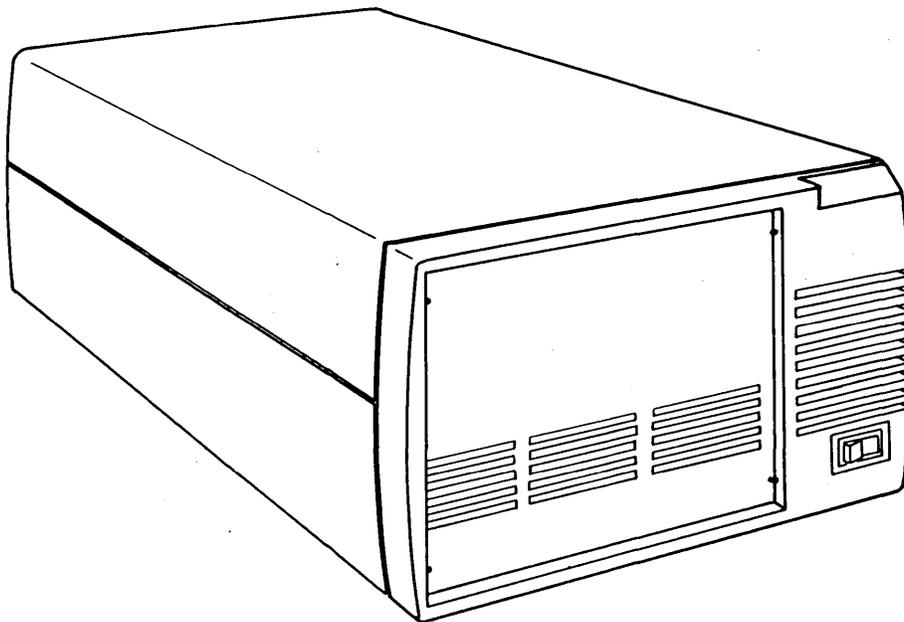




WINCHESTER PERIPHERAL CHASSIS SERVICE MANUAL



**WINCHESTER
PERIPHERAL CHASSIS
SERVICE MANUAL**

Order Number: 134170-002

CAUTION

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested with a Class A Computing Device and found to comply with the limits for a Class A Computing Device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

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|---------------|--|-----------------|---------------|
| AEDIT | iDBP | iOSP | MULTIMODULE |
| BITBUS | iDIS | iPDS | Plug-A-Bubble |
| BXP | iLBX | iRMX | PROMPT |
| COMMputer | i _m | iSBC | Promware |
| CREDIT | iMMX | iSBX | QUEX |
| Data Pipeline | Insite | iSDM | QUEST |
| GENIUS | int _e l | iSXM | Ripplemode |
| i | int _e IBOS | Library Manager | RMX/80 |
| Δ | Intelevison | MCS | RUPI |
| iATC | int _e l _i gent Identifier | Megachassis | Seamless |
| iPICE | int _e l _i gent Programming | MICROMAINFRAME | SOLO |
| ICE | Intellec | MULTIBUS | SYSTEM 2000 |
| iCS | Intellink | MULTICHANNEL | UPI |

and the combination of ICE, iCS, iRMX, iSBC, iSBX, or MCS and a numerical suffix.

| REV. | REVISION HISTORY | DATE |
|------|--|----------|
| -001 | Original issue released. | 12/15/83 |
| -002 | Changes jumper for interrupt priority in Table 1-3, Table 1-5, and Figure 1-4. | 05/02/84 |



This manual is intended for the Intel Customer Engineer who will be providing field service support for the Winchester Peripheral Chassis installed on the Series II or Series III Microcomputer Development System.

Additional information about the development system, its diagnostics, and the ISIS-II(W) operating system may be found in the following Intel documents:

Winchester Peripheral Chassis ISIS-II(W) Supplement,
Order Number: 121899

CE Diagnostic System Test Operating Instructions for Series II Systems,
Order Number: 121619

Intellec Series III Field Service Manual,
Order Number: 121640

WARNING

Risk of electrical shock may be present on exposed metal parts unless this product is adequately grounded in accordance with the following guidelines:

- A. An insulated grounding conductor that is identical in size, insulation material, and thickness to the grounded and ungrounded branch-circuit supply conductors except that it is green with or without one or more yellow stripes is to be installed as part of the branch circuit that supplies the unit or system.
- B. The grounding conductor mentioned in item A is to be grounded to earth at the service equipment or other acceptable building earth ground such as the building frame in the case of a high-rise steel-frame structure.
- C. The attachment-plug receptacles in the vicinity of the unit or system are all to be of a grounding type, and the grounding conductors serving these receptacles are to be connected to earth ground at the service equipment or other acceptable building earth ground, such as the building frame in the case of a high-rise steel-frame structure.

Notational Conventions

| | |
|---|---|
| UPPERCASE | Characters shown in uppercase must be entered in the order shown. You may enter the characters in uppercase or lowercase. |
| <i>italics</i> | Italics indicate variable information, such as <i>filename</i> or <i>address</i> . |
| [] | Brackets indicate optional arguments or parameters. |
| { } | One and only one of the enclosed entries must be selected unless the field is also surrounded by brackets, in which case it is optional. |
| { }... | At least one of the enclosed items must be selected unless the field is also surrounded by brackets, in which case it is optional. The items may be used in any order unless otherwise noted. |
| ... | Ellipses indicate that the preceding argument or parameter may be repeated. |
| punctuation | Punctuation other than ellipses, braces, and brackets must be entered as shown. For example, the punctuation shown in the following command must be entered. SUBMIT PLM86(PROGA, SRC, '9SEPT81') |
| input lines | In interactive examples, input lines and user responses are printed in white on black to differentiate input lines from system output. |
| <cr> or  | Carriage return indicates depression of the RETURN key. |



TABLE OF CONTENTS

Contents

| CHAPTER 1 | PAGE | CHAPTER 5 | PAGE |
|---|-------------|---|-------------|
| GENERAL INFORMATION | | REMOVAL AND REPLACEMENT | |
| Introduction | 1-1 | Introduction | 5-1 |
| Subassembly Functional Description | 1-1 | Pre-Removal Requirements | 5-1 |
| iMDX 704—Winchester Drive Controller | 1-1 | Series II/III Development System FRU | |
| iMDX 712—Series II/Series III Rear Panel ... | 1-1 | R/R Procedures | 5-2 |
| iMDX 761—Winchester Peripheral Chassis | 1-1 | Winchester Disk Drive Controller | 5-2 |
| Specifications | 1-2 | Development System Rear Panel | 5-2 |
| Series II/Series III Drive Configurations | 1-3 | Winchester Interface Internal Cable | 5-4 |
| Winchester Disk Controller Configuration | 1-7 | Peripheral Chassis FRU Removal/Replacement .. | 5-4 |
| iSBC 215B Disk Controller | 1-7 | Winchester Drive Assembly | 5-4 |
| iSBC 215G Disk Controller | 1-8 | On/Off Switch/Circuit Breaker | 5-7 |
| CHAPTER 2 | | AC Line Filter | 5-8 |
| INSTALLATION PROCEDURES | | Rear Panel Fan | 5-8 |
| Introduction | 2-1 | Scrambler Board | 5-10 |
| Winchester Chassis Characteristics | 2-1 | Power Supply | 5-11 |
| Series II/Series III Development System | | Winchester External Interface Cable | 5-14 |
| Preparation | 2-1 | CHAPTER 6 | |
| Series II Development System Upgrades | 2-2 | ILLUSTRATED PARTS LIST | |
| Upgrade Preparation Kit Requirements | 2-2 | Introduction | 6-1 |
| Integrated Processor Card | 2-3 | Winchester Peripheral Chassis Parts Listing | 6-1 |
| Development System Rear Panel Replacement | 2-3 | Winchester Chassis Exploded View | 6-2 |
| Removing the Rear Panel | 2-3 | CHAPTER 7 | |
| Installing the New Rear Panel | 2-4 | STFS COMMAND SUMMARY | |
| Winchester Disk Controller Installation | 2-6 | Introduction | 7-1 |
| Peripheral Chassis Installation | 2-7 | Line Editing | 7-1 |
| CHAPTER 3 | | Command Notational Convention | 7-2 |
| ALTMAP | | STFS Commands | 7-2 |
| Introduction | 3-1 | BASE Command | 7-3 |
| Executing the ALTMAP CUSP | 3-1 | CLEAR Command | 7-4 |
| Verifying the Defective Track Information | 3-1 | COUNT Command | 7-5 |
| ALTMAP Command Summary | 3-2 | DEBUG Command | 7-6 |
| Reading Defective/Alternate Maps | 3-4 | DESCRIBE Command | 7-7 |
| Marking Defective/Alternate Tracks | 3-4 | EXIT Command | 7-8 |
| Freeing the Tracks | 3-5 | IGNORE Command | 7-9 |
| Writing the Maps | 3-6 | LIST Command | 7-10 |
| Initializing the Maps | 3-6 | RECOGNIZE Command | 7-11 |
| Listing the Maps | 3-7 | REPEAT Command | 7-12 |
| Peripheral Chassis Initialization Procedure | 3-8 | SUMMARY Command | 7-13 |
| CHAPTER 4 | | TEST Command | 7-14 |
| DIAGNOSTICS | | | |
| Introduction | 4-1 | | |
| Winchester Customer Engineer Diagnostic | | | |
| Description | 4-1 | | |
| Diagnostic Test Execution Times | 4-4 | | |

Tables

| TABLE | TITLE | PAGE | TABLE | TITLE | PAGE |
|-------|--|------|-------|---|------|
| 1-1 | Winchester Peripheral Chassis Specifications | 1-2 | 4-2 | Test Execution Times | 4-4 |
| 1-2 | Drive Configurations | 1-3 | 4-3 | Diagnostic V-Variable Description | 4-8 |
| 1-3 | iSBC 215B Jumper Configuration | 1-7 | 4-4 | WCED Messages | 4-10 |
| 1-4 | S1 and S2 Switch Configurations | 1-8 | 6-1 | Parts List | 6-1 |
| 1-5 | iSBC 215G Jumper Configuration | 1-8 | 7-1 | STFS Command Description | 7-1 |
| 4-1 | WCED Test Suite | 4-1 | 7-2 | Line Editing Commands | 7-1 |
| | | | 7-3 | Command Notational Convention | 7-2 |

Figures

| FIGURE | TITLE | PAGE | FIGURE | TITLE | PAGE |
|--------|---|-----------|--------|--|------|
| 1-1 | Peripheral Chassis with Level 1 Power Supply Wiring Diagram | 1-4 | 2-2 | Internal Cable Mounting | 2-5 |
| 1-2 | Peripheral Chassis with Level 3 Power Supply Wiring Diagram | 1-5 | 2-3 | Drive Locking Lever | 2-7 |
| 1-3 | Scrambler Board Schematic | 1-6 | 2-4 | R/W Control Board Configurations | 2-9 |
| 1-4 | iSBC 215B Controller Configuration | 1-9/1-10 | 5-1 | Development System Rear Panel | 5-3 |
| 1-5 | iSBC 215G Controller Configuration | 1-11/1-12 | 5-2 | Drive Assembly Removal | 5-6 |
| 2-1 | Rear Panel Removal | 2-4 | 5-3 | AC Line Filter | 5-9 |
| | | | 5-4 | Rear Panel Fan Removal | 5-10 |
| | | | 5-5 | Scrambler Board | 5-11 |
| | | | 5-6 | Power Supply | 5-13 |
| | | | 6-1 | Winchester Chassis Exploded View | 6-3 |



1.1 Introduction

The Model iMDX 750 Winchester Subsystem provides an additional 29 Megabytes of on-line, high-capacity storage for the Intel Series II, Series III, and Series IV development systems and the Zero Peripheral Attachment NRM in a free-standing peripheral chassis. The Winchester Peripheral Chassis houses an 8-inch, 35 Megabyte Winchester disk drive, a requisite power supply, a scrambler board which reroutes the controller's logic signals to the disk drive, fans for cooling, line filter, and a circuit breaker.

1.2 Subassembly Functional Description

The following paragraphs briefly identify and describe the major field replaceable units of the Model iMDX 750 Winchester Subsystem.

1.2.1 iMDX 704—Winchester Drive Controller

The iSBC 215B or iSBC 215G Winchester disk controller (each with modified firmware) allows the Winchester disk drive to interface with the host system Multibus and enables the 8085 microprocessor (on the IPC in the Series II and Series III) or the 8088 microprocessor (on the CPIO board in the Series IV and Zero Peripheral Attachment NRM) to access the disk drive and perform read/write operations.

1.2.2 iMDX 712—Series II/Series III Rear Panel

The modified rear panel is installed on each Series II and Series III development system whenever the Winchester Peripheral Chassis is added. The new rear panel contains the modified interface connector cutout for the internal and external signal cable.

1.2.3 iMDX 761—Winchester Peripheral Chassis

Internal to the Winchester Peripheral Chassis are the following field replaceable units (FRU):

- The requisite power supply (level 1 or level 3) inputs voltages of 110 VAC 50 Hz or 220 VAC 60 Hz and provides the Winchester drive with the necessary operating dc voltages and the rear panel fans with the requisite ac voltage.
- The 8-inch Winchester disk drive has a storage capacity of 29 Megabytes of formatted memory. The drive has a sealed head disk assembly consisting of the drive spindle assembly, drive motor, voice coil actuator, head carriage assembly, read/write heads, three magnetic discs, and air filter assemblies. Two printed circuit boards mounted on each side of the drive assembly provide the electronic circuitry for the drive: a Read/Write Digital Control Board

which contains read/write circuitry, controls command execution and data transfers across the user interface, and a Servo Motor Control Board which contains circuitry for driving the spindle motor, processing the Servo signals from the Servo read head, and controlling the head carriage position.

- The scrambler board (a small printed circuit board mounted on the inside of the rear panel) reassigns the pinouts of the read/write data and control logic signals on the external cable to the 50-pin Winchester drive ribbon cable. Switch 1 scrambles the drive select signal output on connector J4; this switch should always be in the UP position.
- The line filter prevents spikes on the incoming ac lines from affecting the system and reduces the radio frequency noise emitted from the chassis.
- The circuit breaker is part of the ON/OFF switch and will shut down the system if excessive current is drawn.

1.3 Specifications

Specifications for the Winchester Peripheral Chassis are outlined in the Table 1-1. Figure 1-1 is the wiring diagram for the Winchester Peripheral Chassis with the level 1 power supply. Figure 1-2 is the wiring diagram for the Winchester Peripheral Chassis with the level 3 power supply. Figure 1-3 is the Scrambler Board Schematic.

Table 1-1. Winchester Peripheral Chassis Specifications

| Drive Characteristics | |
|---------------------------|--|
| Type: | Winchester sealed disk |
| Tracks per Inch: | 480 |
| Sectors per Track: | 70 |
| Tracks per Surface: | 525 |
| Recording Surfaces: | 5 |
| Recording Technique: | MFM (Modified Frequency Modulation) |
| Bytes per Sector: | 128 |
| Track Density: | 6670 bits/in. (innermost track) |
| Transfer Rate: | 6.4 Megabits/second |
| Rotational Speed: | 3600 rpm |
| Access Times | |
| Track to Track: | 10 ms max |
| Full Stroke: | 90 ms |
| Physical Characteristics | |
| Width: | 16.9 in (42.9 cm) |
| Height: | 11.3 in (28.7 cm) |
| Depth: | 24.3 in (61.7 cm) |
| Weight: | 55 lbs (25 kg) |
| Electrical Requirements | |
| Chassis AC Power: | 110 VAC, 60 Hz, 5A (max) 220 VAC, 50 Hz, 3A (max) |
| Disk Controller DC Power: | 5 VDC, 2.5A (typ), 3.25A (max) |

Table 1-1. Winchester Peripheral Chassis Specifications (Cont'd.)

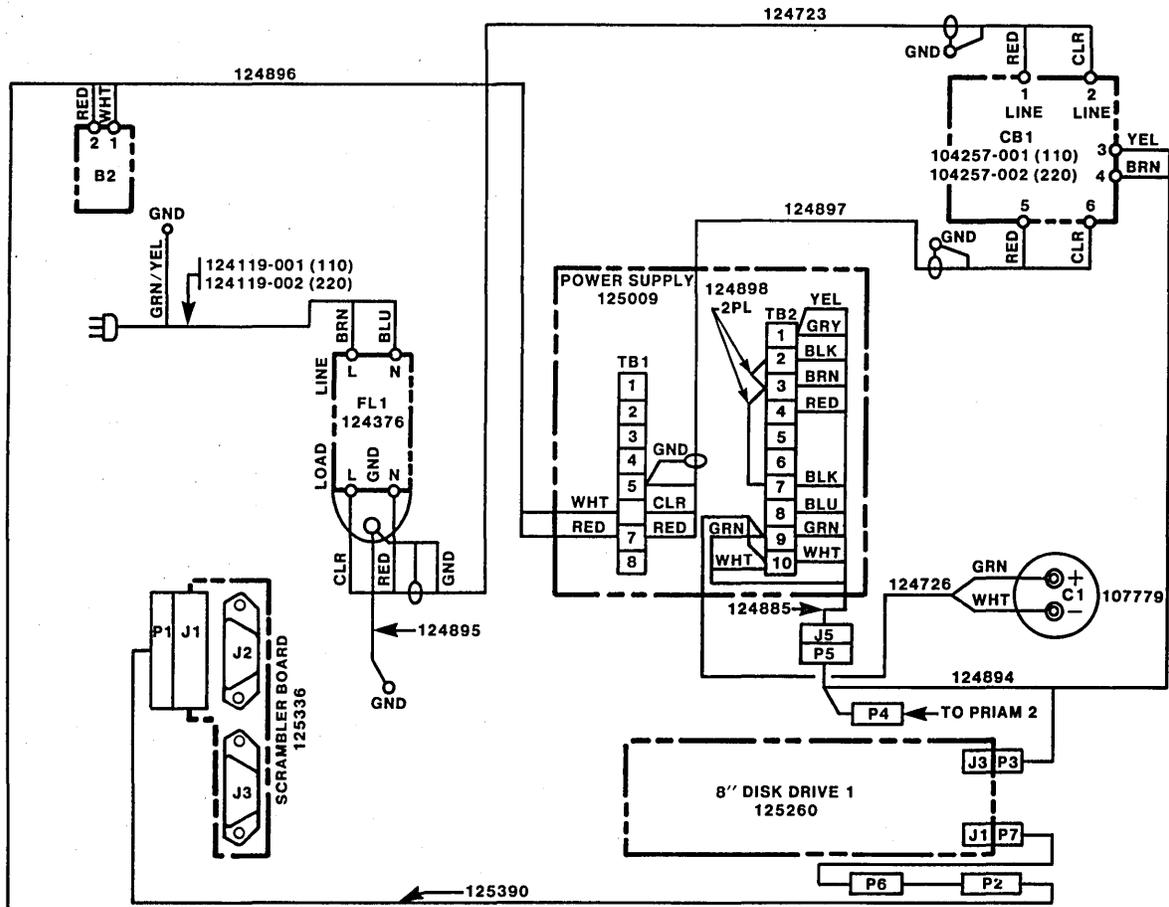
| Environmental Characteristics | |
|---|--|
| Winchester Chassis Temperature: | 15°C to 35°C operating -9°C to 60°C storage |
| Humidity: | 10% to 90% non-condensing |
| Disk Controller Temperature: | 0°C to 55°C operating -55°C to 85°C storage |
| Humidity: | To 90% non-condensing |
| Equipment Supplied | |
| iMDX 750-(A/B) Winchester Subsystem | Peripheral chassis with a 35 Megabyte Winchester drive iSBC 215B/G disk controller with modified firmware literature kit with diagnostics and ISIS-II(W) software diskettes Series II/III backpanel with an internal cable and an external interface cable Integrated Processor Card (IPC) |
| * iMDX 761-(A/B): | |
| iMDX 704: | |
| iMDX 2009: | |
| iMDX 712: | |
| Model 505: | |
| * (A) designation indicates 115 VAC operation (B) designation indicates 230 VAC operation. | |

1.4 Series II/Series III Drive Configurations

When the Winchester peripheral chassis is attached to a Series II or Series III development system, the system must run under the ISIS-II(W) operating system; the Winchester disk drive is identified as drive 0 (:F0:) through drive 3 (:F3:). Table 1-2 lists the supported drive configurations.

