MARK 6

System Installation/ Maintenance Manual

POINT 4 DATA CORPORATION

MARK 6

SYSTEM INSTALLATION AND MAINTENANCE MANUAL

Revision A

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.

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PREFACE

The MARK 6 System Installation and Maintenance Manual is designed for value added resellers, installers, maintenance, and service persons of the MARK 6 minicomputer system. Its purpose is to provide instructions for installing and starting up the system, installing and replacing individual components, a routine for troubleshooting, and power-fail instructions.

The overview section describes the features of the MARK 6, an integrated system, the options available, and the peripherals supported. The specifications section provides physical, environmental, and power information and requirements for the system and its optimum placement. The section on controls and indicators describes the controls and indicators of the card chassis mini-panel and the power monitor board, as well as the MANIP program and its features. The section on installing provides procedures for checking out the system to insure correct installation and for installing the battery backup option. The section on getting started describes the self-tests of the system and it provides instructions for the start-up routines. The section on installing and replacing components describes the installation and replacement of MARK 6 components for technicians who are upgrading the system or repairing or replacing a faulty component. If a problem occurs, the troubleshooting section provides a routine and diagnostic information to help locate the problem. The last section provides instructions for what to do in a power-fail situation.

Some sections begin with a list of reference documents pertinent to the subject of that section. Those unfamiliar with POINT 4 Data Corporation products should note these references and have the documents available. Those who are well acquainted with the POINT 4 product line may find the references useful but not as important. The reference documents provide comprehensive information about particular components and procedures.

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>.
key	The word "key" refers to a password.

Related Manuals

Related manuals include:

Title	Document Order No.
IRIS R8 Installation and Configuration Manual	ITP0009
IRIS R8 Operations Manual	ITP0010
IRIS R8 Peripherals Handbook	ITP0018
IRIS R8 Release Notes	ITP0021
IRIS R8 User Manual	ITP0011
IRIS R9 System Configuration Manual	ITP0029
IRIS R9 System Manager Manual	ITP0030
IRIS R9 User Reference Manual	ITP0034
LCM Diagnostic Document	HTP0036
LCM Hardware Manual	ITP0026
LOTUS DISCUTILITY Manual	ITP0018
LOTUS 720/730 Disk/Tape Controller Diagnostics Document	HTP0052
LOTUS 725/740/745 Disk/Tape Controller Diagnostics Document	HTP0059
LOTUS 710/720/730 Controllers Manual	ITP0033
Mag Tape Controller, Model TC200, Technical Manual (for LOTUS 725)	
MARK 6/12 Map/Memory Diagnostic Manual	HTP0054
MARK 6/12 Self-Test/MANIP Manual	HTP0064
MIGHTY MUX Diagnostic Manual	HTP0067
MIGHTY MUX User Manual	HTP0015
Rack-Mounted Peripheral Subsystem, Unpacking and Installation Technical Memorandum	
SPECTRA 320/310L Product Reference Manual (for LOTUS 740/745)	

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Section 1
OVERVIEW

The POINT 4 MARK 6 is a multi-user minicomputer system, a derivative of the high speed MARK 12 architecture and technology. It supports up to 128 users; performs simultaneous, multiple tasks; and provides up to 16MB of extended memory.

The MARK 6 fully utilizes the POINT 4 IRIS (Interactive Real-Time Information System) Operating System, R9.0* or later revision. It can run existing application software written in IRIS Business BASIC and SMbasic.

The MARK 6 is available as an integrated system or as separate components. Its distinguishing features are the MARK 6 central processing unit (CPU), optional extended memory, eight-slot card chassis and backplane assembly, and a heavy duty power supply with an optional battery backup.

Figure 1-1 illustrates the POINT 4 integrated MARK 6 minicomputer in a highboy cabinet.

*With a special patch, the MARK 6 can be used with IRIS R8.3E.

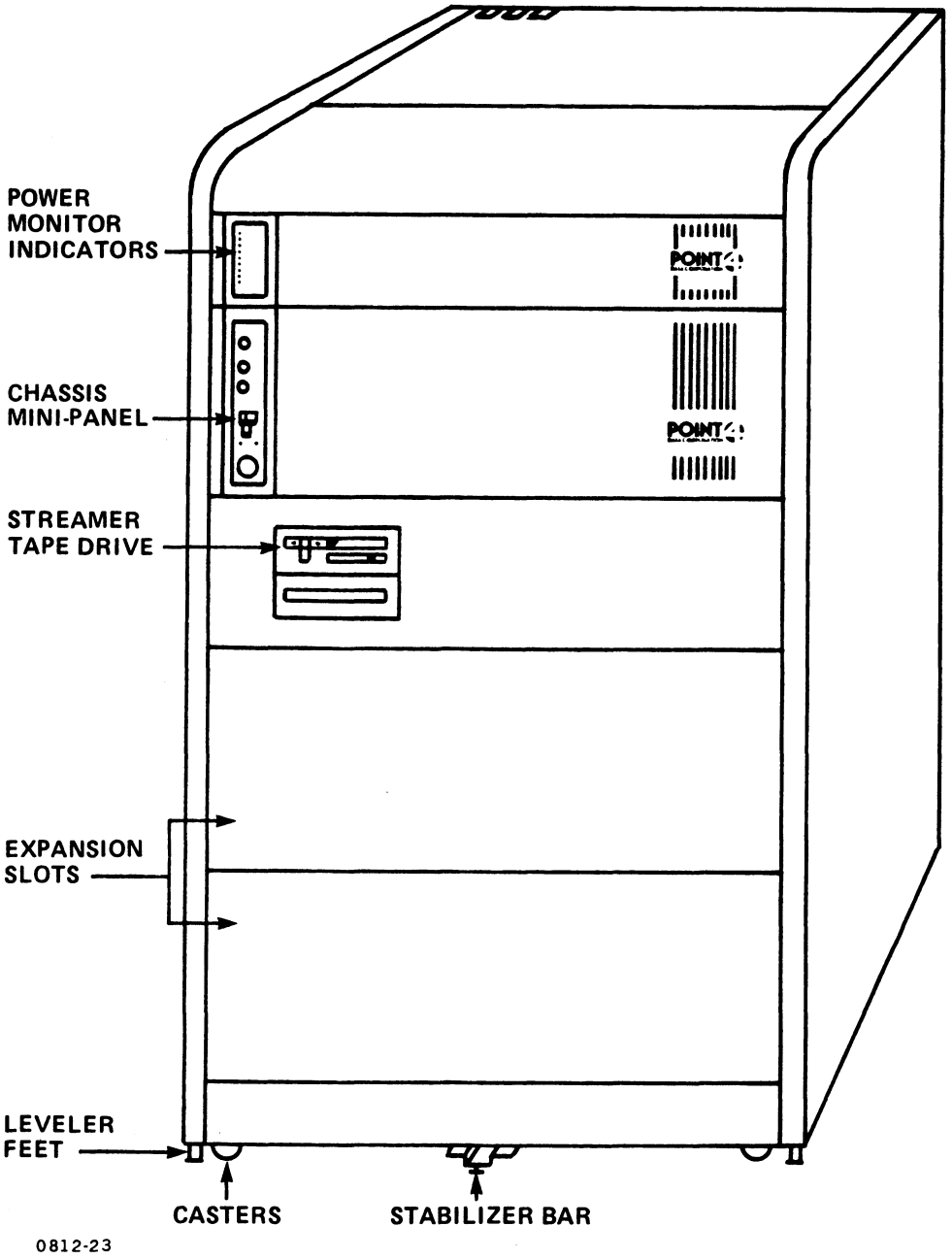


Figure 1-1. POINT 4 MARK 6 Minicomputer in a Highboy Cabinet

1.1 FEATURES OF THE MARK 6

The following subsections list the distinguishing features and characteristics of the MARK 6.

1.1.1 16-Bit Central Processor Unit (CPU)

- Uses a four-stage pipeline architecture to fetch and queue four instructions simultaneously for decoding and execution
- Executes instructions at a rate of 6.25 MIPS (million instructions per second)
- Operates on a 160-nanosecond effective instruction execution cycle time
- Employs 128KB of high speed main memory and can access an additional 16MB of extended memory
- Uses 5-volt TTL circuitry on a single, 4-layer, 15-inch board

1.1.2 Extended Memory

- Provides a maximum of 16MB of extended memory in 2 or 4MB boards (four boards maximum)
- Transfers data to the central processing unit (CPU) over a 32-bit, VME-like bus at a rate of 33.3MB per second
- Detects and corrects single-bit errors automatically and reports double-bit errors

1.1.3 Eight-Slot Card Chassis and Backplane Assembly

- Provides superior cooling capabilities through increased fan capacity and space between slots
- Supports many configurations including an expansion chassis

1.1.4 Power Supply

- Provides a 425-watt power supply
- Replaces the multiplexer external power supply ($\pm$12 volts) and provides enough power for up to 128 ports
- Facilitates installation and maintenance with its separate chassis and modular construction

1.2 MARK 6 INTEGRATED SYSTEM

The MARK 6 integrated system is available in several configurations. The subsections that follow describe the components that may be included in an integrated system (see Figure 1-2). For more information on the options and their requirements, see Section 1.3.

1.2.1 Power Supply

The power supply is made up of a main power supply board, the power monitor board and, if present, battery backup. The power supply is housed in a chassis, separate from the card chassis.

The main power supply board is on the right side of the chassis. It supports a fully loaded eight-slot card chassis. Power requirements are detailed in Section 2.2.

The power monitor board is on the far left side of the chassis. It contains eight light-emitting-diode (LED) indicators that monitor the power supply and battery backup voltages. The indicators are described in Section 3.2.

Battery backup, if present, occupies the space to the left of the main power supply. It provides power to extended memory if power fails. Additional information about battery backup is given in Sections 2.2, 4.2, and Appendix A.

1.2.2 Card Chassis and Backplane

The card chassis is made up of a mini-panel and an eight-slot card cage and backplane assembly. The mini-panel, located on the left, houses the controls and indicators for basic central processing unit (CPU) functions. The controls and indicators monitor and control power, control program execution, and monitor the CPU. Additional information about the mini-panel is provided in Section 3.1.

A card chassis may hold the following boards:

- MARK 6 central processing unit with 128KB of main memory
- Extended memory in 2 or 4MB capacities, four boards (16MB) maximum
- LOTUS 710, 720, 725, 730, 740, or 745 controller
- 310 multiplexer with eight ports
- 301 expansion boards with 8, 16, or 24 ports

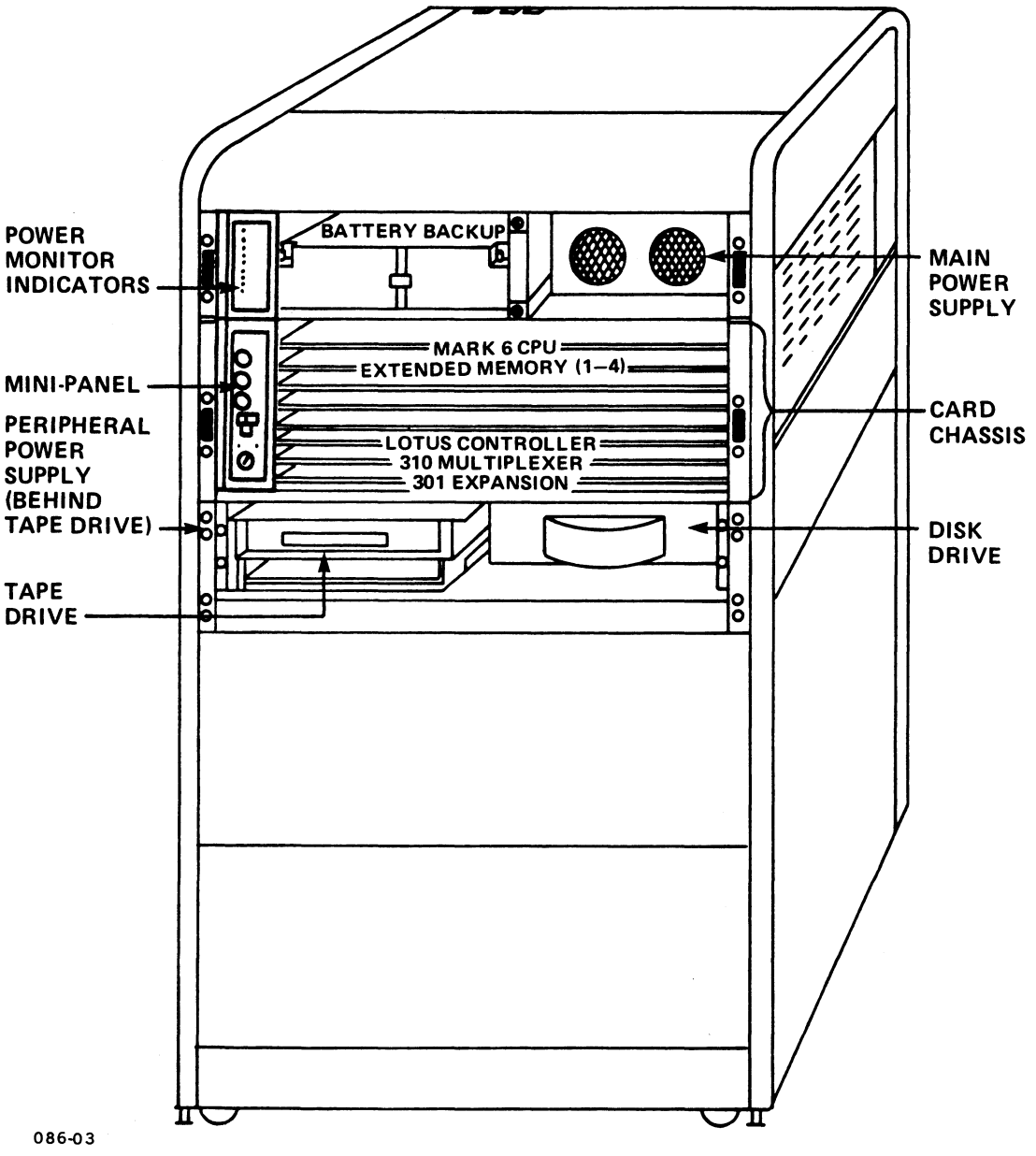


Figure 1-2. A MARK 6 Integrated System

1.2.3 Rack-Mounted Peripheral Subsystem (RPS)

Integrated systems have a rack-mounted peripheral subsystem that includes the following:

- 8-inch Winchester disk with 84, 168, or 337MB capacity
- Peripheral power supply
- 1/4-inch streamer with a QIC-02 interface in 60MB capacity or 1/2-inch tape drive with a Pertec interface in 92 or 500MB capacity

1.2.4 Cabinet

Lowboy and highboy model cabinets are available. The choice is partly determined by the particular components selected for a system.

1.2.5 Extended IRIS License

The extended IRIS license includes Business BASIC, ABASIC, utilities and the extended IRIS feature for the MARK 6 extended memory. On MARK 6 integrated systems, the SMbasic Interpreter and Utilities are available at no extra cost.

1.2.5.1 PICO-N

The Pico-N is a hardware security device that must be installed on the MARK 6 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 customer-provided software. The Pico-N is provided at no charge with each IRIS license. It remains the property of POINT 4.

1.3 OPTIONS

The following options are available in an integrated system or as separate components:

- Extended memory: 2 and 4MB boards are available; a maximum of four boards (16MB) is allowed.

- Additional ports: 8, 16, or 24-port 301 expansion boards are available; a maximum of five expansion boards is allowed for a total of 128 ports.

- Disks drives: 84, 168, and 337MB-capacity disk drives are available. The 84 and 168MB drives require a LOTUS 710, 730, 740 or 745 disk controller; the 337MB drive requires a LOTUS 740 or 745 disk controller. A maximum of four disk drives can be used.

- Battery backup (BBU): This option provides battery power to the extended memory. During a power fail, information in main memory transfers to extended memory.

- 1/2-inch magnetic tape subsystem: This can be substituted for the 1/4-inch cartridge streamer tape drive. It is a separate rack-mounted unit that requires a highboy cabinet and a LOTUS 725 Tape Controller or a LOTUS 740 Multifunction Controller.

- Lotus Cache Memory (LCM): This memory option is available in 2 and 4MB boards that are fully software compatible with the old style LCMs. LCMs can be used instead of, but not together with, extended memory.

- Expansion chassis: This eight-slot card chassis can be used in addition to the main card chassis to provide a total of 16 slots per system. A highboy cabinet is required.

1.4 PERIPHERALS

A complete range of peripherals compatible with the MARK 6 is available from various manufacturers. Peripherals that can interface with the MARK 6 are: video display and printing terminals, CMD and SMD-type disk drives, magnetic tape units, line and character printers, plotters, and modems.

Section 2
SPECIFICATIONS

To ensure optimum performance, it is important that a system be placed in the proper environment. The physical, environmental, and power specifications in this section provide information about the best environment for the MARK 6.

2.1 PHYSICAL DIMENSIONS

1. Boards

   All boards measure approximately 15 inches x 15 inches (38.1 cm x 38.1 cm)

2. Card Chassis

   Height: 6.86 inches (17.4 cm)
   Width: 17.51 inches inside rail (44.5 cm);
   19 inches flange-to-flange (48.3 cm)
   Depth: 17.30 inches (43.9 cm)

3. Power Supply

   Height: 3.56 inches (9.0 cm)
   Width: 17.64 inches inside rail (44.8 cm);
   19 inches flange-to-flange (48.3 cm)
   Depth: 23.00 inches (58.4 cm)

4. Rack-mounted Peripheral Subsystem

   Height: 7.00 inches (17.8 cm)
   Width: 17.40 inches inside rail (44.2 cm);
   19 inches flange-to-flange (48.3 cm)
   Depth: 25.00 inches (63.5 cm)

5. Lowboy Cabinet

   Height: 31 inches (78.7 cm)
   Width: 22 inches (55.9 cm)
   Depth: 30 inches (76.2 cm)

6. Highboy Cabinet

   Height: 42 inches (106.7 cm)
   Width: 22 inches (55.9 cm)
   Depth: 30 inches (76.2 cm)

2.2 POWER REQUIREMENTS

1. AC Wiring

   POINT 4 recommends a three-wire dedicated line (AC high, AC low, and AC earth ground). 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. Power Supply

   a. The required AC inputs for the MARK 6 power supply are:

      Fuse Rating: 7 amps (U.S.), 3.2 amps (International)

      Voltages: 90-132 volts
      180-264 volts

      Cycles: 47-63 Hz

   b. The DC output is 425 watts. A separate multiplexer power supply is not required. Tables 2-1 and 2-2 list the power supply outputs and requirements respectively.

3. Battery Backup (Optional)

   a. The required AC inputs for the battery backup are:

      Fuse Rating: 2 amps (U.S.), 1 amp (International)

      Voltages: 90-132 volts
      180-264 volts

      Cycles: 47-63 Hz

   b. DC outputs for the battery backup are shown in Table 2-1.

TABLE 2-1. MARK 6 POWER SUPPLY/BBU OUTPUTS

Outputs	Maximum Current	Rated Capacity
Power Supply		
+5V DC (1)	70.00A	350.00W
-5V DC	1.50A	7.50W
+15V DC (2)	2.25A	33.75W
-15V DC (2)	2.25A	33.75W
Total P/S Capacity (3)		425.00W
Battery Backup		
+5V BBU DC	11.0A	55.0W
-5V BBU DC (4)	0.1A	0.5W
+12V BBU DC (4)	1.0A	12.0W
Total BBU Capacity		67.5W

Notes:

(1) +5V power is not current limited; it will provide up to 70 amps of power. Loads in excess of 70 amps may damage the power supply.

(2) +12V and -12V power is regulated from the +15V and -15V circuits respectively. When calculating the amount of the +/-15V power being used by a configuration, remember to add the +/-12V current to the +/-15V current.

(3) The maximum capacity of the power supply is 425 watts. If the +5V level at 70 amps is 350 watts, the combined total for the other three voltages may not exceed 75 watts.

(4) -5V BBU and +12V BBU power is supplied by the MARK 5/8 backup option board. This option is required for MARK 5/8 CPUs when used with the 425-watt power supply and eight-slot chassis.

TABLE 2-2. MARK 6 CPU AND CONTROLLER POWER REQUIREMENTS

Component	+5V	(1) +5VBBU	-5V	+15V	-15V	(2) +12V	(2) -12V
MARK 6 CPU	10.00						
EXM, 2MB w/o BBU (3)	6.30						
EXM, 2MB w/BBU (3)	2.30	4.00					
EXM, 4MB w/o BBU (3)	6.30						
EXM, 4MB w/BBU (3)	2.30	4.00					
LCM, 1MB w/o BBU	4.00						
LCM, 1MB w/BBU		4.00					
LCM, 2MB w/o BBU (3)	6.30						
LCM, 2MB w/BBU (3)	2.30	4.00					
LCM, 4MB w/o BBU (3)	6.30						
LCM, 4MB w/BBU (3)	2.30	4.00					
L710 Disk Ctlr	5.00		0.80				
L720 1/4" Tape Ctlr	0.50						
L725 1/2" Tape Ctlr	4.00						
L730 1/4" Disk/Tape Ctlr	5.50		0.80				
L740 1/2" Disk/Tape Ctlr	10.30		1.20				
L745 Disk Ctlr	10.00		1.20				
MUX, 310-A8 w/Reg	5.00			0.25	0.25		
MUX, 310-A8 w/o Reg	5.00					0.25	0.25
MUX, 301-A8	1.00					0.10	0.10
MUX, 301-A16	2.00					0.20	0.20
MUX, 301-A24	3.00					0.30	0.30

(1) +5V BBU is provided by the BBU supply for the 425 watt power supply.

(2) Add +/-12V requirements to +/-15V requirements to determine total +/-15V requirements for the system.

(3) The currents shown for 2MB and 4MB EXM or LCM are for a board in operating mode. If more than one board is included, only the first board is in operating mode. All other boards are in standby mode. Standby currents for 2MB and 4MB EXM or LCM boards are:

w/o BBU	+5V = 4.2 amps	
w/BBU	+5V = 2.3 amps	+5V BBU = 1.9 amps

2.3 ENVIRONMENTAL

1. Placement

   Place the MARK 6 out of direct sunlight and with three feet of air circulation space around it. Avoid plugging other electrical devices into the same power line as the system.

2. Temperature

   Operating: +41 to 113°F
   +5 to 45°C

   Storage: +41 to 140°F
   +5 to 60°C

3. Humidity: 15 to 90% noncondensing

Section 3
CONTROLS AND INDICATORS

This section describes the controls and indicators of the card chassis mini-panel and the power monitor board, as well as the MANIP program and its features.

3.1 CARD CHASSIS MINI-PANEL

The mini-panel, located on the front left side of the card chassis, houses the controls and indicators that regulate the operations of the MARK 6. It has three functions: controlling and monitoring power, controlling program execution, and monitoring the central processing unit (CPU).

The card chassis mini-panel is illustrated in Figure 3-1; its controls and indicators are explained in Tables 3-1, 3-2, 3-3, and 3-4.

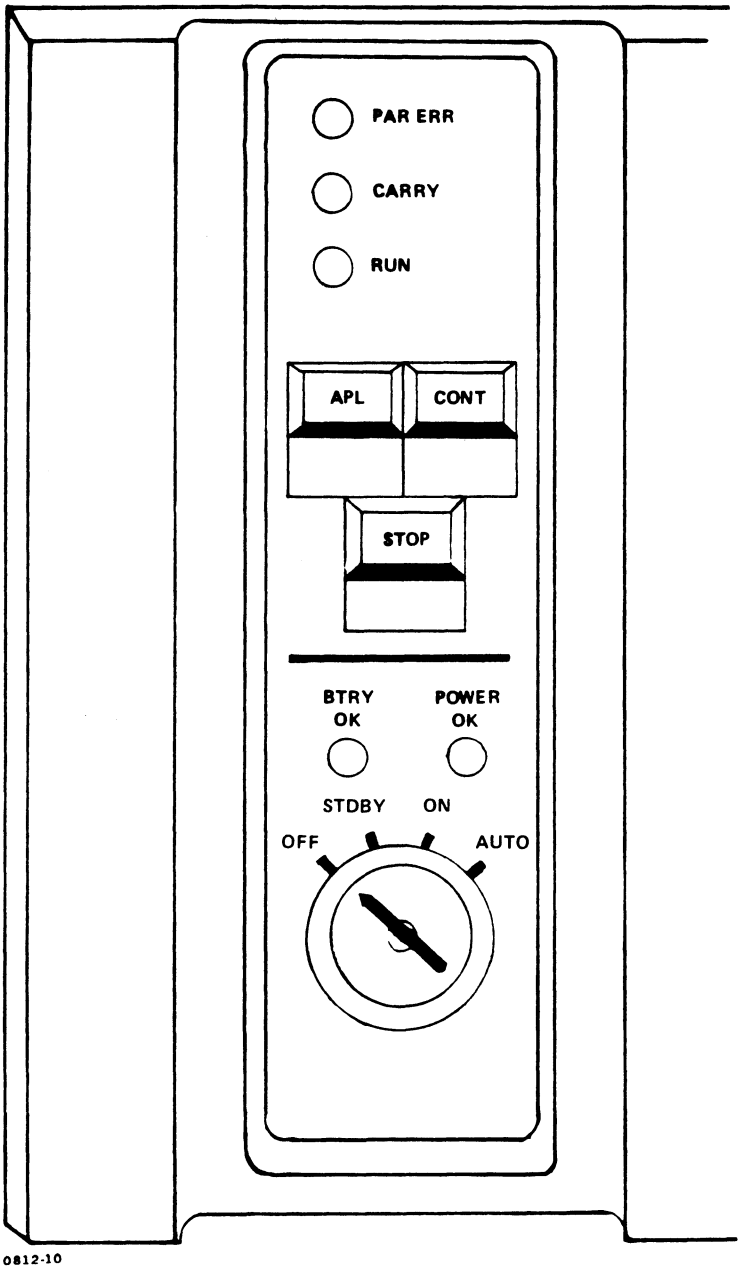


Figure 3-1. Card Chassis Mini-Panel

TABLE 3-1. CARD CHASSIS MINI-PANEL POWER CONTROL SWITCHES

Key-switch	Function
OFF	This position is used when the power is OFF for extended periods or when specified operations require the power to be off, for example, when installing or replacing components. OFF disables the battery backup and all other DC voltages.
STDBY	Main power supply voltages to the chassis are disabled, but the BBU voltages (if battery backup is installed) are maintained for the CPU (slot 1) and extended memory (slots 2 through 5). Note that the voltage to slot 1 is not used by the MARK 6 CPU, but is used by MARK 5 and 9 CPUs.
ON	Turns on power and enables all controls and indicators on the mini-panel. The power fail, auto-restart feature available with battery backup (BBU) is disabled. In this position, the central processing unit (CPU) must be started manually after a power failure.
AUTO	Maintains power to the central processing unit (CPU) and indicators, and disables all mini-panel controls. This prevents interference with the CPU. If battery backup (BBU) is installed, the power fail, auto-restart feature enables the computer to resume operations automatically after a power failure.

