MARK 4/4E

System Installation/ Maintenance Manual

DATA POINT CORPORATION

POINT 4
DATA CORPORATION

MARK 4/4E

SYSTEM INSTALLATION/ MAINTENANCE MANUAL

Revision C

NOTICE

Every attempt has been made to make this manual complete, accurate and up-to-date. However, all information herein is subject to change due to updates. All inquiries concerning this manual should be directed to POINT 4 Data Corporation.

WARNING!

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 and found to comply with the limits for Class A computing devices 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. Only shielded cables with the shield terminated to the metal hood of the connector should be used. Use of non-POINT 4 cables may violate FCC rules.

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01	Preliminary release	05/29/87
A	Initial release	06/12/87
B	Complete revision incorporating 100 Hz clock; SSDC Controller; 85, 143, 190MB disk drives; 512K-memory, 8-port basic MARK 4E system	06/20/88
C	Update package incorporating the 150MB cartridge tape drive, the required revision of IRIS, and an appendix on the care and handling of tape cartridges and floppy disks	09/19/88

LIST OF EFFECTIVE PAGES

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PREFACE

The POINT 4 MARK 4/4E System Installation and Maintenance Manual is designed for value added resellers, installers, maintenance and service persons of the MARK 4/4E minicomputer system. Its purpose is to provide an overview of the system and its major components; information and instructions for installing and starting up the system, installing or replacing individual components, and for troubleshooting and power-fail situations. The sections of the manual are summarized below:

Section 1 - Overview: A brief description of the MARK 4/4E system including its major components.

Section 2 - Installing the System: A suggested procedure for installing the system hardware.

Section 3 - Controls and Indicators: Information about the location, operation, and function of the controls and indicators including the key and reset switches, MANIP, and front panel indicators.

Section 4 - Getting Started: A description of the initial and routine power-ups used in operating the MARK 4/4E.

Section 5 - Upgrading the System: A description of instructions for extending the basic system, adding options, and converting a MARK 4 to a MARK 4E.

Section 6 - Troubleshooting: A suggested routine for locating problems and malfunctions including how to determine system HALTS; MANIP(ulate) and check out the system; and run diagnostics.

Section 7 - Removing and Replacing Components: Instructions for removing and replacing faulty components.

Section 8 - Power-Fail Instructions: An explanation of what occurs during a power failure and procedures for recovering information.

Standard Writing Conventions

< >	Angle bracket symbols around any character or word refer to a specific key on the keyboard.
<RETURN>	Indicates a carriage return. It is required to activate a command input. Procedures normally do not state press <RETURN> unless the procedure repeats what is displayed on the terminal.
<CTRL-a>	Indicates a control character where "a" is an alpha key. It is entered by holding down the CTRL key and pressing the alpha key indicated. Both keys are then released.
enter	"Enter" means that the user is to type the specified information and then press <RETURN>.
default	A parameter value established by the software or hardware. For example, the IRIS system default for the Manager password is X. This and other defaults may be changed.

Related Documents

Related documentation includes:

Title	Document Order No.
MARK 2/4 DISCUTILITY (DU.WDI) Technical Memorandum	ITP0026
MARK 2/2E/3/4/4E System Diagnostics Document	HTP0046
MARK 2/2E/3/4/4E Mux Diagnostic Document	HTP0042
MARK 2/2E/4/4E Disk/Diskette/Tape Diagnostic Document	HTP0043
MARK 2E/4/4E Map and Memory Diagnostic Document	HTP0045
IRIS R9 System Configuration Manual	ITP0029
IRIS R9 Peripherals Handbook	ITP0032
IRIS R9 User Reference Manual	ITP0034
IRIS R8 Installation/Configuration Manual	ITP0009
IRIS R8 Operations Manual	ITP0010
IRIS R8 Peripherals Handbook	ITP0015
IRIS R8 User Manual	ITP0011
Hardware Information Tech Support Bulletins:	
HITS.17 - MARK 4 Power Supplies	
HITS.19 - RS232 Serial Interfaces and New Modular Connectors	
HITS.23 - Board Compatibility Chart and PROM Revisions	

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Section 1
OVERVIEW

The POINT 4 MARK 4 and MARK 4E systems are high speed minicomputers designed to fit under or beside a desk (see Figure 1-1). Both systems perform 3.5 million instructions per second (MIPS) and operate on a 280-nanosecond cycle time. The MARK 4 and MARK 4E, each with 8-16 ports, support a maximum of 16 asynchronous and one bisynchronous ports; the MARK 4E with 16-32 ports supports a maximum of 32 asynchronous and one bisynchronous ports. Systems are shipped fully assembled and ready to use with minimal installation.

The MARK 4 and MARK 4E utilize the IRIS (Interactive Real-Time Information System) Operating System. The MARK 4/4E (8-16) normally requires IRIS 8.3E or later revision; the MARK 4E (16-32) requires IRIS 9.1 or later revision (see Section 1.1.8). Both can run existing application software written in IRIS Business BASIC and SMbasic.

The following subsections describe the MARK 4 and the MARK 4E basic components, options, and peripherals. Throughout the manual, the MARK 4 and MARK 4E will be referred to as the MARK 4/4E when information and instructions are the same for the MARK 4, MARK 4E (8-16), and MARK 4E (16-32). Where differences occur, the systems will be discussed separately.

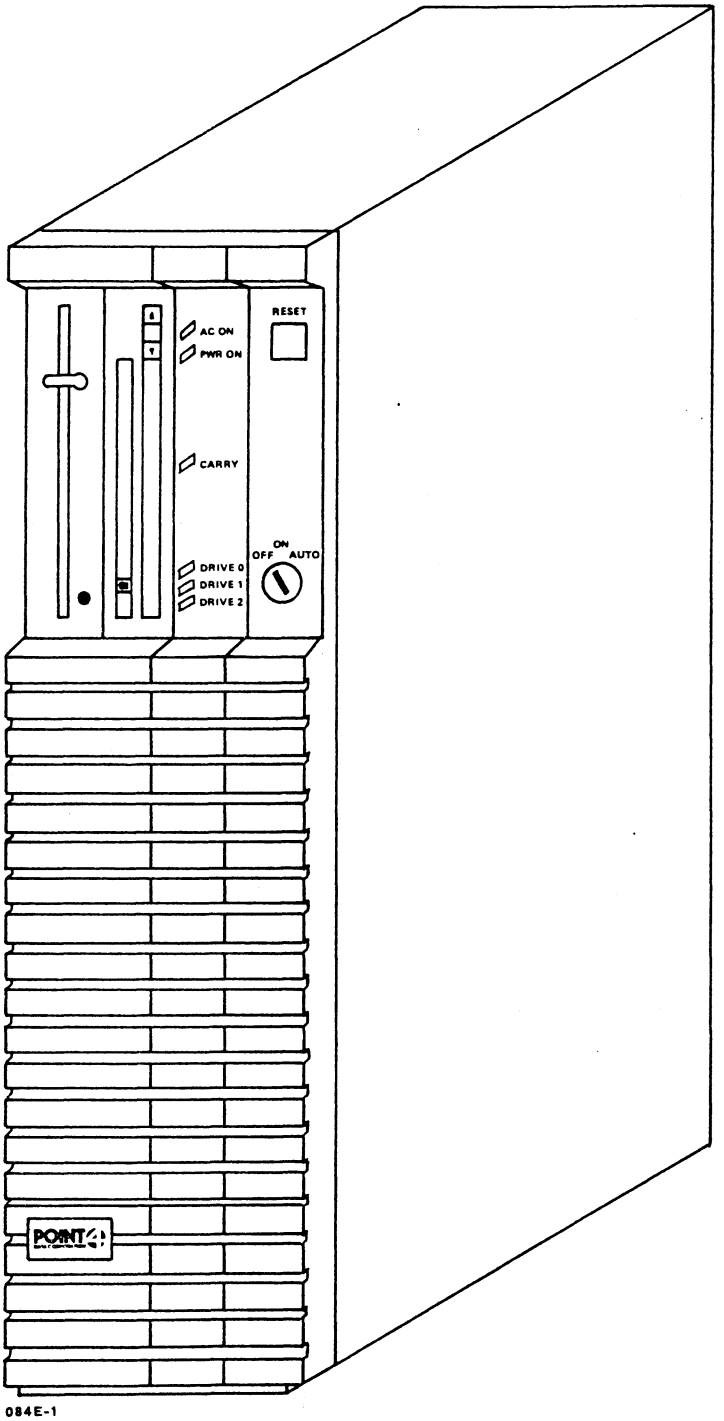


Figure 1-1. POINT 4 MARK 4/4E Minicomputer System

1.1 GENERAL DESCRIPTION OF THE BASIC MARK 4/4E SYSTEM

The basic MARK 4/4E system consists of a central processing unit (CPU) with 512KB memory capacity, a MARK 4 or a MARK 4E peripheral interface board (PIB), a disk/floppy controller board, an 85MB Winchester disk, a 1/4-inch streaming cartridge tape drive, and a mapped IRIS license. These components are housed in a tower-style cabinet. For information on board compatibility and prom revisions, see Appendix A.

If required, the capabilities of the basic system can be extended by adding memory and ports, and by increasing disk capacity. The system can also be expanded by adding options that are described in Section 1.2.

The following subsections describe the MARK 4/4E basic components and their major characteristics.

1.1.1 Cabinet

The MARK 4/4E is housed in a tower-style cabinet that is designed to fit under or beside a desk. Its I-beam construction and vertically-attached components enable the cabinet to occupy less than two square feet of floor space. System controls are located on the front, and cables to external peripherals are connected to the rear. A front handle and two rear wheels allow the system to be lifted and moved easily from one location to another. Removable side panels provide easy access to interior hardware components.

1.1.2 Power Supply

A 250-watt power supply provides power for the basic system: CPU, controllers, and system peripherals. It is contained in an open-frame package located on the bottom, right side of the chassis (as viewed from the front). Power controls are located on the front. For information on power requirements, see Appendix A.

1.1.3 Central Processing Unit

The 16-bit CPU executes instructions at a rate of 3.5 million instructions per second (MIPS) and operates on a 280-nanosecond cycle time. It uses 5-volt TTL circuitry on a 4-layer board.

The basic system has a mapped main memory capacity of 512KB. This is provided by a separate board, which is mounted on the CPU board. For information on additional memory capacity, see Section 1.2.1.

1.1.4 Peripheral Interface Board

The peripheral interface board (PIB) links the peripherals to the central processing unit (CPU). It provides disk/floppy controller and tape controller interfaces; it provides controller information; and it directs port, tape, and disk transfer between the CPU and the peripherals. The PIB is driven by the CPU micro-engine.

The PIB contains the port interfaces (see Section 1.1.4.1). It supports the disk/floppy controller board that is mounted on it, baud rate jumpers or a rotary switch (see Section 1.1.4.2), and a real-time clock, which can be jumpered to 10 or 100 Hertz (IRIS 9.2 requires 100 Hertz).

Options that can be mounted on the PIB include the port expansion board, and for the MARK 4E (16-32), the bisynchronous board.

1.1.4.1 PORTS

Each port provides a communication link between the CPU and an external peripheral such as a terminal or printer. Each port has software-programmable characteristics. This allows the selection of the number of bits per character; the number of stop bits; and odd, even, or no parity.

The MARK 4/4E (8-16) supports eight asynchronous ports on the PIB. An additional eight asynchronous ports, and if desired, a bisynchronous port are supported on an optional port expansion board. Port connectors for the MARK 4 are the DB25-type; for the MARK 4E (8-16), connectors are 8-pin, RJ45 modular phone-type with RS232C standard voltage levels for connection to external devices. RJ45 connectors are compatible with 4, 6, or 8-pin modular phone-type connectors. Port connectors are located on the rear of the chassis.

The MARK 4E (16-32) supports 16 asynchronous ports on the PIB. An additional 16 asynchronous ports are supported on an optional port expansion board. Port connectors are 8-pin, RJ45 modular phone-type. Connectors are located on the rear of the chassis. A bisynchronous port is available on a separate, optional board that is mounted on the PIB.

1.1.4.2 BAUD RATES

On the MARK 4/4E (8-16), baud rates are set by movable jumpers located on the PIB. On the MARK 4E (16-32), the master terminal baud rate is set by a rotary switch located on the PIB; the remaining baud rates are configured through the IRIS SETUP utility.

1.1.5 Disk/Floppy Controller Board

The disk/floppy controller board controls the Winchester disk drive, and if present, the optional floppy disk drive. It is mounted on the peripheral interface board (PIB), and controlled by the central processing unit (CPU) micro-engine via the PIB.

1.1.6 Winchester Disk Drive

The basic MARK 4/4E uses a 5-1/4-inch Winchester disk drive with an 85MB capacity and an ST506/412 interface. It is mounted on the center frame on the left side (as viewed from the front). For information on additional disk capacity or drives, see Section 1.2.2.

1.1.7 Streaming Cartridge Tape Drive

A 1/4-inch streaming cartridge tape drive with a QIC-02 interface is standard. It is available in 45/60MB or 125/150MB capacities. For information on cartridge tape types and functions, and the care and handling of tapes, see Appendix B.

1.1.8 Mapped IRIS License

The MARK 4/4E is supported by IRIS (Interactive Real-Time Information System). The mapped IRIS software license includes Business BASIC, ABASIC, Utilities and the mapped IRIS feature for the MARK 4/4E. The SMbasic Interpreter and Utilities are available at no extra cost.

The MARK 4/4E (8-16) is normally supported by IRIS 8.3E or later revision. (Early MARK 4 systems with 512KB of mapped memory can use 8.2C2 or later revision.) The MARK 4E (16-32), which has programmable baud rates, normally requires IRIS 9.1 or later revision.

The particular revision of IRIS required also depends partly on the components used in the system. When using a 190MB disk drive, IRIS 9.1.1 and DISCUTILITY V2.16 are required; a 150MB tape drive requires IRIS 9.2 and DISCUTILITY V2.18.

1.1.8.1 PICO-N

The Pico-N is a hardware security device that must be installed on the MARK 4/4E before the IRIS Operating System can be run. It protects against the unauthorized use of POINT 4 software, and if desired, against the unauthorized use of dealer packages. The Pico-N is provided at no charge with each IRIS license. It remains the property of POINT 4.

1.2 OPTIONS

A number of options can be added to the MARK 4/4E to expand its capabilities. These options are described in the following subsections. For detailed descriptions and requirements, see the appropriate subsections of Section 5, Upgrading the System.

1.2.1 Additional Memory

The basic MARK 4/4E system has 512KB mapped main memory. If desired, memory can be increased by replacing the 512KB board with a 1 or 2MB board. The board is mounted on the central processing unit (CPU).

1.2.2 Additional Disk Capacity and Disk Drives

The basic system uses an 85MB Winchester disk drive. In the MARK 4/4E (8-16), the 85MB drive can be replaced by the 143MB drive; in the MARK 4E (16-32), the 85MB drive can be replaced by either a 143 or a 190MB drive. The 190MB drive requires an SSDC Controller.

A second or third Winchester disk drive can be added to the MARK 4/4E. The second disk drive requires an auxiliary power supply. If a third disk drive is added, it uses the same auxiliary power supply.

1.2.3 Auxiliary Power Supply

An 85-watt auxiliary power supply is required when more than one disk drive is present. The auxiliary power supply is installed on the left side of the chassis at the bottom (as viewed from the front). For information on the auxiliary power supply requirements, see Appendix A.2.

1.2.4 Floppy Disk Drive

A 5-1/4-inch floppy disk drive with an SA 400 interface and a 1MB capacity can be added to a MARK 4/4E. The drive requires double-density (MFM), double-sided floppy disks. This option is installed to the left of the streaming cartridge tape drive (as viewed from the front). It is powered by the main power supply. For information on the care and handling of floppy disks, see Appendix B.

1.2.5 Port Expansion Board

A port expansion board can be added to the MARK 4/4E to double the number of asynchronous ports available on the basic system. The board mounts on the peripheral interface board (PIB).

There are two port expansion board options for the MARK 4. One accommodates eight additional asynchronous ports; the other accommodates eight additional asynchronous ports and a bisynchronous port. On the MARK 4E, the port expansion board accommodates either eight or 16 additional asynchronous ports.

When adding a port expansion board, it is also necessary to install an additional port panel and appropriate connectors on the rear of the chassis, and a cable for each eight ports.

1.2.6 Bisynchronous Port

A bisynchronous port can be added to the MARK 4/4E to provide efficient communication of large volumes of data. The port connector is a DB25 type, and it is located on the chassis rear below the asynchronous port connectors.

On the MARK 4, the bisynchronous port is the 17th port. It is accommodated on the port expansion board with the bisynchronous option. Before ordering this option, make certain that there is a cutout on the chassis rear for this port. Early chassis may not have this feature.

On the MARK 4E, the bisynchronous port is the 17th or 33rd port. It is on a separate board with a cable and DB25 connector attached. When installed, the board is mounted on the MARK 4E PIB.

Software for the bisynchronous port is the "BISYNC" package, which is available under license from and supported by Starburst Data Systems, Inc., Rte. 2, Box 362A, Vashon, WA 98070.

1.3 PERIPHERALS

A complete range of peripherals compatible with the MARK 4/4E is available from various manufacturers. Peripherals that can interface with the MARK 4/4E include: video display and printing terminals, line and character printers, plotters, and modems.

Section 2
INSTALLING THE SYSTEM

Once unpacked, a MARK 4/4E system is easy to move to its designated location and to install. Grasp the cabinet by the handle located at the top front, lift it slightly, and roll it on the wheels located at the bottom rear. Move it to an open space, close to its final location, that allows access to the rear and sides of the cabinet. Then use the instructions provided on the following pages to check out and install the system.

Once the checkout is completed, the cables connecting the external peripherals may be installed. Appendix C provides signal lists; wiring diagrams for video display, printer and modem cables; and related information.

2.1 SYSTEM CHECKOUT

Before beginning, have at hand a Phillips screwdriver. Make certain that the AC power cord is disconnected. Then, to ensure that components are intact and in place, complete the system checkout procedure. Figure 2-1 shows the removal of the top and side panels; Figures 2-2 and 2-3 show the location of components within the system when the sides are removed. **Do not plug in the AC power cord or turn on the system until instructed to do so.**

1. Remove the top panel as follows:

   a. Remove the two screws from the rear of the top panel.

   b. Slide the panel back and off the rear.

   c. Set the panel and screws aside.

2. Remove each side panel as follows:

   a. Remove the two screws at the top of the panel.

   b. Remove the two screws at the rear of the panel.

   c. Slide the panel toward the rear to release the front retainer clips, then pull it up to release the bottom retainer clips, and finally pull the panel away from the cabinet.

   d. Set the panels and screws aside.

3. Visually inspect the system components for obvious damage. If any damage is evident, report it to the shipping company.

4. Remove the shipping brackets that secure the central processing unit (CPU) and the peripheral interface board (PIB) as follows:

   a. Remove the screw that secures each bracket to the frame.

   b. Pull each bracket out of its slot.

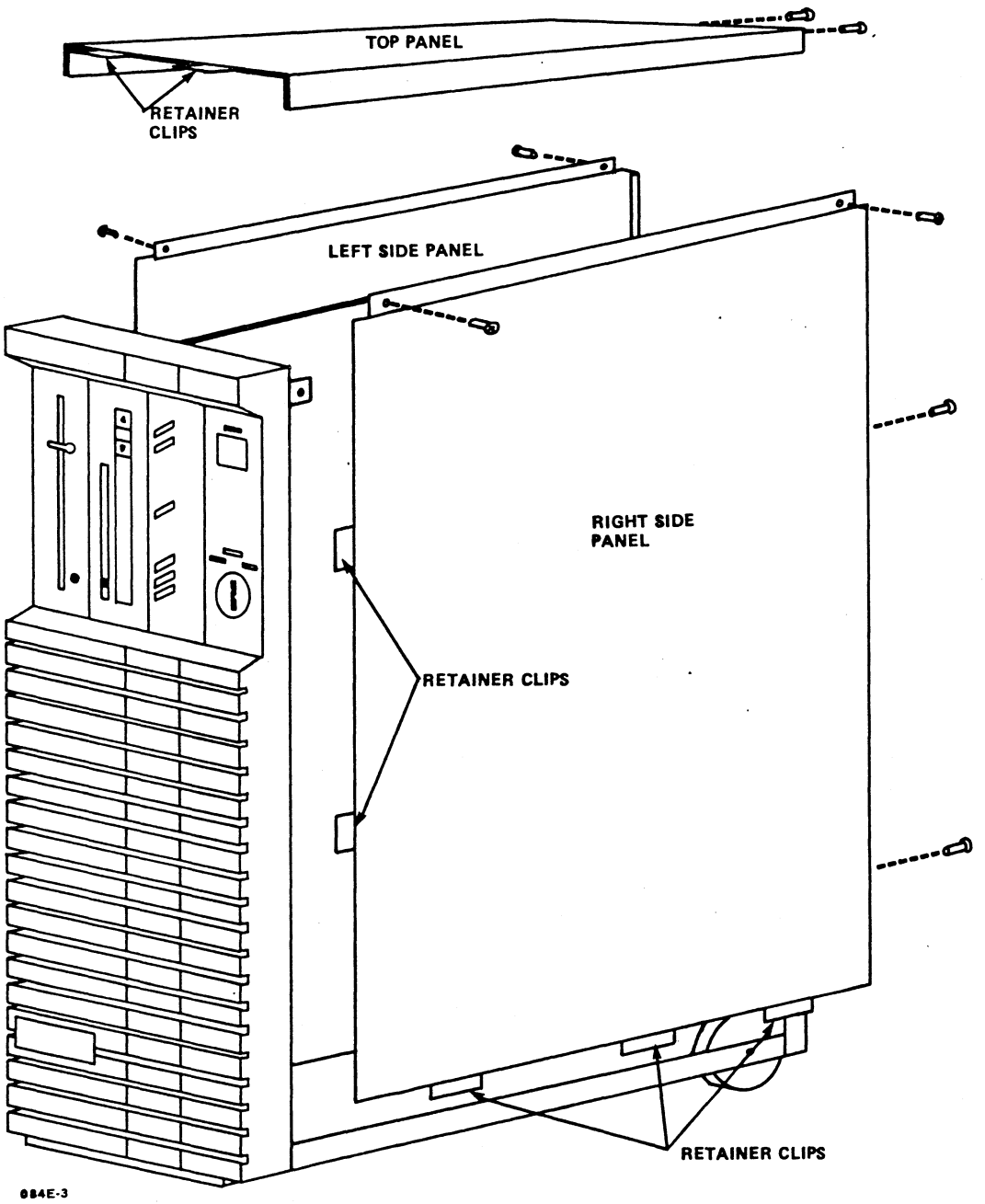
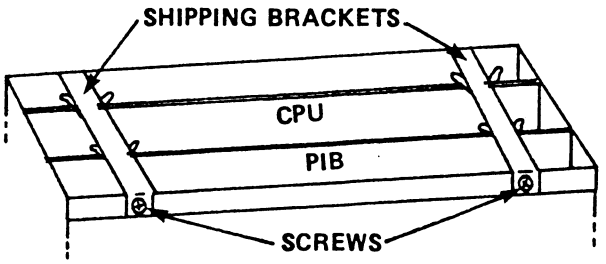


Figure 2-1. Removing the Top and Side Panels



TOP VIEW OF CARD CAGE WITH SHIPPING BRACKETS IN PLACE

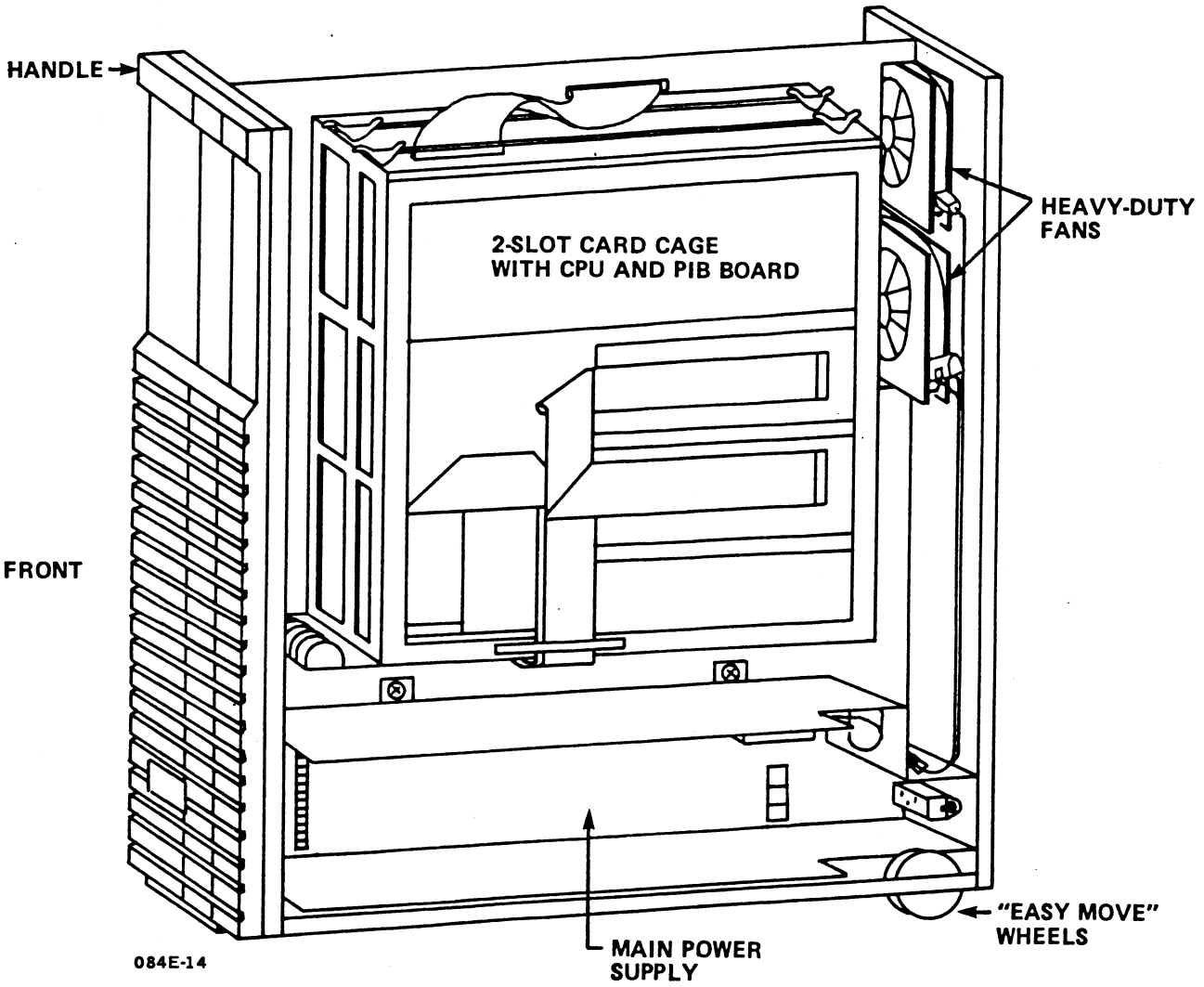


Figure 2-2. Location of Components on the Right Side

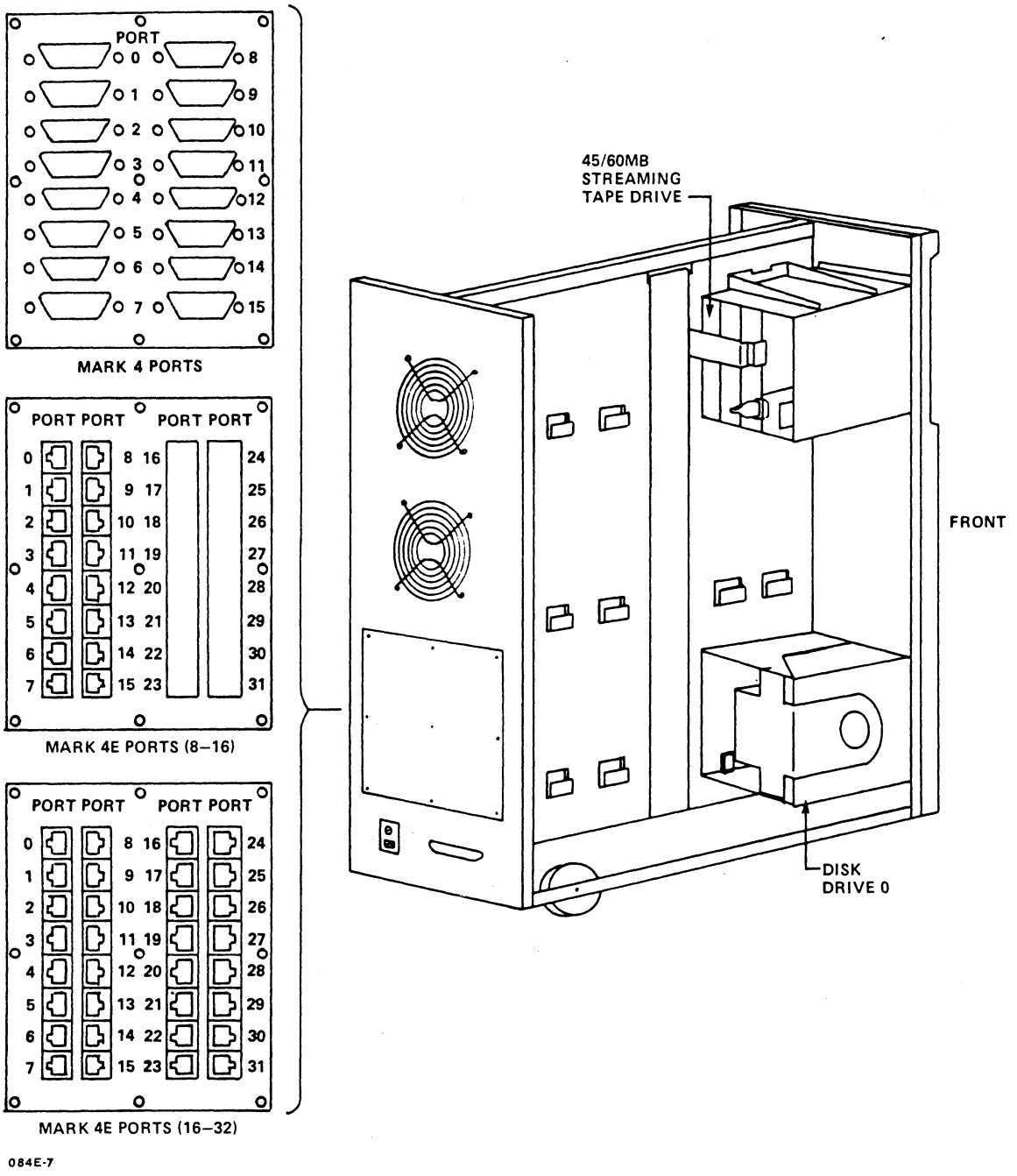


Figure 2-3. Location of Components on the Left Side

5. Disconnect the port distribution cables (see Figure 2-4).

A MARK 4/4E (8-16) system may have three port distribution cables: an asynchronous cable on the peripheral interface board (PIB), and an asynchronous cable and a bisynchronous cable on the port expansion board.

A MARK 4E (16-32) system may have five port distribution cables: two asynchronous cables on the PIB, two asynchronous cables on the port expansion board, and a bisynchronous cable connected to the bisynchronous board, which is mounted on the PIB. The cables and their locations are listed below.