Table 1-2. Drive Configurations

| Configuration | Device Unit Number | | | | | | | | | |
|--|--------------------|------|------|------|------|------|------|------|------|------|
| | :F0: | :F1: | :F2: | :F3: | :F4: | :F5: | :F6: | :F7: | :F8: | :F9: |
| W + DD | W | W | W | W | DD | DD | (DD) | (DD) | | |
| W + SD | W | W | W | W | SD | SD | (SD) | (SD) | | |
| W + IS | W | W | W | W | IS | * | | | | |
| W + DD + SD | W | W | W | W | DD | DD | (DD) | (DD) | SD | SD |
| W + DD + IS | W | W | W | W | DD | DD | (DD) | (DD) | IS | * |
| W + SD + IS | W | W | W | W | SD | SD | (SD) | (SD) | IS | * |
| W = Winchester Disk DD = Double-Density Flexible Disk SD = Single-Density Flexible Disk IS = Integrated Single-Density Flexible Disk * = Not Available (DD), (SD) = Optional to Configuration | | | | | | | | | | |



WIRING DIAGRAM

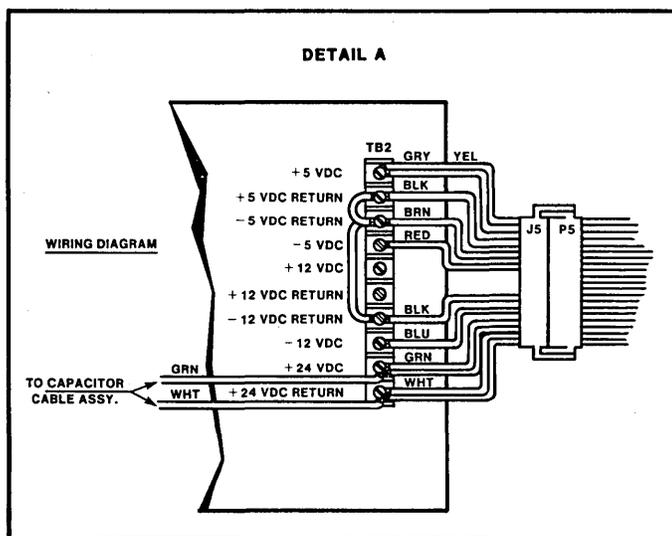
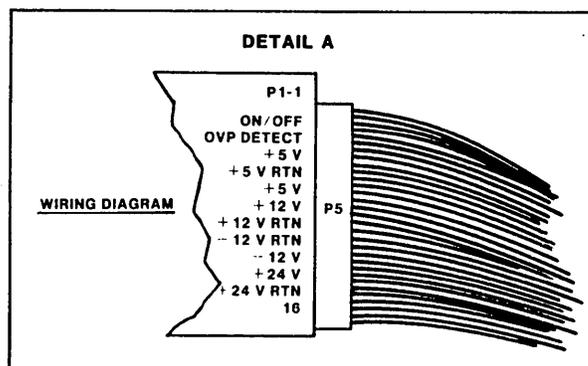
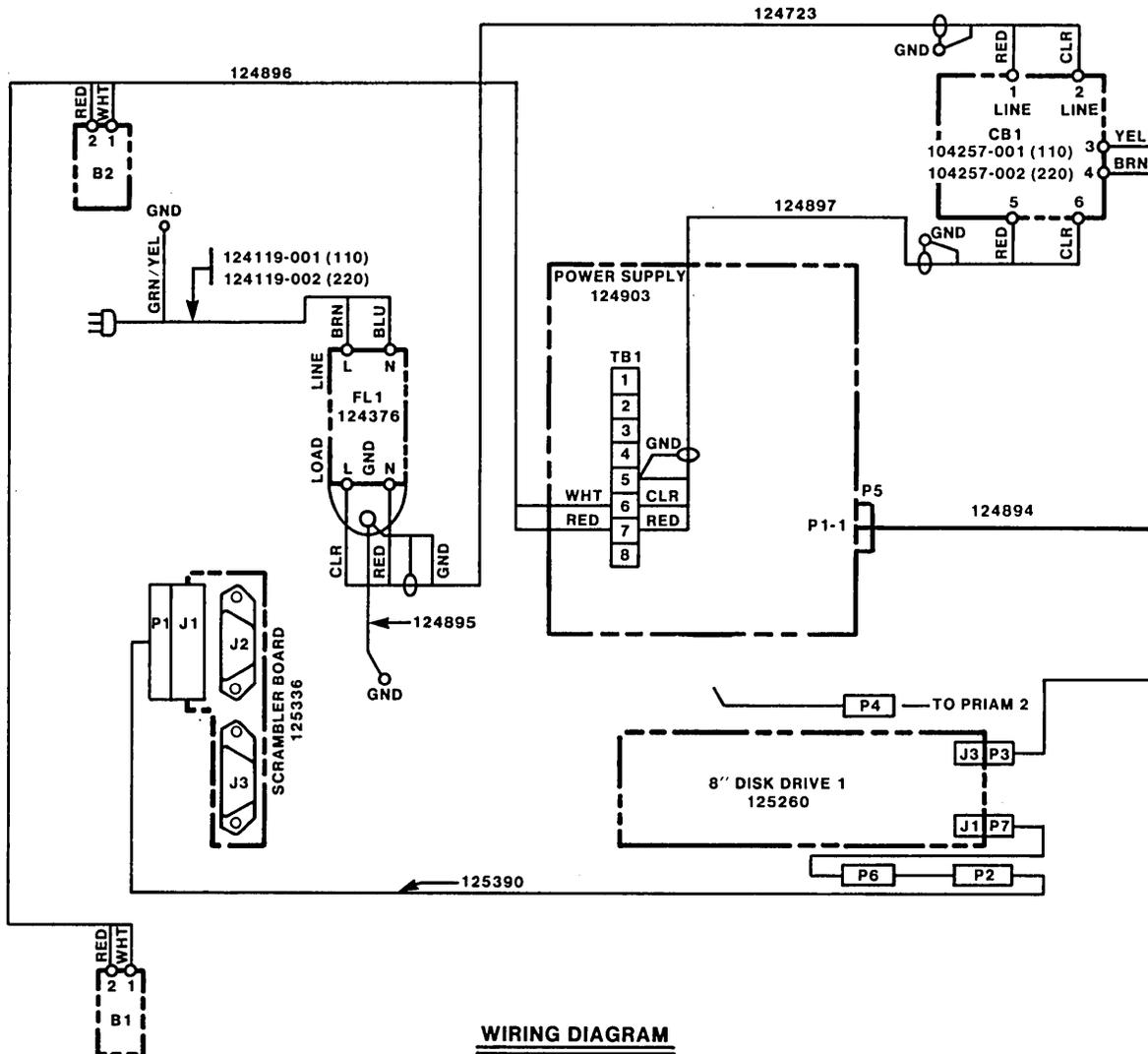


Figure 1-1. Peripheral Chassis with Level 1 Power Supply Wiring Diagram



134170-2

Figure 1-2. Peripheral Chassis with Level 3 Power Supply Wiring Diagram

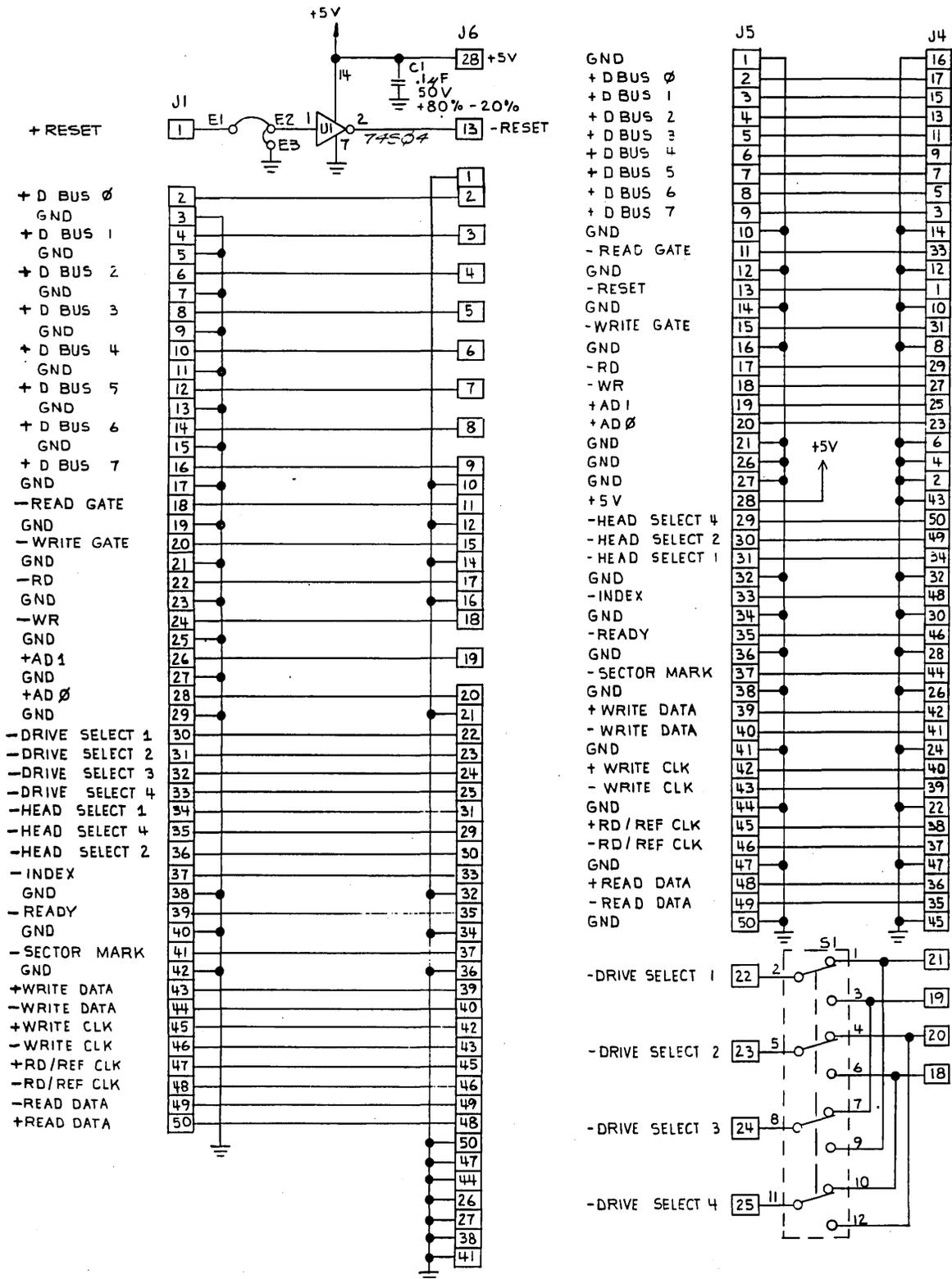


Figure 1-3. Scrambler Board Schematic

134170-3

1.5 Winchester Disk Controller Configuration

The iSBC 215B or iSBC 215G Winchester disk controller is installed in the host development system to control the Read/Write and data transfer operations on the Winchester disk drive. The two mini-dip switches, S1 and S2 (on the iSBC 215B only) are set to select the wake-up address of the first I/O communication block in the host memory. Switch S2 also selects the I/O port address through which the host CPU talks to the controller. Switches S1 and S2 are replaced on the iSBC 215G board by jumper blocks W29-1 to W29-16 and W30-1 to W30-20, respectively. The suitcase jumpers configure the following functions on the controller:

- Interrupt Priority Level
- Any Request
- Common Bus Request
- Winchester Drive Interface
- iSBX Bus Control

1.5.1 iSBC 215B Disk Controller

Table 1-3 provides a functional description of the configured jumpers on the iSBC 215B controller. Table 1-4 shows the switch configuration for S1 and S2 for each host development system. Figure 1-4 illustrates the location of the user selectable suitcase jumpers and other jumpered pins on the controller board.

Table 1-3. iSBC 215B Jumper Configuration

| Jumper | Function |
|--|--|
| W19-C - OPEN | Interrupt Priority Level |
| W18-1 - W18-3 | Any Request Allows any device, higher or lower priority to gain control of the Multibus interface. |
| W23-1 - W23-2 | Common Bus Request Allows controller to arbitrate for bus use on every bus access request. |
| W1-1 - W1-2 W2-1 - W2-2 W5-1 - W5-2 W6-1 - W6-2 W7-1 - W7-2 W8-1 - W8-2 W10-1 - W10-2 W13-1 - W13-3 W14-1 - W14-3 W15-1 - W15-2 W16-1 - W16-3 W22-1 - W22-3 | Winchester Drive Interface Selects closed-head positioning Vendor Select Selects RD- signal output to pin 1 of U13 Selects RD+ signal output to pin 2 of U13 Selects RDCL+ signal output to pin 7 of U13 Selects RDCL- signal output to pin 6 of U13 Radial Select Selects Hard Sectors AM Control GAP Control Selects Hard Sectors Enables RD Clock Select input on pin 3 of U18 |
| W3-1 - W3-2 W4-1 - W4-2 | iSBX Bus Control iSBX Control iSBX Control |

Table 1-4. S1 and S2 Switch Configurations

| System | Switch S1 | Switch S2 |
|--------------------------|----------------------------|---|
| Series II/ Series III | 1 - 8 OFF | 1 - 7 and 9 OFF 8 and 10 ON |
| Series IV/ NRM | 1, 2 and 4 - 8 OFF 3 ON | 3 and 6 - 8 OFF 1, 2, 4, 5, 9, and 10 ON |

1.5.2 iSBC 215G Disk Controller

Table 1-5 lists the suitcase jumpers that configure the iSBC 215G controller for the Series II and Series III development systems. Figure 1-5 illustrates the location of the user selectable suitcase jumpers and other jumpered pins on the controller board.

Table 1-5. iSBC 215G Jumper Configuration

| Jumper | Function |
|---|---|
| W19-C - OPEN | Interrupt Priority Level |
| W18-1 - W18-3 | Any Request Allows any device, higher or lower priority to gain control of the Multibus interface. |
| W23-1 - W23-2 | Common Bus Request Allows controller to arbitrate for bus use on every bus access request. |
| W1-1 - W1-2 W2-1 - W2-2 W5-1 - W5-2 W6-1 - W6-2 W7-1 - W7-2 W8-1 - W8-2 W10-1 - W10-2 W13-1 - W13-3 W14-1 - W14-3 W15-1 - W15-2 W16-1 - W16-3 W22-1 - W22-3 W26-1 - W26-2 W27-1 - W27-2 W33-1 - W33-2 W37-1 - W37-2 W38-1 - W38-2 | Winchester Drive Interface Selects closed-head positioning Vendor Select Selects RD- signal output to pin 1 of U13 Selects RD+ signal output to pin 2 of U13 Selects RDCL+ signal output to pin 7 of U13 Selects RDCL- signal output to pin 6 of U13 Radial Select Selects Hard Sectors AM Control GAP Control Selects Hard Sectors Enables RD Clock Select input on pin 3 of U18 Selects Priam Selects Priam Enables SECT 0/ Selects Priam Selects Priam |
| W3-1 - W3-2 W4-1 - W4-2 | iSBX Bus Control iSBX Control iSBX Control |
| W28-1 - W28-2 | Bus Priority Out Enables BPRO/ signal |
| W30-8 - W30-13 W30-10 - W30-11 | I/O Address Selection Wake-Up Address Bit 2 Wake-Up Address Bit 0 |

| Location | Jumper |
|----------|----------------|
| 1 | W13-1 to W13-3 |
| 2 | W1-1 to W1-2 |
| 3 | W14-1 to W14-3 |
| 4 | W4-1 to W4-2 |
| 5 | W3-1 to W3-2 |
| 6 | W2-1 to W2-2 |
| 7 | W6-1 to W6-2 |
| 8 | W5-1 to W5-2 |
| 9 | W7-1 to W7-2 |
| 10 | W8-1 to W8-2 |
| 11 | W22-1 to W22-3 |
| 12 | W10-1 to W10-2 |
| 13 | W15-1 to W15-2 |
| 14 | W16-1 to W16-3 |
| 15 | W19-C to Open |
| 16 | W23-1 to W23-2 |
| 17 | W18-1 to W18-3 |

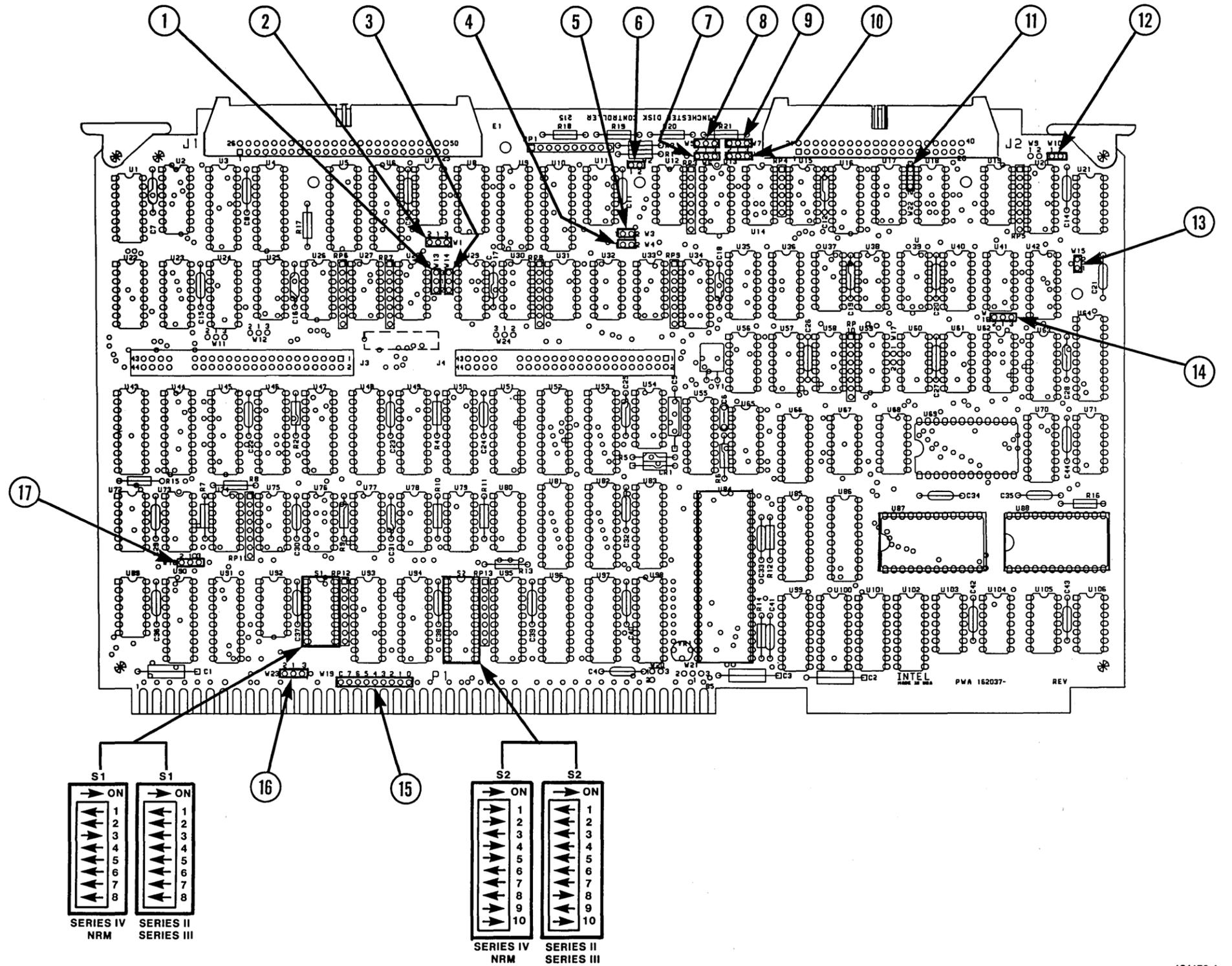


Figure 1-4. iSBC 215B Controller Configuration

| Location | Jumper |
|----------|------------------|
| 1 | W1-1 to W1-2 |
| 2 | W14-1 to W14-3 |
| 3 | W33-1 to W33-2 |
| 4 | W3-1 to W3-2 |
| 5 | W5-1 to W5-2 |
| 6 | W2-1 to W2-2 |
| 7 | W4-1 to W4-2 |
| 8 | W6-1 to W6-2 |
| 9 | W8-1 to W8-2 |
| 10 | W26-1 to W26-2 |
| 11 | W7-1 to W7-2 |
| 12 | W22-1 to W22-3 |
| 13 | W10-1 to W10-2 |
| 14 | W15-1 to W15-2 |
| 15 | W38-1 to W38-2 |
| 16 | W37-1 to W37-2 |
| 17 | W16-1 to W16-3 |
| 18 | W30-8 to W30-13 |
| 19 | W30-10 to W30-11 |
| 20 | W19-C to OPEN |
| 21 | W28-1 to W28-2 |
| 22 | W18-1 to W18-3 |
| 23 | W27-1 to W27-2 |
| 24 | W13-1 to W13-3 |

