Errata

Title & Document Type: **6943A Multiprogrammer Extender Operating and Service Manual**

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HEWLETT PACKARD

MULTIPROGRAMMER EXTENDER MODEL 6943A

INSTALLATION AND ASSEMBLY LEVEL SERVICE MANUAL FOR SERIALS 2216A-00331

For Serials Above 2216A-00331
a change page may be included.

For Serials Below 2216A-00331
refer to Appendix A.

HP Part No. 06943-90001
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SECTION I
GENERAL INFORMATION

1-1 SCOPE

1-2 This manual provides installation, principles of operation, and assembly level service information for the 6943A Multiprogrammer Extender. Assembly level service instructions for the 6942A Multiprogrammer, the master unit in a Multiprogrammer System, are provided in a separate manual. Accessory Input/Output (I/O) cards are also covered in separate manuals. Programming, installation, and operating instructions for the entire Multiprogrammer System (6942A, 6943A, and all I/O cards are provided in the 6942A Multiprogrammer User's Guide, HP Part No. 06942-90003. Chapter 1 of the User's Guide provides a list of additional publications that are pertinent to the 6942A Multiprogrammer System and HP-IB computing controllers. The HP-IB, a versatile interconnect system for instruments and controllers, is Hewlett-Packard's implementation of IEEE standard 488-1978, "Standard Digital Interface for programmable instrumentation".

1-3 The service instructions provided in this manual consist of assembly (board) level isolation procedures for the 6943A's logic circuits. Component level troubleshooting procedures for the 6943A's power circuits, which are identical to the 6942A's power circuits, are covered in the instruction manual for the 6942A (HP Part No. 06942-90006) and will not be repeated in this manual. Component level troubleshooting procedures for the 6943A's logic circuits are beyond the scope of this manual but are included with the 6942A Multiprogrammer Service Kit, HP Part No. 14710A. The 14710A, purchased separately (see paragraph 1-17) contains all the service aids required for component level troubleshooting of the entire Multiprogrammer system.

1-4 DESCRIPTION

1-5 6943A Multiprogrammer Extender

1-6 The 6943A is intended for use only as an addition to the 6942A and must be controlled through this unit. The 6942A is the master control unit for bidirectional communication, data processing, and data transfer between an HP-IB controller and the 6942A/6943A Multiprogrammer System. The 6942A can be used in a single-unit system employing from one to sixteen input/output (I/O) cards or in a multi-unit system consisting of one 6942A master unit and up to seven 6943A extender units. Each 6943A can also accommodate up to sixteen I/O cards allowing a Multiprogrammer system to be expanded to 128 I/O cards. The last 6943A in the chain can operate at a distance of up to 500 feet from the controller.

1-7 The 6943A mainframe is similar in construction to the 6942A but is less complex electronically. The power supplies and rear I/O card slots are the same for the 6943A as for the 6942A. However, the 6942A's HP-IB Interface, CPU/ROM, and Control/RAM boards are not included in the 6943A. The 6943A only contains a Backplane Control board and a transmission System board.

1-8 Transmission System boards (part of the 14700A and 14701A Extender Kits, see paragraph 1-17) must be installed in rear slot A6 of the 6942A and 6943A units in order to interface the 6942A with up to seven 6943A extenders. Chaining cables are connected between each unit. The Transmission System boards installed in the "Middle" extenders have two edge connectors to accommodate two chaining cables (one towards the 6942A and one towards the next 6943A). A frame address switch for each unit is located on the associated Transmission System board. Frame address switch settings are described in Chapter 2 for the 6942A User's Guide. Frame address decoder and frame interrupt decoder circuits are located on the transmission system boards. The boards also contain data bus transceivers (6942A and 6943A), address bus drivers (6942A)/receivers (6943A), and control bus drivers (6942A)/receivers (6943A). These circuits interface the 6942A and 6943A units with balanced transmission lines. Detailed procedures for installing Transmission System boards and chaining cables are provided in Chapter 2 of the 6942A Multiprogrammer User's Guide.

1-9 The data, address, and control bus lines are distributed from the transmission system board to the 6943A's I/O card slots via backplane connector board A3 and backplane control board A2. The address and control bus lines transfer data between the external data bus and the I/O cards. The 6943A's backplane control board contains a card address decoder circuit and a card interrupt priority circuit. The card address decoder selects the I/O card slot which will receive or send data on the external data bus lines. The card interrupt circuit monitors the interrupt request ($\overline{IRQ}$) line from each of the 16 slots in the 6943A mainframe. The interrupt request lines are used by the microprocessor in the 6942A master unit to determine when the associated I/O card has completed operations.

1-10 Input/Output Cards

1-11 Paragraph 1-17 lists each I/O card model available at the time of this publication and provides a brief functional description of each card type. In general, the function of an output card is to develop the output quantity specified by the programmed instruction and to deliver this quantity to the user's system. The basic function of an input card is to receive data from the user's system and make it available to the HP-IB

controller. All I/O cards, both input and output, contain a custom LSI circuit called the Universal Control Chip (UCC). The UCC interfaces the card to the 6942A's microprocessor via the 6942A/6943A backplane and controls all communications between the microprocessor in the 6942A and the I/O card. Using identical interfaces (Control Chips) on all cards eliminates the need for special instructions for each card type. Paragraphs 4-32 through 4-52 in the User's Guide describe typical I/O card operations. Chapter 7 in the User's Guide provides programming examples for each I/O card type. Individual I/O card circuit descriptions are provided in the applicable I/O card manual.

1-12 All I/O cards are fabricated on a 299.72mm (11.8") x 132.08mm (5.2") printed circuit board. The inner end of the card contains a dual 36 pin (72 pin total) printed circuit plug which mates to any I/O slot connector in the rear of a 6942A or 6943A unit. Each I/O card is equipped with a handle which is useful when installing or removing the I/O card from its slot. The handle is marked to identify the card type. The outer edge of the card also contains a dual 36 pin (72 pin total) printed circuit plug for interfacing the card to the user's device. One edge connector assembly is supplied with each I/O card allowing the user to make interconnections as required.

1-13 INTERFACING

1-14 Interfacing the Multiprogrammer System with an HP-IB controller is accomplished by the A5 HP-IB Interface Board installed in the 6942A Master unit. This board provides the proper interface for bidirectional communication between the Multiprogrammer System and a Hewlett-Packard Interface Bus (HP-IB) controller. Extender Kits, Models 14700A and 14701A (see Table 1-3), contain the transmission system boards (A6 boards) which are required to interface the 6942A Multiprogrammer with up to seven 6943A Multiprogrammer Extender Units. One 14702A Chaining cable is required to interconnect each 6943A used in the system.

1-15 HP-IB CAPABILITIES

1-16 The 6942A/6943A Multiprogrammer System's HP-IB interface capabilities are specified in Table 1-1. The interface codes and functions are defined in accordance with IEEE Standard 488-1978, "Standard Digital Interface for Programmable Instrumentation".

Table 1-1. 6942A/6943A Multiprogrammer System

Code	Capability
SH1	Source Handshake capability
AH1	Acceptor Handshake capability
T6	Talker (basic talker, serial poll, unaddress to talk if addressed to listen)
TE6	Extended Talker (basic extended talker, serial poll)
L4	Listener (basic listener, unaddress to listen if addressed to talk)
LE0	No Extended Listener capability
SR1	Service Request capability
RL0	No Remote/Local capability
PP1	Parallel Poll capability (remote configuration)
DC1	Device Clear capability
DT0	No Device Trigger capability
C0	No Controller capability

1-17 ACCESSORIES

1-18 Tables 1-2 and 1-3, respectively, list the accessories furnished with and available for use with the 6943A. The descriptions of the available accessories in Table 1-3 are very general and in no way represent complete specifications. Complete specifications are covered in the instruction manuals for each accessory.

1-19 OPTIONS

1-20 The following options are available with this instrument.

Option No.	Description
908	Rack Mounting Kit
910	One additional service manual shipped with the Multiprogrammer Extender.

1-21 SPECIFICATIONS

1-22 Specifications for the 6943A Multiprogrammer Extender are given in Table 1-4.

1-23 SAFETY CONSIDERATIONS

1-24 This product is a Safety Class I instrument (provided with a protective earth terminal). The instrument and this manual should be reviewed for safety markings and instructions before operation of the instrument.

1-25 INSTRUMENT AND MANUAL IDENTIFICATION

1-26 Hewlett-Packard instruments are identified by a two-part serial number. The first part is the serial number prefix, a number-letter combination that denotes the date of a significant design change and the country of manufacture. The first two digits of the prefix indicate the year (19 = 1979, 20 = 1980, etc), the second two digits indicate the week, and the letter "A" designates the USA as the country of manufacture. The second part of the serial number is a different sequential number assigned to each instrument, starting with 00101.

1-27 If the serial number on your instrument does not agree with those of the title page of this manual, change sheets or manual backdating changes in Appendix A define the differences between your instrument and the instrument described by this manual.

1-28 ORDERING ADDITIONAL MANUALS

1-29 One manual is shipped with each instrument. Additional manuals may be purchased directly from your local Hewlett-Packard Sales office. Specify the model number, instrument serial number prefix, and the manual part number provided on the title page. (When ordered at the same time as the instrument, additional manuals may be purchased by adding Option 910 to the order and specifying the number of additional manuals desired).

Table 1-2. Accessories Furnished

Accessory	Description
6942A Multiprogrammer User's Guide HP Part No. 06942-90010	Provides programming, operating, installation, and verification procedures for the entire Multiprogrammer System (consisting of the 6942A, 6943A(s), transmission system boards, and complete family of I/O cards). The User's Guide consists of the following items: Part No. — Description 06942-90003 — User's Guide Pages 06942-90004 — Quick Reference Programming Guide 06942-13001 — Utility Program Cartridge for HP 9825A Computing Controller 06942-13002 — Utility Program Cartridge for HP 9835/9845 Computing Controller 9282-0971 — Binder

Table 1-3. Accessories Available

Accessory	Description
INPUT/OUTPUT CARDS	
Resistance Output Cards (RES OUTPUT): Models 69700A-69702A,69704A-69706A	The output of each card is a programmable resistance value. Twelve mercury-wetted relay contacts close across binary weighted precision resistors in a series string. Typical use is power supply programming. Model 69700A is supplied without resistors so that customers may choose and install their own resistors.
Power Supply Control Card Model 69709A	Provides all the features required to easily program, control, and monitor HP's 6012A and 6024A Autoranging Power Supplies equipped with Option 002.
Digital to Analog Voltage Converter Card (VOLTAGE D/A): Model 69720A	Provides a high speed bipolar output voltage (−10.240 V to +10.235 V) from 12 bits of data.
Digital to Analog Current Converter Card (CURRENT D/A): Model 69721A	Has the same capabilities as the 69720A card plus a voltage to current amplifier that provides a −20.78 mA to +20.47 mA current output in addition to the voltage output.
Relay Output Card (RELAY OUTPUT): Model 69730A	Provides sixteen independent, normally open, mercury wetted relay contacts. The contacts may be used as separate switches or may be externally interconnected to form a relay scanner or switch.
Digital Output Card (DIGITAL OUT): Model 69731B	Provides sixteen TTL, or CMOS compatible outputs; or sixteen 100 mA open collector switches.
Pulse Train Output and Stepping Motor Control Card (PULSE TRAIN): Model 69735A	Generates a programmable number of pulses (up to 32,767) at a programmable frequency.
Timer/Pacer Card (TIMER/PACER): Model 69736A	Provides a pulse of programmable period or a square wave of programmable frequency.

Table 1-3. Accessories Available (continued)

Accessory	Description
Scan Control/Pacer Card Model 69750	Used with the 69752A and 69755A FET Scanner Cards to provide channel selection, pacing, and synchronization with A/D converters and DVM's. Can operate up to 1024 channels on 32 scanner cards.
Analog to Digital Converter Card (HI SPEED A/D): Model 69751A	Measures bipolar dc voltages in one of four ranges: ± 100 mV, ± 1V, ± 10 V, or ± 100 V with 12 bit resolution.
64 Channel FET Scanner Card Model 69752A	High speed 64 channel single ended FET scanner, cascadable to 1024 channels, ideal for large multi-channeled systems.
16 Channel FET Scanner Card Model 69755A	High speed 16 channel single ended FET scanner, cascadable to 1024 channels, ideal for smaller systems or more closely rounding out a larger one.
Isolated Digital Input Card (ISO DIG INPUT): Model 69770A	Provides sixteen optically isolated inputs. The optically coupled isolator in each input line breaks the path of a potential ground loop.
Digital Input/Analog Comparator Card (DIGITAL INPUT): Model 69771A	Monitors up to sixteen contact closures, switches, TTL signals, CMOS signals, or analog signals.
Counter/Totalizer Card (COUNTER): Model 69775A	Counts contact closures, TTL logic level pulses, CMOS logic level pulses, or analog waveform transitions in the range of 0 to 65,535.
Interrupt Card (WORD INT): Model 69776A	Compares up to sixteen logic level or contact closure inputs with a sixteen bit reference word stored on the card. The card has four programmable modes: it can interrupt when the input data is unequal to (≠), equal to (=), greater than (>), or less than (<) the reference word.
Memory Card (MEMORY): Model 69790B	Provide 4k x 16-bit words for use with the DAC cards (69720A, 69721A) or the 69751A ADC card or for other input/output tasks that must run independently from other Multiprogrammer or computer tasks. The 69790B consists of two interconnected cards (require two slots that function as a single memory).
Breadboard Card Model 69793A	Provides an area for mounting custom circuits for use with the Multiprogrammer.
Card Edge Connector HP Part No. 5060-2806	Interfaces I/O cards with each other or with external devices. One connector is shipped with each I/O card. Order Model 14703A when extra connectors are required.
LAST EXTENDER KIT Model 14700A	Required when one or more 6943A Units are used in a system. Consists of two transmission system boards. Board 14700-60020 is installed in slot A6 of the 6942A and board 14700-60021 is installed in slot A6 of the last 6943A unit.

Table 1-3. Accessories Available (continued)

Accessory	Description
INTERMEDIATE (MIDDLE) EXTENDER KIT Model 14701A	Required when two or more 6943A units are used in a system. One 14701A kit is required for each middle 6943A (up to 6).
CHAINING CABLE Model 14702A	One (5 feet long) required for each 6943A used in a system.
CARD EDGE CONNECTOR Model 14703A	Model 14703A is ordered when an extra I/O card connector is required.
SERVICE AIDS 6942A Multiprogrammer Service Kit Model 14710A	Contains the service aids for component level troubleshooting of the entire Multiprogrammer System: 6942A Multiprogrammer 6943A Extender 14700A Last Extender Kit 14701A Middle Extender Kit All I/O cards, Models 69700A-69790A
Signature Analyzer Model HP 5004A	Used to verify and troubleshoot all logic circuits in the Multiprogrammer System.

Table 1-4. Specifications

Input Power: 100/120/240 Vac (selectable), +5%, −10%, 47 to 63 Hz, 600 Va.

I/O Card Positions: Maximum of 16 I/O cards per 6942A or 6943A unit. Since up to seven 6943A extenders may be placed in a chain with one 6942A, up to 128 I/O cards (8 units x 16 I/O cards) can be used in a Multiprogrammer system.

Maximum Chain Length: A chain of mainframes can be up to 152 meters (500 feet) long. This maximum length is the sum of the lengths of all 14702A Chaining Cables used in one chain.

Power Supplies: All power supplies for up to 16 I/O cards are built-in including three ±18 V supplies isolated from each other and from ground.

Cooling: Built-in forced air cooling draws air in through the front panel and exhausts air thorugh the ventilated rear cover.

Operating Temperature Range: 0°C to 55°C.

Dimensions: 177.0mm high x 4.25mm wide x 597.0mm deep. (6.969in. high x 16.750in. wide x 23.500in. deep).

Weight (without I/O cards): Net 20Kg. (45 lbs). Shipping, 27Kg. (60 lbs).

SECTION II
INSTALLATION AND VERIFICATION

2-1 INITIAL INSPECTION

2-2 Before shipment, this instrument was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is received, proceed as instructed in the following paragraphs.

2-3 Mechanical Check

2-4 If external damage to the shipping carton is evident, ask the carrier's agent to be present when the instrument is unpacked. Check the instrument for external damage such as broken controls or connectors, and dents or scratches on the panel surfaces. If the instrument is damaged, file a claim with the carrier's agent and notify your local Hewlett-Packard Sales and Service Office as soon as possible (see list at rear of this manual for addresses).

2-5 Operational Check

2-6 Make an operational check of the instrument as soon as possible after receipt. Verification procedures, using the Multiprogrammer's self test feature and utility program cartridges, are described in Chapter 2 of the 6942A Multiprogrammer User's Guide. Additional verification procedures using the 6942A's built-in Signature Analysis (SA) capabilities are provided in Section IV. The SA procedures can be performed at any time but are intended primarily for post repair verification. Refer to the inside front cover for the Certification and Warranty statements.

2-7 REPACKAGING FOR SHIPMENT

2-8 To insure safe shipment of the instrument, it is recommended that the package designed for the instrument be used. The original packaging material is reusable. If it is not available, contact your local Hewlett-Packard field office to obtain the materials. This office will also furnish the address of the nearest service office to which the instrument can be shipped. Be sure to attach a tag to the instrument specifying the owner, model number, full serial number, and service required, or a brief description of the trouble.

2-9 INSTALLATION DATA

2-10 The 6943A is shipped with the A2 Backplane Control board installed within the mainframe. I/O cards and the transmission system board (A6 slot) are not installed when the 6943A is shipped from the factory. Before proceeding with the installation procedures, ensure that transmission system board(s) are available for "middle" and/or "last" 6943A extenders. Table 1-3 describes the Model 14700A Last Extender Kit and the Model 14701A Intermediate (Middle) Extender Kit that provide the required transmission system boards.

2-11 Location and Cooling

2-12 The unit should be used in an area where the ambient temperature does not exceed 55°C. Built-in forced air cooling draws air in through the front panel grill and exhausts air through the ventilated rear cover. A fan speed control circuit changes the fan speed depending upon the temperature within the unit and primary load current changes. The front panel grill and the air filter behind it must be kept clean (see paragraph 2-29 in User's Guide).

2-13 Rack Mounting

2-14 A rack mounting kit is available for the 6942A and 6943A Multiprogrammer Units. The rack mounting kit is obtained by specifying Option 908 when ordering the instrument. The instructions, provided with the kit, illustrate and describe the procedures for preparing the Multiprogrammer unit for rack mounting. One kit is required for each unit to be rack mounted.

2-15 Installation Procedures

2-16 Step by step installation procedures are provided in Chapter 2 of the User's Guide. The procedures include gathering the proper equipment, setting address switches, installing I/O cards, and connecting the cables. Refer to paragraphs 2-2 through 2-28 in the User's Guide for detailed installation instructions. The general installation procedures are outlined below.

1. Install ROM's and HP-IB interface card in the controller. Check that the select code for the HP-IB interface card is preset to "7". The utility program cartridges and sample programs, supplied with the User's Guide, use a select code of "7".

2. Remove rear cover from 6942A and any 6943A extenders used in system. Rear covers are installed in the 6942A and 6943A units to hold the I/O plug-in card connectors in place and prevent them from loosening. The covers must be removed in order to gain access to the I/O card slots, cable connectors, address switches, and power module. Four quarter-turn fasteners secure the cover to the rear of the units.

3. Check the HP-IB address of the 6942A. The HP-IB address for the Multiprogrammer System is selected by the address switches on the A5 HP-IB Interface Board. The switches are set for an address of "23" as the unit is shipped from the factory. Since the controller's HP-IB Interface Code is 7, the Multiprogrammer System's complete address as programmed from the controller is "723".

4. Set the frame address in the 6942A and 6943A units used in the system. Make sure that each Multiprogrammer unit in the system is set to a different frame address before

power is applied. The frame address (0-7) is part of any overall address that identifies a particular I/O card in the system.

5. Connect cables between the controller and the 6942A, between the 6942A and first 6943A unit, and between all additional 6943A units (up to six) used in the system. Ensure that the proper transmission system board is installed in the A6 slot of each unit.

CAUTION

Always turn off power at a Multiprogrammer unit before installing or removing an I/O card. If power is not removed, it is possible to short components in the Multiprogrammer when installing or removing a card, thereby causing possible damage.

6. Install the I/O cards and make connections from the I/O card's edge connector to the user's device. One edge connector assembly is provided with each I/O card purchased. Assembly instructions are included with the connector. As installation and wiring are completed for each card, record the following information.

a. Card type
b. Application in external system
c. Card main address:
   Slot No. + (Frame No. X100)
d. Card subaddresses (if applicable)
e. Data format parameters: data type, LSB value, number of bits.

7. Ensure that the proper line voltage has been selected and power cord is connected to power module.

8. Verify operation (see Section IV in this manual) and then replace the rear covers.

2-17 Input Power Requirements

2-18 The 6942A and 6943A may be operated from a nominal 100V, 120V, 220V, or 240V single-phase ac power source (48-63Hz). The input voltage range for each of the nominal inputs is listed below. A label on the rear panel indicates the nominal line voltage for which the instrument was set at the factory. If necessary, the user can convert the instrument from one line voltage option to another by following the instructions in paragraph 2-9 of the User's Guide.

Nominal Voltage	Line Voltage Range	Fuse
100Vac	87-106	6A
120Vac	104-127	6A
220Vac	191-233	3A
240Vac	208-250	3A

CAUTION

Failure to correctly match the Multiprogrammer's primary voltage setting to the available source may result in damage to the instrument.

2-19 Power Cable

2-20 Model 6943A is shipped from the factory with a power-cord plug appropriate for the user's location. Figure 2-1 illustrates the standard configuration of power-cord plugs used by Hewlett-Packard. Below each drawing is the HP Part Number for a replacement power cord equipped with a plug of that configuration. If a different power cord is required, contact the nearest Hewlett-Packard Sales and Service office.

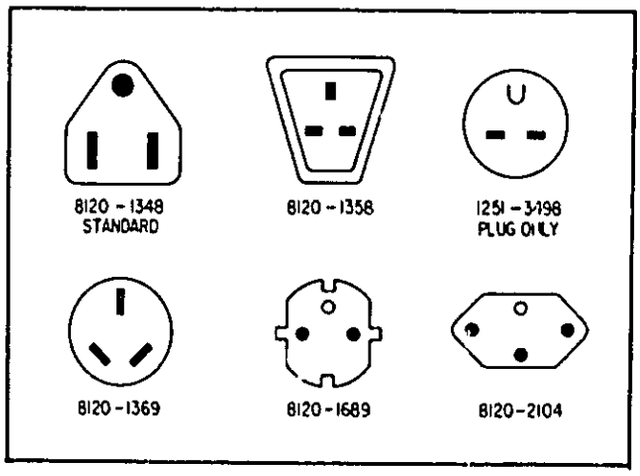


Figure 2-1. Power-Cord Plug Configurations

2-21 To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a three-conductor power cable; the third conductor is the ground conductor. When the cable is plugged in to an appropriate receptacle, the instrument is grounded. In no event shall this instrument be operated without an adequate cabinet ground connection.

2-22 The offset pin on the standard power cable three-prong connector is the ground connection. To preserve the protection feature when operating the instrument from a two-contact outlet, use a parallel-ground adapter (if permitted by local regulations) and connect the green lead on the adapter to ground.

THEORY

SECTION III
PRINCIPLES OF OPERATION

3-1 INTRODUCTION

3-2 This section contains principles of operation for the 6943A Multiprogrammer Extender. The section is divided into the following paragraphs: first, a basic block diagram description of the 6942A/6943A Multiprogrammer System, then a description of the signal flow between the 6942A/6943A transmission system boards, and finally block diagram descriptions of the "Last" and "Middle" 6943A Extender Units. The descriptions provide a basic understanding of circuit operation and are intended as troubleshooting aids. Circuits which are identical to those used in the 6942A are not discussed in detail in this section, since it is assumed that the reader is familiar with the operation of the 6942A. Principles of operation for the 6942A are provided in Section III of the 6942A Service Manual, HP Part No. 06942-90006. It is also assumed in the following discussions that the reader is familiar with the 6942A instruction set and the programming concepts presented in the 6942A Multiprogrammer User's Guide, HP Part No. 06942-90003.

3-3 6942A/6943A SYSTEM BLOCK DIAGRAM DESCRIPTION

3-4 6943A Multiprogrammer Extender units expand the number of I/O cards that can be used in a Multiprogrammer System. The 6942A is the master unit in a system that can contain up to eight units (one 6942A and up to seven 6943A units). Since each unit can accommodate up to 16 I/O cards, the maximum number of I/O cards in a system is 128 (8 units x 16 I/O cards). In order to connect 6943A units, the appropriate transmission system boards must be installed in slot A6 of each 6942A and 6943A unit.

3-5 Figure 3-1 is a simplified block diagram of a multiple unit system comprised of one 6942A and two 6943A units. The diagram illustrates the major assemblies in each unit as well as the signal flow (data, address, and control signal buses) between assemblies. Model 14702A chaining cables are used to interconnect the data, address, and control signal buses from unit to unit. Each 6942A and 6943A unit contains backplane control circuits on mainframe board A2, a plug-in transmission system board A6, power supplies, and I/O card slots. The 6942A master unit contains additional circuit boards: HP-IB interface board A5 and CPU/ROM board A1. Note also that the 6942A units' A2 board is more complex than the 6943A's A2 board. The 6942A's A2 board contains a 2Kx16 RAM as well as additional control circuitry.

3-6 The A5 board provides the bidirectional communications interface between the 6942A and an HP-IB controller. The CPU (Central Processing Unit) on the A1 board decodes and executes all instructions and controls all data transfers. The programs, required to process the instructions received from the HP-IB, are stored in a 12Kx16 ROM (Read Only Memory) also located on the A1 board. Backplane control circuits on the 6942A unit's A2 board decode I/O card addresses, encode frame and I/O card interrupts, control the functions on each I/O card, and process the return clock and power fail interrupt signals received from the transmission system. The 6942A circuits are described in detail in Section III of the 6942A Service manual.

3-7 Transmission system boards in the 6942A and 6943A units interface the data, address, and control signal lines. The transmission system boards are included in extender kits. When a system consisting of a mainframe (6942A) and extender (6943A) is configured, a Model 14700A Extender Kit containing two transmission system boards is required. One of these boards, marked "XMSN HP6942" on its extractor handle, is installed in the A6 slot of the 6942A. The other board with "XMSN HP6943L" marked on its handle ("L" specifies last), is installed in the A6 slot of the 6943A. These boards, in addition to having a frame address switch and decoder, contain bus transceivers to interface the 6942A and 6943A backplanes with balanced transmission lines. The control, address, and data buses are interfaced to a transmission (chaining) cable which interconnects the 6942A and 6943A A6 boards. Figure 3-1 shows a three unit system. If only two units are used, the chaining cable would be connected between the A6 boards in the 6942A (XMSN HP6942A) and the 6943A (XMSN HP6943L).

3-8 When a system has more than one extender, the 14700A kit is used with the 6942A and the "last" 6943A in the chain. The "middle extenders", that is, all except the "last one, require a Model 14701A kit which consists of a single transmission board. The extractor on this board is marked "XMSN HP6943M" ("M" for middle). This board performs the same functions as the other transmission boards but is designated to accept two transmission cable connectors (one towards the "last" 6943A and one towards the 6942A). Figure 3-1 illustrates the chaining cable connections for a three unit system. A 14701A Extender Kit is required with each middle (up to six) extender. One 14702A chaining cable is required for each extender (up to seven).