APL (automatic program load), CONTinue and STOP are the buttons that control program execution. They are enabled when the mini-panel keyswitch is set to ON and disabled when it is set to AUTO.

TABLE 3-2. CARD CHASSIS MINI-PANEL PROGRAM EXECUTION CONTROLS

Button	Function
STOP	Stops central processing unit (CPU) operation. The CPU finishes the current instruction, fetches the next one and then stops. The program counter points to the next instruction to be executed.
CONT	Causes program execution to resume, starting at the address in the program counter.
APL	Loads the MANIP program into the top 1000 octal words of memory to enable the use of MANIP. **If the central processing unit (CPU) is already running, press STOP before APL.** If the CPU mini-switches are set to octal 100200, pressing APL causes the CPU software self-test to be loaded (see Section 7.2.2). If the CPU mini-switches are set to octal 200 + nn, the CPU does an automatic initial program load (IPL) from device nn when APL is pressed.

Indicators, light-emitting diodes (LEDs), illuminate to show an active state. They monitor power with and without battery backup (see Table 3-3), and they monitor the central processing unit (CPU) operations (see Table 3-4).

TABLE 3-3. POWER INDICATORS WITH/WITHOUT BATTERY BACKUP

With Battery Backup (BBU)		
Power Supply **AC IN**	Card Chassis **BTRY OK**	Description
OFF	OFF	AC power is OFF. If the keyswitch is set to ON, AUTO or STDBY, the battery is completely discharged.
OFF	ON	AC power is OFF. If the keyswitch is set to ON, AUTO or STDBY, the BBU is supplying +5V to extended memory to maintain memory contents and +12V and -5V to slot 1 if the +12/-5V option card is used in BBU.
ON	OFF or BLINKING	AC power is on and BBU is recharging.
ON	ON	AC power is on and BBU is fully charged.
With or Without Battery Backup (BBU)		
Power Supply **AC IN**	Card Chassis **POWER OK**	Description
OFF	OFF	AC power source is OFF.
ON	OFF	If keyswitch is set to ON or AUTO, one of the power supply voltages may be out of tolerance (see power supply indicator panel), the power monitor board or power supply may be faulty, or a cable problem may exist between the card chassis and the power supply.
ON	ON	Power supply voltages are in tolerance and available to the card chassis.

TABLE 3-4. CENTRAL PROCESSING UNIT (CPU) INDICATORS

Indicator	Function
PAR ERR	Not used.
CARRY	Indicates the current state of the central processing unit (CPU) carry flag. Indicator lights when carry flag is set to a 1.
RUN	Indicates that the CPU is operating. The indicator does not light when the CPU is halted.

3.2 POWER MONITOR BOARD

The MARK 6 power supply contains a set of light-emitting-diode (LED) indicators that monitor the power supply and battery backup (BBU) voltages. It also generates the power-fail and power-gone signals for the system. The board is located on the front left side of the power supply. Figure 3-2 illustrates the indicators, and Table 3-5 lists the indicators and the meaning of each when illuminated.

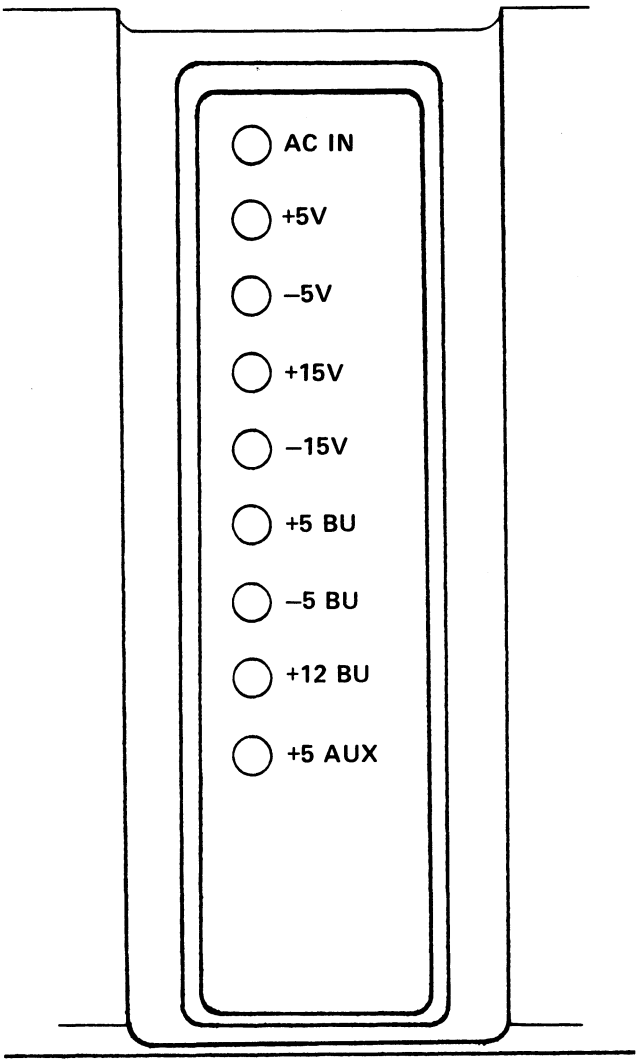


Figure 3-2. Power Monitor Board Indicators

TABLE 3-5. POWER MONITOR BOARD INDICATOR DESCRIPTIONS

Indicator	Description
AC IN	AC power is on.
+5V	+5V output voltage is in tolerance and ready for user application.
-5V	-5V output voltage is in tolerance and ready for user application.
+15V	+15V output voltage is in tolerance and ready for user application.
-15V	-15V output voltage is in tolerance and ready for user application.
+5 BU*	+5 battery backup supply is in tolerance. This output voltage is used by extended memory, slots 2-5. It may be used by some central processing units (CPU) that back up main memory (MARK 5/8/9).
-5 BU*	-5 battery backup supply is in tolerance. This output voltage is available on slot 1 only. It is not used by the MARK 6 CPU or extended memory. It is optional on the battery backup.
+12 BU*	+12 battery backup supply is in tolerance. This output voltage is available on slot 1 only. It is not used by the MARK 6 CPU or extended memory. It is optional on the battery backup.
+5 AUX	Not used.
*If battery backup is not installed, these are connected to their non-BU counterparts: +5BU = +5V; -5BU = -5V; +12BU = +15V.	

3.3 MANIP

MANIP is a program that allows the user to perform several system functions from the master terminal keyboard. These functions include loading the program, running the CPU software self-test, and allowing the user to display and examine the contents of memory on the master terminal.

The MANIP program is automatically loaded into memory at initial power-up and when APL is pressed. It can also be loaded if the system halts by pressing <ESC> on the master terminal keyboard.

3.3.1 MARK 6 MANIP Features

The MARK 6 MANIP program has expanded capabilities over MARK 5/8/9 series computers. The additional features allow MANIP to:

- Display the program counter (PC), four accumulators, and the CPU status word
- Modify the CPU status word
- Jump to the address where the last halt occurred
- Initialize extended memory (if present) before performing a program load function
- Load the CPU software self-test and begin to execute it in a continuous loop
- Load DBUG and BZUD into memory
- Begin every line with the prompt ->

For more information about MANIP, see Sections 5.2, 7.2, and Appendix C.

Section 4
INSTALLING THE SYSTEM

Because the MARK 6 integrated system is delivered fully assembled and housed in a cabinet, it is easy to install. This section includes information and instructions for installing an integrated system, including a procedure for checking out the system after it is unpacked, and instructions for installing the Pico-N and battery backup.

NOTE

For information on installing individual components, see Section 6, Installing and Replacing Components.

4.1 SYSTEM CHECKOUT

Although the MARK 6 integrated system is shipped fully assembled in a cabinet and does not require internal cabling, the system should be checked out, after the system is unpacked and before the software is loaded, to ensure that its components have arrived intact and in place. The checkout includes instructions for installing the Pico-N. The recommended procedure follows. **Do not attempt to plug in or turn on the system until instructed to do so.**

1. To prevent the cabinet from tipping over, pull out the stabilizer bar, located at the bottom front of the cabinet (see Figure 4-1).

2. Make certain that the keyswitch on the mini-panel is turned to OFF.

3. Snap off the card chassis bezel and check each board as follows:

   a. Pull out the metal tabs, which are located on the outside edges of each board, and pull on them to slide the board out. This may involve disconnecting cables. If so, note where cables are attached before disconnecting, so that they can be reconnected properly when the boards are returned to the chassis in Step 3 (e).

   b. Inspect each board to ensure that all components are intact.

   c. If a board contains socketed components, place the board on a table and carefully push down on all socketed components to make certain they are firmly seated.

   d. Slide the boards back into the chassis and push the tabs back into place.

   e. Reconnect the cables to the boards.

4. Snap the card chassis bezel back into place.

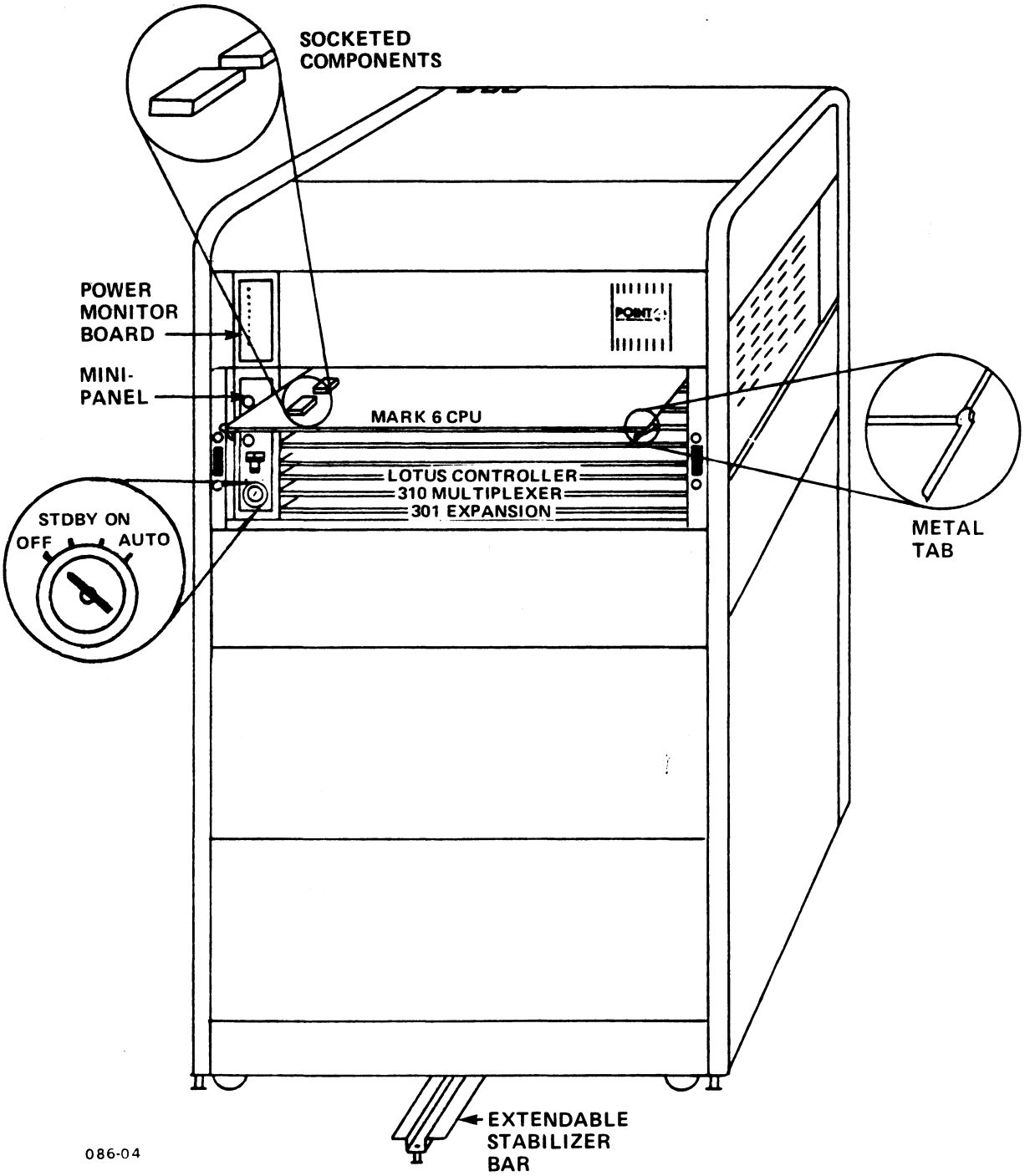


Figure 4-1. Front View, MARK 6 Integrated System

5. Detach the Allen key from the rear panel. Unlock the panel by inserting the key into the lock and turning it counterclockwise. Open the panel.

6. Make certain that the main power switch at the bottom of the cabinet is set to OFF (see Figure 4-2).

7. Check that the fuses on the back of the main power supply are intact. Make certain that the switch above them is turned to ON.

8. Check that all cables are firmly connected.

9. On the rear of the rack-mounted peripheral subsystem, make certain that the fuse is intact, the AC plug is firmly seated, and the power is ON.

10. If IRIS is the operating system, install the Pico-N. To install, push the Pico-N's connector carefully onto the pins on the left side of the backplane. It can be placed anywhere that does not interfere with the multiplexer or any other backplane connectors.

11. Connect the CRT and printer cables into the multiplexer connector panel on the rear rails of the cabinet. The first connector is Port 0, which is at the extreme left. Port 0 is the port for the master terminal.

    Placement of CRT and printer cables is determined on site at installation time.

12. If battery backup is being installed, see the instructions provided in Section 4.2. Otherwise, proceed to Step 13.

13. Close the rear panel making certain that the cables extend freely through the bottom of the cabinet.

14. Push the stabilizer bar back so that it does not extend beyond the cabinet.

15. Move the MARK 6 to its permanent place.

16. Turn the leveler feet counterclockwise until the rollers are lifted off the floor.

17. Adjust the leveler feet until the MARK 6 is level.

18. Proceed to Section 5, Getting Started.

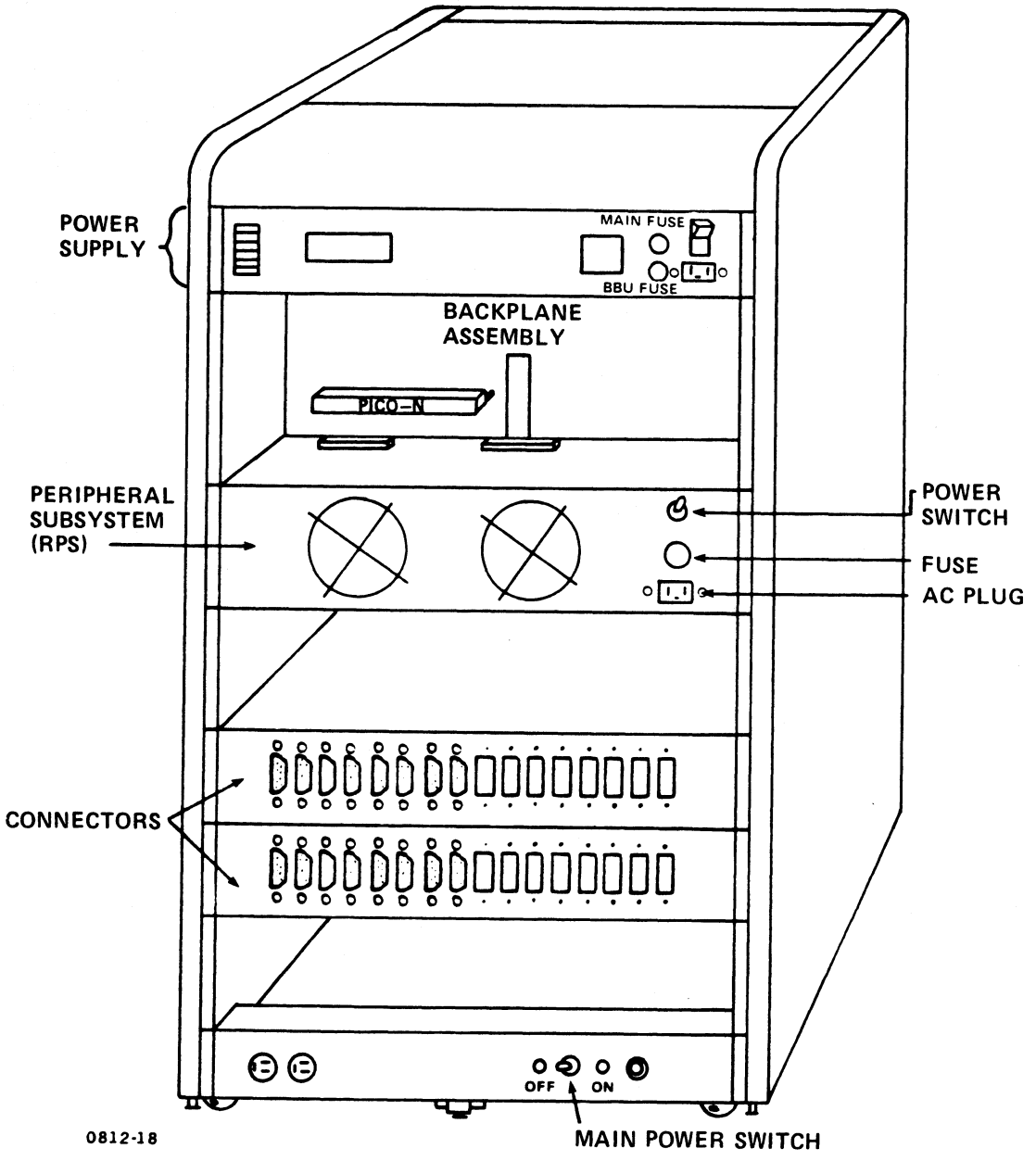


Figure 4-2. Rear View, MARK 6 Integrated System

4.2 INSTALLING BATTERY BACKUP

Battery backup (BBU) is an optional feature of the MARK 6 which helps to ensure that information will not be lost in case of a power failure. It is normally installed during the system check-out (see Step 12, Section 4.1).

The battery backup (BBU) is installed in the left side of the power supply as follows (see Figure 4-3):

1. Snap off the power supply bezel (not shown).

2. Unscrew the three screws of the BBU front panel and remove the panel.

3. Remove the AC and DC cables from the back and slide the BBU tray out of the power supply (not shown).

4. Plug the battery cable (88039) into the BBU board at J5 (not shown).

5. Slide the BBU assembly tray (142058) into the BBU compartment (not shown).

6. Replace the front panel and three screws removed in Step 2; then replace the power supply bezel.

7. At the rear of the power supply, install a slow blow fuse into F2: two amp for 115 VAC; one amp for 230 VAC.

8. Install the BBU cables as follows:

   a. AC power cable (88041) - Connects from J16 to J20 on the power supply.

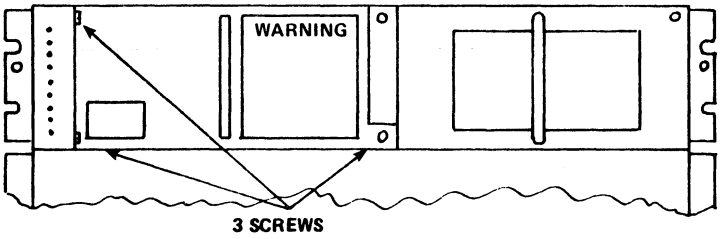
   b. DC power cable (88036) - Connects from J6 on the back-plane to J18 on the power supply.

   c. BBU control cable (88035) - Connects from J7 on the backplane to J17 on the power supply.

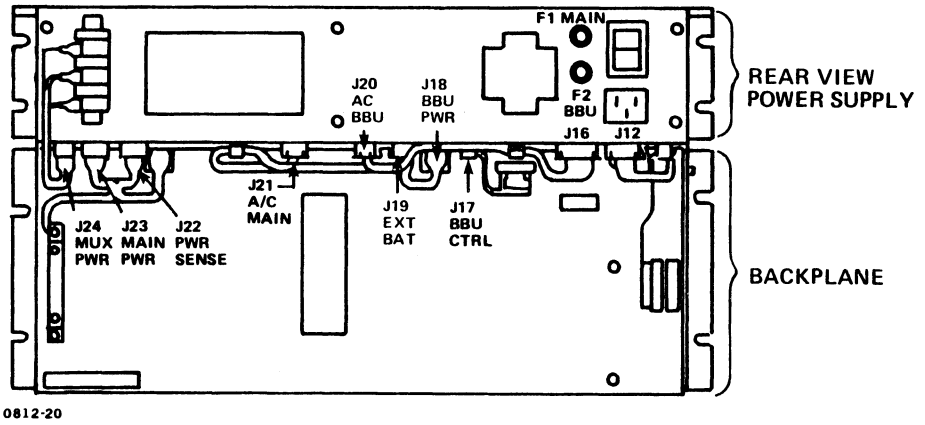
9. Use cable clamp (72107) to secure the battery backup AC power cable (88041) to the power supply.

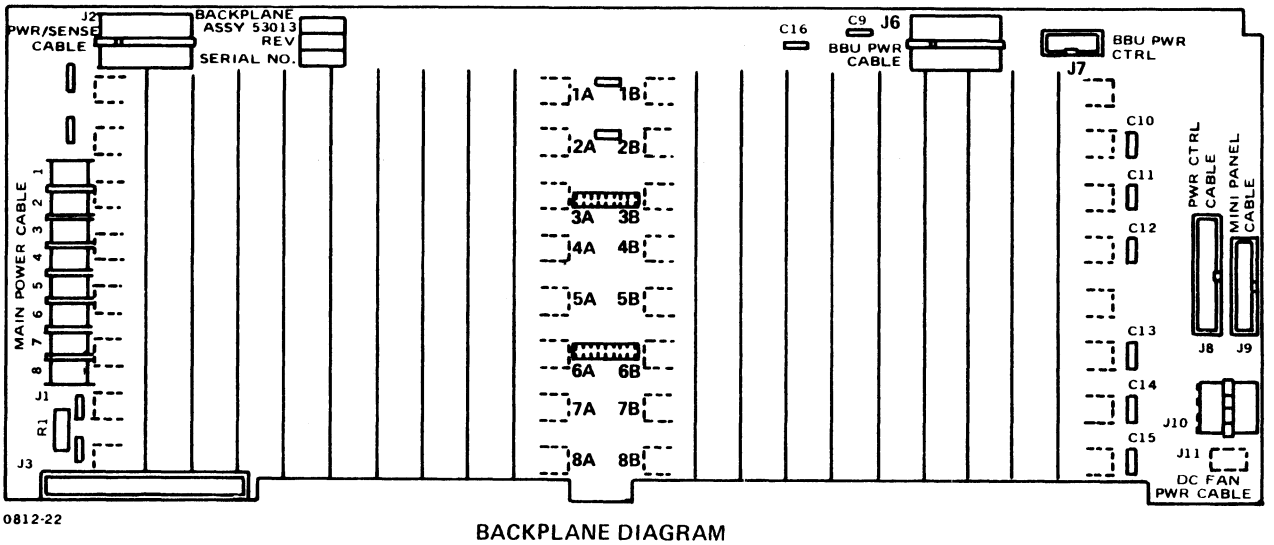
NOTE

If the battery backup unit is removed from the system for any reason, disconnect the battery.



BATTERY BACKUP FRONT PANEL





BACKPLANE DIAGRAM

Figure 4-3. Battery Backup Installation

Section 5
GETTING STARTED

Once the installation has been completed, the procedures or routines in this section can be initiated: power-up, self-test, loading software, and initial program load (IPL). Power-up, self-test, and initial program load are described in the following subsections. For information on loading software, see Section 5.3.

For additional information, refer to:

- LOTUS DISCUTILITY Manual
- IRIS R9 System Configuration Manual
- IRIS R9 Peripherals Handbook
- IRIS R9 System Manager Manual
- IRIS R8 Installation and Configuration Manual
- IRIS R8 Operations Manual
- IRIS R8 Peripherals Handbook
- IRIS R8 Release Notes

5.1 POWERING UP

A power-up is initiated when the power is turned ON. This action also initiates the CPU Self-Test. Powering-up is a function of the mini-panel (see Figure 3-1), which is located on the front left side of the card chassis. The steps of the power-up procedure are reflected in the LEDs of the power monitor board (see Figure 3-2).

1. Make certain the mini-panel keyswitch is turned to OFF.

2. Make certain the main power switch at the bottom of the cabinet is OFF.

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

4. Turn ON the main power switch.

   The AC indicator on the power monitor board lights.

   If the AC indicator does not light, check that:

   a. AC power is connected at the wall and at the bottom rear of the cabinet

   b. Power control cable is connected to the card chassis

   c. Fuse in the power supply fuse box is good

5. Turn the mini-panel keyswitch to STDBY.

   If the power supply contains battery backup (BBU), the +5 BU should light; if the BBU has the +12/-5 Volt Regulator option, the -5 BU, and the +12 BU indicators should light.

6. Turn the mini-panel keyswitch to ON.

   The POWER OK indicator on the mini-panel and the power monitor board indicators should light.

   If an indicator on the power monitor board does not light, check its voltage (see Section 7.3.1).

5.2 SELF-TESTS

The power-up procedure initiates the central processing unit (CPU) Self-Test. The CPU Self-Test includes a firmware self-test that verifies hardware is functioning enough to communicate with a terminal, and a CPU software self-test that verifies the CPU software is functioning. The firmware self-test runs once and the software self-test repeats four times. The sequence is as follows:

- Firmware self-test routine
- Loading of MANIP, a software program that controls the operation of the CPU from the master terminal
- CPU software self-test

If the CPU Self-Test completes successfully, the RUN indicator lights, and the CARRY indicator blinks on the mini-panel and also on the front of the CPU board. Control is turned back to the MANIP program. The following message is displayed on the master terminal:

```
POINT 4 MARK 6 SELF TEST
CPU LOGIC OK, ON-BOARD MEMORY OK
000001:VVVV
PRESS ? FOR HELP MENU
->
```

POINT 4 recommends that testing be continued by running diagnostics and then the CPU software self-test for an extended period. If any part of the CPU Self-Test sequence described above fails, refer to Section 7, Troubleshooting.