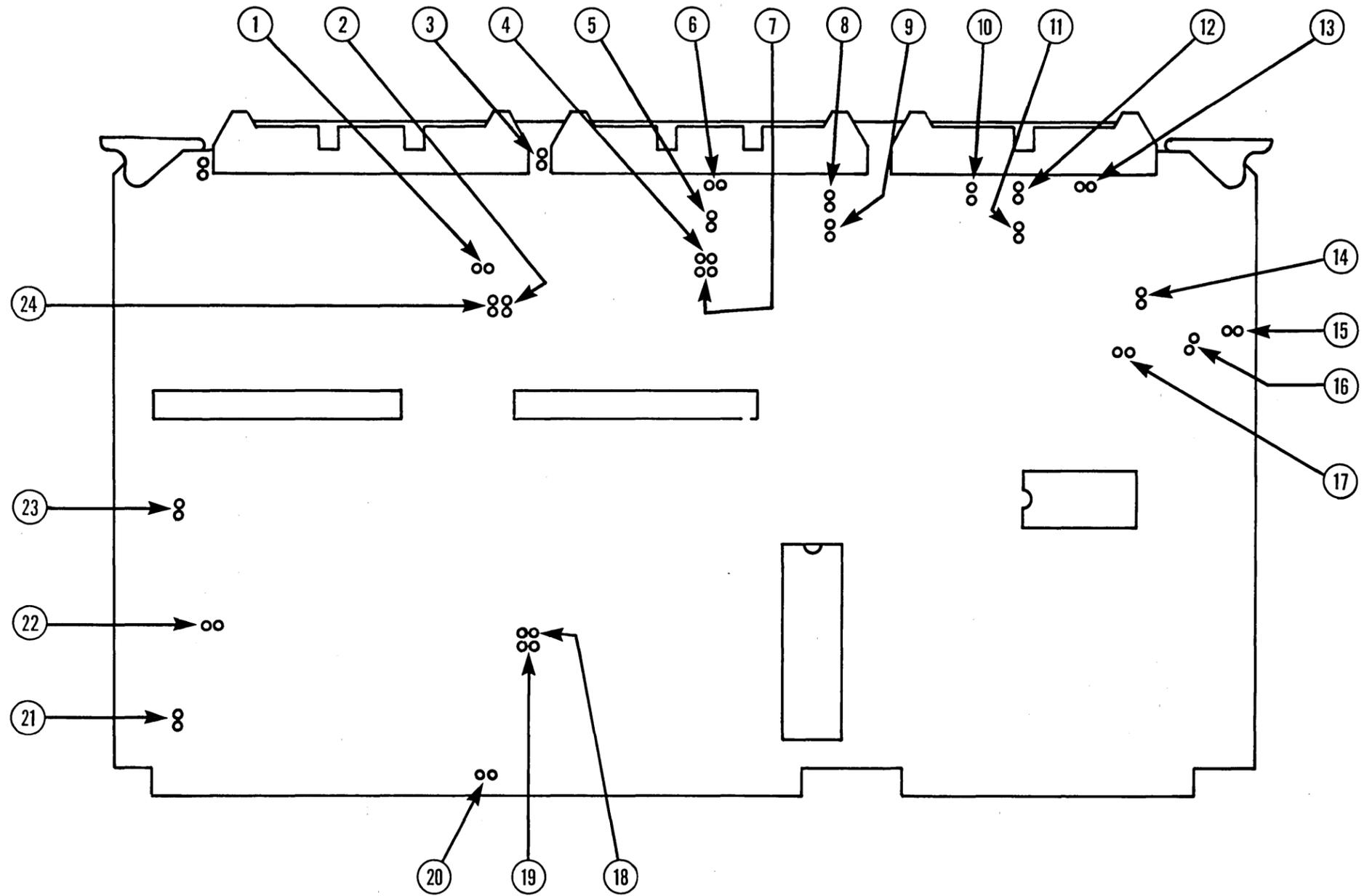


Figure 1-5. iSBC 215G Controller Configuration



2.1 Introduction

This chapter contains only the requirements and procedures for installing the Winchester peripheral chassis on the Series II or Series III development systems. Information on installing the peripheral chassis on the Series IV development system can be found in the *Intellec Series IV Field Service Manual*, Order Number: 121889. Installation instructions for connecting the peripheral chassis to the Zero Peripheral Chassis NRM can be found in the *Zero Peripheral Attachment Network Resource Manager Installation and Checkout Manual*, Order Number: 134004.

The Intel Customer Engineer should read the following sections on the Winchester chassis characteristics, development system upgrades, and the installation procedures before actually starting the installation.

NOTE

Intel Product Service does not support the installation of the Winchester peripheral chassis to a Series 800 development system.

2.2 Winchester Chassis Characteristics

The Winchester Peripheral Chassis is designed to operate in either a horizontal or a vertical position (resting on the bumper strips). The Customer Engineer should ensure that the selected site will accommodate and support the chassis. The chassis must be located within six feet (1.8 meters) of the development system. A minimum of six inches (25 centimeters) must be provided at the front and rear of the chassis and any vertical chassis surface to ensure that adequate air circulation is maintained in the chassis.



Do not place any material near the front of the chassis that may restrict the airflow to the chassis.

The peripheral chassis includes an attached 3-wire power cord that must be connected to a 3-conductor (grounded) AC outlet (a 3-to-2 wire adapter must never be used).

2.3 Series II/Series III Development System Preparation

The Intel Customer Engineer must perform the following steps prior to installing the peripheral chassis on the development system:

1. Perform the diagnostic tests described in the appropriate installation or service manual to ensure that the development system is operational. Refer to the *Intellec Series II Model 22X/23X Installation Manual*, Order Number: 9800559, to run the Series II system diagnostics or to the *Intellec Series III*

Microcomputer Development System Installation and Checkout Manual, Order Number: 121612, to run the Series III system diagnostics.

NOTE

Do not proceed with the development system upgrade until the system is functioning properly.

2. Perform the development system upgrade (if necessary) to maximize system immunity to electrostatic discharge (ESD) and to ensure compatibility with the peripheral chassis (refer to section 2.4). Note that later models of the Series II and Series III systems do not require upgrading.
3. Install the new rear panel provided in the iMDX 712 package on the development system as described in section 2.5.
4. Install the Winchester disk controller (iSBC 215B or iSBC 215G) in the development system's card cage as described in section 2.6.

2.4 Series II Development System Upgrades

The Series II development system, depending upon model and manufacturing version, may require one or both of the following upgrades:

- Installation of one or more Upgrade Preparation Kits (designated as INK-xxx, where xxx denotes one of several iterations of the kits) as described in section 2.4.1
- Installation of an 8085 microprocessor-based Integrated Processor Card (IPC) as described in section 2.4.2

2.4.1 Upgrade Preparation Kit Requirements

NOTE

When installing a UPK on the Series II, do not reinstall the rear panel as the panel will be replaced when performing the procedure in section 2.5.

The Upgrade Preparation Kit (hereafter referred to as the UPK upgrade) is only applicable to earlier models of the Series II development system and the Model 201/202 expansion chassis. To determine if a UPK upgrade is necessary, examine the serial number tag on the development system rear panel and, if it is installed, on the back of the expansion chassis. If the serial number on the development system or expansion chassis is prefixed by a letter other than 'D', an Upgrade Preparation Kit is NOT required.

If the serial number is prefixed with a 'D', check for the presence of an 'F' suffix. If the 'F' suffix is missing, a UPK upgrade is required (the Series II system requires an INK-001, P/N: 123185-005; the expansion chassis requires an INK-002, P/N: 123185-002). Note that even with an 'F' suffix, the development system may still require an INK-001 because earlier Reliability Improvement Program (RIP) upgrades used the same 'F' prefix. The major difference between the RIP and UPK upgrade for the Series II system is that the IOC board in a 'ripped' system may be the earlier 1001241-07 assembly rather than the 1002104-xx assembly (the 1002104 assembly is included in the INK-003, P/N: 123185-003). Also, the improved internal power cables and high-capacity fans were not

included in the RIP program (these parts are available in the INK-007, P/N: 123185-006).

2.4.2 Integrated Processor Card

The 8085-based Integrated Processor Card (IPC) is required to ensure compatibility between the Series II development system and the Winchester peripheral chassis. An IPC is provided with the Series II Model 225 and with all Series III development systems; an Integrated Processor Board (IPB) was provided with the earlier Series II Models 220 and 230. The iMDX 750I 'Winchester subsystem with IPC' (MDS 505) is ordered if the development system to be upgraded includes an IPB; the iMDX 750 'Winchester subsystem' is ordered if the system to be upgraded already includes an IPC. Note that when the targeted system includes an IPC, the IPC itself may have to be upgraded. Remove the IPC from the development system's card cage and verify that the following modifications have been made:

- The integrated circuit A79 is an Intel 8202A component and not an 8202.
- The bus controller 'piggy-back' assembly (123605) is installed at location A96 in place of an Intel 8219 component.

The components required for the above modifications can be found in a Series II Accessory Kit, P/N: 123992. This accessory kit also includes the enhanced IOC firmware PROM set.

When replacing an IPB with an IPC, remember that the IPC has a full 64K of memory and that the optional 32K RAM board must be removed from the development system's card cage.

2.5 Development System Rear Panel Replacement

The subsystem's iMDX 712 package includes a special development system rear panel (with modified interface connector cutouts) that replaces the standard Series II/III rear panel. To remove the old rear panel and install the new rear panel, follow the procedures in sections 2.5.1 and 2.5.2.

2.5.1 Removing the Rear Panel

Proceed as follows to remove the rear panel from the Series II or Series III development system:

1. Power-down the peripheral devices first, then the development system, disconnect power cord(s) from the electrical outlets, and disconnect all cables attached to the development system's rear panel.
2. If the development system includes the low-profile drive chassis, remove the two aluminum ground strips between the system and drive chassis and lift the chassis off the development system.
3. Remove the development system top cover.

WARNING

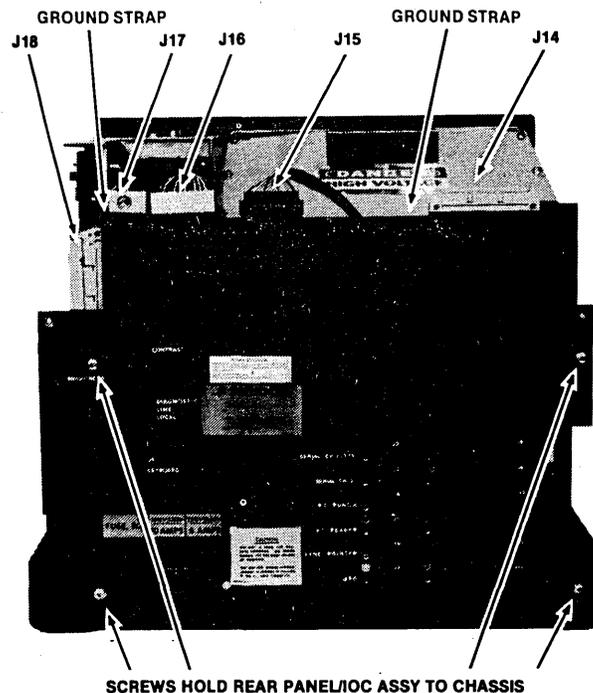
Hazardous voltages are present within the development system. Make sure that the power is off and that the line cord is removed before proceeding.

4. Refer to Figure 2-1 and disconnect the cables from connectors J14, J15, and J16 and, if the development system includes an integral drive, disconnect the drive interface cables from connectors J17 and J18. Disconnect the cable ground braids at the rear panel/IOC board.
5. If the development system includes optional hard or flexible disk drives, remove the card cage front panel and disconnect the interface cable from the controller interface board so that the cable can be removed with the rear panel.
6. Refer to Figure 2-1 and remove the four rear panel mounting screws. Pull the panel away from the development system and if present, guide the disk controller interface cable out of the chassis.
7. Place the rear panel assembly face down on a padded, flat surface and remove the eleven screws that secure the IOC board to the rear panel.
8. Disconnect the drive interface cable, if present, from the rear panel. Keep the cable mounting hardware so that the cable may be installed on the new rear panel; the old panel may be discarded.

2.5.2 Installing the New Rear Panel

Proceed as follows to install the new rear panel on the Series II or Series III development systems:

1. Remove the rear panel and internal cable assembly (part number 125367) from the iMDX 712 package.



134170-6

Figure 2-1. Rear Panel Removal

2. Refer to Figure 2-2 and secure the internal cable assembly P10 connector to the inside of the rear panel at the J10 connector cutout with two mounting screws.
3. If the optional flexible disk drives are included, connect the drive interface cable to the rear panel's J8 and J9 connector cutouts with the previously removed hardware. Connect the cable's ground lead to a ground lug.

NOTE

The connector cutouts J8 and J9 are reversed on the new panel (J8 now is on the bottom).

4. Place the IOC board on the new rear panel and secure the board with the eleven mounting screws.
5. Position the rear panel assembly on the back of the development system and guide the attached cable assembly(s) along the inside of the chassis, through the front opening into the card cage area. Ensure that the cable assembly is not pinched between the IOC and the power supply. Secure the rear panel to the development system with the four screws previously removed.
6. Reconnect the internal cables and ground braids to their appropriate connectors on the IOC board (connectors J14, J15, and J16 and, with an integral drive, connectors J17 and J18; see Figure 2-1).

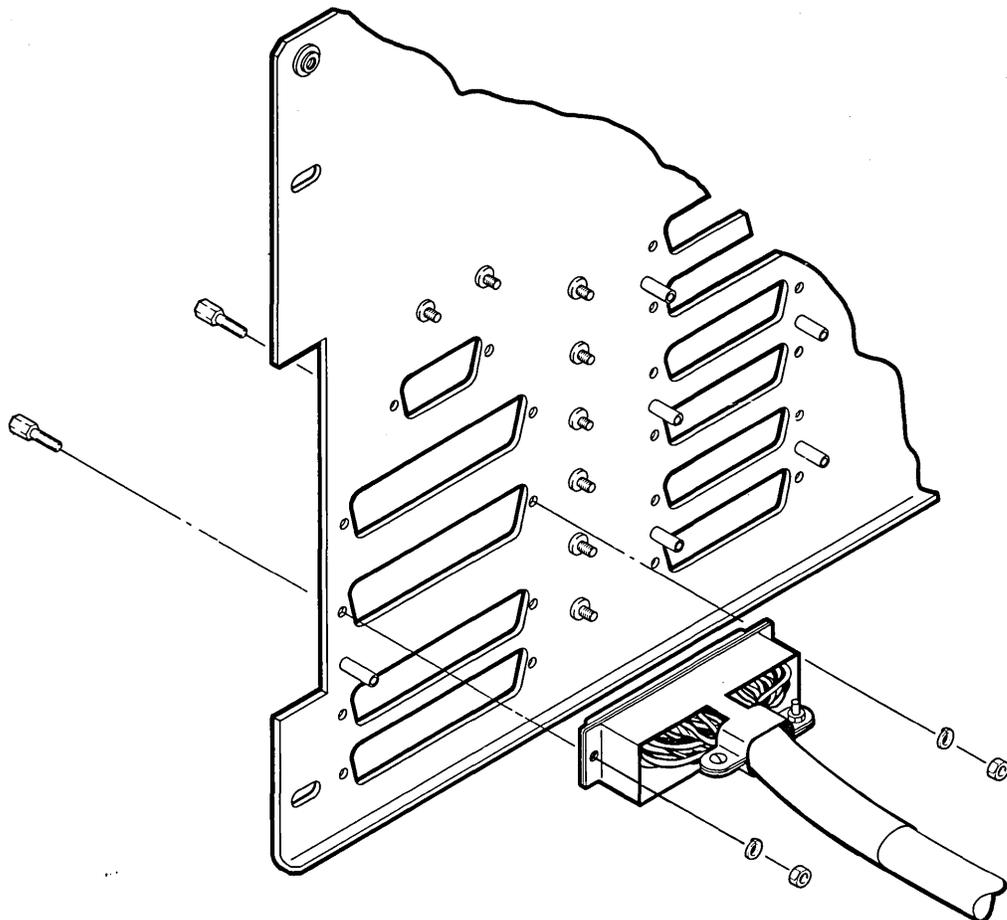


Figure 2-2. Internal Cable Mounting

134170-7

7. Replace the development system's top cover and, if included, the low-profile drive chassis. Reconnect all cables and ground strips that were removed previously.
8. Inspect the old rear panel for the UL caution sign, service information, and Intel serial number tag. Attach the new labels and accurately duplicate the data on the Intel serial number tag using a pen or pencil.

WARNING

A new UL caution label can only be installed on the new rear panel if it was present on the old rear panel.

9. Apply power to the development system and verify the system's operational status using the appropriate customer confidence tests and system diagnostics. Do not continue with the installation procedures until the system is fully operational.

NOTE

If the CRT remains blank after power is applied, the brightness control pot on the IOC may have been turned down inadvertently when the rear panel was changed.

2.6 Winchester Disk Controller Installation

Refer to chapter 1 for the configuration information of both the iSBC 215B and iSBC 215G Winchester disk controllers. Verify that the controller board is properly jumpered for the Series II or Series III systems. Proceed as follows to install the Winchester disk controller in the Series II or Series III development systems:

1. Loosen the two retaining screws on the front panel of the system and remove the panel.
2. Insert the controller into a vacant slot in the card cage above any other installed disk controller(s) and slide the controller partially into its slot.

NOTE

To prevent the Winchester controller from monopolizing the bus in the presence of other Intel disk controllers, it must be given the lowest priority (i.e., must be located above all other disk controllers in the card cage).

3. The white dot on the internal interface cable connector indicates pin 1 and must align with the triangle on the controller's connector. Connect the internal Winchester subsystem Interface cable (P/N: 133476) to the Winchester disk controller as follows:
 - P1 to J1
 - P2 to J2

4. Slide the disk controller completely into the card cage making a good connection to the backplane.

2.7 Peripheral Chassis Installation

Preparation of the development system must be completed before the peripheral chassis is installed. Once the development system is prepared and system operation is verified, install the chassis on the development system as follows:

1. Remove the peripheral chassis from its packing container and set the chassis in an area that allows access to the rear panel. **DO NOT PLUG THE AC POWER CORD INTO AN AC OUTLET.**
2. Remove the five top cover retaining screws from the back of the chassis and lift the cover off the chassis.
3. Remove the four quick disconnect fasteners from the peripheral chassis front panel and remove the front panel.
4. Refer to Figure 2-3. Looking through the front panel opening, verify that the locking lever for the Read/Write head assembly is in the LOCK position (for those drives **WITHOUT** the auto head lock feature).