3-9 TRANSMISSION SYSTEM SIGNAL FLOW DESCRIPTION

3-10 Figure 3-2 illustrates the signal flow through the transmission system boards in a three unit Multiprogrammer System (one 6942A and two 6943A units). The diagram illustrates the transceivers, drivers, and receivers on each board as well as the data, address, and control signal lines between each board.

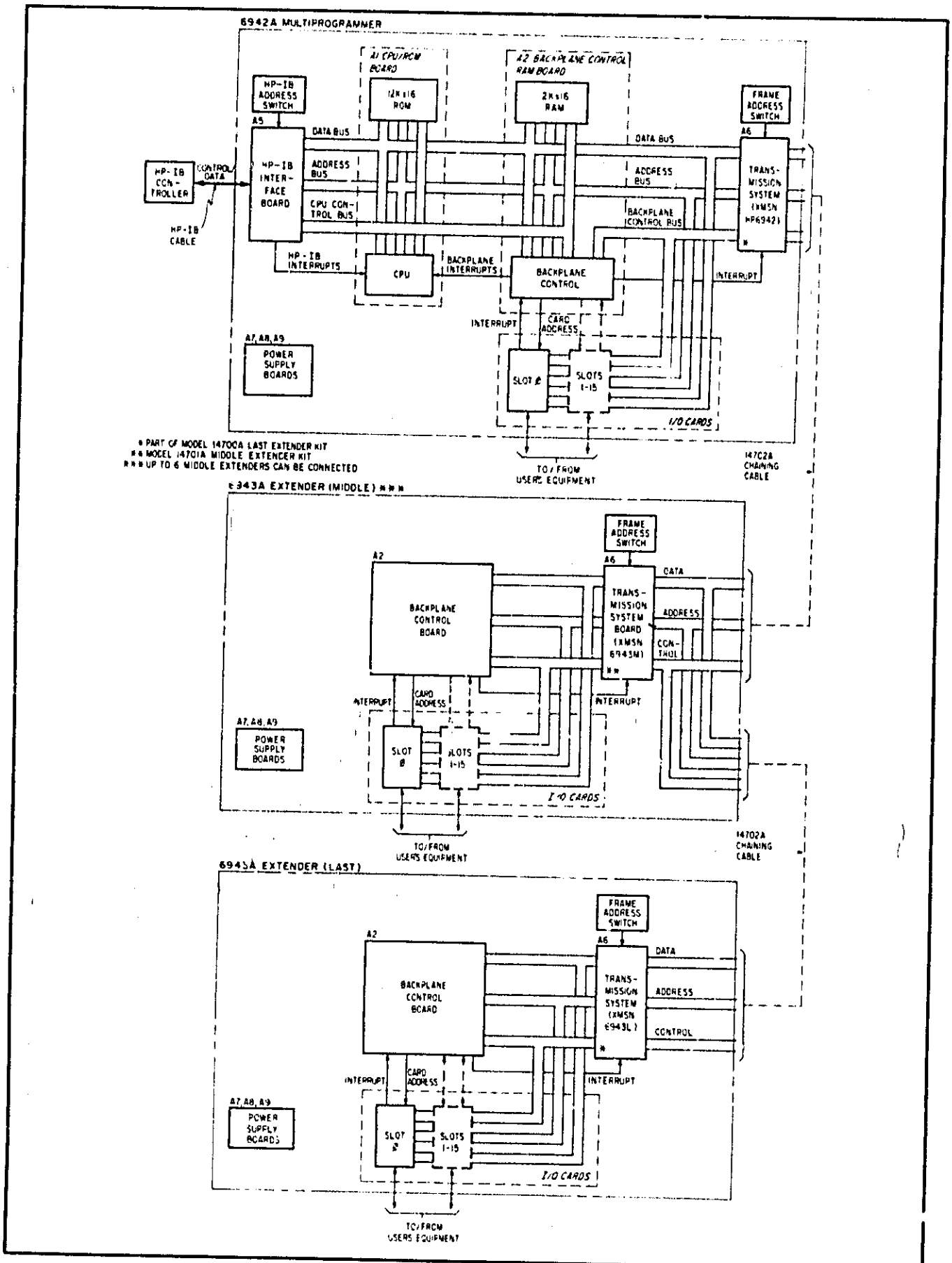


Figure 3-1. 6942A/6943A Multiprogrammer System, Block Diagram

3-11 Data Lines

3-12 Data is transferred between the 6942A and the I/O cards installed in the 6943A units via data bus transceivers on the transmission system boards. Each transceiver consists of a three-state differential (balanced) — output line driver and a differential-input line receiver. The driver inputs and receiver outputs are TTL compatible. When the CPU in the 6942A writes data to an extender unit, the 16 data bus drivers in the 6942A and the 16 data bus receivers in the addressed 6943A extender unit are enabled transferring the data on lines B15-B0 from the 6942A to the addressed 6943A. When the CPU reads data from an extender unit, the 16 data bus receivers in the 6942A and the 16 data bus drivers in the addressed 6943A are enabled transferring the data on lines B15-B0 (LSB) from the addressed 6943A to the 6942A. Note in Figure 3-2 that the "Middle" Extender's transmission system board is equipped with two edge connectors, designated J2 and P3. The 14702A cable that interfaces the 6942A is connected to J2 and the 14702A cable that interfaces the "Last" Extender is connected to P3.

3-13 Address Lines

3-14 Address lines EA8-EA0 (LSB) are connected to the 6943A extender units via nine address bus drivers in the 6942A and nine address bus receivers in each 6943A unit. Each driver has a differential output and each receiver has a differential input. The 14702A cable provides a twisted wire pair for each differential (balanced) address lines. The address line bit assignments are as follows:

EA8, EA7:	I/O card subaddress (0-3)
EA6-EA4:	Frame address (0-7)
EA3-EA0:	I/O card slot address (0-15)

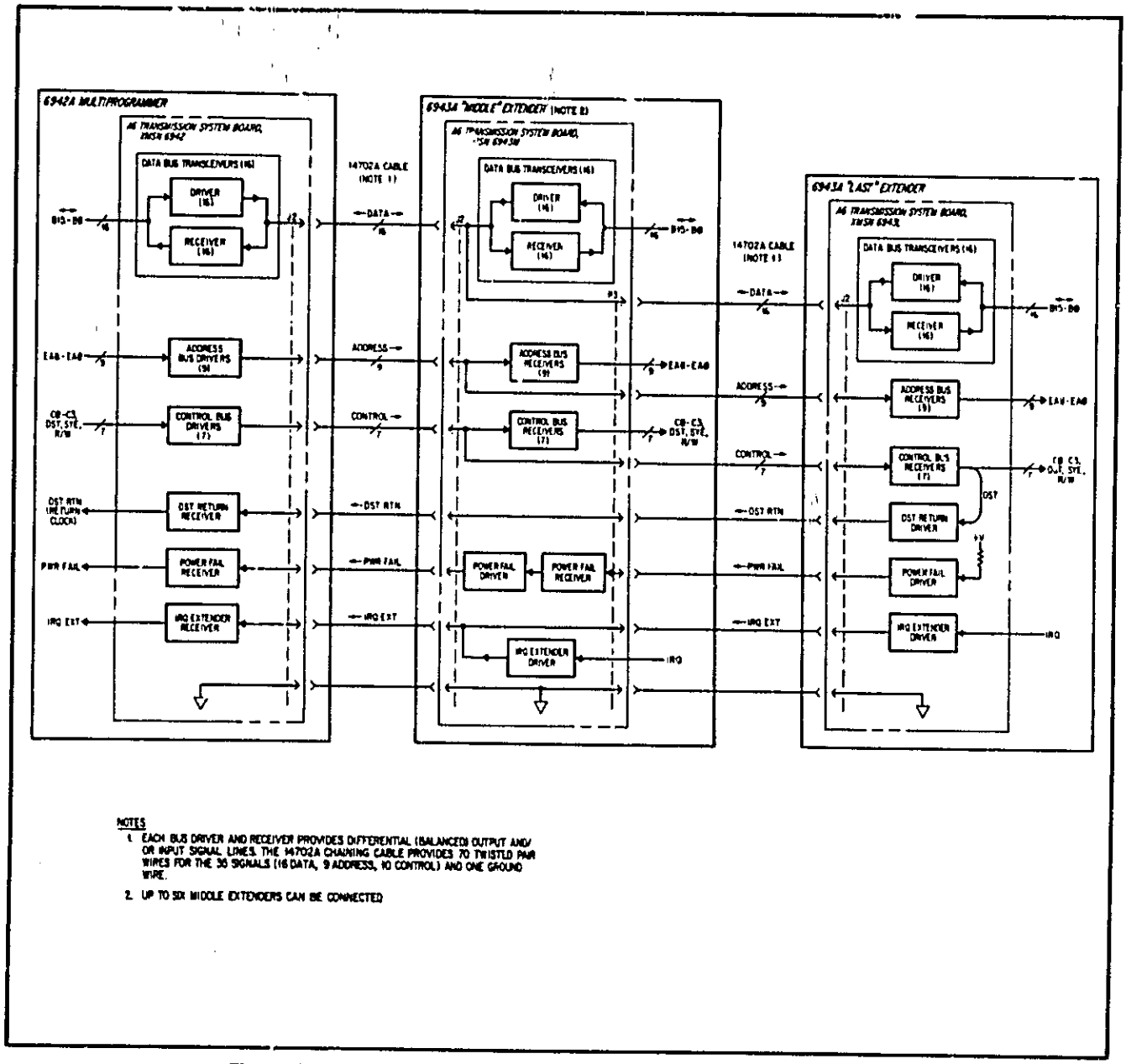


Figure 3-2. 6942A/6943A Transmission System, Signal Flow Diagram

3-15 Control Lines

3-16 The control lines are connected to the 6943A extender units via seven differential drivers in the 6942A and seven differential receivers in each 6943A unit. The seven control signals are as follows:

C0-C3 (Control Bits) - C0, C1, C2 identify one of eight write or eight read I/O card functions to be performed on the selected (addressed) I/O card. Control bit C3 is reset when I/O card operations are performed. Control bit C3 is set in order to read frame and I/O card interrupts (see paragraphs 3-33 and 3-34).

DST (Data Strobe): Initiates operations on the selected I/O card. See DST RTN (Data Strobe Return) description in paragraph 3-17.

SYE (System Enable): When reset, all output cards are placed in a "safe" state. When SYE is set, all output cards are enabled and the SYSTEM ENABLE indicator on each 6943A front panel is lighted (see paragraph 3-35).

R/W (Read/Write): Determines if the 6942A performs a read or write function to the selected I/O card.

The control signals are described in greater detail in Section III of the 6942A Service Manual.

3-17 Data Strobe Return

3-18 Each time the data strobe (DST) control signal is generated it is sent out and returned (return clock signal) via the DST Return driver circuit on the "Last" extender and direct wiring on the "Middle" extender(s) as shown in Figure 3-2. The DST RTN (or return clock signal) is received by a differential line receiver on the 6942A's transmission system board. The return signal indicates that the backplane is ready for another I/O card control sequence. DST RTN also verifies the transmission path (cable connections) from the 6942A through all 6943A extenders in the system. (See paragraph 3-60 in 6942A Service Manual).

3-19 Extender Power Fail

3-20 The EXT PWR FAIL (Extender Power Failure) signal is sent back to the "Middle" 6943A as shown in Figure 3-2. The signal is received by a differential line receiver on the 6942A. If any 6943A has its power removed after a normal system turn-on, the return signal is removed and the CPU in the 6942A detects an extender power failure (see paragraph 3-60 in 6942A Service Manual).

3-21 Extender Interrupt Request (IRQ)

3-22 The Interrupt Request (IRQ) signal from each 6943A extender is sent back to the 6942A through a driver on the corresponding 6943A transmission system board. An active IRQ line indicates that one or more I/O cards in the associated 6943A extender is requesting service.

3-23 6943A LAST EXTENDER BLOCK DIAGRAM DESCRIPTION

3-24 Figure 3-3 illustrates the major circuits in a 6943A "Last" Extender unit and shows the signal flow between the A6 Transmission System Board, the A2 Backplane Control Board, and I/O card slots 0 through 15. Complete circuit details are shown on the functional schematics of Figures 6-1 and 6-3 in the rear of the manual.

3-25 A6 Last Extender Transmission System Board

3-26 In addition to the bus transceivers, address bus receivers, and control bus receivers/drivers previously described, the A6 board contains frame address switches, frame address decoder, and a frame interrupt decoder. The Last Extender Transmission System Board HP Part No. 14700-60021 is part of Last Extender Kit HP Part No. 14700A (see Table 1-3).

3-27 The frame address switches select the frame (or unit) address number (0-7). The frame address decoder compares the switch settings with the address present on lines EA6-EA4. If this address is the same as the switch settings, the decoder generates a HI level MYADD (My Address) signal. The MYADD signal is applied to the card address decoder and to the read card interrupt circuit on the A2 board. The MYADD signal is also applied to data bus drivers (0-7) through a pair of NAND gates and to drivers (8-15) through an AND gate. When the CPU in the 6942A is reading data (R/W line is HI) from an I/O card in this extender unit (MYADD is HI), data bus drivers 0 through 15 are enabled. The receiver section of the data bus transceivers are enabled any time that the CPU is writing (R/W line is LO) to any I/O card in the system.

3-28 The frame interrupt decoder circuit consists of a 3-to-8 line decoder and data bus buffers. The decoder decodes the frame number specified by the address switches when the CPU in the 6942A checks for the highest priority frame that is requesting service (has an I/O card interrupt). The decoder outputs are applied directly to the buffers and through eight NAND gates to data bus drivers 0-7. The decoded output line (LO level) enables the corresponding data bus driver. The buffers (part of frame interrupt decoder) also receive the interrupt request (IRQ) signal from the card interrupt priority encoder on the A2 board. If any of this extender unit's I/O cards have activated the IRQ line, the buffer transfers the frame number (0-7), specified by the 3-to-8 line decoder, onto bus lines 0-7. The outputs of the frame interrupt decoders in all units (6942A and 6943A(s)) in the system are transferred via bus lines B0-B7 to the frame interrupt priority encoder in the 6942A master unit. The encoder in the 6942A encodes the highest priority frame (0-7) in the system that has interrupted. A complete description of the 6942A/6943A interrupt system is provided in paragraphs 3-60 through 3-70 of the 6942A Service Manual (HP Part No. 06942-90006).

3-29 A2 Backplane Control Board

3-30 The A2 board contains the card address decoder, card interrupt priority encoder, and the frame/card interrupt readback control circuit. Each circuit is described in the following paragraphs.

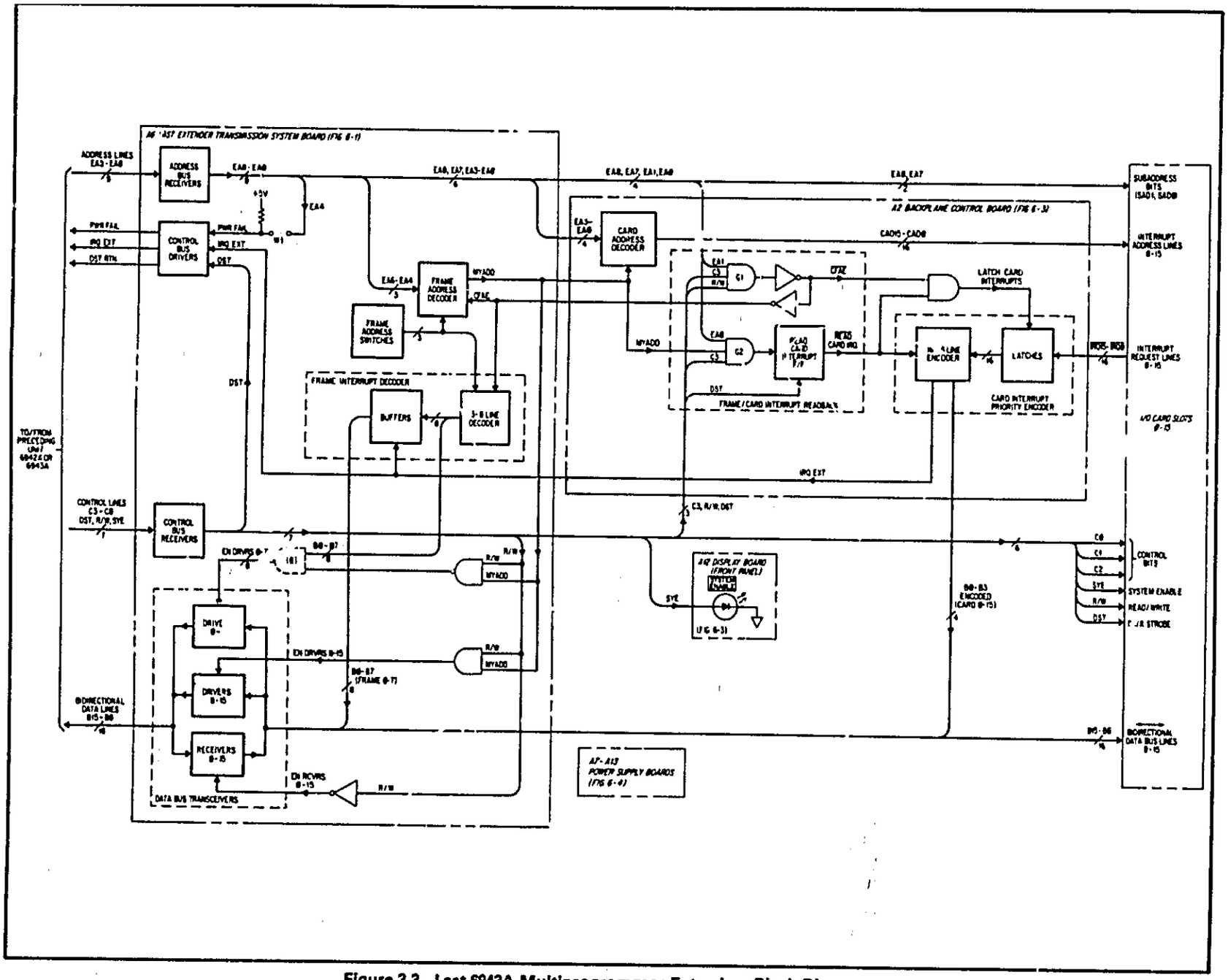


Figure 3-3. Last 6943A Multiprogrammer Extender, Block Diagram

3-31 The card address decoder provides 16 I/O card address lines (CAD0-CAD15) which are connected to the corresponding I/O card slot. One of these address lines is decoded from address bits EA3-EA0 when this extender's address is also decoded (MYADD signal is HI). The CAD select line, the data strobe (DST) signal, read/write (R/W) control line, card control bits (C0-C2), and subaddress lines, EA8 (SAD1) and EA7 (SAD0), can instruct the I/O card to load data from the data bus into an internal latch on the card and cycle the card, or transfer data from an I/O card latch onto the data bus. I/O card circuit details are provided in paragraph 3-50 of the 6942A Service Manual and also in the applicable I/O card manual.

3-32 The 16 I/O card interrupt request lines (IRQ0-IRQ15) are connected to the card interrupt priority encoder. The I/O cards are prioritized first by frame (unit) number and next by their slot position in the frame. The frame address switch establishes the frame priority (0-7), 0 is highest, 7 is lowest. Within a frame, I/O card slot priority is from left to right (from rear of unit) with slot 0 (IRQ0) having the highest and slot 15 (IRQ15) having the lowest interrupt priority. When any I/O card requests service, it sets its IRQX line LO causing the card interrupt priority encoder to activate (set HI) its IRQ line. The IRQ line is connected to the frame interrupt decoder and to a control bus driver on the A6 board. The card interrupt priority encoder also encodes the highest priority card (0-15) that is requesting service. The card number will be read back by the CPU on bus lines B3-B0.

3-33 The I/O card readback consists of two CPU operations. The first operation consists of reading back the highest priority frame number that has an active IRQ line. This is accomplished by setting the address bus to $E004_{16}$ (address bit EA1 on) with control bit C3 active (HI level) and the R/W line HI (see gate G1 in the frame/card interrupt readback control circuit). For these conditions, the frame interrupt decoder on the A6 board is enabled and the decoded frame number is placed on data bus lines 0-7. A frame interrupt priority encoder in the 6942A receives the frame numbers on lines B7-B0 and encodes the highest priority frame on lines B10-B8.

3-34 Once the highest priority frame is known, the CPU performs the second read operation to determine the highest priority card requesting service. This is accomplished by reading the applicable frame's card priority interrupt encoder. The highest priority interrupting card number (0-15) is encoded on bus lines B3-B0. The card interrupt priority encoder is read using the applicable address (MYADD and EA on) and with backplane control bit C3 activated (see gate G2). The encoder addresses are as follows:

Frame	Card Interrupt Encoder Address (Hex)
0	$E002_{16}$
1	$E022_{16}$
2	$E042_{16}$
3	$E062_{16}$
4	$E082_{16}$
5	$E0A2_{16}$
6	$E0C2_{16}$
7	$E0E2_{16}$

3-35 System Enable Indicator

3-36 The SYSTEM ENABLE indicator on the 6943A front panel indicates the status of the system enable (SYE) line that is controlled by the CPU in the 6942A and is sent to each 6943A unit in the system. When the SYE line is reset (LO level), the SYSTEM ENABLE indicator is turned-off and all output cards are disabled (e.g. resistance outputs are shorted, voltage outputs are held at 0 volts). This feature protects the external system from potentially damaging outputs resulting from the storage registers on the output cards assuming random states at power turn-on. Thus, SYE line is reset (indicator on front panel is off) at initial power turn-on and will remain reset until an instruction is executed. As soon as an instruction is sent to any card in the system, the SYE is set and the SYSTEM ENABLE indicator(s) on all 6943A's will light. With SYE set, output cards are enabled but will remain in a "safe" state until the CPU sends instructions to them.

3-37 Power Supplies

3-38 The dc power supply circuits are contained on boards designated: A7 top board, A8 middle board, and A9 bottom board. The A7 board contains the main +5 V supply and the power turn-on clear circuit for some of the logic circuits. The crowbar circuitry for all supplies, the current limit circuit for the +5 V supply, and one ± 18 V isolated supply are on the A8 board. The A9 board contains the ± 12 V, −5 V, +12 V bias, and two ± 18 V isolated supplies. The three boards plug into power supply mother board A10. The mother board interconnections as well as complete circuit details of all power supply circuits are shown on the functional schematics provided in Figure 6-4, sheets 1 through 5. The 6943A's power supply circuits are identical to those used in the 6942A Master unit (see paragraphs 3-81 through 3-114 in the 6942A Service Manual). Note that since the 6943A does not have an A1 or an A5 board, the power distribution shown in Figure 6-3 in this manual differs from that shown in the 6942A Service Manual. Also, the real time clock on the A8 middle board is not used in the 6943A unit.

3-39 MIDDLE EXTENDER TRANSMISSION SYSTEM BOARD BLOCK DIAGRAM DESCRIPTION

3-40 Figure 3-4 illustrates the major circuits on a Intermediate (or Middle) Extender Transmission System Board, HP Part No. 14701-60020. This board is obtained by ordering the Intermediate Extender Kit HP Part No. 14701A (see Table 1-3). Complete circuit details are shown on the functional schematics of Figures 6-2 and 6-3 in the rear of the manual. The "Middle" extender board performs the same functions as the "Last" extender board with the following exceptions:

1. The "Middle" board has two edge connectors to accommodate two chaining cables: one towards the preceding unit (the 6942A or another "Middle" 6943A) and one towards the next unit (the "Last" 6943A or another "Middle" 6943A).
2. The power fail signal is returned to the 6942A or to a preceding 6943A "Middle" unit via a receiver/driver combination as shown in Figure 3-4. Refer also to the signal flow diagram of Figure 3-2.
3. The data strobe return (DST RTN) signal is returned to the 6942A or to a preceding 6943A "Middle" unit via direct wiring as shown in Figures 3-4 and 3-2.

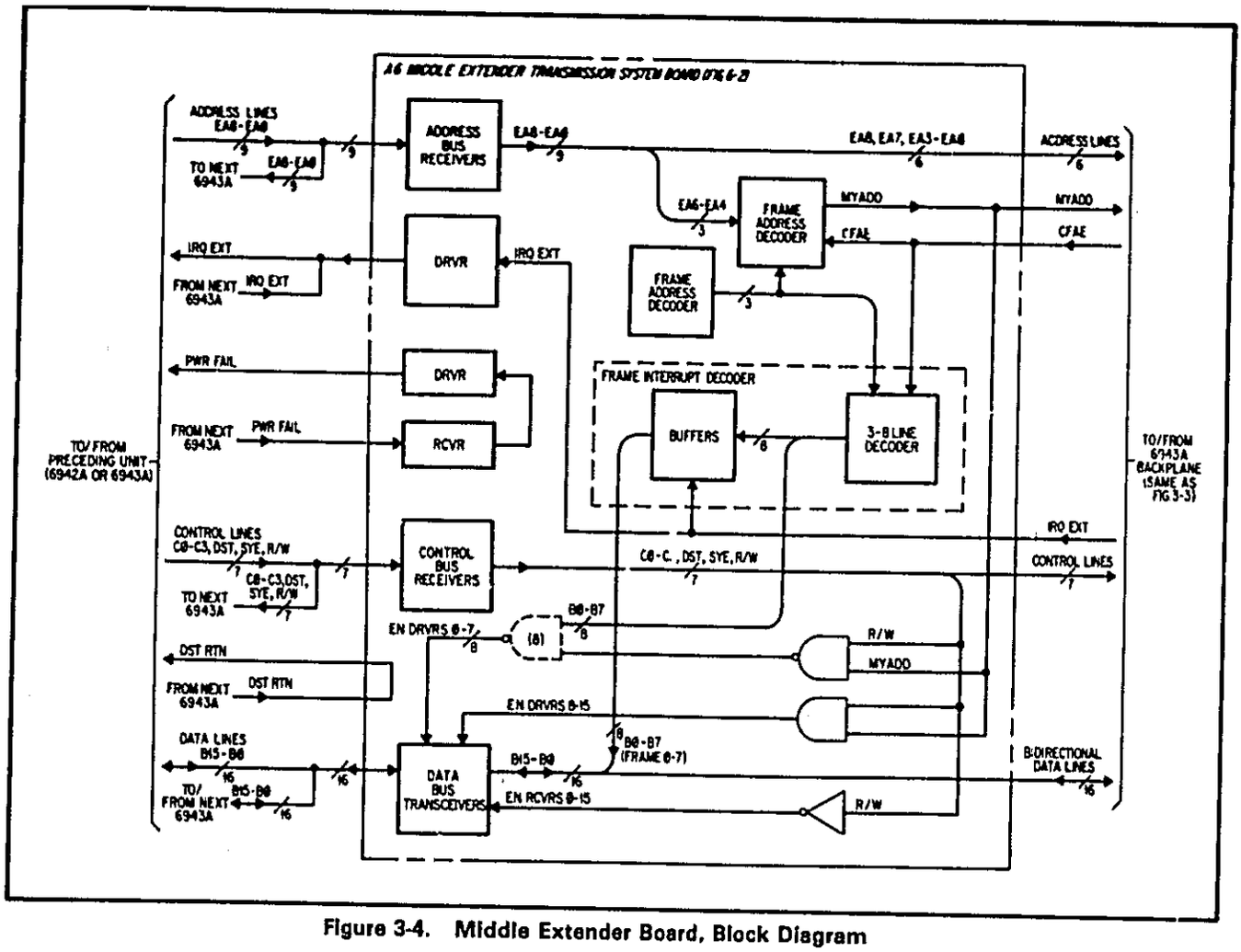


Figure 3-4. Middle Extender Board, Block Diagram

MAINTENANCE

SECTION IV
MAINTENANCE

WARNING

These servicing instructions are for use by trained service personnel only. To avoid electrical shock, do not perform any servicing unless you are trained to do so.