MARK 4/4E (8-16)		**MARK 4E (16-32)**	
Cable	Location	Cable	Location
Ports 0-7	PIB J5	Ports 0-7	PIB J6
Ports 8-15	PIB Exp J16	Ports 8-15	PIB J7
		Ports 16-23	PIB Exp J8
		Ports 24-31	PIB Exp J9
Bisync Port 16	PIB Exp J15	Bisync Port 16 or 32	PIB J2

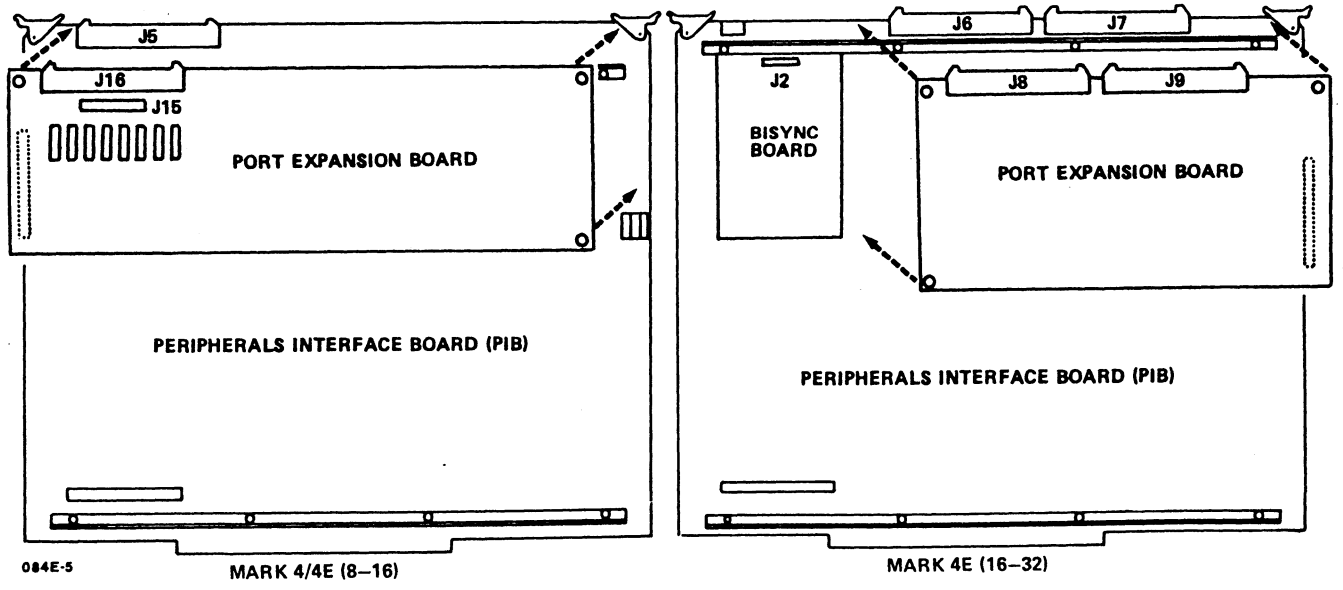


Figure 2-4. Location of the Port Distribution Cables

6. Remove the central processing unit (CPU) from the card cage by grasping the plastic tabs that secure it to the card cage, pulling up to release it from the backplane, and sliding it out of the guide rails (see Figure 2-5).

7. Place the CPU, component side up, on a table or desk.

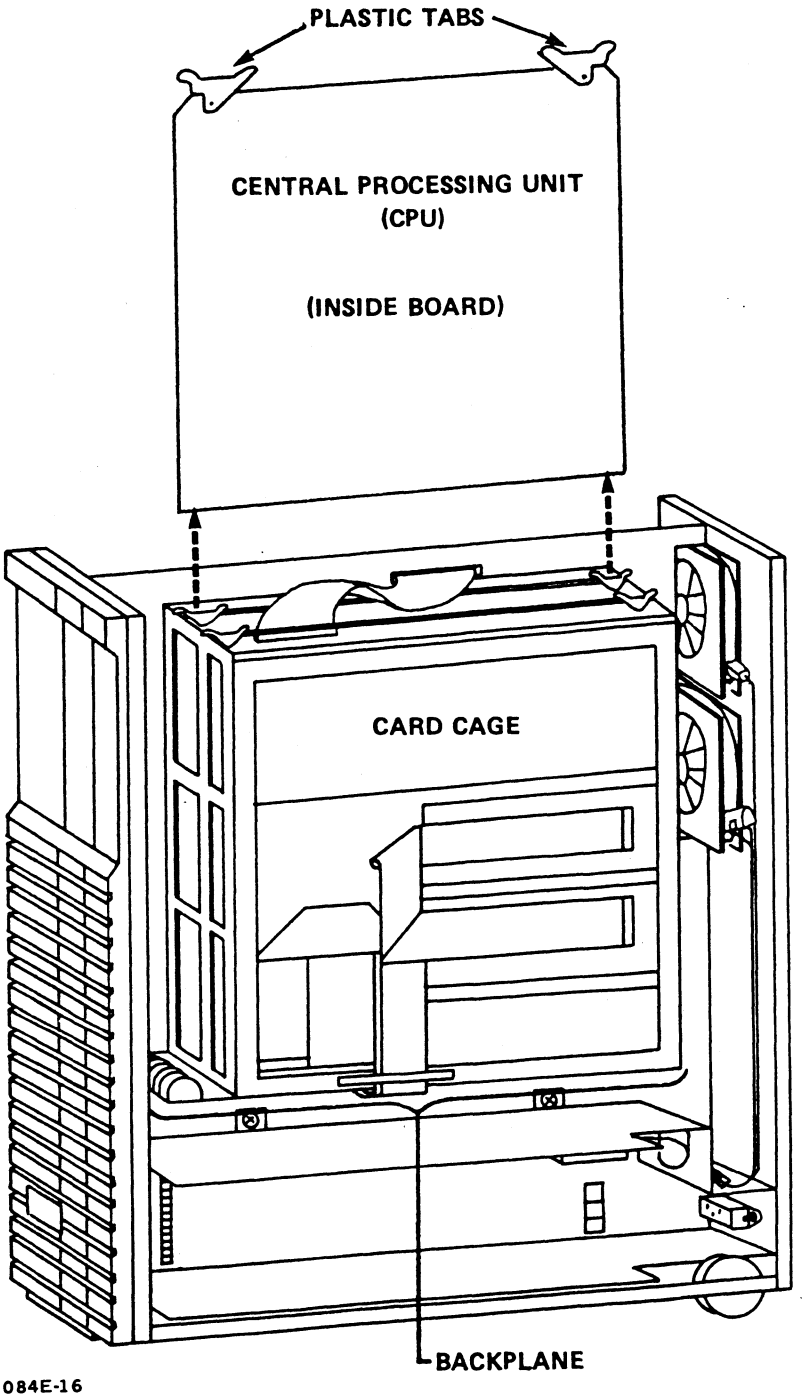


Figure 2-5. Removing the CPU from the Card Cage

8. Check that all socketed components on the central processing unit (CPU) are intact and firmly seated. It is necessary to remove the memory board first to gain access to the socketed components underneath it (see Figure 2-6). To check socketed components, follow the instructions below.

   a. Remove the memory board as follows:

      - Cut the plastic shipping rivets in the upper left and right corners that attach the memory board to the CPU flex bar.

      - Pinch the two plastic standoffs in the lower left and right corners of the memory board and lift it off the standoffs.

      - Pull up on the memory board connectors at locations P2 and P3, which connect to the pins on the CPU at locations J2 and J3. Since the contacts may be tight, pull carefully, one location at a time.

      - Set the memory board aside.

   b. Visually inspect the socketed components for obvious damage. If any damage is evident, report it to the POINT 4 Data Corporation representative.

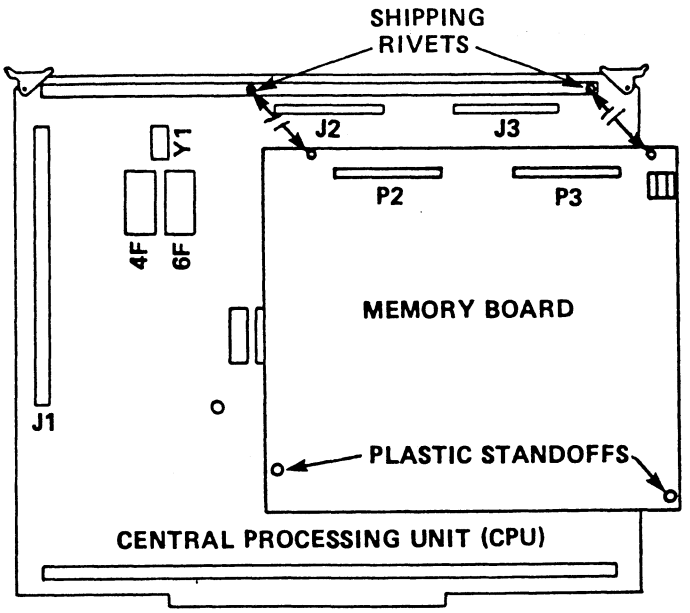
   c. Press down on the socketed components (see Figure 2-6). The following list of socketed components applies to all revisions of the CPU board:

Component	Location
Crystal Y1	5G
PROMs	4F 6F 8D through 17D 17B 19D

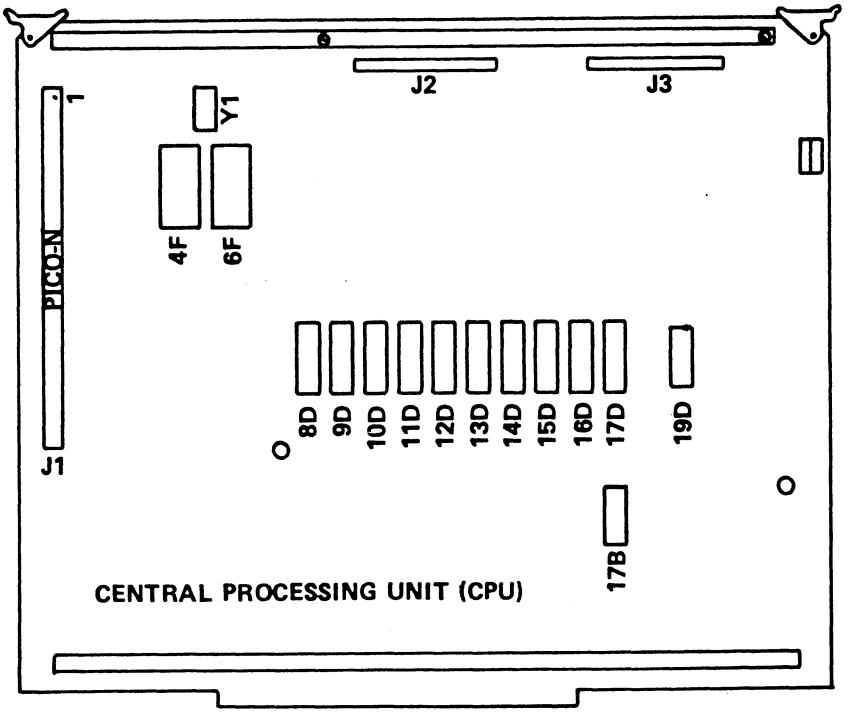
   d. Reconnect the memory board to the standoffs on the CPU. It is not necessary to reconnect the memory board to the CPU flex bar.

9. If the Pico-N is installed on the CPU, check that it is firmly seated. To install the Pico-N, carefully push the Pico-N connector on the pins of the CPU at location J1. Make certain that pin 1 of the Pico-N is aligned with pin 1 on the CPU board.

10. Return the CPU to the card cage by sliding it down into the guide rails and then pushing down on the plastic tabs until the board snaps into the backplane connectors.



REMOVING MEMORY BOARD FROM CENTRAL PROCESSING UNIT (CPU)



SOCKETED COMPONENTS ON CENTRAL PROCESSING UNIT (CPU)

084E-13

Figure 2-6. Removing the Memory Board from the CPU and Checking the Socketed Components and Pico-N

11. Reconnect the port distribution cables that were disconnected in Step 5.

12. Make certain that all cables connected to the peripheral interface board (PIB), disk/floppy controller board, and the MARK 4E (16-32) bisynchronous board (if present) are firmly connected (see Figure 2-7). Check connections at both ends.

Cable	Connector Locations	
Streaming cartridge tape drive	PIB J1	Rear, tape drive
Floppy disk drive (if present)	Ctlr J8	Rear, floppy disk drive
A cable (daisy chain)	Ctlr J7	All disk drives present
B cable		
Disk drive 0	Ctlr J1	Rear, disk drive 0
Disk drive 1 (if present)	Ctlr J2	Rear, disk drive 1
Disk drive 2 (if present)	Ctlr J3	Rear, disk drive 2
Disk select cable (190MB)	SSDC Ctlr J4	Front LED panel, J205,6,7
Interface PIB/Ctlr	PIB J2	Ctlr J5
Power	PIB J3	Ctlr J6
MARK 4/4E (8-16) Bisync (if present)	Pt Exp J15	Chassis rear
MARK 4E (16-32) Bisync (if present)	Bisync J2	Chassis rear

13. Make certain that the components on the PIB are firmly seated (see Figure 2-7).

Component		Connector Locations
Crystal Y1		PIB C2
Crystal Y2, MK 4E (16-32)		PIB adjacent to C28
Disk/floppy controller board	Standoffs	One, each corner
Port expansion board (if present)	Standoffs	As illustrated
	Pt Exp P4	PIB J4 (MARK 4)
	Pt Exp P5	PIB J5 (MARK 4E)
MARK 4E (16-32) Bisync (if present)	Standoffs	As illustrated
	PIB J4	Bisync board P2

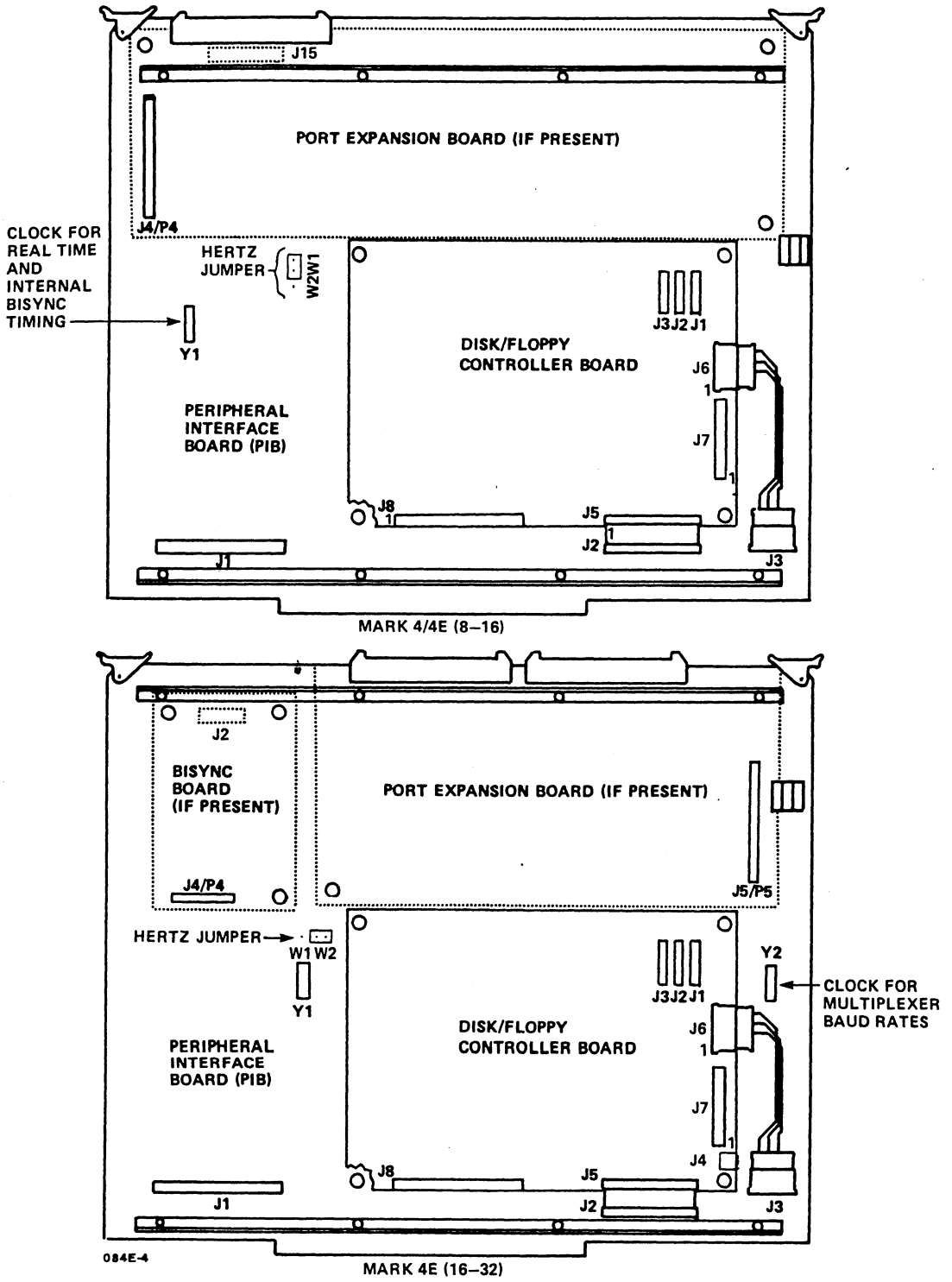


Figure 2-7. Checking Cable and Component Connections on the Peripheral Interface Board

14. Check that the baud rate setting is appropriate for the system. The baud rate is set on the peripheral interface board (PIB).

    MARK 4/4E systems are shipped with all ports set to a standard baud rate of 9600. To change the baud rate on a MARK 4/4E (8-16) or a MARK 4/4E (16-32), use the appropriate set of instructions provided below.

    MARK 4/4E (8-16)

    To change the baud rate setting for any port (see Figure 2-8):

    a. Pull up and remove the jumper adjacent to 9600.

    b. Install the jumper adjacent to the appropriately marked pins.

       If the port expansion board is present, it must be removed before the baud rates for ports 0 through 7 can be changed.

       To disconnect the port expansion board, pinch the plastic standoffs and pull the board off the standoffs. Then pull the port expansion board connector at location P4 off the PIB pins at location J4.

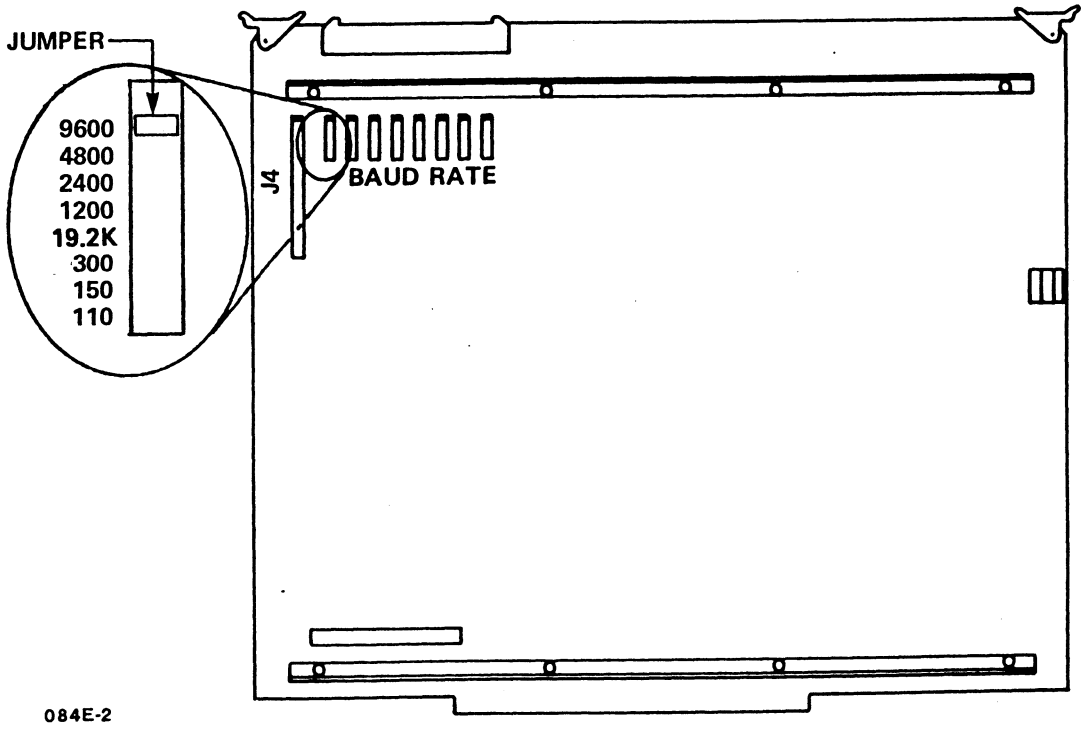


Figure 2-8. Changing the Baud Rate on a MARK 4/4E (8-16)

MARK 4E (16-32)

A rotary switch on the peripheral interface board (PIB) determines the initial baud rate for port 0. When shipped, this switch is set to the standard rate of 9600 baud. The baud rate setting on the master terminal must match that of the switch on the PIB; if not, either the switch or the terminal baud rate must be changed before the terminal can communicate with the system. After the operating system is loaded, the baud rates for all ports are software selectable.

To set the baud rate for a MARK 4E (16-32) system:

a. For Port 0, to change the baud rate to a setting other than 9600, insert a screwdriver into the rotary baud rate switch (SW1), located near the upper edge of the PIB, and turn the arrow to the appropriate setting (see Figure 2-9).

b. After the IRIS Operating System has been loaded, use SETUP to set the baud rate for ports other than 0, then refer to the IRIS R9 System Configuration Manual.

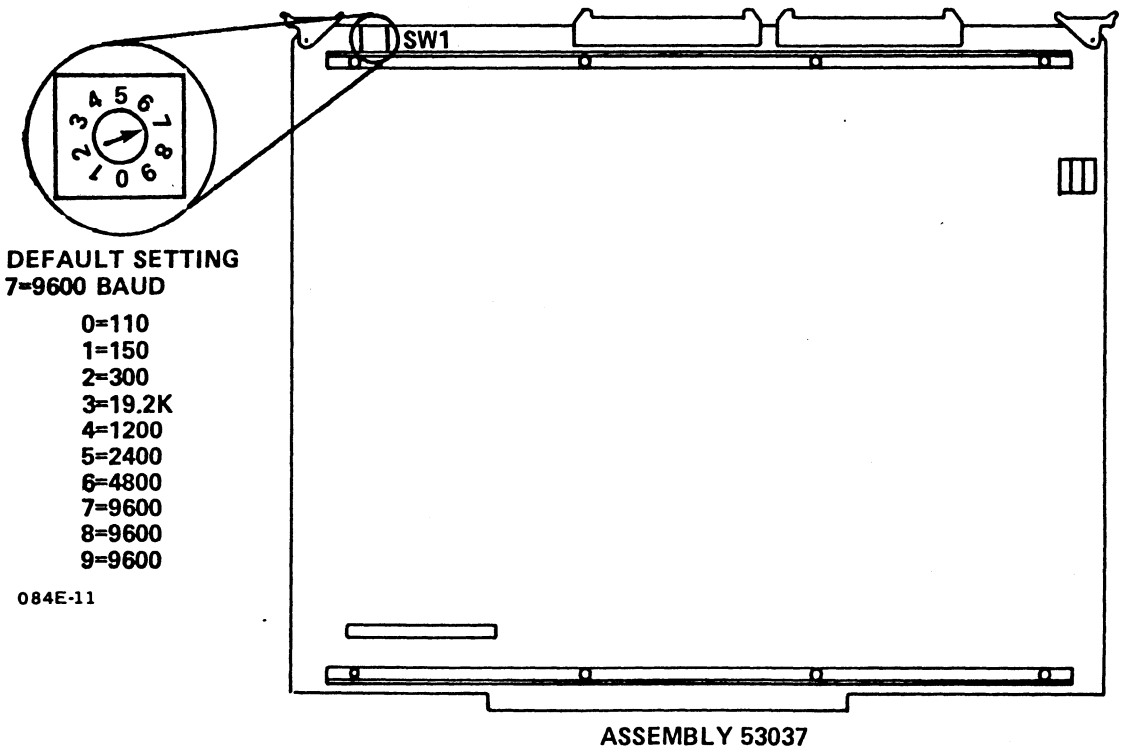


Figure 2-9. Changing the Baud Rate for Port 0 on a MARK 4E (16-32)

15. Make certain that the disk select cable(s), which attaches to the rear of the disk drive(s) and to the front LED display panel, is firmly connected.

16. Connect the AC power cord to the rear of the chassis and plug it into the wall outlet.

    The AC indicator should light. If it does not, unplug the AC cord. Check the power at the wall outlet, then the fuse on the chassis rear. To remove the fuse, insert a screwdriver into the fuse plug and turn it left until it pops out.

17. Turn the keyswitch on the front panel to ON.

18. Measure the voltages (see Figure 2-10).

    Using a digital volt meter, measure the voltages on the backplane board at location TB1. If the voltages are out of tolerance, call POINT 4 Hardware Technical Support (see Appendix A).

19. Replace the side panels, then the top panel.

20. Connect the cables for the external peripherals to the port panel.

    On a MARK 4, peripherals are connected with DB25 connectors. On a MARK 4E, peripherals are connected with RJ45 phone-type connectors. Cable wiring diagrams for both the MARK 4 and MARK 4E are given in Appendix C.

21. Proceed to Section 3, Controls and Indicators, and to Section 4, Getting Started.

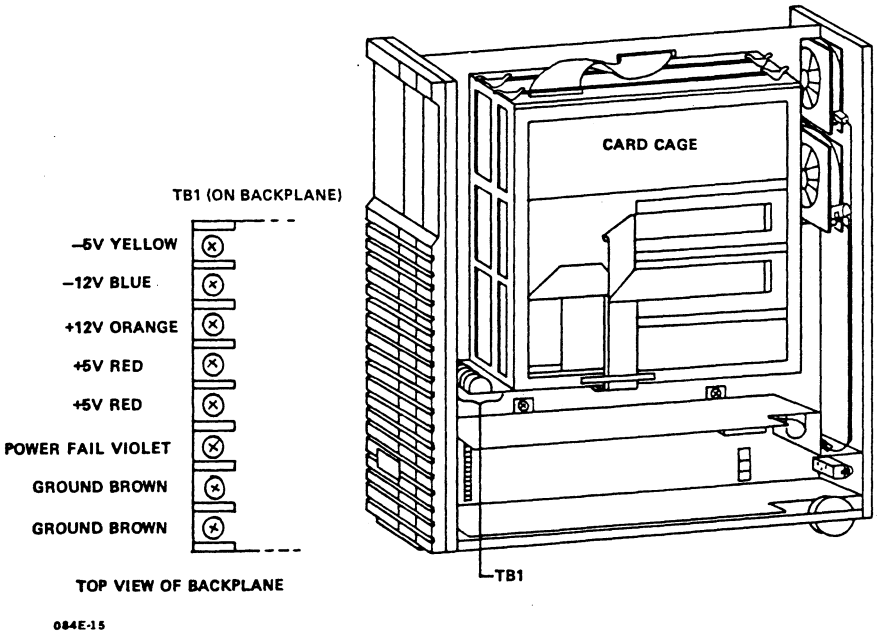


Figure 2-10. Measuring Voltages

Section 3
CONTROLS AND INDICATORS

The front panel of the MARK 4/4E contains the controls and indicators that control program execution, monitor operations, and access MANIP, a stand-alone program that allows the operator to perform several system functions through the master terminal keyboard. This section provides information about the location, operation, and function of the controls and indicators. It also describes the hardware verify test that is associated with MANIP.

3.1 KEYSWITCH CONTROLS

The keyswitch controls program execution. It is located on the front panel and has three settings: ON, OFF, and AUTO. The keyswitch settings are described in Table 3-1.

TABLE 3-1. KEYSWITCH CONTROLS

Setting	Function
OFF	Turns OFF power supply and all system functions.
ON	Turns ON power, i.e., DC voltages and fans, and enables the reset switch and all indicators. Causes the system to display the MANIP Menu and the MANIP prompt (->).
AUTO	Turns ON power, i.e., DC voltages and fans, and enables all indicators. It disables the reset switch. Causes the system to automatically complete one pass of the hardware verify test and then perform an APL (automatic program load) once the operating system is on the disk.

3.2 RESET SWITCH

The reset switch is located on the front panel above the keyswitch. It is enabled when the keyswitch is set to ON and disabled when the switch is set to AUTO. Pressing the reset switch loads MANIP at location 77000. MANIP is described in Section 3.3.

3.3 MANIP

MANIP is a stand-alone program that is loaded automatically into memory by system firmware when the system is turned ON, a HALT occurs, or the reset switch is pressed. It performs the following functions:

- Enables the user to load programs
- Initiates an automatic IPL when the keyswitch is turned to AUTO (once the operating system is on the disk)
- Enables the user to display and examine memory contents on the master terminal
- Initiates the hardware verify test
- Enables a qualified programmer to debug the system, if necessary

MANIP functions are controlled by the operator through commands entered on the master terminal. One function of MANIP, the hardware verify test, is described below because it is normally run after the installation and just before the operating system is loaded.

The MANIP Menu is shown in Section 4.1. For additional information on the use of MANIP functions, see Section 6.1 and Appendix D.

3.3.1 Hardware Verify Test

The hardware verify test verifies the operation of the MARK 4/4E system as a whole. It tests the central processing unit (CPU), all system memory, the tape interface, and all available serial ports (except on the MARK 4 where only the first eight ports are tested). If terminals or printers are turned on, some characters will be displayed or printed on these devices. It also invokes the disk/floppy controller self-test and checks for its successful completion.

The hardware verify test is accessed through the V command of MANIP. POINT 4 suggests that this test be run continuously for an extended period once the system is installed and periodically thereafter to test overall system operation. It can also be run to help diagnose system trouble (see Section 6.3.1).

To access the hardware verify test, make certain the power is ON and then:

1. Press the reset switch located on the front panel.

   The program counter, four accumulators, carry flip flop and the MANIP prompt (->) are displayed.

2. Press V <RETURN> on the master terminal keyboard to load and run the hardware verify test.

   This test will run in a continuous loop until a HALT occurs (see Section 6.3.1.1), or until the operator presses <ESC> or the reset switch. Several seconds may pass before the test stops.

3.4 INDICATORS

The front panel has six indicators that monitor system activity. It also has an indicator that monitors the streamer cartridge tape drive, and one that monitors the floppy disk drive (if present). These indicators are described in Table 3-2.

TABLE 3-2. FRONT PANEL INDICATORS

Indicator	Function
AC On (red)	Indicates that AC power is ON.
Pwr On (red)	Indicates that all DC power supply voltages are in tolerance and available to the system.
Carry (yellow)	Indicates the current state of the central processing unit (CPU) carry flag. Indicator lights when carry is set to 1.
Drive 0 (green)	The drive 0 indicator lights when the drive is ready. It is default selected.
Drive 1 (green)	Indicator lights if this drive is present and selected. If selected, drive 0 indicator goes out.
Drive 2 (green)	Indicator lights if this drive is present and selected. If selected, drive 0 indicator goes out.
Streamer cartridge tape drive (red)	Indicator lights when drive is selected.
Floppy disk drive (red), if present	Indicator lights when drive is selected.

Section 4
GETTING STARTED

Once the hardware installation has been completed, and the controls and indicators have been identified, the MARK 4/4E can be powered up, and the software loaded. Subsequent power ups are routine. The initial power up and the routine power ups are described in this section.

4.1 INITIAL POWER UP

To power up the system for the first time, make certain that the power switch is OFF, then:

1. Plug the AC power cable into the wall outlet.

2. Turn the power switch of the master terminal (port 0) to ON.

3. Turn the front panel keyswitch to ON. The MANIP Menu is displayed.

   The MANIP Menu shown below is that of the MARK 4E. The MARK 4 Menu differs in format, and its J function is not listed on the screen although it is included in the MANIP program and can be used.

```
     POINT 4 Data Corporation                          444    4
     MARK 4E                                         4444    444
                                                    444  4    4444
                                                    4   444   4444



     ENTER COMMAND LETTER                          44444444   4444
     (PLUS OPERAND(S) WHERE APPROPRIATE)             444444    444
     FOLLOWED BY A CARRIAGE RETURN                     4444    4

     A = DISPLAY CONTENTS OF ACCUMULATORS
     C = CHANGE ACCUMULATOR CONTENTS
     D = DISPLAY CONTENTS OF MEMORY
     F = BOOT FROM FLOPPY DISK
     H = LOAD PROGRAM FROM STREAMER TAPE
     J = JUMP WITH ACCUMULATORS AND CARRY RESTORED
     K = STORE CONSTANT IN BLOCK OF MEMORY
     M = MOVE A BLOCK OF MEMORY
     P = PROGRAM LOAD (BOOT) FROM HARD DISK
     V = LOAD (@20000) AND RUN HARDWARE VERIFY TEST
     : = OPEN SPECIFIC LOCATION TO EXAMINE OR STORE
     @ = LOAD DBUG AT 73000
     ? = DISPLAY THIS MENU
  ->
```

4. Insert the DISCUTILITY tape into the tape drive (or, if appropriate, the floppy disk with DISCUTILITY into the disk drive).

5. To load the DISCUTILITY program from streamer tape, enter H on the master terminal keyboard and press <RETURN> (or, if the program is to be loaded from a floppy disk, enter F).

6. To load software, refer to the MARK 2/4 DISCUTILITY (DU.WDI) Technical Memorandum. The general steps are as follows:

   - Format the disk
   - Load the software (Restore)
   - Configure the system
   - Run MAPACTIVATE

4.2 ROUTINE POWER UP

Once the software is loaded, a routine power up takes place when the keyswitch is turned to ON or AUTO.

If the keyswitch is turned to ON, the MANIP Menu is displayed on the screen. The operator is required to make an entry on the master terminal to initiate a program load (IPL).

If the keyswitch is turned to AUTO, the hardware verify test completes one pass and an automatic program load occurs. The AUTO setting (with the key removed) can prevent accidental turning off of the system, and ensures that the system will load automatically without operator intervention if a power fail occurs.

The procedures and screen displays associated with both keyswitch positions are described in the following subsections.