Diagnostics are available as stand-alone programs or on the IRIS Operating System. To use the diagnostic programs on the IRIS Operating System, it is necessary to load the operating system first. If IRIS cannot be accessed or if another operating system is used, stand-alone diagnostics should be run. These diagnostics can be ordered from POINT 4. Instructions for running diagnostics are in Section 7.4.

To access the CPU software self-test (whether or not IRIS is loaded), press STOP and then APL on the mini-panel. To instruct MANIP to run the CPU software self-test, enter T on the master terminal. The self-test will run in a continuous loop until stopped. Typically it is allowed to run overnight at the time of installation. To stop the self-test, press <ESC> twice.

5.3 LOADING SOFTWARE

The loading of software normally takes place after the CPU self-test has been run for an extended period. For information on loading IRIS R9.0 or later revision, refer to the IRIS R9 System Configuration Manual; for information on loading IRIS R8.3E, see Appendix B. After the software is loaded, perform an initial program load (IPL) as described in Section 5.4.

5.4 INITIAL PROGRAM LOAD (IPL)

Loading software places the IRIS Operating System on the disk. To transfer IRIS from disk to memory, it is necessary to perform an initial program load (IPL). Perform the IPL as follows:

1. Make certain the mini-panel keyswitch is turned to ON.

2. Press the STOP and then the APL buttons. The following is displayed:

```
->
```

3. Turn the keyswitch to AUTO.

   This prevents the system from halting if STOP is accidentally pressed. In the event of a power fail, operation will resume once the power comes on, if the keyswitch is set to AUTO.

4. At the master terminal, enter P. The following is displayed:

```
PRESS RETURN
```

5. Press <RETURN>. The following is displayed:

```
                    IRIS n.n

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ENTER YEAR,MONTH,DAY,HOUR,TIME
```

6. Enter the date and time in the YY,MM,DD,HH,MI format.

   Time is based on the 24-hour clock. For example, the date and time format for entering 7:30 A.M., April 25, 1987 is: 87,04,25,07,30. Do not space after commas.

   To default to the date and time that the system was last shut down, press <DELETE>.

7. Press <ESC>. The following is displayed:

```
ACCOUNT ID?
```

At this point, the initial program load (IPL) is completed. To continue, refer to the IRIS or other appropriate software documentation.

Section 6
INSTALLING AND REPLACING COMPONENTS

This section is for technicians who are upgrading a system or who need to remove and replace a faulty component. It provides instructions for the installation and replacement of essential MARK 6 components: the power supply, card chassis, and central processing unit (CPU). It also provides instructions for the installation and replacement of other components or boards where the procedure is unique to a MARK 6: extended memory, Lotus Cache Memory, 310 multiplexer, and 301 expansion boards; and the expansion chassis. For all other components or boards, refer to the manual that relates to that specific component or board.

Removal procedures are provided for the power supply and its modules in the event that the power supply or one of its modules becomes faulty. To remove other components, reverse the installation procedure.

Additional installation and configuration information for specific boards is available in the following:

- LOTUS 710/720/730 Controllers Manual
- SPECTRA 320/310L Product Reference Manual (LOTUS 740/745)
- Mag Tape Controller, Model TC200, Technical Manual (LOTUS 725)
- MIGHTY MUX User Manual
- LCM Hardware Manual

For installation of other components, refer to:

- Rack-Mounted Peripheral Subsystem Unpacking and Installation Technical Memorandum
- LOTUS DISCUTILITY (V5.3) Manual (for 1/2-inch Magnetic Tape Subsystem)
- Battery Backup, Section 4.2.

6.1 PLACEMENT OF COMPONENTS IN A SYSTEM

MARK 6 components occupy designated positions in the chassis. The power supply, card chassis, rack-mounted peripheral subsystem, and expansion chassis (if required) mount into the standard RETMA (Radio Electronics Television Manufacturer's Association) rack and a cabinet in a given order. Boards also fit into the card chassis and the expansion chassis in a given order. The correct placement of components ensures that all cables will connect, and the system will perform optimally (see Figure 6-1).

6.1.1 Major Components

The power supply sits on top of and connects to the card chassis. If an expansion chassis is required, it occupies the space immediately below the card chassis. Otherwise, the rack-mounted peripheral subsystem which houses the disk/tape drive occupies the space below the card chassis.

6.1.2 Boards

Boards fit into the slots of the card chassis and the expansion chassis (if required) in the following order:

Board	Slot
MARK 6 CPU	1
Extended Memory	2,3,4,5 as needed
Disk/Tape Controller	The first slot below the extended memory boards
310 Multiplexer	The slot below the disk/tape controller
301 Expansion Boards	Up to the next five slots
LOTUS Cache Memory (LCM)	The next slot(s); LCMs cannot be used with extended memory

NOTE

If a 1/2-inch tape controller is used for on-line data input/output, place it above the disk controller. If it is used only as a streamer backup, place it above or below the disk controller.

If a system has an expansion chassis, do not use slot 8 of the main card chassis and slot 1 of the expansion chassis for any boards that require connectors to be pushed onto the backplane such as multiplexer Z cables or LOTUS 725 tape drive cables.

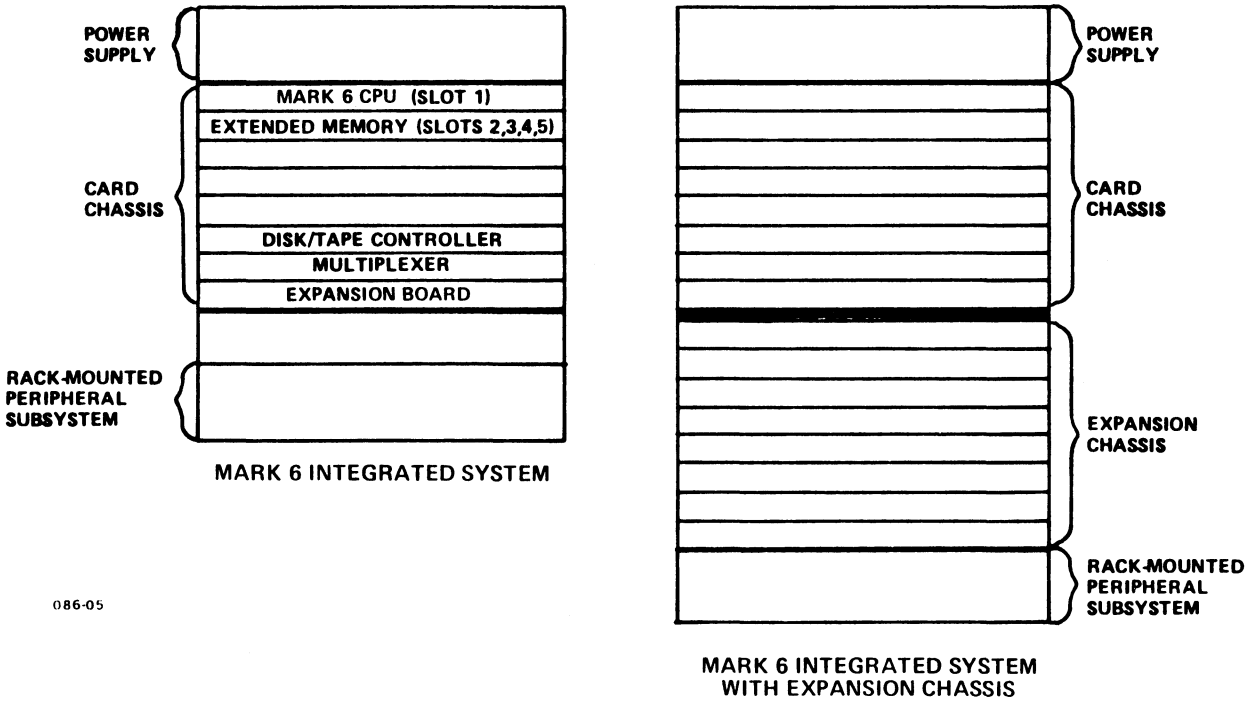


Figure 6-1. Placement of Components

6.2 INSTALLING THE CARD CHASSIS AND POWER SUPPLY

The card chassis (082013) is installed in the rack first; then the power supply (082012) is installed on top of it. Install them as follows (see Figures 6-2):

1. Make certain that the power is OFF.

2. Snap off the front bezels of the power supply and card chassis. Set them aside.

3. Mount the card chassis in the rack leaving sufficient room above it to mount the power supply. Secure it to the rack as illustrated.

4. Mount the power supply in the rack above the card chassis. Secure it to the rack as illustrated.

5. Secure the rear of the power supply to the rack with brackets (142061) and screws (708 FSP 8-32 x 3/8 Phillips head).

6. Connect the card chassis to the power supply:

   Mount the brackets (141052), one on each side of the chassis and spanning both card chassis and power supply, with screws (707 EGP 6-32 flat head). The bottom screw of the left bracket requires a washer (712240).

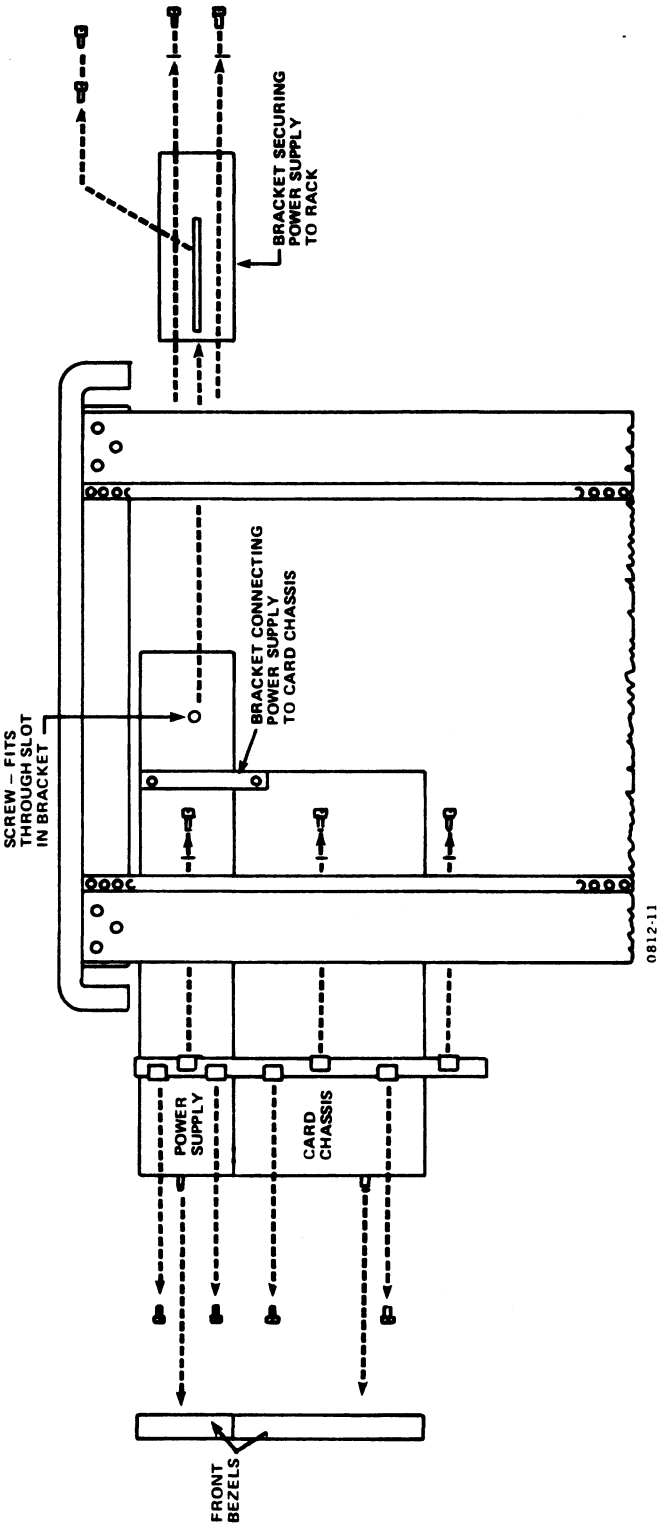


Figure 6-2. Connecting the Card Chassis and Power Supply

7. Connect the loose cables between the card chassis (C/C) and power supply (P/S) as follows (see Figure 6-3):

	From	To
Main AC cable (088040)	P/S J21	P/S J15
AC power cord (505006)	P/S J12	115/220 source
MUX power cable assembly (088052) - Orange to +12V - Red to -12V - Brown to GND	P/S J24	P/S TB1
Mux power supply dist. cable assembly (088060)	P/S TB1	322 cable/connector (32200)

8. Secure the AC cable with the cable clamp (721027) and screw (707FSP) to the underside of the power supply.

9. Connect the cables originating on the card chassis backplane to the rear of the power supply as follows:

	From	To
DC harness (88026)	C/C J1 C/C J2	P/S J23 P/S J22
Display control/Power monitor (88033)	C/C J8	P/S J25
Fan cable (82015)	C/C black cord	P/S J13

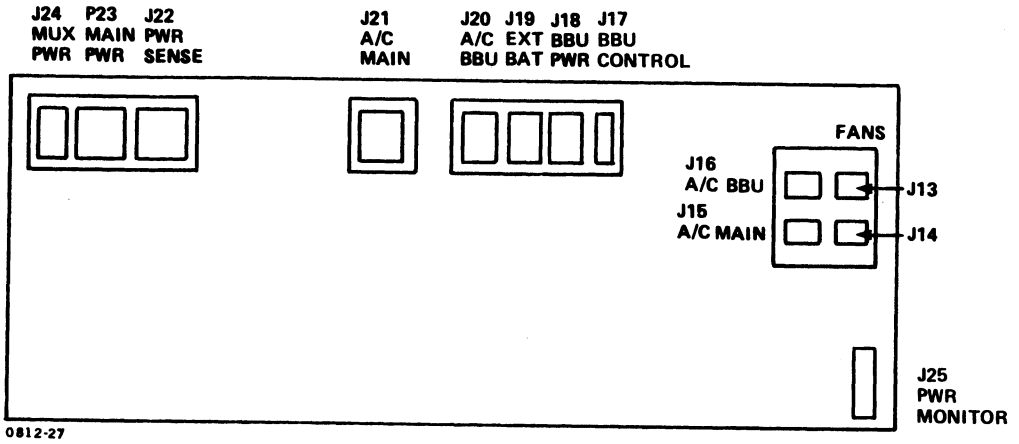
10. If boards are to be installed, see Section 6.5. After the boards are installed, replace the front bezels.

11. If the system includes a battery backup unit (BBU), perform the following at the rear of the chassis:

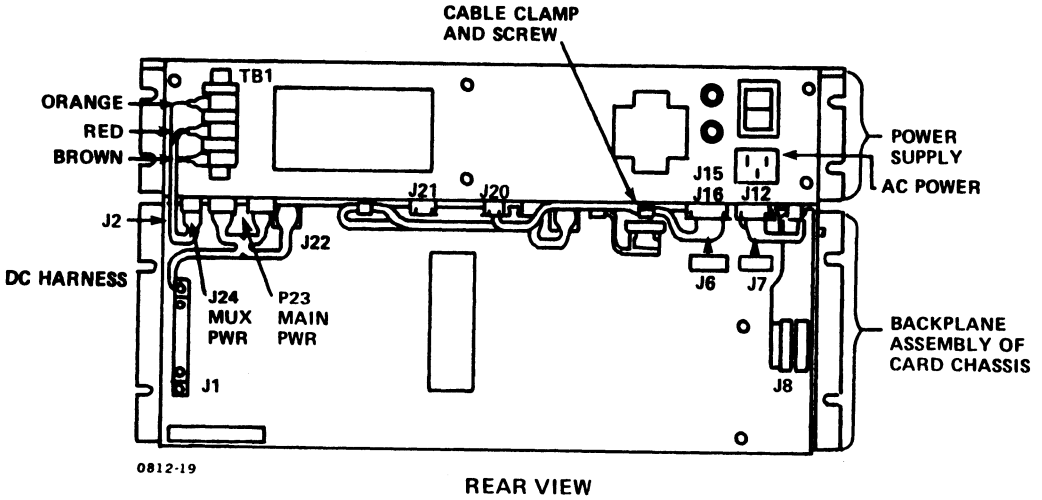
    a. Check location J6 to make sure there is no jumper plug.

    b. Connect the following cables:

	From	To
BBU AC cable (088041)	P/S J20	P/S J16
BBU DC cable (088036)	P/S J18	C/C J6
BBU control cable (088035)	P/S J17	C/C J7



POWER SUPPLY
UNDERSIDE VIEW



REAR VIEW

Figure 6-3. Connecting the Cables of the Card Chassis and Power Supply

6.3 INSTALLING THE RACK-MOUNTED PERIPHERAL SUBSYSTEM

Instructions for installing the rack-mounted peripheral subsystem, which houses the disk/tape drive, are described in a Technical Memorandum, (RPS) Unpacking and Installation. To install a rack-mounted peripheral subsystem (RPS), refer to that document. When connecting cables, the procedure is the same as that for the MARK 5/9.

6.4 INSTALLING THE EXPANSION CHASSIS

The expansion chassis is an optional eight-slot card chassis that can be installed directly below the main eight-slot card chassis to provide a total of 16 slots.

The expansion chassis connects to and uses the main power supply. Controller and multiplexer functions are extended to the main card chassis through inter-chassis cables. Because of rack space requirements, the expansion chassis requires a highboy cabinet.

In order to install the expansion chassis, it is necessary to begin by removing the rack-mounted peripheral subsystem (RPS) from the MARK 6. If the MARK 6 is housed in a POINT 4 cabinet, the next step is to install a U channel on the front of the rack frame to extend the existing U channel. The channel (126721-03) can be ordered from POINT 4. Once the U channel is attached to the frame, the expansion chassis is installed. Finally the rack-mounted peripheral subsystem is remounted below the expansion chassis.

To remove and replace the rack-mounted peripheral subsystem, refer to the technical memorandum, Rack-Mounted Peripheral Subsystem, Unpacking and Installation.

Install the expansion chassis as follows:

1. Make certain that the power is OFF.

2. Ensure adequate access to the chassis by removing the front bezel and opening the rear and side panels of the cabinet.

3. Remove the rack-mounted peripheral subsystem (RPS) as follows:

    a. Unplug the AC cord to the rack-mounted peripheral subsystem (RPS).

    b. Remove the ribbon cables from the controller board that connect to the rack-mounted peripheral subsystem in the main card chassis.

    c. Reverse the installation instructions provided in the technical memorandum, Rack-Mounted Peripheral Subsystem, Unpacking and Installation, and remove the RPS and its slides from the MARK 6.

4. Extend the existing U channel on each side of the front of the rack frame by adding a 6-1/2-inch section of U channel as follows (see Figure 6-4):

   a. Fit the new section of U channel against the existing channel. Orient it so that it corresponds to the existing channel and will span both the card chassis and the rack-mounted peripheral subsystem when reinstalled.

   b. Secure the channel to the frame with screws (709HSP) and and nuts at the top and bottom.

5. Slide the expansion chassis into the cabinet directly below the main eight-slot card chassis.

6. Secure the expansion chassis to the rack frame with two screws (709HSP) on each side.

7. Connect the expansion chassis to the main card chassis as follows:

   a. Mount the brackets (142080), one on each side of the chassis at the rear and spanning the main and expansion card chassis with screws (707FSP).

   b. Secure the bottom of the main card chassis to the expansion chassis with a screw (707DGP).

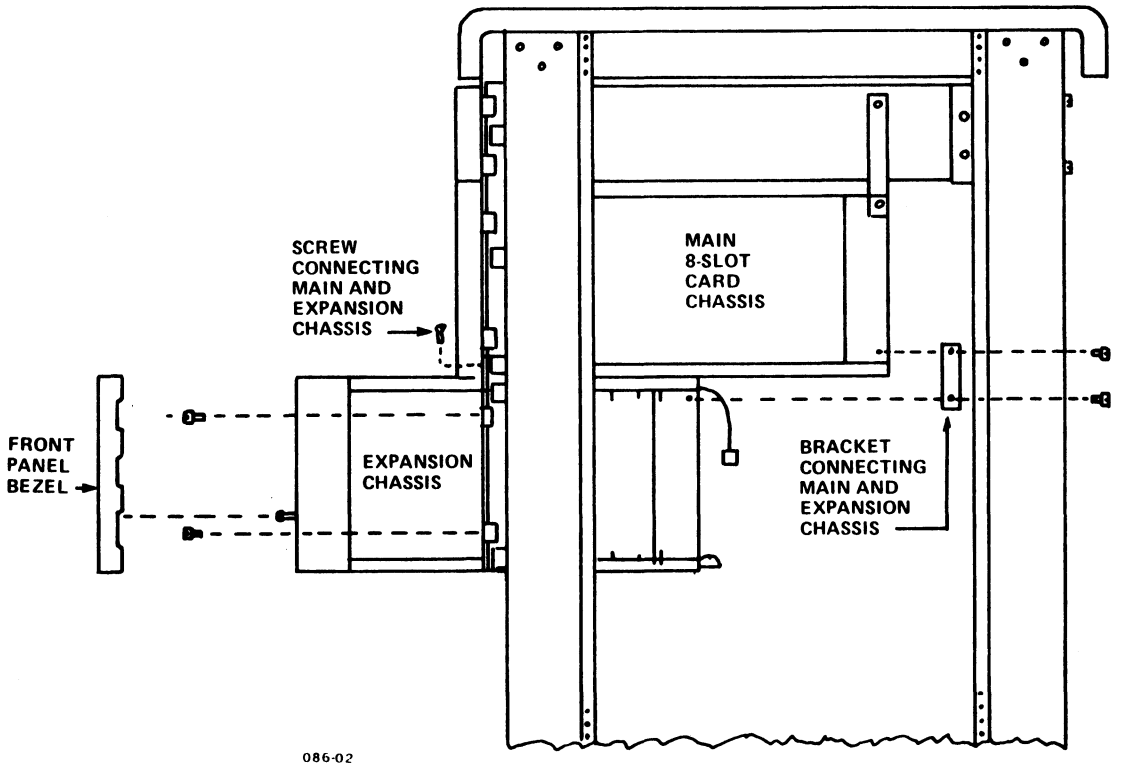


Figure 6-4. Installing the Expansion Chassis

8. Unclamp the multiplexer cables from the cable mounting bracket assembly (82027).

9. Unscrew the wingnuts (711029), which are located at each end of the cable mounting bracket assembly, and remove the assembly.

10. Install the inter-chassis cables as follows (see Figure 6-5):

    a. Cable assembly A (88054-01P): Carefully push the top connector (labeled) onto the main card chassis at location 8A; and the bottom connector onto the expansion chassis at location 1A. Pin 1 is to the left.

    b. Cable assembly B (88054-02P): Carefully push the top connector (labeled) onto the main card chassis at location 8B; and the bottom connector onto the expansion chassis at location 1B. Pin 1 is to the left.

    c. Expansion power cable (088053): Remove the screws from the main chassis terminal (J1) at positions 4 and 5. Connect the wires as described below; then secure the screws onto the terminals again.

        - Connect the red wire on the expansion chassis terminal, position 4 at location J1, to the main chassis terminal, position 4 at location J1.

        - Connect the brown wire on the expansion chassis terminal, position 5 at location J1, to the main chassis terminal, position 5 at location J1.

    d. Jumper saver cable (088055): Connect the cable on the expansion chassis jumper saver at location J3 to the main chassis jumper saver at location J3.

    e. Fan cable (082015): Connect the cable on the upper right side of the expansion chassis to the main power supply at location J13.

11. Reinstall the rack-mounted peripheral subsystem below the expansion chassis according to the instructions in the technical memorandum, Rack-Mounted Peripheral Subsystem Unpacking and Installation.

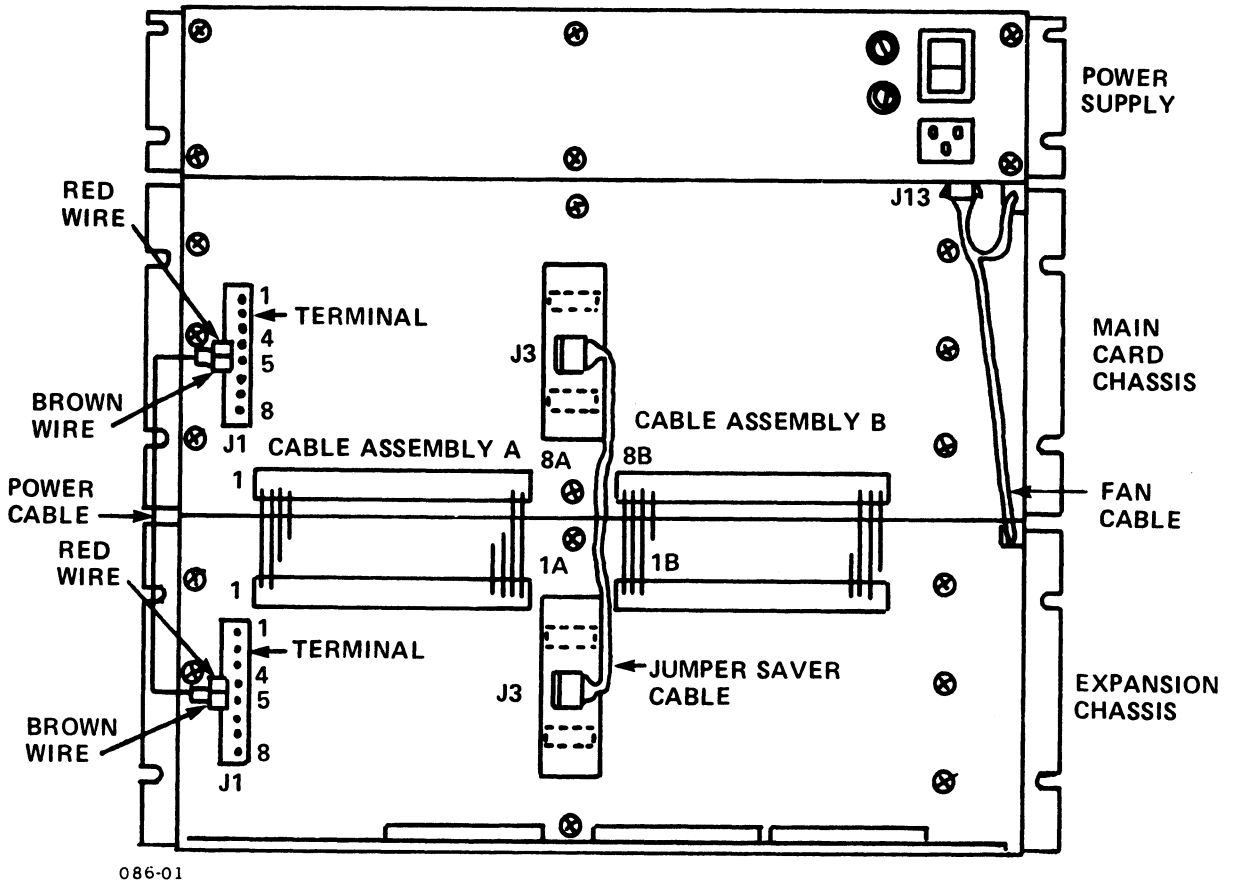


Figure 6-5. Connecting the Main and Expansion Chassis

12. Before reconnecting the controller and multiplexer cables, use a digital volt meter to check the voltage at the +5V pins (not at the lugs) to make certain that the voltage is in tolerance.