4-1 INTRODUCTION

4-2 This section contains system checkout procedures and troubleshooting procedures that isolate a malfunction to a defective 6942A or 6943A unit. Assembly level isolation (board substitution) procedures are included for the 6943A's Backplane Control (A2) and Transmission System (A6) boards as well as the 6942A's Transmission System board (A6). Component level troubleshooting procedures for the 6943A's power supplies are provided in the 6942A Service Manual (HP Part No. 06942-90006) and are not repeated in this manual. The power supplies in the 6943A are identical to those in the 6942A. The 6942A Service Manual provides complete service instructions for power supply boards (A7-A13) including calibration, troubleshooting, and repair.

4-3 Component level troubleshooting procedures for the logic circuits are beyond the scope of this manual but are included with the 6942A Multiprogrammer Service Kit, HP Part No. 14710A. This service kit includes the service aids (hardware and software) required for component level troubleshooting and repair of the entire Multiprogrammer System (6942A, 6943A, and all I/O card models). In addition, to the 14710A service kit, an HP5004A Signature Analyzer and an HP9825A desktop computer are required for component level troubleshooting of the logic circuitry in the 6942A/6943A units and each type of I/O card.

4-4 SERVICE FEATURES

4-5 6942A Master Unit

4-6 Service features that include both firmware (diagnostic programs) and hardware (switches, indicators, test points, etc.) have been incorporated into the 6942A for the purpose of minimizing down time and for convenience in troubleshooting and isolating malfunctions in a defective 6942A Master of 6943A Extender unit. All of the 6942A's service features (firmware, self test, signature analysis testing, etc.) are described in Section IV of the 6942A Service Manual.

4-7 6943A Extender Unit

4-8 As described above, the self test and signature analysis testing features incorporated in the 6942A Master unit are utilized in testing any 6943A units in the system. The self test diagnostic programs residing in the 6942A's ROM check most of the 6943A's mainframe circuitry as well as the read/write and control portions of any I/O cards plugged in to the 6943A.

4-9 The LINE switch and power supply indicators on the 6943A's front panel (see Figure 4-1) are identical to those on the 6942A front panel. The 6943A, however, has a SYSTEM ENABLE indicator (LED) on its front panel instead of the SELF TEST indicator that is on the 6942A's front panel. The SYSTEM ENABLE LED indicates the status of the system enable (SYE) line that runs throughout the system. When the SYE line is reset (SYSTEM ENABLE indicator off), all output cards in the system are disabled (e.g. resistance outputs are shorted, voltage outputs are held at 0 volts, digital outputs are held in the open or zero state). This feature protects the external system (user's process) from potentially damaging outputs resulting from the storage registers on the output cards assuming random states at power turn-on. Thus, the SYE line is reset at initial power turn-on and will remain reset until an instruction is executed. As soon as the appropriate instruction is executed, the SYE line is set and the SYSTEM ENABLE indicator(s) on all 6943A's will light green. With SYE set, an output card is enabled but will remain in the "safe" state until it is addressed in an instruction.

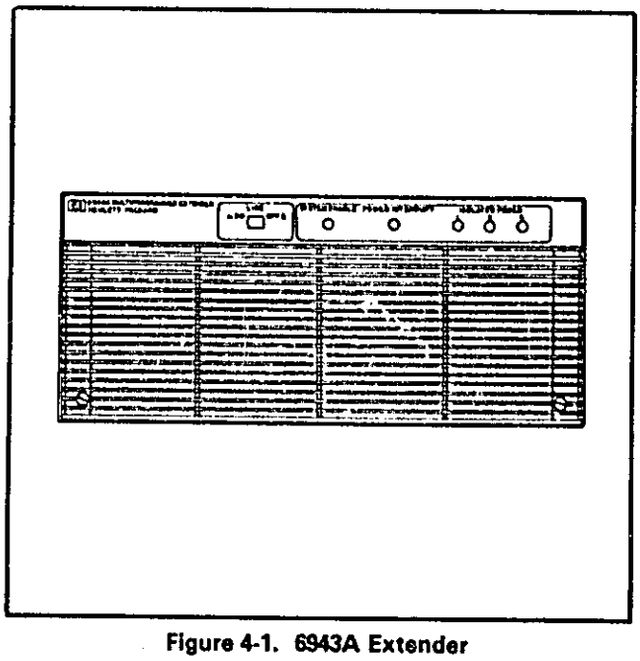


Figure 4-1. 6943A Extender

4-10 SYSTEM POWER ON/SELF TEST

NOTE

Power must be applied to all 6943A Extenders first and then to the 6942A. If this sequence is not followed, the system will fail "Self Test".

4-11 The Multiprogrammer System has a self test feature that is initiated whenever power is turned-on at the 6942A front panel or when power is already turned-on and the HP-IB "Device Clear" command is executed by the controller (see paragraph 4-13). When the self test runs to completion in approximately four seconds, the SELF TEST indicator on the 6942A front panel should light (green) indicating that the main components of the system are operating properly. The lighted SELF TEST indicates that there are no "major" mainframe errors but does not rule out the possibility of "minor" mainframe errors or I/O card errors.

4-12 Procedures for performing the system power on/self test are provided in Figure 4-2. The procedures first ensure that the power supplies in each unit (one 6942A and up to seven 6943A's) are operating properly. After these checks are made, the SELF TEST indication on the 6942A is checked. If the system passes "self test", additional verification procedures are performed (paragraph 4-13). If the system fails "self test" troubleshooting procedures are performed (paragraph 4-16).

4-13 CONTROLLER VERIFICATION

4-14 The procedures provided in Figure 4-3 check that the Multiprogrammer responds correctly to controller commands. With the controller connected to the 6942A, the system is reset using the controller's "Device Clear" command. The clear command should initiate the self test causing the 6942A's front panel indicator to go out and then come on again in about four seconds. This verifies the ability of the Multiprogrammer System to respond to a bus command in addition to passing the power on/self test described above. Upon the successful completion of self test (SELF TEST lights after four seconds), the operator can check if any errors were detected by reading the Multiprogrammer's SRQ status (see paragraph 5-172 in User's Guide). If error(s) are detected, the Self Test Error Detection and Card Identifier Utility program should be run. This program is recorded on a data cartridge (HP 9825/35/45 Controllers only) supplied with the User's Guide. If errors were detected, during self test, this program provides a printout of the error codes.

4-15 After checking for errors, the procedures in Figure 4-3 verify operation of the SYSTEM ENABLE (SYE) line. Finally, power is removed from each unit in the system. The POWER INTERRUPT indicator on each unit should flash on briefly when power is switched off to indicate that the power supply's crowbar circuits are operating properly.

4-16 TROUBLESHOOTING

4-17 Logic Circuits

4-18 The board level troubleshooting procedures provided in Figure 4-4 are performed if the system fails "self test". The procedures first isolate a malfunction to a defective unit (the 6942A Master unit, 6943A "Last" Extender unit, or one of the 6943A "Middle" Extender units). Once the defective unit is detected, board substitution is used to isolate to the defective board assembly. The spare boards required to perform these procedures are as follows:

Board	Ref. Desig.	HP Part No.
6942A DST Jumper Board	A6	06942-60020
6942A Transmission System Board (XMSN HP6942)	A6	14700-60020
6942A Control/RAM Board	A2	06942-60023
6943A Last Extender Transmission System Board (XMSN HP6943L)	A6	14700-60021
6943A Middle Extender Transmission System Board (XMSN HP6943M)	A6	14701-60020
6943A Backplane Control Board	A2	06943-60020

4-19 Power Supplies

4-20 The 6943A's power supplies are identical to the power supplies in the 6942A. Complete service instructions including troubleshooting procedures are provided in paragraphs 4-52 through 4-69 in the 6942A Service Manual. If a 6943A power supply problem is encountered while performing the checkout procedures in Figures 4-2 and 4-3, the power supply troubleshooting procedures in the 6942A manual must be performed.

4-21 SIGNATURE ANALYSIS VERIFICATION

4-22 Signature Analysis (SA) is a method developed by Hewlett-Packard for verifying and troubleshooting microprocessor-based logic circuits. In order to perform SA, the HP5004A Signature Analyzer and a modified Model 69731A Digital Output Card (See Figure 4-3 in the 6942A Service Manual) are required. The SA procedures can be performed at any time but are intended primarily for post repair verification. SA verification can also be used when the controller based software (Self Test Error Detection and Card Identifier Utility Program Cartridge) is not available or cannot be run. SA verification tests the 6942A/6943A and all I/O card slots, indicating any errors the utility program would report. Figure 4-5 illustrates the transmission board configurations and cabling requirements for a one extender system and for a multiple extender (up to 7 6943A's) system.

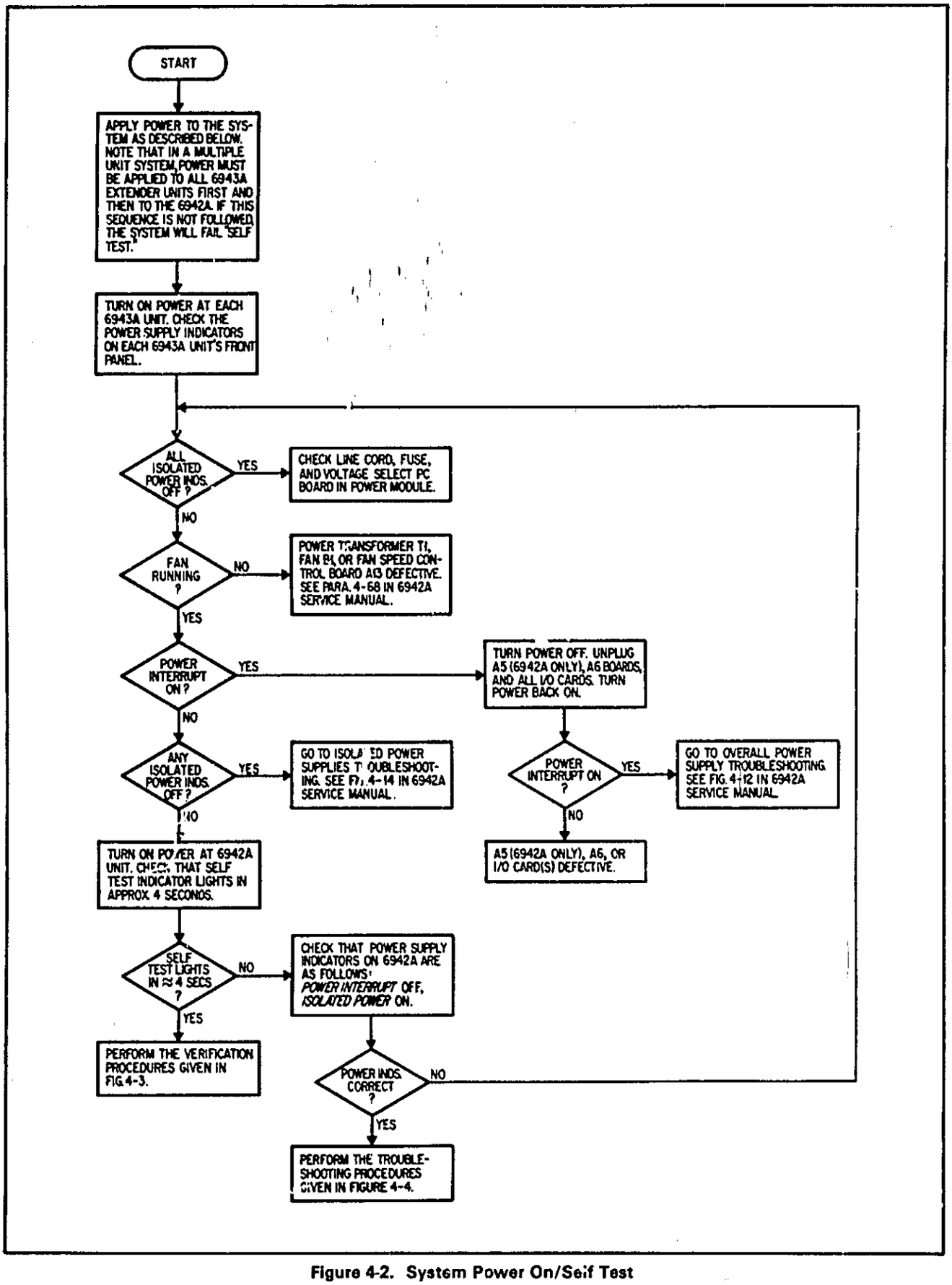


Figure 4-2. System Power On/Self Test

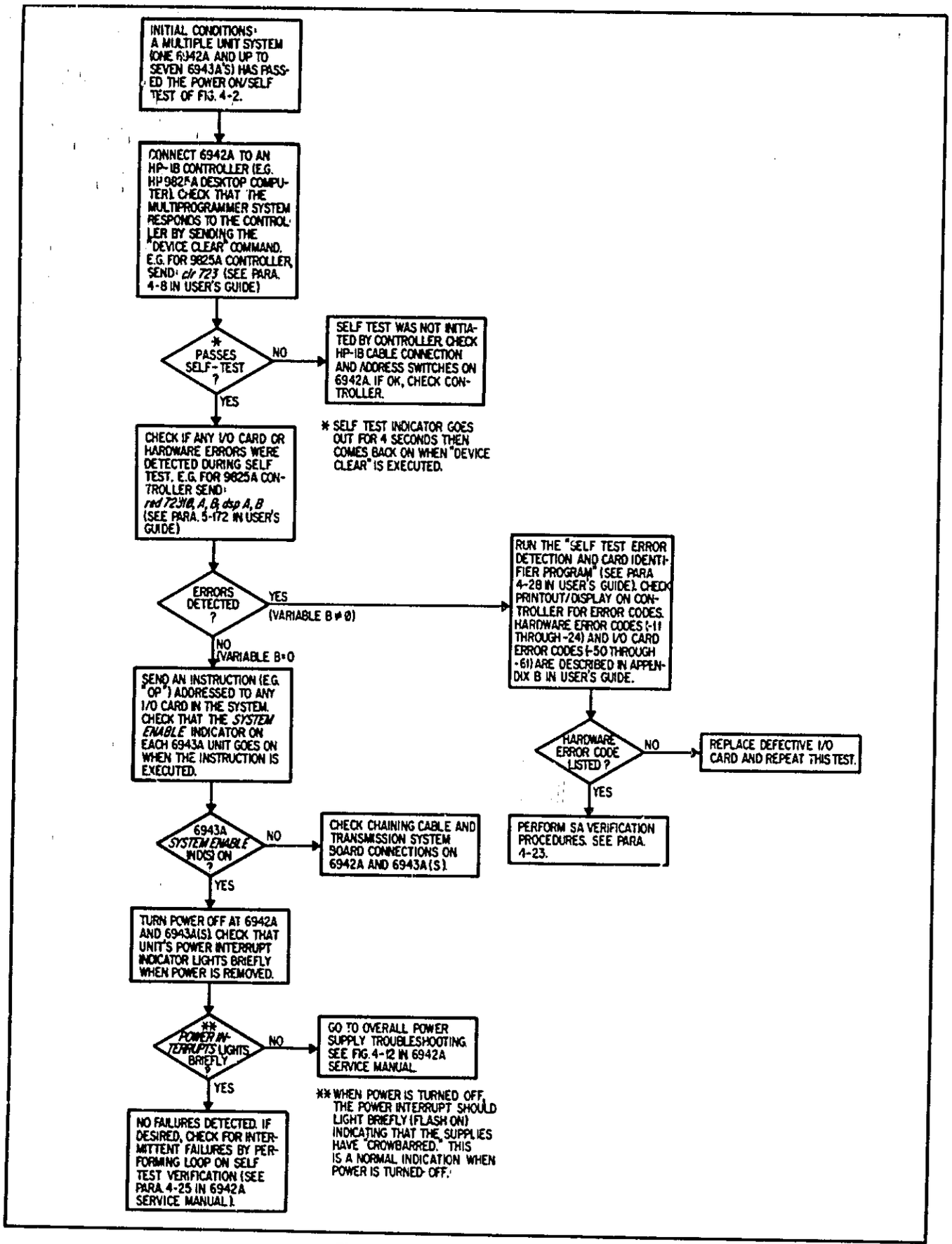


Figure 4-3. Controller Verfication

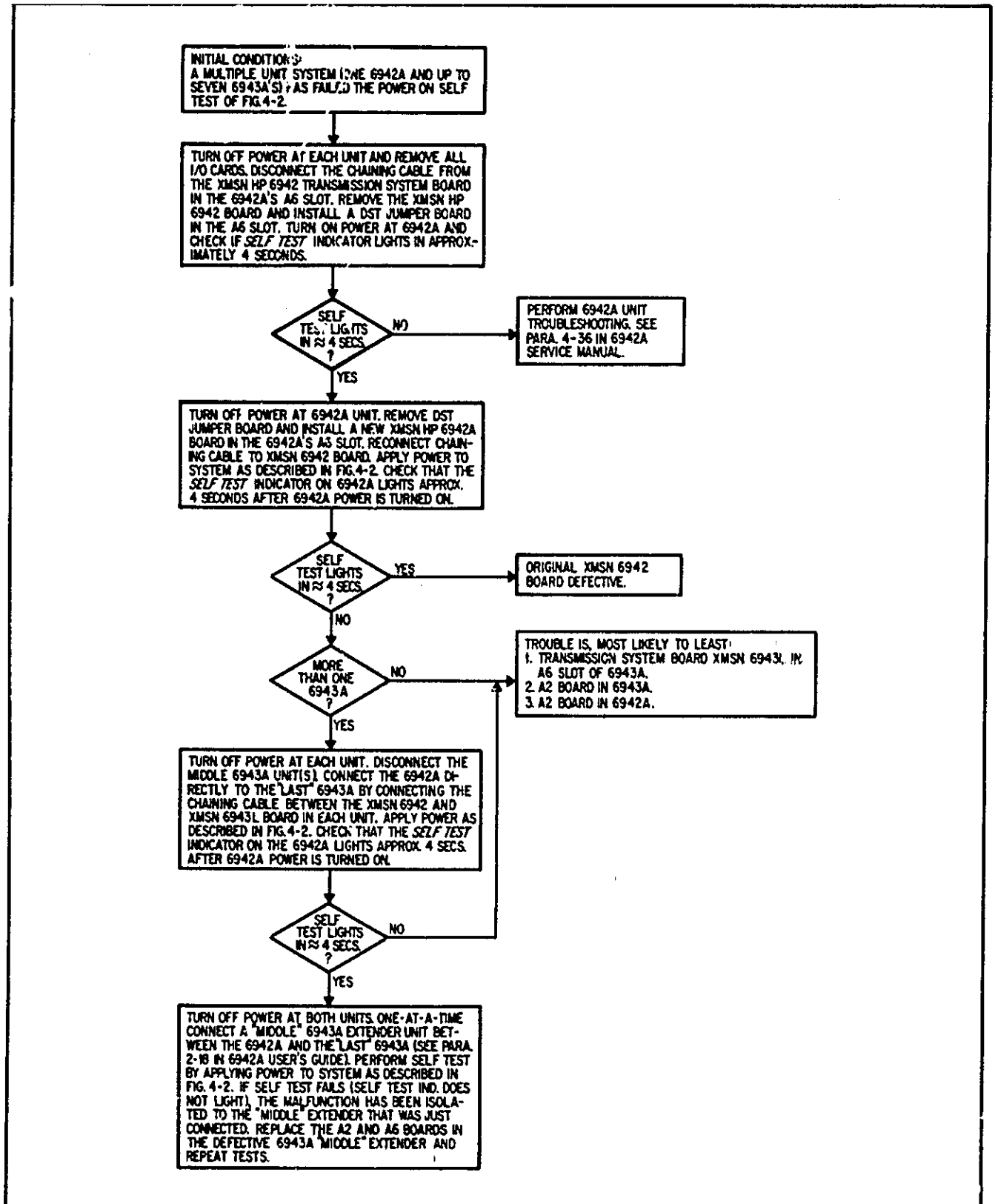


Figure 4-4. Board Isolation Procedures.

4-23 To perform SA verification, the 6942A's top cover is removed to gain access to test points on the A4 board (see Figure 4-2 in the 6942A Service Manual). Also, the rear covers are removed from the 6942A and all 6943A units. The modified 69731A card is inserted in the specified 6942A or 6943A I/O card slot. The HP5004A is connected to the specified test points on the 6942A's A4 top interconnect board. Different test points are used depending upon the circuits being tested. There are three different test setups used to verify the 6942A/6943A system. The setups, designated A, B, and C are described in Table 4-1. These test setups will be used in subsequent SA verification procedures. In all three test setups, the START and STOP inputs to the HP5004A are connected to the same test point, A4TP1 (SAGO). The SAGO (Signature Analysis Gate) signal is firmware derived and begins (STARTS) with a positive-going transition. The period of SAGO is determined by the particular test routine being exercised. Positive or negative transitions are used for the CLOCK input as specified by the procedure. The START and STOP inputs define the gating period during which the signature is developed. The CLOCK input clocks the logic level existing at the HP5004A probe input during the gating period. The HP5004A takes the signature by counting the logic HI levels at the data probe at each clock pulse. For operating information on the HP5004A, refer to its Operating and Service Manual, HP Part No. 05004-90001.

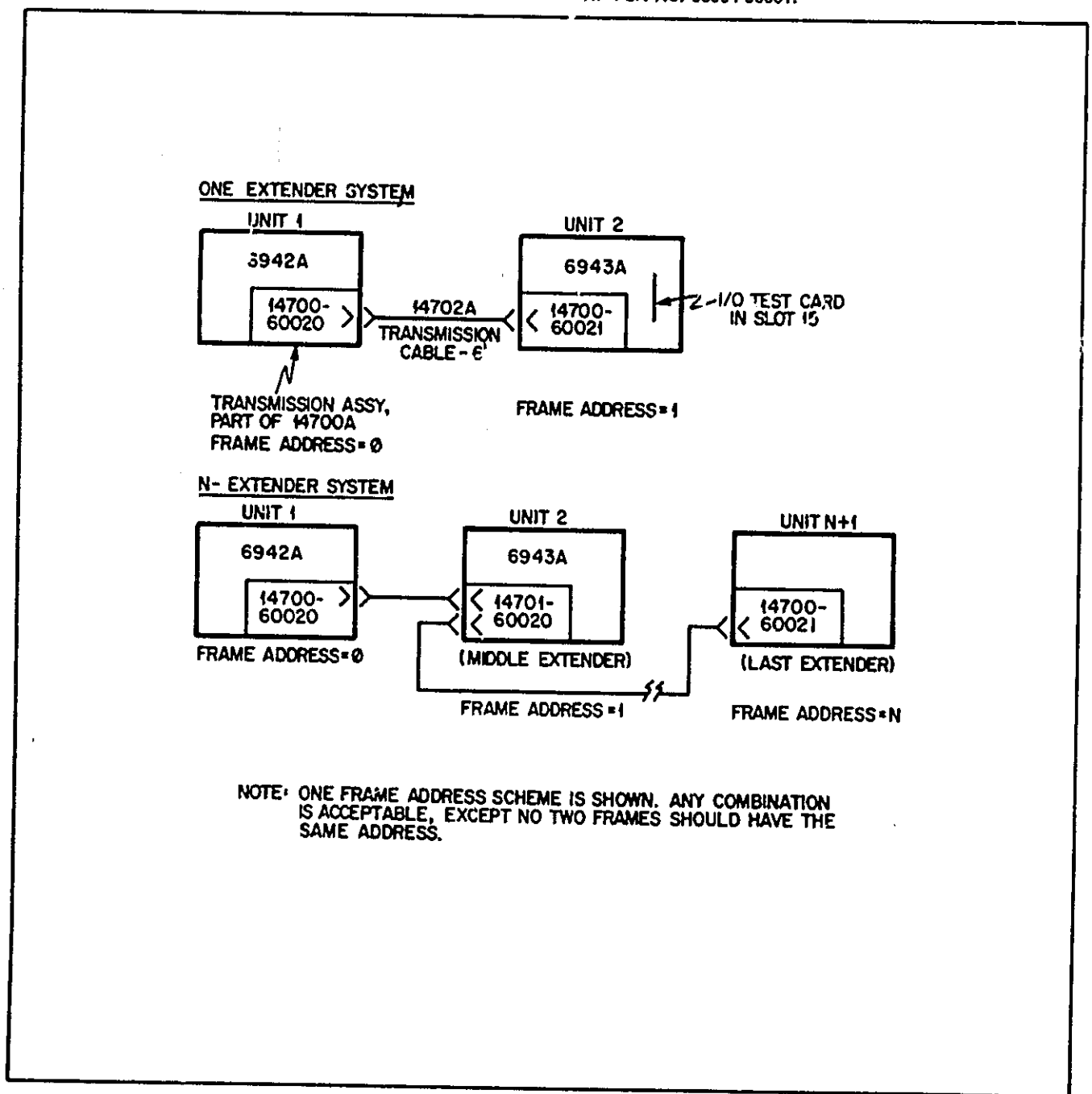


Figure 4-5. 6942A/6943A Transmission System Configurations

4-24 The SA verification procedures for the 6942A/6943A are provided in the flow chart of Figure 4-6. The test setups (Table 4-1) required are given in the chart. Maintain the same test setup (gating, clocking input, etc.) until you are instructed to change it. If a fault is detected, the flow chart specifies a troubleshooting procedure to follow. After verification is completed, make sure to open all test switches on the A4 board (6942A unit) and set the address switches on the A5 board (6942A unit) to "23". The flow chart performs the following verification steps (see [A], [B], [C], etc. on Figure 4-6).

[A] The four signatures verify that SA test programs are running correctly, indicating that the hardware used for SA troubleshooting is operating correctly.

[B] This test verifies that the HP-IB address switch and the address encoder are operating correctly.

[C] The "auto-search" jumper allows the test program to identify the slot the test card is in. Many tests are made on the backplane control circuits that cannot be made during power-on self test. The "not found" signature indicates the test program does not read data back via the auto-search jumper. The "found" signature indicates the card is found and that all tests are passed. Any other signature implies a failure of the backplane control circuits (or possibly frame address circuits on A6).

[D] This is a partial check on the frame addressing circuits. A further check is made when software generates on I/O card inventory which is compared to cards installed.

[E] This CRUIN signature, while clocking on MEM (processor signal) will show up errors that may otherwise be reported by power-on- self-test. Any testing sequence that would cause any branching from the "OK" path will generate extra MEMEN cycles that would affect this signature.

[F] Removing A6 generates an error condition. This checks the ability to identify an "extender power fail".

[G] Three HP-IB addresses are given here for convenience. If the mainframe had previously been verified, the address 23 (10111) can be used to check extenders.

[H] This check is similar to [E] above, but for an extender system.

[I] Similar to [F] above.

Table 4-1. Test Setups for SA Verification and Troubleshooting Procedures

5004A CONNECTION OR FRONT PANEL CONTROL	TEST SETUP		
	A	B	C
Start and Stop inputs (both); connect to test point on	A4TP1 (SAGO)	A4TP1 (SAGO)	A4TP1 (SAGO)
Clock input; connect to test point on A4 board	A4TP2 (SACLK)	A4TP4 ($\overline{\text{ECRUCLK}}$)	A4TP6 ($\overline{\text{EMEMEN}}$)
GND lead; connect to test point on A4 board	COM	COM	COM
START switch; set to	positive-going (UP)	positive-going (UP)	positive-going (UP)
STOP switch set to	negative-going (DOWN)	negative-going (DOWN)	negative-going (DOWN)
CLOCK switch	(UP)	(DOWN)	(UP)
HOLD, SELF-TEST switches; set to	OFF (out)	OFF (out)	OFF (out)

4-25 REMOVAL AND REPLACEMENT

4-26 The 6943A is physically identical to the 6942A except that it does not contain an A1 CPU Board or an A5 HP-IB Interface Board. Refer to the procedures provided in paragrapns 4-70 through 4-81 in the 6942A Manual when it is necessary to remove or replace any assembly in the 6943A unit.