4.2.1 Routine Power Up to ON

1. Turn the keyswitch to ON.

   The MANIP Menu is displayed followed by the MANIP prompt (->).

2. At the MANIP prompt (->), enter P <RETURN>.

   It is not necessary to make any further entries. After several pauses, a message similar to the following is displayed:

```
                                IRIS 9.n

A LICENSED, UNPUBLISHED, RESTRICTED AND CONFIDENTIAL WORK. IF AND
WHEN THIS WORK IS PUBLISHED, THE FOLLOWING COPYRIGHT NOTICE APPLIES:

COPYRIGHT (C) 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982,
1983, 1984, 1985, 1986, 1987, 1988, POINT 4 DATA CORPORATION.

ENTER YEAR,MONTH,DAY,HOUR,MINUTE !

#IRIS.START.IPL

#BYE   GROUP 0 USER 1   mmm dd, yyyy   nn:nn:nn

NET ACCRUED CHARGES        $nn.nn

CPU TIME USED          nn:nn:nn
CONNECT TIME USED      nn:nn:nn

nnnn BLOCKS IN USE, nnnn AVAILABLE ON UNIT #n
```

   If desired, the operator can enter the date as requested, or press <DELETE> after ENTER YEAR,MONTH,DATE,HOUR,MINUTE to skip the entry.

3. Press <ESC>. A message similar to the following is displayed:

```
Welcome to "IRIS" R.9n timesharing !
ACCOUNT ID?
```

   The system is now ready to use.

4.2.2 Routine Power Up to AUTO

1. Turn the keyswitch to AUTO.

   It is not necessary to make any entry. The hardware verify test completes one pass, and displays a message similar to one of the following:

   On a MARK 4E:

   ```
   MARK 4E SELFTEST REV. 1.n
   CPU OK, MAP OK, nMB MEMORY OK, TAPE LOGIC OK, DISK LOGIC OK, nn PORTS OK.
   PRESS RETURN
   ```

   On a MARK 4:

   ```
   MARK 4 SELFTEST...
   CPU OK, MAP OK, nMB MEMORY OK, MUX OK, TAPE LOGIC OK, DISC LOGIC OK.
   PRESS RETURN
   ```

   The hardware verify message is followed by an IRIS message similar to the following:

   ```
                        IRIS 9.n

   A LICENSED, UNPUBLISHED, RESTRICED AND CONFIDENTIAL WORK. IF AND
   WHEN THIS WORK IS PUBLISHED, THE FOLLOWING COPYRIGHT NOTICE APPLIES:

   COPYRIGHT (C) 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982,
   1983, 1984, 1985, 1986, 1987, 1988, POINT 4 DATA CORPORATION.

   ENTER YEAR,MONTH,DAY,HOUR,MINUTE !

   #IRIS.START.IPL

   #BYE   GROUP 0 USER 1   mmm dd, yyyy   nn:nn:nn

   NET ACCRUED CHARGES        $nn.nn

   CPU TIME USED          nn:nn:nn
   CONNECT TIME USED      nn:nn:nn

   nnnn BLOCKS IN USE, nnnn AVAILABLE ON UNIT #n
   ```

   If desired, the operator can enter the date as requested or press <DELETE> after ENTER YEAR,MONTH,DATE,HOUR,MINUTE to skip the entry.

2. Press <ESC>. A message similar to the following is displayed:

   ```
   Welcome to "IRIS" R.9n timesharing !
   ACCOUNT ID?
   ```

   The system is now ready to use.

Section 5
UPGRADING THE SYSTEM

The MARK 4/4E system can be upgraded by extending the basic system, by adding options, or by converting a MARK 4 to a MARK 4E.

The basic system can be extended by expanding memory, increasing disk capacity, and adding ports. Options that can be added include a second and third disk drive (with the addition of an auxiliary power supply), a floppy disk drive, and a bisynchronous port. Converting a MARK 4 to a MARK 4E allows expansion beyond 16 ports.

This section describes the available upgrades and gives instructions for installing them. Before undertaking any one of them, perform the following preliminary steps:

1. If the system has been in use, shut down and back up (refer to the IRIS R9 User Reference Manual or to the IRIS R8 Operations Manual as appropriate).

2. Disconnect the AC power cord from the rear of the chassis.

3. Grasp the handle of the cabinet and pull it to an open space that allows access to the back and sides.

4. Remove the top and side panels of the cabinet (see Section 2).

5.1 EXTENDING THE BASIC SYSTEM

The following subsections provide instructions for extending the basic system by expanding the memory, increasing the disk capacity, and adding more ports. The instructions are the same for the MARK 4/4E except for adding ports where separate instructions are provided.

5.1.1 Expanding Memory

Memory can be expanded by exchanging a smaller capacity memory board for a larger one. A 512KB memory board is part number 53002-02, 1MB is 53026-01, and 2MB is 53026-02. Expanded memory also requires a 53027-xx central processing unit (CPU) and the appropriate revision of the IRIS Operating System. To exchange memory boards, perform the preliminary steps provided at the beginning of this section, then:

1. Unplug the port distribution cables from the peripheral interface board (see Section 2 and Figure 2-4).

2. Remove the CPU from the card cage by grasping the plastic tabs that secure it to the card cage frame, pulling up to release it from the backplane, and sliding it out of the guide rails.

3. Remove the memory board from the CPU as follows (see Figure 5-1):

   a. If it has not already been done, cut the plastic shipping rivets that connect the memory board to the CPU flex bar.

   b. Pinch the two plastic standoffs in the lower left and right corners of the memory board and lift the board off the standoffs.

   c. Grasp the memory board on each side, rock and lift it carefully to disengage the connectors at locations P2 and P3 from the pins on the CPU at locations J2 and J3. Do not bend or break the pins.

4. Install the expanded memory board on the CPU as follows:

   a. Plug the memory board onto the two plastic standoffs on the CPU board.

   b. Push down on the memory board connectors at locations P2 and P3 that connect to the CPU at locations J2 and J3.

5. Return the CPU to the card cage and reconnect the port distribution cables.

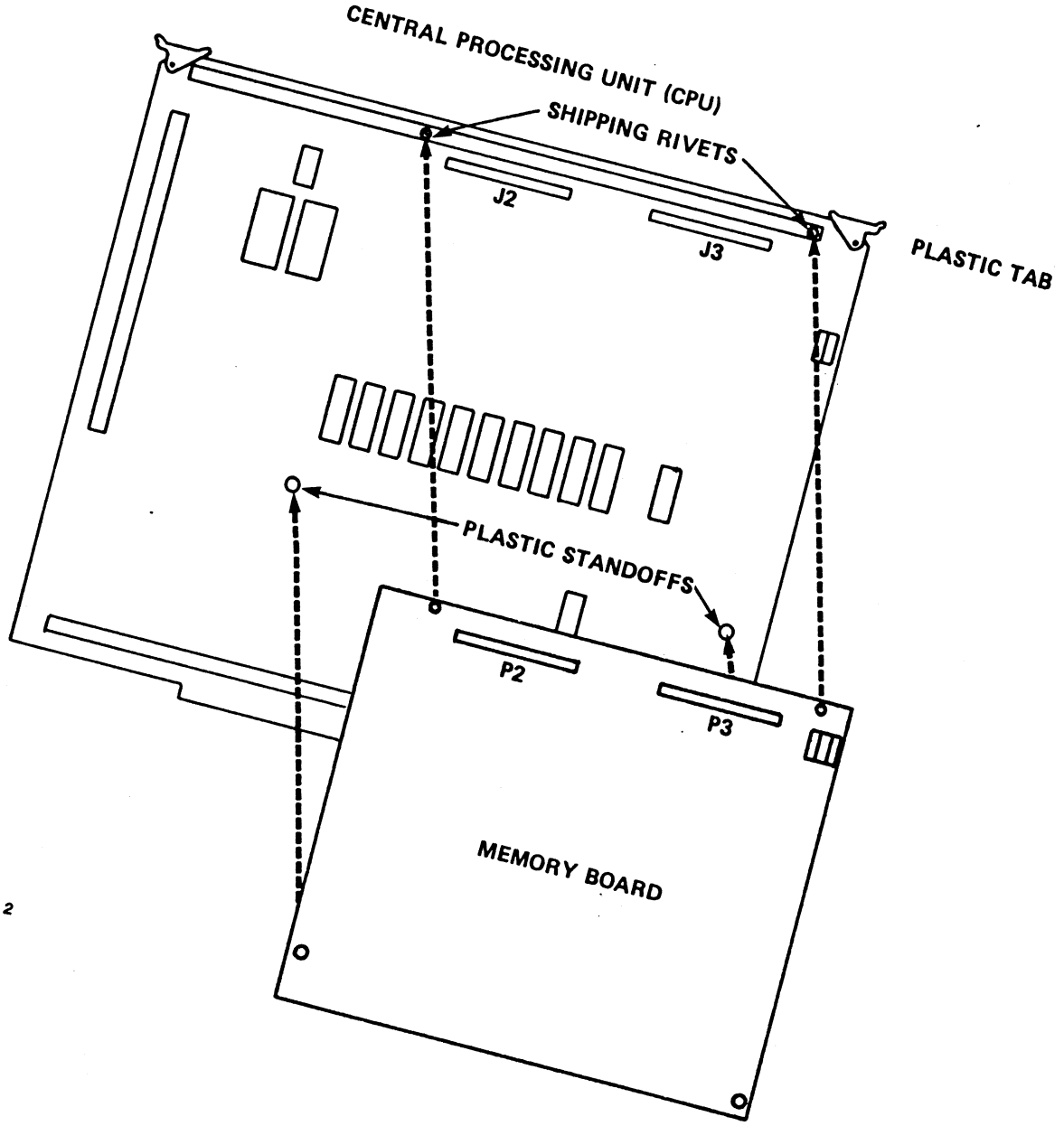


Figure 5-1. Adding a Larger Memory Board to the System

5.1.2 Increasing Disk Capacity On a Single Drive System

The disk capacity of the basic MARK 4/4E system can be increased by removing the 85MB disk drive and replacing it with a larger capacity disk drive: a 143MB capacity drive is available for all MARK 4/4E systems (kit 082005-03); a 190MB drive is available for MARK 4E (16-32) systems (kit 082005-06). If the 190MB drive is used, the SSDC disk/tape controller (053045) is required. This may necessitate replacing the existing disk/tape controller on the peripheral interface board (PIB).

Perform the preliminary steps provided at the beginning of this section; then remove disk drive 0, located on the bottom left side of the chassis (as viewed from the front), as follows (see Figure 5-2):

1. Disconnect the disk drive end of the following cables that connect the disk drive to other components:

   a. A cable (34-pin connector)

   b. B cable (20-pin connector)

   c. Power cable

2. Disconnect the select light LED cable from the front LED panel at location J205. This cable is removed with the disk drive.

3. Remove disk drive 0 from the center frame as follows:

   a. Remove the screw from the mounting bracket above the disk drive. Set the screw aside.

   b. Lift the disk drive with the mounting bracket, release it from the notches on the center frame, and remove it.

4. Remove the mounting bracket from the disk drive by removing the four screws that secure the mounting to the drive. Set the bracket and screws aside. Store the disk drive.

   Proceed to installing the larger capacity disk drive in Step 5.

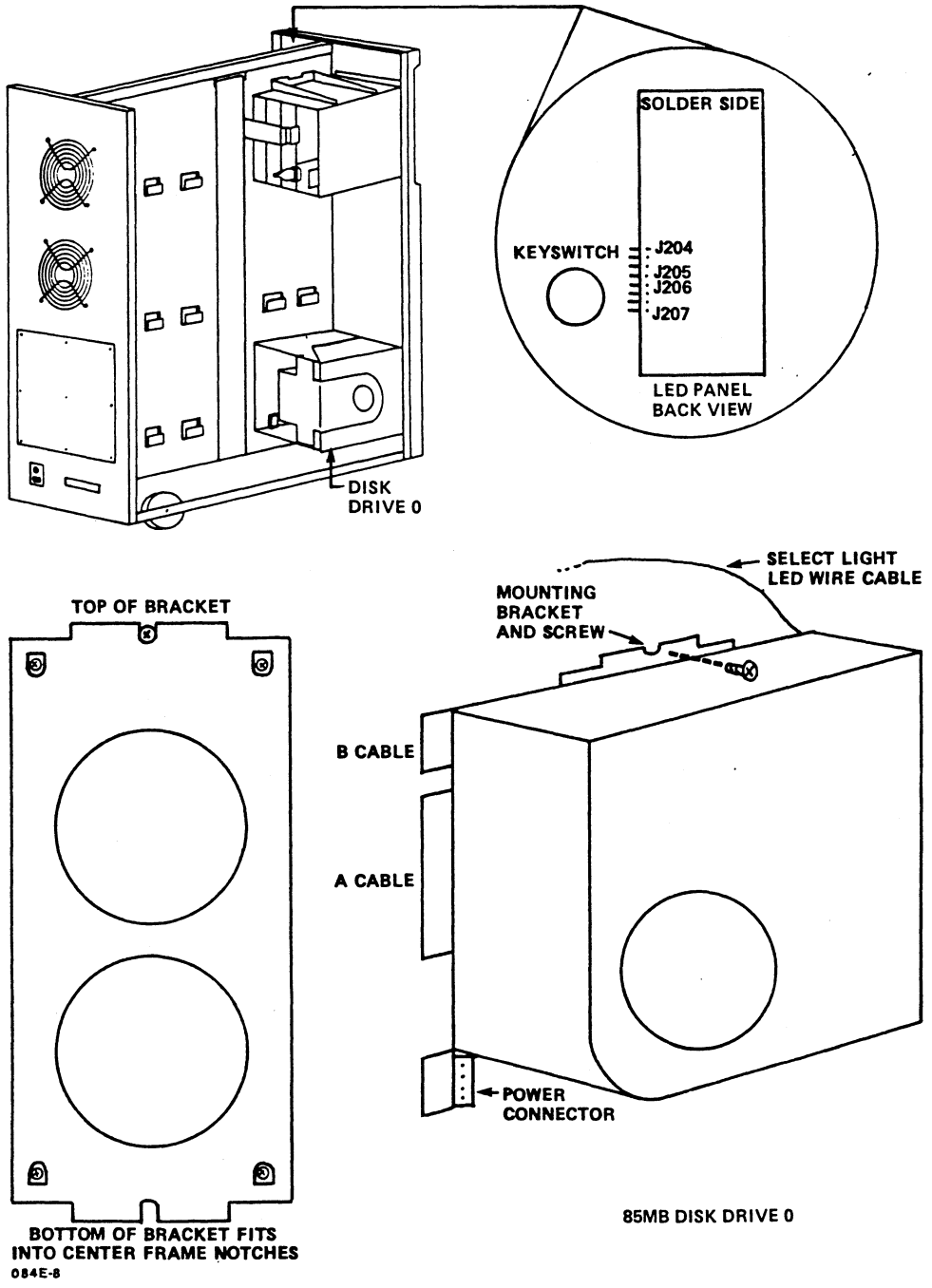


Figure 5-2. Removing the 85MB Disk Drive on a Single-Drive System

5. On the 143 or 190MB replacement disk drive, position the push-on jumper between 1 and C (or alternately between 5 and 6 if 1 through 6 is the numbering system used) at location J7 (see Figure 5-3). This is the jumper assignment for drive 0.

6. Make certain that the terminator is present on the disk drive.

7. Mount the replacement disk drive as follows (see Figure 5-2):

   a. Connect the mounting bracket that was removed from the 85MB drive to the replacement drive with its four screws.

   b. Mount the disk drive on the notches of the center frame.

   c. Screw the mounting bracket to the center frame using the screw that was removed in Step 3a.

   If the replacement drive is a 190MB drive, proceed to Step 8; if it is an 85 or 143MB drive, proceed to Step 9.

8. For a 190MB drive, it is necessary to install an SSDC disk/tape controller (053045), if one is not already present. To remove a non-SSDC disk/tape controller, remove the attached cables, pinch the plastic standoffs at each corner of the controller, and pull the board off. To install the SSDC controller, push it down on the plastic standoffs. Connect all peripheral cables as instructed in Step 12, Section 2.

9. Connect the cables to the disk drive as follows:

   a. A cable - connects to the 34-pin connector

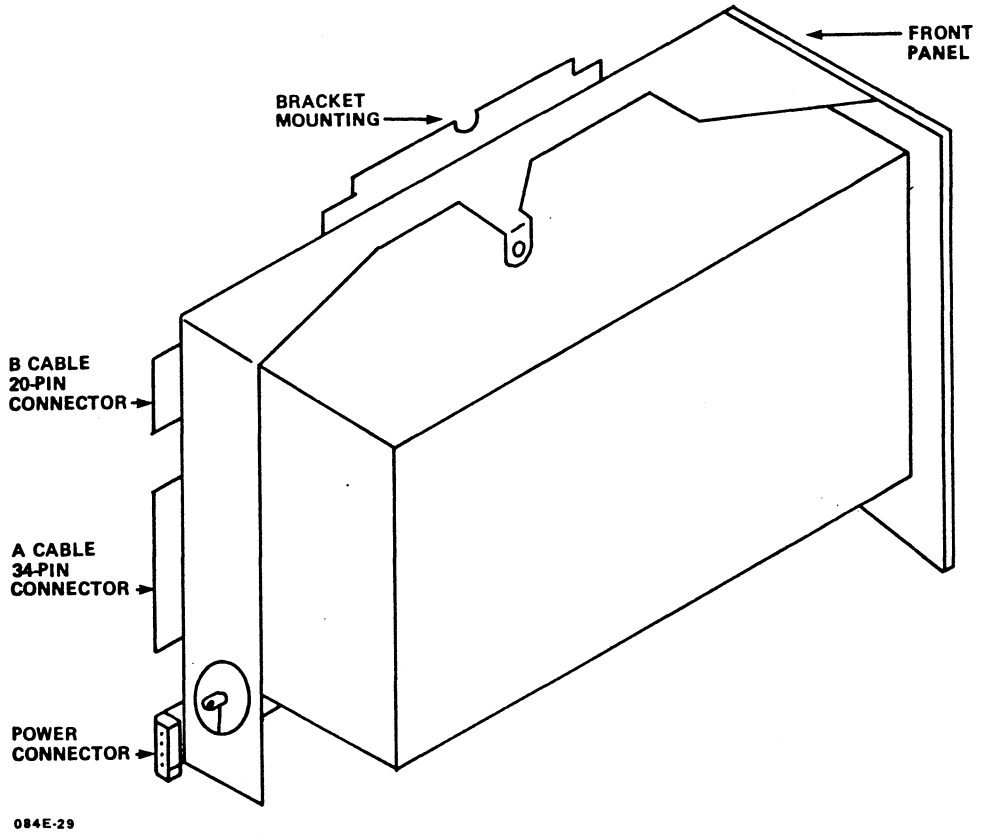
   b. B cable - connects to the 20-pin connector

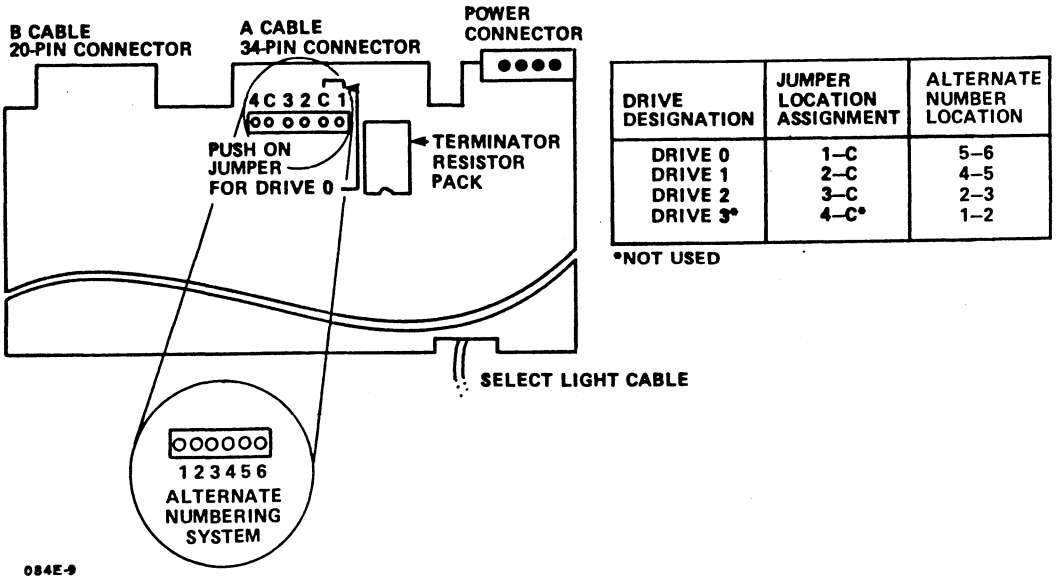
   c. Power cable - connects at location J3

10. Route and connect the select light LED cable as follows:

    a. For a 143MB drive, insert the cable through the middle cutout of the center frame, route it to the front LED panel, and connect it at location J205 (brown wire on top). See Figure 5-2.

    b. For a 190MB drive, connect one end of the cable to the SSDC disk/tape controller at location J4, pins 1 and 2 (see Figure 2-7). The cable connector is notched to ensure a correct fit. Route the cable to the front LED panel and connect it at location J205 (brown wire on top).





DRIVE DESIGNATION	JUMPER LOCATION ASSIGNMENT	ALTERNATE NUMBER LOCATION
DRIVE 0	1–C	5–6
DRIVE 1	2–C	4–5
DRIVE 2	3–C	2–3
DRIVE 3*	4–C*	1–2

*NOT USED

Figure 5-3. Installing a 143 or 190MB Disk Drive on a Single-Drive System

5.1.3 Adding Ports

To add more than eight asynchronous ports to a MARK 4/4E (8-16) or more than 16 asynchronous ports to a MARK 4E (16-32), it is necessary to add a port expansion board to the peripheral interface board (PIB) and an additional connector panel to the rear of the chassis. After adding ports, it is necessary to set baud rates and to modify the software configuration to include the new ports.

Although the instructions for adding ports are similar for the MARK 4 and the MARK 4E, there are differences. For this reason, separate sets of instructions are provided.

For information on adding a bisynchronous port, see Section 5.2.4.

5.1.3.1 ADDING PORTS TO A MARK 4/4E (8-16) SYSTEM

To extend the number of asynchronous ports from eight to 16 in a MARK 4/4E (8-16) system, order the following: for a MARK 4, a port expansion board (053019-01) and port kit (082006); for the MARK 4E (8-16), a port expansion board (053019-01) and port kit (DCF 3410). The port kits include an I/O panel with attached cable(s), DB25 or RJ45 connectors as appropriate, ground wire, and associated hardware.

To install the ports, perform the preliminary steps provided at the beginning of this section, then:

1. Unplug the port distribution cables from the PIB (see Section 2 and Figure 2-4).

2. Disconnect the following cables from the PIB and the disk/floppy controller board that is mounted on the PIB (see Figure 2-7):

    a. Streaming cartridge tape drive cable on the PIB at location J1

    b. A cable (daisy chain) on the disk/floppy controller board at location J7

    c. B cable on the disk/floppy controller board at location J1, and if present, at locations J2 and J3

    d. If present, the floppy disk drive cable on the disk/floppy controller board at location J8

3. Remove the peripheral interface board (PIB) from the card cage as follows:

   a. Grasp the plastic tabs that secure the PIB to the card cage frame, pull up to release it from the backplane, and slide it out of the guide rails.

   b. Place the PIB, component side up, on a table or desk.

   c. If the baud rate for any port 0 through 7 is to be changed, move the designated baud rate jumper(s) to the appropriate setting (see Figure 2-8).

4. Plug the port expansion board on the plastic standoffs and push the port expansion board connector at location P4 onto the PIB pins at location J4 (see Figure 5-4).

5. Set the baud rates for ports 8 through 15 by moving the baud rate jumpers to the appropriate setting. Additional information on setting baud rate jumpers is given in Section 2.

6. Return the PIB to the card cage and reconnect the port distribution cables by reversing the procedure given in Steps 1 through 3a.

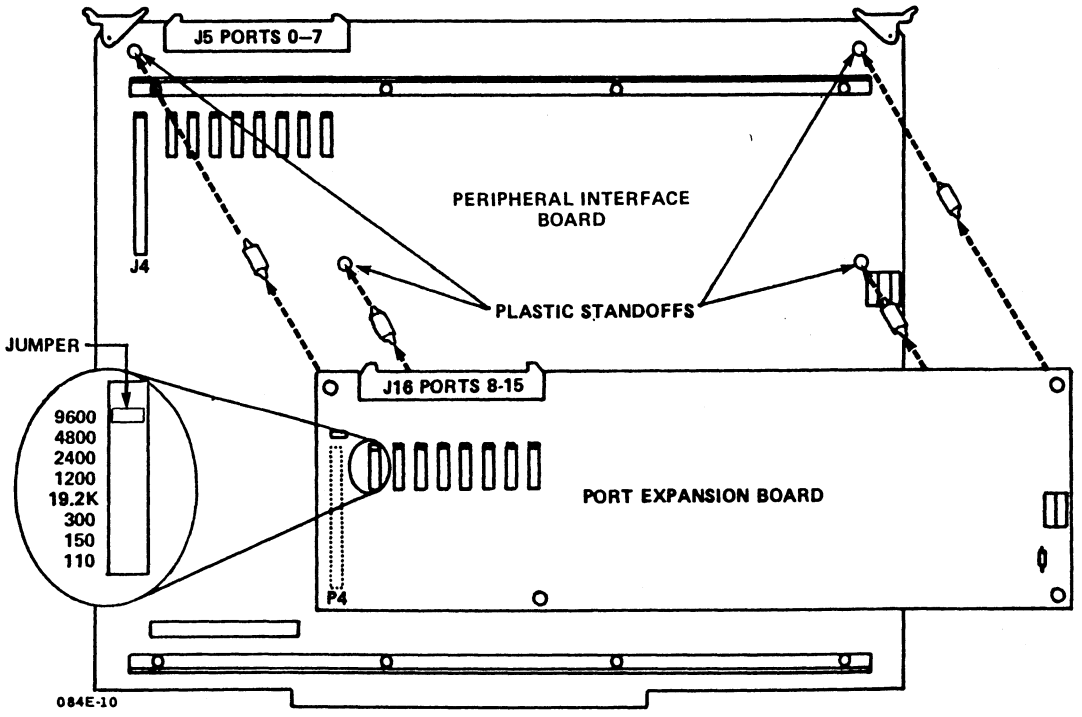


Figure 5-4. Adding a Port Expansion Board to a MARK 4/4E (8-16)

7. For a **MARK 4**, install the 8-port I/O panel on the rear of the chassis as follows (see Figure 5-5):

   a. Remove the eight screws that connect the metal plate to the port panel on the rear right of the chassis. Set the screws aside (not shown).

   b. From inside the rear of the chassis, insert the DB25 connectors of the 8-port I/O panel into the port panel cutout.

   c. From outside the rear of the chassis, screw on the 16 metal standoffs, one on each side of each DB25 connector.

   d. Fasten the ground wire to the inside rear of the chassis as follows:

      - On the 8-port panel, attach the push-on connector to the lug.

      - Above the port panel, mount the eye on the threaded standoff with a nut.

   e. Route the port distribution cable along the center frame and mount it with other ribbon cables. Guide it through the cutout at the top of the center frame (not shown).

   f. Reconnect the port distribution cables disconnected in Step 1 (not shown).

   g. Connect the new cable to the port expansion board at location J16 (see Figure 5-4).

   h. Proceed to Step 9.

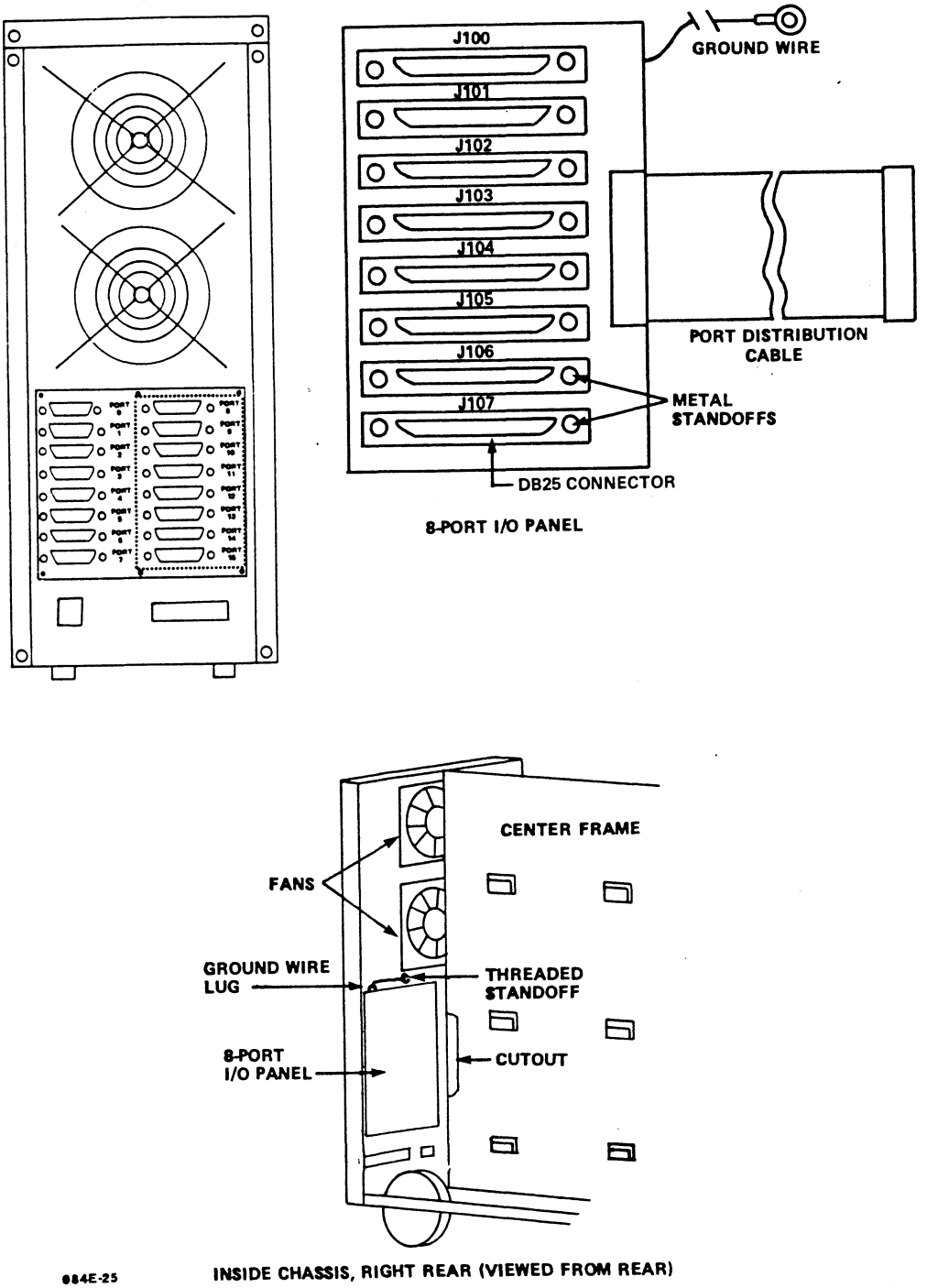


Figure 5-5. Adding Ports to a MARK 4

8. For a **MARK 4E (8-16)**, install the 16-port panel on the rear of the chassis as follows (see Figure 5-6):

   a. From inside the chassis, unscrew the four screws in the metal standoffs that connect the 8-port panel and blank to the chassis rear. Remove the 8-port panel and blank.