13. Run the controller and multiplexer cables from the main chassis, down and over the front of the expansion chassis, under the bottom slot of the expansion chassis and out the rear of the chassis.

14. Place the controller and multiplexer cables in the cable clamps of the cable mount bracket.

15. Replace the front bezels and the rear and side panels of the cabinet.

6.5 INSTALLING BOARDS

This section describes the installation of the MARK 6 central processing unit (CPU) board and extended memory board(s). Boards that have variations or installation procedures specific to the MARK 6 (for example, multiplexer and expansion boards and Lotus Cache Memory) are also described. For other boards, refer to the manuals that describe the installation of those boards.

In addition to the specifics provided for the installation of individual boards, the following instructions apply generally to any board installation:

1. Make certain that the power is OFF.

2. Press down firmly on any socketed components.

3. Slide each board into its slot with the component side up, and its cable(s) hanging down in front.

4. Route the cables downward and slide them back toward the rear of the chassis below the bottom board.

5. Use the appropriate diagnostics to test each board as it is installed. Diagnostics are listed in Section 7.4.

6.5.1 Central Processing Unit (CPU)

The central processing unit (CPU) is easily recognized by the POWER/ERROR/CARRY/RUN and 16 green indicators, two banks of mini-switches, and the STOP/APL/CONT buttons on the front edge.

The mini-switches determine the manner in which an initial program load (IPL) is performed and/or the manner of access to the CPU software self-test. The switches can also be manipulated by technicians to read any location in main memory during troubleshooting. Table 6-1 illustrates the three options for setting the mini-switches and the results of each option.

Install the CPU board as follows (see Figure 6-6):

1. Set the mini-switches as desired (see Table 6-1).

2. Slide the board into the first slot of the card chassis. Close the metal tabs which are located on each side of the front edge of the board.

TABLE 6-1. CPU MINI-SWITCH SETTINGS

Switch Value	Switch Setting* Bank 1	Switch Setting* Bank 2	To IPL	Access Self-Test
Standard PT 4 Configuration Octal 0	▲▲▲▲▲▲▲▲	▲▲▲▲▲▲▲▲	From Disk: Turn keyswitch ON Wait for MANIP ->* Enter Pnn Press <RETURN>	Through MANIP
Octal 200+mm	▲▲▲▲▲▲▲▲	▼▲xxxxxx	Turn keyswitch ON Press APL	Through MANIP
Octal 100200**	▼▲▲▲▲▲▲▲	▼▲▲▲▲▲▲▲	WILL NOT IPL	Directly. Runs self-test forever.

nn - device code to boot from. If P <RETURN> is entered, it defaults to 27; this is valid for a LOTUS disk controller board.

mm - device code to boot from.

*Switch setting:
▼ - on or closed **(down)**
▲ - off or open **(up)**
xxxxxx - binary form of mm

**This setting is used when running self-test overnight at initial installation or when troubleshooting.

086-06

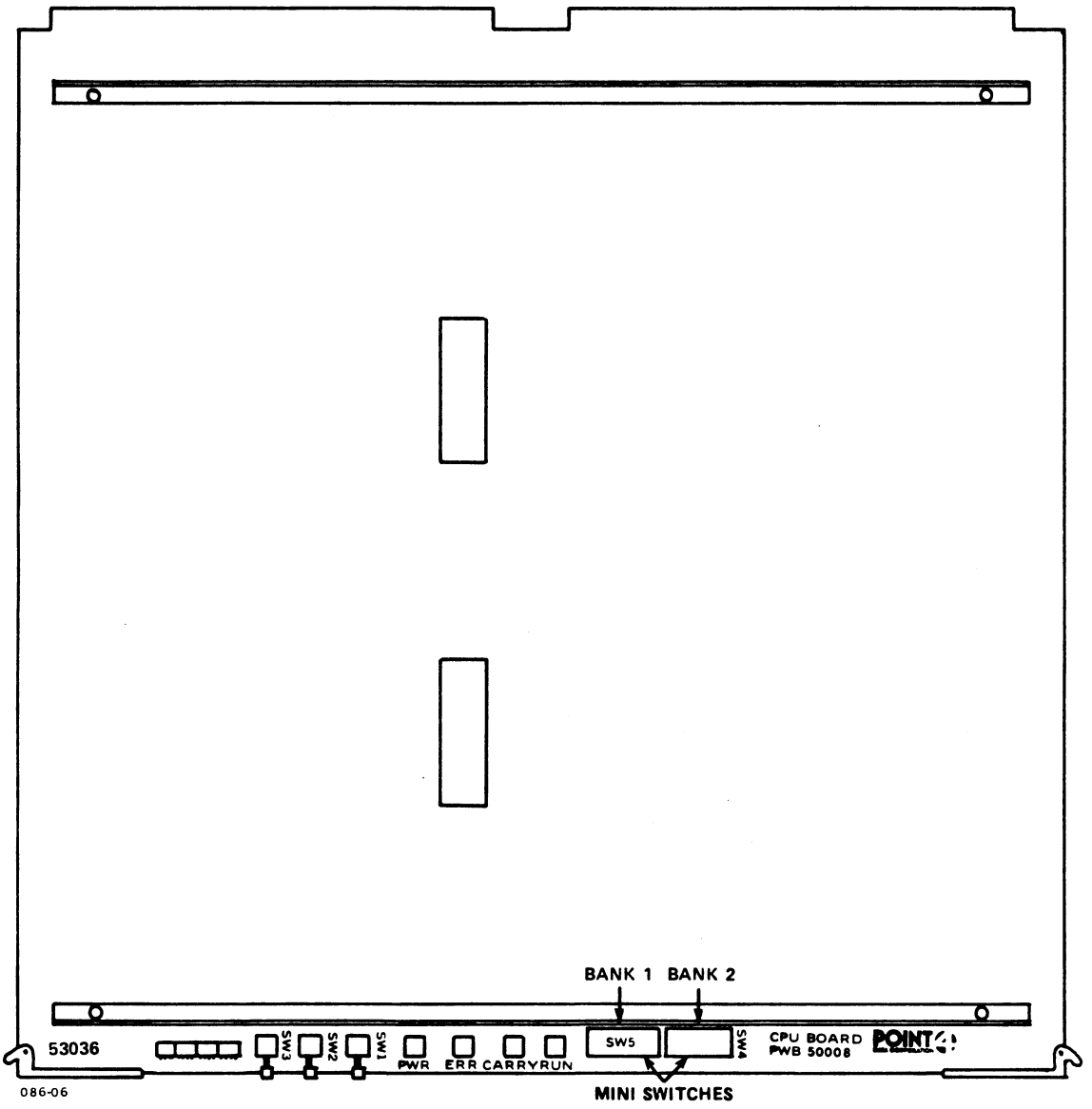


Figure 6-6. Central Processing Unit (CPU)

6.5.2 Extended Memory Boards

A maximum of four memory boards providing up to 16MB of additional memory can be installed in a MARK 6. The boards are available in 2 or 4MB capacities. They are identifiable by part numbers in the front left corner: a 2MB board is 053009-01; a 4MB board is 053009-02.

Install each extended memory board (must be Rev A3 or later, or have ECO 1606 installed) as follows (see Figure 6-7):

1. Set the power jumpers as follows:

   With no battery backup, leave the following jumpers in: W1, W3, W4, W5, W6, W7, W8, and W21. Cut these jumpers: W2, W14, W15, and W20.

   With battery backup, leave the following jumpers in: W1, W2, W3, W8, W14, W15, W20, and W21. Cut these jumpers: W4, W5, W6, and W7.

2. Set the switch at location A30 to the **beginning** block address as follows:

   For each extended memory board, set the four-position switch to indicate the total number of megabytes of Extended Memory already defined. Address the larger memory (4MB) board(s) first and then proceed to the smaller memory (2MB) board(s) regardless of their installed order in the card chassis. The following is a guide for setting the switches:

Total MB of Extended Memory Already Defined	**SW1 Switch/Setting***			
	Key1	**Key2**	**Key3**	**Key4**
0 (First Board - any size)	0	0	0	NU
2	0	0	1	NU
4	0	1	0	NU
6	0	1	1	NU
8	1	0	0	NU
10	1	0	1	NU
12	1	1	0	NU

   *1 - on or closed
   0 - off or open
   NU - not used

3. Slide the extended memory board(s) in slot 2 (3, 4, 5) of the card chassis.

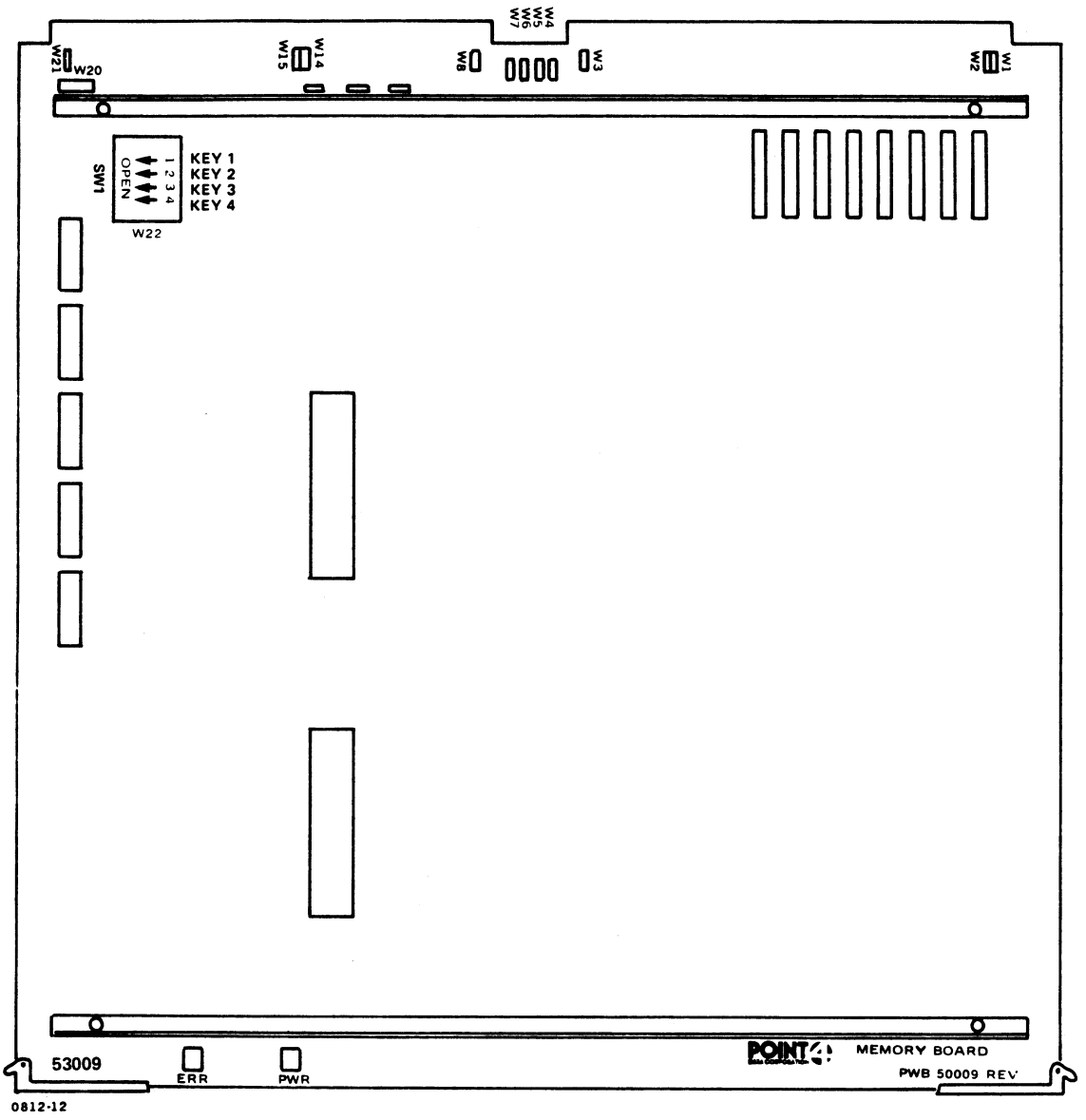


Figure 6-7. Extended Memory Board

6.5.3 LOTUS Controller Board

For installation instructions for LOTUS Controllers, refer to one of the following documents as appropriate:

LOTUS 710, 720, 730: LOTUS 710/720/730 Controllers Manual
LOTUS 725: Mag Tape Controller, Model TC200, Technical Manual
LOTUS 740, 745: SPECTRA 320/310L Product Reference Manual

6.5.4 Multiplexer and Expansion Boards

The 310 multiplexer board and the 301 expansion boards provide communications between the central processing unit (CPU) and up to 128 peripheral devices. The 310 multiplexer board provides eight ports for peripherals; the 301 expansion boards provide 8, 16, or 24 ports each. Each MARK 6 has one 310 multiplexer board and a maximum of five optional 301 expansion boards.

Although the installation of the 310 multiplexer board and the 301 expansion boards is described in the MIGHTY MUX User Manual, the basic procedure is included here because it differs for the MARK 6. Comprehensive information about the 310 multiplexer and the 301 expansion boards, including hardware selectable options, is provided in the MIGHTY MUX User Manual.

Table 6-2 is a MARK 6 configuration guide for the 310 multiplexer and 301 expansion boards where DB25 connectors are used.

TABLE 6-2. MARK 6 MULTIPLEXER (MIGHTY MUX) CONFIGURATION GUIDE

NUMBER OF PORTS	MUX 310	EXPANSION 301			PANEL	CABLE ASSY	INTRBRD (Z) CABLE	POWER CABLE	CHASSIS SLOTS NEEDED*
		8	16	24					
8**	1				1	1		***	1
16	1	1			1	2	324-1	1	2
24	1		1		2	3	"	2	2
32	1			1	2	4	"	2	2
40	1	1		1	3	5	324-2	3	3
48	1		1	1	3	6	"	3	3
56	1			2	4	7	"	4	3
64	1	1		2	4	8	324-3	4	4
72	1		1	2	5	9	"	5	4
80	1			3	5	10	"	5	4
88	1	1		3	6	11	324-4	6	5
96	1		1	3	6	12	"	7	5
104	1			4	7	13	"	7	5
112	1	1		4	7	14	324-5	7	6
120	1		1	4	8	15	"	8	6
128	1			5	8	16	"	8	6

*MARK 6 card chassis has eight slots. If more than eight slots are needed, an expansion chassis is required.

**Included with all integrated systems.

***First eight ports use main power (PSS5010), power cable required for ports 9 through 128.

6.5.4.1 310 MULTIPLEXER

Install the 310 multiplexer board as follows (see Figure 6-8):

1. Set the baud rate rotary switch, located at 10M on the 310 multiplexer board (Rev C only) to the appropriate Port 0 default baud rate. Use one of the settings below.

Setting	Baud Rate	
0	110	
1	150	
2	300	
3	600	19.2KB if using option B*
4	1200	
5	2400	
6	4800	
7	9600	Standard POINT 4 setting
8,9		Do not use

*To install the B option which replaces 600 baud with 19.2KB, refer to MIGHTY MUX User Manual.

2. Insert the 310 multiplexer board into the first or other slot below the disk controller.

3. If 301 expansion boards are to be installed, refer to Section 6.5.4.2.

4. Attach the ribbon cable originating on the connector panel, located on the rear rail, to the 50-pin connector on the front edge of the 310 multiplexer board.

   Pin 1 is to the right of the connector. If the cable is reversed, it will reverse the numbering of the eight connectors on the connector panel.

5. For systems with 100 or more ports, the MSB of the port control block base address must be fixed to 0 as follows:

   a. Cut the etch between the two pins at X located between integrated circuit chips at 13J and 14J on the 310 multiplexer board.

   b. Install a jumper as indicated in Figure 6-8.

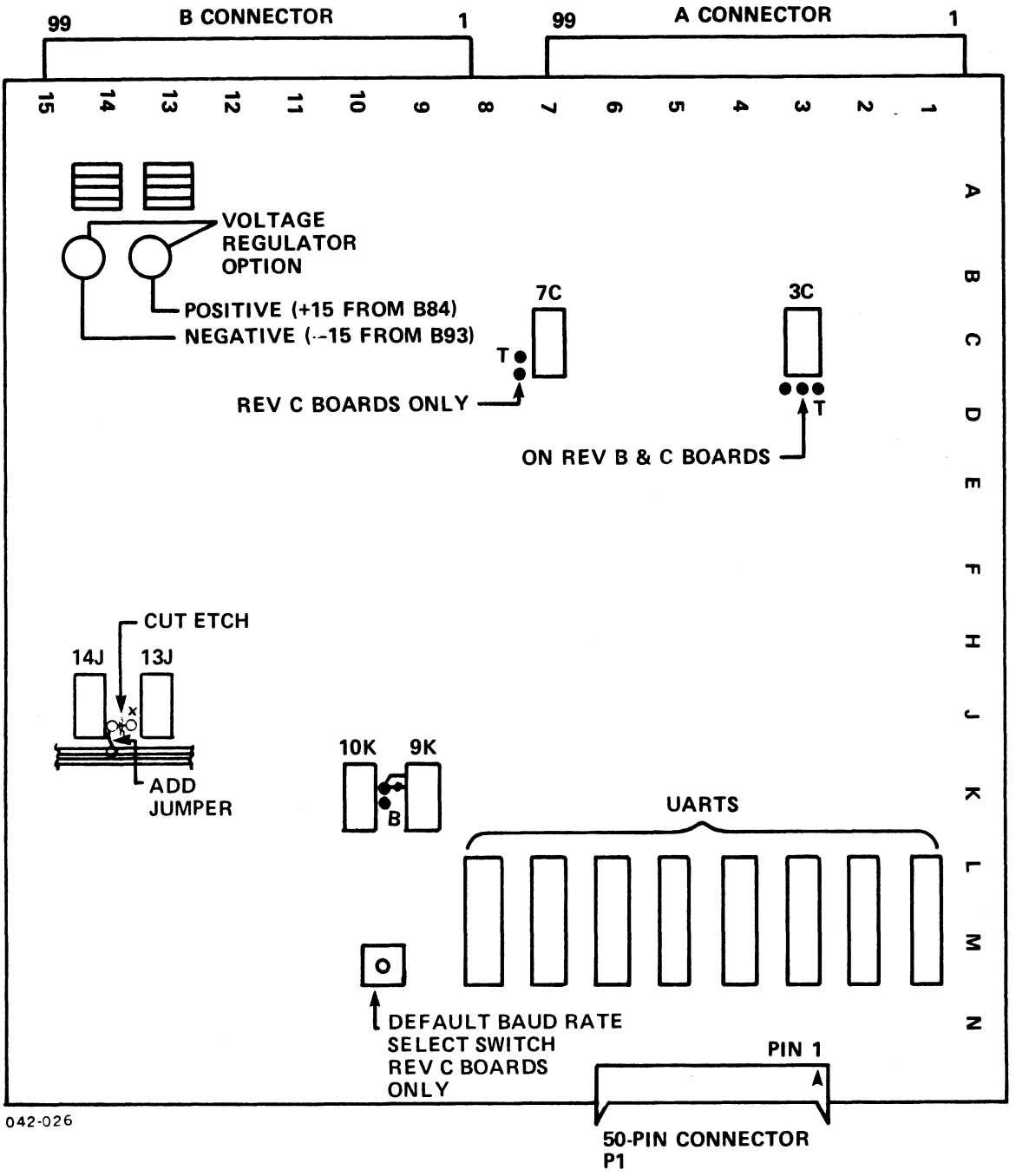


Figure 6-8. 310 Multiplexer Board

6.5.4.2 301 EXPANSION BOARDS

Install the 301 expansion board(s) as follows (see Figures 6-9, 6-10, and 6-11):

1. Set each four-position port set switch on the 301 boards.

   A 301-8 board supports eight ports and has a four-position switch at location 5C; a 301-16 board supports 16 ports and has four-position switches at locations 5C and 10C; a 301-24 board supports 24 ports and has four-position switches at locations 5C, 10C, and 15C.

   Set the four-position port set switches sequentially, starting with set 1 on the first 301 board at location 5C, and continuing until all port switch switches on all expansion boards are set. Figure 6-9 illustrates all possible port set switch settings for a 128-port system.

2. Insert the 301 expansion board(s) into the slot(s) immediately below the 310 multiplexer board. If the number of expansion boards required exceeds the number of slots available, an expansion chassis will be required.

3. Attach the ribbon cable originating on the connector panel, located on the rear rail, to the 50-pin connector on the front edge of the 310 multiplexer board (see Figure 6-6).

   Pin 1 is to the right of the connector. If the cable is reversed, it will reverse the numbering of the eight connectors on the connector panel.

4. Attach the ribbon cable(s) originating on the connector panel to the appropriate connector on the front of the 301 board. One cable is required for each eight ports.

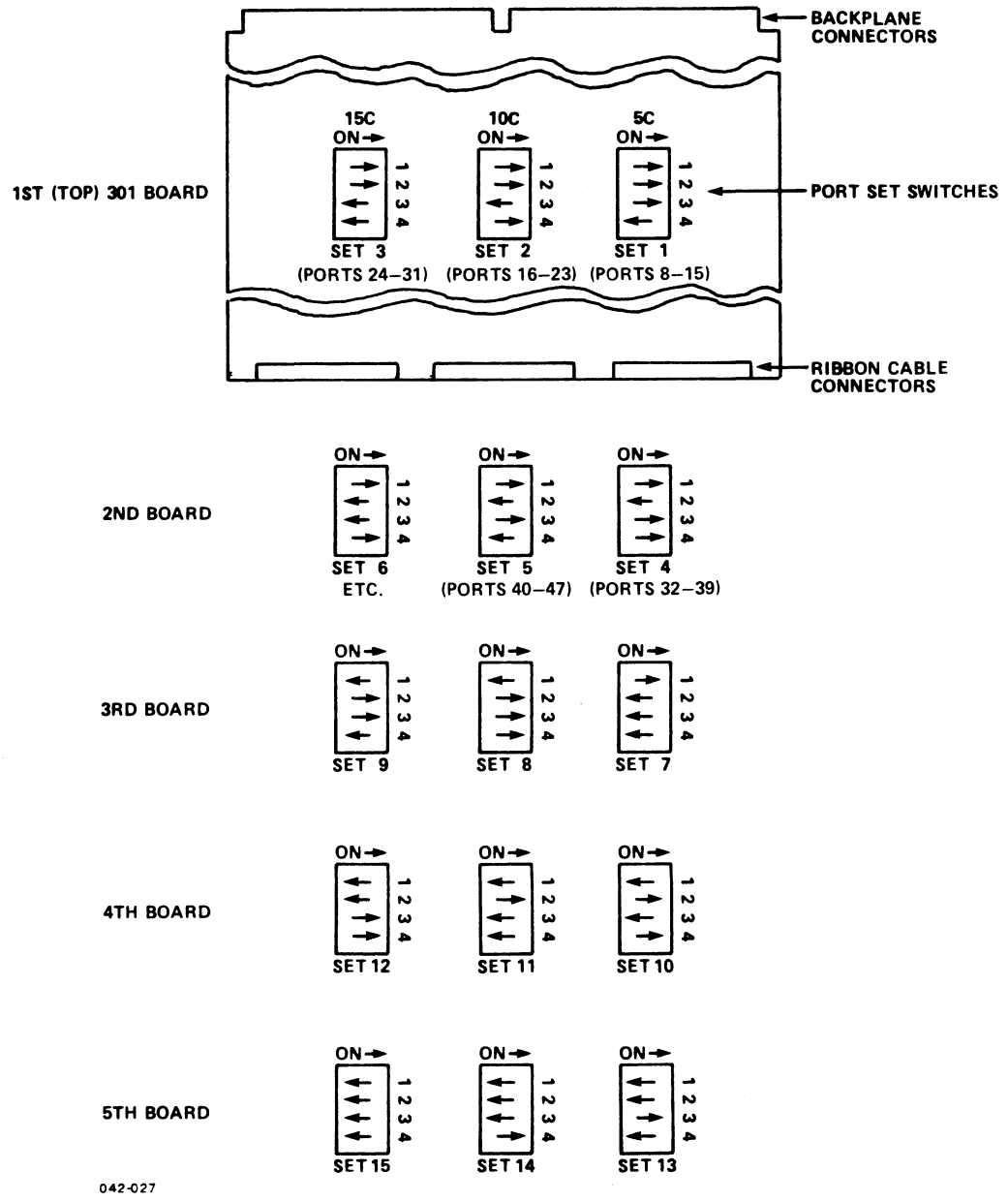


Figure 6-9. Setting Port Set Switches on 301 Expansion Boards

5. Attach the Z cables, A and B (Model 324), to the chassis backplane. Place the top connector of the A cable on the backplane where the 310 multiplexer is located and the bottom connector of the A cable on the backplane where the 301 expansion board is located (see Figure 6-10).

   Repeat this procedure with the B cable.