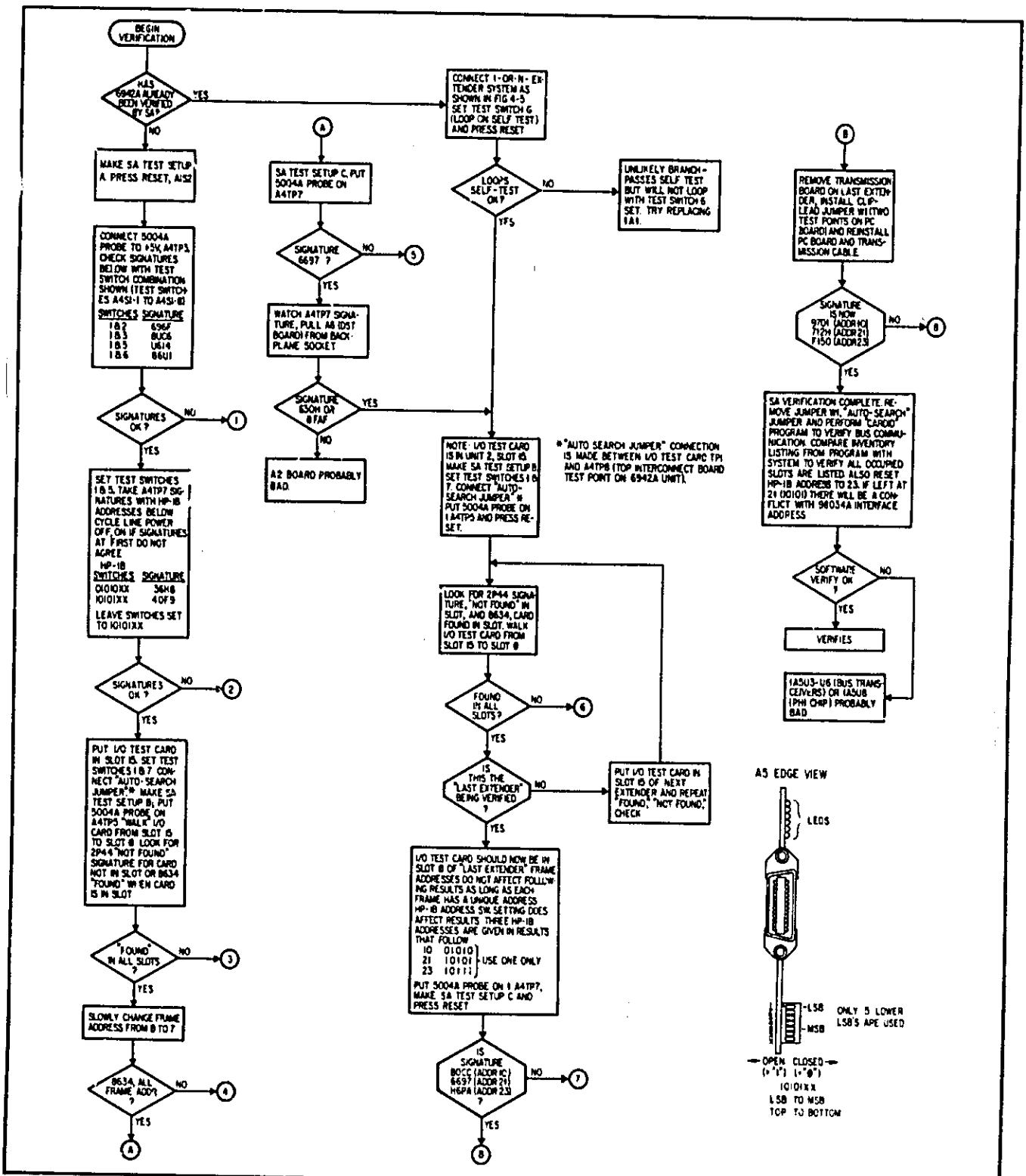


Figure 4-6 (Sheet 1). 6942A/6943A Signature Analysis Verification Procedures

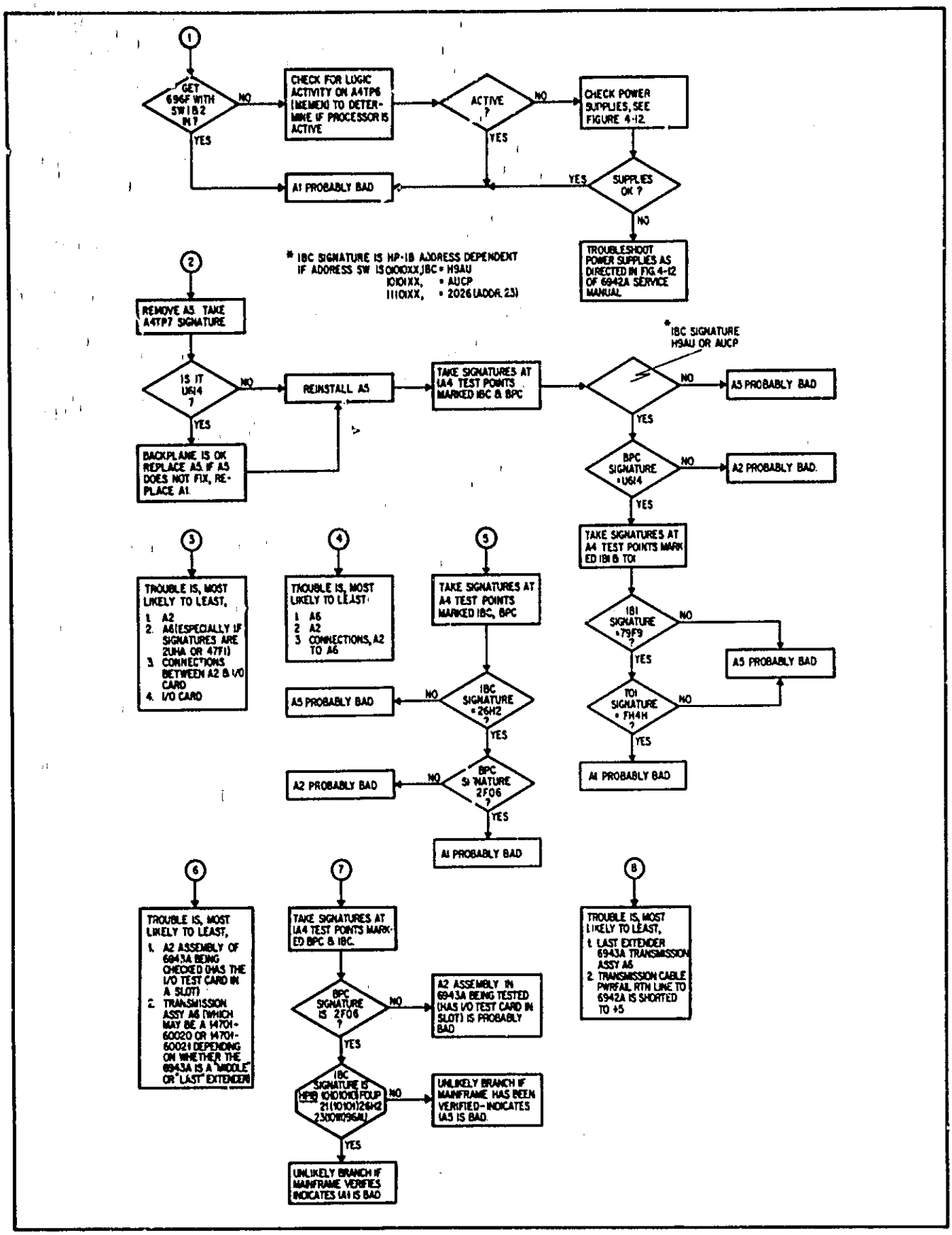


Figure 4-6 (Sheet 2). 6942A/6943A Signature Analysis Verification Procedure

PARTS LIST

SECTION V
REPLACEABLE PARTS

5-1 INTRODUCTION

5-2 This section contains replacement part ordering information. Table 5-4 lists parts in alphanumeric order by reference designator and provides the following information:

a. Reference Designator. Refer to Table 5-1.

b. Hewlett-Packard Part Number.

c. Total Quantity (Qty). Given only the first time the part number is listed (except in instruments containing sub-modular assemblies, in which case the total for the assembly appears the first time the part number is listed in each assembly).

d. Description. Refer to Table 5-2 for abbreviations.

e. Federal Supply Code Number for a typical manufacturer. Refer to Table 5-3 for manufacturer's name and address.

f. That manufacturer's part number or type.

Parts not identified by a reference designator are listed at the end of Table 5-4 under Mechanical or Miscellaneous. The former consists of parts belonging to and grouped by individual assemblies; the latter consists of all parts not immediately associated with an assembly.

5-3 ORDERING INFORMATION

5-4 To order a replacement part, address order or inquiry to your local Hewlett-Packard sales office (see lists at rear of this manual for addresses). Specify the following information for each part: Model, complete serial number, and any Option or special modification (J) numbers of the instrument; Hewlett-Packard part number; circuit reference designator; and description. To order a part not listed in Table 5-4, give a complete description of the part, its function, and its location.

Table 5-1 Reference Designators

A	= assembly	E	= miscellaneous electronic part
B	= blower (fan)	F	= fuse
C	= capacitor	J	= jack, jumper
CB	= circuit breaker	K	= relay
CR	= diode	L	= inductor
DS	= device, signaling (lamp)	M	= meter

Table 5-1. Reference Designators (Continued)

P	= plug	V	= vacuum tube, neon bulb, photocell, etc.
Q	= transistor	VR	= zener diode
R	= resistor	X	= socket
S	= switch	U	= integrated circuit or network
T	= transformer	Z	= resistor network
TB	= terminal block		
TS	= thermal switch		

Table 5-2. Description Abbreviations

A	= ampere	mod.	= modular or modified
ac	= alternating current	mtg	= mounting
assy.	= assembly	n	= nano = 10^{-9}
bd	= board	NC	= normally closed
bkt	= bracket	NO	= normally open
°C	= degrees Celsius	NP	= nickel-plated
cd	= card	Ω	= ohm
coef	= coefficient	obd	= order by description
comp	= composition	OD	= outside diameter
CRT	= cathode-ray tube	p	= pico = 10^{-12}
CT	= center-tapped	pc	= printed circuit
dc	= direct current	pot.	= potentiometer
DPDT	= double-pole double-throw	p-p	= peak-to-peak
DPST	= double-pole single-throw	ppm	= parts per million
elect	= electrolytic	piv	= peak inverse voltage
encap	= encapsulated	rect	= rectifier
F	= farad	rms	= root mean square
°F	= degrees Farenheit	Si	= silicon
fxd	= fixed	SPDT	= single-pole double-throw
Ge	= germanium	SPST	= single-pole single-throw
H	= Henry	SS	= small signal
Hz	= Hertz	T	= slow-blow
IC	= integrated circuit	tan.	= tantalum
ID	= inside diameter	Ti	= titanium
incnd	= incandescent	V	= volt
k	= kilo = 10^{3}	var	= variable
m	= milli = 10^{-3}	ww	= wirewound
M	= mega = 10^{6}	W	= Watt
μ	= micro = 10^{-6}		
met.	= metal		
mfr	= manufacturer		

Table 5-3. Code List of Manufacturers

Code	Manufacturer	Address
00853	Sangamo Electric Company	Pickens, SC
01121	Allen Bradley Company	Milwaukee, WI
01295	Texas Instruments Inc., Semicon Comp. Division	Dallas, TX
02735	RCA, Solid State and Receiving Tube Division	Somerville, NJ
03508	G.E. Company, Semiconductor Products Department	Auburn, NY
04713	Motorla Semiconductor Products	Phoenix, AZ
07263	Fairchild Semiconductor Division	Mountainview, CA
24546	Corning Glassworks	Bradford, PA
27014	National Semiconductor Corporation	Santa Clara, CA
28480	Hewlett-Packard	Palo Alto, CA
3L585	RCA Corp. Solid State Division	Somerville, NJ
34335	Hycor Inc.	Woburn, MA
56289	Sprague Electric Company	North Adams, MA
75915	Littlefuse, Inc.	Des Plains, IL
91637	Dale Electronics, Inc.	Columbus, NE

Table 5-4. Replaceable Parts

Ref. Desig	HP Part No.	TQ.	Description	Mfr. Code	Mfr. Part No.
A2	06943-60021		Backplane Control Board Assembly	28480	
C1	0180-1835	1	fxd elect 68μF ±20% 15V	56289	150D686X0015R2
C2-8	0160-4722	7	fxd cer 0.1μF 50 V	28480	
R1	0757-0453	1	fxd film 30.1k 1% 1/8W	24546	C4-1/8-TO-3012-F
U1	1820-1199	3	IC, hex inverters	01295	SN74LS04N
U2	1820-1203	1	IC, triple 3-input positive AND GATES	01295	SN74LS11N
U3	1820-1416	3	IC, hex Schmitt triggers inverters	01295	SN74LS14N
U4	1820-1199		IC, hex inverters	01295	SN74LS04N
U5	1820-1216	2	IC, 3-line-to-8-line decoder	01295	SN74LS138N
U6	1820-1416		IC, hex Schmitt triggers inverters	01295	SN74LS14N
U7	1820-1199		IC, hex inverters	01295	SN74LS04N
U8	1820-1216		IC, 3-line-to-8-line decoder	01295	SN74LS138N
U9	1820-1416		IC, hex Schmitt triggers inverters	01295	SN74LS14N
U10	1820-1676	2	IC, octal D-type latches, 3-state outputs	01295	SN74S373N
U11	1820-1851	2	IC, 8-line-to-3-lien octal priority encoder	01295	SN74LS148
U12	1820-1492	1	IC, hex bus drivers with 3-state outputs	01295	SN74LS148N
U13	1820-1423	1	IC, dual retriggerable monostable multivibrator	01295	SN74LS368AN
U14	1820-1676		IC, octal D-type latches, 3-state outputs	01295	SN74S373N
U15	1820-1851		IC, 8-line-to-3-line octal priority encoder	01295	SN74LS148N
U16	1820-1197	1	IC, quad 2-input positive NAND gates	01295	SN74LS00N
U17	1820-1112	1	IC, dual D-type positive edge triggered F/F's	01295	SN74LS74AN
Z1-4	1810-0164	4	resistor network, SIP 4.7k x 8	91637	CSP09C07-472J
A3	06943-60020	1	Backplane Connector Board Assembly	28480	
*J1-16	1251-5895	16	Connector, PC, 72-contact (I/O slot connectors 0-15)	28480	
*J17	1251-5876	1	Connector, PC, 72-contact (A6 Board connector)	28480 28480	
R1	0757-0416	1	fxd film 511 1% 1/8W	24546	C4-1/8-TO-511R-F

* Replacement of 72-pin connectors on A3 requires care. The PCB is multi-layered, presenting difficulty in desoldering; the plastic connector body must be spread open and cut apart to expose the connector pins, which must then be removed individually. Consider the economics of board replacement rather than replacing individual connectors, especially if several connectors require replacement.

Table 5-4. Replaceable Parts (continued)

Ref. Desig.	HP Part No.	Qty	Description	Mfr. Code	Mfr. Part No.
A4	* 06943-60001	1	**Top Interconnect Board Assembly**	28480	
P19	1251-8116	4	PC connector (2x18), A3 Board (J19)	28480	
P20	1251-8115	1	PC connector (2x22), A3 Board (J20)	28480	
P21	1251-8116		PC connector (2x18), A3 Board (J21)	28480	
P22			Not assigned		
P23	1251-8116		PC connector (2x18) A2 Board (J23)	28480	
P24	1251-8117		PC connector (2x6), A2 Board (J24)	28480	
P25	1251-8116		PC connector (2x18), A2 Board (J25)	28480	
P26, P27			Not Assigned		
P28	1251-8114		PC connector (2x24), A10 Board (J28)	28480	
A6	** 14700-60021	1	**6943A Transmission System Board Assembly (Part of 14700A Last Extender Kit)**	28480	
C1	0180-1835	1	fxd elect 68μF ±20% 15 V	56289	150D686X0015R2
C2-8	0150-0093	14	fxd cer 0.01μF 100 V	28480	
C9			Not Assigned		
C10-16	0150-0093		fxd cer 0.01μF 100 V	28480	
CR1	1901-0033	1	diode, general purpose	28480	
R1-3	0757-0438	5	fxd film 5.11k 1% 1/8W	24546	C4-1/8-TO-5111-F
R4-6	0757-0280	4	fxd film 1k 1% 1/8W	24546	C4-1/8-TO-1001F
R7	0757-0284	2	fxd film 150 1% 1/8W	24546	C4-1/8-TO-151-F
R8	0698-3444	2	fxd film 316 1% 1/8W	24546	C4-1/8-TO-316R-F
R9	0757-0284		fxd film 150 1% 1/8W	24546	C4-1/8-TO-151-F
R10	0698-3444		fxd film 316 1% 1/8W	24546	C4-1/8-TO-316R-F
R11-13	1810-0325	3	resistor network, DIP 150x8	01121	316B151
R14	0757-0280		fxd film 1k 1% 1/8W	24546	C4-1/8-TO-1001-F
R15, 16	0757-0438		fxd film 5.11k 1% 1/8W	24546	C4-1/8-TO-5111-F
S1	3100-3364	1	switch, rotary (frame select)	28480	
U1-35	1820-2352	35	IC, differential line transceivers	01295	SN75119P
U36	1820-1216	1	IC, 3-to-8 line decoder	01295	SN74LS138N
U37, 38	1820-1197	3	IC, quad 2-input positive NAND gates	01295	SN74LS00N
U39	1820-1201	1	IC, quad 2-input positive AND gates	01295	SN74LS08N
U40	1820-1419	1	IC, 4-bit comparator	01295	SN74LS85N
U41	1820-1197		IC, quad 2-input positive NAND gate	01295	SN74LS00N

*If an A4 board connector requires replacement, consider replacing the board.

**Installed in slot A6 of last 6943A in a chain of 6942A/6943A Multiprogrammer Units.

Table 5-4. Replaceable Parts (continued)

Ref. Desig.	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
U42	1820-1199	1	IC, hex inverters	01295	SN74LS04N
U43, 44	1820-1568	2	IC, quad bus buffer gates with 3-state outputs	01295	SN74LS125AN
Z1, 2	1810-0272		resistor network, SIP 330x9	01121	210A331
A6	*14701-60020	1	**6943A Transmission System Board (14701A Intermediate Extender Kit)**	28480	
C1	0180-1835	1	fxd elect 68μF ±20% 15 V	56289	150D686X0015R2
C2-15	0150-0093	14	fxd cer. 0.01μF 100 V	28480	
R1-3	0757-0438	4	fxd film 5.11k 1% 1/8W	24546	C4-1/8-TO-5111-F
R4-6	0757-0280	3	fxd film 1k 1% 1/8W	24546	C4-1/8-TO-1001-F
R7, 8	0698-3444	4	fxd film 316 1% 1/8W	24546	C4-1/8-TO-316R-F
R9	0757-0438		fxd film 5.11k 1% 1/8W	24546	C4-1/8-TO-5111-F
R10, 11	0698-3444		fxd film 316 1% 1/8W	24546	C4-1/8-TO-316R-F
S1	3100-3364	1	switch, rotary (frame select)	28480	
U1-35	1820-2352	35	IC, differential line transceivers	01295	SN75119P
U36	1820-1216	1	IC, 3-to-8 line decoder	01295	SN74LS138N
U37, 38	1820-1197	3	IC, quad 2-input positive NAND gates	01295	SN74LS00N
U39	1820-1201	1	IC, quad 2-input positive AND gates	01295	SN74LS08N
U40	1820-1419	1	IC, 4-bit comparator	01295	SN74LS85N
U41	1820-1197		IC, quad 2-input positive NAND gates	01295	SN74LS00N
U42	1820-1199	1	IC. hex inverters	01295	SN74LS04N
U43, 44	1820-1568	2	IC, quad bus buffer gates with 3-state outputs	01295	SN74LS125AN
	5060-2770		**Power Supply**		
A7	5060-2767	1	Top Power Supply Board Assy	28480	
A8	5060-2766	1	Middle Power Supply Board Assy	28480	
A9	5060-2768	1	Bottom Power Supply Board Assy	28480	
A10	5060-2769	1	Power Supply Mother Board Assy	28480	
A11	5060-2785	1	Fuse Board Assy	28480	
A13	5060-2779	1	Fan Speed Control Board Assy	28480	
B1	3160-0301	1	fan-TBAX	28480	
J33	1251-5931	1	Connector, 14 pin (A12 Display Bd)	28480	
J34	1251-4203	1	Connector, 12 pin (Line Module, ON/OFF switch)	28480	
S1	3101-0447	1	switch, pushbutton DPDT (ON/OFF switch) part of Switch and Bracket Assy 5060-2789	28480	
T1	5080-1917		transformer, primary power	28480	

*Installed in slot A6 of intermediate (middle) 6943A's (up to 6) in a chain of 6942A/6943A Multiprogrammer units. Replaceable components on these assemblies are listed under the applicable assembly reference designation.

Table 5-4. Replaceable Parts (continued)

Ref. Desig.	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
A7	5060-2767	1	Top Power Supply Board Assembly	28480	
C1	0180-2963	1	fxd elect 2300μF 100V	56289	36DX232G100BA2A
C2	0180-0160	1	fxd elect 22μF 20% 35V	56289	150D226X0035R2
C3	0180-2166	1	fxd elect 120μF 100V	56289	39D127F100GJ4
C4	0180-0228	3	fxd elect 22μF 10% 15V	56289	150D226X9015B2
C5	0160-0163	1	fxd poly 0.033μF 10% 200V	28480	
C6, 7	0180-2624	2	fxd elect 2000 μF 10V	28480	
C8	0160-0174	1	fxd cer 0.47μF 25V	28480	
C9	0160-3092	2	fxd mica 1600 pF 1% 100V	28480	
C10	0160-0161	2	fxd poly 0.01μF 10% 200V	28480	
C11	0180-0228		fxd elect 22μF 10% 15V	56289	150D226X9015B2
C12, 13	0160-0128	2	fxd cer 2.2μF 20% 50V	28480	
C14	0180-1954	1	fxd elect 4.7μF 6V	56289	150D475X5006A2
C15	0160-0161		fxd poly 0.01μF 10% 200V	28480	
C16	0160-3092		fxd mica 1600pF 1% 100V	28480	
C17	0180-0228		fxd elect 22μF 10% 15V	56289	150D226X9015B2
C18	0160-2453	1	fxd poly 0.22μF 10% 80V	28480	
C19			Not Assigned		
C20	0150-0121	1	fxd cer 0.1μF 50V	28480	
C21	0160-0938	1	fxd mica 1000pF 5% 100V	28480	
CR1, 2	1901-0418	2	diode, power rectifier	28480	
CR3-8	1901-1065	6	diode, power rectifier	28480	
CR9	1901-0460	2	diode, stabistor 15V 150 mA	28480	
CR10	1901-0050	4	diode, switching	28480	
CR11	1901-0460		diode, stabistor 15V 150mA	28480	
CR12-14	1901-0050		diode, switching	28480	
F1	2110-0010	1	fuse 5A, 250V	75915	312005
L1	5080-1786	1	inductor, 10μH	28480	
L2-4	9140-0210	3	inductor, 100μH 5%	28480	
L5	5080-1915	1	inductor, 40μH	28480	
Q1	1853-0398	1	SS, PNP, Si	28480	
Q2	1854-0739	2	Power NPN Si	28480	
Q3	1854-0843	1	Darlington	28480	
Q4	1854-0477	1	SS, NPN, Si	04713	2N2222A
Q5	1854-0739		Power NPN Si	28480	
R1	0698-3646	1	fxd metal oxide 12k 5% 2W	28480	
R2	0812-0086	1	fxd power ww 5 5% 3W	91637	CW261-3W-T2-5R0-J
R3	0686-0515	1	fxd comp 5.1 5% 1/2W	01121	EB-0515
R4	5020-2519	1	fxd 2 milliohm	28480	
R5	0757-0419	2	fxd film 681 1% 1/8W	24546	C4-1/8-T0-681R-F
R6	0757-0346	2	fxd film 10 1% 1/8W	24546	C4-1/8-T0-10R0-F
R7	2100-0391	1	var cermet 1k 20%(current limit adj)	28480	
R8	0698-3150	1	fxd film 2.37k 1% 1/8W	24546	C4-1/8-T0-2371-F
R9	0757-0346		fxd film 10 1% 1/8W	24546	C4-1/8-T0-10R0-F
R10	0757-0289	1	fxd film 13.3k 1% 1/8W	24546	C4-1/8-T0-1332-F

Table 5-4. Replaceable Parts (cont.)

Ref. Desig.	HP Part No.	Qty	Description	Mfr. Code	Mfr. Part No.
R11	0698-3155	1	fxd film 4.64k 1% 1/8W	24546	C4-1/8-T0-4641-F
R12	0686-3015	2	fxd comp 300 5% 1/2W	01121	EB-3015
R13	0757-0442	1	fxd film 10k 1% 1/8W	24546	C4-1/8-T0-1002-F
R14	0686-3015		fxd comp 300 5% 1/2W	01121	EB-3015
R15	0757-0199	1	fxd film 21.5k 1% 1/8W	24546	C4-1/8-T0-2152-F
R16	0698-4443	1	fxd film 4.53k 1% 1/8W	24546	C4-1/8-TO-4531-F
R17	0757-0427	2	fxd film 1.5k 1% 1/8W	24546	C4-1/8-T0-1501-F
R18			Not Assigned		
R19	0757-0416	1	fxd film 511 1% 1/8W	24546	C4-1/8-TO-511R-F
R20	0757-0419		fxd film 681 1% 1/8W	24546	C4-1/8-TO-681R-F
R21	0757-0410	1	fxd film 301 1% 1/8W	24546	C4-1/8-TO-301R-F
R22	0757-0401	1	fxd film 100 1% 1/8W	28480	
R23	0757-0427		fxd film 1.5k 1% 1/8W	24546	C4-1/8-T0-1501-F
R24	0757-0420	1	fxd film 750 1% 1/8W	24546	C4-1/8-TO-751-F
R25	2100-0328	1	var cermet 500 10% (voltage adj)	28480	
R26	0757-0430	1	fxd film 2.21k 1% 1/8W	24546	C4-1/8-T0-2211-F
R27	0757-0273	1	fxd film 3.01k 1% 1/8W	24546	C4-1/8-T0-3011-F
R28	0757-0443	1	fxd film 11k 1% 1/8W	24546	C4-1/8-T0-1102-F
R29	0757-0413	1	fxd film 392 1% 1/8W	24546	C4-1/8-TO-392R-F
R30	0757-0738	1	fxd comp 1.82k 1% 1/8W	24546	C4-1/8-TO-1821-F
R31	0757-0461	1	fxd film 68.1k 1% 1/8W	24546	C4-1/8-TO-6812-F
T1	5080-1916	1	transformer, 20kHz	28480	
U1	1906-0227	1	diode package, center tapped rectifier	28480	
U2	1826-0119	1	IC, timer	27014	LM555CH
U3	1820-2730	1	IC, timer	28480	
U4	1820-1422	1	IC, retriggerable monostable multi-vibrator	01295	SN74LS122N
U5	1826-0049	1	IC, voltage regulator	07263	UA723DC
VR1			Not Assigned		
VR2, 3	1902-0597	2	diode, zener 56V 5%	28480	
VR4	1902-0049	1	diode, zener 6.19V 5%	28480	
VR5	1902-0533	1	diode, zener 4.99V 2%	28480	
A8	**5060-2766**	**1**	**Middle Power Supply Board Assembly**	28480	
C1	0150-0121	2	fxd cer 0.1μF, 50V	28480	
C2	0160-0128	7	fxd cer 2.2μF 20% 50V	28480	
C3, 4	0160-0127	5	fxd cer 1μF 25V 20%	28480	
C5			Not Assigned		
C6	0160-0174	1	fxd cer 0.47μF 25V	28480	
C7	0160-0128		fxd cer 2.2μF 20% 50V	28480	
C8	0160-0161	2	fxd poly 0.01μF 10% 200V	28480	
C9	0150-0121		fxd cer 0.1μf 50V	28480	
C10	0160-0128		fxd cer 2.2μF 20% 50V	28480	
C11, 12	0160-0127		fxd cer 1μF 25V 20%	28480	
C13	0160-0128		fxd cer 2.2μF 20% 50V	28480	

Table 5-4. Replaceable Parts (cont.)

