					
C247 - C2[illegible]					
C1	300-4018-	18U	CAP TANT AXIAL 10% 15V		16
C26 - C27					
C52 - C53					
C78 - C79					
C104 - C105					
C130 - C131					
C156 - C157					
C182 - C183					
C209					
C237	300-4022-	15U	CAP TANT AXIAL 10% 20V		2
C246					
SW1	325-1501-	SWITCH	SLIDE SPST 5 POS		1
R19 - R25	330-1048-	47.000	RES FIXED METAL FILM 1/4W 5% 200PPM		56
R27 - R33					
R52 - R58					
R60 - R66					
R85 - R91					
R93 - R99					

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L SCHEMATIC REVISION (S): 01 SHEET OF PAGE 2

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
R118 - R124					
R126 - R132					
R1 - R16	330-1067-	56.000	RES FIXED METAL FILM 1/4W 5% 200PPM		54
R67 - R92					
R133 - R143					
R145 - R156					
R17	330-3011-	1K *	RES FIXED METAL FILK 1/4W 5% 200PPM		16
R59					
R33					
R116					
R144 - R145					
R157 - R1[illegible]					
R16[illegible]4					
R1[illegible]5	333-0999-	10.00[illegible]	RESISTOR NETWORK TYPE: 10/09/C/SS		1
P6 - P7	380-[illegible]36-	2 CONT	COMM SHUNT .109 CTR		4
L231	376-0119-	74LS175	IC QUAD D-TYPE FLIP-FLOP		1
L227	375 0171-	74[illegible]	IC 8-LINE-TO-3-LINE OCTAL PRIORITY ENCODER		1
L229	376 0197-	74S04	IC HEX INVERTER		1
L35 - L37	37[illegible]-0[illegible]-	74S08	IC QUAD 2 INPUT POSITIVE AND GATES		8
L39 - L86					
L132 - L133					
L1[illegible]9 - L181					
L212 - L218	376-0212-	74S74	IC DUAL D-TYPE POS EDGE TRIGRD F/F W/PRESET/C		8
L237					
L254					
L257 - L258					
L201	376-0294-	74LS257	IC QUAD 2-LINE TO 1-LINE DATA SEL/MUX		7
L222 - L226					
L243					
L256	376-0205-	74S32	IC QUAD 2-INPUT OR GATE		1
L234 - L235	376-0228-	74S00	IC QUAD 2-INPUT NAND GATE		2
L252	376-0259-	74S85	IC 4-BIT MAGNITUDE COMPARATOR		1
L207	376-0278-	74S161	IC SYN 4-BIT BINARY COUNTER W/DIRECT CLEAR		1
L221	376-0286-	74LS374	IC OCTAL D-TYPE FLIP-FLOP TRI-STATE		4
L242					
L248 - L249					
L196 - L198	376-0288-	74LS244	IC OCTAL BUFFER/LINE DRIVER W/TRI STATE		12
L200					
L208					
L210 - L211					
L244 - L247					
L251					
L228	376-[illegible]94-	74LS138	IC 3-LINE TO 8-LINE DECODER/MULTIPLEXER		1
L12 - L13	376-0297-	74LS240	IC OCTAL BUFFER/LINE DRIVER/LINE RECEIVER		5
L108 - L109					
L253					
L205	376-0298-	74S138	IC 3-LINE TO 8-LINE DECODER/MULTIPLEXER		1
L202	376-0301-	74S158	IC QUAD 2 TO 1-LINE DATA SELECTOR/MUX INVERT		1
L233	376-0305-	74S374	IC OCTAL D-TYPE EDGE TRIG F/F TRI-STATE		1
L199	376-0307-	74LS393	IC DUAL 4-BIT BINARY COUNTER		2

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L SCHEMATIC REVISION (S): 01 SHEET OF PAGE 3

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
L230					
L245	376-0333-	74S139	IC 2 TO 4-LINE DECODER/MULTIPLEXER		1
L236	376-0336-	74S151	IC 1-OF-8 DATA SEL/MUX		1
L204	376-0338-	74S244	IC OCTAL BUFFER/LINE DRIVER/RECEIVER TRI STATE		1
L60	376-0553-	AM2966	IC OCTAL DYN MEM DRIVER W/3-ST OUT		6
L60A					
L61					
L156					
L156A					
L157					
L220	376-9015-	SKT 28	IC SOCKET 28 PIN DIL MOUNT		1
L97 - L107	377-0415-	4164	IC 64KX1 DRAM 200NS REF REQUIRE 4MS/256 ROW		88
L110 - L131					
L134 - L155					
L158 - L179					
L182 - L192					
#3	452-2707-	STIFFN	STIFFENER LOWER		1
#2	452-2708-	STIFFN	STIFFENER UPPER		1
#26 - #[illegible]	465-1238-	EXTRCTOR	EXTRACTOR		2
#1	510-9300-		PCB		1
#4 - #10	650-2[illegible]83-	SCREW	SCREW		7
#18 - #24	652-2004-	NUT	NUT		7
#11 - #17	653-2039-	WASHER	WASHER		7
J1 - J4	654-0104-	3 CONT	CONN PC HEADER SINGLE ROW .100		4
#25	[illegible]60-0341-	L.T.	LOCK TITE (QTY FOR THIS A/R)		1