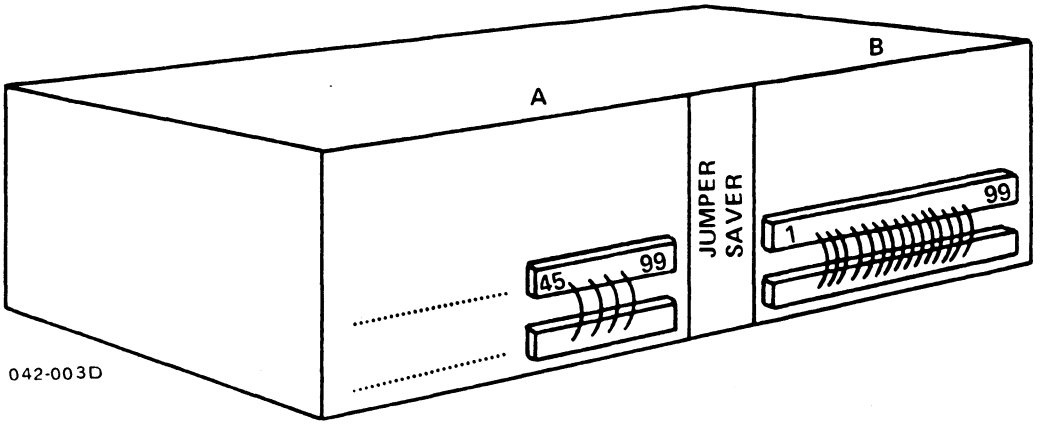


Figure 6-10. Z Cable Attachment from 310 to 301 Board

6. Connect the power supply to the multiplexer boards as follows (see Figure 6-11):

   Connect the power cable(s) from MUX PWR, which is located at J24, to TB1, which is located on the rear left of the power supply. Match the wires to the same color existing wires that are attached to the respective lugs as follows:

Lugs 1 and 2	orange	+12V
Lugs 3 and 4	red	-12V
Lugs 5 and 6	brown	Ground

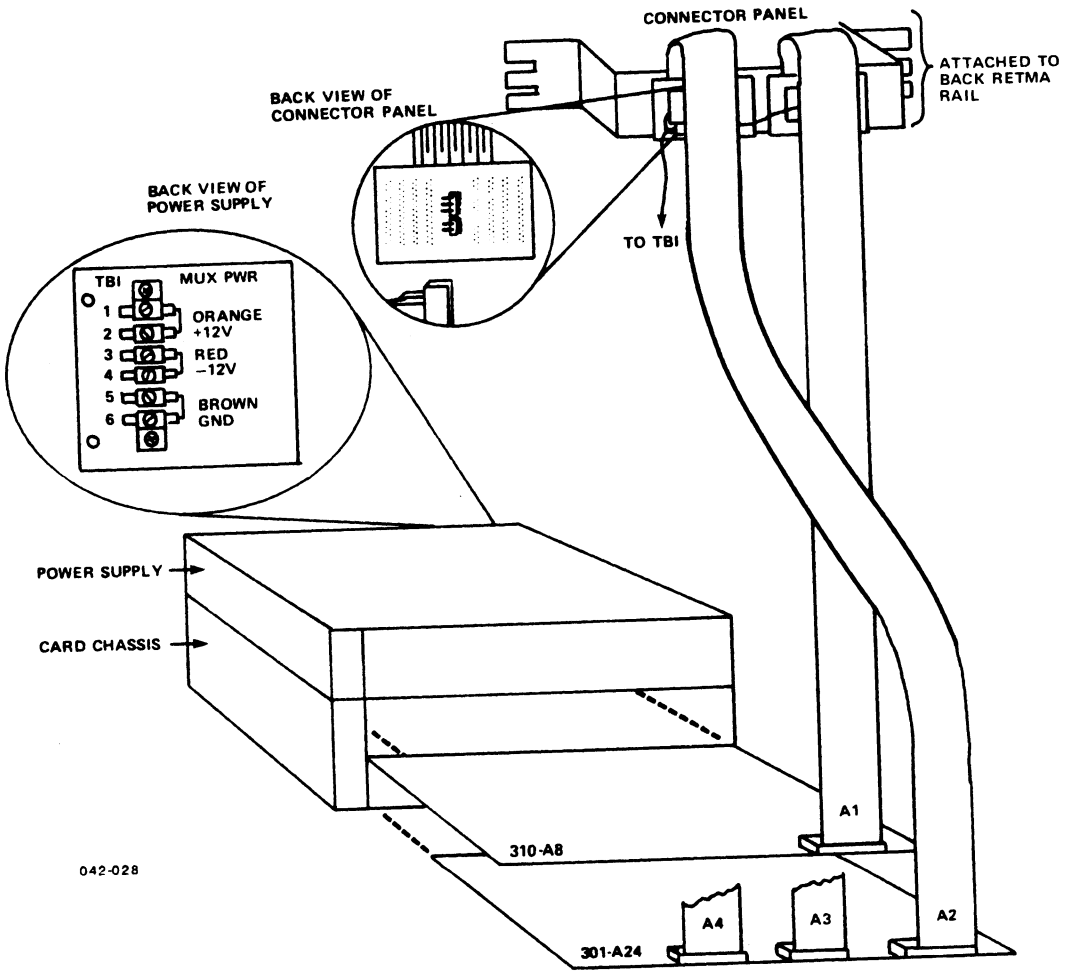


Figure 6-11. Installing 310 Multiplexer and 301 Boards

6.5.5 2/4MB Lotus Cache Memory (LCM) Board

A maximum of four Lotus Cache Memory (LCM) boards providing up to 16MB of cache can be installed in a MARK 6. The boards are available in 2 or 4MB capacities. They are identifiable by part numbers in the front left corner: a 2MB board is 053016-01; a 4MB board is 053016-02. LCMs cannot be used with extended memory boards.

Install the Lotus Cache Memory (LCM) board(s) as follows (see Figure 6-12):

1. Check that the power jumpers are set as follows:

   With no battery backup, leave the following jumpers in: W1, W3, W4, W5, W6, W7, W8, and W21. Cut these jumpers: W2, W14, W15, and W20.

2. Set the switches at location A30 to the **beginning** block address as follows:

   For each Lotus Cache Memory (LCM) board, set the four-position switch to indicate the total number of megabytes of cache already defined. Address the larger (4MB) board(s) first and then proceed to the smaller (2MB) board(s) regardless of their installed order in the card chassis. The following is a guide for setting the switches:

Total Megabytes of LCM Cache Already Defined	**SW1 Switch/Setting***			
	Key1	**Key2**	**Key3**	**Key4**
0 (First Board - any size)	0	0	0	NU
2	0	0	1	NU
4	0	1	0	NU
6	0	1	1	NU
8	1	0	0	NU
10	1	0	1	NU
12	1	1	0	NU

   *1 - on or closed
   0 - off or open
   NU - not used

3. To use the standard configuration of 100% for the data channel hit rate, make sure there is no jumper at location W22. To use a hit rate of 50%, install a jumper at W22.

   The standard configuration of 100% requires the Lotus Cache Memory (LCM) to be lowest in the data channel priority chain to prevent the tie up of the data channel by the LCM.

4. Slide the Lotus Cache Memory (LCM) board(s) into slot(s) below the 301 expansion board.

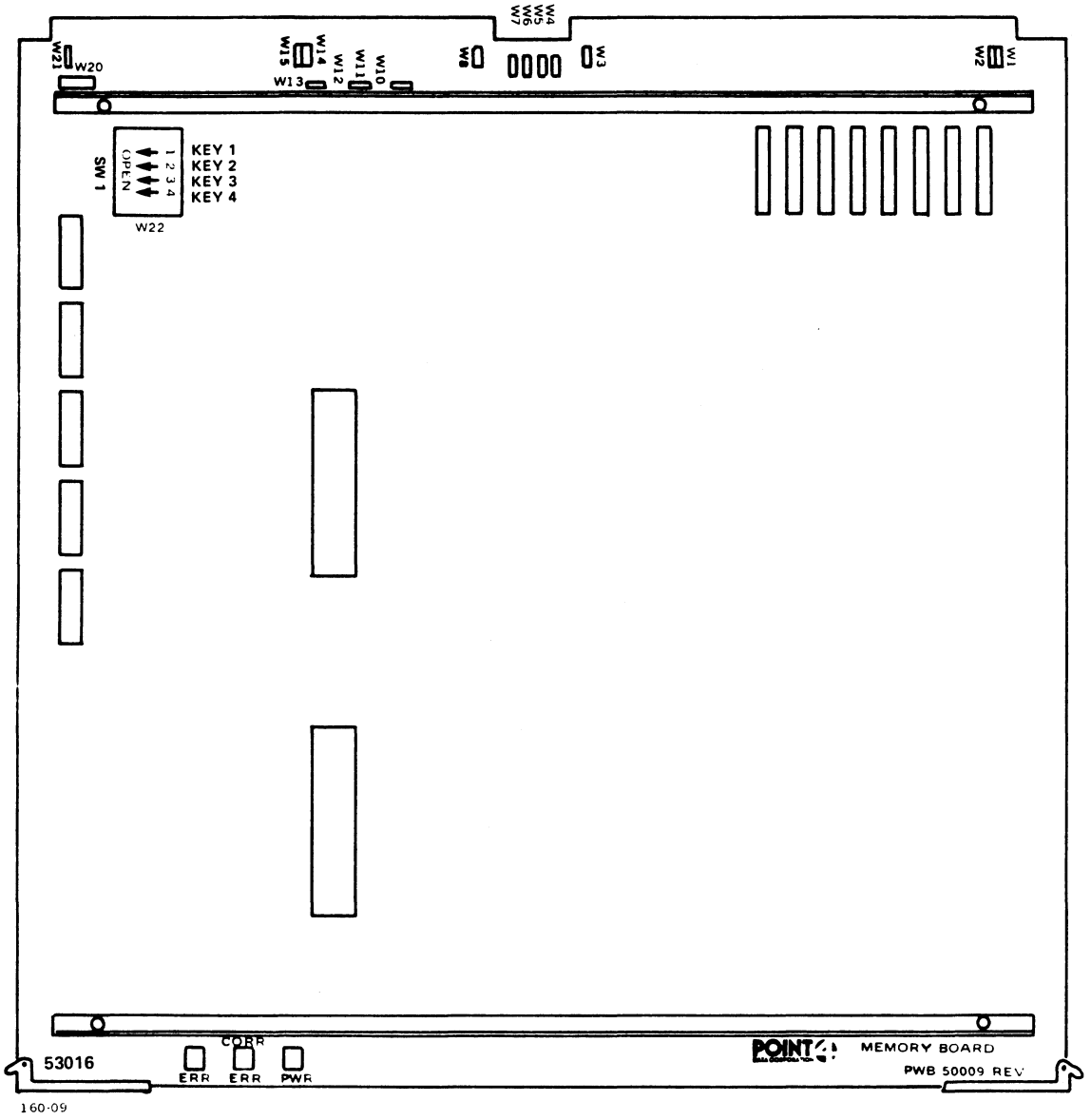


Figure 6-12. Lotus Cache Memory (LCM) Board

6.6 REPLACING THE POWER SUPPLY

If there is a known or suspected problem with the power supply, such as improper voltages or no voltages, the power supply or one of its modules may need repair (see Section 7, Troubleshooting). To remove the power supply, reverse the installation instructions provided in Section 6.2. To remove one of the modules (power supply board, voltage regulator, or power monitor board), use the instructions provided in the appropriate subsection that follows. Once the suspected component is removed, it should be sent to POINT 4 for repair.

To replace any of these components, reverse the removal instructions.

6.6.1 Removing the Power Supply Board

The power supply board includes the main power supply regulator and multiplexer power supply.

Remove the power supply board as follows (see Figure 6-13):

1. Turn the power OFF and unplug the AC cord.

2. Open the rear panel door and disconnect the J24, P23, J22, and J21 cables from the power supply (see Figure 6-3).

3. Remove the front bezel of the power supply and set it aside.

4. Remove the Phillips round head screws from the top left and right corners of the power supply board.

5. Pull the handle of the power supply board and slide the tray out of the power supply.

   It is necessary to send the entire power supply board for repair.

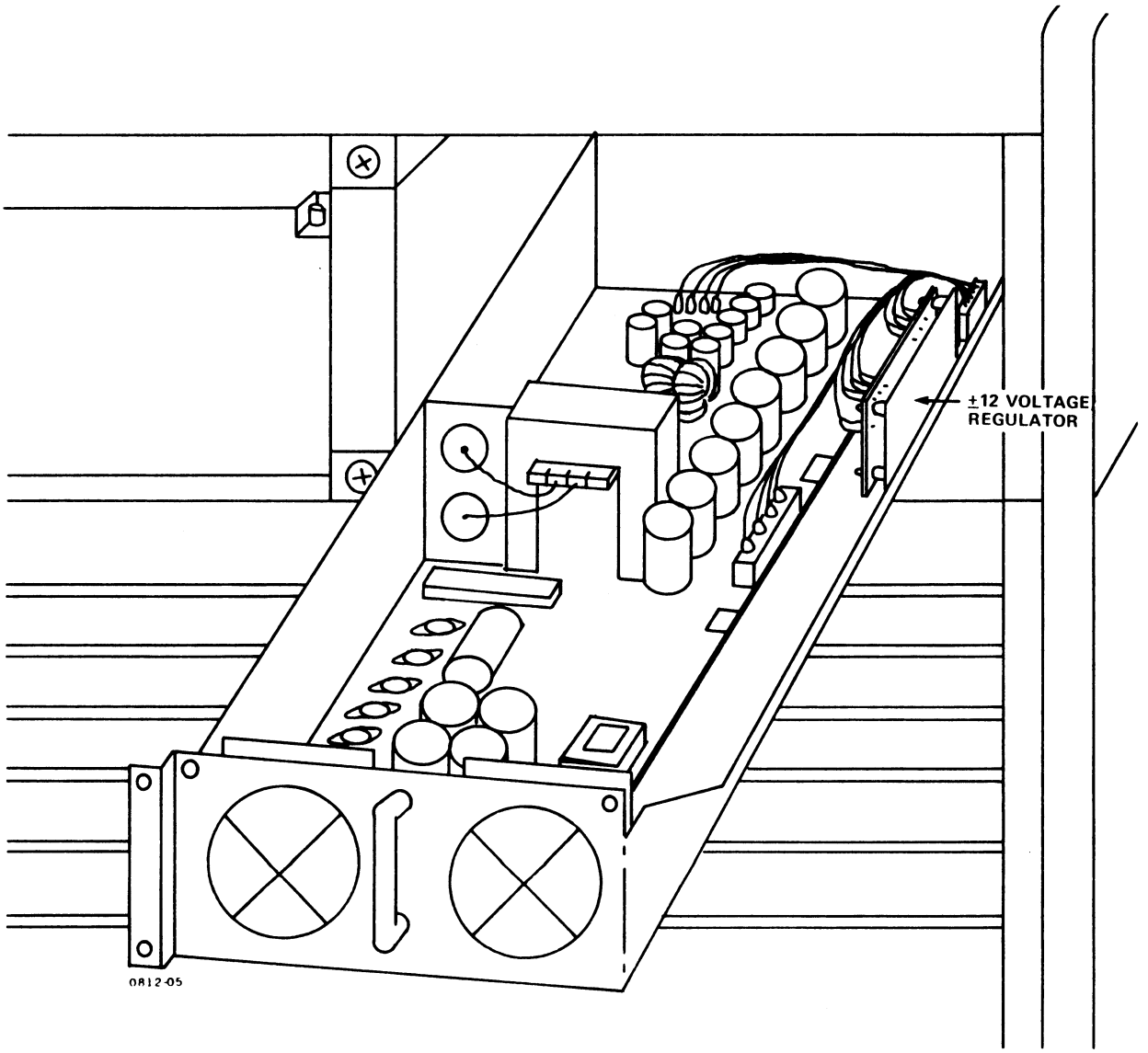


Figure 6-13. Removing the Power Supply Board

6.6.2 Removing the +/-12 Voltage Regulator

Remove the +/-12 voltage regulator as follows (see Figures 6-13 and 6-14):

1. First, remove the power supply board as described in Section 6.6.1.

2. Note the color code and locations of the wire connections, then disconnect the push-on connectors.

3. Pinch the tabs on the stand-offs and pull the regulator board off.

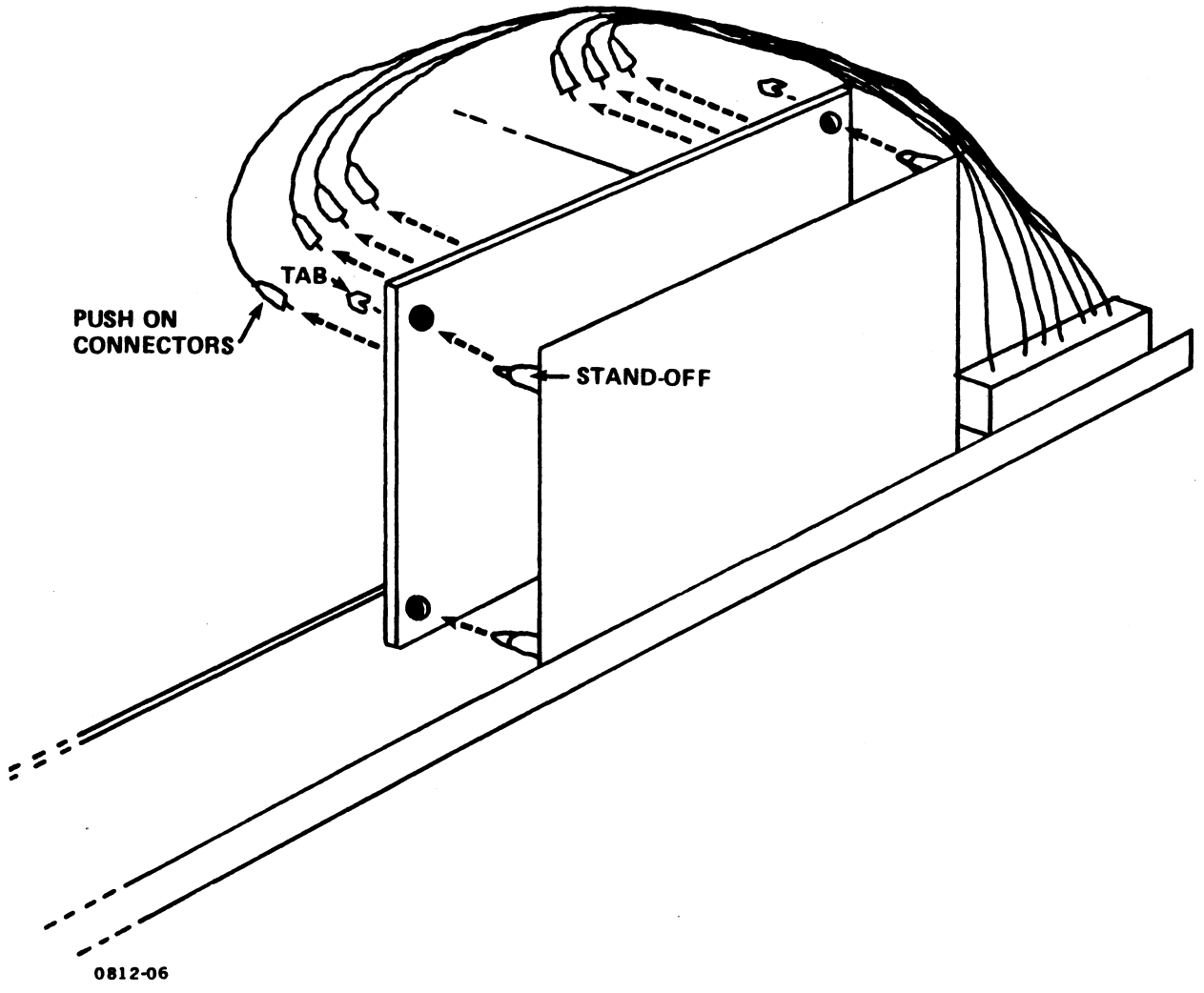


Figure 6-14. Removing the +/-12 Voltage Regulator

6.6.3 Removing the Power Monitor Board

Remove the power monitor board as follows (see Figure 6-15):

1. Turn the power OFF and unplug the AC cord.

2. Remove the front bezel of the power supply and set it aside.

3. Unscrew the Phillips flat head screws from the right side top and bottom of the black indicator display board located on the left side of the power supply.

4. Carefully pull out the power monitor board panel approximately five inches.

5. Disconnect cable J27 from the power monitor board.

   When reinstalling the power monitor board, keep the ribbon cable J27 clear of the board as it is pushed back into the power supply.

6. Pull the power monitor board out of the power supply.

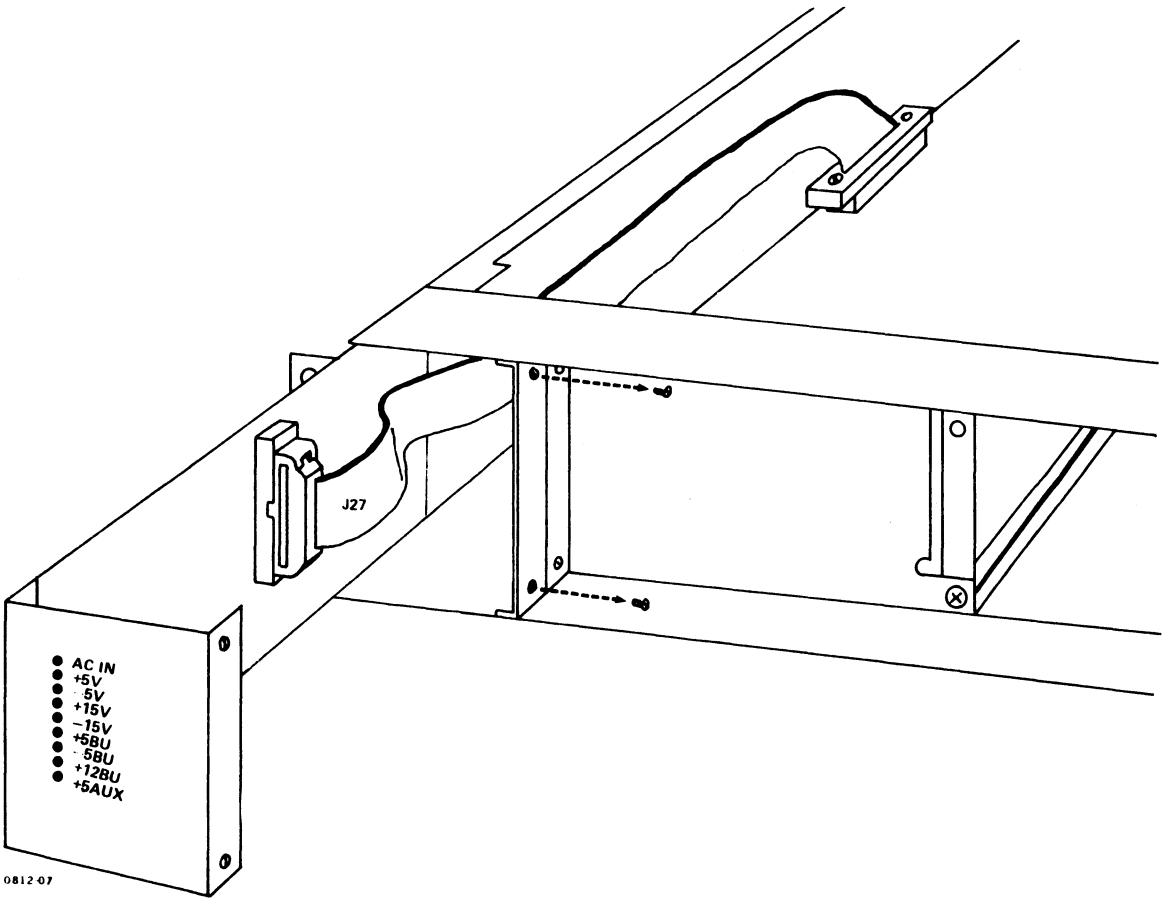


Figure 6-15. Removing the Power Monitor Board

Section 7
TROUBLESHOOTING

The MARK 6 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 does occur. If it does, the troubleshooting routine described in this section will help to 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.

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

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.

For additional troubleshooting information, refer to:

- Section 6, Installing and Replacing Components
- MARK 6/12 Map/Memory Diagnostic Manual
- LCM Diagnostic Document
- LOTUS 720/730 Disk/Tape Controller Diagnostic Document
- LOTUS 725/740/745 Disk/Tape Controller Diagnostic Document
- MIGHTY MUX Diagnostic Manual
- IRIS R8 Installation and Configuration Manual
- IRIS R8 Operations Manual
- IRIS R8 Release Notes
- IRIS R9 System Configuration Manual
- IRIS R9 System Manager Manual
- IRIS R9 User Reference Manual

7.1 SYSTEM HALTS

A system 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.

If a HALT occurs, a firmware program activated by the halt transfers control to the master terminal. Two lines of information are displayed on the screen. The first contains the address of the HALT instruction +1 (the program counter), the four accumulators, and the CPU status word; the second contains the value coded in the mini-switches on the front edge of the central processing unit (CPU) followed by the contents of eight words in main memory beginning at the address.

To determine the type of HALT, use the following procedure:

1. Set the mini-switches to one less than the address in the program counter and press any key on the master terminal **except** <ESC>.*

   The two lines of information described in the paragraph above are displayed.

2. Check the IRIS R9 System Manager Manual for an explanation of the HALT.

3. If the explanation of the HALT indicates that a further examination of memory is advised, set the mini-switches on the edge of the central processing unit (CPU) to the starting address of the next eight words you want to examine.

   By operating the mini-switches in this way, the user can read any location in memory.

*If <ESC> is pressed, the MANIP program is loaded from the APL PROM into the top 1000 octal words of memory and runs. The operator can use any of the MANIP functions, but the top 1000 octal words of main memory are lost.

7.2 MANIPULATE THE SYSTEM

Even if the system is running, trouble may be suspected because of any of the following conditions: the program will not load from tape, the system will not perform an Initial Program Load (IPL), the user is waiting for some action but none occurs, or the action that occurs is not the one expected.

If any of these conditions occur, the first step in troubleshooting is to MANIP(ulate) the system, that is, to use MANIP to locate a problem or malfunction. The MANIP functions relevant to troubleshooting are those that allow the user to display and examine the contents of memory on the master terminal, and the CPU software self-test.