Ref. Desig.	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
C14	0160-0127		fxd cer 1μF 25V 20%	28480	
C15-17	0160-0153	3	fxd poly 1000pF 10% 200V	28480	
C18	0160-0161		fxd poly 0.01μF 10% 200V	28480	
C19, 20	0180-2547	2	fxd elect 4000μF 45 V	28480	
C21-23	0180-2964	3	fxd elect 500μF 50V	00853	301AHE501U050B
C24-26	0160-0128		fxd cer 2.2μF 20% 50V	28480	
C27	0180-1731	1	fxd elect 4.7μF, 50V	56289	150D475X9050B2
CR1, 2	1901-0461	2	diode, general purpose	28480	
CR3	1901-0841	1	diode, Schottky	28480	
CR4-9	1901-0050	6	diode, switching	28480	
CR10-13			Not Assigned		
CR14-17	1901-0327	4	diode, power rectifier	03508	A14B
L1	9140-0210	1	inductor, 100μH 5%	28480	
Q1, 2	1854-0215	3	SS, NPN, Si	04713	2N3904
Q3-5	1884-0082	3	thyristor, SCR	28480	2N4441
Q6	1854-0215		SS, NPN, Si	04713	2N3904
R1	0698-4121	2	fxd film 11.3k 1% 1/8W	24546	C4-1/8-T0-1132-F
R2	0757-0451	1	fxd film 24.3k 1% 1/8W	24546	C4-1/8-T0-2432-F
R3	0698-4121		fxd film 11.3k 1% 1/8W	24546	C5-1/8-T0-1132-F
R4	0698-3151	1	fxd film 2.87k 1% 1/8W	24546	C4-1/8-T0-2871-F
R5	0757-0408	2	fxd film 243 1% 1/8W	24546	C4-1/8-TO-243R-F
R6	0757-0442	6	fxd film 10k 1% 1/8W	24546	C4-1/8-T0-1002-F
R7	0698-3156	1	fxd film 14.7k 1% 1/8W	24546	C4-1/8-T0-1472-F
R8	0698-4428	1	fxd film 1.69k 1% 1/8W	24546	C4-1/8-T0-1691-F
R9	0757-0440	1	fxd film 7.5k 1% 1/8W	24546	C4-1/8-TO-7501-F
R10	0757-0438	2	fxd film 5.11k 1% 1/8W	24546	C4-1/8-T0-5111-F
R11	0757-0442		fxd film 10k 1% 1/8W	24546	C4-1/8-TO-1002-F
R12	0757-0434	1	fxd film 3.65k 1% 1/8W	24546	C4-1/8-T0-3651-F
R13	0698-3136	4	fxd film 17.8k 1% 1/8W	24546	C4-1/8-T0-1782-F
R14	0757-0430	2	fxd film 2.21k 1% 1/8W	24546	C4-1/8-T0-2211-F
R15	0757-0200	2	fxd film 5.62k 1% 1/8W	24546	C4-1/8-T0-5621-F
R16	0757-0438		fxd film 5.11k 1% 1/8W	24546	C4-1/8-T0-5111-F
R17	0757-0442		fxd film 10k 1% 1/8W	24546	C4-1/8-T0-1002-F
R18, 19	0757-0453	3	fxd film 30.1k 1% 1/8W	24546	C4-1/8-T0-3012-F
R20	0757-0467	1	fxd film 121k 1% 1/8W	24546	C4-1/8-T0-1213-F
R21	0698-3428	1	fxd film 14.7 1% 1/8W	24546	C4-1/8-10-14R7-F
R22	0757-0430		fxd film 2.21k 1% 1/8W	24546	C4-1/8-TO-2211-F
R23	0757-0199	2	fxd film 21.5k 1% 1/8W	24546	C4-1/8-T0-2152-F
R24	0757-0274	1	fxd film 1.21k 1% 1/8W	24546	C4-1/8-T0-1211-F
R25	0698-3136		fxd film 17.8k 1% 1/8W	24546	C4-1/8-T0-1782-F
R26	0757-0453		fxd film 30.1k 1% 1/8W	24546	C4-1/8-T0-3012-F
R27	0698-0083	1	fxd film 1.96k 1% 1/8W	24546	C4-1/8-T0-1961-F
R28	0757-0433	1	fxd film 3.32k 1% 1/8W	24546	C4-1/8-T0-3321-F
R29	0757-0449	1	fxd film 20k 1% 1/8W	24546	C4-1/8-T0-2002-F
R30	0757-0442		fxd film 10k 1% 1/8W	24546	C4-1/8-T0-1002-F
R31	0698-3493	1	fxd film 4.12k 1% 1/8W	24546	C4-1/8-T0-4121-F

Table 5-4. Replaceable Parts (cont.)

Ref. Desig.	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
R32	0698-3159	1	fxd film 26.1k 1% 1/8W	24546	C4-1/8-T0-2612-F
R33, 34	0698-3136		fxd film 17.8k 1% 1/8W	24546	C4-1/8-T0-1782-F
R35, 36	0757-0442		fxd film 10k 1% 1/8W	24546	C4-1/8-T0-1002-F
R37, 38	0757-0472	2	fxd film 200k 1% 1/8W	24546	C4-1/8-T0-2003-F
R39	0757-0199		fxd film 21.5k 1% 1/8W	24546	C4-1/8-T0-2152-F
R40	0757-0200		fxd film 5.62k 1% 1/8W	24546	C4-1/8-T0-5621-F
R41	0757-027[illegible]	1	fxd film 3.16k 1% 1/8W	24546	C4-1/8-T0-3161-F
R42	0698-508[illegible]	1	fxd film 33k 1% 1/8W	24546	C4-118-T0-3302-F
R43	0698-3433	1	fxd film 28.7k 1% 1/8W	24546	C4-1/8-T0-2872-F
R44-46	0757-0399	3	fxd film 82.5k 1% 1/8W	24546	C4-1/8-T0-8252-F
R47	0811-1826	1	fxd ww 0.05 10% 3W	28480	
R48, 49	0811-1830	2	fxd ww 0.5 10% 3W	28480	
R50	0698-4440	1	fxd film 3.4k 1% 1/8W	24546	C4-1/8-T0-3401-F
R51	0698-4470	1	fxd film 6.98k 1% 1/8W	24546	C4-1/8-T0-6981-F
R52	0757-0408		fxd film 243 1% 1/8W	24546	C4-1/8-T0-243R-F
R53	0757-0444	1	fxd film 12.1k 1% 1/8W	24546	C4-1/8-TO-1212-F
R54	0689-1025	1	fxd comp 1 k 5% 1W	01121	GB1025
T1	5080-1929	1	transformer	28480	
U1	1820-1600	1	IC, Schmitt trigger NAND gate	04713	MC14093BCD
U2	1826-0138	2	IC, quad comparator	27014	LM339N
U3	1821-0001	1	IC, transistor array	02735	CA3046
U4	1826-0138		IC, quad comparator	27014	LM339N
U5	1820-2090	1	IC, 4-input AND	04713	MC14082BCP
U6	1826-0119	1	IC, timer	34335	NE555T
U7	1826-0673	1	IC, voltage regulator	27014	LM217K
U8	1826-0418	1	IC, voltage regulator negative	27014	LM320T-12
VR1	1902-0018	1	diode, zener 11.7 V 5%	28480	IN941
VR2	1902-3125	1	diode, zener 6.98V 2%	28480	
VR3	1902-1348	1	diode, zener 18V 10%	28480	
A9	5060-2768	1	**Bottom Power Supply Board Assembly**	28480	
C1	0180-2280	1	fxd elect 950μF 15V	28480	
C2	0160-0128	12	fxd cer 2.2μF 20% 50V	28480	
C3	0160-0153	1	fxd mylar 1000pF 10% 20V	28480	
C4, 5	0180-2964	2	fxd elect 500μF 50V	28480	
C6, 7	0180-2966	4	fxd elect 250μF 50V	28480	
C8	0160-0128		fxd cer 2.2μF 20% 50V	28480	
C9, 10	0180-2966		fxd elect 250μF 50V	28480	
C11-16	0160-0128		fxd cer 2.2μF 20% 50V	28480	
C17	0140-0203	1	fxd mica 30pF 5% 500V	28480	
C18-21	0160-0128		fxd cer 2.2μF 20% 50V	28480	
C22, 23	0180-2651		fxd elect 470μF 16V	28480	
CR1, 2	1901-0327	13	diode, power rectifier	28480	
CR3-6	1901-0418	6	diode, power rectifier	28480	
CR7-14			Not Assign[illegible]		

Table 5-4. Replaceable Parts (cont.)

Ref. Desig.	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
CR15-20	1901-0327		diode, power rectifier	28480	
CR21, 22	1901-0418		diode, power rectifier	04713	SR1846-12
CR23-27	1901-0327		diode, power rectifier	28480	
F1	2110-0003	1	fuse 3A 250V	75915	
Q1	1853-0351	1	power, PNP, Si Darlington	28480	2N6053
Q2	1854-0611	1	power, NPN, Si Darlington	28480	2N6055
Q3	1854-0823	1	SS, NPN, Si	28480	
Q4	1853-0099	1	SS PNP, Si	28480	
R1	0757-0283	1	fxd film 2k 1% 1/8W	24546	C4-1/8-T0-2001-F
R2	0757-0280	2	fxd film 1k 1% 1/8W	24546	C4-1/8-T0-1001-F
R3	0811-1340	1	fxd ww 1 5% 1W	28480	
R4	0698-4457	1	fxd film 576 1% 1/8W	24546	C4-1/8-TO-576R-F
R5, 6	0757-0436	2	fxd film 4.32k 1% 1/8W	24546	C4-1/8-T0-4321-F
R7	0757-0416	2	fxd film 511 1% 1/8W	24546	C4-1/8-TO-511R-F
R8	0811-2556	1	fxd ww 1.25 1% 4W	28480	
R9	0757-0280		fxd film 1k 1% 1/8W	24546	C4-1/8-T0-1001-F
R10	2100-1756	1	var ww 200 5% (± 12V)	28480	
R11	0757-0427	1	fxd film 1.5k 1% 1/8W	24546	C4-1/8-T0-1501-F
R12, 13	0757-0444	2	fxd film 12.1k 1% 1/8W	24546	C4-1/8-T0-1212-F
R14	0698-3497	1	fxd film 6.04k 1% 1/8W	24546	C4-1/8-T0-6041-F
R15, 16	0689-1025	2	fxd comp 1k 5% 1W	01121	GB1025
R17	0757-0416		fxd film 511 1% 1/8W	24546	C4-1/8-TO-511R-F
U1	1826-0445	1	IC, voltage regulator, fixed neg.	07263	UA7905UC
U2	1826-0049	1	IC, voltage regulator, pos. adj.	07263	UA723DC
U3, 4	1826-0147	3	IC, voltage regulator, fixed pos	04713	MC7812CT
U5	1826-0418	2	IC, voltage regulator, fixed neg.	27014	LM320T-12
U6	1826-0147		IC, voltage regulator, fixed pos.	04713	MC7812CT
U7	1826-0418		IC, voltage regulator, fxd neg.	27014	LM320T-12
U8	1820-0223	1	IC, operational amplifier	27014	LM301AH
VR1-4	1902-3125	4	diode, zener 6.98V 2%	28480	
VR5	1902-0049	1	diode, zener 6.19V 5%	28480	
VR6, 7	1902-1348	2	diode, zener 18 V 10%	28480	
A10	**5020-2769**	**1**	**Power Supply Mother Board Assembly**	**28480**	
J29	1251-1626	1	PC connector (2x12), A7 Board	28480	
J30	1251-7171	1	PC connector (2x18), A8 Board	28480	
J32	1251-5872	1	12-pin connector, female (A11 cover interlock)	28480	
J31B	1251-7173	1	PC connector (2x24), A9 Board	28480	

Table 5-4. Replaceable Parts (cont.)

Ref. Desig.	HP Part No.	Qty	Description	Mfr. Code	Mfr. Part No.
A11	**5060-2785**	**1**	**Fuse Board Assembly**	28480	
CR1-12	1901-0327	12	diode, power rectifier	28480	
F1	2110-0043	1	fuse, 1.5A 250V	28480	
F2, 3	2110-0007	2	fuse, 1A 250V ± 18V Isolated	75915	313001
F4, 5	2110-0202	2	fuse, 0.5A 250V Supply Fuses	75915	313.500
F6	2110-0044	1	fuse, 0.3A 250V	28480	
J31A	1251-5871	1	Connector, female 12-pin	28480	
P31	5060-2786	1	Cover assembly (includes 12-pin male connector)	28480	
W1	1258-0164	1	jumper plug (safety ground)	28480	
A12	**5060-2778**	**1**	**Display Board Assembly**	28480	
DS1	1990-0521	4	LED indicator (SYSTEM ENABLE, green)	28480	
DS2	1990-0517	1	LED indicator (POWER FAIL, red)	28480	
DS3-5	1990-0521		LED indicators (ISOL. 1, 2, 3 supplies, green)	28480	
J33	1251-0646	14	Connector, contacts male	28480	
R1	0683-1215	1	fxd. comp 120 5% 1/4W	01121	CB-1215
R2	0683-6215	1	fxd. comp 620 5% 1/4W	01121	CB-6215
A13	**5060-2779**	**1**	**Fan Speed Control Board Assembly**	28480	
C1	0180-2419	1	fxd elect 470μF 10V	28480	
C2	0180-0160	1	fxd elect 22μF 35V	56289	150D226X0035R2
CR1-3	1901-0050	3	diode, switching	28480	
CR4, 5	1901-0330	2	diode, power rectifier	03508	A14N
K1-3	0490-1227	3	relay, reed	28480	
Q1-3	1854-0477	3	SS, NPN, Si	07263	2N2222A
Q4	1884-0216	1	thyristor, triac	3L585	T2302D
R1	0812-0050	1	fxd power ww 3k 5% 5W	28480	
R2	0757-0466	2	fxd film 110k 1% 1/8W	24546	C4-1/8-TO-1103-F
R3	0757-0441	4	fxd film 8.25k 1% 1/8W	24546	C4-1/8-T0-8251-F
R4	0757-0466		fxd film 110k 1% 1/8W	24546	C4-1/8-T0-1103-F
R5	0757-0446	3	fxd film 15k 1% 1/8W	24546	C4-1/8-T0-1502-F
R6	0757-0948	3	fxd film 10k 2% 1/8W	24546	C4-1/8-T0-1002-F
R7	0757-0924	3	fxd film 1k 2% 1/8W	24546	C4-1/8-T0-1001-F
R8	0757-0948		fxd film 10k 2% 1/8W	24546	C4-1/8-TO-1002-G
R9	0757-0472	2	fxd film 200k 1% 1/8W	24546	C4-1/8-TO-2003-F
R10	0757-0446		fxd film 15k 1% 1/8W	24546	C4-1/8-T0-1502-F
R11	0757-0924		fxd film 1k 2% 1/8W	24546	C4-1/8-T0-1001-F
R12	0757-0948		fxd film 10k 2% 1/8W	24546	C4-1/8-TO-1002-G
R13	0757-0472		fxd film 200k 1% 1/8W	24546	C4-1/8-T0-2003-F

Table 5-4. Replaceable Parts (cont.)

Ref. Desig.	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
R14	0757-0446		fxd film 15k 1% 1/8W	24546	C4-1/8-T0-1502-F
R15	0757-0924		fxd film 1k 2% 1/8W	24546	C4-1/8-T0-1001-F
*R16	0812-0066	1	fxd power ww 0.33 5% 2W	28480	
R17-19	0757-0441		fxd film 8.25k 1% 1/8W	24546	C4-1/8-T0-8251-F
R20	0689-5125	1	fxd comp 5.1k 5% 1W	01121	GB5125
R21	0811-1905	1	fxd ww 135 5% 10W	28480	
R22	0812-0097	1	fxd power ww 75 5% 5W	28480	
R23	0811-1854	1	fxd ww 50 5% 5W	28480	
*R24	0837-0026	1	thermistor, 100k, negative T.C.	28480	
U1	1826-0138	1	IC, quad comparator	27014	LM339N
U2	1820-1355	1	IC, 8-bit binary encoder	04713	MC14532BCP
VR1	1902-0033	1	diode, zener	28480	IN823
	5060-2790	1	**Line Module Assembly (includes fuse, select card, and filter)**		
F1	2110-0056	1	fuse, 6A @ 250V, 100V/120V input	75915	312006
F1	2110-0029	1	fuse, 3A @ 250V, 220V/240V input	28480	
FL1	9135-0036	1	filter line	28480	
P34	1251-4202	1	Connector, 12-pin	28480	
			A2 Control/RAM Board-Mechanical		
	5020-2589	1	Insulator, fiberglass	28480	
	5020-2590	1	Bar, mounting	28480	
	5020-2619	3	Standoff, hex	28480	
			A3 Backplane Connector Board-Mechanical		
	0590-1113	4	Spacer	23480	
	1251-5877	18	Plug, keying (J1-J17)	28480	
	5020-2589	1	Insulator, fiberglass	28480	
	5020-2593	2	Bar, stiffening	28480	
			A4 Top Interconnect Board-Mechanical		
	5020-2615	1	Insulator	28480	
	5020-2616	1	Insulator	28480	
			***A6 6943A Transmission System Board (Part of 14700A Last Extender Kit) - Mechanical**		
	14700-80002	1	Extractor handle (XMSN HP6943L)	28480	
	1480-0059	1	Pin, roll, .062D	28480	
			*Installed in slot A6 of last 6943A in a chain of 6942A/6943A Multi-programmer units		

*Resistor/Thermistor Assembly 5080-1950 Comprises A13R16 and A13R24.

Table 5-4. Replaceable Parts (continued)

Ref. Desig.	HP Part No.	Qty	Description	Mfr. Code	Mfr. Part No.
			**A6 6943A Transmission System Board (14701A Intermediate Extender Kit) - Mechanical		
	14701-80001	1	Extractor handle (XMSN HP6943M)	28480	
	1480-0059	1	Pin, roll, .062D		
			**Installed in slot A6 of intermediate (middle) 6943A's (up to 6) in a chain of 6942A/6943A Multi-programmer units.		
			Power Supply Assembly-Mechanical		
	0380-0173	4	Standoff, hex	28480	
	0400-0082	1	Grammet	28480	
	0403-0407	3	Guide, PC board	28480	
	0510-0056	1	Fastener	28480	
	1251-3914	12	Connector contacts (J34 connector)	28480	
	1251-4223	12	Connector contacts (J33 connector)	28480	
	1251-3942	1	Keying plug-connector	28480	
	1390-0473	2	Fastener	28480	
	1390-0490	2	Receptacle	28480	
	1390-0491	2	Fastener	28480	
	3160-0092	1	Finger guard	28480	
	5000-3154	3	Chassis bracket	28480	
	5000-3155	3	Bracket, PC support	28480	
	5000-3161	1	Support	28480	
	5000-3165	1	Chassis	28480	
	5040-7221	4	Standoff	28480	
	5041-0202	1	Key, half-china	28480	
	5000-3166	1	Mounting plate	28480	
	5000-3168	1	Bracket, connector	28480	
	5000-3170	3	Bracket, PC board rear	28480	
	5000-3178	1	Bracket, PC board rear	28480	
			A7 Top Power Supply Board-Mechanical		
	1205-0282	2	Heat sink (Q1, Q2)	28480	
	1205-0267	2	Heat dissipator TO-3 (Q3, Q5)	28480	
	5000-3171	2	Heatsink, alum. (U1)	28480	
	2110-0269	2	Fuseholder, clip type	28480	
	1251-2913	4	Connector, single (U1, U3 pins)	28480	
	0340-0167	6	Bushing, insulating (T1, CR1, CR2)	28480	
			A8 Middle Power Supply Board-Mechanical		
	0340-0167	2	Bushing, insulating	28480	
	1205-0266	1	Heat sink (U7)	28480	
	1205-0392	2	Heat sink (U8)	28480	

Table 5-4. Replaceable Parts (continued)

Ref. Desig.	HP Part No.	Qty	Description	Mfr. Code	Mfr. Part No.
			A9 Bottom Power Supply Board-Mechanical		
	0340-0166	10	Insulator, bushing (Q2,2,CR3-6, CR21, CR22)	28480	
	0340-0167	10	Bushing, insulating	28480	
	0340-0174	2	Insulator, transistor, mica (Q1,Q2)	28480	
	0340-0795	2	Insulator, transistor, polyester (Q1,Q2)	28480	
	0360-0124	6	Terminal, stud (test points)	28480	
	1205-0282	6	Heat dissipator (U1, U3-7)	28480	
	1251-2913	4	Connector single (for Q1, Q2 pins)	28480	
	2110-0269	2	Fuseholder, clip type (for F1)	28480	
	5020-2501	1	Heat sink (Q1, Q2)	28480	
			A10 Power Supply Mother Board-Mechanical		
	2190-0079	2	Washer, lock, helical	28480	
			A11 Fuse Board-Mechanical		
	2110-0269	12	Fuseholder, clip type	28480	
			A12 Display Board-Mechanical		
	1251-0646	14	Contact, connector male (P33)	28480	
			A13 Fan Speed Control Board-Mechanical		
	1205-0011	1	Heat dissipator (Q4)	28480	
			Chassis-Mechanical		
	06943-00003	1	Front panel, marked	28480	
	1390-0088	4	Fastener, ¼ turn	28480	
	1390-0510	4	Fastener, ¼ turn	2848[illegible]	
	1400-0332	2	Clamp, cable	28480	
	4040-1083	2	Cover, safety	28480	
	4040-1518	1	Grill, front	28480	
	4208-0297	1	Foam filler, plastic	28480	
	5000-3162	1	Bracket, display	28480	
	5000-3187	1	door	28480	
	5040-7201	4	Foot, full and ½	28480	
	5040-7202	1	Trim strip top	2848	
			Card Cage Assembly-Mechanical		
	0340-0598	1	Bushing, insulating	28480	
	1390-0391	4	Fastener, ¼ turn	28480	
	5000-3186	1	Bracket door	28480	
	5000-3156	2	Bracket, power supply mounting	28480	

Table 5-4. Replaceable Parts (cont.)

Ref. Desig.	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
	5000-3158	1	Plate, left side	28480	
	5000-3159	1	Plate, right side	28480	
	0403-0407	3	Guide, PC board	28480	
	5000-3176	1	Rear panel	28480	
	5001-0440	2	Trim, side	28480	
	5020-2691	1	Bar support	28480	
	5020-2602	4	Struts, corner	28480	
	5020-8805	1	Frame, front	28480	
	5020-8806	1	Frame, rear	28480	
	5040-6007	4	Guide, PC board	28480	
	5040-7219	2	Retainer, strap	28480	
	5040-7220	2	Retainer, strap (lipped)	28480	
	5050-9805	2	Strap, handle	28480	
	5060-9885	2	Cover, side	28480	
	5060-9836	1	Top cover assembly	28480	
	5060-9848	1	Bottom cover assembly	28480	
	06943-00003	1	Front panel	28480	
			Miscellaneous		
	06943-90001	1	Installation and Assembly Level Service Manual	28480	
	9220-3172	1	Foam pad	28480	
	9220-3171	1	Corrugated Pad	28480	
	9211-3251	1	Packing Carton, unit	28480	
	9211-4160	1	Packing Carton, literature	28480	
		1	Line Cord (see para. 2-19)	28480	
	9282-0972	1	Binder, 3-ring	28480	
	9282-0978	1	Spine, insert	28480	

SCHEMATIC DIAGRAMS

SECTION VI
CIRCUIT DIAGRAMS

6-1 INTRODUCTION

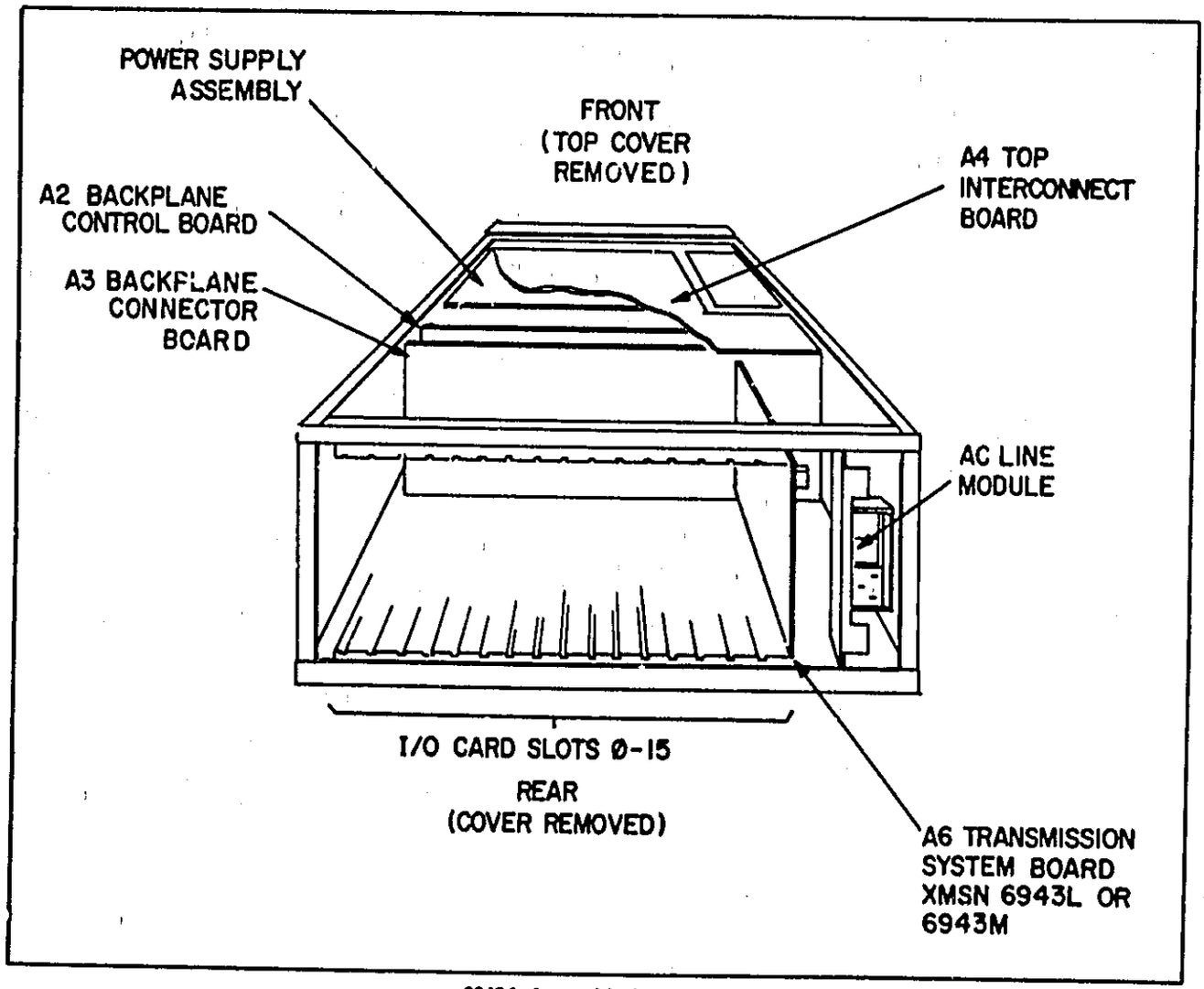
6-2 This section contains circuit diagrams necessary for the operation and maintenance of the Model 6943A Multiprogrammer Extender.