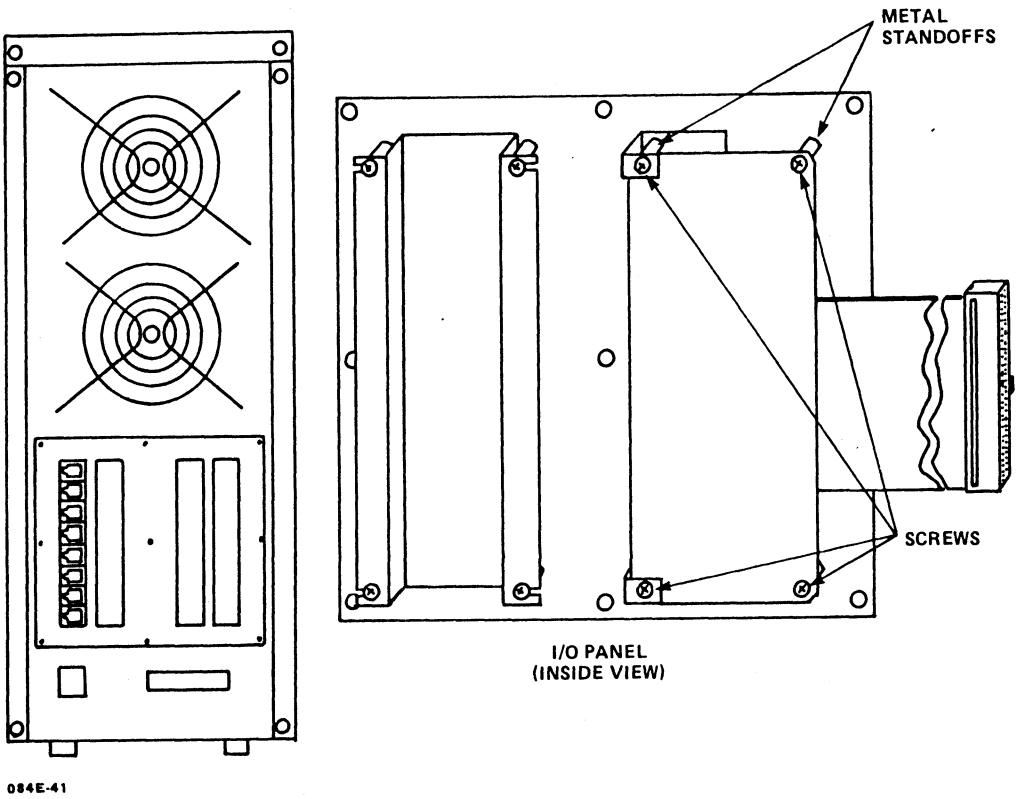
   b. Insert the 16-port panel into the opening and reconnect the screws into the metal standoffs.

   c. Route the port distribution cables along the center frame and mount them with the other ribbon cables. Guide them through the cutout at the top of the center frame (not shown).

   d. Connect the cables to the port expansion board at location J5 and J16 (see Figure 5-4).

   e. If present, reconnect the bisynchronous port distribution cable disconnected in Step 1 (not shown).

9. Configure the software to include the new ports. Refer to the IRIS R9 System Configuration Manual.



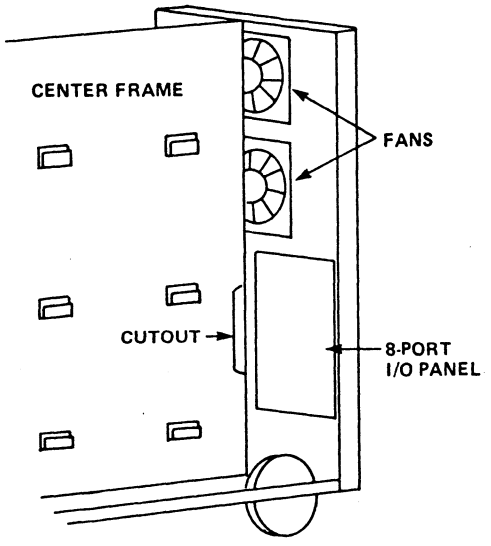


Figure 5-6. Adding Ports to a MARK 4E (8-16)

5.1.3.2 ADDING PORTS TO A MARK 4E (16-32) SYSTEM

To extend the number of asynchronous ports from 16 to 32 in a MARK 4E (16-32) system, order a port expansion board (53038) and a 16-port kit (53040). The kit includes a MARK 4E 16-port I/O panel with attached cables and RJ45 connectors.

To install these components, perform the preliminary steps provided at the beginning of this section, then:

1. Unplug the port distribution cables from the peripheral interface board (see Section 2 and Figure 2-4).

2. Disconnect the following cables from the peripheral interface board (PIB) and the disk/floppy controller board that is mounted on the PIB (see Figure 2-7):

   a. Streaming cartridge tape drive cable on the PIB at location J1

   b. A cable (daisy chain) on the disk/floppy controller board at location J7

   c. B cable on the disk/floppy controller board at location J1, and if present, at locations J2 and J3

   d. If present, the floppy disk drive cable on the disk/floppy controller board at location J8

   e. If present, the select light LED cable(s) from the disk/floppy controller board at location J4.

3. Remove the PIB from the card cage as follows:

   a. Grasp the plastic tabs that secure the PIB to the card cage frame, pull up to release it from the backplane, and slide it out of the guide rails.

   b. Place the PIB, component side up, on a table or desk.

4. Install three plastic standoffs on the PIB at the locations illustrated in Figure 5-7.

5. Plug the port expansion board on the plastic standoffs and push the port expansion board connector at location P5 onto the PIB pins at location J5.

6. Return the PIB to the card cage and reconnect the port distribution cables by reversing the procedure given in Steps 1 through 3a.

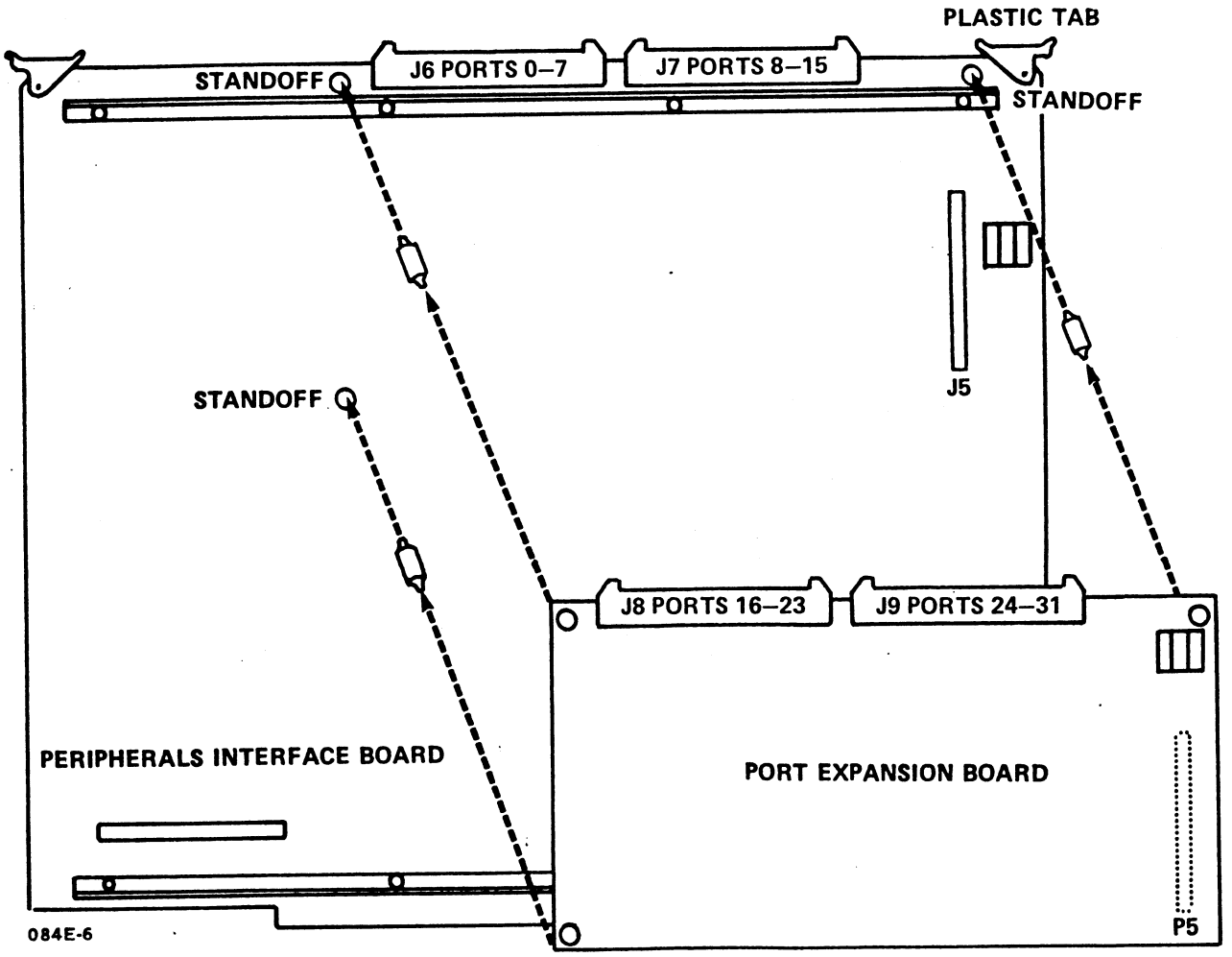


Figure 5-7. Adding a Port Expansion Board to a MARK 4E (16-32)

7. Install the 16-port I/O panel on the rear of the chassis as follows:

   a. Remove the four screws that connect the blank plate to the port panel on the rear right of the chassis. Set the screws aside. Store the plate.

   b. From inside the rear of the chassis, insert the new 16-port I/O panel with its RJ45 connectors into the port panel cutout (see Figure 5-8).

   c. From outside the rear of the chassis, connect the I/O panel to the panel plate with the four screws.

   d. Route the port distribution cables along the center frame and mount them with the other cables. Guide them through the cutout at the top of the center frame.

   e. Connect the port distribution cables to the peripheral interface board (PIB) as follows (see Figure 5-7):

      - Reconnect the cables for ports 0 through 7 and 8 through 15 on the PIB at locations J6 and J7, respectively.

      - Connect the cables for ports 16 through 23 and 24 through 31 at locations J8 and J9, respectively.

8. Configure the software to include the new ports. Refer to the IRIS R9 System Configuration Manual.

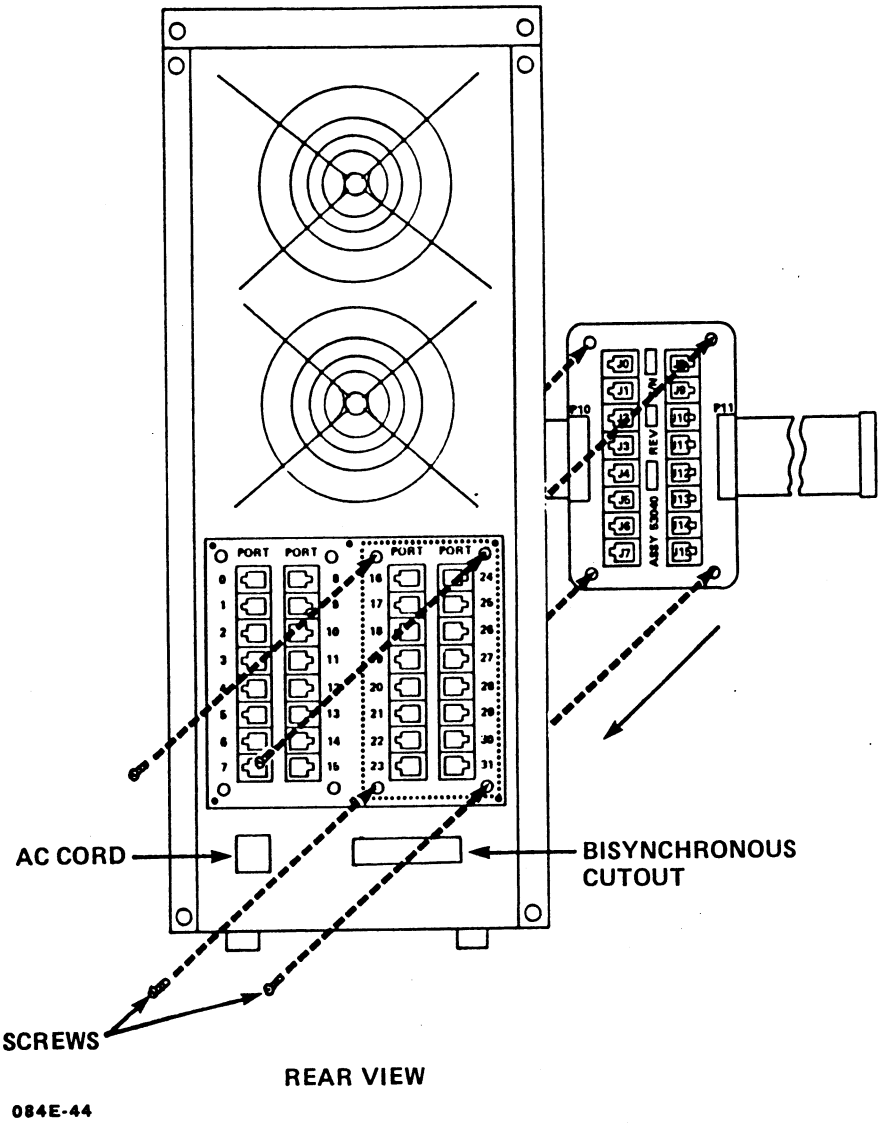


Figure 5-8. Adding Ports to a MARK 4E (16-32)

5.2 ADDING OPTIONS

In addition to extending the basic system, the MARK 4/4E can be upgraded by adding options: a second and third disk drive, a floppy disk drive, and a bisynchronous port. These options are described in the following subsections.

5.2.1 Disk Drives

The MARK 4/4E system supports a maximum of three disk drives. The optional second and third drives (drive 1 and drive 2, respectively) can provide either 85 or 143MB storage capacity on a MARK 4/4E (8-16); or 85, 143, or 190MB on a MARK 4/4E (16-32).

The drives are shipped as kits that include the appropriate drive, cables, mounting bracket, and associated hardware. The kits are as follows: 85MB (082005-05), 143MB (082005-03), and 190MB (082005-06). If a 190MB drive is added to a MARK 4/4E (16-32), The SSDC controller (053045) must also be installed on the peripheral interface board (PIB) if it is not already present (see Step 8 of Section 5.1.2).

When a second disk drive is added, an auxiliary power supply is required (see Section 5.2.2). The auxiliary power supply also supports a third drive.

Before installing a second and a third disk drive, the first disk drive (0) must be removed and modified so that it can operate with the additional drive(s). The following instructions include the steps necessary to remove and modify the first disk drive (0) as well as the steps required to add a second and a third disk drive.

5.2.1.1 REMOVING DISK DRIVE 0

Perform the preliminary steps provided at the beginning of this section, then:

1. Disconnect the port distribution cables from the peripheral interface board (PIB) and from their mounting restraints. Fold them back out of the work area for easier access (see Section 2 and Figure 2-4).

2. Remove the 34-pin A cable that connects to disk drive 0 and to the disk/floppy controller at location J7. Save the cable to use as a spare.

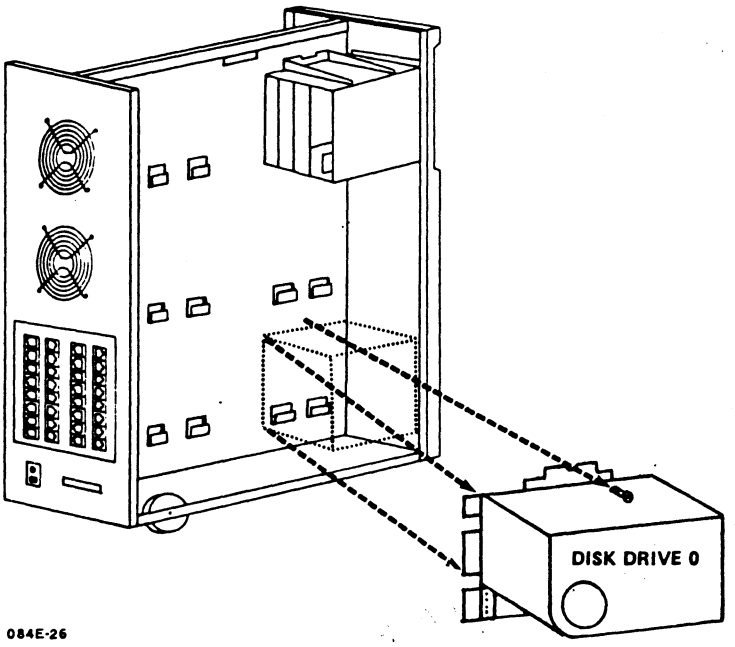
3. Remove disk drive 0 from the center frame (see Figure 5-9) as follows:

   a. Remove the screw from the mounting bracket above the disk drive. Set the screw aside.

   b. Lift up on the disk drive and mounting to release it from the notches on the center frame. Be careful not to catch the select light LED cable, 20-pin B cable, and power cable, which are still attached.

4. Remove the terminator from the disk drive.

5. Remount disk drive 0 by reversing the instructions given in Step 3.



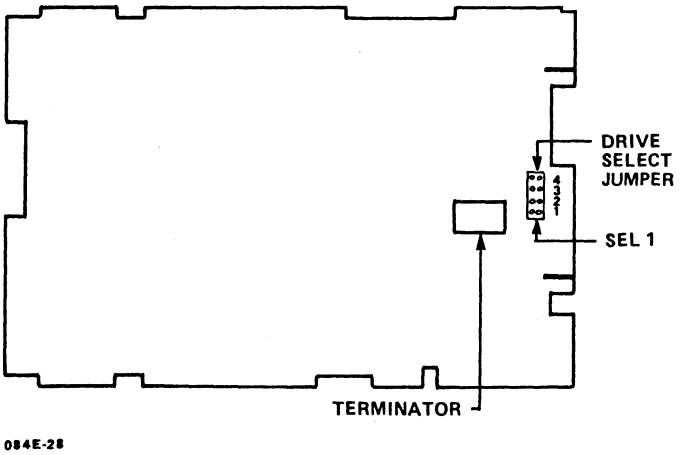


Figure 5-9. Removing and Modifying Disk Drive 0

5.2.1.2 ADDING A SECOND DISK DRIVE (DISK DRIVE 1)

Before adding a second disk drive (drive 1), remove and modify disk drive 0 (see Section 5.2.1.1), then:

1. If the second drive (drive 1) will be the last in the system, leave the terminator connected; if a third drive (drive 2) will be added, remove the terminator from the second drive (see Figure 5-9).

2. On disk drive 1, set the drive select jumper using one of the following options as appropriate:

   a. For an 85MB drive, position the jumper to 2 for drive 1 (see Figure 5-9).

   b. For a 143 or 190MB drive, position the jumper to 2-C (or alternately to 4-5) for drive 1 (see Figure 5-3).

3. Secure the mounting bracket to the drive with four screws.

4. Mount disk drive 1 immediately below the streaming cartridge tape and/or floppy disk drive(s) as follows (see Figure 5-10):

   a. Mount the drive on the center frame notches so that the cable connectors exit to the left. Be careful not to catch the select light LED cable.

   b. Connect the drive to the frame with the single screw at the top of the mounting bracket.

5. Route and connect the select light LED cable as follows:

   a. For an 85 or 143MB drive, insert the cable through the middle cutout of the center frame, route it to the front LED panel, and connect it at location J206 (brown wire is on top).

   b. For a 190MB drive, connect one end of the cable to the SSDC disk/tape controller at location J4; pins 1 and 2 for the first drive, and pins 3 and 4 for the second (the connector is notched to ensure a correct fit). Route the cable to the front LED panel and connect it at location J206 (brown wire on top).

6. Connect the following ribbon cables making certain that location 1 of the pins and the connectors are aligned:

   a. Connect the B cable to disk drive 1 on the 20-pin connector. Route the cable through the center frame cutout to the disk/floppy controller board at location J2.

   b. Connect the single end of the A cable (daisy chain) to the disk/floppy controller board at J7. Route the cable through the center frame cutout. Plug the connectors to the disk drives on the 34-pin connectors: the first to disk drive 0, and the second to disk drive 1. Leave the third cable disconnected.

7. Remount disk drive 0 by reversing the instructions given in Step 3 of Section 5.2.1.1.

8. To add a third drive to the system, proceed to Section 5.2.1.3.

   If the second disk drive (drive 1) will be the last drive, proceed to Section 5.2.2 for instructions on installing the auxiliary power supply.

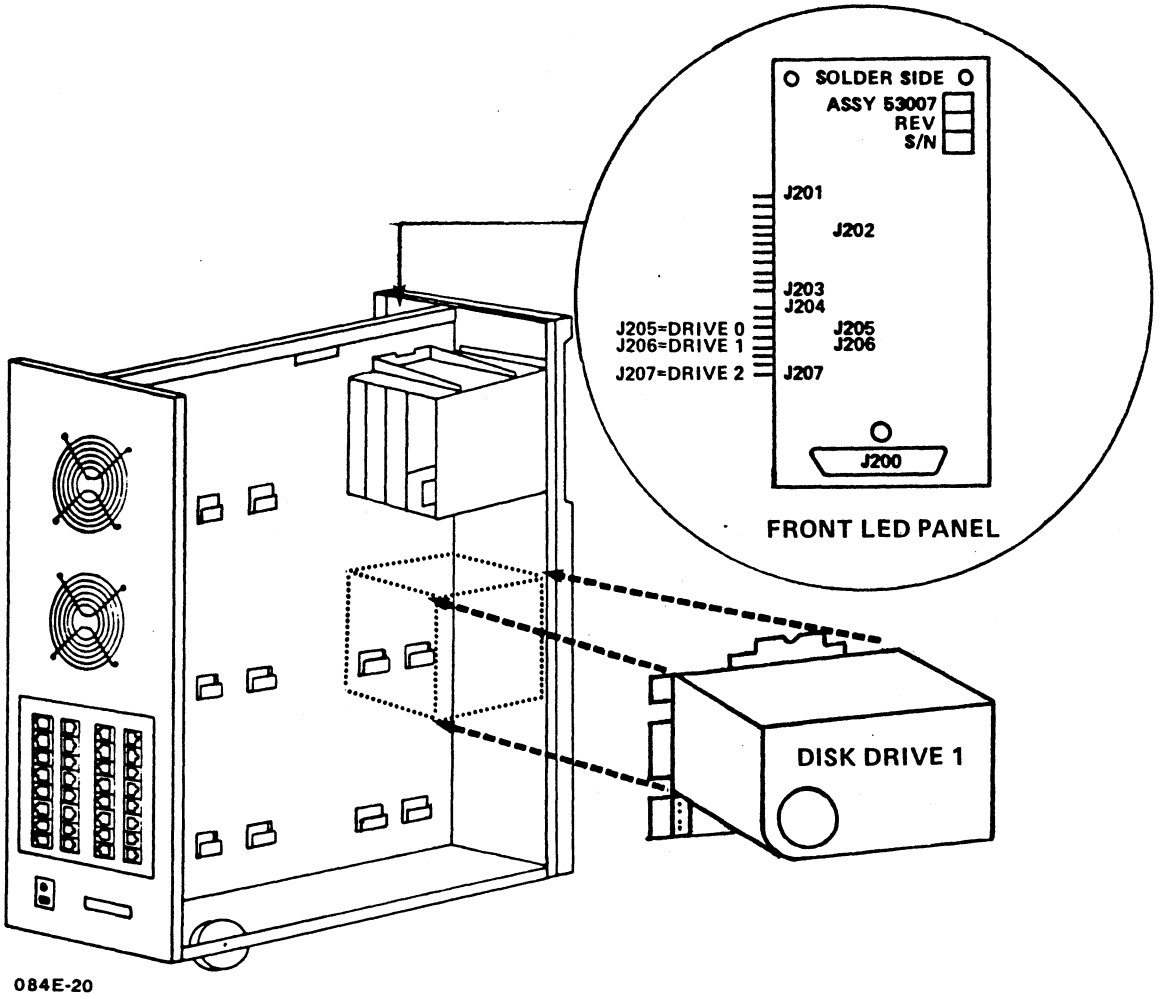


Figure 5-10. Adding a Second Disk Drive

5.2.1.3 ADDING A THIRD DISK DRIVE (DISK DRIVE 2)

If the second and third disk drives are added at the same time, it is necessary to remove and modify the first disk drive (0) as instructed in Section 5.2.1.1. This is to ensure that only the last disk drive on the system has a terminator.

If the third drive is added to the system at some time after the second has been installed, it is necessary to remove and modify only the second drive according to the instructions below.

Perform the preliminary steps provided at the beginning of this section, then:

1. To add a third disk drive (drive 2) remove disk drive 1. Follow the general instructions for removing disk drives provided in Section 5.2.1.1.

2. Remove the terminator from drive 1; leave the drive select jumpers positioned as before.

3. Remount disk drive 1.

4. On the third disk drive (drive 2):

   a. Make certain that the terminator is left on.

   b. For an 85MB drive, position the jumper to 3 (see Figure 5-9).

   c. For a 143 or 190MB drive, position the jumper to 3-C (or alternately to 2-3).

5. Secure the mounting bracket to the drive with the four screws.

6. Mount the third disk drive (drive 2) to the left of the second disk drive (drive 1) as follows:

   a. Mount the disk drive on the center frame notches so that the cable connectors exit to the right. Be careful not to catch the select light LED cable, if present.

   b. Connect the disk drive and the mounting bracket to the center frame with the single screw.

7. Route and connect the select light LED cable as follows (see Figure 5-10):

   a. For an 85 or 143MB drive, insert the cable through the middle cutout of the center frame, route it to the front LED panel, and connect it at location J207 (brown wire on top).

   b. For a 190MB drive, connect one end of the A cable to the SSDC disk/tape controller at location J4; pins 1 and 2 for the first drive, pins 3 and 4 for the second, and pins 5 and 6 for the third (the connector is notched to ensure a correct fit). Route the cable to the front LED panel and connect it at location J207 (brown wire on top).

8. Connect the following ribbon cables making certain that location 1 of the pins and the connectors are aligned:

   a. Connect the B cable to the third disk drive (drive 2) on the 20-pin connector. Route the cable through the center frame cutout to the disk/floppy controller board at location J3.

   b. Connect the single end of the A cable (daisy chain) to the disk/floppy controller board at J7. Route the cable through the center frame cutout. Plug the connectors to the disk drives on the 34-pin connectors: the first to disk drive 0, the second to disk drive 1, and the third to disk drive 2.

9. If the auxiliary power supply is not already in the system, proceed to Section 5.2.2.

5.2.2 Auxiliary Power Supply

An auxiliary power supply is required when more than one disk drive is used in a MARK 4/4E system. It is mounted to the left of the first disk drive (drive 0) after the disk drives are in place. The auxiliary power supply kit (082008) includes the power supply, cables, mounting bracket, and associated hardware.

To install the auxiliary power supply, perform the preliminary steps provided at the beginning of this section, then:

1. Mount the auxiliary power supply to the left of the first disk drive (drive 0) as follows (see Figure 5-11):

   a. Mount the power supply on the notches of the center frame so that the cables exit to the right.

   b. Connect the power supply to the frame with the single screw at the top of the mounting bracket.

2. Connect the AC power cable (green/brown/blue wire), which originates on the auxiliary power supply at J1, to the main power supply at location TB1 (terminal block 1). This wire exits the auxiliary power supply to the right (see Figure 5-11).

   a. Run the AC power cable through the round cutout in the center frame to the left of the main power supply.

   b. Connect the push-on lug of each wire. **The connection is different depending upon whether the main power supply is manufactured by Power One or CEC. On the Power One, pin 1 is toward the bottom; on the CEC, pin 1 is at the bottom.** Figure 5-11 illustrates the CEC power supply.

AC Power Cable	Pin Number Power One	CEC
Green (AC chassis ground)	3	3
Brown (AC high)	2	1
Blue (AC low)	1	2

3. Connect the DC power cables, which originate on the auxiliary power supply at J1, to the disk drives: one to the second disk drive (drive 1) power connector; the other to the third disk drive (drive 2) power connector (if present).

4. Connect the single DC ground wire (brown), which originates at the auxiliary power supply, to the main power supply at location TB2, pin 5 (DC ground).

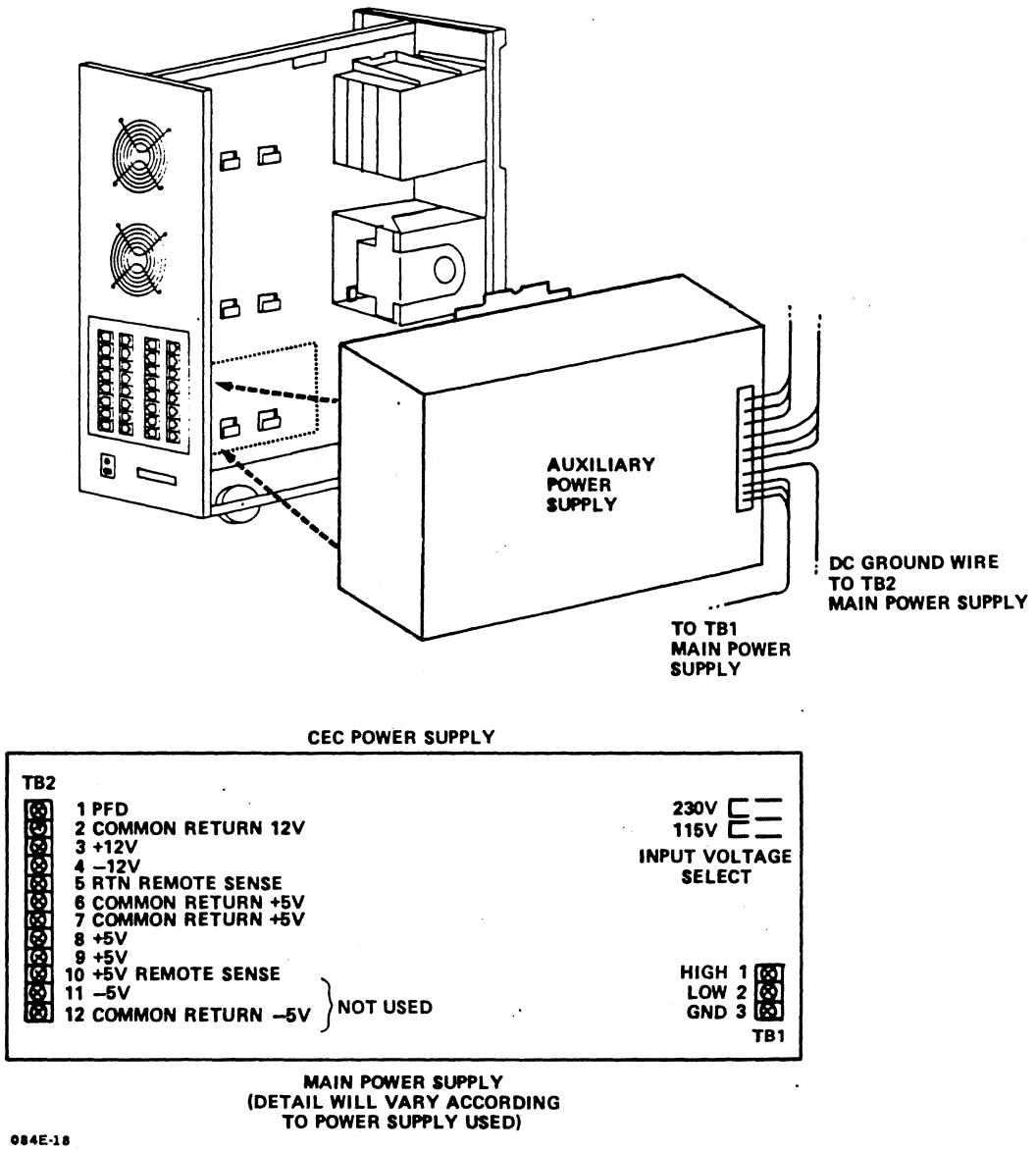


Figure 5-11. Adding the Auxiliary Power Supply

5.2.3 Adding a Floppy Disk Drive

The MARK 4/4E can support a 5-1/4-inch floppy disk drive with a 1MB capacity. The floppy disk drive kit (82007) includes the floppy disk drive (901207-01), a floppy controller cable (88009), a power cable (88003), a mounting bracket (42008), a streamer expansion cable (88012), and associated hardware.

When installed, the floppy disk drive is mounted with the streaming cartridge tape drive on the left side of the chassis (as viewed from the front).

Before installing the floppy disk drive, it is necessary to remove the tape drive from the chassis and to separate it into two sections. On a 45/60MB tape drive, the section containing the stand-alone controller is mounted toward the rear of the chassis; on a 125/150MB tape drive, the filler chassis is stored.

The floppy disk drive is then installed next to the section containing the tape drive; finally the combined tape/floppy drive is installed in the place originally occupied by the tape drive. This procedure is described below and illustrated in Figures 5-12 and 5-13.

To remove the streaming cartridge tape drive, perform the preliminary steps provided at the beginning of this section, then continue as follows (see Figure 5-12):

1. From the rear of the tape drive, disconnect the following connectors:

   a. 50-pin ribbon cable

   b. Power cable connector

2. Remove the top two screws that connect the mounting bracket of the tape drive to the center frame. Set the screws aside.

3. Remove the tape drive with its brackets by lifting it slightly to release it from the notch in the center frame and then sliding it toward the rear of the chassis.

4. Remove the eight screws that secure the tape drive to the mounting brackets. Set the brackets and the screws aside.

5. Separate the two sections of the tape drive. To do this, use a 5/64-inch Allen hex driver with a 4-inch shank to reach and loosen the screws through the threaded screw holes above the screw locations. **Do not remove the screws.**

6. Lift up slightly on the stand-alone controller section (45/60MB drive) or the filler chassis (125/150MB drive) and shift it to release the plastic notch of the faceplate and separate it from the tape drive.