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L SCHEMATIC REVISION (S): 01 SHEET OF PAGE 4

(CAUTION - THE FOLLOWING PARTS/COMPONENTS CONTAINED IN THIS B.O.M. ARE NOT RECOMMENDED FOR NEW DESIGNS)

	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
	376-0197-	74S04	IC HEX INVERTER		1
	376-0200-	74S08	IC QUAD 2 INPUT POSITIVE AND GATES		8
	376-0202-	74S74	IC DUAL D-TYPE POS EDGE TRIGRD F/F W/PRESET/C		8
	376-0205-	74S32	IC QUAD 2-INPUT OR GATE		1
	376-0228-	74S00	IC QUAD 2-INPUT NAND GATE		2
	376-0298-	74S138	IC 3-LINE TO 8-LINE DECODER/MULTIPLEXER		1
	376-0301-	74S158	IC QUAD 2 TO 1-LINE DATA SELECTOR/MUX INVERT		1
	376-0305-	74S374	IC OCTAL D-TYPE EDGE-TRIG F/F TRI-STATE		1
	376-0333-	74S139	IC 2 TO 4-LINE DECODER/MULTIPLEXER		1
	376-0336-	74S151	IC 1-OF-8 DATA SEL/MUX		1
	376-0338-	74S244	IC OCTAL BUFFER/LINE DRIVER/RECEIVER TRI-STATE		1

*** END-OF-REPORT ***

WANG LABORATORIES, INC. LOWELL, MA U.S.A.	BY	DATE	APPROVED BY	DATE
DWN			E ENGR	
CHK			M ENGR	
MODEL NO.			MFG ENGR	

TITLE: 4 MEG BYTE MEMORY

WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
210-9300	C	9300	1

SCALE SHT 3 OF 12

W A N G   L A B O R A T O R I E S ,   I N C .   RUN DATE: 12/17/84 14:16

»»» E L E C T R I C A L   P A R T S   L I S T «««   SHEET OF   PAGE 1

(FINAL PARTS LIST)

BOARD NO. & TITLE: C9300   4 MEG BYTE MEMORY H/L
ASSEMBLY LEVEL & TITLE: 209-2   PCA VS SM SYS 1M MEM ML
PARTS LIST REVISION (P): 1
ARTWORK REVISION (R): 00
ASSEMBLY REVISION (A): 01
SCHEMATIC REVISION (S): 01
DWR OR MOST RECENT ECO: 339900

CREATED: 07/12/84 14:58
LAST MODIFIED: 12/17/84 14:02 BY: MS
EDITING REVISION: 12

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
C7 - C12	300-1833-	.1U	CAP CERAMIC MONO AXIAL LEADED +80%-20% 50V Z5U		176
C15 - C26					
C28 - C38					
C41 - C51					
C54 - C64					
C67 - C77					
C80 - C90					
C93 - C103					
C106 - C116					
C119 - C129					
C132 - C142					
C145 - C155					
C158 - C168					
C171 - C181					
C184 - C194					
C198 - C208					
C13 - C14	300-1966-	.047U	CAP CERAMIC MONO AXIAL +80 -20% 50V Z5U		54
C39 - C40					
C65 - C66					
C91 - C92					
C117 - C118					
C143 - C144					
C169 - C170					
C195 - C197					
C210 - C236					
C238 - C245					
C247 - C248					
C1	300-4018-	18U	CAP TANT AXIAL 10% 15V		16
C26 - C27					
C52 - C53					
C78 - C79					
C104 - C105					
C130 - C131					
C156 - C157					
C182 - C183					
C209					
C237	300-4022-	15U	CAP TANT AXIAL 10% 20V		2