6-3 COMPONENT LOCATION ILLUSTRATIONS

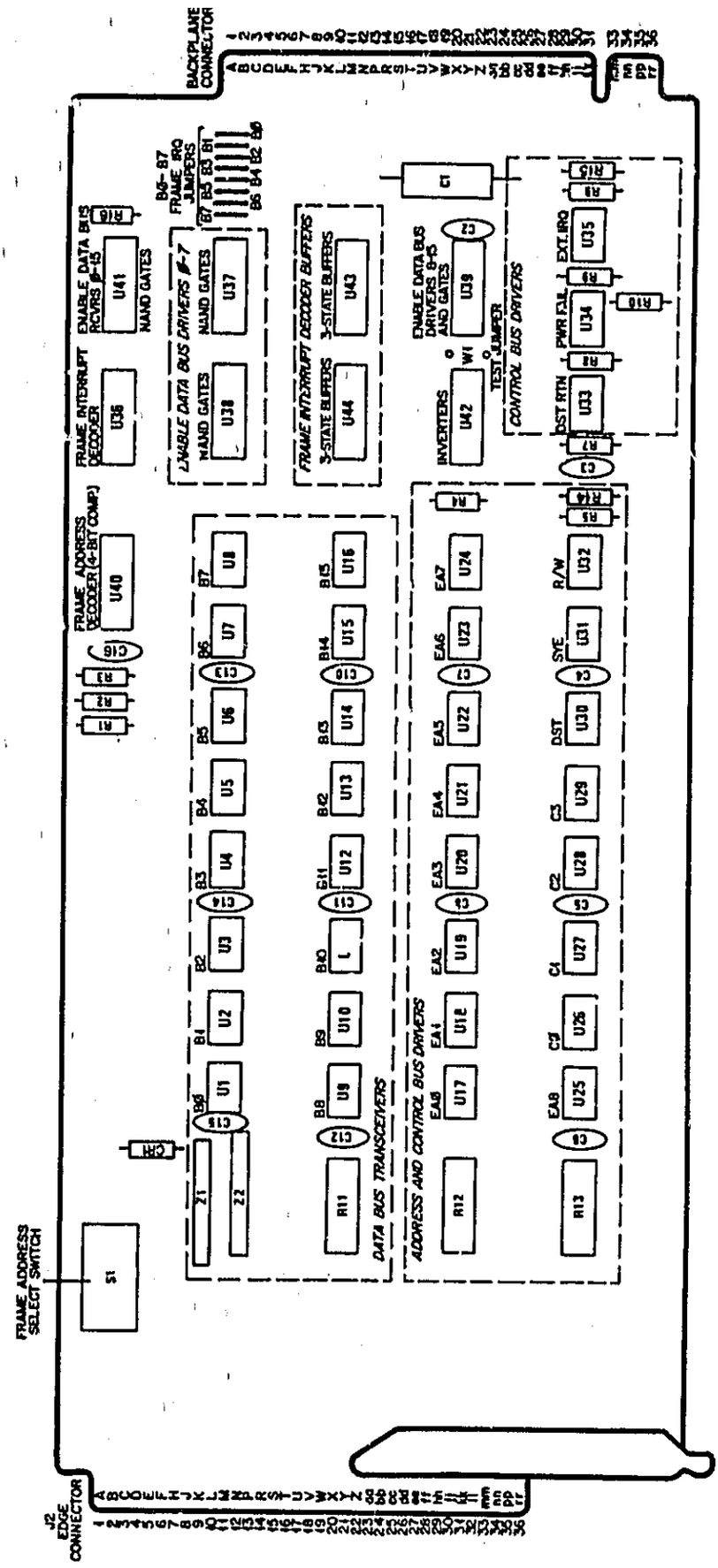
6-4 The component location diagrams show the physical location of parts mounted on each assembly. They are included on the schematic diagrams where they apply or on the rear of the previous schematic. Thus, the schematic diagram is unfolded to the right and component location diagram is unfolded to the left.

6-5 SCHEMATIC DIAGRAMS

6-6 The 6943A circuits are functionally separated and included on the schematics of Figure 6-1 through 6-4. Figure 6-1 illustrates the circuits on transmission system board 14700-60021 (included with Last Extender Kit 14700A). Figure 6-2 shows the circuits on transmission system board 14701-60020 (included with Intermediate Extender Kit 14701A). In a multiple unit system, the 14700-60021 board must be installed in the A6 slot of the "Last" 6943A unit in the chain and a 14701-60020 board must be installed in each "Intermediate" (or "Middle") 6943A unit. Figure 6-3 illustrates the backplane control circuits (A2 Board) and interconnections (A3, A4 Boards) in a 6943A Figure 6-4 includes 5 sheets which show all of the 6943A's power supply circuits.



6943A Assembly Locations



A6 6943A Last Extender Transmission System Board (Part of 14700A Extender Kit), Component Locations

SCHEMATIC NOTES

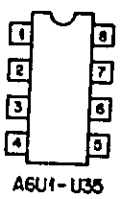
1. ALL RESISTORS ARE IN OHMS, 1/8W, 1% UNLESS OTHERWISE INDICATED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE INDICATED.
3. IN A MULTIPLE UNIT SYSTEM, TRANSMISSION SYSTEM BOARD 14700-6002 (PART OF THE 14700A LAST EXTENDER KIT) MUST BE INSTALLED IN THE A6 SLOT OF THE LAST 6943A (SEE PARAGRAPH 2-15).
4. THE FRAME ADDRESS FOR THE LAST 6943A UNIT IS SPECIFIED BY ROTARY SWITCH A6S1 ON THE 14700-6002 BOARD. THE SWITCH HAS 16 POSITIONS WHICH ARE MARKED IN HEXADECIMAL. NOTE THAT ONLY THE FIRST 8 POSITIONS (0-7) SHOULD BE USED. BECAUSE THE MSB OF THE SWITCH IS NOT USED, THE LAST 8 POSITIONS ARE A REPETITION OF THE FIRST EIGHT; THAT IS, POSITION 8 IS THE SAME AS POSITION 0, POSITION 9 IS THE SAME AS POSITION 1, ETC. REFER TO THE TRUTH TABLE BELOW. THE LAST EXTENDER'S ADDRESS SHOULD BE SET TO A NUMBER FROM 1-7 DEPENDING UPON ITS POSITION IN THE CHAIN (SEE PARAGRAPH 2-15).

A6S1

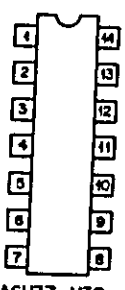
FRAME ADDRESS SWITCH A6S1 TRUTH TABLE

POLE POS	8	4	2	1	$\overline{8}$	$\overline{4}$	$\overline{2}$	$\overline{1}$
0	—	1	1	1	—	0	0	0
1	—	1	1	0	—	0	0	1
2	—	1	0	1	—	0	1	0
3	—	1	0	0	—	0	1	1
4	—	0	1	1	—	1	0	0
5	—	0	1	0	—	1	0	1
6	—	0	0	1	—	1	1	0
7	—	0	0	0	—	1	1	1
8	—	1	1	1	—	0	0	0
9	—	1	1	0	—	0	0	1
A	—	1	0	1	—	0	1	0
B	—	1	0	0	—	0	1	1
C	—	0	1	1	—	1	0	0
D	—	0	1	0	—	1	0	1
E	—	0	0	1	—	1	1	0
F	—	0	0	0	—	1	1	1

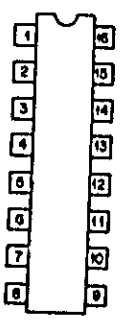
5. THE DOTS (•) MARKED ON THE A6 BOARD INDICATE PIN 1 OF ANY IC OR RESISTOR NETWORK. PIN LOCATIONS ARE AS FOLLOWS:



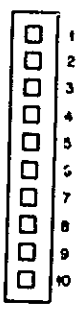
A6U1-U35



A6U37-U39
A6U41-U44



A6U36, U40
A6R11, R12, R13



A6Z1
Z2

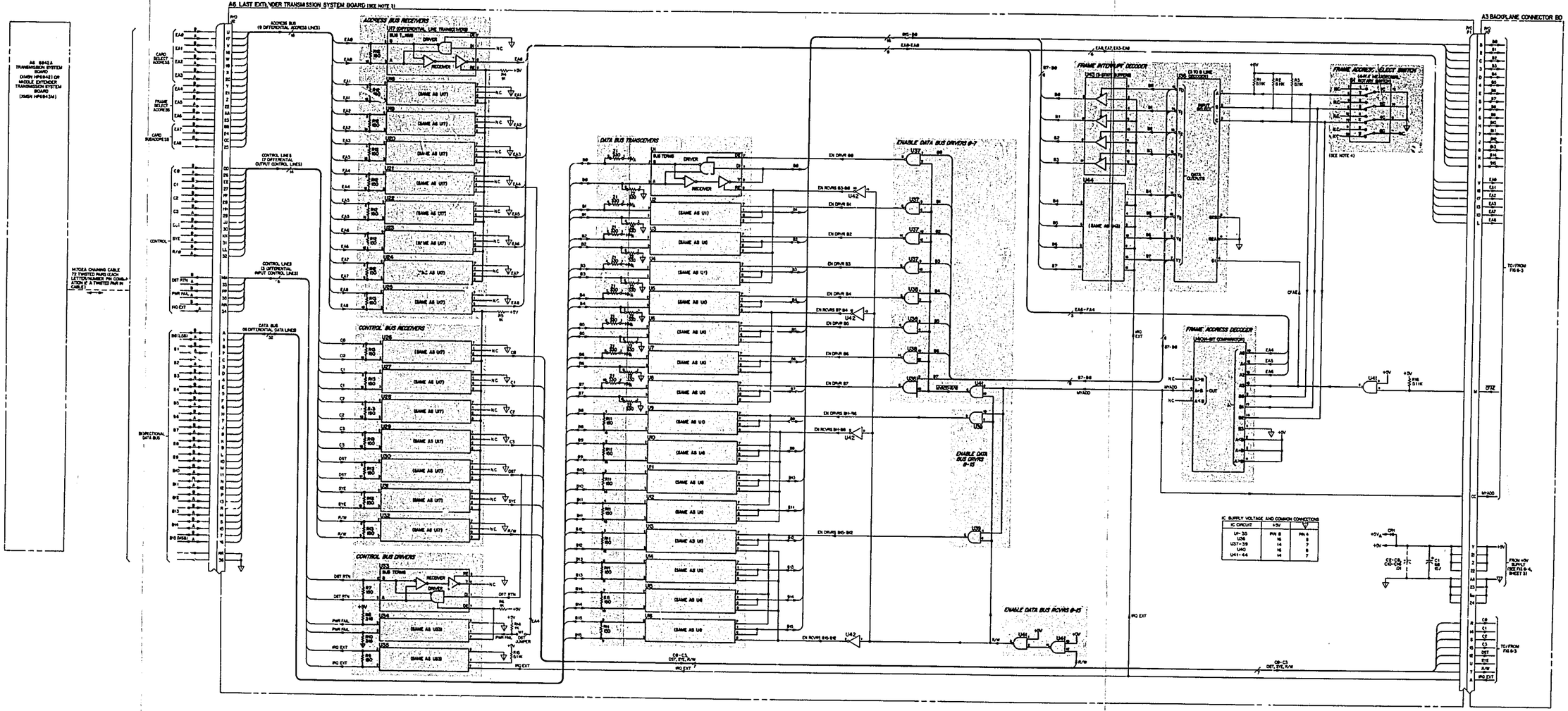
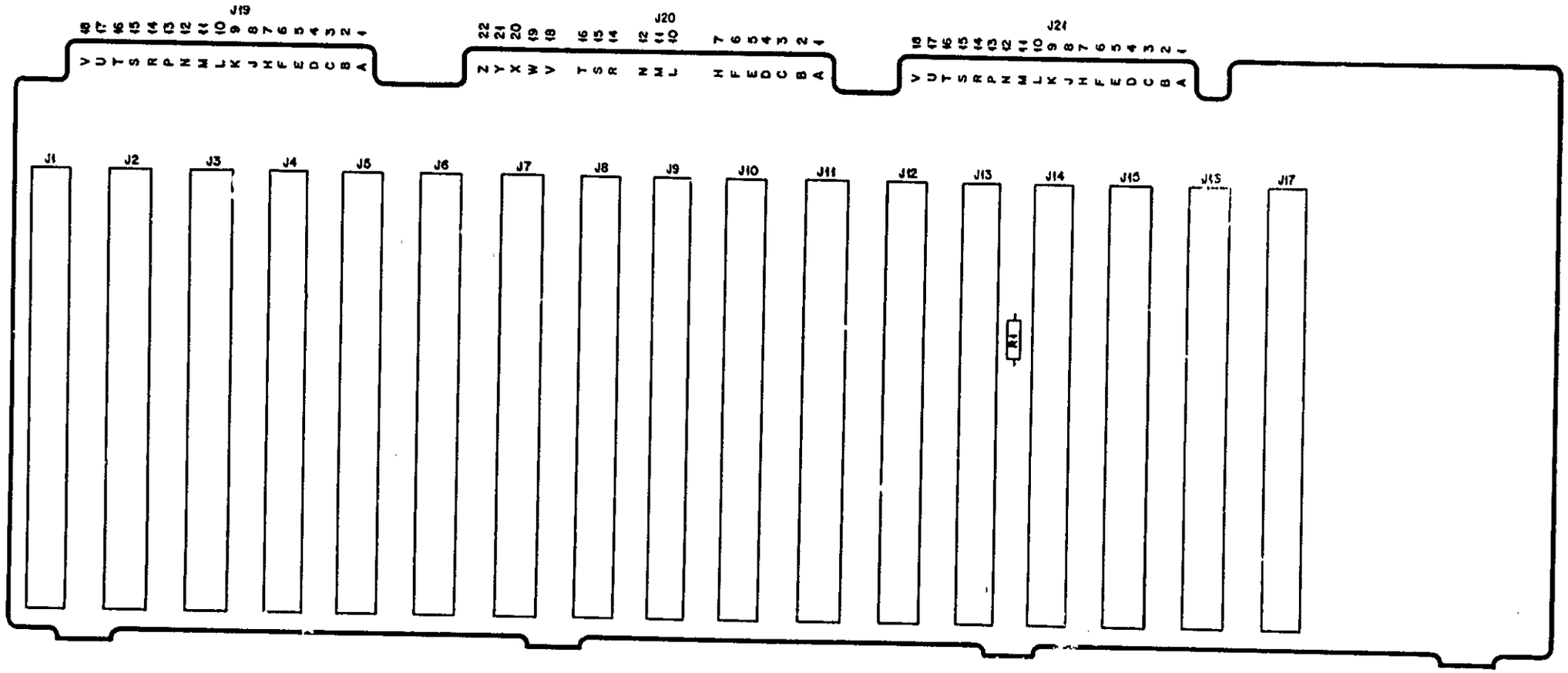
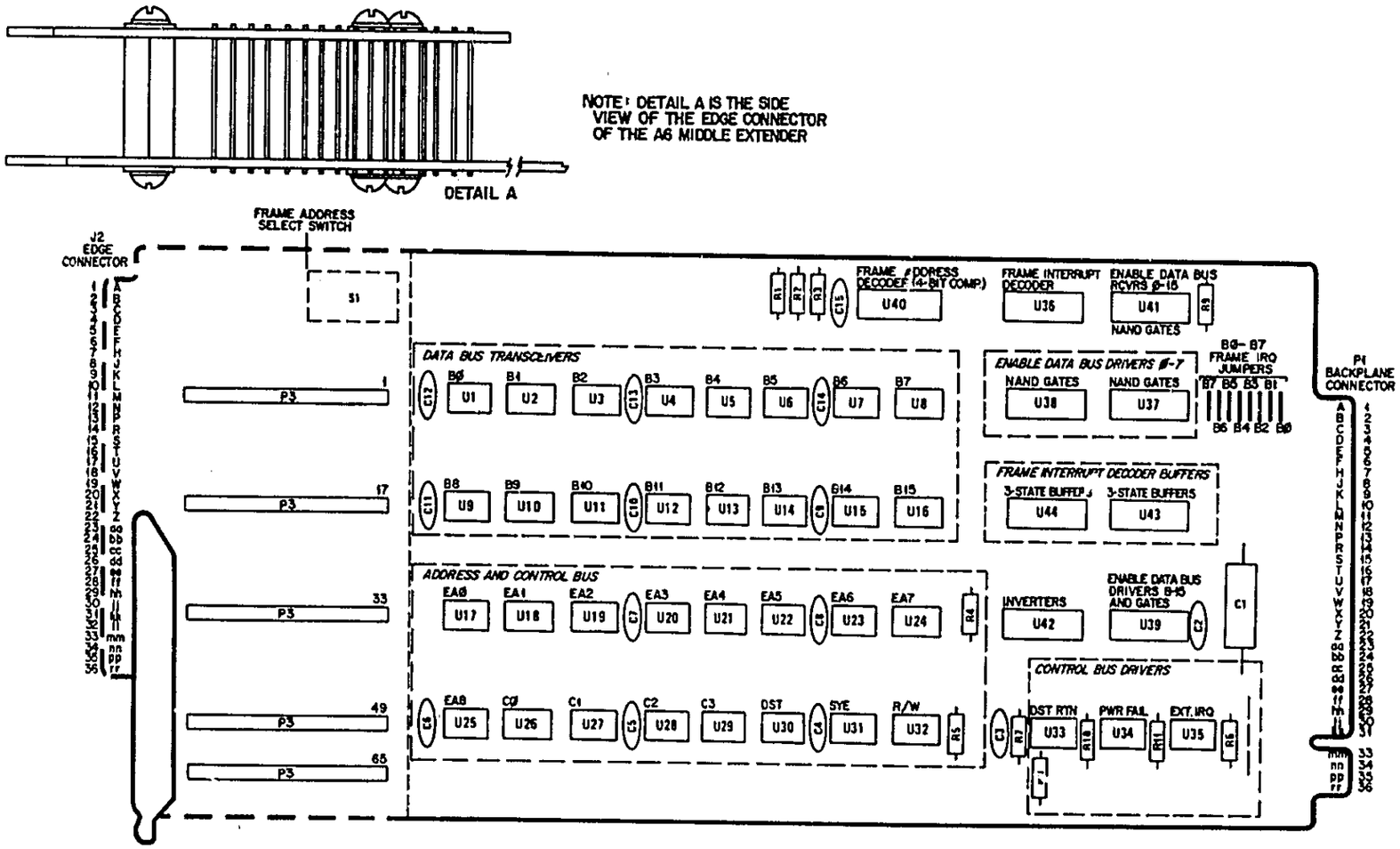


Figure 6-1. 6943A Last Extender, Transmission System



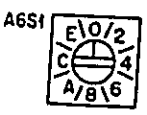
A3 Backplane Connector Board, Component Locations



A6 6943A Middle Extender Transmission System Board (Part of 14701A Extender Kit), Component Locations

SCHEMATIC NOTES

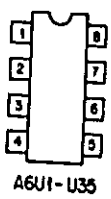
1. ALL RESISTORS ARE IN OHMS, 1/8W, 1% UNLESS OTHERWISE INDICATED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE INDICATED.
3. IF MORE THAN TWO MULTIPROGRAMMER UNITS ARE CONNECTED, TRANSMISSION SYSTEM BOARD(S) 14701-60020 (PART OF THE 14701A INTERMEDIATE EXTENDER KIT) MUST BE INSTALLED IN THE A6 SLOT(S) OF THE INTERMEDIATE (MIDDLE) 6943A EXTENDERS (SEE PARAGRAPH 2-15).
4. THE FRAME ADDRESS FOR A MIDDLE 6943A UNIT IS SPECIFIED BY ROTARY SWITCH A6S1 ON THE 14701-60020 BOARD. THE SWITCH HAS 16 POSITIONS WHICH ARE MARKED IN HEXADECIMAL. NOTE THAT ONLY THE FIRST 8 POSITIONS (0-7) SHOULD BE USED. BECAUSE THE MSB OF THE SWITCH IS NOT USED, THE LAST 8 POSITIONS ARE A REPETITION OF THE FIRST EIGHT; THAT IS, POSITION 8 IS THE SAME AS POSITION 0, POSITION 9 IS THE SAME AS POSITION 1, ETC. REFER TO THE TRUTH TABLE BELOW. THE MIDDLE EXTENDER'S ADDRESS SHOULD BE SET TO A NUMBER FROM 1-6 DEPENDING UPON ITS POSITION IN THE CHAIN (SEE PARAGRAPH 2-15).



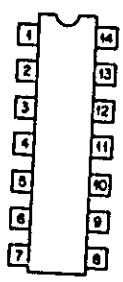
FRAME ADDRESS SWITCH A6S1 TRUTH TABLE

POLE POS	8	4	2	1	$\overline{8}$	$\overline{4}$	$\overline{2}$	$\overline{1}$
0	–	1	1	1	–	0	0	0
1	–	1	1	0	–	0	0	1
2	–	1	0	1	–	0	1	0
3	–	1	0	0	–	0	1	1
4	–	0	1	1	–	1	0	0
5	–	0	1	0	–	1	0	1
6	–	0	0	1	–	1	1	0
7	–	0	0	0	–	1	1	1
8	–	1	1	1	–	0	0	0
9	–	1	1	0	–	0	0	1
A	–	1	0	1	–	0	1	0
B	–	1	0	0	–	0	1	1
C	–	0	1	1	–	1	0	0
D	–	0	1	0	–	1	0	1
E	–	0	0	1	–	1	1	0
F	–	0	0	0	–	1	1	1

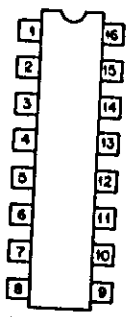
5. THE DOTS (•) MARKED ON THE A6 BOARD INDICATE PIN 1 OF ANY IC. PIN LOCATIONS ARE AS FOLLOWS:



A6U1-U35



A6U37-U39
A6U41-U44



A6U36, U40

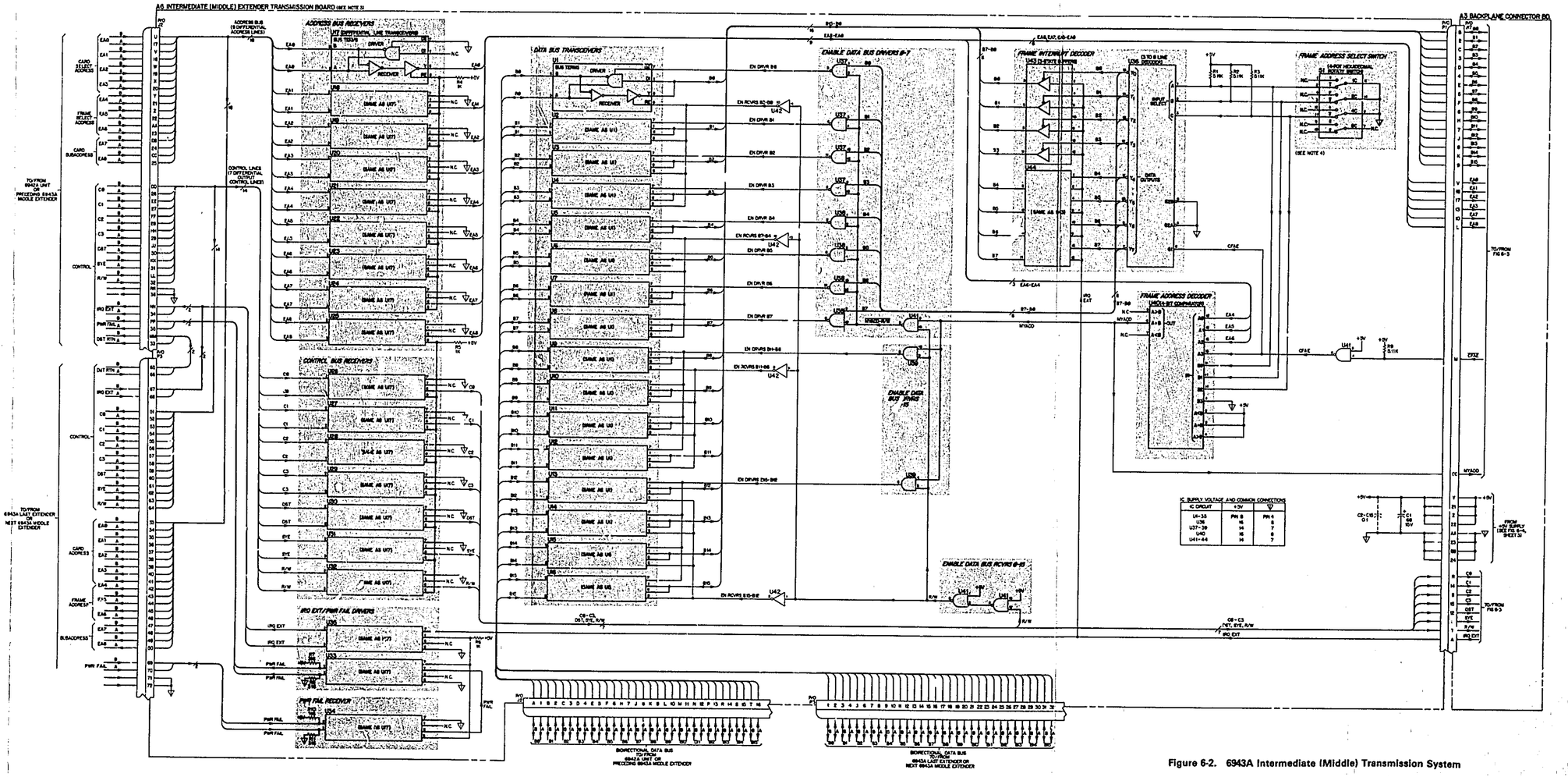
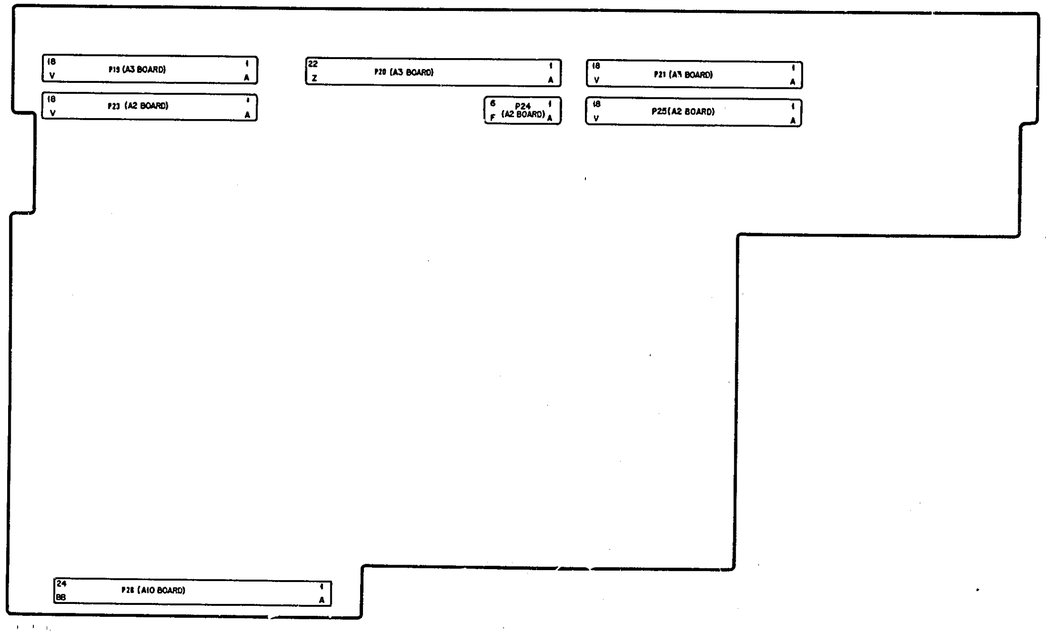
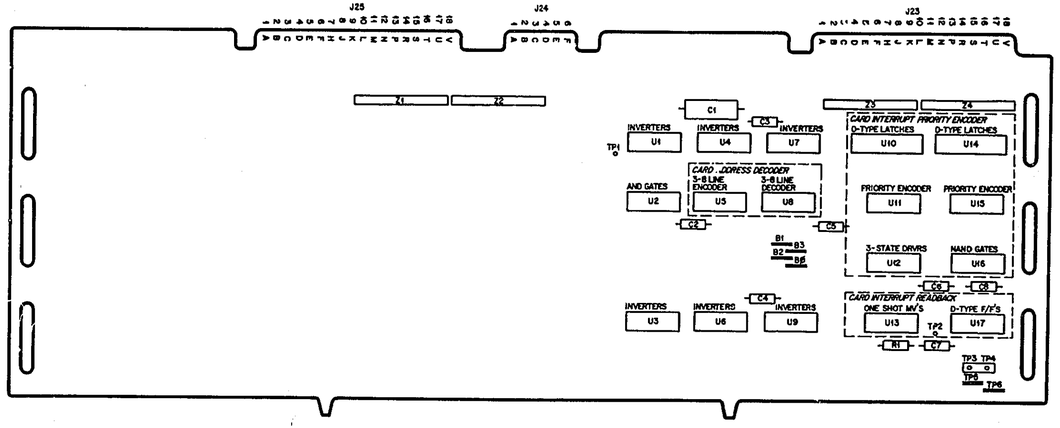