CAUTION

If the drive locking lever is not in the LOCK position, damage to the Read/Write heads and/or the disk surfaces may have occurred during shipping. Discontinue the installation and return the drive to the manufacturer.

5. The Winchester disk drive assembly supports two configurations of the Read/Write Digital Control board, P/N: 200233. The -21 version only, supports

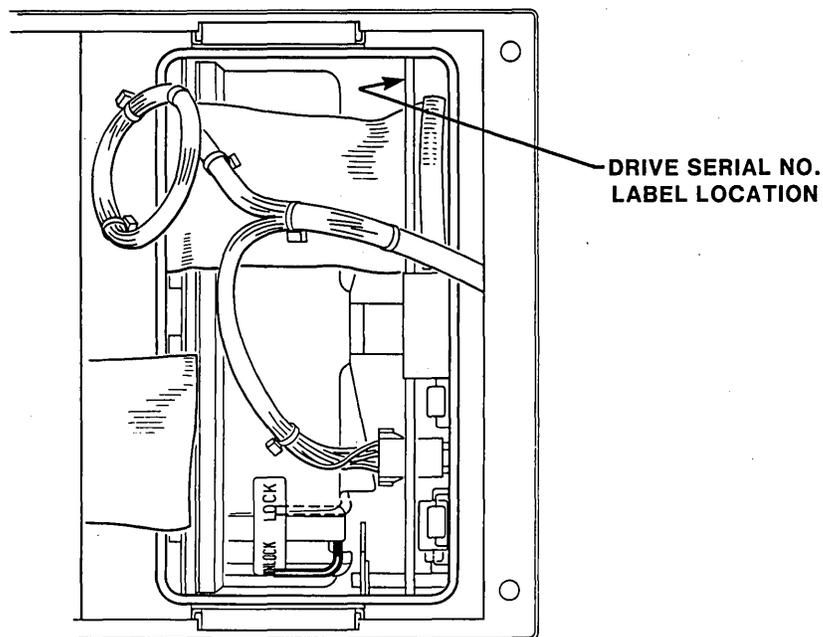


Figure 2-3. Drive Locking Lever

134170-8

the auto head lock function (thus, the drive has no manual locking lever), although it also supports the drives with the manual locking lever. Figure 2-4 illustrates the two R/W Control Boards. Inspect the Read/Write Digital Control board on the drive assembly for the proper configuration as follows:

- **Version 200233-01:** Switch **5H** (selects the drive sector size), Positions 2, 3, and 7 are ON. Switch **6K** (selects the drive sector size and drive address), Positions 1, 7, and 8 are ON.
- **Version 200233-21:** Switch **6J** (selects the drive sector size), Positions 2, 3, and 7 are CLOSED. Switch **5L** (selects the drive sector size and drive address), Positions 1 and 8 are CLOSED. (The Write Enable Clock function is a soldered jumper at W7).

Verify the configuration of the following four suitcase jumpers:

- W1 – IN — selects proper current for drive model
 - W2 – IN — selects long reset
 - W3B–W3C – IN — selects “Skip Defect Record Not Protected”
 - W5 – IN — selects drive model, gives a low input on data bus
6. Verify that the scrambler board (mounted on the rear panel between the fans, inside the chassis) toggle switch is in the UP position.
 7. Locate the defective track information label attached to the drive’s top mounting bracket and record that information on a separate piece of paper. This information will be used during the alternate track mapping procedure (ALTMAP) later in the installation.
 8. Reposition the top cover on the chassis and replace the five cover-retaining screws.
 9. Remove the external interconnect cable (P/N 125309) from the iMDX 712 package. Secure connector P1 of this cable to the I/O cutout J10 on the development system rear panel. Secure connector P2 to the rear panel of the peripheral chassis at J1. Ensure that the cable ground leads are connected to the adjacent ground lugs on **BOTH** rear panels.

CAUTION

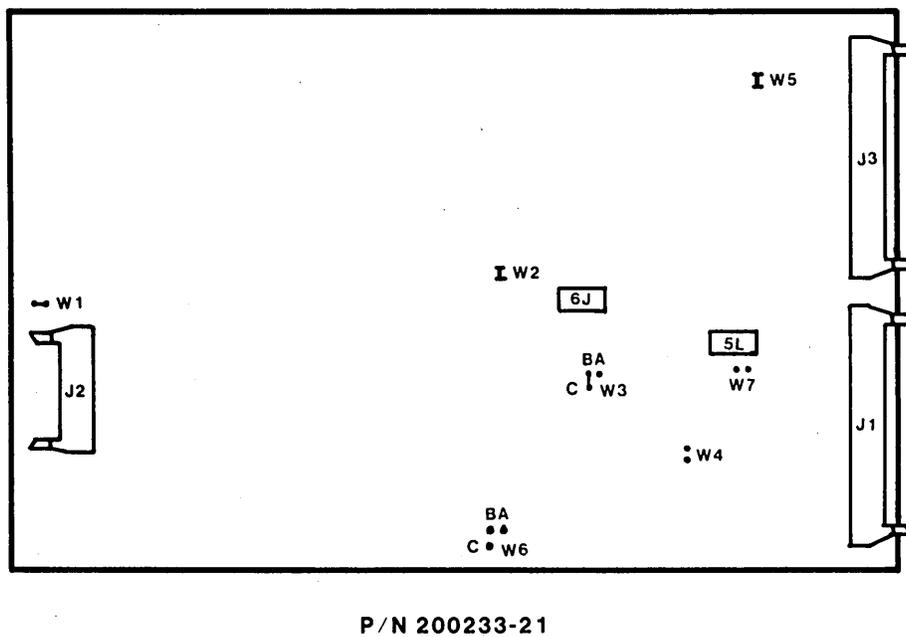
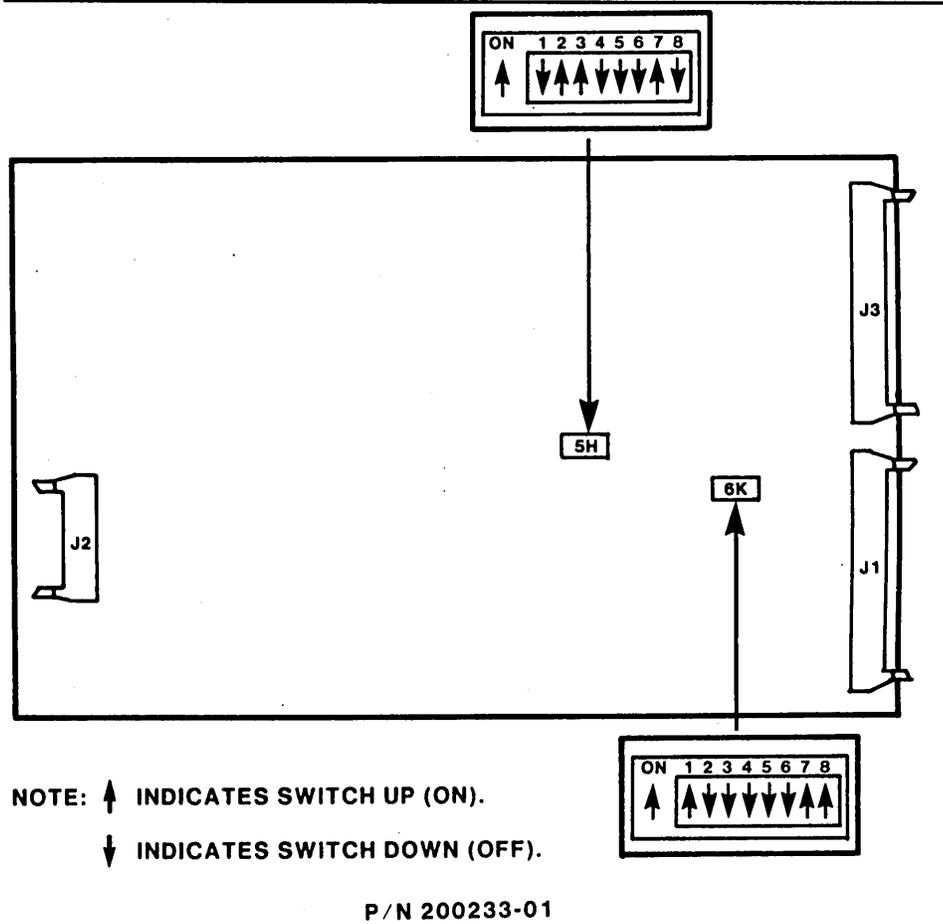
All cable assembly ground leads must be connected to panel ground lugs to maximize immunity to ESD.

10. Ensure that the read/write heads are **LOCKED** and place the peripheral chassis in its permanent location. The chassis can be positioned either horizontally or vertically.

CAUTION

For proper drive operation, the chassis must be level within two degrees with respect to its mounting surface.

11. Ensure that the chassis’ front panel ON/OFF switch is in the OFF position (OFF side of switch pushed in). Do not connect the AC line cord until the Winchester drive Read/Write heads have been unlocked as described in the following step.
12. Refer to Figure 2-3. Look through the front panel opening. If the drive has a manual head locking lever, move the lever to the right and down to the



134170-9

Figure 2-4. R/W Control Board Configurations

UNLOCK position (the lever is fully unlocked when positioned in the notch). Do nothing if the drive has no locking lever.

CAUTION

Never move or jar the peripheral chassis when the drive is unlocked, as damage to the surfaces or heads could result.

13. Replace the front cover panel on the chassis and press the quick-disconnect fasteners to lock the panel in place.

CAUTION

If power is applied to the peripheral chassis before it is applied to the development system, data on the drive could be overwritten.

14. Power up the development system, then press the ON/OFF on the Winchester peripheral chassis. The LED indicator in the switch face will light and the fans will turn when the switch face is pressed all the way in (switch face will be parallel with the front panel).

3.1 Introduction

The ALTMAP procedure on the Customer Engineer diagnostic diskette is a Commonly Used System Program (CUSP) that can set and/or modify the hard-error defective and alternate track information stored on cylinders 522 and 523 respectively, of the Winchester drive.

NOTE

The alternate track mapping procedure hereafter referred to as ALTMAP should be used only at installation or Winchester drive replacement. Reassigning alternate tracks on drives storing customer data may overwrite customer files.

3.2 Executing the ALTMAP CUSP

The ALTMAP CUSP is used during installation to verify that the defective track information written to the Winchester drive is consistent with the information on the defective track label (attached to the upper mounting bracket).

3.2.1 Verifying the Defective Track Information

Before formatting the Winchester drive, the list of defective tracks included with the drive should be verified against the defective track information previously written on the disk; and alternate tracks assigned (mapped) to those defective tracks. Proceed with the following steps to map the defective tracks.

1. Apply power first to the host development system, and then to the Winchester Peripheral Chassis ensuring that the Read/Write Head locking lever is in the UNLOCK position.
2. Insert the Winchester diagnostic test diskette (P/N 125214 for single density, P/N 125215 for double density) into the host development system flexible disk drive (:F4:).

NOTE

The symbol, <cr>, denotes that the RETURN key on the development system keyboard is to be pressed.

3. Press the "RESET" switch on the front panel of the development system, and **within 2 seconds**, press the "F" key on the keyboard.
4. Approximately 15 seconds after the "F" key is pressed, the system's CRT will display the ISIS-II(W) sign-on message:

```
ISIS-II(W), Vx.y
```

```
-
```

5. When the ISIS prompt (-) appears on the CRT, enter the following command on the system keyboard:

```
:F4:ALTMAP<cr>
```

6. The CRT will display the ALTMAP sign-on message as follows:

```
ISIS-II WINCHESTER DEFECTIVE TRACK MAPPER Vx.y
*
```

7. Enter the following commands to display the defective track and alternate track lists on the system CRT:

```
READ B<cr>
LIST<cr>
```

8. A list of the defective and alternate tracks for that drive will appear on the CRT as shown in the following sample output:

```
74,4:512,0
75,4:512,1
102,3:512,2
309,2:512,3
*
```

In the list output, the numbers preceding the colon are the cylinder and head numbers of the defective track (i.e., the first list entry indicates that cylinder 74 on head 4 has been marked defective). Compare the CRT display of defective track information with the information on the defective track label (attached to the upper mounting bracket in the Winchester Peripheral Chassis). The two lists should be identical. If they are not, verify that the serial number on the defective track label is the same as the seven digit serial number on the inside of the drive's Servo Motor Control board, (see Figure 2-3). If the serial numbers match, use the information from the defective track label. If the serial numbers differ, reject the drive assembly.

When the ALTMAP procedure is complete, continue with the initialization procedures in section 3.3.

3.2.2 ALTMAP Command Summary

The following commands may be used in the ALTMAP procedure.

- **INIT X** — Initializes the Winchester tracks
where *X* is one of three parameters specifying which map track is to be initialized.
 - INIT A* — indicates that the alternate map track is to be reformatted
 - INIT D* — indicates that the defective map track is to be reformatted
 - INIT B* — indicates that both defective and alternate map tracks are to be reformatted
- **MARK (cylinder), (head) [:(alt. cylinder), (alt. head)]**
Assigns alternate cylinder and head for a cylinder and head known to be defective. If an alternate cylinder and head are specified, that information is entered into the alternate map.

NOTE

The sequence in which the cylinder numbers is entered is very important. The cylinder numbers must be entered in ascending order, beginning with the smallest number. If two or more cylinder numbers are the same, then enter the smallest head number first.

- **AUTO** — Automatically assigns alternate tracks and heads to tracks and heads marked defective in the defective map. When the AUTO command is specified, all defective tracks are assigned alternate tracks starting at cylinder 512, head 0. Alternate tracks are assigned in order, leaving out only the alternate tracks that are designated defective in the defective track map.

NOTE

The AUTO command is used during the installation and check-out procedure. If other defective tracks occur after this procedure, it is necessary to use the manual MARK command to assign alternate tracks. The AUTO command will overwrite previously assigned alternate tracks, thereby destroying customer data.

- **FREE (cylinder) (head)** — Removes the specified cylinder and head from the defective track map.

NOTE

The FREE command should only be used if a defective track is marked incorrectly. If it is used with a known defective track, this command will erase the customer data assigned to the alternate track.

- **LIST [(path name)]**

where (path name) could be:

| | |
|----------------------|---|
| < cr > | list all defective cylinders and heads in the buffer, after a READ command. If a "READ B" command was used, list of all the alternate cylinders and heads will also be displayed. |
| D | list only the defective cylinders and heads. |
| A | list only the alternate cylinders and heads. |
| B | list both defective and alternate cylinders and heads. |
| { file name } | allows a disk file to become a log file. Filename is a 1-6 digit alpha-numeric character. For a detailed explanation of filenames, refer to the <i>ISIS-II User's Guide</i> , Order Number: 9800306-06. |

- **COUNT** — Lists the number of known defective tracks on the console.
- **READ** — Records the changes specified by the MARK and FREE commands. The alternate map will not be written unless alternate tracks are specified through the MARK and or AUTO commands.
 - READ A** — Records the changes in the alternate map.
 - READ D** — Records the changes in the defective map.
 - READ B** — Records the changes in the alternate and defective maps.
- **QUIT** — Exits to ISIS without recording changes.
- **EXIT** — Records changes and exits to ISIS.
- **WRITE** — Writes the track map on the Winchester disk drive. This command must be entered next after the MARK or FREE commands are used.
 - WRITE A** — Writes the alternate track map on the Winchester drive.
 - WRITE D** — Writes the defective track map on the Winchester drive.

WRITE B — Writes the alternate and defective track map on the Winchester drive.

3.2.3 Reading Defective/Alternate Maps

ALTMAP keeps a copy of the defective track map and the alternate track map in memory. Initially, these memory copies are nulled. In order to load the existing maps into memory, the READ command must be used. If ALTMAP cannot read the specified map(s), the CRT will display one or both of the following messages (depending upon what READ command was given, A, D, or B):

```
CANNOT READ DEFECTIVE TRACK MAP
CANNOT READ ALTERNATE TRACK MAP
```

When a defective track map is read from the disk, the alternate track map is automatically cleared. When the alternate track map is read from the disk, the number of entries is compared to the number of entries in the defective track map (already stored in memory). If these numbers do not agree, the CRT will display the following message:

```
ALTERNATE TRACK MAP DOES NOT MATCH DEFECTIVE TRACK MAP
```

3.2.4 Marking Defective/Alternate Tracks

If a defective track map is not present on the disk, the READ command should not be used; instead, the MARK command should be used to describe the defective and alternate tracks. Two forms of the MARK command are recognized:

1.

```
MARK 123 3 : 512 1<cr>
WRITE B<cr>
```

This marks the track at cylinder 123, head 3, as defective, assigns an alternate at cylinder 512, head 1 and writes this data on the disk drive.

2.

```
MARK 123 3<cr>
WRITE B<cr>
```

This marks the track at cylinder 123, head 3 as defective with no alternate currently assigned.

When marking defective tracks and assigning alternates, if the specified alternate track is already in use, the CRT will display the following message:

```
ALTERNATE TRACK IN USE
```

If the alternate already appears in the defective track map, the CRT will display the following message:

```
ALTERNATE TRACK IS DEFECTIVE
```

If an alternate track is specified as defective, it is automatically mapped to cylinder 0, head 0. In this case, the original defective track must be freed using the FREE command and remarked (with a new alternate track). If it is mapped to any other track, the CRT will display the following message:

```
DEFECTIVE ALTERNATE MUST BE MAPPED TO ``0 0``
```

If the specified defective track is already marked, the CRT will display the following message:

```
TRACK ALREADY MARKED
```

Alternate tracks may be assigned in two ways: manually, as described above in the MARK command; and automatically, using the AUTO command. The AUTO command assigns alternate tracks for all defective tracks in the defective track map. Alternates are assigned in increasing order starting at cylinder 512 head 0. If more alternates are needed than are available between cylinder 512 and cylinder 522, the CRT will display the following message:

```
ALTERNATE TRACKS EXCEEDED
```



The AUTO command is used only during the installation and check-out procedure. If other tracks become defective, the MARK command must be used to assign alternate tracks. The AUTO command will overwrite previously assigned alternate tracks, thereby destroying customer data.

3.2.5 Freeing the Tracks

If a track is incorrectly marked as defective, or a defective track is marked incorrectly, the FREE command can be used to remove the marked track from the defective track map. Enter the following commands at the system keyboard:

```
FREE (cylinder#) (head#)<cr>
WRITE D<cr>
```



The FREE command should only be used if a defective track is marked incorrectly. If it is used to free a known defective track, this command will erase the customer data assigned to the alternate track.

If the track specified in the FREE command cannot be found in the defective track map, the following message will appear on the CRT:

```
TRACK ALREADY FREE
```

3.2.6 Writing the Maps

After marking defective tracks and/or assigning alternates, the maps are written to the disk drive using the WRITE command. Each map can be written individually or together.

When a WRITE D command is specified, it will change the defective track map, and the CRT will display the following message:

```
THIS COMMAND CHANGES THE DEFECTIVE TRACK MAP  
DO YOU WISH TO CONTINUE (Y/N)?
```

When a WRITE A command is specified, it changes the alternate track map, and the CRT will display the following message:

```
THIS COMMAND CHANGES THE ALTERNATE TRACK MAP  
DO YOU WISH TO CONTINUE (Y/N)?
```

If the alternate track map has not been completely defined (i.e., an alternate track has not been specified for each defective track) and an attempt is made to write the alternate track map to the disk, using the WRITE command, the following message will appear on the CRT:

```
ALTERNATE TRACKS NOT COMPLETELY SPECIFIED
```

3.2.7 Initializing the Maps

The disk tracks that contain the defective and alternate track information must be formatted before they can be initially written. If these tracks have not previously been written, the INIT command should be used to format the defective track map (using the "D" parameter), the alternate track map (using the "A" parameter), or both defective and alternate track maps (using the "B" parameter). If an error occurs when ALTMAP attempts to format the defective or alternate map tracks on the drive (during execution of the INIT command), the CRT will display the following message:

```
CANNOT INITIALIZE MAP, DISK ERROR: xx
```

NOTE

This error indicates a hardware fault either with the controller or the drive. The customer should notify the Customer Engineer who in turn, should verify the proper switch settings and jumpers on both the drive and controller. If the configuration is correct, replacement of one or both FRUs is in order.