BOARD NO. & TITLE: C9300   4 MEG BYTE MEMORY H/L   SCHEMATIC REVISION (S): 01   SHEET OF   PAGE 2

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
C246					
SW1	325-1501-	SWITCH	SLIDE SPST 5 POS		1
R19 - R25	330-1048-	47.000	RES FIXED METAL FILM 1/4W 5% 200PPM		56
R27 - R33					
R52 - R58					
R60 - R66					
R85 - R91					
R93 - R99					
R118 - R124					
R126 - R132					
R1 - R16	330-1057-	56.000	RES FIXED METAL FILM 1/4W 5% 200PPM		54
R67 - R82					
R133 - R143					
R146 - R156					
R17	330-3011-	1K	RES FIXED METAL FILM 1/4W 5% 200PPM		15
R50					
R83					
R116					
R144 - R145					
R157 - R164					
R165A					
R165	333-0809-	10.000KN	RESISTOR NETWORK TYPE: 10/09/C/SS		1
P4 - P7	350-4506-	2 CONT	CONN SHUNT .100 CTR		4
L231	376-0160-	74LS175	IC QUAD D-TYPE FLIP-FLOP		1
L227	376-0171-	74148	IC 8-LINE-TO-3-LINE OCTAL PRIORITY ENCODER		1
L229	376-0197-	74S04	IC HEX INVERTER		1
L36 - L37	376-0200-	74S08	IC QUAD 2 INPUT POSITIVE AND GATES		8
L84 - L85					
L132 - L133					
L180 - L181					
L212 - L215	376-0202-	74S74	IC DUAL D-TYPE POS EDGE TRIGRD F/F W/PRESET/C		8
L237					
L254					
L257 - L258					
L201	376-0204-	74LS257	IC QUAD 2-LINE TO 1-LINE DATA SEL/MUX		7
L222 - L226					
L243					
L256	376-0205-	74S32	IC QUAD 2-INPUT OR GATE		1
L234 - L235	376-0228	74S00	IC QUAD 2-INPUT NAND GATE		2
L252	376-0259-	74S85	IC 4-BIT MAGNITUDE COMPARATOR		1
L207	376-0278-	74S161	IC SYN 4-BIT BINARY COUNTER W/DIRECT CLEAR		1
L221	376-0286-	74LS374	IC OCTAL D-TYPE FLIP-FLOP TRI-STATE		4
L242					
L248 - L249					
L196 - L198	376-0268-	74LS244	IC OCTAL BUFFER/LINE DRIVER W/TRI STATE		12
L200					
L208					
L210 - L211					
L244 - L247					
L251					

WANG	WANG LABORATORIES, INC. LOWELL, MA U.S.A.	BY	DATE	APPROVED BY / DATE
		DWN		E ENGR
		CHK		M ENGR
				M.G ENGR
MATERIAL	MODEL NO.	TITLE 4 MEG BYTE MEMORY		
FINISH	SCALE / SHT 10 OF 12	210-9300 (WANG PART NUMBER)	C (SIZE)	9300 (DRAWING NUMBER) / REV 1

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L SCHEMATIC REVISION (S): 01 SHEET OF PAGE 3

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
L228	376-0294-	74LS138	IC 3-LINE TO 8-LINE DECOD[illegible]MULTIPLEXER		1
L12 - L13 L108 - L109 L253	376-0297-	74LS240	[illegible] OCTAL [illegible] RECEIVER		6
L205	376-0298-	74S138	IC 3-LINE TO 8-LINE DECODER/MULTIPLEXER		1
L202	376-0301-	74S158	IC QUAD 2 TO 1-LINE DATA SELECTOR MUX INVERT		1
L233	376-0305-	74S374	IC OCTAL D-TYPE E[illegible]E-TRIG F/F TRI-STATE		1
L199 L210	376-0307-	74LS393	IC DU[illegible] COU[illegible]ER		2
L255	376-0333-	74S139	IC 2 TO 4-LINE DECODER/MULTIPLEXER		1
L236	376-0336-	74S151	IC 1-OF-8 DATA SEL/MUX		1
L204	376-0338-	74S244	IC OCTAL BUFFER/LINE DRIVER RECEIVER TRI-STATE		1
L60 L60A L61 L156 L156A L157	376-0553-	AM2966	IC OCTAL [illegible] DRIVER W/3 ST OUT		6
L220	376-9013-	SKT 28	IC SOCKET 28 PIN DIL MOUNT		1
L1 - L11 L14 - L35 L38 - L59 L62 - L83 L86 - L107 L110 - L131 L134 - L155 L158 - L179 L182 - L192	377-0415-	4164	IC 64KX1 DRAM 200NS REF REQUIRE 4MS/256 ROW		176
03	452-2707-	STIFFN	STIFFENER LOWER		1
02	452-2708-	STIFFN	STIFFENER UPPER		1
026 - 027	465-1238-	EXTRCTOR	EXTRACTOR		2
01	510-9300-		PCB		1
04 - 010	650-2083-	SCREW	SCREW		7
018 - 024	652-2004-	NUT	NUT		7
011 - 017	653-2009-	WASHER	WASHER		7
J1 - J4	654-0104-	3 CONT	CONN PC HEADER SINGLE ROW .100		4
025	660-0341-	L.T.	LOCK TITE (QTY FOR THIS A/R)		1

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L SCHEMATIC REVISION (S): 01 SHEET OF PAGE 4

	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.