Figure 6-2. 6943A Intermediate (Middle) Transmission System



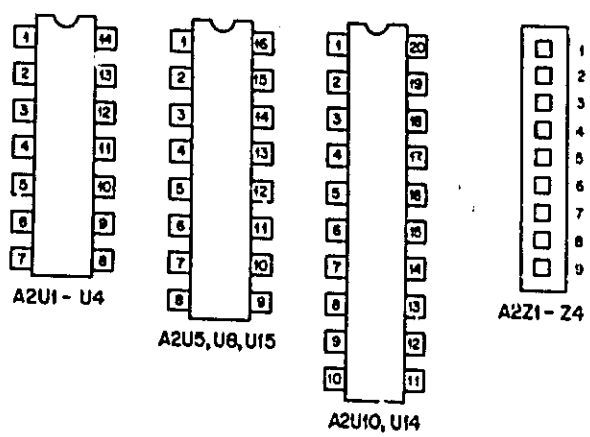
A4 Top Interconnect Board, Component Locations



A2 Backplane Control Board, Component Locations

SCHEMATIC NOTES

1. ALL RESISTORS ARE [illegible] OHMS, 1/8W, 1% UNLESS OTHERWISE INDICATED.
2. ALL CAPACITORS [illegible] MICROFARADS UNLESS OTHERWISE INDICATED.
3. THE DOTS (•) [illegible] ON THE A2 BOARD INDICATE PIN 1 OF ANY IC OR RESISTOR NETWORK.



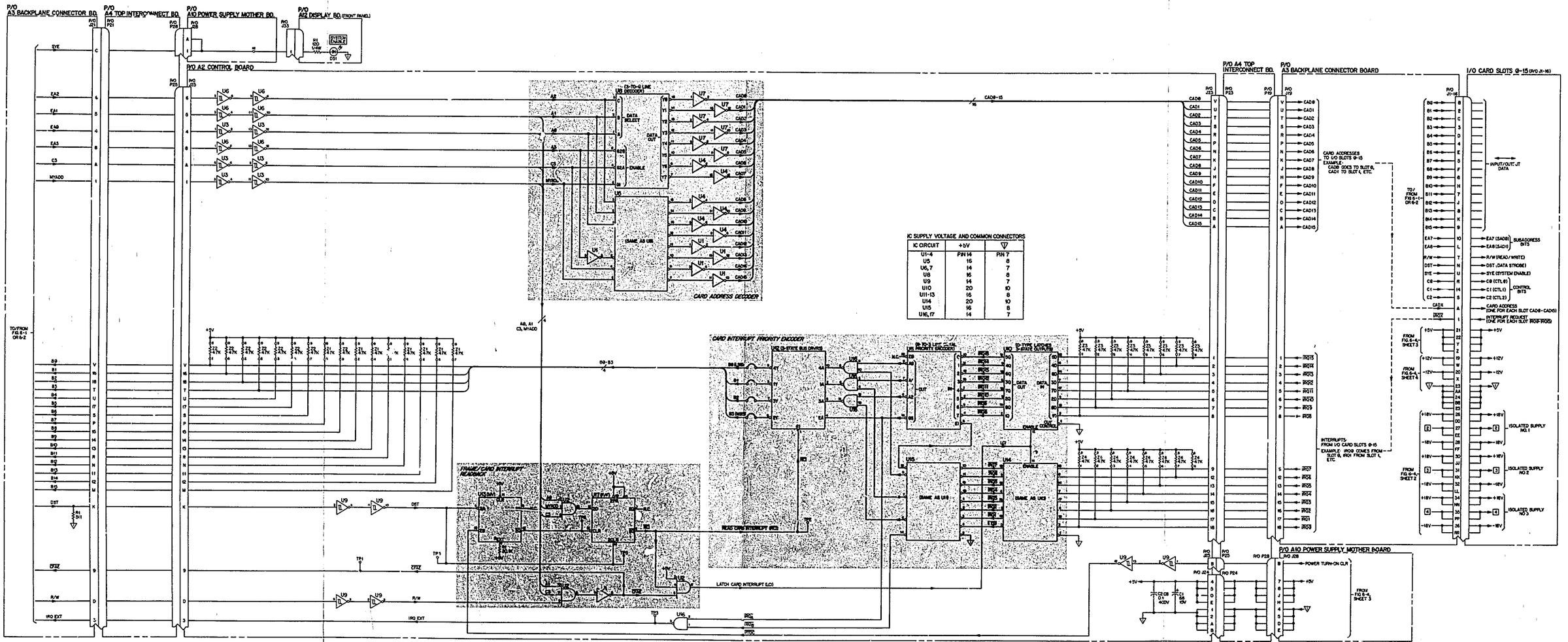
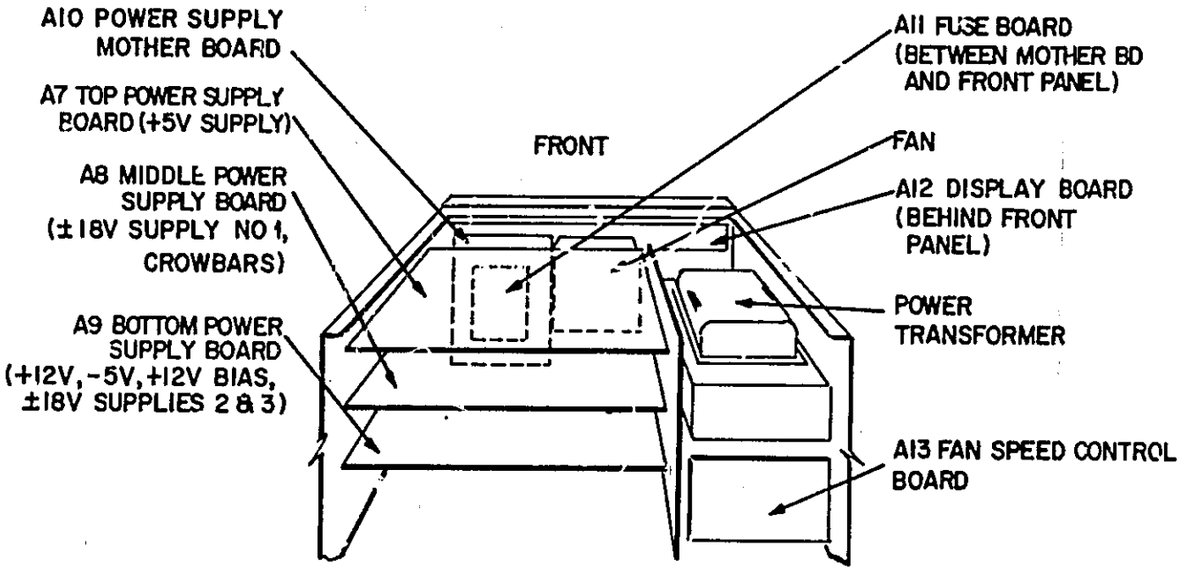
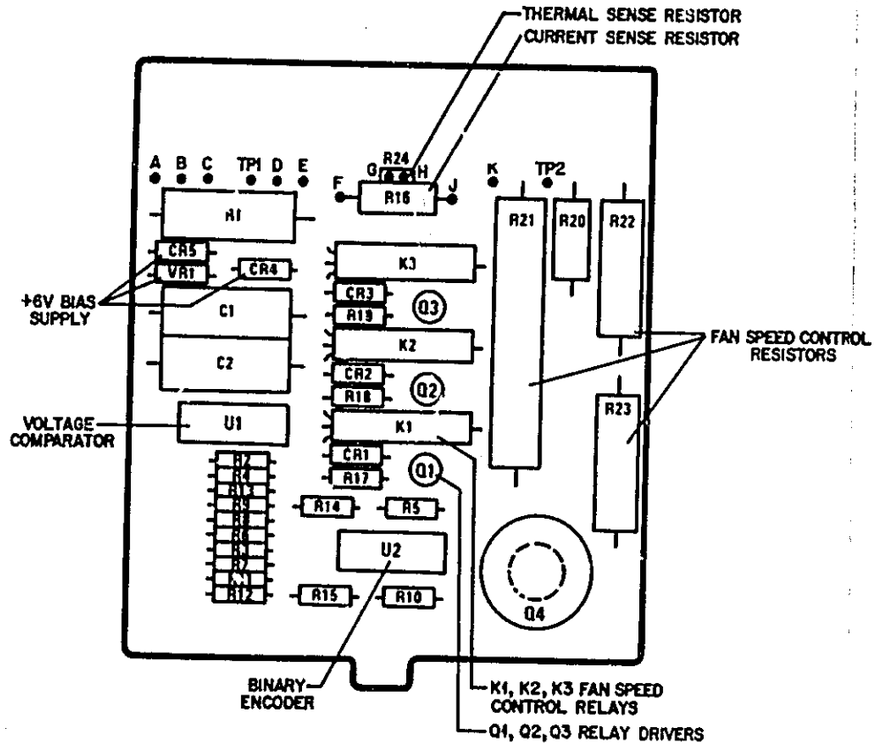


Figure 6-3. 6943A Backplane Control Circuits



(SHOWN REMOVED FROM MAINFRAME)

6443A Power Supply Assembly Locations

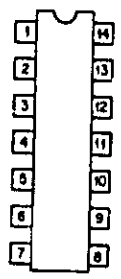


A13 Fan Speed Control Board, Component Locations

SCHEMATIC DIAGRAMS CON'T

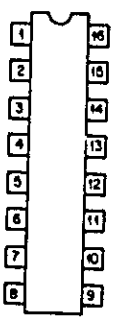
SCHEMATIC NOTES

1. ALL RESISTORS ARE IN OHMS, 1/8W, 1% UNLESS OTHERWISE INDICATED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE INDICATED.
3. FUSE F1 IS 6A FOR 100/120 VAC INPUT OR 3A FOR 220/240 VAC INPUT.
4. VOLTAGE CHOICE IS ON BOTH SIDES AND ON EACH END OF VOLTAGE SELECT PC BOARD. VOLTAGE IS SELECTED BY ORIENTING PC BOARD TO POSITION DESIRED (VOLTAGE ON TOP LEFT SIDE) AND PUSHING BOARD FIRMLY INTO SLOT.
5. ▭ DENOTES FRONT PANEL MARKING.
6. THE SQUARE PLATED PADS ON THE PC BOARDS INDICATE ONE OF THE FOLLOWING:
   A. PIN 1 OF ANY IC OR RESISTOR NETWORK.
   B. POSITIVE END OF A POLARIZED CAPACITOR.
   C. CATHODE OF A DIODE OR EMITTER OF A TRANSISTOR.
7. PIN LOCATIONS FOR IC'S, VOLTAGE REGULATORS, TRANSISTORS, ETC., ARE AS FOLLOWS:

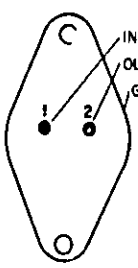


A7U4
U5
A8U1-U5

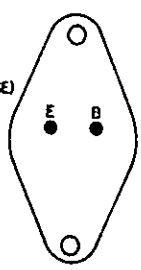
A9U2
A13U1



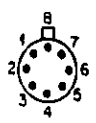
A13U2



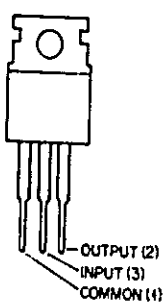
A7U1



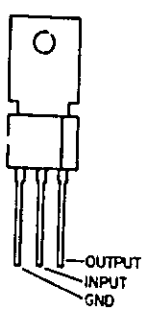
A7Q3, A9Q1, Q2



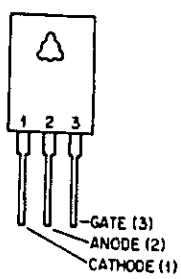
A7U2 A8U6
U3 A9U8



A8U8 A9U3
A9U1 U4
U6



A9U5, U7



A8Q3-Q5

8. CONNECTOR P31 IS PART OF THE COVER FOR THE A11 FUSE BOARD AND SERVES AS AN INTERLOCK WHICH DISCONNECTS THE FUSES WHEN THE COVER IS REMOVED.
9. JUMPER A11W1 ON THE FUSE BOARD CONNECTS DATA COMMON ⏚ TO THE POWER SAFETY GROUND.

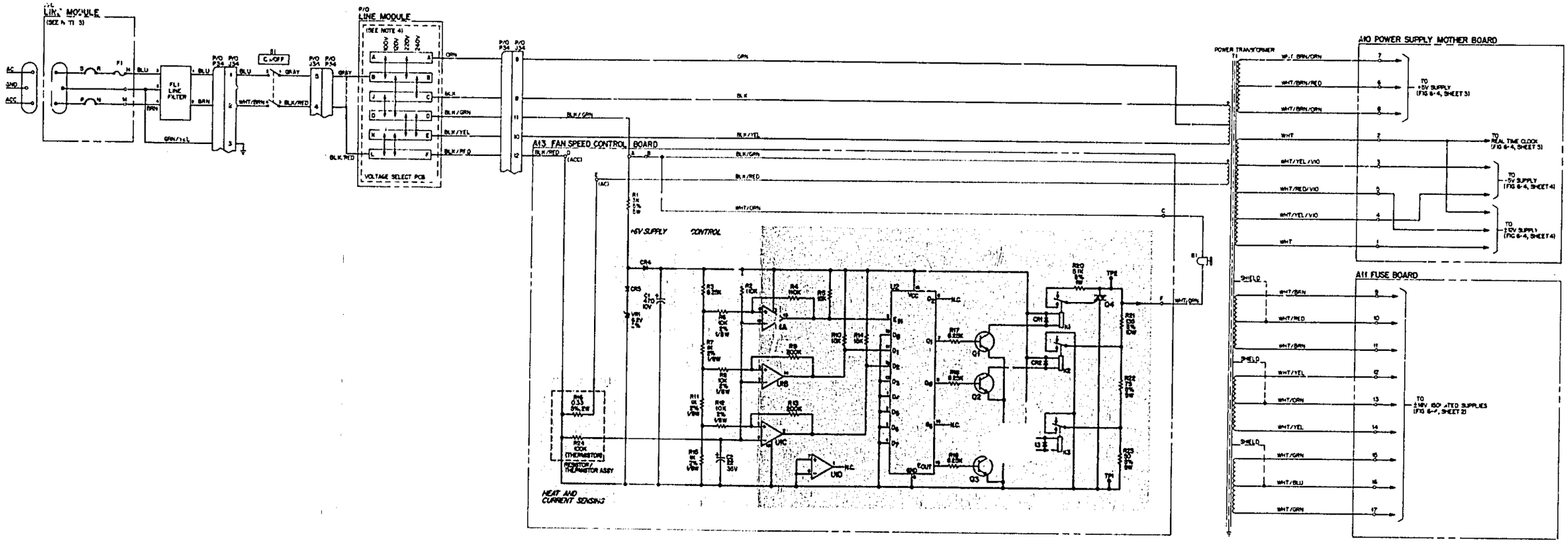
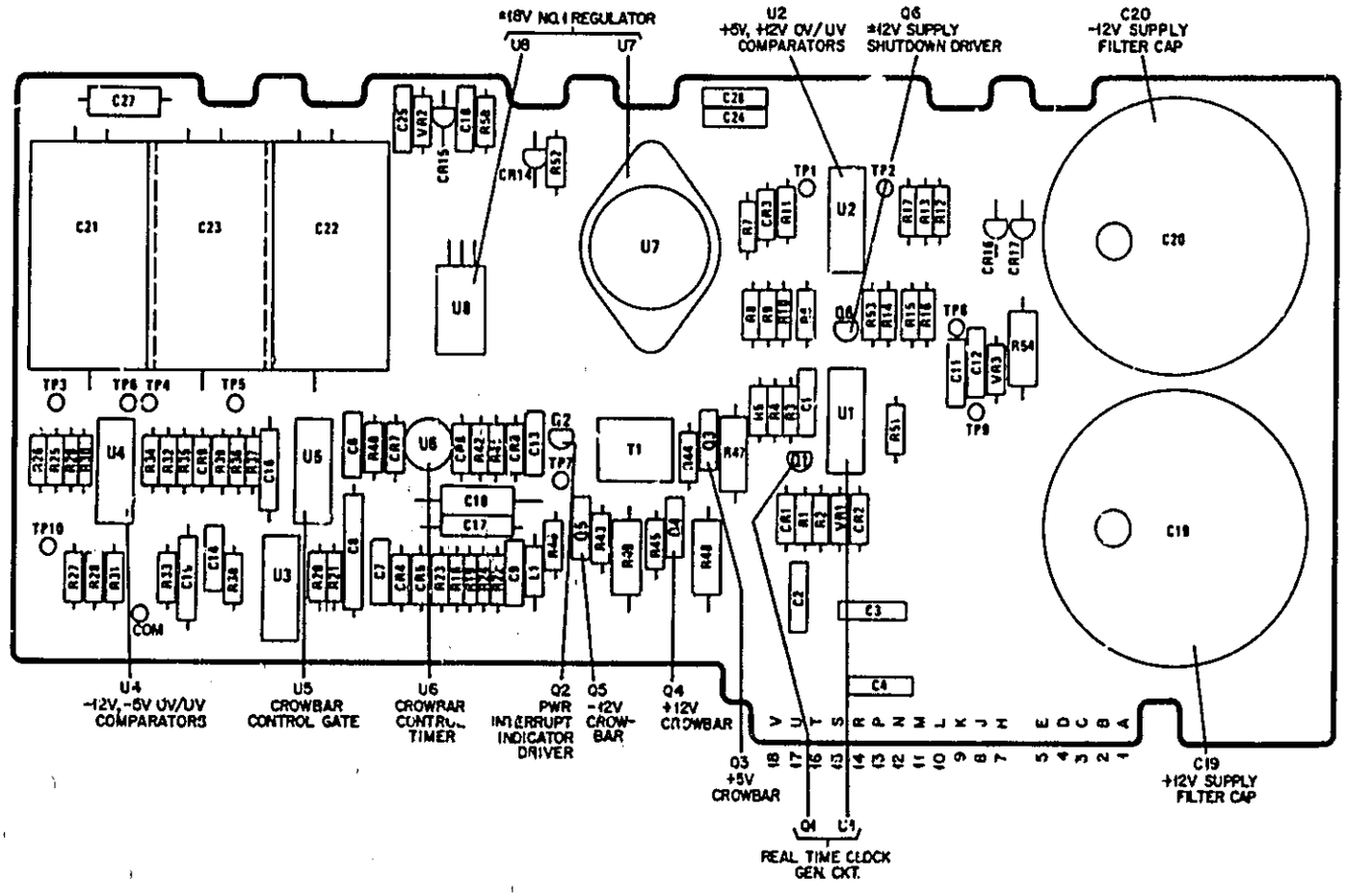
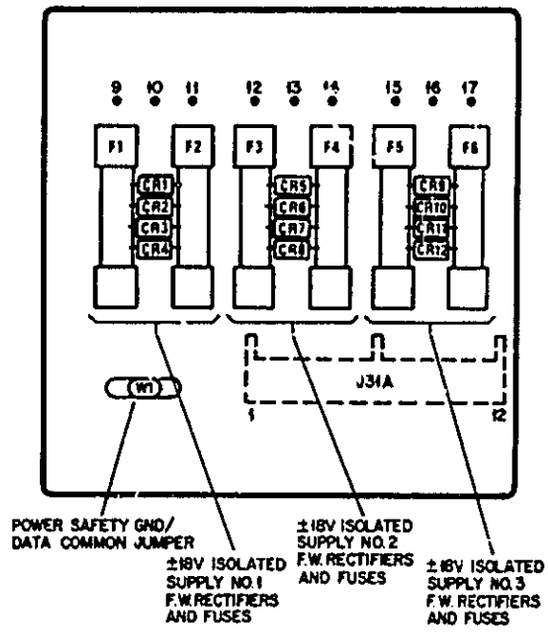


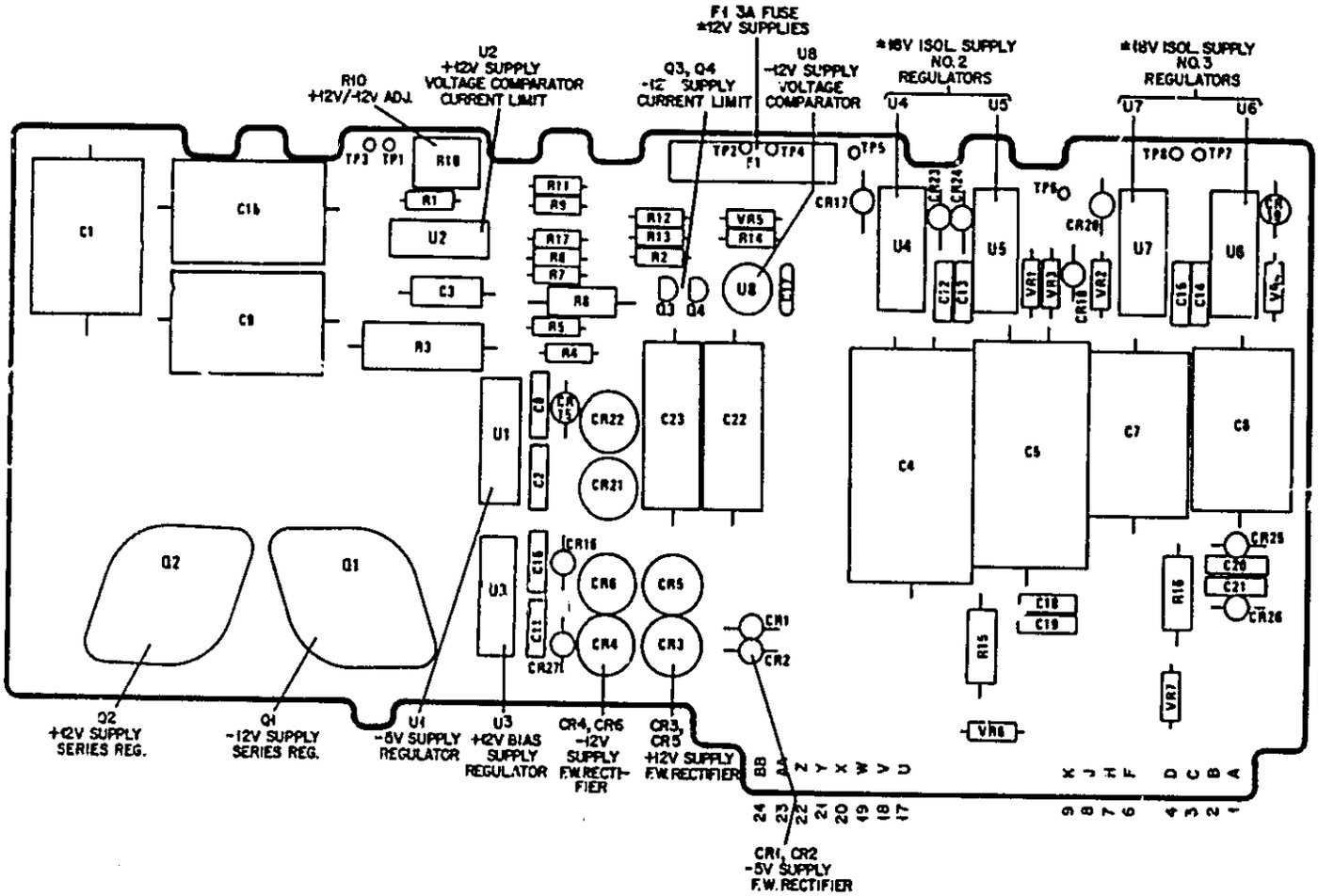
Figure 6-4 (Sheet 1). AC Power Distribution and Fan Speed Control



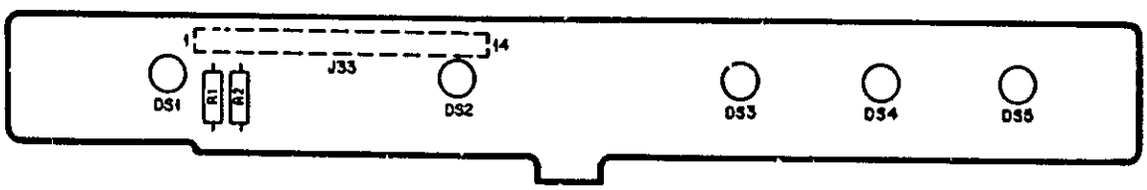
A8 Middle Power Supply Board, Component Locations