The INIT A command formats the alternate track map on the drive. When the carriage return (<cr>) is entered, the INIT command prompts the following CRT display:

```
INIT WILL REFORMAT THE MAP AREA ON THE DISK
DO YOU WANT TO CONTINUE (Y/N)?
```

1. Enter a Y (for yes) on the keyboard and press the RETURN key. The CRT will display the following message:

```
THIS COMMAND CHANGES THE ALTERNATE TRACK MAP
DO YOU WANT TO CONTINUE (Y/N)?
```

2. Enter a Y (for yes) on the keyboard and press the RETURN key. The program will reformat the alternate track map and the CRT will display the following message:

```
ALTERNATE TRACK MAP CHANGES RECORDED
*
```

3. To exit from the ALTMAP program, enter the EXIT command on the keyboard when the ALTMAP prompt appears on the CRT.

```
*EXIT<cr>
```

The exit command returns control to the ISIS operating system; the CRT will display the ISIS prompt (-).

3.2.8 Listing the Maps

The LIST command enables the CRT to display a list of the defective tracks and the alternate tracks (if they have been assigned). The following sample display illustrates the CRT output of defective and alternate tracks when the LIST and READ commands are entered on the system keyboard.

```
*READ<cr>
*LIST<cr>
```

The CRT will display defective and alternate track information in the following format:

```
50, 1:515, 2
62, 3:515, 3
130, 2:515, 4
```

If an alternate track has not been specified for a defective track when the LIST command is invoked, the listing will show asterisks in place of the alternate track information as in the following example:

```
50, 1:***,**
62, 3:***,**
130, 2:***,**
```

3.3 Peripheral Chassis Initialization Procedure

The Winchester drive, when shipped from the factory, is formatted as follows:

| | |
|---------|--------------------------------|
| Drive 0 | System disk (ISIS-II(W), Vx.y) |
| Drive 1 | non-system disk |
| Drive 2 | non-system disk |
| Drive 3 | non-system disk |

The directory names in which each logical drive (ISIS takes the five platters and divides them into four logical drives) is formatted are **DRIVE.0**, **DRIVE.1**, **DRIVE.2**, and **DRIVE.3**. If the directory names require modification, perform the following procedures (be advised that the system's flexible disk drive is now recognized as drive unit :F4: and the Winchester drive is identified as drive units :F0: through :F3:).

1. Insert the ISIS-II(W) operating system diskette into the system's flexible disk drive (:F4:).
2. Press the "RESET" switch on the front panel of the development system, and **within 2 seconds**, press the "F" key on the keyboard.
3. The CRT will display the following message:

```
ISIS-II(W), Vx.y
-
```

4. To format and initialize Winchester drive unit :F0: as the system disk, enter the following command on the keyboard:

```
:F4:FORMAT :F0:filename S FROM 4<cr>
```

where **filename** is the one to six character alpha-numeric name, followed by a period and a one to three character alpha-numeric name (.extension) you create for a file. For a detailed explanation of filename, consult the *ISIS-II Users Guide*, Order Number: 9800306-06.

5. The CRT will display the following message:


```
FORMATTING WILL DESTROY ALL FILES AND DATA ON DEVICE :F0:
DO YOU WANT TO CONTINUE?
```
6. Enter a Y (for yes) on the keyboard and press the RETURN key to initiate the formatting operation. If N (for no) is entered, the formatting operation is aborted and the system will return to the ISIS operating system.
7. When a Y is entered from the keyboard, the following message appears on the CRT:

```
FORMATTING ...
```

8. The formatting operation requires approximately **two minutes**. When the formatting is complete, the CRT will display the following message to indicate that the data written on the drive during the formatting sequence is being verified:

```
CHECK READ ...
```

9. The verification sequence takes approximately five minutes. The CRT will display the following message upon completion of the read verification:

COPY SYSTEM FILES

As each system file is copied to the Winchester drive, its name is displayed on a new line; when the last file has been copied, the ISIS prompt displays on the next line. Time to complete the formatting operation (format, verify, and copy files) depends upon the number of files, having the "S" attributes, on the floppy disk.

The development system will now boot from drive unit :F0: whenever the RESET or INTERRUPT 1 switch is pressed, or whenever an ISIS error occurs (refer to the *ISIS-II Users Guide*, Order Number: 9800306-06). Remember, that an ISIS-II(W) diskette must be installed in drive :F4: to boot the system using the RESET switch on the front panel of the development system.

4.1 Introduction

The diskette-based diagnostics provide a comprehensive test routine that the Intel Customer Engineer can use to verify the operational status of the Winchester Peripheral Chassis Subsystem (including the Winchester disk drive controller board). The Customer Confidence test is a group of selected tests from the Winchester Customer Engineer Diagnostic suite which the customer can invoke to verify system operation. The Customer Engineer diagnostics are contained on a separate flexible diskette (single density, P/N 125214; double density, P/N 125215). Both the Customer Confidence test and the Winchester Customer Engineer Diagnostic (WCED) tests are based on the System Test Foundation Software (STFS). This chapter describes the entire Winchester Customer Engineer Diagnostic test suite as well as, individual test execution times, diagnostic initialization procedures, error messages, and troubleshooting information.

4.2 Winchester Customer Engineer Diagnostic Description

Test descriptions of the Winchester Customer Engineer Diagnostic are contained in the Table 4-1. Tests 0H through 14H and 19H, 1AH, and 1CH comprise the Customer Confidence test (contained on a separate diskette). All aspects of the Customer Confidence test (i.e., execution times, error messages) except the initial CRT sign-on message are the same as for the Customer Engineer version.

Table 4-1. WCED Test Suite

| Test No. | Test Description |
|----------|---|
| 0H | Reset/Initialize Test. Causes a reset to the controller and initializes each unit specified during test initialization. |
| 1H | Transfer Status Test. Tests communication lines between the Winchester controller and drive by invoking the controller's transfer status function. |
| 2H | Buffer I/O Test. Ensures that data can be sent by and received from the controller by transferring 128 bytes to and from the controller and comparing the data after the transfer. |
| 3H | ROM Checksum Test. Executes a checksum on the contents of the controller's ROM by using the ROM's on-board checksum test. |
| 4H | RAM Window Test. Uses an 8089 routine located in the system memory to run a RAM window test on all of RAM. The 8089 routine waits for the 8089 to complete. If the 8089 does not finish after this routine has looped for 01FFFFH times, a time out error occurs. |

Table 4-1. WCED Test Suite (Cont'd.)

| Test No. | Test Description |
|----------|--|
| 5H | <p>RAM Address Test. Uses an 8089 routine located in the system memory to run a RAM address test on all of RAM. This routine tests the address of the ROM and RAM by copying the ROM into the RAM then comparing addresses. Contents of the RAM are then inverted and compared to the inverted values of the ROM. Any mis-compare halts test.</p> |
| 6H | <p>Format Diagnostic Track Test. Formats and verifies all diagnostic tracks on each specified unit on the Winchester drive. This test must be run before executing tests 7H, 8H, AH through FH, and 11H through 14H.</p> |
| 7H | <p>Micro-Diagnostic Test. Executes the controller's on-board micro-diagnostics which writes and reads one sector on one diagnostic track on each unit.</p> |
| 8H | <p>Seek/Verify Test. Checks seek and verify functions by verifying a sector on the last track and then on the first track of the drive.</p> |
| 9H | <p>Worst Case Seek Test. Checks seek and verify function by executing a worst case seek sequence (seek from track 0 to track (0 + 1), back to track 0, then to track (0 + 2), etc.).</p> |
| AH | <p>Write/Read Test. Tests the controller's write and read logic by writing out to each sector of each diagnostic track on each attached unit, then reading back the sectors to compare data.</p> |
| BH | <p>Reserved for Future Use</p> |
| CH | <p>Platter/Head Selection Test. Verifies that each recording surface and head can be selected and accessed individually.</p> |
| DH | <p>Sector Selection Test. Verifies that each sector of a track can be addressed.</p> |
| EH | <p>Reserved for Future Use</p> |
| FH | <p>Track Verify Test. Verifies the data fields on a pre-determined number of tracks using the "read into controller memory and verify" command to the controller board. This command checks the CRC and ECC fields associated with each of the ID and data fields.</p> |
| 10H | <p>Platter Verify Test. Verifies all of the ID and data fields and their ECC's on the entire data area of the drives under test. Displays the cylinder currently being verified. If test results are being logged on a disk file using the STFS List command, the cylinder number displayed during the test will not be recorded to the disk file regardless of the status of V-variable B.</p> |
| 11H | <p>Alternate Track Test. Formats the first diagnostic track as an alternate pointing to the last diagnostic track and then formats the last diagnostic track as a defective track pointing to the first one as its alternate. Test then reads the last (defective) track and does a read ID to determine if the invisible seek has occurred. It concludes by reformatting the two tracks.</p> |
| 12H | <p>Zero Fill Test. Verifies the controller's zero fill capabilities by performing writes of various lengths (non-integral sectors, less than one sector) then reading them back and verifying:</p> <ul style="list-style-type: none"> a) that data was written and read correctly b) that remainder of the partial sectors written were properly zero-filled. |

Table 4-1. WCED Test Suite (Cont'd.)

| Test No. | Test Description |
|----------|--|
| 13H | <p>Data Overrun Test. Verifies the controller's ability to perform partial reads with:</p> <ul style="list-style-type: none"> a) the correct data, as requested and b) no data (or garbage) running over the bounds of the specified operation. <p>To test (b), it is assumed that if a data overrun were to occur, it would be in the area immediately following the area specified for the partial sector read.</p> |
| 14H | <p>Auto-Increment Test. Verifies the controller's ability to properly increment to:</p> <ul style="list-style-type: none"> a) the next sector, or, if at last sector, b) to the next head (surface) (first sector), or if on the last surface, c) to the next cylinder (first head/surface). <p>The auto-sector and auto-head increments are checked by writing two sectors into the diagnostic cylinder, reading them back singly to check the auto-increment write and then reading them back in a pair to check the auto-increment read facility for similarity. For the auto-cylinder increment only the two read sequences are used because writing to two cylinders would require writing to a non-diagnostic cylinder.</p> |
| 15H* | <p>Write/Read/Compare Test. Tests each sector on all tracks and surfaces by writing out 9249H (from 1t 2t = 6DB6H) to each sector, reading them back and comparing what was written to what was read. The inverse is used because the data stored inverted. By default, the test will display the cylinder and head it is currently testing. This can be suppressed by setting the V-variable B to 00. If the test results are being logged on a disk file using the STFS "LIST" command, the cylinder and head number will not be recorded to the disk file regardless of the status of V-variable B. THIS TEST DESTROYS ALL DATA ON THE DISK.</p> |
| 16H* | <p>Write All/Read/Compare Test. Writes random data to the entire drive recognized, and then, by saving the "random" seed, reads all of the data back and compares it to what was written. The test routine provides:</p> <ul style="list-style-type: none"> a) a good test of the surface being used (by writing and reading all of them) b) a good test of addressing uniqueness, because, different data is written to every sector before any of the data is read back for verification. <p>By default, the test will display the cylinder and head it is currently testing. This feature can be suppressed by setting the V-variable B to 00. If the test results are being logged on a disk file using the STFS "LIST" command, the cylinder and head number will not be recorded to the disk file, regardless of the status of V-variable B. THIS TEST DESTROYS ALL DATA ON THE DISK.</p> |
| 17H* | <p>Format Entire Drive. This utility is included for ease of formatting a "new" disk. It will format all sectors using an interleave factor of four and all tracks are designated as data tracks. This routine will NOT format the four tracks used for the INTEL standard permanent defect information nor the defective tracks contained in the permanent defect information. By default the test will display the cylinder it is currently formatting. This feature can be suppressed by setting the V-variable B to 00. If the test results are being logged on a disk file using the STFS "LIST" command, the cylinder number displayed during the test will not be recorded to the disk file regardless of the status of V-variable B. THIS TEST DESTROYS ALL DATA ON THE DISK.</p> |
| 18H | <p>Speed Test. This test attempts to determine the RPM of the drive. A READ and VERIFY of the same drive is performed two (or more) times, timing the interval between the response time.</p> |

Table 4-1. WCED Test Suite (Cont'd.)

| Test No. | Test Description |
|--|---|
| 19H | Drive Spin-Down Test. This test issues a series of 8089 code to spin-down the drive. The test will first determine if the iSBC 215B or iSBC 215G controller is being used and then execute the spin-down appropriately. The test then waits for 5 to 7 seconds and then executes a seek to Cylinder 524, Head 0, Sector 0 to ensure that the drive has in fact spun down. |
| 1AH | Drive Spin-Up Test. This test issues a sequence-up command to the drive, causes a reset to the controller, then initializes each unit specified during the initialization. |
| 1BH* | Random Write/Read/Compare Test. This test will write random data on a random cylinder, head, and sector on the recognized drive. The test will then read the data back and compare it with what was written. By default, the test will display the cylinder and head it is currently testing. The display can be suppressed by setting the V-variable B to 00. If the test results are being logged on a disk file using the STFS "LIST" command, the cylinder and head number will not be recorded to the disk file regardless of the status of V-variable B. THIS TEST DESTROYS ALL DATA ON THE DISK. |
| 1CH | Display Defective Tracks Test. This test causes the controller to seek to the track containing the defective track list and then display the defective track list on the CRT. |
| * Denotes destructive test (destroys data on the disk); they are automatically ignored during test initialization. | |

WARNING

The tests identified with asterisks are not included in the Winchester Peripheral Customer Confidence Test because of their destructive nature. The execution of these tests will destroy the data currently stored on the drives. Before running tests 15H, 16H, 17H, and 1BH ensure that the customer has back up for all the data on the drive.

4.3 Diagnostic Test Execution Times

A number of the individual tests in the CE diagnostic test require a significant amount of time to execute. Table 4-2 outlines the approximate test times of these tests; those tests omitted from the table execute in 10 seconds or less.

Table 4-2. Test Execution Times

| Test No. | Test Name | Time |
|--|---------------------------|-------------|
| 09H | Worst Case Seek | 2.5 minutes |
| 10H | Platter Verify | 5 minutes |
| 15H* | Write/Read/Compare | 2-2.5 hours |
| 16H* | Write All/Read/Compare | 4 hours |
| 17H* | Format Entire Drive | 7 minutes |
| 1BH* | Random Write/Read/Compare | 13 minutes |
| * Denotes destructive test (destroys data on disk); they are automatically ignored during test initialization. | | |

4.4 CE Diagnostic Test Initialization Procedures

The following section describes the procedures to initialize the CE Diagnostic Test. It is recommended that the Intel Customer Engineer read through the entire initialization sequence before performing the procedures. The development system must be powered up before power is applied to the Winchester Peripheral Chassis.

NOTE

Any deviation from the displays in the following procedures denotes an error.

<cr> denotes press the RETURN key.

1. To boot the development system to ISIS, insert the diagnostic diskette into the development integral floppy disk drive or drive DR0 (if the MDS-720/730 Floppy Disk Drive is used).
2. Press the "RESET" switch on the front panel of the development system, and **within 2 seconds**, press the "F" key on the keyboard.

3. The system CRT will display the following sign-on message:

```
ISIS-II(W), Vx.y
```

4. Enter the following command on the system's keyboard to invoke STFS:

```
:F4:STFS<cr>
```

5. The system CRT will display the STFS sign-on message as follows:

```
ISIS-II STFS, Vx.y
```

6. To invoke the diagnostics, enter the following command on the keyboard:

```
INIT :F4:STFWIN-CE<cr>
```

7. The system CRT will display the following diagnostic sign-on message:

```
WINCHESTER CUSTOMER ENGINEER DIAGNOSTIC
  FOR ISIS-II(W) PERIPHERAL CHASSIS Vx.y

I/O MAP SWITCHES MUST BE SET AT 0005H,
ALL INITIALIZE NUMBERS MUST BE DECIMAL

IS DATA ON THIS UNIT BACKED-UP (Y or N)
```

NOTE

In order to run tests 15H, 16H, and 17H, and 1BH an affirmative answer (Y) must be given to this question. The RECOGNIZE command must then be given to execute the tests.

8. Respond to the question, "IS DATA ON THIS UNIT BACKED-UP?" by pressing the "N" key on the system keyboard then pressing the RETURN key.
9. The system CRT will then display the following question:
USE INITIALIZATION DEFAULTS (Y or N)?
10. Use the initialization defaults by entering a "Y" <cr> on the system keyboard.
11. The system CRT will then display the following message:
PASS
MDS/VERSION Xx.x
READ DEFECTIVE TRACK DATA (Y or N)?
12. To allow the diagnostic test suite to read the defective track block, enter a "Y" <cr> on the system keyboard.

When the user enters the above commands, the diagnostic will establish where the defective track information exists on each unit attached, and read that information from the appropriate permanent defect information track.
13. If the answer to the question, "READ DEFECTIVE TRACK DATA?", is "Y" the system CRT will display the following question:
DISPLAY DEFECTIVE TRACK DATA (Y or N)?
14. If the user wants the defective track list displayed on the system CRT, enter a "Y" <cr> on the keyboard.
15. After the CRT displays the list of defective tracks (or if an "N" was entered on the keyboard), the diagnostic suite will return control back to the user and the CRT will display the following message:
USER RETURN
*
16. Enter the following command on the system keyboard to invoke the Winchester Customer Engineer Diagnostic test suite.
T<cr>
17. As each test is executed, the system CRT displays the results (PASSED or FAILED). The following sample shows the screen display when all the recognized tests successfully execute:
TEST 000BH ****IGNORED****
TEST 000EH ****IGNORED****
TEST 0015H ****IGNORED****
TEST 0016H ****IGNORED****
TEST 0017H ****IGNORED****
TEST 0018H ****IGNORED****
TEST 0019H ****IGNORED****
TEST 001AH ****IGNORED****
TEST 001BH ****IGNORED****
TEST 001CH ****IGNORED****

```

0000H Reset/Initialize Test
0000H RESET/INITIALIZE TEST           ``PASSED``
0001H Transfer Status
0001H TRANSFER STATUS                 ``PASSED``
0002H Buffer I/O Test
0002H BUFFER I/O TEST                 ``PASSED``
0003H ROM Checksum Test
0003H ROM CHECKSUM TEST               ``PASSED``
0004H RAM Window Test
0004H RAM WINDOW TEST                 ``PASSED``
0005H RAM Address Test
0005H RAM ADDRESS TEST                ``PASSED``
0006H Format Diagnostic Tracks Test
0006H FORMAT DIAGNOSTIC TRACKS TEST   ``PASSED``
0007H Micro-Diagnostics
0007H MICRO-DIAGNOSTICS               ``PASSED``
0008H Seek/Verify Test
0008H SEEK/VERIFY TEST                ``PASSED``
0009H Worst Case Seek Test
0009H WORST CASE SEEK TEST            ``PASSED``
0010H Platter Verify Test
0010H PLATTER VERIFY TEST             ``PASSED``
000AH Write/Read Test
000AH WRITE/READ TEST                 ``PASSED``
000CH Platter/Head Test
000CH PLATTER/HEAD TEST               ``PASSED``
000DH Sector Selection
000DH SECTOR SELECTION                ``PASSED``
0011H Alternate Track Test
0011H ALTERNATE TRACK TEST            ``PASSED``
0012H Zero Fill Test
0012H Zero FILL TEST                 ``PASSED``
0013H Data Overrun Test
0013H DATA OVERRUN TEST              ``PASSED``
0014H Auto-Increment Test
0014H AUTO-INCREMENT TEST            ``PASSED``
*
```

18. The STFS prompt (*) on the screen display indicates the completion of the Winchester Customer Engineer diagnostics. If no further testing is required, the Intel Customer Engineer should complete the steps 19 through 22 to: a) exit from STFS, b) boot the system to ISIS-II (W), and c) spindown the disk drive in the Winchester Peripheral Chassis.
19. To exit from STFS, enter the following command on the system keyboard:


```
EXIT<cr>
```
20. To spin down the Winchester drive, press the RESET switch on the development system's front control panel and then, immediately press the "F" key on the system's keyboard.
21. The CRT will display the ISIS-II(W) operating system sign-on message:


```
ISIS-II(W), Vx.y
```

22. Enter the following command on the keyboard:

```
:F4:SPINDN<cr>
```

This step is done only for the disk drives that have the manual Read/Write head lock lever.