7. After the sections are separated, take off the four screws that were loosened with the Allen hex driver. Store the screws of the 45/60MB tape drive, or the filler chassis and screws from the 125/150MB tape drive. If the tape drive is a 45/60MB capacity, proceed to Steps 8 and 9; for a 125/150MB capacity drive, proceed to Step 10.

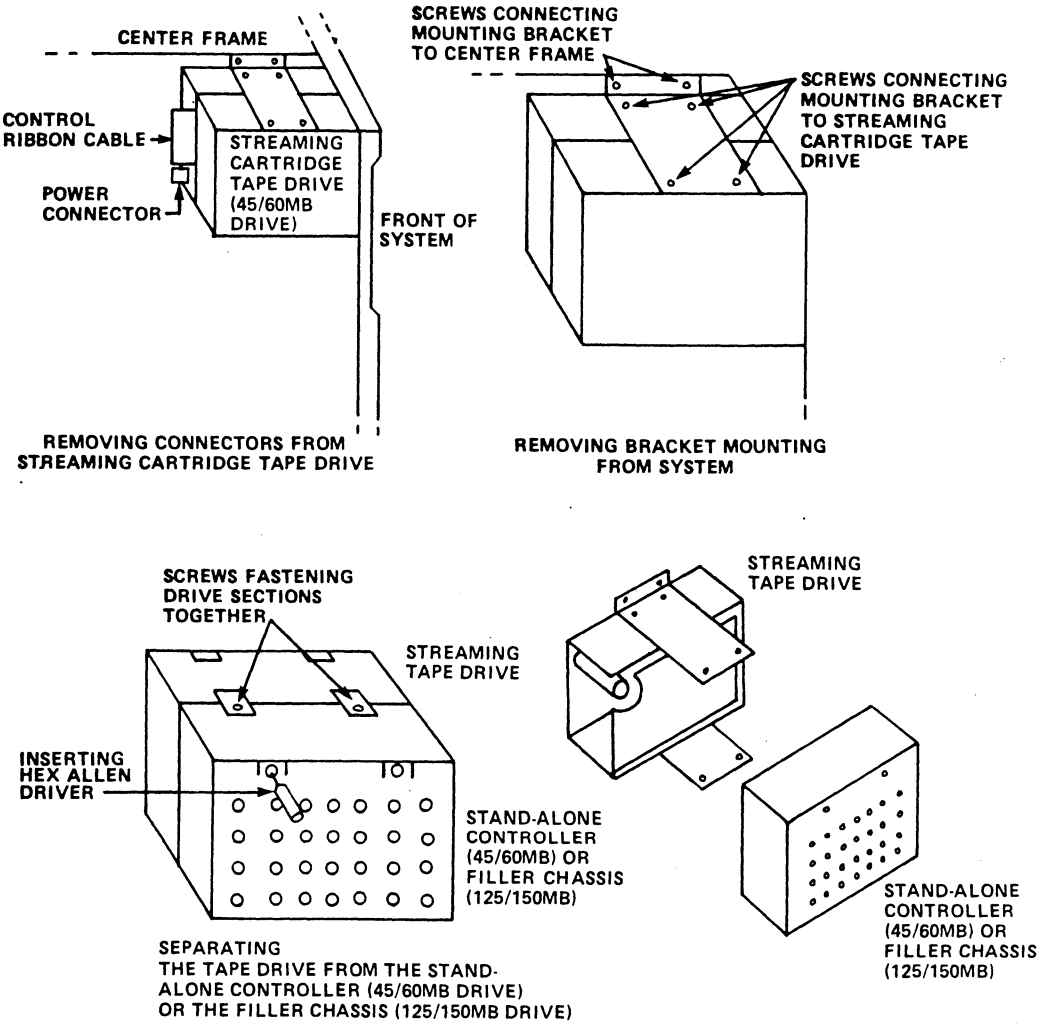


Figure 5-12. Removing the Tape Drive and Separating the Tape Drive Section from the Stand-Alone Controller or Filler Chassis

8. On the 45/60MB tape drive, disconnect the ribbon cable that connects to J1 and J3. It will be replaced by another longer cable.

9. Mount the stand-alone controller section of the 45/60 tape drive to the center frame as follows (see Figure 5-13).

   a. With four pan head screws, connect the stand-alone controller to the new mounting bracket (42008).

   b. Mount the stand-alone controller and bracket on the notch of the center frame and secure the bracket to the frame with a single sems screw. The J1 connector should exit to the right.

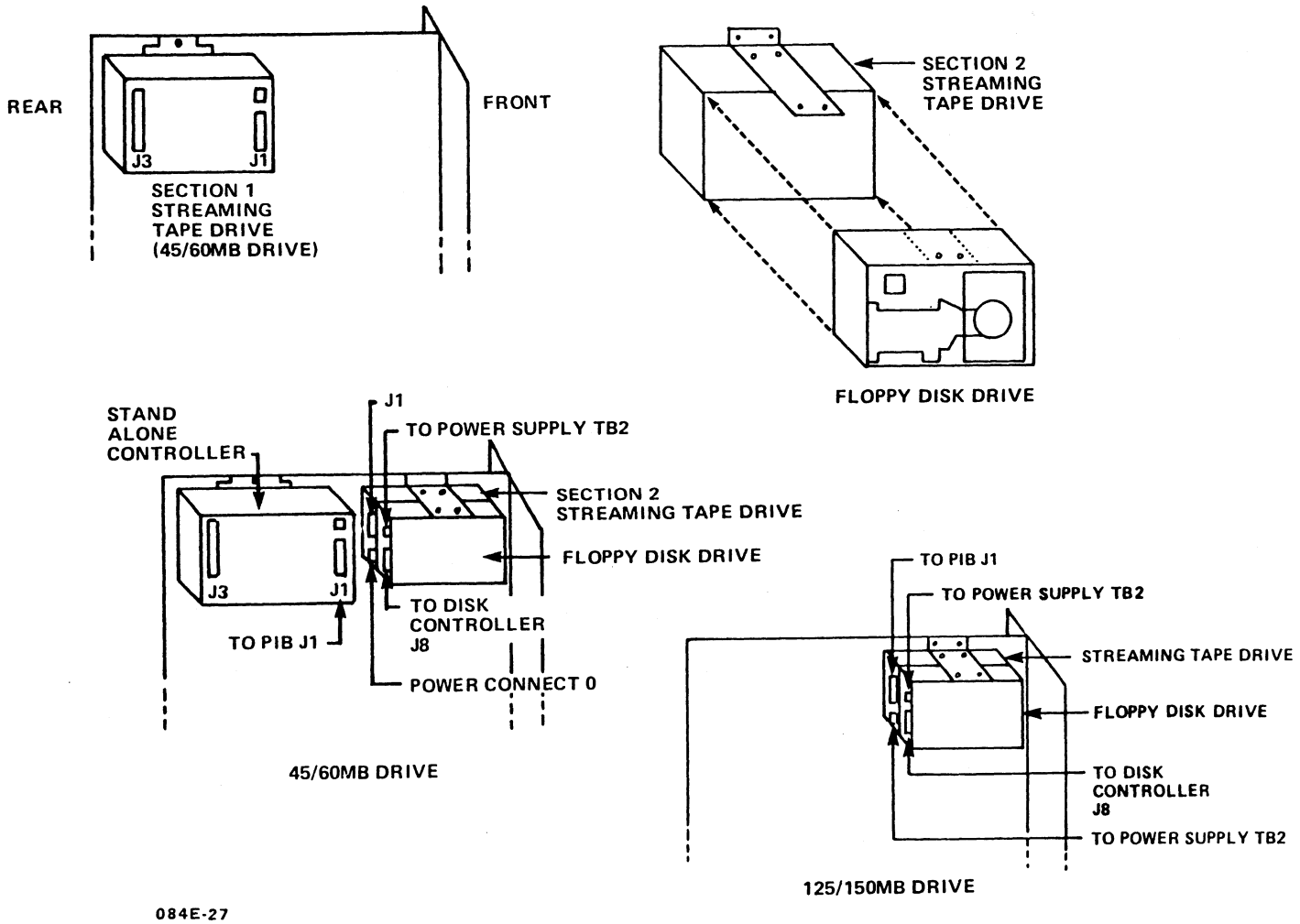


Figure 5-13. Adding a Floppy Disk Drive

10. Connect the floppy disk drive to the tape drive (either 45/60MB or 125/150MB) and remount the combined drives as follows:

    a. Reconnect the tape drive to the original mounting brackets as illustrated.

    b. With the four remaining sems screws, mount the floppy disk drive to the mounting bracket adjacent to the tape drive. There will be two screws on the top and two on the bottom.

    c. Using the two screws removed in Step 2, mount the combined tape/floppy drive to the center frame in the location originally occupied by the tape drive and the standalone controller section or filler chassis.

11. Install the cables as follows:

    a. Reconnect the tape drive interface cable, which originates at the peripheral interface board (PIB) at location J1, to the rear of the streaming tape drive.

    b. On the 45/60MB drive only, connect one end of the replacement streamer expansion cable (88012) to the stand-alone controller of the tape drive at location J3 and the other end to the tape drive at location J1.

    c. Connect the disk/floppy drive control cable (88009), which originates on the rear of the floppy disk drive, to the disk/floppy controller board at location J8.

    d. Reconnect the tape drive power cable connector(s) to the tape drive at the rear. The 45/60MB drive has a power connector on both the stand-alone controller and the tape drive; the 125/150MB drive has one connector on the tape drive.

    e. Connect the floppy disk drive power cable (88003) to the back of the floppy disk drive, route it through the bottom cutout to the main power supply at location TB2. Push the power cable lugs onto TB2 making certain to match corresponding colors.

12. Run the floppy diagnostics using the MK2/2E/4/4E Standard Disk/Diskette/Tape Diagnostic, Rev 1.11 or later.

5.2.4 Adding a Bisynchronous Port

The MARK 4/4E system can be upgraded to include one bisynchronous port. Because the components and the installation instructions are different for the MARK 4 and the MARK 4E, they are described separately. Software for the bisynchronous port can be obtained from Starburst Data Systems, Inc., Rte. 2, Box 362A, Vashon, WA 98070.

5.2.4.1 BISYNCHRONOUS OPTION FOR A MARK 4/4E (8-16) SYSTEM

On a MARK 4/4E (8-16), the bisynchronous option requires: peripheral interface board (PIB 53018), port expansion board (53019-03), and a bisynchronous cable (88050) with a DB25 connector. (Before ordering this option for a MARK 4, check that it has a cutout on the rear panel of the chassis to accommodate the DB25 connector. Some early MARK 4 systems may not have this feature.) The central processing board (053027-xx) must have firmware Rev 5 or later.

To install the bisynchronous option, perform the preliminary steps provided at the beginning of this section, then:

1. Install port expansion board 53019-03 on the PIB (see Section 5.1.3.1). (This will necessitate removal of port expansion board 53019-01.)

2. Install the bisynchronous cable with the DB25 connector as follows (see Figure 5-14):

   a. On the chassis rear, pry off the tabs that secure the black plastic cover to the bisynchronous cutout.

   b. From inside the rear of the cabinet, insert the DB25 connector through the cutout.

   c. From outside the rear of the cabinet, secure the connector to the panel by tightening the screws on the metal standoffs on either side of the connector.

   d. Route the bisynchronous cable from the rear of the chassis to the port expansion board as follows:

      - Follow the path of the other cables and route the cable through the hole in the center frame and up to the port expansion board.
      - Tie or clamp the bisynchronous cable to the other cables.
      - Plug the cable connector onto the port 18 connector of the port expansion board at location J15.

3. Run the bisynchronous diagnostic tests, using the MK2/2E/3/4/4E Standard MUX Diagnostic, Rev 1.5 or later.

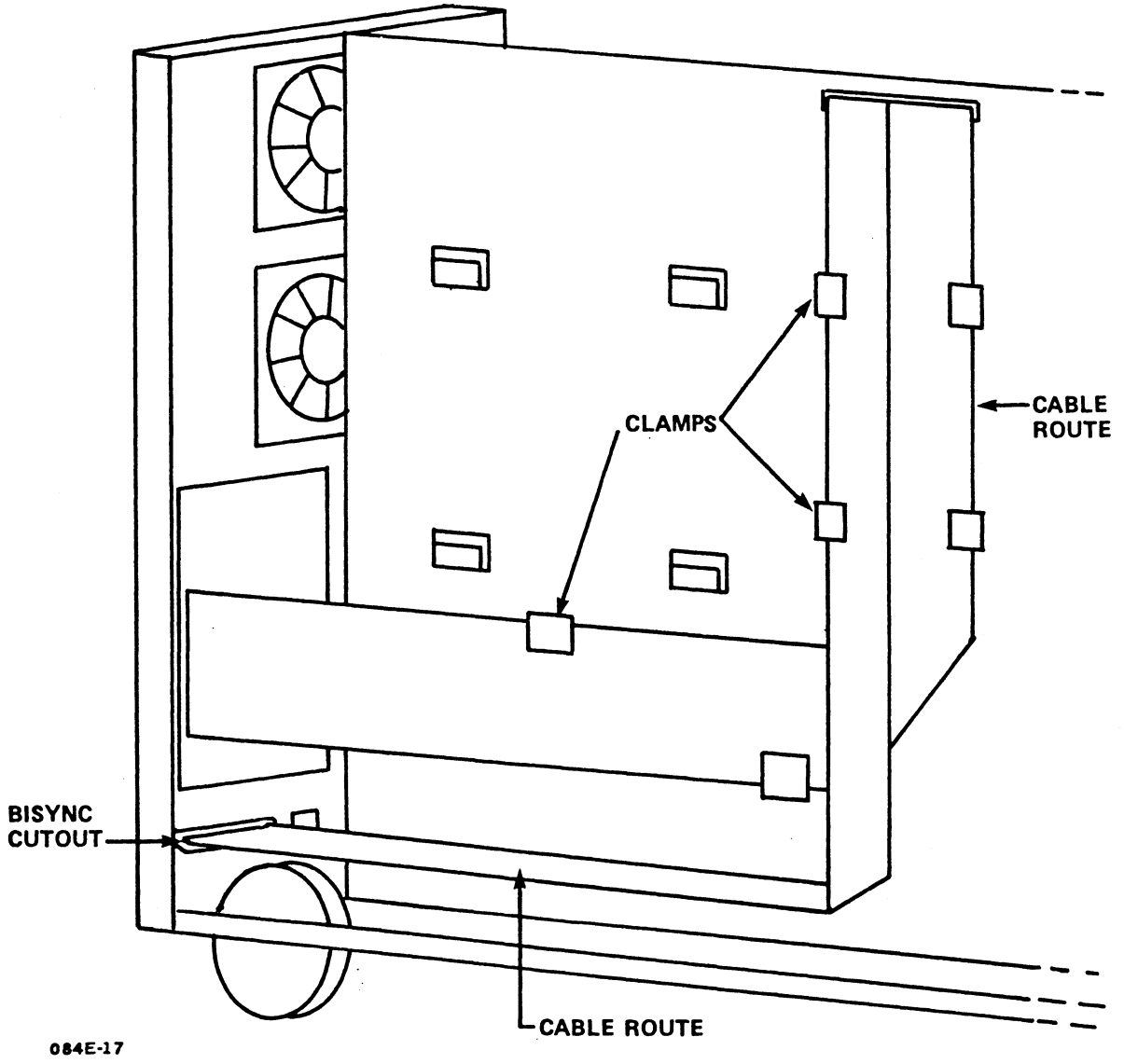


Figure 5-14. Adding the Bisynchronous Option to a MARK 4/4E

5.2.4.2 BISYNCHRONOUS OPTION FOR A MARK 4E (16-32) SYSTEM

Adding the bisynchronous option to a MARK 4E (16-32) system requires a separate bisynchronous board (53039-02). The board is shipped with three plastic standoffs, and a bisynchronous cable with an attached DB25 connector.

To install the bisynchronous option, perform the preliminary steps provided at the beginning of this section, then:

1. Unplug the port distribution cables from the peripheral interface board (see Section 2 and Figure 2-4).

2. Remove the peripheral interface board (PIB) from the card cage (see Section 5.1.3.2).

3. Install the three plastic standoffs on the PIB (see Figure 5-7).

4. Position the bisynchronous board so that the pin connector at location P4 plugs onto the pins of the PIB at location J4.

5. Install the cable with the DB25 connector to the chassis rear as follows:

   a. On the chassis rear, pry off the tabs that secure the black plastic cover to the bisynchronous cutout.

   b. From inside the rear of the cabinet, insert the DB25 connector into the cutout.

   c. From outside the rear of the cabinet, secure the connector to the panel by tightening the screws on the two metal standoffs on either side of the connector.

   d. Route the bisynchronous cables from the rear of the chassis to the port expansion board as follows:

      - Follow the path of the other cables and route the cables through the hole in the center frame and up to the port expansion board.

      - Tie or clamp the bisynchronous cables to the other ribbon cables.

      - Plug the cable connector onto the PIB at location J4.

6. Run the bisynchronous diagnostic tests, using the MK2/2E/3/4/4E Standard MUX Diagnostic, Rev 1.5 or later.

5.3 CONVERTING A MARK 4 OR MARK 4E (8-16) TO A MARK 4E (16-32)

The instructions below enable a MARK 4 or a MARK 4E (8-16) to be converted to a MARK 4E (16-32).

To convert a MARK 4 system to a MARK 4E (16-32) system, the following is required: a new central processing unit (CPU 53027-01) a new 16-port peripheral interface board (PIB 53037), one or two new 16-port back panels with RJ45 connectors, and cables depending upon whether an additional eight or 24 ports are being added.

To upgrade a MARK 4E (8-16) to a MARK 4E (16-32) system, the following is required: a 16-port peripheral interface board (PIB), a new 16-port back panel with RJ45 connectors, cables and a new central processing unit (CPU) firmware set.

To upgrade a MARK 4 or a MARK 4E (8-16) to a MARK 4E (16-32), perform the preliminary steps provided at the beginning of this section, then:

1. Remove the cabinet top and side panels (see Section 2). On a MARK 4, proceed to Step 2; on a MARK 4E (8-16) proceed to Step 3.

2. On a **MARK 4,** install the new CPU (53027-01) as follows:

   a. Unplug the port distribution cables from the PIB.

      There may be cables at locations J5, J16, and J15 of the PIB.

   b. Remove the existing CPU from the card cage by grasping the plastic tabs that secure it to the card cage frame, pulling up to release it from the backplane, and sliding it out of the guide rails.

   c. Install the new CPU (53027-01) by sliding it down the guide rails of the card cage and locking it into place with the plastic tabs.

   d. Proceed to Step 4.

3. On a **MARK 4E (8-16),** install new firmware on the existing CPU as follows:

   a. Unplug the port distribution cables from the PIB.

      There may be cables at locations J5, J16, and J15 of the PIB.

b. Remove the CPU from the card cage by grasping the plastic tabs that secure it to the card cage frame, pulling up to release it from the backplane, and sliding it out of the guide rails.

c. Remove the memory board from the CPU as follows (see Figure 5-1):

- If it has not already been done, cut the plastic shipping rivets that connect the memory board to the CPU flex bar.

- Pinch the two plastic standoffs in the lower left and right corners of the memory board and lift the board off the standoffs.

- Grasp the memory board on each side, rock and lift it carefully to disengage the connectors at locations P2 and P3 from the pins on the CPU at locations J2 and J3. Do not bend or break the pins.

d. Remove the firmware from the CPU at locations 8D through 17D, 4F, and 6F (see Figure 2-6).

e. Install the new firmware on the CPU at locations 8D through 17D, 4F, and 6F.

f. Return the CPU to the card cage by sliding it down into the guide rails of the card cage and locking it into place with the plastic tabs.

g. Proceed to Step 4.

4. Install the new peripheral interface board (PIB) as follows:

a. Remove all streaming cartridge tape drive and disk/floppy drive cables.

b. Remove the older PIB from the card cage by grasping the plastic tabs that secure it to the card cage frame, pulling up to release it from the backplane, and sliding it out of the guide rails.

c. If the new PIB is to have a port expansion board for additional ports, install the port expansion board on the PIB (see Section 5.1.3.2).

d. Insert the new PIB into the card cage by sliding it down into the guide rails and locking it in place with the plastic tabs.

e. Reconnect the PIB cables.

f. For a MARK 4, proceed to Step 5. For a MARK 4E (8-16), proceed to Step 6.

5. To install additional ports on a **MARK 4**, use the following instructions:

   a. At the chassis rear, remove the nine screws that connect the port panel with the DB25 connectors to the chassis. Set the screws aside.

   b. Carefully pull the board and cable assembly out making certain not to damage the cables.

   c. On the chassis rear, install the new port panel(s) with 16 (or 32) RJ45 connectors and the cables into the hole previously occupied by the old port panel.

   d. Connect the port panel to the chassis rear with the screws removed in Step 5a.

   e. Proceed to Step 7.

6. To install additional ports on a **MARK 4E (8-16)**, use the following instructions:

   a. At the chassis rear, remove the nine screws that connect the RJ45 connectors to the chassis. Set the screws aside.

   b. If the existing system has eight ports, remove the existing back panel with eight RJ45 connectors and a blank and replace it with a 16-port back panel. To increase the number of ports to 32, remove the blanks covering the port area 16-32 and add a second 16-port back panel.

   c. Connect the port panel to the rear of the cabinet with the screws removed in Step 6a.

   d. Proceed to Step 7.

7. Route the port distribution cables along the path with other cables through the cutout in the top of the center frame. Tie or clamp them with the other cables.

8. Connect the port distribution cables to the peripheral interface board (PIB): the cable from ports 0 through 7 connects to the PIB at location J6; the cable from ports 8 through 15 connects to the PIB at location J7 (see Figure 2-4).

9. If a port expansion board is installed for ports 16 through 31, connect the cable from ports 16 through 23 to the port expansion board at location J8 and the cable from ports 24 through 31 to the port expansion board at location J9 (see Figure 2-4).

10. If necessary, make cables to link the external peripherals to the back panel, see Appendix C for cable wiring diagrams.

11. Check and set the default baud rate rotary switch for Port 0 (see Figure 2-9).

12. Use SETUP to configure the additional ports and to set the baud rates for ports other than zero (refer to the IRIS R9 System Configuration Manual). IRIS 9.1 or later is required.

Section 6
TROUBLESHOOTING

The MARK 4/4E system requires little preventive or ongoing maintenance. Systems that are correctly installed and managed with reasonable care, perform well over a long period of time. Occasionally, however, a problem or a malfunction does occur. If it does, the troubleshooting routine described in this section will help identify the problem or malfunction. In some cases, qualified technicians can easily accomplish corrective action; in others a faulty component may need to be removed and sent to POINT 4 for repair or replacement.

If a problem or a malfunction relates to the operating system, refer to the IRIS or other appropriate software documentation.

If you are unable to identify a problem, locate a malfunction or take corrective action, call Hardware Technical Support, POINT 4 Data Corporation, (714) 259-0777.

Before undertaking the troubleshooting routine that follows, check that the AC power cord and the cables between the ports and the peripherals are properly plugged in, and that the cables are correctly wired.

6.1 MANIPULATE THE SYSTEM

The first step in troubleshooting is to MANIP(ulate) the system, that is, to use MANIP to help locate a problem or a malfunction.

MANIP is a program that allows the user to perform several system functions from the master terminal keyboard (see Sections 3.3, 4.1, and Appendix D). MANIP functions used in troubleshooting are those that allow the user to display and examine the contents of memory on the master terminal, and the hardware verify test.

6.1.1 Using MANIP

MANIP is used if the system HALTs, or if the system is running but trouble is suspected.

A HALT is a condition that brings the entire system to a standstill. It can be caused by a power failure, or a hardware or software problem. The type of problem is indicated by a HALT code contained in memory.

Any of the following conditions may indicate a problem: the program will not load from tape or floppy disk, the system will not IPL, the user is waiting for some action but none occurs, or the action that occurs is not the one expected.

When any of these conditions occur, it is necessary to display and examine memory contents on the master terminal to gather data useful in locating a problem or malfunction. To access MANIP, use the following instructions.

6.1.2 Accessing MANIP

The MANIP program is loaded, and the MANIP Menu is displayed on the master terminal screen under the following circumstances:

- The keyswitch is turned from OFF to ON.
- The system is ON and the reset switch is pressed.
- The keyswitch is turned from AUTO to ON, then the reset switch is pressed.

To load MANIP when the system is already running and the key-switch is turned to ON:

1. Press the reset switch that is located on the front panel.

   The program counter, four accumulators, carry flip-flop and MANIP prompt (->) are displayed.

2. Enter ? on the master terminal keyboard and press <RETURN>.

   A MANIP Menu similar to the following is displayed:

```
POINT 4 Data Corporation                          444    4
MARK 4E                                         4444     444
                                               444   4   4444
                                               4   444   4444


ENTER COMMAND LETTER                          44444444   4444
(PLUS OPERAND(S) WHERE APPROPRIATE)             444444   444
FOLLOWED BY A CARRIAGE RETURN                     4444   4

A = DISPLAY CONTENTS OF ACCUMULATORS
C = CHANGE ACCUMULATOR CONTENTS
D = DISPLAY CONTENTS OF MEMORY
F = BOOT FROM FLOPPY DISK
H = LOAD PROGRAM FROM STREAMER TAPE
J = JUMP WITH ACCUMULATORS AND CARRY RESTORED
K = STORE CONSTANT IN BLOCK OF MEMORY
M = MOVE A BLOCK OF MEMORY
P = PROGRAM LOAD (BOOT) FROM HARD DISK
V = LOAD (@20000) AND RUN HARDWARE VERIFY TEST
: = OPEN SPECIFIC LOCATION TO EXAMINE OR STORE
@ = LOAD DBUG AT 73000
? = DISPLAY THIS MENU
->
```

3. To use any of the functions listed in the Menu, enter a command and command parameters where required.

   See Appendix D for instructions on using MANIP, and a description of the commands and command parameters.

6.2 CHECK OUT THE SYSTEM

If MANIP(ulating) the system does not locate a problem or malfunction, methodically check out the system as described in the following subsections.

6.2.1 Measure the Power Supply Voltages

Using a digital volt meter, measure the voltages of the main power supply and the auxiliary power supply, if present.

On the main power supply, measure the voltages on the backplane at location TB1. See Figure 2-10 for an illustration of color codes and pin locations. Refer to HITS.17 for additional information on CEC and Power One power supply voltages.

On the auxiliary power supply, measure the voltages at the power connector that plugs into the second and third disk drives (drives 1 and 2). The voltages should be as follows: brown wire is ground, red is +5V, and orange is +12V.

6.2.2 Use the System Checkout Procedure

The system checkout procedure is provided in Section 2. It consists of the steps used at installation time to ensure that system components are intact and in place. It includes the instructions for setting baud rates.

6.3 DIAGNOSTICS

There are two types of diagnostics for the MARK 4/4E system: internal, consisting of the hardware verify test; and external, consisting of a number of diagnostic programs. These types of diagnostics are described in the following subsections.

6.3.1 Hardware Verify Test

The hardware verify test can be accessed through MANIP at the operator's discretion. It is normally run for an extended period after the system is installed, and before the operating system is IPLed, to verify the operation of the system as a whole. It should be run periodically to check system operation and when troubleshooting. Once accessed, the hardware verify will run in a continuous loop until an error causes it to HALT, or the operator stops the test by pressing <ESC> or the reset switch (see Sections 3.3.1 and 6.3.1.1).

When troubleshooting, it is important to remember that when MANIP is loaded, it replaces the contents of memory between addresses 77000 and 77777. For this reason, running the hardware verify test should be postponed until other options for locating a problem or malfunction have been tried.

To access the hardware verify test for troubleshooting, use the procedure in Section 6.1.2.

6.3.1.1 SYSTEM HALTS

When a HALT occurs, control of the system returns to MANIP.

Before corrective action can be taken, it is necessary to identify the type of HALT that has occurred. Use the following steps to identify the HALT:

1. Enter A on the master terminal keyboard.

   The program counter, four accumulators and the carry flip-flop are displayed.

2. Record these values for future reference.

3. Subtract one from the program counter.

4. Enter D followed by the octal number from Step 3 and press <ESC> immediately.

   The contents of the memory location containing the HALT are displayed. The HALT code is the word that follows the colon (:). The following example illustrates this procedure.

```
Program   A0      A1     A2    A3    Carry
Counter

2462:    76742   76742   0    2454   0
D2461
2461     73377   16024   <ESC>
```

   The particular HALT code contained at address 2461 is 73377.

5. Refer to the IRIS R9 System Manager Manual for an explanation of the HALT code.

   If POINT 4 help is required, the Software Support Staff may also need the first 20 words of memory starting at location 0.

NOTE

A recurring HALT may indicate a problem that requires future action. The HALT information will be useful to support persons at POINT 4 if assistance is required.

6.3.2 Diagnostic Programs

Diagnostic programs are available from a stand-alone tape, or by shutting down from IRIS to a program stored on logical unit 5. POINT 4 recommends that the diagnostic tape be ordered so that diagnostics are available in the event that IRIS cannot be loaded.

The diagnostic programs available for the MARK 4/4E include the following:

- MARK 2/2E/3/4/4E System Diagnostic 1.9 or later*
- MARK 2/2E/3/4/4E Standard Disk/Diskette/Tape Diagnostic V1.12 or later
- MARK 2/2E/3/4/4E Standard Mux Diagnostic V1.6 or later
- MARK 2E/4/4E Standard Map and Memory Diagnostic V1.6 or later

*Not included on IRIS logical unit 5

6.3.2.1 DIAGNOSTIC TAPES

All the diagnostic programs for the MARK 4/4E are available on a single stand-alone 1/4-inch tape (in either QIC-11 or QIC-24 format). This tape consists of a stand-alone system executive program and six additional tests that are loaded and controlled by the executive program. These programs and tests are referred to as the System Diagnostics. The tape also includes the standard MARK 2/2E/3/4/4E diagnostics. The standard diagnostics may be loaded by the executive program but do not run under system diagnostic executive control.

The System Diagnostic may be used to verify that the MARK 4/4E and all peripherals are operational. It can also be used to detect failing devices. Once detected, the appropriate standard diagnostic program can be loaded and used to isolate and investigate problems.

The Tape test of the System Diagnostic requires operator intervention; the other tests do not. The tests do not stop if an error is encountered; instead they keep a running error count. The System Executive will display an error count for any device at the end of all testing.

For more information on these diagnostic programs and instructions on how to use them, refer to the appropriate diagnostic manual.

6.3.2.2 DIAGNOSTICS ON IRIS LOGICAL UNIT 5

Once the IRIS Operating System is installed, the standard MARK 4/4E diagnostics can be accessed from IRIS logical unit 5. Note that logical unit 5 does not include the System Diagnostic; and if IRIS cannot be IPLed, the standard diagnostics are not available for use.

The names and filenames of the diagnostics shipped with the IRIS Operating System on logical unit 5 are as follows:

- MARK 2/2E/3/4/4E Standard Disk/Diskette/Tape Diagnostic, DI.24TDK.1.12 or later
- MARK 2/2E/3/4/4E Standard Mux Diagnostic, DI.M234MX.1.6 or later
- MARK 2E/4/4E Standard Map and Memory Diagnostic, DI.M4MM.1.6 or later

To shut down from IRIS to a diagnostic program, use the following instructions:

1. At the IRIS prompt (#), enter the SHUTDOWN command followed by a logical unit/diagnostic name as illustrated in the example below. The word "key" represents the SHUTDOWN password; the default is X.

   SHUTDOWN <CTRL-E>key<CTRL-E>5/DI.M4MM.1.6

   The diagnostic program begins to run.

2. If the central processing unit (CPU) halts, press the reset switch located on the front panel.

   The program counter, first four accumulators and the carry flip-flop are displayed on the terminal.

3. Enter J2 on the master terminal keyboard.

   The diagnostic program begins to run.

Section 7
REMOVING AND REPLACING COMPONENTS

This section is for technicians who need to remove and replace a faulty component. Instructions are provided for removing the following components: the power supply, fuse, fans, and the front LED panel.

To remove and replace other components, reverse the installation instructions given for the components in Section 2, Installation, and Section 5, Upgrading the System. The components include the central processing unit (CPU), peripheral interface board (PIB), memory, expansion, disk/floppy controller, and the MARK 4E (16-32) bisynchronous boards, the Pico-N; Winchester disk, streaming cartridge tape and floppy disk drives; auxiliary power supply; and the MARK 4 and MARK 4E port panels.

Before removing any components from a MARK 4/4E system, perform the following preliminary steps:

1. Make certain that all users are logged off the system.

2. Shut down and back up the system.

3. Disconnect the AC power.

7.1 POWER SUPPLY

This section describes the removal of the main power supply and the power supply fuse for the MARK 4/4E system. The main power supply is located in the bottom right side of the chassis (as viewed from the front), and the power fuse is located on the chassis rear.

7.1.1 Main Power Supply

The main power supply currently in use in the MARK 4/4E system is the CEC power supply (513531). The instructions provided below and illustrated in Figure 7-1 are for the current model.