A11 Fuse Board, Component Locations



A9 Bottom Power Supply Board, Component Locations



A12 Display Board, Component Locations

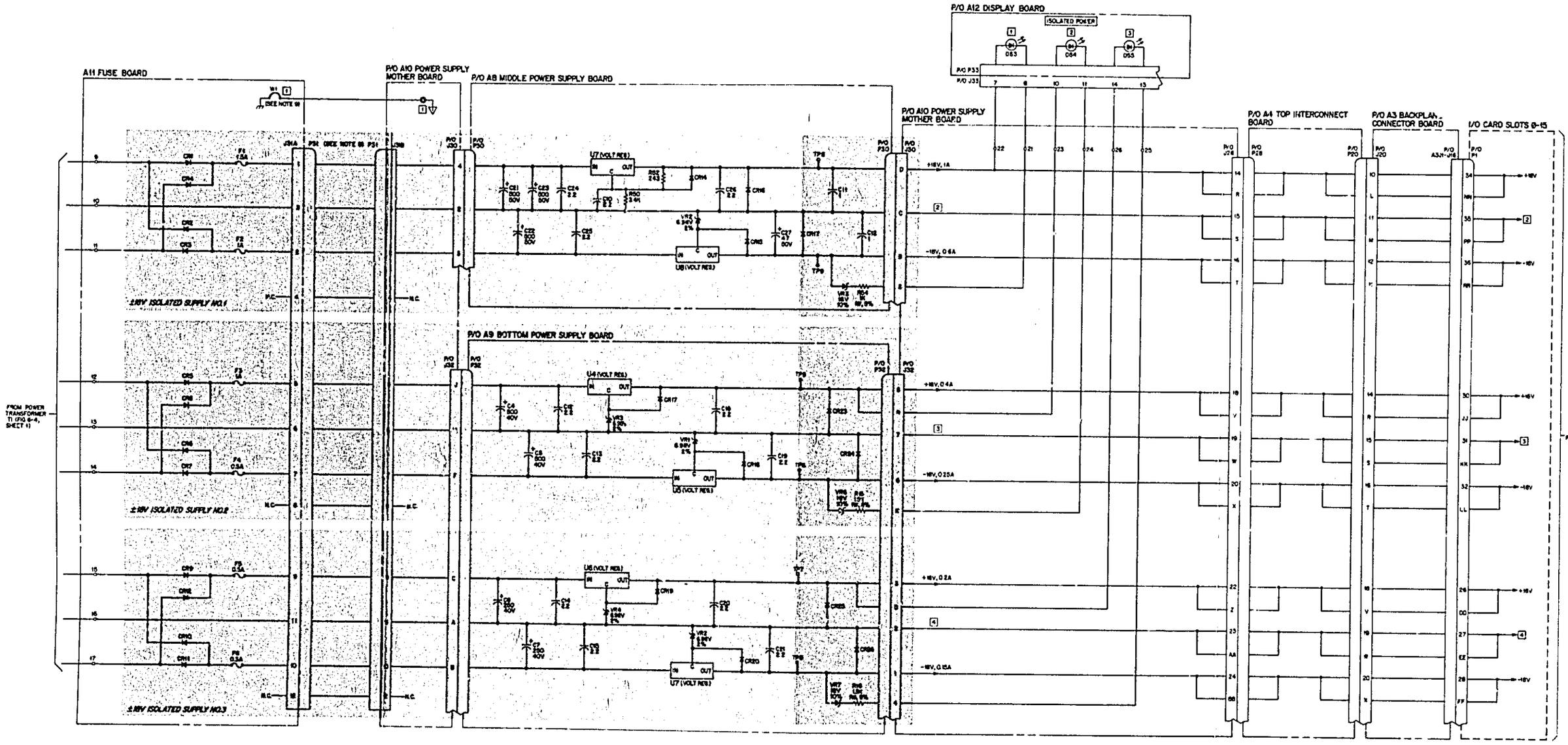
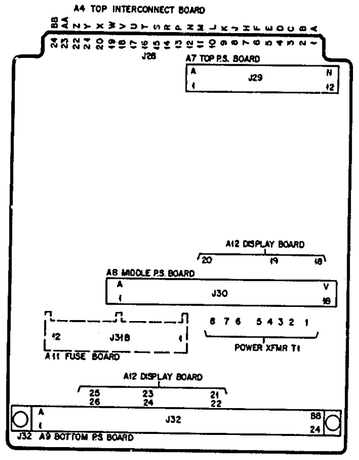
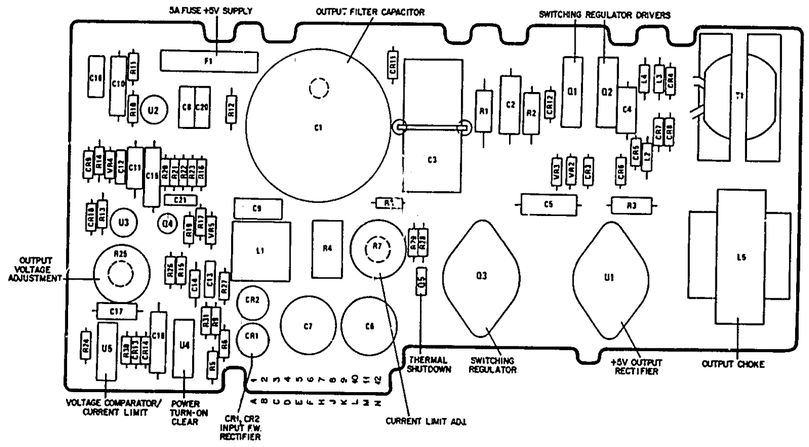


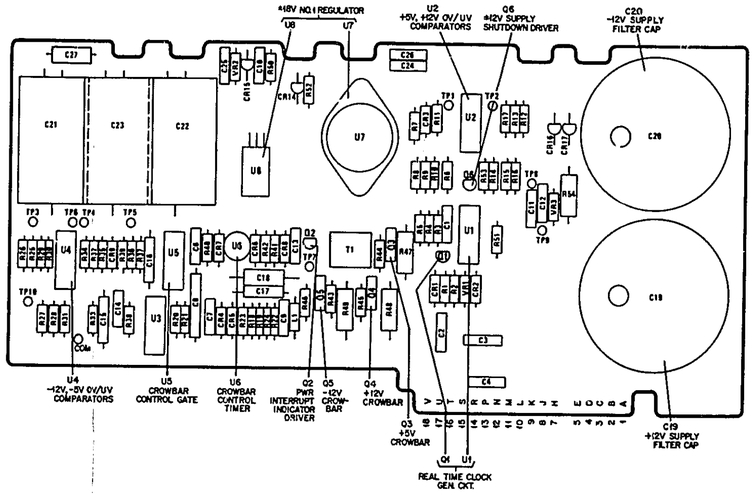
Figure 6-4 (Sheet 2). ±18 V Isolated Supplies



A10 Power Supply Mother Board, Component Locations



A7 Top Power Supply Board, Component Locations



A8 Middle Power Supply Board, Component Locations

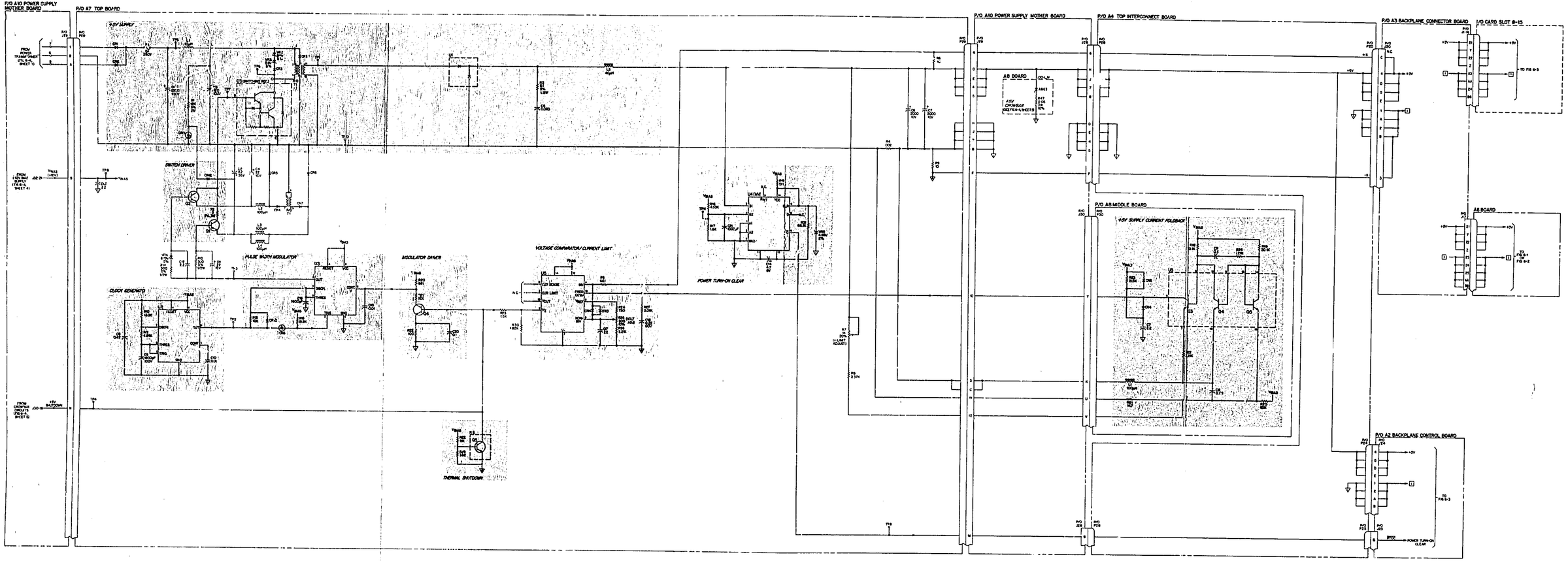
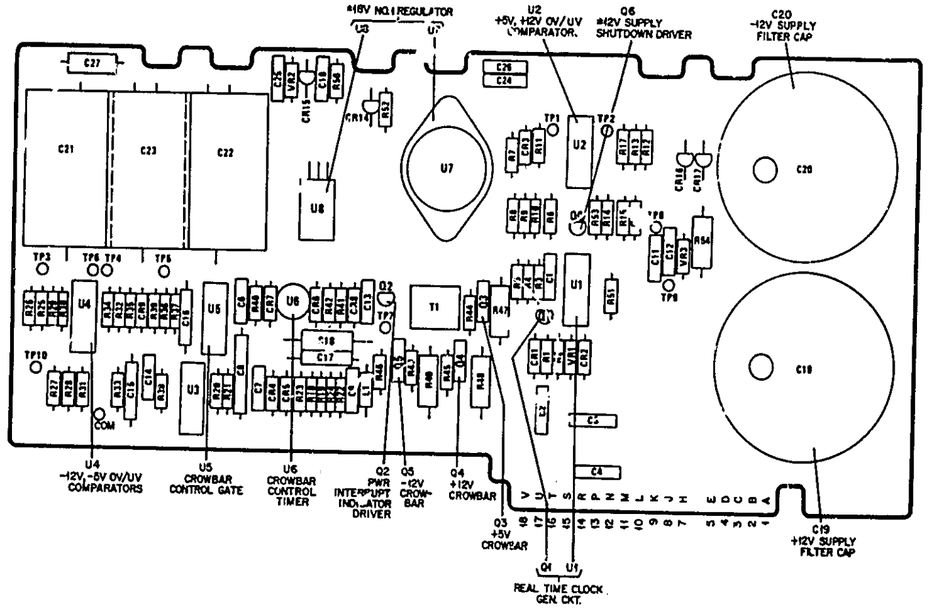
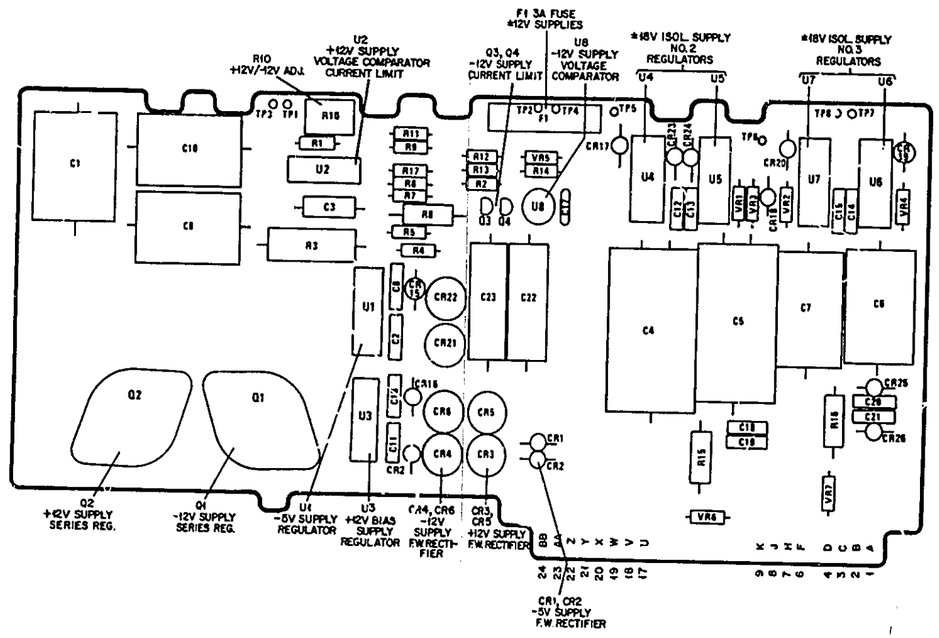


Figure 6-4 (Sheet 3). +5 V Main Supply



A8 Middle Power Supply Board, Component Locations



A9 Bottom Power Supply Board, Component Locations

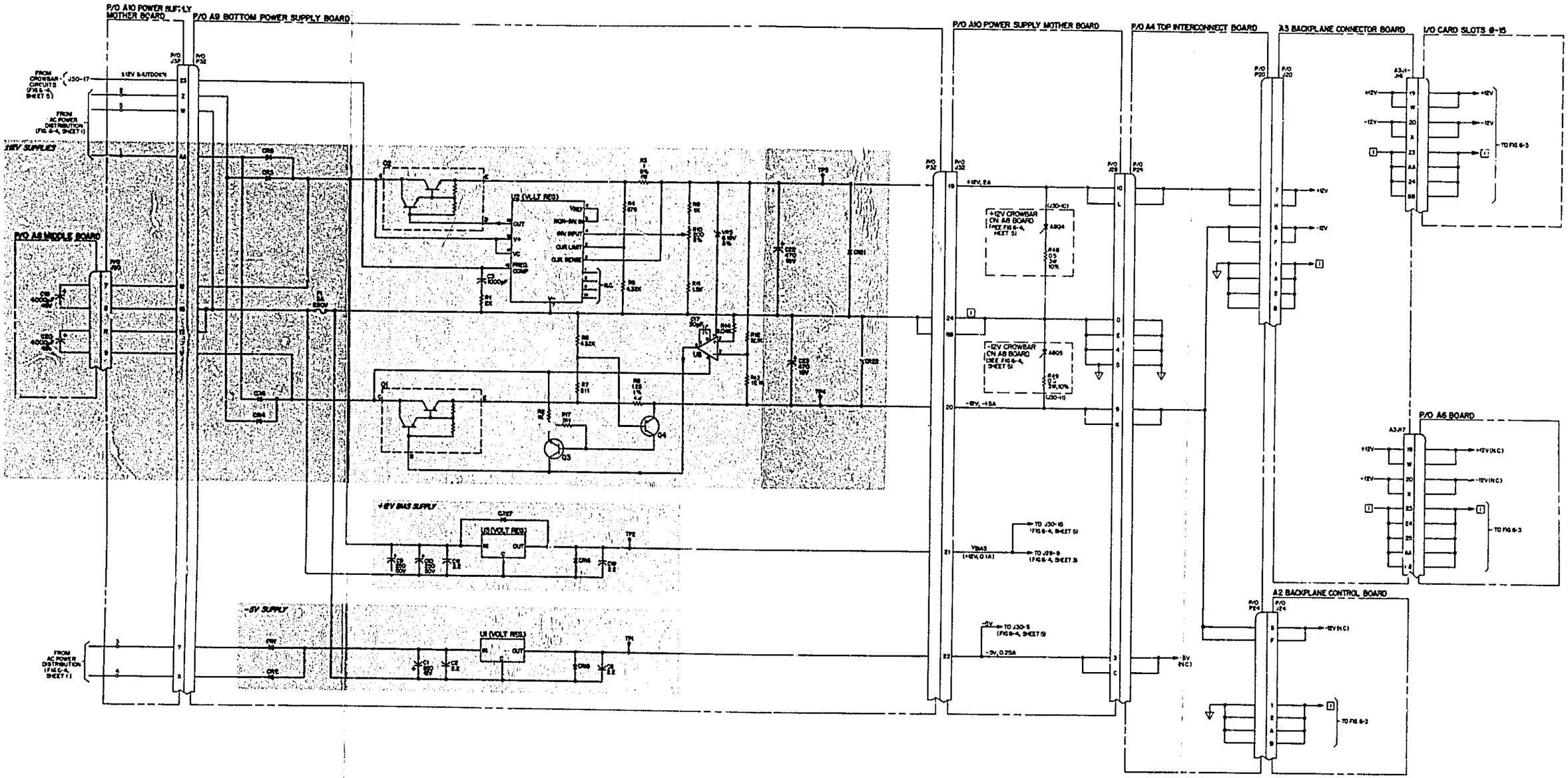
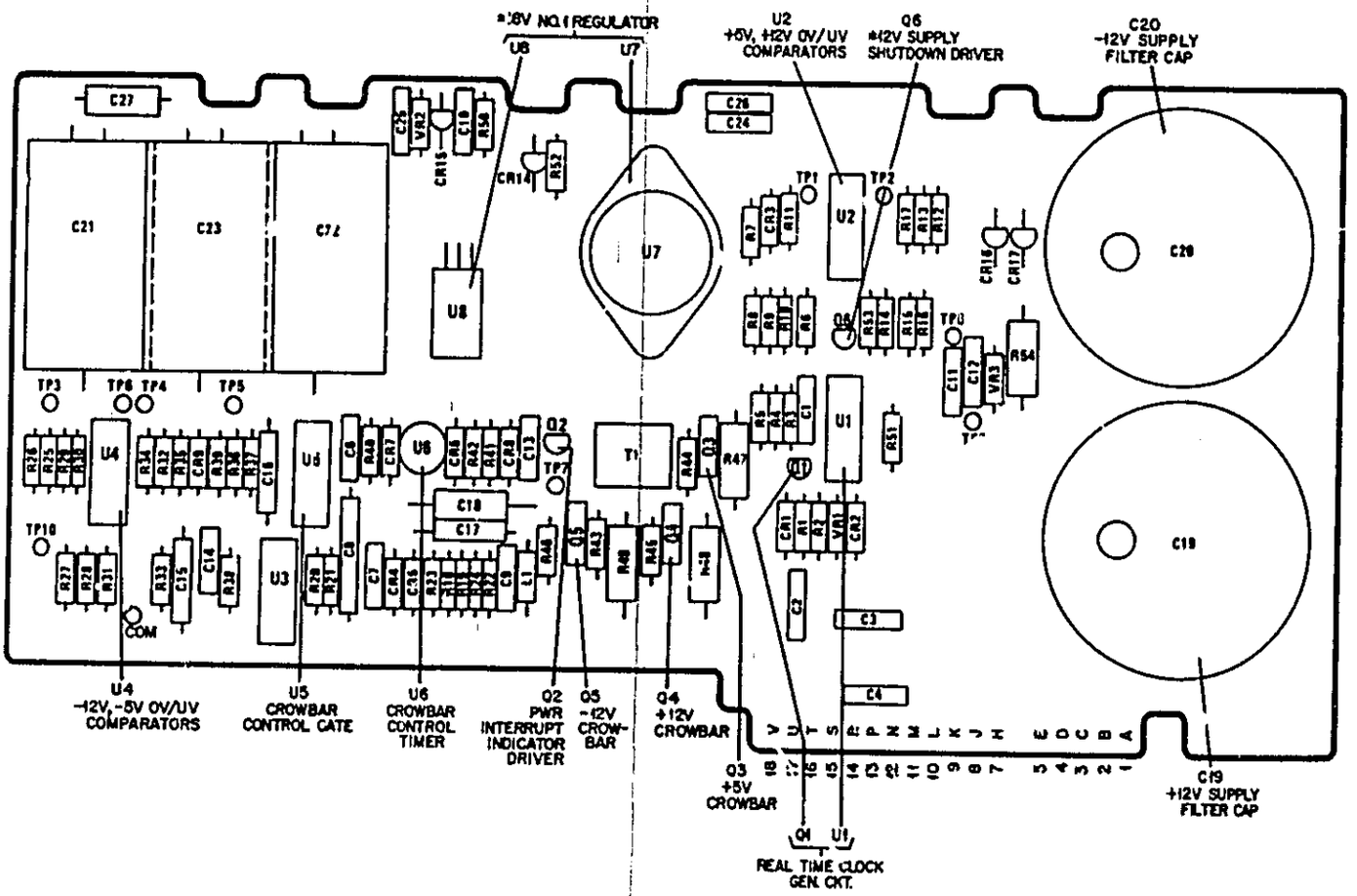


Figure 6-4 (Sheet 4). ±12 V, −5 V, +12 V Bias Supplies



A8 Middle Power Supply Board, Component Locations

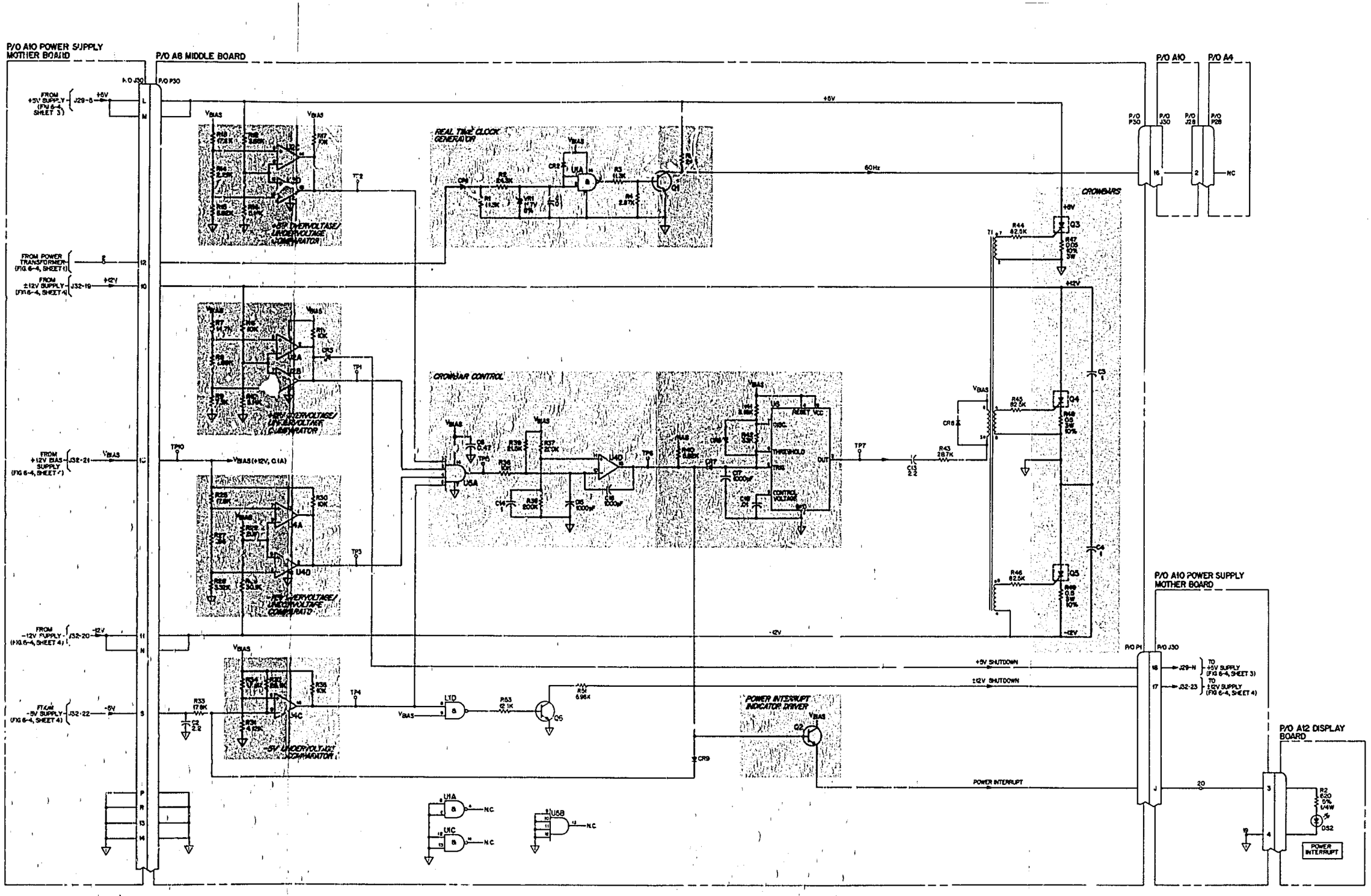


Figure 6-4 (Sheet 5). Crowbar Circuits

APPENDIX

APPENDIX A
MANUAL BACKDATING CHANGES

Manual backdating changes describe changes necessary to adapt this manual to earlier instruments. To adapt the manual to serial numbers prior to 2115A-0181 inspect the following table for your serial number and then make the appropriate changes. For serial numbers 2115A-0181 and up, a change page may be included.

SERIAL Prefix	Number	MAKE CHANGES
2115A	0330-01E2	1
2040A	0180-0151	1,2
2022A	0150-0136	1-3
2005A	0135-0121	1-4
1928A	0120-0101	1-5

CHANGE 1:

In Table 5-4 (A8 Middle Power Supply Assembly), pages 5-8 and 5-10, and on the schematic (Figure 6-4, Sheet 2), make the following changes;

A8R54: Change to 1 k, 1W, HP Part No. 0689-1025
A8RV3: Change to 18 V, 10%, HP Part No. 1901-1348

In Table 5-4 (A9 Bottom Power Supply Assembly), pages 5-10 and 5-11, and on the schematic (Figure 6-4, Sheet 2), make the following changes:

A9R15, R16: Change to 1k, 1 W HP Part No. 0689-1025.
A9VR6, VR7: Change to 18 V, 10%, HP Part No. 1902-1438

CHANGE 2:

In Table 5-4 (A12 Display Board), make the following changes:

A12DS1,DS3-5: Change to HP Part No. 1990-0631
A12DS2: Change to HP Part No. 1990-0681

In Table 5-4 (Chassis Mechanical), make the following changes:

Door: Change to HP Part No. 5000-3163.
Door bracket: Change to HP Part No. 5000-3153.

CHANGE 3:

In Table 5-4 (A7 Top Power Supply Board Assembly), and on the schematic (Figure 6-3, Sheet 3), make the following changes:

A7R30, R31: Delete
A7CR13, CR1: Delete

Make additional changes to schematic (Figure 6-3 Sheet 3) as follows:

1. Delete connection between A7U4-11 and A7U4-7
2. Connect A7U4-9 to junction of A7U4-14, A7U-5, and A7R19.

CHANGE 4:

In Table 5-4 (A8 Middle Power Supply Board Assembly) and on schematic (Figure 6-3, Sheet 5) make the following change:

A8R37, R38: Change to 121k, HP Part No. 0757-0467, qty 2.

CHANGE 5:

In Table 5-4 (A8 Middle Power Supply Assembly) make the following change:

A8U7: Change HP Part No. to 1826-0393.

In Table 5-4 (Card Cage Assembly-Mechanical), make the following changes:

Delete: Rear Panel HP Part No. 5000-3176.
Add: Rear Panel HP Part No. 5000-3157.