23. The CRT screen will display the following message:

```
SYSTEM INACTIVE
```

24. Observe that the "RUN" light on the IPC goes out. This is not an error.
25. Remove the diagnostic diskette from the floppy drive.
26. Turn the power switch on the front panel of the Winchester peripheral chassis to "OFF" position.
27. Press the power switch on the development system's front panel to power down the development system.

4.5 Diagnostic V-Variables

The following flags are user-controllable and may be individually set by entering commands on the development system's keyboard. Collectively, these test variables allow the Intel Customer Engineer to exercise additional control over test execution. When STFS is initialized, V-variables V(6), V(A), V(B), and the DEBUG flag are set to FF. Table 4-3 describes the V-variables used by the STFS test monitor.

To set any of the V-variables enter the following command on the system keyboard:

```
V(Number of Variable)=FF<cr>
```

To disable any of the V-variables enter the following command on the system keyboard:

```
V(Number of Variable)=00<cr>
```

Table 4-3. Diagnostic V-Variable Description

| Variable | Description |
|----------|---|
| V(1)* | Turns ON or OFF the displaying of the Seek complete and Pack Change message. |
| V(2)* | Is incremented once for every PASS or FAIL displayed by a CALL procedure (even if ERR=FF). |
| V(3)* | Is incremented once for every PASS displayed by a CALL procedure (even if ERR=FF). |
| V(4)* | Is incremented once for every FAIL displayed by a CALL procedure (even if ERR=FF). |
| V(5) | Used internally by the diagnostic. |
| V(6) | When V(6)=FF, the Winchester controller will skip over every defective track it encounters. |
| V(7) | Used internally by the diagnostic. |

Table 4-3. Diagnostic V-Variable Description (Cont'd.)

| Variable | Description |
|----------|---|
| V(8) | Used internally by the diagnostic. |
| V(9) | Used internally by the diagnostic. |
| V(A) | Enables the diagnostic to monitor the error rate. Five soft errors and one hard error are allowed for every 10 to the 10th bits transferred. Default value is FF. |
| V(B) | Enables the diagnostic to display the Cylinder number and Head number currently being tested or verified. Default value is FF. |
| V(C)* | Will keep count of the FAILED messages throughout the testing. Default value is 00. |
| V(D)* | Will keep count of the PASSED messages throughout the testing. Default value is 00. |
| V(E) | Not used in the diagnostic. |
| V(F) | Not used in the diagnostic. |

* Denotes a counter which has a default value of 00 (hex) To change the value, enter the desired hexadecimal value in the following format: V[variable name]=[hex value]

4.6 Troubleshooting the P-Box

The STFS Diagnostic test is the primary troubleshooting tool for the Intel Customer Engineer. The following list shows, by test number, the probable field replaceable unit (FRU) responsible for the test returning a FAILED message.

| Test Number | Subassembly |
|-------------|-------------------------|
| 0 to 5 | Controller |
| 6,7 | Controller/Cables/Drive |
| 8 to, D | Drive |
| E | Drive/Controller |
| F to 18 | Drive |

The Intel Customer Engineer should check each test's results as they may indicate the relationship between two or more subassemblies. For example, if tests 0 through 5 pass but test 8 fails, the drive should be considered faulty. Another example is, if test 2 and tests 8 through A fail, the controller is the probable cause and should be replaced. A bad controller can cause the drive tests to fail as can a faulty cable.

Table 4-4 lists additional test messages that the system CRT will display during test execution (depending on the failure) if the DEBUG flag is set to its default value, 0FFH.

Table 4-4. WCED Messages

| Error Code | Description |
|---------------------------|--|
| FORMAT | Format error |
| LBUF | I/O buffer error |
| DIAG | Micro-Diagnostic error |
| READID | Read sector ID error |
| READ | Read error |
| RESET | Reset error |
| SEEK | Seek error |
| TRANST | Transfer error status error |
| WRTBUF | Write controller buffer to disk error |
| WRITE | Write error |
| VERIFY | Verify error |
| Status Message | Description |
| DIAGNOSTIC FAULT | Micro-Diagnostic fault |
| DRIVE FAULT | Read/Write, position, power, or speed fault in selected drive |
| INVALID COMMAND | Controller issued an invalid function or other parameter which would cause an illegal function |
| INVALID ADDR | Attempt to access a cylinder beyond available tracks (includes alternates) |
| SELECTED UNIT NOT READY | Selected unit not ready or not responding |
| WRITE PROTECTION FAULT | Attempted write to write protected unit |
| END OF MEDIA | End of media detected |
| DEFECTIVE ALTERNATE | Alternate cylinder also defective |
| SECTOR NOT FOUND | Desired sector not found |
| ILLEGAL SECTOR SIZE | Test suite sector size variable does not match actual disk sector size |
| Soft Error Status Message | Description |
| SYNC NOT FOUND | Read electronics unable to synchronize on either ID or data field |
| DATA FIELD | Correctable error found in data field (note retry count) |
| ID FIELD | Correctable error found in ID field (note retry count) |
| CYLIN. ADDR MISC. | ID field contains address different than expected address |
| SEEK ERROR | Seek error detected |
| Time Out Error Message | Description |
| NON-INTERRUPT TIME-OUT | Controller has not posted an operation complete response for a function that does not use the operation complete interrupt |
| INTERRUPT TIME-OUT | Controller has not interrupted for an operation complete |
| TIME-OUT ON SEEK COMPLETE | Controller has not posted a seek complete response. |



5.1 Introduction

This chapter contains the removal and replacement procedures for the defined field replaceable units in the Winchester Peripheral Chassis and Series II/III development system. Step-by-step instructions with illustrations provide efficient service operations to replace the faulty equipment while ensuring personnel and equipment safety.

5.2 Pre-Removal Requirements

The following procedures must be performed in sequential order to avoid equipment damage or data loss on the Winchester drive.

1. If the development system and Winchester Peripheral Chassis is operational, reboot the to ISIS-II(W) operating system. Press the RESET switch on the development system's front panel and **within 2 seconds** press the "F" key on the keyboard.
2. Enter the following command to spindown the Winchester drive in the peripheral chassis:

```
:F4:SPINDN<cr>
```

This step is required only for those drives without the auto head lock feature.

3. Wait for the drive to stop (about 30 seconds) and turn off the power to the Winchester Peripheral Chassis.



Always remove power from the Winchester drive before removing power from the development system as damage may occur to the data content of the drive.



Damage to the drive heads and recording surfaces will occur if the peripheral chassis is moved prior to setting the head lock lever in the **LOCK** position.

4. Pull out the four quick-disconnect fasteners securing the front panel of the Winchester Peripheral Chassis and remove the panel.
5. Refer to Figure 2-3 and move the locking lever (if it is present) to the **LOCK** position as labelled on the drive.
6. Press the power switch on development system's front control panel to power down the system.

5.3 Series II/III Development System FRU R/R Procedures

This section describes the recommended removal and replacement procedures for the field replaceable units within the development system.

5.3.1 Winchester Disk Drive Controller

To remove the Winchester disk controller from the Series II/III development system chassis, proceed as follows:

1. Ensure that all power is removed from the development system. Loosen two screws and remove the front panel.
2. Disconnect the Winchester subsystem interface internal cable from the controller by detaching the cable's P1 connector from the controller's J1 connector and the cable's P2 connector from the controller's J2 connector.
3. Remove the disk controller board from the card cage, noting its position with respect to any other disk controllers in the card cage.

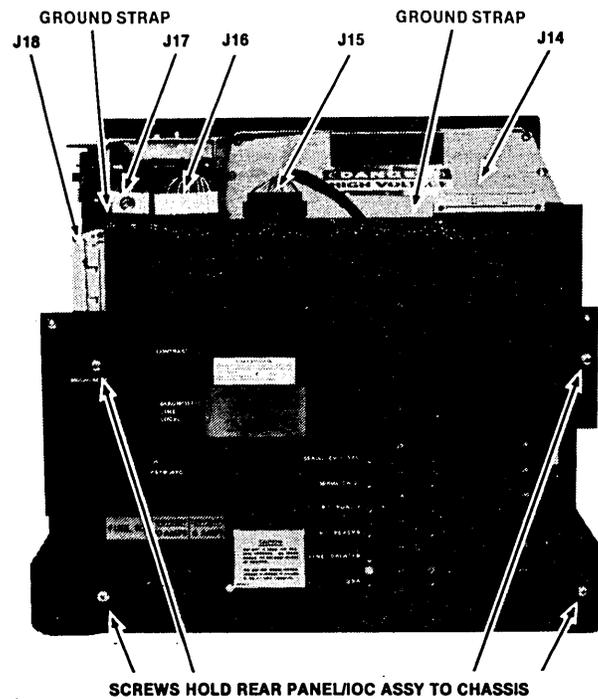
To replace the Winchester disk controller (either iSBC 215B or iSBC 215G), proceed as follows:

1. Insert the Winchester controller board into a vacant slot in the development system's card cage such that it is above all other disk controllers. This ensures that the Winchester controller will not monopolize the bus. Slide the board partially into the slot.
2. Connect the Winchester subsystem Interface Internal cable (P/N: 133476) to the controller; Internal cable connector P1 connects to J1 on the controller and Internal cable connector P2 connects to the J2 on the controller board. The white dot on the Internal cable connectors indicates pin 1 and must align with pin 1 on connectors J1 and J2 on the controller (indicated by a triangle on the top of the connector). Slide the controller board all the way into its slot.
3. Replace the development system's front panel.

5.3.2 Development System Rear Panel

To remove the rear panel of the Series II or Series III development system chassis proceed as follows:

1. If necessary, power-down any peripheral devices connected to the development system then, power-down the development system.
2. Disconnect the power cord(s) from the equipment and disconnect all cables attached to the development system's rear panel. Refer to Figure 5-1 for cable connections.
3. If the development system includes the low-profile drive chassis, remove the two aluminum ground strips between the system and drive chassis and lift the chassis off of the development system.



134170-10

Figure 5-1. Development System Rear Panel

4. Remove the development system top cover.

WARNING

Hazardous voltages are present within the development system. Ensure that the power is off and the power cord is disconnected from the outlet before proceeding.

5. Refer to Figure 5-1 and disconnect the cables from connectors J14, J15, and J16. If the development system includes an integral flexible disk drive, disconnect the cables from connectors J17 and J18. Disconnect any cable ground braids at the IOC.
6. Refer to Figure 5-1 and remove the rear panel mounting screws. Pull the panel away from the chassis and disconnect the Winchester Interface Internal cable assembly (P/N: 133476) from the panel's J10 connector slot.
7. Place the rear panel assembly face down on a padded flat surface and remove the eleven screws that secure the IOC board to the rear panel.

To install the development system rear panel, follow these steps:

1. Reinstall the internal cable assembly's P10 connector to the inside of the rear panel's J10 connector slot.
2. Position the rear panel assembly in place on the back of the development system and secure it with the four previously removed screws.
3. Reconnect the remaining cables and ground braids to their appropriate connectors on the IOC board (connectors J14 through J18; see Figure 5-1).

4. Replace the development system's top cover and, if included, the low-profile drive chassis. Reconnect all cables and ground strips that were previously removed.

5.3.3 Winchester Interface Internal Cable

To remove the Winchester Interface Internal cable refer to section 5.3.1 (Winchester Controller Removal) and section 5.3.2 (Development System Rear Panel Removal) and perform those procedures first. Complete the following steps to remove the cable from the Series II/III chassis.

1. Remove the development system top cover.
2. If the development system includes the low-profile drive chassis, remove the two aluminum ground strips between the system and drive chassis and lift the chassis off of the development system.

WARNING

Hazardous voltages are present within the development system. Ensure that the power is off and the power cord is disconnected before proceeding.

3. Disconnect the Internal cable from the Winchester disk controller by detaching the cable's connectors P1 and P2 from the controller's connectors J1 and J2.
4. Remove the socket screw assembly from the rear panel at J10 and remove the internal cable from the development system.

To replace the Internal cable in the Series II/III chassis proceed as follows:

1. Attach Internal cable to External signal cable at J10 on the development system's rear panel and replace the socket assembly screws.
2. Route the Internal cable along the side of the development system chassis and through the front opening into the card cage area. Ensure that the cable assembly is not pinched between the IOC and the power supply.
3. Secure the rear panel to the development system with the four previously removed screws.
4. Reconnect P1 and P2 to the controller's J1 and J2 respectively, noting that the white dot on the cable connectors aligns with pin 1 of the controller's J1/J2 connectors (pin 1 is indicated by a triangle on the top of the connector).

5.4 Peripheral Chassis FRU Removal/Replacement

This section describes the recommended removal and replacement procedures for the field replaceable units within the peripheral chassis.

5.4.1 Winchester Drive Assembly

To remove the drive assembly from the Winchester chassis, proceed as follows:

1. Ensure that the Winchester drive is powered-down and that the AC power cord has been disconnected.

2. Remove the four quick-disconnect screws from the peripheral chassis front panel and remove the front panel.
3. Look through the front panel opening, and if the drive has a manual locking lever, move the lever to the **LOCK** lever.

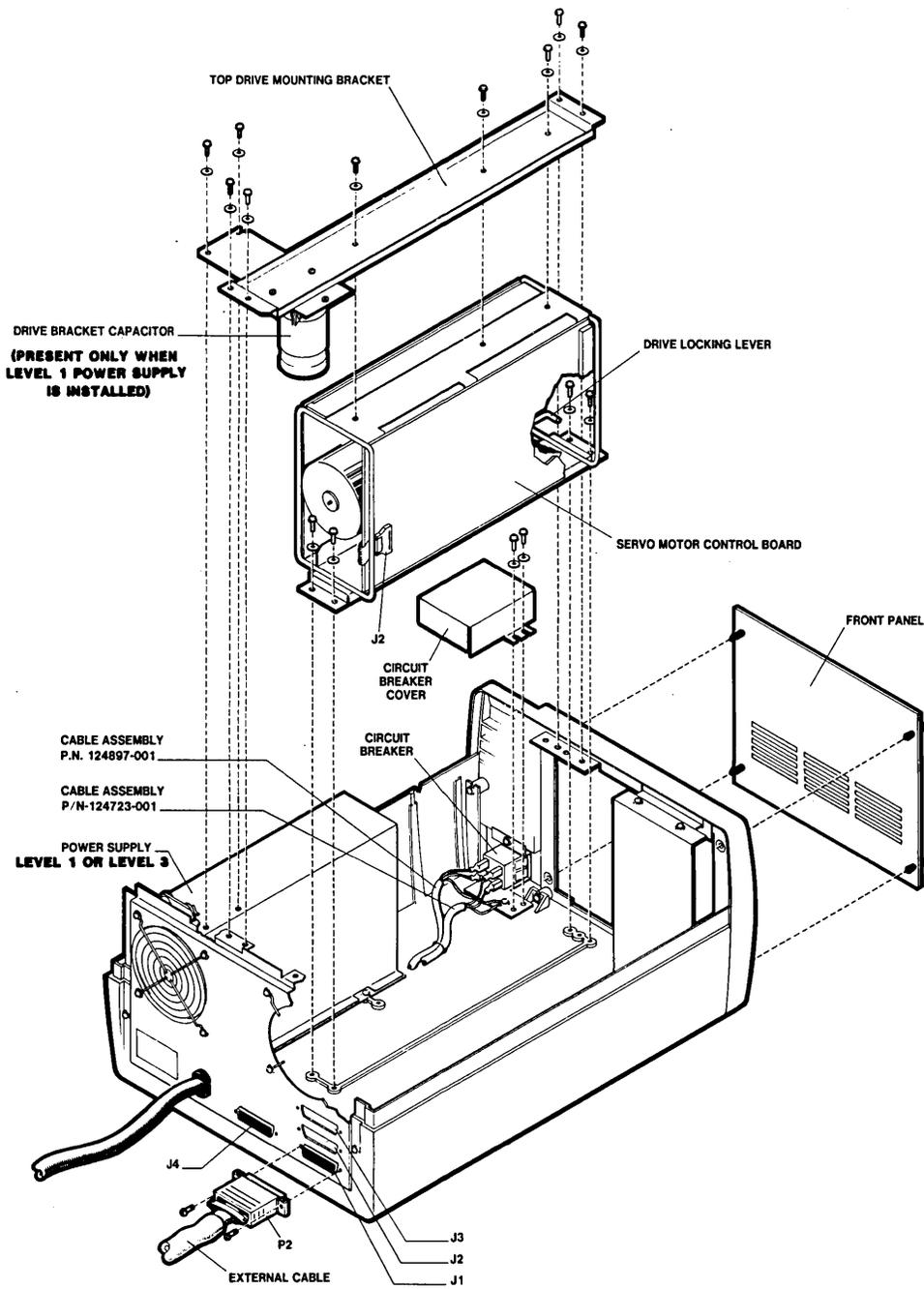


Damage to the heads and/or platter surfaces will occur if the drive assembly is moved and the heads are **NOT LOCKED** in place.

4. Remove the peripheral chassis' top cover.
5. Refer to Figure 5-2 and remove the nine screws from the drive's mounting bracket.
6. Carefully lift the mounting bracket up from drive assembly and set it to rest on the power supply frame. The blue capacitor (required for the level 1 power supply) is still attached to the bracket and connected to the level 1 power supply.
7. Disconnect the power drive adapter cable (P/N: 124885) connector P5 from power supply cable (P/N: 124894) connector J5 (if the level 1 power supply is installed). If the level 3 power supply is installed in the chassis, disconnect the power supply cable (P/N: 124894) connector P5 from the power supply at J1.
8. Disconnect the power supply cable (P/N: 124894) connector P3 from the drive's Servo Motor Control Board at connector J3 (located next to the locking lever).
9. Disconnect the 50 pin ribbon signal cable (P/N: 125390) connector P7 from the Read/Write Digital Control Board on the drive assembly from connector J1.
10. Remove the four mounting screws from the drive's lower mounting bracket and lift the drive out of the chassis. The lower mounting bracket is still attached to the drive and provides a stable base for the drive. Leave the bracket attached unless the drive itself requires replacement.

To replace the drive assembly in the Winchester chassis follow these procedures:

1. If the lower mounting bracket was removed from the drive assembly, replace it correctly on the bottom of the drive and tighten the mounting three screws.
2. Place the drive assembly in the chassis frame (refer to Figure 5-2 for proper alignment) and tighten the four mounting bracket screws securing the drive assembly to the floor of the chassis.
3. Reconnect the 50 pin ribbon signal cable connector P7 to connector J1 on the Read/Write Digital Control Board of the drive, ensuring that the arrows on the two connectors align.
4. Reconnect the power supply cable (P/N: 124894) connector P3 to connector J3 on the Servo Motor Control Board.
5. Reconnect the power supply cable (P/N:124894) connector P5 to the level 1 power supply cable adapter (P/N: 124885) connector J5. If the level 3 power supply is installed, reconnect the power supply cable (P/N:124894) connector P5 to the power supply at J1.



134170-11

Figure 5-2. Drive Assembly Removal

6. Replace the top mounting bracket (reconnect the capacitor ground leads if they were removed) on the drive assembly and tighten the nine mounting screws.
7. Replace the peripheral chassis' top cover and front panel.