To remove power supply (513531), perform the preliminary steps provided at the beginning of this section, then:

1. Remove the top and right side panels of the cabinet (see Section 2).
2. Remove the two screws, one on each side of the AC outlet, located on the chassis rear.
3. Cut the tie wrap that secures the fan cable to the power supply.
4. Remove all wires on the main power supply at TB2.
5. If the auxiliary power supply is present, remove the three wires that connect the auxiliary power supply to the main power supply at TB1.
6. Remove the two screws that secure the mounting bracket of the power supply to the center frame.
7. Lift the mounting bracket and attached power supply off the notches of the center frame and remove them from the chassis.

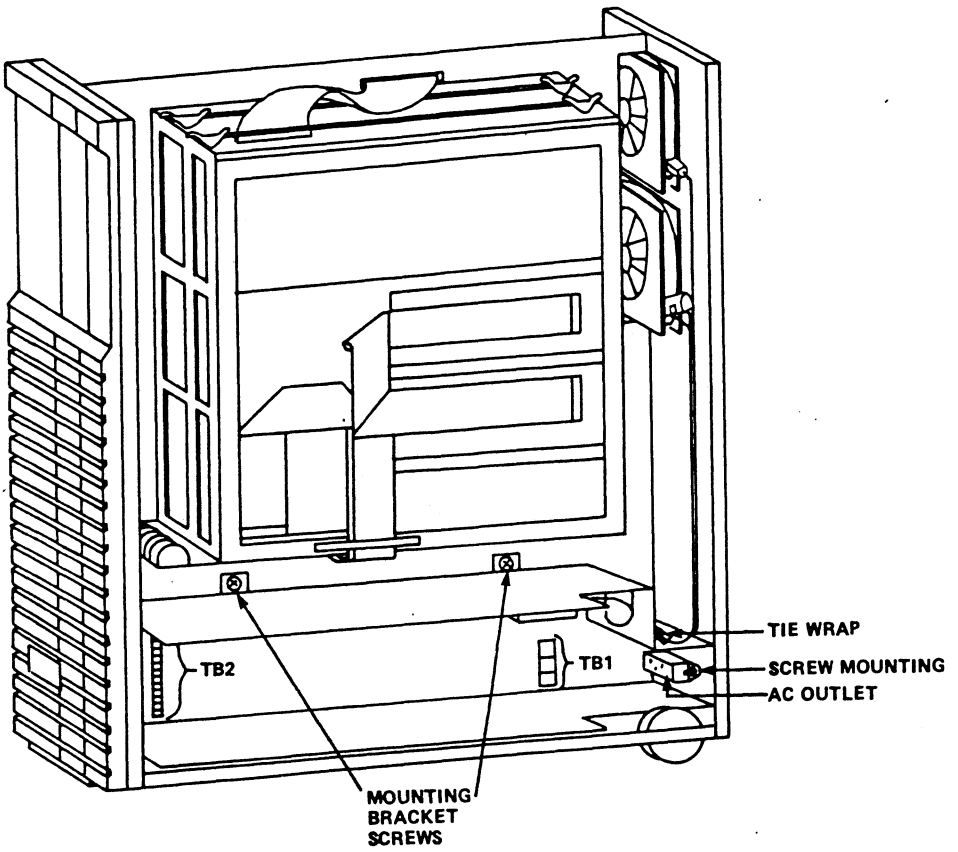
To replace the main power supply, reverse the removal instructions.

NOTE

If removing and replacing the Power One power supply (513530) used in early MARK 4 systems, refer to HITS.17.

7.1.2 Power Fuse

The fuse used in the MARK 4/4E system is five amperes. To remove it, insert a flat head screwdriver into the fuse hold cap, push in and turn counterclockwise until it pops out.



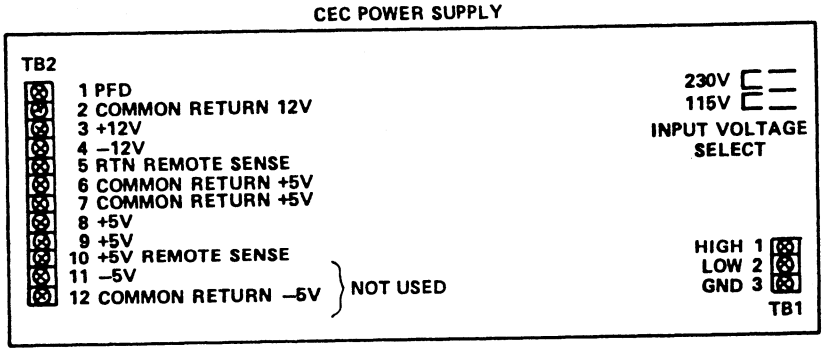


Figure 7-1. Removing the Main Power Supply

7.2 FANS

The MARK 4/4E system has two fans (530009), which are mounted on the chassis rear (see Figure 7-2). To remove the fan(s), perform the preliminary steps provided at the beginning of this section, then:

1. Remove the top and side panels of the cabinet (see Section 2).

2. Unplug the cables that connect the fans to the main power supply.

3. Unscrew the four screws, one located in each corner. Set the screws and fan guards aside and lift the fans out of the chassis.

To replace the fans, reverse the removal instructions. Make certain that the airflow goes out of the system when the power is turned ON. Outward airflow is indicated by the arrow on the fan frame.

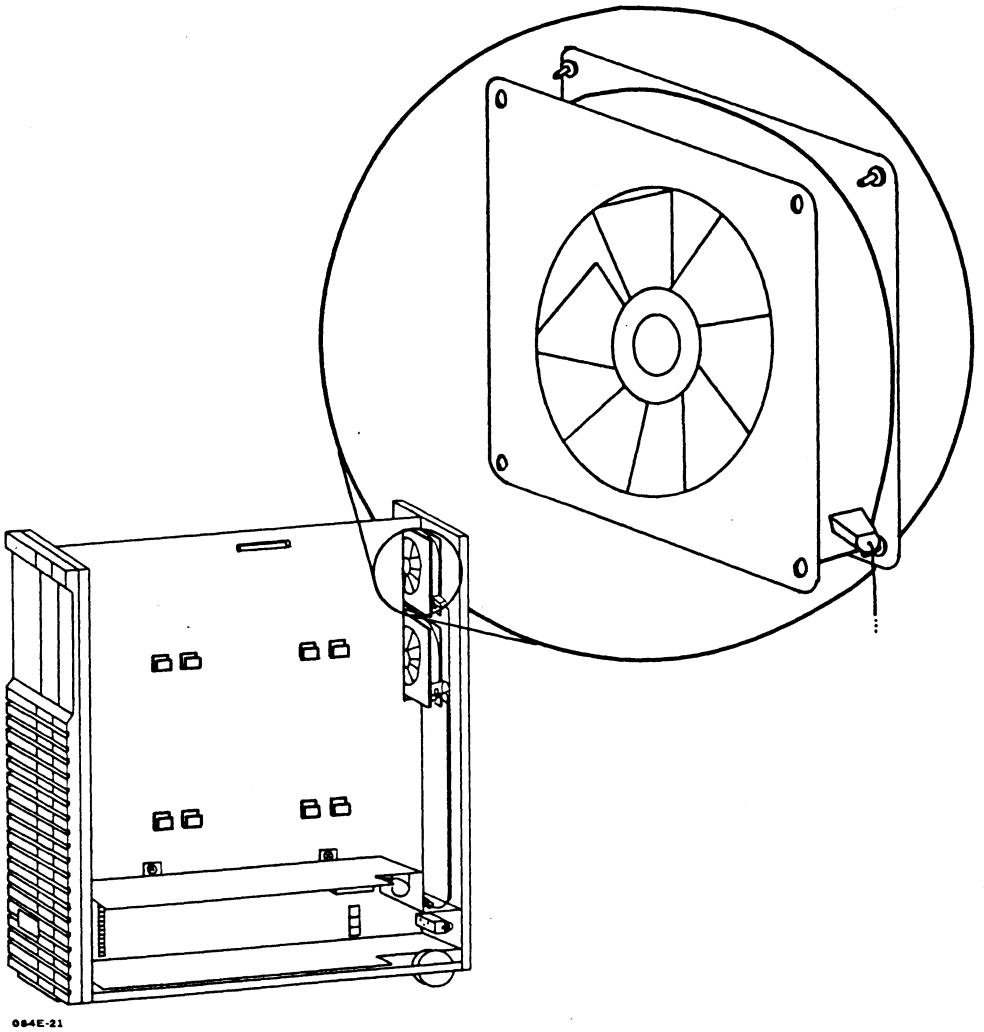


Figure 7-2. Removing the Fans

7.3 LED PANEL

The LED (or display) panel (053007) is located at the upper right side of the chassis as viewed from the front (see Figure 7-3). To remove the panel from the chassis, perform the preliminary steps provided at the beginning of this section, then:

1. Remove the top and right side panels from the cabinet (see Section 2).

2. Unplug the cables connected to the LED panel.

3. Pinch the three plastic standoffs, located at the top corners and the middle of the bottom, and pull the board off the stand-offs.

To replace the LED panel, reverse the removal instructions.

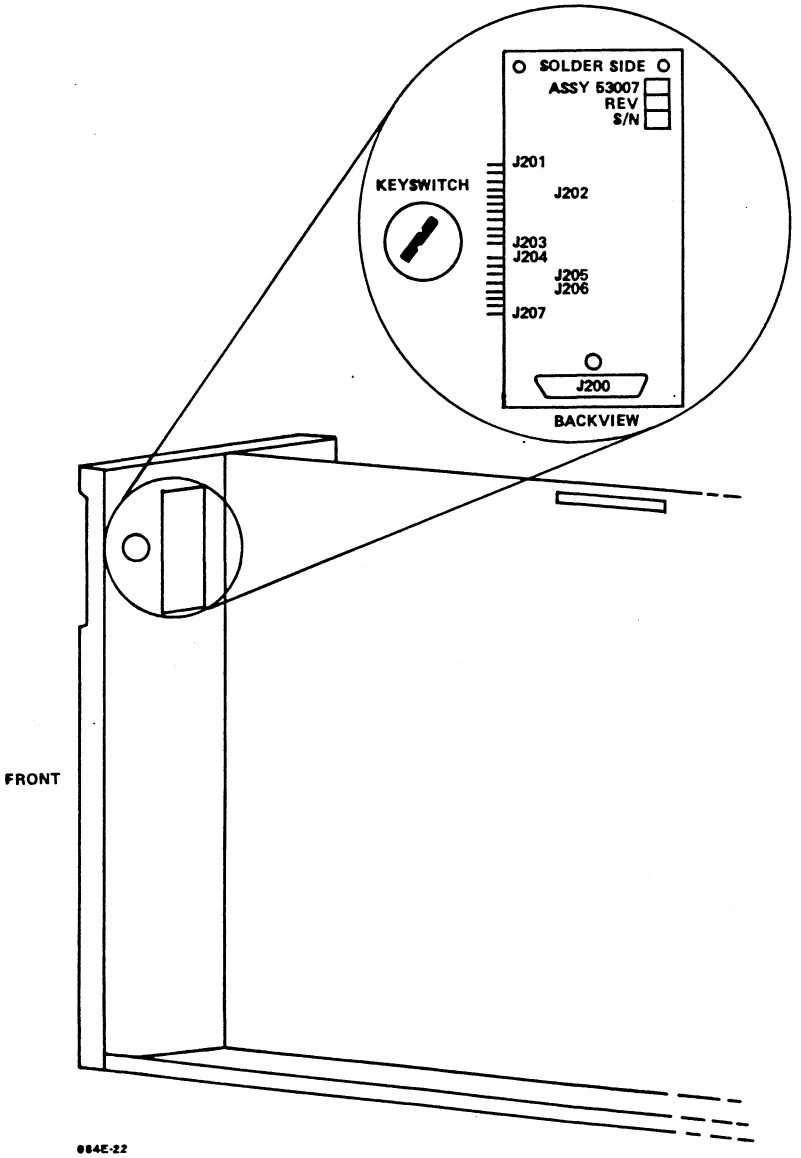


Figure 7-3. Removing the LED Panel

Section 8
POWER-FAIL INSTRUCTIONS

This section explains what happens during a power failure, and it provides a procedure to follow to determine what, if any, information has been lost as a result of a power failure.

When a power failure occurs, the MARK 4/4E power supply generates a warning signal, and the IRIS Operating System terminates operation.

When the power returns, one of the following occurs:

- If the keyswitch is set to AUTO, an automatic IPL (Initial Program Load) occurs, and the system is ready to use.
- If the keyswitch is set to ON, MANIP is loaded, and the user must enter P at the master terminal keyboard to IPL (Initial Program Load). The system is then ready to use.

After a power failure, the more appropriate of the following procedures should be used:

Procedure 1

1. IPL (Initial Program Load) the system.
2. Check the information entered on the system just prior to the power failure and check backward to determine if and what information was lost.
3. If it is determined that information has been lost, reenter the lost information.

Procedure 2

1. Insert the most recent backup tape(s) into the tape drive and perform a Restore.
2. IPL (Initial Program Load) the system.
3. Reenter all data from the time of the backup to the power failure.

APPENDICES

Appendix A
SPECIFICATIONS

A.1 PHYSICAL

Tower-Style Cabinet

Height:	24.0 inches (60.0 cm)
Width:	8.0 inches (20.0 cm)
Depth:	22.0 inches (55.0 cm)
Weight:	75 pounds (34 kgs)

A.2 POWER REQUIREMENTS

The power requirements for the MARK 4/4E system are as follows:

1. AC Wiring

   POINT 4 recommends a three-wired line (AC high, AC low and AC earth ground) free of excessive noise. Sharing a line with equipment that draws high energy such as a motor, or turns on and off repeatedly can adversely affect system performance.

2. Main Power Supply

   a. AC Input Power

      The required AC inputs for the MARK 4/4E power supply are:

      Voltages: 90-130 volts
      180-260 volts

      Frequency: 47-63 Hz

      Fuse: 5 amps (U.S.)
      3 amps (international)

   b. DC Output Power

      The power supply is rated at 250 watts. It provides power for all logic plus one Winchester disk drive, one streaming cartridge tape drive and one floppy disk drive. In the event that a system has more than one Winchester disk drive, an auxiliary power supply is required. Table A-1 lists voltages, amperes and tolerances for the MARK 4/4E system.

   c. Heat Dissipation: 852 BTUs

TABLE A-1. MARK 4/4E VOLTAGES, AMPERES, AND TOLERANCES

Voltage	Maximum Amps	Tolerance
+5V	20.0	5%
+12V	4.0	5%
-12V	1.0	5%
-5V (not used)	1.0	5%

3. Auxiliary Power Supply

The auxiliary power supply is required on any MARK 4/4E system that has more than one Winchester disk drive. It is rated at 85 watts. Table A-2 lists the voltages, amperes, and tolerances for the auxiliary power supply.

TABLE A-2. MARK 4/4E AUXILIARY POWER SUPPLY VOLTAGES, AMPERES, AND TOLERANCES

Voltage	Maximum Amps	Tolerance
+5V	8.0	5%
+12V	5.0	5%

A.3 ENVIRONMENTAL

1. Placement

   A MARK 4/4E system is normally placed under or beside a desk. It should have free air circulation at the front and rear sides, and it should be out of direct sunlight.

2. Temperature

Operating:	+40 to 95° F
	+5 to 35° C
Non-Operating:	-20 to +140° F
	-30 to +60° C

3. Humidity

Operating:	20 to 80% non-condensing
Non-Operating:	5 to 95% non-condensing

A.4 MARK 4 AND MARK 4E BOARD TYPES

Original MARK 4	
CPU, 53003	Addresses up to 512KB memory
Memory, 53002-02	512KB
PIB, 53001-01	Supports ST506 disk drives, 1MB floppy disk drive, QIC-02 streamer interface and 8 asynchronous ports
Port Expansion, 53000-01	Supports 8 asynchronous ports
Extended MARK 4	
CPU, 53027*	Addresses 512KB, 1, or 2MB memory
Memory, 53002-02 53026-01 53026-02	512KB memory 1MB memory 2MB memory
PIB, 53018-01	Same as PIB 53001 with added bisynchronous capability
Port Expansion, 53019-01	Supports 8 asynchronous ports
Port Expansion, 53019-03	Supports 8 asynchronous ports and one bisynchronous port
MARK 4E (8-16 Ports)	
CPU, 53027-02**	Addresses 512KB, 1, or 2MB memory and contains MARK 4E PROM set
Memory, 53002-02 53026-01 53026-02	512KB memory 1MB memory 2MB memory
PIB, 53018-01	Same as PIB 53001 with added bisynchronous capability
Port Expansion, 53019-01	Supports 8 asynchronous ports
Port Expansion, 53019-03	Supports 8 asynchronous ports and one bisynchronous port
MARK 4E (16-32 Ports)	
CPU, 53027-01	Addresses 512KB, 1, or 2MB memory and contains MK 4E PROM set for 16-32 ports
Memory, 53002-02 53026-01 53026-02	512KB memory 1MB memory 2MB memory
PIB, 53037	Supports 16 asynchronous ports and one bisynchronous board
Port Expansion, 53038	Supports 16 asynchronous ports
Bisynchronous, 53039-02	Bisynchronous board, one port

*Converting CPU 53027 Rev A to 53027-01 requires ECO 2131; CPU 53027 Rev B to 53027-01 requires ECO 1910A; CPU 53027 Rev B to 53027-02 Rev B requires ECO 1957A. Each requires a PROM set change.

**Converting CPU 53027-02 to 53027-01 requires only a PROM set change.

A.5 MARK 4 AND MARK 4E COMPATIBILITY CHART

Board	Part No.	CPU 53003 53027 53027-02 53027-01	Memory 53002-02 53026-01 53026-02	PIB 53001-01 53018-01 53037	Port Exp 53000-01 53019-01 53019-03 53038	Bisync 53019-03 53039-02
Original MARK 4s						
CPU	53003	1 / / /	Y N N	Y Y N	Y Y 2 N	2 N
Memory 512KB	53002-02	Y Y Y Y	/ / /	Y Y Y	Y Y Y Y	Y Y
PIB 8-port	53001-01	Y Y Y 3	Y Y Y	/ / /	Y 4 2 N	2 N
Port Exp 8-port	53000-01	Y Y Y 3	Y Y Y	Y Y N	/ / / /	/ N
Extended MARK 4s						
CPU	53027	/ / / /	Y Y Y	Y Y 5	Y Y Y 5	6 5
Memory 1MB/2MB	53026-01/02	N Y Y Y	/ / /	Y Y Y	Y Y Y Y	Y Y
PIB 8-port	53018-01	Y Y Y 3	Y Y Y	/ / /	Y Y Y N	Y N
Port Exp 8-port	53019-01	Y Y Y 3	Y Y Y	4 Y N	/ / / /	Y N
Port Exp w/bisync	53019-03	2 6 Y 3	Y Y Y	2 Y N	/ / / /	/ /
MARK 4E (8-16)						
CPU 8-16 port	53027-02	/ / / /	Y Y Y	Y Y 7	Y Y Y 7	Y 7
Memory 512KB	53002-02	Y Y Y Y	/ / /	Y Y Y	Y Y Y Y	Y Y
PIB 8-port	53018-01	Y Y Y 3	Y Y Y	/ / /	Y Y Y N	Y N
Port Exp 8-port	53019-01	Y Y Y 3	Y Y Y	4 Y N	/ / / /	/ N
Port Exp w/bisync	53019-03	2 6 Y 3	Y Y Y	2 Y N	/ / / N	/ /
MARK 4E (16-32)						
CPU 16-32 port	53027-01	/ / / /	Y Y Y	3 3 Y	3 3 3 Y	3 Y
Memory 1MB/2MB	53026-01/02	N Y Y Y	/ / /	Y Y Y	Y Y Y Y	Y Y
PIB 16-port	53037	N 5 7 Y	Y Y Y	/ / /	N N N Y	N Y
Port Exp 16-port	53038	N 5 7 Y	Y Y Y	N N Y	/ / / /	N Y
Bisync	53039-02	N 5 7 Y	Y Y Y	N N Y	N N N Y	/ /

Symbols

/ - Not Applicable

Y - Compatible

N - Not compatible

1 - For firmware Revision 3 or higher, must have ECO 1395 and 1678; these ECOs may correct a MAPACTIVATE problem

2 - Async ports will work but not bisync

3 - Must have PROM set for 8-16 port CPU; CPU becomes 53027-02

4 - PIB must be Revision P3 or later

5 - CPU must have a complete MARK 4E PROM set and ECO (see footnote in A.4) CPU becomes 53027-01

6 - CPU must have firmware of Revision 5 or later

7 - Must have PROM set for 16-32 port CPU; CPU becomes 53027-01

A.6 MARK 4/4E PROM REVISIONS

FIRMWARE **Locations 8D through 17D**	**CPU Assy**	**Revision**
Initial release	53003	1
Timing problem with disk controller; no alternate sectors w/IRIS	53003	2
Correct data channel; also must have ECO 1395	53003	3
Not issued		4
Allows Bisync	53027	5
Corrects streaming tape w/Bliss-Cobol software	53027	6
Initial release for MARK 4E w/16-32 ports; new PROM code ID	53027-01	091022
Initial release for MARK 4E w/8-16 ports	53027-02	091028

APL MANIP **Locations 4F and 6F**	**CPU Assy**	**Revision**
Initial release	53003	1
Added "F" Command for floppy boot	53003	2
Enhancements to MANIP and Self-Test program	53003	3
Change Self-Test to test 1 and 2MB memory	53027	4
Initial release for MARK 4E w/16-32 ports; new PROM code ID	53027-01	091024
Initial release for MARK 4E w/8-16 ports	53027-02	091030

VECTOR at Location 19D **EXCEPTION at Location 17B**	**CPU Assy**	**Revision**
Initial release for MARK 4	53003 53027	1
Initial release for MARK 4E w/16-32 ports w/8-16 ports (new PROM code ID)	53027-01 53027-02	091023

Appendix B
TAPE CARTRIDGES AND FLOPPY DISKS

Streaming tape cartridges and floppy disks are media on which computer programs and information are stored. Both media are sensitive and need to be handled carefully to ensure that the tape or floppy disk drives can read and write reliably. This appendix contains information and/or instructions about the proper care and handling of streaming tape cartridges and floppy disks.

B.1 1/4-INCH TAPE CARTRIDGE

With proper care, the typical life of a tape cartridge is up to 5000 track passes. The information and instructions provided below will help to ensure reliable operation and long life.

B.1.1 Specifications

A 1/4-inch streaming tape cartridge drive with a QIC-02 interface is standard. It is available in 45/60MB or 125/150MB capacities. Table B-1 lists tape cartridge types and functions.

TABLE B-1. CARTRIDGE TYPES AND FUNCTIONS

Drive Capacity	POINT 4 Order No.	Cartridge Type	Functions Supported
45/60MB	QCT0200	DC300XLP	Read/Write QIC-24 Read only QIC-11
125/150MB	QCT0270	DC600XTD	Read/Write QIC-150 Read only QIC-120 Read only QIC-24 Read only QIC-11
	QCT0250	DC600A	Read/Write QIC-120 Read only QIC-24 Read only QIC-11
	QCT0200	DC300XLP	Read only QIC-24 Read only QIC-11

B.1.2 Labeling

Each tape cartridge should be labeled with the date of creation, a description of the tape contents, and any other relevant information. The label should be placed on the plastic top of the cartridge and not on the metal bottom plate.

B.1.3 Storage

When not in use, the tape cartridge should always be returned to its protective case and stored at a temperature that is similar to that of the computer room. If this is not possible, condition tape cartridges before use by exposing them to the operating environment temperature for a time equal to or greater than the time away from the operating environment temperature.

B.1.4 Handling a Tape Cartridge

Incorrect handling can adversely affect tape performance.

Avoid the following: touching the recording media, having the cartridge close to magnetic fields and magnetic materials, manually moving the tape from one hub to another, and incorrect tape tension. Incorrect tape tension can be caused by any of the following: physical shock, temperature change, sitting on a shelf or start/stop operations (such as reading a stand-alone tape or a tape with errors).

To help ensure correct tape tension, retension the tape before each use. To retension a tape, use the RETENSION command of DISCUTILITY: a 1/4-inch tape requires Rev 2.3 or later.

B.1.5 Write-Protecting a Tape Cartridge

The tape cartridge has a write-protect plug which can be rotated before the cartridge is inserted into the drive to either permit or prohibit writing to the tape. If the user is allowed to read from and write to the tape, use a screwdriver to rotate the plug so that the arrow points away from SAFE. If the user is only allowed to read from the tape, make certain the arrow of the drive plug point to SAFE (see Figure B-1).

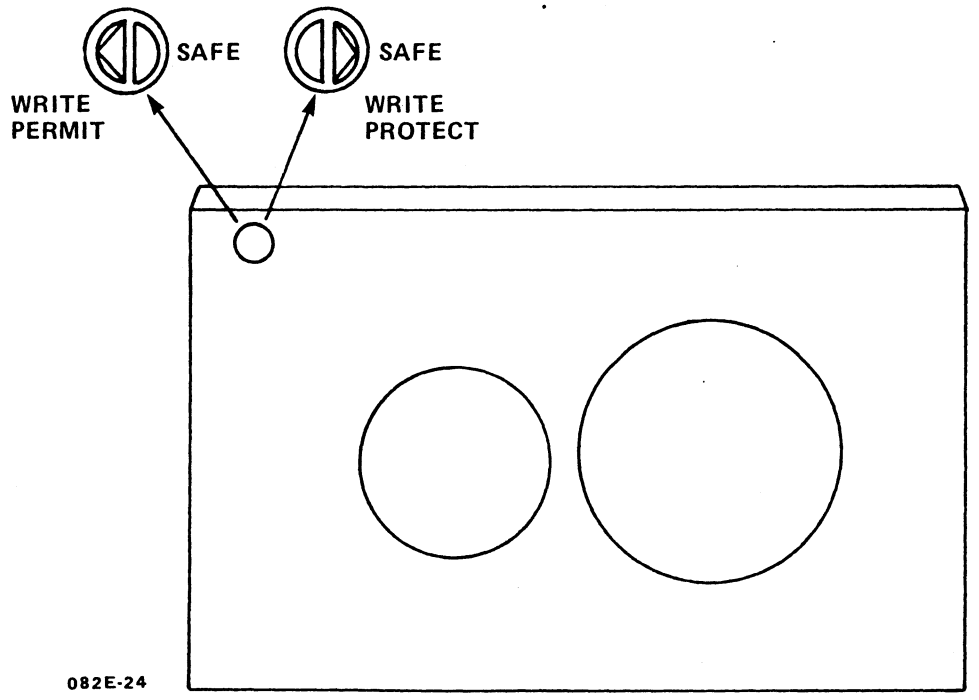


Figure B-1. Write-Protecting a Tape Cartridge

B.1.6 Inserting and Removing a Tape Cartridge

Once the tape cartridge has been removed from its protective case, and the write-protect plug is set as desired, insert the tape cartridge into the drive as follows (see Figure B-2):

1. Insert the cartridge into the tape drive opening and push it in until it stops.

   The drive is designed so that the tape cartridge can be inserted only in the correct way.

2. Move the loading lever toward the cartridge to lock the cartridge into it operating position.

To remove the tape cartridge from the tape drive:

1. Push the loading lever away from the cartridge.

2. When the tape cartridge ejects, remove it from the tape drive.

3. Return the tape cartridge to its protective case.

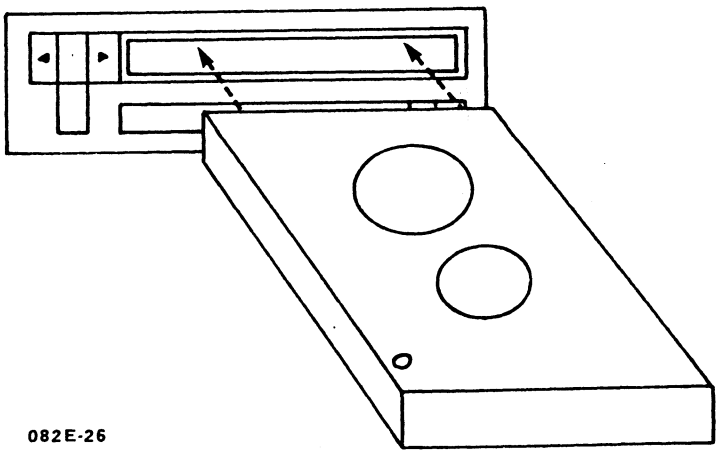


Figure B-2. Inserting the Tape Cartridge into the Tape Drive

B.1.7 Cleaning a Tape Cartridge

To prevent tape problems from occurring, establish a regular cleaning routine. The read/write/erase heads of the tape cartridge should be cleaned after each initial pass with a new tape cartridge and after every eight hours of normal use. The sensor openings and cartridge cavity should be cleaned whenever dust or dirt are visible. **Before doing any cleaning, turn off power to the tape drive.**

Clean heads with a lint free swab and Freon TF. Do not use solutions that contain alcohol or water. Cartridge cleaning kits can be ordered from POINT 4.

Clean the sensor heads and cartridge cavity by carefully blowing out dust or dirt with low pressure air from an aerosol can of dry air.

B.2 FLOPPY DISKS

B.2.1 Specifications

POINT 4 recommends using only high quality floppy disks. They should be 5-1/4-inch, double density, dual-sided 96 TPI (tracks per inch) certified for a 1MB drive. Floppy disks that do not conform to these specifications may result in lost information.

B.2.2 Labeling

Each floppy disk should be labeled with the date of creation, a description of the contents, and other relevant information. Ideally, the label should be written on before it is affixed to the floppy disk. If a label is affixed before writing on it, make certain to use only a felt tip pen to write the disk label. Pens or pencils can dent the disk or deposit harmful particles on it.

B.2.3 Storage

When not in use, the floppy disk should always be returned to its storage envelope and stored in a cool, dry place.

Keep the disk away from magnetic fields and magnetic material.

B.2.4 Handling a Floppy Disk

Incorrect handling can adversely affect floppy disk performance.

Avoid the following: touching the disk surface exposed by the jacket slot, fastening paper or other clips to the jacket edges, and cleaning the disk.

Protect the floppy disk from liquids, dust, and metallic substances.

B.2.5 Write-Protecting a Floppy Disk

The floppy disk has a write-protect notch on one side of its protective jacket. If the notch is left uncovered, the user can read from or write to the disk. To prevent the user from writing to the disk, the notch can be covered with a tab (see Figure B-3).

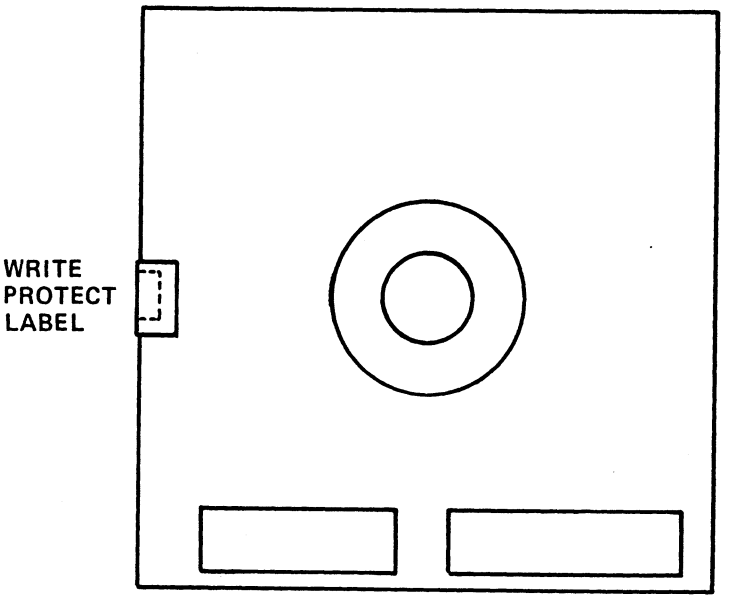


Figure B-3. Write-Protecting a Floppy Disk

B.2.6 Inserting and Removing a Floppy Disk

Once the floppy disk has been removed from its storage envelope and the write-protect notch has been covered with a tab (if required), insert the disk into the floppy disk drive as follows (see Figure B-4):

1. Turn the locking lever on the front of the floppy disk drive to right and up.

2. Hold the floppy disk so that the label is facing up and the write-protect notch is to the left and insert it into the disk drive.

3. Turn the locking lever down to hold the disk in place and to engage the read/write heads of the drive.

   While the drive is reading from or writing to the floppy disk, the disk drive indicator is lighted. When the indicator is not lighted, the task of reading or writing is completed; the floppy disk can be removed from the drive.

To remove a floppy disk drive:

1. Turn the locking lever to the right and up.

2. Remove the floppy disk. Label and store it as directed.

   When not in use, the locking lever should remain in the upright position to prevent damage to the read/write heads of the drive.