7.2.1 Locating a Problem

To gather data useful in locating a problem, a MANIP command is entered on the master terminal keyboard. The command allows the user to display and examine memory contents on the terminal. A command consists of a single letter to identify the command and an octal number (if required) to specify address modes, memory addresses and data input. For more information on MANIP functions, commands, and parameters, see Appendix C.

Enter MANIP and use the commands as follows:

1. Make sure all the mini-switches on the central processing unit (CPU) board are in the UP position.

   UP is the standard position. If different, note the position of the switches so that they can be returned to their original positions once the MANIP function is complete.

2. Press STOP and APL on the card chassis mini-panel.

   The CARRY indicator flashes while MANIP waits for a command to be entered. The following is displayed:

   ```
   ->
   ```

3. Enter ?. The MANIP Menu is displayed as follows:

```
POINT 4 DATA CORP.          MARK 6 VIRTUAL CONSOLE          CPU/FW Rev. nnnn
COPYRIGHT (C) 1986                d mmm, yy                  MANIP rev.   n.n
================================================================================
_FORMAT__ ____________DESCRIPTION (all parameters octal)_____________________
A          Display ADRS: AC0 AC1 AC2 AC3 CPU-STAT (msb = Carry)
Cx,y       CHANGE ACx or CRY/CPU-STAT to y; Cx (x>4): change real adrs to virtual
Dx*        DISPLAY memory contents in octal, starting at adrs x
Ex* or x:  EXAMINE/ENTER into location x. ^ opens prev. adrs. ESC to end
Fx,y       Establish OFFSET for virtual adrss, x=real, y=virtual adrs
Jx*        JUMP to adrs x and execute; default = continue from last HALT
Kx,y,z     Store CONSTANT z in locations x through y
Mx,y,z     MOVE memory block x through y to location z
Nx,y,z,m   SEARCH memory x through y for NOT-EQUAL z, with optional mask m
Ox*        OUTPUT memory in ASCII, starting at
Px         PROGRAM LOAD (IPL) from device code x; default=(mini-switches), or 27
Sx,,y,z,m  SEARCH memory x through y for the value z, with optional mask m
T          Run Mark 6 SELF-TEST.  After HALT, press CONT, or type <ESC>J<RETURN>
Ux,y,z,a   UNLOAD PROM:x=PROM adrs.,y=#wds,z=mem.adrs,a=opt.exec.adrs; dflt=DBUG
Xx,y       Calc, and print CHECKSUM over mem. block x through y
Yx         Set up CRT new-line DELAY; 0=max. delay, 177777=none
  * Opt.  adrss mode: 0=word,real; 1=byte,virt; 2=byte,lower 64KB; 3=byte,upper
<CTRL-X>   etc.  CTU (Cassette Tape Unit) access commands
?          Shows this Help menu
->
```

4. For more information on specific commands and parameters, see Appendix C.

NOTE

In the upper right corner of the MANIP Menu, there are two revision numbers: CPU firmware and MANIP. Before requesting help from POINT 4 Hardware Technical Support, note the revision numbers and report them to the Hardware Technical Support staff.

7.2.2 Perform the Self-Tests

Two self-tests are associated with the central processing unit (CPU) that check the functioning of the MARK 6: the firmware self-test and the CPU software self-test. The tests run automatically at the initial power up. The normal sequence of the self-tests is: firmware self-test, loading of MANIP and the CPU software self-test. The tests are described below.

- Firmware self-test: At the firmware level, this initial test verifies that hardware is functioning enough to communicate with a terminal. If an error is detected, the firmware stops at a fixed address. This address is displayed on the green indicators on the front edge of the central processing unit (CPU). Pressing STOP and CONT together and releasing CONT first advances to the next test. Report any errors to POINT 4 Hardware Technical Support.

- The CPU software self-test: **(Note: this does not refer to program software).** This test verifies that the CPU software is functioning. The test is contained in the MANIP PROM. It can be accessed in three ways: at the initial power on, through MANIP, and by setting the mini-switches located on the front edge of the central processing unit (CPU) to octal 100200.

Accessing the CPU software self-test at power-up is described in Section 5.2. Accessing the test through MANIP, the standard way, is described below. Accessing the test by setting the mini-switches to octal 100200, is described at the end of this subsection.

Access the CPU software self-test through MANIP, following the procedure below. The procedure assumes that all the mini-switches are in the standard UP position. Remember that when MANIP is loaded, it replaces the top 1000 octal words of memory.

1. If in IRIS, enter SHUTDOWN <CTRL-E>key<CTRL-E>. A message similar to the following is displayed:

```
SYSTEM IS QUIESCENT

#BYE   GROUP n USER n  mmm,dd,yyyy  hh:mm:ss

NET ACCRUED CHARGES      $nn.nn

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

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

2. Turn the disk drive OFF.

   If the disk drive remains ON and generates an interrupt request signal, the test halts. (The interrupt device code is in Accumulator 0).

3. Press STOP and then APL on the mini-panel.

   The RUN indicator is ON and the CARRY indicator blinks on the front of the CPU board. The following is displayed:

```
->
```

4. To instruct MANIP to run the CPU software self-test, enter T. The following is displayed:

```
pppppp: aaaaaa bbbbbb cccccc dddddd ssssss
vvvvvv wwwwww wwwwww wwwwww wwwwww wwwwww wwwwww wwwwww wwwwww
```

   pppppp = value of program counter when halt was encountered
   aaaaaa = value of accumulator 0
   bbbbbb = value of accumulator 1
   cccccc = value of accumulator 2
   dddddd = value of accumulator 3
   ssssss = saved CPU status word
   vvvvvv = value in mini-switches on front edge of CPU
   wwwwww = content of eight words of main memory starting at address vvvvvv

   The processor halts, and the RUN indicator goes out.

5. Press <CONT> or press <ESC> and enter J. The following is displayed:

```
POINT 4 MARK 6 SELF-TEST
CPU LOGIC OK, ON-BOARD MEMORY OK.
000001:VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
000002:VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
000003:VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
000004:VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
000005:VVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVVV
```

6. To halt the CPU software self-test, press <ESC>.

The third way to access the CPU Self-Test is by setting the mini-switches on the front edge of the CPU to octal 100200. This setting is used to run the self-test in a continuous loop. Set the switches as follows:

1. Set the leftmost switch on each of the two banks of mini-switches to the DOWN position.

2. Set all remaining switches on each bank to the UP position.

3. Press APL and then CONT on the mini-panel.

7.3 CHECK OUT THE SYSTEM

The checkout procedure described in the following subsections can also be used to help locate problems.

7.3.1 Measure the Voltages

The power monitor board on the front left side of the power supply houses the voltage indicators. If the power is ON, but an indicator is not lighted, the voltage tolerance or the power supply designated by that indicator may be faulty. Even if all the indicators are lighted, it is possible that voltages may be out of tolerance. To check voltages:

1. Refer to Appendix E to locate the backplane pin assignment of the voltages to be checked.

2. Unlock and open the rear panel of the MARK 6.

3. With a digital voltage meter, check the appropriate voltages on the backplane as indicated on the backplane pin assignment sheet.

4. If a voltage is out of tolerance, remove the appropriate power supply module (refer to Section 6.6), and return it to POINT 4.

WARNING!

Do not attempt to adjust any voltages or the warranty may be invalid.

7.3.2 Check the CPU Board

It is possible that the socketed components on the central processing unit (CPU) board are loose. Check these components as follows:

1. Turn the power OFF.

2. Pull the central processing unit (CPU) board out by pulling the tabs on the edges of the board and sliding the board out of its slot.

3. Lay the board on a flat surface and press down on the socketed components to ensure that they are firmly seated.

4. Slide the board back into its slot and push the tabs in.

5. Turn the power ON.

7.4 DIAGNOSTIC PROGRAMS

In addition to the troubleshooting procedures already outlined, a number of diagnostic programs are available to help to locate problems. These programs are available with the IRIS Operating System or on 1/4 or 1/2-inch streamer tapes.

This section summarizes how to access a diagnostic from IRIS, how to load from streamer tape, and describes the required cabling connections. For comprehensive information about the diagnostic programs, refer to the following diagnostic documents:

- MARK 6/12 Map/Memory Diagnostic Document
- LOTUS 720/730 Disk/Tape Controller Diagnostic Document
- LOTUS 725/740/745 Disk/Tape Controller Diagnostics Document
- LCM Diagnostic Document
- MIGHTY MUX Diagnostic Manual

7.4.1 Accessing a Diagnostic from IRIS

The program names (under IRIS) and version numbers of the diagnostics that pertain to MARK 6 System components are as follows:

Component	Name/Version Number
MARK 6 CPU & Extended Memory	DI.M12.1.5 or later
LOTUS 720/730	DI.720730.1.5 or later
LOTUS 725/740/745	DI.740.1.5 or later
LCM	DI.LCM.2.2 or later
MIGHTY MUX	DI.310MX.2.0 or later

When IRIS is active, access and run a diagnostic as follows:

1. At the IRIS prompt (#), enter SHUTDOWN <CTRL-E>key<CTRL-E> followed by logical unit/diagnostic name. The word "key" represents the manager password.

   For example, to access the MIGHTY MUX diagnostic that is located on the standard logical unit 5, the entry is

   ```
   SHUTDOWN <CTRL-E>key<CTRL-E>5/DI.310MX.2.0
   ```

   The diagnostic program begins to run.

2. If the central processing unit (CPU) halts, press APL on the mini-panel or <ESC> on the keyboard to load MANIP.

   The program counter and first four accumulators are displayed on the terminal.

3. Enter J2.

   The diagnostic program begins to run.

7.4.2 Loading a Diagnostic from Streamer Tape

Load the diagnostic program from a 1/4-inch (QIC-02) or a 1/2-inch streamer tape as follows:

1. Insert the tape cartridge into the tape drive.

2. Press STOP and then APL on the mini-panel.

3. Load the program by entering the appropriate step as follows on the master terminal:

   a. For a 1/4-inch tape drive, enter P42 and proceed to Step 4.

   b. For a 1/2-inch tape drive, enter P22 and press <RETURN>. The message displayed is the same as the message in Step 4. Proceed to Step 5.

4. If the entry is P42 for the 1/4-inch tape drive, enter 0.

   The diagnostic program loads and begins to run. For example, if the MARK 6/12 diagnostic is loaded, a message similar to the following is displayed:

```
*** POINT 4 DATA CORPORATION ***
15442 DEL AMO AVE., TUSTIN, CA.
PHONE NO. (714)-259-0777

*** MARK 6/12 DATA CHANNEL MAP & MEMORY DIAGNOSITCS - VERSION n.n***

ALL NUMERIC INPUT AND OUTPUT IS OCTAL

*** CHECKSUM COMPLETE ***

***CHECKSUMS AGREE ***

CPU FIRMWARE REVISION LEVEL = nnnn
```

   The program checks to ensure that the standard hamming option is installed. The following is displayed:

```
HAMMING IS INSTALLED
BOARD SIZES (LEGITIMATE SIZES ARE 20000/10000 BLOCKS, IN DESCENDING ORDER:)
BOARD 1  BOARD 2  BOARD 3  BOARD 4  BOARD 5  BOARD 6  BOARD 7  BOARD 10
  20000    20000    10000
TOTAL NUMBER OF BLOCKS = nnnnnn
PRESS RETURN TO CONTINUE >
```

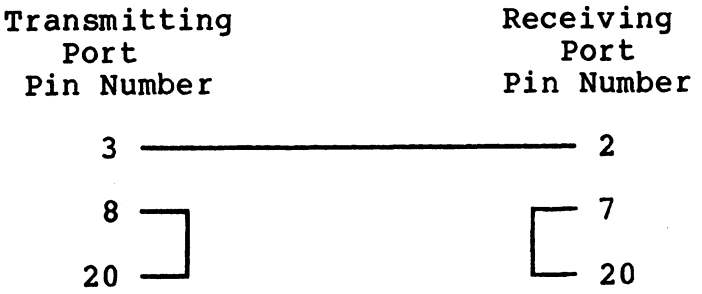
5. If the entry is P22 for the 1/2-inch tape drive, press <RETURN>.

6. Remove the streamer tape and keep it in a safe place.

7.4.3 Cable Connections for MARK 6 Diagnostics

The MIGHTY MUX diagnostic cable connections are required to run both the MIGHTY MUX and MARK 6/12 diagnostics. On the latter, these cable connections permit the diagnostic to check the ability of the data channel to transmit and receive information and to run the Simultaneous Expansion Memory Access through Mux and On-board (Main) Memory Test.

The cable should be set up to transfer data from port 1 (the transmitting port) to port 2 (the receiving port) on the 310 multiplexer board by making the following connections:



No other wires should be connected.

Note: The master port is 0.

7.5 SOFTWARE DIAGNOSTICS

EXERCISER and SWAPTEST are two software diagnostics that can be used to help locate hardware problems. They are discussed in Appendix B, Loading Software.

If a system HALT or a TRAP is encountered when using EXERCISER or SWAPTEST, refer to the IRIS R9 System Manager Manual or the IRIS R8 Operations Manual for help.

Section 8
POWER FAIL INSTRUCTIONS

This section explains what occurs during a power failure on a MARK 6 system that has the battery backup option, and it provides procedures to follow in the event a power failure lasts longer than the battery backup holding capability. The battery backup option is available on systems using IRIS R9.0 or a later revision.

If a MARK 6 with extended memory and battery backup detects that a power fail is about to occur, the power supply system alerts the IRIS Operating System. IRIS immediately transfers the contents of main memory into extended memory where it is saved during a power failure.

When the power returns after a failure, hardware and software self-tests run automatically. If both tests complete successfully, the MARK 6 transfers back to main memory the contents which it earlier transferred to extended memory. Operations can resume without any action or input from the user if the keyswitch is set to AUTO.

NOTE

If the keyswitch is set to ON, the system comes up and enters MANIP; to IPL, press P.

The length of time that battery backup can hold information varies with the load, and the size and charge of the battery. For example, a six-ampere-hour battery with a load current of six amperes saves information for about one hour (see Appendix A for additional information about hold times and conditions). Additional protection can be provided by using an external battery in conjunction with battery backup. POINT 4 does not provide external batteries.

If the power failure lasts longer than the holding capability of the battery backup, memory is lost. If that is the case, perform the more appropriate of the procedures that follow.

Systems that use IRIS R8.3E or do not have battery backup can also use the following procedures after a power failure.

Procedure 1

1. Insert the most recent backup tape 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.

Procedure 2

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.

APPENDICES

Appendix A
BATTERY BACKUP

Battery backup (BBU) is an optional feature of the MARK 6. Its purpose is to ensure that information will not be lost in the event of a power failure.

During a power failure, the BBU provides uninterrupted +5BBU power to slots 1 through 5. If the +12/-5 volt option card is installed in the battery backup so that a MARK 5 or 9 CPU can be used in a MARK 6 system, the BBU also provides +12BBU and -5BBU to slot 1 of the card chassis. Option card instructions are shipped with the card. The actual hold time varies with the amount of the load, the size of the battery, and the amount of charge. Table A-1 shows the various hold times for the BBU.

The battery charges with sufficient AC voltage when the keyswitch is in the STDBY, ON or AUTO position. When depleted, a six-ampere-hour battery recharges in less than 20 hours.

TABLE A-1. BATTERY BACKUP HOLD TIMES*

Load Current (Amps)	Minutes for Battery Size	
	6.0 Ahr**	15.0 Ahr
11	10	45
10	13	50
9	17	60
8	20	70
7	25	85
6	30	100
5	40	130
4	50	170
3	80	240
2	235	370
1	300	900

*These times are for a fully charged battery and are approximate. Times vary slightly with temperature, battery conditions and loads due to usage.

**This is the battery shipped by POINT 4.

A provision allows an external +12V DC battery to be connected to the MARK 6 through the external battery connector (J19) in the power supply chassis. It is not charged by the system. The external battery is isolated; fusing and charging is supplied by the user. Table A-2 describes the interface connectors.

TABLE A-2. INTERFACE CONNECTORS

Pin Number	Signal	Description
J17 BBU CONTROL		
1	BTYOK	Battery OK signal to card chassis mini-panel indicator
2-6		Not used
7	BTROFF	Off signal from keyswitch
8		Not used
9	+S	+5BBU sense line
10	-S	+5BBU sense return
J18 BBU POWER		
1	+5BU	+5 BBU voltage
2	+5BU	+5 BBU voltage
3	GND	+5 BBU common
4	GND	+5 BBU common
5	-5BU	-5 BBU voltage
6	+12BU	+12 BBU voltage
7	+12/-5RTN	+12/-5 BBU common
8	+12/-5RTN	+12/-5 BBU common
9	SPARE	Not used
J19 AUXILIARY BATTERY*		
1	+BTR/AUX	+12VDC from auxil. battery
2	-BTR/AUX	Common from auxil. battery
J20 BBU AC JUMPER		
1	ACH	Switch AC line high
2	ACN	Switch AC line neutral
3	GND	Chassis Ground
*Mates with Amp connector Part 1-480698-0 and pin 350547-1.		

Appendix B
LOADING SOFTWARE

NOTE

POINT 4 ships SMbasic already loaded and preconfigured. This appendix does not apply to systems with SMbasic.

Loading software follows the initial power-up of the system. The loading procedures differ for IRIS R8 and IRIS R9 revisions. This appendix describes loading software under IRIS 8.3E, which requires a special patch. To load IRIS 9.0 or a later revision, refer to the IRIS R9 System Configuration Manual.

The instructions given for loading software are simplified and apply to the MARK 6 integrated system. If a problem is encountered, refer to the comprehensive instructions in the LOTUS DISCUTILITY (V5.3 or later) Manual and the IRIS R8 Operations Manual.

If software is loaded into a non-integrated system, the simplified instructions may not apply. Refer directly to the LOTUS DISCUTILITY and IRIS R8 Operations manuals. If an operating system other than IRIS is used, refer to the documentation for that system.

The following subsections describe the loading of IRIS and include:

- Loading DISCUTILITY: DISCUTILITY is a utility program that must be loaded into memory before it is possible to format disks, load IRIS or other software or perform backups.
- Formatting a Disk: This procedure writes the headers of all sectors to disk, analyzes the headers and surfaces for errors, and records and chains hard errors to alternate sectors.
- Restoring IRIS from tape to disk: IRIS is loaded onto the disk to a standard starting configuration. SETUP may then be used to complete the configuration. The MARK 6 is then available to use.
- Running IRIS tests: To test the reliability of the total system, run the EXERCISER and SWAPTEST on several different ports. They should be run overnight.

B.1 LOADING DISCUTILITY

Use DISCUTILITY (V5.3) or later. Load DISCUTILITY into memory as follows:

1. Turn the mini-panel keyswitch to ON.

   BATT OK and POWER OK indicators light.

2. Insert the DISCUTILITY tape into the tape drive.

3. Press STOP and then APL on the mini-panel.

   Green RUN indicator lights; CARRY indicator flashes.

4. On the master terminal keyboard,

   - For 1/4-inch tape, enter P42
   - For 1/2-inch tape, enter P22

   The following is displayed:

```
PROGRAM?
```

5. At the PROGRAM? prompt, enter 0.

   DISCUTILITY is loaded into memory and a message similar to the following is displayed:

```
DISCUTILITY VERSION n.n  DATED -n-nn
FOR POINT 4 LOTUS 700, 710 AND 730 DISK CONTROLLERS

- - - -NOTICE- - - -

FIRST SURFACE OF REMOVABLE OR FIXED IN 9448 CMD DRIVE IS NUMBER 0.

ALL NUMBERS ARE OCTAL!

AT ANY TIME, YOU MAY ENTER:
     H          FOR HELP
     ESC        TO ABORT BACK TO "PROGRAM NAME:"
     CONTROL S TO PAUSE OUTPUT (HIT ANY OTHER CHRACTER TO RESUME)
     CONTROL H TO ERASE LAST CHARACTER INPUT (ON MOST CRTs)

ESC MAY ALSO BE USED TO PRINT OUT THE CURRENT CYLINDER NUMBER WHILE A
PROGRAM IS RUNNING.  THEN ENTER X TO RESUME THE PROGRAM.

QUARTER INCH TAPE MODE    [or 1/2 inch tape mode]

PROGRAM NAME:
```

6. Remove DISCUTILITY tape from the tape drive.

7. Proceed to B.2, Formatting a Disk.

B.2 FORMATTING A DISK

It is important to note that the formatting procedure overwrites **all** information on the disk, that is, all pre-existing information is deleted. While this is not a concern when installing a new system, it becomes critical once information is entered.

There are two formatting options: Format (F) and Quick Format (Q). Use Format (F). Quick Format is used by technicians to format a disk for hardware testing. The regular Format (F) should be run before the disk is used to store data.

Comprehensive instructions for formatting a disk are given in the LOTUS DISCUTILITY Manual; if questions or difficulties arise, refer to that manual. The IRIS R8 Peripherals Handbook is also required when performing this procedure.

After loading DISCUTILITY as described in Section B.1, format the disk as follows:

1. At the PROGRAM NAME prompt, enter F.

2. At the DRIVE TYPE prompt, enter the appropriate drive type.

   If the drive type is not known, enter H; a MANIP menu similar to the following is displayed:

```
THIS LIST SHOWS DRIVES WHICH SHOULD BE THEORETICALLY COMPATIBLE
WITH THE LOTUS 700, 710 & 730 DISC CONTROLLERS.  POINT 4 RESERVES
THE RIGHT TO REMOVE DRIVES AT ANY TIME FROM THIS LIST WHICH PROVE
IN ACTUAL EXPERIENCE TO BE INCOMPATIBLE.
     IF YOU ARE USING POINT 4 DATA CORPORATION'S IRIS OPERATING
SYSTEM, PLEASE NOTE THAT NOT ALL THE DRIVES IN THIS LIST ARE SUP-
PORTED UNDER IRIS.

     THE LAST 5 CYLINDERS ON DISC ARE RESERVED FOR CHAINING BAD
MEDIA TO ALTERNATE SECTORS WITHIN THESE LAST 5 CYLINDERS.  THE
LAST 5 CYLINDERS ARE NOT ACCESSED BY COPY OR VERIFY.  IF YOU ARE
USING THE IRIS OPERATING SYSTEM, SET UP YOUR LOGICAL UNITS SO
THAT THEY DO NOT CONTAIN THE LAST 5 CYLINDERS ON THE DISC.

PRESS RETURN TO CONTINUE.

CODE  MNEMONIC  TYPE  CAPACITY  CYL'S  HEADS  SECT'S  MODEL
```

   A list of drive types, by manufacturer, is displayed a screen at a time; press <RETURN> until the appropriate drive type is found and to get to the end of the list. The drive type is listed under **Code** on the left side. Make certain the drive type selected corresponds to the drive type of the system and its model number. Make a note of the drive type; it will be entered again when restoring IRIS (Section B.3).

3. At the DRIVE UNIT NUMBER prompt, enter 0.

4. At the SURFACE(S) prompt, enter ALL.

5. At the WHEN DRIVE IS READY, PRESS RETURN TO START prompt, press <RETURN>.

   Formatting the disk may take an hour or longer depending on the type of disk. A number of messages are displayed while formatting is in process. The program prompts for entry of bad sectors:

   ```
   THIS OPTION ALLOWS MARGINAL OR KNOWN BAD SECTORS TO BE RE-ASSIGNED.

   TYPE 'Y' TO ENTER BAD SECTORS OR RETURN.
   ```

6. If bad sectors (such as those listed on the hard error map provided by the disk manufacturer) need to be entered, refer to the LOTUS DISCUTILITY Manual.

   If there are no bad sectors to enter, press <RETURN>. The following is displayed:

   ```
   TOTAL DISC ERRORS IN OCTAL:   nn HARD,   nn SOFT

        TOTAL     DRIVE  SURFACE   CYLINDER   SECTOR
        DISC      UNIT      #         #         #
        ERROR
   ```

   The display includes a list of any errors found, followed by:

   ```
   PRESS RETURN TO CONTINUE
   ```

7. Press <RETURN>.

   If the format process encounters hard errors, the following is displayed:

   ```
   >>>>>HARD ERROR CHAINING IN PROGRESS, PLEASE WAIT

   >>>>>ALL HARD ERRORS WERE CHAINED TO ALTERNATE GOOD SECTORS
   SUCCESSFULLY

   FORMAT/ANALYZE GOOD COMPLETION

   PROGRAM NAME:
   ```

8. Proceed to B.3, Restore IRIS.

B.3 RESTORE IRIS

The following procedure is used to load IRIS into memory.

1. Make certain that the IRIS Operating System tape is write-protected and insert it into the tape drive.

2. At PROGRAM NAME, enter R. (R stands for Restore.) The following is displayed:

```
DESTINATION
   DRIVE TYPE:
```

3. Enter the same drive type that was entered during Step 2 of B.2, Formatting a Disk.

   If the drive type was not noted, enter H for the help message.

4. At the DRIVE UNIT NUMBER prompt, enter 0.

5. At the SURFACE(S) prompt, enter OPT,ALL.

6. At the STARTING CYLINDER NUMBER prompt, enter 0.

7. At the prompt, TOTAL (OCTAL) NUMBER OF CYLINDERS TO USE, enter the number of cylinders listed on the IRIS tape cartridge.

8. At the prompt, IF VALIDATION OF DESCRIPTOR & DATE IS NOT DESIRED, ENTER A '!', enter !.

9. At the prompt, WHEN DRIVE IS READY, PRESS RETURN TO START, press <RETURN>.

   If no hard errors are found, a message similar to the following is displayed:

```
THE TAPE BEING PROCESSED CONTAINS THE FOLLOWING LABEL:

VOLUME SEQUENCE #: N
CREATION DATE nn-nn-nn
DESCRIPTOR: aaaaa
STREAMING FROM TAPE
CURRENT CYLINDER IN OCTAL = n

>>>>> GOOD COMPLETION (NO HARD ERRORS).

TOTAL DISK ERRORS : 0  HARD,  0  SOFT.

TAPE STATUS:
    CARTRIDGE IS WRITE PROTECTED
    NUMBER OF SOFT READ ERRORS:  0
    NUMBER OF READ BUFFER UNDERRUNS:  0

VERIFY TAPE AGAINST DISK?
```

10. To verify tape, enter Y. For a good verify, a message similar to the following is displayed:

```
CHECKSUMMING TAPE
CHECKSUMS= n
  BLOCK COUNT= n

CHECKSUMMING DISK
CURRENT CYLINDER IN OCTAL = 0
CHECKSUMS= n
  BLOCK COUNT= n

GOOD VERIFY - RECORD CHECKSUMS FOR FUTURE REFERENCE

PROGRAM NAME:
```

If a bad verify occurs, POINT 4 recommends that a hardware technician check out the system.

11. TO IPL the system, at the PROGRAM NAME prompt, enter I. The following is displayed:

```
    INITIATED...