(CAUTION - THE FOLLOWING PARTS/COMPONENTS CONTAINED IN THIS B.O.M. ARE NOT RECOMMENDED FOR NEW DESIGNS)

	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
	376-0197-	74S04	IC HEX INVERTER		1
	376-0200-	74S08	IC QUAD 2 INPUT POSITIVE AND GATES		8
	376-0202-	74S74	IC DUAL D-TYPE POS EDGE TRIGRD F/F W/PRESET/C		8
	376-0[illegible]5-	74S32	IC QUAD 2-INPUT OR GATE		1
	376-0228-	74S00	IC QUAD 2-INPUT NAND GATE		2
	376-0298-	74S138	IC 3-LINE TO 8-LINE DECODER/MULTIPLEXER		1
	376-0301-	74S158	IC QUAD 2 TO 1-LINE DATA SELECTOR/MUX INVERT		1
	376-0305-	74S374	IC OCTAL D-TYPE EDGE-TRIG F/F TRI STATE		1
	376-0333-	74S139	IC 2 TO 4-LINE DECODER/MULTIPLEXER		1
	376-0336-	74S151	IC 1-OF-8 DATA SEL/MUX		1
	376-0338-	74S244	IC OCTAL BUFFER/LINE DRIVER/RECEIVER TRI-STATE		1

*** END-OF-REPORT ***

WANG	WANG LABORATORIES, INC. LOWELL, MA U.S.A.	BY	DATE	APPROVED BY	DATE
		DWN		E ENGR	
		CHK		M ENGR	
MATERIAL	MODEL NO.			MFG ENGR	
	SEE ENG'G SPECIFICATIONS	TITLE 4 MEG BYTE MEMORY			
FINISH	TOL. EXCEPT AS NOTED	210-9300	C	9300	1
	SCALE SHT 11 OF 12	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

WANG LABORATORIES, INC. RUN DATE: 12/17/84 14:47

»»» ELECTRICAL PARTS LIST ««« SHEET OF PAGE 1

(FINAL PARTS LIST)

BOARD NO. & TITLE: C9300 4 MEG BYTE MEMORY M/L
ASSEMBLY LEVEL & TITLE: 209-3 PCA VS SM SYS 2M MEM ML
PARTS LIST REVISION (P): 1
ARTWORK REVISION (R): 00
ASSEMBLY REVISION (A): 01
SCHEMATIC REVISION (S): 01
CWR OR MOST RECENT ECO: 33990D

CREATED: 07/12/84 14:55
LAST MODIFIED: 12/17/84 14:07 BY: NS
EDITING REVISION: 12

REF. DES.	WANG PART NO.	VALUE/TYPE	DESCRIPTION	DRAWING NO.	QTY.
C106 - C116	300-1833-	.1U	CAP CERAMIC MONO AXIAL LEADED +80%-20% 50V Z5U		88
C119 - C129					
C132 - C142					
C145 - C155					
C158 - C168					
C171 - C181					
C184 - C194					
C198 - C208					
C13 - C14	300-1966-	.047U	CAP CERAMIC MONO AXIAL +80 -20% 50V Z5U		54
C39 - C40					
C65 - C66					
C91 - C92					
C117 - C118					
C143 - C144					
C169 - C170					
C195 - C197					
C210 - C236					
C238 - C245					
C247 - C248					
C1	300-4018-	18U	CAP TANT AXIAL 10% 15V		16
C26 - C27					
C52 - C53					
C78 - C79					
C104 - C105					
C130 - C131					
C156 - C157					
C182 - C183					
C209					
C237	300-4022-	15U	CAP TANT AXIAL 10% 20V		2
C246					
SW1	325-1501-	SWITCH	SLIDE SPST 5 POS		1
R19 - R25	330-1048-	47.000	RES FIXED METAL FILM 1/4W 5% 200PPM		56
R27 - R33					
R52 - R58					
R60 - R66					
R85 - R91					
R93 - R99					

WANG LABORATORIES, INC. LOWELL, MA U.S.A.		BY	DATE	APPROVED BY	DATE
		DWN		E ENGR	
		CHK		M ENGR	
MATERIAL	MODEL NO.			MFG ENGR	
	SEE ENGRG SPECIFICATIONS No	TITLE 4 MEG BYTE MEMORY			
FINISH	TOL. EX. AS NOTED XX ± .010 FRAC. ± 1/64 XXX ± .005 ANG. ± 1°30' FINISH	210-9300	C	9300	1
	SCALE / SHT 12 OF 12	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

WANG LABORATORIES, INC.

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851, TEL. (617) 459-5000, TWX 710 343-6769, TELEX 94-7421

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END