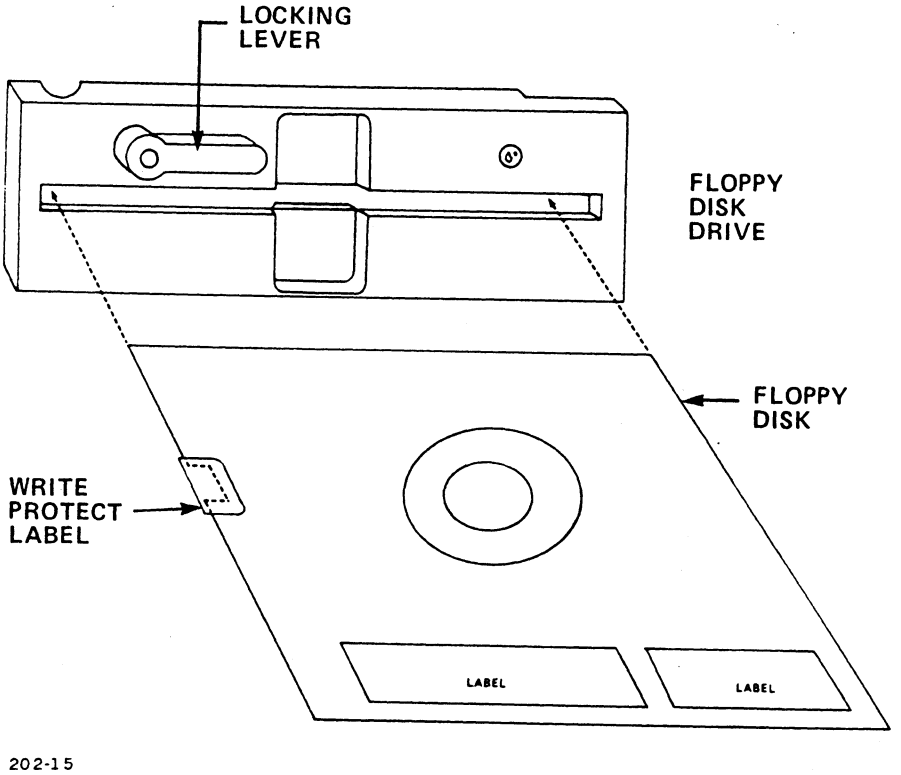


Figure B-4. Inserting a Floppy Disk into the Floppy Disk Drive

Appendix C
CABLING TO EXTERNAL PERIPHERALS

This appendix provides information and recommendations about the cables and connectors used to connect POINT 4 computer systems to external peripherals such as terminals, printers, or modems. Implementing the recommendations can help protect systems from crosstalk that may result in interrupts, errors, system halts, or slowdowns; and from static discharge and lightning.

C.1 CABLES

POINT 4 recommends using shielded RS232 cables.* Shielded cables are required for FCC compliance. The shield portion of a cable should have a good electrical connection to earth ground at both ends of the cable, and it should be tied to earth ground at the point of exit from the building.

Cable wires that are not used by external peripheral devices should be disconnected at both ends. To disconnect an unused wire in a DB25-to-DB25 cable, cut the wire at each connector. To achieve a similar effect with a cable ending in a RJ45 connector, ground unused signals at the DB25 end of the cable.

*Shielded RS232 cables are available from POINT 4, outside vendors, or they can be assembled as required.

C.2 GROUNDING CONNECTORS

POINT 4 uses two types of connectors to attach cables to external peripherals: a modular telephone type 8-pin RJ45 connector and a 25-pin DB connector. Connectors at the computer end may be either RJ45s or DB25s; connectors at the external peripheral device end are DB25s. To ground DB25 connectors, see Section C.2.1; for RJ45 connectors, see Section C.2.2.

C.2.1 Grounding DB25 Connectors

When used at the computer end, DB25 connectors attach to a model 322 connector panel. On older revisions, pin 1 of all ports are connected together, but they are not connected to chassis ground. To ground the connectors, do one of the following (see Figure C-1).

- Order a cable (88082) and two quick disconnect lugs (725034). Solder the quick disconnect lugs to the grounding points on the 322 connector panel. Screw the ring lug to the chassis frame and push the quick disconnect of the cable onto the nearest grounding point.

- Create a cable from minimum 16-gauge wire. Solder it onto the grounding point nearest to the chassis frame. Run the cable to frame ground and attach it by means of a lug and screw.

On newer revisions, a ground wire is included. Push on the cable (as indicated in Figure C-1) and screw it to frame ground.

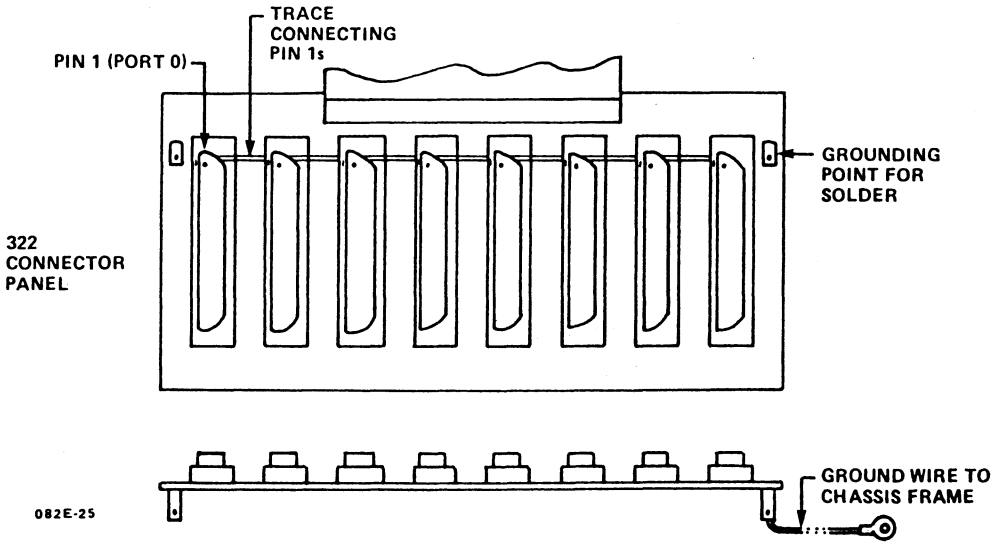


Figure C-1. Chassis Ground Points on a 322 Connector Panel

On a MARK 4, fasten the ground wire to the inside of the chassis rear as follows: fasten the end with the push-on connector to the lug on the 8-port panel and the end with a ring lug to the threaded stud above the port panel.

C.2.2 Grounding RJ45 Connectors

To ground RJ45 connectors, make certain that the following connections are made:

- On a MARK 2E, secure the screw that connects each computer board support bracket to the metal frame of the chassis.
- On a MARK 4E, secure the screws in the metal standoffs that connect the port panel to the chassis rear.
- On a MARK 5/5E/6/6E/8/9/12/12E secure the screws that fasten each port panel board to the I/O panel.

C.3 CABLE WIRING DIAGRAMS

POINT 4 recommends that cables be wired according to the diagrams provided in this appendix. Diagrams are provided for the following:

- Modular-to-DB25 signal list

  - Wiring diagram for modular-to-DB25 CRT cable
  - Wiring diagram for modular-to DB25 printer cable
  - Wiring diagram for modular-to-DB25 modem cable - asynchronous port

- Signal list for POINT 4 computers with DB25 connectors

  - Wiring diagram for DB25-to-DB25 CRT cable
  - Wiring diagram for DB25-to-DB25 printer cable
  - Wiring diagram for DB25-to-DB25 modem cable - asynchronous port

- Bisynchronous interface signals

If assembling cables and connectors, first see Section C.4.

C.3.1 Modular-to-DB25 Signal List

Async Board Jack	SYSTEM END Modular Plug				DEVICE END
10-Pos #	8-* Pos #	6-Pos #	Signal Name		DB25 Pin #
1			CHASGND (SHIELD)		
2 -----	1		CHASGND (SHIELD)	---	1
3 -----	2 -----	1	CONTROL OUT	-->	8
4 -----	3 -----	2	DATA OUT	-->	3
5 -----	4 -----	3	STATUS IN	<--	20
6 -----	5 -----	4	DATA IN	<--	2
7 -----	6 -----	5	SIGNAL GND	---	7
8 -----	7 -----	6	SIGNAL GND		
9 -----	8		SPARE		
10			SPARE		

*The 8-pin connector allows for the use of shielded cables. Shielded cables must be used to meet FCC requirements (see Figure C-2).

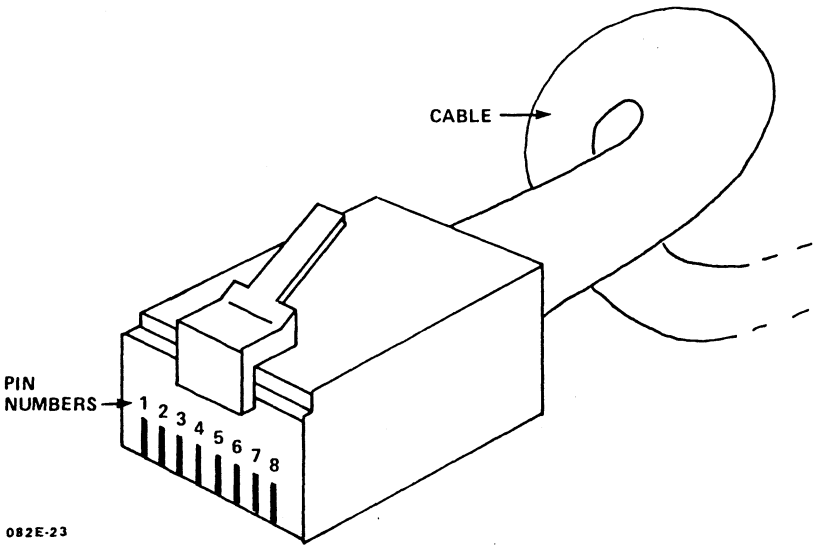


Figure C-2. 8-Pin Modular Connector

C.3.1.1 WIRING DIAGRAM FOR MODULAR-TO-DB25 CRT CABLE

The CRT cable should have all the signals required for a CRT. It should also work with printers that use X-ON/X-OFF instead of a busy signal.

Unused wires should not be connected at either end of the cable.

SYSTEM END Position # in 8-position Modular Plug	POINT 4 Signal Description		DEVICE END DB25 Pin #	
1	SHIELD	---	1	
2				
3	DATA OUT	-->	3	
4		---	20	*
5	DATA IN	<--	2	
6	SIGNAL GROUND	---	7	
7				
8				

*Since this signal is not required by most CRTs, it is recommended that this signal be cut at both ends. If that is not possible, then ground the signal at the device end of the cable.

C.3.1.2 WIRING DIAGRAM FOR MODULAR-TO-DB25 PRINTER CABLE

This cable should work with printers that use a busy signal instead of X-ON/X-OFF.

Unused wires should not be connected at either end of the cable.

SYSTEM END Position # in 8-position Modular Plug	POINT 4 Signal Description		DEVICE END DB25 Pin #
1	SHIELD	---	1
2			
3	DATA OUT	-->	3
4	STATUS IN	<--	20*
5			
6	SIGNAL GROUND	---	7
7			
8			

*This signal is the printer busy signal commonly called "DTR". Some printers provide this signal on other pins, such as pins 11 or 19. The MARK 2E/4/4E requires this signal be high=ready, low=busy (-3 volts).

Although the 310 multiplexer can be programmed to accept either high or low as busy, POINT 4 recommends setting it as high=ready, low=busy.

C.3.1.3 WIRING DIAGRAM MODULAR-TO-DB25 MODEM CABLE - ASYNCHRONOUS PORT

SYSTEM END Position # in 8-position Modular Plug	POINT 4 Signal Description		DEVICE END DB25 Pin #
1	SHIELD	---	1
2	CONTROL OUT	-->	20*
3	DATA OUT	-->	2
4	STATUS IN	<--	8**
5	DATA IN	<--	3
6	SIGNAL GROUND	---	7
7			
8			

*Some modems require this signal, which is commonly called DTR, to operate. If the modem does not use this signal, POINT 4 recommends cutting this wire.

**On the 310 multiplexer, this signal, which is commonly called "carrier detect", is used to initiate an auto log-off. POINT 4 recommends this feature for modem ports.

On the MARK 2E and 4E, this signal must be ground, busy, or high to enable system data exchange. A low (-3 volts) to the system inhibits data exchange.

C.3.2 Signal List for POINT 4 Computers with DB25 Connectors - Asynchronous Port

SYSTEM END Pin # in DB25 Connector	Signal Name/Description	
1	CHASSIS GND	---
2	DATA IN	<--
3	DATA OUT	-->
7	SIGNAL GND	---
8	CONTROL OUT (DTR)	-->
20	STATUS IN (BUSY)	<--

C.3.2.1 WIRING DIAGRAM FOR DB25-TO-DB25 CRT CABLE

This cable should work with CRTs and printers that use X-ON/X-OFF instead of a busy signal.

Unused wires should not be connected at either end of the cable.

SYSTEM END DB25 Pin #	POINT 4 SIGNAL Description		DEVICE END DB25 Pin #
1	SHIELD	---	1
2	DATA IN	<--	2
3	DATA OUT	-->	3
7	SIGNAL GROUND	---	7

C.3.2.2 WIRING DIAGRAM FOR DB25-TO-DB25 PRINTER CABLE

This cable should work with printers that use a busy signal instead of X-ON/X-OFF. For printers that use X-ON/X-OFF, see C.3.2.1.

Unused wires should not be connected at either end of the cable.

SYSTEM END DB25 Pin #	POINT 4 SIGNAL Description		DEVICE END DB25 Pin #
1	SHIELD	---	1
3	DATA OUT	-->	3
7	SIGNAL GROUND	---	7
20	STATUS IN	<--	20*

*This signal is the printer busy signal commonly called "DTR". Some printers provide this signal on other pins, such as pins 11 or 19. The MARK 4 requires this signal be high=ready, low=busy (-3 volts).

Although the 310 multiplexer can be programmed to accept either high or low as busy, POINT 4 recommends setting it as high=ready, low=busy.

C.3.2.3 WIRING DIAGRAM FOR DB25-TO-DB25 MODEM CABLE - ASYNCHRONOUS PORT

Unused wires should be cut at both ends.

SYSTEM END DB25 Pin #	POINT 4 SIGNAL Description		DEVICE END DB25 Pin #
1	SHIELD	---	1
2	DATA IN	<--	3
3	DATA OUT	-->	2
7	SIGNAL GROUND	---	7
8	CONTROL OUT	-->	20*
20	STATUS IN	<--	8**

*Some modems require this signal, which is commonly called DTR, to operate. If the modem does not use this signal, POINT 4 recommends cutting this wire.

**On the 310 multiplexer, this signal, which is commonly called "carrier detect", is used to initiate an auto log-off. POINT 4 recommends this feature for modem ports.

On the MARK 4, this signal must be ground, open, or high to enable system data exchange. A low (-3 volts) to the system will inhibit data exchange.

C.3.3 Bisynchronous Interface Signals

Bisynchronous interface signals are relevant only for POINT 4 computers that support a bisynchronous port.

SYSTEM END Pin # in DB25 Connector	Description	
1	SHIELD	---
2	DATA OUT	-->
3	DATA IN	<--
4	REQUEST TO SEND	-->
5	CLEAR TO SEND	<--
6	DATA SET READY	<--
7	SIGNAL GROUND	---
8	CARRIER	<--
15	TRANSMIT CLOCK	<--
17	RECEIVE CLOCK	<--
20	DATA TERMINAL READY	-->

All signals are straight through to modem.

C.4 CRIMPING TOOLS FOR MODULAR PLUGS

Standard modular plugs are crimped onto the end of cables. They require a good crimping tool to avoid incorrect crimping, missing some of the pins, and damage to the jacks into which the plugs are connected.

To make cables, POINT 4 suggests that a quality crimping tool be used. Such crimping tools are available from distributors of telephone wiring equipment and connectors. Although more expensive (about $150.00), a good crimping tool will make good crimps every time and will outlast many others.

Appendix D
MANIP

MANIP is a program that allows the user to display and examine the contents of memory on the master terminal for the purpose of locating problems. This appendix provides information on how to use MANIP and lists the MANIP commands and definitions (see Table D-1). For more information on MANIP, see Section 6.1.

To use MANIP, a command and command parameters (where required) must be entered on the master terminal keyboard. A command consists of a single letter (the command identifier) and parameters that specify addressing modes, memory addresses and data input. All parameters must be entered in octal. The letters x, y and z are used to represent octal parameters.

If an error is made while entering a command, correct it by using one of the following:

1. Press <ESC> or any other control character except <RETURN> to delete the entry and then enter the command again.

2. If an error is made when entering an octal value, enter several zeros and then the correct octal number. Only the last six octal digits will be used.

TABLE D-1. MANIP COMMANDS (1 of 3)

Command & Parameters	Definition
A	Causes the program counter, the contents of accumulators A0, A1, A2, A3, and the carry flip-flop to be displayed on the master terminal as they were at the time MANIP was entered.
Cx,y	Change accumulator or carry flip-flop: • If x is 0, 1, 2, or 3, then y is stored as saved value for accumulator x (A0, A1, A2, A3, respectively). • If x is 4, then saved value of the carry flip-flop is set equal to the LSB of y • Parameter description x - 1 octal digit 0-4 y - 1 word octal
Dx	Dump memory in octal, beginning at location x. Eight words are displayed per line, with the address of the first word at the beginning of each line. • Parameter Description x - octal number representing a 16-bit memory address
F	Reads block 0 from floppy disk and idles at 377 waiting to be overwritten by DMA from floppy disk.
H	Reads block 0 of a 45MB (QIC-24) or a 125 or 150MB (QIC-120 or QIC-150 respectively) tape and idles at 377 waiting to be overwritten by DMA from tape.
H46	Reads block 0 of a 20MB (QIC-11) tape. Following an H46 command, the drive cannot read 45MB (QIC-24) tapes until a tape RESET command is issued or the MARK4/4E power has been turned OFF and ON. Does not apply to 150MB tape.

TABLE D-1. MANIP COMMANDS (2 of 3)

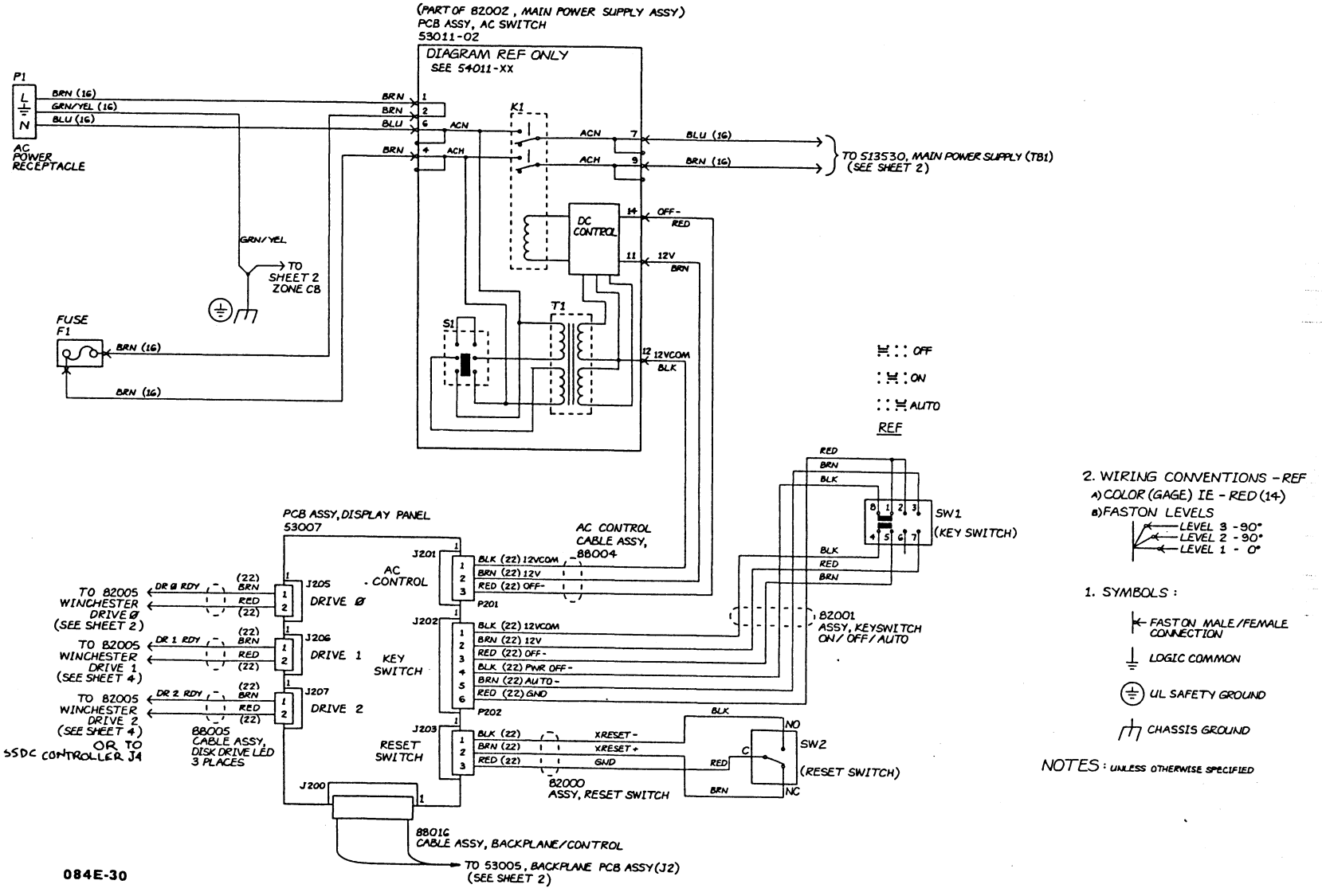
Command & Parameters	Definition
Jx	Jump to location x after restoring accumulator and carry values. • Parameter Description x - octal number representing 16-bit memory address
Kx,y,z	Store the octal constant z in locations x through y, inclusive. • Parameter Description x - octal number representing 16-bit beginning memory address y - octal number representing 16-bit ending memory address z - octal number representing constant
Mx,y,z	Move block in memory. Locations x through y, inclusive, are moved to area starting at location z. • Source and destination areas may overlap in either direction without bad effects. • May be used to move MANIP itself as long as destination area does not overlap source area. • Parameter Description x - octal number representing 16-bit beginning memory address y - octal number representing 16-bit ending memory address z - octal number representing 16-bit beginning memory address of new location
P	Initial Program Load from disk (Sector 0, Surface 0, Cylinder 0). Performs standard bootstrap APL function (i.e., starts DMA action and then idles at location 377 waiting for the disk to overwrite that location).

TABLE D-1. MANIP COMMANDS (3 of 3)

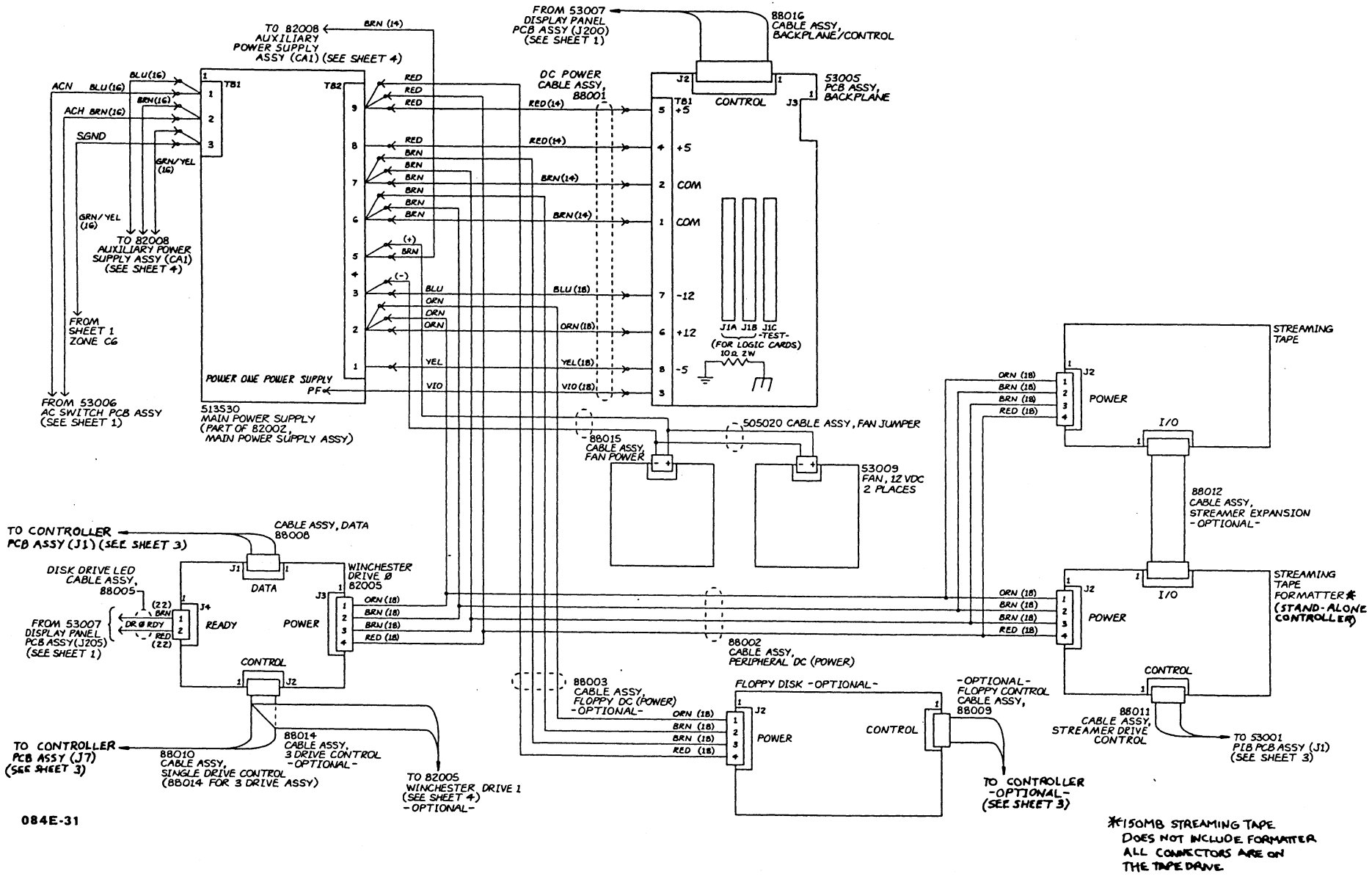
Command & Parameters	Definition
V	Loads hardware verify test at location 20000 and runs it. Upon successful completion, one of the following is displayed on the terminal: MARK 4 SELFTEST... CPU OK, MAP OK, nMB MEMORY OK, MUX OK, TAPE LOGIC OK, DISK LOGIC OK. MARK 4E SELFTEST REV. 1.n CPU OK, MAP OK, nMB MEMORY OK, TAPE LOGIC OK, nnPorts OK. The hardware verify test then moves itself to another memory location and repeats the above. Main memory will be overwritten.
x:y	Octal value y is stored at location x, and next cell is opened. • Parameter Description x - octal number representing 16-bit memory address y - 1 to 6 digits representing an octal value If y is omitted, the current content of location x is displayed. A new y may then be entered, or the next cell opened without change.
@	Loads DBUG at location 73000; main memory will be overwritten.

Appendix E
WIRING DIAGRAMS

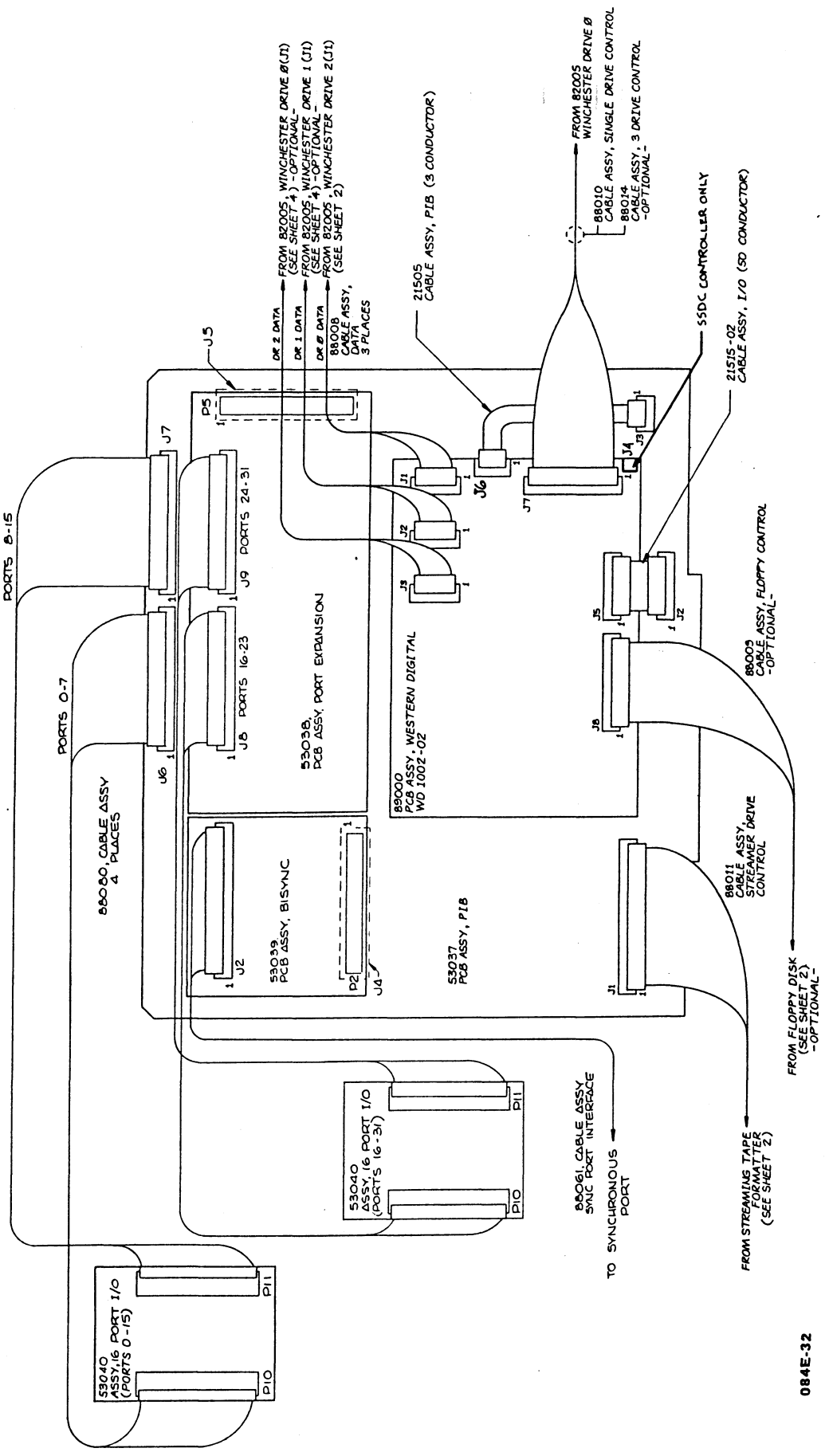
This appendix includes the wiring diagrams and the pin assignments for the MARK 4/4E central processing unit (CPU), the MARK 4 and MARK 4E peripheral interface boards (PIB), and the disk/tape controller.