WHEN DRIVE IS READY, PRESS RETURN TO START:
```

12. Press <RETURN>.

13. At the second PRESS RETURN prompt, press <RETURN> again. A message similar to the following is displayed:

```
                IRIS n.na

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

COPYRIGHT (C) 19nn, POINT 4 DATA CORPORATION

ENTER YEAR,MONTH,DAY,HOUR,MINUTE
```

14. At the enter date prompt, enter the date in the form

    YY,MM,DD,HH,MI.

    For example, May 5, 1987, 4:30 P.M. is 87,05,05,16,30.

    The IRIS welcome message is displayed and IRIS.INIT is automatically accessed.

15. At the START INITIALIZATION? (Y/N) prompt, enter Y.

    Initialization begins, system messages are displayed, followed by

    ```
    #SHUTDOWN :IRIS.IPL
    PRESS RETURN
    ```

16. At the PRESS RETURN prompt, press <RETURN>. The IRIS copyright message is displayed.

17. At the prompt, ENTER YEAR,MONTH,DAY,HOUR,MINUTE, press <DELETE>. The IRIS welcome message is displayed, followed by the prompt

    ```
    CONFIGURE FOR SMBASIC?
    ```

18. If SMbasic configuration is desired, enter Y and refer to the SMbasic Manual.

    For a non-SMbasic configuration, enter N.

19. At the prompt, PERIPHERALS HANDBOOK DISC ENTRY NUMBER, enter the appropriate disk specification entry number for the disk drive as listed in the IRIS R8 Peripherals Handbook.

20. The program prompts

    ```
    HAVE YOU MODIFIED THIS CONFIGURATION IN ANY WAY? (Y/N):
    ```

    For a non-standard LU #5, refer to the IRIS R8 Release Notes.

    To accept the standard LU #5, enter N; the following is displayed:

    ```
    #SHUTDOWN :IRIS.IPL
    PRESS RETURN
    ```

21. At the PRESS RETURN prompt, press <RETURN>. The IRIS copyright message is displayed.

22. At the prompt, ENTER YEAR,MONTH,DAY,HOUR,MINUTE, press <DELETE>. A number of system messages are displayed while logical units are installed followed by the SETUP Menu:

```
PORT n      SYSTEM CONFIGURATION      SETUP n.n nn-nn-nn

        (0) EXIT SYSTEM CONFIGURATION
        (1) CREATE/MAINT CONFIGURATION CONTROL FILE
        (2) LIST CONFIGURATION CONTROL FILE
        (3) UPDATE THE SYSTEM CONFIGURATION
        (4) DISC DRIVE ENTRIES FILE MAINTENANCE

COMMENT:  ENTER THE NUMBER OF THE FUNCTION YOU WISH TO EXECUTE
COMMAND:
MESSAGE:
```

At this point, the IRIS Operating System is loaded onto disk and into memory. The next step is to set up the system configuration using the SETUP utility.

SETUP is a utility that enables the user to configure parts of the IRIS Operating System without the use of Disk Service Processor. It configures the following types of system parameters: information tables in the configuration file, Port Definition Table, Memory Resident DISCSUB Table, Disk Driver Table and BAKUP file.

Refer to "A Guide To Using SETUP" in the IRIS R8 Release Notes for the procedure.

B.4 RUNNING IRIS TESTS

Two IRIS programs, EXERCISER and SWAPTEST, are used at installation to test the interaction of the IRIS Operating System, the computer, and the disk. POINT 4 recommends that these reliability tests be run overnight and concurrently, each test on several ports. Before these tests can be run, logical units must be installed (refer to the appropriate IRIS documentation). If no errors or malfunctions occur, these tests will run forever until aborted by an operator. If an error or a malfunction occurs during a test, that test aborts and returns to the IRIS prompt (#). At the end of the test period, run PORT ALL MONITOR to see if all test ports are still in RUN. If any are at SCOPE, a hardware malfunction has occurred, and hardware diagnostics should be run. Refer to the IRIS manuals for more information on PORT ALL MONITOR.

EXERCISER tests the ability of the disk controller or cache memory to do single block transfers from formatted files and the ability of the memory buffer pool to maintain that information.

SWAPTEST swaps active files to test the ability of the disk controller or cache memory to do multi-block transfers reliably.

B.4.1 Running EXERCISER

To initiate EXERCISER on one or more terminals, enter the following on each of the selected terminal keyboards:

1. At the IRIS prompt (#), enter EXERCISER. The following is displayed:

```
#EXERCISER

THIS CORE AND DISC EXERCISER PROGRAM WAS NOT DESIGNED TO BE A
REPLACEMENT FOR A COMPREHENSIVE STAND-ALONE RELIABILITY PROGRAM.
RATHER, IT IS A CONVENIENT TOOL WHICH CAN BE RUN USING LIVE
DATA PACKS, WITHOUT HAVING TO ASK EVERYONE ELSE TO LOG OFF.
POINT 4 ADVISES YOU TO RUN IT OVERNIGHT OR WEEKENDS.  ANY ERROR
FOUND IN CORE OR ON DISC WILL ABORT THE PROGRAM AND PRINT
AN ERROR MESSAGE.

CHOOSE THE # OF BLOCKS TO BE USED BY THIS EXERCISER.
THE # SHOULD BE GREATER THAN THE # OF BLOCKS IN THE BUFFER
POOL, IF POSSIBLE.
CONVERT THE # OF BLOCKS FROM OCTAL TO DECIMAL.
MAKE SURE THAT THE CHOSEN BLOCK COUNT DOES NOT EXCEED THE # OF
BLOCKS AVAILABLE TO THIS ACCOUNT ON THE SELECTED LOGICAL UNIT.
ENTER # OF BLOCKS TO USE:
```

2. Enter the number of blocks to use in accordance with the preceding message.

   A minimum of 1000 blocks is recommended, although less may be entered if 1000 blocks are not available.

   The following is displayed:

```
ENTER LOGICAL UNIT # TO USE:
```

3. Enter the number of a logical unit that has a sufficient number of blocks available. The test begins and progress messages are displayed.

   In the following example, a block count of 60 is used to illustrate a complete test:

```
HAVE COMPLETED THROUGH BLOCK     10 OF WRITE OUT PHASE
HAVE COMPLETED THROUGH BLOCK     20 OF WRITE OUT PHASE
HAVE COMPLETED THROUGH BLOCK     30 OF WRITE OUT PHASE
HAVE COMPLETED THROUGH BLOCK     40 OF WRITE OUT PHASE
HAVE COMPLETED THROUGH BLOCK     50 OF WRITE OUT PHASE
HAVE COMPLETED THROUGH BLOCK     60 OF WRITE OUT PHASE
HAVE COMPLETED THROUGH BLOCK     10 OF READ BACK AND VERIFY PHASE
HAVE COMPLETED THROUGH BLOCK     20 OF READ BACK AND VERIFY PHASE
HAVE COMPLETED THROUGH BLOCK     30 OF READ BACK AND VERIFY PHASE
HAVE COMPLETED THROUGH BLOCK     40 OF READ BACK AND VERIFY PHASE
HAVE COMPLETED THROUGH BLOCK     50 OF READ BACK AND VERIFY PHASE
HAVE COMPLETED THROUGH BLOCK     60 OF READ BACK AND VERIFY PHASE

POINT 4 CORE AND DISC EXERCISER (VERSION n)
WITH # OF BLOCKS IN TEST = 60
PASS #          n              COMPLETED OK. (NO ERRORS)
PRESS CONTROL C TO ABORT
```

4. To end the test, press <CTRL C>. The following is displayed:

```
USER REQUESTED EXIT
#
```

   This completes the EXERCISER test.

B.4.2 Running SWAPTEST

To initiate SWAPTEST on one or more terminals, enter the following on each of the selected terminal keyboards:

1. At the IRIS prompt (#), enter SWAPTEST. The following is displayed:

```
#SWAPTEST
.
.
.
```

   A vertical row of dots displays slowly on the left side screen. The more terminals that are tested, the slower the display of dots.

2. To end the test, press <CTRL-C>. The following is displayed:

```
USER REQUESTED EXIT
#
```

   This completes the SWAPTEST.

Appendix C
MANIP COMMANDS

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 lists the MANIP commands and descriptions as well as the MANIP program listing. More information on MANIP is available in Section 7, Troubleshooting.

A MANIP command consists of a single letter which is the command identifier and parameters which specify addressing modes, memory addresses and data input. All parameters must be entered in octal. The letters x, y, z, a, m, and n are used to represent octal parameters.

For some commands, MANIP allows either word or byte addressing using either real memory addresses or offset memory addresses (see the F command). These optional addressing modes are invoked by the parameter "a". They can be used with the commands D, E, J and O. The "a" parameter definitions are as follows:

a Parameter	Definition
omitted	Word address, including "F" offset, if any
0	Word address, absolute
1	Byte address, using offset, if any
2	Byte address, lower 64 KB
3	Byte address, upper 64 KB

NOTE

The J command does not permit byte addresses.

If no "a" parameter is given, the addressing mode is "word address, including offset, if any". If there is no "a" parameter, the preceding comma is optional.

Table C-1 shows the MANIP commands, parameters, and definitions. Table C-2 lists the MANIP commands used to control a cassette tape unit (CTU).

TABLE C-1. MANIP COMMAND DESCRIPTIONS (1 of 7)

Command & Parameters	Definition
A	Displays initial value of program counter (PC) saved in first location of MANIP, contents of accumulators A0, A1, A2, A3, and CPU status word as they were at the time MANIP was entered. The MSB of the CPU status word represents the carry flip-flop.
Cx,y	Changes accumulator or CPU status word, or address representation. • 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 the CPU status word (MSB = carry) is set equal to y. • If x is greater than 4 and an address offset has been established (see F command), x is interpreted as a real address and converted to a virtual address using the offset previously established, and displayed on the master terminal. In this case, the y parameter is not used. • Parameter Description x - 1 octal digit 0-7 or one word octal y - 1 word octal
Dx,a	Dumps memory in octal, beginning at location x, using address mode a. Eight words (or bytes if using a byte address mode) are displayed per line, with the address of the first word (byte) at the beginning of each line. To temporarily pause output, press <CTRL-S> (XOFF); to start, press <CTRL-Q> (XON); to terminate output, press <ESC> or any other key. • Parameter Description x - octal number representing a 16-bit memory address a - optional one digit (0-3) representing an address mode

TABLE C-1. MANIP COMMAND DESCRIPTIONS (2 OF 7)

Command & Parameters	Definition
Ex,a	Enables entry at address x, using address mode a. The address (changed to a word address if it was a byte address) is printed, followed by a colon. An octal value can then be entered into the memory location, followed by <RETURN>. The next address (x+1) is then printed and opened for entry. Entry can be continued into sequential address locations until terminated by pressing <RETURN> and then <ESC>. • If there is no entry before <RETURN>, the present content of the opened location is displayed in octal to allow examination of a value before entering a new one. If <RETURN> is pressed again without an entry, the current value is saved; and the next address is printed and opened for entry. • If a caret (^) is entered instead of <RETURN>, the previous address is printed and opened. This feature is convenient for confirming an entry just made. • Parameter Description x - octal number representing a 16-bit memory address a - optional one digit (0-3) representing an address mode
Fx,y	Establishes an address offset (a fixed difference between real memory addresses and virtual addresses as entered and listed in MANIP). The difference x-y is added to an address entered and subtracted from a memory address before listing. If y is not entered, it is assumed to be zero. Whenever a nonzero offset is established, an F is printed at the beginning of each line. To revert to real memory addressing, enter F0. • Parameter Description x - octal number representing a real memory address y - octal number representing listing address equivalent to address specified in x

TABLE C-1. MANIP COMMAND DESCRIPTIONS (3 of 7)

Command & Parameters	Definition
F	Saves current offset value, and reinstates previous offset. Displays offset being reinstated. Provides a convenient way to toggle back and forth between two offsets (or one offset and real memory addressing).
Jx,a	Jumps to location x (using address mode a) with accumulators and carry restored. • Parameter Description x - octal number representing a 16-bit memory address a - optional one digit (0) representing absolute word address mode (byte address modes not available for J command)
J	Jumps to address where last halt occurred (does a CONTinue function)
Kx,y,ø	Stores 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 main memory. Locations x through y, inclusive, are moved to the area starting at location z. • Source and destination areas can overlap in either direction without bad effects. • Can move MANIP as long as destination area does not overlap source area. • Parameter Description x - octal number representing a 16-bit beginning memory address y - octal number representing a 16-bit ending memory address z - octal number representing a 16-bit beginning memory address of a new location

TABLE C-1. MANIP COMMAND DESCRIPTIONS (4 of 7)

Command & Parameters	Definition
Nx,y,z,m	Searches locations x through y, inclusive, for values not equal to constant z. Each word is ANDed with mask m before comparison with z. • If m is not entered, 177777 is assumed. • Parameter Description x - octal number representing a 16-bit beginning memory address y - octal number representing a 16-bit ending memory address z - octal number representing constant m - octal number representing mask; if omitted defaults to 177777. **Example of the use of mask:** The command Nx,y,0,170000 searches locations x through y for any value whose four MSBs are nonzero, i.e., for any value greater than 7777. If such a value is found, its address and contents are displayed in octal.
Ox,a	Outputs ASCII. Contents of memory starting at location x (using address mode a) are displayed as text. If a zero byte is found, the output is terminated. • Parameter Description x - octal number representing a 16-bit memory address a - optional one digit (0-3) representing an address mode

TABLE C-1. MANIP COMMAND DESCRIPTIONS (5 of 7)

Command & Parameters	Definition
Px	Program loads from disk or other DMA device. Performs standard bootstrap APL (gives a NIOS instruction with device code x, then idles at location 377 waiting for the disk to overwrite that location). If x is omitted, P reads the CPU mini-switches and uses their contents as the device code; if mini-switches are not set to a valid device code, P uses device code 27. **If the switch representing the 200 bit is set in addition to the device code switches, MANIP cannot be accessed. Pressing APL causes MANIP to try to boot from the disk.** • Parameter Description x - One or two-digit octal number (1 through 76) representing the device code from which the program is to be loaded
Sx,y,z,m	Searches locations x through y, inclusive, for constant z. Each word is ANDed with mask m before comparison with z. • If m is omitted, 177777 is assumed. • Parameter Description x - octal number representing a 16-bit beginning memory address y - octal number representing a 16-bit ending memory address z - octal number representing a constant m - octal number representing a mask; if omitted defaults to the value 177777 **Example of the use of mask.** The command Sx,y,60025,160077 searches location x through y for any I/O instruction for device 25. If a comparison is found, its address and contents are displayed in octal.
T	Runs software self-test. CPU halts. Press <CONT> or press <ESC> J <RETURN>. See Section 6.2.2 for more on Self-Test.

TABLE C-1. MANIP COMMAND DESCRIPTION (6 of 7)

Command & Parameters	Definition
Ux,y,z,a	Loads from APL PROM beginning at PROM location x, and reading y words into main memory starting at location z, then jumps to starting address a. • Parameter Description x - an octal number representing a beginning PROM location y - an octal number representing the number of words to be loaded z - an octal number representing a beginning memory address a - optional octal number representing a starting address
U	Loads DBUG from APL PROM into main memory starting at location 73000 and jumps into it.
Xx,y	Calculates and prints checksum over memory locations x through y. Uses a revolving checksum (using a SUBL 0,1 instruction with A0 = each word from x through y, and A1 = accumulating checksum; initially 0). This ensures that if two words in memory are swapped, the swap is detected by the checksum. Useful for determining if any word in memory has changed. • Parameter Description x - an octal number representing a 16-bit beginning memory address y - an octal number representing a 16-bit ending memory address
Yx	Sets up a <RETURN> delay. Required on some terminals for proper scrolling. After each carriage return/line feed, MANIP counts up an accumulator from x to 0 before proceeding. For maximum delay set x=0, for no delay set x=177777. • Parameter Description x - octal number representing <RETURN> delay value

TABLE C-1. MANIP COMMAND DESCRIPTIONS (7 of 7)

Command & Parameters	Definition
x:y	Octal value y is stored at location x, and the next cell is opened (see E command). • Parameter Description x - octal number representing a 16-bit memory address y - 1 to 6 digits representing an octal value
<CTRL-X> or other control character	Any control character is interpreted as a cassette tape unit (CTU) command. MANIP passes the command to the CTU and displays responses from the CTU, if any. CTU commands in MANIP are described in Table C-2. For more information, refer to the IRIS R9 System Manager Manual.

TABLE C-2. MANIP CTU COMMAND DESCRIPTIONS

Command & Parameters	Definition
<CTRL-D>	List directory (index) from tape, if tape is so formatted
<CTRL-E>	Enquire (error status).
<CTRL-K>file	Kill the named file.
<CTRL-O>file	Open named file if it is in the directory.
<CTRL-O>file,x,y	Create a directory entry for named file starting at block x and containing y+1 blocks of 128 words each.
<CTRL-R>	Read the open file from tape into memory.
<CTRL-R>x,y	Read from tape into memory; read y+1 blocks starting at block x.
<CTRL-S>x	Seek to block x on tape. <CTRL-S>999 winds tape all the way forward.
<CTRL-T>n	Select track n (0 or 1).
<CTRL-X>	Cancel partially entered command.
<CTRL-Z>	Rewind tape to starting position.
<ESC>	Exits CTU mode and reverts to MANIP.

Appendix D
SYSTEM WIRING DIAGRAMS

This appendix contains the following system wiring diagrams for the MARK 6:

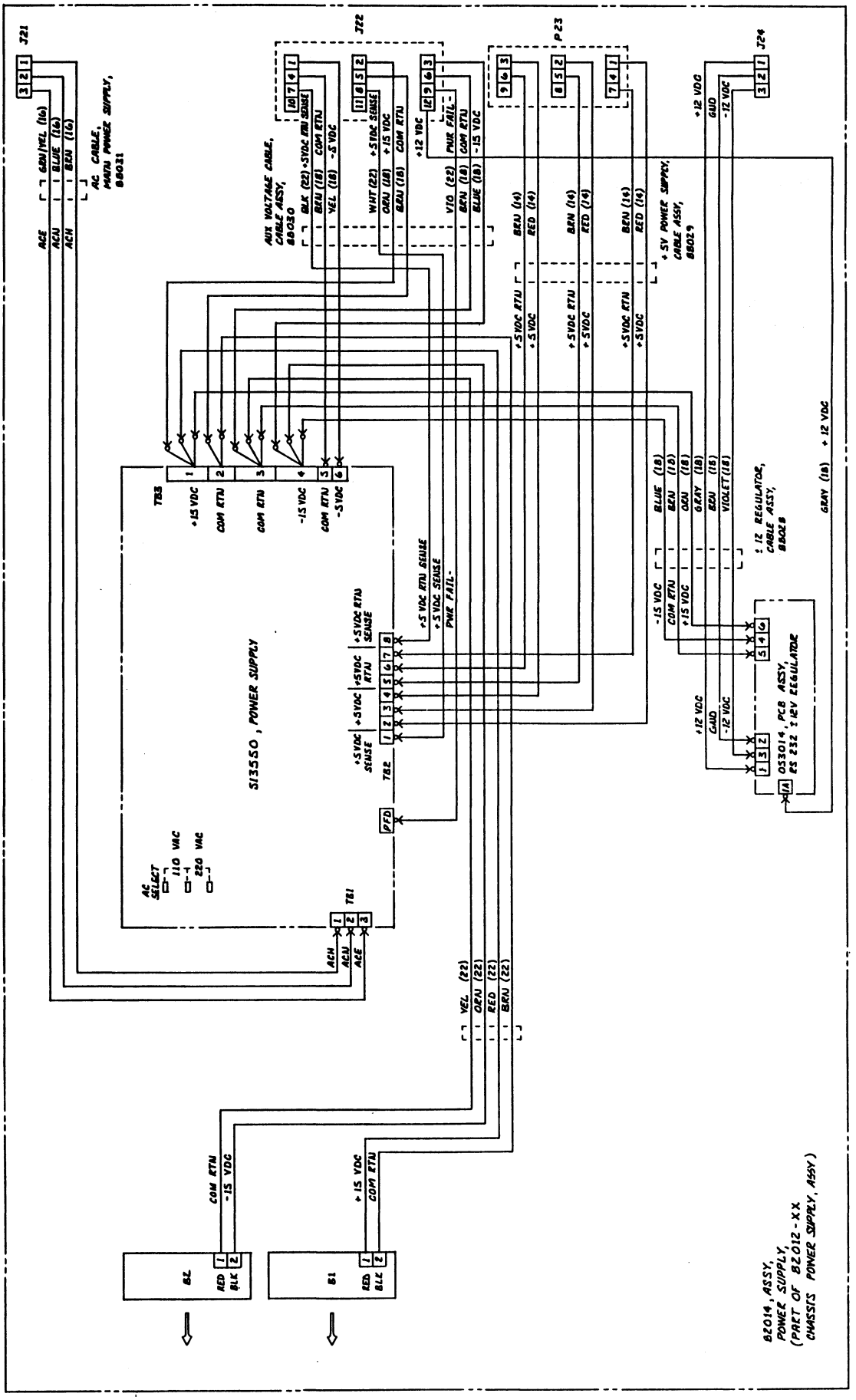
Main Power Supply - DC Wiring

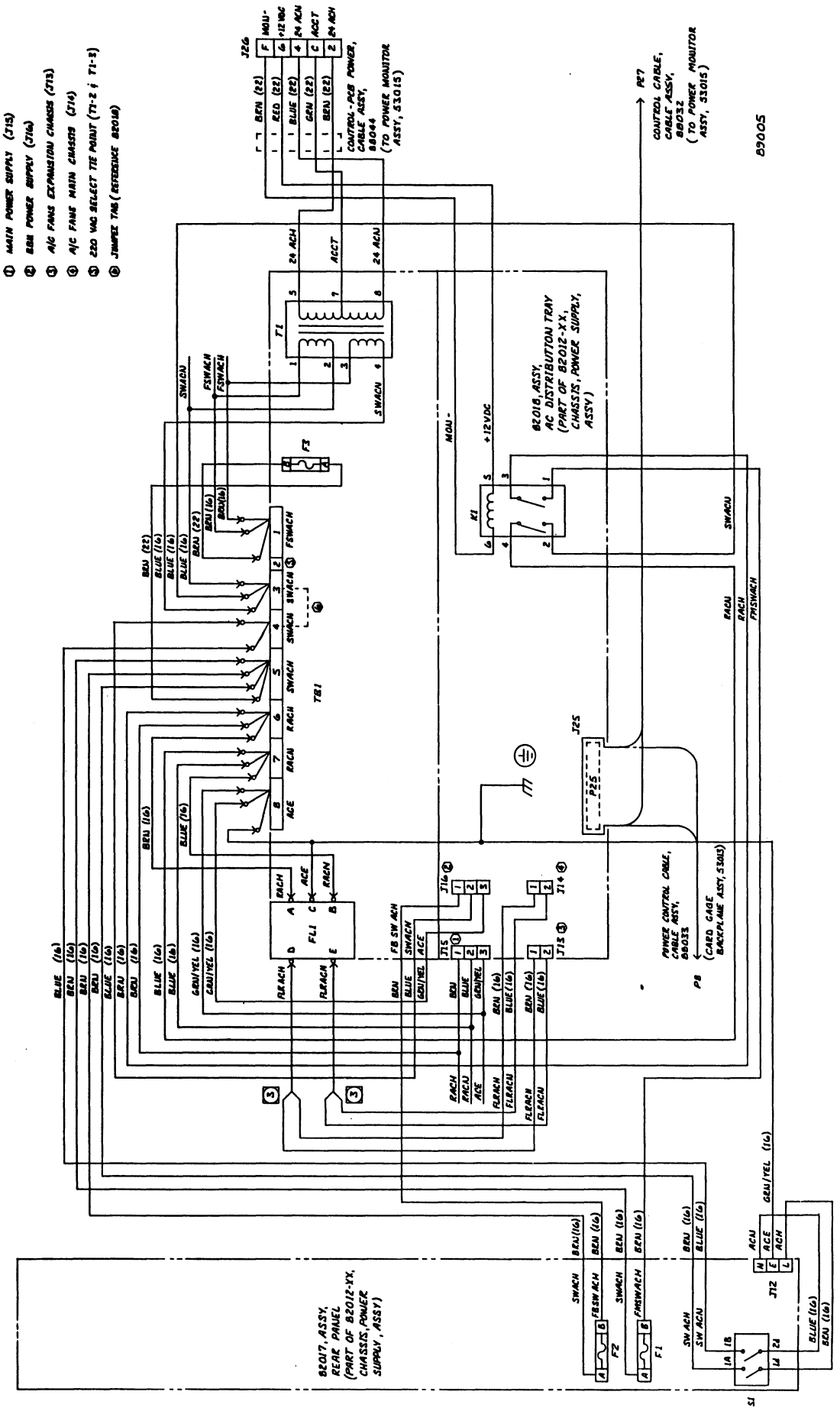
Main Power Supply - AC Wiring

Power Supply-to-Backplane Wiring

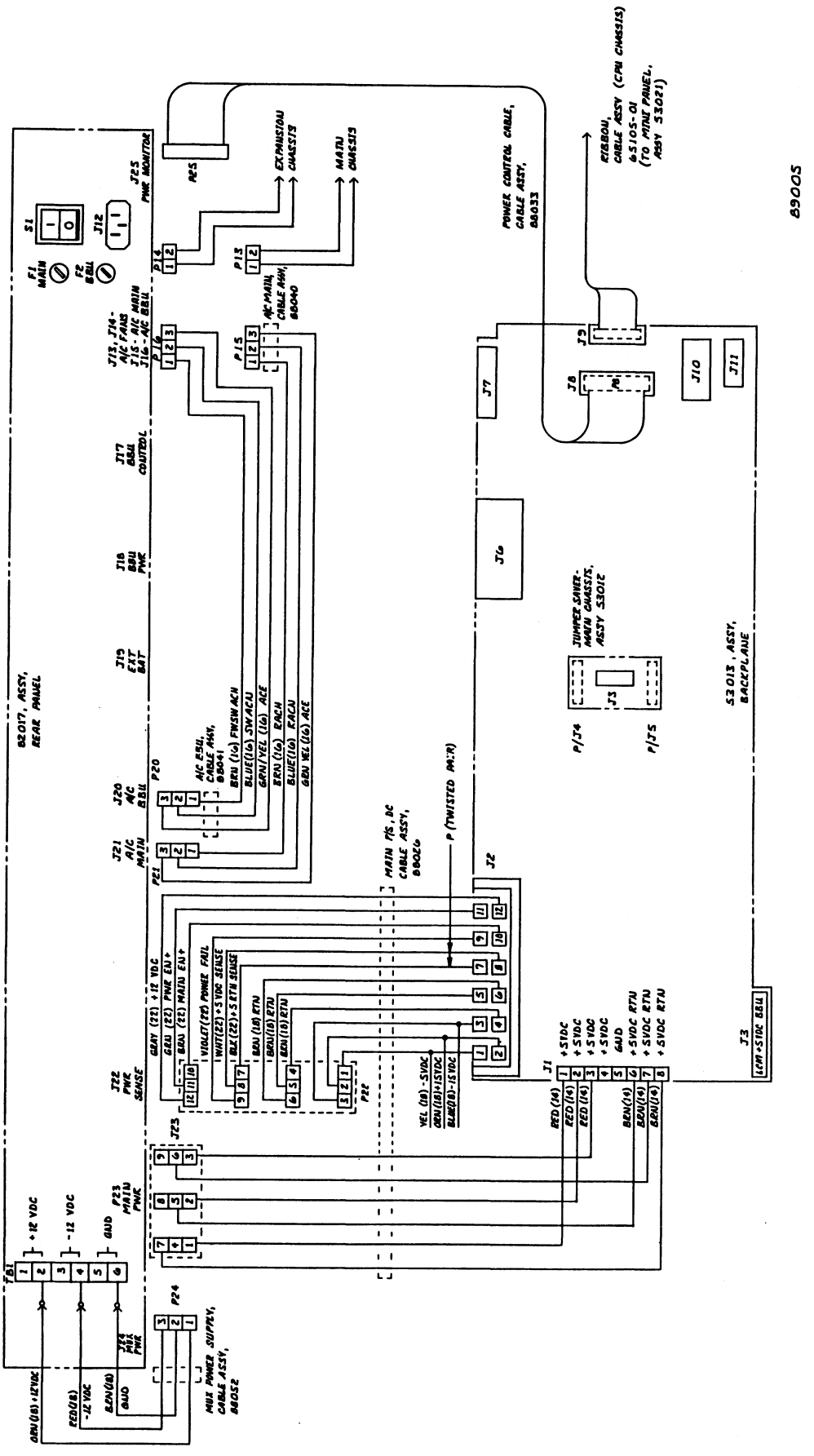
Power Monitor Cabling

Front Mini-Panel Wiring


MAIN POWER SUPPLY - DC WIRING
89005
J21
J22
P23
J24
AC CABLE, MAIN POWER SUPPLY, 88031
AUX VOLTAGE CABLE, CABLE ASSY, 88030
+5V POWER SUPPLY, CABLE ASSY, 88029
± 12 REGULATOR, CABLE ASSY, 88028
TB3
TB2
TB1
PFD
AC SELECT
110 VAC
220 VAC
S13550, POWER SUPPLY
033014, PCB ASSY, ES 232 ± 12V REGULATOR
82014, ASSY, POWER SUPPLY, (PART OF 82012-XX CHASSIS POWER SUPPLY, ASSY)
B2
B1

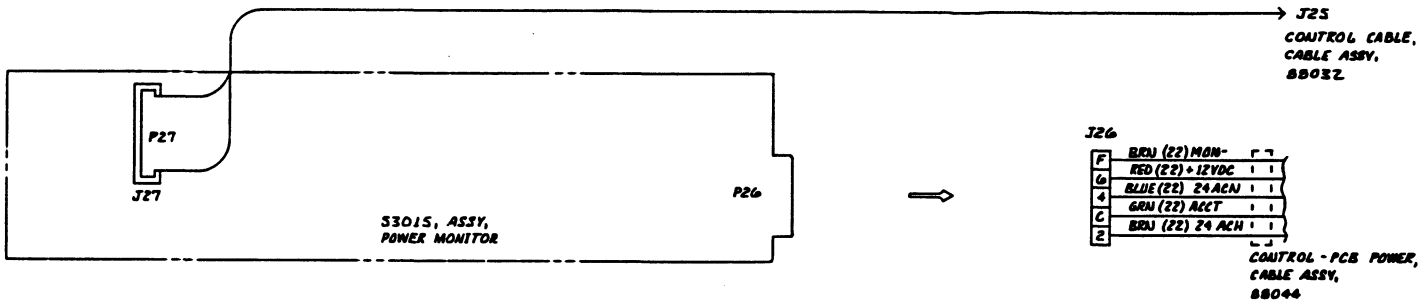


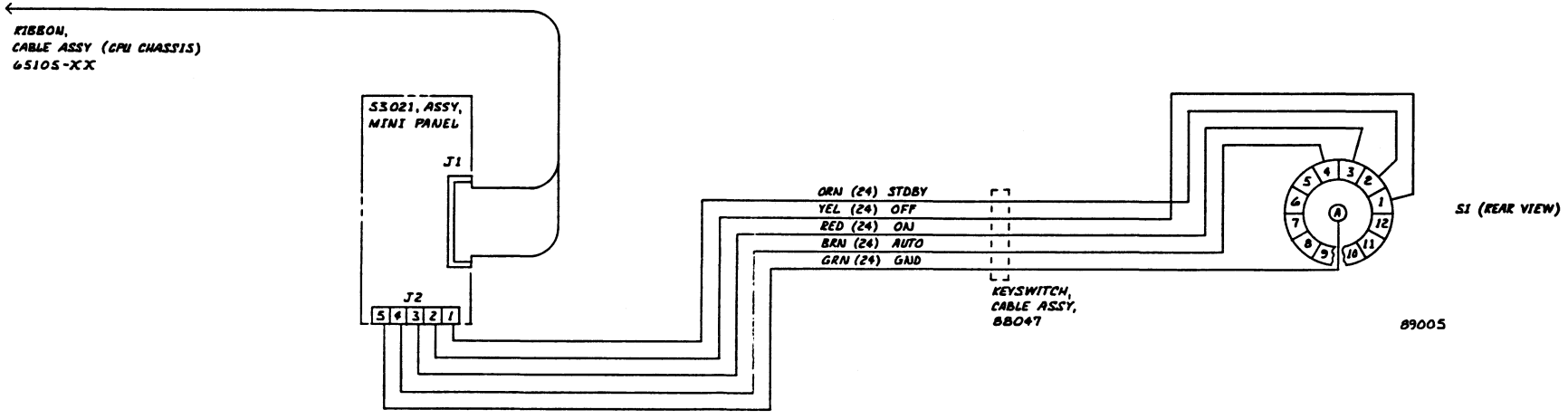
MAIN POWER SUPPLY - AC WIRING



POWER SUPPLY-TO-BACKPLANE WIRING

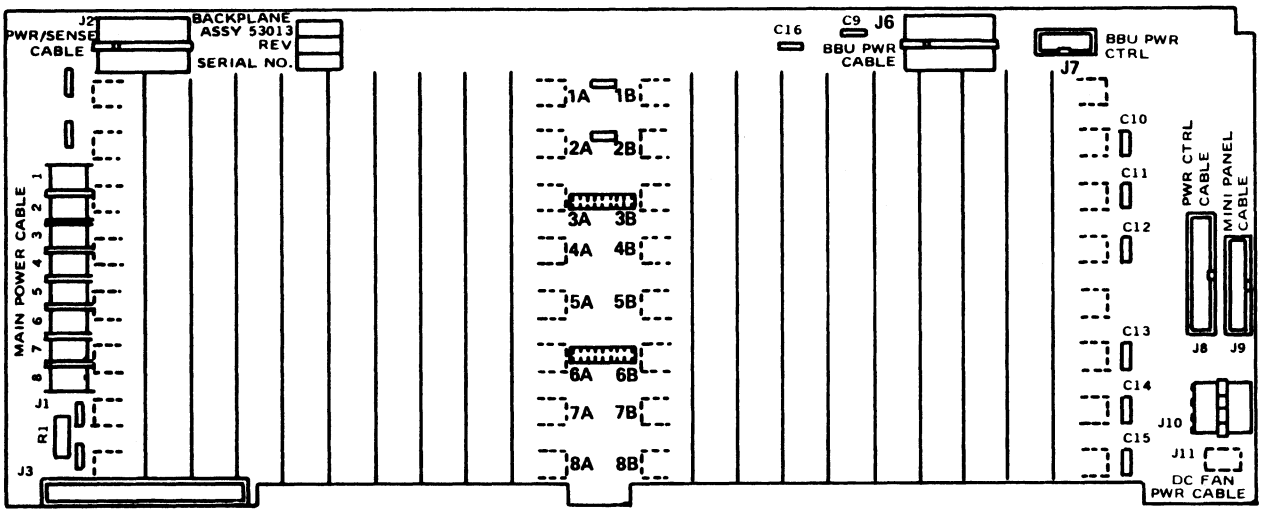
POWER MONITOR CABLING





FRONT MINI-PANEL WIRING

Appendix E
BACKPLANE ASSEMBLY AND PIN ASSIGNMENTS



BACKPLANE DIAGRAM

SLOT 1 - CPU PIN ASSIGNMENTS

CPU ONLY

1A			
TOP		BOTTOM	
PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND
3	+5V	4	+5V
5	+5BU	6	-5V
7	PWRGON-	8	V0-
9	-5BU	10	+15V
11	PWRF-	12	
13	V2-	14	V3-
15	V4-	16	V5-
17	V6-	18	V7-
19	V8-	20	V9-
21	V10-	22	V11-
23	V12-	24	V13-
25	V14-	26	V15-
27	V16-	28	V17-
29	V18-	30	V19-
31	V20-	32	V1-
33	GND	34	GND
35	V21-	36	V22-
37	V23-	38	MSK0-
39	V24-	40	INTA+
41	V25-	42	DATIB+
43	V26-	44	DATIA+
45	V27-	46	DS3-
47		48	DATOC+
49		50	CLR+
51	V28-	52	STRT+
53	V29-	54	DATIC+
55	V30-	56	DATOB+
57		58	DATOA+
59		60	DCHA-
61		62	DS4-
63		64	DS5-
65		66	DS2-
67		68	DS1-
69		70	IORST+
71		72	DS0-
73		74	IOPLS+
75		76	
77		78	
79		80	SELD-
81		82	SELB-
83		84	PEL-
85		86	RUNL-
87		88	CL-
89		90	CNT-
91		92	STP-
93		94	
95		96	
97	+5V	98	+5V
99	GND	100	GND

1B			
TOP		BOTTOM	
PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND
3	+5V	4	+5V
5	V31-	6	
7	VB1-	8	WRITE-
9	LWORD-	10	VB2-
11		12	AS-
13		14	DS-
15		16	VB3-
17	DCHMO-	18	SYSCLK-
19		20	VB4-
21		22	VB5-
23		24	VB6-
25		26	BBUSY-
27		28	BERA-
29	INTR-	30	BERC-
31		32	DTACK-
33	DCHO+	34	
35	DCHR-	36	
37	DCHI+	38	
39		40	
41	RQENB-	42	BACKUP+
43	+5BU	44	+5BU
45		46	+15V
47		48	
49		50	GND
51		52	
53		54	
55	DATA7-	56	DATA14-
57	DATA5-	58	DATA11-
59	DATA12-	60	DATA8-
61	DATA4-	62	DATA0-
63	DATA9-	64	DATA13-
65	DATA1-	66	DATA15-
67		68	
69		70	
71		72	
73	DATA3-	74	
75	DATA10-	76	
77		78	
79		80	
81	-5V	82	DATA2-
83		84	+15V
85		86	
87		88	
89		90	
91	-15V	92	GND
93	-15V	94	+12BU
95	DATA6-	96	+5BU
97	+5V	98	+5V
99	GND	100	GND

SLOTS 2 thru 5 - MEMORY/I/O PIN ASSIGNMENTS

MEMORY / I/O

2A			
TOP		BOTTOM	
PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND
3	+5V	4	+5V
5	+5BU	6	-5V
7	PWRGON-	8	V0-
9		10	+15V
11	PWRF-	12	
13	V2-	14	V3-
15	V4-	16	V5-
17	V6-	18	V7-
19	V8-	20	V9-
21	V10-	22	V11-
23	V12-	24	V13-
25	V14-	26	V15-
27	V16-	28	V17-
29	V18-	30	V19-
31	V20-	32	V1-
33	GND	34	GND
35	V21-	36	V22-
37	V23-	38	MSK0-
39	V24-	40	INTA+
41	V25-	42	DATIB+
43	V26-	44	DATIA+
45	V27-	46	DS3-
47		48	DATOC+
49		50	CLR+
51	V28-	52	STRT+
53	V29-	54	DATIC+
55	V30-	56	DATOB+
57		58	DATOA+
59		60	DCHA-
61		62	DS4-
63		64	DS5-
65		66	DS2-
67		68	DS1-
69		70	IORST+
71		72	DS0-
73		74	IOPLS+
75		76	
77		78	
79		80	SELD-
81		82	SELB-
83		84	
85		86	
87		88	
89		90	
91		92	
93		94	DCHPIN2-
95		96	INTPIN2-
97	+5V	98	+5V
99	GND	100	GND

2B			
TOP		BOTTOM	
PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND
3	+5V	4	+5V
5	V31-	6	
7	VB1-	8	WRITE-
9	LWORD-	10	VB2-
11		12	AS-
13		14	DS-
15		16	VB3-
17	DCHM0-	18	SYSCLK-
19		20	VB4-
21		22	VB5-
23		24	VB6-
25		26	BBUSY-
27		28	BERR-
29	INTR2-	30	BERC-
31		32	DTACK-
33	DCH0+	34	
35	DCHR2-	36	
37	DCHI+	38	
39		40	
41	RQENB-	42	BACKUP+
43	+5BU	44	+5BU
45		46	+15V
47		48	
49		50	GND
51		52	
53		54	
55	DATA7-	56	DATA14-
57	DATA5-	58	DATA11-
59	DATA12-	60	DATA8-
61	DATA4-	62	DATA0-
63	DATA9-	64	DATA13-
65	DATA1-	66	DATA15-
67		68	
69		70	
71		72	
73	DATA3-	74	
75	DATA10-	76	
77		78	
79		80	
81	-5V	82	DATA2-
83		84	+15V
85		86	
87		88	
89		90	
91	-15V	92	GND
93	-15V	94	
95	DATA6-	96	+5BU
97	+5V	98	+5V
99	GND	100	GND

SLOTS 6 thru 8 - I/O ONLY PIN ASSIGNMENTS

I/O ONLY

6A				6B			
TOP		BOTTOM		TOP		BOTTOM	
PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	GND	2	GND	1	GND	2	GND
3	+5V	4	+5V	3	+5V	4	+5V
5		6	-5V	5		6	
7		8		7		8	
9		10	+15V	9		10	
11		12		11		12	
13		14		13		14	
15		16		15		16	
17		18		17	DCHMO-	18	
19		20		19		20	
21		22		21		22	
23		24		23		24	
25		26		25		26	
27		28		27		28	
29		30		29	INTR6-	30	
31		32		31		32	
33	GND	34	GND	33	DCHO+	34	
35		36		35	DCHR6-	36	
37		38	MSKO-	37	DCHI+	38	
39		40	INTA+	39		40	
41		42	DATIB+	41	RQENB-	42	
43		44	DATIA+	43		44	
45		46	DS3-	45		46	+15V
47		48	DATOC+	47		48	
49		50	CLR+	49		50	GND
51		52	STRT+	51		52	
53		54	DATIC+	53		54	
55		56	DATOB+	55	DATA7-	56	DATA14-
57		58	DATOA+	57	DATA5-	58	DATA11-
59		60	DCHA-	59	DATA12-	60	DATA8-
61		62	DS4-	61	DATA4-	62	DATA0-
63		64	DS5-	63	DATA9-	64	DATA13-
65		66	DS2-	65	DATA1-	66	DATA15-
67		68	DS1-	67		68	
69		70	IORST+	69		70	
71		72	DS0-	71		72	
73		74	IOPLS+	73	DATA3-	74	
75		76		75	DATA10-	76	
77		78		77		78	
79		80	SELD-	79		80	
81		82	SELB-	81	-5V	82	DATA2-
83		84		83		84	+15V
85		86		85		86	
87		88		87		88	
89		90		89		90	
91		92		91	-15V	92	GND
93		94	DCHPIN6-	93	-15V	94	
95		96	INTPIN6-	95	DATA6-	96	
97	+5V	98	+5V	97	+5V	98	+5V
99	GND	100	GND	99	GND	100	GND

CABLE PIN ASSIGNMENTS

MAIN POWER CABLE

J1	
PIN	SIGNAL
1	+5V
2	+5V
3	+5V
4	+5V
5	GND
6	GND
7	GND
8	GND

PWR/SENSE CABLE

J2	
PIN	SIGNAL
1	-5V
2	+15V
3	-15V
4	GND
5	GND
6	GND
7	GND
8	+5V
9	PFAIL-
10	MAINEN+
11	PWREN+
12	+12V

LCM +5BU PWR CABLE

J3	
PIN	SIGNAL
1	GND
2	GND
3	+5BU
4	+5BU
5	GND
6	GND
7	+5BU
8	+5BU
9	GND
10	GND
11	+5BU
12	+5BU
13	GND
14	GND
15	+5BU
16	+5BU
17	GND
18	GND
19	+5BU
20	+5BU
21	GND
22	GND
23	
24	
25	
26	
27	
28	
29	GND
30	GND
31	+5BU
32	+5BU
33	GND
34	GND
35	+5BU
36	+5BU
37	GND
38	GND
39	+5BU
40	+5BU
41	GND
42	GND
43	+5BU
44	+5BU
45	GND
46	GND
47	+5BU
48	+5BU
49	GND
50	GND

JUMPER SAVER

J4	
PIN	SIGNAL
1	DCHR-
2	DCHR5-
3	DCHR4-
4	DCHR3-
5	DCHR2-
6	DCHR6-
7	DCHR7-
8	DCHR8-
9	+5V
10	GND
11	
12	DCHPIN6-
13	DCHPIN7-
14	DCHPIN8-
15	DCHPIN2-
16	DCHPIN3-
17	DCHPIN4-
18	DCHPIN5-

JUMPER SAVER

J5	
PIN	SIGNAL
1	INTR-
2	INTR5-
3	INTR4-
4	INTR3-
5	INTR2-
6	INTR6-
7	INTR7-
8	INTR8-
9	+5V
10	GND
11	
12	INTPIN6-
13	INTPIN7-
14	INTPIN8-
15	INTPIN2-
16	INTPIN3-
17	INTPIN4-
18	INTPIN5-

CABLE PIN ASSIGNMENTS

BBU POWER CABLE

J6	
PIN	SIGNAL
1	+5BU
2	+5BU
3	+5V
4	+12BU
5	+12V
6	BACKUP+
7	GND
8	GND
9	GND
10	-5BU
11	-5V
12	GND

BBU POWER CONTROL

J7	
PIN	SIGNAL
1	BTRYOK-
2	PFBBU-
3	
4	PWREN+
5	GND
6	GND
7	BTROFF-
8	SPARE1
9	+5BU
10	GND

PWR CONTROL CABLE

J8	
PIN	SIGNAL
1	GND
2	GND
3	+5BU
4	+12BU
5	PWREN+
6	+15V
7	+5AUX
8	-5V
9	PFAUX-
10	-15V
11	GND
12	BACKUP+
13	GND
14	PWRF-
15	PWRGON-
16	-5BU
17	+5V
18	MAINEN+
19	PWRL-
20	PFBBU-
21	+5V
22	PFAIL-
23	+5MPL
24	+5MPL
25	GND
26	GND

MINI PANEL CABLE

J9	
PIN	SIGNAL
1	+5MPL
2	RUNL-
3	PWREN+
4	PEL-
5	+5MPL
6	CNT-
7	+5BU
8	CL-
9	+5BU
10	STP-
11	GND
12	BTRYOK-
13	GND
14	PWRGON-
15	GND
16	SPARE1
17	GND
18	PWRL-
19	GND
20	BTROFF-

PWR CONTROL REMOTE

J10	
PIN	SIGNAL
1	PWREN+
2	SPARE1
3	GND
4	BTROFF-
5	+5AUX
6	PFAUX-

FAN CABLE

J11	
PIN	SIGNAL
1	GND
2	+15V

Appendix F
GLOSSARY

Account ID - an access code consisting of up to 12 alphanumeric characters that is assigned to a user in order to sign on to the IRIS system.

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

Address - a label, name or number identifying a register, unit or location where information is stored.

APL (Automatic Program Load) - a button on the mini-panel of the card chassis that when pressed loads the MANIP program into the top 1000 (octal) words of memory.

Backplane assembly - the rear panel of the card chassis where signals are connected from board to board.

Backup - the process of copying part or all the information on a disk onto another disk or tape. The information copied can include the operating system, configuration, application programs and all data that has been entered on the system.

Battery backup - a MARK 6 option that backs up power to the extended memory in the event of a power failure.

Baud rate - the rate at which one device communicates with another device.

Bit - a binary digit.

Board - a printed circuit board that holds capacitors, diodes, resistors, transistors and other elements of electrical circuits.

Byte - a unit of eight binary digits; eight bits.

BZUD (Block Zero Utility Driver) - a simple disk driver that is unique for each disk controller/disk drive/logical unit combination.

Card chassis - the eight-slot card cage and backplane assembly that holds the printed circuit boards of the system.

CMD (Cartridge Module Drive) - a type of hard disk.

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

CPU Self-Test - consists of two tests that check the functioning of the MARK 6: the firmware self-test routine and the CPU software self-test.

CPU software self-test - the part of the CPU Self-Test that verifies that CPU software is functioning.

CPU status word - 16-bit word whose individual bits indicate status or control various functions. Some are manipulated by software, all by hardware.

Data channel - a 16-bit bi-directional information path between the CPU memory and input/output devices.

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

Default - a parameter to which the system reverts if another customized parameter is not substituted in its place, e.g., the default password for SHUTDOWN is X.

Device code - a code used to select individual controllers, e.g., P27 is the device code for the LOTUS Controller.

Diagnostic - a program or routine used to help locate a malfunction or problem in system hardware.

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

Disk - a storage device on which information is recorded on the magnetized surface of a rotating disk.

Disk controller - a printed circuit board that controls access and enables the exchange of information between disk and the computer's memory.

EXERCISER - a software test that tests the ability of the disk controller or cache memory to do single-block transfers from formatted files and the ability of the memory buffer pool to maintain that information.

Expansion board - a printed circuit board associated with the multiplexer that increases the number of terminals and printers that can be connected to the system.

Expansion chassis - an auxiliary eight slot chassis that can be added to the system to increase the number of printed circuit boards that can be accommodated.

Extended memory - a printed circuit board that provides 2 or 4MB of expanded memory in addition to the 128KB on the CPU board.

Firmware self-test - a routine that verifies that hardware is functioning enough to communicate with a terminal. It is one part of the CPU Self-Test.

Formatting - a procedure that writes the headers of all sectors to disk, analyzes the headers and surfaces for errors and records and chains hard errors to alternate sectors.

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

Hardware - the physical components that make up the computer and its peripheral equipment.

Hz (Hertz) - A unit of frequency equal to one cycle per second.

Integrated system - a fully assembled MARK 6 system housed in a cabinet and including an extended IRIS license.

In tolerance - within an acceptable limit of a required value.

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

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

KB (kilobyte) - equal to 1024 bytes.

LCM (Lotus Cache Memory) - a solid state memory board, which provides auxiliary mass storage for frequently used information that normally resides on a disk.

LEDs (Light-emitting diodes) - light indicators on the power monitor board, the mini-panel and several printed circuit boards that monitor computer operations.

Logical Unit (LU) - designation used to refer to software on a disk or memory-based partition.

Log-on - the procedure to sign on to a computer terminal so that it can be used.

Log-off - the procedure to sign off a computer terminal.

MANIP - a stand-alone program that enables the user to "manipulate" the computer's registers and memory; that is, memory contents can be displayed, modified, searched, moved, checksummed, etc. MANIP is also used to run the CPU software self-test, and to load and run a program from disk.

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

MB (megabytes) - equal to 1,048,576 bytes.

Mini-panel - the panel that houses the controls and indicators and regulates the operations of the computer. It is located on the left side of the card chassis.

Mini-switches - the two groups of red and white switches on the front edge of the CPU board. Their setting determines the manner in which an IPL is performed and/or the manner of access to the CPU software self-test. In troubleshooting, they can also be used to read any location in memory.

Multiplexer, MIGHTY MUX - a printed circuit board that manages information transfer between the computer memory and video display and printer terminals.

Octal - the base eight number system used by IRIS.

Onboard memory - also known as main memory. Refers to the 128KB memory stored on the CPU board which is directly accessible.

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

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

Port - interactive input/output channel on the IRIS system.

Port 0 - the first port on a MUX 310 board.

Power monitor board - a board, located on the left side of the power supply, that contains eight light indicators (LEDs) that monitor power supply and battery backup voltages.

Power supply board - the subassembly which houses the main power supply regulator and the Multiplexer power supply.

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

RETMA (Radio Electronics-Television Manufacturer's Association) - now the EIA (Electronics Industries Association). Represents an industry-accepted standard.

RPS (Rack-mounted Peripheral Subsystem) - the separate unit that houses the disk and/or tape drive and a power supply.

Scratch tape - a blank tape used to back up the system or to copy programs or diagnostics.

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

SHUTDOWN - a system command used to shut down the system.

SMD (Storage Module Drive) - a type of hard disk.

Streamer tape drive - a tape drive which inputs and outputs a larger quantity of information faster than other tape drives because it does not stop while transferring information.

SWAPTEST - an IRIS program that tests the interaction and the reliability of the IRIS operating system.

Tape cartridge - a cartridge containing magnetic tape used to store programs and information.

TRAP - a system error condition caused by a program or hardware error.

TTL - transistor-transistor logic.

Voltage regulator - a circuit that holds an output voltage at a predetermined value or causes it to vary according to a predetermined plan, regardless of normal input-voltage changes.

Word - 16 bits or two bytes.

Write-protect - a mechanism on a tape cartridge that can be set to prevent the tape from being written on.

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