5.4.2 On/Off Switch/Circuit Breaker

To remove the circuit breaker from the peripheral chassis, proceed with the following steps:

1. Remove the peripheral chassis' top cover.
2. Loosen the two screws securing the circuit breaker cover to the chassis and remove the cover.
3. Disconnect all cable attachments from the circuit breaker. Loosen the mounting bracket screw securing the drain line of the cable assemblies, P/N: 124723 and P/N: 124897.
4. Loosen and remove the remaining mounting plate screw and inside front panel mounting bracket retaining screw. Remove the switch/circuit breaker assembly from the chassis.
5. Press each side of the On/Off Switch/Circuit Breaker and pull the switch assembly out of the mounting bracket.

To reinstall the On/Off Switch/Circuit Breaker into the peripheral chassis, consult the interconnect wiring diagram, Figure 1-1, and Figure 5-2 (specifically in the circuit breaker area) for the proper cable lead connections. Proceed with the following steps to replace the circuit breaker assembly:

1. Place new switch/circuit breaker into mounting bracket such that the On/Off switch has OFF on the right side.
2. Place switch/circuit breaker and mounting bracket into the peripheral chassis and replace the mounting bracket retaining screws. Remember, one of the mounting screws securing the bracket to the chassis floor also secures the drain lines of cable assemblies P/N: 124723 and P/N: 124897.
3. Secure both the drain lines to the base of the circuit breaker mounting bracket with the retaining screw.
4. Replace the leads from cable assembly P/N: 124723 (Line Filter to Circuit Breaker cable) on the circuit breaker terminals marked **LINE** such that the red lead is above the clear (white) lead. Viewed from above, and assuming the On/Off switch has the OFF on the right side, the **LINE** terminals are nearest the chassis side.
5. Replace the brown and yellow leads from cable assembly P/N: 124894 on the two smaller, inside circuit breaker terminals such that the brown lead is above the yellow lead.
6. Replace the red and white (clear) leads from cable assembly P/N: 124723) on the remaining circuit breaker terminals such that the red lead is above the white lead.
7. Replace the circuit breaker safety cover and secure with the two retaining screws. The front panel may be taken off to access the area between the drive and circuit breaker.
8. Replace the peripheral chassis' top cover and, if it was removed, the front panel.

5.4.3 AC Line Filter

To remove the AC line filter from the chassis proceed with the following steps:

1. Remove the top cover from the peripheral chassis.
2. Remove the two screws securing the filter cover to the chassis and remove the cover (see Figure 5-3).
3. Remove the two screws securing the filter to the chassis floor. Detach the AC cord leads at the **LINE** end and the circuit breaker cable assembly P/N: 124723 leads at the **LOAD** end of the filter. Remove the ground leads from the **LOAD** end at the filter's base and remove the filter from the chassis.

To replace the line filter, follow these steps:

1. Place the filter on the mounting bracket between the drive and the rear panel in the chassis and reconnect the AC cord leads at the **LINE** end of the filter; the brown wire connects to the terminal marked, "L" and the blue wire connects to the terminal marked, "N" (see Figure 5-3).
2. Reconnect the circuit breaker leads (cable assembly P/N: 124723) to the **LOAD** end of the filter; the white wire connects to the terminal marked, "L" and the red wire connects to the terminal marked, "N" (see Figure 5-3).
3. Replace the circuit breaker ground and chassis ground (cable assembly P/N: 124895) on the line filter mounting bracket at the **LOAD** end and secure both leads with the mounting bracket retaining screw. Replace and tighten the remaining mounting bracket retaining screw at the **LINE** end of the filter.
4. Replace the filter cover, ensuring that the cable assemblies are NOT crimped between the cover and the filter mounting bracket. Replace and tighten the two filter cover retaining screws.
5. Replace the top cover on the chassis.

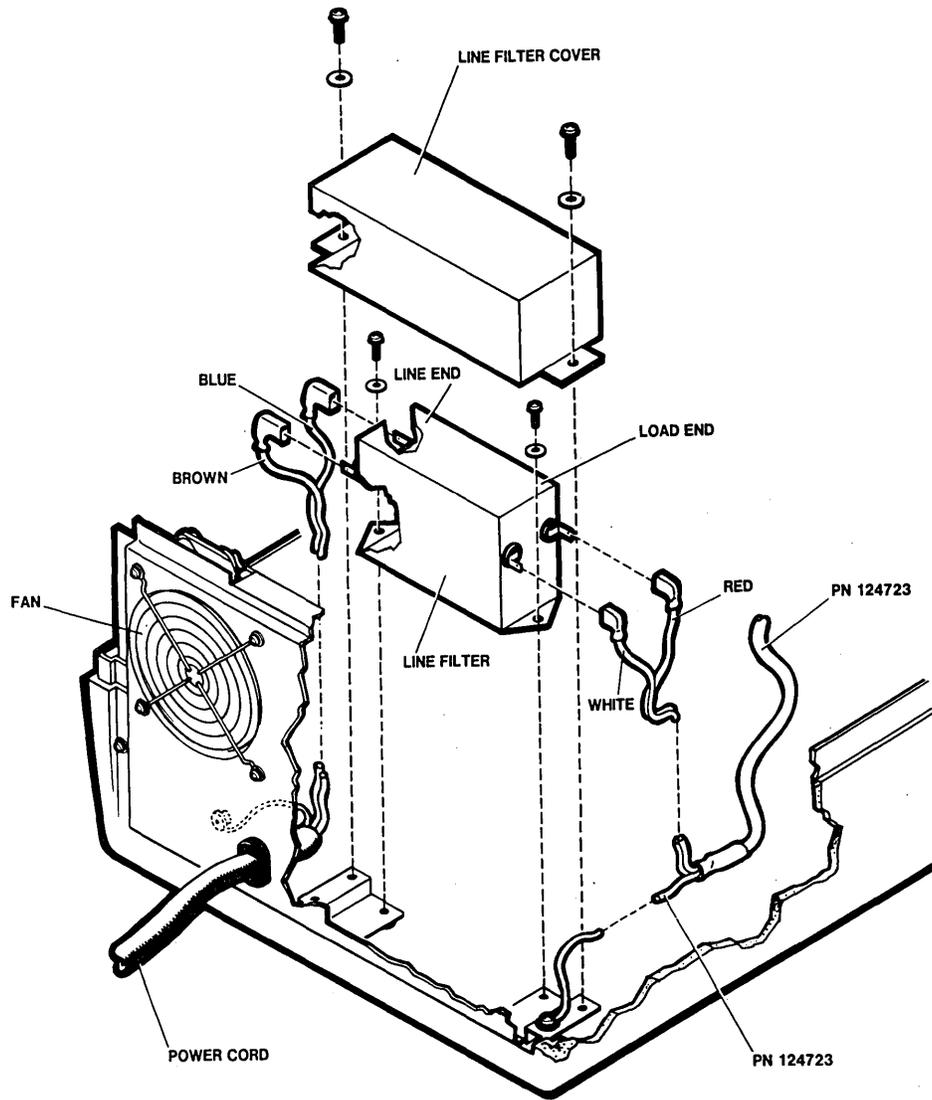
5.4.4 Rear Panel Fan

To remove the fan(s) from the rear panel of the chassis proceed as follows:

1. Remove the top cover from the chassis and the top mounting bracket from the drive.
2. Disconnect the two wire leads from the fan housing, noting their orientation for proper position during reassembly (white wire nearest rear panel).
3. Refer to Figure 5-4 and remove the four long screws securing the fan housing (including finger guards) to the rear panel and guide the fan housing and outside finger guard out of the chassis. The inside finger guard may remain tie-wrapped to the fan cable assembly.

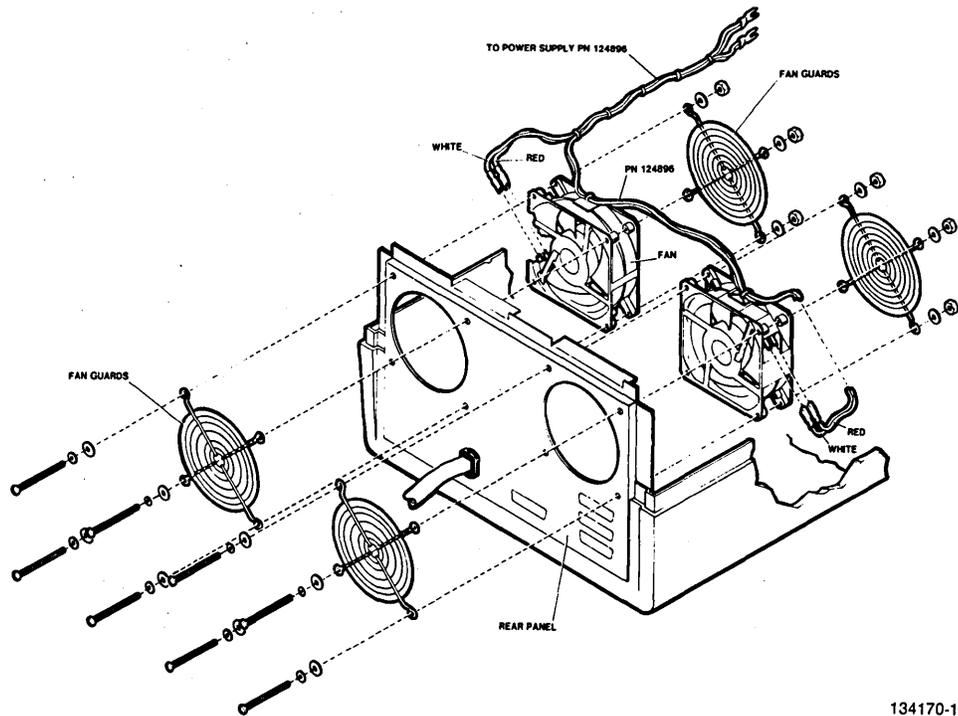
To replace the fan(s) on the rear panel of the chassis, proceed with the following steps:

1. Guide the fan assembly into the chassis and place in the cutout on the rear panel, ensuring that the fan label is visible from the outside of the chassis.



134170-12

Figure 5-3. AC Line Filter



134170-13

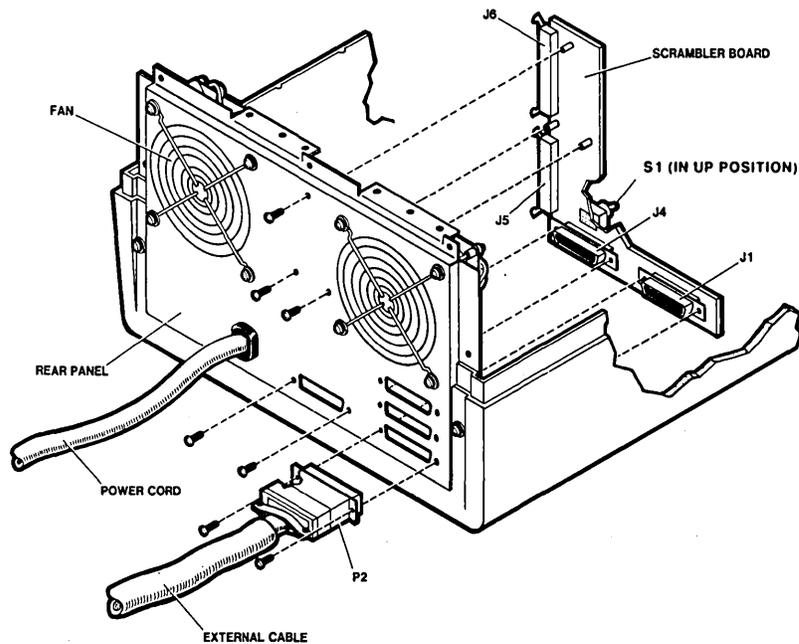
Figure 5-4. Rear Panel Fan Removal

2. Align the outside finger guard on the outside of the rear panel, the fan assembly, and inside finger guard with the screw holes and replace the four retaining screws. If the fan nearest the power supply is being replaced, use a pair of needle-nosed pliers to place and hold the washer and nut onto the lower left retaining screw.
3. Replace the fan wire assembly leads on the fan housing terminals (white wire nearest the rear panel).
4. Replace and secure the drive's top mounting bracket and the chassis' top cover.

5.4.5 Scrambler Board

To remove the scrambler board from the Winchester Peripheral Chassis, following these steps.

1. Remove the chassis' top cover and the drive's top mounting bracket.
2. Refer to Figure 5-5, and disconnect the 50 pin ribbon signal cable connector P1 from the top scrambler board connector (J6).
3. Remove the three small philips screws from the outside of the chassis rear panel.
4. Disconnect the Winchester Interface External cable from the rear panel at slot J1.



134170-14

Figure 5-5. Scrambler Board

5. Remove the four hex socket assembly screws from the rear of the chassis.

To install the scrambler board in the chassis following these steps:

1. Refer to Figure 5-5 and guide the scrambler board into the chassis between the AC filter cover and rear panel, aligning scrambler board connector J1 to rear panel slot J1 and scrambler board connector J4 to slot J4 on the panel.
2. Replace the three small philips screws on the rear panel to secure the board to the inside of the rear panel.
3. Reconnect the Winchester External Interface cable assembly (see section 5.4.7) to the scrambler board via connector slot J1 on the rear panel and replace the four socket assembly screws.
4. Reconnect the 50 pin ribbon signal cable connector P1 to the top connector, J6, on the scrambler board. Ensure that the arrow on connector P1 aligns with pin 1 on J6.
5. Place scrambler board switch S1 toggle in the UP position.
6. Replace the drive's top mounting bracket and the chassis' top cover.

5.4.6 Power Supply

Procedures for removing the level 1 or level 3 power supply from the chassis are essentially the same. The differences between the two supplies are:

- The level 3 P/S has no capacitor attached to the drive's top mounting bracket.
- The level 3 P/S DC power cable assembly connector P5 plugs directly into the power supply at P1.

Refer to Figure 5-6 (and detail A, for the level 3 P/S) and proceed with the following steps to **remove** the power supply from the chassis:

1. Remove the chassis' top cover and remove the nine retaining screws from the drive's mounting bracket.

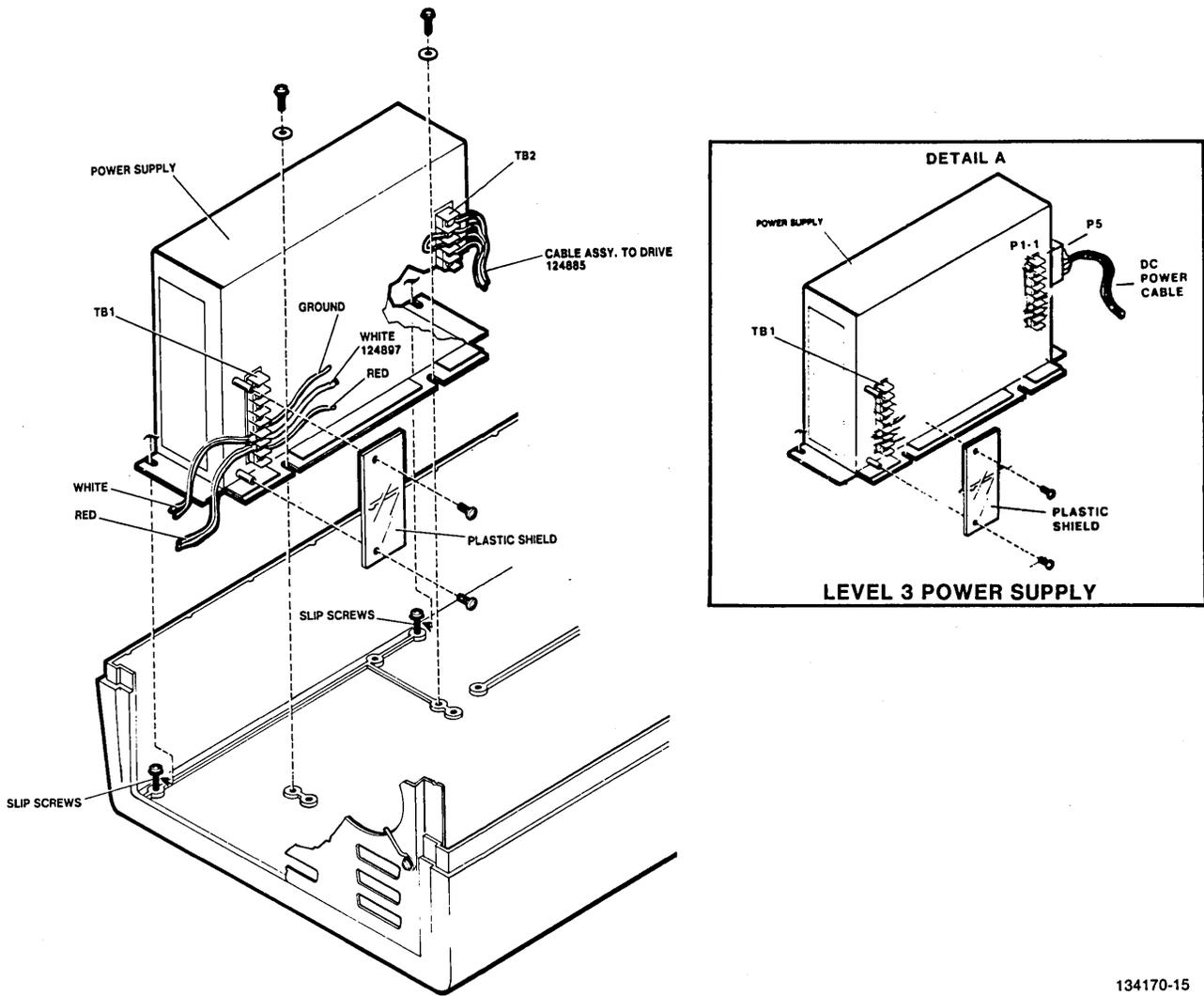


The level 1 power supply requires a capacitor which is mounted on the drive's mounting bracket. This capacitor will continue to discharge after the chassis is powered-down. To **SAFELY** discharge the capacitor so it can be disconnected from the power supply, use a plastic handled screwdriver, grip the handle, and place the metal blade across both terminals.

2. Disconnect the leads from the capacitor (if it is present).
3. Remove the plastic shield on the power supply at TB1. For easier access to the shield, remove the AC line filter cover, disconnect the AC power cord leads from the **LINE** end of the filter, remove the retaining screw from the **LINE** end of the filter, and slide the filter towards the drive.
4. Record the wire connections at TB1, then disconnect the leads from TB1.
5. Disconnect the DC power cable connector P5 from the power supply adapter cable connector J5 if the level 1 power supply is installed. If the level 3 power supply is installed in the chassis, disconnect the DC power cable connector P5 from the power supply connector P1.
6. Loosen the two slip screws at each end of the power supply frame and remove the two inboard screws from the power supply mounting bracket.
7. Slide the power supply frame away from the chassis wall to clear the slip screws and lift the power supply out of the chassis.

To install the power supply in the chassis, follow these procedures:

1. Guide the power supply into the chassis (refer to Figure 5-6) between the fan and circuit breaker. Align the frame with the slip screws and tighten.
2. Replace the two inboard screws on the power supply frame and tighten them to secure the power supply to the chassis floor.
3. Reconnect the cable assemblies, P/N: 124896 and P/N: 124897 to TB1 at the correct terminal lugs. Use the cable connection record made during step #4 of the removal procedures to ensure that the cable leads are connected to the correct terminal lugs.
4. Replace the plastic shield over TB1 and tighten the two retaining screws to secure the shield to the power supply.
5. Reconnect the DC power cable assembly P/N: 124894, connector P5 to the power supply; for the level 1 power supply, connect P5 to the DC adapter cable connector J5; for the level 3 power supply, connect P5 to connector P1-1.
6. Reconnect the AC cord leads to the **LINE** end of the filter, (the brown lead attaches to the "N" terminal) replace and tighten the line filter retaining screw, and replace and secure (with the two retaining screws) the filter cover. Ensure that the filter wires are not crimped when the cover is replaced.