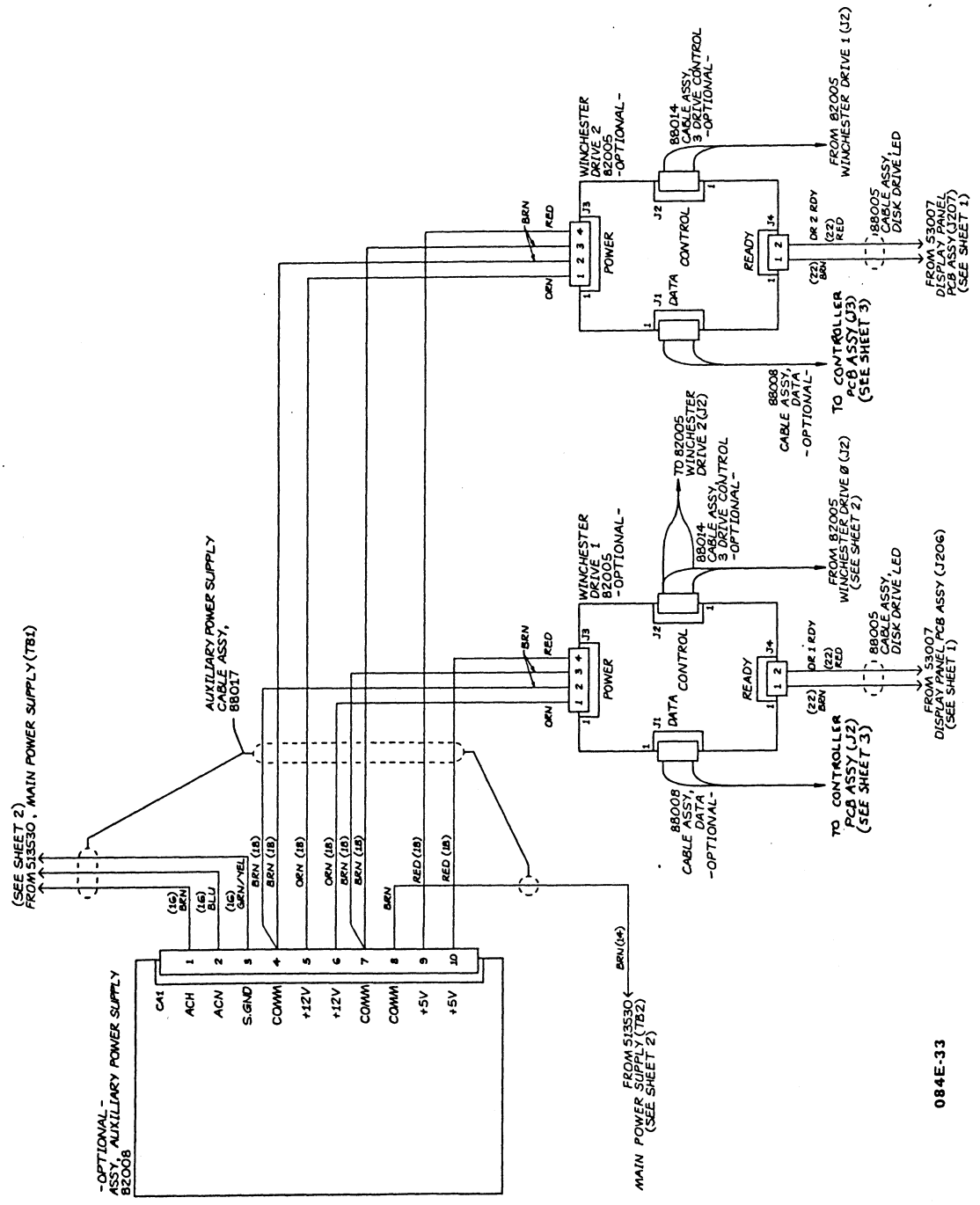
MARK 4E SCHEMATIC DIAGRAM (Sheet 1 of 5)



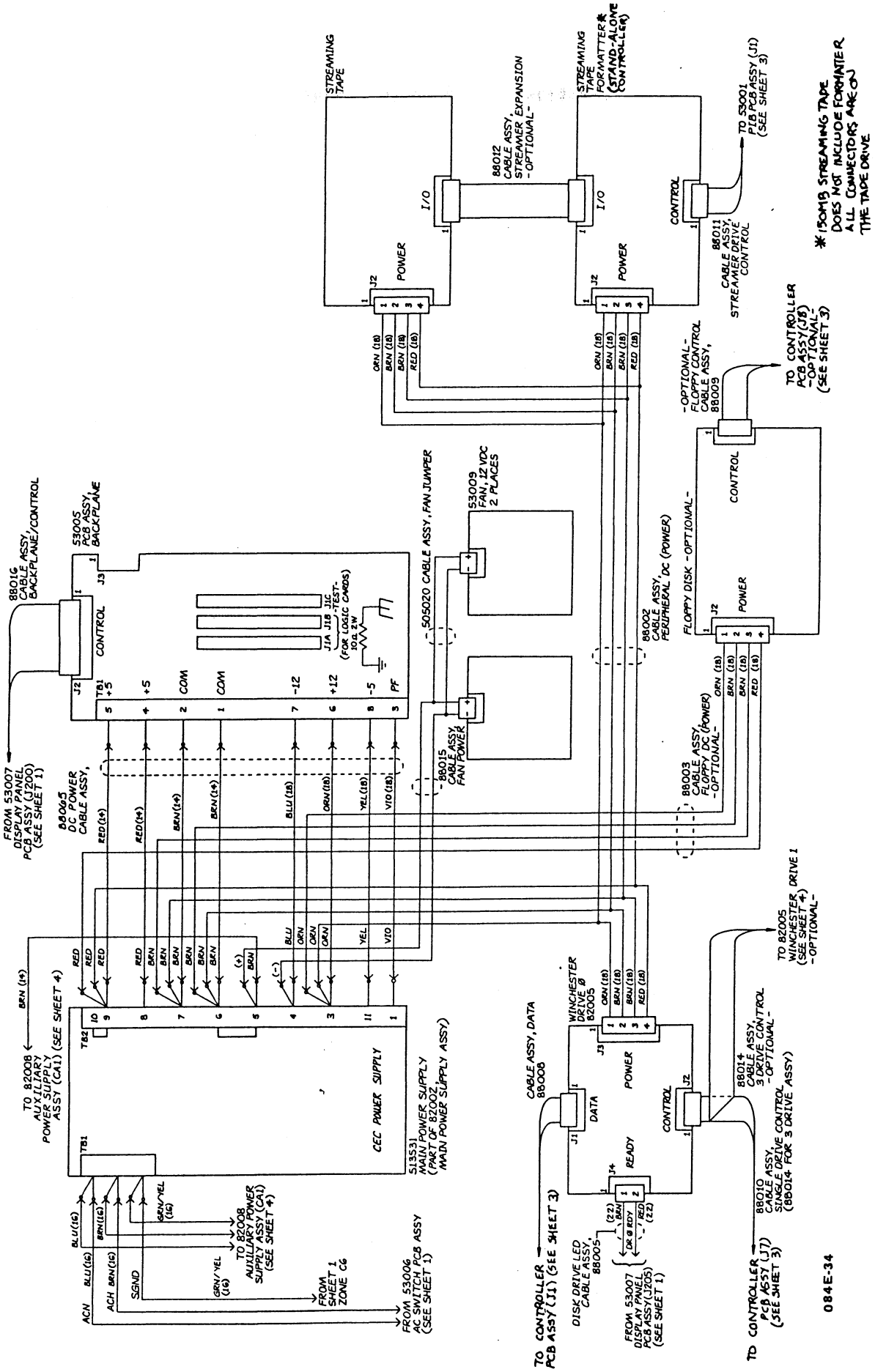
MARK 4E SCHEMATIC DIAGRAM (Sheet 2 of 5)



MARK 4E SCHEMATIC DIAGRAM (Sheet 3 of 5)



MARK 4E SCHEMATIC DIAGRAM (Sheet 4 of 5)


MARK 4E SCHEMATIC DIAGRAM (Sheet 5 of 5)
* 150MB STREAMING TAPE DOES NOT INCLUDE FORMATTER A LL CONNECTORS ARE ON THE TAPE DRIVE
STREAMING TAPE
88012 CABLE ASSY, STREAMER EXPANSION -OPTIONAL-
STREAMING TAPE FORMATTER* (STAND-ALONE CONTROLLER)
TO 53001 P1&P2 PCB ASSY (J1) (SEE SHEET 3)
88011 CABLE ASSY, STREAMER DRIVE CONTROL
-OPTIONAL- FLOPPY CONTROL CABLE ASSY, 88009
TO CONTROLLER PCB ASSY (J8) -OPTIONAL- (SEE SHEET 3)
88016 CABLE ASSY, BACKPLANE/CONTROL
53005 PCB ASSY, BACKPLANE
FROM 53007 DISPLAY PANEL PCB ASSY (J200) (SEE SHEET 1)
88005 DC POWER CABLE ASSY,
J1A J1B JIG -TEST- (FOR LOGIC CARDS) 10Ω 2W
505020 CABLE ASSY, FAN JUMPER
53009 FAN, 12 VDC 2 PLACES
88015 CABLE ASSY FAN POWER
88002 CABLE ASSY PERIPHERAL DC (POWER)
FLOPPY DISK -OPTIONAL-
88003 CABLE ASSY, FLOPPY DC (POWER) -OPTIONAL-
TO 82008 AUXILIARY POWER SUPPLY ASSY (CA1) (SEE SHEET 4)
CEC POWER SUPPLY
513531 MAIN POWER SUPPLY (PART OF 82002 MAIN POWER SUPPLY ASSY)
TO 82008 AUXILIARY POWER SUPPLY ASSY (CA1) (SEE SHEET 4)
FROM SHEET 1 ZONE C6
FROM 53006 AC SWITCH PCB ASSY (SEE SHEET 1)
WINCHESTER DRIVE Ø 82005
CABLE ASSY, DATA 88008
88014 CABLE ASSY, 3 DRIVE CONTROL -OPTIONAL-
TO 82005 WINCHESTER DRIVE 1 (SEE SHEET 4) -OPTIONAL-
DISK DRIVE LED CABLE ASSY, 88005
FROM 53007 DISPLAY PANEL PCB ASSY (J205) (SEE SHEET 1)
88010 CABLE ASSY, SINGLE DRIVE CONTROL (88014 FOR 3 DRIVE ASSY)
TO CONTROLLER PCB ASSY (J1) (SEE SHEET 3)
084E-34

BACKPLANE INTERFACE

P1			
TOP		BOTTOM	
PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND
3	GND	4	GND
5	+5V	6	+5V
7	+5V	8	+5V
9	DS2-	10	DS1-
11	DS0-	12	DS5-
13	DS4-	14	DS3-
15	WRITE-	16	DB15+
17	DB14+	18	DB13+
19	DB12+	20	DB11+
21	DB10+	22	DB09+
23	DB08+	24	DB07+
25	DB06+	26	DB05+
27	DB04+	28	DB03+
29	DB02+	30	DB01+
31	DB00+	32	GND
33	GND	34	IOBRST-
35	GND	36	GND
37	IOBPLS-	38	GND
39	GND	40	FLAG4-
41	FLAG3-	42	FLAG2-
43	FLAG1-	44	FLAG0-
45	ATNDISC-	46	ATNMUX-
47	ATNTAPE-	48	GND
49	GND	50	
51		52	
53		54	
55		56	GND
57	GND	58	AUTO-
59	CL-	60	GND
61	GND	62	PWRGON-
63	PWRF-	64	GND
65	GND	66	XRESET-
67	XRESET+	68	
69		70	
71	GND	72	GND
73		74	
75		76	GND
77	GND	78	
79		80	GND
81	GND	82	
83		84	GND
85	GND	86	
87		88	GND
89	GND	90	
91		92	
93	GND	94	GND
95	+5V	96	+5V
97	+5V	98	+5V
99		100	

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MEMORY BOARD INTERFACE

J2	
PIN	SIGNAL
1	GND
2	GND
3	GND
4	GND
5	+5V
6	+5V
7	+5V
8	+5V
9	+5V
10	MA1+
11	MA2+
12	MA3+
13	MA4+
14	MA5+
15	MA6+
16	MA7+
17	MA8+
18	MA0+
19	1MBMEM+
20	B0+
21	B1+
22	B2+
23	B3+
24	B4+
25	B5+
26	B6+
27	B7+
28	B8+
29	B9+
30	B10+
31	B11+
32	B12+
33	B13+
34	B14+
35	B15+
36	GND
37	GND
38	+5V
39	+5V
40	EA/PC0+
41	EA/PC1+
42	EA/PC2+
43	EA/PC3+
44	EA/PC4+
45	EA/PC5+
46	EA/PC6+
47	GND
48	GND
49	GND
50	GND

J3	
PIN	SIGNAL
1	+5V
2	+5V
3	D.MAPWE-
4	GND
5	IRHENB-
6	GND
7	DBERMS-
8	GND
9	TIR-
10	GND
11	EMENB-
12	GND
13	MAPRAENB-
14	GND
15	OMENB-
16	GND
17	D.IND-
18	GND
19	D.MAPLD-
20	GND
21	DBEMAPRD-
22	GND
23	D.WMS-
24	GND
25	TL-
26	GND
27	REFR+
28	GND
29	MAP-
30	GND
31	D.PMI-
32	GND
33	D.DCH+
34	GND
35	+5V
36	+5V
37	RAS-
38	GND
39	CAS-
40	GND
41	EMWER-
42	GND
43	EMWEL-
44	GND
45	OMWER-
46	GND
47	OMWEL-
48	GND
49	+5V
50	+5V

MARK 4/4E CPU (53027)

BACKPLANE INTERFACE

P1			
TOP		BOTTOM	
PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND
3	GND	4	GND
5	+5V	6	+5V
7	+5V	8	+5V
9	DS2-	10	DS1-
11	DS0-	12	DS5-
13	DS4-	14	DS3-
15	WRITE-	16	DB15+
17	DB14+	18	DB13+
19	DB12+	20	DB11+
21	DB10+	22	DB09+
23	DB08+	24	
25		26	
27		28	
29		30	
31	DB00+	32	GND
33	GND	34	IOBRST-
35	GND	36	GND
37	IOBPLS-	38	GND
39	GND	40	
41	DSC-	42	
43		44	END-
45	ATNDSC-	46	ATNMUX-
47	ATNTPE-	48	GND
49	GND	50	
51		52	
53		54	
55		56	GND
57	GND	58	
59		60	GND
61	GND	62	PWRGON-
63		64	GND
65	GND	66	
67		68	
69		70	
71	GND	72	GND
73	-12V	74	-12V
75	-12V	76	GND
77	GND	78	+12V
79	+12V	80	GND
81	GND	82	
83		84	GND
85	GND	86	
87		88	GND
89	GND	90	
91		92	
93	GND	94	GND
95	+5V	96	+5V
97	+5V	98	+5V
98		100	

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TAPE CONTROL INTERFACE

J1	
PIN	SIGNAL
1	
2	
3	GND
4	
5	GND
6	
7	
8	
9	GND
10	
11	GND
12	DA7-
13	GND
14	DA6-
15	GND
16	DA5-
17	GND
18	DA4-
19	GND
20	DA3-
21	GND
22	DA2-
23	GND
24	DA1-
25	GND
26	DA0-
27	GND
28	ONL-
29	GND
30	REQ-
31	GND
32	REST-
33	GND
34	XFER-
35	GND
36	ACKN-
37	
38	RDY-
39	GND
40	EXC-
41	GND
42	DIRC-
43	GND
44	
45	GND
46	
47	GND
48	
49	GND
50	

DISK CONTROL INTERFACE

J2	
PIN	SIGNAL
1	DB15+
2	GND
3	DB14+
4	GND
5	DB13+
6	GND
7	DB12+
8	GND
9	DB11+
10	GND
11	DB10+
12	GND
13	DB09+
14	GND
15	DB08+
16	GND
17	FUNC2+
18	GND
19	FUNC1+
20	GND
21	FUNC0+
22	GND
23	CS-
24	GND
25	WEP-
26	GND
27	REP-
28	GND
29	HS3+
30	GND
31	
32	GND
33	
34	GND
35	INTRQ+
36	GND
37	DRQ+
38	GND
39	MR-
40	GND

CONTROLLER POWER

J3	
PIN	SIGNAL
1	
2	GND
3	GND
4	+5V

MARK 4E PERIPHERAL INTERFACE BOARD (53037)
(Sheet 1 of 2)

BISYNC INTERFACE

J4	
PIN	SIGNAL
1	
2	
3	+12V
4	-12V
5	FUNC1+
6	FUNC2+
7	SYNCLK+
8	EIORST+
9	SYNCEN-
10	IRQSYNC-
11	
12	W+/R-
13	DB08+
14	DB09+
15	DB10+
16	DB11+
17	DB12+
18	DB13+
19	DB14+
20	DB15+
21	+5V
22	+5V
23	GND
24	GND
25	
26	

PORT EXPANSION INTERFACE

J5	
PIN	SIGNAL
1	GND
2	GND
3	+5V
4	+5V
5	MXTSTENB-
6	MXENB-
7	-12V
8	CLK+
9	+12V
10	GND
11	IRQ18/19-
12	IRQ16/17-
13	IRQ22/23-
14	IRQ20/21-
15	IRQ26/27-
16	IRQ24/25-
17	IRQ30/31-
18	IRQ28/29-
19	GND
20	GND
21	DB09+
22	DB08+
23	DB11+
24	DB10+
25	DB13+
26	DB12+
27	DB15+
28	DB14+
29	
30	
31	GND
32	GND
33	
34	
35	PORT+
36	
37	RDN-
38	BANK1-
39	WRN-
40	DS2+
41	DS1+
42	FUNC0+
43	DRS3+
44	DRS2+
45	DRS1+
46	DRS0+
47	+5V
48	+5V
49	GND
50	GND

PORTS 0–7

J6	
PIN	SIGNAL
1	DTR-OT0+
2	TX-OT0-
3	GND
4	RX-IN0-
5	CTS-IN0+
6	DTR-OT1+
7	TX-OT1-
8	GND
9	RX-IN1-
10	CTS-IN1+
11	DTR-OT2+
12	TX-OT2-
13	GND
14	RX-IN2-
15	CTS-IN2+
16	DTR-OT3+
17	TX-OT3-
18	GND
19	RX-IN3-
20	CTS-IN3+
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	CTS-IN4+
32	RX-IN4-
33	GND
34	TX-OT4-
35	DTR-OT4+
36	CTS-IN5+
37	RX-IN5-
38	GND
39	TX-OT5-
40	DTR-OT5+
41	CTS-IN6+
42	RX-IN6-
43	GND
44	TX-OT6-
45	DTR-OT6+
46	CTS-IN7+
47	RX-IN7-
48	GND
49	TX-OT7-
50	DTR-OT7+

PORTS 8–15

J7	
PIN	SIGNAL
1	DTR-OT8+
2	TX-OT8-
3	GND
4	RX-IN8-
5	CTS-IN8+
6	DTR-OT9+
7	TX-OT9-
8	GND
9	RX-IN9-
10	CTS-IN9+
11	DTR-OT10+
12	TX-OT10-
13	GND
14	RX-IN10-
15	CTS-IN10+
16	DTR-OT11+
17	TX-OT11-
18	GND
19	RX-IN11-
20	CTS-IN11+
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	CTS-IN12+
32	RX-IN12-
33	GND
34	TX-OT12-
35	DTR-OT12+
36	CTS-IN13+
37	RX-IN13-
38	GND
39	TX-OT13-
40	DTR-OT13+
41	CTS-IN14+
42	RX-IN14-
43	GND
44	TX-OT14-
45	DTR-OT14+
46	CTS-IN15+
47	RX-IN15-
48	GND
49	TX-OT15-
50	DTR-OT15+

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MARK 4E PERIPHERAL INTERFACE BOARD (53037)
(Sheet 2 of 2)

BACKPLANE INTERFACE

P1			
TOP		BOTTOM	
PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND
3	GND	4	GND
5	+5V	6	+5V
7	+5V	8	+5V
9	DS2-	10	DS1-
11	DS0-	12	DS5-
13	DS4-	14	DS3-
15	WRITE-	16	DB15+
17	DB14+	18	DB13+
19	DB12+	20	DB11+
21	DB10+	22	DB09+
23	DB08+	24	
25		26	
27		28	
29		30	
31	DB00+	32	GND
33	GND	34	IOBRST-
35	GND	36	GND
37	IOBPLS-	38	GND
39	GND	40	
41	DSC-	42	
43		44	END-
45	ATNOSC-	46	ATNMUX-
47	ATNTPE-	48	GND
49	GND	50	
51		52	
53		54	
55		56	GND
57	GND	58	
59		60	GND
61	GND	62	PWRGON-
63		64	GND
65	GND	66	
67		68	
69		70	
71	GND	72	GND
73	-12V	74	-12V
75	-12V	76	GND
77	GND	78	+12V
79	+12V	80	GND
81	GND	82	
83		84	GND
85	GND	86	
87		88	GND
89	GND	90	
91		92	
93	GND	94	GND
95	+5V	96	+5V
97	+5V	98	+5V
99	FRAMEGND	100	FRAMEGND

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TAPE CONTROL INTERFACE

J1	
PIN	SIGNAL
1	
2	
3	GND
4	
5	GND
6	
7	
8	
9	GND
10	
11	GND
12	DA7-
13	GND
14	DA6-
15	GND
16	DA5-
17	GND
18	DA4-
19	GND
20	DA3-
21	GND
22	DA2-
23	GND
24	DA1-
25	GND
26	DA0-
27	GND
28	ONL-
29	GND
30	REQ-
31	GND
32	REST-
33	GND
34	XFER-
35	GND
36	ACKN-
37	
38	RDY-
39	GND
40	EXC-
41	GND
42	DIRC-
43	GND
44	
45	GND
46	
47	GND
48	
49	GND
50	

DISK CONTROL INTERFACE

J2	
PIN	SIGNAL
1	DB15+
2	GND
3	DB14+
4	GND
5	DB13+
6	GND
7	DB12+
8	GND
9	DB11+
10	GND
11	DB10+
12	GND
13	DB09+
14	GND
15	DB08+
16	GND
17	FUNC2+
18	GND
19	FUNC1+
20	GND
21	FUNC0+
22	GND
23	CS-
24	GND
25	WEP-
26	GND
27	REP-
28	GND
29	HS3+
30	GND
31	
32	GND
33	
34	GND
35	INTRQ+
36	GND
37	DRQ+
38	GND
39	MR-
40	GND

CONTROLLER POWER

J3	
PIN	SIGNAL
1	
2	GND
3	GND
4	+5V

PORT EXPANSION INTERFACE

J4	
PIN	SIGNAL
1	CHASSISGND
2	CHASSISGND
3	GND
4	GND
5	MXTSTENB-
6	-12V
7	MXENB-
8	+12V
9	9600X16+
10	4800X16+
11	2400X16+
12	1200X16+
13	19.2KX16+
14	300X16+
15	150X16+
16	110X16+
17	EIORST+
18	ESYNCLK+
19	ESYNC/TAPE-
20	SYNCENB-
21	PORT89AB-
22	W-/R+
23	FUNC2+
24	IOPLS+
25	FUNC0+
26	PORTCDEF-
27	EIRQSYNC-
28	FUNC1+
29	GND
30	GND
31	DB08+
32	DB09+
33	DB10+
34	DB11+
35	DB12+
36	DB13+
37	DB14+
38	DB15+
39	IRQ15-
40	IRQ14-
41	IRQ13-
42	IRQ12-
43	IRQ11-
44	IRQ10-
45	IRQ9-
46	IRQ8-
47	+5V
48	+5V
49	GND
50	GND

MARK 4 PERIPHERAL INTERFACE BOARD (53018)
(Sheet 1 of 2)

PORTS 0–7

J5	
PIN	SIGNAL
1	DTR-OT0+
2	TX-OT0-
3	GND
4	RX-IN0-
5	CTS-IN0+
6	DTR-OT1+
7	TX-OT1-
8	GND
9	RX-IN1-
10	CTS-IN1+
11	DTR-OT2+
12	TX-OT2-
13	GND
14	RX-IN2-
15	CTS-IN2+
16	DTR-OT3+
17	TX-OT3-
18	GND
19	RX-IN3-
20	CTS-IN3+
21	CHASSIS GND
22	CHASSIS GND
23	
24	
25	
26	
27	
28	
29	CHASSIS GND
30	CHASSIS GND
31	CTS-IN4+
32	RX-IN4-
33	GND
34	TX-OT4-
35	DTR-OT4+
36	CTS-IN5+
37	RX-IN5-
38	GND
39	TX-OT5-
40	DTR-OT5+
41	CTS-IN6+
42	RX-IN6-
43	GND
44	TX-OT6-
45	DTR-OT6+
46	CTS-IN7+
47	RX-IN7-
48	GND
49	TX-OT7-
50	DTR-OT7+

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PORTS 8–15

J16	
PIN	SIGNAL
1	DTR-OT8+
2	TX-OT8-
3	GND
4	RX-IN8-
5	CTS-IN8+
6	DTR-OT9+
7	TX-OT9-
8	GND
9	RX-IN9-
10	CTS-IN9+
11	DTR-OT10+
12	TX-OT10-
13	GND
14	RX-IN10-
15	CTS-IN10+
16	DTR-OT11+
17	TX-OT11-
18	GND
19	RX-IN11-
20	CTS-IN11+
21	CHASSIS GND
22	CHASSIS GND
23	
24	
25	
26	
27	
28	
29	CHASSIS GND
30	CHASSIS GND
31	CTS-IN12+
32	RX-IN12-
33	GND
34	TX-OT12-
35	DTR-OT12+
36	CTS-IN13+
37	RX-IN13-
38	GND
39	TX-OT13-
40	DTR-OT13+
41	CTS-IN14+
42	RX-IN14-
43	GND
44	TX-OT14-
45	DTR-OT14+
46	CTS-IN15+
47	RX-IN15-
48	GND
49	TX-OT15-
50	DTR-OT15+

PORT 16

J15	
PIN	SIGNAL
1	CHASSIS GND
2	
3	TX-OT16-
4	TXCLK16+
5	RX-IN16-
6	
7	RTS-OT16+
8	RXCLK16+
9	CTS-IN16+
10	
11	DSR-IN16+
12	
13	GND
14	DTR-OT16+
15	CAR-IN16+
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	

PIB INTERFACE

P4	
PIN	SIGNAL
1	CHASSIS GND
2	CHASSIS GND
3	GND
4	GND
5	MXTSTENB-
6	-12V
7	MXENB-
8	+12V
9	9600X16+
10	4800X16+
11	2400X16+
12	1200X16+
13	19.2KX16+
14	300X16+
15	150X16+
16	110X16+
17	EIOAST+
18	ESYNCLK+
19	ESYNC/TAPE-
20	SYNCENB-
21	PORTB9AB-
22	W-/R+
23	FUNC2+
24	IOPLS+
25	FUNC0+
26	PORTCDEF-
27	EIRQSYNC-
28	FUNC1+
29	GND
30	GND
31	DB08+
32	DB09+
33	DB10+
34	DB11+
35	DB12+
36	DB13+
37	DB14+
38	DB15+
39	IRQ15-
40	IRQ14-
41	IRQ13-
42	IRQ12-
43	IRQ11-
44	IRQ10-
45	IRQ09-
46	IRQ08-
47	+5V
48	+5V
49	GND
50	GND

MARK 4 PERIPHERAL INTERFACE BOARD (53018)
(Sheet 2 of 2)

DISK DRIVE 0 DATA INTERFACE

J1	
PIN	SIGNAL
1	
2	GND
3	
4	GND
5	
6	GND
7	
8	GND
9	
10	
11	GND
12	GND
13	DV1MFMWR+
14	DV1MFMWR-
15	GND
16	GND
17	DV1MFMRD+
18	DV1MFMRD-
19	GND
20	GND

DISK DRIVE 2 DATA INTERFACE

J3	
PIN	SIGNAL
1	
2	GND
3	
4	GND
5	
6	GND
7	
8	GND
9	
10	
11	GND
12	GND
13	DV3MFMWR+
14	DV3MFMWR-
15	GND
16	GND
17	DV3MFMRD+
18	DV3MFMRD-
19	GND
20	GND

PIB/CONTROLLER INTERFACE

J5	
PIN	SIGNAL
1	DAL0+
2	GND
3	DAL1+
4	GND
5	DAL2+
6	GND
7	DAL3+
8	GND
9	DAL4+
10	GND
11	DAL5+
12	GND
13	DAL6+
14	GND
15	DAL7+
16	GND
17	AO+
18	GND
19	A1+
20	GND
21	A2+
22	GND
23	CS-
24	GND
25	WE-
26	GND
27	RE-
28	GND
29	HDHS3+
30	GND
31	
32	GND
33	
34	GND
35	INTRQ+
36	GND
37	DRQ+
38	GND
39	MR-
40	GND

DRIVE CONTROL INTERFACE

J7	
PIN	SIGNAL
1	GND
2	HDHS3-
3	GND
4	HDHS2-
5	
6	HDWGATE-
7	GND
8	HDSKCOMP-
9	GND
10	HDTRK000-
11	GND
12	HDWRTFLT-
13	GND
14	HDHS0-
15	GND
16	
17	GND
18	HDHS1-
19	GND
20	HDINDEX-
21	GND
22	HDDRVRDY-
23	GND
24	HDSTEP-
25	GND
26	HDDS0-
27	GND
28	HDDS1-
29	GND
30	HDDS2-
31	GND
32	
33	GND
34	HDDIRC-

DISK DRIVE 1 DATA INTERFACE

J2	
PIN	SIGNAL
1	
2	GND
3	
4	GND
5	
6	GND
7	
8	GND
9	
10	
11	GND
12	GND
13	DV2MFMWR+
14	DV2MFMWR-
15	GND
16	GND
17	DV2MFMRD+
18	DV2MFMRD-
19	GND
20	GND

LED INTERFACE

J4	
PIN	SIGNAL
1	DV1BUSY+
2	DV1BUSY-
3	DV2BUSY+
4	DV2BUSY-
5	DV3BUSY+
6	DV3BUSY-

SSDC ONLY

POWER CONNECTOR

J6	
PIN	SIGNAL
1	
2	GND
3	GND
4	+5V

FLOPPY INTERFACE

J8	
PIN	SIGNAL
1	GND
2	
3	GND
4	
5	
6	
7	GND
8	FDINDEX-
9	GND
10	FDDS0-
11	GND
12	
13	GND
14	
15	GND
16	FDMOTRON-
17	GND
18	FDDIRC-
19	GND
20	FDSTEP-
21	GND
22	FDWRTDAT-
23	GND
24	FDWRGATE-
25	GND
26	FDTRK000-
27	GND
28	FDWRPROT-
29	GND
30	FDRDDATA-
31	GND
32	FDSIDSEL-
33	GND
34	FDDRVRDY-

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DISK/TAPE CONTROLLER INTERFACE SIGNALS

Appendix F
GLOSSARY

Accumulator - a part of the logical-arithmetic unit of a computer.

Address - a number identifying a location where information is stored.

APL (Automatic Program Load) - the loading of the program, which occurs whenever the AC power switch is turned to AUTO once the software is loaded.

Auxiliary power supply - an 85-watt power supply that is required in addition to the main power supply when more than one disk drive is used on a MARK 4/4E system.

Asynchronous - a mode of communications that transmits a single character with additional bits, stop and start, to provide the timing. Each character is individually timed.

Bisynchronous - a communications protocol that includes control characters and procedures for controlling the establishment of a valid connection and transfer of data. Usually one block of characters is transmitted at a time.

CPU (Central Processing Unit) - the principal unit of the computer that controls the processing routines, performs arithmetic functions and stores directly-accessible memory.

DBUG - a position-independent debugging utility package. It is independent of the IRIS Operating System and is controlled from the master terminal.

Diagnostic - a hardware program or routine used to help locate a malfunction or problem in system hardware. POINT 4 diagnostics are available on stand-alone tapes; the standard diagnostics are supplied with the IRIS Operating System on logical unit 5 (does not include system diagnostics).

DISCUTILITY - a program that is used to format a disk and to save and restore information from disk and/or streamer tape. It is available on the IRIS Operating System on logical unit 0 or as a stand-alone program.

HALT - a ceasing of computer operations because of a hardware or software problem or a power failure.

Hardware verify test - a test that verifies the operation of the MARK 4/4E system as a whole: CPU, all system memory, tape interface and serial ports. It also invokes the disk/floppy controller self-test and checks for its successful completion. It can be accessed through MANIP.

IPL (Initial Program Load) - a procedure that reads the IRIS Operating System from disk to memory.

IRIS (Interactive Real-Time Information System) - POINT 4's operating system that supports multi-user business software.

MANIP - a stand-alone program that is automatically loaded into memory by system firmware when the system is powered up, a HALT occurs, or a user pushes the reset switch. It initiates the hardware verify test and an automatic program load when the operating system is on the disk and the keyswitch is turned to AUTO. It also enables the user to load programs or display and examine the contents of memory on the master terminal; and it enables programmers to debug the system.

MAPACTIVATE - utility on the IRIS Operating System that activates the memory map driver.

Mapped memory - hardware architecture used to increase the memory available to the system by redirecting the CPU to different areas of physical memory.

Master terminal - the terminal connected to port zero and used to perform certain system operations.

Memory board - a 1 or 2MB board that piggybacks onto the central processing unit.

Octal - the base eight numbering system used by IRIS.

Operating system - a collection of programs that direct and supervise the computer's operation. POINT 4's operating system is IRIS.

PAL - programmable array logic, an integrated circuit and trademark of Monolithic Memories, Inc.

PIB - peripheral interface board that links the peripherals to the CPU.

Pico-N - a 100-pin connector with encapsulated circuitry that prevents unauthorized use of IRIS, POINT 4 application packages, or specified dealer packages. It is supplied under a non-transferrable license with each paid IRIS license and remains the property of POINT 4.

Port expansion board - a board that piggybacks onto the peripheral interface board to provide 8 or 9 additional ports for the MARK 4/4E (8-16) and 16 additional ports on a MARK 4E (16-32).

Port 0 - the first port on the first asynchronous board.

Program counter - the register that contains the address of the current instruction being executed.

SETUP - an interactive utility used to configure the IRIS Operating System.

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INDEX