134170-15

Figure 5-6. Power Supply

7. Reconnect the ground leads from cable assembly P/N: 124726 to the capacitor on the mounting bracket (green lead to positive post, white lead to negative post). This is done only if the level 1 power supply is installed.
8. Replace the top mounting bracket and tighten the nine retaining screws.
9. Replace the chassis' top cover.

5.4.7 Winchester External Interface Cable

To remove the External cable from the system follow these steps:

1. Remove the two hex socket assembly screws from I/O cutout J10 on the development system rear panel. Unplug the Winchester External Interface cable P2 from J10.
2. Remove the two hex socket assembly screws from I/O cutout J1 on the Winchester Peripheral Chassis rear panel and unplug the cable from J1.

To install the Winchester External Interface cable, proceed as follows:

1. Plug the External cable connector P1 into the development system rear panel at I/O connector J10 and secure the connection by tightening the two hex socket assembly screws.
2. Plug the External cable connector P2 into the Winchester Peripheral Chassis rear panel at I/O connector J1 and replace the socket assembly screws.



6.1 Introduction

This chapter lists the part numbers of the field replaceable units for the Winchester Peripheral Chassis subsystem. This list also includes the development system subassemblies associated with the Winchester Peripheral Chassis. Table 6-1 contains the complete parts list with the cable assemblies being grouped respective of their origin. Figure 6-1 is an exploded view of the major subassemblies (cable assemblies are deleted) contained in the peripheral chassis.

6.2 Winchester Peripheral Chassis Parts Listing

Table 6-1 contains the description and part numbers of all the field replaceable units in the Winchester Peripheral Chassis subsystem.

Table 6-1. Parts List

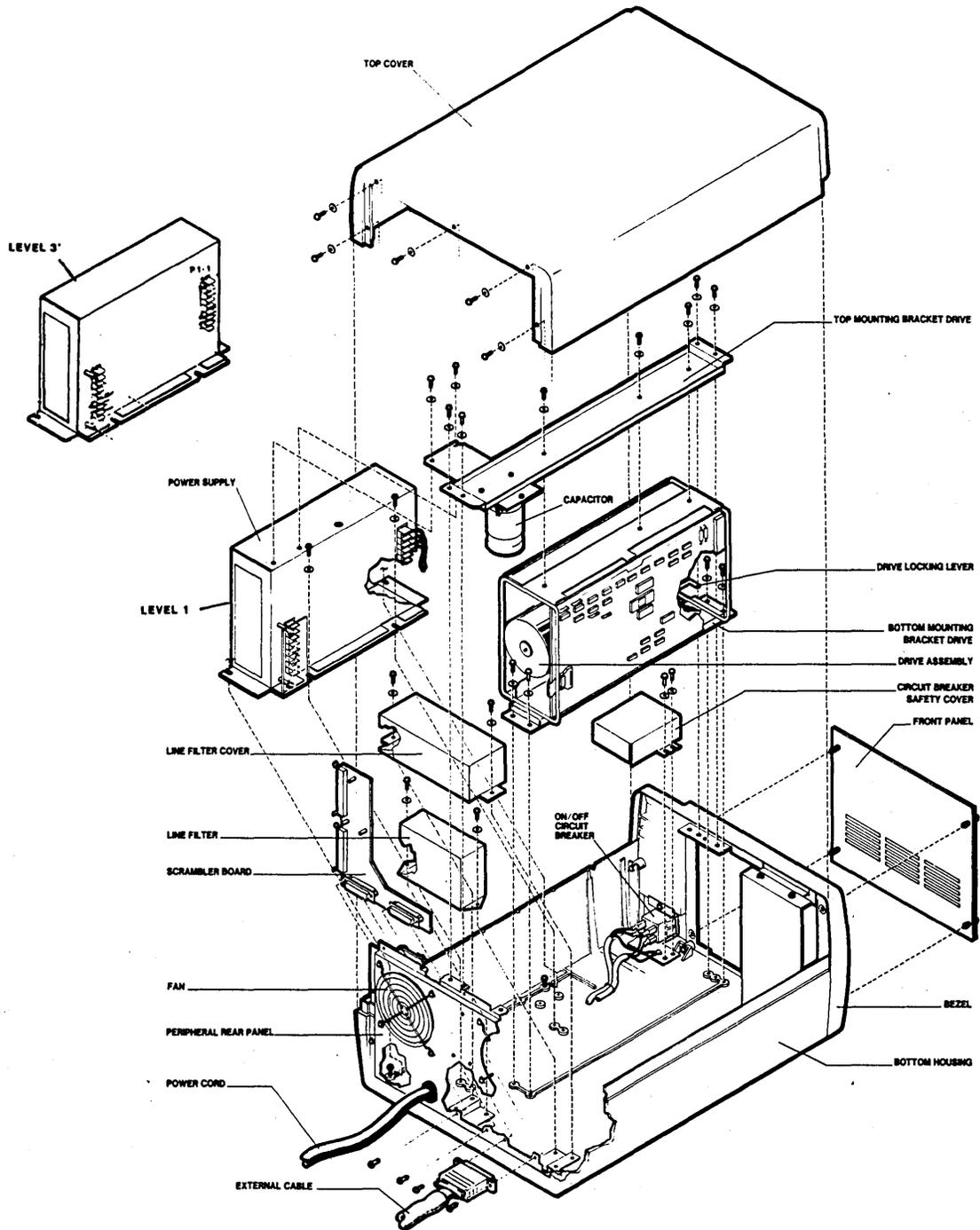
| Part No. | Description |
|----------------------------------|--|
| Winchester Chassis | |
| 107752 | Rubber Bumper strip |
| 107760 | Cab Access Latch Grip RCP (nylatch grommet) |
| 107760 | Cab Access Latch Grip (nylatch plunger) |
| 123946 | Intel Logo |
| 123952 | Top Cover |
| 123953 | Bottom Housing Peripheral Box |
| 123954 | Bezel Peripheral Box |
| 124236 | Panel, Front |
| 125368 | Panel, Rear |
| Winchester Drive Assembly | |
| 107779 | Capacitor, 50V (only when level 1 P/S present) |
| 124246 | Bottom Mounting Bracket, Drive |
| 124247 | Top Mounting Bracket, Drive |
| 124885 | Cable Assembly, Power Drive Adapter (only when level 1 power supply present) |
| 124894 | Circuit Breaker to Power Supply Cable Assembly |
| 125260 | Formatted Winchester Drive |
| 125390 | Winchester Drive Signal Cable Assembly |
| Chassis Power Supply | |
| 124726 | Cable Assembly to Capacitor (only when level 1 power supply is present) |
| 124896 | Power Supply to Fan Cable Assembly |
| 124898 | Jumper (only when level 1 P/S is present) |
| 125009 | Level 1 Power Supply |
| 124903 | Level 3 Power Supply |

Table 6-1. Parts List (Cont'd.)

| Part No. | Description |
|---|--|
| On/Off Circuit Breaker | |
| 104257-002 | On/Off Circuit Breaker (110 VAC) |
| 104257-003 | On/Off Circuit Breaker (220 VAC) |
| 124240 | On/Off Circuit Breaker Mounting Bracket |
| 124897 | On/Off C.B. Cable Assembly to Power Supply |
| 124923 | On/Off Circuit Breaker Safety Cover |
| AC Line Filter | |
| 124376 | AC Line Filter |
| 124723 | Line Filter to On/Off Circuit Breaker |
| 124895 | Line Filter Grounding Cable |
| 125159 | Line Filter Mounting Bracket |
| 125160 | Line Filter Cover |
| Chassis Rear Panel Area | |
| 103001-001 | Fan (110 VAC) |
| 103001-002 | Fan (220 VAC) |
| 124119-003 | Power Cord (110 VAC) |
| 124119-004 | Power Cord (220 VAC) |
| 125337 | Scrambler Board |
| Development System Subassemblies | |
| 125218 | Development System Rear Panel |
| 133475 | Winchester External Interface Cable |
| 125249 | Winchester Disk Controller (iSBC 215B) |
| 133476 | Winchester Internal Interface Cable |

6.3 Winchester Chassis Exploded View

Figure 6-1 presents an illustrated exploded view of the major subassemblies (cable assemblies are deleted) contained within the Winchester Peripheral Chassis.



*DOES NOT REQUIRE CAPACITOR (MOUNTED ON TOP MOUNTING BRACKET DRIVE)

134170-16

Figure 6-1. Winchester Chassis Exploded View



7.1 Introduction

The Customer Engineer diagnostics are based on the System Test Foundation Software (STFS) which is a software monitor designed to provide varied environments during diagnostic testing. The commands are entered on the development system keyboard after STFS is loaded and the STFS prompt (*) appears on the CRT. Each of the commands can be abbreviated to the first three letters of the command name (the TEST command also can be abbreviated with the letter T). Commands are terminated by pressing the RETURN key on the keyboard (indicated by <cr>).

Table 7-1. STFS Command Description

| Command Name | Description |
|--------------|---|
| BASE | Set or display the base of numerical output |
| CLEAR | Clear the total test count |
| COUNT | Perform a set of commands a given number of times |
| DEBUG | Set or display the debug switch |
| DESCRIBE | Display the names of all tests |
| EXIT | Return control to ISIS-II(W) |
| IGNORE | Disable a test from execution |
| LIST | Establish the given file as a log file |
| RECOGNIZE | Enable test for execution |
| REPEAT | Repeat a set of commands following forever |
| SUMMARY | Display test summary |
| TEST | Perform all or specified tests |

7.2 Line Editing

The ISIS-II line editing commands may be used to correct or modify command entries at any time before the RETURN key on the keyboard is pressed. Table 7-2 lists and summarizes the line editing commands.

Table 7-2. Line Editing Commands

| Edit Commands | System Response |
|---------------|--------------------------------------|
| CONTROL + X | Aborts current input line |
| CONTROL + R | Echoes entire input line |
| CONTROL + S | Freezes the current system operation |

Table 7-2. Line Editing Commands (Cont'd.)

| Edit Commands | System Response |
|---------------|--|
| CONTROL + Q | Resumes current system operation after a CTL + S |
| RUBOUT | Deletes the last character entered |
| ESC | Aborts current operation, prepares for a command |

7.3 Command Notational Convention

Table 7-3 summarizes the notational convention used in the description of the test manager commands.

Table 7-3. Command Notational Convention

| Notation | Description |
|-------------|---|
| UPPERCASE | Elements in uppercase are specific keywords that may be entered in uppercase or lowercase (or abbreviated as described in section 7.4). |
| [] | Brackets indicate optional arguments or parameters. When two or more elements are enclosed in brackets, all elements are optional, but only one element may be entered. |
| { } | Braces indicate that only one of the elements can be entered. |
| ... | Ellipses indicate the the preceding argument may be repeated. |
| punctuation | Punctuation other than ellipses, braces, and brackets must be entered as shown. |
| <cr> | Indicates that the RETURN key must be pressed. |

7.4 STFS Commands

The following paragraphs describe each of the STFS test commands and provide the syntax and example entries for each command. In the examples, the command prompt for user input is indicated by an asterisk (*). Test lines without an asterisk are output messages from the test program or from the STFS test manager.

BASE Command

The BASE command displays or changes the default base for most numeric data shown on the CRT. The initial default base is hexadecimal.

Syntax for the BASE command is as follows:

| | | | | | |
|------|---|--------|---|-------|----------------------------|
| BASE | [| Y |] | Y | = Binary (base 2) |
| | | O or Q | | O/Q | = Octal (base 8) |
| | | T | | T | = Decimal (base 10) |
| | | H | | H | = Hexidecimal (base 16) |
| | | ASCII | | ASCII | = ASCII value of each byte |

Example entries for the BASE command are as follows:

- To display output default base:
*BASE<cr>
- To set output default base to binary:
*BAS = Y<cr>

CLEAR Command

The CLEAR command allows the user to set the execution and error counts for any or all tests to zero. Execution and error counts for each individual test accumulate in a test activity summary table. The CLEAR command does not affect test status (ignored or recognized). The CLEAR command will clear the count to zero in the summary table. (See the SUMMARY command for instructions on displaying the test activity summary table).

Syntax for the CLEAR command is as follows:

```
CLEAR [ test# , test# ]  
      [ test# TO test# ]
```

Example entries for the CLEAR command are as follows:

1. To clear all execution and error counts:
*CLEAR<cr>
2. To clear execution and error counts for test 14H through 20H (inclusive):
*CLE 14 TO 20<cr>
3. To clear execution and error counts for tests 3H, 5H, and CH:
*CLE 3, 5, C<cr>

COUNT Command

The COunt command will execute any set of STFS commands the number of times given in the COUNT command. The set of commands to be executed are entered on a separate line following the COUNT command entry. The last entry must be the END command. The COUNT loop can be aborted by pressing the ESC key.

Syntax for the COUNT command is as follows:

```
COUNT [ n n n ]  
.*  
.*  
.*  
.*
```

Example entry for the COUNT command is as follows:

1. To loop tests 10H and CH 100 times:

```
*COUNT 100T<cr>  
.*TEST 10<cr>  
.*TEST C<cr>  
.*END<cr>
```

DEBUG Command

The DEBUg command is used to set or display the status of the DEBUG switch. When DEBUG = FFH, error messages are displayed. When DEBUG = 0 (default), error message are suppressed.

Syntax for the DEBUG command is as follows:

```
DEBUG [ = 0  
        = 1 ]
```

Example entries for the DEBUG command are as follows:

1. To display current DEBUG status:
*DEBUG<cr>
0000H
2. To set the DEBUG switch to display error messages:
*DEB=FF<cr>
3. To set the DEBUG switch to suppress error messages:
*DEB=0<cr>

DESCRIBE Command

The DESCRIBE command displays the test number and test name for any or all the tests in the test program currently loaded into memory and displays the test status (ignored or recognized).

Syntax for the DESCRIBE command is as follows:

```
DESCRIBE [ test# [ , test# ] ]  
         [ test# TO test# ]
```

Example entries for the DESCRIBE command are as follows:

1. To describe all the tests of the test program:
`*DES<cr>`
2. To describe tests 1H through 4H of the test program:
`*DESCRIBE 1 TO 4<cr>`
OR
`*DES 1 TO 4<cr>`

EXIT Command

The EXIt command terminates the test session and returns control of the host to ISIS-II operating system. When the test program is exited, any summary information is lost.

Syntax for the EXIT command is as follows:

```
EXIT<cr>
```

IGNORE Command

The IGNore command allows the user to tell the test manager to ignore and not execute test(s) even if those tests are in a test partition in the TEST command.

Syntax for the IGNORE command is as follows:

```
IGNORE [ test# [ , test# ] ... ]  
       test# TO test#
```

Example entries for the IGNORE command are as follows:

1. To ignore all tests:
*IGNORE<cr>
2. To ignore tests 14H through 20H (inclusive):
*IGN 14 TO 20<cr>
3. To ignore tests 3H, 9H, and CH:
*IGN 3, 9, .C<cr>

LIST Command

The LIST command allows a logical device to become a log file. This device can be anything that ISIS-II operating system recognizes as file capable of an output. Diskette files are the most useful log files. The console will also display the output as well as the list device. Use of this command causes a copy of all subsequent output including prompts, user input, line echo, and test messages to be sent to the line printer or teletype.

Syntax for the LIST command is as follows:

```
LIST [ :device name:
      OR
      file name ]
```

Example entries for the LIST command are as follows:

1. To send the test display output to the line printer:
*LIST :LP:<cr>
2. To send the test display output to a diskette file TEST.LOG in drive 0:
*LIST TEST.LOG<cr>
3. To send the test display output to a diskette file TEST.LOG in drive 1:
*LIST :F1:TEST.LOG<cr>
4. To restore normal operation where all outputs are directed only to the system CRT:
*LIST :CD:<cr>

RECOGNIZE Command

The RECOGNIZE command permits tests that were previously disabled with the IGN command to run when the TEST command is invoked.

Syntax for the RECOGNIZE command is as follows:

```
RECOGNIZE [ test# [ , test# ] ... ]  
          test# TO test#
```

Example entries for the RECOGNIZE command are as follows:

1. To recognize all tests:
`*RECOGNIZE<cr>`
2. To recognize tests FH through 15H (inclusive):
`*REC F TO 15<cr>`
3. To recognize tests 1H through 4H (inclusive), test BH, and test 14H:
`*REC 1 TO 4, B, 14<cr>`

REPEAT Command

The REPEAT command repeats the sequence of commands entered within the command block. All commands entered after the REPEAT command and before the END command are looped the specified number of times. If the number of repeats is not specified, the sequence repeats forever. The number of repeat iterations (*nnn*) may be specified in hexadecimal (H), (the default base), decimal (T), octal (O or Q), or binary (Y) number bases. The maximum number of iterations specified by (*nnn*) is 65,535T. Note that a nested prompt (.*) is issued for all commands entered in the REPEAT/END command block, including the END command. The REPEAT loop can be aborted by pressing the ESC key.

Syntax for the REPEAT command block is as follows:

```
REPEAT (nnn)
  command
  command
  . . .
END
```

The following example runs a series of tests 1000 times and displays the execution summary for test 6 after each pass through the sequence:

```
*REPEAT 1000T<cr>
.*TEST 0 TO C<cr>
.*SUM 6<cr>
.*END
```

The test sequence begins execution immediately following the last carriage return (<cr>).

SUMMARY Command

The SUMmary command displays the test activity summary table for any or all tests in the test program. The summary table contains the following information about each test: (1) test number, (2) test name, (3) execution count, and (4) error count. The summary table will also list the ignored tests. The counts in the summary table accumulate until the test program is reinitialized or until the CLEAR command is entered. If the errors only (EO) switch is selected, only the tests that have failed one or more times will be included in the summary display.

Syntax for the SUMMARY command is as follows:

```
SUMMARY [ test# [ , test# ] ... ] [EO]
```

Example entries for the SUMMARY command are as follows:

1. To display the summary table entry for test 9:

```
*SUMMARY 9<cr>
0009H WORST CASE SEEK TEST      0005 FAILED IN 0017 TRIALS ←
```

2. To display all tests that failed:

```
*SUM EO<cr>
```

TEST Command

The TEST command loads and executes specified tests in numerical order (regardless of the order in which the test numbers are entered). When no test numbers are specified, all tests are executed. Tests specified as ignored are not invoked by the TEST command.

To terminate a test sequence, press the ESC key.

TEST Command Parameters

The TEST command uses a REPEAT element with any one of four modifiers: FOREVER, *nnnn*, UNTIL ERROR, and UNTIL NOERROR.

If REPEAT FOREVER is used with the TEST command (or REPEAT without a modifier), the specified tests execute in numerical order regardless of errors until the ESC key is pressed.

If REPEAT *nnnn* is used with the TEST command, the specified tests loop *nnnn* times. When *nnnn*=0, the first specified test is loaded into memory but is not executed. The modifier *nnnn* may be hexadecimal (H), decimal (T), octal (O or Q), or binary (Y). The default number base is hexadecimal. The maximum number of iterations specifiable by *nnnn* is 65,535T.

If REPEAT UNTIL ERROR is used with the TEST command, the specified tests loop until one test returns an error condition.

If REPEAT UNTIL NOERROR is used with the TEST command, the specified tests loop until all tests pass.

Syntax for the TEST command is as follows:

```
TEST [ test# [ , test# ] ... ]
      test# TO test#
```

Example entries for the TEST command are as follows:

1. To run all (recognized) tests:
***TEST<cr>**
2. To run a sequence of tests 50 times:
***T 3 TO 1B 50t<cr>**
3. To loop test AH indefinitely:
***T A REPEAT FOREVER<cr>**
4. To loop tests 3H, 5H, 7H, and 9H until an error occurs:
***T 3, 5, 7, 9 REP UNTIL ERROR<cr>**
5. To loop all tests until the entire sequence passes:
***TES REP UNT NOERROR<cr>**



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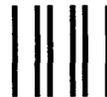
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